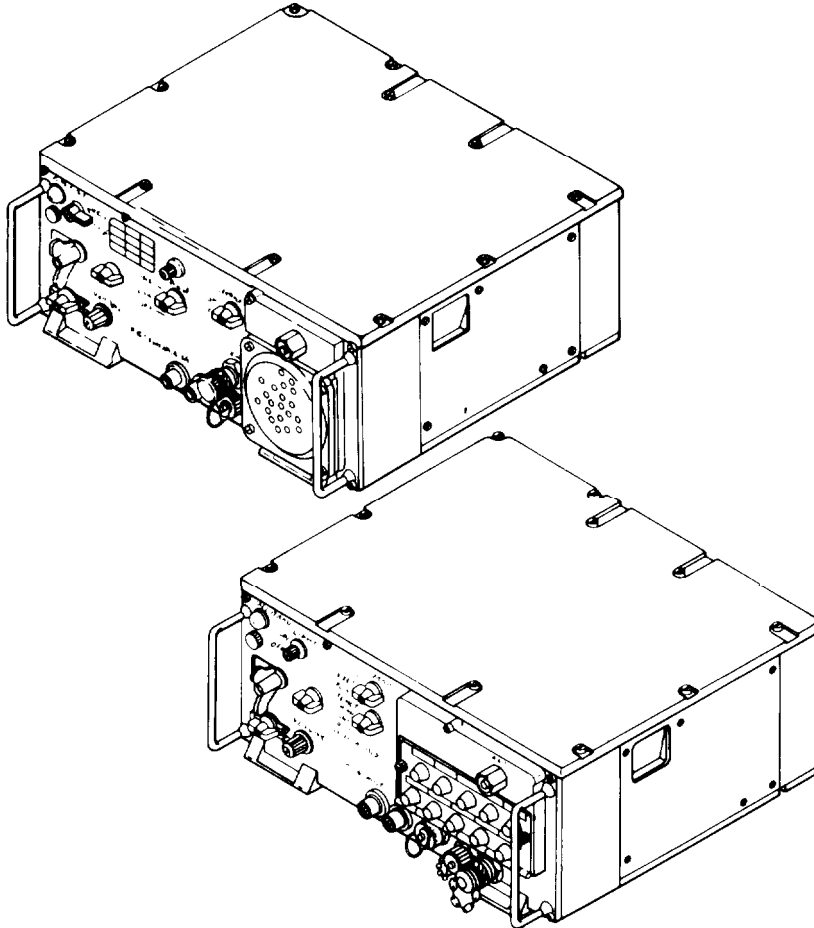


**ARMY TM 11-5820-401-34-2-1**  
**NAVY NAVELEX 0967-LP-432-3030**  
**TECHNICAL MANUAL**  
**DIRECT SUPPORT AND GENERAL SUPPORT**  
**MAINTENANCE MANUAL**  
**VOLUME 1 OF 2**



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OPERATION**

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PERFORMANCE TESTS  
USING MK-1978/VRC  
AND TMDE**

**PAGE 3-2**

**RADIO SETS**

**AN/VRC-12 (NSN 5820-00-223-7412), AN/VRC-43  
(NSN 5820-00-223-7415), AN/VRC-44 (NSN 5820-00-223-7417),  
AN/VRC-45 (NSN 5820-00-223-7418), AN/VRC-46  
(NSN 5820-00-223-7433), AN/VRC-47 (NSN 5820-00-223-7434),  
AN/VRC-48 (NSN 5820-00-223-7435), AND AN/VRC-49  
(NSN 5820-00-223-7437)**

**RECEIVER-TRANSMITTERS**

**RADIO RT-246/VRC AND RT-246A/VRC  
(NSN 5820-00-892-0623)**

**AND**

**RT-524/VRC AND RT-524A/VRC (NSN 5820-00-892-0622)**

**DEPARTMENTS OF THE ARMY AND NAVY**

**16 APRIL 1984**



Change

DEPARTMENTS OF THE ARMY  
AND THE NAVY

No. 3

Washington, DC, 1 September 1995

**Direct Support and General Support  
Maintenance Manual  
(Volume 1 of 2)**

**RADIO SETS**

**AN/VRC-12 (NSN 5820-00-223-7412) (EIC: GCC)  
AN/VRC-43 (NSN 5820-00-223-7415) (EIC: GCD)  
AN/VRC-44 (NSN 5820-00-223-7412) (EIC: GCE)  
AN/VRC-45 (NSN 5820-00-223-7418) (EIC: GCF)  
AN/VRC-46 (NSN 5820-00-223-7433) (EIC: GCG)  
AN/VRC-47 (NSN 5820-00-223-7434) (EIC: GCH)  
AN/VRC-48 (NSN 5820-00-223-7435) (EIC: GCJ)  
AN/VRC-49 (NSN 5820-00-223-7437) (EIC: GCK)**

**(USED WITHOUT INTERCOM SETS)**

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*Insert Pages*

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3-85 and 3-86  
3-97 through 3-100  
3-167 and 3-168

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AND THE NAVY  
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**Direct Support and General Support  
Maintenance Manual**

**RADIO SETS: AN/VRC-12 (NSN 5820-00-223-7412), AN/VRC-43  
(NSN 5820-00-223-7415), AN/VRC-44 (NSN 5820-00-223-7417),  
AN/VRC-45 (NSN 5820-00-223-7418), AN/VRC-46 (NSN 5820-00-223-7433),  
AN/VRC-47 (NSN 5820-00-223-7434), AN/VRC-48 (NSN 5820-00-223-7435),  
AND AN/VRC-49 (NSN 5820-00-223-7437)**

**RECEIVER-TRANSMITTERS, RADIO  
RT-246/VRC (NSN 5820-00-892-0623)  
AND RT-246-A/VRC (NSN 5820-01-140-9071)  
AND  
RT-524/VRC AND RT-524A/VRC (NSN 5820-00-892-0622)**

VOLUME 1 OF 2

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Washington, DC, 01 DECEMBER 1986

No. 1

**Direct Support and General Support  
Maintenance Manual**

**RADIO SETS: AN/VRC-12 (NSN 5820-00-223-7412), AN/VRC-43  
(NSN 5820-00-223-7415), AN/VRC-44 (NSN 5820-00-223-7417),  
AN/VRC-45 (NSN 5820-00-223-7418), AN/VRC-46 (NSN-5820-00-223-7433),  
AN/VRC-47 (NSN 5820-00-223-7434), AN/VRC-48 (NSN 5820-00-223-7435),  
AND AN/VRC-49 (NSN 5820-00-223-7437)**

**RECEIVER-TRANSMITTERS, RADIO  
RT-246/VRC (NSN 5820-00-892-0623)  
AND RT-246-A/VRC (NSN 5820-01-140-9071)  
AND  
RT-524/VRC AND RT-524A/VRC (NSN 5820-00-892-0622)**

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3-203 through 3-208 . . . . .	3-203 through 3-208

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

**1** DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL

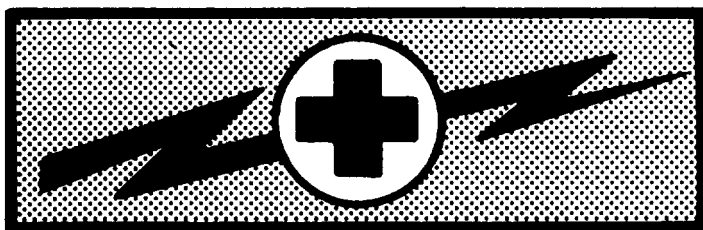
**2** IF POSSIBLE, TURN OFF THE ELECTRICAL POWER

**3** IF YOU CANNOT TURN OFF THE ELECTRICAL POWER, PULL, PUSH, OR LIFT THE PERSON TO SAFETY USING A WOODEN POLE OR A 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



## WARNING

### HIGH VOLTAGE

IS USED IN THE OPERATION OF THIS EQUIPMENT

### DEATH ON CONTACT

MAY RESULT IF PERSONNEL FAIL TO OBSERVE SAFETY PRECAUTIONS

Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When the technician is aided by operators, he must warn them about dangerous areas.

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.

Be careful not to contact high-voltage connections of 115 volt ac input connections when installing or operating this equipment.

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

WARNING Do not be misled by the term "low voltage". Potentials as low as 50 volts may cause death under adverse conditions.

For Artificial Respiration, refer to FM 21-11.

**WARNING**

**HIGH VOLTAGE**

is used in this equipment.

DEATH ON CONTACT

MAY RESULT IF SAFETY PRECAUTIONS

ARE NOT OBSERVED.

Remove all rings, watches and jewelry before turning power on.

Make certain you are not grounded when working inside the equipment with power turned on. 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.

**WARNING**

Never attempt to lift a radio receiver-transmitter (RT) alone. Serious injury could result.

**WARNING**

**TRICHLOROTRIFLUOROETHANE**

Fumes of TRICHLOROTRIFLUOROETHANE are poisonous. Provide adequate ventilation whenever you use TRICHLOROTRIFLUOROETHANE. Do not use solvent near heat or open flame. TRICHLOROTRIFLUOROETHANE will not burn, but heat changes the gas into poisonous, irritating fumes. DO NOT breathe the fumes or vapors. TRICHLOROTRIFLUOROETHANE dissolves natural skin oils. DO NOT get the solvent on your skin. Use gloves, sleeves, and an apron which the solvent cannot penetrate. If the solvent is taken internally, consult a physician immediately.



TECHNICAL MANUAL  
 NO. 11-5820-401-34-2-1  
 NAVELEX 0967-LP-432-3030

DEPARTMENTS  
 OF THE ARMY AND THE NAVY  
 Washington, DC, 16 April 1984

Direct Support and General Support  
 Maintenance Manual

**RADIO SETS: AN/VRC-12 (NSN 5820-00-223-7412), AN/VRC-43  
 (NSN 5820-00-223-7415), AN/VRC-44 (NSN 5820-00-223.7417),  
 AN/VRC-45 (NSN 5820-00-223-7418), AN/VRC-46 (NSN 5820-00-223-7433),  
 AN/VRC-47 (NSN 5820-00-223-7434), AN/VRC-48 (NSN 5820-00-223-7435),  
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**RECEIVER-TRANSMITTERS, RADIO  
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 AND RT-246A/VRC (NSN 5820-01-140-9071)  
 AND  
 RT-524/VRC AND RT-524A/VRC (NSN 5820-00-892-0622)**

**REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS**

You can help improve this manual. If you find any mistakes or if you know of 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 back of this manual direct to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-LC-ME-PS, Fort Monmouth, New Jersey 07703-5000. For Navy, mail comments to the Commander, Space and Naval Warfare Systems Command, ATTN: SPAWAR 8122, Washington, DC, 20363-5100. A reply will be furnished direct to you.

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\*This manual, together with, TM 11-5820-401-34-2-2/NAVELEX 0967-LP-432-3030, 16 April 1984 and TM 11-5820-401-34-3/NAVELEX 0967-LP-432-3060, 16 April 1984 supersedes TB 11-5820-401-34-1/EE150-JA-MMI-DID/E154RT246, 23 February 1984 and TM 11-5820-401-34-2/NAVELEX 0967-LP-432-3030, 9 April 1976. This manual also supersedes TM 11-5820-401-10 LD-1, LD-2, LD-3, and LD-4, 1 June 1978.

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## HOW TO USE THIS MANUAL

This manual is designed to help you maintain receiver-transmitters used in the AN/VRC-12 series radio sets.

The table of contents on the front cover is provided for quick reference to important information. There is also an alphabetical Index to help locate specific information.

Measurements in this manual are given in both US standard and metric units.

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 in the front of this manual. You should learn the warnings before doing maintenance on the equipment.

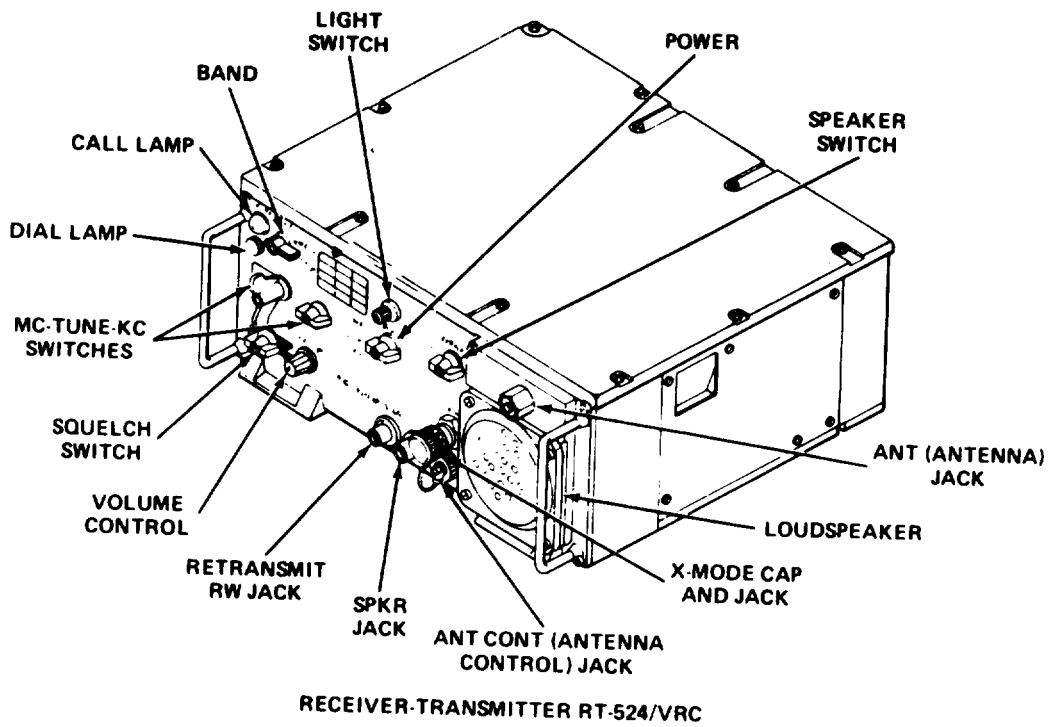
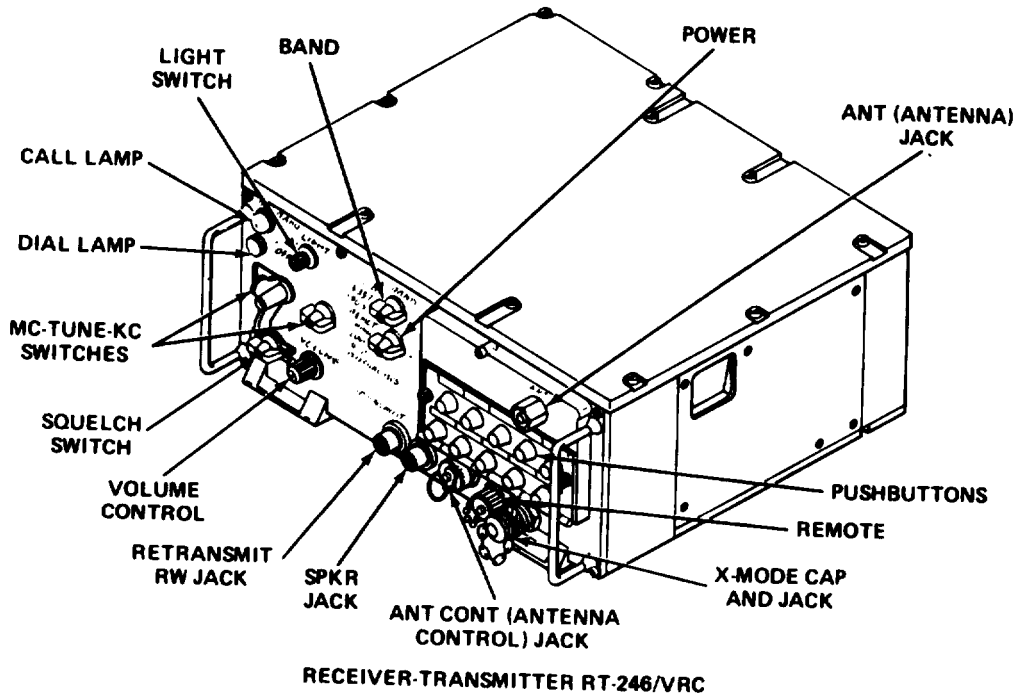
Paragraphs in this manual are numbered by chapter and order of appearance within a chapter. A subject index appears at the beginning of each chapter, breaking the chapter into sections. A more specific subject Index is located at the beginning of each section to help you find the exact paragraph you are looking for.

There are three chapters covering direct support performance tests, troubleshooting, and alignment procedures. Each chapter shows-how to perform these tasks using a different set of test equipment; that is:

1. Chapter 3 contains performance and troubleshooting procedures, using Maintenance Kit MK-1978/VRC and discrete test equipment (TMDE).
2. Chapter 4 contains performance and troubleshooting procedures, using Test Set AN/GRM-114A.
3. Chapter 5 contains performance and troubleshooting procedures, using Test Cable No. 1 and discrete test equipment (TMDE).

The procedures you follow will depend upon the test equipment at your disposal.

For repair parts and tools required for direct support and general support maintenance, refer to TM 11-5820-401-34P-2-1 (RT-246(\*)/VRC) and TM 11-5820-401-34P-2-2 (RT-524(\*)/VRC).



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# CHAPTER 1

## INTRODUCTION

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### OVERVIEW

This chapter will familiarize you with Receiver-Transmitters Radio RT-246/VRC, RT-246A/VRC, RT-524/VRC, and RT-524A/VRC. It contains general information about the equipment, references to pertinent forms and publications, equipment specifications, and principles of operation.

### Section I GENERAL INFORMATION

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#### 1-1. SCOPE.

Type of Manual: Direct support and general support maintenance manual.

Equipment Names and Model Numbers: Receiver-Transmitters Radio RT-246/VRC and RT-246A/VRC (part of Radio Sets AN/VRC-12, AN/VRC-43, AN/VRC-44, and AN/VRC-45); RT-524/VRC and RT-524A/VRC (part of Radio Sets AN/VRC-46, AN/VRC-47, AN/VRC-48, and AN/VRC-49).

Purpose of Equipment: To provide short-range, two-way, frequency-modulated (fm) radio communication in the 30.00- to 75.95-MHz frequency range.

#### 1-2. CONSOLIDATED INDEX OF ARMY PUBLICATIONS AND BLANK FORMS.

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

### 1-3. MAINTENANCE FORMS, RECORDS, AND REPORTS.

#### REPORT OF MAINTENANCE AND UNSATISFACTORY EQUIPMENT

Department of the Army forms and procedures used for equipment maintenance and status will be those prescribed in DA PAM 738-750, as contained in Maintenance Management Update.

Navy personnel will report maintenance performed utilizing the Maintenance Data Collection Sub-system (MDCS) IAW OPNAVINST 4790.2, Vol 3, and unsatisfactory material/conditions (UR submissions) IAW OPNAVINST 4790.2, Vol 2, chapter 17.

#### 1-3.2 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 4355-18B/AFR 400-54/MCO 4430.3J.

#### 1-3.3 TRANSPORTATION DISCREPANCY REPORT

Fill out 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.

### 1-4. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR).

#### ARMY

If your receiver-transmitter 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 the design. Put it on an 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, NJ 07703-5000. We'll send you a reply.

#### NAVY

Navy personnel are encouraged to submit EIR's through their local Beneficial Suggestion Program.

### 1-5. 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.

### 1-6. ADMINISTRATIVE STORAGE.

Preventive Maintenance, in accordance with PMCS charts, will be performed prior to administrative storage of equipment issued to and used by Army activities. When removing the equipment from administrative storage, the PMCS shall be performed to ensure operational readiness. Refer to TM 11-5820-401-20-1 and TM 11-5820-401-20-2 for PMCS.

Administrative storage of equipment shall be done in accordance with TM 740-90-1.

Repacking of equipment for storage or shipment is covered in TM 11-5820-401-20-1 and TM 11-5820-401-20-2.

**1-7. NOMENCLATURE CROSS-REFERENCE LIST.**

**NOTE**

When (\*) follows equipment nomenclature, all models are represented. RT-524(\*)/VRC, for example, covers both Receiver-Transmitters, Radio RT-524/VRC and RT-524A/VRC.

This list contains common names used throughout this manual in place of official nomenclature.

Common Name	Official Nomenclature
AN/VRC-12 series radio sets	AN/VRC-12, AN/VRC-43, AN/VRC-44, AN/VRC-45, AN/VRC-46, AN/VRC-47, AN/VRC-48, and AN/VRC-49
frequency counter	Frequency Counter AN/USM-207
handset	Handset H-250/U
loudspeaker or speaker	Loudspeaker LS-454/U
microphone	Microphone Dynamic M-80/U
port	jack or connector
receiver-transmitter or RT	Receiver-Transmitter, Radio RT-246(*)/VRC and RT-524(*)/VRC
T-connector	Adapter UG-274/U
wattmeter	Wattmeter AN/URM-120

**Section II EQUIPMENT DESCRIPTION AND DATA**

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Equipment Data .....	1-10	1-4
Differences Between Models/Silicon Versions .....	1-11	1-4
Safety, Care, and Handling.....	1-12	1-6

**1-8. GENERAL.**

This section contains overall information about the RT-246(\*)/VRC and RT-524(\*)/VRC. It includes references to publications that provide detailed equipment description and data, coverage of major differences between models, and a summary of warnings, cautions, and general handling procedures.

**1-9. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES.**

Equipment characteristics, capabilities, and features of the RT-246(\*)/VRC and RT-524(\*)/VRC are found in TM 11-5820-401-20-1 and TM 11-5820-401-20-2.

## 1-10. EQUIPMENT DATA.

The following publications cover RT-246(\*)/VRC and RT-524(\*)/VRC equipment data:

1. TM 11-5820-401-10-1
2. TM 11-5820-401-10-2
3. TM 11-5820-401-20-1
4. TM 11-5820-401-20-2

## 1-11. DIFFERENCES BETWEEN MODELS/SILICON VERSIONS.

This paragraph contains information covering redesigned RT modules using silicon semiconductors in lieu of germanium devices. For details of model differences affecting operation (controls, pushbutton tuning, etc.), refer to TM 11-5820-401-10-1.

Silicon modules are considered to be throw away items, however all silicon modules replaced shall be returned to depot for final disposition.

### MODULES CONTAINING SILICON SEMICONDUCTORS

Modules equipped with silicon semiconductors are identified by the suffix letters A or B. For example, A8100A denotes a silicon version transmitter modulator. The A8100 is the germanium version of the same module. The suffix B denotes a late version silicon power supply.

It is possible that radios in field use might be equipped with a combination of germanium and silicon modules in the receiver and transmitter sections.

Receiver Section Silicon Modules:

#### **CAUTION**

Module A1200B contains parts sensitive to Electrostatic Discharge (ESD)

A1200B 1st RF Board Assy	A3500A CRS Limiter
A1400A Mixer Assy	A3600A CRS Hunt Discriminator
A1500A Local Oscillator	A3700A CRS Phase Discriminator
A1600A Tuner Power Supply	A4100A First and Second IF Amps
A2000A CRS Oscillators	A4200A IF Amps and Limiter
A2100A Voltage Regulator	A4300A Audio and Squelch Preamp
A3100A CRS Harmonic Generator	A5100A Audio Amplifier
A3200A CRS Balanced Mixer	A5200A Squelch Amplifier
A3300A CRS Second Mixer	A5300A Squelch Filter
A3400A CRS First and Second IF Amps	

Transmitter Section Silicon Modules:

A6300A Master Oscillator	A8400A Hunt Generator
A6400A Buffer Amplifier	A8500A Speech Amplifier
A7200A Servoamplifier	A9000A Power Supply Rectifier
A8100A 11.5-MHz Modulator	A9400A Power Supply (2-kHz Oscillator)
A8300A First and Second IF Amps	A9400B Power Supply (4-kHz Oscillator)

## 1-11. DIFFERENCES BETWEEN MODELS/SILICON VERSIONS. (CONT)

## INTERCHANGEABILITY OF MODULES

Germanium and silicon modules may be used together in the same radio with the following exceptions.

Squelch Amplifier A5200(\*) and Squelch Filter A5300(\*). The germanium version of the squelch amplifier must not be used with the silicon version of the squelch filter, nor can the silicon squelch amplifier be used with the germanium squelch filter.

Any individual radio must be equipped with either an A5200 and A5300 or an A5200A and A5300A in matched pairs.

Power Supply Rectifier A9000 and Power Supply Oscillator A9400. The A9400 power supply oscillator assembly exists in the following three versions:

1. A9400 germanium
2. A9400A silicon, 2 kHz
3. A9400B silicon, 4kHz

The A9400 germanium version is compatible only with the A9000 germanium assembly. The A9400A silicon version may also be used with the A9000 germanium assembly. The A9400B contains a 4 kHz high power oscillator, and therefore, may be used only with an A9000A. These modules may only be paired as follows: (DO NOT USE ANY OTHER COMBINATIONS)

1. A9000/A9400
2. A9000/A9400A
3. A9000A/A9400B

## ALIGNMENT DIFFERENCES

With the following exceptions, there is no difference in germanium and silicon version alignment procedures.

IF Amplifiers A4200(\*) and Audio/Squelch Preamp A4300(\*). The A4200A uses an integrated circuit, quadrature-type fm demodulator in place of the Travis discriminator used in the A4200. Therefore, only one coil (L4202) requires peaking, and no dc offset voltage is present at TP4003. Since the A4200A demodulator's output is only 53 millivolts minimum compared to 100 millivolts minimum for germanium version, readjustment of the Squelch Preamp A4300(\*) is necessary when an A4200A is used to replace an A4200.

Squelch Amplifier A5200(\*) and Squelch Filter A5300(\*). The silicon versions of these two modules differ from the germanium versions in operating levels and ac feedback. An integrated circuit dual differential amplifier is used as a squelch amplifier, tone detector, and voltage comparator.

A separate relay driver circuit is provided to operate K5002, eliminating this relay's effect on squelch adjustment with temperature changes and age.

The amplifier gain between TP5012 and TP 5008 is minimal, but independent of the frequency setting of A5300A. Therefore, offsetting the squelch filter to achieve the required gain is not required.

Transmitter 11.5 MHz Modulator A8100(\*). Rearrangement of the circuit board in the A8100A silicon version has moved the shorting point for modulator testing and alignment (see page 3-109).

## 1-11. DIFFERENCES BETWEEN MODELS/SILICON VERSIONS. (CONT)

### ALINEMENT DIFFERENCES (CONT)

Additionally, the polarity of the variable capacitance diodes has been reversed, eliminating the 180-degree phase shift in the modulation. This permits compatible interface with various data systems.

### TRANSMITTER SPEECH AMPLIFIER A8500A – LATE VERSION

There are two silicon versions of the speech amplifier module. The original version was redesigned to correct a loud 400-to 800-Hz squeal audible in the headset when the transmitter is keyed in high power at 64 to 75.95 MHz, using an AS-1729/VRC antenna and CX-4722/VRC cable.

The revised A8500A contains an inductor (L8501) added to the module. Other changes include repositioning of Capacitor C8513, and relocation of various components on the circuit board.

A schematic diagram of the late version A8500A is contained in FO-22 located at the back of this manual.

### ALINEMENT STICKER

There is no standard sticker to record the required annual alinement of your RT and REC equipments. Two of the types you could use are: NSN 7530-00-082-2662, Labels, Class C, GS-02F47205 (cut down), or NSN 9905-00-639-1679, Designation Strip, SC-B-84438. Minimum information you record should be: Date (alined), Unit (alined by), Due Date (one year from date alined).

## 1-12. SAFETY, CARE, AND HANDLING.

### WARNING

High voltage is used in this equipment. Death on contact may result if safety precautions are not observed.

Remove all rings, watches, and jewelry before turning power on.

Make certain you are not grounded when working inside the equipment with power turned on. 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.

Never attempt to lift a radio receiver-transmitter (RT) alone. Serious injury could result.

Fumes of TRICHLOROTRIFLUOROETHANE are poisonous. Provide adequate ventilation whenever you use TRICHLOROTRIFLUOROETHANE. Do not use solvent near heat or open flame. TRICHLOROTRIFLUOROETHANE will not burn, but heat changes the gas into poisonous, irritating fumes. DO NOT breathe the fumes or vapors. TRICHLOROTRIFLUOROETHANE dissolves natural skin oils. DO NOT get the solvent on your skin. Use gloves, sleeves, and an apron which the solvent cannot penetrate. If the solvent is taken internally, consult a physician immediately.

## Section III PRINCIPLES OF OPERATION

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### 1-13. GENERAL.

This section contains information covering principles of operation of the major electronic assemblies of the receiver-transmitter, beginning with the receiver. The material is presented in functional block diagram format, with supporting text which explains the operation of each electronic module in the radio.

Details pertaining to the operation of most individual components in each module are not discussed in this section. Instead, the text is intended to explain the overall effect each module has on an incoming signal, and how the module contributes to the operation of the radio. Individual circuit details can be found in the foldouts in the back of this manual.

At the DS/GS level of maintenance, electronic components within radio modules are not replaced. Because of this maintenance approach, this section generally does not discuss the performance of specific circuits and components such as diodes, transistors, etc. In fact, it is not necessary to understand how the circuits in a module operate to effectively troubleshoot or align it. However, it is very important to know what a module actually does in order to perform signal checks at test points for the purpose of testing, troubleshooting, or aligning the module.

### 1-14. RECEIVER SIGNAL PATH.

A system block diagram showing receiver signal flow can be found in FO-26 in the back of this manual. Refer to the foldout while reading the text in this paragraph.

Frequency-modulated rf signals are applied through K301 to the antenna tuning and protection circuits in the A1100 module (1) of the receiver's vhf section. The A1100 module passes signals of the frequency to which the receiver is tuned and rejects all other frequencies.

Very low amplitude rf is applied to the first rf Amplifier A1200 module (2) which provides the first stage of amplification. A second stage of amplification is provided by the second rf Amplifier A1300 module (3).

Amplified rf is then applied to the Mixer A1400 module (4) where the signals are heterodyned (mixed) with the output of the local oscillator (5) in the A1500 module. For all MC-TUNE-KC settings in the **(A)** band range, the local oscillator runs exactly 11.5 MHz above the frequency to which the receiver A1100 module (1) is tuned. For all MC-TUNE-KC settings in the **(B)** band range, the local oscillator runs exactly 11.5 MHz below the receiver's tuned frequency.

The Mixer A1400 module (4) produces sum and difference frequencies as a result of the mixing process. All frequencies, except the 11.5-MHz intermediate frequency, are rejected by the 11.5-MHz Crystal Filter FL4001 (6).

The intermediate frequency (i f) is amplified by the first and second i f Amplifier A4100 module (7), filtered by FL4002 (8) to eliminate any unwanted frequencies, and further amplified by the third and fourth i f amplifiers in the A4200 module (9).

In the fifth i f Amplifier and Limiter A4200 (10), the 11.5-MHz rf is again amplified, and i f noise spikes are clipped. The limiter clips noise, that is, excessive amplitude from the i f, to prevent distortion in the demodulated audio output of the Travis-type discriminator. Both positive and negative spikes are clipped, keeping the i f amplitude constant. Several i f amplification stages are used to insure that the signals applied to the limiter are strong enough to reach the limiter's minimum clipping amplitude. If the signals applied to the limiter are too low in amplitude, the limiter cannot clip the upper and lower wave peaks; therefore the i f applied to the discriminator can vary in amplitude resulting in distorted audio.



**1-14. RECEIVER SIGNAL PATH. (CONT)****SILICON VERSION THIRD I F AMPLIFIER/LIMITER/DISCRIMINATOR A4200A**

The silicon version of the A4200 module contains silicon instead of germanium transistors. Discrete fourth and fifth i f amplifier stages are not required because an integrated circuit quadrature detector is used which incorporates amplification, limiting, and discriminating stages. The quadrature detector also simplifies alinement.

Demodulated audio output from the discriminator is applied to Audio and Squelch Preamplifier A4300 (12) for initial amplification. The A4300's output is fed to the Audio Filter FL5001 (13), and by a parallel circuit to Squelch Amplifier A5200 (14). However, in the OFF positions of the front panel SQUELCH switch, the squelch amplifiers and related circuits are essentially inoperative. The reason for this is as follows.

Audio signals are amplified by Monitor Ampilfier A5100 (15), whose output is not volume controlled, and by Audio Amplifier A5100 (16), the output of which is determined by the position of the volume control. Both amplifiers require 16 vdc to operate. In the OFF position of the SQUELCH switch, the amplifiers get their 16-vdc power directly from the SQUELCH switch (17); therefore, the amplifiers operate independent of the squelch circuits. The squelch function is covered in greater detail in paragraph 1-30.

Output from the audio amplifier (16) is applied to the Audio Transformer T5100 (18), which provides unmuted audio and muted audio through Muting Circuit R5117 (19).

**1-15. LOCAL OSCILLATOR AFC/CRYSTAL REFERENCE SYSTEM.**

Correct operation of the receiver depends on a very precisely controlled local oscillator whose frequency is maintained with minimal variation. At any frequency selected by the MC-TUNE-KC control, the local oscillator is held to a tolerance of  $\pm 3.5$  kHz by the action of the crystal reference system. Therefore, the crystal reference system (CRS) functions as an automatic frequency control (AFC) loop.

A system block diagram showing CRS signal flow can be found in FO-27 in the back of this manual. Refer to the foldout while reading the text in this paragraph.

The local oscillator's (1) output is applied to a high-pass Filter FL3002 (2) and then to balanced Mixer A3200 (3). At the same time, 12 frequencies (ie, 1 to 12 MHz) are applied to CRS balanced mixer from the crystal-controlled Harmonic Generator A3100 (4).

The inputs to the balanced mixer are heterodyned, thereby producing 12 sum and difference frequencies. Two frequencies closest to 53 MHz are passed by band pass Filter FL3003 (5), while other signals are attenuated. The two accepted frequencies are then applied to CRS Second Mixer A3300 (6), and heterodyned with the output of the interpolation oscillator (7).

Within the interpolation oscillator (Crystal Switch A2000) are ten crystals. Each crystal corresponds to a group of frequencies tunable by the MC-TUNE-KC control. When a frequency is selected, the radio's gear train also selects one of ten crystals, which precisely controls the frequency of the interpolation oscillator.

**1-15. LOCAL OSCILLATOR AFC/CRYSTAL REFERENCE SYSTEM. (CONT)**

The heterodyning process in the CRS Second Mixer A3300 (6) produces sum and difference frequencies. Two of the difference frequencies are very close to 5.625 MHz. The frequency closest to 5.625 MHz is coupled across a 5.625-MHz tuned tank contained within the second mixer, to the first and second i f Amplifiers A3400 (8). Other frequencies are greatly attenuated by the resonant tank circuit.

After amplification, the i f signals are filtered by FL3004 (9), which is sufficiently selective to attenuate any unwanted frequencies. The third i f Amplifier and Limiter A3500 (10) functions in a manner similar to that described in paragraph 1-26, covering Amplifier and Limiter A4200 stages.

Output from the A3500 (10) is applied to the phase discriminator and hunt generator at the same time to coarse tune, and then fine tune the local oscillator.

**COARSE TUNING THE LOCAL OSCILLATOR**

The A3500's output is applied to band pass Filter FL3005 (11) to attenuate any unwanted frequencies which may have passed through the limiter. From the filter, the signals are applied to the Hunt Discriminator A3600 (12).

The hunt discriminator contains a triple tuned Travis-type discriminator similar to the one used in the A4200 module described in paragraph 1-26. Large deviations away from the discriminator's 5.625 MHz center frequency cause the discriminator to output a plus or minus dc signal with an ac component riding on it.

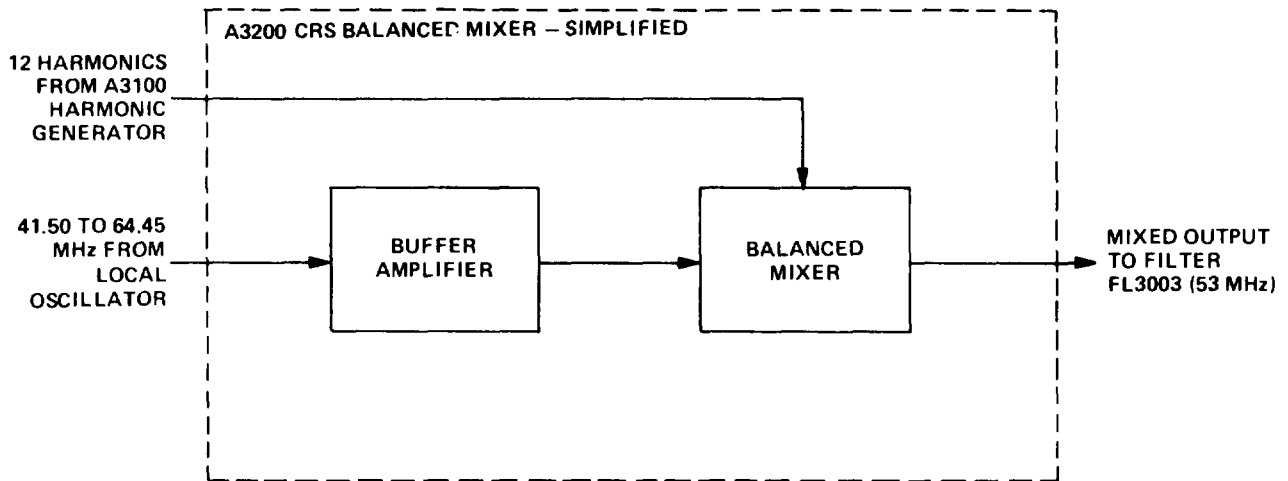
Both the dc and ac outputs are applied to the damping network (13), wherein the ac component is damped or attenuated. From the damping network, a positive or negative dc error signal is applied to the local oscillator (1). The error signal biases the local oscillator close to correct frequency by a hunting action, that is, an initial large dc error signal followed by smaller error signal voltages until the oscillator is close enough to its correct frequency for the phase discriminator to begin fine tuning.

The hunt discriminator can coarse tune the local oscillator when its frequency error is within  $\pm 400$  kHz.

**FINE TUNING THE LOCAL OSCILLATOR**

The hunt discriminator is sensitive to large errors in local oscillator frequency, while the phase discriminator (14) responds to small errors. The phase discriminator compares the fixed output of the reference oscillator (15) with the variable output of the limiter (10). When the two input signals are of unequal frequency (due to incorrect local oscillator frequency), the phase difference causes the phase discriminator to output a dc error voltage which is applied to the local oscillator to bias it into correct frequency operation.

1-16. CRS BALANCED MIXER A3200.



EL4GP413

The balanced mixer accepts inputs from the following two sources:

1. The local oscillator through high-pass Filter FL3002.
2. The harmonic generator.

Local oscillator signals are applied to the mixer through a buffer amplifier to prevent loading down the local oscillator. Twelve frequencies, 1 to 12 MHz, are applied to the mixer along with the local oscillator's output. The signals are heterodyned to produce four strong mixed output frequencies.

BALANCED MIXER OPERATING EXAMPLE

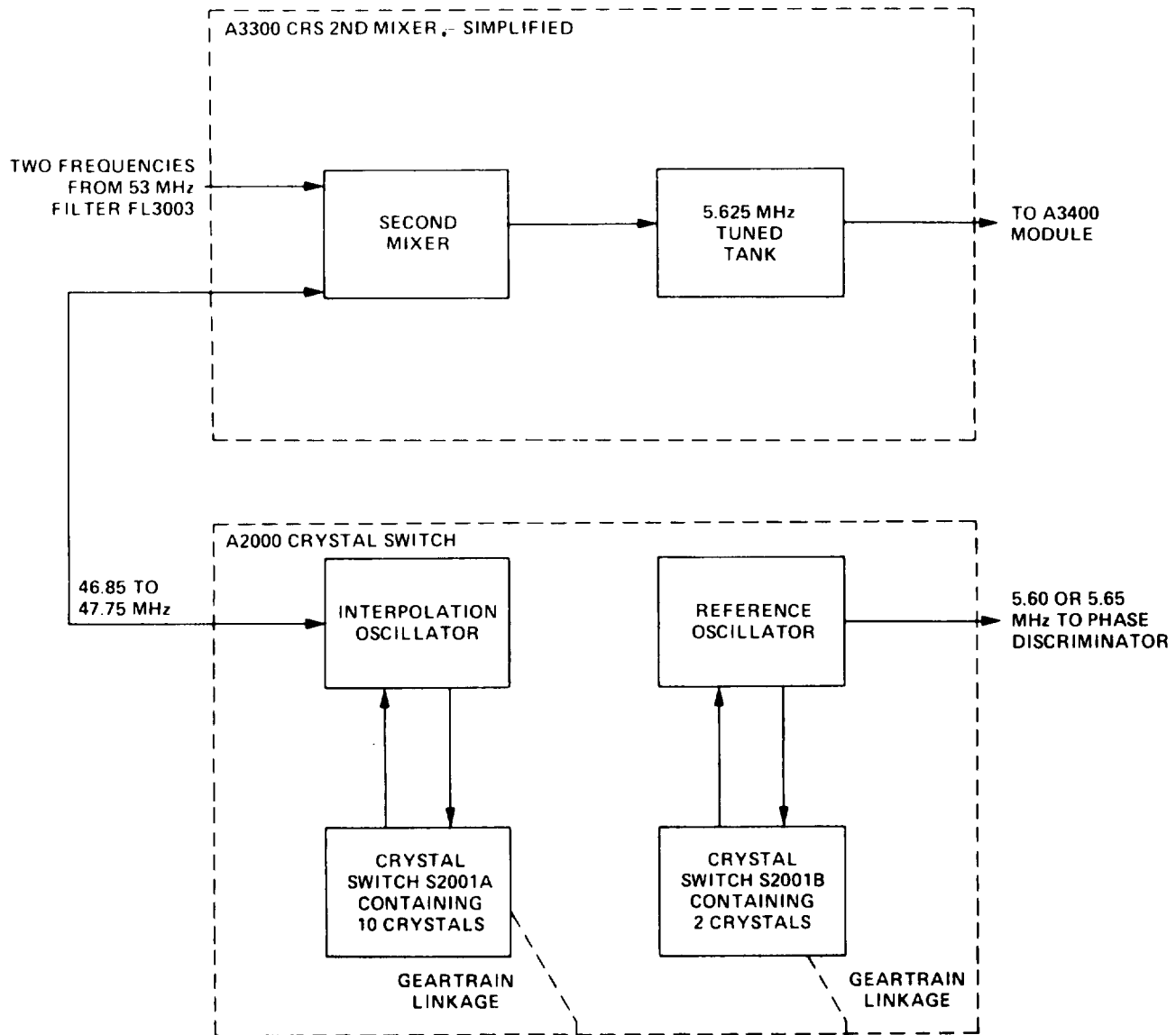
Assume that the radio is tuned to 30 MHz, in which case the local oscillator runs at 41.50 MHz. The 41.50-MHz frequency is mixed with 12 signals generated by the harmonic generator, producing mixed output containing each of the 12 harmonics, the local oscillator frequency, and sum and difference frequencies listed below.

LOCAL OSCILLATOR FREQUENCY	HARMONIC GERERATOR FREQUENCY	SUM	DIFFERENCE
41.50 MHz	1 MHz	42.50 MHz	40.50 MHz
41.50 MHz	2 MHz	43.50 MHz	39.50 MHz
41.50 MHz	3 MHz	44.50 MHz	38.50 MHz
41.50 MHz	4 MHz	45.50 MHz	37.50 MHz
41.50 MHz	5 MHz	46.50 MHz	36.50 MHz
41.50 MHz	6 MHz	47.50 MHz	35.50 MHz
41.50 MHz	7 MHz	48.50 MHz	34.50 MHz
41.50 MHz	8 MHz	49,50 MHz	33.50 MHz
41.50 MHz	9 MHz	50.50 MHz	32.50 MHz
41.50 MHz	10 MHz	51.50 MHz	31.50 MHz
41.50 MHz	11 MHz	52.50 MHz	30.50 MHz
41.50 MHz	12 MHz	53.50 MHz	29.50 MHz

1-16. CRS BALANCED MIXER A3200. (CONT)

Since the output of the balanced mixer is applied to a 53-MHz filter (FL3003), only two of the frequencies listed are close enough to the filter's band pass to reach the next CRS module without substantial attenuation. These two frequencies are 52.50 and 53.50 MHz, which are applied to the second mixer.

1-17. CRS SECOND MIXER A3300 AND CRYSTAL SWITCH A2000.



EL4GP414

**1-17. CRS SECOND MIXER A3300 AND CRYSTAL SWITCH A2000. (CONT)**

**SECOND MIXER**

The second mixer performs a signal heterodyning function, mixing the output of the 53-MHz filter with a frequency from the interpolation oscillator.

Within the mixer module is a tuned tank circuit which couples the mixer's output to the first and second i. f. Amplifiers A3400. The tank circuit is tuned to resonate at 5.625 MHz so that frequencies near 5.625 MHz are coupled, while frequencies below and above the tank's half-power points are severely attenuated.

**CRYSTAL SWITCH A2000**

The A2000 assembly contains two crystal-controlled oscillators, the interpolation oscillator and the reference oscillator. The reference oscillator is discussed in paragraph 1-15.

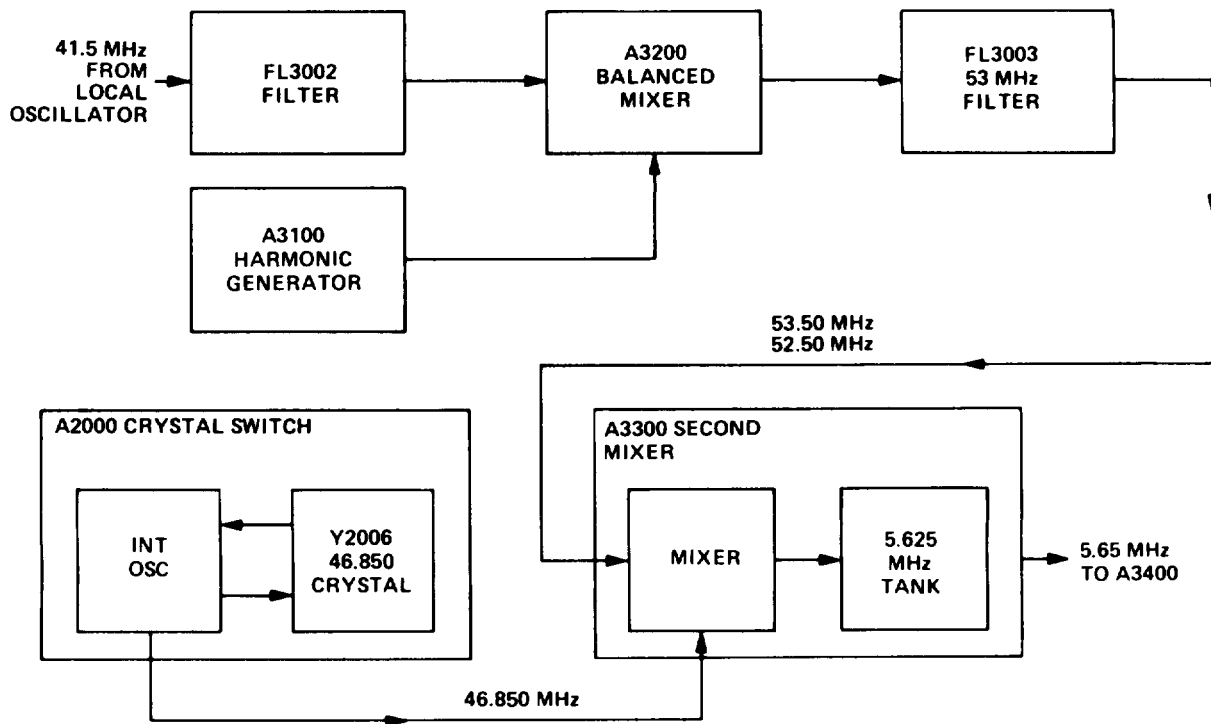
The interpolation oscillator's output frequency is controlled by one of 10 possible crystals which are selected by a switch through the action of the radio's gear train. Each crystal corresponds to two positions of the radio's KC control, out of the 20 possible 50-kHz increments that can be selected between whole-numbered frequencies. For example, in tuning from 30 to 31 MHz, the KC control selects frequencies of 30.05, 30.10, 30.15, 30.20, 30.25, etc. The first two steps (ie, 30.05 and 30.10) correspond to a particular crystal in the crystal switch. The next two steps (30.15 and 30.20) have a different corresponding crystal. This pattern repeats itself until all 10 crystals have been individually selected. When the MC-TUNE-KC control reaches 31.00 MHz, the same crystal is selected as was used for 30.00 MHz.

The following table lists the ten pairs of radio dial frequencies between each whole-number setting, the number of the corresponding crystal, and the interpolation oscillator's frequency when that particular crystal is selected.

RADIO DIAL KC FREQUENCY	CRYSTAL NUMBER	OSCILLATOR FREQUENCY
.05 or .10	Y 2007	46.950 MHz
.15 or .20	Y 2008	47.050 MHz
.25 or .30	Y 2009	47.150 MHz
.35 or .40	Y 2010	47.250 MHz
.45 or .50	Y 2005	47.350 MHz
.55 or .60	Y 2004	47.450 MHz
.65 or .70	Y 2003	47.550 MHz
.75 or .80	Y 2002	47.650 MHz
.85 or .90	Y 2001	47.750 MHz
.95 or .00	Y 2006	46.850 MHz

1-17. CRS SECOND MIXER A3300 AND CRYSTAL SWITCH A2000. (CONT)

SECOND MIXER AND CRYSTAL SWITCH OPERATING EXAMPLE



EL4GP415

Radio MC-TUNE-KC Control Set to 30.00 MHz

Two strong frequencies enter the second mixer from the 53-MHz filter, 53.50, and 52.50 MHz. These signals are heterodyned with the output from the interpolation oscillator.

With the radio tuned to 30 MHz, the Y2006 crystal is selected. This crystal sets the interpolation oscillator's output at 46.850 MHz. When 46.850 MHz is mixed with 53.50 and 52.50 MHz, several strong frequencies are produced. However, the difference frequencies are closest to the 5.625-MHz resonant frequency of the A3300 tank circuit.

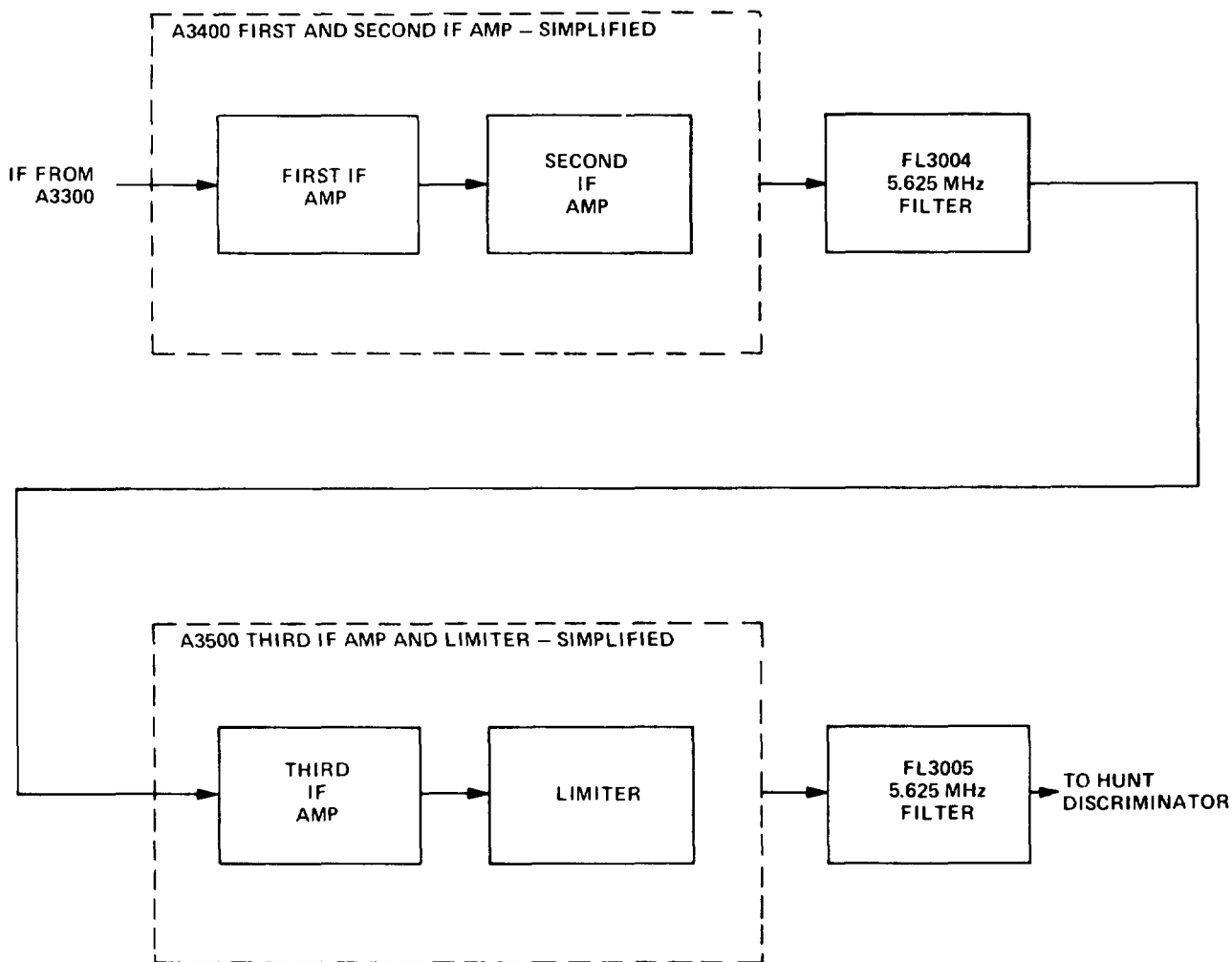
The two difference frequencies are produced as follows:

$$\begin{array}{r}
 53.500 \\
 -46.850 \\
 \hline
 6.650
 \end{array}
 \qquad
 \begin{array}{r}
 52.500 \\
 -46.850 \\
 \hline
 5.650
 \end{array}$$

Of the two difference frequencies, 5.650 MHz is coupled across the tank to the next module. The other frequency, 6.650, is beyond the tank's bandwidth and, therefore, is attenuated.

The example presented assumes that the local oscillator is running exactly at its correct frequency. In this case, exactly 5.65 MHz is passed by the second mixer's tank circuit. However, if the local oscillator is running above or below 41.5 MHz when the radio is tuned to 30.00 MHz, the heterodyning occurring in Mixer A3200 and in Second Mixer A3300 causes the second mixer to output a signal that differs from 5.65 MHz by the amount the local oscillator differs from 41.5 MHz. When the second mixer's output is not exactly 5.65 MHz, an error signal is generated to correct the local oscillator.

1-18. CRS FIRST AND SECOND I F AMP A3400/ CRS THIRD I F AMP AND LIMITER A3500.



EL4GP416

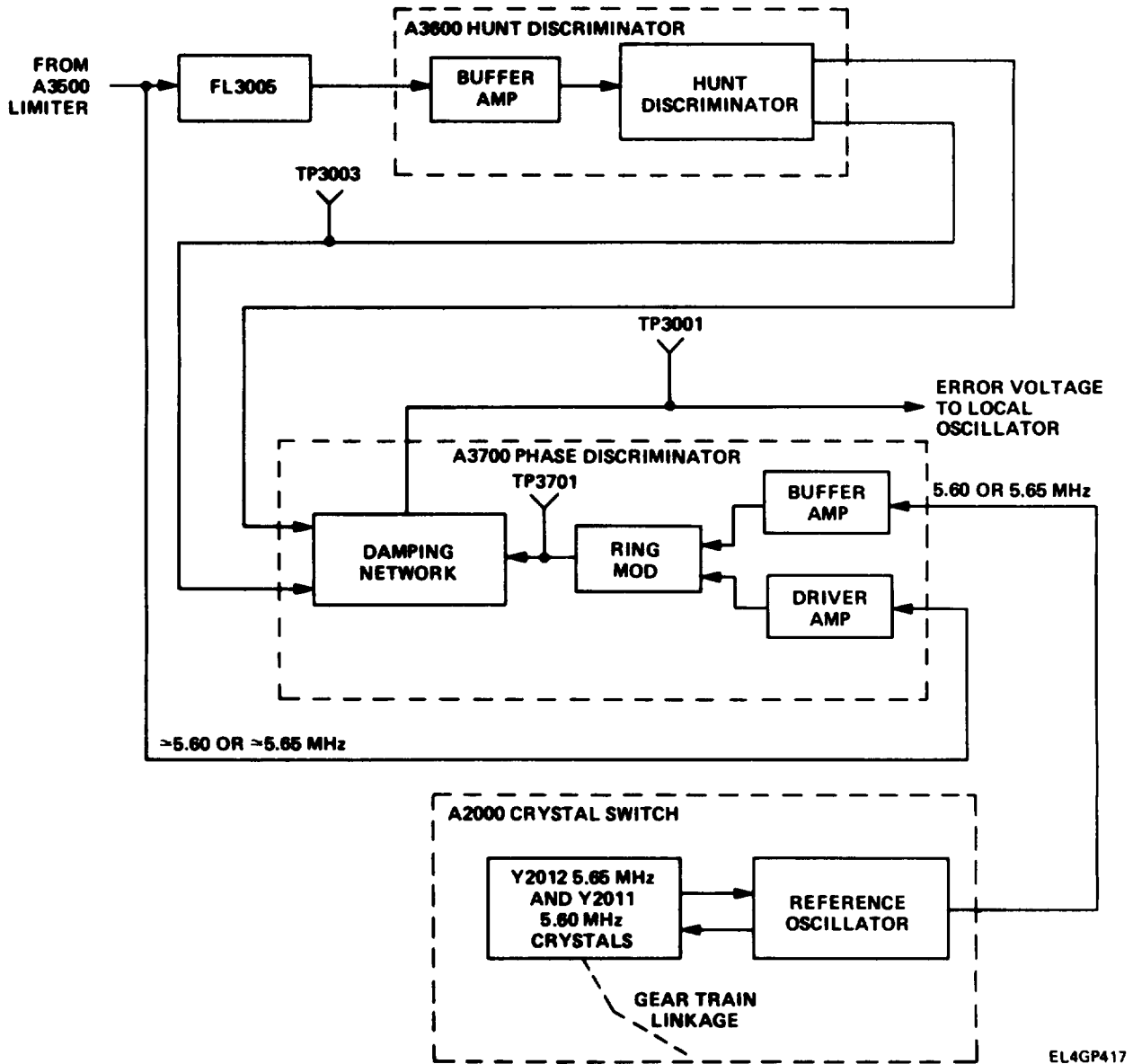
An intermediate frequency from the second mixer is applied to the first i f amplifier. The intermediate frequency is approximately 5.65 MHz for all front panel KC control settings which are even, such as 30.00,30.10,30.20, etc. An i f of approximately 5.60 MHz is applied to the first i f amplifier for all odd KC control settings, such as 30.05, 30.15, 30.25, etc. The i f inputs are given as approximations because they vary in response to the local oscillator's frequency error.

Further amplification is provided by the second i f amplifier after which the signal is passed through Filter FL3004. The filter's band pass is narrow, and, therefore, causes attenuation of any frequencies other than the i f which might pass through the A3400.

1-18. CRS FIRST AND SECOND I F AMP A3400/ CRS THIRD I F AMP AND LIMITER A3500. (CONT)

The third i f amplifier increases signal strength sufficiently to drive the limiter. The limiter clips the upper and lower peaks of the i f to maintain the constant amplitude required by the Travis-type discriminator in Hunt Discriminator A3600. Filter FL3005 provides additional attenuation of all signals other than the i f input.

1-19. CRS HUNT DISCRIMINATOR A3600, CRS PHASE DISCRIMINATOR A3700, AND REFERENCE OSCILLATOR A2000.



HUNT DISCRIMINATOR A3600

I f signals with a frequency of approximately 5.60 or 5.65 MHz are applied to Buffer Amplifier A3600, which prevents loading down the limiter. The buffer amplifier's output is then fed to the Travis-type hunt discriminator.



### 1-19. CRS HUNT DISCRIMINATOR A3600, CRS PHASE DISCRIMINATOR A3700, AND REFERENCE OSCILLATOR A2000. (CONT)

The hunt discriminator is tuned to a 5.625-MHz center frequency. Therefore, it will generate output signals when its i f input is substantially under or over 5.625 MHz which condition corresponds to a large local oscillator error.

The hunt discriminator generates two kinds of signals, one of which is applied to the local oscillator through the damping network to coarse tune the oscillator. When the local oscillator is far off frequency (eg, -250 kHz), as it could be when changing channels, the hunt discriminator outputs a negative dc voltage. This voltage can be measured at TP3003 with a dc voltmeter. When changing channels, the local oscillator could be off frequency by some positive number of cycles, in which case a positive voltage could be measured at TP3003. The plus or minus dc signal is applied to the local oscillator as an error voltage, which corrects the local oscillator's frequency. Therefore, the dc voltage at TP3003 is only momentary (ie, it disappears when the local oscillator approaches the correct frequency).

Besides the dc error voltage, the hunt discriminator outputs an ac signal riding on the dc level. This occurs because the local oscillator can drift around its steady state tuned frequency. The rate of drift produces an ac from the hunt discriminator at the oscillator's drift rate. However, this ac component is almost completely attenuated in the phase discriminator's damping network, and therefore has no effect on the local oscillator.

The hunt discriminator is capable of outputting an error signal as great as  $\pm 2.6$  vdc measured at TP3001 when a ground is applied to TP3701 (shorting the phase discriminator's output) and the local oscillator is running  $\pm 350$  kHz off frequency. The strong dc output from the hunt discriminator rapidly biases the local oscillator to within approximately 100 kHz of its correct frequency. Once the local oscillator is running  $\pm 100$  kHz from center frequency, the hunt discriminator is not sensitive enough to fine tune the oscillator further. At this point, the phase discriminator begins to take control.

#### PHASE DISCRIMINATOR

Phase Discriminator A3700 contains a ring modulator similar to that found in the transmitter Phase Discriminator A8200. It compares the phase of the signals from Buffer and Driver Amplifiers A3700, and outputs a dc error voltage when a phase difference exists. An ac component will ride the dc level due to oscillator drift, but the ac is attenuated in the damping network and, therefore, is not measurable at TP3001.

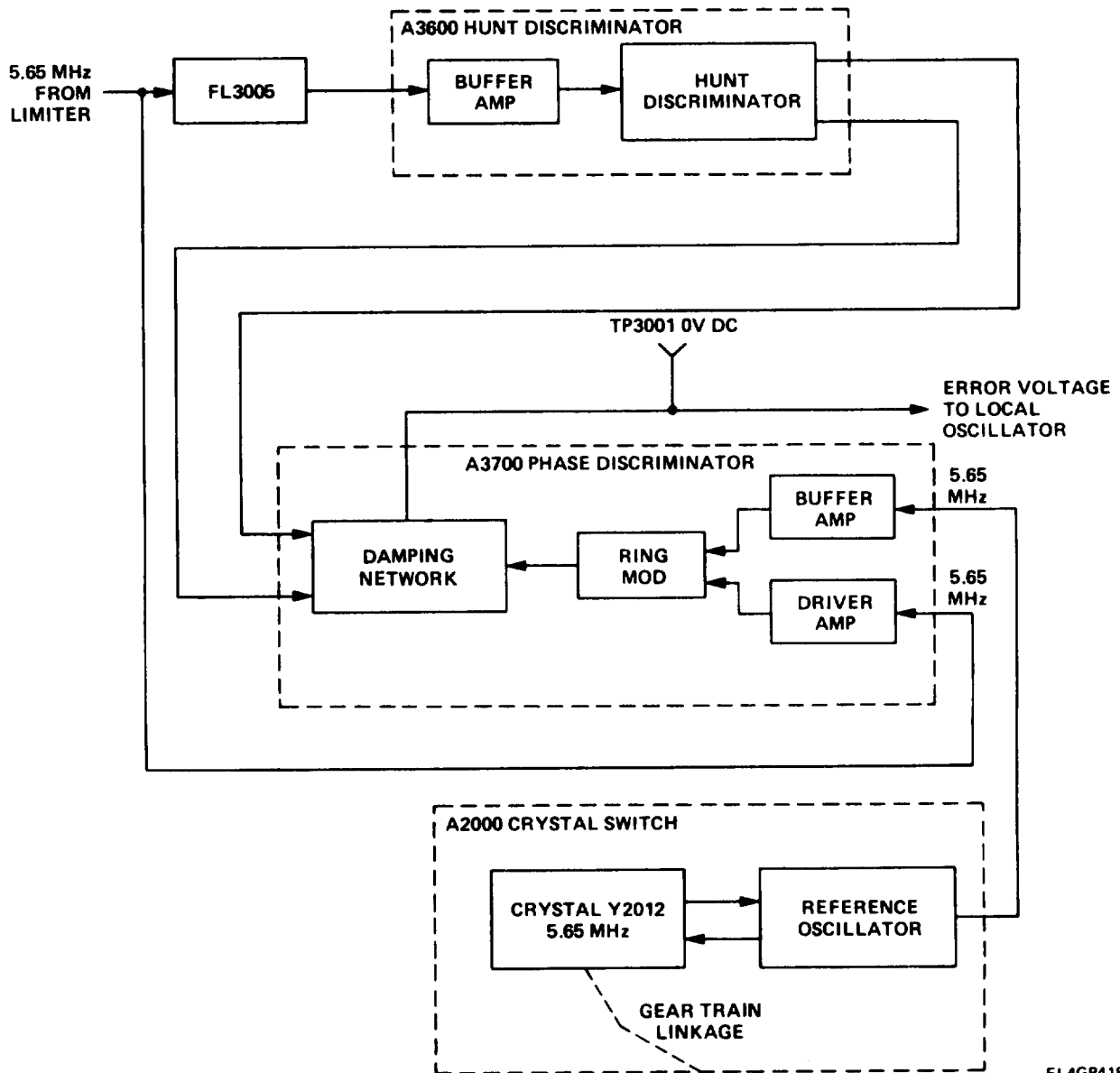
Once the hunt discriminator forces the local oscillator close to its correct frequency, the phase discriminator maintains a  $\pm 3.5$ -kHz oscillator tolerance. Because of its sensitivity to small errors in oscillator frequency, the phase discriminator performs a fine tuning function.

#### REFERENCE OSCILLATOR

Output of the reference oscillator is controlled by one of two crystals: a 5.60-MHz crystal and another at 5.65 MHz. The crystals are selected by a switch through the action of the radio's gear train. The switch contains contacts that correspond to the 20 possible 50-kHz increments that can be selected between whole-numbered frequencies. All frequencies whose KC digits end in zero utilize the 5.65-MHz crystal. For example, the rotary switch selects the 5.65-MHz crystal for 30.00, 30.10, 30.20, 30.30, MHz, etc. KC frequencies ending in five use the 5.60-MHz crystal (eg, 30.05, 30.15, 30.25 MHz, etc).

1-19. CRS HUNT DISCRIMINATOR A3600, CRS PHASE DISCRIMINATOR A3700, AND REFERENCE OSCILLATOR A2000. (CONT)

HUNT DISCRIMINATOR. PHASE DISCRIMINATOR; REFERENCE OSCILLATOR - WORKING EXAMPLE - LOCAL OSCILLATOR AT CORRECT FREQUENCY



EL4GP418

If the radio is set to 30.00 MHz, the local oscillator runs at 41.50 MHz, assuming that it is properly aligned. In this case, the output of the limiter is 5.65 MHz.

When 5.65 MHz is applied to the hunt discriminator through the buffer amplifier, no dc signal is fed from the hunt discriminator to the damping network. Therefore, no dc voltage will be present at TP3001 due to hunt discriminator action.

**1-19. CRS HUNT DISCRIMINATOR A3600, CRS PHASE DISCRIMINATOR A3700, AND REFERENCE OSCILLATOR A2000. (CONT)**

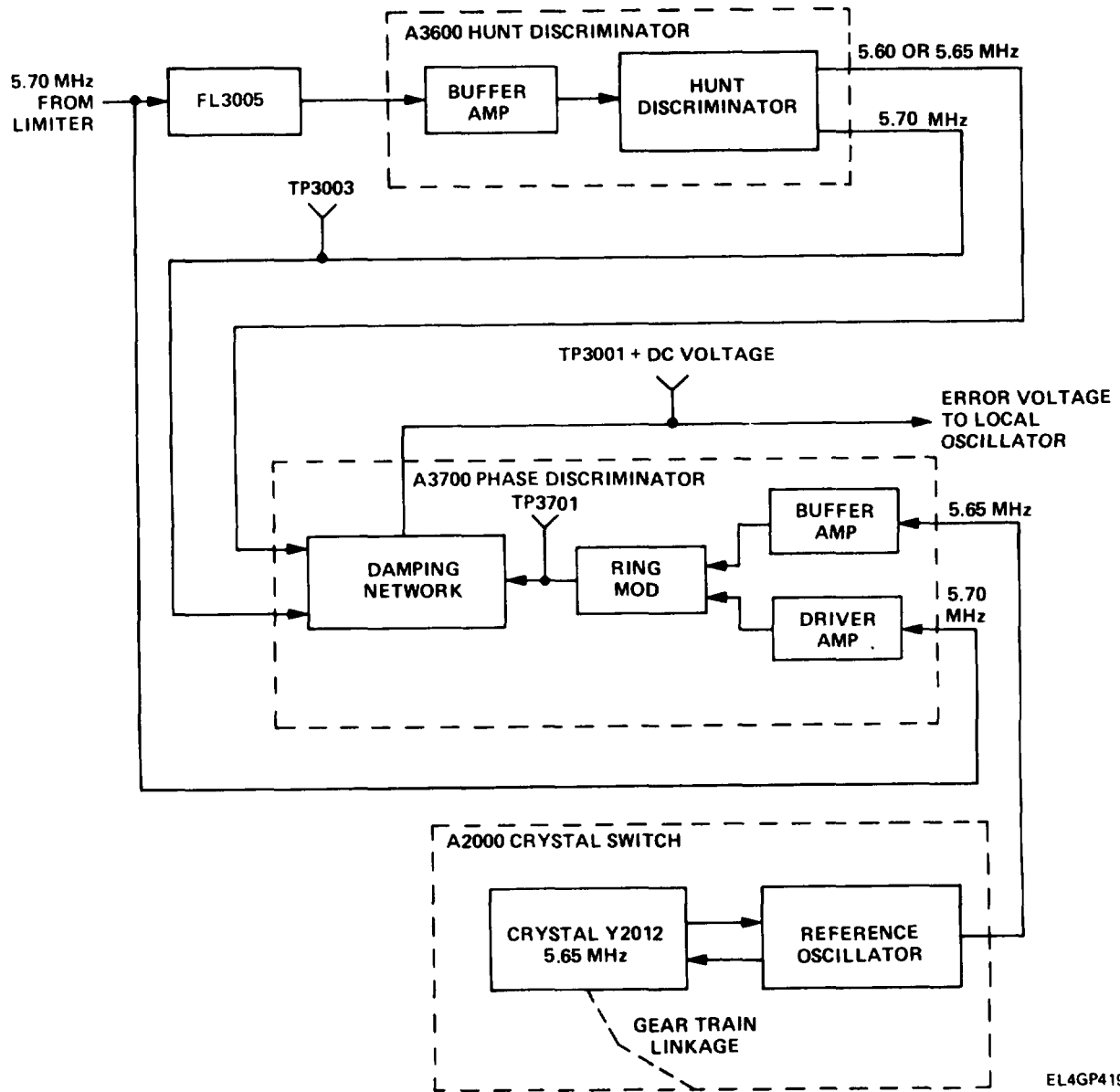
The same 5.65-MHz signal applied to the hunt discriminator is fed to the driver amplifier in the phase discriminator module. This frequency is compared with the output of the reference oscillator which is applied to Buffer Amplifier A3700.

With the radio set to 30.00 MHz, the 5.65-MHz crystal is selected, causing the reference oscillator to output a 5.65-MHz fixed frequency. Since the reference oscillator and limiter output frequencies are the same, the phase discriminator does not output a dc voltage to the damping network. Therefore, no dc voltage will be present at TP3001 due to phase discriminator action.

In actual operation even with the local oscillator almost perfectly aligned, a slight plus or minus dc voltage is present at TP3001. Its presence is due to normal imbalances in the hunt discriminator and phase discriminator circuits.

**1-19. CRS HUNT DISCRIMINATOR A3600, CRS PHASE DISCRIMINATOR A3700, AND REFERENCE OSCILLATOR A2000. (CONT)**

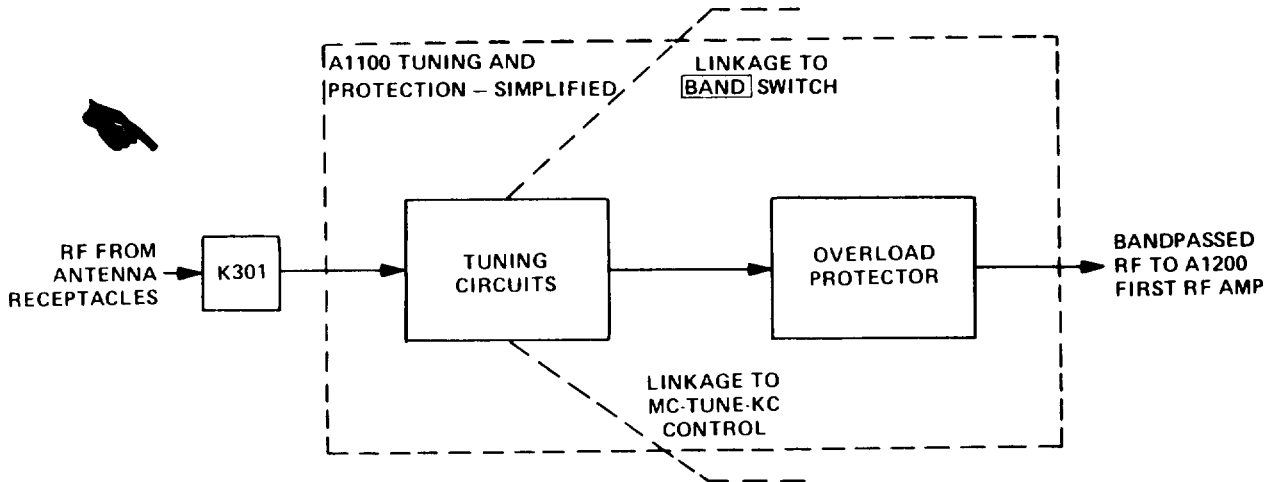
HUNT DISCRIMINATOR, PHASE DISCRIMINATOR; REFERENCE OSCILLATOR – WORKING EXAMPLE - LOCAL OSCILLATOR RUNNING TOO HIGH



Assume that the radio is set to 30.00 MHz and the local oscillator is misaligned, thereby causing it to operate at 41.550 MHz. The output of the limiter, 5.70 MHz, is 50 kHz higher than it would be if the oscillator were exactly on frequency.

The two signals entering the phase discriminator are 5.65 MHz from the reference oscillator and 5.70 MHz from Limiter A3500. Because of the difference in frequencies, the phase discriminator outputs a dc voltage. This positive dc voltage is measurable at TP3001.

1-20. ANTENNA TUNING AND PROTECTION MODULE A1100.



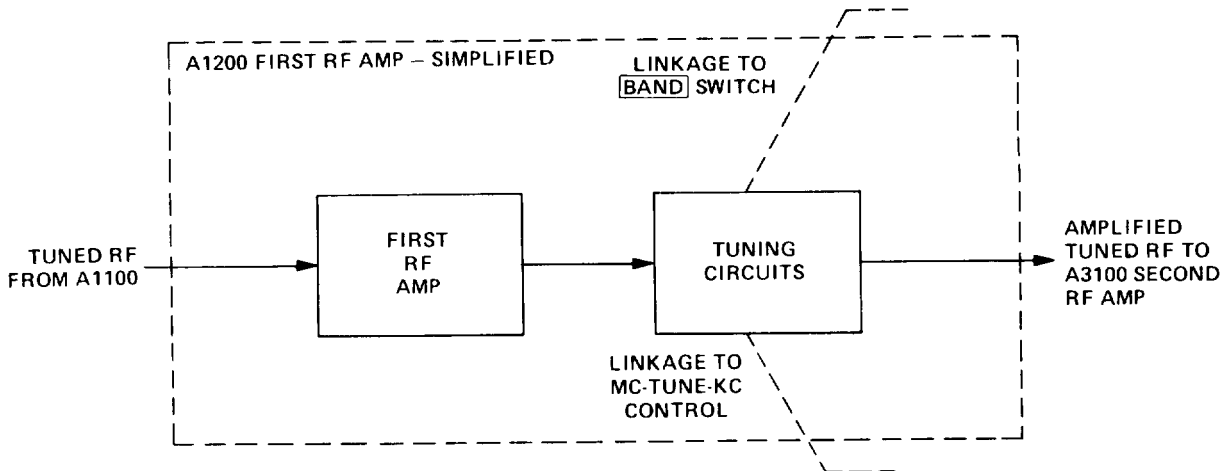
EL4GP420

Frequency-modulated rf signals from the antenna are fed through K301 to the A1100 tuning circuits which consist of tuned tank circuits. The resonant frequencies of the tank circuits are varied by altering the inductance when the MC-TUNE-KC control is rotated, and by changing their overall LC ratio when the band is changed from (A) to (B).

The band widths of the resonant tank circuits allow passage of signals of the selected frequency while unwanted frequencies are rejected.

The overload protector consists of a neon lamp which fires, shunting excess rf signal strength to ground. From the overload protector, the rf signals are applied to the tuning circuits in the first rf amplifier.

1-21. FIRST RF AMPLIFIER MODULE A1200.



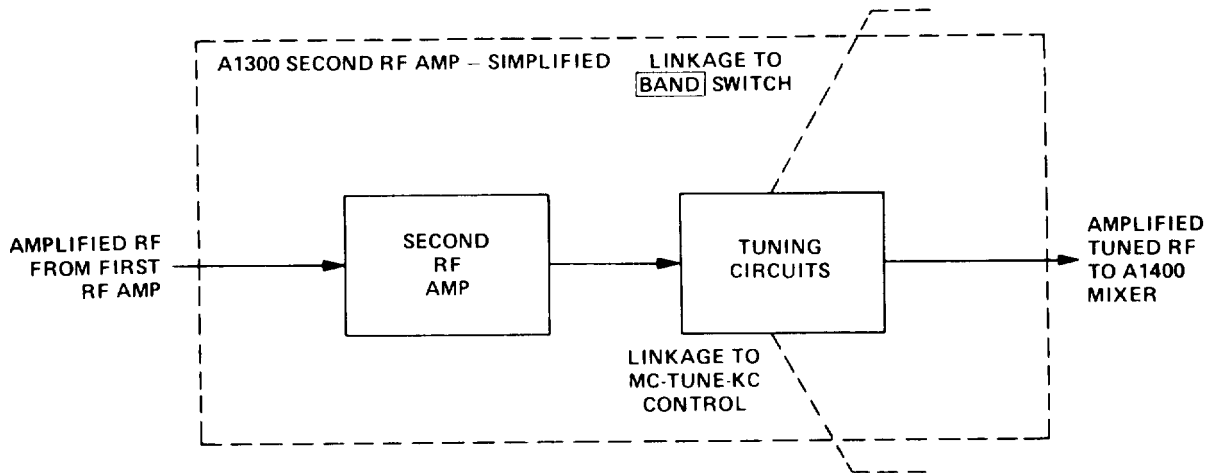
EL4GP421

Rf signals are voltage amplified by the first rf amplifier, which consists of Vacuum Tube V1201. Amplified signals are then fed to the tuning circuits which function similarly to those described in the previous paragraph.

**1-21. FIRST RF AMPLIFIER MODULE A1200. (CONT)**

The A1200 tuning circuits provide additional attenuation of unwanted frequencies by the action of their narrow band pass resonant tanks.

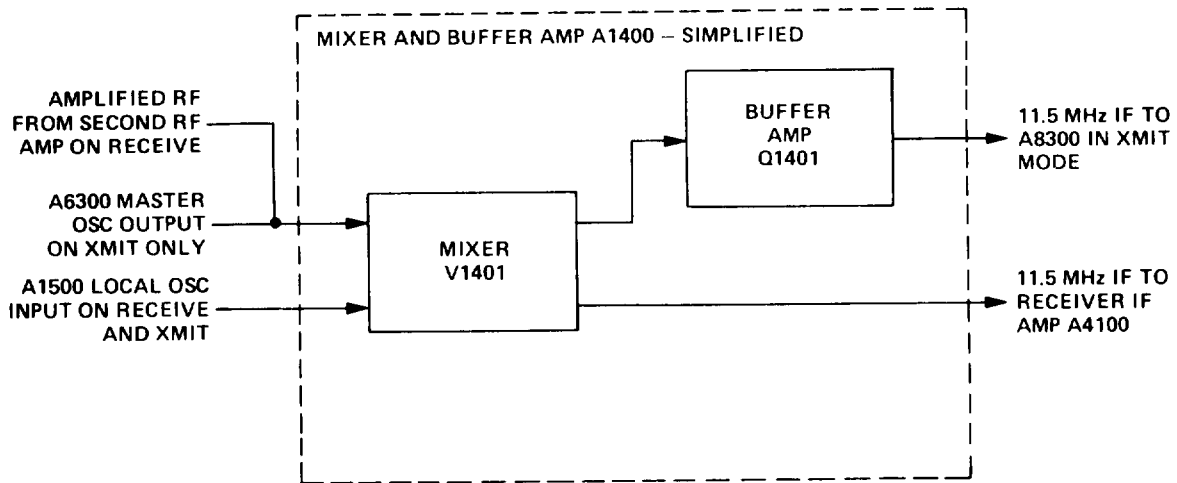
**1-22. SECOND RF AMPLIFIER MODULE A1300.**



EL4GP422

The signals from the first rf amplifier are further voltage amplified by the second rf amplifier. The tuning circuits function similarly to those in the A1200 module.

**1-23. MIXER AND BUFFER AMPLIFIER A1400.**



EL4GP423

**MIXER V1401**

Mixer V1401 is the last of three vacuum tubes in the receiver section of the RT. During receive operation it accepts the following inputs:

1. Amplified fm rf from the A1300 module.
2. Rf from the local oscillator 11.5 MHz above or 11.5 MHz below frequency of A1300 input.

**1-23. MIXER AND BUFFER AMPLIFIER A1400. (CONT)**

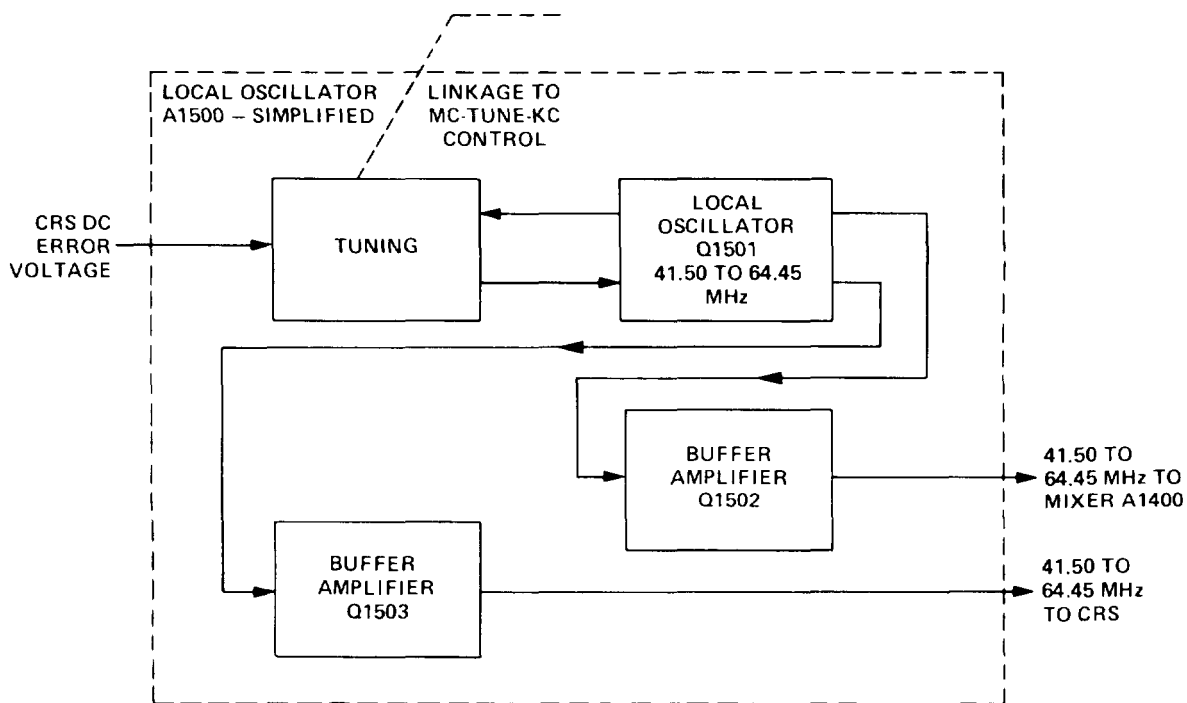
The signals applied to the mixer are heterodyned to produce four strong frequencies. One of these, the 11.5-MHz difference frequency, is applied to the receiver i f amplifiers. The 11.5-MHz difference frequency carries the audio intelligence, and is referred to as the i f (intermediate frequency).

**BUFFER AMPLIFIER Q1401**

The buffer amplifier in the A1400 assembly is a pnp transistor, which receives 16-vdc bias voltage only when the transmitter operates.

In the transmit mode, the mixer receives a sample of the master oscillator's output, heterodynes it with the local oscillator's output, and applies an i f to the buffer amplifier and from there to the transmitter A8300 module. The buffer amplifier matches the impedance of the oscillator to that of the A8300 input.

The buffer amplifier in the A1400 is used as part of the transmitter frequency control loop, which is explained in greater detail in paragraph 1-32.

**1-24. LOCAL OSCILLATOR A1500.**

EL4GP424

The Local Oscillator A1500 assembly contains the following items:

1. Tuning circuits
2. Local oscillator
3. Buffer Amplifier Q1502
4. Buffer Amplifier Q1503

**1-24. LOCAL OSCILLATOR A1500. (CONT)**

TUNING CIRCUITS

The tuning circuits control the frequency of the oscillator. They contain resonant tanks with a mechanical linkage from a variable inductor slug to the gear train linkage.

A feedback dc signal from the crystal reference system is applied to a varactor (variable capacitance diode) in the tuning circuits to alter the tank capacitance, thereby changing the resonant frequency and the operating frequency of the oscillator. The dc voltage from the CRS keeps the oscillator running to within  $\pm 3.5$  kHz of the frequency selected by the MC-TUNE-KC control.

LOCAL OSCILLATOR Q1501

Q1501 is a pnp transistor. The overall oscillator design is a modified colpitts configuration. Frequency tuning by the tuning circuits enables the oscillator to operate within a range 41.50 to 64.45 MHz.

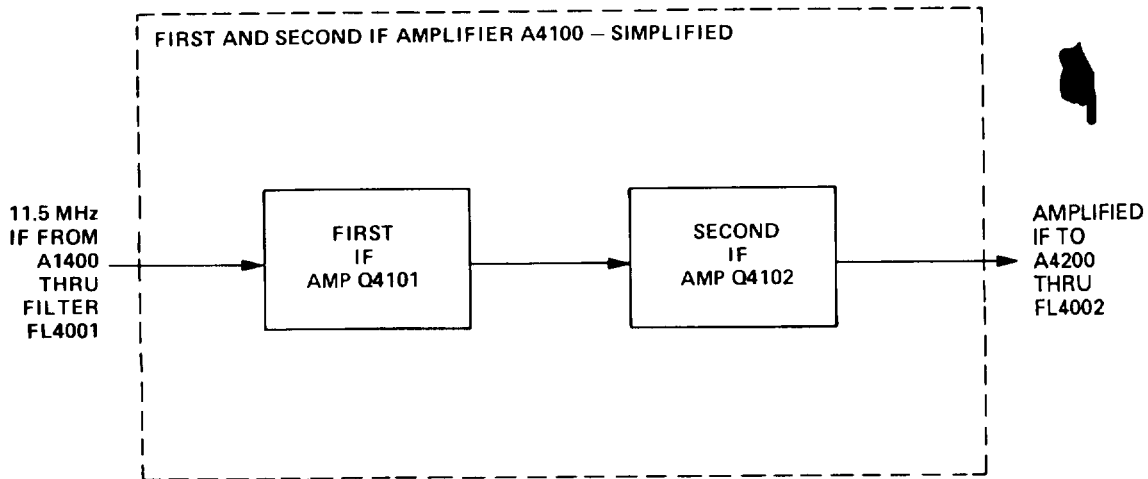
BUFFER AMPLIFIER Q1502

Q1502 impedance matches the oscillator's output to the input impedance of Mixer A1400.

BUFFER AMPLIFIER Q1503

Q1503 impedance matches the oscillator's output to the input impedance of the crystal reference system.

**1-25. FIRST AND SECOND I F AMPLIFIER A4100.**



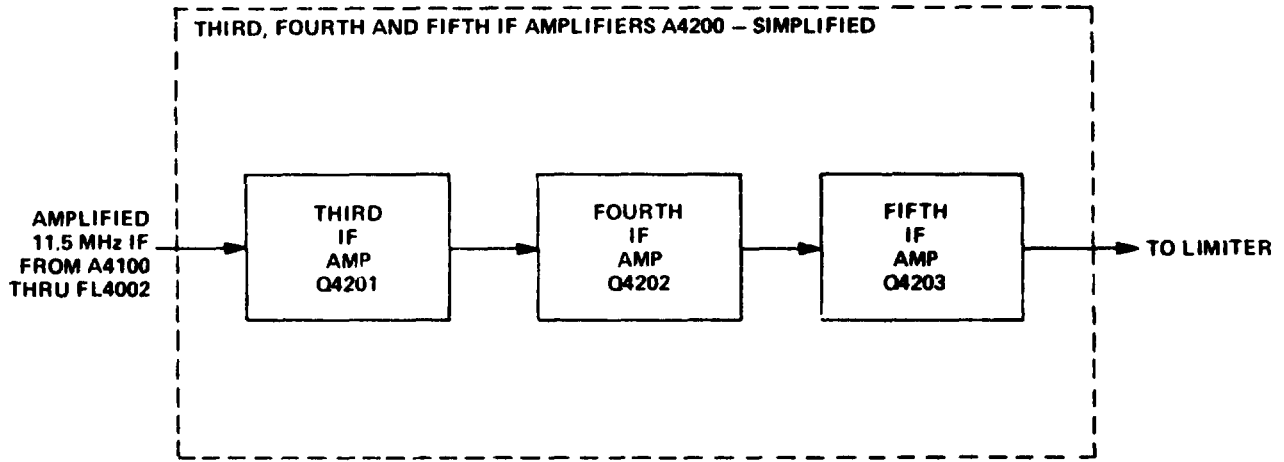
EL4GP425

The intermediate 11.5-MHz frequency carrying audio intelligence is applied to Amplifier Q4101 which performs the first stage of amplification. Second i f Amplifier Q4102 provides a second stage of amplification. Overall, the first and second i f amplifiers provide a gain of X100.



**1-26. THIRD, FOURTH, AND FIFTH, I F AMPLIFIER, LIMITER, AND DISCRIMINATOR  
A4200 - GERMANIUM TRANSISTOR VERSION.**

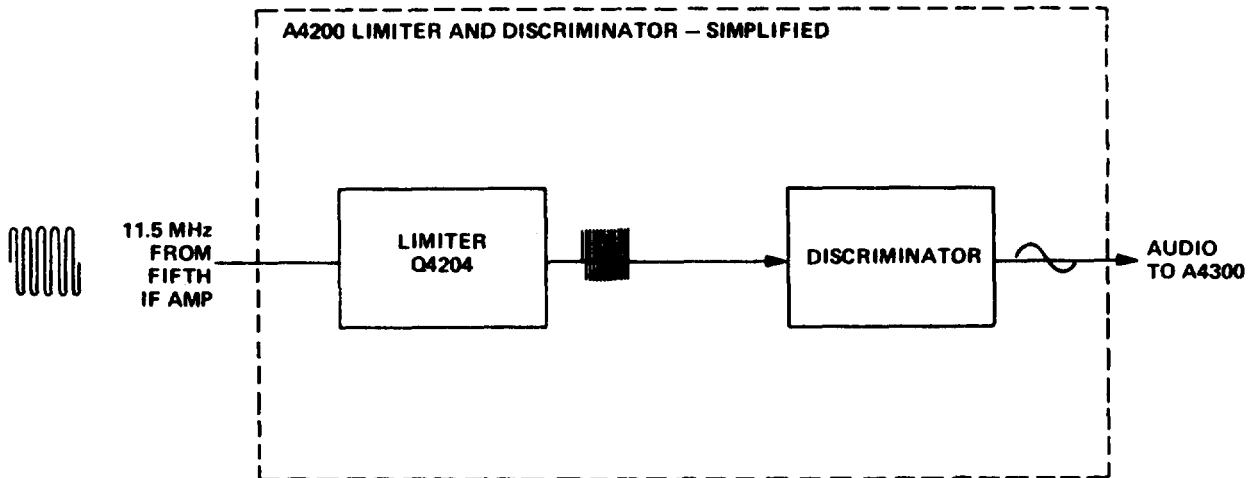
**THIRD, FOURTH, AND FIFTH I F AMPLIFIERS**



EL4GP426

The third, fourth, and fifth i f amplifiers provide the additional gain necessary to drive the limiter.

**LIMITER AND DISCRIMINATOR**

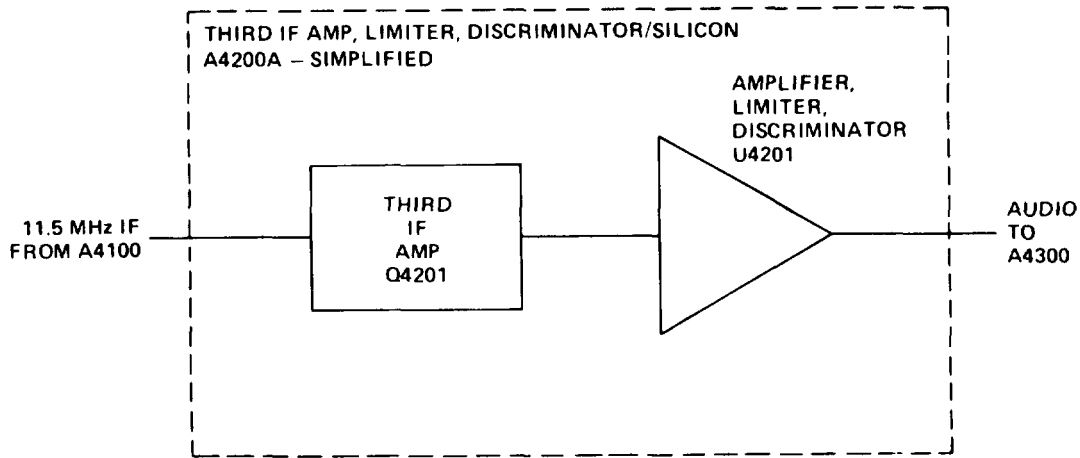


EL4GP427

The limiter receives i f input from the fifth i f amplifier. The upper and lower peaks of the i f waveform are clipped by the limiter to provide a constant amplitude signal to the discriminator.

The discriminator is a Travis-type containing upper and lower tuned resonant tanks. When properly aligned, the output is the modulating intelligence with no dc offset. Any residual i f is shunted to ground by an rf trap.

1-27. **THIRD I F AMPLIFIER, LIMITER AND DISCRIMINATOR A4200A - SILICON TRANSISTOR VERSION.**

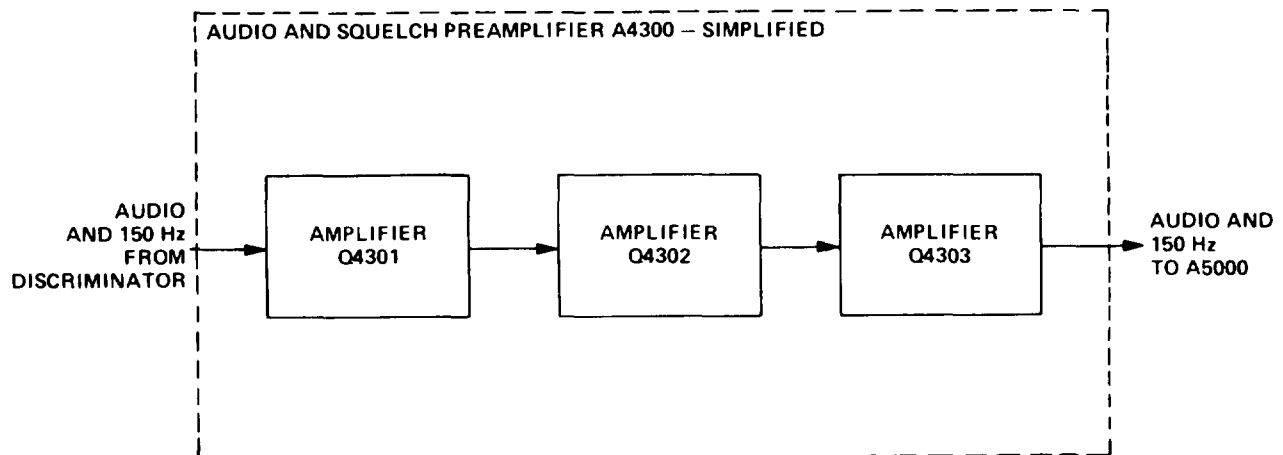


FL4GP428

Silicon Transistor Q4201 provides the third stage of amplification in the A4200A module. However, discrete fourth and fifth stages are not used as in the germanium A4200 version.

Integrated Circuit U4201 provides additional amplification, limiting and then detection of the audio intelligence. The discriminator consists of a quadrature coil detector which makes alignment easier than it is when a Travis-type discriminator is used.

1-28. **AUDIO AND SQUELCH PREAMPLIFIER A4300.**



EL4GP429

The discriminator in the A4200 demodulates both audio intelligence and the transmitted 150-Hz new squelch signals. The Audio and Squelch Preamplifier A4300 subjects both these frequencies to preliminary stages of amplification.

**1-29. AUDIO AMPLIFICATION/A5000.**

A block diagram showing a simplified layout of the A5000 tray is contained in FO-28. Refer to the foldout while reading the information in this paragraph.

**FILTER FL5001**

Audio signals from the preamplifier are applied to low-pass Filter FL5001, which filters noise components above 3000 Hz.

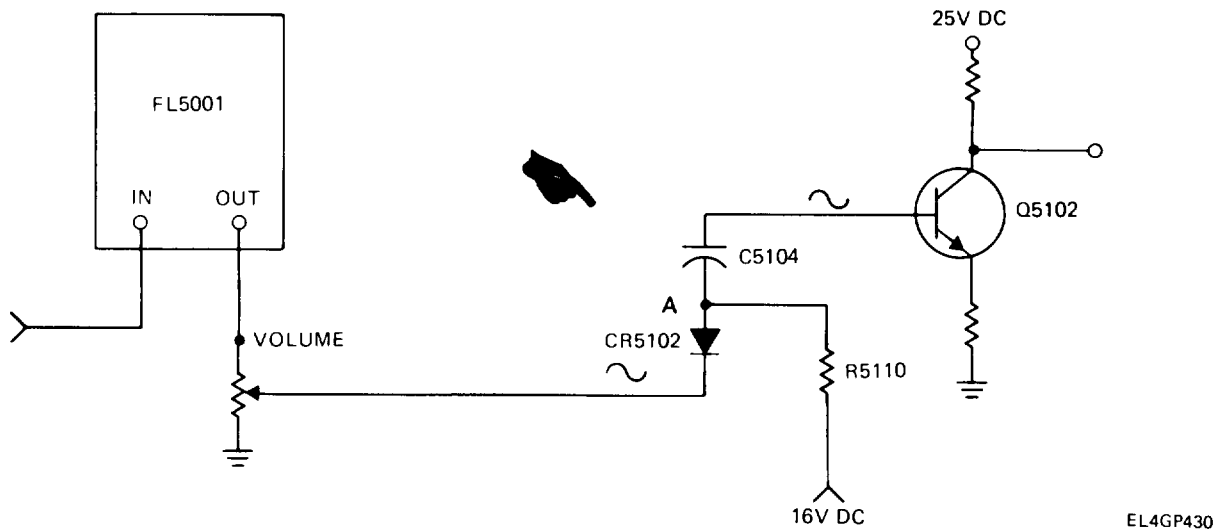
**MONITOR AMPLIFIER A5100**

Output from FL5001 is applied directly to the monitor amplifier. The monitor amplifier's output is a low-level audio signal of constant amplitude (under 1 vac) due to the absence of any volume control on its input.

**AUDIO AMPLIFIER A5100**

The audio amplifier receives its input through the volume control which attenuates signal amplitude to control the amplifier's gain. Amplified audio from the A5100 is then applied to the power amplifier.

A biasing voltage of 16 vdc must be applied to the audio amplifier for it to function. This can be seen in the following illustration, which shows a simplified version of the biasing circuit.



With no audio signals from Filter FL5001, 16 vdc flows through R5110, charges C5104, flows through CR5102, and through the volume control resistor to ground.

### 1-29. AUDIO AMPLIFICATION/A5000. (CONT)

When a positive going audio signal is applied to the cathode of CR5102, the reverse biasing causes the voltage at point A to increase due to reduced current flow through R5110 and CR5102. The voltage increase is coupled across C5104 and applied to the base of Q5102 for amplification.

When the audio signal swings negative, the voltage at point A drops due to the change in biasing at the CR5102 cathode and increased current flow through R5110 and CR5102. The voltage drop at point A is coupled across C5104 and applied to the base of Q5102 for amplification.

Transistor Q5102 receives 25 vdc as operating voltage; however, this is not the voltage which is switched by the squelch relay to turn the amplifier on and off. As shown in FO-28, 16 vdc is switched by the squelch relay. However, it is applied constantly when the SQUELCH switch is in either of the two OFF positions.

Referring back to the simplified version of the biasing circuit, it can be seen that the absence of 16 vdc removes the bias at point A and the anode of CR5102. Without the bias, positive going audio signals are clipped by the diode, and no signal is coupled across Capacitor C5104. Therefore, the amplifier cannot work.

#### POWER AMPLIFIER Q402

Q402 is a power transistor which is not mounted in the A5000 tray. A5100 amplified output is applied to the power amplifier prior to application of the signal to Transformer T5001.

#### TRANSFORMER T5001

The transformer performs an impedance matching function between the power amplifier and external audio accessories. One of its outputs, unmuted audio, is a volume-controlled signal to a set of external earphones.

#### MUTING RELAY K5001 AND MUTING RESISTOR R5117

The muting relay is an electromechanical switch which applies one of the transformer's audio outputs to the muting resistor or otherwise bypasses the resistor.

When the relay is not energized, audio signals bypass the resistor, resulting in full amplitude loud-speaker audio output. If the relay is energized by an external ground source, the audio signals are applied to the resistor, which provides attenuation and resultant speaker quieting.

Speaker quieting prevents acoustic feedback from the speaker into the microphone of a second transmitter located near the receiving RT. The muting relay ground is provided by the second transmitter when it is keyed.

### 1-30. RECEIVER SQUELCH FUNCTION.

A block diagram showing a simplified layout of the A5000 tray along with related squelch components is contained in FO-28. Refer to the foldout while reading the information in this paragraph.

#### OLD SQUELCH

The receiver is squelched when 16-vdc power to the audio amplifier is turned off. In the OLD SQUELCH position of the SQUELCH switch, 16-vdc power is available through the squelch relay only when rf signals of at least 0.5 microvolt are received.

**1-30. RECEIVER SQUELCH FUNCTION. (CONT)**

When no rf signals are received, the radio's components generate internal noise frequencies. The noise is quieted by rf reception. One of the most pronounced frequencies, 7.3 kHz, is used to switch the squelch relay through a series of actions involving the following components.

**SQUELCH Switch**

In the OLD ON position, the SQUELCH switch selects a special set of circuits that respond particularly to 7.3 kHz. The circuits are located in the Squelch Filter A5300,

**Squelch Filter**

The Squelch Filter contains circuitry to filter out 7.3 kHz signals. The 7.3-kHz noise is applied to the Squelch Amplifier A5200. A feedback loop applies the noise (many frequencies including 7.3 kHz) to the squelch filter. The squelch filter attenuates 7.3 kHz and feeds back all other frequencies degeneratively to the ac amplifier. Therefore, the ac amplifier responds well to 7.3 kHz, but degenerates sharply for any other frequencies.

The degenerative feedback is important to insure that the receiver remains squelched in response to the presence of 7.3-kHz internal noise, which is the best possible frequency of internal noise to indicate the absence of a valid rf input. Other noise frequencies can be present even when rf is received, in which case the radio would remain squelched if it were not for the selectivity of the squelch filter.

**Squelch Amplifiers**

The ac amplifier increases the signal amplitude of the 7.3-kHz sine wave. The sine wave is then rectified and applied to the OLD ON dc amp. Application of the rectified signal to the dc amplifier results in a ground path being opened at one of the amplifier's transistors. The ground path is the enable circuit for the squelch relay. With no ground path, the relay cannot energize.

**Squelch Relay**

When the relay's enable circuit is ungrounded at the OLD ON dc amp, the relay deenergizes, switching 16 vdc off. With no 16-vdc power available, no audio can be coupled to the amplifier; therefore, the radio is silent.

As soon as rf at 0.5 microvolt level or above is received, the 7.3-kHz noise disappears, a ground is created by the dc amplifier in the A5200, and the squelch relay energizes, applying 16 vdc to the audio amplifier.

**NEW SQUELCH**

In the NEW SQUELCH position of the SQUELCH switch, 16-vdc power to the audio amplifier is available through the squelch relay only when a 150-Hz new squelch tone is received along with the rf carrier. The 150-Hz tone is used to switch the squelch relay through a series of actions involving the following components.

**SQUELCH Switch**

In the NEW ON position, the SQUELCH switch selects a special set of circuits that respond particularly to 150 Hz. The circuits are located in Squelch Filter A5300.

### 1-30. RECEIVER SQUELCH FUNCTION. (CONT)

#### Squelch Filter

The squelch filter contains circuitry to filter out 150-Hz signals. These signals are applied to Squelch Amplifier A5200. A feedback loop applies the 150-Hz signals to the squelch filter. Since the 150-Hz signals come from Audio and Squelch Preamplifier A4300, audio frequencies and some noise are also applied to the squelch filter along with the 150-Hz tone.

However, the squelch filter attenuates 150-Hz signals and feeds back all other frequencies degeneratively to the ac amplifier. Therefore, the ac amplifier responds well to 150 Hz, but degenerates sharply for any other frequencies.

The degenerative feedback is important to insure that the receiver remains squelched until 150 Hz is received with the rf carrier. Without degenerative feedback, frequencies other than 150 Hz could unsquelch the radio.

#### Squelch Amplifiers

The ac amplifier increases the signal amplitude of the 150-Hz sine wave. The sine wave is then rectified and applied to the NEW ON dc amp. Application of the rectified signal to the dc amplifier results in a ground path being made available at one of the amplifier's transistors.

The ground path is the enable circuit for the squelch relay. When grounded, the relay energizes, providing 16-vdc power to the audio amplifier. Therefore, when a 150-Hz tone is received, the audio amplifier turns on, thus unsquelching the radio.

### 1-31. TRANSMITTING SIGNAL PATH.

A system block diagram showing transmitter signal flow can be found in FO-29 in the back of this manual. Refer to the foldout while reading the text in this paragraph.

Low amplitude voice signals are developed in the microphone (1), and then fed to the transmitter speech amplifier (2) which contains three amplifier stages. The amplified signals are next fed to the 11.5-MHz modulator (3).

The 11.5-MHz modulator includes an rf oscillator which is frequency-modulated by the voice signals from the speech amplifier. The rf output of the 11.5-MHz modulator is fed to the phase discriminator (4). The signals entering the phase discriminator no longer include discrete voice frequencies because these frequencies are riding on the 11.5-MHz rf carrier as the modulating intelligence.

The phase discriminator compares the precise 11.5-MHz output from the 11.5-MHz modulator with the rf output from the first and second i f amplifiers (5). The rf output from the first and second i f amplifiers can vary in frequency due to master oscillator drift, and, therefore, may not be at its ideal 11.5-MHz frequency. If the i f amplifiers are outputting other than 11.5 MHz, the phase discriminator outputs the following two signals:

1. A dc error voltage generated by comparison of the two rf signals. If the rf signals are of equal frequency, no error signal is generated.
2. Audio frequency voice signals demodulated from the 11.5-MHz rf carrier.

The phase discriminator contains circuitry which shorts the rf to ground; therefore, the 11.5-MHz carrier is not fed to the next stage.

**1-31. TRANSMITTING SIGNAL PATH. (CONT)**

The voice signals are next applied to the master oscillator (7) after first passing through the damping network (6). The voice signal's frequency modulates the master oscillator, which outputs an fm rf carrier to the buffer amplifier (8). The dc error voltage from the phase discriminator is also applied to the master oscillator, causing it to operate at the correct frequency.

The fm rf carrier is amplified by the driver (9), further amplified by the power amplifier (10), and then applied to coaxial relay K301 (11) mounted on the radio's front panel assembly. From the coaxial relay, the rf carrier is fed to the antenna matching network (12) which is located at the antenna base, and finally transmitted from the antenna.

**1-32. TRANSMITTER FREQUENCY CONTROL LOOP.**

In order for the radio transmitter to work properly, the fm output of the master oscillator must be within  $\pm 3.5$  kHz of the selected channel frequency. To prevent master oscillator frequency drift beyond these limits, a frequency control loop is built into the radio. Several electronic modules comprise the frequency control loop (automatic frequency control), all of which are shown in FO-30. These modules are as follows:

1. Master Oscillator A6300
2. Buffer Amplifier A6400
3. Receiver Mixer A1400
4. Receiver Local Oscillator A1500
5. First and second I f Amplifiers A8300
6. Phase Discriminator A8200
7. 11.5-MHz Modulator A8100
8. Receiver I f Amplifiers A4000
9. Hunt Generator A8400

Correction of master oscillator frequency drift is accomplished in two ways. Slight frequency drift is fine tuned to proper frequency by a dc correction voltage from the phase discriminator. Extreme frequency drift is coarse tuned to proper frequency by a sawtooth voltage from the hunt generator. Fine tuning and coarse tuning of the master oscillator are done as follows.

**FINE TUNING****Master Oscillator**

The master oscillator outputs rf signals at a frequency corresponding to the channel indicated by the radio's MC-TUNE-KC control. For this discussion, it is assumed that the channel selected is 30.00 MHz.

Due to master oscillator drift, its rf output is not precisely 30 MHz. This signal is applied to the receiver mixer through the buffer amplifier which prevents excessive loading of the master oscillator.

**Receiver Mixer**

The receiver mixer is used by both the receiver and the transmitter for the purpose of heterodyning rf signals. During transmission, the receiver mixer heterodynes the 30-MHz master oscillator output, which is not necessarily exactly 30 MHz, with the 41.5-MHz output from the receiver local oscillator. Sum and difference frequencies are generated by the mixer. The difference frequency, which approximates 11.5 MHz, is applied to the first and second i f amplifiers. Other frequencies are filtered.

## 1-32. TRANSMITTER FREQUENCY CONTROL LOOP. (CONT)

### Receiver Local Oscillator

The local oscillator performs an identical function during reception and transmission. During transmission, when the radio is set to 30.00 MHz, the local oscillator outputs a precise 41.5-MHz rf signal. Since the local oscillator is prevented from drifting by the crystal reference system, the oscillator's output is extremely accurate. The 41.5-MHz signal is applied to the receiver mixer and heterodyned with the master oscillator's 30-MHz signal to produce a signal which varies around 11.5 MHz.

### First and Second IF Amplifiers

These amplifiers increase the amplitude of the 11.5-MHz intermediate frequency to make the signal strong enough for processing by the phase discriminator.

### Phase Discriminator

The phase discriminator performs the following four functions:

1. Phase comparison
2. Correction voltage generation
3. Demodulation
4. Filtering

Two rf signals are applied to the phase discriminator for comparison. One is the 11.5-MHz signal from the first and second if amplifiers. This signal may not be exactly 11.5 MHz. The other input is an 11.5-MHz signal from the 11.5-MHz modulator. This signal contains the audio intelligence and is precisely controlled at 11.5 MHz by a crystal-controlled oscillator.

A difference in the frequencies of the rf signals applied to the phase discriminator causes it to generate a dc correction voltage which is applied to the master oscillator circuitry. The dc signal forces the master oscillator back to exactly 30 MHz. At that instant, the difference frequency produced by the receiver mixer becomes almost 11.5 MHz, and the phase discriminator no longer outputs a correction voltage.

In actual operating conditions, master oscillator drift causes a constant plus or minus dc correction signal to be generated by the phase discriminator.

The audio intelligence is demodulated by the phase discriminator and rides on the dc correction voltage. This audio signal is applied to the master oscillator to modulate its rf output.

The 11.5-MHz rf signals applied to the phase discriminator are shunted to ground by a series resonant rf trap circuit.

### 11.5-MHz Modulator

The 11.5-MHz modulator provides the fixed 11.5-MHz modulated input to the phase discriminator.

## COARSE TUNING

The coarse tuning process is initially identical to the fine tuning process and follows the same signal path up to the receiver mixer. However, at the receiver mixer, a different chain of events begins to occur.



## 1-32. TRANSMITTER FREQUENCY CONTROL LOOP. (CONT)

### Receiver Mixer

The heterodyned 11.5-MHz output of the receiver mixer is applied to the receiver i f amplifiers in parallel with the transmitter's first and second i f amplifiers.

### Receiver IF Amplifiers

The receiver i f amplifier module is used during reception and transmission. Two 11.5-MHz filters wired in series with the i f amplifiers attenuate rf signals other than 11.5 MHz. Therefore, the i f amplifiers produce the highest amplitude signal from an 11.5-MHz input. As the input varies above or below 11.5 MHz, the i f amplifier's output drops in amplitude.

When the master oscillator is running almost exactly on proper frequency, the receiver mixer's difference frequency is very close to 11.5 MHz. This signal, applied to the i f amplifiers, results in minimum attenuation by the filters and maximum amplifier gain. The high amplitude output of the receiver's fourth i f amplifier is applied in parallel to the hunt cutoff detector within the A4200 module.

The hunt cutoff detector is basically a diode clipper and a filter, which clips off the negative half of the rf sine wave, filters it, and outputs a constant positive dc level. This dc level is applied to the hunt generator where it biases off the sawtooth generator. Consequently, no sawtooth voltage is applied to the master oscillator.

When the master oscillator drifts off frequency, the receiver mixer's difference frequency moves further away from 11.5 MHz. Consequently, the i f series' filters attenuate the signal, causing reduced amplification by the receiver i f amplifiers. If the master oscillator is far enough off frequency ( $\pm 400$  kHz or more), the positive half of the rf sine wave clipped by the hunt cutoff detector is very low in amplitude, resulting in a reduced dc level applied to the hunt generator.

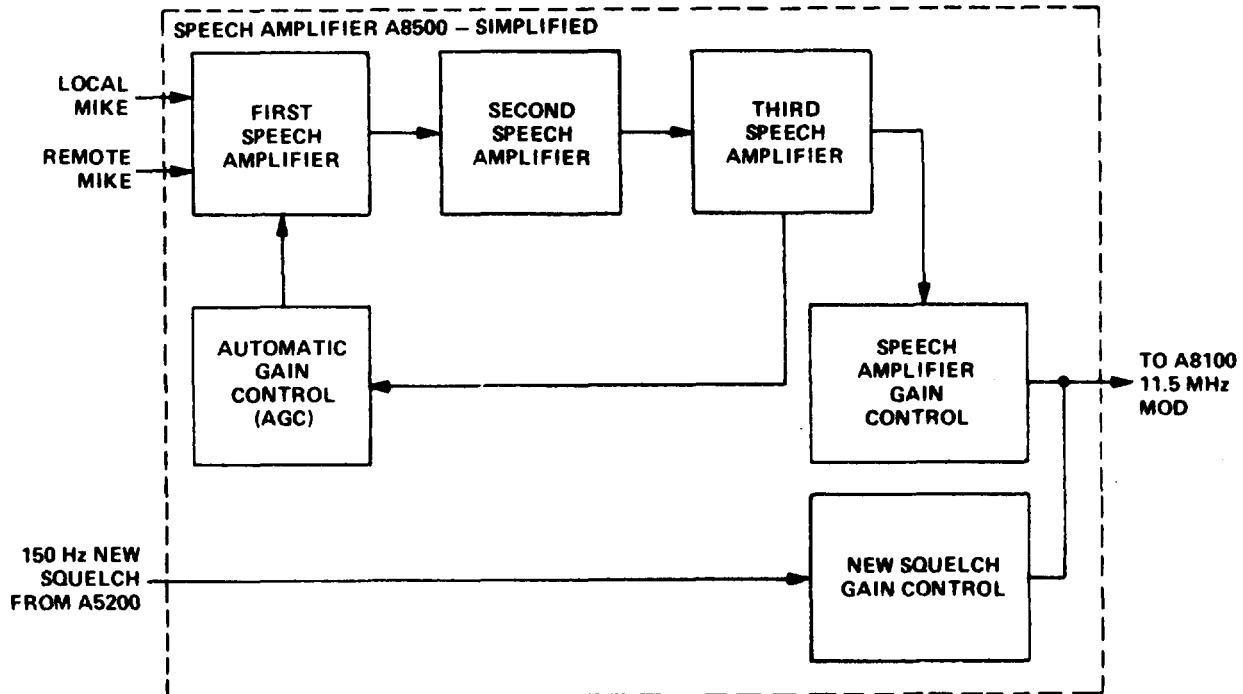
The reduced dc signal is not strong enough to bias the sawtooth generator off, so it begins to output a sawtooth voltage.

### Hunt Generator

The sawtooth generator in the hunt detector applies a sawtooth voltage to the master oscillator when its frequency varies from the mechanically selected frequency by more than  $\pm 400$  kHz. The sawtooth voltage brings the master oscillator close enough to the correct frequency for the phase discriminator to fine tune it.

Output from the hunt generator occurs primarily when channels are switched by the radio's MC-TUNE-KC control. Once the phase discriminator takes over master oscillator frequency control, the sawtooth generator is once again biased off.

**1-33. SPEECH AMPLIFIER A8500.**



EL4GP394

The Speech Amplifier A8500 module accepts the following three inputs:

1. Local microphone voice signals
2. Remote microphone voice signals
3. New squelch 150-Hz signal from the A5200 module

Both microphone inputs go through three stages of amplification. However, the new squelch tone is not amplified in the A8500 module. This signal is amplified by the A5200 module and gain-controlled in the A8500 module by an adjustable resistor. Once properly adjusted, the resistor will attenuate the 150-Hz signal sufficiently to allow it to deviate an otherwise unmodulated rf carrier 3.5 kHz.

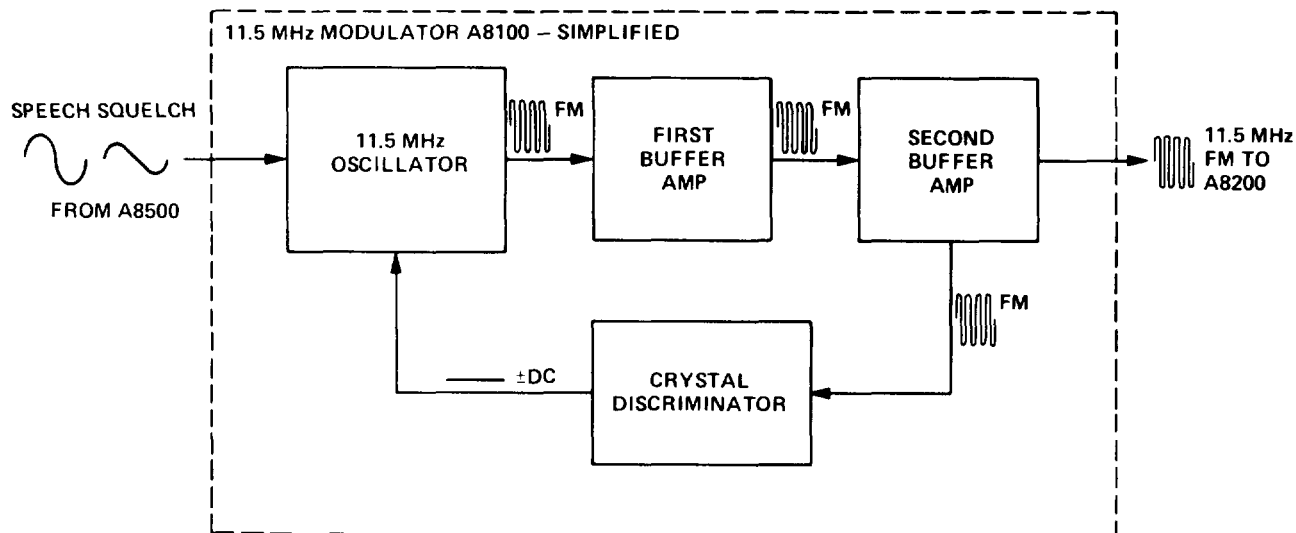
The speech amplifier gain control also is simply an adjustable resistor used to adjust the gain of the amplifier stages. It is set to cause a deviation of 8 kHz in a transmitted rf carrier when a 0.78-vac voice signal is applied to the first speech amplifier.

The automatic gain control function is discussed in paragraph 1-34.

**1-34. AUTOMATIC GAIN CONTROL (AGC).**

The AGC circuit uses feedback from the third speech amplifier to control the gain of the first speech amplifier. This insures fairly constant output signal voltage despite minor variations in input signal voltage. The overall effect is that of keeping voice loudness steady as heard at a distant receiver unit, even though the transmitter operator's voice may be changing in volume. The AGC circuits are not adjustable.

## 1-35. 11.5-MHZ MODULATOR A8100.



EL4GP395

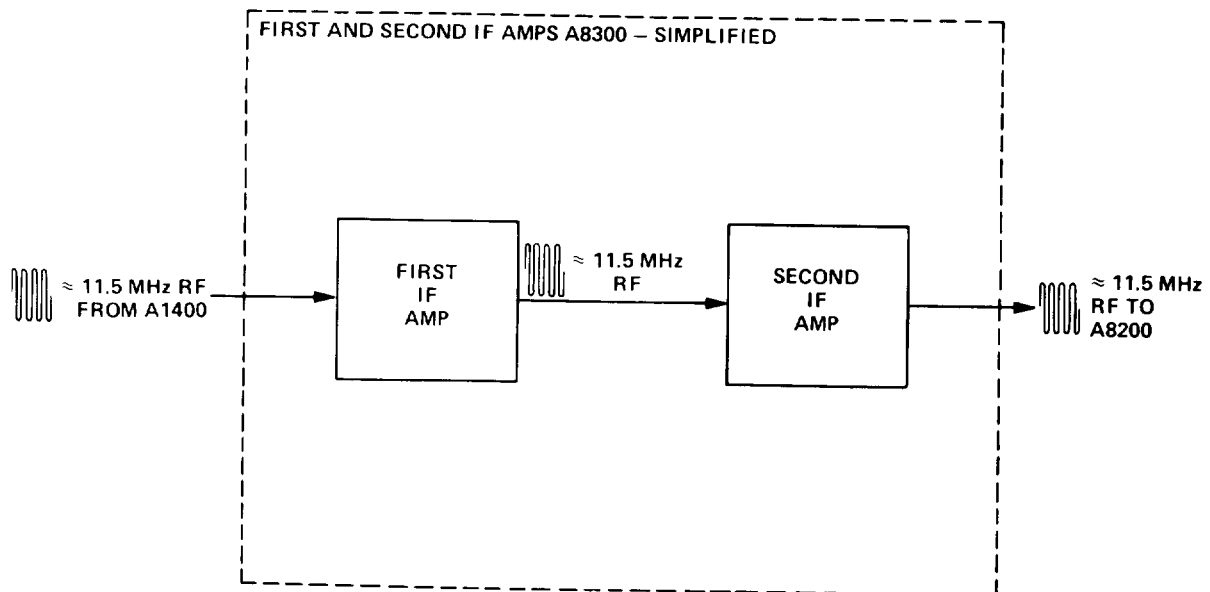
The 11.5-MHz Modulator A8100 establishes an 11.5-MHz fixed intermediate frequency for comparison in the phase discriminator. Voice frequencies and the 150-Hz new squelch signals from the speech amplifier are applied to the 11.5-MHz oscillator to frequency modulate its output.

The oscillator's fm output passes through two stages of amplification before being applied to Phase Discriminator A8200 for comparison with the output of the first and second i f amplifiers. The oscillator's output is also applied to the crystal discriminator.

The crystal discriminator provides automatic frequency control of the 11.5-MHz oscillator. Within the crystal discriminator is a crystal-controlled tank circuit tuned to 11.525 MHz. When the 11.5-MHz oscillator drifts off frequency, the crystal discriminator senses the frequency error and outputs a dc correction voltage which forces the oscillator back on frequency.

Without the dc feedback, the oscillator has a frequency tolerance of  $\pm 3.5$  kHz. The crystal discriminator narrows the tolerance to  $\pm 150$  Hz. This accuracy is particularly important for error-free data transmission. (Consequently, correct alignment of the A8100 module is critical.)

1-36. FIRST AND SECOND I F AMPLIFIERS A8300.

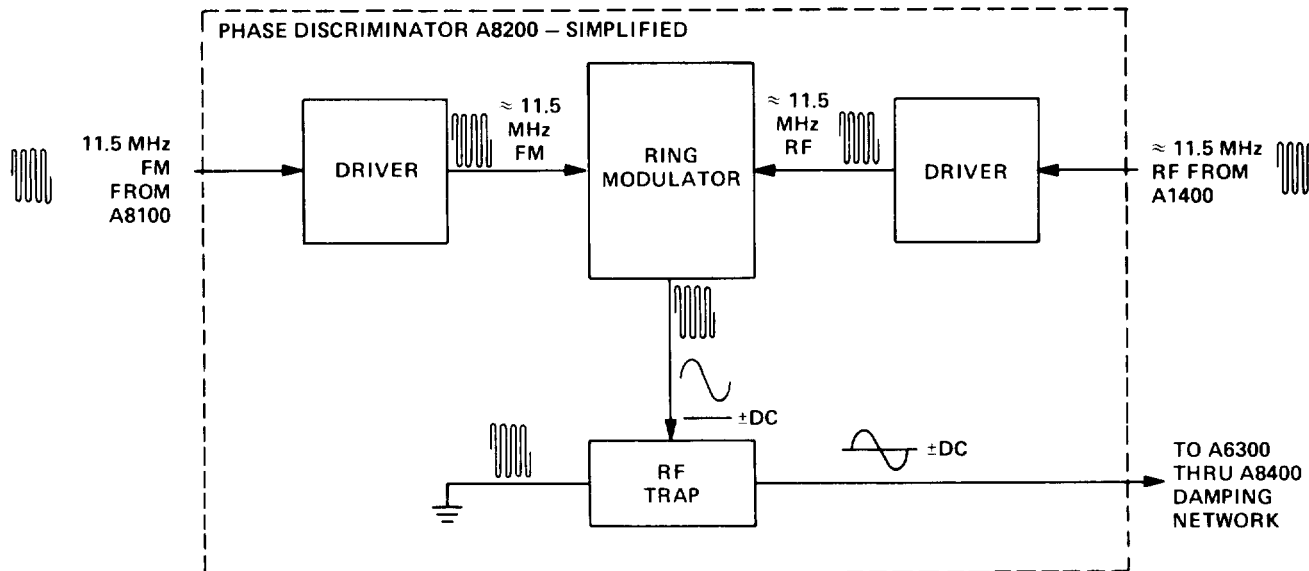


EL4GP396

First and second i f Amplifier A6300 module receives inputs from the receiver Mixer A1400. The incoming signals have a frequency of approximately 11.5 MHz with no modulation (with no audio and the squelch switch in the OLD ON position). If the squelch switch is not at OLD ON, the 11.5 MHz frequency would be modulated.

These 11.5-MHz signals are amplified twice to a +6-dbm level, and then applied to Phase Discriminator A8200.

1-37. PHASE DISCRIMINATOR A8200.



EL4GP397

A block diagram showing the subassemblies of the phase discriminator is contained in this paragraph. For details of its operation, see paragraph 1-32.

1-38. MASTER OSCILLATOR A6300.

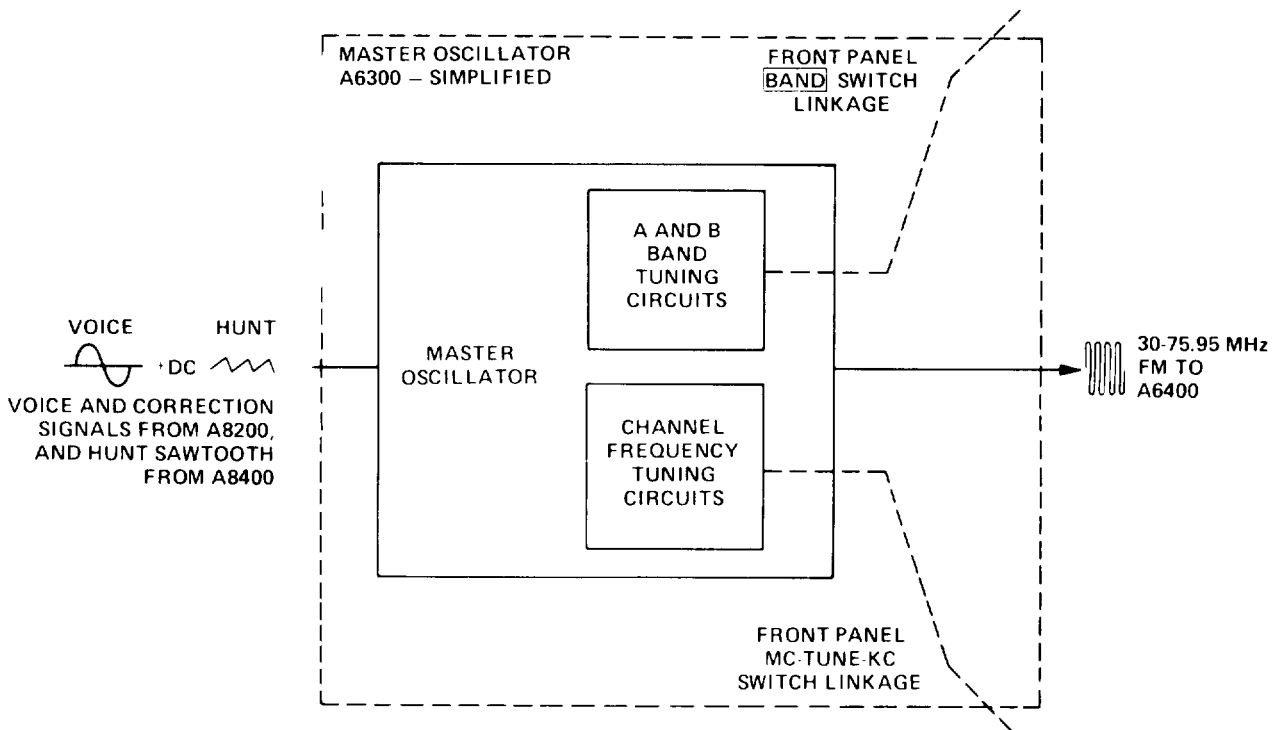
Master Oscillator A6300 accepts the following four input signals from Phase Discriminator A8200:

1. Voice frequency ac
2. Dc correction voltage
3. 150-Hz new squelch ac when transmitting in all squelch modes (except OLD ON).
4. Hunt sawtooth voltage

**1-38. MASTER OSCILLATOR A6300. (CONT)**

The voice and new squelch signals frequency modulate the output of the master oscillator. When the master oscillator frequency drifts slightly, the phase discriminator outputs a dc correction voltage which biases the master oscillator back to the correct frequency. The hunt sawtooth voltage is generated by the A8400 module to coarse tune the master oscillator when it is running substantially off frequency. Normally, no sawtooth voltage is present at the A6300 input except during a change of channel.

The BAND switch linkage mechanically selects (A) or (B) band tuned resonant tank circuits. The MC-TUNE-KC switch linkage mechanically tunes a variable inductor to change the resonant frequency of the tank circuits, thus producing a range of rf output from 30.00 to 75.95 MHz. Frequency-modulated rf output is applied to Buffer Amplifier A6400.



EL4GP398

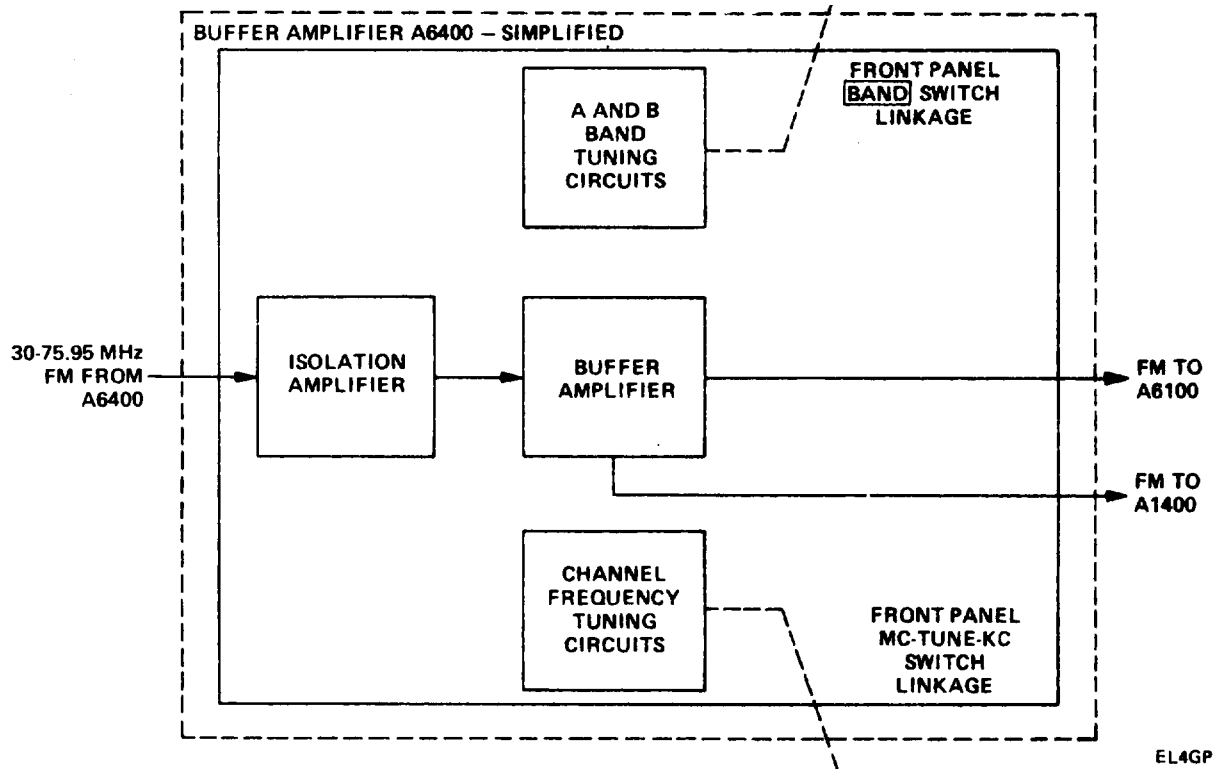
**1-39. BUFFER AMPLIFIER A6400.**

Buffer Amplifier A6400 accepts 30.00-to 75.95-MHz fm inputs from the master oscillator. Within the buffer amplifier module are two separate amplifier stages: the isolation amplifier and the buffer amplifier.

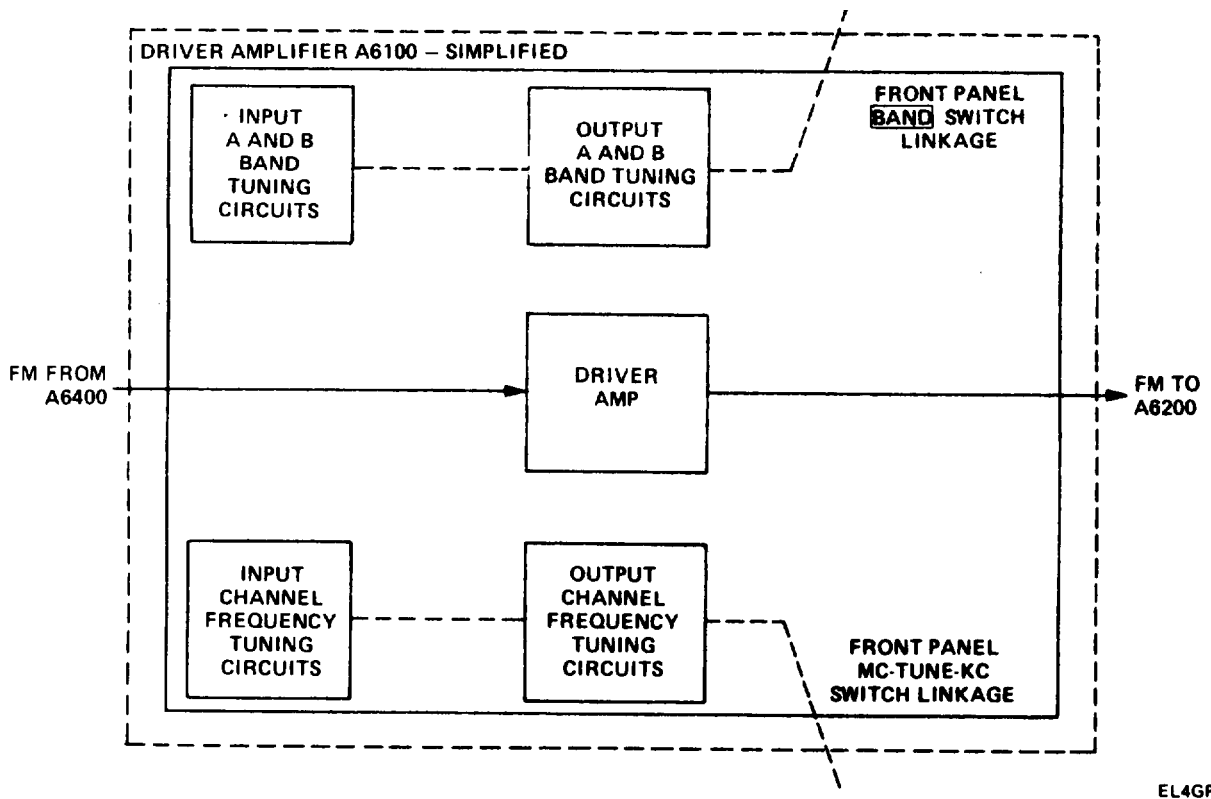
The buffer amplifier outputs amplified fm signals to Driver Amplifier A6100 for further amplification, and to the A1400 as part of the master oscillator frequency control loop.

The mechanically tuned circuits function identical to those contained in the master oscillator module.

1-39. BUFFER AMPLIFIER A6400. (CONT)



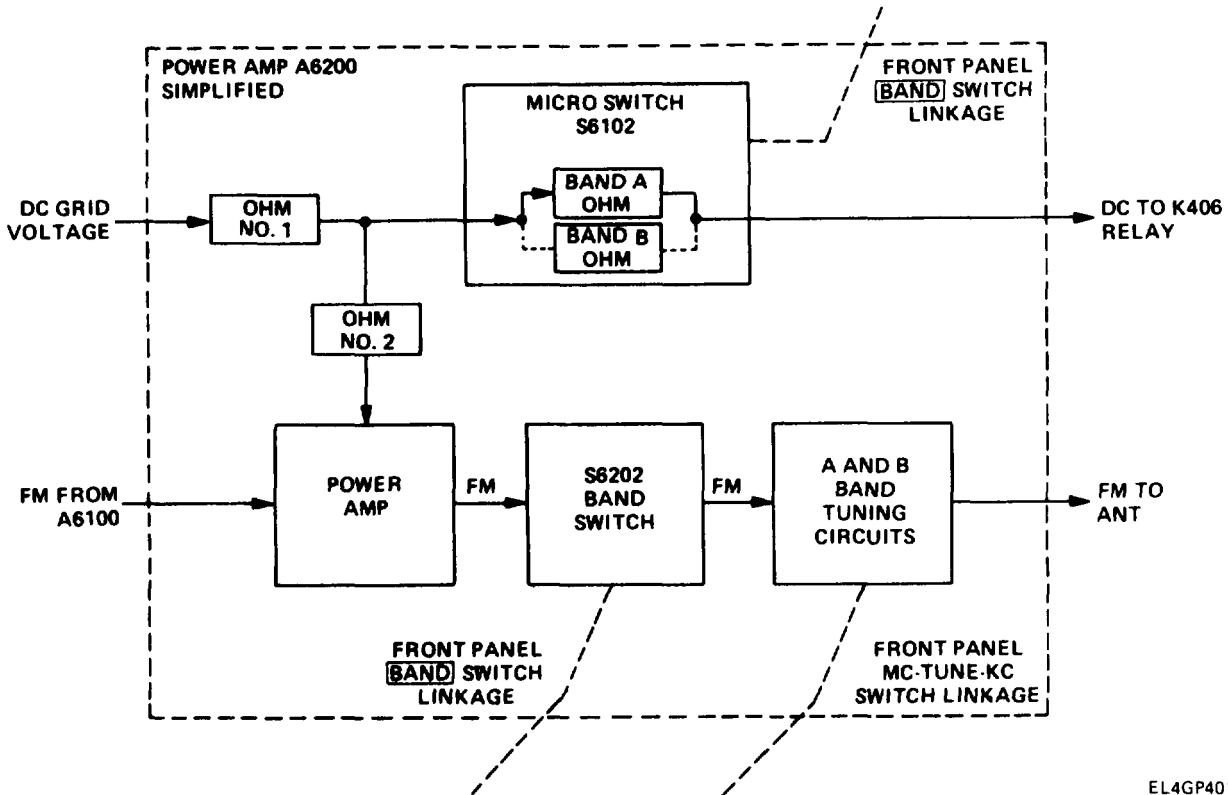
1-40. DRIVER AMPLIFIER A6100.



1-40. DRIVER AMPLIFIER A6100. (CONT)

Fm signals from the buffer amplifier are fed to Driver Amplifier A6100 for additional amplification prior to final amplification by Power Amplifier A6200. The mechanically tuned circuits function similar to those contained in the master oscillator.

1-41. POWER AMPLIFIER A6200.



EL4GP401

Fm signals from the driver amplifier are applied to Power Amplifier A6200 where they are amplified by the power amplifier tube V6201. The fm signals are then fed to the mechanically controlled BAND switch S6202, which applies the signals to either the **(A)** or the **(B)** band tuned antenna coupling circuits. The coupling circuits are mechanically tuned by the action of the front panel MC-TUNE-KC switch.

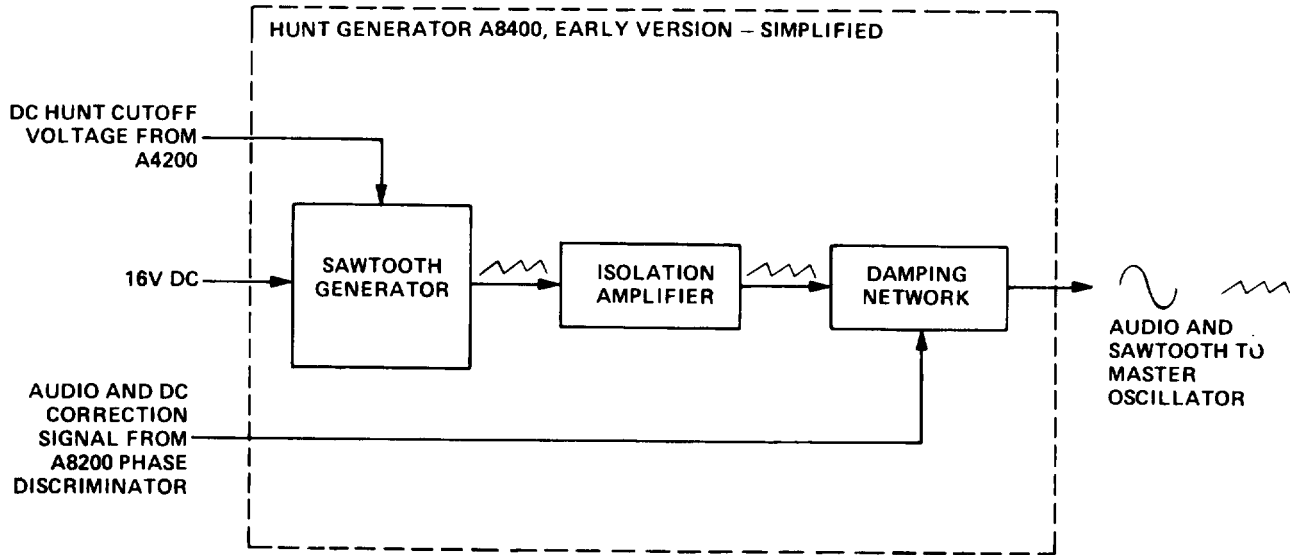
Power tube dc grid voltage is applied to the microswitch S6102 which, depending on its mechanically controlled position, selects a different voltage-dropping resistor in parallel with resistor no. 1

A or B band operation. The voltage-dropping resistors permit two different power levels available at the tube during LOW power operation to adjust for slightly different power requirements in each band. Only one power level is available at the grid during HIGH power operation.

In HIGH power operation, the band **(A)** and band **(B)** voltage-dropping resistors are not operational in the circuit. During LOW power operation, relay K406 introduces a ground in the dc circuit, thus adding resistance in parallel with resistor no. 1. In HIGH power, the circuit is open, causing the band resistors to be inoperative, thus making more power available to the grid for greater amplification.



1-42. HUNT GENERATOR A8400, EARLY VERSION.



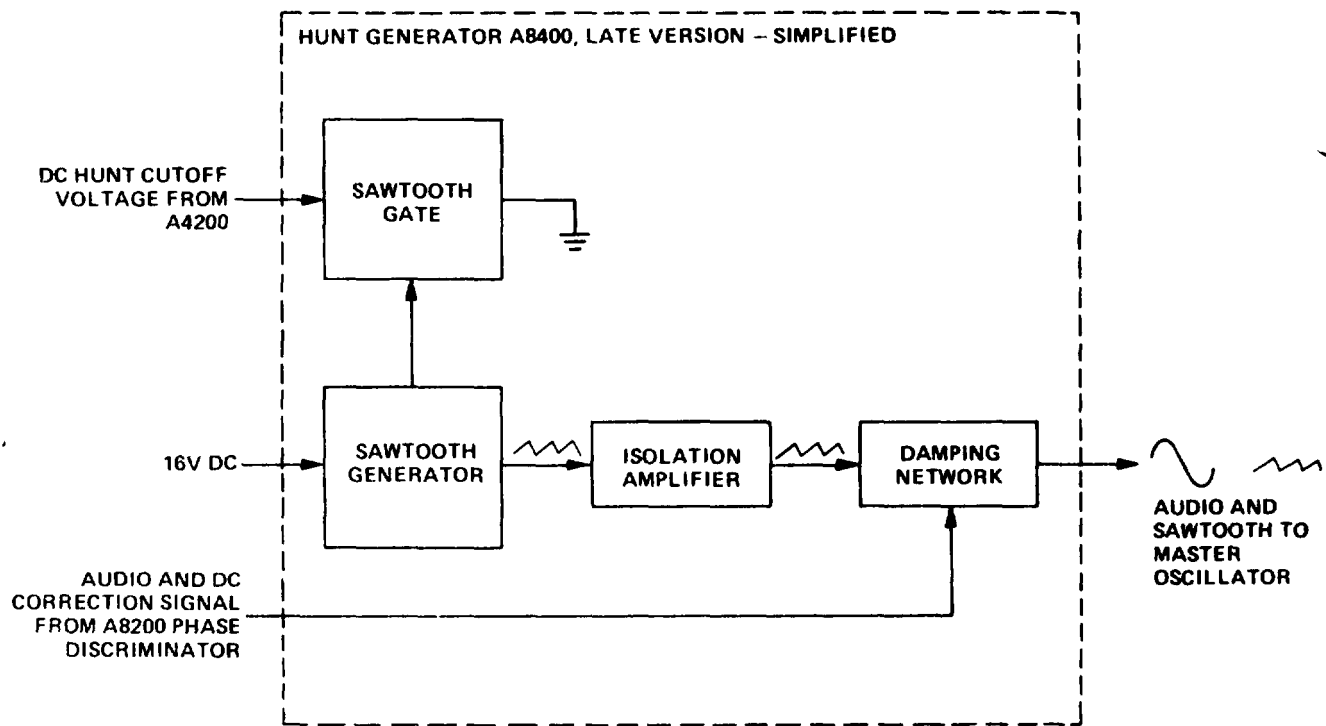
EL4GP402

The manner in which the hunt generator controls master oscillator frequency drift is discussed in paragraph 1-32. The following information covers operation of its subassemblies.

When the master oscillator drifts off frequency, dc hunt cutoff voltage drops and allows the sawtooth generator to start running. Sawtooth voltage is applied to the isolation amplifier which isolates the sawtooth generator from the phase discriminator.

The sawtooth voltage passes through the damping network along with signals from the phase discriminator. Output from the damping network is applied to the master oscillator.

1-43. HUNT GENERATOR A8400, LATE VERSION.



EL4GP40

The late version of the hunt generator works the same as the early version with the exception of the sawtooth gate. The sawtooth gate is an npn transistor biased into conduction by the presence of the dc hunt cutoff voltage.

When the sawtooth gate transistor is conducting, it provides a ground path for the sawtooth generator's output. When the hunt cutoff voltage is eliminated, the gate transistor shuts off, and the sawtooth generator is no longer grounded, thus allowing its output to reach the isolation amplifier.

1-44. SERVOSYSTEM, RT-248(\*)/VRC.

A servosystem block diagram showing signal flow can be found in FO-31 at the back of this manual. Refer to the foldout while reading the text in this paragraph.

GENERAL OPERATION

The servosystem permits automatic retuning of the RT-248(\*)/VRC. Any 10 of the 920 available channels can be preselected by a simple adjustment and then quickly tuned when a pushbutton is pressed. The following information covers the operation of pushbutton no. 1, which is typical of all pushbuttons in the system.

**1-44. SERVOSYSTEM, RT-246(\*)/VRC. (CONT)**

The servomotor continues to turn a few additional degrees in the direction it was going; the total amount depending on the level of attenuation provided by R304. If R304 is incorrectly adjusted, the control-phase winding signal will be too strong, causing too much additional servomotor rotation, imbalance of the bridge circuit due to R303 wiper movement, and a resultant condition called "hunting". Hunting refers to a chattering in the gear train caused by the servosystem attempting to balance the bridge circuit when the overshoot signal is not sufficiently attenuated. Overshoot is also partly affected by the action of the null switch which is explained in greater detail under Overall System Operation in the following subparagraph.

**OVERALL SYSTEM OPERATION**

The following information covers the operation of the servosystem when the no. 1 channel pushbutton is pressed. Refer to FO-31 to follow signal flow through various system components.

With the front panel BAND switch in the AUTO position, 25.5 vdc is applied to relay K9002 and pushbutton no. 1. The 25.5-vdc output from pushbutton no. 1 turns on K7102 which then supplies power to S7103. S7103 activates the band switch motor which mechanically sets the radio's tuning components to band (A) or (B) as selected by the S7103 switch.

As K7102 turns on, it sends 25.5 vdc to the null switch, causing it to ground out internally. The null switch then provides a ground for the K9002 relay, thereby turning it on. Power supplied by the activated relay K9002 turns on the 115-vac, 400-Hz power converter.

**Null Switch Operation**

K7102 only supplies a short dc pulse to the null switch as the relay is turning on. When K7102 is fully turned on, its 25.5-vdc signal to the null switch terminates. However, the short dc signal charges a pair of capacitors whose subsequent discharge keeps the null switch turned on (grounded) until an alternate dc supply becomes available. The alternate supply is made available by the 115-vac, 400-Hz power converter.

**Generation of Alternate Null Switch Enable**

115 vac, 400 Hz is applied to relay K7101. Relay K7101 is turned on by 25.5-vdc power from either the (A) or (B) leg of the S7103 output. A ground path to the null switch through the limit switch activates relay K7101.

With K7101 turned on, 115 vac, 400 Hz is applied to Transformer T301, which steps it down to 24 vac. The transformer's output is applied to the phase shift network, and then to the resistive bridge network including R303 and R7101. The bridge outputs servoamp drive current as described under the subheading, Frequency Select Resistor R7101, page 1-44.

**OPERATION OF SCREWDRIVER-ADJUSTED CHANNEL SELECT SYSTEM****Band Select Switch S7103**

The band select switch is set by screwdriver to one of two possible positions: band (A) or band (B). Each switch position is a source of 25.5-vdc power to separate circuits in the band switch motor, driving it either clockwise or counterclockwise, depending on the band selected.

The band switch motor, in turn, is connected to the front panel band switch through a mechanical linkage which sets the switch to the (A) or (B) position.

## 1-44. SERVOSYSTEM, RT-246(\*)/VRC. (CONT)

### TUNE Pushbutton

When the TUNE pushbutton is pressed, it provides a ground path for relay K7101 and relay K9002, turning both relays on. This action turns on the servoamplifier and the detent release, enables the servomotor, and provides power to the phase shift network.

### Frequency Select Resistor R7101

Resistors R7101 and R303 form a bridge to which power from the phase shift network is applied. R7101 is manually adjusted to vary its resistance, while R303 is varied by the action of its wiper arm which is connected to the servomotor.

When the bridge is out of balance electrically, servoamp drive current flows out of the R7101 wiper to R304, out of the R304 wiper, and into the servoamplifier. The servoamplifier boosts the signal and applies it to the servomotor's control phase winding, causing the motor to operate.

The motor operates, moving the R303 wiper until the bridge is balanced in relation to the position of the R7101 wiper. At that point, current stops flowing from the R7101 wiper and the motor stops turning.

Whenever R7101 is adjusted to a new position (corresponding to a new frequency), the motor will turn clockwise or counterclockwise until the R303 wiper once again balances the bridge circuit, turning off servoamp drive current.

### R304 Sensitivity Adjustment (Overshoot)

The servosystem is adjusted for slight channel overshoot when a pushbutton is pressed. The amount of overshoot is controlled by R304. The position of the R304 wiper varies attenuation of the overshoot signal from the motor generator, thereby regulating the strength of the control phase winding signal to the servomotor. The overshoot signal acts in lieu of the servoamp drive current which is lost when the bridge circuit balances.

Servoamp drive current passes through K7101 to Transformer T7001. The transformer's output is an ac signal which is subsequently rectified and then applied to the null switch to keep it grounded.

As long as the bridge circuit is unbalanced, servoamp drive current keeps power supplied to the null switch, thereby maintaining its grounded condition.

### Other Circuits Activated by K7101

When K7101 turns on, it supplies 25.5 vdc to the detent release solenoid and the servoamplifier. It also Supplies 115 vac, 400 Hz to the servomotor/generator.

### Detent Release

When the detent release solenoid is activated by 25.5 vdc, it removes the ratchet from the front panel gear train so that it can be freely rotated by the servomotor.

### Servoamplifier

The servoamplifier is turned on by 25.5 vdc. Its amplification stages boost the servoamp drive signal to supply the control phase winding signal to the servomotor, causing the servomotor to operate.

**1-44. SERVOSYSTEM, RT-246(\*)/VRC. (CONT)****Servomotor/Generator**

The radio is tuned by the motor's mechanical connection to the front panel gear train. As the motor turns, it also mechanically moves the R303 wiper. Movement continues until the wiper reaches a point where the bridge circuit is balanced. When this happens, servoamp drive current terminates.

However, the servomotor does not stop turning immediately because of the action of the generator.

**Overshoot**

When servoamp drive current stops flowing, Transformer T7001 no longer outputs 25.5 vdc.

However, the null switch stays on for a brief period of time because its capacitors begin to discharge, keeping the null switch transistor saturated and conducting to ground.

During this brief period of continued null switch operation, the slight output of the generator (overshoot signal) is applied to R304 and then to the servoamplifier. The servoamplifier boosts this signal to keep the servomotor operating until the null switch capacitors finally discharge completely, turning off the null switch. When the null switch turns off, the entire servosystem shuts down completely.

The amount of overshoot is determined by the R304 adjustment. Less attenuation of the overshoot signal by the resistor results in greater amplification and greater motor speed during the brief period of continued null switch operation.

**TUNE Pushbutton**

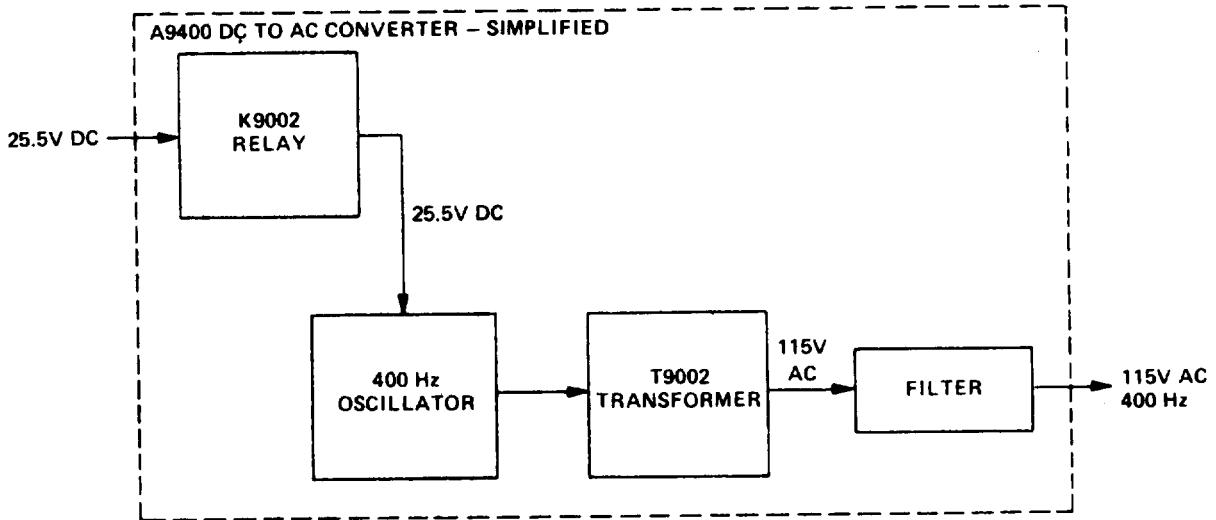
The TUNE pushbutton provides a manually controlled ground circuit to activate the servosystem when the channel pushbuttons are preset. When pressed, the TUNE pushbutton creates a simulated null switch ground.

**Limit Switch**

The Limit switch is mechanically controlled by the front panel gear train assembly. Normally, the switch is closed. However, a detent plunger forces it open at the frequency extremes (ie, 30.00 MHz or 75.95 MHz).

If the bridge circuit fails and cannot balance electrically, continued servoamp drive current could force the servomotor into rotation beyond the gear train's operating limits, resulting in severe damage. The limit switch prevents this by opening the K7101 ground circuit, thus turning off the servoamplifier and servomotor.

1-45. A9400 DC-TO-AC CONVERTER.

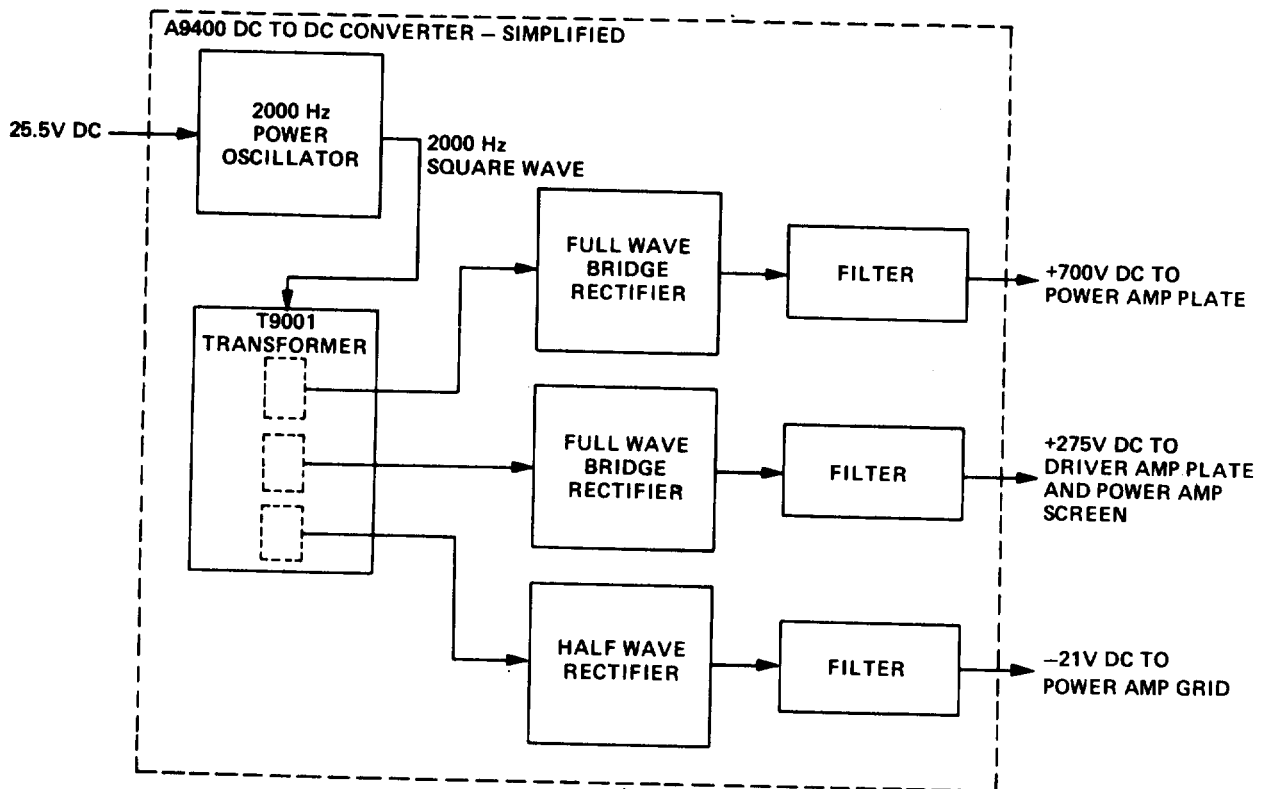


EL4GP408

The dc to ac converter supplies 115-vac, 400-Hz power to the transmitter blower motor and servo-system. The converter is activated by 25.5 vdc from relay K9002 which is applied to the 400-Hz oscillator.

The 400-Hz oscillator establishes the frequency of the converter's output. A 400-Hz ac signal is applied next to the T9002 step-up transformer which boosts voltage to 115 vac. After passing through a filter, the 115-vac 400-Hz signal is available for use by the servosystem components and transmitter blower motor.

## 1-46. A9000 DC-TO-DC CONVERTER.



The dc-to-dc converter provides two positive dc supplies and one negative dc output for operation of the driver and power tubes. EL4GP409

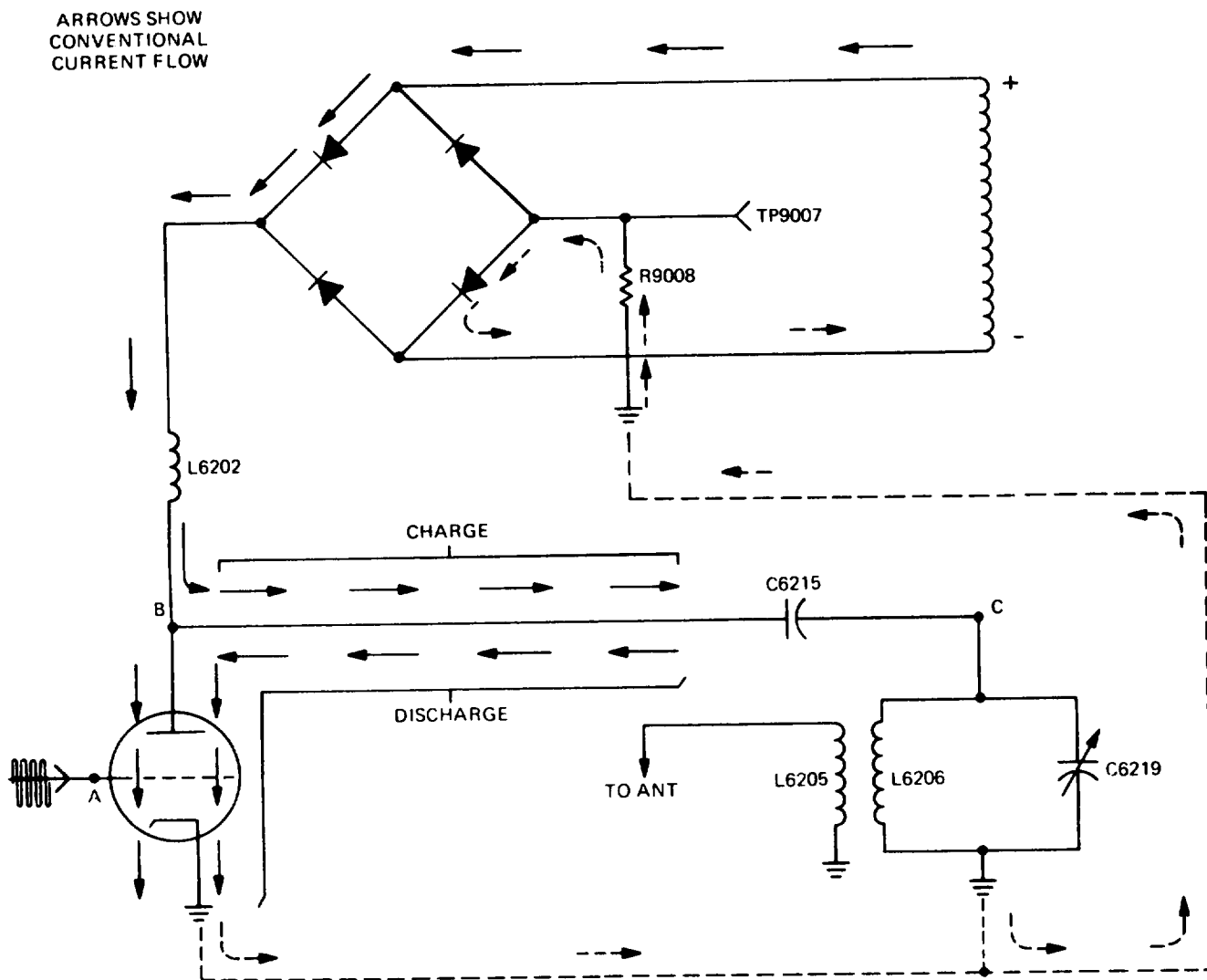
Within the converter, a 2000-Hz oscillator is turned on by 25.5 vdc. The oscillator's 2000-Hz square wave output drives Transformer T9001 which contains three output coils.

The three outputs are rectified and filtered and then applied to the appropriate tubes.

1-46. A9000 DC-TO-DC CONVERTER. (CONT)

TEST POINT TP9007/POWER AMP ALINEMENT

The + 700-vdc full-wave bridge rectifier contains a test point (TP9007) electrically located at its bridge ground. This test point permits a determination of the current demand on the bridge by means of a voltmeter measurement of the voltage drop across a resistor wired in series with the bridge ground. This measurement is critical during alinement of the A6200 power amplifier because it allows tuning for correct power tube plate current draw, to prevent premature burnout of the tube. Use of TP9007 and operation of related circuits in connection with A6200 alinement is as follows.



EL4GP410



**1-46. A9000 DC-TO-DC CONVERTER. (CONT)**

During alinement of Power Amplifier A6200, a voltmeter is connected between TP9007 and ground. This measures the voltage drop across R9008. Since TP9007 is at lower-than-ground potential, a negative indication is produced by the voltmeter. As current flow across R9008 increases, the voltage drop increases. Current flow across R9008 is influenced by the tank circuit containing C6219.

C6219 is first adjusted for minimum negative indication, then readjusted for a slightly more negative reading which corresponds to greater R9008 current. The increased current comes from the tank circuit.

When the tank circuit is tuned for resonance, almost no current flows through it. Therefore, at resonance, no current passes point C above the tank and no signal is coupled across capacitor C6215. The only current flow is through the power tube past point B and up through R9008. Therefore, at or close to resonance, the voltmeter reads a minimum negative voltage because the voltage drop is minimum.

However, at resonance no current can be coupled across C6215. Therefore, none of the amplified signal is applied to L6206 for coupling to the antenna coil. The resonant tank behaves like an open circuit, so C6215 cannot accept a charge.

When the tank is tuned off-resonance, the following occurs: During the positive alternation at the rectifier bridge transformer, conventional current flows as indicated by the arrows. Rf applied to the tube grid at point A is amplified at B. Current flows from B to the plate, to the cathode, and ground. Current also flows from B to C6215, which charges and discharges with the sine wave alternations at B.

The charge/discharge current is coupled across C6215, flows through the nonresonant tank, to ground, and through R9008. As C6219 adjusts the tank further from resonance, current through the tank increases.

Increased current flow results in additional signal coupling across C6215, and greater amplitude in the rf output. This shows up as a higher reading on the wattmeter connected to the antenna output.

As power output increases, greater current flows through the tube. This occurs because the additional C6215 charging current must discharge through the tube. Adjusting C6219 for too much current flow through the tank enhances rf power but also causes excessive C6215 discharge current through the tube, thereby shortening its life.

It is extremely important to adjust C6219 for correct voltage drop across R9008 to prolong tube life. If the tank current is too high, rf power is also high and can be reduced by adjusting Antenna Coupling Coil L6205. Although this adjustment lowers rf power to an apparently safe level, the antenna matching unit will be protected but not the tube. Rf power should not be adjusted down from an excessively high level without first checking the voltage drop across R9008 as outlined in the alinement section of this manual.



## CHAPTER 2

### DIRECT SUPPORT REPAIR PROCEDURES

Subject	Section	Page
Direct Support Repair Parts, Tools and TMDE . . . . .	I	2-1
Direct Support Troubleshooting. . . . .	II	2-2
Direct Support Maintenance Procedures . . . . .	III	2-7

#### OVERVIEW

This chapter contains direct support repair procedures for the RT-246(\*)/VRC and RT-524(\*)/VRC. References are made to those publications listing repair parts, tools, and TMDE. The description of this manual's approach to troubleshooting includes an explanation of how to use the troubleshooting charts in chapters 3, 4, and 5. The maintenance section covers assembly, disassembly, and replacement procedures.

There are three other direct support chapters in this manual. Each chapter covers direct support performance tests, troubleshooting, and alignment procedures performed with a different set of test equipment; that is:

1. Chapter 3 contains procedures using Maintenance Kit MK-1978/VRC and discrete test equipment (TMDE).
2. Chapter 4 contains procedures using Test Set AN/GRM-114A.
3. Chapter 5 contains procedures using Test Cable No. 1 and discrete test equipment (TMDE).

The procedures you follow will depend upon the equipment at your disposal.

#### Section I DIRECT SUPPORT REPAIR PARTS, TOOLS AND TMDE

Subject	Para	Page
Direct Support Repair Parts and Tools. . . . .	2-1	2-1
Special Tools and TMDE. . . . .	2-2	2-1

##### 2-1. DIRECT SUPPORT REPAIR PARTS AND TOOLS.

For repair parts and tools required for direct support maintenance, refer to TM 11-5820-401-34P-2-1 and TM 11-5820-401-34P-2-2.

##### 2-2. SPECIAL TOOLS AND TMDE.

For special tools and TMDE, refer to the Maintenance Allocation Chart (MAC) in TM 11-5820-401-20-1 or TM 11-5820-401-20-2.

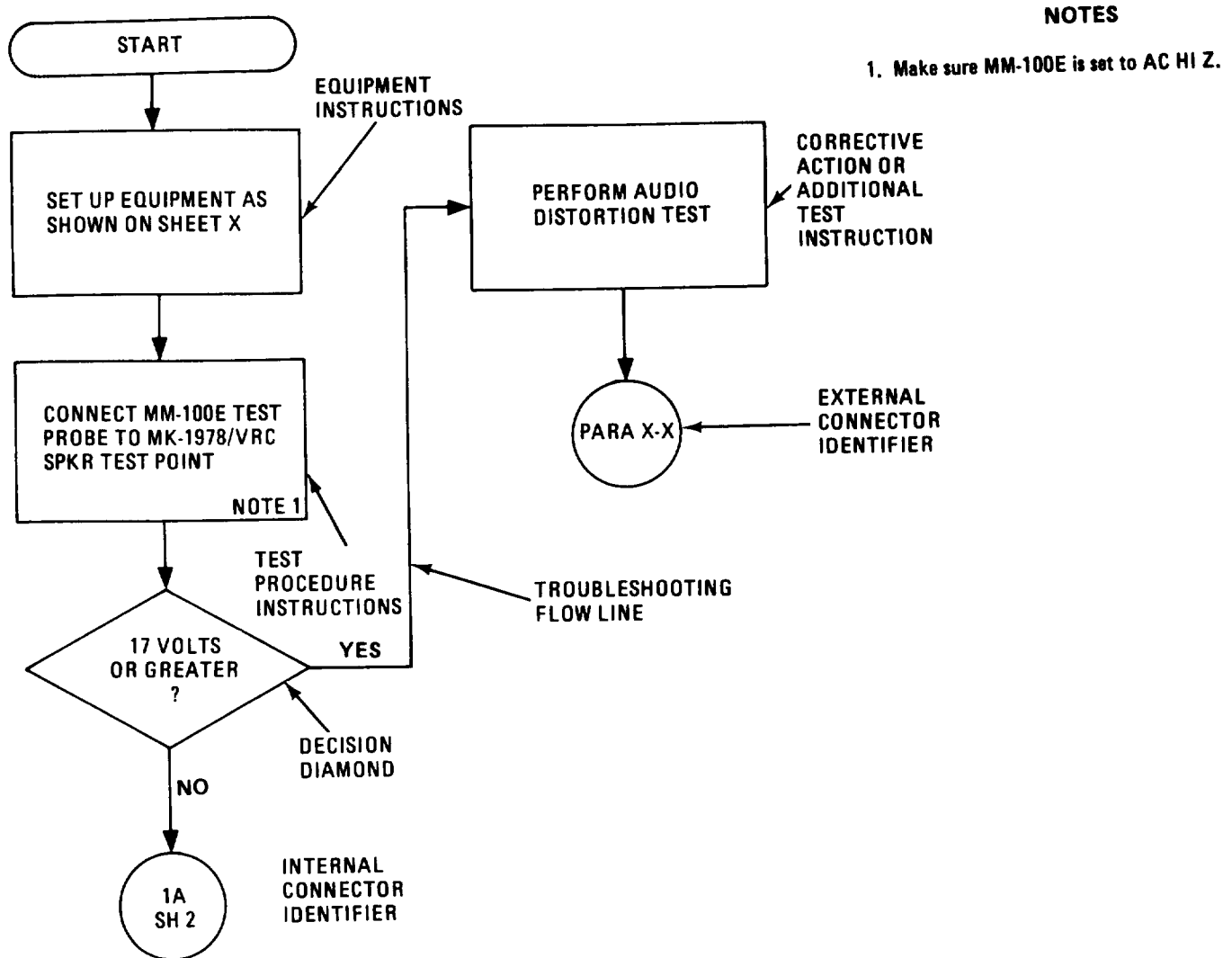
## Section II DIRECT SUPPORT TROUBLESHOOTING

Subject	Para	Page
General .....	2-3	2-2
How to Use Troubleshooting Charts.....	2-4	2-2
Organization of Troubleshooting Charts.....	2-5	2-4

### 2-3. GENERAL.

This manual contains procedures that will assist the technician in troubleshooting failures in the receiver-transmitter. The procedures are written as troubleshooting logic flow charts. Information covering the use of these charts is contained in the following paragraph.

### 2-4. HOW TO USE THE TROUBLESHOOTING CHARTS.



## **2-4. HOW TO USE THE TROUBLESHOOTING CHARTS. (CONT)**

The preceding illustration is a sample portion of a troubleshooting logic flow chart. Refer to the illustration while reading the following information.

### **START**

Each individual chart contains a start segment indicating the start of the troubleshooting procedure.

### **EQUIPMENT INSTRUCTIONS**

Equipment instructions are contained in a rectangular box. They provide details concerning proper hookup of test equipment and correct control settings necessary to perform the troubleshooting procedure.

The initial equipment instructions found at the beginning of each troubleshooting chart reference a sheet number where an equipment test setup diagram can be found. The sheet number is located at the top of each page of the troubleshooting chart, next to the title.

Within a troubleshooting procedure, many changes of equipment control settings, and even hookups, are often required. These changes are detailed in the equipment instruction boxes. At any step in the troubleshooting chart, the equipment status is always that defined by the nearest equipment instruction box in the troubleshooting chain.

### **TEST PROCEDURE INSTRUCTIONS**

These instructions usually contain details covering specific receiver test points to be probed,

### **DECISION DIAMOND**

As a result of a particular test point probe, some electrical value should be observed, such as a voltage indication on a piece of test equipment. The decision diamond defines what value should be observed, and permits a yes or no decision in response to what is observed.

### **TROUBLESHOOTING FLOW LINE**

Troubleshooting flow lines provide direction to successive steps in the logic chart. An arrow at the end of each flow line indicates the next step in the troubleshooting chain.

### **INTERNAL CONNECTOR IDENTIFIER**

There are two sizes of circular identifiers used in the troubleshooting charts. The smaller of the two is the internal connector identifier. The internal connector identifier indicates a continuation of the procedure to another sheet in the troubleshooting flow chart. The sheet on which the procedure is continued contains a corresponding identifier, ie, a small circle in which the same number and letter are printed.

## 2-4. HOW TO USE THE TROUBLESHOOTING CHARTS. (CONT)

For example, in the sample illustration the NO branch of the decision diamond flows to the identifier containing 1A SH 2. This means that the procedure is continued on sheet 2, at the small circle containing 1A.

### EXTERNAL CONNECTOR IDENTIFIER

The external connector identifier is a large circle which references a paragraph or another troubleshooting chart. In the sample illustration, the large circle contains the information Para x-x. This paragraph reference identifies the location of the audio distortion test, which is not found anywhere in that flow chart. In fact, a large circle always references some information **external** to the flow chart containing the circle.

### CORRECTIVE ACTION OR ADDITIONAL TEST INSTRUCTION

A corrective action box can contain the following information when a problem is defined by a decision diamond:

1. Instructions to align an electronic module.
2. Instructions to replace a module or other radio component.
3. Instructions to repeat a performance test sequence or do a particular performance test found elsewhere in the manual.

### NOTES

The third column on each troubleshooting sheet may contain written notes and/or illustrations used to clarify information contained in the troubleshooting chart.

## 2-5. ORGANIZATION OF TROUBLESHOOTING CHARTS.

### LOCATION IN MANUAL

Troubleshooting charts are contained in chapters 3, 4, and 5. The charts in each chapter are tailored to the use of specific test equipment.

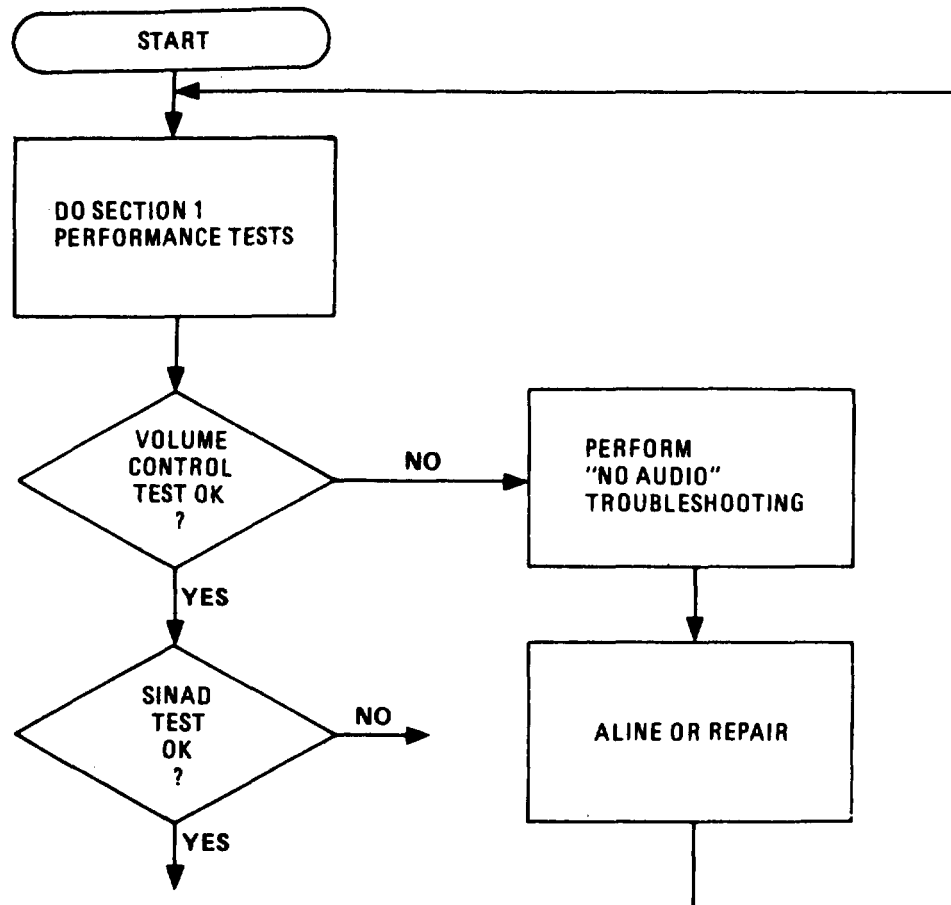
Chapter 3 contains charts which are intended for use if the equipment available includes Maintenance Kit MK-1978/VRC and TMDE (discrete test equipment, eg, signal generators, voltmeters, etc).

Chapter 4 contains charts intended for use if the equipment available includes Test Set AN/GRM-114A and Maintenance Kit MK-1978/VRC.

The troubleshooting charts in chapter 5 are used if the equipment available includes TMDE and Test Cable No. 1.

2-5. ORGANIZATION OF TROUBLESHOOTING CHARTS. (CONT)

GENERATION OF TROUBLESHOOTING CHARTS



Each troubleshooting logic flow chart is generated by the failure of one of several performance tests, all of which are located in section 1 of chapters 3, 4, and 5. The preceding illustration shows the logic flow involved in generating a troubleshooting procedure.

Referring to the illustration, it can be noted that the performance tests in section 1 are done prior to troubleshooting. The first performance test is the VOLUME control test. If the radio fails the VOLUME control test, troubleshooting must be done to determine the cause of failure. In this example, the NO flow line leads to the box containing the instruction "perform 'no audio' troubleshooting."

Performance of the troubleshooting procedure results in the determination of the need for alinement or repair. When these tasks are accomplished, the performance test must be repeated to insure that the corrective action was sufficient to enable the radio to pass the VOLUME control test. Therefore, a flow line from the corrective action box leads back to the start of the performance tests.

If the radio passes the VOLUME control test, the SIN AD test is next in order. The decision diamond containing the SINAD test has YES and NO flow lines as does the previous diamond. The YES flow line leads to an additional performance test, while the NO flow line leads to a second troubleshooting flow chart. This pattern is repetitive down to the last performance test. If the radio passes all performance tests, no troubleshooting is done and it is returned to service.





**Section III DIRECT SUPPORT MAINTENANCE PROCEDURES**

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X-Mode Connector J305 Replacement (RT-246(*)/VRC only) .....	2-23	2-47
ANT CONT Connector J353 Replacement (RT-524(*)/VRC only) .....	2-24	2-50
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### Section III DIRECT SUPPORT MAINTENANCE PROCEDURES (CONT)

Subject	Para	Page
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#### 2-6. GENERAL.

This section contains instructions for direct support maintenance of the receiver-transmitter. The following initial setup information applies to all procedures.

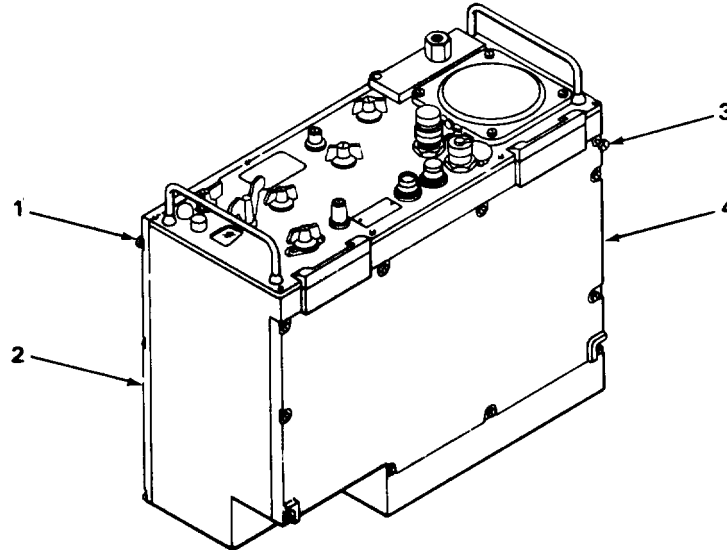
All procedures apply to both RT-246(\*)/VRC and RT-524(\*)IVRC receiver-transmitter unless otherwise specified.

These procedures can be performed using Tool Kit, Electronic Equipment TK-105/G. Tools will not be listed unless special tools are required.

The normal equipment condition to start a maintenance task is power turned to OFF. Equipment condition is not listed unless some other condition is required.

**2-7. TOP AND BOTTOM COVER REPLACEMENT.**

MATERIALS/PARTS: Top Cover  
 Bottom Cover, P/N SMD 414288  
 Silicone Insulating Compound



EL4GP001

**WARNING**

Two technicians will be needed to lift and place radio on workbench.

**REMOVAL**

1. Using screwdriver, loosen 11 captive screws (1) on top cover (2).
2. Remove top cover(2).
3. Using screwdriver, loosen 11 captive screws (3) on bottom cover (4).
4. Remove bottom cover(4).

**INSTALLATION**

1. Apply a light coat of silicone compound to top and bottom cover seals.
2. Install top cover (2).
3. Using screwdriver, tighten 11 captive screws (1).
4. Install bottom cover (4).
5. Using screwdriver, tighten 11 captive screws (3).

## 2-8. FRONT PANEL REPLACEMENT.

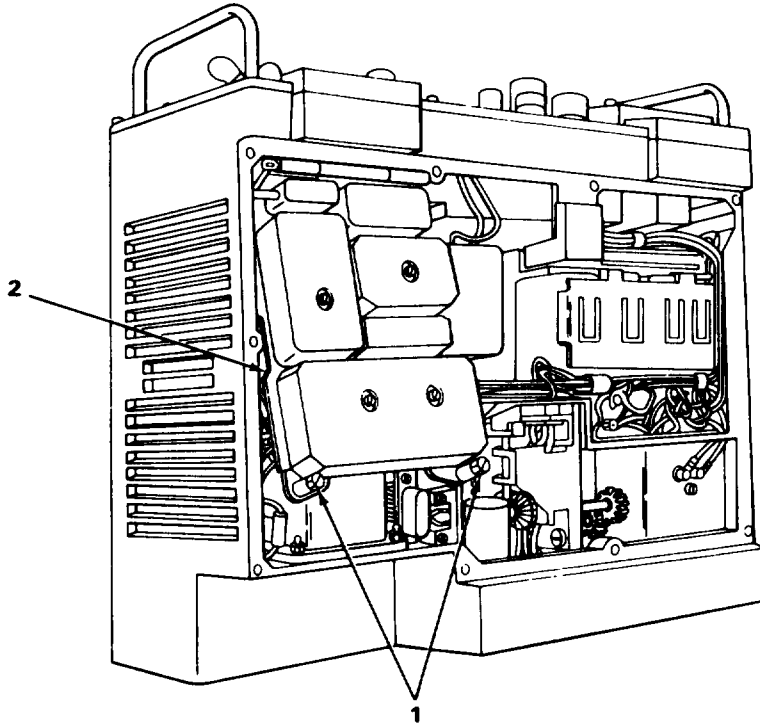
MATERIALS/PARTS: RT-524(\*)/VRC Front Panel Assembly, P/N SMC 414793

RT-246(\*)/VRC Front Panel Assembly, P/N SMD 414366

PRELIMINARY PROCEDURE: Remove top and bottom covers. (See paragraph 2-7.)

### NOTE

For ease of disassembly, stand radio on back.

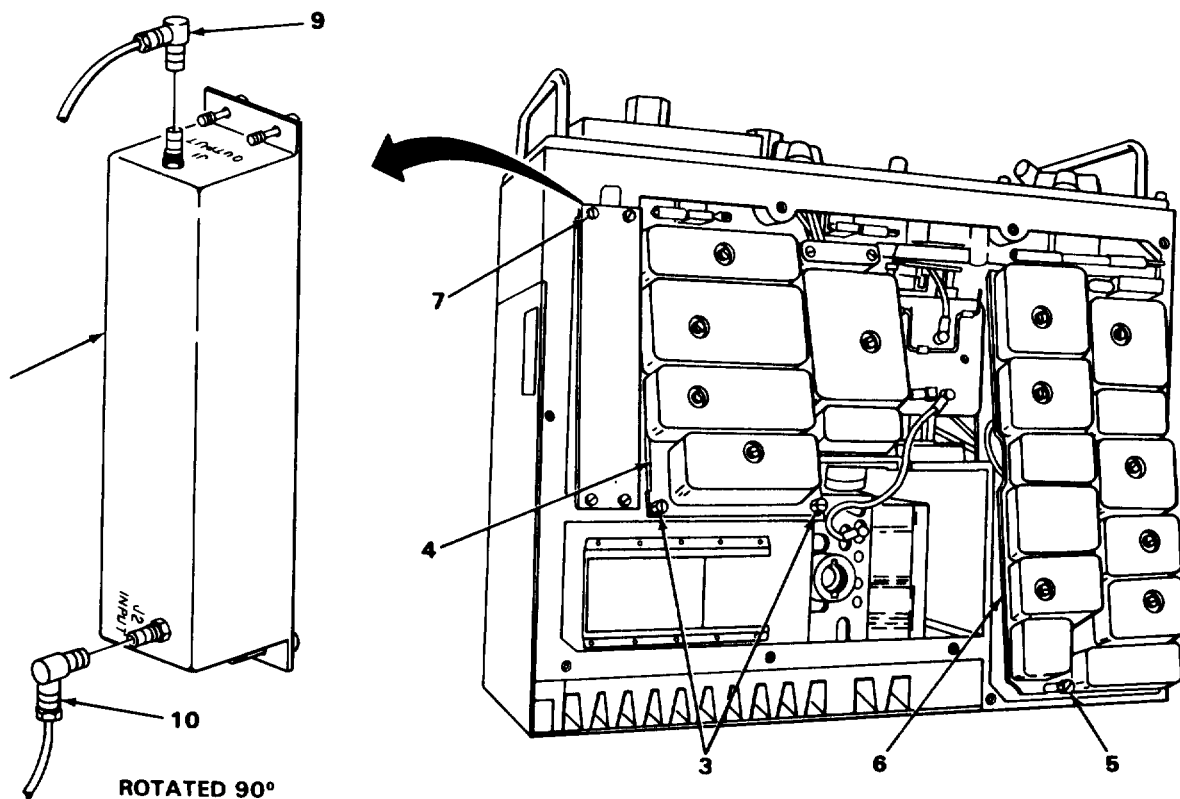


EL4GP002

### REMOVAL

1. Using screwdriver, loosen two captive screws (1) on A4000 assembly (2).
2. Swing A4000 assembly (2) out and secure brace.

2-8. FRONT PANEL REPLACEMENT. (CONT)

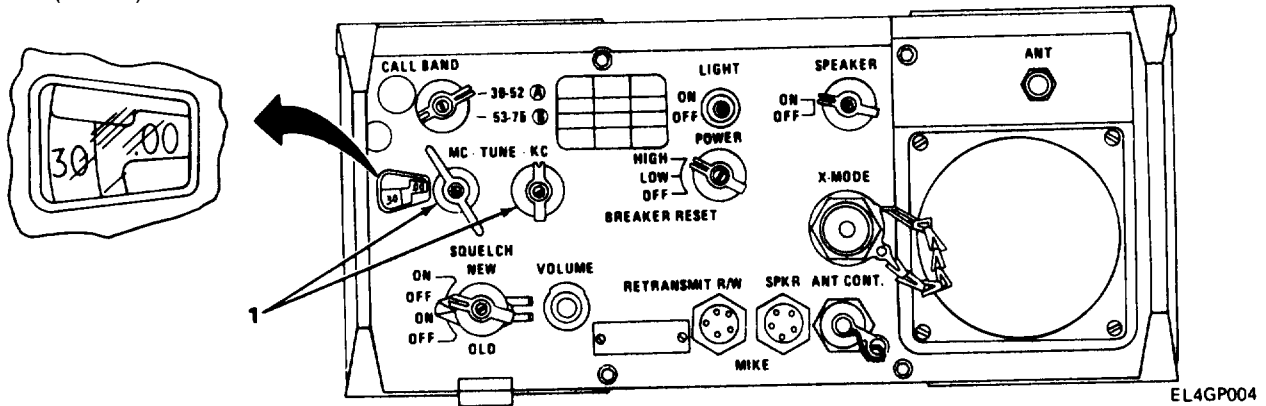


EL4GP003

3. Using screwdriver, loosen two captive screws (3) on A8000 assembly (4), then swing assembly out and secure brace.
4. Using screwdriver, loosen one captive screw (5) on A3000 assembly (6), then swing assembly out and secure brace.
5. Using screwdriver, loosen four captive screws (7) on Filter FL401 (8).
6. Pull filter out of case, disconnect green wire(W411) (9) and orange wire (W410) (10), and remove Filter FL401 (8).

2-8. FRONT PANEL REPLACEMENT. (CONT)

REMOVAL (CONT)



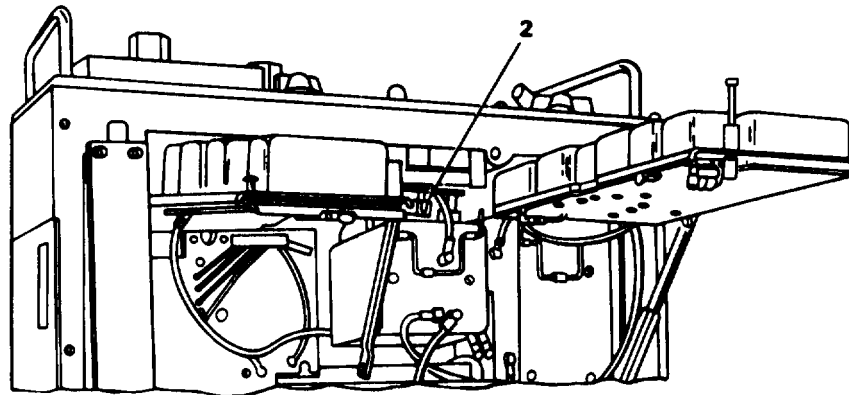
**NOTE**

If you are working on RT-524(\*)/VRC, do step 7, then proceed to step 9.

If you are working on RT-246(\*)/VRC, and MC-TUNE-KC controls are between 30.00 and 52.00 MHz, do step 7 then proceed to step 9.

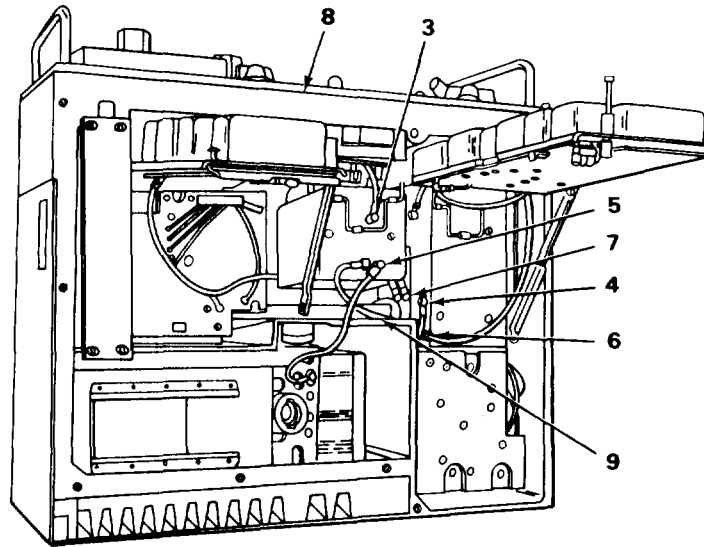
If you are working on RT-246(\*)/VRC, and MC-TUNE-KC controls are between 53.00 and 75.00 MHz, do step 8 only.

7. Rotate MC-TUNE-KC controls (1) to 30.00-MHz channel.



8. Move lever arm (2) to extreme left to reach BAND **A** then set to 30.00-MHz channel.

2-8. FRONT PANEL REPLACEMENT. (CONT)



EL4GP006

**NOTE**

The instructions given below are performed on top of radio.

If color coding on unit varies from one shown, note corrected color coding before disassembly.

9. Disconnect wires listed in table below.

TOP OF RADIO

RT ONLY	WIRE NO.	COLOR	FROM	TO	INDEX NO.
524	W403	BRN	A8000 Assy	J6002	3
246	W408	BRN	A8000 Assy	J6002	3
524	W409	Vio	A8000 Assy	J1003	4
246	W409	WHT/VIO	A8000 Assy	J1003	4
	W407	GRA	J6101	J6001	5
	W202/W402	GRN	A3000 Assy	J1004	6
	W403	BLK	A3000 Assy	J2002	7
	* W412	VIO	J6202	K301P2	8
	W303	YEL	CLIP		9

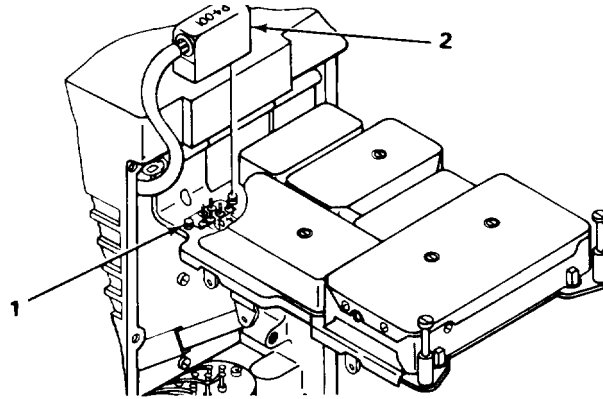
\* Remove when front panel is raised.

**2-8. FRONT PANEL REPLACEMENT. (CONT)**

REMOVAL (CONT)

**NOTE**

The instructions given below are performed on the bottom of radio.

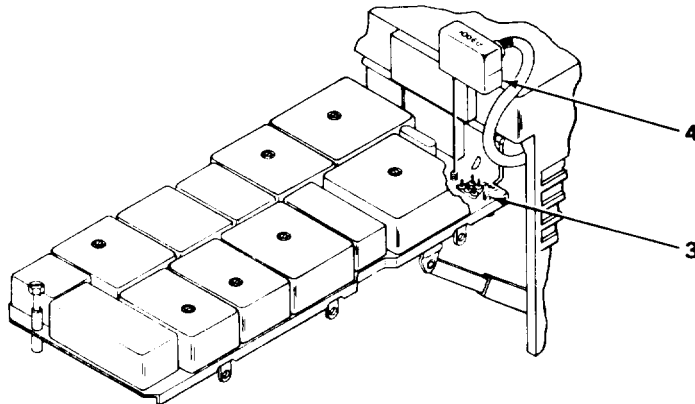


EL4GP007

10. Using screwdriver, loosen two captive screws (1) under A4000 assembly to free P4001 (2) for removal.
11. Lift P4001 (2) carefully so pins on assembly are not damaged.

**NOTE**

The instructions given below are performed on the top of radio.

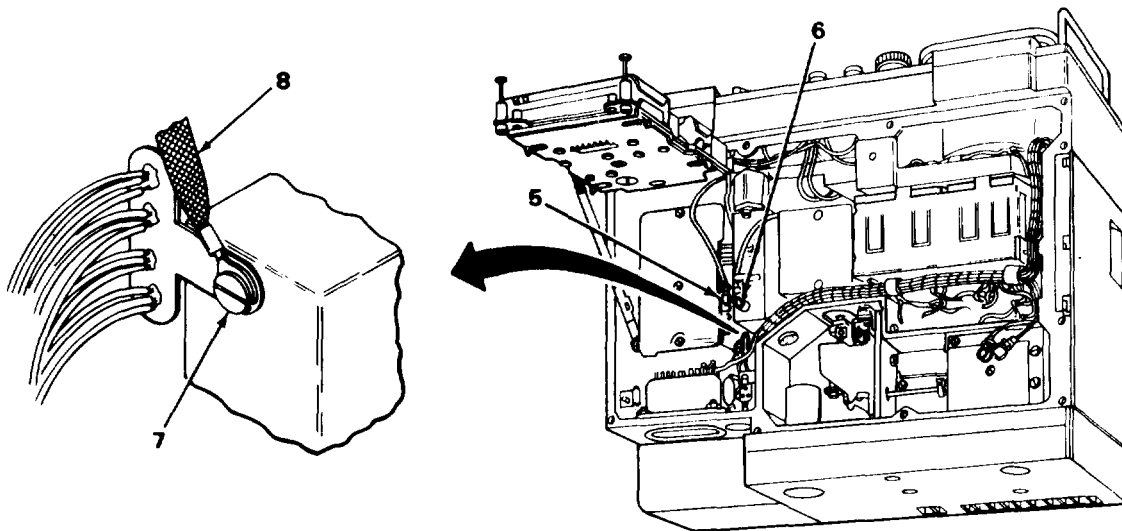


EL4GP008

- Using screwdriver, loosen two captive screws (3) under A3000 assembly to free P3001 (4) for removal.
13. Lift P3001 (4) carefully so pins on assembly are not damaged.



2-8. FRONT PANEL REPLACEMENT. (CONT)



EL4GP009

**NOTE**

The instructions given below are performed on bottom of radio.

If color coding on unit varies from one shown, note corrected color coding before disassembly.

14. Disconnect wires listed in table below.

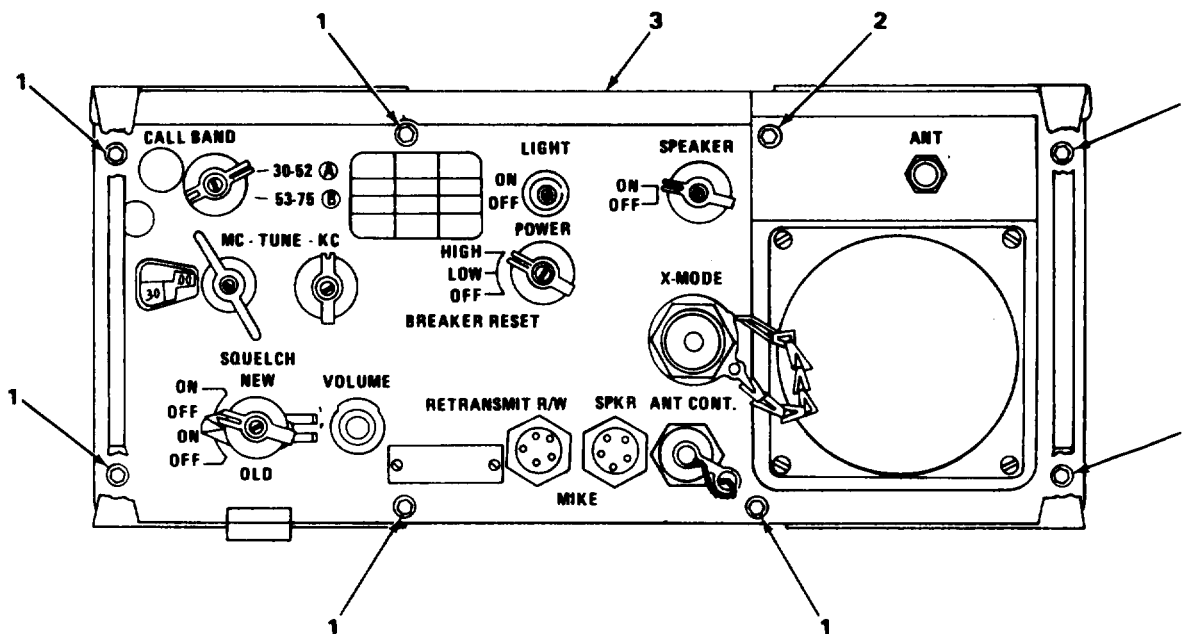
BOTTOM OF RADIO

WIRE NO.	COLOR	FROM	TO	INDEX NO.
W201/W401	BLU	A4000 Assy	J1005	5
W404	RED	A3000 Assy	J2003	6

15. Using screwdriver, loosen screw (7) to free ground strap (8). Do not remove screw.

2-8. FRONT PANEL REPLACEMENT. (CONT)

REMOVAL (CONT)



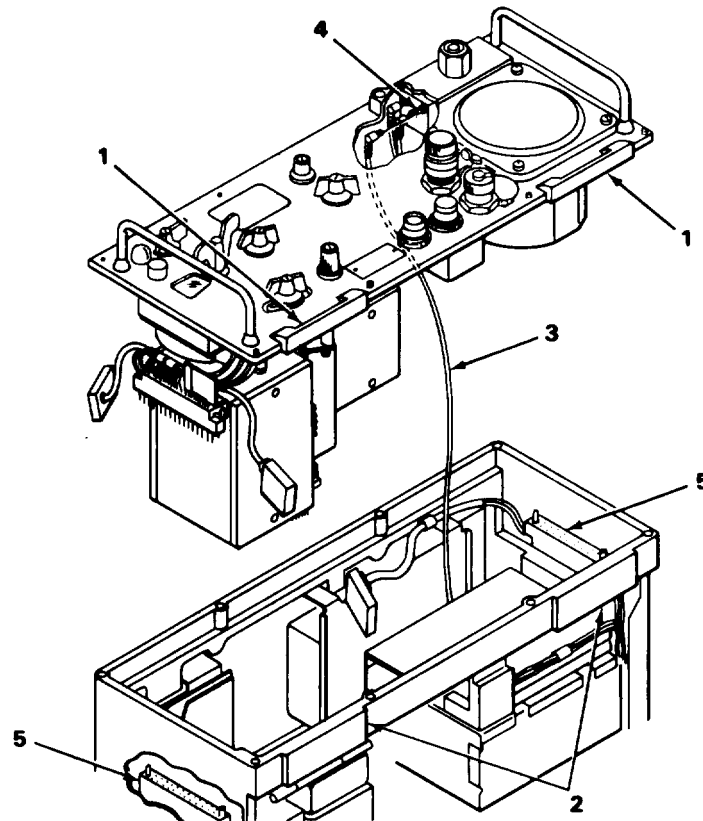
EL4GP010

16. Using hex wrench, remove seven short screws (1) and one long screw (2).

**CAUTION**

Make sure all interconnecting cables between front panel and case have been disconnected. Note relative positions of all gear train couplers and their mating parts on front panel. Do not disturb any of them.

17. Carefully remove front panel (3) from case.

**2-8. FRONT PANEL REPLACEMENT (CONT)****INSTALLATION**

EL4GP011

1. Line up clamp bosses (1) on front panel and clamp bosses (2) on case. Carefully lower front panel into case, part way.
2. Connect violet wire no. 412 (3) to pin K301P2 (4) on front panel.

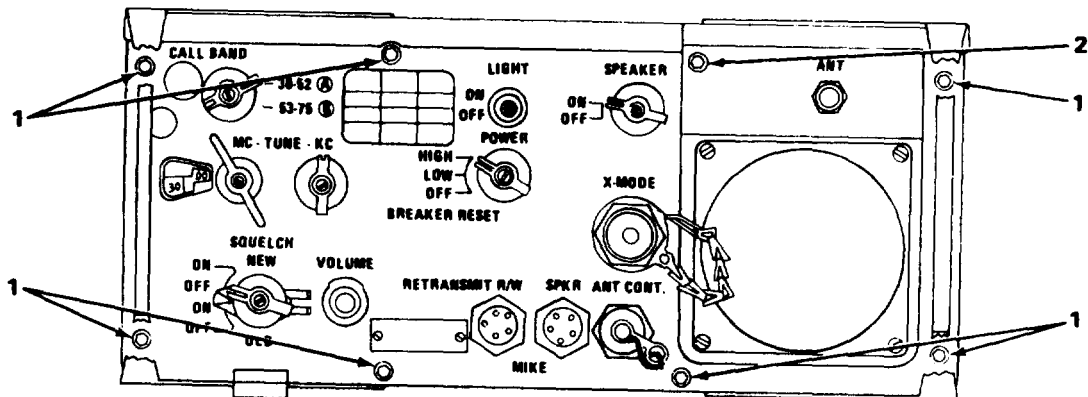
**CAUTION**

In the following step, make sure all gear train couplers mate with their corresponding parts on front panel, and that side Connectors (5) P301 and P352 for the RT-246(\*)/VRC or P351 and P352 for the RT-524(\*)/VRC mate properly. Pin damage may occur.

3. Lower front panel into case completely, making sure wires are not pinched.

2-8. FRONT PANEL REPLACEMENT. (CONT)

INSTALLATION (CONT)



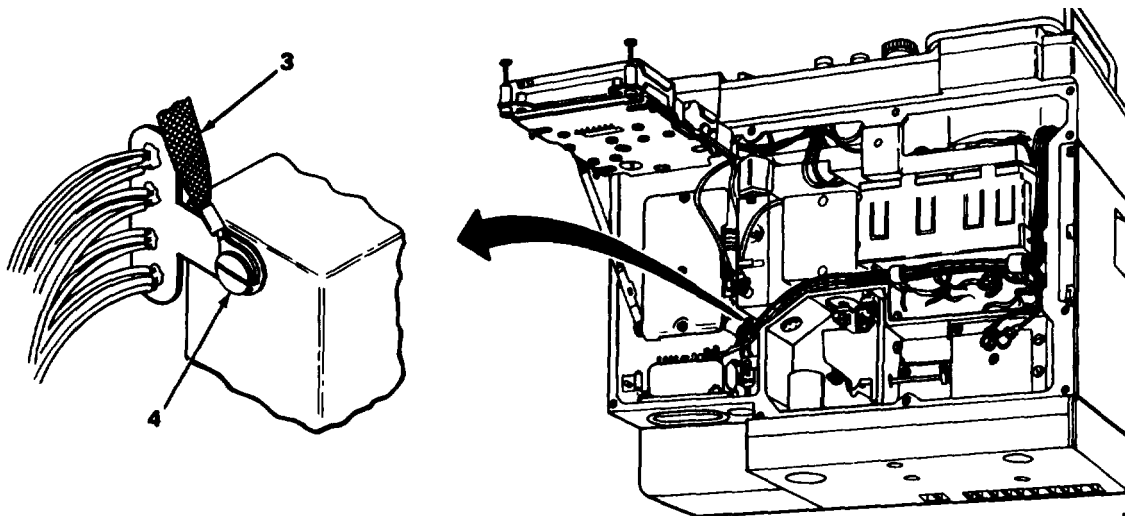
EL4GP012

4. Install seven short screws (1) in holes on front panel.

**NOTE**

Long screw is in same position on RT-246(\*)/VRC.

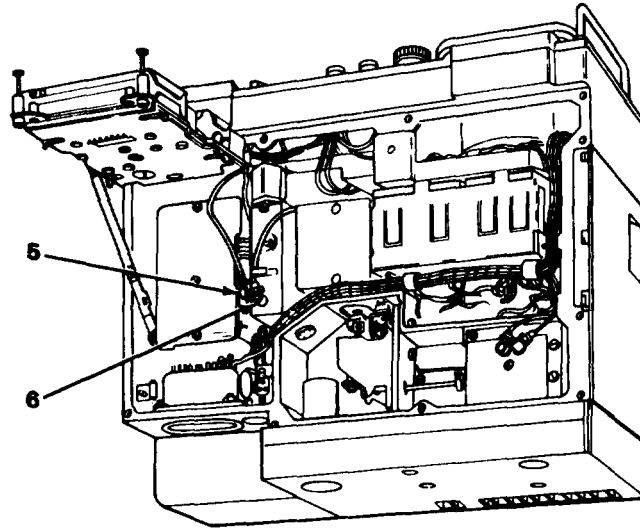
5. Install one long screw (2) in hole on front panel,  
6. Using hex wrench, tighten screws (1) and (2) evenly.



EL4GP013

7. Insert ground strap (3) under screw (4).  
8. Using screwdriver, tighten screw (4).

2-8. FRONT PANEL REPLACEMENT. (CONT)



EL4GP014

**NOTE**

The instructions given below are performed on bottom of radio.

If color coding on unit varies from one shown, note corrected color coding before disassembly.

9. Connect wires listed in table below.

BOTTOM OF RADIO

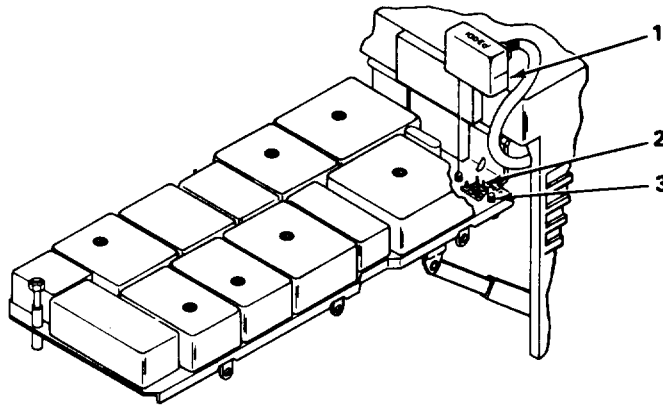
WIRE NO.	COLOR	FROM	TO	INDEX NO.
W201/W401 W404	BLU RED	A4000 Assy A3000 Assy	J1005 J2003	5 6

## 2-8. FRONT PANEL REPLACEMENT. (CONT)

### INSTALLATION (CONT)

#### NOTE

The instructions given below are performed on the top of radio,

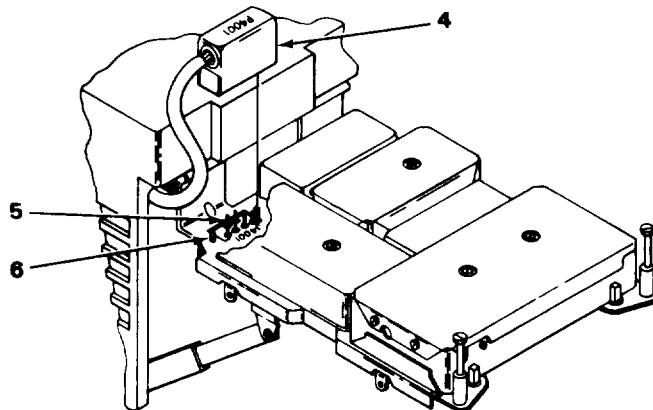


EL4GP015

10. Position P3001 (1) on pins of receptacle J3001 (2) and press down carefully.
11. Using screwdriver, tighten two captive screws (3) on bottom of assembly.

#### NOTE

The instructions given below are performed on bottom of radio.



EL4GP016

12. Position P4001 (4) on pins of receptacle J4001 (5) and press down carefully,
13. Using screwdriver, tighten two captive screws (6) on bottom of assembly.

2-8. FRONT PANEL REPLACEMENT. (CONT)

**NOTE**

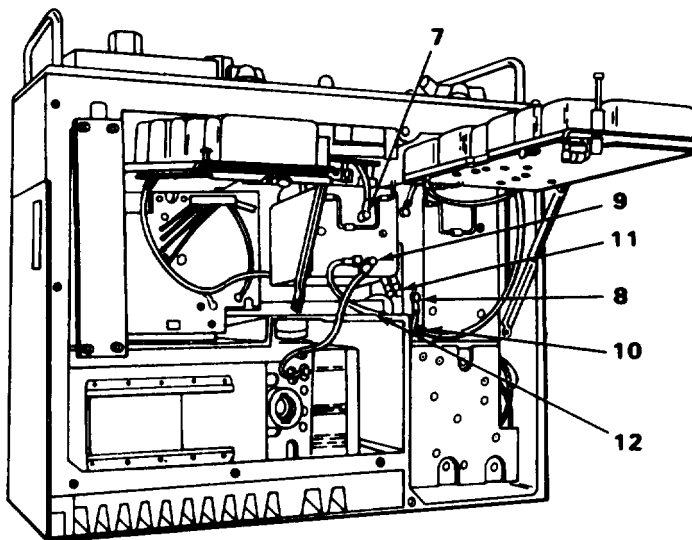
The instructions given below are performed on top of radio.

If color coding on unit varies from one shown, note corrected color coding before disassembly.

14. Connect wires listed in table below.

TOP OF RADIO

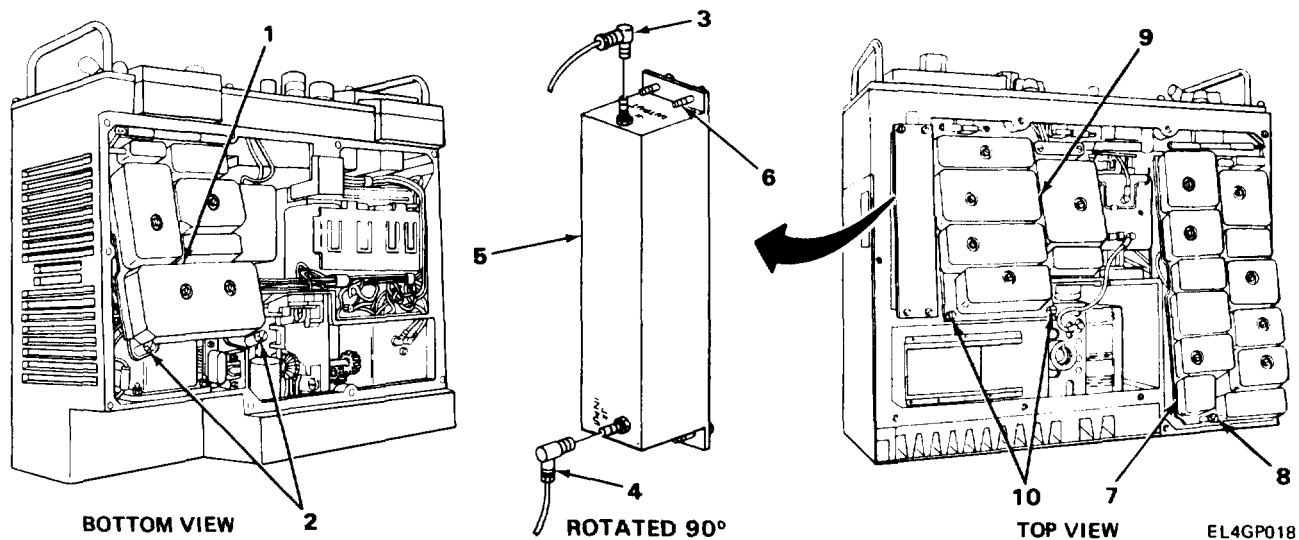
RT ONLY	WIRE NO	COLOR	FROM	TO	INDEX NO.
524	W403	BRN	A8000 Assy	J6002	7
246	W408	BRN	A8000 Assy	J6002	7
524	W409	VIO	A8000 Assy	J1003	8
246	W409	WHT/VIO	A8000 Assy	J1003	8
	W407	GRA	J6101	J6001	9
	W202/W402	GRN	A3000 Assy	J1004	10
	W403	BLK	A3000 Assy	J2002	11
	W303	YEL		CLIP	12



EL4GP017

**2-8. FRONT PANEL REPLACEMENT. (CONT)**

INSTALLATION (CONT)



15. Release brace on A4000 assembly (1) and lower assembly into position.
16. Using screwdriver, secure two captive screws (2).

**NOTE**

Color-coded dots on Filter FL401 aid in correct wire installation.

17. Connect green wire (W411) (3) and orange wire (W410) (4) to respective receptacles on filter (see note).
18. Position filter (5) in case and, using flat-tip screwdriver, secure four captive screws (6).
19. Release brace on A3000 assembly (7) and lower assembly into position.
20. Using screwdriver, secure one captive screw (8).
21. Release brace on A8000 assembly (9) and lower assembly into position.
22. Using screwdriver, secure two captive screws (10).

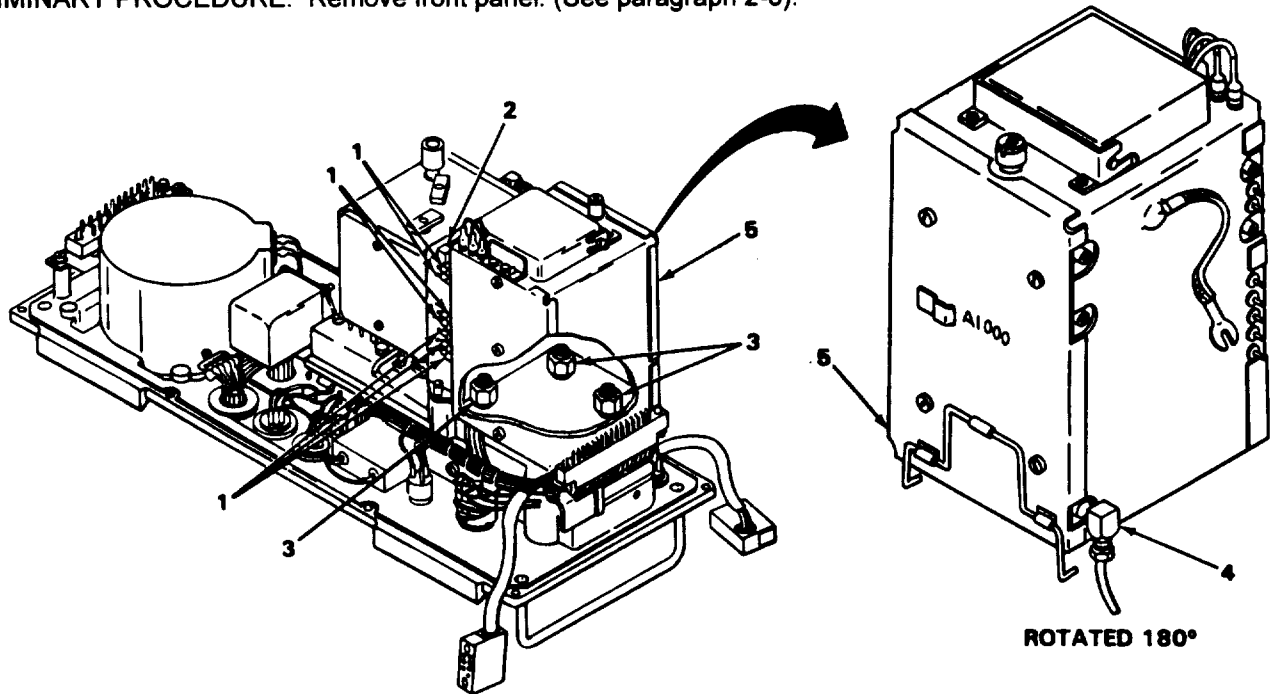
FOLLOW-ON MAINTENANCE: Install top and bottom covers. (See paragraph 2-7.)



**2-9. A1000(\*) ASSEMBLY REPLACEMENT.**

**MATERIALS/PARTS:** Radio Frequency Tuning Unit

**PRELIMINARY PROCEDURE:** Remove front panel. (See paragraph 2-8).



**REMOVAL**

EL4GP019

1. Disconnect seven color-coded wire plugs (1).
2. Disconnect yellow wire (W303) (2) from J1002.

**CAUTION**

Care must be taken when performing next step to prevent damage to VHF tuner linkage arm.

3. Using wrench, loosen three captive nuts (3).
4. Disconnect brown wire (W301) (4) from J1001.
5. Remove A1000(\*) assembly (5).

**CAUTION**

Note relative position of gear train couplers on A1000(\*) assembly and front panel. Do not turn couplers or band switch cam.

**CAUTION**

Module A1200B contains parts sensitive to Electrostatic Discharge (ESD)

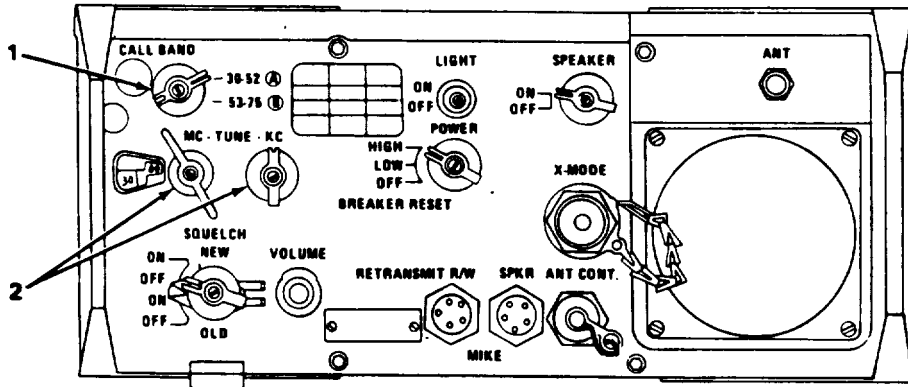
2.9. A1000 ASSEMBLY REPLACEMENT. (CONT)

INSTALLATION

NOTE

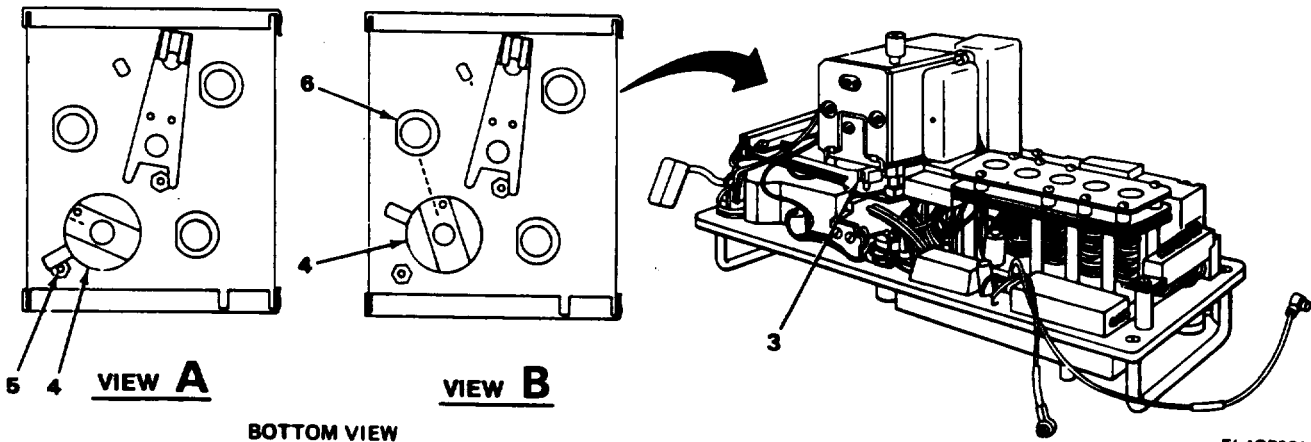
The steps below are used only if MC-TUNE-KC controls or unit coupler have been turned during repair. If not, proceed to step 6.

Do step 3 only for RT-246(\*)/VRC.



EL4GP020

1. Turn CALL BAND switch (1) to BAND A.
2. Turn MC-TUNE-KC controls (2) to 30.00 MHz.



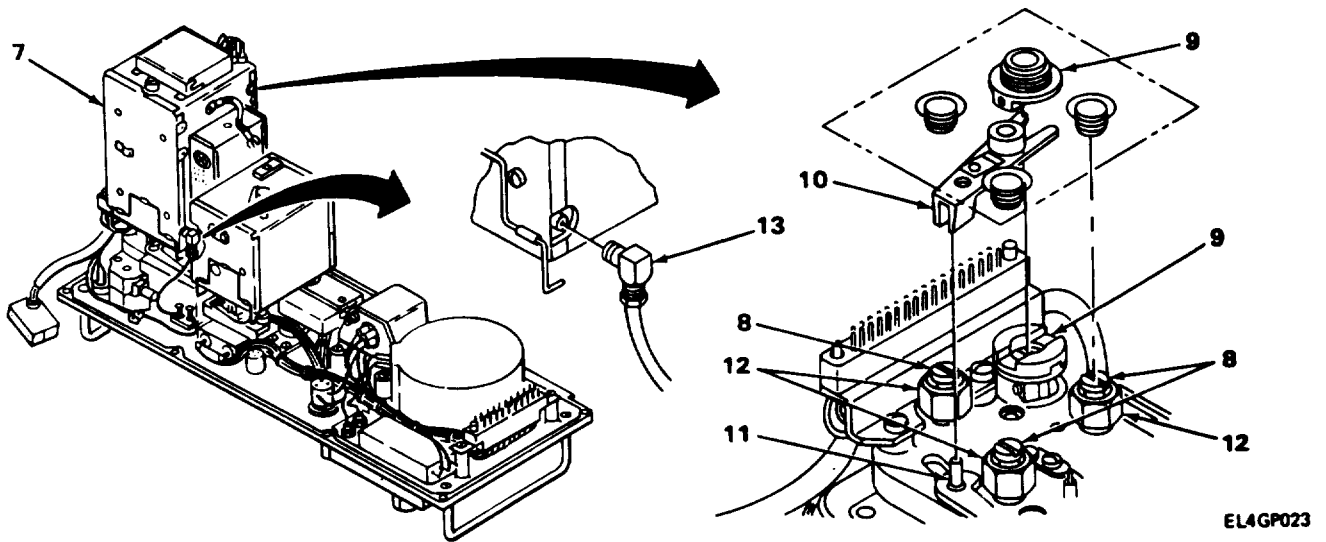
EL4GP021

3. Move lever arm (3) to extreme right to reach 30.00 MHz on dial.
4. Turn coupler (4) counterclockwise to stop (5) (view A).
5. Then turn coupler (4) clockwise to lineup with threaded stud (6) (view B).

NOTE

Coupler may have to be turned slightly to engage with mating part.

2-9. A1000 ASSEMBLY REPLACEMENT. (CONT)

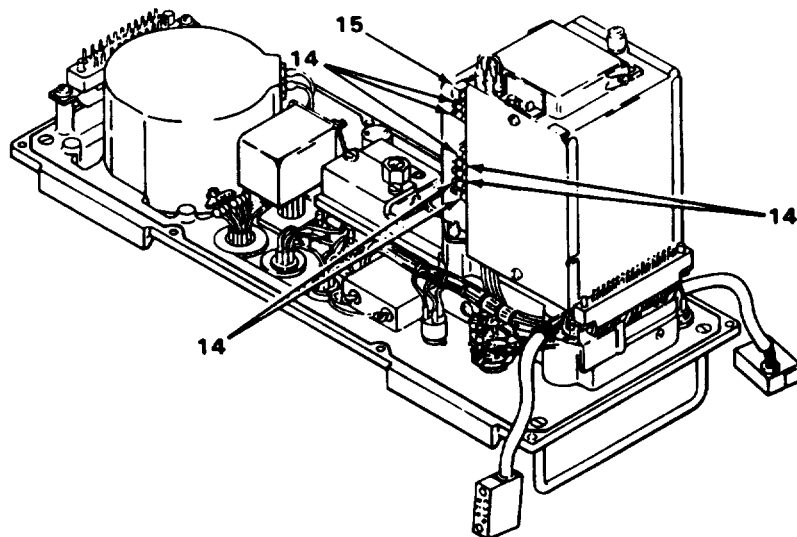


6. Carefully place A1000 assembly (7) on captive nut towers (8) and align gear train couplers (9), linkage arm (10), and band switch cam (11).
7. Handtighten three captive nuts (12).

CAUTION

Care must be taken when performing next step to prevent damage to VHF tuner linkage arm.

8. Using wrench, carefully tighten three captive nuts (12).
9. Connect brown wire (W301) (13) to J1001.



10. Connect seven color-coded wire plugs (14).
11. Connect yellow wire (W303) (15) to J1002.

FOLLOW-ON MAINTENANCE: Install front panel. (See paragraph 2-6.)

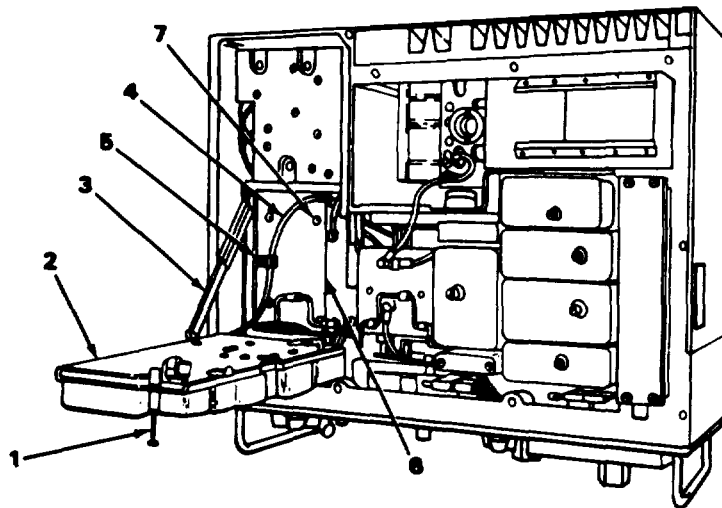
2-10. A1100 THROUGH A1500(\*) MODULE REPLACEMENT.

**CAUTION**

Module A1200B contains parts sensitive to Electrostatic Discharge (ESD)

**MATERIALS/PARTS:** Circuit Card Assembly A1100  
Circuit Card Assembly A1200  
Circuit Card Assembly A1300  
Circuit Card Assembly A1400  
Circuit Card Assembly A1500(\*)

**PRELIMINARY PROCEDURE:** Remove top cover. (See paragraph 2-7).



EL4GP129

**REMOVAL:**

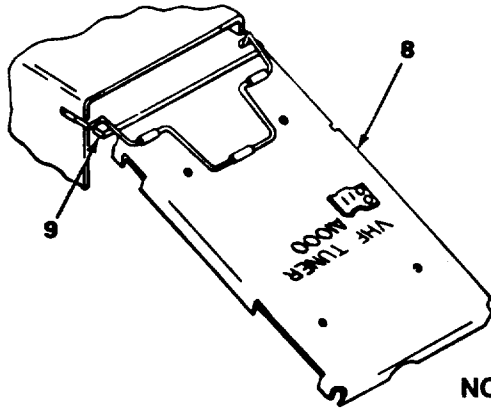
**NOTE**

Modules A1100 through A1500(\*) are housed within the A1000 assembly. To get to the A1000 assembly, A3000 assembly must first be moved out of the way.

The steps given are typical for removal of all modules.

1. Place BAND switch control on front panel to BAND **(A)**.
2. Using screwdriver, loosen one captive screw (1) on A3000 assembly (2).
3. Lower A3000 assembly (2) and secure brace (3).
4. Disconnect green wire (W202/W402) (4) from clip (5) on A1000 assembly cover (6).
5. Using screwdriver, loosen four captive screws (7) and remove A1000 assembly cover (6).

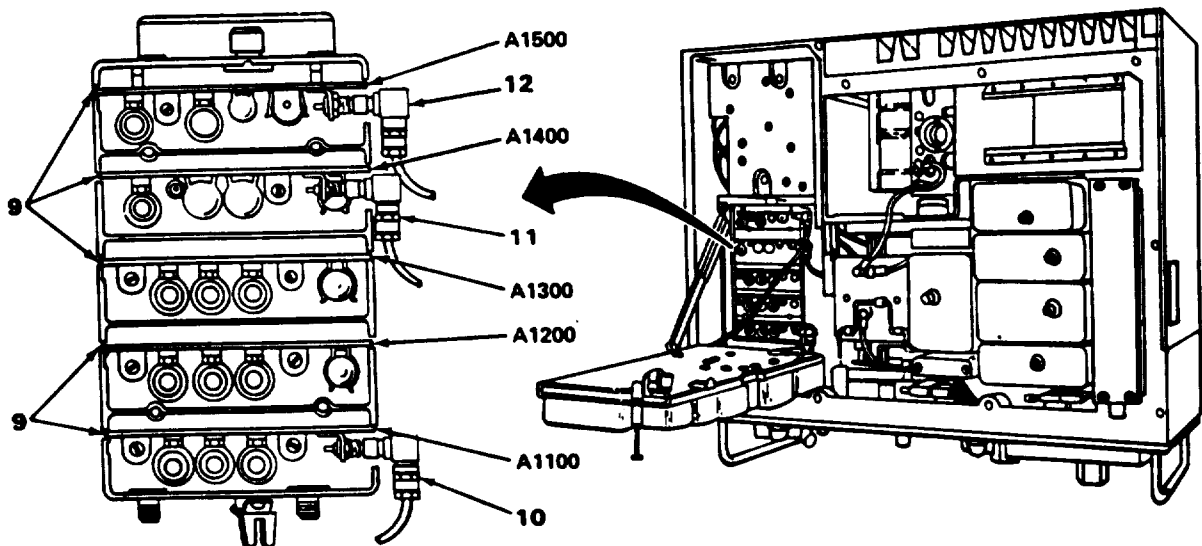
2-10. A1100 THROUGH A1500(\*) MODULE REPLACEMENT. (CONT)



NOTE

EL4GP130

Card puller (8) is used to remove all modules (9) as shown above.



EL4GP131

6. Before removing A1100 module, disconnect brown wire (W301) (10) from J1001; before removing A1400 module, disconnect violet wire (W409) (11) from J1003; and before removing A1500(\*) module, disconnect green wire (W202/W402) (12) from J1004.
7. Using card puller, carefully remove modules (9).

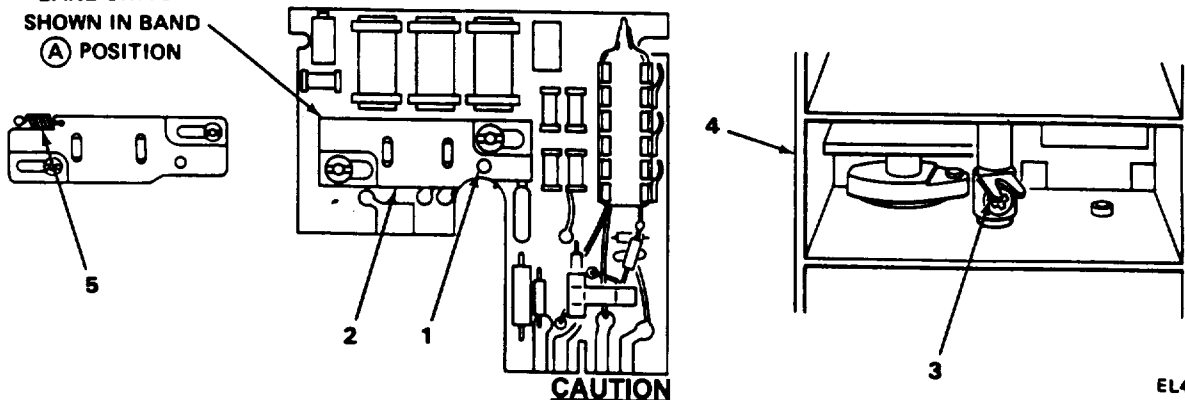
**CAUTION**

Module A1200B contains parts sensitive to Electrostatic Discharge (ESD)

2-10. A1100 THROUGH A1500(\*) MODULE REPLACEMENT. (CONT)

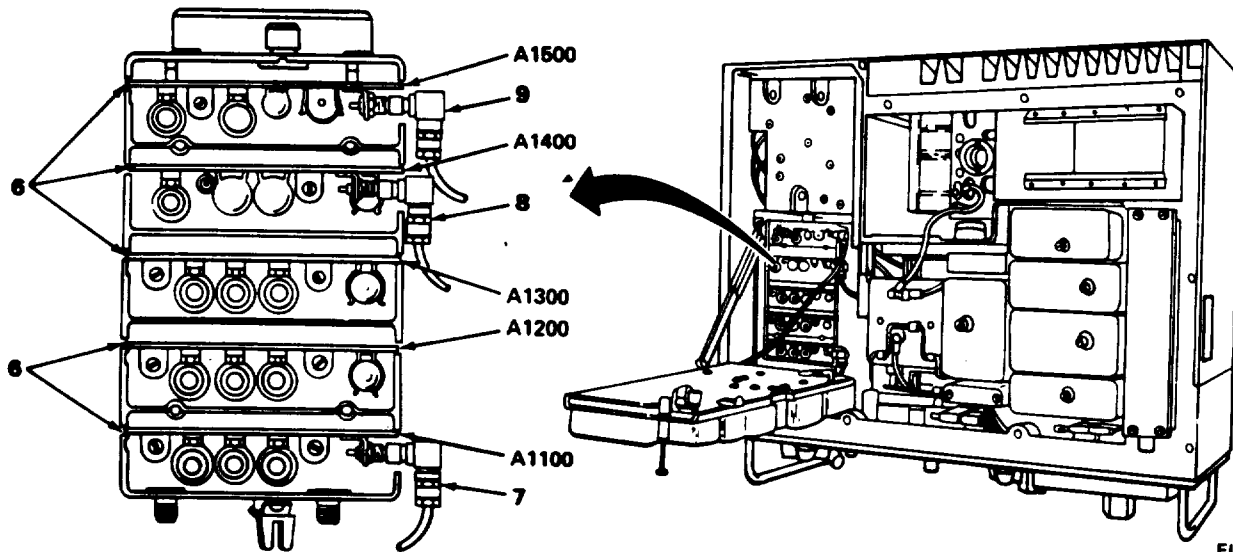
INSTALLATION

BAND SWITCH  
SHOWN IN BAND  
A POSITION



EL4GP132

Before installing A1100, A1200 and A1300 modules, make sure band switch pin (1) on module (2) is positioned to mate with band switch actuating pawl (3) on A1000A assembly (4). On some A1100, A1200 and A1300 modules, spring (5) returns band switch to BAND B position. On these modules turn band switch control to BAND B for installation, then return to BAND A position. Module A1200B contains parts sensitive to Electrostatic Discharge (ESD).



EL4GP133

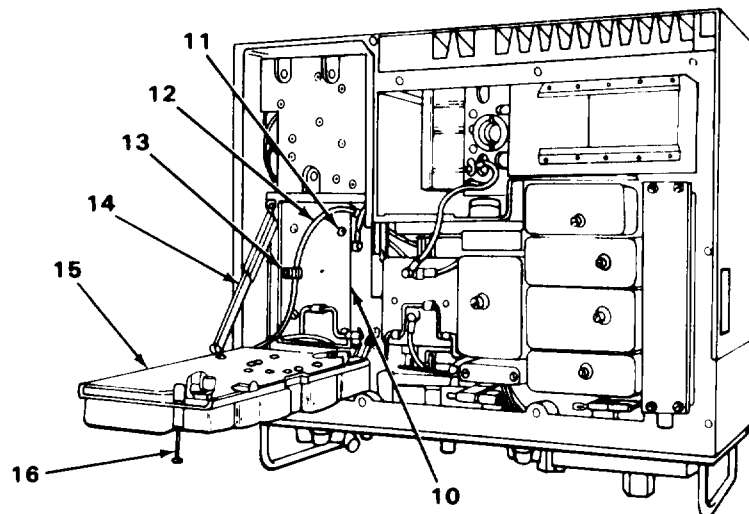
1. Carefully push modules (6) into place.

NOTE

Make sure spring contacts on modules make contact with partitions between modules.

2. If A1100, A1400 or A1500(\*) modules were removed, reconnect brown wire (W301) (7) to J1001, violet wire (W409) (8) to J1003 and green wire (W202/W402) (9) to J1004.

## 2-10. A100 THROUGH A1500 MODULE REPLACEMENT. (CONT)



EL4GP134

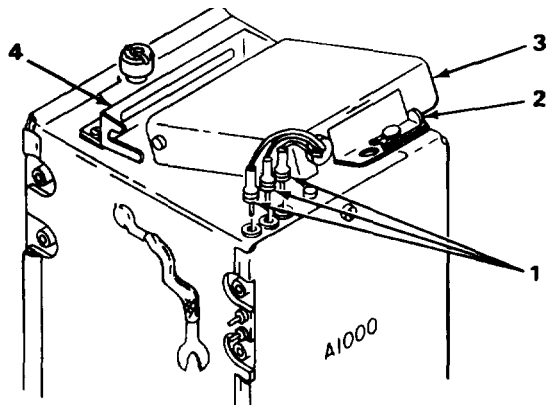
3. Install A1000 assembly cover (10) on A1000 assembly.
4. Using screwdriver, tighten four captive screws (11).
5. Connect green wire (W202/W402) (12) to clip (13).
6. Release brace (14) and raise A3000 assembly (15) into position.
7. Using screwdriver, tighten one captive screw (16).

FOLLOW-ON MAINTENANCE: Install top cover. (See paragraph 2-7.)

## 2-11. A1600 ASSEMBLY REPLACEMENT

MATERIALS/PARTS: Power Supply Assembly,

PRELIMINARY PROCEDURE: Remove top and bottom cover. (See paragraph 2-7.)



EL4GP026

### NOTE

A1600 assembly is located on top of A1000 assembly.

### REMOVAL

1. Disconnect three color-coded wire plugs (1).
2. Unfasten retaining clip (2) by moving clip to right.
3. Lift front of assembly (3) and pull forward to remove from bracket (4).

### INSTALLTION

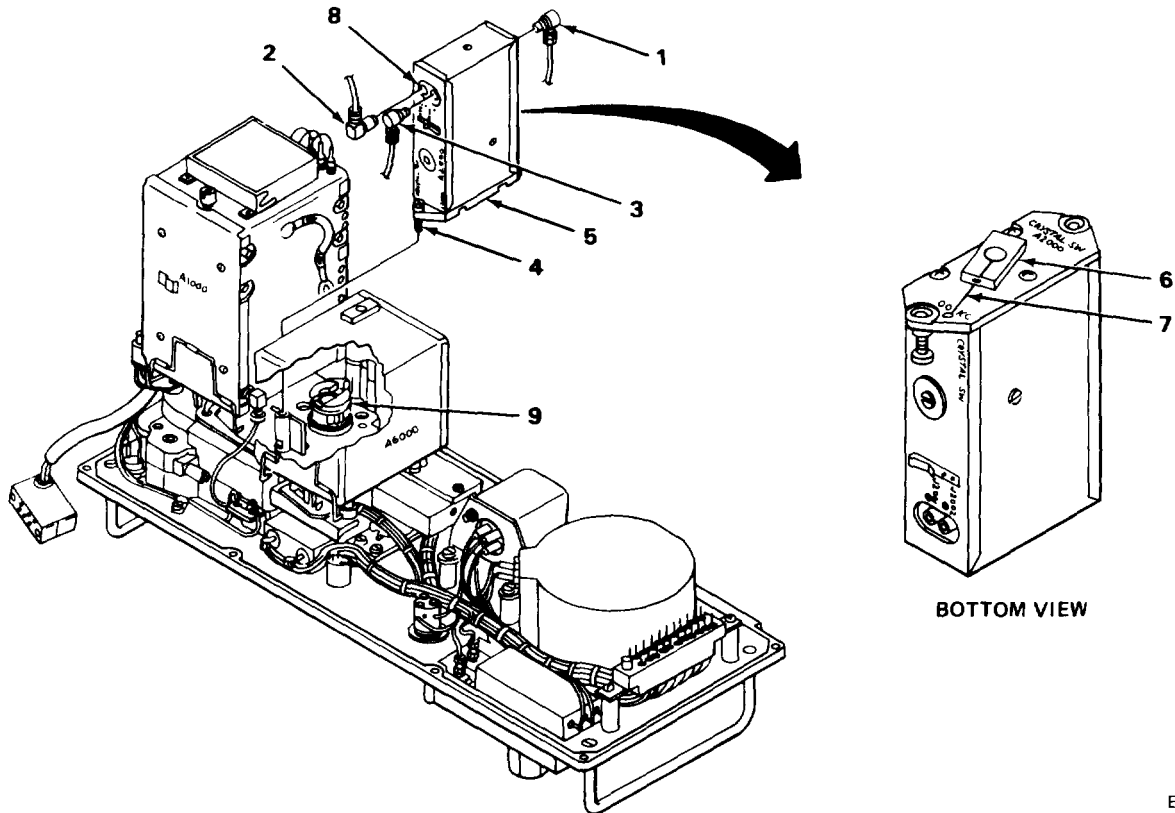
1. Place assembly (3) in bracket (4) and push into place.
2. Push front of assembly (3) down and secure by moving retaining clip (2) to left.
3. Connect three color-coded wire plugs (1).

FOLLOW-ON MAINTENANCE: Install top and bottom cover. (See paragraph 2-7.)



## 2-12. A2000 ASSEMBLY REPLACEMENT.

MATERIALS/PARTS: Radio Frequency Oscillator Assembly,  
 PRELIMINARY PROCEDURE: Remove top and bottom cover. (See paragraph 2-7.)



EL4GP027

### REMOVAL

1. Disconnect red wire (W404) (1) from J2003.
2. Disconnect black wire (W403) (2) from J2002.
3. Disconnect orange wire (W304) (3) from J2001.
4. Using screwdriver, loosen two captive screws (4).
5. Remove A2000 assembly (5).

### INSTALLATION

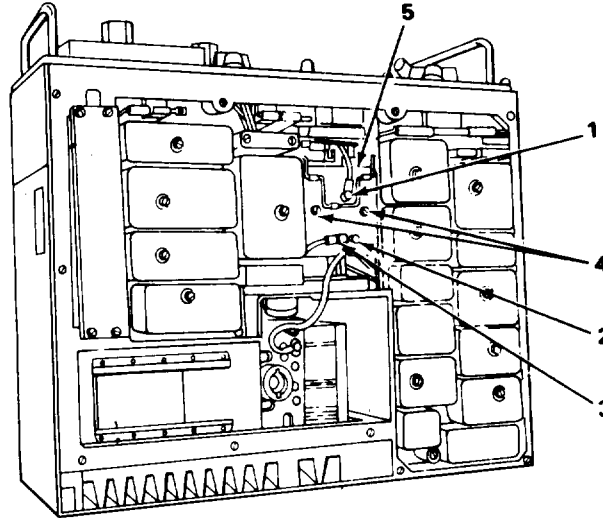
1. Aline coupler (6) with scribe mark (7).
2. Install A2000 assembly so J2001 and J2002 terminals (8) face top of radio.
3. Aline coupler (6) with mating coupler (9). Coupler (6) might have to be turned slightly to mate with coupler (9).
4. Using screwdriver, tighten two captive screws (4).
5. Connect orange wire (W304) (3) to J2001.
6. Connect black wire (W403) (2) to J2002.
7. Connect red wire (W404) (1) to J2003.

FOLLOW-ON MAINTENANCE: Install top and bottom cover. (See paragraph 2-7.)

### 2-13. A6300 AND A6400 MODULE REPLACEMENT.

MATERIALS/PARTS: Circuit Card Assembly A6300,  
Circuit Card Assembly A6400

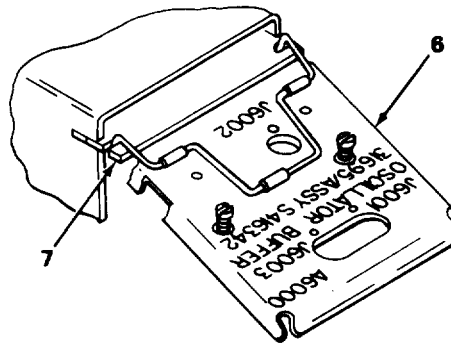
PRELIMINARY PROCEDURE: Remove top and bottom cover. (See paragraph 2-7.)



EL4GP193

#### REMOVAL

1. Set MC-TUNE-KC controls on front panel to 30.00 MHz.
2. Disconnect brown wire (W408) (1), grey wire (W407) (2) and yellow wire (W303) (3).
3. Using screwdriver, loosen two captive screws (4) and remove top cover (5).

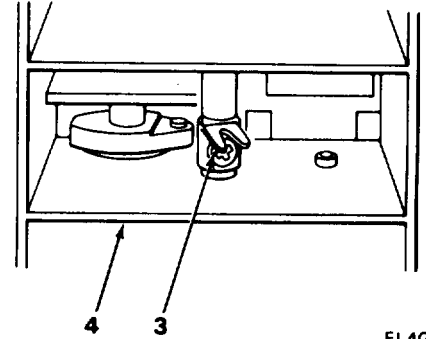
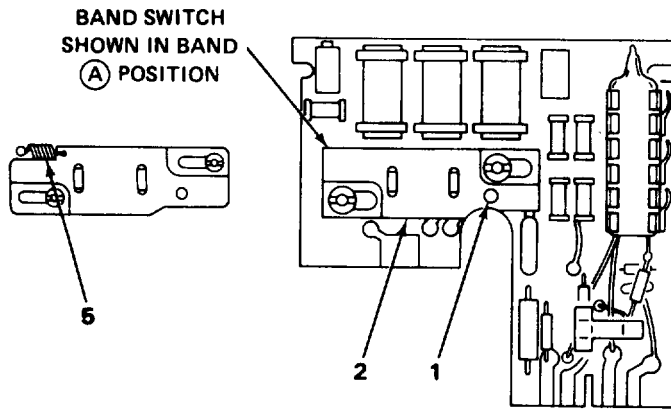


EL4GP194

4. Using module puller (6), carefully remove both modules (7).

2-13. A6300 AND A6400 MODULE REPLACEMENT. (CONT)

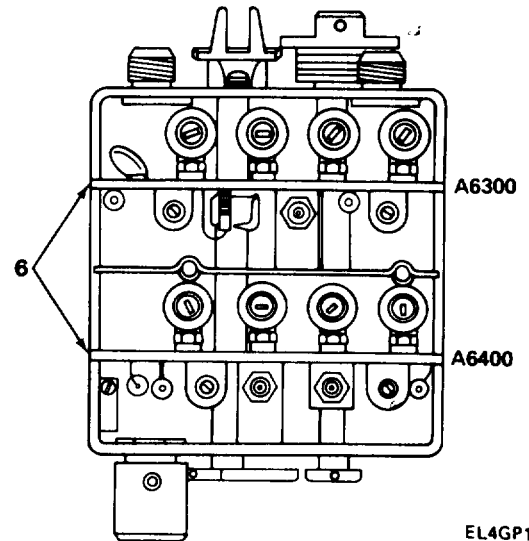
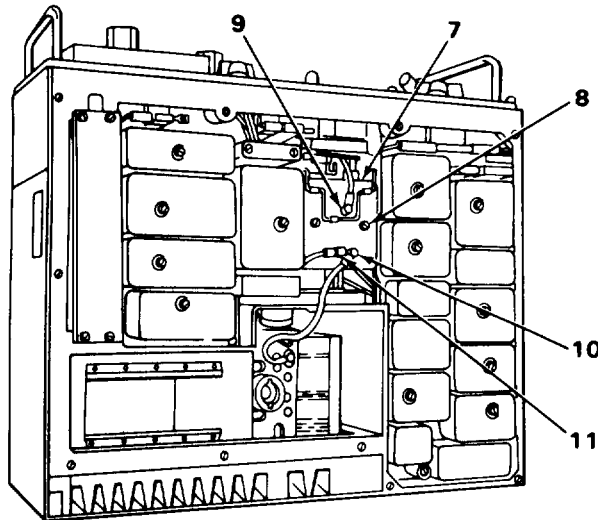
INSTALLATION



EL4GP539

**CAUTION**

Before installing modules, make sure band switch cam pin (1) on module (2) is positioned to mate with band switch actuating pawl (3) on A6000 assembly (4). On some modules, spring (5) returns band switch to BAND (B) position. On these modules, turn band switch control to BAND (B) for installation then return to BAND (A) position.



EL4GP198

**NOTE**

Note locations of different numbered modules.

Make sure spring contacts on modules make contact with partitions between modules.

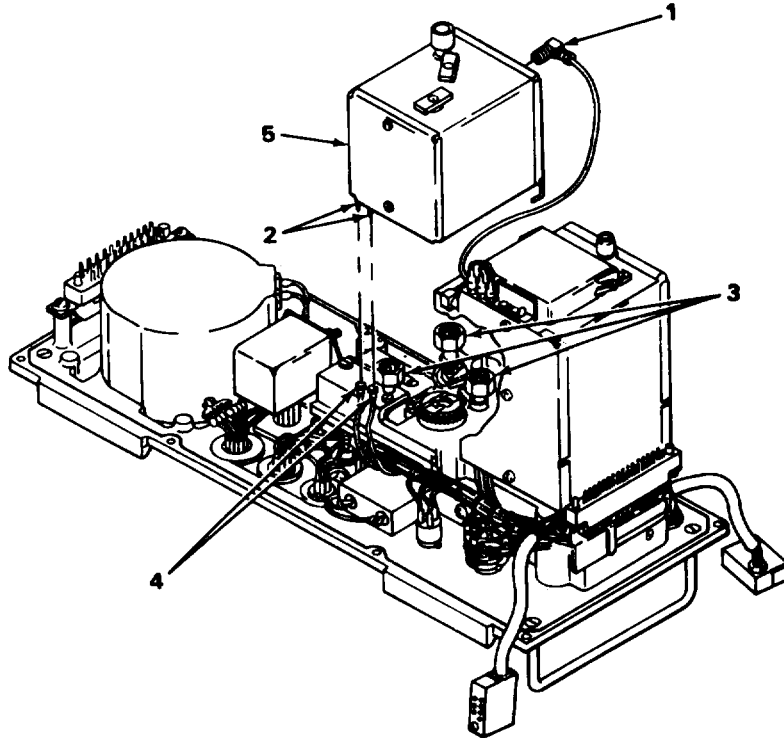
1. Carefully push modules (6) into place.
2. Install top cover (7).
3. Using screwdriver, tighten two captive screws (8).
4. Connect brown wire (W408) (9), grey wire (W47) (10) and yellow wire (W303) (11).

FOLLOW-ON MAINTENANCE: Install top and bottom cover. (See paragraph 2-7.)

## 2-14. A6000 ASSEMBLY REPLACEMENT.

MATERIALS/PARTS: Buffer Assembly Oscillator, P/N SMD 416342

PRELIMINARY PROCEDURE: Remove front panel. (See paragraph 2-8.)



EL4GP031

### REMOVAL

1. Disconnect yellow (W303) (1) from J6003.

### CAUTION

Care must be taken when performing next step to prevent damage to linkage arm and color-coded wire plug pins (2).

2. Using wrench, carefully loosen three captive nuts (3).
3. Disconnect two color-coded wire plugs (4).
4. Remove A6000 assembly (5).

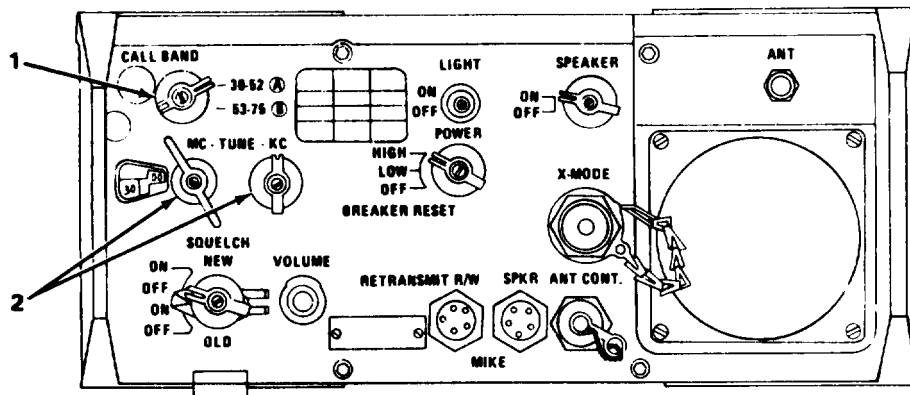
2-14. A6000 ASSEMBLY REPLACEMENT. (CONT)

INSTALLATION

NOTE

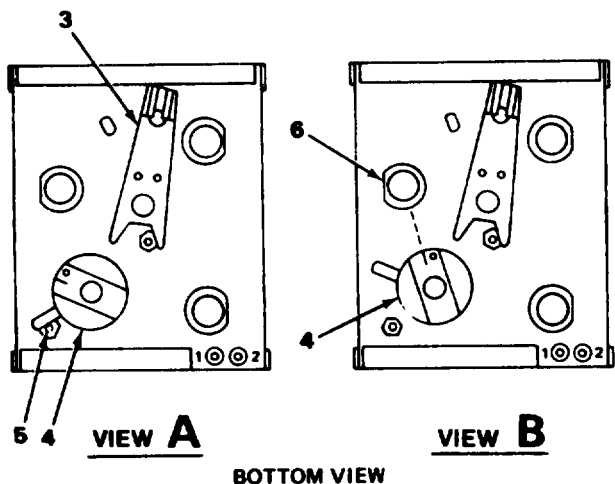
The steps below are used only if any front panel controls or the unit coupler has been turned during repair. If not, proceed to step 6.

For RT-246(\*)/VRC, do steps 3, 4, and 5 only.

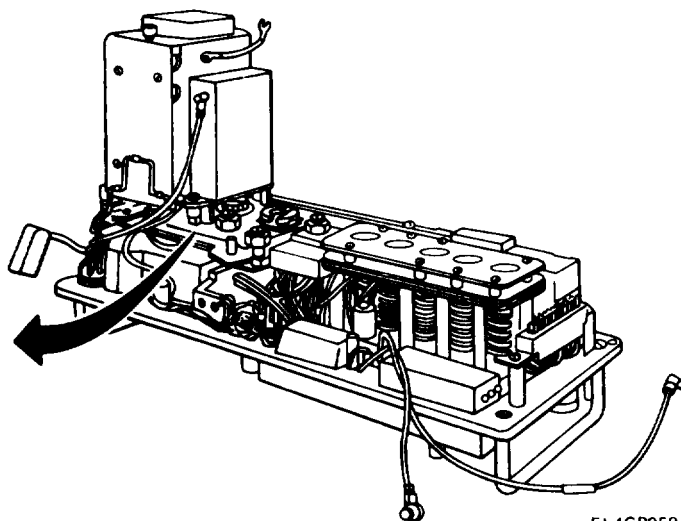


EL4GP020

1. Turn CALL BAND switch (1) to BAND **A**.
2. Turn MC-TUNE-KC controls (2) to 30.00 MHz.



BOTTOM VIEW



EL4GP058

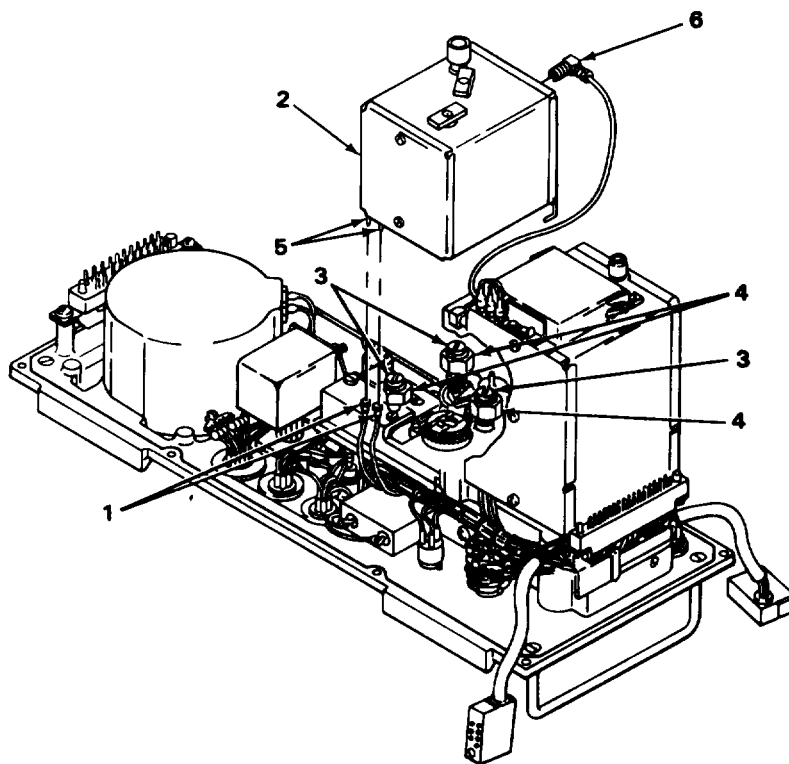
3. Move linkage arm (3) to extreme left to reach 30.00 MHz on dial.
4. Turn coupler(4) counterclockwise to stop (5) (view A).
5. Then turn coupler(4) clockwise to line up with threaded stud (6) (view B).

NOTE

Coupler may have to be turned slightly to engage with mating part.

## 2-14. A6000 ASSEMBLY REPLACEMENT. (CONT)

### INSTALLATION (CONT)



EL4GP032

6. Connect two color-coded wire plugs (1).
7. Carefully place A6000 assembly (2) on captive nut posts (3) and align with gear train coupler.
8. Handtighten three captive nuts (4).

### **CAUTION**

Care must be taken when performing next step to prevent damage to linkage arm and color-coded wire plug pins (5).

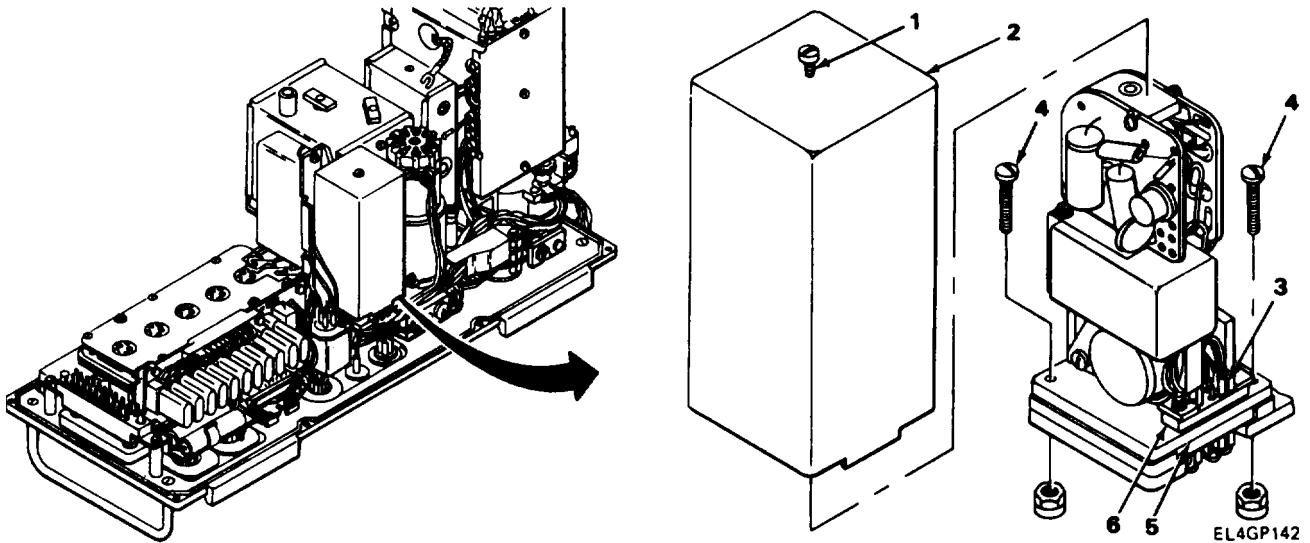
9. Using wrench, tighten three captive nuts (4).
10. Connect yellow wire (W303) (6) to J6003.

FOLLOW-ON MAINTENANCE: Install front panel. (See paragraph 2-8.)

**2-15. SERVOAMPLIFIER A7200 REPLACEMENT (RT-246(\*)/VRC ONLY).**

MATERIALS/PARTS: Electrical Control Amplifier

PRELIMINARY PROCEDURE: Remove front panel. (See paragraph 2-8.)



**REMOVAL**

1. Using screwdriver, loosen one captive screw (1) and lift can (2) off of assembly (3).
2. Using screwdriver, loosen two captive screws (4) and pull assembly (3) out of connector (5) to remove.

**INSTALLATION**

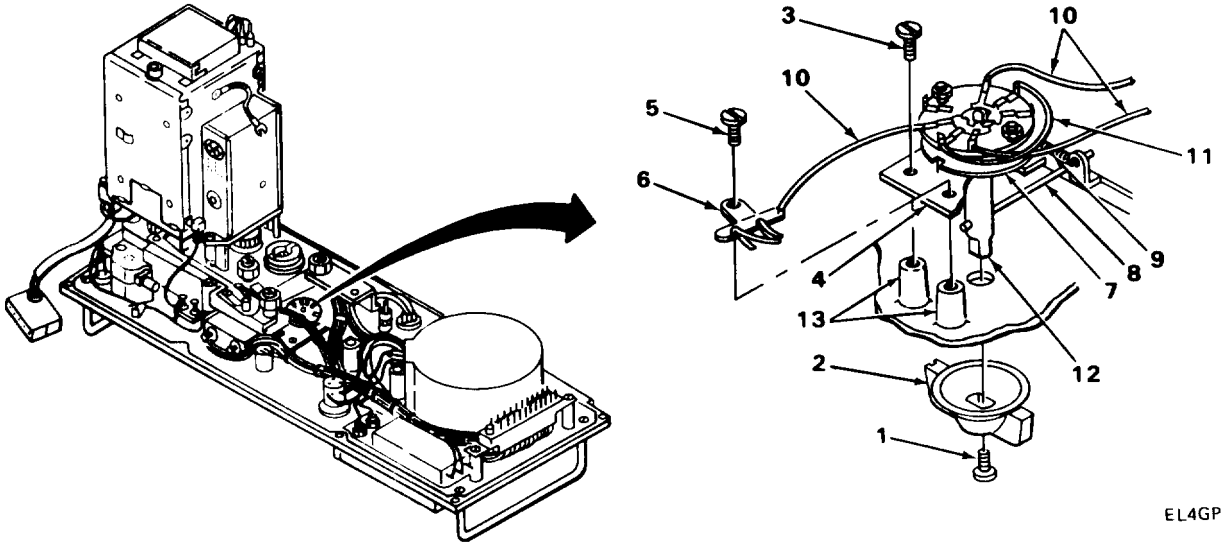
1. Aline connector(6) on assembly (3) with connector(5) and push into place.
2. Using screwdriver, tighten two captive screws (4).
3. Install can (2) on assembly (3).
4. Using screwdriver, tighten one captive screw (1).

FOLLOW-ON MAINTENANCE: Install front panel. (See paragraph 2-8.)

### 2-16. POWER SWITCH S353 (FOR RT-524(\*)/VRC) AND S304 (FOR RT-246(\*)/VRC) REPLACEMENT.

MATERIALS/PARTS: Rotary Switch, P/N SMC 414881

PRELIMINARY PROCEDURE: Remove Switch S359. (See paragraph 2-32.)



EL4GP037

#### REMOVAL

#### NOTE

Make sure POWER switch is in HIGH position.

1. Using screwdriver, remove screw (1) and knob (2).
2. Using screwdriver, remove screw (3) from bracket (4) and screw (5) from grounding lug (6) and bracket (4).
3. Turn POWER switch (7) counterclockwise to move pin (8) from under spring (9) and push switch (7) out of panel.
4. Using soldering iron, remove and resolder three wires (10) one at a time from defective switch to replacement switch.
5. Using soldering iron, remove and resolder one jumper wire(11) from defective switch to replacement switch.

#### INSTALLATION

1. Set POWER switch (7) to HIGH by turning switch stem (12) clockwise to stop.
2. Push POWER switch (7) into front panel and turn clockwise to position pin (8) under spring (9). Aline holes in bracket (4) with holes in screw towers (13).
3. Install screw (3).
4. Install screw (5) through grounding lug (6).
5. Using screwdriver, tighten screws (3) and (5).
6. Install knob (2) and screw (1).
7. Using screwdriver, tighten screw (1).

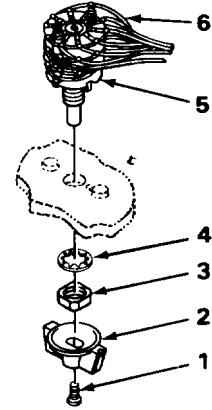
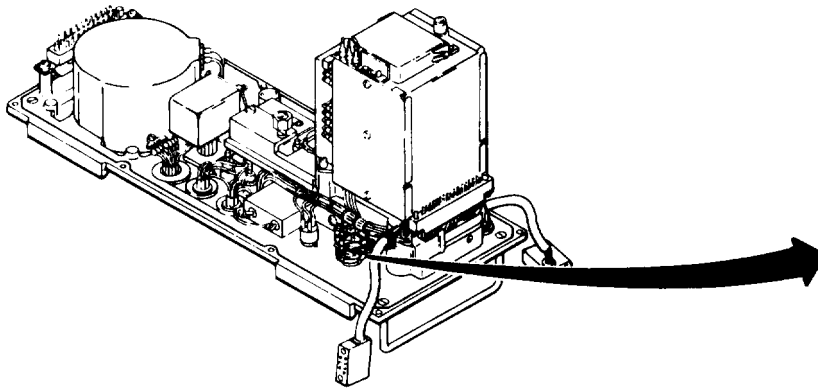
FOLLOW-ON MAINTENANCE: Install Switch S359. (See paragraph 2-32.)



**2-17. SQUELCH SWITCH S354(FOR RT-524(\*)/VRC) AND S302(FOR RT-246(\*)/VRC) REPLACEMENT.**

MATERIALS/PARTS: Rotary Switch S354 and S302

PRELIMINARY PROCEDURE: Remove front panel. (See paragraph 2-8.)



EL4GP025

**REMOVAL**

1. Using screwdriver, remove screw (1).
2. Remove knob (2).
3. Using wrench, remove nut (3).
4. Remove IT lockwasher (4) and push switch (5) out of panel.

**NOTE**

Switch S354 has 14 wires and Switch S302 has 15 wires.

5. Using soldering iron, remove and resolder wires (6) one at a time from defective switch to replacement switch.

**INSTALLATION**

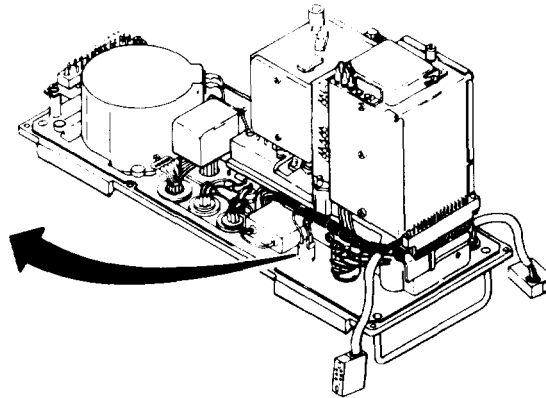
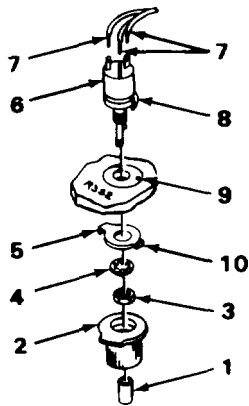
1. Push switch (5) back into panel.
2. Install IT lockwasher (4) and nut (3) on switch.
3. Using wrench, tighten nut (3).
4. Install knob (2) and screw (1).
5. Using screwdriver, tighten screw (1).

FOLLOW-ON MAINTENANCE: Install front panel. (See paragraph 2-8.)

## 2-18. VOLUME CONTROL R352 (FOR RT-524(\*)/VRC) AND R301 (FOR RT-246(\*)/VRC) REPLACEMENT.

MATERIALS/PARTS: Variable Composition Resistor

PRELIMINARY PROCEDURE: Remove front panel. (See paragraph 2-8.)



EL4GP055

### NOTE

Steps given are typical for both switches.

### REMOVAL

1. Using screwdriver, remove screw (1) and knob (2).
2. Using wrench, remove nut (3), ET lockwasher (4) and stop clip (5).
3. Push switch (6) out of front panel.
4. Using soldering iron, unsolder three wires (7) one at a time and resolder on replacement switch.

### INSTALLATION

1. Push switch (6) into front panel and position stop pin (8) in hole (9).
2. Install stop clip (5) with short end (10) in hole (9).
3. Install ET lockwasher (4) and nut (3).
4. Using wrench, tighten nut (3).
5. Install knob (2) and screw (1).
6. Using screwdriver, tighten screw (1).

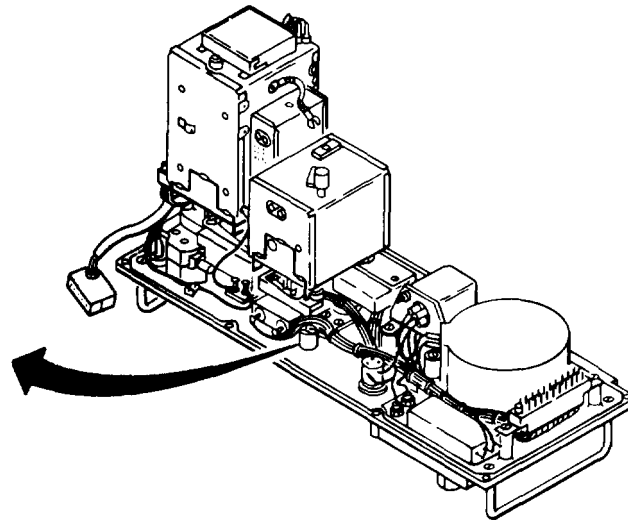
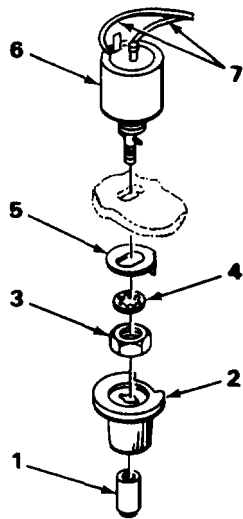
FOLLOW-ON MAINTENANCE: Install front panel. (See paragraph 2-8.)

**2-19. LIGHT SWITCH S352 (FOR RT-524(\*)/VRC) AND S305 (FOR RT-246(\*)/VRC) REPLACEMENT.**

MATERIALS/PARTS: Rotary Switch S352

Rotary Switch S305

PRELIMINARY PROCEDURE: Remove front panel (See paragraph 2-8.)



EL4GP056

**NOTE**

Steps given are typical of both switches.

**REMOVAL**

1. Using screwdriver, remove screw (1) and knob (2).
2. Using wrench, remove nut (3), IT lockwasher(4), and stop clip (5).
3. Push switch (6) out of front panel.
4. Using soldering iron, unsolder two wires (7) one at a time and resolder on replacement switch.

**INSTALLATION**

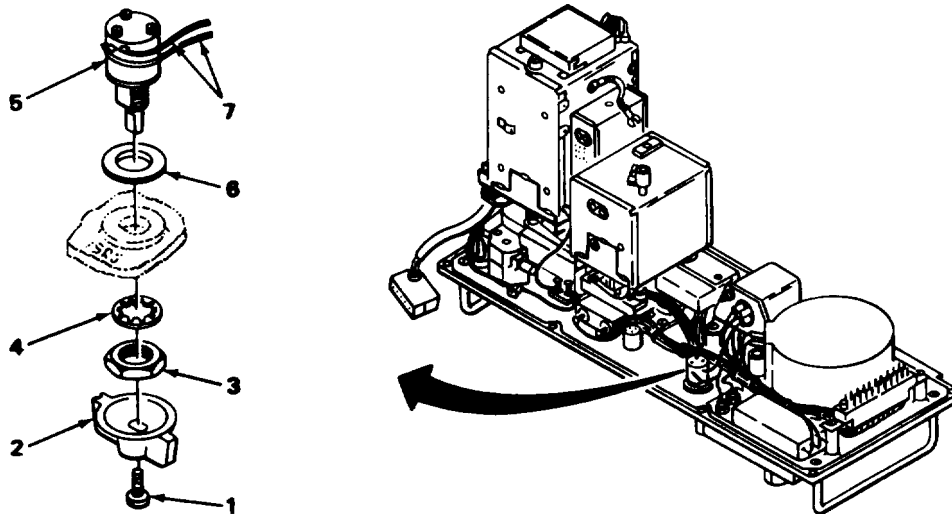
1. Push switch (6) into front panel and install stop clip (5), IT lockwasher (4) and nut (3).
2. Using wrench, tighten nut (3),
3. Install knob (2) and screw (1).
4. Using screwdriver, tighten screw (1).

FOLLOW-ON MAINTENANCE: Install front panel. (See paragraph 2-8.)

## 2-20. SPEAKER SWITCH S351 REPLACEMENT (RT-524(\*)/VRC ONLY).

MATERIALS/PARTS: Rotary Switch S351

PRELIMINARY PROCEDURE: Front panel removed. (See paragraph 2-8.)



EL4GP057

### REMOVAL

1. Using screwdriver, remove screw (1) and knob (2).
2. Using wrench, remove nut (3) and IT lockwasher (4).
3. Push switch (5) and plain washer (6) out of front panel.
4. Using soldering iron, unsolder two wires (7) one at a time and resolder on replacement switch.

### INSTALLATION

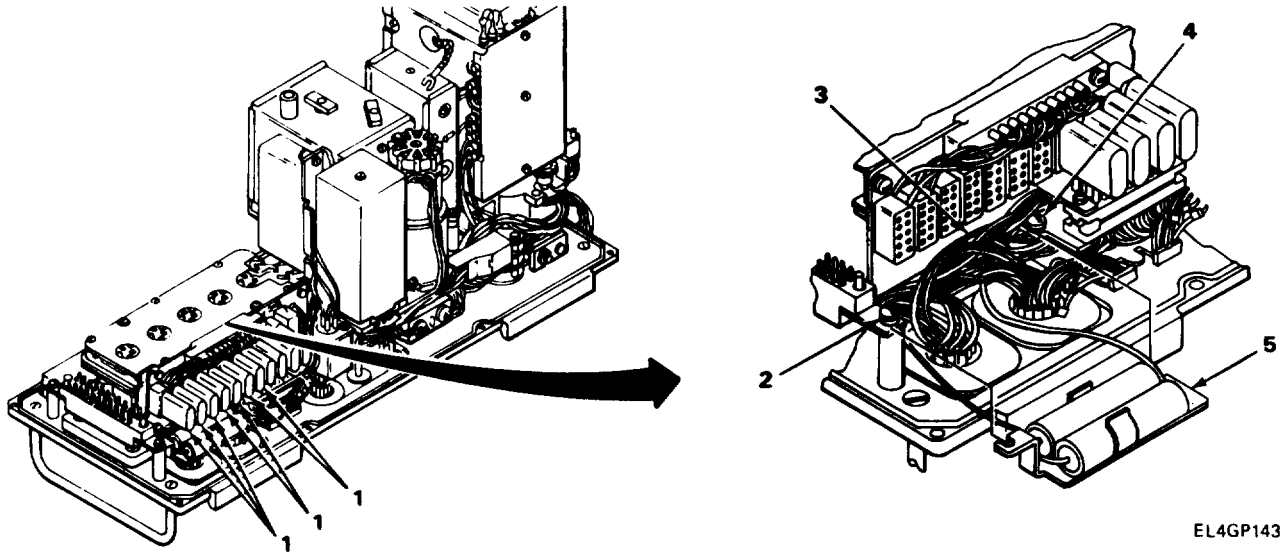
1. Push switch (5) and plain washer (6) into front panel and install IT lockwasher (4) and nut (3).
2. Using wrench, tighten nut (3).
3. Install knob (2) and screw (1).
4. Using screwdriver, tighten screw (1).

FOLLOW-ON MAINTENANCE: Install front panel. (See paragraph 2-8.)

**2-21. REMOTE CONNECTOR J306 REPLACEMENT (RT-246(\*)/VRC ONLY).**

**MATERIALS/PARTS:** Electrical Receptacle Connector, PIN SMC374841-2

**PRELIMINARY PROCEDURE:** Remove front panel. (See paragraph 2-8.)



EL4GP143

**REMOVAL**

1. Carefully remove seven armature relays (1), K7105 through K7111.
2. Using screwdriver, loosen screw (2).

**CAUTION**

Extreme care must be taken when performing next step to prevent damage to nearby wiring harness (3).

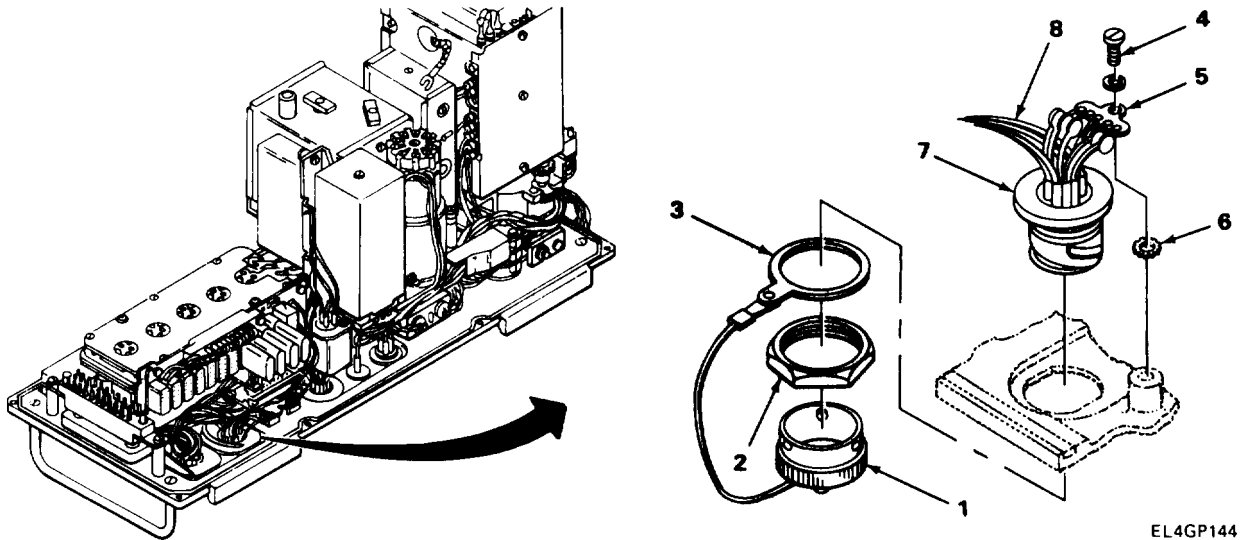
**NOTE**

Loosen screw (4) only enough to remove Terminal Board TB301.

3. Using screwdriver, carefully loosen screw (4).
4. Pull Terminal Board TB301 (5) straight out from under screws (2) and (4) and move Terminal Board TB301 out of way.

2-21. REMOTE CONNECTOR J306 REPLACEMENT (RT-246(\*)/VRC ONLY). (CONT)

REMOVAL (CONT)



5. Remove protective cap (1).
6. Using wrench, remove retaining nut (2).
7. Remove protective cap retaining ring (3).
8. Using screwdriver, remove screw (4), ground lug (5) and ET lockwasher (6).
9. Push connector (7) out of front panel.
10. Using soldering iron, carefully remove and resolder 29 wires (8) from defective connector to replacement connector one at a time.

INSTALLATION

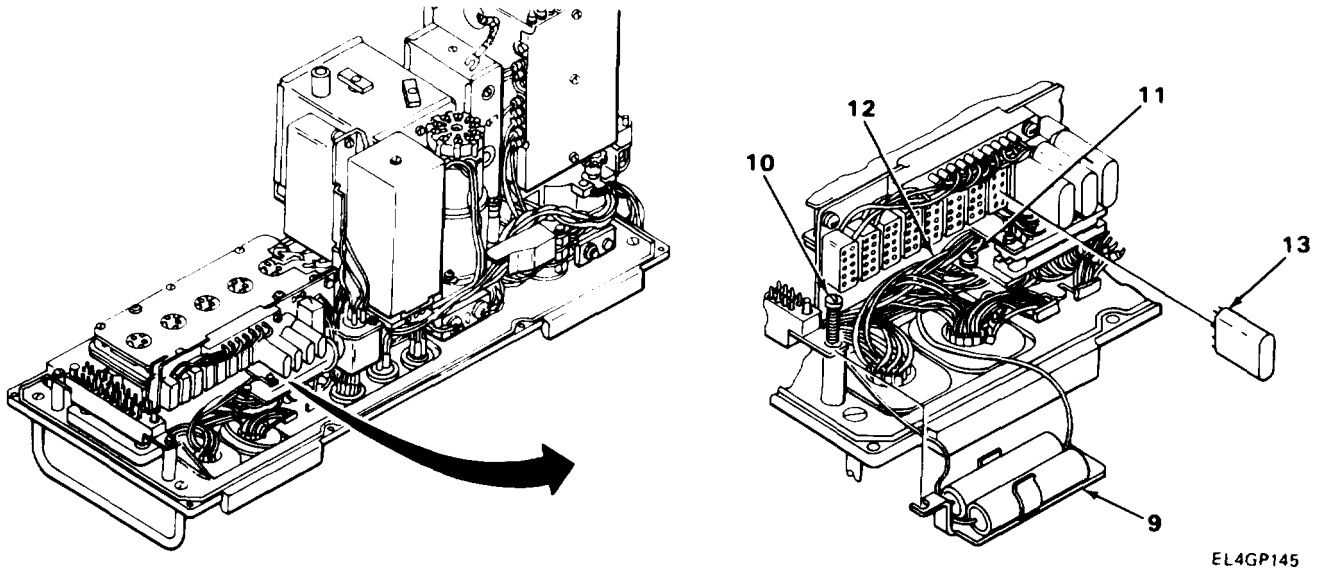
**CAUTION**

Care must be taken when performing next step to prevent pinching wires under connector.

1. Push connector (7) back into front panel.
2. Install protective cap retaining ring (3) and retaining nut (2).
3. Using wrench, tighten retaining nut (2).
4. Install protective cap (1),
5. Install screw (4), ground lug (5) and ET lockwasher (6).
6. Using screwdriver, tighten screw (4).

2-21. REMOTE CONNECTOR J306 REPLACEMENT (RT.246(\*)/VRC ONLY). (CONT)

INSTALLATION(CONT)



7. Carefully position Terminal Board TB301 (9) under screws (10) and (11) and push into place.

**CAUTION**

Extreme care must be taken when performing next step to prevent damage to nearby wiring harness (12).

8. Using screwdriver, tighten screws (10) and (11).

**CAUTION**

Care must be taken when performing next step to prevent bending pins on armature relays (13). Straighten any bent pins.

**NOTE**

Armature relays (13) may be installed in either direction.

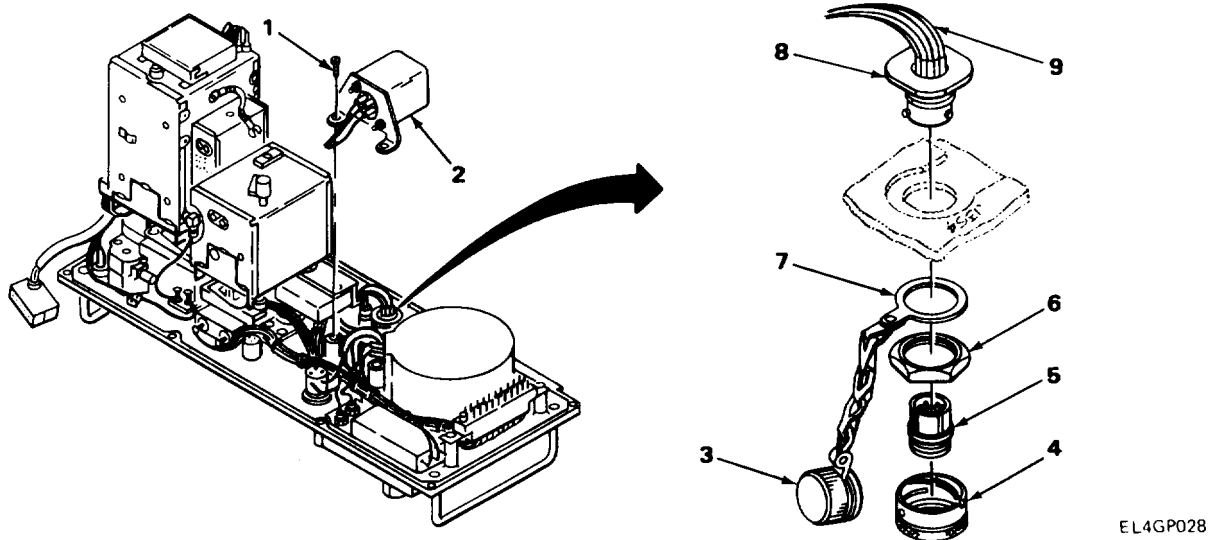
9. Carefully install seven armature relays (13), K7105 through K7111.

FOLLOW-ON MAINTENANCE: Install front panel. (See paragraph 2-8.)

**2-22. X-MODE CONNECTOR J354 REPLACEMENT (RT-524(\*)/VRC ONLY).**

**MATERIALS/PARTS:** Electrical Receptacle Connector, P/N SMC439958-2

**PRELIMINARY PROCEDURE:** Remove front panel. (See paragraph 2-8.)



EL4GP028

**REMOVAL**

1. Using screwdriver, remove two screws (1) from Transformer T351 (2) and move transformer out of way.
2. Remove protective cap (3).
3. Remove knurled plug retainer(4) and jumper plug (5).
4. Using wrench, remove retaining nut (6).
5. Remove protective cap retaining ring (7).
6. Push connector (8) out of front panel.
7. Using soldering iron, carefully remove and resolder eight wires (9) from defective connector to replacement connector one at a time.

**INSTALLATION**

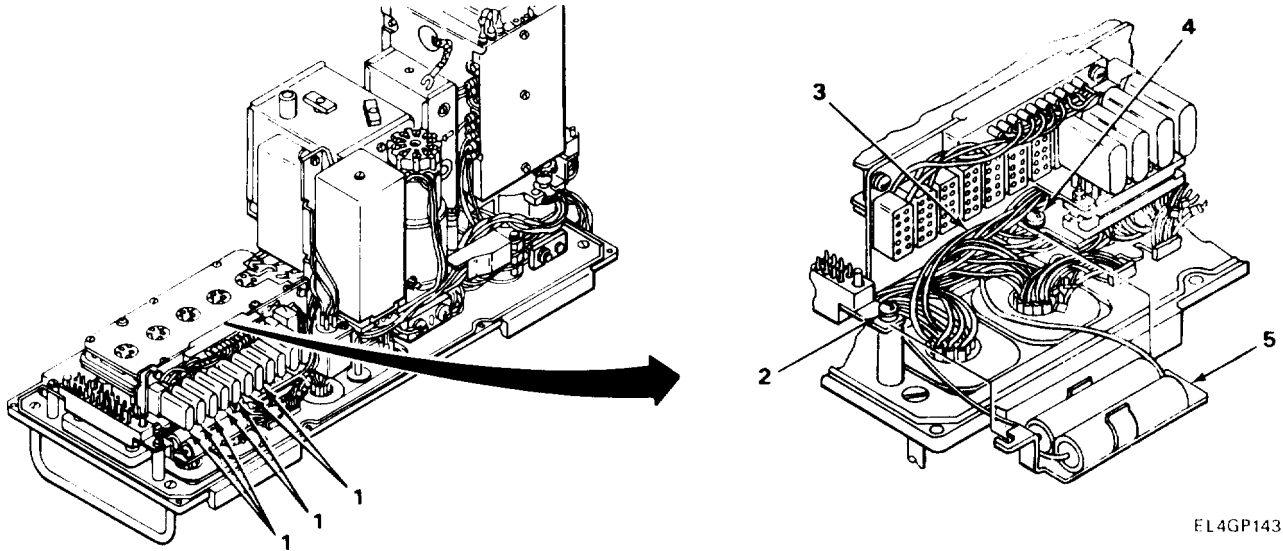
1. Push connector (8) back into front panel.
2. Install protective cap retaining ring (7).
3. Install retaining nut (6).
4. Using wrench, tighten retaining nut (6).
5. Install jumper plug (5) and knurled plug retainer(4).
6. Install protective cap (3).
7. Install two screws (1) in Transformer T351 (2) and put in place.
8. Using screwdriver, tighten two screws (1).

**FOLLOW-ON MAINTENANCE:** Install front panel. (See paragraph 2-8.)



**2-23. X-MODE CONNECTOR J305 REPLACEMENT (RT-246(\*)/VRC ONLY).**

MATERIALS/PARTS: Electrical Receptacle Connector, P/N SM-C-374841-2  
 PRELIMINARY PROCEDURE: Remove front panel. (See paragraph 2-8.)



EL4GP143

**REMOVAL**

1. Carefully remove seven armature relays (1), K7105 through K7111.
2. Using screwdriver, loosen screw (2).

**CAUTION**

Extreme care must be taken when performing next step to prevent damage to nearby wiring harness (3).

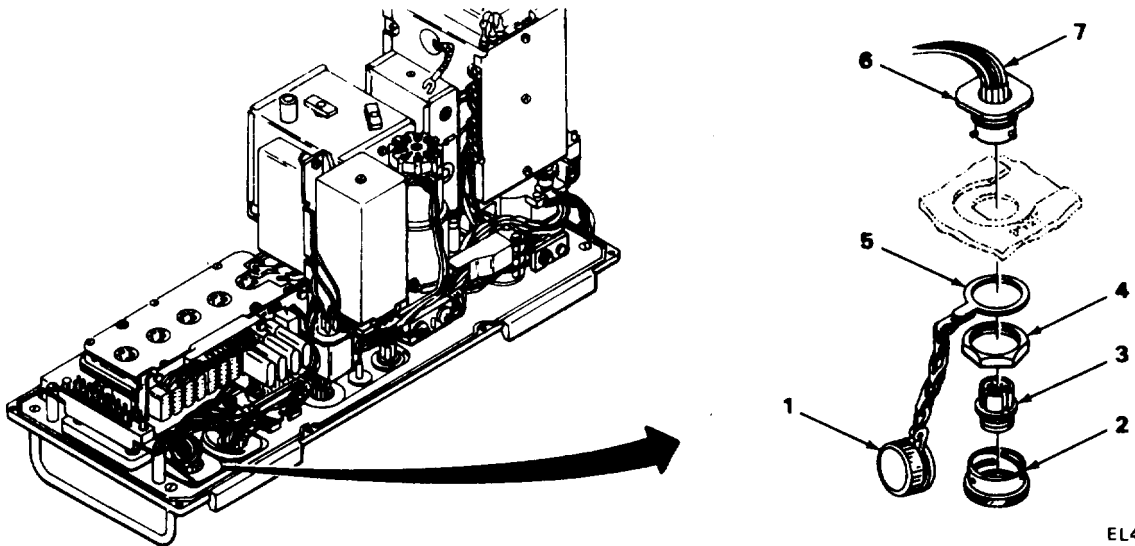
**NOTE**

Loosen screw (4) only enough to remove Terminal Board TB301.

3. Using screwdriver, carefully loosen screw (4).
4. Pull Terminal Board TB301 (5) straight out from under screws (2) and (4) and move Terminal Board TB301 out of way.

## 2-23. X-MODE CONNECTOR J305 REPLACEMENT (RT-246(\*)/VRC ONLY). (CONT)

### REMOVAL (CONT)



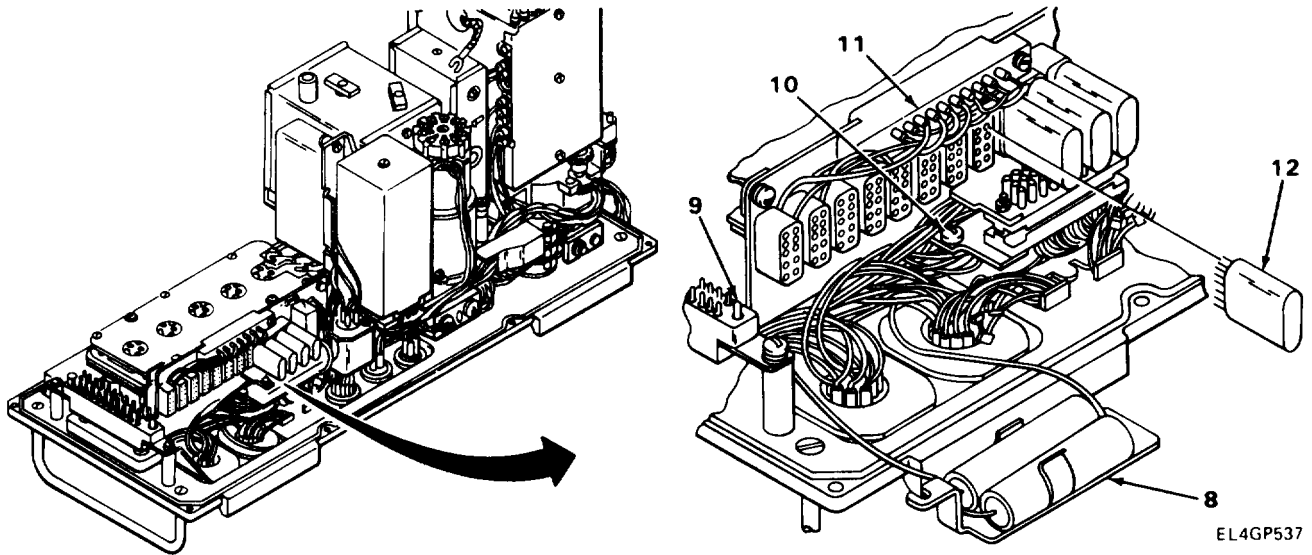
EL4GP146

5. Remove protective cap (1).
6. Remove knurled plug retainer(2) and jumper plug (3).
7. Using wrench, remove retaining nut (4).
8. Remove protective cap retaining ring(5).
9. Push connector (6) out of front panel.
10. Using soldering iron, carefully remove and resolder eight wires (7) from defective connector to replacement connector one at a time.

### INSTALLATION

1. Push connector (6) back into front panel.
2. Install protective cap retaining ring (5).
3. Install retaining nut (4).
4. Using wrench, tighten retaining nut (4).
5. Install jumper plug (3) and knurled plug retainer(2).
6. Install protective cap (1).

2-23. X-MODE CONNECTOR J305 REPLACEMENT (RT-246(\*)/VRC ONLY). (CONT)



7. Carefully position Terminal Board TB301 (8) under screws (9) and (10) and push into place.

**CAUTION**

Extreme care must be taken when performing next step to prevent damage to nearby wiring harness (11).

8. Using screwdriver, tighten screws (9) and (10).

**CAUTION**

Care must be taken when performing next step to prevent bending pins on armature relays (12). Straighten any bent pins.

**NOTE**

Armature relays (12) may be installed in either direction.

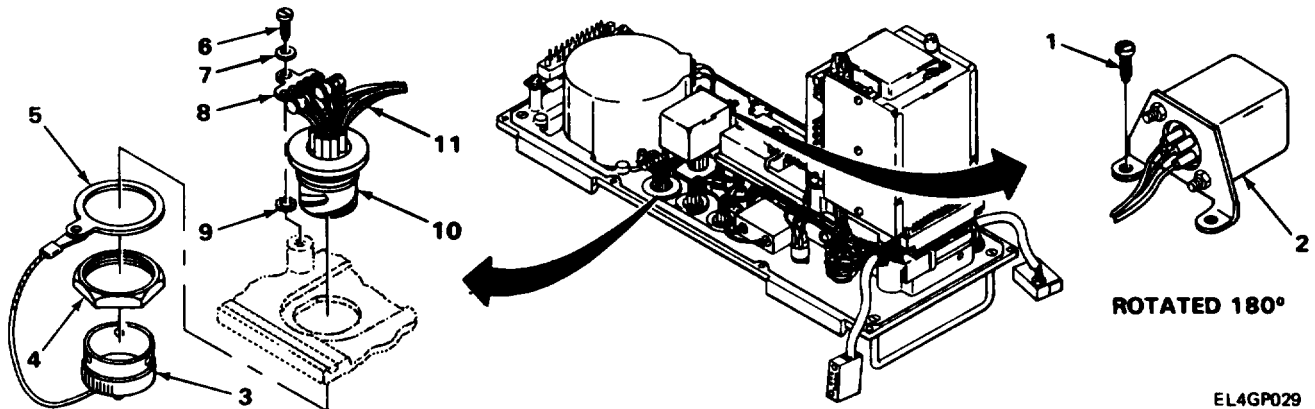
9. Carefully install seven armature relays (12), K7105 through K7111.

FOLLOW-ON MAINTENANCE: Install front panel. (See paragraph 2-8.)

**2-24. ANT CONT CONNECTOR J353 REPLACEMENT (RT-524(\*)/VRC ONLY).**

MATERIALS/PARTS: Electrical Receptacle Connector, P/N SMC374816

PRELIMINARY PROCEDURE: Remove front panel. (See paragraph 2-8.)



**REMOVAL**

1. Using screwdriver, remove two screws (1) from Transformer T351 (2) and move transformer to side.
2. Remove protective cap (3).
3. Using wrench, remove retaining nut (4).
4. Remove protective cap retaining ring (5).
5. Using screwdriver, remove screw (6).
6. Remove flat washer (7), ground lug (8) and ET lockwasher (9).
7. Push connector (10) out of front panel.

**CAUTION**

Replace all protection capacitors along with connector to ensure proper performance.

- a. Using soldering iron, carefully remove and resolder 17 wires (11) from defective connector to replacement connector one at a time.

**INSTALLATION**

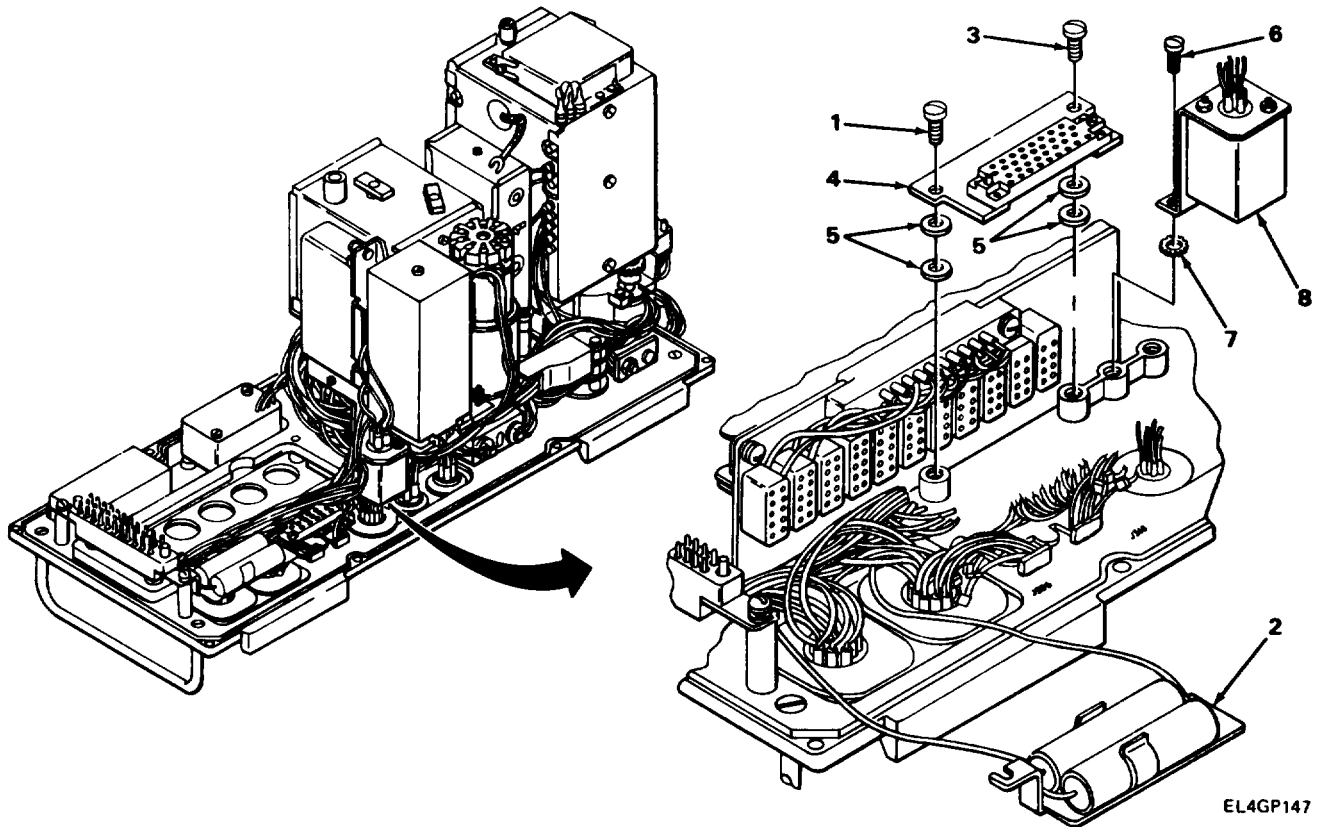
1. Push connector (10) back into front panel.
2. Install protective cap retaining ring (5) and retaining nut (4).
3. Using wrench, tighten retaining nut (4).
4. Install protective cap (3).
5. Install screw (6), flat washer(7), ground lug (8) and ET lockwasher(9).
6. Using screwdriver, tighten screw (6).
7. Install two screws (1) in Transformer T351 (2) and put in place.
8. Using screwdriver, tighten two screws (1).

FOLLOW-ON MAINTENANCE: install front panel. (See paragraph 2-8.)

**2-25. ANT CONT CONNECTOR J310 REPLACEMENT (RT-246(\*)/VRC ONLY).**

MATERIALS/PARTS: Electrical Receptacle Connector

PRELIMINARY PROCEDURE: Remove Pushbutton Assembly A7100. (See paragraph 2-35.)



EL4GP147

**REMOVAL**

1. Using screwdriver, remove screw (1) and move Terminal Board TB301 (2) out of way.
2. Using screwdriver, remove screw (3).

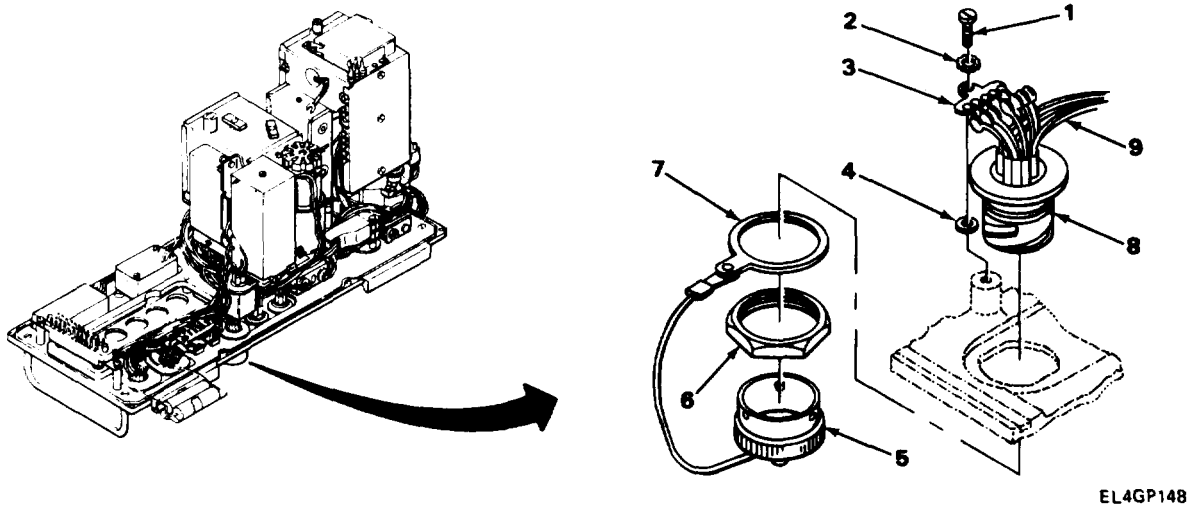
**NOTE**

Note number of shims used under Connector J7101 (4).

3. Move Connector J7101 (4) out of way and remove shims (5). (See note.)
4. Using screwdriver, remove two screws (6) and one ET lockwasher (7), and move Transformer T301 (8) out of way.

## 2-25. ANT CONT CONNECTOR J310 REPLACEMENT (RT-246(\*)/VRC ONLY). (CONT)

### REMOVAL (CONT)



5. Using screwdriver, remove screw (1), ET lockwasher (2), ground lug (3) and ET lockwasher (4).
6. Remove protective cap (5).
7. Using wrench, remove retaining nut (6).
8. Remove protective cap retaining ring (7).
9. Push connector (8) out of front panel.

### **CAUTION**

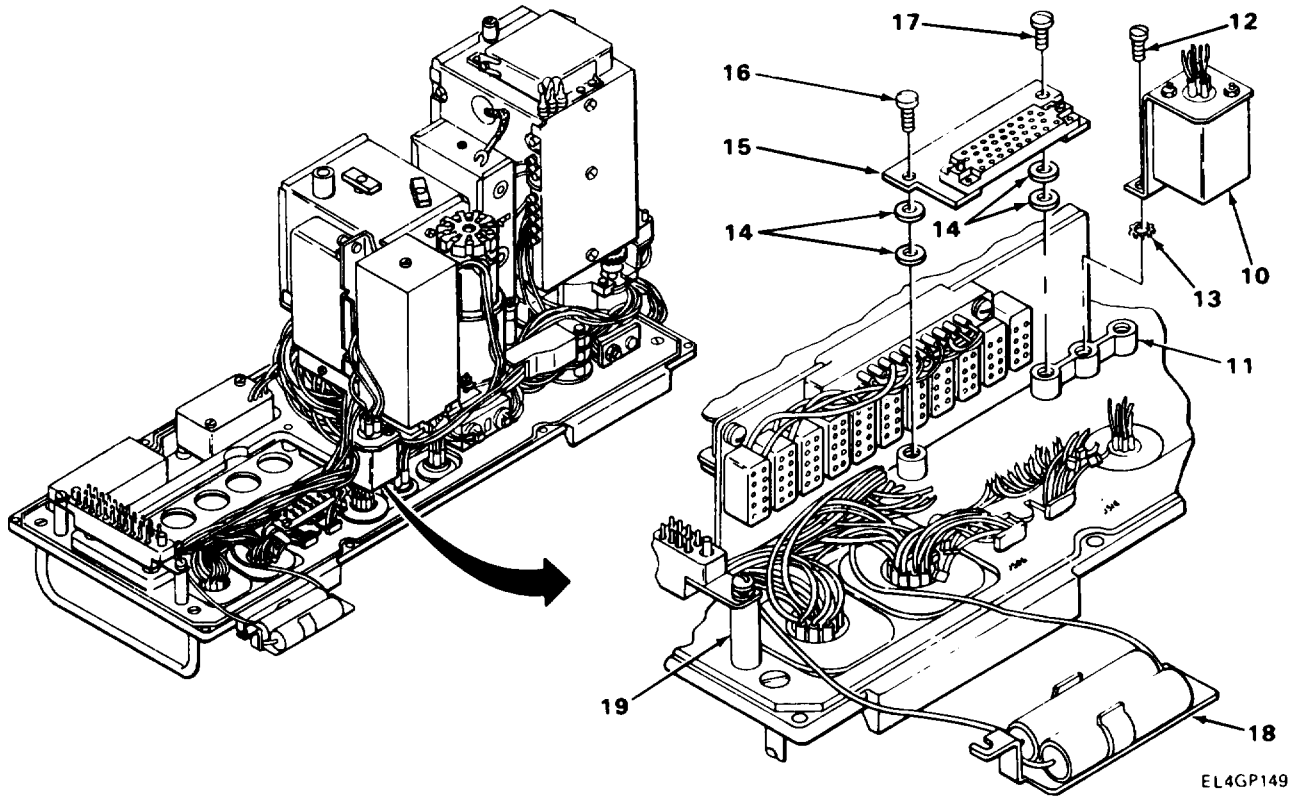
Replace all capacitors along with connector to ensure proper performance.

10. Using soldering iron, carefully remove and resolder 17 wires (9) from defective connector to replacement connector one at a time.

### INSTALLATION

1. Push connector (8) back into front panel.
2. Install protective cap retaining ring (7) and retaining nut (6).
3. Using wrench, tighten retaining nut (6).
4. Install protective cap (5).
5. Install screw (1), ET lockwasher (2), ground lug (3) and ET lockwasher (4).
6. Using screwdriver, tighten screw (1).

2-25. ANT CONT CONNECTOR J310 REPLACEMENT (RT-246(\*)/VRC ONLY). (CONT)



7. Position Transformer T301 (10) on towers (11) and install two screws (12) and one ET lockwasher (13).
8. Using screwdriver, tighten two screws (12).

**NOTE**

Note different length screws used to secure Connector J7101.

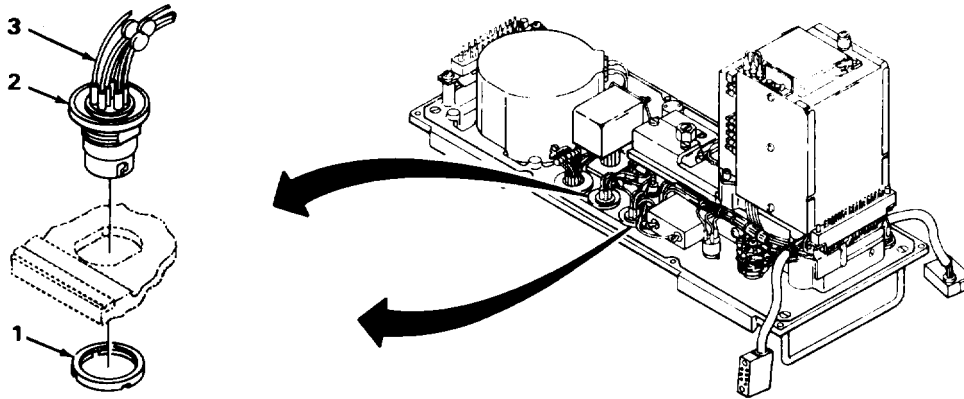
9. Install shims (14) under Connector J7101 (15) and install 3/8-inch-long screw (16) and 5/16-inch-long screw (17).
10. Position Terminal Board TB301 (18) under screw (16) and on tower (19).
11. Using screwdriver, tighten screws (16) and (17).

FOLLOW-ON MAINTENANCE: Install Pushbutton Assembly A7100. (See paragraph 2-35.)

**2-26. MIKE CONNECTOR J356 AND J357 REPLACEMENT (RT-524 (\*)/VRC ONLY).**

MATERIALS/PARTS: Electrical Connector Assembly

PRELIMINARY PROCEDURE: Remove front panel. (See paragraph 2-8.)



EL4GP030

**REMOVAL**

1. Using spanner wrench, remove locknut (1).
2. Carefully push connector (2) out of panel.

**NOTE**

The steps given are typical for both above connectors. The only difference is that J357 has nine wires connected and J356 has eight wires connected.

3. Using soldering iron, remove and resolder wires (3) from defective connector to replacement connector one at a time.

**INSTALLATION**

1. Carefully push connector (2) back into panel.
2. Install locknut (1) on connector (2).
3. Using spanner wrench, tighten locknut (1).

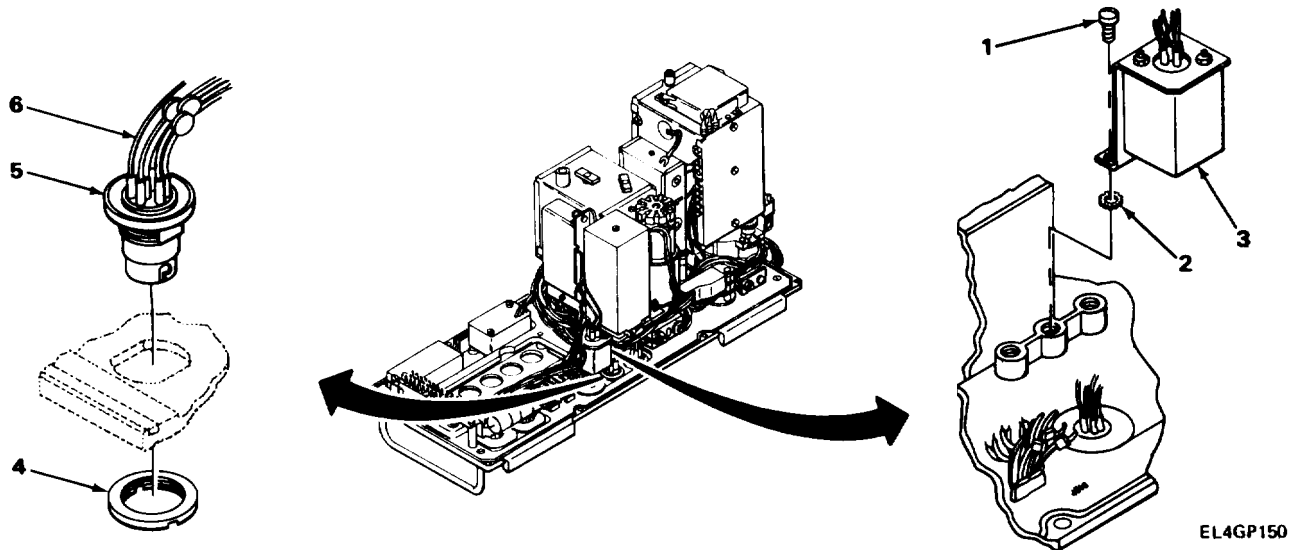
FOLLOW-ON MAINTENANCE: Install front panel. (See paragraph 2-8.)



**2-27. MIKE CONNECTOR J303 AND J304 REPLACEMENT (RT-246 (\*)/VRC ONLY).**

MATERIALS/PARTS: Electrical Connector Assembly

PRELIMINARY PROCEDURE: Remove Pushbutton Assembly A7100. (See paragraph 2-35.)



**REMOVAL**

**NOTE**

The steps given are typical for the removal of both J303 and J304.

1. Using screwdriver, remove two screws (1) and ET lockwasher (2) and move Transformer T301 (3) out of way.
2. Using spanner wrench, remove nut (4) and carefully push connector (5) out of front panel.

**NOTE**

Both connectors have same amount of wires connected.

3. Using soldering iron, carefully remove and resolder ten wires (6) from defective connector to replacement connector one at a time.

**INSTALLATION**

**NOTE**

The steps given are typical for the installation of both J303 and J304.

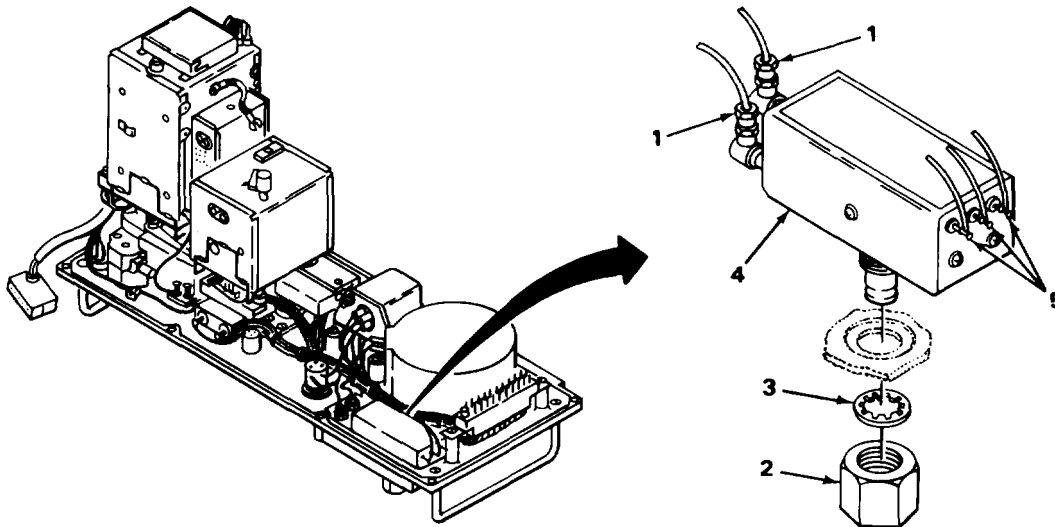
1. Push connector (5) back into front panel and Install nut (4).
2. Using spanner wrench, tighten nut (4).
3. Position Transformer T301 (3) and install two screws (1) and ET lockwasher (2).
4. Using screwdriver, tighten two screws (1),

FOLLOW-ON MAINTENANCE: Install Pushbutton Assembly A7100. (See paragraph 2-35.)

## 2-28. ANTI COAXIAL RELAY K301 REPLACEMENT

MATERIALS/PARTS: Relay Switch

PRELIMINARY PROCEDURE: Remove front panel. (See paragraph 2-8.)



EL4GP033

### REMOVAL

1. Disconnect two color-coded wire plugs (1).
2. Using wrench, remove nut (2).
3. Remove lockwasher (3).
4. Remove relay (4) from front panel.
5. Using soldering iron, remove three color-coded wires (5).

### INSTALLATION

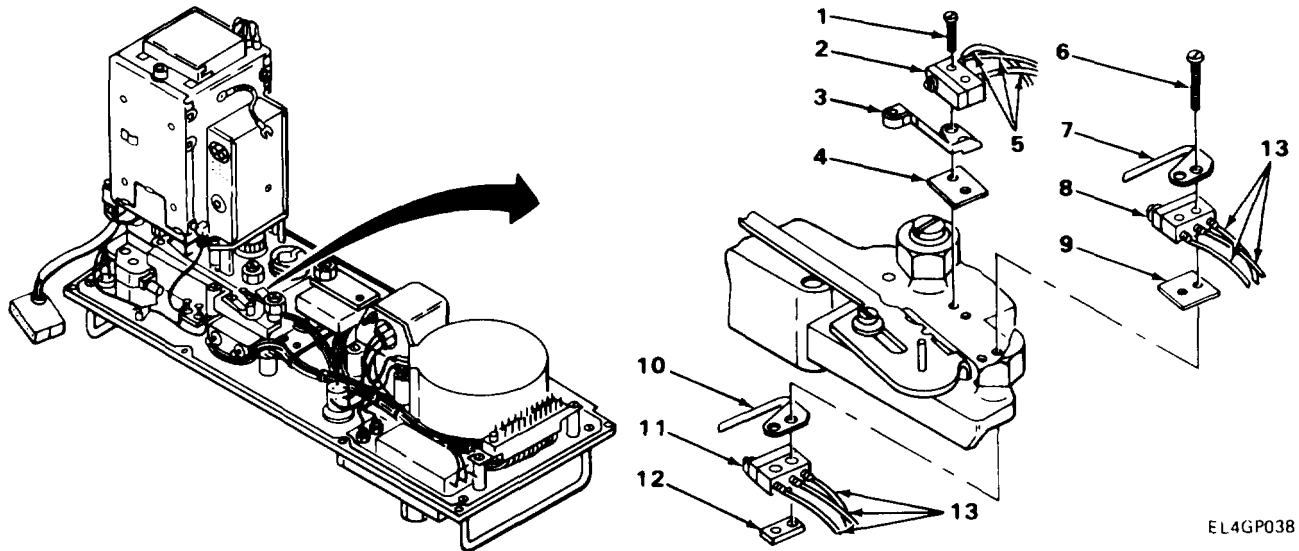
1. Using soldering iron, resolder three color-coded wires (5) on replacement relay.
2. Install relay (4) in front panel.
3. Install lockwasher (3) and nut (2).
4. Using wrench, tighten nut (2). Do not overtighten.
5. Connect two color-coded wire plugs (1).

FOLLOW-ON MAINTENANCE: Install front panel. (See paragraph 2-8.)

**2-29. SWITCH S357, S358 AND/OR S356 (FOR RT-24 (\*)/VRC) AND S307 (FOR RT-246(\*)/VRC)REPLACEMENT.**

MATERIALS/PARTS: Sensitive Switch

PRELIMINARY PROCEDURE: Remove A6000 assembly. (See paragraph 2-14.)



EL4GP038

**NOTE**

The steps given are for the RT-524(\*)/VRC. Similar steps are used for the removal of Switch S307 for the RT-246(\*)/VRC.

**REMOVAL OF SWITCHS357**

1. Using screwdriver, remove two screws (1), switch (2), switch actuator (3) and plastic insulator (4).
2. Using soldering iron, remove and resolder three wires (5) one at a time from defective switch to replacement switch.

**REMOVAL OF SWITCH S358 AND/OR SWITCH S356**

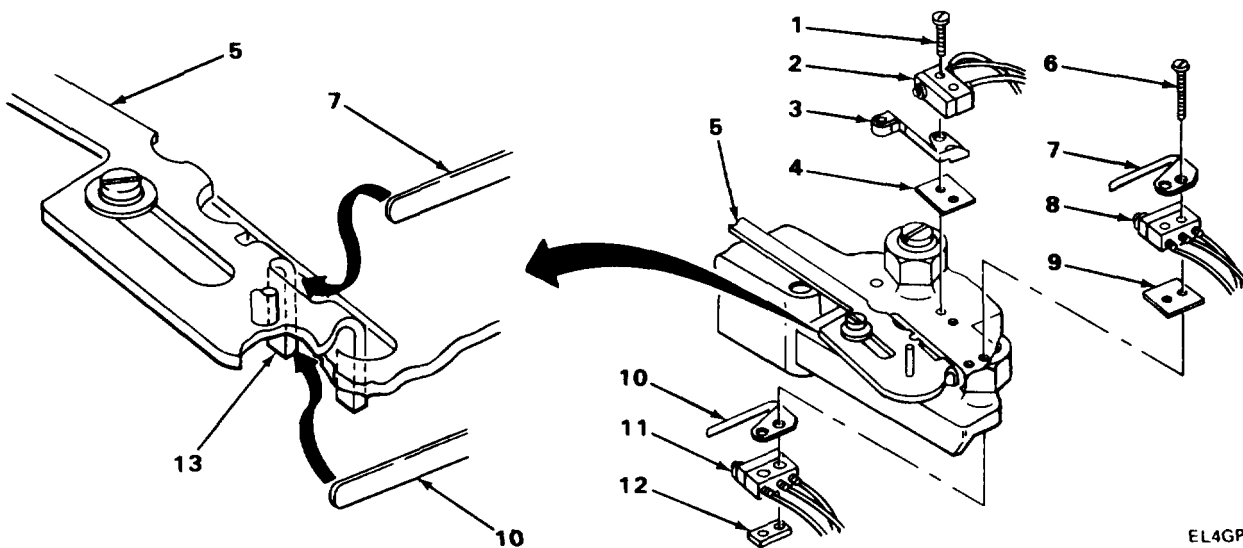
**NOTE**

Tag switches for identification.

Both switches share common hardware. Removal procedures apply to either switch.

1. Using screwdriver, remove two screws (6), switch actuator(7), Switch S358 (8), plastic insulator (9), switch actuator (10), Switch S356(11) and nut plate (12).
2. Using soldering iron, remove and resolder three wires (13) one at a time from either Switch S358 (8) or Switch S356 (11).

**2-29. SWITCH S357, S358 AND/OR S356(FOR RT-524(\*)/VRC) AND S307(FOR RT-246(\*)/VRC) REPLACEMENT. (CONT)**



EL4GP039

**NOTE**

The steps given are for the RT-524(\*)/VRC. Similar steps are used for the installation of Switch S307 and for the RT-246(\*)/VRC.

**INSTALLATION OF SWITCH S357**

1. Install two screws (1), switch (2), switch actuator (3) and plastic insulator (4).
2. Position roller on end of switch actuator (3) in groove of lever (5).
3. Using screwdriver, tighten screws (1).

**INSTALLATION OF SWITCHES S358 AND/OR SWITCH S356**

**NOTE**

Both switches share common hardware. Installation procedures apply to either switch.

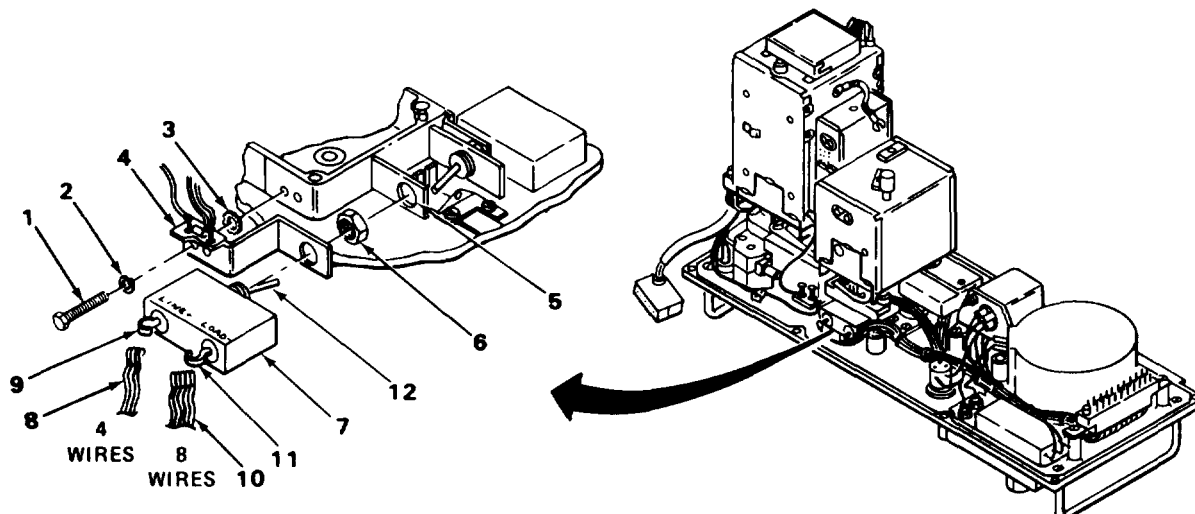
1. Install two screws (6), switch actuator (7), Switch S358 (8), plastic insulator (9), switch actuator (10), Switch S356 (11) and nut plate (12).
2. Position ends of switch actuators (7) and (10) against tang (13) of lever (5).
3. Turn Switch S358 (8) fully clockwise to apply pressure against actuators (7) and (10), then, using screwdriver, tighten screws (6).

**FOLLOW-ON MAINTENANCE:** Install A6000 assembly. (See paragraph 2-14.)

## 2-30. CIRCUIT BREAKER CB351 (FOR RT-524 (\*)/VRC) AND CB301 (FOR RT-246 (\*)/VRC) REPLACEMENT.

MATERIALS/PARTS: Circuit Breaker

PRELIMINARYPROCEDURE: Remove front panel. (See paragraph 2-8.)



### REMOVAL OF CIRCUIT BREAKER CB351/CB301

1. Using screwdriver, remove two screws (1), lockwashers (2) and ET lockwashers (3) from bracket (4), and pull assembly free of guide hole (5).
2. Using wrench, remove nut (6) from circuit breaker (7).
3. Using soldering iron, unsolder four wires (8) from LINE + terminal (9).
4. Solder four wires (8) to LINE + terminal of replacement circuit breaker.
5. Unsolder eight wires (10) from LOAD - terminal (11).
6. Solder eight wires (10) to LOAD - terminal of replacement circuit breaker.

### INSTALLATION OF CIRCUIT BREAKER CB351/CB301

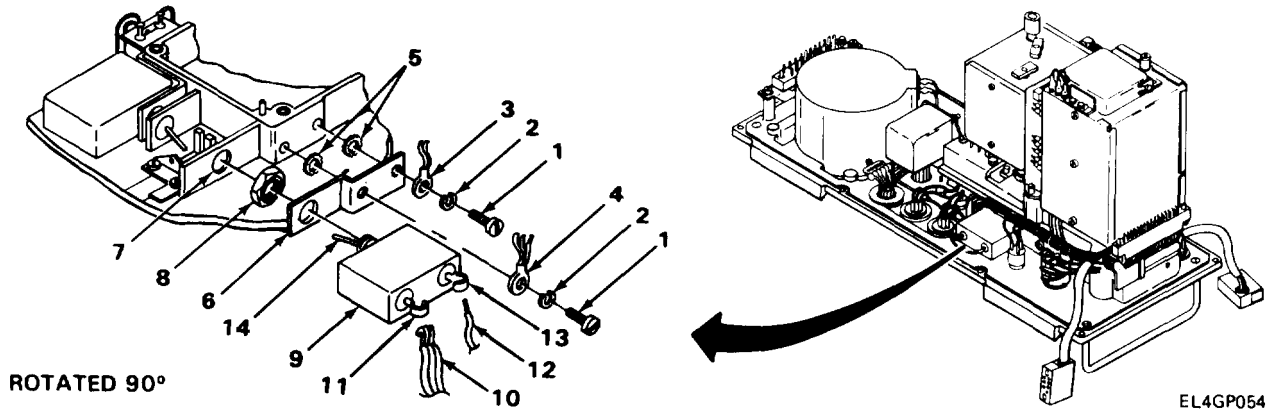
1. Install circuit breaker(7) through hole in bracket (4) and install nut (6). Place circuit breaker toggle (12) in position shown.
2. Using wrench, tighten nut (6).
3. Install circuit breaker toggle (12) through guide hole (5) and aline screw holes.
4. Install two screws (1), lockwashers (2) and ET lockwashers (3) through bracket (4).
5. Using screwdriver, tighten screws (1).

FOLLOW-ON MAINTENANCE: Install front panel. (See paragraph 2-8.)

**2-31. CIRCUIT BREAKER CB352 (FOR RT-524 (\*)/VRC) AND CB302 (FOR RT-246 (\*)/VRC) REPLACEMENT.**

MATERIALS/PARTS: Circuit Breaker

PRELIMINARY PROCEDURE: Remove front panel. (See paragraph 2-8.)



**REMOVAL OF CIRCUIT BREAKER CB352/CB302**

1. Using screwdriver, remove two screws (1), lockwashers (2), ground lugs (3) and (4), and ET lockwashers (5) from bracket (6), and pull assembly free of guide hole (7).
2. Using wrench, remove nut (8) from circuit breaker(9).
3. Using soldering iron, unsolder three wires (10) from LOAD – terminal (11).
4. Solder three wires (10) to LOAD - terminal of replacement circuit breaker.
5. Unsolder one wire (12) from LINE + terminal (13).
6. Solder one wire (12) to LINE + terminal of replacement circuit breaker.

**INSTALLATION OF CIRCUIT BREAKER CB352/CB302**

1. Install circuit breaker (9) through hole in bracket (7) and install nut (8). Place circuit breaker toggle (14) in position shown.
2. Using wrench, tighten nut (8).
3. Install circuit breaker toggle (14) through guide hole (7) and align screw holes.

**NOTE**

Note positioning of two- and three-wire ground lugs.

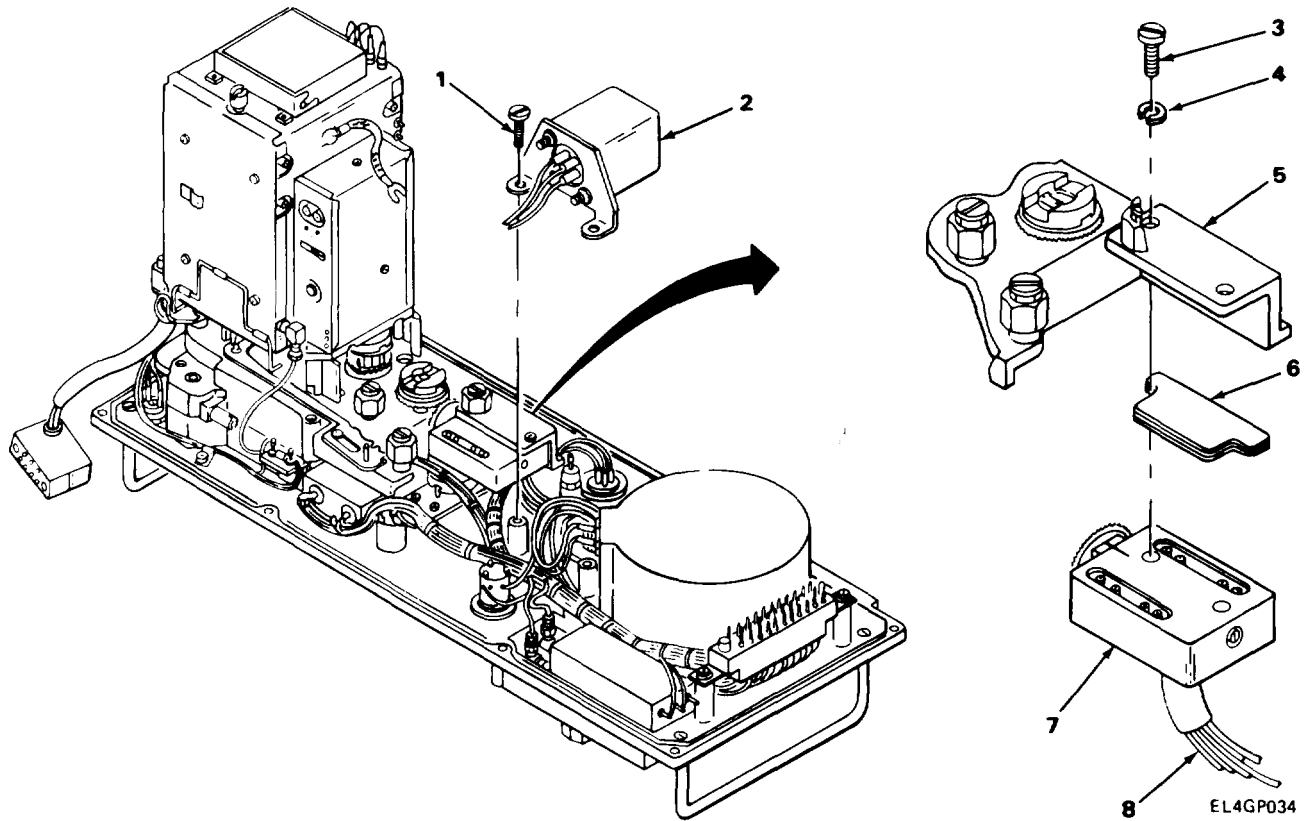
4. Install two screw (1), lockwashers (2), ground lugs (3) and (4), and ET lockwashers (5) through bracket (6).
5. Using screwdriver, tighten screws (1).

FOLLOW-ON MAINTENANCE: Install front panel. (See paragraph 2-8.)

**2-32. ANTENNA CONTROL RELAY SWITCH S359 (FOR RT-524 (\*)/VRC) AND S309 (FOR RT-246 (\*)/VRC) REPLACEMENT. (CONT)**

MATERIALS/PARTS: Switch Assembly

PRELIMINARY PROCEDURE: Remove A6000 assembly. (See paragraph 2-14.)



**NOTE**

For RT-246 (\*)/VRC only, proceed to step 2.

**REMOVAL**

1. Using screwdriver, remove two screws (1) and move Transformer T351 (2) out of way.

**NOTE**

For RT-246 (\*)/VRC only, remove Null Switch A7000 and Pushbutton Assembly A7100 before proceeding with next step.

2. Using screwdriver, remove two screws (3) and lockwasher (4) from bracket (5).

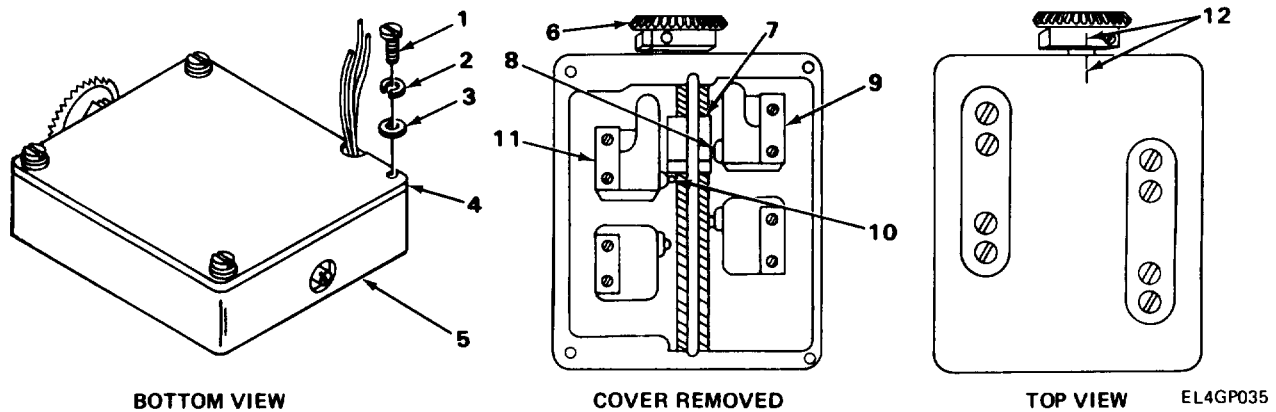
**CAUTION**

Care must be taken when performing next step to prevent damage to Switch S353 located under bracket (5).

3. Slide shims (6) and switch (7) out from under bracket (5).
4. Using soldering iron, remove and resolder six wires (8) one at a time from defective switch to replacement switch.

2-32. ANTENNA CONTROL RELAY SWITCH S359 (FOR RT-524(\*)/VRC AND S309 (FOR

INSTALLATION



1. Using screwdriver, remove four screws (1), lockwashers (2) and flat washers (3), and cover plate (4) from switch body (5).
2. Turn gear (6) to allow plastic actuator (7) to depress button (8) on switch 3 (9) and button (10) on switch 2 (11).
3. Turn gear (6) in opposite direction to release button (10) on switch 2 (11) and listen for two audible clicks. Stop turning gear when second audible click is heard.
4. Scribe an alignment mark (12) across gear coupler and top of switch body.

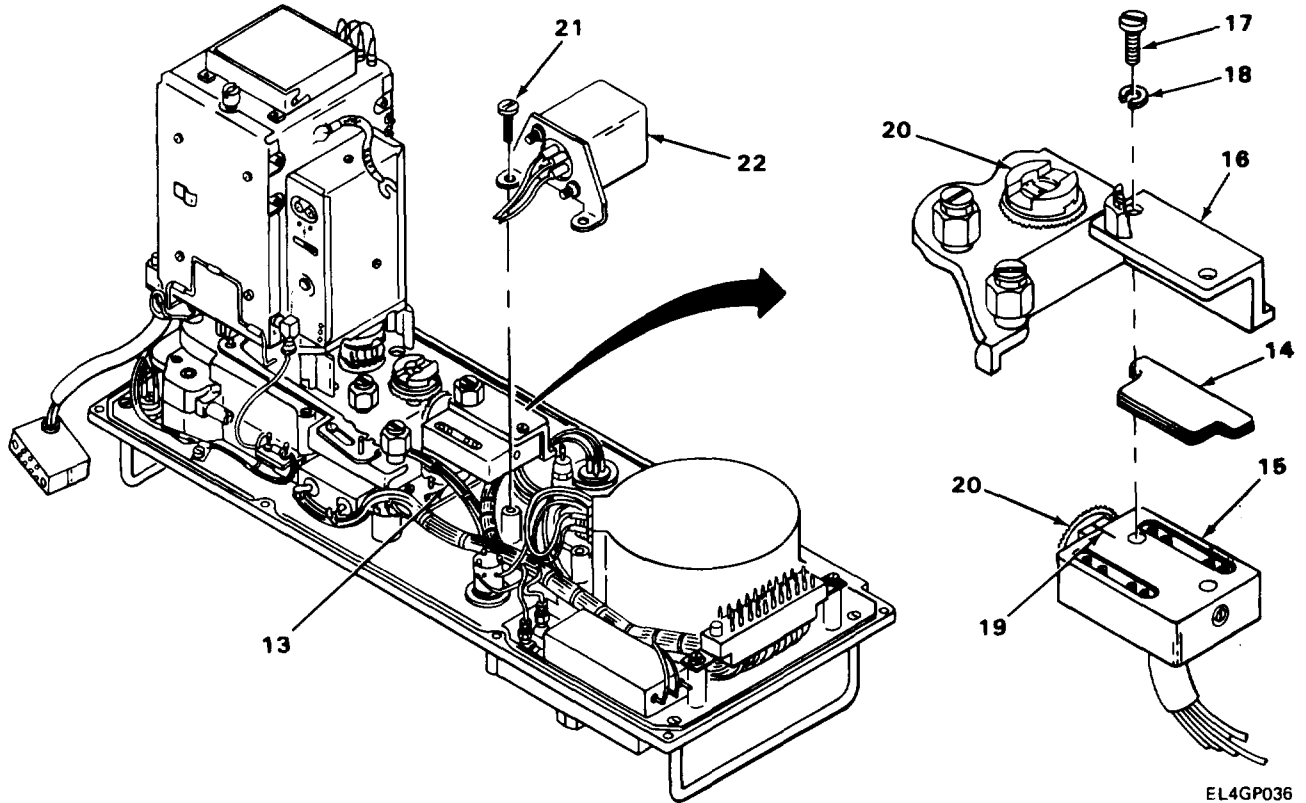
**NOTE**

Extreme care must be taken not to turn gear out of alignment.

5. Install cover plate (4), screws (1), lockwashers (2) and flat washers (3).
6. Using screwdriver, tighten screws (1).



2-32. ANTENNA CONTROL RELAY SWITCH S359 (FOR RT-524 (\*)/VRC) AND S309 (FOR RT-246 (\*)/VRC) REPLACEMENT. (CONT)



**CAUTION**

Care must be taken when performing next step to prevent damage to Switch S353 (13) located beneath bracket.

7. Place shims (14) on top of switch (15) and position switch under bracket (16).
8. Install two screws (17) and lockwashers (18) through bracket (16) and into switch.

**NOTE**

Make sure alignment marks (19) are in line and that gears (20) mesh properly.

9. Using screwdriver, tighten screws (17).

**NOTE**

For RT-246(\*)/VRC only, install Null Switch A7000 and Pushbutton Assembly A7100, and omit steps 10 and 11.

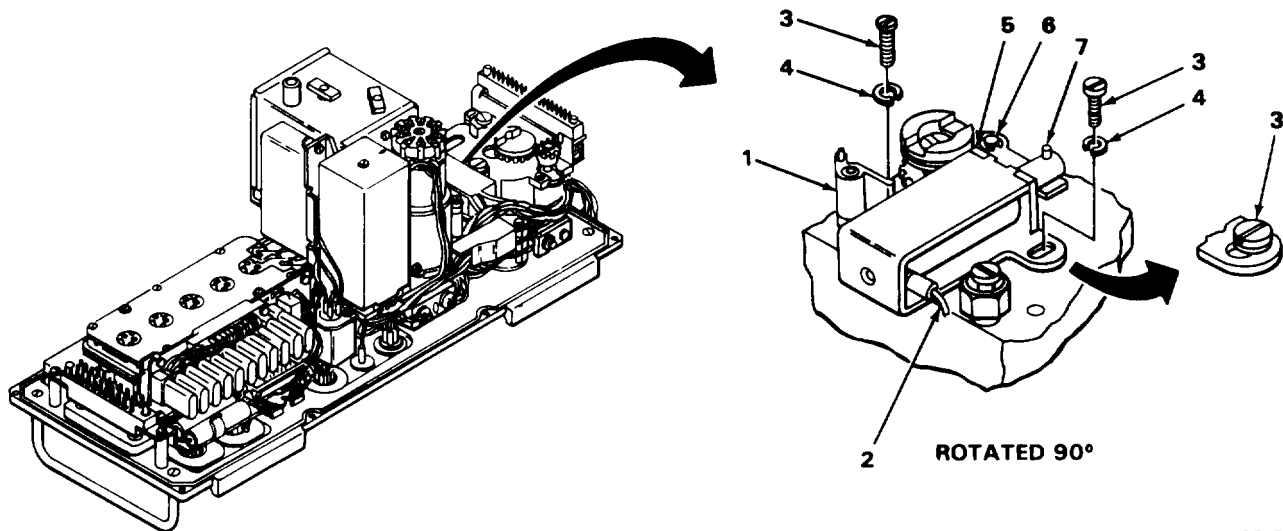
10. Install two screws (21) in Transformer T351 (22) and put in place.
11. Using flat-tip screwdriver, tighten screws (21).

FOLLOW-ON MAINTENANCE: Install A6000 assembly. (See paragraph 2-14.)

### 2-33. SOLENOID L301 REPLACEMENT (RT-246 (\*)/VRC ONLY).

MATERIALS/PARTS: Electrical Solenoid

PRELIMINARY PROCEDURE: Remove A1000 assembly. (See paragraph 2-9).  
Remove A2000 assembly. (See paragraph 2-12).



EL4GP151

#### REMOVAL

1. Using soldering iron, carefully unsolder two white/red wires (1) and one black wire (2).
2. Using screwdriver, remove two screws (3) and lockwashers (4).
3. Remove solenoid (5).

#### INSTALLATION

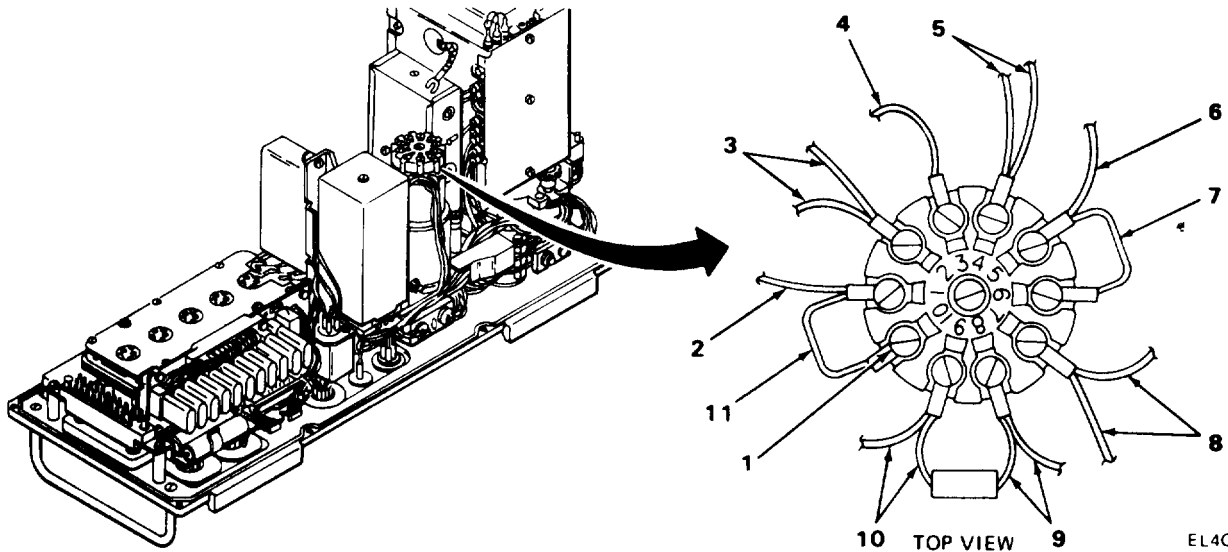
1. Place solenoid plunger hole (6) over pin (7) and install two screws (3) and lockwashers (4).
2. Pull solenoid (5) back to allow screws (3) to be in forward position of slot.
3. Using screwdriver, tighten two screws (3).
4. Using soldering iron, carefully solder two white/red wires (1) and one black wire (2).

FOLLOW-ON MAINTENANCE: Install A2000 assembly. (See paragraph 2-12.)  
Install A1000 assembly. (See paragraph 2-9.)

**2-34. SERVOMOTOR GENERATOR MG301 REPLACEMENT (RT-246(\*)/VRC ONLY).**

MATERIALS/PARTS: Generator Assembly Motor

PRELIMINARY PROCEDURE: Remove A6000 assembly. (See paragraph 2-14.)



**REMOVAL**

**NOTE**

Tag wires with terminal numbers before removing from generator,

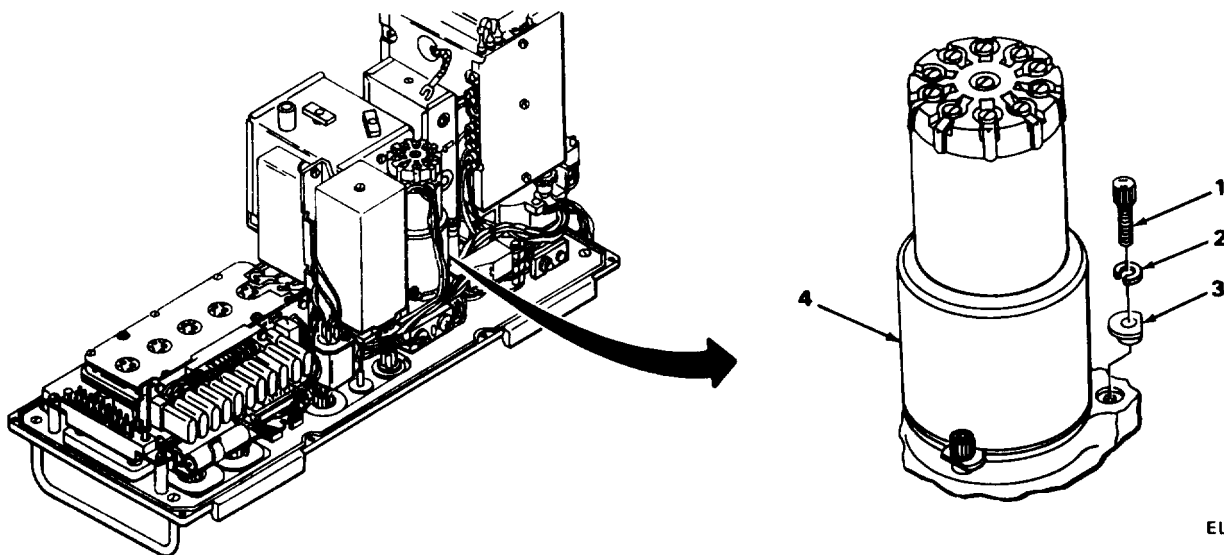
1. Using screwdriver, remove ten screws (1) and wires listed in table below.

TERMINAL NO.	WIRE COLOR	INDEX NO.
1	WHT/GRA	2
2	BLU	3
3	BLK	4
4	WHT/BLU	5
5	WHT/RED	6

TERMINAL NO.	WIRE COLOR	INDEX NO.
6/5	WHT/RED	7
7	BLK	8
8	WHT/CLR	9
9	WHT/CLR	10
10/1	WHT/GRA	11

**2-34. SERVOMOTOR GENERATOR MG301 REPLACEMENT (RT-246(\*)/VRC ONLY). (CONT)**

REMOVAL (CONT)



EL4GP153

2. Using hex wrench, remove three screws (1), lockwashers (2) and cleats (3).
3. Pull generator (4) out of front panel.

INSTALLATION

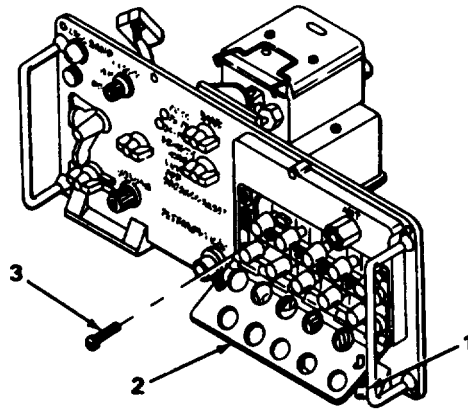
1. Install generator (4) in mount, alining terminal no. 3 with Servoamplifier A7200.
2. Install three screws (1), lockwashers (2) and cleats (3).
3. Using hex wrench, tighten three screws(1).
4. Install wires listed in table on page 2-65 and secure with ten screws.
5. Using screwdriver, tighten ten screws.

FOLLOW-ON MAINTENANCE: Install A6000 assembly. (See paragraph 2-14.)

**2-35. PUSHBUTTON ASSEMBLY A7100 REPLACEMENT (RT-246(\*)/VRC ONLY).**

MATERIALS/PARTS: Select Control Assembly A7100

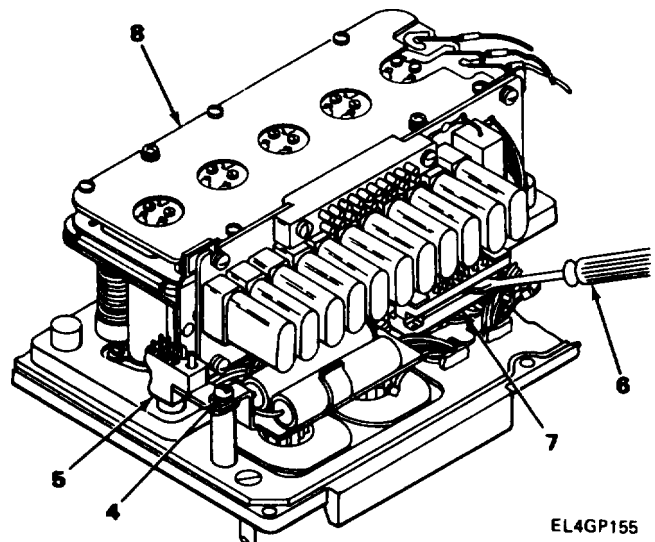
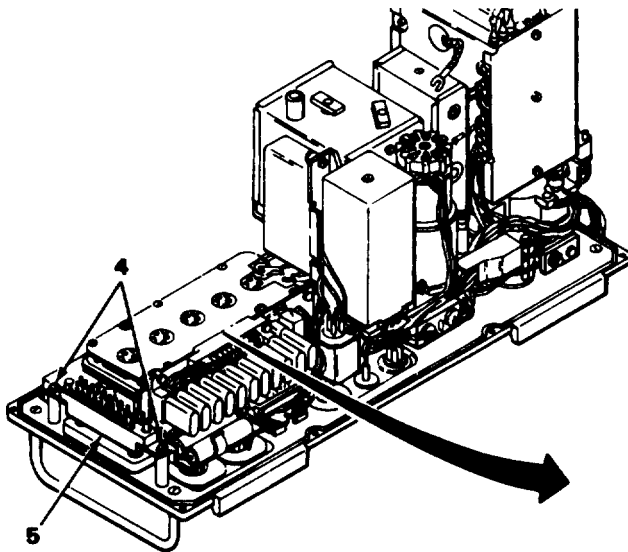
PRELIMINARY PROCEDURE: Remove front panel. (See paragraph 2-8.)



EL4GP154

**REMOVAL**

1. Using screwdriver, loosen two captive screws (1) and lower hinged cover(2).
2. Using screwdriver, remove four screws (3).

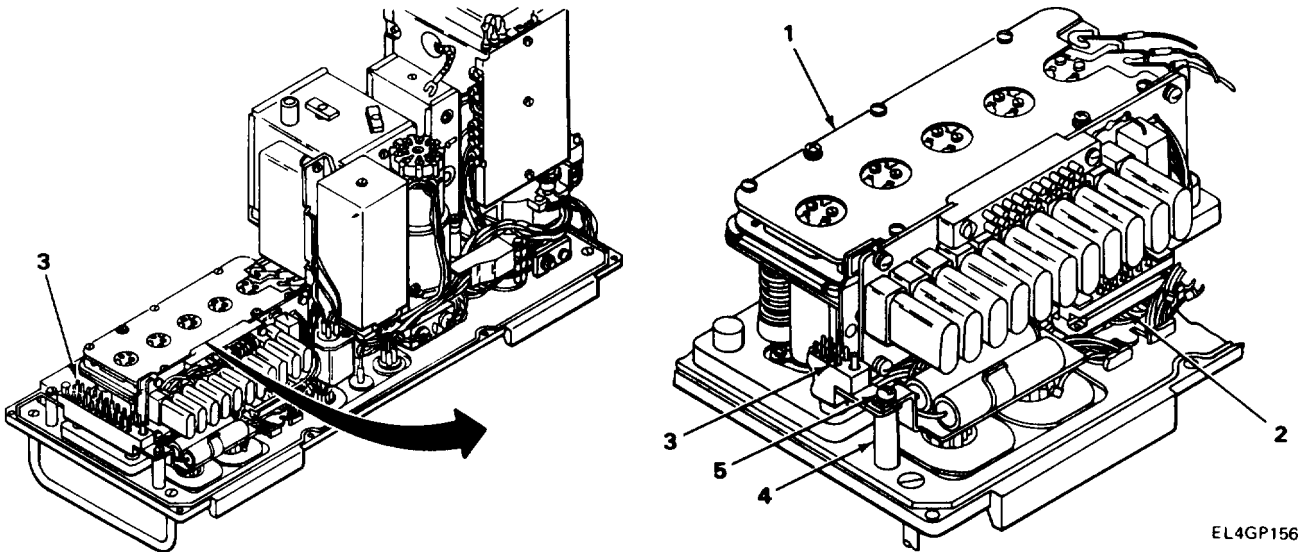


EL4GP155

3. Using screwdriver, remove two screws(4) and move Connector P302 (5) out of way.
4. Using screwdriver(6), carefully pry Connector J7101 (7) apart while lifting pushbutton assembly (8) out of front panel.

2-35. PUSHBUTTON ASSEMBLY A7100 REPLACEMENT (RT-246(\*)/VRC ONLY). (CONT)

INSTALLATION

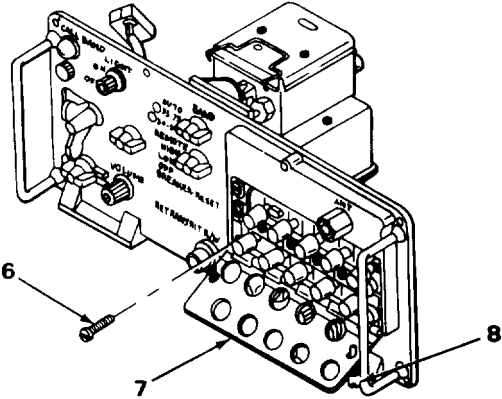


EL4GP156

**CAUTION**

Care must be taken when performing next step to prevent damaging or pinching wires, Make sure both halves of Connector J7101 mate properly.

1. Carefully position pushbutton assembly (1) in front panel and push into place engaging both halves of Connector J7101(2).
2. Position Connector P302 (3) on towers (4) and install two screws (5).
3. Using screwdriver, tighten two screws (5).

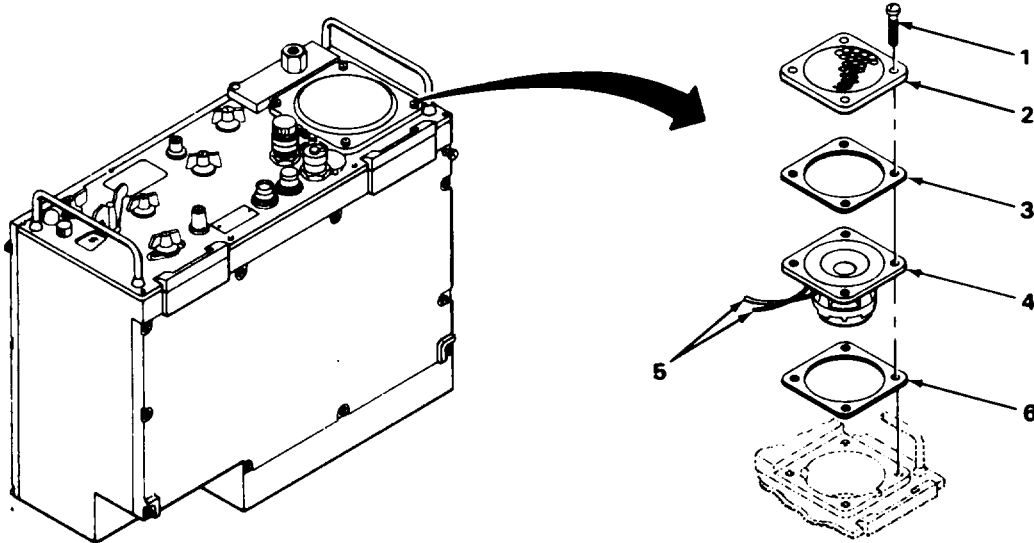


4. Install four screws (6) and, using flat-tip screwdriver, tighten.
5. Lift hinged cover (7) into position and, using flat-tip screwdriver, tighten two captive screws (8).

FOLLOW-ON MAINTENANCE: Install front panel. (See paragraph 2-8.)

## 2-36. LOUDSPEAKER LS351 REPLACEMENT (RT-524(\*)/VRC ONLY).

MATERIALS/PARTS: Loudspeaker LS351



EL4GP052

### REMOVAL

1. Using screwdriver, loosen four screws (1).
2. Remove speaker cover (2) and gasket (3).
3. Lift speaker (4) out of speaker well and lay on side.
4. Using soldering iron, unsolder two wires (5).
5. Remove gasket (6) only if damaged.

### INSTALLATION

1. Install gasket (6) only if it was removed.
2. Using soldering iron, resolder two wires (5) to speaker (4).
3. Place speaker (4) in speaker well and align holes.
4. Install speaker cover (2) and gasket (3) and align four captive screws (1) with holes.
5. Using screwdriver, tighten four screws (1).

## 2-37. A3000 MODULES AND ASSEMBLY REPLACEMENT.

MATERIALS/PARTS: Crystal REF System Assembly A3000, P/N SMD413519

Harmonic Generator Assembly A3100

Amplifier Mixer Assembly A3200

Second Mixer Assembly A3300

IF Amplifier A3400

Limiter Amplifier A3500

Electrical Frequency Discriminator A3600

Phase Disc Assembly A3700

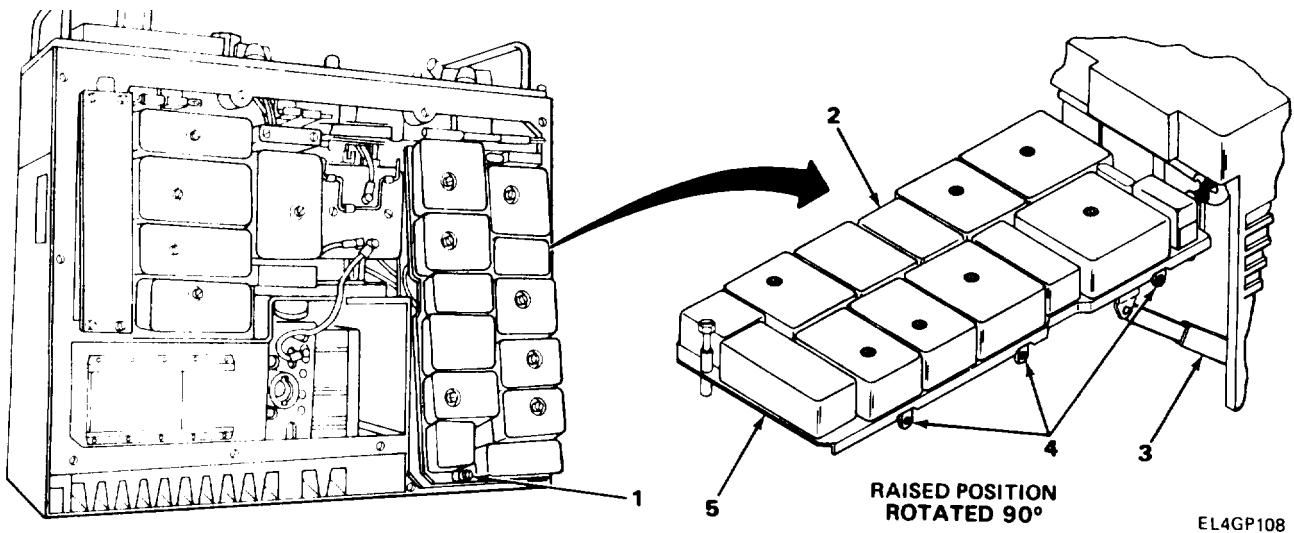
Low Pass Filter FL3001

High Pass Filter FL3002

Band Pass Filter. FL3003

Band Pass Filter FL3004 and FL3005

PRELIMINARY PROCEDURE: Remove top cover. (See paragraph 2-7.)



### REMOVAL

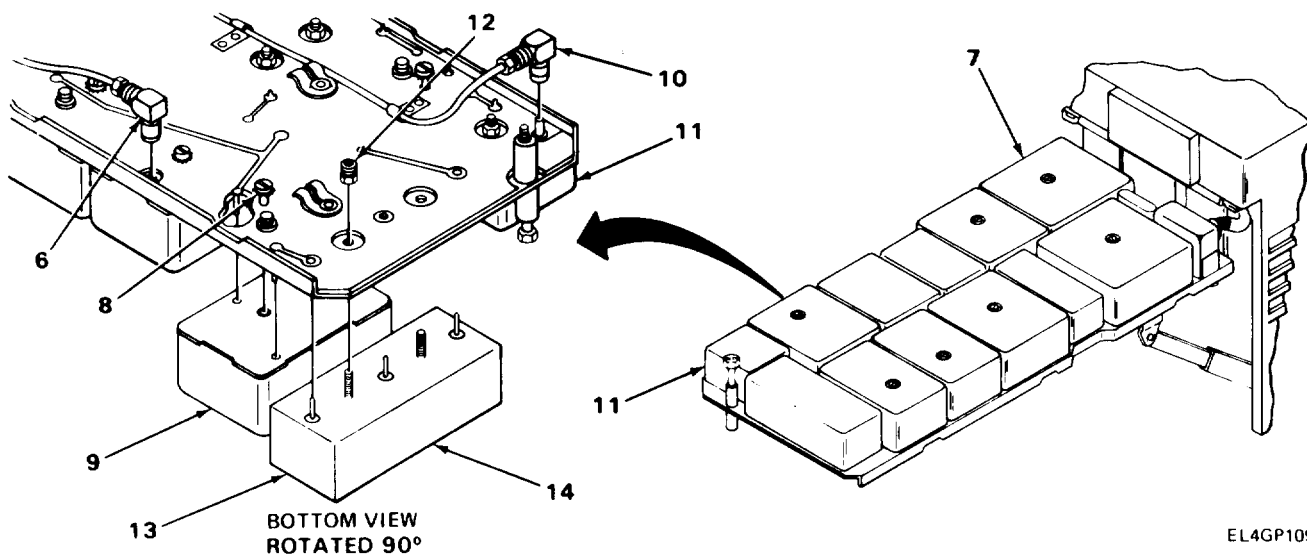
1. Using screwdriver, loosen one captive screw (1).
2. Swing assembly (2) out and secure brace (3).
3. Pull out five slide clips (4) and remove shield (5).

### NOTE

Assembly can be removed with or without first removing modules. If assembly is to be removed without removing modules, proceed to step 11.



2-37. A3000 MODULES AND ASSEMBLY REPLACEMENT. (CONT)



EL4GP109

**NOTE**

Modules A3100 through A3700 are secured with captive screws. Steps 4, 5, and 6 are typical for all modules.

4. Disconnect black wire (W403) (6) from A3300 and red wire (W404) from A3700 (7).
5. Using screwdriver, loosen captive screws (8).
6. Carefully pull module (9) off board to release from pins. Do not twist from side to side to remove.

**NOTE**

Modules FL3001 through FL3005 are secured with locknuts and are soldered to printed circuit board. Steps 7 through 10 are typical for all modules.

7. Disconnect green wire (W202/W402) (10) from FL3002 (11).
8. Using wrench, remove locknuts (12).

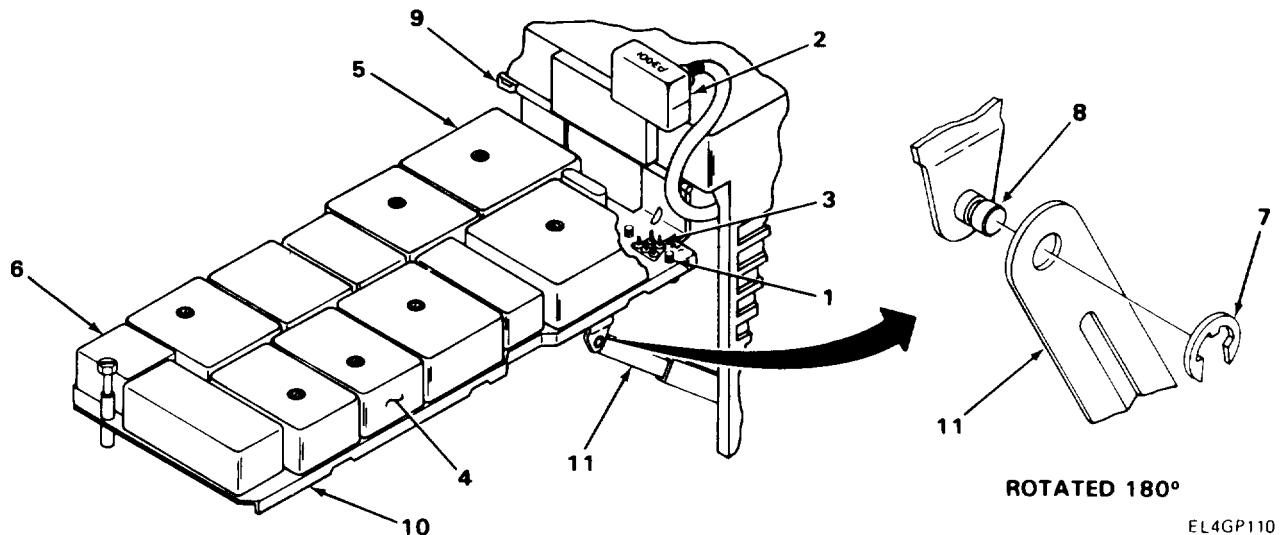
**CAUTION**

Care must be taken when performing next step to prevent damage to printed circuit board.

9. Using soldering iron, carefully unsolder module wires (13) from printed circuit board.
10. Carefully pull module (14) off board.

**2-37. A3000 MODULES AND ASSEMBLY REPLACEMENT. (CONT)**

REMOVAL (CONT)



11. Using screwdriver, loosen two captive screws (1).

**CAUTION**

Care must be taken when performing next step to prevent damage to pins on assembly.

12. Carefully pull P3001 (2) off pins (3).
13. Disconnect black wire (W403) from A3300 (4), red wire (W404) from A3700 (5), green wire (W202/W402) from FL3002 (6) and all wires from wire clips.
14. Using small screwdriver, remove C-clip (7) from pin (8) and remove brace.
15. Using pliers, pull hinge pin (9) out of hinge.
16. Remove assembly (10).

INSTALLATION

**CAUTION**

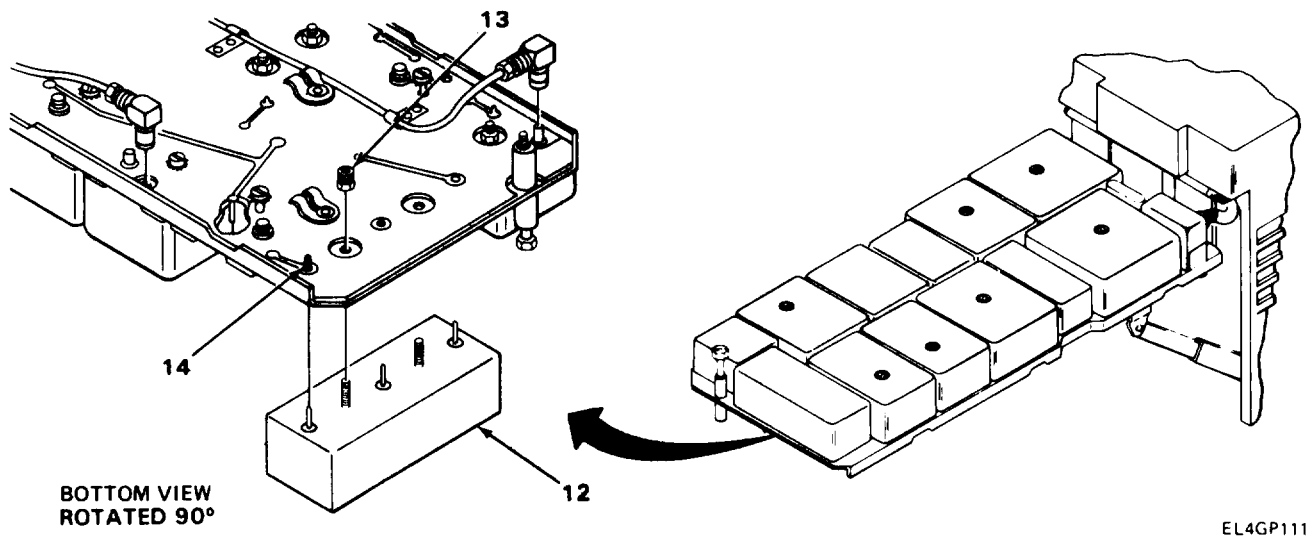
Before installing assembly, make sure pins (3) are not bent. Straighten any bent pins.

1. Position assembly (10) in hinge and insert hinge pin (9).
2. Position brace (11) on pin (8) and install C-clip (7).

**NOTE**

If modules were not removed from assembly, proceed to step 8 for installation of assembly.

2-37. A3000 MODULES AND ASSEMBLY REPLACEMENT. (CONT)



**NOTE**

Modules FL3001 through FL3005 are secured with locknuts and soldered to printed circuit board. Steps 3, 4, and 5 are typical for all modules.

Module number location is stamped on board.

3. Position module (12) on board and install locknuts (13).
4. Using wrench, tighten locknuts (13).

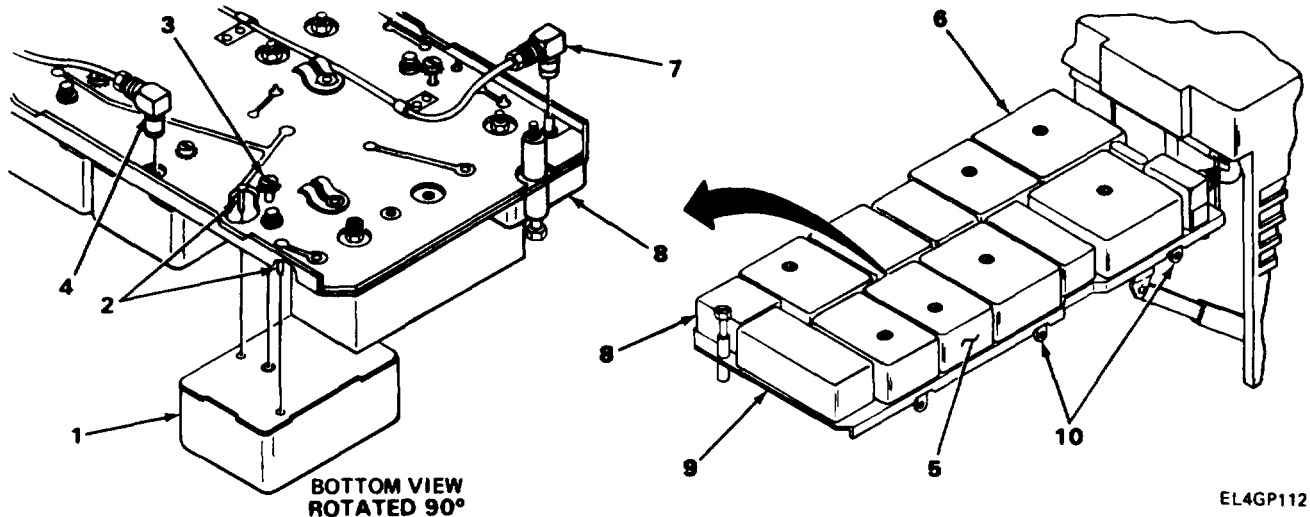
**CAUTION**

Care must be taken when performing next step to prevent damage to printed circuit board.

5. Using soldering iron, carefully solder pins (14) of module to printed circuit board.

## 2-37. A3000 MODULES AND ASSEMBLY REPLACEMENT. (CONT)

### INSTALLATION (CONT)



### **CAUTION**

Before installing modules, make sure pins on assembly are not bent. Straighten any bent pins.

Extreme care must be taken when performing next step to prevent damage to pins on assembly.

### **NOTE**

Modules A3100 through A3700 are secured with captive screws. Steps 6 and 7 are typical for all modules.

Module number location is stamped on board.

6. Carefully position module (1) on pins (2) and push into place.
7. Using screwdriver, tighten captive screws (3).

### **CAUTION**

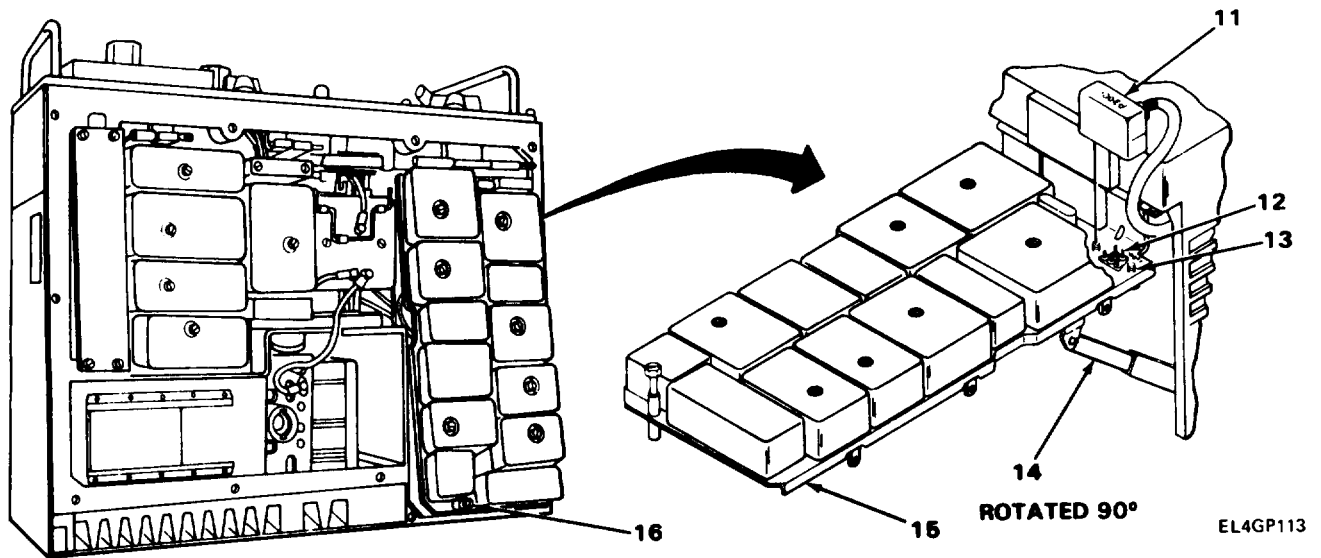
Wrap black wire (W403) (4) connector at A3300 (5) with electrical tape to prevent shorting to TP3016.

8. Connect black wire (W403) (4) to A3300 (5), red wire (W404) to A3700 (6), green wire (W202/W402) (7) to FL3002 (8), and all wires to wire clips.
9. Position shield (9) under board and align with pins.
10. Secure shield (9) by pushing in five slide clips (10).

### **CAUTION**

Check screws on top of modules for tightness. If loose, tighten.

2-37. A3000 MODULES AND ASSEMBLY REPLACEMENT. (CONT)



**CAUTION**

Care must be taken when performing next step to prevent damage to pins on assembly.

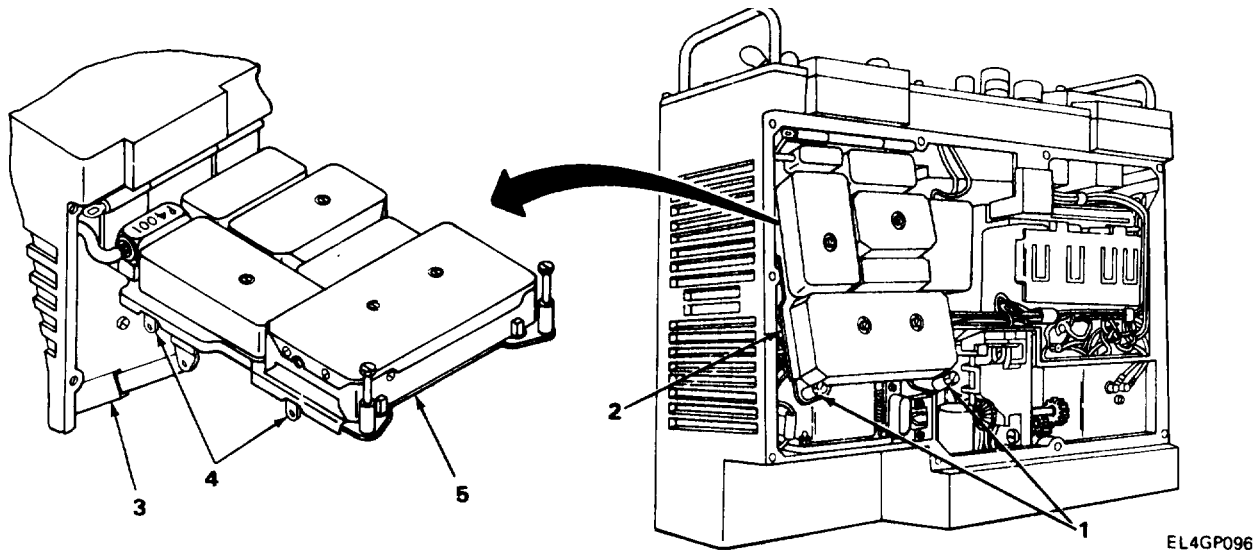
11. Carefully position P3001 (11) on pins (12) and push into place.
12. Using screwdriver, tighten two captive screws (13).
13. Release brace (14) and lower assembly (15) into position.
14. Using screwdriver, tighten one captive screw (16).

FOLLOW-ON MAINTENANCE: Install top cover. (See paragraph 2-7.)

## 2-38. A4000 MODULES AND ASSEMBLY REPLACEMENT.

MATERIALS/PARTS: I.F. Amplifier Assembly A4000  
Electrical Frequency Discriminator A4200  
Band-Pass Filter FL4001 and FL4002  
I.F. Amplifier Assembly A4100  
Audio Frequency Amplifier A4300

PRELIMINARYPROCEDURE: Remove bottom cover. (See paragraph 2-7.)



### REMOVAL

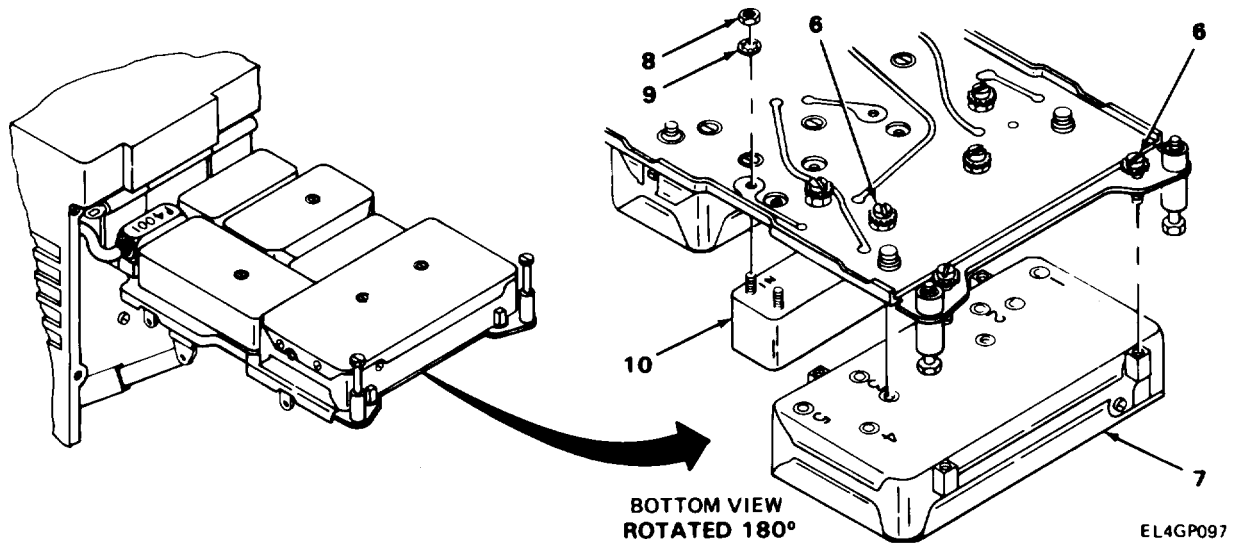
1. Using screwdriver, loosen two captive screws (1).
2. Swing assembly (2) out and secure brace (3).

### NOTE

Assembly can be removed with or without first removing modules. If assembly is to be removed without removing modules, proceed to step 8.

3. Pull out four slide clips (4) and remove shield (5).

2-38. A4000 MODULES AND ASSEMBLY REPLACEMENT. (CONT)



**NOTE**

Modules A4100 through A4300 are secured with captive screws. Steps 4 and 5 are typical for all modules.

4. Using screwdriver, loosen captive screws (6).
5. Carefully pull module (7) off board to release from pins. Do not twist from side to side to remove.

**CAUTION**

Extreme care must be taken when performing next step to prevent damaging test points on printed circuit board.

**NOTE**

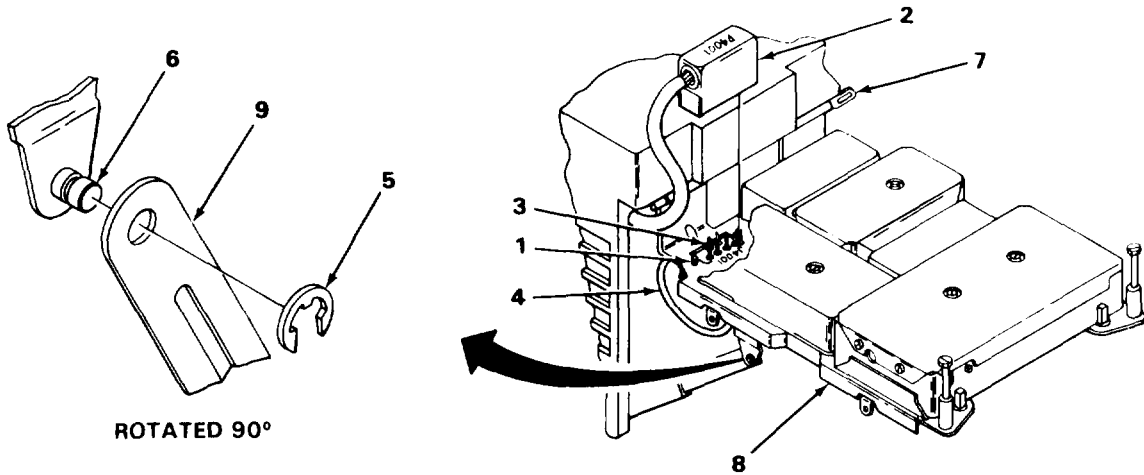
Modules FL4001 and FL4002 are secured with locknuts. Steps 6 and 7 are typical for both modules.

Note position of FL4002 module for 50 KC or WIDE BAND operation mode.

6. Using wrench, remove locknuts (8) and IT lockwashers (9).
7. Carefully pull module (10) off board.

2-38. A4000 MODULES AND ASSEMBLY REPLACEMENT. (CONT)

REMOVAL(CONT)



EL4GP098

8. Using screwdriver, loosen two captive screws (1).

**CAUTION**

Care must be taken when performing next step to prevent damage to pins on assembly.

9. Carefully lift P4001 (2) off pins (3).
10. Remove blue wire (W201/W401) (4) from J1005.
11. Using small screwdriver, remove C-clip (5) from pin (6).
12. Using pliers, pull hinge pin (7) out of hinge.
13. Remove assembly (8).

INSTALLATION

**CAUTION**

Before installing assembly, make sure pins (3) are not bent. Straighten any bent pins.

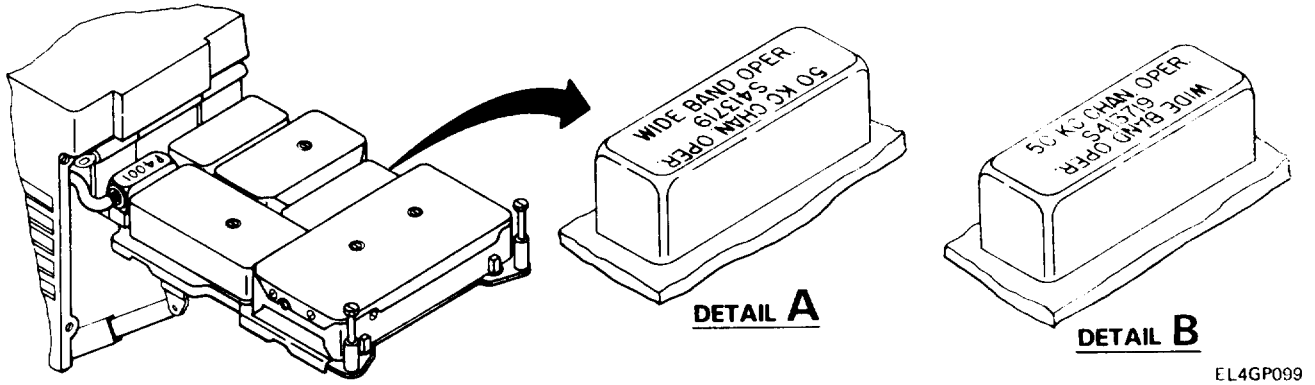
1. Position assembly (8) in hinge and insert hinge pin (7).
2. Position brace (9) on pin (6) and install C-clip (5).

**NOTE**

If modules were not removed from assembly, proceed to step 9 for installation of assembly.

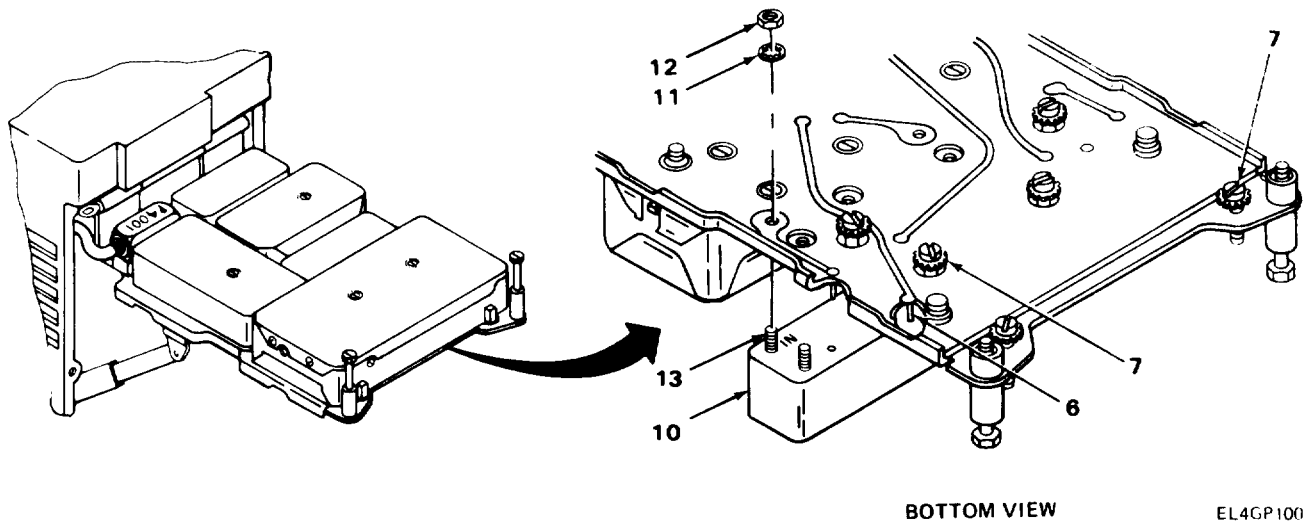


2-38. A4000 MODULES AND ASSEMBLY REPLACEMENT. (CONT)



**NOTE**

Before installing Filter FL4002, establish whether a 50 KC or WIDE BAND operation mode will be used. The position of the Filter FL4002 will depend on operation mode selected. See detail A for 50 KC operation mode and detail B for WIDE BAND operation mode.



**NOTE**

Modules FL4001 and FL4002 are secured with locknuts. Steps 3 and 4 are typical for both modules.

Module number location is stamped on board.

3. Position module (10) on board and install IT lockwashers (11) and locknuts (12) on studs(13).

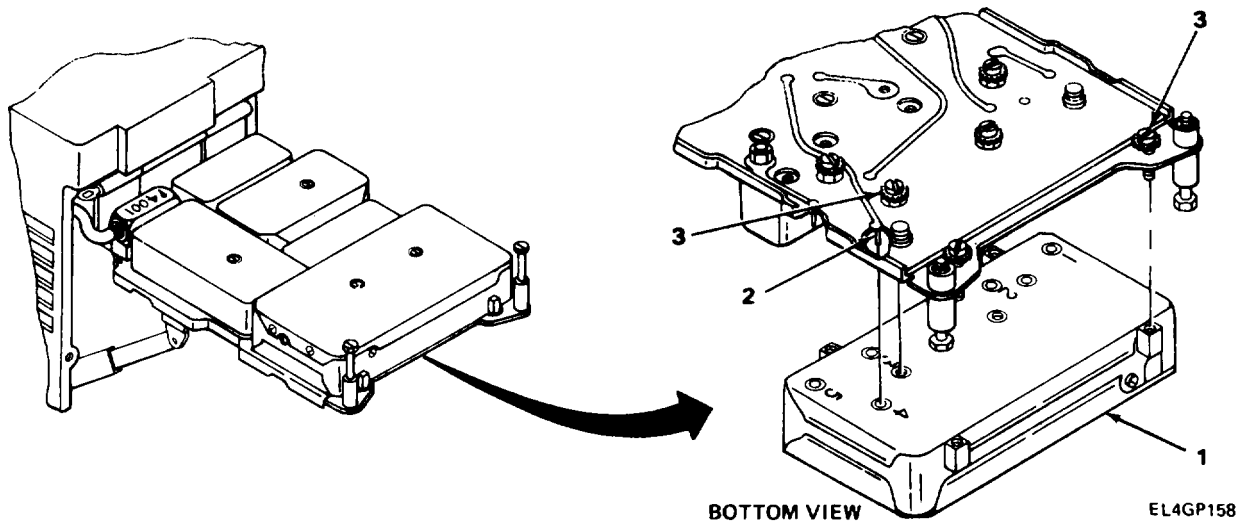
**CAUTION**

Extreme care must be taken when performing next step to prevent damaging test points on printed circuit board. Do not overtighten.

4. Using wrench, carefully tighten locknuts (12).

2-38. A4000 MODULES AND ASSEMBLY REPLACEMENT. (CONT)

INSTALLATION (CONT)



**CAUTION**

Before installing modules, make sure pins on assembly are not bent. Straighten bent pins.

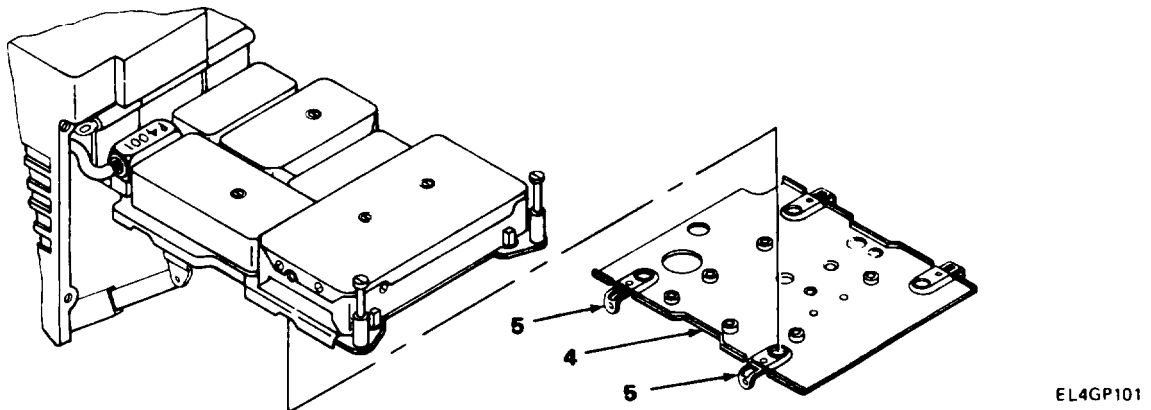
Extreme care must be taken not to damage pins.

**NOTE**

Modules A4100 through A4300 are secured with captive screws. Steps 5 and 6 are typical for all modules.

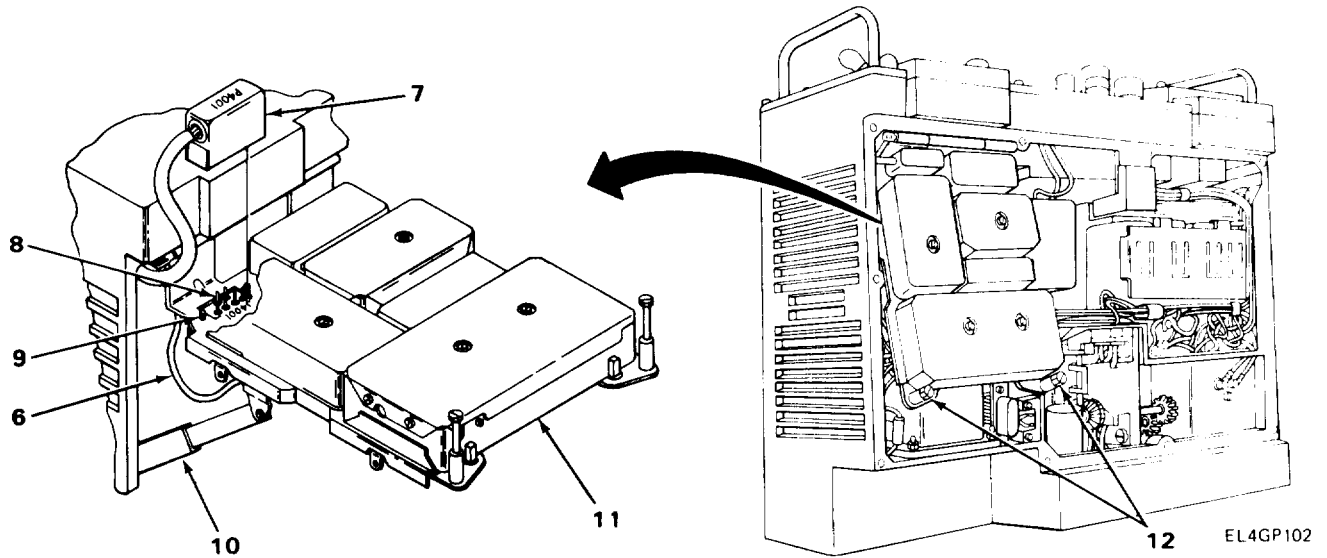
Module number is stamped on board.

5. Carefully position module (1) on pins (2) and push into place.
6. Using screwdriver, tighten captive screws (3).



7. Position shield (4) under board and align with pins.
8. Secure shield (4) by pushing in four slide clips (5).

2-38. A4000 MODULES AND ASSEMBLY REPLACEMENT.(CONT)



9. Install blue wire (W201/W401)(6) to J1005.

**CAUTION**

Care must be taken when performing next step to prevent damage to pins on assembly.

10. Carefully position P4001 (7) on pins (8) and push into place.
11. Using screwdriver, tighten two captive screws (9).
12. Release brace (10) and lower assembly (11) into position.
13. Using screwdriver, tighten two captive screws (12).

FOLLOW-ON MAINTENANCE: Install bottom cover. (See paragraph 2-7.)

## 2-39. A5000 MODULES AND ASSEMBLY REPLACEMENT.

MATERIALS/PARTS: I.F. Amplifier Assembly A5000

Amplifier Audio Frequency Assembly A5100

Amplifier Limiter A5200

Squelch Assembly A5300

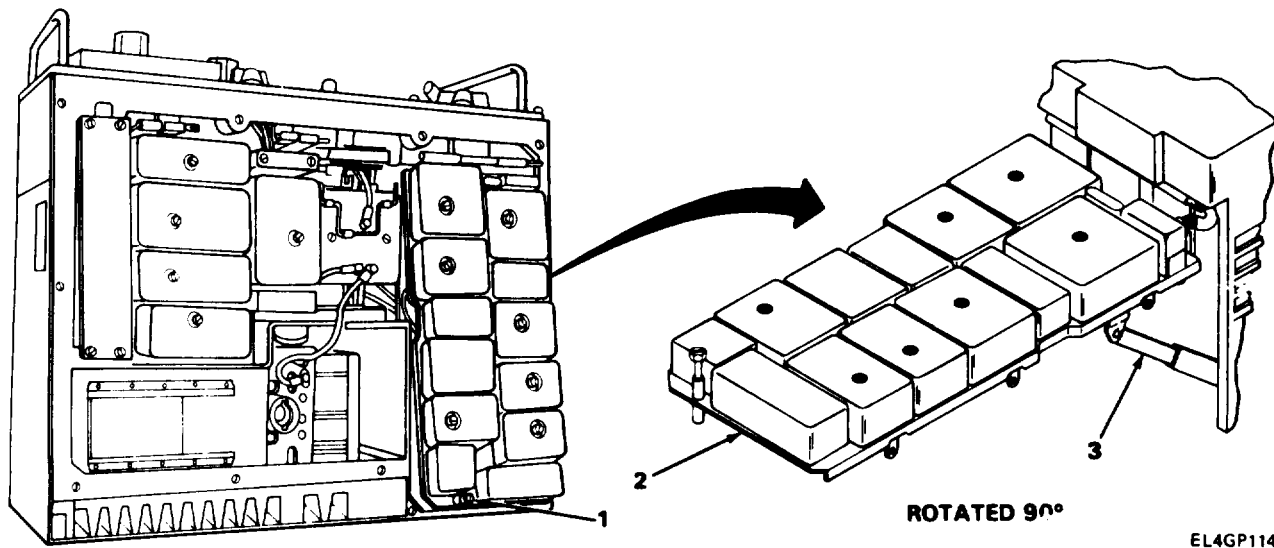
Transformer, Audio Frequency T5001

Band-Pass Filter FL5001

Relay Armature K5001

Relay Armature K5002

PRELIMINARY PROCEDURE: Remove top cover. (See paragraph 2-7.)



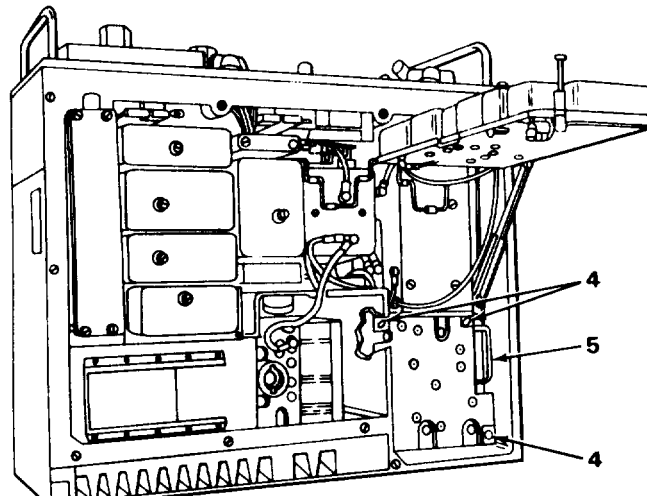
### REMOVAL

#### NOTE

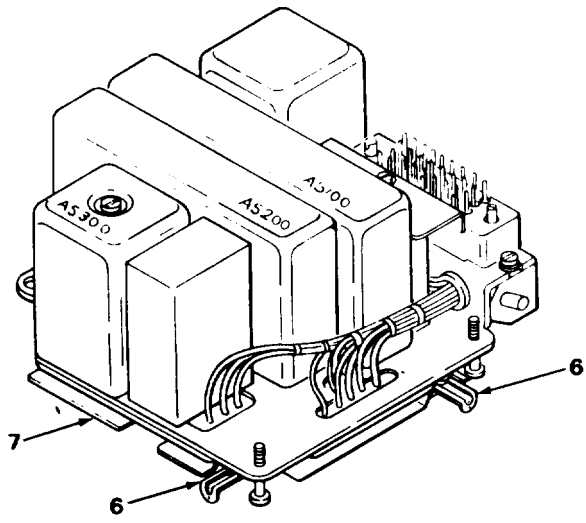
To get to A5000 assembly, A3000 assembly must be moved out of the way.

1. Using screwdriver, loosen one captive screw (1).
2. Swing A3000 assembly (2) out and secure brace (3).

2-39. A5000 MODULES AND ASSEMBLY REPLACEMENT. (CONT)



- 3. Using screwdriver, loosen three captive screws (4).
- 4. Pry up pull ring (5) and carefully pull assembly out of case.

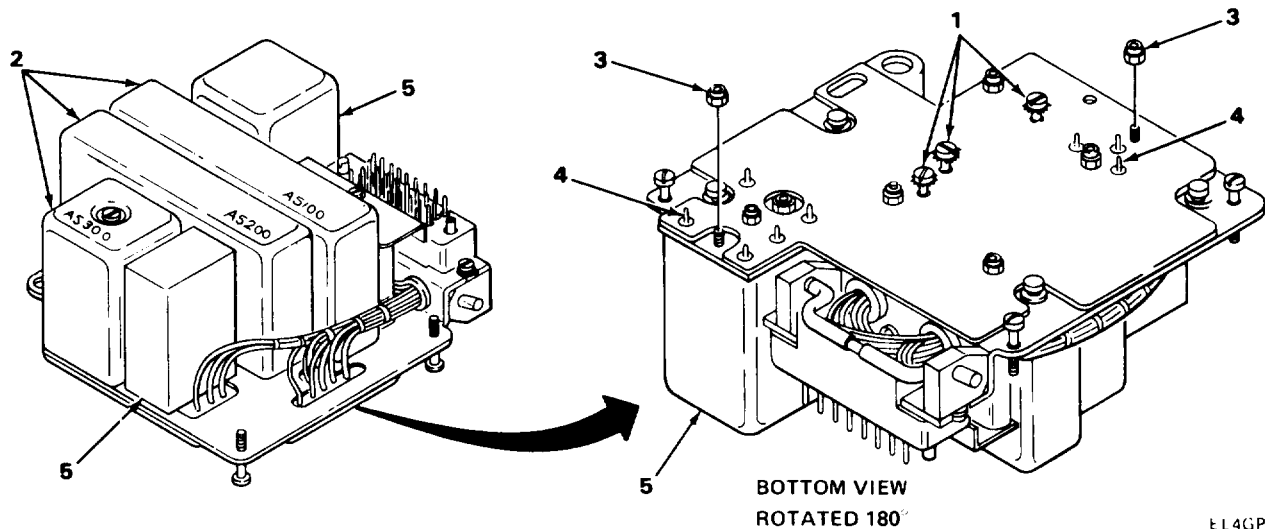


- 5. Pull out four slide clips (6) and remove shield (7).

EL4GP116

**2-39. A5000 MODULES AND ASSEMBLY REPLACEMENT. (CONT)**

REMOVAL (CONT)



**NOTE**

Modules A5100 through A5300 are secured with captive screws. Steps 6 and 7 are typical for all modules.

6. Using screwdriver, loosen captive screws (1).
7. Carefully pull modules (2) off board to release from pins. Do not twist from side to side.

**NOTE**

Modules FL5001 and T5001 are secured with locknuts and are soldered to printed circuit board. Steps 8,9, and 10 are typical for both modules.

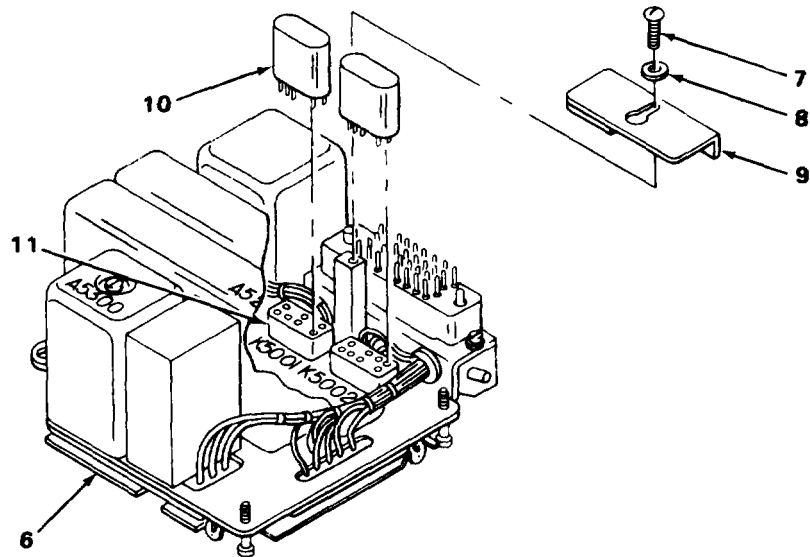
8. Using wrench, remove locknuts (3).

**CAUTION**

Care must be taken when performing next step to prevent damage to printed circuit board.

9. Using soldering iron, carefully unsolder module wires (4) from printed circuit board.
10. Carefully pull module (5) off board.

2-39. A5000 MODULES AND ASSEMBLY REPLACEMENT. (CONT)



EL4GP118

**NOTE**

Shield (6) does not have to be removed in order to replace K5001 and K5002 modules.

Steps for removing K5001 and K5002 modules are the same.

11. Using screwdriver, remove screw (7), flat washer (8) and holddown (9).
12. Carefully pull module (10) from receptacle (11).

INSTALLATION

**NOTE**

If modules were not removed from assembly, proceed to step 11.

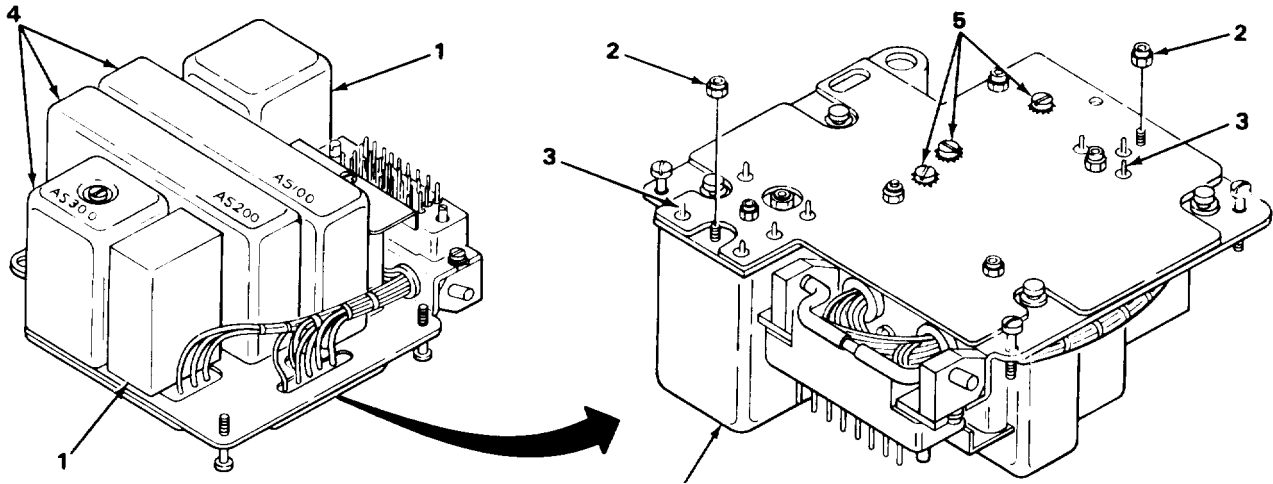
Steps for installing K5001 and K5002 modules are the same.

Module number location is stamped on board.

1. Carefully position module (10) in receptacle (11) and push into place.
2. Install holddown (9), flat washer (8) and screw (7).
3. Using screwdriver, tighten screw (7).

2-39. A5000 MODULES AND ASSEMBLY REPLACEMENT. (CONT)

INSTALLATION (CONT)



**NOTE**

Modules FL5001 and T5001 are secured with locknuts and are soldered to printed circuit board. Steps 4,5, and 6 are typical for both modules.

Module number location is stamped on board.

4. Position module (1) on board and install locknuts (2).
5. Using wrench, tighten locknuts (2).

**CAUTION**

Care must be taken when performing next step to prevent damage to printed circuit board.

6. Using soldering iron, carefully solder pins (3) of module to printed circuit board.

**NOTE**

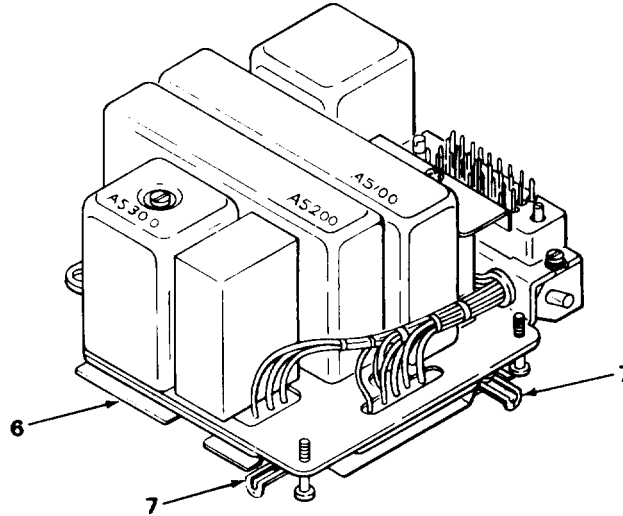
Modules A5100 through A5300 are secured with captive screws. Steps 7 and 8 are typical for all modules.

Module number location is stamped on board.

7. Carefully position modules (4) on pins and push into place.
8. Using screwdriver, tighten captive screws (5).

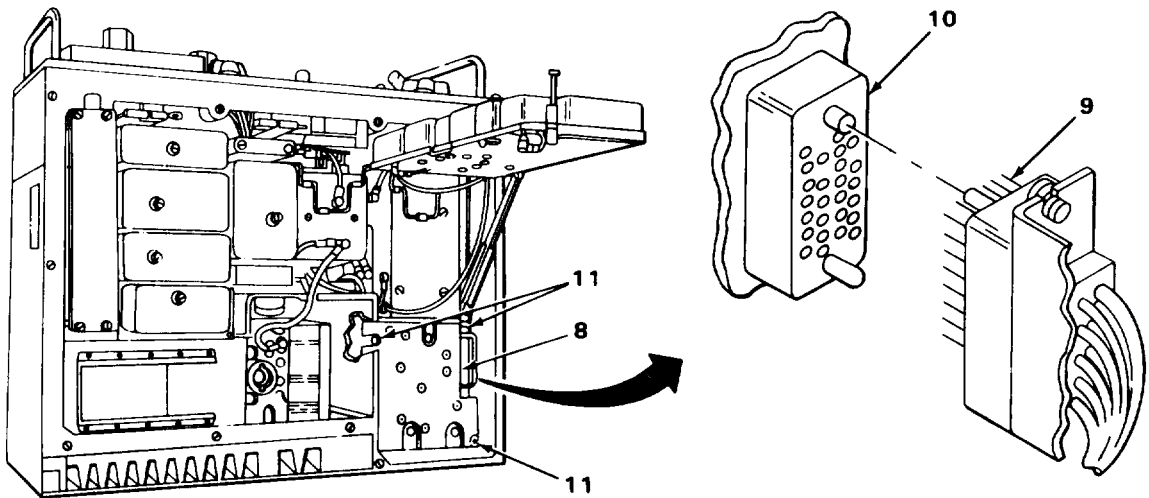


2-39. A5000 MODULES AND ASSEMBLY REPLACEMENT. (CONT)



EL4GP120

9. Position shield (6) under board and align with pins.
10. Secure shield (6) by pushing in four slide clips (7).



EL4GP121

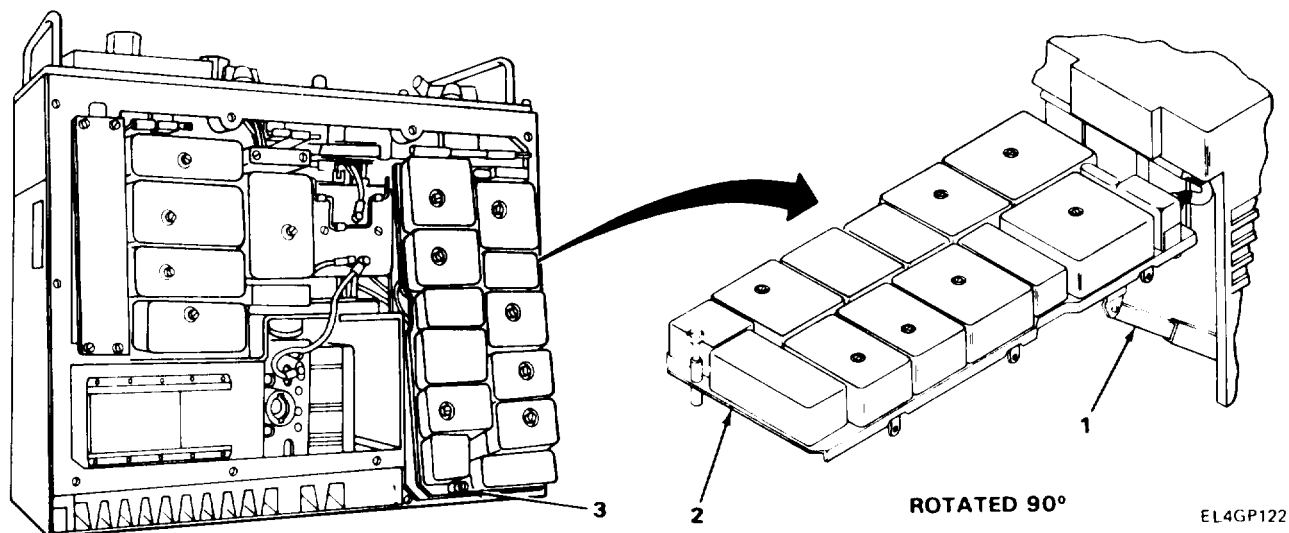
**CAUTION**

Care must be taken when performing next step to prevent damage to pins on assembly connector.

11. Carefully position assembly (8) in case and push into place engaging assembly connector pins (9) and case connector (10).
12. Using screwdriver, tighten three captive screws (11).

**2-39. A5000 MODULES AND ASSEMBLY REPLACEMENT. (CONT)**

INSTALLATION (CONT)



13. Release brace (1) on A3000 assembly (2) and lower into place.
14. Using screwdriver, tighten one captive screw (3).

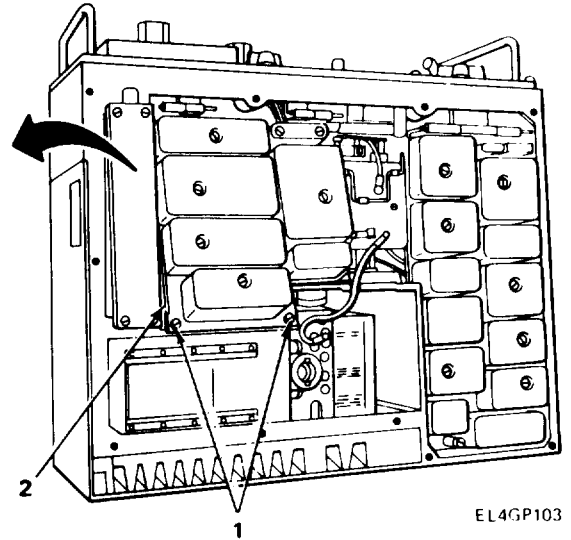
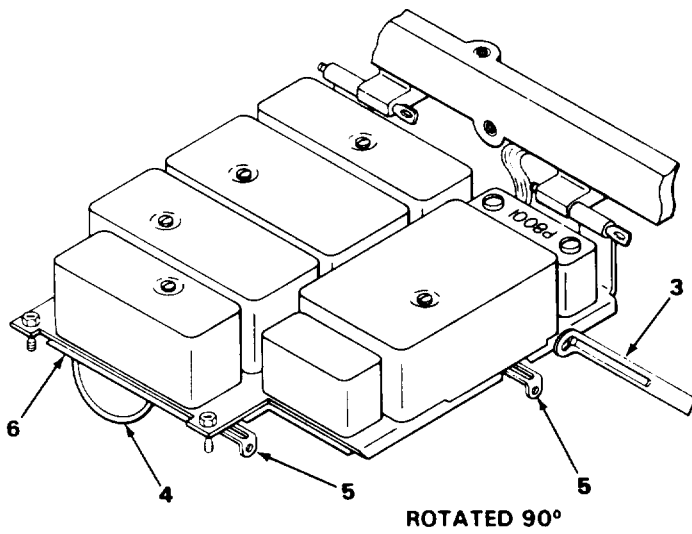
FOLLOW-ON MAINTENANCE: Install top cover. (See paragraph 2-7.)

**2-40. A8000 MODULES AND ASSEMBLY REPLACEMENT.**

MATERIALS/PARTS: Amplifier Modulator A8000, P/N SMC414170  
Oscillator RF Assembly A8100  
Phase Discriminator Assembly A8200  
I F Amplifier A8300  
Generator REF Signal Assembly A8400  
Speech Amplifier Assembly A8500  
Low-Pass Filter

PRELIMINARY PROCEDURE: Remove top cover. (See paragraph 2-7.)

2-40. A8000 MODULES AND ASSEMBLY REPLACEMENT. (CONT)



REMOVAL

1. Using screwdriver, loosen two captive screws (1).
2. Swing assembly (2) out, allowing brace (3) to lock in place.

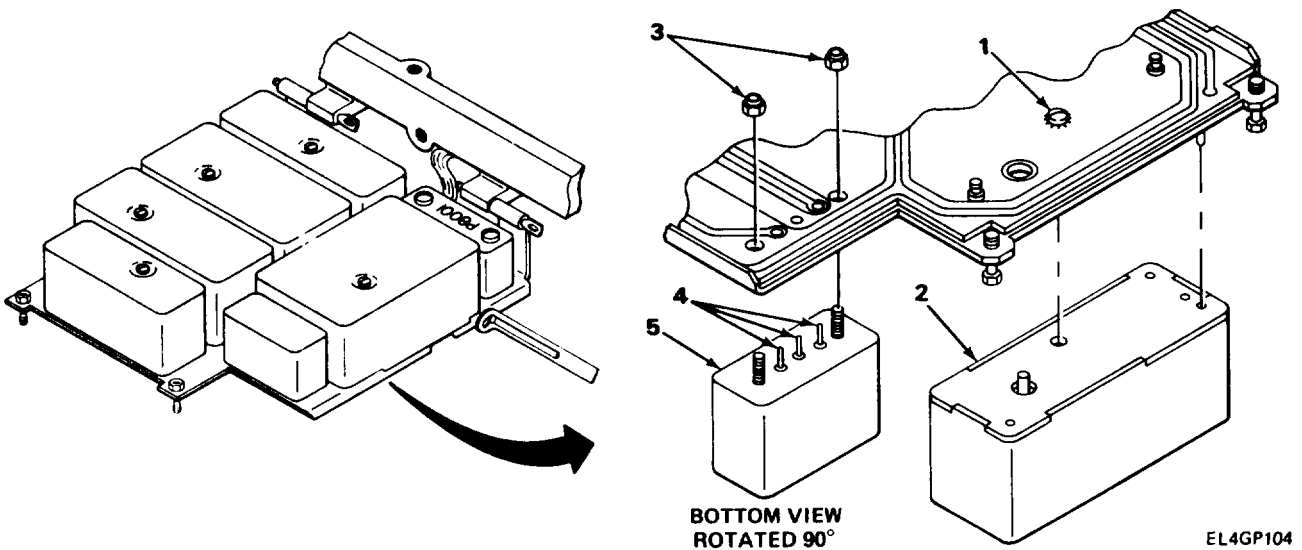
**NOTE**

Assembly can be removed with or without first removing modules. If assembly is to be removed without removing modules, proceed to step 10.

3. Disconnect violet wire (W409) (4) from J8301 on assembly.
4. Pull out four slide clips (5) and remove shield (6).

2-40. A8000 MODULES AND ASSEMBLY REPLACEMENT. (CONT)

REMOVAL (CONT)



**NOTE**

Modules A8100 through A8500 are secured with captive screws. Steps 5 and 6 are typical for all modules.

5. Using screwdriver, loosen captive screws (1).
6. Carefully pull module (2) off board to release from pins. Do not twist from side to side to remove.

**NOTE**

Module FL8001 is secured with locknuts and is soldered to the printed circuit board.

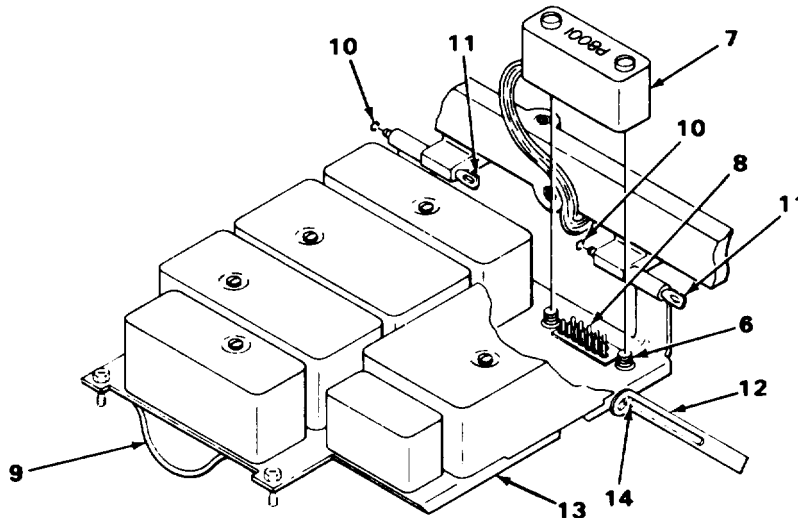
7. Using wrench, remove locknuts (3).

**CAUTION**

Care must be taken when performing the next step to prevent damage to printed circuit board.

8. Using soldering iron, carefully unsolder pins (4) of module from printed circuit board.
9. Carefully pull module(5) off board.

**2-40. A8000 MODULES AND ASSEMBLY REPLACEMENT. (CONT)**



EL4GP105

10. Using screwdriver, loosen two captive screws (6).

**CAUTION**

Care must be taken when performing next step to prevent damage to pins on assembly.

11. Carefully lift P8001 (7) off pins (8).
12. Disconnect violet wire (W407) (9) from J8301 on assembly.
13. Using long-nose pliers, remove two C-clips (10) from two hinge pins (11).
14. Disconnect brace (12) by pulling down at end and pushing away from assembly.
15. Remove two hinge pins (11).
16. Remove assembly (13).

**INSTALLATION**

**CAUTION**

Before installing assembly, make sure pins (8) are not bent. Straighten any bent pins.

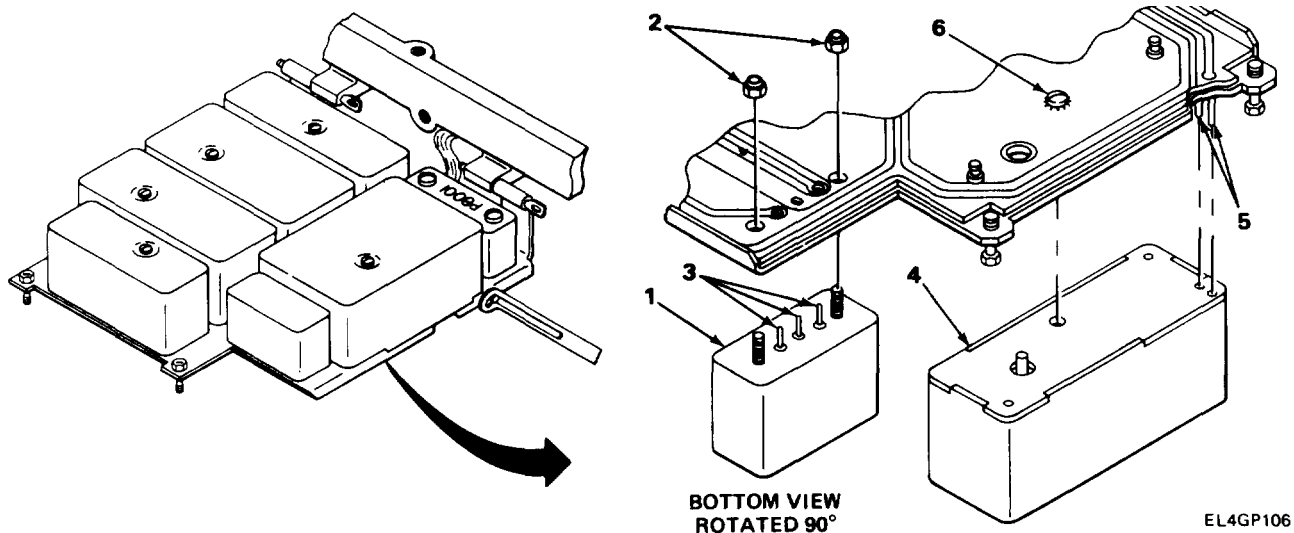
1. Position assembly (13) in hinges and insert two hinge pins (11).
2. Position brace (12) on pin (14) of assembly (13).
3. Using long-nose pliers, install C-clips (10) on hinge pins (11).

**NOTE**

If modules were not removed from assembly, proceed to step 10 for installation of assembly.

## 2-40. A8000 MODULES AND ASSEMBLY REPLACEMENT. (CONT)

### INSTALLATION (CONT)



#### NOTE

Module FL8001 is secured with locknuts and is soldered to printed circuit board.

Module number location is stamped on board.

4. Position module (1) on board and install locknuts (2).
5. Using wrench, tighten locknuts (2).

#### CAUTION

Care must be taken when performing next step to prevent damage to printed circuit board.

6. Using soldering iron, carefully solder pins (3) to printed circuit board.

#### CAUTION

Before installing modules, make sure pins on assembly are not bent. Straighten any bent pins.

Extreme care must be taken when performing next step to prevent damage to pins on assembly.

#### NOTE

Modules A8100 through A8500 are secured with captive screws. Steps 7 and 8 are typical of all modules.

Module number location is stamped on board.

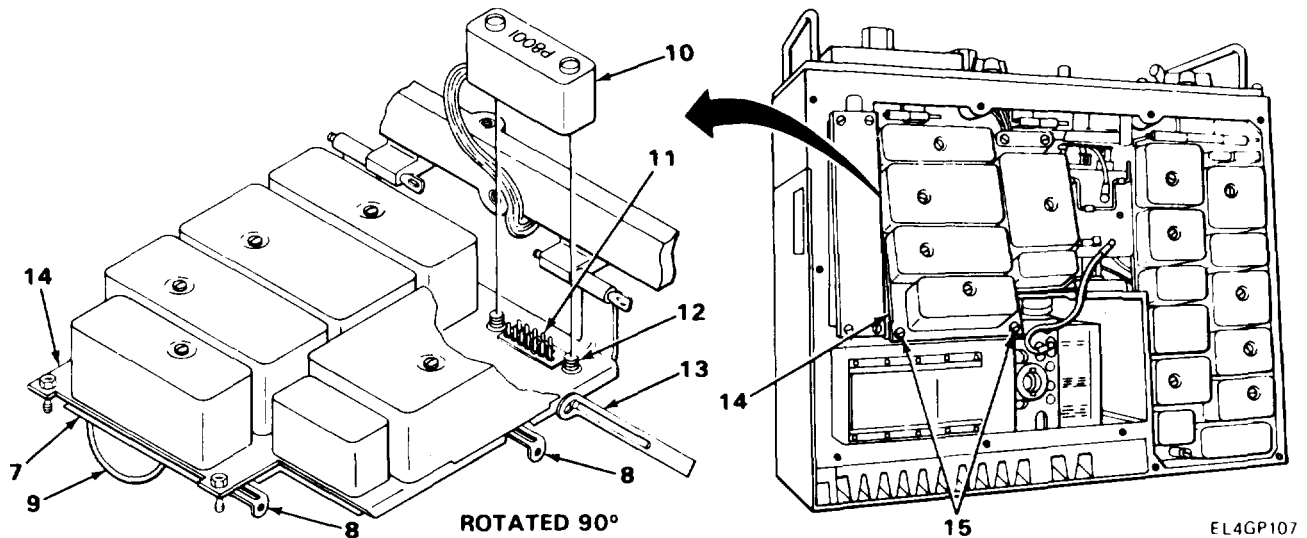
7. Carefully position module (4) on pins (5) and push into place.

**2-40. A8000 MODULES AND ASSEMBLY REPLACEMENT. (CONT)**

**CAUTION**

Care must be taken when performing next step to prevent damage to solder points.

8. Using screwdriver, tighten captive screws (6).



9. Position shield (7) under board and align with pins.
10. Secure shield (7) by pushing in four slide clips (8).

**CAUTION**

Check screws on top of modules for tightness. If loose, tighten.

11. Connect violet wire (W407) (9) to J8301 on assembly.

**CAUTION**

Care must be taken when performing next step to prevent damage to pins on assembly.

12. Carefully position P8001 (10) on pins (11) and push into place.
13. Using screwdriver, tighten two captive screws (12).
14. Release brace (13) and lower assembly (14) into place.
15. Using screwdriver, tighten two captive screws (15).

**FOLLOW-ON MAINTENANCE:** Install top cover. (See paragraph 2-7.)

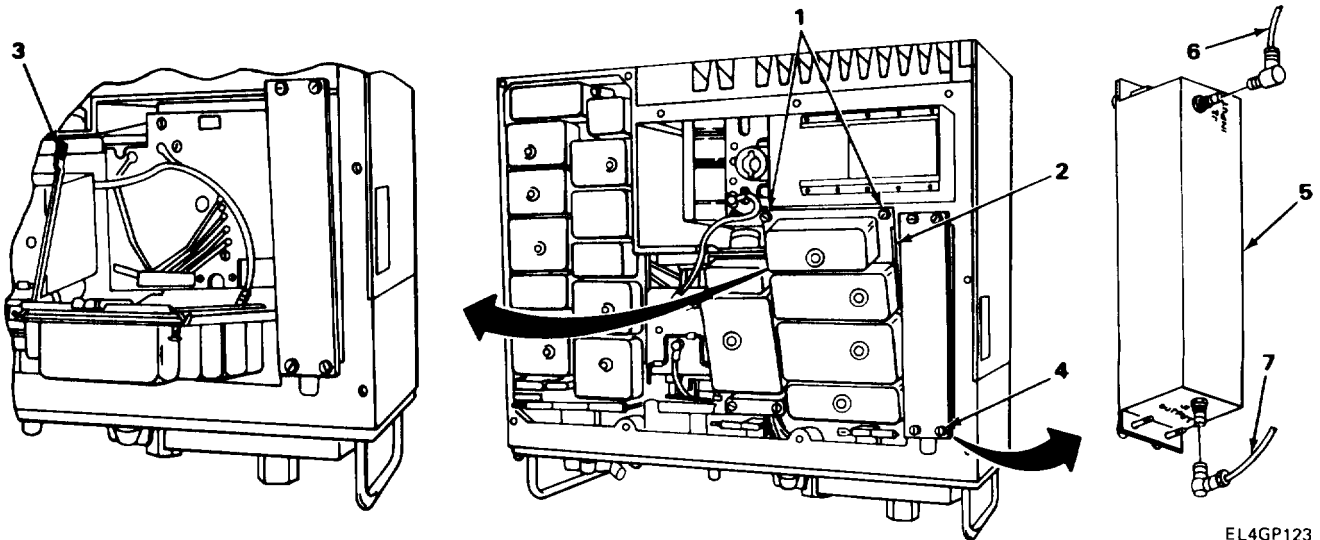
**2-41. POWER SUPPLY ASSEMBLY A9000 REPLACEMENT.**

MATERIALS/PARTS: Power Supply Assembly A9000

PRELIMINARY PROCEDURE: Remove top and bottom covers. (See paragraph 2-7.)

**WARNING**

Disconnect power before starting this procedure.



EL4GP123

**REMOVAL**

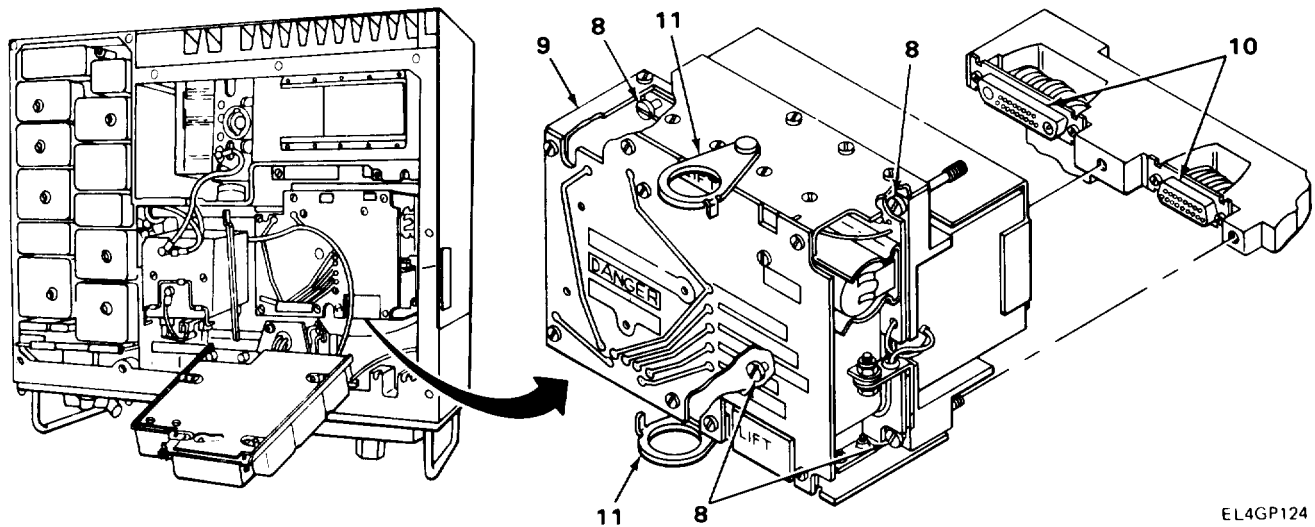
**NOTE**

To get to A9000 assembly, A8000 assembly and Filter FL401 must first be moved out of the way.

1. Using screwdriver, loosen two captive screws (1).
2. Swing A8000 assembly (2) out, disconnect brace (3) and lower A8000 assembly.
3. Using screwdriver, loosen four captive screws (4).
4. Pull Filter FL401 (5) out of radio case and disconnect orange wire (W410) (6) from FL401 J2 and green wire (W411) (7) from FL401 J1.



2-41. POWER SUPPLY ASSEMBLY A9000 REPLACEMENT. (CONT)



EL4GP124

5. Using screwdriver, loosen four captive screws (8).
6. From opposite side of assembly (9), push slightly at bottom of assembly to free from connectors (10).
7. Lift two pull rings(11) and carefully pull assembly (9) out of radio case.

INSTALLATION

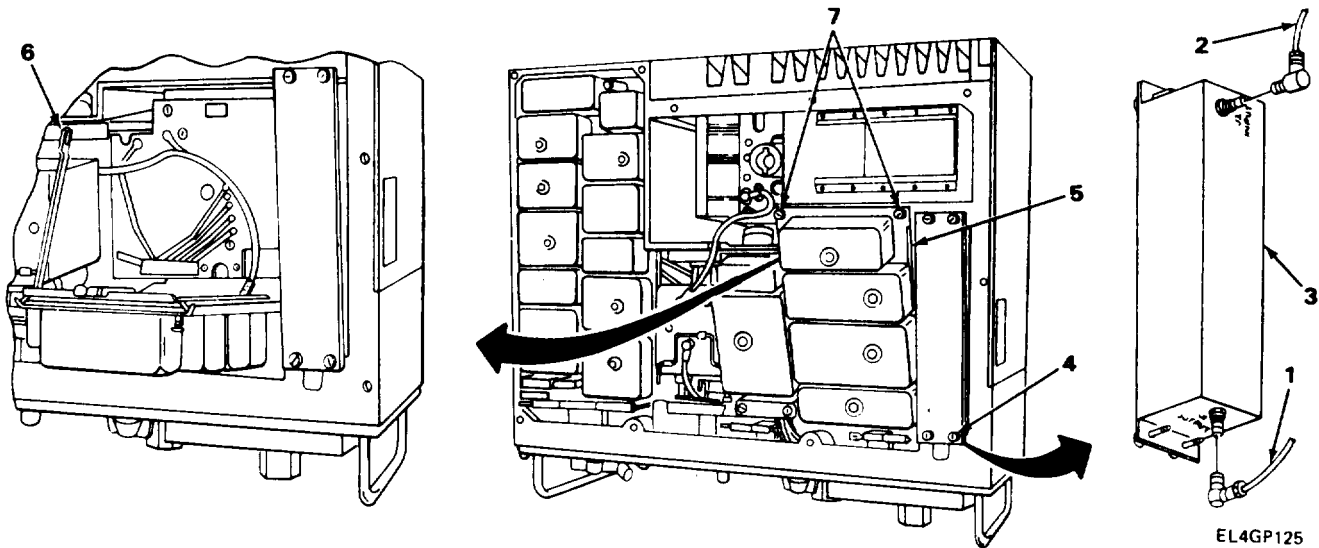
**CAUTION**

Before installing assembly, make sure pins on assembly are not bent. Straighten any bent pins.

1. Position assembly (9) in radio case, alining connectors on assembly with connectors (10) in radio case.
2. Carefully push assembly (9) into place and close pull rings (11).
3. Using screwdriver, tighten four captive screws (8).

2-41. POWER SUPPLY ASSEMBLY A9000 REPLACEMENT. (CONT)

INSTALLATION (CONT)



4. Connect green wire (W411) (1) to FL401 J1 and orange wire (W410) (2) to FL401 J2.
5. Carefully position Filter FL401 (3) in radio case.

**CAUTION**

Care must be taken when performing next step not to overtighten screws.

6. Using screwdriver, tighten four captive screws (4).
7. Raise A8000 assembly (5) and connect brace (6).
8. Raise A8000 assembly (5) into position and secure two captive screws (7).
9. Using screwdriver, tighten two captive screws (7).

FOLLOW-ON MAINTENANCE: Install top and bottom covers. (See paragraph 2-7.)

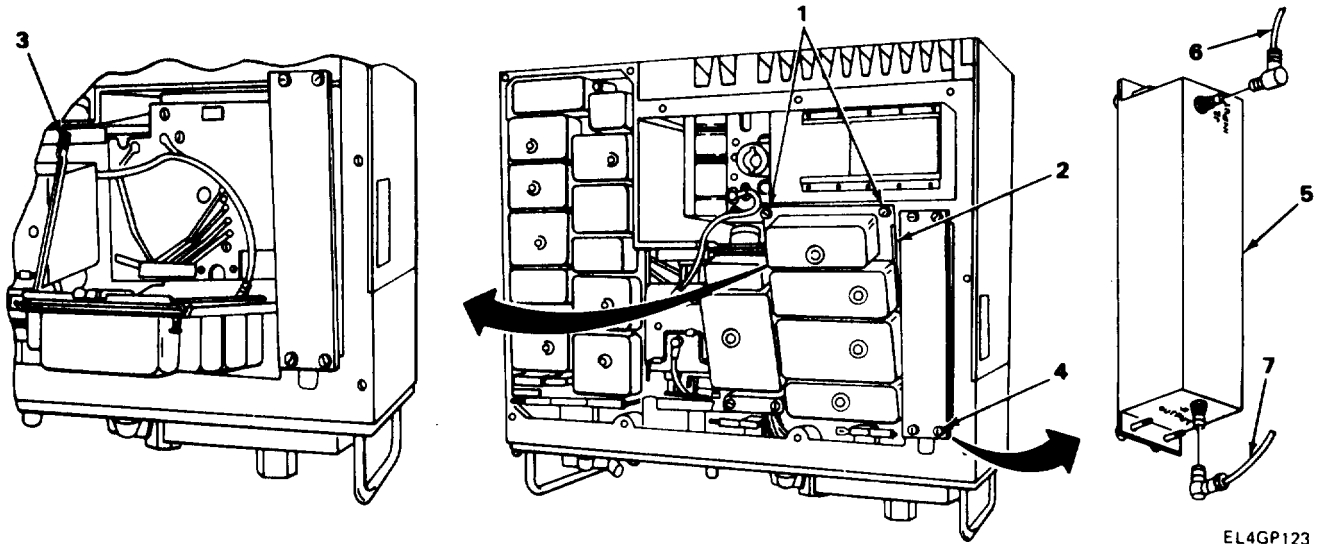
**2-42. RELAY K9001 AND K9002 REPLACEMENT.**

MATERIALS/PARTS: Armature Relay K9001 and K9002

PRELIMINARY PROCEDURE: Remove top cover. (See paragraph 2-7.)

**WARNING**

Disconnect power before starting procedure.



EL4GP123

**REMOVAL**

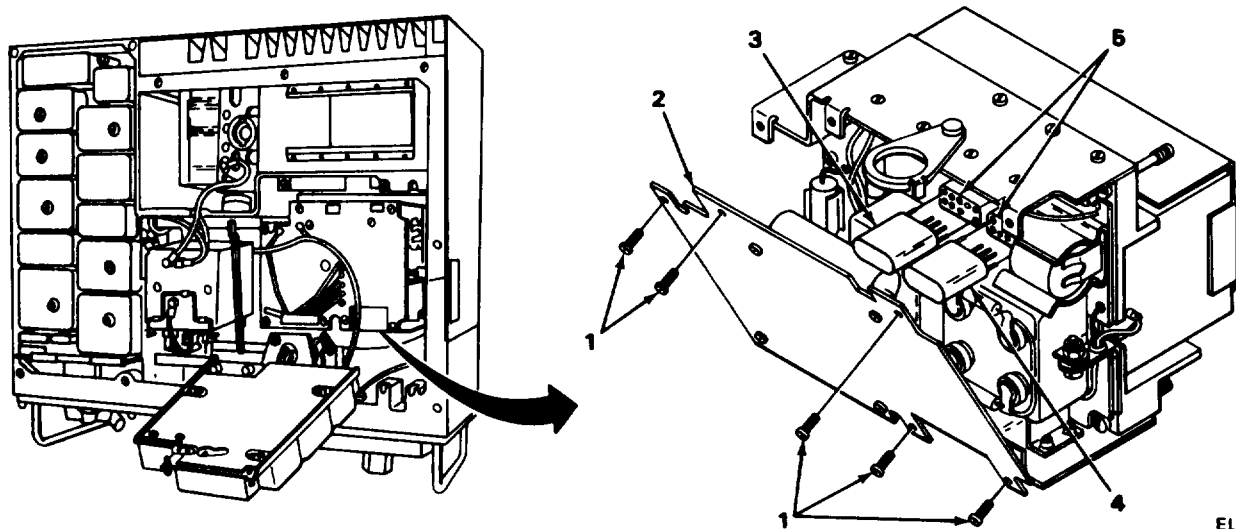
**NOTE**

To get to Relay K9001 and K9002, A8000 assembly and Filter FL401 must first be moved out of the way.

1. Using screwdriver, loosen two captive screws (1).
2. Swing A8000 assembly (2) out, disconnect brace (3) and lower A8000 assembly.
3. Using screwdriver, loosen four captive screws (4).
4. Pull Filter FL401 (5) out of radio case and disconnect orange wire (W410) (6) from FL401 J2 and green wire(W411) (7) from FL401 J1.

2-42. RELAY K9001 AND K9002 REPLACEMENT. (CONT)

REMOVAL (CONT)



EL4GP127

5. Using screwdriver, remove five screws (1) from test board (2).
6. Lower test board (2) to gain access to relays K9001 (3) and K9002 (4).
7. Carefully pull relays(3) and (4) from sockets (5).

INSTALLATION

**CAUTION**

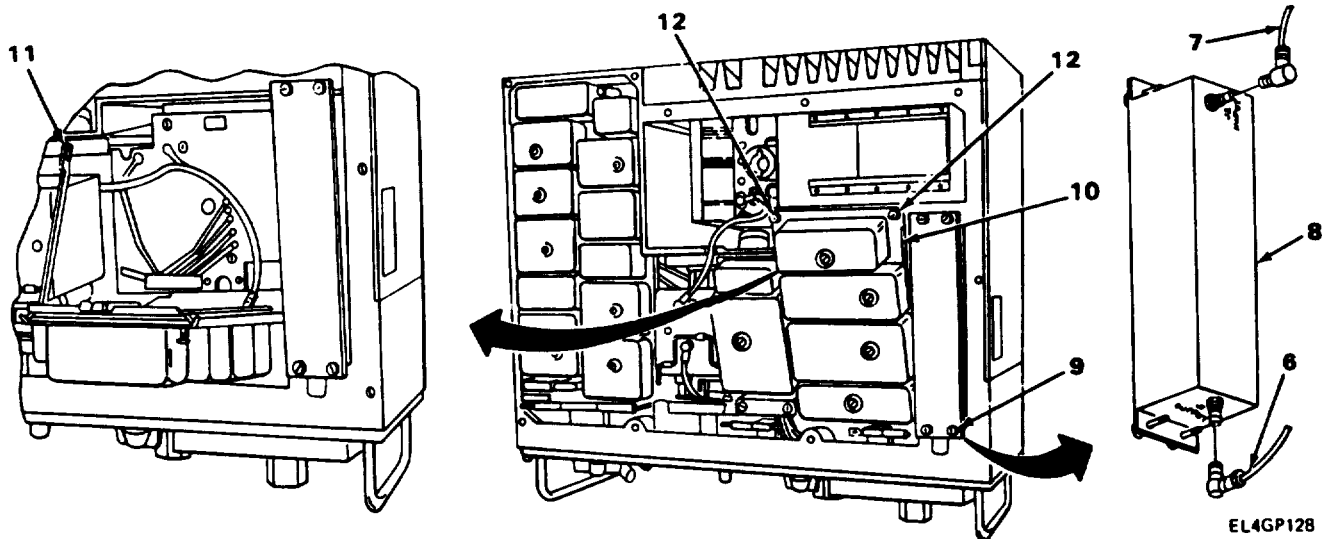
Before installing relays, make sure pins are not bent. Straighten any bent pins.

**NOTE**

Pin arrangement is identical on both relays.

1. Carefully push relays (3) and (4) into sockets (5).
2. Push test board (2) into place and install five screws (1).
3. Using screwdriver, tighten five screws (1). Do not overtighten.

2-42. RELAY K9001 AND K9002 REPLACEMENT. (CONT)



4. Connect green wire (W411) (6) to FL401 J1 and orange wire (W410) (7) to FL401 J2.
5. Carefully position Filter FL401 (8) in radio case.

**CAUTION**

Care must be taken when performing next step not to overtighten screws.

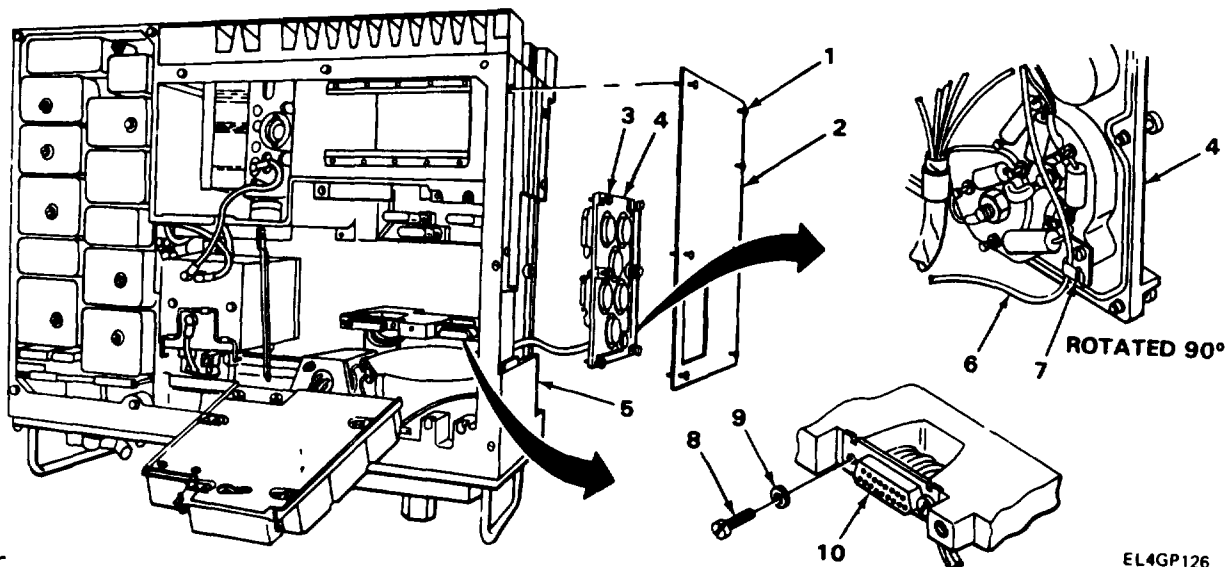
6. Using screwdriver, tighten four captive screws (9).
7. Raise A8000 assembly (10) and connect brace (11).
8. Raise A8000 assembly (10) into position and secure two captive screws.
9. Using screwdriver, tighten two captive screws (12).

FOLLOW-ON MAINTENANCE: Install top cover. (See paragraph 2-7.)

**2-43. POWER OSCILLATOR ASSEMBLY A9400 AND A9400A REPLACEMENT.**

**MATERIALS/PARTS:** Power Oscillator Assembly A9400A

**PRELIMINARY PROCEDURE:** Remove Power Supply Assembly A9000. (See paragraph 2-41).



**REMOVAL**

1. Using screwdriver, loosen six captive screws (1) and remove side cover (2).
2. Using screwdriver, loosen six captive screws (3) and carefully pull assembly (4) out of radio case (5).
3. Disconnect violet wire (W412) (6) from clip (7) on assembly (4).
4. Using small screwdriver, remove two screws (8) and flat washers (9) from Connector P9001 (10).
5. Remove assembly (4) from radio case (5).

EL4GP126

**INSTALLATION**

1. Install assembly (4) in radio case (5) and align holes.
2. Using screwdriver, tighten six captive screws (3).
3. Position Connector P9001 (10) in mount and install two screws (8) and flat washers (9).
4. Using small screwdriver, tighten two screws (8). Make sure Connector P9001 (10) floats in mount.
5. Connect violet wire (W412) (6) to clip (7) on assembly (4).
6. Install side cover (2) on radio case (5) and align holes.
7. Using screwdriver, tighten six captive screws (1).

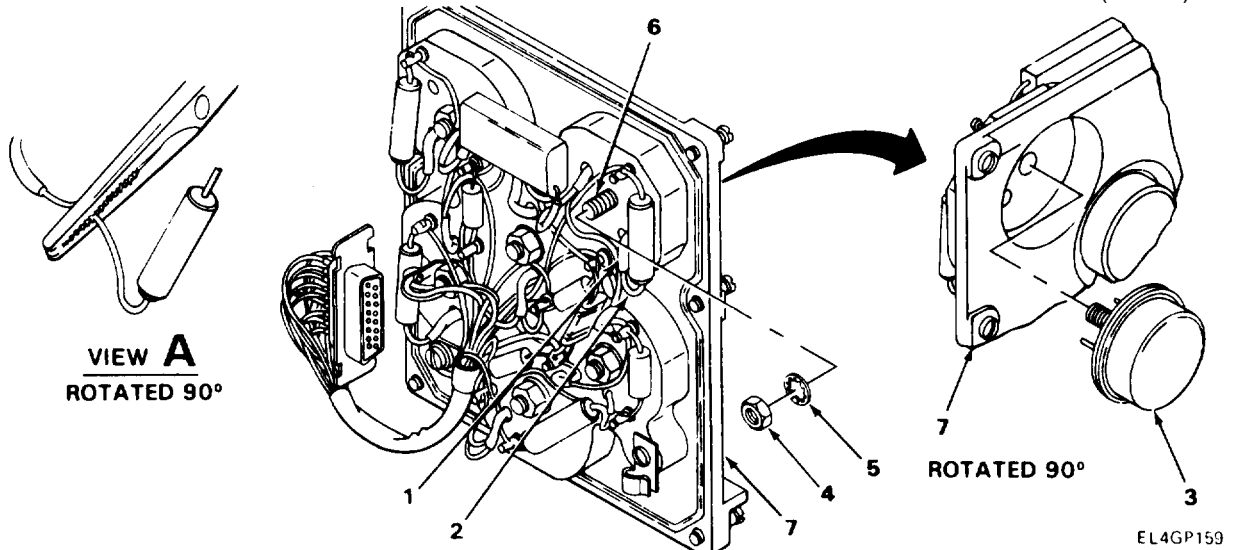
**FOLLOW-ON MAINTENANCE:** Install Power Supply Assembly A9000. (See paragraph 2-41).

**2-44. POWER OSCILLATOR ASSEMBLY A9400 AND A9400A TRANSISTOR REPLACEMENT.**

**NOTE**

**This procedure is no longer authorized below Depot level, however the paragraph numbering sequence is being retained for purposes of continuity.**

2-44. POWER OSCILLATOR ASSEMBLY A9400 AND A9400A TRANSISTOR REPLACEMENT. (CONT)



REMOVAL

**NOTE**

The instructions given below are common for removal of all transistors.

1. Carefully pull shielding (1) away from solder point.

**CAUTION**

Care must be taken when performing next step to prevent damage to nearby components.

2. Using soldering iron, carefully unsolder wire (2) from transistor (3).
3. Using nut driver and 3/8-inch socket, remove nut (4) and ET lockwasher (5) from transistor stud (6).
4. Carefully remove transistor (3) from housing (7).

INSTALLATION

**NOTE**

The instructions given below are common for installation of all transistors.

1. Carefully install transistor (3) into housing (7).
2. Install ET lockwasher (5) and nut (4) on transistor stud (6).
3. Using nut driver and 3/8-inch socket, carefully tighten nut (4).

**CAUTION**

Extreme care must be taken when performing next step to prevent damage to transistor and nearby components. Clamp heat sink pliers (see detail A) between transistor and wire to prevent heat transfer during soldering operation.

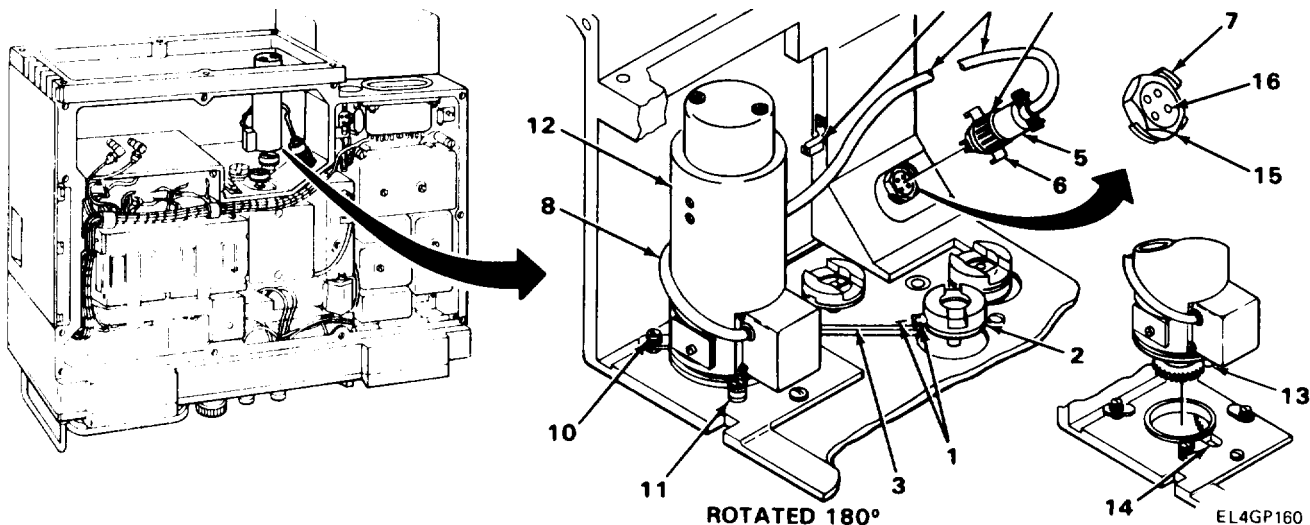
4. Using soldering iron, carefully solder wire (2) to transistor (3).
5. Push shielding (1) over solder point.

FOLLOW-ON MAINTENANCE: Install Power Oscillator Assemblies A9400 and A9400A. (See paragraph 2-43.)

**2-45. BAND SWITCH MOTOR B401 REPLACEMENT (RT-246(\*)/VRC ONLY).**

MATERIALS/PARTS: Control Motor

PRELIMINARY PROCEDURE: Remove Power Amplifier Assembly A6200. (See paragraph 2-46.)



**REMOVAL**

**NOTE**

Set front panel controls to BAND (A) 30.00 MHz before proceeding.

1. Scribe alinement marks (1) across band switch coupler (2) and gear train body (3).
2. Loosen collar (4) on Plug P404 (5) and turn lock clip (6) out from under locking tabs (7) and pull Plug P404 free.
3. Remove wire (8) from clip (9).
4. Using screwdriver, loosen four screws (10) and turn cleats(11) away from groove in band switch motor (12) .
5. Remove band switch motor (12).

**INSTALLATION**

**NOTE**

Make sure band switch motor is set to BAND (A)

1. Install band switch motor (12) with alinement pin (13) in hole (14) and allow band switch motor to sit flat.
2. Connect wire (8) to clip (9).
3. Install Plug P404 (5) in socket (15), alining large pin on Plug P404 with large hole (16) in socket, and push into place.
4. Turn lock clip (6) under locking tabs (7) and tighten collar (4).
5. Turn four cleats (11) into groove of band switch motor (12).
6. Turn band switch motor (12) to allow alinement marks (1) to be alined.
7. Using screwdriver, tighten four screws (10).

FOLLOW-ON MAINTENANCE: Install Power Amplifier Assembly A6200. (See paragraph 2-46.)

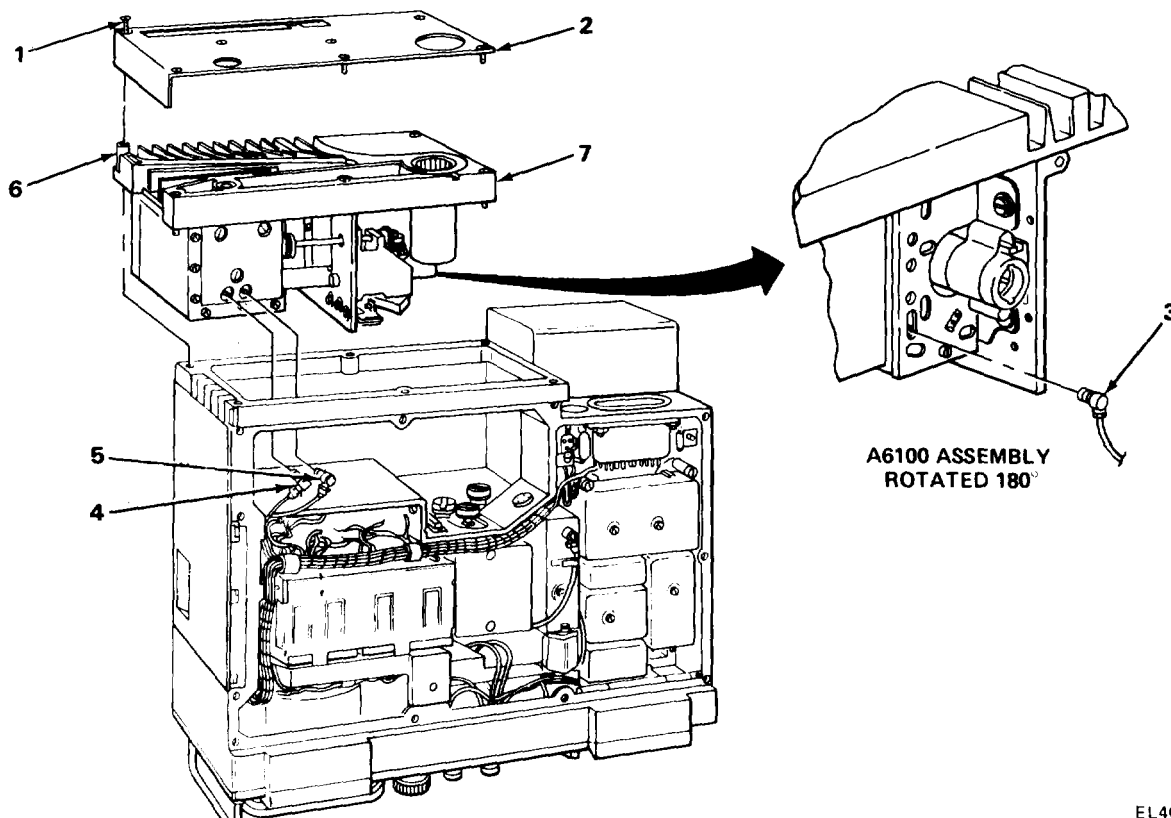
**2-46. POWER AMPLIFIER ASSEMBLY A6200 REPLACEMENT.**

MATERIALS/PARTS: Amplifier Assembly, SMD 413994

PRELIMINARY PROCEDURE: Remove top and bottom covers. (See paragraph 2-7.)



2-46. POWER AMPLIFIER ASSEMBLY A6200 REPLACEMENT. (CONT)



REMOVAL

EL4GP059

**NOTE**

Turn MC-TUNE-KC controls to 30.00 MHz.

1. Using screwdriver, loosen eight captive screws (1) and remove heat sink cover (2).

**NOTE**

If color coding on unit varies from one shown, note corrected color coding before disassembly.

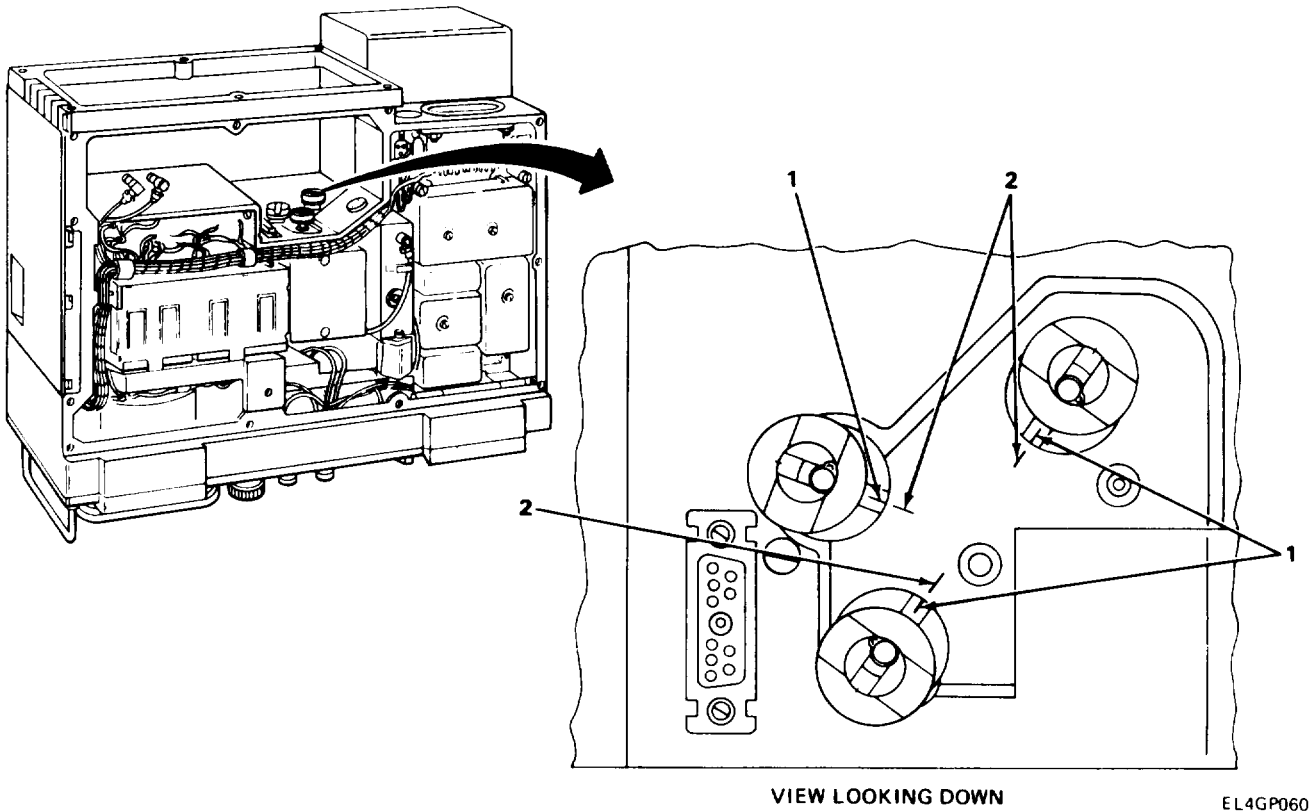
2. Disconnect wires shown in table below.

WIRE NO.	COLOR	FROM	TO	INDEX NO.
W407	GRY	J6001	J6101	3
W410	ORG	EL401P2	J6201	4
W412	V10	K301P2	J6202	5

3. Using screwdriver, loosen six captive screws (6).
4. Carefully lift power amplifier assembly(7) out of case.

2-46. POWER AMPLIFIER ASSEMBLY A6200 REPLACEMENT. (CONT)

REMOVAL (CONT)



**NOTE**

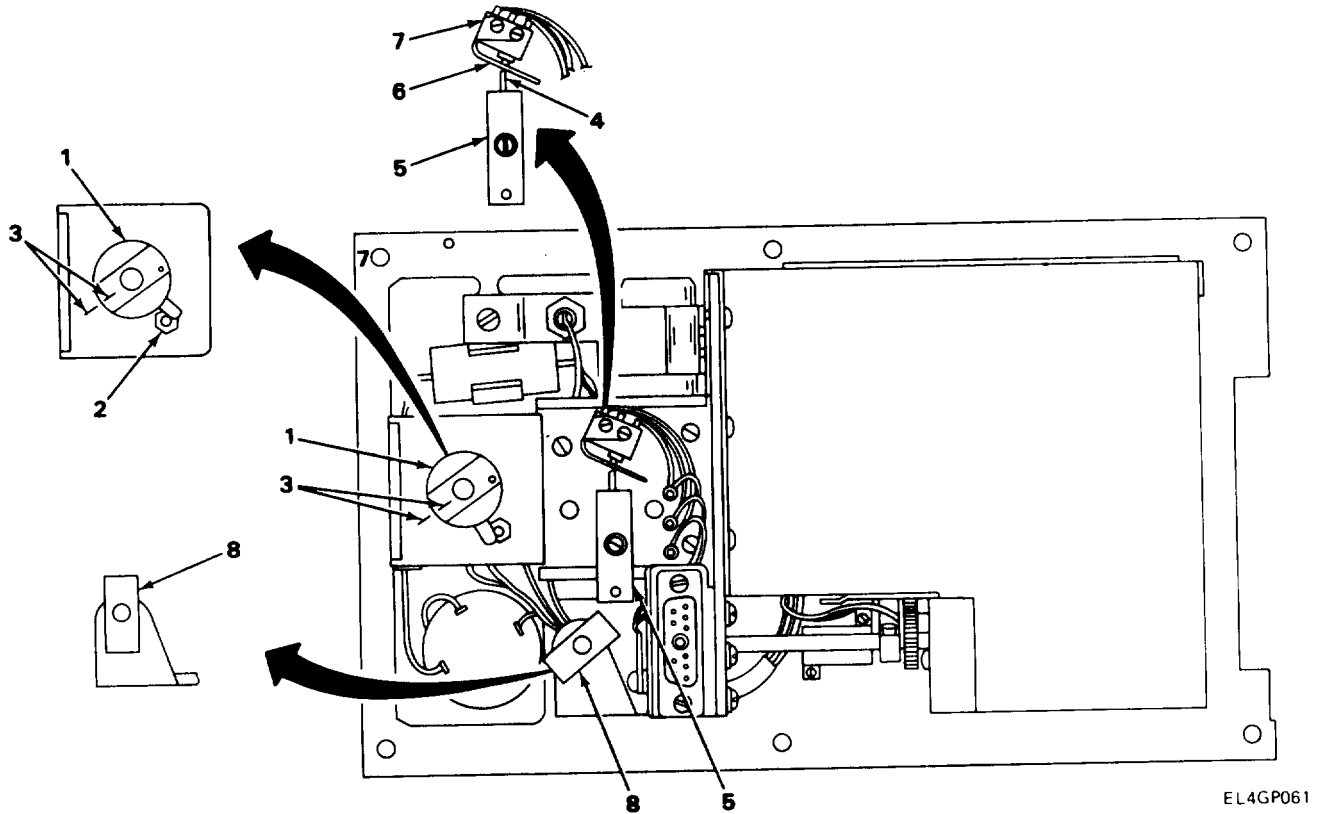
Scribe gear train coupler alinement mark (1) and body alinement mark (2) to aid in installation.

## 2-46. POWER AMPLIFIER ASSEMBLY A6200 REPLACEMENT. (CONT)

## INSTALLATION

## NOTE

If any gear train couplers on power amplifier assembly have been turned, do steps 1 through 4 to aline.

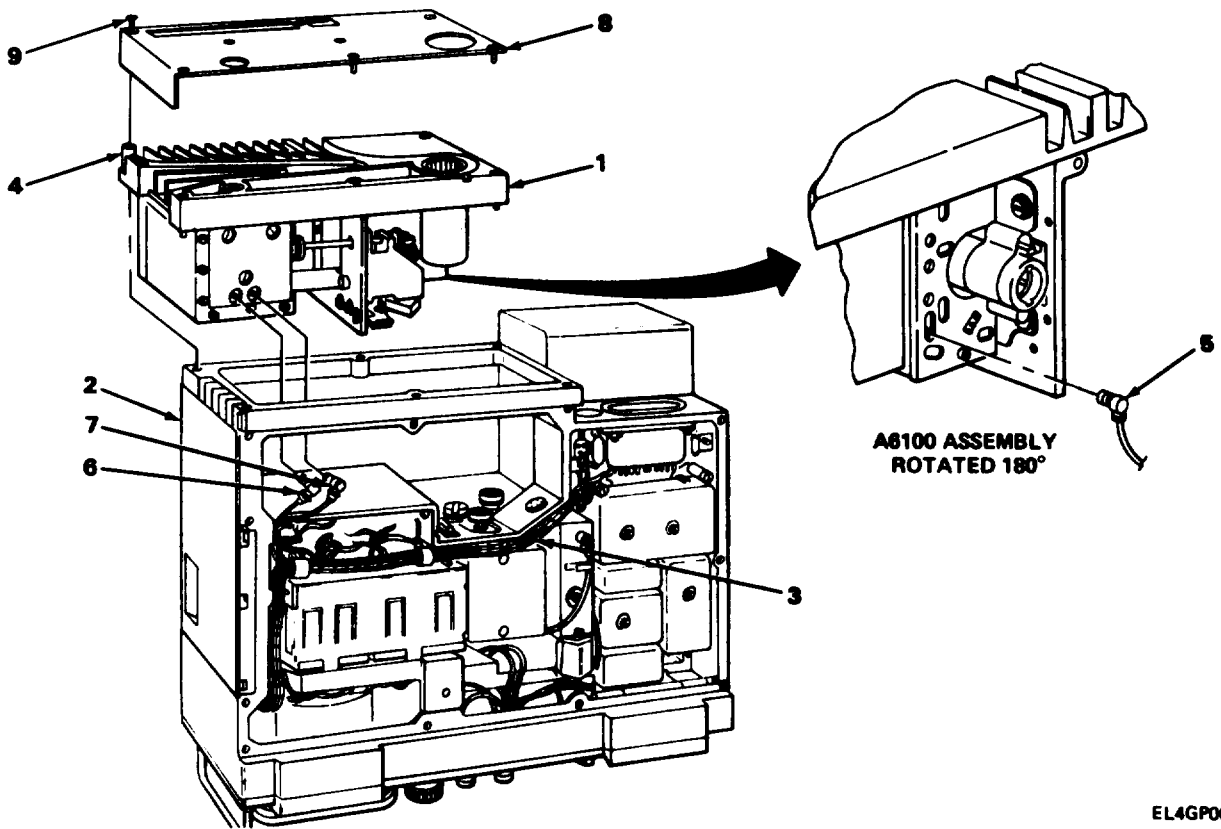


EL4GP061

1. Turn coupler (1) clockwise to stop (2) and scribe a mark (3) across coupler and body.
2. Turn coupler (1) one full rotation (360°) counterclockwise to align coupler and body alignment marks again .
3. Align pin (4) on drive assembly coupler (5) with button (6) on microswitch (7).
4. Turn tank circuit assembly coupler (8) counterclockwise until it stops, then turn clockwise until left corners of tank circuit assembly coupler (8) and drive assembly coupler (5) are in alignment as shown.

2-46. POWER AMPLIFIER ASSEMBLY A6200 REPLACEMENT. (CONT)

INSTALLATION (CONT)



**CAUTION**

Make sure alignment marks on couplers and body in radio case are in alignment.

5. Carefully lower power amplifier assembly (1) into case (2) making sure connector(3) and all gear train couplers mate properly.

**NOTE**

Gear train couplers might have to be turned slightly to properly engage with mating part.

6. Using screwdriver, tighten six captive screws (4).

**2-46. POWER AMPLIFIER ASSEMBLY A6200 REPLACEMENT. (CONT)****NOTE**

If color coding on unit varies from one shown, note corrected color coding before assembly.

7. Connect wires shown in table below.

WIRE NO.	COLOR	FROM	TO	INDEX NO.
W407	GRY	J6001	J6101	5
W410	ORG	EL401P2	J6201	6
W412	VIO	K301P2	J6202	7

8. Install heat sink cover(8) and, using flat-tip screwdriver, tighten eight captive screws(9).

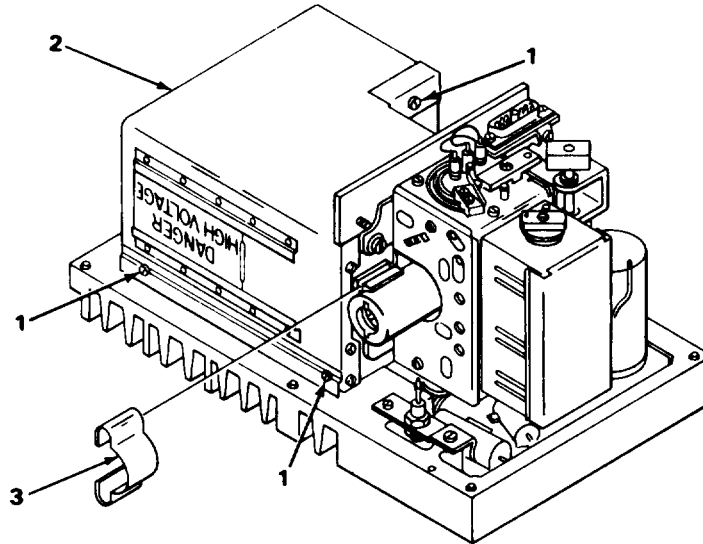
FOLLOW-ON MAINTENANCE: Install top and bottom covers. (See paragraph 2-7.)



**2-48. DRIVER ASSEMBLY A6100 REPLACEMENT.**

**MATERIALS/PARTS:** Amplifier Radio Frequency Assembly A6100

**PRELIMINARY PROCEDURE:** Remove Power Amplifier Assembly A6200. (See paragraph 2-46.)



EL4GP069

**REMOVAL**

**NOTE**

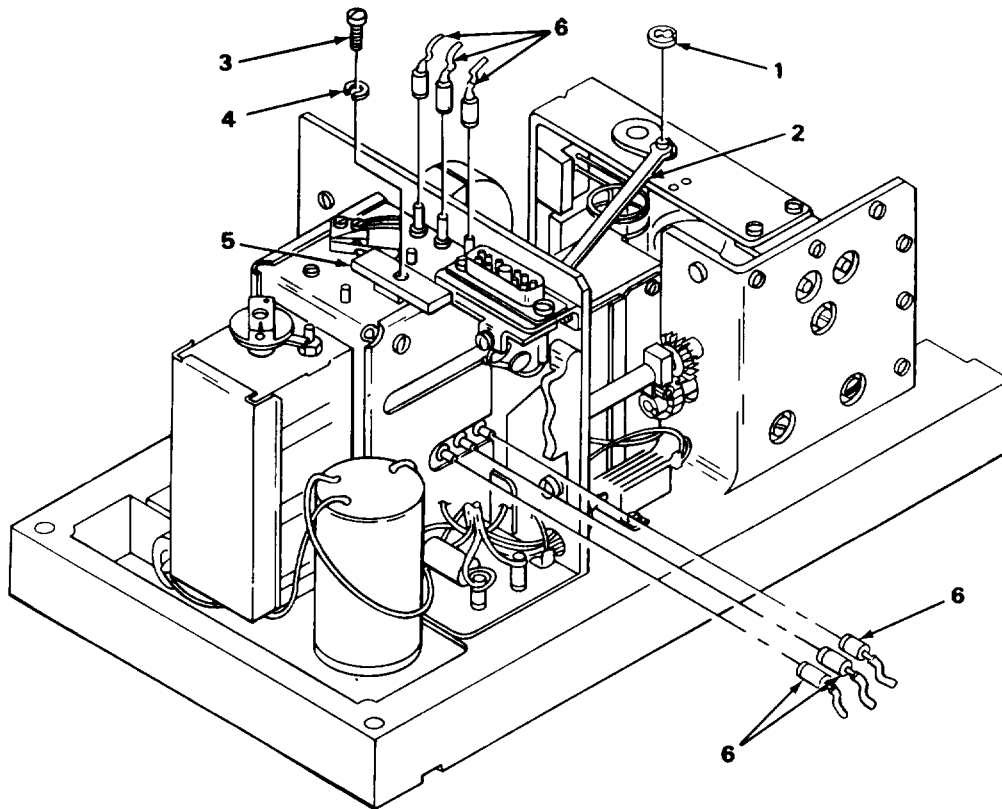
Cover configuration and number of screws will vary between plain and A-models. A-model is shown.

Screws of different lengths are used to secure cover.

1. Using screwdriver, remove 19 screws (1).
2. Carefully remove cover(2) by lifting off of base.
3. Remove driver tube retaining clip (3) by sliding out of grooves.

2-48. DRIVER ASSEMBLY A6100 REPLACEMENT. (CONT)

REMOVAL (CONT)

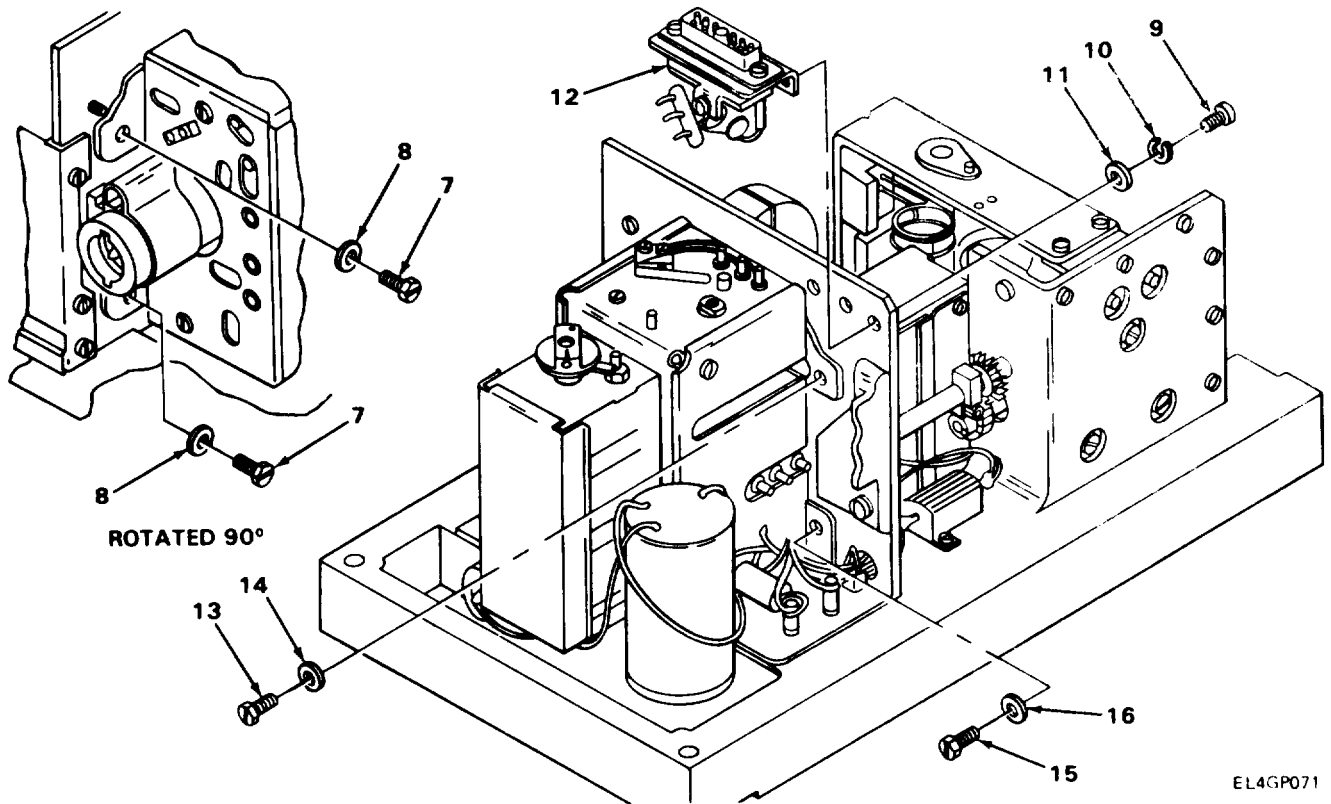


EL4GP070

4. Using small screwdriver , remove C-clip (1) from band switch actuator linkage (2).
5. Using screwdriver, remove screw (3) and lockwasher (4) from drive assembly coupler (5) .
6. Remove band switch actuator linkage (2) and drive assembly coupler(5) as an assembly.
7. Disconnect six color-coded wire plugs (6).



2-48. DRIVER ASSEMBLY A6100 REPLACEMENT.(CONT)



8. Using screwdriver, remove two screws (7) and flat washers (8).
9. Using screwdriver, remove three screws (9), lockwashers (10) and flat washers (11), then move P6204 connector (12) out of way.
10. Using screwdriver, remove screw (13) and flat washer (14).

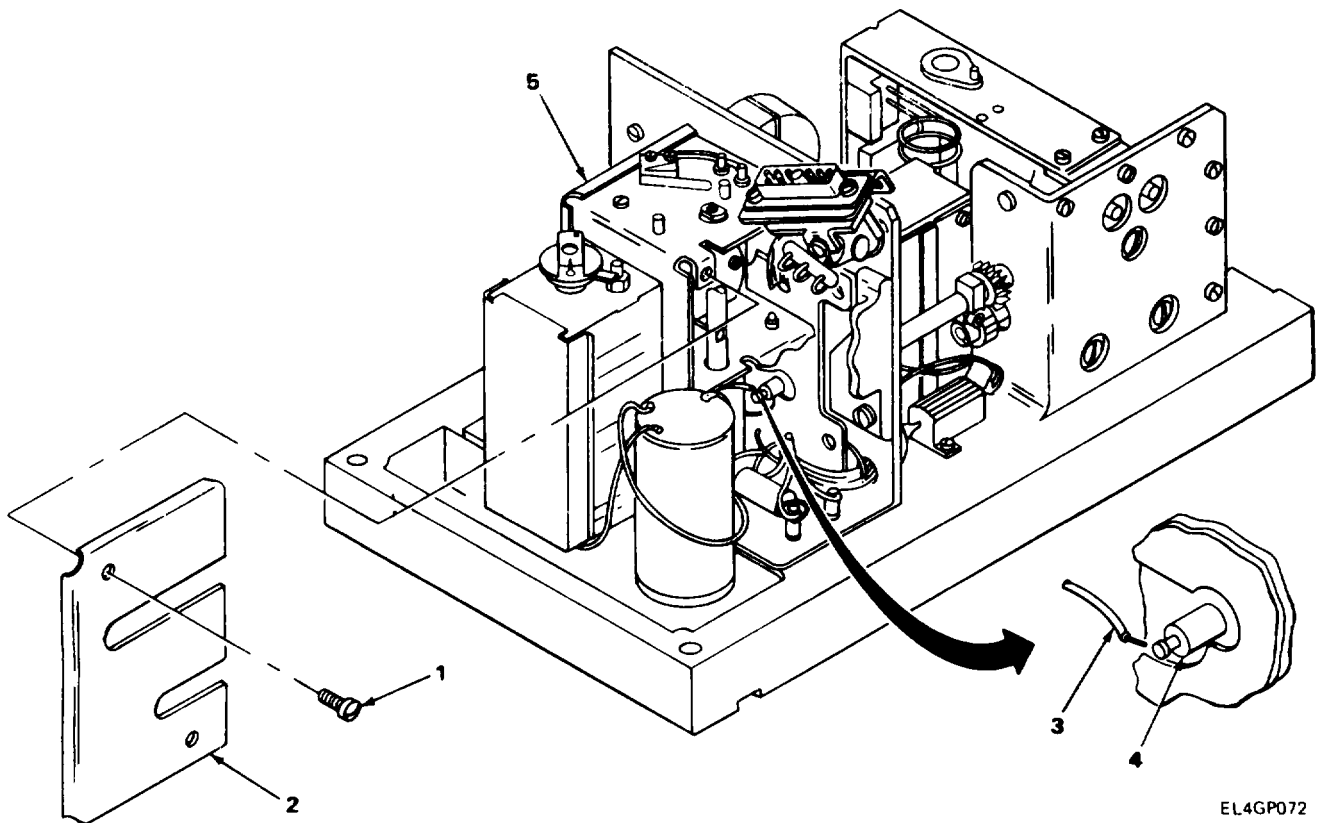
**CAUTION**

Care must be taken when performing next step to prevent damaging grounding lug.

11. Using wrench, remove screw (15) and flat washer (16).

2-48. DRIVER ASSEMBLY A6100 REPLACEMENT. (CONT)

REMOVAL (CONT)



12. Using screwdriver, remove two screws (1) from cover (2) and carefully slide cover to side to remove.

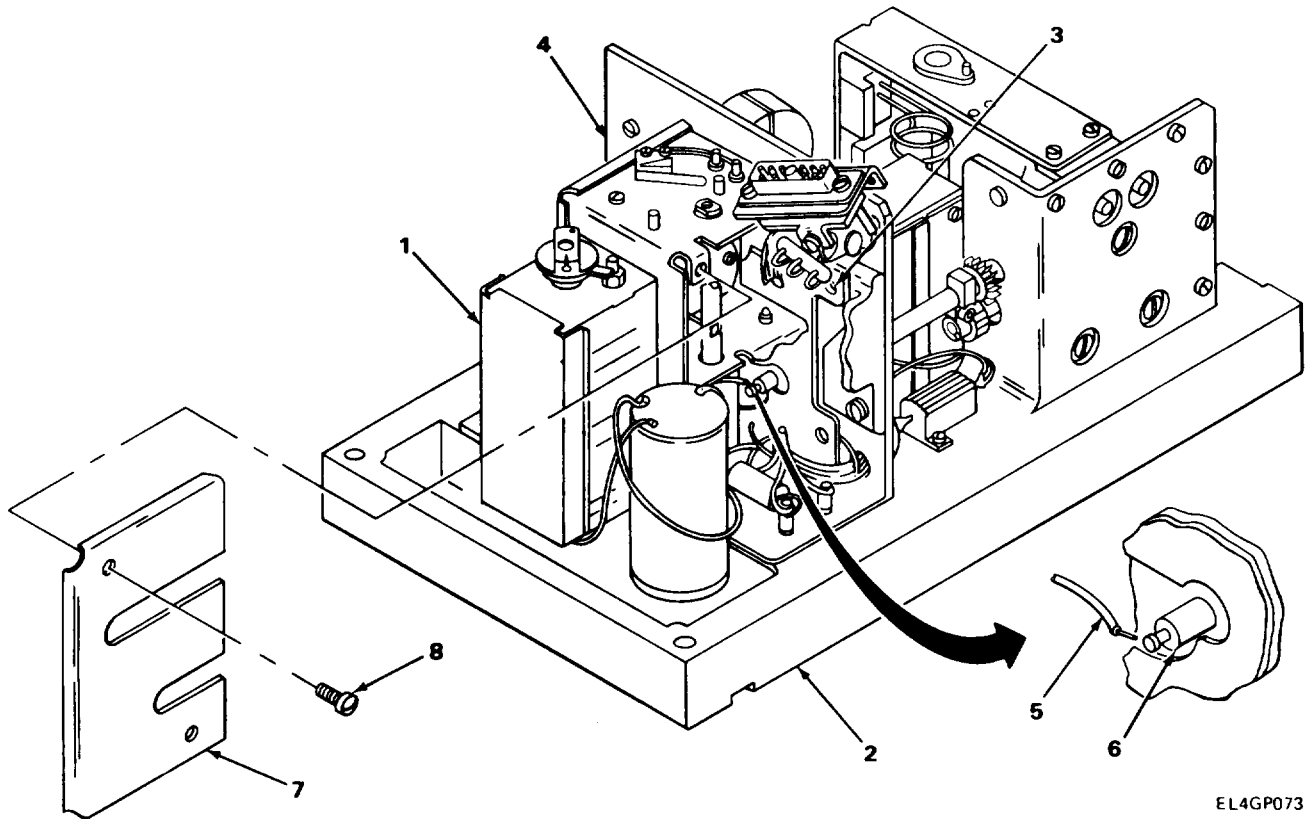
**CAUTION**

Extreme care must be taken when performing next step to prevent damage to wiring and components housed in A6100 assembly.

13. Using soldering iron, carefully unsolder wire (3) from insulated standoff (4).
14. Carefully remove A6100 assembly (5).

2-48. DRIVER ASSEMBLY A6100 REPLACEMENT. (CONT)

INSTALLATION



EL4GP073

**CAUTION**

Extreme care must be taken when performing next step to prevent pinching wires between A6100 assembly and mounting plate.

1. Place A6100 assembly (1) on heat sink (2) and align with four holes (3) on mounting plate (4).

**NOTE**

Do not secure A6100 assembly (1) to mounting plate (4) at this time.

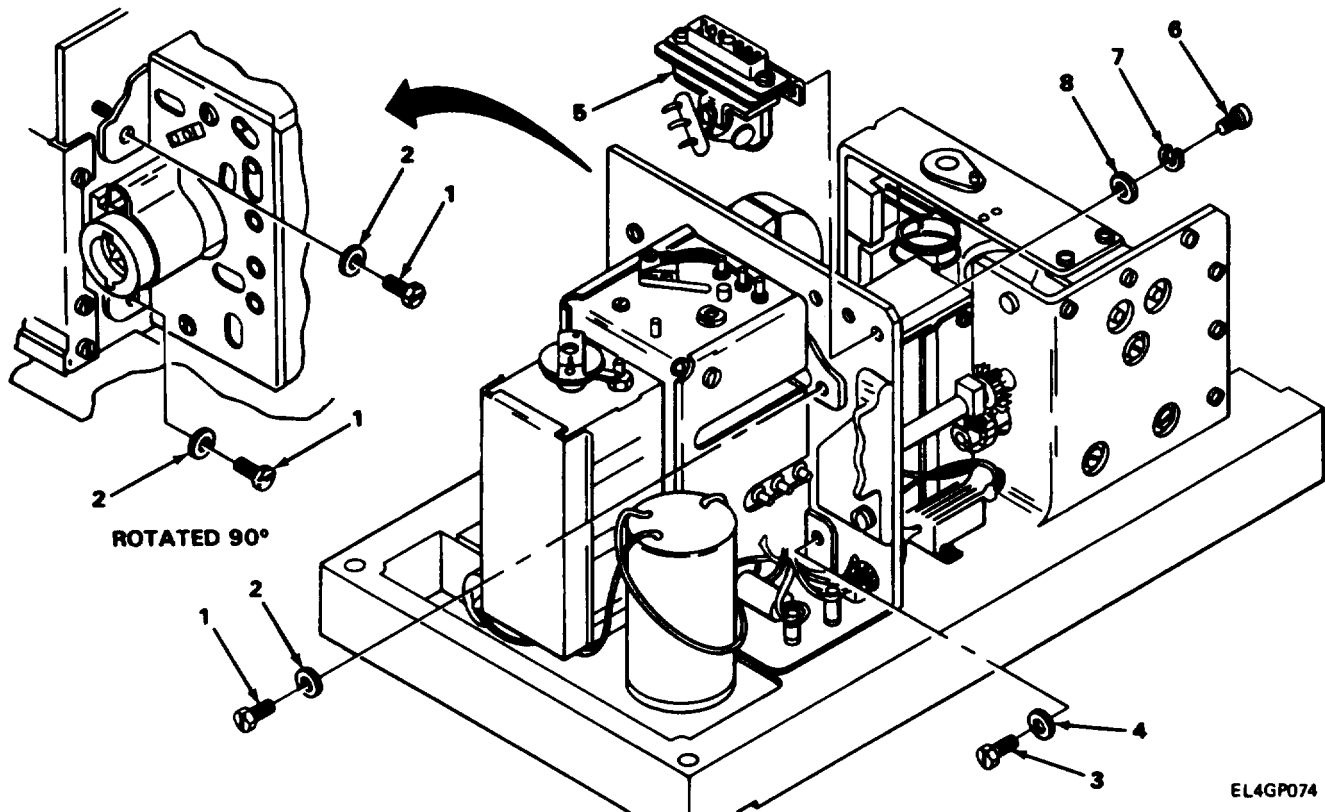
**CAUTION**

Extreme care must be taken when performing next step to prevent damage to wiring and components housed in A6100 assembly.

2. Using soldering iron, carefully solder wire (5) to insulated standoff (6).
3. Carefully slide cover (7) into place and install two screws (8).
4. Using screwdriver, tighten two screws (8).

2-48. DRIVER ASSEMBLY A6100 REPLACEMENT. (CONT)

INSTALLATION (CONT)



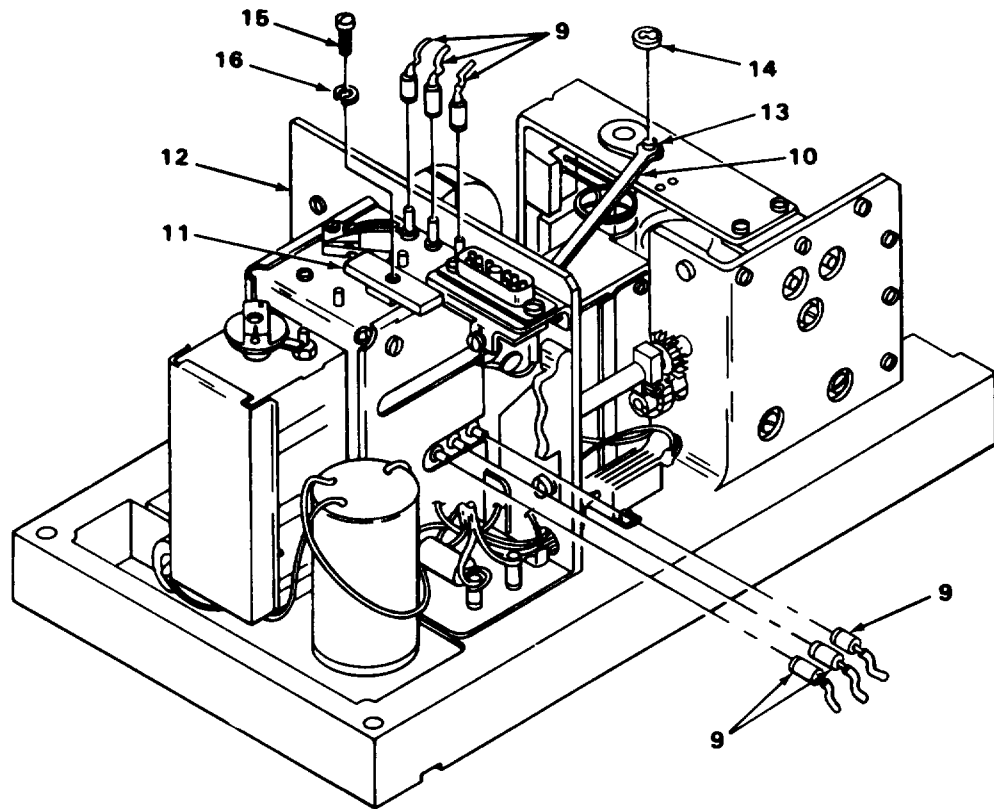
5. Install three screws (1) and flat washers (2).
6. Install one screw (3) and flat washer (4).
7. Using screwdriver, tighten three screws (1).

**CAUTION**

Care must be taken when performing next step to prevent damaging grounding lug.

8. Using wrench, tighten screw (3).
9. Put Connector P6204 (5) in place and install three screws(6), lockwashers (7) and flat washers (8).
10. Using screwdriver, tighten three screws (6).

2-48. DRIVER ASSEMBLY A6100 REPLACEMENT. (CONT)

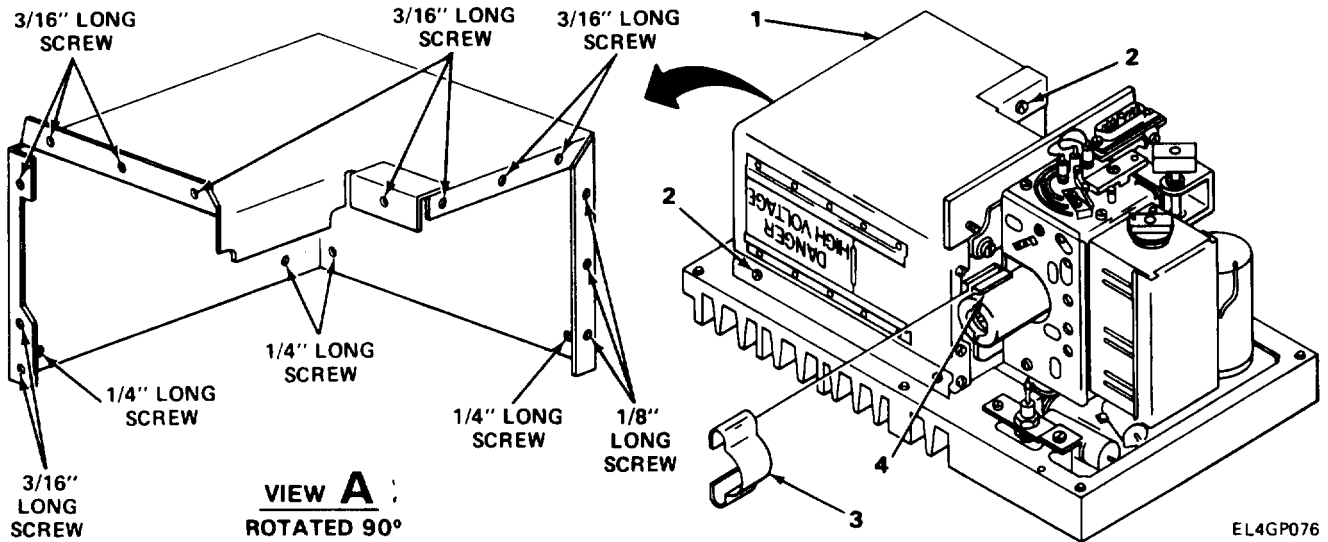


EL4GP075

11. Connect six color-coded wire plugs (9).
12. Install band switch actuator linkage (10) and drive assembly coupler (11) assembly through hole in mounting plate (12) and connect to pin (13).
13. Install C-clip (14) on pin (13).
14. Install drive assembly coupler (11) on shaft of drive assembly.
15. Using screwdriver, install screw (15) and lockwasher(16).

2-48. DRIVER ASSEMBLY A6100 REPLACEMENT. (CONT)

INSTALLATION (CONT)



**NOTE**

Cover configuration and number of screws will vary between plain and A-models. (A-model shown.)

See view A for locations of different length screws used to secure cover.

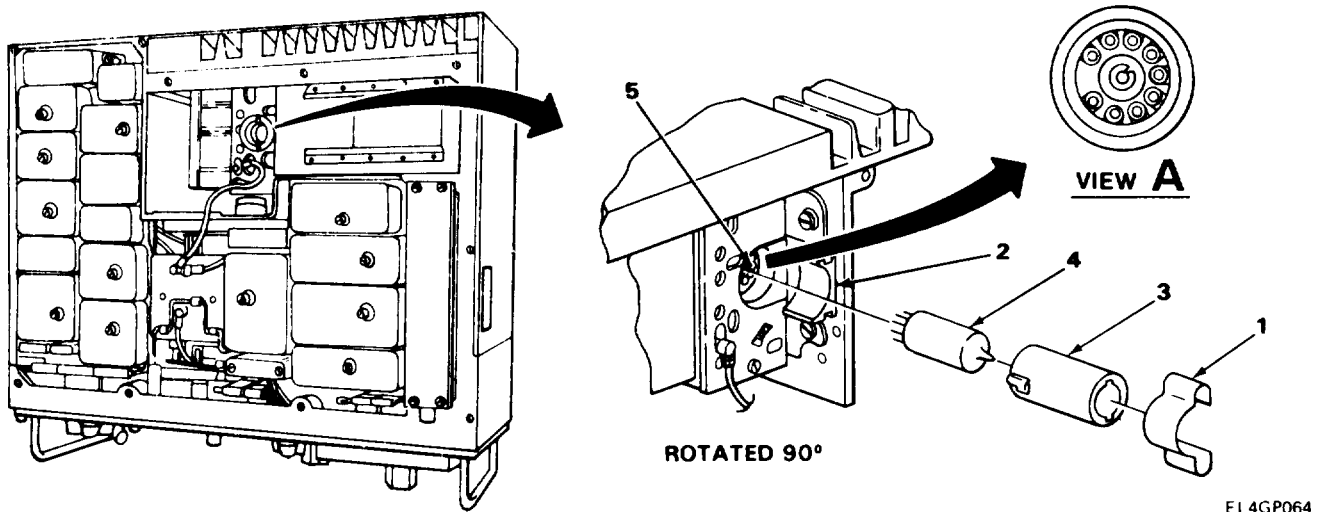
16. Install cover (1) and align screw holes.
17. Install 19 screws (2).
18. Using screwdriver, tighten 19 screws (2).
19. Install driver tube retaining clip (3) in grooves (4).

FOLLOW-ON MAINTENANCE: Install Power Amplifier Assembly A6200. (See paragraph 2-46.)

**2-49. DRIVER TUBE V6101 REPLACEMENT.**

MATERIALS/PARTS: Electron Tube

PRELIMINARY PROCEDURE: Remove top cover. (See paragraph 2-7.)



**REMOVAL**

1. Remove retaining clip (1) by sliding out of grooves (2).
2. Remove tube shield (3) by pushing in and turning counterclockwise. When tube shield is released, it will pop out.

**CAUTION**

When performing next step, do not twist or angle tube to side to prevent bending or breaking pins.

3. Using tube puller, carefully pull tube (4) straight out of socket (5).

**INSTALLATION**

**CAUTION**

Check pins on tube for straightness before inserting into tube socket. If bent, straighten any bent pins. When performing next step, note pin arrangement on tube and tube socket for correct installation. (See view A.)

1. Aline pins on tube (4) with holes in tube socket (5) and push into place.

**CAUTION**

Make sure metal shield coil is inside tube shield (3).

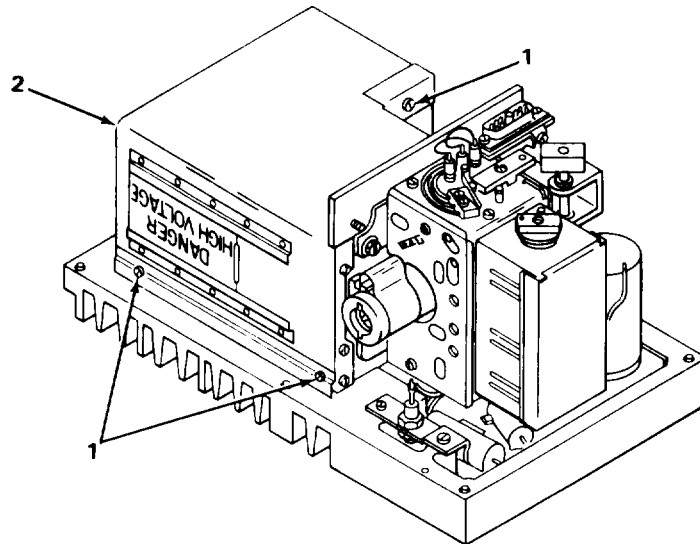
2. Install tube shield (3) by pushing in and turning clockwise to lock.
3. Install retaining clip (1) in grooves (2).

FOLLOW-ON MAINTENANCE: Install top cover. (See paragraph 2-7.)

2-50. POWER AMPLIFIER TUBE V6201 REPLACEMENT (A-MODEL ONLY).

MATERIALS/PARTS: Electron Tube, P/N JAN7843

PRELIMINARY PROCEDURE: Remove Power Amplifier Assembly A6200. (See paragraph 2-46).



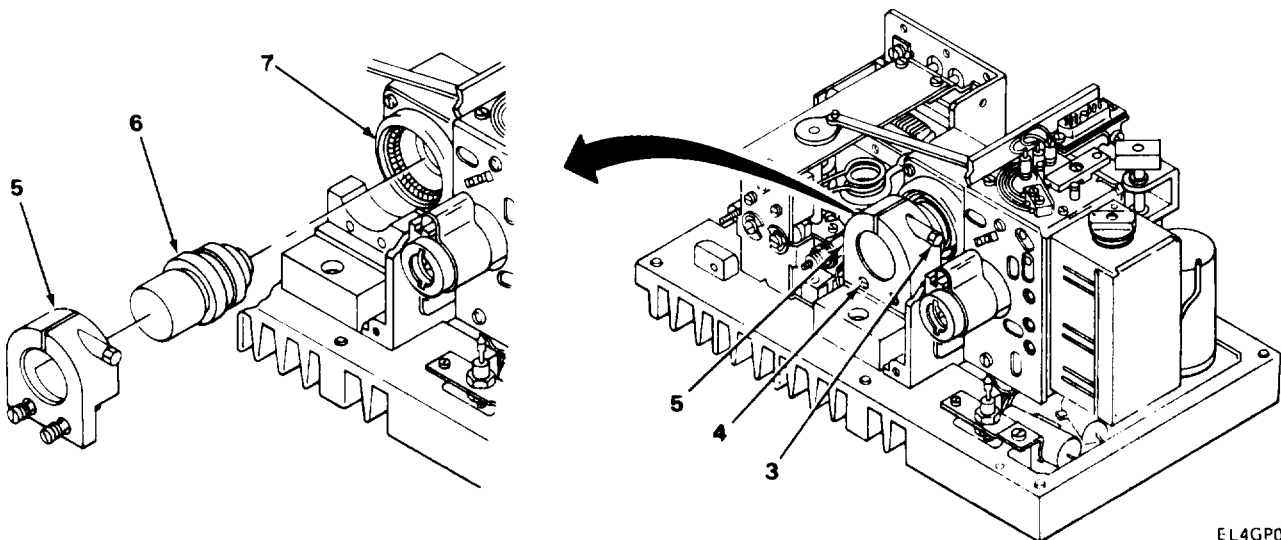
EL4GP065

REMOVAL

NOTE

Screws of different lengths are used to secure cover.

1. Using screwdriver, remove 19 screws (1).
2. Carefully remove cover (2) by lifting off base.



EL4GP066

3. Using wrench, loosen yoke screw (3).
4. Using screwdriver, loosen two captive screws (4) in heat sink (5).
5. Remove heat sink (5) by pulling away and off tube (6).
6. Remove tube (6) by pulling straight out of tube socket (7).



**2-50. POWER AMPLIFIER V6201 TUBE REPLACEMENT (A-MODEL ONLY). (CONT)**

**INSTALLATION**

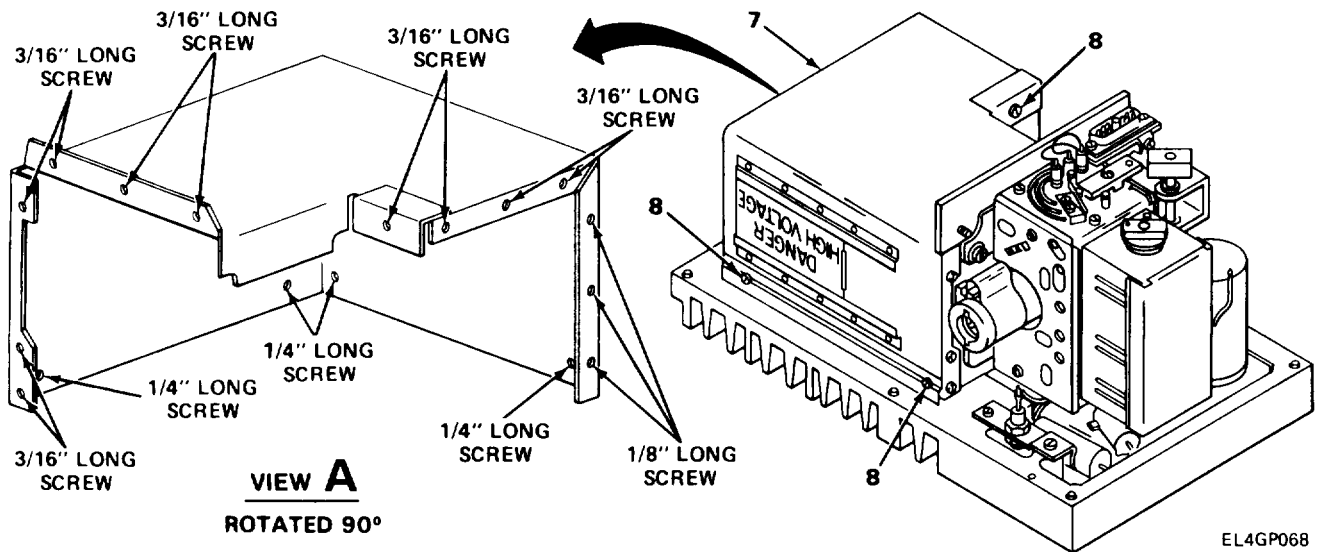
1. Install tube (6) into heat sink (5) allowing back of tube to be flush with back of heat sink.
2. Position (6) in tube socket (7) and push into place.
3. Using screwdriver, tighten two captive screws (4).

**CAUTION**

When performing next step, overtightening may damage tube.

Do not force tube into socket.

4. Using wrench, tighten yoke screw (3).



**NOTE**

See view A for locations of different length screws used to secure cover.

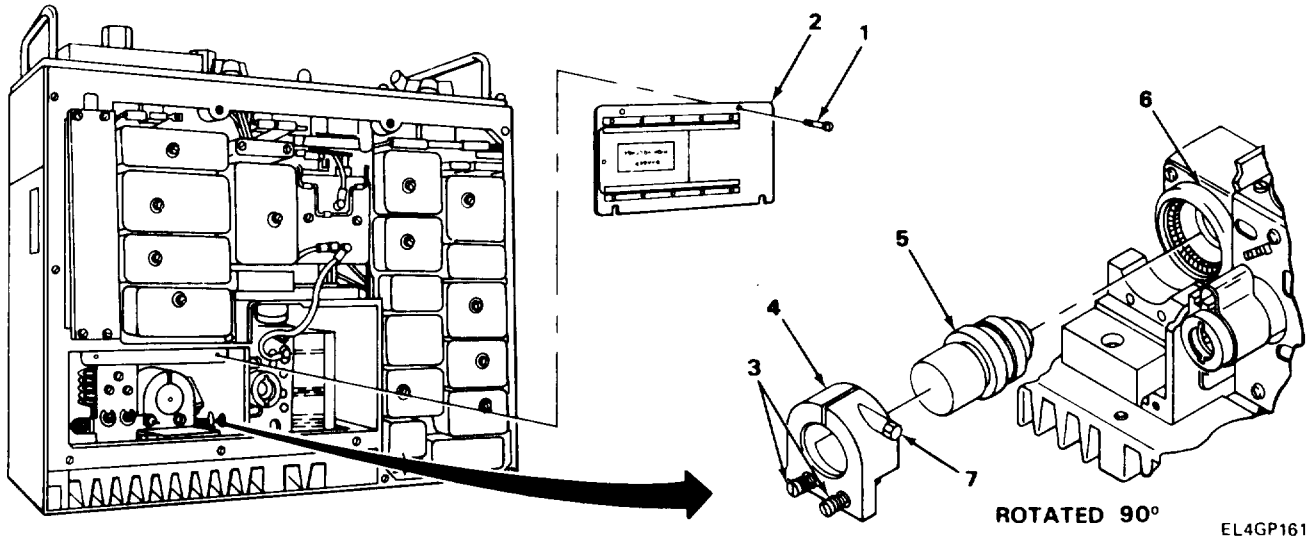
5. Install cover (7) and align screw holes.
6. Install 19 screws (8).
7. Using flat-tip screwdriver, tighten 19 screws (8).

**FOLLOW-ON MAINTENANCE:** Install Power Amplifier Assembly A6200. (See paragraph 2-46.)

**2-51. POWER AMPLIFIER TUBE V6201 REPLACEMENT (PLAIN MODEL ONLY).**

MATERIALS/PARTS: Electron Tube, P/NJAN7843

PRELIMINARY PROCEDURE: Remove top cover. (See paragraph 2-7.)



**REMOVAL**

1. Using screwdriver, loosen two captive screws (1) and pull top of cover (2) out and up to remove.
2. Using screwdriver, loosen two captive screws (3) and carefully pull heat sink (4) and tube (5) out of tube socket (6).
3. Using wrench, loosen yoke screw (7) and remove tube (5) from heat sink (4).

**INSTALLATION**

1. Install tube (5) into heat sink (4) allowing back of tube to be flush with back of heat sink.

**CAUTION**

When performing next step, overtightening may damage tube.

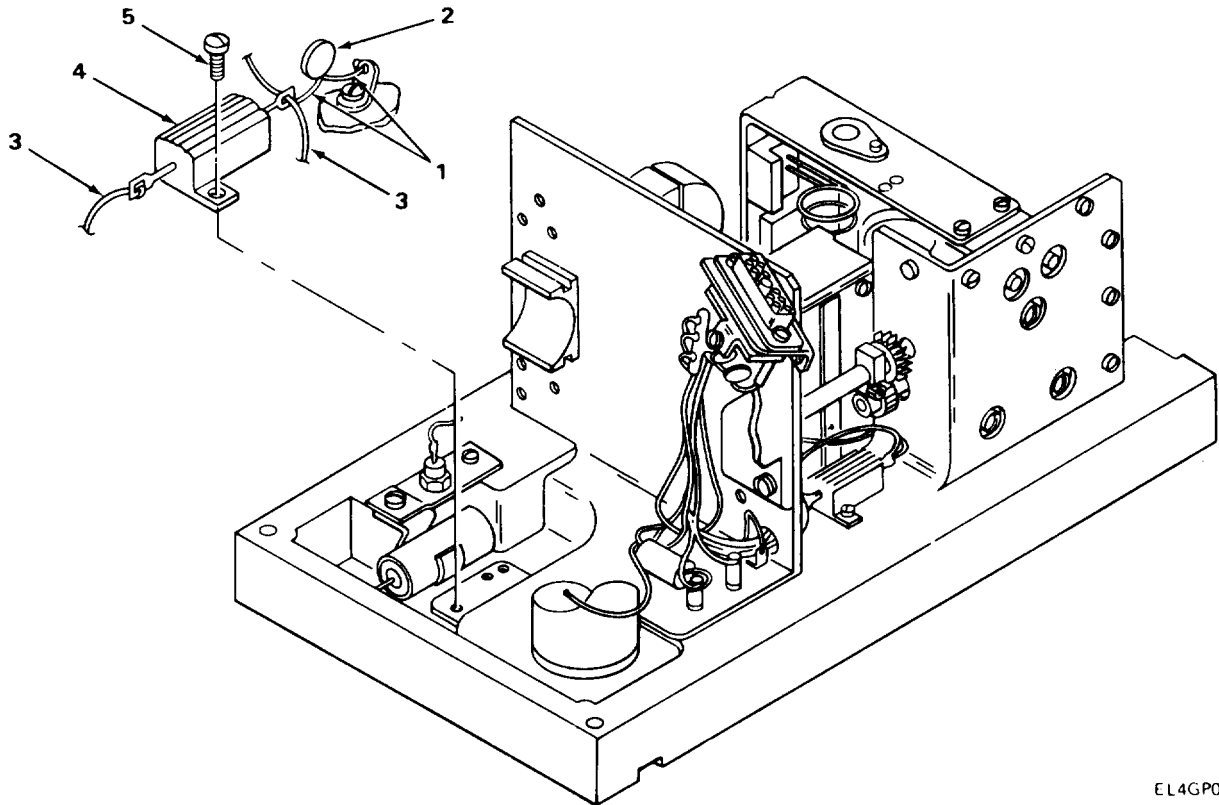
2. Using wrench, tighten yoke screw (7).
3. Position tube (5) in tube socket (6) and push into place.
4. Using screwdriver, tighten two captive screws (3).
5. Install cover (2) and using flat-tip screwdriver, tighten two captive screws (1).

FOLLOW-ON MAINTENANCE: Install top cover. (See paragraph 2-7.)

**2-52. CAPACITOR C6203 AND RESISTOR R6201 REPLACEMENT.**

MATERIALS/PARTS: Fixed Ceramic Capacitor  
Fixed Wire Wound Resistor

PRELIMINARY PROCEDURE: Remove Driver Assembly A6100. (See paragraph 2-48.)



EL4GP077

**REMOVAL**

1. Using soldering iron, unsolder two wires (1) to remove capacitor (2).
2. Using soldering iron, unsolder three wires (3) and one wire (1) from resistor (4).
3. Using screwdriver, remove two screws (5) and remove resistor (4).

**INSTALLATION**

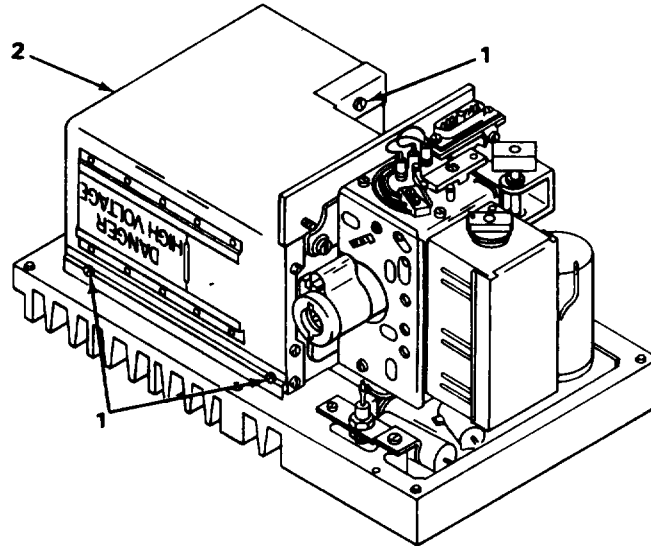
1. Set resistor (4) in place and install two screws (5).
2. Using screwdriver, tighten two screws (5).
3. Using soldering iron, solder three wires (3) and one wire (1) to resistor (4).
4. Using soldering iron, solder two wires (1) to capacitor (2).

FOLLOW-ON MAINTENANCE: Install Driver Assembly A6100. (See paragraph 2-48.)

**2-53. DIODE CR6201 AND CAPACITOR C6202 REPLACEMENT.**

MATERIALS/PARTS: Semiconductor Device Diode  
Capacitor, Fixed, Paper, Dielectric

PRELIMINARY PROCEDURE: Remove Power Amplifier Assembly A6200. (See paragraph 2-46.)



EL4GP078

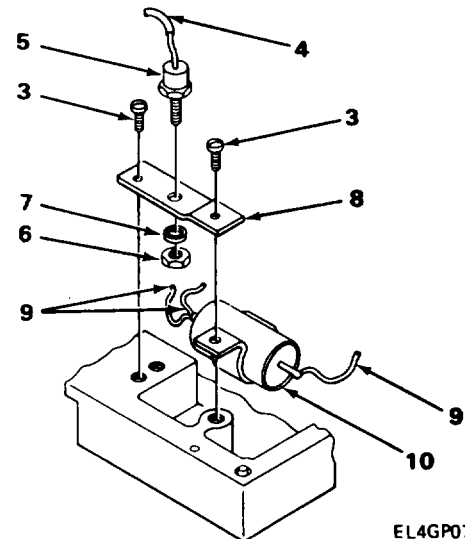
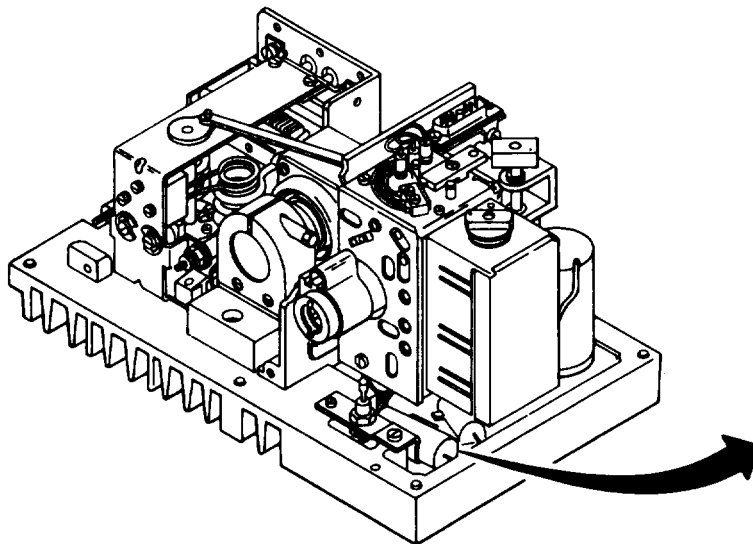
REMOVAL

**NOTE**

Cover configuration and number of screws will vary between plain and A-models (A-model shown).

Screws of different lengths are used to secure cover.

1. Using screwdriver, remove 19 screws (1).
2. Carefully remove cover(2) by lifting off of base.



EL4GP079

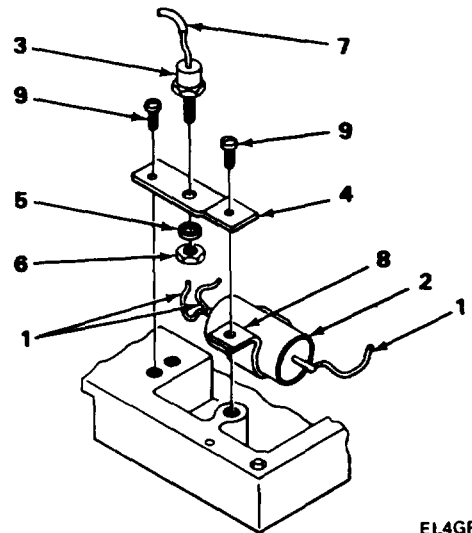
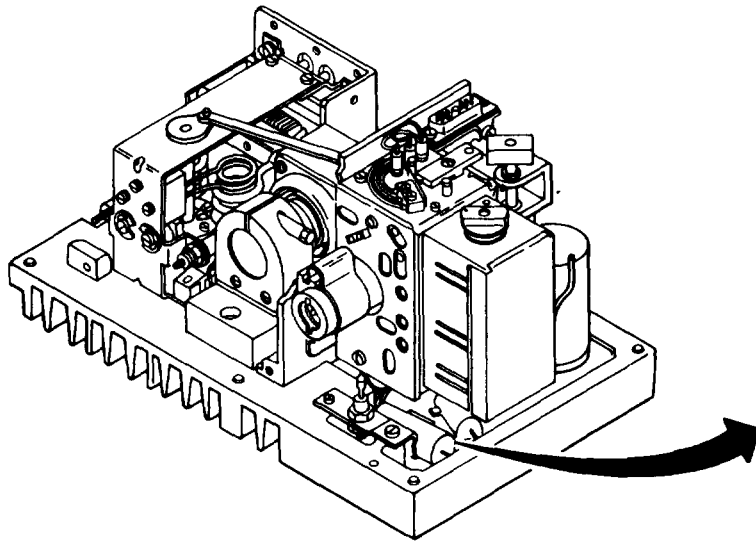
2-53. DIODE CR6201 AND CAPACITOR C6202 REPLACEMENT. (CONT)

**NOTE**

Step 3 is typical for removal of diode and/or capacitor.

3. Using screwdriver, remove two screws (3).
4. Using soldering iron, unsolder one wire (4) from diode (5).
5. Using wrench, remove nut (6), lockwasher (7) and remove diode (5) from bracket (8).
6. Using soldering iron, remove three wires (9) and remove capacitor (10).

INSTALLATION



EL4GP080

1. Using soldering iron, solder three wires (1) to new capacitor (2).
2. Place diode (3) through hole in bracket (4) and install lockwasher(5) and nut (6).

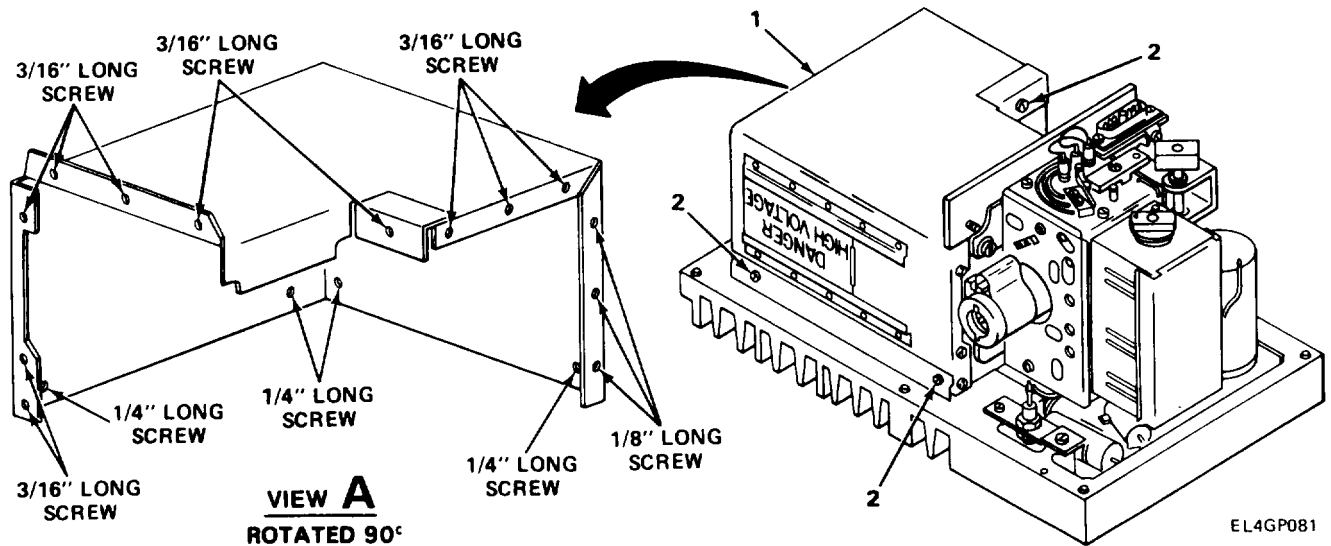
**CAUTION**

When performing next step, do not overtighten nut. Damage to diode may occur.

3. Using wrench, carefully tighten nut (6).
4. Using soldering iron, solder one wire (7) on diode (3).
5. Aline holes in bracket (4) and bracket (8); install two screws (9).
6. Using flat-tip screwdriver, tighten two screws (9).

2-53. DIODE CR6201 AND CAPACITOR C6202 REPLACEMENT. (CONT)

INSTALLATION (CONT)



**NOTE**

Cover configuration and number of screws will vary between plain and A-models. (A-model shown).

See view A for locations of different length screws used to secure cover.

7. Install cover (1) and align screw holes.
8. Install 19 screws (2). (See note.)
9. Using screwdriver, tighten 19 screws (2).

FOLLOW-ON MAINTENANCE: Install Power Amplifier Assembly A6200. (See paragraph 2-46.)

**CHAPTER 3**

**DIRECT SUPPORT PERFORMANCE AND TROUBLESHOOTING PROCEDURES USING MAINTENANCE KIT MK-1978/VRC AND DISCRETE TEST EQUIPMENT (TMDE)**

Subject	Section	Page
Performance Tests .....	I	3-2
Troubleshooting .....	II	3-64
Alinement and Adjustment Procedures .....	III	3-155

**OVERVIEW**

This chapter contains performance tests, troubleshooting, and alinement procedures at the direct support level using the Maintenance Kit MK-1978/VRC and discrete test equipment (TMDE).

The performance tests are diagnostic in purpose. They should be used to verify that an RT is operating properly or to point out the existence of faults,

If failure to meet a performance test standard confirms that a fault is present in the unit under test, the test procedure will refer you to a specific chart in the troubleshooting section, The troubleshooting charts are designed to isolate the faults noted in the performance tests. They will guide you to the source of defects and/or misalinements.

Once it has identified the source of a fault, a troubleshooting chart will refer you to the appropriate repair/replacement instructions or alinement procedures. Because each stage of the RT's receiver or transmitter sections depends upon its other stages for overall operating efficiency, the replacement, repair, or realinement of even one component could alter the RT's signals enough to create the need for other realinements. Therefore, after making any alterations in the RT, do all the performance tests, even those you have done already.

**NOTE**

When using the MK-1978A, some differences in testing may be apparent. As far as these are known, they are identified and the alternate setting for the "A" version annotated as close as possible to the setting for the plain version.

Section I PERFORMANCE TESTS

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OLD SQUELCH Test .....	3-5	3-13
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Receiver Audio Distortion Test .....	3-7	3-19
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Transmitter Low and High Power Output Test .....	3-12	3-36
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Transmitter Limiting Test .....	3-14	3-42
Transmitter Distortion Test (Normal Mode).....	3-15	3-45
Transmitter Deviation Test (W-Mode) .....	3-16	3-48
Transmitter Distortion Test (X-Mode) .....	3-17	3-52
Transmitter Squelch Tone Stability Test .....	3-18	3-56
Receiver Recovery Time Test .....	3-18.1	3-58.1
Antenna Information (Switching) Test .....	3-19	3-59
Automatic Frequency Selection Test .....	3-20	3-61

3-1. GENERAL.

This section contains performance test procedures for use with Maintenance Kit MK-1978/VRC and discrete test equipment(TMDE). They will enable you to determine whether or not an RT is operating acceptably. Each test procedure checks specific functions of the receiver or transmitter sections to help you find and isolate faults.

Each test is complete and may be performed individually. Therefore, you may choose an appropriate test to verify gross equipment failure or performance degradation of specific stages. However, this maintenance approach is not recommended. It is best to perform all the tests in sequence. This systematic maintenance approach will insure that all faults are found and corrected.

Faults in the RT are evidenced by failure of the unit to meet the performance **standards** found within the test procedures in **bold type**. When an RT fails to meet a performance standard, discontinue the test and turn to the troubleshooting chart referred to in the procedure.



**3-2. VOLUME CONTROL TEST.**

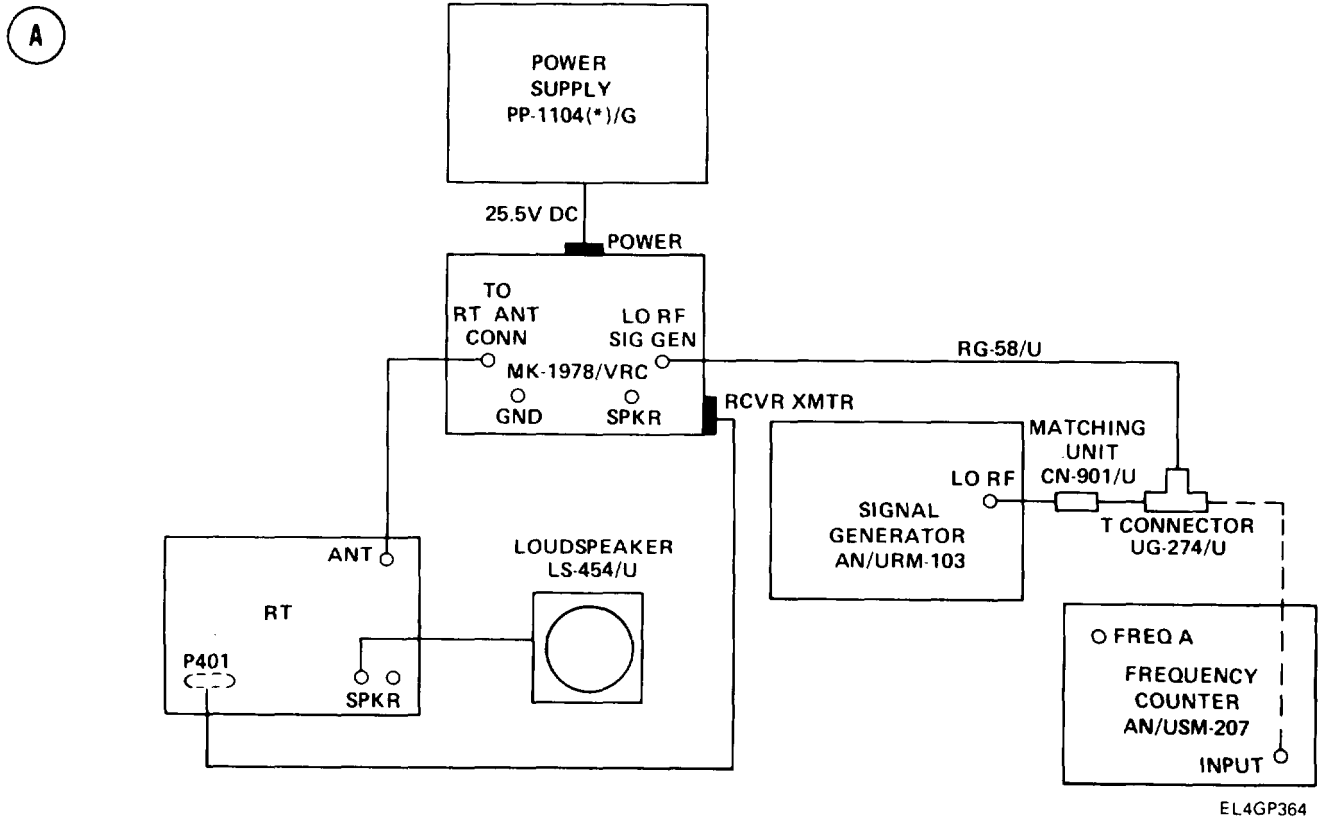
**PURPOSE.** This test checks the VOLUME control of the RT for proper operation. When a 1-kHz tone is injected into the RT ANTENNA port, the speaker should output a clear tone with no scratchy sound or sudden drop in volume. The absence of a tone means that the signal is not passing completely through the RT circuitry and could even indicate total equipment failure: therefore, perform this test before the others in this section.

**TEST EQUIPMENT AND MATERIALS**

Power Supply PP-1104(\*)/G  
 Frequency Counter AN/USM-207  
 Signal Generator AN/URM-103  
 Adapter (T-Connector) UG-274B/U

Matching Unit CN-901/U  
 Loudspeaker LS-454/U (RT-246/VRC)  
 Maintenance Kit MK-1978/VRC  
 Rf Cables (two) RG-58/U

**TEST SETUP.** Connect equipment as shown in test setup diagram (A) .



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Turn on test equipment. Allow at least 15 to 30 minutes for warmup.

3-2. VOLUME CONTROL TEST. (CONT)

INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment controls as indicated in the following table. If using alternate test equipment, adjust for 30.00 MHz, 20- $\mu$ v rf input level, 1-kHz modulation, and 8-kHz frequency deviation.

CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
AN/USM-207	FREQUENCY TUNING - MC POWER DISPLAY INPUT GATE TIME SENSITIVITY FUNCTION DIRECT/HETERODYNE	100 TRACK MIN(fullycounterclockwise) 0.3 V MAX (both switches to left) 10 <sup>3</sup> (black knob) PLUG IN FREQ DIRECT
AN/URM-103	OPERATE/OFF/STAND BY BAND SWITCH RF TUNING DEVIATION RANGE KHZ FUNCTION DEVIATION RF SET TO LINE RF OUTPUT LO RF UV	OPERATE (B) 30.0 0 10 1000 Hz Adjust for 8-kHz meter indication To red line LO, 0-10 KUV 20 $\mu$ v
RT	BAND MC-TUNE-KC SQUELCH LIGHT VOLUME POWER SPEAKER(RT-524/VRC)	(A) 30.00 OLD OFF ON Fully counterclockwise LOW ON
MK-1978/VRC	AUX POWER AUDIO KEY AUX RCVR X-MODE(RT) SQUELCH	ON MUTED RCVE NORMAL NORMAL ON

**3-2. VOLUME CONTROL TEST. (CONT)**

## TEST PROCEDURE

1. Adjust AN/URM-103 RF TUNING control for 30.00-MHz display on AN/USM-207.

**NOTE**

To produce a display on the AN/USM-207, the AN/URM-103 rf level must be increased by turning the LO RF UV control clockwise. When the display appears, readjust the AN/URM-103 RF TUNING control until the AN/USM-207 indicates 30.00 MHz, and reset the LO RF UV control to 20  $\mu$ v.

2. Disconnect T-connector from AN/USM-207.
3. Turn RT VOLUME control fully clockwise, then fully counterclockwise,

**STANDARD.** Tone from speaker should be clear with no scratchiness or sudden changes in volume at any point in the rotation of the VOLUME control.

4. If volume changes suddenly, if tone is scratchy, or if no tone at all is heard, see troubleshooting chart 3-1.

**3-3. RECEIVER SENSITIVITY TEST.**

**PURPOSE.** This test checks the ability of the RT to detect low-level rf signals by measuring its SINAD at several frequencies. SINAD gives receiver sensitivity in terms of the following ratio:

$$\text{Signal} + \text{noise} + \text{distortion} / \text{noise} + \text{distortion}.$$

SINAD is expressed in decibels. The better a receiver's SINAD, the better signals, even weak ones, can be heard over unwanted internal noise. The SINAD for the RT should be at least -10 db (from a zero-db reference) when the rf level is 0.5  $\mu$ v.

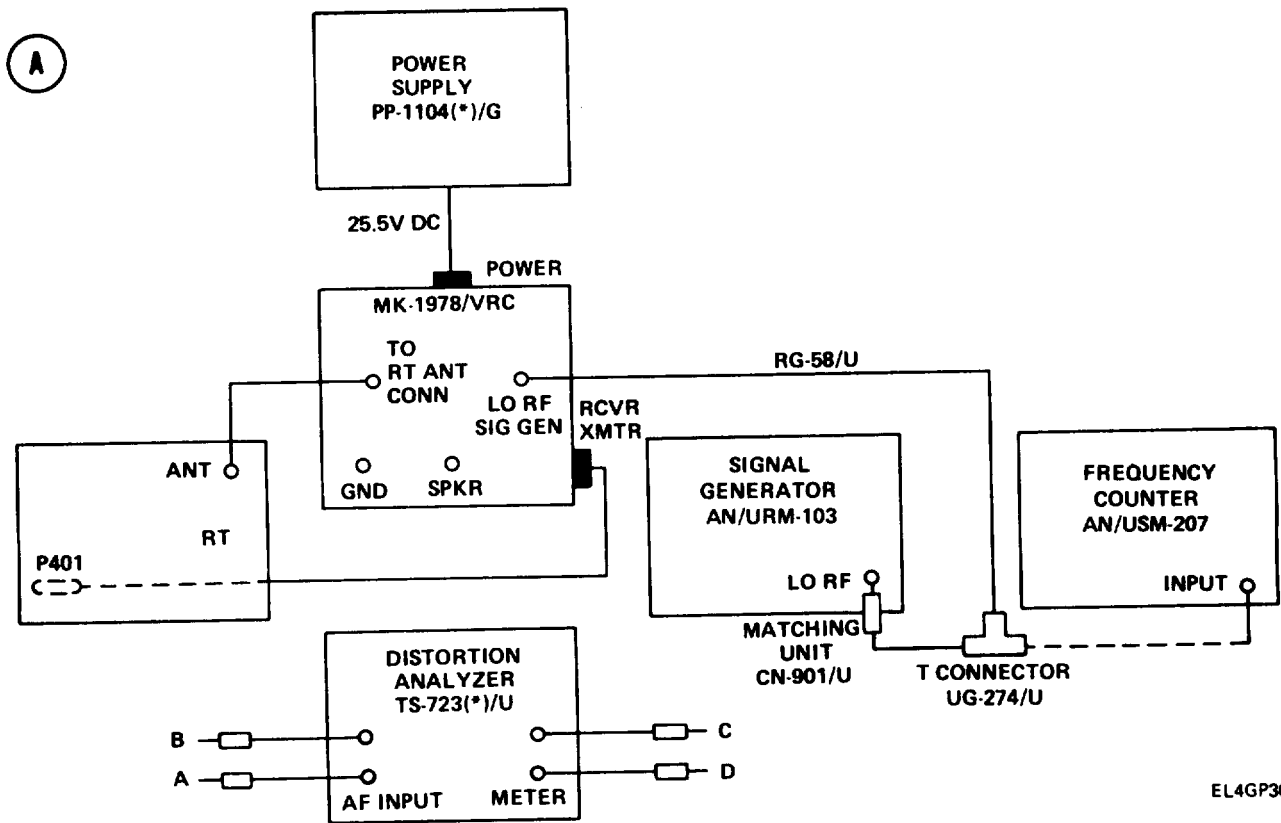
## TEST EQUIPMENT AND MATERIALS

Power Supply PP-1104(\*)/G  
Distortion Analyzer TS-723(\*)/U  
Frequency Counter AN/USM-207  
Signal Generator AN/URM-103

Adapter (T-Connector) UG-274B/U  
Matching Unit CN-901/U  
Maintenance Kit MK-1978/VRC  
Rf Cables (two) RG-58/U

3-3. RECEIVER SENSITIVITY TEST. (CONT)

TEST SETUP. Connect equipment as shown in test setup diagram **A**.



Turn on test equipment. Allow at least 5 minutes for warmup.

INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment controls as indicated in the following table. If using alternate test equipment, adjust for 30.00 MHz, 0.5- $\mu$ v rf input level, 1-kHz modulation, and 8-kHz frequency deviation.

CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
AN/USM-207	FREQUENCY TUNING - MC POWER DISPLAY INPUT GATE TIME SENSITIVITY FUNCTION DIRECT/HETERODYNE	100 TRACK MIN (fully counterclockwise) 0.3 V MAX (both switches to left) 10 <sup>3</sup> (blackknob) PLUG IN FREQ DIRECT

3-3. RECEIVER SENSITIVITY TEST. (CONT)

CONTROL AND SWITCH SETTINGS (CONT)

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
AN/URM-103	OPERATE/OFF/STAND BY BAND SWITCH RF TUNING DEVIATION RANGE KHZ FUNCTION DEVIATION RF SET TO LINE RF OUTPUT LO RF UV	OPERATE ⓑ 30.00 10 1000 Hz Adjust for 8-kHz meter indication To red line LO, 0-10 KUV 0.5 μv
RT	BAND MC-TUNE-KC SQUELCH LIGHT VOLUME POWER SPEAKER (RT-524/VRC)	Ⓐ 30.00 OLD OFF ON Fully counterclockwise LOW OFF
MK-1978/VRC	AUX POWER AUDIO KEY X-MODE (RT) AUX RCVR SQUELCH	ON MUTED RCVE NORMAL NORMAL ON (MK-1978A - OFF)
TS-723(*)/U	RANGE AF INPUT AF-RF FREQUENCY FUNCTION R.M.S. VOLTS/DB	x10 MIN AF 100 METER 30 v

TEST PROCEDURE

Sensitivity Test at 30.00 MHz

1. Connect TS-723(\*)/U METER lead C to MK-1978/VRC SPKR jack; connect lead D to GND jack.  
(See test setup diagram Ⓐ page 3-6.)
2. Adjust AN/URM-103 RF TUNING control for 30.00-MHz display on AN/USM-207.

**NOTE**

To produce a display on the AN/USM-207, the AN/URM-103 rf level must be increased by turning the LO RF UV control clockwise, When the display appears, readjust the AN/URM-103 RF TUNING control until the AN/USM-207 indicates 30.00 MHz, and reset the LO RF UV control to 0.5 μv.

**3-3. RECEIVER SENSITIVITY TEST. (CONT)**

3. Disconnect T-connector from AN/USM-207.
4. Adjust RT VOLUME control for 17-volt indication on TS-723(\*)/U meter.
5. If 17-volt indication cannot be obtained, see troubleshooting chart 3-2.
6. Disconnect TS-723(\*)/U METER leads from MK-1978/VRC jacks.
7. Connect TS-723(\*)/U AF INPUT lead B to MK-1978/VRC SPKR jack; connect lead A to GND jack. (See test setup diagram A .)
8. Turn TS-723(\*)/U FUNCTION switch to SET LEVEL.
9. Adjust TS-723(\*)/U AF INPUT control for zero-db indication on meter.
10. Change TS-723(\*)/U FUNCTION switch to DISTORTION.
11. Adjust TS-723(\*)/U FREQUENCY and BALANCE controls for minimum meter indication.

**STANDARD.** The new TS-723(\*)/U meter indication (step 11) should beat least -10 db from the previous zero-db indication (step 8).

12. If TS-723(\*)/U meter indication is not at least -10 db from previous indication, see troubleshooting chart 3-2.

Sensitivity Test at 53.00 MHz

13. Change RT MC-TUNE-KC switch to 53.00 MHz and BAND to (B).
14. Turn AN/URM-103 BAND SWITCH to (C) and RF TUNING control for 53.00-MHz meter indication.
15. Reconnect TS-723(\*)/U METER lead C to MK-1978/VRC SPKR jack; reconnect lead D to GND jack.
16. Adjust AN/URM-103 RF TUNING control for 53.00-MHz display on AN/USM-207. To produce display, see note under step 2 and readjust RF TUNING control until AN/USM-207 indicates 53.00 MHz.
17. Repeat steps 3 through 12.

Sensitivity Test at 41.00 MHz

18. Change RT MC-TUNE-KC switch to 41.00 MHz and BAND to (A) .
19. Turn AN/URM-103 BAND SWITCH to (C) and RF TUNING control for 41.00-MHz meter indication.
20. Reconnect TS-723(\*)/U METER lead C to MK-1978/VRC SPKR jack; reconnect lead D to GND jack.
21. Adjust AN/URM-103 RF TUNING control for 41.00-MHz display on AN/USM-207. To produce display, see note under step 2 and readjust RF TUNING control until AN/USM-207 indicates 41.00 MHz.
22. Repeat steps 3 through 12.

Sensitivity Test at 64.00 MHz

23. Change RT MC-TUNE-KC switch to 64.00 MHz and BAND to (B) .
24. Turn AN/URM-103 BAND SWITCH to (D) and RF TUNING control for 64.00-MHz meter indication.
25. Reconnect TS-723(\*)/U METER lead C to MK-1978/VRC SPKR jack; reconnect lead D to GND jack.
26. Adjust AN/URM-103 RF TUNING control for 64.00-MHz display on AN/USM-207. To produce display, see note under step 2 and readjust RF TUNING control until AN/USM-207 indicates 64.00 MHz.
27. Repeat steps 3 through 12.

**3-3. RECEIVER SENSITIVITY TEST. (CONT)**

Sensitivity Test at 52.00 MHz

28. Change RT MC-TUNE-KC switch to 52.00 MHz and BAND to **(A)**.
29. Turn AN/URM-103 BAND SWITCH to **(C)** and RF TUNING control for 52.00-MHz meter indication.
30. Reconnect TS-723(\*)W METER lead C to MK-1978/VRC SPKR jack; reconnect lead D to GND jack.
31. Adjust AN/URM-103 RF TUNING control for 52.00-MHz display on AN/USM-207. To produce display, see note under step 2 and readjust RF TUNING control until AN/USM-207 indicates 52.00 MHz.
32. Repeat steps 3 through 12.

Sensitivity Test at 75.00 MHz

33. Change RT MC-TUNE-KC switch to 75.00 MHz and BAND to **(B)**.
34. Turn AN/URM-103 BAND SWITCH to **(D)** and RF TUNING control for 75.00-MHz meter indication.
35. Reconnect TS-723(\*)/U METER lead C to MK-1978/VRC SPKR jack; reconnect lead D to GND jack.
36. Adjust AN/URM-103 RF TUNING control for 75.00-MHz display on AN/USM-207. To produce display, see note under step 2 and readjust RF TUNING control until AN/USM-207 indicates 75.00 MHz.
37. Repeat steps 3 through 12.

**3-4. NEW SQUELCH TEST.**

PURPOSE. This test checks the sensitivity of RT squelch modules (A5200, A5300) to the NEW SQUELCH signal (150 Hz) at several carrier frequencies. The 150-Hz signal is injected into the ANTENNA port, energizing Squelch Module Relay K5002, which unsquelches the receiver. Proper operation of the squelch modules is verified by CALL lamp response to carrier signal strength at or below a 0.5- $\mu$ v rf level.

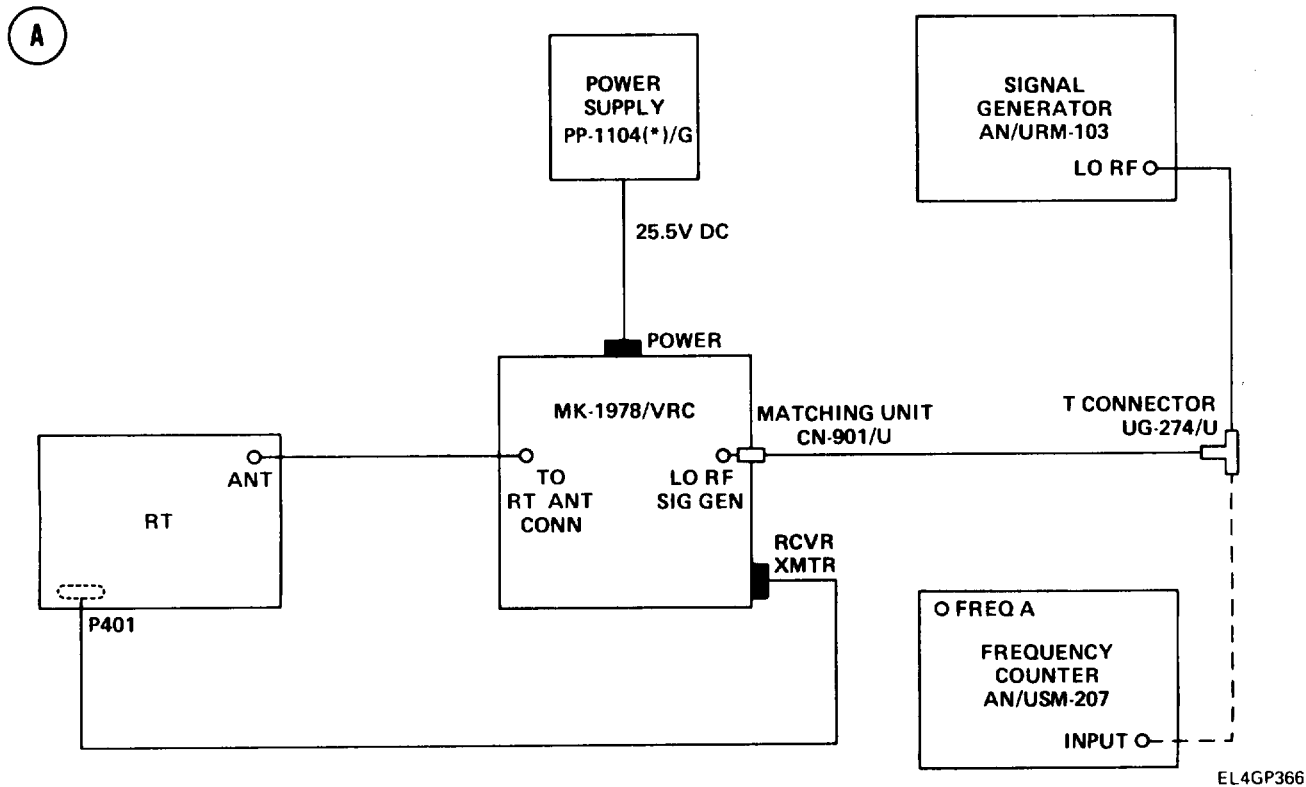
## TEST EQUIPMENT AND MATERIALS

Power Supply PP-1104(')/G  
 Frequency Counter AN/USM-207  
 Signal Generator AN/U RM-103  
 Adapter (T-Connector) UG-274 B/U

Matching Unit CN-901/U  
 Rf Cables (two) RG-58/U  
 Maintenance Kit MK-1978/VRC

3-4. NEW SQUELCH TEST. (CONT)

TEST SETUP. Connect equipment as shown in test setup diagram (A).



Turn on test equipment. Allow at least 15 to 30 minutes for warmup.

INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment controls as indicated in the following table. If using alternate test equipment, adjust for 30.00 MHz, minimum rf input level, 150-Hz modulation, and 3-kHz frequency deviation.

CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
AN/USM-207	FREQUENCY TUNING-MC POWER DISPLAY INPUT GATE TIME SENSITIVITY FUNCTION DIRECT/HETERODYNE	100 TRACK MIN (fully counterclockwise) 0.3 V MAX (both switches to left) 10 <sup>3</sup> (black knob) PLUG IN FREQ DIRECT



3-4. NEW SQUELCH TEST. (CONT)

CONTROL AND SWITCH SETTINGS (CONT)

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
RT	BAND MC-TUNE-KC SQUELCH VOLUME POWER LIGHT SPEAKER (RT-524/VRC)	(A) 30.00 NEW ON Fully counterclockwise LOW ON OFF
MK-1978/VRC	AUX POWER AUDIO KEY X-MODE (RT) AUX RCVR SQUELCH	ON MUTED RCVE NORMAL NORMAL ON (MK-1978A - OFF)
AN/URM-103	OPERATE/OFF/STAND BY BAND SWITCH RF TUNING DEVIATION RANGE KHZ FUNCTION DEVIATION RF SET TO LINE RF OUTPUT LO RF UV	OPERATE (B) 30.00 10 150 Hz Adjust for 3-kHz meter indication To red line LO, 0-10 KUV Minimum setting

TEST PROCEDURE

NEW SQUELCH Test at 30.00 MHz

1. Adjust AN/URM-103 RF TUNING control for 30.00-MHz display on AN/USM-207.

**NOTE**

To produce a display on the AN/USM-207, the AN/URM-103 rf level must be increased by turning the LO RF UV control clockwise. When the display appears, readjust the AN/URM-103 RF TUNING control until the AN/USM-207 indicates 30.00 MHz, and reset the LO RF UV control to minimum setting.

2. Disconnect T-connector from AN/USM-207.
3. If necessary, readjust AN/URM-103 DEVIATION control for 3-kHz meter indication.
4. Turn AN/URM-103 LO RF UV control slowly clockwise until RT CALL lamp lights.

STANDARD. RT CALL lamp should light while the AN/URM-103 LO RF UV control setting is at or below 0.5  $\mu$ v.

### 3-4. NEW SQUELCH TEST. (CONT)

5. If LO RF UV control setting is more than 0.5  $\mu$ v when CALL lamp lights or if CALL lamp does not light, see troubleshooting chart 3-3.
6. Remove cable from RT ANTENNA port.

**STANDARD.** RT CALL lamp should go out. Remember without the 150-Hz tone, Relay K5002 will not be energized to supply the 16 volts necessary to turn on the audio amplifiers; therefore, the receiver is squelched.

7. If CALL lamp does not go out, see troubleshooting chart 3-3.
8. Reconnect cable to RT ANTENNA port.

**STANDARD.** RT CALL lamp should light.

9. If CALL lamp does not light, see troubleshooting chart 3-3.

#### NEW SQUELCH Test at 41.00 MHz

10. Change RT MC-TUNE-KC switch to 41.00 MHz and BAND to **(A)**.
11. Turn AN/URM-106 BAND SWITCH to **(C)** and RF TUNING control for 41.00-MHz meter indication.
12. Adjust AN/URM-103 RF TUNING control for 41.00-MHz display on AN/USM-207. To produce display, see note under step 1 and readjust RF TUNING control until AN/USM-207 indicates 41.00 MHz.
13. Repeat steps 2 through 9.

#### NEW SQUELCH Test at 52.00 MHz

14. Change RT MC-TUNE-KC switch to 52.00 MHz.
15. Turn AN/URM-103 RF TUNING control for 52.00-MHz meter indication.
16. Adjust AN/URM-103 RF TUNING control for 52.00-MHz display on AN/USM-207. To produce display, see note under step 1 and readjust RF TUNING control until AN/USM-207 indicates 52.00 MHz.
17. Repeat steps 2 through 9.

#### NEW SQUELCH Test at 53.00 MHz

18. Change RT MC-TUNE-KC switch to 53.00 MHz and BAND to **(B)**.
19. Turn AN/URM-103 RF TUNING control for 53.00-MHz meter indication.
20. Adjust AN/URM-103 RF TUNING control for 53.00-MHz display on AN/USM-207. To produce display, see note under step 1 and readjust RF TUNING control until AN/USM-207 indicates 53.00 MHz.
21. Repeat steps 2 through 9.

#### NEW SQUELCH Test at 65.00 MHz

22. Change RT MC-TUNE-KC switch to 65.00 MHz.
23. Turn AN/URM-103 BAND SWITCH to **(D)** and RF TUNING control for 65.00-MHz meter indication.
24. Adjust AN/URM-103 RF TUNING control for 65.00-MHz display on AN/USM-207. To produce display, see note under step 1 and readjust RF TUNING control until AN/USM-207 indicates 65.00 MHz.
25. Repeat steps 2 through 9.

**3-4. NEW SQUELCH TEST. (CONT)**

NEW SQUELCH Test at 75.00 MHz

26. Change RT MC-TUNE-KC switch to 75.00 MHz.
27. Turn AN/URM-103 RF TUNING control for 75.00-MHz meter indication.
28. Adjust AN/URM-103 RF TUNING control for 75.00-MHz display on ANLJSM-207. To produce display, see note under step 1 and readjust RF TUNING control until AN/USM-207 indicates 75.00 MHz.
29. Repeat steps 2 through 9.

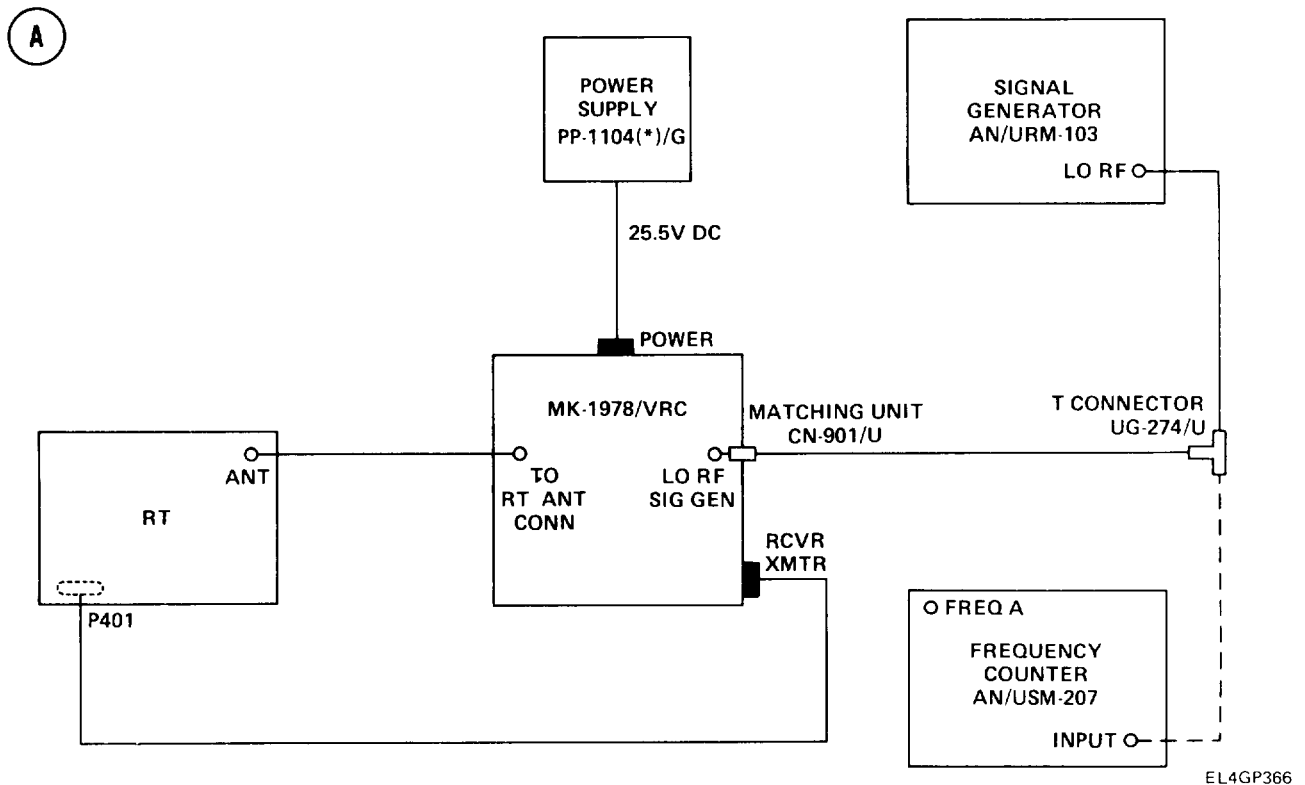
**3-5. OLD SQUELCH TEST.**

PURPOSE. This test checks the sensitivity of the RT squelch modules (A5200, A5300) to OLD SQUELCH noise components (7300 Hz) at several carrier frequencies. Proper operation of the squelch modules is verified by CALL lamp response to signal strength at or below a 0.7.µv rf carrier level.

TEST EQUIPMENT AND MATERIALS

- |                                  |                             |
|----------------------------------|-----------------------------|
| Power Supply PP-1104(*)/G        | Matching Unit CN-901/U      |
| Frequency Counter AN/USM-207     | Rf Cables (two) RG-58/U     |
| Signal Generator AN/URM-103      | Maintenance Kit MK-1978/VRC |
| Adapter (T-Connector) UG-274 B/U |                             |

TEST SETUP. Connect equipment as shown in test setup diagram (A) .



Turn on test equipment. Allow at least 15 to 30 minutes for warmup.

3-5. OLD SQUELCH TEST. (CONT)

INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment controls as indicated in the following table. If using alternate test equipment, adjust for 30.00 MHz, minimum rf input level, 1-kHz modulation, and 8-kHz frequency deviation.

CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
AN/USM-207	FREQUENCY TUNING-MC POWER DISPLAY INPUT GATE TIME SENSITIVITY FUNCTION DIRECT/HETERODYNE	100 TRACK MIN (fully counterclockwise) 0.3 V MAX (both switches to left) 10 <sup>3</sup> (black knob) PLUG IN FREQ DIRECT
AN/URM-103	OPERATE/OFF/STAND BY BAND SWITCH RF TUNING DEVIATION RANGE KHZ FUNCTION DEVIATION RF SET TO LINE RF OUTPUT LO RF UV	OPERATE Ⓑ 30.00 10 1000 Hz Adjust for 8-kHz meter indication To red line LO, 0-10 KUV Minimum setting
RT	BAND MC-TUNE-KC SQUELCH LIGHT VOLUME POWER SPEAKER (RT-524/VRC)	Ⓐ 30.00 OLD ON ON Fully counterclockwise LOW OFF
MK-1978/VRC	AUX POWER AUDIO KEY X-MODE (RT) AUX RCVR SQUELCH	ON MUTED RCVE NORMAL NORMAL ON (MK-1978A - OFF)

**3-5. OLD SQUELCH TEST. (CONT)**

## TEST PROCEDURE

## OLD SQUELCH Test at 30.00 MHz

1. Adjust AN/URM-103 RF TUNING control for 30.00-MHz display on AN/USM-207.

**NOTE**

To produce a display on the AN/USM-207, the AN/URM-103 rf level must be increased by turning the LO RF UV control clockwise. When the display appears, readjust the AN/URM-103 RF TUNING control until the AN/USM-207 indicates 30.00 MHz, and reset the LO RF UV control to minimum setting.

2. Disconnect T-connector from AN/USM-207.
3. Turn AN/URM-103 LO RF UV control clockwise until RT CALL lamp lights.

**STANDARD.** RT CALL lamp should light while LO RF UV control setting is at or below 0.7  $\mu$ v.

4. If LO RF UV control setting is more than 0.7  $\mu$ v, see troubleshooting chart 3-3.
5. Remove cable from RT ANTENNA Port.

**STANDARD.** RT CALL lamp should go out.

6. If CALL lamp stays lit, see troubleshooting chart 3-3.
7. Reconnect cable to RT ANTENNA port.

**STANDARD.** RT CALL lamp should light.

8. If CALL lamp does not light, see troubleshooting chart 3-3.

## OLD SQUELCH Test at 41.00 MHz

9. Change RT MC-TUNE-KC switch to 41.00 MHz and BAND to **(A)**.
10. Turn AN/URM-103 BAND SWITCH to **(C)** and RF TUNING control for 41.00-MHz meter indication.
11. Adjust AN/URM-103 RF TUNING control for 41.00-MHz display on AN/USM-207. To produce display, see note under step 1 and readjust RF TUNING control until AN/USM-207 indicates 41.00 MHz.
12. Repeat steps 2 through 8.

## OLD SQUELCH Test at 52.00 MHz

13. Change RT MC-TUNE-KC switch to 52.00 MHz.
14. Turn AN/URM-103 RF TUNING control for 52.00-MHz meter indication.
15. Adjust AN/URM-103 RF TUNING control for 52.00-MHz display on AN/USM-207. To produce display, see note under step 1 and readjust RF TUNING control until AN/USM-207 indicates 52.00 MHz.
16. Repeat steps 2 through 8.

### 3-5. OLD SQUELCH TEST. (CONT)

OLD SQUELCH Test at 53.00 MHz

17. Change RT MC-TUNE-KC switch to 53.00 MHz and BAND to **B**.
18. Turn AN/URM-103 RF TUNING control for 53.00-MHz meter indication.
19. Adjust AN/URM-103 RF TUNING control for 53.00-MHz display on AN/USM-207. To produce display, see note under step 1 and readjust RF TUNING control until AN/USM-207 indicates 53.00 MHz.
20. Repeat steps 2 through 8.

OLD SQUELCH Test at 65.00 MHz

21. Change RT MC-TUNE-KC switch to 65.00 MHz.
22. Turn AN/URM-103 BAND SWITCH to **D** and RF TUNING control for 65.00-MHz meter indication.
23. Adjust AN/URM-103 RF TUNING control for 65.00-MHz display on AN/USM-207. To produce display, see note under step 1 and readjust RF TUNING control until AN/USM-207 indicates 65.00 MHz.
24. Repeat steps 2 through 8.

OLD SQUELCH Test at 75.00 MHz

25. Change RT MC-TUNE-KC switch to 75.00 MHz.
26. Turn AN/U RM-103 RF TUNING control for 75.00-MHz meter indication.
27. Adjust AN/U RM-103 RF TUNING control for 75.00-MHz display on AN/USM-207. To produce display, see note under step 1 and readjust RF TUNING control until AN/USM-207 indicates 75.00 MHz.
28. Repeat steps 2 through 8.

### 3-6. RECEIVER AUDIO POWER TEST.

PURPOSE. This test checks the ability of the RT to drive its three audio outputs, namely:

1. The MUTED audio output which supplies power to the speaker.
2. The UNMUTED audio output which supplies power to the headphones.
3. The FIXED LEVEL audio output which supplies power to the interphone system.

An rf level strong enough to drive A4200 module into limiting (20  $\mu$ v) is injected into RT ANTENNA port. Audio output voltages are measured at SPKR and INTERCOM jacks of MK-1978/VRC.

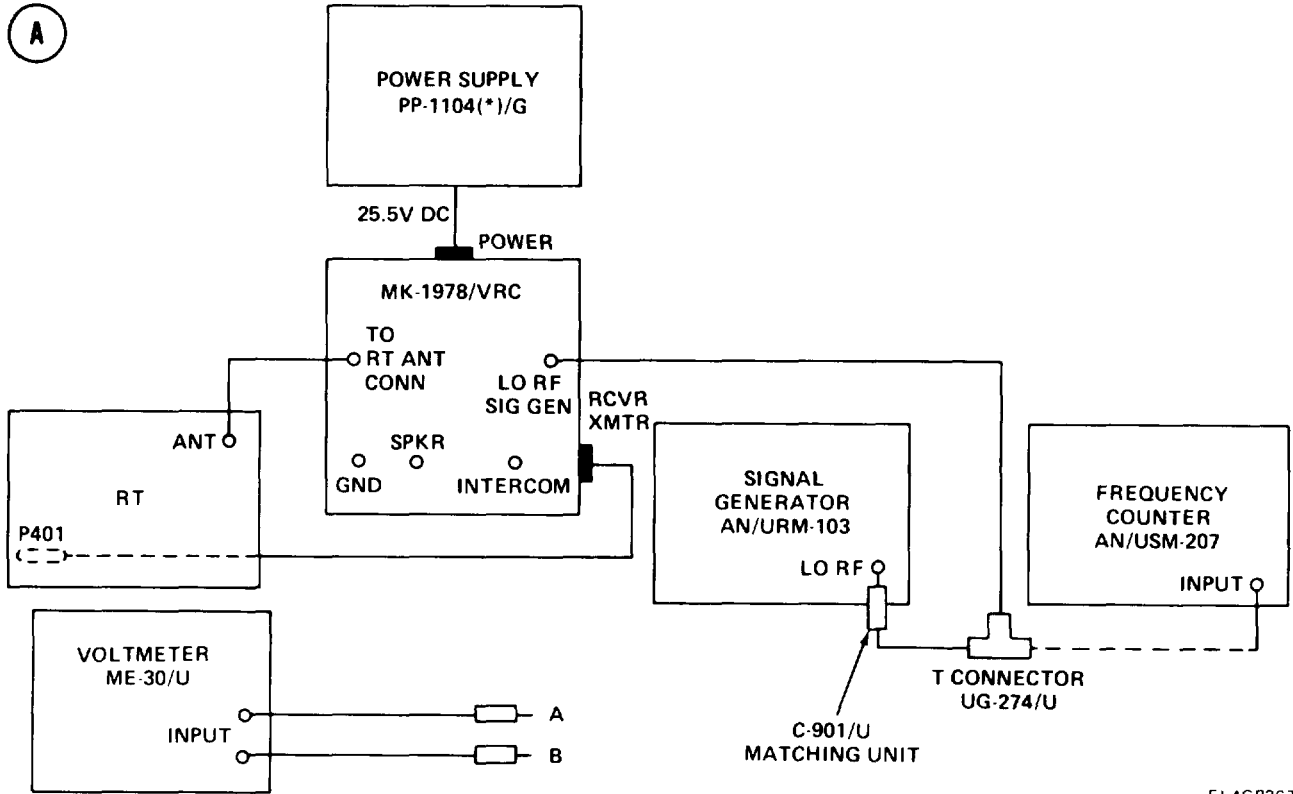
#### TEST EQUIPMENT AND MATERIALS

Power Supply PP-1104(\*)/G  
Ac Voltmeter ME-30(\*)/U  
Frequency Counter AN/USM-207  
Signal Generator AN/URM-103  
Adapter UG-514

Adapter (T-Connector) UG-274B/U  
Matching Unit CN-901/U  
Maintenance Kit MK-1978/VRC  
Rf Cable RG-58/U

3-6. RECEIVER AUDIO POWER TEST. (CONT)

TEST SETUP. Connect equipment as shown in test setup diagram (A)



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Turn on test equipment. Allow at least 15 to 30 minutes for warmup.

INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment controls as indicated in the following table. If using alternate test equipment, adjust for 60.00 MHz, 20- $\mu$ v rf input level, 1-kHz modulation, and 8-kHz frequency deviation.

CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
AN/USM-207	FREQUENCY TUNING - MC POWER DISPLAY INPUT GATE TIME SENSITIVITY FUNCTION DIRECT/HETERODYNE	100 TRACK MIN (fully counterclockwise) 0.3 V MAX (both switches to left) 10 <sup>3</sup> (black knob) PLUG IN FREQ DIRECT

3-6. RECEIVER AUDIO POWER TEST. (CONT)

CONTROL AND SWITCH SETTINGS (CONT)

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
AN/URM-103	OPERATE/OFF/STAN D BY BAND SWITCH RF TUNING DEVIATION RANGE KHZ FUNCTION DEVIATION RF SET TO LINE RF OUTPUT LO RF UV	OPERATE Ⓓ 60.00 10 1000 Hz Adjust for 8-kHz meter indication To red line LO, 0-10 KUV 20 μv
ME-30(*)/U	RANGE selector switch	30 v
MK-1978/VRC	AUX POWER AUDIO KEY AUX RCVR X-MODE (RT) SQUELCH	ON MUTED RCVE NORMAL NORMAL ON
RT	BAND MC-TUNE-KC SQUELCH LIGHT VOLUME POWER SPEAKER (RT-524/VRC)	Ⓑ 60.00 OLD OFF ON Fully counterclockwise LOW OFF

TEST PROCEDURE

Muted Audio Power Test

1. Connect ME-30(\*)/U INPUT level A to MK-1978/VRC SPKR jack; connect lead B to GND jack. (See test setup diagram Ⓐ, page 3-17.)
2. Adjust AN/URM-103 RF TUNING control for 60.00-MHz display on AN/USM-207.

**NOTE**

To produce a display on the AN/USM-207, the AN/URM-103 rf level must be increased by turning the LO RF UV control clockwise. When the display appears, readjust the AN/URM-103 RF TUNING control until the AN/USM-207 Indicates 60.00 MHz, and reset the LO RF UV control to 20 μv.

3. Disconnect T-connector from AN/USM-207.
4. Turn RT VOLUME control fully clockwise.



**3-6. RECEIVER AUDIO POWER TEST. (CONT)**

**STANDARD.** ME-30(\*)/U meter should indicate at least 17 volts.

5. If ME-30(\*)/U meter indication is less than 17 volts, see troubleshooting chart 3-10.

Unmuted Audio Power Test

6. Change MK-1978/VRC AUDIO switch to UNMUTED setting.
7. Set ME-30(\*)/U RANGE selector switch to lower settings until reaching most exact on-scale reading.

**STANDARD.** ME-30(\*)/U meter should indicate at least 7.75 volts.

8. If ME-30(\*)/U meter reading is less than 7.75 volts, see troubleshooting chart 3-10.

Fixed Audio Power Test

9. Connect ME-30(\*)/U INPUT lead A to MK-1978/VRC INTERCOM jack.
10. Set ME-30(\*)/U RANGE selector switch to lower settings until reaching most exact on-scale reading.

**STANDARD.** ME-30(\*)/U meter should indicate at least 0.16 volts (up to 0.31 volts).

11. If ME-30(\*)/U meter indicates less than 0.16 volts, see troubleshooting chart 3-10.

**3-7. RECEIVER AUDIO DISTORTION TEST.**

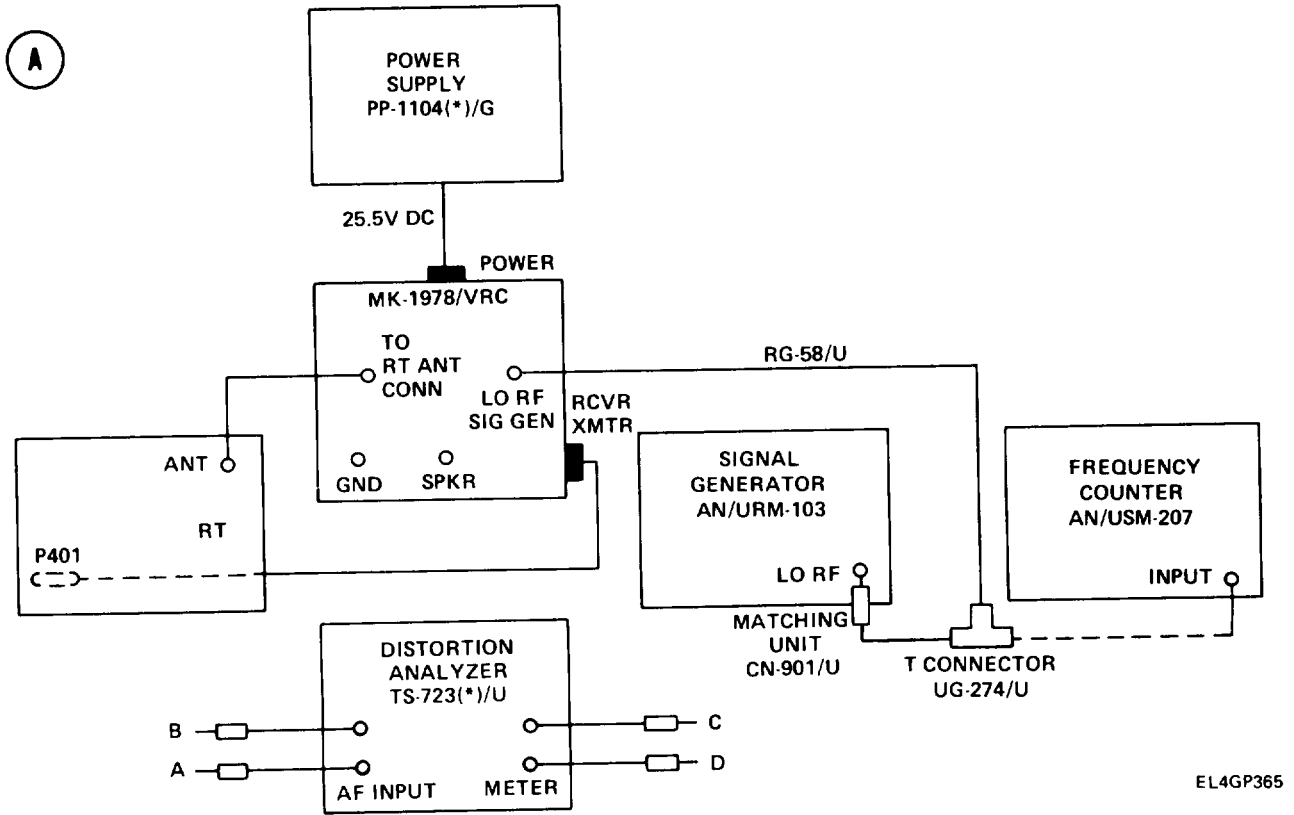
PURPOSE. This test checks the ability of the RT to minimize distortion. It is similar to the Receiver Sensitivity Test (paragraph 3-3), except that now a strong (20- $\mu$ v) rf level is used instead of a weak (0.5- $\mu$ v) one. The 20- $\mu$ v rf level is injected into the RT ANTENNA port. The audio distortion, measured at the MUTED AUDIO output jack of the MK-1978/VRC, should be less than 8 percent.

TEST EQUIPMENT AND MATERIALS

Power Supply PP-1104(*)/G	Adapter (T-Connector) UG-274B/U
Distortion Analyzer TS-723(*)/U	Matching Unit CN-901/U
Frequency Counter AN/USM-207	Rf Cables (two) RG-58/U
Signal Generator AN/URM-103	Maintenance Kit MK-1978/VRC

3-7. RECEIVER AUDIO DISTORTION TEST. (CONT)

TEST SETUP. Connect equipment as shown in test. Set up diagram (A).



EL4GP365

Turn on test equipment. Allow at least 15 to 30 minutes for warmup.

INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment controls as indicated in the following table. If using alternate test equipment, adjust for 64.00 MHz, 20- $\mu$ v rf input level, 1-kHz modulation, and 8-kHz frequency deviation.

CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
AN/USM-207	FREQUENCY TUNING - MC POWER DISPLAY INPUT GATE TIME SENSITIVITY FUNCTION DIRECT/HETERODYN E	100 TRACK MIN (fully counterclockwise) 0.3 V MAX (both switches to left) 10 <sup>3</sup> (black knob) PLUG IN FREQ DIRECT

3-7. RECEIVER AUDIO DISTORTION TEST. (CONT)

CONTROL AND SWITCH SETTINGS (CONT)

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
AN/URM-103	OPERATE/OFF/STAND BY BAND SWITCH RF TUNING DEVIATION RANGE KHZ FUNCTION DEVIATION RF SET TO LINE RF OUTPUT LO RF UV	OPERATE (D) 64.00 10 1000 Hz Adjust for 8-kHz meter indication To red line LO, 0-10 KUV 20 μv
TS-723(*)/U	RANGE INPUT AF-RF FREQUENCY FUNCTION R.M.S. VOLTS/DB	x10 MIN AF 100 METER 30 v
RT	BAND MC-TUNE-KC SQUELCH LIGHT VOLUME POWER SPEAKER (RT-524/VRC)	(B) 64.00 OLD OFF ON Fully counterclockwise LOW OFF
MK-1978/VRC	AUX POWER AUDIO KEY X-MODE (RT) AUX RCVR SQUELCH	ON MUTED RCVE NORMAL NORMAL ON (MK-1978A - OFF)

TEST PROCEDURE

1. Connect TS-723(\*)/U METER lead C to MK-1978/VRC SPKR jack; connect lead D to GND jack. (See test setup diagram (A) page 3-20.)
2. Adjust AN/URM-103 RF TUNING control for 64.00-MHz display on AN/USM-207.

NOTE

To produce a display on the AN/USM-207, the AN/URM-103 rf level must be increased by turning the LO RF UV control clockwise. When the display appears, readjust the AN/URM-103 RF TUNING control until the AN/USM-207 indicates 64.00 MHz, and reset the LO RF UV control to 20 μv.

**3-7. RECEIVER AUDIO DISTORTION TEST. (CONT)**

3. Disconnect T-connector from AN/USM-207.
4. Adjust RT VOLUME control for 17-volt indication on TS-723(\*)/U meter.
5. Disconnect TS-723(\*)/U METER leads from MK-1978/VRC jacks.
6. Connect TS-723(\*)/U AF INPUT lead B to MK-1978/VRC SPKR jack; connect lead A to GND jack. (See test setup diagram (A), page 3-20.)
7. Turn TS-723(\*)AJ FUNCTION switch to SET LEVEL.
8. Set TS-723(\*)/U METER RANGE switch to 100 percent.
9. Adjust TS-723(\*)AJ signal INPUT control for full scale meter deflection.
10. Turn TS-723(\*)/U FUNCTION switch to DISTORTION.
11. Adjust TS-723(\*)/U FREQUENCY and BALANCE controls for minimum meter indication.

**STANDARD.** TS-723(\*)/U meter should indicate less than 8 percent (distortion).

12. If TS-723(\*)/U meter indicates 8 percent or above, see troubleshooting chart 3-4.

**3-8. RECEIVER AUDIO RESPONSE TEST (NORMAL MODE).**

**PURPOSE.** This test checks the RT A5000 tray circuits for a flat response to modulating frequencies at and below 3 kHz. Receiver circuits are said to have a flat response if their gain remains nearly constant over a specified bandwidth. Frequencies not falling within this limited range receive little or no gain. The ability of the RT to detect and respond flatly to the desired voice frequencies is verified by injecting 1 kHz, 500 Hz, and 3 kHz into its ANTENNA port and insuring that the power measured at the SPKR jack of the MK-1978/VRC falls within the required db range.

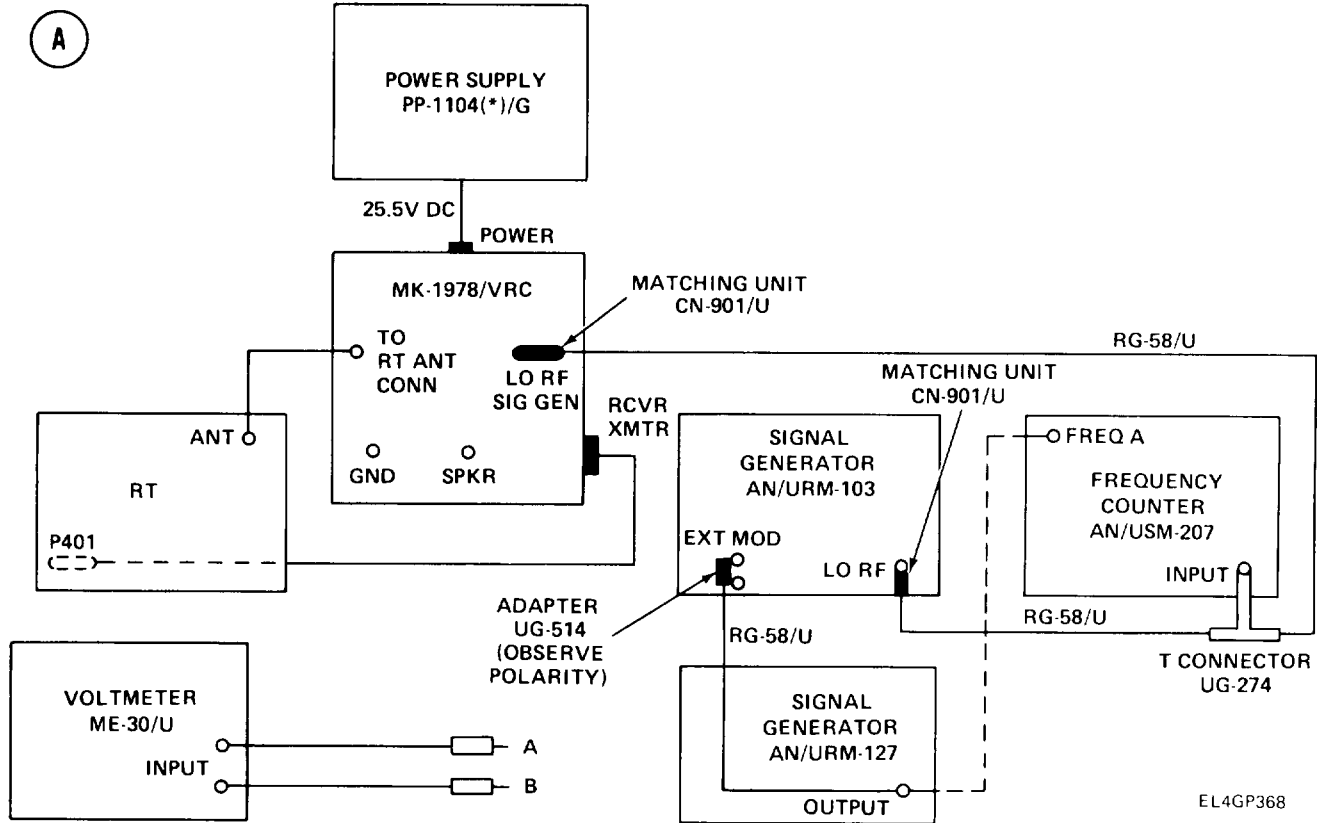
**TEST EQUIPMENT AND MATERIALS**

Power Supply PP-1104(\*)/G  
Frequency Counter AN/USM-207  
Signal Generator AN/URM-127  
Signal Generator ANWRM-103  
Ac Voltmeter ME-30(\*)/U

Adapters UG-274 B/U and UG-514  
Matching Unit CN-901/U  
Rf Cables (five) RG-58AJ  
Maintenance Kit MK-1978/VRC

3-8. RECEIVER AUDIO RESPONSE TEST (NORMAL MODE). (CONT)

TEST EQUIPMENT SETUP. Connect test equipment as shown in test setup diagram (A)



Turn on test equipment. Allow at least 15 to 30 minutes for warmup.

INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment controls as indicated in the following table. If using alternate test equipment, adjust for 64.00 MHz, 20- $\mu$ v rf input level, 1-kHz modulation, and 8-kHz frequency deviation.

CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
AN/USM-207	FREQUENCY TUNING – MC POWER DISPLAY INPUT GATE TIME SENSITIVITY FUNCTION DIRECT/HETERODYNE	100 TRACK MIN (fully counterclockwise) 0.3 V MAX (both switches to left) 10 <sup>3</sup> (black knob) PLUG IN FREQ DIRECT

3-8. RECEIVER AUDIO RESPONSE TEST (NORMAL MODE). (CONT)

CONTROL AND SWITCH SETTINGS (CONT)

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
AN/URM-103	OPERATE/OFF/STAN D BY BAND SWITCH RF TUNING DEVIATION RANGE KHZ FUNCTION DEVIATION RF SET TO LINE RF OUTPUT LO RF UV	OPERATE Ⓓ 64.00 10 EXT MOD Adjust for 8-kHz meter indication To red line LO, 0-10 KUV 20 μv
RT	BAND MC-TUNE-KC SQUELCH LIGHT VOLUME POWER SPEAKER (RT-524/VRC) X-MODE-NORMAL	Ⓑ 64.00 OLD OFF ON Fully counterclockwise LOW OFF NORMAL

**NOTE**

The X-MODE-NORMAL switch is located on the A4000 assembly.

AN/URM-127	FREQ RANGE MULTIPLIER FREQ RANGE DIAL ATTENUATOR OUTPUT CONTROL	x10 100 x1 Fully clockwise (maximum)
ME-30(*)U	RANGE selector switch	30 v
MK-1978/VRC	AUX POWER AUDIO KEY X-MODE (RT) AUX RCVR SQUELCH	ON MUTED RCVE NORMAL NORMAL ON (MK-1978A - OFF)

**3-8. RECEIVER AUDIO RESPONSE TEST (NORMAL MODE). (CONT)**

TEST PROCEDURE

1. Adjust AN/URM-103 RF TUNING control for 64.00-MHz display on AN/USM-207.

**NOTE**

To produce a display on the AN/USM-207, the AN/URM-103 rf level must be increased by turning the LO RF UV control clockwise. When the display appears, readjust the AN/URM-103 RF TUNING control until the AN/USM-207 indicates 64.00 MHz, and reset the LO RF UV control to 20  $\mu$ v.

2. Disconnect T-connector from AN/USM-207.

Audio Response Test (Normal Mode) at 1 kHz

3. Set AN/USM-207 controls to following positions:

CONTROL/SWITCH	POSITION/SETTING
POWER	TRACK
DISPLAY	MIN (fully counterclockwise)
SENSITIVITY	0.1 v
GATE TIME	1 (black knob)
FUNCTION	FREQ

4. Disconnect rf cable (1) from Adapter UG-514 (2) (See test setup diagram (A) , page 3-23.)
5. Connect rf cable (1) to AN/USM-207 FREQ A connector (3).
6. Adjust AN/URM-127 FREQ RANGE DIAL for 1-kHz display on AN/USM-207.
7. Disconnect rf cable (1) from AN/USM-207 FREQ A connector (3).
8. Reconnect rf cable (1) to Adapter UG-514 (2).
9. Connect ME-30(\*)/U INPUT lead A to MK-1978/VRC SPKR jack; connect lead B to GND jack.
10. Adjust RT VOLUME control for 17-volt indication on ME-30(\*)/U. Do not change VOLUME control position during rest of test.

**STANDARD.** A 1-kHz modulating tone injected into the RT should produce 17 volts at the output.

11. If RT VOLUME control adjustment cannot produce 17-volt indication on ME-30(\*)/U, see troubleshooting chart 3-10.

Audio Response Test (Normal Mode) at 500 Hz

12. Turn AN/URM-127 FREQ RANGE DIAL to 50.
13. Disconnect rf cable (1) from Adapter UG-514 (2). (See test setup diagram (A) .)
14. Connect rf cable (1) to AN/USM-207 FREQ A connector (3).
15. Adjust AN/URM-127 FREQ RANGE DIAL for 500-Hz display on AN/USM-207.
16. Disconnect rf cable (1) from AN/USM-207 FREQ A connector (3).
17. Reconnect rf cable (1) to Adapter UG-514 (2).

### 3.8. RECEIVER AUDIO RESPONSE TEST (NORMAL MODE). (CONT)

**STANDARD.** ME-30(\*)/U should indicate between 14 and 22 volts.

18. If ME-30(\*)AJ indicates below 14 volts or above 22 volts, see troubleshooting chart 3-5.

Audio Response Test (Normal Mode) at 3 kHz

19. Switch AN/URM-127 FREQ RANGE MULTIPLIER to x100.
20. Turn FREQ RANGE DIAL to 30.
21. Disconnect rf cable (1) from Adapter UG-514(2). (See test setup diagram (A) .)
22. Connect rf cable (1) to AN/USM-207 FREQ A connector (3).
23. Adjust AN/URM-127 FREQ RANGE DIAL for 3-kHz display on AN/USM-207.
24. Disconnect rf cable (1) from FREQ A connector (3).
25. Reconnect rf cable (1) to Adapter UG-514.

**STANDARD.** ME-30(\*)/U should indicate between 14 and 22 volts.

26. If ME-30(\*)/U indicates below 14 volts or above 22 volts, see troubleshooting chart 3-5.
27. Reset RT X-MODE-NORMAL switch to X-MODE position.

### 3-9. RECEIVER AUDIO RESPONSE TEST (X-MODE).

**PURPOSE.** This test is similar to the Receiver Audio Response Test (Normal Mode). When setup for X-mode, however, the receiver responds to a wider band of frequencies because the A5000 tray is not used. The ability of the RT to detect and respond flatly to the desired intelligence is verified by comparing db readings taken at the MK-1978/VRC X-MODE AUX RCVR jack while injecting several modulating frequencies to a reference voltage taken at 1-kHz modulation.

#### TEST EQUIPMENT AND MATERIALS

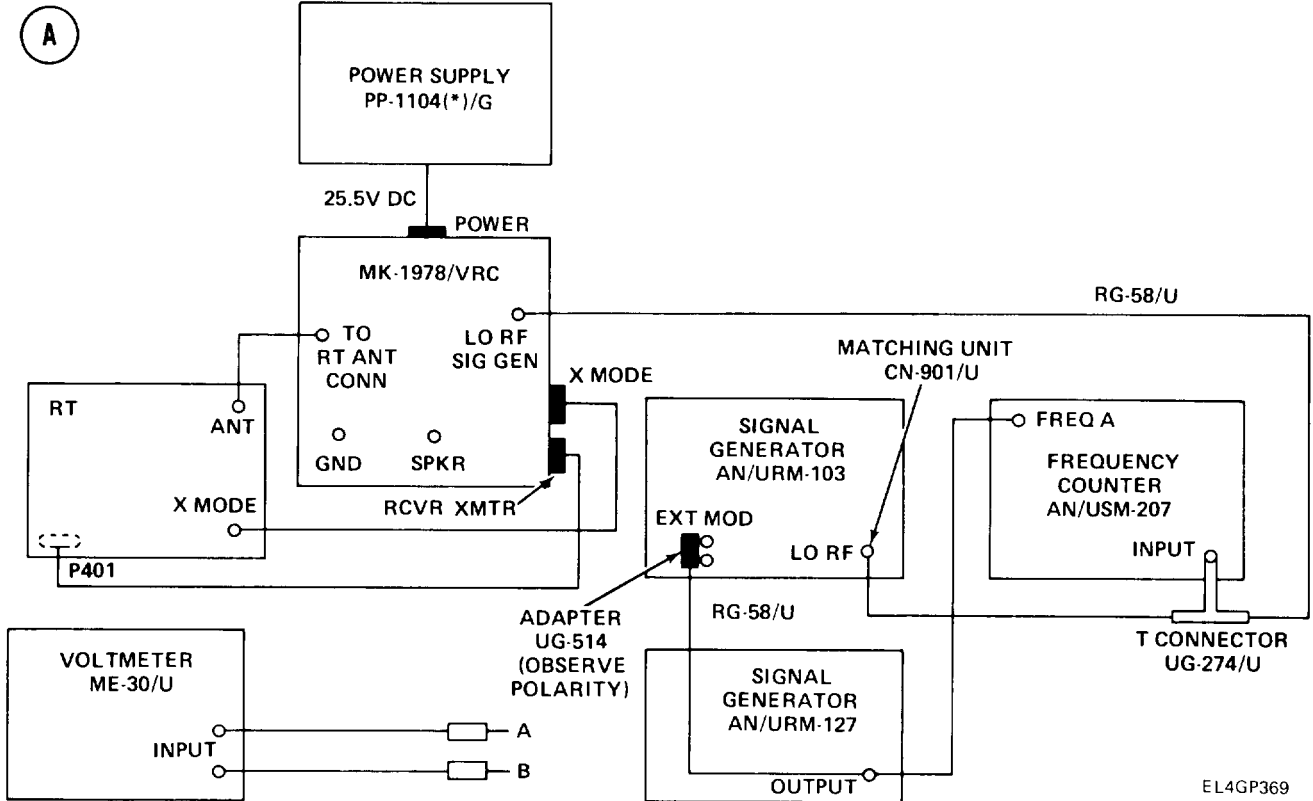
Power Supply PP-1104(\*)/G  
Frequency Counter AN/USM-207  
Signal Generator AN/URM-103  
Signal Generator AN/URM-127  
Ac Voltmeter ME-30(\*)/U

Adapters UG-274 B/U (T-Connector)  
and UG-514  
Matching Unit CN-901/U  
RF Cables (three) RG-58/U  
Maintenance Kit MK-1978/VRC



**3-9. RECEIVER AUDIO RESPONSE TEST (X-MODE). (CONT)**

TEST SETUP. Connect equipment as shown in test setup diagram (A)



Turn on test equipment. Allow at least 15 to 30 minutes for warmup.

INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment controls as indicated in the following table. If using alternate test equipment, adjust for 64.00 MHz, 20- $\mu$ v rf input level, 1-kHz modulation, and 8-kHz frequency deviation.

CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
AN/URM-127	FREQ RANGE MULTIPLIER FREQ RANGE DIAL ATTENUATOR OUTPUT CONTROL	x10 100 x1 Fully clockwise (maximum)

3-9. RECEIVER AUDIO RESPONSE TEST (X-MODE). (CONT)

CONTROL AND SWITCH SETTINGS (CONT)

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
AN/USM-207	FREQUENCY TUNING-MC POWER DISPLAY INPUT GATE TIME SENSITIVITY FUNCTION DIRECT/HETERODYNE	100 TRACK MIN (fully counterclockwise) 0.3 V MAX (both switches to left) 10 <sup>3</sup> (black knob) PLUG IN FREQ DIRECT
AN/URM-103	OPERATE/OFF/STAND BY BAND SWITCH RF TUNING DEVIATION RANGE KHZ FUNCTION DEVIATION RF SET TO LINE RF OUTPUT LO RF UV	OPERATE Ⓓ 64.00 10 EXT MOD Adjust for 8-kHz meter indication To red line LO, 0-10 KUV 20 μv
RT	BAND MC-TUNE-KC SQUELCH LIGHT VOLUME POWER SPEAKER (RT-524/VRC)	Ⓑ 64.00 OLD OFF ON Fully counterclockwise LOW OFF
ME-30(*)/U	RANGE selector switch	3 v
MK-1978/VRC	AUX POWER AUDIO KEY RT SWITCH SQUELCH	ON MUTED RCVE CIPHER ON (MK-1978A - OFF)

TEST PROCEDURE

1. Adjust AN/URM-103 RF TUNING control for 64.00-MHz display on AN/USM-207.

**NOTE**

To produce a display on the AN/USM-207, the AN/URM-103 rf level must be increased by turning the LO RF UV control clockwise. When the display appears, readjust the AN/URM-103 RF TUNING control until the AN/USM-207 indicates 64.00 MHz, and reset the LO RF UV control to 20 μv.

**3-9. RECEIVER AUDIO RESPONSE TEST (X-MODE). (CONT)**

2. Disconnect T-connector from AN/USM-207.

Audio Response Test (X-Mode) at 1 kHz

3. Set AN/USM-207 controls to the following positions:

CONTROL/SWITCH	POSITION/SETTING
POWER DISPLAY SENSITIVITY GATE TIME FUNCTION	TRACK MIN (fully counterclockwise) 0.1 v 1 (black knob) FREQ

4. Disconnect rf cable (1) from Adapter UG-514 (2). (See test setup diagram (A) , page 3-27.)
5. Connect rf cable (1) to AN/USM-207 FREQ A connector (3).
6. Adjust AN/URM-127 FREQ RANGE DIAL for 1-kHz display on AN/USM-207.
7. Disconnect rf cable (1) from AN/USM-207 FREQ A connector (3).
8. Reconnect rf cable (1) to Adapter UG-514 (2).
9. Connect ME-30(\*)/U INPUT lead A to MK-1978/VRC RCVR jack (inside X-MODE square). Connect lead B to GND jack. Note meter indication.

**STANDARD.** ME-30(\*)/U meter should indicate between 0.725 and 0.825 volt

10. If ME-30(\*)/U meter does not indicate at least 0.725 volt, see troubleshooting chart 3-9,

Audio Response Test (X-Mode) at 500 Hz

11. Turn AN/URM-127 FREQ RANGE DIAL to 50.
12. Disconnect rf cable (1) from Adapter UG-514 (2). (See test setup diagram (A) .)
13. Connect rf cable (1) to AN/USM-207 FREQ A connector (3).
14. Adjust AN/URM-127 FREQ RANGE DIAL for 500-Hz display on AN/USM-207.
15. Disconnect rf cable (1) from AN/USM-207 FREQ A connector (3).
16. Reconnect rf cable (1) to Adapter UG-514 (2).

**STANDARD.** ME-30(\*)/U meter should indicate between +2db and -3 db of reading noted in step 9.

17. If ME-30(\*)/U meter does not indicate between +2 db and -3 db of reading taken in step 9, see troubleshooting chart 3-9.

### 3-9. RECEIVER AUDIO RESPONSE TEST (X-MODE). (CONT)

Audio Response Test (X-Mode) at 3 kHz

18. Turn AN/URM-127 FREQ RANGE MULTIPLIER to x100.
19. Turn FREQ RANGE DIAL to 30.
20. Disconnect rf cable (1) from Adapter UG-514 (2). (See test setup diagram (A) .)
21. Connect rf cable (1) to AN/USM-207 FREQ A connector (3).
22. Adjust AN/URM-127 FREQ RANGE DIAL for 3-kHz display on AN/USM-207.
23. Disconnect rf cable (1) from AN/USM-207 FREQ A connector (3).
24. Reconnect rf cable (1) to Adapter UG-514 (2).

**STANDARD.** ME-30(\*)/U meter should indicate between +2 db and -3 db of reading noted in step 9.

25. If ME-30(\*)/U meter does not indicate between +2 db and -3 db of reading taken in step 9, see troubleshooting chart 3-9.

Audio Response Test (X-Mode) at 5 kHz

26. Turn AN/URM-127 FREQ RANGE DIAL to 50.
27. Disconnect rf cable (1) from Adapter UG-514 (2). (See test setup diagram (A) .)
28. Connect rf cable (1) to AN/USM-207 FREQ A connector (3).
29. Adjust AN/URM-127 FREQ RANGE DIAL for 5-kHz display on AN/USM-207,
30. Disconnect rf cable (1) from AN/USM-207 FREQ A connector (3).
31. Reconnect rf cable (1) to Adapter UG-514 (2).

**STANDARD.** ME-30(\*)/U meter should indicate between +2 db and -3 db of reading noted in step 9.

32. If ME-30(\*)/U meter does not indicate between +2 db and -3 db of reading taken in step 9, see troubleshooting chart 3-9.

Audio Response Test (X-Mode) at 10 kHz

33. Turn FREQ RANGE DIAL to 100.
34. Disconnect rf cable (1) from Adapter UG-514 (2). (See test setup diagram (A) .)
35. Connect rf cable (1) to AN/USM-207 FREQ A connector (3).
36. Adjust AN/URM-127 FREQ RANGE DIAL for 10-kHz display on AN/USM-207.
37. Disconnect rf cable (1) from AN/USM-207 FREQ A connector (3).
38. Reconnect rf cable (1) to Adapter UG-514 (2).

**STANDARD.** ME-30(\*)/U meter should indicate between +2 db and -3 db of reading noted in step 9.

39. If ME-30(\*)/U meter does not indicate between +2 db and -3 db of reading noted in step 9, see troubleshooting chart 3-9.

### 3-10. RECEIVER SELECTIVITY TEST.

**PURPOSE.** This test checks the ability of the RT A4000 tray IF Filters FL 4001 and FL 4002 to reject unwanted signals and, thus, determine bandwidth. The RT should have a minimum bandwidth of 32 kHz at the filters' 6-db attenuation point and a maximum bandwidth of 80 kHz at their 60-db attenuation point. This is verified by:

**3-10. RECEIVER SELECTIVITY TEST. (CONT)**

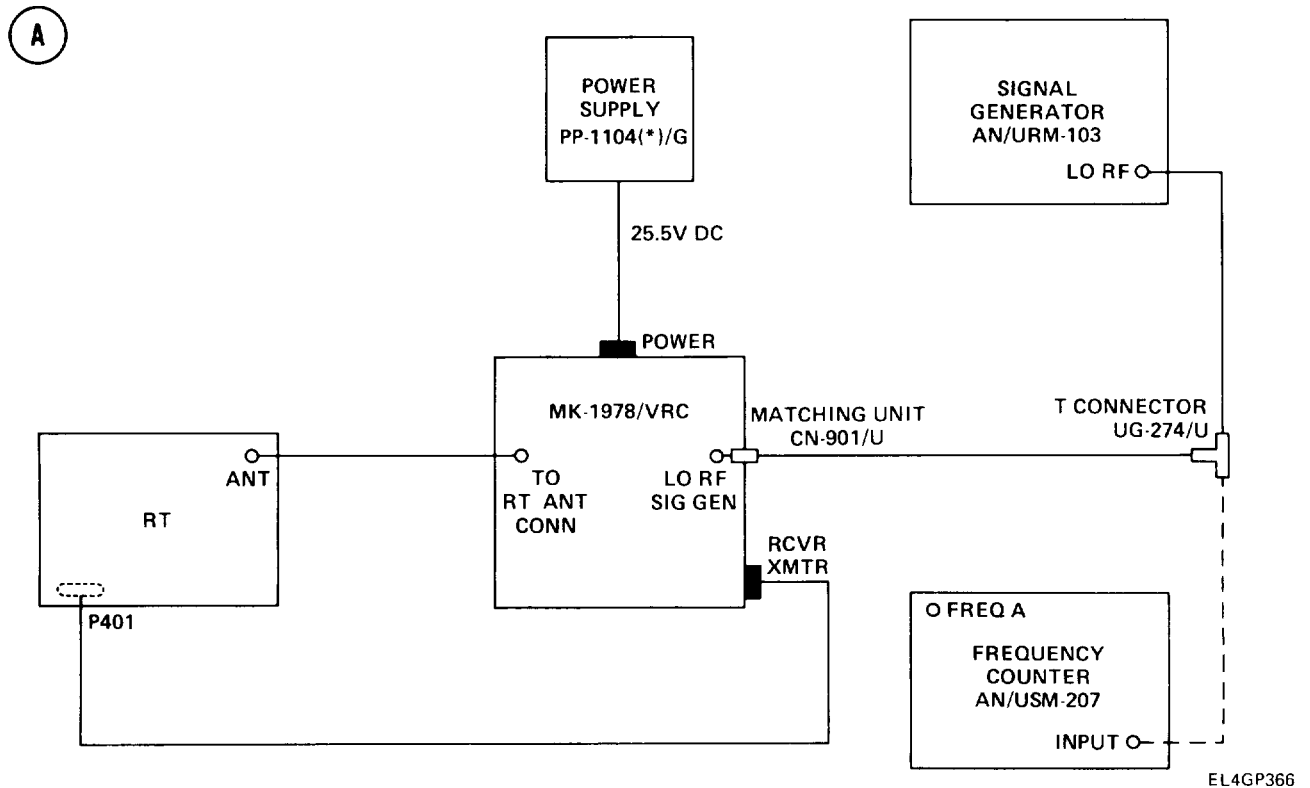
1. Finding the minimum rf level which must be injected into the RT ANTENNA port to cause the CALL lamp to light.
2. Injecting twice the rf level found in step 1 while observing that the RT CALL lamp is lit when the frequency is offset  $\pm 16$  kHz from the carrier.
3. Injecting 1000 times the rf level found in step 1, while observing that the RT CALL lamp is off when the frequency is offset more than  $\pm 40$  kHz from the carrier.

**TEST EQUIPMENT AND MATERIALS**

Power Supply PP-1104(\*)/G  
 Frequency Counter AN/USM-207  
 Signal Generator AN/URM-103  
 Adapter (T-Connector) UG-274 B/U

Matching Unit CN-901/U  
 Rf Cables (two) RG-58/U  
 Maintenance Kit MK-1978/VRC

TEST SETUP. Connect equipment as shown in test setup diagram (A) .



**Turn on test equipment. Allow at least 15 to 30 minutes for warmup.**

**INITIAL EQUIPMENT CONTROL SETTINGS.** Set equipment controls as indicated in the following table. If using alternate test equipment, adjust for 30.00 MHz, minimum rf input level, and no modulation.

3-10. RECEIVER SELECTIVITY TEST. (CONT)

CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
AN/USM-207	FREQUENCY TUNING – MC POWER DISPLAY INPUT GATE TIME SENSITIVITY FUNCTION DIRECT/HETERODYNE	100 TRACK MIN (fully counterclockwise) 0.3 V MAX (both switches to left) 10 <sup>3</sup> (black knob) PLUG IN FREQ DIRECT
AN/URM-103	OPERATE/OFF/STAND BY BAND SWITCH RF TUNING DEVIATION RANGE KHZ FUNCTION RF SET TO LINE RF OUTPUT LO RF UV	OPERATE (B) 30.00 10 MOD OFF To red line LO, 0-10 KUV Minimum setting
RT	BAND MC-TUNE-KC SQUELCH LIGHT VOLUME POWER SPEAKER (RT-524/VRC)	(A) 30.00 OLD ON ON Fully counterclockwise LOW OFF
MK-1978/VRC	AUX POWER AUDIO KEY X-MODE (RT) AUX RCVR SQUELCH	ON MUTED RCVE NORMAL NORMAL ON (MK-1978A - OFF)

TEST PROCEDURE

1. Adjust AN/URM-103 RF TUNING control for 30.00-MHz display on AN/USM-207.

**NOTE**

To produce a display on the AN/USM-207, the AN/URM-103 rf level must be increased by turning the LO RF UV control clockwise. When the display appears, readjust the AN/URM-103 RF TUNING control until the AN/USM-207 indicates 30.00 MHz, and reset the LO RF UV control to minimum setting.

2. Disconnect T-connector from AN/USM-207.

**3-10. RECEIVER SELECTIVITY TEST. (CONT)**

3. Turn AN/URM-103 LO RF UV control slowly clockwise until RT CALL lamp lights. Note control setting.
4. Increase AN/URM-103 LO RF UV level to twice the reading noted in step 3.

**STANDARD.** RT CALL lamp should remain lit.

5. If RT CALL lamp goes off, see troubleshooting chart 3-6.
6. Change AN/USM-207 GATE TIME to  $10^2$ .
7. Reattach T-connector to AN/USM-207.
8. Adjust AN/URM-103 RF TUNING control for 30.019-MHz (30019.0-kHz) display on AN/USM-207. To produce display, follow instructions in note under step 1, but reset AN/URM-103 LO RF UV control to level arrived at in step 4.
9. Disconnect T-connector from AN/USM-207.

**STANDARD.** RT CALL lamp should be off

10. If RT CALL lamp is lit, see troubleshooting chart 3-6.
11. Turn AN/URM-103 RF TUNING control slowly counterclockwise until RT CALL lamp lights.
12. Reattach T-connector to AN/USM-207.
13. Turn AN/URM-103 LO RF UV control clockwise until display appears on AN/USM-207. Note frequency displayed.
14. Adjust AN/URM-103 RF TUNING control for 29.981-MHz (29981.0-kHz) display on AN/USM-207.
15. Disconnect T-connector from AN/USM-207.
16. Reset AN/URM-103 LO RF UV control to level arrived at in step 4.

**STANDARD.** RT CALL lamp should be off.

17. If RT CALL lamp is lit, see troubleshooting chart 3-6.
18. Turn AN/URM-103 RF TUNING control slowly clockwise until RT CALL lamp lights.
19. Reattach T-connector to AN/USM-207.
20. Turn AN/URM-103 LO RF UV control clockwise until display appears on AN/USM-207. Note frequency displayed.
21. Subtract frequency noted in step 20 from frequency noted in step 13.

**STANDARD.** The difference between the two frequencies should be at least 32 kHz, but not more than 38 kHz, with a  $\pm 16$  kHz minimum and a  $\pm 19$  kHz maximum.

22. If difference between frequencies noted in steps 13 and 20 less than 32 kHz, see troubleshooting chart 3-6.
23. Increase LO RF UV level to 1000 times reading noted in step 3.
24. Change AN/USM-207 GATE TIME to  $10^4$ .
25. Reattach T-connector to AN/USM-207.
26. Adjust AN/URM-103 RF TUNING control for 30.041-MHz display on AN/USM-207. To produce display, follow instructions in note under step 1, but reset AN/URM-103 LO RF UV control to level arrived at in step 23.
27. Disconnect T-connector from AN/USM-207.

**STANDARD.** RT CALL lamp should be off.

28. If RT CALL lamp is lit, see troubleshooting chart 3-6.
29. Turn AN/URM-103 RF TUNING control slowly counterclockwise until RT CALL lamp lights.
30. Reattach T-connector to AN/USM-207.

**3-10. RECEIVER SELECTIVITY TEST. (CONT)**

31. Turn AN/URM-103 LO RF UV control clockwise until display appears on AN/USM-207. Note frequency displayed.
32. Adjust AN/URM-103 RF TUNING control for 29.959-MHz display on AN/USM-207.
33. Disconnect T-connector from AN/USM-207.
34. Reset AN/URM-103 LO RF UV control to level arrived at in step 23.

**STANDARD.** RT CALL lamp should be off.

35. If RT CALL lamp is lit, see troubleshooting chart 3-6.
36. Turn AN/URM-103 RF TUNING control slowly clockwise until RT CALL lamp lights.
37. Reattach T-connector to AN/USM-207.
38. Turn AN/URM-103 LO RF UV control clockwise until display appears on AN/USM-207. Note frequency displayed.
39. Subtract frequency noted in step 38 from frequency noted in step 31.

**STANDARD.** The difference between the two frequencies should be 80 kHz or less.

40. If difference between frequencies noted in steps 31 and 38 is more than 80 kHz, see troubleshooting chart 3-6.

**3-11. TRANSMITTER FREQUENCY ACCURACY TEST.**

**PURPOSE.** This test verifies proper operation of the frequency crystals and antenna control circuits in the transmitter. The RT is keyed, and the frequency error is measured with a frequency counter. Frequency accuracy must be within  $\pm 3.5$  kHz of the RT MC-TUNE-KC switch setting to meet the standard.

**TEST EQUIPMENT AND MATERIALS**

Power Supply PP-1104(\*)/G  
Frequency Counter AN/USM-207  
Dummy Load DA-75/U

Adapter UG-201/U  
Rf Cables (three) RG-58/U  
Maintenance Kit MK-1978/VRC



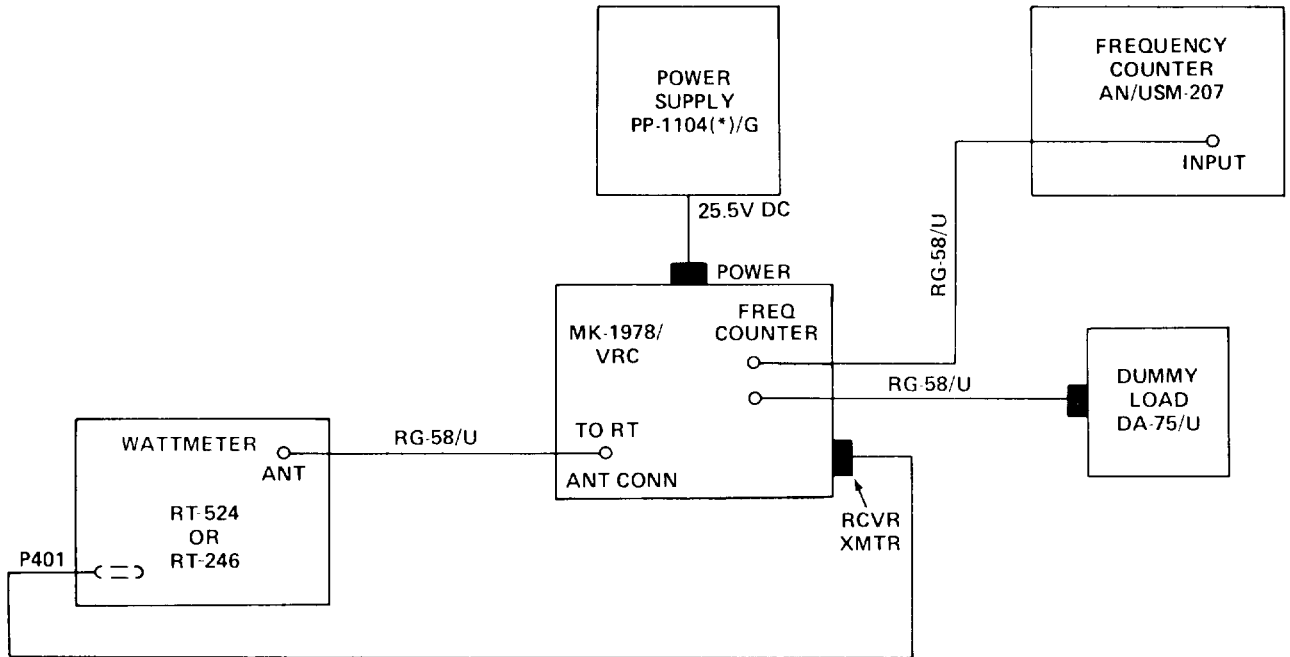
3-11. TRANSMITTER FREQUENCY ACCURACY TEST. (CONT)

TEST SETUP. Connect equipment as shown in test setup diagram (A)

**CAUTION**

Do not set MK-1978/VRC KEY switch to XMIT unless DA-75/U is connected to MK-1978/VRC WATTMETER jack.

(A)



EL4GP232

Turn on test equipment. Allow at least 15 to 30 minutes for warmup.

INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment controls as indicated in the following table.

CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
AN/USM-207	FREQUENCY TUNING-MC POWER DISPLAY INPUT GATE TIME SENSITIVITY FUNCTION DIRECT/HETERODYNE	100 TRACK MIN (fully counterclockwise) 0.3 V MAX (both switches to left) 10 <sup>2</sup> (black knob) PLUG IN FREQ DIRECT

3-11. TRANSMITTER FREQUENCY ACCURACY TEST. (CONT)

CONTROL AND SWITCH SETTINGS (CONT)

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
AN/URM-120	10W-500W	100W
RT	LIGHT BAND MC-TUNE-KC POWER SQUELCH VOLUME SPEAKER (RT-524/VRC)	ON Ⓐ 30.0 LOW OLD ON Fully counterclockwise OFF
MK-1978/VRC	POWER AUDIO KEY AUX RCVR X-MODE (RT) SQUELCH	ON MUTED RCVE NORMAL NORMAL ON

TEST PROCEDURE

1. Key transmitter by setting MK-1978/VRC KEY switch to XMIT.

**STANDARD.** AN/USM-207 should display 30000.0 kHz (30.0 MHz) ± 3.5 kHz.

2. If AN/USM-207 displays less than 29996.5 kHz or more than 30003.5 kHz, see troubleshooting chart 3-11.
3. Unkey transmitter by setting MK-1978/VRC KEY switch to RCVE.
4. Set RT MC-TUNE-KC switch to frequencies listed below. At each frequency key transmitter and note AN/USM-207 frequency display. Then unkey transmitter. (Turn RT BAND switch to Ⓑ for frequencies above 52.95 MHz.) Test frequencies: 30.05, 35.10, 41.20, 46.30, 50.40, 52.85, 54.50, 56.60, 60.70, 62.80, 63.90, 66.95, 70.95, 75.85, and 75.95 MHz.

**STANDARD.** AN/USM-207 display should be within ± 3.5 kHz of MC-TUNE-KC switch setting.

5. If AN/URM-207 display is not within ± 3.5 kHz of MC-TUNE-KC switch setting, see troubleshooting chart 3-11.

3-12. TRANSMITTER LOW AND HIGH POWER OUTPUT TEST.

**PURPOSE.** This test checks the RT's ability to transmit a modulated rf carrier with sufficient power. The radio is keyed, and the power output is measured with a wattmeter. Low output power should be between 0.5 and 10 watts; high power between 30 and 65 watts.

**3-12. TRANSMITTER LOW AND HIGH POWER OUTPUT TEST. (CONT)**

**TEST EQUIPMENT AND MATERIALS**

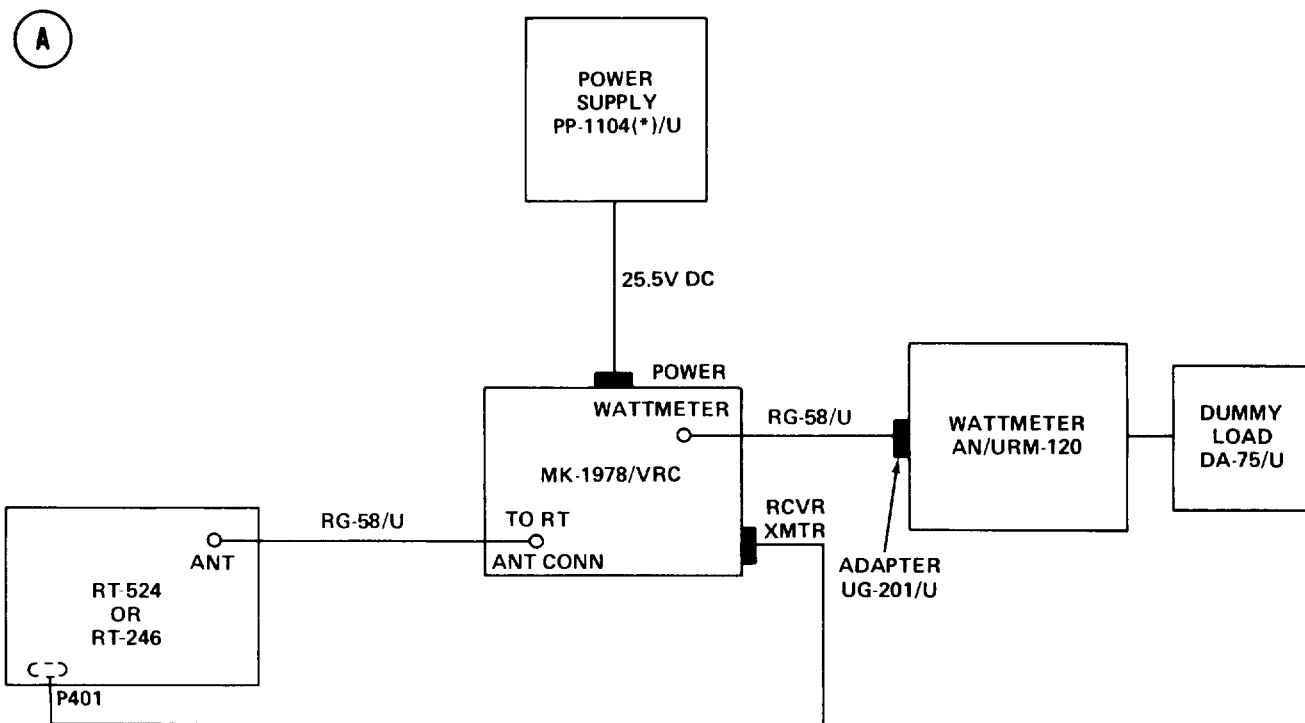
Power Supply PP-1 104(\*)/G  
 Wattmeter AN/URM-120  
 Dummy Load DA-75/U

Maintenance Kit MK-1978VRC  
 Rf Cables (two) RG-58/U

TEST SETUP. Connect equipment as shown in test setup diagram (A) .

**CAUTION**

Do not set MK-1978/VRC KEY switch to XMIT unless AN/URM-120 and DA-75/U are connected to MK-1978/VRC WATTMETER jack.



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Turn on test equipment. Allow at least 15 to 30 minutes for warmup.

3-12. TRANSMITTER LOW AND HIGH POWER OUTPUT TEST. (CONT)

INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment controls as indicated in the following table.

CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
AN/URM-120	10 W – 500 W	10 W
RT	LIGHT BAND MC-TUNE-KC POWER SQUELCH VOLUME	ON Ⓐ 30.0 LOW OLD OFF Fully counterclockwise
MK-1978/VRC	POWER AUDIO KEY AUX RCVR X-MODE (RT) SQUELCH	ON MUTED RCVE NORMAL NORMAL ON

TEST PROCEDURE

1. Key transmitter by setting MK-1978/VRC KEY switch to XMIT. Note AN/URM-120 meter indication.

**STANDARD.** AN/URM-120 should indicate between 0.5 and 10.0 watts.

2. If AN/URM-120 indicates less than 0.5 or more than 10.0 watts, see troubleshooting chart 3-12.
3. Unkey transmitter by setting MK-1978/VRC KEY switch to RCVE.
4. Turn AN/URM-120 10 W – 500 W switch to 100 W.
5. Turn RT POWER switch to HIGH.
6. Key transmitter.

**STANDARD.** AN/URM-120 should indicate between 30 and 65 watts.

7. If AN/URM-120 indicates less than 30 or more than 65 watts, see troubleshooting chart 3-12.
8. Unkey transmitter.
9. Turn RT POWER switch to LOW.
10. Turn AN/URM-120 10 W – 500 W switch to 10 W.
11. Repeat steps 1 through 10 with RT MC-TUNE-KC switch set at 41.00,52.00,53.00,64.00, and 75.00 MHz. (Turn BAND switch to Ⓑ for frequencies 53.00 MHz and above.)

**3-13. TRANSMITTER DEVIATION TEST (NORMAL MODE).**

**PURPOSE.** Carrier wave variation, or deviation, is directly proportional to the amplitude variations of the modulating signal. This test checks both (1) Transmitter Speech Amplifier A8500 Assembly gain control circuits, which develop proper signal strength before modulation, and (2) Modulators A8100 and A6300. An audio signal is injected into the MK-1978/VRC MIC/PIN N jack, the transmitter is keyed, and the output is measured with a deviation meter.

**TEST EQUIPMENT AND MATERIALS**

Power Supply PP-1104(\*)/G  
 Signal Generator AN/URM-127  
 Voltmeter ME-30(\*)/U  
 Wattmeter AN/URM-120  
 Dummy Load DA-75/U  
 Frequency Counter AN/USM-207

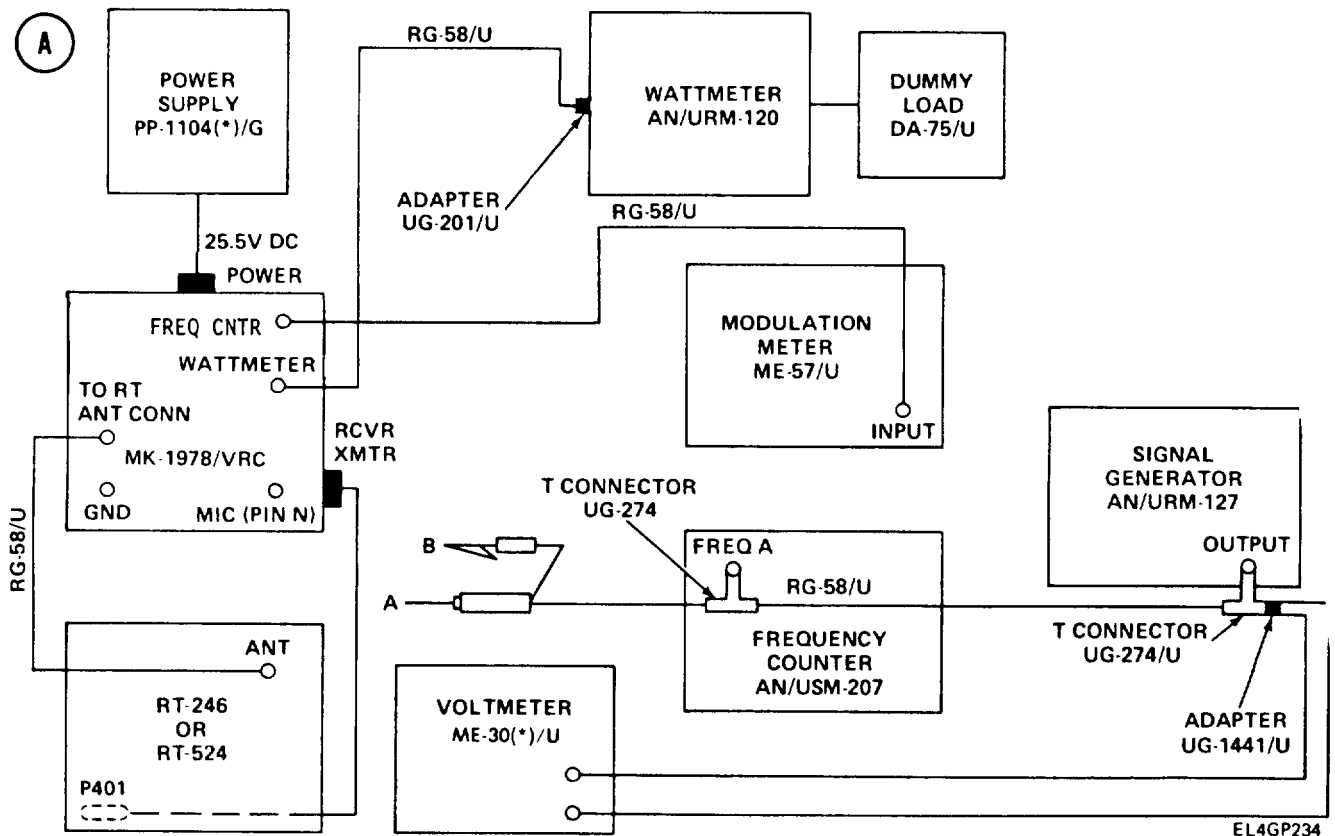
Modulation Meter ME-57/U  
 Rf Cables (two) RG-58/U  
 Maintenance Kit MK-1978/VRC  
 Adapters UG-274/U (two) , UG-1441/U, UG-201/U

**TEST SETUP.** Connect equipment as shown in test setup diagram (A)

**CAUTION**

Do not set MK-1978/VRC KEY switch to XMIT unless AN/URM-120 and DA-75/U are connected to MK-1978/VRC WATTMETER jack.

ME-57/U DEVIATION RANGE-KC switch must be in 1000 TUNE position.



**3-13. TRANSMITTER DEVIATION TEST (NORMAL MODE). (CONT)**

Turn on test equipment. Allow at least 30 minutes for warmup.

INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment controls as indicated in the following table. If using alternate test equipment, adjust for 30.00 MHz, 0.22-volt rf level, and 1-kHz modulation.

CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
AN/URM-127	FREQ RANGE MULTIPLIER FREQ RANGE DIAL ATTENUATOR OUTPUT CONTROL	x10 100 x1 Fully counterclockwise
ME-30(*)/U	RANGE selector switch	0.3 v
AN/URM-120	10 W – 500 W	10 W
ME-57/U	TUNE-FINE TUNE DEVIATION RANGE-KC FREQUENCY RANGE-MC TUNING  POWER	TUNE 1000 TUNE 20-55 30-MHz indication FREQUENCY-MC meter with transmitter keyed ON
AN/USM-207	POWER DISPLAY SENSITIVITY GATE TIME FUNCTION	TRACK MIN (fully counterclockwise) 0.1 v 1 (black knob) FREQ
RT	LIGHT BAND MC-TUNE-KC POWER SQUELCH VOLUME SPEAKER (RT-524/VRC)	ON Ⓐ 30.0 LOW OLD ON Fully counterclockwise OFF
MK-1978/VRC	POWER AUDIO KEY AUX RCVR X-MODE (RT) SQUELCH	ON MUTED RCVE NORMAL NORMAL ON

**3-13. TRANSMITTER DEVIATION TEST (NORMAL MODE). (CONT)**

## TEST PROCEDURE

Deviation Test (Normal Mode) at 1 kHz

1. Key transmitter by setting MK-1978/VRC KEY switch to XMIT.
2. Rotate ME-57/U TUNING knob until CARRIER SHIFT meter indicates 0 KC.
3. Change ME-57/U TUNE-FINE TUNE switch to FINE TUNE.
4. Readjust ME-57/U TUNING knob until CARRIER SHIFT meter again indicates 0 KC.

**NOTE**

ME-57/U LIMITING meter pin must be in BLACK area.

5. Unkey transmitter by setting MK-1978/VRC KEY switch to RCVE,
6. Turn AN/URM-127 OUTPUT CONTROL clockwise until display appears on AN/USM-207.
7. Adjust AN/URM-127 FREQ RANGE DIAL for 1-kHz display on AN/USM-207.
8. Disconnect T-connector from AN/USM-207.
9. Turn AN/URM-127 OUTPUT CONTROL fully counterclockwise.
10. Connect AN/URM-127 lead A to MK-197/VRC MIC/PIN N jack (inside KEY square) and lead B to GND jack. (See test setup diagram **A**, page 3-39.)
11. Adjust AN/URM-127 OUTPUT control for 0.22-volt indication on ME-30(\*)/U meter.
12. Key transmitter.
13. Set ME-57/U DEVIATION RANGE-KC switch to lower settings until obtaining highest on-scale reading (without pinning needle) on DEVIATION meter.

**STANDARD.** ME-57/U DEVIATION meter should indicate between 8 kHz and 12 kHz.

14. If DEVIATION meter indicates more than 12 kHz, see troubleshooting chart 3-14.
15. If DEVIATION meter indicates less than 8 kHz:
  - a. unkey transmitter;
  - b. set AN/URM-120 to 100 W;
  - c. set RT POWER to HIGH;
  - d. key transmitter.

**NOTE**

If DEVIATION meter still indicates below 8 kHz, see troubleshooting chart 3-14.

16. Unkey transmitter.

Deviation Test (Normal Mode) at 500 Hz

17. Connect T-connector to AN/USM-207.
18. If necessary, turn AN/URM-127 OUTPUT CONTROL clockwise until display appears on AN/USM-207.
19. Turn AN/URM-127 FREQ RANGE DIAL to 50, then adjust for 500-Hz indication on AN/USM-207.
20. Repeat steps 8 through 16.

### 3-13. TRANSMITTER DEVIATION TEST (NORMAL MODE). (CONT)

Deviation Test (Normal Mode) at 3 kHz

21. Connect T-connector to AN/USM-207.
22. If necessary, turn AN/URM-127 OUTPUT CONTROL clockwise until display appears on AN/USM-207.
23. Turn AN/URM-127 FREQ RANGE MULTIPLIER to x100.
24. Turn AN/URM-127 FREQ RANGE DIAL to 30, then adjust for 3-kHz display on AN/USM-207.
25. Repeat steps 8 through 16.

### 3-14. TRANSMITTER LIMITING TEST.

PURPOSE. Limiting circuits eliminate those portions of a signal that exceed a specific amplitude. This test verifies that higher than acceptable audio frequency input levels will not force the RT to overdeviate. As in the Transmitter Deviation Test (Normal Mode) (paragraph 3-13); an audio signal is injected into the MK-1978/VRC MIC/PIN N jack, the transmitter is keyed, and the output is measured with a deviation meter.

#### TEST EQUIPMENT AND MATERIALS

Power Supply PP-1104(\*)/G  
Signal Generator AN/URM-127  
Voltmeter ME-30(\*)/U  
Wattmeter AN/URM-120  
Dummy Load DA-75/U  
Frequency Counter AN/USM-207

Modulation Meter ME-57/U  
Rf Cables (four) RG-58/U  
Maintenance Kit MK-1978/VRC  
Adapters UG-274/U (two) ,  
UG-1441/U, UG-201/U

TEST SETUP. Connect equipment as shown in test setup diagram (A), page 3-43.

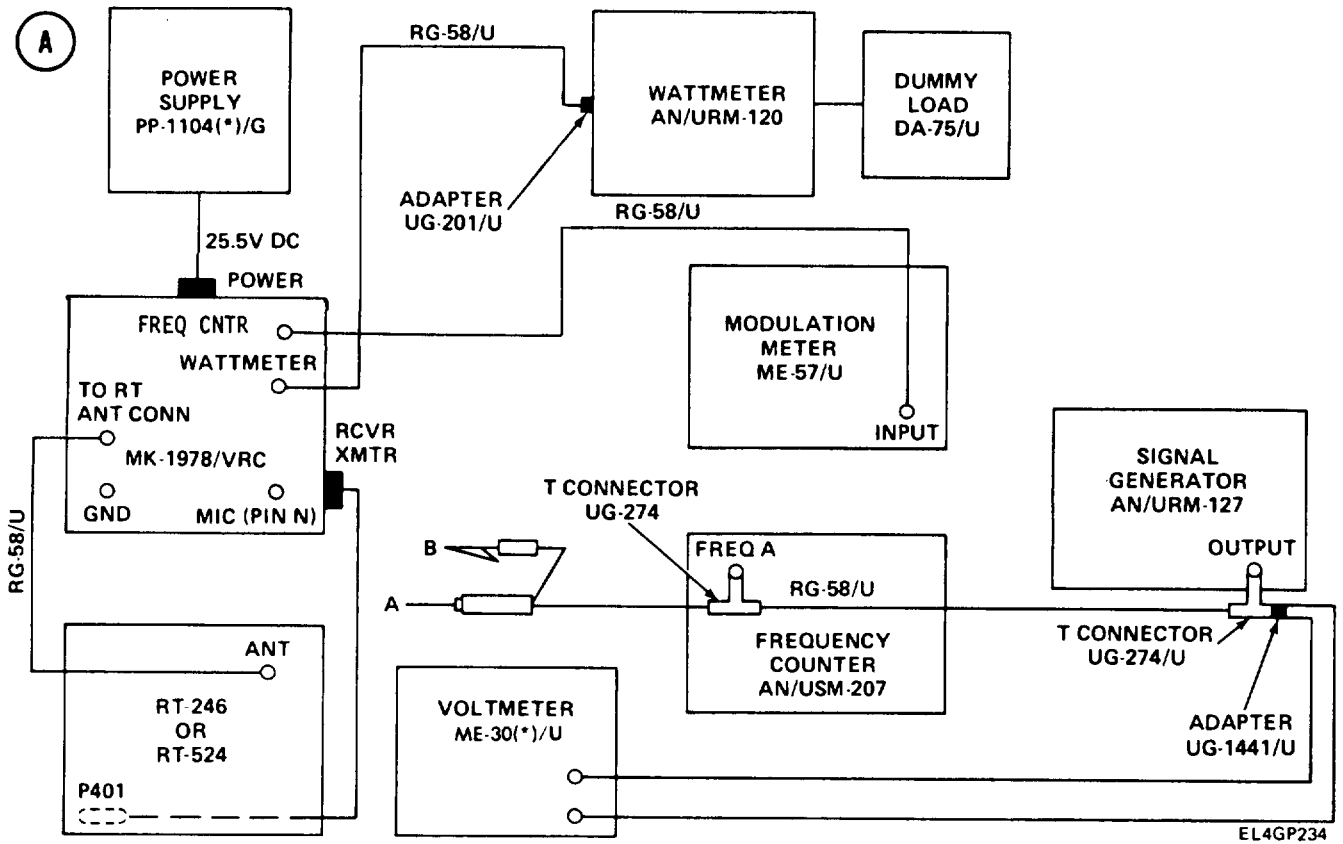
#### CAUTION

Do not set MK-1978/VRC KEY switch to XMIT unless AN/URM-120 and DA-75/U are connected to MK-1978/VRC WATTMETER jack.

ME-57/U DEVIATION RANGE-KC switch must be in 1000 TUNE position.



3-14. TRANSMITTER LIMITING TEST. (CONT)



Turn on test equipment. Allow at least 30 minutes for warmup.

INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment controls as indicated in the following table. If using alternate test equipment, adjust for 30.00 MHz, 1.1-volt rf level, and 1-kHz modulation.

CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
AN/U RM-127	FREQ RANGE MULTIPLIER FREQ RANGE DIAL ATTENUATOR OUTPUT CONTROL	x10 100 x1 Fully counterclockwise
ME-30(*)/u	RANGE selector switch	3 v
AN/URM-120	10 W - 500 W	10 W

3-14. TRANSMITTER LIMITING TEST. (CONT)

CONTROL AND SWITCH SETTINGS (CONT)

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
ME-57/U	TUNE-FINE TUNE DEVIATION RANGE-KC FREQUENCY RANGE-MC TUNING  POWER	TUNE 1000 TUNE 20-55 30-MHz indication on FREQUENCY-MC meter with transmitter keyed ON
AN/USM-207	POWER DISPLAY SENSITIVITY GATE TIME FUNCTION	TRACK MIN (fully counterclockwise) 0.1 volt 1 (black knob) FREQ
RT	LIGHT BAND MC-TUNE-KC POWER SQUELCH VOLUME SPEAKER (RT-524/VRC)	ON Ⓐ 30.0 LOW OLD ON Fully counterclockwise OFF
MK-1978/VRC	POWER AUDIO KEY AUX RCVR X-MODE (RT) SQUELCH	ON MUTED RCVE NORMAL NORMAL ON

TEST PROCEDURE

Limiting Test at 1 kHz

1. Key transmitter by setting MK-1978/VRC KEY switch to XMIT.
2. Rotate ME-57/U TUNING knob until CARRIER SHIFT meter indicates 0 KC.
3. Change ME-57/U TUNE-FINE TUNE switch to FINE TUNE.
4. Readjust ME-57/U TUNING knob until CARRIER SHIFT meter again indicates 0 KC.

**NOTE**

ME-57/U LIMITING meter pin must be in BLACK area.

5. Unkey transmitter by setting MK-1978/VRC KEY switch to RCVE.
6. Turn AN/URM-127 OUTPUT CONTROL clockwise until display appears on AN/USM-207.
7. Adjust AN/URM-127 FREQ RANGE DIAL for 1-kHz display on AN/USM-207.
8. Disconnect T-connector from AN/USM-207.
9. Turn AN/URM-127 OUTPUT CONTROL fully counterclockwise.

**3-14. TRANSMITTER LIMITING TEST. (CONT)**

10. Connect AN/URM-127 lead A to MK-1978/VRC MIC/PIN N jack (inside KEY square) and lead B to GNDjack. (See test setup diagram (A) .)
11. Adjust AN/URM-127 OUTPUT CONTROL for 1.1-volt indication on ME-30(\*)/U meter.
12. Key transmitter.
13. Set ME-57/U DEVIATION RANGE-KC switch to lower settings until obtaining highest on-scale reading (without pinning needle) on DEVIATION meter.

**STANDARD.** ME-57/U DEVIATION meter should indicate between 12 kHz and 20 kHz.

14. If DEVIATION meter indicates more than 20 kHz, see troubleshooting chart 3-18.
15. If DEVIATION meter indicates less than 12 kHz:
  - a. unkey transmitter;
  - b. set AN/URM-120 to 100 W;
  - c. set RT POWER to HIGH;
  - d. key transmitter.

**NOTE**

If DEVIATION meter indication is still below 12 kHz, see troubleshooting chart 3-18.

16. Unkey transmitter.

## Limiting Test at 500 Hz

17. Connect T-connector to AN/USM-207.
18. If necessary, turn AN/URM-127 OUTPUT CONTROL clockwise until display appears on AN/USM-207.
19. Turn AN/URM-127 FREQ RANGE DIAL to 50, then adjust for 500-Hz indication on AN/USM-207.
20. Repeat steps 8 through 16.

## Limiting Test at 3 kHz

21. Connect T-connector to AN/USM-207.
22. If necessary, turn AN/URM-127 OUTPUT CONTROL clockwise until display appears on AN/USM-207.
23. Turn AN/URM-127 FREQ RANGE MULTIPLIER to x100.
24. Turn AN/URM-127 FREQ RANGE DIAL to 30, then adjust for 3-kHz display on AN/USM-207.
25. Repeat steps 8 through 16.

**3-15. TRANSMITTER DISTORTION TEST (NORMAL MODE).**

**PURPOSE.** Distortion will ruin the quality of an audio signal and must, therefore, be kept at the lowest possible level. This test measures the percentage of distortion in the signal transmitted by the RT. An audio signal is injected into the MK-1978/VRC MIC/PIN N jack. The transmitter is then keyed, and the output is demodulated with a modulation meter. Finally, the distortion is measured at the modulation meter's AUDIO OUTPUT port with a distortion analyzer.

3-15. TRANSMITTER DISTORTION TEST (NORMAL MODE). (CONT)

TEST EQUIPMENT AND MATERIALS

Power Supply PP-1104(\*)/G  
 Signal Generator AN/URM-127  
 Voltmeter ME-30(\*)/U  
 Wattmeter AN/URM-120  
 Dummy Load DA-75/U  
 Frequency Counter AN/USM-207

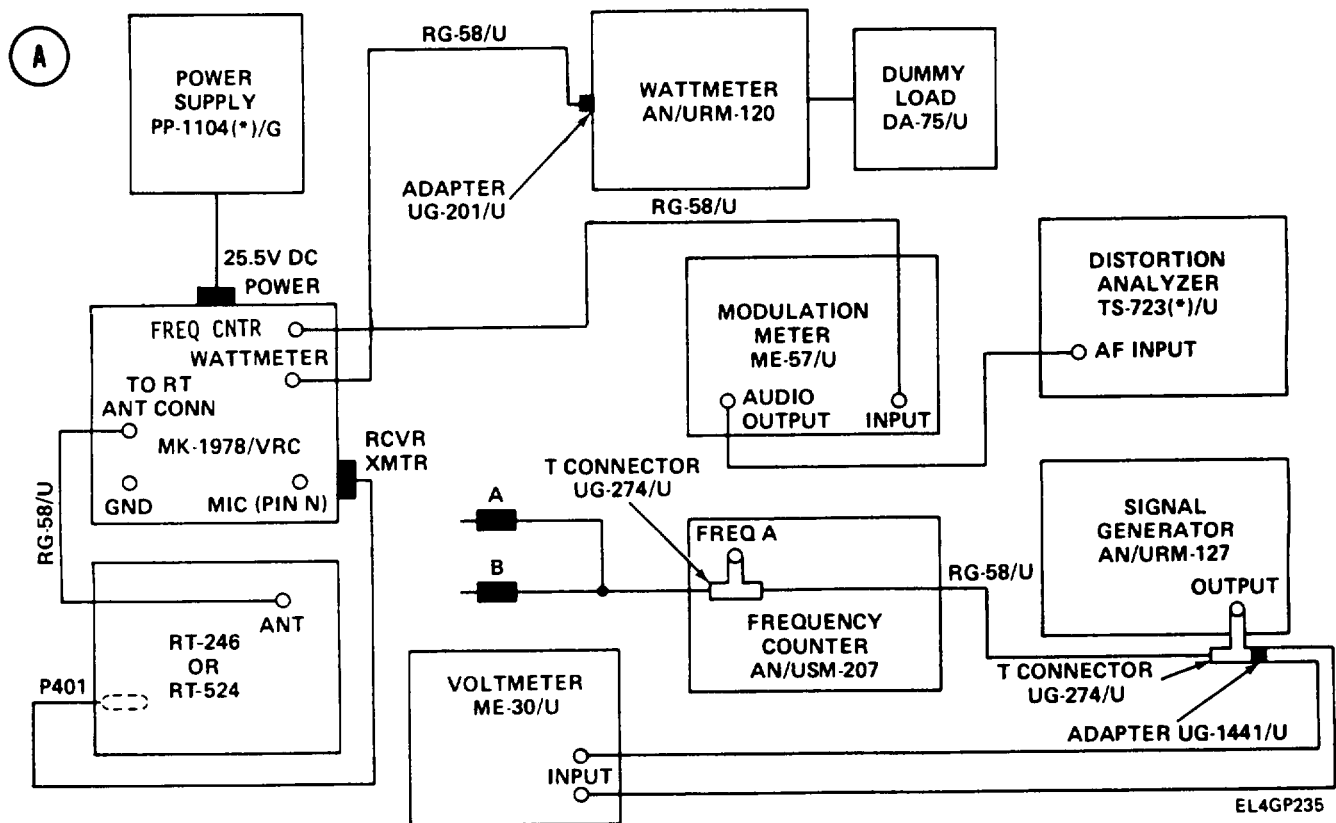
Adapters UG-274/U (two) ,  
 UG-1441/U, UG-201/U  
 Modulation Meter ME-57/U  
 Distortion Analyzer TS-723(\*)/U  
 Rf Cables (four) RG-58  
 Maintenance Kit MK-1978/VRC

TEST SETUP. Connect equipment as shown in test setup diagram (A)

**CAUTION**

Do not set MK-1978/VRC KEY switch to XMIT unless AN/URM-120 and DA-75/U are connected to MK-1978/VRC WATTMETER jack.

ME-57/U DEVIATION RANGE-KC switch must be in 1000 TUNE position.



Turn on test equipment. Allow at least 30 minutes for warmup.

INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment controls as indicated in the following table. If using alternate test equipment, adjust for 30.00 MHz, 0.22-volt rf level, and 1-kHz modulation.

3-15. TRANSMITTER DISTORTION TEST (NORMAL MODE). (CONT)

CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
AN/URM-127	FREQ RANGE MULTIPLIER FREQ RANGE DIAL ATTENUATOR OUTPUT CONTROL	x10 100 x1 Fully counterclockwise (maximum)
ME-30(*)/U	RANGE selector switch	0.3 v
AN/URM-120	10 W-500 W	10 W
ME-57/U	TUNE-FINE TUNE DEVIATION RANGE-KC FREQUENCY RANGE-MC TUNING  POWER	TUNE 1000 TUNE 20-55 30-MHz indication on FREQUENCY-MC meter with transmitter keyed ON
AN/USM-207	POWER DISPLAY SENSITIVITY GATE TIME FUNCTION	TRACK MIN (fully counterclockwise) 0.1 v 1 (black knob) FREQ
TS-723(*)/U	RANGE AF INPUT AF-RF FREQUENCY FUNCTION R.M.S. VOLTS/DB	x10 MIN AF 100 SET LEVEL 100%
RT	LIGHT BAND MC-TUNE-KC POWER SQUELCH VOLUME SPEAKER (RT-524/VRC)	ON Ⓐ 30.00 LOW OLD ON Fully counterclockwise OFF
MK-1978/VRC	POWER AUDIO KEY AUX RCVR X-MODE (RT) SQUELCH	ON MUTED RCVE NORMAL NORMAL ON

**3-15. TRANSMITTER DISTORTION TEST (NORMAL MODE). (CONT)**

TEST PROCEDURE

1. Key transmitter by setting MK-1978/VRC KEY switch to XMIT.
2. Rotate ME-57/U TUNING knob until CARRIER SHIFT meter indicates 0 KC.
3. Change ME-57/U TUNE-FINE TUNE switch to FINE TUNE.
4. Readjust ME-57/U TUNING knob until CARRIER SHIFT again indicates 0 KC.

**NOTE**

ME-57/U LIMITING meter pin must be in BLACK area.

5. Unkey transmitter by setting MK-1978/VRC KEY switch to RCVE.
6. Turn AN/URM-127 OUTPUT CONTROL clockwise until display appears on AN/USM-207.
7. Adjust AN/URM-127 FREQ RANGE DIAL for 1-kHz display on AN/USM-207.
8. Disconnect T-connector from AN/USM-207.
9. Turn AN/URM-127 OUTPUT CONTROL fully counterclockwise.
10. Connect AN/URM-127 lead A to MK-1978/VRC MIC/PIN N jack (inside KEY square) and lead B to GND jack. (See test setup diagram (A), page 3-46.)
11. Adjust AN/URM-127 OUTPUT CONTROL for 0.22-volt indication on ME-30(\*)/U meter.
12. Key transmitter.
13. Step ME-57/U DEVIATION RANGE-KC switch to lower settings until obtaining highest on-scale reading (without pinning needle) on DEVIATION meter.
14. Set TS-723(\*)/U signal INPUT control for full-scale meter deflection.
15. Turn TS-723(\*)/U FUNCTION switch to DISTORTION.
16. Adjust TS-723(\*)/U FREQUENCY and BALANCE controls for minimum meter indication.

**STANDARD.** TS-723(\*)/U meter should indicate less than 10 percent (distortion).

17. If TS-723(\*)/U meter indicates 10 percent (distortion) or greater, see troubleshooting chart 3-18.
18. Unkey transmitter.

**3-16. TRANSMITTER DEVIATION TEST (X-MODE).**

**PURPOSE.** This test checks much of the same circuitry as the Transmitter Deviation Test (Normal Mode) (paragraph 3-13). When setup for X-mode, however, the RT does not utilize Speech Amplifier Assembly A8500. An audio signal is injected directly into the X-MODE receptacle, the transmitter is keyed, and the output is measured with a deviation meter.

TEST EQUIPMENT AND MATERIALS

Power Supply PP-1104(\*)/G  
Signal Generator AN/URM-127  
Voltmeter ME-30(\*)/U  
Wattmeter AN/URM-120  
Dummy Load DA-75  
Frequency Counter AN/USM-207

Modulation Meter ME-57/U  
Rf Cables (four) RG-58/U  
Adapters UG-274/U (three),  
UG-1441/U, UG-201/U  
Maintenance Kit MK-1978/VRC

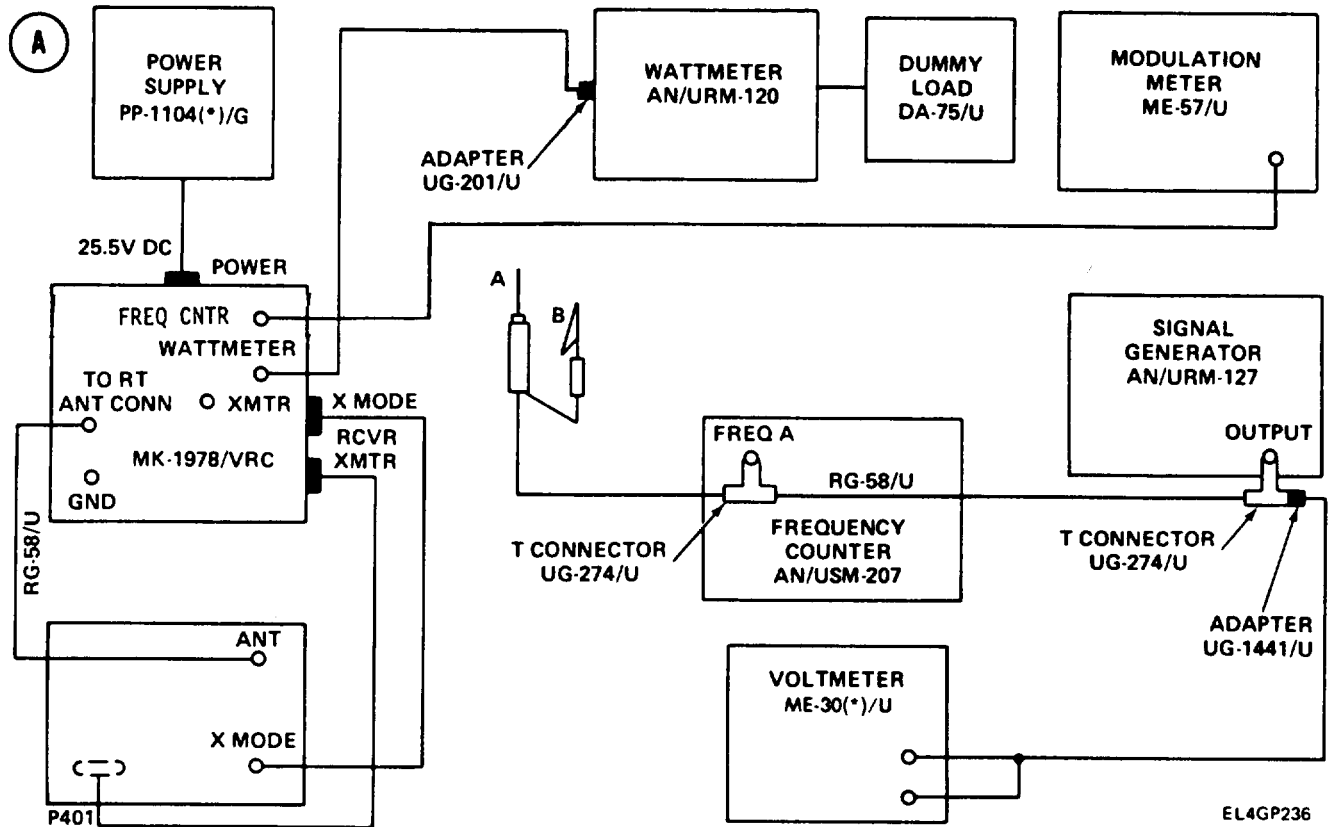
**3-16. TRANSMITTER DEVIATION TEST (X-MODE). (CONT)**

TEST SETUP. Connect equipment as shown in test setup diagram (A) .

**CAUTION**

Do not set MK-19781VRC KEY switch to XMIT unless AN/URM-120 and DA-75/U are connected to MK-1978/VRC WATTMETER jack.

ME-57/U DEVIATION RANGE-KC switch must be in 1000 TUNE position.



Turn on test equipment. Allow at least 30 minutes for warmup.

INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment controls as indicated in the following table. If using alternate test equipment, adjust for 30.00 MHz, 0.8-volt rf level, and 1-kHz modulation.

3-16. TRANSMITTER DEVIATION TEST (X-MODE). (CONT)

CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
AN/URM-127	FREQ RANGE MULTIPLIER FREQ RANGE DIAL ATTENUATOR OUTPUT CONTROL	x10 100 x1 Fully counterclockwise
ME-30(*)/U	RANGE selector switch	1 v
AN/URM-120	10 v - 500 W	10 w
ME-57/U	TUNE FINE TUNE DEVIATION RANGE-KC FREQUENCY RANGE-MC TUNING  POWER	TUNE 1000 TUNE 20-55 30-MHz indication on FREQUENCY-MC meter with transmitter keyed ON
AN/USM-207	POWER DISPLAY SENSITIVITY GATE TIME FUNCTION	TRACK MIN (fully counterclockwise) 0.1 v 1 (black knob) FREQ
RT	LIGHT BAND MC-TUNE-KC POWER SQUELCH VOLUME SPEAKER (RT-524/VRC)	ON Ⓐ 30.00 LOW OLD ON Fully counterclockwise OFF
MK-1978/VRC	POWER AUDIO KEY AUX RCVR X-MODE (RT) SQUELCH	ON MUTED RCVE CIPHER CIPHER ON

TEST PROCEDURE

Deviation Test (X-Mode) at 1 kHz

1. Key transmitter by setting MK-1978/VRC KEY switch to XMIT.
2. Rotate ME-57/U TUNING knob until CARRIER SHIFT meter indicates 0 KC.
3. Change ME-57/U TUNE-FINE TUNE switch to FINE TUNE.



**3-16. TRANSMITTER DEVIATION TEST (X-MODE). (CONT)**

4. Readjust ME-57/U TUNING knob until CARRIER SHIFT again indicates 0 KC.

**NOTE**

ME-57/U LIMITING meter pin must be in BLACK area.

5. Unkey transmitter by setting MK-1978/VRC KEY switch to RCVE.
6. Turn AN/URM-127 OUTPUT CONTROL clockwise until display appears on AN/USM-207.
7. Adjust AN/URM-127 FREQ RANGE DIAL for 1 kHz display on AN/USM-207.
8. Disconnect T-connector from AN/USM-207.
9. Turn AN/URM-127 OUTPUT CONTROL fully counterclockwise.
10. Connect AN/URM-127 lead A to MK-1978/VRC XMTR jack (inside X-MODE square); connect lead B to GND. (See test setup diagram **(A)**, page 3-49.)
11. Adjust AN/URM-127 OUTPUT CONTROL for 0.8-volt indication on ME-30(\*)/U meter.
12. Key transmitter.
13. Step ME-57/U DEVIATION RANGE-KC switch to lower settings until obtaining highest on-scale reading (without pinning needle) on DEVIATION meter.

**STANDARD.** ME-57/U DEVIATIONmeter should indicate between 6 kHz and 10 kHz.

14. If DEVIATION meter indicates more than 10 kHz, see troubleshooting chart 3-18.
15. If DEVIATION meter indicates less than 6 kHz,
  - a. unkey transmitter;
  - b. set AN/URM-120 to 100W;
  - c. set RT POWER to HIGH;
  - d. key transmitter.

**NOTE**

If DEVIATION meter still indicates less than 6 kHz, see troubleshooting chart 3-18.

16. Turn ME-30(\*)/U RANGE selector switch to 3 volts.
17. Turn ME-57/U DEVIATION RANGE-KC switch to 50.
18. Adjust AN/URM-127 OUTPUT CONTROL for 2.5-volt indication on ME-30(\*)/U meter.
19. Key transmitter.

**STANDARD.** ME-57/U DEVIATION meter should indicate between 17 and 36 kHz.

20. If ME-57/U DEVIATION meter indicates below 17 kHz or above 36 kHz, see troubleshooting chart 3-18.
21. Unkey transmitter.

**Deviation Test (X-Mode) at 500 Hz**

22. Connect T-connector to AN/USM-207.
23. If necessary, turn AN/URM-127 OUTPUT CONTROL clockwise until display appears on AN/USM-207.
24. Turn AN/URM-127 FREQ RANGE DIAL to 50, then adjust for 500-Hz indication on AN/USM-207.
25. Disconnect T-connector from AN/USM-207.
26. Repeat steps 10 through 21.

**3-16. TRANSMITTER DEVIATION TEST (X-MODE). (CONT)**

Deviation Test (X-Mode) at 3 kHz

27. Connect T-connector to AN/USM-207.
28. If necessary, turn AN/URM-127 OUTPUT CONTROL clockwise until display appears on AN/USM-207.
29. Turn AN/URM-127 FREQ RANGE MULTIPLIER to x100.
30. Turn AN/URM-127 FREQ RANGE DIAL to 30, then adjust for 3-kHz indication on AN/USM-207.
31. Disconnect T-connector from AN/USM-207.
32. Repeat steps 10 through 21.

Deviation Test (X-Mode) at 5 kHz

33. Connect T-connector to AN/USM-207.
34. If necessary, turn AN/URM-127 OUTPUT CONTROL clockwise until display appears on AN/USM-207.
35. Turn AN/URM-127 FREQ RANGE DIAL to 50, then adjust for 5-kHz indication on AN/USM-207.
36. Disconnect T-connector from AN/USM-207.
37. Repeat steps 10 through 21.

Deviation Test (X-Mode) at 10 kHz

38. Connect T-connector to AN/USM-207.
39. If necessary, turn AN/URM-127 OUTPUT CONTROL clockwise until display appears on AN/USM-207.
40. Turn AN/URM-127 FREQ RANGE DIAL to 100, then adjust for 10-kHz indication on AN/USM-207.
41. Disconnect T-connector from AN/USM-207.
42. Repeat steps 10 through 21.

**3-17. TRANSMITTER DISTORTION TEST (X-MODE).**

**PURPOSE.** This test measures the percentage of distortion in the X-mode signal transmitted by the RT. It is the same as the Transmitter Distortion Test (Normal Mode) (paragraph 3-15), except for a change in the signal injection point and the use of a wider band of test frequencies.

**TEST EQUIPMENT AND MATERIALS**

Power Supply PP-1104(\*)/G  
Signal Generator AN/URM-127  
Voltmeter ME-30(\*)/U  
Wattmeter AN/URM-120  
Dummy Load DA-75/U  
Maintenance Kit MK-1978/VRC  
Frequency Counter AN/USM-207

Adapters UG-274/U (three),  
UG-1441/U, UG-201/U  
Modulation Meter ME-57/U  
Distortion Analyzer TS-723(\*)/U  
Rf Cables (four) RG-58/U

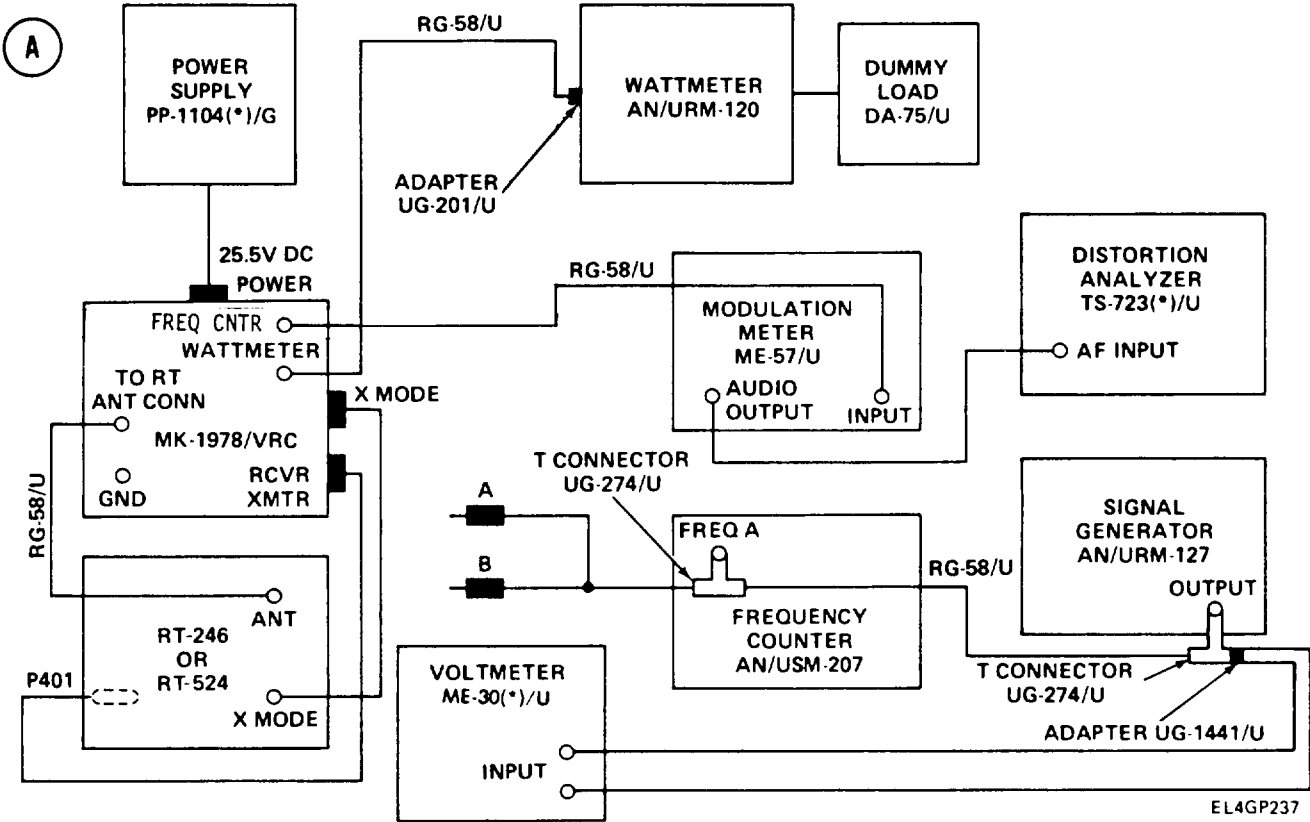
3-17. TRANSMITTER DISTORTION TEST (X-MODE). (CONT)

TEST SETUP. Connect equipment as shown in test setup diagram (A) .

**CAUTION**

Do not set MK-1978/VRC KEY switch to XMIT unless AN/URM-120 and DA-75/U are connected to MK-1978/VRC WATTMETER jack.

ME-57/U DEVIATION RANGE-KC switch must be in 1000 TUNE position.



Turn on test equipment, Allow at least 30 minutes for warmup.

3-17. TRANSMITTER DISTORTION TEST (X-MODE). (CONT)

INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment controls as indicated in the following table. If using alternate test equipment, adjust for 30.00 MHz, 25-volt rf level, and 1-kHz modulation.

CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
AN/URM-127	FREQ RANGE MULTIPLIER FREQ RANGE DIAL ATTENUATOR OUTPUT CONTROL	x10 100 x10 Fully counterclockwise (maximum)
ME-57/U	TUNE-FINE TUNE DEVIATION RANGE-KC FREQUENCY RANGE-MC TUNING  POWER	TUNE 1000 TUNE 20-55 30-MHz indication on FREQUENCY-MC meter with transmitter keyed  ON
ME-30(*)/U	RANGE selector switch	3 v
AN/URM-120	10 W – 500 W	10 W
AN/USM-207	POWER DISPLAY SENSITIVITY GATE TIME FUNCTION	TRACK MIN (fully counterclockwise) 0.1 v 1 (black knob) FREQ
RT	LIGHT BAND MC-TUNE-KC POWER SQUELCH VOLUME	ON Ⓐ 30.00 LOW OLD ON Fully counterclockwise
TS-723(*)/U	RANGE AF INPUT AF-RF FREQUENCY FUNCTION R.M.S. VOLTS/DB	x10 MIN AF 100 SET LEVEL 10%
MK-1978/VRC	POWER AUDIO KEY AUX RCVR X-MODE (RT) SQUELCH	ON MUTED RCVE CIPHER CIPHER ON

**3-17. TRANSMITTER DISTORTION TEST (X-MODE). (CONT)**

## TEST PROCEDURE

1. Key transmitter by setting MK-1978/VRC KEY switch to XMIT.
2. Rotate ME-57/U TUNING knob until CARRIER SHIFT meter indicates 0 KC.
3. Change ME-57/U TUNE-FINE TUNE switch to FINE TUNE.
4. Readjust ME-57/U TUNING knob until CARRIER SHIFT again indicates 0 KC.

**NOTE**

ME-57/U LIMITING meter pin must be in BLACK area.

5. Unkey transmitter by setting MK-1978/VRC KEY switch to RCVE.
6. Turn AN/URM-127 OUTPUT CONTROL clockwise until display appears on AN/USM-207.
7. Adjust AN/URM-127 FREQ RANGE DIAL for 1-kHz display on AN/USM-207,
8. Disconnect T-connector from AN/USM-207.
9. Turn AN/URM-127 OUTPUT CONTROL fully counterclockwise.
10. Connect AN/URM-127 lead A to MK-1978/VRC XMTR jack (inside X-MODE square); connect lead B to GND. (See test setup diagram **(A)**, page 3-53.)
11. Adjust AN/URM-127 OUTPUT CONTROL for 2.5-volt indication on ME-30(\*)/U meter.
12. Key transmitter.
13. Step ME-57/U DEVIATION RANGE-KC switch to lower settings until obtaining highest on-scale reading (without pinning needle) on DEVIATION meter.
14. Adjust TS-723(\*)/U signal INPUT control for full-scale meter deflection.
15. Turn TS-723(\*)/U FUNCTION switch to DISTORTION.
16. Adjust TS-723(\*)/U FREQUENCY and BALANCE controls for minimum meter indication.

**STANDARD.** TS-723(\*)/U meter should indicate less than 7 percent (distortion).

17. If TS-723(\*)/U meter indicates 7 percent (distortion) or greater, see troubleshooting chart 3-18.
18. Unkey transmitter.

## Distortion Test (X-Mode) at 500 Hz

19. Connect T-connector to AN/USM-207.
20. If necessary, turn AN/URM-127 OUTPUT CONTROL clockwise until display appears on AN/USM-207.
21. Turn AN/URM-127 FREQ RANGE DIAL to 50, then adjust for 500-Hz indication on AN/USM-207.
22. Disconnect T-connector from AN/USM-207.
23. Set TS-723(\*)/U FUNCTION switch to SET LEVEL.
24. Repeat steps 10 through 18.

## Distortion Test (X-Mode) at 3 kHz

25. Connect T-connector to AN/USM-207.
26. If necessary, turn AN/URM-127 OUTPUT CONTROL clockwise until display appears on AN/USM-207.
27. Turn AN/URM-127 FREQ RANGE MULTIPLIER to x100.
28. Turn FREQ RANGE DIAL to 30, then adjust for 3-kHz indication on AN/USM-207.
29. Disconnect T-connector from AN/USM-207.
30. Set TS-723(\*)/U FUNCTION switch to SET LEVEL.
31. Repeat steps 10 through 18.

### 3-17. TRANSMITTER DISTORTION TEST (X-MODE). (CONT)

Distortion Test (X-Mode) at 5 kHz

32. Connect T-connector to AN/USM-207.
33. If necessary, turn AN/URM-127 OUTPUT CONTROL clockwise until display appears on AN/USM-207.
34. Turn FREQ RANGE DIAL to 50, then adjust for 5-kHz indication on AN/USM-207.
35. Disconnect T-connector from AN/USM-207.
36. Set TS-723(\*)/U FUNCTION switch to SET LEVEL.
37. Repeat steps 10 through 18.

Distortion Test (X-Mode) at 10 kHz

38. Connect T-connector to AN/USM-207.
39. If necessary, turn AN/URM-127 OUTPUT CONTROL clockwise until display appears on AN/USM-207.
40. Turn FREQ RANGE DIAL to 100, then adjust for 10-kHz indication on AN/USM-207.
41. Disconnect T-connector from AN/USM-207.
42. Set TS-723(\*)/U FUNCTION switch to SET LEVEL.
43. Repeat steps 10 through 18.

### 3-18. TRANSMITTER SQUELCH TONE STABILITY TEST.

PURPOSE. Transmitter squelch tone must be accurate if a distant radio is to receive the desired signals. This test checks Speech Amplifier A8500 and Squelch Amplifier A5200 modules for proper squelch tone development. The RT is keyed with the SQUELCH switch set to NEW ON. Frequency accuracy and deviation measurements are then taken with a frequency counter and a deviation meter.

#### TEST EQUIPMENT AND MATERIALS

Power Supply PP-1104(\*)/G  
Frequency Counter AN/USM-207  
Modulation Meter ME-57/U  
Adapters UG-274/U, UG-201/U

Wattmeter AN/URM-120  
Dummy Load DA-75/U  
Rf Cables (four) RG-58/U  
Maintenance Kit MK-1978/VRC

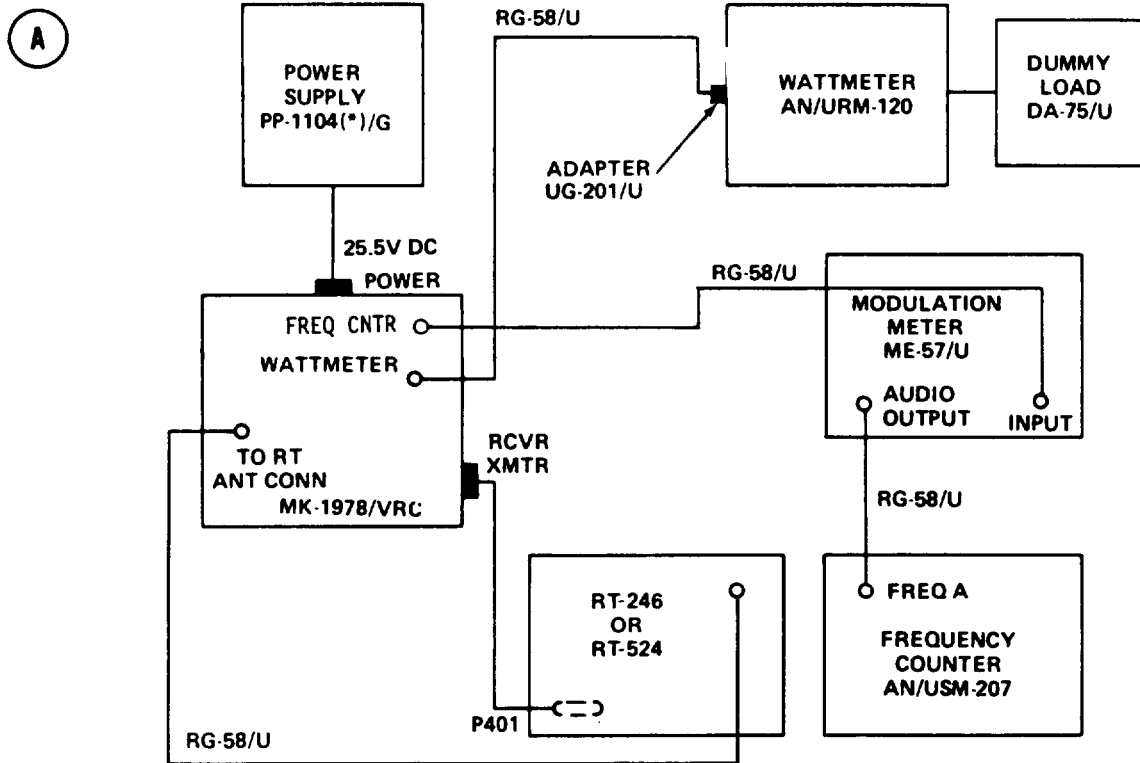
TEST SETUP. Connect equipment as shown in test setup diagram **(A)**, page 3-57.

#### **CAUTION**

Do not set MK-1978/VRC KEY switch to XMIT unless AN/URM-120 and DA-75/U are connected to MK-1978/VRC WATTMETER jack.

ME-57/U DEVIATION RANGE-KC switch must be in 1000 TUNE position.

3-18. TRANSMITTER SQUELCH TONE STABILITY TEST. (CONT)



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Turn on test equipment. Allow at least 30 minutes for warmup.

INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment controls as indicated in the following table.

CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
AN/USM-207	POWER DISPLAY SENSITIVITY GATE TIME FUNCTION	TRACK MIN (fully counterclockwise) 0.1 v 10' (black knob) FREQ

3-18. TRANSMITTER SQUELCH TONE STABILITY TEST. (CONT)

CONTROL AND SWITCH SETTINGS (CONT)

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
AN/URM-120	10 W – 500 W	10 W
ME-57/U	TUNE-FINE TUNE DEVIATION RANGE-KC FREQUENCY RANGE-MC TUNING  POWER	TUNE 1000 TUNE 20-55 30-MHz indication on FREQUENCY-MC meter with transmitter keyed  ON
RT	LIGHT BAND MC-TUNE-KC POWER SQUELCH VOLUME SPEAKER (RT-524/VRC)	ON Ⓐ 30.00 LOW OLD ON Fully counterclockwise OFF
MK-1978/VRC	POWER AUDIO KEY AUX RCVR X-MODE (RT) SQUELCH	ON MUTED RCVE NORMAL NORMAL ON

TEST PROCEDURE

1. Key transmitter.
2. Rotate ME-57/U TUNING knob until CARRIER SHIFT meter indicates 0 KC.
3. Change ME-57/U TUNE-FINE TUNE switch to FINE TUNE.
4. Readjust ME-57/U TUNING knob until CARRIER SHIFT meter again indicates 0 KC.

**NOTE**

ME-57/U LIMITING meter pin must be in BLACK area.

5. Turn RT SQUELCH switch to NEW ON.
6. Step ME-57/U DEVIATION RANGE KC switch to lower settings until obtaining highest on-scale reading (without pinning needle) on DEVIATION meter.

**STANDARD.** ME-57/U DEVIATION meter should indicate 3 kHz ± 0.5 kHz. AN/USM-207 should display 150 Hz ± 1 Hz (0.150 kc ± 0.001 kc).

7. If ME-57/U DEVIATION meter indicates below 2.5 kHz or above 3.5 kHz; or if AN/USM-207 displays below 149 Hz or above 151 Hz, see troubleshooting chart 3-13.
8. Unkey transmitter.



### 3-18.1 RECEIVER RECOVERY TIME TEST

**PURPOSE.** This test checks the receiver recovery time. The test measures the time between unkeying the transmitter and reception of a signal. This test is applicable only to radio sets in systems requiring rapid recovery time.

#### TEST EQUIPMENT AND MATERIALS

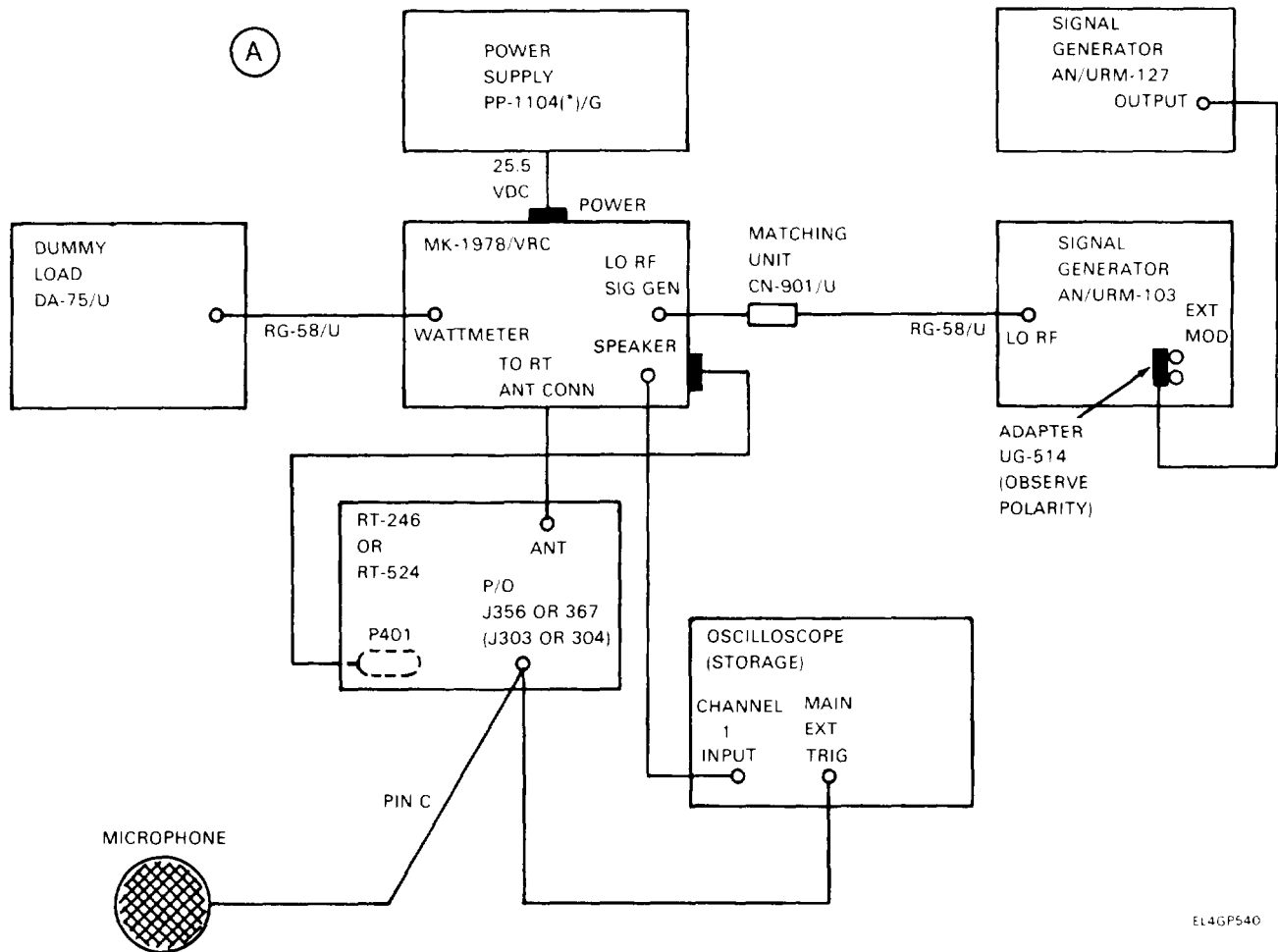
Power Supply PP-1104(\*)/G  
 Oscilloscope (STORAGE)  
 Signal Generator AN/URM-103  
 Dummy Load DA-75/U  
 Signal Generator AN/URM-127

Maintenance Kit MK-1978/VRC  
 Matching Unit CN-901/U  
 Adapter UG-514  
 Rf Cables (five) RG-58/U  
 Handset H-250/U

**TEST SETUP.** Connect equipment as shown in test setup diagram (A).

#### CAUTION

Do not key RT Unit unless DA-75/U is connected to MK-1978/VRC WATTMETER jack.



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**3-18.1 RECEIVER RECOVERY TIME TEST. (CONT)**

Turn on test equipment and allow at least 30 minutes for warmup.

INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment controls as indicated in the following table.

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
AN/URM-127	POWER FREQ RANGE MULTIPLIER FREQ RANGE DIAL ATTENUATOR OUTPUT CONTROL	ON x1 150 x1 Adjust to cause 3 kHz deviation on AN/URM-103
AN/URM-103	OPERATE/OFF/STANDBY BAND SWITCH RF TUNING DEVIATION RANGE KHZ FUNCTION DEVIATION RF SET TO LINE RF OUTPUT LO RF $\mu$ V	OPERATE Ⓑ 30.00 10 EXT MOD Adjust for 3 kHz meter indication (with AN/URM-127) To red line LO, 0-10 KUV 20 $\mu$ v
RT	BAND MC-TUNE-KC SQUELCH LIGHT VOLUME POWER SPEAKER	Ⓐ 30.00 NEW ON ON Fully counterclockwise LOW OFF

**3-18.1 RECEIVER RECOVERY TIME TEST. (CONT)**

CONTROL AND SWITCH SETTINGS (CONT)

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
OSCILLOSCOPE (Storage)	Refer to storage oscilloscope manual for procedures and control settings to observe receiver recovery time.	
MK-1978/VRC	AUX POWER AUDIO KEY X-MODE (RT) AUX RCVR SQUELCH	ON MUTED RCVE NORMAL NORMAL ON

TEST PROCEDURE

1. Reset storage oscilloscope single sweep.
2. Set storage oscilloscope trigger slope level to (-).
3. Key RT Unit using handset, then release PTT switch.

**NOTE**

Repeat steps 1 and 3 as required for accurate adjustment of oscilloscope.

**STANDARD.** Recovery time should be less than 1.0 second.

4. If recovery time is more than 1.0 second realine A5000 and/or replace relay K5001.



**3-19. ANTENNA INFORMATION (SWITCHING) TEST.**

**PURPOSE.** This test checks the performance of the RT ANTENNA CONTROL switches and ANT CONT jack connectors. The transmitter is keyed, and the MK-1978/VRC indicator lights are observed for proper response to band and frequency selections.

**TEST EQUIPMENT AND MATERIALS**

Power Supply PP-1104(\*)/G  
 Wattmeter AN/URM-120  
 Dummy Load DA-75/U

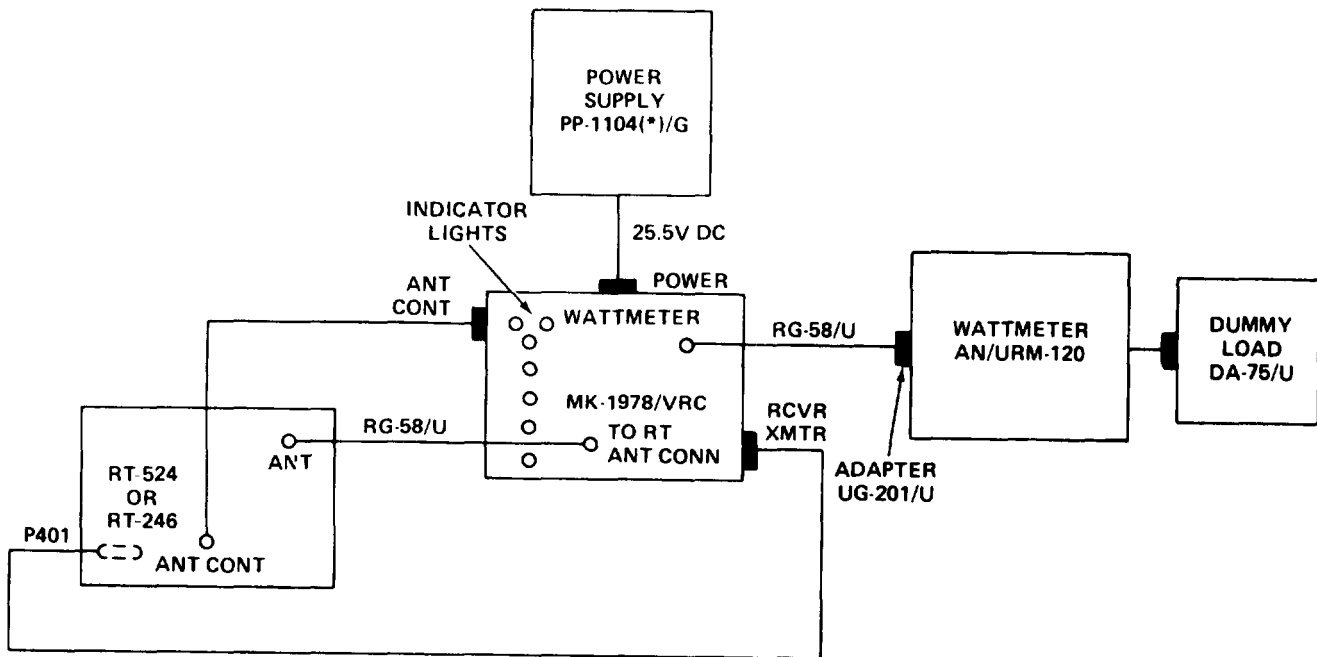
Rf Cables (two) RG-58/U  
 Maintenance Kit MK-1978/VRC

**TEST SETUP.** Connect equipment as shown in test setup diagram (A).

**CAUTION**

Do not set MK-1978/VRC KEY switch to XMIT unless AN/URM-120 and DA-75/U are connected to MK-1978/VRC WATTMETER jack.

(A)



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Turn on test equipment. Allow at least 15 to 30 minutes for warmup.

3-19. ANTENNA INFORMATION (SWITCHING) TEST. (CONT)

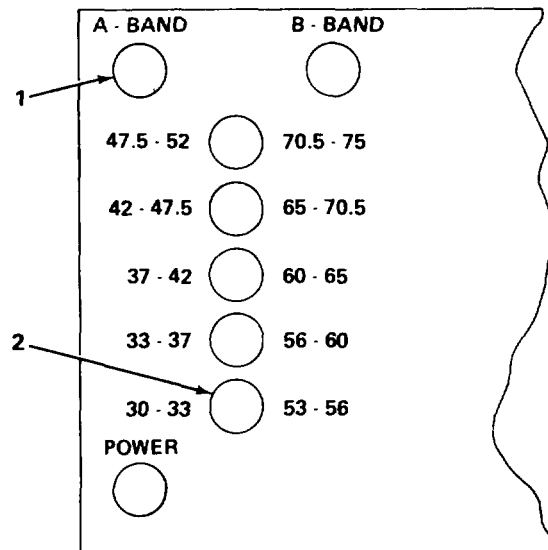
INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment controls as indicated in the following table.

CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
AN/URM-120	10 W-500 W	10 W
RT	LIGHT BAND MC-TUNE-KC POWER SQUELCH VOLUME SPEAKER(RT-524/VRC)	ON Ⓐ 30.00 LOW OLD ON Fully counterclockwise OFF
MK-1978/VRC	POWER AUDIO KEY AUX RCVR X-MODE (RT) SQUELCH	ON MUTED RCVE NORMAL NORMAL ON

TEST PROCEDURE

Ⓑ



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1. Observe MK-1978/VRC indicator lamps.

**STANDARD.** MK-1978/VRC Ⓐ -BAND (1) and 30-33 (2) indicator lamps light. (See test setup diagram Ⓑ .)

2. If proper lamps do not light, see troubleshooting chart 3-15.

**3-19. ANTENNA INFORMATION (SWITCHING) TEST. (CONT)**

3. Turn RT MC-TUNE-KC switches to frequencies listed in following table. At each frequency, observe MK-1978/VRC indicator lamps for proper response. (See standard below.)

**NOTE**

Turn RT BAND switch to **(B)** for frequencies 53.00 MHz and above.

MC-TUNE-KC FREQUENCY (MHZ)	MK-1978 INDICATOR LAMPS	
	BAND	RANGE
35.05	(A)	33-37
38.10	(A)	37-42
41.20	(A)	37-42
45.30	(A)	42-47.5
52.80	(A)	47.5-52
53.00	(B)	53-56
54.40	(B)	53-56
56.50	(B)	56-60
61.60	(B)	60-65
69.70	(B)	65-70.5
75.95	(B)	70.5-75

**STANDARD.** Proper MK-1978/VRC frequency range and BAND lamps light at each tuned frequency.

4. If proper lamps do not light at each tuned frequency, see troubleshooting chart 3-15.

**3-20. AUTOMATIC FREQUENCY SELECTION TEST.**

**NOTE**

This test can be conducted on the RT-246/VRC only. The RT-524/VRC does not feature automatic frequency control.

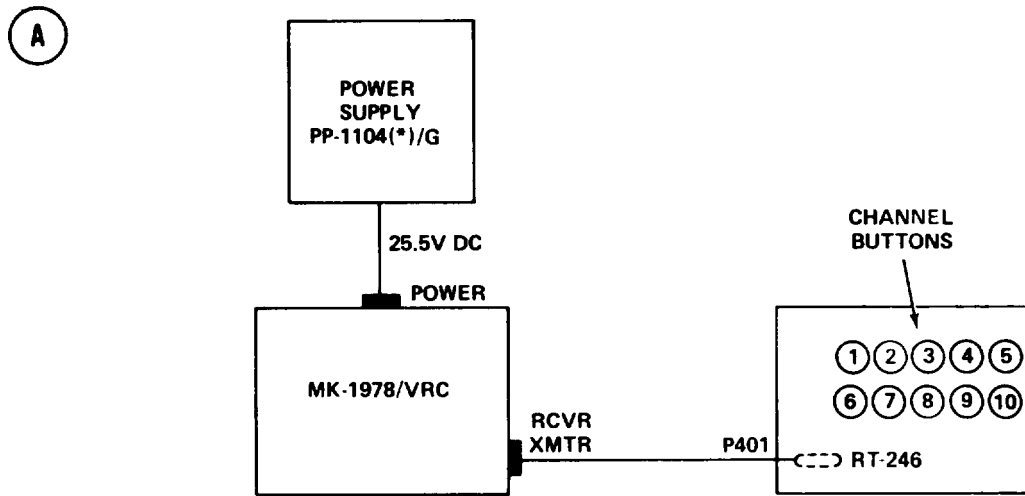
**PURPOSE.** This test checks the RT-246/VRC servosystem, which allows the operator to pretune the radio to any 10 of the 920 available channels. Each channel button is preset, then pressed in turn The selected frequency should appear in the dial window within 5 seconds.

**TEST EQUIPMENT AND MATERIALS**

- Power Supply PP-1104(\*)/G
- Maintenance Kit MK-1978/VRC
- Wristwatch or Stopwatch

3-20. AUTOMATIC FREQUENCY SELECTION TEST. (CONT)

TEST SETUP. Connect equipment as shown in test setup diagram (A).



Turn on test equipment. Allow at least 15 to 30 minutes for warmup.

INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment controls as indicated in the following table.

CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
MK-1978/VRC	POWER	ON
RT-246/VRC	LIGHT	ON
	BAND	AUTO
	MC-TUNE-KC	75.95
	POWER	LOW
	SQUELCH	OLD OFF
	VOLUME	Fully counterclockwise
	Channel Buttons (preset)	① 30.00 MHZ
		② 39.15 MHZ
		③ 42.20 MHZ
		④ 43.30 MHZ
	⑤ 54.40 MHZ	
	⑥ 56.50 MHZ	
	⑦ 67.60 MHZ	
	⑧ 68.70 MHZ	
	⑨ 71.80 MHZ	
	⑩ 75.95 MHZ	



**3-20. AUTOMATIC FREQUENCY SELECTION TEST. (CONT)****NOTE**

Directions for presetting channel buttons appear in paragraph 3-45.

**TEST PROCEDURE**

1. Press RT-246/VRC channel button (1) (See test setup diagram **(A)**, page 3-62.)  
Note time required for frequency to appear in dial window.

**STANDARD.** 30.00-MHz display should appear in RT-246/VRC dial window within 5 seconds.

2. If 30.00-MHz display does not appear in RT-246/VRC dial window within 5 seconds, see paragraph 3-45.
3. Press each channel button (in any order). Note time required for each frequency to appear in dial window.

**STANDARD.** Each preset frequency should appear in dial window within 5 seconds of selection.

4. If correct display does not appear within 5 seconds of each new frequency selection, see paragraph 3-45.

**Section II TROUBLESHOOTING**

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**3-21. GENERAL.**

This section contains troubleshooting charts which will help you diagnose failures in the RT. The troubleshooting charts are designed to isolate faults in response to specific performance problems noted during performance testing in section I of this chapter.

There are two basic kinds of troubleshooting charts provided: gross failure troubleshooting and performance degradation troubleshooting. Both kinds of troubleshooting are based on the use of TMDE and Maintenance Kit MK-1978/VRC.

**GROSS FAILURE TROUBLESHOOTING**

Gross failure troubleshooting is generated by failure of the VOLUME control test, the first of the performance tests in section I of this chapter. Failure of the VOLUME control test indicates that no audio at all is available at the receiver's loudspeaker jack. This implies a total failure of some module or component resulting in complete loss of signal. Therefore, the gross troubleshooting charts are designed to help you locate component, with the assumption that the failed part does not operate at all.

This assumption differs from the approach taken in performance degradation troubleshooting, which assumes that a module or component may be responsible for slight defect symptoms because the part may be only partially operational.

**3-21. GENERAL. (CONT)**

**PERFORMANCE DEGRADATION TROUBLESHOOTING**

When its signals fail to meet certain standards, the RT's performance is considered degraded. Degraded performance can result in weak audio, limited reception range, distortion, and many other problems.

The troubleshooting charts are designed to locate the cause of the performance degradation by using procedures more complex than those utilized for gross troubleshooting. Added complexity is due to the fact that the troubleshooting tests must evaluate the quality of the signals at various test points, instead of merely confirming the presence of signals as is usually the case in gross troubleshooting.

**OVERALL TROUBLESHOOTING APPROACH**

Both kinds of troubleshooting charts contained in this section are intended for use based on the following assumptions in connection with the RT.

1. Only one malfunction exists which is causing the defect symptom.
2. The troubleshooting charts do not isolate every possible defect.
3. Failure to locate a defect using the charts suggests a wiring-related problem which can be isolated using the schematics located in the back of this manual.
4. Troubleshooting procedures for germanium and silicon versions of the RT are the same.

**3-22. GROSS TROUBLESHOOTING PRELIMINARY INSTRUCTIONS.**

The gross troubleshooting charts in this section are based on the assumption that the receiver fails the VOLUME control test at any frequency setting of the MC-TUNE-KC control. However, certain defects in the crystal reference system can result in loss of audio at some frequencies while the receiver can function normally at other frequency settings.

Before proceeding with the steps given in the gross troubleshooting charts, determine whether or not the failure of the VOLUME control test conforms to any of the following failure modes.

FAILURE MODE	CAUSE	CORRECTION
No audio on all channels ending in "0", (eg, 30.00, 30.10,30.20,etc).	Crystal Y2012 (5.65 MHz) in A2000 assembly.	Replace A2000 assembly.
No audio on all channels ending in "5", (eg, 30.05, 30.15,30.25,etc).	Crystal Y2011 (5.60 MHz) in A2000 assembly.	Replace A2000 assembly.
NO audio on the same 100-kHz segment for each MHz of tuning.	Defective interpolation oscillator crystal.	Replace A2000 assembly. See interpolation oscillator crystal chart.

**3-22. GROSS TROUBLESHOOTING PRELIMINARY INSTRUCTIONS (CONT)**

INTERPOLATION OSCILLATOR CRYSTAL CHART

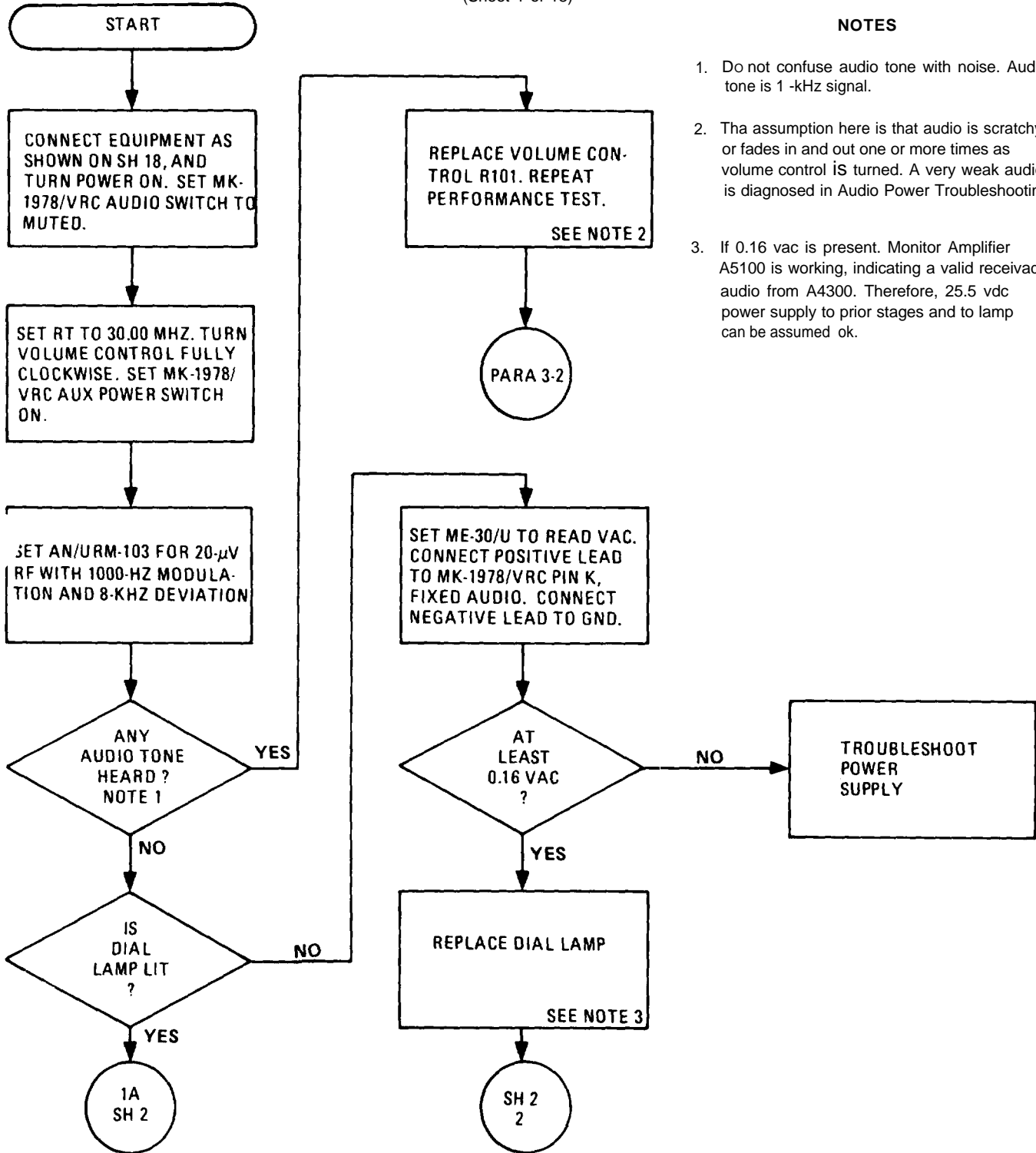
The following chart is used to isolate the particular crystal responsible for audio failure in the same 100-kHz segment for each MHz of tuning. In this failure mode, if audio is absent at 30.05 and 30.10, it will be absent at 40.05 and 40.10; 50.05 and 50.10, etc.

INTERPOLATION OSCILLATOR CRYSTAL CHART

SEGMENT OF KC CONTROL WHERE AUDIO IS ABSENT	CAUSE	CORRECTION
05 and 10	Crystal Y2007	Replace A2000 assembly.
15 and 20	Crystal Y2008	Replace A2000 assembly.
25 and 30	Crystal Y2009	Replace A2000 assembly.
35 and 40	Crystal Y2010	Replace A2000 assembly.
45 and 50	Crystal Y2005	Replace A2000 assembly.
55 and 60	Crystal Y2004	Replace A2000 assembly.
65 and 70	Crystal Y2003	Replace A2000 assembly.
75 and 80	Crystal Y2002	Replace A2000 assembly.
85 and 90	Crystal Y2001	Replace A2000 assembly.
95 and 100	Crystal Y2006	Replace A2000 assembly.

3-23. TROUBLESHOOTING FLOW CHARTS.

CHART 3-1  
No Audio Troubleshooting  
(Sheet 1 of 18)

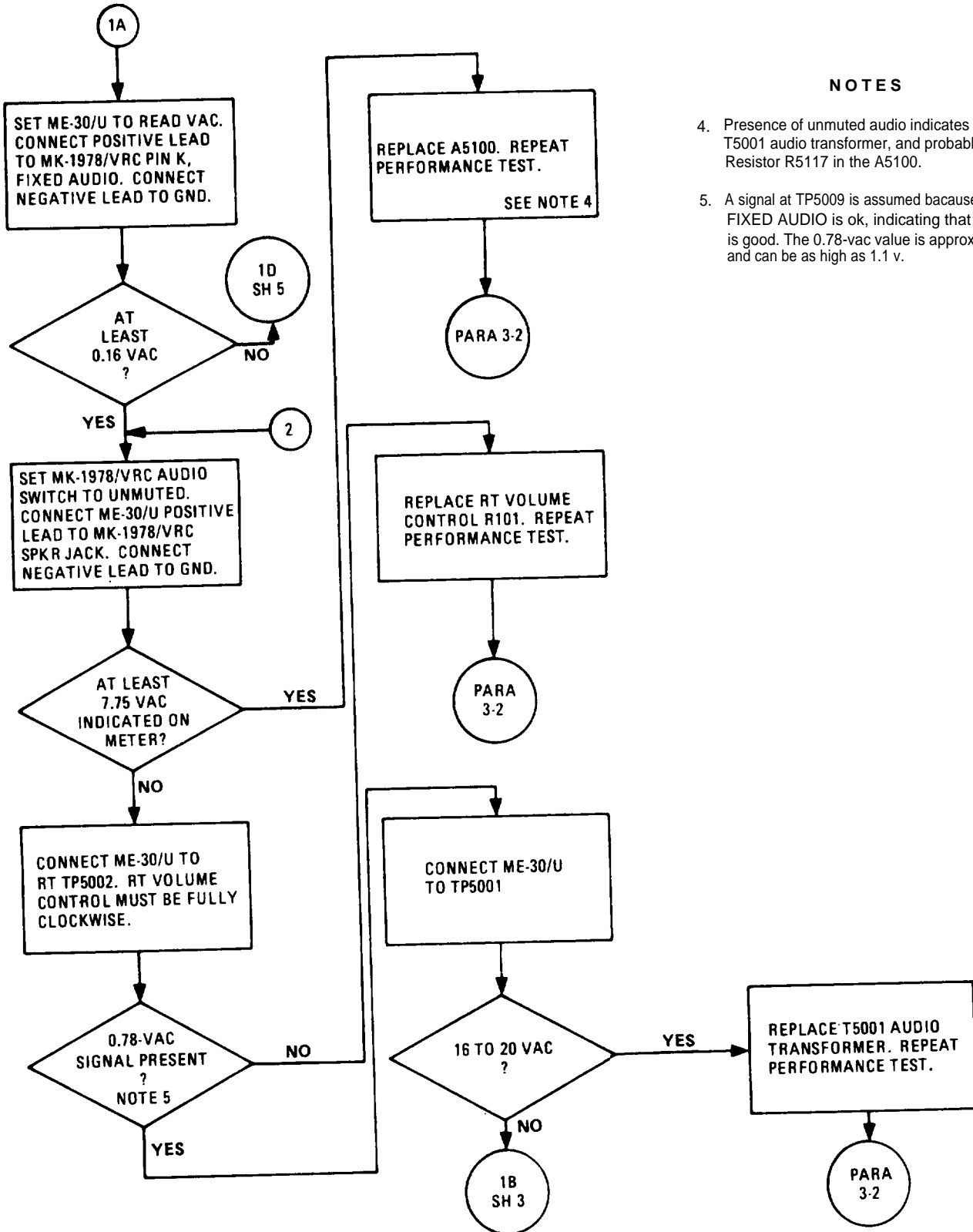


NOTES

1. Do not confuse audio tone with noise. Audio tone is 1-kHz signal.
2. The assumption here is that audio is scratchy or fades in and out one or more times as volume control is turned. A very weak audio is diagnosed in Audio Power Troubleshooting.
3. If 0.16 vac is present. Monitor Amplifier A5100 is working, indicating a valid received audio from A4300. Therefore, 25.5 vdc power supply to prior stages and to lamp can be assumed ok.

3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-1  
 No Audio Troubleshooting  
 (Sheet 2 of 18)

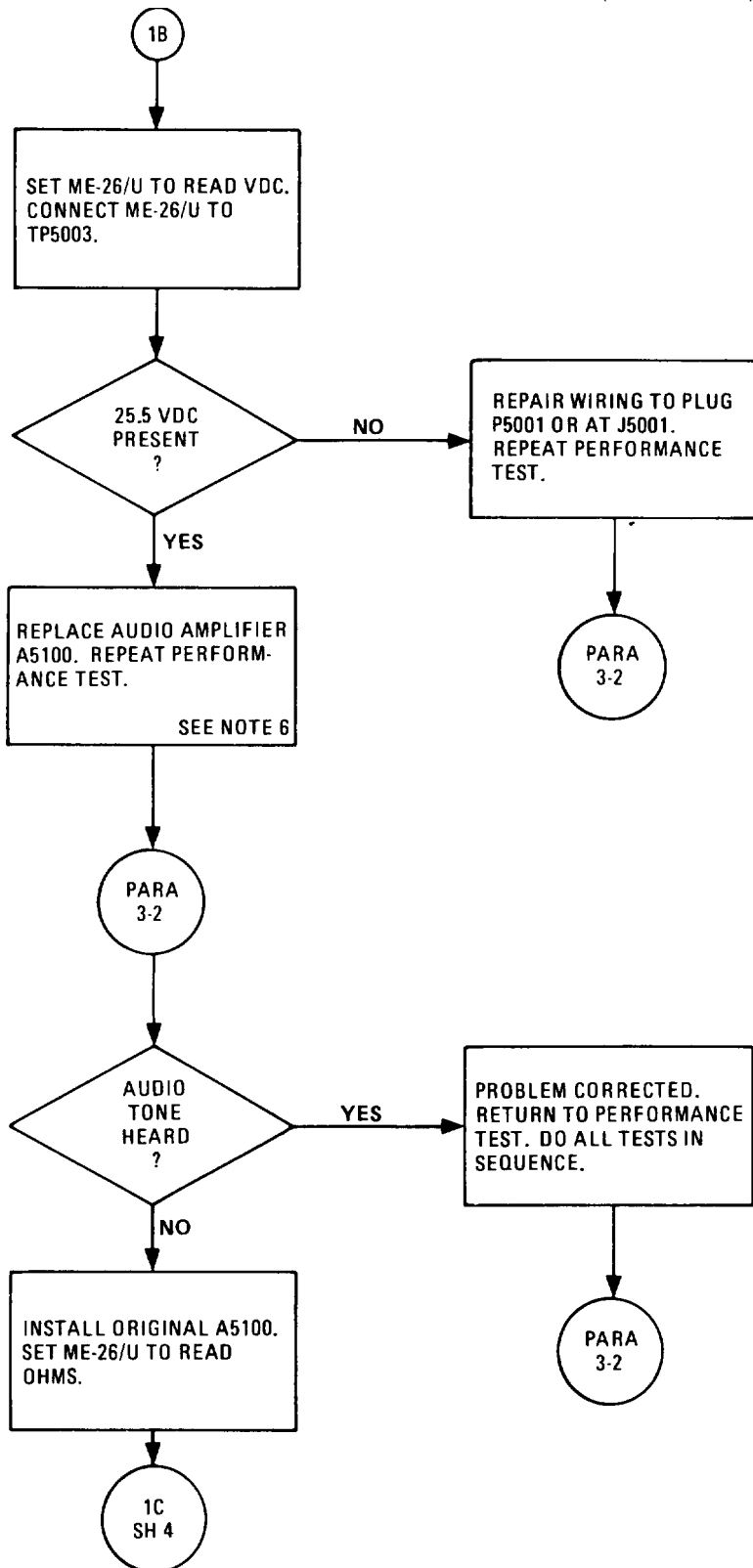


NOTES

4. Presence of unmuted audio indicates good T5001 audio transformer, and probable bad Resistor R5117 in the A5100.
5. A signal at TP5009 is assumed because FIXED AUDIO is ok, indicating that FL5001 is good. The 0.78-vac value is approximate, and can be as high as 1.1 v.

3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-1  
No Audio Troubleshooting  
(Sheet 3 of 18)

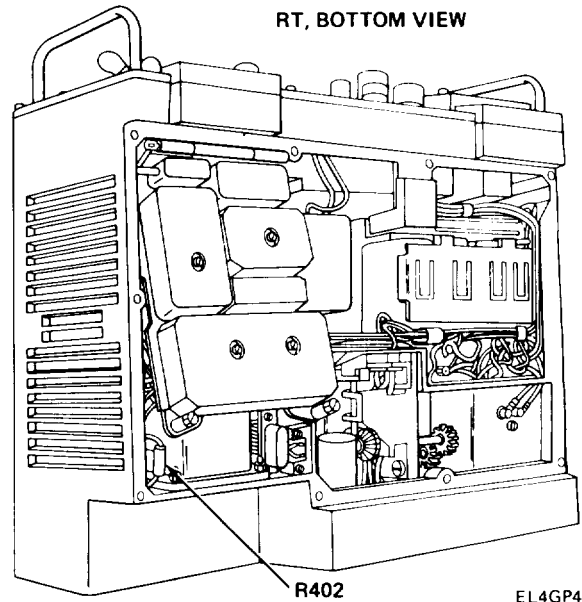
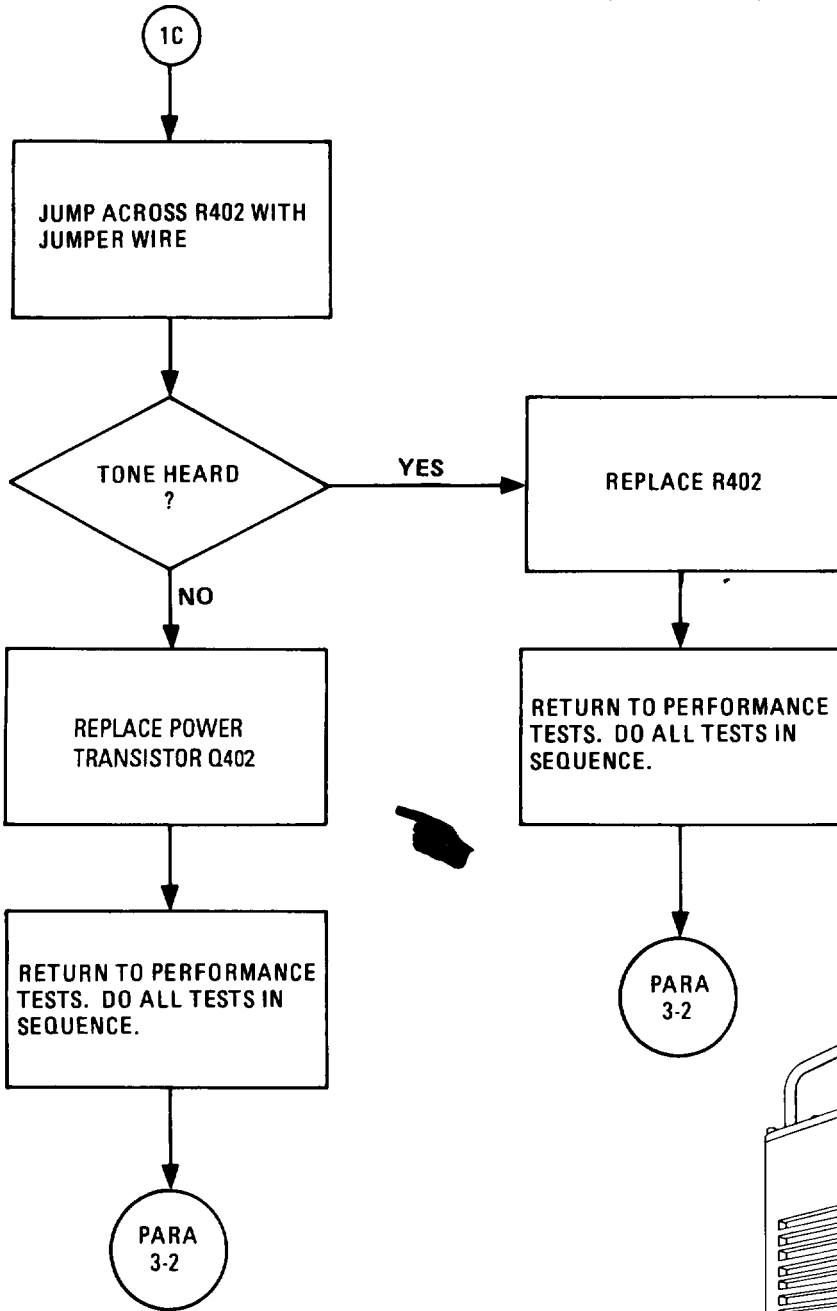


NOTES

- 6. Due to limited number of test points, component substitution is sometimes necessary. Absence of signal at TP5001 could be due to failed Power Transistor 0401 or Resistor R402. These components are difficult to test directly, and much more difficult to substitute than the A5100 Assembly.

3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-1  
No Audio Troubleshooting  
(Sheet 4 of 18)

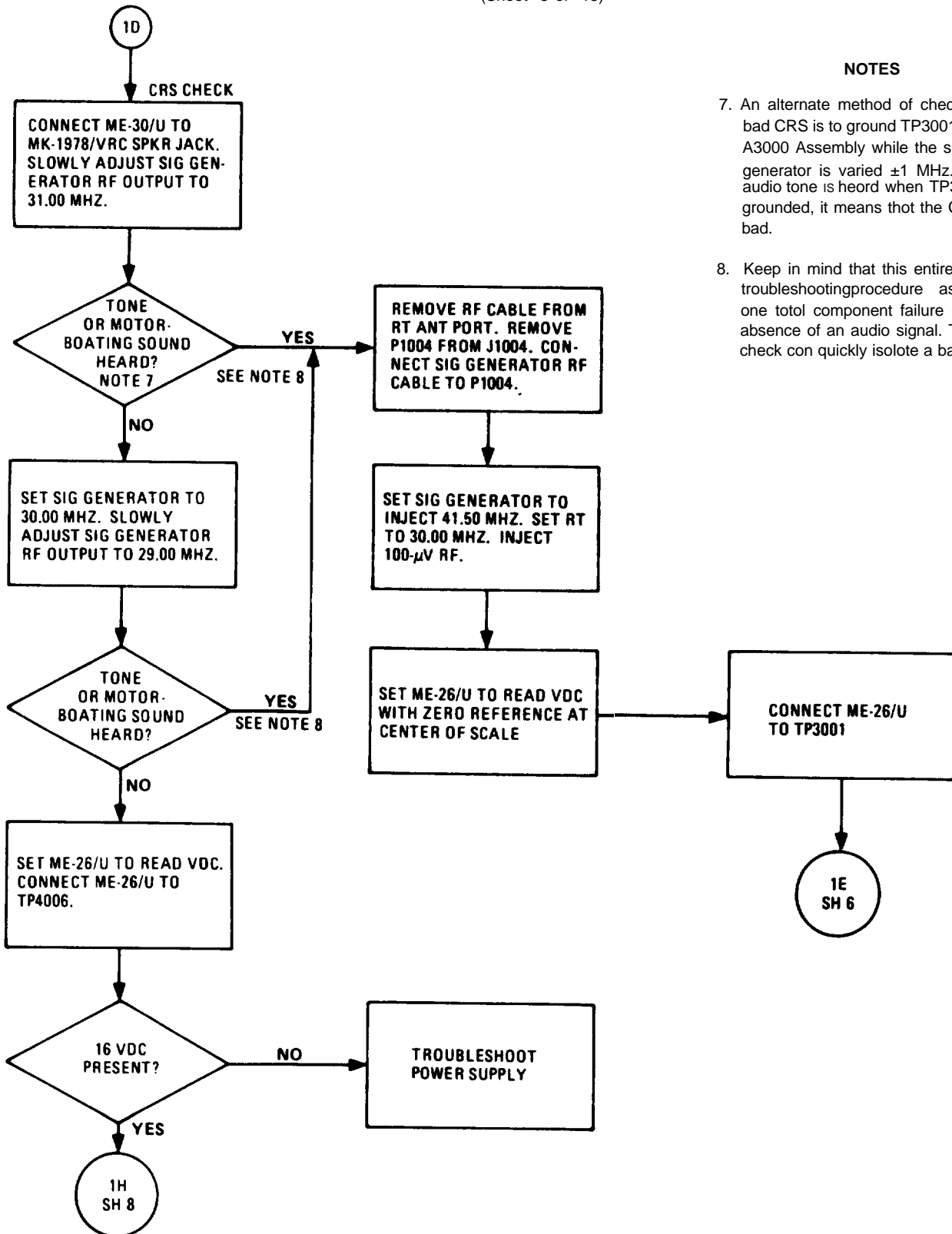


EL4GP486



3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-1  
No Audio Troubleshooting  
(Sheet 5 of 18)

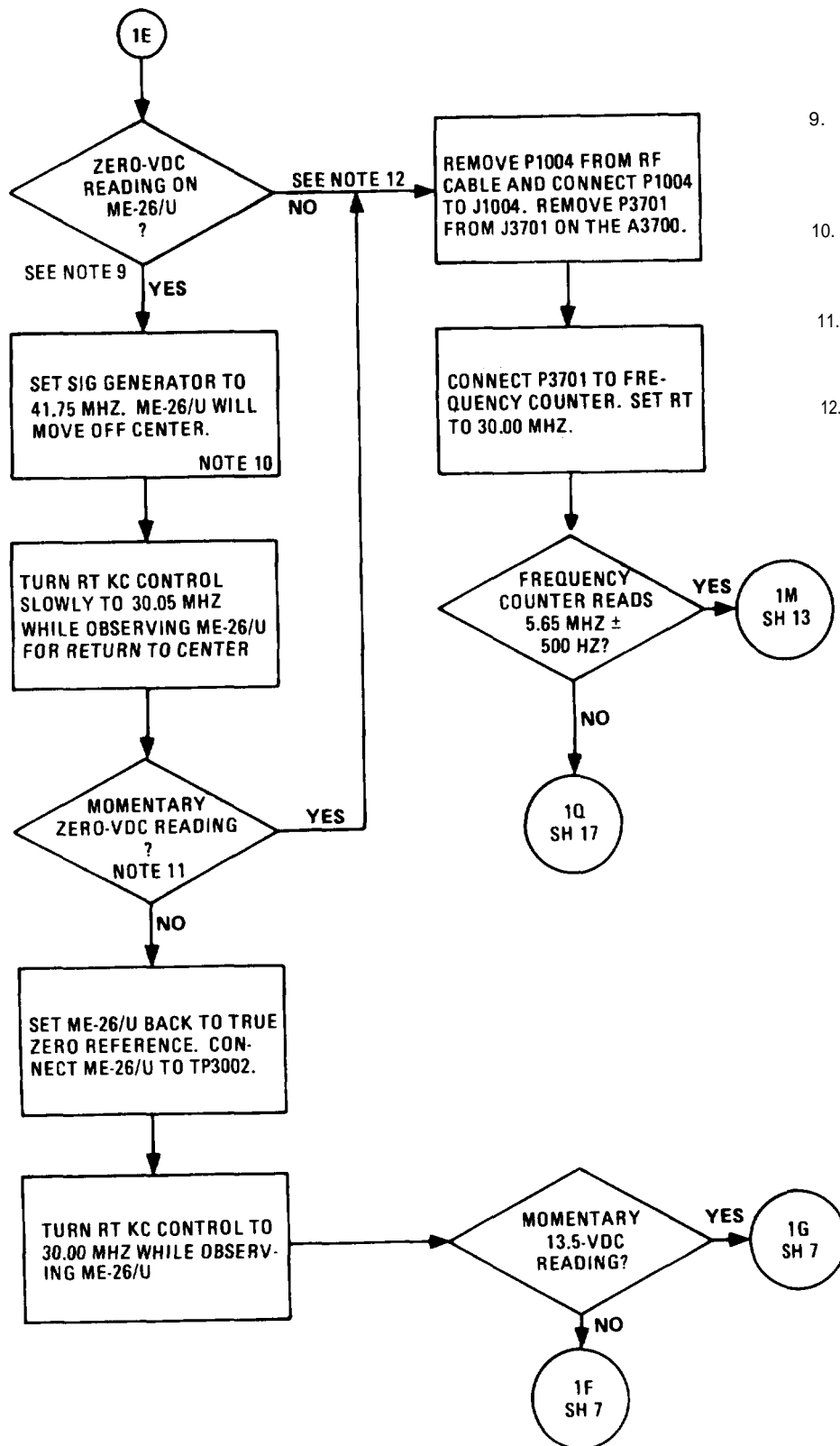


NOTES

7. An alternate method of checking for a bad CRS is to ground TP3001 in the A3000 Assembly while the sig generator is varied  $\pm 1$  MHz. If the audio tone is heard when TP3001 is grounded, it means that the CRS is bad.
8. Keep in mind that this entire troubleshooting procedure assumes one total component failure causing absence of an audio signal. This simple check can quickly isolate a bad CRS.

3-23. Troubleshooting Flow Charts. (CONT)

CHART 3-1  
No Audio Troubleshooting  
(Sheet 6 of 18)

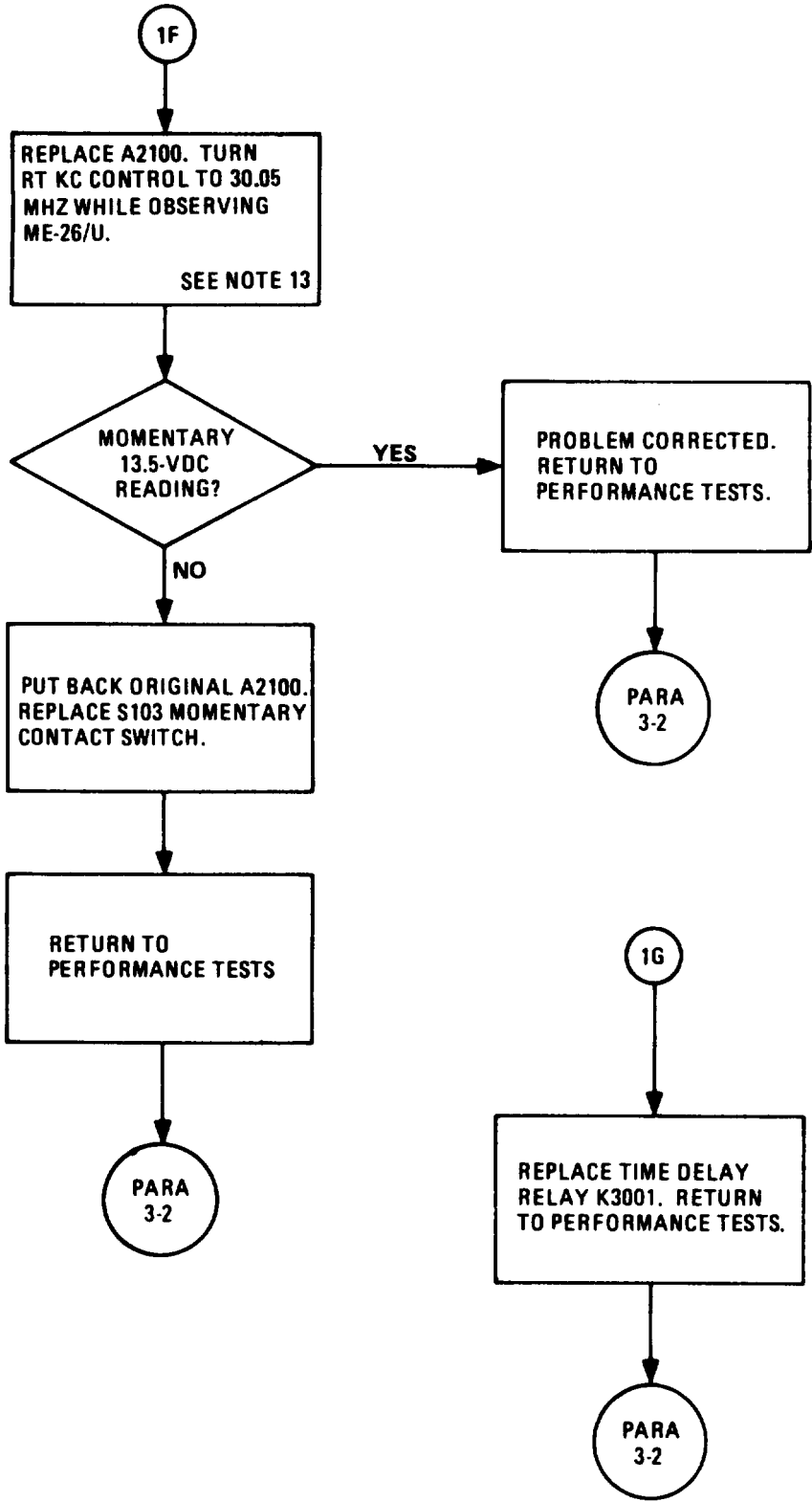


NOTES

9. With RT set at 30.00 MHz and 41.50 MHz injected into FL3002, there should be no error signal from the CRS. The meter will remain centered.
10. This setting should force the CRS to output a dc error voltage. The voltmeter will indicate this voltage.
11. If the Time Delay Relay K3001 fails to momentarily short the dc error signal, the CRS can shift the local oscillator 1 MHz.
12. Since previous steps confirmed presence of audio tone when CRS was isolated from other stages, the local oscillator can be considered aligned. Therefore, CRS must be generating incorrect error signal, driving local oscillator off frequency.

3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-1  
No Audio Troubleshooting  
(Sheet 7 of 18)

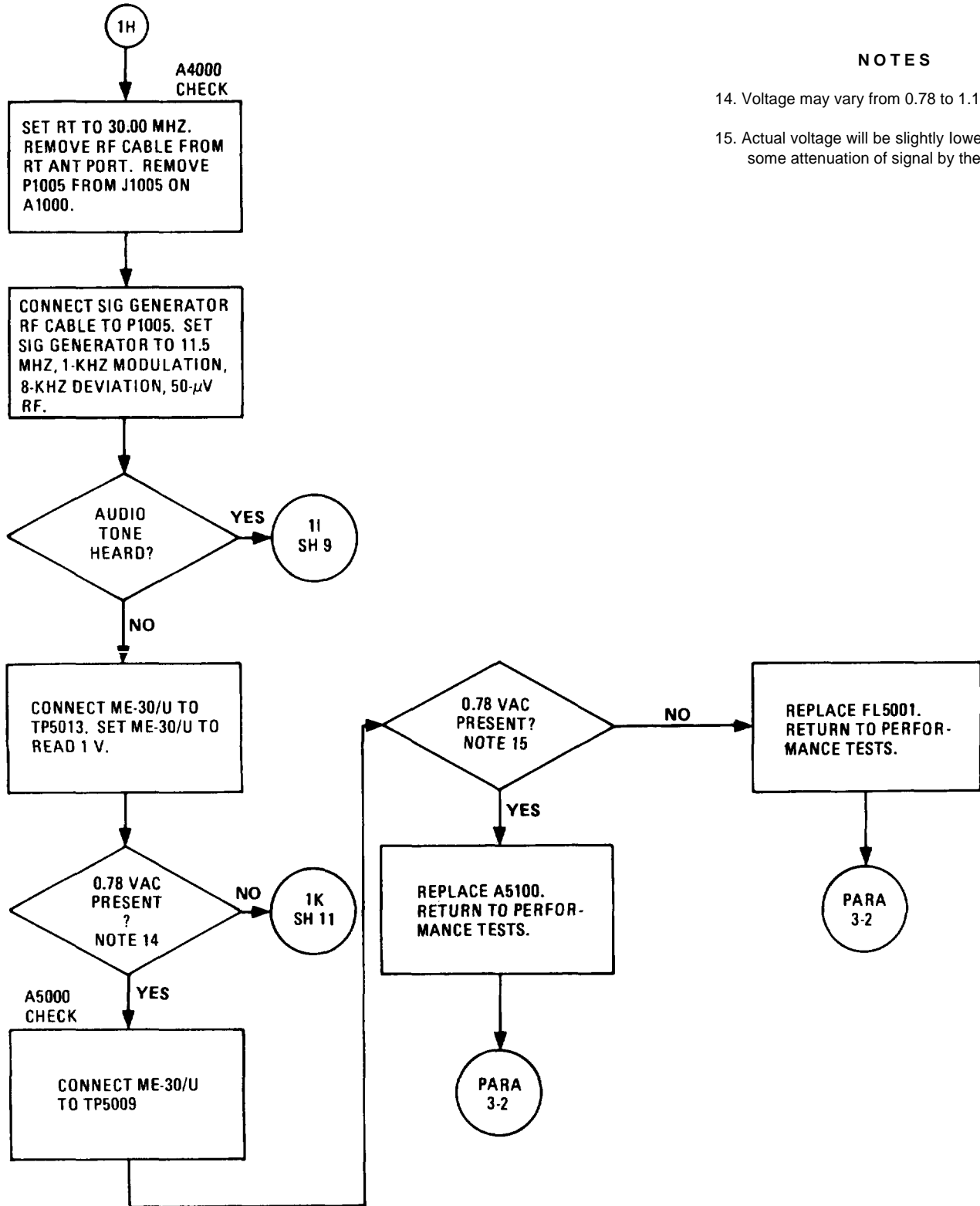


NOTE

13. Do not discard A2100.

3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-1  
No Audio Troubleshooting  
(Sheet 8 of 18)



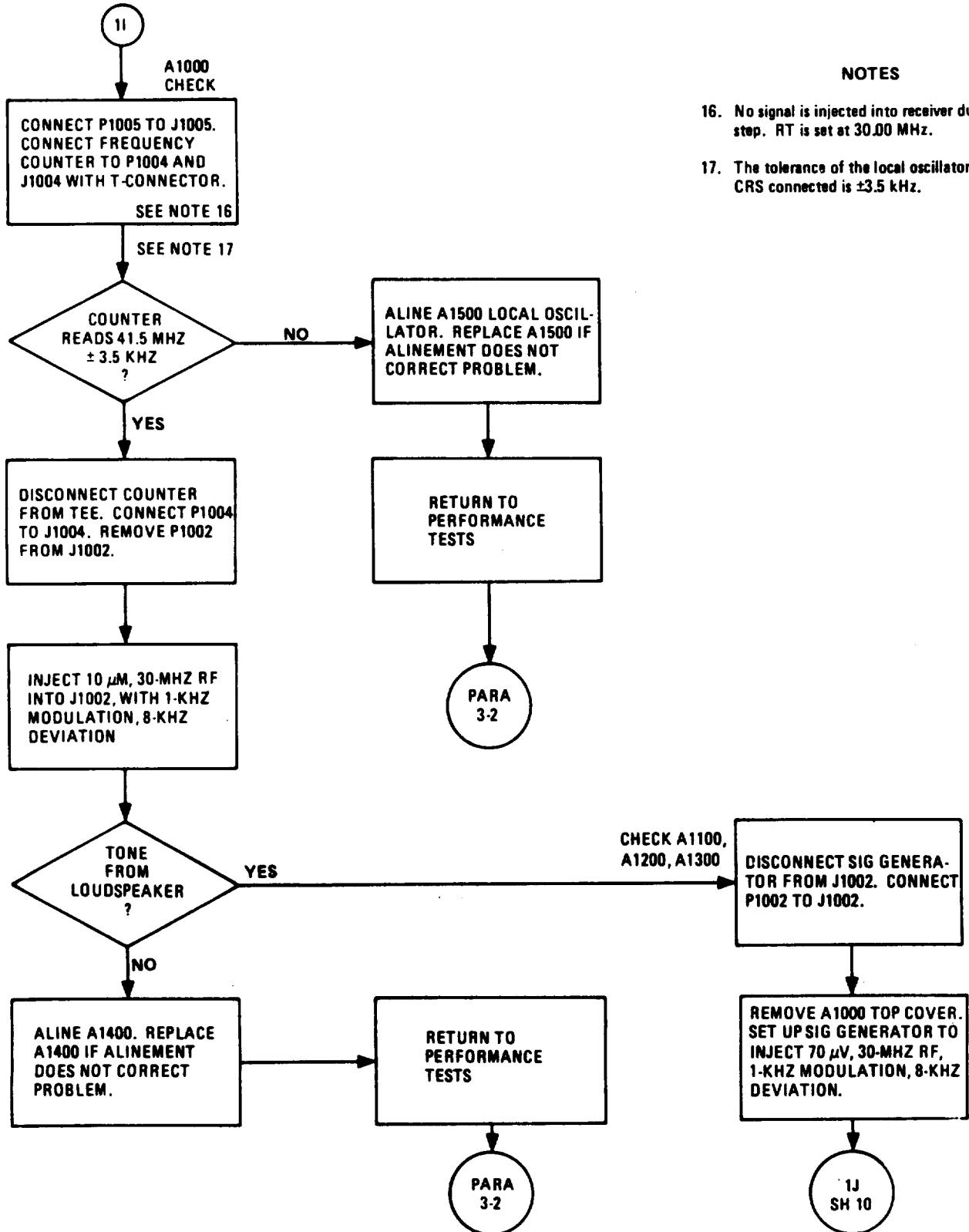
NOTES

14. Voltage may vary from 0.78 to 1.1 vac.

15. Actual voltage will be slightly lower due to some attenuation of signal by the filter.

3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-1  
No Audio Troubleshooting  
(Sheet 9 of 18)



NOTES

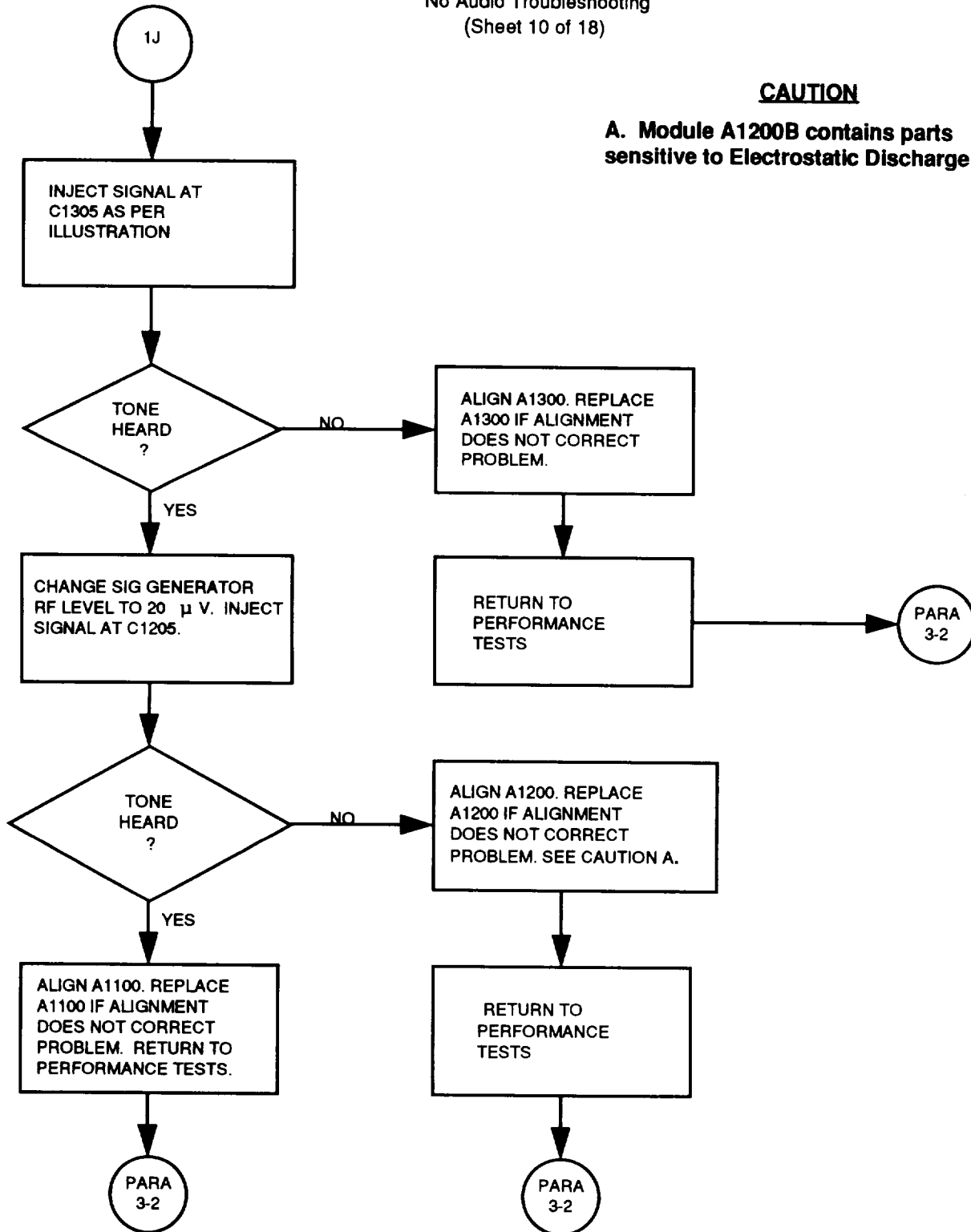
- 16. No signal is injected into receiver during this step. RT is set at 30.00 MHz.
- 17. The tolerance of the local oscillator with the CRS connected is  $\pm 3.5$  kHz.

3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-1  
No Audio Troubleshooting  
(Sheet 10 of 18)

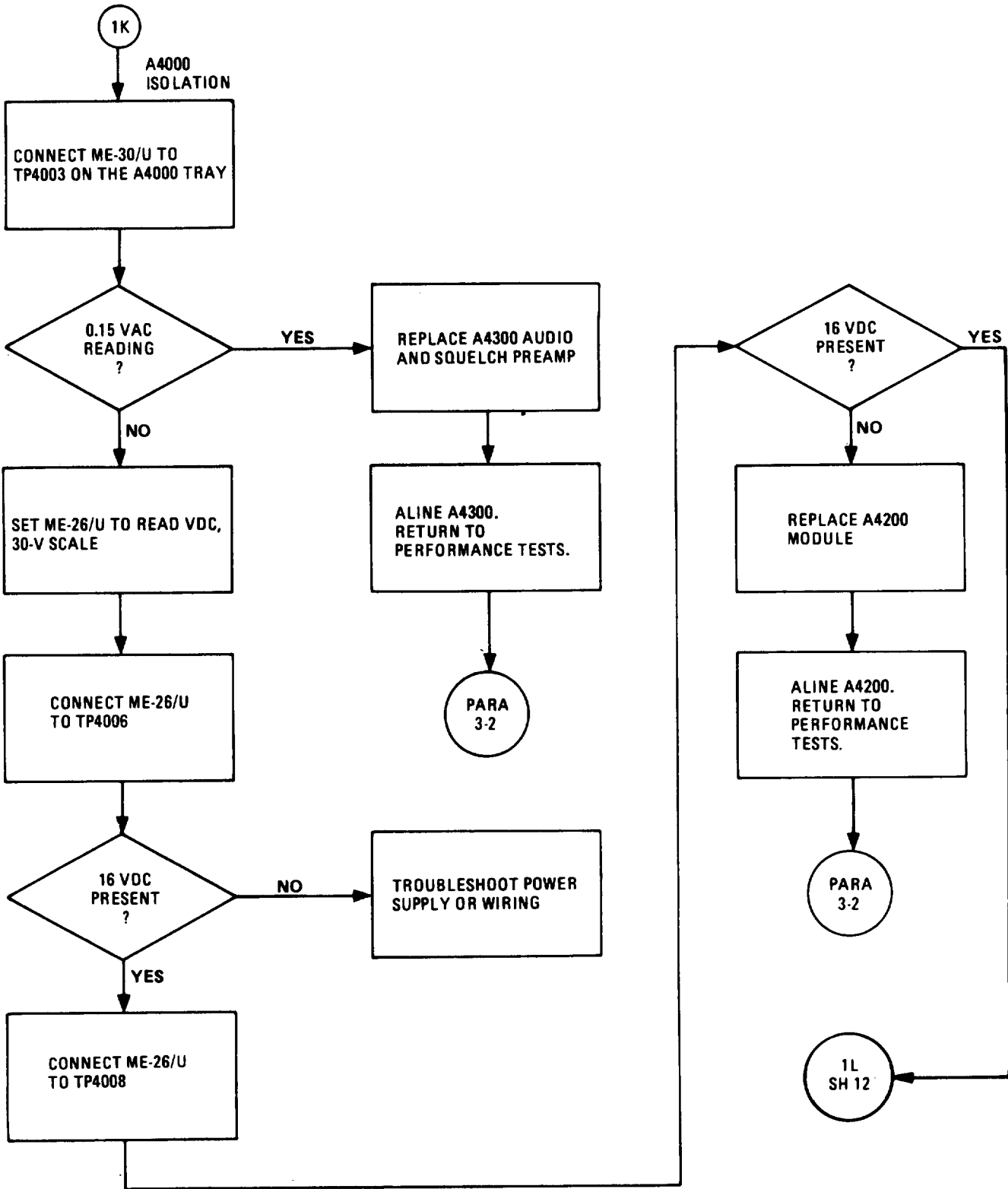
**CAUTION**

**A. Module A1200B contains parts sensitive to Electrostatic Discharge (ESD).**



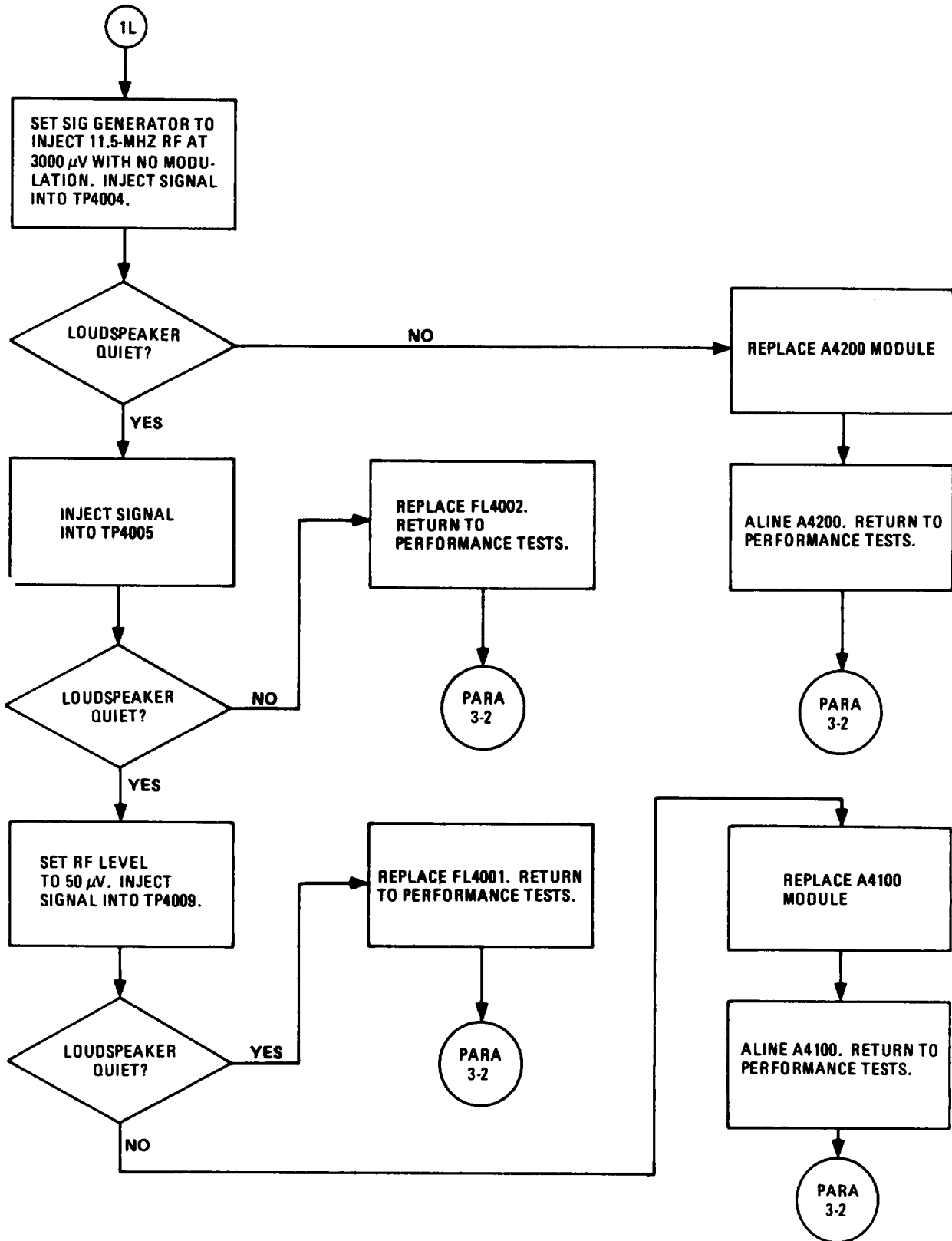
3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-1  
No Audio Troubleshooting  
(Sheet 11 of 18)



3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

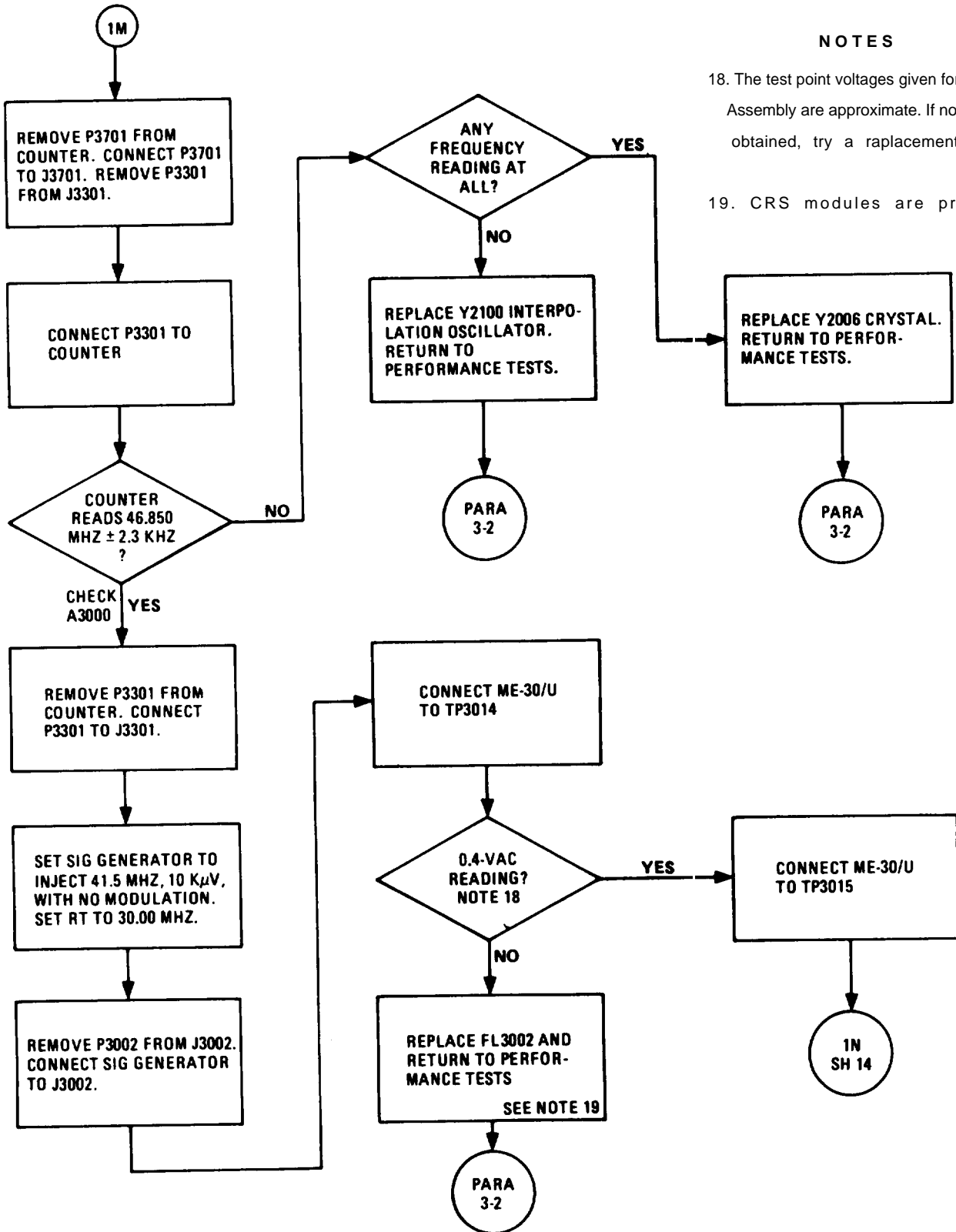
CHART 3-1  
No Audio Troubleshooting  
(Sheet 12 of 18)





3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-1  
No Audio Troubleshooting  
(Sheet 13 of 18)



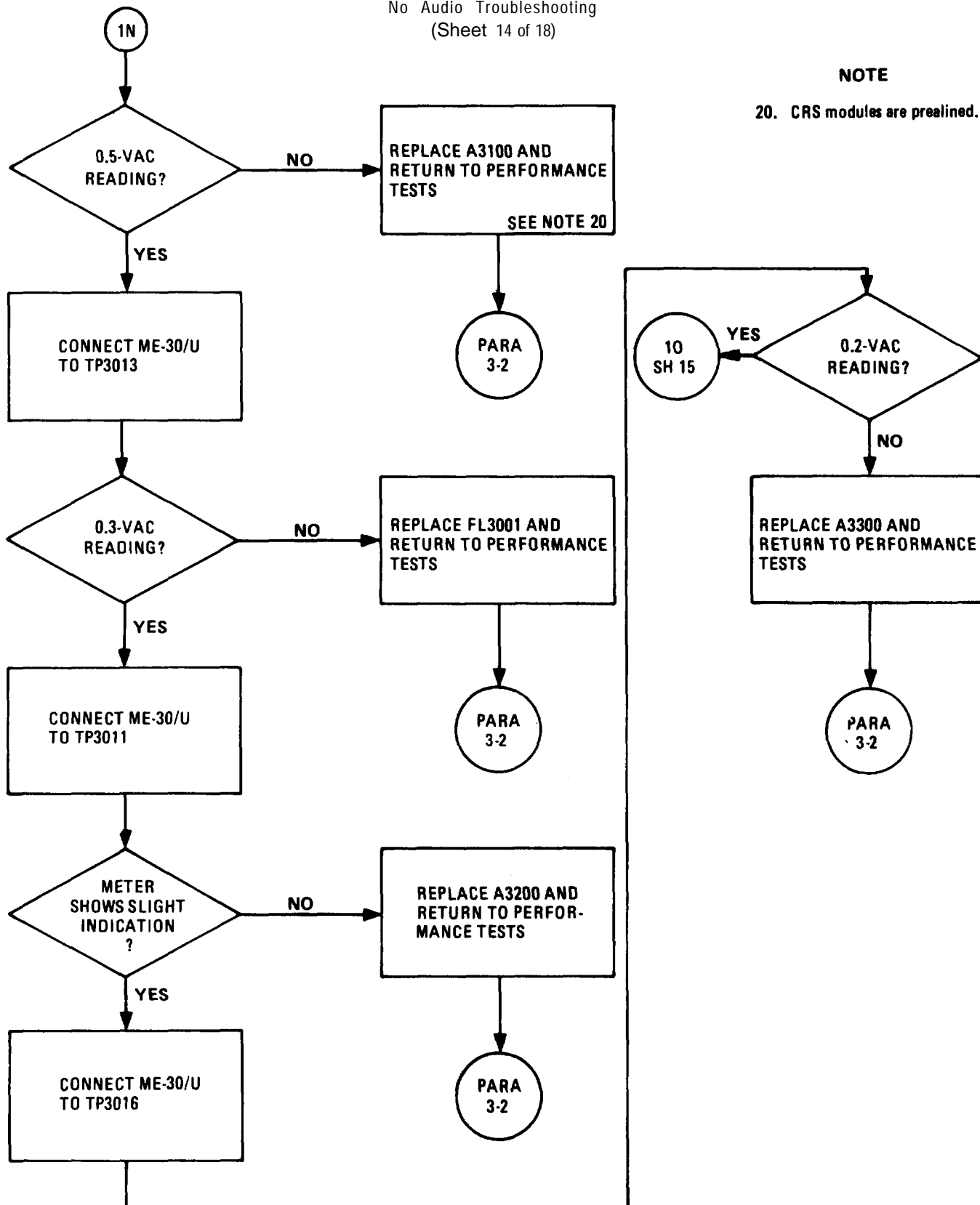
NOTES

18. The test point voltages given for the A3000. Assembly are approximate. If no reading is obtained, try a replacement module.

19. CRS modules are prealigned.

3-23. TROUBLESHOOTING FLOWCHARTS. (CONT)

CHART 3-1  
No Audio Troubleshooting  
(Sheet 14 of 18)

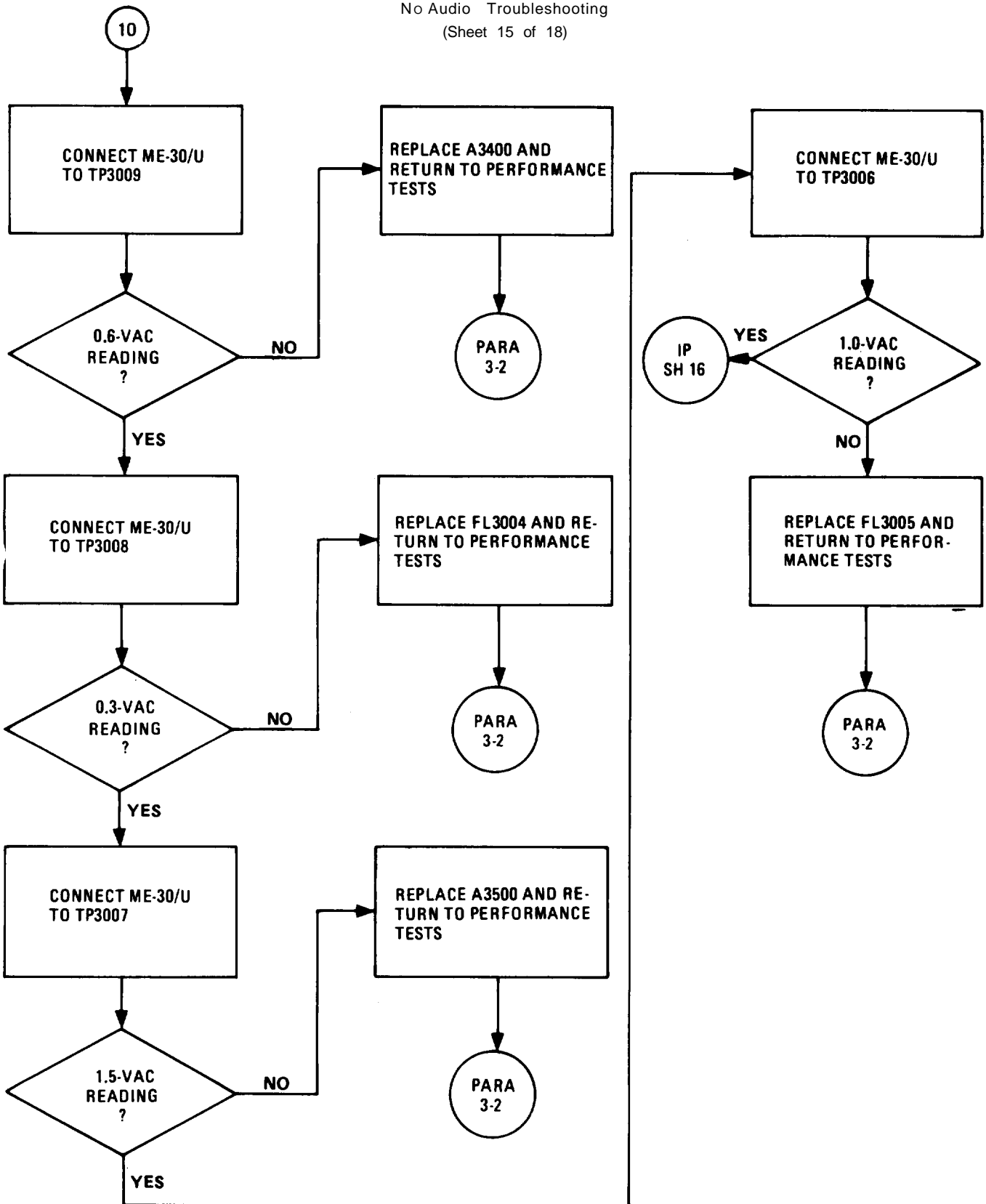


**NOTE**

20. CRS modules are prealigned.

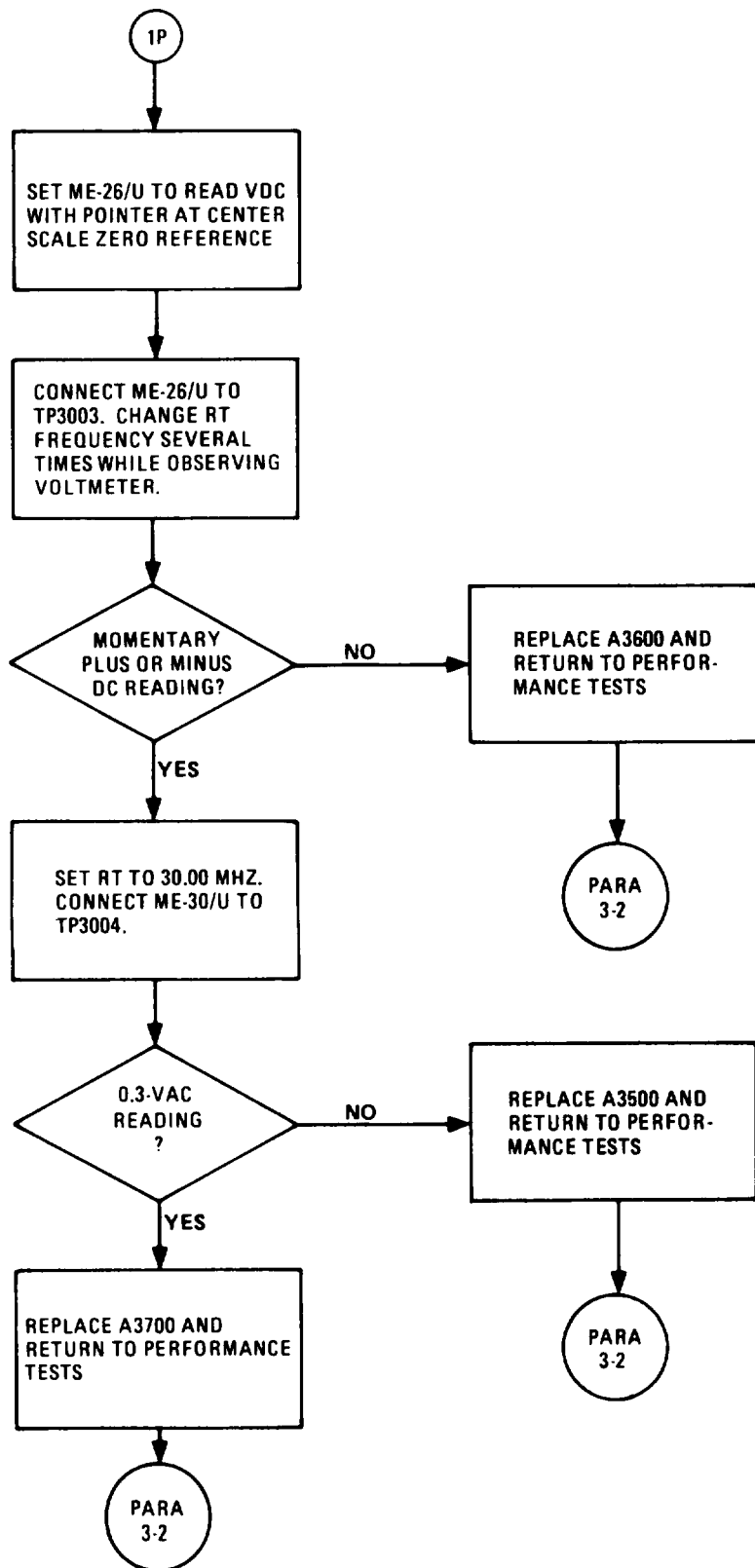
3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-1  
No Audio Troubleshooting  
(Sheet 15 of 18)



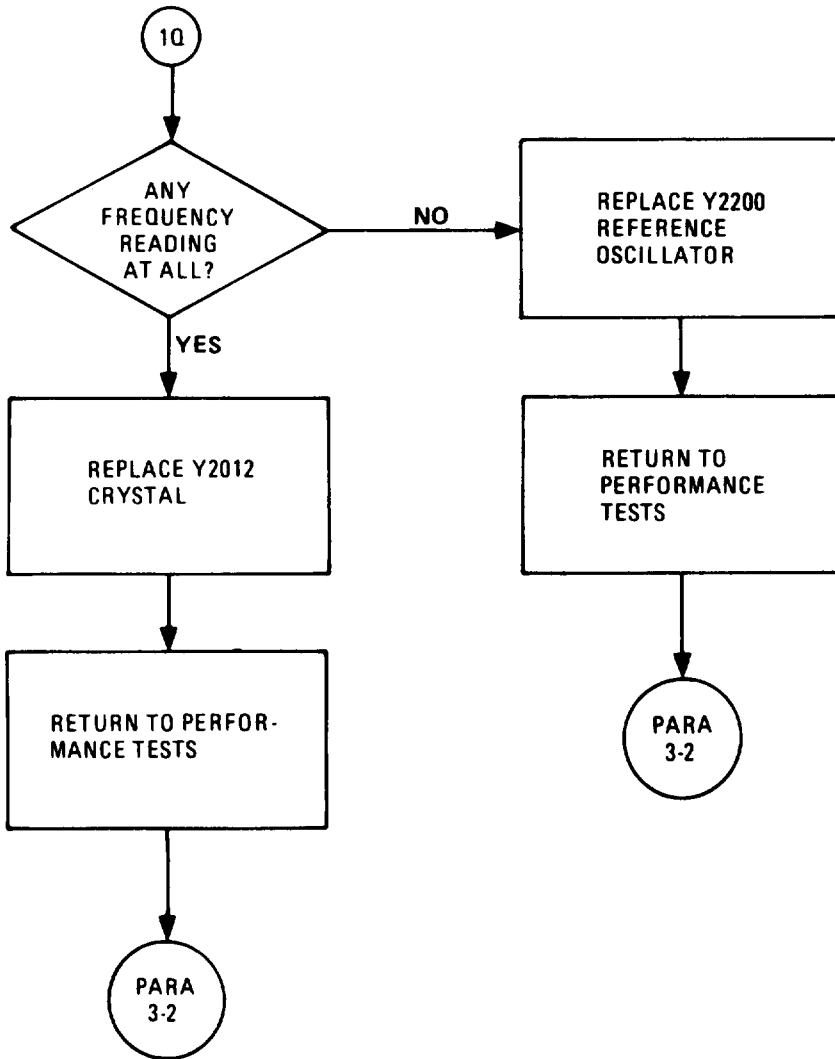
3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-1  
No Audio Troubleshooting  
(Sheet 16 of 18)



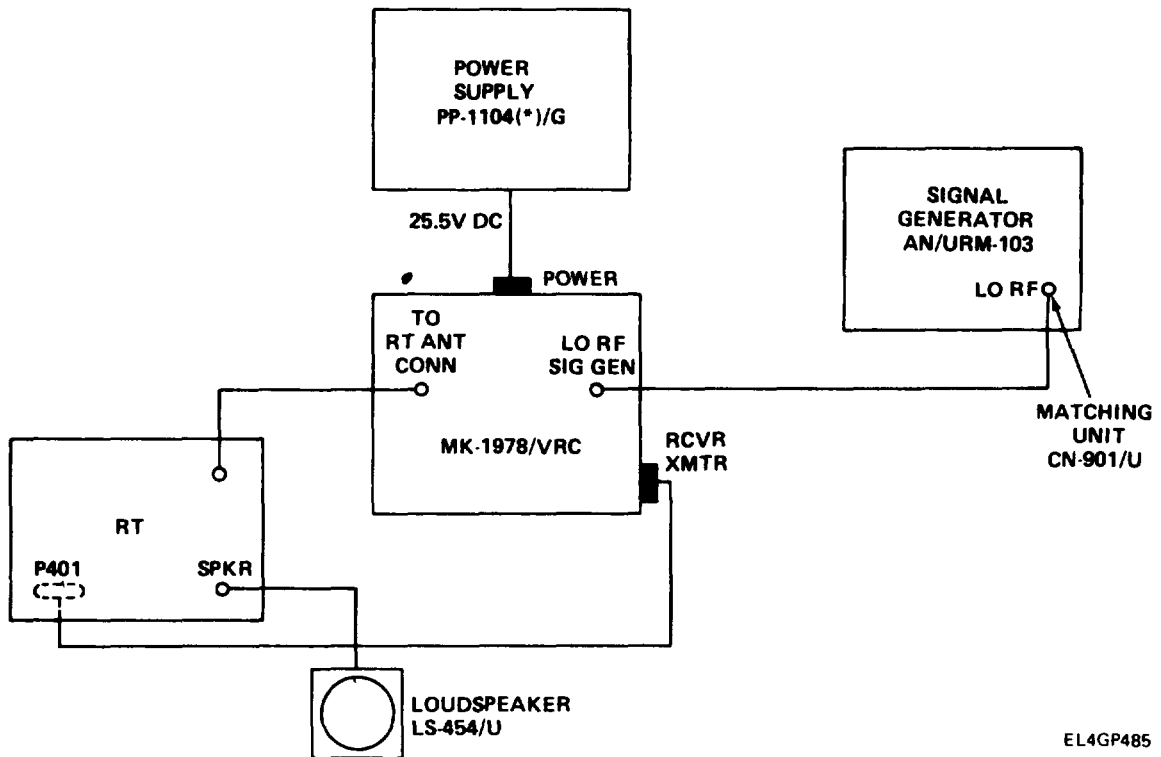
3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-1  
No Audio Troubleshooting  
(Sheet 17 of 18)



3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-1  
No Audio Troubleshooting  
(Sheet 18 of 18)



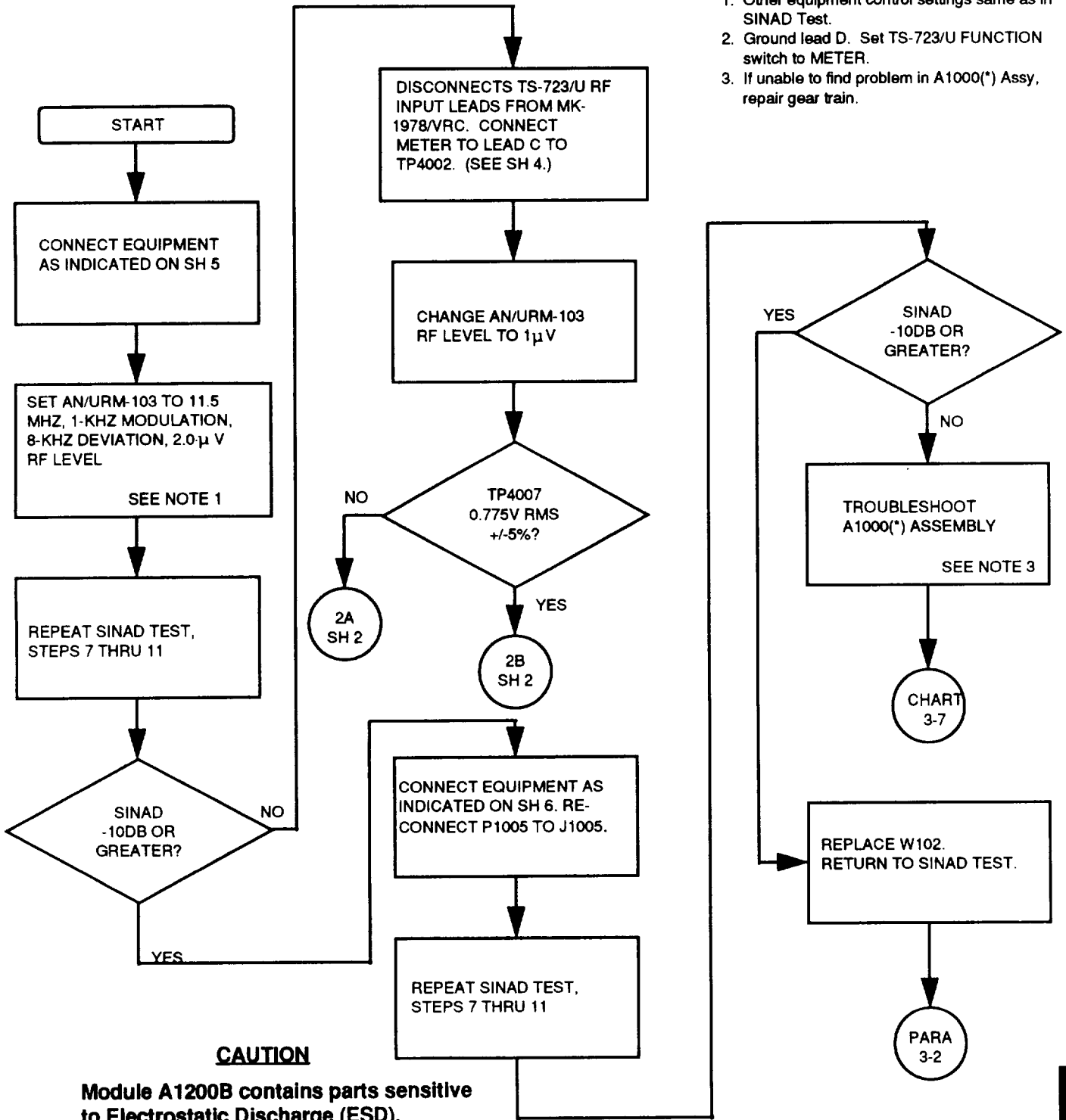
EL4GP485

3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-2  
SINAD Test Failure Troubleshooting  
(Sheet 1 of 7)

NOTES

1. Other equipment control settings same as in SINAD Test.
2. Ground lead D. Set TS-723/U FUNCTION switch to METER.
3. If unable to find problem in A1000(\*) Assy, repair gear train.

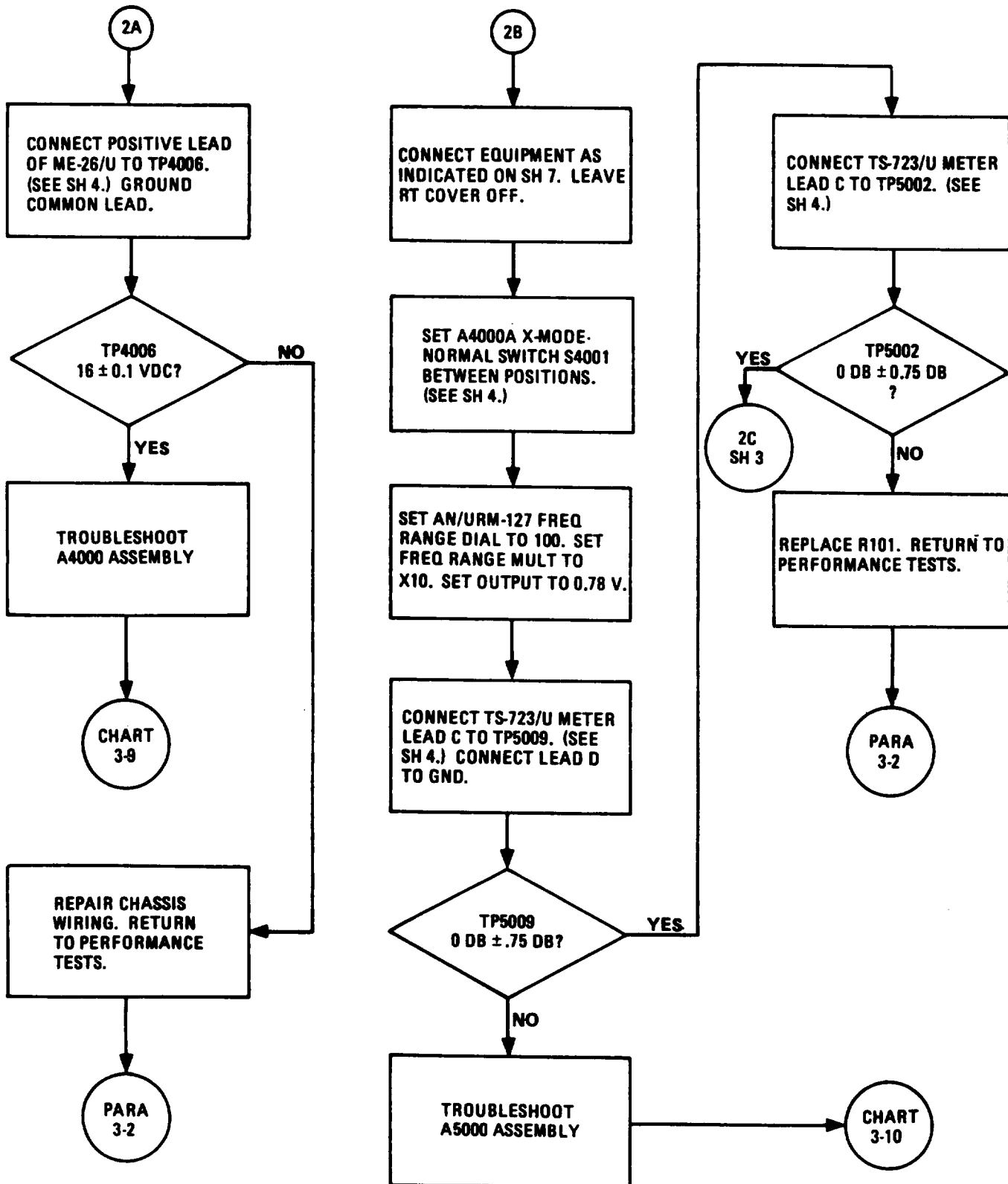


**CAUTION**

Module A1200B contains parts sensitive to Electrostatic Discharge (ESD).

3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

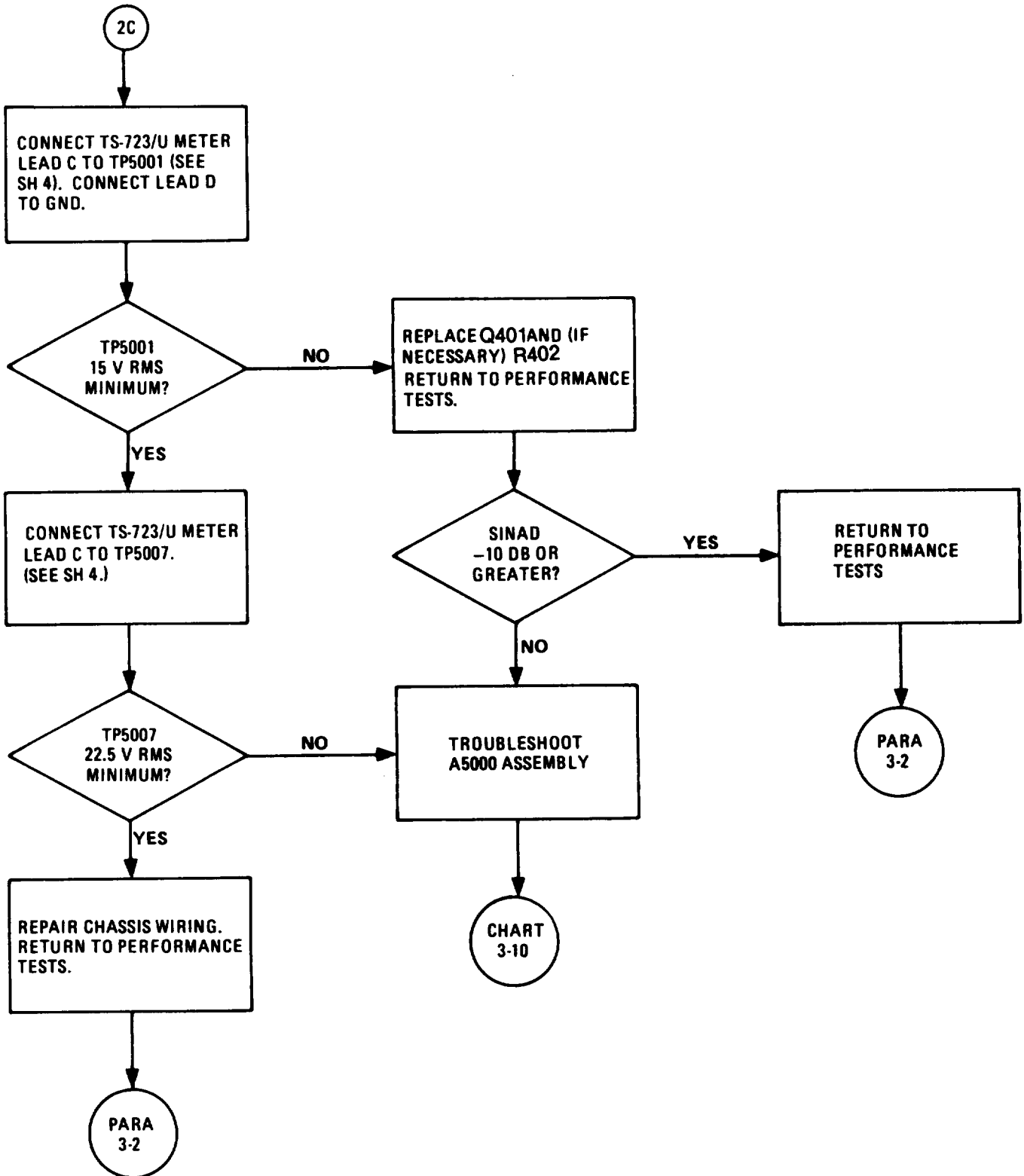
CHART 3-2  
SINAD Test Failure Troubleshooting  
(Sheet 2 of 7)





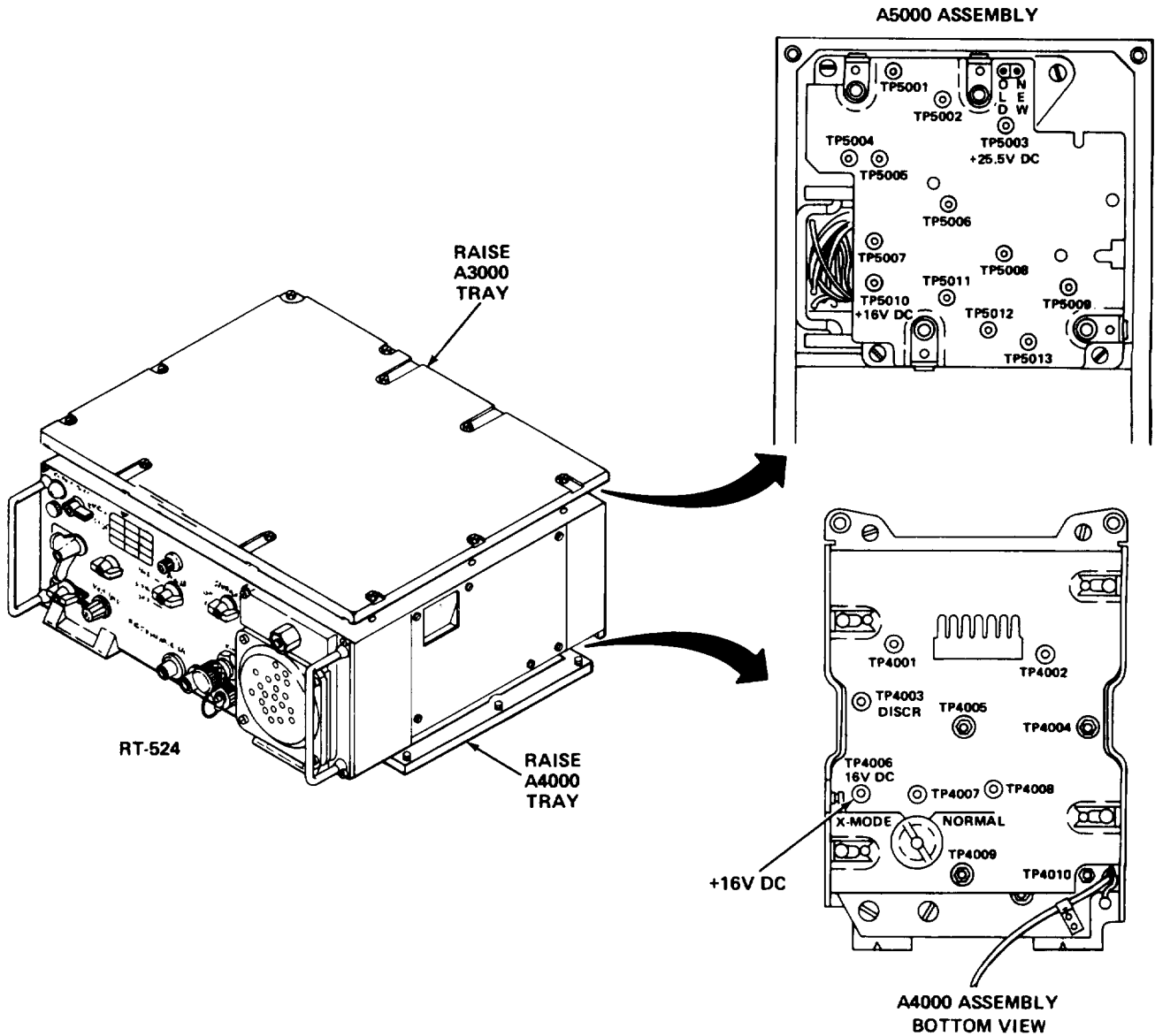
3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-2  
 SINAD Test Failure Troubleshooting  
 (Sheet 3 of 7)



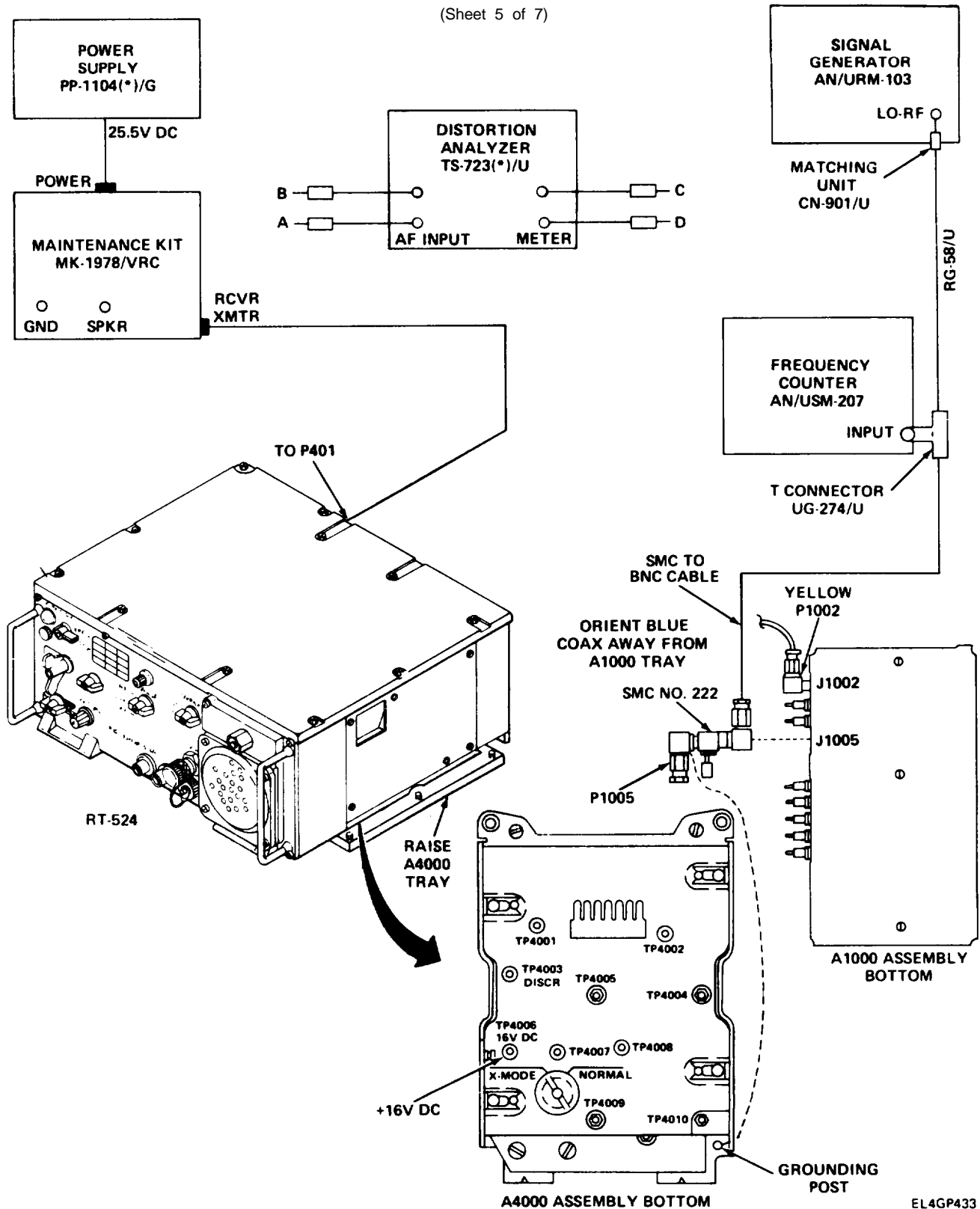
3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-2  
SINAD Test Failure Troubleshooting  
(Sheet 4 of 7)



3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

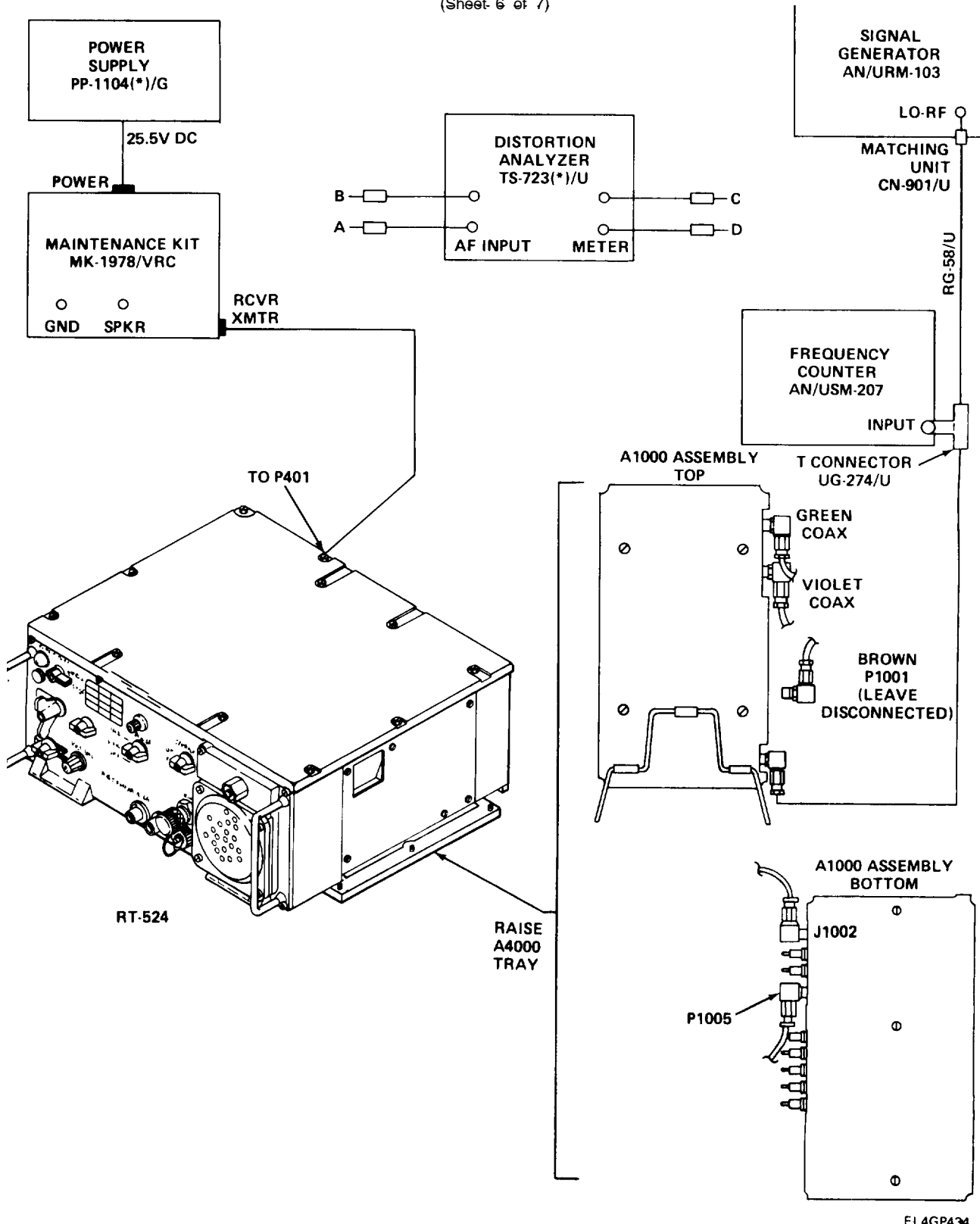
CHART 3-2  
SINAD Test Failure Troubleshooting  
(Sheet 5 of 7)



EL4GP433

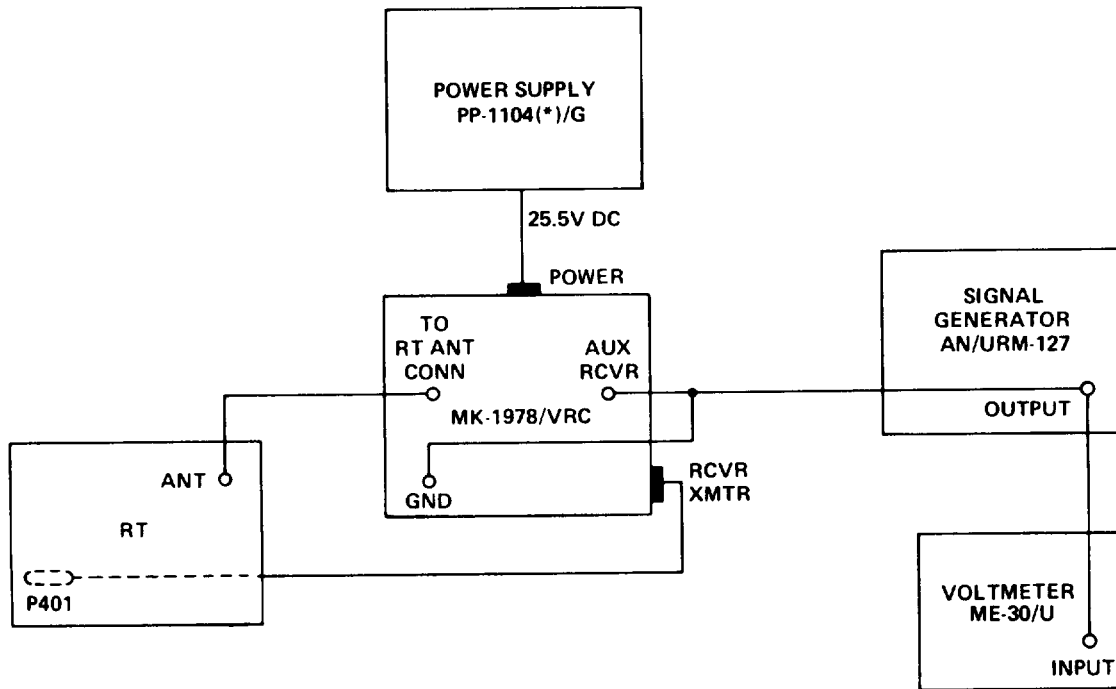
3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-2  
 SINAD Test Failure Troubleshooting  
 (Sheet 6 of 7)



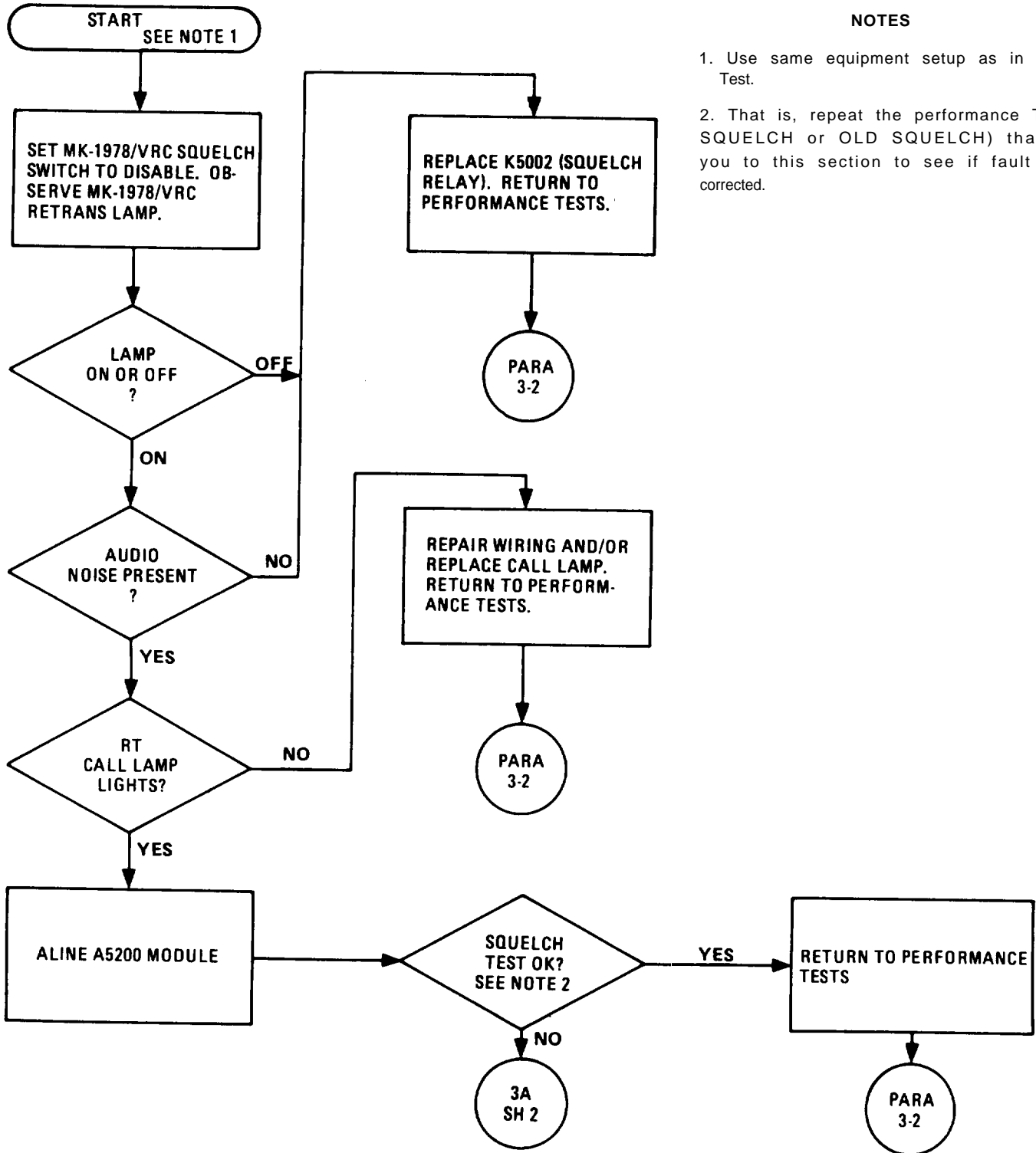
3-23. Troubleshooting Flow Charts. (CONT)

CHART 3-2  
 SINAD Test Failure Troubleshooting  
 (Sheet 7 of 7)



3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-3  
 Squelch Test Failure Troubleshooting  
 (Sheet 1 of 2)

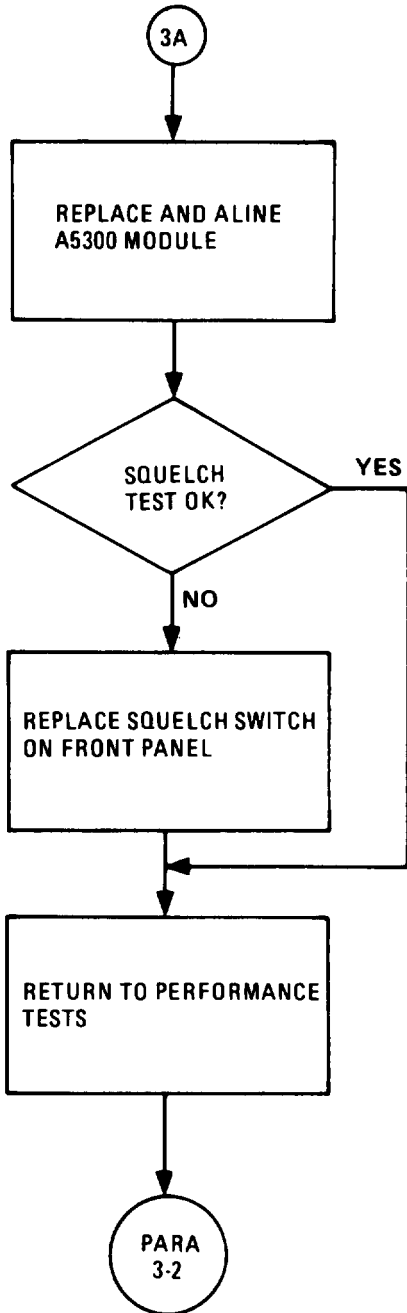


NOTES

1. Use same equipment setup as in Performance Test.
2. That is, repeat the performance Test (NEW SQUELCH or OLD SQUELCH) that referred you to this section to see if fault has been corrected.

3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-3  
Squelch Test Failure Troubleshooting  
(Sheet 2 of 2)

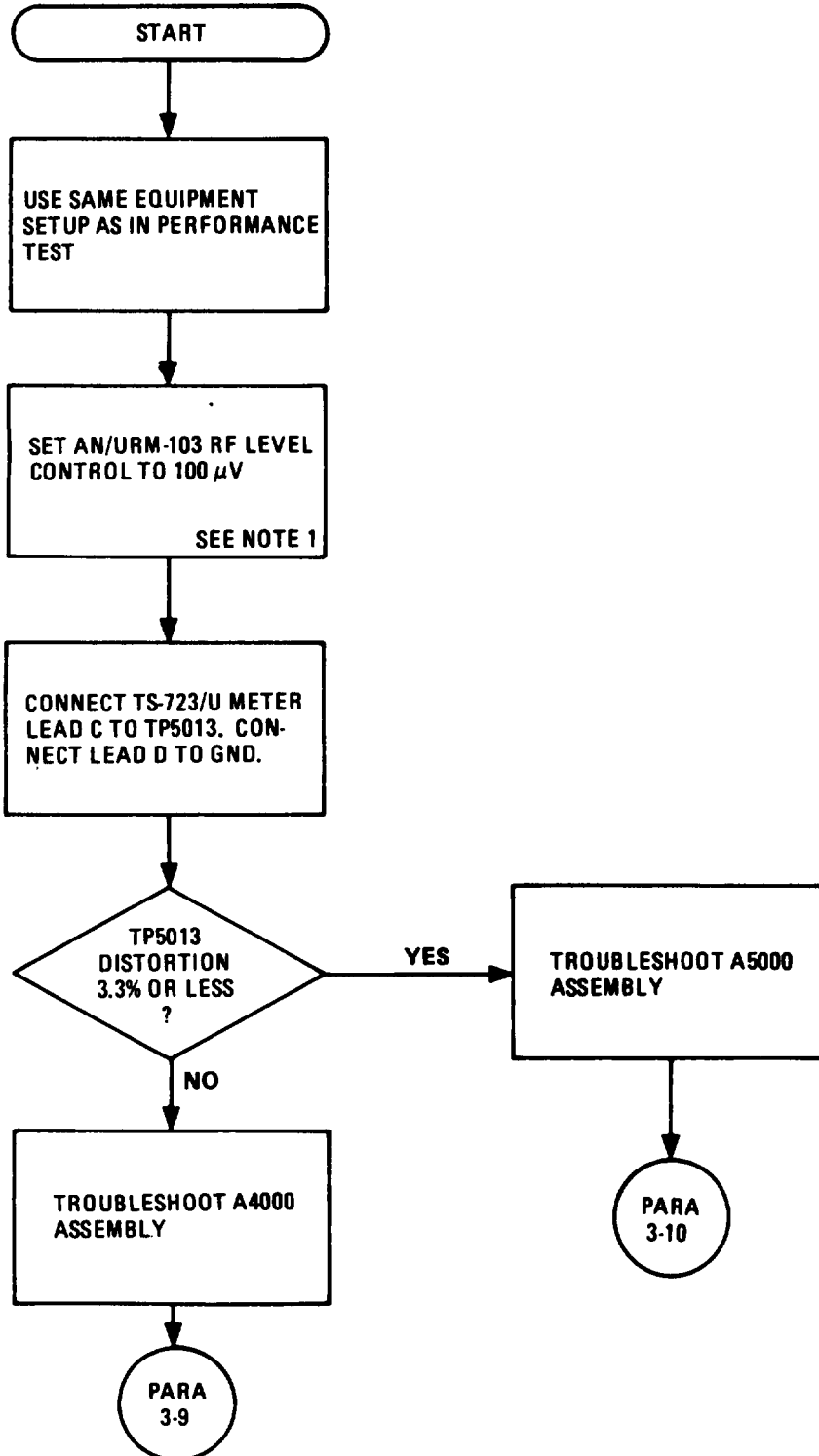


3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-4  
Audio Distortion Test Failure Troubleshooting  
(sheet 1 of 1)

NOTES

1. Other equipment control settings same as in Distortion Test.
2. Set TS-723/U FUNCTION switch to DISTORTION.



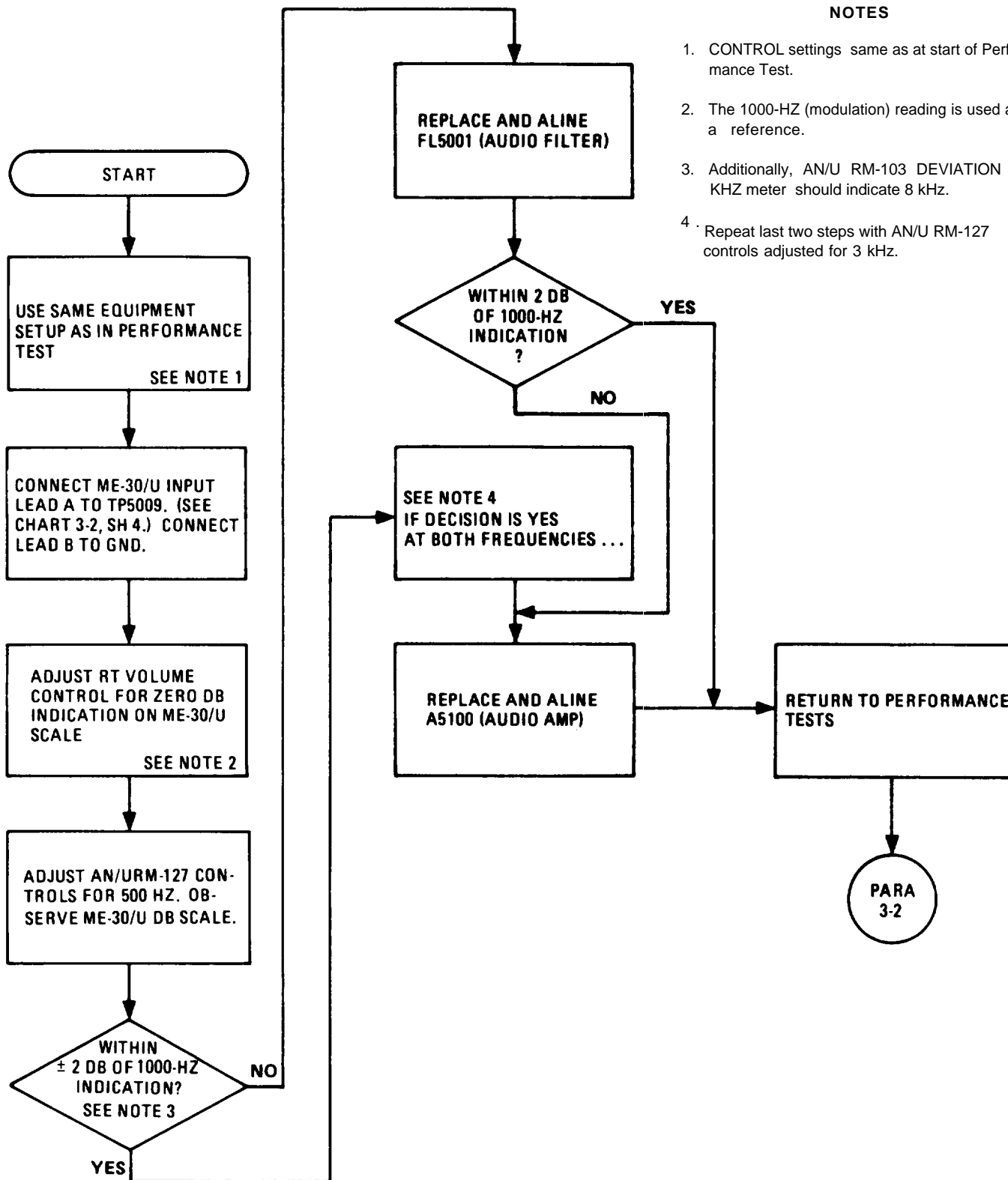


3-23. TROUBLESHOOTING FLOW CHARTS.

CHART 3-5  
Audio Response Test Failure (Normal Mode) Troubleshooting  
(Sheet 1 of 1)

NOTES

1. CONTROL settings same as at start of Performance Test.
2. The 1000-HZ (modulation) reading is used as a reference.
3. Additionally, AN/U RM-103 DEVIATION KHZ meter should indicate 8 kHz.
4. Repeat last two steps with AN/U RM-127 controls adjusted for 3 kHz.

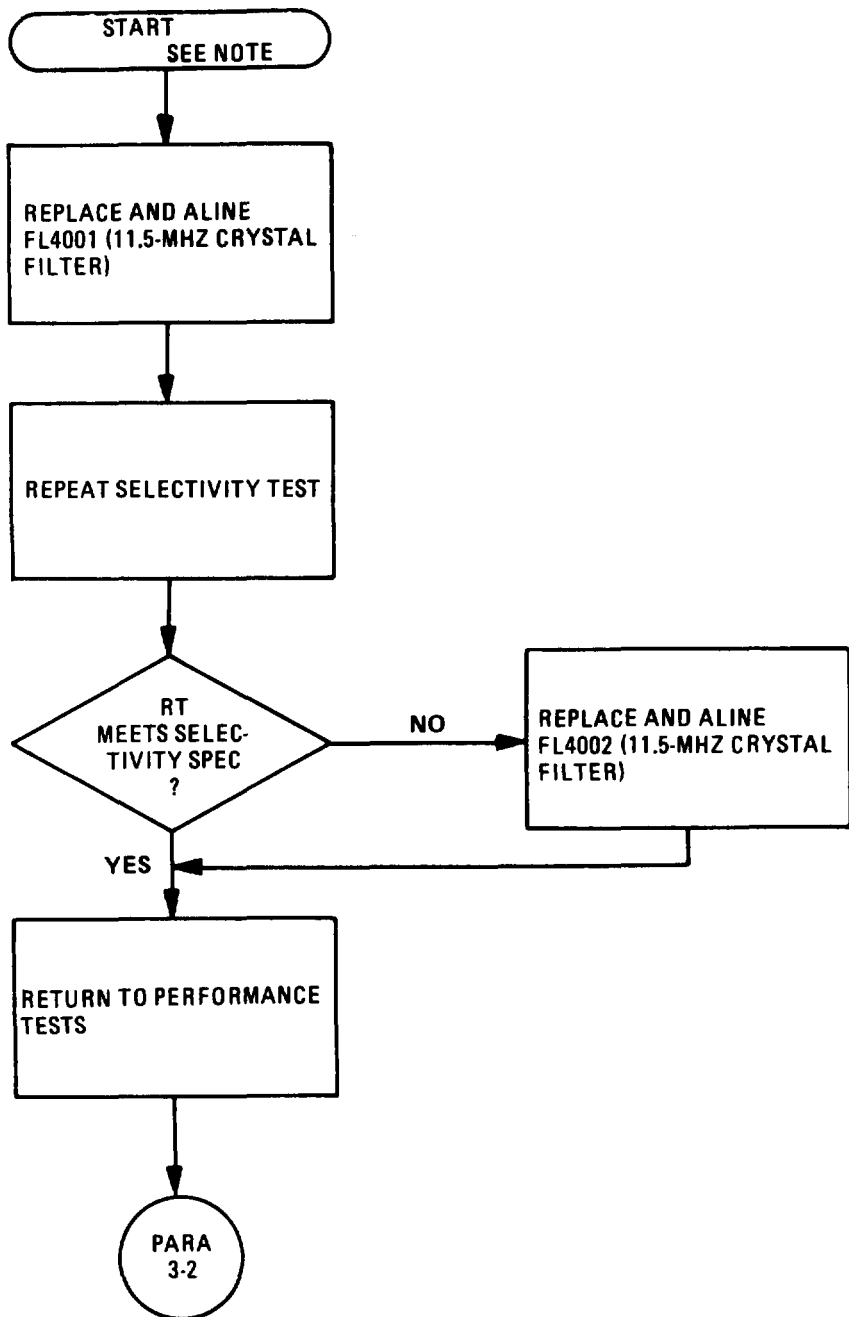


3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-6  
Selectivity Test Failure Troubleshooting  
(Sheet 1 of 1)

NOTE

Use same equipment setup as in performance test.



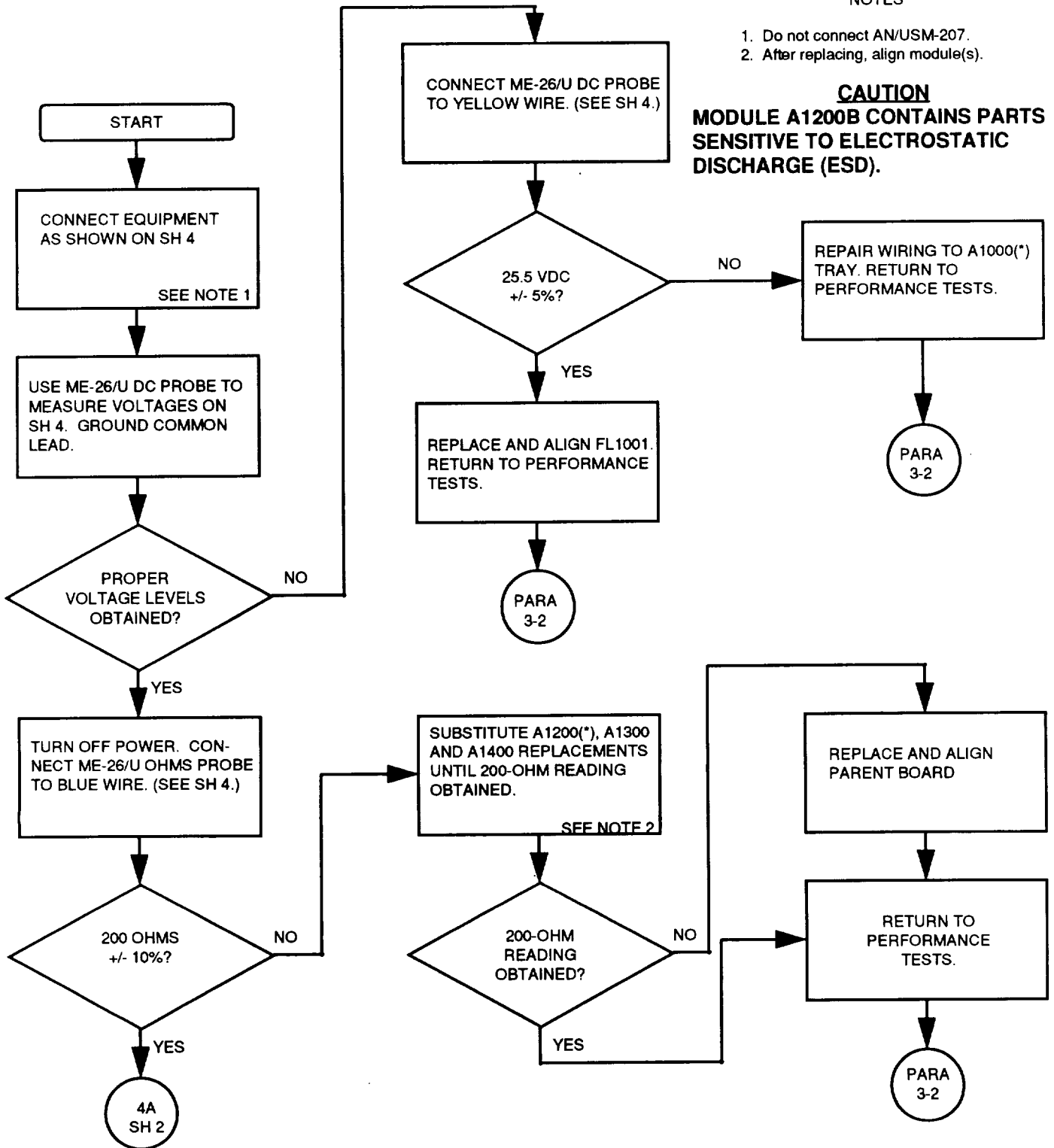
3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-7  
A1000(\*) Assembly Troubleshooting  
(Sheet 1 of 5)

NOTES

1. Do not connect AN/USM-207.
2. After replacing, align module(s).

**CAUTION**  
MODULE A1200B CONTAINS PARTS  
SENSITIVE TO ELECTROSTATIC  
DISCHARGE (ESD).



3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-7  
A1000 Assembly Troubleshooting  
(Sheet 2 of 5)

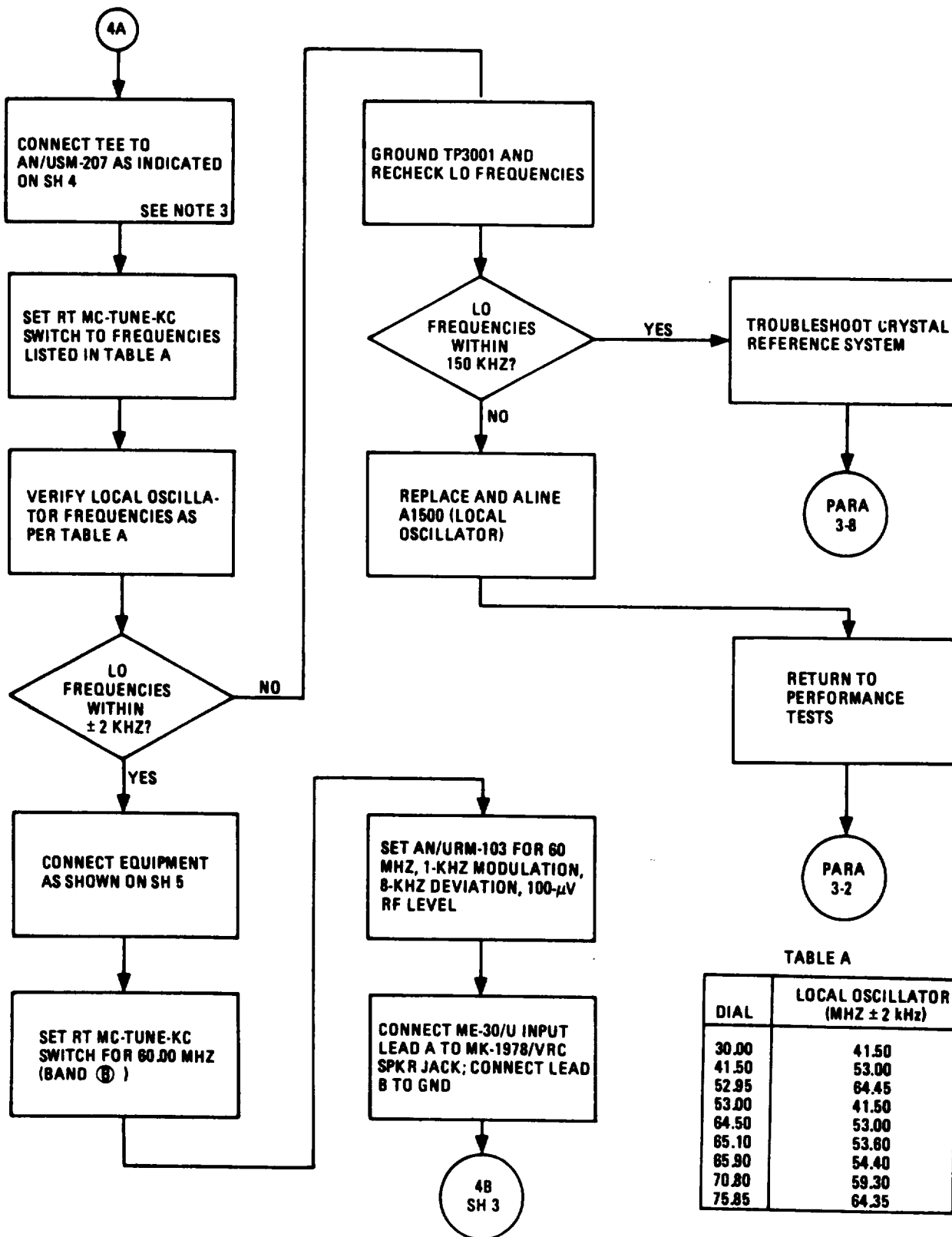


TABLE A

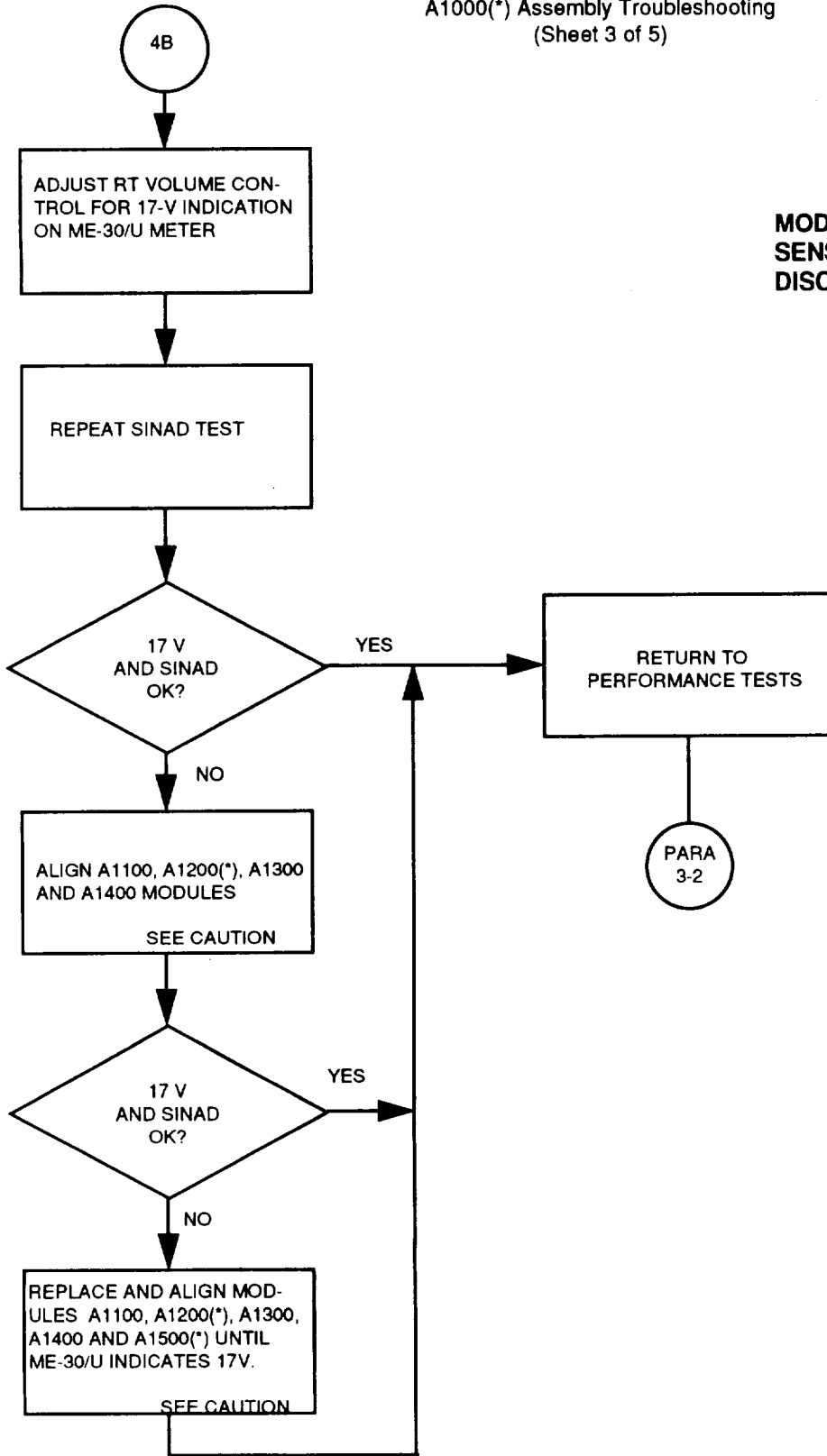
DIAL	LOCAL OSCILLATOR (MHZ ± 2 kHz)
30.00	41.50
41.50	53.00
52.95	64.45
53.00	41.50
64.50	53.00
65.10	53.60
65.90	54.40
70.80	59.30
75.85	64.35

3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-7  
A1000(\*) Assembly Troubleshooting  
(Sheet 3 of 5)

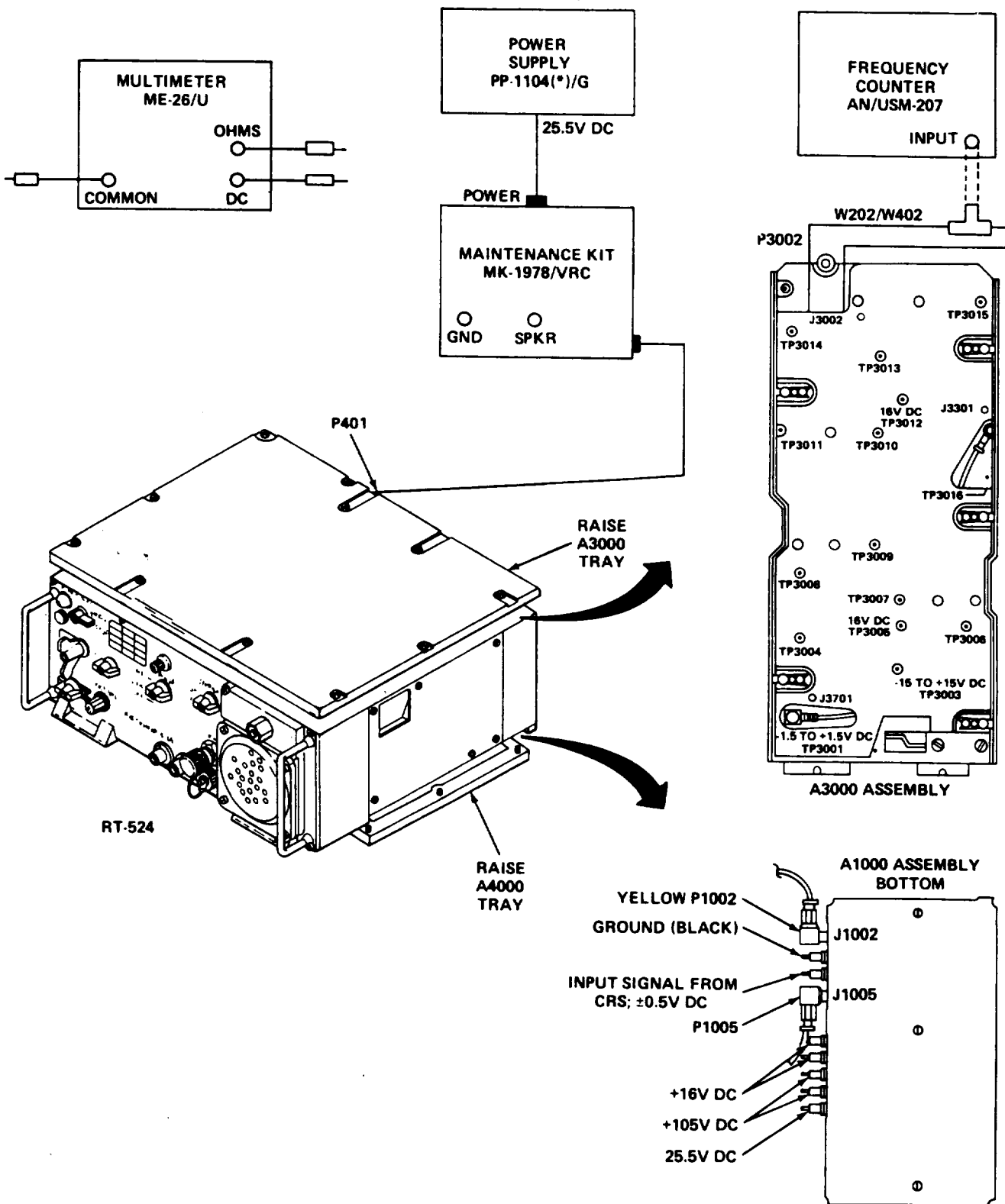
**CAUTION**

MODULE A1200B CONTAINS PARTS SENSITIVE TO ELECTROSTATIC DISCHARGE (ESD).



3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

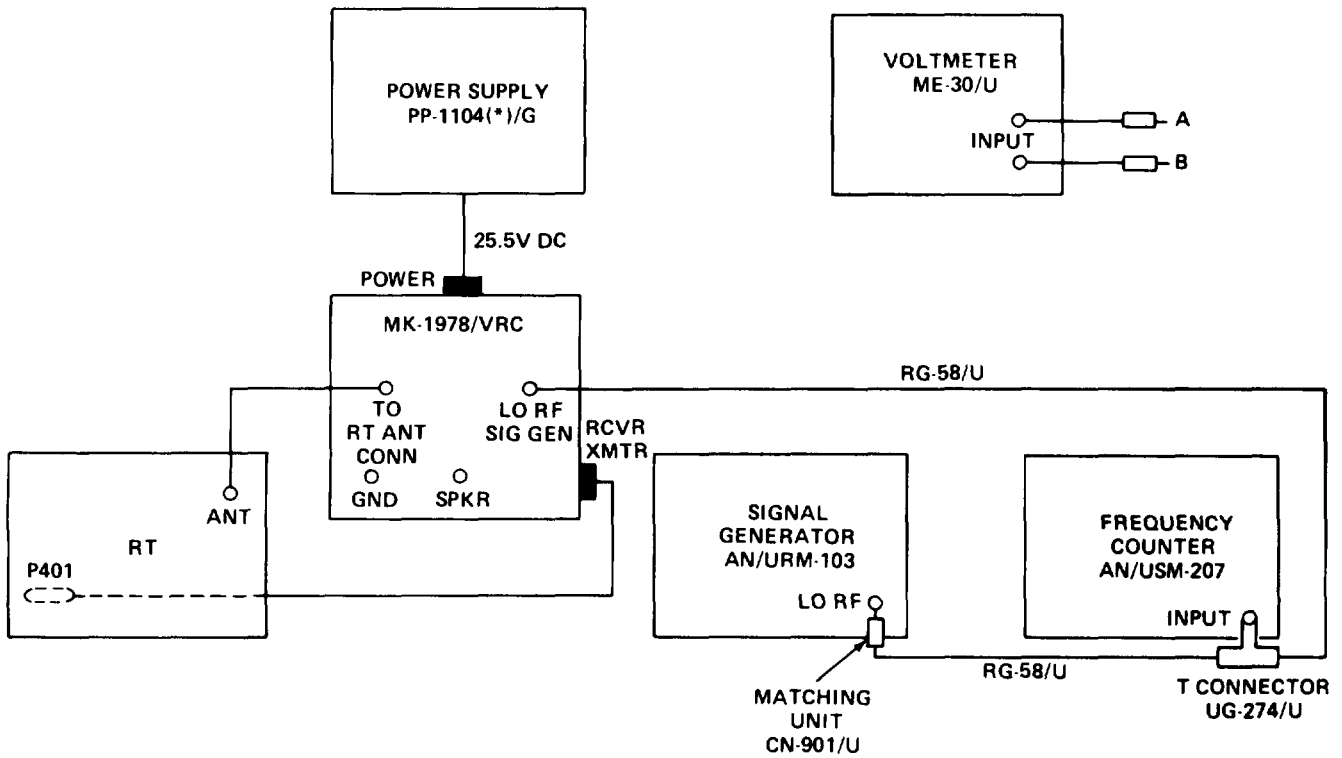
CHART 3-7  
A1000 Assembly Troubleshooting  
(Sheet 4 of 5)



EL4GP436

3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

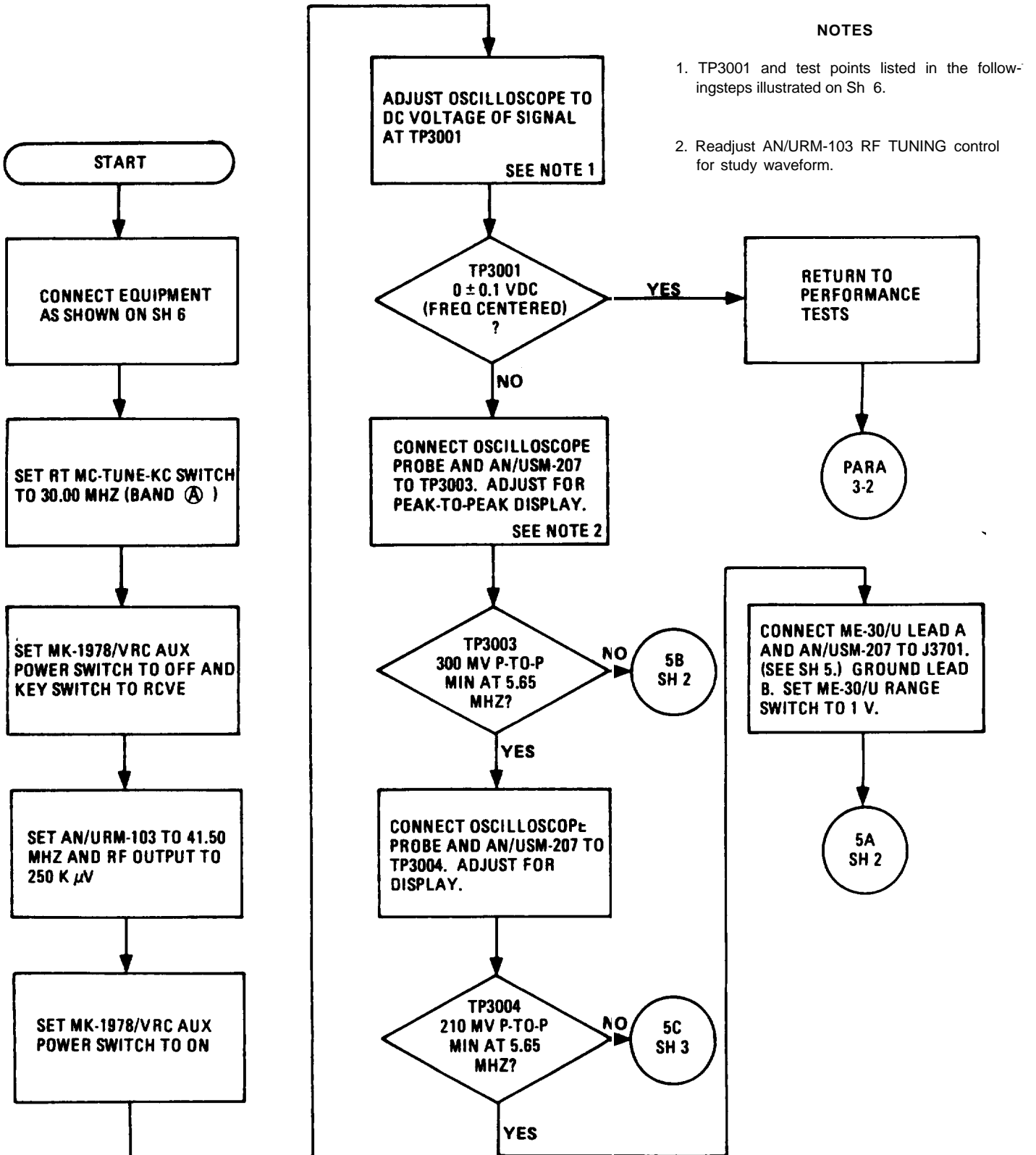
CHART 3-7  
 A1000 Assembly Troubleshooting  
 (Sheet 5 of 5)



EL4GP437

3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

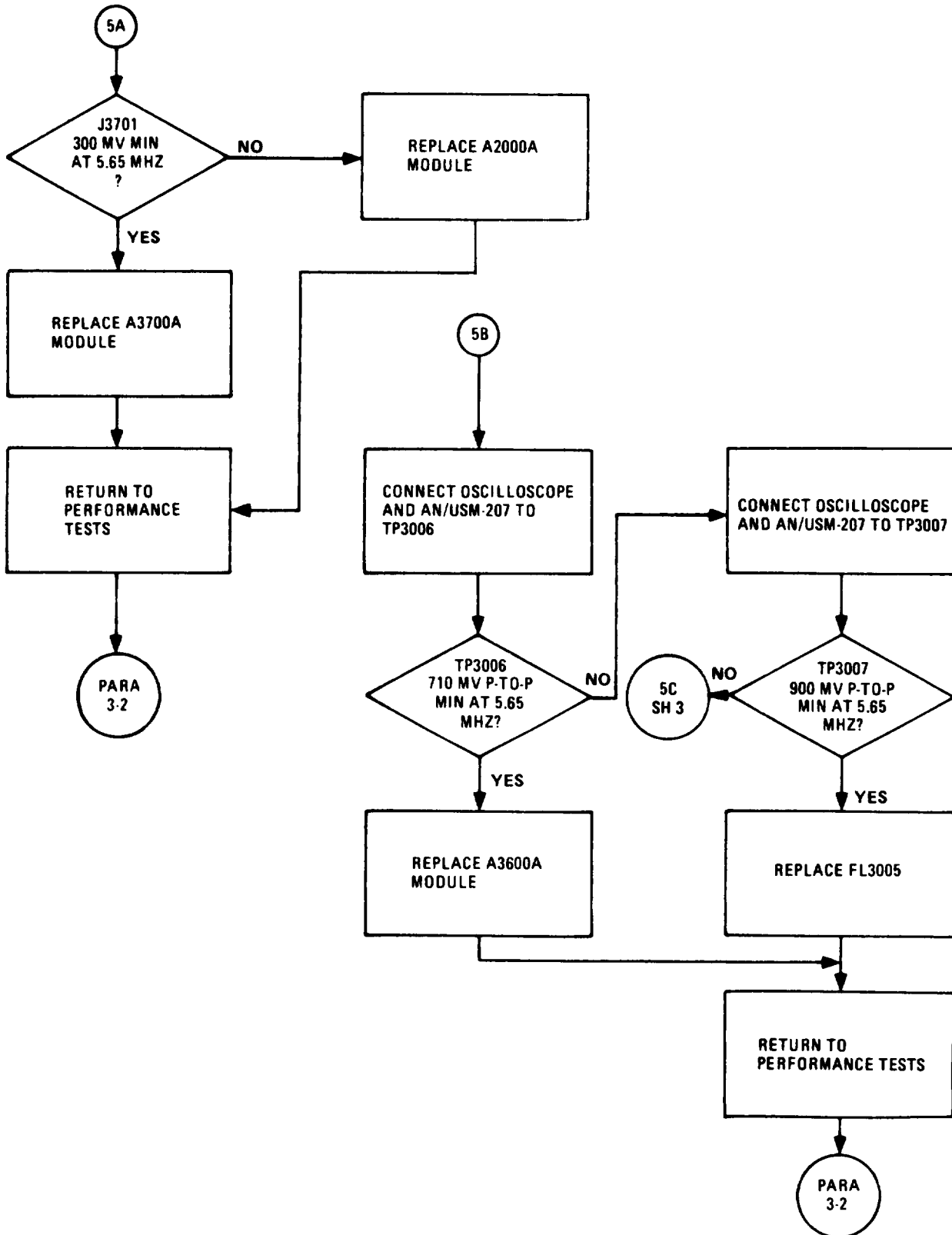
CHART 3-8  
A20D0, A30D0 Assemblies Troubleshooting  
(Sheet 1 of 6)





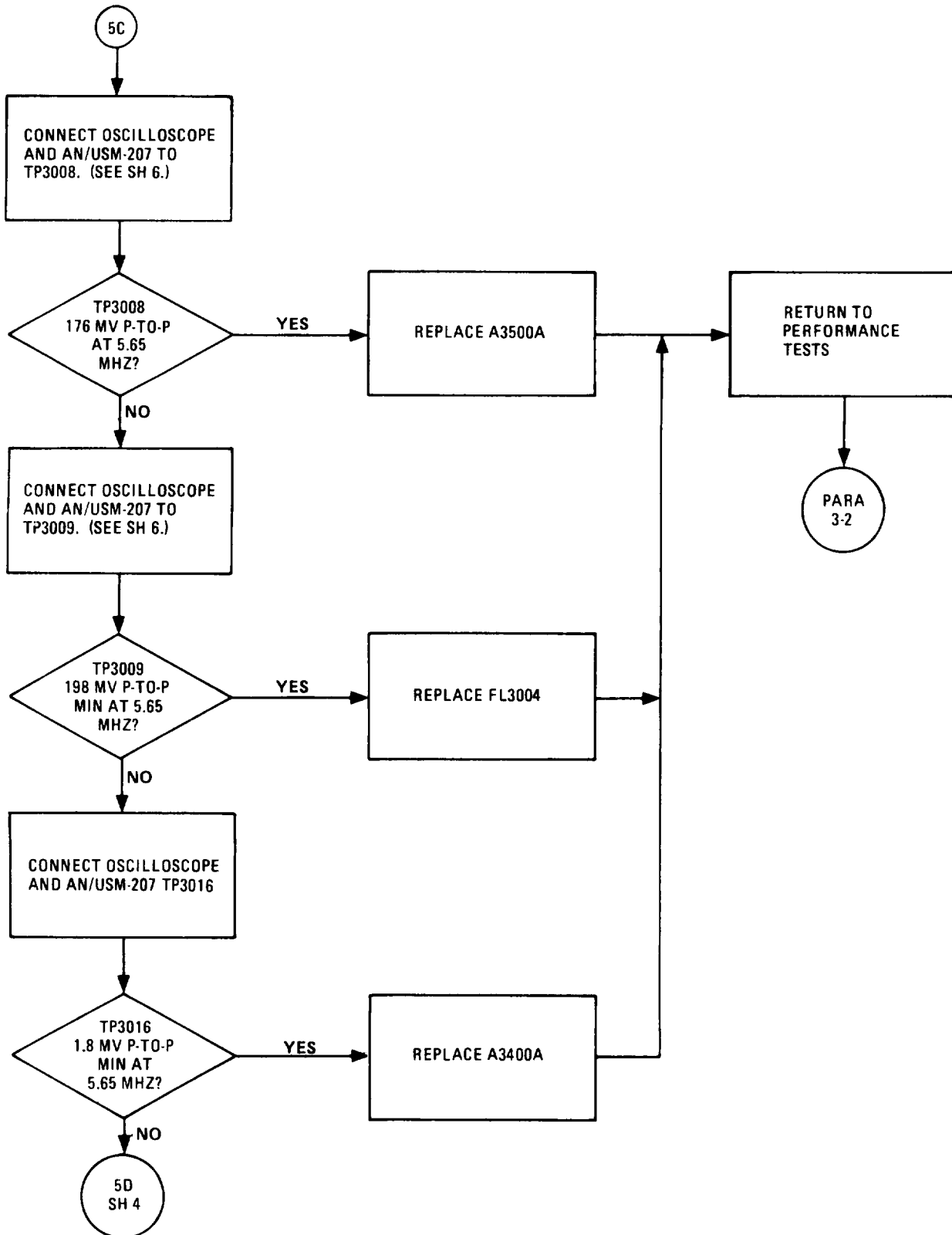
3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-8  
A2000, A3000 Assemblies Troubleshooting  
(Sheet 2 of 6)



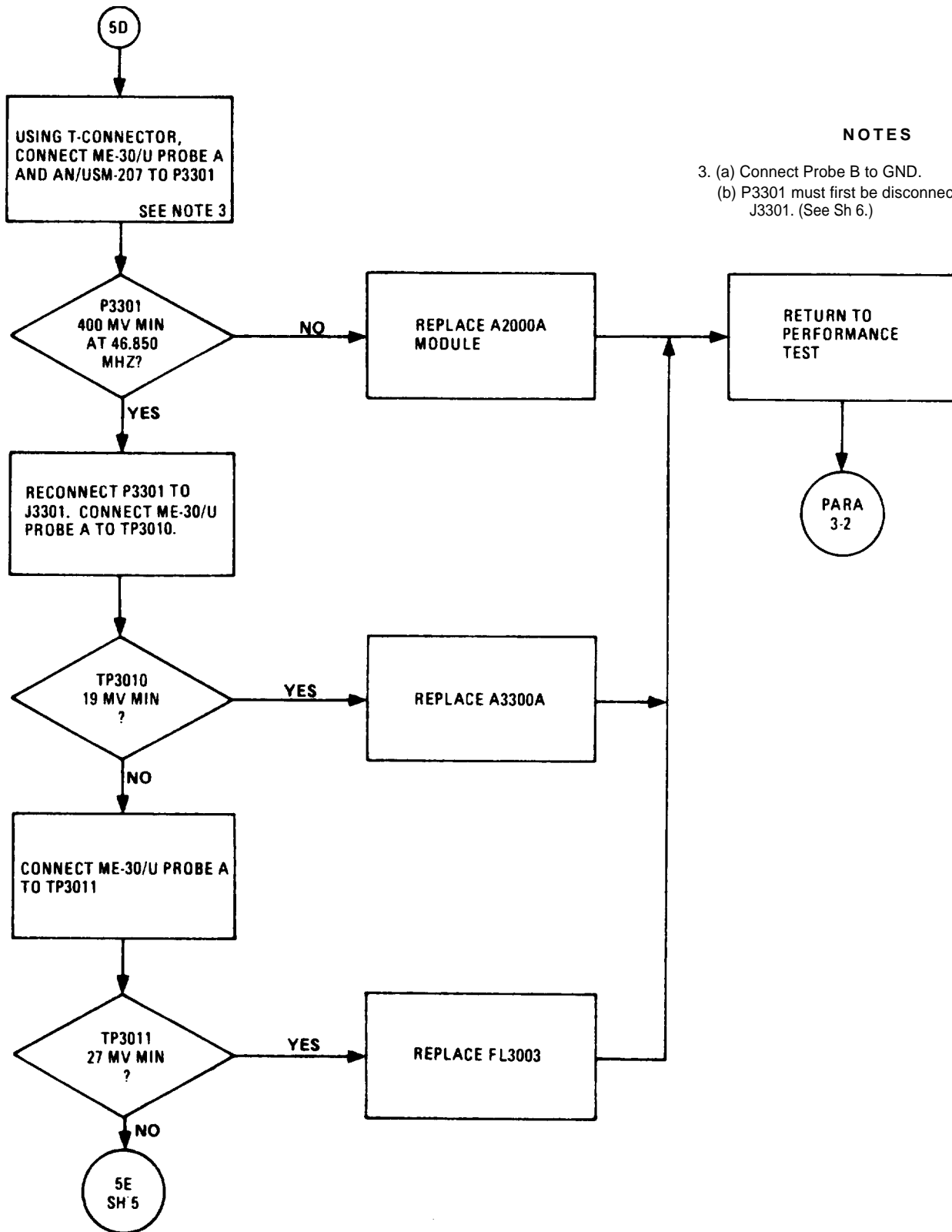
3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART3-8  
A2000, A3000 Assemblies Troubleshooting  
(Sheet 3 of 6)



3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-8  
A2000, A3000 Assemblies Troubleshooting  
(Sheet 4 of 6)

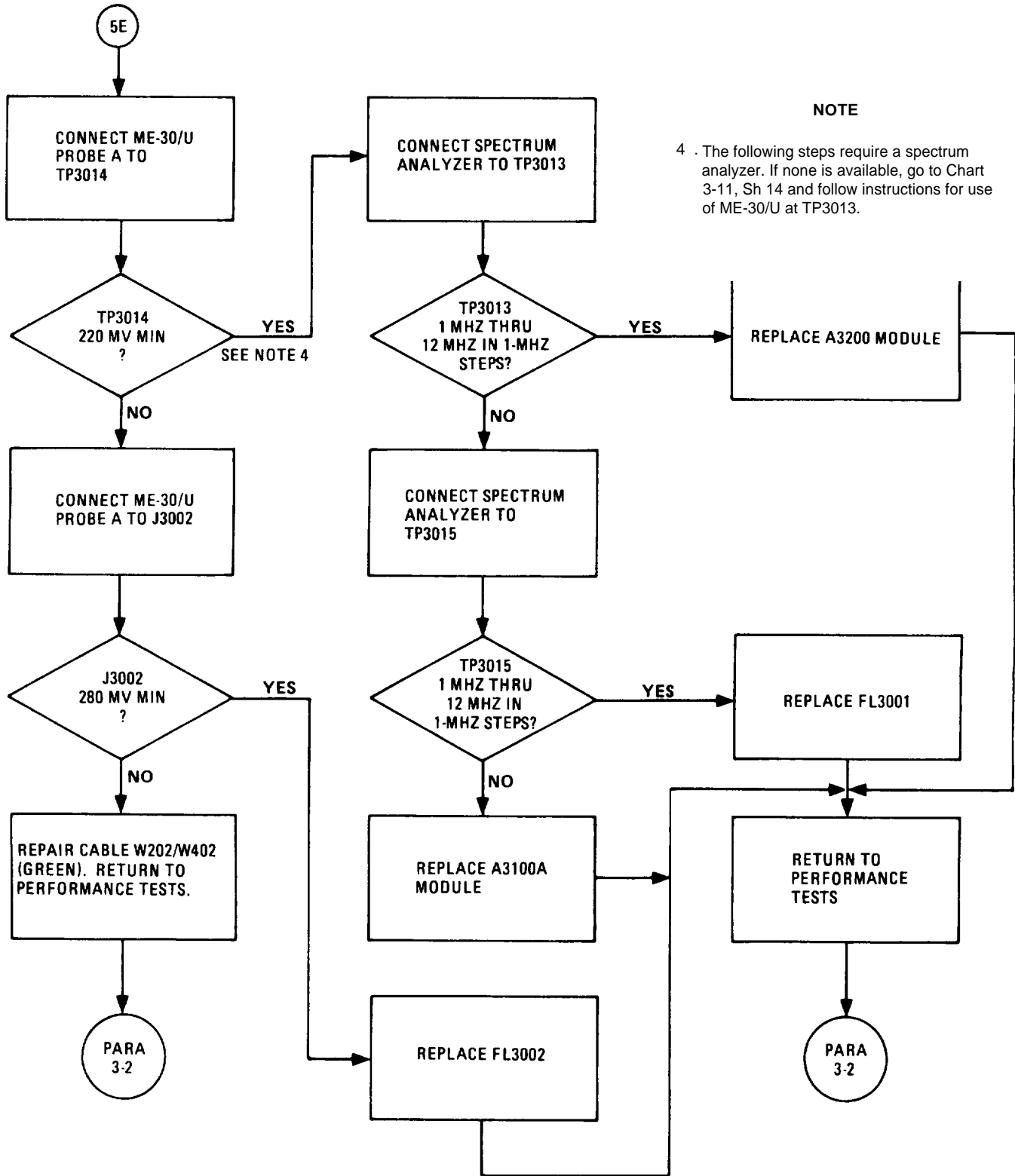


NOTES

- 3. (a) Connect Probe B to GND.
- (b) P3301 must first be disconnected from J3301. (See Sh 6.)

3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-8  
A2000, A3000 Assemblies Troubleshooting  
(Sheet 5 of 6)

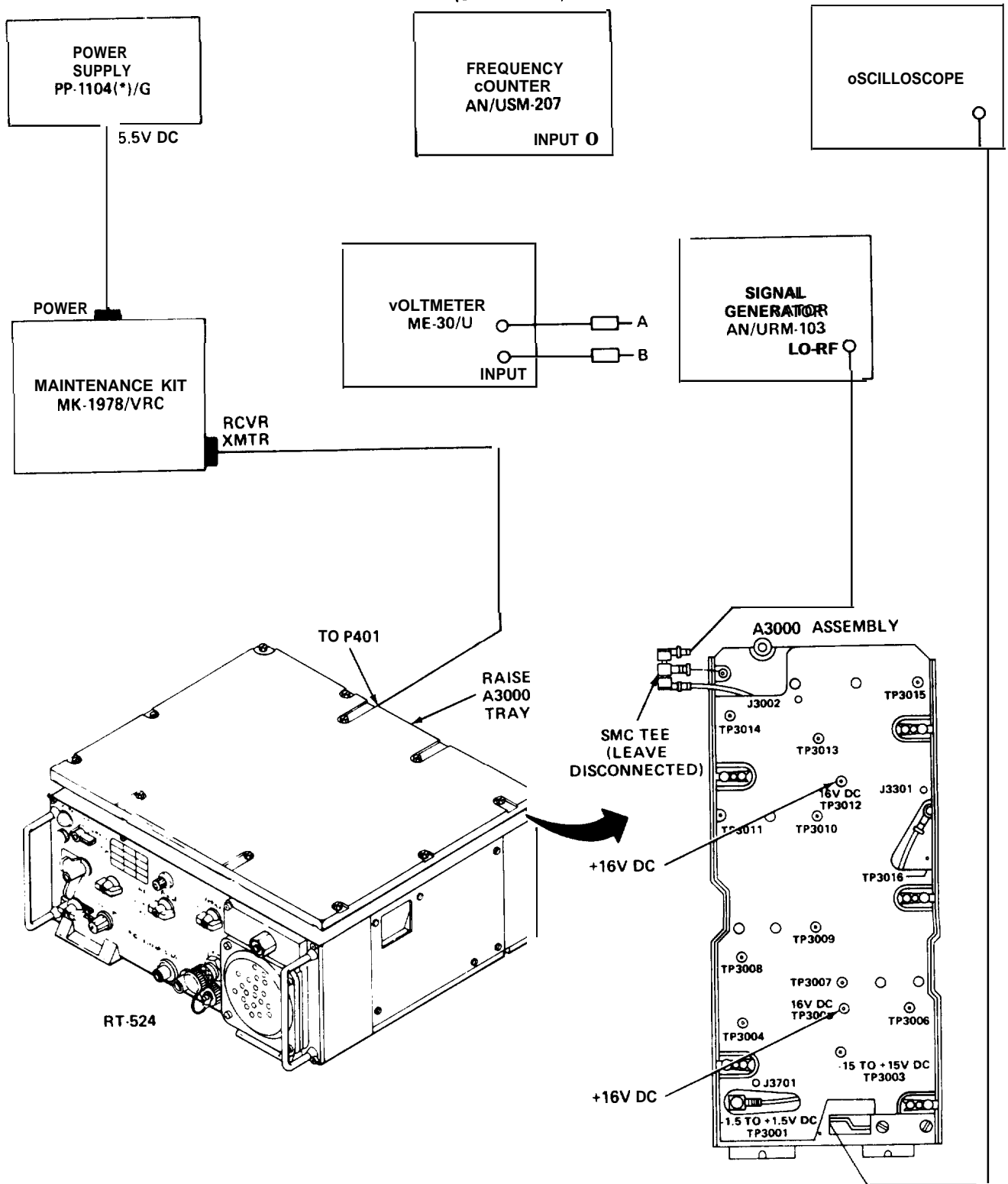


NOTE

4 . The following steps require a spectrum analyzer. If none is available, go to Chart 3-11, Sh 14 and follow instructions for use of ME-30/U at TP3013.

3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

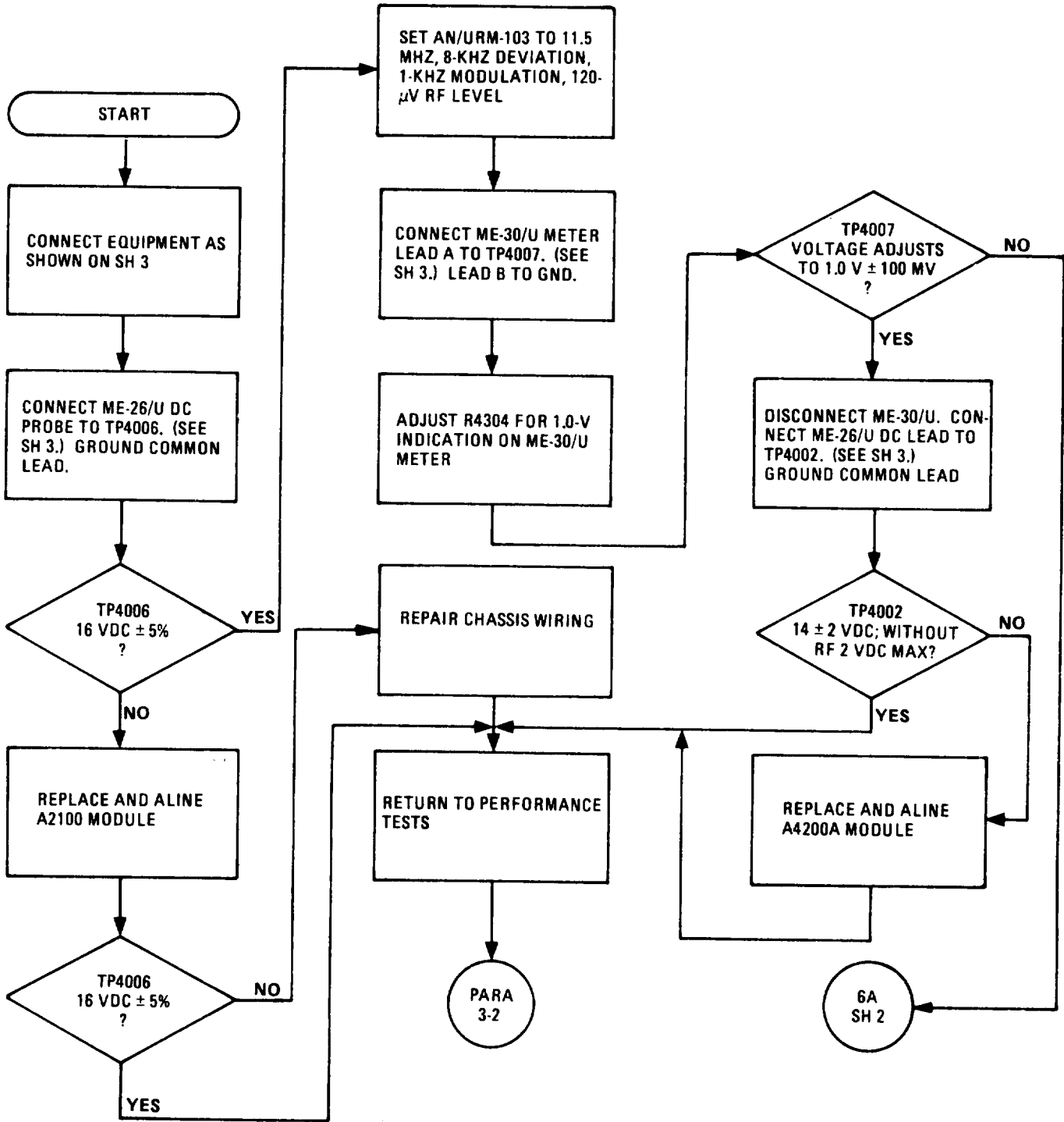
CHART 3-8  
A2000, A3000 Assemblies Troubleshooting  
(Sheet 6 of 6)



E14GP438

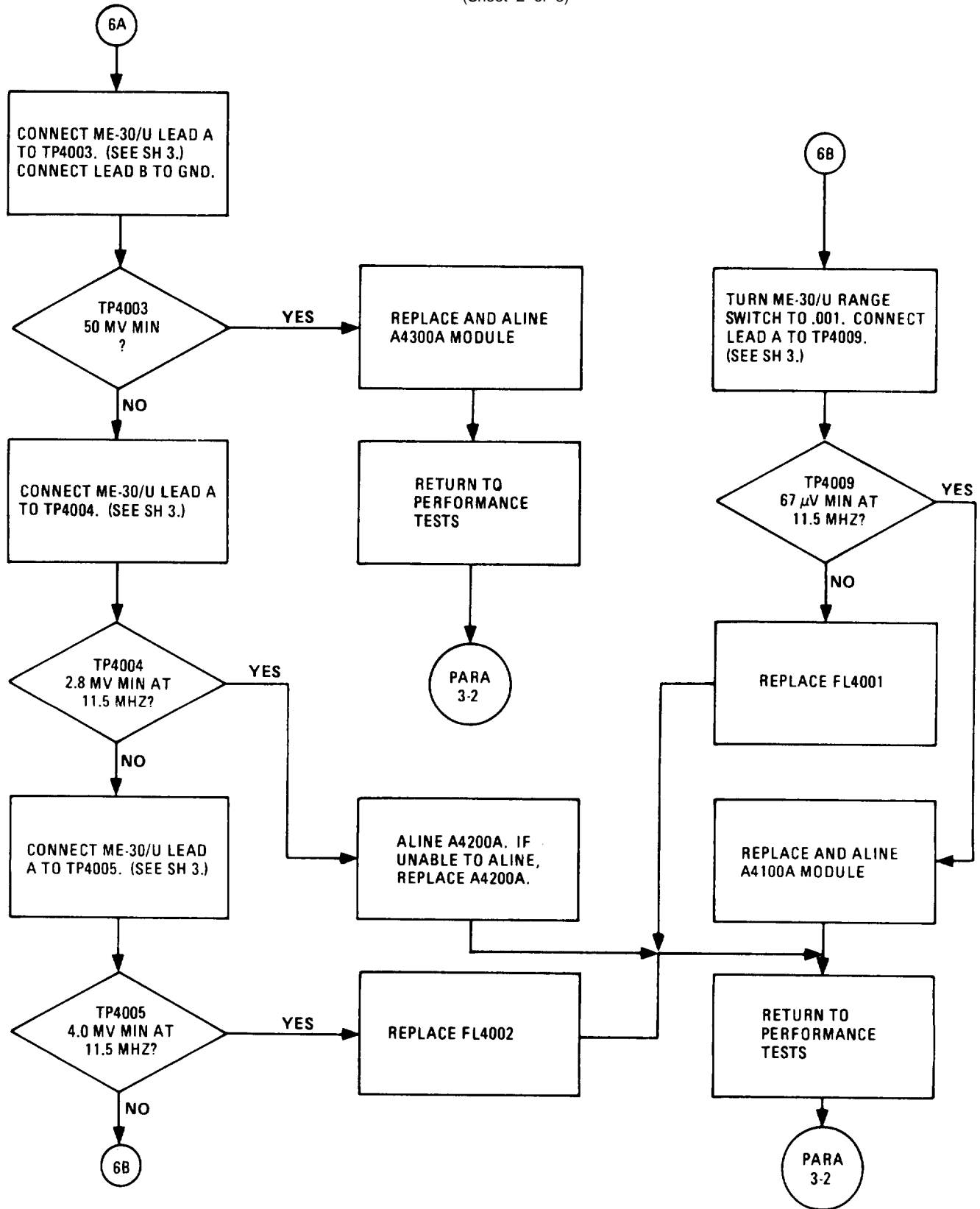
3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-9  
A4000 Assembly Troubleshooting  
(Sheet 1 of 3)



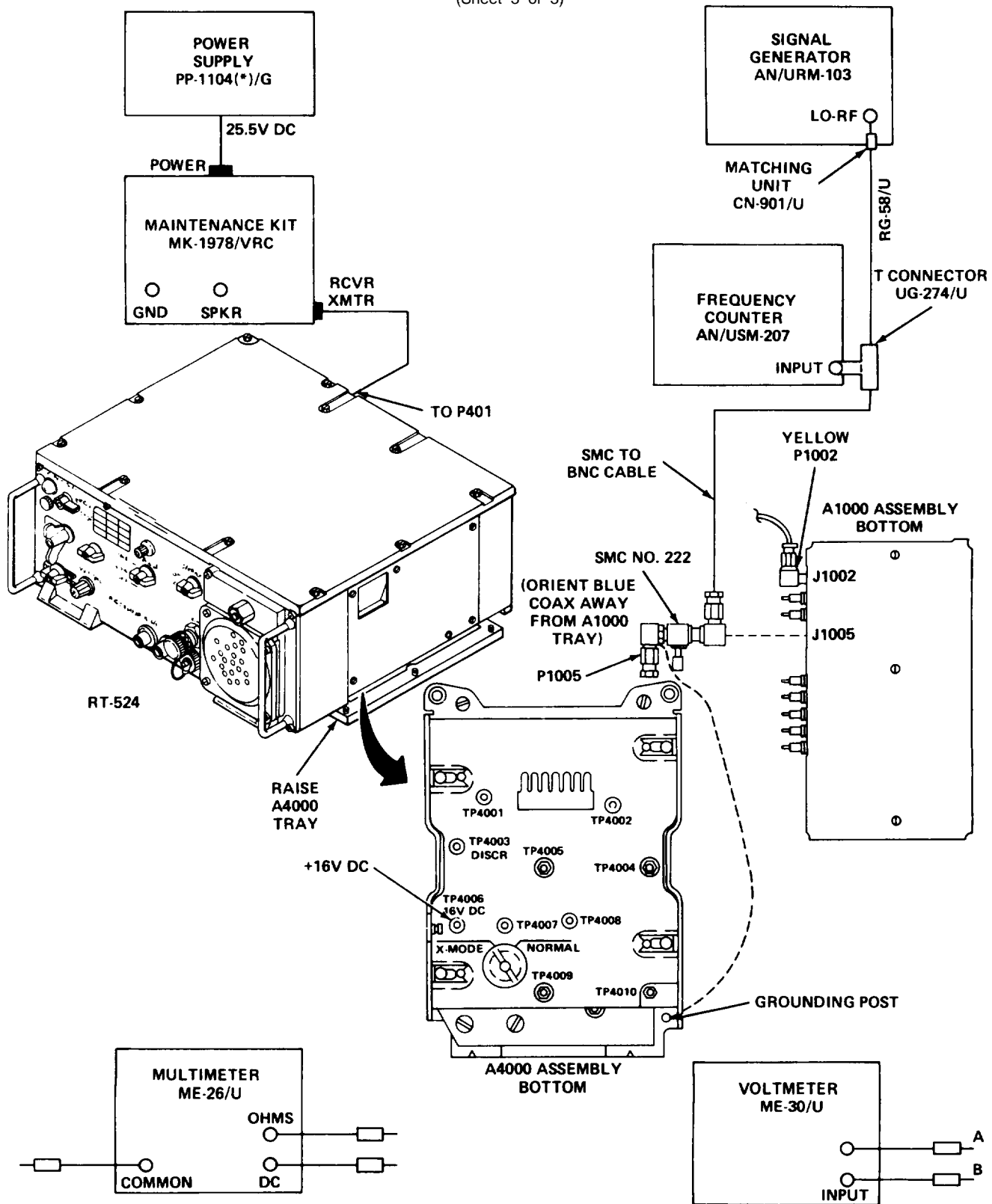
3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-9  
A4000 Assembly Troubleshooting  
(Sheet 2 of 3)



3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-9  
A4000 Assembly Troubleshooting  
(Sheet 3 of 3)



EL4GP439



3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-10  
 A5000 Assembly Troubleshooting  
 (Sheet 1 of 10)

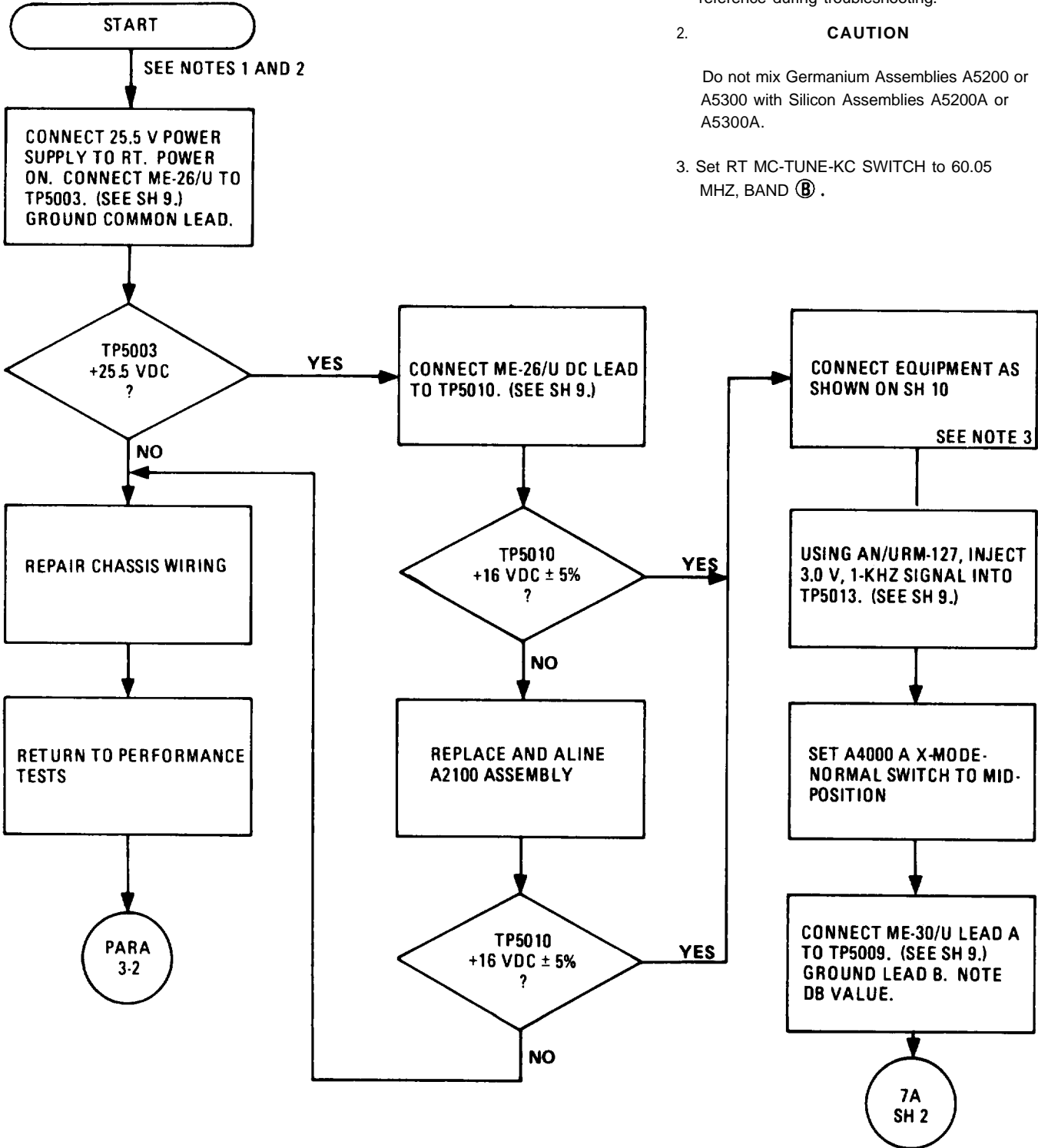
NOTES

1. Use A5000 signal flow diagram (FO-13) for reference during troubleshooting.

2. CAUTION

Do not mix Germanium Assemblies A5200 or A5300 with Silicon Assemblies A5200A or A5300A.

3. Set RT MC-TUNE-KC SWITCH to 60.05 MHZ, BAND **B**.



3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-10  
A5000 Assembly Troubleshooting  
(Sheet 2 of 10)

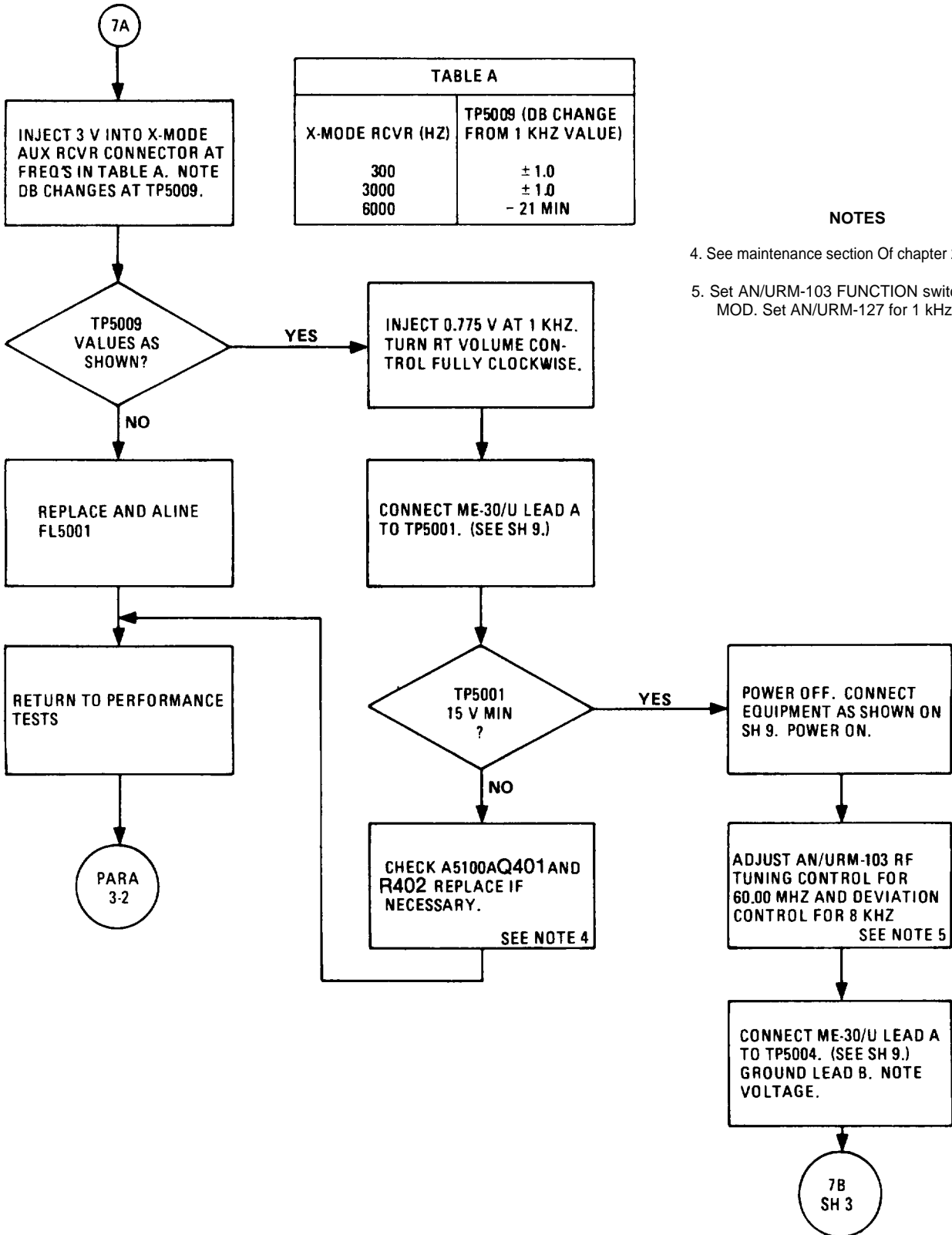


TABLE A	
X-MODE RCVR (HZ)	TP5009 (DB CHANGE FROM 1 KHZ VALUE)
300	± 1.0
3000	± 1.0
6000	- 21 MIN

NOTES

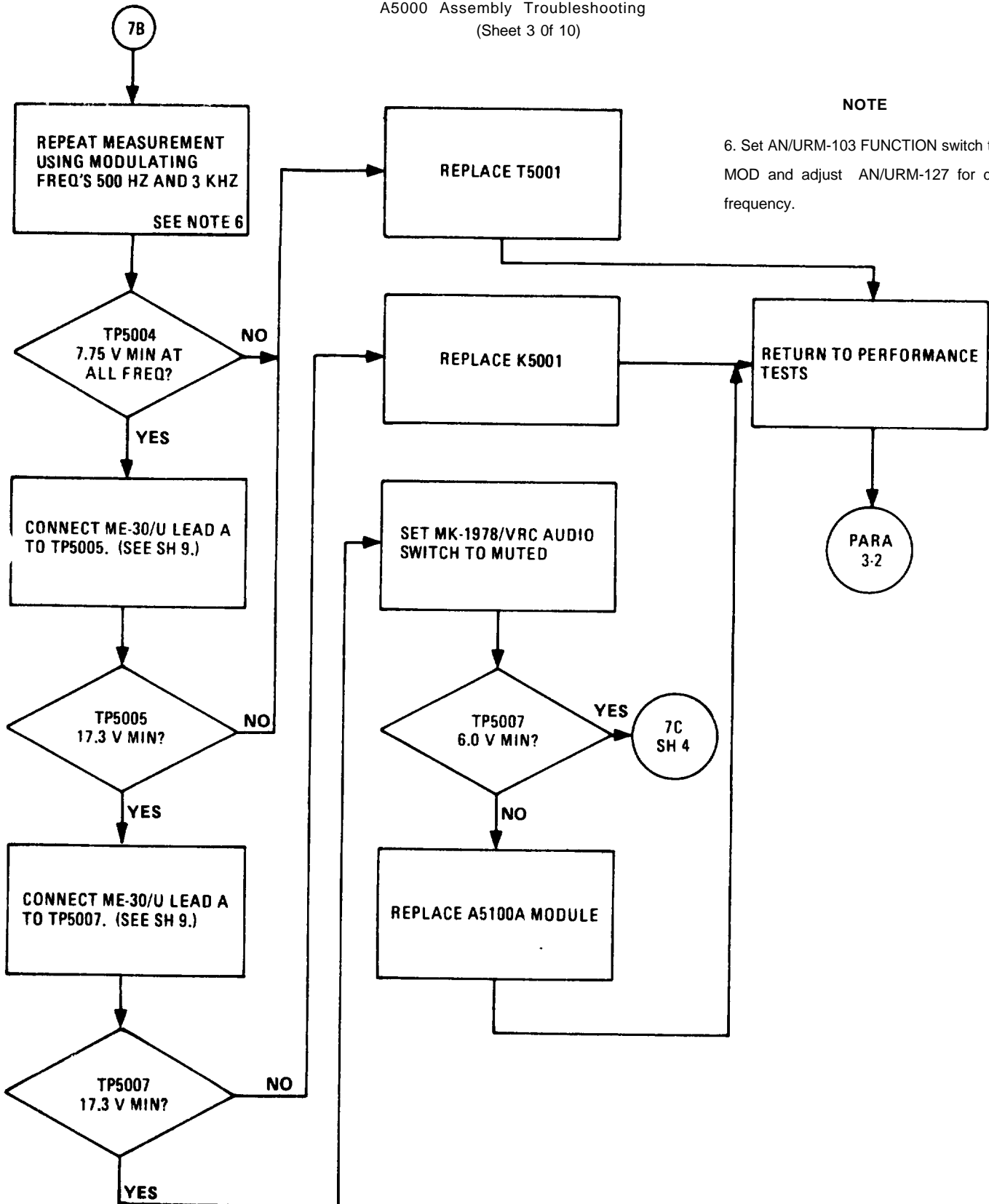
- 4. See maintenance section Of chapter 2.
- 5. Set AN/URM-103 FUNCTION switch to EXT MOD. Set AN/URM-127 for 1 kHz at 10 µV.

3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-10  
A5000 Assembly Troubleshooting  
(Sheet 3 Of 10)

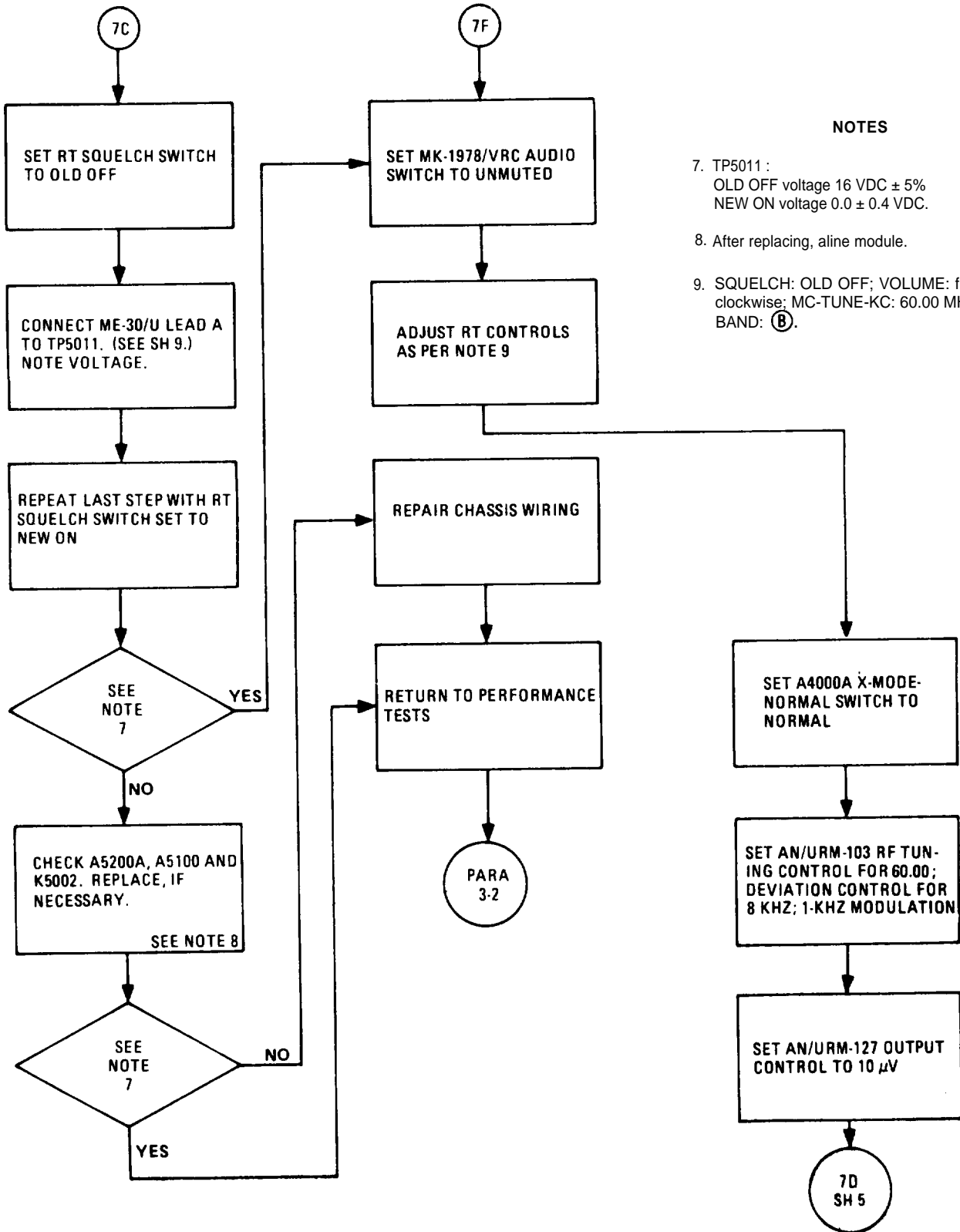
NOTE

6. Set AN/URM-103 FUNCTION switch to EXT MOD and adjust AN/URM-127 for desired frequency.



3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-10  
A5000 Assembly Troubleshooting  
(Sheet 4 of 10)

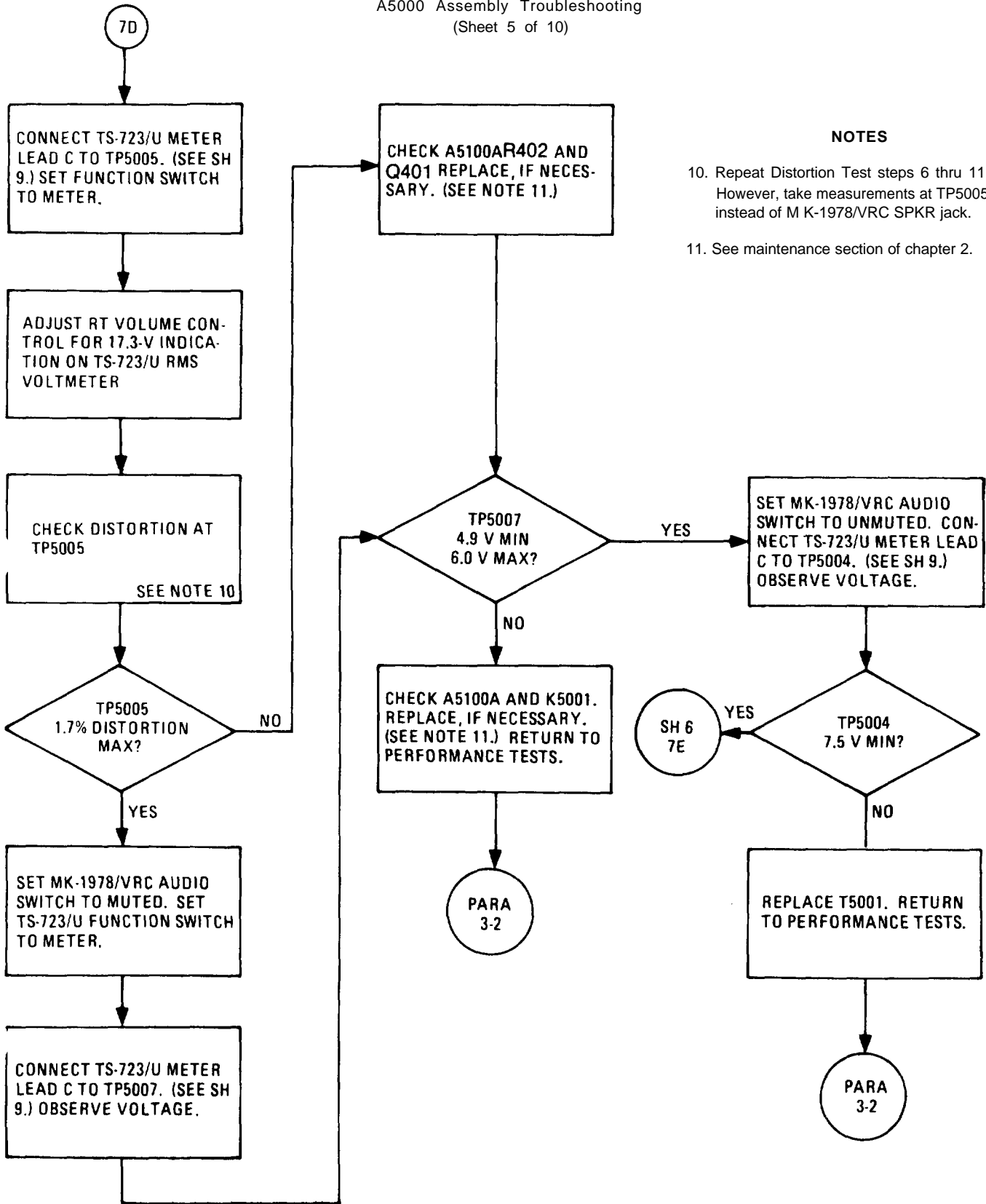


NOTES

- 7. TP5011 :  
OLD OFF voltage 16 VDC ± 5%  
NEW ON voltage 0.0 ± 0.4 VDC.
- 8. After replacing, aline module.
- 9. SQUELCH: OLD OFF; VOLUME: fully clockwise; MC-TUNE-KC: 60.00 MHZ; BAND: (B).

3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-10  
A5000 Assembly Troubleshooting  
(Sheet 5 of 10)

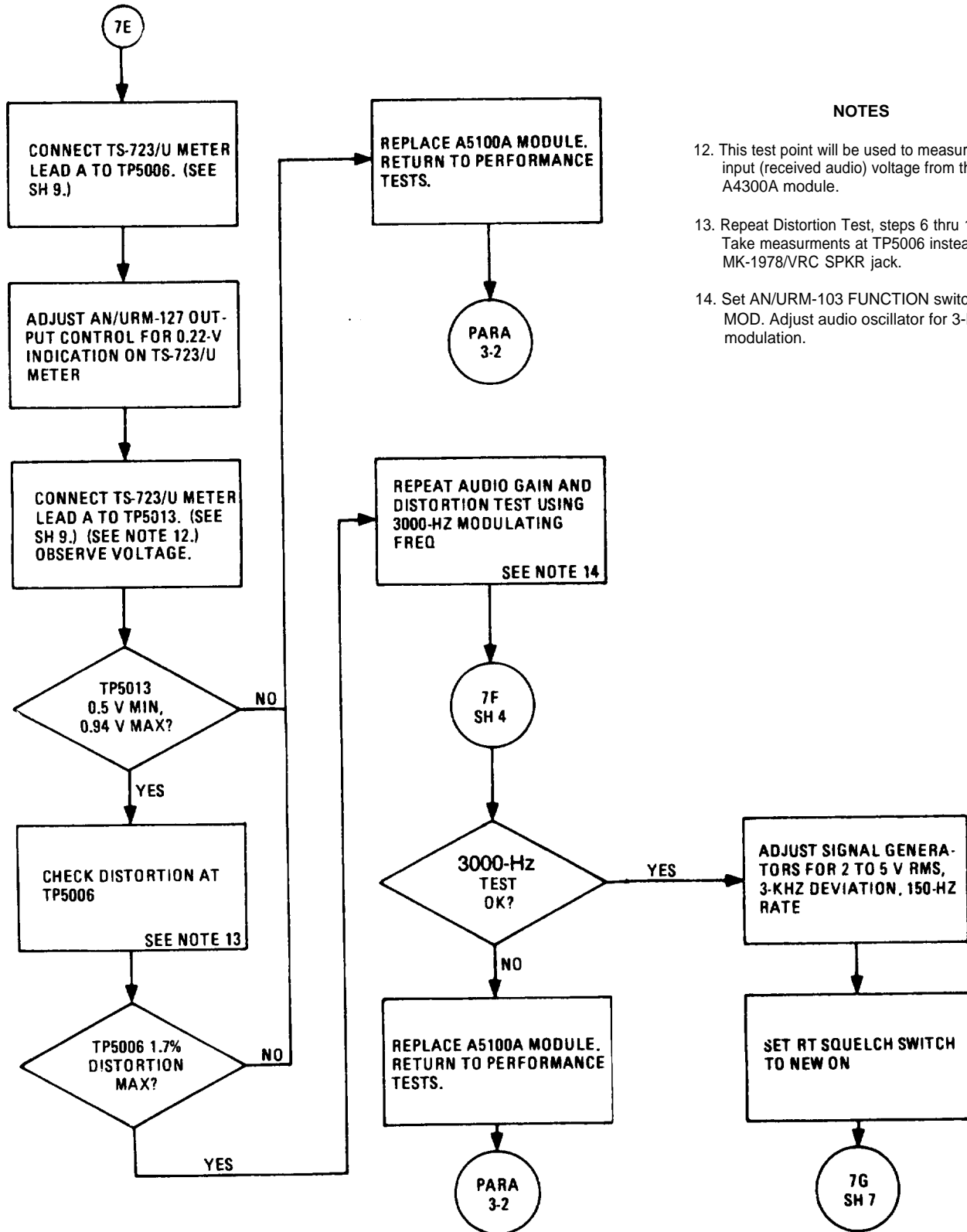


NOTES

- 10. Repeat Distortion Test steps 6 thru 11. However, take measurements at TP5005, instead of M K-1978/VRC SPKR jack.
- 11. See maintenance section of chapter 2.

3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-10  
A5000 Assembly Troubleshooting  
(Sheet 6 of 10)

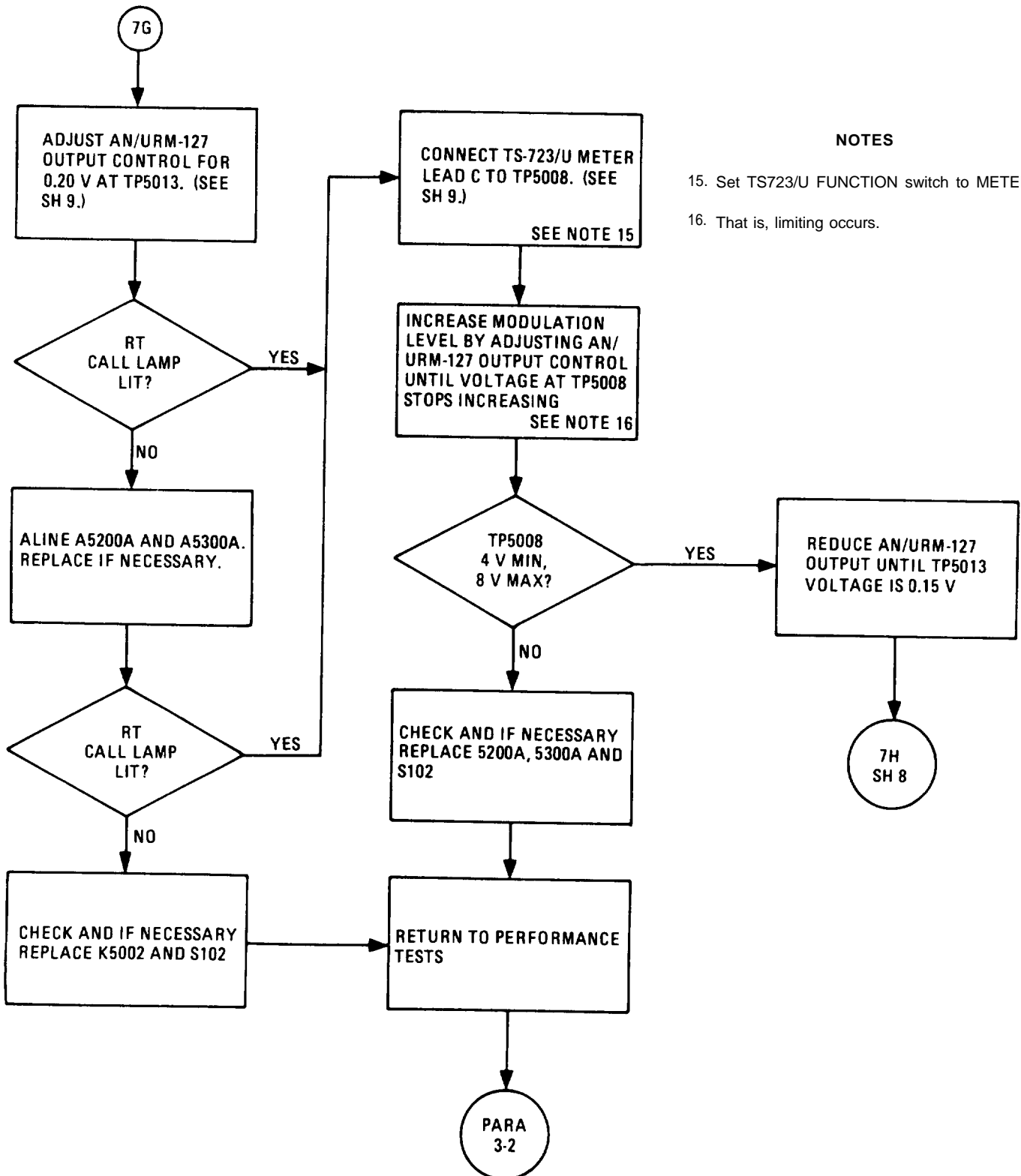


NOTES

- 12. This test point will be used to measure the input (received audio) voltage from the A4300A module.
- 13. Repeat Distortion Test, steps 6 thru 11. Take measurements at TP5006 instead of MK-1978/VRC SPKR jack.
- 14. Set AN/URM-103 FUNCTION switch to EXT MOD. Adjust audio oscillator for 3-kHz modulation.

3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-10  
A5000 Assembly Troubleshooting  
(Sheet 7 of 10)

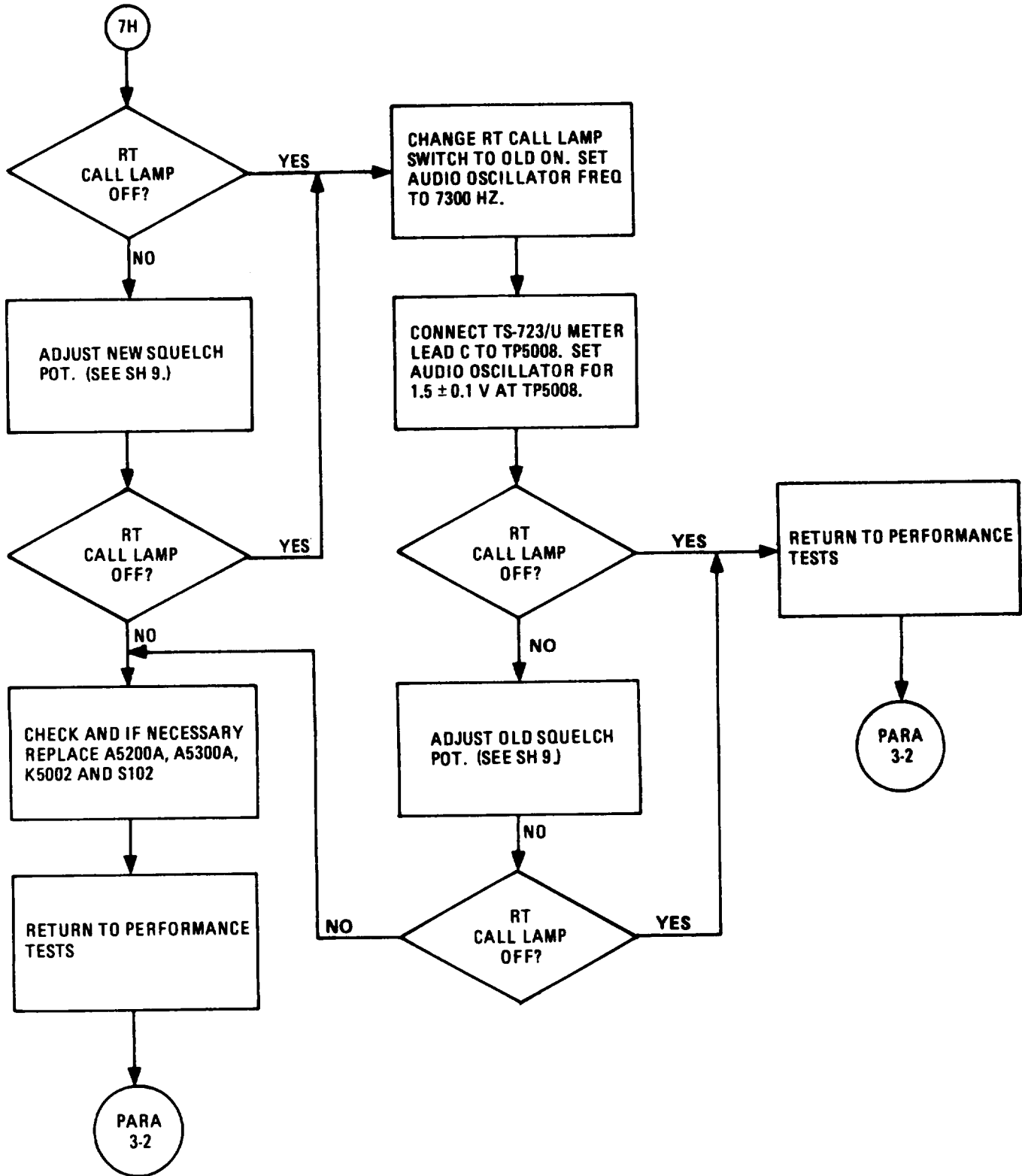


NOTES

- 15. Set TS723/U FUNCTION switch to METER.
- 16. That is, limiting occurs.

3-23. TROUBLESHOOTING FLOW CHARTS.

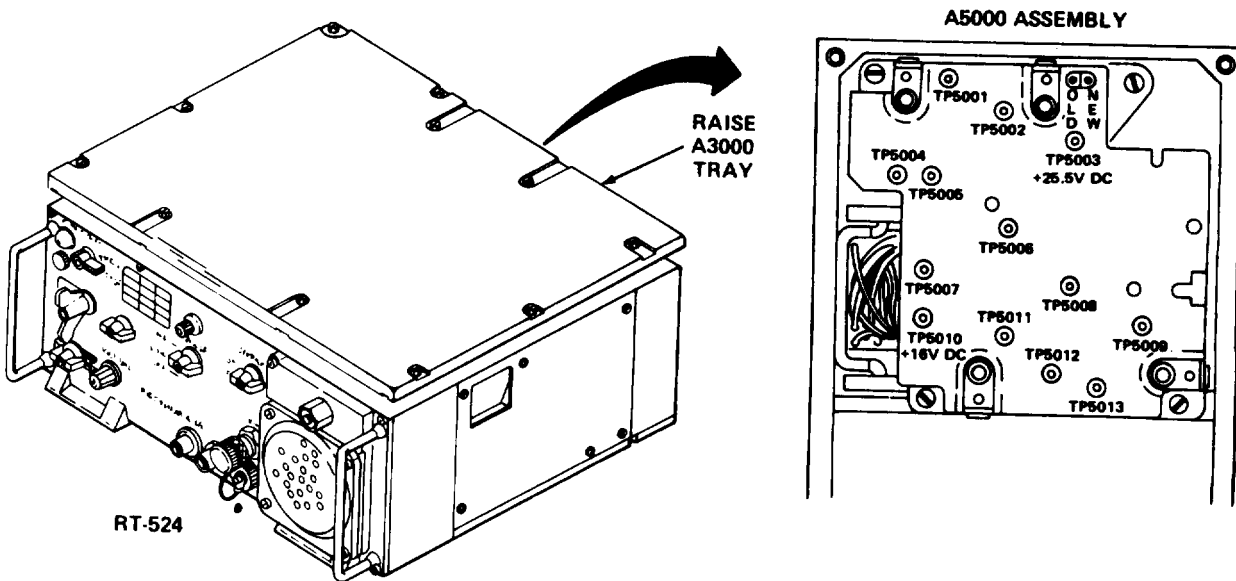
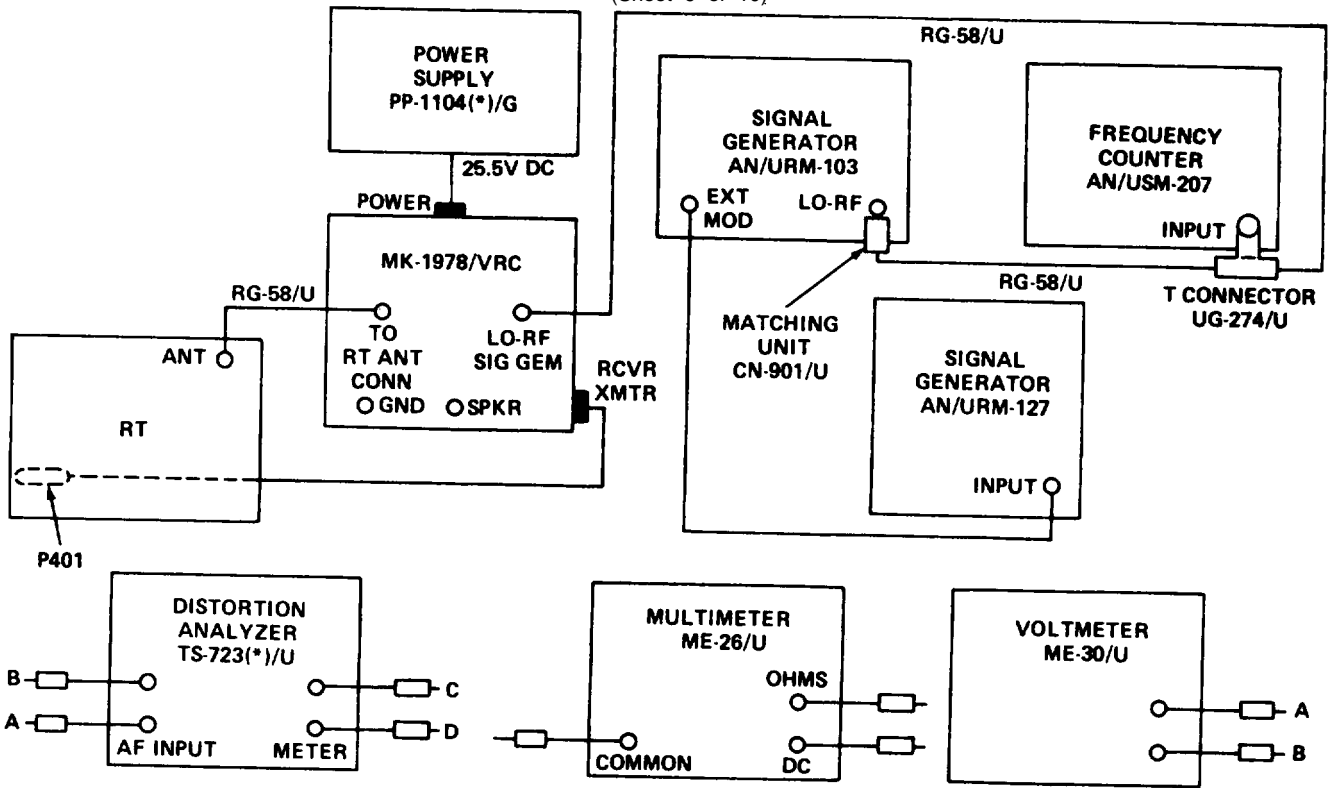
CHART 3-10  
A5000 Assembly Troubleshooting  
(Sheet 8 of 10)





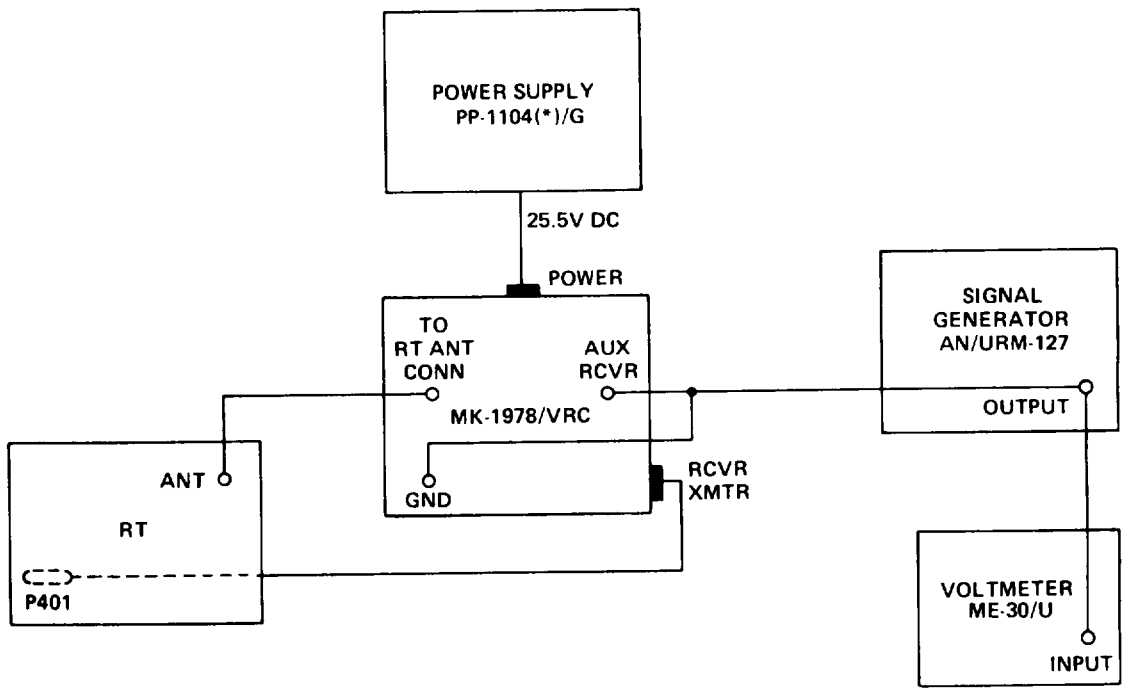
3-23. TROUBLESHOOTING FLOW CHARTS.

CHART 3-10  
A5000 Assembly Troubleshootin  
(Sheet 9 of 10)



3-23. TROUBLESHOOTING FLOW CHARTS.

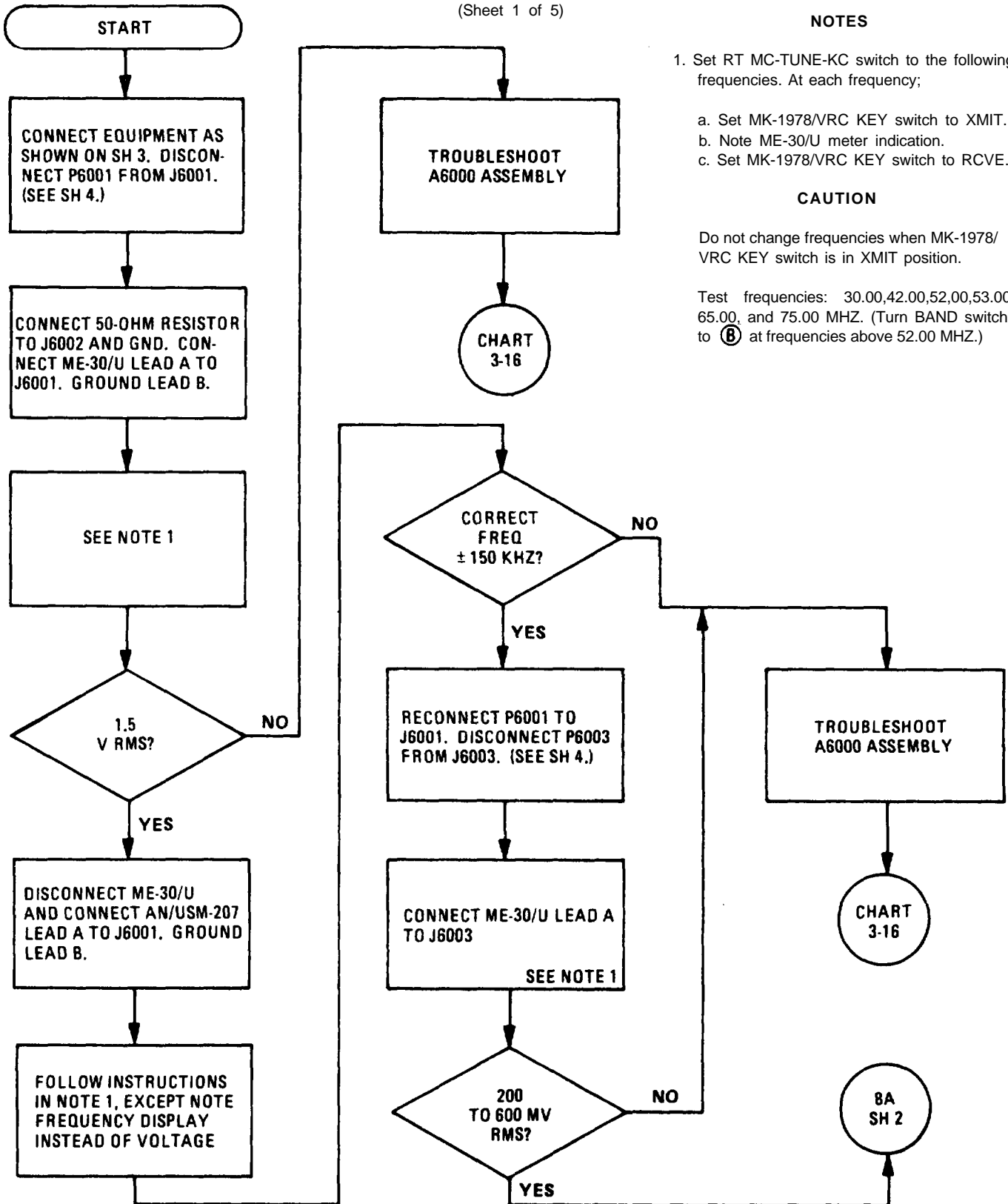
CHART 3-10  
A5000 Assembly Troubleshooting  
(Sheet 10 of 10)



EL4GP435

3-23. TROUBLESHOOTING FLOW CHARTS.

CHART 3-11  
Transmitter Frequency Accuracy Troubleshooting  
(Sheet 1 of 5)



NOTES

1. Set RT MC-TUNE-KC switch to the following frequencies. At each frequency;
  - a. Set MK-1978/VRC KEY switch to XMIT.
  - b. Note ME-30/U meter indication.
  - c. Set MK-1978/VRC KEY switch to RCVE.

CAUTION

Do not change frequencies when MK-1978/VRC KEY switch is in XMIT position.

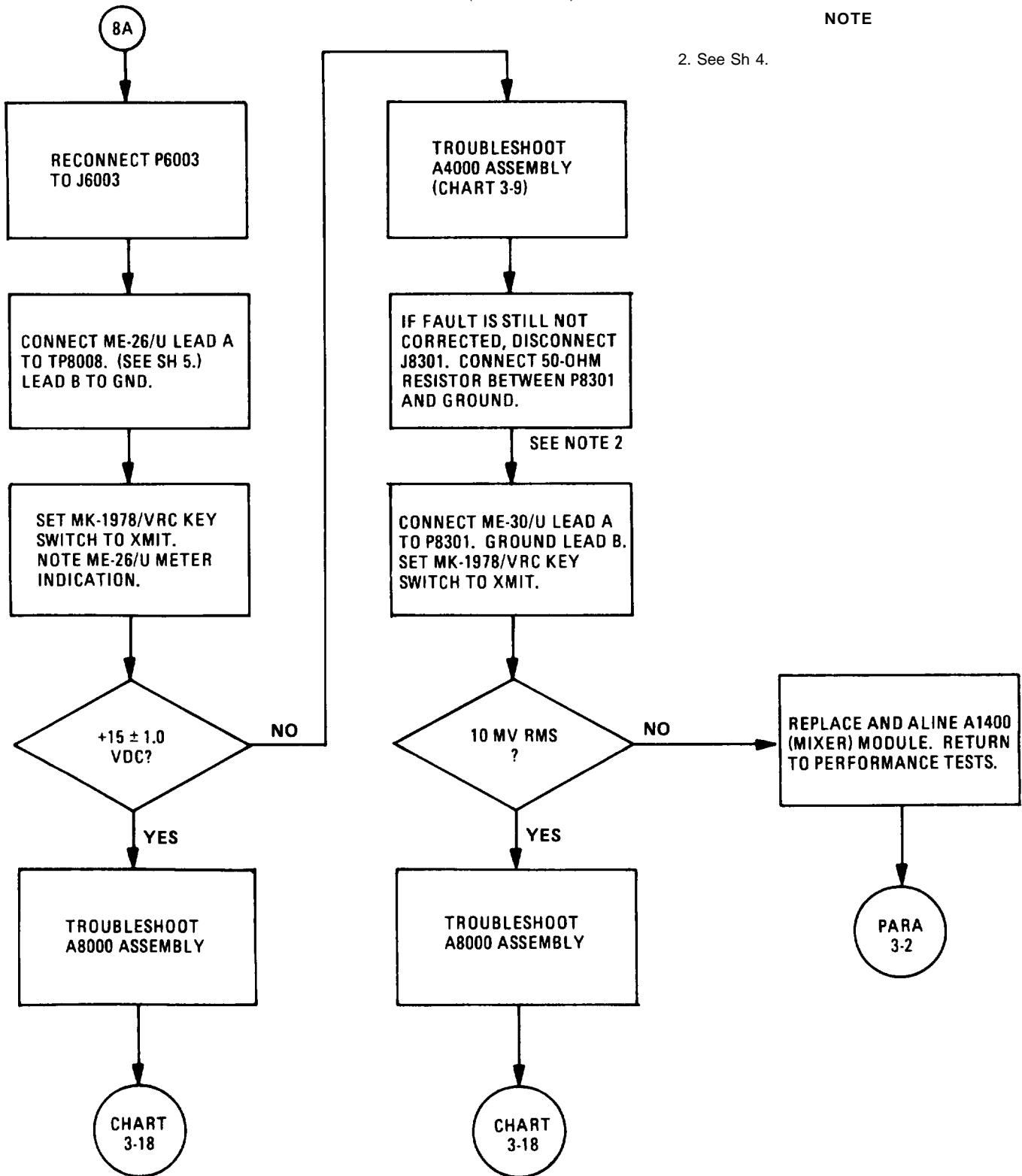
Test frequencies: 30.00,42.00,52.00,53.00, 65.00, and 75.00 MHz. (Turn BAND switch to **B** at frequencies above 52.00 MHz.)

3-23. TROUBLESHOOTING FLOW CHARTS.

CHART 3-11  
 Transmitter Frequency Accuracy Troubleshooting  
 (Sheet 2 of 5)

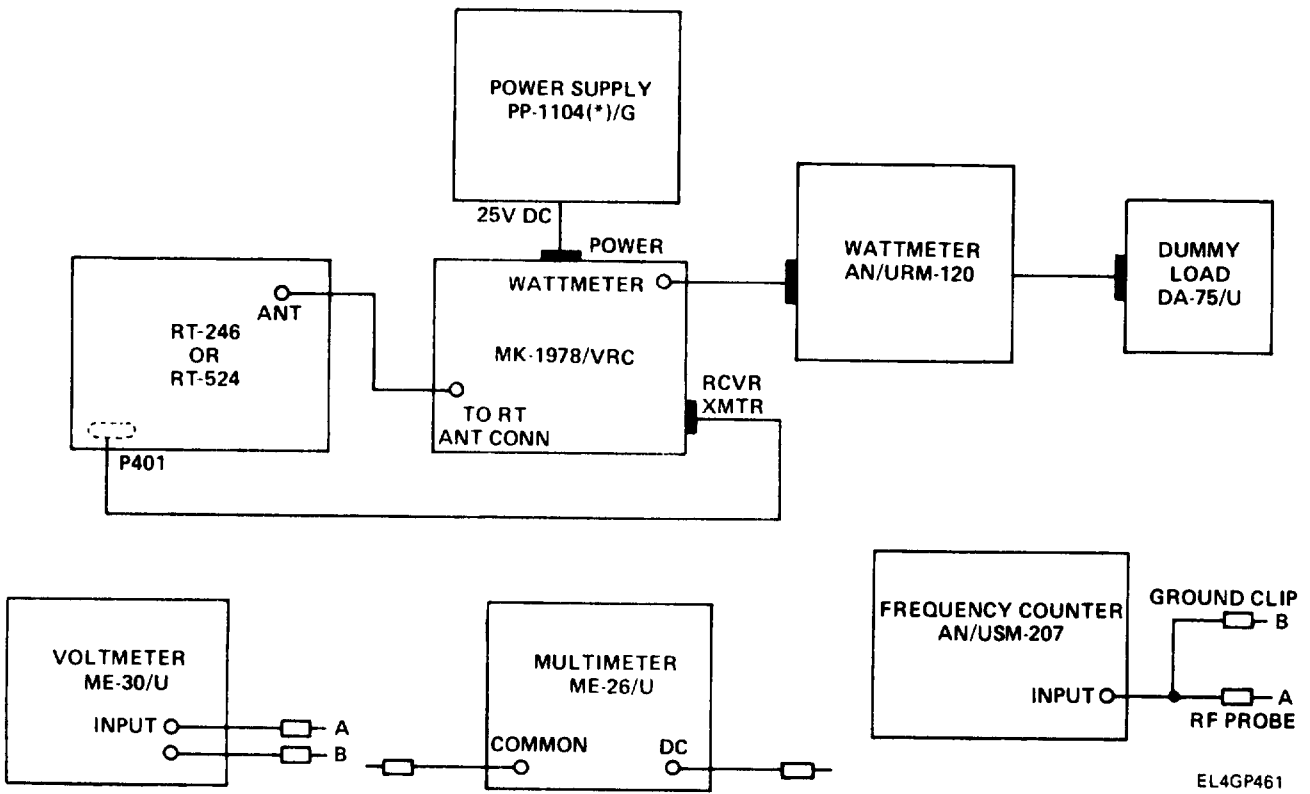
NOTE

2. See Sh 4.



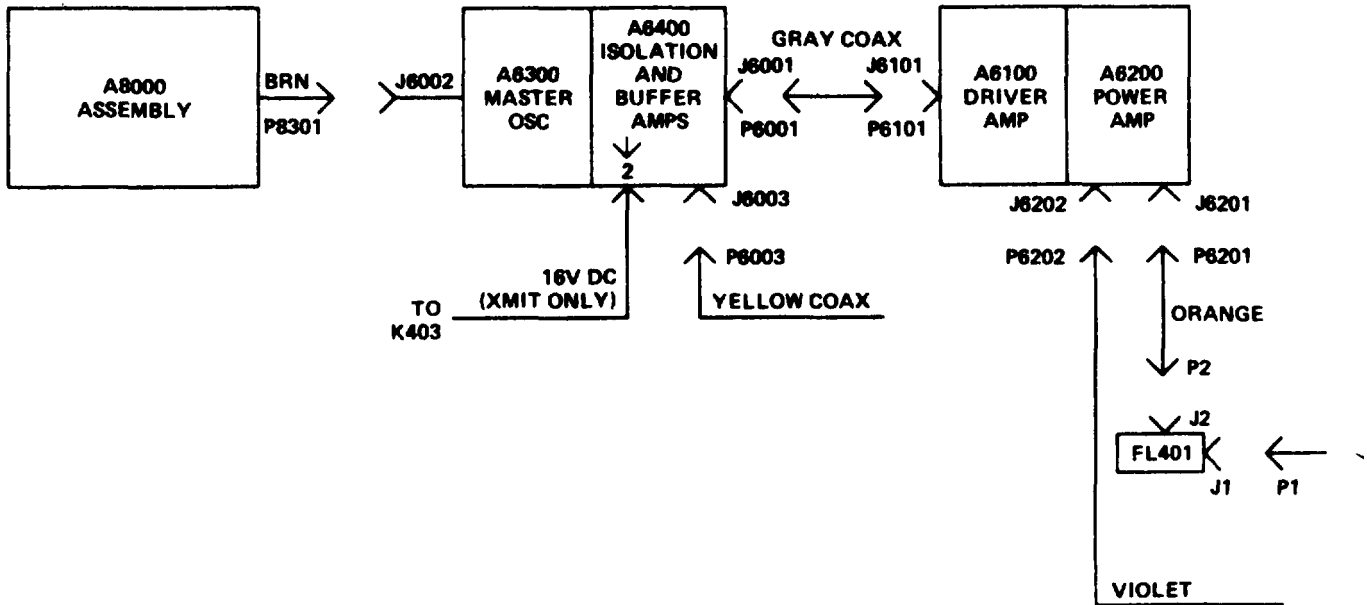
3-23. TROUBLESHOOTING FLOW CHARTS.

CHART 3-11  
 Transmitter Frequency Accuracy Troubleshooting  
 (Sheet 3 of 5)



3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

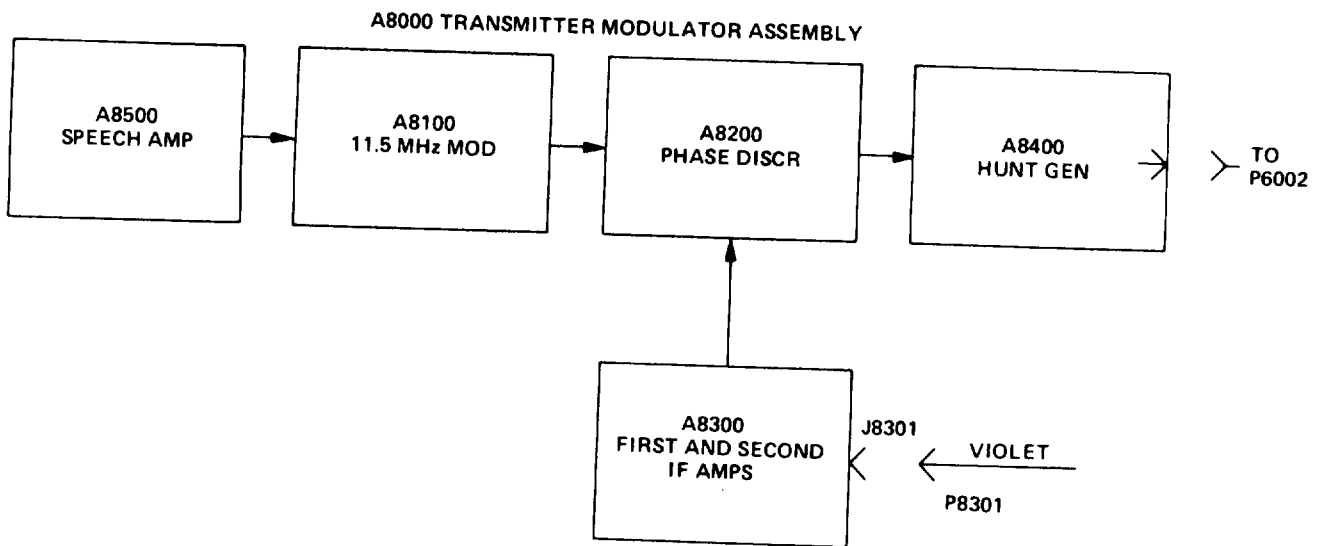
CHART 3-11  
 Transmitter Frequency Accuracy Troubleshooting  
 (Sheet 4 of 5)



EL4GP459

3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-11  
Transmitter Frequency Accuracy Troubleshooting  
(Sheet 5 of 5)



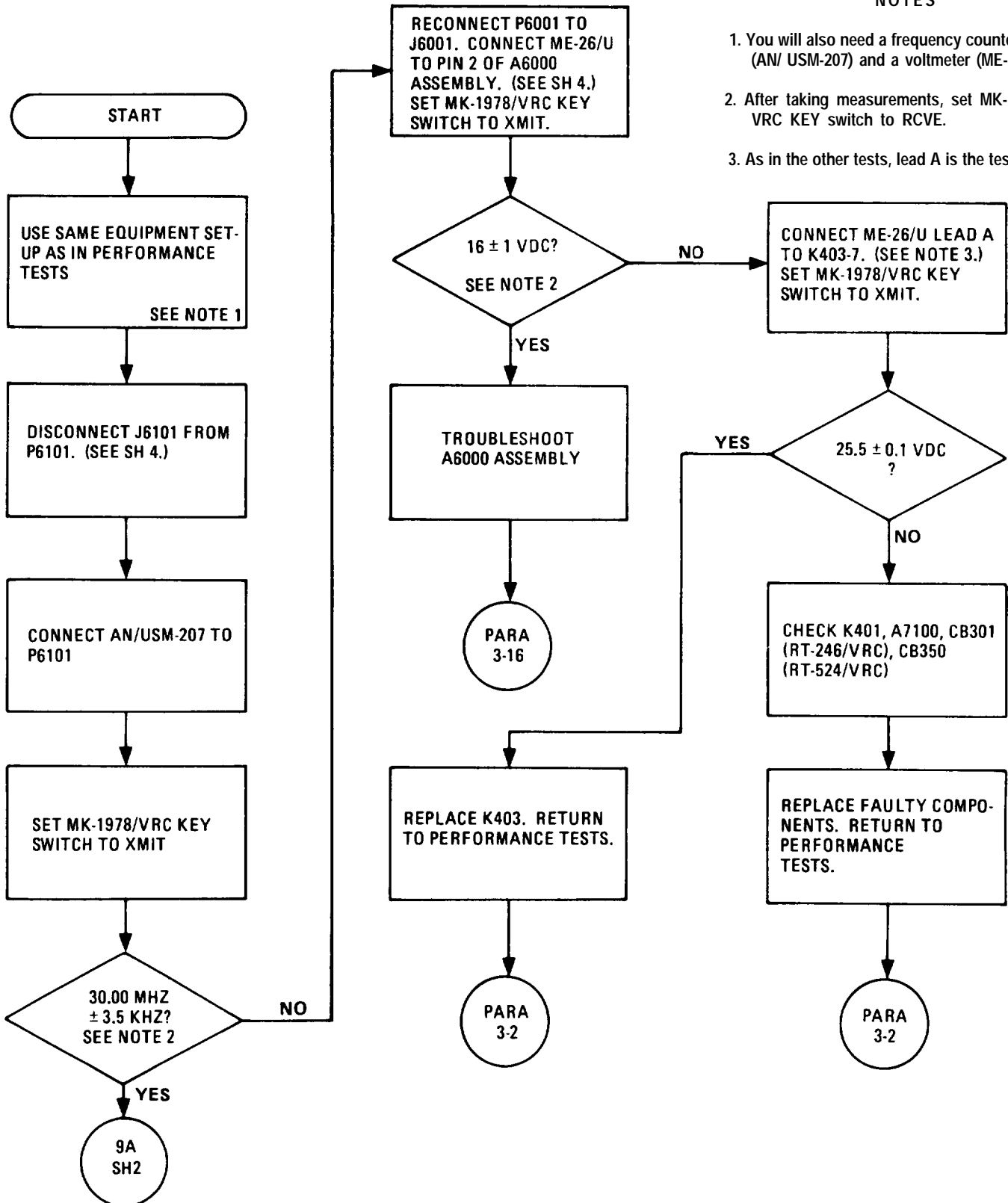
EL4GP460

3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-12  
Transmitter Low and High Power Troubleshooting  
(Sheet 1 of 4)

NOTES

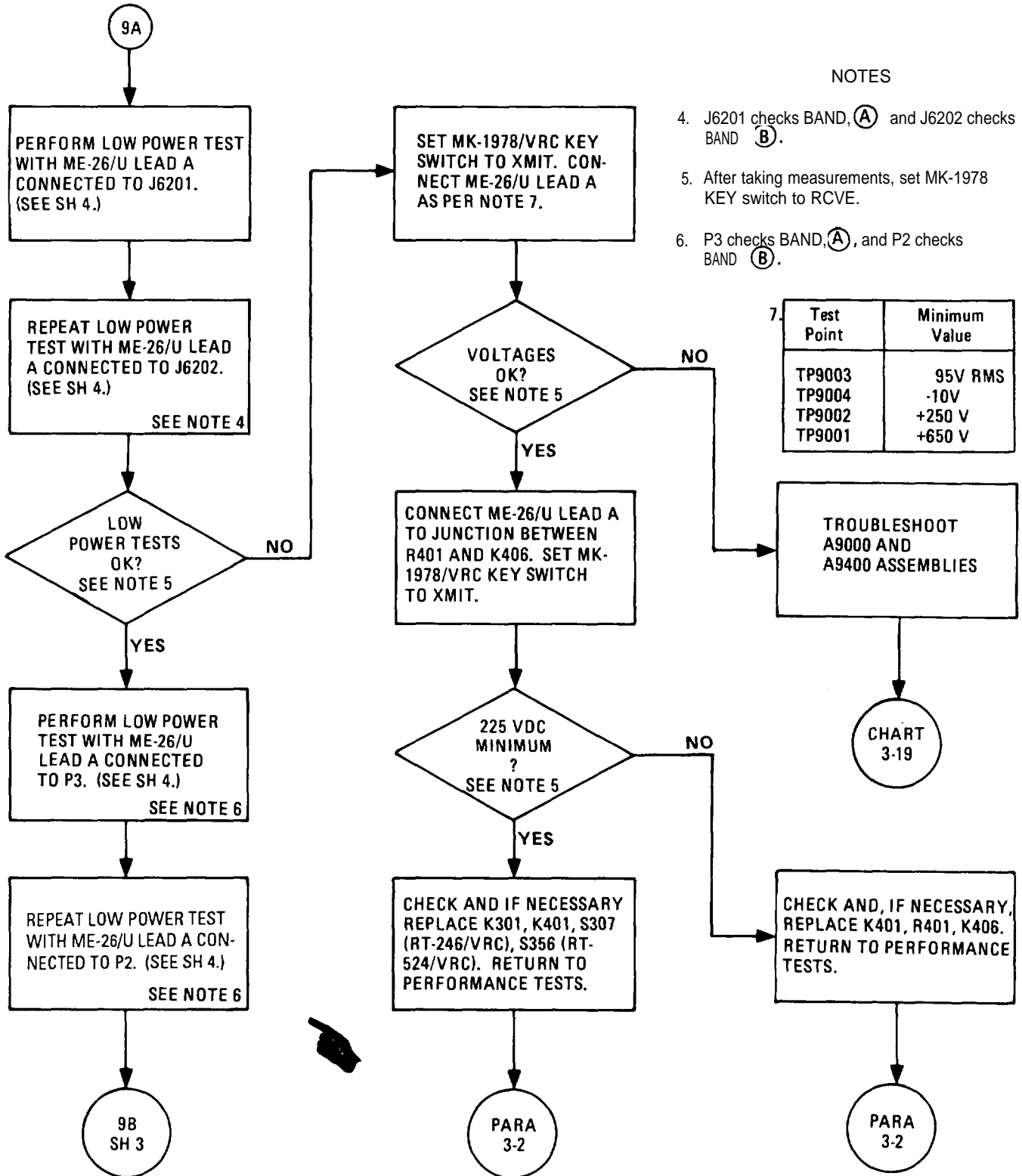
1. You will also need a frequency counter (AN/ USM-207) and a voltmeter (ME-301/U).
2. After taking measurements, set MK-1978/ VRC KEY switch to RCVE.
3. As in the other tests, lead A is the test probe.





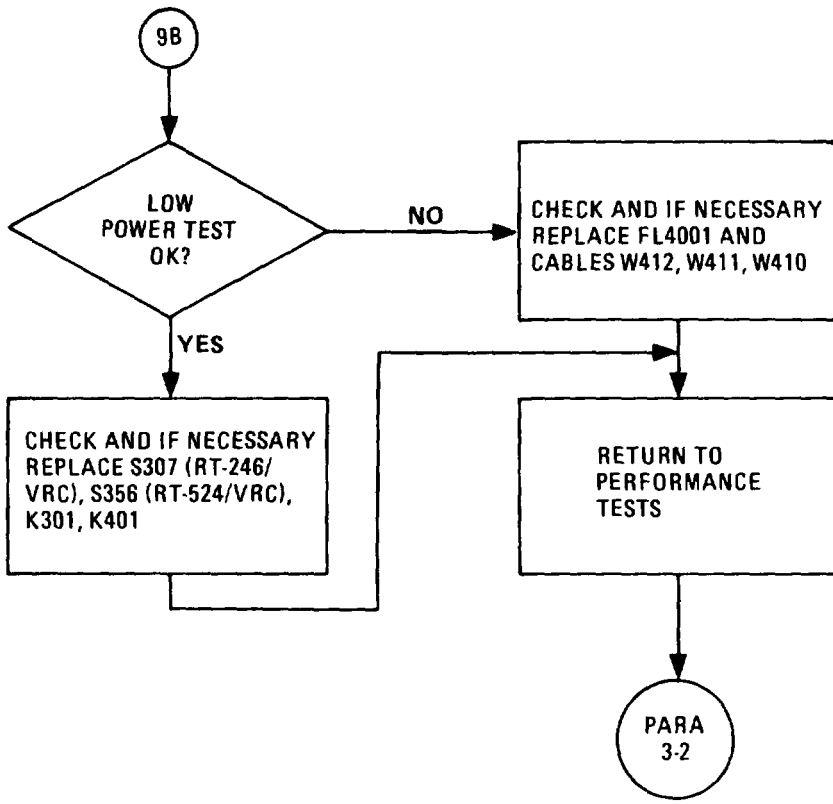
3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-12  
Transmitter Low and High Power Troubleshooting  
(Sheet 2 of 4)



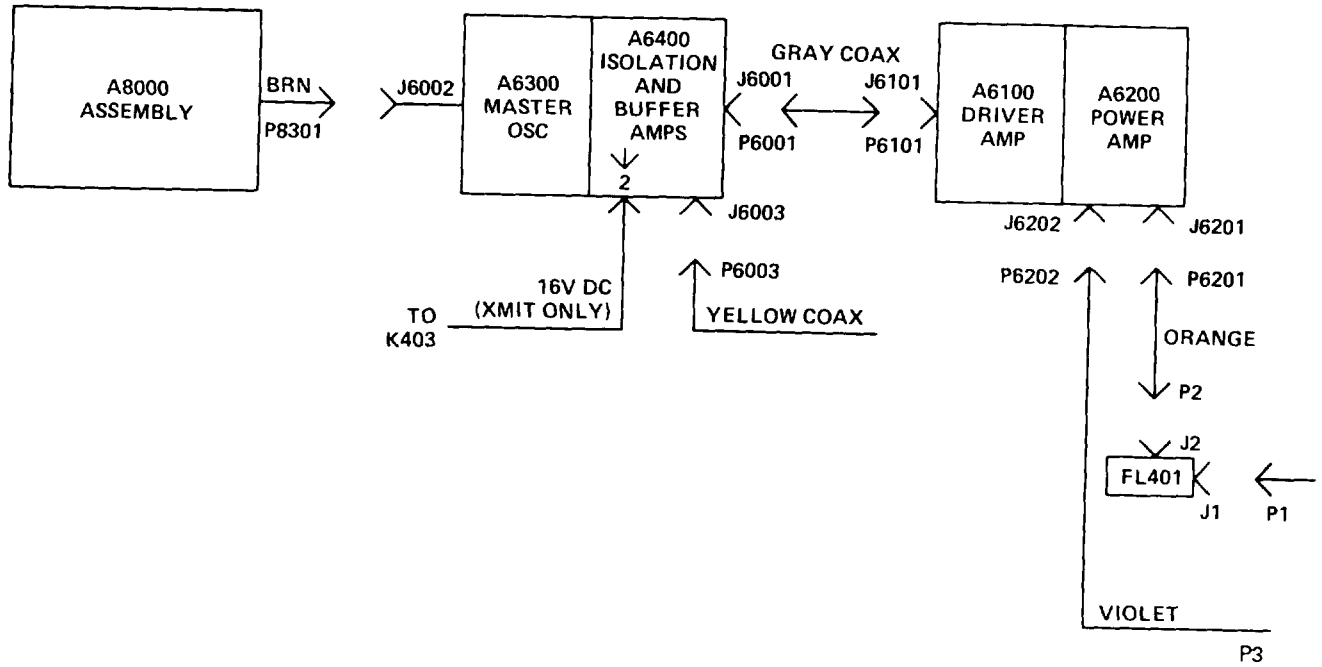
3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-12  
Transmitter Low and High Power Troubleshooting  
(Sheet 3 of 4)



3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

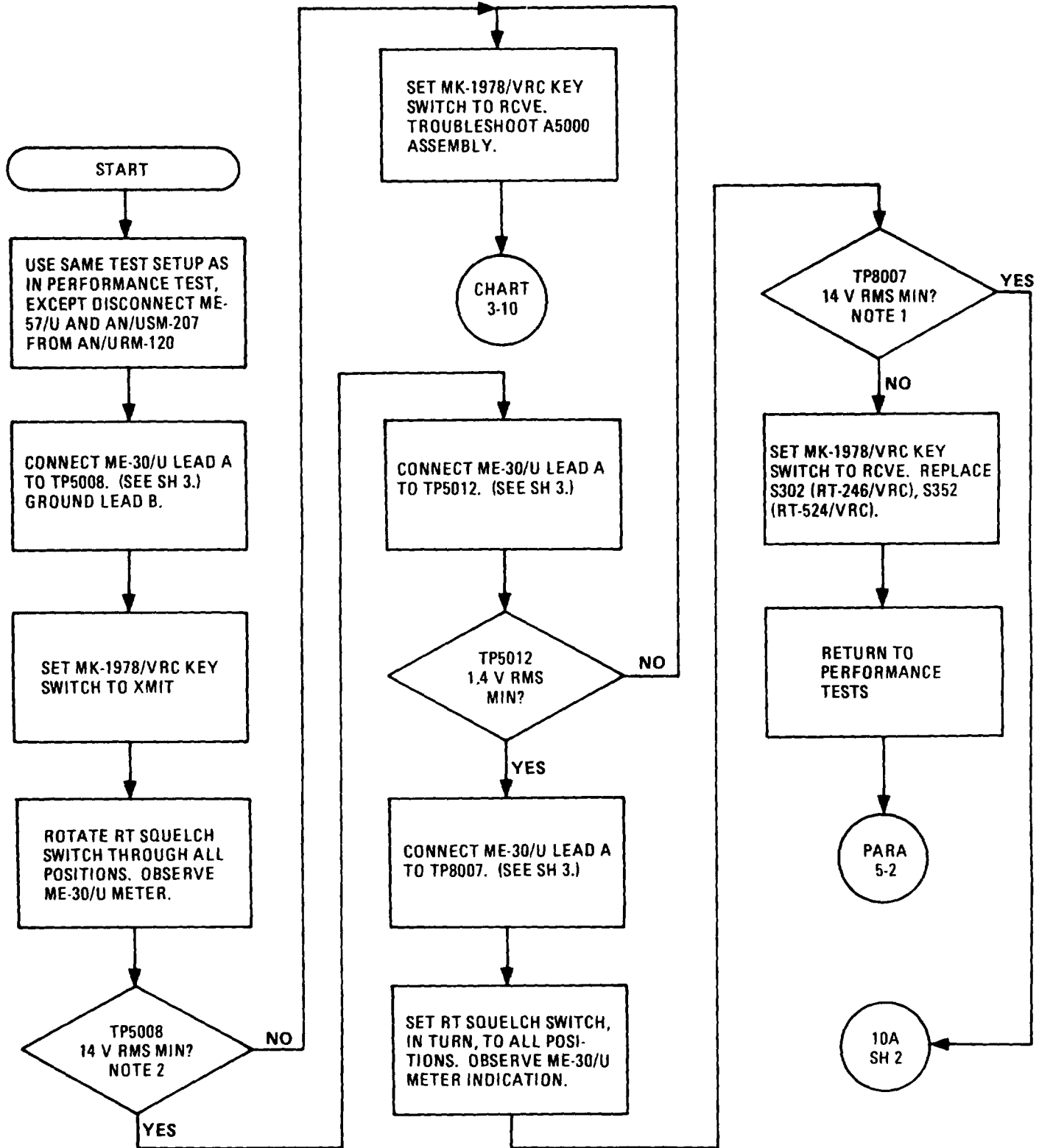
CHART 3-12  
 Transmitter Low and High Power Troubleshooting  
 (Sheet 4 of 4)



EL4GP459

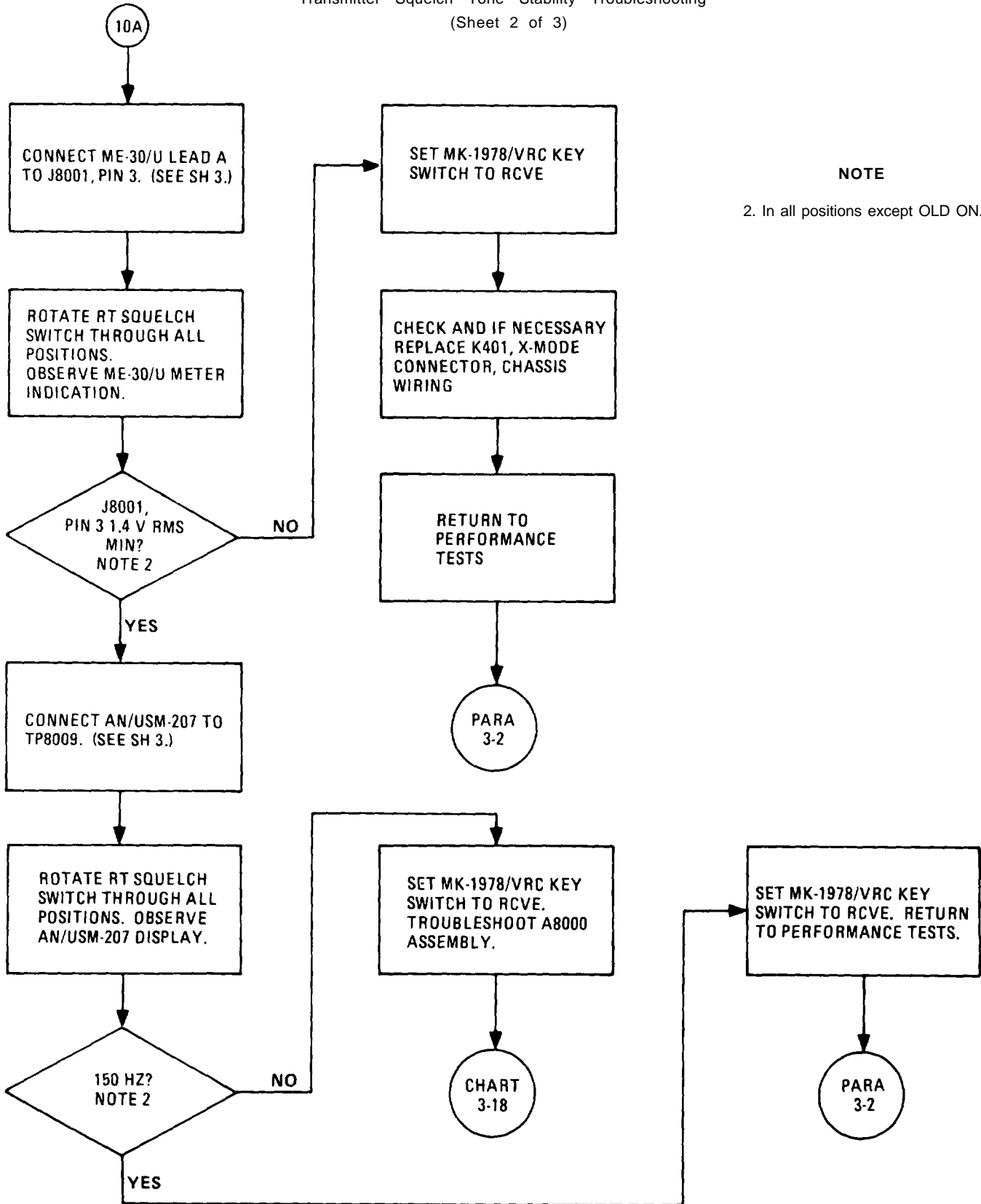
3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-13  
 Transmitter Squelch Tone Stability Troubleshooting  
 (Sheet 1 of 3)



3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-13  
Transmitter Squelch Tone Stability Troubleshooting  
(Sheet 2 of 3)



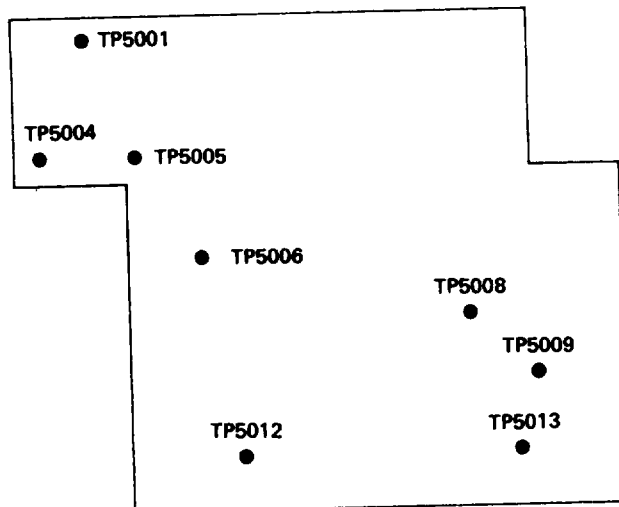
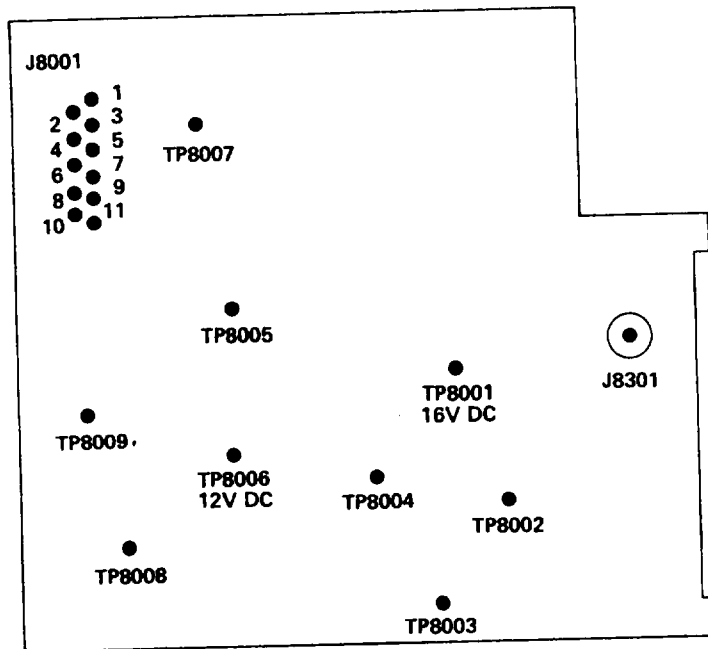
NOTE

2. In all positions except OLD ON.

3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

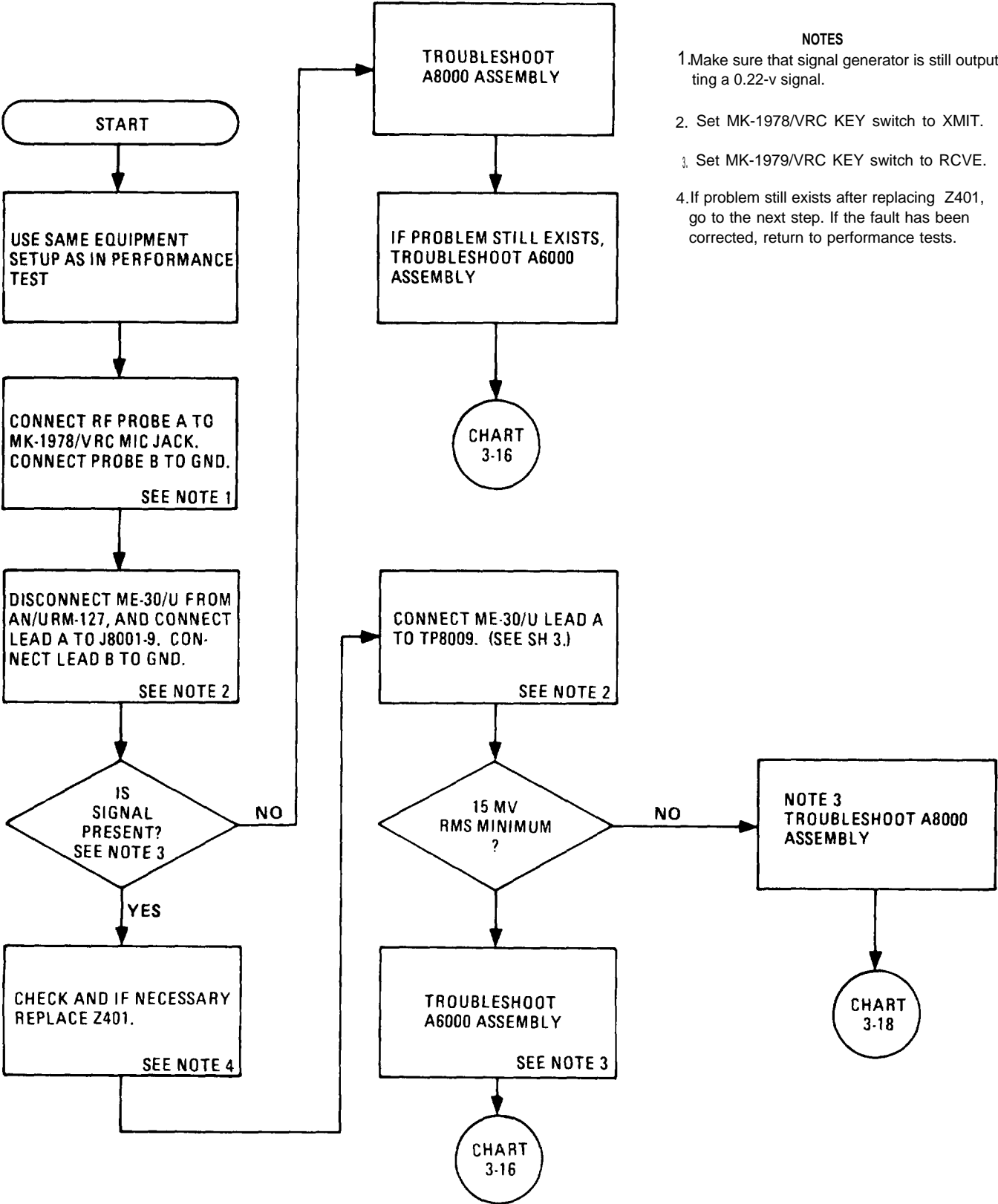
CHART 3-13

Transmitter Squelch Tone Stability Troubleshooting  
(Sheet 3 of 3)



3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-14  
Transmitter Deviation (Normal Mode) Troubleshooting  
(Sheet 1 of 2)

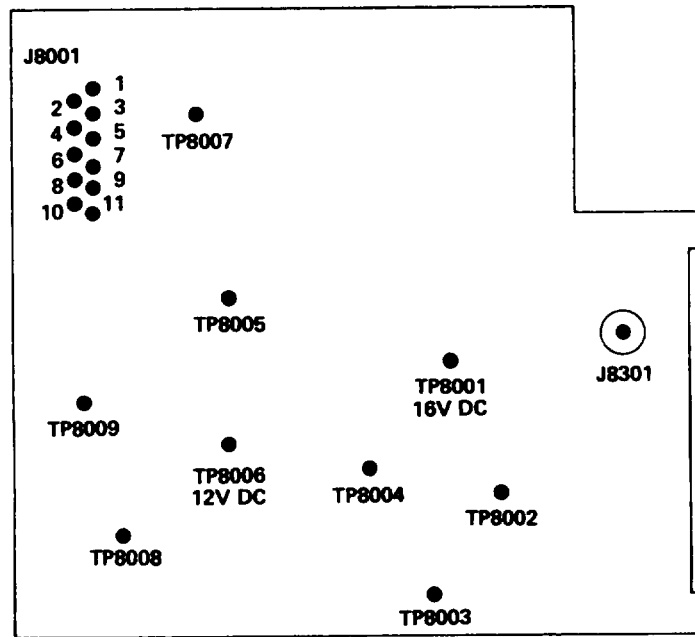


NOTES

- 1. Make sure that signal generator is still outputting a 0.22-v signal.
- 2. Set MK-1978/VRC KEY switch to XMIT.
- 3. Set MK-1979/VRC KEY switch to RCVE.
- 4. If problem still exists after replacing Z401, go to the next step. If the fault has been corrected, return to performance tests.

3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-14  
Transmitter Deviation (Normal Mode) Troubleshooting  
(Sheet 2 of 2)



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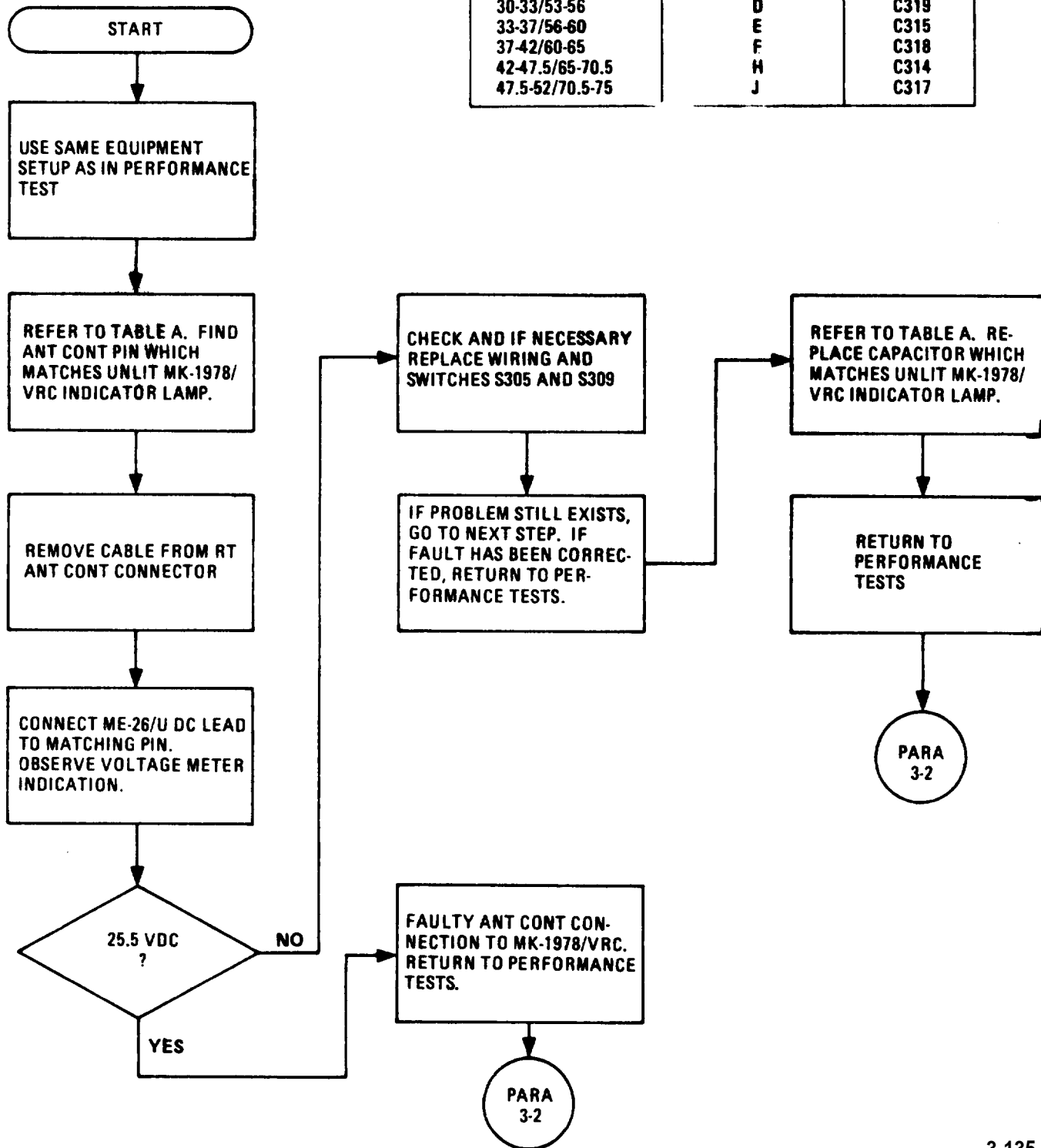


3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-15  
Antenna Information (Switching) Troubleshooting  
(Sheet 1 of 1)

**TABLE A**

MK-1978/VRC INDICATOR LAMP	MATCHING RT ANT CONT PIN	MATCHING CAPACITOR
A-BAND	A	C321
B-BAND	B	C320
30-33/53-56	D	C319
33-37/56-60	E	C315
37-42/60-65	F	C318
42-47.5/65-70.5	H	C314
47.5-52/70.5-75	J	C317



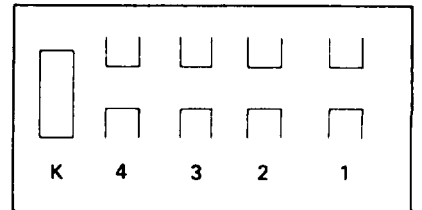
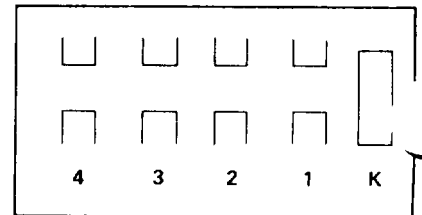
3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-16  
Main Circuit Board Assembly A6000A, and Modules  
A6300A and A6400A Troubleshooting  
(Sheet 1 of 5)

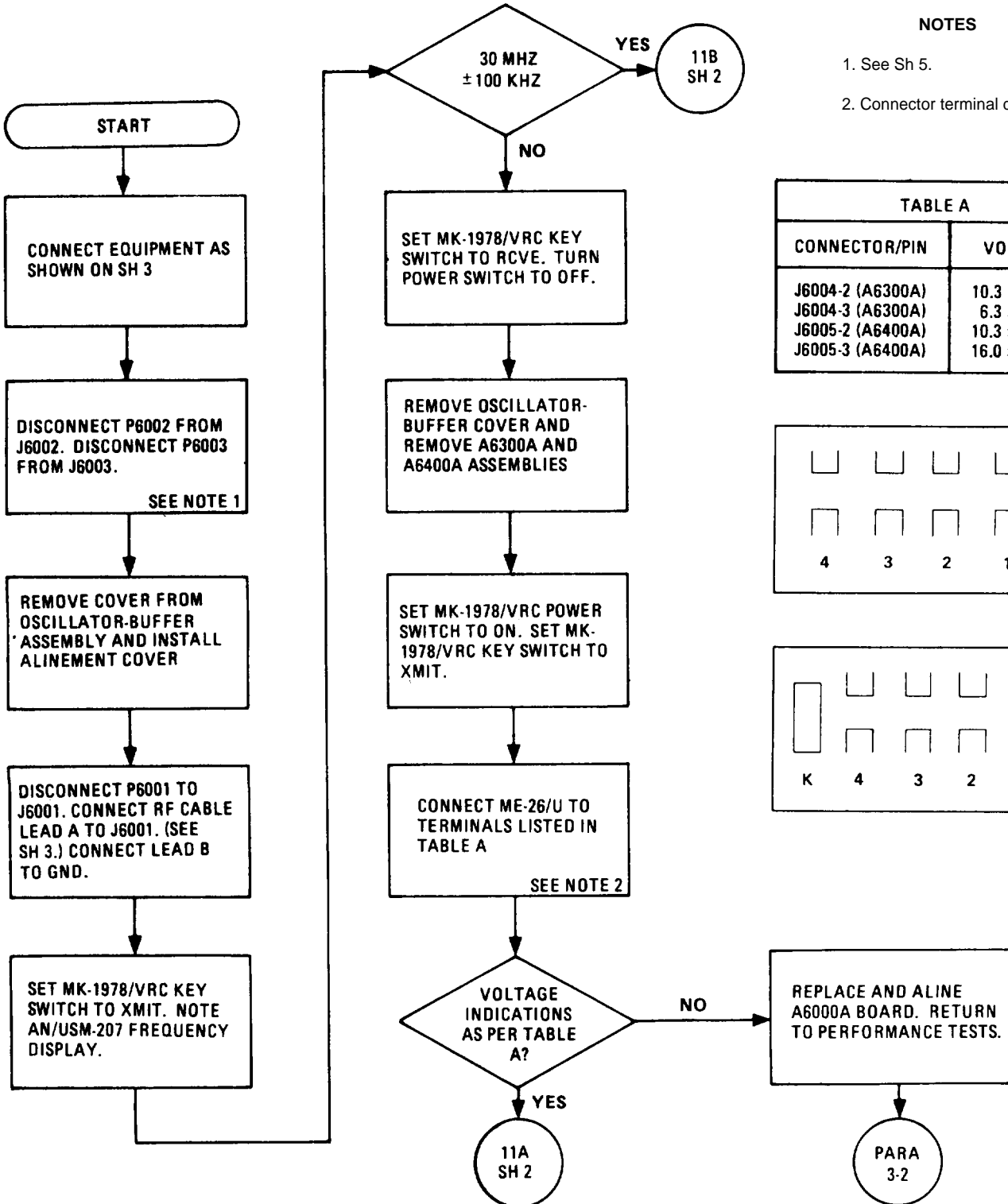
NOTES

1. See Sh 5.
2. Connector terminal diagrams:

TABLE A	
CONNECTOR/PIN	VOLTAGE
J6004-2 (A6300A)	10.3 ± 3%
J6004-3 (A6300A)	6.3 ± 0.2 VDC
J6005-2 (A6400A)	10.3 ± 3%
J6005-3 (A6400A)	16.0 ± 0.2 VDC

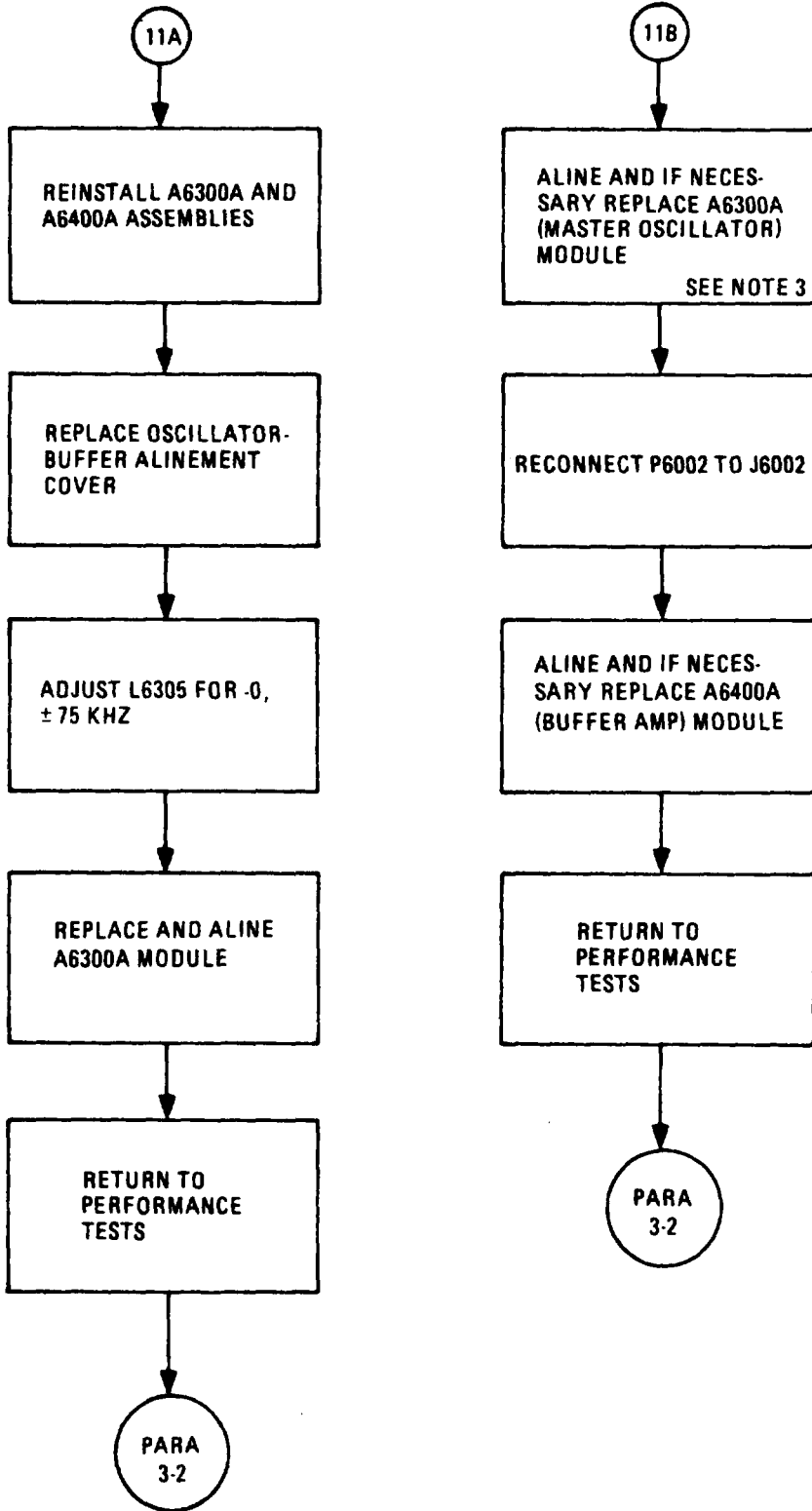


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3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-16  
 Main Circuit Board Assembly A6000A, and Modules  
 A6300A and A6400A Troubleshooting  
 (Sheet 2 of 5)



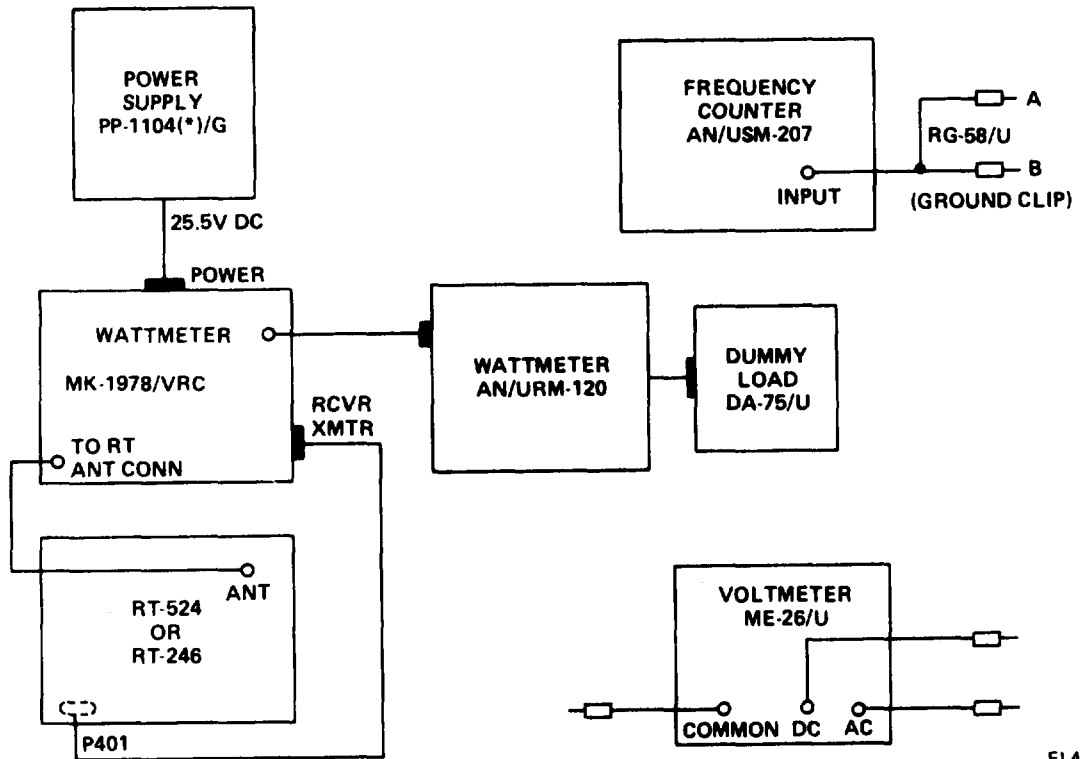
**NOTE**

3. If a problem still exists, go to the next step. If the fault has been corrected, return to Performance Tests, para 3-2.

3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-16

Main Circuit Board Assembly A6000A, and Modules  
 A6300A end A6400A Troubleshooting  
 (Sheet 3 of 5)

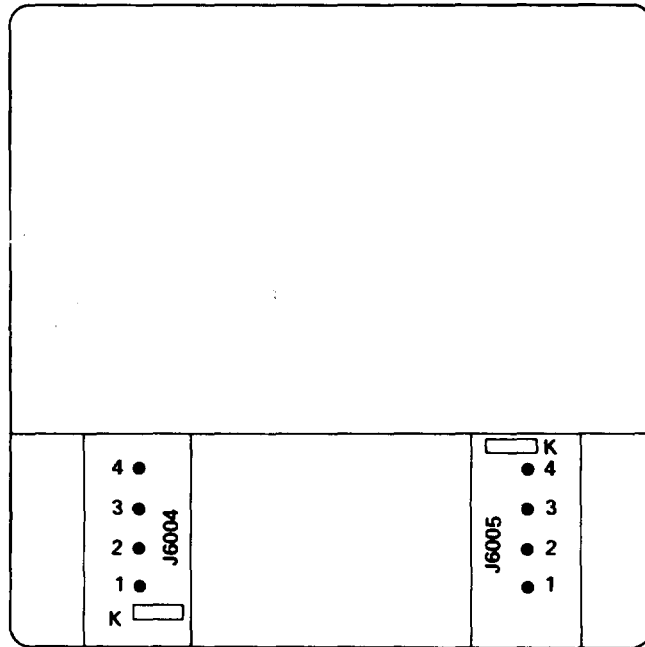


EL4GP485

3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-16  
Main Circuit Board Assembly A6000A, and Modules  
A6300A and A6400A Troubleshooting  
(Sheet 4 of 5)

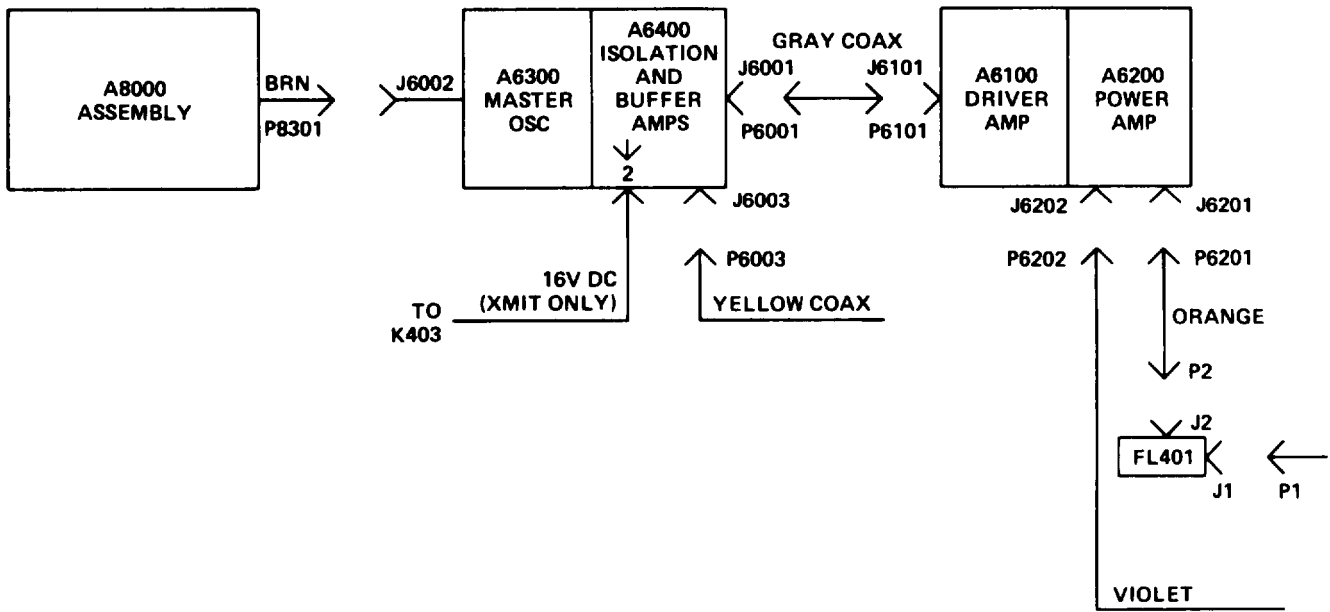
A6000 MAIN CIRCUIT BOARD PINS  
(A6300 AND A6400 REMOVED)



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3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-16  
 Main Circuit Board Assembly A6000A, and Modules  
 A6300A and A6400A Troubleshooting  
 (Sheet 5 of 5)



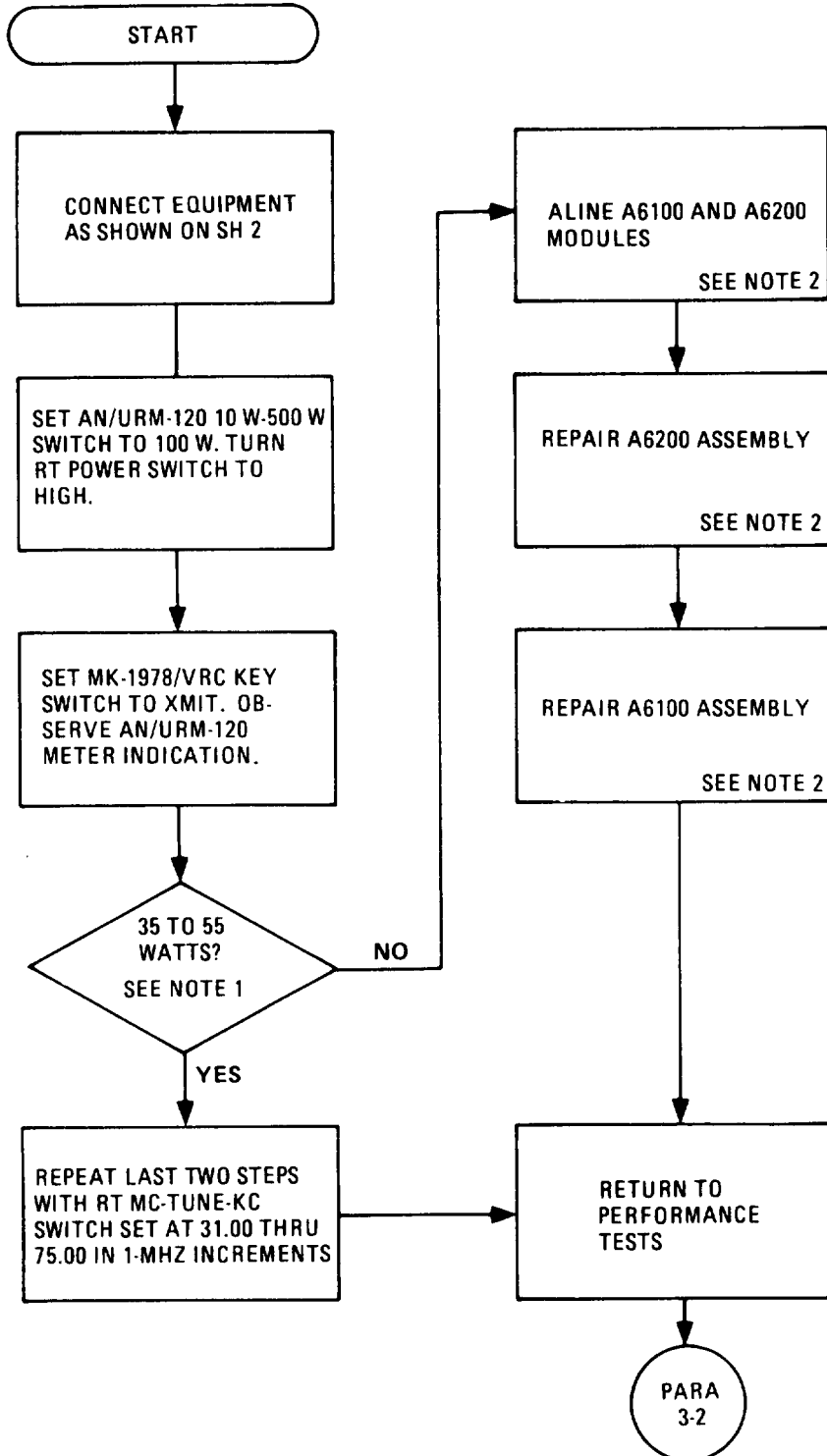
EL4GP459

3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-17  
 A6100 and A6200 Assemblies Troubleshooting  
 (Sheet 1 of 2)

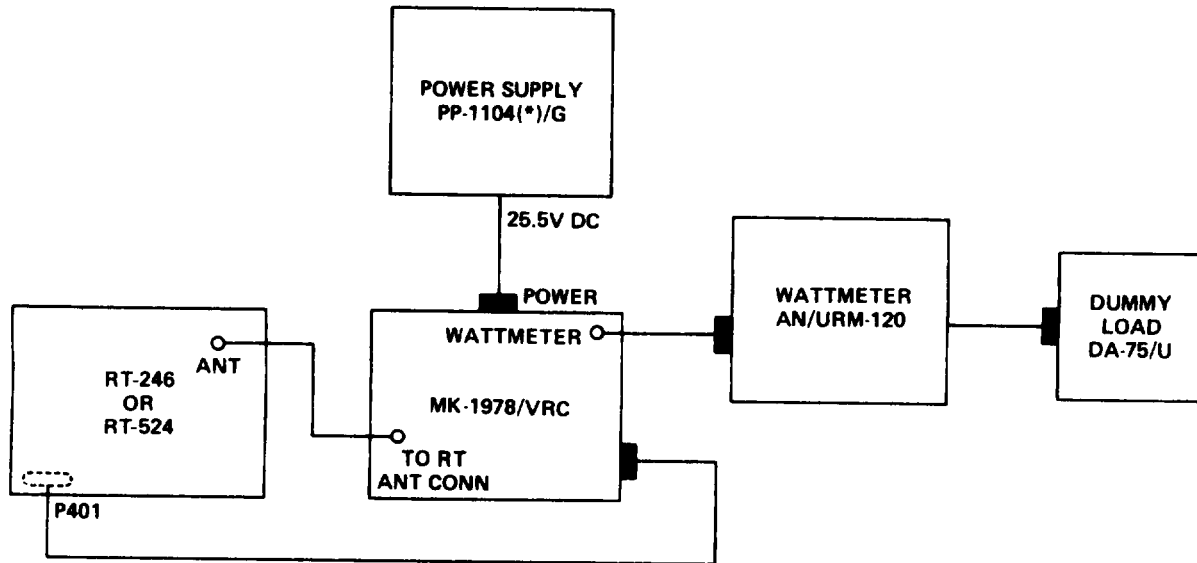
NOTES

1. After taking measurements, set MK-1978/VRC KEY switch to RCVE.
2. If a problem still exists, go to the next step. If the fault has been corrected, return to Performance Tests, para 3-2.



3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-17  
A6100 and A6200 Assemblies Troubleshooting  
(sheet 2 of 2)

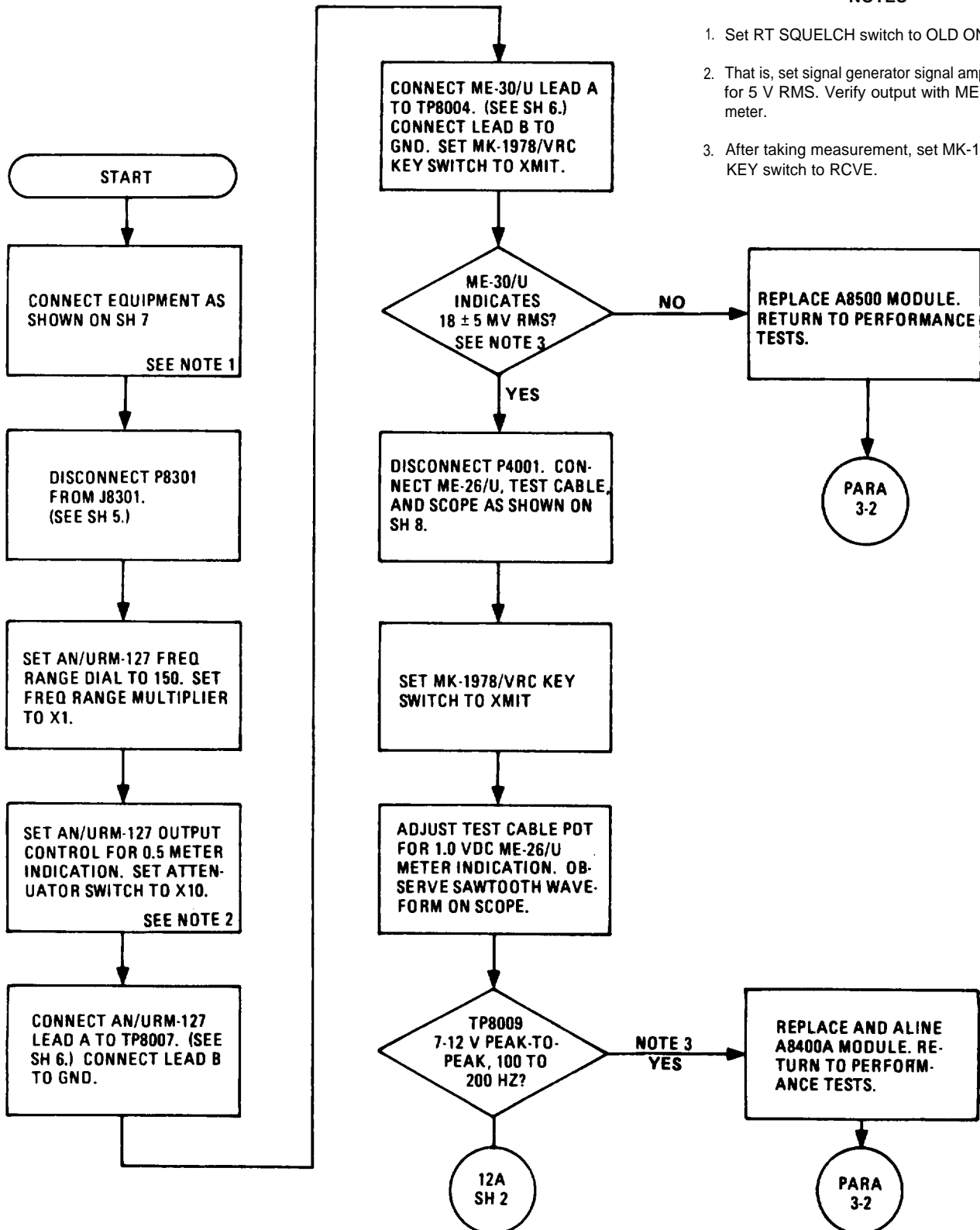


EL4GP475



3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-18  
A8000A Assembly Troubleshooting  
(Sheet 1 of 9)

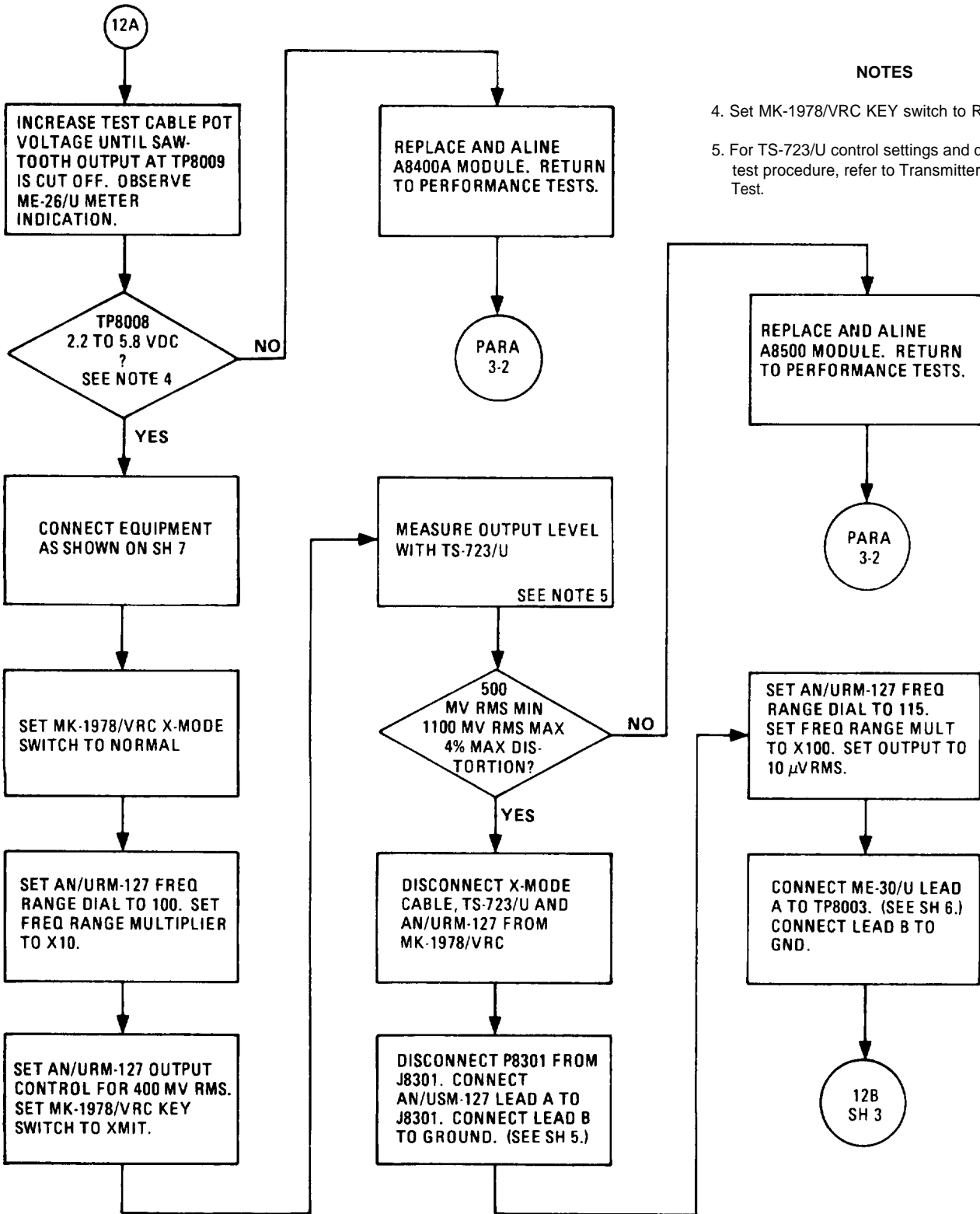


NOTES

1. Set RT SQUELCH switch to OLD ON.
2. That is, set signal generator signal amplitude for 5 V RMS. Verify output with ME-30/U meter.
3. After taking measurement, set MK-1978/VRC KEY switch to RCVE.

3-23. TROUBLESHOOTING FLOW CHARTS.

CHART 3-18  
A8000A Assembly Troubleshooting  
(Sheet 2 of 9)

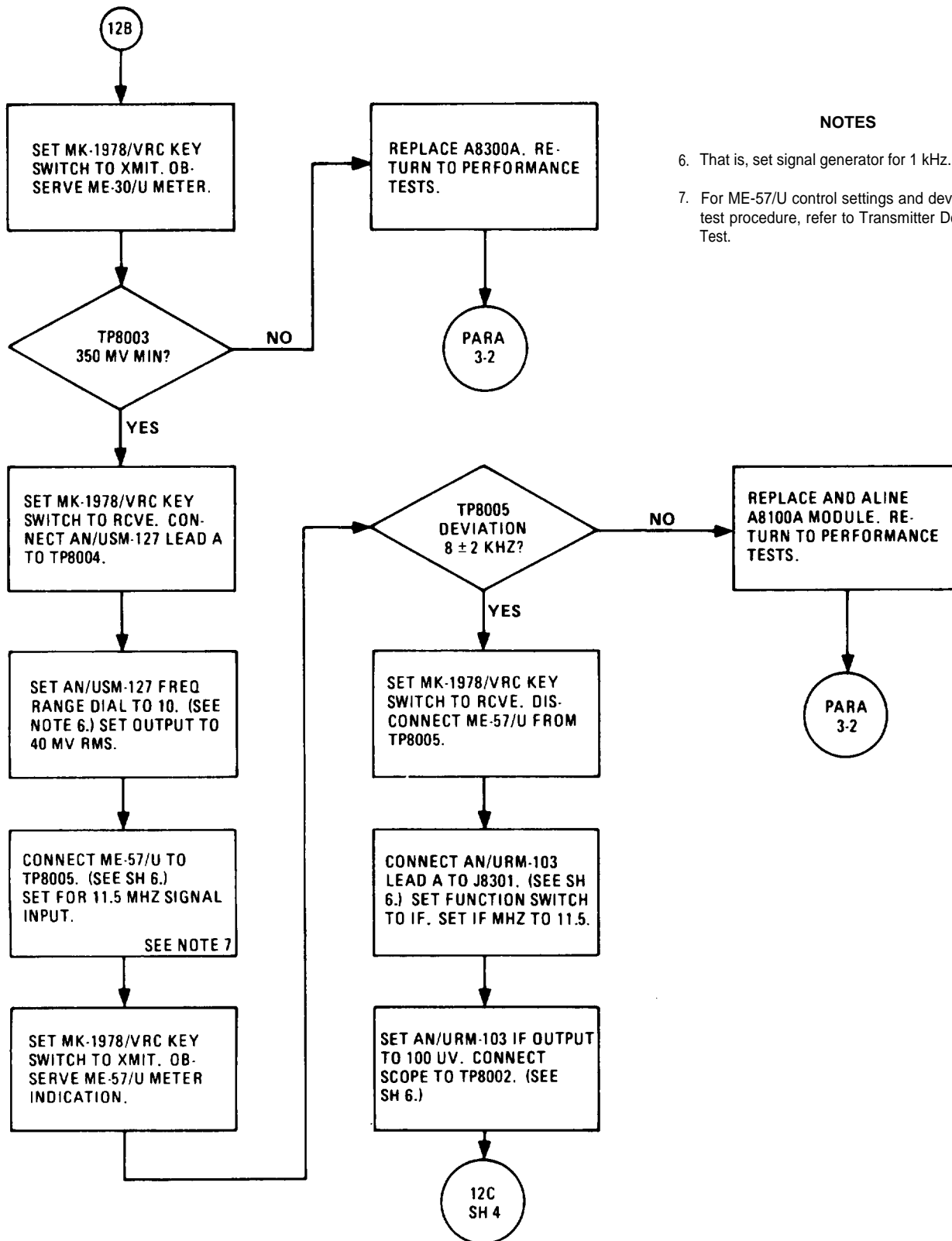


NOTES

- 4. Set MK-1978/VRC KEY switch to RCVE.
- 5. For TS-723/U control settings and distortion test procedure, refer to Transmitter Distortion Test.

3-23. TROUBLESHOOTING FLOW CHARTS.

CHART 3-18  
A8000A Assembly Troubleshooting  
(Sheet 3 of 9)

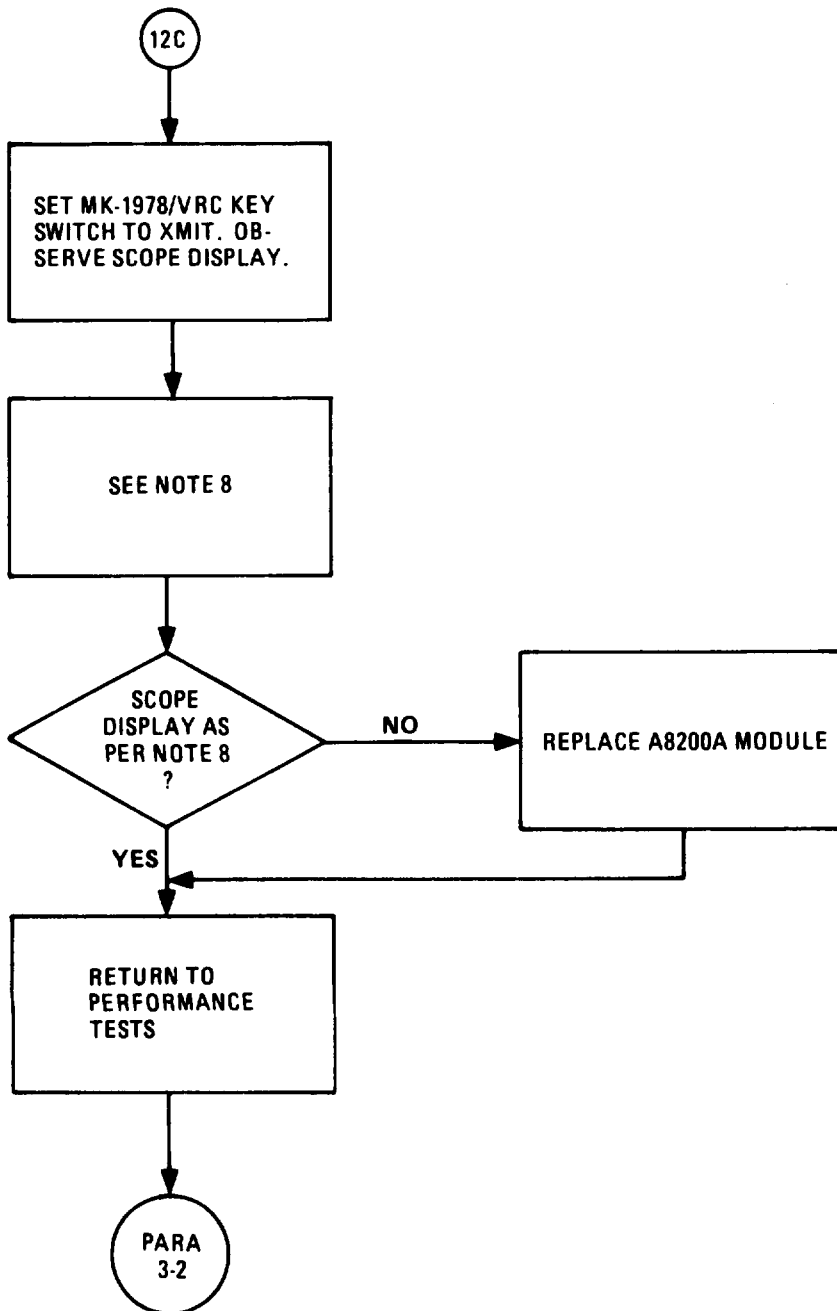


NOTES

- 6. That is, set signal generator for 1 kHz.
- 7. For ME-57/U control settings and deviation test procedure, refer to Transmitter Deviation Test.

3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-18  
 A8000A Assembly Troubleshooting  
 (Sheet 4 of 9)

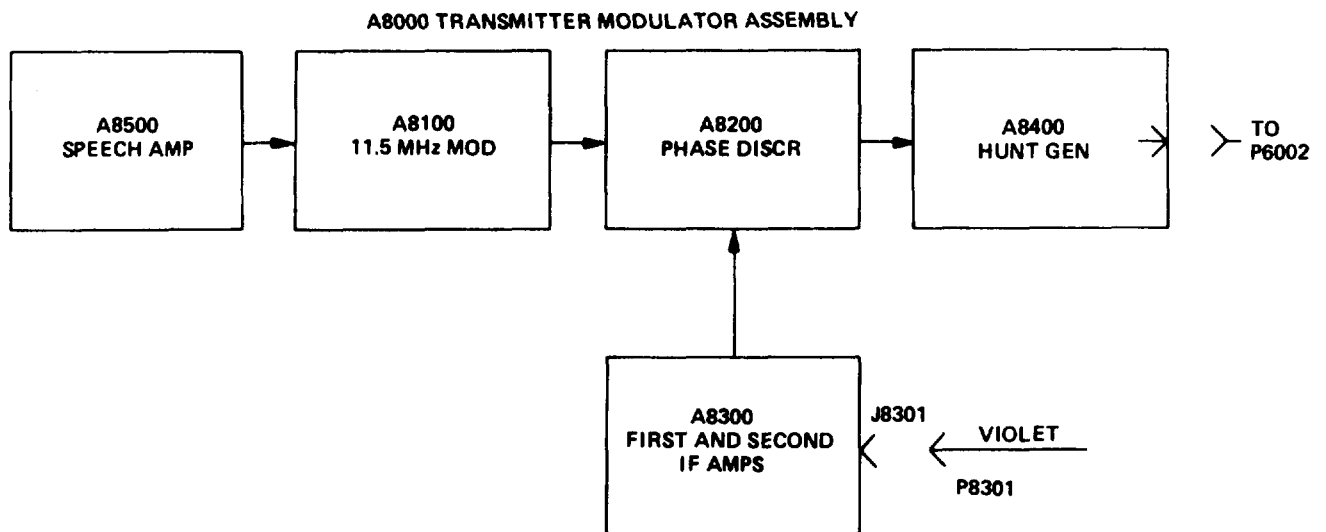


**NOTE**

8. When the signal generator is adjusted to exactly 11.5 MHz, it will be equal to the receiver mixer frequency (via A8300A) and the scope display will be 0. If, however, the signal generator is adjusted even slightly above or below the mixer frequency, the scope will display a combination of the ac beat signal sine wave and the dc component. Dc polarity will be positive or negative, depending on which way the signal generator frequency varies from the mixer frequency. The dc signal should be between 5 and 7 vdc, while the ac signal should be 6.0 v peak-to-peak.

3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

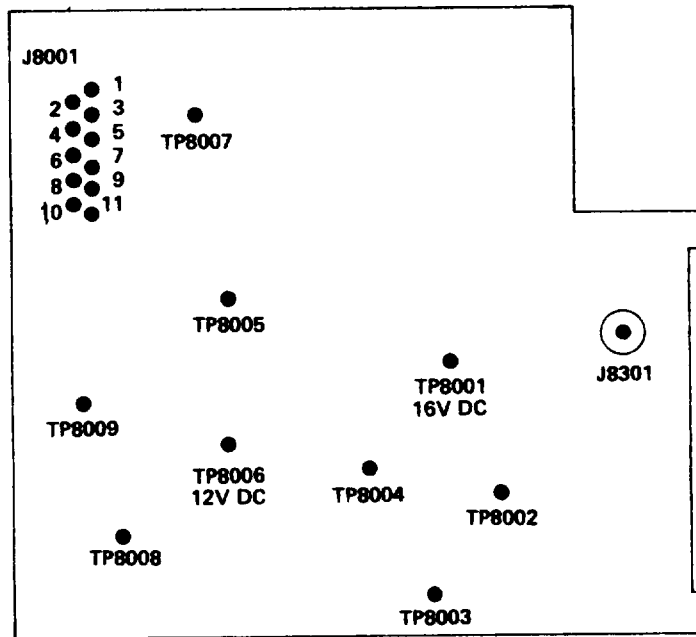
CHART 3-18  
A8000A Assembly Troubleshooting  
(Sheet 5 of 9)



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3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

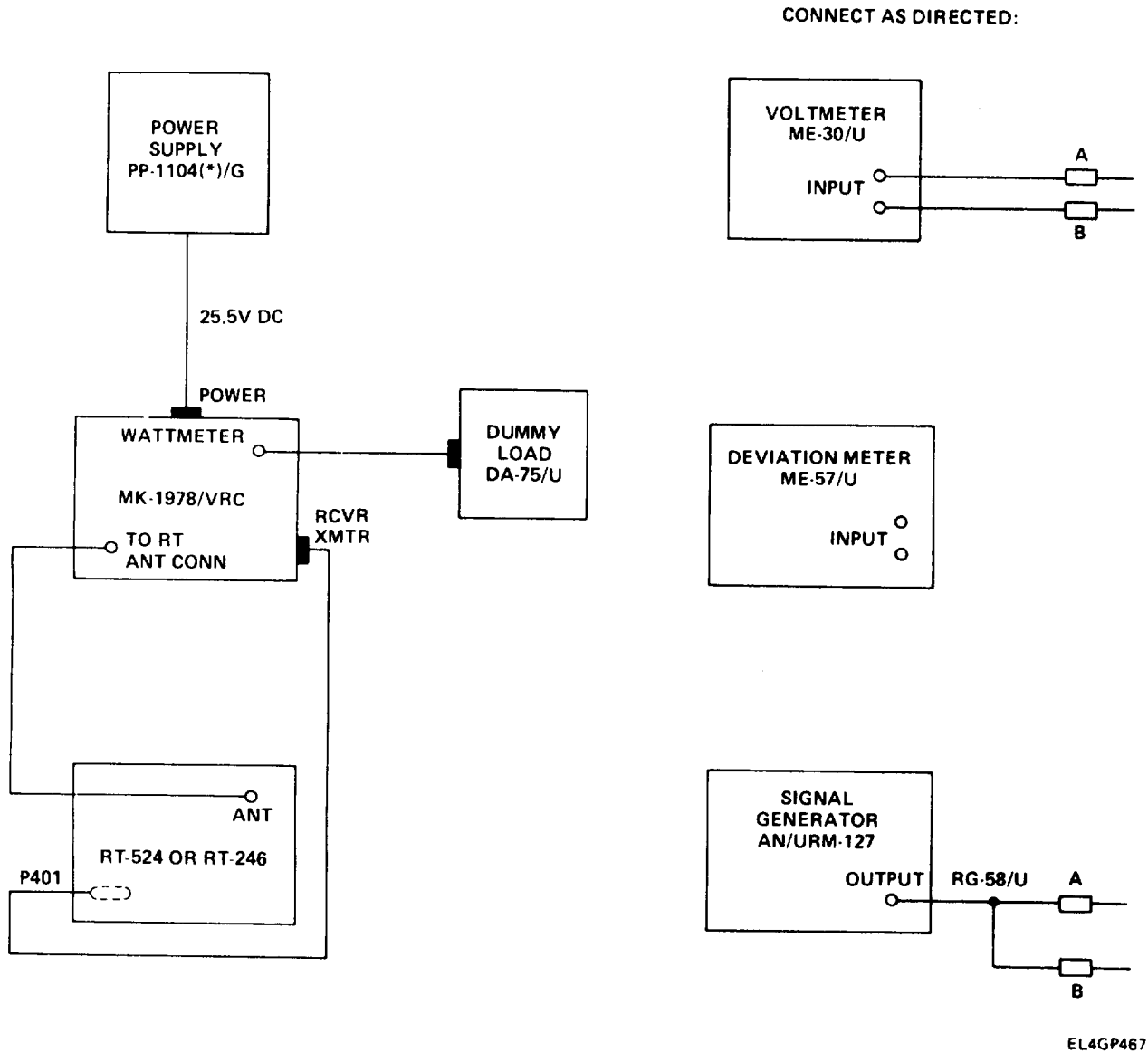
CHART 3-18  
A8000A Assembly Troubleshooting  
(Sheet 6 of 9)



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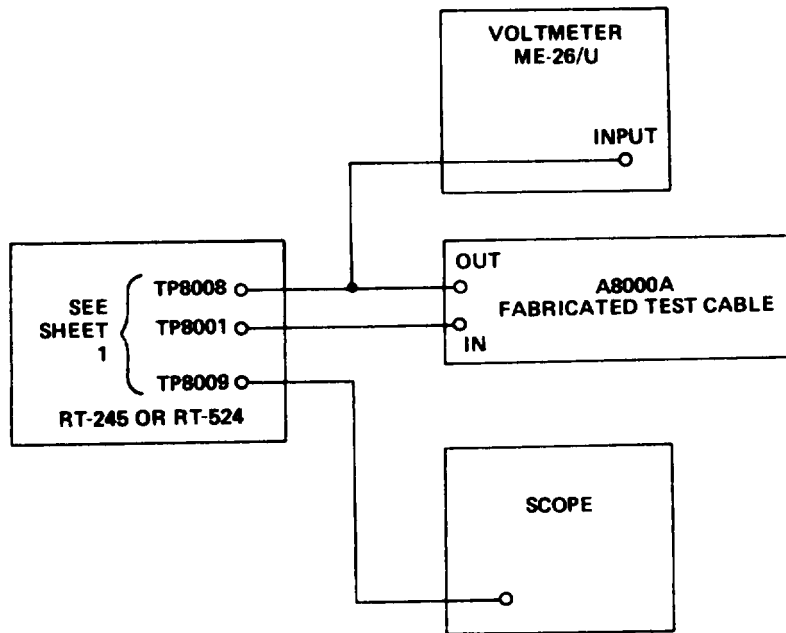
3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-18  
 A8000A Assembly Troubleshooting  
 (Sheet 7 of 9)



3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-18  
A8000A Assembly Troubleshooting  
(Sheet 8 of 9)

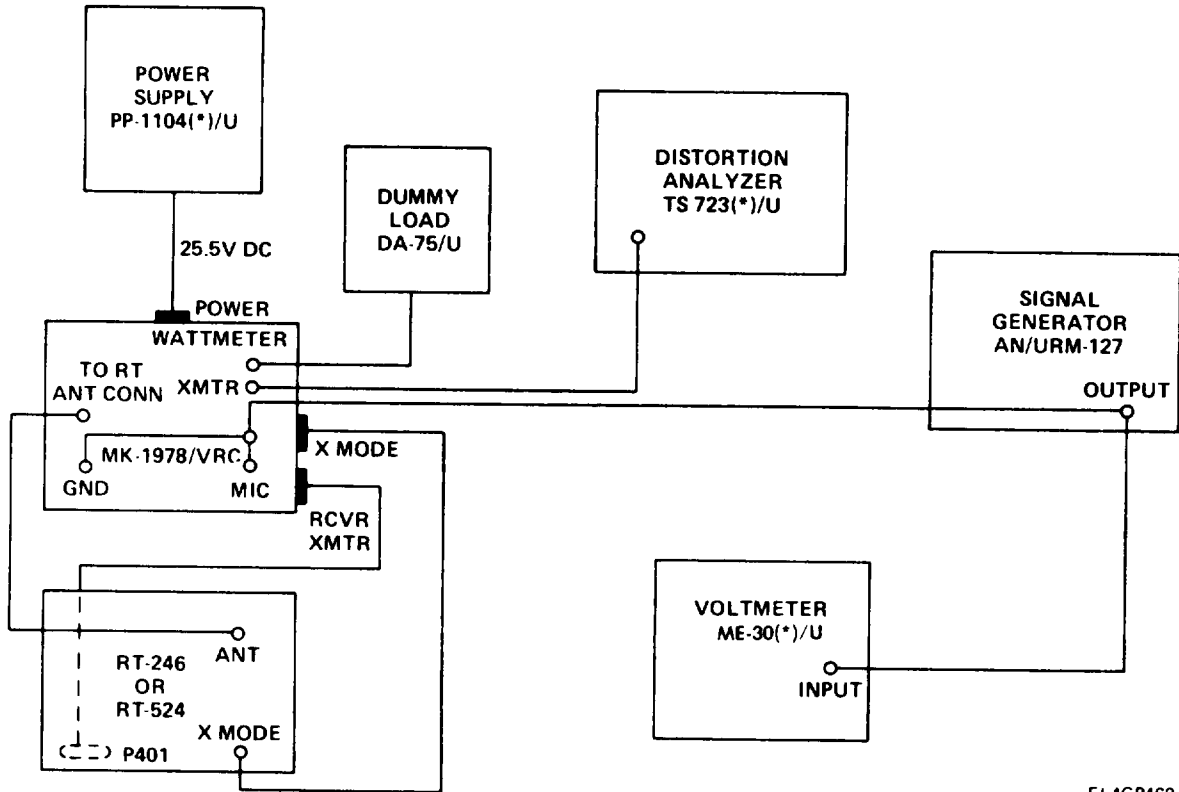


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3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

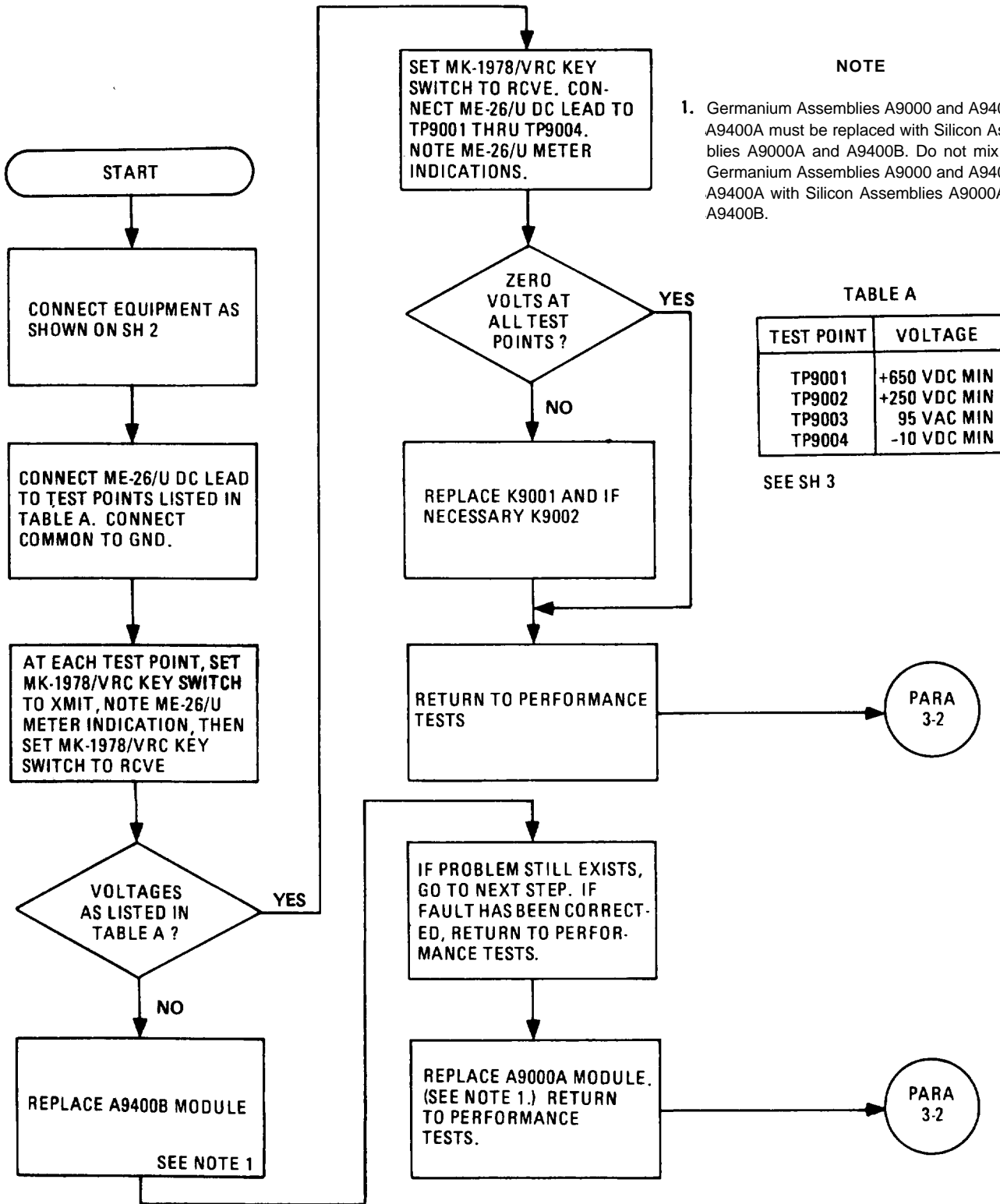
CHART 3-18  
 A8000A Assembly Troubleshooting  
 (Sheet 9 of 9)



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3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-19  
A9000A and A9400B Assemblies Troubleshooting  
(Sheet 1 of 3)



NOTE

1. Germanium Assemblies A9000 and A9400 or A9400A must be replaced with Silicon Assemblies A9000A and A9400B. Do not mix Germanium Assemblies A9000 and A9400 or A9400A with Silicon Assemblies A9000A and A9400B.

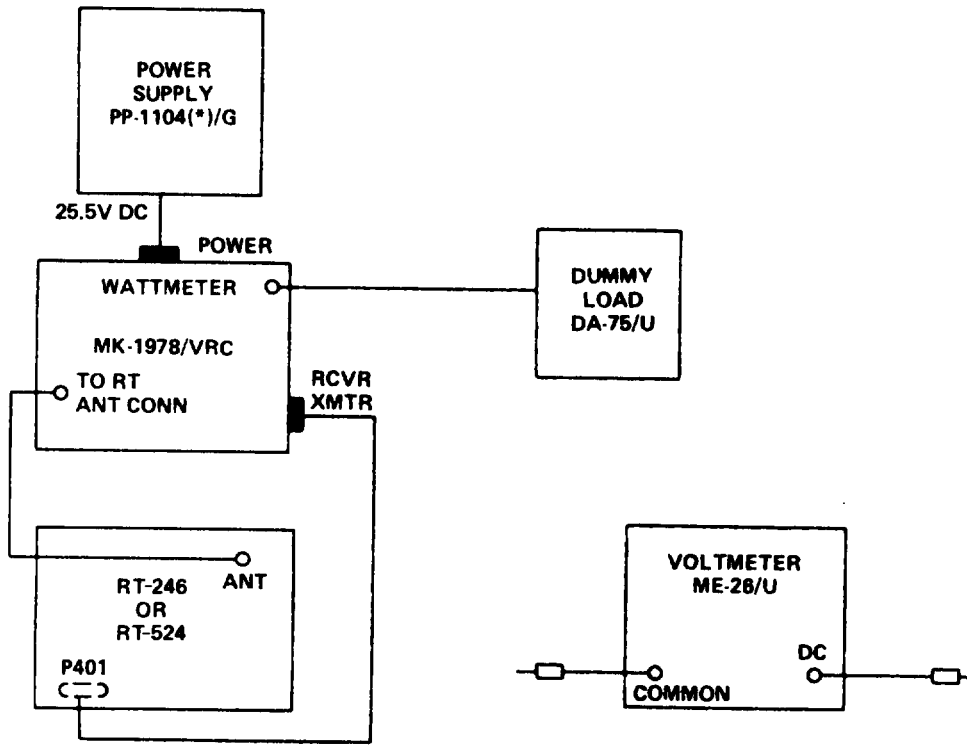
TABLE A

TEST POINT	VOLTAGE
TP9001	+650 VDC MIN
TP9002	+250 VDC MIN
TP9003	95 VAC MIN
TP9004	-10 VDC MIN

SEE SH 3

3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

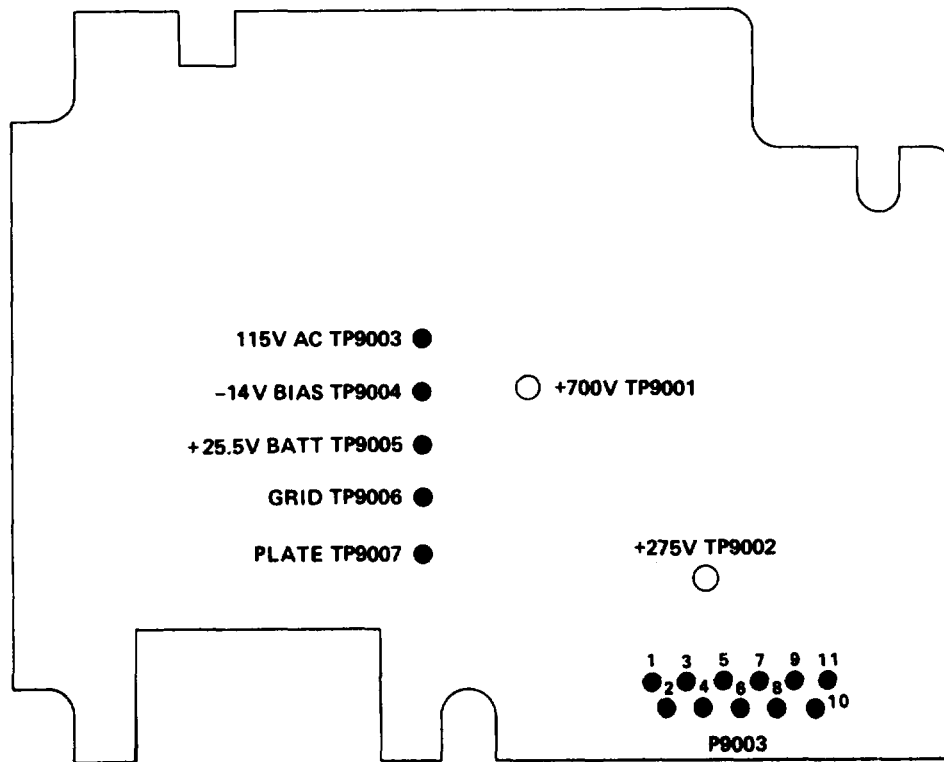
CHART 3-19  
A9000A and A9400B Assemblies Troubleshooting  
(Sheet 2 of 3)



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3-23. TROUBLESHOOTING FLOW CHARTS. (CONT)

CHART 3-19  
A9000A and A9400B Assemblies Troubleshooting  
(Sheet 3 of 3)



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**Section III ALINEMENT AND ADJUSTMENT PROCEDURES**

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Local Oscillator A1500 Alinement .....	3-26	3-160
Local Oscillator A1500 Alternate Alinement Procedure .....	3-27	3-162
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Alinement of A5300 Squelch Filter for Correct Transmitted Squelch Tone .....	3-33	3-181
Alinement of Silicon A5300A Squelch Filter for Correct Transmitted Squelch Tone .....	3-34	3-183
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Silicon Version A5200A Squelch Amplifier Alinement, NEW SQUELCH Level .....	3-36	3-187
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Power Supply A9000/A9400A (A9000A/A9400B) Tests .....	3-39	3-197
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Driver A6100 and Power Amplifier A6200 Alinement .....	3-44	3-210
Alinement of RT-246(*)/VRC Servosystem .....	3-45	3-215

### 3-24. GENERAL.

This section contains alinement instructions for use with Maintenance Kit MK-1978/VRC and TMDE (discrete test equipment). The instructions are presented in individual procedures which apply to a specific stage of the RT receiver or transmitter section.

Except for the local oscillator alinements, 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 an individual module without doing any work on other stages in the radio.

However, this maintenance approach is not recommended. It is best to perform a complete realinement of all modules after replacing an individual module. This should be done even if the radio has undergone its annual realinement less than one year prior to the repair.

Careful performance of all the instructions contained in the receiver and transmitter section alinement procedures ensures that the radio will meet all performance standards outlined in section I of this chapter. Although the radio may seem to work satisfactorily if other quick-fix methods are used, there is no guarantee that such methods will result in proper performance when the radio is used along with secure equipment, or for other than voice communication.

### 3-25. CRYSTAL REFERENCE SYSTEM (CRS) TEST.

**PURPOSE.** This test is performed to make sure that the local oscillator will not be pulled off frequency by a malfunctioning CRS. Steps 1 through 8 involve a quick check to determine whether the CRS is putting out an incorrect error signal causing improper local oscillator frequency and loss of audio tone. The remaining steps are done with the local oscillator disconnected from the CRS in order to check CRS performance in response to a nonfluctuating 42.00-MHz signal generator output. If the CRS passes the second part of this test, it will be able to correct normal fluctuation in local oscillator frequency.

#### TEST EQUIPMENT AND MATERIALS

Signal Generator AN/URM-103  
Frequency Counter AN/USM-207  
Power Supply PP-1104(\*)/G  
Maintenance Kit MK-1978/VRC  
Matching Unit CN-901/U

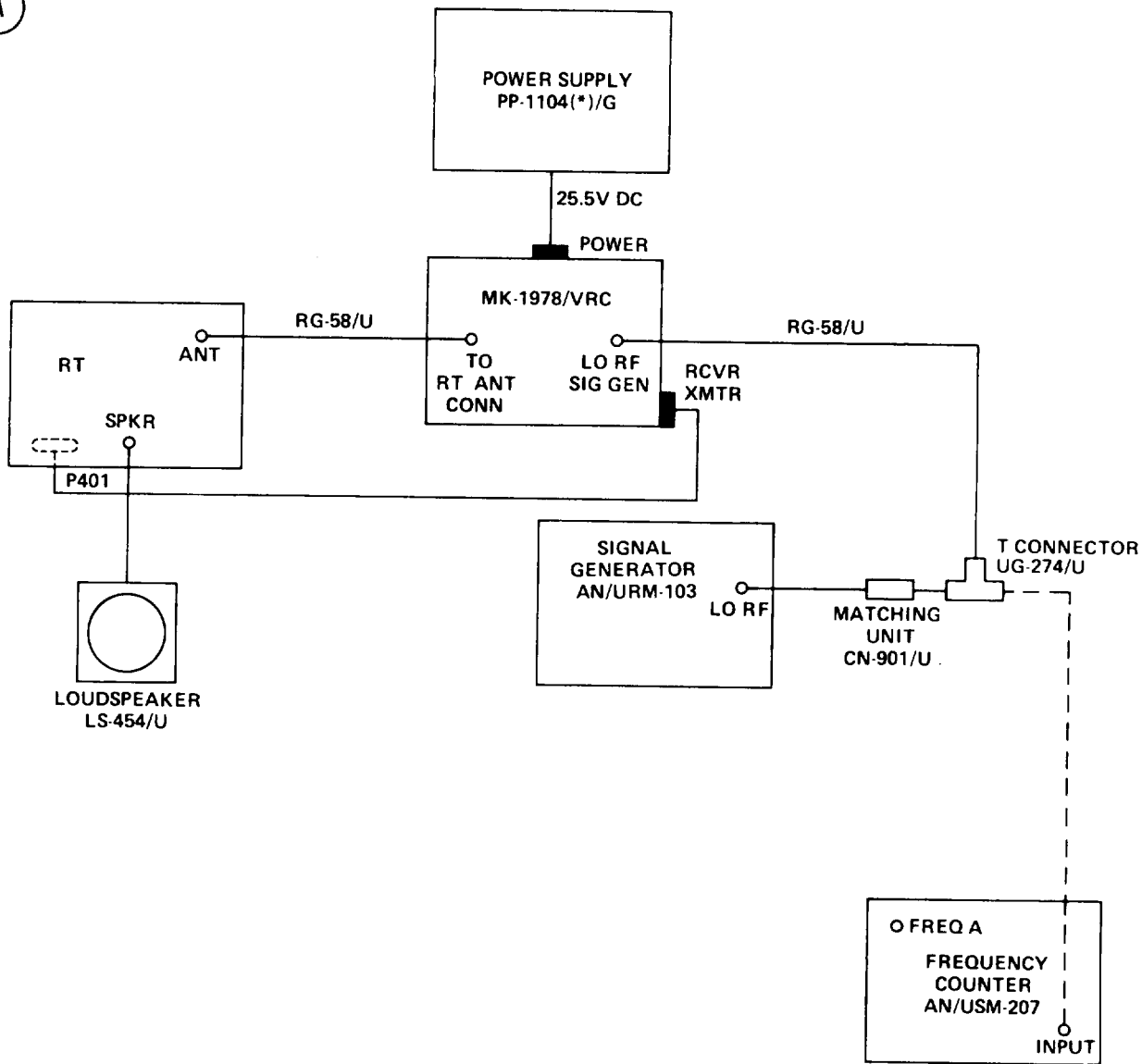
T-Connector UG-274/U  
Loudspeaker LS-454/U  
Multimeter ME-26(\*)/U  
Amphenol Adapter M-39012/16

3-25. CRYSTAL REFERENCE SYSTEM (CRS)TEST. (CONT)

TEST SETUP. Connect the equipment as shown in test setup diagram X-MODE/NORMAL switch to X-MODE.

(A) Set A4000)

(A)



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**3-25. CRYSTAL REFERENCE SYSTEM (CRS)TEST. (CONT)**

INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment controls as indicated in the following table. If using alternate equipment, inject 100- $\mu$ v rf at 30 MHz, 1-kHz modulation, and 8- kHz deviation.

CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
RT	POWER BAND MC-TUNE-KC VOLUME SQUELCH	LOW Ⓐ 30.00 Fully clockwise NEW OFF
AN/URM-103	OPERATE/OFF/STAND BY FUNCTION BAND SWITCH RF TUNING DEVIATION RANGE KHZ RF OUTPUT DEVIATION RF SET TO LINE  LO RF UV	OPERATE (allow 15-minute warmup) 1000 Hz Ⓑ 30.00 10 LO, 0-10 KUV Fully counterclockwise Adjust until needle on IF UV RF SET TO LINE meter is over red line 100 $\mu$ v
AN/USM-207	POWER DISPLAY SENSITIVITY FUNCTION GATE TIME DIRECT/HETERODYNE INPUT FREQUENCY TUNING-MC	TRACK (allow 5-minute warmup) MIN (fully counterclockwise) PLUG IN FREQ 10 <sup>3</sup> (black knob) DIRECT 0.3 V MAX (both switches to left) 100
MK-1978/VRC	All switches	Down, except POWER up

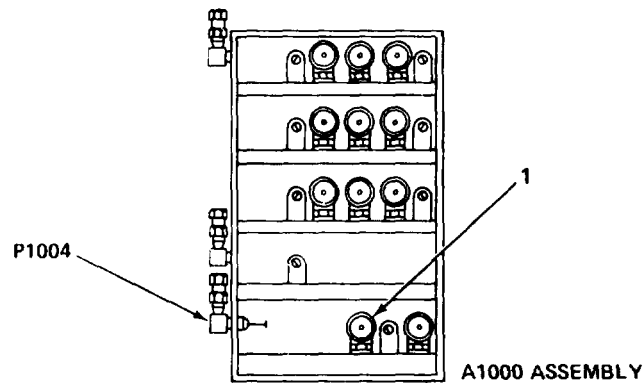
TEST PROCEDURE

**NOTE**

Check the frequency counter to make sure that the signal generator is outputting exactly 30 MHz. The rf level must be increased temporarily to enable the frequency counter to display. Adjust the AN/URM-103 RF TUNING control as necessary, reset to 100- $\mu$ v rf level; then disconnect the T-connector from the counter.



## 3-25. CRYSTAL REFERENCE SYSTEM (CRS)TEST. (CONT)

**B**

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1. Turn AN/URM-103 DEVIATION control clockwise until DEVIATION KHZ meter reads 8 kHz. The 1000-HZ tone will be heard on speaker. If no tone is heard, CRS maybe defective. Proceed to step 2.
2. Adjust RT VOLUME control for comfortable level.
3. Raise A3000 tray.
4. Remove A1000 cover and install alinement cover with at least one screw to ensure good ground.
5. Ground TP3001 with screwdriver.
6. Adjust L1502 to get clearest possible 1000-HZ tone from speaker.
7. Remove ground from TP3001. Tone must not change.

**NOTE**

If the tone heard changes to a rushing noise when step 7 is completed, the CRS is defective. See the troubleshooting section.

8. Set RT MC-TUNE-KC control to 40.00 MHz; then back to 30.00 MHz. Tone must not change.

**NOTE**

If the tone changes after step 8 is completed, the CRS may be defective. See the troubleshooting section.

9. Set RT MC-TUNE-KC control to 30.50 MHz.
10. Remove rf cable and matching unit from AN/URM-103 LO-RF jack and insert in HI-RF jack.
11. Remove P1004 from J1004 on A1000 tray. (See test setup diagram **B** .)
12. Remove rf cable from ANT jack on RT.
13. Using Amphenol Adapter M-39012116, connect rf cable to P1004.
14. Connect AN/USM-207 frequency counter to T-connector.
15. Set AN/URM-103 signal generator RF OUTPUT control to 125 KUV.
16. Adjust AN/URM-103 RF TUNING control for 42.00-MHz output. Verify frequency on frequency counter.
17. Set Multimeter ME-26(\*)/Uto 3-vdc scale and turn ZERO ADJ for midscale reading.
18. Connect ME-26(\*)/U positive lead to TP3001 and negative lead to ground.

### 3-25. CRYSTAL REFERENCE SYSTEM (CRS)TEST. (CONT)

19. Check reading on ME-26(\*)/U. Meter should read zero vdc (midscale), with slight fluctuation.

#### NOTE

If ME-26(\*)/U reads greater than + 0.32 vdc or less than -0.32 vdc, the CRS is defective. See the troubleshooting section.

In steps 20 and 21, ME-26(\*)/U should vary smoothly at least + 0.5 vdc and then at least -0.5 vdc. If not, the CRS is defective. See the troubleshooting section.

20. Slowly turn AN/URM-103 RF TUNING control to increase output frequency to 42.25 MHz. Note change in reading on ME-26(\*)/U.
21. Slowly turn AN/URM-103 RF TUNING control to decrease output frequency to 41.75 MHz. Note change in readings on ME-26(\*)/U.
22. Proceed to paragraph 3-26, Local Oscillator A1500 Alinement.


### 3-26. LOCAL OSCILLATOR A1500 ALINEMENT.

**PURPOSE.** If the local oscillator is operating at the correct frequency, the CRS will not output a dc error signal. This procedure alines the oscillator by tuning its circuits to bring the CRS error signal as close to zero as possible. The Crystal Reference System Test (paragraph 3-25) must be done prior to performing this alinement.

#### TEST EQUIPMENT AND MATERIALS

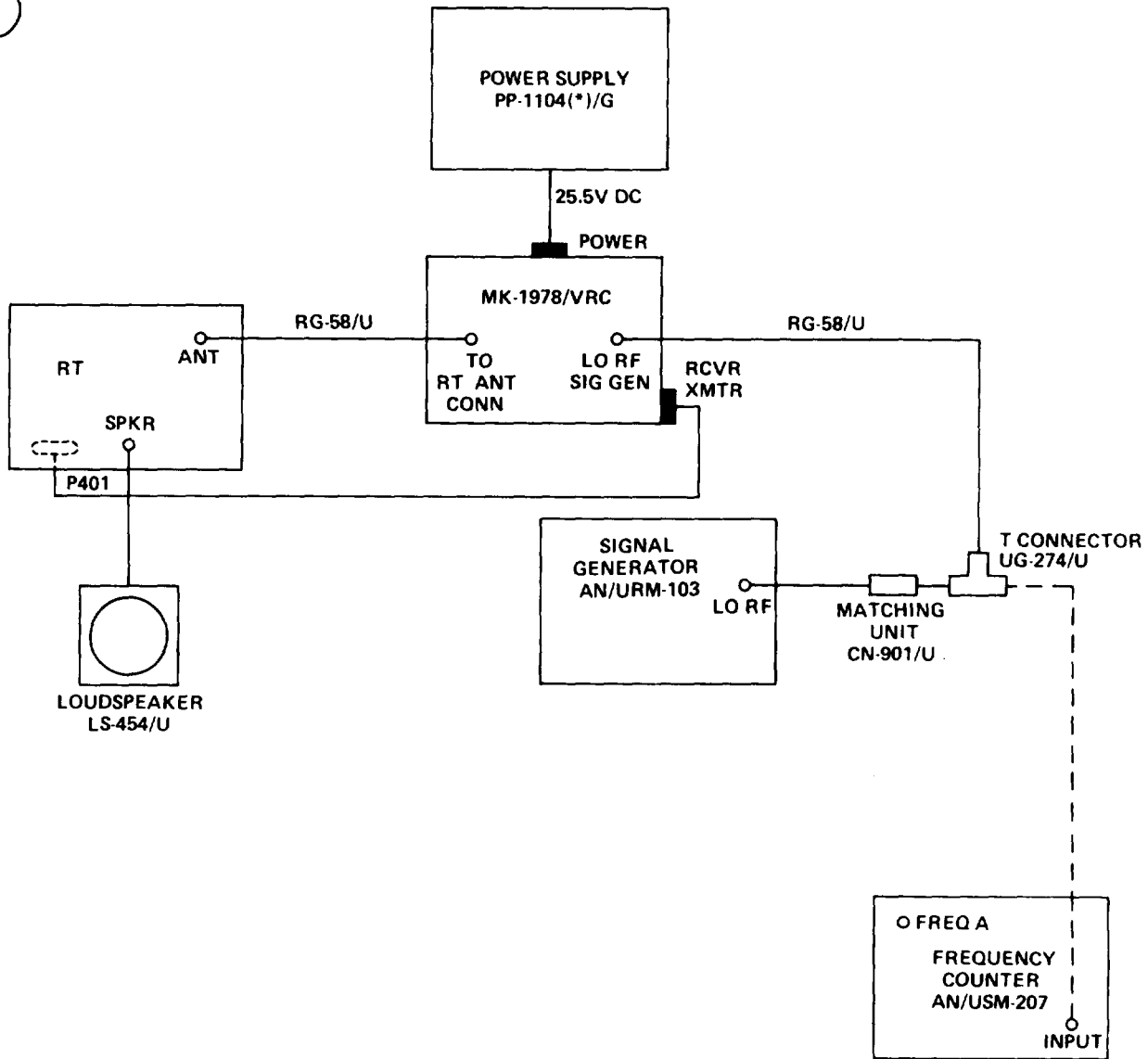
Signal Generator AN/URM-103  
Frequency Counter AN/USM-207  
Power Supply PP-1104(\*)/G  
Maintenance Kit MK-1978/VRC

Matching Unit CN-901/U  
T-Connector UG-274/U  
Loudspeaker LS-454/U  
Multimeter ME-26(\*)/U

**TEST SETUP.** Connect the equipment as shown in test setup diagram , page 3-161. Connect P1004 to J1004 on the A1000 tray.

3-26. LOCAL OSCILLATOR A1500 ALINEMENT. (CONT)

A



EL4GP330

INITIAL EQUIPMENT CONTROL SETTINGS. Change the final settings used in the CRS Test as follows:

1. Set AN/ URM-103 RF OUTPUT switch to 0-10 KUV.
2. Adjust AN/URM-103 RF TUNING control for 42.00-MHz output.

**NOTE**

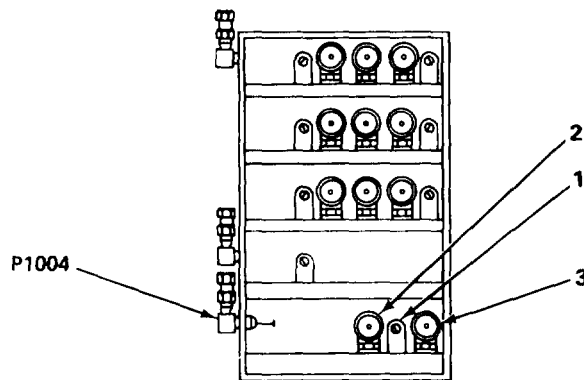
Check the frequency counter to make sure that the signal generator is outputting exactly 42 MHz. The rf level must be increased temporarily to enable the frequency counter to display. Adjust the AN/URM-103 RF TUNING control as necessary, reset to 100-  $\mu$ v rf level; then disconnect the T-connector from the counter.

**3-26. LOCAL OSCILLATOR A1500 ALINEMENT. (CONT)**

3. Set RT MC-TUNE-KC control to 42.00 MHz.
4. Adjust AN/URM-103 DEVIATION control for 8-KHz reading on DEVIATION KHZ meter.

ALINEMENT PROCEDURE

**B**



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1. Connect ME-26(\*)/U positive lead to TP3001 and negative lead to ground.
2. Adjust C1501 (1) for clear audio tone and zero-volt reading on ME-26(\*)/U.
3. Set RT MC-TUNE-KC control to 30.00 MHz.
4. Connect AN/USM-207 frequency counter to T-connector.
5. Adjust AN/URM-103 RF TUNING control for 30.00-MHz output. Check frequency on counter.
6. Adjust L1502 (2) for clear audio tone and zero-volt reading on ME-26(\*)/U.
7. Set RT MC-TUNE-KC control to 52.00 MHz.
8. Connect frequency counter to T-connector.
9. Adjust AN/URM-103 RF TUNING control for 52.00-MHz output.
10. Adjust L1501 (3) for clear audio tone and zero-volt reading on ME-26(\*)/U.
11. Repeat steps 2 through 10 to make sure that local oscillator tracks with no more than 0.5-vdc error signal required in any of the three test frequencies.

**NOTE**

If the ME-26(\*)/U indicates more than + 0.5 vdc or less than -0.5 vdc in any frequency, and repetition of steps 2 through 10 does not correct the problem, replace the A1500 assembly.

**3-27. LOCAL OSCILLATOR A1500 ALTERNATE ALINEMENT PROCEDURE.**

**PURPOSE.** This procedure permits alinement of the local oscillator without the use of a signal generator. The frequency of the local oscillator is checked directly with a counter; therefore, the presence of an audible audio tone is not important. Thus, alinement does not depend on the performance of the A4000 or A5000 sections of the receiver. The CRS Test must be done prior to performing this alinement.

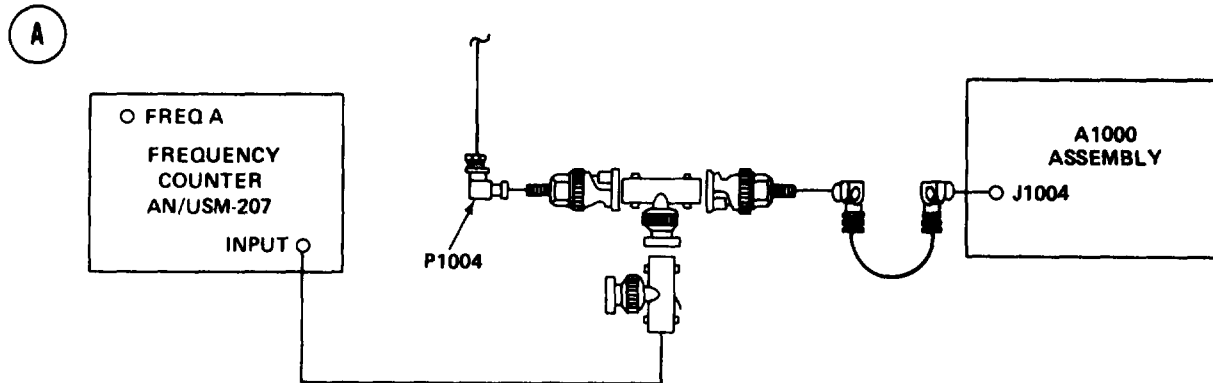
TEST EQUIPMENT AND MATERIALS

Frequency Counter AN/USM-207  
 Amphenol Adapters (two) M-39012/16  
 Multimeter ME-26(\*)/U

One additional rf cable (RG-58)  
 T-Connectors (two) UG-274/U

**3-27. LOCAL OSCILLATOR A1500 ALTERNATE ALINEMENT PROCEDURE. (CONT)**

TEST SETUP. Connect the equipment as shown in test setup diagram (A).

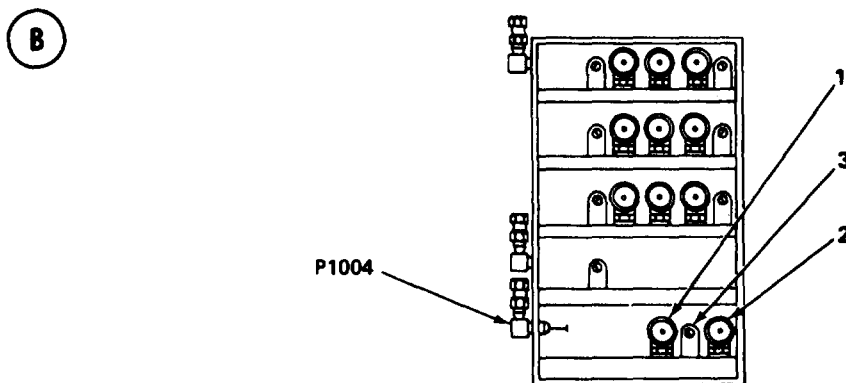


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INITIAL EQUIPMENT CONTROL SETTINGS. Change the final settings used in the CRS Test as follows:

1. Set RT MC-TUNE-KC control to 30.00 MHz.
2. Set AN/USM-207 SENSITIVITY switch as necessary to trigger frequency counter.

**ALINEMENT PROCEDURE**



EL4GP319

1. Connect ME-26(\*)/U positive lead to TP3001 and negative lead to ground.

**NOTE**

In the following adjustments, it may not be possible to achieve zero-frequency error and zero-vdc indication on the ME-26(\*)/U. Local oscillator tolerance with the CRS connected is  $\pm 3.5$  kHz. The ME-26(\*)/U should not exceed  $\pm 0.5$  vdc.

2. Adjust L1502 (1) for 41.50-MHz reading on counter and zero vdc (midscale) on ME-26(\*)/U.
3. Set RT MC-TUNE-KC control to 52.00 MHz.
4. Adjust L1501 (2) for 63.50-MHz reading on counter and zero vdc (midscale) on ME-26(\*)/U.
5. Set RT to 42.00 MHz.
6. Adjust C1501 (3) for 53.50-MHz reading on counter and zero vdc (midscale) on ME-26(\*)/U.
7. Set RT to 30.00 MHz.
8. Repeat steps 2 through 6 until ME-26(\*)/U reads zero vdc for all three frequencies.
9. Reconnect P1004 to J1004.

**3-28. TUNER A1000 ALINEMENT.**

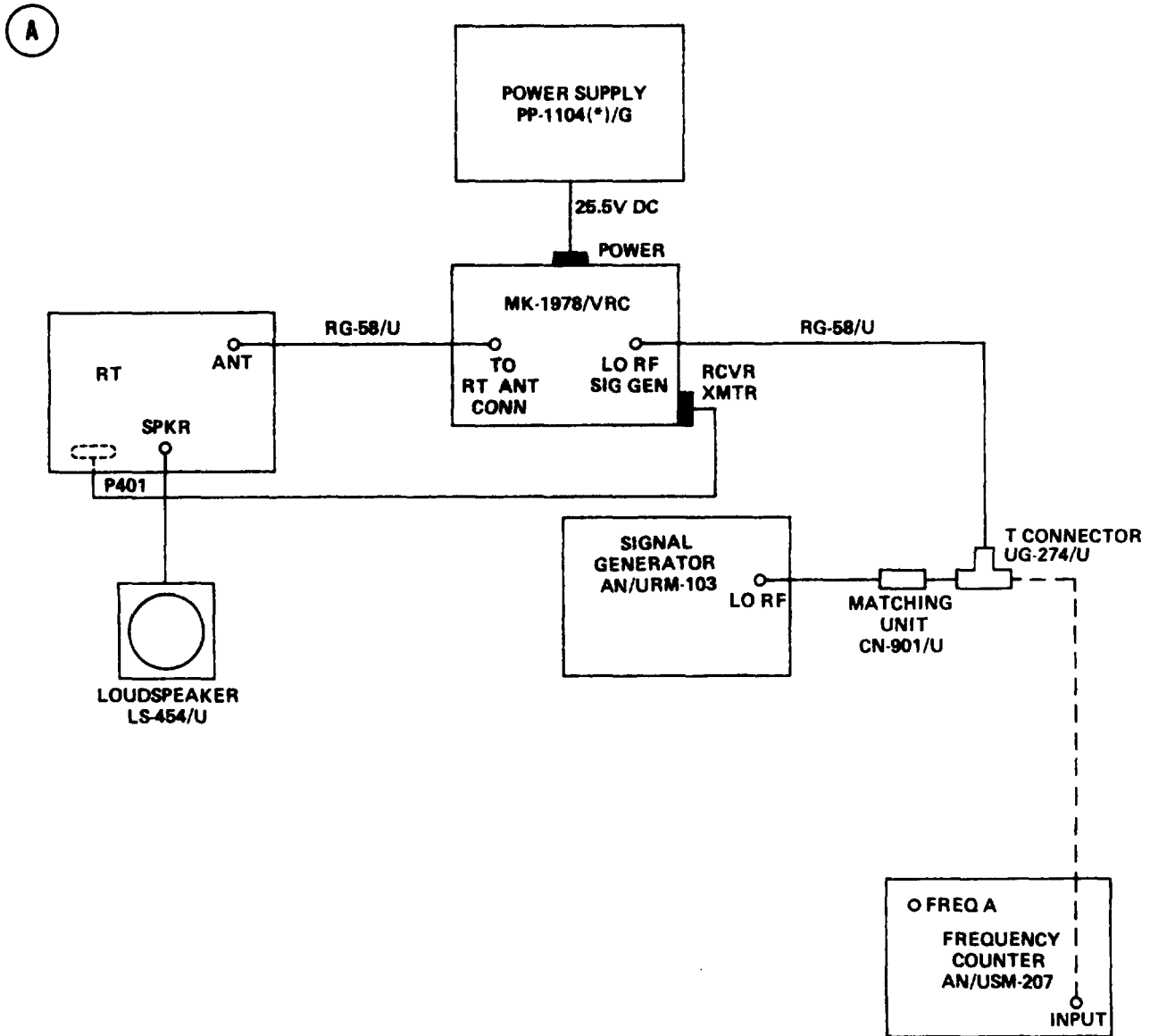
PURPOSE. This procedure tunes the A1000 assembly to produce maximum amplification of low-level signals and maximum attenuation of noise.

TEST EQUIPMENT AND MATERIALS

Signal Generator AN/URM-103  
 Frequency Counter AN/USM-207  
 Power Supply PP-1104(\*)/G  
 Maintenance Kit MK-197/VRC

Matching Unit CN-901/U  
 T-Connector UG-274/U  
 Loudspeaker LS-454/U  
 Voltmeter ME-30(\*)/U

TEST SETUP. Connect equipment as shown in test setup diagram (A).



EL4GP330

**3-28. TUNER A1000 ALINEMENT. (CONT)**

INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment controls as indicated in the following table. If using alternate equipment, inject unmodulated rf carrier at 30,52,53,75,65, and 52 MHz, in that order. Rf output level will vary according to alinement requirements.

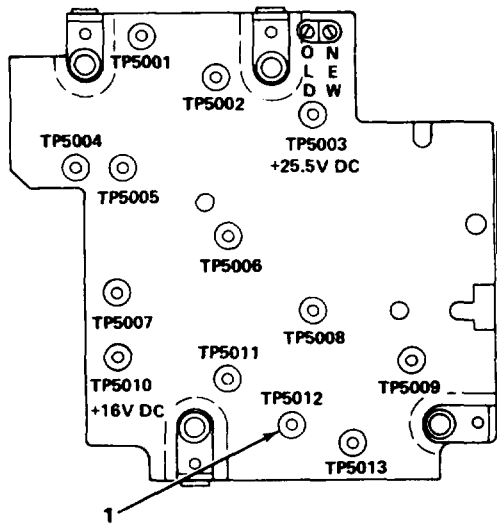
CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
RT	POWER BAND MC-TUNE-KC SQUELCH VOLUME	LOW Ⓐ 30.00 NEW OFF Fully clockwise
AN/URM-103	FUNCTION RF OUTPUT LO RF UV BAND SWITCH RF TUNING OPERATE/OFF/STAND BY	MOD OFF LO, 0-10 KUV Set to zero output Ⓑ 30.00 OPERATE
AN/USM-207	POWER DISPLAY SENSITIVITY FUNCTION GATE TIME DIRECT/HETERODYNE INPUT FREQUENCY TUNING-MC	TRACK (allow 5-minute warmup) MIN (fully counterclockwise) PLUG IN FREQ 10 <sup>3</sup> (black knob) DIRECT 0.3 V MAX (both switches to left) 100
MK-1978/VRC	All switches	Down, except POWER up

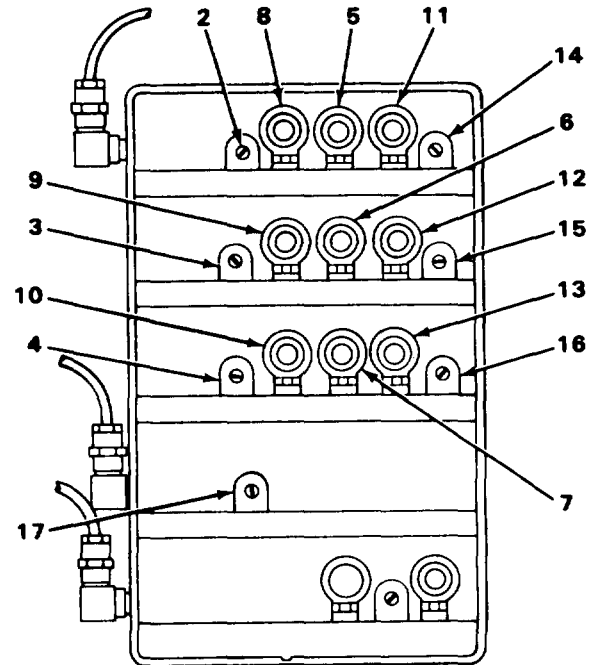
3-28. TUNER A1000 ALINEMENT. (CONT)

ALINEMENT PROCEDURE

**B**



A5000 MODULE



A1000 ASSEMBLY

EL4GP320

30-MHz Test

1. Check AN/URM-103 frequency output on frequency counter.
2. Set ME-30(\*)/U to 3-volt scale.
3. Connect ME-30(\*)/U positive lead to TP5012 (1), and negative lead to ground.
4. Note reading on ME-30(\*)/U.
5. While observing ME-30(\*)/U, increase rf output level of ANA/URM-103 by turning LO RF UV control until ME-30(\*)/U drops to one-half of step 4 reading.
6. Adjust C1104 (2), C1205 (3), and C1305 (4), for lowest possible ME-30(\*)/U reading and minimum noise from speaker.

52-MHz Test

7. Set RT MC-TUNE-KC control to 52.00 MHz.
8. Adjust AN/URM-103 RF TUNING control to 52.00 MHz. Check on frequency counter.
9. Set AN/URM-103 LO RF UV control for zero-rf output.
10. Note reading on ME-30(\*)/U.
11. While observing ME-30(\*)/U, increase rf output level of AN/URM-103 by turning LO RF UV control until ME-30(\*)/U drops to one-half of step 10 reading.
12. Adjust L1102 (5), L1202 (6), and L1302 (7) for lowest possible ME-30(\*)/U reading and minimum noise from speaker. (See test setup diagram (B) .)



**3-28. TUNER A1000A ALIGNMENT. (CONT)****53-MHz Test**

13. Set RT MC-TUNE-KC control to 53.00 Mhz.
14. Adjust AN/URM-103 RF TUNING control to 53.00 Mhz. Check on frequency counter.
15. Set AN/URM-103 LO RF UV control for zero-rf output.
16. Note reading on ME-30(\*)/U.
17. While observing ME-30(\*)/U, increase rf output level of AN/URM-103 by turning LO RF UV control until ME-30(\*)/U drops to one-half of step 16 reading.
18. Adjust L1103 (8), L1203 (9), and L1303 (10) for lowest possible ME-30(\*)/U reading and minimum noise from speaker. (See test setup diagram **(B)**, page 3-166.)

**75-MHz Test**

19. Set RT MC-TUNE-KC control to 75.00 Mhz.
20. Adjust AN/URM-103 RF TUNING control to 75.00 Mhz. Check on frequency counter.
21. Set AN/URM-103 LO RF UV control for zero-rf output.
22. Note reading on ME-30(\*)/U.
23. While observing ME-30(\*)/U, increase rf output level of AN/URM-103 by turning LO RF UV control until ME-30(\*)/U drops to one-half of step 22 reading.
24. Adjust L1101 (11), L1201 (12), and L1301 (13) for lowest possible ME-30(\*)/U reading and minimum noise from speaker. (See test setup diagram **(B)**.)

**65-MHz Test**

25. Set RT MC-TUNE-KC control to 65.00 Mhz.
26. Adjust AN/URM-103 RF TUNING control to 65.00 Mhz. Check on frequency counter.
27. Set AN/URM-103 LO RF UV control for zero-rf output.
28. Note reading on ME-30(\*)/U.
29. While observing ME-30(\*)/U, increase rf output level of AN/URM-103 by turning LO RF UV control until ME-30(\*)/U drops to one-half of step 28 reading.
30. Adjust C1101 (14), C1201 (15), and C1301 (16) for lowest possible ME-30(\*)/U reading and minimum noise from speaker. (See test setup diagram **(B)**.)

**Mixer Adjustment**

31. Set RT MC-TUNE-KC control to 52.00 Mhz.
32. Adjust AN/URM-103 RF TUNING control to 52.00 Mhz. Check on frequency counter.
33. Set AN/URM-103 LO RF UV control for zero-rf output.
34. Note reading on ME-30(\*)/U.
35. While observing ME-30(\*)/U, increase rf output level of AN/URM-103 by turning LO RF UV control until ME-30(\*)/U drops to one-half of step 34 reading.
36. Set ME-30(\*)/U to 1-volt scale.
37. Adjust C1404 (17) for lowest possible ME-30(\*)/U reading.

**NOTE**

The ME-30(\*)/U reading can also decrease if C1404 is turned in or out too far. The first sharp decrease in the ME-30(\*)/U reading will indicate the correct C1404 adjustment.

### 3-29. IF DISCRIMINATOR A4200 ALINEMENT.

**PURPOSE.** This procedure enables the discriminator to provide maximum separation of the audio signal from the rf carrier. Adjusting for zero vdc at TP4003 ensures that T4206 and T4207 are conducting equally around the carrier frequency. Adjusting for maximum ac at TP4007 ensures that the discriminator is tuned exactly to the 11.5-MHz center frequency.

#### TEST EQUIPMENT AND MATERIALS

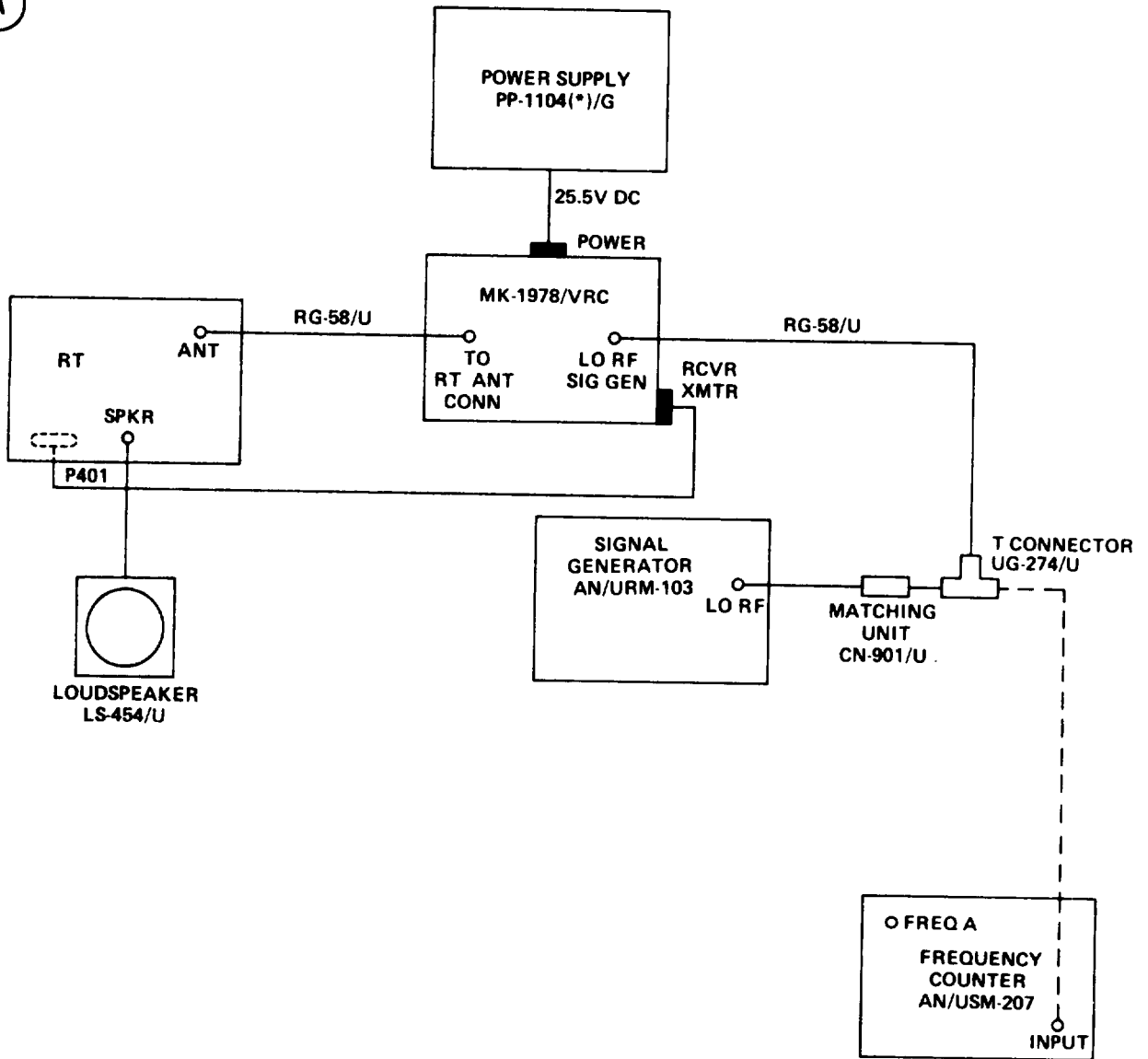
Signal Generator AN/URM-103  
Frequency Counter AN/USM-207  
Power Supply PP-1104(\*)/G  
Maintenance Kit MK-1978/VRC  
Multimeter ME-26(\*)/U

Matching Unit CN-901/U  
T-Connector UG-274/U  
Loudspeaker LS-454/U  
Voltmeter ME-30(\*)/U

**TEST SETUP.** Connect the equipment as shown in test setup diagram (A), page 3-169.

3-29. IF DISCRIMINATOR A4200 ALINEMENT. (CONT)

(A)



EL4GP330

INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment controls as indicated in the following table. If using alternate equipment, inject 20- $\mu$ v rf at 30-MHz, 1-kHz modulation, and 8- kHz deviation.

3-29. IF DISCRIMINATOR A4200 ALINEMENT. (CONT)

CONTROL AND SWITCH SETTINGS

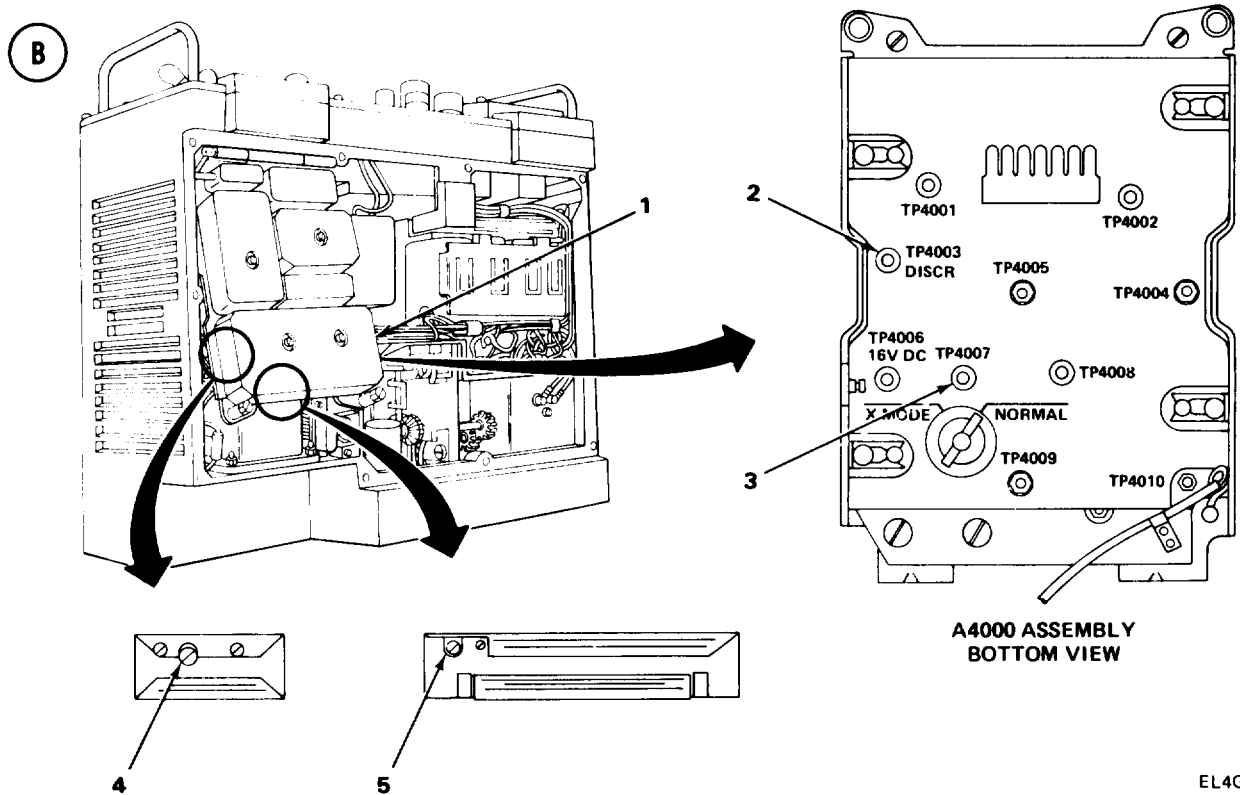
EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
RT	POWER BAND MC-TUNE-KC VOLUME SQUELCH	LOW Ⓐ 30.00 Fully clockwise NEW OFF
AN/URM-103	OPERATE/OFF/STAND BY FUNCTION BAND SWITCH RF TUNING DEVIATION RANGE KHZ RF OUTPUT DEVIATION RF SET TO LINE  LO RF UV	OPERATE 1000 Hz Ⓑ 30.00 10 LO, 0-10 KUV Fully counterclockwise Adjust until needle on IF UV RF SET TO LINE meter is over red line 20 μv
AN/USM-207	POWER DISPLAY SENSITIVITY FUNCTION GATE TIME DIRECT/HETERODYNE INPUT FREQUENCY TUNING-MC	TRACK (allow 5-minute warmup) MIN (fullycounterclockwise) PLUG IN FREQ 10 <sup>3</sup> (black knob) DIRECT 0.3 MAX (both switches to left) 100
MK-1978/VRC	All switches	Down, except POWER up

ALINEMENT PROCEDURE

**NOTE**

Check the frequency counter to make sure that the signal generator is outputting exactly 30 MHz. The rf level must be increased temporarily to enable the frequency counter to display. Adjust the AN/URM-103 RF TUNING control as necessary, reset to 20-μv rf level; then disconnect the T-connector from the counter.

**3-29. IF DISCRIMINATOR A4200 ALINEMENT. (CONT)**



EL4GP321

1. Turn AN/URM-103 DEVIATION control clockwise until DEVIATION KHZ meter reads 8 kHz.
2. Set ME-26(\*)/U to 1-vdc scale and turn ZERO ADJ for midscale reading.
3. Set ME-30(\*)/U to 3-volt scale.
4. Lift A4000tray(1). (See test setup diagram (B) .)
5. Connect ME-26(\*)/U positive lead to TP4003 (2), and negative lead to ground.
6. Connect ME-30(\*)/U positive lead to TP4007 (3), and negative lead to ground.
7. Adjust T4206 (4) for zero-vdc reading on ME-26(\*)/U.
8. Adjust T4207 (5) for peak reading ME-30(\*)/U.
9. Repeat steps 7 and 8 until maximum ME-30(\*)/U reading and zero-vdc ME-26(\*)/U reading occur at the same time.

**3-30. SILICON VERSION IF DISCRIMINATOR A4200A ALINEMENT.**

**PURPOSE.** This procedure enables the integrated circuit discriminator to provide maximum separation of the audio signal from the rf carrier. Coil L4202 is adjusted to tune the fm detector portion of the integrated circuit exactly to the 11.5-MHz center frequency.

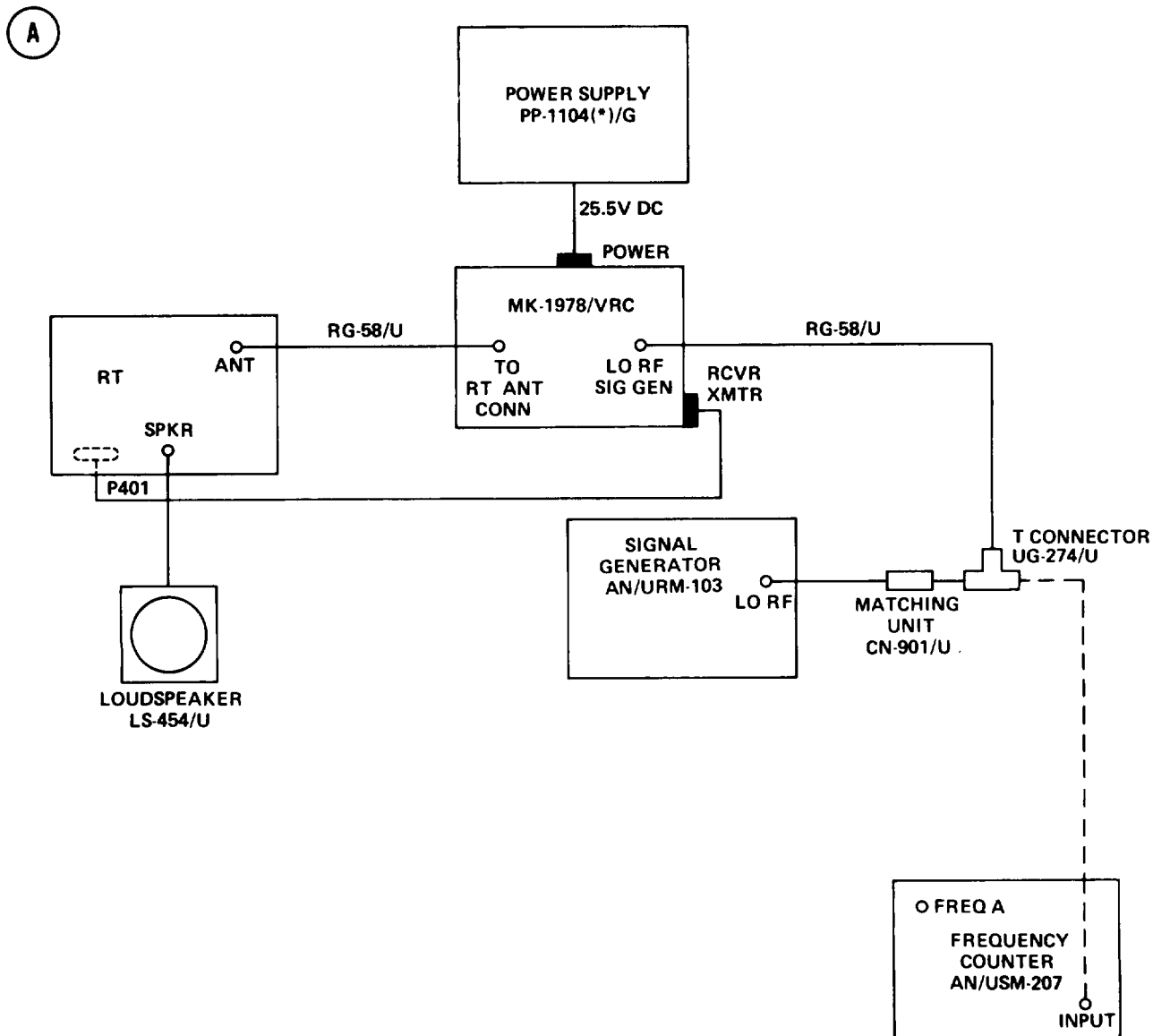
**TEST EQUIPMENT AND MATERIALS**

Signal Generator AN/URM-103  
 Frequency Counter AN/USM-207  
 Power Supply PP-1104(\*)/G  
 Maintenance Kit MK-1978/VRC

Matching Unit CN-901/U  
 T-Connector UG-274/U  
 Loudspeaker LS-454/U  
 Voltmeter ME-30(\*)/U

3-30. SILICON VERSION IF DISCRIMINATOR A4200A ALINEMENT. (CONT)

TEST SETUP. Connect the equipment as shown in test setup diagram (A) .



EL4GP330

**3-30. SILICON VERSION IF DISCRIMINATOR A4200A ALINEMENT. (CONT)**

INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment controls as indicated in the following table. If using alternate equipment, inject 20- $\mu$ v rf at 30 MHz, 1-kHz modulation, and 8-kHz deviation.

CONTROL AND SWITCH SETTINGS

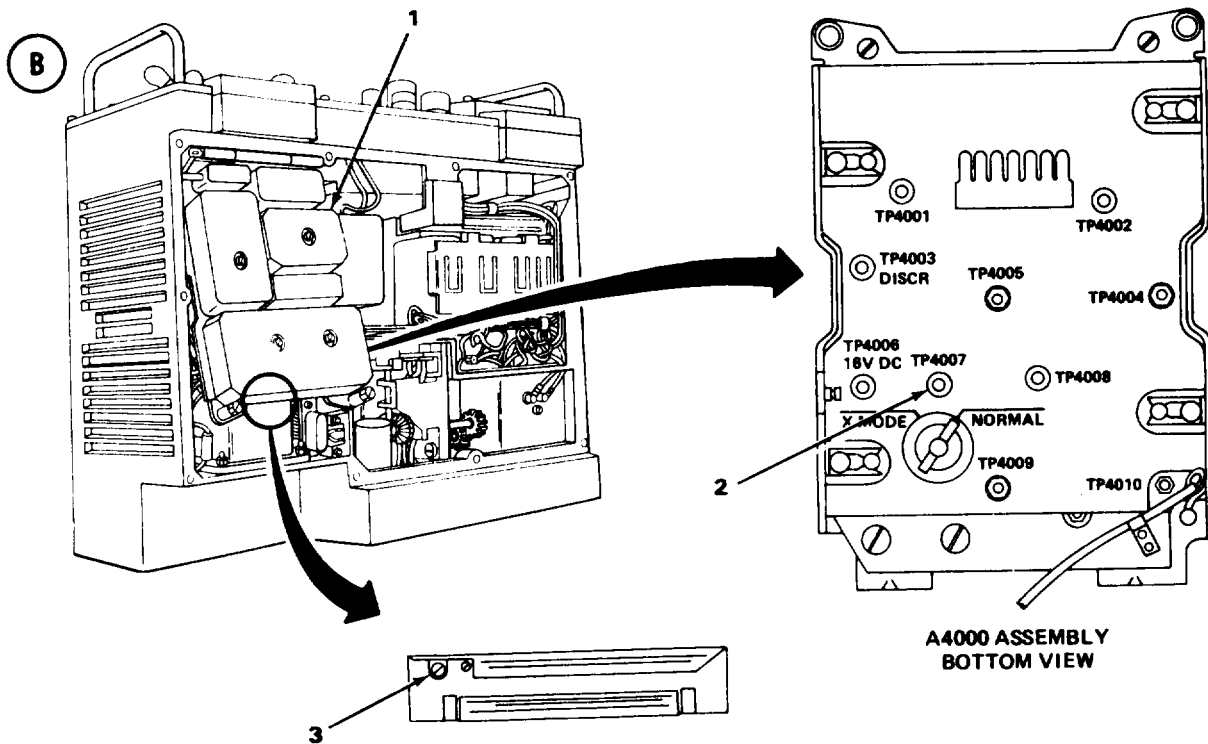
EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
RT	POWER BAND MC-TUNE-KC VOLUME SQUELCH	LOW Ⓐ 30.00 Fully clockwise NEW OFF
AN/USM-207	POWER DISPLAY SENSITIVITY FUNCTION GATE TIME DIRECT/HETERODYNE INPUT FREQUENCY TUNING-MC	TRACK (allow 5-minute warmup) MIN (fully counterclockwise) PLUG IN FREQ 10 <sup>3</sup> (black knob) DIRECT 0.3 V MAX (both switches to left) 100
AN/U RM-103	OPERATE/OFF/STAND BY FUNCTION BAND SWITCH RF TUNING DEVIATION RANGE KHZ RF OUTPUT DEVIATION RF SET TO LINE  LO RF UV	OPERATE 1000 Hz Ⓐ 30.00 10 LO, 0-10 KUV Fully counterclockwise Adjust until needle on IF UV RF SET TO LINE meter is over red line 20 $\mu$ v
MK-1978/VRC	All switches	Down, except POWER up

ALINEMENT PROCEDURE

**NOTE**

Check the frequency counter to make sure that the signal generator is outputting exactly 30 MHz. The rf level must be increased temporarily to enable the frequency counter to display. Adjust the AN/URM-103 RF TUNING control as necessary, reset to 20- $\mu$ v rf level; then disconnect the T-connector from the counter.

**3-30. SILICON VERSION IF DISCRIMINATOR A4200A ALINEMENT. (CONT)**



EL4GP322

1. Turn AN/URM-103 DEVIATION control clockwise until DEVIATION KHZ meter reads 8 kHz.
2. Set ME-30(\*)/U to 1-volt scale.
3. Lift A4000 tray(1). (See test setup diagram (B) .)
4. Connect ME-30(\*)/U positive lead to TP4007 (2), and negative lead to ground.
5. Adjust L4202 (3) for maximum indication on ME-30(\*)/U.

**3-31. AUDIO AND SQUELCH PREAMPLIFIER A4300 ALINEMENT.**

**PURPOSE.** This procedure adjusts the gain of the A4300 assembly.

**TEST EQUIPMENT AND MATERIALS**

Signal Generator AN/URM-103  
 Frequency Counter AN/USM-207  
 Power Supply PP-1104(\*)/G  
 Maintenance Kit MK-1978/VRC

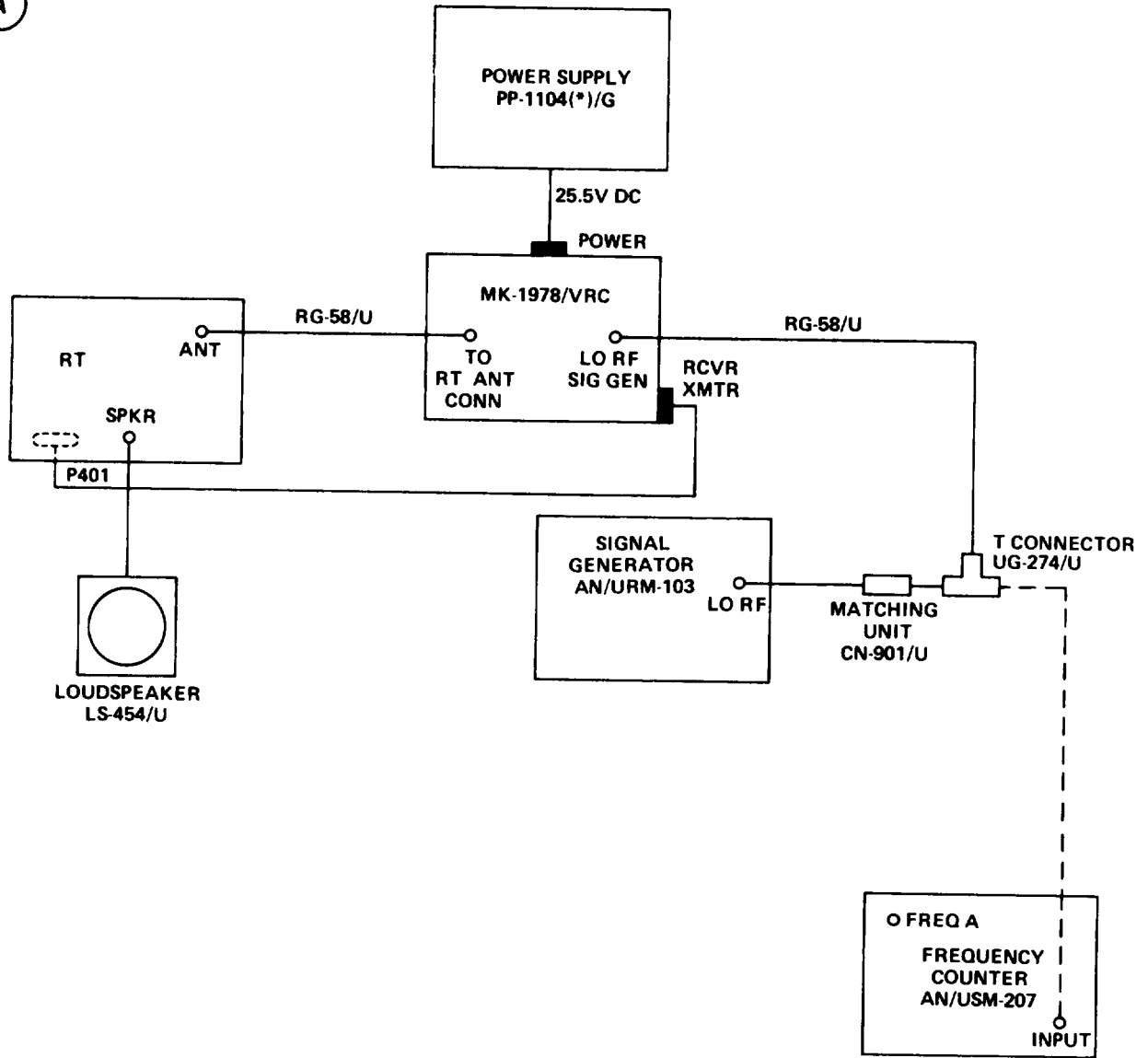
Matching Unit CN-901/U  
 T-Connector UG-274/U  
 Loudspeaker LS-454/U  
 Voltmeter ME-30(\*)/U

**TEST SETUP.** Connect the equipment as shown in test setup diagram (A) , page 3-175.



3-31. AUDIO AND SQUELCH PREAMPLIFIER A4300 ALINEMENT. (CONT)

A



EL4GP330

INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment controls as indicated in the following table. When using alternate equipment, inject 20- $\mu$ v rf at 30 MHz, 1-kHz modulation, and 8- kHz deviation.

3-31. AUDIO AND SQUELCH PREAMPLIFIER A4300 ALINEMENT. (CONT)

CONTROL AND SWITCH SETTINGS

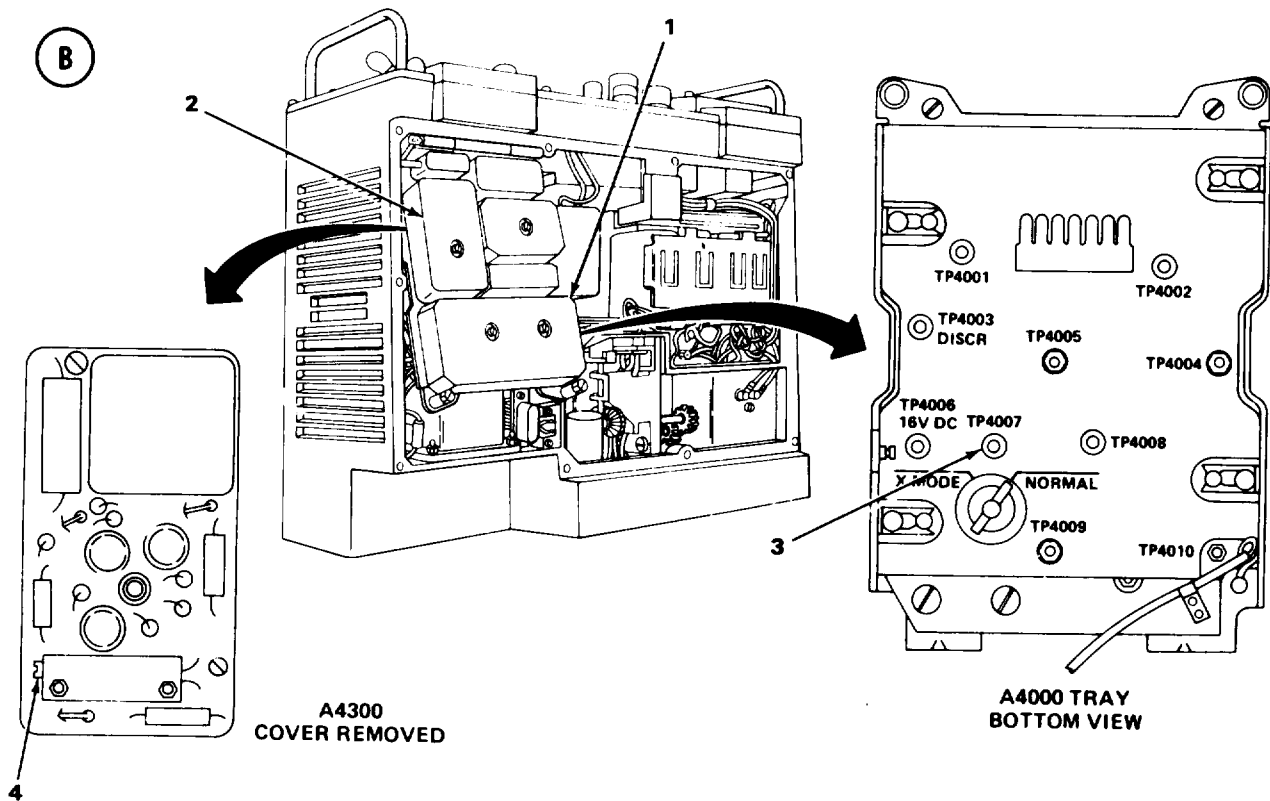
EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
RT	POWER BAND MC-TUNE-KC VOLUME SQUELCH	LOW Ⓐ 30.00 Fully clockwise NEW OFF
AN/URM-103	OPERATE/OFF/STAND BY FUNCTION BAND SWITCH RF TUNING DEVIATION RANGE KHZ RF OUTPUT, DEVIATION RF SET TO LINE  LO RF UV	OPERATE (allow 15-minute warmup) 100 Hz Ⓑ 30.00 10 LO, 0-10 KUV Fully counterclockwise Adjust until needle on IF UV RF SET TO LINE meter is over red line 20 μv
AN/USM-207	POWER DISPLAY SENSITIVITY FUNCTION GATE TIME DIRECT/HETERODYNE INPUT FREQUENCY TUNING-MC	TRACK (allow 5-minute warmup) MIN (fully counterclockwise) PLUG IN FREQ 10 <sup>3</sup> (black knob) DIRECT 0.3 V MAX (both switches to left) 100
MK-1978/VRC	All switches	Down, except POWER up

ALINEMENT PROCEDURE

**NOTE**

Check the frequency counter to make sure that the signal generator is outputting exactly 30 MHz. The rf level must be increased temporarily to enable the frequency counter to display. Adjust the AN/URM-103 RF TUNING control as necessary, reset to 20-μv rf level; then disconnect the T-connector from the counter.

3-31. AUDIO AND SQUELCH PREAMPLIFIER A4300 ALINEMENT. (CONT)



EL4GP323

1. Turn AN/URM-103 DEVIATION control clockwise until DEVIATION KHZ meter reads 8 kHz.
2. Set ME-30(\*)/U to 1-volt scale.
3. Lift A4000 tray(1). (See test setup diagram (B) .)
4. Remove A4300 cover(2).
5. Connect ME-30(\*)/U positive lead to TP4007 (3) and negative lead to ground.
6. Adjust R4304 (4) for 0.8-vac reading on ME-30(\*)/U.

3-32. SILICON VERSION AUDIO AND SQUELCH PREAMPLIFIER A4300A ALINEMENT.

PURPOSE. This procedure adjusts the gain of the A4300A assembly.

TEST EQUIPMENT AND MATERIALS

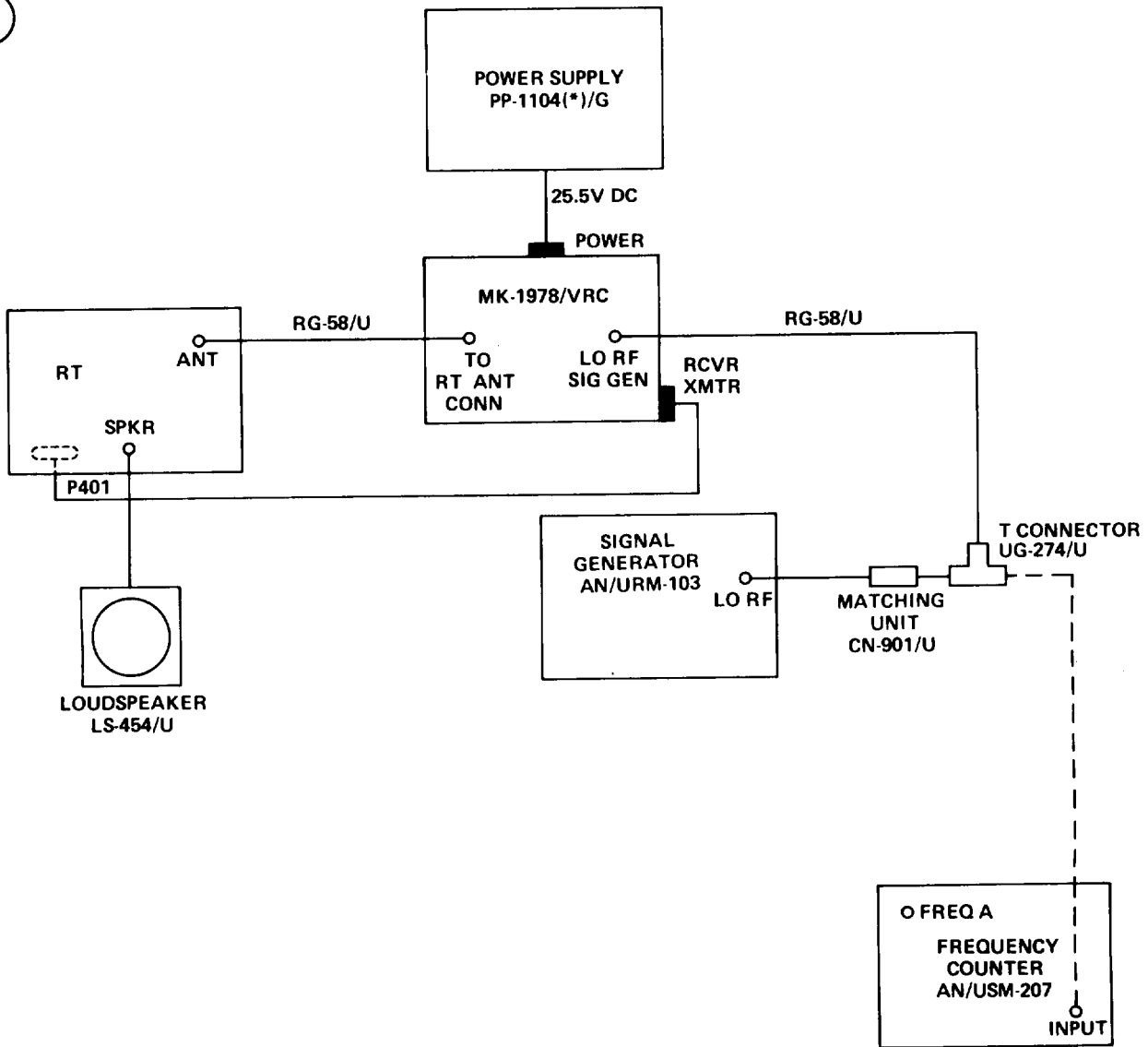
Signal Generator AN/URM-103  
 Frequency Counter AN/USM-207  
 Power Supply PP-1104(\*)/G  
 Maintenance Kit MK-1978/VRC

Matching Unit CN-901/U  
 T-Connector UG-274/U  
 Loudspeaker LS-454/U  
 Voltmeter ME-30(\*)/U

TEST SETUP. Connect the equipment as shown in test setup diagram (A) , page 3-178.

3-32. SILICON VERSION AUDIO AND SQUELCH PREAMPLIFIER A4300A ALINEMENT. (CONT)

A



EL4GP330

INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment controls as indicated in the following table. When using alternate equipment, inject 10- $\mu$ v rf at 64 MHz; 1-kHz modulation, and 8-kHz deviation.

3-32. SILICON VERSION AUDIO AND SQUELCH PREAMPLIFIER A4300A ALINEMENT. (CONT)

CONTROL AND SWITCH SETTINGS

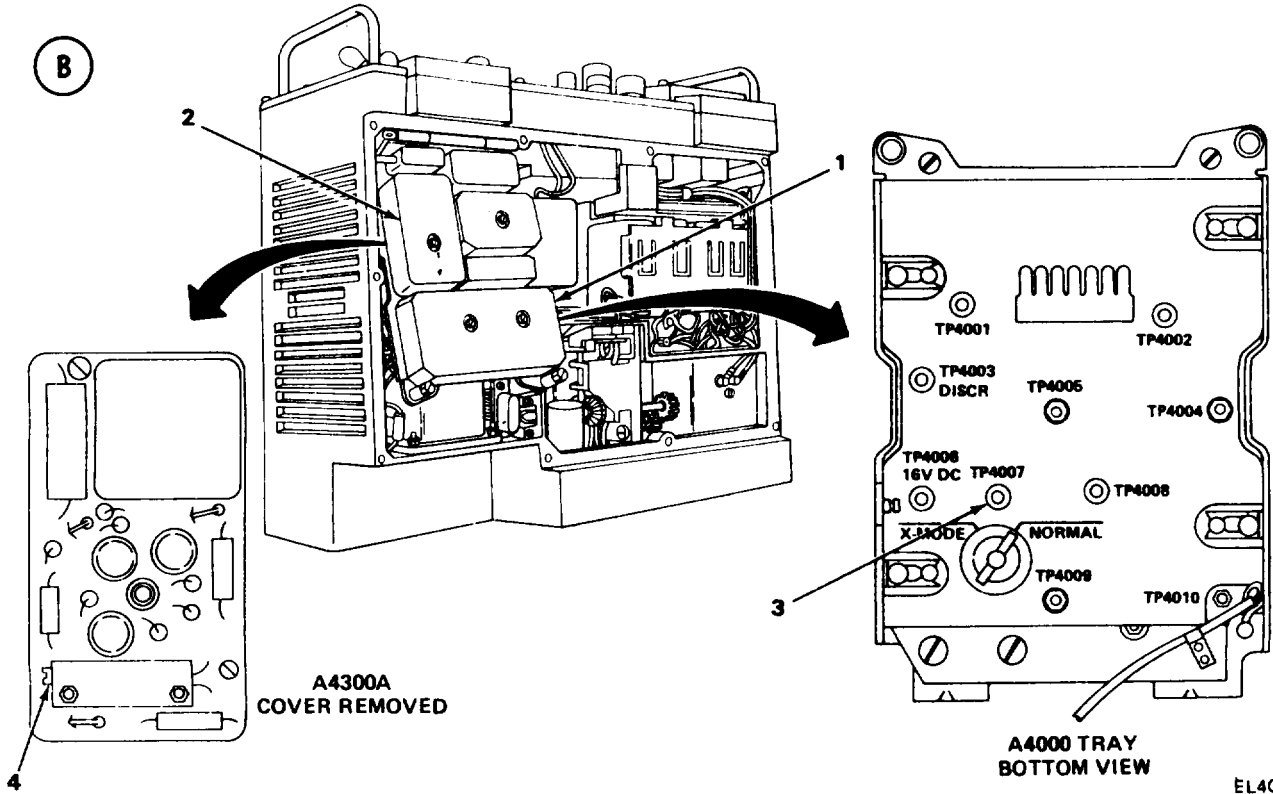
EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
RT	POWER BAND MC-TUNE-KC VOLUME SQUELCH	LOW ⓑ 64.00 Fully clockwise NEW OFF
AN/URM-103	OPERATE/OFF/STAND BY FUNCTION BAND SWITCH RF TUNING DEVIATION RANGE KHZ RF OUTPUT DEVIATION RF SET TO LINE  LO RF UV	OPERATE (allow 15-minute warmup) 1000 Hz ⓓ 64.00 10 LO, 0-10 KUV Fully counterclockwise Adjust until needle on IF UV RF SET TO LINE meter is over red line 10 μv
MK-1978/VRC	All switches	Down, except POWER up
AN/USM-207	POWER DISPLAY SENSITIVITY FUNCTION GATE TIME DIRECT/HETERODYNE INPUT FREQUENCY TUNING-MC	TRACK (allow 5-minute warmup) MIN (fully counterclockwise) PLUG IN FREQ 10 <sup>3</sup> (black knob) DIRECT 0.3 V MAX (both switches to left) 100

3-32. SILICON VERSION AUDIO AND SQUELCH PREAMPLIFIER A4300A ALINEMENT. (CONT)

ALINEMENT PROCEDURE

**NOTE**

Check the frequency counter to make sure that the signal generator is outputting exactly 64 MHz. The rf level must be increased temporarily to enable the frequency counter to display. Adjust the AN/URM-103 RF TUNING control as necessary, reset to 10- $\mu$ v rf level; then disconnect the T-connector from the counter.



EL4GP324

1. Turn AN/URM-103 DEVIATION control clockwise until DEVIATION KHZ meter reads 8 kHz.
2. Set ME-30(\*)/U to 1-volt scale.
3. Lift A4000 tray (1). (See test setup diagram (B) .)
4. Remove A4300A cover(2).
5. Connect ME-30(\*)/U positive lead to TP4007 (3) and negative lead to ground.
6. Adjust R4304 (4) for 0.8-vac reading on ME-30(\*)/U.

**3-33. ALINEMENT OF A5300 SQUELCH FILTER FOR CORRECT TRANSMITTED SQUELCH TONE.**

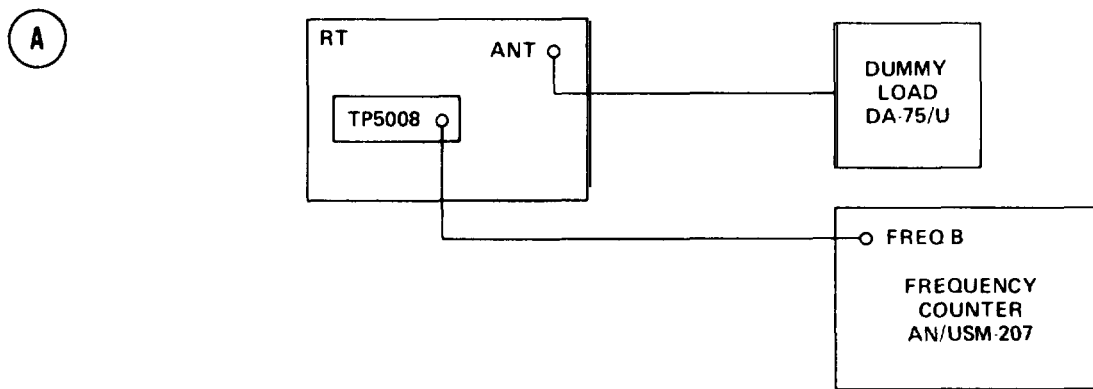
PURPOSE. This procedue adjusts Resistor R5301 in the squelch filter to ensure transmission of a 150-Hz NEW SQUELCH tone. Adjustment of R5301 during transmission also properly tunes the squelch filter for 150-Hz NEW SQUELCH tone reception.

TEST EQUIPMENT AND MATERIALS

Power Supply PP-1104(\*)/G  
 Frequency Counter AN/U SM-207  
 Dummy Load DA-75/U

T-Connector UG-274/U  
 Maintenance Kit MK-1978/VRC

TEST SETUP. Connect the equipment as shown in test setup diagram (A)



EL4GP325

INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment as indicated in the following table.

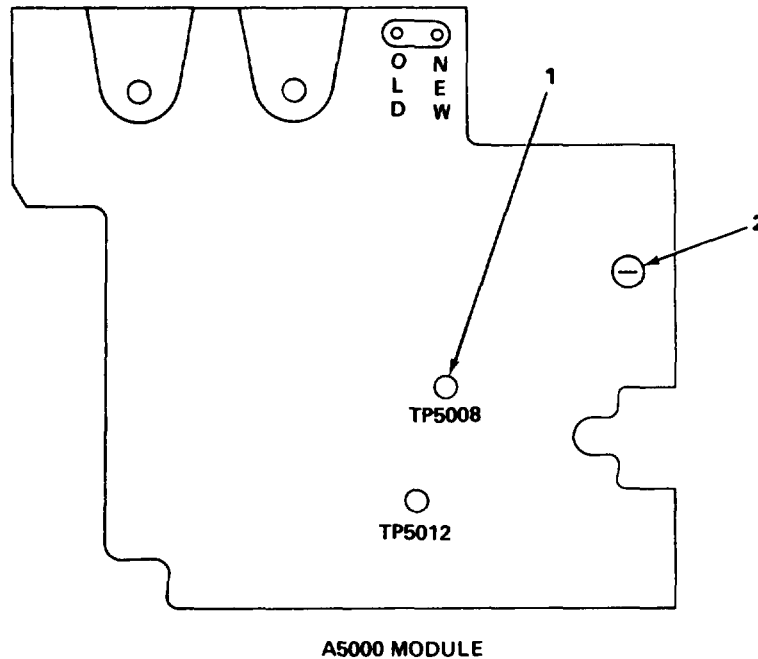
CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
RT	POWER BAND MC-TUNE-KC VOLUME SQUELCH	LOW (A) 30.00 Fully counterclockwise NEW ON
AN/USM-207	POWER DISPLAY SENSITIVITY GATE TIME FUNCTION	TRACK MIN (fully counterclockwise) 0.1 v 1 (black knob) FREQ

### 3-33. ALINEMENT OF A5300 SQUELCH FILTER FOR CORRECT TRANSMITTED SQUELCH TONE. (CONT)

#### ALINEMENT PROCEDURE

**(B)**



EL4GP326

1. Connect frequency counter to TP5008. (See test setup diagram **(B)** .)
2. Key transmitter.
3. Check frequency counter. Indication should be  $150 \pm 1$  Hz. If frequency is not correct, go to step 4.
4. Adjust R5301 (2) until frequency counter indicates 150 Hz. (See test setup diagram **(B)** .)
5. Unkey transmitter.



**3-34. ALINEMENT OF SILICON A5300A SQUELCH FILTER FOR CORRECT TRANSMITTED SQUELCH TONE**

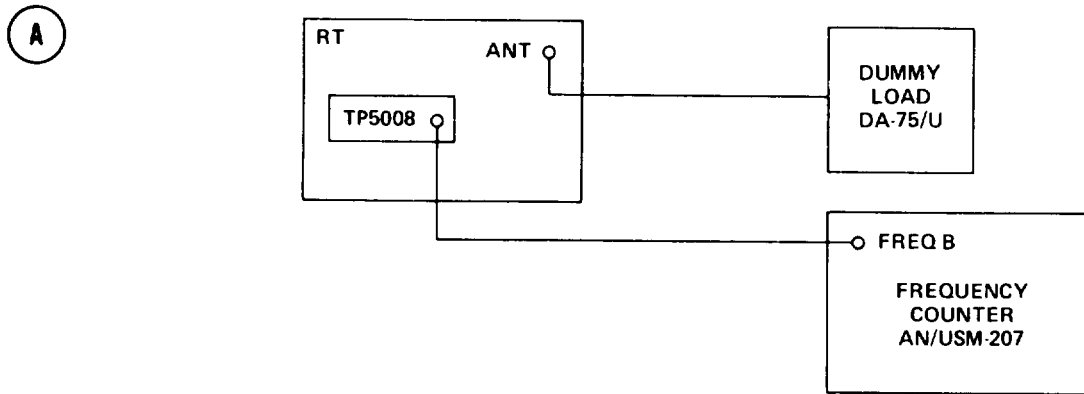
**PURPOSE.** This procedure adjusts Resistor R5303 in the squelch filter to ensure transmission of a 150-Hz NEW SQUELCH tone. Adjustment of R5303 during transmission also properly tunes the squelch filter for 150-Hz NEW SQUELCH tone reception.

**TEST EQUIPMENT AND MATERIALS**

Power Supply PP-1104(\*)/G  
 Frequency Counter AN/USM-207  
 Test Cable No. 1

Dummy Load DA-75/U  
 T-Connector UG-274/U

**TEST SETUP.** Connect the equipment as shown in test setup diagram (A).



EL4GP325

**INITIAL EQUIPMENT CONTROL SETTINGS.** Set equipment as indicated in the following table.

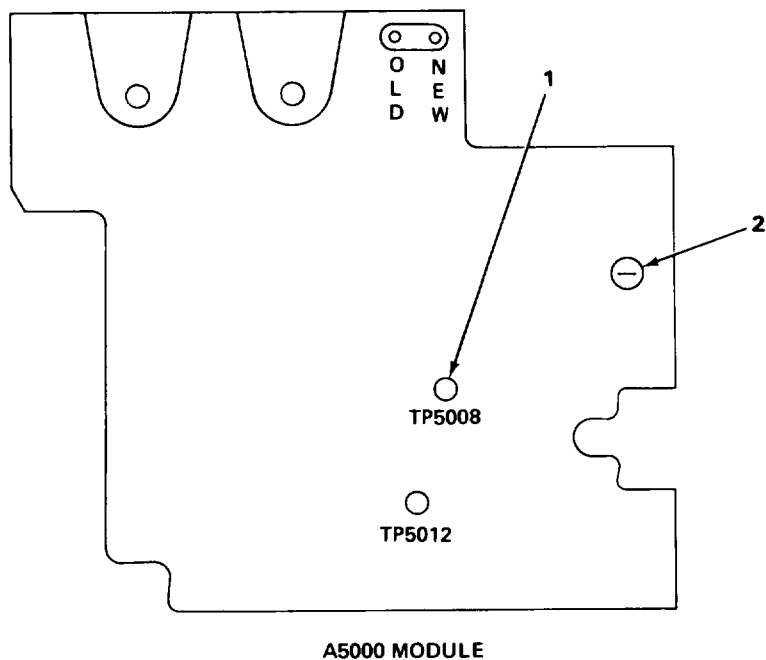
**CONTROL AND SWITCH SETTINGS**

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
RT	POWER BAND MC-TUNE-KC VOLUME SQUELCH	LOW A 30.00 Fully counterclockwise NEW ON
AN/USM-207	POWER DISPLAY SENSITIVITY GATE TIME FUNCTION	TRACK MIN (fully counterclockwise) 0.1 v 1 (black knob) FREQ

3-34. ALINEMENT OF SILICON A5300A SQUELCH FILTER FOR CORRECT TRANSMITTED SQUELCH TONE. (CONT)

ALINEMENT PROCEDURE

(B)



EL4GP326

1. Connect frequency counter to TP5008. (See test setup diagram (B) .)
2. Key transmitter.
3. Check frequency counter. Indication should be  $150 \pm 1$ Hz. If frequency is not correct, go to step 4.
4. Adjust R5303 (2) until frequency counter indicates 150 Hz. (See test setup diagram (B) .)
5. Unkey transmitter.

3-35. A5200 SQUELCH AMPLIFIER ALINEMENT, NEW SQUELCH LEVEL.

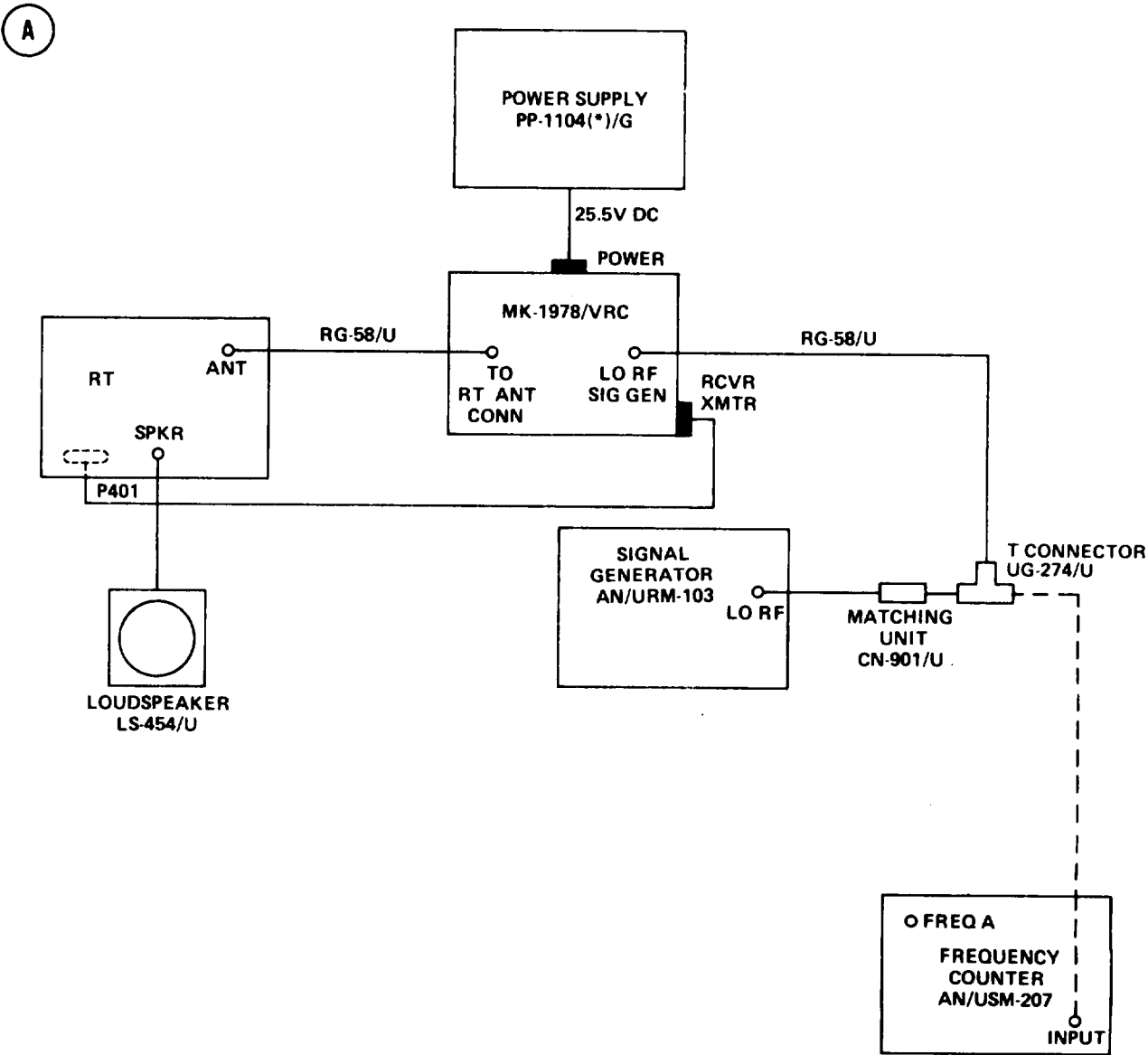
PURPOSE. This procedure adjusts the receiver sensitivity to the 150-Hz NEW SQUELCH tone.

TEST EQUIPMENT AND MATERIALS

- Signal Generator AN/URM-103
- Frequency Counter AN/USM-207
- Power Supply PP-1104(\*)/G
- Maintenance Kit MK-1978/VRC

- Matching Unit CN-901/U
- T-Connector UG-274/U
- Loudspeaker LS-454/U
- Voltmeter ME-30(\*)/U

TEST SETUP. Connect the equipment as shown in test setup diagram (A) .)



EL4GP330

**3-35. A5200 SQUELCH AMPLIFIER ALINEMENT, NEW SQUELCH LEVEL. (CONT)**

INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment as indicated in the following table. When using alternate equipment, inject 20- $\mu$ v rf at 30 MHz, with 150-Hz modulation, deviation as per alinement requirements.

CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
RT	POWER BAND MC-TUNE-KC VOLUME SQUELCH	LOW Ⓐ 30.00 Fully clockwise NEW ON
AN/U RM-103	OPERATE/OFF/STAND BY FUNCTION BAND SWITCH RF TUNING DEVIATION RANGE KHZ RF OUTPUT DEVIATION RF SET TO LINE  LO RF UV	OPERATE 150 Hz Ⓑ 30.00 10 LO, 0-10 KUV Fully counterclockwise Adjust until needle on IF UV RF SET TO LINE meter is over red line 20 $\mu$ v
MK-1978/VRC	All switches	Down, except POWER up
AN/USM-207	POWER DISPLAY SENSITIVITY FUNCTION GATE TIME DIRECT/HETERODYNE INPUT FREQUENCY TUNING-MC	TRACK MIN (fully counterclockwise) PLUG IN FREQ 10 <sup>3</sup> (black knob) DIRECT 0.3 V MAX (both switches to left) 100

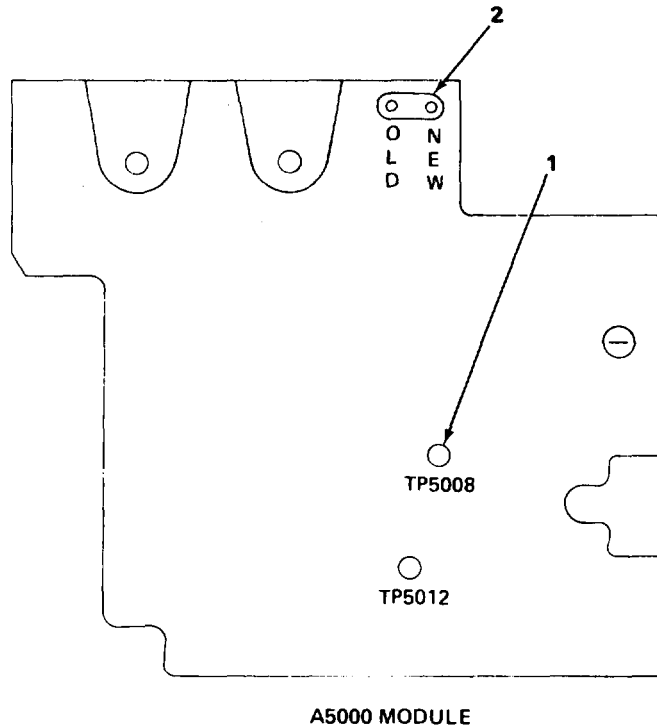
ALINEMENT PROCEDURE

**NOTE**

Check the frequency counter to make sure that the signal generator is outputting exactly 30 MHz, The rf level must be increased temporarily to enable the frequency counter to display, Adjust the AN/URM-103 RF TUNING control as necessary, reset to 20- $\mu$ v rf level, then disconnect the T-connector from the counter.

**3-35. A5200 SQUELCH AMPLIFIER ALINEMENT, NEW SQUELCH LEVEL. (CONT)**

**B**



EL4GP327

1. Lift RT A3000 tray.
2. Set ME-30(\*)NJ to 10-volt scale.
3. Connect ME-30(\*)/U positive lead to TP5008 (1) and negative lead to ground.
4. Turn AN/URM-103 DEVIATION control clockwise until ME-30(\*)/U reads 4 vac.
5. Remove ME-30(\*)/U positive lead.
6. Adjust NEW Squelch Resistor R5217 (2) until RT CALL light just comes on.

**3-36. SILICON VERSION A5200A SQUELCH AMPLIFIER ALINEMENT, NEW SQUELCH LEVEL.**

**PURPOSE.** This procedure adjusts the receiver sensitivity to the 150-Hz NEW SQUELCH tone.

**TEST EQUIPMENT AND MATERIALS**

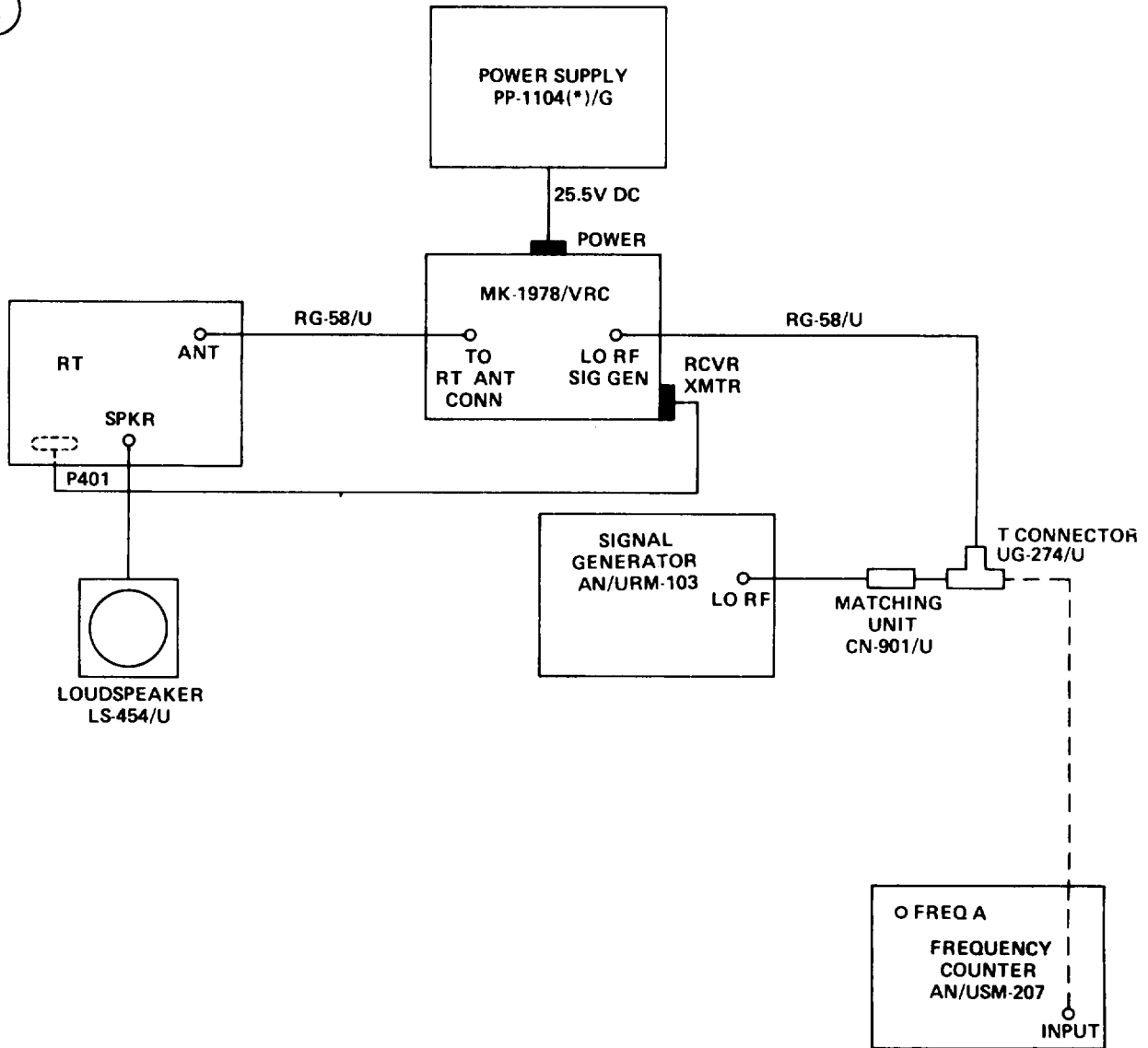
Signal Generator AN/URM-103  
 Frequency Counter AN/USM-207  
 Power Supply PP-1104 (\*)/G  
 Maintenance Kit MK-1978/VRC

Matching Unit CN-901/U  
 T.Connector UG-274/U  
 Loudspeaker LS-454/U  
 Voltmeter ME-30 (\*)/U

**TEST SETUP,** Connect the equipment as shown in test setup diagram **A**, page 3-188.

3-36. SILICON VERSION A5200A SQUELCH AMPLIFIER ALINEMENT, NEW SQUELCH LEVEL. (CONT)

A



EL4GP330

INITIAL EQUIPMENT CONTROL SEETINGS. Set equipment as indicated in the following table. When using alternate equipment, inject 2000- $\mu$ v rf at 64 MHz, 150-Hz modulation; deviation as per alinement requirements.

3-36. SILICON VERSION A5200A SQUELCH AMPLIFIER ALINEMENT, NEW SQUELCH LEVEL. (CONT)

CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
RT	POWER BAND MC-TUNE-KC VOLUME SQUELCH	LOW ⓑ 64.00 Fully clockwise NEW ON
AN/USM-207	POWER DISPLAY SENSITIVITY FUNCTION GATE TIME DIRECT/HETERODYNE INPUT FREQUENCY TUNING-MC	TRACK MIN (fully counterclockwise) PLUG IN FREQ 10 <sup>3</sup> (black knob) DIRECT 0.3 V MAX (both switches to left) 100
MK-1978/VRC	All switches	Down, except POWER up
AN/URM-103	OPERATE/OFF/STANDBY FUNCTION BAND SWITCH RF TUNING DEVIATION RANGE KHZ RF OUTPUT DEVIATION RF SET TO LINE  LO RF UV	OPERATE 15 Hz ⓓ 64.00 10 LO, 0-10 KUV Fully counterclockwise Adjust until needle on IF UV RF SET TO LINE meter is over red line 2000 μv

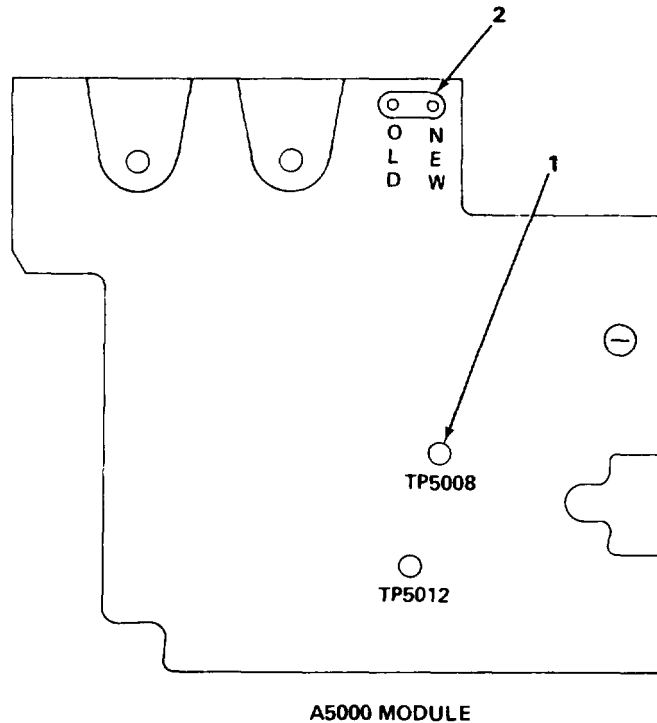
3-36. SILICON VERSION A5200A SQUELCH AMPLIFIER ALINEMENT, NEW SQUELCH LEVEL. (CONT)

ALINEMENT PROCEDURE

**NOTE**

Check the frequency counter to make sure that the signal generator is outputting exactly 64 MHz. The rf level must be increased temporarily to enable the frequency counter to display. Adjust the AN/URM-103 RF TUNING control as necessary, reset to 2000- $\mu$ v rf level; then disconnect the T-connector from the counter.

**B**



A5000 MODULE

EL4GP327

1. Lift RT A3000 tray. (See test setup diagram **B**.)
2. Set ME-30(\*)/U to 0.3-volt scale.
3. Connect ME-30(\*)/U positive lead to TP5008(1), and negative lead to ground.
4. Turn AN/URM-103 DEVIATION control clockwise until ME-30(\*)/U reads  $0.20 \pm 0.01$  vac.
5. Adjust NEW Squelch Resistor 5207(2) until RT CALL light just comes on.
6. Turn AN/URM-103 DEVIATION control counterclockwise until ME-30(\*)/U reads  $0.15 \pm 0.01$  vac. CALL light should be off.

**NOTE**

If CALL light does not go off in step 6, repeat steps 4 and 5.



**3-37. A5200 SQUELCH AMPLIFIER ALINEMENT, OLD SQUELCH LEVEL.**

PURPOSE. This procedure adjusts the receiver sensitivity to the OLD SQUELCH signals which include internal noise and the received carrier.

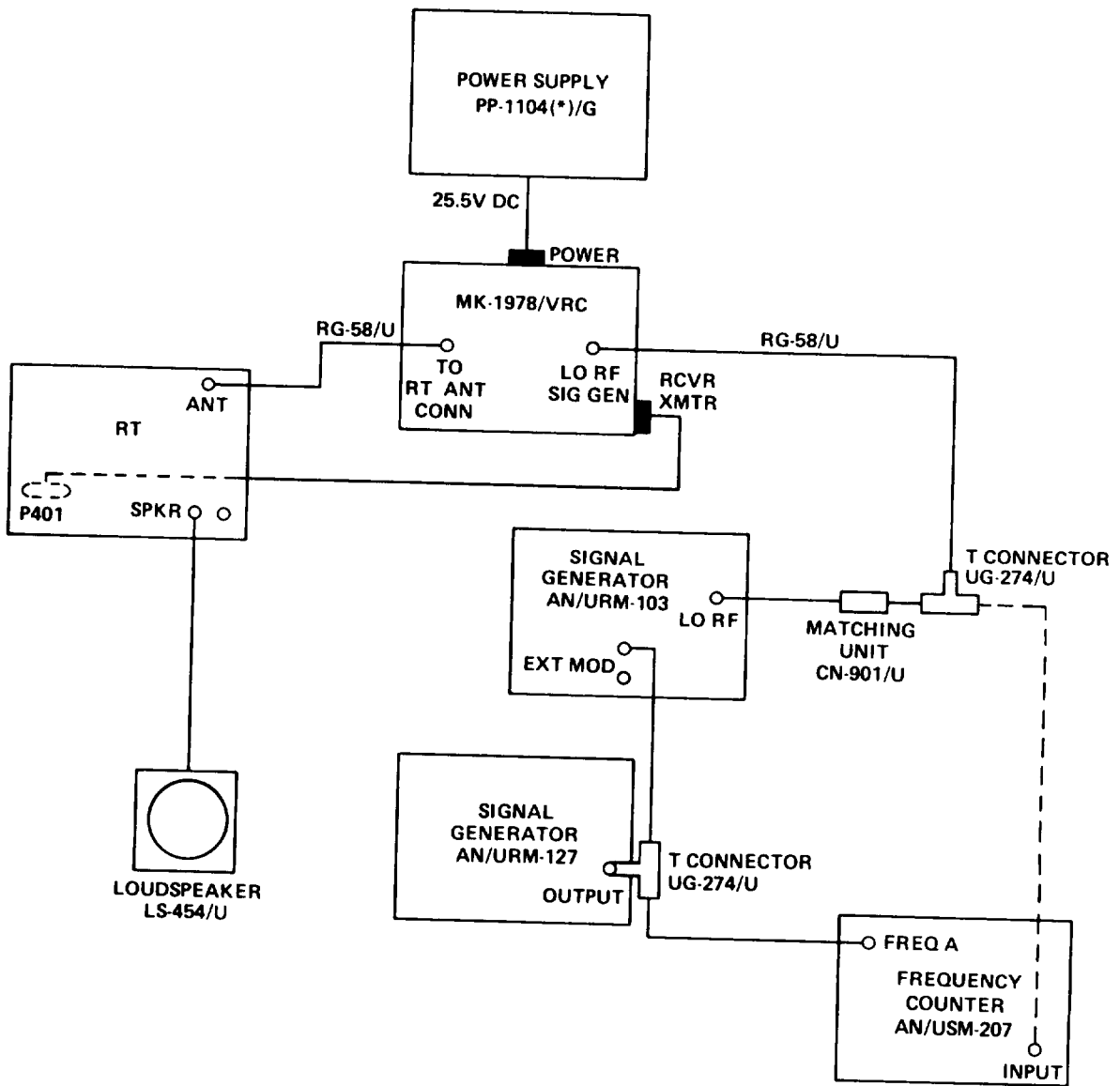
TEST EQUIPMENT AND MATERIALS

Signal Generator AN/URM-103  
 Frequency Counter AN/USM-207  
 Power Supply PP-1104(\*)/G  
 Signal Generator AN/URM-127  
 Maintenance Kit MK-1978/VRC

Matching Unit CN-901/U  
 T-Connector UG-274/U  
 Loudspeaker LS-454/U  
 Voltmeter ME-30(\*)/U

TEST SETUP: Connect the equipment as shown in test setup diagram (A) .

(A)



EL4GP331

**3-37. A5200 SQUELCH AMPLIFIER ALINEMENT, OLD SQUELCH LEVEL. (CONT)**

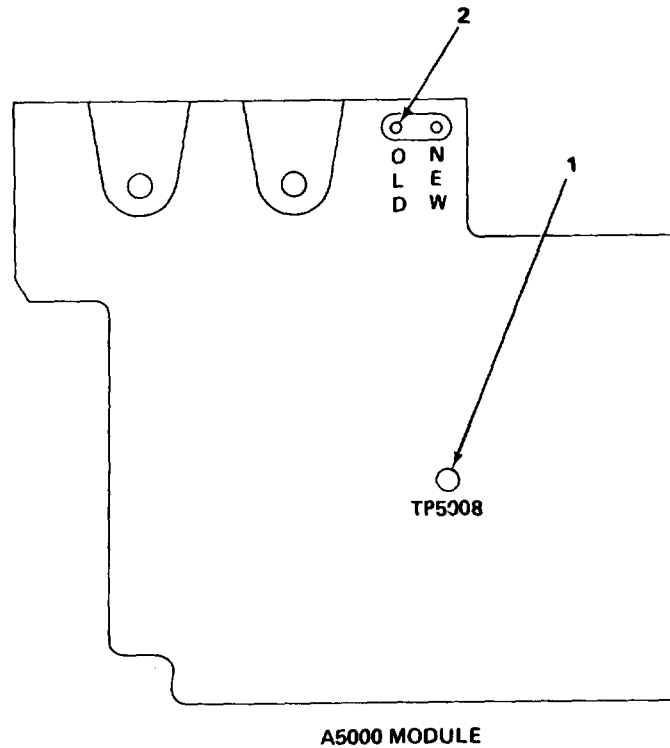
INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment as indicated in the following table. When using alternate equipment, inject 20- $\mu$ v rf at 42 MHz, 7.3-kHz modulation, deviation as per alinement requirements.

CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
RT	POWER BAND MC-TUNE-KC VOLUME SQUELCH	LOW Follow instructions in alinement procedure Follow instructions in alinement procedure Fully clockwise OLD ON
AN/URM-103	OPERATE/OFF/STAND BY FUNCTION: BAND SWITCH RF TUNING DEVIATION RANGE KHZ RF OUTPUT DEVIATION RF SET TO LINE  LO RF UV	OPERATE EXT MOD Follow instructions in alinement procedure Follow instructions in alinement procedure 10 LO, 0-10 KUV Fully counterclockwise Adjust until needle on IF UV RF SET TO LINE meter is over red line 20 $\mu$ v
AN/USM-207 (to verify AN/USM- 127 low-fre- quency output)	POWER DISPLAY SENSITIVITY GATE TIME FUNCTION	TRACK MIN (fully counterclockwise) 0.1 v 1 FREQ
AN/USM-207 (to verify AN/USM- 103 high-fre- quency output)	POWER DISPLAY SENSITIVITY FUNCTION GATE TIME DIRECT/HETERODYNE INPUT FREQUENCY TUNING-MC	TRACK MIN (fully counterclockwise) PLUG IN FREQ 10 <sup>3</sup> (black knob) DIRECT 0.3 V MAX (both switches to left) 100
MK-1978/VRC	All switches	Down, except POWER up
AN/URM-127	POWER FREQ RANGE MULTIPLIER FREQ RANGE DIAL ATTENUATOR OUTPUT CONTROL  FREQ METER	ON x100 73 x10 Turn clockwise for 2.2-volt reading on panel voltmeter ON

**3-37. A5200 SQUELCH AMPLIFIER ALINEMENT, OLD SQUELCH LEVEL. (CONT)**

## ALINEMENT PROCEDURE

**(B)**

EL4GP329

1. Disconnect rf cable from RT ANTENNA port.
2. Lift RT A3000 tray.
3. Set ME-30(\*)/U to 10-volt scale.
4. Connect ME-30(\*)/U positive lead to TP5008 (1) and negative lead to ground. (See test setup diagram (B) .)
5. Set RT MC-TUNE-KC control to any frequency which results in at least a 4-vac reading on ME-30(\*)/U. Record ME-30(\*)/U reading.
6. Reconnect rf cable to ANTENNA port.
7. Set AN/URM-103 BAND switch to range that includes RT frequency setting.
8. Set AN/URM-103 RF TUNING control the same frequency selected in step 5.

**NOTE**

Check the frequency counter to make sure that the signal generator is outputting the correct frequency. The rf level must be increased temporarily to enable the frequency counter to display. Adjust the AN/URM-103 RF TUNING control as necessary, reset to 20- $\mu$ v rf level; then disconnect the T-connector from the counter.

9. Adjust AN/URM-103 DEVIATION control for 3-kHz reading on DEVIATION KHZ meter.
10. Adjust AN/URM-127 FREQ RANGE DIAL to vary frequency above and below 7.3 kHz while observing ME-30(\*)/U. Stop at frequency that gives highest possible ME-30(\*)/U reading. At the same time, adjust AN/URM-103 DEVIATION control to keep ME-30(\*)/U reading between 2 and 4 vac. If adjustment of DEVIATION control is required, readjust AN/URM-127 frequency for peak ME-30(\*)/U reading.

**3-37. A5200 SQUELCH AMPLIFIER ALINEMENT, OLD SQUELCH LEVEL. (CONT)**

11. Adjust AN/URM-103 DEVIATION control for ME-30(\*)/U reading 4 db less than reading recorded in step 5.
12. Check RT CALL light. If light is out, go to step 13. If light is on, go to step 14.
13. CALL LIGHT OUT. Turn R5216 (2) counterclockwise slowly and stop at point where light just

OLD SQUELCH Final Test

15. Adjust AN/URM-103 DEVIATION control for 8-kHz reading on DEVIATION KHZ meter.
16. Set AN/USM-127 FREQ RANGE MULTIPLIER to x10.
17. Set AN/USM-127 FREQ RANGE DIAL to 35 (350 Hz). RT CALL light should be on.

**NOTE**

CALL light must stay on through range of 350 to 3500 Hz.

18. Rotate FREQ RANGE DIAL fully clockwise to 2000 Hz. CALL light should stay on.
19. Rotate FREQ RANGE DIAL fully counterclockwise.
20. Set FREQ RANGE MULTIPLIER to x100.
21. Rotate FREQ RANGE DIAL to 35 (3500 Hz). CALL light should stay on.

**NOTE**

If RT fails the OLD SQUELCH Final Test, replace the A5300 module and repeat the entire alinement procedure.

**3-38. SILICON VERSION A5200A SQUELCH AMPLIFIER ALINEMENT, OLD SQUELCH LEVEL.**

PURPOSE. This procedure adjusts the receiver sensitivity to the OLD SQUELCH signals which include internal noise and the received carrier.

TEST EQUIPMENT AND MATERIALS

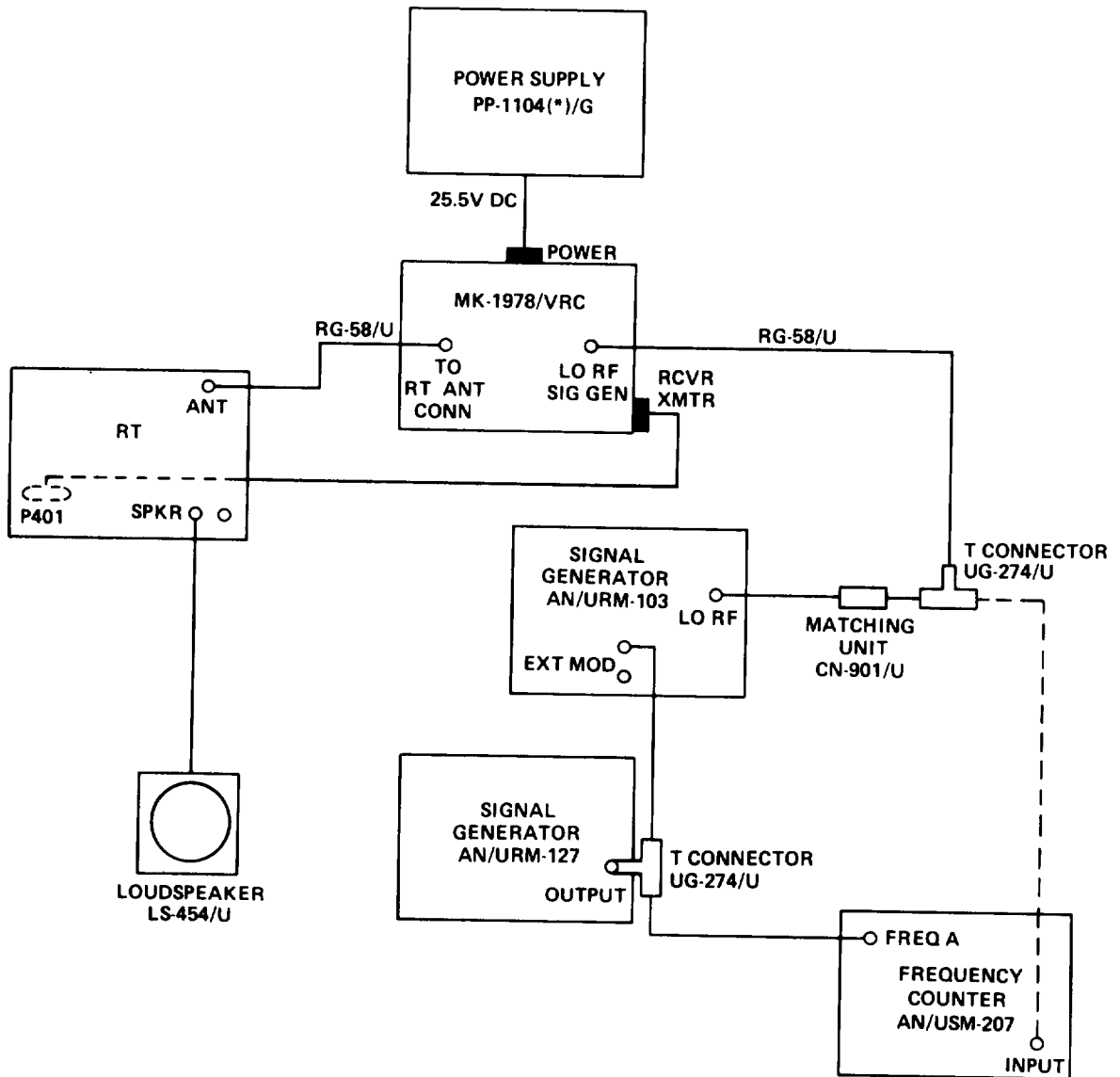
Signal Generator AN/URM-103  
Frequency Counter AN/USM-207  
Power Supply PP-1104(\*)/G  
Signal Generator AN/URM-127  
Maintenance Kit MK-1978/VRC

Matching Unit CN-901/U  
T-Connector UG-274/U  
Loudspeaker LS-454/U  
Voltmeter ME-30(\*)/U

3-38. SILICON VERSION A5200A SQUELCH AMPLIFIER ALINEMENT, OLD SQUELCH LEVEL. (CONT)

TEST SETUP. Connect the equipment as shown in test setup diagram (A).

(A)



EL4GP331

INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment as indicated in the following table. When using alternate equipment, inject 20- $\mu$ v rf at 64 MHz, 7.3-kHz modulation, deviation as per alinement requirements.

3-38. SILICON VERSION A5200A SQUELCH AMPLIFIER ALINEMENT, OLD SQUELCH LEVEL. (CONT)

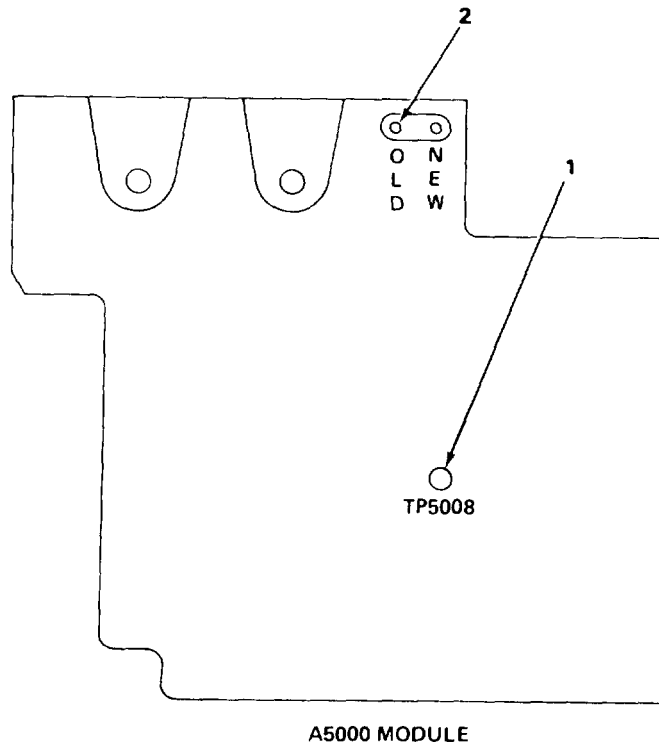
CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
RT	POWER BAND MC-TUNE-KC VOLUME SQUELCH	LOW Follow instructions in alinement procedure Follow instructions in alinement procedure Fully clockwise OLD ON
MK-1978/VRC	All switches	Down, except POWER up
AN/URM-103	OPERATE/OFF/STAND BY FUNCTION BAND SWITCH RF TUNING DEVIATION RANGE KHZ RF OUTPUT DEVIATION RF SET TO LINE  LO RF UV	OPERATE EXT MOD ⓓ 64.00 10 LO, 0-10 KUV Fully counterclockwise Adjust until needle on IF UV RF SET TO LINE meter is over read line 20 μv
AN/URM-127	POWER FREQ RANGE MULTIPLIER FREQ RANGE DIAL ATTENUATOR OUTPUT CONTROL  FREQ METER	ON x100 73 x10 Turn clockwise for 2.2-volt reading on panel voltmeter ON
AN/USM-207 (to verify AN/URM- 127 low-fre- quency output)	POWER DISPLAY SENSITIVITY GATE TIME FUNCTION	TRACK MIN (fully counterclockwise) 0.1 v 1 (black knob) FREQ
AN/USM-207 (to verify AN/URM- 103 high-fre- quency output)	POWER DISPLAY SENSITIVITY FUNCTION GATE TIME DIRECT/HETERODYNE INPUT FREQUENCY TUNING-MC	TRACK MIN (fully counterclockwise) PLUG IN FREQ 10 <sup>3</sup> (black knob) DIRECT 0.3 V MAX (both switches to left) 100

**3-38. SILICON VERSION A5200A SQUELCH AMPLIFIER ALINEMENT, OLD SQUELCH LEVEL. (CONT)**

**ALINEMENT PROCEDURE**

**B**



EL4GP329

1. Lift RT A3000 tray.
2. Set ME-30(\*)/U to 3-volt scale
3. Connect ME-30(\*)/U positive lead to TP5008 (1) and negative lead to ground.
4. Turn AN/URM-103 DEVIATION control clockwise until ME-30(\*)/U reads 1.5 vac. RT CALL light should be off. If necessary, adjust R5208 (2) until CALL light goes off.
5. Turn DEVIATION control counterclockwise until ME-30(\*)/U reads 1.0 vac. Adjust R5208 (2) and stop at point where CALL light just comes on.

**3-39. POWER SUPPLY A9000/A9400A (A9000A/A9400B) TESTS.**

**PURPOSE.** This test verifies the availability of adequate power before the transmitter is alined.

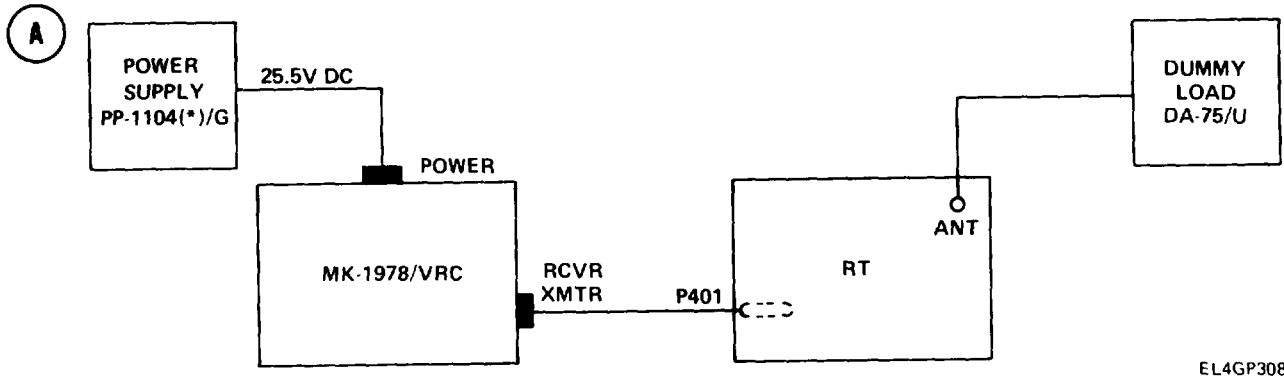
**TEST EQUIPMENT AND MATERIALS**

Dummy Load DA-75/U  
Multimeter ME-26(\*)/U

Power Supply PP-1104(\*)/G  
Maintenance Kit MK-1978/VRC

3-39. POWER SUPPLY A9000/A9400A (A9000A/A9400B) TESTS. (CONT)

TEST SETUP. Connect the equipment as shown in test setup diagram (A)



EL4GP308

INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment as indicated in the following table.

CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
RT	BAND MC-TUNE-KC POWER SQUELCH	(A) 30.00 HIGH NEW ON
MK-1978/VRC	POWER X-MODE (RT) SQUELCH KEY AUDIO	ON NORMAL ON RCVE MUTED

TEST PROCEDURE

NOTE

The power supply voltage measured at TP9005 should not drop significantly below 25 vdc when the RT is keyed. If the voltage at TP9005 is much less than 25 volts, the driver and power amplifier are probably out of alignment, causing excessive current draw. If TP9005 voltage is satisfactory, but other test points given in the following table are not up to normal readings, troubleshoot the power supply.

Check power supply voltages at the test points given in the following table.

NOTE

Key the transmitter before performing voltage checks.



3-39. POWER SUPPLY A9000/A9400A (A9000A/A9400B) TESTS. (CONT)

A9000 TEST POINT	REQUIRED VOLTAGE
TP9005	25 vdc minimum
TP9001	640 to 760 vdc
TP9002	250 to 300 vdc
TP9003	90 vac minimum
TP9004	-20 vdc minimum (-14 vdc minimum; older units)

3-40. MASTER OSCILLATOR A6300 AND BUFFER AMPLIFIER A6400 ALINEMENT.

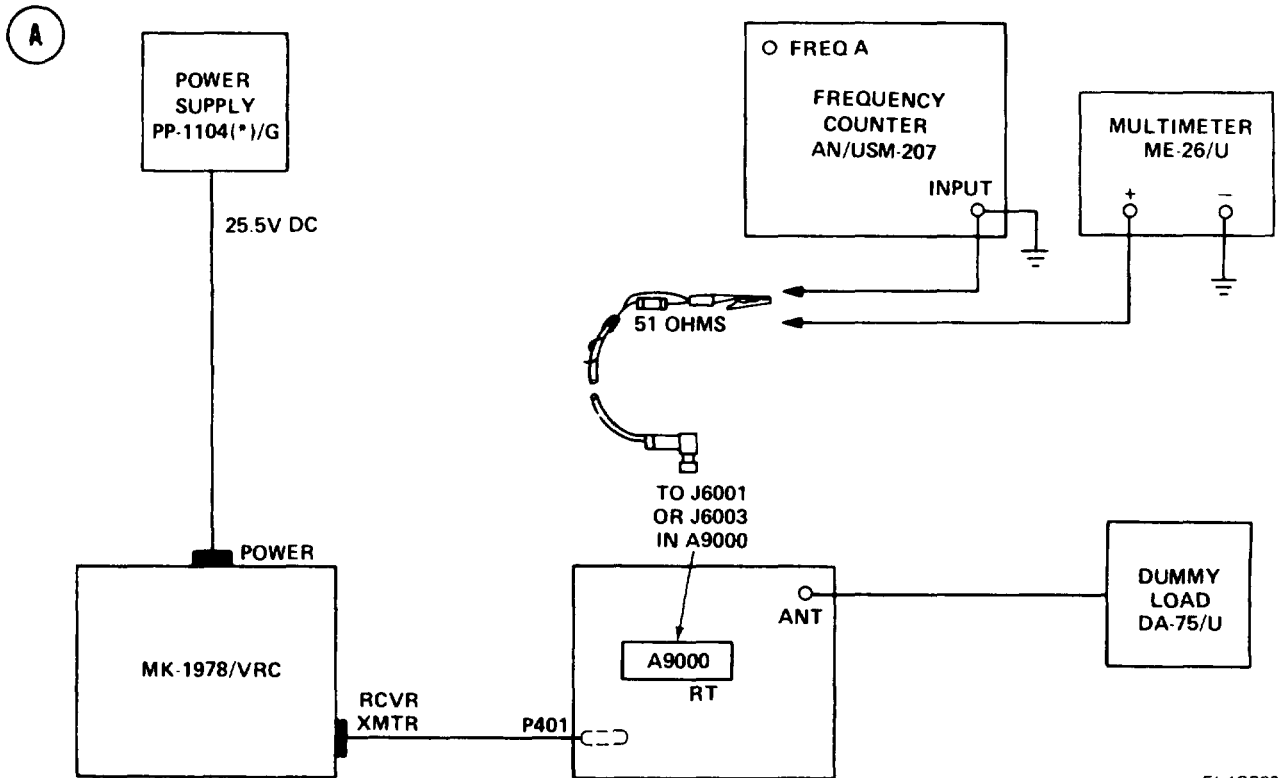
PURPOSE. The master oscillator is one of the most critical sections of the radio set. It must generate an rf frequency within  $\pm 3.5$  kHz of the selected transmit frequency. The following procedure ensures that the master oscillator operates within the correct frequency range.

TEST EQUIPMENT AND MATERIALS

Dummy Load DA-75/U  
 Multimeter ME-26(\*)/U  
 Maintenance Kit MK-1978/VRC  
 Frequency Counter AN/USM-207

Test Cable No. 9 or substitute. (See test setup diagram (A) for substitute.)

TEST SETUP. Connect the equipment as shown in test setup diagram (A).



**3-40. MASTER OSCILLATOR A6300 AND BUFFER AMPLIFIER A6400 ALINEMENT. (CONT)**

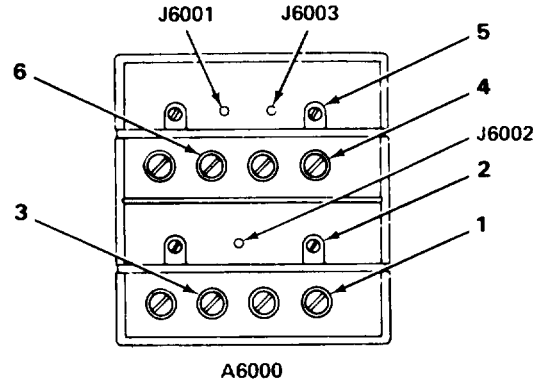
INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment as indicated in the following table.

**CONTROL AND SWITCH SETTINGS**

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
RT	POWER BAND MC-TUNE-KC	LOW <b>(A)</b> 30.00
AN/USM-207	POWER DISPLAY SENSITIVITY FUNCTION GATE TIME DIRECT/HETERODYNE INPUT FREQUENCY TUNING – MC	TRACK MIN (fully counterclockwise) PLUG IN FREQ 10 <sup>3</sup> (black knob) DIRECT 0.3 V MAX (both switches to left) 100

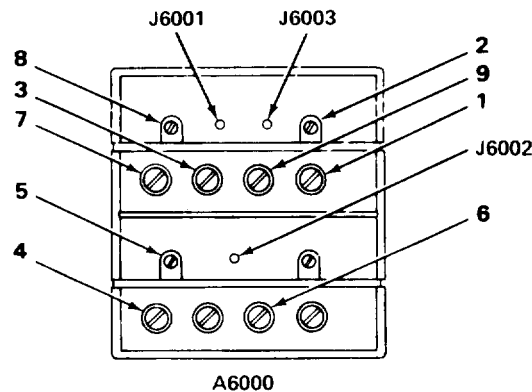
**ALINEMENT PROCEDURE**

**(B)**



EL4GP294

**(C)**



EL4GP295

**3-40. MASTER OSCILLATOR A6300 AND BUFFER AMPLIFIER A6400 ALINEMENT. (CONT)****(A) BAND**

1. Remove cover from A6000 assembly.
2. Install alinement cover using at least one screw.
3. Do not reconnect plugs to, J6001, J6002, and J6003.
4. Connect Test Cable No. 9 or substitute to J6003.
5. Connect frequency counter to test cable.
6. Set MK-1978/VRC KEY switch to XMIT.
7. Adjust L6305 (1) for 30 MHz  $\pm$  100 kHz, then unkey transmitter. (See test setup diagram **(B)** , page 3-200.)
8. Set RT to 40.00 MHz.
9. Set MK-1978/VRC KEY switch to XMIT.
10. Adjust C6314 (2) for 40 MHz  $\pm$  100 kHz, then unkey transmitter. (See test setup diagram **(B)** .)
11. Set RT to 52.00 MHz.
12. Set MK-1978/VRC KEY switch to XMIT.
13. Adjust L6303 (3) for 52.00 MHz  $\pm$  100 kHz, then unkey transmitter. (See test setup diagram **(B)** .)
14. Repeat steps 6 through 13 until alinement is correct at all three frequencies.
15. Remove Test Cable No. 9 from J6003 and connect to J6001.
16. Connect ME-26 (\*)/U to test cable as shown in test setup diagram **(A)** , page 3-199.
17. Set ME-26 (\*)/U to read vac, on 10-volt scale.
18. Set RT to 30.00 MHz.
19. Set MK-1978/VRC KEY switch to XMIT.
20. Adjust L6405 (1) for maximum reading on ME-26 (\*)/U. (See test setup diagram **(C)** , page 3-200.)
21. Unkey transmitter.
22. Set RT to 40.00 MHz.
23. Set MK-1978/VRC KEY switch to XMIT.
24. Adjust C6409 (2) for maximum reading on ME-26 (\*)/U. (See test setup diagram **(C)** .)
25. Unkey transmitter.
26. Set RT to 52.00 MHz.
27. Set MK-1978/VRC KEY switch to XMIT.
28. Adjust L6403 (3) for maximum reading on ME-26 (\*)/U. (See test setup diagram **(C)** .)
29. Unkey transmitter.
30. Remove Test Cable No. 9 from J6001 and connect to J6003.

**(B) BAND**

31. Set RT BAND switch to B and set frequency to 53.00 MHz.
32. Set MK-1978/VRC KEY switch to XMIT.
33. Adjust L6302 (4) for 53 MHz  $\pm$  100 kHz. (See test setup diagram **(C)** .)
34. Unkey transmitter.
35. Set RT to 63.00 MHz.
36. Set MK-1978/VRC KEY switch to XMIT.
37. Adjust C6313 (5) for 63 MHz  $\pm$  100 kHz. (See test setup diagram **(C)** .)
38. Unkey transmitter.
39. Set RT to 75.00 MHz.
40. Set MK-1978/VRC KEY switch to XMIT,

**3-40. MASTER OSCILLATOR A6300 AND BUFFER AMPLIFIER A6400 ALINEMENT. (CONT)**

41. Adjust L6304 (6) for 75 MHz  $\pm$  100 kHz. (See test setup diagram (C) .)
42. Unkey transmitter.
43. Remove Test Cable No. 9 from J6003 and connect to J6001.
44. Connect ME-26(\*)/U to test cable as shown in test setup diagram (A) .)
45. Set RT to 53.00 MHz.
46. Set MK-1978/VRC KEY switch to XMIT.
47. Adjust L6402 (7) for maximum reading on ME-26(\*)/U. (See test setup diagram (C) .)
48. Unkey transmitter.
49. Set RT to 63.00 MHz.
50. Set MK-1978/VRC KEY switch to XMIT.
51. Adjust C6406 (8) for maximum reading on ME-26(\*)/U.
52. Unkey transmitter.
53. Set RT to 75.00 MHz
54. Set MK-1978/VRC KEY switch to XMIT.
55. Adjust L6404 (9) for maximum reading on ME-26(\*)/U.
56. Unkey transmitter.

**3-41. ADJUSTMENT OF A8500 RESISTOR R8515 FOR TRANSMITTED NEW SQUELCH TONE DEVIATION.**

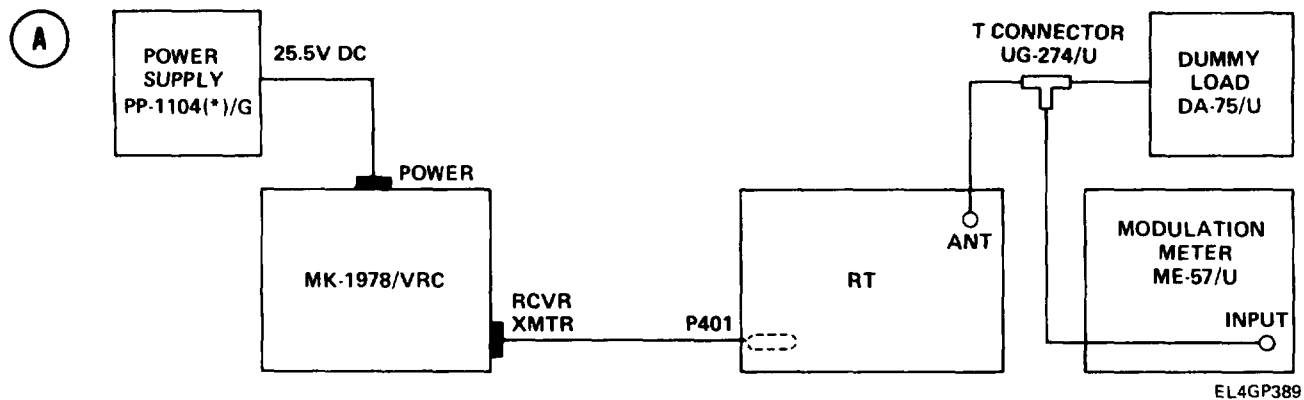
PURPOSE. Resistor R8515 is used to control the overall gain of the squelch amplifier. When the resistor is properly adjusted, the 150-Hz NEW SQUELCH tone causes a carrier deviation of 3.5 kHz.

TEST EQUIPMENT AND MATERIALS

Dummy Load DA-75/U  
Maintenance Kit MK-1978/VRC

Modulation Meter ME-57/U  
Power Supply PP-1104(\*)/G

TEST SETUP. Connect the equipment as shown in test setup diagram (A) .



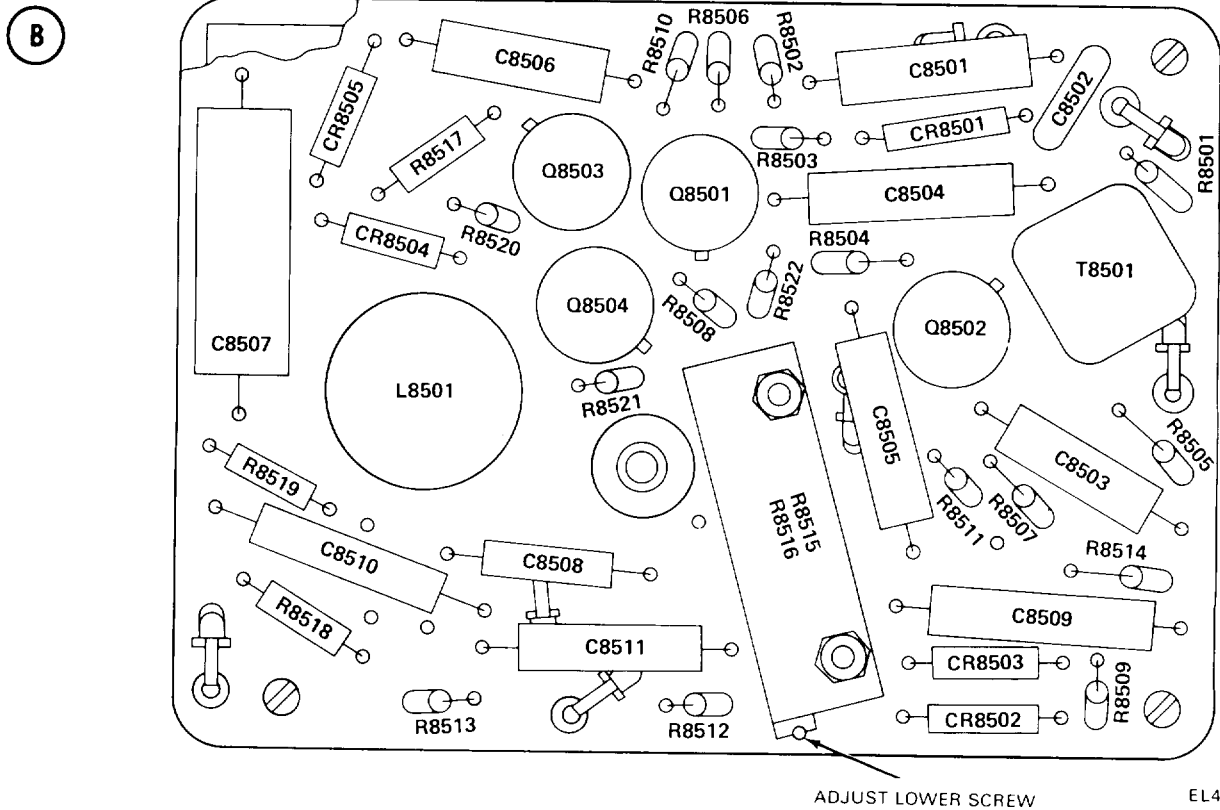
**3-41. ADJUSTMENT OF A8500 RESISTOR R8515 FOR TRANSMITTED NEW SQUELCH TONE DEVIATION. (CONT)**

INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment as indicated in the following table.

CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
RT	BAND MC-TUNE-KC POWER SQUELCH	ⓑ 64.00 LOW NEW ON
ME-57/U	FREQUENCY RANGE-MC DEVIATION RANGE-KC TUNE-FINE TUNE TUNING	55-120 1000 TUNE TUNE 64.00-MHz indication on FREQUENCY-MC meter with transmitter keyed
MK-1978/VRC	All switches	Down, except POWER up

ADJUSTMENT PROCEDURE



1. Key transmitter.
2. ME-57/U LIMITING meter must be in BLACK area.

**3-41. ADJUSTMENT OF A8500 RESISTOR R8515 FOR TRANSMITTED NEW SQUELCH TONE DEVIATION. (CONT)**

3. Tune ME-57/U slightly around 64 MHz with TUNING knob; stop when CARRIER SHIFT meter indicates zero kilocycles.
4. Set ME-57/U DEVIATION RANGE-KC knob to 20.
5. Check reading on ME-57/U. Deviation should be 3.5 kHz. If deviation is incorrect, go to step 6.
6. Unkey transmitter.
7. Remove cover from A8500.
8. Key transmitter.
9. Adjust R8515 for 3.5-kHz deviation. (See test setup diagram **(B)**, page 3-203.)
10. Unkey transmitter.

**3-42. ALINEMENT OF A8500 RESISTOR R8516 FOR CORRECT TRANSMITTER NARROWBAND DEVIATION.**

PURPOSE. This procedure adjusts the gain of the transmitter speech amplifier. Resistor R8516 must be adjusted so that a 0.78-vac audio signal injected into the A8100 11.5-MHz modulator through the resistor results in  $8.0 \pm 0.5$ -kHz deviation of the transmitted rf carrier.

TEST EQUIPMENT AND MATERIALS

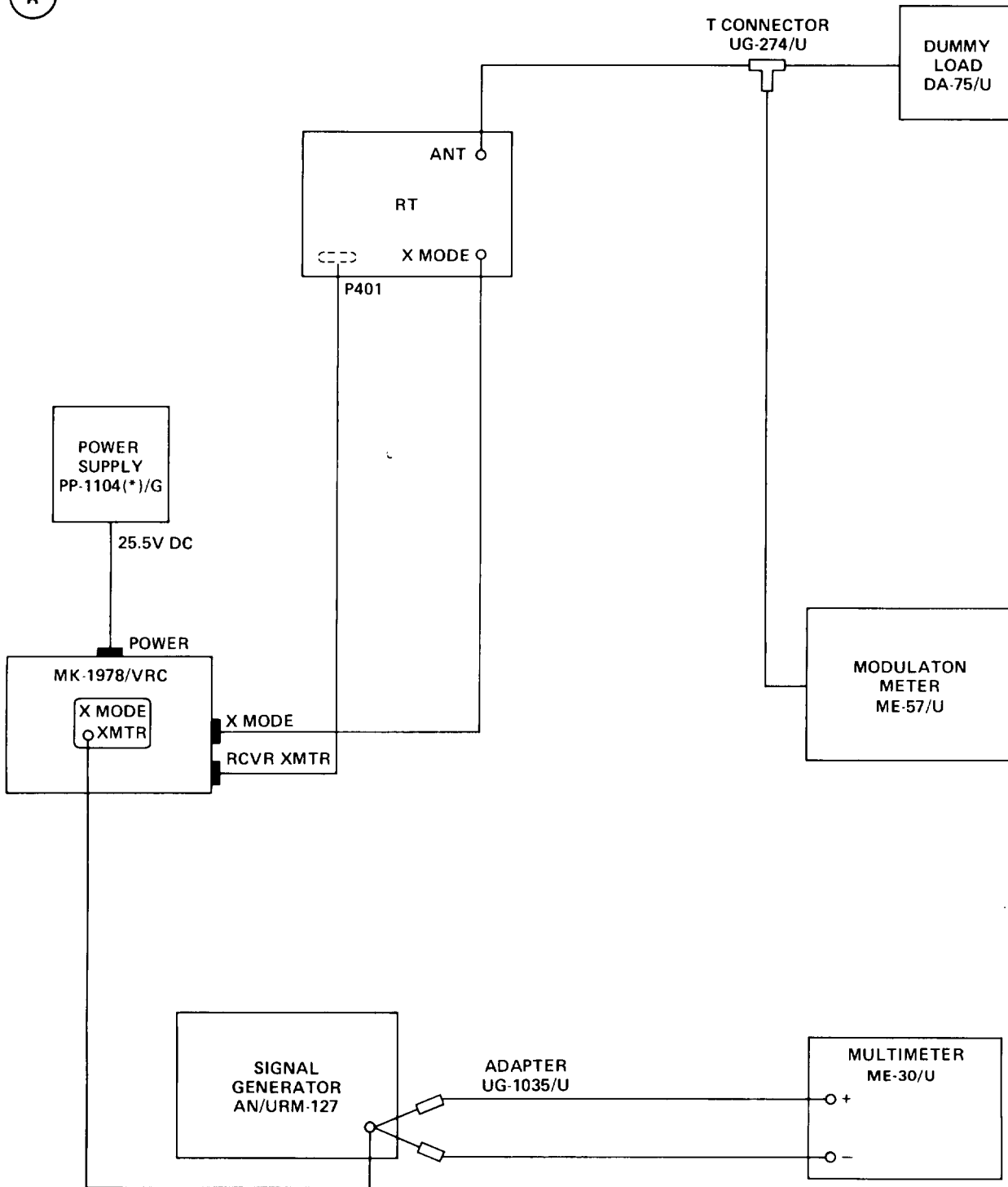
Dummy Load DA-75/U  
Multimeter ME-30(\*)/U  
Power Supply PP-1104(\*)/G  
Modulation Meter ME-57/U

Signal Generator AN/URM-127  
Maintenance Kit MK-1978/VRC  
Adapter UG-1035/U

TEST SETUP. Connect the equipment as shown in test setup diagram **(A)**, page 3-205.

3-42. ALINEMENT OF A8500 RESISTOR R8516 FOR CORRECT TRANSMITTER NARROWBAND DEVIATION. (CONT)

A



EL4GP311

**3-42. ALINEMENT OF A8500 RESISTOR R8516 FOR CORRECT TRANSMITTER NARROWBAND DEVIATION. (CONT)**

INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment controls as indicated in the following table.

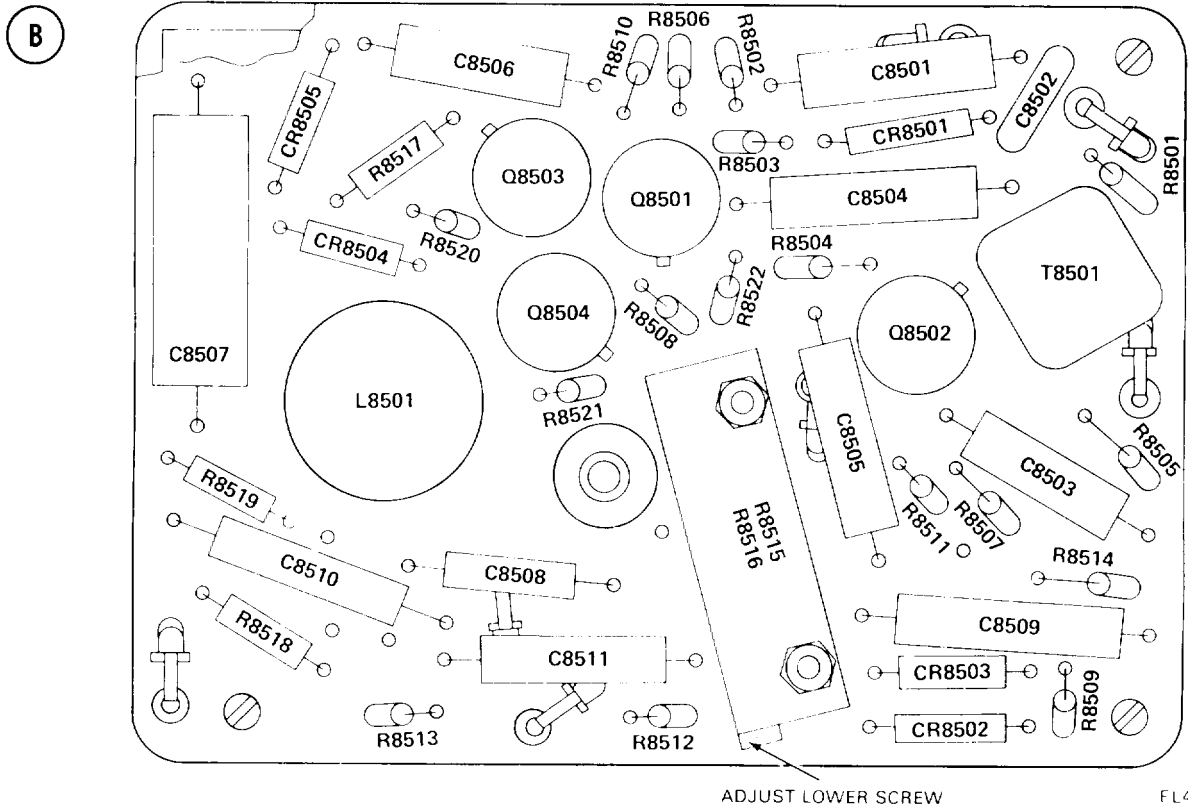
CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
RT	BAND MC-TUNE-KC POWER SQUELCH	(B) 64.00 LOW OLD ON
ME-57/U	TUNE-FINE TUNE DEVIATION RANGE-KC FREQUENCY RANGE-MC TUNING	TUNE 1000 TUNE 55-120 64-MHz indication on FREQUENCY-MC meter with transmitter keyed
AN/URM-127	POWER FREQ RANGE MULTIPLIER FREQ RANGE DIAL ATTENUATOR OUTPUT CONTROL	ON x100 10 x10 Turn clockwise for 0.78-vac reading on multimeter
MK-1978/VRC	POWER X-MODE (RT) SQUELCH KEY AUDIO	ON NORMAL ON RCVE MUTED



3-42. ALINEMENT OF A8500 RESISTOR R8516 FOR CORRECT TRANSMITTER NARROWBAND DEVIATION. (CONT)

ALINEMENT PROCEDURE



1. Set MK-1978/VRC KEY switch to XMIT.
2. Check reading on ME-57/U. Deviation should be  $8.0 \pm 0.5$  kHz. If reading is incorrect, go to step 3.
3. Unkey transmitter.
4. Remove cover from A8500.
5. Set MK-1978/VRC KEY switch to XMIT.
6. Adjust R8516 for  $8.0 \pm 0.5$ -kHz deviation. (See test setup diagram (B) .)
7. Unkey transmitter.
8. Repeat steps 1 and 2 with audio oscillator set at 500 Hz, 3000 Hz, 5000 Hz, and 10 kHz, keeping the signal amplitude at 0.78 volts in each case. Do not readjust R8516.

**NOTE**

Failure to achieve correct deviation reading at frequencies listed in step 8 indicates a defective A8100 module.

**3-43. A8100 MODULATOR ALINEMENT.**

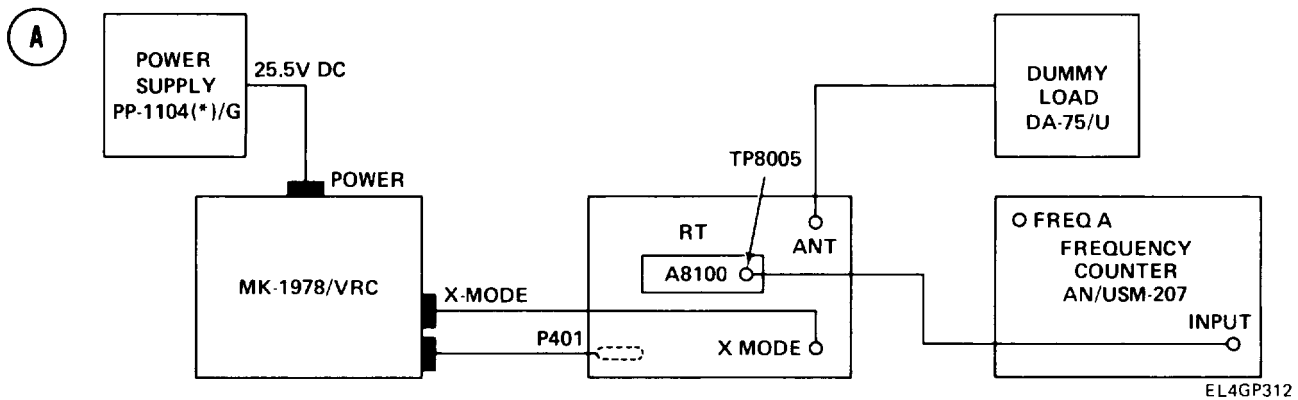
PURPOSE. This procedure ensures that the A8100 oscillator runs at 11.5 MHz ± 3.5 kHz with no dc correction from the crystal discriminator.

TEST EQUIPMENT AND MATERIALS

Dummy Load DA-75/U  
 Frequency Counter AN/USM-207  
 Power Supply PP-1104(\*)/G

No. 24 or No.26 AWG wire (single strand) (7-inch length)  
 Maintenance Kit MK-1978/VRC

TEST SETUP. Connect the equipment as shown in test setup diagram **(A)**.



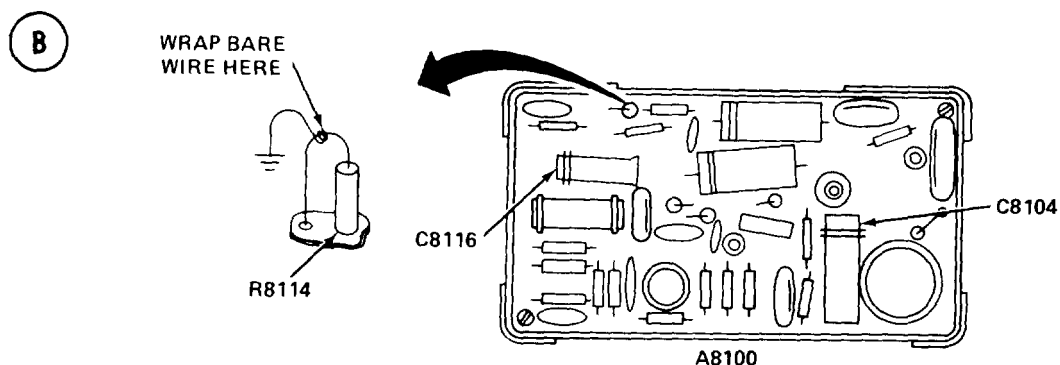
INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment controls as indicated in the following table.

CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
RT	BAND MC-TUNE-KC POWER SQUELCH	<b>(A)</b> 30.00 LOW OLD OFF
AN/USM-207	POWER DISPLAY SENSITIVITY FUNCTION GATE TIME DIRECT/HETERODYNE INPUT FREQUENCY TUNING-MC	TRACK MIN (fully counterclockwise) PLUG IN FREQ 10 <sup>2</sup> (black knob) DIRECT 0.3 V MAX (both switches to left) 100
MK-1978/VRC	POWER X-MODE (RT) SQUELCH KEY AUDIO	ON NORMAL ON RCVE MUTED

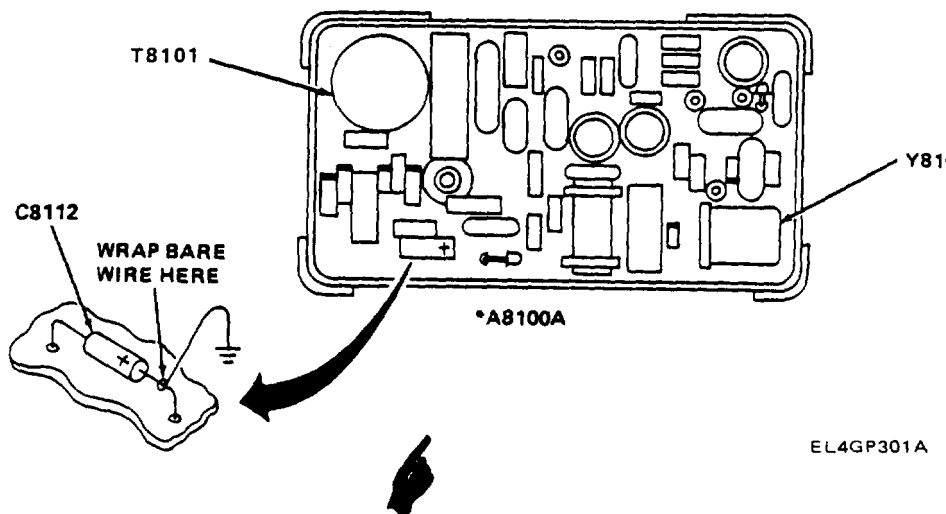
3-43. A8100 MODULATOR ALINEMENT. (CONT)

ALINEMENT PROCEDURE



EL4GP301

1. Remove A8100 cover.
2. Wrap grounding wire around exposed terminal of R8114. (See test setup diagram (B).)\*
3. Reinstall A8100 cover. Wrap grounding wire around hold-down screw.
4. Set MK-1978/VRC KEY switch to XMIT.
5. Check frequency counter. Frequency should be 11.5 MHz  $\pm$  3.5 kHz. If not, go to step 6.
6. Unkey transmitter,
7. Remove A8100 cover.
8. Install A8100 alinement cover.
9. Secure grounding wire to alinement cover screw.
10. Remove A8400 HUNT GENERATOR module.
11. Set MK-1978/VRC KEY switch to XMIT.
12. Adjust C8104 for 11.5 MHz  $\pm$  3.5 kHz reading on frequency counter.
13. Unkey transmitter.
14. Remove grounding wire from R8114.
15. Install A8400 HUNT GENERATOR module.
16. Set MK-1978/VRC KEY switch to XMIT.
17. Check frequency counter. Reading should be 11.5 MHz  $\pm$  150 Hz. If reading is incorrect, go to step 18.
18. With transmitter keyed, adjust C8116 for 11.5 MHz  $\pm$  150 Hz reading on counter. (See test setup diagram (B).)\*
19. Unkey transmitter.



EL4GP301A

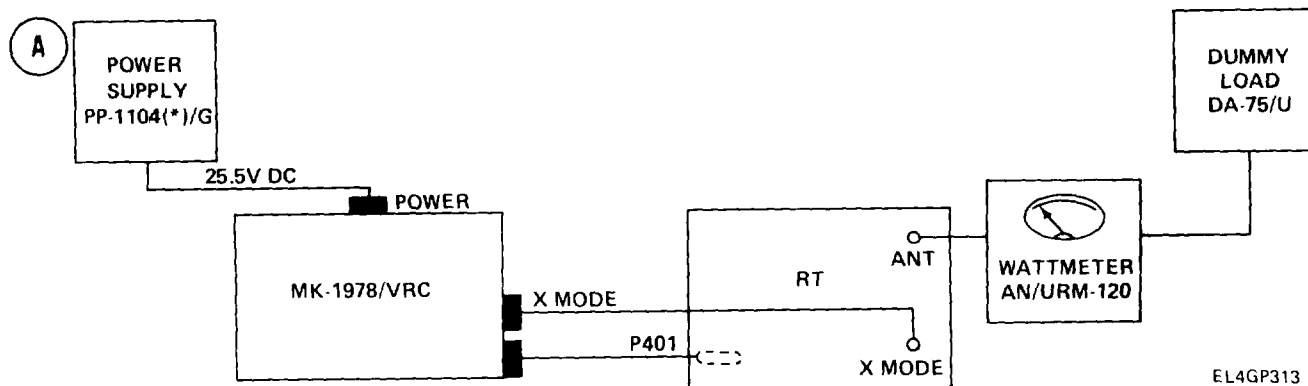
**3-44. DRIVER A6100 AND POWER AMPLIFIER A6200 ALINEMENT.**

**PURPOSE.** This procedure enables the transmitter to generate maximum rf power without overdriving the power stages. Correct alinement prolongs the life of Power Tube V6201 and Power supply A9000/A9400.

**TEST EQUIPMENT AND MATERIALS**

- |  |                             |
|--|-----------------------------|
| Dummy Load DA-75/U                             | Wattmeter AN/URM-120        |
| Tool Kit TK-105/G                              | Multimeter ME-26(*)/U       |
| T-Connector UG-274/U                           | Amphenol Adapter M-39012/16 |
| Nonmetallic feeler gages, 0.073 and 0.078 inch | Crocus cloth                |

**TEST SETUP.** Connect the equipment as shown in test setup diagram (A)



**INITIAL EQUIPMENT CONTROL SETTINGS.** Set equipment controls as indicated in the following table.

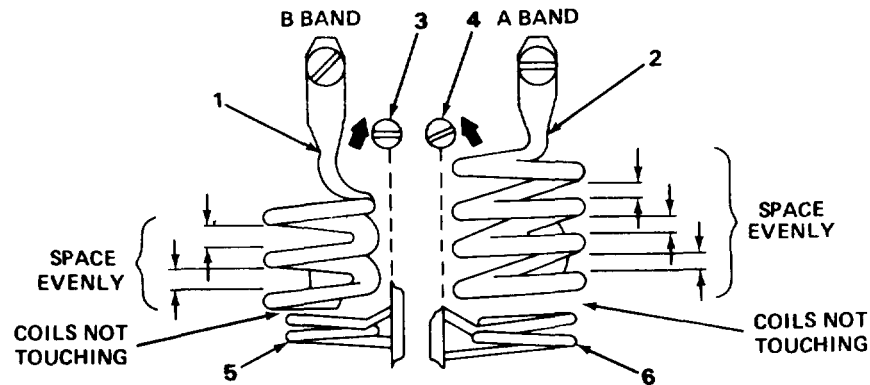
**CONTROL AND SWITCH SETTINGS**

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
RT	MC-TUNE-KC POWER	30.00 HIGH
MK-1978/VRC	POWER X-MODE (RT) SQUELCH KEY AUDIO	ON NORMAL ON RCVE MUTED

3-44. DRIVER A6100 AND POWER AMPLIFIER A6200 ALINEMENT. (CONT)

ALINEMENT PROCEDURE

Tuning Coil Adjustment



EL4GP303

**CAUTION**

Do not use pliers or any metal tool to adjust Tuning Coils L6206 and L6203.

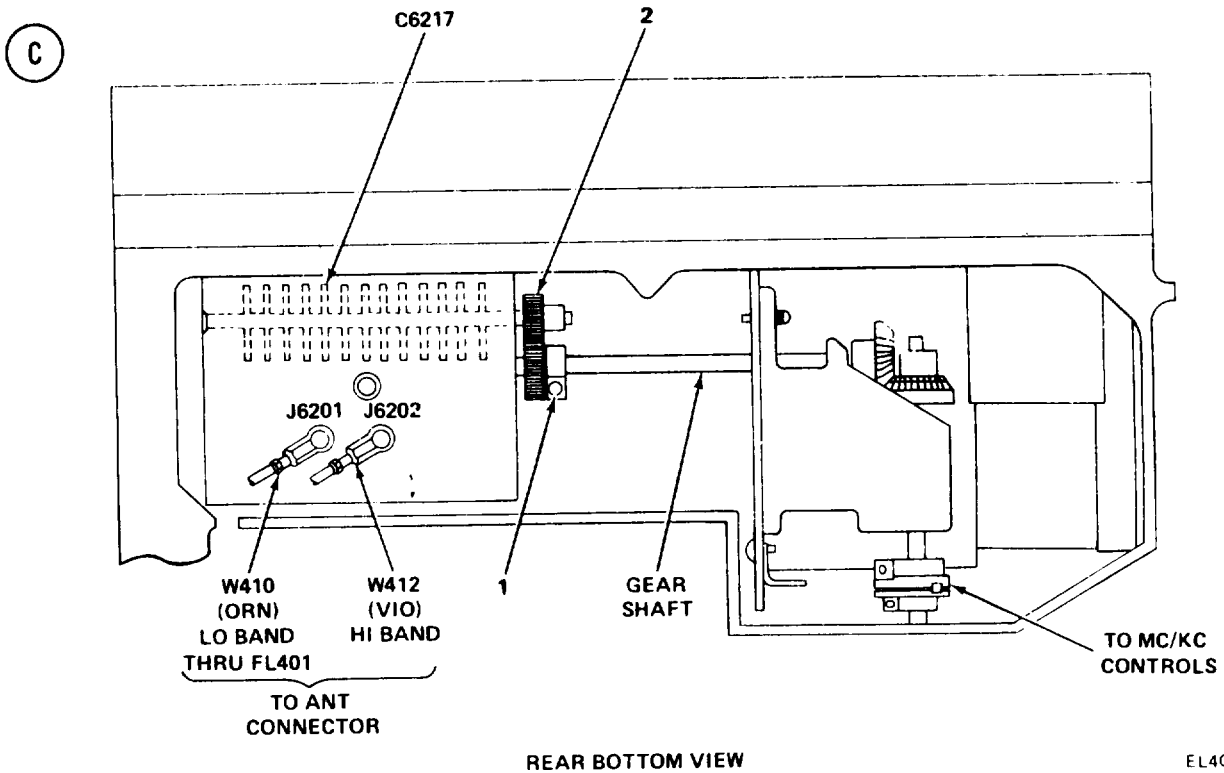
**NOTE**

Coils L6206 and L6203 shall be adjusted with a nonmetallic spacing tool to ensure the proper spacing. This is required to ensure even RF output throughout the frequency range. If the coils are evenly spaced they should only be adjusted if the desired output can not be obtained by first adjusting the power amplifier and driver sections.

1. Remove A6100/A6200 assembly after marking gear couplers to insure installation in original position. (See paragraphs 2-46 and 2-48.)
2. Using crocus cloth, remove burrs from tuning coils.
3. Using nonmetallic tool, adjust spacing of Coil L6203 (1) to 0.078 inch.
4. Using nonmetallic tool, adjust spacing of Coil L6206 (2) to 0.073 inch.
5. Turn L6204 screw (3) fully clockwise.
6. Turn L6205 screw (4) fully counterclockwise.
7. Adjust screw (3) to bring coil (5) as close as possible to coil (1) without touching.
8. Adjust screw (4) to bring coil (6) as close as possible to coil (2) without touching.
9. Install A6100/A6200 assembly. (See paragraphs 2-46 and 2-48.)

3-44. DRIVER A6100 AND POWER AMPLIFIER A6200 ALINEMENT. (CONT)

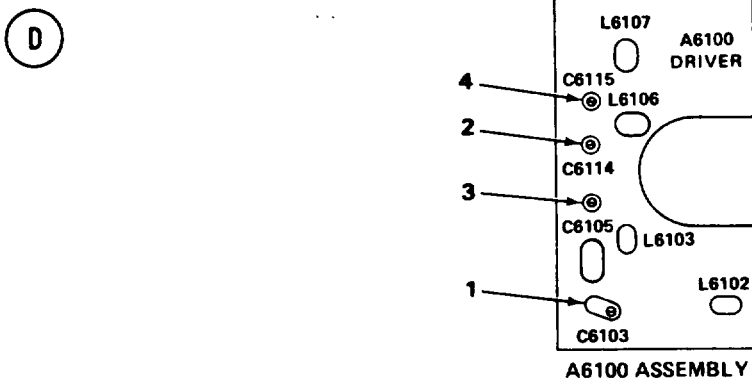
Air Capacitor Adjustment



EL4GP304

10. Remove RT bottom cover.
11. Using 3/32" inch allen wrench, loosen gear locking clamp screw (1). (See test setup diagram (C).)
12. Set MK-1978/VRC KEY switch to XMIT.
13. Move C6217 gear (2) back and forth to obtain peak wattmeter indication.
14. Tighten clamp screw (1). Wattmeter indication should not change.
15. Unkey transmitter.

A6100 Tuning Procedure



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3-44. DRIVER A6100 AND POWER AMPLIFIER A6200 ALINEMENT. (CONT)

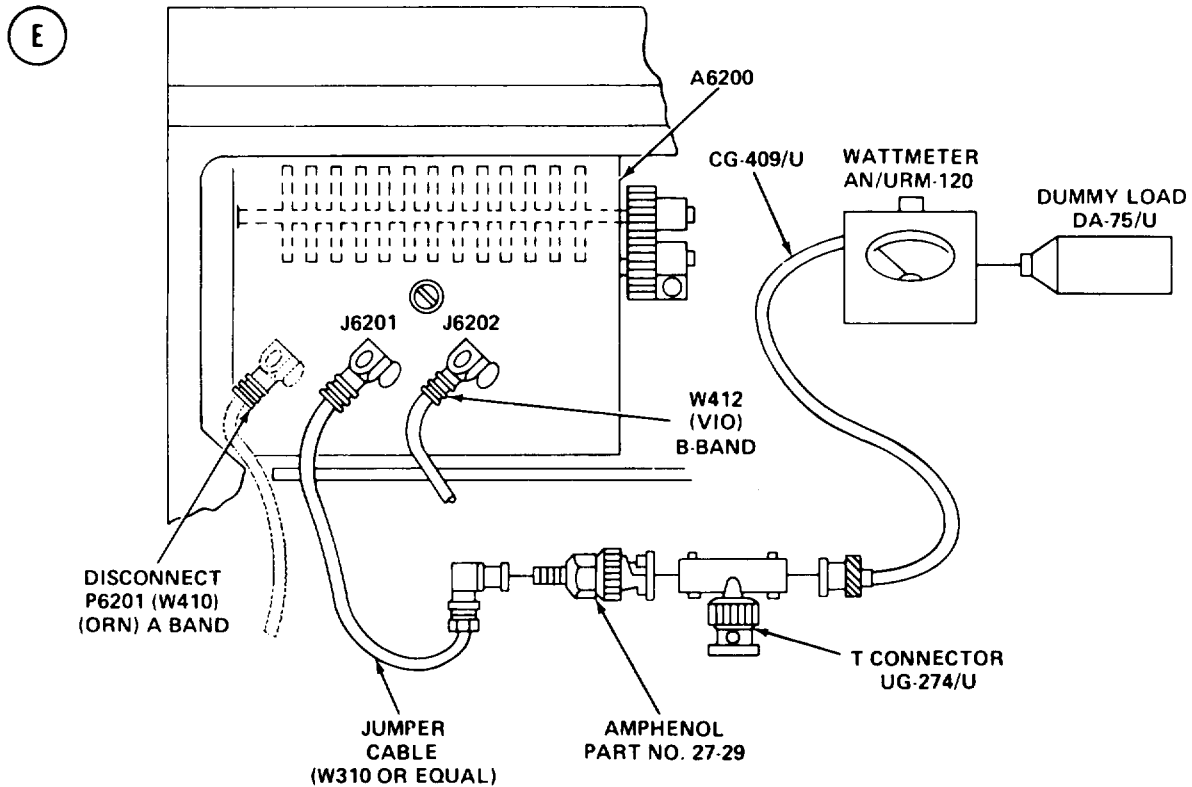
**NOTE**

If 35-watt minimum power output cannot be obtained, replace Power Tube V6201.

16. Set ME-26(\*)U to measure -3 vdc and connect meter to TP9007 on A9000 tray.
17. Set MK-1978/VRC KEY switch to XMIT.
18. Adjust (A) BAND Capacitors C6103 (1) and C6114 (2) for maximum negative voltage reading on ME-26(\*)/U. (See test setup diagram (D) , page 3-212.)
19. Unkey transmitter.
20. Set RT to 53.00 MHz.
21. Set MK-1978/VRC KEY switch to XMIT.
22. Adjust (B) BAND Capacitors C6105 (3) and C6115(4) for maximum negative voltage reading on ME-26( \*/)U. (See test setup diagram D .)

A6200 Tuning Procedure

23. Connect equipment as shown in test setup diagram (E) .



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**NOTE**

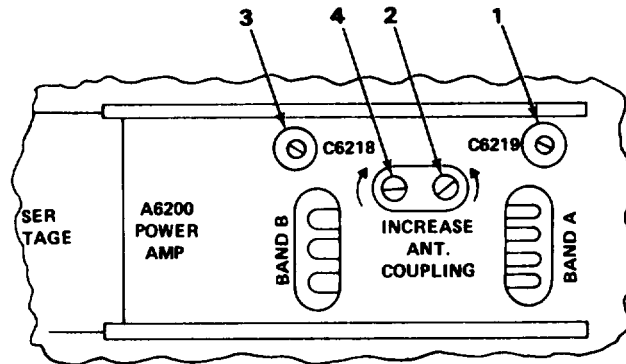
See chapter 1, section III Principles of Operation, for details covering use of TP9007.

24. Set ME-26(\*)/U to measure -3 vdc and connect meter to TP9006 on A9000 tray.
25. Set RT to 52.00 MHz.

3-44. DRIVER A6100 AND POWER AMPLIFIER A6200 ALINEMENT. (CONT)

26. Set MK-1978/VRC KEY switch to XMIT.

(F)



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27. Adjust Capacitor C6219(1) for minimum negative ME-26(\*)/U indication. (See test setup diagram (F) .)
28. Readjust C6219 to increase wattmeter indication by one watt.
29. Adjust Coil L6205 (2) for maximum reading on wattmeter but not higher than 55 watts.
30. Unkey transmitter.

**CAUTION**

In the following steps, always unkey the transmitter before changing RT frequency.

31. Tune RT to 30.00,41.00, and 52.00 MHz, keying transmitter at each frequency. Adjust C6219 ((1), test setup diagram (F) ) until output powers at all frequencies fall within 3 to 4 watts of each other. Record final output power at each frequency.
32. Unkey transmitter.
33. Set RT POWER switch to LOW.
34. Set MK-1978/VRC KEY switch to XMIT.
35. Check wattmeter indication at 30,41, and 52 MHz. Wattmeter should indicate at least one-half watt. If power is too low, go to step 36.
36. Unkey transmitter.
37. Set RT to 52.00 MHz.
38. Set MK-1978/VRC KEY switch to XMIT.
39. Adjust C6103 ((1), test setup diagram (D) ) for minimum one-half watt indication.
40. Unkey transmitter.
41. Reconnect P6201 to J6201. (See test setup diagram (E) , page 3-213.)
42. Connect rf cable from wattmeter to RT ANTENNA port.
43. Set RT POWER switch to HIGH.
44. Tune RT to 30.00 MHz.
45. Set MK-1978/VRC KEY switch to XMIT.
46. Check wattmeter indication and compare with reading obtained at 30 MHz in step 31. Replace FL401 if wattmeter indication is not within + 1 watt to -7 watts of step 31 reading.
47. Unkey transmitter.
48. Tune RT to 41.00 MHz.
49. Set MK-1978/VRC KEY switch to XMIT.
50. Repeat step 46.



**3-44. DRIVER A6100 AND POWER AMPLIFIER A6200 ALINEMENT. (CONT)**

51. Unkey transmitter.
52. Tune RT to 52.00 MHz.
53. Set MK-1978/VRC KEY switch to XMIT.
54. Check wattmeter indication and compare with reading obtained at 52.00 MHz in step 31. Replace FL401 if wattmeter indication is not within + 1 to -9 watts of step 31 reading.
55. Unkey transmitter.
56. Tune RT to 75.00 MHz.
57. Set ME-26(\*)/U to read -3 vdc.
58. Connect ME-26(\*)/U to TP9007 on A9000 tray.
59. Set MK-1978/VRC KEY switch to XMIT.
60. Adjust Capacitor C6218 ((3), test setup diagram (E) ) for minimum ME-26(\*)/U indication.
61. Readjust C6218 to increase wattmeter indication by one watt.
62. Adjust L6204 ((4), test setup diagram (F) ) for maximum wattmeter indication, but not more than 55 watts.
63. Unkey transmitter.

**CAUTION**

In the following steps, always unkey the transmitter before changing RT frequency.

64. Tune RT to 53.00,64.00, and 75.00 MHz keying transmitter at each frequency. Adjust C6218 ((3), test setup diagram (F) ) until output powers at all frequencies fall within 3 to 4 watts of each other.
65. Unkey RT.
66. Set RT POWER switch to LOW.
67. Set MK-1978/VRC KEY switch to XMIT.
68. Check wattmeter indication at 53,64, and 75 MHz. Wattmeter should indicate at least one-half watt. If power is too low, go to step 69.
69. Unkey transmitter.
70. Tune RT to 75.00 MHz.
71. Set MK-1978/VRC KEY switch to XMIT.
72. Adjust C6105 ((3), test setup diagram (D) ) for at least one-half watt indication on wattmeter.
73. Unkey transmitter.

**3-45. ALINEMENT OF RT-246(\*)/VRC SERVOSYSTEM.**

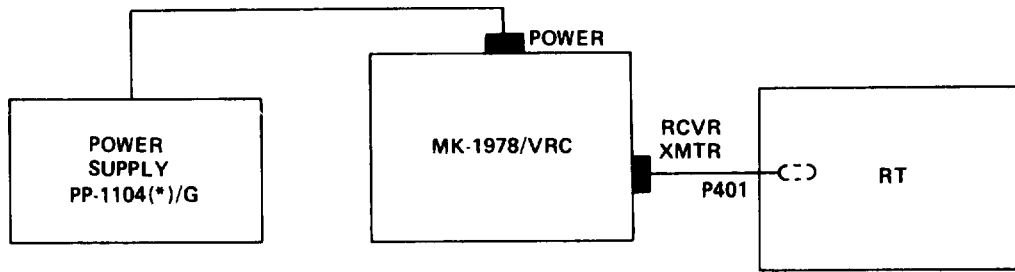
**PURPOSE.** This procedure adjusts the sensitivity of the servoamplifier to ensure correct frequency tuning in response to the preset pushbuttons.

**TEST EQUIPMENT AND MATERIALS**

Power Supply PP-1104(\*)/G

3-45. ALINEMENT OF RT-246(\*)/VRC SERVOSYSTEM. (CONT)

TEST SETUP. Connect the equipment as shown in test setup diagram (A).



EL4GP290

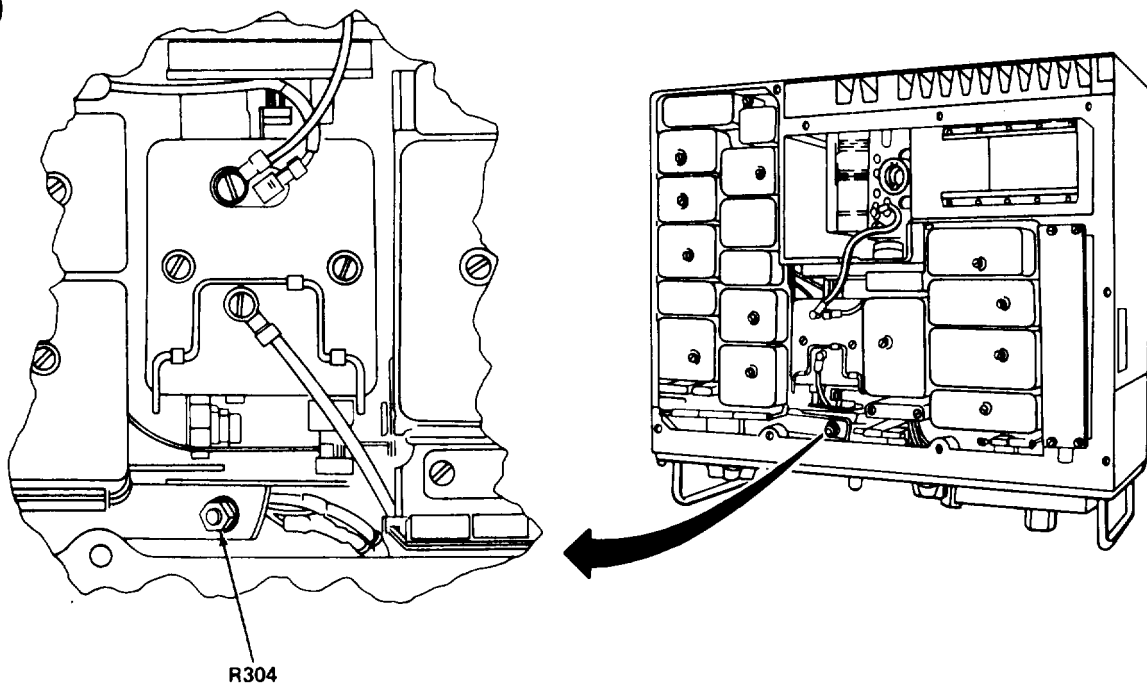
INITIAL EQUIPMENT CONTROL SETTINGS. Set equipment controls as indicated in the following table.

CONTROL AND SWITCH SETTINGS

EQUIPMENT	CONTROL OR SWITCH	POSITION/SETTING
RT	BAND POWER	AUTO LOW

ALINEMENT PROCEDURE

(B)



EL4GP291

**3-45. ALINEMENT OF RT-246(\*)/VRC SERVOSYSTEM. (CONT)**

1. Remove RT top cover.
2. Loosen locknut on R304. (See test setup diagram (B) , page 3-216.)
3. Turn R304 shaft fully clockwise.
4. Back off R304 shaft one-eighth turn.
5. Tune pushbutton no. (1) to 30.00 MHz and pushbutton no. (2) to 48.00 MHz. Follow instructions on back of pushbutton cover.
6. Press pushbutton no. (2) and wait for servomotor to stop.
7. Back off R304 shaft fully counterclockwise.
8. Press pushbutton no. (1) . Before servomotor stops, press TUNE button. Servo will hunt (chattering sound). Keep TUNE button pressed.
9. Turn R304 shaft clockwise and stop at point where servomotor just stops hunting.
10. Press pushbutton no. (2) . Wait for servomotor to stop. Press pushbutton no. (1) . RT should tune to exactly 30.00 MHz after a slight overshoot.

**NOTE**

Overshoot means that when pushbutton no.(1) is pressed, the numbers in the RT viewing window move from 00 to 95 and then back to 00 (30.00) when the servomotor stops. If overshoot is excessive, turn R304 very slightly clockwise and recheck.

11. Repeat step 10 with power supply set at 20 vdc.

**NOTE**

If tuning is unsatisfactory at 20 vdc, repeat steps 5 through 10.



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Radar Set AN/PRC-76

BE EXACT... PIN-POINT WHERE IT IS

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO
2-25	2-28		
3-10	3-3		3-1
5-6	5-8		
		F03	

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

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.

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.

Add new step f.1 to read, "Replace cover plate removed in step e.1, above."

REASON: To replace the cover plate.

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

SSG I. M. DeSpirito 999-1776

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PARA-GRAPH

FIGURE NO.

TABLE NO.

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