# TM 11-5820-540-40-1

**TECHNICAL MANUAL**

## GENERAL SUPPORT MAINTENANCE MANUAL

# RADIO SETS AN/GRC-103(V)1

# (NSN 5820-00-935-4931),

# AN/GRC-103(V)2 (NSN 5820-00-116-6029),

# AN/GRC-103(V)3 (NSN 5820-00-116-6030),

# AN/GRC-103(V)4 (NSN 5820-01-081-8866),

# AND

# EXTENSION KIT, MAST

# MK-1009/GRC-103(V)

# (NSN 5985-00-179-7767)



**HEADQUARTERS, DEPARTMENT OF THE ARMY**

**1 OCTOBER 1989**

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

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

## WARNINGS

Be careful when working on the 115-volt ac line connections. SERIOUS INJURY OR DEATH may result from contact with these terminals.

## DON'T TAKE CHANCES!

## EXTREMELY DANGEROUS VOLTAGES EXIST IN THE FOLLOWING

| | |
|---|---|
| **UNITS OF RADIO SETS AN/GRC-103(V)** | **1,2,3, and 4** |
| **TRANSMITTER, RADIO 5TR1** | **800 volts dc** |
| **AMPLIFIER-FREQUENCY MULTIPLIERS** | **600 volts dc** |

## DANGEROUS RADIO FREQUENCY VOLTAGES EXIST AT THE ANTENNA TERMINALS

Be careful when working around the antenna or the antenna terminals. High voltages exist at these points.

Operator and maintenance personnel should be familiar with the requirements of TB 43-0129 before attempting installation or operation of the equipment covered in this manual. Failure to follow requirements of TB 43-0129 could result in injury or DEATH.

Whenever the antenna (with or without the parabolic reflector) is used in a room, the 50-foot coaxial cable must be utilized and connected to the antenna output of the transmitter. This will eliminate the potential radiation hazard when power is applied.

Technical Manual

No. 11-5820-540-40-1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 1 October 1989

## GENERAL SUPPORT MAINTENANCE MANUAL

# RADIO SETS AN/GRC-103(V)1 (NSN 5820-00-935-4931), AN/GRC-103(V)2 (NSN 5820-00-116-6029), AN/GRC-103(V)3 (NSN 5820-00-116-6030), AN/GRC-103(V)4 (NSN 5820-01-081-8866), AND EXTENSION KIT, MAST MK-1009/GRC-103(V) (NSN 5985-00-179-7767)

This series consists of three manuals. This manual contains chapters 1, 2, and 3. TM 11-5820-540-40-2 contains chapter 4. TM 11-5820-540-40-3 contains chapters 5 and 6, appendix A and Index.

**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 the back of this manual direct to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-LC-ME-P, Fort Monmouth, NJ 07703-5000.**

**In either case, a reply will be furnished direct to you.**

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***This manual supersedes TM 11-5820-540-40-1, 15 March 1982.**

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# CHAPTER 1

# INTRODUCTION

**NOTE**

Only activities authorized for the use of the AN/GRM-95(V)2 will perform this phase of maintenance. All other activities will not perform this phase of maintenance, but forward unserviceable units to a higher category of maintenance activities. In this technical manual, some units or parts will be referenced by a CMC number or drawing number. These numbers will appear on the units or parts for identification purposes of the plain or A model. These units or parts are not to be interchanged, and replacement will be by like items.

## 1-1. Scope

*a.* This manual contains instructions for general support maintenance of Radio Sets AN/GRC-103(V) 1 (Band I), AN/GRC-103(V)2 (Band II), AN/GRC-103 (V)3 (Band III), AN/GRC-103(V)4 (Band IV) and Extension Kit, Mast MK-1009/GRC-103(V). It lists the tools and test equipment required to test and repair the radio set. It also covers all tests and alinements performed at system, unit, and/or module levels. Applicable tests and alinement procedures must be performed after the module, unit or system has been repaired. Repair of some mechanical assemblies is also included in this manual.

b. Cables, adapters, filters and similar accessories that are required for tests but are not listed in the appropriate test equipment and material required paragraph will be found in the Use of Test Facility Set AN/GRM-95(V)2 (para. 2-4).

## 1-2. Consolidated Index of Army Publications and Blank Forms

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

## 1-3. Maintenance Forms, Records, and Reports

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

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

c. *Transportation Discrepancy Report (TDR) (SF 361).* Fill out and forward Transportation Discrepancy Report (TDR) (SF 361) as prescribed *in* AR 55-38/ NAVSUIVNST 4610.33C/AFR 765-18/MCO P4610. 18/ DLAR 4500.15.

## 1-4. Destruction of Army Electronics Materiel

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

## 1-5. Reporting Equipment improvement Recommendations (EIR)

If your equipment needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. 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, New Jersey 07703-5000. We'll send you a reply.

## 1-6. Administrative Storage

Administrative storage of equipment issued to and used by Army activities will have preventive maintenance performed in accordance with the PMCS charts before storing. When removing the equipment from administrative storage the PMCS should be performed to assure operational readiness. Disassembly and repacking of equipment for shipment or limited storage are covered in TM 11-5820-540-12.

# CHAPTER 2

# GENERAL SUPPORT MAINTENANCE

## Section I. INTRODUCTION

### 2-1. General

*a.* This chapter covers general support maintenance of Radio Set AFVGRC-103(V). It lists the tools and test equipment required to test and repair the above radio sets. Applicable tests and alinement procedures must be performed after the module, unit, or system has been repaired Repair of some mechanical assemblies is also included in this chapter.

*b.* Cables, adapters, filters, and similar accessories that are required for tests but are not listed in the appropriate test equipment and material required paragraph will be found in the Use of Test Facility Set AN/GRM-95(V)2 (para. 2-4).

### 2-2. Test Equipment and Material Required

The following chart lists the test equipment special purpose cables, special tools, and additional accessories required for general support maintenance of the radio set.

**NOTE**

Cables and connectors included in the test facility are not listed in this paragraph.

*a Test Equipment.*

| *Equipment* | Common *name* |
|---|---|
| Test Facility Set AN/GRM-95(V)2 | Test facility set |
| Generator, Signal HP-8640B with Options 001,002 and 003 | Signal generator |
| Generator, Signal SG1171/U | Signal generator |
| Generator, Signal AN/USM-213 | Signal generator |
| Generator, Signal AN/USM-205A | Wide range oscillator |
| Generator, Sweep Wiltron 610D<br>With Plug-in Wiltron 61084D<br>With Plug-in Wiltron 6110C | Sweep generator |
| Wattmeter, Thruline AN/USM-298<br>With Element, Bird No. 50D, 200-500 MHz<br>With Element, Bird No. 50E, 500-1000 MHz<br>With Element, Bird No. 433-103, 50W Modified, 1350-1850 MHz | Wattmeter |
| Megohmeter, GR-1864 | Megohmeter |
| Bridge, Impedance ZM-71/U | Universal bridge |
| Noise Source HP-346B with Option 001 | Noise source |

*b. Special Purpose Cables (See* para. *2-10).*

Cable Assembly, Special Purpose, Electrical CMC 217-800009. Cable Assembly, Special Purpose, Electrical CMC 217-8000010. Cable Assembly, Special Purpose, Electrical CMC 217-8000011. Cable Assembly, Special Purpose, Electrical CMC 217-8000012.

c. *Special Tools.*

Gauge Thickness 0.003 in. Gauge, Depth, Micrometer- Starrett 440A-3P or equivalent Caliper, Inside Vernier-Mitutoyo P-52 or equivalent Caliper, Vernier-Starrett CAT 120 or equivalent. Gauges, Feeler-Ludell or equivalent. Wrench, Torque-Omni Spectra T-8438 or equivalent Wrench, Torque-Ornni Spectra T-4592 or equivalent Tool, Extractor-Cannon CET C6B.

*d. Additional Accessories Required*

Termination, Mismatch-Telonic TRM 1-3.50F. Attenuator, 3 dB, 50 W-Weinschel 25-3-34. Clamp-CMC 702-800013-000. Pin, Shouldered-CMC 716-800009-000. Resistor, Carbon 1- k-ohm ±5%, 1/4 watt

*a. Test Equipment* – Continued

| *Equipment* | *Common name* |
|---|---|
| Counter, Microwave Frequency TD-1225(V)1/U | Frequency counter |
| Power Supply, DC HP-6002A | Variable power supply |
| Power Supply, Dual Output, DC HP-6205B | Dual output variable power supply |
| Meter, Power HP-435A | Power *meter* |
| Sensor, Power HP-8481A | Power sensor |
| Sensor, Power HP-8484A | Power sensor |
| Analyzer, Distortion AN/USM-164A | Distortion analyzer |
| Source, Signal, RF Power | |
| Airborne Instrument Lab. 125A | Power signal source |
| Multimeter, Digital AN/USM-451 | Digital multimeter |
| Multimeter, Digital AN/USM-486 | Digital multimeter |
| Voltmeter, Electronic ME-459/U | |
| Voltmeter, RF ME-426/U | Rf voltzmeter |
| Voltmeter, Selective TS-3066(V)3/U | selective voltmeter |
| Voltmeter, Vector ME-512/U With Probe Tee HP-11536A | Vector voltmeter |
| Oscilloscope, Dual Trace AN/USM-281C | Oscilloscope |
| Meter, Deviation ME-505/U | Deviation meter |
| Resistor, Decade ZM-58/U | Decade resistor |
| Test Set, Semiconductor Device AN/USM-206 | Semiconductor tester |
| Amplifier, Unit IF AM-4822/U | Unit if. amplifier |
| Multiplexer TD-660()/G | Multiplexer |
| Amplifier, Power Logimetrics A200L | Power amplifier |
| Amplifier, RF, Wideband ENI603L | Wideband rf amplifier |
| Indicator, SWR AN/USM-261 | SWR meter |

## 2-3. Organization and Troubleshooting and Repair Procedure

Listed below is a group of tests arranged to reduce necessary work and to aid in tracing the trouble to the defective stage or component

*a. Operational Tests.* The first step in servicing a defective module, assembly, or unit is to connect it to the test facility and check its performance to determine the nature of the fault When abnormal indications have been obtained, isolate the fault with the appropriate troubleshooting procedures.

**CAUTION**

If no output is available during tests, do not change the setting of any of the variable components; serious misalinement may be introduced.

*b. Visual Inspection* Look for broken or loose wires in cables and connectors external connector-to-cable joints may be broken during attempts to disconnect the cable. Remove the module covers and inspect the wiring and solder points for loose connections. Tiny cracks in printed circuit boards can cause intermittent operation, a magnifying glass is often helpful in locating these defects.

*c. Troubleshooting Charts.* Troubleshooting charts, where furnished, provide a systematic method of locating the fault to a defective stage, circuit, or component

*d. Voltage Measurements.* Voltage measurements along the signal path are very useful in signal tracing. Weak signal or the absence of a signal will aid in isolating the trouble to defective stage or component General procedures for voltage measurements are given in paragraph 2-5.

*e. Waveform Analysis.* Where required, waveforms are used to analyze the nature of trouble. These waveforms are compared with waveforms provided and resistance measurements are then used to locate the trouble.

*f.* Resistance *Measurements.* Resistance measurements help locate a faulty component. Use the resistance charts provided. Refer to paragraph 2-6 for resistance measurement procedures.

*g.* Test *Points. Where* possible, test points should be used for connection to test equipment. Test points are shown on the schematic diagrams and on parts location diagrams.

*h. Intermittent Trouble.* There is a possibility of intermittent troubles on all of the tests. This type of fault may often be made to appear by tapping or jarring the module while under test

## 2-4. Use of Test Facility Set AN/GRM-95(V)2

*a.* Test Facility Set AN/GRM-95(V)2 is made up of five major units and seven separate test fixtures. Each item is contained in its own case. The five major units are as follows.

(1) Test Facility, Transmitter TS-2866(V)2/GRM-95(V)2.

(2) Test Facility, Receiver TS-2867(V)2/GRM-95(V)2.

(3) Accessory Kit Test Facilities Set MK-1173(V)2/GRM-95(V)2.

(4) Test Facility, Radio Frequency Modules TS-3837(V)2/GRM-95(V)2.

(5) Accessory Kit, Test Facility Set MK-1985(V)2/GRM-95(V)2.

*b.* The test facility permits testing, alinement, and troubleshooting procedures to be carried out on the complete radio set, the individual modules. In conjunction with additional test equipment, the test facility provides the following

(1) An interface between the radio set and the test equipment

(2) Internal signal sources, power sources, and detection, measurements, and internal calibration facilities.

(3) A means of checking some radio set modules by substitution.

*c.* The accessory kits contain a power supply, numerous test jigs, and items of specialized test equipment of particular use in testing certain modules.

*d.* Before using the test facility, refer to TM 11-6625-1696-14 for starting and stopping procedures.

## 2-5. Dc Servicing and Voltage Measurements

*a. Dc Servicing.* Dc voltage measurements are an effective method of troubleshooting defective radio sets and modules.

(1) The radio set is largely self-sectionalizing most faults in the transmitter and receiver will provide one or more abnormal indications on the respective front panel meter. When dc servicing is done in conjunction with the test facility, additional information may be obtained from the test facility indicator lamps and/or meter indications. In general, any fault related to the +28 V, +26 V, +12 V, –12 V, and/or 630 V supplies can be easily traced through meter indications. Refer to the applicable troubleshooting charts to localize and isolate the defective module or components.

(2) Dc servicing of individual modules is easily done by removing the module covers, connecting the module to the appropriate connector of the test facility; and checking the supply voltages. A short in the supply voltage module will be readily indicated by the associated supply indicator lamp on the test facility lamp being extinguished. Check the supply voltage at all distribution points with a multimeter and use the appropriate schematic diagram to isolate the fault

*b. Voltage Measurements.* In-circuit voltage measurements are useful in isolating a defective component or stage. Transistors can be easily checked by measuring the base to emitter bias. A transistor functioning as an amplifier is always forward biased. The base to emitter voltage of any turned-on silicon transistor is approximately 0.8 V; that of a germanium-type transistor approximately 0.4 V. A nonconducting transistor shows the full supply voltage at the collector.

(1) A quick method to check whether a forward-biased transistor functions as an amplifier is to remove the forward bias by shorting the emitter to base. The collector voltage in this case should rise to the approximate level of the supply voltage.

(2) Incorrect or absent supply voltage is usually caused by defective Zener diodes. Check for the correct operating voltage across the Zener diode. Refer to the appropriate schematic, troubleshooting procedure, and/or semiconductor reference books.

(3) PIN diodes, normally used as switching diodes, are semiconductor devices with very low resistance when forward-biased and high resistance when reverse-biased. A large voltage drop across the PIN diode when forward-biased indicates a defective diode.

(4) Field effect transistors (FET) can be checked by varying the voltage at the gate and observing the voltage change appearing at drain and source. Only two field effect transistors are used in the radio set, one in electrical frequency synthesizer 1RE1A2 and the other in electrical frequency synthesizer 5TR1A2. Changing synthesizer frequency is an effective way of varying the voltage at the gate of the FET.

**CAUTION**

Be careful when using a VTVM or oscilloscope to measure voltages within an operating module. The measuring instrument may upset the characteristics of some circuits, particularly rf circuits, and false indications may be obtained. Refer to the appropriate module troubleshooting procedure for correct use of measuring instruments.

(5) Checking signal voltages within an operating module is, in most cases, an effective way of troubleshooting a module. Signal voltages can be checked using a VTVM or oscilloscope.

(6) Peak-to-peak voltages of pulse and square waves can be measured with an oscilloscope.

(7) When measuring voltages, use the test points provided rather than break the conformal coating to get to connections. Synthesizer boards can be extended using extender boards; test points are provided in all extender boards for signal and supply voltage measurements

(8) The 600 V supply to the power amplifier tubes can be readily measured at tube plate cooling fins or an appropriate filter-connector, test points have been provided for measuring and adjusting filament voltage and *power* amplifier tubes bias.

## 2-6. Resistance Measurements

*a. In- Circuit Resistance Measurements.*

**CAUTION**

Do not make resistance measurements on Q1 and Q2 of radio frequency amplifier 2A1AR1 and elapsed time indicator DS1 in power supply 5TR1PS1 and circuit card assembly 6AR1A2A2. If the correct polarity of meter leads are not observed when checking FL28 or FL29 in power supply 5TR1PS1 and the low voltage tantalum electrolytic capacitors, the components will be damaged. In-circuit checking of components should be carried out as much as possible. Most components can be checked for open or shorted conditions using the allocated multirneter. Use the R X 100 or R X 10K scale when there is a possibility of damaging the components. Loss of signal or supply voltage in a module may be caused by shorts, poor connections at plugs, broken wires, etc. Continuity checks using the allocated multimeter will usually indicate the source of trouble; use the appropriate schematic diagram and interconnecting diagram for guidance. Use the interconnecting box test set supplied with the test facility accessory kit to check the interconnecting cables of the receiver and transmitter case. In-circuit resistance checking will usually provide adequate indication of a faulty transistor or diode. The following is a suggested method.

(1) *NPN* transistors. With the positive lead of the multimeter on the base and the negative lead first on the collector and then on the emitter, the multimeter should normally indicate several hundred ohms (R X 100 scale). With reverse leads (negative on base) the resistance to collector should be very high or infinity, while the resistance to the emitter should be several megohms (depending on the other components in the circuit).

(2) *PNP transistors.* Reverse connections and indications in (1) above.

(3) Diodes. With diodes of type 1N914 or similar, place the negative lead of multimeter on the cathode, the positive on the anode; the meter should indicate several hundred ohms. Reverse the leads and a very high or infinite resistance should be obtained, depending on the circuit configuration.

*b. Out-of-Circuit Resistance Measurements.* Under certain conditions, due to circuit configurations, it may not be possible to check a transistor or other component in-circuit; in this case the component must be disconnected. Remove the suspected faulty component using the proper procedure (para. 2-14) and check as described in *a* above. Only one end need be disconnected in order to check diodes, varicaps, and some types of Zener diodes. An additional test for an NPN transistor consists of connecting the negative lead of the multimeter to the emitter and the positive to the collector which should give an infinite resistance indication. Next connect the positive lead to base and note the resistance reading then short the base lead to collector to turn on the transistor and this should produce a slightly lower reading on the meter. Reverse multimeter leads for PNP transistors.

**CAUTION**

Do not check field effect transistors, integrated circuits, or operational amplifiers with the multimeter; static charge from hands to gate when the transistor is out of circuit and when leads are not shorted can damage the component.

## 2-7. Inspection of Cable Assemblies

a. If trouble is suspected in cable assemblies, look for broken wires, poor grounds, or in the case of shielded wires, inner conductor shorted to grounded shield. Continuity checks, referring to the appropriate schematic diagram, will reveal broken wires in cable assemblies. A wiring fault in the interconnecting cable assemblies in the transmitter or receiver case can be located by using the test set interconnecting box (part of the test facility accessory kit). Connections to subminiature rf connectors can be pull-tested, and visually inspected for open circuits, poor solder connections, or poor ground connections.

*b.* If one or more defective wires are found in a wiring harness, replace the damaged wire with another of the same size and length, running the wire through the plastic cable covering. Wiring can be checked using the allocated multimeter and using the appropriate schematic diagram. If a damaged wire to a connector is found, remove the cover from the wiring side of the connector and repair, following approved soldering techniques; replace the short insulation sleeve over the wire to the connector pin.

c. If a wire in a laced harness requires replacement the lacing should be cut, and the defective wire removed and replaced by a new wire the same size and length. It is sometimes possible, if the lacing is not too tight, for the faulty wire to be slipped out and a new one substituted. When replacing the lacing, it should be laced tightly so that it cannot loosen again. Another but less acceptable method is to run new wire along the cable, lacing it at intervals. The old conductor should be cut back into the cable as far as possible and the ends insulated.

*d.* A broken wire can be joined together, soldered and the joint covered with spaghetti, but this method should only be used as a last resort when no other methods are possible.

**2-8. Soldering and Unsoldering Procedures**

To ensure high reliability of electrical connections, certain procedures for hand soldering must be adhered to.

*a.* Use low wattage or temperature controlled soldering irons and thermal (heat) sinks to prevent damage to heat-sensitive components, such as semiconductors, glass bead capacitors, and insulating materials.

*b.* Use appropriate soldering iron tips and solder quickly to prevent long periods of excessive heat during soldering and unsoldering on printed circuit boards covered with conformal coating.

*c.* Do not use transformer-type solder guns.

*d.* Check the condition of soldering tips. Do not allow oxidation scale to accumulate on the tip. Maintain a bright, thin, but continuous tinned tip surface.

*e.* Use a 60/40 type solder for tinning and general use. Use a low-melting point 63/37 type solder on printed circuit boards and when soldering heat-sensitive components.

*f.* Remove excess flux, grease, or oil from the soldering points, using ethyl or isopropyl alcohol.

*g.* Remove the conformal coating from the joint to be soldered with a board knife or soldering iron.

*h.* Use a heated copper braid to absorb the melted solder when unsoldering. Avoid using a solder sucker to remove the solder from printed circuit boards; this method may damage the joint and/or the printed circuit board.

*i.* Avoid excessive temperatures to prevent unreliable joints and damage to parts. Use heat sinks, such as long-nose pliers, to protect the components.

*j.* Allow the solder to cool at room temperature. Do not use liquids to cool a soldered connection.

**NOTE**

Never use any abrasive cleaning agents on solder areas.

*k.* Remove all visible flux and impurities from a cool solder joint using a medium stiff material or synthetic bristle brush and approved solvent. The soldered connection should be clean and have a smooth, undisturbed appearance.

*l.* Use a wire brush to remove oxide, paint, and any other foreign matter from terminals before attaching wires and leads for soldering. Use special type white eraser to clean gold-plated solder areas.

**2-9. Replacement of Filter Connectors**

a. There are two basic types of filter connectors used in the radio set: the soldered-in type and the screw-in type. The screw-in type filter connectors are used mainly at output connectors of rf heads and power supplies. The soldered-in type are used mainly within modules.

**NOTE**

Care must be taken when filter connectors are installed so that the porcelain is not cracked or damaged, or that excess solder does not run over the body of a component, causing a short circuit to chassis.

*b.* To replace the screw-in type filter connector, remove connecting wires, lockwasher, and nut. When the new component is installed, check first for continuity and shorts to ground or chassis, then replace the connecting wires.

c. To replace the soldered-in type filter connector, remove the connecting wires and unsolder the defective component ensure that the mounting and mounting hole are clear of solder. Install the new unit by heating the mounting frame until solder flows freely to both sides of the mounting frame. Cut the end leads to the required length check for continuity and absence of shorts to chassis or ground, then replace the connecting wires, using no more heat than necessary. Excessive heating may change the characteristics of a component. Normally, a heat sink is not required, since filter connectors are usually mounted on a chassis or a metal frame.

*d.* Thoroughly inspect the filter connectors after connections are completed.

### 2-10. Replacement of Connectors

Radio Set AN/GRC-103 uses several types of multipin and rf connectors which will need replacing if they become defective.

*a. Multpin Connectors.* Remove and label all wires connected to the connector. Clean all wires of solder and ensure that the wires are properly stripped. Fill the pin cups on the replacement connector with a small amount of solder before inserting the wire ends into the pin cups. Allow the solder to cool, pull the wire to ensure that it is solidly attached, then slide the insulating sleeve over the soldered connection so that it fits snugly against the connectors.

*b. Microminiature-Type Connectors (fig.* 2-1). The following is a general procedure applying to most microminiature connectors:

(1) Slide the connector clamp nut over the covering of the rf cable.

(2) Remove 1/8 inch of the outer covering of the cable (fig. 2-2).

(3) Remove 1/16 inch of the braid and inner insulation.

(4) Insert the inner conductor into the connector pin and solder through the small opening.

(5) Trim off excess braid

(6) Slide the clamp nut over the connector and tighten the clamp nut.

*c.* Type UG573A Connectors. The following is a basic procedure:

(1) Slide the connector nut and gasket over the cable and remove 5/16 inch of the outer covering of the cable.

(2) Comb the braid and fold it out

(3) Pull the braid wires forward and taper to the center conductor.

(4) Place the clamp over the braid and push back against the cable jacket

(5) Fold back the braid wires, trim to the proper length, and fold over the clamp.

(6) Cut back the dielectric to the correct length so that the contact pin fits snugly against the center conductor.

(7) Solder the contact pin to the center conductor through the opening in the contact pin.

(8) Insert the cable end with the soldered contact into the connector body.

(9) Ensure that the sharp edge of the clamp is properly seated in the gasket Tighten the nut

**NOTE**

In a plug the end of the contact pin should be flush with the insulator. In a jack, there should be a clearance of 0.10 inch between the end of the contact and the top of the insulator.

### 2-10.1. Fabrication of Special-Purpose Cables

Refer to figure 2-3. Assemble t-he special cables as shown in A through D, figure 2-3 (also see para. 2-10).

### 2-11. Conformal Coating

a All printed circuit boards in the radio set are protected against environmental conditions by conformal coating. The conformal coating used on printed circuit boards is Conathane CE-1155 which has a good repairability factor, and does not normally require any tool except a soldering iron to make repairs, althrough a board knife is useful when removing the conformal coating.

b. All printed circuit boards should be thoroughly cleaned using Freon or alcohol, dried then conformal coated and cured before being restored to service. If Conathane CE-1155 is not available use the nearest equivalent material that is acceptable.

### 212. Sealing Controls

*a.* In keeping with the general procedure of using red paint on all areas that normally should not be moved or adjusted nearly all adjustable resistors, capacitors, and all alinement controls, are sealed after adjustment

*b. These sealed* controls should not be adjusted except when required to follow alinement or adjustment procedures. Consult the appropriate module test and repair procedures before adjusting any of the sealed controls. The majority of such controls are usually sealed with red paint

c. All duplexer cavity cups and adjustment screws on cups are sealed after alinement with Glyptal. The filament and bias controls for power amplifier tubes located on the transmitter rf head use locknuts to keep them fixed at their adjustment points.

**NOTE**

Use heat or solvent (i.e., ketone) to soften the sealant on adjustment screws before adjusting.

### 2-13. Setscrew Removal and Replacement

*a The majority* of setscrews in the radio set are secured with Loctite to ensure there is no possibility of movement after the mechanical alinement and adjustment is carried out Several types of Loctite are used depending on the retaining requirements of the component

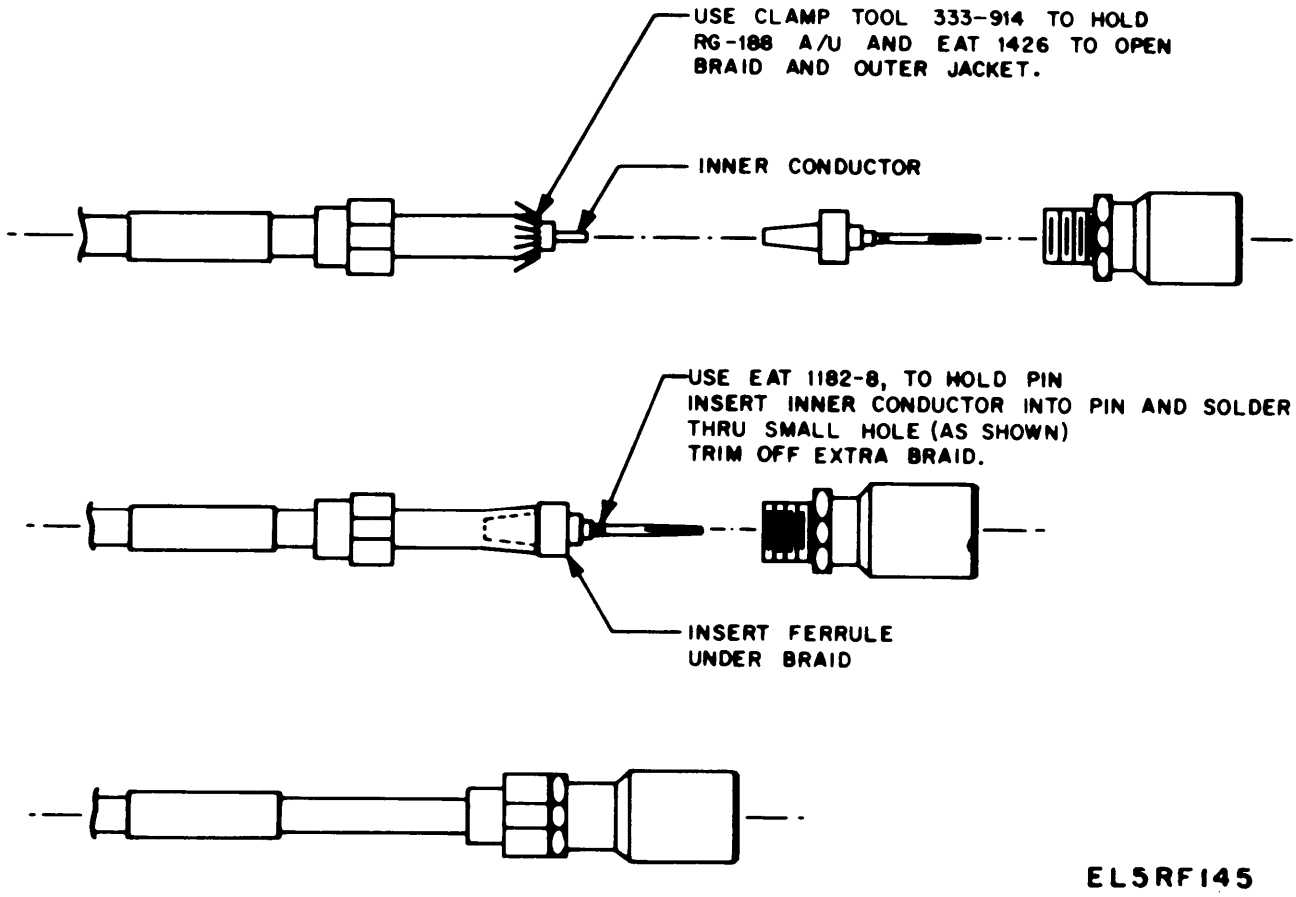



*Figure 2-1. Details of Cable Connector Assembly.*

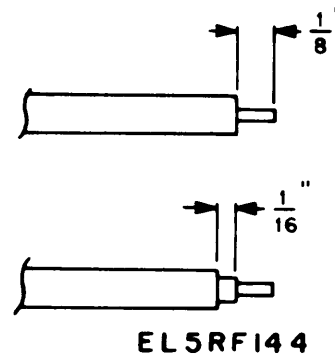



*Figure 2-2. Details of Rf Cable Stripping.*

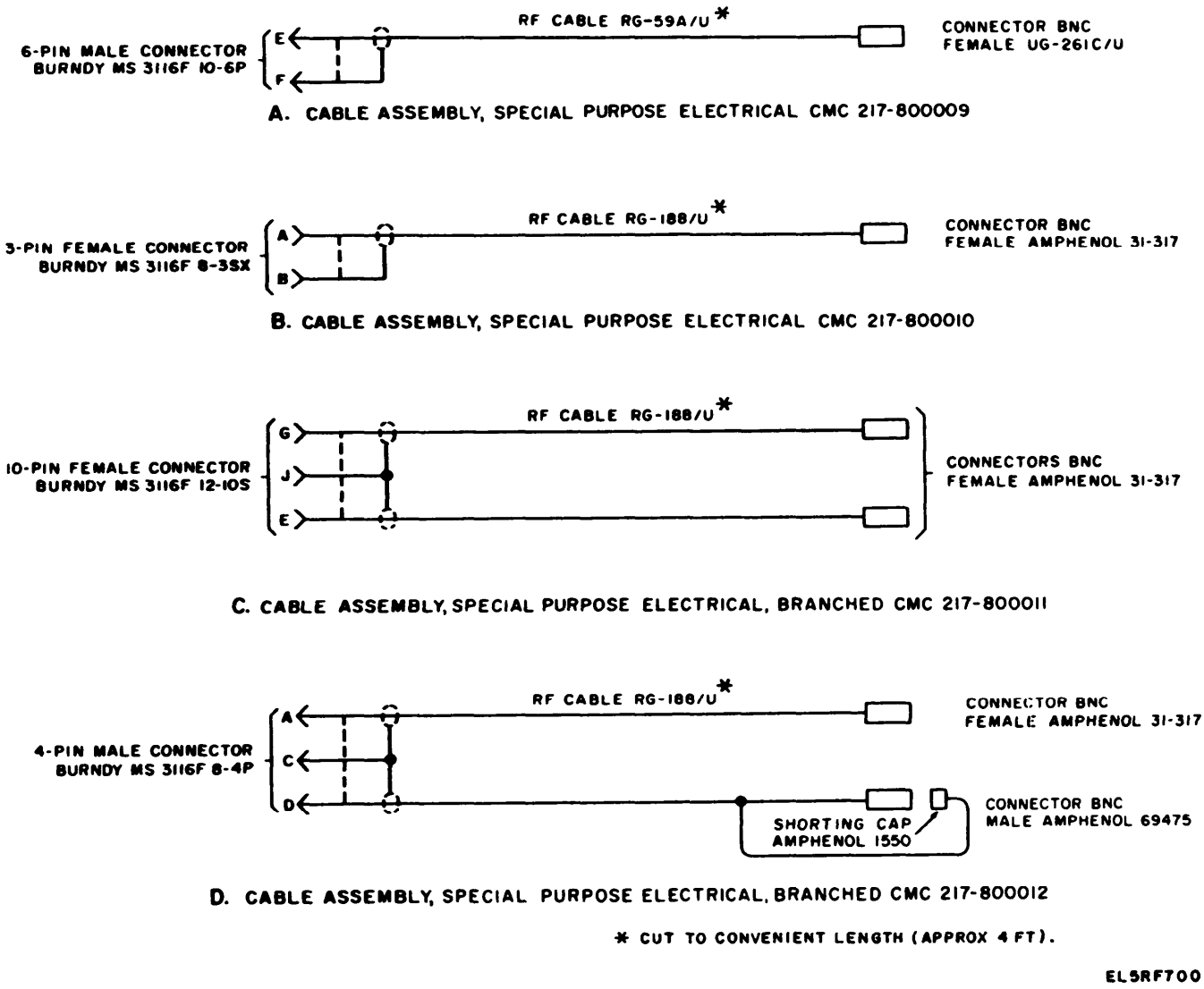



*Figure 2-3. Special Purpose Cables, Fabricated*

(1) Type AA for maximum locking of fine threads.

(2) Type AVV for high strength locking of coarse threads.

(3) Type C for locking any fine threads that must be easily removable.

*b.* To remove a setscrew, it may be necessary to cautiously heat the joint locally using a high wattage iron. Tapping the setscrews carefully, using a hammer and pin-punch, will assist in jarring the screw loose and removing hardened sealant from disassembled parts. After the disassembly of Loctite-treated parts, an accumulation of power may remain, this should be removed by wiping or air hosing. Loctite can then be reapplied and the setscrew replaced

*c.* To reassemble, apply the correct type of sealer required (a holding power of 20% to 90% is appropriate where maximum holding is necessary and 5% to 20% for setscrews that might possibly require ocasional adjustment).

*d.* Before any setscrew is removed, refer to the appropriate test procedures; the removal of a component secured by a setscrew may result in realinement or adjustment being necessary.

**NOTE**

The setscrews securing the microswitches of control indicators 2A2 and 6A3 are secured by Glyptal rather than Loctite.

**2-14. Replacement of Components**

*a. Component Mounted on Printed Circuit Boards.* Remove the defective component by unsoldering its leads from the printed circuit board following approved unsoldering procedure (para.2-8)

(1) Check and clean all replacement component leads prior to soldering, regardless of visual appearance.

(2) Use smooth finished tools for bending and avoid any sharp-edged tool which may pinch or break the lead. Leave a distance of at least twice the diameter of the lead from the end seal of the component to the start of the bend. This rule also applies to all components with welded leads, such as tantalum capacitors.

(3) Components that weigh ¼ oz or more are secured by a suitable mounting bracket, and potted or embedded in silicon rubber or its equivalent. When replacing such a component, be sure that the original mounting bracket is retained.

(4) Components mounted in a vertical position should not exceed ½ inch in height, otherwise they may cause a short circuit to the module cover. When diodes must be mounted vertically, with the cathode end close to a source of heat, use a setback loop in the cathode lead.

(5) Position the replacement component in the same place as the removed component. Do not mount components on top of other components. Position the replacement components so that any identification mark such as the part number, symbol, value, etc., is readily visible.

(6) Observe the polarity of replacement diodes, transistors, and electrolytic and tantalum capacitors.

(7) Position all delicate lead-mounted components at least 1/64 inch away from boards or adjacent components. Components which are expected to dissipate more than 1 watt of heat should clear the board and all adjacent components by 1/32 to 1/16 inch. When the component is attached to a printed circuit board by a clinched lead, the clinched lead must be on and in the direction of the circuit pattern.

(8) Components mounted over exposed circuitry must be insulated unless the components are glass encased.

(9) Jumper wires longer than 1½ inch used in joining two terminals should be secured to the board with a small amount of potting compound at suitable points along the wires.

*b. Components Mounted Other Than on Printed Circuit Boards.* When components are mounted on standoff terminals, allow sufficient slack in the leads to components to allow for vibration and temperature changes.

(1) When wires are attached to terminals, sufficient insulation should be stripped off the wire to avoid contact between the insulation and the solder connection. Use proper stripping tools to avoid nicking, damaging, or breaking wires.

(2) The ends of wires soldered to terminals should be wrapped around the terminals ½ to ¾ turn (wires larger than 26 AWG) or ¾ to 1½ turns (wires smaller than 26 AWG). All portions of stranded wire and component leads which will be soldered should be properly tinned before attachment.

(3) Use the correct type of insulated heat-shrinkable sleeving when replacing a circuit breaker. Use a thermogun for shrinking the sleeving.

c. *Component Replacement Procedure.*

(1) *Air-core coils.* Install the replacement air-core coil, using approved soldering techniques, without changing the contour of the coil, and maintaining the same board-to-coil distance. A complete realinement of the module will be required.

(2) *Ferrite tuned coils.* To replace ferrite tuned coils proceed as instructed in (1) above observing polarity, start, and finish of the coil. Realinement is required after replacement.

(3) *Relays.* Relays are either soldered to the board or chassis-mounted and secured by two screws. Mark the relay pin numbers on individual connecting wires with masking tape before removing the faulty relay. Replace the relay using approved soldering techniques.

(4) *PIN diodes.* The PIN diodes are either soldered to the board or mechanically mounted in special holders. Press the replacement PIN diode into position observing the polarity.

(5) *Small components.* Small fixed capacitors, chokes, fixed resistors, varicaps, and diodes are all replaced following the general procedures described in *a* and *b* above. Observe polarity on all types of diodes, varicaps, and electrolytic capacitors.

**CAUTION**

Do not touch the leads of field effect transistors with the hands. Damage to the transistor may result

(6) *Semiconductor devices and microcircuits.* Replace transistors, binaries, and NOR gates following the general procedure in *a* above. Observe the polarity when replacing the component, and use spreaders where applicable. When replacing power transistors on head sink boards, be sure that the insulator is correctly positioned and apply heat sink compound. On board-mounted transistors, replace the case shield or heat sink where applicable.

(7) *Board-mounted potentiometers.* Replace the component following general procedures in *a* or *b* above; refer to the applicable paragraph for alinement procedures.

(8) Transformers. Transformers are readily replaced. Identify all connecting wires before removing the defective component to facilitate installation of the replacement transformer.

**NOTE**

Any repairs on printed circuit boards will require the application of conformal coating (para.2-11).

## Section II. REMOVAL AND REPLACEMENT

## PROCEDURES - BAND I FIXED AND RF HEADS

### 2-15. General

When trouble has been localized to a module of the radio set, replace the defective part as described in paragraphs 2-18 to 2-97 and TM 11-5820-540-30. Before installing a module, always check connectors for bent or damaged pins. Do not tighten the module mounting screws to press home connectors. Whenever difficulty is encountered in mating connectors, remove the module and inspect the connectors for damage.

### 2-16. Equipment Required

The following equipment is required for the replacement of power monitor 6AR1A3 and power monitor 2A1A5.

| *Description* | *Manufacturer number* | *Qty* |
|---|---|---|
| Socket wrench, 7/8 inch | | 1 |

### 2-17. General Module Replacement Procedures

*a. Transmitter, Radio T-983(P)/GRC-103,* T-983A *(P)/GRC-103 or T983B(P)/GRC-103 Modules.* To replace a module, first remove radio transmitter 5TR1 from the transmitter case as described in chapter 6, TM 11-5820-540-12. To replace centrifugal fan 5A2B1, the transmitter Rf head must also be removed from the transmitter case, as described in chapter 6, TM 11-5820-540-12.

*b. Amplifier-Frequency Multiplier AM-4320/GRC-1O3(V), AM-4320A/GRC-103(V) or AM-4320B/GRC-103(V) Modules.* To replace a module, first remove the transmitter rf head from the transmitter case, as described in chapter 6, TM 11-5820-540-12, the remove the transmitter rf head dust cover, which is secured to the unit with nine screws. Reinstall the dust cover after replacing the faulty module.

*c. Receiver, Radio R-1329(P)/GRC-103(V), R-1329A (P)/GRC-103(V),R-1329B(P)/GRC-103(V) or R-1329C (P)/GRC-103(V) Modules.* To replace a module remove radio receiver 1RE1 from the receiver case as described in chapter 6, TM 11-5820-540-12.

*d. Amplifier-Converter AM-4316/GRC-103(V), or AM-4316A/GRC-103(V) Modules.* To replace a module of this unit, first remove the receiver rf head from the receiver case, as described in chapter 6, TM 11-5820-540-12, then remove the receiver rf head dust cover, which is secured to the unit with twelve screws and two hexagonal nuts on the locating pins. Reinstall the dust cover after replacing the faulty module.

*e. Receiver-Transmitter, Order Wire RT-773/GRC-103(V) Modules.* Replacement of telephone signal converter 9A3 and amplifiler assembly 9A4 is covered in chapter 6, TM 11-5820-540-12.

### 2-18. Replacement of Rotary Switch 1RE1A1S1

*a.* Place radio receiver 1RE1 top side up and locate rotary switch 1RE1A1S1.

*b.* Remove power supply 1RE1PS1 as described in chapter 6, TM 11-5820-540-12.

*c.* On the front panel, loosen the two setscrews that secure the control knob of 1RE1A1S1. Remove the control knob.

*d.* Remove the nut and washer that secure 1RE1A1S1 to the front panel.

*e.* Remove rotary switch 1RE1A1S1 from its mounting hole. Unsolder and tag the wires from the 1RE1A1S1 terminals.

*f.* Refer to FO-1 or FO-2, as applicable, and use wire of similar gauge as that on the defective switch to connect all switch contacts necessary to complete the circuit, with the exception of the wires removed in e above.

g. Position the replacement switch in its mounting hole. Connect and solder the wires removed in e above.

*h.* Secure the switch to the front panel with the nut and washer.

*i.* Replace the front panel knob and secure it in position with its two setscrews.

*j.* Replace power supply 1RE1PS1 as described in chapter 6, TM 11-5820-540-12.

### 2-19. Replacement of Push Switch 1RE1A1S2

*a.* Place radio receiver 1RE1 bottom side up and locate push switch 1RE1A1S2.

*b.* Remove electrical frequency synthesizer 1RE1A2 as described in TM 11-5820-540-30.

*c.* Remove the protective cover from the rear of 1RE1A1S2.

*d.* Unsolder and tag the wires from the 1RE1A1S2 terminals.

*e.* Remove the nut and washer that secure 1RE1A1S2 to the front panel. Remove 1RE1A1S2.

*f.* Connect terminals 2 and 4 of the replacement switch together using a short piece of wire of similar gauge to that used in the defective switch.

*g.* Install the new push switch and secure it with the nut and washer.

*h.* Connect and solder the wires removed in *d* above.

*i.* Place the protective cover over the rear of the switch and secure it with a piece of cord.

*j.* Replace electrical frequency synthesizer 1RE1A2 as described in TM 11-5820-540-30.

### 2-20. Replacement of Rotary Switch 1RE1A1S3

*a.* Place radio receiver 1RE1 top side up and locate rotary switch 1RE1A1S3.

*b.* Remove the control knob by loosening its two setscrews.

c. Remove the nut and washer that secure 1RE1A1S3 to the chassis. Pull the switch free of 1RE1.

*d.* Unsolder and tag the wires from 1RE1A1S3. Remove 1RE1A1S3.

*e.* Connect and solder the wires removed in *d* above to the replacement switch.

*f.* Install the switch in the mounting hole and secure it with the nut and washer. Replace and secure the control knob.

### 2-21. Replacement of Meter 1RE1A1M1

a. Place radio receiver 1RE1 top side up and locate meter 1RE1A1M1.

*b.* Remove power supply 1RE1PS1 as described in chapter 6, TM 11-5820-540-12.

*c.* Unsolder and tag the wires from meter 1RE1A1M1.

*d.* Loosen and remove the four mounting screws and nuts that secure 1RE1A1M1 to the front panel. Remove 1RE1A1M1.

e. Install the replacement meter and secure it with the four nuts and screws.

*f.* Connect and solder the wires, removed in *c* above, on their appropriate terminals on the new meter.

*g.* Replace power supply 1RE1PS1 as described in chapter 6, TM 11-5820-540-12.

### 2-22. Replacement of Circuit Breaker 1RE1A1CB1

*a.* Place radio receiver 1RE1 bottom side up and locate circuit breaker 1RE1A1CB1.

*b.* Locate and remove electrical frequency synthesizer 1RE1A2 as described in TM 11-5820-540-30.

c. Remove and discard the insulating tubing on the circuit breaker 1RE1A1CB1 terminals.

*d.* Unsolder and tag the wires from the 1RE1A1CB1 terminals.

*e.* Loosen and remove the hexagonal nut and washer that secure the circuit breaker to front panel. Remove 1RE1A1CB1.

*f.* Install the replacement circuit breaker in the mounting hole and secure it with the hexagonal nut and washer.

*g.* Remove approximately 1 inch of insulation from the ends of the wires to be connected to the circuit breaker.

*h.* Place a suitable length of heat shrinkable tubing type CMC 334-362/3 over each wire.

*i.* Wrap the wires around both sides of the hook in the terminals on the circuit breaker. Ensure good mechanical connection and that the wires are connected to the correct terminals with regard to LOAD and LINE.

j. Solder the leads to the terminals.

*k.* Position the heat shrinkable tubing on the wires, over the terminals and, using a thermogun, shrink the tubing to fit snugly over the terminals.

*1.* Secure the cable assembly below 1RE1A1CB1 by passing the cord attached to the cable assembly between 1RE1A1CB1 and the front panel and tying firmly.

*m.* Replace electrical frequency synthesizer 1RE1A2 as described in TM 11-5820-540-30.

### 2-23. Replacement of Electrical Connector Assembly 1RE1A1A1 Components

For repair and replacement of connectors and wires in electrical connector assembly 1RE1A1A1 (FO-1 or FO-2 as applicable), refer to paragraphs 2-8 and 2-10.

### 2-24. Replacement of Circuit Card Assembly 1RE1A1A3

a. Place radio receiver 1RE1 top side up and locate circuit card assembly 1RE1A1A3.

*b.* Remove power supply 1RE1PS1 as described in chapter 6, TM 11-5820-540-12.

c. Remove the two mounting screws that secure 1RE1A1A3 to the mounting posts on the chassis.

*d.* Unsolder and tag the wires from 1RE1A1A3. Remove 1RE1A1A3.

*e.* Connect and solder the wires to the replacement circuit card assembly 1RE1A1A3.

*f.* Position 1RE1A1A3 on the mounting posts and secure with the two screws.

g. Replace power supply 1RE1PS1 as described in chapter 6, TM 11-5820-540-12.

### 2-25. Removal of Distribution Box 1A2A1

*a.* Remove the four shouldered screws that secure J10 (XA1A3P3) and its mounting bracket to the receiver case.

*b.* At the rear of the case remove the eight screws that secure distribution box 1A2A1 to the case.

c. Remove the distribution box and the cable assembly by pulling J10 (XA1A3P3) through the slot in the case partition.

d. Proceed with required repairs. Avoid removal of J10 (XA1A3P3) from its mounting bracket However if J10 (XA1A3P3) has to be removed, before reinstalling the distribution box and cable assembly, realine J10 (XA1A3P3) as follows

(1) Secure J10 to the mounting bracket with the four mounting screws sufficiently to hold the plug firmly but allow movement with some pressure.

(2) Connect J10 (XA1A3P3) to 2A1A3P3 of the receiver rf head and adjust J10 (XA1A3P3) until the connectors are alined.

(3) Carefully remove J10 (XA1A3P3) from the receiver rf head and tighten the four mounting screws.

(4) Reconnect J10 (XA1A3P3) to 2A1A3P3 to check the alinement. Repeat (2) and (3) above until the alinement is satisfactory.

*e.* Replace the distribution box and the cable assembly by feeding J10 (XA1A3P3) through the slot in the case partition. Secure J10 (XA1A3P3) to the case with the four shouldered screws.

*f.* Hold the distribution box in place and secure it with the eight screws from the rear of the case.

### 2-26. Replacement of Control Panel 2A1MP2

*a.* Place the receiver rf head rear side down and locate control panel 2A1MP2 (fig. 3-18, TM 11-5820-540-30). Locate 2A1AR1 and remove two cables and four screws holding 2A1AR1 and set aside.

*b.* Locate and loosen the two screws that secure P1 (2A1W4J4) to 2A1W4J4. Remove P1 (2A1W4J4).

*c.* Release the cable that is connected to P1 (2A1W4J4) by removing the screws that secure the cable clips (TM 11-5820-540-12, fig. 6-13) to the chassis.

*d.* Loosen the screws in the three control panel knobs; MULT PEAK RCVR SIG, and XMTR CUPL Remove the control knobs.

*e.* Using a socket wrench remove the two nuts that secure the ANT. and FROM XMTR connectors to the control panel. Pull the connectors away from the control panel.

*f.* Loosen the eight mounting screws that secure control panel 2A1MP2 to the chassis. Remove the control panel.

*g.* To reinstall 2A1MP2, hold the control panel and the cable that is connected to P1 (2A1W4J4) so that the cable will be located at the bottom of the rf head when the control panel is replaced

*h.* Place control panel 2A1MP2 in the connect position on the chassis so that the mounting holes are properly alined. Secure 2A1MP2 with the eight mounting screws.

*i.* Insert the connectors through the ANT and FROM XMTR mounting holes and secure them with the nuts and washers removed in e above.

j. Replace and secure the control knobs. Make sure that the backs of the RCVR SIG and XMTR DUPL knobs clear the control panel by one-eighth inch.

*k.* Connect P1 (2A1W4J4) to 2A1W4J4 and secure the plug in position with the two screws. Replace unit 2A1AR1 using four mounting screws and connect the two cables removed in *a* above.

*l.* Secure the cable to the chassis using the two cable clips.

### 2-27. Replacement of Frequency Multiplier 2A1A2A1

*a Removal and Replacement (fig. 2-4).*

(1) Place the receiver rf head top side up and locate 2A1A2A1 at the tip front, left side. Disconnect the P2 rf lead from the J1 (2A1A3P2) connector of 2A1A2A1 and the P2 (2A1A2A3J3) rf lead of 2A1A2A1 from connector J3 of bandpass falter assembly 2A1A2A3.

(2) Loosen the Allen screw on the coupling between the 2A1A2A1 shaft and the flexible drive shaft

(3) Loosen the three red-circled screws that secure 2A1A2A1 to the chassis. Lift 2A1A2A1 up from the chassis to disengage its chassis connector and flexible drive shaft

(4) To install the replacement 2A1A2A1 unit first set the receiver rf head RCVR CHANNEL and RCVR SIG controls to channel 400.

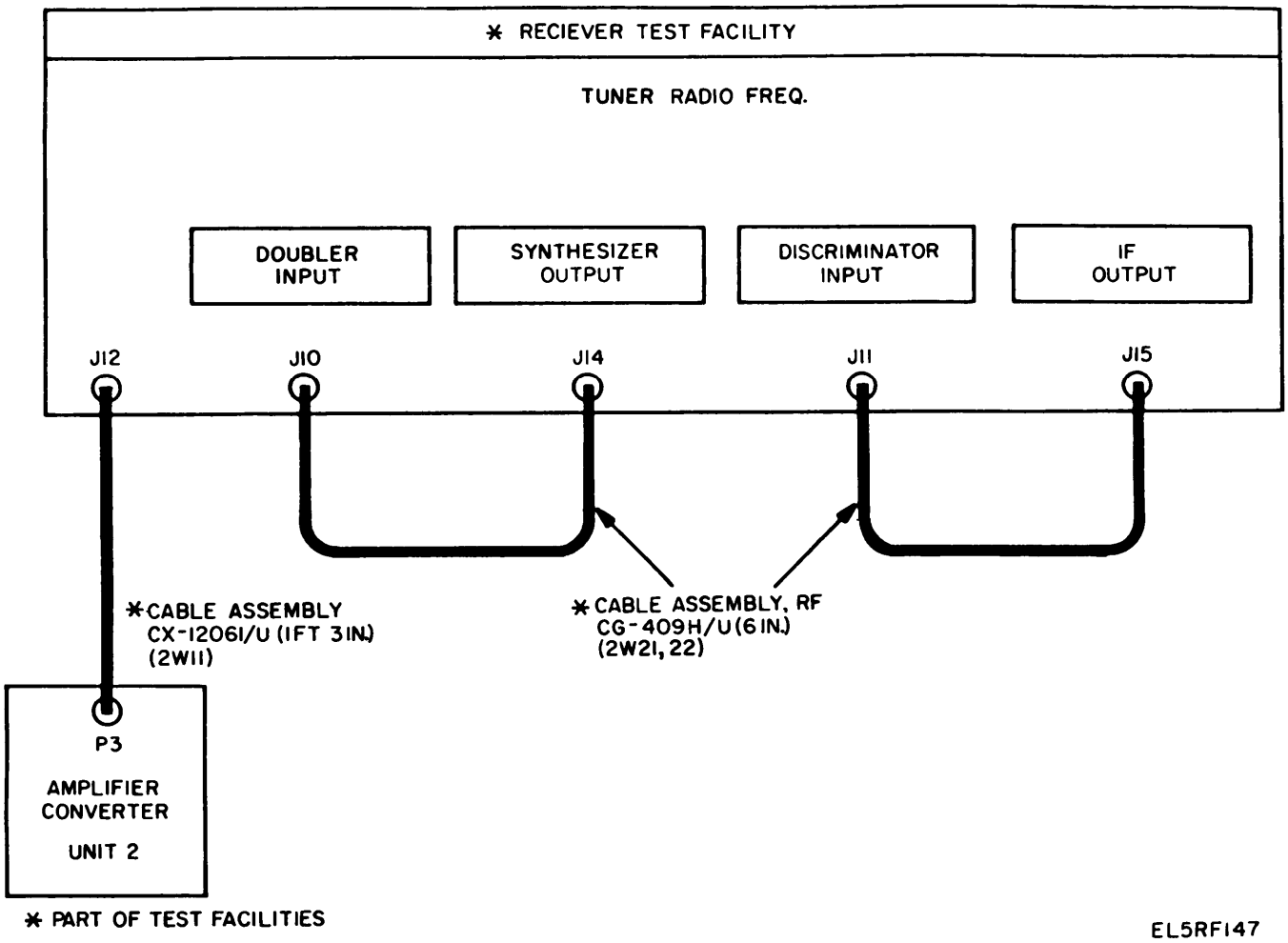



Figure 2-4. *Frequency Multiplier* 2A1A2A1, *Installation Check, Test Setup.*

(5) Set the cam of the 2A1A2A1 replacement so that the line on the cam identified by the letter H is adjacent to and in line with the cam-follower stud in the body of 2A1A2A1.

(6) Position 2A1A2A1 on the chassis and press straight down to engage the connectors. Tighten the three red-circled screws. Do not engage flexible drive shaft to 2A1A2A1 at this time.

(7) Connect rf lead P2 (2A1A2A3J3) to connector J3 of bandpass filter assembly 2A1A2A3, and the P2 rf lead to the J1 (2A1A3-P2) connector of 2A1A2A1.

*b. Alinment Procedure.*

(1) Connect the equipment as shown in figure 2-4.

(2) Set the test facility switches as follows:

| *Switch* | *Position* |
|---|---|
| S1 | ON |
| S5 | S6 |
| S6 | MULTIPLIER |
| S7 | AGC |

(3) Be sure that SYNTHESIZER FREQUENCY switch S8 is set to OFF.

(4) Tune the receiver rf head MULT PEAK control for a maximum reading on test facility meter Ml.

(5) Carefully rotate the cam of 2A1A2A1 until a maximum reading is obtained on the meter. Hold the cam in this position.

(6) Slide the coupling of the flexible drive shaft over the shaft of 2A1A2A1. Tighten the Allen screw in the flexible drive shaft coupling.

(7) Set the RCVR CHANNEL and RCVR SIG controls to channel 40.

(8) Tune the MULT PEAK knob for maximum indication on test facility meter Ml. The meter should indicate between 25 percent and 90 percent of full scale.

(9) If the meter indication in (8) above is below normal, reset the RCVR CHANNEL and RCVR SIG controls to channel 400, and repeat (4) through (8) above.

(10) Repeat (7) through (9) above for channels 119 and 120.

(11) Set test facility switch S1 to OFF.

## 2-28. Removal of Connector-Filter Assembly 2A1A3

Connector-filter assembly 2A1A3 must be removed in order to permit replacement of the filter-connectors of 2A1A3P3.

*a.* Place the receiver rf head rear side up and locate filter-connector assembly 2A1A3.

**CAUTION**

The two locating pins on the sides of 2A1A3P3 are factory alined and should never be loosened or removed

*b.* Remove the four screws that secure 2A1A3 to chassis XA1A3. Pull 2A1A3 free of the chassis.

*c.* Replace the fiiter-connectors as required Refer to paragraph 2-9 and FO-3 or FO-4 as applicable for replacement of filter-connectors.

*d.* If 2A1A3P3 requires replacement unsolder and tag the wires from the pins. Refer to paragraph 2-10 and FO-3 or FO-4 as applicable for replacement of connectors.

*e.* Remove the four screws that secure 2A1A3-P3 to the assembly. Remove 2A1A3P3 from the assembly.

*f.* Install the replacement 2A1A3P3 and secure it with the four mounting screws provided

*g.* Connect and solder the wires removed in *d* above.

*h.* Place 2A1A3 in position on the chassis and secure it with the four screws provided

## 2-29. Replacement of Channel Frequency Indicators 2A1A1A1DS1 and 2A1A1A1DS2

*a. Removal and Replacement Procedure.*

(1) Remove control panel 2A1MP2 as described in paragraph 2-26.

(2) Loosen the two setscrews that secure the flexible shaft at the coupling end (fig. 2-5).

**NOTE**

The two setscrews are held in place by Loctite. Melt the Loctite before loosening the screws.

(3) Remove the four red-circled mounting screw, that secure the defective channel frequency indicator to the chassis.

(4) Grasp channel indicator and slide it sideways to disengage the flexible shaft. Remove the defective channel frequency indicator.

(5) Remove the pin through the flexible shaft and remove the flexible shaft.

(6) Install the flexible shaft on the replacement channel frequency indicator.

(7) Slip the other end of the flexible shaft over the other shaft, place the channel frequency indicator in position and secure with the four mounting screws. Tighten the two setscrews.

(8) Using the flexible shaft pin holes as guides drill a hole through the channel frequency indicator shaft end and press the pin through.

*b. Channel Frequency Indicator 2A1A1A1DS1 (RCVR CHANNEL), Alinement Procedure*

(1) Connect the test equipment as shown in C, figure 4-5.

(2) Install the RCVR SIG control knob and rotate it fully clockwise.

(3) Adjust the sweep generator until the receiver filter response is cetrally displayed on the oscilloscope.

(4) With the air of the markers, adjust the RCVR SIG control until the maximum amplifier (center) of response is tuned to exactly 405 MHz as shown on the oscilloscope.

**NOTE**

Do not move the RCVR SIG control beyond this step.

(5) Loosen the two setscrews using using the flexible shaft, turn the tape clockwise until 410 is in line with the calibration mark

(6) Holding the channel frequency indicator tape firmly in place tighten the two setscrews to secure the flexible shaft.

(7) Check the alinement of the tape every 20 channels down to channel 40. Check to see that the indicated channel and the frequency are in the following relationship, ± one half inch from the calibration mark

Channel number = 2 (Frequency (MHz) –200)

$$\text{Frequency (MHz)} = \frac{\text{Channel Number}}{2} + 200)$$

**NOTE**

When the RCVR SIG control is tuned to channel 70, set the XMTR DUPL control to channel 410.

(8) If at any point the alinement is off, adjust the shaft slightly at that frequency and repeat (7) above.

c. *Channel Frequency Indicator 2A1A1A1DS2 (XMTR DUPL), Alinement Procedure.*

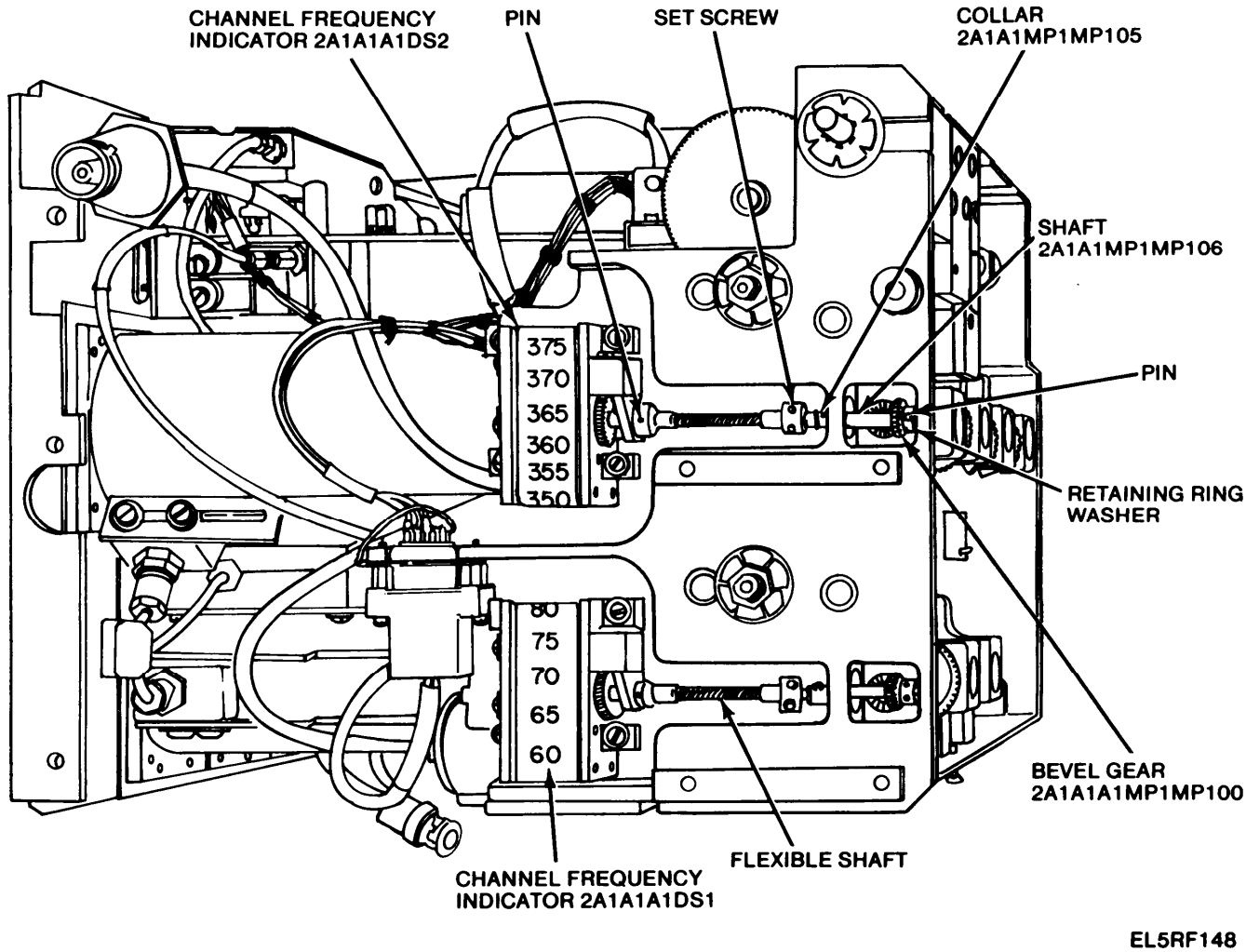



*Figure 2-5. Receiver Rf Head Front View with Front Panel Removed AM-4316/GRC-103(V).*

(1) Connect the test equipments shown in C, figure 4-5.

(2) Install the XMTR DUPL control knob and rotate it fully clockwise.

(3) Adjust the sweep generator until the transmitter filter response is centrally displayed in the oscilloscope.

(4) With the aid of the markers, adjust the XMTR DUPL control until the maximum amplitude (center) of the response is tuned to exactly 405 MHz as shown on the oscilloscope.

**NOTE**

Do not move the XMTR DUPL control beyond this point.

(5) Proceed with b(6) through (8) above.

**NOTE**

When the XMTR DUPL control is tuned to channel 70, set the RCVR SIG control to channel 410.

### 2-30. Replacement of Channel Frequency Indicators 2A1A1DS1 and 2A1A1DS (AM-4316A/GRC-103(V))

*a. Removal and Replacement Procedure (fig. 2-6).*

(1) Remove control panel 2A1MP2 as described in paragraph 2-26.

(2) Remove the three red-circled mounting screws that secure the defective channel frequency indicator to the chassis.

(3) Grasp the channel frequency indicator and slide it sideways to disengage the flexible shaft from the coupling shaft.

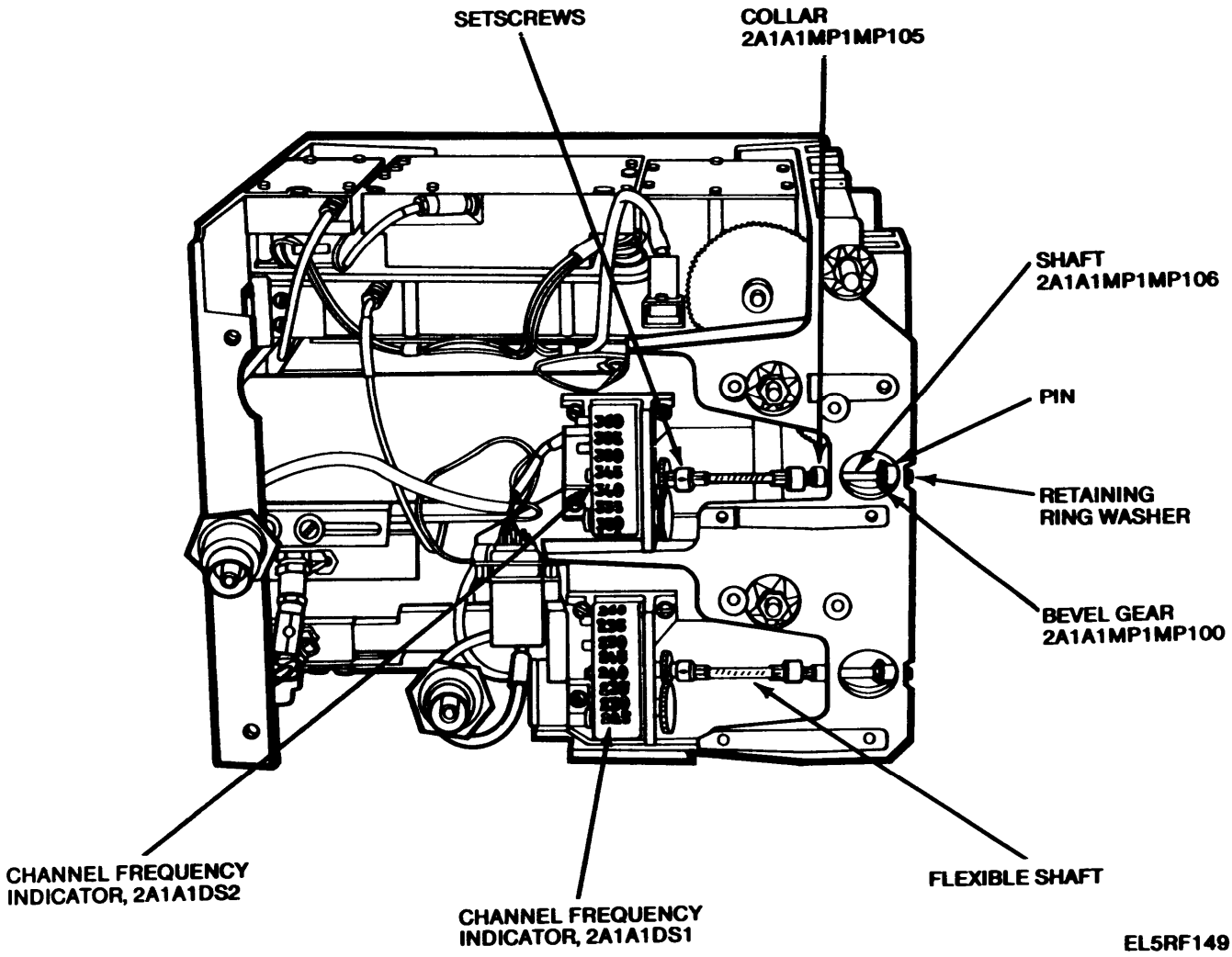



*Figure 2-6. Receiver Rf Head Front View With Front Panel Removed AM-4316A/GRC-103(V).*

**NOTE**

The two setscrews in (4) below are held in place by Loctite. Melt the Loctite before loosening the screws.

(4) Loosen the two setscrews securing the flexible shaft at the frequency indicator.

(5) Install the flexible shaft on replacement channel frequency indicator.

(6) Slip the other end of the flexible shaft over the coupling shaft. Slide the assembly in position and secure with three screws.

**NOTE**

Apply Loctite to flexible shaft setscrews after alinement (b. below).

*b. Channel Frequency Indicator 2A1A1DS1 (RCVR CHANNEL) Alinement Procedure.*

(1) Connect the test equipment as shown in C, figure 4-5.

(2) Install the RCVR SIG control knob and rotate it fully clockwise.

(3) Adjust the sweep generator until the receiver filter response is centrally displayed on the oscilloscope.

(4) With the aid of the markers, adjust the RCVR SIG control until the maximum amplitude (center) of response is tuned to exactly 405 MHz as shown on the oscilloscope.

**NOTE**

Do not move the RCVR SIG control beyond this step.

(5) Loosen the two setscrews, and using the flexible shaft turn the tap clockwise until 410 is in line with the calibration mark.

(6) Holding the channel frequency indicator tape firmly in place, tighten the two setscrews to secure the flexible shaft.

(7) Check the alinement of the tape every 20 channels down to channel 40. Check to see that the indicated channel and the frequency are in the following relationship:

Channel number = 2 (Frequency (MHz) –200)

$$\text{Frequency (MHz)} = \left(\frac{\text{Channel Number}}{2} + 200\right)$$

**NOTE**

When the RCVR SIG control is tuned to channel 70, set the XMTR DUPL control to channel 410.

(8) If at any frequency the corresponding channel number is more than ½ inch from the calibration mark, adjust the tape slightly and repeat (7) above.

c. *Channel Frequency Indicator 2A1A1DS2 (XMTR DUPL) Alinement Procedure.*

(1) Connect the test equipment as shown in C, figure 4-5.

(2) Install the XMTR DUPL control knob and rotate it fully clockwise.

(3) Adjust the sweep generator until the transmitter filter response is centrally displayed in the oscilloscope.

(4) With the aid of the markers, adjust the XMTR DUPL control until the maximum amplitude (center) of the response is tuned to exactly 405 MHz as shown on the oscilloscope.

**NOTE**

Do not move the XMTR DUPL control beyond this point.

(5) Perform procedures given in *b(6),* (7) and (8) above.

**NOTE**

When the XMTR DUPL control is tuned to channel 70, set the RCVR SIG control to channel 410.

## 2-31. Replacement of Rotary Switch 5TR1A1S1

*a.* Replacement of switch 5TR1A1S1 is a fourth order removal. Electrical frequency synthesizer 5TR1A2, power supply 5TR1PS1, and alarm control 5TR1A3 must be removed first.

*b.* Remove 5TR1A2, 5TR1PS1 and 5TR1A3 as described in TM 11-5820-540-30 and chapter 6, TM 11-5820-540-12.

*c.* On the front panel, loosen the two screws in the switch control knob, and remove the knob.

*d.* Locate switch 5TR1A1S1. Loosen and remove the nut that secures 5TR1A1S1 to the front panel. Remove the switch from the mounting hole.

*e.* Unsolder and tag the wires from switch 5TR1A1S1. Refer to FO-5 or FO-6, as applicable.

*f.* Remove diode CR1 and resistor R3 from the defective switch. Check the diode and the resistor and install them in their correct positions on the replacement switch.

*g.* Refer to FO-5 or FO-6, as applicable and use wire of similar gauge to that on the defective switch to interconnect all switch contacts necessary to complete circuit, with the exception of wires removed in e above.

*h.* Position the replacement switch in its mounting hole. Connect and solder the wires, removed in e above, to their appropriate terminals.

*i.* Secure the switch with the hexagon nut and the lockwasher.

*j* Replace the front panel knob and secure it in position with its two setscrews.

*k.* Reinstall 5TR1A2, 5TR1PS1, and 5TR1A3 as described in TM 11-5820-540-30 and chapter 6, TM 11-5820-540-12.

## 2-32. Replacement of INPUT Control 5TR1A1R1

*a.* Replacement of INPUT control 5TR1A1R1 is a third order removal. Electrical frequency synthesizer 6TR1A2 and power supply 5TR1PS1 must be removed first.

*b.* Remove 5TR1A2 and 5TR1PS1 as described in TM 11-5820-540-30.

*c.* Locate 5TR1A1AR1 (TM 11-5820-540-30). Unsolder and tag the wires from the defective 5TR1A1R1.

*d.* Loosen the two setscrews in the front panel knob and remove the knob.

*e.* On the front panel, loosen and remove the hexagon nut that secures R1, and remove the potentiometer.

*f.* Remove resistor R2 from the defective potentiometer 5TR1A1R1. Install resistor R2 on the replacement potentiometer.

*g.* Install the replacement potentiometer in the mounting hole and secure it with the nut provided.

*h.* Connect and solder the wires removed in c. above.

*i.* Rotate the potentiometer fully clockwise; replace the front panel knob in position with the indicator dot opposite the last calibration point at the HIGH end; secure the knob in position with its two setscrews.

*j.* Replace 5TR1A2 and 4TR1PS1 as described in TM 11-5820-540-30.

### 2-33. Replacement of Meter 5TR1A1M1

*a.* Replacement of meter 5TR1A1M1 is a third order removal. Electrical frequency synthesizer 5TR1A2 and power supply 5TR1PS1 must be removed first

*b.* Remove 5TR1A2 and 5TR1PS1 as described in TM 11-5820-540-30.

c. Locate meter 5TR1A1M1 (TM 11-5820-540-30). Unsolder and tag the wires from the defective meter.

*d.* Loosen and remove the four mounting screws and nuts and remove the meter.

*e.* Position the replacement meter and secure with the four nuts and screws.

*f.* Connect and solder the wires removed in c. above.

g. Replace 5TR1A2 and 5TR1PS1 as described in TM 11-5820-540-30.

### 2-34. Replacement of Push Switch 5TR1A1S2

a. Place radio transmitter 5TR1 bottom side up and locate push switch 5TR1A1S2.

*b.* Unsolder and tag the three wires from 5TR1A1S2.

c. Remove the nut and washer that secure 5TR1A1S2 to the front panel. Remove 5TR1A1S2.

*d.* Connect terminals 2 and 4 of the replacement switch together using a short piece of wire of similar gauge to that used on the defective switch.

e. Install the new switch and secure it with nut and washer. Connect and solder the wires removed in *b.* above.

### 2-35. Replacement of Rotary Switch 5TR1A1S3

*a.* Place radio transmitter 5TR1 top side up and locate rotary switch 5TR1A1S3.

*b.* Remove the control knob by unscrewing its two setscrews.

*c.* Remove the nut and washer securing 5TR1A1S3 to the chassis. Pull the switch free of 5TR1.

*d.* Unsolder and tag the wires from 5TR1A1S3. Remove 5TR1A1S3.

*e.* Connect and solder the wires removed in *d.* above to the replacement switch

*f.* Install the switch in its mounting hole and secure it with the nut and washer. Replace and secure the control knob.

### 2-36. Replacement of Circuit Breaker 5TR1A1CB1

*a* Place radio transmitter 5TR1 bottom side up and locate circuit breaker 5TR1A1CB1.

*b.* Locate and remove the electrical frequency synthesizer 5TR1A2 as described in TM 11-5820-540-30.

*c.* Remove and discard the insulating tubing on the circuit breaker 5TR1A1CB1 terminals.

*d* Unsolder and tag the wires from 5TR1A1CB1 terminals.

*e.* Loosen and remove the hexagonal nut and washer that secure the circuit breaker to the tint panel. Remove 5TR1A1CB1.

*f.* Install the replacement circuit breaker in its mounting hole and secure it with the hexagonal nut and washer.

g. Remove approximately 1 inch of insulation from the ends of the wires to be connected to the circuit breaker.

*h.* Place a suitable length of heat shrinkable tubing type CMC 334-362/3 over each wire.

*i.* Wrap the wires around both sides of the hook in the terminals on the circuit breaker. Ensure a good mechanical connection and that the wires are connected to the correct terminals with regard to LOAD and LINE.

*j.* Solder the leads to the terminals.

*k.* Position the heat shrinkable tubing on the wires, over the terminals and using a thermogun, shrink the tubing to fit snugly over the terminals.

*l.* Replace electrical frequency synthesizer 5TR1A2 as described in TM 11-5820-540-30.

### 2-37. Repair of Electrical Connector Assembly 5TR1A1A1 Components

For repair and replacement of connectors and wires in electrical connector assembly 5TR1A1A1 (FO-5 or FO-6, as applicable). Refer to paragraphs 2-8 and 2-10.

### 2-38. Removal of Distribution Box 5A2A1 and Radio Interference Filter 5A2FL1

**NOTE**

Distribution box 5A2A1 must be removed to repair or replace the associated plugs and wiring.

*a* Remove centrifugal fan 5A2B1 and temperature control-monitor 5A2A2 (CY-4637NGRC-103 (V) only) (TM 11-5820-540-30).

*b.* Remove the four screws securing J6 (XAR1A2A3P1) to the case.

**NOTE**

To ensure correct alinement when replacing plug J6, note the order in which the washers or shims are placed under J6.

c. Remove the four screws securing the diaphragm to case partition; slide the diaphragm back on the cable.

*d.* At the rear of case, remove the eight screws securing radio interference filter 5A2FL1 and distribution box 5A2A1 to case.

e. Remove the cable assembly by pulling J6 through the slot in the case partition.

*f.* Replace the cable assembly by feeding J6 and the cable through the slot in the case partition. Position the shims and washers under J6 in the order noted in *b.* above. Secure J6 with the four screws provided.

g. Position radio interference filter 5A2FL1 and distribution box 5A2A1 and secure them with the screws provided.

*h.* Replace and secure the diaphragm to the case partition.

*i.* Replace centrifugal fan 5A2B1 and temperature control monitor 5A2A2 (CY-4637A/GRC-103 (V) only) (TM 11-5820-540-30).

### 2-39. Replacement of Circuit Card Assembly 6AR1A2A2

*a.* Locate circuit card assembly 6AR1A2A2. Remove the elapsed time indicator by pulling it straight away from the printed circuit board.

*b.* Unsolder and tag the wires from connecting pins E1 through E10.

**NOTE**

Measure the resistance between TP5 and TP7 of replacement circuit card assembly 6AR1A2A2. If gold-plated cavities are used in the output stage of amplifier 6AR1, this resistance should be 5.1 ohms ±5%. If nickel-plated cavities are used, the resistance should be 4.7 ohms ±5%. If necessary, replace resistor R2 with the appropriate resistor, 4.7 ohms (P/N RWR 89S4R70DR, NSN 5905-01-009-1878) or 5.1 ohms (P/N RWR 69V5R1 or RWR 89S5R11FS, NSN 5905-01-173-8930).

d. Position replacement board 6AR1A2A2 and secure it with the four screws provided.

e. Connect and resolder the wires removed in *b.* above.

*f.* Reinstall the elapsed time indicator in its sockets.

### 2-40. Removal of Connector-Filter Assembly 6AR1A2A3

Connector-filter assembly 6AR1A2A3 must be removed in order to replace the filter-connectors located nearest the 6AR1 chassis, or to repair or replace P1 (6AR1A2A3). The filter-connectors located on the side of 6AR1A2A3 which is not secured to the 6AR1 chassis, may be replaced by removing the cover plate on the side of 6AR1A2A3.

a. Locate connector-filter assembly 6AR1A2A3. Measure as accurately as possible and record the distance from front panel 6MP1 to the rear edge of 6AR1A2A3.

*b.* Remove the four red-circled screws that secure 6AR1A2A3 to the chassis.

c. Replace connector P1 or the filter-connector as required. Refer to paragraph 2-10 for replacement of connectors.

*d.* Replace 6AR1A2A3 and secure it with the four screws provided. Before tightening the mounting screws, position 6AR1A2A3 at the same distance measured in *a.* above; also check the vertical plane of connector P1 using a small square and the top edge of the 6AR1 chassis as a reference.

### 2-41. Replacement of Amplifier Assembly 6AR1A1 (Fig. 2-7)

a. *Removal Procedure.*

(1) Remove control panel 6MP1 as described in paragraph 2-45.

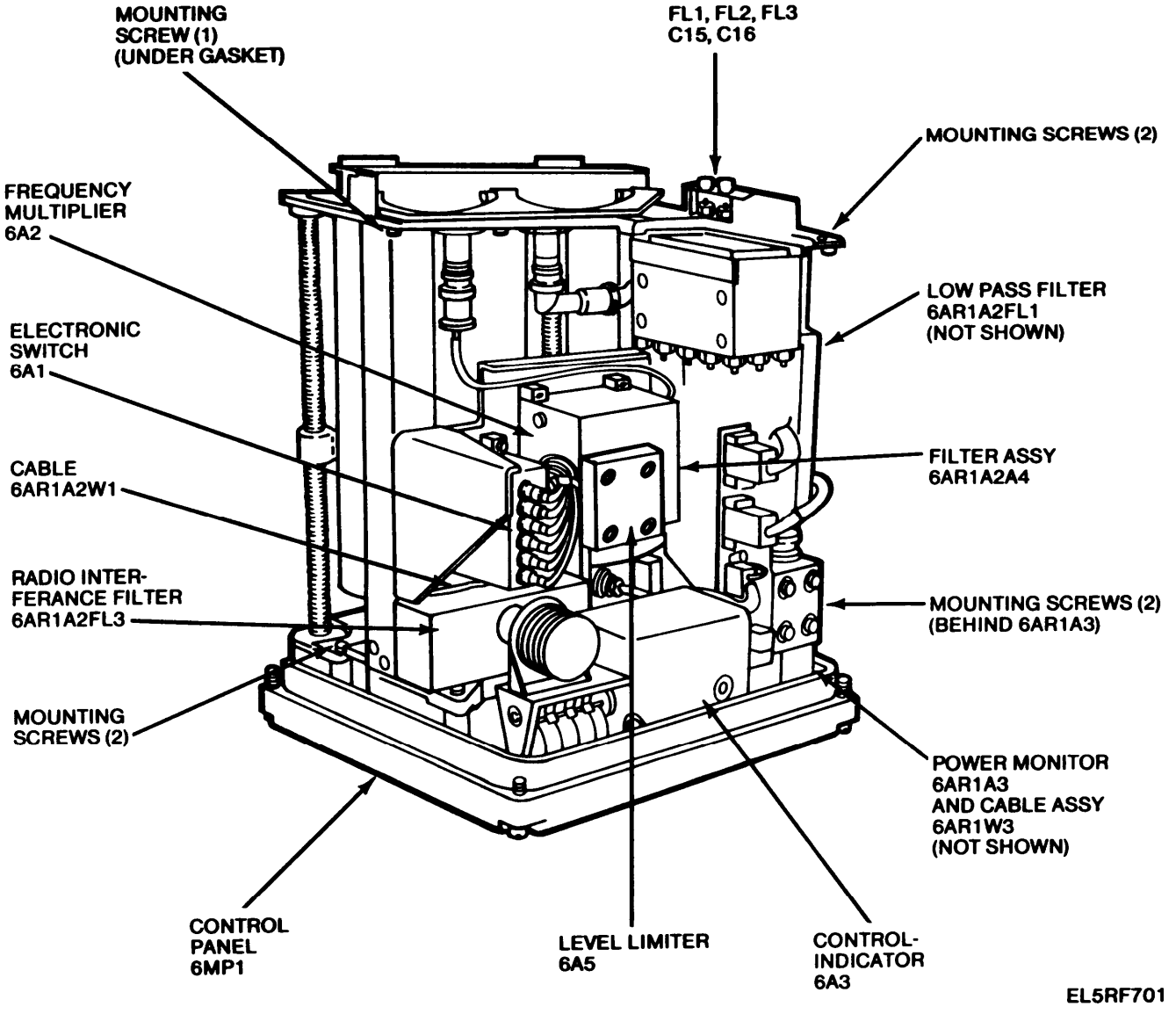



*Figure 2-7. Amplifier-Frequency MultiplierAM-4320/GRC-103(V), Top View.*

(2) Replace the XMTR TUNE control knob temporarily and tune the amplifier-frequency multiplier to channel 340. Remove the control knob.

**NOTE**

Step (3) applies only to Amplifier-Frequency Multiplier AM-4320/GRC-103(V).

(3) Locate and disconnect the three rf leads from 6A5:P1 (6W2J1), *P1 (6A5J2), and P1 (XA1J6).*

*(4)* Locate and disconnect the rf leads connected to electronic switch 6A1 connectors J1 through J6.

(5) Locate, loosen the screws on, and disconnect P2 (XW1J1) from 6W1J1.

**NOTE**

Remove cable lacing located to the rear of 6A1 and 6A2 as necessary to free the leads. Note the manner that the cables were laced for later relating.

**CAUTION**

Do not move the XMTR TUNE control shaft, the flexible drive shaft, or the drive shaft of multiplier 6A2.

(6) Locate and loosen the four red-circled screws that secure frequency multiplier 6A2 to the chassis. Carefully slide the 6A2 away from the front panel to disengage the flexible drive shaft. Remove frequency multiplier 6A2.

(7) Locate and disconnect rf cables P1 (XAR1A1J2) and P2 (XAR1A1J1) from J2 and J1 of 6AR1A1.

(8) Locate and disconnect rf leads P1 (6AR1A2A4J2) and P2 (6AR1A2A4J4) from filter 6AR1A2A4.

(9) Locate, unsolder, and tag the two wires (part of 6W1) from capacitors C13 and C14 on the 6AR1A1 front panel. Carefully pull the wires out of the panel from the rear of the panel.

**CAUTION**

Do not disturb the wires that lead from C13 and C14 to the center of the cavity drive gears.

(10) Release cable 6W1 by removing the mounting screw of the cable clamp located between electronic switch 6A1 and filter 6AR1A2FL3.

(11) Locate and remove the mounting screw that secures filter 6AR1A2FL3 to the front panel of 6AR1A1.

(12) Locate, loosen the screws on, and disconnect P1 (XW1J3) from 6W1J3.

**NOTE**

On some Amplifier-Frequency Multiplier AM-4320/GRC-103 (V), a special cable assembly 6AR1W3 is used and is secured under the power monitor 6AR1A3 by one of the mounting screws that secure chassis 6AR1A2 to amplifier assembly 6AR1A1. Loosen the mounting screw and remove cable 6AR1W3.

(13) Locate and disconnect rf cable P2 (XAR1A3J1) from 6AR1A3J1.

(14) Locate and remove the four red-circled mounting screws that secure power monitor 6AR1A3 to chassis 6AR1A2. Remove 6AR1A3.

(15) Locate and loosen the two green-circled screws that secure lowpass filter 6AR1A2FL1. Remove 6AR1A2FL1.

(16) Locate, unsolder, and tag the five wires connected to the 6AR1A2 chassis side of FL1, FL2, FL3, C15, and C16 which are mounted on the rear panel of 6AR1A1.

(17) Locate and remove the seven mounting screws that secure amplifier assembly 6AR1A1 to chassis 6AR1A2. One of the screws is located under the upper right-hand corner of the rubber gasket on the 6AR1A1 rear panel.

(18) Carefully lift and tilt the 6AR1A2 chassis toward the right-hand cavity of 6AR1A1 and remove the cable lacing joining the cavity rf lead to cable 6W1. Be sure that the cavity rf leads are free from the 6AR1A2 chassis.

(19) Carefully lift the 6AR1A2 chassis up and away from Amplifier Assembly 6AR1A1.

*b.* Replacement Procedure.

(1) Be sure that amplifier assembly 6AR1A1 is tuned to channel 340.

(2) Carefully place electronic chassis 6AR1A2 into amplifier assembly 6AR1A1. With the 6AR1A2 chassis tilted toward the right hand cavity, use lacing twine to loosely tie the left-hand cavity rf lead to the two loose wires from cable 6W1, with the loose end of the rf head up, and the loose ends of the 6W1 wires down.

**NOTE**

Be sure that the left-hand cavity rf lead is routed to the rear over the cavity and under the left side of the 6AR1A2 chassis, that the right hand cavity rf lead is routed upward, that the 6W1 wires are routed downward between, and in front of the cavities, and that the loose wires at the right rear corner of the 6AR1A2 chassis are not caught between the chassis and the rear panel of amplifier assembly 6AR1A1.

(3) Carefully lower the 6AR1A2 chassis until it is alined with the mounting screw holes used to secure the chassis to amplifier assembly 6AR1A1.

(4) Secure the 6AR1A2 chassis to the 6AR1A1 amplifier assembly with the eight (or seven, if. cable 6AR1W3 is to be used) mounting screws provided.

(5) Reconnect and solder the three wires, disconnected and tagged in *a,* (16) above, to the 6AR1A2 chassis side of FL1, FL2, and FL3 on the 6AR1A1 rear panel.

(6) Using suitable lengths of heat shrinkable tubing, reconnect, solder, and insulate the wire and jumper wire to the 6AR1A2 chassis end of C15 and C16 on the 6AR1A1 rear panel. Use a thermogun to shrink the tubing over the connections and the bodies of Cl 5 and C16.

(7) Install power monitor 6AR1A3 (and cable 6AR1W3, if used) to the 6AR1A2 chassis with the mounting screws provided. Do not tighten the four red-circled screws at this time.

(8) Reconnect and secure plug P1 (XW1J3) to 6W1J3.

(9) Install and secure lowpass filter 6AR1A2FL1 with the two green-circled captive screws.

(10) Reconnect rf cable P2 (XAR1A3J1) to 6AR1A3J1.

(11) Reconnect rf cable P1 (XAR1A1J2) to 6AR1A1J2.

(12) Route the two wires from cable 6W1 through the amplifier assembly 6AR1A1 front panel holes provided and reconnect and solder them to C 13 and C 14. Pull the two wires through the lacing (b. (2) above) as required to provide a stress loop at C13 and C14.

(13) Resecure cable 6W1 between electronic switch 6A1 and filter 6AR1A2FL3 with the mounting screw and cable clamp provided.

(14) Reconnect rf lead P1 (6AR1A2A4J2) to 6AR1A2A4J2 and rf lead P2 (6AR1A2A4J4) to 6AR1A2A4J4.

(15) Carefully slide frequency multiplier 6A2 toward the front panel and engage the flexible drive shaft.

**CAUTION**

Be sure that the multiplier drive shaft and flexible drive shaft do not rotate.

(16) Position and secure frequency multiplier 6A2 with the four red circled captive screws provided.

(17) Reconnect and secure P2 (XW1J1) to 6W1J1.

(18) Reconnect the rf leads to electronic switch 6A1 as indicated below

| *Rf lead* | *Connects to* |
|---|---|
| P4 (XA1J1) | J1 (6A1) |
| P3 (XA1J2) | J2 (6A1) |
| P2 (XA1J3) | J3 (6A1) |
| P1 (XA1J4) | J4 (6A1) |
| P2 (XA1J5) | J5 (6A1) |
| P1 (XA1J6) | J6 (6A1) |

(19) Reconnect the rf leads from power level control 6A5 (if used), P1 (6W2J1) to 6W2J1 and P1 (6A5J2) to 6A5J2.

(20) Using lacing twine, tie the rf leads from electronic switch to cable P2 (XWIJ1), and tie the rf leads from amplifier assembly 6AR1A1 and connector assembly 6AR1A2A3 together and also to chassis 6AR1A2.

(21) Replace control panel 6MP1 as described in paragraph 2-45.

### 2-42. Replacement of Filter Assembly 6AR1A2A4 (Fig. 2-7)

*a.* Removal Procedure.

(1) Separate amplifier assembly 6AR1A1 from chassis 6AR1A2 as described in paragraph 2-41 *a.(1)* through (15).

(2) Disconnect rf leads from filter assembly 6AR1A2A4; P2(6AR1A2A4J1) and P1 (6AR1A2A4J3).

(3) Unsolder and tag the two wires from FL1 and FL2 (6AR1A2A4).

(4) Continue 6AR1A1/6AR1A2 separation as described in paragraph 2-41a (17) and (18).

(5) While chassis 6AR1A2 is tilted (para. 2-41 a. (18)), remove the two mounting screws that secure filter assembly 6AR1A2A4. Remove 6AR1A2A4.

*b. Replacement Procedure.*

(1) Install and secure replacement filter assembly 6AR1A2A4 with the two mounting screws provided.

(2) Install amplifier assembly 6AR1A1 on chassis 6AR1A2 as described in paragraph 2-41 *b.* (1) through (4).

(3) Reconnect and solder the two wires to FL1 and FL2 of 6AR1A2A4. Connect the two rf leads to 6AR1A2A4: P2(6AR1A2A4J1) to J1 and P1 (6AR1A2A4J3) to J3.

(4) Continue 6AR1A1/6AR1A2 reassembly as described in paragraph 2-41 *b.(7)* through (21).

### 2-43. Replacement of Radio Interference Filter, 6AR1A2FL3 (Fig. 2-7)

*a. Removal Procedure.*

(1) Remove control panel 6MP1 as described in paragraph 2-45.

(2) Unsolder and tag the three wires on terminals E1, E2, and E3 of filter 6AR1A2FL3.

(3) Remove the mounting screw that secures filter 6AR1A2FL3 to the front panel of amplifier assembly 6AR1A1.

**NOTE**

If the two nuts securing 6AR1A2FL3 cannot be removed, and replaced, with available tools then amplifier assembly 6AR1A1 must be removed as described in paragraph 2-41. Replace amplifier 6AR1A1 after replacing filter 6AR1A2FL3.

(4) Remove the two nuts and washers that secure falter 6AR1A2FL3 to chassis 6AR1A2. Remove 6AR1A2FL3.

*b. Replacement Procedure.*

(1) Install and secure filter 6AR1A2FL3 with the mounting screw and two nuts and washers provided.

(2) Place a suitable length of heat shrinkable tubing over each of the three wires.

(3) Reconnect and solder the wires to E1, E2, and E3 of filter 6AR1A2FL3.

(4) Position the shrinkable tubing to cover the connections and terminals and use a thermogun to shrink the tubing as positioned.

(5) Replace control panel 6MP1 as described in paragraph 2-45.

### 2-44. Replacement of Channel Frequency Indicator6AR1A1DS1

*a. Removal and Replacement Procedure.*

(1) Remove control panel 6MP1 as described in paragraph 2-45.

(2) Remove the red-circled mounting screws that secure the defective channel frequency indicator to the chassis.

(3) Grasp the channel frequency indicator and slide the unit sideways to disengage the flexible shaft. Remove the defective channel frequency indicator.

(4) Remove the flexible shaft from the defective channel frequency indicator.

**NOTE**

The two setscrews in the flexible shaft are held in place with Loctite. Melt the Loctite before loosening the setscrews.

(5) Install the flexible shaft to the replacement channel frequency indicator.

(6) Slip the other end of the flexible shaft over the hexagonal shaft. Place the channel frequency indicator in position on the chassis and secure it with the mounting screws.

(7) Position the flexible shaft equally between the channel frequency indicator and the hexagonal shaft. Secure the flexible shaft to the channel frequency indicator with the two setscrews. Lock the setscrews as described in paragraph 2-13.

(8) Loosen the mounting screws, remove the charnel frequency indicator from the chassis and proceed with alinement procedures described in *b.* below.

*b. Alinement Procedure.*

(1) Connect plug P1 (6W1J2) at the end of control-indicator 6A3 cable to connector 6W1J1.

(2) Set the XMTR CHANNEL control to channel 320.

(3) Connect the transmitter rf head to the test facility as shown in figure 4-26.

(4) Set the test facility switches as follows:

| *Switch* | *Switch position* | *Normal indication* |
|---|---|---|
| S1 | ON | |
| S20 | S12 | |
| S12 | OSC | Test facility meter M1 indicates between 25% and 90% of full scale deflection. |

(5) Check the 115 Vac on the power supply (part of the accessory kit); adjust if required.

(6) Set the test facility switches as follows:

| *Switch* | *Switch position* | *Normal indication* |
|---|---|---|
| *S12* | DBLR | M1 indicates between 25% and 90% of full scale |
| S12 | MULT | M1 indicates between 25% and 90% of full scale |
| S13 | ON | |

(7) Recheck 115 Vac on the power supply; readjust if required

(8) Install the XMTR TUNE control knob and tune for maximum ouput at 370 MHz.

(9) Set test facility switch S12 to the DRIVER position. Push in the PWR OUT PEAK control and tune for maximum indication on meter Ml. Meter Ml should indicate between 25 percent and 90 percent of full scale.

(10) Set test facility switch S12 to the PWR OUT position. Pull out the PWR OUT PEAK control and tune for maximum indication on meter Ml. The meter should indicate between 25 percent and 90 percent of full scale.

(11) Set test facility switch S1 to OFF.

**NOTE**

Do not move the XMTR TURN control after the power amplifier has been peaked

(12) On the replacement channel frequency indicator 6AR1A1DS1, rotate the flexible shaft clockwise until 320 is in line with the calibration mark (notch) on the frame.

(13) Hold the channel frequency indicator tape firmly and slip the flexible shaft over the hexagonal-ended shaft Secure 6AR1A1DS1 to the chassis with the mounting screws provided

**NOTE**

The flexible shaft may have to be moved slightly while installing the assembly to fit the hexagonal-ended shaft

(14) Set test facility switch S1 to ON. Readjust the XMTR TUNE and PWR OUT PEAK controls for maximum output. Check to see that the channel frequency indicator number 320 is not more than one-eighth inch above or below the calibration mark (notch) on 6AR1A1DS1. If necessary, remove 6AR1A1DSl and readjust the tape position.

(15) Set the XMTR TUNE and XMTR CHANNEL controls to indicate channel 40 in line with the calibration mark.

(16) Set test facility switch S12 to the DRIVER position. On the transmitter rf head, push the PWR OUT PEAK control and tune for maximum meter indication on test facility meter M1.

(17) Set switch S12 to PWR OUT. Pull out the PWR OUT PEAK control and tune for maximum reading on meter M1. The level measured by the wattmeter should be greater than 35 watts.

(18) Repeat (15) through (17) above for channels 100,200, and 410. Check to see that the number of the channel being checked is not more than ½-inch above or below the calibration mark

(19) Restore the test facility switches to normal and disconnect plug P1 (6W1J2) from connector 6W1J1.

(20) Install control panel 6MP1 as described in paragraph 2-45.

### *2-45.* Replacement of Control Panel 6MP1

*a Removal Procedure.*

*(1)* Remove the XMTR TUNE and the PWR OUT PEAK control knobs.

(2) Remove the hexagon nut and washer from the PWR OUT connector.

(3) Loosen the two screws that secure plug P1 (6W1J2) to its mating connector 6W1J2 (TM 11-5820-540-30) and disconnect the plug.

(4) Loosen and remove the six mounting screws located at the rear of the panel and remove control panel 6MP1.

*b. Replacement Procedure.*

(1) Loosen, but do not remove, the four red-circled screws that secure Power Monitor 6AR1A3 to chassis 6AR1A2.

(2) Place control panel 6MP1 in position and secure it with the six mounting screws provided

(3) Connect plug P1 (6W1J2) of the control-indicator 6A3 cable to connector 6W1J2. Secure the plug in position with the two screws provided

(4) Replace and secure the nut and washer to the PWR OUT connector. Tighten the power monitor 6AR1A3 mounting screws. Install the XMTR TUNE and PWR OUT PEAK control panel knobs.

### 2-46. Replacement of Order Wire (Unit *9)*

For removal and replacement procedures on order wire, see section VI (para. 2-96).

## Section III. REMOVAL AND REPLACEMENT PROCEDURES - BAND II RF HEAD

### 2-47. Replacement of Channel Frequency Indicator 33A1A1DS1 or 33A1A1DS2

*a.* Remove front panel 33A6 as described in paragraph 2-55.

*b.* Remove the red-circled mounting screws that secure the defective channel frequency indicator (33A1A1DS1 or 33A1A1DS2 fig. 4-62) to the chassis.

c. Grasp channel frequency indicator and slide it sideways to disengage the flexible shaft. Remove the defective channel frequency indicator.

*d.* Remove the pin through the flexible shaft and remove the flexible shaft from the defective channel frequency indicator.

*e.* Install the flexible shaft on the replacement channel frequency indicator and secure with a setscrew.

*f.* Install the RCVR SIG control knob if 33 Al AI-DS1 is being replaced, or XMTR CHANNEL control knob if 33A1A1DS2 is being replaced.

*g.* Turn the control knob clockwise to the stop position.

*h.* Turn the flexible shaft, on the replacement channel frequency indicator, clockwise until the start position, indicated by an arrow head and the letter "S," is alined with the calibration mark. The calibration mark is a notch centrally located on the front edge of the unit's frame.

*i.* Place the channel frequency indicator in position and slip the hexagonal recessed end of the flexible shaft over the coupling shaft (fig. 4-62).

*j.* If the stop position of the channel control and the start position on the tape do not coincide, proceed as follows:

(1) Loosen the setscrew in the flexible shaft

(2) Ensure that the channel control is turned fully clockwise.

(3) Adjust the tape to realine the start position as in step *h.* above.

(4) Retighten the setscrew securing the flexible shaft.

*k.* Remove the channel frequency indicator. Using the guide holes in the flexible shaft drill a hole through the channel frequency indicator shaft Press a pin through both shafts. Remove the setscrew.

*l.* Reinstall the channel frequency indicator and secure in position with the mounting screws.

### 2-48. Replacement of Connector-Filter Assembly 33A1W1A1

*a.* Place the receiver rf head rear side up and locate connector-filter assembly 33A1W1A1 (fig. 2-8).

**CAUTION**

The two locating pins on the sides of 33A1WIA1 are factory alined and should never be loosened or removed.

*b.* Remove the four screws that secure 33A1W1A1 to the chassis. Pull 33A1W1 Al free of the chassis.

*c.* Replace filter-connectors as required. Refer to paragraph 2-9 and FO-7 for replacement of filter-connectors. If the existing plug 33A1W1A1P1 is to be used, proceed to step *h.* below.

*d.* If 33A1W1A1P1 required replacement, unsolder and tag the wires from the pins.

*e.* Remove the four screws that secure 33A1W1A1P1 to the assembly remove 33A1W1A1P1 from the assembly.

*f.* Install the replacement 33A1W1A1P1 and secure it with the four mounting screws provided.

*g.* Connect and solder the wires removed in *d.* above. Refer to paragraph 2-10 and FO-7 for connections.

*h.* Place 33A1W1A1 in position on the chassis and secure it with the four screws removed in *b.* above.

### 2-49. Replacement of Terminal Board 33A1W1TB1

*a.* Remove intermediate frequency amplifier 33AR1, frequency mixer 33A7, lowpass filter 33FL1, signal level control monitor 33A5 (TM 11-5820-540-30), and power supply 33PS1 (if used) (TM 11-5820-540-12).

*b.* Locate and remove the mounting screws of chassis connectors 33A1W1J8 and 33A1W1J9. Push these connectors down through the holes provided in the bottom support

*c.* Remove the six mounting screws of the bottom support Remove the bottom support

d. Remove the two mounting screws that secure the defective terminal board to the bottom support.

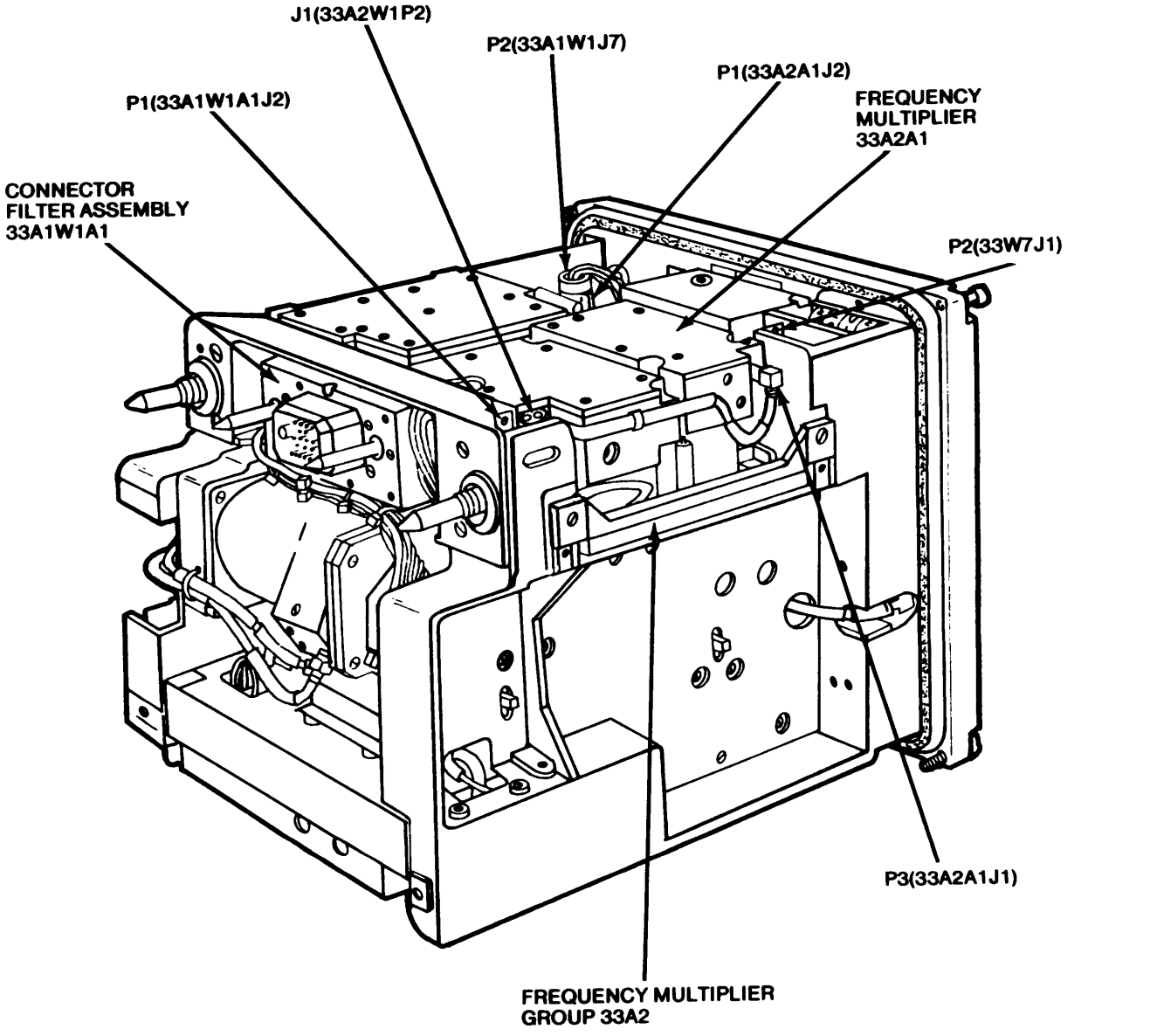



*Figure 2-8. Band II Receiver Rf Head Top and Left-Hand Side View.*

*e.* Unsolder and tag the wires attached to the terminal board 33A1W1TB1.

*f.* Solder the wires to the replacement terminal board. Refer to wiring diagram FO-7 if necessary.

*g.* Mount the replacement terminal board in its position and tighten the two mounting screws.

*h.* Place the bottom support in its position and pull the connectors 33A1W1J8 and 33A1W1J9 up through the holes provided. Secure the bottom support with six mounting screws.

*i.* Secure the two chassis connectors 33A1W1J8 and 33A1W1J9 to the bottom support with the mounting screws provided.

*j.* Replace 33AR1, 33A7, 33FL1, and 33A5 (TM 11-5820-540-30).

*k.* Replace 33PS1 (if used) (TM 11-5820-540-12).

### 2-50. Replacement of Speed Decreaser Gear Assembly 33A1MP1

*a.* Loosen the screws in the MULT PEAK knob on the front panel. Remove the knob.

*b.* Loosen the two screws in the coupling shaft that secure the speed decreaser gear assembly shaft

c. Place the receiver rf head right side up and locate the speed decreaser gear assembly 33A1MP1. Unscrew the three red-circled screws and remove the speed decreaser gear assembly 33A1MP1.

*d.* To install replacement speed decreaser gear assembly 33A1MP1, rotate the MULT PEAK shaft until the speed decreaser gear shaft will fit into the coupling shaft when speed decreaser gear assembly 33A1MP1 is placed in position over the three mounting holes. The MULT PEAK shaft should project from the hole in the front panel.

*e.* Tighten the three red-circled mounting screws.

*f.* Tighten the two screws in the coupling shaft

*g.* Replace and secure the MULT PEAK knob.

*h* Aline the amplifier-converter unit 33 as described in paragraph 4-19 *d.*

**NOTE**

It should not be necessary to perform the alinement procedures of the voltage control assembly 33A1A2.

### 2-51. Replacement of Frequency Multiplier Group 33A2

*a.* Place the receiver rf head upright and locate the multiplier group 33A2 (fig. 2-10).

*b.* Disconnect rf leads P1 (33 A1W1A1J2) and P2 (33W7J1) (fig. 2-8) from their respective connectors.

c. Locate and loosen the two screws that secure P3 (33A1W1J7) (fig. 2-8) to chassis connector 33A1W1J7. Disconnect P2 (33A1W1J7) plug.

*d.* If the flexible type coupling shaft is used, loosen the two setscrews that secure it to the multiplier group drive shaft. Apply heat to soften the sealant on the setscrews.

*e.* Place the receiver rf head right side up. Locate and unscrew four red-circled mounting screws securing the multiplier group 33A2.

*f.* Place the receiver rf head left side up. Locate and unscrew the remaining two red-circled mounting screws securing the multiplier group 33A2.

**NOTE**

Be sure that the rigid rf lead is not damaged or bent while removing or installing 33A2.

*g.* Lift the frequency multiplier group 33A2 straight up.

*h.* To install replacement frequency multiplier group 33A2, loosen the clamp on gear A (fig. 4-62) and disengage gear A from the speed decreaser drive gear. Lower the multiplier group straight down into its mounting position after rotating the MULT PEAK control so that the multiplier group drive shaft fits into the coupling shaft.

*i* Replace and tighten the two red-circled screws securing the module to the left side of the chassis. Tighten the setscrews in the coupling shaft, if the flexible type coupler is used. Replace and tighten the four remaining red-circled screws securing the module to the right side of the chassis.

*j.* Connect rf leads P1 (33A1W1A1J2) and P2 (33W7J1) to their respective connectors.

*k.* Connect plug P2 (33A1W1J7) to chassis connector 33A1W1J7 and secure in position with the screws provided.

*l.* Realine the band II receiver rf head as described inparagraph 4-19 d.(1).

### 2-52. Replacement of Frequency Multiplier 33A2A1

a. Set the receiver rf head RCVR SIG control to channel 390.

*b.* Turn the MULT PEAK control so that the red mark on gear B (fig. 4-65) coincides with the red mark on the casting.

*c.* Locate and loosen, but do not disconnect, rf leads P2 (33A2A2J1) and P2 (33A2FL1J1).

*d.* Locate and disconnect rf leads P3 (33A2A1J1) and P1 (33A2A1J2) from their respective connectors on frequency multiplier 33A2A1. Be sure that the rf leads are not damaged or bent.

*e.* Locate and loosen the three green-circled screws that secure frequency multiplier 33A2A2. Remove 33A2A2.

*f.* Locate and loosen the three red-circled screws that secure frequency multiplier 33A2A1.

*g.* Move frequency multiplier 33A2A1 toward the rear of the rf head and lift the module out, carefully disengaging the drive gears and disconnecting the power connector located under the module.

*h.* To install the replacement frequency multiplier 33A2A1, adjust the module drive shaft so that the red mark on the gear coincides with the red mark on the module casting.

*i.* Position frequency multiplier 33A2A1 to the rear of its mounting holes and then move the module forward, carefully engaging the gears and the connector located under the module. Tighten the three red-circled mounting screws.

*j.* Replace and secure frequency multiplier 33A2A2 with the mounting screws provided

*k. Carefully connect rf* leads P3 (33A2A1J1) to J1 of 33A2A1 and P1 (33A2A1J2) to J2 of 33A2A1. Tighten the connectors at both ends of the rf leads.

*l.* Aline multiplier group 33A2 as described in paragraph 4-33 *b.(3),* with the following exceptions:

(1) Connect receiver test facility J12 to rf head connector 33A1W1A1P1 with cable assembly CX-12061 (2W11).

(2) Disconnect P2 (33A7J2) from 33A7J2 and connect the test setup, shown in figure 4-64 as connected to 33 A2J2, to P2 (33A7J2).

(3) Disconnect PI (33A1W1A1J2) from 33A1W1A1J2.

(4) Use MULT PEAK control, and RCVR SIG control as needed, to turn shaft C (fig. 4-65).

(5) Reconnect P2 (33A7J2) to 33A7J2 and P1 (33A1W1A1J2) to 33A1W1A1J2 after alinement of 33A2.

*m.* Realine the local oscillator to the rf head as described in paragraph 4-19 *d.* (1).

## 2-53. Replacement of Bandpass Filter 33A2FL1 and Cable Assembly 33A2FL1W1 Components

*a.* Replacement of Cable Assembly 33A2FL1W1 Components.

(1) Remove frequency multiplier 33A2A1 as described in paragraph 2-52 *a.* through *g.*

(2) Tag the wires, unsolder, replace, and resolder the component(s) as described in the appropriate sections of paragraphs 2-7, 2-8, 2-10, and 2-11. Refer to FO-7 for cable 33A2FL1W1 connections.

(3) Replace frequency multiplier 33A2A1 as described in paragraph 2-52 *h.* through *m.*

*b. Removal of Bandpass Filter 33A2FL1.*

(1) Remove frequency multiplier 33A2A1 as described in paragraph 2-52 a through g.

(2) Remove bandpass filter 33A2FL1 as described for multiplier group 33A2 in paragraph 2-51 *a* through g.

c. *Replacement of Bandpass Filter 33A2FL1.*

(1) Position frequency multiplier 33A2A1 to properly engage its connector and gear and press it in place. Secure 33A2A1 with the mounting screws provided

(2) Install and secure frequency multiplier 33A2A2 with the mounting screws provided.

(3) Connect plug P1 (33A2A1J2) to J2 of 33A2A1, plug P2 (33A2A2J1) (part of 33A2W1) to J1 of 33A2A2, and plug P3 (33A2A1J1) (part of 33A2W1) to J1 of 33A2A1.

(4) Aline and check assembled multiplier group 33A2 as described in paragraph 4-23 *b.* (3).

(5) Reinstall multiplier group 33A2 as described in paragraph 2-51 *h.* through *l.*

## 2-54. Replacement of Rf power Monitor 33A3

*a.* Remove control panel 33A6 as described in paragraph 2-55.

*b.* Place the receiver rf head front side up and locate the rf power monitor 33A3 (fig. 4-62).

c. Locate and loosen the two screws that secure P1(33A1W1J3) to 33A1W1J3 (fig. 4-62). Remove P1(33A1W1J3) plug.

*d.* Loosen, but do not disconnect plug P1(33A3J2).

*e.* Locate and remove the four mounting screws that secure the rf power monitor 33A3 to the chassis.

*f.* Disconnect P2(33A3J1) and P1(33A3J2) (fig. 4-62) from the J1 and J2 connectors of 33A3.

g. Lift the rf power monitor complete with cable from the chassis.

*h.* To install the replacement module, position 33A3 in its place and loosely connect rf lead P1(33A3J2) to J2 of 33A3.

*i* Secure power monitor 33A3 in position with the four mounting screws.

j. Connect and secure P1(33A3J2) rf lead to connector J2 and P2(33A3J1) rf lead to connector J1 of rf power monitor 33A3.

k. Connect P1(33A1W1J3) plug to 33A1W1J3 chassis connector. Secure in position with screws provided.

l. Replace control panel 33A6 as described in paragraph 2-55.

**2-55. Replacement of Control Panel 33A6**

a. Place the receiver rf head top side up and locate control panel 33A6.

*b. Locate* and loosen the two screws that secure P1(33A1W1J5) to 33 A1W1J5. Remove P1(33A1W1J5).

c. Loosen the screws in the MULT PEAK, RCVR SIG and XMTR DUPL control panel knobs and remove the knobs.

*d.* Using a socket wrench, remove the two nuts and washers that secure the ANT. and FROM XMTR connectors to the control panel. Note the manner in which cable P1(33A1W1J5) is routed to control indicator 33A4.

*e.* Loosen the eight mounting screws that secure control panel 33A6 to the chassis. Remove the control panel. Be sure that the ANT. and FROM XMTR connectors are free from the control panel.

*f.* To reinstall 33A6, place the control panel over the ANT. and FROM XMTR connectors and position the panel on the chassis so that the guide pins and mounting holes are properly alined.

*g.* Secure control panel 33A6 with the eight mounting screws. Secure the ANT. and FROM XMTR connectors with the nuts and washers provided.

*h.* Replace and secure the MULT PEAK, RCVR SIG and XMTR DUPL control knobs. Make sure that the backs of the knobs clear the control panel by 1/8 inch.

*i* Route cable P1(33A1W1J5) as noted in *b.* above and connect it to 33A1W1J5 and secure the plug in position with the screws.

**2-56. Replacement of Frequency Multiplier 37A1**

*a Test Equipment and Material Required.*

| *Equipment* | *Common name* |
|---|---|
| Test Facility, Transmitter TS-2866(V)2/GRM-95(V)2. | Transmitter test facility |
| *Accessory Kit,* Test Facilities Set MK-1173(V)2/GRM-95(V)2. | Accessory kit |
| Wattmeter AN/USM-298 | Wattmeter |

*b. Removal and Replacement Procedure.*

(1) Set the transmitter rf head XMTR TUNE and XMTR CHANNEL controls to channel 1010.

(2) Place the transmitter rf head upright and locate frequency multiplier 37A1. Disconnect the 37AR1A1W1A1P2 and P1(37A1J2) rf leads connected to frequency multiplier 37A1.

(3) Locate and remove the strap and two screws that secure rf lead 37W1 to chassis 37AR1A1.

(4) Locate and loosen P2(37AR1AR1J1). Allow rf lead 37W1 to swing away from multiplier 37A1.

(5) Loosen the four red-circled screws that secure the frequency multiplier 37A1 to the chassis. Pull 37A1 straight up, carefully disengaging P1 (37AR1A1W1J2) from the chassis connector 37AR1A1W1J2. Slide 37A1 away from the front panel to disengage the flexible shaft.

**NOTE**

The 37A1 replacement module is shipped with its shaft clamped to channel 1010 (705 MHz). Remove the clamp carefully to avoid disturbing the shaft position.

(6) Lower the 37A1 replacement module into position carefully engaging the flexible shaft to its drive mechanism. Carefully engage P1(37AR1A1W1J2) to chassis connector 37AR1A1W1J2.

(7) Secure 37A1 to the chassis with the four screws provided.

(8) Reconnect rf leads 37AR1A1W1A1P2 and P1(37A1J2) to 37A1J1 and 37A1J2, respectively.

(9) Tighten rf lead P2(37AR1AR1J1) on J1 of amplifier 37AR1AR1.

(10) Replace the strap and two screws removed in (3) above.

c. *Alinement Check.*

(1) Connect the equipment as shown in figure 2-9.

(2) Direct cooling air from the AIR OUTLET of the transmitter test facility to the rear of the unit under test.

(3) With the XMTR TUNE and XMTR CHANNEL controls set to channel 1010, set the test facility switches as follows:

| *Switch* | *Switch position* | *Normal indication* |
|---|---|---|
| S1 | ON | |
| S13 | ON | |
| S20 | S12 | |
| S12 | OSC | Meter MI indicates between 20% and 90% of full scale. |

(4) Turn test facility switch S12 to PWR OUT and adjust PWR OUT PEAK control for maximum indication on the test facility meter MI.

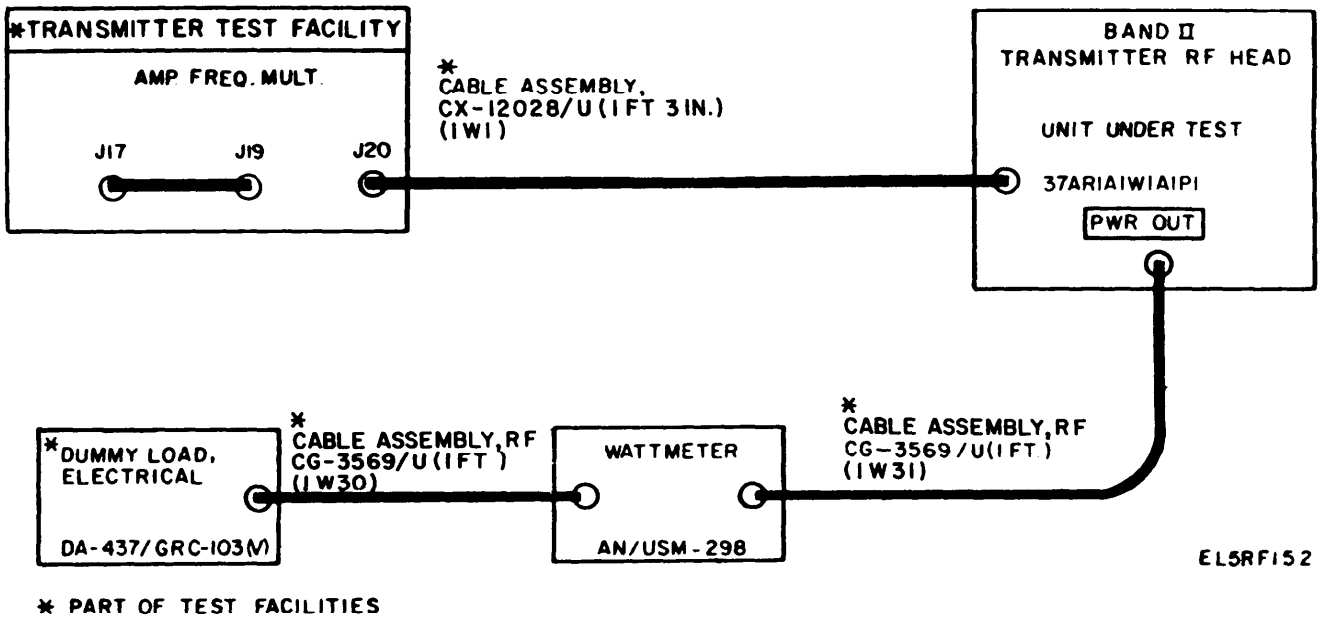



*Figure 2-9. Frequency Multiplier 37A1, Alinement Check, Test Setup.*

(5) Adjust the XMTR TUNE and PWR OUT PEAK controls for maximum indication on the wattmeter. The wattmeter should indicate at least 25 watts. The XMTR TUNE channel indication should be within 0.5 inch of the centerline of the display window.

(6) Repeat steps (4) and (5) above with the XMTR CHANNEL and XMTR TUNE controls set to channels 390, 400, 480, 560, 640, 720, 760, 800, 880, 960 and 1000 in turn.

(7) Select the channel giving the highest error above ±0.5 inch on the XMTR TUNE charnel indicator tape. Set the XMTR CHANNEL control to the channel selected.

(8) Set the test facility switch S12 to MULT and tune the XMTR TUNE control for maximum indication on the test facility meter M1.

(9) Set the test facility switch S1 to OFF and remove 37A1 as described in steps *b.(2)* through (5) above.

(10) Turn the XMTR TUNE control until the channel selected in step (7) above is within 0.5 inch of the display window center line.

(11) Repeat steps *b.(6)* through (10) to reinstall 37A1.

(12) Set the test facility switch S1 to ON and repeat step (6) above. Repeat steps (7) through (11) above as necessary.

### 2-57. Replacement of Radio Interference Filter 37AR1A1FL2

*a.* Place the transmitter rf head rightside up and locate radio interference filter 37AR1A1FL2.

*b.* Remove the two screws securing the red cover plate to the filter remove the red cover plate.

c. Unsolder and tag the three wires from connecting pins E1, E2, and E3 of filter 37AR1A1FL2.

d. Remove the two screws securing the radio interference filter and remove the filter.

*e.* Position the replacement filter and secure it with the two screws removed in *d.* above.

*f.* Remove the two screws securing the red cover plate on the replacement filter remove the red cover plate.

*g.* Place a suitable length of heat shrinkable tubing type CMC 334-362/3 over each wire to be connected to E1, E2, and E3 of 33 AR1A1FL2.

*h.* Wrap the wires around both sides of the hook terminals on the radio interference falter. Ensure a good mechanical connection and solder leads to the terminals.

*i.* Position the heat shrinkable tubing on the wires over the soldered terminals. Use a thermogun to shrink the tubing over the terminals.

*j.* Replace the red cover plate and secure with the screws removed in/l above.

### 2-58. Replacement of Control Panel 37MP1

*a. Removal Procedure.*

(1) Remove the XMTR TUNE and the PWR OUT PEAK control knobs.

(2) Remove the hexagon nut and the flat washer from the PWR OUT connector.

(3) Loosen the two screws that secure plug P1(37AR1A1W1J3) to its mating connector 37AR1 A1W1J3 and disconnect the plug.

(4) Loosen and remove the six green-circled mounting screws and washers located at the rear of the control panel, and remove the control panel.

**NOTE**

Pull the panel forward from the rf head to release it from the guiding pin.

*b. Replacement Procedure.*

(1) Place the control panel in position and press to slide home the guiding pin.

**NOTE**

It may be necessary to loosen the four screws holding the power monitor 37AR1A2 in position. Do not retighten screws at this time.

(2) Secure the control panel to the chassis using the six screws removed in *a.* (4) above.

(3) Connect Pl(37AR1A1WlJ3) of the the control indicator 37A2 to connector 37AR1A1W1J3 and secure the plug in position with the two screws provided.

(4) Replace and secure the nut and washer to the PWR OUT connector. Tighten the power monitor 37AR1A2 mounting screws.

(5) Install the XMTR TUNE and PWR OUT PEAK control panel knobs.

### 2-59. Replacement of Channel Frequency Indicator 37AR1AR1DSl

*a. Removal and Replacement Procedure.*

(1) Remove control panel 37MP1 as described in paragraph 2-58.

(2) Reconnect the XMTR TUNE knob to the shaft of the XMTR TUNE control. Turn the XMTR TUNE control fully clockwise to the stop.

(3) Locate the channel frequency indicator (fig. 2-10). Remove the three red-circled screws that secure the channel frequency indicator to the chassis.

(4) Grasp the channel frequency indicator and slide it sideways to disengage the flexible shaft from the hexagonal shaft Remove the defective channel frequency indicator.

(5) Remove the flexible shaft from the defective channel frequency indicator by removing the straight pin through the end of the shaft and loosening the two setscrews (if installed).

(6) Slide the flexible shaft on to the hexagonal shaft

(7) Turn the replacement channel frequency indicator until the white cross hatch (above charnel 1010) on the tape is alined with the calibration mark (notch) on the frame.

(8) Slide the replacement channel frequency indicator sideways to connect the shaft of the channel frequency indicator to the free end of the flexible shaft

(9) Secure the channel frequency indicator with the three screws removed in a. (3) above.

(10) Position the flexiable shaft midway between the channel frequency indicator and the hexagonal shaft Secure the flexible shaft to the channel frequency indicator using setscrews. (Do not drill and pin flexible shaft in position at this time.)

*b. Channel Alinement Check and Adjustment*

(1) Connect control indicator plug P1 (37AR1A1W1J3) on the control panel to connector 37AR1A1W1J3 on the transmitter rf head chassis.

(2) Connect the test equipment as shown in figure 2-9.

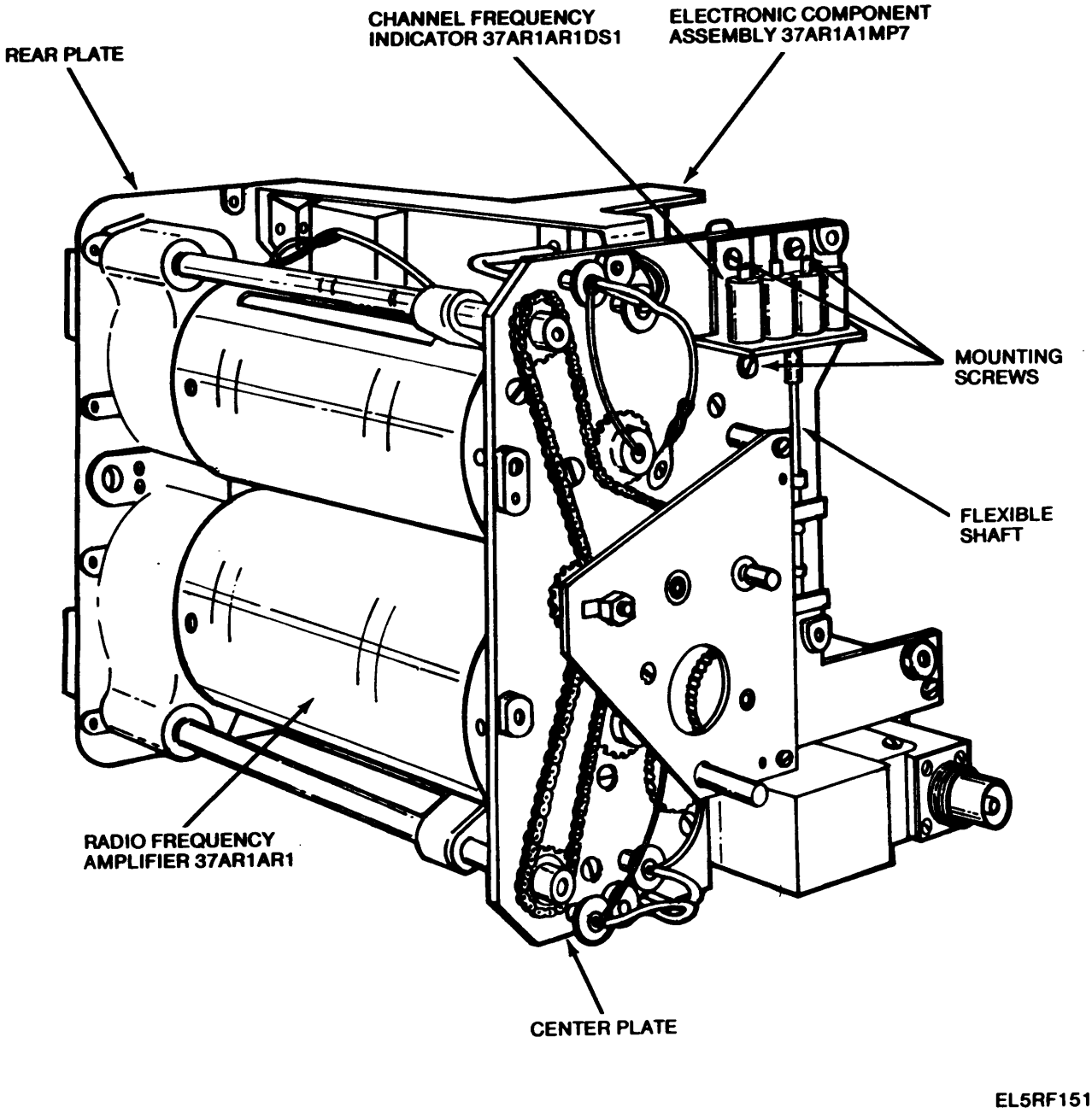



Figure 2-10. *Band II Transmitter Rf Head Front View, Front Panel Removed.*

(3) Turn XMTR CHANNEL control to channel 390 (395 MHz).

(4) Turn XMTR TUNE control to channel 390.

(5) Set test facility switches S1 to ON, S20 to S12, S12 to OSC, and S13 to ON.

(6) Install the PWR OUT PEAK knob to the shaft of the PWR OUT PEAK control.

(7) Adjust the PWR OUT PEAK control two-thirds of a rotation away from the fully clockwise position.

(8) Adjust the XMTR TUNE control for a maximum power indication on the wattmeter.

(9) Check that the PWR OUT PEAK control is capable of tuning the power output both sides of the peak power indication. Readjust the XMTR TUNE and the PWR OUT PEAK control, if necessary, to obtain this capability.

(10) Check the channel frequency indicator; channel 390 should not be more the 1/8 inch above or below the calibration mark (notch) on 37AR1AR1DS1.

**CAUTION**

Ensure that the flexible shaft does not move during the adjustment in (11) below.

(11) If the channel frequency indication is more than 1/8 inch removed from the calibration mark loosen the two setscrews holding the flexible shaft to the channel frequency indicator and adjust the channel frequency indicator until the channel indication (390) is alined with the calibration mark.

(12) Tighten the setscrews to secure the flexible shaft to the channel frequency indicator.

(13) Check the alinement at channels 450, 550, 650, 750,850 and 1000 as shown in steps (3), (4), (8), and (9) above. If the channel number of the charnel being checked is more than ½ inch above or below the calibration mark, slightly readjust as in (11) and (12) above.

(14) Drill the shaft of the channel frequency indicator shaft using the pilot hole provided. Pin the flexible shaft.

(15) Remove the XMTR TUNE and PWR OUT PEAK knobs and disconnect P1(37AR1A1W1J3) from connector 37 AR1A1W1J3. Install control panel 37MP1 as described in paragraph 2-58.

## 2-60. Replacement of Resistor Assembly 37AR1A1A2

a. Turn transmitter rf head left side up and locate resistor assembly 37AR1A1A2.

*b.* Unsolder and tag leads connected to terminal E 1.

*c.* Remove the two green-circled screws that secure the resistor assembly to the chassis; remove the resistor assembly.

*d.* Secure the replacement resistor assembly to the chassis using the two screws removed inc. above.

*e.* Place a suitable length of heat shrinkable tubing type CMC 334-362/3 over the wires removed in *b.* above.

*f.* Connect and solder the wires to the terminal E1. Position the heat shrinkable tubing on the wires over the terminal. Use a thermogun to shrink the tubing over the terminal.

## 2-61. Replacement of Connector-Filter Assembly 37AR1A1W1A1

Connector-filter 37AR1A1W1A1 must be removed in order to replace the filters next to the 37AR1 chassis, or to repair or replace 37AR1A1W1A1P1. The filters located on the side not secured to the chassis may be replaced by removing the side cover plate of 37 AR1A1W1A1.

*a.* Place the transmitter rf head 37 right side up and locate the voltage regulator assembly 37 AR1A1A1. Loosen the four green-circled screws on the voltage rgulator assembly and remove the voltage regulator assembly.

*b.* Locate the connector-filter assembly 37AR1A1W1A1. Measure as accurately as possible and record the distance from control panel 37MP1 to the rear edge of 37 AR1A1W1A1.

*c.* Remove the four red-circled screws that secure the 37 AR1A1W1A1 to the chassis and move the connector-filter carefully away from the chassis.

*d.* If the connector-filter assembly is to be changed, unsolder and tag the wires connected to the filters FL1 to FL46. Remove the defective connector-filter assembly and resolder the tagged wires to the replacement connector-falter assembly.

e. If a single filter is to be changed, unsolder the wires from both sides of the filter and remove the defective filter. Install the replacement filter and connect and solder the wires removed from the defective filter.

*f.* Refer to paragraph 2-10 for replacement of connector.

*g.* Replace connector-falter assembly 37AR1A1W1A1 using the four mounting screws removed in c. above. Position 37 AR1A1W1 at the same distance as measured in *b.* above, and check the vertical plane of connector P1 using a small square and the top edge of the 37AR1 chassis as a reference. Tighten the four mounting screws.

*h.* Reinstall the voltage regulator assembly 37AR1A1A1 and tighten the 4 mounting screws.

## Section IV. REMOVAL AND REPLACEMENT PROCEDURES - BAND III RF HEADS

### 2-62. Replacement of Channel Frequency Indicator 34A1A1DS1 or 34A1A1DS2

*a.* Remove "control panel 34A6 as described in paragraph 2-70.

*b.* Remove the three red-circled mounting screws that secure the defective channel frequency indicator 34 A1A1DS1 or 34A1A1DS2 (fig. 4-62) to the chassis.

c. Grasp channel indicator and slide it sideways to disengage the flexible shaft. Remove the defective channel frequency indicator.

*d.* Remove the pin through the flexible shaft and remove the flexible shaft from the defective channel frequency indicator.

e. Install the flexible shaft on the replacement channel frequency indicator and secure with a setscrew.

*f.* Install the RCVR SIG control knob if 34A1A1DS1 is being replaced, or the XMTR CHANNEL control knob if 34A1A1DS2 is being replaced.

g. Turn the control knob fully clockwise to the stop position.

h. Turn the flexible shaft, on the replacement channel frequency indicator, clockwise until the start position, indicated by an arrow head and the letters "RS" for 34A1A1DS1 and "TS" for 34A1A1DS2, is alined with the calibration mark The calibration mark is a notch centrally located on the front edge of the unit's frame.

*i.* Place the channel frequency indicator in position and slip the hexagonal recessed end of the flexible shaft over the associated coupling shaft (fig. 4-62).

*j.* If the stop position of the channel control and the start position on the tape do not coincide, proceed as follows:

(1) Loosen the setscrew in the flexible shaft

(2) Ensure that the channel control is turned fully clockwise.

(3) Adjust the tape to realine the start position as in step *h.* above.

(4) Retighten the setscrew securing the flexible shaft.

*k.* Remove the channel frequency indicator. Using the guide holes in the flexible shaft drill a hole through the channel frequency indicator shaft. Press a pin through both shafts. Remove the setscrew.

*I.* Reinstall the channel frequency indicator and secure in position with the three mounting screws.

### 2-63. Replacement of Connector-Filter Assembly 34A1W1A1

*a* Place the receiver rf head rear side up and locate connector filter assembly 34A1W1A1.

**CAUTION**

The two locating pins on the sides of 34A1W1A1 are factory dined and should never be loosened or removed.

*b.* Remove the four screws that secure 34A1W1A1 to the chassis. Pull 34A1W1A1 free of the chassis.

c. Replace filter-connectors as required Refer to paragraph 2-9 and FO-8 for replacement of filter-connectors. If the existing plug 34A1W1A1P1 is to be used, proceed to step *h.* below.

*d.* If 34A1W1A1P1 required replacement, unsolder and tag the wires from the pins.

e. Remove the four screws that secure 34A1W1A1P1 to the assembly remove 34A1W1A1P1 from the assembly.

*f.* Install the replacement 34A1W1A1P1 and secure it with the four mounting screws provided

g. Connect and solder the wires removed in *d.* above. Refer to paragraph 2-10 and FO-8 for connections.

*h.* Place 34A1W1A1 in position on the chassis and secure it with the four screws removed in *b.* above.

### 2-64. Replacement of Speed Decreaser Gear Assembly 34A1MP1

*a.* Loosen the screws in the MULT PEAK knob on the front panel. Remove the knob.

*b.* Loosen the two screws in the coupling shaft that secure the speed decreaser gear assembly shaft

c. Place the receiver rf head right side up and locate the speed decreaser gear assembly 34A1MP1. Unscrew the three red-circled screws and remove the speed decreaser gear assembly 34A1MP1.

*d.* To install replacement speed decreaser gear assembly 34A1MP1, rotate the MULT PEAK shaft until the speed decreaser gear shaft will fit into the coupling shaft when speed decreaser gear assembly 45A1MP1 is placed in position over the three mounting holes. The MULT PEAK shaft should project from the hole in the front panel.

e. Tighten the three red-circled mounting screws.

*f.* Tighten the two screws in the coupling shaft

g. Replace and secure the MULT PEAK knob.

*h.* Aline the amplifier-converter unit 34 as described in paragraph 4-44 *d.*

**NOTE**

It should not be necessary to perform the alinement procedures of the voltage control assembly 34A1A2.

### 2-65. Replacement of Terminal Board 34A1W1TB1

a. Remove intermediate frequency amplifier 34AR1, frequency mixer 34A7, lowpass filter 34FL1, signal level control monitor 34A5 (TM 11-5820-540-30), and power supply 34PS1 (if used) (TM 11-5820-540-12).

*b.* Locate and remove the mounting screws of chassis connectors 34A1W1J8 and 34A1W1J9. Push these connectors down through the holes provided in the bottom support.

c. Remove the six mounting screws of the bottom support. Remove the bottom support

*d.* Remove the two mounting screws that secure the defective terminal board to the bottom support.

*e.* Unsolder and tag the wires attached to the terminal board 34A1W1TB1.

*f.* Solder the wires to the replacement terminal board. Refer to wiring diagram FO-8 if necessary.

g. Mount the replacement terminal board in its position and tighten the two mounting screws.

*h.* Place the bottom support in its position and pull the connectors 34A1W1J8 and 34A1W1J9 up through the holes provided. Secure the bottom support with six mounting screws.

*i.* Secure the two chassis connectors 34A1W1J8 and 34A1W1J9 to the bottom support with the mounting screws provided.

*j.* Replace 34AR1, 34A7, 34FL1, and 34A5 (TM 11-5820-540-30).

*k.* Replace 34PS1 (if used) (TM 11-5820-540-12).

### 2-66. Replacement of Frequency Multiplier Group 34A2

a. Place the receiver rf head upright and locate the multiplier group 34A2.

*b.* Disconnect plug P2 (34A1W1J7) from 34A1W1J7.

c. Disconnect rf leads P2 (34W7J1) and P1 (34A1W1A1J2).

*d.* If the flexible type coupling shaft is used, loosen the two setscrews that secure it to the multiplier group drive shaft. Apply heat to soften the sealant on the setscrews.

e. Place the receiver rf head right side up. Locate and unscrew the four red-circled screws that secure the multiplier group 34A2.

*f.* Place the receiver rf head left side up. Locate and unscrew the remaining four red-circled mounting screws that hold multiplier group 34A2.

**CAUTION**

Be sure that the rigid rf lead is not damaged or bent while removing or installing 34A2.

g. Pull the frequency multiplier group 34A2 away from the chassis.

h. To install replacement frequency multiplier group 34A2, loosen the clamp on gear A (fig. 4-62) and disengage gear A from the speed decreaser drive gear. Lower the multiplier group straight down into its mounting position after rotating the MULT PEAK control so that the multiplier group drive shaft fits into the coupling shaft

i. Replace and tighten the four red-circled screws securing the module to the left side of the chassis. Tighten the setscrews in the coupling shaft, if the flexible type coupler is used. Replace and tighten the four remaining red-circled screws securing the module to the right side of the chassis.

*j.* Connect the rf leads removed in *d.* above to their respective connectors.

*k.* Connect P2 (32A1W1J7) to 34A1W1J7 and secure with the two screws provided.

*l.* Realine the band III receiver rf head as described in paragraph 4-44 *d.*

### 2-67. Replacement of Frequency Multiplier 34A2A1

a. Remove frequency multiplier 34A2A2 as described in TM 11-5820-540-30.

*b.* Remove frequency multiplier group 34A2 as described in paragraph 2-66 *a.* through 2-66 g.

c. Locate and disconnect rf cable P2(34A2A1J1) from connector 34A2A1J1.

*d.* Locate and disconnect P1(34A2A1J2).

e. Locate and remove the two screws A and B (fig. 4-138). Remove the brass shim (if used) located on the clamp.

*f.* Locate and loosen the three red-circled mounting screws of the frequency multiplier 34A2A1.

*g.* Lift frequency multiplier 34A2A1 straight up carefully disengaging connector P1 from chassis connector 34A2FL1W1J2.

*h.* To install frequency multiplier 34A2A1, position the module over the mounting holes carefully engaging P1 to chassis connector 34A2FL1W1J2.

*i.* Tighten the three red-circled mounting *screws.*

*j. Insert* brass shim (if used) in position on the clamp. Position the tuning plunger coupling over the shim (if used) and secure to the drive mechanism clamp with the two screws.

*k.* Turn the multiplier group 34A2 tuning shaft and be sure that the tuning plungers of multiplier 34A2A1 move smoothly through their tuning range. If necessary, loosen the red-circled screws that secure 34A2A1 and slightly reposition the module.

*l.* Connect rf lead P2(34A21J1) to 34A2A1J1 and P1(34A2A1J2) to 34A2A1J2.

*m.* Realine the frequency multiplier group 34A2 as described in paragraph 4-48 *d.* Reinstall multiplier 34A2A2 as described in TM 11-5820-540-30.

n. Reinstall frequency multiplier group 34A2 as described in paragraph 2-66 *h.* through 2-661.

### 2-68. Replacement of Bandpass Filter 34A2FL1 and Cable 34A2FL1W1 Components

*a* Remove bandpass filter 34A2FL1 using the procedure descibed for multiplier 34A2A1 in paragraph 2-67a. through 2-67g.

*b.* Repair cable 34A2FL1W1 components, as needed, as described in paragraphs 2-7 through 2-14, as appropriate. Tag all wires before unsoldering them. Refer to FO-8 for wire connections.

c. Replace bandpass filter 34A2FL1 using the procedures described for frequency multiplier 34A2A1 in paragraph 2-67 *h.* through 2-67 *n.*

### 2-69. Replacement of Rf Power Monitor 34A3

a. Remove control panel 34A6 as described in paragraph 2-70.

*b.* Place the receiver rf head front side up and locate rf power monitor 34A3.

c. Locate and loosen the two screws that secure P1(34A1W1J3) to 34A1W1J3 (fig. 4-62). Remove plug P1(34A1W1J3).

d. Locate and loosen, but do not disconnect rf lead P1(34A3J2).

e. Locate and remove the four mounting screws that secure power monitor 34A3 to the chassis.

*f.* Disconnect P2(34A3J1) and P1(34A3J2) from J1 and J2 of 34A3. Remove power monitor 34A3.

g. To install the replacement power monitor 34A3, position the module in its place and loosely connect rf lead P1(34A3J2) to 34A3J2.

*h* Secure power monitor 34A3 with the four mounting screws provided

*i.* Connect and secure rf leads P1 (34A3J2) and P2(34A3J1) to J2 and J1 of 34A3.

j. Connect and secure plug P1(34A1W1J3) to chassis connector 34A1W1J3 with the two screws provided.

*k.* Replace control panel 34A6 as described in paragraph 2-70.

### 2-70. Replacement of Control Panel 34A6

*a.* Place the receiver rf head top side up and lcoate control panel 34A6.

*b.* Locate and loosen the two screws that secure plug P1(34A1W1J5) to chassis connector 34A1W1J5. Remove plug P1(34A1W1J5). Note the routing of cable P1(34A1W1J5).

c. Loosen the screws that secure the MULT PEAK, RCVR CHAN, and XMTR DUPL control knobs. Remove the control knobs.

*d* Using a socket wrench, remove the nuts and washers that secure the ANT. and FROM XMTR con*nectors to* control panel 34A6.

e. Loosen the eight mounting screws that secure control panel 34A6 to the chassis. Remove the control panel. Be sure that the connectors are free from the panel.

*f.* To reinstall control panel 34A6, place 34A6 over the ANT. and FROM XMTR connectors and position 34A6 so that the guide pins and mounting holes are properly alined.

*g.* Secure control panel 34A6 with the eight mounting screws provided

*h.* Secure the ANT. and FROM XMTR connectors to control panel 34A6 with the nuts and washers provided

*i.* Replace and secure the MULT PEAK, RCVR CHAN, and XMTR DUPL control knobs. Make sure that the backs of the control knobs clear the control panel by approximately 1/8 inch.

*j.* Route cable P1(34A1W1J5) as noted in *b.* above and connect and secure the plug to 34A1W1J5 with the screws provided.

### 2-71. Replacement of Amplifier-Frequency Multiplier 38A1

*a. Test Equipment and Material Required.*

| *Equipment* | *Common name* |
|---|---|
| Test Facility, Transmitter TS-2866(V)2/GRM-95(V)2 | Transmitter test facility |
| Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2 | Accessory kit |
| Wattmeter AN/USM-298 | Wattmeter |
| Shouldered Pin 716-800009-000 | Pin |

*b. Removal and Replacement Procedure.*

(1) Tune the rf head to channel 1600. Locate amplifier-frequency multiplier 38A1. Insert shouldered pin 716-800009-000 into hole adjacent to the tuning drive socket. Disconnect the 38AR1W1A1P2 and P1(38A1J2) rf leads connected to ampltiler-frequency multiplier.

(2) Locate and remove the strap and two screws, on the left side of the transmitter rf head, that secure rf lead 38W1 to chassis 38AR1A1.

(3) Locate and disconnect plug P2(38AR1AR1J1) from J1 of the driver cavity of 38AR1AR1. Remove rf lead 38W1.

(4) Locate idler sprocket bracket (fig. 4-16) of the frequency multiplier drive chain. Loosen the two screws securing the idler sprocket bracket.

(5) Facing the front panel of the unit push the idler sprocket bracket toward the right to loosen the drive chain. Remove the chain from the frequency multiplier sprocket

(6) Loosen the four red-circled mounting screws that secure the amplifier-frequency multiplier 38A1 to the chassis.

(7) Lift the amplifier-frequency multiplier 38A1 straight up, carefully disengaging P1 (38AR1A2W1J2) from its mating connector.

**NOTE**

The 38A1 replacement module is pinned at channel 1600 (1000 MHz). Do not remove the pin until the module is secured in the transmitter with the drive chain engaged.

(8) To install the replacement amplifier-frequency multiplier 38A1, lower the replacement module down carefully engaging mating connectors 38AR1A1W1J2 and P1 (38AR1A1W1J2).

(9) Install and tighten the four mounting screws.

(10) Connect plug P2 (38AR1AR1J1) of rf lead 38W1 to J1 of the driver cavity of 38AR1AR1 and plug P1 (38A1J2) to J2 of frequency multiplier 38A1.

(11) Secure rf lead 38W1 to chassis 38AR1A1 with the strap and two screws removed in (2) above.

(12) Connect rf lead 38AR1W1A1P1 to J1 of frequency multiplier 38A1.

(13) Set the transmitter rf head XMTR TUNE and XMTR CHANNEL controls to charnel 1600.

(14) Place the drive chain over the frequency multiplier 38A1 sprocket

(15) Tighten the chain by adjusting the position of the idler sprocket bracket. Tighten the two screws to secure the bracket in place.

(16) Remove the shouldered pin from the frequency multiplier sprocket

c. *Alinement Check.*

(1) Connect the equipment as shown in figure 2-11.

(2) Direct cooling air from the AIR OUTLET of the transmitter test facility to the rear of the unit under test.

(3) With the XMTR TUNE and XMTR CHANNEL controls set to channel 1600, set the test facility switches as follows:

| *Switch* | *Switch position* | *Normal indication* |
|---|---|---|
| S1 | ON | |
| S13 | ON | |
| S20 | S12 | |
| S12 | OSC | Meter Ml indicates between 20% and 90% of full scale. |

(4) Turn test facility switch S12 to PWR OUT and adjust the transmitter XMTR TUNE control for maximum indication on the test facility meter Ml. The wattmeter should indicate at least 20 watts and the XMTR TUNE channel indication should be within 0.5 inch of the display window centerline.

(5) Repeat step (4) above with the XMTR TUNE and XMTR CHANNEL controls set to channel 990, 1000, 1080, 1160, 1240, 1279, 1280, 1320, 1400, 1480, and 1540.

(6) If required, select the channel giving the highest error above ±0.5 inch on the XMTR TUNE channel indicator tape. Set the XMTR CHANNEL and XMTR TUNE controls to the channel selected and proceed as follows

*(a)* Set the test facility switch S12 to MULT and tune the XMTR TUNE control for maximum indication on the test facility meter Ml.

*(b)* Loosen the idler sprocket bracket Disengage the drive chain from the amplifier-frequency multiplier drive sprocket without disturbing the position of the sprocket

(c) Turn the XMTR TUNE control until the channel selected in step (6) above is on the window centerline.

*(d)* Replace the chain over the drive sprocket and tighten the idler sprocket bracket

*(e)* Repeat steps (4) and (5) above.

## 2-72. Replacement of Radio Interference Filter 38AR1A1FL2

a. Place transmitter rf head right side up and locate radio interference falter 38AR1A1FL2.

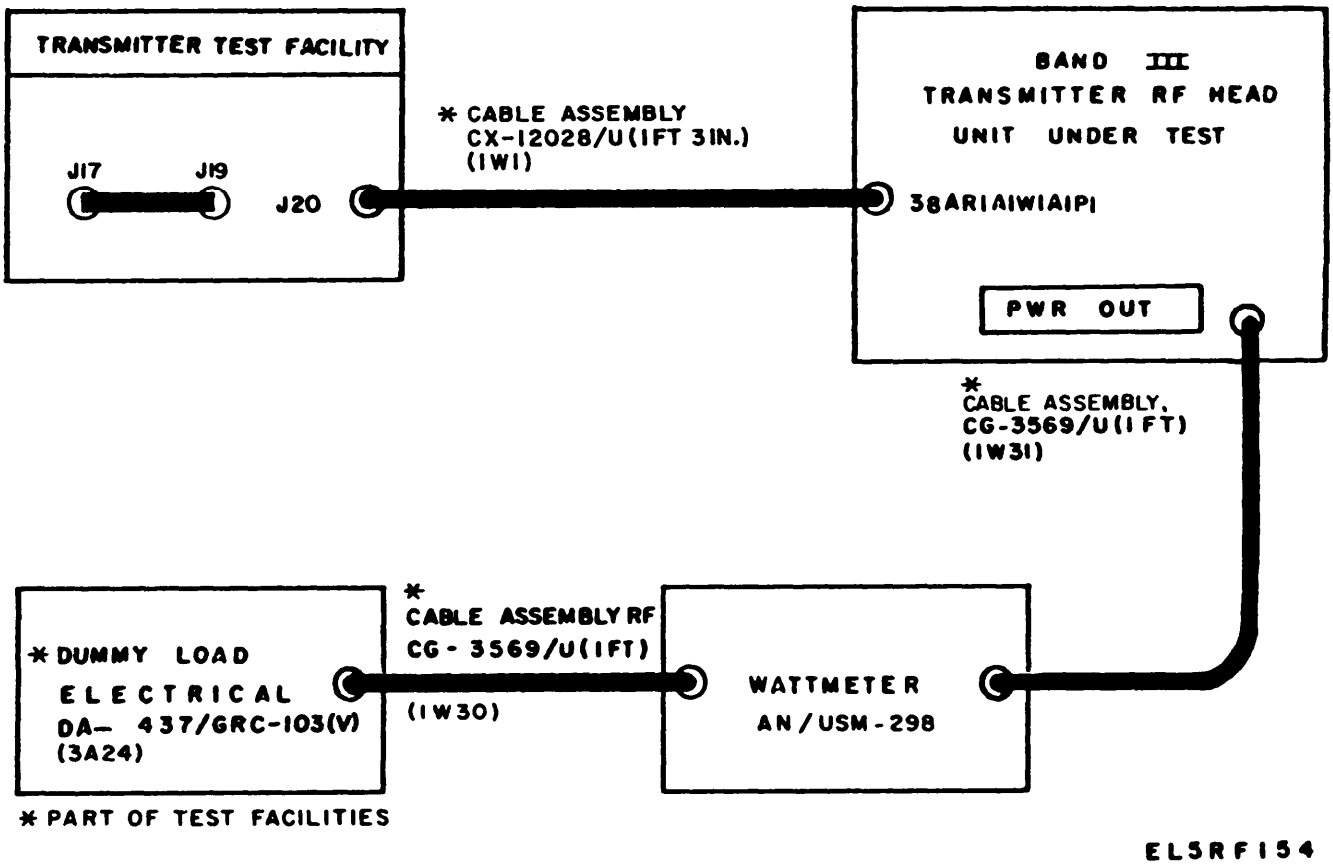



*Figure 2-11. Amplifier-Frequency Multiplier 38A1, Alinement Test Setup.*

*b.* Remove the two screws securing the red cover plate to the filter remove the red cover plate.

c. Unsolder and tag the three wires from connecting pins E1, E2 and E3.

*d.* Remove the two screws securing the radio interference filter and remove the defective radio interference filter.

*e.* Position the replacement filter and secure it with the two mounting screws.

*f.* Remove the two screws securing the red cover plate on the replacement filter remove the red cover plate.

g. Place a suitable length of heat shrinkable tubing type CMC 334-362/3 over each wire to be connected to E1, E2 and E3.

*h.* Wrap the wires around both sides of the hook in the terminals on the radio interference filter. Ensure a good mechanical connection and solder leads to the terminals.

*i.* Position the heat shrinkable tubing over the soldered terminals. Use a thermogun to shrink the tubing over the terminals.

j. Replace the red cover plate and secure it with two screws.

### 2-73. Replacement of Connector-Filter Assembly 38AR1A1W1A1

Connector-filter assembly 38AR1A1W1A1 must be removed in order to replace individual falter connectors or to repair or replace P1 (38AR1A1W1A1).

*a.* Place the transmitter rf head 38 right side up and locate voltage regulator assembly 38AR1A1A1. Loosen the four green-circled mounting screws on the voltage regulator assembly 38AR1A1A1 and remove the voltage regulator assembly.

*b.* Locate connector-filter assembly 38AR1A1W1A1. Measure as accurately as possible and record the distance from front panel 38MP1 to the rear edge of 38AR1A1W1A1.

c. Remove the four red-circled screws that secure the connector-filter assembly 38AR1A1W1A1 to the chassis. Carefully remove the connector-filter assembly.

*d.* If the connector-falter assembly must be replaced, unsolder and tag the wires connected to filters FL1 to FL46. Remove the defective connector-filter assembly and resolder the tagged wires to the replacement connector filter assembly (FO-9).

e. If a single filter must be changed, unsolder the wires from both sides of the falter and remove the filter. Install the replacement filter connect and solder the wires removed from the defective falter.

*f.* Refer to paragraph 2-10 for replacement of connectors.

g. Replace connector-falter assembly 38AR1A1W1A1 using the four mounting screws provided. Position 38AR1A1W1A1 at the same distance as measured in a above and check the vertical plane of connector P1 using a small square and the top edge of 38AR1 chassis as a reference. Tighten the four mounting screws.

*h.* Reinstall the voltage regulator assembly 38AR1A1A1 and tighten the four mounting screws.

### 2-74. Replacement of Resistor Assembly 38AR1A1A2

*a.* Turn transmitter rf head left side up and locate resistor assembly 38AR1A1A2 (TM 11-5820-540-30).

*b.* Unsolder and tag leads connected to terminal El.

c. Remove the two green-circled screws that secure the resistor assembly 38AR1A1A2 to the chassis; remove the resistor assembly.

*d.* Secure the replacement resistor assembly to the chassis using the two mounting screws.

e. Place a suitable length of heat shrinkable tubing type CMC 334-362/3 over the wires removed in *b.* above.

*f.* Connect and solder the wires to the terminal E1. Position the heat shrinkable tubing over the terminaL Use a thermogun to shrink the tubing over the terminal.

### 2-75. Replacement of Channel Frequency Indicator38ARIARIDSI

*a Test Equipment and Material Requiml*

| *Equipment* | Common name |
|---|---|
| Test Facility, Transmitter TS-2866(V)2/GRM-95 (V)2 | Transmitter test facility |
| Accessory Kit Test Facilities Set MK-1 173(V)2/GRM-95(V)2 | Accessory kit |
| Wattmeter AN/USM-298 | Wattmeter |
| Frequency counter TD-I125(V)l/U | Frequency counter |

*b. Removal and Replacement Procedure.*

(1) Remove the control panel 38MP1 as described in paragraph 2-77.

(2) Reconnect the XMTR TUNE knob to the shaft of the XMTR TUNE control. Turn the XMTR TUNE control fully clockwise to the stop.

(3) Locate the channel frequency indicator 38AR1AR1DS1 (TM 11-5820-540-30). Remove the three red-circled screws that secure the channel frequency indicator to the chassis.

(4) Grasp the channel frequency indicator and slide it sideways to disengage the flexible shaft from the hexagonal shaft Remove the defective channel frequency indicator.

(5) Remove the pin that secures the flexible shaft to the channel frequency indicator and loosen the two setscrews (if installed). Remove the flexible shaft from the defective channel frequency indicator.

(6) Slide the flexible shaft on the hexagonal shaft

(7) Turn the replacement channel frequency indicator until the white cross hatch (above channel 1610) on the tape is alined with the calibration mark (notch) on the frame.

(8) Slide the replacement channel frequency indicator sideways to connect the shaft of the channel frequency indicator to the free end of the flexible shaft

(9) Secure the channel frequency indicator to the chassis with the three mounting screws.

(10) Position the flexible shaft midway between the channel frequency indicator and the hexagonal shaft Secure the flexible shaft to the channel frequency indicator using the setscrews. (Do not drill and pin flexible shaft in position at this time.)

*c. Channel Alinement Check and Adjustment*

(1) Connect control indicator plug P1 (38AR1A1W1J3) (TM 11-5820-540-30) on the control panel to connector 38AR1A1W1J3 on the transmitter rf head chassis.

(2) Connect the test equipment as shown in A, figure 4-160.

(3) Turn XMTR CHANNEL control to channel 990 (695 MHz).

(4) Turn XMTR TUNE control to channel 990.

(5) Set test facility switches S1 to ON, S20 to S12 and S12 to OSC.

(6) Adjust the XMTR TUNE control for a maximum power indication on the wattmeter.

(7) Check the channel frequency indicator. Channel 990 should not be more than 1/8 inch above or below the calibration mark (notch) on 38AR1AR1DS1.

(8) If the channel frequency indication is more than 1/8 inch away from the calibration mark, loosen the two setscrews holding the flexible shaft to the channel frequency indicator. Adjust the channel frequency indicator until channel 990 is in line with the calibration mark.

**NOTE**

Ensure that the flexible shaft does not move during this adjustment

(9) Tighten the two setscrews to secure the flexible shaft to the channel frequency indicator.

(10) Check the alinement at channels 1050, 1150, 1250 and 1610 as shown in steps (3), (4) and (6) above. If the channel number being checked is more than ½ inch above or below the calibration mark, slightly readjust the channel frequency indicator ((8) and (9) above) so that all channels checked are within their specified tolerance.

(11) Drill through the channel frequency indicator shaft using the pilot hole provided in the flexible shaft Press the pin through. Remove the setscrews.

(12) Remove the XMTR TUNE knob and disconnect P1 (38AR1A1W1J3) from connector 38AR1A1W1J3. Install control panel 38MP1 as described in paragraph 2-77.

### *2-76.* Replacement of Circulator 38AR1HY1 and Electrical Dummy Load 38AR1AT1

*a Replacement of Circulutor 38AR1HY1.*

**NOTE**

Amplifier frequency multiplier 38A1 must be removed in order to give access to the mounting screws of circulator 38AR1HY1. Refer to paragraph 2-71 for the removal of amplifier-frequency multiplier 38A1.

(1) Place the transmitter rf head bottom side up and locate circulator 38AR1HY1 (TM 11-5820-540-30). Remove the rf leads connected to the circulator.

(2) Place the transmitter rf head upright- Locate and remove the four mounting screws which secure the circulator 38AR1HY1 to the chassis.

(3) Remove the defective circulator.

(4) To install the replacement circulator 38AR1HY1, position the replacement module on the mounting holes and tighten the four mounting screws.

(5) Connect P2 plug of 38AR1W1 for J1 connector of circulator 38AR1HY1, P1 plug of 38AR1W2 to J2 connector and P1 of 38AR1W4 to J3 connector.

*b.* Replacement *of Electrical Dummy* Load *38AR1AT1.*

(1) Remove control panel as described in paragraph 2-77.

(2) Locate the electrical dummy load 38AR1AT1 (TM 11-5820-540-30) and disconnect the rf lead from connector J1.

(3) Remove the two mounting screws that secure the dummy load to the chassis and remove the defective electrical dummy load

(4) To install the replacement module, place the electrical dummy load on its mounting holes and secure it with two mounting screws.

(5) Comect P2 of rf lead 38AR1W4 to connector J1 of electrical load 38AR1AT1.

(6) Replace control panel 38MP1 (para. 2-77).

### 2-77. Replacement of Control Panel 38MP1

*a. Removal Procedure.*

(1) Remove the XMTR TUNE control knob.

(2) Remove the hexagon nut and the flat washer from the PWR OUT connector.

(3) Loosen the two screws that secure plug P1 (38AR1A1W1J3) (TM 11-5820-540-30) to its mating connector 38AR1A1W1J3 and disconnect the plug.

(4) Loosen and remove the six green-circled mounting screws and washers located at the rear of the control panel.

**NOTE**

Pull the panel forward from the rf head to release it from the guiding pin.

*b. Replacement Procedure.*

(1) Place the control panel in position and press to slide home the guiding pin.

**NOTE**

It may be necessary to loosen the four screws holding power monitor 38AR1A2 (TM 11-5820-540-30) in position. Do not retighten screws at this time.

*(2) Secure* the control panel to the chassis using the six mounting screws removed in *a. (4)* above.

(3) Connect P1 (38AR1A1W1J3) of the control indicator 38A2 to its mating connector 38AR1A1W1J3 and secure it in position with the two screws provided.

(4) Replace and secure the nut and washer to the PWR OUT connector. Tighten the power monitor 38AR1A2 mounting screws.

(5) Install the XMTR TUNE control panel knob.

## Section V. REMOVAL AND REPLACEMENT PROCEDURE - BAND IV RF HEADS

### 2-78. Replacement of Channel-Frequency Indicator 39A1DS1 or 39A1DS2

*a.* Remove control panel 39A5 (para. 2-83).

*b.* Loosen the two setscrews securing the coupling shaft (fig. 2-12) to the defective indicator (39A1DS1 or 39A1DS2).

c. Remove the three red-circled mounting screws that secure the defective indicator.

*d.* Grasp the indicator and slide it sideways to disengage the shaft, then remove the defective indicator.

*e.* Install the RCVR SIG control knob if 39A1DS1 is being replaced, or the XMTR CHANNEL control knob if 39A1DS2 is being replaced.

*f.* Turn the control knob fully clockwise to the stop position.

g. Turn the shaft on the replacement indicator counterclockwise until the start position is alined with the calibration mark. The calibration mark is a notch centrally located on the front edge of the unit frame, while the start position is indicated by an arrowhead and the letters TS.

*h.* Place the indicator in position, engaging the coupling shaft with the shaft on the unit

*i.* Secure the indicator with the three mounting screws removed inc. above.

j. Tighten the setscrews in the coupling shaft *(b* above), remove the control knob installed in e. above, and install control panel 39A5 (pars. 2-83).

### 2-79. Replacement of Circulator 39A1HY1

a *Removal Procedure.*

(1) Place the receiver rf head top side up, and remove control panel 39A5 (para. 2-83).

**CAUTION**

Do not bend or otherwise damage the rigid rf leads.

(2) Locate circulator 39A1HY1. Disconnect plug P2 (39A1HY1J1) from 39A1HY1J1 on circulator 39A1HY1. Jack 39A1HY1J1 is located directly below the control-indicator.

(3) Place the receiver rf head bottom side up. Disconnect plug P2 (39A1HY1J3) from 39A1HY1J3 and plug P1 (39A1HY1J2) from 39A1HY1J2.

(4) Remove the four green-circled mounting screws which secure circulator 39A1HY1 to the chassis. Lift the circulator away from the chassis.

*b. Replacement Procedure.*

(1) Position the replacement circulator on the chassis, and aline with the four green-circled mounting holes. Install and tighten the four mounting screws.

(2) Connect plug P1 (39A1HY1J2) to 39A1HY1J2, plug P2(39A1HY1J3) to 39A1HY1J3, and plug P2(39AlHYlJl) to 39A1HY1J1.

(3) Replace control panel 39A5 (para. 2-83).

### 2-80. Replacement of Connector-Filter Assembly 39A1W1A1

*a* Place the receiver rf head with the rear facing upward. Locate connector-filter assembly 39A1W1A1 (TM 11-5820-540-30).

**CAUTION**

Never loosen or remove the locating pins on either side of connector-filter assembly 39A1W1A1. Both pins are factory-alined.

*b.* Remove the four screws that secure assembly 39A1W1A1 to the chassis.

c. Pull the assembly free of the chassis, taking care not to break any of the wires.

d. Replace the assembly as required (para. 2-9, FO-10).

**NOTE**

If existing plug 39A1W1A1P1 is to be used, proceed to step *i.* below.

*e.* If connector 39A1W1A1P1 requires replacement, unsolder and tag the wires from the pins.

*f.* Remove the four screws that secure connector 39A1W1A1P1 to the assembly.

*g.* Remove 39A1W1A1P1 and install the replacement. Secure it with the four mounting screws *(f.* above).

*h.* Resolder the wires removed in e. above.

*i.* Position assembly 39A1W1A1 on the chassis. Secure the assembly with the four screws removed in *b.* above.

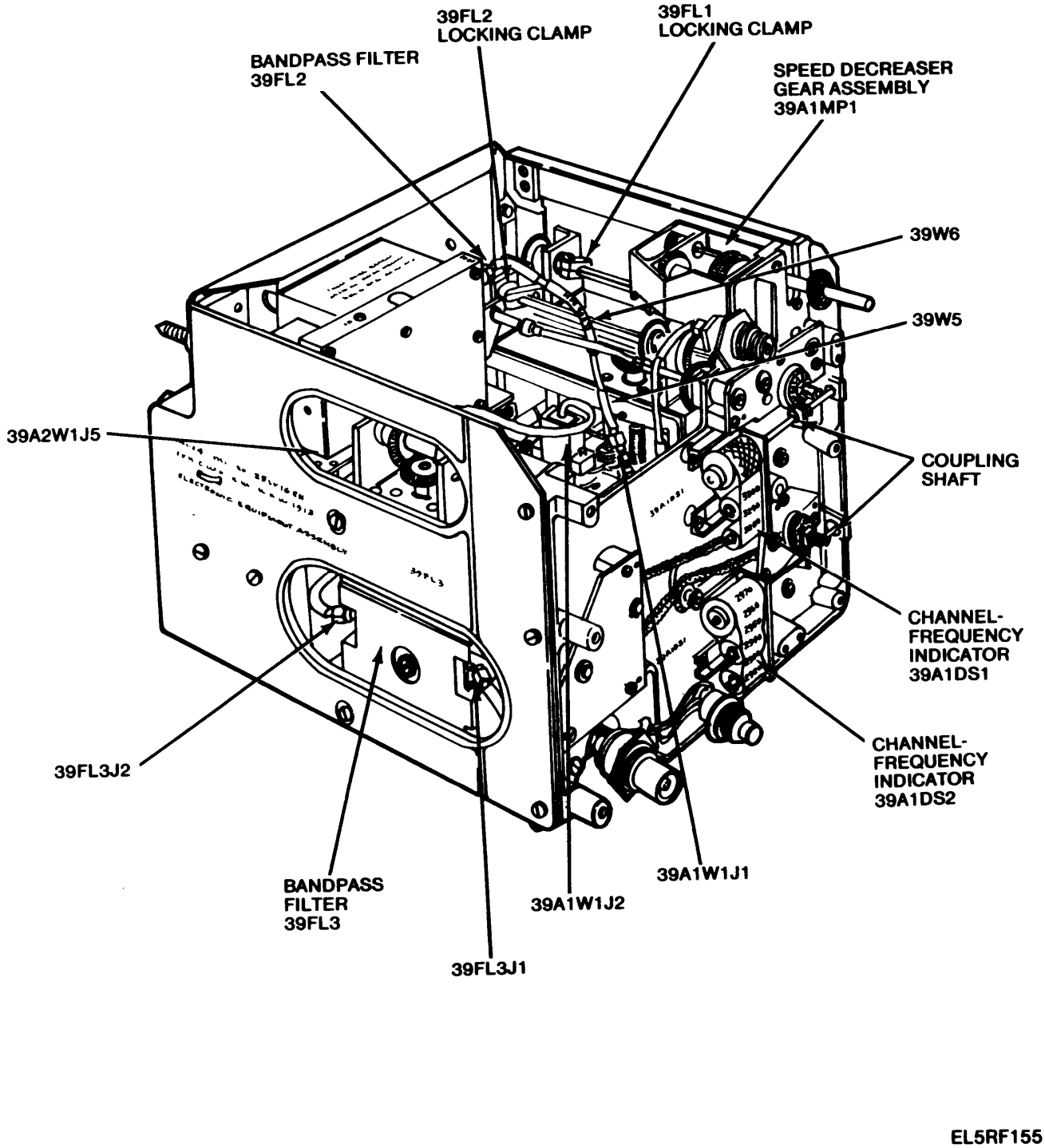



*Figure 2-12. Band IV Receiver Rf Head, Front View, Control Panel Removal.*

## 2-81. Replacement of Terminal Board 39A1W1TB1

*a.* Place the receiver rf head top side up. Locate terminal board 39A1W1TB1 (TM 11-5820-540-30).

*b.* Remove the two mounting screws that secure the terminal board to the chassis.

c. Unsolder and tag the wires attached to each terminal on the board.

*d.* Solder the wires to the replacement terminal board (FO-1O, FO-11).

e. Install the terminal board in position on the chassis. Tighten both mounting screws.

## 2-82. Replacement of Frequency Multiplier 39A3

*a. Test Equipment and Material Required.*

| *Equipment* | Common name |
|---|---|
| Teat Facility, Receiver TS-2867(V)2/GRM-95(V)2 | Receiver test facility |
| Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2 | Accessory kit |
| Counter, Electronic, Digital TD-1225(V)1/U | Frequency counter |
| Generator, Signal AN/USM-213 | Signal generator |
| Meter, Power HP-435A | Power meter |
| Sensor, Power HP-8481A | Power sensor |
| Voltmeter, Electronic ME-459/U | VTVM |

**CAUTION**

Do not bend or damage the rigid rf leads.

*b. Removal Procedure.*

(1) Tune the RCVR SIG control of the receiver rf head to channel 3240, and adjust MULT PEAK control to midpoint.

(2) Place the receiver rf head top side up and locate frequency multiplier 39A3 (TM 11-5820-540-30).

(3) Secure the tuning mechanism of unit 39A3 by tightening the screw in the unit locking clamp (TM 11-5820-540-30).

(4) Disconnect plug P1 (39A3A2J1) from 39A3A2J1 (TM 11-5820-540-30).

(5) Remove the three red-circled mounting screws that secure unit 39A3 to the chassis. Lift out the unit carefully, disengaging the drive shaft from the flexible coupling and the module connector from mating connector 39A1W1J5.

c. *Replacement Procedure.*

(1) Set the RCVR SIG control of the receiver rf head to channel 3240.

(2) Adjust the MULT PEAK control to midpoint

**NOTE**

Make sure the flexible shaft does not move during the following operation.

(3) Lower the replacement module carefully. Engage 39A1W1J5 with P1(39A1W1J5) and the drive shaft of 39A3 with the flexible coupling.

(4) Replace and tighten the three red-circled mounting screws removed in *b.* (5) above.

(5) Reconnect plug P1 (39A3A2J1) to 39A3A2J1 on the frequency multiplier (TM 11-5820-540-30).

(6) Loosen the clamp on the drive shaft of 39A3.

d. *Alinement Test*

(1) Connect the equipment as in A, figure 4-183.

(2) Set the receiver test facility switches as follows:

| *Switch* | *Position* |
|---|---|
| S1 | ON |
| S5 | S6 |
| S7 | AGC |
| S8 | OFF |
| S6 | MULTIPLIER |

(3) Set the RCVR CHANNEL and RCVR SIG control on the receiver rf head to channel 3299. Then set the XMTR DUPL control at least 100 channels away from the RCVR CHANNEL setting.

(4) Adjust the signal generator, using the internal level meter and the attenuator, to obtain a level of –74 dBm at 1849.5 MHz.

(5) Adjust the MULT PEAK control on the receiver rf head for the maximum indication on receiver test facility meter M1. The meter should indicate not less than 25 percent of full scale deflection.

(6) Set switch S6 on the receiver test facility to REC SIG. Adjust the RCVR SIG control on the unit under test for the maximum indication on receiver test facility meter MI. The VTVM should indicate less than –46 dBm

(7) Repeat (3) through (6) above for all channels and signal generator frequencies listed below.

| *RCVR CHANNEL and RCVR SIG channel settings* | *Signal generator frequency* (MHz) |
|---|---|
| 3299 | 1849.5 |
| 2904 | 1652.0 |
| 2612 | 1506.0 |
| 2300 | 1350.0 |

## 2-83. Replacement of Control Panel 39A5

*a. Removal Procedure.*

(1) Place the receiver rf head upright. Locate control panel 39A5 (TM 11-5820-540-30).

(2) Locate and loosen the two screws that secure P1(39A4) to 39A1W1J2 (TM 11-5820-540-30). Remove plug P1 (39A4) from socket 39A1W1J2.

(3) Loosen the attaching screws, and remove the following control knobs from the control panel:

MULT PEAK
RCVR SIG
XMTR DUPL

(4) Remove the two nuts and washers that secure the ANT. and FROM XMTR connectors to the control panel, using a socket wrench.

**CAUTION**

Do not bend or damage the rigid rf leads.

(5) Loosen the eight mounting screws that secure control panel 39A5 to the chassis frame.

(6) Carefully remove control panel 39A5 (MULT DRIVER switch is still attached). If observation windows and handle assemblies are defective, refer to paragraph 2-84 before proceeding to *b.* below.

(7) Remove the nut and washer that secure the MULT DRIVER switch to the control panel, using socket wrench.

*b. Replacement Procedure.*

(1) Secure the MULT DRIVER switch to panel 39A5 with the nut and washer removed in *a.* (7) above.

(2) Position control panel 39A5 on the chassis, insert the coaxial connectors through the ANT. and FROM XMTR mounting holes and aline the mounting holes.

(3) Secure the panel with the eight mounting screws removed in *a.* (6) above. Secure the connectors with the two nuts and washers removed in *a.* (4) above.

(4) Replace and secure the MULT PEA, RCVR SIG, and XMTR DUPL control knobs.

**NOTE**

Make sure the backs of the RCVR SIG, RCVR CHANNEL, and XMTR DUPL control knobs clear the control panel by 1/8 inch.

(5) Connect P1(39A4) to 39A1W1J2. Secure the plug with the two screws provided.

### 2-84. Replacement of Observation Windows and Handle Assemblies (Control Panels 39A5 and 40MP1)

*a. Observation Windows.* Each observation window is sandwiched between gaskets and secured to the window frame on the back of the control panel with a metal frame, four screws, and four washers. To replace defective windows, proceed as follows:

(1) Remove the control panels as required (para. 2-83, 2-95).

(2) Remove the metal frames, windows, and gaskets from the window frames by detaching the screws and washers. Discard the faulty windows.

(3) Put the bottom gaskets back into the window frames of the panels.

(4) Set the replacement windows on top of these gaskets. Make sure the markings (metallic surfaces) on each glass face the interior of the radio set and are not visible from the front of the control panel.

(5) Place the top gaskets on the windows, followed by the metal frames.

(6) Tighten the four screws and washers evenly, to secure each window which was replaced.

(7) Replace the control panels (para. 2-83, 2-95).

*b. Handle Assemblies.* Each handle assembly is secured to the front of the control panel with two sets of attaching hardware consisting (in order of disassembly) of a screw, flat washer, lockwasher, spring, and ball bearing. The hardware is accessed from the back of the panel. Sealing, locking, and retaining compound (MIL-S-22473, grade C) is used to fix the screw. To replace a defective handle assembly, proceed as follows:

(1) Remove the control panel (para. 2-83, 2-95).

(2) Undo the two sets of attaching hardware on the back of the panel. Remove the defective handle assembly and discard it.

(3) Attach the replacement handle assembly to the control panel by replacing the two sets of attaching hardware in assembly order; namely, ball bearings, springs, lockwashers, flat washers, and screws. Apply sealing, locking, and retaining compound (MIL-S-22473, grade C) as required.

(4) Replace the control panel on the radio set (para. 2-83, 2-95).

### 2-85. Replacement of Adapter-Connectors 39A5CP1 and 39A5CP2

*a.* Remove control panel 39A5 (para. 2-83).

*b.* Disconnect 39A5CP1 from P2 (39A1W4) and 39A5CP2 from P1 (39W3) as required.

c. Replace the defective adapter-connector(s).

*d.* Remake the connections which were broken in *b.* above.

*e.* Replace control panel 39A5 (para. 2-83).

2-86. Replacement of Bandpass Filter 39FL1

*a. Test Equipment and Material Required. See* paragraph 2-82 *a.*

*b. Removal Procedure.*

(1) Place the receiver rf head right side up. Locate bandpass filter 39FL1.

(2) Set the RCVR SIG control to channel 3300.

(3) Loosen the screw in the locking clamp (TM 11-5820-540-30), but do not move the tuning mechanism of the bandpass filter.

(4) Slide the locking clamp toward the end of the shaft until the locking clamp screwpin enters the hole in the bandpass filter chassis. Tighten the screw which secures the locking clamp.

(5) Remove control panel 39A5 (para. 2-83).

(6) Disconnect plug P1(39FL1J2) from 39FL1J2.

(7) Disconnect plug P1(39A1HY1J2) from 39A1HY1J2.

(8) Remove the five red-circled mounting screws which secure the bandpass filter to the chassis.

(9) Move the filter slightly, to disengage the coupling gear, and lift the filter from the chassis. Remove P2(39FL1J1) from 39FL1J1.

c. *Replacement Procedure.*

(1) Set the RCVR SIG control on the receiver rf head to channel 3300.

**NOTE**

Be sure that the position of the coupling gear (RCVR SIG control mechanism) is not altered during the following operation.

(2) Place the new bandpass filter on the chassis and aline, with the five mounting holes. At the same time, engage the drive shaft of the bandpass filter with the coupling gear on the chassis.

(3) Install and tighten all five mounting screws.

(4) Connect P1(39FL1J2) to 39FL1J2 and P1(39A1HY1J2) to 39A1HY1J2.

(5) Replace control panel 39A5 (Para. 2-83).

(6) Loosen the locking clamp on the drive shaft of the bandpass falter.

*d. Alinement Check.*

(1) Connect the equipment as in A, figure 4-183.

(2) Repeat the receiver rf head setability test, paragraph 4-71 *b.* (1).

2-67. Replacement of Bandpass Filter 39FL2

*a. Test Equipment and Material Required. See* paragraph 2-82 *a.*

*b. Removal Procedure.*

(1) Place the receiver rf head top side up (fig. 2-12). Locate bandpass filter 39FL2.

(2) Set the RCVR SIG control to channel 3240. Adjust the MULT PEAK control to midpoint.

(3) Loosen the screw in the locking clamp of unit 39FL2, but do not move the tuning mechanism of the bandpass filter.

(4) Slide the locking clamp toward the end of the shaft until the locking clamp screwpin enters the hole in the bandpass filter chassis. Tighten the screw which secures the locking clamp.

(5) Remove control panel 39A5 (para. 2-83).

(6) Disconnect plug P2 of 39W6 from J1 of 39W5 (fig. 2-12).

(7) Disconnect plug P1(39FL2J2) from 39FL2J2.

(8) Remvoe the five red-circled mounting screws which secure the bandpass filter to the chassis.

(9) Slide the bandpass filter toward the rear of the receiver rf head to disengage the coupling gear of the tuning mechanism.

(10) Lift the filter from the chassis.

(11) Note the location of cable 39W5 and remove the cable from the filter.

c. *Replacement Procedure.*

(1) Install cable 39W5 on the replacement bandpass filter.

(2) Set the RCVR SIG control:on the receiver rf head to channel 3240, and the MULT PEAK control to midpoint.

**NOTE**

Be sure that the position of the coupling gear (RCVR SIG control mechanism) is not altered during the following operation.

(3) Place the new bandpass falter on the chassis and aline with the five mounting holes. At the same time, engage the drive shaft of the bandpass filter with the coupling gear on the chassis.

(4) Install and tighten all five mounting screws.

(5) Connect P1(39FL2J2) to 39FL2J2.

(6) Connect plug P2 of 39W6 to J1 of 39W5.

(7) Replace control panel 39A5 (para. 2-83).

(8) Loosen the locking clamp on the drive shaft of the bandpass falter.

*d. Alinement Test.*

(1) Connect the equipment as in A, figure 4-182.

(2) Repeat the receiver rf setability test paragraph 4-71 *b.* (1).

**2-88. Replacement of Bandpass Filter 39FL3**

*a. Test Equipment and Material Required.*

(1) *Major items, including test facilities.*

| *Equipment* | *Common name* |
|---|---|
| Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2 | Accessory kit |
| Accessory Kit, Test Facility Set MK-1985(V)2/GRM-95(V)2 | Accessory kit, band 2,3,4 |
| Counter, Electronic Digital TD-1225(V)1/U | Frequency counter |
| Generator, Signal AN/USM-213 | Signal generator |
| Meter, Power HP-435A | Power meter |
| Power Sensor HP-8481A | Power sensor |

(2) *Test facility components.*

| Name | *Description* |
|---|---|
| Adapter-Connectors | UG-565A/U (2 reqd); UG-643/U. |
| Attenuator, Fixed | CN-1531/U (203-800006-000,2 reqd). |
| Cable Assemblies, RF | CG-3568/U (1 ft, 2 ft). |

*b. Removal Procedure.*

(1) Place the receiver rf head top side up. Locate bandpass filter 39FL3 (fig. 2-12).

(2) Loosen the screw in the locking clamp (TM 11-5820-540-30).

(3) Set the receiver rf head XMTR DUPL control to channel 3300.

(4) Slide the locking clamp toward the end of shaft until the locking clamp screwpin enters the hole in the bandpass falter chassis, but do not move the tuning shaft of the bandpass filter. Tighten the screw which secures the locking clamp.

(5) Disconnect plug P1(39FL3J1) from 39 FL3J1 and plug P2(39FL3J2) from 39FL3J2 (see fig. 2-12).

(6) Remove control panel 39A5 (para. 2-83).

(7) Remove the six red-circled mounting screws which secure the bandpass falter to the chassis. Remove cable 39A1W3.

(8) Remove the filter carefully, disengaging it from the coupling gear on the chassis.

c. *Replacement Procedure.*

(1) Set the XMTR DUPL control on the receiver rf head to channel 3300.

**NOTE**

Be sure that the position of the coupling gear (XMTR DUPL control mechanism) is not altered during the following operation.

(2) Place the new bandpass filter on the chassis, and aline with the six mounting holes. At the same time, engage the drive shaft of the bandpass falter with the coupling gear on the chassis.

(3) Install and tighten all six mounting screws.

(4) Connect plug P1(39FL3J1) to 39FL3J1, plug P2(39A1HY1J3) to 39A1HY1J3, and plug P2(39FL3J2) to 39FL3J2; see figure 2-12.

(5) Replace control panel 39A5 (para. 2-83).

*d. Alinement Test.*

(1) Connect the equipment as in A, figure 4-186.

(2) Repeat the transmitter duplexer loss check for the receiver rf head, paragraph 4-71 *b.* (6).

**2-89. Removal and Replacement Procedures 40A1**

There is no overall removal and replacement procedure for the electronic component assembly. Individual subassemblies are removed and replaced as indicated below.


| | Para. |
|---|---|
| Channel frequency indicator 40A1DS1 | 2-90 |
| Connector filter assembly 40A1W1A1 | 2-91 |
| Amplifier-frequency multiplier 40A2 | 2-92 |
| Radio frequency amplifier 40AR1 | 2-93 |
| Bandpass filter 40FL1 | 2-94 |
| Control panel 40MP1 | 2-95 |


2-90. Replacement of Channel-Frequency Indicator 40A1DS1

*a. Test Equipment and Material Required. See* paragraph 2-92 *a.*

*b. Removal and Replacement Procedure.*

(1) Remove control panel 40MP1 (para. 2-95).

(2) Reconnect the XMTR TUNE knob to the shaft of the XMTR TUNE control Turn the XMTR TUNE control fully counterclockwise to the stop.

(3) Locate the charnel-frequency indicator. Loosen the two setscrews that secure the tuning shaft to the indicator.

(4) Remove the three red-circled screws that secure the channel-frequency indicator to the chassis.

(5) Grasp the channel-frequency indicator, and slide it sideways to disengage the tuning shaft. Remove the defective channel-frequency indicator.

(6) Turn the replacement channel-frequency indicator until the white crosshatch (below channel 2300) on the tape is alined with the calibration notch on the frame.

(7) Slide the replacement channel-frequency indicator sideways to connect the shaft of the channel-frequency indicator to the tuning mechanism shaft.

(8) Secure the channel-frequency indicator to the chassis with the three mounting screws.

(9) Secure the tuning shaft to the channel-frequency indicator using the setscrews.

*c. Channel Alinement Test and Adjustment.*

(1) Connect control-indicator plug P1 (40A1W1J5), which is located on the control panel, to comector 40A1W1J5 on the transmitter rf head chassis.

(2) Connect the test equipment as shown in figure 4-224.

(3) Direct the cooling air from the AIR OUTLET of the transmitter test facility to electrical shield assembly 40MP3 with hose assembly MX-8414/GRM-95(V).

(4) Turn the XMTR CHANNEL control to channel 2300 (1350 MHz).

(5) Turn the XMTR TUNE control to channel 2300.

(6) Set transmitter test facility switch S1 to ON, S20 to S12, S12 to OSC, and S13 to ON.

(7) Adjust the PWR OUT PEAK control for the maximum power indication on the power meter.

(8) Check the channel-frequency indicator. Channel 2300 should not be more than 1/8 inch from the calibration notch on unit 40A1DS1.

(9) If the channel is more than 1/8 inch away from the calibration mark, loosen the two setscrews holding the shaft to the channel-frequency indicator. Adjust the channel-frequency indicator until channel 2300 is in line with the calibration notch.

**NOTE**

Be sure that the shaft does not move during this adjustment

(10) Tighten the two setscrews to secure the shaft to the channel-frequency indicator.

(11) Check the alinement at channels 2550,2800, 3050, and 3300 as in (4), (5), (6), and (7) above. If the channel number being checked is more than ½ inch above or below the calibration mark, readjust slightly as in steps (9) and (10) above and recheck channel 2300,2550,2800,3050, and 3300.

(12) Remove the XMTR TUNE knob, disconnect P1(40A1W1J5) from connector 40A1W1J5, and install control panel 40MP1 (pars. 2-95).

## 2-91. Replacement of Connector-Filter Assembly 40A1W1A1

**NOTE**

The connector-filter assembly must be removed in order to replace individual filter connectors or to repair or replace P1(40A1W1A1).

*a.* Place the transmitter rf head right side up and locate voltage regulator 40A3 (TM 11-5820-540-30). Loosen the four green-circled mounting screws on the voltage regulator assembly and remove it.

*b.* Locate connector-filter assembly 40A1W1A1 (TM 11-5820-540-30). Measure the distance from front panel 40MP1 to the rear edge of 40A1W1A1 as accurately as possible. Record the distance.

c. Remove the four red-circled screws that secure assembly 40A1W1A1 to the chassis. Carefully remove the assembly.

d. If the connector-filter assembly must be replaced, unsolder and tag the wires connected to falters FL1 to FL46. Remove the defective connector-filter assembly, and resolder the tagged wires to the replacement unit. See FO-12 for connections.

e. If a single filter must be changed, unsolder the wires from both sides of the falter and remove it Install the replacement filter. Connect and resolder the wires.

*f.* To replace a connector, refer to paragraph 2-10.

g. Replace the connector-filter assembly on the chassis, using the four red-circled mounting screws removed inc. above. Position assembly 40A1W1A1 at the same distance as measured in *b.* above. Check the vertical plane of connector P1 (40A1W1A1), using a small square and the top edge of the chassis of unit 40 as a reference. Tighten the four mounting screws.

h. Reinstall voltage regulator 40A3, and tighten the four green-circled mounting screws.

## 2-92. Replacement of Amplifier-Frequency Multiplier 40A2

a. *Test Equipment and Material Required.*

(1) *Major Items.*

| *Equipment* | *Common name* |
|---|---|
| Test Facility, Transmitter TS-2866(V)2/GRM-95(V)2 | Transmitter test facility |
| Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2 | Accessory kit |
| Acceseory Kit Test Facility Set MK-1985(V)2/GRM-95(V)2 | Accessaory kit, band 2,3,4 |
| Counter, Electronic TD-1225(V)1/U | Frequency counter |
| Meter, Power HP-435A | Power meter |
| Power Sensor HP-8481A | Power sensor |
| Voltmeter, Digital AN/USM-451 | Digital voltmeter |

*(2) Test facility components.*

| Name | *Descon* |
|---|---|
| Adapter-Connector | UG-29B/U |
| Attenuator, Freed | CN-1287/U (20 dB) |
| Cable Assemblies, RF | CG3659/U (1 ft); CG3568/U (2 ft) |
| Cable Assembly, Special Purpose, Electrical | CX-12028/U (1.3 ft) |
| Coupler, Directional | CU-2247/U (280-S00154-000) |
| Dummy Load, Electrical | DA-6WU (336-8000052-000) |
| Hose Assembly, Air Duct | MX-6414/GRM-95(V) |
| Power Supply | PP-6304/GRM-95(V') |
| Test Lead | 267-800020-000 (3 ft) |

*b. Removal ~edure.*

*(1)* Set the transmitter rf head XMTR TUNE control to channel 3300.

(2) Locate amp~ler-frequency multiplier 40A2 on the transmitter rfhead (TM 11-5820-540-30).

(3) Secure the amplifier-fkequency multiplier drive shaft at channel 3300 (1850 MHz) by tightening the securing screw in the locking clamp (TM 11-5820-540-30).

(4) Disconnect plug PI (40A2AR2J1) born 40A2AR2J1 on the amp~ler-frequency multiplier (TM 11-582-540-30).

(5) Loosen the three red-circled mounting screws that secure unit 40A2 to the chassis.

(6) Carefully lift unit 40A2 straight up, disengaging the drive shaft from the flexible coupling and the mating connector.

c. *Replacement 13wcedum.*

**NOTE**

The 40A2 replacement module is locked at channel 3300 (1850 MHz). Do not loosen the locking clamp until the unit is secured in the transmitter.

(1) Set the XMTR TUNE control on the transmitter rf head to channel 3300.

**NOTE**

Be sure that the flexible shaft to the XMTR TUNE control does not rotate during the following operation.

(2) Lower the replacement module, carefully engaging mating connectors 40A1 W1J2 and P1 (40A1W1J2), as well as the drive shaft of unit 40A2, to the flexible shaft

(3) Tighten the three mounting screws.

(4) Connect plug P1(40A2AR2J1) to 40A2AR2J1 on the amplifier &quency multiplier (TM 11-5820-540-30).

(5) Loosen the searing acrewin the locking clamp.

d. *AfinmentRvcetium*

(1) Connect the test equipment as ahown in figure 4-224.

(2) Direct cooling air horn the **AIR OUTLET** of the transmitter test facility to electrical shield 40MP3 (TM 11-5820-540-30) at the rear of the transmitter rf head using hose assembly A!IX-8414/GRM-95 (V).

(3) Set the accessory kit power supply AC POWER switch to ON. Adjust the voltage control for 115 Vac on the VOLTS meter.

(4) Set the **XMTR CHANNEL** and XMTR 'ITJNE controls to channel 3300.

(5) Set transmitter test fkcility switch S1 to ON, S20 to S12, S12 to MULT, and S13 to ON. Transmitter test facility meter Ml should indicate between 20 and 60 percent fidl scale.

(6) Adjust the PWR OUT PEAK control on the transmitter rf head for the maximum indication on the power meter.

(7) Ascertain the correct attenuation of each item at the output frequency from the calibration charts on the directional coupler and the 20 dB attenuator. Add the sum of these to the power meter indication to obtain the output power of the unit under test The output power should be +41.8 dBm minimum (15 watts). Check that the output fkequency indicated on the frequency meter ia 1850 MHz (+37 kHz).

(8) Repeat (4) through (7) above for channels 2300 and 2900, corresponding to output frequencies of 1350 and 1650 MHz respectively.

(9) If the output power is lower than specified in (7) above, but the frequency is as required, proceed as follows:

*(a)* Set transmitter test facility switches S1 and S13 to **OFF.**

(V reengage the tive shaft of unit 40A2 fkom the flexible shaft as described in *b.(4)* through (6) above. Take care not to turn the XMTR TUNE flexl%le shaft

(c) Reinstall unit 40A2, carefidly engaging mating connectors 40A1W1J2 and P1(40A1W1J2). Do not engage the drive shaft

(i# Recomect plug P1(40A2AR2J1) to 40A2AR2J1.

(e) With the test equipment connected as in figure 4-224, set transmitter test facility switches S1 and S13 to ON.

**NOTE**

Only a slight adjustment of the drive shaft of unit 40A2 should be necessary to peak the output power.

*(f)* Turn the drive shaft of unit 40A2 to peak the output power indicated on the power meter. Note that the frequency remains within the limits specified in (7) above.

*(g)* Set transmitter test facility switches S2 and S13 to OFF.

*(h)* Remove and replace unit 40A2 as described in *b* and c. above.

(i) Recheck the alinement as decribed in d. (1) through (7) above.

**2-93. Replacement of Rf Arnplifier 40AR1**

*a. Test Equipment and Material Required. See* paragraph 2-92 *a.*

*b. Removal Procedure.*

(1) Place the transmitter rf head front side down and locate electrical shield 40MP3.

(2) Remove electrical shield 40MP3 and dust cover 40MP2 as described in TM 11-5820-540-12.

(3) Set the XMTR TUNE control on the transmitter rf head to channel 3300.

(4) Turn the PWR OUT PEAK control clockwise until the cathode tuning plunger (TM 11-5820-540-30) bottoms. Then turn the control one and one-half turns counterclockwise.

(5) Lock the leadscrews in position as follows:

*(a)* Loosen the setscrew in the locking clamp of unit 40AR1 (TM 11-5820-540-30).

*(b)* Slide the clamp to the end of the leadscrew until the pin in the clamp enters the recess at the end of the V1 cavity (TM 11-5820-540-30).

*(c)* Tighten the setscrew in the locking clamp.

(6) Disconnect plug P2(40A1HY1J3) from 40A1HY1J3, and plug 40AR1P1 from 40A1W1J3 (TM 11-5820-540-30).

(7) Disconnect plug P1(40FL1J2) from 40FL1J2 (TM 11-5820-540-30).

(8) Remove the two green-colored screws that hold the bracket to the transmitter rf head rear chassis casting (TM 11-5820-540-30).

(9) Remove the two red-circled mounting screws which hold the rear chassis casting (TM 11-5820-540-30) to the left side chassis bracket

(10) Remove the red-circled mounting screw located in the rear chassis casting and directly below 40A1W1A1P1 (TM 11-5820-540-30).

(11) Remove the two red-circled mounting screws located in the right side chassis, on either side of electrical dummy load 40A1A2 (TM 11-5820-540-30).

(12) Push the rear chassis casting toward the left side of the transmitter rf head to disengage the locating pins in the chassis.

(13) Lift the rf amplifier, with the rear chassis casting, away from the transmitter rf head. Be sure that the rf leads and the power cable are free from the rf head chassis.

(14) Remove cable clamp 40W2 from the rear chassis casting.

(15) Remove the rf amplifier from the rear chassis casting by removing the four red-circled mounting screws.

(16) Remove P2(40AR1J1) from 40AR1J1 and P1(40AR1J4) from 40AR1J4.

*c. Replacement Procedure.*

(1) Secure the rear chassis casting to the replacement rf amplifier. Connect P2(40AR1J1) to 40AR1J1 and attach cable clamp 40W2 to the rear casting. Then connect P1(40AR1J4) to 40AR1J4.

(2) Set the XMTR TUNE control of the transmitter rf head to channel 3260. Set the PWR OUT PEAK control to the midposition.

(3) Place the transmitter rf head front down with the bottom toward the front. Lower the rf amplifier into position carefully, engaging the coupling to the main chassis tuning mechanism and the rear chassis casting with the locating pins in the rf head chassis.

(4) Replace the five red-circled screws that secure the rear chassis casting to the other chassis pieces.

(5) Replace the two green-circled screws that secure the rear chassis casting to the bracket on chassis 40A1.

(6) Reconnect plug P2(40A1HY1J3) to 40A1HY1J3 (TM 11-5820-540-30).

(7) Reconnect plug 40AR1P1 to 40A1W1J3 (TM 11-5820-540-30).

(8) Reconnect P1(40FL1J2) to 40FL1J2 (TM 11-5820-540-30).

(9) Loosen the locking clamp of unit 40AR1, and slide the clamp along the leadscrew until free from the cavity. Secure the locking clamp.

(10) Replace dust cover 40MP2 and electrical shield 40MP3 with the screws provided.

*d. Alinement Test.*

(1) Connect the test equipment as shown in figure 4-224.

(2) Direct the cooling air from the AIR OUTLET of the transmitter test facility to electrical shield 40MP3 with Hose Assembly MX-8414/GRM-95(V).

(3) Set the XMTR TUNE and XMTR CHANNEL controls to channel 3300.

(4) Set the accessory kit power supply AC POWER switch to ON. Adjust the voltage control for 115 Vac on the VOLTS meter.

(5) Set the transmitter test facility switches as follows:

| *Switch* | *Switch position* | Normal *indication* |
|---|---|---|
| S1 | ON | *None* |
| S20 | S12 | None |
| S12 | OSC | Test facility meter Ml indicates between 20 and 90 percent of full scale |
| S13 | ON | None |

(6) Adjust the PWR OUT PEAK control on the transmitter rf head for the maximum power indication on the power meter.

(7) Ascertain the correct attenuation of each item at the output frequency, using the calibration charts on the directional coupler and the 20 dB attenuator. Add the sum of these to the power meter indication, to obtain the output power of the unit under test. The output power should be +41.8 dBm minimum (15 watts).

(8) Check that the output frequency indicated on the frequency meter is 1850 MHz (±37 kHz).

(9) Repeat (3) and (6) to (8) above for channels 2300 and 2800, corresponding to output frequencies of 1350 and 1600 MHz respectively.

**2-94. Replacement of Bandpass Filter 40FL1**

*a. Test Equipment and Material Required. See* paragraph 2-92 *a.*

*b. Removal Procedure.*

(1) Remove shield 40MP3 and dust cover 40MP2 described in TM 11-5820-540-12.

(2) Set the transmitter rf head XMTR TUNE control to channel 3300 and locate bandpass falter 40FL1.

(3) Lock the bandpass filter tuning mechanism in position as follows:

*(a)* Loosen the securing screw in the locking clamp of unit 40FL1 (TM 11-5820-540-30).

*(b)* Slide the clamp to the end of the drive shaft until the screwpin in the clamp enters the pinhole in the chassis of unit 40FL1 (TM 11-5820-540-30).

*(c)* Tighten the securing screw of the locking clamp.

(4) Loosen the four green-circled screws securing the bracket to chassis 40A1 (TM 11-5820-540-30).

(5) Remove control panel 40MP1 (para. 2-95).

(6) Disconnect plug P1(40FL1J2) from 40 FL1J2 (TM 11-5820-540-30).

(7) Disconnect plug P2(40FL1J1) from 40FL1J1 through the access hole in the front chassis.

(8) Remove the four red-circled screws that secure the bandpass falter to the center chassis plate (TM 11-5820-540-30).

(9) Remove the bandpass falter from the transmitter rf head.

c. *Replacement Procedure.*

*(1) Set the* transmitter rf head XMTR TUNE control to channel 3300.

(2) Carefully slide the replacement falter into position and engage the coupling gear without changing the position of the gear.

(3) Secure the filter to the center chassis plate with the four red-circled screws.

(4) Loosen the locking clamp on bandpass filter 40FL1, and slide the clamp along the drive shaft until it is free from the chassis of unit 40FL1. Secure the clamp.

(5) Connect P1(40FL1J2) to 40FL1J2 and P2(40FL1J1) to 40FL1J1.

(6) Replace control panel 40MP1 (para. 2-93).

(7) Replace the bracket between the rear casting and the center chassis plate. Secure with the four green-circled screws.

d *Alinement Test* Check the alinement of the transmitter rf head as in paragraph 2-93 d.

**2-95. Replacement of Control Panel 40MP1**

*a. Removal Procedure.*

*(1)* Remove the XMTR TUNE control knob.

(2) Remove the XMTR CHANNEL control knob.

(3) Remove the PWR OUT PEAK knob by loosening the setscrew.

(4) Loosen the two screws that secure plug P1(40A1W1J5) to 40A1W1J5 (TM 11-5820-540-30). Remove P1(40A1W1J5).

(5) Remove the hexagon nut and the flat washer from the PWR OUT connector.

(6) Loosen and remove the six green-circled mounting screws and washers at the rear of the control panel. Remove the control panel.

**NOTE**

Pull the panel forward from the rf head to release it from the guiding pin. If the fit is tight, it may be necessary to wiggle the panel out on some units.

(7) If observation windows or handle assemblies are defective, refer to paragraph 2-84 before proceeding to *b.* below.

*b. Replacement Procedure.*

(1) Place the control panel in position. Press and slide home the guiding pin.

**NOTE**

It may be necessary to loosen the four screws holding power monitor 40A1A1 in position. Do not retighten the screws at this time.

(2) Secure the control panel to the chassis using the six mounting screws removed in *b.* (6) above.

(3) Connect P1(40A1W1J5) of control-indicator 40A4 to mating connector 40A1W1J5. Secure with the two screws provided.

(4) Replace and secure the nut and washer on the PWR OUT connector. Tighten the power monitor 40A1A1 mounting screws.

(5) Install the XMTR TUNE control knob.

(6) Install the XMTR CHANNEL control knob.

(7) Install the PWR OUT PEAK control knob.

## Section VI. REMOVAL AND REPLACEMENT PROCEDURE - ORDER WIRE

2-96. Replacement of Push Switch 9A2S1

a. Remove monitor panel 9A2 (as described in TM 11-5820-540-30).

*b.* Unsolder and tag the wires from 9A2S1.

c. Loosen and remove the hexagonal nut and washer that secure 9A2S1 to the monitor panel, remove 9A2S1.

*d.* Connect terminals 5 to 6 and 7 to 8 on the new switch, using wire of similar guage as that on the defective switch. Refer to FO-13.

e. Install the new push switch in the mounting hole and secure it with the hexagonal nut and washer.

f. Connect and solder the wires removed in *b.* above.

g. Replace and secure control panel 9A2.

2-97. Replacement of Toggle Switch 9A2S2

a. Remove monitor panel 9A2 (as described in TM 11-5820-540-30).

*b.* Loosen and remove the hexagonal nut and washer that secure 9A2S2 to the mounting bracket.

c. Pull 9A2S2 free from the mounting bracket. Unsolder and tag the wires from 9A2S2.

*d. Connect* terminal 2 to 4 on new switch using wire of similar gauge as that used on defective switch. Refer to FO-13.

e. Connect and solder wires removed inc. above.

*f.* Install the new switch in its mounting hole and secure it with the hexagonal nut and washer.

*g.* Replace and secure control panel 9A2.

# CHAPTER 3

# TEST AND REPAIR PROCEDURES (FIXED HEADS AND ORDER WIRE) SRA ACTIVITIES ONLY

**NOTE**

Only activities authorized the use of the AN/GRM-95(V)2 will perform this phase of maintenance. All other activities will not perform this phase of maintenance, but will forward unserviceable units to a higher category of maintenance.

## Section I. RECEIVER RADIO FIXED HEAD RECEIVER RADIO R-1329(P)/GRC-103(V) SM-A-698826, R-1329A(P)/GRC-103(V) SM-D-883585, R-1329 B(P)/GRC-103(V) SM-D-967352, OR R-1329C(P)/GRC-103(V) SM-D-990508

**NOTE**

Reference is to all units unless otherwise specified in the text

### 3-1. Receiver, Radio 1RE1 (Receiver, Fixed Head)

*a. Test Equipment and Material Required.*

| Equipment | Common name |
|---|---|
| Test Facility, Receiver TS-2867(V)2/GRM-95(V)2 | Receiver test facility |
| Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2 | Accessory kit |
| Test Facility, Transmitter TS-2866(V)2/GRM-95(V)2 | Transmitter test facility |
| Voltmeter, Electronic ME-459/U | VTVM |
| Oscilloscope AN/USM-281C | Oscilloscope |
| Generator, Signal AN/USM-205A | Wide range oscillator |
| Selective Voltmeter TS-3066(V)3/U | Selective voltmeter |
| Power Meter HP 435A | Power meter |
| Power Sensor HP 8481A | Power sensor |
| Canter, Electronic TD-1225(V)1/U | Frequency counter |

*b. Test Procedures.*

*(1)* Operational check.

*(a)* Perform the following preliminary checks:

1. Remove pulse form restorer 1RE1A3 and limiter-disc riminator 1RE1A4 as described in TM 11-5820-540-12.

2. Test pulse form restorer 1RE1A3 as described in paragraph 3-9 (SM-D-698146) or paragraph 3-10 (SM-D-990510).

3. Test limiter-discriminator 1RE1A4 as described in paragraph 3-11.

4. Reinstall pulse form restorer 1RE1A3 and limiter-disc riminator 1RE1A4 as described in TM 11-5820-540-12.

*(b)* Connect equipment as shown in figure 3-1. Turn power supply ON and maintain its output at 115 Vac throughout the following procedures. Set the test facility switches as follows:

| *Switch* | *Position* |
|---|---|
| S1 | ON |
| S5 | S10 |
| S10 | –12 v |

*(c)* On the unit under test set BUZZER OFF-ALARMS NORMAL switch S3 to ALARMS NORMAL position, and the AC POWER switch to ON. Observe the unit under test for the following indications:

1. AC POWER lamp lights.
2. SYNC lamp lights.
3. LOW SIGNAL lamp may light.

*(d) If* the buzzer does not sound, *press* the BUZZER OFF button and the buzzer should sound.

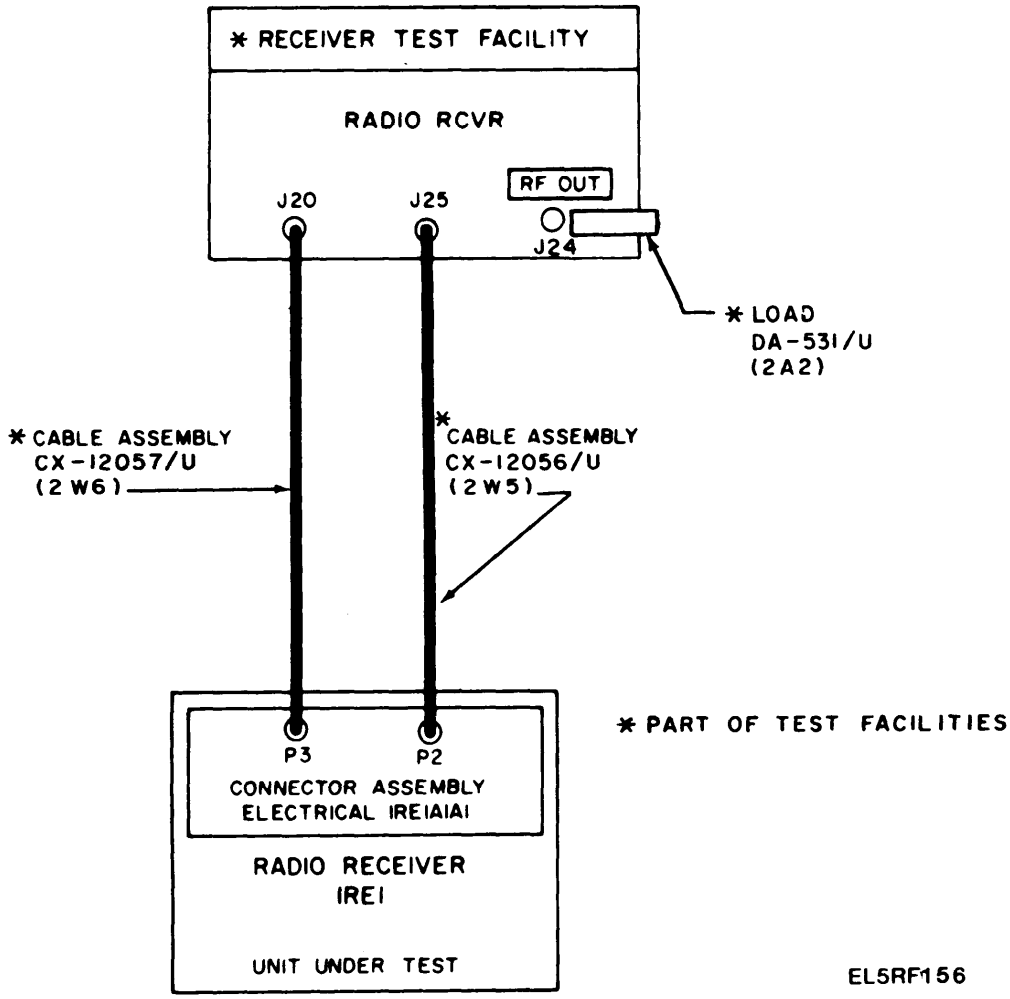



*Figure* 3-1. *Receiver Fixed Head, Operational Check Test Setup.*

*(e)* Set BUZZER OFF-ALARMS NORMAL switch S3 on unit under test to BUZZER OFF position. Buzzer should silence, and alarm lamps should dim.

*(f) Set BUZZER* OFF-ALARMS NORMAL switch S3 on unit under test to ALARMS NORMAL. Buzzer should sound and alarm lamps should brighten.

*(g)* Press the BUZZER OFF button on the unit under test to silence the buzzer.

*(h)* Set test facility switch S8 to 47.50. The SYNC lamp should go out on unit under test.

*(i)* Press test facility HIGH SIG ALM switch S11. The HIGH SIGNAL lamp on the unit under test should light.

*(j)* Observe the indications at all positions of the meter switch on the unit under test as follows:

| *Switch position* | *Indication* |
|---|---|
| +12 v | Green band |
| –12V | Green band |
| REFL PWR | Zero |
| XMTR DUPL | Zero |
| OSC | Between 20% and 90% of full scale. |
| DOUBLER | Between 20% and 90% of full scale (20% to 70% for A, B, and C models). |
| MULT | Zero |
| RECVR SIG | May be zero or a positive indication: should not exceed 40% of full scale. |
| 12 CH PCM<br>24 CH PCM<br>FDM<br>OW | Possible indication due to receiver noise. |

(2) *Video level, metering check.*

*(a)* Connect the equipment as shown in A, figure 3-2.

*(b)* Set the test facility switches as follows:

| *Switch* | *Position* | *Normal indication* |
|---|---|---|
| AT1 | 20 dB | |
| S5 | S9 | |
| S9 | 1 kHz | |
| S8 | 4-7.5 | |
| S10 | –12V | Test Facility Meter M1 shoud indicate in green band |
| S14 | 30 MHz | |

*(c)* Set Test facility switch *S9 to 300 kHz.* The LOW SIGNAL lamp on the unit under test will be out The VTVM should indicate 265 mV ±15 mV.

*(d)* Set the meter switch on the unit under test to 24 CH PCM. The meter on the unit under test should indicate in the green band

*(e)* Set test facility switch S9 to 180 kHz. The VTVM should indicate 159 mV ±16 mV.

*(f)* Set the meter switch on the unit under test to 12 CH PCM. The meter on the unit under test should indicate in the green band.

*(g)* Transfer the VTVM to J21 of the test facility (B, fig. 3-2) and terminate the VTVM with 91 ohms.

*(h)* Set test facility switch S9 to 75 kHz. The VTVM should indicate 190 mV ±20 mV.

*(i)* Set the meter switch on the unit under test to FDM. The meter on the unit under test should indicate in the green band

*(j)* Transfer the VTVM to J22 of the test facility (C, fig. 3-2) and terminate the VTVM with 600 ohms.

*(k)* Set test facility switch S9 to 45 kHz. The VTVM should indicate 245 mV ±45 mV.

*(l)* Set the meter switch on the unit under test to OW. The meter on the unit under test should indicate in the green band

(3) *Wideband noise check*

*(a) Connect the* VTVM to J17 of the test facility (A, fig 3-2).

*(b)* Disconnect the cable at J19 of the test facility. The VTVM should indicate not lower than –25 dBm.

(4) *Pcm regeneration and timing checks.*

*(a)* Connect the equipment as shown in figure 3-3.

*(b)* Set test facility swith S9 to the 180 kHz position and record the level indicated on the VTVM.

*(c)* Set switch S9 to the EXT VIDEO position.

*(d)* Adjust the output of the wide range oscillator until the VTVM indicates the level that was recorded in *(b)* above.

*(e)* Observe the timing pulses displayed on the oscilloscope. The pulse train should be 2 volts ±0.2 volts peak to peak with a pulse width, at 50 percent amplitude, of between 80 and 150 nanoseconds.

*(f)* Interchange the test facility connections at J18 and J23.

*(g)* Set the meter switch on the unit under test to 12 CH PCM. The meter should indicate in the green band. The oscilloscope should display a 2 volt ±0.2 volt (+0.2-0.4 volt for 1RE1 units using pulseform restorer SM-D-990510) peak to peak negative going square wave.

*(h)* Vary the output level of the wide range oscillator by +3 and –3 dB as indicated on the wide range oscillator meter. The level of the PCM train displayed on the oscilloscope should not change. The meter indication on the unit under test should stay in the green band.

(i.) Remove the 91 ohm load from the oscilloscope. The oscilloscope display should be greatly diminished and the meter indication on the unit under test should be almost zero. Replace the 91 ohm load at the oscilloscope.

(5) PCM squelch

(a) Set test facility switch AT1 to 40 dB and S9 to 180 kHz. Note the VTVM indication in dB.

*(b)* On the test facility, set S9 to EXT VIDEO.

*(c)* Set the wide range oscillator to 10 kHz and adjust the output level until the VTVM indicates the same as noted in *(a)* above.

*(d)* Maintaining the frequency constant at 10 kHz, slowly decrease the output level until the PCM output disappears. The VTVM level should be at least 5.1 dB below the indication noted in *(a)* above.

(6) *Receiver low signal alarm.*

*(a)* Connect the equipment as shown in figure 3-4.

*(b)* Set the test facility switches as follows:

| *Switch* | *Position* |
|---|---|
| S9 | 30 MHz |
| S14 | 30 MHz |
| S8 | 47.5 |

*(c)* Set the wide range oscillator to 600 kHz and turn the output level control fully counterclockwise.

*(d)* Adjust the variable attenuators for an indication of 5 mV or less on the VTVM.

*(e)* Set test facility switch S9 to EXT VIDEO.

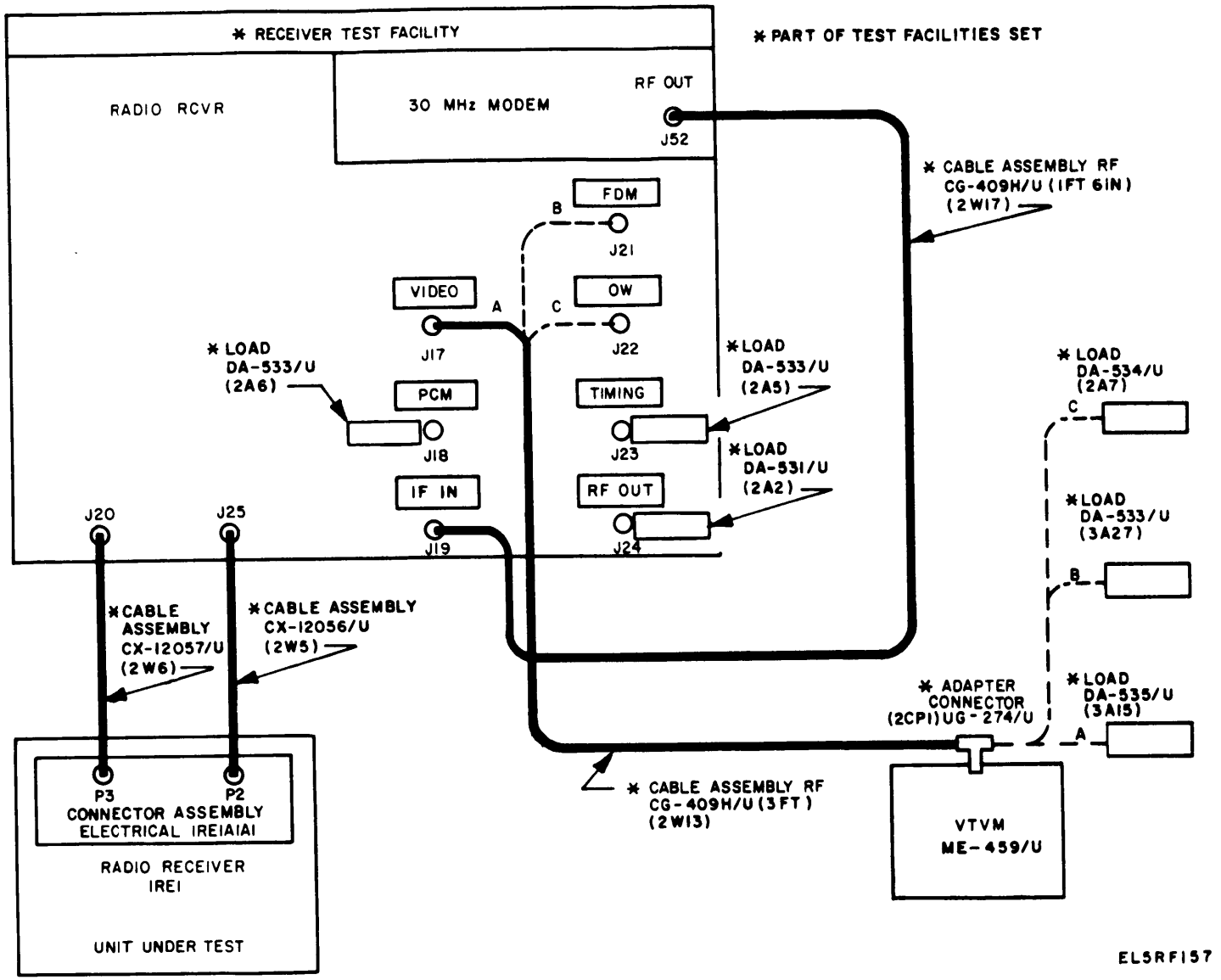



*Figure 3-2. Receiver Fixed Head, Video Level, Metering and Wideband Noise Check, Test Setup.*

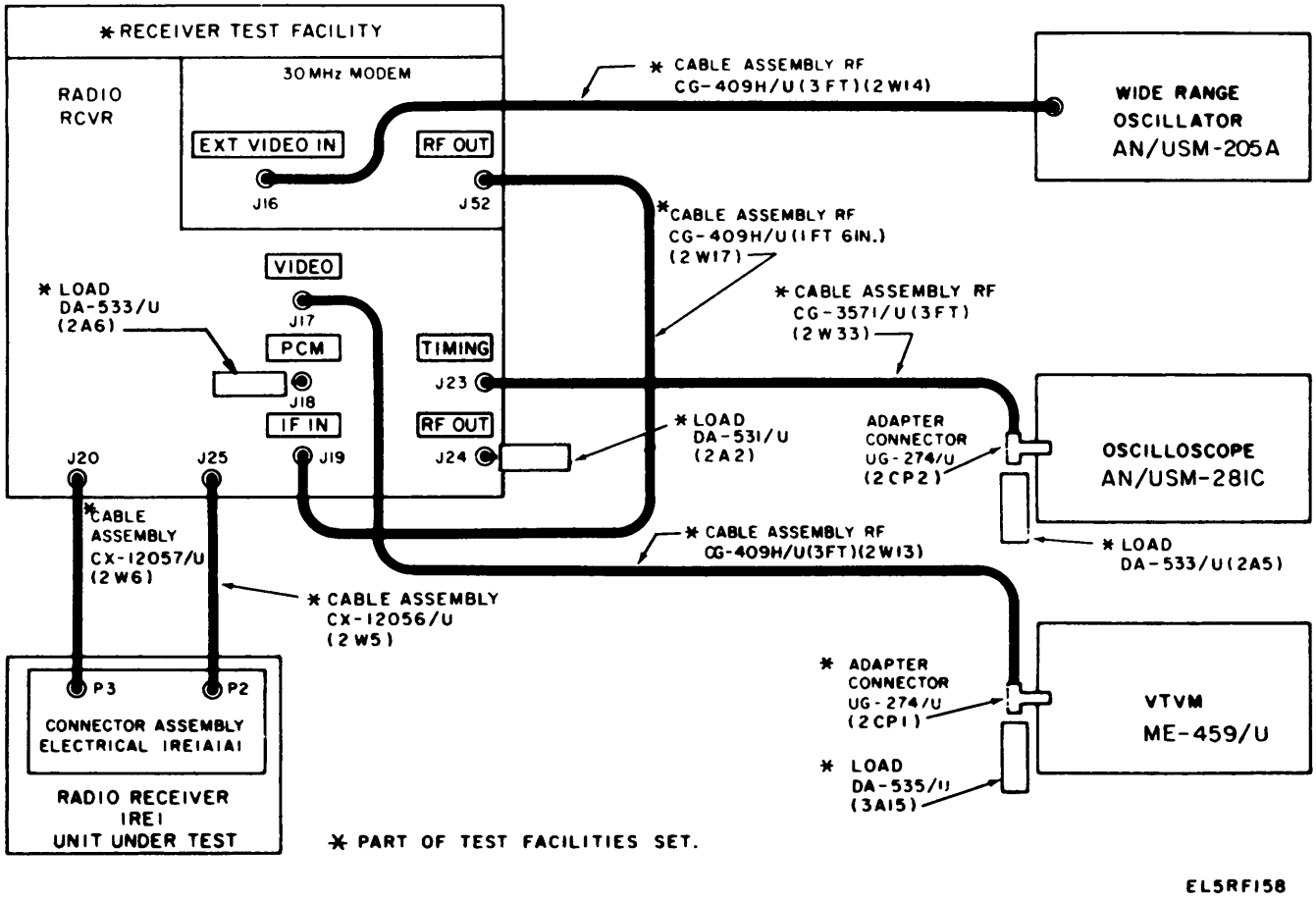



Figure 3-3. *Receiver Fired Head* PCM *Regeneration Timing, and PCM* Squelch *Check Test Setup*

*(f)* Slowly increase the output level of the wide range oscillator until the LOW SIG lamp lights and the buzzer sounds on the unit under test. The VTVM should indicate between 26 mV and 34 mV. Note the VTVM indication in dB.

*(g)* Decrease the output of the wide range oscillator until the LOW SIG lamp goes out and the buzzer silences on the unit under test This decrease in level from the wide range oscillator should not exceed 2.4 dB.

(7) *Receiver signal monitor check.*

*(a)* Connect equipment as shown in figure 3-5.

| Switch | *Position* |
|---|---|
| S9 | 30 MHz |
| AT1 | 20 dB |
| S8 | 47.5 |

*(c)* Set the meter switch on the unit under test to REC SIG.

*(d)* On the unit under test set the RCVR SIG ADJUSTMENT (right hand side panel) fully clockwise.

*(e)* Set the variable attenuators to 1 dB. The meter on the unit under test should indicate approximately 80% of full scale deflection.

*(f)* Slightly adjust the RCVR SIG METER ZERO on video amplifier 1RE1AR1 of the unit under test to obtain a meter indication of 80% of full scale deflection.

*(g)* Set AT1 on the test facility to 50 dB. The meter on the unit under test should indicate a low reading.

*(h)* Final adjustment are made during the system test Refer to paragraph 5-1.

(8) *Rf output power level and frequency generation check.*

*(a)* Connect the equipment as shown in A, figure 3-6.

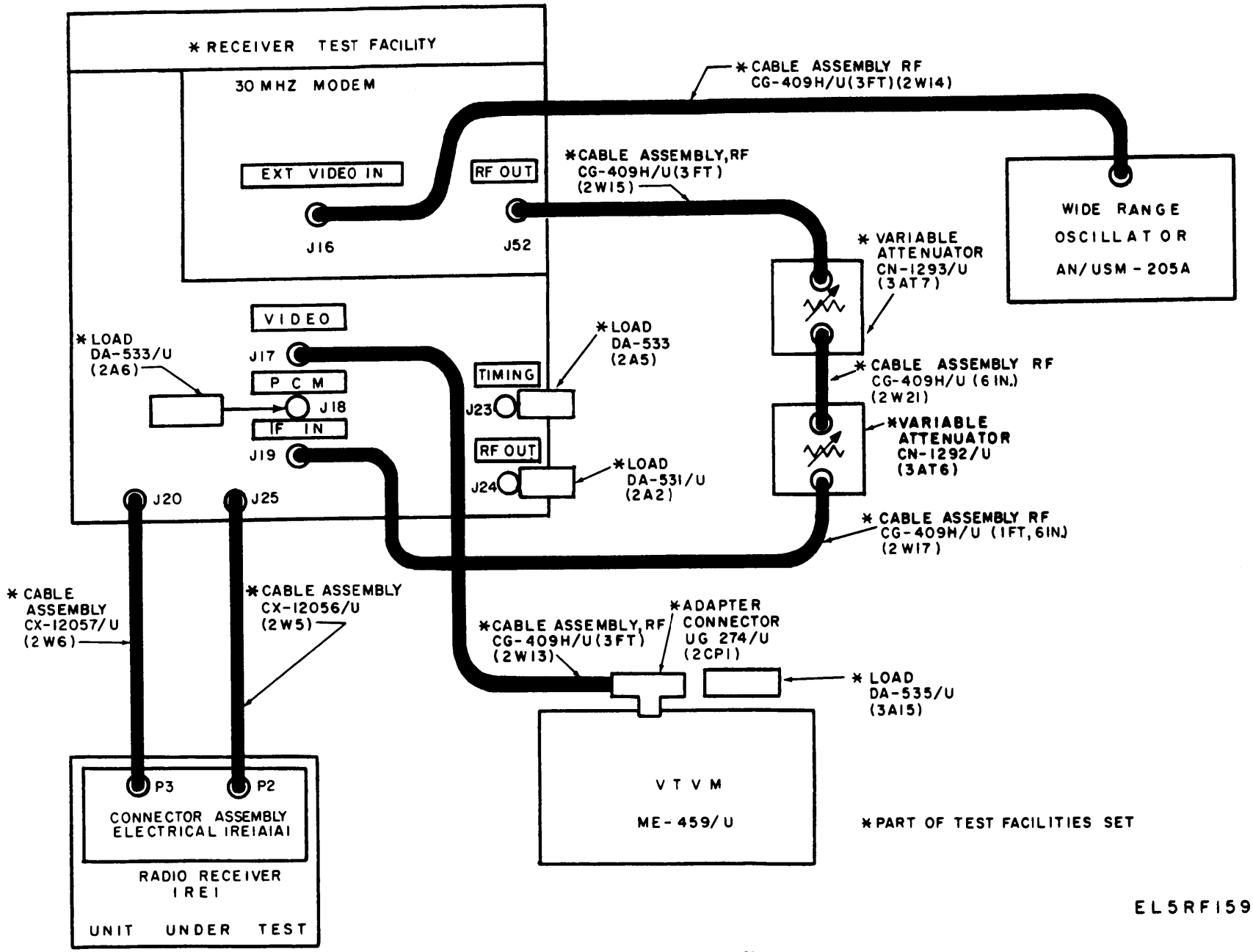



*Figure 3-4. Receiver Fixed Head, Receiver Squelch Check, Test Setup.*

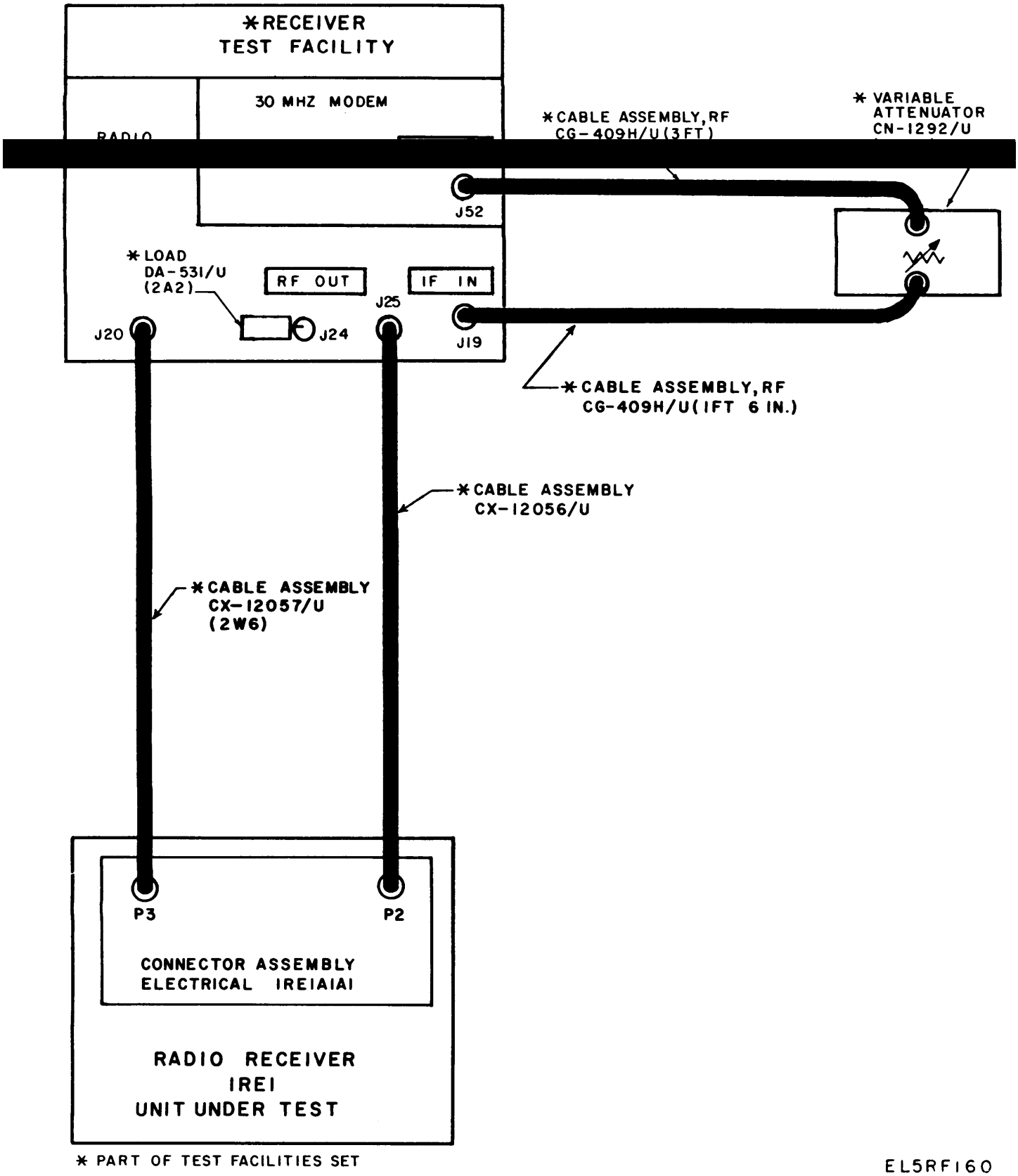



*Figure 3-5. Receiver Fixed Head, Receiver Signal Monitor Check Test Setup.*

*(b)* For all positions of test facility switch S8, the output power indicated on the power meter should be between +2.5 and +7 dBm (+12.5 to +17 dBm output).

*(c)* Connect the equipment as shown in B, figure 3-6.

*(d)* For all positions of test facility switch S6, the output frequency indicated on the counter should be as follows:

| | Frequency (MHz) ±0.001% Synthesizer installed | |
|---|---|---|
| *Switch S8 Position* | *SM-D-698145* | *SMD-865030* |
| 47.50 | *95.000000* | *95.000000* |
| 48.33 | *96.666666* | *96.687500* |
| 50.65 | *101.312500* | *101.312500* |
| 52.31 | *104.625000* | *104.656250* |
| 54.98 | *109.958330* | *109.958330* |
| 58.25 | *116.500000* | 116.531250 |
| 61.66 | 123.333333 | 123.333333 |
| 63.46 | 126.937500 | 126.968750 |
| 66.00 | 132.000000 | 132.000000 |
| 67.50 | 135.000000 | 135.020834 |
| 72.50 | 145.000000 | 145.000000 |

(9) *Video frequency response check.*

*(a) Initial calibration.*

*1.* Connect the test equipment as shown in figure 3-7.

2. Set the test facility switches as follows

| *Switch* | *Position* |
|---|---|
| S9 | EXT VIDEO |
| S14 | 30 MHz |
| AT1 | 30 dB |
| S10 | –12 v |
| S8 | 47.5 |

3. Set the coaxial switch to position 2.

4. Set the wide range oscillator frequency to 10 kHz.

5. Set the meter switch on the unit under test to FDM.

6. Set the wide range oscillator output level to give an approximate deviation of 100 kHz peak deviation as determined by a 65% indication on the unit under test meter.

7. Set the wide range oscillator for 960 kHz.

8. Set the selective voltmeter switches as follows:

| switch | Position |
|---|---|
| INPUT MODE | TERMINATED (50 Ω) |
| BAL-UNBAL | UNBAL |
| BANDWIDTH | 1000 |
| RECEIVER MODE | AM |
| FREQUENCY | 960 kHz |

9. Adjust the wide range oscillator frequency ontrol, and selective voltmeter controls (REFERENCE LEVEL and AMPLITUDE RANGE) for a maximum upper scale selective voltmeter indication Set the RECEIVER MODE switch to AM/AFC and fine tune the wide range oscillator for a selective voltmeter indication of 960 kHz. Record the selective voltmeter level indication.

10. Temporarily disconnect the wide range oscillator and note the selective voltmeter indication It should be at least 20 dB below the level recorded in 9. above. If necessary, increase the wide range oscillator output level slightly to obtain the 20 dB signal-to-noise ratio.

*(b)* Frequency *response measurement*

*1. Tune* the wide range oscillator to 10 kHz.

2. Set the selective voltmeter to 10 kHz as in 9. above. Record the selective voltmeter level indication.

3. Set the coaxial switch to position No. 1. Adjust the variable attenuator for the same selective voltmeter indication as in 2. above (k less than 0.1 dB). Record the variable attenuator settings; this is the 10 kHz reference attenuation

4. Repeat 1. through 3. above for all frequencies listed in the chart below. Record the attenuation with respect to the reference attenuation obtained in 3. above. It should be as listed in the chart below.

| Modulating frequency (kHz) | Relative attenaution *(dB) - reference attenuation 10 kHz* | | |
|---|---|---|---|
| | *Nominal* | *Minimum* | *Maximum* |
| 10.0 | *0* | *-0.1* | 0.1 |
| 30.0 | 0 | -0.1 | 0.1 |
| 60.0 | 0.15 | 0.0 | 0.3 |
| 120.0 | 0.6 | 0.5 | 0.7 |
| 180.0 | 1.3 | 1.1 | 1.5 |
| 240.0 | 2.3 | 2.0 | 2.6 |
| 360.0 | 5.1 | 4.6 | 5.6 |
| 480.0 | 9.0 | 8.2 | 9.8 |
| 600.0 | 14.0 | 12.8 | 15.2 |
| 720.0 | 20.2 | 18.4 | 22.0 |
| 840.0 | 27.5 | 25.3 | 29.7 |
| 960.0 | 36.0 | 33.0 | 39.0 |

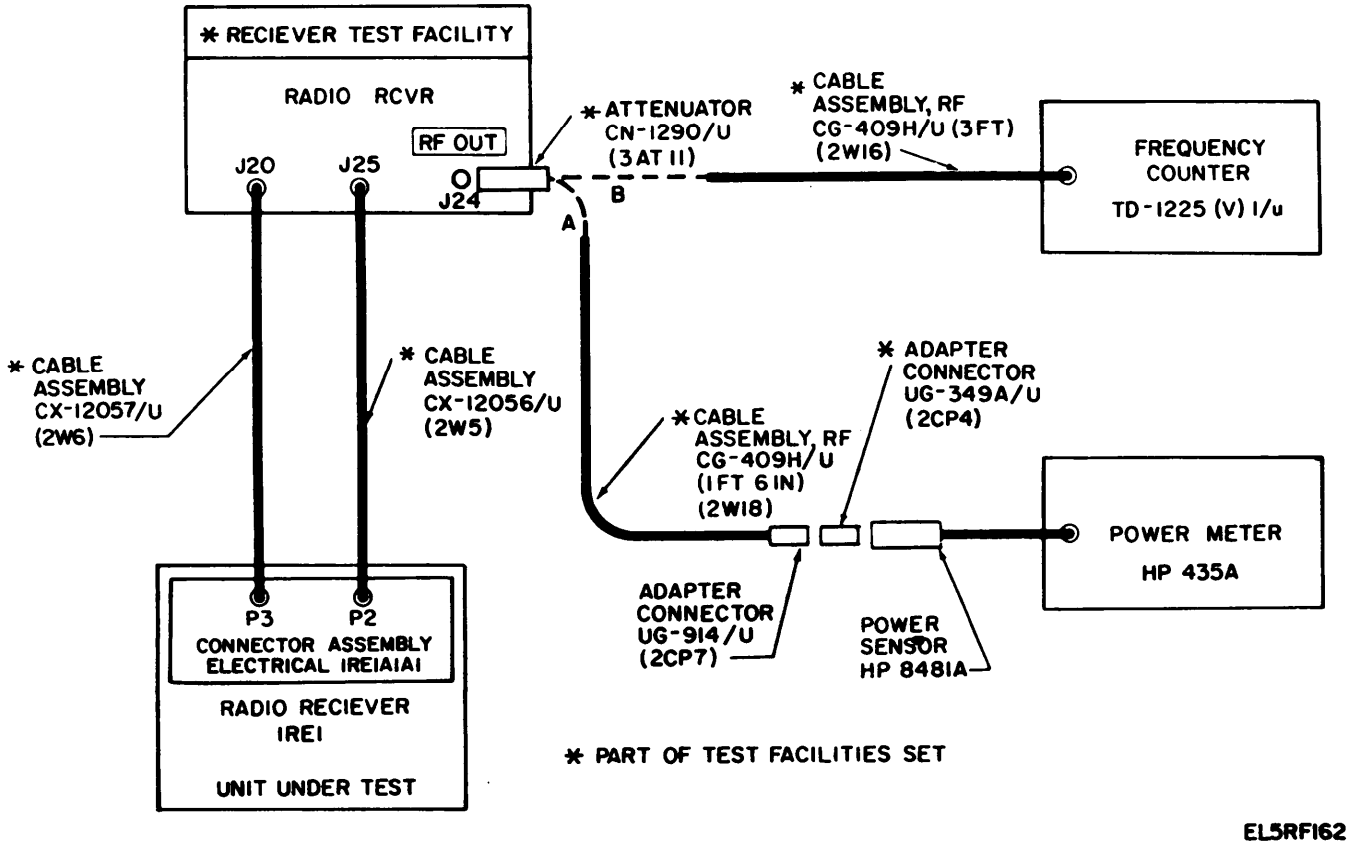



Figure 3-6. *Receiver Fixed Head, Synthesizer Ouput Level and Frequency Generator Check Test Setup.*

*c. Troubleshooting procedures (fig. 1 or FO-2 as applicable).*

| Symptoms | *Probable cause* | *Checks & corrective measures* |
|---|---|---|
| 1. AC POWER switch trips (b.(1)(c) above). | Short circuit in wiring or modules | Disconnect unit from test facility and check DC lines for short circuits (FO-1 or FO-2 as applicable). Remove modules as required Repair or replace wiring or modules as neccessary. |
| 2. Abnormal alarm indications (b.(1)(d) to *(g)* above). | a Incorrect setting of BUZZER OFF-ALARMS NORMAL Switch. | *a* Check setting of BUZZER OFF-ALARMS NORMAL switch S3. |
| | *b.* Defective Buxxer 1RE1A1DS5. | *b.* Check for 26 Vdc across buzzer terminals. Replace buzzer if necessary. |
| | *c.* Defective BUZZER OFF switch. | c. Refer to FO-1 or FO-2 as applicable. Check continuity of BUZZER OFF switch. Replace as *necessary.* |
| 3. Abnormal alarm lamp indications (b(1)(c) or *(i)* above. | *a* Defective alarm lamps.<br>*b.* Defective alarm control 1RE1A1A2 or related circuits. | *a* Replace defective lamps.<br>*b.* Check voltages, continuity, and resistances of components and circuits (FO-1 or FO-2 as applicable). Repair or replace defective circuits as indicated |
| 4. Abnormal meter indications (b.(1)(j) above). | *a* Defective meter circuits (any switch positions). | *a* Perform resistance and continuity checks of wiring, 1RE1A1S1 and 1RE1A1A3 (FO-1 or FO-2 as applicable). Check dc voltage between terminals of meter (meter indicates in percent, 100%=5OO mV.). |

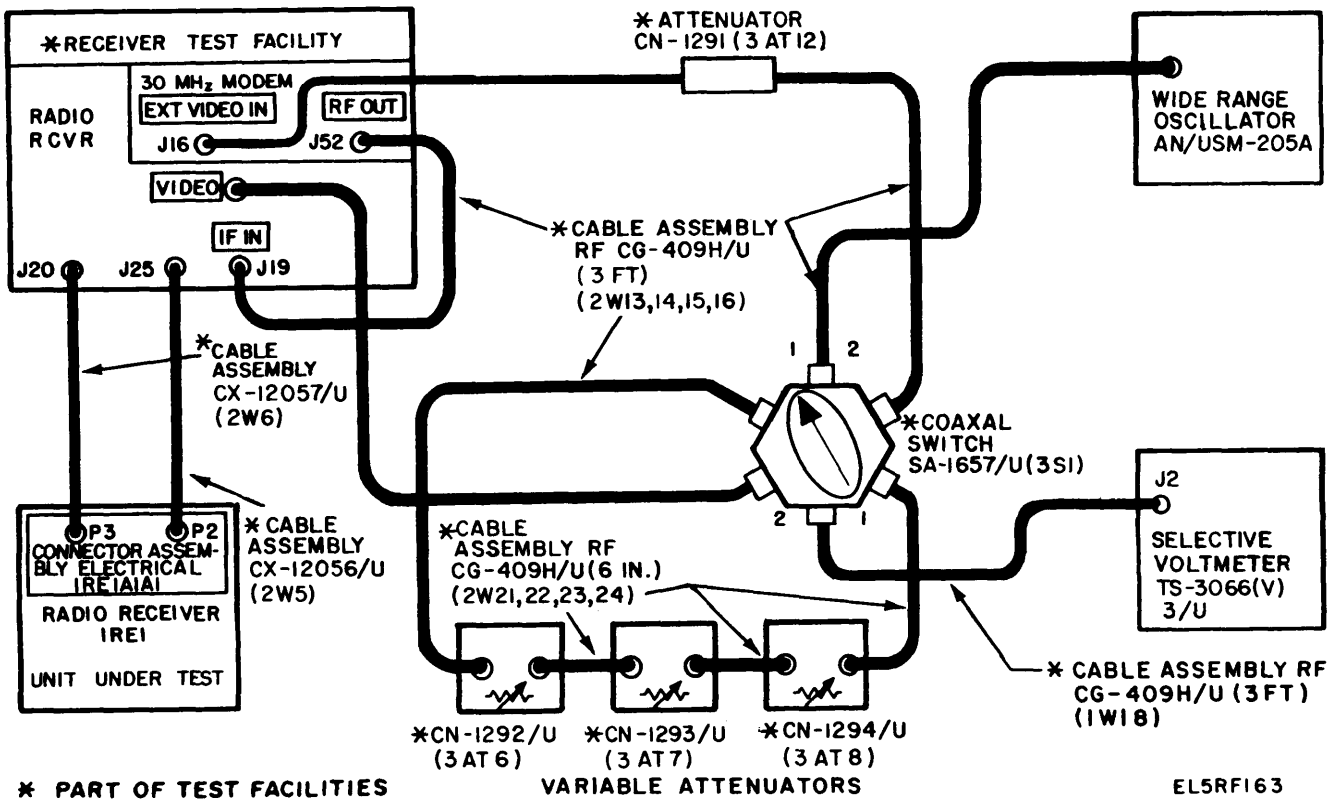



*Figure 3-7. ReceiverFixed Head, Video Frequency Response, Test Setup.*

c. Troubleshooting. -Continued

| symptoms | *Probable cause* | *Checks & corrective rneasures* |
|---|---|---|
| | *b.* Defective power supply 1RE1PS1 (+12 V and –12 V switch positions). | *b.* Remove power supply 1RE1PS1 and test as described in paragraph 3-6. |
| | c. Defective Amplifier-multiplier 1RE1A5 or synthesizer 1RE1A2 (OSC switch position). | c. Remove 1RE1A5 and connect dummy load DA-538/U (3A18) to pin A1 of 1RE1A2J11 with RF cable CG-357/U (1W32). If indication is abnormal repair or replace 1RE1A2 as appropriate (para. 3-21 or 1-22). If normal, repair or replace 1RE1A5 as appropriate (para. 3-12). |
| | *d* Defective Amplifier-multiplier 1RE1A5 (DOUBLER switch position). | d Test 1RE1A5 as described in paragraph 3-12. Repair or aline as indicated. |
| | e. Defective video amplifier 1RE1AR1 or if. amplifier 1RE1AR2 (RCVR SIG position). | e. Test 1RE1AR1 (para. 3-13) and 1RE1AR2 (para. 3-13). Repair as appropriate. |
| 5. Abnormal metering or levels (b(2)or(3) above). | Defective video amplifier 1RE1AR1. | Test 1RE1AR1 as described in paragraph 3-13. Repair as necessary. |
| 6. Abnormal PCM, timing or PCM squelch indications (b.(4) and (5) above). | a. Defective 1RE1A3 interface connection (pulse form restorer 1RE1A3 was tested and adjusted in (b.(l)(a) above). | a. Check continuity of lines to connector 1RE1A1A1J2 (FO-1 or FO-2 as applicable). |

c. Troubleshooting. – Continued

| *Symptoms* | *Probable cause* | *Ckecks & corrective measures* |
|---|---|---|
| | *b.* Defective video amplifier 1RE1AR1. | *b.* Remove 1RE1AR1 and check resistance between pins 9 and 24 of 1RE1AR1P1. Repair 1RE1AR1 if resistance is not approximately 1056 ohms (FO-14). Check continuity between pins 10 and 11 of 1RE1AR1P1. Repair as required. On 1RE1 units using video amplifier 1RE1AR1 SM-B-698003, reinstall 1RE1AR1 and perform the lower signal alarm check (b.(6) above). Repair as necessary. |
| 7. Abnormal low signal alarm indication. | a Defective LOW SIGNAL alarm lamp.<br>*b.* Defective video amplifier 1RE1AR1.<br>c. Defective alarm control 1RE1A1A2. | a Replace lamp.<br>*b.* Test 1RE1AR1 (para. 3-13). Repair as indicated.<br>c. Check continuity, resistances and voltages on 1RE1A1A2 (FO-1 or FO-2 as applicable). Repair as indicated |
| 8. Abnormal REC SIG indications (b.(7) above). | *a.* Defective circuit card assembly 1RE1A1A3. | *a* Check resistances on 1RE1A1A3 (FO- 1 or FO-2 *as* applicable). Repair or replace as appropriate. |
| | *b.* Defective if amplifier 1RE1AR2 | *b.* Test 1RE1AR2 as described in paragraph 3-14. Repair as indicated. |
| | c. Defective video amplifier 1RE1AR1. | c. Test 1RE1AR1 as described in paragraph 3-13. Repair as indicated |
| 9. Lower power indication (b.(8)(b) above). | *a* Defective or miaalined multiplier 1RE1A5. | *a* Remove 1RE1A5 and connect equipment as in *A,* figure 3-6 except: connect power meter (and adaptor UG-914/U) to pin A1 of 1RE1A2J11 with rf cable CG3570/U (1W32). Repeat b.(8)(b) above. Power meter should indicate +12 to +17 dBm for synthesizer SM-D-698145 or +12.5 to +16 for synthesizer SM-D-865030. If power output is normal test 1RE1A5 as in paragraph 3-12. |
| | *b.* Defective or miaalined synthesizer 1RE1A2. | *b.* Test 1RE1A2 as described in paragraph 3-21 (SM-D-698145) or para 3-22 (SM-D-865030). |
| 10. Frequency not within limits (b.(8)(d) above). | Defective or miaalined synthesizer 1RE1A2. | Test 1RE1A2 as in para 3-21 (SM-D-698145) or paragraph 3-22 (SM-D-865030). |
| 11. Video frequency response not within limits (b.(9)(b)4). | Defective video amplifier 1RE1AR1. | Test 1RE1AR1 as described in paragraph 3-13. |

### 3-2. Monitor Panel 1RE1A1

Monitor panel 1RE1A1 includes electrical connector assembly 1RE1A1A1, alarm control 1RE1A1A2, circuit card assembly 1RE1A1A3, and the front panel switches, controls, alarms, and indicators. Refer to paragraph 3-1 for a complete operational check of the monitor panel 1RE1A1.

### 3-3. Electrical Connector Assembly 1RE1A1A1

Electrical connecter assembly 1RE1A1A1 includes the wiring harness and associated connectors of monitor panel 1RE1A1. Check electrical connector 1RE1A1A1 when troubleshooting procedures in paragraph 3-1 indicate defective wiring.

*a Test Equipment and Material Required*

| *Equipment* | *Common name* |
|---|---|
| Digital Multimeter AN/USM-451 | Multimeter |

*b. Test Frocedure.* Refer to the receiver interconnecting diagram (FO- 1 or FO-2 as applicable) and check the continuity between the associated connector pins. Refer to paragraph 2-10 for repair and/or replacement of cables and connectors.

### 3-4. Alarm Control 1RE1A1A2

Alarm control 1RE1A1A2 is identical to alarm control 5TR1A1A2. Refer to paragraph 3-20 for testing and troubleshooting procedures.

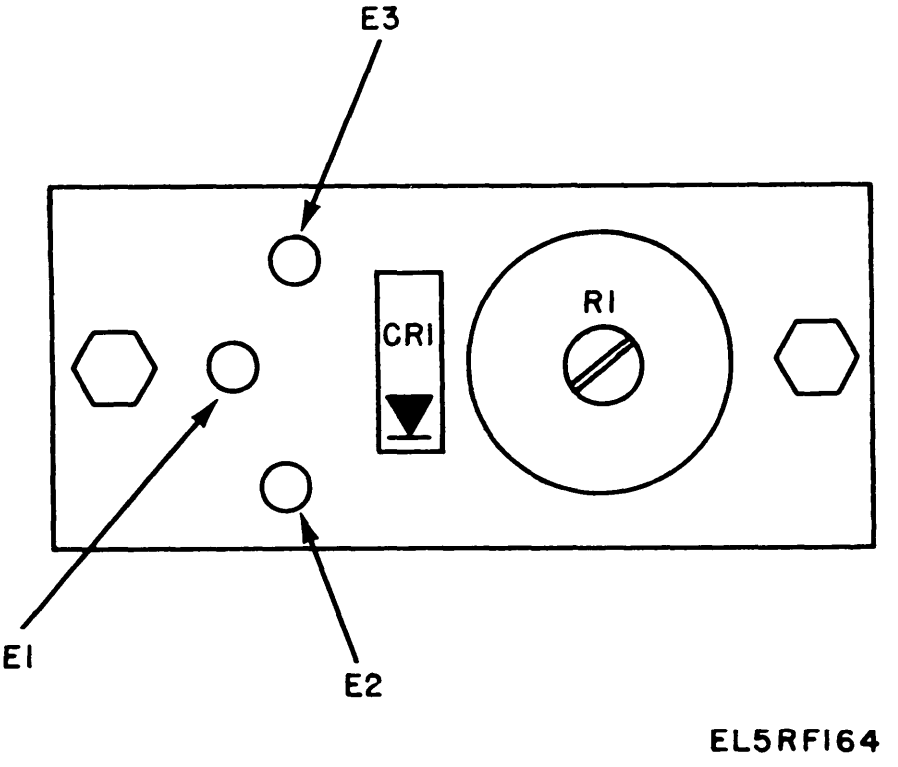



Figure 3-8. Circuit Card Assembly 1RE1A1A3, Parts Location.

### 3-5. Circuit Card Assembly 1RE1A1A3

a. Test Equipment and Material Required

| Equipment | Common name |
|---|---|
| Digital Multimeter AN/USM-451 | Multimeter |

b. Test Procedure.

(1) Using the multimeter, measure the forward and reverse resistances of diode CR1 across pins E2 and E3 (fig. 3-8).

(2) Check 20k resistor R1 by connecting the multimeter across pins E1 and E3 (fig. 3-8). Vary R1 through its range to check for intermittent contacts.

### 3-6. Power Supply 1RE1PS1 (Overall)

a. Test Equipment and Material Required.

| Equipment | Common name |
|---|---|
| Test Facility, Receiver TS-2867(V)2/GRM-95(V)2 | Receiver test facility |
| Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2 | Accessory kit |
| Oscilloscope AN/USM-281C | Oscilloscope |

b. Test Procedure.

(1) Connect the test equipment as shown in figure 3-9. Set the PP-6304/GRM-95(V) to ON and set it to 115 Vat.

(2) Set test facility switch S2 to the 24 V position and press switch S3. Meter Ml should indicate 50 percent ± the width of the pointer.

(3) Set switch S2 to the +12 V position and press switch S3. Meter M1 should indicate 50 percent ± the width of the pointer.

(4) Set the voltage control on power supply PP-6304 to 105 Vac and 125 Vac in turn. Repeat (2) and (3) above for each of the input voltage settings. Meter M1 indication should remain within the green band.

(5) Reset the power supply to 115 Vat.

(6) Set switch S2 to the METER +12 V position and press switch S3. Meter M1 should indicate 50 percent ± the width of the pointer. Observe the ripple voltage on the oscilloscope; the peak-to-peak voltage of 120 Hz ripple should not exceed 2 mV.

(7) Repeat (6) above with switch S2 in the METER –12 V position.

(8) Set switch S2 to the 26 V UNREG position and press switch S3. Meter Ml should indicate 47 to 53 percent. Observe the ripple voltage on the oscilloscope; the peak-to-peak voltage of 120 Hz ripple should not exceed 600 mV.

C. TroubleShooting (FO-15).

| *Symptom* | *Probable cause* | *Checks and corrective measures* |
|---|---|---|
| No meter indication with switch S2 in positive +12 V. | Defective transistor Q3. | Check resistances of Q3 (chassis fig. 3- 10). Replace if necessary. |
| No meter indication with switch S2 in position METER –12 V. | Defective transistor Q4. | Check resistances of Q4 (chassis, fig. 3-10). Replace if necessary. |
| High ripple voltage observed with switch S2 in position METER +12 V and METER –12 V. | No pre-regulation supply or R5 requires adjustment. | Check for 30 Vdc between TP1 (+) to TP4 (–) (fig. 3-12). If voltage is not present, check and replace CR1 and CR2 (fig. 3-12), if necessary, Readjust R5 (fig. 3-12). |

### 3-7. Power Supply 1RE1PS1 (Chassis) and Voltage Regulator Amplifier 1RE1PS1AR1

*a. Test Equipment and Material Required*

| *Equipment* | *Common name* |
|---|---|
| Test Facility, Receiver TS-2867(V)2/GRM-95(V)2 | Receiver test facility |
| Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2 | Accessory kit |
| Oscilloscope AN/USM-281C | Oscilloscope |
| Digital Multimeter AN/USM-451 | Digital multimeter |

*b. Test Procedure.*

(1) Remove voltage regulator amplifier 1RE1PS1AR1 (fig. 3-10) from power supply 1RES1PS1.

(2) Connect the unit under test as shown in figure 3-13. Set power supply (PP-6304/GRM-95(V) to ON and adjust its output to 115 Vat.

(3) Set the test facility switches as follows:

| *Switch* | *Position* | *Normal indication* |
|---|---|---|
| S1 | ON | |
| S5 | S2 | |
| S2 | 26 V UNREG | Meter M1 reads in green band. Peak-to-peak voltage of 120 Hz ripple, measured on the oscilloscope, should not exceed 600 mV. |
| S2 | 24 V UNREG | Meter M1 reads in green band. |

*c. Voltage Regulator Amplifier 1RE1PS1AR1.*

(1) Connect the test equipment as shown in figure 3-11.

(2) Set test facility switch S2 to the 24 V position and the power supply to ON.

(3) Adjust the power supply voltage control for 115 Vac ±2 V indicated on the voltmeter. Test facility meter Ml should indicate within the green band.

(4) Press and hold test facility switch S3. On the unit under test adjust R7 for 50 percent deflection (fig. 3-9) on meter M1 (center of green band).

(5) Release S3. Meter M1 should still indicate within the green band.

(6) Set switch S2 to position +12 V. Press and hold switch S3. On the unit under test adjust R11 (fig. 3-12) for 50 percent deflection on meter M1.

(7) Release S3. Meter M1 should still indicate within the green band

(8) Set switch S2 to the METER +12 V position. Press and hold switch S3.

(9) On the unit under test adjust R22 (fig. 3-12) for 50 percent deflection on meter M1.

(10) Set switch S2 to the METER –12 V position and adjust R19 (fig. 3-12) on the module for 50 percent deflection on meter Ml. Release S3.

(11) Set switch S2 to METER +12 V. Press and hold S3. Adjust R5 (fig. 3-12) for a minimum peak-to-peak ripple voltage. The ripple voltage observed on the oscilloscope should be less than 2 mV peak-to-peak.

(12) Set switch S2 to the METER –12 V position The ripple voltage observed on the oscilloscope should be less than 2 mV peak-to-peak. Readjust R5 if necessary.

(13) Set switch S2 to OFF.

(14) Seal potentiometers R5, R7, R11, R19, and R22 as described in paragraph 2-12.

(15) Install voltage regulator amplifier 1RE1PS1AR1 on power supply 1RE1PS1 chassis and test the complete units as described in paragraph 3-6.

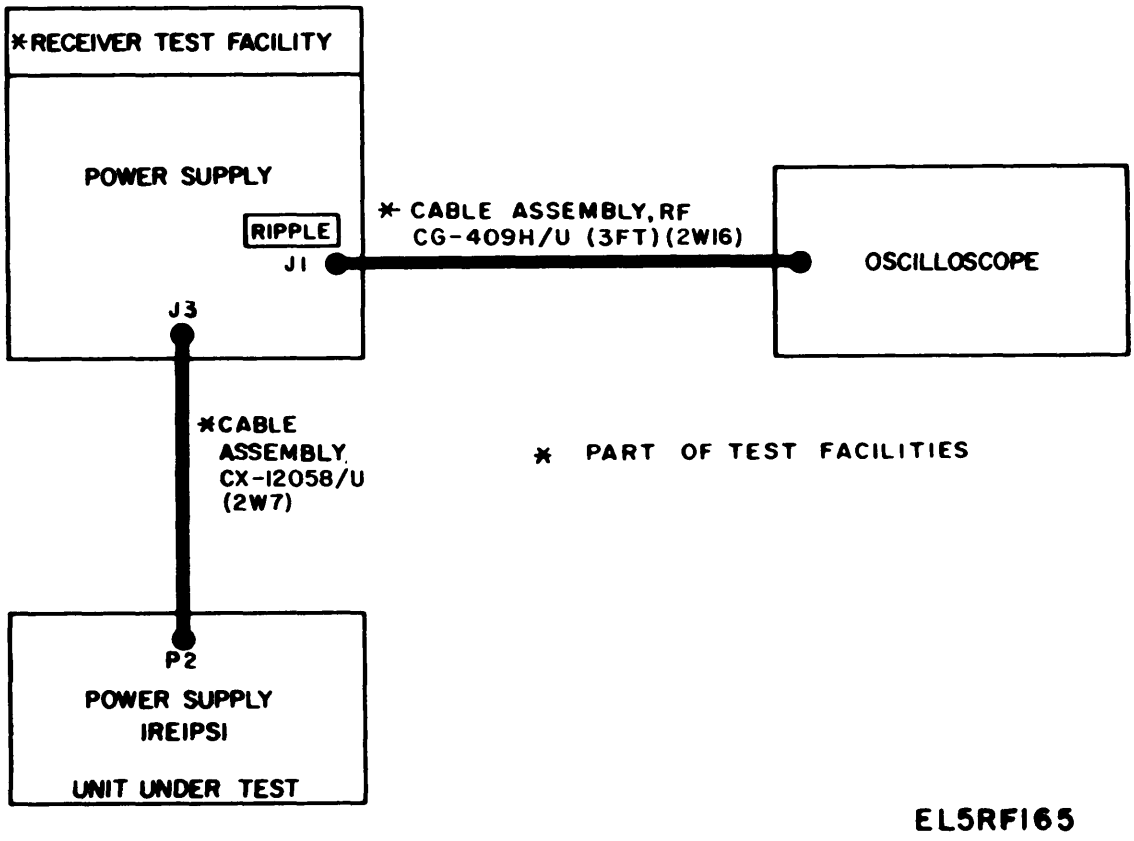



Figure 3-9. *Power Suppy 1RE1PS1, (Overall) Test Setup.*

*d. Troubleshooting (FO-15).*

| *Symptom* | *Probable cause* | *Checks and corrective measures* |
|---|---|---|
| Abnormal indication with switch S2 in the 26 V UNREG position. | u. Defective rectifier assembly A1 (fig. 3-14). | a. Check and replace A1 if necessary. |
| | b. Defective diode CR1 (3-14). | *b.* Check CR1 for short circuit. Replace if necessary. |
| | c. Defective capacitor C1 (fig. 3-14). | c. Check C1 for short circuit. Replace if necessary. |
| Abnormal ripple measured at 26 V UNREG position. | Capacitor C1 open. | Check and replace C1. |
| Abnormal meter indication with switch S2 on positions 24 V, +12 V and/or-12 V (para. 3-6 (2), (4), (6), (10)). | a Rectifier assembly A2 or rectifier CR2 shorting (fig. 3-15). | a Check and replace A2 or CR2 if necessary. |
| | *b.* Defective transistor Q1 or Q2 on heatsink. (fig. 3-9). | *b.* Measure resistance of Q1 and Q2 (e below). |
| | *c.* C2 shorting or C4 open circuit (fig. 3- 14). | *c.* Check C2 and C4. Replace as required. |
| | *d* Defective voltage regulator amplifier (fig. 3-9). | d Isolate the defective components by observing the voltage, and making resistance measurements shown in e. below, and by checking the resistances of Zener diodes. |

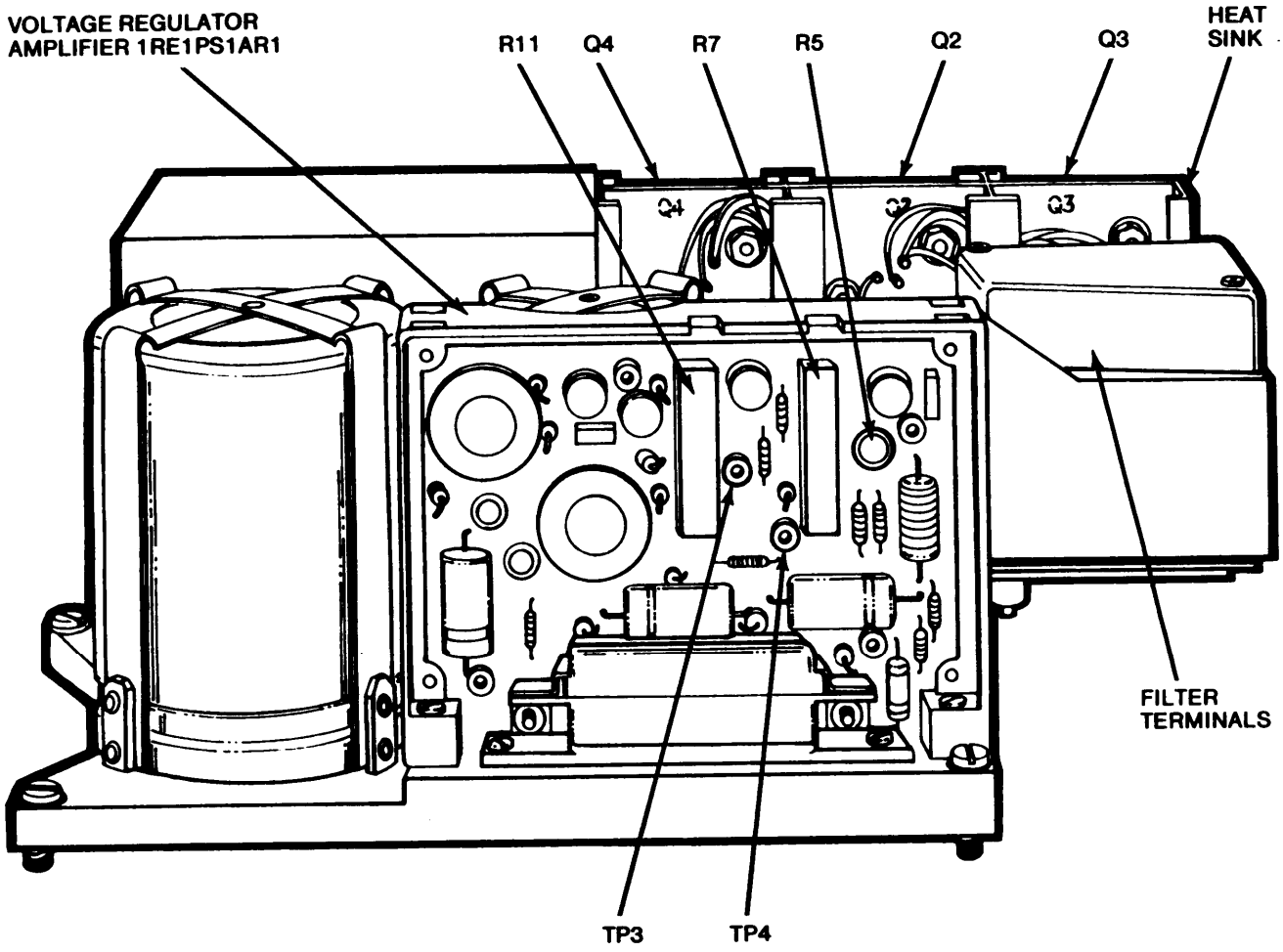



*Figure 3-10. Power Supply 1RE1PS1, Side View.*

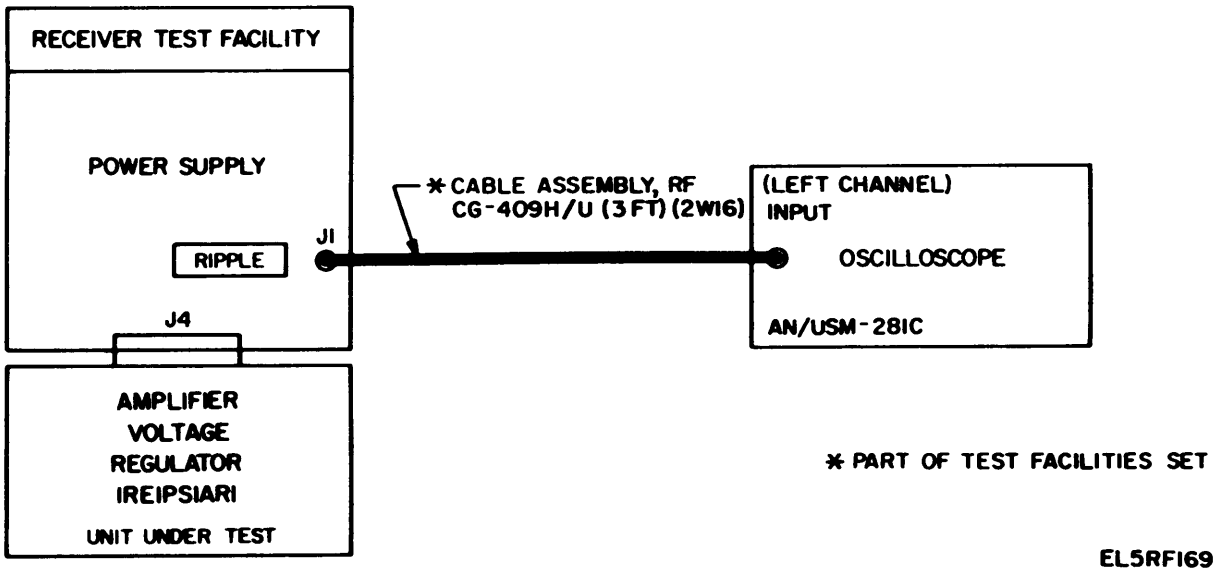



*Figure 3-11. Voltage Regulator Amplifier 1RE1PS1AR1, Test Setup.*

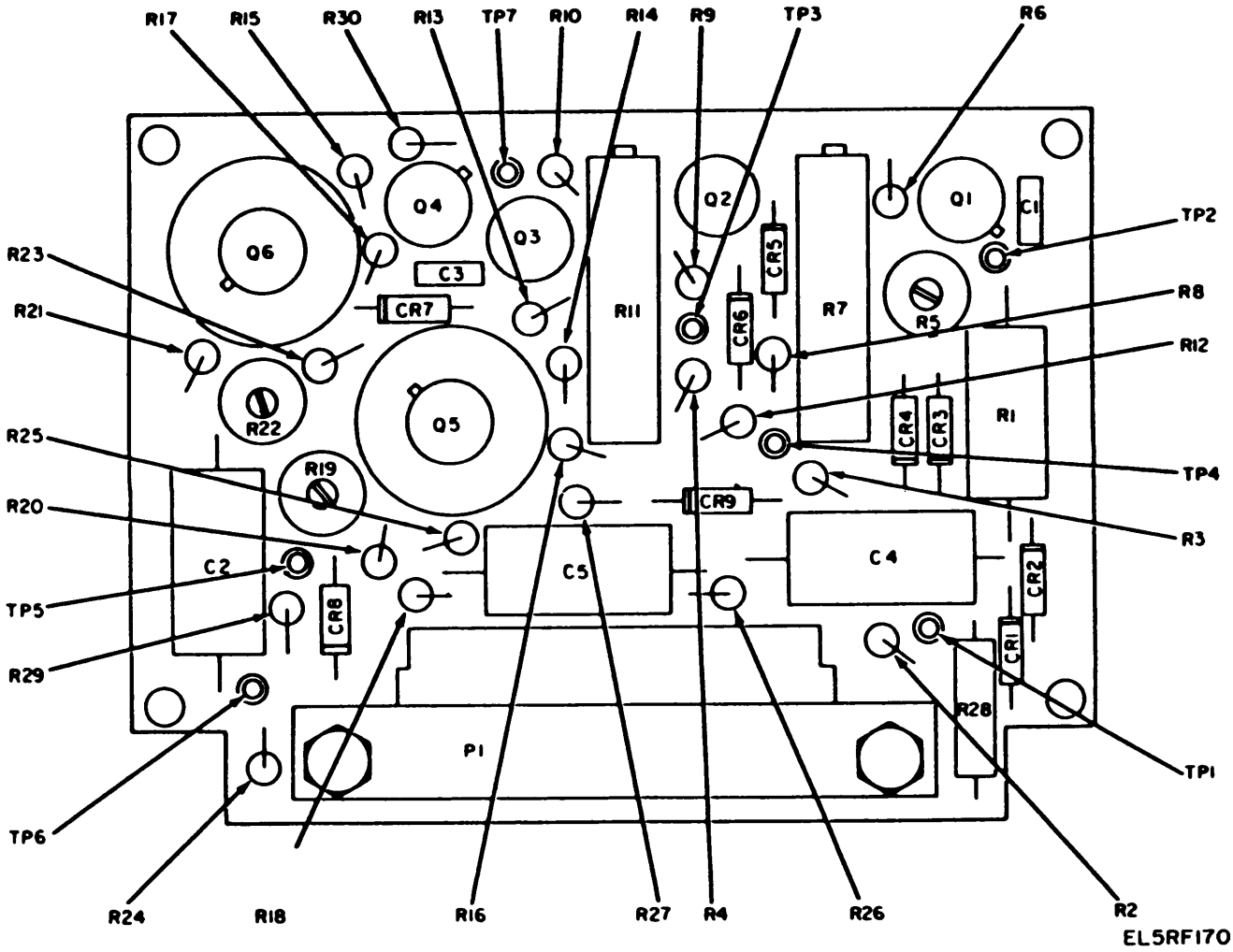



Figure 3-12. *Voltage Regulator Arnplifier 1RE1RS1AR1AR1, Parts Location.*

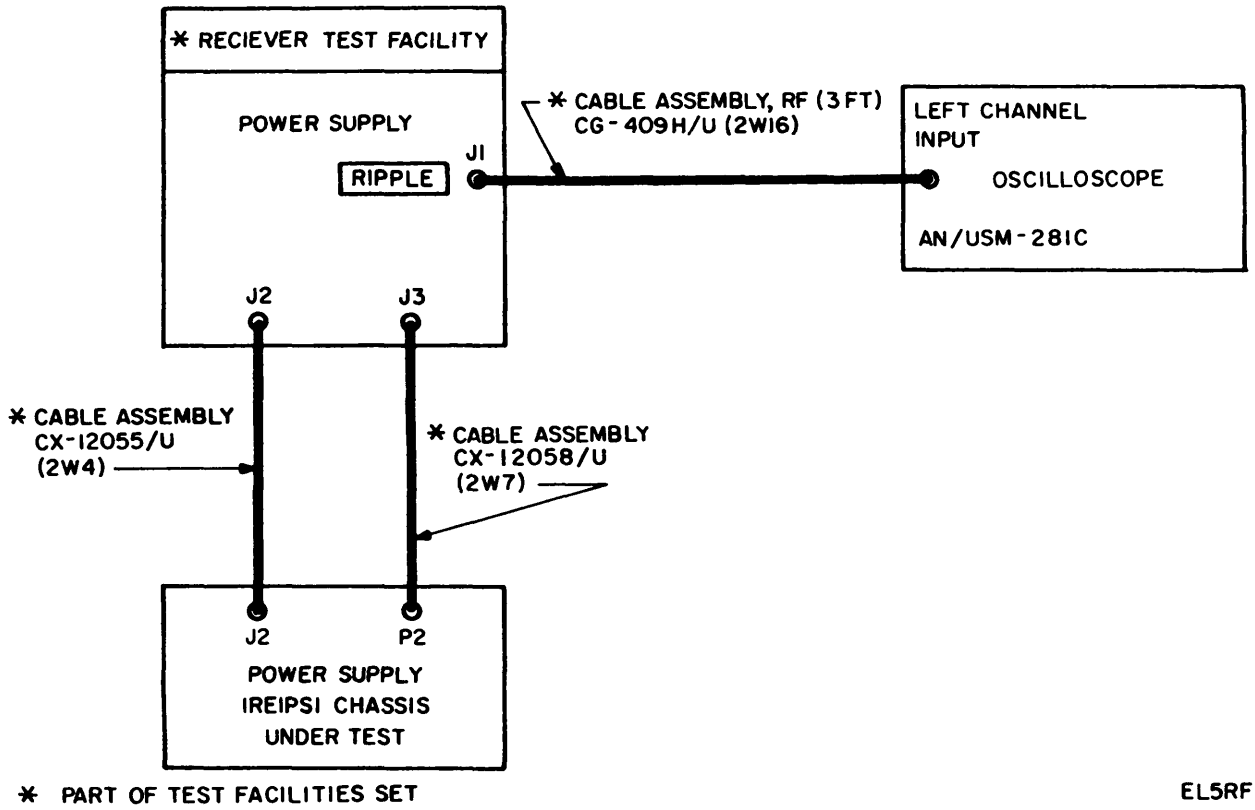



*Figure 3-13. Power Supply 1RE1PS1, (Chassis), Test Setup.*

*e. Transistor In-Circuit Resistance Measurements.*

**NOTE**

All resistances are measured with the allocated multimeter. The voltage regulator must be installed for the chassis assembly measurements.

Voltage Regulator 1RE1PS1AR1 and chassis Assembly, Transistor In-circuit Resistance Measurements

| Assembly | Transistor | | Emitter (+) | | Collector (+) | | Emitter (−) | | Collector (−) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Ref. | Type | Res. (kΩ) | Multimeter range (kΩ) | Res. (kΩ) | Multimeter range (kΩ) | Res. (kΩ) | Multimeter range (kΩ) | Res. (kΩ) | Multimeter range (kΩ) |
| VOLTAGE Regulator Amplifier 1RE1PS1AR1 (fig. 3-12) | Q1 | 2N697 | 3.0 | 200 | 30 | 200 | 3 | 200 | 30 | 200 |
| | Q2 | 2N697 | 6.0 | 200 | 2.2 | 200 | 6 | 200 | 2.1 | 200 |
| | Q3 | 2N697 | 1.7 | 200 | 7 | 200 | 1.7 | 200 | 7 | 200 |
| | Q4 | 2N697 | 1.5 | 200 | 6.8 | 200 | 1.5 | 200 | 6.7 | 200 |
| | Q5 | 2N1132 | 9.6 | 200 | 6 | 200 | 9.5 | 200 | 6 | 200 |
| | Q6 | 2N697 | 9.6 | 200 | 2.6 | 200 | 9.6 | 200 | 2.6 | 200 |
| Power Supply Chassis 1RE1PS1 (fig. 3-9) | Q1 | 2N1490 | 10 | 200 | ∞* | 200 | 15 | 200 | ∞* | 200 |
| | Q2 | 2N1485 | 43 | 200 | ∞* | 200 | 40 | 200 | 60 | 200 |
| | Q3 | 2N1485 | 0.470 | 200 | 7 | 200 | 0.470 | 200 | 7 | 200 |
| | Q4 | 2N1484 | 0.470 | 200 | 7 | 200 | 0.470 | 200 | 7 | 200 |

*An overrange indication is designated as ∞.

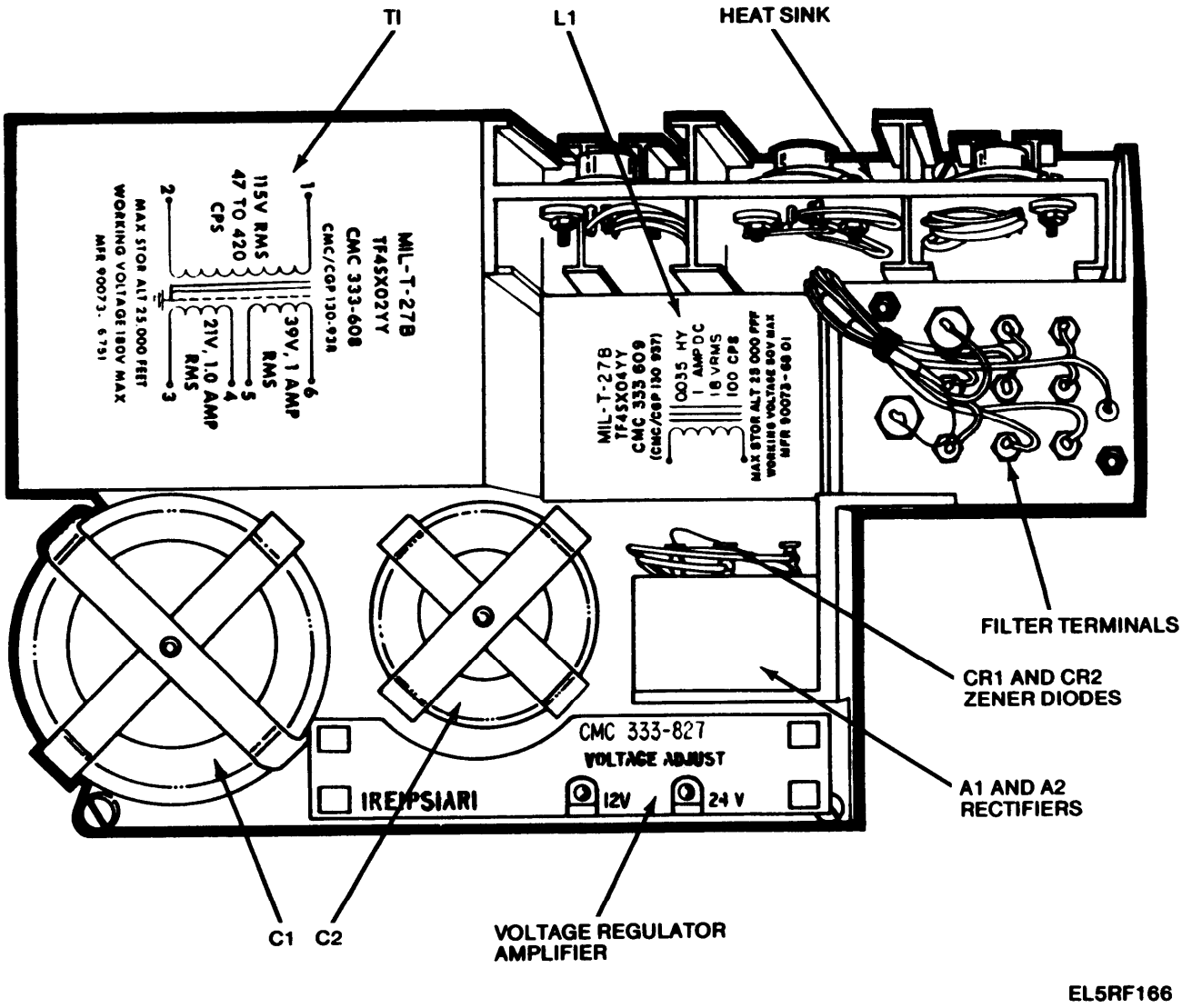



Figure 3-14. *Power Supply 1RE1PS1, Top View.*

*f Post Repair Procedure.*

(1) Repeat test procedure described in paragraph *b.* (chassis 1RE1PS1) or c. (voltage regulator amplifier 1RE1PS1AR1) above, as appropriate.

**NOTE**

If transistors 1RE1PS1AR1AR1Q4 and/or Q5, or transistor 1RE1PS1Q4 are replaced, oscillations may occur causing the system baseband noise to exceed specifications. If necessary, remove capacitor 1RE1PS1 AR1AR1C3 to correct this problem.

*(2) Seal* potentiometers R5, R7, R11, R19 and R22 as described in paragraph 2-12 if normal indications are obtained in tests (1) above.

### 3-8. Electrical Frequency Synthesizer 1RE1A2

Electrical frequency synthesizer 1RE1A2 is identical to electrical frequency synthesizer 5TR1A2 and is tested with the transmitter test facility. Refer to paragraph 3-21 (SM-D-698145) or 3-22 (SM-D-865030) for testing and troubleshooting procedures.

## 3-9. Pulse Form Restorer 1RE1A3 (SM-D-696146), (Part No. CMC 24S-455624-000)

*a Test Equipment and Material Required*

| *Equipment* | *Common name* |
|---|---|
| Receiver, Test Facility TS-2867(V)2/GRM-95(V)2 | Receiver test facility |
| Accessory Kit Test Facilities Set MK-1173(V)2/GRM-95(V)2 | Accessory kit |
| Oscilloscope AN/USM-281C complete with vertical and horizontal units | Oscilloscope |
| Frequency Counter TD-1225(V)1/U | Frequency counter |
| Generator, Signal AN/USM-205A | Wide range oscillator |
| Voltmeter, Electronic ME-459/U | VTVM |
| Digital Multimeter AN/USM-451 | Multimeter |
| Accessories P/O Transmitter Test Facility TS-2866(V)2/GRM-95(V)2 | Adaptor connector UG-1882/U(ICP14) |

*b. Test Procedure.*

(1) *Timing pulse generator check.*

*(a)* Remove covers from the unit under test and connect the test equipment as shown in A, figure 3-15. Set the power supply to ON and adjust for 115 Vat.

*(b)* Set the test facility switches as follows:

| *Switch* | *Position* |
|---|---|
| *S5* | S15 |
| S15 | PCM & TMG |
| S1 | ON |

(c) Observe the waveform displayed for the oscilloscope right channel (A, figure 3-16), and adjust the PCM LEVEL control for a 1.5 V peak-to-peak display.

*(d)* Adjust the test facility FREQ ADJ control for 576.00 kHz, as indicated on the counter.

*(e)* Observe the waveform displayed for the oscilloscope left channel; it should be as shown in B, figure 3-16, with the following characteristics:

1. 2 V peak-to-peak ±10 percent measured from the average baseline to the peak. Ignore a small pip, if present
2. 80 to 150 nanosecond pulse width at the 1 volt point
3. Rise time (10% to 90% amplitude) of less than 70 nanoseconds.
4. Fall time (10% to 90% amplitude) of less than 70 nanoseconds.

(2) *Pcm regenerator check.*

*(a)* Connect the test equipment as shown in B, figure 3-15.

*(b)* Observe the waveform displayed for the oscilloscope left channe; it should be as shown in C, figure 3-16.

*(c)* Set S15 to OUPUT. Observe waveform displayed for the right channel.

*(d)* Adjust PCM LEVEL control for a sinewave display of 1.5 volts peak-to-peak amplitude (G, fig. 3-16). Set S15 to NOISE.

**NOTE**

On earlier metallic cased models, remove the 'L' shaped cover to gain access to TP1.

*(e)* Connect the oscilloscope probe to the oscilloscope left channel and monitor test point TP1 on the 1RE1A3A3 printed circuit board. The oscilloscope display should be as shown in F, figure 3-16. The peaks (F, inset fig. 3-16) should be of nearly the same amplitude with minimal blur.

*(f)* Connect the oscilloscope left channel to the test facility TIMING OUT connector J46 as shown in A, figure 3-15.

*(g)* Set the oscilloscope VERT MODE control to ADD and ajdust the left and right channel display controls to obtain a waveform as shown in D2, figure 3-16. The leading edge of the timing pulse should be positioned 0.25 microsecond to the right of the peak of the pcm pulse (sinewave).

*(h)* Adjust the test facility FREQ ADJ control so that the frequency of the timing pulse is varied between 575.975 kHz and 576.025 kHz as indicated on the counter. Check to see that the waveform display on the oscilloscope remains synchronized to the timing pulses.

*(i)* Reset the FREQ ADJ control to 576.000 kHz.

*(j)* Reconnect the oscilloscope left channel to PCM OUT connector J40.

*(k)* Set S15 to PCM & TMG.

*(l)* Observe the waveform displayed for the oscilloscope left channel; it should be as shown in C, figure 3-16 with the following characteristics:

1. Negative-going square wave at 2 V peak-to-peak ±10 percent
2. Rise time (10% to 90% amplitude) less than 50 nanoseconds.
3. Fall time (10% to 90% amplitude) less than 50 nanoseconds.

(3) *-Pcm metering check.*

*(a)* With the test equipment set Up as in (2)(k) above, test facility meter Ml should indicate in the green band.

*(b)* Momentarily set test facility switch S16 to TEST, meter Ml should indicate zero and pulse display on oscilloscope should disappear.

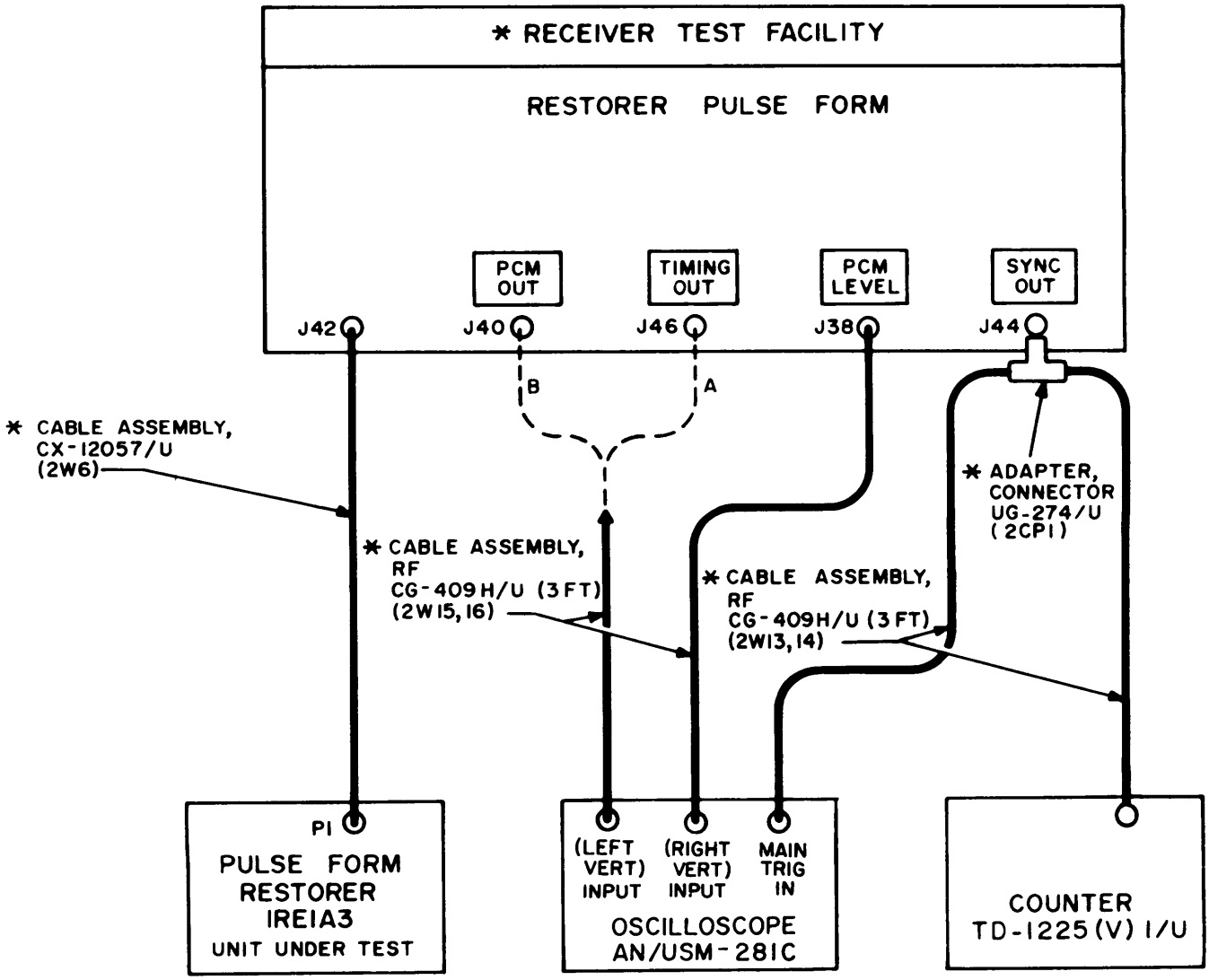



*Figure 3-15. Pulse Form Restorer 1RE1A3, (SM-D-698146) Timing Pulse Check Test Setup.*

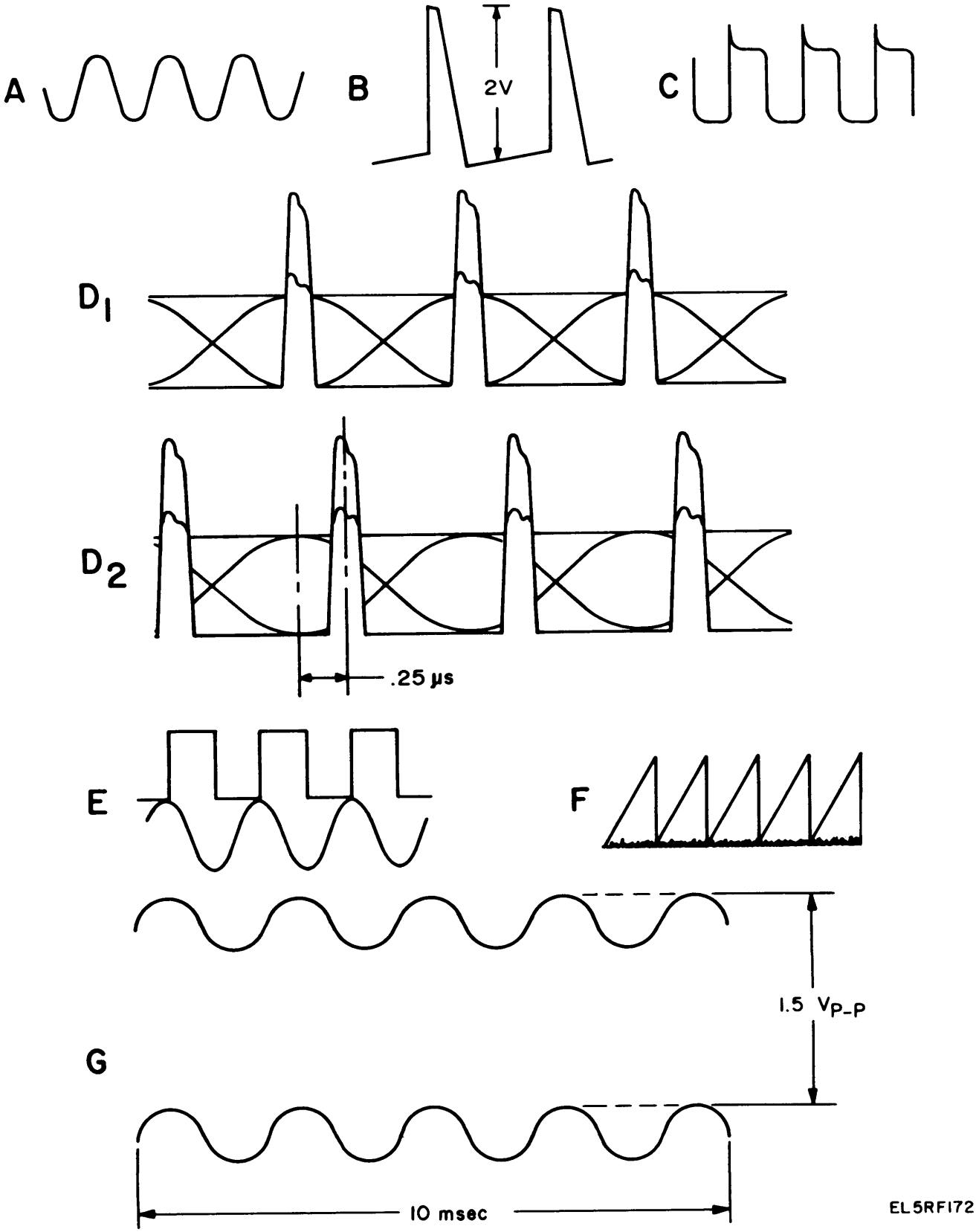



*Figure 3-16. Pulse Form Restorer 1RE1A3, (SM-D-698146) Waveform Displays.*

*(c)* Set the oscilloscope VERT MODE control to ALT, the waveform displayed should be as shown in E, figure 3-16.

*(d)* Vary the test facility PCM LEVEL control between 1.2 V and 1.75 V. The regenerated pcm amplitude and timing should remain constant (E, fig. 3-16).

*(e)* Adjust the test facility PCM LEVEL control to reduce the display (right channel) to 0.4 V peak-to-peak (E, fig. 3-16).

*(f)* Check to see that the regenerated pcm pulses displayed disappear and meter MI indicates zero when the display for the right channel is reduced to 0.4 V peak-to-peak

(4) Order *wire noise test*

*(a)* Connect the test equipment as shown in figure 3-17.

*(b)* Set switch S15 to the OUTPUT position.

*(c)* Observe the oscilloscope left channel and adjust the test facility PCM LEVEL control for a 1.5 V peak-to-peak display (G, fig. 3-16). The PCM LEVEL must remain at this setting for test (5) below. Note the VTVM indication it should be –16 dBm nominal. The test facility meter MI should indicate in the green band.

*(d)* Set switch S15 to NOISE: the VTVM should indicate at least 32 dB below the indication noted in *(c)* above.

(5) *Order wire gain and frequency response test.*

*(a)* Connect the test equipment as shown in figure 3-18.

*(b) Set switch S15 to RESPONSE.*

*(c)* Set the coaxial switch to position 1. Adjust the wide range osillator frequency to 1 kHz at an output level of 130 mvrs as indicated on the VTVM.

*(d)* Set the coaxial switch to position 2; the VRVM should indicate –9.5 dBm ±0.2 dB. Note the VTVM indication.

*(e)* Set S15 to OUTPUT. Meter MI should indicate in the green band.

*(f)* Set S15 to RESPONSE. Set the coaxial switch to position 1 and tune the wide range oscillator to 200 Hz at an output level of 130 mvrms.

*(g)* Set the coaxial switch to position 2; the VTVM should indicate within ± 1 dB of the indication noted in *(d)* above.

*(h)* Repeat *(f)* and *(g)* above with the wide range oscillator tuned to 250 Hz, 500 Hz, 1.5 kHz, and 2 kHz.

(6) *Order wire distortion test*

*(a)* Connect the test equipment as shown in A, figure 3-19.

*(b)* Rotate the test facilty PCM LEVEL control fully ccw (minimum position).

*(c)* Set switch S15 to DISTORTION.

*(d)* Tune the wide range oscillator frequency to 1 kHz and adjust the output level to 365 mV peak-to-peak as indicated on the oscilloscope left channel.

*(e)* Vary the wide range oscillator frequency adjustment slightly for a minimum indication on the VTVM. The level indicated on the VTVM should be less than –35 dBm.

(7) *Order wire relay and combiner routing check.*

*(a)* Set test facility switch S15 to RESPONSE.

*(b)* Connect the test equipment as shown in B, figure 3-19. (The oscilloscope is not used in this test)

*(c)* Tune the wide range oscillator frequency to 1 kHz and adjust the output level to obtain a –4 dBm indication on the VTVM.

*(d)* Connect the test equipment as shown in A, figure 3-19.

*(e)* Push and hold test facility switch S16 at TEST; the VTVM should indicate –10 dBm ±0.5 dB.

*(f)* Release S16 and set S15 to OFF.

*C. Troubleshooting (FO-16).*

| *Symptom* | *Probable cause* | *Ckecks and corrective measures* |
|---|---|---|
| 1. Sawtooth waveform leading edge blurred excessively *(b. (2)(e)* above). | SLICER LEVEL control R13 on 1RE1A3A3 (fig. 3-21) misadjusted. | Adjust R13 as in *d.* (1) below. |
| 2. Timing pulse not positioned at 0.25 microsecond *(b. (2)(g)* above). | PCM SYNC control R26 on 1RE1A3A3 (fig. 3-21) misadjusted | Adjust R26 as in d. (1) below. |
| 3. High noise level (b. (4)(d) above). | PCM CANCEL contol R11 and OW NOISE control R24 on 1RE1A3A1 (fig. 3-21) misadjusted. | Adjust R11 and R24 as in *d.* (2) below. |
| *4.* VTVM indication out of tolerance *(b. (5)(d)* above). | OW GAIN control (R13 on 1RE1A3A1 (fig. 3-20) misadjusted | Adjust R13 as in *d.* (3) below. |

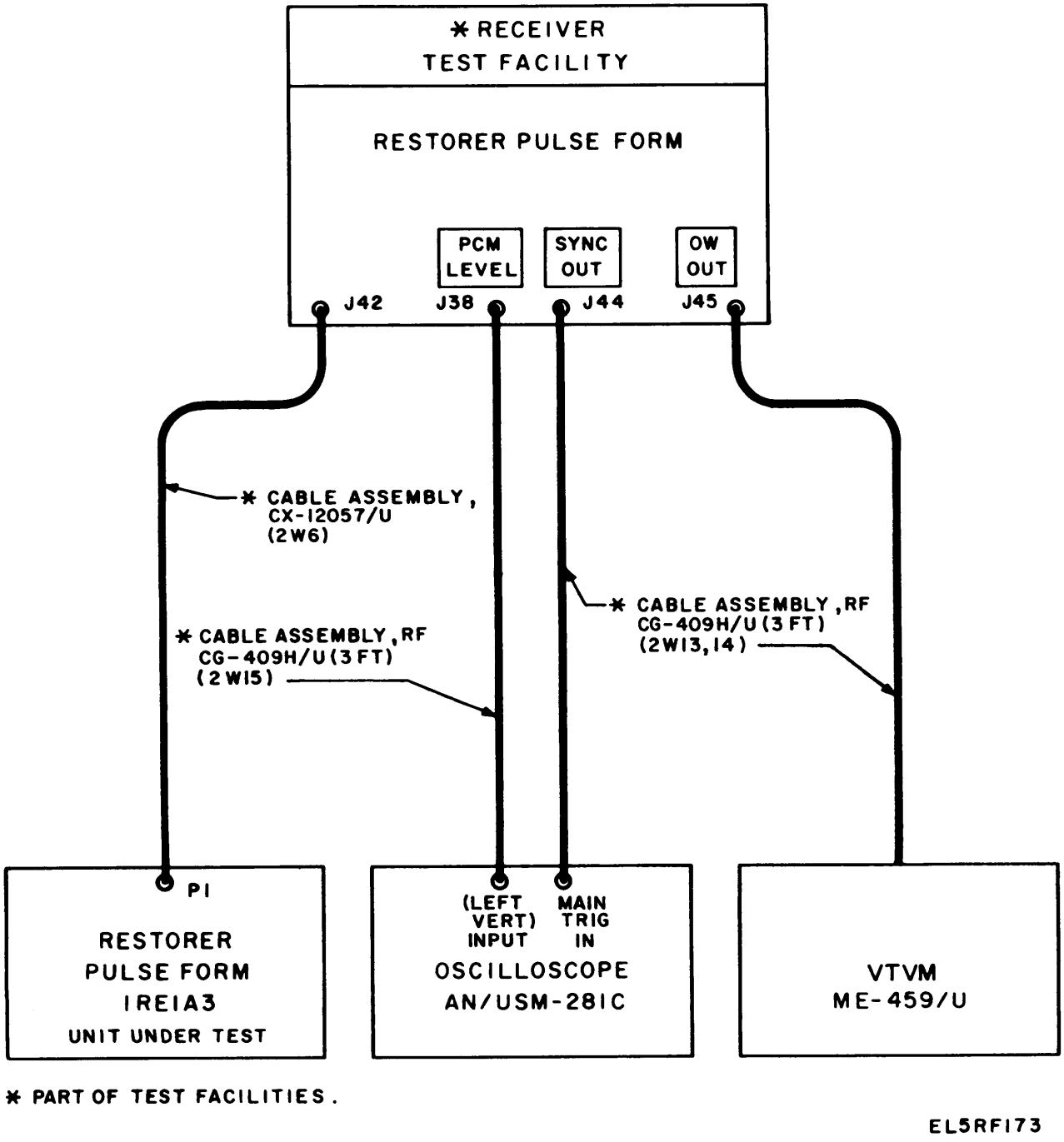



*Figure 3-17. Pulse Form Restorer 1RE1A3, (SM-B6981 46) Order Wire Noise Check*

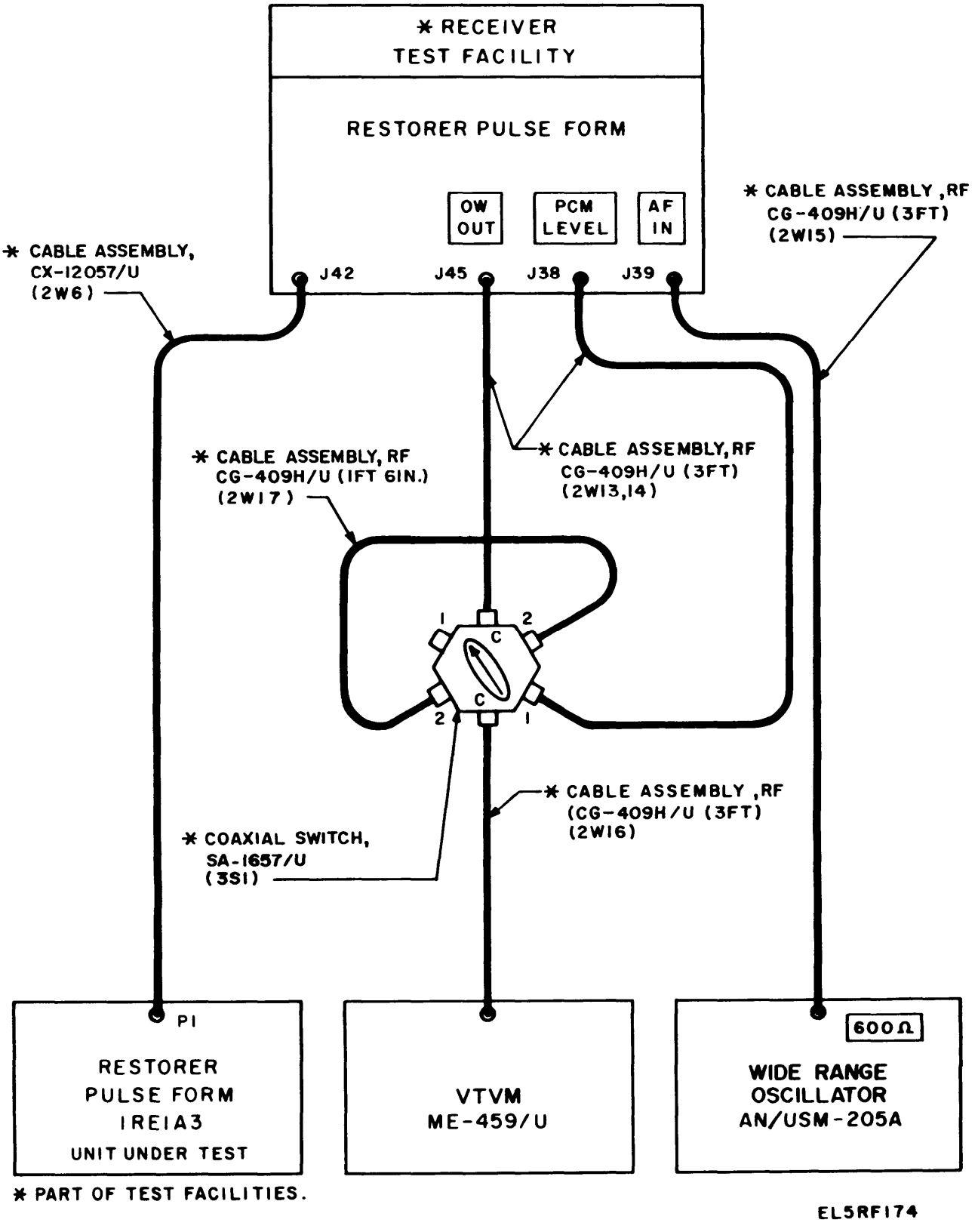



*Figure 3-18. Pulse Form Restorer 1RE1A3, (SM-D-698146) Order Wire Gain and Frequency Response Check Test Setup.*

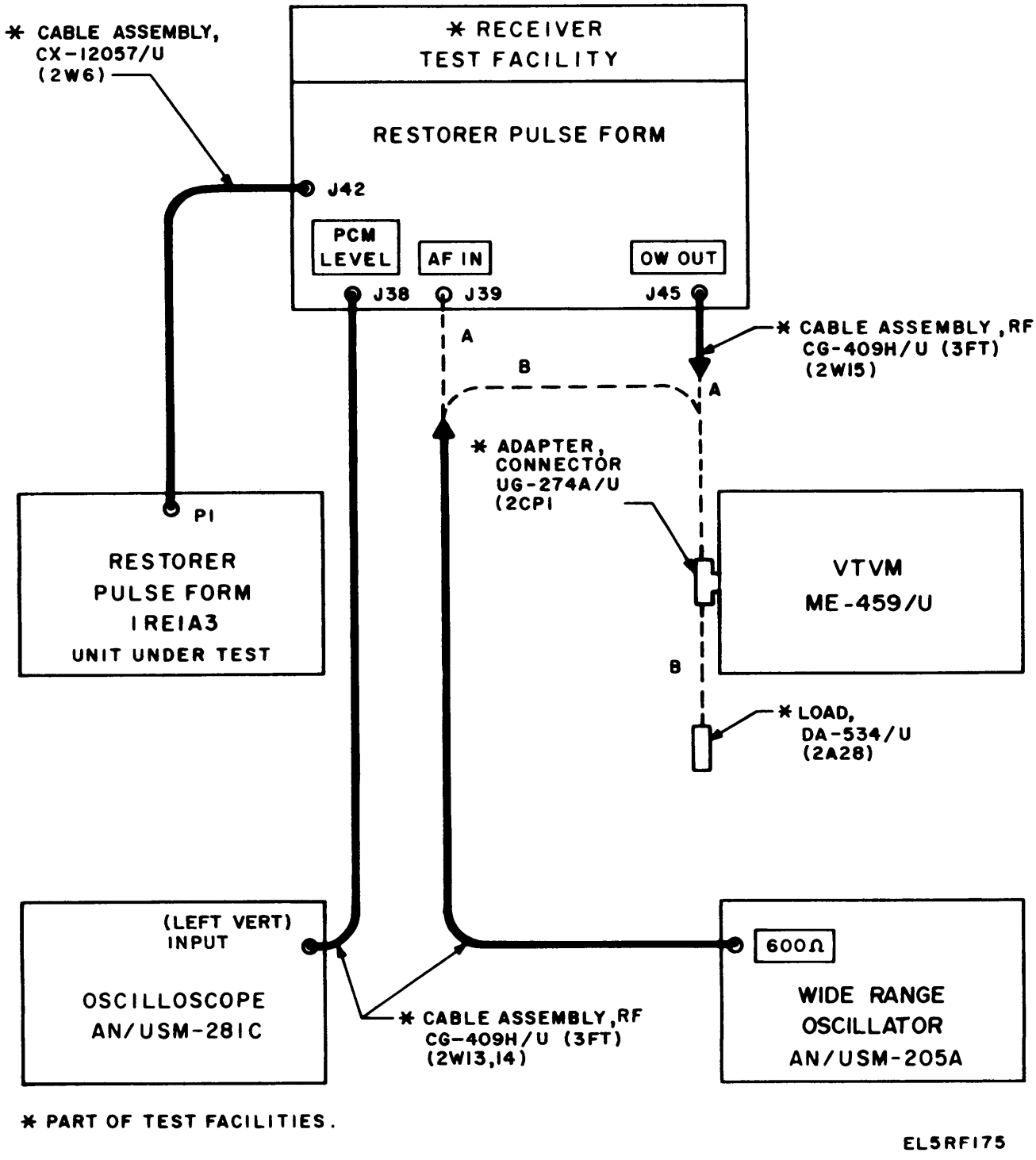



*Figure 3-19. Pulse Form Restorer 1RE1A3, (SM-D-698146) Order Wire Distortion Check, Test Setup.*

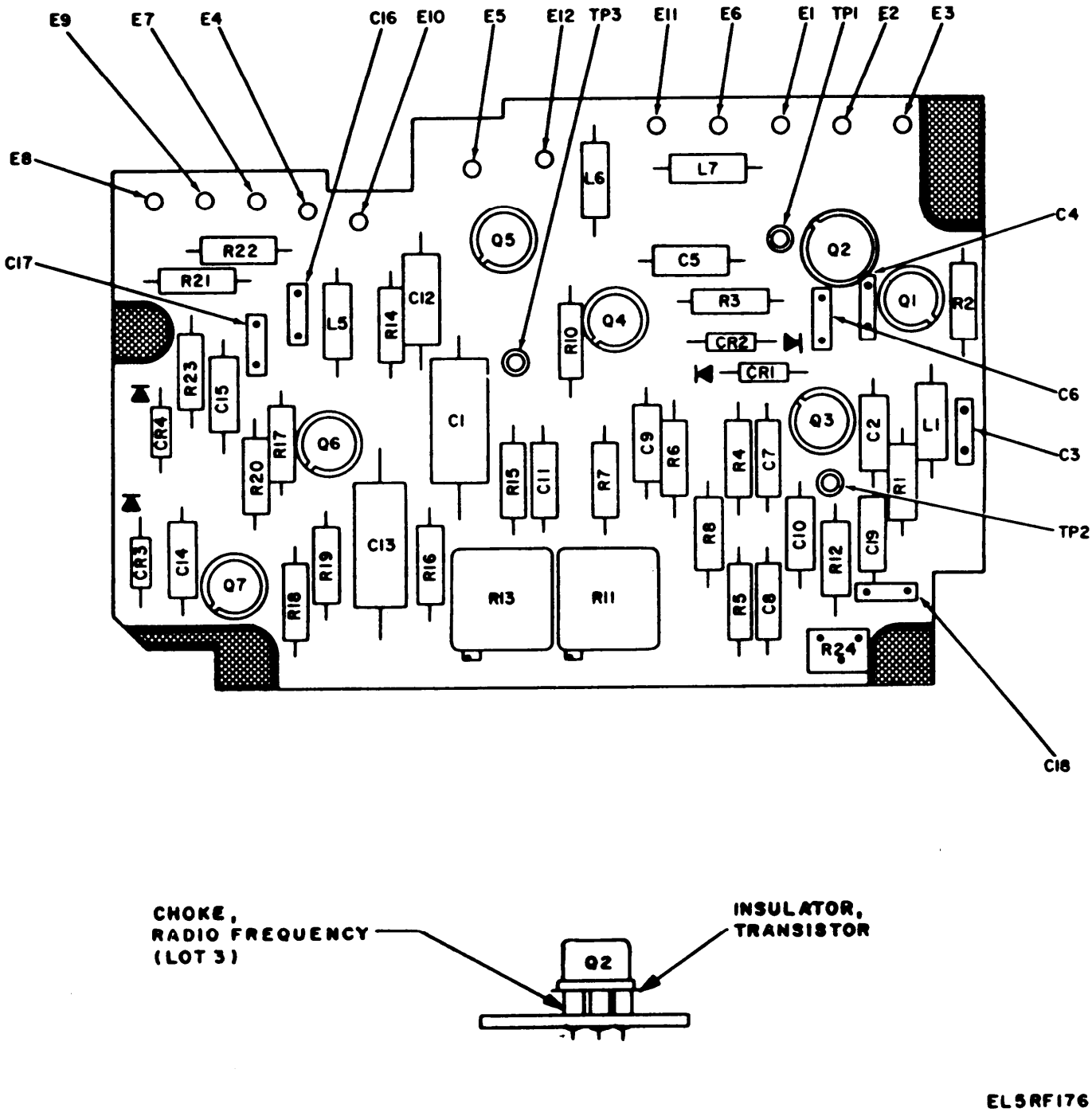



*Figure 3-20. Modulation Eliminator 1RE1A3A1, Pulse Form Restorer 1RE1A3 (SM-D-698146) Parts Location.*

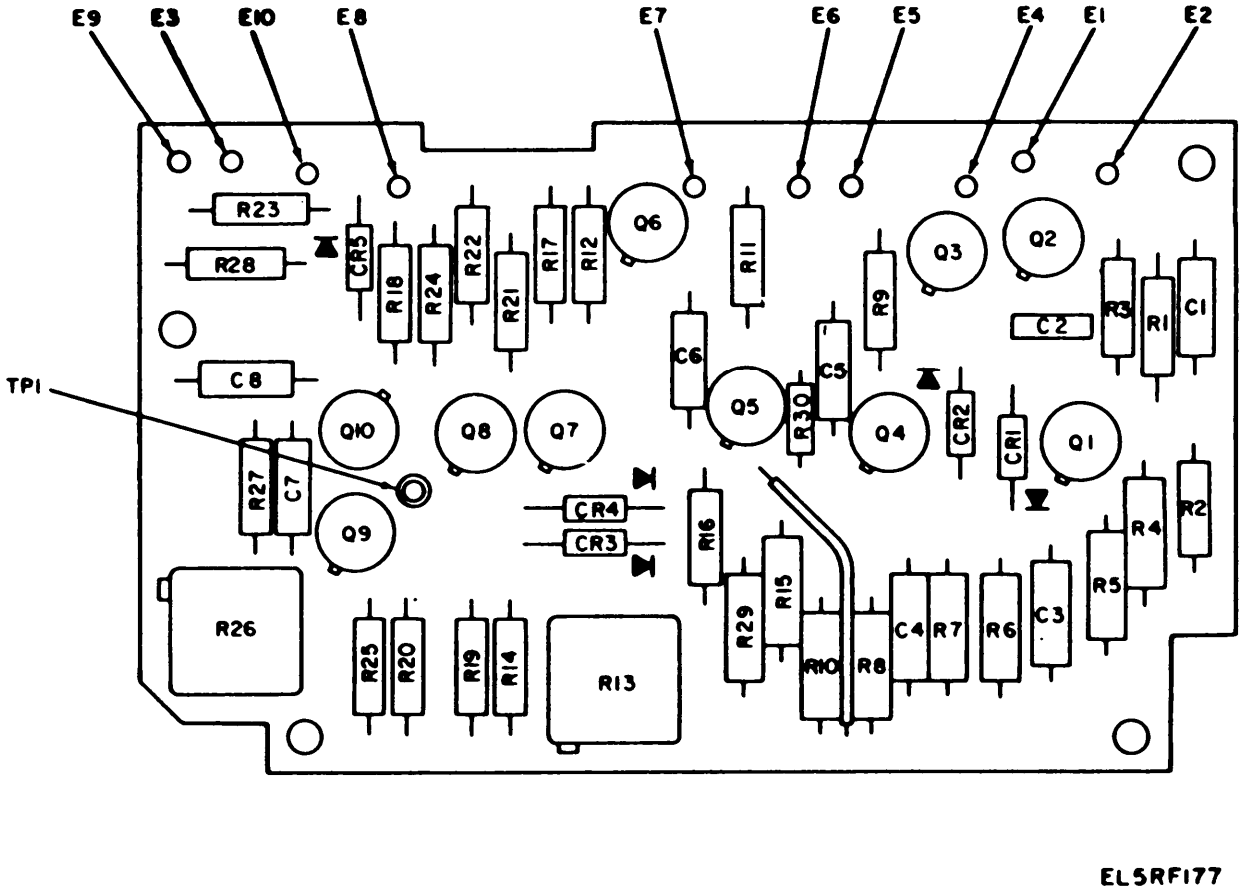



*Figure 3-21. Electrical Synchronizer 1RE1A3A3, Pulse Form Restorer 1RE1A3 (SMD-698146) Parts Location*

**NOTE**

If the requirements of paragraph *b. are* not met after performing the adjustments in paragraph *d,* replace the pulse form restorer with Dual Rate Pulse Form Restorer SM-D-990510.

*d. Adjustments.*

(1) PCM SYNC CONTROL R26 AND SLICER LEVEL control R13 (1RE1A3A3).

*(a)* Connect test equipment as shown in B, figure 3-15.

*(b)* Set test facility switch S1 to ON, and S15 to OUTPUT.

*(c)* Adjust the PCM LEVEL control to obtain a 1.5 V peak-to-peak display on the oscilloscope screen as shown in G, figure 3-16. Set test facility switch S15 to NOISE.

*(d)* Connect the oscilloscope probe to the left vertical INPUT of the oscilloscope and monitor TP1 on 1RE1A3A3.

*(e)* Adjust SLICER LEVEL control R13 (1RE1A3A3) for minimum blur (F, fig. 3-16). The sawtooth amplitude will be constant (F, inset, fig. 3-16).

*(f)* Remove probe from TP1 and connect it to TIMING OUT, J46 on the test facility.

*(g)* Set oscilloscope to ADD.

*(h)* Adjust vertical controls to obtain the waveform shown in D1, figure 3-16.

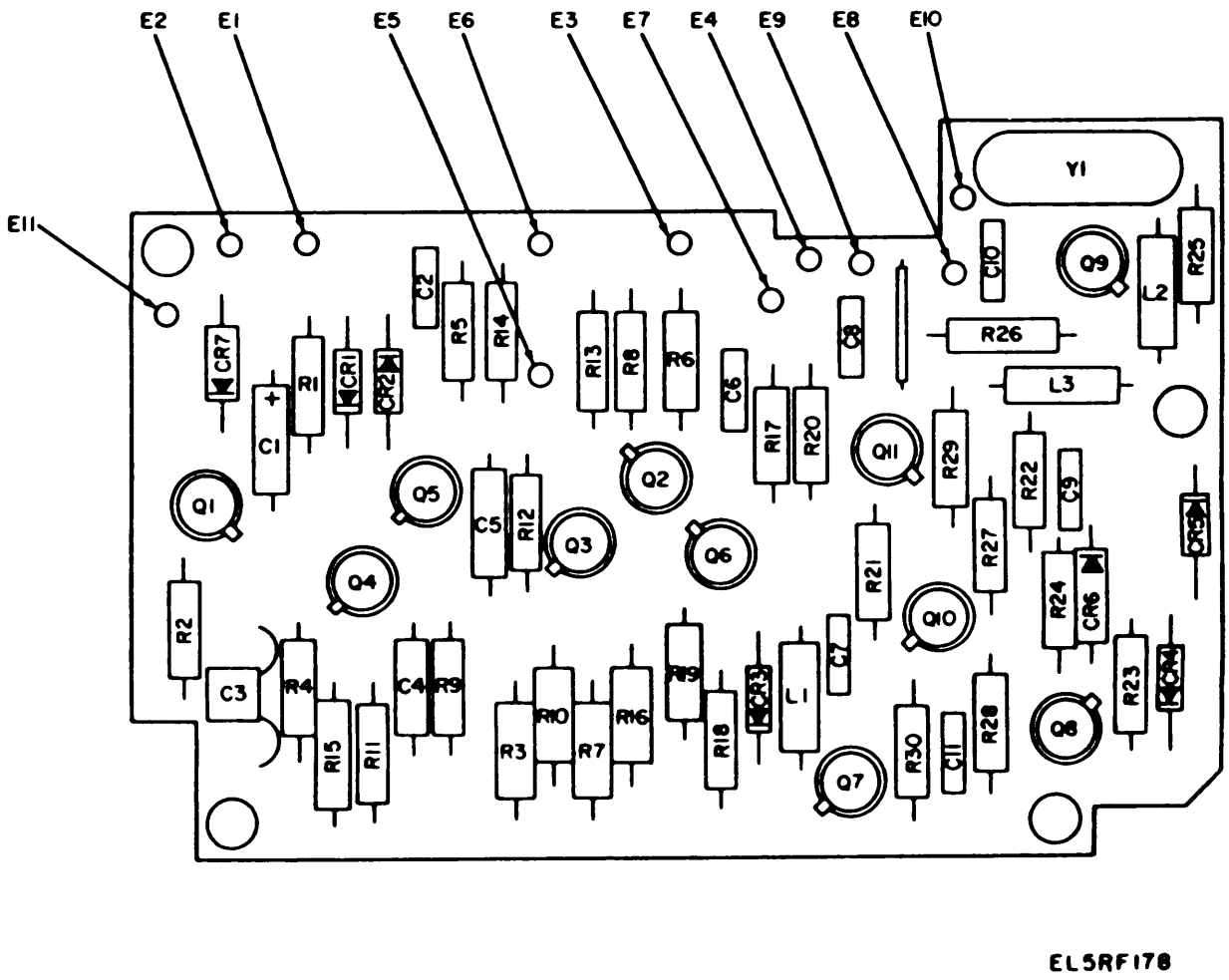



*Figure* 3-22. Pulse *Form Restorer 1RE1A3A2, Pulse Form Restorer 1RE1A3 (SM-D-698146) Parts Location*

*(i)* Adjust R26 (1RE1A3A3) so that the timing pulse midpoints occur 250 nanoseconds to the right of the pcm pulse peaks (D2, figure 3-16).

**NOTE**

The center of the timing pulse must be exactly 250 nanoseconds to the right of the center of the pcm pulse peak

*(j)* Vary test facility FREQ ADJ control between 575.975 kHz and 576.025 kHz while observing the oscilloscope display. The relationship between the pcm pulses and the timing pulses shall remain constant (synchronized) as shown in D2, figure 3-16.

*(k)* Reset FREQ ADJ control to 576.000 kHz as indicated on the frequency counter.

(2) *PCM CANCEL control R11 and O W NOISE control R24 (1RE1A3A1).*

*(a) Carry* out *(a)* thru *(c)* of the order wire noise test *(b* (4) above). Set S15 to NOISE.

*(b)* Adjust R11 PCM CANCEL and R24 OW NOISE control for a minimum indication on the VTVM.

(3) OW GAIN control *R13 (1RE1A3A1).*

*(a)* Carry out *(a)* thru *(d)* of the order wire gain and frequency response test *(b.* (5) above).

*(b)* Adjust OW GAIN control R13 for a –9.5 dBm ±0.1 dB reading on the VTVM.

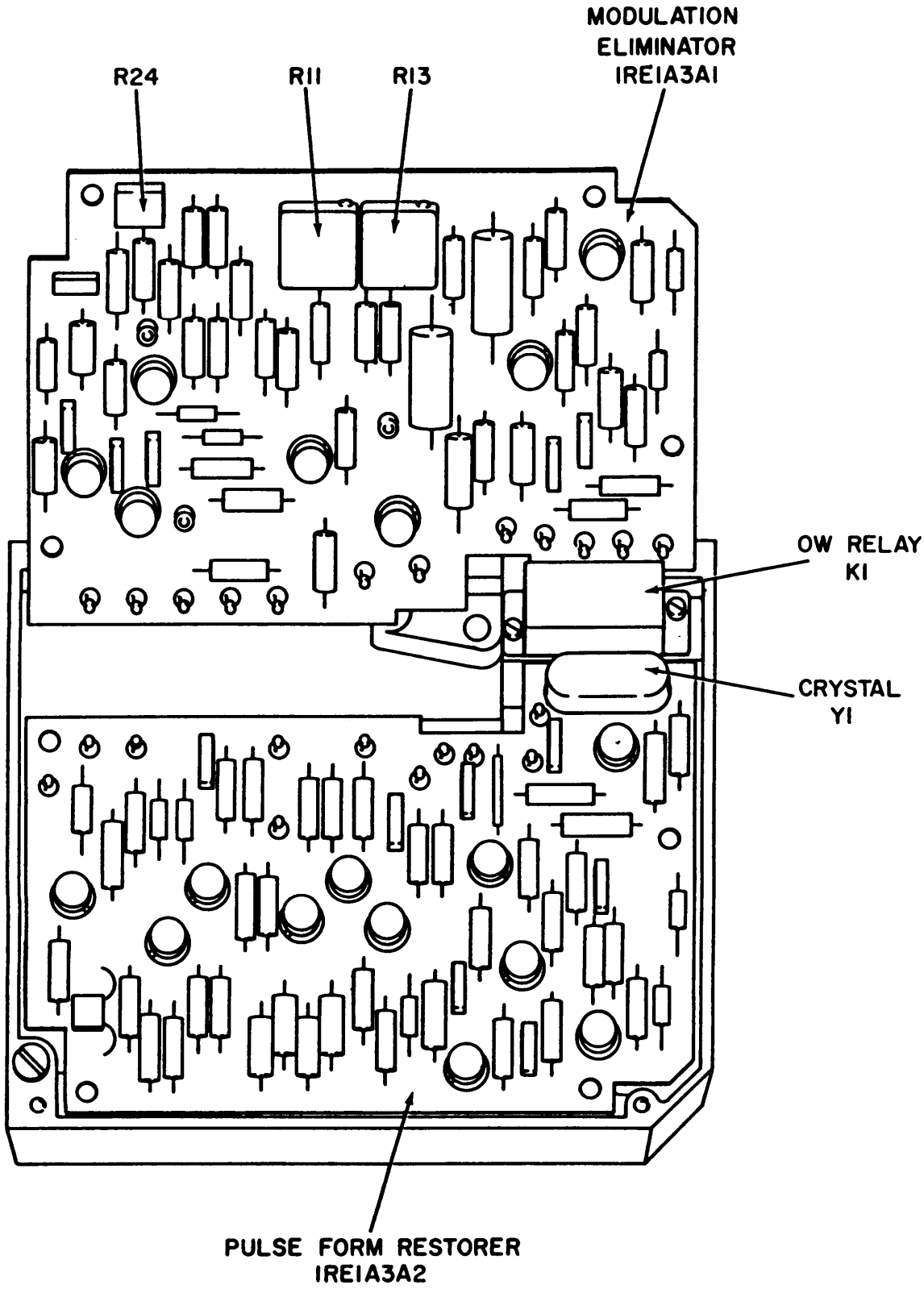



Figure 3-23. *Pulse Form Restorer 1RE1A3 (SM-D-698146), Opened Showing Pulse Form Restorer 1RE1A3A2.*

### 3-10. Dual Rate Pulse Form Restorer 1RE1A3 (SM-D-990510), (Part No. CMC 245-8031 10-000)

*a. Test Equipment and Material Required.*

| *Equipment* | *Common name* |
|---|---|
| Generator, Signal SG-1171/U | Signal generator |
| Test Fixture, Restorer Pulse Form TS-4116/GRM-95(V)2 | PFR test set |
| Oscilloscope AN/USM-281C | Oscilloscope |
| Frequency Counter TD-1225(V)1/U | Frequency counter |
| Generator, Signal AN/USM-205A | Wide range oscillator |
| Voltmeter, Electronic ME-459/U | VTVM |
| Multimeter AN/USM-451 | Multimeter |
| Test Facility, Transmitter TS-28662/GRM-95(V)2 | Transmitter test facility |
| Test Facility, Receiver TS-28672/GRM-95(V)2 | Receiver test facility |
| Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2 | Accessory kit |

*b. Test Procedure.*

(1) *Timing phase adjustments.*

*(a)* Connect test equipment as shown in A of figure 3-24.

*(b)* Install the pulse form restorer (PFR) unit under test (UUT) onto connector J7 of the PFR test set and secure the mounting screw to the mounting block.

*(c)* Set power supply PP-6304/GRM-95 to 115 Vac as indicated on its panel voltmeter. Maintain this indication throughout the following procedures.

*(d)* Set the PFR test set switches as follows:

| *Switch* | *Position* |
|---|---|
| POWER ON/OFF (S7) | ON |
| PCM (S2) | PR CODE |
| LEVEL SWITCH (S6) | O dB |
| FUNCTION (S1) | 1 |
| COMBINER CONTROL (S5) | 1k |
| COUNTER (S3) | CLK |
| VTVM *(S4)* | VIDEO |
| NOISE (S8) | OFF |
| LOAD (S9) | ON |

*(e)* Adjust the PFR test set LEVEL ADJ control (R12) for a level of 1.38 ±0.1 V peak-to-peak as indicated on right channel of the oscilloscope (triggered externally by SYNC signal). Do not disturb the setting of the LEVEL ADJ control (R12) for the remainder of these tests.

*(f)* Adjust the FREQ CONTROL (R5) on the PFR test set for 576.000 Hz ±1 Hz as indicated on the frequency counter. Set the FUNCTION switch (S1) to position 2.

*(g)* Set the PFR test set PCM switch (S2) to position 10.

*(h)* Connect test equipment as shown in B figure 3-24. Monitor both the DCDR CLK and the DCDR PCM of the UUT, on oscilloscope LEFT and RIGHT channels respectively (use J 11 and J13 on PFR test set as common points). Adjust the oscilloscope TRIGGER control to obtain waveforms as shown in figure 3-25.

*(i)* Adjust the PHASE ADJ potentiometer of the unit under test such that pulse widths T1 and T2 shown in figure 3-25 are equal.

(2) *Timing output test.*

*(a)* Connect the equipment as shown in figure 3-26.

*(b)* Set the PFR test set switches as follows:

| *Switch* | *Position* |
|---|---|
| FUNCTION (S1) | 1 |
| COMBINER CONTROL (S5) | OPEN |
| PCM (S2) | PR CODE |
| LOAD (S9) | ON |

*(c)* Observe the TIMING OUTPUT waveform on LEFT channel of the oscilloscope. Ensure it is synchronized with the SYNC signal. The TIMING OUTPUT pulse should have the following characteristics:

1. A level of 1.8 Vp-p to 2.2 Vp-p, measured from the average baseline to the peak. Ignore a small pip, if present

2. Rise and fall times (10% to 90% amplitude) of 25 nsec to 45 nsec.

3. Pulse width at 50% points, of 85 nsec to 145 nsec.

*(d)* On the PFR test set set the PCM switch (S2) to OFF for 5 seconds, then return it to the PR CODE position.

*(e)* The TIMING OUTPUT waveform should remain synchronized with the VIDEO waveform displayed on oscilloscope LEFT and RIGHT channels respectively.

*(f)* Set the PFR test set LEVEL SWITCH (S6) to the –6 dB, O dB, and +6 dB positions. The TIMING OUTPUT and VIDEO waveforms should remain synchronized.

*(g)* Set the PFR test set LEVEL SWITCH (S6) tn O dB.

*(h)* Adjust the PFR test set FREQ CONTROL (R5) for a clock frequency of 576,090 Hz ±2 Hz as indicated on the frequency counter. Repeat steps *(d)* through *(g)* above.

*(i)* Adjust the PFR test set FREQ CONTROL (R5) for a clock frequency of 575,910 Hz ±2 Hz as indicated on the frequency counter. Repeat steps *(d)* through *(g)* above.

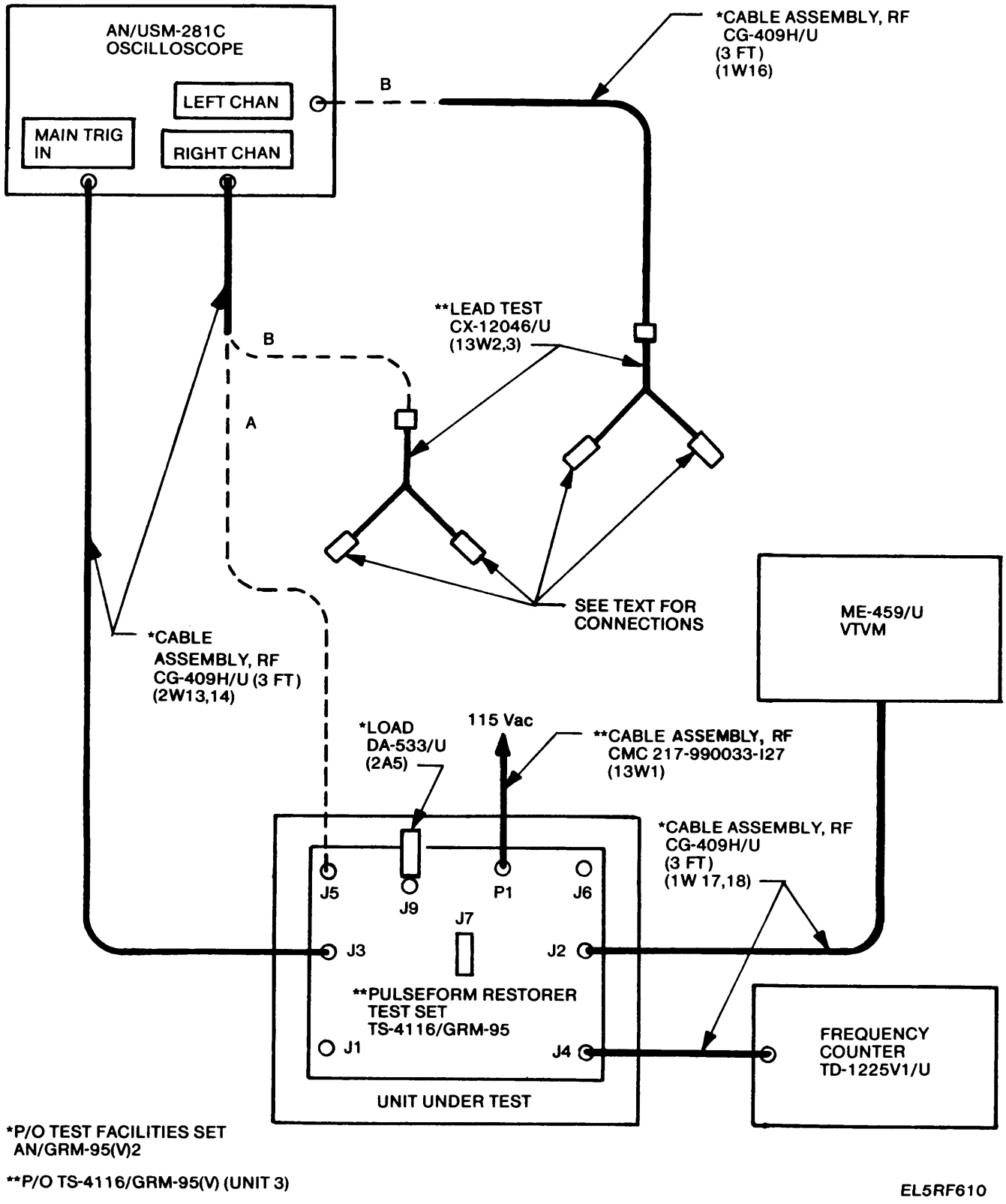



Figure 3-24. *Pulse Form Restorer 1RE1A3 (SM-D-990510), Timing Phase Adjustment, Test Setup.*

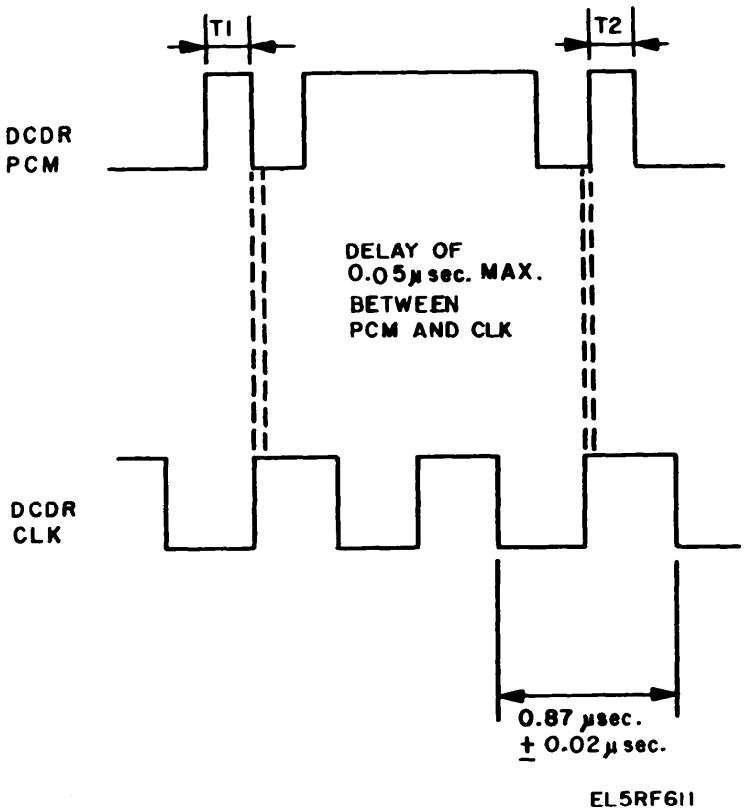



*Figure 3-25. Pulse Form Restorer 1RE1A3 (SM-D-990510), Waveform Diagram of DCDR PCM and DCDR CLK*

*(j)* Set the PFR test set switches as follows

| *Switch* | *Position* |
|---|---|
| FUNCTION (S1) | 3 |
| COMBINER CONTROL (S5) | 1k |

*(k)* Adjust the PFR test set FREQ CONTROL (R5 for a clock frequency of 1,152,000 Hz ±2 Hz as indicated on the frequency counter. Repeat steps *(d)* through *(g)* above.

*(l)* Adjust the PFR test set FREQ CONTROL (R5) for a clock frequency of 1,152,180 Hz ±2 Hz as indicated on the frequency counter. Repeat steps *(d)* through *(g)* above.

*(m)* Adjust the PFR test set FREQ CONTROL (R5) for a clock frequency of 1,151,820 Hz ±2 Hz as indicated on the frequency counter. Repeat steps *(d)* through *(g)* above.

*(3)* PCM output check

*(a)* Set the PFR test set switches as follows

| *Switch* | *Position* |
|---|---|
| *FUNCTION* (S1) | 1 |
| COMBINER CONTROL (S5) | OPEN |
| PCM (S2) | 10 CODE |
| LEVEL SWITCH (S6) | *0 dB* |
| *LOAD* (S9) | OFF |

*(b)* Connect test equipment as shown in figure 3-27. Adjust the PFR test set FREQ CONTROL (R5) for a clock frequency of 576,000 Hz ±2 Hz as indicated on the frequency counter.

*(c)* Set the oscilloscope LEFT CHAN and RIGHT CHAN inputs to DC. Observe the PCM waveform and the TIMING OUTPUT waveform on oscilloscope LEFT and RIGHT channels respectively.

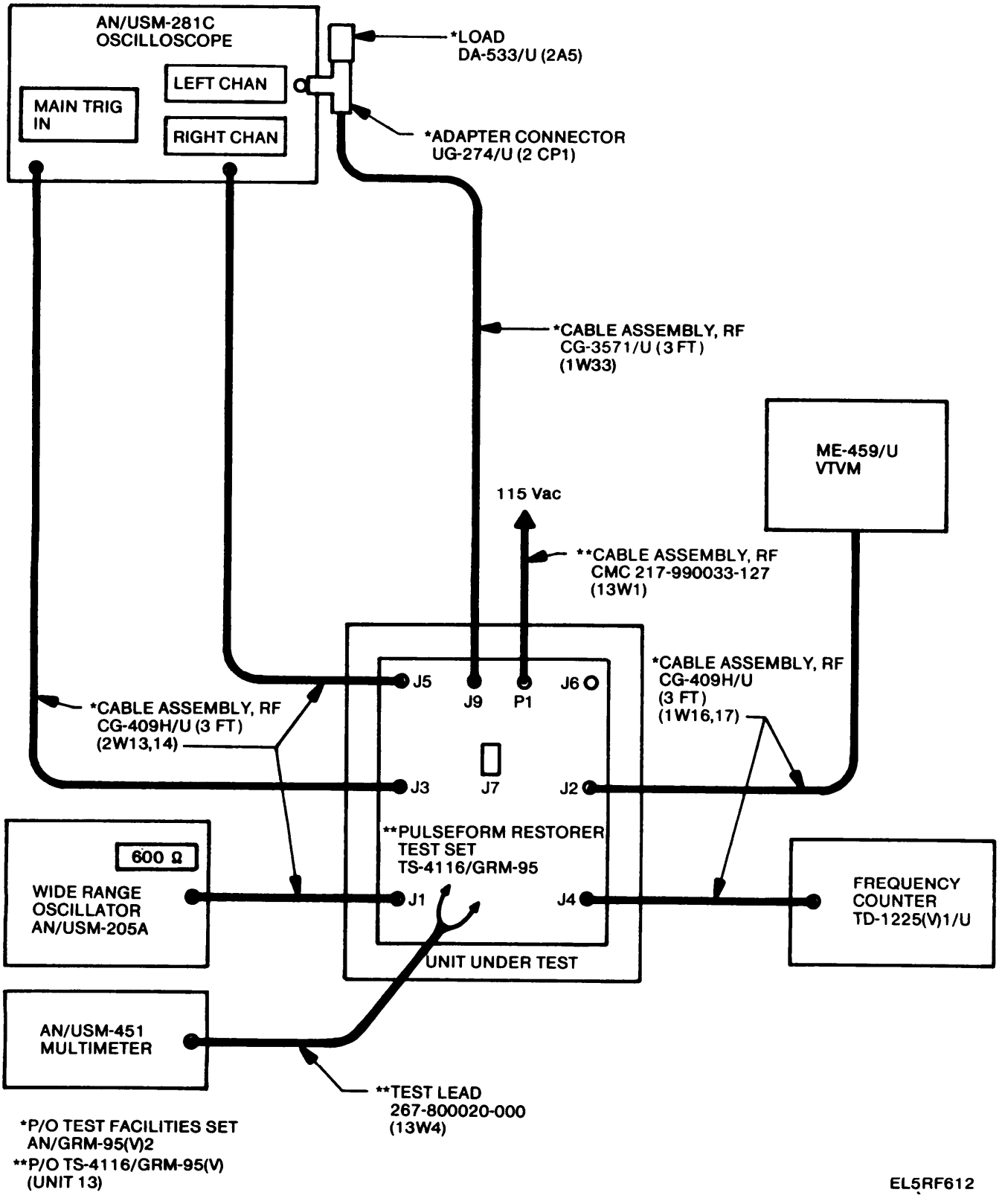



*Figure 3-26. Pulse Form Restorer 1RE1A3 (SM-D-99051O), Timing Output, Test Setup.*

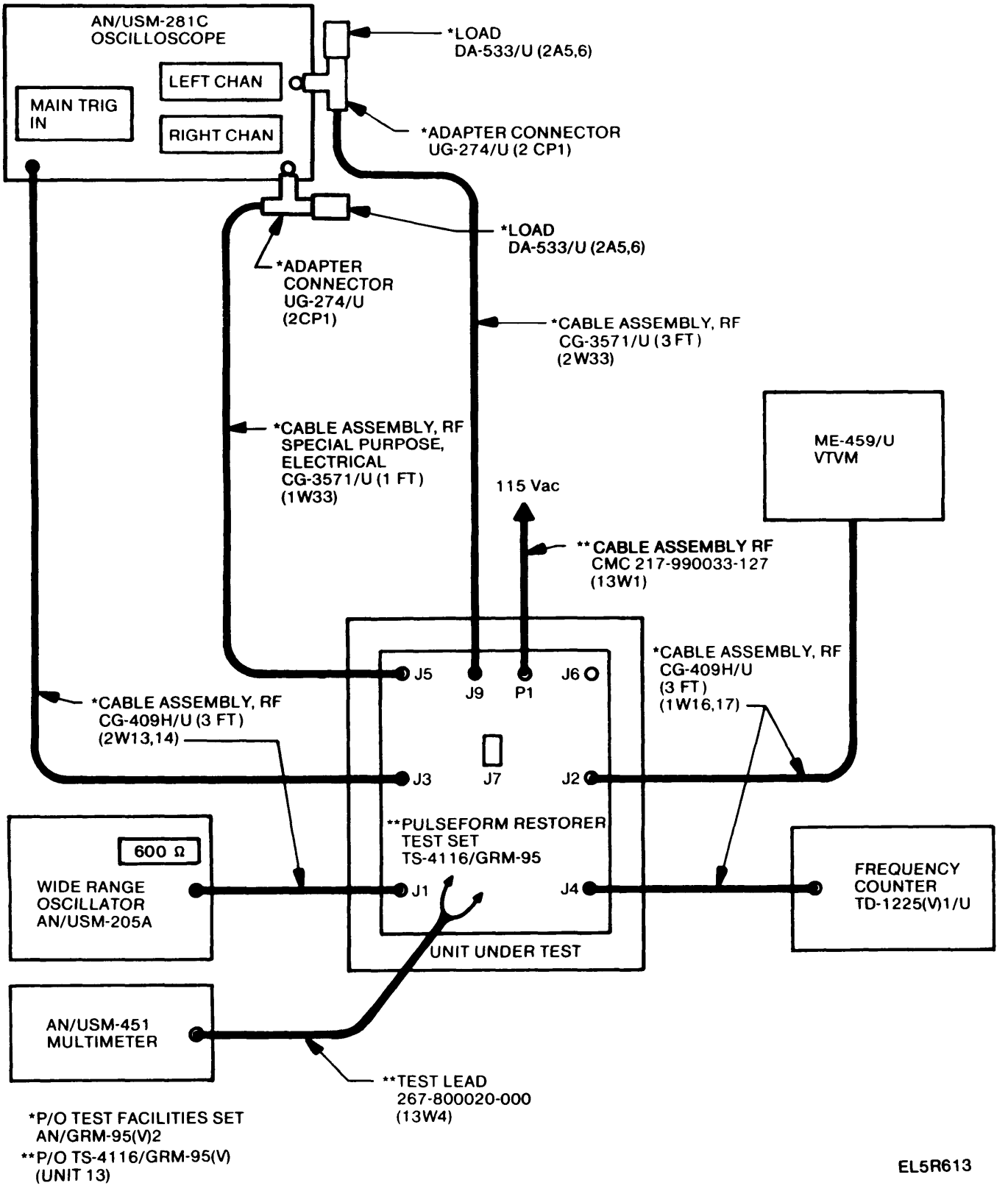



*Figure 3-27. Pulse Form Restorer 1RE1A3 (SM-D-9905 10), Pcm Output Test Setup.*

*(d)* The PCM pulse should have the following characteristics:

1. Logic "1" level: 0.0 V to –0.2 V.
2. Logic "0" level: –1.8 V to –2.2 V.
3. Rise and fall times (10% to 90% amplitude): 10 ns to 45 ns.
4. Delay of rising pcm pulse transitions relative to 50% point of rising edge of timing output: 40 ns to 75 ns.

*(e)* Set the PFR test set switches as follows:

| *Switch* | *Position* |
|---|---|
| FUNCTION (S1) | 3 |
| COMBINER CONTROL *(S5)* | 1k |
| PCM(S2) | 10 CODE |
| LEVEL SWITCH (S6) | +6 dB |

*(f)* Repeat steps(c) and(d) above.

*(g)* Set PCM (S2) to PR CODE and LEVEL SWTICH (S6) to 0 dB.

*(h)* Remove the 91 ohm load at the oscilloscope channel. Both the PCM and the TIMING OUTPUT signals should disappear. The signals should reappear when the 91 ohm load is replaced.

*(i)* Set the PFR test set PCM switch (S2) to OFF. Both the PCM and the TIMING OUTPUT signals should disappear.

*(j)* Set the PCM switch (S2) back to the PR CODE position The signals should reappear.

*(k)* Using the multimeter, measure the voltages at J10 (+) and J11 (—) of the PFR test set The multimeter should indicate between 230 and 280 mV.

(4) *Order wire check*

*(a) Set the PFR test set switches as follows:*

| *Switch* | *position* |
|---|---|
| FUNCTION (S1) | 4 |
| VTVM (S4) | VIDEO |
| PCM (S2) | OFF |
| COMBINER CONTROL (S5) | OPEN |
| COUNTER (S3) | OW FREQ |
| NOISE (S6) | OFF |
| LOAD (S9) | OFF |
| LEVEL SWITCH (S6) | 0 dB |

*(b)* Adjust the wide range oscillator for a frequency of 1000 Hz ±2 Hz and a level of –16 dBm ±0.1 dB as indicated on the counter and the VTVM respectively.

*(c)* Set the PFR test set switches as follows:

| *Switch* | *Position* |
|---|---|
| VTVM *(S4)* | OW NOISE |
| PCM (S2) | PR CODE |

*(d)* Adjust the LF ADJ potentiometer on the unit under test and fine tune the 1 kHz signal frequency of the test oscillator for a minimum indication on the VTVM (typically below —40 dBm). Adjust the OW NOISE potentiometer on the UUT and then readjust the LF ADJ on the UUT for a minimum indication on the VTVM. Record the indication.

*(e)* Set the PFR test set VTVM switch (S4) to OW LEVEL. The VTVM should indicate –10 dBm ±0.5 dB. Record this indication.

*(f)* Set the PFR test set COMBINER CONTROL switch (S5) to GND. The VTVM should indicate –16 dBm ±0.5 dB.

*(g)* Reset the COMBINER CONTROL switch (S5) to OPEN. Set the test oscillator to sweep between 250 Hz and 2 kHz as read on the frequency counter. The VTVM reading should not vary by more than ±0.4 dB from the indication recorded in *(e)* above.

*(h)* Tune the wide range oscillator frequency to 1000 Hz ±2 Hz.

(i) Set the PFR test set VTVM switch (S4) to OW NOISE. Fine tune the test oscillator frequency for a minimum indication on the VTVM (typically below –40 dBm).

*(j)* Set the PFR test set LEVEL SWITCH (S6) as listed below. The VTVM should indicate less than the maximum indications listed below.

| *LEVEL SWITCH (S6) position* | *Maximum indication* |
|---|---|
| *6 dB* | *–30* dBm |
| 0 dB | *–40* dBm |
| -6 dB | *–42* dBm |

*(k)* If the reading at –6 dB is below –44 dBm readjust the OW NOISE control on the unit under test until the reading is –42 dBm, then repeat step *(j)* above.

*(l)* Set the PFR test set switches as follows:

| *Switch* | *Position* |
|---|---|
| FUNCTION (S1) | *5* |
| COMBINER CONTROL *(S5)* | 1 k |

*(m)* Set the PFR test set LEVEL SWITCH (S6) as listed below. The VTVM should indicate less than the maximum indication listed below.

| *LEVEL SWITCH position* | *Maximum indication* |
|---|---|
| *6* dB | –33.0 dBm |
| 0 dB | –39.0 dBm |
| -6 dB | –45.0 dBm |

*(n)* Reset the PFR test set LEVEL SWITCH (S6) to 0 dB.

(o) Using the digital multirneter, measure the OW voltage between J12(+) and J13(–). The multimeter should indicate between 230 and 280 mV.

(5) 576 *kb/s error rate check*

**NOTE**

In order to count the error pulses generated over the required time interval, it will be necessary to use an external time base for the frequency counter, and to calibrate the oscilloscope to trigger at a vertical input level of –10 mV.

*(a)* Set the PFR test set switches as follows:

| *Switch* | *Position* |
|---|---|
| FUNCTION (S1) | 1 |
| VTVM *(S4)* | VIDEO |
| COUNTER (S3) | ERRORS |
| PCM (S2) | OFF |
| COMBINER CONTROL (S5) | OPEN |
| NOISE (S8) | ON |
| LOAD (S9) | ON |

*(b)* vary the NOISE ADJ control (R11) on the PFR test set for an indication of 0.103 vrms on the VTVM. (Set VTVM volts scale to 1 volt after setting noise level.)

*(c)* Set the PFR test set PCM switch (S2) to PR CODE.

*(d)* Refer to figure 3-28. Using the frequency counter and VTVM, adjust the signal generator frequency to 1 MHz ±1 kHz at an output level of 2 volts.

*(e)* Connect test equipment as shown in figure 3-28.

*(f)* Position INT-EXT OSC switch (rear of frequency counter) to EXT OSC and RESOLUTION switch (front panel) to 1 Hz. The frequency counter is now set for a sample time of 10 seconds.

*(g)* Set the oscilloscope switches as follows:

| *Switch* | *Position* |
|---|---|
| VERT MODE | LEFT |
| TRIG SOURCE | LEFT |
| AC-GND-DC (left chennel) | GND |
| VOLTS/DIV (left channel) | 10 mV |
| MAIN TRIGGERING MODE | AUTO |
| MAIN TRIGGERING COUPLING | DC |
| MAIN TRIGGERING SOURCE | INT |
| MAIN TRIGGERING SLOPE | NEG(–) |
| MAIN TRIGGERING LEVEL | CENTER |
| TIME/DIV | 50 us |

*(h)* Position the trace (left channel) to the upper half of the graticule. Set MAIN TRIGGERING MODE to NORM

*(i)* Repeatedly adjust the left channel POSITION control to move the trace towards the bottom half of the graticule while adjusting the MAIN TRIGGERING LEVEL control until triggering just occurs at the center vertical graticule line.

*(j)* Set MAIN TRIGGERING MODE to AUTO. Adjust the left channel POSITION control to place the trace 1 cm above the center vertical graticule line.

*(k)* Set the MAIN TRIGGERING MODE to NORM and left channel AC-GND-DC switch to AC. The oscilloscope is now calibrated to trigger on all negative going pulses of—10 mV or greater.

*(l)* The frequncy counter reading should not exceed 58 errors in the 10 second interval established in *(f)* above.

(6) 1152 *kb/s error rate check.*

*(a)* Set the PFR test set switches as follows:

| *Switch* | *Position* |
|---|---|
| COUNTER (S3) | ERRORS |
| PCM (S2) | OFF |
| FUNCTION (S1) | 3 |
| COMBINER CONTROL (S5) | 1k |
| NOISE (S8) | ON |
| VTVM (S4) | VIDEO |
| LOAD (S9) | ON |

*(b)* Vary the NOISE ADJ control (R11) on the PFR test set for an indication of 0.062 vrms on the VTVM. Set VTVM VOLTS scale to 1 volt after setting noise level.

*(c)* Set the PFR test set PCM switch (S2) to PR CODE. The frequency counter should count less than 115 errors in a 10 second interval.

*(d)* Set the PFR test set switches as follows:

| *Switch* | *Position* |
|---|---|
| PCM (S2) | OFF |
| COUNTER (S3) | OW FREQ |
| NOISE (S8) | OFF |
| FUNCTION (S1) | 5 |
| COMBINER CONTROL (S5) | 1k |
| LOAD (S9) | ON |

*(e)* The VTVM should indicate –16 dBm ±0.1 dB. If necessary, adjust wide range oscillator level control to obtain this reading.

*(f)* Temporarily position INT-EXT OSC switch (rear of frequency counter) to INT. Refer to figure 3-28. Using the frequency counter and VTVM: adjust the signal generator for and output frequency of 166.667 Hz ±200 Hz at a level of 2 volts. Adjust the output frequency of the wide range oscillator to 1000 Hz ±2 Hz.

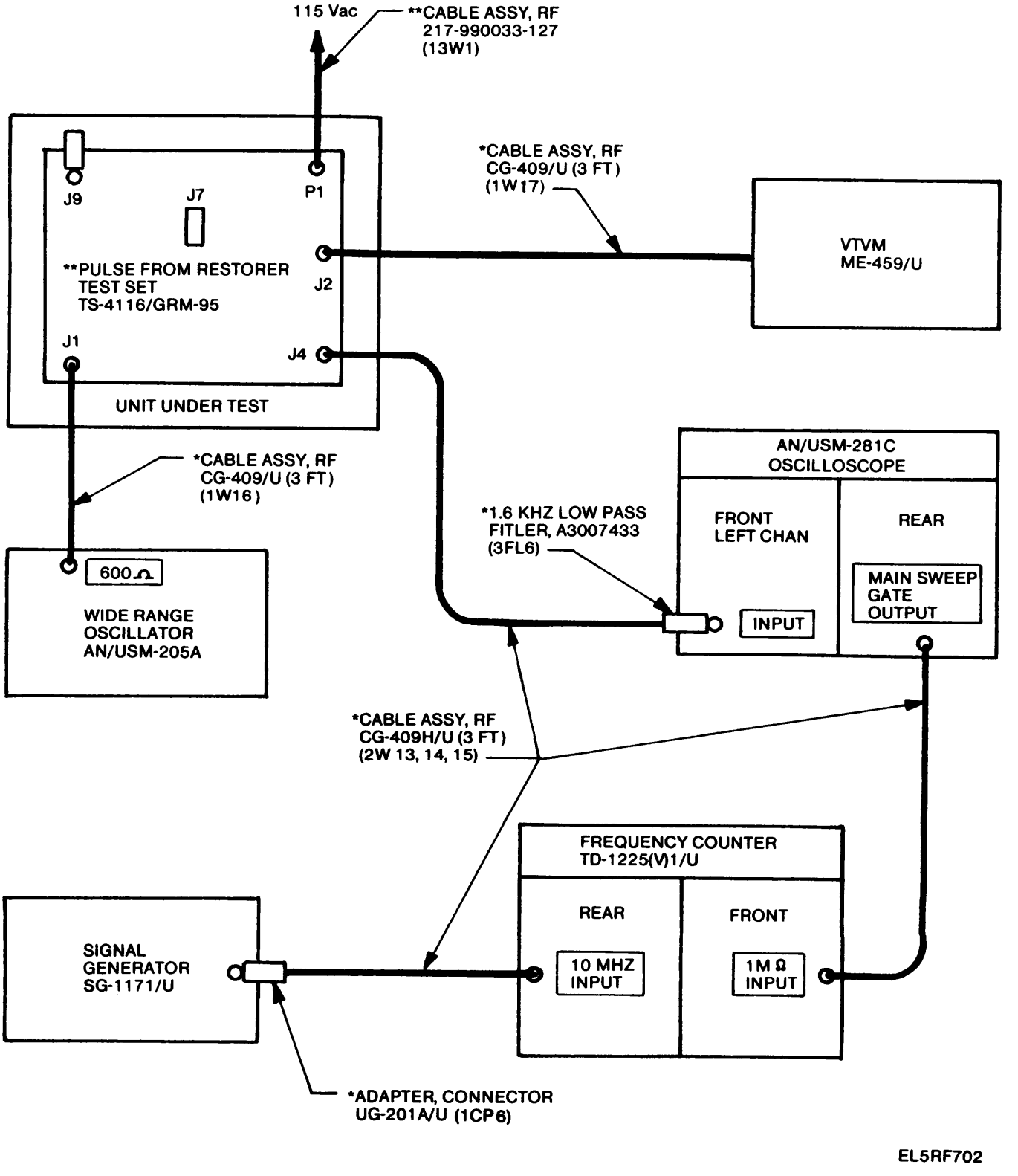



*Figure 3-28. Pulse Form Restorer 1RE1A3, Error Rate Check Test Setup.*

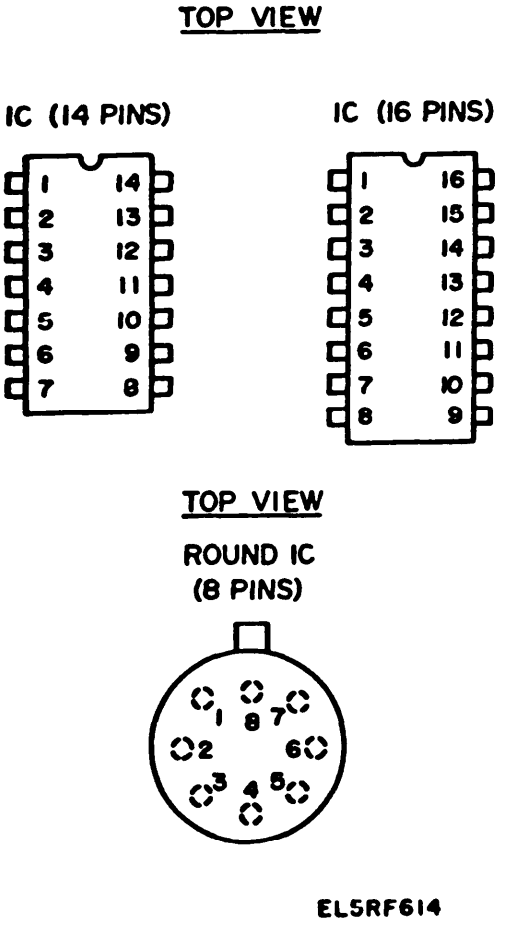



*Figure 3-29. Pulse Form Restorer 1RE1A3 (SM-B990510), Pin Diagrams, Integrated Circuits.*

*(g)* Reposition INT-EXT OSC switch to EXT. Connect equipment as shown in figure 3-28. Frequency counter is now set for a sample time of 60 seconds.

*(h).* Set the PFR test set switches as follows:

| *Switch* | *Position* |
|---|---|
| PCM (S2) | PR CODE |
| COUNTER (S3) | ERRORS |
| NOISE (S8) | OFF |
| FUNCTION (S1) | 5 |
| COMBINER CONTROL (S5) | 1k |
| LOAD (S9) | ON |

*(i)* The frequency counter should count less than 100 errors in a 60-second interval.

C. *Troubleshooting (FO-17).*

(1) In order to troubleshoot the pulse form restorer it is necessary to gain access to the interior circuitry. See paragraph 3-10 d. for disassembly and assembly instructions.

(2) To troubleshoot Pulse Form Restorer 1RE1A3, connector test equipment as shown in figure 3-27 (S9 OFF). Figures 3-29 and 3-30 show the location of pins on the integrated circuits and transistors. Figures 3-31, 3-32, 3-33, and 3-34 show the postion of components and test points on each board.

(3) Refer to the table below to determine the most probable location of faults.

| *Output signal abnormal* | *Most likely location of fault* |
|---|---|
| PCM, PCM meter | Board A2 |
| Timing pulses | Board A4 |
| Order wire, order wire meter | Board A1 |
| Order wire relay | Board A3 |

(4) After determining probable location of fault troubleshoot as described in the appropriate chart below.

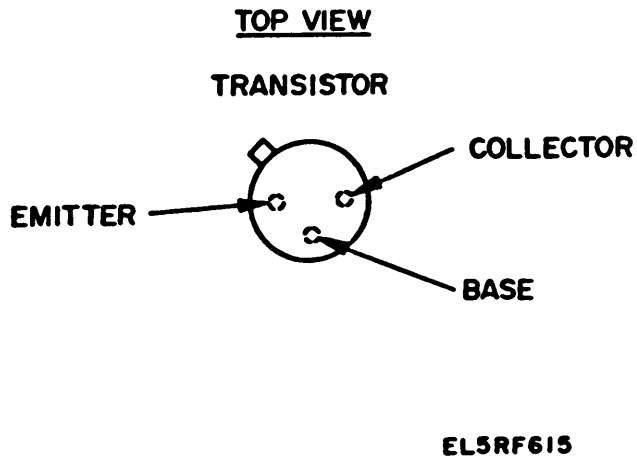



Figure 3-30. Pulse *Form Restorer 1RE1A3 (SM-D-990510), Pin Diagram Transistor.*

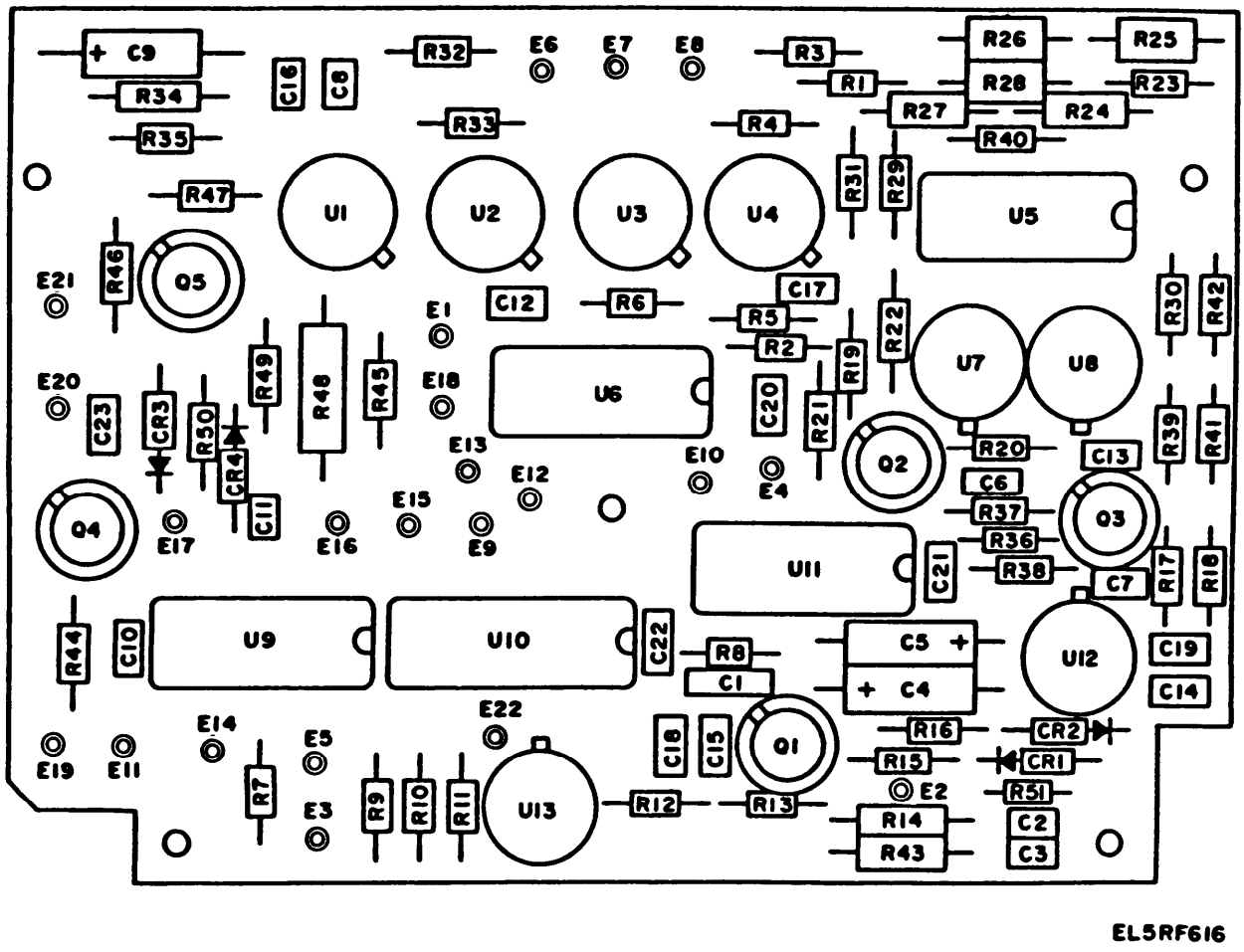



*Figure 3-31. Pulse Form Restorer 1RE1A3 (SM-D-990510), Pulse Form Restorer Pcb 1RE1A3A2,* Component *Location Diagram.*

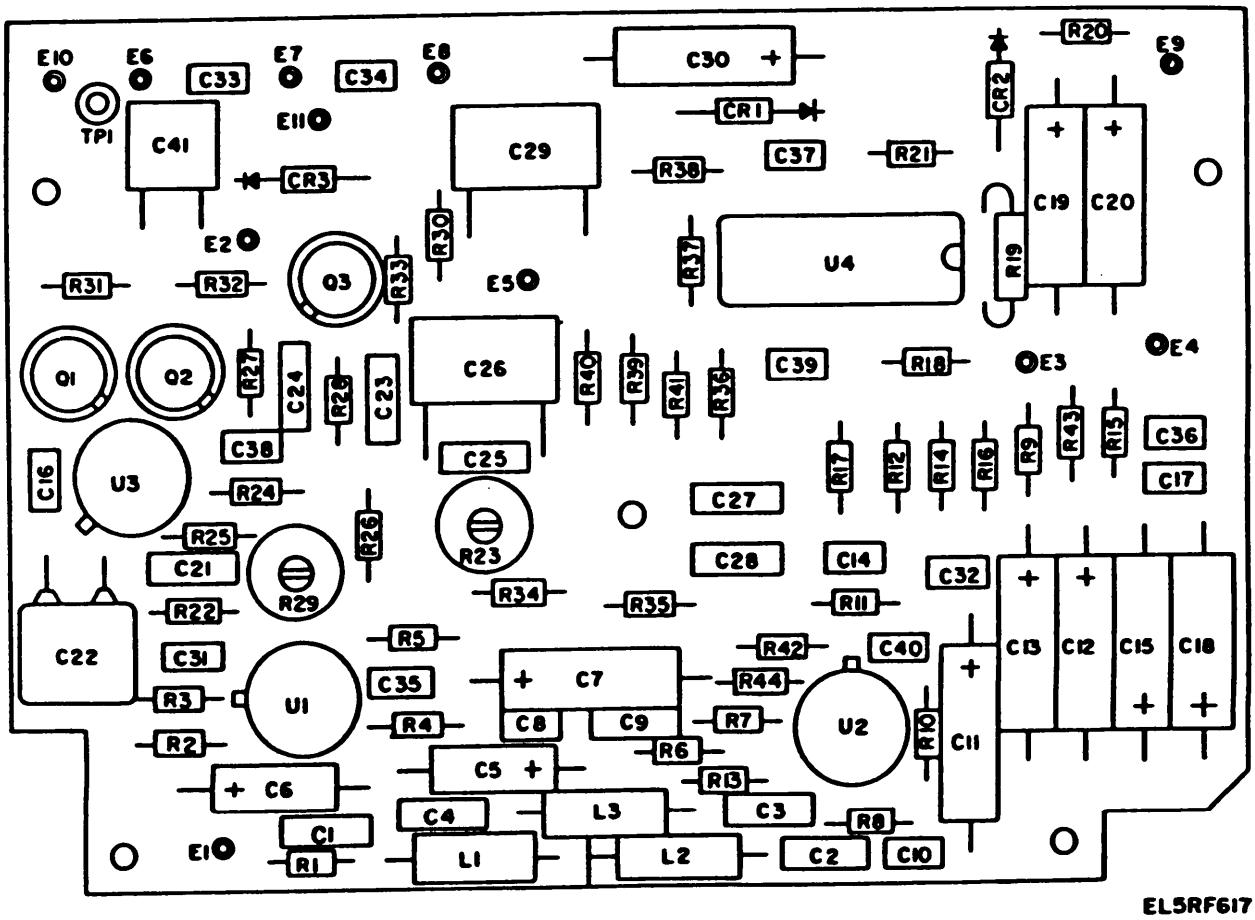



*Figure* 3-32. Pulse *Form Restorer 1RE1A3 (SM-D-990510),* Modulation *Eliminator Pcb* 1RE1A3A1, Compment Location Diagram

c. *Troubleshooting.* - Continued

| *Symptom* | Checks and corrective measures |
|---|---|
| PULSE FORM RESTORER BOARD 1RE1A3A2 | |
| No pcm pulse indication | Check that there are no broken wires on 1RE1A3A2. Check that the +5 V, +12 V and –12 V supply voltages appear at E4, ES, and E7 respectively (fig. 3-31). If the voltage levels are incorrect check ground connection at E5 and E6 for broken wires. If the +12 V or –12 Vie absent, check the wires attached to E8 and E7. If the +5 V is abesnt check the wire at E4. If it is not broken, measure the voltage at pin 2 of the external regulator. It should be +5 V. The voltage at pin 1 should be +12 V. |
| Pcm waveform abnormal (binary mode). | a To check board 1RE1A3A2 (fig. 3-31) in the binary mode, follow b. through y. below. Set the PFR test set switches as indicated below and use the SYNC signal from the test set to trigger the scopce: |

| *Switch* | Position |
|---|---|
| FREQ CONTROL (R5) | Center of range |
| LEVEL SWITCH (S6) | 0 dB |
| FuNCTION (S1) | 1 |
| NOISE (S6) | OFF |
| PCM (S2) | PR CODE |
| COMBINER CONTROL (S5) | OPEN |
| LOAD (S9) | OFF |

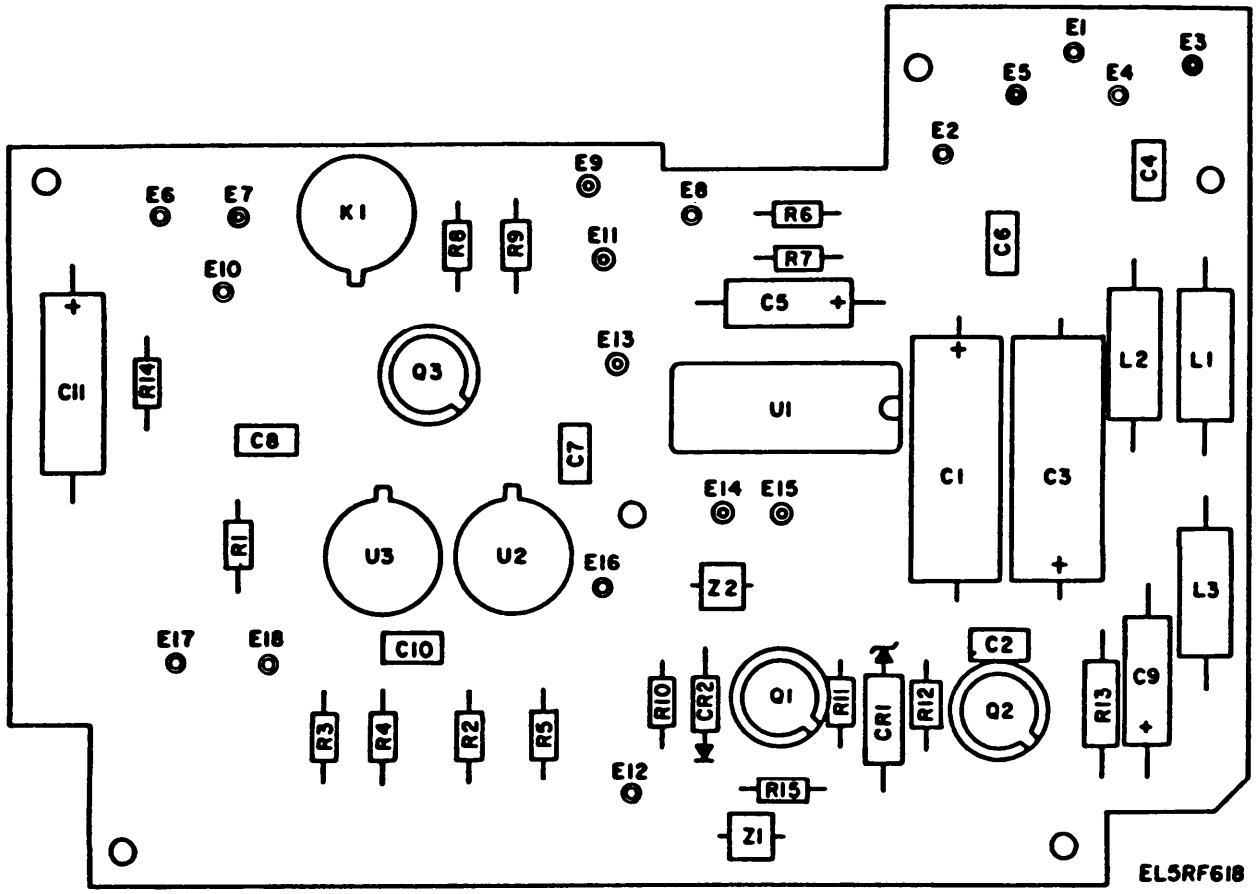



*Figure 3-33. Pulse Form Restorer 1RE1A3 (SM-D-990510), Electrcial Interface Pcb 1RE1A3A3, Component Location Diagram.*

c. *Troubleshooting.* – Continued

| *Symptom* | Checks and corrective measures |
|---|---|
| PULSE FORM RESTORER BOARD 1RE1A3A2 - (Cont) | |
| Pcm waveform abnormal (binary mode) - (Cont) | b. Check that the input signal at E3 is as shown in figure 3-35 (1a). If incorrect check the PFR test set |
| | c. If the signal at pin 6 of U13 is not as shown m figure 3-35 (3a), replace U13. |
| | d. If the signal at E2 is not as shown in figure 3-35 (3a), replace Q1. |
| | e. If the signal at pin 6 of U12 is not as shown in figure 3-35 (3a), replace U12. |
| | f. Check that the signal at pin 7 of U8 switches between 0 V and greater than 4.5 V. If it does not change U8. |
| | g. The signal at pin 3 of U5 should be 0.75 Vdc ±0.1 V. If it is not replace Q2. |
| | h. Check that the signal at pin 1 of US is 0.75 Vdc ±0.1 V. If it is not replace U5. |
| | i The signal at pin 7 of U7 should switch between O V and greater than 4.5 Vdc. If it does not change U7. |
| | j. Check that the signal at the collector of Q3 is 0.75 Vdc ±0.1 V. If it is not, change Q3. |
| | k Check that the signal at pin 7 of U5 is -0.75 Vdc ±0.1 V. If it is not then change U5. |
| | l. The signal at pin 14 of U5 should be 1.5 Vdc ±0.2 V. If it is not replace U5. |

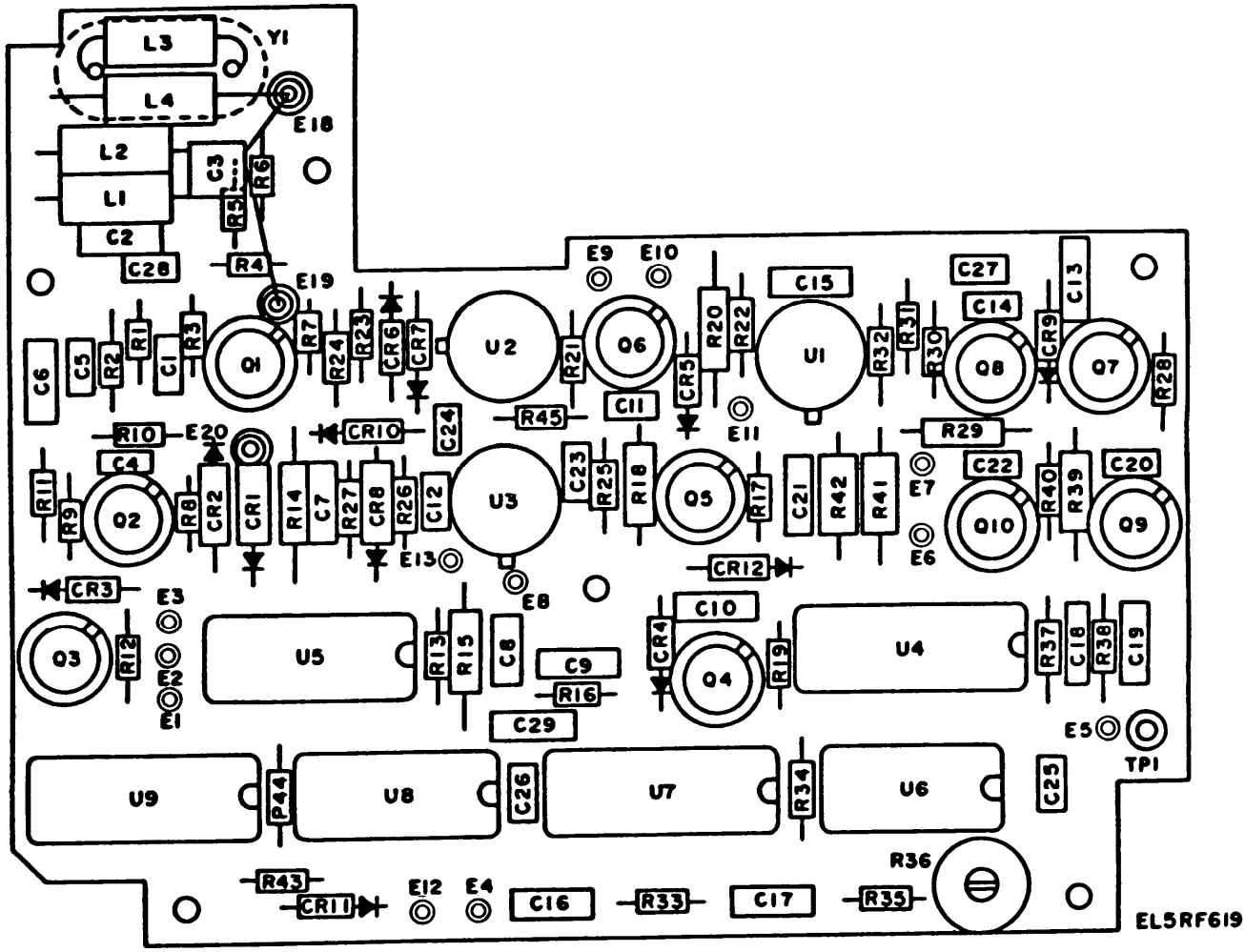



*Figure* 3-34. *Pulse Form Restorer 1RE1A3 (SM-D-990510), Electrical Synchronizer Pcb 1RE1A3A4, Component Location Diagram.*

c. Troubleshooting. – Continued

| *Symptom* | Checks and corrective measures |
|---|---|
| PULSE FORM RESTORER BOARD 1RE1A3A2 - (Cont) | |
| Pcm waveform abnormal (binary mode) - (Cent) | m. The signal at E1 shoud be less than 0.5 Vdc. If it is not replace U1. |
| | n. Turn the PCM switch (S2) on the PFR test set to OFF. The signal at E 1 should be 3 Vdc or greater. If not replace U1. Return the PCM switch (S2) to PR CODE. |
| | o. The signal at E12 should be as shown in figure 3-35 (4a). If it is not, change U2. |
| | p. The signal at E19 should be as shown in figure 3-35 (7a). If it is not, check that the signal at E15 is less than 0.5 Vdc. If the signal at E15 is wrong, the problem lies on the electrical interface board. If the signal at E15 is correct but that at E19 is wrong, change U1O. |
| | q. The signal at E21 should be as shown in figure 3-35 (8a). If it in not check that the signal at E14 is as shown in figure 3-35 (15a), and that the signal at E16 is 3 Vdc or greater. If E21 is wrong, while E14 and E16 are correct then change U9. If E14 is wrong the problem lies on the electrical synchronizer board. If E16 is wrong, then the problem lies on the electrical interface board. |
| | r. Check that the signal at E9 is as shown in figure 3-35 (21a). If it is incorrect change U10. |
| | s. Check that the signal at E10 is as shown in figure 3-35 (18a). If it is incorrect then the problem is on the electrical synchronizer board. |

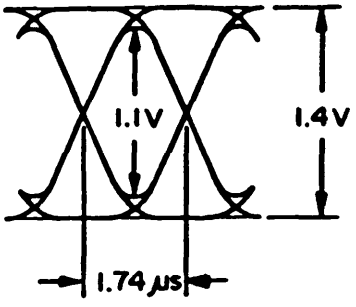
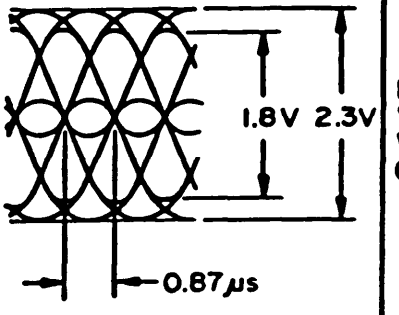
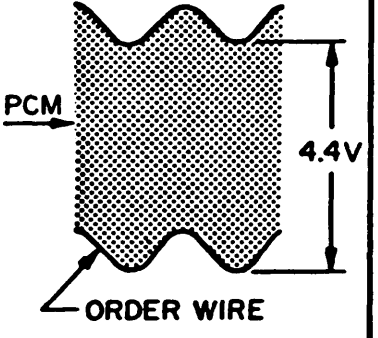
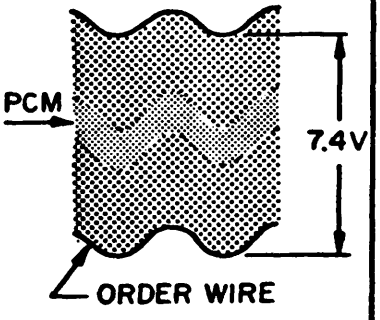
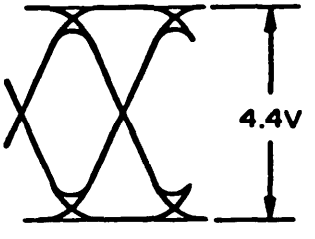
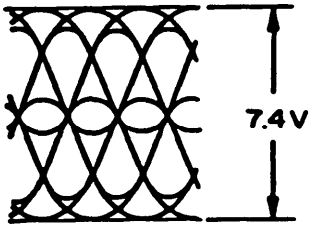
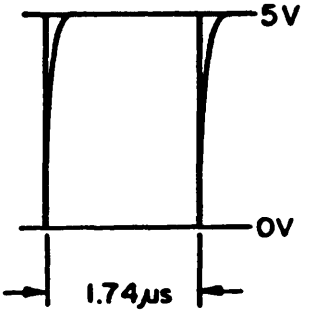
| NO | TEST POINT | SIGNAL | | SIGNAL DESCRIPTION |
|---|---|---|---|---|
| | | BINARY MODE (a) | BITERNARY MODE (b) | |
| 1 | TEST POINT E3 ON BOARD A2 |  |  | INPUT VIDEO SIGNAL WITH NO ORDER WIRE |
| 2 | TEST POINT E1 ON BOARD A1 |  |  | ORDER WIRE ADDED TO VIDEO SIGNAL<br><br>NOTE: OSCILLOSCOPE SWEEP RATE IS SLOW |
| 3 | BOARD A2<br><br>IC U12 PIN 6<br><br>IC U13 PIN 6<br><br>TEST POINT E2 |  |  | VIDEO SIGNAL WITH ORDER WIRE REMOVED |
| 4 | BOARD A2<br><br>IC U2 PIN 7<br><br>TEST POINT E12 |  | NOT APPLICABLE | BINARY SLICER OUTPUT |

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*Figure 3-35. Waveform Diagrams for Pulse Form Restorer 1RE1A3 (SM-D-990510) (Sheet 1 of 8).*

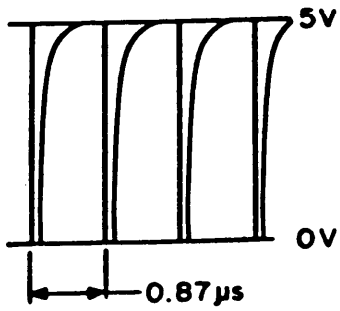
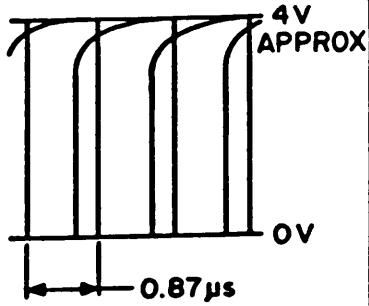
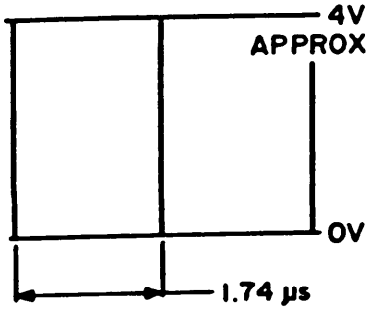
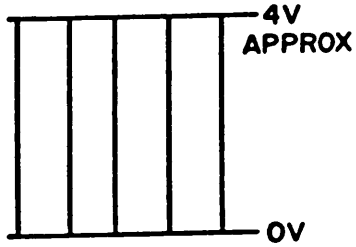
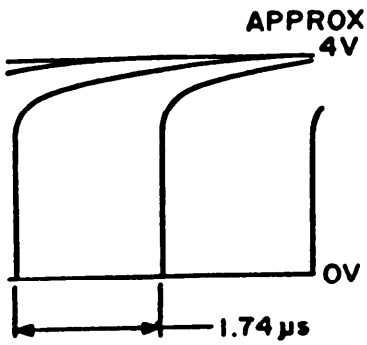
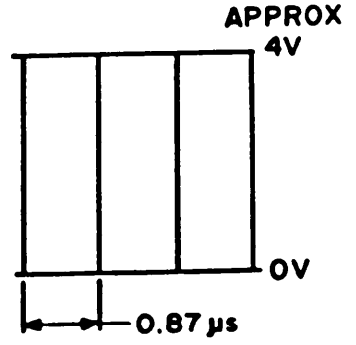
| NO. | TEST POINT | SIGNAL | | SIGNAL DESCRIPTION |
|---|---|---|---|---|
| | | BINARY MODE (a) | BITERNARY MODE (b) | |
| 5 | BOARD A2<br>IC U3 PIN 7<br>IC U4 PIN 7 | NOT APPLICABLE |  | BITERNARY SLICER<br>NOTE:<br>SIGNAL TRANSITIONS ARE JITTERY |
| 6 | BOARD A2<br>TEST POINT E13 | NOT APPLICABLE |  | BITERNARY TIMING INFORMATION<br>NOTE:<br>SIGNAL TRANSITIONS ARE JITTERY |
| 7 | BOARD A2<br>IC U9 PIN 2<br>TEST POINT E19 |  |  | SLICED VIDEO SIGNALS TO BE RETIMED<br>NOTE:<br>SIGNAL TRANSITIONS ARE JITTERY<br>TOP OF SIGNAL MAY BE CURVED |
| 8 | BOARD A2<br>IC U9 PIN 6,8<br>TEST POINTS E9, E21 |  |  | RETIMED SLICED VIDEO EDGE JITTER REMOVED<br>NOTE:<br>TOP OF SIGNAL MAY BE CURVED |

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*Figure 3-35. Waveform Diagrams for Pulse Form Restorer 1RE1A3 (SM-D-990510) (Sheet 2).*

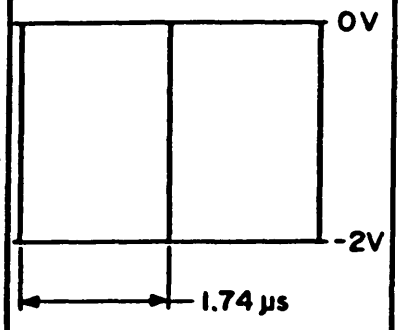
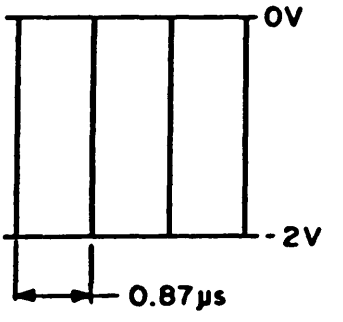
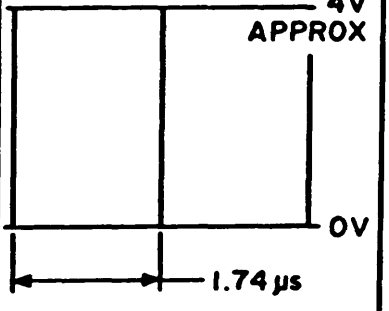
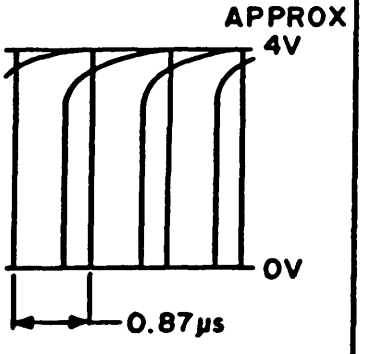
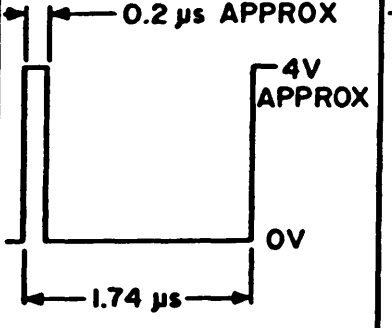
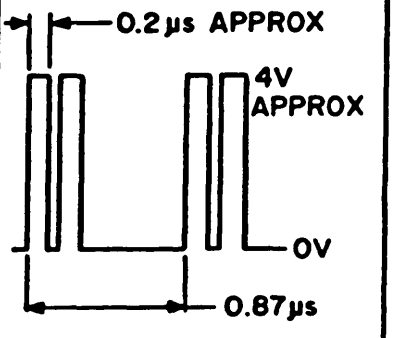
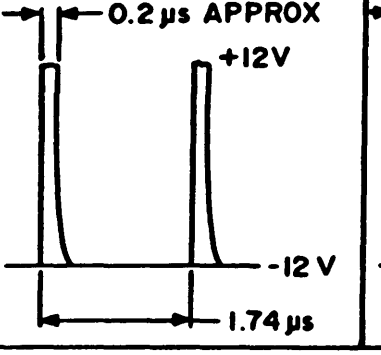
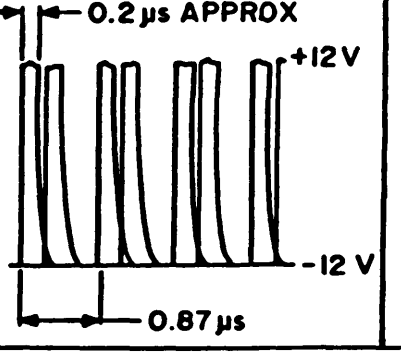
| NO. | TEST POINT | SIGNAL | | SIGNAL DESCRIPTION |
|---|---|---|---|---|
| | | BINARY MODE (a) | BITERNARY MODE (b) | |
| 9 | BOARD A2<br>TEST POINT E18<br>BOARD A3<br>TEST POINT E12 |  |  | PCM OUTPUT |
| 10 | BOARD A4<br>IC U5 PIN 1 |  |  | TIMING INFORMATION FROM SLICERS<br>NOTE:<br>SIGNAL TRANSITIONS ARE JITTERY |
| 11 | BOARD A4<br>IC U5 PIN 11 |  |  | NARROW PULSES AT TRANSITIONS OF SLICED VIDEO SIGNALS<br>NOTE:<br>SIGNAL TRANSITIONS ARE JITTERY<br>TOP OF SIGNAL MAY BE CURVED |
| 12 | BOARD A4<br>TRANSISTOR Q5 COLLECTOR |  |  | NARROW PULSES AT TRANSITIONS OF SLICED VIDEO SIGNALS<br>NOTE:<br>SIGNAL TRANSITIONS ARE JITTERY |

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Figure 3-35. *Waveform Diagrams for Pulse Form Restorer 1RE1A3 (SM-D-990510) (Sheet 3).*

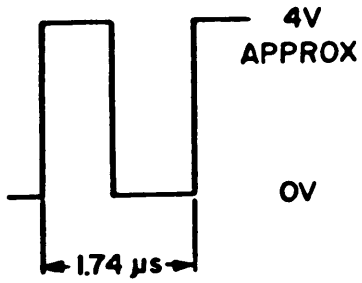
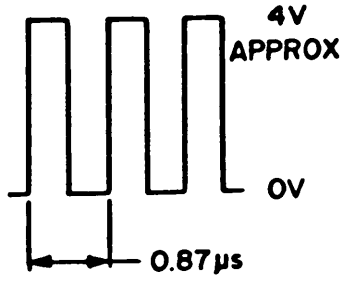
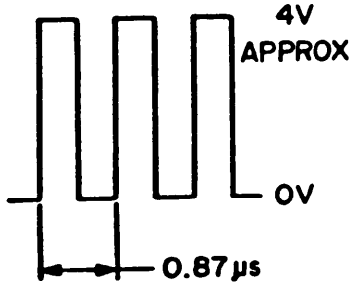
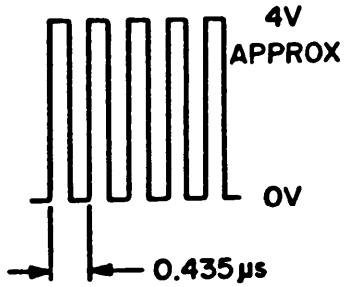
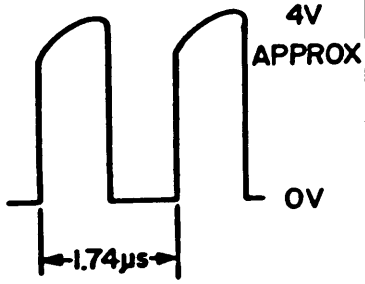
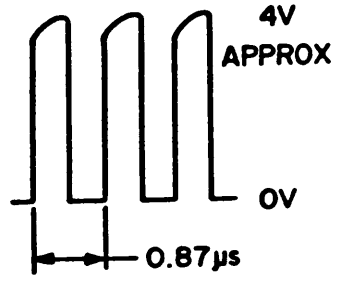
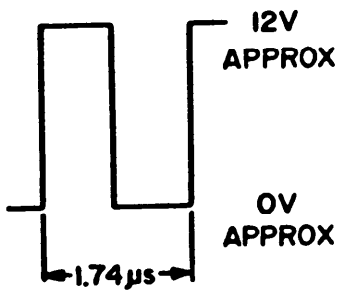
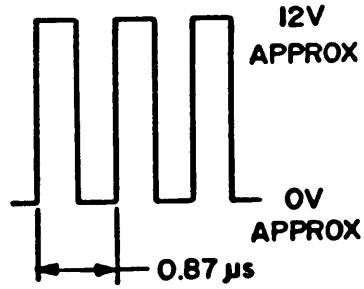
| NO. | TEST POINT | SIGNAL | | SIGNAL DESCRIPTION |
|---|---|---|---|---|
| | | BINARY MODE (a) | BITERNARY MODE (b) | |
| 13 | BOARD A4<br>IC U8 PIN 8 |  |  | TIMING WAVEFORMS<br>NOTE:<br>TOP OF SIGNAL MAY BE CURVED AS IN WAVEFORM 15 |
| 14 | BOARD A4<br>IC U8 PIN 9 |  |  | TIMING WAVEFORMS AT TWICE THE FREQUENCY OF THOSE AT PIN 8<br>NOTE:<br>TOP OF SIGNAL MAY BE CURVED AS IN WAVEFORM 15 |
| 15 | BOARD A4<br>TP1<br>IC U6 PIN 6 |  |  | RETIMING CLOCK |
| 16 | BOARD A4<br>TRANSISTOR Q3 EMITTER<br>TRANSISTOR Q7 COLLECTOR |  |  | INPUT FOR TRIANGULAR WAVE GENERATING FILTER<br>NOTE:<br>TOP OF SIGNAL MAY BE CURVED AS IN WAVEFORM 15 |

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Figure 3-35. *Waveform Diagrams for Puke Form Restorer 1RE1A3 (SM-D-990510) (Sheet 4).*

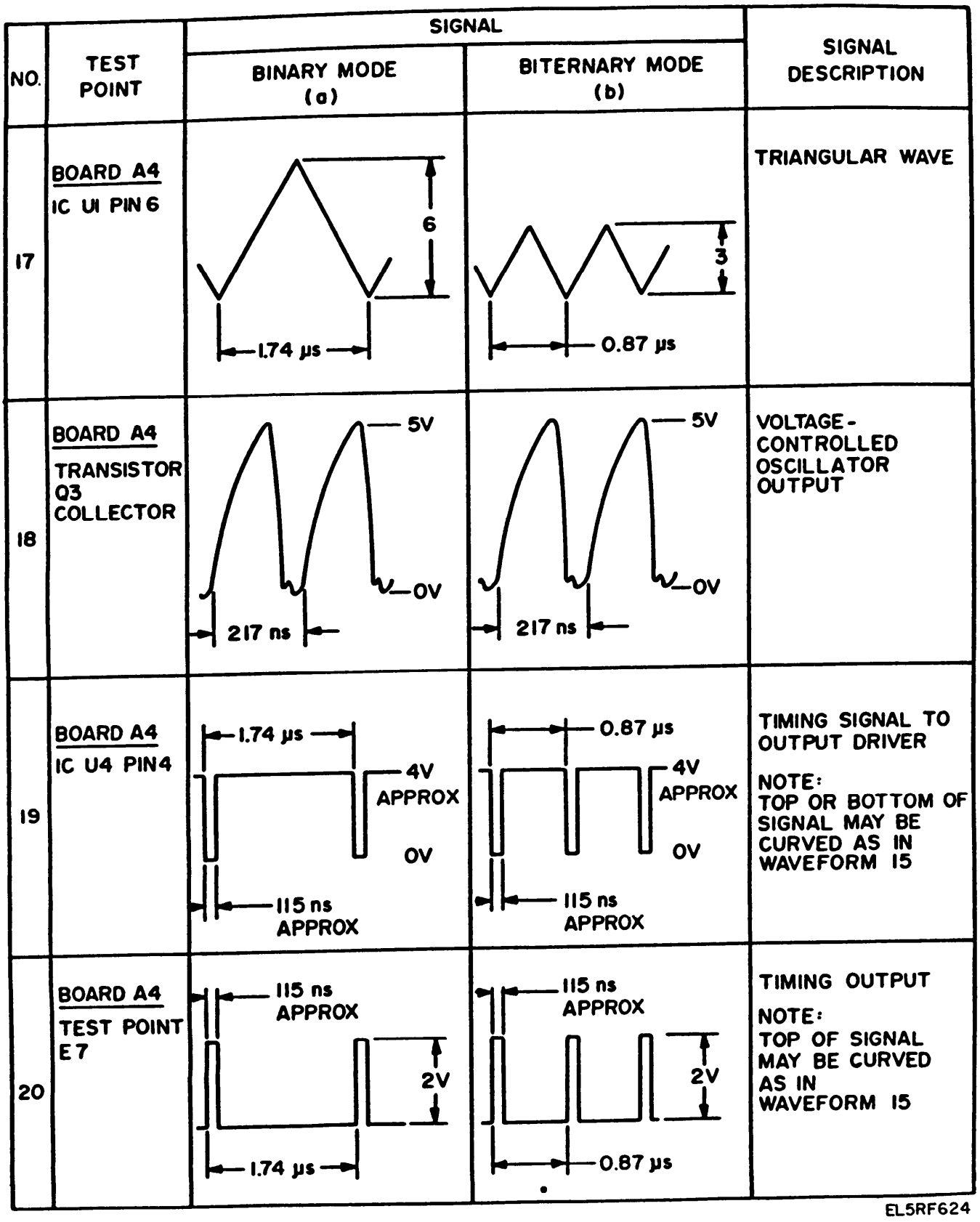



*Figure 3-35. Waveform Diagrams for Pulse Form Restorer 1RE1A3 (SM-D-990510) (Sheet 5).*

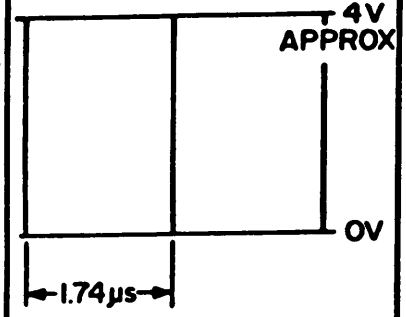
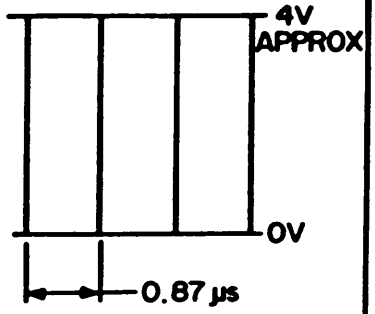
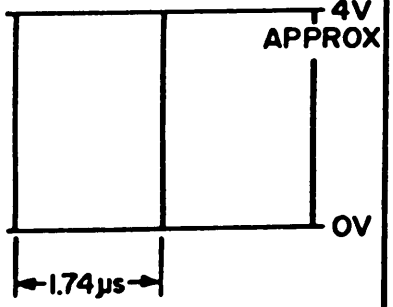
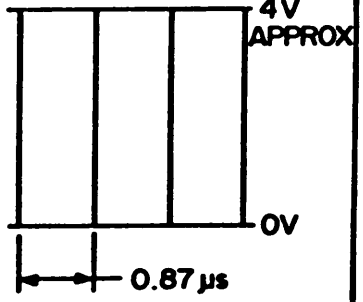
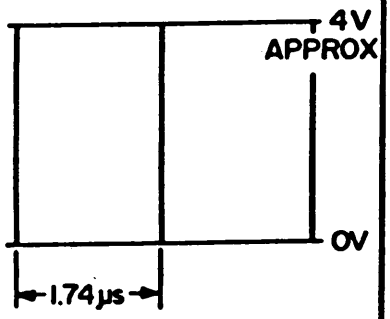
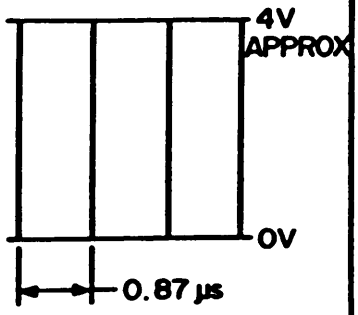
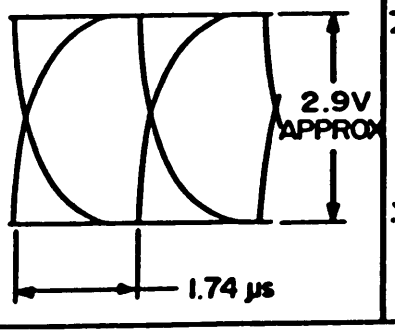
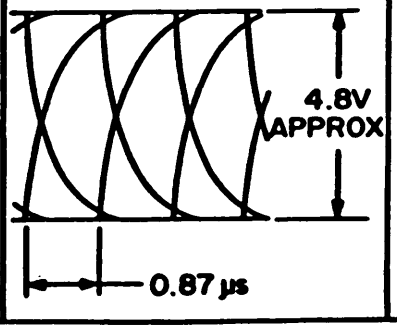
| NO. | TEST POINT | SIGNAL | | SIGNAL DESCRIPTION |
|---|---|---|---|---|
| | | BINARY MODE (a) | BITERNARY MODE (b) | |
| 21 | BOARD A1 TEST POINT E3 BOARD A2 TEST POINT E9 |   |   | DELAYED RETIMED PCM. NOTE: TOP OF SIGNAL MAY BE CURVED |
| 22 | BOARD A1 TEST POINT E2 |   |   | DELAYED RETIMED PCM. NOTE: TOP OF SIGNAL MAY BE CURVED |
| 23 | BOARD A1 TEST POINT E11 |   |   | DELAYED RETIMED PCM. INVERSE OF SIGNAL AT A3A1E2. NOTE: TOP OF SIGNAL MAY BE CURVED |
| 24 | BOARD A1 IC U3 PIN 6 |   |   | LEVEL-CONTROLLED SIGNAL TO SUBTRACTION AMPLIFIER. |

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Figure 3-35. *Waveform Diagrams for Pulse From Restorer 1RE1A3 (SM-LM90510) (Sheet 6).*

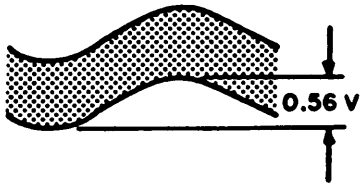
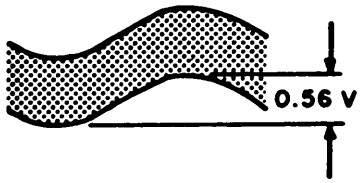
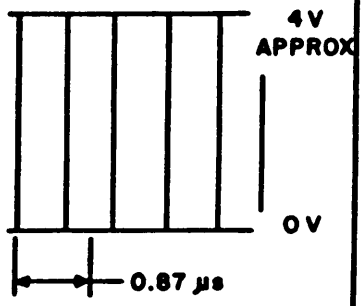
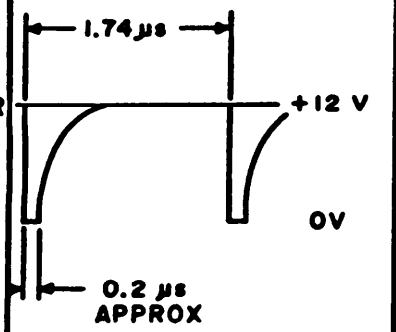
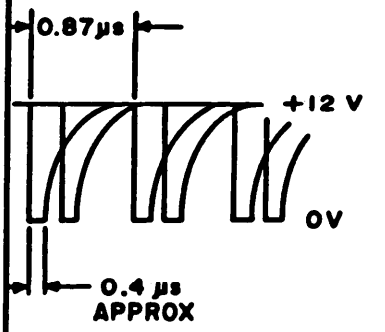
| NO. | TEST POINT | SIGNAL | | SIGNAL DESCRIPTION |
|---|---|---|---|---|
| | | BINARY MODE (a) | BITERNARY MODE (b) | |
| 25 | BOARD A1<br>IC U1<br>PIN 6 |  |  | ORDER WIRE PLUS HIGH FREQUENCY PCM COMPONENTS. |
| 26 | BOARD A1<br>TEST POINT<br>E5 |  |  | FILTERED ORDER WIRE SIGNAL.<br>NOTE: OSCILLOSCOPE SWEEP RATE IS SLOW. |
| 27 | BOARD A2<br>IC U6<br>PIN 11 | NOT APPLICABLE |  | BITERNARY DECODER OUTPUT.<br>NOTE: SIGNAL TRANSITIONS ARE JITTERY. TOP OF SIGNAL MAY BE CURVED. |
| 28 | BOARD A4<br>TRANSISTOR Q4 COLLECTOR |  |  | NARROW PULSES AT TRANSITIONS OF SLICED VIDEO SIGNALS.<br>NOTE: SIGNAL TRANSITIONS ARE JITTERY. |

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*Figure 3-35. Waveform Diagrams for Pulse Form Restorer 1RE1A3 (SM-D-990510) (Sheet7).*

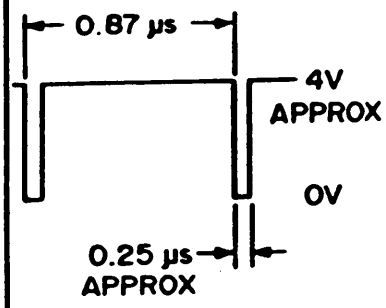
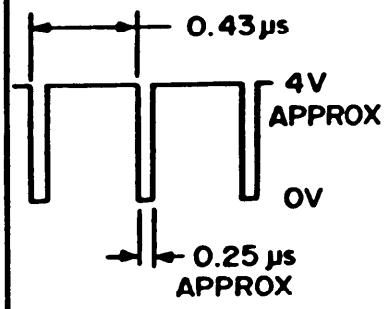
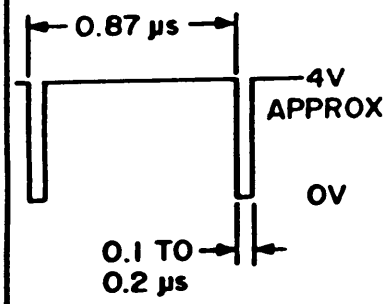
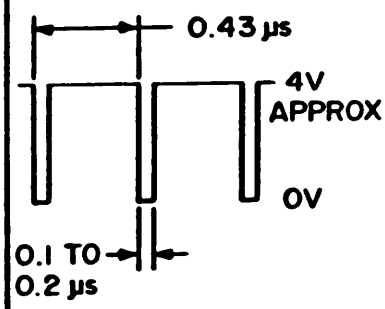
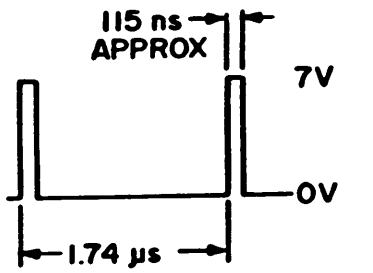
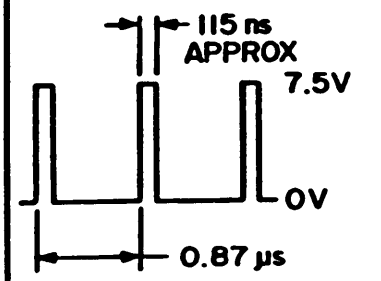
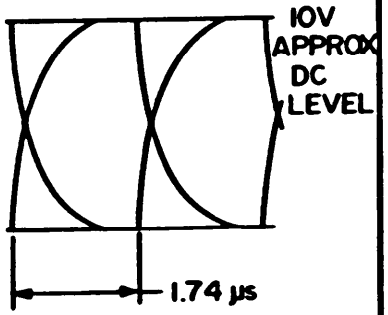
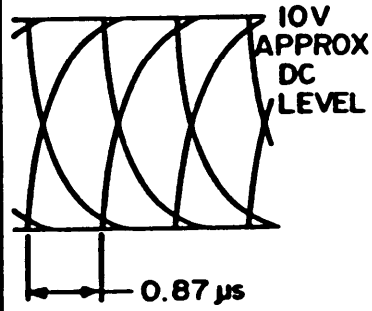
| NO. | TEST POINT | SIGNAL | | SIGNAL DESCRIPTION |
|---|---|---|---|---|
| | | BINARY MODE (a) | BITERNARY MODE (b) | |
| 29 | BOARD A4<br>IC U7<br>PIN 12 |  |  | PHASE SHIFT PULSES<br>NOTE:<br>TOP OR BOTTOM OF SIGNAL MAY BE CURVED AS IN WAVEFORM 15 |
| 30 | BOARD A4<br>IC U7<br>PIN 4 |  |  | PHASE SHIFT PULSES<br>NOTE:<br>TOP OR BOTTOM OF SIGNAL MAY BE CURVED AS IN WAVEFORM 15 |
| 31 | BOARD A4<br>TRANSISTOR Q9<br>COLLECTOR |  |  | CLOCK DRIVER PULSES<br>NOTE:<br>TOP OR BOTTOM OF SIGNAL MAY BE CURVED AS IN WAVEFORM 15 |
| 32 | BOARD AI<br>TRANSISTORS Q1 AND Q9<br>COLLECTORS |  |  | LEVEL-CONTROLLED PCM SIGNAL |

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*Figure 3-35. Waveform Diagram for Pulse Form Restorer 1RE1A3 (SM-D-990510) (Sheet 8).*

*c. Troubleshooting.* – Continued

| *Symptom* | *Checks and corrective measures* |
|---|---|
| PULSE FORM RESTORER BOARD 1RE1A3A2 - (Cont) | |
| Pcm waveform abnormal (binary mode) - (Cent) | t. Check that the signal at pin 3 of U11 is as shown in figure 3-35 (21a). If it is not, change U11. |
| | u. Check that the signal at E11 is as shown in figure 3-35 (21a). If it is not change U11. |
| | v. The signal at E20 should be as shown in figure 3-35 (21a). If it is not, then the problem is on the electrical synchronizer board. |
| | w. The signal at the emitter of Q4 should be switching between –0.5 and +4 Vdc ±.0.5 V. If it is not, change Q4 |
| | x. The signal at E18 should be as shown in figure 3-35 (9a). If it is not then change Q5. |
| | y. The signal at E17 should be between 0.2 Vdc and 0.3 Vdc. If not, check the following components and replace if necessary CR3, CR4, C11, C23, R49 and R50. |
| Pcm waveform abnormal (biternary mode) | a. To check board 1RE1A3A2 (figure 3-31) in the biternary mode, follow b. through v. below. Set the PFR test set switches as indicated below |

| | |
|---|---|
| FREQ CONTROL (R5) | Center of range |
| LEVEL SWITCH (S6) | O dB |
| FUNCTION (S1) | 3 |
| NOISE (S8) | OFF |
| PCM (S2) | PR CODE |
| COMBINER CONTROL | 1k OHM |

b. The signal at E15 should be 3 Vdc or greater. If it is not then there is a fault on the electrical interface board.

c. Check that the signal at pin 6 of U13 is as shown in figure 3-35 (3b). If it is incorrect replace U13.

d Check that the signal at E2 is as shown in figure 3-35 (3b). If it is incorrect, change Q1.

e. Check that the signal at pin 6 of U12 is as shown in figure 3-35 (3b). Change U12 if the signal is wrong.

f. The signal at pin 7 of U8 should switch between O V and greater than 4.5 Vdc. If it does not replace U8.

g. Check that the signal at pin 3 of U5 is 1.2 Vdc ±0.1 V. If it is not, replace Q2.

h. The signal at pin 1 of U5 should be 1.2 Vdc ±0.1 V. If it is not replace U5.

i. The signal at pin 7 of U7 should switch between O V and greater than 4.5 Vdc. If it does not change U7.

j. Check that the signal at the collector of Q3 is 1.2 Vdc ±0.1 V. If it is not, change Q3.

k. Check that the signal at pin 7 of U5 is –1.2 Vdc ±0.1 V. If it is not replace U5.

l. The signal at pin 7 of U3 should be as shown in figure 3-35 (5b). If it is incorrect, change U3.

m. The signal at pin 7 of U4 should be as shown in figure 3-35 (5b). If it is incorrect change U4.

n. The signal at E13 should be as shown in figure 3-35 (6b). If it is incorrect change U6.

o. Check that the signal at pin 11 of U6 is as shown in figure 3-35 (27 b). If it is incorrect change U6.

p. The signal at E19 should be as shown in figure 3-35 (7 b). If it is not, then check if the signal at E15 is greater than 3 Vdc. If E15 is incorrect the problem is on the electrical interface board. If E15 is correct, and E19 is wrong, then change U10.

*c. Troubleshooting.* – Continued

| symptom | Checks and corrective measures |
|---|---|
| PULSE FORM RESTORER BOARD 1RE1A3A2 - (Cont) | |
| Pcm waveform abnormal (biternary mode) - (Cont) | q. The signal at pin 8 of U9 should be as shown in figure 3-35 (8 b). If it is not check that the signal at E14 is as shown in figure 3-35 (15b) and that the signal at E16 is 3 Vdc or greater. If the signal at U9, pin 8 is wrong while E14 and E16 are correct, change U9. If E 14 is wrong, the problem is on the electrical synchronizer board If Ex6 is wrong, the problem is on the electrical interface board. |
| | r. Check that the signal at E9 is as shown in figure 3-35 (8 b). If incorrect change U10. |
| | s. Check that the signal at E10 is as shown in figure 3-35 (18 b). If it is incorrect the problem is on the electrical synchroniser board. |
| | t. Check that the signal at pm 13 of U11 is as shown in figure 3-35 (8b). If it is not, replace U11. |
| | u Check that the signal at E11 is as shown in figure 3-35 (8b). If it is incorrect, replace U10. |
| | v. Check that the signal at E22 is M shown in figure 3-35 (8b). If it is incorrect, change U10. |
| ELECTRICAL SYNCHRONIZER BOARD 1RE1A3A4 | |
| No timing pulse indication. | Check that there are no broken wires on 1RE1A3A4. Check that the +5 V, +12 V and –12 V supply voltages appear at E8, E9 and E10 respectively (figure 3-34). If voltage levels are incorrect, check ground connection at E11 for a broken wire. If the +12 V or –12 V supplies are absent check the wiring attached to E9 and E10. If the +5 V is absent check the wire attached to E4. If the wire is not broken check the external regulator U5. The voltage at pin 2 should be 5 V. The voltage at pin 1 should be 12 V. |
| Timing output waveform abnormal (binary mode). | a. To check board 1RE1A3A4 (figure 3-34) m the binary mode, follow b. through z. below. Set the PFR teat set switches as indicated below: |

| Switch | Position |
|---|---|
| **FREQ CONTROL (R5)** | Center of range |
| **FUNCTION (S1)** | 1 |
| **NOISE (S6)** | OFF |
| **LEVEL SWITCH (S6)** | 0 dB |
| **PCM (S2)** | PR CODE |
| **COMBINER CONTROL (S5)** | OPEN |
| **LOAD (S9)** | OFF |

b. The signal at E12 should be as shown in figure 3-35 (8a). If it ix incorrect then the problem is on the pulse form restorer board.

c. The signal at E13 should be as shown in figure 3-35 (7a). If it is incorrect change U5.

d The signal at E6 should be 3 Vdc or greater. If it is incorrect there is a fault on the electrical interface board.

e. Check that the signal at E3 is less than 0.5 Vdc. If it is not, there is a fault on the electrical interface board.

f. The signal at E4 should be as shown in figure 3-35 (18a). If it is incorrect, check that the signal at the collector of Q2 contains an oscillatory component greater than 1.8 V peak-to-peak If the output of Q2 is correct while E4 is wrong, change Q3. If there is no oscillation at the collector Q2, check the bias voltages on U1. The base should be at 2.7 Vdc, the emitter at 2.0 Vdc, while the collector should be at 2.7 Vdc. If the bias voltages differ from these values by more than 0.2 V, one ore more of the bias resistors, R1, R2, R4, R5, R6 or transistor Q1 may be faulty. If these components are found to be working correctly, check Q2.

g. The signal at E2 should be as shown in figure 3-35 (4a). If not there is a fault on the pulse form restorer board.

h. The signal at pin 1 of U5 should be as shown in figue 3-35 (10a). If it is incorrect, change U9.

i The signal at pin 11 of U5 should be as shown in figure 3-35 (11a). If it is incorrect replace U5.

c. *Troubleshooting.* – Continued

| *Symptom* | *Checks and corrective measures* |
|---|---|
| ELECTRICAL SYNCHRONIZER BOARD 1RE1A3A4 - (Cont) | |
| Timing output waveform abnormal (binary mode) - (Cent) | j. The signal at the collector of Q4 should be as hewn in figure 3-35 (28a). If it is incorrect, then replace Q4. |
| | k. The signal at the collector of Q5 should be as shown in figure 3-35 (12a). If it is wrong change Q5. If it is still wrong after changing Q5, then replace Q6. |
| | l. The signal at pin 8 of U8 should be as shown in figure 3-35 (13a). If it is incorrect, replace U8. |
| | m The signal at pin 9 of U8 should be as shown in figure 3-35 (14a). If it is incorrect, change U8. |
| | *n.* The signal at pin 12 of U7 should be as shown in figure 3-35 (29a). If it is not, replace U7. |
| | *o.* The signal at pin 4 of U7 should be as shown in figure 3-35 (30a). The pulse width should be adjustable over the given range by potentiometer R36. If the signal is incorrect change U7. If the adjustment does not function, change R36. |
| | P. The signal at TP1 should be as shown in figure 3-35 (15a). If it is incorrect replace U6. NOTE: this signal should be synchronized with the SYNC signal from the PFR test set. |
| | q. If the signal at pin 6 of U6 is not as shown in figure 3-35 (15a), *then* replace U6. |
| | r. The signal at the *collector* of Q7 should be as shown in figure 3-35 (16a). If it is incorrect replace Q7. |
| | s. The signal at the emitter of Q8 should be as shown in figure 3-35 (16a). If it is incorrect, replace Q8. |
| | t. If the signal at pin 6 of U1 is not a triangular waveform as shown in figure 3-35 (17a), then replace U1. |
| | u The signal at pin 3 of U2 is a dc voltage of leas than 0.5 Vdc when the signal at TP1 is synchronized with the SYNC signal from the PFR test set. If it is incorrect change Q6. |
| | v. The signal at pin 6 of U2 should be less than 0.5 Vdc when TP1 signal is synchronized with the SYNC signal. If it is not, change U2. |
| | w. The signal at pin 6 of U3 is a variable dc voltage which depends on the difference between the input bit rate and the center frequency of the voltage controlled oscillator. It can vary between –0.5 V and +10 V. Normally it should be approximately +5 V. If it goes below —0.5 V, then change CR10. If it goes above +10 V, then change CR8. If the voltage is still not correct replace U3. |
| | x. The signal at pin 4 of U4 should appear as in figure 3-35 (19a). If it is incorrect, replace U4. |
| | y. The signal at the collector of Q9 should appear as shown in figure 3-35 (31a). If it is incorrect, then replace Q9. |
| | z. The signal at E7 should be as shown in figure 3-35 (20a). If it is incorrect change Q10. |
| Timing output waveform abnormal (biternary mode). | a. To check board 1RE1A3A4 (figure 3-34) in the binternary mode, follow b. through t below. Set the PFR test set switches as indicated below. |

| *Switch* | *Position* |
|---|---|
| FREQ CONTROL (R5) | Center of range |
| LEVEL SWITCH (S6) | O dB |
| FUNCTION (S1) | 3 |
| PCM (S2) | PR CODE |
| COMBINER CONTROL (S5) | 1 K OHM |
| NOISE (S8) | OFF |
| LOAD (S9) | OFF |

b. The signal at E3 should be 3 Vdc or greater. If the level is incorrect, there is a fault on the electrical interface board:

c. The signal at E 1 should be as shown in figure 3-35 (6 b). If it is incorrect there is a fault on the pulse form restorer board.

*c. Troubleshooting.* – Continued

| *Symptom* | *Checks and* measures |
|---|---|
| ELECTRICAL SYNCHRONIZER BOARD 1RE1A3A4 - (Cont) | |
| Timing output d waveform abnormal (biternary mode) - (Cent) | The signal at pin 1 of U5 should be as shown in figure 3-35 (10b). If it is incorrect replace U9. |
| | e. If the signal at pin 11 of U5 is not as shown in figure 3-35 (11b), change U5. |
| | f. IF the signal at the collector of Q4 is not as shown in figure 3-35 (28b), change Q4. |
| | g. The signal at the collector of Q5 should be as shown in figure 3-35 (12b). If incorrect change Q5. If incorrect after cahnging Q5, then change Q6. |
| | h. If the signal at pin 8 of U8 is not as shown in figure 3-35 (13b), then change U8. |
| | i. If the signal at pin 9 of U8 is not as shown in figure 3-35 (14b), then change U8. |
| | j. If the signal at pin 12 of U7 is not as shown in figure 3-35 (29b), then change U7. |
| | k. The signal at pin 4 of U7 should be as shown in figure 3-35 (30b). The pulse width should be adjustable over the given range by potentiometer R36. If the signal is incorrect, then change U7. If the signal cannot be adjusted, then change R36. |
| | l. The signal at TP1 should be as shown in figure 3-35 (15b). If it is incorrect then replace U6. NOTE: this signal should be synchronized with the SYNC signal from the PFR test set. |
| | m. If the signal at pin 6 of U6 is not as shown in figure 3-35 (15b), then replace U6. |
| | n. If the signal at the collector of Q7 is not as shown in figure 3-35 (16b), then replace Q7. |
| | o. If the signal at the emitter of Q8 is not as shown in figure 3-35 (16b), then replace Q8. |
| | p. The signal at pin 6 of U1 should be triangular waveform as shown in figure 3-35 (17b). If it is not, then replace U1. |
| | q. The signal at pin 3 of U2 is a dc voltage of less than 0.5 Vdc when the signal at TP1 is synchronized with the SYNC signal from the PFR test set If it is incorrect then change Q6. |
| | r. The signal at pin 6 of U2 should be less than 0.5 Vdc when the TP1 signal is synchronized with the SYNC signal If it is not, then change U2. |
| | s. The signal at pin 6 of U3 is a variable de voltage which depends on the difference between the input bit rate and the center frequency *of* the voltage controlled oscillator. It can very between -0.5 V end +10 V. Normally it should be approximately +5 V. If it goes below –0.5 V, change CR10. If it goes above +10 V, change CRE. If after changing CR8 and CR10 the voltage is still not correct then replace U3. |
| | t. Turn the PCM switch (S2) on the PFR test set to OFF. Check that the signal at E6 is less than 0.5 Vdc. If it is not there is a fault either on the pulse form restorer board, or on the electrical interface board. If E6 is correct then the signal at E7 should go to zero. If it does not change U4. |
| MODULATION ELIMINATOR BOARD 1RE1A3A1 | |
| No order wire output. | Check that there are no broken wires on 1RE1A3A1. Check that the +5 V, +12 V, –12 V supply voltages appear at E4, E6, end E8 respectively (figure 3-32). If the voltage levels are incorrect check the ground connection at E7 for a broken wire. If the +12 V or – 12 V is absent, check the wiring attached to E6 and E8. If the +5 V is absent check the wiring attached to E4. If the wires are not broken then check the external regulator U5. The voltage at pin 2 should be 5 V. The voltage at pin 1 should be 12 V. |
| Order wire signal abnormal (binary mode). | a. To check 1RE1A3A1 (figure 3-32) in the binary mode, follow b. through n. below. Set the PFR test set switches as indicated below and use the SYNC signal from the teat set to trigger the scope: |

*c. Troubleshooting.* – Continued

| *Symptom* | *Checks and corrective measures* |
|---|---|

MODULATION ELIMINATOR BOARD 1RE1A3A1 - (Cont)

Order wire signal abnormal (biternary mode) - (Cent)

a. Continued

| *Switch* | *Position* |
|---|---|
| FREQ CONTROL (R5) | Center of range |
| LEVEL SWITCH (S6) | 0 dB |
| FUNCTION (S1) | 4 |
| NOISE (S8) | OFF |
| PCM (S2) | PR CODE |
| COMBINER CONTROL (S5) | OPEN |
| LOAD (S9) | OFF |

b. Check that the signal at E3 is as shown in figure 3-35 (2 la). If it is not correct then there is a fault on the pulse form restorer board.

c. Check that the signal at E2 is as shown in figure 3-35 (22a). If it is incorrect there is a fault on the pulse form restorer board.

d Check that the signal at El 1 appears as shown in figure 3-35 (23a). If it is not correct then there is a fault on the pulse form restorer board.

e. The signal at El should appear as shown in figure 3-35 (2a). If the signal is incorrect then there is a fault on the pulse form restorer board.

f. If the signal shape at the collector of Q1 is not as shown in figure 3-35 (32a), then replace Q1.

g. The signal shape at the collector of Q2 is as shown in figure 3-35 (32a).
NOTE: the amplitude is different from the signal at the collector of Q1. If the signal shape is wrong, replace Q2. If the signal is wrong at both the collectors of Q1 and Q2, then check Q3 and CR3.

h. The shape of the signal at pin 6 of U3 should be as shown in figure 3-35 (24a). If the shape is wrong, change U3.
NOTE: the amplitude may be different if another part of the board is not functioning properly.

i. The signal at pin 6 of U1 should be as shown in figure 3-35 (25a). If the signal is incorrect replace U1.

j. The signal at pins 6 and 9 of U2 should be a voltage of 1.8 Vdc ±0.1 V. If it is incorrect change U2.

k. The signal at pin 14 of U4 should be a voltage of less than 0.5 Vdc. If not, change U4.

L The signal at pin 1 of U4 should be a voltage of –7.4 Vdc to –8.0 Vdc. If it is incorrect replace U4.

m. The signal at E5 should be a faltered sine wave as shown in figure 3-35 (26a). If it is not correct change U4.

n. The signal at E9 should be a dc voltage between 2.7 Vdc and 4.0 Vdc. If the level is incorrect check CR1, CR2, and C30, as well as C11 and R14 on the electrical interface board.

Order wire signal abnormal (biternary mode).

a. To check board 1RE1A3A1 (figure 3-32) in the biternary mode, follow b. through n. below. Set the PFR test set switches as indicated below:

| *Switch* | *Position* |
|---|---|
| **FREQ CONTROL (R5)** | Center of range |
| **LEVEL SWITCH (S6)** | O dB |
| **FUNCTION (S1)** | 5 |
| **NOISE (S8)** | OFF |
| **PCM (S2)** | PR CODE |
| **COMBINER CONTROL (S5)** | 1 KOHM |
| **LOAD (S9)** | OFF |

b. Check that the signal at E3 is as shown in figure 3-35 (21b). If it is incorrect, there is a fault on the pulse form restorer board.

*c. Troubleshooting.* - Continued

| *Symptom* | *Checks and corrective measures* |
|---|---|
| MODULATION ELIMINATOR BOARD 1RE1A3A1 - (Cont) | |
| | c. The signal at E2 shoudl be as shown in figure 3-35 (22b). If it is incorrect there is a fault on the pulse form restorer board |
| | d. If the signal at E11 is not as shown in figure 3-35 (23b), or if the signal at E1 is not as shown in figure 3-35 (2b), then there is a fault on the pulse form restorer board |
| | e. The signal shape at the collector of Q1 should be as shown in figuer 3-35 (32b). If the signal shape is wrong, replace Q1. |
| | f. The signal shape at the collector of Q2 is as shown in figure 3-36 (32b). NOTE: the amplitude is difference from the signal at the collector of Q. If the signal shape is wrong, replace Q2. If the signal is incorrect at both Q1 and Q2, then check Q8 and CR3. |
| | g. The signal shape at pin 6 of U3 should be as shown in figure 3-35 (24b). If the shape is wrong change U3. NOTE the amplitude may be different if another part of the board is not functioning properly. |
| | h. The signal at pin 6 of U1 should be as shown in figure 3-36 (25b). If the signal is incorrect, change U1. |
| | i. The signal at pins 6 and 9 of U2 should be a voltage of 1.8 Vdc ±0.1 V. If incorrect, then change U2. |
| | j. The signal at pin 14 U4 should a voltage of less than 0.5 Vdc. If it is not, change U4. |
| | k. The signal at pin 1 of U4 should be a voltage of –5.6 Vdc to -6.2 Vdc. If it is incorrect, change U4. |
| | l. If the signal at E5 is not a filtered sine wave as shown in figure 3-35 (26b), then change U4. |
| | m The signal at E9 should be a voltage between 2.7 V and 4.0 V. If it is incorrect check CR1, CR20 and C30; check as well C11 and R14 on the electrical interface board |
| | n. If all the signals are correct but the order wire baa a high amount of noise then check potentiometer R23 and R29. |
| ELECTRICAL INTERFACE BOARD 1RE1A3A3 | |
| Order wire relay operation defective. | a Check that there are no broken wires on 1RE1A3A3. Check that the +5 V, +12 V and –12 V supply voltages appear at E2, E4 and E5 respectively (figure 3-33). If the voltage levels are incorrect, check the ground correction at E3 for broken wires. If the +12 V or –12 Via absent check the wiring attached to E5 and E4. If the +5 Via absent, check the wiring at E2. If the wire is not broken, measure the voltage at pin 2 *of the* external regulator U5. It should be +5 V. The voltage at pin 1 should be 12 V. |
| | b. To check operation of 1RE1A3A3, set the PFR test set switches to the positions indicated below and perform steps c. through u. following. |

| *Switch* | *Position* |
|---|---|
| FREQ CONTROL (R5) | Center of range |
| LEVEL SWITCH (S6) | O dB |
| FUNCTION (S1) | 4 |
| NOISE (S8) | OFF |
| PCM (S2) | PR CODE |
| COMBINER CONTROL (S5) | OPEN |
| LOAD (S9) | OFF |

| | |
|---|---|
| | c. The signal at E6 should be 2.7 Vdc to 4.0 Vdc. If incorrect there could be a fault on the pulse form restorer board, or a fault in R14 or C11. |
| | d The signal at E7 should be 0.2 Vdc to 0.3 Vdc. If incorrect check R14 and C11. |
| | e. The signal at E14 should be approximately 0 Vdc. If it is incorrect there is a fault on the pulse form restorer board |

*c. Troubleshooting.* – Continued

| *Symptom* | *Checks and corrective measures* |
|---|---|
| ELECTRICAL INTERFACE BOARD 1RE1A3A3 - (Cont) | |
| Order wire relay operation defective - (Cent) | f. The signal at E12 should be as shown in figure 3-35 (9a). If it is incorrect there is a fault on the pulse form restorer board. |
| | g. The signal at the collector of Q1 should be between –5 Vdc and –7 Vdc. If it is not, check Q1 and CR1. |
| | h. The signal at the collector of Q2 should be greater than 3 Vdc. If it is not, check Q2, CR2, C9 and U1. |
| | i. The signal at pin 13 of U1 should be less than 0.5 Vdc. If it is not, then change U1. |
| | j. The signal at E15 should be greater than 3 Vdc. If it is not, then change U1. |
| | k. Set PFR test set LOAD switch (S9) to the OFF position. The signal at E12 should be –12 Vdc ±0.5 V. If it is not, and if El 5 is less than 0.5 Vdc, then there is a fault on the pulse form restorer board. (U9 on that board is the most likely cause of the problem.) If the signal at E15 is greater than 3 Vdc, then the fault is on the electrical interface board. |
| | L The signal at the collector of Q2 should be less than 0.5 Vdc. If it is not, check Q1, Q2, CR1 and CR2. |
| | m. The signal at pin 13 of U 1 should be greater then 3 Vdc. If it is not, replace U1. |
| | n. Set the PFR test set LOAD switch (S9) to the ON position. |
| | o. The signal at the E15 should be less than 0.5 Vdc. If not change U1. |
| | p. Set the PCM switch (S2) on the PFR test set to the OFF position. The signal at E14 should be greater than 3 Vdc. If it is not, there is a fault on the pulse form restorer board. |
| | q. Set the PCM switch (S2) on the PFR test set to PR CODE. The signal at pin 7 of U3 should be a dc voltage greater than 3 Vdc. If it is not change U3. The signal at pin 7 of U2 should be less than 0.5 Vdc. If not, change U2. The collector of Q3 should be 26 Vdc. If not change Q3. The signal at E10 should be as shown in figure 3-35 (26a). If it is not change the relay K1. The signal at E13 should be less than 0.5 Vdc. If not, change U1. |
| | r. Set the COMBINER CONTROL switch (S5) on the PFR test set to 1 k The signal at pin 7 of U3 should be less than 0.5 Vdc. If it is not, then change U3. The signal at pin 7 of U2 should be less then 0.5 Vdc. It is not then change U2. The signal at E13 should be greater than 3 Vdc. If it is not, then replace U1. The collector of Q3 should be at 26 Vdc. If it is not, then change Q3. The signal at E10 should be as shown in figure 3-35 (26 b). If it is not, then replace relay K1. |
| | 8. Set the COMBINER CONTROL switch (S5) on the PFR test set to GND. The signal at pin 7 of U3 should be less than 0.5 Vdc. If not change U3. The signal at pin 7 of U2 should be greater than 1.5 Vdc. If not, replace U2. The signal at E13 should be less than 0.5 Vdc. If not replace U1. The signal at the collector of Q3 should be less than 0.5 Vdc. If it is not, then replace Q3. |
| | t. The signal at E11 should be a sine wave with a peak-to-peak voltage of about 0.7 Vdc. If it is not then check the PFR test set |
| | u. The signal at E10 should be a sinewave with a peak-to-peak voltage of about 0.35 Vdc, If it is not then replace relay K1. |

*d. Disassembly and Assembly.*

(1) *Removal and disassembly.*

*(a)* Remove Pulse Form Restorer 1RE1A3 from Radio Receiver 1RE1 as described in TM 11-5820-540-12.

*(b)* To gain access to the four circuit boards perform steps *(c)* through *(f)* below.

**NOTE**

*This* unit need not be disassembled for testing. All test points are accessible with the covers of the unit in place. Should it become necessary to replace a component however, the covers of the unit must be removed to provide access to the interior circuitry.

*(c)* For boards 1RE1A3A1 and 1RE1A3A2 (the modulation eliminator and pulse form restorer boards respectively) locate the side of the unit which bears the DCDR PCM, OW NOISE, and LF ADJ test points. Remove the 4 corner screws which secure the brass cover in place and liftoff the cover.

*(d)* Board 1RE1A3A1 now faces outward. To gain access to board 1RE1A3A2, remove the five screws securing board 1RE1A3A1 to the unit's case. Genetly lift out board 1RE1A3A1, being careful not to strain the wires which attach it to the other boards. The bottom of board 1RE1A3A2 is now visible. Access to the top of board 1RE1A3A2 can be obtained by lifting the board up by its top edge while being careful not to place undue strain on the wires which secure it to the other boards.

*(e)* For boards 1RE1A3A4 and 1RE1A3A3 (the electrical synchronizer and electrical interface boards respectively) locate the side of the unit which bears the DCDR CLK and PHASE ADJ test points. Remove the 3 corner screws which secure the brass cover in place and liftoff the cover.

*(f)* Board 1RE1A3A4 now faces outward. To gain access to board 1RE1A3A3, remove the six screws securing board 1RE1A3A4 to the unit's case. Gently lift out board 1RE1A3A4 being careful not to strain the wires which attach it to the other boards. The bottom of board 1RE1A3A3 is now visible. Access to the top of board 1RE1A3A3 can be obtained by lifting the board up by its top edge while being careful not to place undue strain on the wires which secure it to the other boards.

(2) *Assembly.* To reassemble the unit, place the circuit boards back inside the case. They should lie flat. Be certain that no wires are caught under the screw holes in the boards. Securely fasten each set of two boards with the five slotted-head screws and replace the covers. Secure the covers with the appro priate number of screws (four screws for the cover bearing the OW NOISE, LF ADJ and DCDR PCM test points; three screws for the other cover).

### 3-11. Electrical Frequency Limiter-Discriminator 1RE1A4

a. *Test Equipment and Material Required.*

| *Equipment* | *Common name* |
|---|---|
| Test Facility, Receiver TS-2867(V)2/GRM-95(V)2 | Receiver test facility |
| Test Facility, Transmitter TS-2866(V)2/GRM-95(V)2 | Transmitter test facility |
| Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2 | Accessory kit |
| Multimeter, Digital, AN/USM-451 | Digital Multimeter |
| Generator, Signal, AN/USM-205A | Wide range oscillator |
| Frequency Counter, TD-1225(V)1/U | Frequency counter |
| Voltmeter, Electronic, ME-459/U | VTVM |
| Generator, Signal, HP 8640B | Signal generator |
| Meter, Modulation, ME-505/U | Deviation meter |
| Oscilloscope, AN/USM-281C | oscilloscope |

*b. Performance Test*

(1) *AGC line continuity.*

*(a)* Connect the digital multimeter between P1 pins 1 and 4, and then between P1 pin 1 and P2 pin 1. The digital multimeter shall read less than 0.5 ohms.

*(b)* Connect the digital multimeter between P1 and 1 and ground. The digital multimeter shall indicate and open.

(2) *Output level.*

*(a)* Set the power supply to 115 Vac as indicated on its front panel voltmeter. Maintain this level throughout the remaining procedures.

*(b)* Connect the equipment as shown in ***A,*** figure 3-36.

(c) Set test facility switches as follows:

| *Switch* | *Position* |
|---|---|
| AT1 | 70 |
| S1 | ON |
| S5 | S9 |
| S14 | 30 MHz |
| S9 | EXT VIDEO |

*(d)* Set the wide range oscillator to 1 kHz output and adjust the level for a VTVM indication of 178 mV.

*(e)* Connect equipment as shown in B, figure 3-36. The VTVM shall indicate 178 ±5 mV.

(3) *Discriminator linearity.*

*(a)* Install oscilloscope right vertical amplifier plug in unit into the horizontal amplifier position of the oscilloscope and the horizontal amplifler into the right vertical amplifier position.

*(b)* Connect test equipment as shown in A, figure 3-37. Set S9 to DISCR RESPONSE.

*(c)* Set the oscilloscope controls to display a S-shaped curve as shown in figure 3-38.

*(d)* Adjust the signal generator output level and test facility AT1 as necessary to display a 30 MHz marker on the S-shaped curve (see figure 3-38).

*(e)* The waveform displayed on the oscilloscope should be an S-shaped curve with frequency peak-to-peak excursion, linearity and amplitude between peaks as shown in figure 3-38.

*(f)* connect test equipment as shown in B, figure 3-37.

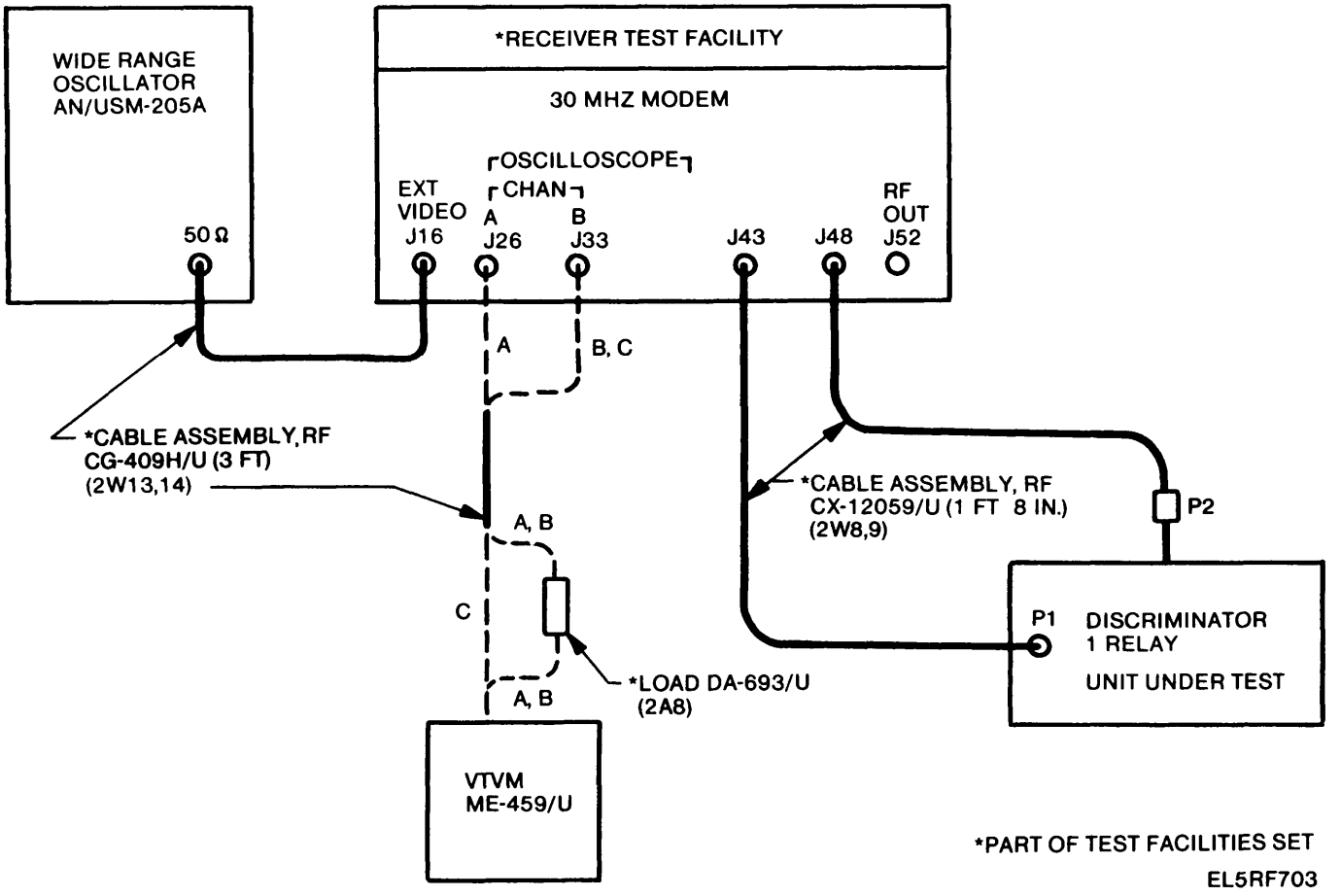



*Figure* 3-36 *Electrical Frequency Limiter-Discrirninator 1RE1A4, Output Level Check, Test Setup.*

*(g)* Set test facility switch S9 to EXT VIDEO.

*(h)* Set the wide range oscillator frequency to 50 kHz and adjust its output level for 100 kHz deviation as measured on the deviation meter. Note and record the VTVM indication.

*(i)* Repeat step *(h)* above with test facility switch S14 set to 29 and 31 MHz in turn.

*(j)* Calculate the maximum difference between VTVM indications obtained m steps *(h)* and@ above. The difference should not exceed 10% of the maximum indication recorded.

(4) *Frequency response.*

*(a)* Connect the test equipment as shown in figure 3-39.

*(b)* Set S9 to EXT VIDEO and S14 to 30 MHz.

*(c)* Set the wide range oscillator to 10 kHz. Adjust the 0-10 dB attenuator and wide range oscillator amplitude control as required to establish a –60 dBm reference indication on the VTVM with a wide range oscillator panel meter indication in the upper 10% F.S.D (meter scale NORMAL).

*(d)* Set the wide range oscillator to EXPAND meter scale and adjust the reference control to center scale. This meter indication is the input amplitude. Reference at all test frequencies.

*(e)* Set the wide range oscillator to 125 Hz and adjust the amplitude control to maintain the reference input level in *(d)* above. The VTVM shall be within ±1.5 dB of reference established in *(c)* above.

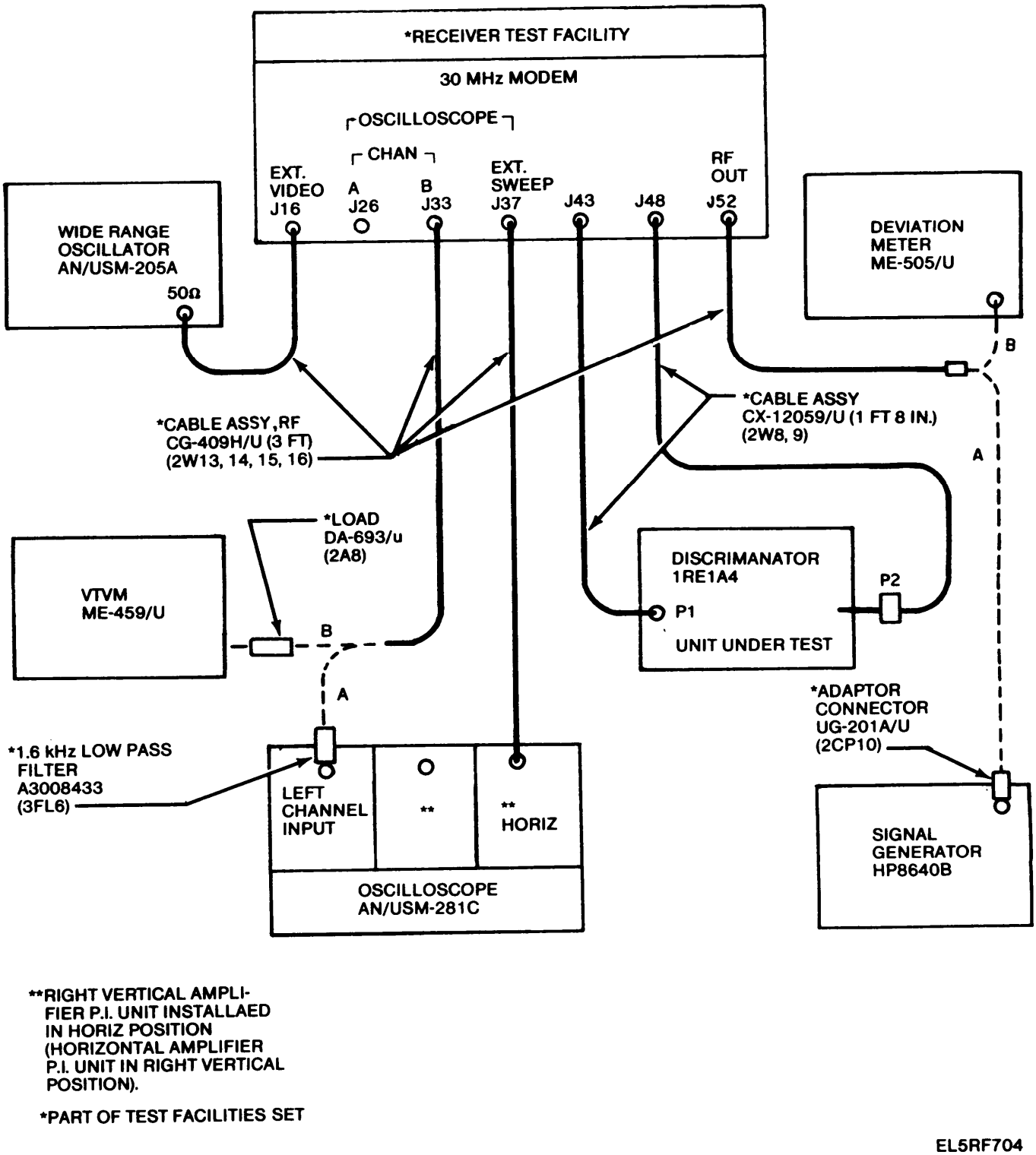



*Figure 3-37. Electrical Frequency Limiter-Discriminator 1RE1A4, Discriminator Linearity Check, Test Setup.*

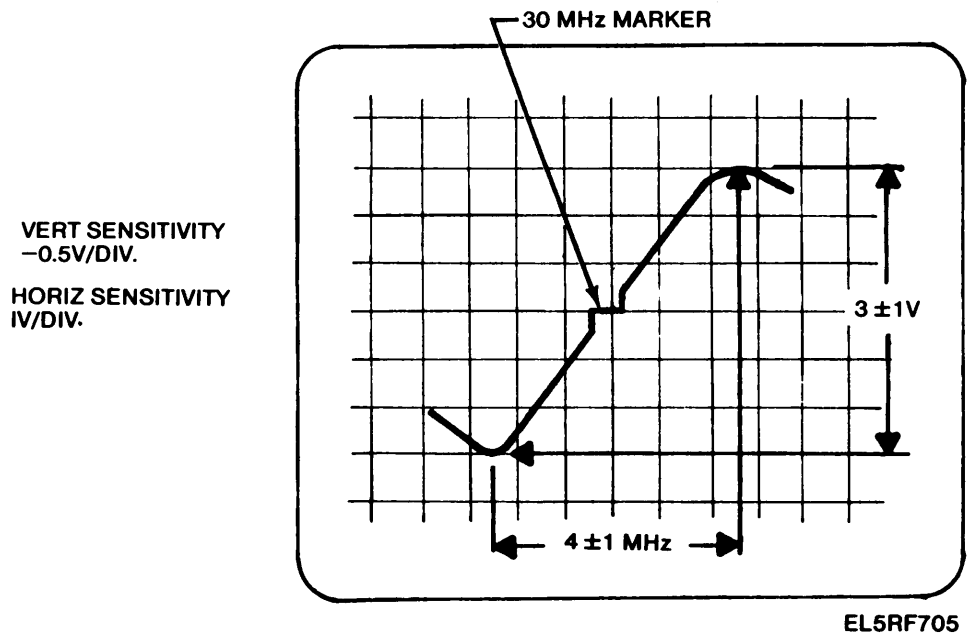



*Figure* 3-38. *Electrical Frequency Limiter-Discriminator 1RE1A4, S-Shape Curve Oscilloscope Display.*

*(f)* Repeat *(e)* above for all other frequencies listed below.

| *Wide Range Oscillator Freq kHz* | *VTVM Level* |
|---|---|
| 0.2 | Reference ±1.5 dB |
| 0.5 | Reference ±1.5 dB |
| 1.0 | Reference ±1.0 dB |
| 10.0 | Reference |
| 100.0 | Reference ±0.3 dB |
| 200.0 | Reference ±0.6 dB |
| 500.0 | Reference ±0.8 dB |
| 800.0 | Reference ±0.8 dB |
| 900.0 | Reference ±0.8 dB |
| 960.0 | Reference ±0.8 dB |
| 1000.0 | Reference ±0.8 dB |

*C. Troubleshooting* (FO-18).

*(1) Initial* Checks.

*(a)* Dc supply check. Check the –12 Vdc at E5 (AR1), E1 (A4), and E1 (A3).

*(b)* Preliminary capacitor setup. If capacitor assembly A5 is replaced while troubleshooting, carry out the following preliminary adjustments before repeating the alignment procedure given in *d.* below.

1. Turn C1, C2, and C3 clockwise to their stops.
2. Turn C1 5 turns counterclockwise.
3. Turn C2 2 turns counterclockwise.
4. Turn C3 9 turns counterclockwise.
5. Center R1.

*(2) Troubleshooting* chart

**NOTE**

The p-p voltages in the chart are typical indications measured with the allocated oscilloscope.

| *Symptom* | *Probable cause* | *Checks and corrective measures* |
|---|---|---|
| (a) No output indication (b.(2)(b) above). | 1. Defective electrical noise limiter. | Set test facility switch S9 to 30 MHz. Observe input signal at E2 of A3 (1.25 Vp-p) and output signal at E5 (1.5 Vp-p). If output signal is abnormal, replace A3. |

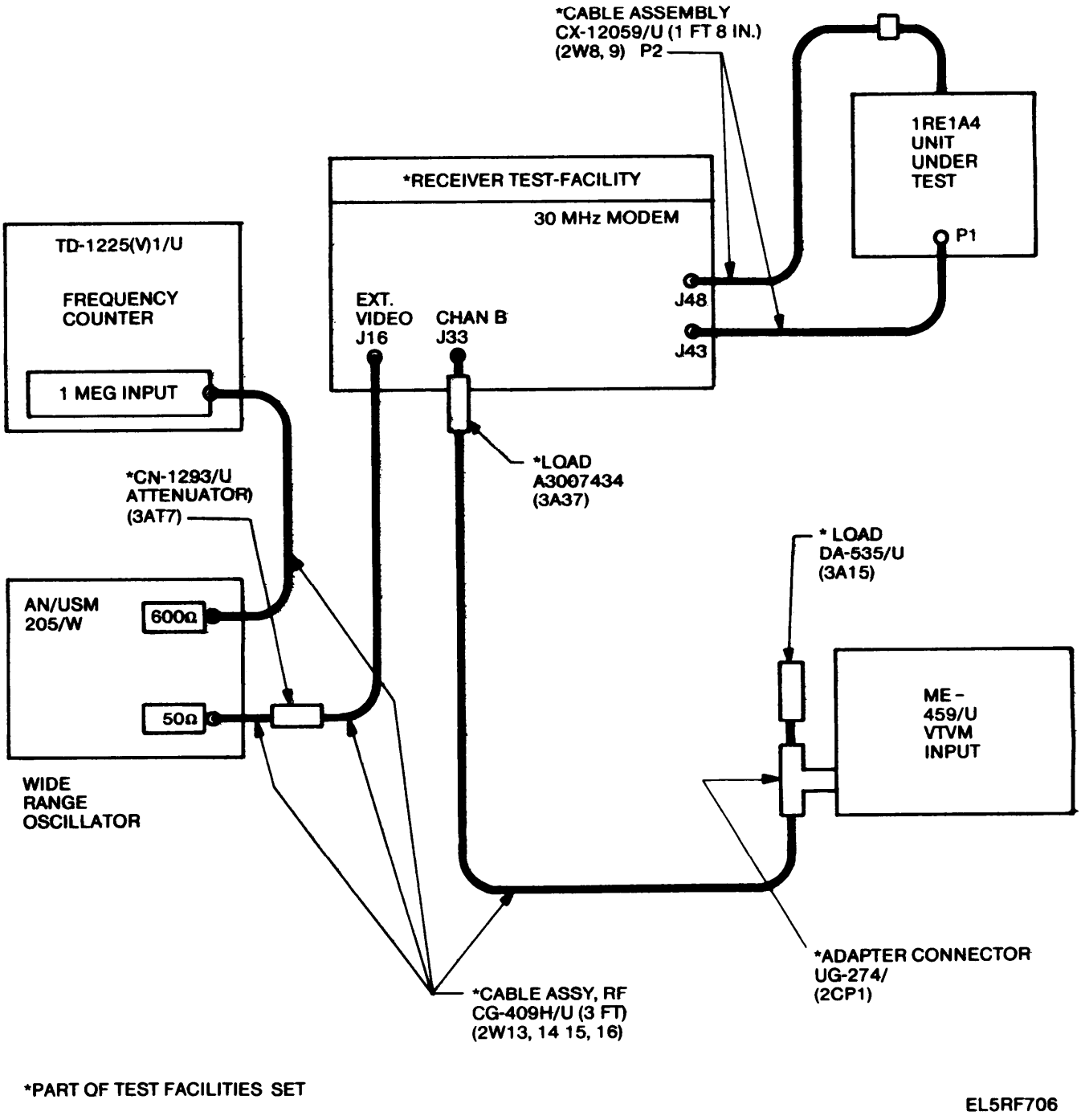



Figure 3-39. *Electrical Frequency Limiter-Discriminator 1RE1A4, Frequency Response Check, Test Setup.*

*Troubleshooting* - Continued

| *Symptom* | *Probable cause* | *Checks and corrective measures* |
|---|---|---|
| | 2. Defective electrical noise limiter A4. | Check the output signal at E5 of A4 (1.0 Vp-p). If abnormal, replace A4. |
| | 3. Defective video amplifier AR1. | Check signal at E3 (400 mVp-p). If normal, check resitance between E3 and the center pin of 1RE1A4P2A1 (0 to 2 k ohms) replace R2 if indicated Check signal at E2 (1.375 Vp-p) and E4 (2.125 Vp-p). If normal replace AR1. |
| | 4. Defective discriminator subassembly A1 or C1 of A5. | Check the signal at E3 of A1 (approx. 1.25 Vp-p). If indication is abnormal disconnect and check C1 and C4 of A5. Replace if necessary. If C1 and C4 are normal, replace A1. Check voltage at E6 (1.375 Vp-p) nominal and E7 (2.125 Vpp) of A1. Replace A1 if indications are abnormal. Recheck voltage at E6 and E7 of A1. If still abnormal replace A5. |
| (b) Upper half of S-shaped DISCR RESPONSE curve missing. (b.(3)(d) above). | 1. Defective A1-diode CR1 shorting or TP1 open circuit | 1. Check resistance of diode CR1 (across E6 and ground) and continuity of T1 (E5 to ground). |
| | 2. Defective capacitor C3 (A5). | 2. Check C3 for short short circuit. |
| (c) Lower half of S-shaped DISCR RESPONSE curve missing (b.(3)(d) above). | 1. Defective A1-diode CR2 shorting or TP1 open circuit | 1. Check resistance of CR2 (across E7 and ground) and continuity of T1 (E4 to ground). |
| | 2. Defective capacitor C2 (A5). | 2. Check C2 for short circuit |
| (d) Difference between VTVM indications exceeds 10% (b.(3)(i) above). | Misalined or defective capacitor assembly (A5). | Aline discriminator 1RE1A4 as in d. below. If necessary, replace capcitor assembly A5 and realine 1RE1A4. |
| (e) Frequency response abnormal (b.(4)(e) above). | Defective discriminator 1RE1A4, | Repeat the checks in b.(2) above at the abnormal frequency and perform the troubleshooting checks in paragraph (c.(2)(a) above). Replace subassemblies as indicated. |

*d. Alinement Procedures.*

(1) Remove the unit under test cover plates and install test covers C W-1083/GRM-95 (V) (2MP2) and DWG A307435 (3A38).

(2) Connect test equipment as shown in A, figure 3-40 and set test facility switches as follows:

| *Switch* | *Position* |
|---|---|
| AT1 | 70 |
| S1 | ON |
| S5 | S9 |
| S14 | 30 MHz |
| S9 | DISCR RESPONSE |

*(3)* Set the oscilloscope HORIZ and VERT controls to obtain a display similar to the display shown in figure 3-41.

*(4)* The CHAN B (right channel) waveform displayed on the oscilloscope should be an S-shaped curve with frequency peak to peak excursion and linearity similar to the CHAN A (left channel) S-shaped curve. The amplitude between peaks should be 3 ±1 volt P-P (figure 3-41). If necessary adjust R2, C1, C2 and C3 to meet above requirements.

(5) Connect test equipment as shown in B, figure 3-40.

(6) Adjust signal generator output level and test facility AT1 as necessary to display a 30 MHz marker on the CHAN B (right oscilloscope channel) S-shaped curve.

(7) Adjust the signal generator frequency as necessary to determine the frequency peak-to-peak excursion of the CHAN B (right oscilloscope channel) S-shaped curve. It should be 4 ±1 MHz (figure 3-41).

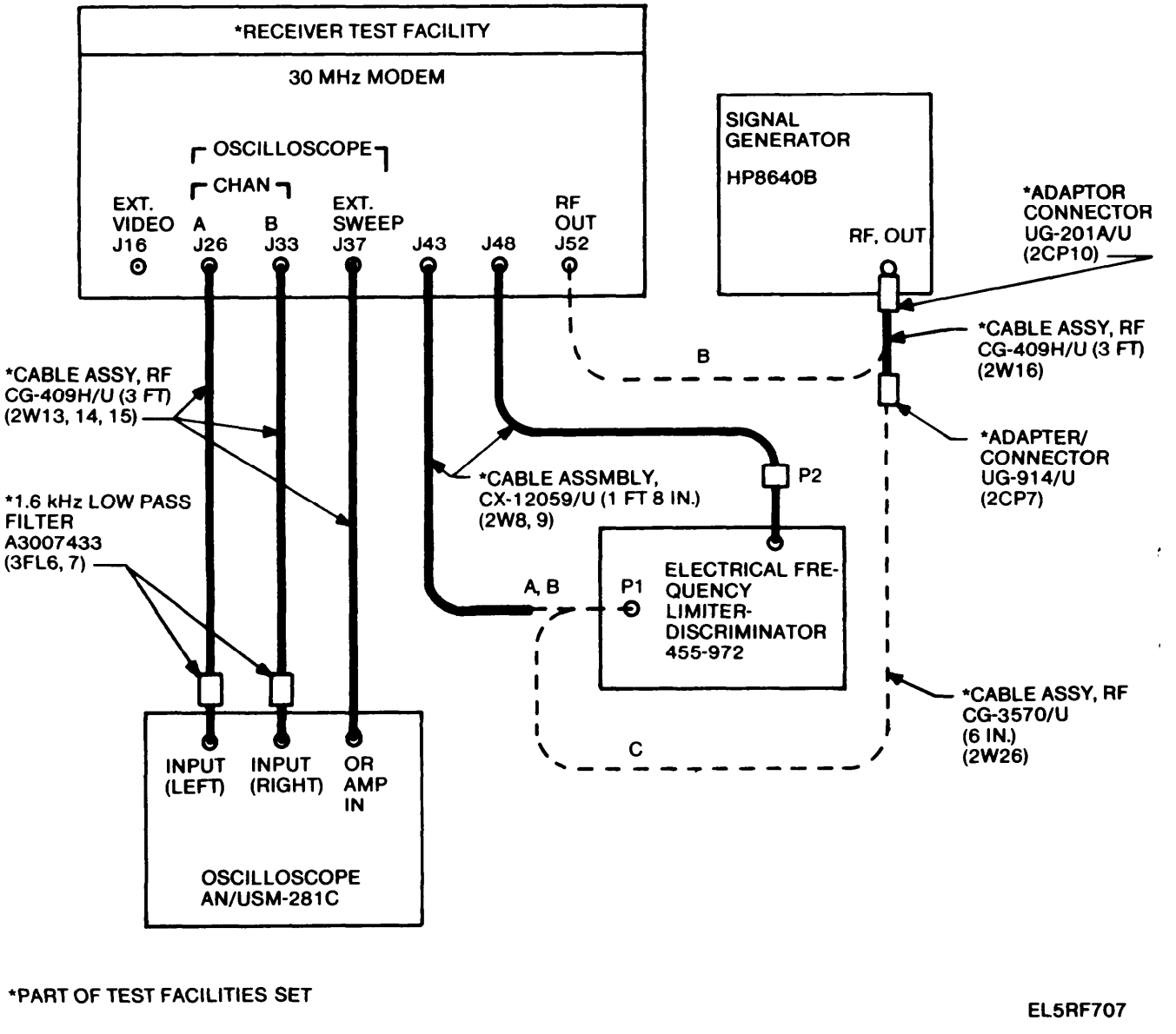



*Figure* 3-40. *Electrical Frequency Limiter-Discriminator 1RE1A4, Alinement Test Setup.*

(8) Connect test equipment as shown in C, figure 3-40.

(9) Adjust the signal generator for an output level of –30 dBm at 30 MHz with 50% amplitude modulation. Adjust R1 for a minimum oscilloscope right channel (CHAN B) indication. NOTE: Normal" indication is less than 1 millivolt P-P.

(10) Reconnect test equipment as shown in A, figure 3-40.

(11) Adjust the oscilloscope vertical sensitivity and position controls to align the CHAN A and CHAN B S-shaped curve slopes parallel with each other. Adjust C1, C2 and C3 for best slope match between CHAN A and CHAN B S-shaped curves (figure 3-41).

(12) Repeat steps (8) thru (11) until no further adjust is necessary.

(13) Connect test equipment as shown in C, figure 3-36.

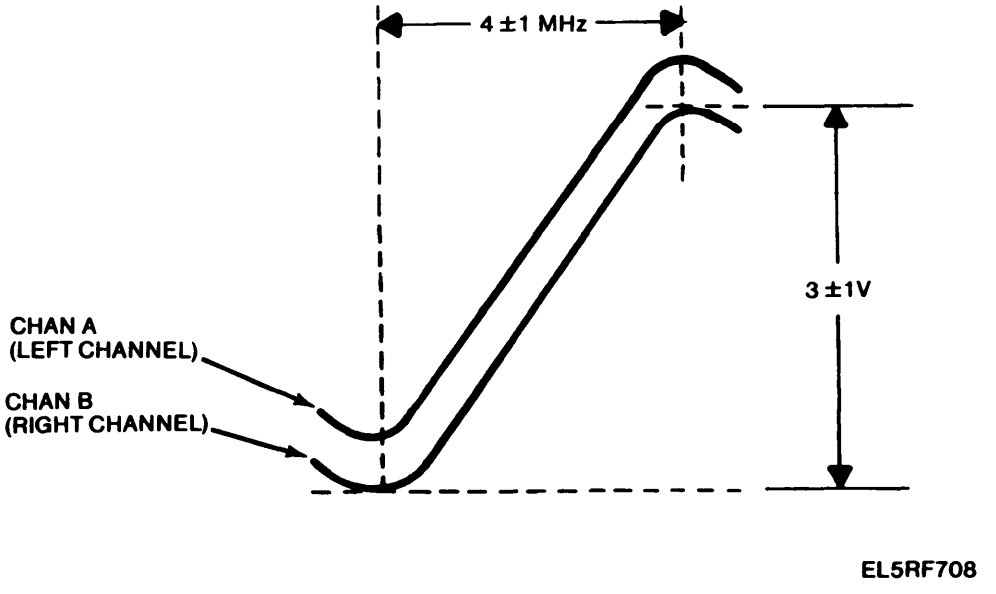



*Figure 3-41. Electrical Frequency Limiter-Discriminator 1RE1A4, Channel A and B Waveform Display.*

(14) Set tst facility switch S9 to EXT VIDEO. Set AT1 to minimum output required to operate deviation meter.

(15) Set the wide range oscillator frequency to 50 kHz and adjust its output level for 100 kHz deviation as measured on the deviation meter. Note and record the VTVM indication.

(16) Repeat step (15) above with test facility switch S14 set to 29 and 31 MHz in turn.

(17) Calculate the maximum difference between VTVM indications obtained in steps (15) and (16) above. The difference should not exceed 10% of the maximum indication recorded.

**NOTE**

If above requirement is not met, slight readjustment of C1, C2 or C3 maybe necessary to minimize the difference. If any adjustment is necessary recheck R1 adjustment per step (8) and (9) above.

(18) Connect test equipment as shown in B, figure 3-36.

(19) Set test facility switch S14 to 30 MHz. Set wide range oscillator frequency to 1 kHz and adjust its output level for 500 kHz deviation as measured on the deviation meter and set AT1 to 70. The VTVM should indicate 178 ±10 mV. If necessary adjust R2 for a VTVM indication of 178 mV.

(20) Repeat test in paragraph b(2) through (4) above.

## 3-12. Amplifier Frequency Multiplier

*a. Test Equipment Required*

| *Equipment* | *Common name* |
|---|---|
| Test Facility, Transmitter TS-2866(V)2/GRM-95(V)2 | Transmitter test facility |
| Accessory Kit, Test Facilities MK-1173(V)2/GRM-95(V)2 | Accessory kit |
| Test Facility, Receiver TS-2867(V)2/GRM-95(V)2 | Receiver test facility |
| Sweep Generator, Wiltron 61OD Plug-in Unit Wiltron 61084D | Sweep generator |
| Power Meter HP-435A | Power meter |
| Power Sensor HP-8481A | Power sensor |
| Oscilloscope AN/USM-281C | Oscilloscope |
| Rf Power AmplifierENI 6031 | Power amplifier |
| Signal Generator HP-8640B | Signal generator |
| Rf Voltmeter ME-426/U | Rf voltmeter |
| Digital Multimeter AN/USM-451 | Digital multimeter |

**NOTE**

Set power supply PP-6304/GRM-95(V) for a 115 Vac output as indicated on its panel voltmeter. Maintain this output through out the following procedures.

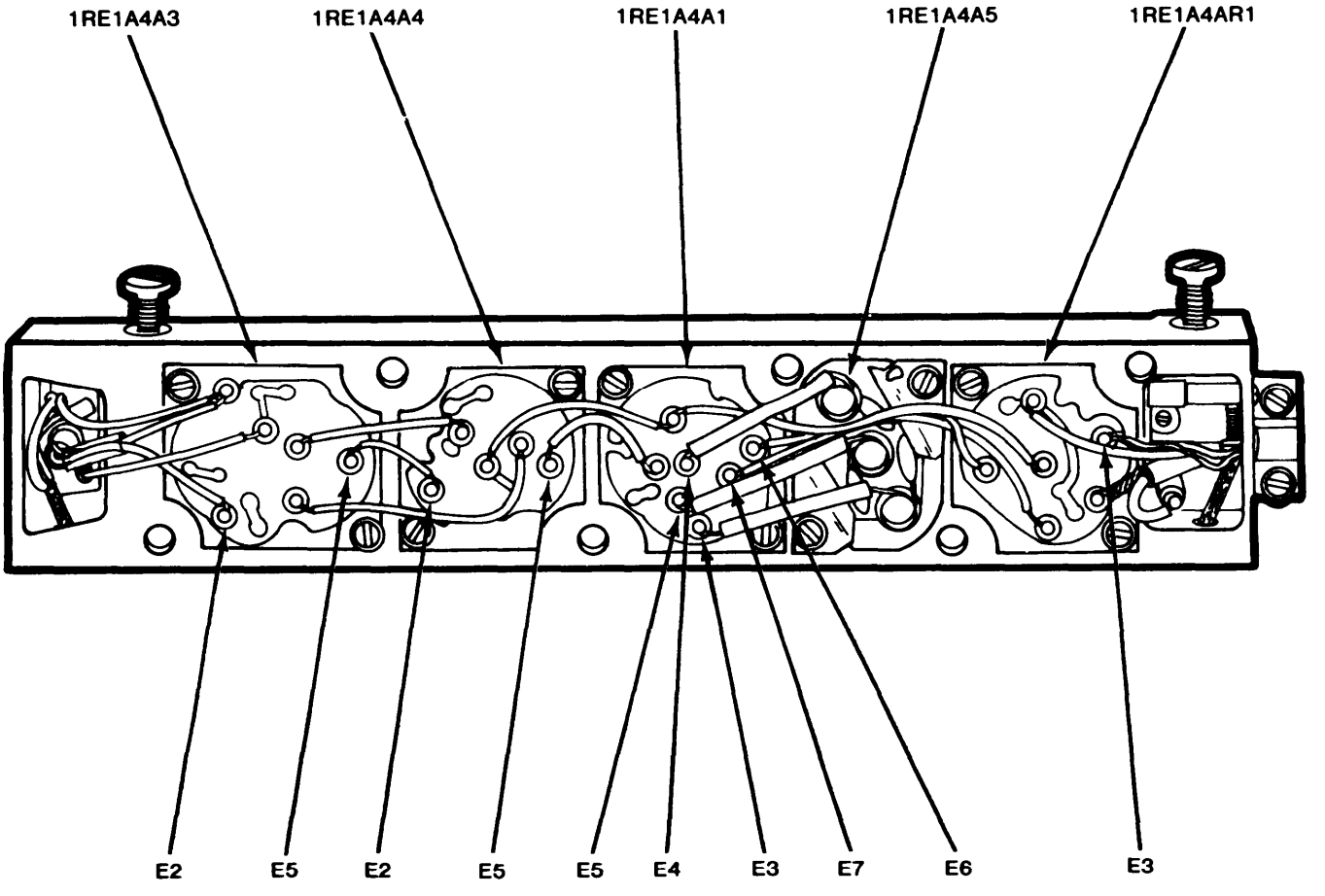



*Figure 3-42. Electical Frequency Limiter-Discriminator 1RE1A4, Cover Removed.*

*b. Test procedures.*

**CAUTION**

Rf input level to power amplifier ENI 603L must not exceed —5 dBm. The attenuators, selected for use throughout these procedures, are to prevent accidental damage to test equipment and the unit under test Extreme caution must be exercised if these attenuators are not used.

(1) *Input VSWR test*

*(a)* Connect the equipment as shown in A, figure 3-43.

*(b)* Set the sweep generator controls for a cw output at a frequency of approximately 60 MHz. Adjust the rf output level for a +12 dBm indication on the power meter.

*(c)* Connect the equipment as shown in B, figure 3-43.

*(d)* Using EXT markers, set the sweep generator controls for a sweep output from 49.5 MHz to 72.5 MHz. Adjust the oscilloscope controls for a convenient display with at least a 4 cm vertical displacement This is the 2:1 VSWR reference. Note this reference and do not readjust the sweep generator output or oscilloscope vertical controls.

*(e)* Connect the equipment as shown in C, figure 3-43. Set test facility switches S1 to ON and S12 to AMPL FREQ MULT.

*(f)* The VSWR as displayed on the oscilloscope shall be less than the 2:1. Reference from 47.5 to 72.5 MHz.

*(g)* Turn S1 to OFF.

(2) *Power output and metering check.*

*(a)* Connect the equipment as shown in figure 3-44.

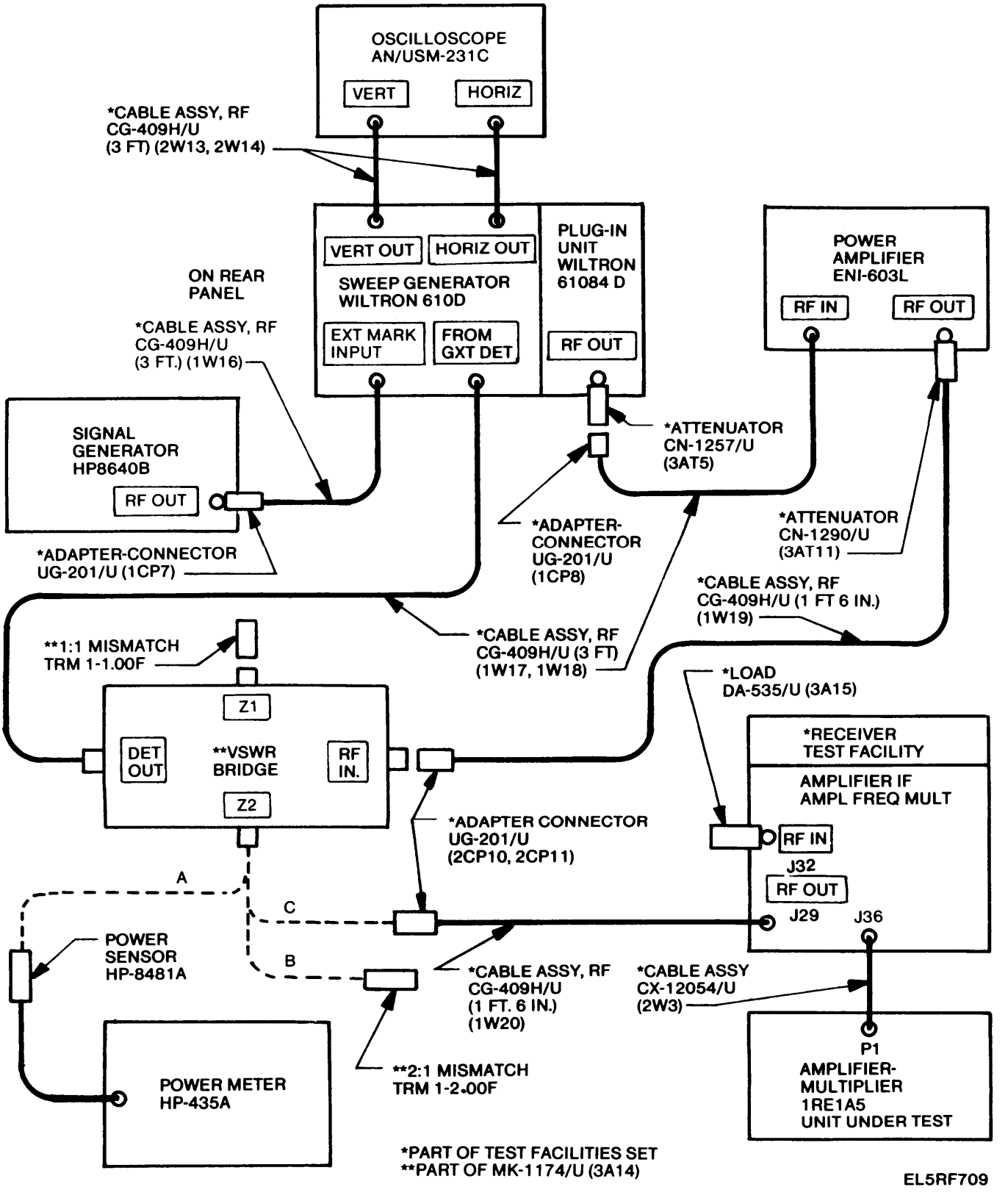



*Figure 3-43. Ampl#ier-Frequency Multiplier 1RE1A5, VSWR, Test Setup.*

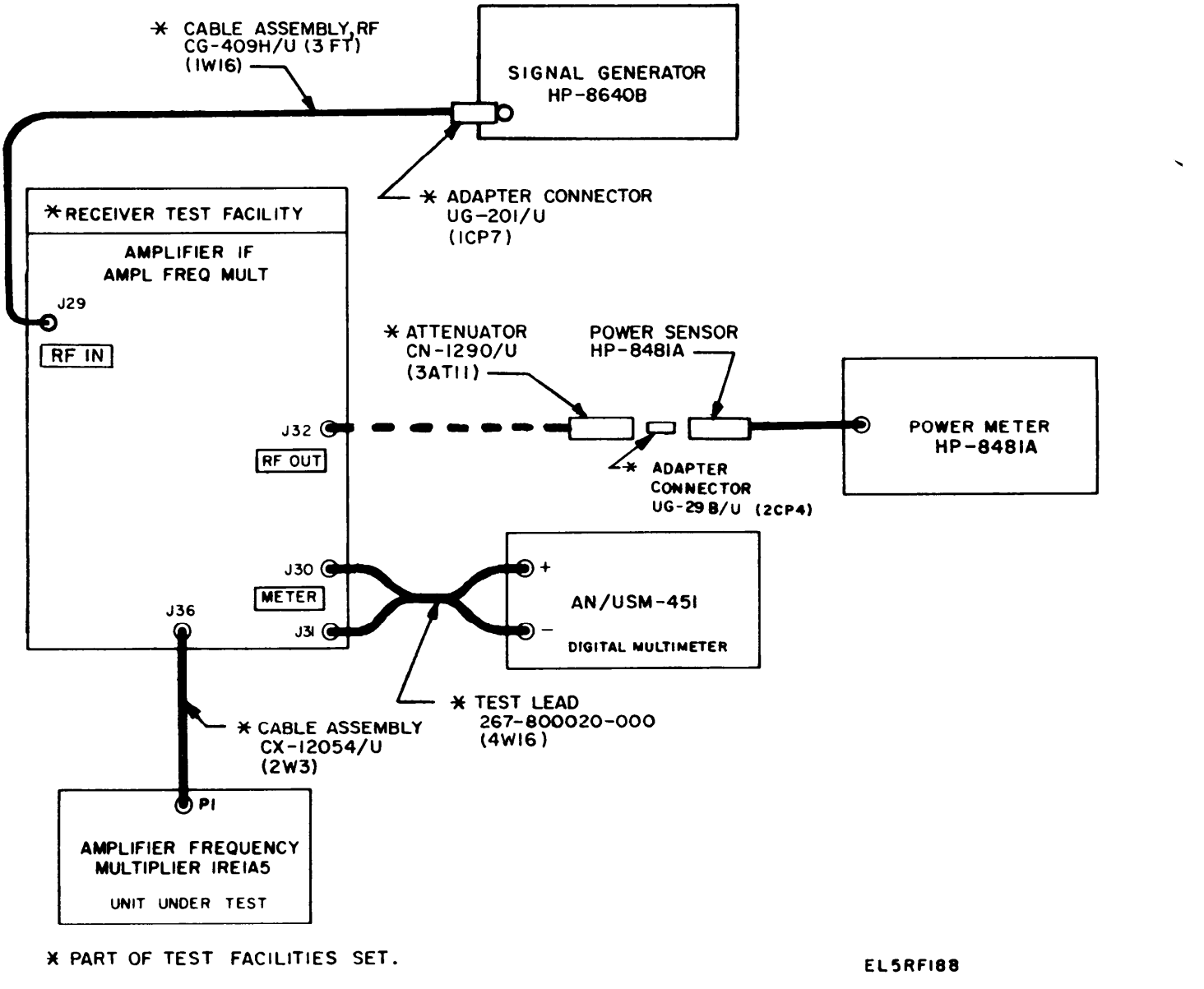



*Figure 3-44. Amplifier-Frequency Multiplier 1RE1A5, Power Output and Metering, Test Setup.*

*(b)* Set test factility switches S1 to ON and S12 to AMPL FREQ MULT.

*(c)* Set the signal generator for an output level of +14 dBm at 47.5 MHz.

*(d)* Slowly increase the signal generator frequency to 72.5 MHz while observing the power meter indication. The power meter should indicate +4 dBm, +3.0-0 dB.

*(e)* Repeat *(c)* and *(d)* above observing the digital multimeter. The digital multimeter should read between 175 and 350 mVdc.

(3) *Harmonic and fundamental frequency rejection test*

*(a)* Connect the equipment as shown in figure 3-45 using the 95 to 190 MHz filter, and set test facility switch S1 to ON.

*(b)* Set the signal generator to 47.5 MHz and adjust the OUTPUT LEVEL control for an output of +12.5 dBm.

*(c)* Adjust the filter around 142.5 MHz for a peak indication on the rf voltmeter. This is the third harmonic of the UUT input frequency. The peak rf voltmeter indication should not exceed —16 dBm.

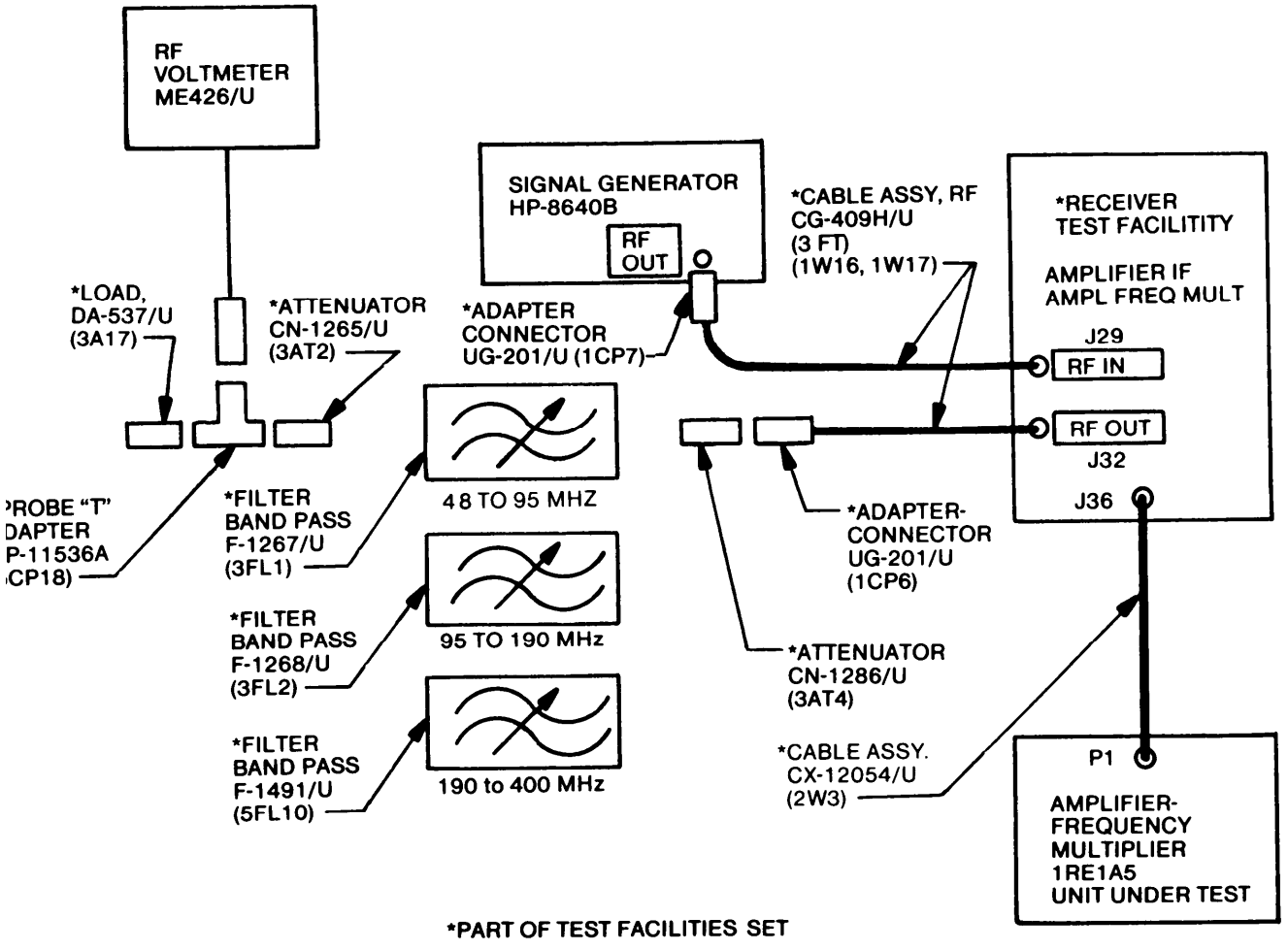



Figure 3-45. Amplifier-Frequency Multiplier 1RE1A5, Harmonic Rejection Test Setup.

(d) Tune the signal generator from 47.5 to 72.5 MHz while maintaining a peak indication on the rf voltmeter by tracking the filter to the third harmonic of the signal generator frequency (142.5 to 217.5 MHz filter frequency). The rf voltmeter peak indication should not exceed –16 dBm.

**NOTE**

For third harmonic frequencies above 190 MHz (63.3 MHz signal generator frequency), change to the 190 to 400 MHz filter.

*(e)* set the signal generator to 48.5 MHz and tune the 190 to 400 MHz falter around 194 MHz for a peak rf voltmeter indication of the fourth harmonic. The rf voltmeter shall not indicate more than –16 dB.

*(f)* Repeat *(b)* through *(d)* above using the 48 to 95 MHz filter tuned to the fundamental (input) frequencies from 48.3 to 72.5 MHz. The rf voltmeter peak indication shall not exceed –16 dBm.

*(g)* Set the signal generator to 60 MHz.

*(h)* Tune the 48 to 95 MHz filter for a peak indication on the rf voltmeter. The indication shall not be greater than –36 dBm.

*(i)* Set receiver test facility switches S1 and S12 to OFF.

*c. Troubleshooting Procedure (FO-19).*

Remove the four countersunk screws securing the top cover and the six screws securing the bottom cover of 1RE1A5.

Amplifier-Frequency Multiplier 1RE1A5, Troubleshooting Chart

| symptom | *Proboble cause* | *Checks and corrective measures* |
|---|---|---|
| (1) VSWR display exceeds 2:1 reference (b.(l)(f). | (a) Miaalinement of 1RE1A5. | (a) If VSWR display is less than the 2:1 reference for most of the display, aline 1RE1A5 as described in e. below (adjustment of R1, R2, C5 and C11 can affect input VSWR). |
| | (b) Defective lowpass filter 1RE1A5FL1 (fig. 3-46). | (b) Using oscilloscope, check the input signal at E1 and E3 (1RE1A5FL1) with the sweep generator in manual sweep mode, the signal should be the same amplitude at both points. Check for continuity between El and E3 (1RE1A5FL1). Check component, replace 1RE1A5FL1, if defective. |
| | (c) Defective resistors R1 or R2, transformer T1, or rectifier pair CR1 figure 3-46. | (c) Using the oscilloscope check the signal waveform and amplitude at the base of Q1 (para. d. below). A difference in amplitude between adjacent peaks indicates defective components or misadjustment of R1 or R2. |
| | (d) Defective transistor Q1 or related circuit | (d) Check Q1 and related circuit. Replace defective components. |
| (2) *No* output (b.(2)(d)). | (a) No dc supply to transistor stages. | (a) Check +12 V and –12 V supply to transisator stages. |
| | (b) Defective circuit components or wiring. | *(b)* (1) Using the oscilloscope, check the input *signal* at E1 and E3 (1RE1A5FLI) as indicated m d below. If signal is not present at E3, *check the continuity of* L1 thru LA (1RE1A5FL1) (figure 3-46). Check connector and cable A1 to E1 (1RE1A5FL). Replace if defective.<br>*(2)* Check signal through transistor stages (d below) and observe doubler lction If signal at Q1 is abnormal, check continuity of transformer T1 windings and forward and reverse resistance *of diode* CR1.<br>*(3)* Check continuity *of* components from Q3 and E4 and the cable from E4 to *connector* P1A2. Replace defective components as required. |
| (3) Output normal, DMM reading Out of tolerance (b(2)(e)). | Defective components in meter circuit | Check metering components CR1; A1L13, CR2, C1, and C27 figure 3-46. Replace defective components. |
| (4) Abnormal output level (b.(2)(d). | (a) 1RE1A5 alinement incorrect. | (a) Check the alinement and frequency response as described in paragraph e. below. |

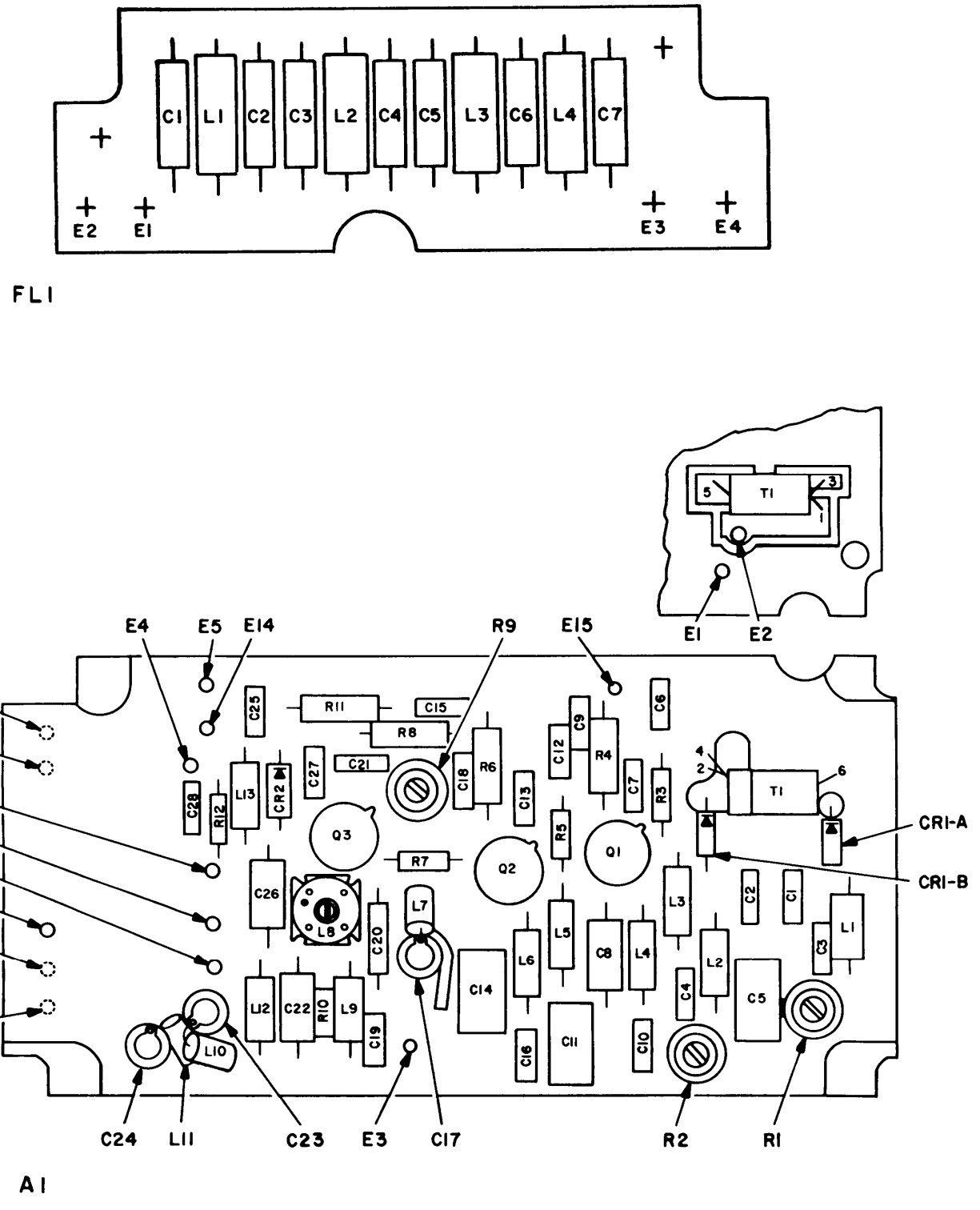



Figure 3-46. *Amplifier-Frequency Multiplier 1RE1A5, Circuit Boards A1 and FL1 Parts Location.*

*c. Troubleshooting.* – Continued

| *Symptom* | *Probable cause* | *Checks and corrective measures* |
|---|---|---|
| | (b) Defective resistor R9. | (b) Check R9 and replace if defective. |
| | (c) Incorrect transistor gain. | (c) Using the oscilloscope, check the gain of transistor stages as indicated in d. below. |
| | (d) Defective resistors R1 and R2. | (d) Check R1 and R2 for open circuit resolder any loose connections. |
| (5) Excessive harmonic output (b.(3)). | 1RE1A5 alinement incorrect. | Check the alinement and harmonic rejection as described in paragraph e.(3) below. |

*d. Signal Voltage Measurements.*

Arnplifier-Frequency Multiplier 1RE1A5, signal voltages.

| *Test point* | *Typical oscilloscope indications* |
|---|---|
| E1 | 3.0 Vp-p |
| E3 | 3.0 Vp-p |
| Q1-Base | 100 mVp-p |
| Q1-Collector | 250 mVp-p |
| Q2-Base | 150 mVp-p |
| Q2-Collector | 1.0 Vp-p |
| Q3-Base | 300 mVp-p |
| Q3-Collector | 3.5 Vp-p |

*e. Alinement*

(1) *Power output test setup calibration*

*(a)* Connect the equipment as shown in A, figure 3-47.

*(b)* Set the sweep generator for a power amplifier output level of +14 dBm (+4 dBm power meter indication) at approximately 60 MHz.

*(c)* Connect the equipment as shown in B, figure 3-47.

*(d)* Set the variable attenuator to 5 dB and, without disturbing the RF POWER LEVEL controls, set the sweep generator and oscilloscope controls for a convenient sweep response display from 40 MHz to 80 MHz (using markers) with a vertical displacement of at least 4 cm.

*(e)* Note the vertical deflection level displayed for 60 MHz. This is the minimum output power level (+14 dBm) reference line (disregard deflection level variations at other frequencies).

*(f)* Set the variable attenuator to 2 dB and repeat *(e)* above. This is the maximum output power level (+17 dBm) reference line. Do not readjust the oscilloscope vertical controls without repeating *(a)* through *(f)* above.

*(g)* Reset the variable attenuator to 5 dB.

(2) *Response alignment*

*(a)* Remove the protective caps from the tuning capacitors.

**NOTE**

The chassis covers should be secured in place during the following procedures.

*(b)* Set the controls on the UUT as listed below. Refer to figure 3-48.

| control | *Position* |
|---|---|
| C-5 | Fully ccw - min. capacitance |
| C-17 | Fully ccw - min. capacitance |
| C-14 | Fully cw - max capacitance |
| C-11 | midrange |
| C-23 | midrange |
| C-24 | midrange |
| R-9 | midrange |
| L-8 | midrange |
| R-1 | Fully ccw - min. resistance |
| R-2 | Fully ccw - min resistance |

**NOTE**

Check that the wires that connect FL1E3 to A1E2 and FL1E4 to A1E1 are at maximum separation.

*(c)* Connect the equipment, calibrated as in (1) above, to the unit under test as shown in figure 3-49.

*(d)* Set test facility switches S1 to ON and S12 to AMPL FREQ MULT.

*(e)* Refer to figure 3-50 and make the following adjustment in the sequence given.

**NOTE**

Use internal or external markers (signal generator) as necessary to determine the display position at the frequency of interest

*1.* C17 and then C11 for maximum response at 72.5 MHz.

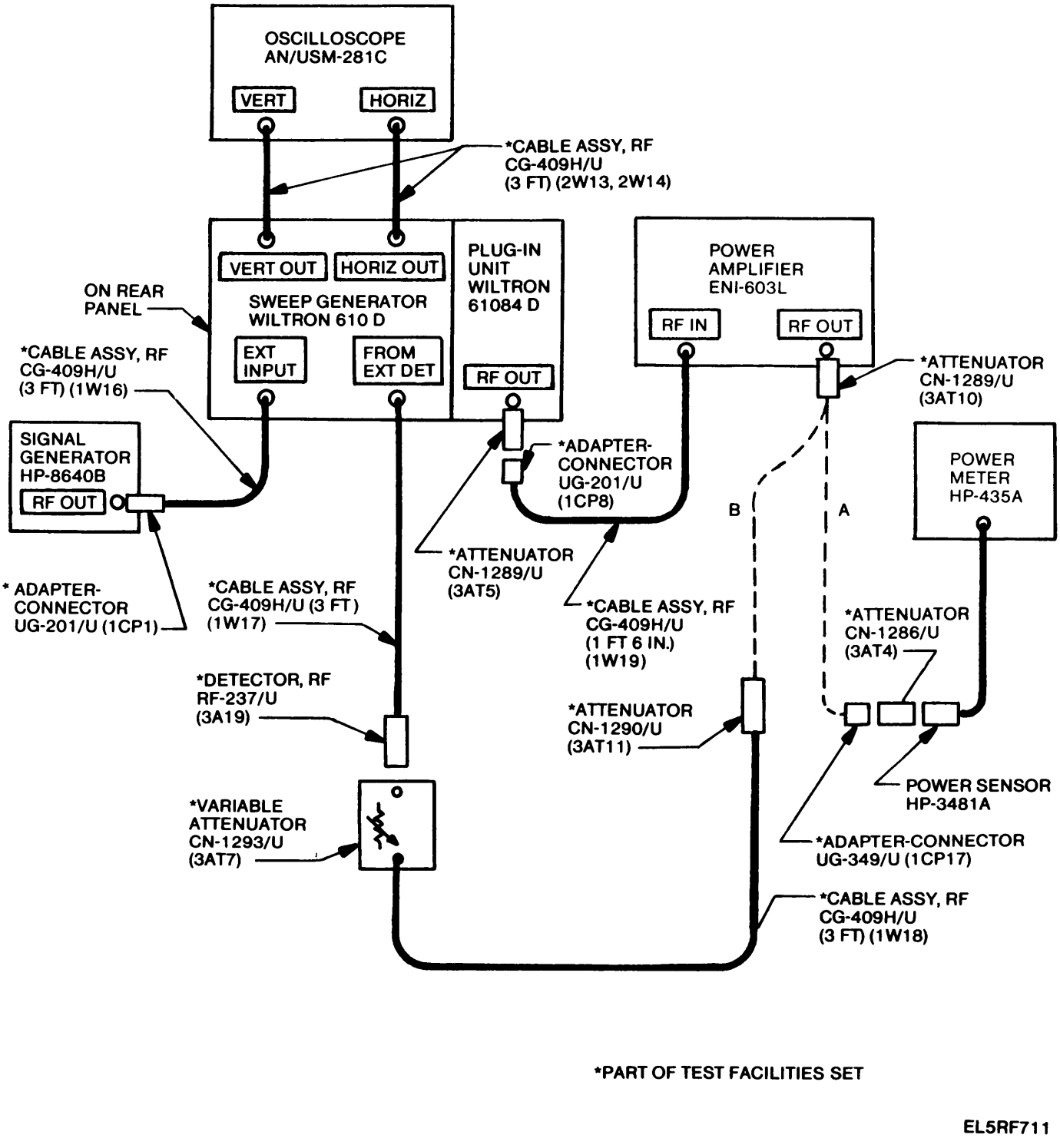



*Figure 3-47. Amplifier-Fmquency Multiplier 1RE1A5, Power Output Test Setup Calibration.*

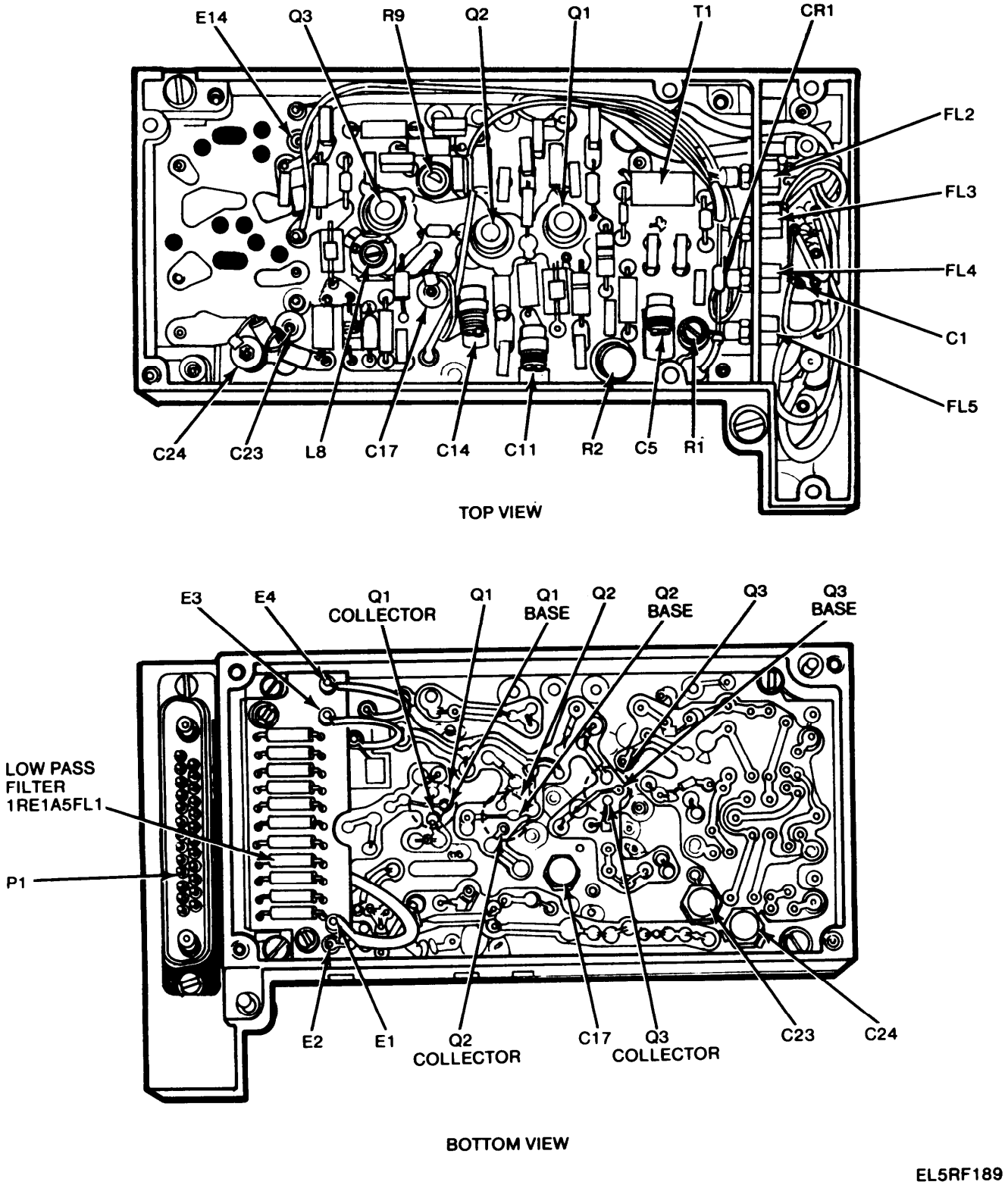



*Figure 3-48. Amplifier-Frequency Multiplier 1RE1A5, Top and Bottom Views (Covers Removed).*

*2. C24 to* position the notch at approximately 45 MHz.

3. C14 for overall flatness.

4. C23 for maximum response at 72.5 MHz.

5. R9 for minimum acceptable output ((1)(e) above). Do not adjust R9 for max output. Unit under test may go into oscillation.

6. L8 for maximum output at 72.5 MHz.

7. R1 and R2 for minimum amplitude at the notch, with resistance as close to minimum as possible.

**NOTE**

The objective of this step is to minimize the power output below 47.5 MHz while maintaining a +14 dBm minimum output from 47.5 to 72.5 MHz (95-145 MHz). During the alignment, C5 is to be kept as close to minimum capacitor as possible.

8. Adjust C5 and as necessary readjust Cl 1, C14, C17, L8 and R9 for a minimum output of +14 dBm from 47.5 to 72.5 MHz and for the response to be as flat as possible. Readjust C24 as necessary to obtain minimum required output at 47.5 MHz.

*(f)* Replace the tuning capacitor protective caps while observing the response remains within limits. Make slight adjustments as necessary.

*(g)* Set test facility switch S1 and power amplifier to OFF.

(3) Harmonic rejection

**NOTE**

If adjustments are made while performing the following checks, repeat the tests and adjustments in paragraph (2) above until all requirements are met.

*(a)* Connect the equipment as shown in figure 3-45 using the 95 to 190 MHz filter.

*(b)* Set test facility switch S1 to ON.

*(c)* Set the signal generator for 47.5 MHz at +14 dBm output

*(d)* Adjust the filter around 142.5 MHz for a peak indication on the rf voltmeter of the third harmonic of the input frequency. The rf voltmeter indication should not exceed –16 dBm.

*(e)* If necessary, adjust R1 or R2 on the unit under test for a minimum rf voltmeter indication. Keep R1 and R2 adjusted as close to minimum resistance as possible.

**NOTE**

For third harmonic frequencies above 190 MHz (63.3 MHz signal generator frequency), change to the 190 to 400 MHz filter.

*(f)* Tune the signal generator from 47.5 to 72.5 MHz while maintaining a peak indication on the rf voltmeter by tracking the filter to the third harmonic of the signal generator frequency. The rf voltmeter peak indication should not exceed —16 dBm.

*(g)* If necessary, repeat *(c)* through *(f)* making slight readjustments of R1 and R2 to meet all requirements.

*(h)* Set the signal generator to 48 MHz and tune the 190 to 400 MHz falter around 192 MHz for a peak rf voltmeter indication of the fourth harmonic. The rf voltmeter peak indication should not exceed –16 dBm. If necessary, slightly readjust C23 on the UUT for a minimum indication on the rf voltmeter.

**NOTE**

Reinstall the protective caps on the tuning capacitors before the final check of fourth harmonic rejection.

*(i)* Repeat *(f)* above using the 48 to 95 MHz filter tuned to fundamental frequencies from 48.3 to 72.5 MHz. The rf voltmeter peak indication should be less than –16 dBm.

*(j)* Set the signal generator and tunable filter to 60 MHz. Measuere the level of the 60 MHz signal. The rf voltmeter should indicate less than –36 dBm. If necessary, adjust either R1 or R2 slightly to bring this measurement within the required value. If R1 or R2 is readjusted, repeat *(f)* through *(j)* above until test conditions are met

*(k)* Ensure that all protective caps and chassis covers are properly secured in place and perform the tests in paragraph 3-12 *b.* above.

### 3-13. Video Amplifier 1RE1AR1

a. *Test Equipment and Material Required*

| *Equipment* | *Common name* |
|---|---|
| Test Facility, Receiver TS2867(V)2/GRM-95(V)2 | Receiver test facility |
| Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2 | Accessory kit |
| Voltmeter, Electronic ME-459A/U | VTVM |
| Generator, Signal AN/USM-205A | Wide range oscillator |
| Oscilloscope AN/USM-281C | Oscilloscope |
| Digital Multimeter AN/USM-451 | Multimeter |

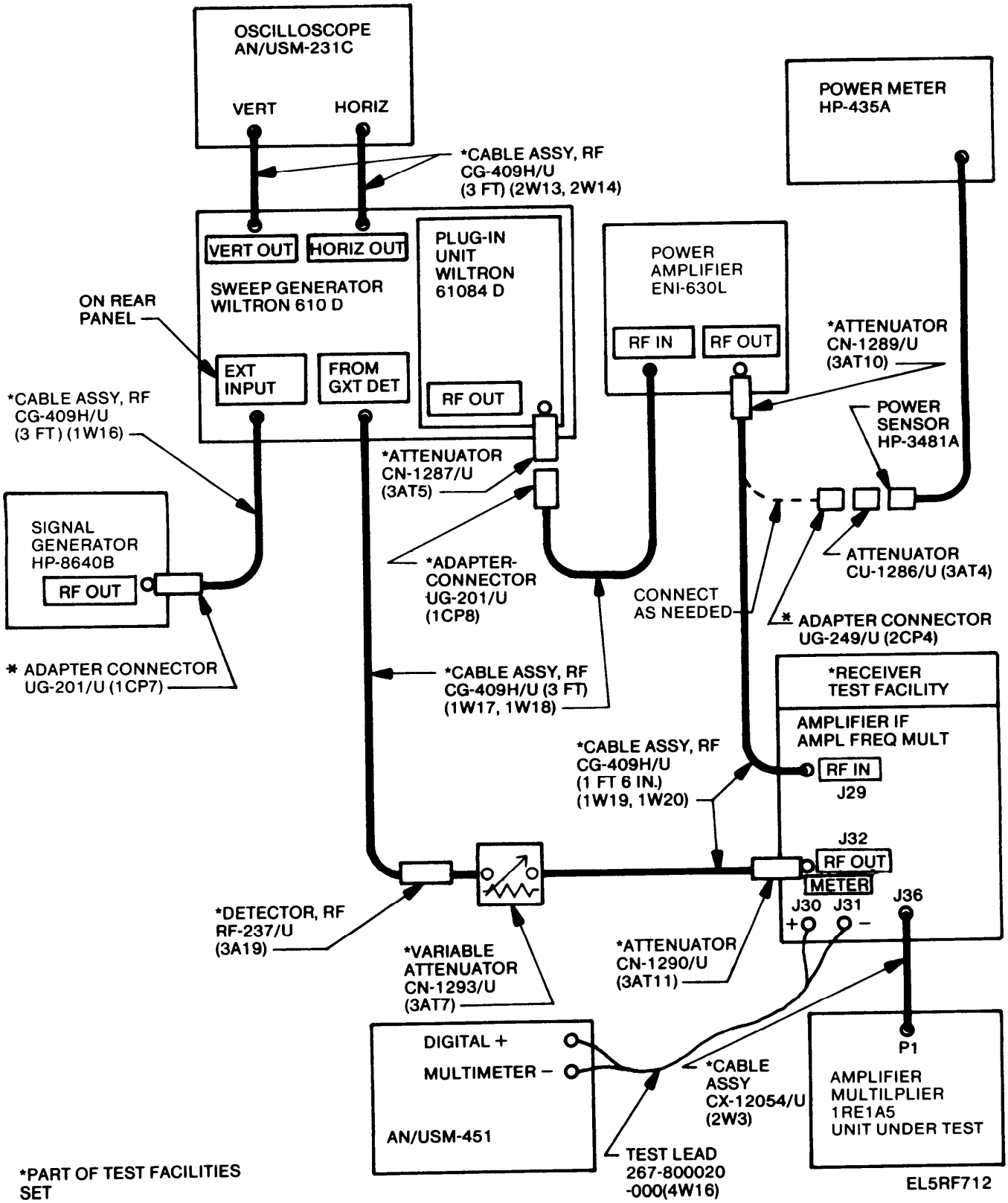



*Figure 3-49. Amplifier-Frequency Multiplier 1RE1A5, Power Output Response, Test Setup*

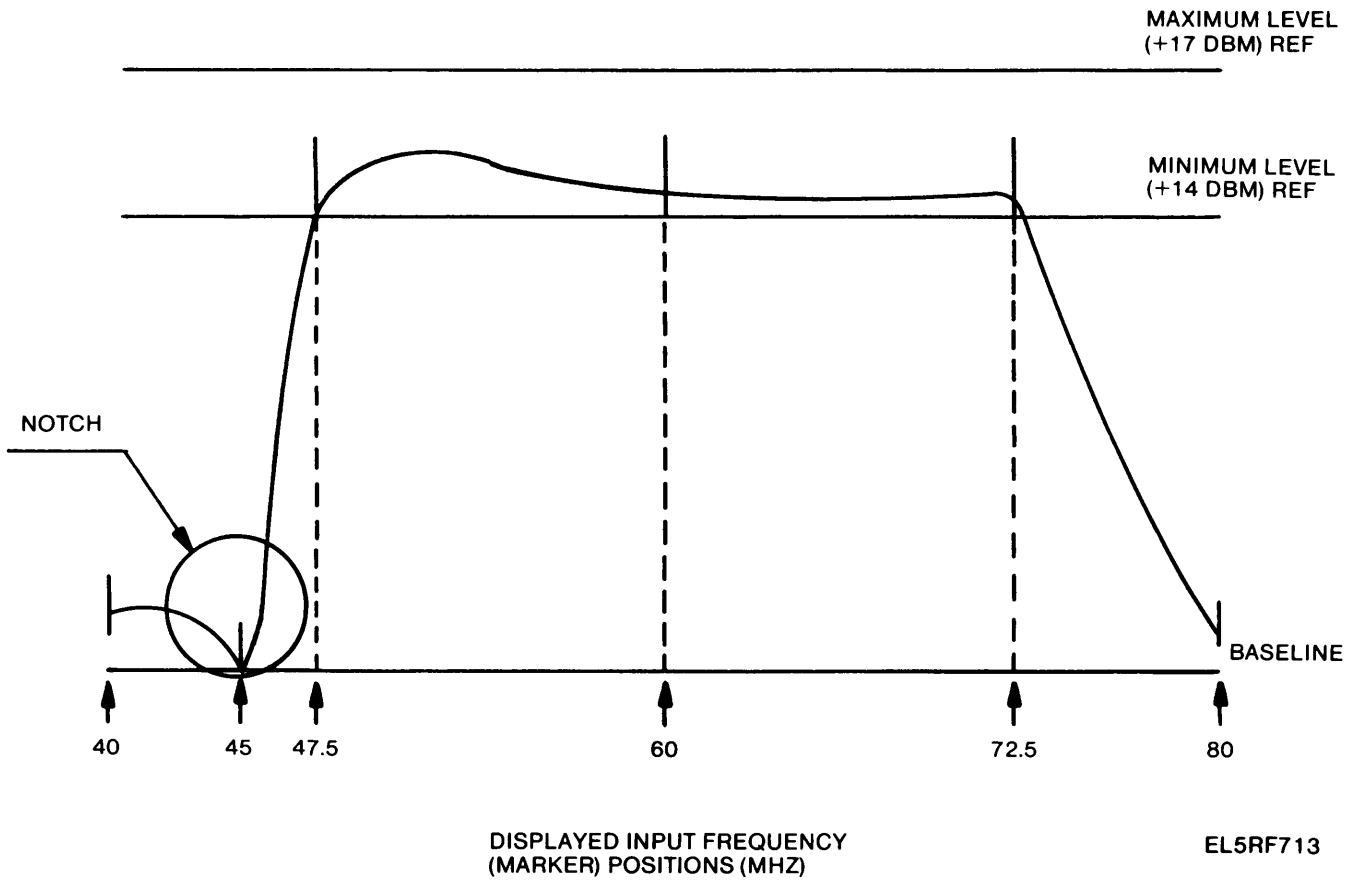



*Figure* 3-50. *Amplifier-Frequency Multiplier 1RE1A5, Typical Output Response Display.*

| *Equipment* | *Common name* |
|---|---|
| Test Facility, Transmitter TS-2866(V)2/GRM-95(V)2 | Transmitter test facility |

**NOTE**

There are two models of video amplifier 1RE1AR1. The two models are distinguished by part number CMC 455-975 (SM-C-698003) and CMC 455-975-2 (SM-C-967354). Except where specified otherwise, this test procedure refers to both units.

*b. Test Procedure.*

*(1) Amplifier gain and metering checks.*

*(a)* Connect the test equipment as shown in A, figure 3-51. Set the power supply for a 115 Vac panel voltmeter indication. Maintain this indication throughout the following procedures.

*(b)* Set the test facility switches as follows:

| *Switch* | *Position* | *Normal indication* |
|---|---|---|
| S1 | ON | |
| S5 | S20 | |
| S20 | RCVR SIG | |
| S21 | OUT | PCM OUT lamp illuminates. |

*(c)* Tune the wide range oscillator to 10 kHz and adjust the amplitude control to obtain a 0.106 Vrrns indication on the VTVM.

*(d)* Connect the test equipment as shown in B, Figure 3-51. The VTVM should indicate 1.98 V. If necessary, adjust GAIN control R1 (fig. 3-52) on the unit under test, to correct the indication. The oscilloscope display should be an undistorted sinewave.

*(e)* Set test facility switch S20 to the 24 CHAN position Meter MI should indicate 50 percent of full scale. Adjust 24 CH METER control R9 on the unit under test for a correct indication.

*(f)* Reduce the wide range oscillator output level until the VTVM indicates 0.5 V.

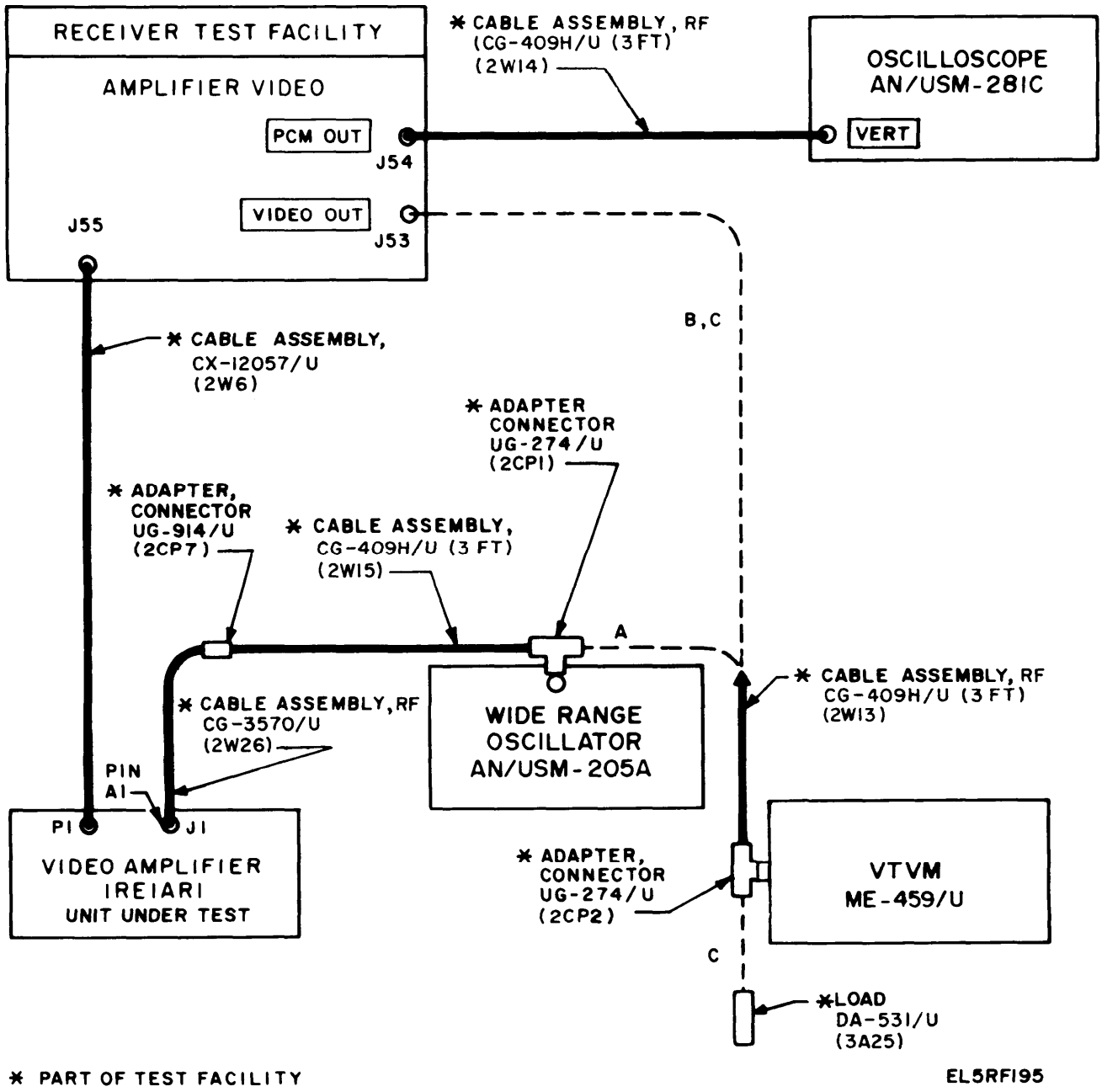



Figure 3-51. Video Amplifier 1RE1AR1, Amplifier Gain and Metering Checks, Test Setup

*(g)* Set test facility switch S20 to the FDM position. Meter M1 should indicate 50 of percent full scale. If necessary, adjust FDM METER control R8 for a correct indication.

(2) Distortion check.

(a) Terminate the VTVM with a 50 ohm termination as shown in C, figure 3-51.

*(b)* Tune the wide range oscillator to 100 kHz.

*(c)* Operate the wide range oscillator amplitude control slowly to increase the signal level until the VTVM indicates 1.0 Vrms. The sine wave displayed on the oscilloscope should have no visible distortion for signal levels less than 1.0 Vrrns. Clipping may occur above 1.0 Vrms.

*(3)* RCVR SIG meter and LOW SIGNAL alarm adjustment.

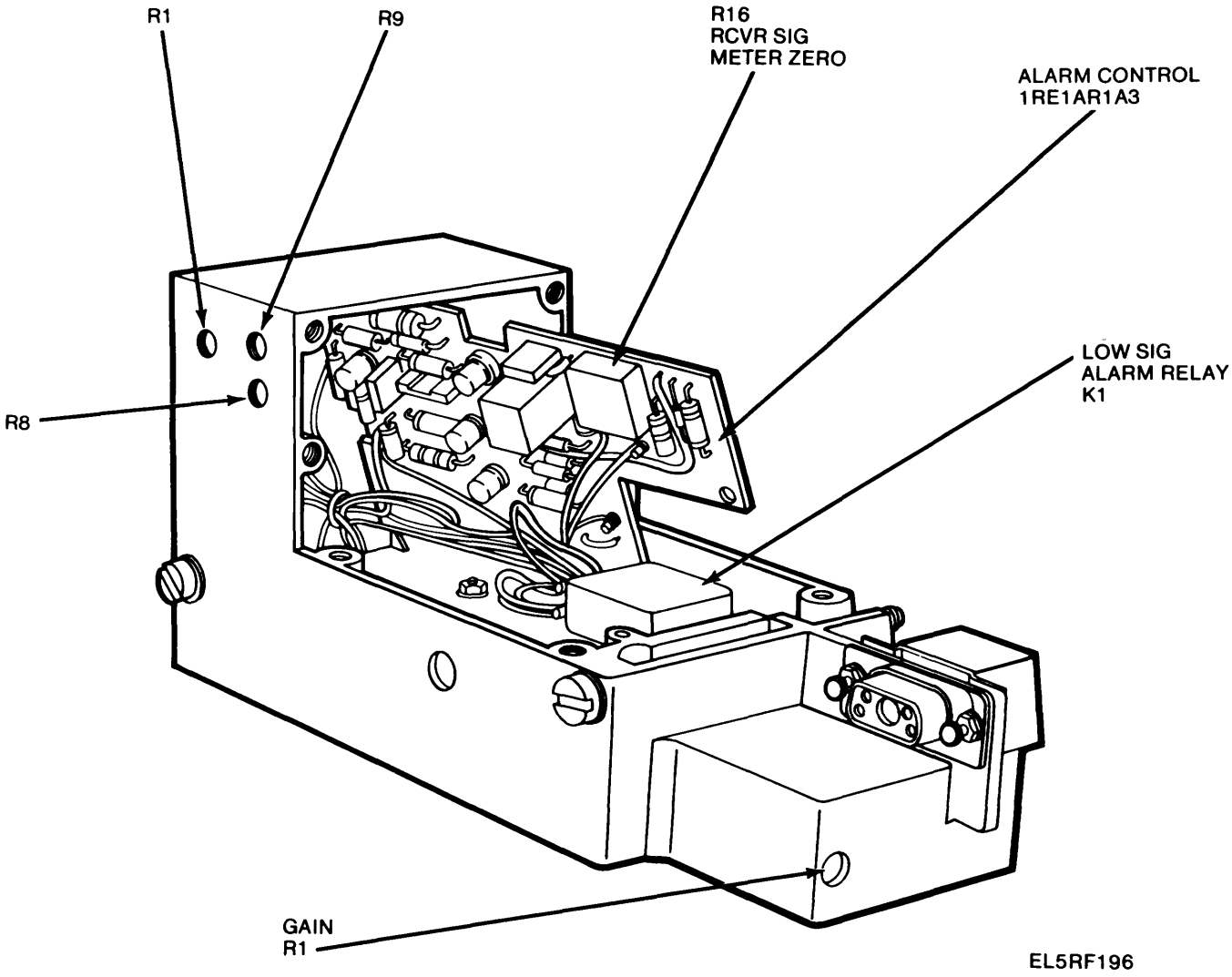



Figure 3-52. *Video Amplifer 1RE1AR1, Top Covers Removed.*

*(a)* Connect the equipment as shown in figure 3-53.

*(b)* Set test facility switch S20 to RCVR SIG and switch S21 to OUT. Meter Ml should indicate 50 percent of full scale. If necessary adjust RCVR SIG control R16 for the correct indication.

*(c)* Tune the wide range oscillator to 600 kHz and adjust the amplitude control until the VTVM indicates 27 mV. The PCM OUT lamp should go out and the LOW SIGNAL alarm should light.

**NOTE**

CMC *455-975-2 (SM-C-967354)* has been modified so that the PCM OUT lamp will remain illuminated.

*(d)* Reduce the wide range oscillator output level to obtain a 25 mV indication on the VTVM. Watch the LOW SIGNAL alarm lamp.

1. If the LOW SIGNAL alarm lamp is out adjust the LOW SIG ALARM control R1 clockwise until the lamp lights.

2. If the LOW SIGNAL alarm lamp remains lit adjust LOW SIG ALARM control R1 counterclockwise until the lamp goes out. Adjust R1 slowly clockwise until the lamp lights again.

*(4) Frequency response check.*

*(a)* Connect test equipment as shown in figure 3-54.

*(b)* Set test facility switch S20 to RCVR SIG and S21 to OUT.

*(c)* Tune the wide range oscillator to 10 kHz using the frequency counter.

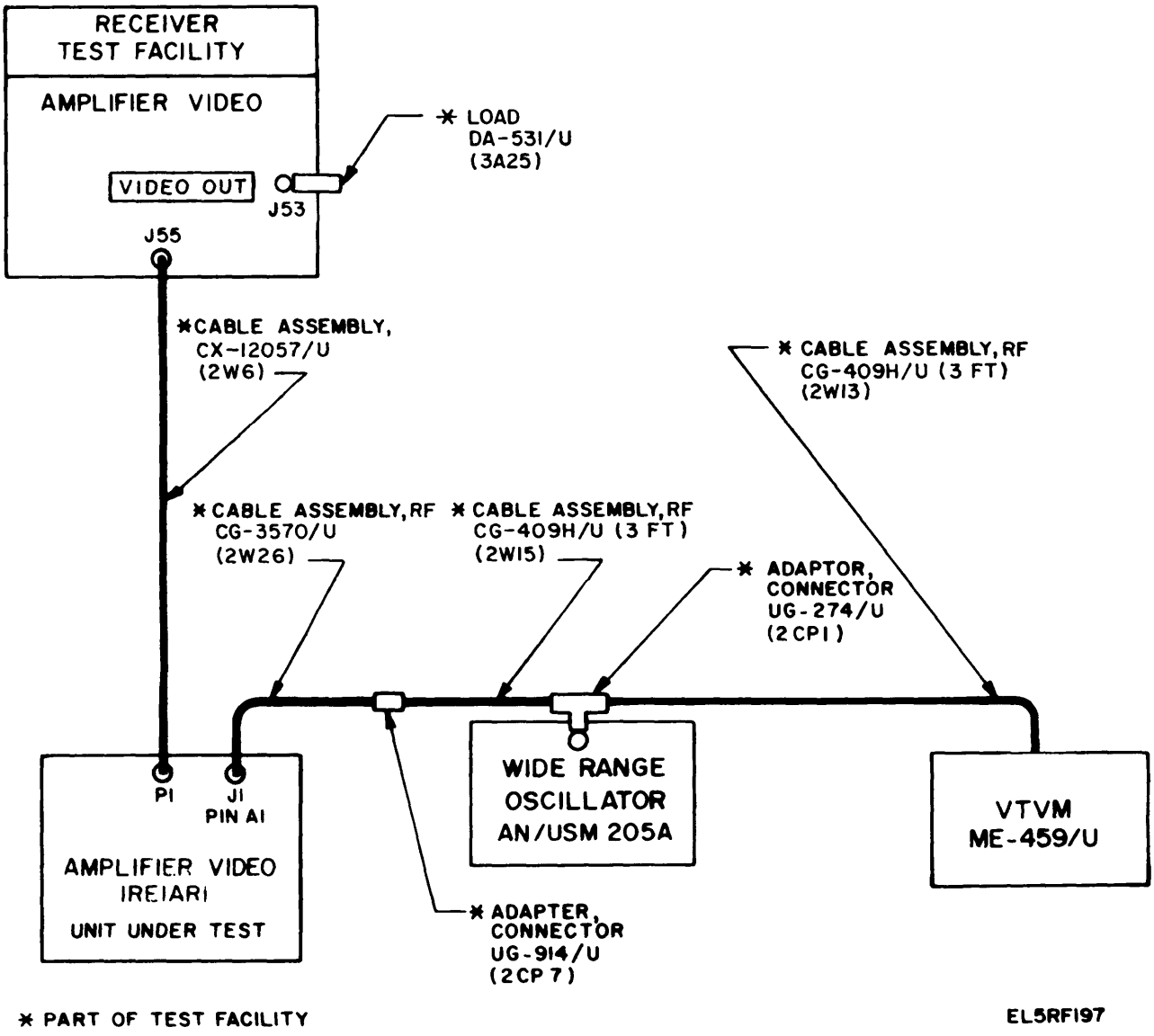



*Figure 3-53. Video Amplifier 1RE1AR1, RCVR SIG Metering and LOW SIGNAL Alarm Check, Test Setup.*

*(d)* Adjust the variable attenuator and the amplitude control of the wide range oscillator to obtain a 0 dBm indication on the VTVM (set to 1.0 volt range) with a wide range oscillator panel meter indication (normal scale) between 90% and 100% of full scale deflection.

*(e)* Set the wide range oscillator to EXPANDED scale and adjust the expanded scale sensitivity control for a center scale panel meter indication. Note this reference indication

*(f)* Adjust the wide range oscillator to the frequencies listed below and adjust the amplitude controls for the panel meter indication noted in *(e)* above. The VTVM shall indicate the levels listed below.

| *Frequency (kHz)* | *Output Level at J53 (VIDEO 0UT) (dB)* |
|---|---|
| 0.125 | -1.0 ±1.O |
| 0.250 | O *0.6 |
| 1.0 | o *0.2 |
| 10.0 | 0 |
| 205.0 | 0.75 *0.2 |
| 410.0 | –3.0 *0.3 |
| 720.0 | –8.75 AO.7 |
| 960.0 | –16.5 *1.7 |

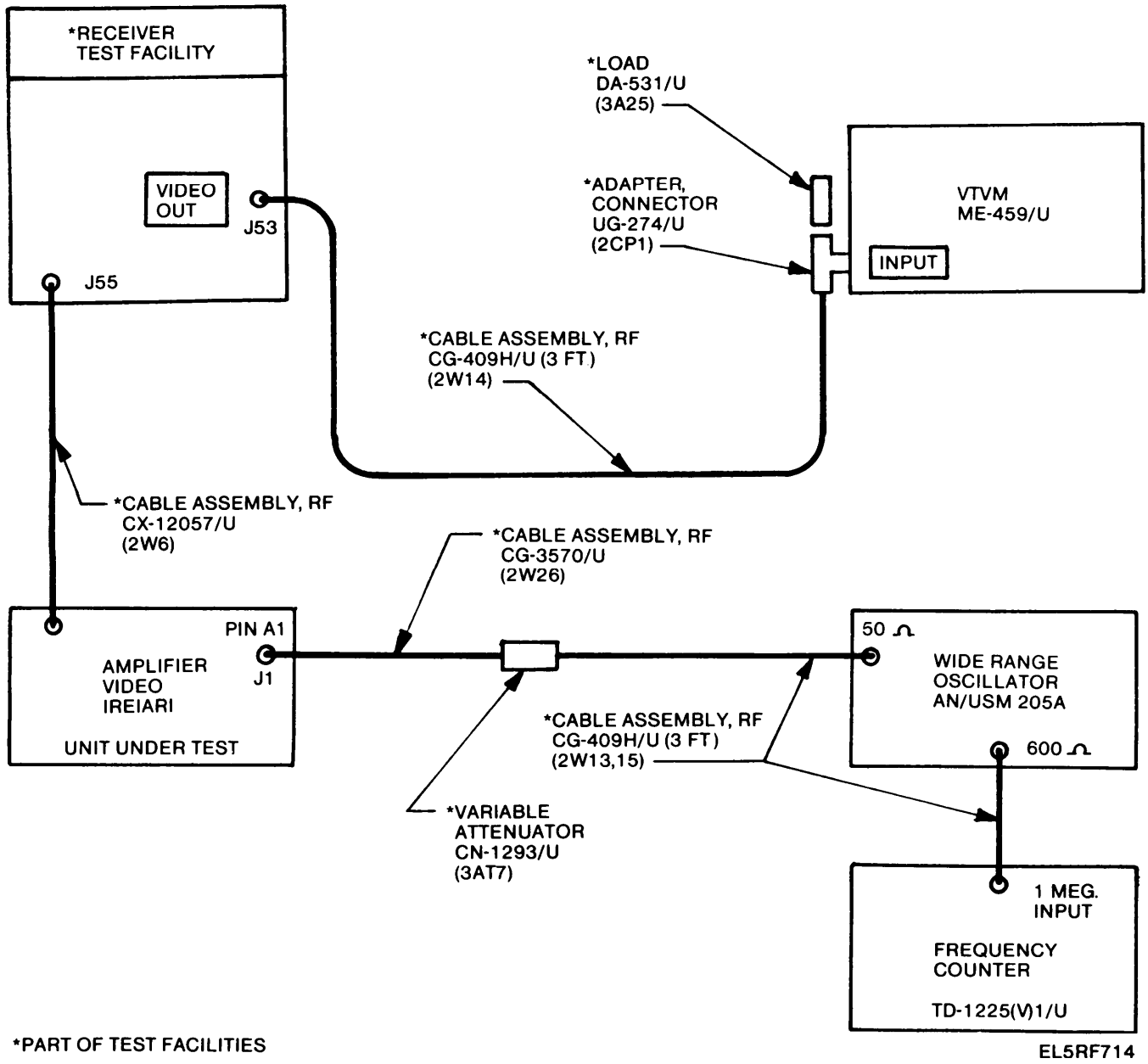



Figure 3-54. *Video Amplifier 1RE1AR1, Frequency Response Measurement Test Setup.*

*C. Troubleshooting (FO-14, FO-20).*

| *Symptom* | *Probable cause* | *Checks and corrective measures* |
|---|---|---|
| PCM OUT indicator lamp does not light (*b* (1) above). | a. Defective relay K1 (fig. 3-52). | a. Check the continuity of relay contacts B2 to B3. Replace relay if defective. |
| | b. Open circuit P1 pin 10 to P1 pin 11. | b. Check continuity of wiring. |
| Low or no output at VIDEO OUT (Test facility connector J53). All meter indications abnormal | a. +12 Vdc or – 12 Vdc shorting to ground. | a. Set test facility switch S5 to positions–12 V and +12 V. M1 should indicate in the green band. If–12 V or +12 V reading is abnormal, disconnect the voltage line at the printed circuit boards in turn to isolate problem. Check for short circuiting component. |

*c. Troubleshooting.* – Continued

| *Symptom* | *Probable cause* | *Checks and corrective measures* |
|---|---|---|
| | b. Defective video amplifier 1RE1AR1AR1 (fig. 3-55 and 3-56). | b. Check the signal through amplifier to isolate the defective stage. Check resistance of components in isolatad stage. Refer to d below for typical readings. |
| Distorted sinewave at VIDEO OUT connector. | Defective transistor stage in video amplifier 1RE1AR1AR1 (fig. 3-55 and 3-56). | Use the oscilloscope to check the signal at the collectors of transistors Q1 through Q3, Q5 and Q6, and at the emitter of Q4 and E3. Check resistance of components in isolated stage (d below). Replace the defective component. |
| Abnormal 24 CHAN or FDM meter indications. VIDEO OUT normal | Defective stage in video monitor 1RE1AR1A2 (fig. 3-57 and 3-58). | Check the signal at points suggested in d below to isolate the defective stage (fig. 3-59). Check resistance of components in isolated stage. Replace the defective component. |
| Abnormal RCVR SIG metering indication all other indications normal. | a. Defective component in alarm control 1RE1AR1A3 (fig. 3-52 and 3-60). | a. Check the voltage at E7; it should mad approximately 9.0 Vdc. If abnormal reading is obtained, check diode CR6, resistors R14, R15, and R16 (fig. 3-61). Replace the defective component as required. |
| | b. Defective L2 (1RE1AR1AR1) (fig. 3-52). | b. Check L2 for open circuit replace if necessary. |
| LOW SIGNAL lamp does not illuminate. PCM OUT light remains on ((b (3) above). | a. Defective stage in high pass filter 1RE1AR1FL1 (fig. 3-57 and 3-63). | a Check the signal through FL1 attest points suggested in d below to isolate the defective stage (fig. 3-64). Check resistance of components: replace as required. |
| **NOTE**<br>Normal condition on 455-975-2 only is that the PCM OUT light should remain on. | b. Defective stage in alarm control 1RE1AR1A3 (fig. 3-52 and 3-60). | b. Check the signal attest points suggested in d below to isolate the defective stage (fig. 3-61). Check resistance of components in faulty stage; replace components as required |
| | c. Defective relay K1 | c. Check operation of relay K1: replace if necessary. |
| 24 CHAN meter indication and VIDEO OUT level excessively high. | Video amplifier 1RE1AR1AR1 transistor stage Q2 oscillatoring due to<br>1. Defective capacitor C8<br>2. Open ground wire to 1RE1AR1AR1 (fig. 3-56 and 3-62). | Disconnect the input signal to unit. If meter M1 does not indicate zero:<br>1. Check and replace capacitor C8.<br>2. Check continuity of ground circuit |
| Poor frequency response. | a. Defective capacitors C6, C7 and C13. | a. Check capacitors by bridging component with equivalent or by substitution Replace component when output improves. |
| | b. Defective transistor Q2 (high or low frequency characteristics changed). | b. Replace Q2. |
| | c. Capacitor C10 out of tolerance. | c. Check capacitor C10. Must be within ±5%. |

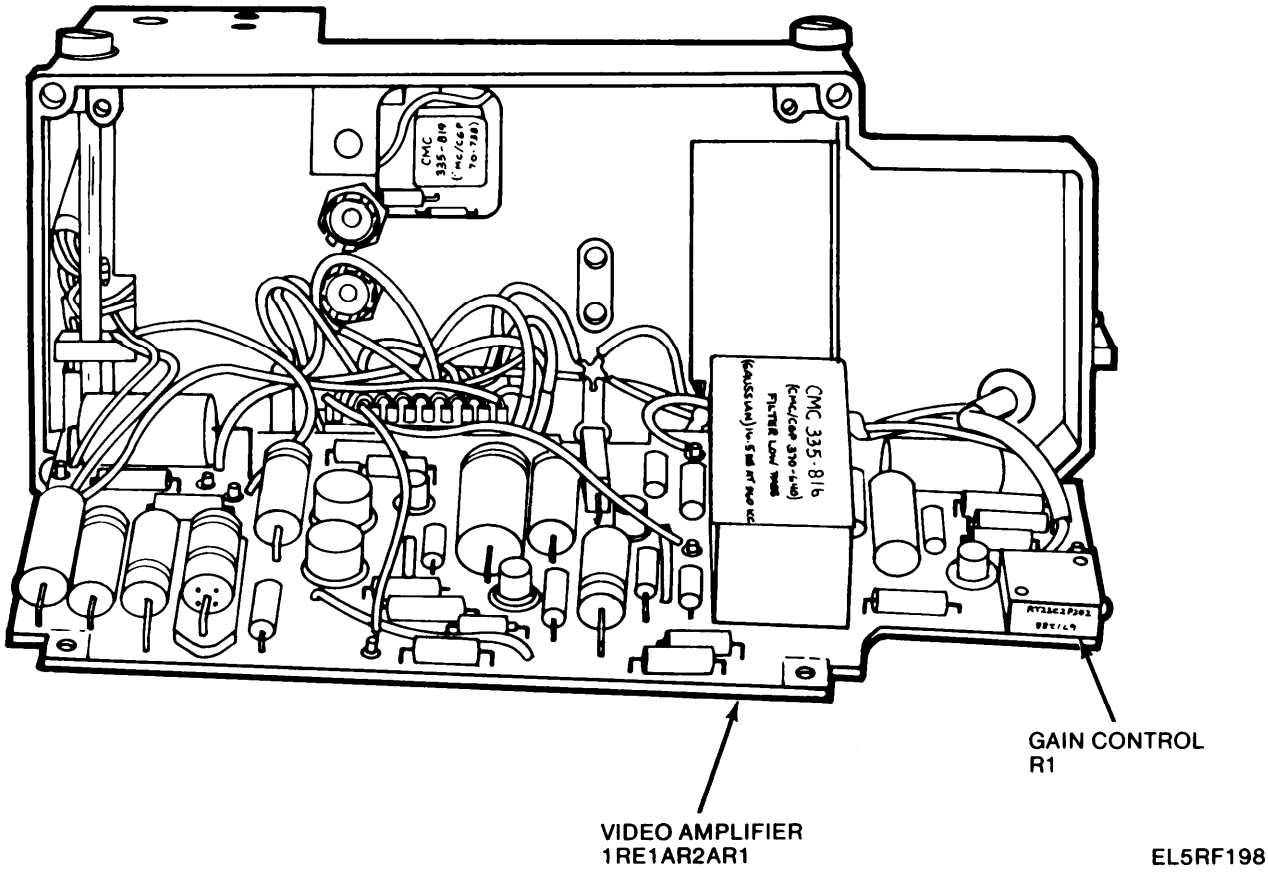



Figure 3-55. *Video Amplifier 1RE1AR1, Bottom Cover Removed.*

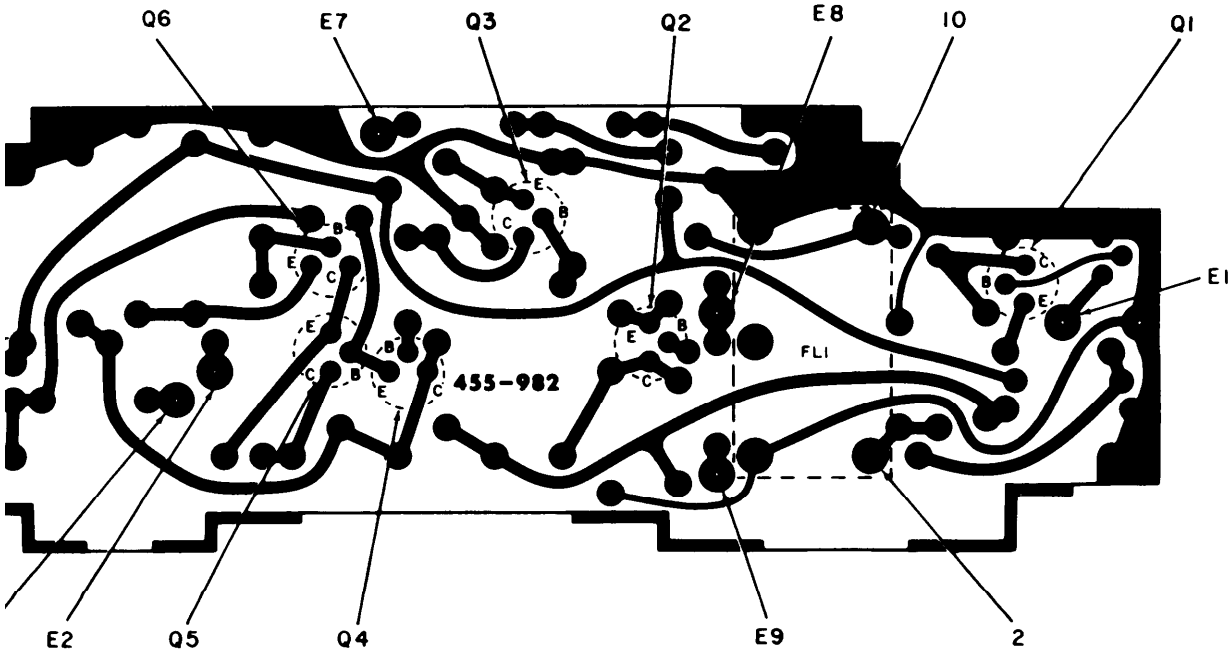



*Figure* 3-56. *Video Amplifier 1RE1AR1AR1, Printed Circuit Board*

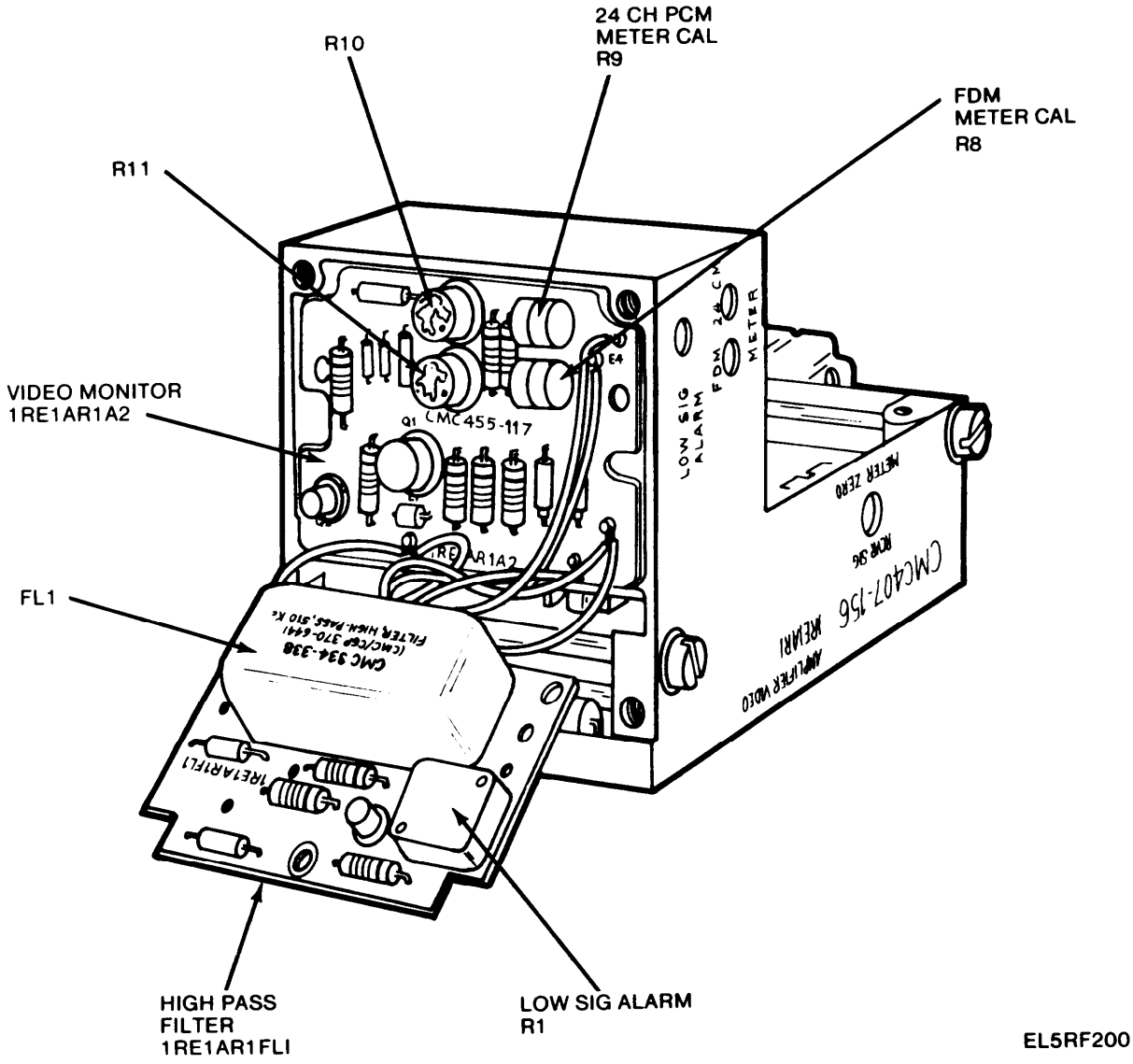



*Figure 3-57. Video Amplifier 1RE1AR1, Side Cover Removed.*

*d. Voltage and Resistance Measurements.*

NOTE

All ac measurements are taken with reference to chassis ground using ac voltmeter. Dc voltages and resistance are measured with the allocated multmeter.

(1) *Voltage measurements.*

*(a)* Apply a 10 kHz signal from the wide range oscillator to the input connector J1 of 1RE1AR1, at a level of 0.106 Vrms measured at E1 of 1RE1AR1AR1 (fig. 3-62).

*(b)* Perform the measurement indicated in the table below.

| *Test points* | *Typical indication (Vrms unless otherwise stated)* | *Remarks* |
|---|---|---|
| Video amplifier 1RE1AR1 (fig. 3-55, 3-56, and 3-62) | | |
| E1 | 0.106 | Terminate VIDEO OUT with 91 Ω load. |
| Q1 - Base | 0.022 | |
| Q1 - Collector | 0.020 | |

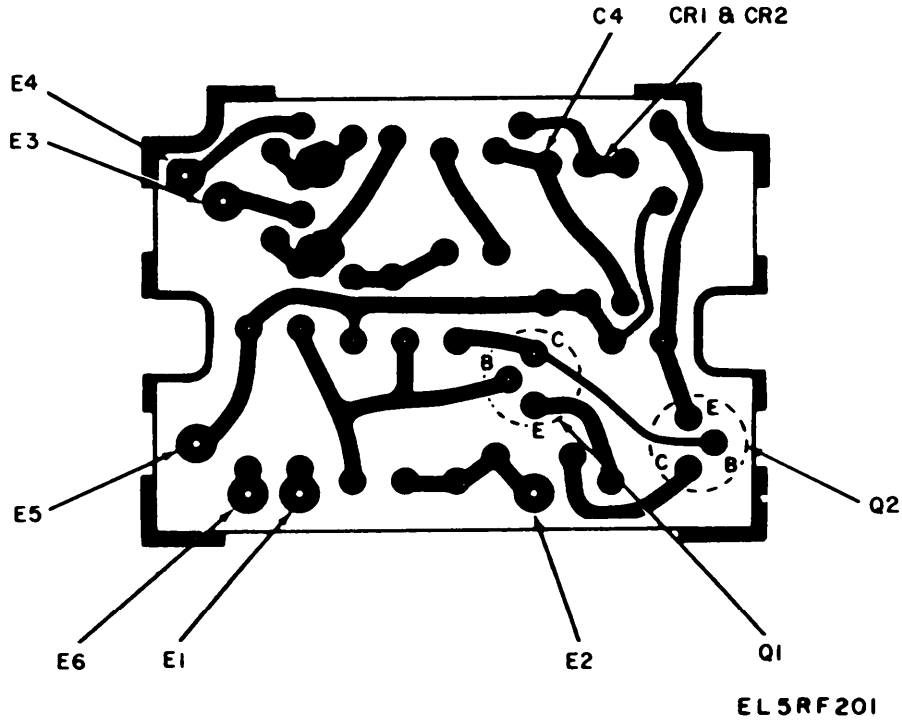



*Figure 3-58. Video Monitor 1RE1AR1A2, Printed Circuit Board.*

| *Test points* | Typical *indication* (Vrms *unless* otherwise *stated)* | *Remarks* |
|---|---|---|
| *Q2* - Base | 0.020 | |
| *Q2* - Collector | 0.1 | |
| *Q3* - Base | 0.019 | |
| *Q3* - Collector | 1.94 | |
| *Q4* - Emitter | 2.15 | |
| Q5 - Collector | 0.032 | |
| Q5 - Emitter | 2.00 | |
| Q6 - Base | *0.032* | |
| Q6 - Collector | 2.00 | |
| E3 | 2.00 | |
| E7 | 3.00 | |
| Video monitor 1RE1AR1A2 (fig. 3-57 3-58, and 3-59) | | |
| E1 | 2.00 | |
| Q1 - Base | *300* mV | |
| Q1 - Collector | 5.0 | |
| Q2 - Emitter | 5.0 | |
| Junction C4 and R10 (+) and E5 (–) | 14.3 Vdc | |
| High pass falter 1RE1AR1FL1 (fig. *3-57,3-63* and *3-64)* | | Set wide range oscillator frequency to 600 kHz at an output level of 40 mV to simulate “alarm on” condition. Remove osillator from connector J1 for “alarm off. |
| E1 | *350* mV | |
| Q1 - Base | 30 mV | |
| Q1 - Collector | 28 mV | |
| E3 | 30 mV | |
| Alarm control 1RE1AR1A3 (fig. 3-52,3-60 and 3-61) | | |
| E9 | *30* mV | |
| Q1 - Collector | 100 mV | |
| Q1 - Emitter | 30 mV | |
| Q2 - Base | 100 mV | |
| Q2 - Collector | 3.0 v | |

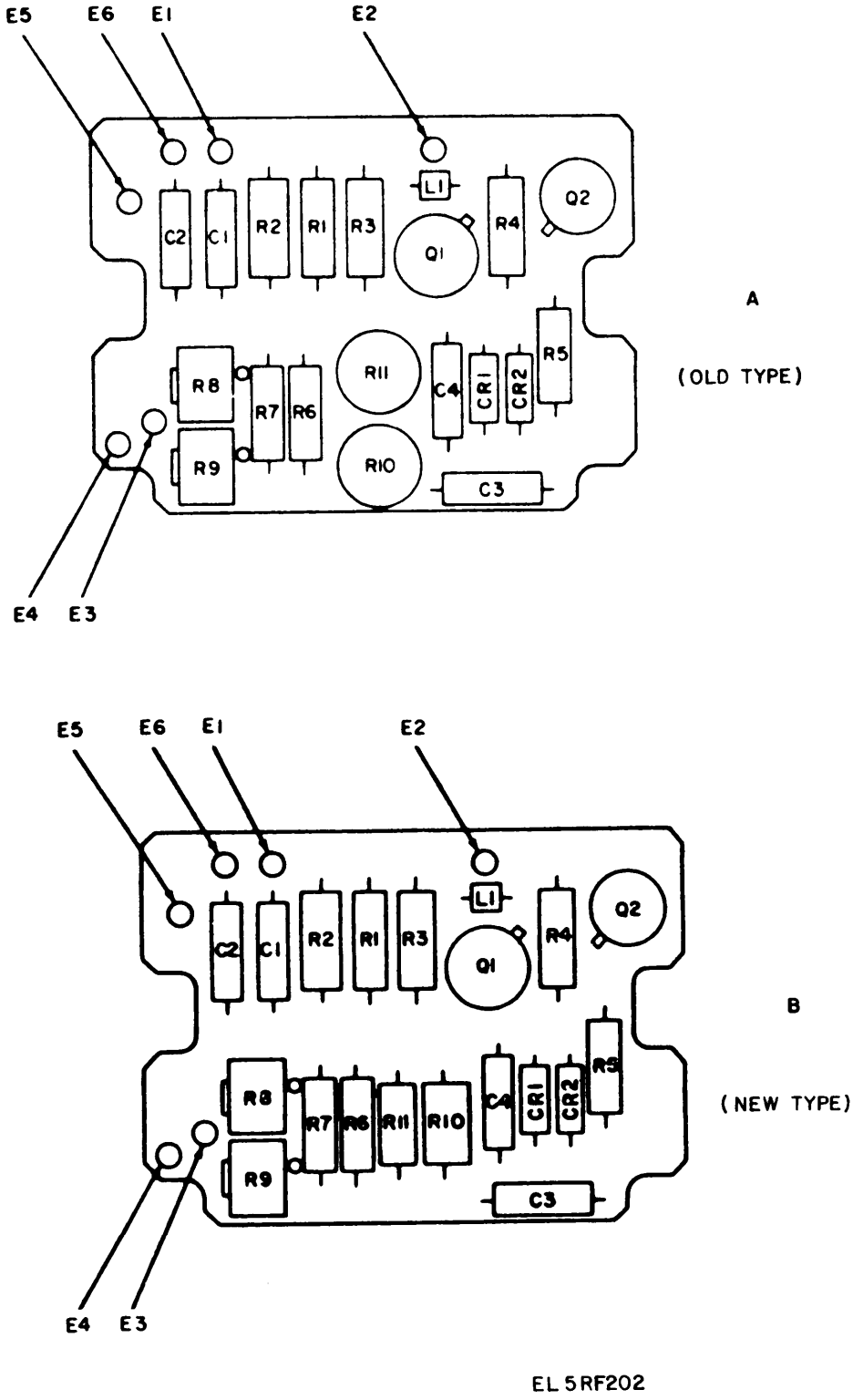



*Figure 3-59. Video Monitor 1RE1AR1A2, Parts Location.*

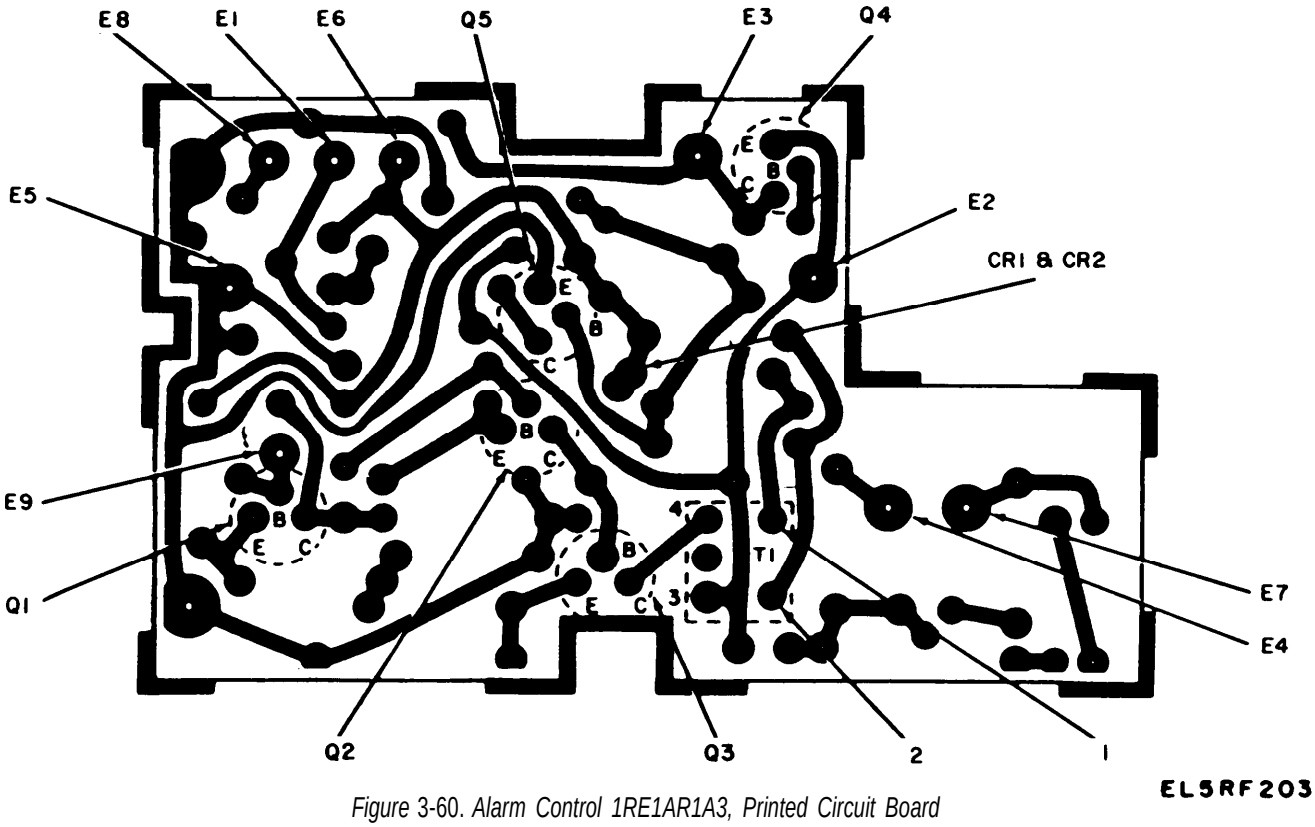



*Figure 3-60. Alarm Control 1RE1AR1A3, Printed Circuit Board*

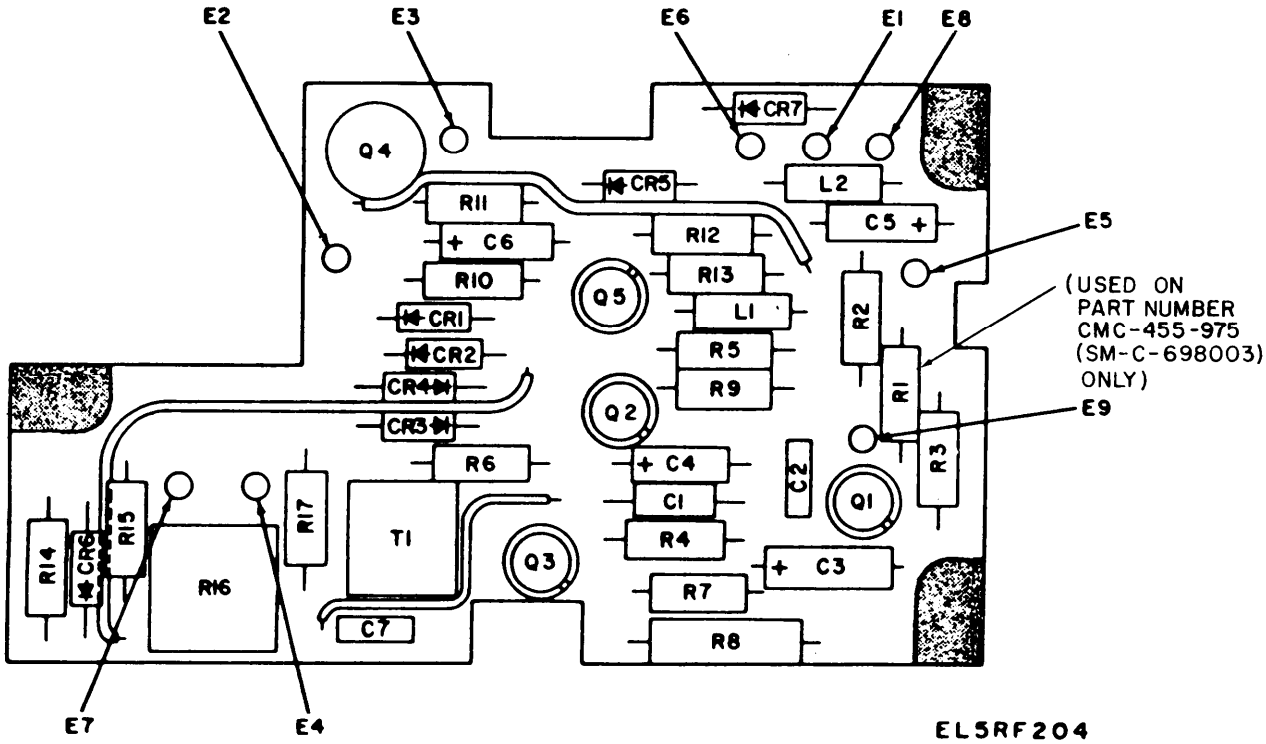



*Figure 3-61. Alarm Control 1RE1AR1A3, Parts Location.*

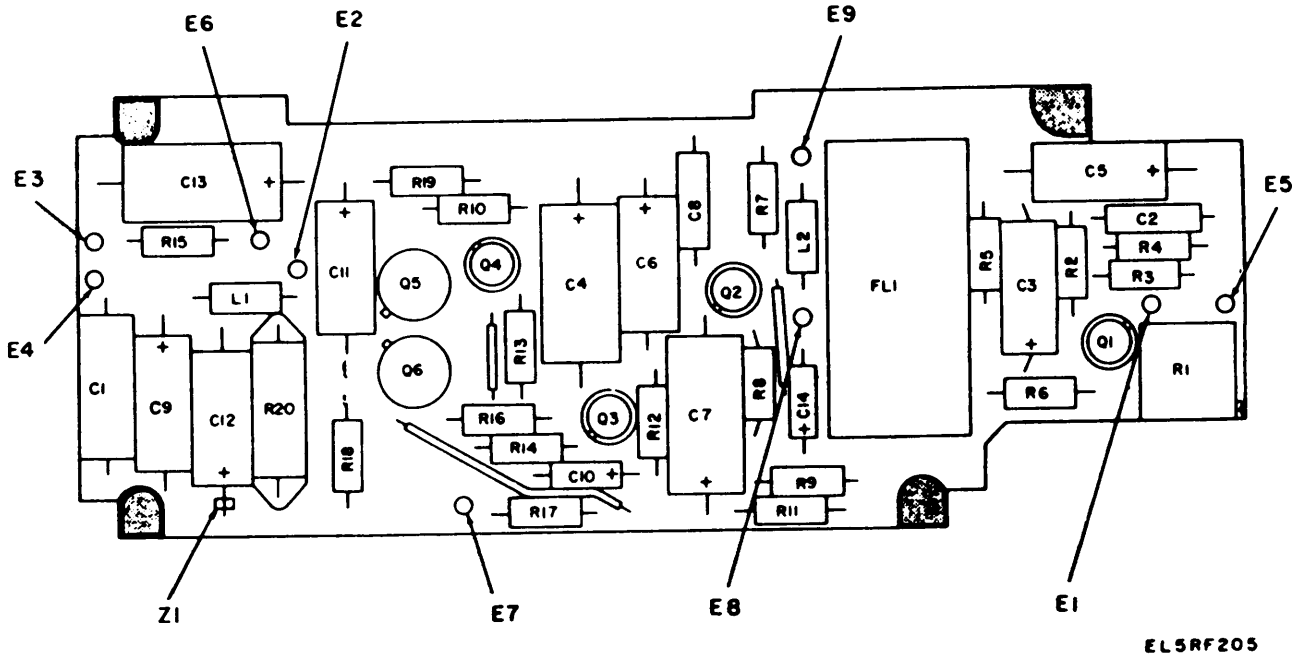



*Figure 3-62. Video Amplifier 1RE1AR1AR1, Parts Location*

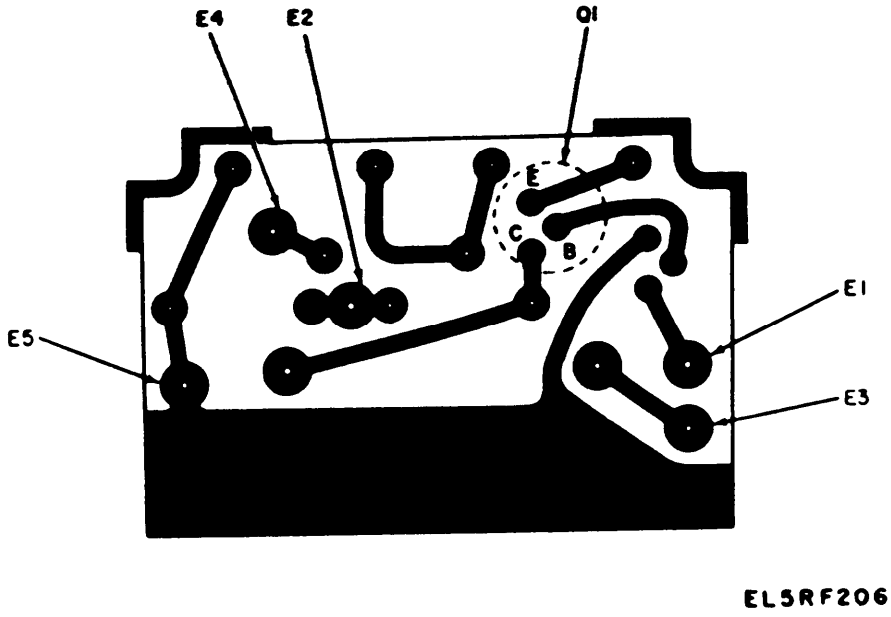



*Figure 3-63. High Pass Filter 1RE1AR1FL1, Printed Circuit Board.*

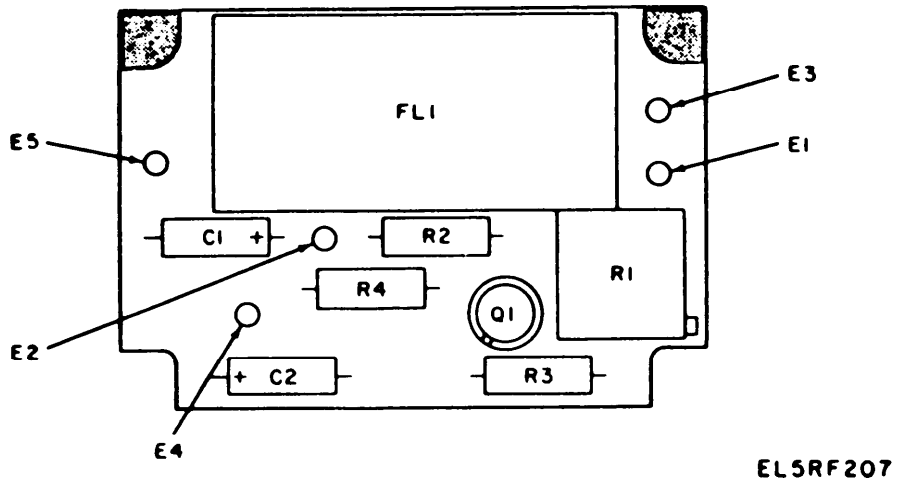



*Figure 3-64. High Pass Filter 1RE1AR1FL1, Parts Location.*

| *Test points* | *Typical indication (Vrms unless otherwise stated)* | *Remarks* |
|---|---|---|
| *Q3* - Collector | 3.62 V | |
| Q3 - Emitter | 2.9 V | |
| T1 pin 1 to pin 2 | 1.35 | Alarm on |
| Q5 - Base | –0.6 Vdc | Alarm off |
| | +0.7 Vdc | Alarm on |
| Q5 - Collector | +11.7 Vdc | Alarm off |
| | +0.55 Vdc | Alarm on |
| Q4 - Base | +11.7 Vdc | Alarm off |
| | +11.2 Vdc | Alarm on |
| Q4 - Collector | 0v | Alarm off |
| | +12.0 Vdc | Alarm on |

(2) *Resistance measurements.*

NOTE

All resistances are measured in k Ω with allocated multimeter except where otherwise stated.

| Assembly | Transistor Ref. | Type | Base (–) to Emitter (+) Res. (k Ω) | Multimeter range (k Ω) | Base (–) to Collector (+) Res. (k Ω) | Multimeter range (k Ω) | Base (+) to Emitter (–) Res. (k Ω) | Multimeter range (k Ω) | Base (+) to Collector (–) Res. (k Ω) | Multimeter range (k Ω) |
|---|---|---|---|---|---|---|---|---|---|---|
| Video Amplifier 1RE1AR1AR1 | Q1 | 2N706 | 25.0 | 200 | 2.3 | 200 | 23.0 | 200 | 2.2 | 200 |
| | Q2 | 2N706 | 24.0 | 200 | 1.5 | 200 | 23.0 | 200 | 1.5 | 200 |
| | Q3 | 2N706 | 33.0 | 200 | 11.3 | 200 | 32.0 | 200 | 11.4 | 200 |
| | Q4 | 2N706 | 2.3 | 200 | 1.0 | 200 | 2.3 | 200 | 1.0 | 200 |
| | Q5 | 2N697 | ∞ | 200 | 1.3 | 200 | 63.0 | 200 | 1.3 | 200 |
| | Q6 | 2N697 | 24.0 | 200 | ∞ | 200 | 23.0 | 200 | 62.0 | 200 |
| Video Monitor 1RE1AR1A2 | Q1 | 2N697 | 10.1 | 200 | 24.0 | 200 | 10.0 | 200 | 25.0 | 200 |
| | Q2 | 2N930 | 27.0 | 200 | 3.9 | 200 | 26.5 | 200 | 3.9 | 200 |
| High Pass Filter 1RE1AR1FL1 | Q1 | 2N706 | 24.0 | 200 | 0.1 | 20 | 23.0 | 200 | 0.1 | 20 |
| Alarm Control 1RE1AR1A3 | Q1 | 2N706 | 24.0 | 200 | 1.6 | 200 | 23.0 | 200 | 1.6 | 200 |
| | Q1 | 2N706 | 38.0 | 200 | 16.0 | 200 | 38.0 | 200 | 16.0 | 200 |
| | Q3 | 2N706 | 1.6 | 200 | 1.0 | 200 | 1.5 | 200 | 1.0 | 200 |
| | Q4 | 2N1132 | 10.0 | 200 | 11.0 | 200 | 10.0 | 200 | 11.0 | 200 |
| | Q5 | 2N930 | 20.0 | 200 | 31.0 | 200 | 30.0 | 200 | 32.0 | 200 |

### 3-14. Intermediate Frequency Amplifier 1RE1AR2

a. *Test Equipment and Material Required.*

| *Equipment* | *Common name* |
|---|---|
| Test Facility Receiver TS2867(V)2/GRM-95(V)2 | Receiver test facility |
| Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2 | Accessory kit |
| Test Facility, RF Modules TS-3837(V)2/GRM-95(V)2 | Rf modules test facility |
| Wattmeter HP-435A | Power meter |
| Power Sensor HP-8481A | Power *sensor* |
| Digital Multimeter AN/USM-451 | Digital multimeter |
| Rf Voltmeter ME-426/U | Rf voltmeter |

*b. Test Procedure.*

(1) Connect the test equipment as shown in figure 3-65. Set the power supply to 115 Vac as indicated on its panel voltmeter.

(2) Set the test facility switches as follows:

| *Switch* | *Position* |
|---|---|
| S1 | ON |
| S14 | 30 MHz |
| S9 | 30 MHz |
| Attenuator AT1 | 30 dB |
| S13 | AGC |

(3) Set the 10 dB step attenuator to maximum attenuation and the 1 dB step attenuator to 10 dB.

(4) On the test facilty, set S12 to AMPL IF.

(5) Reduce the 10 dB step and 1 dB step attenuators until the power meter reads —10 dBm ±0.5 dBm. The attenuators should be set within the range of 22 to 32 dB, indicating and if. amplifier gain of between 45 dB and 55 dB.

(6) Set S14 to 29 MHz and then to 31 MHz. The power meter reading should not vary by more than 3 dB and should be within ±1.5 dB of the reading set in (5) above.

(7) Reset S14 to 30 MHz and set 10 dB step attenuator to 10 dB and 1 dB step attenuator to 0 dB. Power indication should be within the range of –1.5 dBm to –4.5 dBm.

(8) Increase the 1 dB step attenuator to 5 dB. Set the digital multimeter to 20 volt dc range and connect to pin 6 (+) and pin 3 (–) to J35 on test facility. Note the AGC voltage reading.

(9) Increase the 10 dB step attenuator to 20 dB. Measure the AGC voltage. It should have changed by more than 0.1 V.

C. *Troubleshooting. (FO-21)*

| *Symptom* | *Probable cause* | *Checks and corrective measures* |
|---|---|---|
| 1. Step b (5) and (6) above: low or no output. | a. Loss of agc voltage. | a. Set the test facility switch S13 to MAN and the AGC GAIN control to minimum (fully CCW). Check for–11 Vdc at the following points: E6 and E3 (1RE1AR2AR5) (fig. 3-66) E3 (1RE1AR2AR2) and E2 (1RE1AR2AR1). Replace the cordwood module through which age is not being passed |
| | b. One or more defective amplifier cordwood modules. | b. Set test facility attenuator AT1 to 30 dB and the AGC GAIN control to maximum (fully CW). Using rf voltmeter, check in turn the output of each cordwood module at the points indicated below with attenuator AT1 set as follows<br>*Test points* / *AT1 setting (dB)* / *Normal indication (mvrms)*<br>*E4(1RE1AR2AR1)* 30 75<br>E5(1RE1AR2AR2) 30 225<br>E4(1RE1AR2AR3) 40 350<br>E5(1RE1AR2AR5) 40 450<br>Replace the cordwood module with abnormal output indication. |
| 2. Step b (8) above: No agc action | Defective cordwood module 1RE1AR2A1. | Replace 1RE1AR2A1 and repeat test procedure b. |

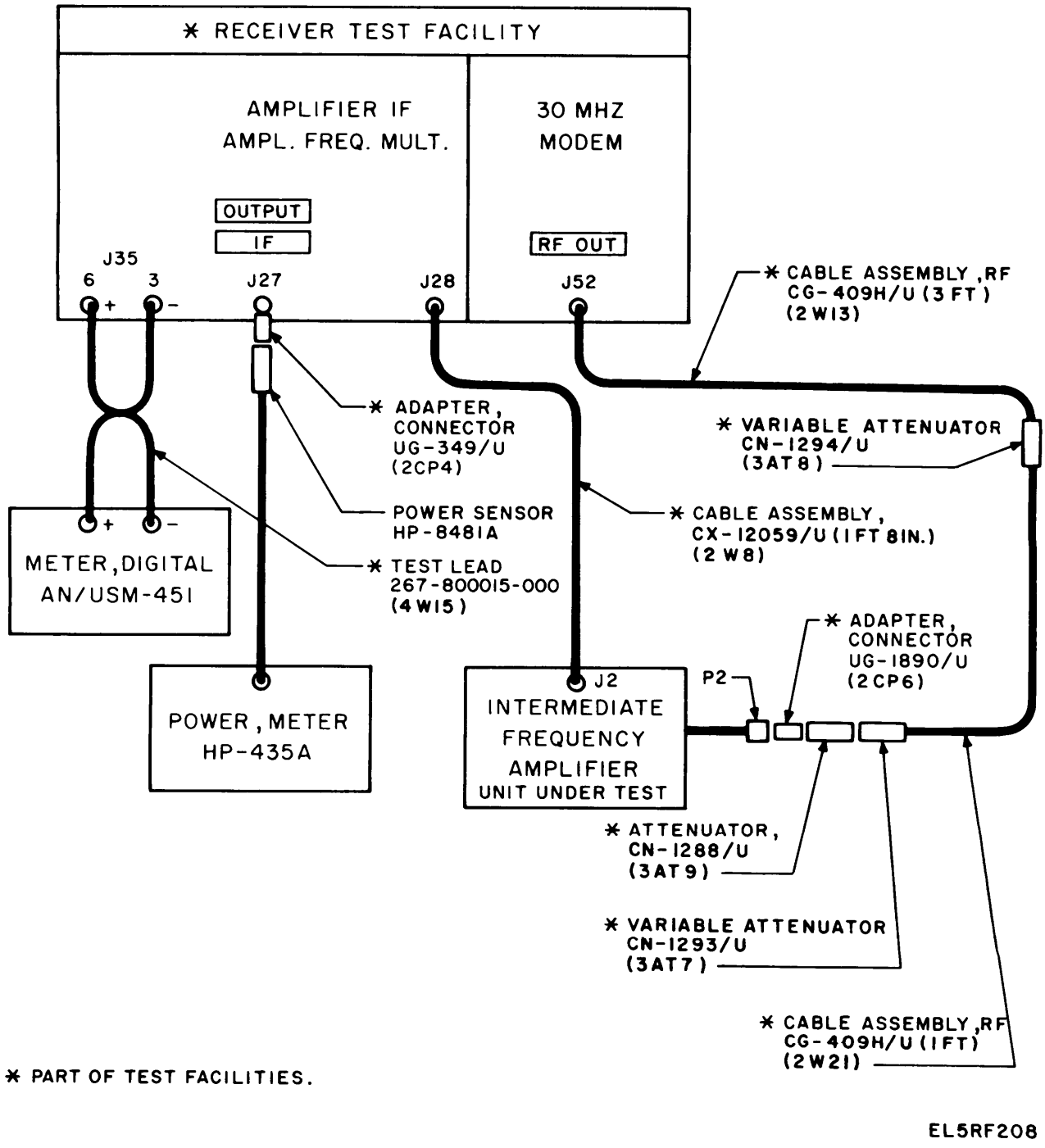



*Figure 3-65. Intermediate Frequency Amplifier 1RE1AR2, Test Setup.*

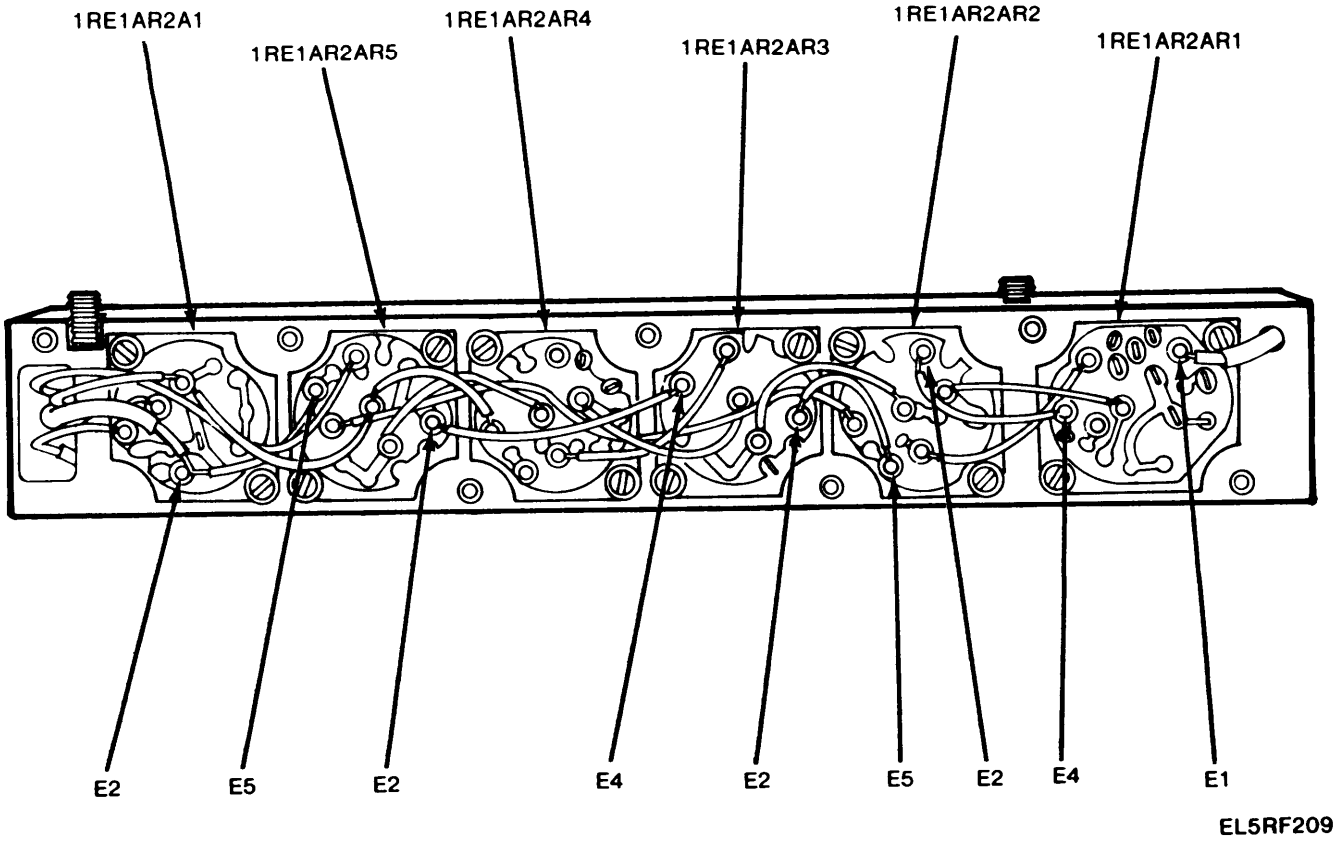



*Figure 3-66. Intermediate Frequency Amplifier 1RE1AR2, Cover Removed*

*d. Resistance Measurements.*

(1) Disconnect intermediate frequency amplifier 1RE1AR2 from the test equipment

(2) Set the digital multimeter to 200 k Ω.

(3) Measure the resistance as indicated below.

| *Test points* | *Typical resistance (k Ω)* |
|---|---|
| 1RE1AR2AR1Q1 (fig. 3-67) | |
| Emitter (+) Collector (–) | 4 |
| Base (–) Emitter (–) | 4.4 |
| Base (–) Collector | 3 |
| 1RE1AR2A1Q1 (fig. 3-68 | |
| Emitter (+) Collector (–) | 11 |
| Collector (+) Emitter (–) | 13 |
| Emitter (+) Base (–) | 12 |
| Base (+) Emitter (–) | 80 |
| Collector (+) Base (–) | 30 |
| Base (+) Collector (–) | 80 |
| *1RE1AR2AR3Q1 (fig 3-69)* | |
| Emitter (+) Collector (–) | 3 |
| Base (+) Emitter (–) | 80 |
| Base (+) Collector (–) | 80 |
| 1RE1AR2AR5Q1 (fig. 3-70) | |
| Collector (+) Emitter (–) | 3.8 |
| Emitter (+) Base (–) | 3.8 |
| Collector (+) Base (–) | 3.1 |

## 3-15. Bandpass Filter, 1RE1FL1

*a. Test Equipment Required.*

| *Equipment* | *Common name* |
|---|---|
| Test Facility, Receiver TS-2867(V)2/GRM-95(V)2 | Receiver test facility |
| Generator, Signal HP-8640B | Signal generator |
| Power Meter HP-435A | Power meter |
| Sensor, Power HP-8484A | Power sensor |
| Attenuator, Fixed CN-1286/U (2 ea.) | 10 dB attenuator (3AT4) (4AT1) |

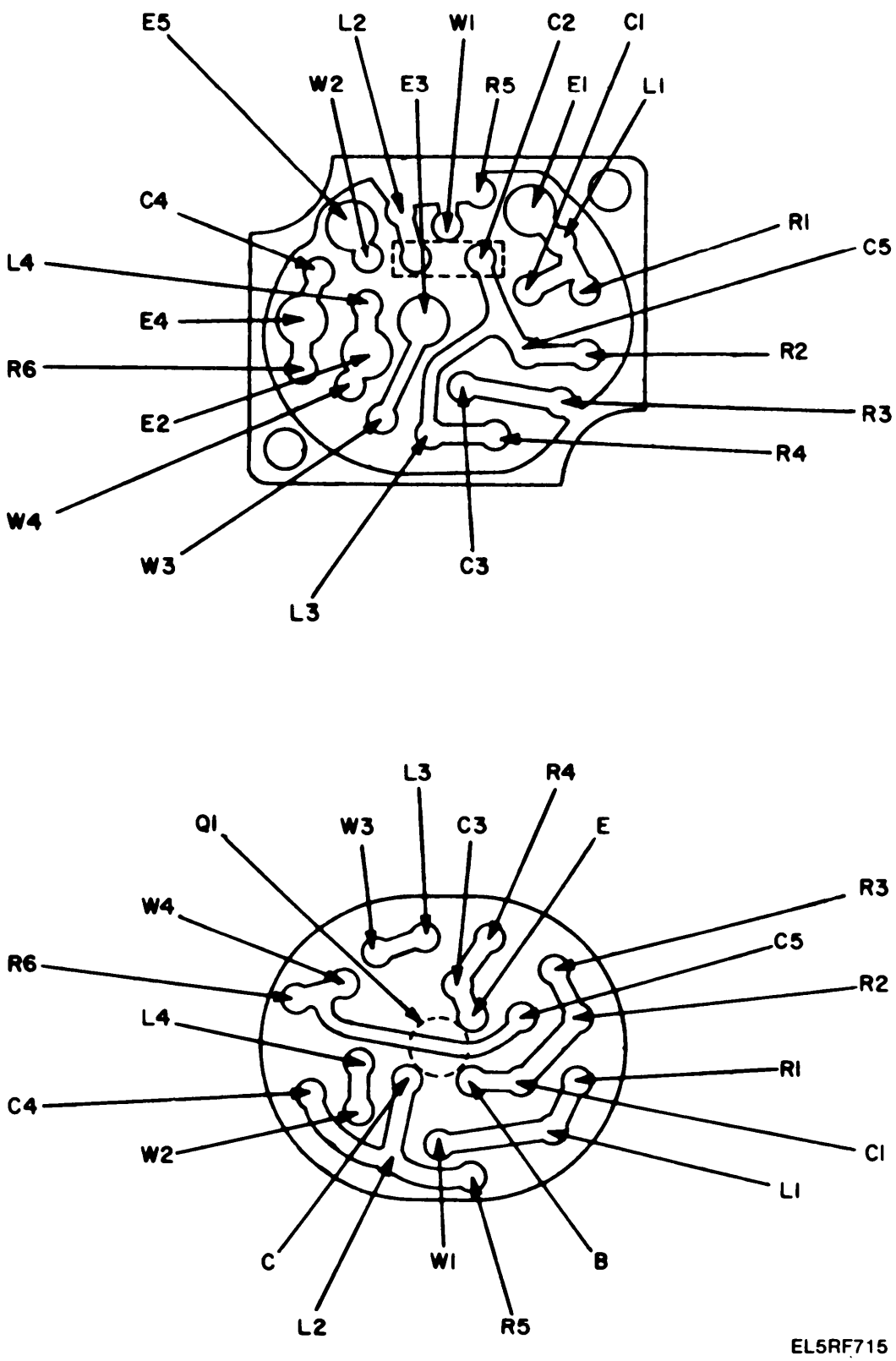



*Figure 3-67. Intermediate Frequency Amplifier 1RE1AR2AR1, Test Point Location.*

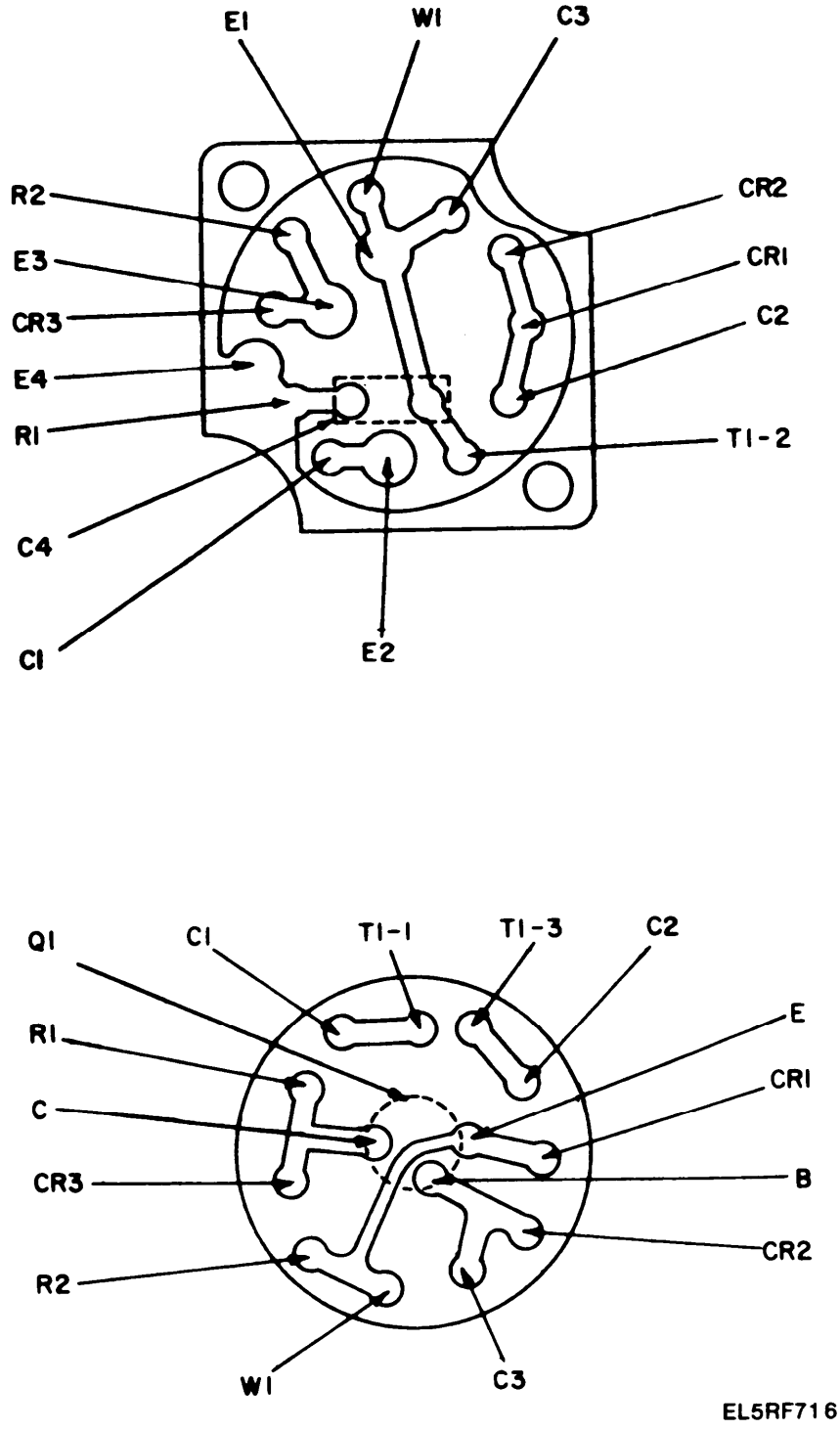



*Figure 3-68. Radio Frequency Detector 1RE1AR2A1, Test Point Location.*

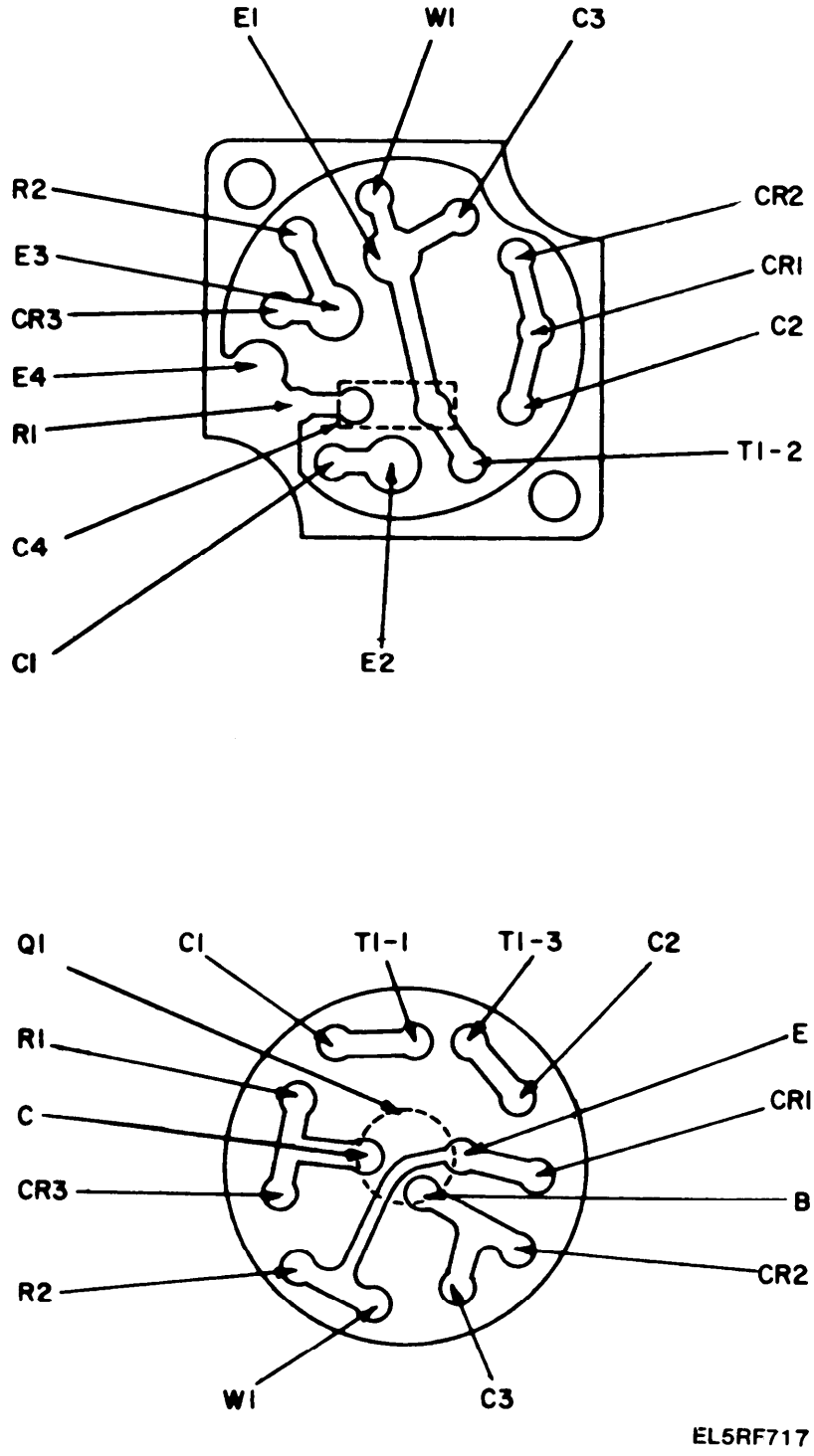



*Figure* 3-69. *Intermediate Frequency Amplifier 1RE1AR2AR3, Test Point Location.*

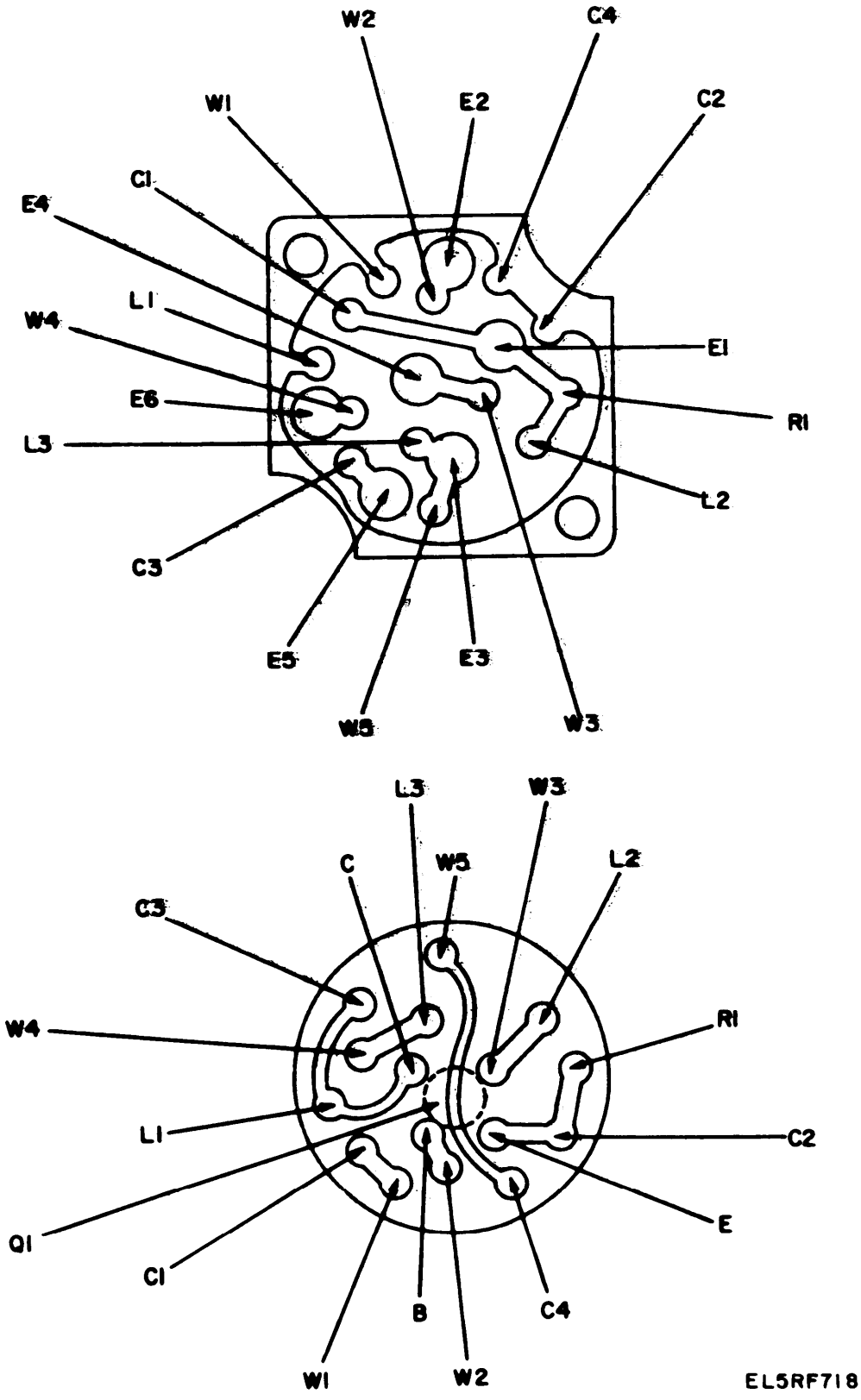



*Figure 3-70. Intermediate Frequency Amplifier 1RE1AR2AR5, Test Point Location.*

*b. Test Procedures.*

(1) Connect the test equipment as shown in A, figure 3-71.

(2) Adjust the signal generator for a CW frequency of 30 MHz, at an output level of —30 dBm as indicated on the power meter.

(3) Connect the test equipment to the UUT as shown in B, figure 3-71. Fine tune the signal generator frequency for a maximum indication on the power meter. The frequency read on the frequency counter of the signal generator shall be 30 MHz ±5O kHz. Note the frequency.

(4) The power meter shall indicate –42 dBm minimum (equivalent to a maximum insertion loss of 12 dB). Note the power meter indication.

(5) Adjust the signal generator to the frequencies listed below. Subtract the power meter indication for each frequency from the power meter indication noted in (4) above, to obtain the frequency response. The results should be within the attenuation (dB) limits specified below.

| Signal *generator frequency reference frequency ((3) above),* +/– frequency below. | *Relative attenuation (dB) from reference ((4) above).* Minimum | Maximum |
|---|---|---|
| –360 kHZ | 2.40 | 3.00 |
| +360 kHz | 2.50 | 3.10 |
| –600 kHZ | 7.00 | 8.40 |
| +600 kHZ | 7.10 | 8.50 |
| –840 kHZ | 14.00 | 18.00 |
| +840 kHz | 13.00 | 17.00 |
| –960 kHZ | 18.50 | 24.50 |
| +960 kHz | 15.50 | 21.50 |

c. *Troubleshooting.*

*If* bandpass filter 1RE1FL1 fails either the insertion loss or frequency response tests in *b.* above, replace it Dispose of the defective filter according to local regulations.

### 3-16. Receiver Case 1A2

**NOTE**

The following procedure checks the continuity and ground connections of the interconnecting cable between the receiver fixed head and the receiver rf head.

*Test Equipment and Material Required.*

| *Equipment* | *Common name* |
|---|---|
| *Test Facility Transmitter TS-2866(V)2/GRM-95(V)2* | *Transmitter test facility* |
| *Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2* | *Accessory kit* |
| Digital MultimeterAN/USM-451 | Digital multimeter |
| Extractor Tool, Cannon CET C6B | Extractor Tool |
| Insulation Tester GR 1864 | Megohmmeter |

*b. Test Procedures.*

(1) *Interconnecting wiring tests.*

*(a)* Connect the equipment as shown in A, figure 3-72. *(b)* Set transmitter test facility switches S1 and S6 to ON.

(c) Set test set S1 to positions 1 through 29. For each position of S1 rotate S2 to positions 1 through 35, the test lamp shall light whenever S2 position matches S1 position and whenever S2 is in position 30 through 35.

*(d)* Set transmitter test facility switches S1 and S6 to OFF and disconnect the test set.

(2) *Continuity tests.*

Use the DMM to perform continuity tests of the connections listed below.

| | |
|---|---|
| J9-1 to J2-C (OW) | J9-5 to J3-C |
| -2 -D | -11 -D |
| -4 -A | -10 -A |
| -5 -B | -8 -B |
| -14 -E | -9 *J7 (TMG)* |
| -8 -F | -13 J6 (PCM) |
| -8 J1-B | -12 J5 (130 Ohms) (VIDEO) |
| -8 (115 Vat) | |
| -6 -A | -12 J4 (51 Ohms) (FDM) |
| -7 -c | J5 pin to ground (68 ohms) |

(3) *Insulation test, wire to wire*

**WARNING**

HIGH VOLTAGE is accessible at the connectors and test leads of the megohmmeter. Ensure that the test switch is in the "DISCHARGE" position before handling test connections.

*(a)* Connect the test equipment as shown in B, figure 3-72.

*(b)* Set the megohmmeter controls to "measure" and "200 volts".

*(c)* Set S2 (test set) to positions 1 through 29. For each position of S2 Rotate S1 through a complete revolution.

*(d)* The megohmmeter shall indicate more than 100 megohms EXCEPT when S1 and S2 poistions match.

*(e)* Set the megohrnmeter to DISCHARGE and OFF and disconnect the test set and cables from receiver case 1A2.

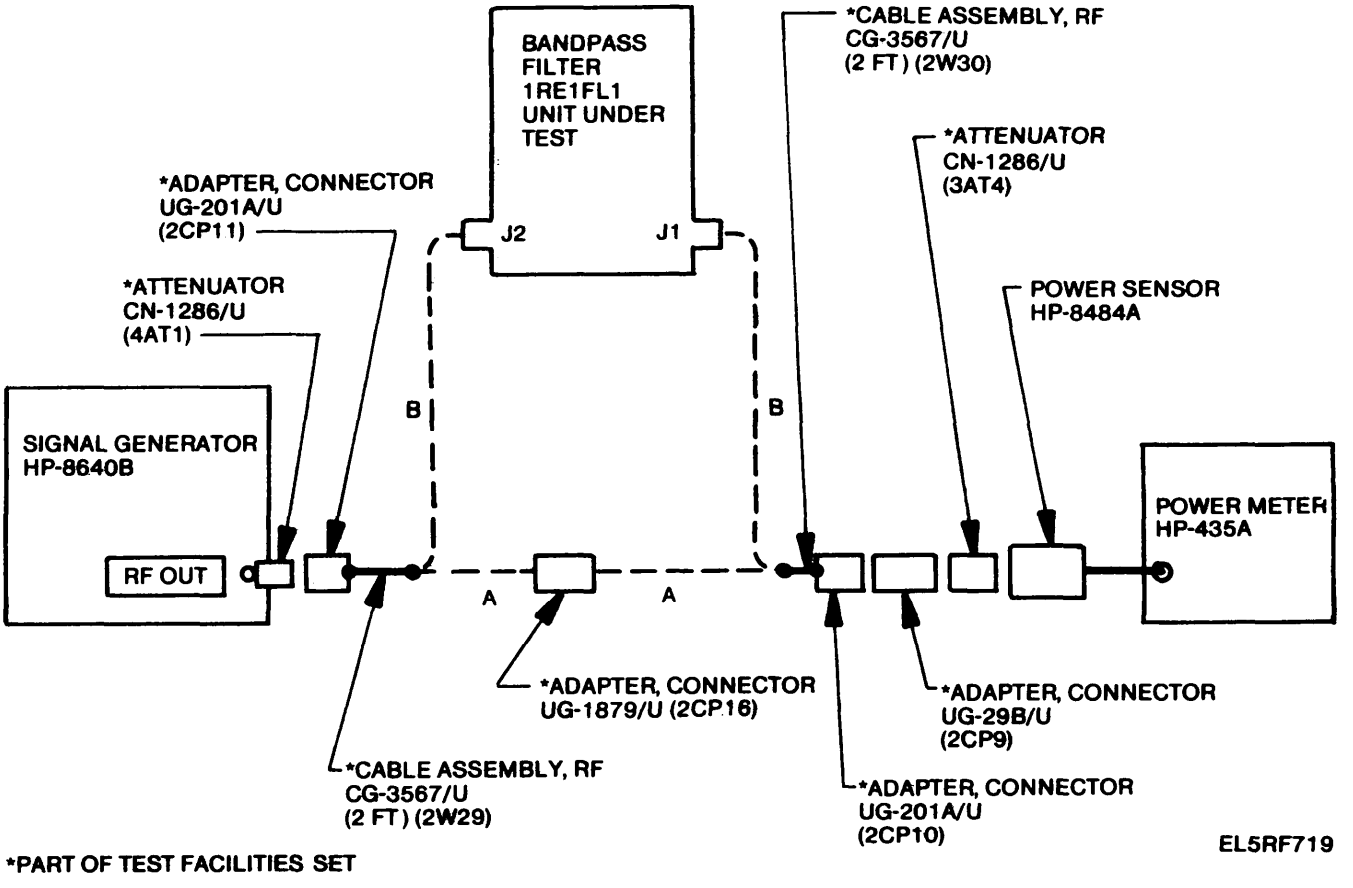



*Figure 3-71. Bandpass Filter 1RE1FL1, Insertion Loss and Frequency Response Measurement, Test Setup.*

*(f)* Connect the (+) and (GND) terminals of the megohmmeter to receiver case 1A2 with test lead CX-12044/U(1W36). Be sure that a good electrical connection is made.

(g) Connect test lead CMC 267-800020-000 (4W16) to the megohmmeter (–) terminal.

**WARNING**

When performing the following procedure, set the megohmmeter controls to ON, 200 V and MEASURE, only after making a connection. Set the megohmmeter to DISCHARGE before changing a connection.

*(h)* Use test lead to check insulation resistance between J9 pins 1 through 7,9, 10, 11, 13, 14, A1 center contact, A2 center contact and GND. The megohmmeter should indicate greater than 100 megohms for each check.

*(i)* Set the megohmmeter to OFF and disconnect the test setup.

(4) *Checking depth of connectors*

*(a)* Use Fixed depth Gage TL-776 to check the proper depth of connectors J7 and J8. With the top of the gage resting on the front edges of the case, the bottom of the gage should barely touch the connectors. Install locally manufactured shims under the retaining plate when this cannot be attained.

*(b)* Use Fixed Depth Gage TL-767 to check the proper depth of connector J10. With the top of the gage resting on the front edges of the case, the bottom of the gage should barely touch the mounting flanges of J10. Install washers between the flange and the case when this cannot be attained.

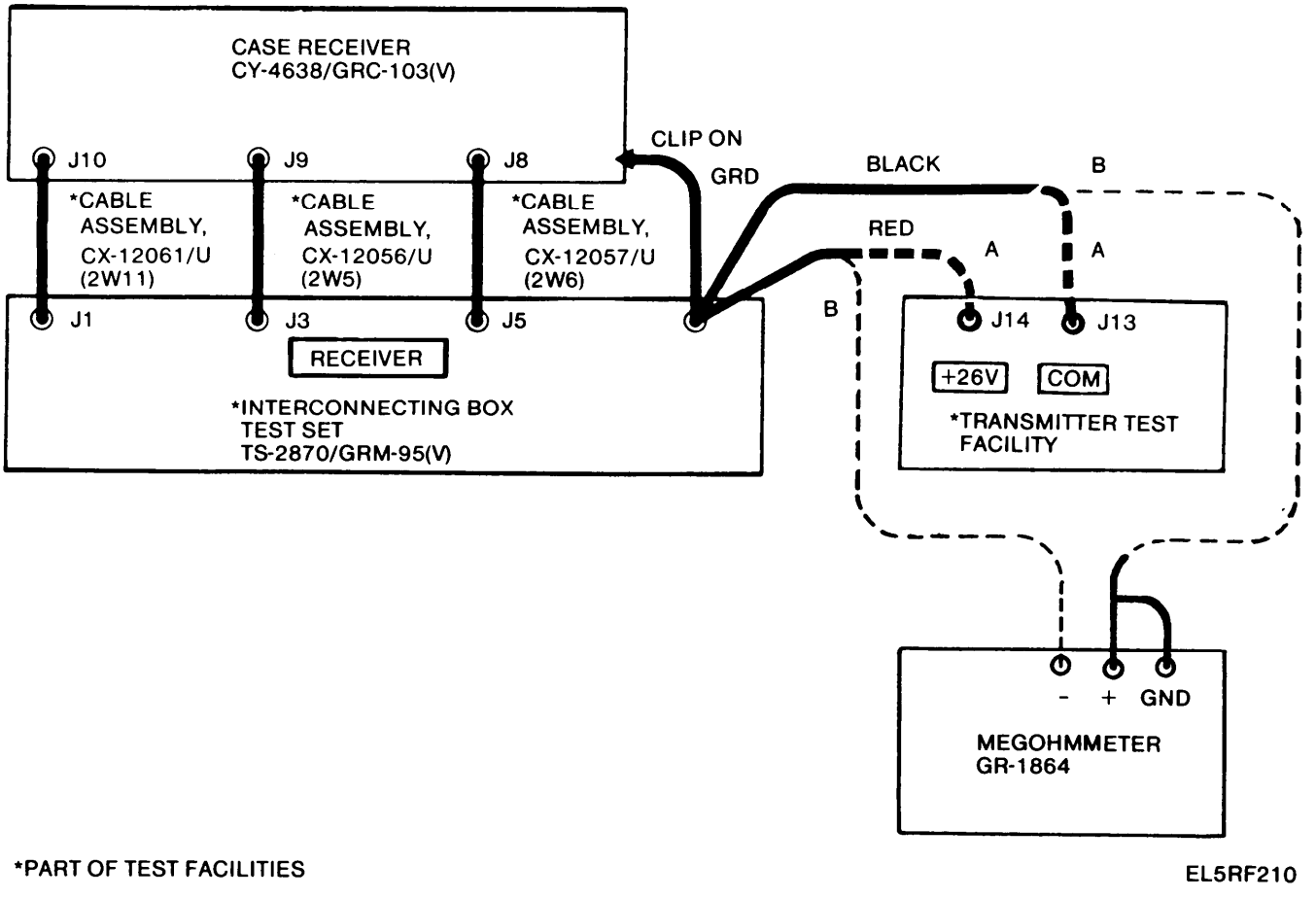



*Figure 3-72. Reciever Case Continuity Check, Test Setup.*

*c. Repairs.*

If an abnormal indication is obtained in the test above, remove the distribution box and cable assembly as described in paragraph 2-25. Refer to FO-1 or FO-2, as applicable, and schematic for interconnecting box test set TS-2870/GRM-95(V) (TM 11-6625-1696-14) to identify faulty connections. Refer to FO-1 or FO-2, as applicable, and paragraph 2-10 for replacement of connectors. To remove rf connectors A1 and A2 of 1A2A1J9, extractor tool Cannon CET C6B is required. Insulation test failures may be caused by contaminants in the cabling and connectors. Thoroughly clean and dry the distribution box, cables, and connectors and retest.

## Section II. TRANSMITTER RADIO FIXED HEAD (TRANSMITTER, RADIO T-983 (P)/GRC-103(v), T-983A(P)/GRC-103(V), OR T-983B(P)/GRC-103(V))

**NOTE**

Reference is to both units unless otherwise specified in the test.

3-17. Transmitter, Radio T-983(P)/GRC-103(V), T-983A(P)/GRC-103(V) or T-983B(P)/GRC-103(V)

*a. Test Equipment and Material Required.*

| *Equipment* | *Common name* |
|---|---|
| Test Facility, Transmitter TS-2866(V)2/GRM-95(V)2 | Transmitter test facility |
| Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2 | Accessory kit |
| Selective Voltmeter TS-3066(V)3/U | Level meter |
| Distortion Analyzer AN/URM-184A | Distortion analyzer |
| Voltmeter, Electronic ME-459/U | VTVM |
| Generator, Signal HP 8640B | Signal generator |
| Generator, Signal AN/USM-205A | Wide range oscillator |
| Counter, Electronic, Digital Readout TD-1225(V)1/U | Counter |
| Digital Multimeter AN/USM-451 | Digital multimeter |
| Wattmeter HP-435A | Power meter |
| Power sensor HP-8481A | Power sensor |

*b. Test Procedure.*

(1) *Operational check.*

*(a)* Perform the following preliminary tests.

*1.* Test electrical frequency synthesizer 5TR1A2 as described in paragraph 3-21 *b.* (7) (SM-D-698145) or paragraph 3-22 *b.* (7) (SM-D-865030). Refer to TM 1-5820-540-30 for synthesizer removal and replacement instructions.

2. Test amplifier monitor 5TR1A5 as described in paragraph 3-25. Refer to TM 11-5820-540-12 for removal and replacement instructions.

3. Test power supply 5TR1PS1 as described in paragraph 3-26. Refer to TM 11-5820-540-30 for removal and replacement instructions.

**NOTE**

Position the air outlet so that the air flow is directed over the power supply heat sink.

*(b)* Connect the test equipment as shown in& figure 3-73. Set PP-6304 to ON and 115 Vat. Maintain this voltage unless otherwise noted. Set test facility switches as follows:

| *Switch* | *Position* |
|---|---|
| S1 | ON |
| S20 | S21 |
| S21 | +28 V |
| PWR ALM SET LEVEL | Fully CCW |

*(c)* Switch on the unit under test and check for the following:

*1.* AC POWER lamp should light.

*2.* LOW POWER lamp should light.

*3.* Set S17 to ON and S18 to 58.25. SYNC lamp may light and should go out within 10 seconds.

*4.* Buzzer should sound. If buzzer doesn't sound, push BUZZER OFF button. If buzzer still does not sound, check setting of BUZ OFF/ALM NOR switch.

*(d)* Press S24 on the test facility. The OVERHEAT alarm lamp on the unit under test should light.

*(e)* On the unit under test, set the BUZZER OFF/ALARM NORMAL switch (mounted on rear of control panel) to the BUZZER OFF position. The buzzer should be silent and all alarm lights should dim.

*(f)* Return the switch to ALARM NORMAL. The buzzer should sound and alarm lamps brighten.

*(g)* Press the BUZZER OFF button on the unit under test to silence the buzzer.

*(h)* Set test facility switch S22 to TEST. The digital multimeter should indicate 14 Vac +1.4 V. Release S22.

*(i)* Connect the counter to connectors J24 and J29 as shown in C, figure 3-73.

*(j)* Set test facility switch S22 to TEST. The counter should indicate 400 Hz ±40 Hz. Release S22.

*(k)* Set switch *S21* to OFF. Press and hold S23. Set S21 to +600 V. Test facility meter Ml should indicate in the green band.

*(l)* Connect the test equipment as shown in figure B, figure 3-73.

*(m)* Set the wide range oscillator to 10 kHz at a level of 705 mvrms as indicated on the VTVM.

*(n)* Check the metering on the unit under test.

*(o)* Indications should be as shown in chart below.

| *Meter position* | Indication |
|---|---|
| 12 Vdc | Within green band |
| 28 Vdc | Within green band |
| OSC | Between 20 and 90 percent of full scale |
| DOUBLER | Between 20 and 90 percent of full scale |
| MULT | Zero |
| DRIVER | Zero |
| PWR OUT | Zero |
| REFL PWR | Zero |
| 12 CHPCM | Within green band using INPUT control on unit under test. |
| 24 CHPCM | As above. |
| FDM | As above. |

**NOTE**

If abnormal indications are obtained in any of the above tests, carry out the trouble-shooting procedures (c below).

(2) *Deviation check.*

*(a)* Connect the test equipment as shown in B, figure 3-73.

*(b)* Set the signal generator frequency to 146.50 MHz and the wide range oscillator to 10 kHz at 705 mvrms.

*(c)* Set test facility switch S20 to the 30 MHz DISCR position.

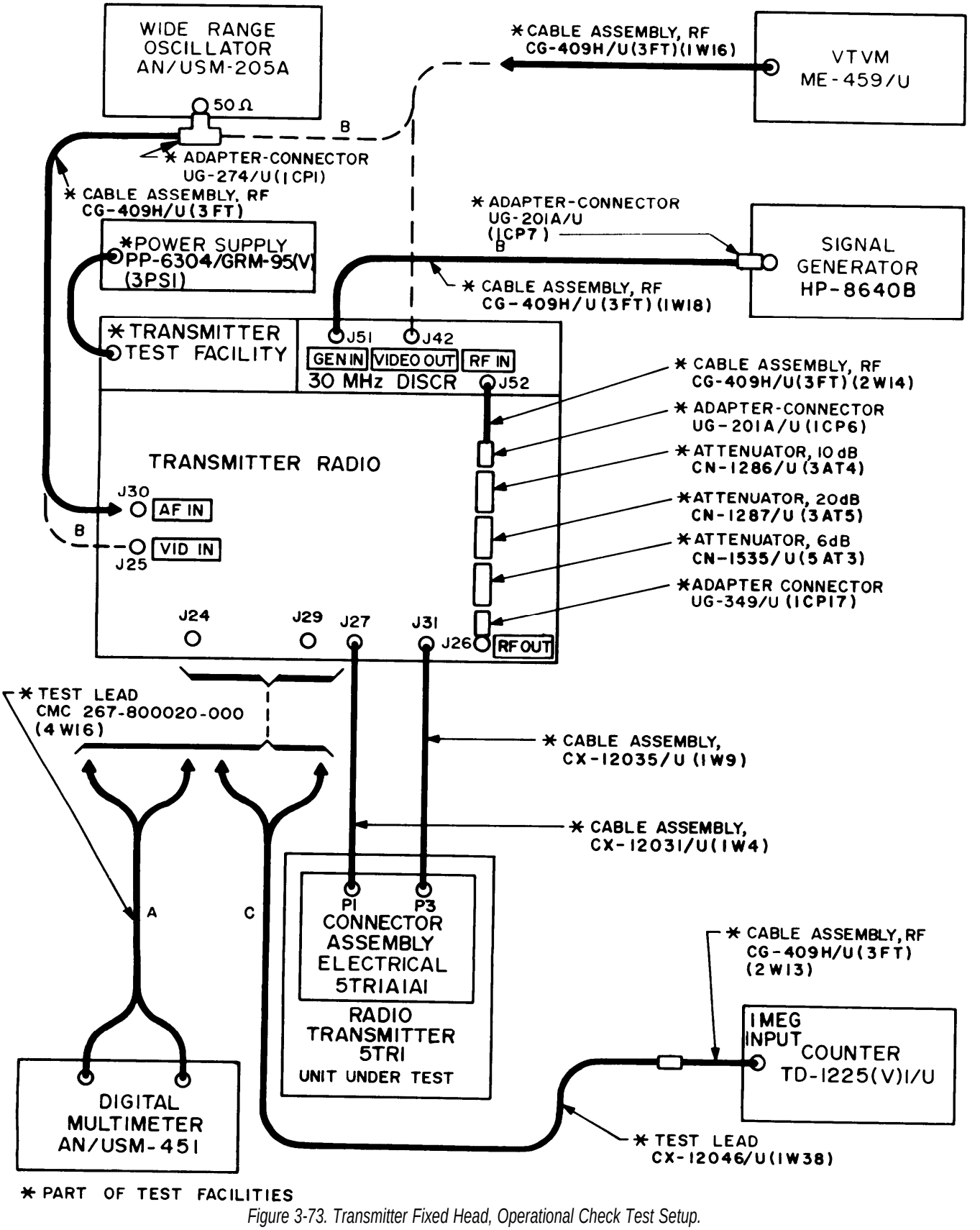



*Figure 3-73. Transmitter Fixed Head, Operational Check Test Setup.*

*(d)* Adjust the signal generator output level for an indication of 50 percent of full scale on test facility meter MI.

*(e)* Adjust the signal generator frequency until test facility meter M2 indicates zero (at center). Recheck the signal level on Ml. If necessary readjust the output level of the signal generator for a 50 percent of full scale indication.

*(f)* Set test facility switch S21 to O dB position.

*(g)* On the unit under test, set the meter selector switch to 24 CH PCM and adjust the INPUT control so that meter indicates exactly 50% full scale deflection.

*(h)* Connect the VTVM to J42 on the test facility. The VTVM should indicate between 130 and 193 mVrms.

*(j)* Tune the wide range oscillator to 1.0 kHz and set the meter switch on the unit under test to FDM position.

*(k)* On the unit under test, adjust the INPUT control so that the meter indicates exactely 50% full scale deflection. The VTVM should indicate between 33 and 48 mVrms.

(1) Connect the wide range oscillator to J30 AF IN connector to the transmitter test facility and the VTVM to the UG274/U connector at the output of the wide range oscillator.

*(m)* Set the wide range oscillator to 1.0 kHz and adjust its output level to 245 mVrms (– 10 dBm into 600 Ω, ) indicated on the 600 Ω scale of the VTVM.

*(n)* Connect the VTVM to connector J42; the VTVM should indicate between 19 and 29 mVrms.

**NOTE**

If due to residual fm on the unit under test the deviation cannot be measured accurately, increase the level of the test signal to +2.0 dBrn. This should give and indication of between 76 and 116 mVrms at J42.

*(o)* If the results in *(h), (i), (k), and(n)* above are not as specified, check electrical frequency synthesizer 5TR1A2 (para. 3-21).

*(3) Deviation attenuator check.*

*(a)* Using the test setup shown in B, figure 3-73, connect the wide range oscillator to VID IN connector J25 on the test facility.

*(b)* Set the wide range oscillator to 10 kHz at a level 705 mVrms.

*(c)* On the unit under test set the INPUT control to obtain a 200 mVrrns indication on the VTVM connected to connector J42.

*(d)* Check the remaining positions of switch S21 as shown in the chart below.

| *Test Facility switch positions* S18 | S21 | *VTVM indication (Millivolts rms)* |
|---|---|---|
| *58.25* | *6 dB* | *100 ±3* |
| *58.25* | *12 dB* | *50 ±2* |
| 61.66* | 3.5 dB | 133±11 |
| 61.66* | 9.5 dB | 67 ±6 |

*Set the signal generator to 153.333 MHz using procedure described in (2)(d) and (e) above and repeat steps (3)(a) through (c).

(4) *Power output and frequency check.*

*(a)* Readjust signal generator as in (2) (d) and (e) above. Connect the test equipment as shown in figure 3-74.

*(b)* Set switch S21 to the +28 V position and S17 to ON. The power meter connected at J26 should indicate not less than +4 dBm for all positions of test facility switch S18.

*(c)* On the unit under test, check the meter indication at the OSC and DOUBLER positions for all positions of switch S18. The meter should indicate between 20 and 90 percent of full scale deflection.

*(d)* Replace the power meter at connector J26 with the counter.

*(e)* Check the frequency at all positions of switch S18. The indications should be as shown in the chart below.

| *S18 position* | *Frequency (MHz ±0.001%)* T-983(P) | *T-983A(P)* or T-983B(P) |
|---|---|---|
| 47.50 | 95.000000 | 95.000000 |
| 48.33 | 96.666666 | 96.687500 |
| 50.65 | 101.312500 | 101.312500 |
| 52.31 | 104.625000 | 104.656250 |
| 54.98 | 109.958330 | 109.958330 |
| 58.25 | 116.500000 | 116.531250 |
| 61.66 | 123.333330 | 123.333333 |
| 63.46 | 126.937500 | 126.968750 |
| 66.00 | 132.000000 | 132.000000 |
| 67.50 | 135.000000 | 135.020834 |
| 72.50 | 145.000000 | 145.000000 |

*(5) Low power alarm check.*

*(a)* Connect the test equipment as shown in figure 3-75.

*(b)* Rotate the PWR ALM SET LEVEL control on the test facility until the LOW POWER alarm lamp on the unit under test goes out The digital voltmeter should indicate 130 mV ±20 mV.

*(c)* Rotate the PWR ALM SET LEVEL control on the test facility until the LOW POWER alarm lamp on the unit under test lights. The digital voltmeter should indicate 80 mV ±5 mV.

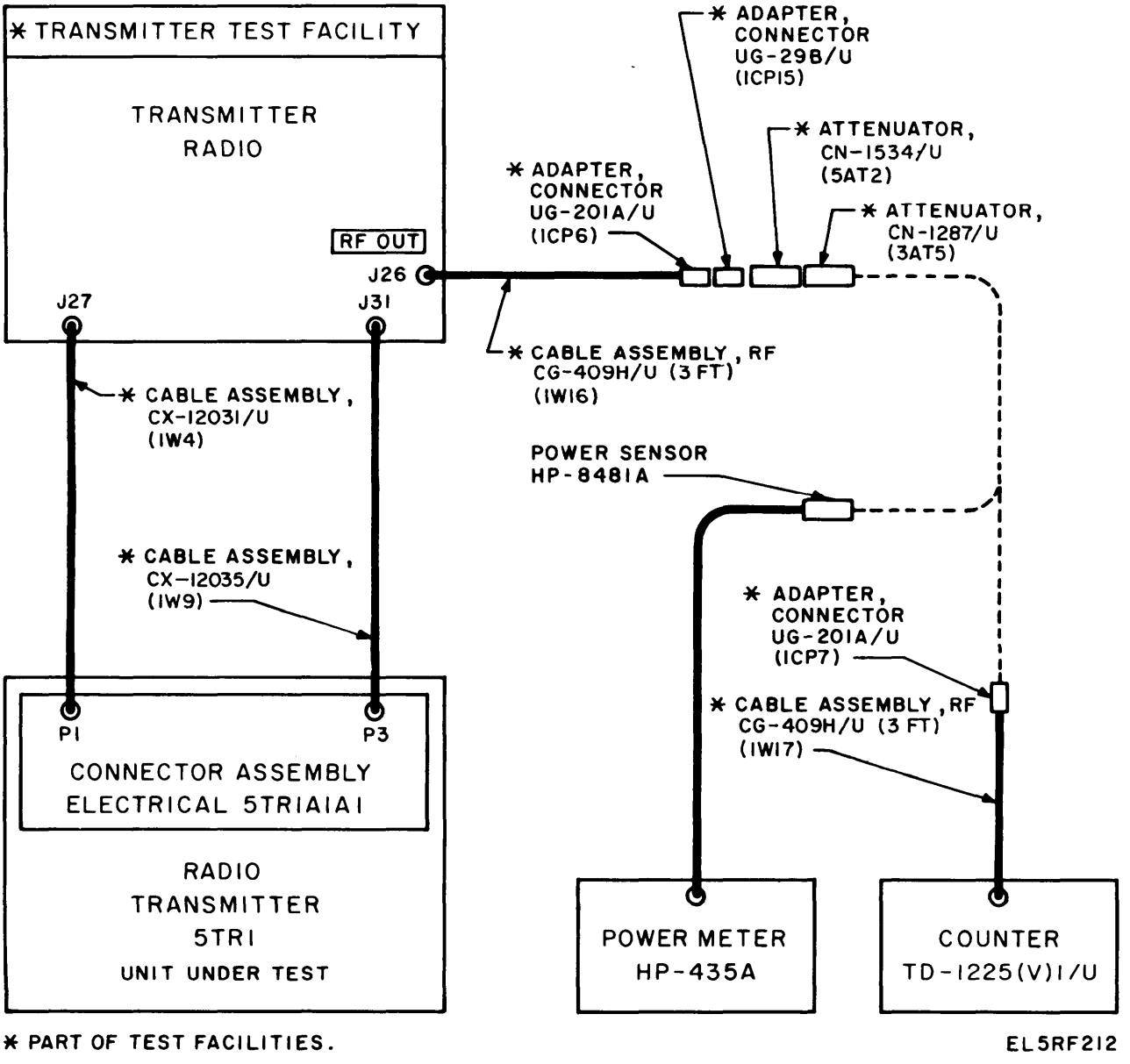



*Figure 3-74. Transmitter Fixed Head Power Output and Frequency Check, Test Setup.*

(6) *Video frequency response testing.*

*(a)* Connect the test equipment as shown in A, figure 3-76.

*(b)* Set the coaxial switch to position 2.

*(c) Set* S21 to +28 V and S20 to 30 MHz DISCR. Set unit under test power to ON. Set S17 to ON and S18 to 58.25.

*(d)* Tune the signal generator to 146.5 MHz and adjust the output level for a 50 percent of full scale indication on test facility meter M1.

*(e)* Adjust the signal generator frequency until test facility meter M2 indicates zero (at center). Recheck the signal level on M1; if necessary readjust the output level of the signal generator for a 50 percent of full scale indication

*(f)* On the unit under test, set the metering switch to the 12 CHPCM position.

*(g)* On the unit under test, set the INPUT control to midrange.

*(h)* Tune the wide range oscillator to 10 kHz and adjust the output level for a 25 percent of full scale indication on the meter of the unit under test

*(i)* Check the signal-to-noise ratio as described below.

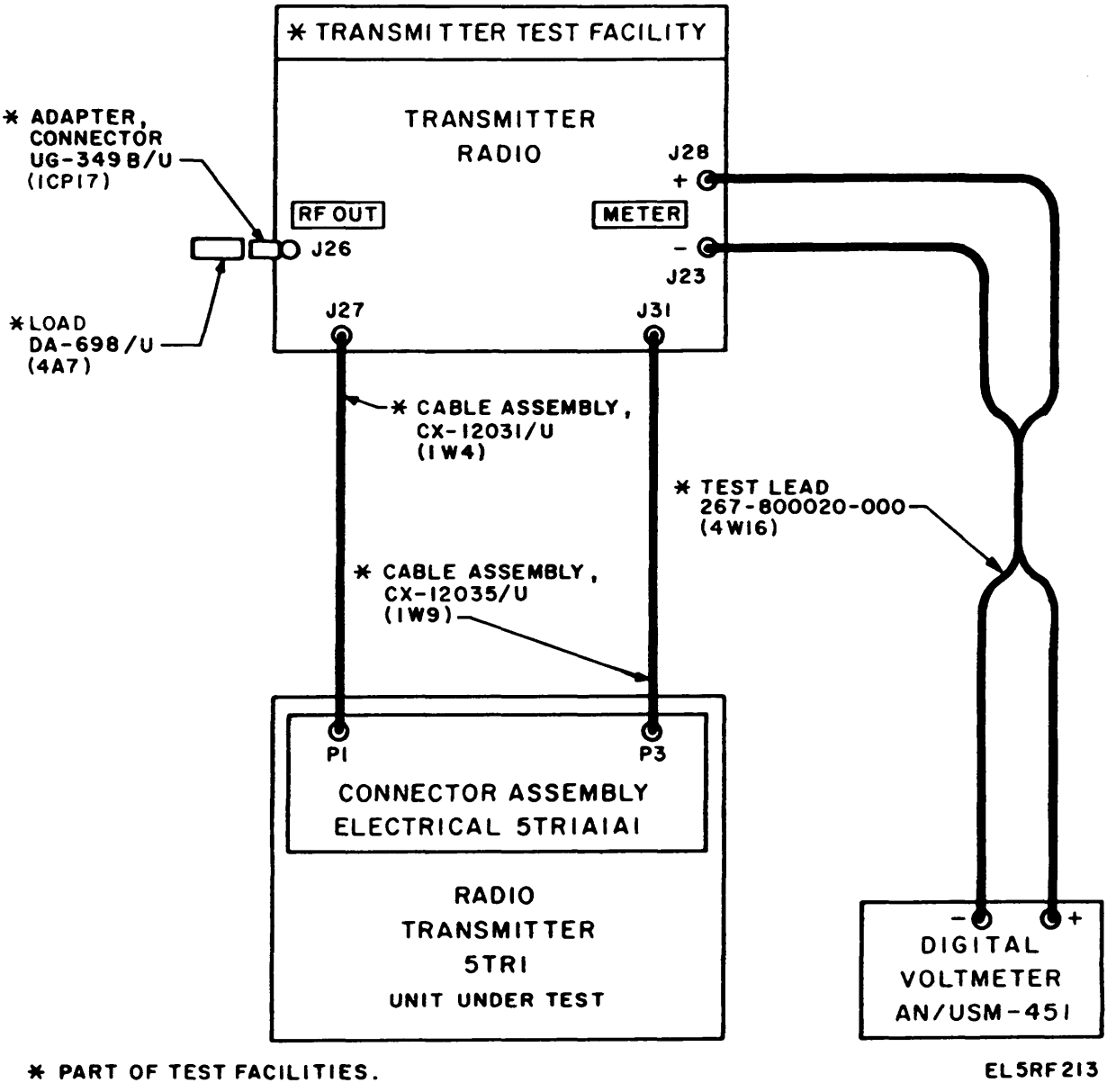



*Figure 3-75. TransmitterFixed Head Low Power Alarm Check, Test Setup.*

*1.* Tune the wide range oscillator to 960 kHz.

2. Adjust the level meter to 960 kHz and record the indication.

3. Disconnect the wide range oscillator and increase the gain of the level meter by 20 dB. The indication should not excced that obtained in 2 above.

**NOTE**

During the following test do not disturb the INPUT control on the unit under test.

*(j)* Tune the wide range oscillator to 10 kHz as read on the counter.

*(k)* Adjust the level meter to 10 kHz and record the indication Use unbalanced 50 Ωinput

*(l)* Set the coaxial switch to position 1.

*(m)* Adjust the variable attenuators to obtain the same indication as that obtained in *(k)* above. Record the attenuator settings. This is the reference level.

*(n)* Set the coaxial switch to position 2.

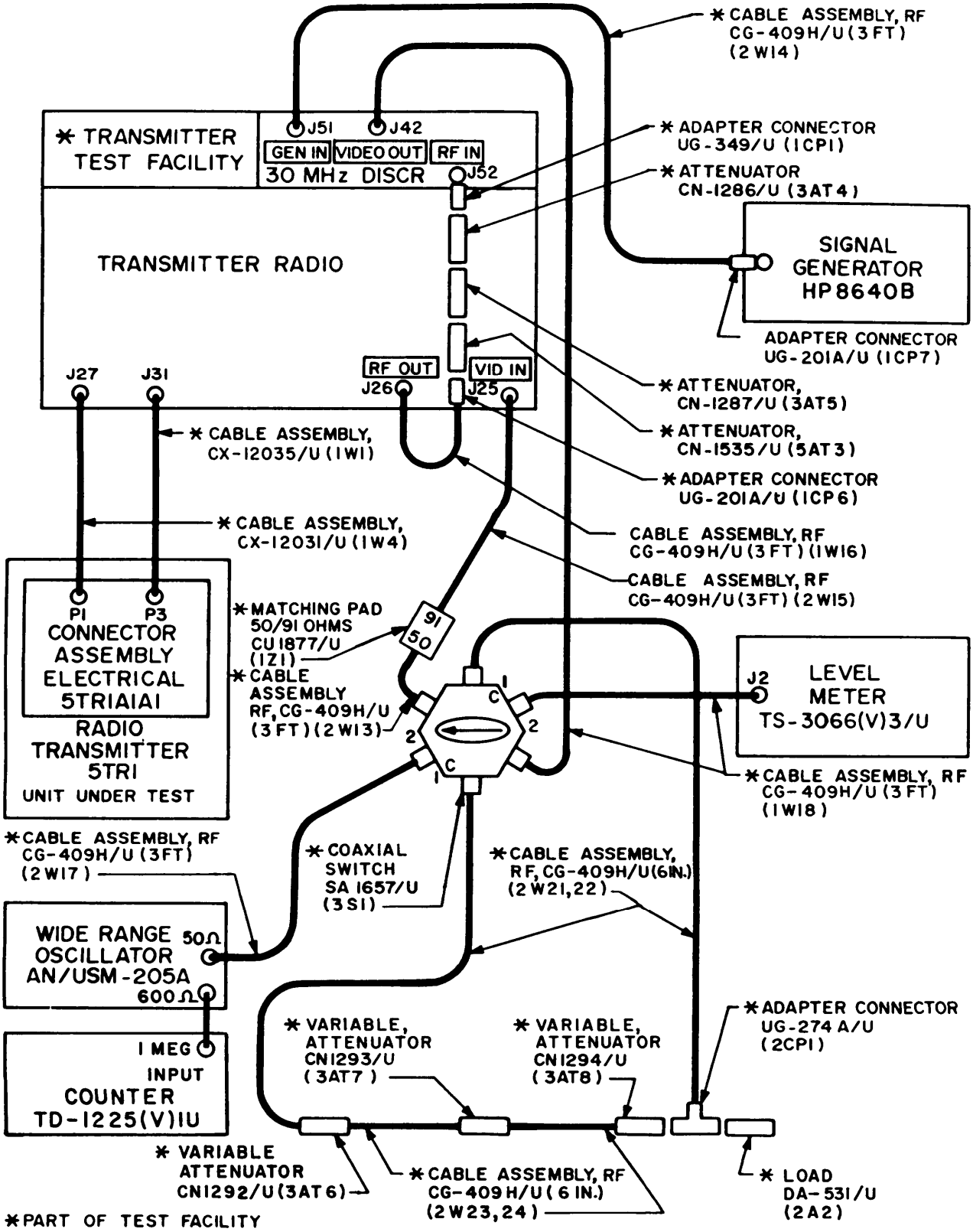



*Figure 3-76. Transmitter Fixed Head Video Frequency Response Check, Test Setup.*

*(o)* Repeat *(j)* through *(n)* above for all frequenties above 10 kHz listed in the chart below. Add the frequency response dB correction for 30 MHz DISCR to the atennuation and record the attenuation with respect to the reference level; it should be as listed in the chart below.

| *Frequency (kHz)* | *Relative attenuation (dB), reference attenuation at 10* kH2 *Nominal* | *Minimum* | *Maximum* |
|---|---|---|---|
| 10 | 0 | 0 | 0 |
| 30 | 0 | -0.1 | 0.2 |
| *60* | 0 | –0.1 | 0.3 |
| 120 | 0.15 | 0 | 0.5 |
| 240 | 0.6 | 0.3 | 1.2 |
| 360 | 1.3 | 0.8 | 2.2 |
| 480 | 2.3 | 1.55 | 3.5 |
| 600 | 3.6 | 2.6 | 5.0 |
| 720 | 5.2 | 4.0 | 7.0 |
| 840 | 7 | 5.7 | 9.0 |
| 960 | 9.2 | 7.8 | 12.0 |

c. *Troubleshooting.*

| *Symptom* | *Probable cause* | *Checks and corrective measures* |
|---|---|---|
| With a signal in at VIDEO connector, no meter indication is obtained when the metering switch is set to 12 CH PCM, 24 CH PCM or FDM. | Defective R1 or R2 resistors on monitor panel 5TR1A1. | Check R1 and R2 (FO-5) replace if necessary. |
| | Defective wiring | Set the INPUT control fully counterclockwise and check for continuity between P1 pin 10 of 5TR1A1 and J2 pin 17 of 5TR1A1. |
| No meter indication with the switch in any position other indications (lamps, buzzer) are normal | Defective meter on the monitor panel 5TR1A1. | Set the metering switch +12 V position and measure the voltage across meter terminals; it should read 0.25 Vdc. If higher voltage is present replace the meter. |
| | Defective wiring | Measure the resistance between the common terminals of meter switch S1-A and S1-B, it should be 5000 ohms. |
| | Defective meter switch on the monitor panel 5TR1A1. | Set the metering switch to 12 CH PCM position. Measure the resistance from contact 7 of S1-A to contact 7 of S1-B, it should be 5000 ohms. |
| OSC metering too high | R3 resistance of 5TR1A1 open circuit. | Check R3 resistance. Replace if necessary. |
| OSC metering low or zero | R3 resistor of 5TR1A1 short circuik | Check R3 resistance. Replace if necessary. |
| When AC POWER switch is set to ON/ RESET, the centrifugal fan does not start, lamps do not light, there is no metering. | Defective switch circuit breaker 5TR1A1CB1. | Check switch operation and replace if necessary. |
| VTVM indication abnormal with meter switch in 24 CH PCM position or FDM position (deiation check *b(2)* above). | Defective metering circuit in amplifler-monitor 5TR1A5 (TM 11-5820-540-30). | Test 5TR1A5 as described in paragraph 3-25. |
| VTVM indication abnormal with meter switch in all positions (24 CH PCM, 12 CH PCM and FDM) or for af modulation check (para *(2)(l))* (deviation check, *b(2)* above). | Defective amplifier-monitor 5TR1A5 (TM 11 -5820-540-30). | Substitute the amplifier-rnonitor 5TR1A5 with a know good one (TM 11-5820-540-30). If VTVM indications are normal, troubleshoot defective module as described in paragraph 3-25. |

*c. Troubleshooting.* – Continued

| *Symptom* | *Probable cause* | *Checks and corrective measures* |
|---|---|---|
| | Defective electrical frequency synthesizer 5TR1A2 (TM 11-5820-540-30). | Substitute electrical frequency synthesizer 5TR1A2 with a known good one (TM 11-5820-540-30). If VTVM indications are normal, troubleshoot defective module as described in paragraph 3-21 (or 3-22). |
| | Defective power supply 5TR1PS1 (TM-11-5820-540-30). | Substitute power supply 5TR1PS1 with a known good one (TM 11-5820-540-30). If VTVM indications are normal, troubleshoot defective module for excessive ripple as described in paragraph 3-26. |
| VTVM indication abnormal for af modulation check only. | Defective amplifier-monitor 5TR1A5 (TM 11-5820-540-30). | Test module as described in paragraph 3-25. |
| Abnormal reading at any position of S21 (deviation attenuator check, *b* (3) above). | Defective amplifier-monitor | Test module as described in paragraph 3-25. |
| Output power abnormal (power output and frequency check *b* (4) above). | Defective amplifier-frequency multiplier 5TR1A4 (TM 11-5820-540-30). | Substitute amplifier-frequency multiplier 5TR1A4 with a known good one (TM 11-5820-540-30). If VTVM indications are normal, troubleshoot defective module as described in paragraph 3-24. |
| | Defective electrical frequency synthesizer 5TR1A2 (TM 11-5820-540-30). | Substitute the electrical frequency synthesizer 5TR1A2 with a known good one (TM 11-5820-540-30). If VTVM indications are normal, troubleshoot defective module as described in paragraph 3-21 or 3-22. |
| Output frequency abnormal | Defective electrical frequency synthesizer 5TR1A2 (TM 11-5820-540-30). | Test module as described in paragraph 3-21 or 3-22. |
| Low power alarm operates outside voltage limits *(b(5)* above). | Defective alarm control 5TR1A1A2 (TM 11-5820-540-30). | Test module as described in paragraph 3-20. Check associated wiring. |
| Frequency response outside limits *(b(6)* above). | Defective amplifier-monitor 5TR1A5 (TM 11-5820-540-30). | Test module as described in paragraph 3-25. |

**NOTE**

Remaining faults could be due to either wiring, connectors, or switch 5TR1A1S1. Use multimeter to check these items.

### 3-18. Monitor Panel 5TR1A1

Monitor panel 5TR1A1 is made up of electrical connector assembly 5TR1A1A1, alarm control 5TR1A1A2, and the front panel switches, controls, alarms, and indicators. Refer to paragraph 3-17 for a complete operational check of monitor panel 5TR1A1.

### 3-19. Electrical Connector Assembly 5TR1A1A1

**NOTE**

Electrical connector assembly 5TR1A1A1 includes the wiring harness and associated connectors of monitor panel 5TR1A1. Check 5TR1A1A1 when troubleshooting procedures in paragraph 3-17 indicate wiring trouble.

*a. Test Equipment Required.*

| *Equipment* | *Common name* |
|---|---|
| Multimeter, Digital AN/USM-451 | Digital multimeter |

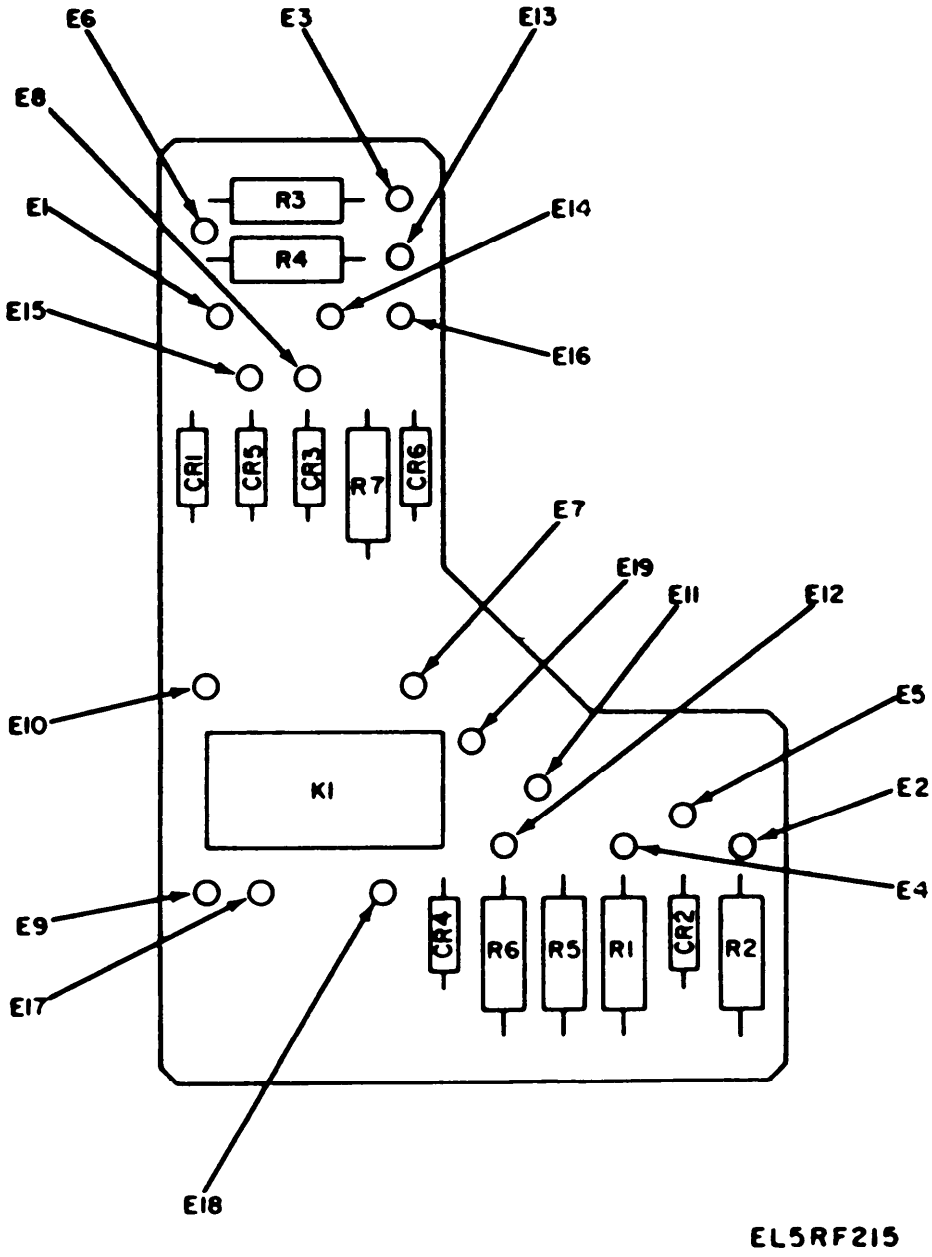



*Figure 3-77. Alarm Control 5TR1A1A2 or 1RE1A1A2, Parts Location.*

*b.* Test Procedure. Refer to the transmitter interconnection diagram, FO-5, and check continuity between associated connector pins. Refer to paragraph 2-10 for repair or replacement of connectors.

### 3-20 Alarm Control 5TR1A1A2 or 1RE1A1A2

*a. Test Equipment and Material Required.*

| *Equipment* | *Common name* |
|---|---|
| Test Facility, Transmitter TS-ZS66(Y)Z/GRM-95(V)Z. | Transmitter test facility |
| Multimeter, Digital AN/USM-451 | Digital multimeter |

*b. Test Procedure.*

(1) Use the multimeter to check resistance between the terminal pins listed in the chart below. Refer to figure 3-77 to locate the terminals.

| Multimeter connections (+) | (–) | Resistance (ohms ±10% unless otherwise indticated) |
|---|---|---|
| E1 | E11 | * Greater than 200k |
| E2 | E4 | * 320 ±5% |
| E2 | E5 | * Greater than 200k |
| E2 | E12 | * 640 ±5% |
| E4 | E5 | * Greater than 100k |
| E3 | E6 | * 100 ±5% |
| E3 | E13 | * 320 ±5% |
| E5 | E4 | Less than 2k |
| E5 | E16 | Less than 3k |
| E7 | E9 | Infinity |
| E7 | E10 | 0 |
| E8 | E11 | Greater than 200k |
| E11 | E1 | Less than 3k |
| E11 | E8 | * Less than 3k |
| E11 | E14 | * 100 |
| E11 | E15 | * Less than 3k |
| E12 | E4 | * 320 |
| E12 | E5 | Greater than 200k |
| E15 | E11 | Greater than 200k |
| E16 | E5 | Greater than 200k |
| E17 | E18 | 0 |

* Digital multimeter

(2) Connect the test equipment as shown in figure 3-78.

(3) Set test facility switches S1, S6, and S17 to their ON positions.

(4) Check the operation of relay K1 in the unit under test; connect the power supply and measure the resistance between the test points as shown in the chart below.

| Power supply connections (+) | (–) | connect multimeter between | Resistance (ohms) |
|---|---|---|---|
| E11 | E1 | E7 and E10 | Infinity |
| | | E7 and E9 | 0 |
| | | E17 and E18 | Infinity |
| | | E17 and E19 | 0 |
| E11 | E8 | E7 and E10 | Infinity |
| E11 | E15 | E7 and E10 | Infinity (1RE1A1A2 only). |

*c. Troubleshooting (FO-5).*

| Symptom | Checks and corrective measures |
|---|---|
| Abnormal indication of any resistance measurement *(b(1)* above.) | Refer to FO-5 check components in defective circuit; replace components as required. |
| Abnormal indication with power supply (–) connected to E1, *(b(4)* above); other tests normal. | Check and replace diode CR1 as required. |
| Abnormal indication with power supply (—) connected to E1 or E8 *(b(4)* above). | Check R7 and K1 relay; replace as required. |
| Abnormal indication with power supply (–) connected to E8 *(b(4)* above); other tests normal. | Check and replace diode CR3 as required. |
| Abnormal indication with power supply (–) connected to E15 *(b(4)* above); other tests normal. | Check and replace diode CR5 as required. |

## 3-21. Electrical Frequency Synthesizer 5TR1A2 or 1RE1A2 (SM-D-698145)

*a. Test Equipment and Material Required.*

| Equipment | Common name |
|---|---|
| Test Facility, Transmitter TS-2866(V)2/GRM-95(V)2 | Transmitter test facility |
| Accessory Kit, Test Facilities Set, MK-1173(V)2/GRM-95(V)2 | Accessory kit, test facility set |
| Multimeter, Digital AN/USM-451 | Digital multimeter |
| Frequency Meter TD-1224(V)1/U | Counter |
| Generator, Signal HP 8640B | Signal generator |
| Power Meter HP-435A | Power meter |
| Power Sensor HP-8481A | Power sensor |
| Meter, modulation ME-505/U | Deviation meter |
| Voltmeter, Electronic ME-459/U | VTVM |
| Generator, Signal AN/USM-205A | Wide range oscillator |
| Distortion Analyzer, AN/URM-184A | Distortion analyzer |

*b. Test Procedure.*

**CAUTION**

Removal and insertion of circuit boards while power is applied to the synthesizer may induce transient voltages which are harmful to certain components. Before removing or inserting a board, set test facility switch S17 to OFF.

(1) *Preliminary setup.*

*(a)* Set the test facilty controls as follows:

| Switch | Position |
|---|---|
| S1 | ON |
| S18 | 72.50 |
| S20 | S17 |

*(b)* Remove the synthesizer cover plate.

(2) *Field effect transistor operating voltage adjustment.*

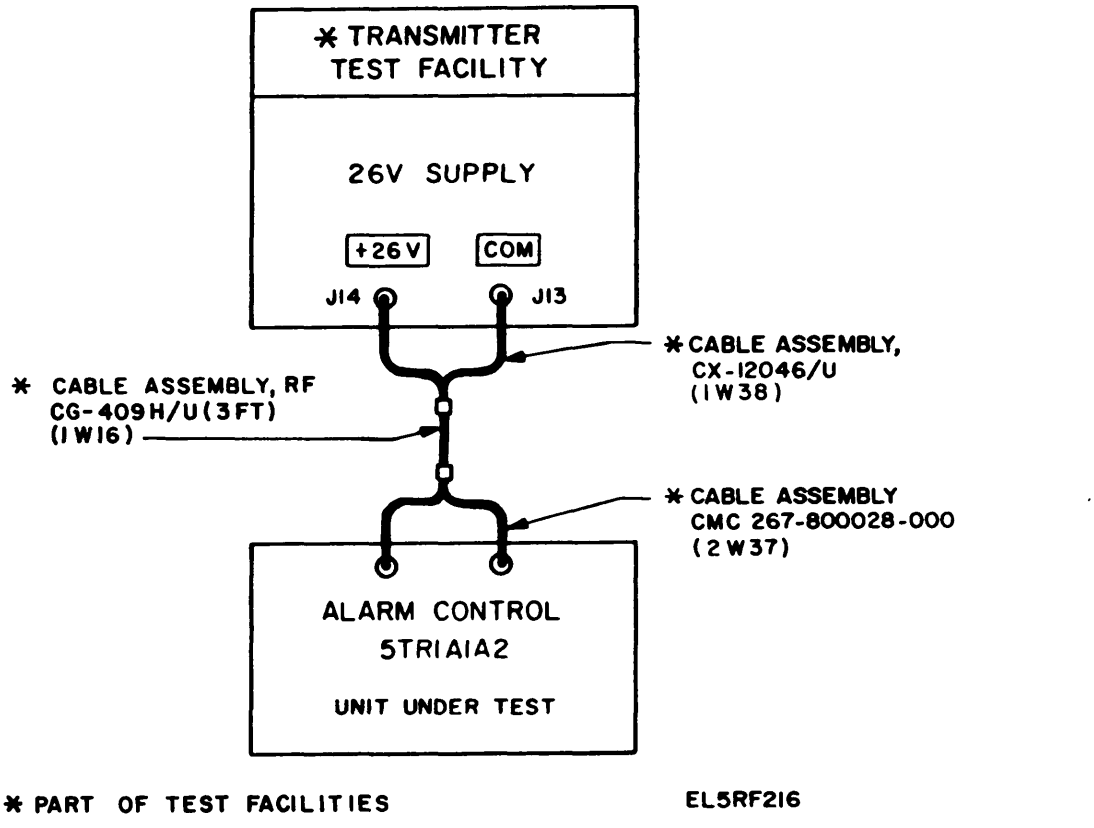



Figure 3-78. Alarm Control *5TR1A1A2 or 1RE1A1A2, Test Setup.*

**NOTE**

Remove signal data converter-storer board 1RE1A2A8 or 5TR1A2A8 from the synthesizer. Pins 14 and 15 of the pc board are to be removed to prevent possible damage to the transmitter test facility TS-2866(V)2/GRM-95(V)2.

*(a)* Extend signal data converter-storer board 1RE1A2A8 or 5TR1A2A8 from the synthesizer, using extender board PL-1247/GRM-95 (V) as shown in figure 3-79 and set test facility control switch S17 to ON.

*(b)* Connect the digital multimeter between pin 4 of Q6 (+) and TP3 (–) of the extender board.

*(c)* If necessary, adjust R15 (fig. 3-80) on 1RE1A2A8 or 5TR1A2A8 or 5TR1A2A8 until the digital multirneter reads 11.5 V ±0.2 Vdc.

*(d)* Set switch S17 on the test facility to OFF and reinstall the extended board.

(3) *Sync alarm test*

*(a)* Set test facility switch S18 to 66.00 and S17 to ALM 1. On the test facility, connect a jumper wire from pin 16 on J20 to the ground terminal next to J20. The SYNC lamp on the test facility should light and remain on (may blink once).

*(b)* Set test facility switch S17 to the ON position. The SYNC lamp should extinuish and remain out

*(c)* If necessary adjust R3 (fig. 3-81) on amp.-monitor board 1RE1A2A3 or 5TR1A2A3 to meet the requirements of *(a)* and *(b)* above.

*(d)* Set switch S17 to ALM 2. After a delay, the SYNC lamp should light and remain on.

*(e)* Set S17 to the ON position and remove the jumper from pin 16 of J20. The SYNC lamp should extinguish and remain out.

*(f)* Set S17 to OFF and remove rf oscillator board 1RE1A2Y1 or 5TR1A2Y1.

*(g)* Set S17 to ON. The SYNC lamp should light.

*(h)* Set S17 to OFF and reinstall the rf oscillator board.

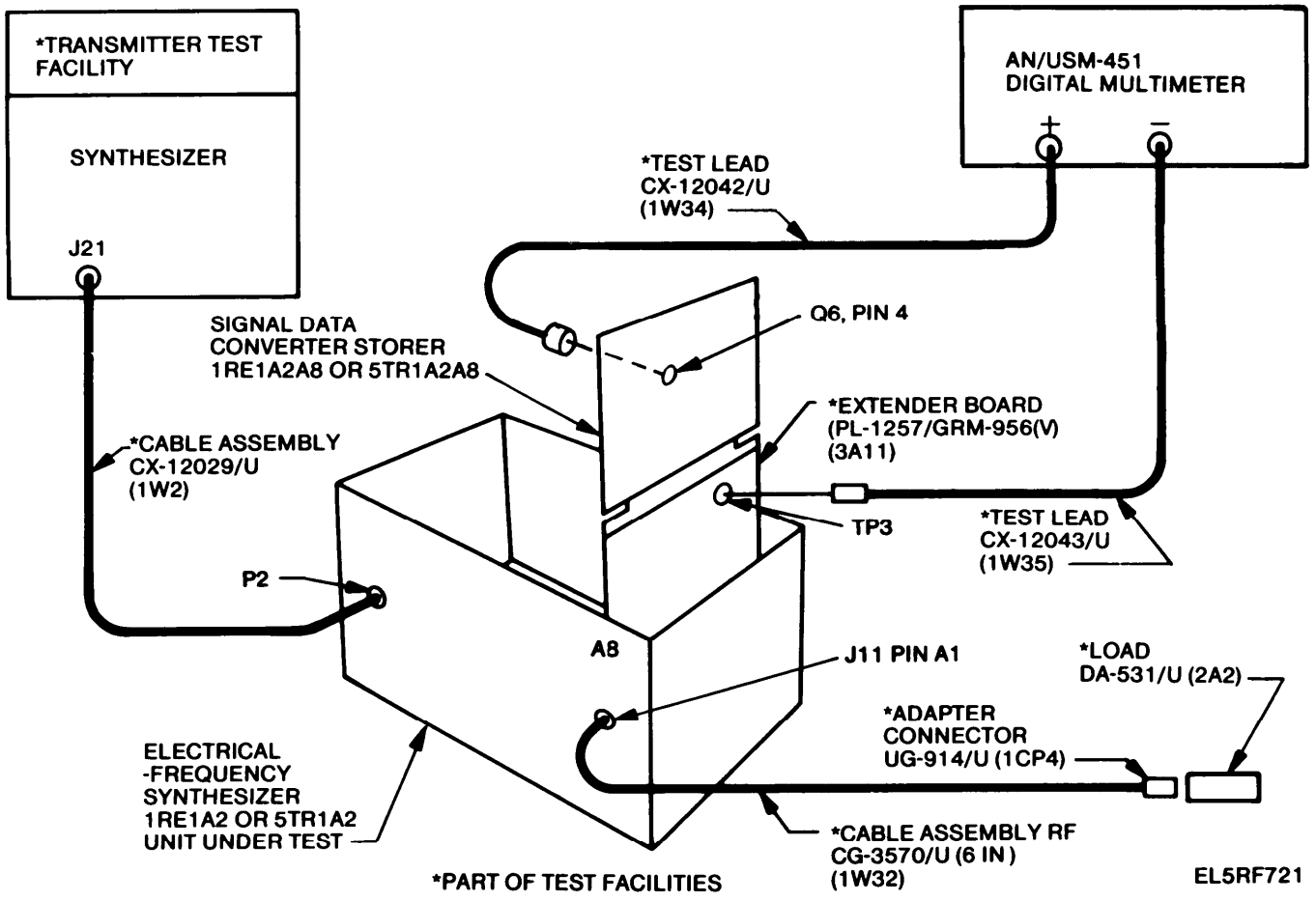



*Figure 3-79. Field Effect Transistor, Operating Voltage Adjustment, Test Setup.*

(4) *Frequency check.*

*(a)* Connect the test equipment as shown in figure 3-82.

*(b)* On the test facility, set switches S17 to on and S 18 to each position in chart below. The counter should indicate the frequencies listed for each portion.

| S18 *Position* | *Freq (MHz)* | *+Tolerance (Hz)* |
|---|---|---|
| *47.50* | *47.50* | *475* |
| *54.98* | *54.979165* | *549* |
| *63.46* | *63.46875* | *634* |
| *72.50* | *72.50* | *725* |

**NOTE**

Due to residual fm, the output frequencies will not be perfectly stable. Using a 1.0 second count on the frequency counter, the fluctuations in frequency should be less than 200 Hz at 47.5 MHz and less than 400 Hz at 72.5 MHz.

*(c)* Set switch S17 to OFF.

**NOTE**

If the output frequency is outside the limits given in *(b)* above, proceed with *(d)* through *(j)* below.

*(d)* Extend RF oscillator board 1RE1A2Y1 or 5TR1A2Y1 from the synthesizer using extender board, PL-1259/GRM-95(V) as shown in figure 3-83.

*(e)* Set switch S18 to 47.5 MHz.

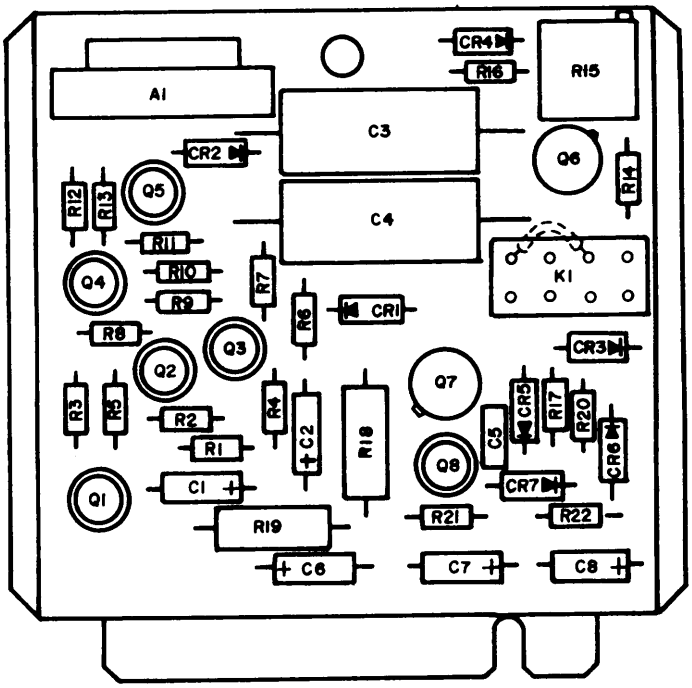
*(f)* Connect the counter between TP1 (–) of rf oscillator 1RE1A2Y1 or 5TR1A2Y1 and TP3 (+) of the extender board.

*(g)* Set switch S17 to ON. The counter should indicate 500 kHz ±25 Hz.

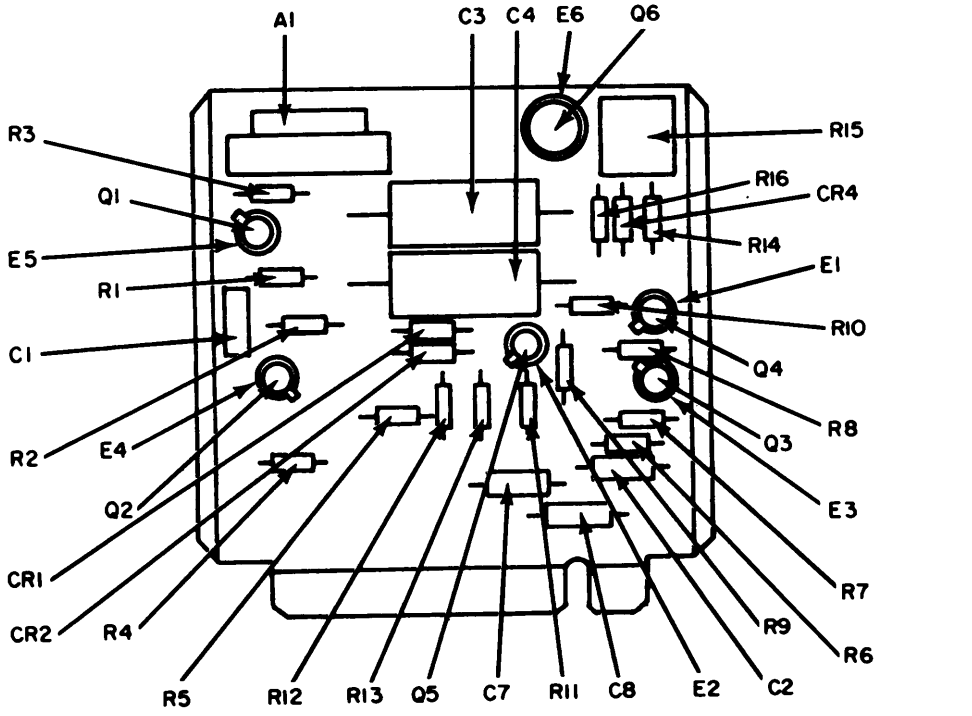
*(h)* If necessary, adjust L1 (fig. 3-84) to obtain the required frequency in *(h)* above.

*(i)* Set switch S17 to OFF and reinstall the extended board.

*(j)* Repeat *(a)* through *(c)* above. Observe the specified tolerances.




(SERIAL NUMBERS 0000 THROUGH 0167)




(SERIAL NUMBERS A0001 THROUGH D0721)

*Figure* 3-80. Signal *Data Converter-Storer 1RE1A2A8 or 5TR1A2A8, Parts Location*

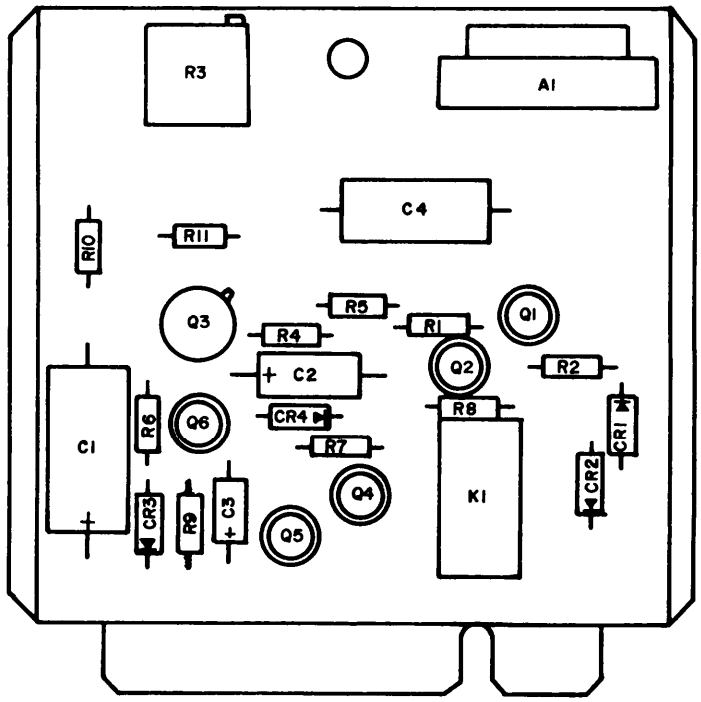



*Figure 3-81. Amplifier-Monitor 1RE1A2A3 or 5TR1A2A3, Parts Location.*

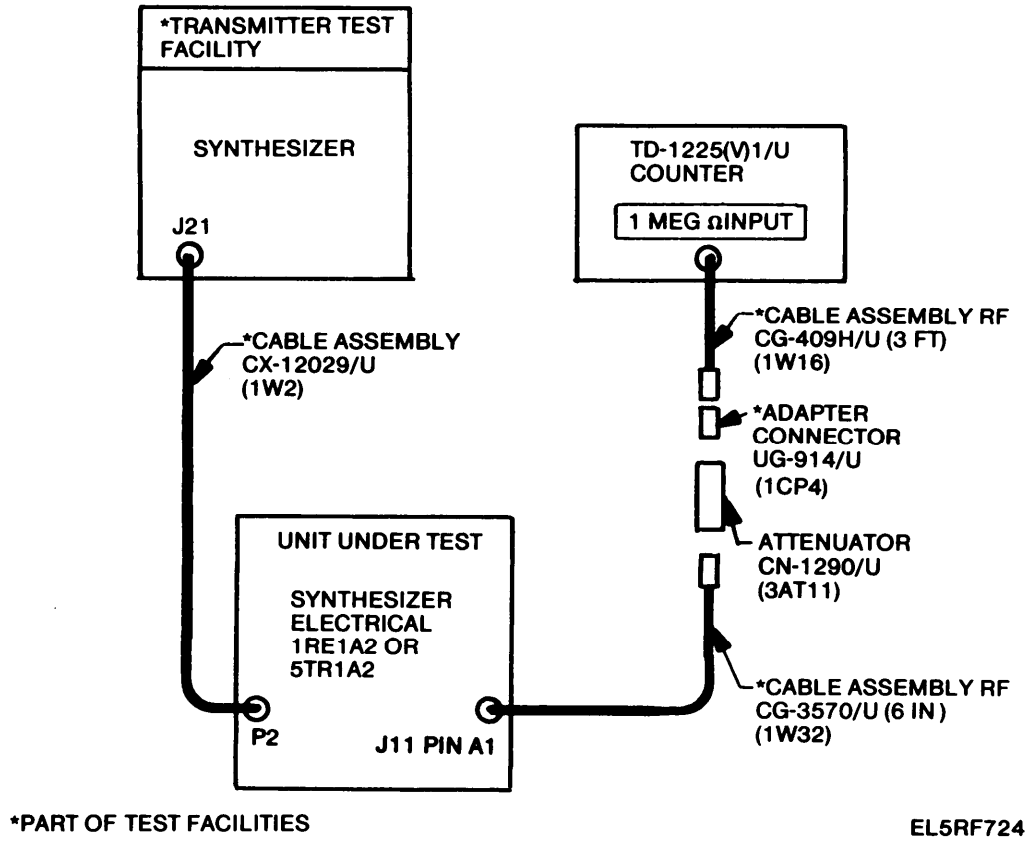



Figure 3-82. *Electrical Frequency Synthesizer 1RE1A2 or 5TR1A2 Frequency Check, Test Setup.*

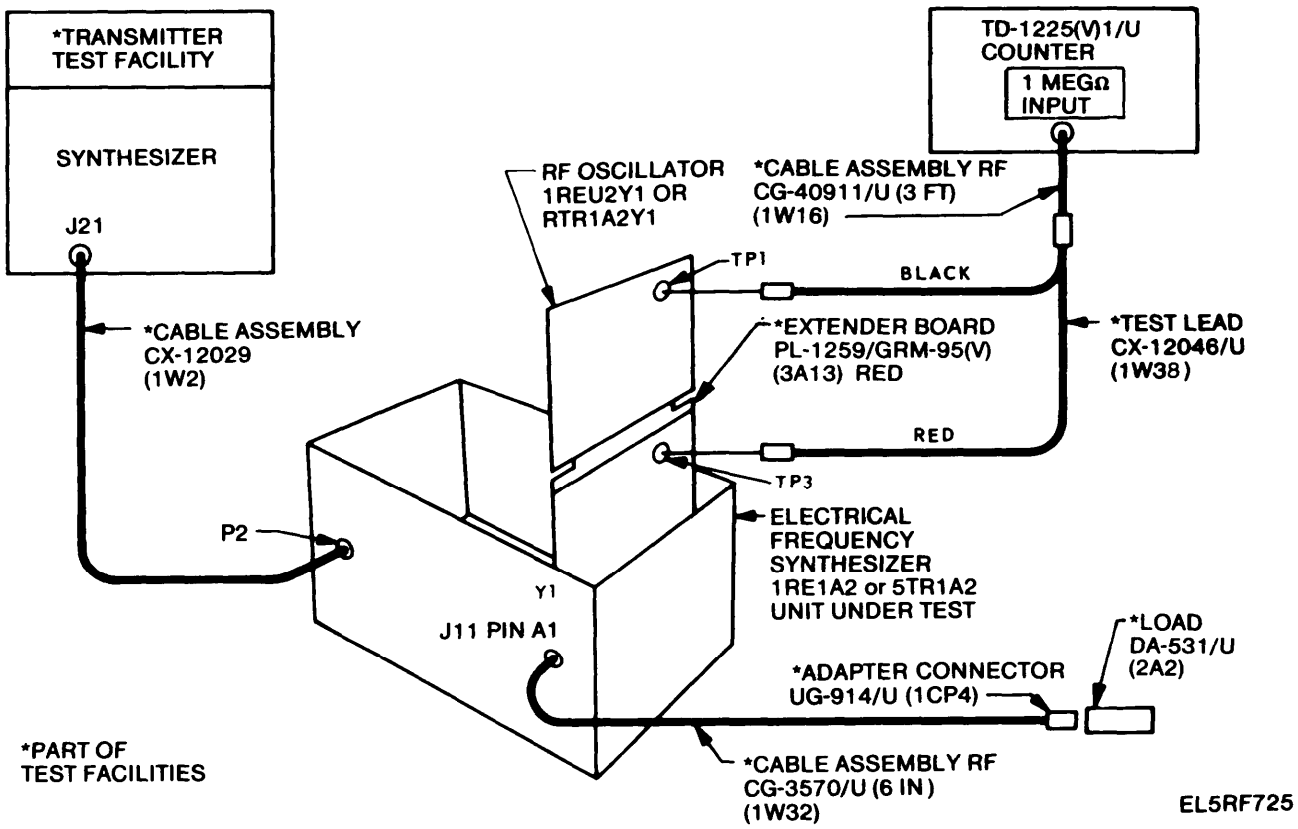



*Figure* 3-83. Rf Oscillator 1RE1A2Y1 *or 5TR1A2Y1 Frequency Check, Test Setup.*

*(5) Power output and metering.*

*(a)* Connect the power meter to pin A1 of J11 on the synthesizer as shown in figure 3-85.

*(b)* Set switch S17 to ON. Set switch S18 to all on positions. Meter M1 should indicate between 20-80% of full scale and the power meter indication should be between +12 dBm and +17 dBm. Set switch S17 to OFF.

*(c)* If power output is abnormal, remove the cover and extend modulator-oscillator board 1RE1A2A2 or 5TR1A2 from the synthesizer using extender board PL-1251/GRM-95(V)(3A5) figure 3-87.

**NOTE**

The extender board will cause a loss of approximately 1 dB. Verify output power before and after adjustments with the extender board removed and 1RE1A2A12 or 5TR1A2A2 reinstalled in the synthesizer.

*(d)* Refer to figure 3-86 and adjust Cl 3 for minimum power meter fluctuation within the limts of *(b)* above

(e) Replace the cover on modulator-oscillator board and reinstall it in the synthesizer.

*(f)* Repeat(b) above.

(g) Set switch S17 to OFF.

(6) *Deviation*

*(a)* Connect the test equipment as shown in figure 3-88.

*(b)* Set test facility switch S20 to 30 MHz DISCR.

(c) Set switch S18 to 47.50 and S17 to ON.

*(d)* Set the signal generator frequency to 77.5 MHz at a level of 0 dBm. Fine tune the signal generator frequency to obtain a zero center indication on test facility meter M2; readjust the signal generator output level until meter M2 indicates 50 percent of full scale deflection.

*(e)* Set switch S17 to the MOD ON position. The VTVM should indicate 50 Mv ±6 mV.

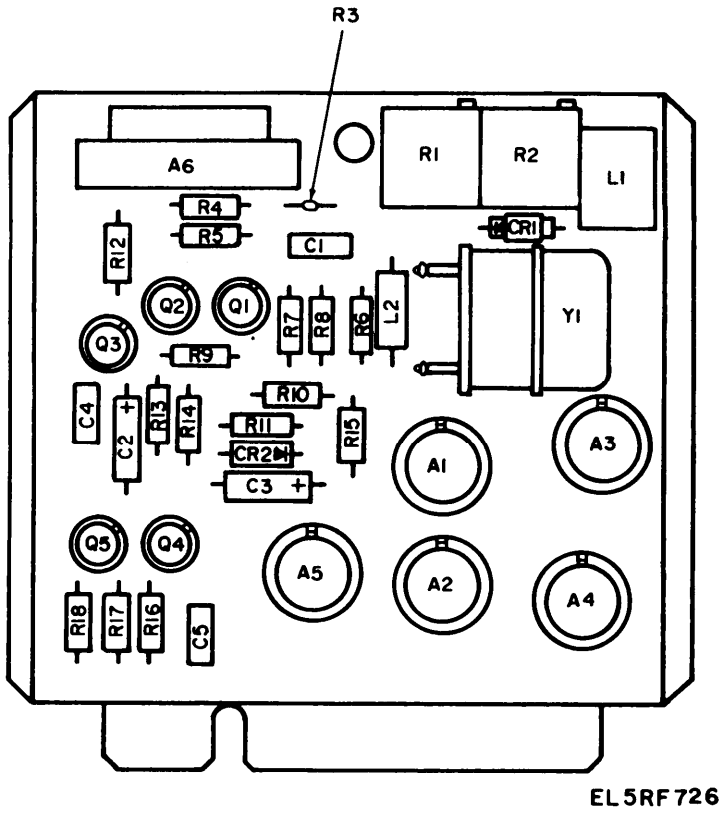



*Figure* 3-84. Rf *Oscillator 1RE1A2Y1 or 5TR1A2Y1, Parts Location*

*(f)* Repeat steps *(c)* through *(e)* for each frequency setting of S18. The signal generator will be set at 30 MHz above the S 18 frequency setting.

*(g)* If the requirements of *(e)* and *(f)* above are not met proceed to *(h)* below.

**NOTE**

R9 controls overall deviation level. R6 is for frequency compensation and will have a greater effect on deviation level at lower frequencies.

*(h)* Perform steps *(c)* through *(f)* above, adjusting R6 and R9 (fig. 3-86) at switch S 18 settings of 47.5 and 72.5 respectively. Adjust for minimum overall variation of VTVM indications from 50 mV at all switch S18 settings.

(7) *Modulation distortion check.*

*(a)* Connect the test equipment as shown in figure 3-89.

*(b)* set test facility switches S18 to 47.50 and S17 to ON.

*(c)* Set test facility switch S20 to 30 MHz DISCR.

*(d)* Set the signal generator frequency to 77.5 MHz at a level of 0 dBm. Fine tune the signal generator frequency to obtain a zero center indication on test facility meter M2; readust the signal generator output level until meter Ml indicates 50 percent of full scale deflection.

*(e)* Set the wide range oscillator to 20 kHz and adjust the output level for an indication of 45 mV using the distortion analyzer, voltmeter function.

*(f)* Set the distortion analyzer to measure distortion. The measured distortion shall not exceed 5 percent.

*(g)* Set switch S17 to OFF.

*(8) Continuity test* Using a digital multimter, check for continuity between chassis ground and the following points on the synthesizer P2 pin 4, J11 pin 5, and J11 pin 2. (If digital multimter reads an open, check for broken or missing wires).

*(9) Fault isolation procedure.* If any of the requirements of (3) through (9) above are not met isolate the fault in the following manner.

*(a)* Remove all boards from the synthesizer and insert a complete set of known good boards.

*(b)* If the synthesizer still fails to function properly, troubleshoot the synthesizer case (d. (2) below).

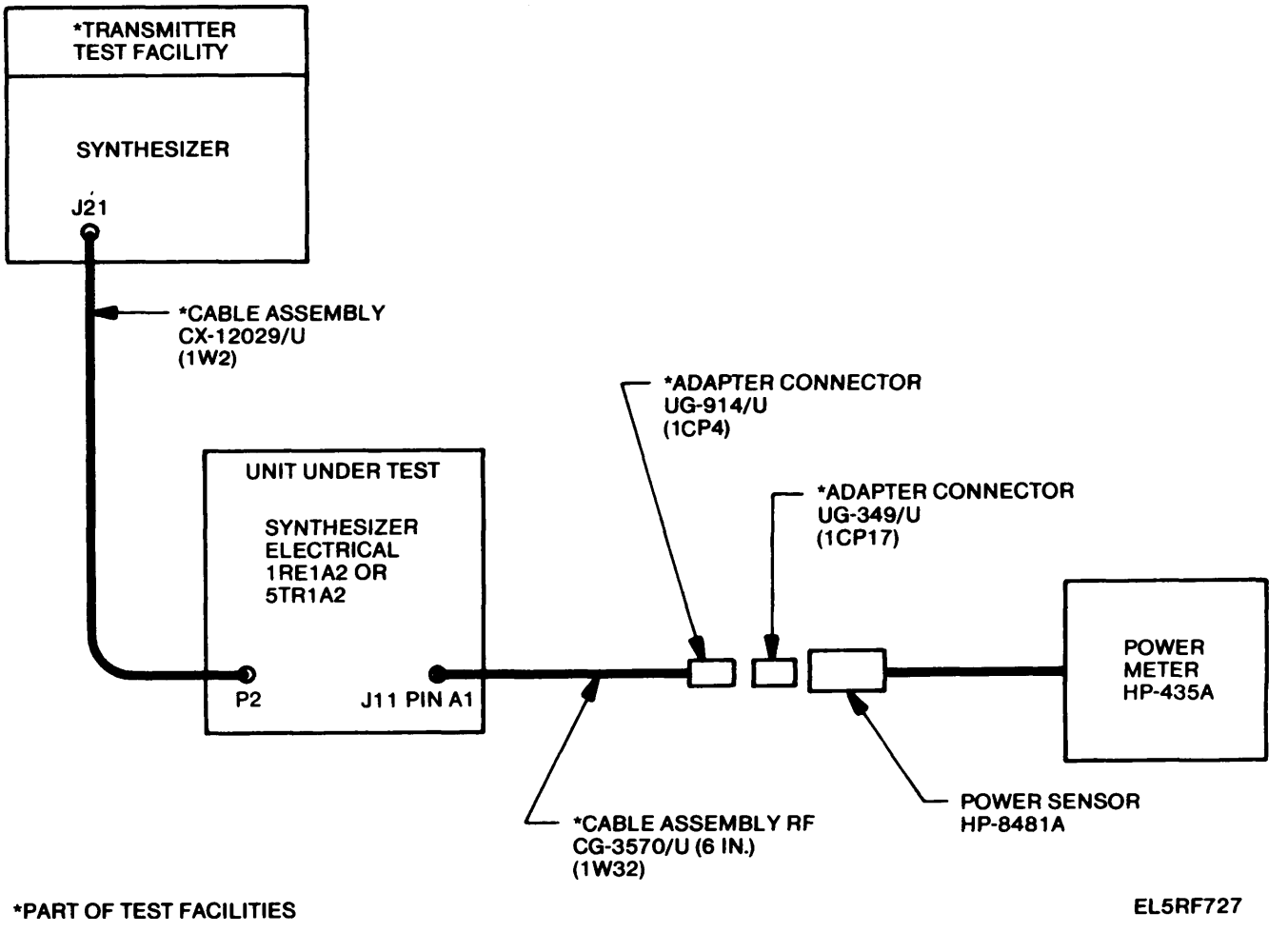



*Figure 3-85. Electrical Frequency Synthesizer, Power Output, Test Setup.*

*(c)* If the fault clears when the complete set of know good boards is installed isolate the fault board(s) of the original set in the following manner.

*1.* Remove know good board.

2. Insert orginal board.

3. Check for proper synthesizer operation. If normal indications are obtained with the original board proceed to *(d)* below. If normal indications are not obtained, replace original board with a new board and recheck synthesizer operation.

*(d)* Repeat *(c)* above for every board in the synthesizer (in case more than one original board is faulty) until all of the orignal boards have been checked (or replaced).

c. Troubleshooting (Modulator-oscillator 1RE1A2A2 or 5TR1A2A2 (FO-22 and fig. 3-86) part no. CMC 456-260).

| *Symptom* | *Probable cause* | *Ckecks and corrective measures* |
|---|---|---|
| SYNC alarm on test facility; No output from synthesizer. | Open or shorted component | To isolate the defective stage, measure the voltages and observe the waveforms listed in *d(1)* below. |
| Wrong synthesizer output frequency and/ or SYNC alarm on test facility. | Defective oscillator stage. | Refer to higher category maintenance. |
| Lower level from synthesizer | Component changed value in Q1, Q2 or Q3 oscillator stages. | To isolate the defective stage, measure the voltages and observe the waveforms listed in *d(1)* below. |

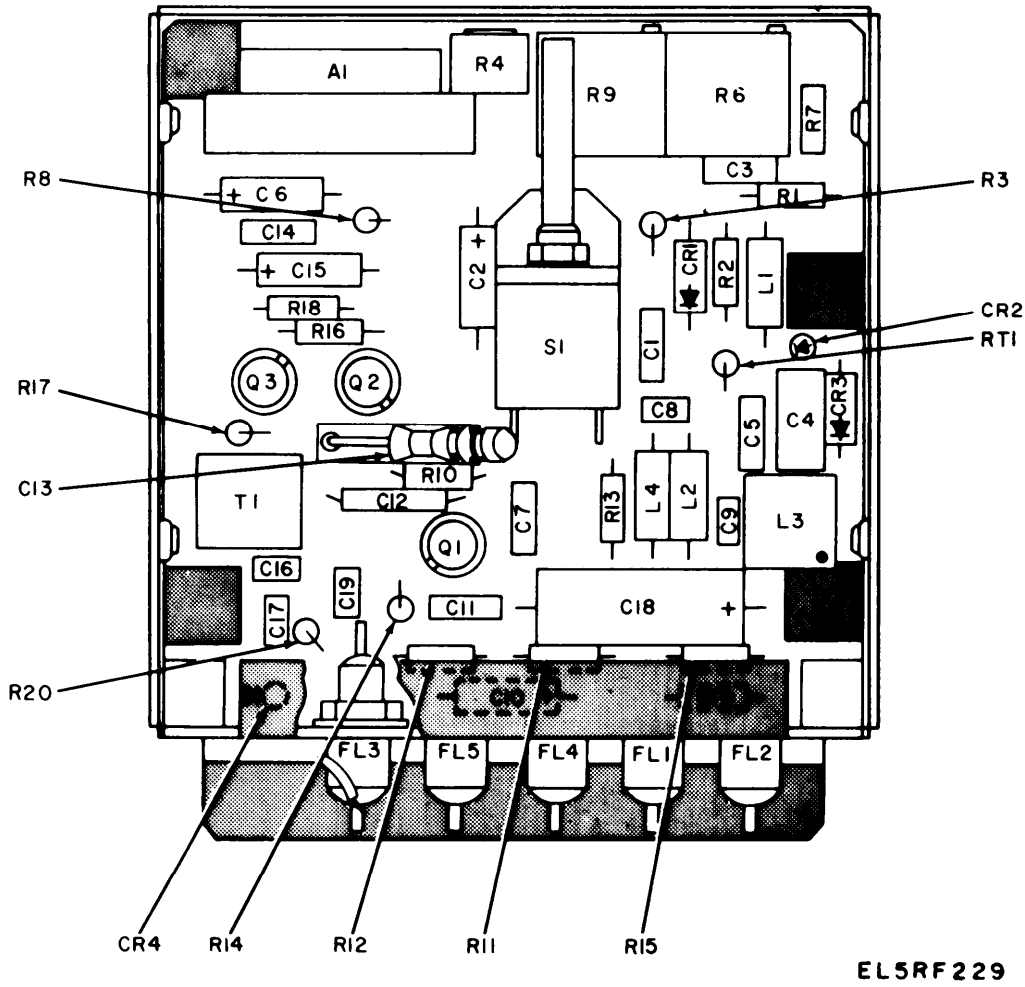



Figure 3-86. *Modulator-Oscillator 1RE1A2A2 or 5TR1A2A2, Parts Location.*

*d. Typical Voltage Measurements.*

*(1) Modulutor-oscillator 1RE1A2A2 or 5TR1A2A2 (fig. 3-86), part No. CMC 456-260).*

*(a)* Typical signal voltage indications using the allocated oscilloscope and test facility switch S18 at 47.50:

**NOTE**

Replacement of Q1 or its circuit components will make complete realinement of the circuit board neccessary. Refer to higher category maintenance for repair or realinement

| *Test points* | *Typical indications (volts ac peak-to-peak)* |
|---|---|
| Q1 collector | 2.6 |
| Q2 collector | 0.8 |
| Q3 collector | 9.0 |
| TP7 of extender board | 4.0 |

*(b)* Typical dc voltage indications using the digital voltmeter, with the synthesizer programed for 47.5 MHz:

| *Testpoints* | *Typical indications (volts dc)* |
|---|---|
| Q2 base | 0.76 |
| Q2 collector | 1.60 |
| Q3 emitter | 0.84 |
| Q3 base | 1.58 |
| Q3 collector | 1,20 |
| TP2(+) and TP3(-) of extender board | 1.30 |

(2) *Interconnecting box 1RE1A2A1A1 or 5TR1A2A1A1* (fig. 3-90). Remove all plug-in circuit boards; set test facility switch S17 to ON. Check the voltages between the following test points:

| *Testpoints* | *Typical indication (volts dc)* |
|---|---|
| *E30(+) to E9(–)* | *20* |
| *E28(+) to E9(–)* | *16* |

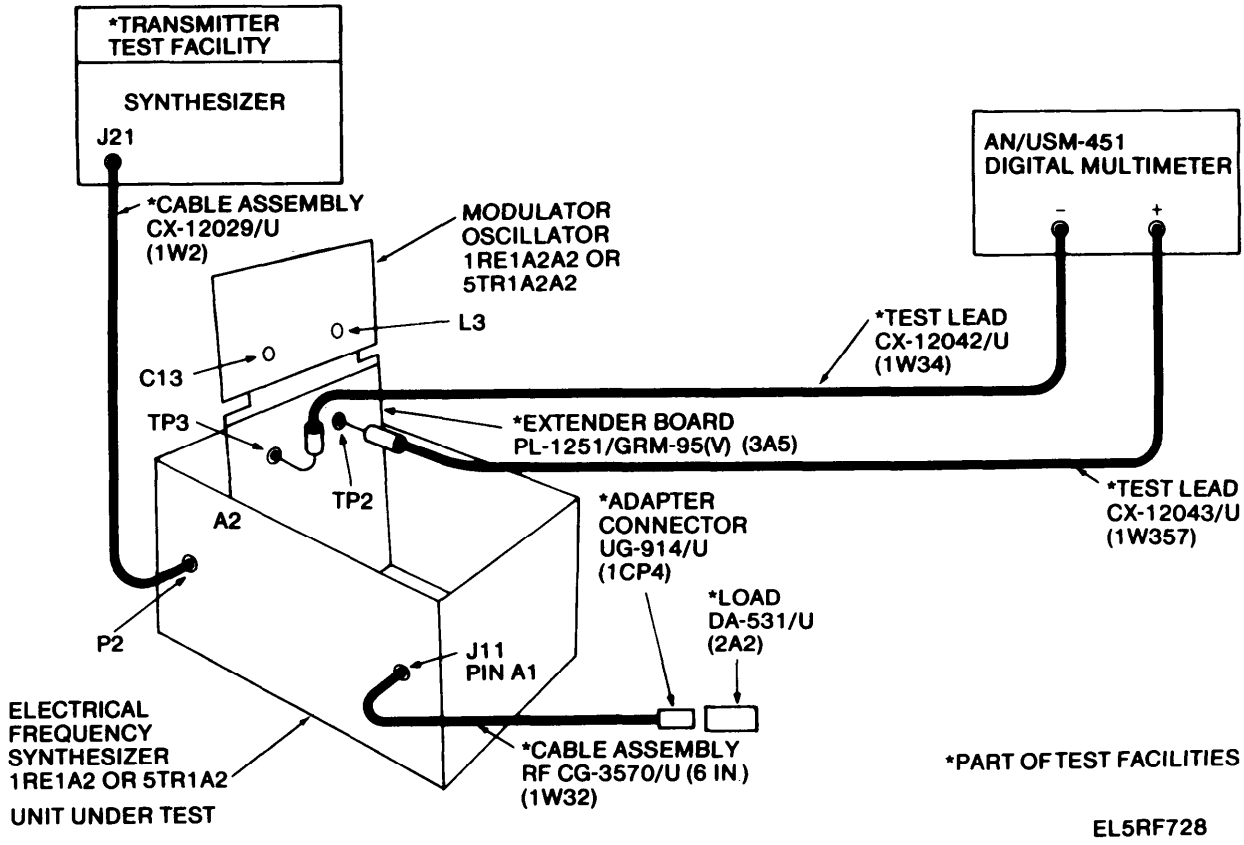



*Figure 3-87. Modulator-Oscillator 1RE1A2A2 or 5TR1A2A2, Varicap Turning Adjustment*

## 3-22. Electrical Frequency Synthesizer 5TR1A2 or 1RE1A2 (SM-D-865030)

*a. Test Equipment Required.*

| *Equipment* | *Common name* |
|---|---|
| Test Facility, Transmitter TS-2866(V)2/GRM-95(V)2 | Transmitter test facility |
| Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2 | Accessory kit, test facility set |
| Multimeter, Digital AN/USM-451 | Digital multimeter |
| Frequency Meter TD-1225(V)1/U | Counter |
| Generator Signal HP-8640B | Signal Generator |
| Power Meter HP-435A | Power meter |
| Power Sensor HP-8481A | Power sensor |
| Meter, Modulation ME-505/U | Deviation meter |
| Distortion Analyzer, AN/U SM-184A | Distortion analyzer |
| Voltmeter, Electronic ME-459/U | VTVM |
| Generator, Signal AN/USM-205A | Wide range oscillator |
| Test Lead CMC 267-800020-000 | Test lead |
| Load, DA-531/U | 50 ohm dummy load |

*b. Test Procedure.*

**CAUTION**

Removal and insertion of circuit boards while power is applied to the synthesizer may induce transient voltages which are harmful to certain components. Before removing or inserting a board, set test facility switch S17 to OFF.

(1) *Preliminary setup.*

*(a)* Set the test facility controls as follows:

| *Switch* | *Position* |
|---|---|
| S1 | ON |
| S18 | 63.46 |
| S20 | S17 |

*(b)* Remove the synthesizer cover plate.

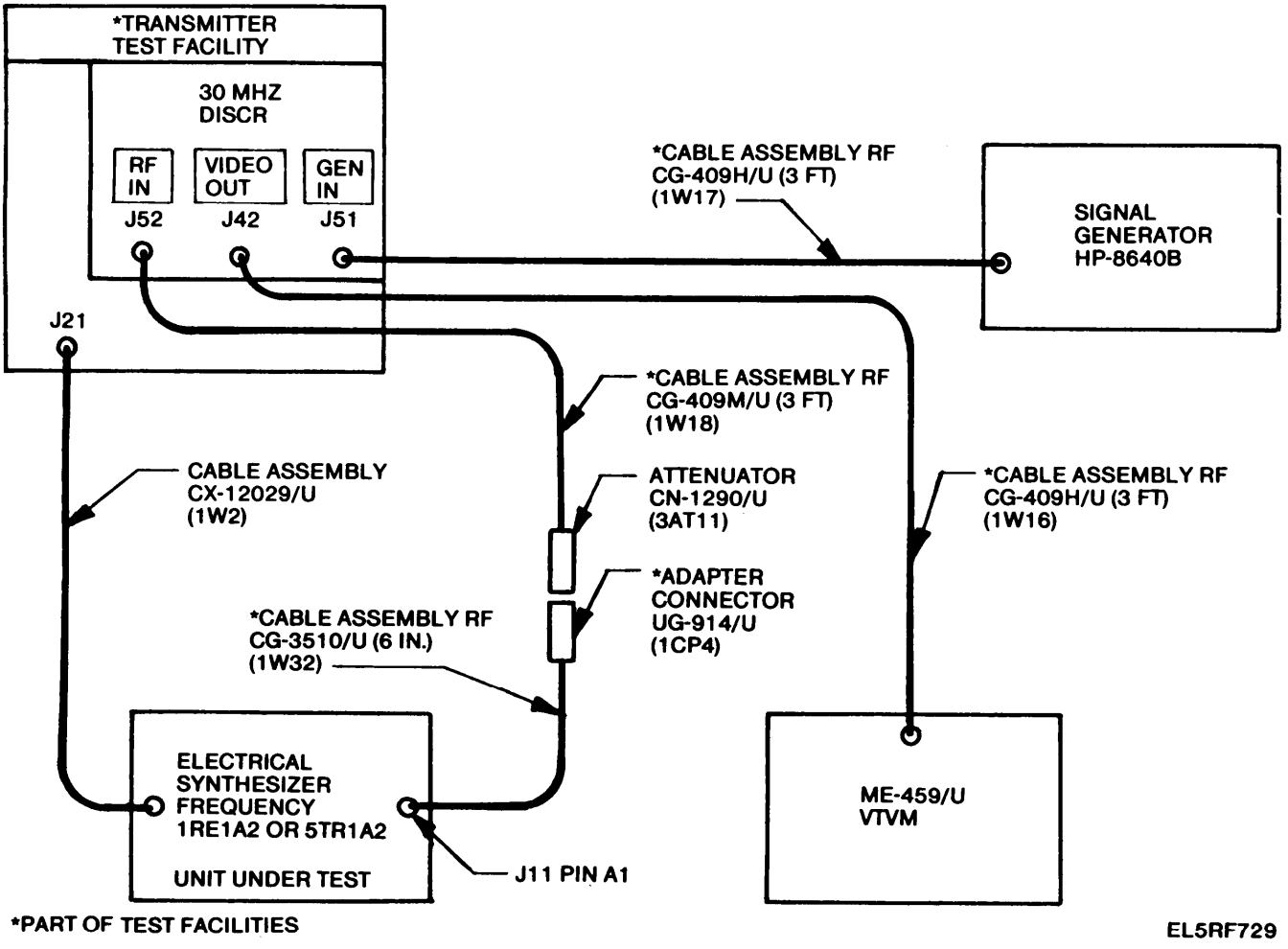



Figure 3-88. *Electical Frequency Synthesizer Deviation, Test Setup.*

(2) *Field effect transistor operating* voltage *adjustment*

*(a)* Extend signal data converter-storer board 1RE1A2A18 or 5TR1A2A19 from the synthesizer, using extender board PL-1257/GRM-95(V) as shown in figure 3-91, and set test facility control switch S17 to ON.

*(b)* Connect the digital voltmeter between A18TP3(+) on the signal converter-storer board and TP3(-) of the extender board.

*(c)* If necessary, adjust R16 on 1RE1A2A18 or 5TR1A2A18 (fig. 3-92) until digital voltmeter indicates 11.5 V ±0.2 Vdc.

*(d)* Set switch S17 on the test facility to OFF and reinstall the extended board.

*(3)* Sync *alarm test*

*(a)* Set test facility switch S18 to 66.00 and S17 to ALM 1. On the test facility, connect a jumper wire from pin 16 on J20 to the ground terminal next to J20. The SYNC lamp on the test facility should light and remain on (may blink once).

*(b)* Set test facility switch S17 to the ON position. The SYNC lamp should extinguish and remain out.

*(c)* If necessary, adjust R3 (fig. 3-81) on amp.-monitor board 1RE1A2A3 or 5TR1A2A3 to meet the requirements of *(a)* and *(b)* above.

*(d)* Set switch S17 to ALM 2. After a delay, the SYNC lamp should light and remain on.

*(e)* Set S17 to the ON position and remove the jumper from pin 16 of J20. The SYNC lamp should extinguish and remain out.

*(f)* Set S17 to OFF and remove rf oscillator board 1RE1A2Y11 or 5TR1A2Y11.

*(g)* Set S17 to ON. The SYNC lamp should light.

*(h)* Set S17 to OFF and reinstall the rf oscillator board.

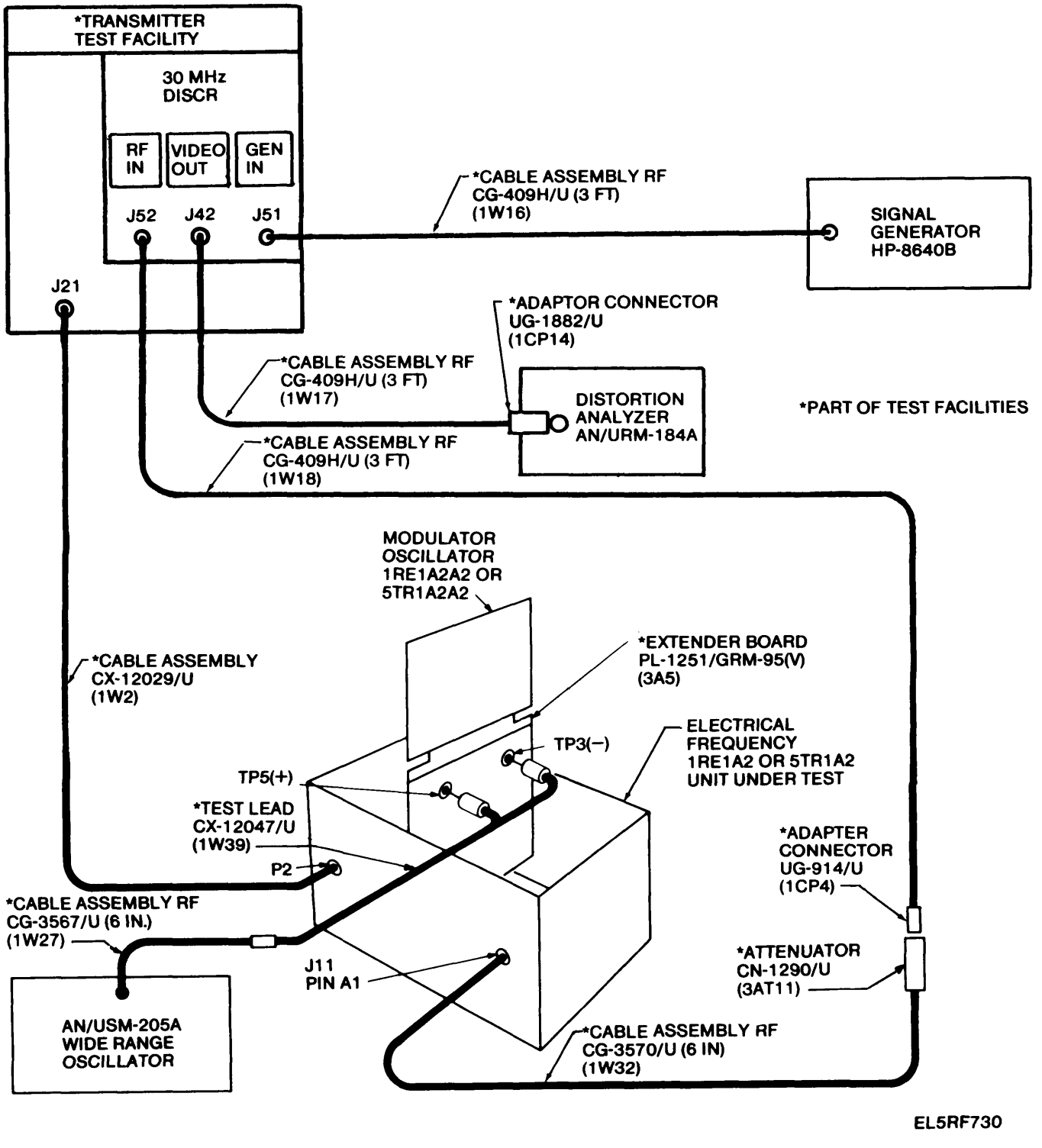



*Figure 3-89. Electrical Frequency Synthesizer Distortion Test Setup.*

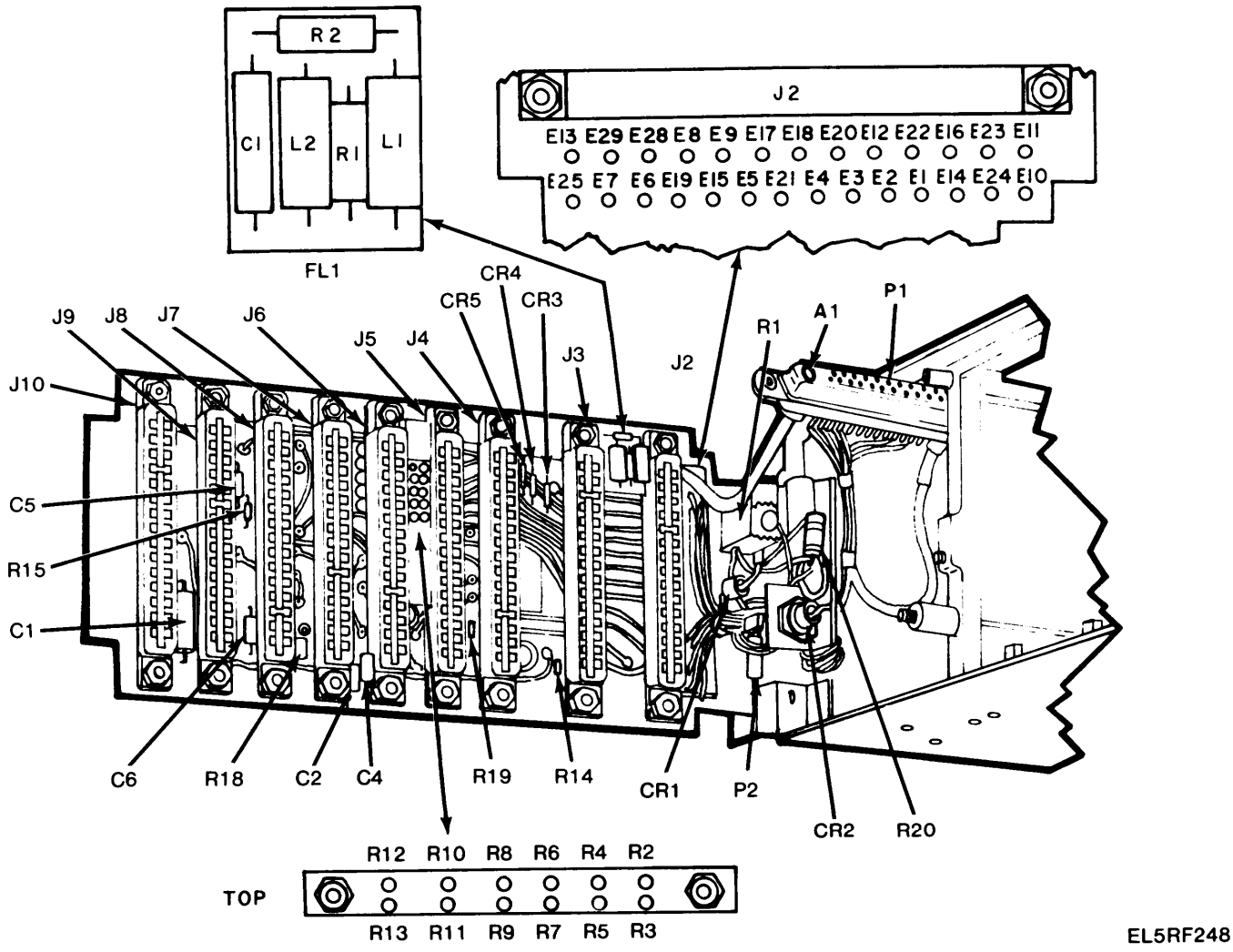



Figure 3-90. *Interconnecting Box 1RE1A2A1 or 5TR1A2A1.*

*(4) Frequency check.*

*(a)* Connect the test equipment as shown in figure 3-82.

*(b)* Set test facility switch S17 to ON and switch S 18 to each position in the chart below. The frequency counter should indicate the frequencies listed for each position.

| *S18 Position* | *Freq (MHz)* | *±Tolerance (Hz)* |
|---|---|---|
| *4'7.50* | 47.50 | 350 |
| 54.98 | 54.979165 | 400 |
| 63.46 | 63.454375 | 450 |
| 72.50 | 72.50 | 500 |

**NOTE**

Due to residual FM, the output frequency may not be perfectly stable. Using 1 Hz resolution and MANUAL Mode settings on the frequency counter, the fluctuations in frequency should be less than 150 Hz at 47.5 MHz and less than 300 Hz at 72.5 MHz.

*(c)* Set switch S17 to OFF.

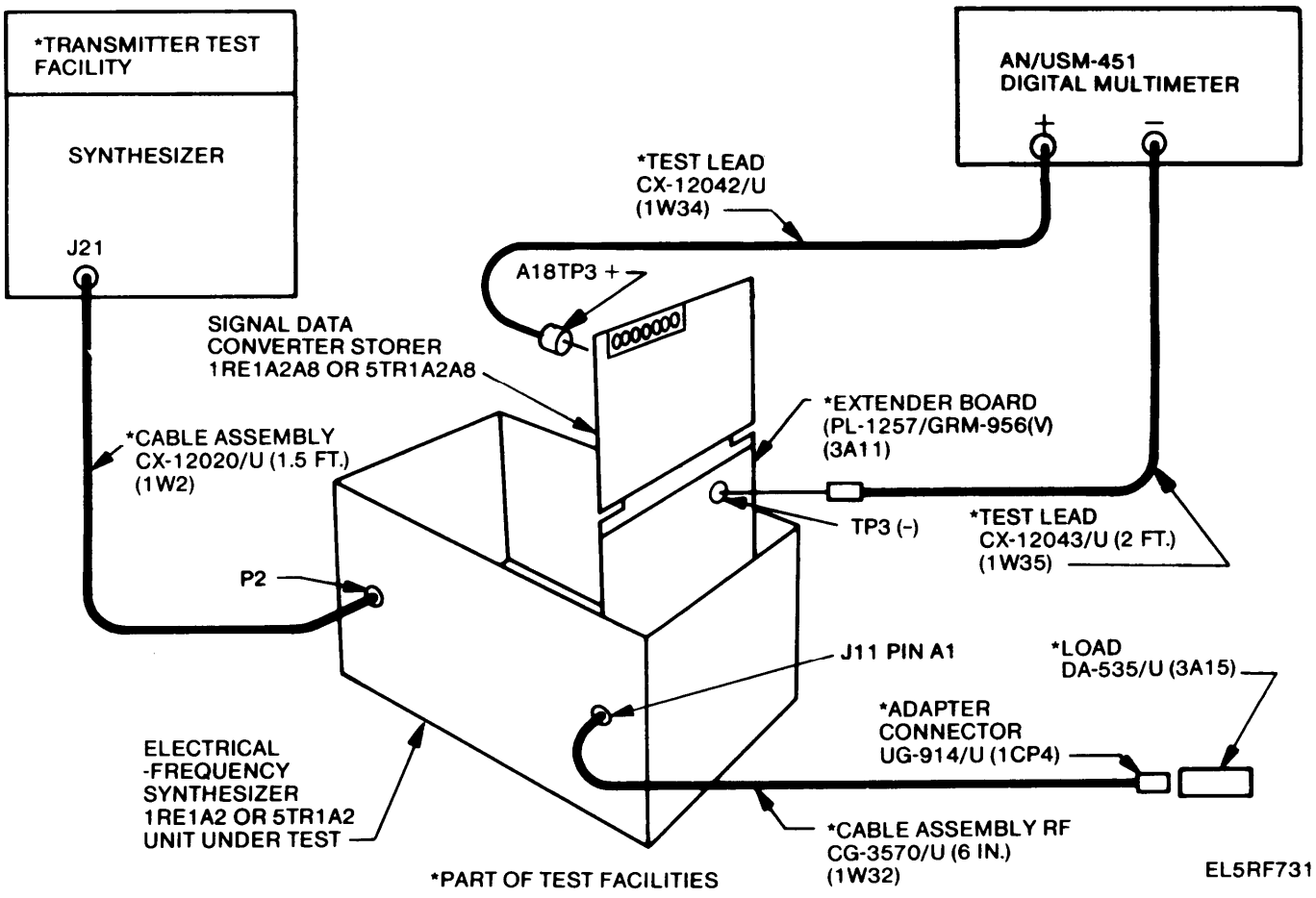



*Figure 3-91. Field Effect Transistor Operating Voltage Adjustment, Test Setup.*

**NOTE**

If the output frequency is outside the limits given in *(b)* and *(c)* above, proceed with *(e)* through *(k)* below.

*(e)* Extend rf oscillator board 1RE1A2Y11 or 5TR1A2Y11 from the synthesizer using extender board PL-1433/GRM-95(V) as shown in figure 3-93.

*(f)* Set switch S18 to 47.5 MHz.

*(g)* Connect the counter between TP1 (+) of rf oscillator 1RE1A2Y11 or 5TR1A2Y11 and TP3 of the extender board.

*(h)* Set switch S17 to ON; the counter should indicate 1 MHz ±30 Hz.

*(i)* If necessary, adjust C5 (fig. 3-94) to obtain the required frequency in *(h)* above.

*(j)* Set switch S17 to OFF and reinstall the extended board.

*(k)* Repeat *(a)* through *(d)* above. Observe the speicifed tolerances.

*(5) Power output and metering.*

*(a)* Connect the power meter to pin A1 of J11 on the synthesizer as shown in figure 3-85.

*(b)* Set test facility switch S17 to ON and switch S18 to each frequency position, in turn. Meter M1 should indicate between 20% and 80% FSD and the power meter indication should be between +12.5 dBm and +16 dBm for each position of S18. Set test facility switch S17 to OFF.

*(c)* If power meter indication is out of tolerance:

1. Extend modulator-oscillator board 1RE1A2A2 or 5TR1A2A2 from the synthesizer using extender board PL-1251/GRM-95(V).

**NOTE**

The extender board will cause a loss of approximately 1 dB. Verify output power before and after adjustments with the extender board removed and 1RE1A2A2 or 5TR1A2A2 reinstalled in the synthesizer.

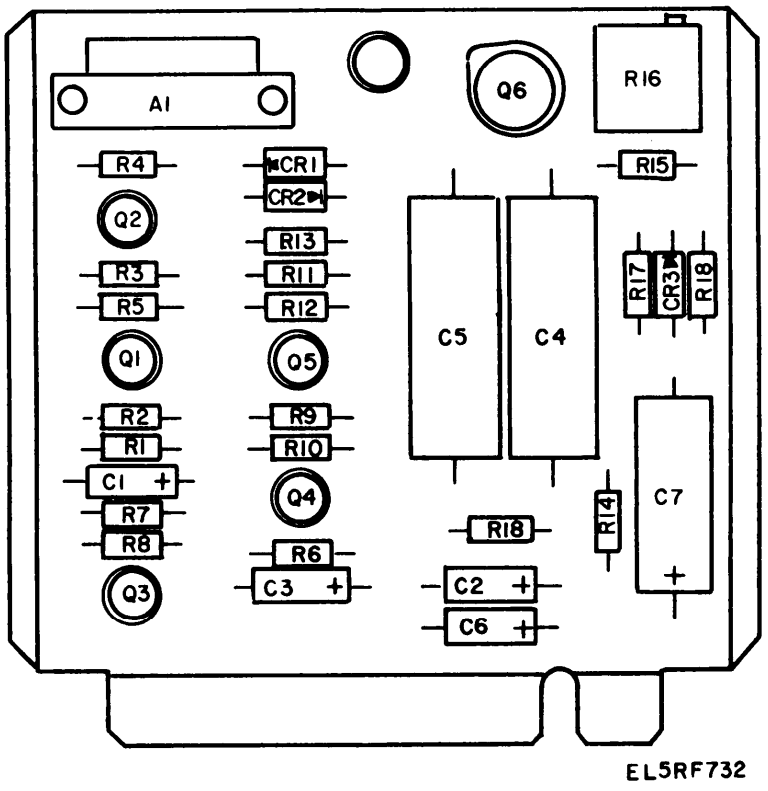



*Figure 3-92. Signal Data Converter-Storer 1RE1A2A18 or 5TR1A2A18, Parts Location.*

2. Adjust R25 (figure 3-97) for minimum power meter variation within the limits of *(b)* above.

3. Repeat *(b)* above.

*(6) Deviation*

*(a)* Connect the test equipment as shown in figure 3-88.

*(b)* Set test facility switch to S20 to 30 MHz DISCR.

*(c)* Set switch S18 to 47.50 and S17 to ON.

*(d)* Set the signal generator frequency to 77.5 MHz at a level of 0 dBm. Fine tune the signal generator frequency to obtain a zero center indication on test facility meter M2; readjust the signal generator output level until meter Ml indicates 50 percent of full scale deflection.

*(e)* Set switch S17 to the MOD ON position. The VTVM should indicate 50 mV ±3.5 mV.

*(f)* Repeat stesp *(c)* through *(e)* for each frequency setting of S18. The signal generator will be set at 30 MHz above the S 18 frequency setting. Note the setting of S18 which has the greatest difference from 50 mV.

*(g)* If the requirements of *(e)* and *(f)* above are not met:

1. Set S17 OFF, extend 1RE1A2A2 or 5TR1A2A2 from the synthesizer with extender board PL-1251/GRM-95(V). Set S17 to ON.

2. Adjust R6 while performing steps *(c)* through *(f)* above with S18 set to 47.5 MHz, 72.5 MHz, and to the position noted in *(f)* above.

3. Repeat *(g)* above until the VTVM indicates 50 mV ±3.5 mV at all frequency settings of switch S18.

4. Set test facility switch S17 to OFF. Reinstall 1RE1A2A2 or 5TR1A2A2 into the synthesizer and set S17 to ON.

5. Repeat steps *(c)* through *(f)* above.

*(h)* Set test facility switch S17 to OFF.

(7) *Modulation distortion check.*

*(a)* Connect the test equipment as shown in figure 3-89.

*(b)* Set test facility switches S18 to 47.50 and S17 to ON.

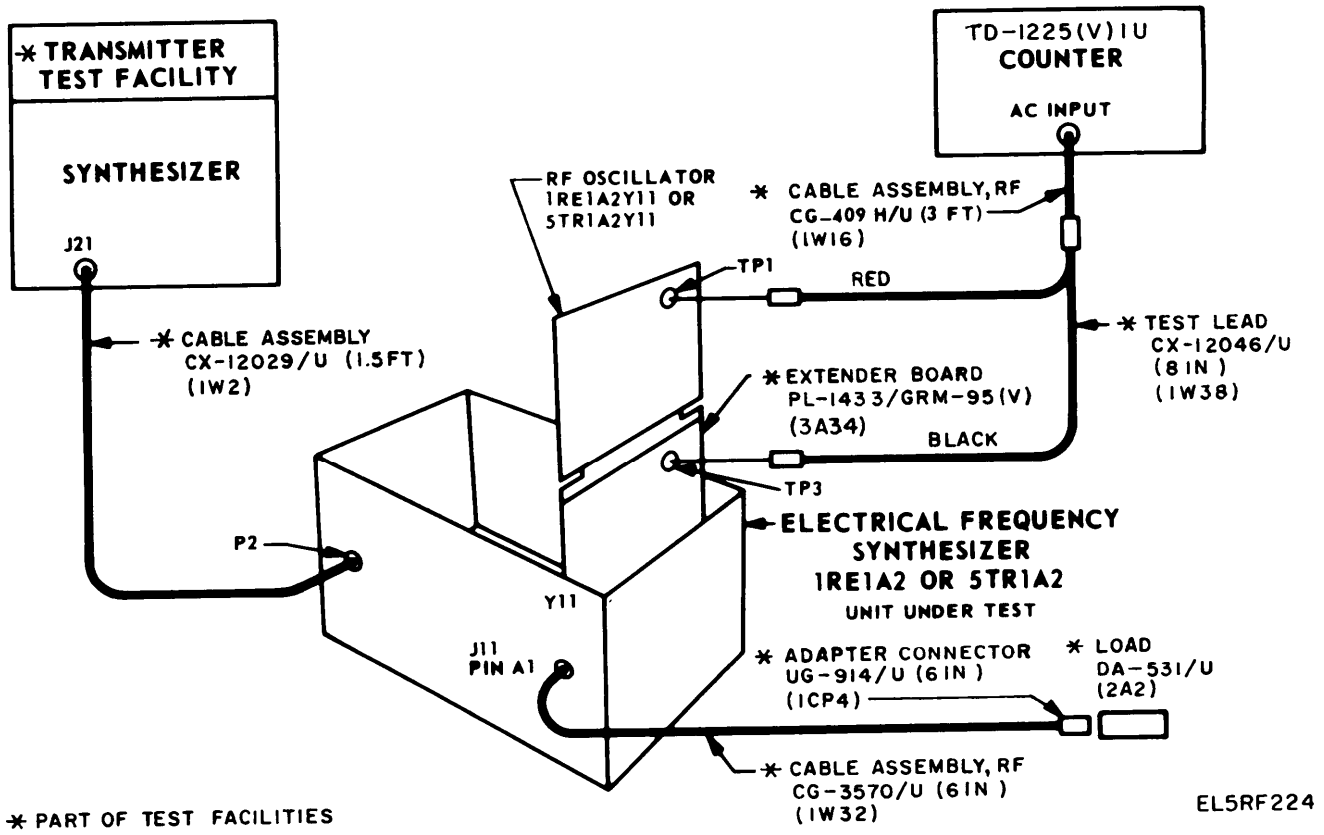



*Figure 3-93. Rf Oscillator 1RE1A2Y11 or 5TR1A2Y11 Frequency Check, Test Setup.*

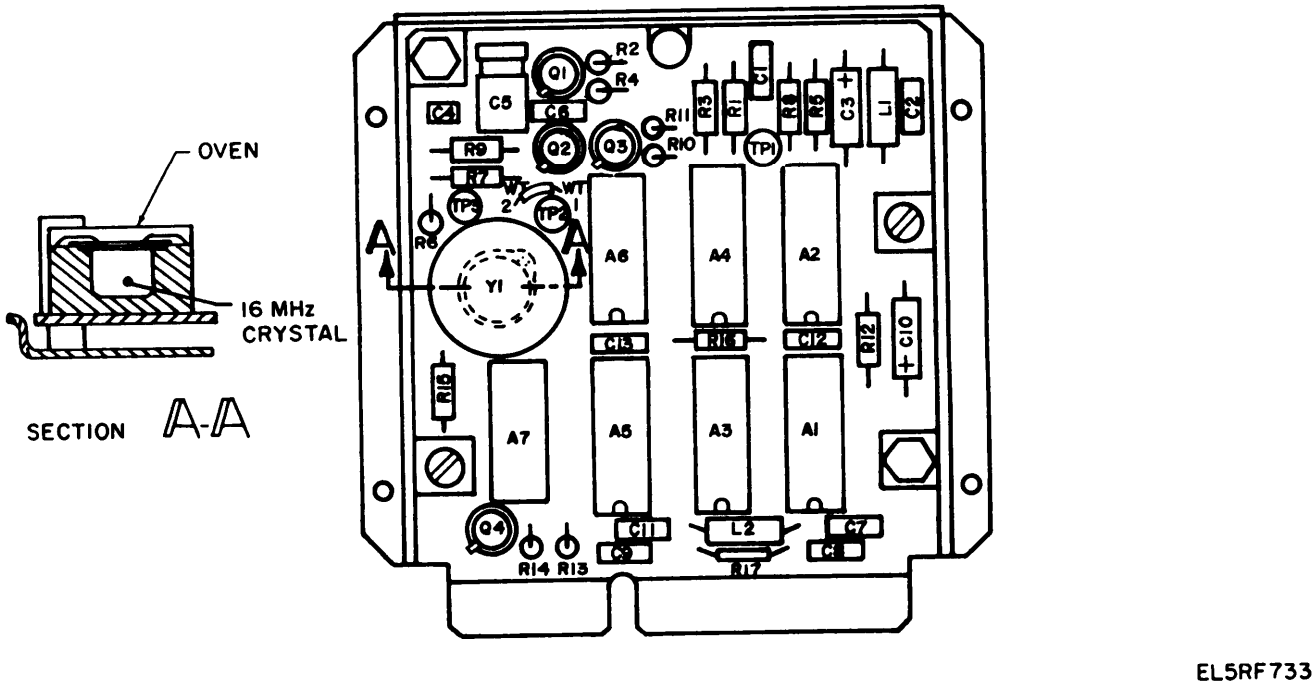



*Figure 3-94. Rf Oscillator 1RE1A2Y11 or 5TRIA2Y11, Parts Location*

*(c)* Set test facility switch to S20 to 30 MHz DISCR.

*(d)* Set the signal generator frequency to 77.5 MHz at a level of 0 dBm. Fine tune the signal generator frequency to obtain a zero center indication on test facility meter M2; readjust the signal generator output level until meter Ml indicates 50 percent of full scale deflection.

*(e)* Set the wide range oscillator to 20 kHz and adjust the output level for an indication of 45 mV using the distortion analyzer, voltmeter function.

*(f)* Set the distortion analyzer to measure distortion. The measured distortion shall not exceed 5 percent.

*(g)* Set switch S17 to OFF.

*(8) Continuity test* Using a digital multimeter, check for continuity between chassis ground and the following points on the synthesizer: P2 pin 4, J11 pin 5, and J11 pin 2. (If the digital multirneter reads an open, check for broken or missing wires.)

(9) *Fault isolation procedure.* If any of the requirements of (3) through (8) above are not met, isolate the fault in the following manner.

*(a)* Remove all boards from the synthesizer and insert a complete set of known good boards.

*(b)* If the synthesizer still fails to function properly, troubleshoot the synthesizer case *(d(2)* below).

*(c)* If the fault clears when the complete set of known good boards is installed isolate the faulty board(s) of the original set in the following manner

1. Remove know good board.
2. Insert original board.
3. Check for proper synthesizer operation. If normal indications are obtained with the original board proceed to *(d)* below. If normal indications are not obtained, replace original board with a new board and recheck synthesizer operation.

*(d)* Repeat *(c)* above for every board in the synthesizer (in case more than one orginal board is faulty) until all of the original boards have been checked (or replaced).

NOTE

If frequency divider board (1RE1A2A14 or 5TR1A2A14) appears to be defective, perform adjustment procedure in (10) below, prior to replacement.

(10) *Frequency divider adjustment (1RE1A2A14 or 5TR1A214).*

*(a)* Extend frequency divider board 1RE1A2A14 or 5TR1A2A14 using extender board PL-1431/GRM-95(V).

*(b)* Remove modulator-oscillator 1RE1A2A2 or 5TR1A2A2 from synthesizer.

*(c)* Connect the test equipment as shown in A, figure 3-95.

*(d)* Set switch S17 (on test facility) to on.

*(e)* Adjust signal generator frequency to 82 MHz *1 MHz, and output level to +12 dBm ±0.5 dB as indicated on the power meter.

*(f)* Connect signal generator to TP5 on extender board as in B, figure 3-95.

*(g)* Adjust L4 (figure 3-96) for a reading of 2.0 Vdc ±0.1 V on the digital voltmeter.

NOTE

There are two core positions at which 2.0 Vdc may be obtained The correct position is with the core more inside of the coil.

*(h)* Disconnect multimeter from TP1 on frequency divider.

*(i)* Adjust the signal generator frequency to 72.5 MHz ±0.8 MHz and the output level to +6 dBm ±0.5 dB. Output frequency should be 1.1333 MHz ±13 kHz.

*(j)* Adjust the signal generator frequency to 47.5 MHz ±0.5 MHz and the output level to +6 dBm ±0.5 dB. The output frequency should be 742 kHz ±8 kHz.

*c. Troubleshooting (Modulator-Oscillator 5TR1A2A2 or 1RE1A2A2 SM-D-698867* (Fig. 3-97 and FO-56)).

| *Symptom* | *Probable* | *Checks and corrective measures* |
|---|---|---|
| *SYNC alarm* on test facility no output from synthesizer. | Open or shorted component | To isolate the defective stage, measure the voltages and observe the waveforms in d(1) below. |
| Wrong synthesizer output frequency and/ or SYNC alarm on test facility. | Defective oscillator stage | Return to higher category maintenance. |
| Low level from synthesizer | Defective amplifier stage Q5 or Q6. | To isolate the defective stage, measure the voltages and observe the waveforms in d(1) below. |

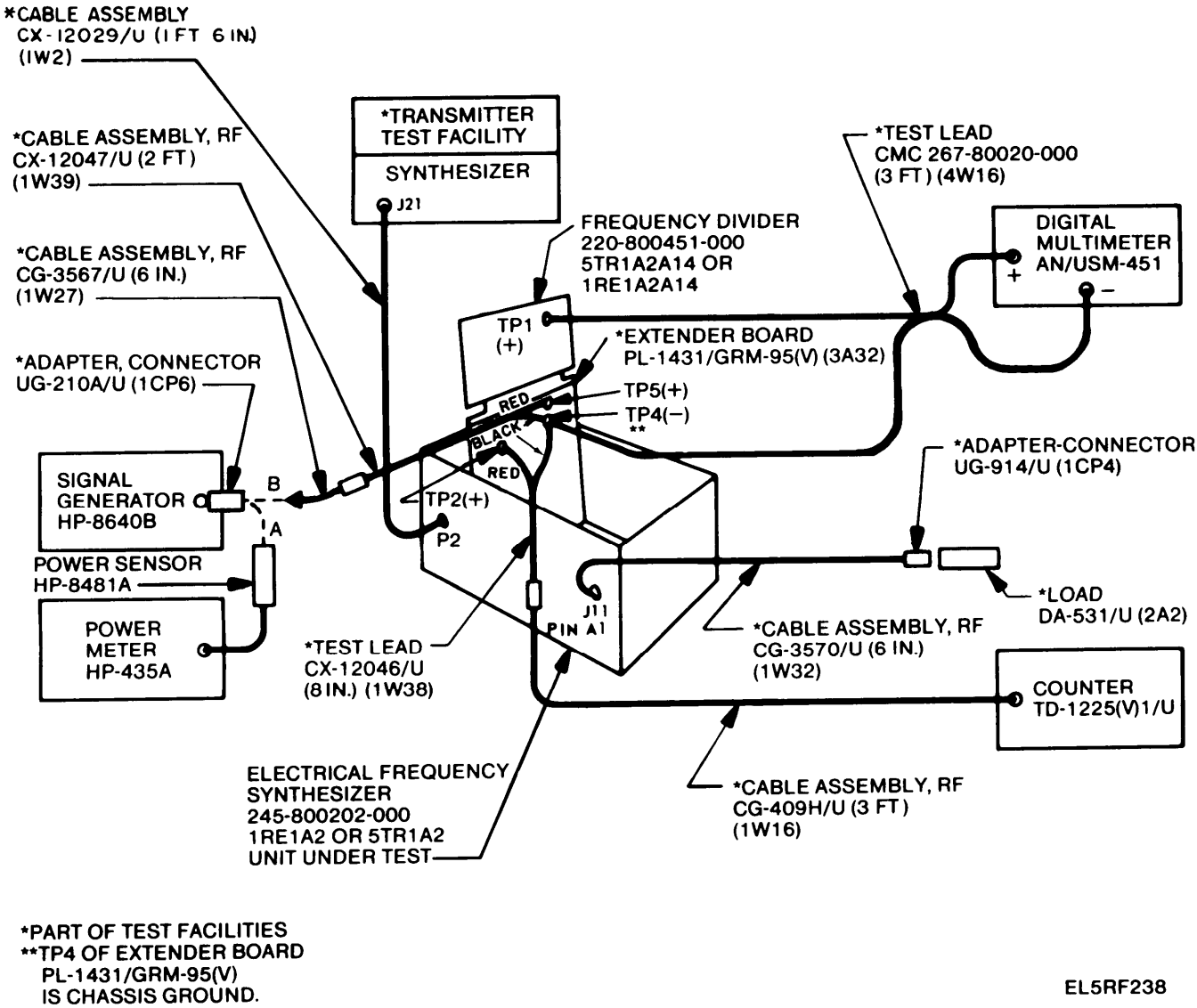



*Figure 3-95. Frequency Divider 1RE1A2A14 or 5TR1A2A14 Operating Voltage Adjustment Test Setup.*

*d. Typical Voltage Measurements.*

(1) *Modulator-oscdlator 1RE1A2A2 or 5TR1A2A2, SM-D-698867 (fig. 3-97).*

*(a)* Typical dc voltage indications using the allocated digital voltmeter and test facility switch S18 set at 47.50:

**NOTE**

Repair or replacement of Q1, Q2, Q3 or their related circuit components will require realinement of the modulator-oscillator. Refer to higher catagory maintenance for repair.

| *Test points* | *Typical indications (volts dc)* |
|---|---|
| Q4 emitter | 5.74 |
| Q4 base | 6.22 |
| Q4 collector | 12.0 |
| Q5 emitter | 4.0 |
| Q5 base | 4.1 |
| Q5 collector | 12.0 |
| Q6 emitter | 4.0 |
| Q6 base | 4.1 |
| Q6 collector | 12.0 |

*(b)* Typical signal voltage indications using the allocated oscilloscope and test facility switch S18 set to 47.50.

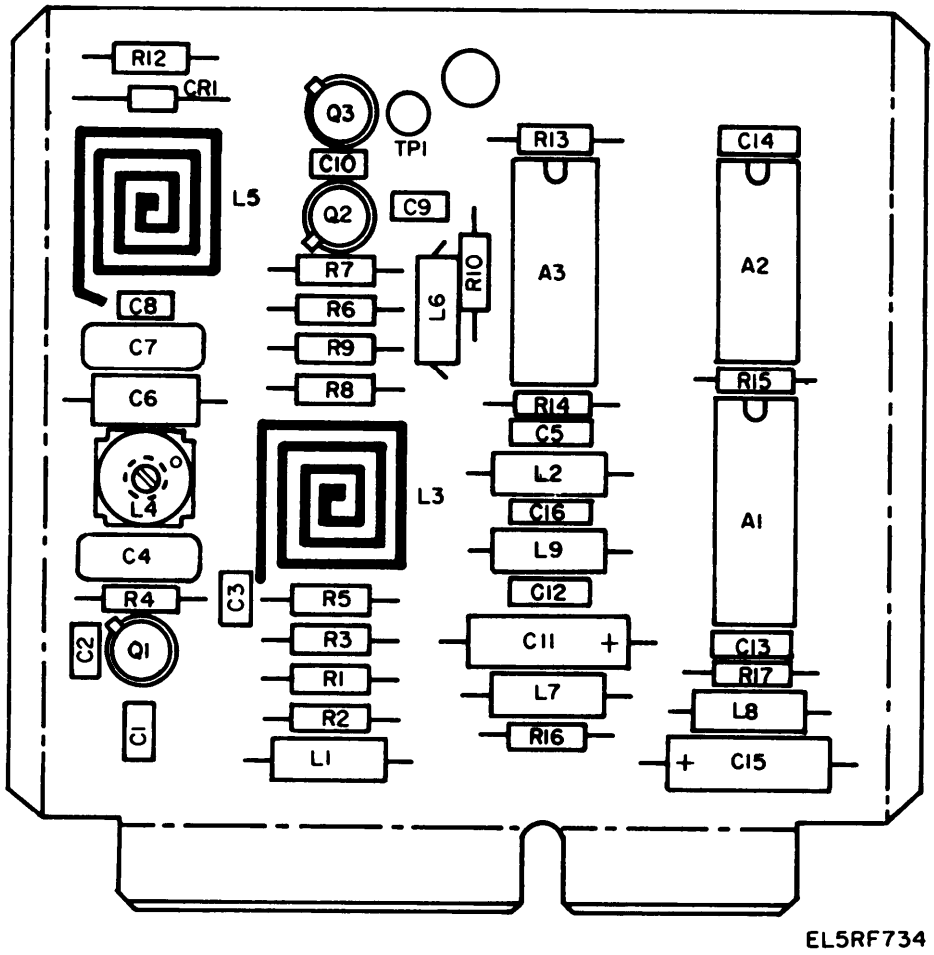



Figure 3-96. *Frequency Divider 1RE1A2A14 or 5TR1A2A14, Parts Location*

| *Test points* | *Typical indications (m V ac p-p)* |
|---|---|
| Q4 base | *260* |
| Q5 base | *250* |
| Q6 base | *350* |
| Q6 collector | *1300* |
| TP7(+) and TP3(–) of extender board | 850 |

(2) *Interconnecting box 1RE1A2A11 or 5TR1A2A11* (fig 3-98). Remove all plug-in circuit boards and set test facility switch S17 to ON. Check the voltages between the following test points.

| *Testpoints* | *Typical indication (volts dc)* |
|---|---|
| TP1(+) to E14(–) | 5 |
| E3(+) to E14(–) | 28 |
| E4(+) to E14(-) | 12 |
| E25(+) to E14(–) | 11.5 |

### 3-23. Alarm Control 5TR1A3

*a. Test Equipment and Material Required*

| *Equipment* | *Common name* |
|---|---|
| Test Facility, Transmitter TS-2866(V)2/GRM-95(V)2 | Transmitter test facility |
| Accessory Kit, Test Facilities Set, MK-1173(V)2/GRM-95(V)2 | Accessory kit |
| Multimeter, Digital AN/USM-451 | Digital multimeter |

*b. Test Procedure.*

(1) Connect the test equipment as shown in figure 3-99, but do not connect the unit under test to the test facility.

(2) Set the digital multimeter to the 2-volt scale. Set test facility switches S1 and S25 to their ON positions.

(3) Adjust the test facility SET INPUT control to give a 0.5 V (500 mV) indication on the digital multimeter.

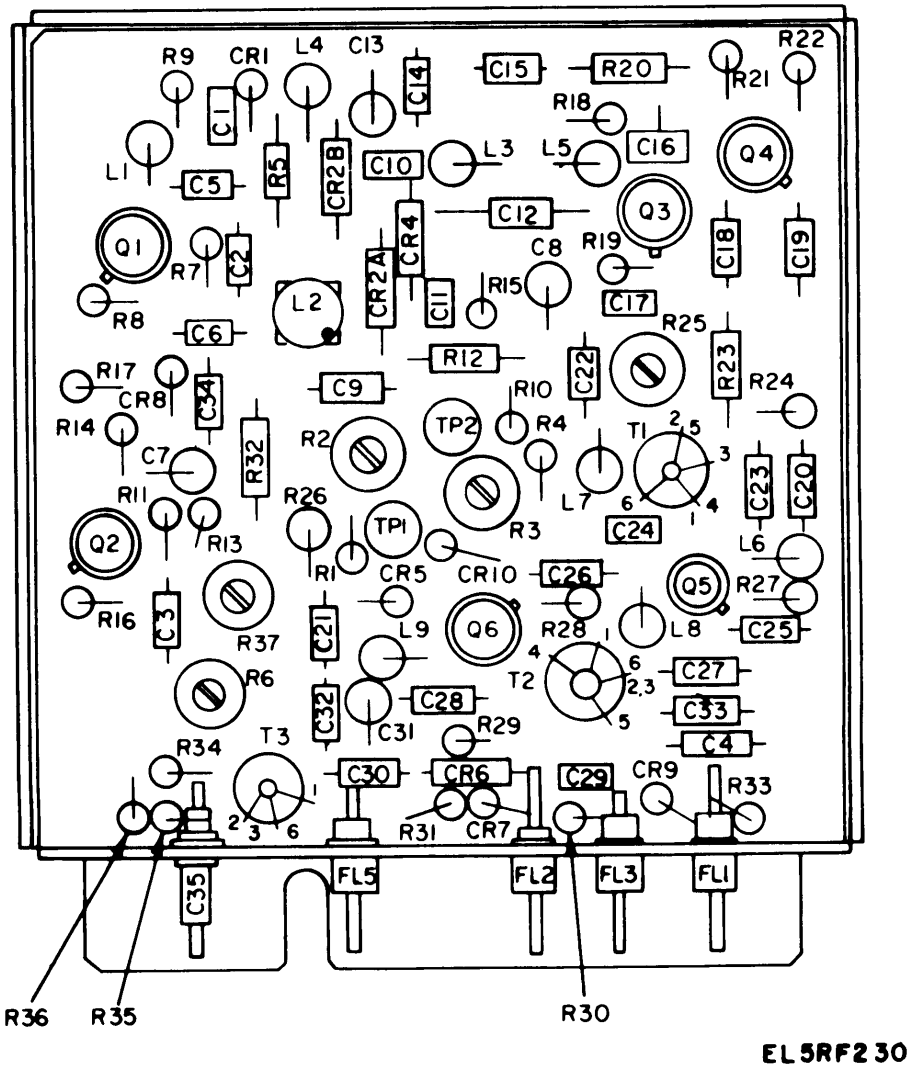



*Figure 3-97. Modulator-Oscillatior 5TR1A2A2 or 1RE1A2A2, Parts Location SM-D-698867.*

*(4)* Connect the unit under test to the test facility at J33 as shown in figure 3-99. The digital multimeter should indicate at least 460 mV.

**NOTE**

If unable to adequately mate connector J1 of UUT and cable assembly CX-12030/U temporarily remove 2 each stand offs from connector J 1 and replace with 2 each 4 X 40 binding head screws.

(5) Slowly adjust the SET INPUT control in a counter clockwise direction (CCW) until the panel alarm lamp lights. The digital multimeter should indicate 0.080 ±0.005 volts (80 mV ±5 mV).

*(6)* Slowly adjust the SET INPUT control in a clockwise direction (CW) until the panel alarm light extinguishes. The digital multimeter should indicate between 0.110 and 0.150 volts (110 mV and 150 rev).

(7) If the above conditions are not met, proceed as follows:

*(a)* Disconnect the unit under test from the test facility. Adjust the SET INPUT control to obtain a 0.5 V (500 mv) indication on the digital multimeter.

*(b)* On the unit under test, turn the ALARM SENS preset adjust, R7 (figure 3-100) potentiometer CCW for more than 22 turns.

*(c)* Connect the unit under test to J33 of the test facility. The digital multimeter should indicate at least 0.46 V (460 mV).

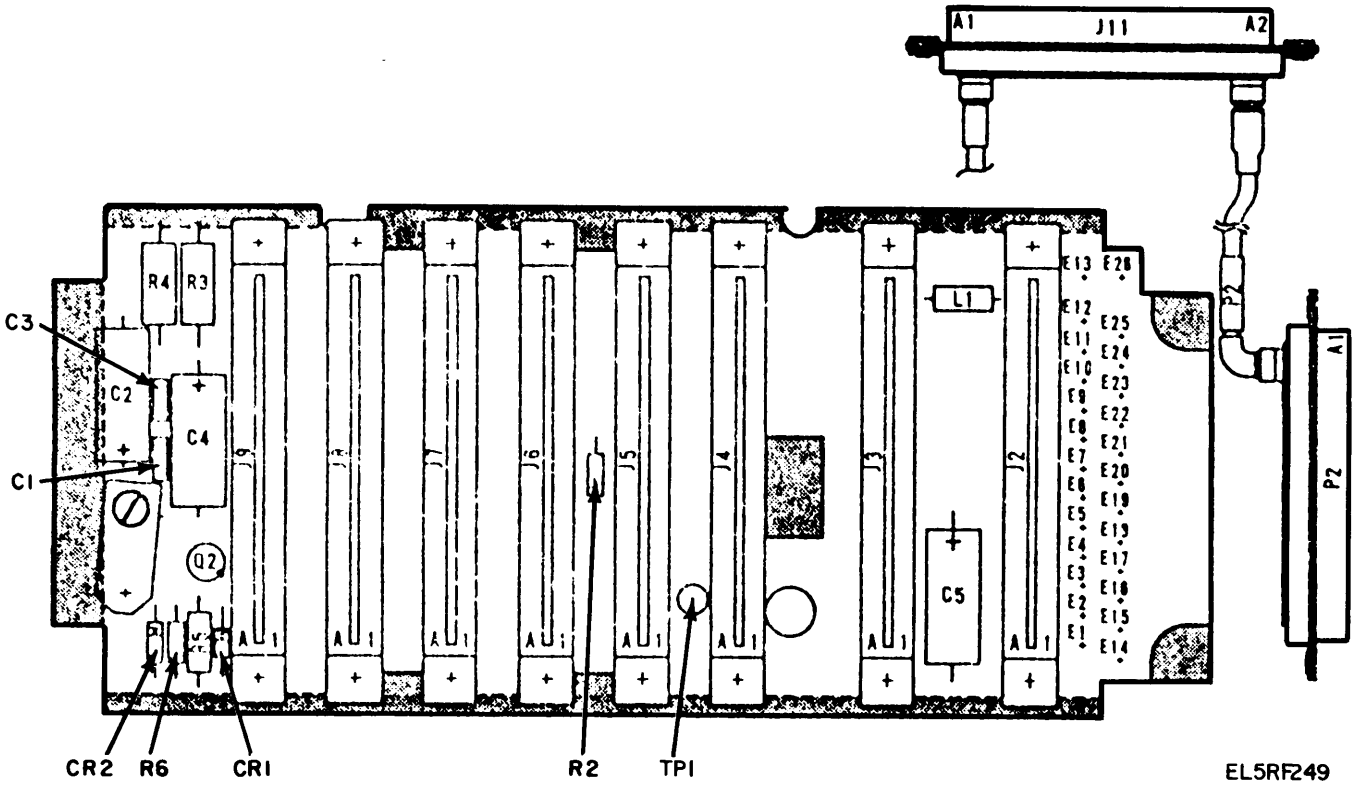



Figure 3-98. *Interconnecting Box 1RE1A2A11 or 5TR1A2A11.*

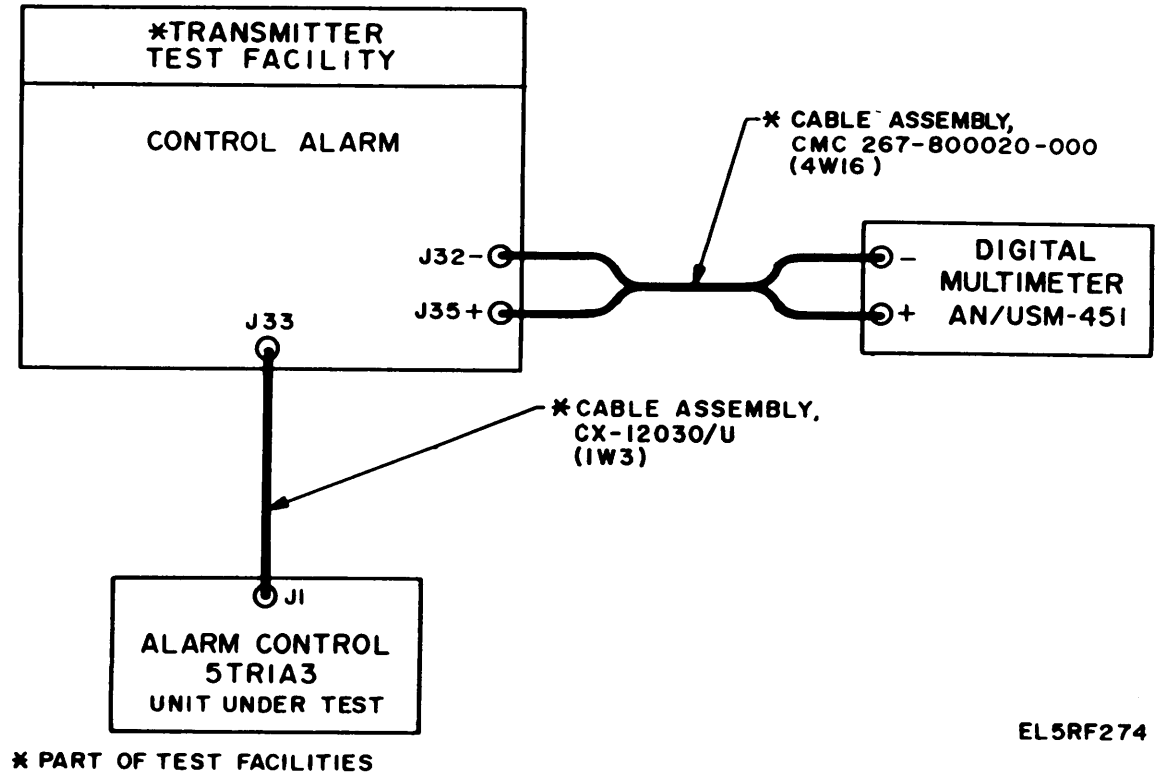



*Figure 3-99. Alarm Control 5TR1A3, Test Setup.*

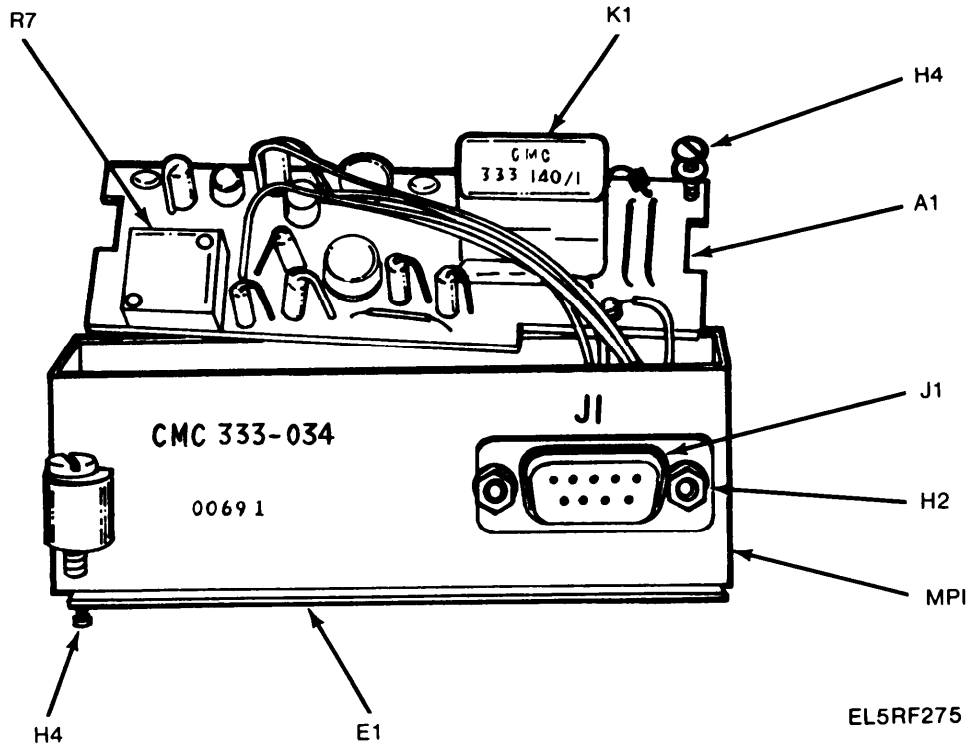



*Figure 3-100. Alarm Control 5 TR1A3, Cover Removed.*

*(d)* Slowly adjust the SET INPUT control CCW until the panel alarm lamp lights. The digital multimeter should indicate more than 0.16 V (160 mv).

*(e)* On the unit under test, turn the ALARM SENS adjust (R7) potentiometer CW for more than 22 turns. Reset the SET INPUT control to obtain a 0.5 V (500 rev') indication on the digital multimeter.

*(f)* Slowy adjust the SET INPUT control CCW until the panel alarm lamp lights. The digital multimeter should indicate less than 0.075 V (75 rev). Turn the SET INPUT control CW until the alarm lamp extinguishes.

*(g)* Adjust the SET INPUT control to obtain an indication of 0.080 V (80 mv) on the digital multimeter. On the unit under test, adjust turn ALARM SENS adjust (R) potentiometer until the alarm lamp lights.

(h.. Adjust the SET INPUT control to obtain a 0.5 V (500 mV) indication on the digital multimeter, then slowly turn the control CCW until the alarm lamp lights. The multimeter should indicate 0.080 ±0.005 V (80 ±5 rev).

(i) Repeat procedures (1) through (7) above.

*C. Troubleshooting (fig. 3-101).*

| *Symptom* | *Check and corrective measures* |
|---|---|
| Incorrect meter reading; Test facility control alarm lamp lights. | Measure the voltage at CR2, CR3, CR4, Q1, and Q2 (fig. 3-101 and FO-36) as described in *d* below. |
| Correct meter reading control alarm lamp lights. | Measure the voltage at Q3 and Q4 (d. below). Check relay K1 as described below. |
| Normal indications; but control alarm lamp does not light | Check relay K1 contacts for continuity (between E1 and E2 terminals). Replace if contacts are sticking. |

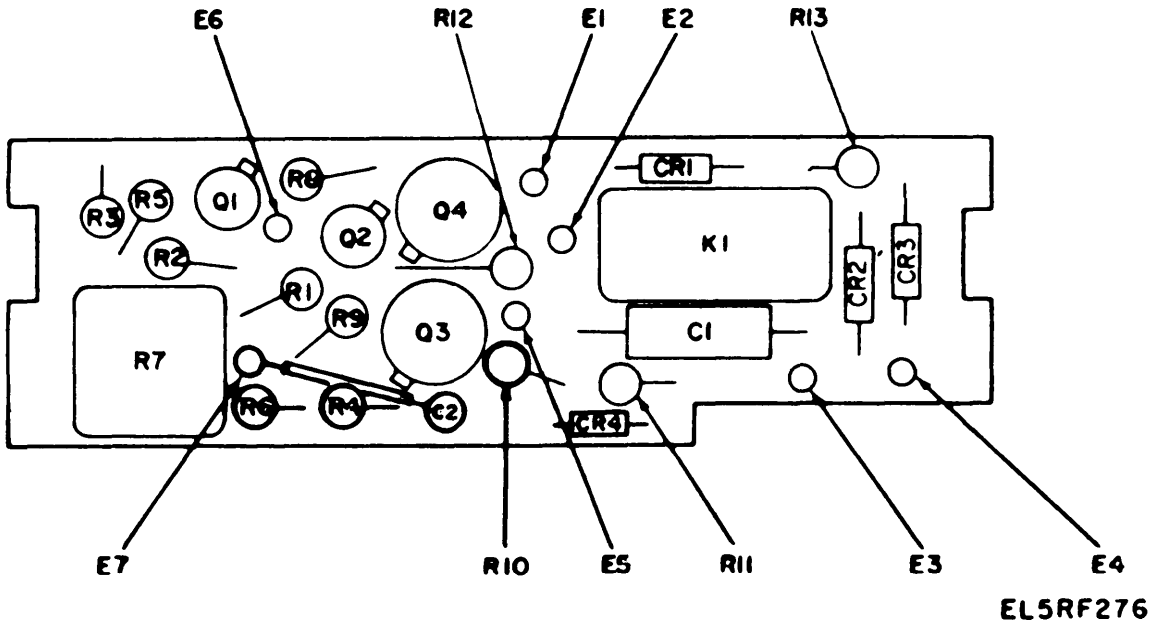



Figure 3-101. Alarm Control 5TR1A3A1, Parts Location

| *Test point* | *Typical indication (Vdc)* | *Probable cause of incorrect result* | *Corrective action* |
|---|---|---|---|
| Junction of CR2 and CR3 | +19.5 | Faulty diodes | Check forward and reverse resistance of diodes. Replace if necessary. |
| Junction of CR4 and R11 | +6.0 | Faulty diode | Same as above. |
| Q1-Emitter | +0.1 | Faulty transistor stage | Measure resistance of R7, Q1, and Q2((2) below). |
| -Base | +0.12 | | |
| Q2-Collector | +1.8 | | Replace transitor or resistor as required. |
| Q3-Emitter | +2.5 | Faulty transistor stage | Measure resistance of Q3 and Q4 to isolate stage. |
| -Collector | +2.3 | | |
| Q4-Emitter | −5.4 | | Refer to resistance chart ((2) below). |
| -Base | −4.6 | | |
| -Collector | −4.7 | K1 defective | Check relay operation. |

(2) *In-circuit resistance measurements.*

**NOTE**

All resistance measured with allocated digital multimeter.

| *Stage transistor type* | *Base (−)* | | | | *Base (+)* | | | |
|---|---|---|---|---|---|---|---|---|
| | *Emitter(+) Resitance (ohms)* | *Range* | *Collector(+) Resistance (ohms)* | *Range* | *Emitter(−) Resistance (ohms)* | *Range* | *Collector(−) Resistance (ohms)* | *Range* |
| Q1 (2N930) | 17k | x 20k | 2k | x 20k | 9.68k | x 20k | 1.7k | x 20k |
| Q2 (2N930) | Infinity | x 20k | Infinity | x 20k | 12.26k | x 20k | 12.0k | x 20k |
| Q3 (2N1132) | 7.5k | x 20k | 10k | x 20k | 7.5k | x 20k | Infinity | x 20k |
| Q4 (2N697) | Infinity | x 20k | Infinity | x 20k | 10k | x 20k | 10k | x 20k |

### 3-24. Amplifier-Frequency Multiplier

a. *Test Equipment Required.*

| *Equipment* | *Common name* |
|---|---|
| Test Facility, Transmitter TS-2866(V)2/GRM-95(V)2 | Transmitter test facility |
| Accessory Kit, Test Facilities MK-1173(V)2/GRM-95(V)2 | Accessory kit |
| Accessory Kit, Test Facilities MK-1985(V)2/GRM-95(V)2 | Accessory kit |
| Test Facility, Receiver TS-2867(V)2/GRM-95(V)2 | Receiver test facility |
| Test Facility, RF Modules TS-3837(V)2/GRM-95(V)2 | Module test facility |
| Sweep Generator, Wiltron 610D | Sweep generator |
| Plug-in Unit Wiltron 61084D | Plug-in unit |
| Power Meter HP-435A | Power meter |
| Power Sensor HP-8481A | Power sensor |
| Oscilloscope AN/USM-281C | Oscilloscope |
| Rf Power Amplifier ENI 603L | Power amplifier |
| Signal Generator HP 8640B | Signal generator |
| Rf Voltmeter ME-426/U | Rf voltmeter |
| Digital Multimeter AN/USM-451 | Digital multimeter |

**NOTE**

Set power supply PP-6304/GRM-95(V) for a 115 Vac output as indicated on its panel voltmeter. Maintain this output throughout the following procedures.

**CAUTION**

- The attenuators selected for use throughout this paragraph are to prevent accidental damage to test equipment and to the unit under test. Extreme caution must be exercised when these attenuators are not used.
- The rf signal level input to RF INPUT of the power amplifier, ENI 603L, must not exceed –5 dBm.
- The rf signal level input to RF IN, J39 on the test facility, must not exceed +20 dBm.
- Rf output levels at RF OUT, J38 on the test facility, can exceed 6 W (+37.8 dBm), and 3 W (+34.8 dBm) at RF OUT on the power amplfler. These outputs must be connected to 50 ohm loads at all times and caution must be exercised to avoid damage to any equipment connected to these outputs.

*b. Test Procedures.*

(1) *Input VSWR Test*

*(a)* Connect the equipment as shown in A, figure 3-102.

*(b)* Set the sweep generator controls for a CW output at a frequency of approximately 60 MHz. Adjust the rf output level for a +10 dBm indication on the power meter.

*(c)* Connect the equipment as shown in B, figure 3-102.

*(d)* Set the sweep generator controls for a sweep output from 47.5 MHz to 72.5 MHz, and adjust the oscilloscope controls for a convenient display with at least a 4 cm vertical displacement. This is the 2:1 VSWR reference. Note this reference and do not readjust the sweep generator output or oscilloscope vertical controls.

*(e)* Connect the equipment as shown in C, figure 3-102. Turn test facility switches S1 to ON, S20 to S30, and S30 to ON.

*(f)* The VSWR as displayed on the oscilloscope shall be less than the 2:1 reference from 47.5 to 72.5 MHz.

*(g)* Turn S30 to OFF.

(2) *Power output check.*

*(a)* Remove the chassis cover opposite P1 of the unit under test and connect the equipment as shown in A, figure 3-103.

(b) Set the test facility switches as follows:

| *Switch* | *Position* |
|---|---|
| S12 | ON |
| S1 | ON |
| S20 | S30 |
| S30 | ON |

*(c)* Adjust the signal generator for an output level of +15 dBm as indicated on the power meter at a frequency of 47.5 MHz.

*(d)* Connect the equipment as shown in B, figure 3-103. The power output of the unit under test should be not less than +34 dBm (+14 dBm power meter indication), test facility meter Ml indication should be not more than 75% and the digital multimeter should indicate not more than 0.450 Vdc.

*(e)* Slowly vary the signal generator frequency from 47.5 MHz to 72.5 MHz. The power output, Ml and digital multimeter indications should remain as specified in *(d)* above.

*(f)* Repeat *(a)* and *(c)* through *(e)* above for a signal generator output level of +12.5 dBm. The power output and Ml indication should remain as specified in *(d)* above and the digital multimeter should indicate not less than 175 m Vdc.

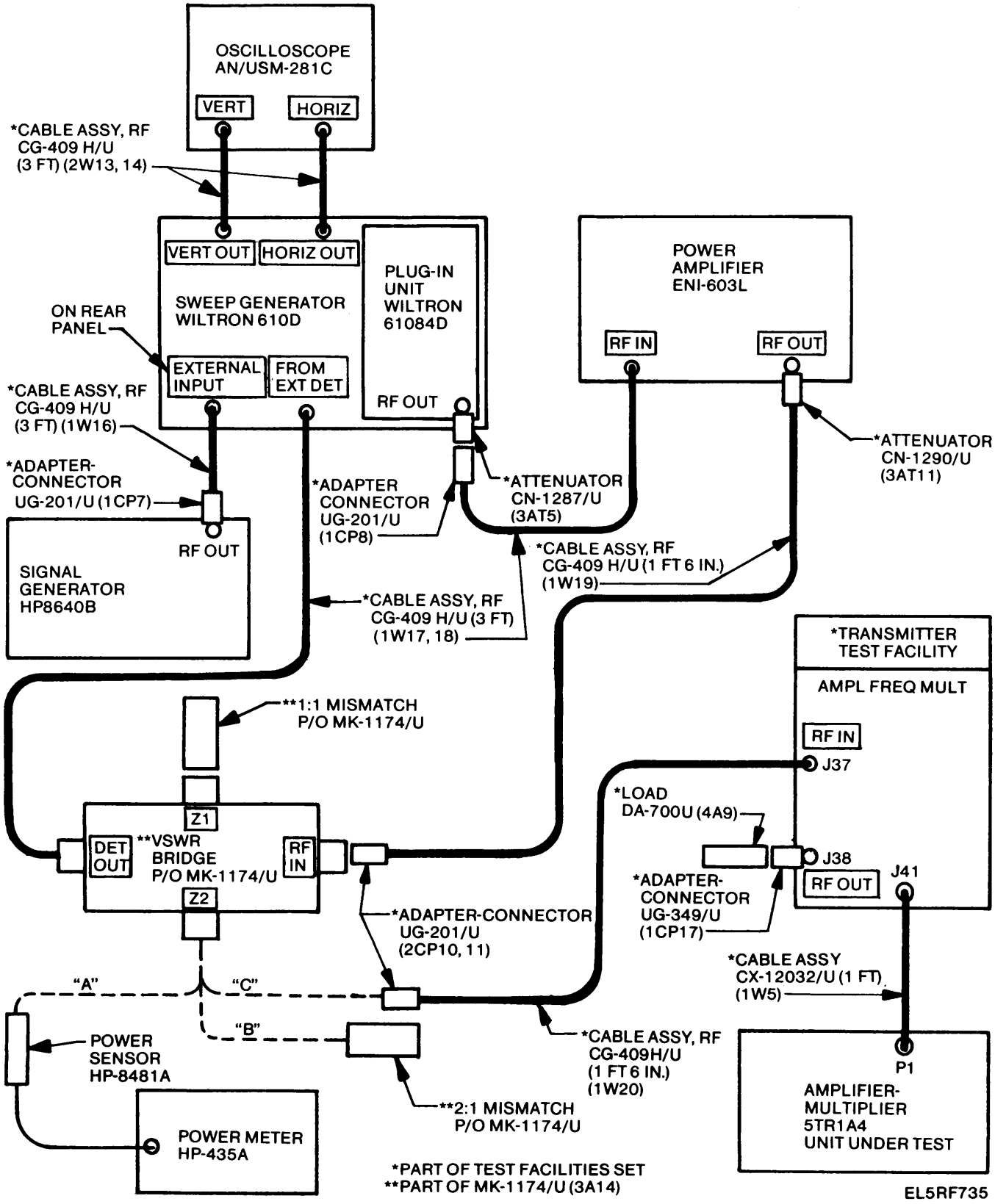



Figure 3-102. *Amplifier-Frequency Multiplier 5TR1A4 VSWR Test Setup.*

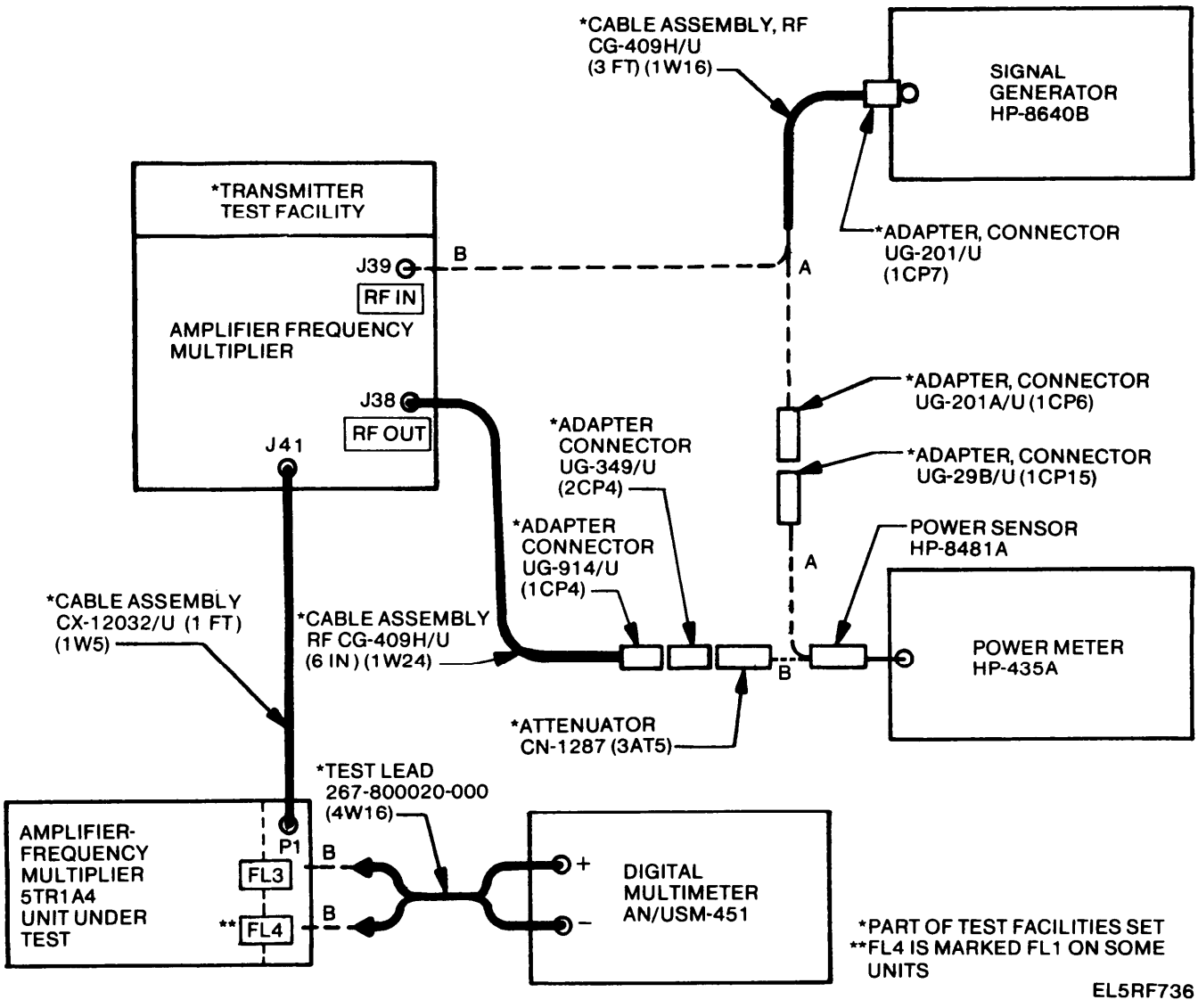



*Figure 3-103. Amplifier-Frequency Multiplier 5TR1A4 Power Output, Test Setup.*

*(g)* Set the signal generator RF switch to OFF. Test facility meter M1 should indicate not more than 20%. Reset the RF switch to ON.

*(h)* If an unstable output is obtained, realine the unit under test as described in the alinement procedure (para. e).

*(i)* Set the signal generator frequency to 47.5 MHz. Note the power meter indication.

*(j)* Set test facility switch S30 to AGC 1. The power meter indication should not decrease more than 1 dB below the indication noted in (i) above.

*(k)* Set test facility switch S30 to AGC 2. The power meter may indicate a decrease in power.

*(l)* Set test facility switch S30 to AGC 3. The power meter indication should decrease further to at least 3 dB below the indication noted in *(i)* above.

(m) Repeat *(i)* through *(l)* above at 60 MHz and 72.5 MHz.

*(n)* Replace the cover on the unit under test.

*(3) Harmonic and fundamental frequency rejection test.*

*(a)* Connect the equipment as shown in figure 3-104 using the 95 to 190 MHz filter, and set test facility switch S30 to ON.

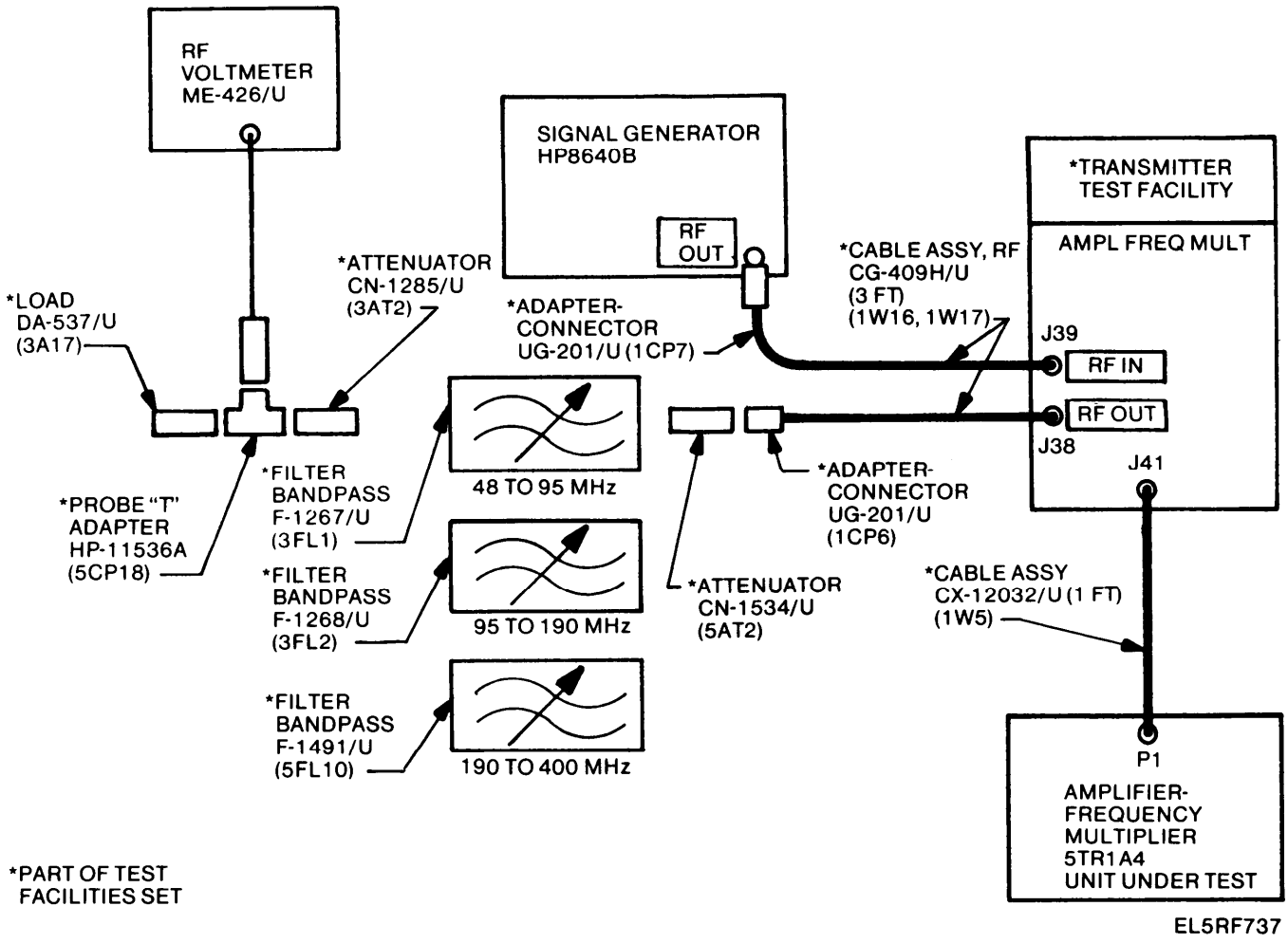



*Figure 3-104. Amplifier-Frequency Multiplier 5TR1A4, Harmonic Rejection Test Setup.*

*(b)* Set the signal generator to 47.5MHz and adjust the OUTPUT LEVEL control for an output of +12.5 dBm.

*(c)* Adjust the filter around 142.5 MHz for a peak indication on the rf voltmeter. This is the third harmonic of the unit under test input frequency. The peak rf voltmeter indication should not exceed – 17 dBm.

*(d)* Tune the signal generator from 47.5 to 72.5 MHz while maintaining a peak indication on the rf voltmeter by tracking the filter to the third harmonic of the signal generator frequency (142.5 to 217.5 MHz filter frequency).

**CAUTION**

Turn test facility switch S30 to OFF when changing filters.

**NOTE**

For third harmonic frequencies above 190 MHz (63.3 MHz signal generator frequency) change to the 190 to 400 MHz filter.

*(e)* The rf voltmeter peak indication should not exceed – 17 dBm.

*(f)* Set the signal generator to 48.5 MHz and tune the 190 to 400 MHz filter around 194 MHz for a peak rf voltmeter indication of the fourth harmonic. The rf voltmeter peak indication shall not exceed – 12 dBm.

*(g)* Repeat *(b)* through *(d)* above using the 48 to 95 MHz filter tuned to the fundamental (input) frequencies from 48.3 to 72.5 MHz. The rf voltmeter peak indication shall not exceed –17.5 dBm.

*(h)* Turn test facility switch S30 to OFF.

*c. Troubleshooting (F0-23).*

| *Symptom* | *Checks and corrective measures* |
|---|---|
| 1. No output (para. *b* (2) above). | a. Check +28 Vdc supply at L10, L12, and L16; investigate any abnormal indication; replace components as required (fig. 3-105).<br>b. Using oscilloscope, check the input signal at E1 and E3 (5TR1A4FL1); refer to chart *d(l)* below. If signal not present at E3, check continuity of L1 through L4 (5TR1A4FL1). If defective, replace 5TR1A4FL1 (fig. 3-106).<br>c. Check connector and cable Al of P1 to E1 (5TR1A4FL1), repair or replace cable and connector.<br>d. If signal normal at E3 (5TR1A4FL1), check signal through transistor stages (chart *d(1)* below). If signal at Q1 is abnormal, check continuity of T1 windings, and forward and reverse resistances of CR1 diodes.<br>e. If problem is isolated to transistor stage, check voltages and resistances. Refer to paragraph *d* below for transistor resistance measurements.<br>f. If transistor stages check normal, check continuity of components from Q3 through E9 and cable from E9 to connector A2 of P1 for short circuit. Repair or replace components as required. |
| 2. Output normal, no meter M1 indication. | Check CR1, mounted between filters FL4 (maybe marked FL1 on older units) and FL3, for possible short circuit, and L 17 and R 17 for open circuit; replace components as required. |
| 3. Excessive current consumption. | Check R1 and R2 for open circuit; resolder connections if loose. |
| 4. Low output | a. Using oscilloscope, check gain of transistor stages. Refer to chart *d(1)* below. Check components in isolated stage and replace as required.<br>b. Check continuity of components from Q3 through A2 of P1. Replace or repair as required.<br>c. Check alinement and frequency response. Refer to paragraph e below. |
| 5. High VSWR level (b (1) above) | Check input filter components; refer to fig.3-106. |
| 6. High harmonic level *(b(3)* above) | Check alinement; refer to *e(2)* below |

*d. Signal Voltage and Resistance Measurements.*

(1) *Signal voltages* (Fig. 3-107).

| *Test points* | *Typical indication* |
|---|---|
| E1 | 3.0 V peak-to-peak |
| E3 | 3.0 V peak-to-peak |
| Q1-Base | 250 mV peak-to-peak |
| -Collector | 875 mV peak-to-peak |
| Q2-Base | 750 mV peak-to-peak |
| -Collector | 4.0 V peak-to-peak |
| Q3-Base | 2.5 V peak-to-peak |
| -Collector | 4.0 V peak-to-peak |

**NOTE**

The value of resistor R12 is selected under test. If Q3 is replaced and the output remains low, change R12 from 56 ohms to 150 ohms or vice versa.

*(2) Transistor resistance measurenments.*

**NOTE**

All resistances measured with the allocated digital multimeter.

| *Transistor* | | *Base (Pos)* | | *Base (Neg)* | |
|---|---|---|---|---|---|
| | | *Emitter (Neg)* | *Collector (Neg)* | *Emitter (Pos)* | *Collector (Pos)* |
| *Ref* | *Type* | *Res (ohms)* | *Res (ohms)* | *Res (ohms)* | *Res (ohms)* |
| Q1 | 2N3866 | 2500 | 3500 | 1950 | 1850 |
| Q2 | 2N3866 | 2500 | 3500 | 1950 | 1850 |
| Q3 | 2N3375 | 0 | 1950 | 0 | 1450 |

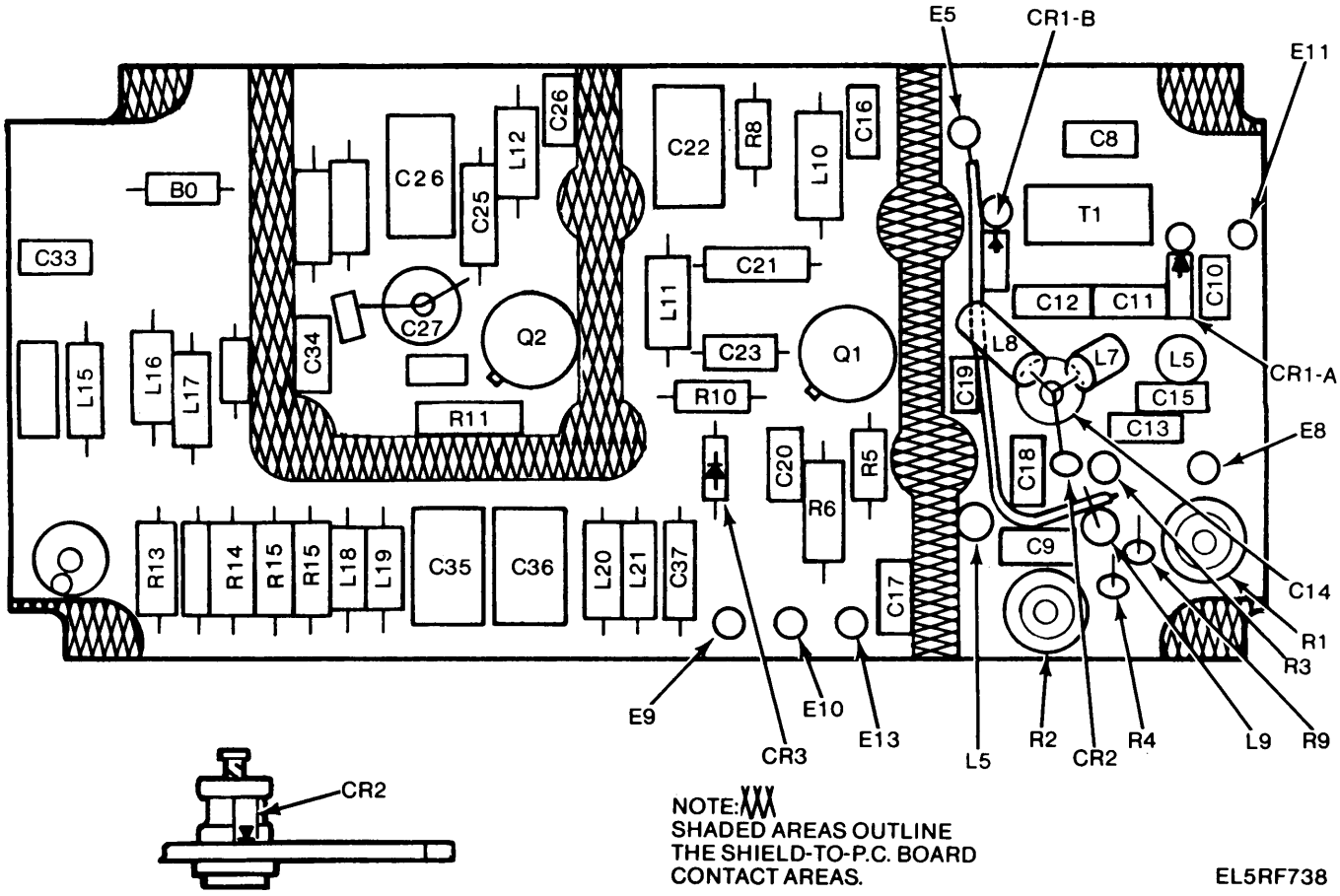



*Figure 3-105. Amplifier-Frequency Multiplier 5TR1A4A1, Parts Location.*

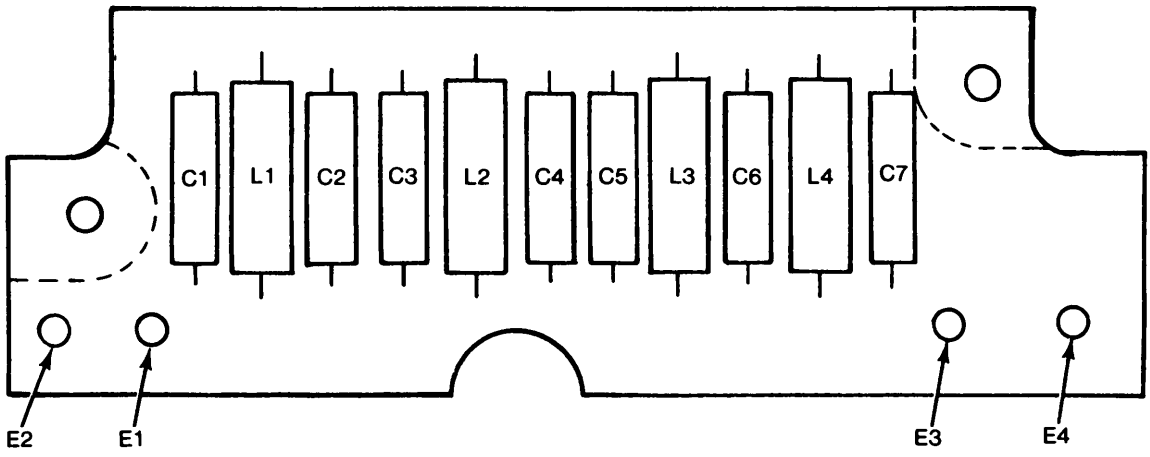



*Figure 3-106. Lowpass Filter 5TR1A4FL1, Parts Location.*

*e. Alinement.*

**CAUTION**

**The CAUTIONS listed in paragraph *b.* above should be observed throughout the following procedures.**

(1) *Power output test setup calibration.*

*(a)* Connect the equipment as shown in A, figure 3-108.

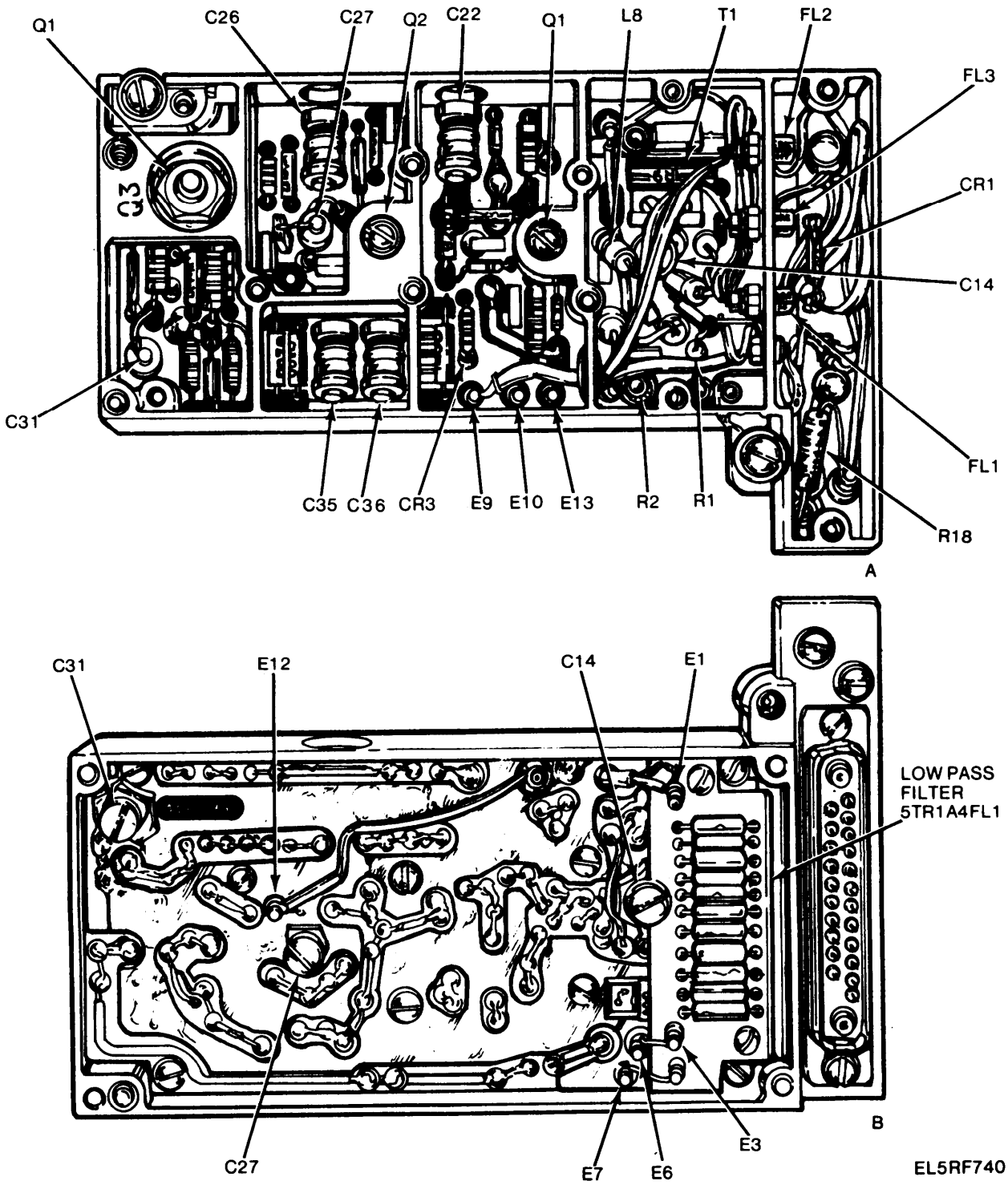



Figure 3-107. Amplifier-Frequency Multiplier 5TR1A4, Parts Location

*(b)* Set the sweep generator for a power amplifier output level of +34 dBm (+14 dBm power meter indication) at approximately 60 MHz.

*(c)* Connect the equipment as shown in B, figure 3-108.

*(d)* Without disturbing the RF POWEF LEVEL controls, set the sweep generator and oscillo scope controls for a convenient sweep response dis play from 40 MHz to 80 MHz (using markers) with a vertical displacement of at least 4 cm.

*(e)* Note the vertical deflection level displayed for 60 MHz. This is the minimum output power level (+34 dBm) reference line (disregard deflection level variations at other frequencies). Do not readjust the oscilloscope vertical controls without repeating *(a)* through *(e)* above.

(f) Connect the equipment as shown in C, figure 3-108.

*(g)* Set the step attenuators for 2.5 dB.

*(h)* Set the sweep generator for a 60 MHz CW power meter indication of –7.5 dBm (equivalent to +12.5 dBm to be delivered to the unit under test).

*(i)* Return the sweep generator to sweep mode.

(2) *Response.*

*(a)* Remove the chassis covers from the unit under test. Remove the protective caps from the tuning capacitors.

*(b)* Set the controls on the unit under test as listed below (refer to figure 3-107 for control locations).

| *Control* | *Setting* |
|---|---|
| *C-31* | Fully counterclockwise (min. capacitance) |
| c-35 | Fully clockwise (max. capacitance) |
| C-36 | Fully clockwise (max. capacitance) |
| C-14 | Midrange |
| c-22 | Midrange |
| C-26 | Midrange |
| C-27 | Midrange |
| R-1 | Fully counterclockwise (min. resistance) |
| R-2 | Fully counterclockwise (min. resistance) |

**NOTE**

1. C-31 is kept at its minimum capacitance.
2. C-35 affects the high frequency cut-off point.
3. C-36 affects the low frequency cut-off point and notch frequency.
4. C-14 and C-22 affect response tilt and amplitude.
5. C-26 and C-27 affect the center of the response.
6. R-1 and R-2 affect the depth of the notch and harmonic rejection.
7. Use internal or external sweep generator markers to identify frequencies of interest.

(c,) Connect the equipment, calibrated as in (1) above, to the unit under test as shown in figure 3-109.

(d) Set the test facility switches as follows:

| *Switch* | *Position* |
|---|---|
| S1 | ON |
| S30 | ON |
| S20 | S30 |

*(e)* Adjust C-35 on the unit under test for a maximum amplitude response at 72.5 MHz. Do not adjust C-35 to its minimum capacitance position.

*(f)* Adjust C-14, C-22, C-26, C-27, C-35 and C-36 for a flat response similar to the response shown in figure 3-110 with the notch adjusted (C-36) to approximately 45 MHz and the response from 47.5 to 72.5 MHz displayed above the reference line noted in (1)(e) above.

*(g)* Adjust R1 and R2 for a minimum amplitude response at the notch. Keep R1 and R2 as close to minimum resistance as possible.

*(h)* Repeat (e) and *(f)* above, as necessay, until the requirements of *(f)* above are met.

*(i)* Set the step attenuators for O dB and the sweep generator for manual sweep operation.

*(j)* Using the MANUAL control, slowly tune the sweep generator from 47.5 MHz to 72.5 MHz while observing test facility meter MI indication. Meter MI indication should not exceed 7 5‘% through the tuning range. If necessary, repeat (c), *(f)* and *(h)* through *(j)* above until the requirements of *(f)* and *(j)* are met (adjust C14 to increase output level or decrease M1 indication).

**NOTE**

R12 is to be selected as required to meet the requirements of *(f)* and *(j)* above and may be either 50 ohms or *150* ohms ±5%.

*(k)* Set transmitter test facility switch S30 and power amplifier switch to OFF.

(3) *Harmonic rejection.*

**NOTE**

If adjustments are made while performing the following checks, repeat the tests (and adjustments) in paragraph *(2)(c)* through(k) until all requirements are met.

*(a)* Connect the equipment as shown in figure 3-104 using the 95 to 190 MHz filter.

*(b)* Set test facility switch S30 to ON.

*(c)* Set the signal generator for 47.5 MHz at +12.5 dBm output.

*(d)* Adjust the filter around 142.5 MHz for a peak indication on the rf voltmeter of the third harmonic of the input frequency. The rf voltmeter indication should not exceed – 17 dBm.

*(e)* If necessary, adjust R1 and R2 on the unit under test for a minimum rf voltmeter indication. Keep R1 and R2 adjusted as close to minimum resistance as possible.

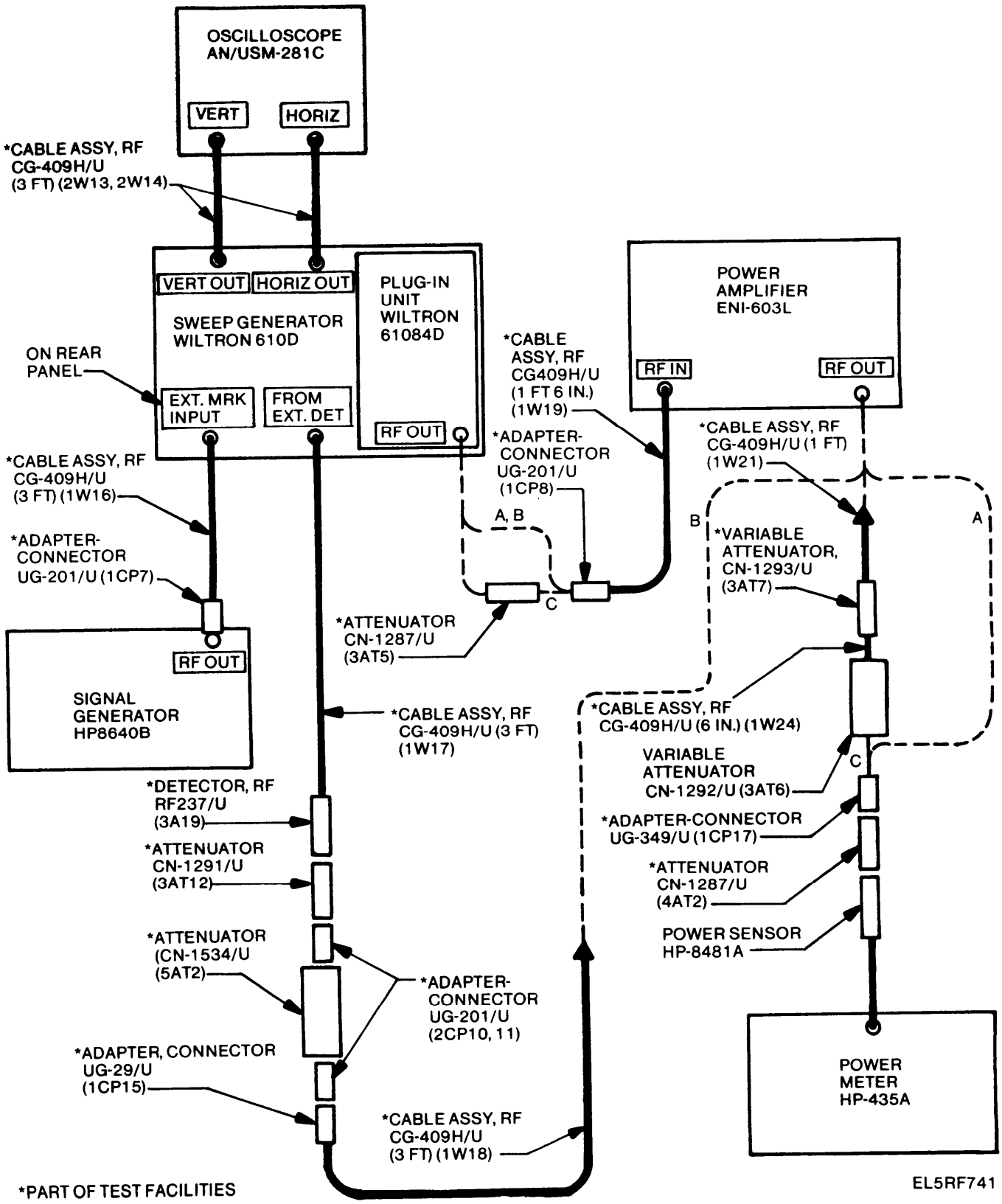



Figure 3-108. Amplifier-Frequency Multiplier 5TR1A4, Power Output Test Setup Calibration.

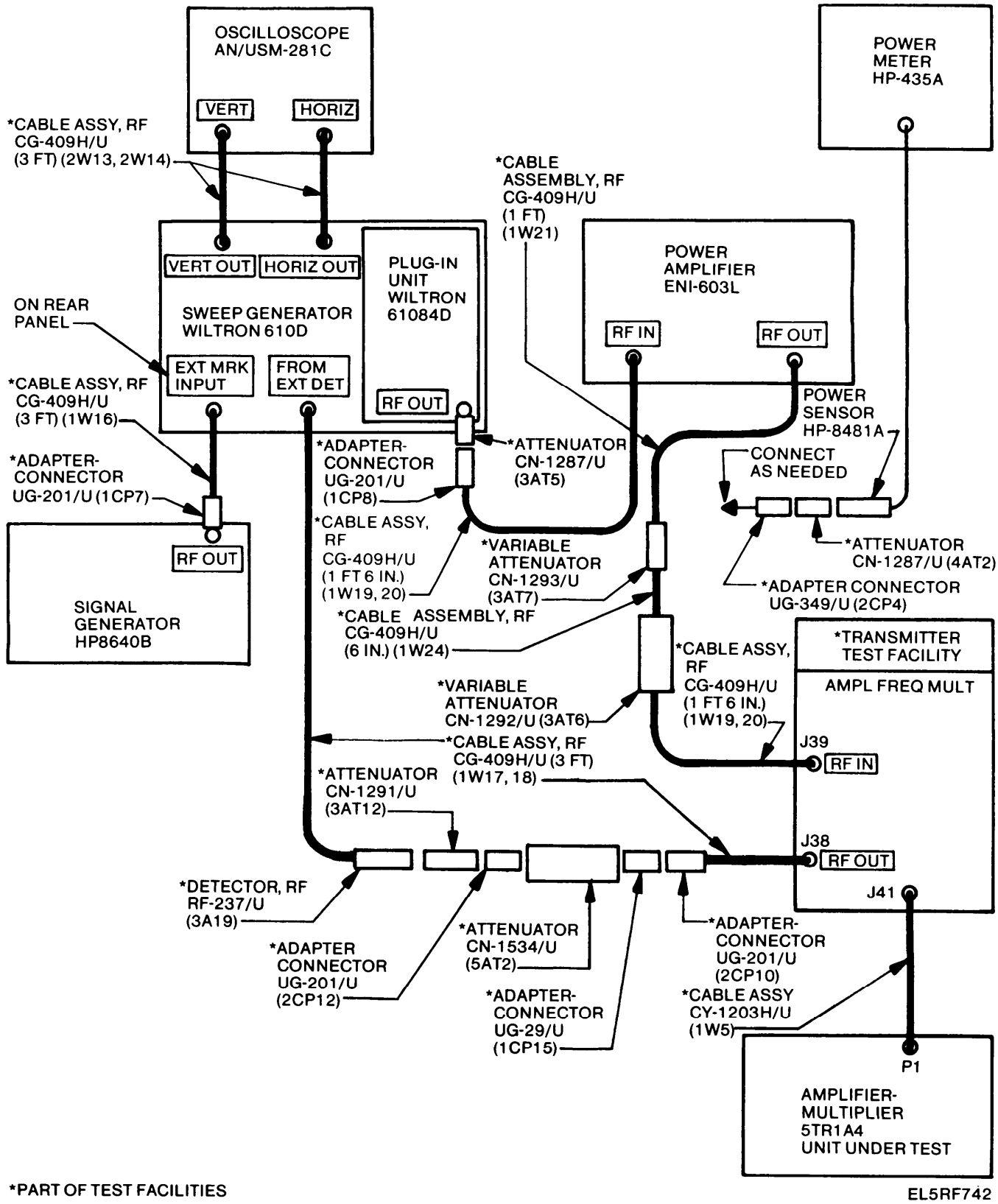



Figure 3-109. Amplifier-Frequency Multiplier 5TR1A4, Power Output Response, Test Setup.

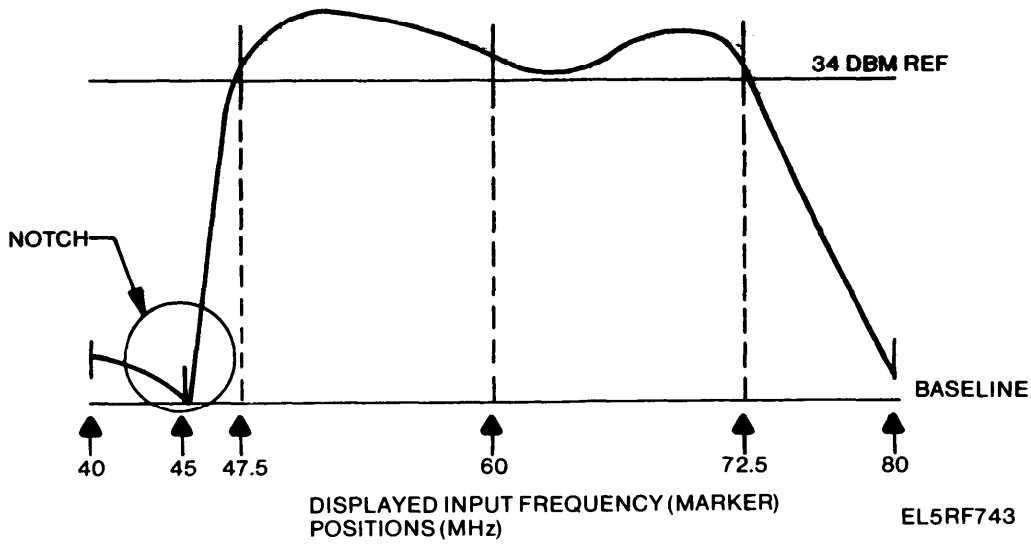



*Figure 3-110. Amplifier-Frequency Multiplier 5TR1A4, Typical Output Response Display.*

**CAUTION**

Turn test facility switch S30 to OFF when changing filters.

**NOTE**

For third harmonic frequencies above 190 MHz (63.3 MHz signal generator frequency), change to the 190 to 400 MHz filter.

*(f)* Tune the signal generator from 47.5 to 72.5 MHz while maintaining a peak indication on the rf voltmeter by tracking the filter to the third harmonic of the signal generator frequency. The rf voltmeter peak indication should not exceed —17 dBm.

*(g)* If necessary, repeat *(c)* through *(f)* making slight readjustments of R1 and R2 to meet all requirements.

**NOTE**

Reinstall the protective caps on the tuning capacitors (except C-35) before the final check of third harmonic rejection.

*(h)* Set the signal generator to 48 MHz and tune the 190 to 400 MHz falter around 192 MHz for a peak rf voltmeter indication of the fourth harmonic. The rf voltmeter peak indication should not exceed –12 dBm. If necessary, slightly readjust C-35 on the uut for a minimum indication on the rf voltmeter.

*(i)* Repeat *(f)* above using the 48 to 95 MHz filter tuned to fundamental frequencies from 48.3 to 72.5 MHz. The rf voltmeter peak indication should be less than –17.5 dBm.

**NOTE**

If necessary, repeat *(f)* through *(i)* above until the requirements of *(j)* below are met.

*(j)* Reinstall all protective caps and chassis covers and perform the tests in para. 3-24 *b.* above.

### 3-25. Amplifier Monitor 5TR1A5

*a. Test Equipment and Material Required.*

| *Equipment* | *Common name* |
|---|---|
| Test Facility Transmitter TS-2866(V)2/GRM-95(V)2 | Transmitter test facility |

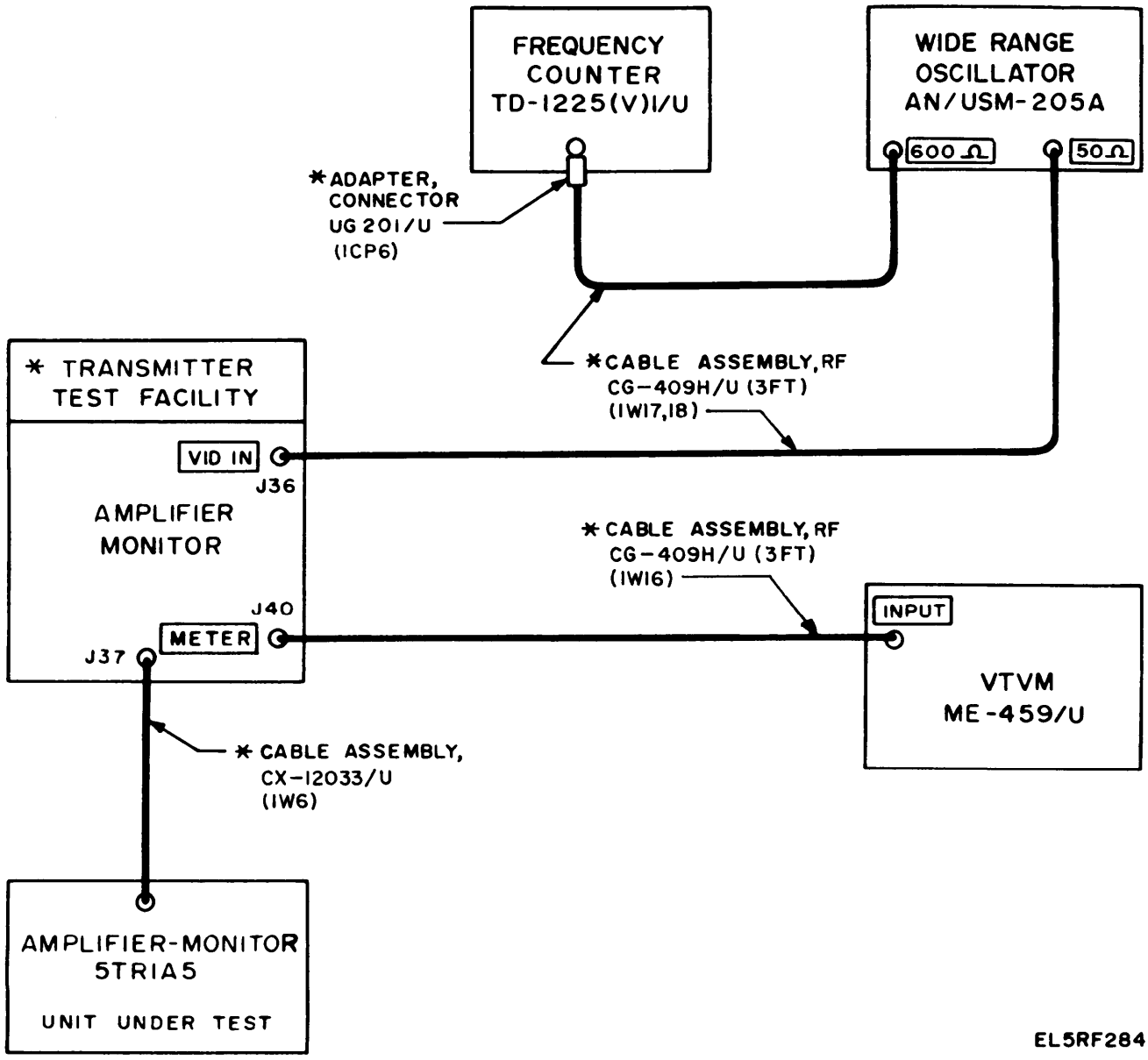



Figure 3-111. *Amplifier-Monitor 5TR1A5, Test Setup.*

| *Equipment* | Common name |
|---|---|
| Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2 | Accessory kit |
| Voltmeter, Elecronic ME-459/U | VTVM |
| Generator, Signal AN/USM-205A | Wide range oscilloscope |
| Multimeter, Digital AN/USM-451 | Digital Multimeter |
| Oscilloscope AN/USM-281C | Oscilloscope |
| Electronic Counter TD-1225(V)1/U | Frequency counter |

*b. Test Procedure.*

(1) *Order wire terminating resistor.*

*(a)* Set multimter to 2k ohm scale.

*(b)* Meausre resistance between pins 3 and 16 of connector P 1 on unit under test. Resistance should be 620 ohms ±5%.

(2) *Amplifier gain test.*

*(a)* Connect the test equipment as shown in figure 3-111.

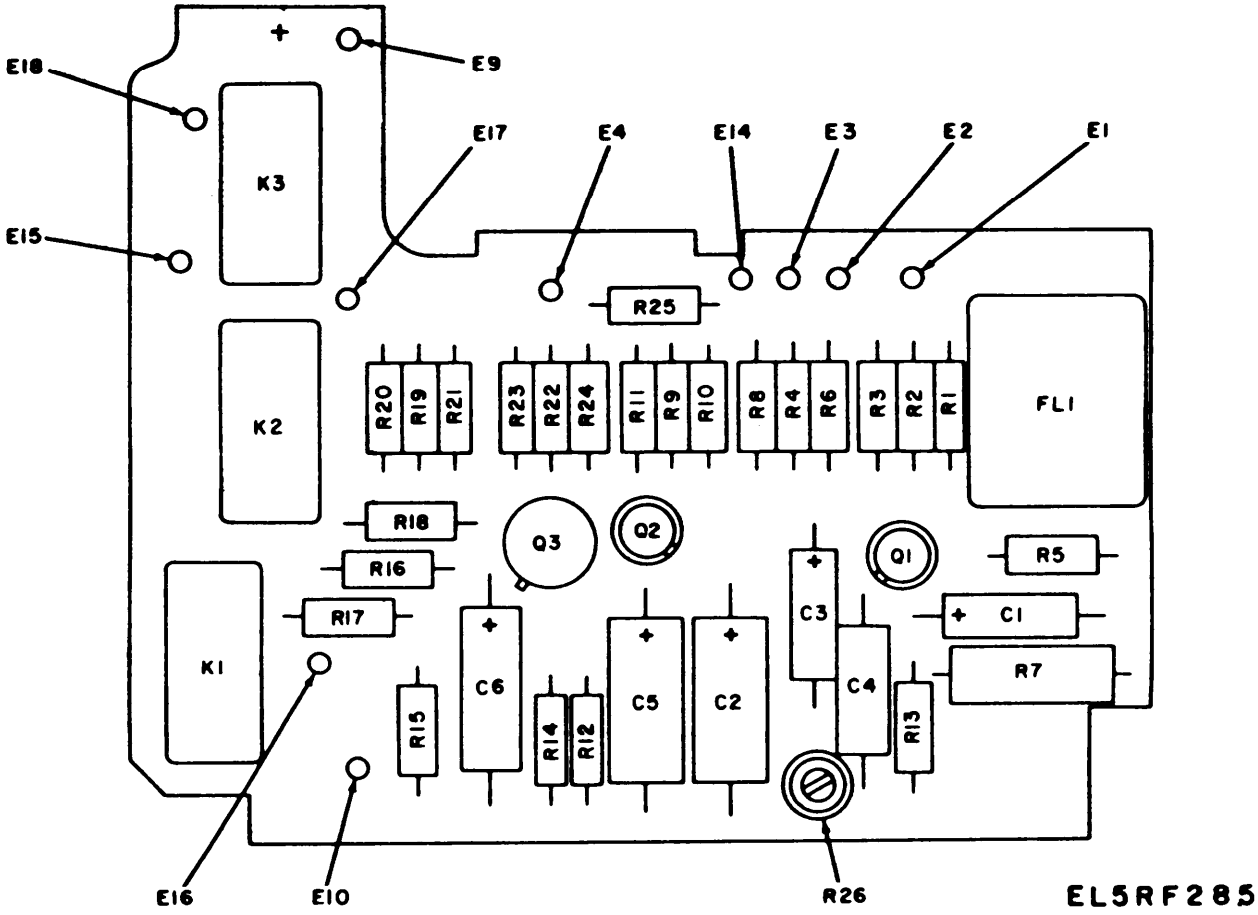



*Figure 3-112. Video Amplifier 5TR1A4AR1, Parts Location*

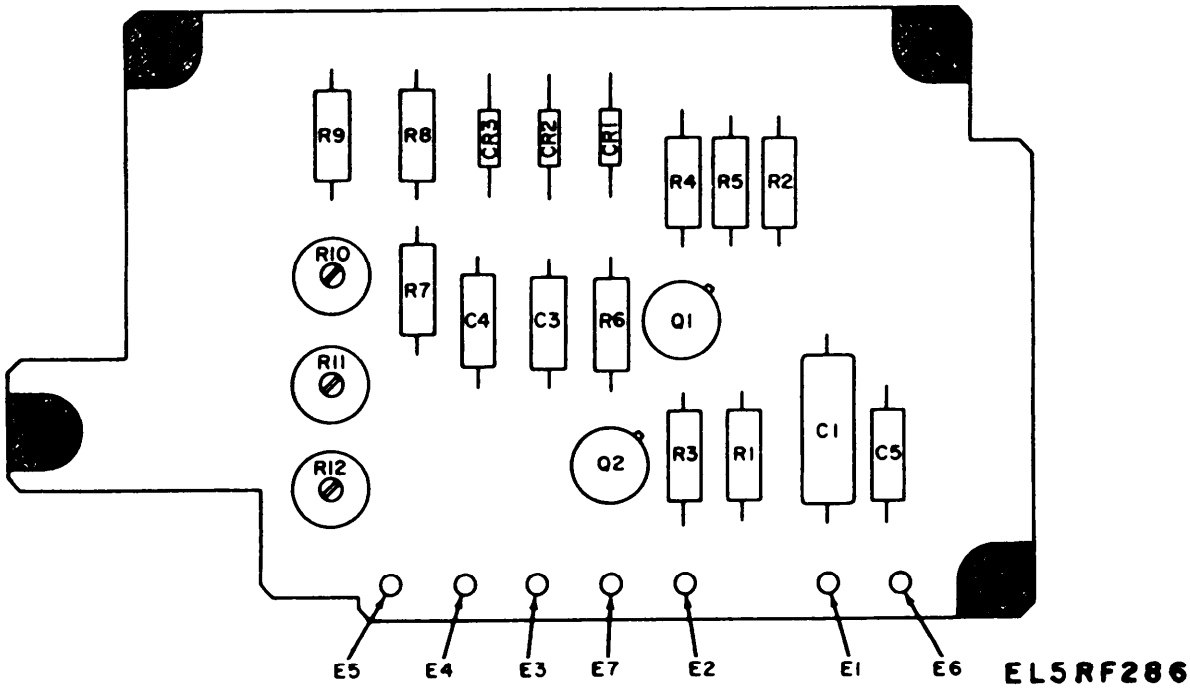



*Figure 3-113. Video Monitor 5TR1A5A1, Parts Location.*

*(b) Set the test facility switches as follows:*

| *Switch* | *Position* |
|---|---|
| S1 | ON |
| S20 | S28 |
| S28 | OW |
| S29 | INPUT |

*(c)* Adjust the wide range oscillator to 10 kHz at 246 mV (– 10 dBm) as shown on the VTVM.

*(d)* Set test facility switch S29 to OUTPUT. The VTVM should indicate 32 mV ±1 mV.

*(e)* If necessary adjust R26 (fig. 3-112) to obtain the value given in *(d)* above.

*(3) Relays and attenuator operation.*

*(a)* Using the test setup shown in figure 3-111, set test facility switch S28 to 0 dB and S29 to OUTPUT.

*(b)* Adjust the wide range oscillator output control to obtain a – 10dB indication on the VTVM.

*(c)* Set test facility switch S28 to 3.5 dB. The VTVM should indicate – 13.5 dB ±0.3 dB.

*(d)* Set switch S28 to 6.0 dB. The VTVM should indicate – 16 dB ±0.3 dB.

*(e)* Set switch S28 to 12.0 dB. The VTVM should indicate –22 dB ±0.3 dB.

*(4) Metering circuits.*

*(a)* Using the test setup shown in figure 3-111 set test facility switches S28 to FDM and S29 to OUTPUT.

*(b)* Adjust the output of the wide range oscillator until the VTVM indicates 53 mV. Test facility meter M1 should indicate 50 percent of full scale deflection.

*(c)* If necessary, on the unit under test, adjust R12 (fig. 3-113) to obtain the indication given in *(b)* above.

*(d)* On the test facility, set switch S28 to 12 CHAN. Adjust the wide range oscillator output for a 128 mV indication on the VTVM. Meter Ml should indicate 50 percent of full scale deflection.

*(e)* If necessary, on the unit under test, adjust R11 (fig. 3-113) to obtain the indication given in *(d)* above.

*(f) Set test* facility switch S28 to 24 CHAN. Adjust the wide range oscillator output for a 212-mV indication on the VTVM. Meter M1 should indicate 50 percent of full scale deflection.

*(g)* If necessary, on the unit under test, adjust R10 (fig. 3-113) to obtain the indication given in *(f)* above.

*(5) Frequency response.*

*(a)* Using the test setup shown in figure 3-111, set test facility switches S28 to 24 CHAN and S29 to INPUT.

*(b)* Set the test oscillator frequency to 10 kHz as indicated on the electronic counter.

*(c)* Adjust the amplitude control on the test oscillator to obtain a – 10 dB indication on the VTVM.

*(d)* Set switch S19 to OUTPUT. The VTVM should indicate –10 dB ±1.0 dB. Note the exact indication obtained.

*(e)* Set switch S29 to INPUT. Set the test oscillator frequency to 283 kHz as indicated on the electronic counter. Adjust the amplitude control on the test oscillator as required to obtain a – 10 dB indication on the VTVM.

*(f)* Set switch S29 to OUTPUT. The VTVM should indicate 0.75 dB ±0.2 dB below the indication obtained at 10 kHz in *(d)* above.

*(g)* Repeat steps *(e)* and *(f)* above for the remaining test frequencies listed in the table below.

| *Test frequencies (kHz)* | *Output voltage relative to output voltage amplitude at 10 kHz (dB)* |
|---|---|
| 283 | –0.75 ±0.2 |
| 567 | –3.00 ±0.2 |
| 850 | –6.75 ±0.3 |
| 960 | –8.60 ±0.6 |

*C. Troubleshooting (FO-24),*

| *Symptom* | *Checks and corrective measures* |
|---|---|
| No output *(b(2)(e)* above). | Check operating voltages of transistor stages on printed circuit board 5TR1A5AR1 *(d* below). Replace defective components as required |
| Low output (b(2)(e) above). | a. Measure the signal voltage between E9 and E1O (5 TR1A5AR1), figure 3-112, with the AC voltmeter while 10 kHz at –10 dB is present at input; level should be 490 mVrms ±10 mV. If level at E 10 is normal, check operation of attenuator relay K1, K2 and K3. Replace relays as necessary.<br>b. Vary R26; if output does not change, check continuity of feedback circuit R26, R13 and C4 (5 TR1A5AR1).<br>c. Check C5 (5 TR1A5AR1 ) for open circuit replace if necessary. |
| Normal output; abnormal indications with switch S28 set to FDM, 12 CHAN or 24 CHAN positions (b(4) above). | a. Measure the voltages and resistances of Q1 and Q2 (fig. 3-113). 5TR1A5A1 *(d* below). Replace component as required. |

| *Symptom* | *Checks and correction measures* |
|---|---|
| | b. Check the forward and reverse resistances of diodes CR 1, CR2 and CR3. Replace as required. |
| Output distorted *(b(5)(g)* above). | Using the oscilloscope, observe the output of transistor stages Q1, Q2 and Q3 (5TRA5AR1). Check the voltage and resistances of isolated stage. Replace component as required |
| Abnormal output indication with switch S28 set to FDM *(b(4)(b)* above). | Check input signal through FL1 (5 TR1A5AR1); replace FL1 if necessary. |

*d. Voltage and Resistance Measurements.*

**NOTE**

All voltages and resistances measured with the allocated digital multimeter.

(1) *In-circuit voltage measurements.*

| *Test points* | *Typical indication (Vdc)* |
|---|---|
| Video Amplifier 5TR1A5AR1: | |
| Q1-Emitter | +1.4 |
| -Base | +2.1 |
| -Collector | +6.0 |
| Q2-Emitter | +1.6 |
| -Base | +2.3 |
| -Collector | +6.0 |
| Q3-Emitter | +5.3 |
| -Base | +6.0 |
| -Collector | +12.0 |
| Video Monitor 5TR1A5A1: | |
| Q1-Emitter | +1.6 |
| -Base | +2.3 |
| -Collector | +10.0 |
| Q2-Emitter | +9.5 |
| -Base | +10.0 |
| -Collector | +28.0 |

(2) *Resistance measurements.*

## 3-26. Power Supply 5TR1PS1

*a. Test Equipment and Material Required.*

| *Equipment* | *Common name* |
|---|---|
| Test Facility, Transmitter TS-2866(V)2/GRM-95(V)2 | Transmitter test facility |
| Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2 | Accessory kit |
| Test Facility, RF Modules, TS-3837(V)2/GRM-95(V)2 | Test facility, rf modules |
| Oscilloscope AN/USM--281C | Oscilloscope |
| Multimeter, Digital AN/USM-451 | Multimeter |
| Counter, Electronic, Digital Read-out TD-1225(V)1/U | Counter |

*b. Test Procedure.*

**WARNING**

High voltages are present on the unit under test. Always switch test facility switch S2 to OFF when connecting probes.

*(1) Input rectification circuit check.*

*(a)* Connect the test equipment as shown in figure 3-114.

*(b)* Place the unit under test in front of the air outlet so that the airflow will be directed over the heat sink.

*(c)* Connect the positive lead of the multimeter to C1 (+) and the negative lead to C1 (–).

*(d)* Set test facility switches S1 and S2 to their ON positions. The test facility blower fan should operate.

*(e)* Check the voltage on the power supply (part of the accessory kit); if necessary adjust for 115 Vat. The multimeter connected to Cl should indicate 103 V ±5V.

*(f)* Set switch S2 to OFF and disconnect the multimeter leads from C1.

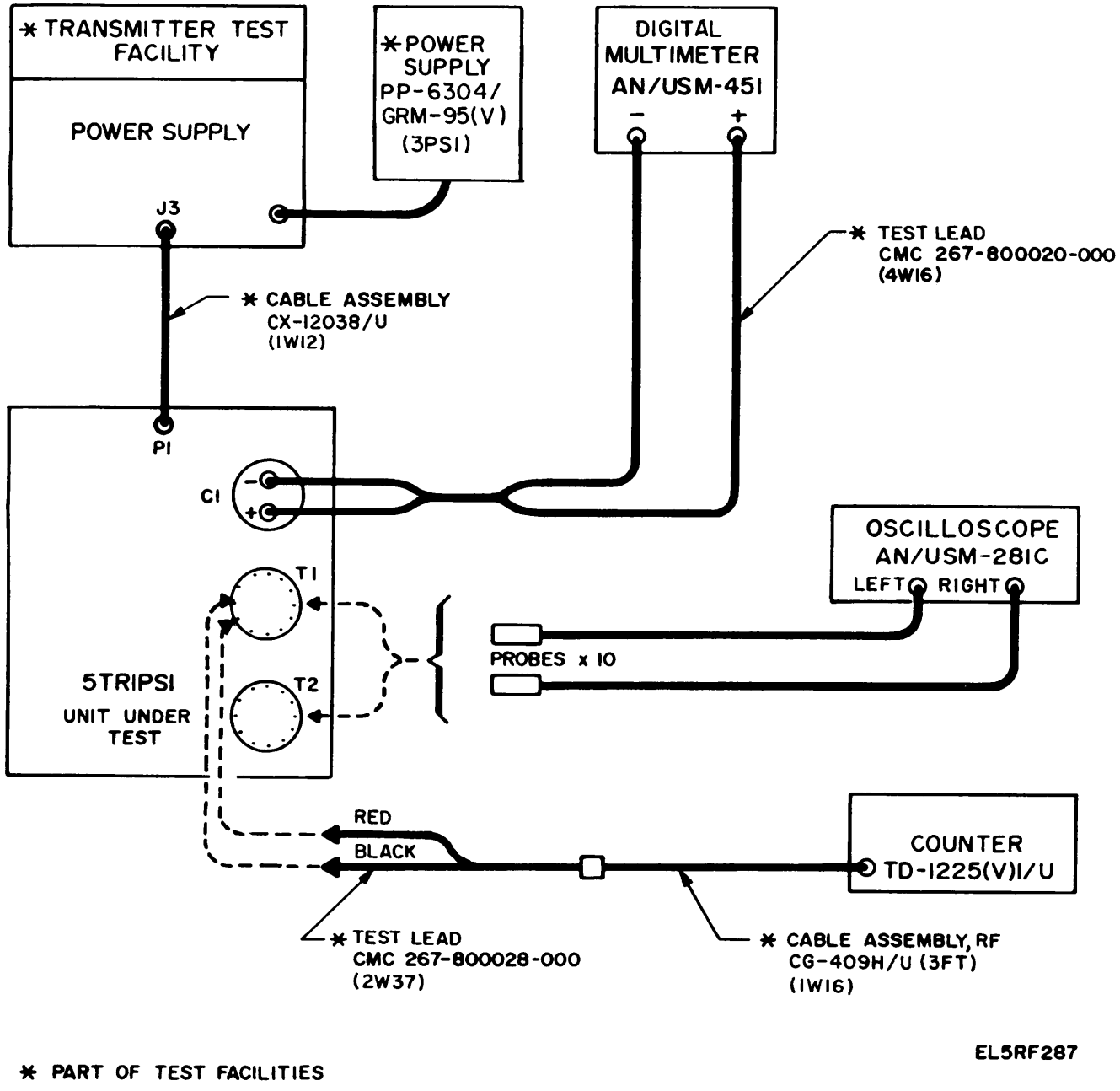



*Figure 3-114. Power Supply 5TR1PS1, Inverter Circuits Checks, Test Setup.*

*(2) Rise time and frequency measurement.*

(a) Using the test setup shown in figure 3-114, locate transformer T2 (fig. 3-115) on the unit under test. Set the oscilloscope MODE selector to ADD and RIGHT vertical channel POLARITY switch to INVERT. Select 10 V scale on each channel and use two 10x probes. Connect the probes to pins 1 and 3 of T2.

*(b)* Press and hold test facility switches S3, S5 and S7, then switch S2 to ON. The oscilloscope should indicate 5 kHz ±1 kHz.

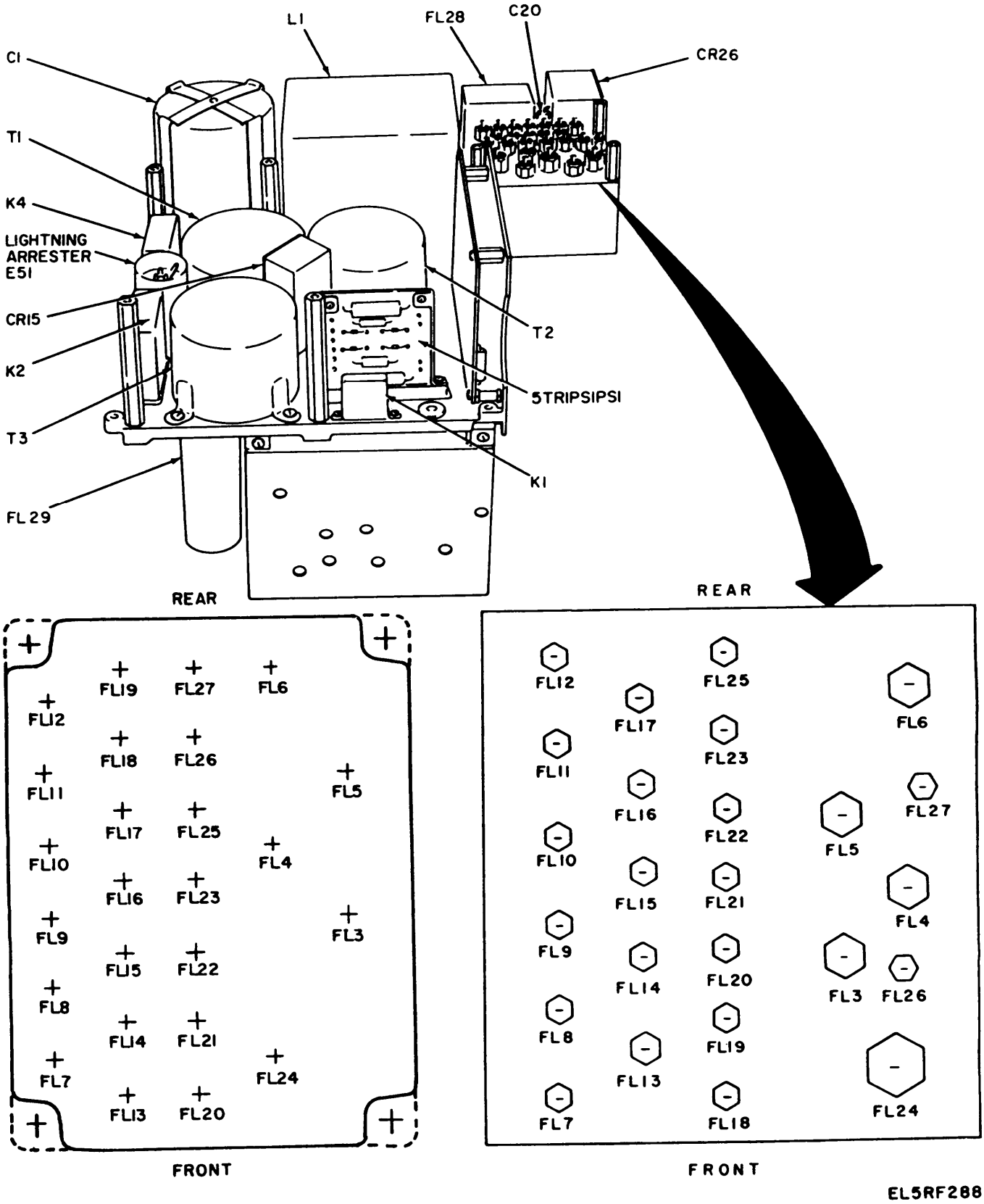



*Figure 3-115. Power Supply 5TR1PS1, with Heat Sink Removed.*

*(c)* Set test facility switch S4 to 600 V. The rise time (10 percent to 90 percent of peak-to-peak amplitude) measured on the oscilloscope should be less than 2.5 microseconds. Set switch S2 to OFF.

*(d)* Connect the oscilloscope probes to pins 4 and 6 of transformer T1.

*(e)* Connect the counter to pins 11 and 12 of transformer T1. Pin 12 should be the ground side of the counter.

*(f)* Set switch S2 to ON. Push and hold S3, S5 and S7. The counter should indicate 400 Hz ±40 Hz. The rise times are as follows:

*1.* From 10% to 90% of peak-to-peak, less than 15 microseconds.

2. From 20% to 90% of peak-to-peak, less than 5 microseconds.

*(g)* Set switch S2 to OFF. Disconnect the oscilloscope and the counter.

*(3) Load and voltage regulation check.*

*(a)* Using the test setup shown in figure 3-114, connect the multimeter to connectors J2 and J6 on the test facility. Set S4 to +12 V, S20 to S4 and set switch S2 to ON. The multimeter should indicate between 12.0 volts and 12.5 volts.

*(b)* Press switches S5 and S7. The multimeter should indicate between 11.8 volts and 12.2 volts. Record this indication. Note test facility meter M 1 indication and set S4 to +12 V METER position. Test facility meter Ml indication should be the same as previously noted, ± the width of the pointer.

*(c)* Keeping switches S5 and S7 pressed, slowly vary the voltage control on the power supply between 105 Vac and 125 Vac. The multimeter indication should not change by more than 0.2 V *from(b)* above.

*(d)* Release switch S5 and S7 and reset the voltage control to 115 Vac.

*(e)* Connect multimeter to connectors J2 and J12 on the test facility. Set switch S4 to +28 V position. Press switches S5 and S7; multimeter should indicate between 28.1 volts and 28.5 volts. Record the multimeter indication. Note test facility meter M 1 indication and set test facility switch S4 to +28 V METER position. Test facility meter Ml indication should be the same as previously noted ± the width of the pointer.

*(f)* Slowly vary the power supply voltage control between 105 Vac and 125 Vat. The multimeter indication should not change by more than 0.2 V from the reading obtained in *(e)* above.

*(g)* Release switches S5 and S7 and reset the voltage control to 115 Vat, and disconnect the multimeter.

*(4) Short Circuit protection check.*

*(a)* Using the test setup shown in figure 3-114, set test facility switch S4 to +12 V and switch S2 to ON. Note the indication on test facility meter Ml. Set switch S2 to OFF.

*(b)* Connect the multimeter (set to 10A DC full scale) to test facility connectors J2 and J6 as shown in figure 3-116.

*(c)* Set switch S2 to ON; the multimeter should indicate 2.2 amp ±0.4 amp.

*(d)* Set switch S2 to OFF. Remove the multimeter leads from connectors J2 and J6.

*(e)* Set switch S2 to ON; meter M1 should indicate the same as *in(a)* above.

*(f) Set switch* S4 to +28 V; note the indication on meter Ml.

*(g)* Set switch S2 to OFF. Connect the multimeter to connectors J2 and J12 on the test facility.

*(h)* Set switch S2 to ON; the multimeter should indicate 2.5 amp ±0.5 amp.

*(i)* Set switch S2 to OFF. Remove the leads from connectors J2 and J12 on the test facility.

*(j)* Set switch S2 to ON; meter M1 should indicate the same as noted in *(f)* above.

*(5) Filament supply check.*

*(a)* Remove the red plastic warning cover from the filter section for the unit under test.

*(b)* Connect the multimeter to FL21 (+) and FL20(–) (output filament) (figure 3-115).

(c) Set multimeter range to 20 Vdc.

*(d)* Set S2 to ON and press S3, S5 and S7. The multimeter should indicate 8.2 Vdc ±0.8 V. Set S2 to OFF.

*(e)* Repeat *(a)* through *(c)* above with multimeter connected to FL23(+) and FL22 (–) (driver filament). The multimeter should indicate 8.2 Vdc ±0.8 V.

*(f)* Set S2 to OFF.

*(6) Constant current check.*

*(a)* Using the test setup shown in figure 3-114, set test facility switch S4 to DRIVER CUR. Test facility meter M1 should indicate in the green band.

*(b)* Turn the power supply voltage control to 70 Vac as indicated on the power supply panel. Ml should indicate in the green band. Reset the voltage control to 115 Vat.

*(c)* Set switch S4 to OUTPUT CUR. Meter M1 should indicate in the green band.

*(d)* Turn the power supply voltage control to 70 Vac as indicated on the power supply panel. Meter M1 should indicate in the green band. Reset the voltage control to 115 Vac and set switch S2 to OFF.

*(7)* 26 *volt unregulated supply check.*

*(a)* Set the multimeter to the 200 volt range and connect to J2 (–) and J9 (+).

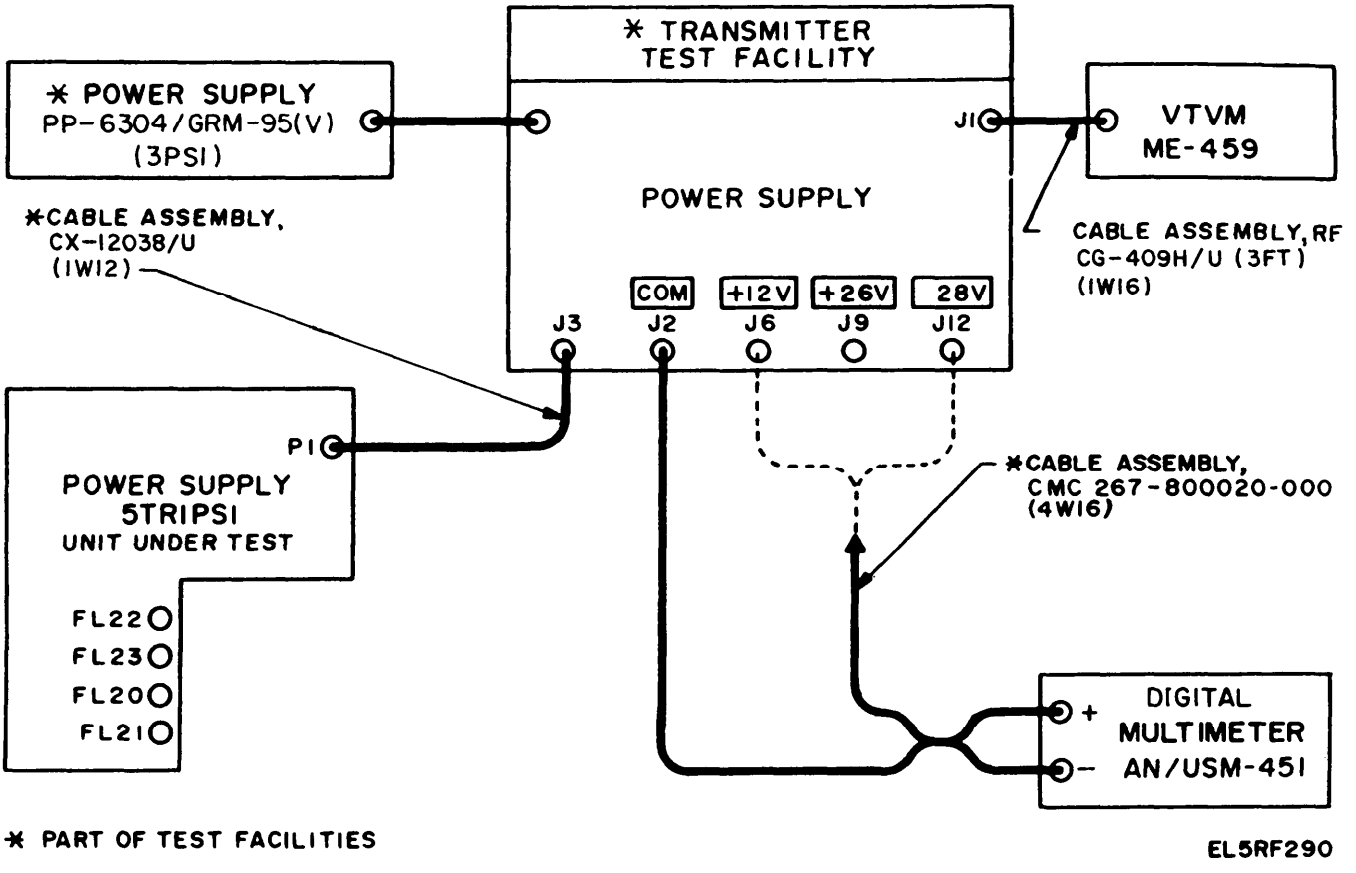



*Figure 3-116. Power Supply 5TR1PS1, Short Circuit Protection and Hum Checks, Test Setup.*

*(b)* Set S4 to 26 volts.

*(c)* Press S3, S5 and S7.

*(d)* Ensure that the ac voltmeter on power supply PP-6304 is indicating a supply voltage of 115 Vat. The multimeter should indicate 26.5 V ±1.5 V and meter M1 should indicate between 4570 and 5570.

(e) Set S2 to OFF.

(8) 600 *V output and meter circuit check.*

*(a)* Using the test setup shown in figure 3-114, connect the multimeter negative lead to ground and the positive lead to FL24 (fig. 3-115).

*(b)* Set switch S4 to 600 V METER position. Press and hold switch S3. Set switch S2 to ON.

*(c)* Adjust the voltage control on the PP 6304 power supply to give an indication of 630 Vdc ±1 V on the multimeter.

*(d)* On the unit under test adjust R18 control (fig. 3-117) for an indication of 50 percent of full scale on test facility meter M1.

*(e)* Release switch S3 and set switch S2 to OFF. Remove the multimeter connections. Reset the voltage control to 115 Vat.

*(f)* Seal R18 as described in paragraph 2-12.

(g) Set S4 to 600 volts.

*(h)* Press load switch S3.

*(i)* Meter M1 should indicate between 45% and 55%.

*(9) Hum measurements.* Using the test setup shown in A, figure 3-116, connect the VTVM to J1 on the transmitter test facility. Set test facility switch S4 to the positions listed below and measure the ripple voltage.

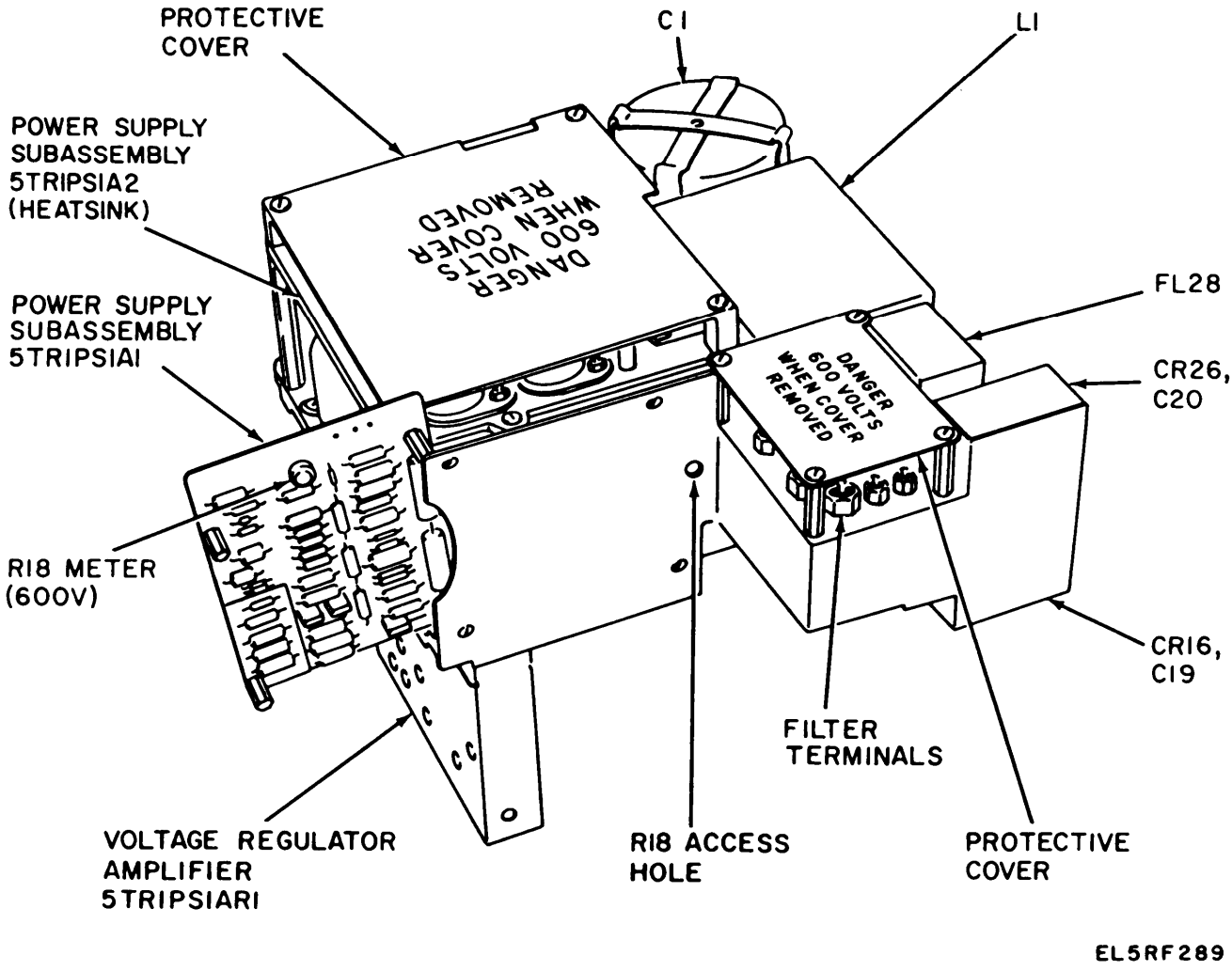



*Figure 3-117. Power Supply 5TR1PS1, Showing Access to Power Supply Subassembly 5TR1PS1A1.*

| *S4 position* | *Secondary action* | *Ripple indicated by VTVM* |
|---|---|---|
| +12V | Press S5 and S7 | Less than 3.5 mV |
| +26 V | Press S3, S5 and S7 | Less than 350 mV |
| +28 V | Press S5 and S7 | Less than 3.5 mV |
| OUTPUT FIL | Press S3, S5 and S7 | Less than 120 mV |
| DRIVER FIL | Press S3, S5 and S7 | Less than 120 mV above OUTPUT FIL indication |

*(10) Blower voltage and low power alarm supply check.*

*(a)* Set the multimeter for ac volts and 200 volt range.

*(b)* Connect the multimeter to FL5 and FL6 (figure 3-1 15).

*(c)* Set S2 to ON. The multimeter should indicate 142 Vac ±8 V.

*(d)* Set S2 to OFF.

*(e)* Connect the multimeter to FL7 and FL8.

*(f)* Set S2 to ON. The multimeter should indicate 30 V ±3 V.

*(g)* Set S2 to OFF.

*(h)* Replace both plastic protective covers.

*c. Troubleshooting (FO-25).*

| *Symptom* | *Probable cause* | *Checks and corrective measures* |
|---|---|---|
| 1. Low voltage across C 1, b(1) above. | a. Relay K4 inoperative. | a. Check for +26 Vdc between FL17 (+) and FL16 (–) (fig. 3-115). If present, check relay K4. |
| | b. Defective diodes CR1, CR2, CR3 or CR4 on heat sink 5TR1PS1A2 (fig. 3-118). | b. Check and replace faulty diodes as required. |
| *2. 5* kHz or 400 Hz risetime or frequency abnormal, *b(2)* above. | Defect components, heat sink 5TR1PS1A2 or 5TR1PS1 (chassis) | Test per paragraph 3-27 or 3-29 and replace defective components. |
| 3. +12 V or 28 V checks abnormal, *b(3)* above. | a. +12 V and +28 V regulator 5TR1PS1AR1 defective or mis-adjusted. | a. Check and adjust 5TR1PS1AR1 as outlined in paragraph 3-28. |
| | b. Defective components, heatsink 5TR1PS1A2. | b. Check 5TR1PS1A2 as described in paragraph 3-27. |
| | c. Defective components, 5TR1PS1 (chassis) | c. Check 5TR1PS1 (chassis) as described in paragraph 3-29. |
| *4.* Abnormal indication, *b(4)(c)* and *(h)* above. | Defective diode CR6, CR5, R2 or R1. | Check and replace components as required. |
| *5.* Abnormal filament supply voltage, *b(5)* above. | Defective power supply 5TR1PS1PS1, T2 or FL29. | Test power supply chassis, paragraph 3-29. |
| *6.* Meter M1 indication abnormal, *b(6)* above. | Defective transistor Q13 or Q14 (5TR1PS1A2)or CR14 or CR15 and associated circuitry (5TR1PS1A1) | Check 5TR1PS1A2, paragraph 3-27 or 5TR1PS1A1 (P/O power supply chassis), paragraph 3-29. |
| *7. 26* volt indication abnormal, *b(7)* above | Defective CR6 or L1 and associated circuitry. | Check 5TR1PS1 (chassis), paragraph 3-29. |
| *8. 600* V supply indications abnormal, *b(8)* above. | Relay K2, T3, CR 15 or associated circuit components. | Check operation of K2. If normal, check 5TR1PS1 (chassis), paragraph 3-29. |
| *9.* Hum measurement beyond specified limits. | a. +12 V: defective C 17 (5TR1PS1A2) | a. Check or replace C17. |
| | b. +28 V: defective C19 or C9 (5TR1PS1) | b. Check or replace C19 or C9. |
| | c. DRIVER HEATER: defective C1 (5TR1PS1PS1) | c. Check or replace C1. |
| | d. OUTPUT HEATER: defective C2 (5TR1PS1PS1) | d. Check or replace C2. |

## 3-27. Power Supply Subassembly 5TR1PS1A2

*a. Test Equipment and Material Required.*

| *Equipment* | *Common name* |
|---|---|
| Test Facility, Transmitter TS-2866(V)2/GRM-95(V)2 | Transmitter test facility |
| Accessory Kit, Test Facilities Set MK-2867(V)2/GRM-95(V)2 | Accessory kit |
| Test Facility, RF Modules, TS3837(V)2/GRM-95(V)2 | Test facility, rf modules |
| Oscilloscope AN/USM-281C | Oscilloscope |
| Multimeter, DigitalAN/USM-451 | Digital multimeter |
| Counter, Electronic, Digital Readout TS-1225(V)I/U | Counter |
| Insulation Tester GR-1864 | Insulation tester |

*b. Test Procedure.*

(1) Remove the larger red protective cover to expose power supply subassembly (heat sink) 5TR1PS1A2.

(2) Remove 5TR1PS1A2 by loosening the two green-circled mounting screws and pulling the module straight up.

(3) Open the test facility power supply door. Remove jumper cables between J4-J5 and J10-J11. Connect 5TR1PS1A2 and the test facility as shown in figure 3-119.

(4) Place the unit under test in front of the air outlet so that the airflow is directed over the heat sink.

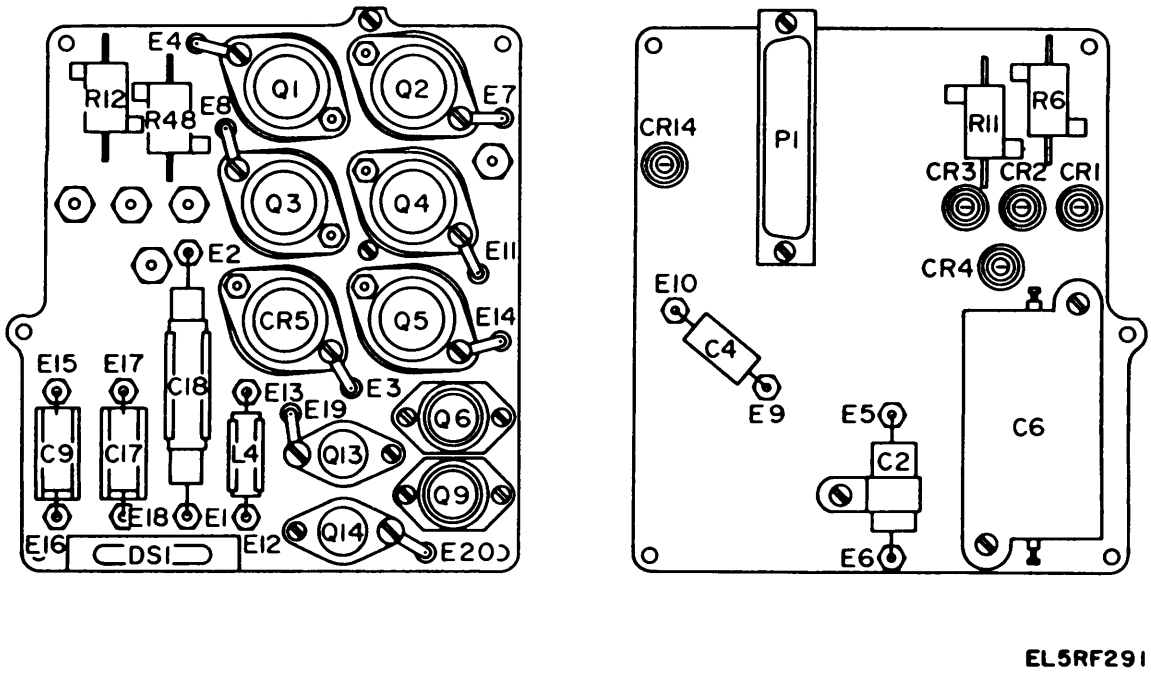



*Figure 3-118. Power Supply Subassembly 5TR1PS1A2, Parts Location*

**WARNING**

The outer cases of the transistors mounted on the heat sink are connected to high voltage.

**NOTE**

Throughout the following tests, maintain the input voltage at 115 Vac as shown on the power supply voltmeter (part of the accessory kit).

(5) Set the test facility switches as follows:

| *Switch* | *Switch position* | *Secondary action* | *Normal M1 indication* |
|---|---|---|---|
| S1 | ON | | |
| S20 | S4 | | |
| S2 | ON | | |
| 54 | +12V METER | Press S5 and S7. | 40% to 60% |
| S4 | +28V METER | Press S7 and S5. | 45% to 55% |
| 54 | +26V | Press S3, S5 and S7. | 45% to 55% |
| 54 | DRIVER FIL | Press S3, S5 and S7. | 50% to 70% |
| S4 | OUTPUT FIL | Press S3, S5 and S7. | 50% to 70% |
| S4 | DRIVER CUR | | Green band. |
| 54 | OUTPUT CUR | | Green band. |
| *Switch* | *Switch position* | *Secondary action* | *Normal MI indication* |
| S4 | 600V | S2 to OFF. Press and hold switch S3 then set switch S2 to ON. | 45% to 55% |
| S4 | 26 VAC | | Green band. |

*(6)* Set S4 to +26 V. Operate S2 to ON and OFF three times fairly quickly. M1 should indicate within the green band each time S2 is switched to ON. This checks the starting circuit.

(7) *Check input rectification circuit as follows:*

*(a)* Connect the digital multimeter across capacitor Cl 8 (observe polarity) as shown in figure 3-119.

*(b)* Set S2 to ON.

*(c)* The digital multimeter should indicate 100 v ±5 V.

*(d)* Set S2 to OFF.

(8) 5 *kHz inverter check.*

*(a)* Connect the oscilloscope 10x probes to terminals E8 and E11 on the unit under test.

*(b)* Set oscilloscope MODE to ADD and RIGHT channel to INVERT. Set both channels to 10 volts/div.

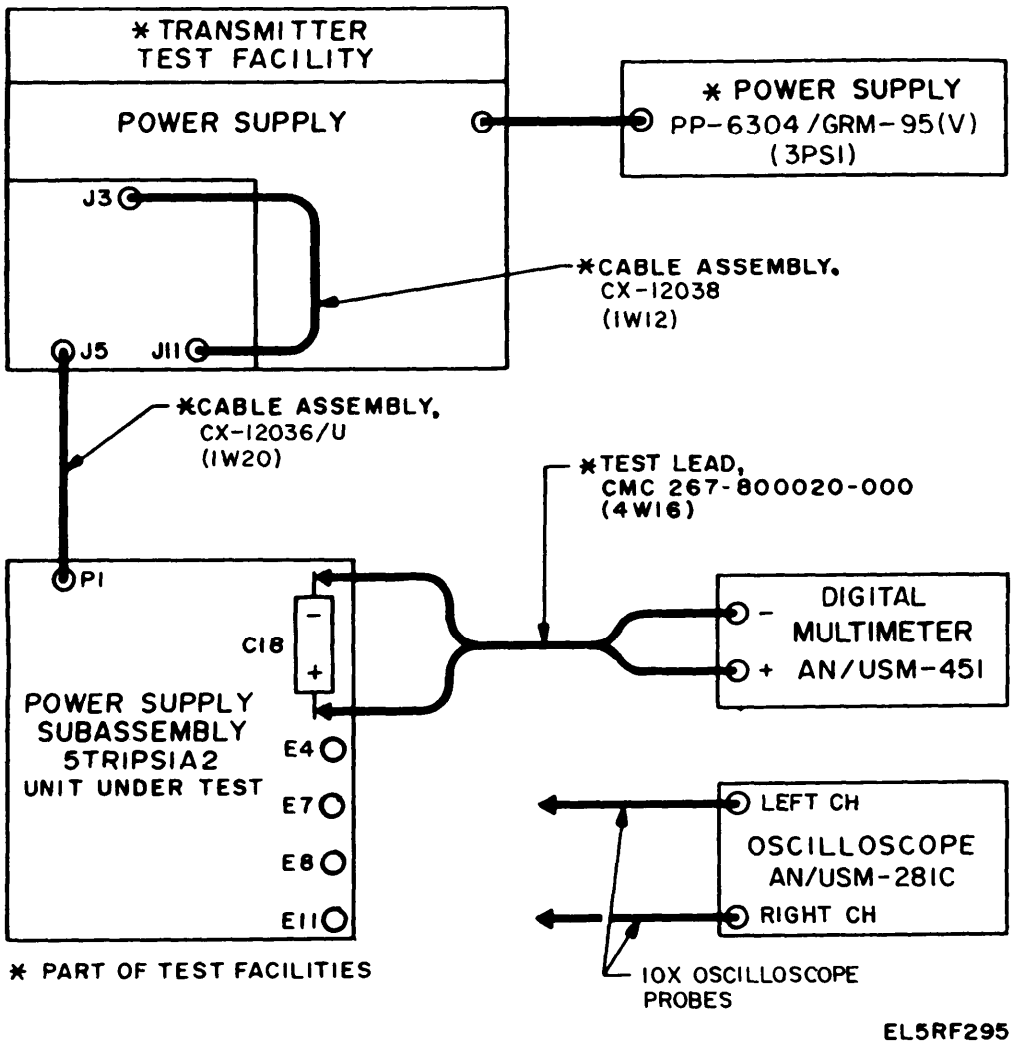



*Figure 3-119. Power Supply Subassembly 5TR1PS1A2, Test Setup.*

*(c)* Set test facility switch S2 to ON. Press S3, S5 and S7. The oscilloscope should display a square-wave signal, 400 ±40 Vp-p, frequency 5 kHz ±1 kHz.

*(d)* Set S2 to OFF.

(9) 400 Hz inverter check.

*(a)* Connect oscilloscope to terminals E4 and E7 on the unit under test.

*(b)* Select oscilloscope setting as in *(8)(b)* above.

*(c)* Set test facility switch S2 to ON. Press S3, S5 and S7. The oscilloscope should display a square-wave signal, 400 ±20 Vp-p, frequency 400 ± 40 Hz.

*(d)* Set S2 to OFF, disconnect the probes.

(10) *Regulator circuit check.*

*(a)* Connect the multimeter to J2(–) and J6(+).

*(b)* Set S2 to ON.

*(c)* Multimeter should indicate between 12.0 Vdc and 12.5 Vdc.

*(d)* Press S5 (12 volt load) and S7 (28 volt load). The multimeter should indicate between 11.8 Vdc and 12.2 Vdc.

*(e)* Connect the multimeter to J2(–) and J12(+).

*(f)* Press S7 (28 volt load) and S5 (12 volt load).

*(g)* The multimeter should indicate between 28.1 Vdc and 28.5 Vdc.

*c. Troubleshooting (FO-25)*

| *Symptom* | *Probable cause* | *Checks and corrective measures* |
|---|---|---|
| 1 No indications with switch S4 in position +12 V through 600 V. Normal indication in 26 Vac in position. | a. CR14 shorting | a. Check CR14 (fig. 3-118) for short circuit. Replace if necessary. |
| | b. Defective transistor Q3, Q4, Q5, Q6, Q9, Q13,or Q14. | b. Measure the resistance of transistors, see *d* below. Replace as required. |
| | c. C4, C9 or C17 shorting | c. Check capacitors; replace as required. Observe the polarity when connecting the multimeter. |
| | d. R11 or R12 open circuit or shorting to ground through heat sink. | d. Check resistors for open circuit. Using insulation tester, check for short circuit to heat sink (fig. 3-118). |
| *2* Abnormal indication with switch S4 in DRIVER CUR position. All other indications are normal. | Defective Q13 | Measure resistance of Q13 *(d* below). Replace Q13, if necessary. |
| *3* Abnormal indication with switch S4 in OUTPUT CUR position. All other indications are normal. | Defective Q14 | Measure resistance of Q14 *(d* below). Replace Q14, if necessary. |
| *4* Abnoral indication with switch S4 in position 26 Vat. All other indications are normal. | Defective 400 Hz inverter | Measure resistance of Q1 and Q2 *(d* below). Check C2 for short circuit and R6 for open circuit (fig. 3-118). Replace components as required. |
| *5* Test facility switch S 1 trips and will not reset. | Short circuited component associated with input circuit of power supply. | Check diodes CR1 through CR5 and CR14 for shorts. Check C18 for short circuit. Replace components as required. |
| *6* Test facility switch S1 stays on. No reading in any of the switch S4 positions. | a. Resistor R48 open circuit | a. Check R48 (4.99 ohms). Replace if necessary. |
| | b. Starting circuit not operating. | b. Check C 18 for open circuit. Using insulation tester check for short circuit through mounting clip to heat sink. |
| *7 600* V test trips *5 kHz* inverter | C6 shorting | Check and replace |
| 8 12 Vdc and 28 Vdc abnormal. | a. Defective transistor Q5, Q6, or Q9. | a. Meausre the resistance of transistors (see para. *d.* below). Replace as required. |
| | b. L4 open. | b. Check and replace as required. |
| | C. C9 to C17 shorting. | c. Check and replace as required. |

*d. Resistance Measurements* (fig. 3-118).

**NOTE**

All resistances measured with allocated digital multimeter and with 5TR1PS1A2 removed from test setup.

| *Stage and transistor type* | *Base (–)* | | | | *Base (+)* | | | |
|---|---|---|---|---|---|---|---|---|
| | *Emitter (–)* | | *Collector (+)* | | *Emitter (–)* | | *Collector (+)* | |
| | *Res. (ohms)* | *Range* | *Res. (ohms)* | *Range* | *Res. (ohms)* | *Range* | *Res. (ohms)* | *Range* |
| Q1 | ∞ | 20M | ∞ | 20M | 550 | 2k | 550 | 2k |
| Q2 | ∞ | 20M | ∞ | 20M | 550 | 2k | 550 | 2k |
| Q3 | ∞ | 20M | ∞ | 20M | 550 | 2k | 550 | 2k |
| Q4 | ∞ | 20M | ∞ | 20M | 550 | 2k | 550 | 2k |
| Q5 | ∞ | 20M | ∞ | 20M | 550 | 2k | 550 | 2k |
| Q6 | ∞ | 20M | ∞ | 20M | 550 | 2k | 550 | 2k |
| Q9 | ∞ | 20M | ∞ | 20M | 550 | 2k | 550 | 2k |
| Q13 | ∞ | 20M | ∞ | 20M | 550 | 2k | 550 | 2k |
| Q14 | ∞ | 20M | ∞ | 20M | 550 | 2k | 550 | 2k |

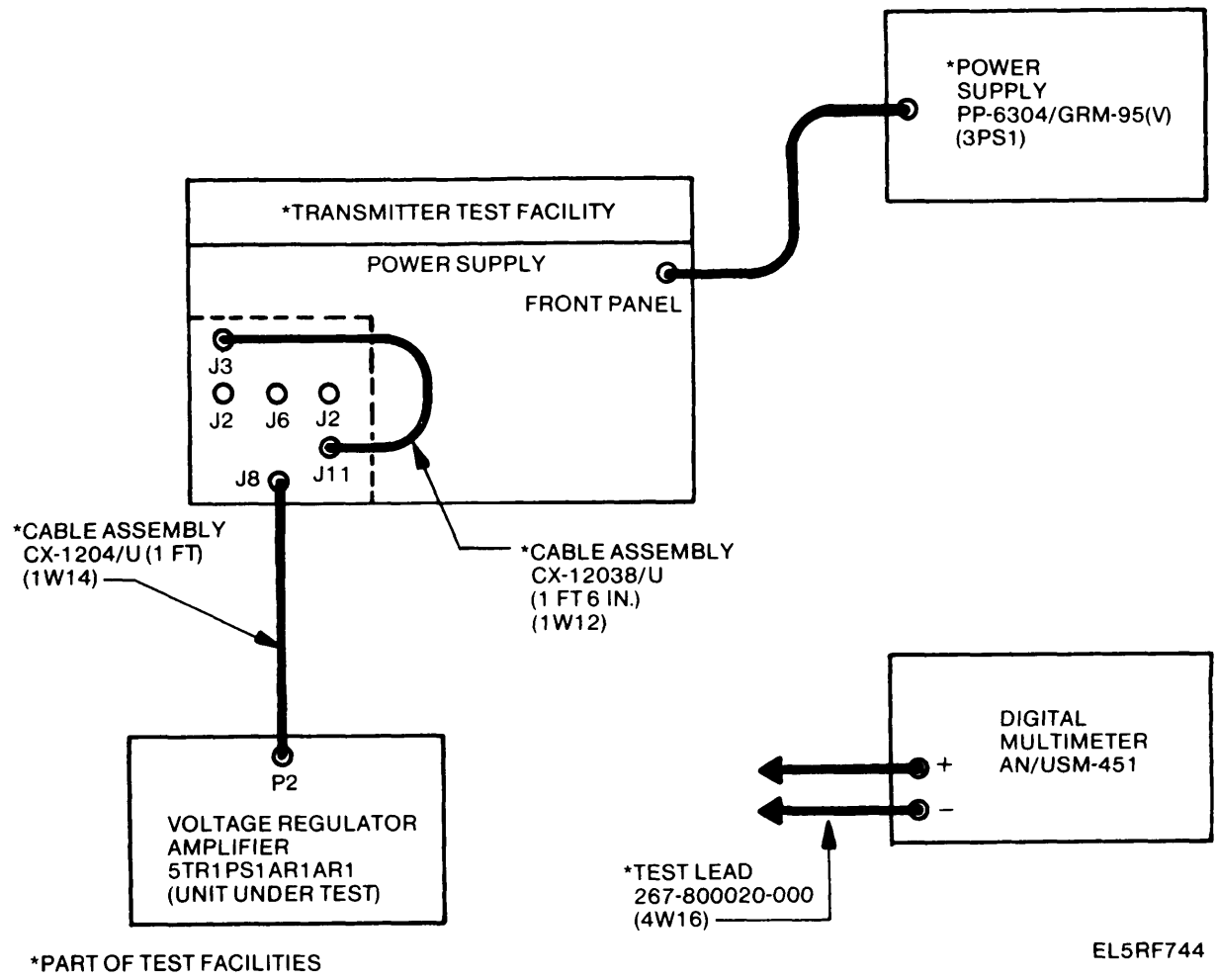



Figure 3-120. *Voltage Regulator Amplifier 5TR1PS1AR1AR1, Test Setup.*

### 3-28. Voltage Regulator Amplifier 5TR1PS1AR1

*a. Test Equipment and Material Required.*

| *Equipment* | *Common name* |
|---|---|
| Test Facility Transmitter TS-2866(V)2/GRM-95(V)2 | Transmitter test facility |
| Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2 | Accessory kit |
| Test Facility, RF Modules, TS 3837(V)2/GRM-95(V)2 | Test facility, rf modules |
| Voltmeter, Electronic ME-459/U | VTVM |
| Multimeter, Digital AN/USM-451 | Digital multimeter |

*b. Test Procedure* (Fig. 3-120 thru 3-122).

(1) Remove both covers from the UUT.

(2) Open the test facility POWER SUPPLY door and remove special purpose cables W2 and W3.

(3) Connect the test equipment as shown in figure 3-120.

(4) Adjust the voltage control on power supply PP-6304/GRM-95(V) to 115 Vac as indicated on the power supply VOLTS meter. Maintain this indication throughout the following procedures unless otherwise instructed.

(5) Set the test facility switches as follows:

| SwitCh | *Position* |
|---|---|
| S1 | ON |
| S20 | S4 |
| S4 | +28 V |
| S2 | ON |

(6) Connect the digital multimeter to J12(+) and J2(–). Press and hold switch S5 and S7. The digital multimeter should read 28.3 ±0.2 Vdc. If necessary, adjust R10 (fig. 3-123) for 28.3 Vdc. Note the indication on meter M1.

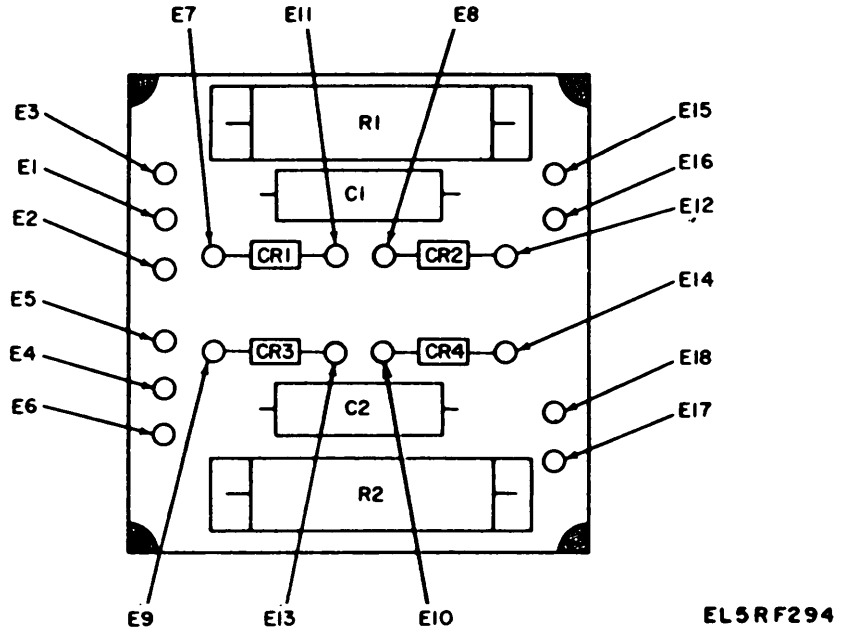



*Figure 3-121. Power Supply 5TR1PS1PS1, Parts Location.*

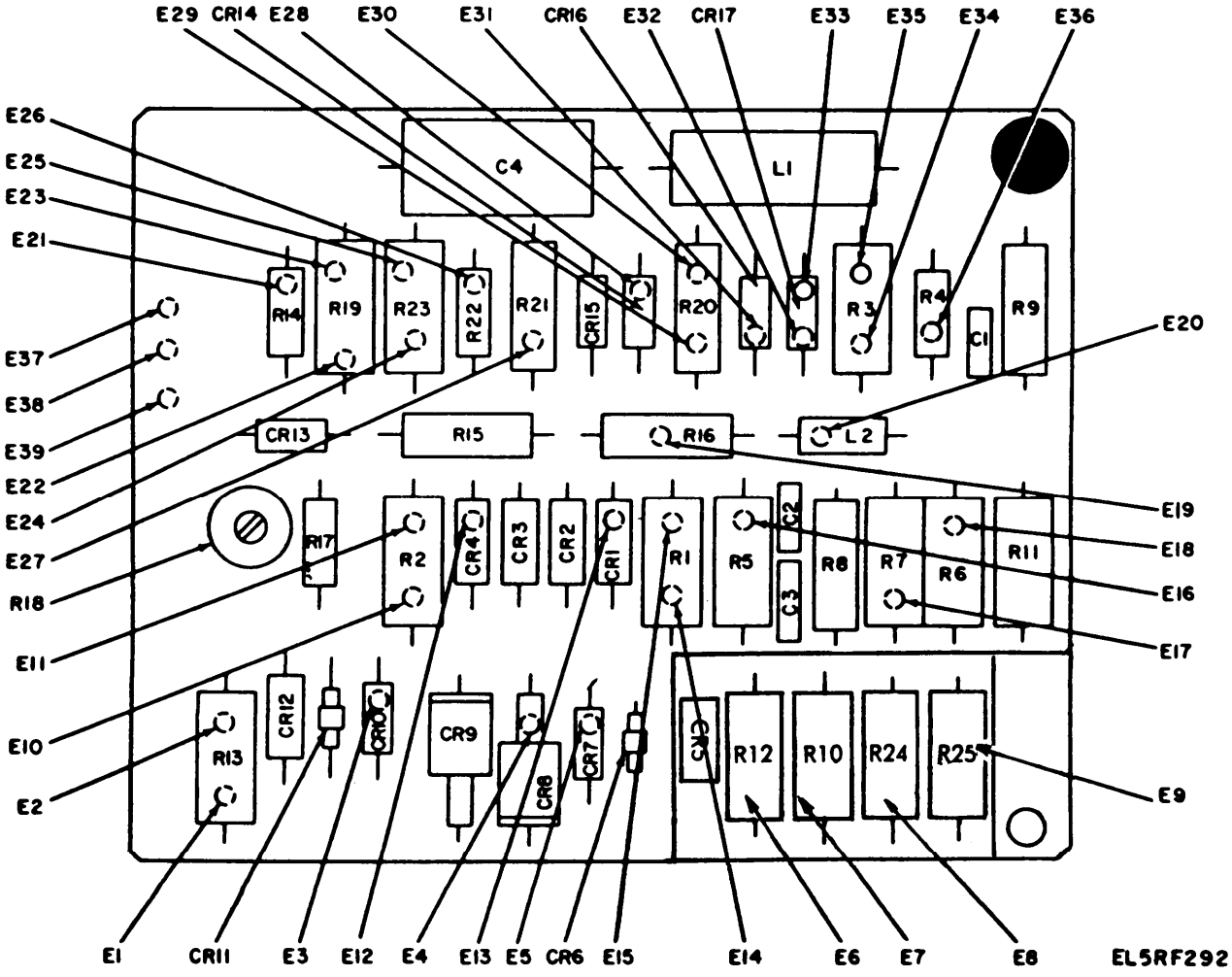



*Figure 3-122. Power Supply Subassembly 5TR1PS1A1, Parts Location.*

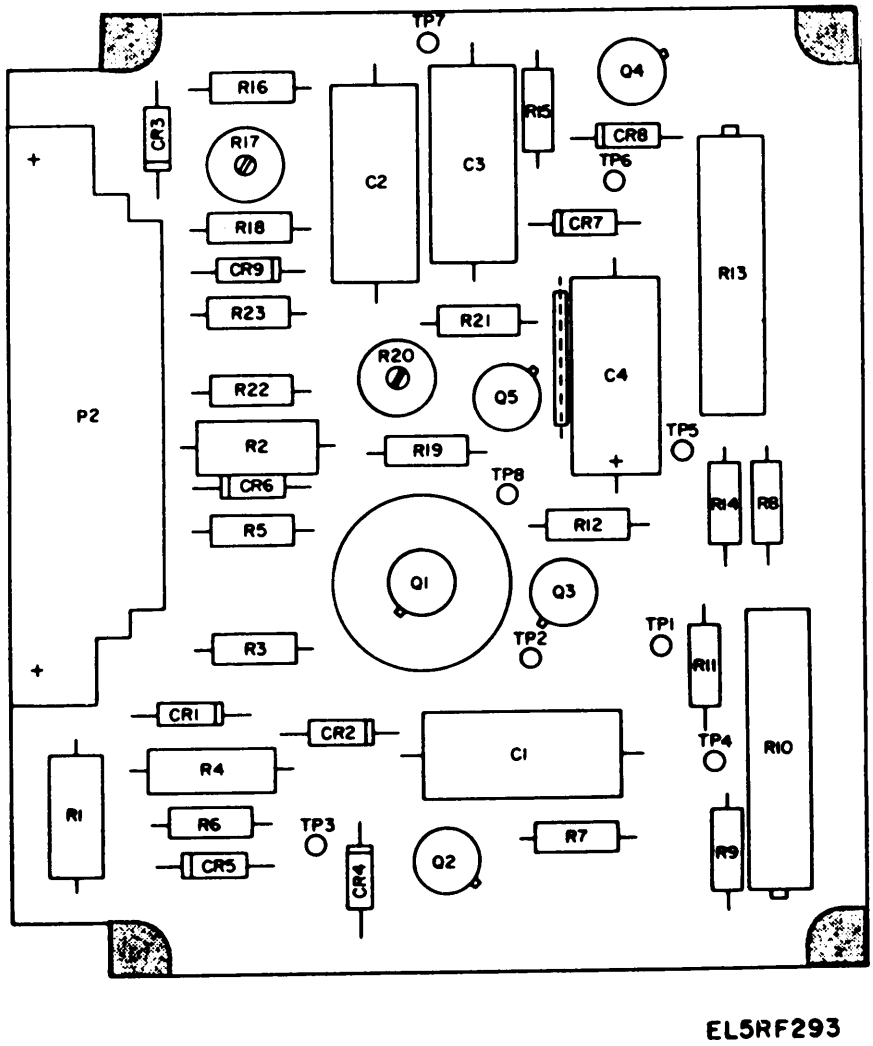



*Figure 3-123. Voltage Regulator Amplifier 5TR1PS1AR1AR1, Parts Location*

(7) Release S5 and S7. Meter M1 should indicate between 40% and 80% Note the indication on meter MI.

(8) Turn switch S4 to the +28 V METER position. Press and hold S5 and S7. Meter M1 should indicate the same as in (6) above. If necessary, adjust R17 (fig. 3-123) for the proper indication. Release S5 and S7. Meter M1 should indicate approximately the same as noted in (8) above.

(9) Turn switch S4 to the +12 V position. Connect the digital multimeter to J6 (+) and J2 (—). Press and hold S5 and S7. The digital multimeter should read 12.0 ±0.2 Vdc. If necessary, adjust R13 (fig. 3-123) for 12.0 Vdc. Record the digital multimeter reading. Note the indication on meter M1.

(10) Release S5 and S7. The digital multimeter should indicate 12.0 Vdc to 12.5 Vdc. Note the indication on meter M1.

(11) Turn switch S4 to the +12 V METER position. Press and hold S5 and S7. Meter M1 should indicate the same as in b(10) above. If necessary, adjust R20 (fig. 3-123) for proper indication.

(12) Release S5 and S7. Meter M1 should indicate approximately the same as in (10) above.

(13) Adjust the voltage control on the PP-6304 to 105 Vac and press and hold S5 and S7. The digital multimeter reading should be within ±0.2 Vdc of the reading recorded in *b(9)* above.

(14) Release S5 and S7. Adjust PP-6304 to 115 Vac and set test facility switches S1 and S2 to OFF.

(15) Reinstall special purpose cables W2 and W3 into the transmitter test facility and close POWER SUPPLY door.

(16) Seal R10, R17, R13, and R20 as described in paragraph 2-12.

(17) Replace both covers on unit under test.

*c. Troubleshooting (FO-25).* If +12 and 28 voltmeter indications are abnormal, isolate the defective component or components by making in-circuit voltage and resistance measurements, using allocated digital multimeter. Typical in-circuit resistance measurements are shown in chart below.

| | | | Base (–) | | | | Base (+) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Translator | | Emitter (+) | | Collector (i-) | | Emitter (–) | | Collector (–) | |
| Stage | Ref | Type | Res (ohms) | Range | Res (ohms) | Range | Res (ohms) | Range | Res (ohms) | Range |
| 12 V regulator | Q1 | 2N697 | 15k | 20k | | 20M | 800 | 2k | 740 | 2k |
| 28 V regulator | Q2 | 2N697 | 3500 | 20k | 75k | 20M | 780 | 2k | 740 | 2k |
| 12 V regulator | Q3 | 2N697 | 1800 | 2k | 15k | 20M | 760 | 2k | 700 | 2k |
| 28 V regulator | Q4 | 2N697 | 8500 | 20k | 1200 | 2k | 780 | 2k | 700 | 2k |
| 12 V regulator | Q5 | 2N697 | 300k | 20M | 300k | 20M | 780 | 2k | 700 | 2k |

## 3-29. Power Supply (Chassis) 5TR1PS1

*a. Test Equipment and Material Required.*

| Equipment | Common name |
|---|---|
| Test Facility, Transmitter TS-2866(V)2/GRM-95(V)2 | Transmitter test facility |
| Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2 | Accessory kit |
| Test Facility, RF Modules, TS 3837(V)2/GRM-95(V)2 | Test facility, rf modules |
| Impedance Bridge ZM-71/U | Impedance analyzer |
| Insulation Tester, CR 1864 | Insulation tester |
| Digital Multimter AN/USM-451 | Digital multimeter |
| Oscilloscope AN/USM-281C | Oscilloscope |
| Voltmeter, Electronic ME-459/U | VTVM |

*b. Test Procedure.*

(1) Open the test facility power supply hinged cover and remove the jumper cables.

(2) Connect the test equipment as shown in figure 3-124. Set power supply PP-6304/GRM-95(V) to 115 Vac as indicated on the panel voltmeter.

(3) Place the unit under test in front of the air outlet so that the airflow will be directed over the heat sink.

(4) Set the test facility switches as follows:

| Switch | Position |
|---|---|
| S1 | ON |
| S20 | S4 |
| S4 | +12 V METER |

(5) Set test facility switch S4 to all position; monitor the indications on meter M1 as follows:

(6) Connect the digital multimeter between FL24 (+) and a convenient ground (–).

| S4 position | Auxiliary operation | Digital multimeter Setup (+) | Digital multimeter Setup (–) | Digital multimeter Indication (Vdc) | M1 reading (%) | Ripple VTVM |
|---|---|---|---|---|---|---|
| +12 V METER | Press S5 and S7 | J6 | J2 | 12 ±0.2 | 40-60 | <3.5 mV |
| +28 V METER | Press S5 and S7 | J12 | J2 | 28.0 ±0.2 | 45-55 | <3.5 mV |
| +26 V | Press S5, S7 and S3 | J9 | J2 | 26 ±1.3 | 45-55 | <350 mV |
| OUTPUT FIL | Press S5, S7 and S3 | *FL20 | *FL21 | 8.2 ±0.8 | 50-70 | <120mV |
| DRIVER FIL | Press S5, S7 and S3 | *FL22 | *FL23 | 8.2 ±0.8 | 50-70 | <120mV above OUTPUT FIL |
| 600 V | Set S2 to OFF, press and hold S3, set S2 to ON. | | | | 45-55 | <17 mV |
| DRIVER CUR | | | | | Green band | |
| OUTPUT CUR | | | | | Green band | |
| 26 VAC | | | | | Green band | |

* NOTE: See Figure 3-115 for test point location on unit under test.

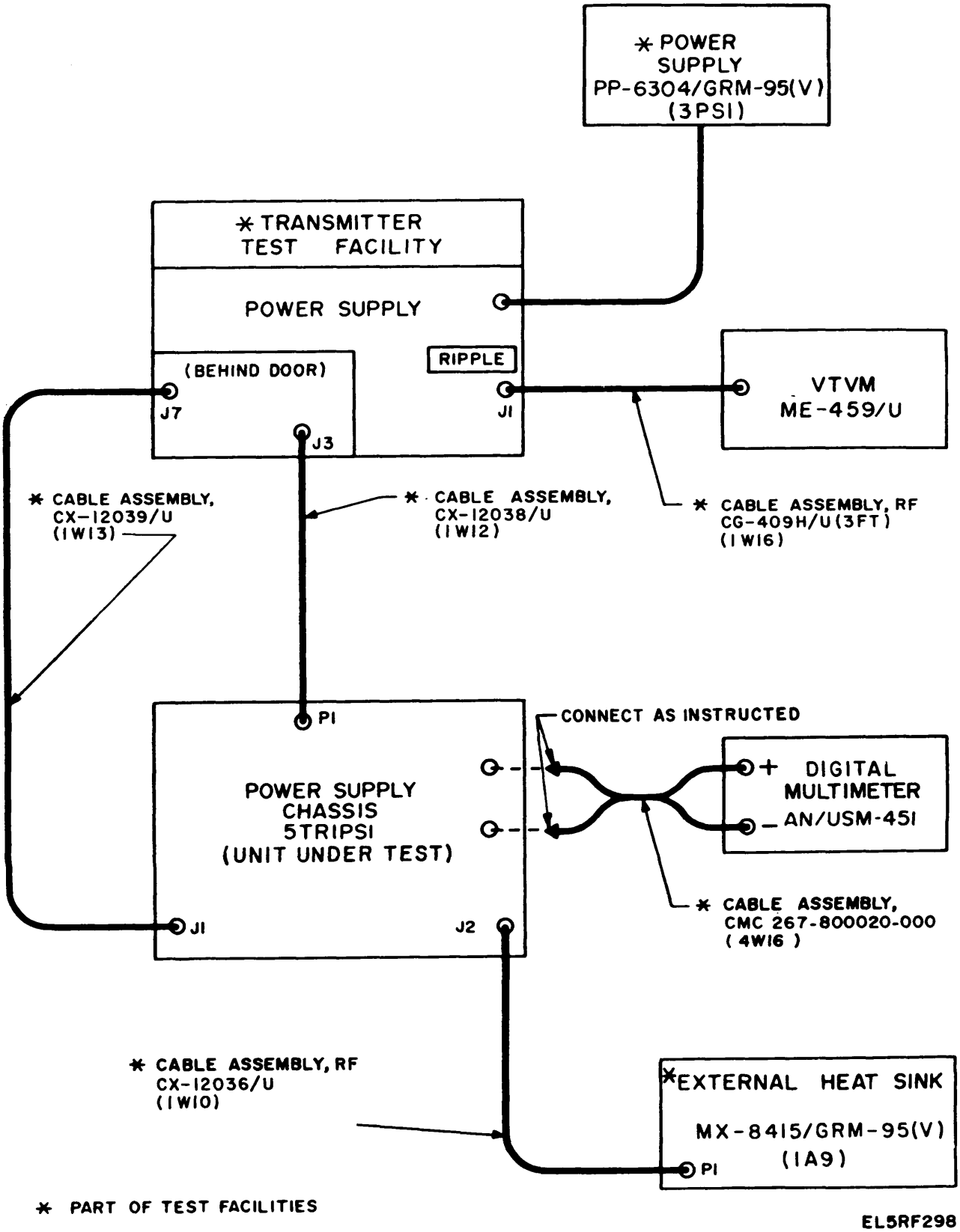



*Figure 3-124. Power Supply (ChassLs) 5TR1PS1, Test Setup.*

(7) Set test facility switch S4 to 600 V METER position and set S2 to OFF.

(8) Press and hold switch S3, set switch S2 to ON and adjust the voltage control on the power supply PP-6304 until the digital multimeter indicates +630 V ±1 V. Meter Ml should indicate 50 percent of full scale deflection.

(9) Ifnecessary adjust R18 on the unit under test for a 50 percent indication on M1 meter.

(10) Release switch S3 and set switch S2 to OFF.

(11) Return the voltage control on power supply PP-6304 to 115 Vat.

c. *Troubleshooting (FO-25).*

**WARNING**

HIGH VOLTAGE is accessible at the connectors and test leads of the insulation tester. Ensure that the test switch is in the "DISCHARGE" position before handling test connections.

| *Symptom* | *Probable cause* | *Checks and corrective measures* |
|---|---|---|
| 1. Test facility switch S1 trips and will not reset. | Short circuit on the input side, E51 failure or conductor shorting to ground. | a. Check lightning arrestor E51 (fig. 3-115) for short circuit.<br>b. Check C1 for short circuit Observe polarity when connecting the digital multimeter. Digital Multimeter should indicate 20k ohm minimum.<br>c. Using the insulation tester, check T2, T1, and associated components. Disconnect the heat sink connect the positive lead of the insulation tester to L1 pins 1 and 4 in turn and the negative lead to the chassis, set the insulation tester controls to 500 V and MEASURE. Reset to DISCHARGE before moving test leads. The insulation tester meter should indicate 100 megohms minimum. Isolate T1 by disconnecting leads at T1 pins 5 and 16. Replace components as required. |
| 2. Test facility switch S1 remains on. No M1 meter indication for any position of S4. | Starting circuit not operating. | Check starting pulses across E17 and E18, then E18 and E9, (figure 3-122) on 5TR1PS1A1. Use an oscilloscope to observe a 70 volt pulse, 10 tQ 30 milliseconds long, immediately after test facilitiy switch S2 is turned on If these pulses are not present check the operation of relay K1 and associated circuits.<br>NOTE<br>On oscilloscope use the ADD mode display with the right channel inverted and 2 volts/div vertical scale for 10:1 probes. |
| 3. No meter indication in the 600 V position. | a. Relay K2 not operating<br>b. Open circuit | a. Check operation of relay K2; replace if necessary.<br>b. Check components in the 600 V circuit for open circuit. |
| 4. No meter indication in 600 V position, +12 V and +28 V tripped on 600 V test. | a. CR15 defective<br>b. T3 shorting to ground. | a. Check CR15 for short circuit, replace if necessary.<br>b. Check T3 and replace if necessary. |
| 5. Test facility meter reads 30% or less in 600 V position. | R48 not bypassed | Check operation of relay K4 and replace if necessary. |

*c. Troubleshooting.* – Continued

| *Symptom* | *Probable cause* | *checks and correctiue measures* |
|---|---|---|
| 6. 26 Vac normal; abnormal indications in all other positions of S4. | a. Defective component in secondary of T2.<br>b. 5 kHz inverter circuit defective. | a. Check T2 secondary circuits for shorts.<br>b. Check T2 primary circuit components. |
| 7. Low indication with switch S4 in DRIVER FIL (or OUTPUT FIL) positions. | Defective FL29, 5TR1PS1PS1, or T2. | Check 5TR1PS1PS1, FL29 and T2. |
| 8. Abnormal reading with switch S4 in DRIVER CUR position. Normal readings at FIL positions. | Defective CR15.R21 or 23 | Check CR15,R21 and/or R23. Replace as required. |
| 9. Abnormal reading with switch S4 in OUTPUT CUR position. Normal reading at OUTPUT FIL position. | Defective CR14, R19 or R20. | Check CR14, R19 and/or R20. Replace as required. |
| 10. +12 V and +28 V ripple measurement high. | Leaky or open filter capacitor C19. | Check and replace C19 if necessary. |
| 11. +26 V ripple measurement high | Leaky or open filter capacitor C20 or C4. | Check capacitor. Replace as required |
| 12. Driver heater and/or output heater ripple measurement high. | Defective 5TR1PS1PS1 and FL29. | Check 5TR1PS1PS1 and FL29. |
| 13. 600 V ripple measurement high. | Defective C6 | Check and replace C6 if necessary. |
| 14. Abnormal indication, S4 in 600 V METER position. 600 V position normal. | 600 V METER circuit defective. | Check CR13 and R14 through R18 (5TR1PS1A1). |

## 3-30. Transmitter Case 5A2 (CY-4637/GRC-103 (V) or CY-4637A/GRC-103(V))

**NOTE**

The following procedure checks the continuity and insulation resistance of the interconnecting cable between the freed head and the RF head of the transmitter.

*a. Test Equipment and Material Required.*

| *Equipment* | *Common name* |
|---|---|
| Test Facility, Transmitter, TS-2866(V)2/GRM-95(V)2 | Transmitter test facility |
| Accessory Kit, Test Facility Set MK-1173(V)2/GRM-95(V)2 | Accessory kit |
| Multimeter, Digital AN/USM-451 | DMM |
| Test Set, Insulation GR-1864 | Megohmmeter |
| Power Decade Resistor ZM-58/U | Decade resistor |
| Test Facility, Radio Frequency Modules TS-3837(V)2/GRM-95(V)2 | Rf module test facility |

*b. Test Procedures.*

**NOTE**

Before performing the following tests.

1. Disconnect fan assembly 5A2B1 and test as described in paragraph 3-33.
2. On CY-4637A model units, remove temperature control monitor 5A2A2 and test as described in paragraph 3-32.
3. On CY-4637 plain model units disconnect and insulate the lead from E3 of differential pressure monitor 5A2A2AR1 (units incorporating ECP 13 have a grounding lug attached to E3).

Do not reconnect the assemblies above until instructed to do so.

(1) *Interconnecting wiring tests.*

*(a)* Connect the equipment as shown in A, figure 3-125.

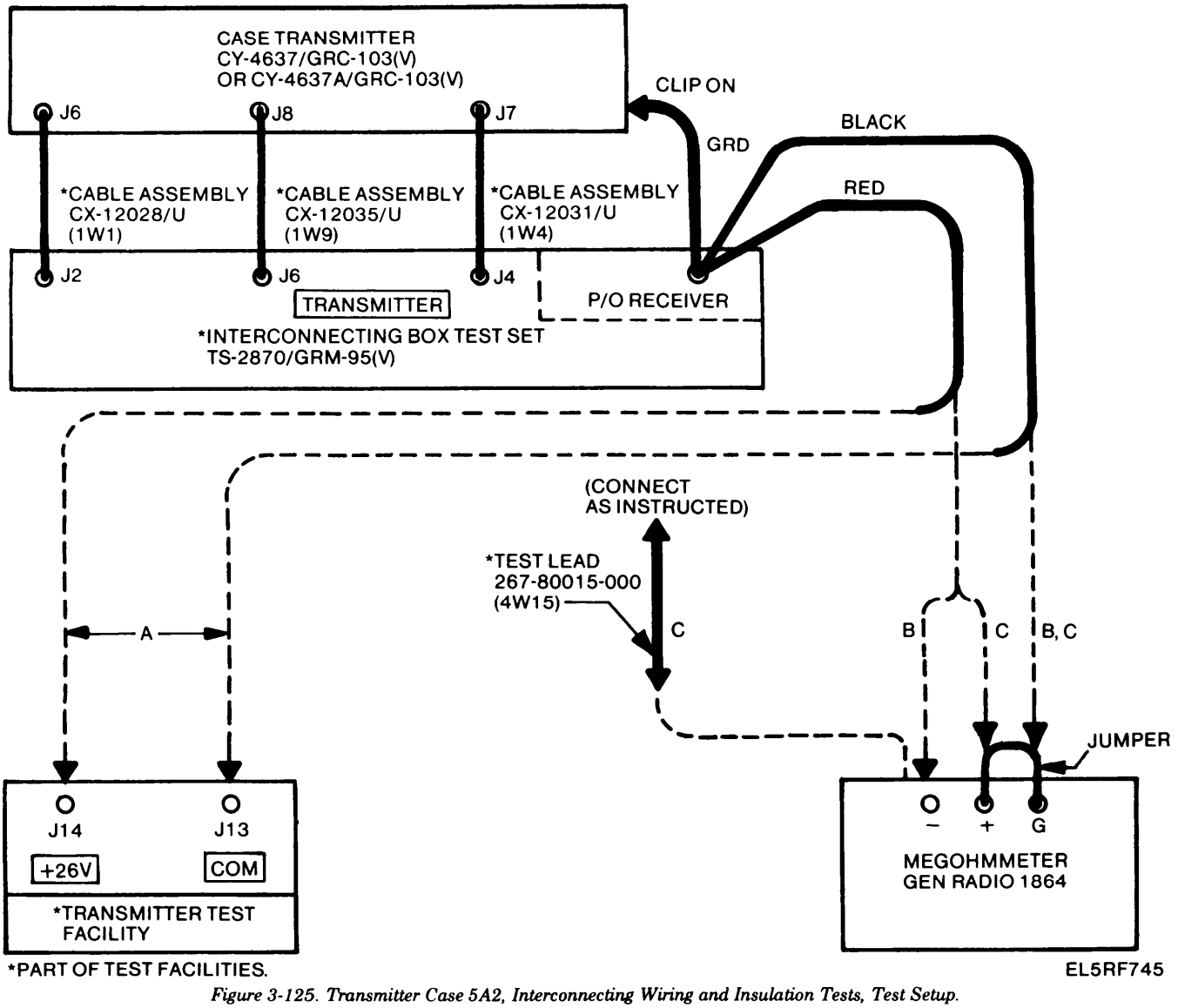



*Figure 3-125. Transmitter Case 5A2, Interconnecting Wiring and Insulation Tests, Test Setup.*

*(b)* Set test facility switches S1 and S6 to ON and adjust power supply PP-6304/GRM-95(V) for 115 Vac as indicated on its panel voltmeter.

*(c)* Set test set TS-2870/GRM-95(V) switch S1 to positions 1 through 43, in turn. For each setting of S1, rotate S2 through a complete revolution. The test lamp shall light whenever S2 position matches S1 position and also whenever S2 is in position 46 or 47, and shall not light when S2 is in position 17. Except:

*1.* On CY-4637A, the test lamp shall not light with switches in position 19 or 41.

*2.* On all CY-4637 plain model without ECP 13 (and on some with ECP 13) the test lamp will light with S2 in position 18 while S1 is in position 17.

*3.* On some early manufacture CY-4637 plain models, the test lamp will light with S2 in positions 44 and 45, and/or positions 20 and 40.

(2) *Continuity tests* (FO-5, FO-6 or FO-26).

*(a)* Use the multimeter to perform point to point tests of connectors listed below.

| | | | |
|---|---|---|---|
| *5A2A1J1 (115 Vac)* | | | |
| Pin A | to | 5A2A1J7 | Pin 6 |
| Pin B | to | 5A2A1J7 | Pin 11 |
| Pin C | to | 5A2A1J7 | Pin 7 |
| *5A2A1J2 (OW)* | | | |
| Pin A | to | 5A2A1J7 | Pin 9 |
| Pin B | to | 5A2A1J7 | Pin 11 |
| Pin C | to | 5A2A1J7 | Pin 12 |
| *5A2A1J3 (Video)* | | | |
| Center Contact | to | 5A2A1J7 | Pin 10 |
| Connector shell | to | 5A2A1J7 | Pin 11 |

(2) *Continuity tests* - Continued

| | | | |
|---|---|---|---|
| *5A2A1J4(FDM)* | | | |
| Pin A | to | 5A2A1J6 and 5A2A1J7 and 5A2A1P1 | Pin 41 Pin 4 Pin 15 (CY-4637A only) |
| Pin B | to | 5A2A1J6 and 5A2A1J7 and 5A2A1P1 | Pin 46 Pin 5 Pin 7 (CY-4637A only) |
| Pin C | to | 5A2A1J6 and 5A2A1J7 | Pin 11 Pin 1 |
| Pin D | to | 5A2A1J7 | Pin 3 |
| *5A2A1J5 (CY-4637/GRC-103(V) only)* | | | |
| Pin 1 | to | 5A2A1J7 | Pin 14 |
| Pin 2 | to | 5A2A1J7 | Pin 15 |
| Pin 3 | to | 5A2A1J7 | Pin 11 |
| *5A2A1J6* | | | |
| Pin 21 | to | 5A2A1J7 | Pin 2 |
| Pin A2 outer shell | to | 5A2A1J7 | Pin A2 outer shell |
| *5A2A1P1(CY-4637A/GRC-103(V) only)* | | | |
| Pin 1 | to | 5A2A1J7 | Pin 15 |
| Pin 2 | to | 5A2A1J7 | Pin 14 |
| Pin 3 | to | 5A2A1J8 | Pin 27 |
| Pin 4 | to | 5A2A1J8 | Pin 26 |
| Pin 5 | to | 5A2A1J6 | Pin 17 |
| Pin 6 | to | 5A2A1J6 | Pin 43 |
| Pin 8 | to | 5A2A1J6 | Pin 19 |
| Pin 9 | to | 5A2A1J5 | Pin 1 |
| Pin 10 | to | 5A2A1J5 | Pin 2 |
| Pin 11 | to | 5A2A1J7 | Pin 11 |

(3) *Insulation test.*

WARNING

HIGH VOLTAGE is accessible at the connectors and test leads of the Megohmmeter. Ensure that the test switch is in the "DISCHARGE" position before handling test connections.

*(a)* Connect the test equipment as shown in B, figure 3-125.

*(b)* Set the Megohmmeter controls to "measure" and "200 volts".

*(c)* Set S2 (test set) to positions 1 thru 43. For each position of S2 rotate S1 through a complete revolution.

*(d)* The megohmmeter shall indicate more than 100 megohms EXCEPT when S1 and S2 positions match (and, for CY-4637/GRC-103(V), EXCEPT the positions described in paragraph (1)(c) 2. and 3. above).

*(e)* Connect the test equipment as shown in C, figure 3-125 and set S2 to position 46 (CY-4637/GRC-103(V), only).

*(f)* Connect the test probe to each pin of P1 (except pin 11). For each connection rotate S1 to position 1 thru 45. The megohmmeter shall measure 100 megohms or more except in one of the following positions; 17, 19, 39, 41 or 43, corresponding to P 1 pins 5, 8, 15, 6, or 7, respectively (CY-4637A/GRC-103(V) only).

(g) Set megohmmeter to DISCHARGE.

*(h)* Connect the megohmmeter "-" terminal to 5A2A1J6 pin 1 and the "+" terminal to 5A2A1J7 pin 11 (chassis ground) with test lead CMC 267-800015-000 (4 W15).

*(i)* Set the megohmmeter to 1000 V and then to MEASURE. The megohmmeter should indicate more than 100 megohms. Set the megohmmeter to DISCHARGE.

*(j)* Set the megohmmeter to 200 V. With the megohmmeter "+" terminal connected to 5A2A1J7 pin 11, connect the "-" terminal to 5A2A1J7 pins 6 through 10, in turn. For each connection set the megohmmeter to MEASURE, not the megohmmeter indication and reset the megohmmeter to DISCHARGE. The megohmmeter should indicate 100 megohms or more to each connection checked.

*(k)* Connect the megohmmeter between the center contact and the shield of 5A2A1J6 pin 2 with the red lead of test lead CMC 267-800015-000 (4W15), test lead CX-12044/U (1W36) and adaptor-connector UG-1878/U (1CP10).

*(1)* Set the megohmmeter to MEASURE. The megohmmeter should indicate 100 megohms or more. Set the megohmmeter to DISCHARGE.

*(m)* Disconnect transmitter case from the test equipment.

(4) *Checking depth of connectors.*

*(a)* Use fixed Depth Gage TL-766/GRM-95(V) (3MP2) to check the proper depth of connectors J7 and J8. With the top of the gage resting on the front edge of the case, the bottom of the gage should barely touch the connectors. Install locally manufactured shims under each end of the retaining plate when this cannot be attained.

*(b)* Use fixed Depth Gage TL-768 (3MP4) to check the proper depth of connector J6. With the top of the gage resting on the front edge of the case, the bottom of the gage should barely touch the shoulders of the bushing around J6. Install washers between J6 and the case when this cannot be attained.

(5) *Overheat lamp and blower operational test.*

*(a)* Reconnect blower 5A2B1 and differential pressure' monitor 5A2A2AR1 (CY-4637) or temperature control monitor 5A2A2 (CY-4637A).

(b) CY-4637IGRC-103(V), *only.*

*1.* Install a working T-983 and AM-4320 in the unit under test and connect the Dummy Load to the AM-4320 PWR OUT connector, and the Power Cable to 5A2A1J1 and a 115 Vac Power Source.

2. Turn the T-983 Power ON/RESET to ON. The OVERHEAT lamp should light and go out within ten seconds.

3. Block the T-983 transmitter air intake completely. The OVERHEAT ALARM lamp should light.

4. Block the air intake approximately 50%. The OVERHEAT alarm lamp should not light.

5. Remove T-983, AM-4320 and test equipment.

(c) CY-4637A/GRC-103(V.), *only.*

*1.* Install a working T-983 in the unit under test. Connect the Power Cable to 5A2A1J1 and to a 115 Vac Power Source.

2. Connect the decade resistor between 5A2A1J6, Pin 17 and 43. Connect a jumper between 5A2A1J6, pins 18 and 19. Adjust the decade resistor to 2 megohms.

3. Turn the T-983 Power ON/RESET to ON. Set the meter selector switch to 600 V position. The blower motor should operate at full speed and meter Ml should read 80% or greater. The OVERHEAT light should be on.

4. Adjust the decade resistor to 300 K and 7.5 K ohms in turn. The blower motor should not operate and the OVERHEAT light should be off.

5. Adjust the decade resistor to 4.8 K ohms. The blower motor should operate at medium speed.

6. Adjust the decade resistor to 800 ohms. The blower motor should operate at maximum speed.

7. Adjust the decade resistor to 600 ohms. The OVERHEAT light should be on.

8. Adjust the decade resistor to 400 ohms. Meter Ml indication should drop to zero.

9. Remove T-983 and test equipment.

*c. Repairs* (FO-5, FO-6 or FO-26).

(1) If an abnormal indication is obtained in the tests in paragraph *b.* (1) or (2) above, use the TS-2870/GRM-95(V) schematic (TM 11-6625-1696-14) in conjunction with the appropriate unit schematic to identify the faulty connection(s), remove distribution box 5A2A1, and repair or replace the faulty connector(s) or wire(s).

*(2)* Abnormal indications in *b.* (3) above may be caused by pinched wires or by contaminants in the cables or connectors.

*(a)* Identify faulty connection(s).

*(b)* Remove, clean, and dry distribution box 5A2A1, cables, and connectors.

*(c)* Retest after completely dry.

*(d)* Replace or repair any remaining faulty parts.

(3) Abnormal indications in *b. (5)(b)* above are probably caused by a faulty differential pressure monitor 5A2A2AR1.

## 3-31. Distribution Box 5A2A1

*a.* Refer to paragraph 2-38 for replacement instructions.

*b.* Test as described in paragraph 3-30 (as appropriate) except:

(1) Connect the shell of connector J6 and the ground lead of test set TS-2870/GRM-95(V) to the chassis of distribution box 5A2A1.

(2) Change or add point to point continuity checks as listed below

| *From* | *To* |
|---|---|
| wire (removed from 5A2A1J 1 pin A) | 5A2A1J7 pin 6 |
| shield wire (removed from 5A2A1J1 pin B) | 5A2A1J7 pin 11 |
| wire (removed from 5A2A1J1 pin C) | 5A2A1J7 pin 7 |

CY-4637/GRC-103 ONLY

| | | |
|---|---|---|
| 5A2A1J8 pin 27 | to | 5A2A1AR1E4 |
| 5A2A1J8 pill 3 | to | 5A2A1AR1E3 |
| or | | |
| ground terminal | to | 5A2A1AR1E3 |

## 3-32. Control Monitor Temperature Sensor, 5A2A2

*a. Test equipment and material required.*

| *Name* | *Description* |
|---|---|
| Transmitter Test Facility TS-2866(V)2/GRM-95(V)2 | Transmitter test facility |
| Oscilloscope AN/USM-281C | Oscilloscope |

*b. Test Procedures* (Fig. 3-126 thru 3-128).

(1) Connect the test equipment as shown in figure 3-127.

(2) Set oscilloscope display to ADD and the right hand channel to INVERT. Set vertical sensitivity to 10 v/cm on each channel.

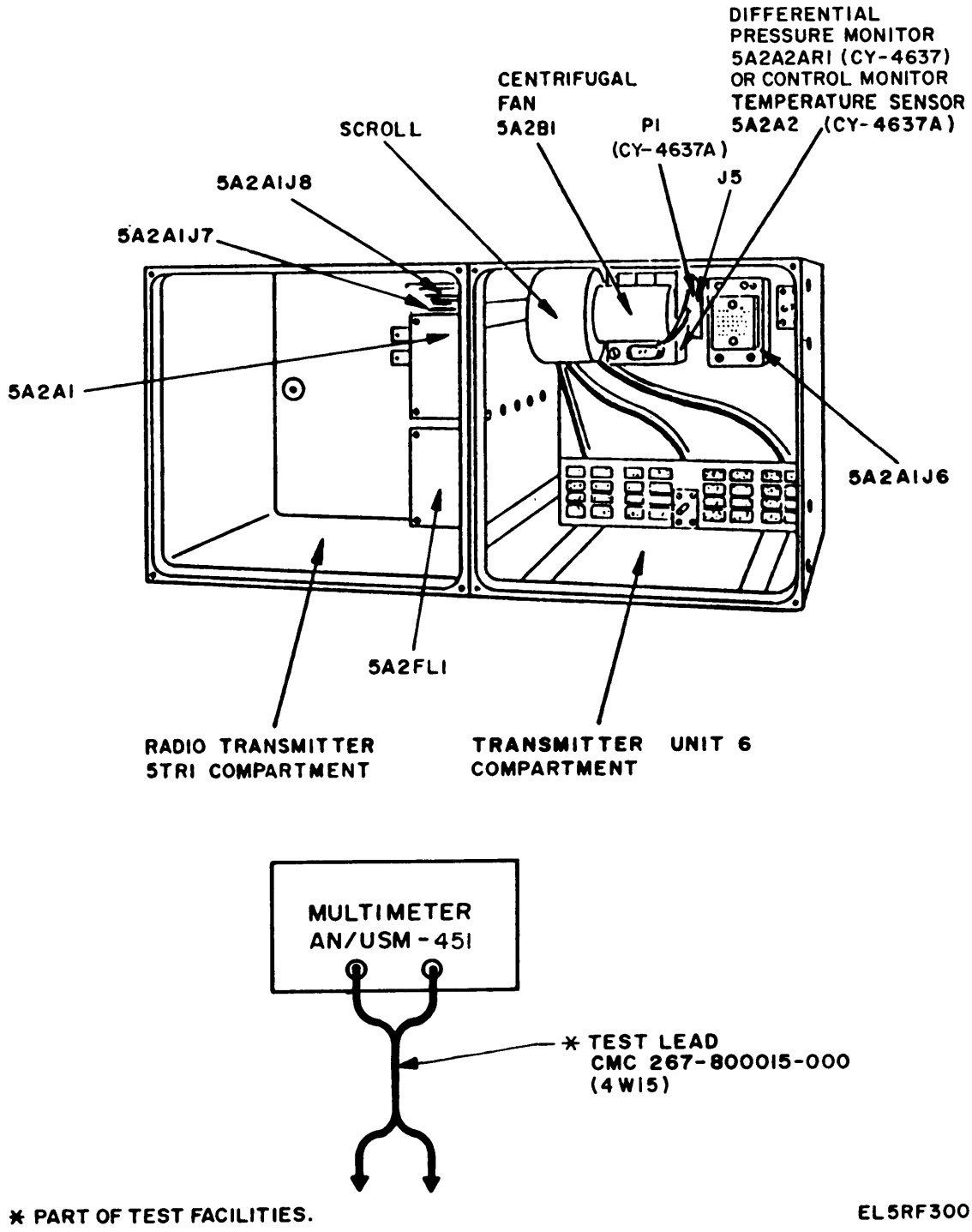



*Figure 3-126. Transmitter Case, Continuity Check, Test Setup.*

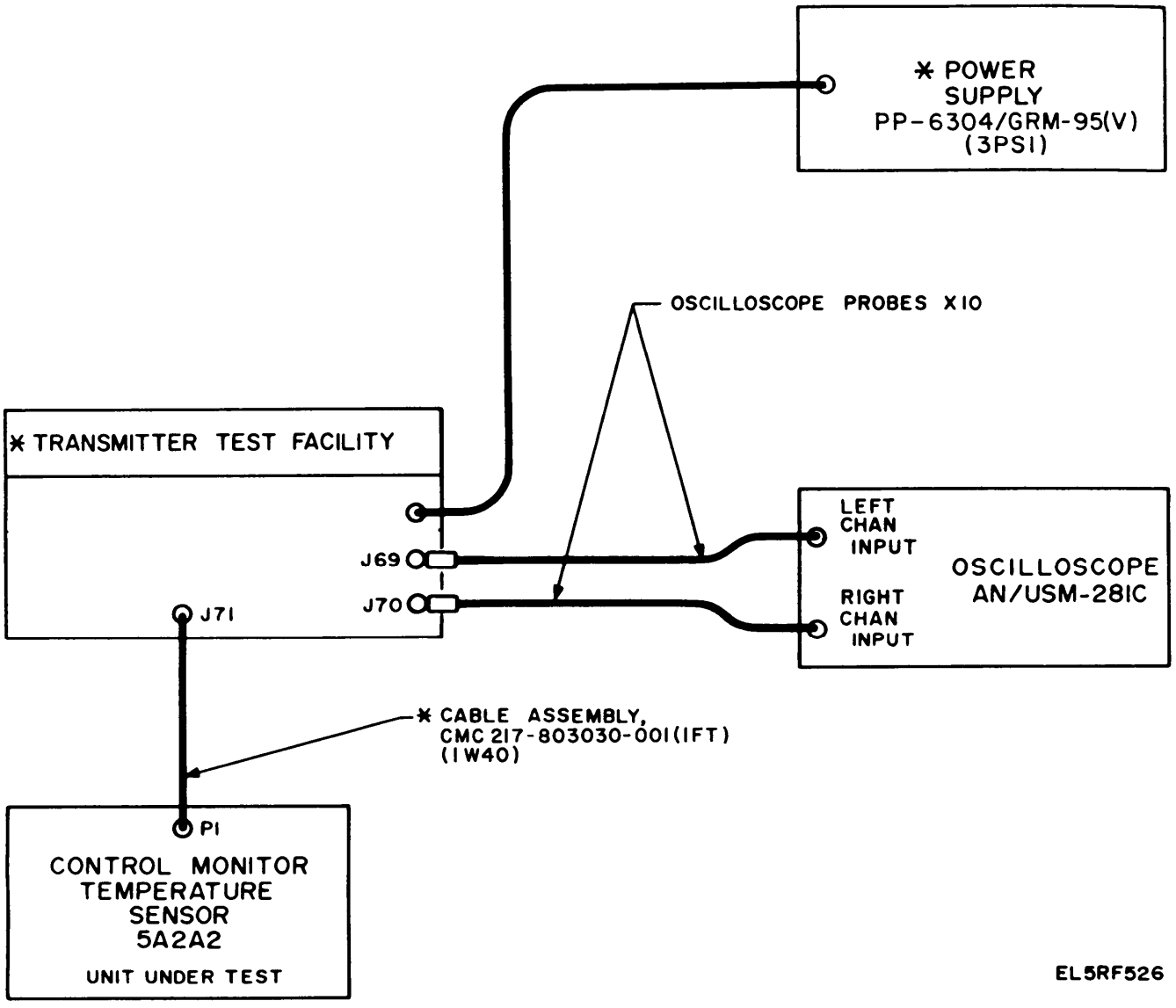



*Figure 3-127. Control Monitor Temperature Sensor, 5A2A2, Speed Control, Test Setup.*

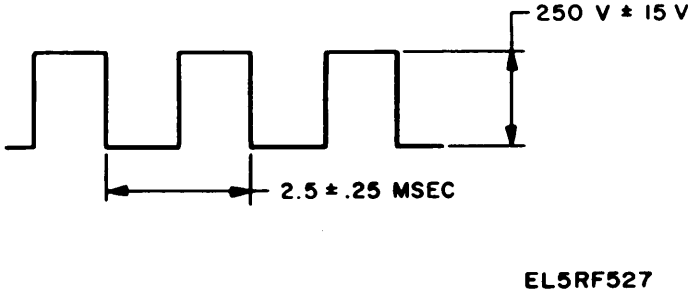



*Figure 3-128. Control Monitor Temperature Sensor, 5A2A2, Waveform.*

*(3)* Set the power supply to 115 Vac as indicated on its panel voltmeter.

*(4)* On the transmitter test facility, set S1 to ON and S33 to OFF. Test facility blower should operate.

(5) Observe the test facility blower operation, oscilloscope display, alarm lamp and trip lamp conditions, for correct conditions while varying S33 position as indicated in table below.

| *S33 position* | *Test facility Blower speed* | *Alarm Lamp* | *Trip Lamp* | *Oscilloscope display (fig. 3-148)* |
|---|---|---|---|---|
| OFF | MAX | OFF | OFF | NO DISPLAY |
| FAIL 1 | MAX | ON | OFF | |
| FAIL 2 | MAX | ON | ON | |
| ZERO SPEED 1 | OFF | OFF | OFF | NO DISPLAY |
| ZERO SPEED 2 | OFF | OFF | OFF | NO DISPLAY |
| MAX SPEED 1 | MAX | OFF | OFF | |
| MAX SPEED 2 | MAX | OFF | OFF | |
| ALARM | MAX | ON | OFF | |
| TRIP | MAX | ON | ON | |

c. Troubleshooting (FO-27).

| *Symptom* | *Probable cause* | *Checks and corrective measures* |
|---|---|---|
| Blower fails to operate at any position of switch S33. | a. Failure of 26 V supply. | a. (1) Check for approx. 20 V at E 12 of board A2 except at OFF and ZERO SPEED 1 and 2 positions of S33. If voltage is +26 V, check Q3 mounted on heat sink (fig. 3-129) and replace if defective. |
| | | (2) Check for +26 Vat E12 at OFF and ZERO SPEED 1 and 2 positions of switch S33. |
| | | (3) Check for +26 Vat pin 14 of J1 and R15 of board Al (figure 3-130). |
| | b. Failure of 6.2 V supply. | b. (1) Check test point E7 of board Al for 6.2 V at all positions of S33 except OFF (fig. 3-130). |
| | | *(2)* Check test point E11 of board A2 for 6.2 Vat all positions of S33 except OFF (fig. 3-134). |
| | | (3) Check CR1 and R1 of board A2 for 6.2 V at all positions of S33 except OFF (fig. 3-131). |
| | c. Failure of 15 V supply. | *c.* (1) Check 15 V at E1 of board A2 (fig. 3-131). |
| | | (2) Check 15 V at E5 of board A1 (fig. 3-130). |
| | | (3) Check A3 of board A2 and associated components (fig. 3-131). |
| | | (4) Check Q3 (2N 3749) on board A2 (fig. 3-131). |
| Blower fails on FAIL 1. | Speed control circuit defective. | a. Check for approx. +3 Vat E5 of board A2 (fig. 3-131). If voltage is high, check A3 and CR6 of board A2. If voltage is low, check for square wave of approx. 15 Vp-p amplitude at collector of Q1 and at pins 1,5,8, 11 and 14 of A2 on board A2. |

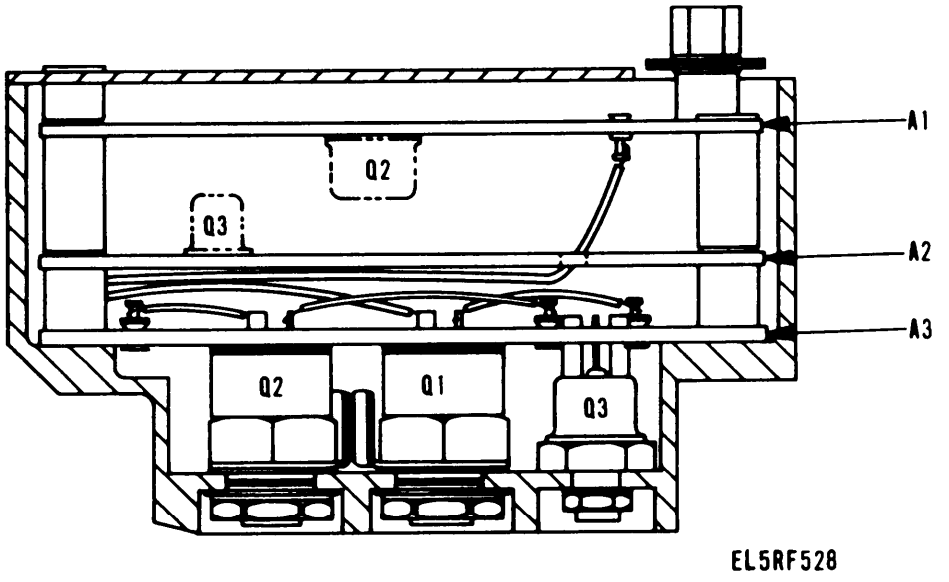



*Figure 3-129. Control Monitor Temperature Sensor, 5A2A2, Parts Location*

*c. Troubleshooting (FO-5).* – Continued

| *Symptom* | *Probable cause* | *Checks and corrective measures* |
|---|---|---|
| | | b. Check for approx. 15 Vp-p square wave at pins 8 and 15 of A1 on board A2 (fig. 3-131).<br>c. Check for approx. 15 Vp-p square wave at collector of Q2 and Q3 on board A2 (fig. 3-131).<br>d. Check for approx. 15 Vp-p square wave at E2 and E4 of board A3. If present check Q1, Q2, T2 and T3 on board A3 (figs. 3-129 and 3-132). |
| Blower fails on FAIL 2. | Speed control circuit defective. | Check A1 on board A1 (fig. 3-130). |
| Blower operates but alarm not activated or blower operates but trip lamp not activated. | Defective components in relay circuit- | s. Check A2 and Q2 on board A2 (fig. 3-131).<br>b. Check A2, Q1 and K1 on board A1 (fig. 3-130). |

**NOTE**

Replace all defective components found during troubleshooting.

### 3-33. Centrifugal Fan 5A2B1

a. *Test Equipment and Material Required.*

| *Equipment* | *Common name* |
|---|---|
| Test Facility, Transmitter TS-2866(V)2/GRM-95(V)2. | Transmitter test facility |
| Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2. | Accessory kit |
| Multimeter, Digital AN/USM-451 | Digital multimeter |

*b. Test Procedure.*

(1) Connect test equipment as shown in figure 3-133.

(2) Set the power supply to 115 Vac as indicated on its panel meter.

(3) Set switch S1 to ON and hold switch S19 in the TEST position. The fan should rotate at full speed. Release S19, and set S1 to OFF.

(4) Using the digital multimeter, measure the resistance between pins of 5A2B1P1 as indicated in table below.

| *Multimeter leads at pins:* | *Resistance* |
|---|---|
| 1 and 2 | 40 –10, +20 ohms |
| 1and3 | ∞ |
| 2 and 3 | ∞ |

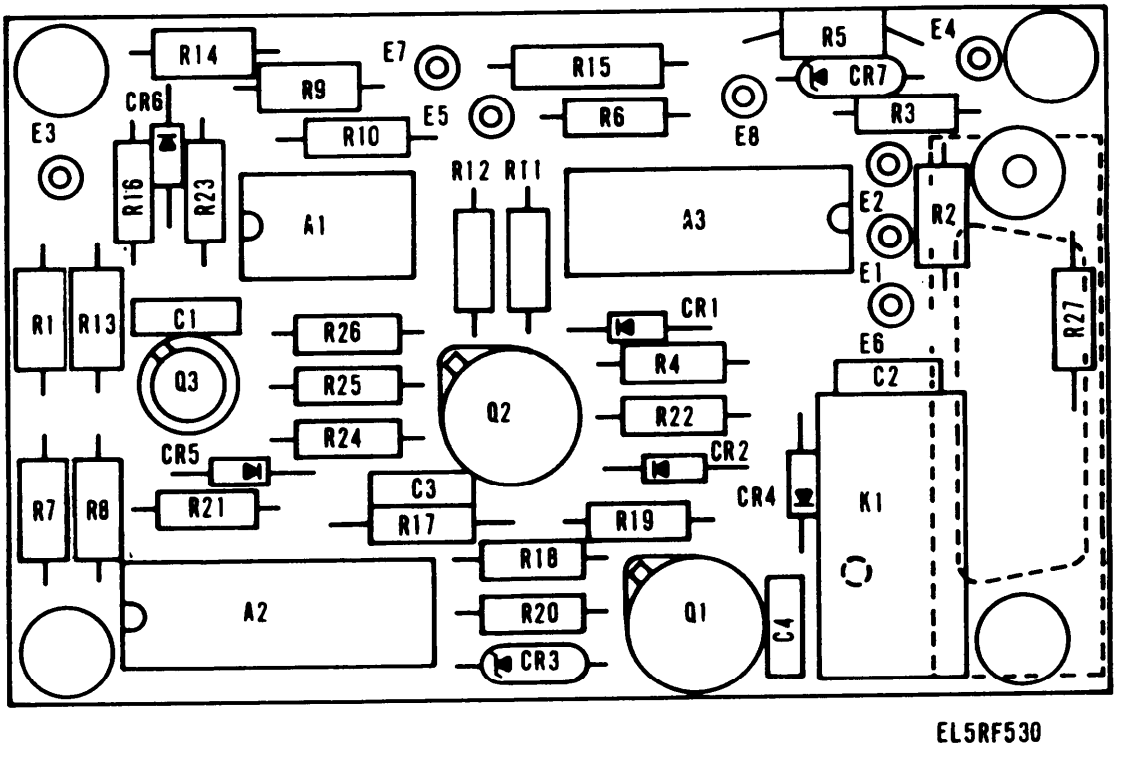



*Figure 3-130. Control Monitor Temperature Sensor, 5A2A2A1, Parts Location.*

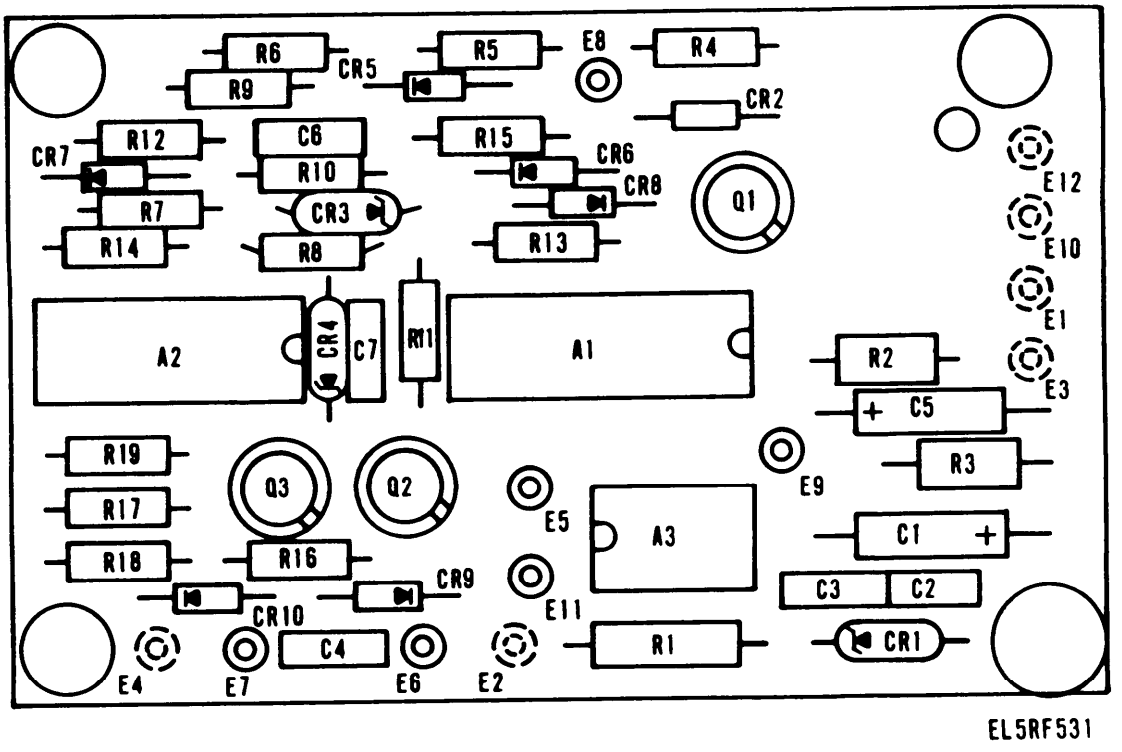



*Figure 3-131. Control Monitor Temperature Sensor, 5A2A2A2, Parts Location.*

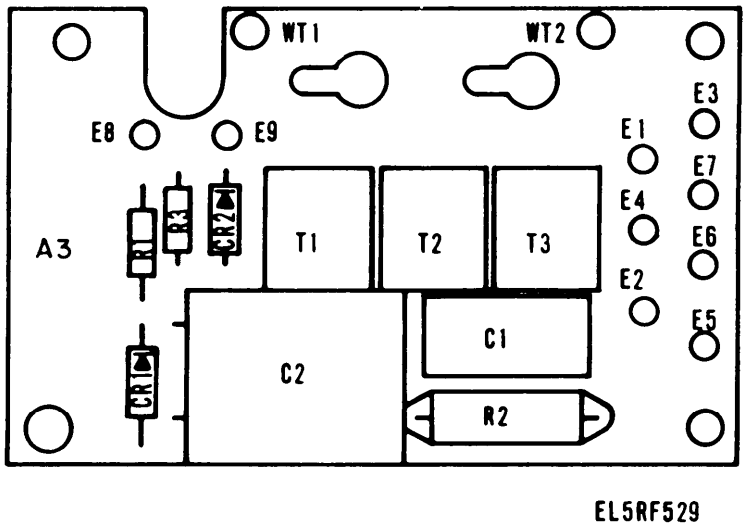



*Figure 3-132. Control Monitor Temperature Sensor, 5A2A2A3, Parts Location.*

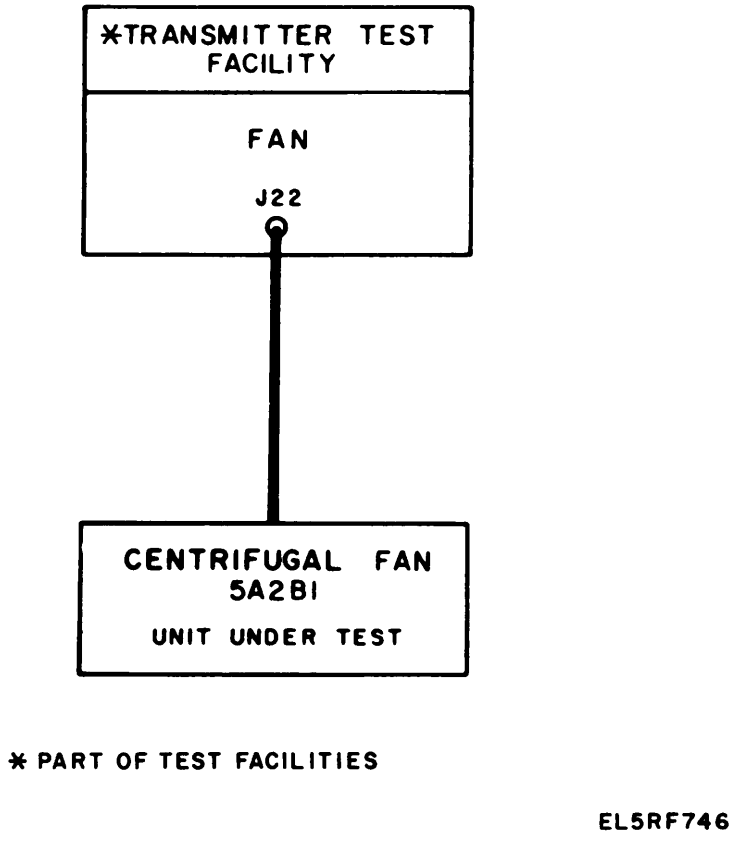



*Figure 3-133. Centrifugal Fan 5A2B1, Test Setup.*

## Section III. RECEIVER–TRANSMITTER ORDER WIRE

## RT-773/GRC-103(V)

### 3-34. Recevier Transmitter Order Wire RT-773/ GRC-103(V) Alinement

a. *Test Equipment and Material Required.*

| *Equipment* | *Common name* |
|---|---|
| Test Facility, Transmitter TS-2867(V)2/GRM-95(V)2 | Transmitter test facility |
| Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2 | Accessory kit |
| Generator, Signal AN/USM-205A | Wide range oscillator |
| Voltmeter, Electronic ME-459/U | VTVM |
| Counter, Electronic TD-1225-(V)1/U | Counter |

*b. Test Procedures.*

**NOTE**

Ensure that the PCM/FDM switch is in the PCM position on board A4 and the buzzer is in ALM NORM. This is accomplished by removing the front panel of the unit under test. Leave the panel off the case for the following tests.

(1) Connect the test equipment as shown in A of figure 3-134.

**NOTE**

Set and maintain the power supply at 115 Vac as indicated on its panel voltmeter.

(2) Set test facility switches S1 to ON and S31 to SET REF.

(3) On the unit under test the POWER lamp should light

(4) Disconnect the cable from test facility J45 (TO RADIO) connector. The POWER lamp should remain lit. Reconnect the cable to the test facility.

(5) Disconnect the cable from test facility J44 (PATCH THRU) connector. The POWER lamp should remain lit. Reconnect the cable to the test facility.

(6) Set the wide range oscillator to 1 kHz as indicated on the counter and adjust the level to —10 dBm as indicated on the VTVM.

(7) Set switch S31 to position A TO B and then position B TO A. In both positions the VTVM should indicate –10 dBm ±0.2 dB. A 1 kHz tone should be heard in the handset of the unit under test.

(8) Set switch S31 to SET REF position. Set the wide range oscillator to 1600 Hz ±4 Hz, as indicated on the counter and adjust the level to – 13 dBm as indicated on the VTVM.

(9) Set switch S31 to A to B then B to A. On the unit under test the CALL lamp should light and the buzzer should sound in both positions.

(10) Set BUZ/ALM NORM switch S2 on the unit under test to BUZ OFF. The buzzer should be silenced. The CALL lamp should remain lit, but with the illumination dimmed.

(11) Set the BUZ OFF/ALM NORM switch S2 to ALM NORM.

(12) Disconnect the cable from connector J43 on the test facility.

(13) On the handset of the unit under test press the PRESS-TO-TALK switch and speak into the microphone. You should be able to hear your own voice in the receiver of the handset. The VTVM should give an indication while you are speaking, for both the A TO B and B TO A position of switch S31.

(14) Connnect the counter as shown in B, figure 3-134. On the unit under test, press and hold the RING button, and set test facility switch S31 from position A TO B to B TO A. The VTVM should indicate – 10 dBm ±1.0 dB, in both the A TO B and B TO A position of switch S31. The counter should indicate 1600 Hz ±1 Hz.

(15) Reinstall panel 9A2 to case CY-4635.

c. *Troubleshooting Procedure.* Refer to the troubleshooting chart in paragraphs 3-35 through 3-38.

### 3-35. Distribution Panel 9A1

*a. Test Equipment and Material Required.*

| *Equipment* | *Common name* |
|---|---|
| Test Facility, Transmitter TS-2866(V)2/GRM-95(V)2 | Transmitter test facility |
| Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2 | Accessory kit |
| Multimeter, Digital AN/USM-451 | Multimeter |

*b. Test Procedure.*

(1) Using the multimeter, check resistances between the points listed below. Refer to figures 3-135 and 3-136.

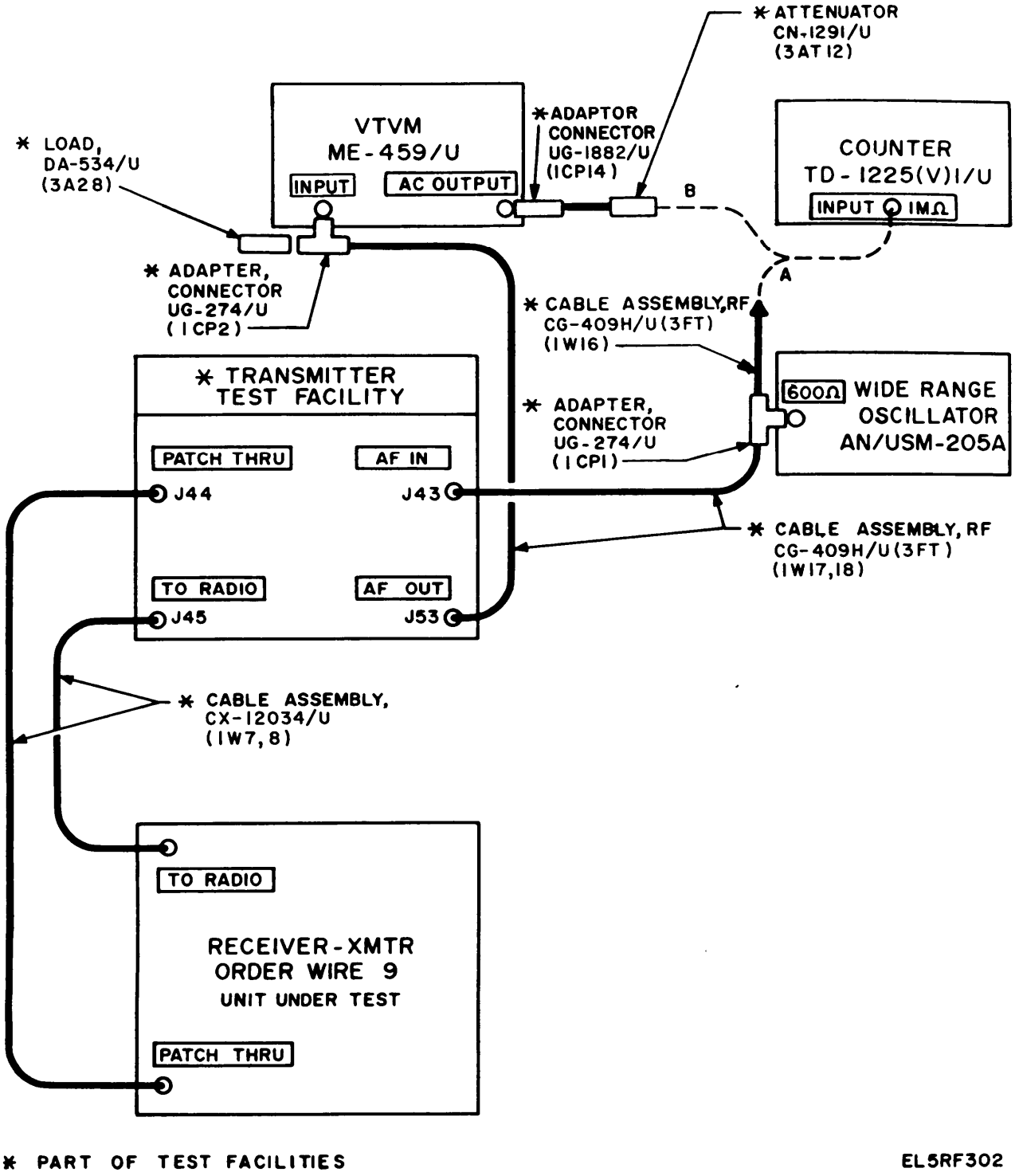



*Figure 3-134. Order Wire Operational Check, Test Setup.*

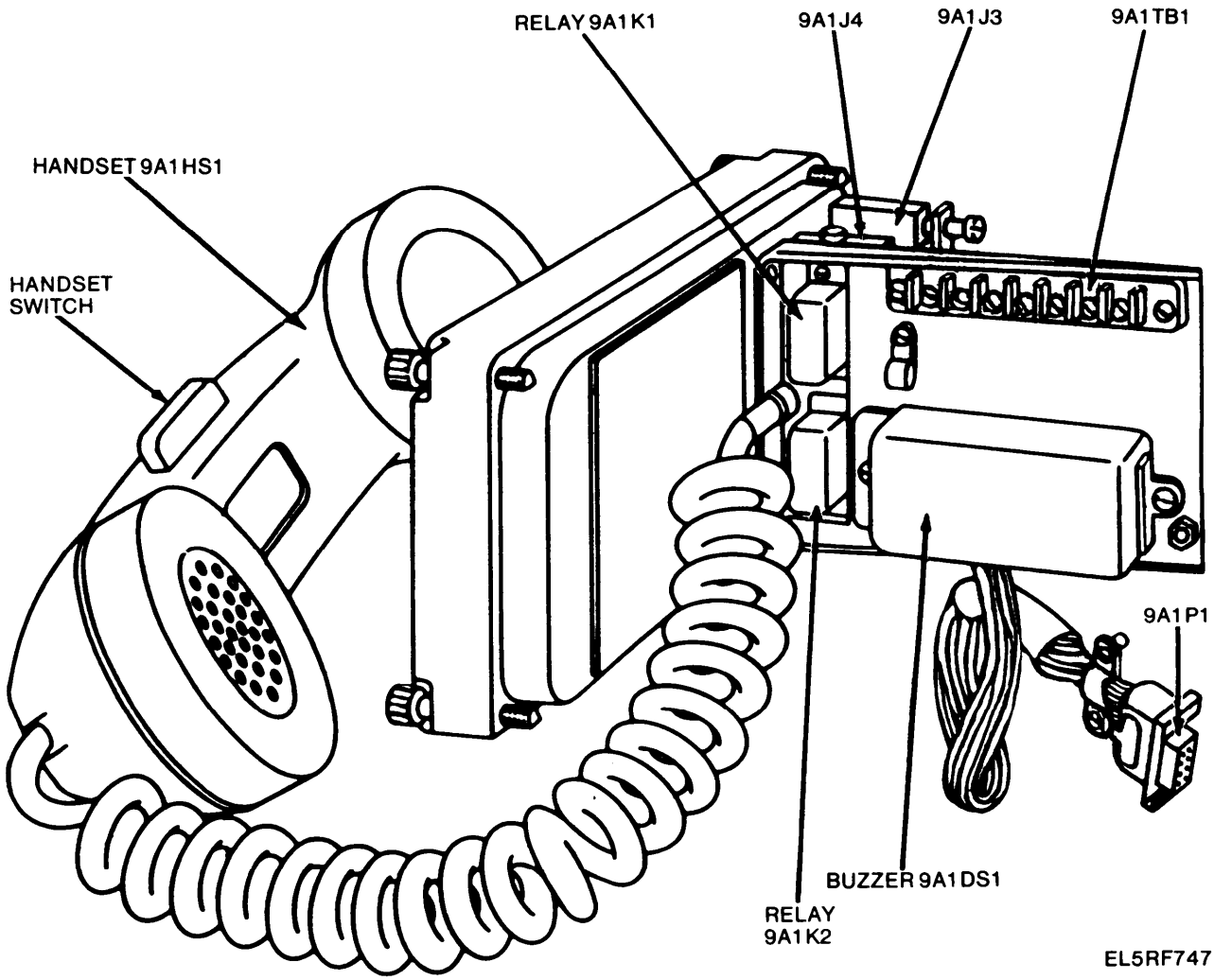



*Figure 3-135. Receiver- Transmitter Order Wire Unit Distribution Panel 9A1.*

**NOTE**

9A1J2 is PATCH THRU and 9A1J1 is TO RADIO.

| *Multimeter connected between* | *Resistance (ohms)* |
|---|---|
| *9A1J1* pin G and 9A1J1 pin K (R2) | 620 ±60 |
| 9A1J2 pin K and 9A1J2 pin G (R1) | 620 ±60 |
| 9A1J2 pin A and 9A1P1 pin 6 | <1 |
| 9A1J2 pin B and 9A1P1 pin 13 | <1 |
| 9A1J2 pin C and 9A1J3 pin A | <1 |

(2) Connect the test equipment as show-n in figure 3-137.

**NOTE**

Set and maintain the power supply output at 115 Vac as indicated on its panel voltmeter.

(3) Set test facility switches S1 to ON and S31 to A TO B.

(4) Using the multimeter, check voltages between the points listed below. Refer to figure FO-13.

| *Multimeter connections* (+) | (-) | *Indication* (Vdc) |
|---|---|---|
| 9A1P1 pin 6 | 9A1P1 pin 13 | +26 ±1.3 |
| 9A1J3 pin A | 9A1J3 pin B | +12 ±0.2 |

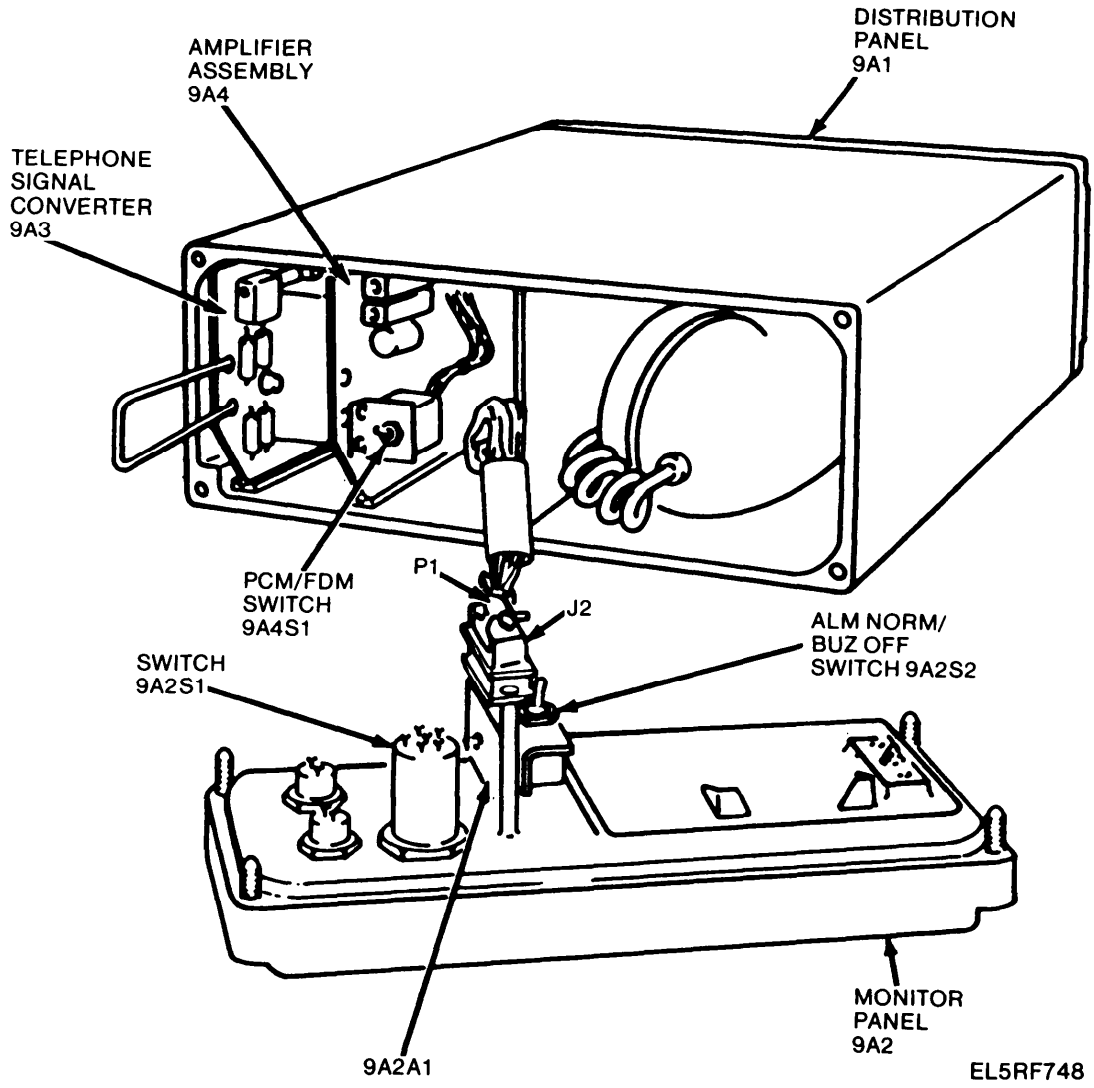



*Figure 3-136. Receiver- Transmitter Order Wire, Unit 9.*

(5) Short circuit 9A1P1 pins 3 and 13. The buzzer should sound.

(6) Set test facility switches S31 and S1 to OFF.

(7) Connect the multimeter across 9A1TB1 pins 4 and 5. It should indicate infinity.

(8) Press the handset PRESS-TO-TALK switch the multimeter should indicate <3 ohms.

(9) Release the handset switch the multimeter indication should return to infinity.

(10) Repeat (8) and (9) above three times.

(11) Connect the multimeter to 9A1TB1 pins 2 and 3 and repeat (7) through (10) above.

c. *Troubleshooting* (FO-13).

| *Symptom* | *Probable cause* | *Checks and corrective measures* |
|---|---|---|
| Abnormal indication of R1 and R2 *(b.* (1) above). | Defective resistor assembly 9A1A1. | Check resistors on resistor assembly 9A1A1 (FO-13). (R1 is connected between El and E2. R2 is connected between E3 and E4.) Replace resistor assembly 9A1A1 as required. |
| Abnormal indication between 9A1J2 (PATCH THRU connector) pins and 9A1P1 pins (b. (1) above). | Defective wiring or relay K1. | Check wiring between 9A1J2 and 9A1P1 and relay K1 contacts If wiring is normal, replace relay K1. |

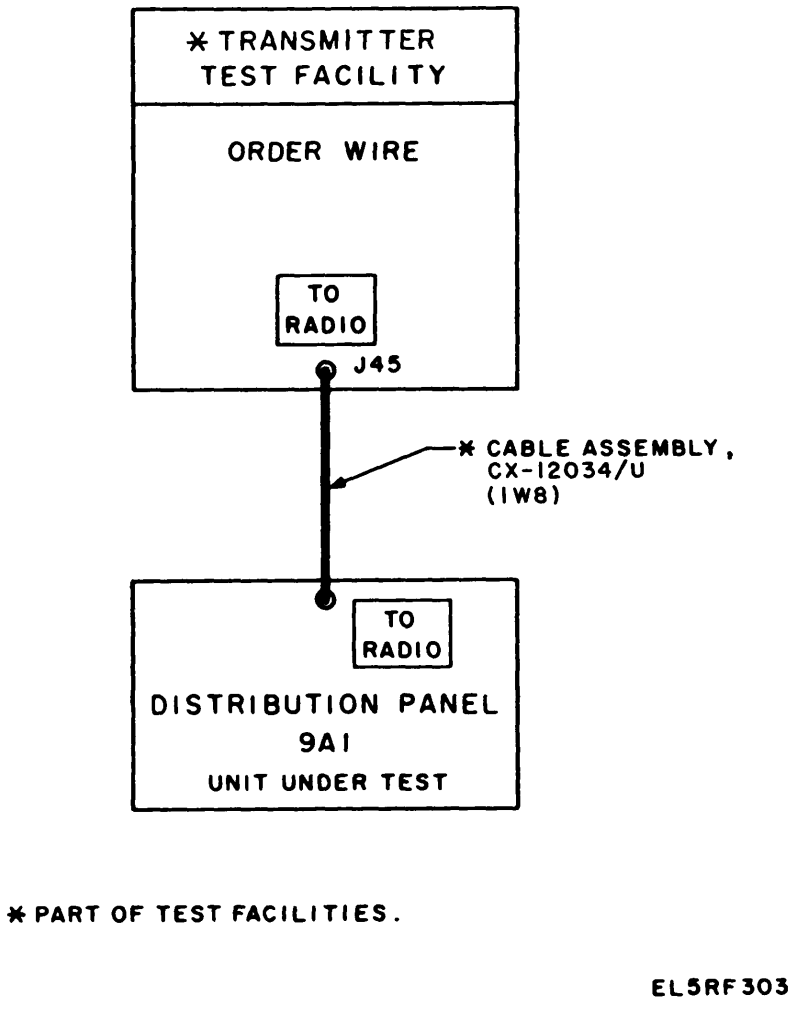



*Figure 3-137. Distribution Panel 9A1, Test Setup.*

*c. Troubleshooting.* -Continued

| *Symptom* | *Probable cause* | *Checks and corrective measures* |
|---|---|---|
| Abnormal indication between 9A1J2 (PATCH THRU connector) pin C and 9A1J3 pin A *(b.* (1) above). | Defective wiring or relay K2. | Check wiring between 9A1J2 pin C and 9A1J3 pin A and relay K2 contacts If wiring is normal, replace relay K2. |
| Abnormal indication when checking voltage between 9A1P1 pin 6 and 9A1P1 pin 13 (b. (4) above). | Defective wiring or relay K1. | Check wiring between 9A1P1 pin 6 and pin 3 and relay K1 contacts. If wiring is norreal, replace relay K1. |
| Abnormal indication when checking voltage between 9A1P3 pin A and 9A1P3 pin B *(b.* (4) above). | Defective wiring *or relay K2.* | Check wiring between 9A1P3 pin A and pin B and relay K2 contacts. If wiring is normal, replace relay K2. |
| Buzzer 9A1DS1 does not sound (b. (5) above). | Defective buzzer 9A1DS1. | Replace buzzer 9A1DS1. |
| Abnormal indication when testing handset switch *(b.* (6) through (10) above). | Defective handset switch. | Replace handset switch |

### 3-36. Monitor Panel 9A2

*a. Test Equipment and Material Required.*

| *Equipment* | *Common name* |
|---|---|
| Multimeter, Digital AN/USM-451 | Multimeter |

*b. Test Procedure.*

(1) Using the multimeter, check resistances to validate operation of switch 9A2S1 (fig. 3-136) as follows:

| *Multimeter connected between following* | *Secondary action* | *Resistance (ohms) infinity* |
|---|---|---|
| *9A2S1* pins | | |
| 7 and 2 | | |
| 7 and 2 | press S1 | <1 |
| 7 and 1 | | <1 |
| 7 and 1 | press S1 | infinity |
| 6 and 3 | | infinty |
| 6 and 3 | press S1 | <1 |
| 6 and 4 | | <1 |
| 6 and 4 | press S1 | infinity |

(2) Using the multimeter check the operation of switch 9A2S2 as follows:

| *Connect multimeter between* | *Secondary action* | *Resistance (ohms)* |
|---|---|---|
| *9A2J2* pin 59A2J2 pin 3 | S2 OFF | |
| 9A2J2 pin 59A2J2 pin 3 | BUZZ ALM | <1 |
| 9A2J2 pin 5 9A2A1E4 | NORM | |
| 9A2J2 pin 59A2A1E4 | S2 OFF | 200 *5 |
| | S2 ALM NORM | <1 |

(3) Using the rnultimeter, check resistance of resistors on resistor assembly 9A2A1 as indicated in the table below.

| *Multimeter connected between* | *Resistance (Ω)* |
|---|---|
| E1 and E4 | 100 *5% |
| E5 and E3 | 100 *5% |

(4) If normal indications are obtained during test procedures carry out the troubleshooting procedures outlined inc. below.

C. *Troubleshooting (FO-13).*

### *3-37.* Telephone Signal Converter 9A3

a. *Test Equipment and Material Required.*

| *Equipment* | *Common name* |
|---|---|
| Test Facility, Transmitter TS-2866(V)2/GRM-95(V)2 | Transmitter test facility |
| Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2 | Accessory kit |
| Generator, Signal AN/USM-205A | Wide range oscillator |
| Multimeter, Digital AN/USM-451 | Multimeter |
| Counter, Electronic Digital Read-out TD-1225(V)1/U | Counter |
| Electronic Voltmeter ME-459/U | VTVM |

*b, Test Procedure.*

(1) *1,600 Hz tone generation.*

*(a)* Connect the test equipment as shown in figure 3-138.

**NOTE**

Set the power supply to 115 Vac as indicated on its panel voltmeter. Maintain this setting throughout the following procedures.

*(b)* Set test facility switch S1 to ON and switch S32 to OSC. The VTVM should indicate 1.6 V ±0.1 V. On the unit under test adjust gain control R13 (fig. 3-139) to obtain 1.6 V ±0.1 V indicated on the VTVM.

*(c)* The counter should indicate 1,600 Hz ±1 Hz. Adjust C4 on the unit under test to obtain the correct frequency.

*(d)* Set switch S32 to OFF.

(2) 1,600 *Hz tone receive gain and tuning measurement.*

*(a)* Connect the test equipment as shown in figure 3-140.

*(b)* Set test facility switch S32 to the RCVR position.

*(c)* Set the coaxial to position 1.

*(d)* Tune the wide range oscillator to 1,600 Hz ±1 Hz, as indicated on the counter and adjust the output level to obtain a 100 mV indication on the VTVM.

| *Symptom* | *Probable cause* | *Checks and corrective measures* |
|---|---|---|
| Abnormal indication in *b.* (1) above. | Defective 9A2S1. | Replace switch 9A2S1. |
| Abnormal indication *b.* (2) above. | Defective 9A2S2. | Replace switch 9A2S2. |
| Abnormal indication in *b.* (3) above. | Defective resistors R1, R2 or R3. | Replace resistor assembly 9A2A2. |

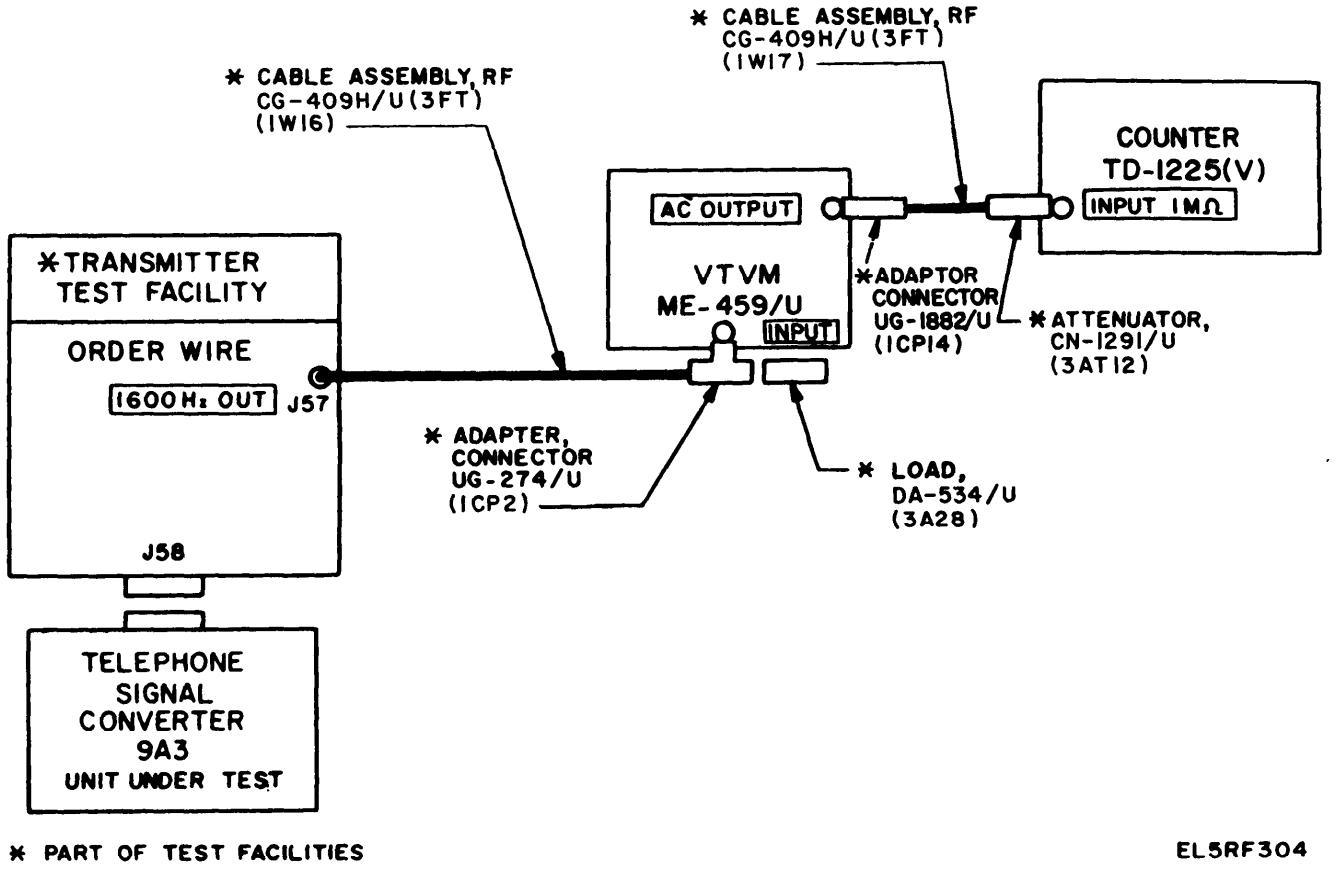



*Figure 3-138. Telphone Signal Converter 9A3, 1600 Hz Tone Generation Test Setup.*

*(e)* Set the coaxial stitch to position 2. Vary the wide range oscillator frequency for maximum indication on the VTVM (peak). The frequency indicated on the counter should be 1,600 Hz ±1 Hz. Note the indication.

(3) 1,600 Hz tone detector sensitivity/selectivity *measurement.*

*(a)* Connect the test equipment as shown in figure 3-140.

*(b)* Set the coaxial switch to position 1.

*(c)* Adjust the output level of the wide range oscillator to 50 mV as indicated on the VTVM. Maintain wide range oscillator frequency at 1,600 Hz ±1 Hz as noted in *(2)(e)* above.

*(d)* Set test facility switch S32 to the ALARM position.

*(e)* Slowly increase the output level of the wide range oscillator until the order wire ALARM lamp on the test facility lights. The VTVM should indicate 108 mV ±5 mV.

*(f)* Adjust the output level of the wide range oscillator to 200 mV as indicated on the VTVM.

*(g)* Set the frequency of the wide range oscillator to 1,550 Hz as indicated on the counter.

*(h)* Slowly increase the frequency of the wide range oscillator until the order wire ALARM lamp on the test facility lights. The frequency indicated on the counter should be 1,580 Hz ±10 Hz.

*(i)* Repeat step *(f)* above and adjust frequency of wide range oscillator to 1,650 Hz.

*(j)* Slowly decrease the frequency of the wide range oscillator until the order wire ALARM lamp on the test facility lights. The frequency indicated on the counter should be 1,620 Hz ±10 Hz.

c. *Adjustments.*

(1) *1,600 Hz tone receive tuning adjustment*

*(a)* Repeat paragraph b. *(2)(a)* through(e).

*(b)* Adjust C2 on the unit under test for a maximum indication on the VTVM.

**NOTE**

If a sharp peak cannot be obtained by adjusting C2, turn R1 several turns counterclockwise and repeat step *b. (2)(e).*

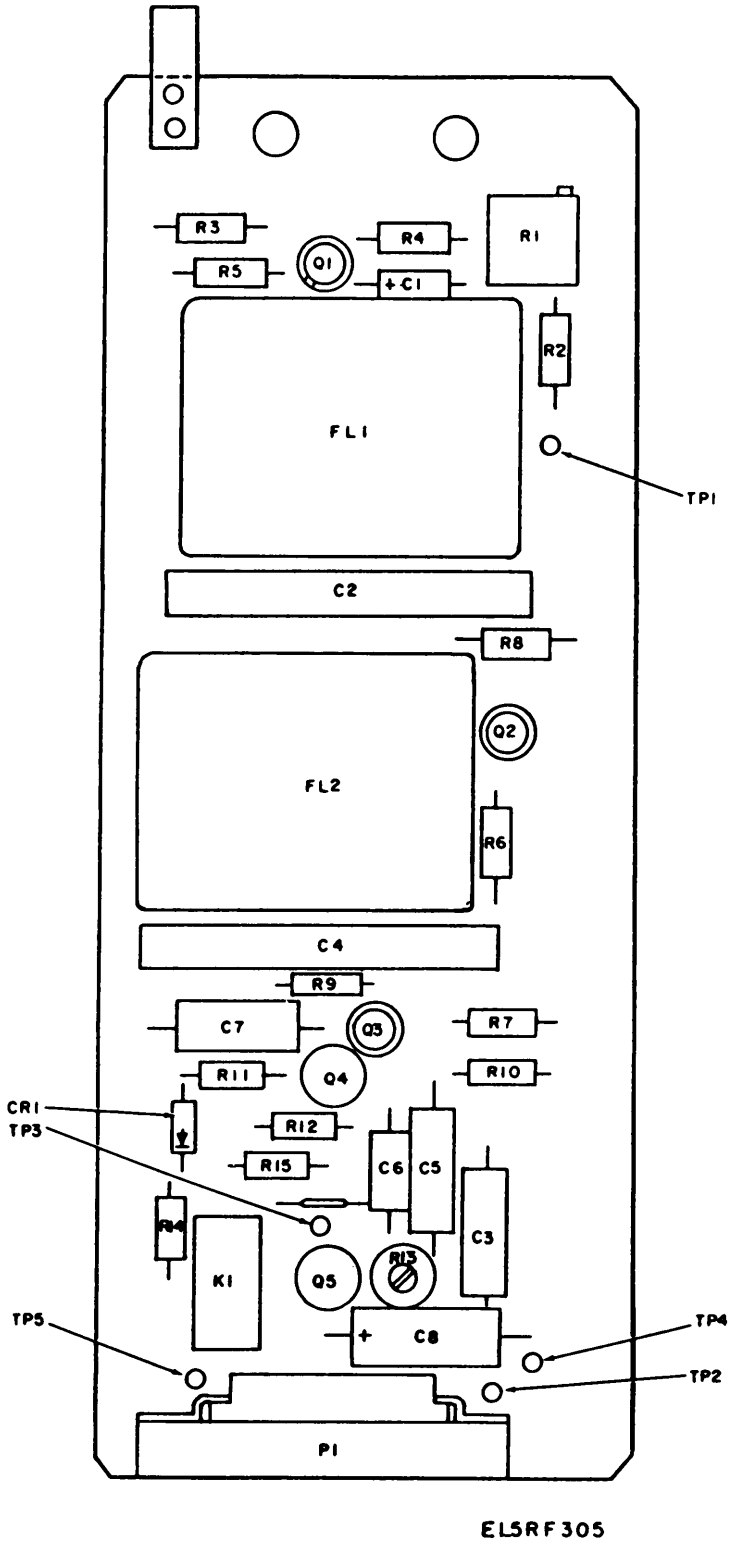



*Figure* 3-139. *Telephone Signal Conuerter 9A3, Parts Location*

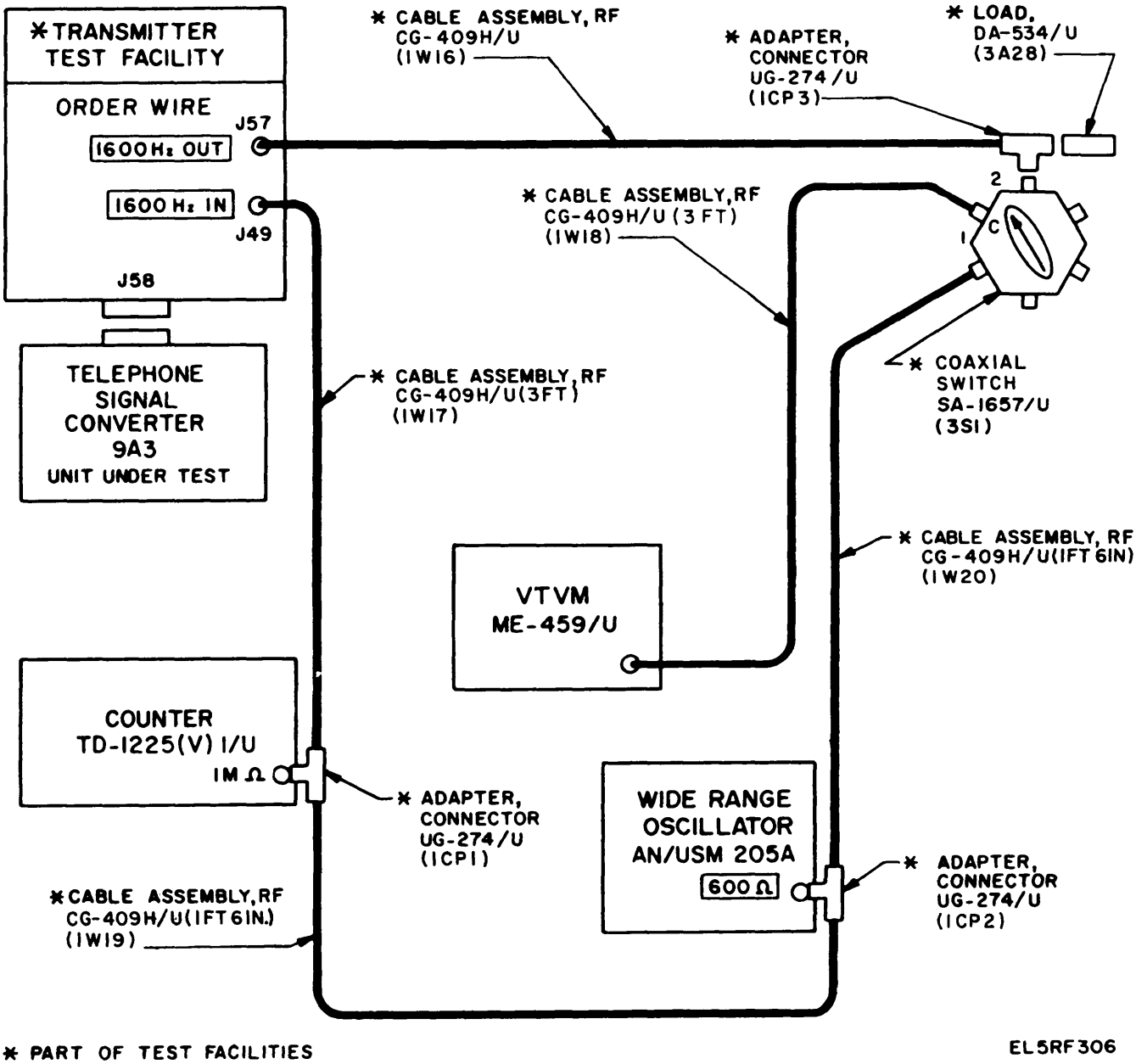



*Figure 3-140. Telephone Signal Converter 9A3, 1600 Hz Tone Receive Checks, Test Setup.*

*(2) 1,600 Hz tone detection and sensitivity/ selectivity adjustment*

*(a)* Connect test equipment as shown in figure 3-140.

*(b)* Repeat paragraph *b.(3)(a)* through *(e).*

*(c)* Adjust R1 control on 9A3 and repeat *b. (3)(a)* through *(e)* until required output is obtained.

d. *Troubleshooting (FO-13).*

| *Symptom* | *Probable cause* | *Checks and corrective measures* |
|---|---|---|
| No output (para. *b.* (1) above). | a. Defective CR1. | a. Measure the voltage across CR1 (fig. 3-139); the multimeter should indicate 5.6 ±0.2 V. If abnormal indication check CR1 for short circuit replace if necessary. |

*d.* Troubleshooting. -Continued

| *Symptom* | *Probable cause* | *Checks and corrective measures* |
|---|---|---|
| | b. Defective transistor stage Q1, Q2, Q3, Q4, Q5. | b. (1) Using the ac voltmeter, measure the signal voltages of transistor stages Q1 through Q5 (see table in para. e. below).<br>(2) If voltage at Q2 base, or FL2, pin 3 is abnormal, check components in Q2 stage, or capacitor C3 for short circuit. Check circuit resistance to determine faulty "" component. Replace as required.<br>(3) If voltage at Q3 emitter is abnormal, check components in Q3 stage. Replace as required<br>(4) If voltage at TP2 is abnormal check components in Q4 stage, or resistor R13 for open circuit. Replace as required.<br>(5) If voltage at Q1 base and collector are abnormal replace Q1.<br>(6) If voltages at Q5 base and collector are abnormal, check Q5 and relay K1. Replace as required |
| Low output: frequency beyond specified limits *(b.* (2) above). | Defective C4 or FL2. | Check C4 and FL2; replace if necessary. |
| No output reading *(b.* (2) above). | a. Defective R1.<br>b. Defective Q1 or FL1. | a. Check continuity of R1, replace if necessary.<br>b. Measure the signal voltage of Q1 stage to FL1 pin 3, (see table, para. e. below). Check continuity of FL1. Replace as required. |
| Order wire ALARM lamp does not light *(b.* (3) *(e)* above). | a Defective transistor Q5.<br>b. Defective relay K1 or transistor Q5.<br>c. Defective C4, FL2, C2 or FL1. | a Measure the voltages at Q5 stage (see table, para e. below).<br>b. Check the operation of relay K1. If Q5 voltages are normal K1 contacts may be open with the relay operated In this case replace K1.<br>c. Check C2 and FL1, or C4 and FL2. Replace defective components as necessary. |

*e. Voltage Measurements.*

NOTE

Except for the dc measurement, all measurements are made with the ac voltmeter, with a 1,600 Hz signal input at a level of 200 mV, and with the test facility switch S32 set to RCVR.

| *Testpoint* | Typical *indication (Vrms unless otherwise indicated)* |
|---|---|
| Q2-base | 0.3 |
| FL2-pin3 | 1.9 |
| Q3-emitter | 1.9 |
| TP2 | 1.6 |
| Q1-base | 0.080 |
| -collector | 1.0 |
| FL1-pin3 | 0.325 |
| Q5-base (TP3) (test facility set switch S32 set to ALARM) | 1.6 |
| Q5-collector | 2.8 Vdc |

| *Test point* | *Typical indication (Vrms unless otherwise indicated)* |
|---|---|

### *3-38.* Amplifier Assembly 9A4

#### *a. Test Equipment and Material Required*

| *Equipment* | *Common name* |
|---|---|
| Test Facility, Transmitter TS-2866(V)2/GRM-95 (V)2 | Transmitter test facility |
| Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95 (V)2 | Accessory kit |
| Generator, Signal AN/USM-205A | Wide range oscillator |
| Voltmeter, Electronic ME-459/U | *VTVM* |
| Analyzer, Distortion AN/URM-184A | Distortion analyzer |

*b. Test Procedure.*

(1) REC *A to TR B thru path.*

*(a)* Connect the test equipment as shown in A, figure 3-141.

**NOTE**

Set the power supply to 115 Vac as indicated on its panel voltmeter. Maintain this setting throughout the following procedures.

*(b)* Set switch S1 (fig. 3-142) on the unit under test to the PCM position and set the coaxial switch to position 1.

*(c)* Set the wide range oscillator to 1 kHz at a level of –10 dBm as indicated on the VTVM.

*(d)* Set the FUNCTION switch on the distortion analyzer to SET LEVEL, the INPUT SENSITIVITY control fully clockwise and the meter range to –10 dB.

*(e)* Set test facility switch S1 to ON and S32 to the OSC position.

*(f)* Set the coaxial switch to position 2.

*(g)* On the unit under test, adjust control R7 (Level A) to obtain an indication of –10 dBm on the VTVM.

*(h)* Adjust the distortion analyzer sensitivity controls to provide a suitable reference reading. Note this reading.

(i) Set the distortion analyzer switch to DISTORTION.

*(j)* Vary the frequency and balance controls to obtain a minimum reading on the distortion analyzer meter. This reading should be at least 40 dB below the reading noted in *(h)* above. This represents less than 1% distortion.

*(k)* Return the distortion analyzer meter range to fully clockwise and the FUNCTION switch to SET LEVEL.

*(l)* Set switch S1 on the unit under test to the FDM position. The VTVM should indicate less that –50 dB. Return VTVM range switch to –10 dB.

*(m)* Return switch S1 on the unit under test to the PCM position

*(n)* Set the coaxial switch to position 1 and set the wide range oscillator to 200 Hz at a level of –10 dBm as indicated on the VTVM.

*(o)* Set the coaxial switch to position 2. The VTVM should indicate within +0.5 dB and –1.0 dB of the level adjusted in *(g)* above.

*(p)* Repeat steps *(n)* and *(o)* above at 250 Hz, 500 Hz, 1.5 k.HZ, and 2 kHZ.

(2) *REC B to TR A thru path*

*(a)* Connect the test equipment as shown in B, figure 3-141.

*(b)* Repeat steps *(b)* through *(p)* of *(1)* above.

**NOTE**

In step *(g)* above, adjust R18 (Level B) control instead of R7.

(3) *Handset to TR B transmit path.*

*(a)* Connect the test equipment as shown in C, figure 3-141.

*(b)* Set the coaxial switch to position 1 and set the wide range oscillator to 1 kHz at a level of 1200 mV on the VTVM.

*(c)* Set the coaxial switch to position 2. The VTVM should indicate –10 dBm ±1.0 dB.

*(d)* Measure the distortion using the method described in paragraph (1) above, steps *(d), (h), (i)* and *(j).* The measured distortion should beat least 34 dB below the measured reference (equivalent to less than 2% distortion).

*(e)* Return the distortion analyzer meter range to fully clockwise and the FUNCTION switch to SET LEVEL.

(4) *Handset to TR A transmit path*

*(a)* Connect the test equipment as shown in D, figure 3-141.

*(b)* Repeat *(b)* through *(e)* of (3) above.

(5) *REC A to TR A crosstalk.*

*(a)* Connect the test equipment as shown in A, figure 3-143.

*(b)* Set the coaxial switch to position 1 and set the wide range oscillator to 50 Hz at a level of –10 dBm.

*(c)* Set the coaxial switch to position 2. The VTVM indication should not exceed –45 dBm.

(6) *REC B to TR B crosstalk.*

*(a)* Connect the test equipment as shown in B, figure 3-143.

*(b)* Repeat *(b)* through *(c)* of (5) above.

(7) *REC A to handset receive path.*

*(a)* Connect the test equipment as shown in C, figure 3-143.

(b) Set the coaxial switch to position 1 and set the wide range oscillator to 1 kHz at a level of –10 dBm.

*(c)* Set the coaxial switch to position 2. The VTVM should indicate –29.4 dBm ±1.0 dB. Record this level.

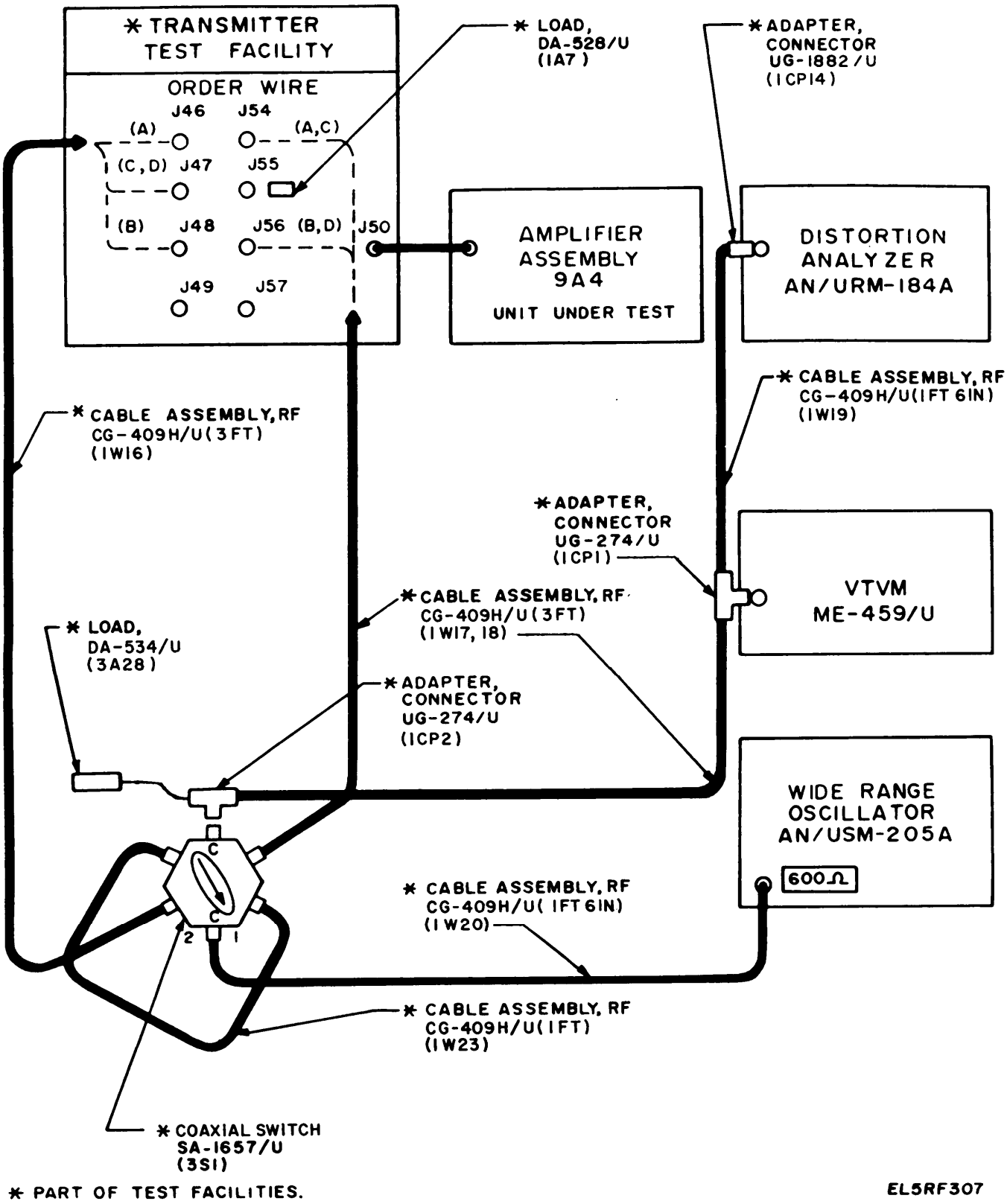



*Figure 3-141.Order Wire Through Circuit Test Setup.*

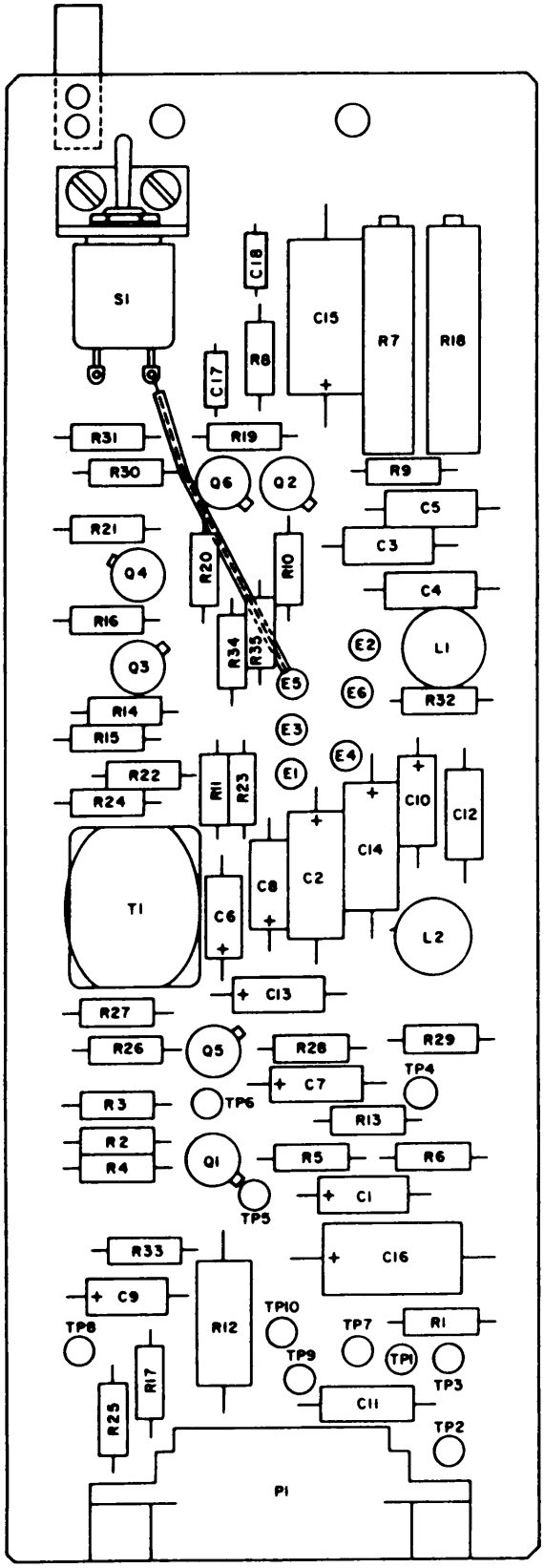



*Figure 3-142. Amplifier Assembly 9A4, Parts Location.*

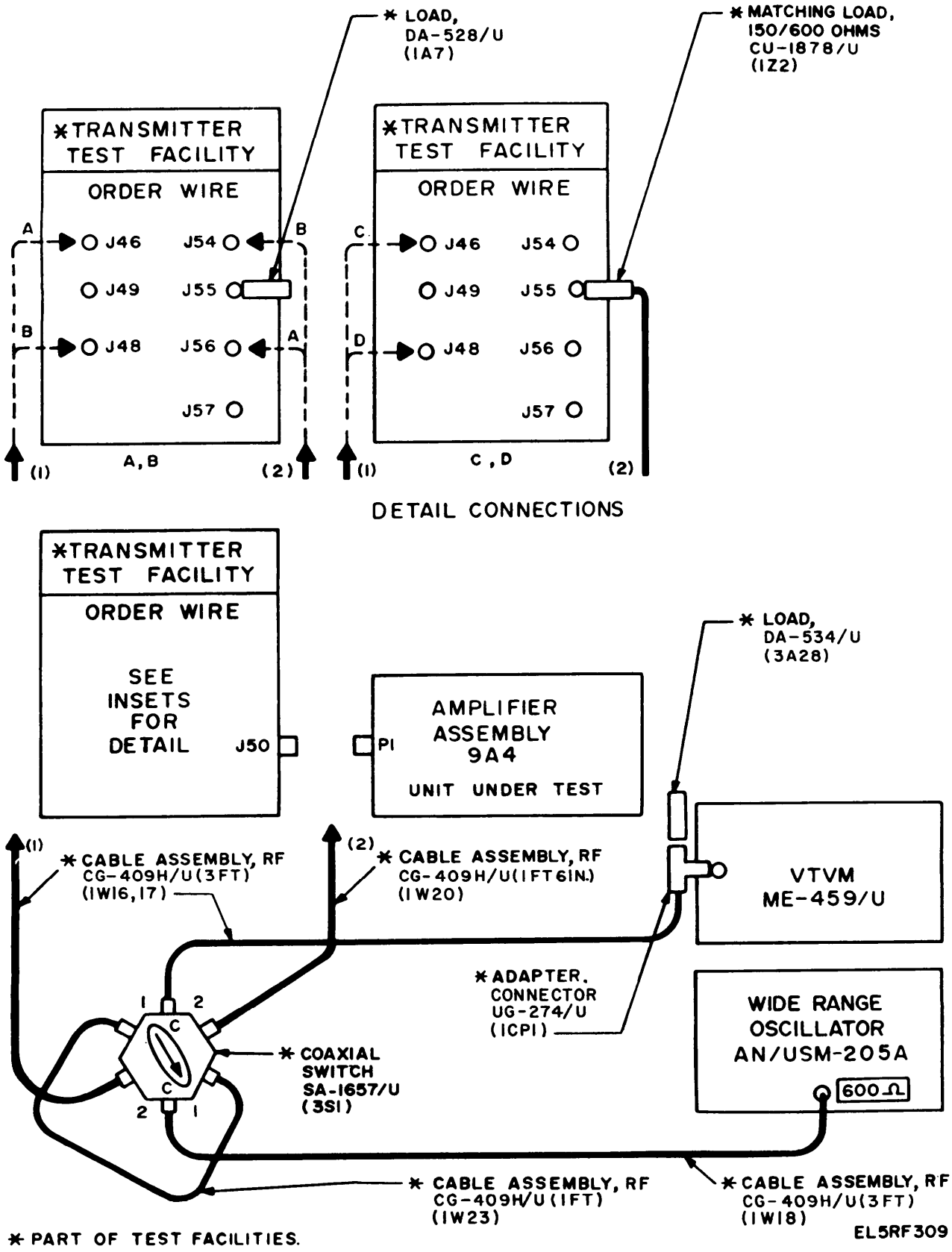



*Figure 3-143. Order Wire Crosstalk Measurement, Test Setup.*

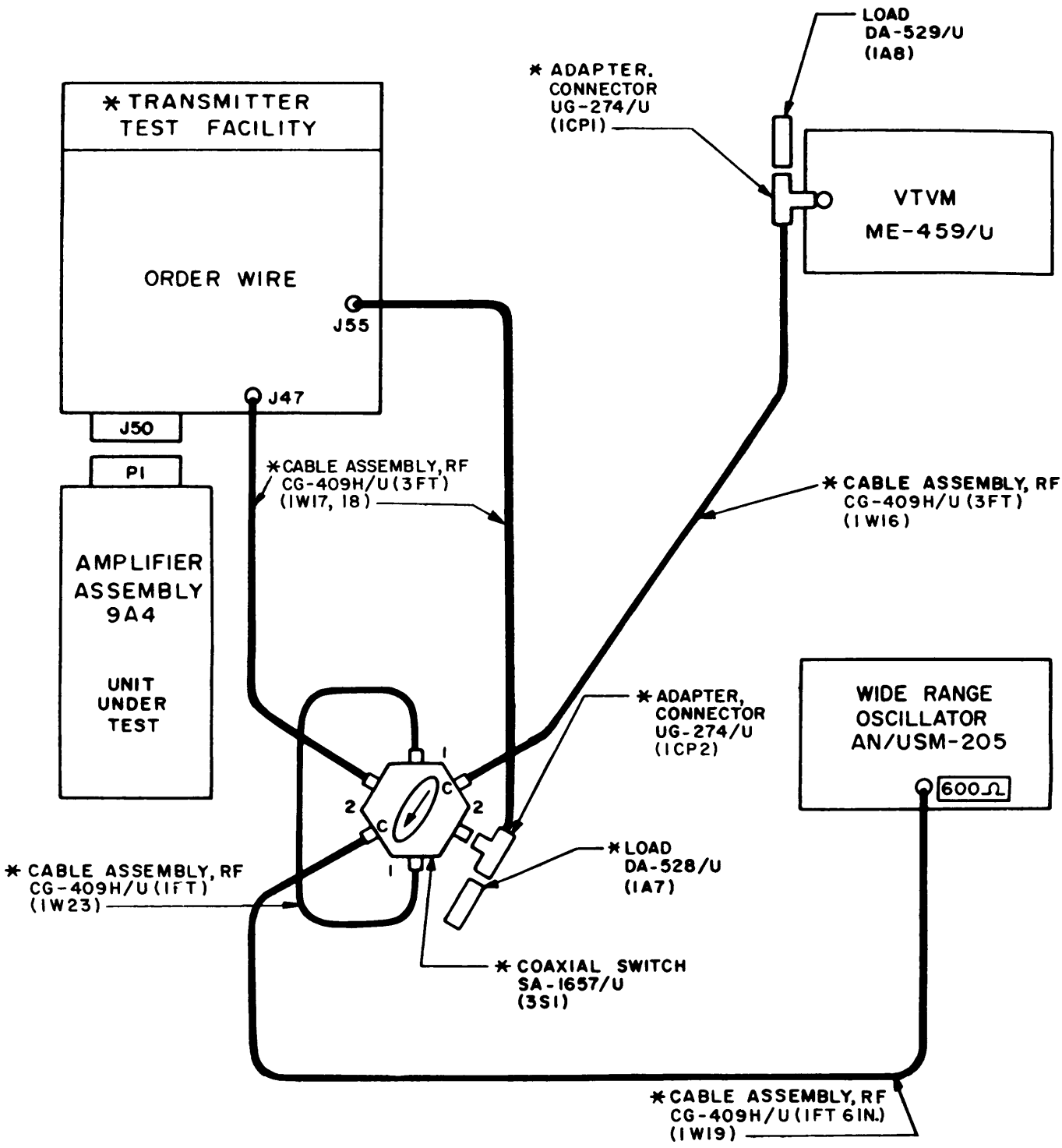



*Figure 3-144. 0rder Wire Sidetone, Test Setup.*

*(d)* Disconnect the cable from the 150/600 ohm adapter and reconnect this cable end to J57 on the test facility. Keep the other end of the cable connected to the coaxial switch.

*(e)* Set the coaxial switch to position 1 and set the wide range oscillator to 1.6 kHz at a level of –10 dBm.

*(f)* Set the coaxial switch to position 2. The VTVM should indicate 100 mV ±20 mV.

(8) *REC B to handset receive path.*

*(a)* Connect the test equipment as shown in D, figure 3-143.

*(b)* Repeat *(b)* through *(f)* of (7) above.

*(9) Sidetone tests.*

*(a)* Set up the test equipment as shown in figure 3-144.

(b) Set the coaxial switch to position 1 and set the wide range oscillator to 1 kHz at an output level of 330 mV as indicated on the VTVM.

(c) Set the coaxial switch to position 2.

*(d)* Remove the 110 ohm load from the VTVM. The VTVM should indicate 25 mV ±7 mV.

*c. Troubleshooting* (FO-13).

**NOTE**

Measurements are taken between the check point and ground.

| *Checkpoint* | *Normal indication (m Vrms unless otherwise indicated)* | *Defective component probable cause of abnormal indication* |
|---|---|---|
| REC A to TB B thru path (Set S32 to OSC) | | |
| Q1 base | *243* | C1 |
| Q1 emitter | 231 | Q1, R2, R3, R4, R5, R6 |
| Q2 emitter | 9 | C2, S1A |
| Q2 base | 2.6 VdC | R30, R31 |
| *Q2* collector | 288 | Q2, R7, R8, R9 |
| TP3 | 235 | L1, C3, C4, C5 |
| REC B to TR A thru path (set S32 to OSC) | | |
| *Q5* base | *243* | *C13* |
| *Q5* emitter | 231 | Q5, R26, R27, R28, R29, R4 |
| Q6 emitter | 6 | C14, SIB |
| Q6 base | 2.69 Vdc | R30, R31 |
| Q6 collector | 304 | Q6, R11, R19, R32 |
| TP9 | 248 | L2, C10, C11, C12 |
| REC A or REC B to handset receive path (set S32 to OSC) | | |
| *TP6* | *201* | *Q1* or *Q5 stage* |
| *TP7* | *48* | T1 |
| Handset to TR A transmit path (set S32 to OSC) | | |
| *Q4* base | *365* | *C8, R15* |
| Q6 collector | *480* | *Q4, R21, R20* |
| | *507* | *L2,* C10, C11, C12 |
| Handset to TR B transmit path (set S32 to OSC) | | |
| *Q3* base | *366* | *C8, R15* |
| *Q2* collector | *321* | *Q3,* R1O, R16 |
| *TP3* | *260* | L1, C3, C4, C5 |

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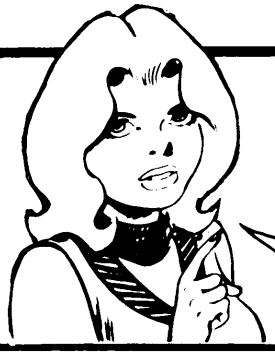


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|---|---|---|---|
| 2-25 | 2-28 | | |
| 3-10 | 3-3 | | 3-1 |
| 5-6 | 5-8 | | |
| | | F03 | |

**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 $2^{o}$ IFF antenna lag rather than $1^{o}$.

REASON: Experience has shown that with only a $1^{o}$ 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 $2^{o}$ 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.

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