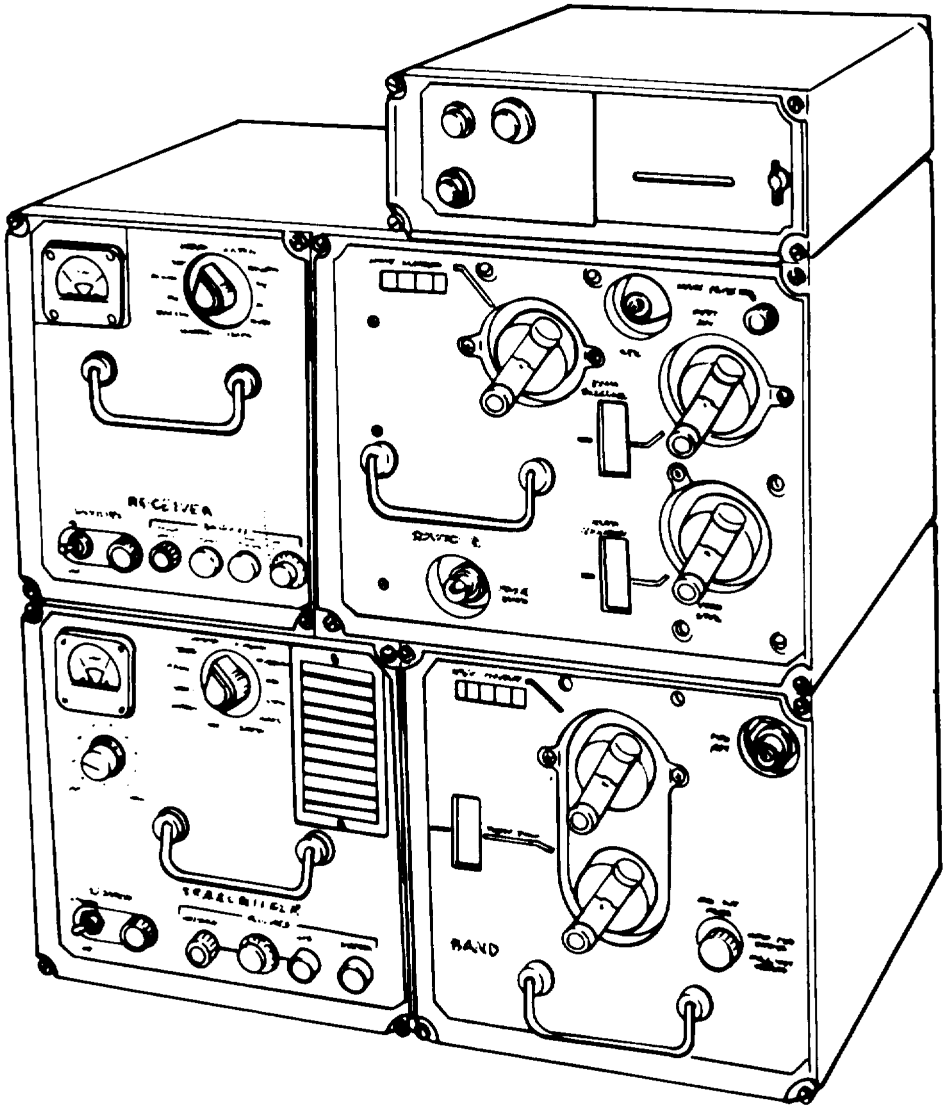
OPERATOR'S AND UNIT MAINTENANCE MANUAL



EL4W0-100 A

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RADIO PROPAGATION AND SYSTEM PLANNING
PAGE E-1

**RADIO SETS AN/GRC-l03(V)1 (NSN 5820-00-935-4931),
AN/GRC-l 03(V)2 (NSN 5820-00-1 16-6029),
AN/GRC-l 03(V)3 (NSN 5820-00-1 16-6030),
AN/GRC-l 03(V)4 (NSN 5820-01-081-8866),
AND
EXTENSION KIT, MAST MK-1009/GRC-l03(V)
(NSN 5885-00-1 79-7767)**

HEADQUARTERS, DEPARTMENT OF THE ARMY

1 JULY 1988

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Change No 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 1 August 1996

OPERATOR'S AND UNIT MAINTENANCE MANUAL
RADIO SETS

AN/GRC-103(V)1	**(NSN 5820-00-935-4931)**	**(EIC: HCG)**
AN/GRC-103(V)2	**(NSN 5820-00-116-6029)**	**(EIC: HDH)**
AN/GRC-103(V)3	**(NSN 5820-00-116-6030)**	**(EIC: HA4)**
AN/GRC-103(V)4	**(NSN 5820-01-081-8866)**	**(EIC: N/A)**

AND
EXTENSION KIT, MAST MK-1009/GRC-103(V)
(NSN 5885-00-179-7767) (EIC: N/A)

TM 11-5820-540-12, 1 July 1988, is changed as follows:

1. Remove old pages and insert new pages as indicated below. New or changed material is indicated by a vertical bar in the margin of the page.

Remove pages	Insert pages
i and ii	i and ii
None	F-1 through F-3/(F-4 blank)

2. File this change sheet in front of the manual for reference purposes.

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By Order of the Secretary of the Army:

DENNIS J. REIMER
General, United States Army
Chief of Staff

Official:
JOEL B. HUDSON
Administrative Assistant to the
Secretary of the Army
02959

DISTRIBUTION:
To be distributed in accordance with the initial distribution number (IDN) 512329, requirements for TM 11-5820-540-12.

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

1 DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL

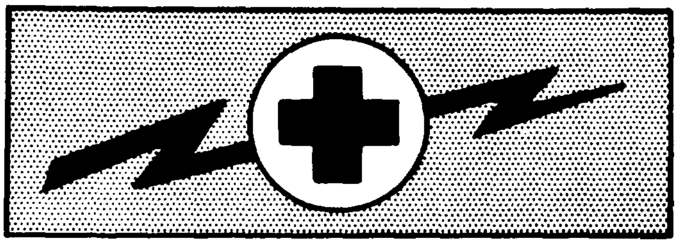
2 IF POSSIBLE, TURN OFF THE ELECTRICAL POWER

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

WARNIN6



HIGH VOLTAGE

IS USED IN THE OPERATION OF THIS EQUIPMENT

DEATH ON CONTACT

MAY RESULT IF PERSONNEL FAIL TO OBSERVE SAFETY PRECAUTIONS

Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When technicians are aided by operators, they must be warned about dangerous areas.

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

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

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

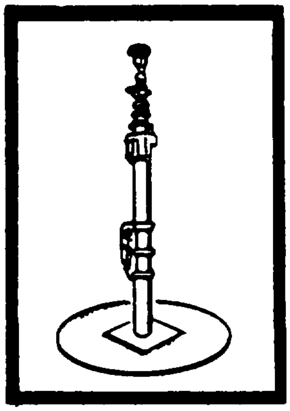
WARNING

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

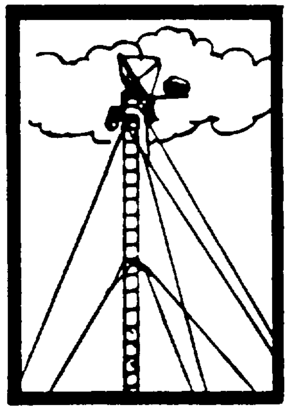
For Artificial Respiration, refer to FM 21-11.

FIXED OPERATION WITH LONG RANGE ANTENNAS

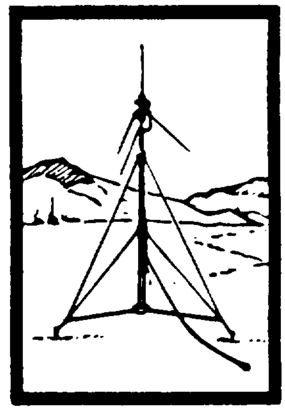
WARNING



TELESCOPING ANTENNA MAST



TYPICAL TOWER



EXTENDED RANGE ANTENNA

DOUBLET ANTENNA

NEVER ERECT THESE LONG RANGE ANTENNAS DIRECTIY UNDER POWER LINES.

If you must erect these long range antennas near powerlines, powerline poles or towers, or buildings with overhead powerline connections, never put the antenna closer than two times the antenna height from the base of the powerline, pole, tower or buildings.

NEVER ATTEMPT TO ERECT ANY LONG RANGE ANTENNA WITHOUT A FULL TEAM.

Before erecting any long range antenna, inspect all the parts making up the antenna kit. Do not erect the antenna if any parts are missing or damaged.

Do as much of the assembly work as possible on the ground.

When erecting the antenna, allow only team personnel in the erection area.

Make sure that the area for the anchors is firm, If the ground is marshy or sandy, get specific instructions from your crew chief or supervisor on how to reinforce the anchors.

When selecting locations for anchors, avoid traveled areas and roads. If you cannot avoid these areas, get specific instructions from your supervisor as to what clearance your guy wires and ropes must have over the traveled areas and road.

Clearly mark all guy wires and ropes with the warning flags or signs supplied by your unit. In an emergency, use strips of white cloth as warning streamers.

If you suspect that powerlines have made accidental contact with your antenna, stop operating, rope off the antenna area, and notify your superiors.

If the weather in your area can cause ice to form on your long range antenna and its guy wires and ropes, add extra guys to support the system. Rope-off the area and post it with warning signs like “Beware of Falling Ice.”

Do not try to erect any antenna during an electrical storm

Keep a sharp eye on your anchors and guys. Check them daily and immediately before and after bad weather.

WARNING

Extremely dangerous voltages exist in the following units of Radio Set AN/GRC-103(V) 1, 2, 3 and 4:

Transmitter, Radio 5TR1 . . . . 600 Vdc
Amplifier, Frequency Multiplier . . . . 600 Vdc

DON'T TAKE CHANCES!

DANGEROUS VOLTAGES EXIST AT THE ANTENNA TERMINALS

Operating and maintenance personnel should be familiar with the requirements of TB SIG 291 before attempting installation or operation of Radio Set AN/GRC-103(V) 1,2,3 and 4. Be careful when working around the antenna or the antenna terminals. High radio-frequency voltages exist at these points, during transmission, Failure to follow requirements of TB SIG 291 could result in injury or DEATH.

All operations must conform to the requirements of TB 385-4, Safety Precautions for Maintenance of Electrical and Electronic Equipment. Review and observe the WARNINGs and CAUTIONS in the technical manuals for this equipment, its components, and associated equipment.

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

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

Grounding connection must be completed before power is connected to the equipment.

A minimum of 2 persons will be utilized in handling or lifting any item in excess of 40 lb. Extreme care will be used in handling to prevent injury to individuals or damage to equipment.

Turn off or disconnect the central power before making any connections.

Compressed air shall not be used for cleaning purposes except where reduced to less than 29 pounds per square inch (psi) and then only with effective chip guarding and personnel protective equipment. Do not use compressed air to dry parts when TRICHLOROTRIFLUOROETHANE has been used, Compressed air is dangerous and can cause serious bodily harm if protective means or methods are not observed to prevent chip or particle (of whatever size) from being blown into the eyes or unbroken skin of the operator or other personnel.

When power is applied to Radio Set AN/GRC-103(V) in the confines of the shop area, caution must be taken to ensure that transmitter output is connected to a dummy load. This will eliminate the potential of any radiation hazard.

Technical Manual
No 11-5820-540-12

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington DC 1 July 1988

OPERATOR'S AND UNIT MAINTENANCE MANUAL
RADIO SETS
AN/GRC-103(V)1 (NSN 5820-00-935-4931) (EIC: HCG)
ANIGRC-103(V)2 (NSN 5820-00-116-6029) (EIC: HDH)
ANIGRC-103(V)3 (NSN 5820-00-116-6030) (EIC: HA4)
AN/GRC-103(V)4 (NSN 5820-01-081-8866) (EIC: N/A)
AND
EXTENSION KIT, MAST MK-1009/GRC-103(V)
(NSN 5885-00-179-7767) (EIC: N/A)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes, or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms) or DA Form 2028-2 located in back of this manual direct to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-LC-LEO-P-MM-T, Fort Monmouth, New Jersey 07703-5007. The fax number is 908-532- 3421, DSN 992-3421. You may also e-mail your recommendations to AMSEL-LC-LEO-PUBS- CHG@cecom3.monmouth.army.mil In either case a reply will be furnished direct to you.

TABLE OF CONTENTS

This manual supersedes TM 11-5820-540-12. 29 December 1967, including all changes.

HOW TO USE THIS MANUAL

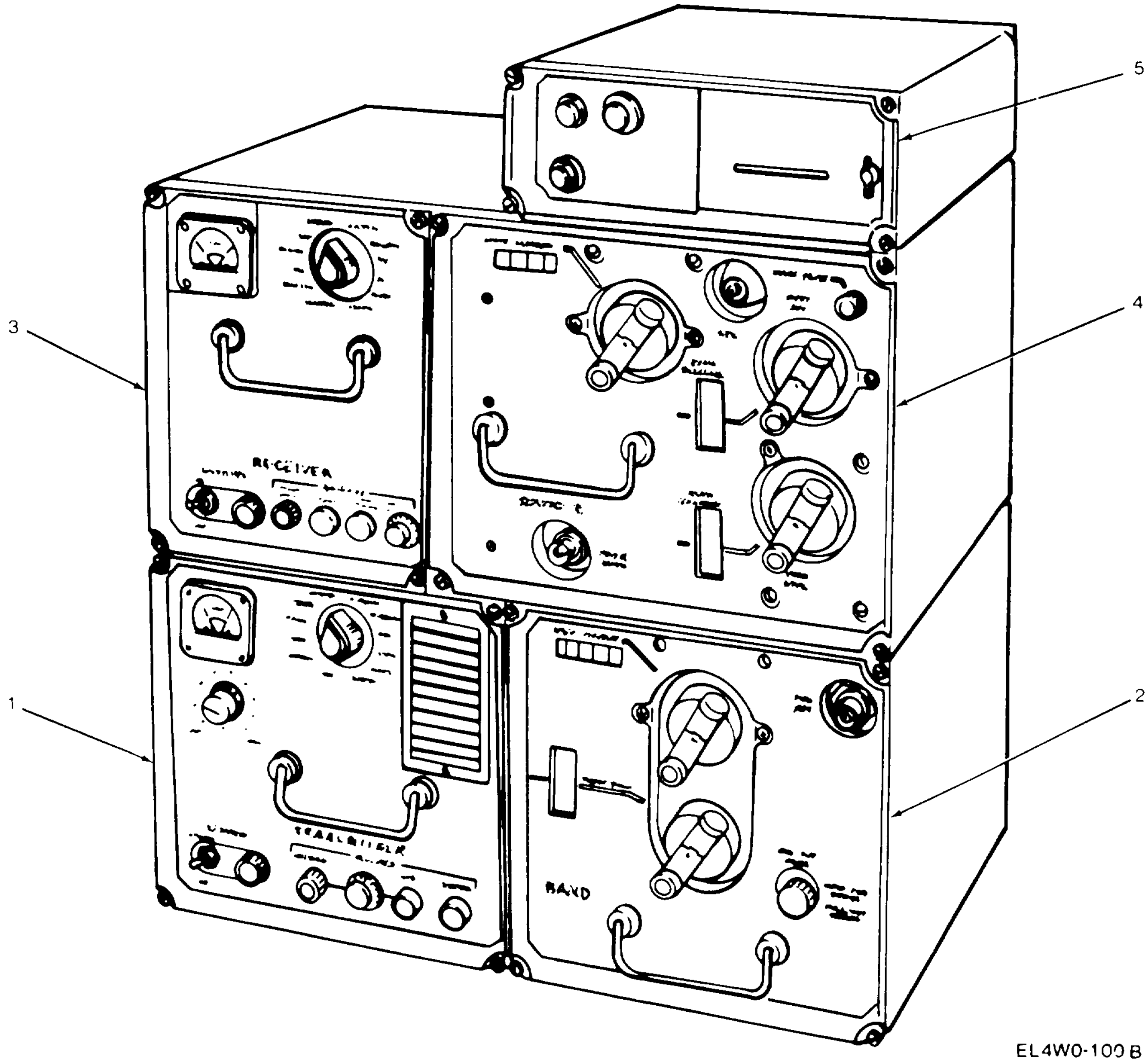
This technical manual covers both operation and maintenance up to the unit maintenance level

Deploying of the radio equipment and the antennas is covered under Operation Under Usual Conditions (section Ill of chapter 2). Information about radio propagation and system planning is given in appendix E, and It is recommended that this material be reviewed before deployment. The **WARNING** located in the front of the manual should also be read before deployment.

Depending upon system application (terminal, repeater, **12** or 24 channels, etc.), cable connections for the radio set are shown and explained under paragraph 2-13, Step-by-step set-up and operating procedures are given under paragraph 2-14.

Preventive maintenance should be performed on both the operator's and unit maintenance level periodically as directed under paragraphs 2-9 and 4-3 respectively.

If a problem with operation occurs, first refer to operator's maintenance (chapter 3), and if that does not remedy the problem, precede to unit maintenance (chapter 4). If neither of these sets of procedures does not solve the problem, higher level maintenance is required. The Maintenance Allocation Chart (MAC) under appendix B may be helpful in referencing specific maintenance levels.



1 Transmitter Radio R-983 (P), GRC-103(V) T-983A(P)/GRC-103(V) or T-983B(P)/ GRC-103(V)
2 Amplifier-Frequency Multiplier AM-4320/GRC-103(V) AM-4320A/GRC-103(V) or AM-4320B/GRC-103(V)
3 Receiver Radio R-1329 (P)/GRC-103(V) R-1329A(P)V GRC-103(V)R-1329B(PI)/GRC-103(V) or R-1329C(P GRC-103(V)
4 Amplifier-Converter AM-4316/GRC-I03(V) or AM-4316A/ GRC-103(V)
5 Receiver-Transmlfler Order Wire RT-773/GRC-103(V)

Radio Set AN/GRC-103(V)(*) (Band I), Less Antenna, Mast and Minor Components

CHAPTER 1
INTRODUCTION

Section I. GENERAL INFORMATION

1-1. SCOPE

A This manual describes Radio Sets AN/GRC-103(V)1, (Band 1), AN/GRC-103(V)2 (Band II), AN/GRC-103(V)3 (Band Ill), AN/GRC-103(V)4 (Band IV) and Mast Extension Kit MK-1009/GRC-103(V). It covers their installation, operation, and operator's and unit maintenance.

B The radio sets for the four bands are similar. Information in this manual that is specified for the Band I configuration is applicable to Bands II Ill, IV unless Indicated otherwise. The nomenclature AN/GRC-103(V)(*) covers all bands.

1-2. 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 Report of Packaging and Handling Deficiencies. FiII out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in AR 735-11-2/DLAR 4140.55/NAVMATINST 4355.73B/AFR 400-54/MCO 4430.3H.

C Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF361) as prescribed in AR 55-38/NAVSUPlNST 4610.33C/AFR 75-18/MCO P4610.19D/DLAR 4500.15.

1-3. CONSOLIDATED INDEX OF ARMY PUBLICATIONS AND BLANK FORMS

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

1-4. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS [EIRs)

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 the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, U.S. Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-PA-MA-D, Fort Monmouth, New Jersey 07703-5000. We'll send you a reply.

1-5. ADMINISTRATIVE STORAGE

Administrative Storage of equipment issued to and used by Army activities wiIl 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 paragraphs 4-20 and 4-21.

1-6. DESTRUCTION OF ARMY ELECTRONICS MATERIEL

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

Section II. EQUIPMENT DESCRIPTION

1-7. EQUIPMENT PURPOSE, CAPABILITIES AND FEATURES

● **PURPOSE OF RADIO SETS**

The radio sets form transportable radio relay facilities, which provide for multichannel radio transmission and reception, and regeneration of pulse code modulation (pcm) signals.

● **CAPABILITIES AND FEATURES**

The radio sets operate in any one of 2,562 radio frequency (rf) channels that are 0.5 MHz apart, in the frequency range of 220 to 1,000 MHz and 1,350 to 1,850 MHz.

Frequency range is divided as follows:

Band I . . . . 220 to 4045MHz
Band II . . . . .394.5 to 705 MHz
Band III 695 to1,000MHz
Band IV . . . . 1,350 to 1,850 MHz

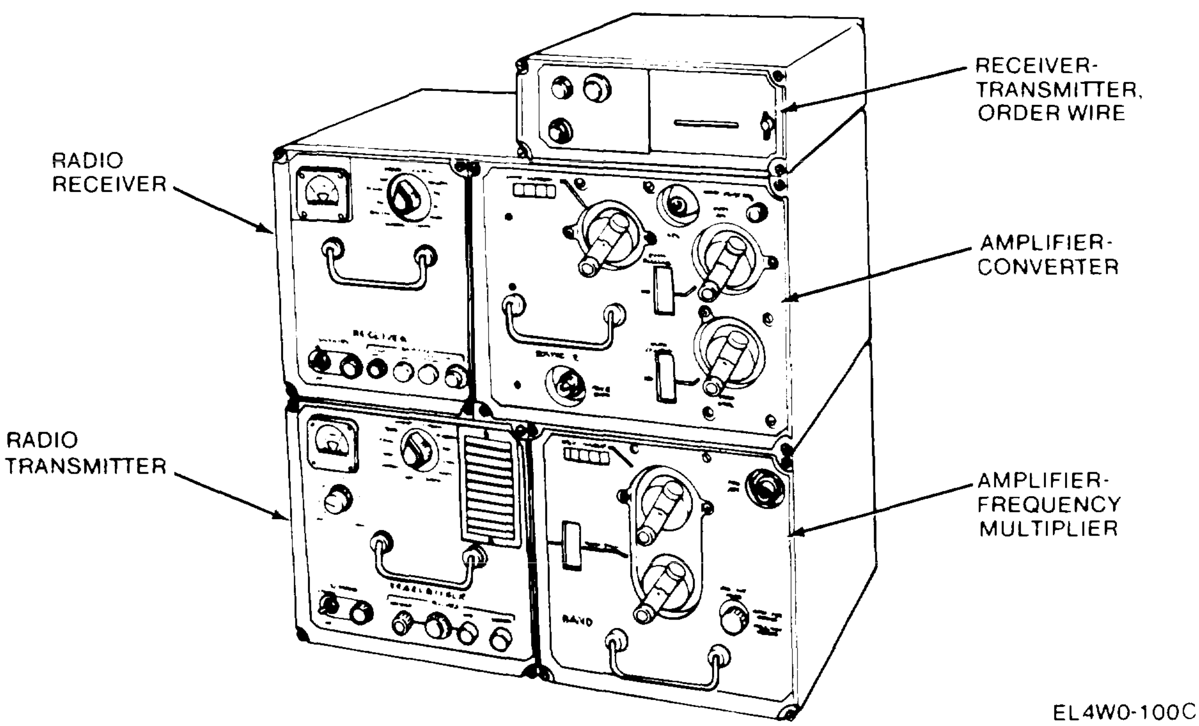
Each band has its own transmitter and receiver rf head. The equipment can accommodate up to 24 telephone channels when used with appropriate pcm multiplex equipment. It also includes an order wire circuit, which connects all stations in a system on a party line basis.

The equipment also has its own antenna system. Mast height can be extended from 25 to 50 feet The radio sets provide good performance over line-of-sight paths of at least 50 miles (80.45 kilometers).

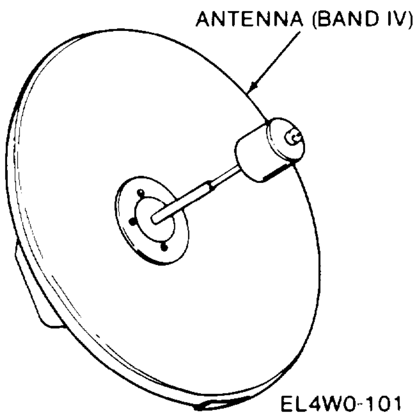
Other equipment features include reserve power capability, enabling the equipment to provide satisfactory operation over obstructed paths. In addition, all units within the radio set are waterproofed.

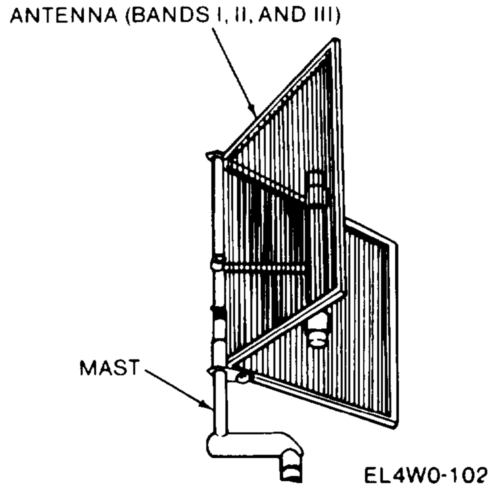
1-8. MAJOR COMPONENTS AND EQUIPMENT CONFIGURATION

The radio set for each band consists of five major components (which vary from band to band), an order wire unit and a mast assembly.



1-8. MAJOR COMPONENTS AND EQUIPMENT CONFIGURATION - Continued

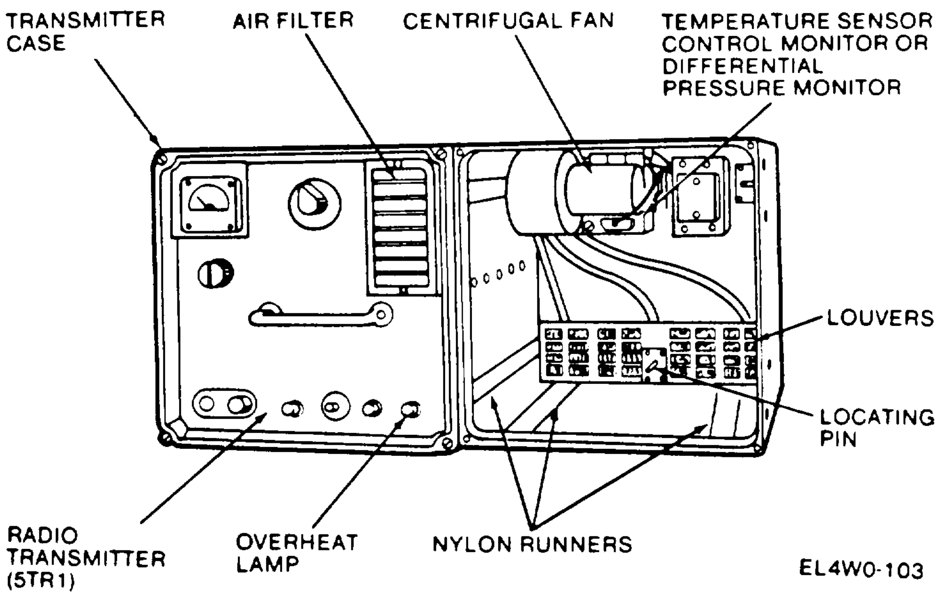




The variable components for each radio set band are:

TRANSMITTER. RADIO	AMPLIFIER-FREQUENCY MULTIPLIER	RECEIVER RADIO	AMPLIFIER-CONVERTER	ANTENNA
		BAND I		
T-983(P) GRC-103(V) or T-983A (P)/GRC-103(V)or T-983B(P)/ GRC-103(V)	AM-4320/GRC-103(V) or AM-4320A, GRC-103(V) or AM-4320B/ GRC-103(V)	R- 1329(P)/ GRC-103V, R-1329A(P) GRC-103(V) R-1329 B(P)/ GRC-103(V)or R-1329C(P)/ GRC-103(V)	AM-4316/GRC-103(V) or AM-4316/GRC-103(V)	AS-1 852/GRC-103(V)
		BAND II		
T-983 (P)/ GRC-103(V) or T-983A (P)\GRC-1031(V)	AM4321/GRC 103(V) or AM-4321B GRC-103(V)	R-1329(P)/ GRC-103(V) R-1329 A(P)/ GRC-103(V) R-1329 B(P)/ GRC-103(V)or R-1329C(P)/ GRC-103(V)	AM-4317/GRC-103 IV)	AS-1853/GRC-103(V)
		BAND III		
T-983(P) GRC-103(V) or T-983A(P) GRC-103(V) or T-983 B(P) GRC-103(V	AM-4322/GRC-103(V) or AM-4222A GRC-103(V)	R-1329(P) GRC-103(V} R-1329A/ GRC-103(V) R-1329B(P), GRC-103(V)or R-1329C(P), GRC-103(V)	AM-4318/ GRC-103(V)	AS-1854/GRC 103(V)
		BAND IV		
T-983A(P) GRC-103(V) or T-983B (P) GRC-103(V)	AM-4323/GRC-103(V)	R-1329 A(P)/ GRC-103(V) R-1329 B(P)/ GRC-103(V) or R-1329C(P)/ GRC103(VI	AM-4319/GRC-103(V)	AS3047/GRC 103(V)

1-9. TRANSMITTER, RADIO T-983 (P)/GRC-103(V), T-983A(P)/GRC-103(V) AND T-983B(P)/GRC-103(V)



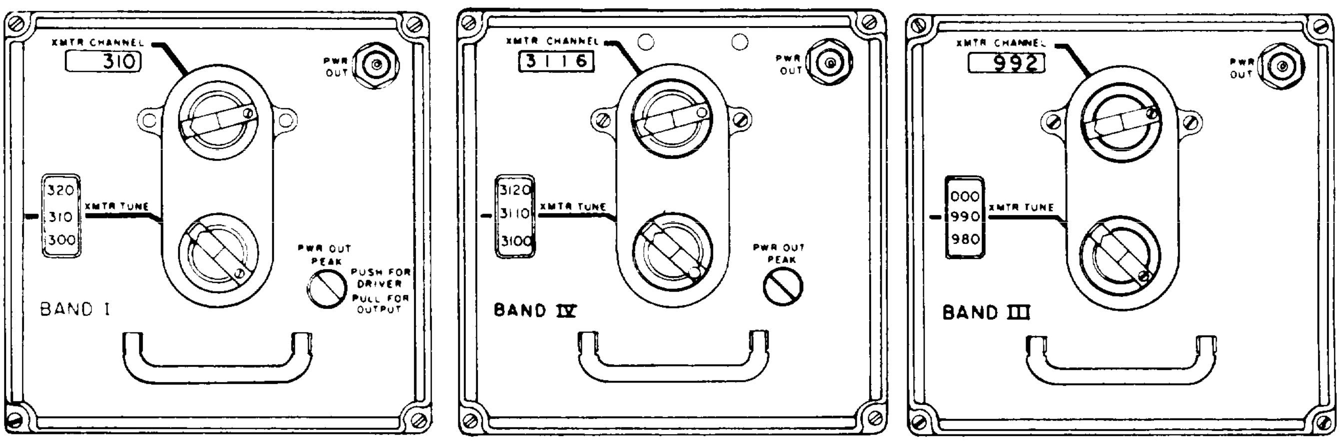
The radio transmitter consists of a case and radio transmitter 5TRI which plugs into the case. The case houses two plug-in units, radio transmitter 5TRI and on amplifier-frequency multiplier. Nylon runners guide these plug-in units into position and locate them by means of pins. A centifugal fan is mounted on the case partition. Air is drawn in through an air filter on the front panel of radio transmitter 5TRI and passed out through louvers at the rear of the transmitter case,

Two types of transmitter cases are used; CY-4637/GRC-103(V) and CY-4637A/GRC-103(V). The first is used with Radio Transmitters T-983(P)/GRC-103(V) and T-983A(P)/GRC-103(V). It employs a differential pressure monitor to sense cooling system failure. The second is used with Radio Transmitter T-983B(P)/GRC-103(V). It employes a temperature sensor control monitor which receives input from a temperature sensor on the transmitter output tube. Both methods of sensing respond to cooling system deficiencies by causing an OVERHEAT lamp on the transmitter to light and a buzzer to sound. However, the temperature sensor control monitor controls the speed of the centrifugal fan to provide a constant cooling level. Also, it will shut the transmitter off if too high a temperature level is reached.

Transmitter 5TRI also includes an input modulation amplifier, a frequency synthesizer, and frequency multiplier circuits as well as power supplies.

1-10. AMPLIFIER-FREQUENCY MULTIPLIER AM-4320/GRC-103 (V), AM-4320A/GRC-103 (V), AM-4320B/GRC-103(V), AM-4321/GRC-103(V), AM-4321B/GRC-103V, AM-4322/GRC-103(V), AM-4322A/GRC-103(V) AND AM-4323/GRC-103(V)

Each type of amplifier frequency multiplier provides frequency multiplying, rf amplifying, filtering, power monitoring, channel selecting, and channel indicating facilities. The rf amplification circuits consist of electron tube coaxial assemblies, which are tuned by an XMTR TUNE control and fine-tuner by a PWR OUT PEAK control. For Band I amplifier frequency multiplier, the driver and output stages are fine-tuned separately, for Bands II and IV simultaneously, and not at all for Band Ill. A dust cover protects the unit and also acts as an electrical shield.

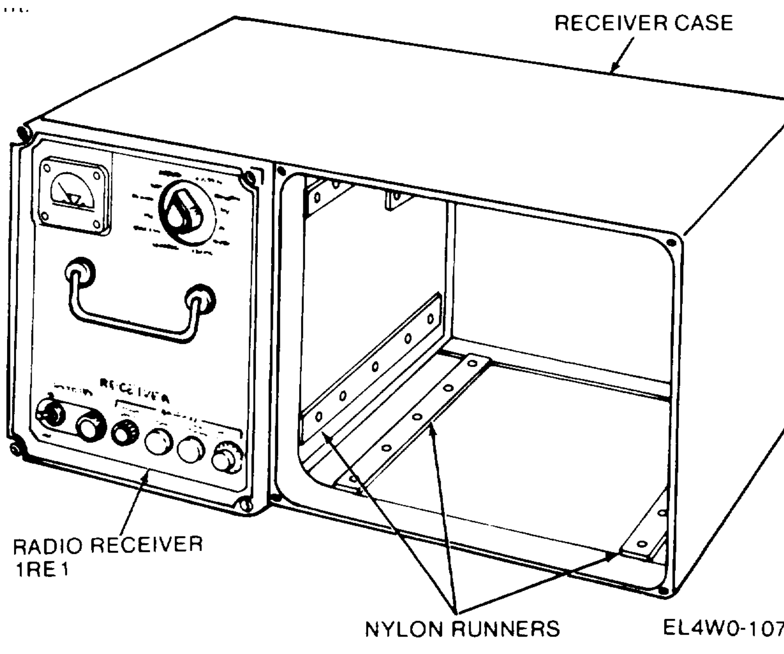


BAND I | BANDS II AND IV | BAND III

EL4W0-104 EL4W0-105 EL4W0-106

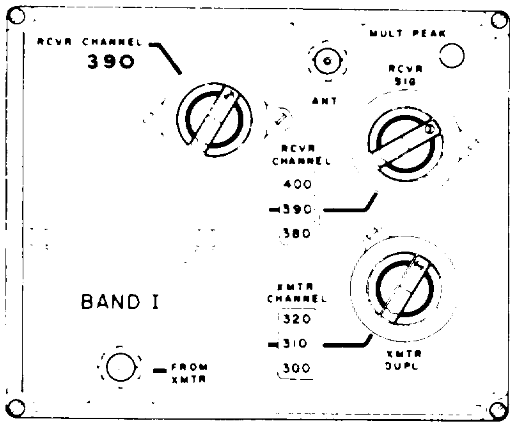
1-11. RECEIVER, RADIO R-1329(P)/GRC-103(V), R-1329A(P)/GRC-103(V), R-1329B(P)/GRC-103(V) AND R-1329C(P)/GRC-103(V)

The radio receiver consists of a case and radio receiver 1 RE1, which plugs into the case. The case houses radio receiver 1 RE1 and an amplifier-converter. Nylon runners guide these plug-in units into position and locate them by means of pins. Radio receiver 1 RE1 includes intermediate frequency (if.) amplifier, limiter, discriminator, video amplifier, and pulse form restorer circuits as well as synthesizer and multiplier circuits, which generate basic oscillator frequency. It provides power supplies for itself and the order wire unit.



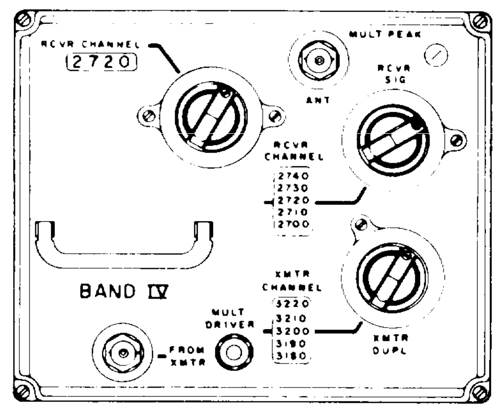
1-12. AMPLIFIER-CONVERTER AM-4316/GRC-103(V), AM-4316A/GRC-103(V), AM-4317/GRC-103(V), AM-4318/GRC-103(V) AND AM-4319/GRC-103(V)

Each amplifier-converter provides duplexing, overload protection, rf amplifying, local oscillator multiplying, mixing, if amplifying, channel selecting and channel indicating facilities. The duplexer for Band I, II, and Ill is made up of six cavities. Two of these are coupled and tuned by a XMTR DUPL control. The remaining four are coupled and tuned by the RCVR SIG control. The duplexer for Band IV has two bandpass filters, one of which is tuned by a XMTR DUPL control and the other by a RCVR SIG control. A MULT PEAK control simultaneously fine tunes the local oscillator multiplier and multiplier bandpass filter. A dust cover provides protection and electrical shielding.



BAND I

EL4W0-108



BAND IV

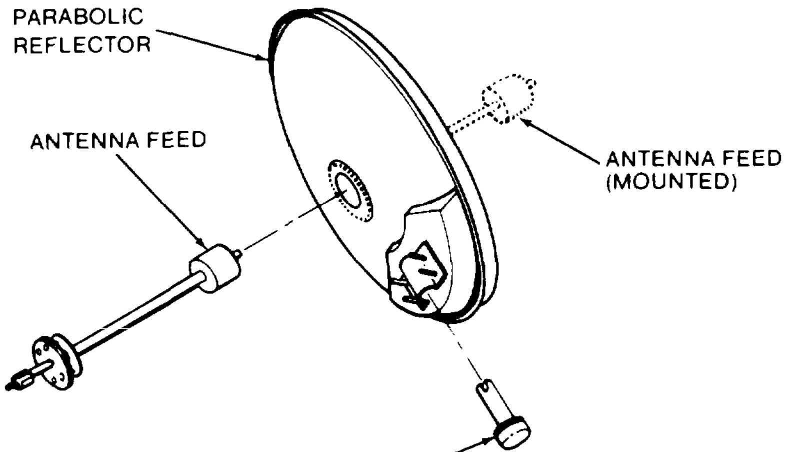
EL4W0-109

1-13. ANTENNAS AS-1852/GRC-103 (V), AS-1853/GRC-103(V), AS-1854/GRC-103(V), AND AS-3047/GRC-103 (V)

The Band I, II and Ill antennas have a common variable-corner reflector AS-2150/GRC-103(V), which is used with either a Band I plug-in dipole element AS-2151/GRC-103(V), Band II dipole element AS-2194/GRC-103(V) or Band Ill dipole element AS-2195/GRC-103(V). The reflector is opened and set to one of three marked angles for Bands I, II or Ill operation. The antenna can be mounted on the mast for either vertical or horizontal polarization.

1-13. ANTENNAS AS-1852/GRC-103(V) AS-1853/GRC-103(V), AS-1854/GRC-103(v), AND AS-3047/GRC-1O3(V)M - Continued

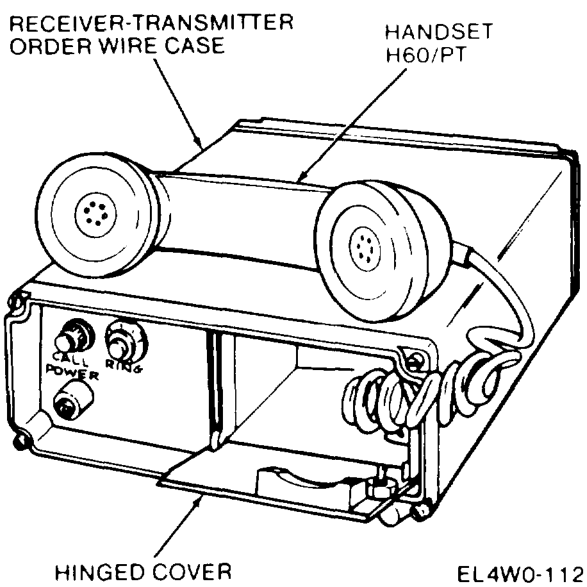
The Band IV antenna employs a parabolic reflector AS-3414/GRC-103(V), an antenna teed AS-3415/ GRC-103(V), and a mast adapter AB-1281/GRC-103(V) for mast AB-577/GRC (refer to TM 11-5820-538-12 for details of mast AB-577/GRC).



EL4W0-111

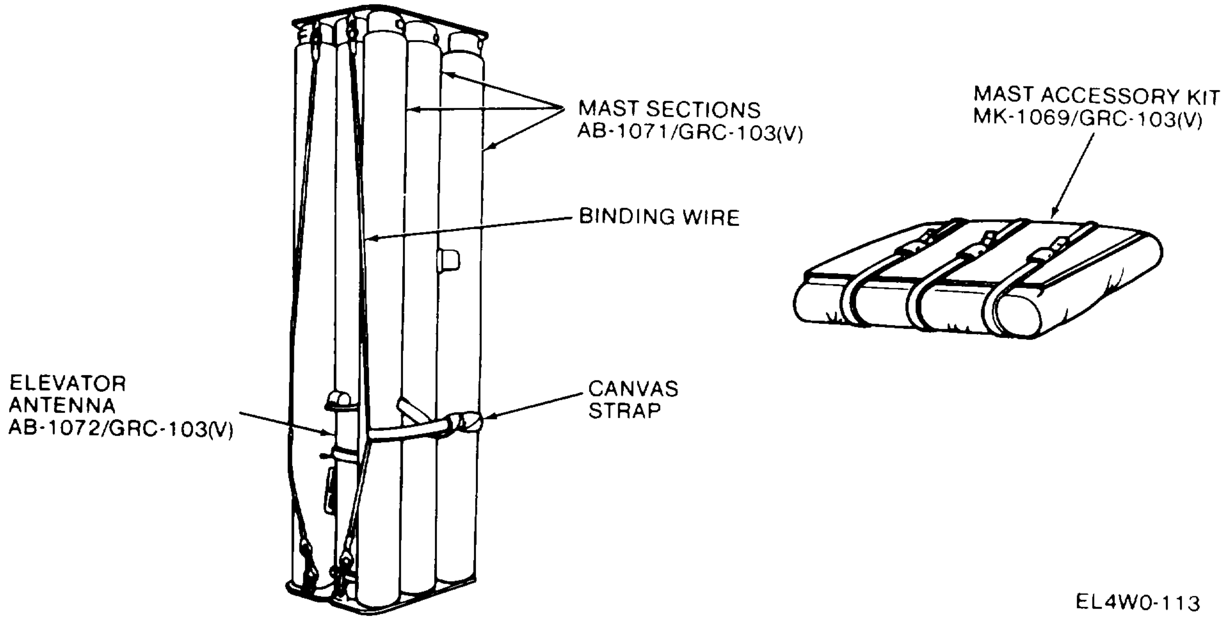
1-14. RECEIVER-TRANSMITTER ORDER WIRE RT-773/GRC-103(V)

The receiver-transmitter order wire consists of a case, front and rear panels. Handset H-60/PT, and two plug-in assembles: a telephone signal converter and an amplifier assembly. The rear panel contains input and output connectors and connectors for the two plug-in assembles. The front panel carries operational controls, that are connected to the case wiring by a fixed connector, which mates with a plug at the rear of the front panel. A hinged cover in the front panel provides access to the handset storage space.

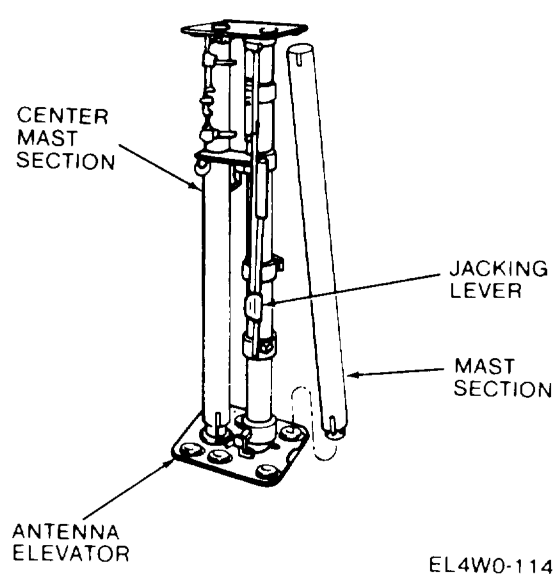


EL4W0-112

1-15. MAST AB-952/GRC-103(V)

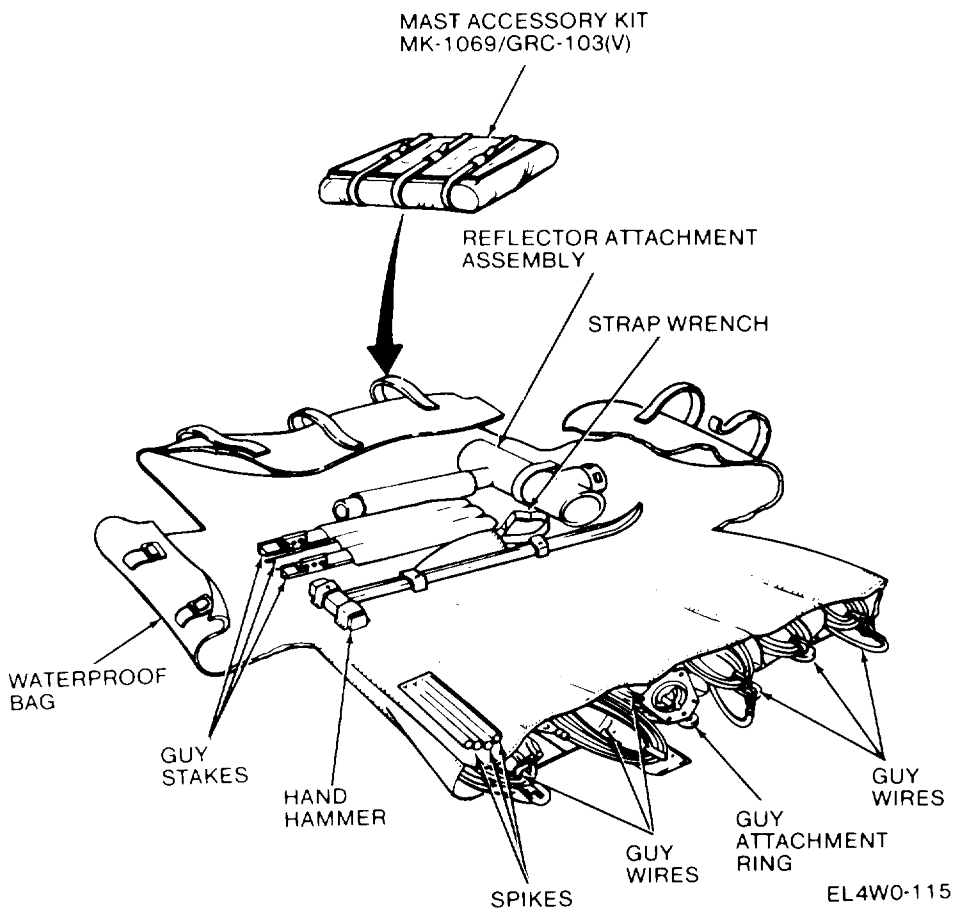


The mast consists of Elevator, Antenna AB-1072/GRC-103(V), seven Mast Sections AB-1071/GRC-103(V), and Accessory Kit, Mast MK-1069/GRC-103(V). When erected the mast assembly is 35 feet high, each mast section adding 5 feet (the height of the mast can be extended to 50 feet by means of Extension Kit. Mast MK-1099/GRC-103(V)). Six mast sections are secured to the antenna e!evator with a canvas strap and binding wire. The seventh mast section, the center section, is stored in the erection mechanism of the elevator. A jacking lever on the antenna elevator is used to raise each section. The mast sections are joined by a snap lock arrangement.

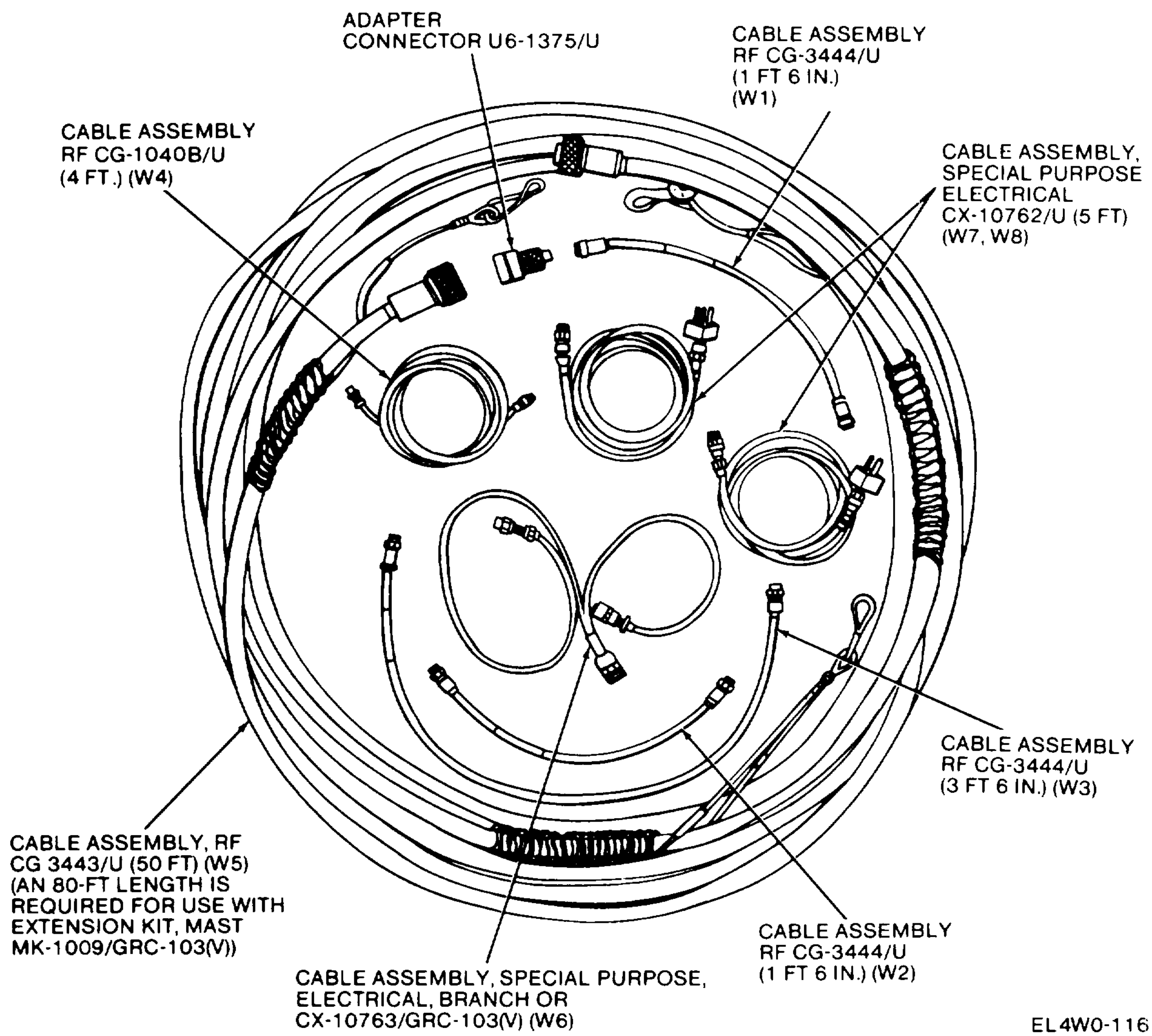


1-15. MAST AB-952/GRC-103(V) - Continued

The mast accessory kit consists of a waterproof bag, which is fitted with a reflector attachment assembly, strap wrench, six guy wires a hand hammer, three spikes, three guy stakes and a guy attachment ring.

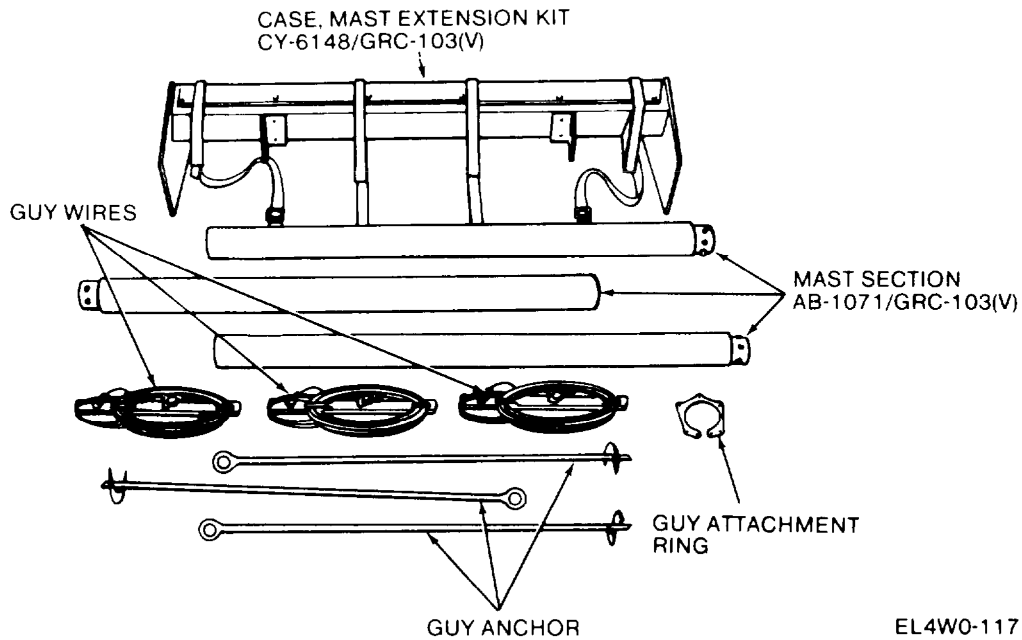


1-16. MINOR COMPONENTS



The radio set includes a group of rf, video and power cables used to Interconnect the various components,

1-17, EXTENSION KIT, MAST MK-1009/GRC-103(V)



The mast extension kit is used to extend the height of the mast assembly from 35 to 50 feet. It consists of case, Mast Extension Kit CY-6148/GRC-103(V), three Mast Sections AB-1071/GRC-103(V), three guy wires, three guy anchors and a guy attachment ring

1-18. EQUIPMENT DATA

• DIMENSIONS AND WEIGHTS

Item	Height (in.)	Width (in.)	Depth (in.)	Weight (lb)
Transmitter Radio T-983(P)/GRC-103(V), T-983A(P)/GRC-103(V) or T-983B(P). GRC-103(V)	8 ½	17 3/8	12	425
Amplifier- Frequency Multiplier AM -4320/ GRC103(V), AM-4320A/GRC-103(V) or AM 4320B/GRC-103(V)(Band I)	8 ½	8 ½	11¾	208
Amplifier Frequency Multiplier AM4321/ GRC-103(V) or AM-4321B/GRC-103(V) (Band III)	8 ½	8 ½	11 ¾	21
Amplifier-Frequency Multiplier AM-4322/ GRC-103(V) or AM-4322A/GRC-103(V) (Band lll)	8 ½	8 ½	11¾	21.5
Amplifier Frequency Multiplier AM-4323/ **GRC-103(V)(Band** IV)				
Receiver Radio **R-1329** GRC-103(V) R-1329A/GRC-103(V) R-1329B/GRC-103(V) or R 1329C/GRC-103(V)	8½	17¾	12	36
Amplifier Converter AM-4316/GRC-103(V) or AM-4316A/GRC-103(V) (Band ll)	8½	10¼	11 ¾	28
Amplifier- Converter AM-4317/GRC-103(V) (Band ll)	8½	10¼	11¾	29
Amplifier Converter AM-4318/GRC-103(V) (Band III)	8 ½	10¼	11¾	275
Amplifier-Converter AM-4319/GRC-103(V) (Band IV)	8½	10¼	11¾	265

1-18. EQUIPMENT DATA - Continued

	Height (in.)	Width (in.)	Depth (in.)	Weight (lb)
Recever-Transmitter. Order Wire RT-773/ GRC-103(V)	3 ¼	8¾	12	76
Antenna AS-1852/GRC-103(V) (Band I) Consisting of				
Reflector, Antenna AS-2150/GRC-103(V)	38½	37 3/8	73¾	24.75
Antenna Element AS-2151/GRC-103(V)	24 1/8	24 5/8	3	5
Antenna AS-1853/ GRC-103(V)(Band II) Consisting of				
Reflector, Antenna AS-2150/GRC-103(V).	38½	37 3/8	7¾	2475
Antenna Element AS-2194/GRC-103(V).	181/8	11	3½	25
Antenna AS-1854/GRC- 103(V) (Band Ill) Consisting of				
Reflector. Antenna AS-2150/GRC-103(V)	38 ½	37 3/8	734	2475
Antenna Element AS-2195 /GRC-103(V)	11	8	15 5/8	12
Antenna AS-3047 /GRC-103(V) (Band IV) Consisting of				
Reflector Antenna AS-3414 /GRC-103(V)	37 ½	37½	8	24
Antenna, Feed AS-3415/GRC-103(V)	6 ¼	6 ¼	2432	32
Mast AB-577/GRC-103(V) (Band IV) (Refer to TM 11-5820538-121				
Mast AB-952/GRC-103(V) Consisting of				
Elevator. Antenna AB-1072/GRC103(V)	63	16¾	15¼	48
Mast Section AB-107/GRC-103(V)	62	4 in. dia		8
Accessorv Kit Mast MK-1069/GRC-103(V)	37	21	6	57.5

• PERFORMANCE OF ANTENNAS

Item	Characteristics
Antenna AS-1852/GRC-103(V) (Band I)	Impedance . . . . 50 ohms unbalanced VSWR . . . . 1. 75: 1 maximum Gain . . . . 220 MHz, 7.0 dB 400 MHz 10.0 dB
Antenna AS-1853/ GRC103(V) (Band II)	Impedance . . . . 50 ohms unbalanced VSWR . . . . 1.75: 1 maximum Gain . . . . 400 MHz, 10.0 dB, 700 MHz 11.2 dB
Antenna AS-1854/GRC-103(V) (Band Ill)	Impedance . . . . 50 ohms unbalanced VSWR . . . . 1. 75: 1 maximum Gain . . . . 700 MHz 11.2 dB 1,000 MHz. 12. 7 dB
Antenna AS-3047/GRC-103(V) (Band IV)	Impedance . . . . 50 ohms unbalanced VSWR . . . . 1. 75: 1 maximum Gain . . . . l.350 MHz. 16 dB,1'850 MHz 18 dB

• PERFORMANCE OF RADIO TRANSMITTERS

Item	Characteristics
Transmitter, Radio T-983(P)/GRC103(V), Transmitter, Radio T-983 A(P),/GRC-103(V), or Transmitter Radio T-983B (P)/GRC-103(V)	Frequency Accuracy . . . . 0.002%(20 Hz per 1 MHz) Output power Band I . . . . 25 watts minimum Band II . . . . 25 watts minimum Band Ill . . . . 20 watts minimum Band IV . . . . 15 watts minimum Output Impedance . . . . 50 ohms. nominal unbalanced Modulation . . . . Frequency modulation (FM) Frequency deviation . . . . ±300 kHz maximum Output VSWR . . . . 1 6 1 maximum Deviation sensitivity . . . . 100 kHz 10400 kHz per volt adjustable Input impedance video . . . . 91 ohms unbalanced

1-18. EQUIPMENT DATA - Continued

Item	Characteristics
Transmitter, Radio T-983 (P)/ GRC-103(V) Transmitter, Radio T-983A(P)/GRC-103(V), or Transmitter Radio T-983B (P)/GRC-103(V)	Input Impedance. . . . . .600 ohms unbalanced order wire
	Frequency response . . . . .Gaussian, --29 ±07 decibels (dB) at 500 kHz: -11.0 ±3.0 db at 960 kHz.
	Spurious outputs . . . . .At least 80 dB down
	Alarms (can be muted) . . . . .Low power (transmitter output), synchronize {sync) (synthesizer automatic frequency control (afc) lock), over heat (transmitter output tube), cooling system failure
	Metering. . . . . .Power supply voltages, reflected power, oscillator and multiplier output levels. power output, modulation levels
	Order wire input . . . . –10 decibels (referred to 1 milliwatt in 600 ohms (d Bin))
	Auxiliary outputs. . . . . .28 volts direct current (vdc) regulated, 26 volts dc, unregulated
	Power requirements . . . . .115 volts alternating current (a) ±5%, 300 volt-amperes single phase, 47 to 420 Hz
Receiver, Radio R-1 329(P)/GRC-103(V), Receiver, Radio 1329 A(P) GRC-103(V), Receiver. Radio R-1329B(P)/GRC-103[V) or Receiver, Radio R-1 329 C(P)/ GRC-103(V)	Frequency accuracy. . . . . 0.002% (20 Hz per 1 MHz)
	Modulation . . . . .FM
	Input Impedance . . . . .50 ohms unbalanced
	Input VSWR at nominal received frequency ±1 MHz . . . . .22 1 maximum
	Minimum transmitter-to- . . . . . . receiver frequency separation required Band I Channel 40 to 119, 165 MHz (33ch) and Channel 120 to 409.44 MHz (88 ch) Bands II, III 16.5 MHz(33ch) Band IV 20.0 MHz(40 ch)
	Maximum operating . . . . receiver Input at nominal received frequency –45d Bm
	Receiver sensitivity . . . .–94dBm(12ch) –88 dBm(24 ch)
	Noise figure . . . . .9dB nominal (11 dB maximum).
	Demodulation sen- . . .. sitivity, pcm video output 0.125 volts/100 kHz.
	Output impedance . . . . regenerated 12-channel pcm video 91 ohms unbalanced.
	Output Impedance, ... 24-channel pcm video. 50 ohms unbalanced.
	Output Impedance, ... order wire 600 ohms unbalanced.
	Output Impedance,. . . . . timing pulse 91 ohms unbalanced
	Output level, ... order wire –10 dBm.
	Input level . . . . order wire from multiplex combiner –4 dBm
	Intermediate fre-.. . . . . quency (if), center. 300 MHz ±20 kHz.
	If response . . . . .Gaussian, –2.9dB ±0.6dB at 375 kHz, –19.0 dB ±3.5 dB at 960 kHz, –60 dB minimum at 2 MHz
	Video frequency . . . . .Gaussian, -30 ±05 dB at 400 kHz, –38.0 ±6.0dB at 960k Hz
	Pcm regenerator . . . . frequency 576 kHz ±90 Hz or 1152 kHz ±180 Hz
	Regenerated pcm . . . . output 2-volt negative peak.
	Timing pulse output. . . . . . . level 2-volt, positive peak,
	Alarms (can be muted) . . . .Rf low signal r! high signal, sync (synthesizer afc lock)

1-18. EQUIPMENT DATA - Continued

Item	Characteristics
Receiver, Radio R-1329 (P)/GRC-l03(V) Receiver, Radio 1329 A(P) GRC-103(V) Receiver, Radio R-1329B(P)/GRC-103(V) or Receiver, Radio R-1 329 C(P) / GRC-103(W	Metering ....Power supply voltages reflected power oscillator and multplier output level transmitter duplex tuning, received signal level output video levels recovered order wire level Auxiliary outputs. . . . . .12 volts dc regulated. 26 volts dc, unregulated Power requirements . . . . .115 volts ac ±5%, 70 volt-amperes singlephase

Section III. TECHNICAL PRINCIPLES OF OPERATION

1-19. SYSTEM APPLICATION

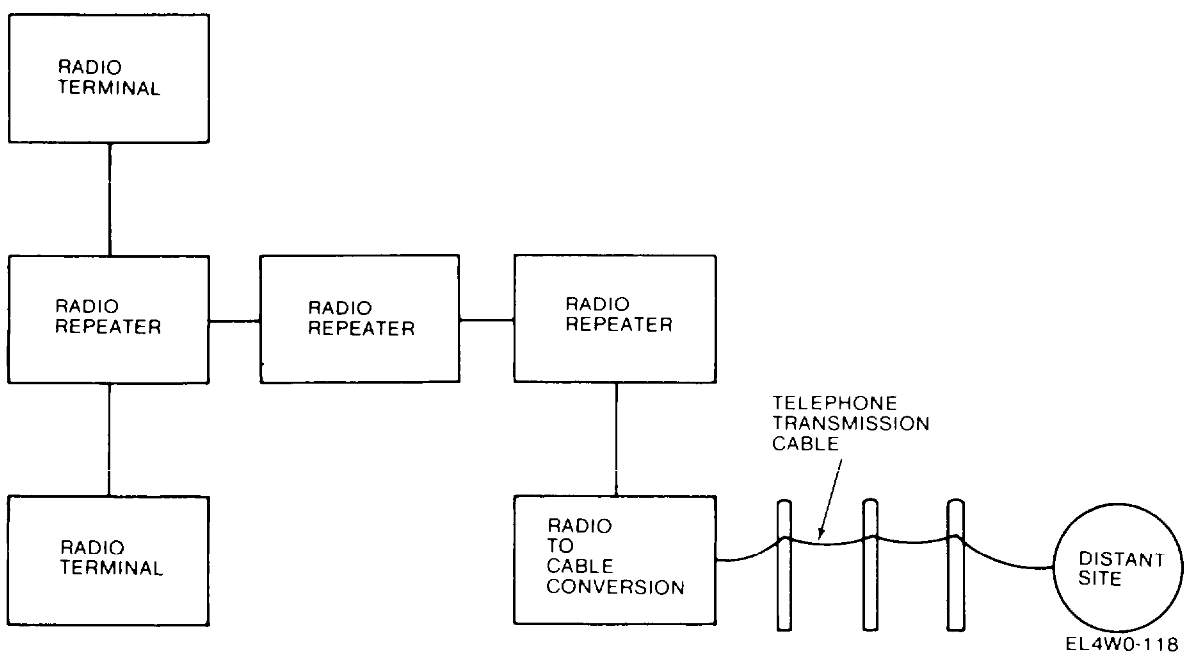
The radio set can be used in a variety of applications within an overall system, depending upon system requirements, location of associated equipment, and tactical environment.

It transmits and receives pulse-code modulation (pcm) signals in the form of frequency modulation of the rf carrier making it particularly valuable for radio relay application.

The radio set can provide transmit-receive facilities from 12 to 24 pcm telephone channels and an order wire channel.

Multiplex equipment is required to produce a pcm from the individual telephone voice channels and to decode the pcm signal into its original form at its destination

It can be applied as a radio terminal, a radio repeater, and a radio-to-cable conversion device.



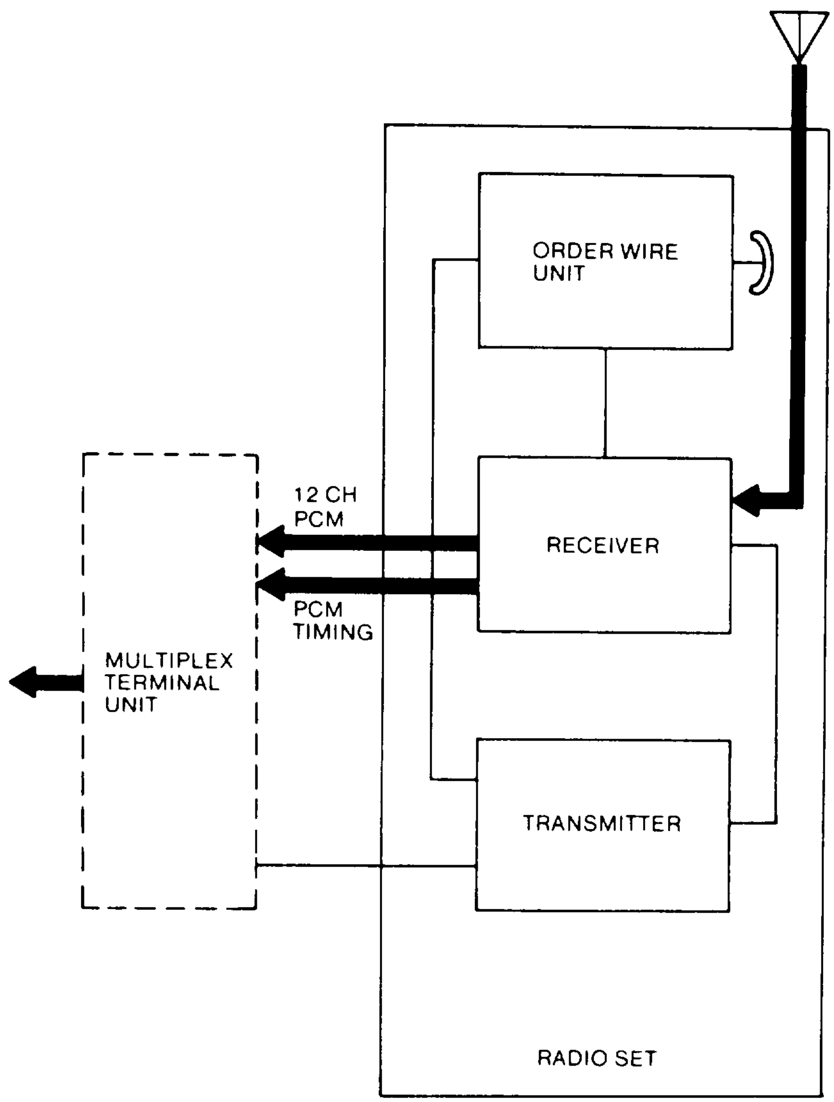
Information is conveyed throughout the communication system in the form of pulses, which are regenerated at each terminal or repeater site.

In 12-channel operation, the pcm signal is regenerated in the receiver. In 24-channel operation, this function is performed by associated multiplex equipment.

1-19. SYSTEM APPLICATION - Continued

• 12-CHANNEL RADIO TERMINAL

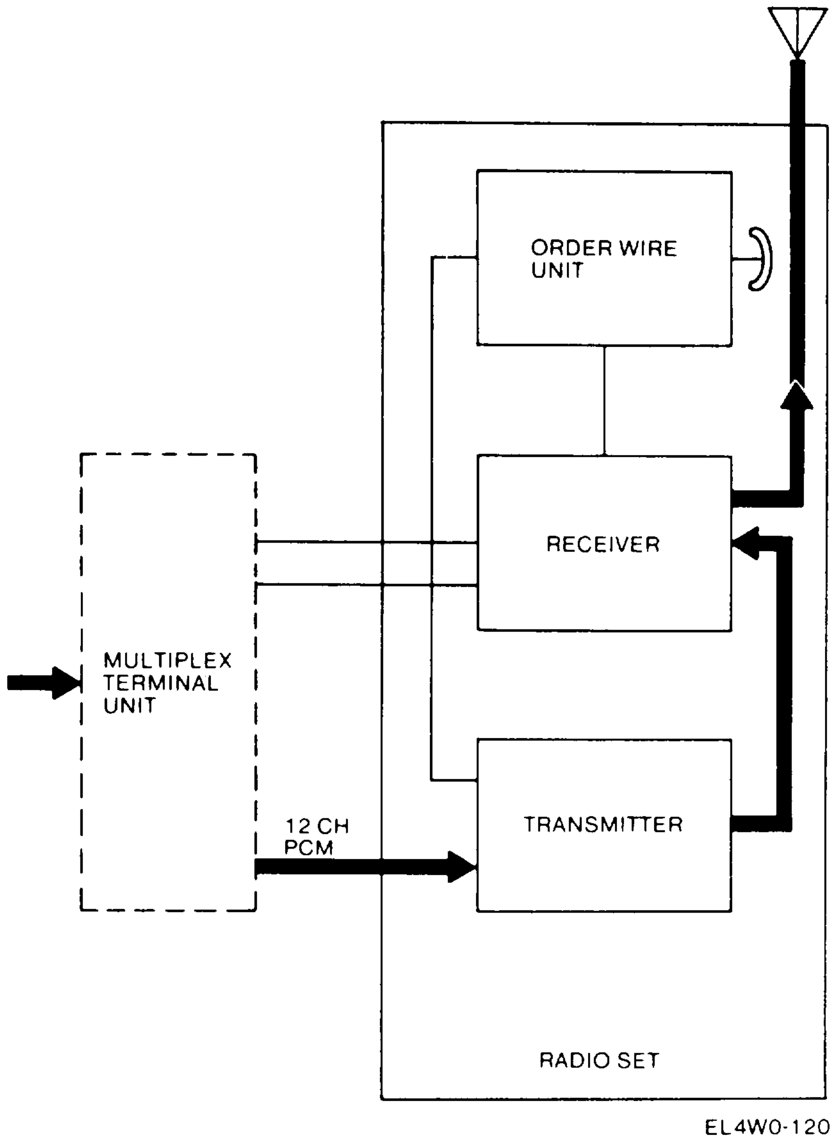
In 12-channel pcm terminal application, the radio receiver feeds regenerated pcm pulses and a timing signal to the associated multiplex equipment, which converts the pcm to its original 12 separate channels.



EL4W0-119

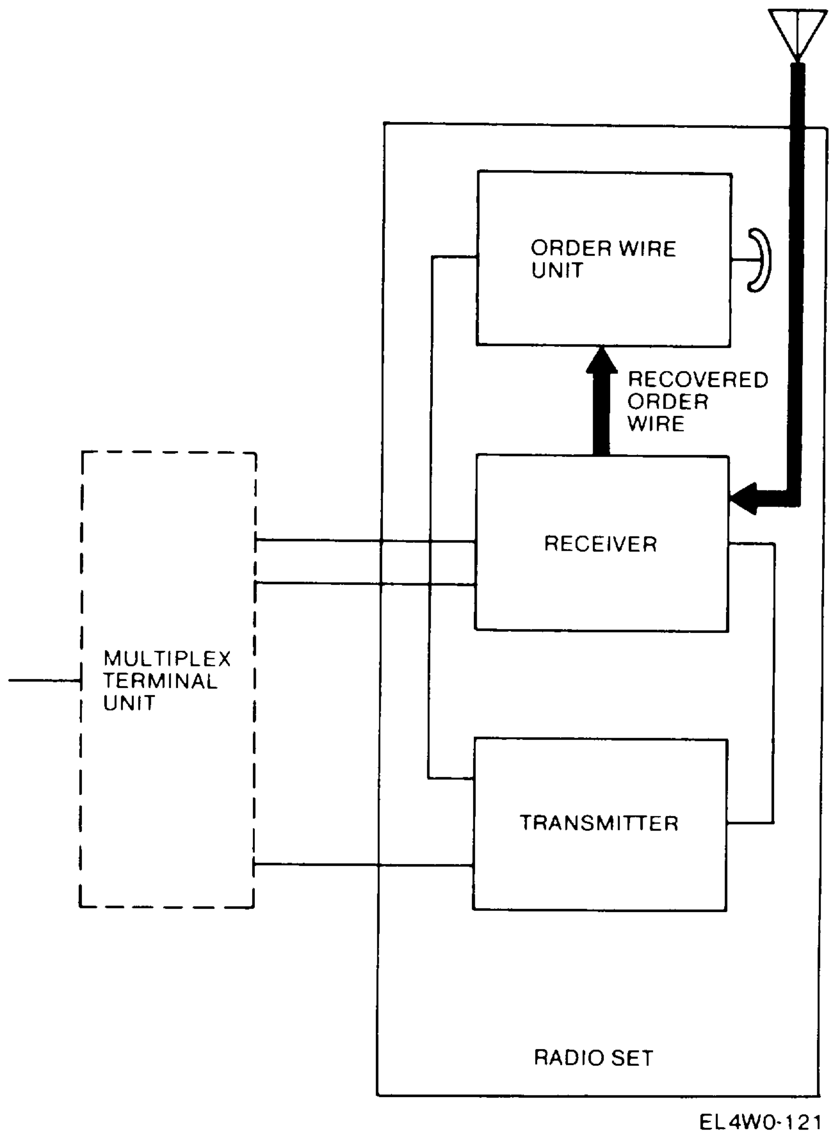
1-19. SYSTEM APPLICATION - Continued

The multiplex equipment also combines up to 12 telephone input channels to a pcm signal for application to the radio transmitter. The radio transmitter output is passed to the antenna through a duplexer in the receiver. In this way simultaneous transmission and reception can take place.



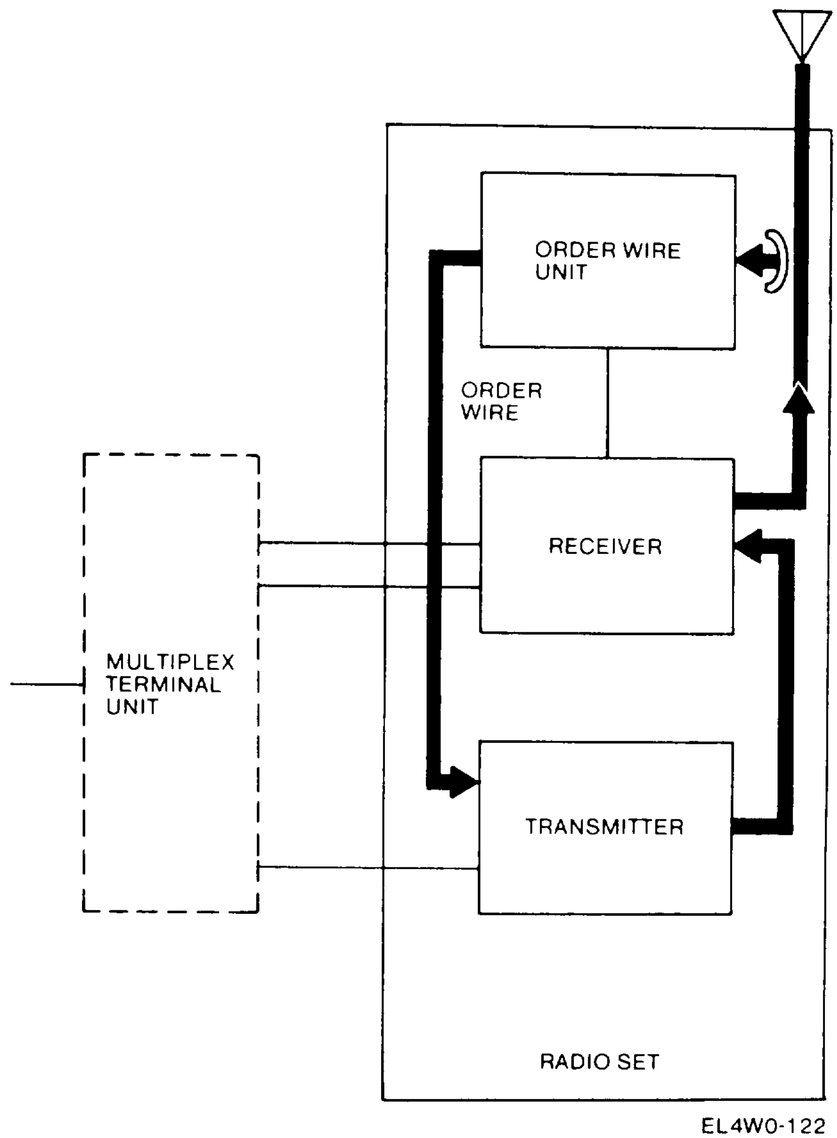
1-19. SYSTEM APPLICATION-Continued

When an order wire signal is received it is recovered in the radio receiver and supplied to the order wire unit.



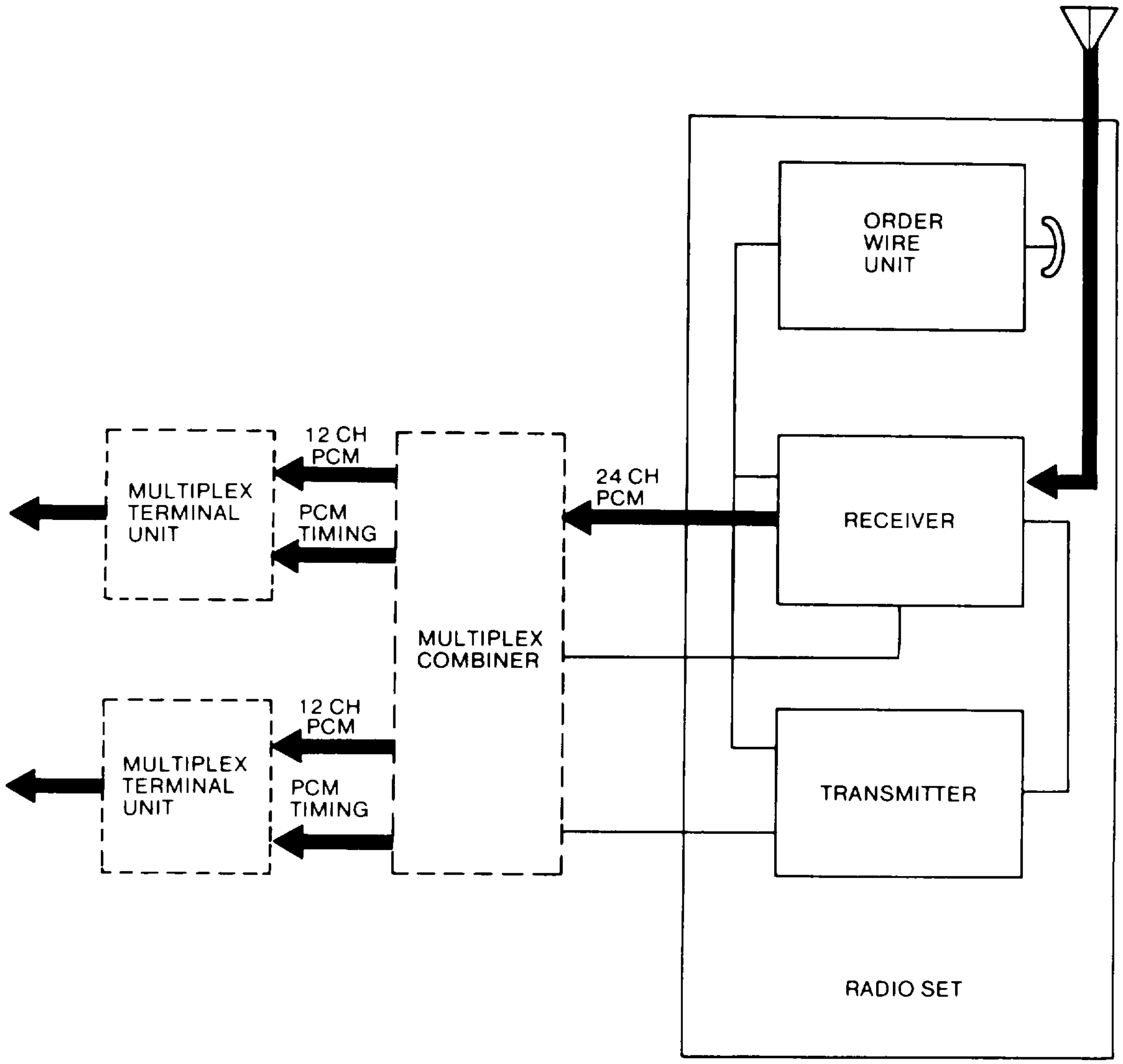
1-19. SYSTEM APPLICATION - Continued

Order wire signals originating to the terminal are fed from the order wire unit 10 the transmitter and passed through the receiver to the antenna.



1-19, SYSTEM APPLICATION - Continued

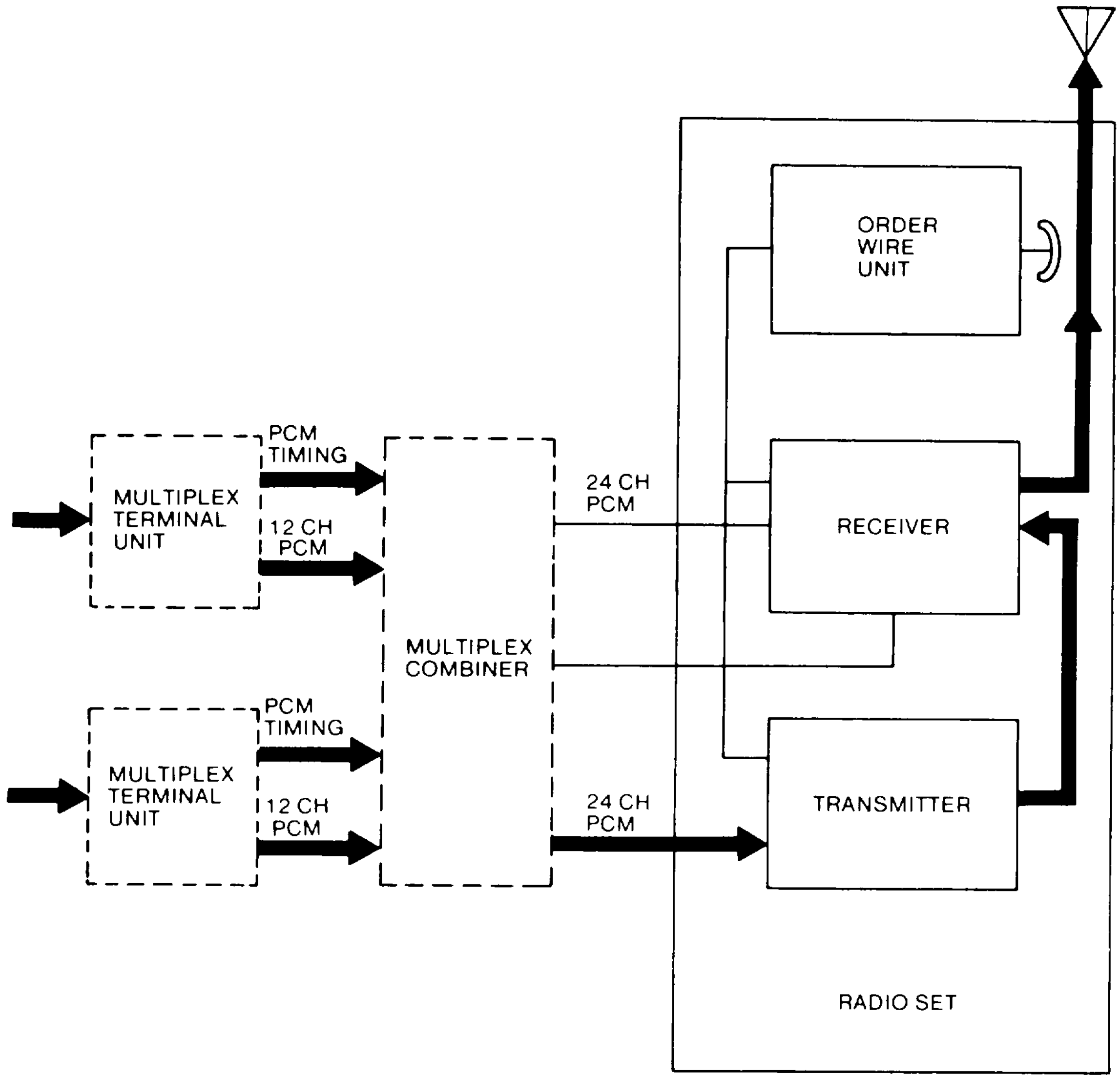
24-CHANNEL RADIO



EL4W0-123

In 24-channel terminal applications, a multiplex combiner, and two pcm multiplex terminal units are required. Pcm signals from the receiver are fed to the multiplex combiner, where they are regenerated The multlilex combiner feeds the regenerated pcm signal and its own timing pulses to the two 12-channel multiplex terminal units for distribution to the 24 telephone output channels.

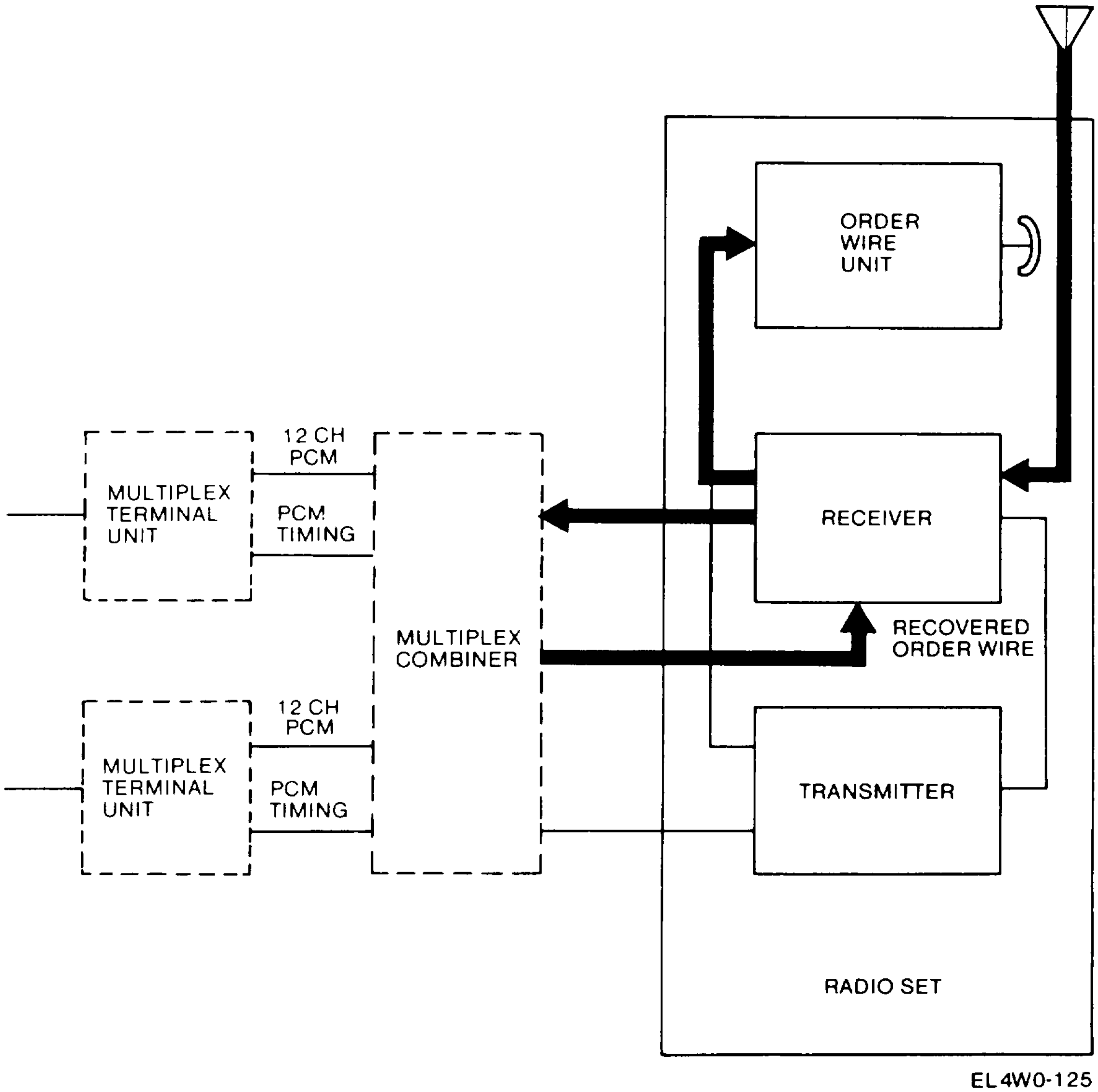
1-19. SYSTEM APPLICATION-Continued



EL4W0-124

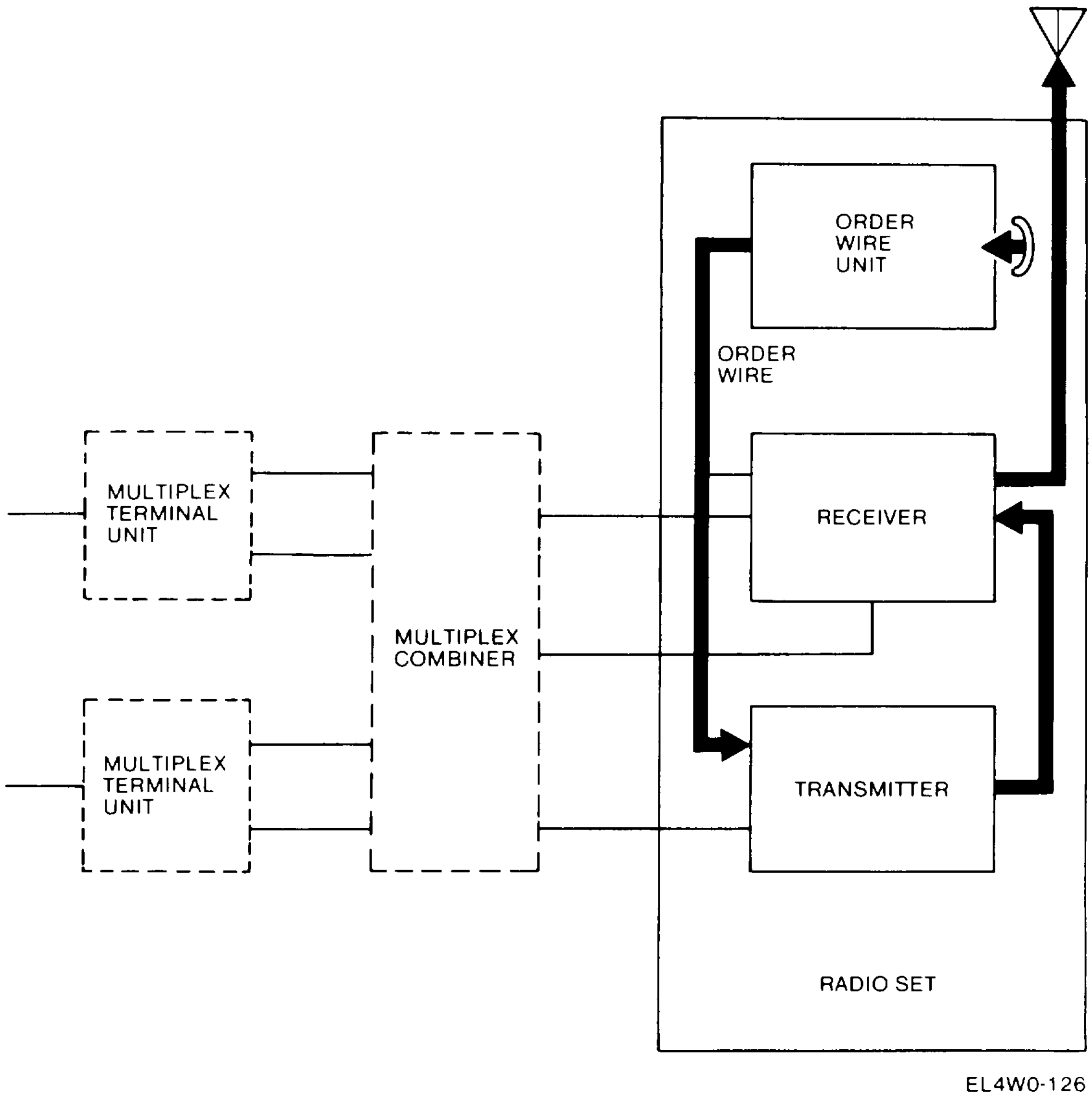
The two groups of 12-channel pcm signals originating at the terminal are fed from the multilplex terminal units to the combiner, where they are added to form a 24-channel pcm signal for application to the transmitter. From the transmitter, it is passed through the receiver to the antenna,

1-19. SYSTEM APPLICATION - Continued



The multiplex combiner also recovers any order wire information from the received signals and feeds it back to the receiver as a recovered order wire signal. From the receiver, it is supplied to the order wire unit.

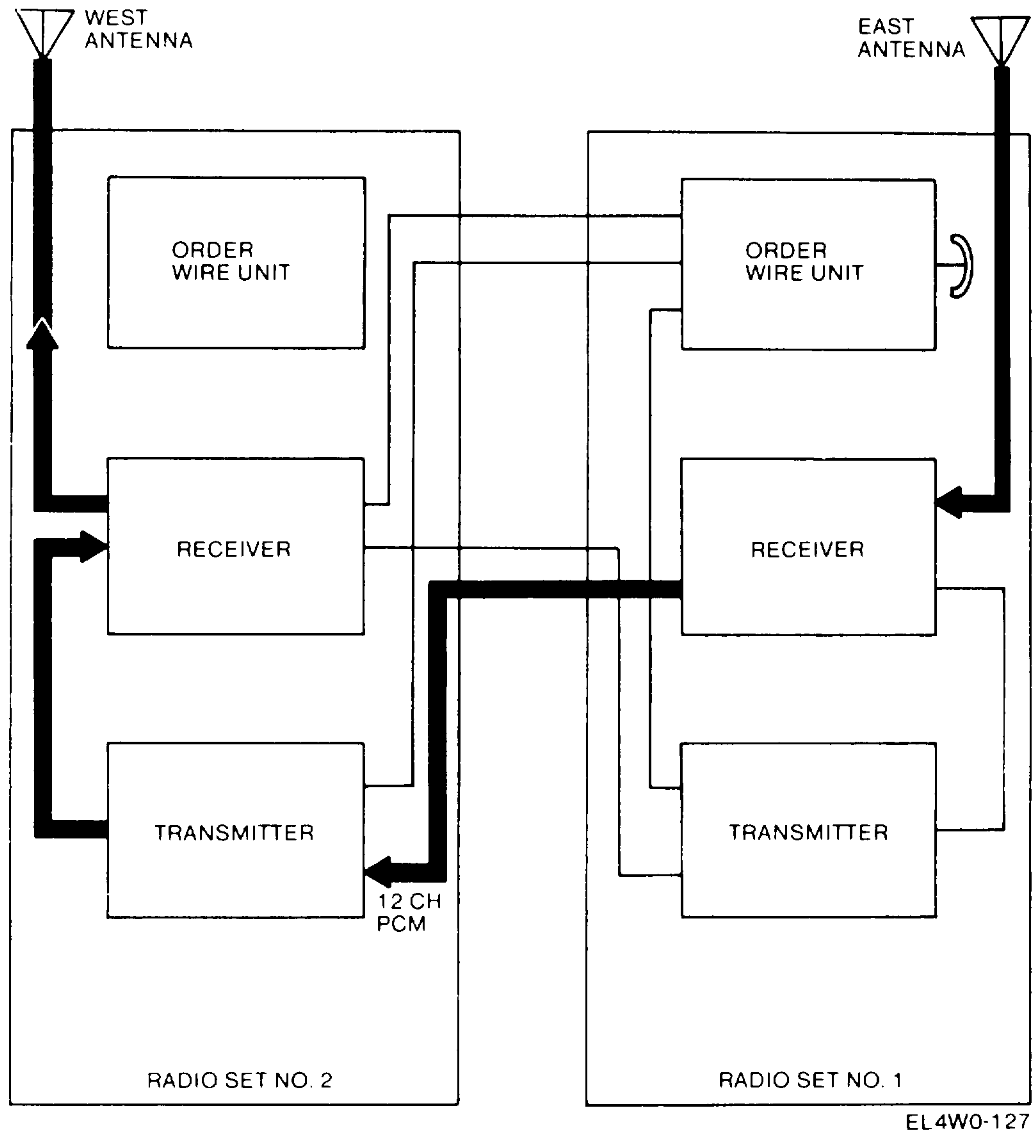
1-19. SYSTEM APPLICATION - Continued



Local order wire signals are applied directly from the order wire unit to the transmitter and passed through the receiver to the antenna.

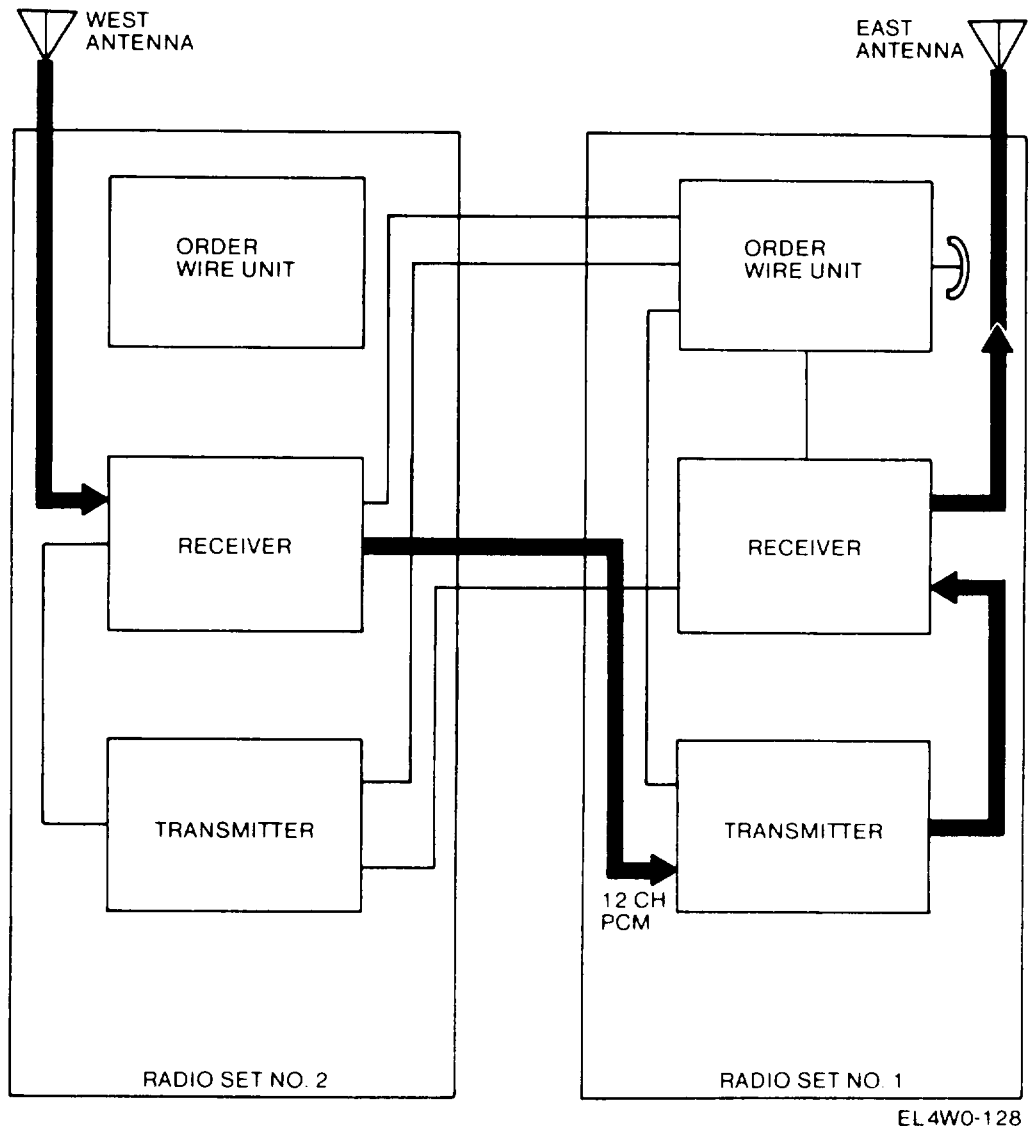
1-19. SYSTEM APPLICATION-Continued

.12-CHANNEL RADIO REPEATER



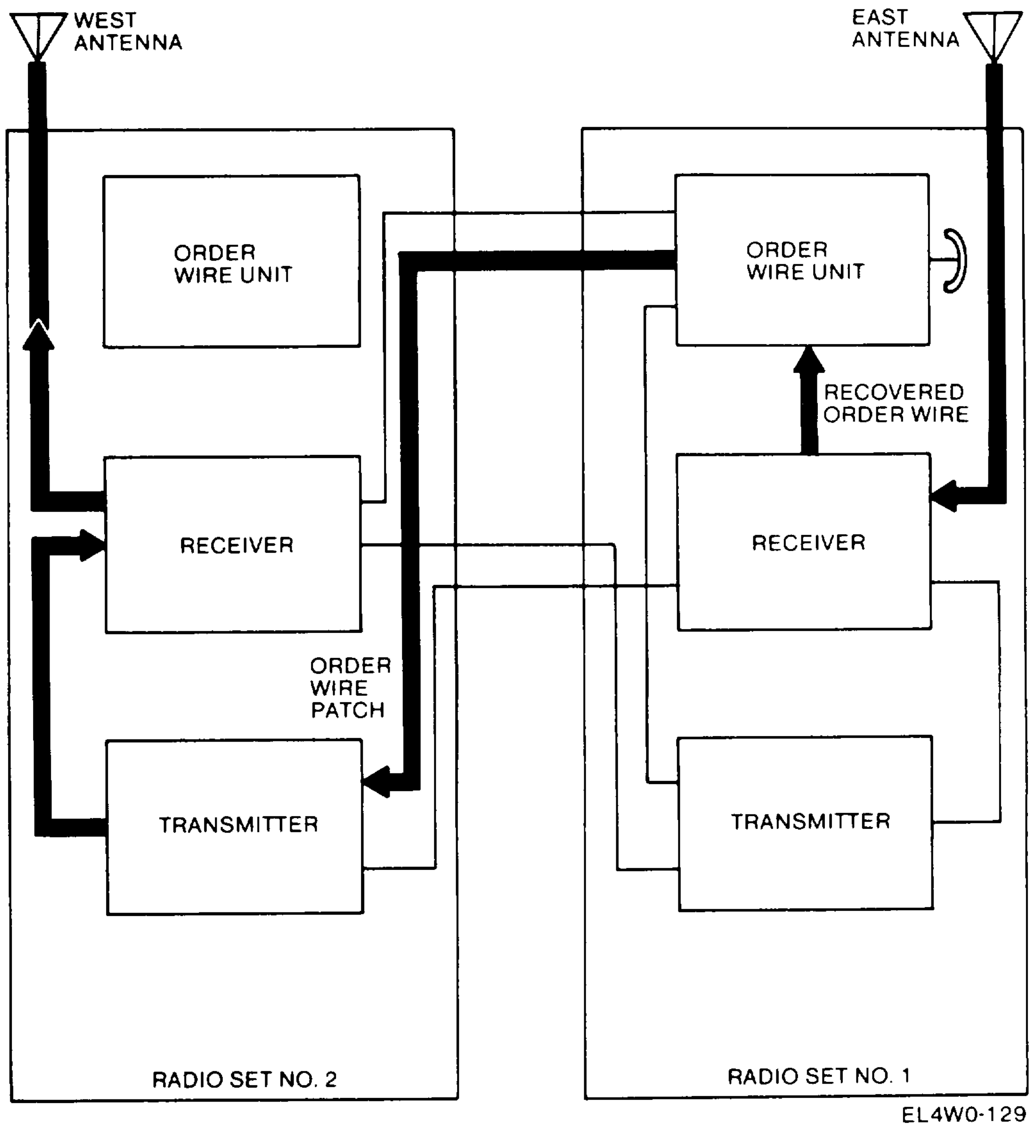
The 12-channel radio repeater uses two radio sets, without any additional multiplex equipment, for the bidirectional reception and transmission of pcm signals. Signals received at the east antenna are regenerated in receiver 1 and fed to transmitter 2 for transmission at the west antenna.

1-19. SYSTEM APPLICATION-Continued



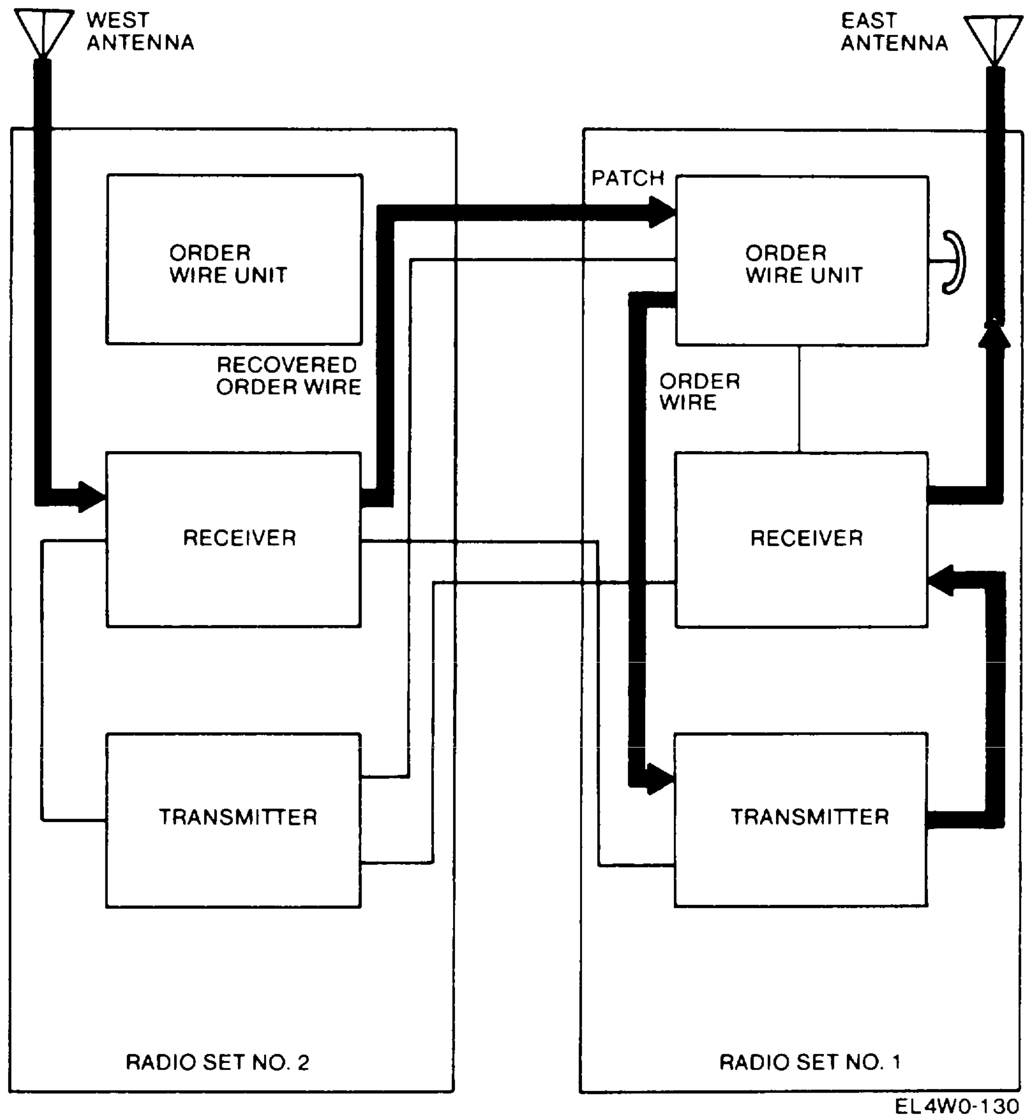
Signals received at the west antenna are regenerated in receiver 2 and fed to transmitter 1 for re-transmission at the east antenna.

1-19. SYSTEM APPLICATION - Continued



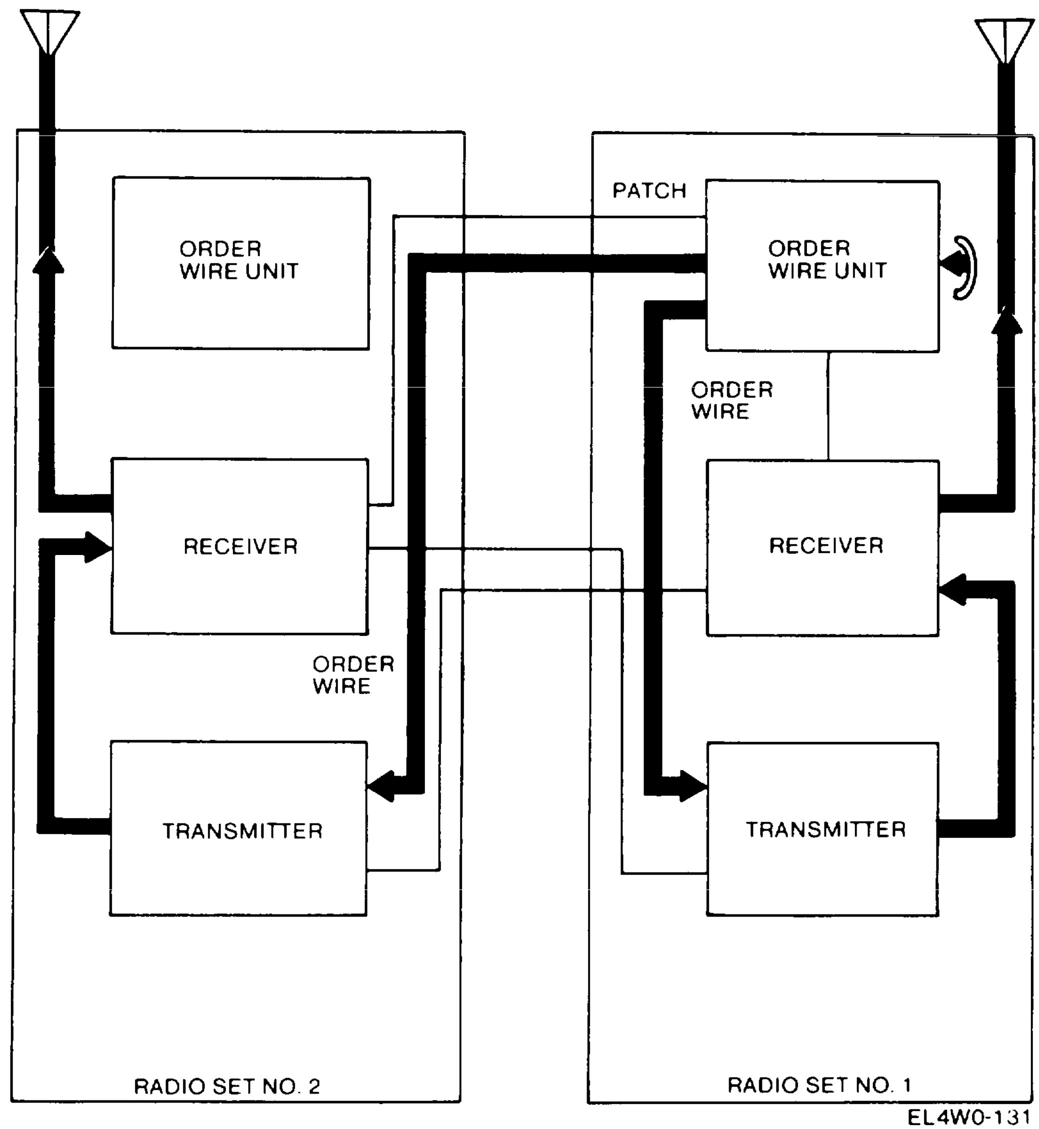
Order wire signals from the east antenna are recovered in receiver 1, passed to the order wire unit, and applied to transmitter 2 for retransmission at the west antenna.

1-19. SYSTEM APPLICATION - Continued



Order wire signals from the west antenna are recovered in receiver 2 and applied to transmitter 1 for retransmission at the east antenna.

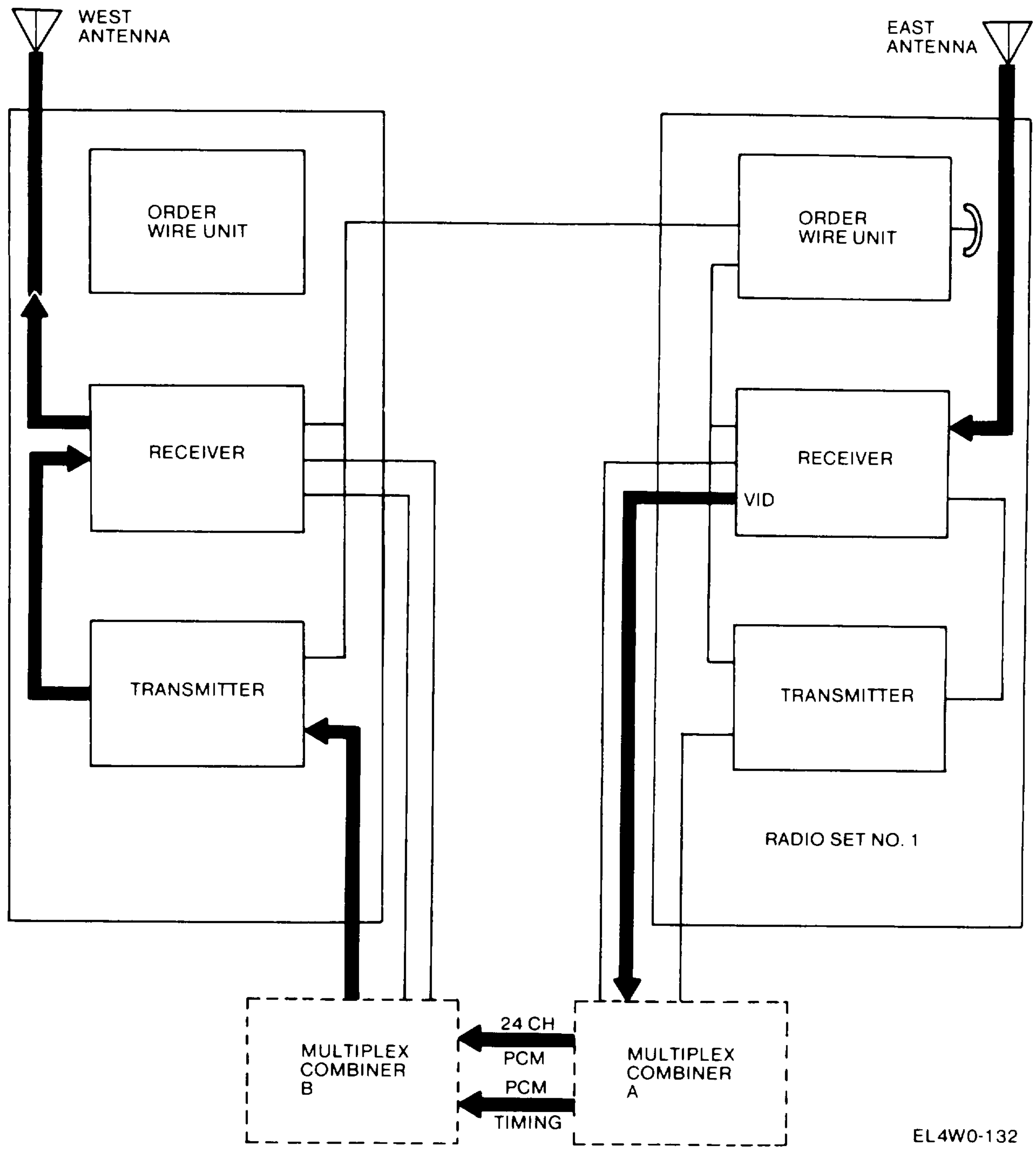
1-19. SYSTEM APPLICATION-Continued



Only one order wire unit is required for the two radio sets at a radio repeater site. Local order wire signals are applied directly to both transmitters and passed through the receivers to the antennas.

1-19. SYSTEM APPLICATION-Continued

. 24-CHANNEL RADIO REPEATER

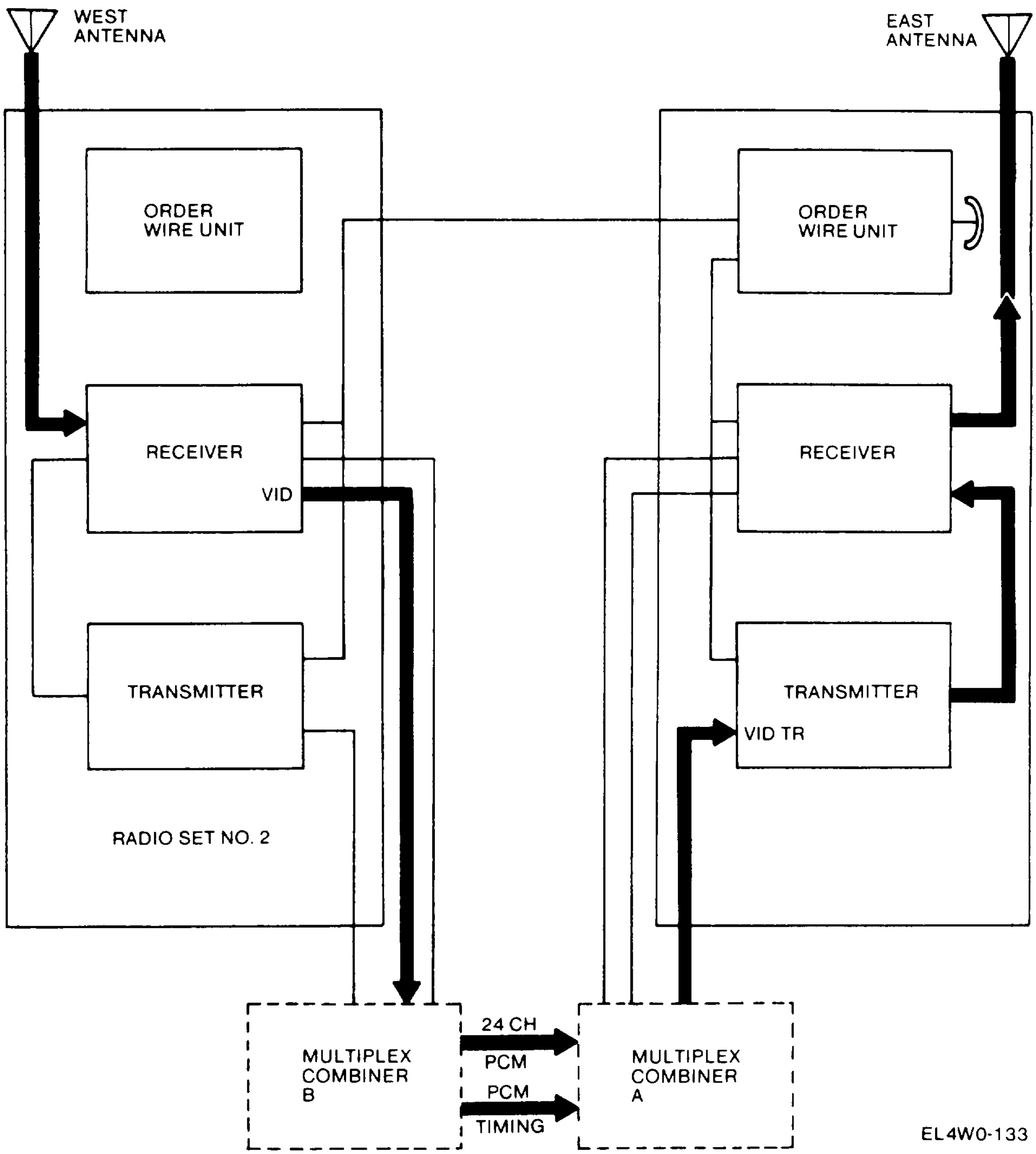


Two radio sets and two multiplex combiners are used in a 24-channel radio repeater. Signals received at the east antenna are converted to video pcm in receiver 1 and fed to combiner A where they are regenerated and fed, along with timing pulses, to combiner B. Combiner B supplies the regenerated 24-channel pcm signal to transmitter for retransmission at the west antenna.

1-19. SYSTEM APPLICATION - Continued

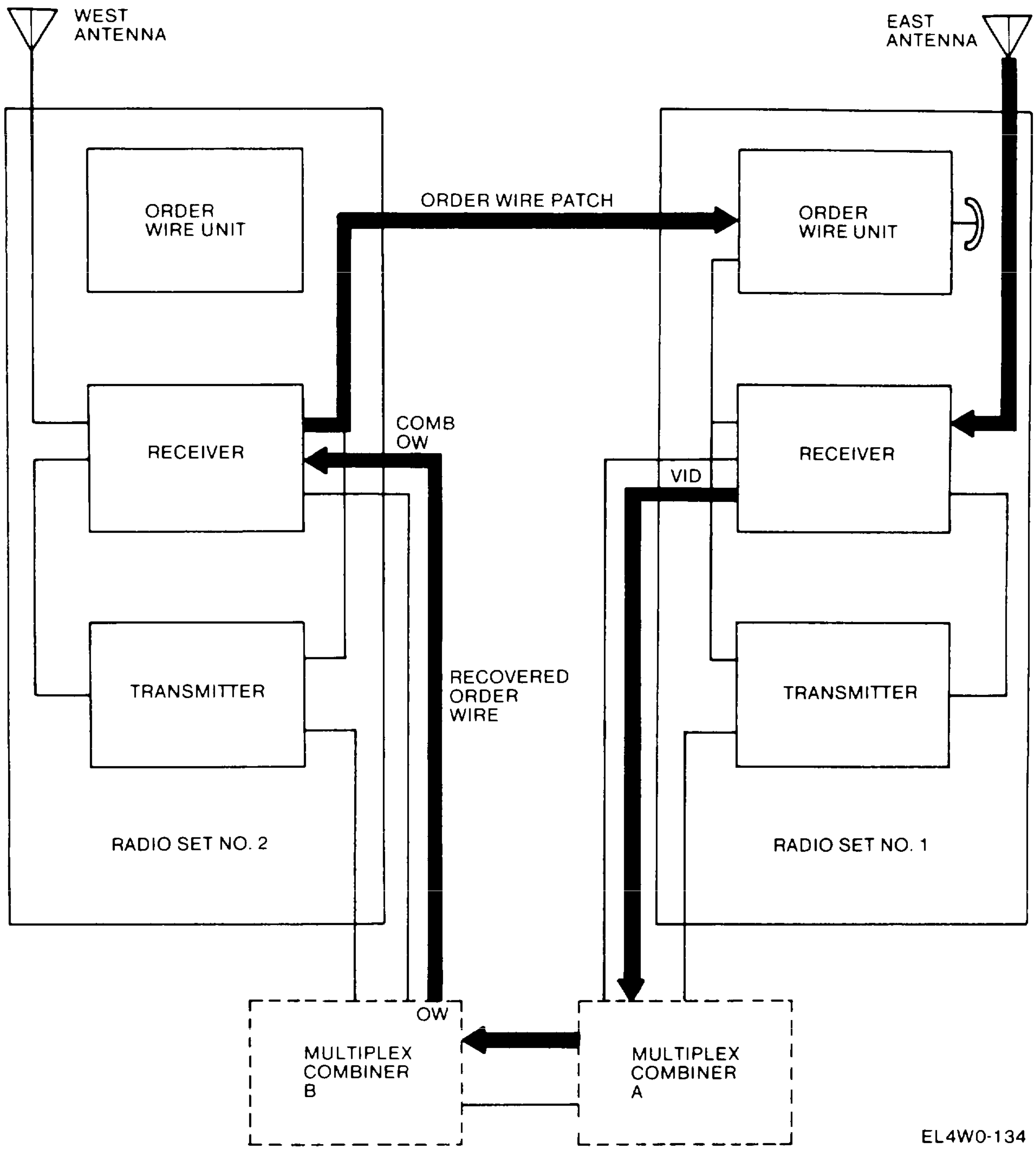
NOTE

Radio sets using Receiver, Radio R-1329 C(P)/GRC-103(V) have the capability of regenerating both 12 and 24 channel pcm without the aid of an external multiplexer/ combiner. In Receiver, Radio R-1329 C(P)/GRC-103(V), regeneration of the 24 channel pcm stream is accomplished within the dual rate pulse form restorer in the receiver itself, thus simplifying system setup for 24 channel operation. As in 12 channel operation the regenerated 24 channel pcm (of 1152 kb/s) and its associated timing signal (of 1152 kHz) are available at the PCM and TMG outputs respectively at the rear of the receiver.



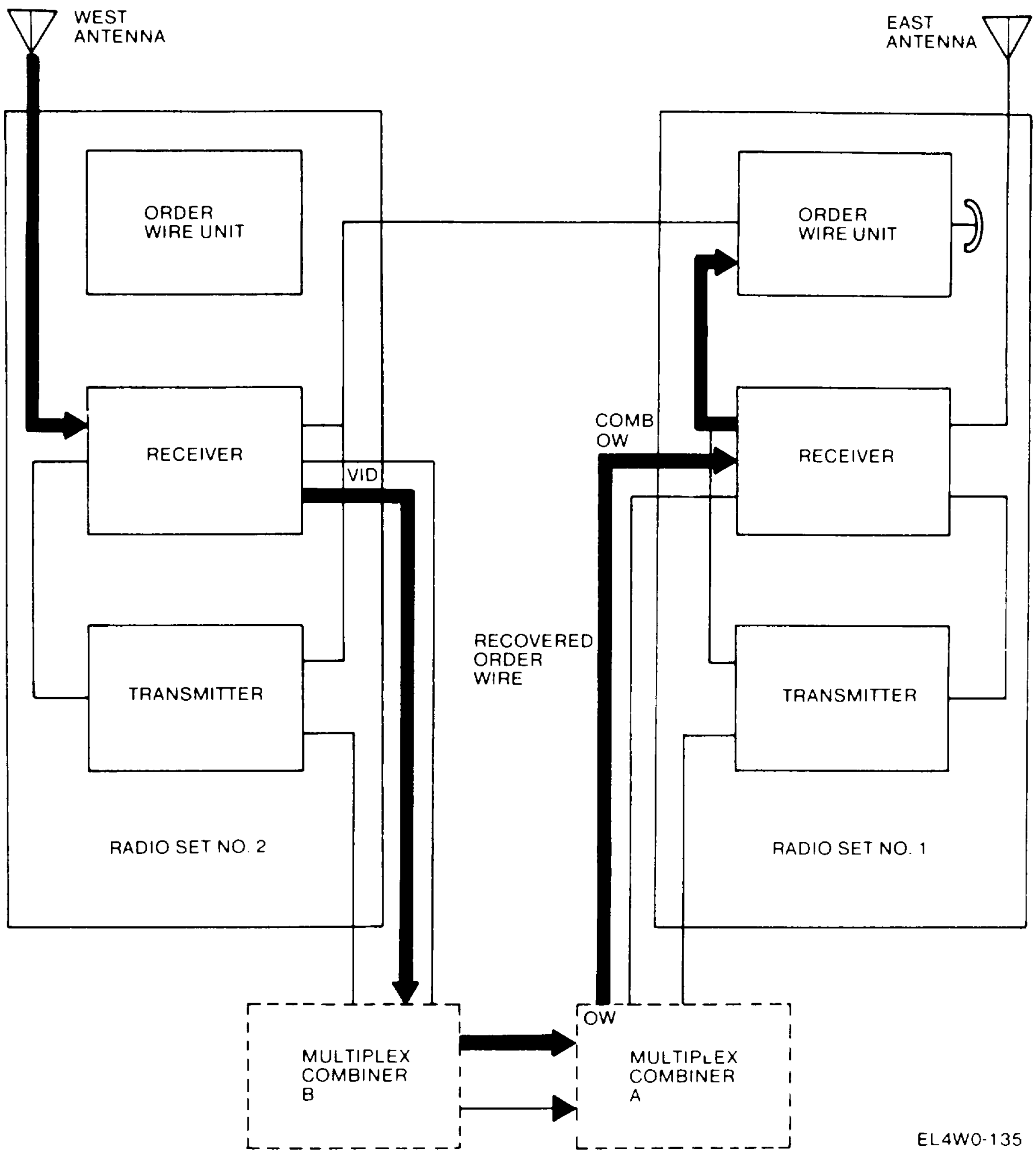
1-19. SYSTEM APPLICATION - Continued

Signals received at the west antenna are converted to video pcm in receiver 2 and fed to combiner B where they are regenerated and fed, along with timing pulses, to combiner A. Combiner A supplies the regenerated 24-channel pcm signal to transmitter 1 for retransmission at the east antenna



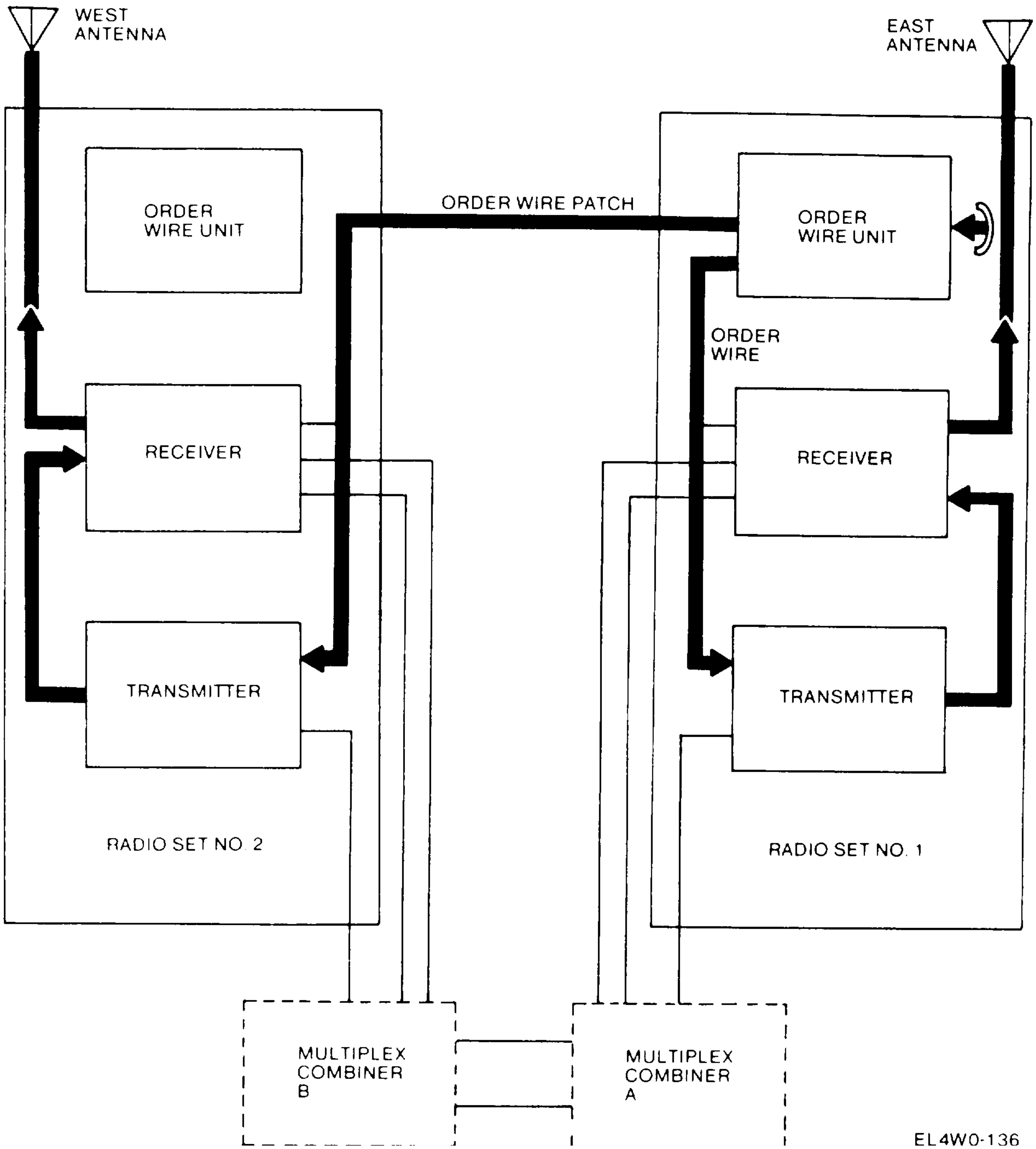
Order wire signals from the east antenna are passed through receiver 1 to combiner A where they are regenerated and fed through combiner B and receiver 2 to the order wire unit.

1-19. SYSTEM APPLICATION-Continued



Order wire signals from the west antenna are passed through receiver 2 to combiner B where they are regenerated and fed through combiner A and” receiver 2 to the order wire unit.

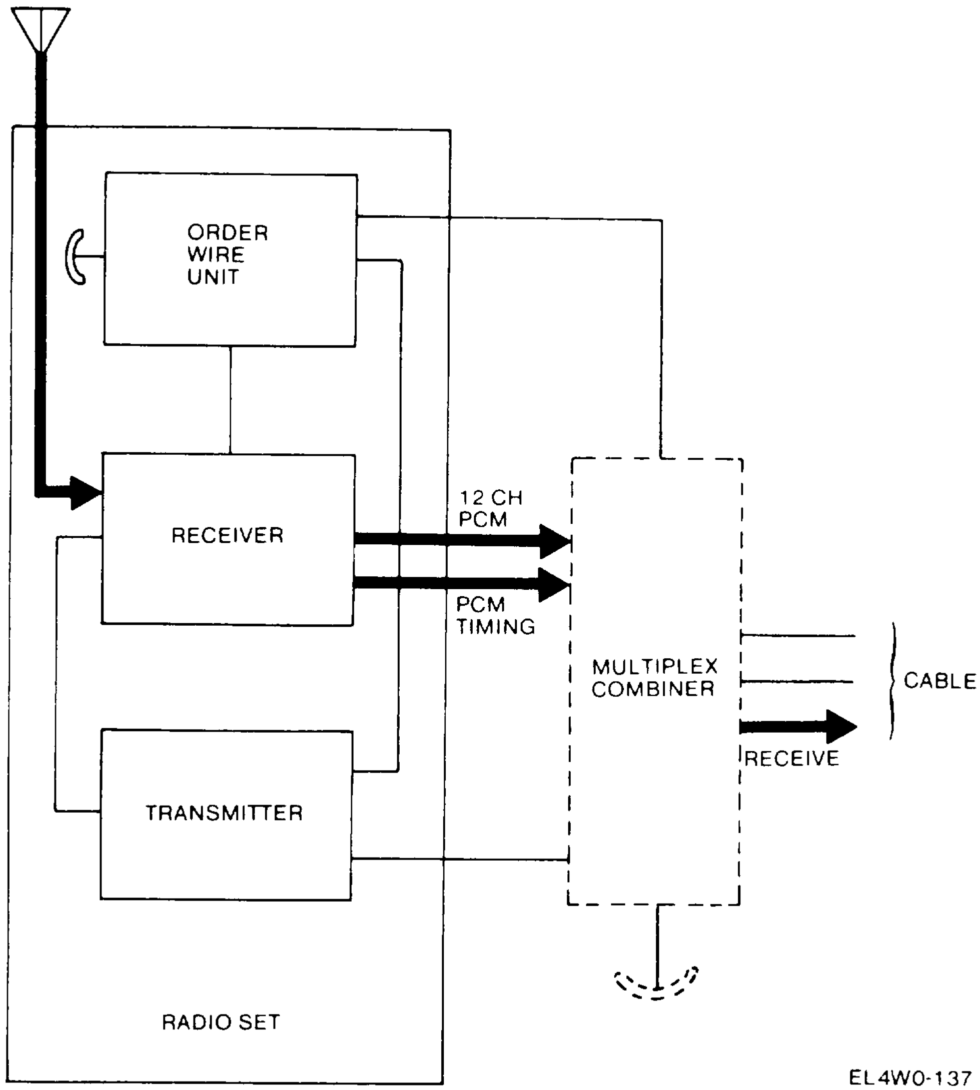
1-19. SYSTEM APPLICATION-Continued



Only one order wire unit is required for the two video sets at a radio repeater site. Local order wire signals are applied directly to both transmitters and passed through the receivers to the antennas.

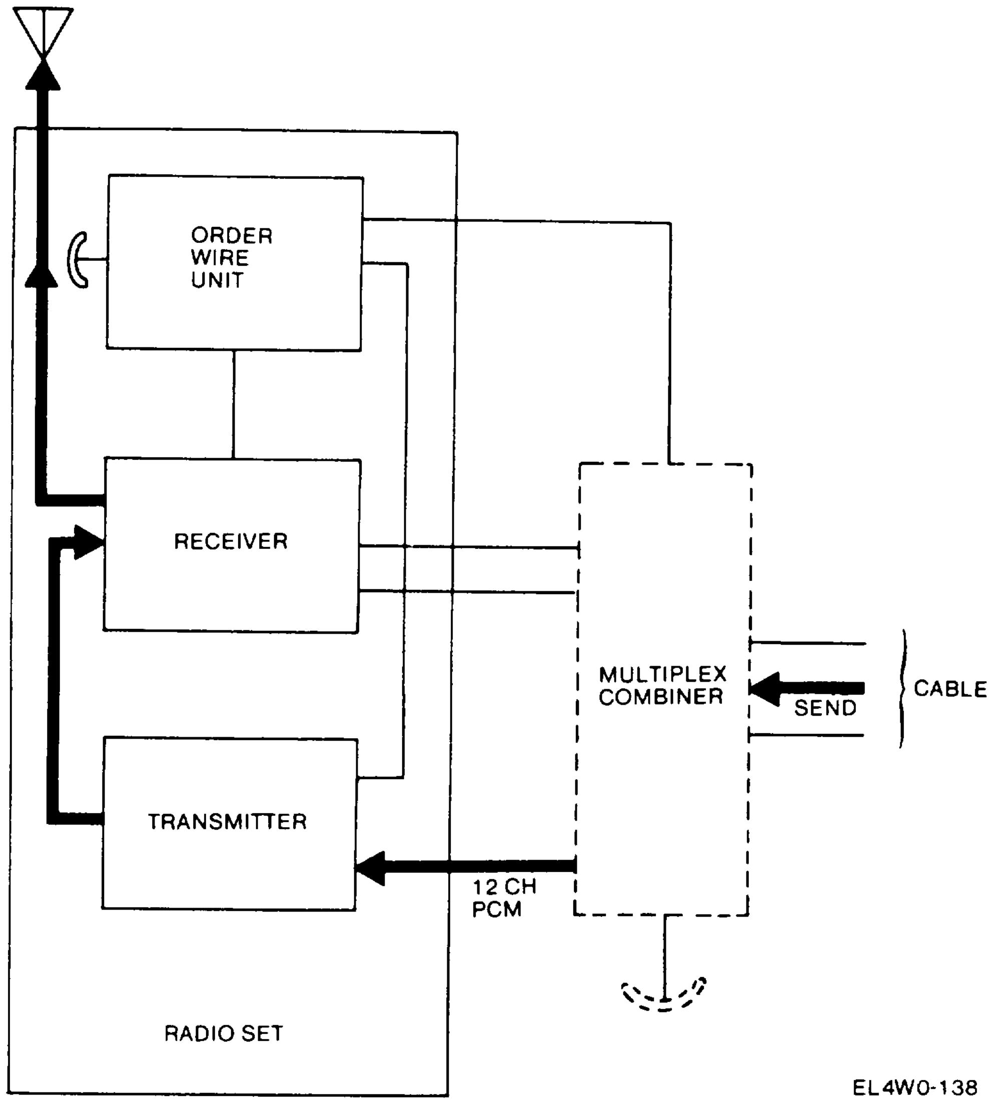
1-19. SYSTEM APPLICATION - Continued

. 12-CHANNEL RADIO-TO-CABLE CONVERSION



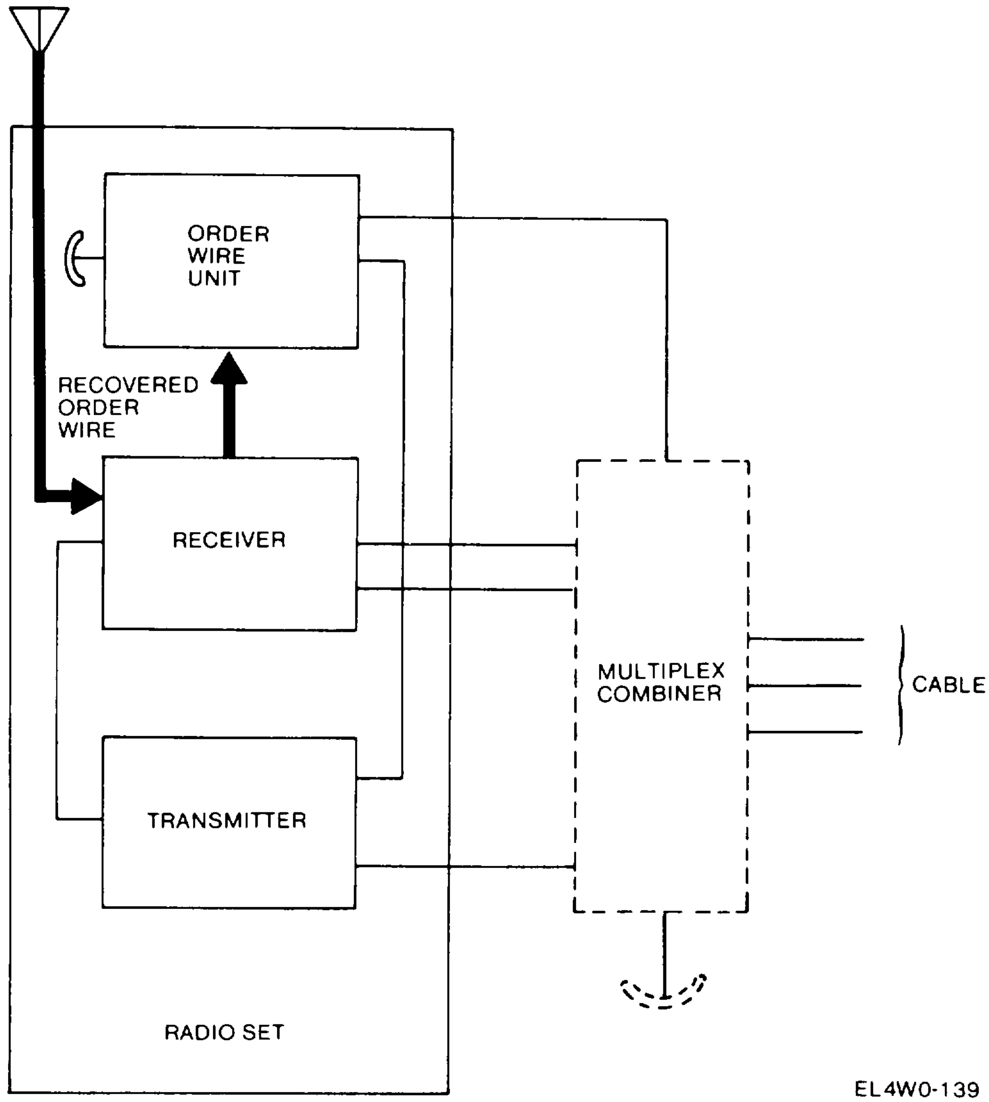
It is possible to transmit and receive pcm signals between a terminal site and distant location by a telephone transmission cable. A multiplex combiner unit is required to convert radio set output and input signals for use with the telephone transmission cable. The incoming pcm signal is regenerated in the receiver and fed, along with timing pulses, to a multiplex combiner for application to the telephone transmission cable.

1-19. SYSTEM APPLICATION - Continued



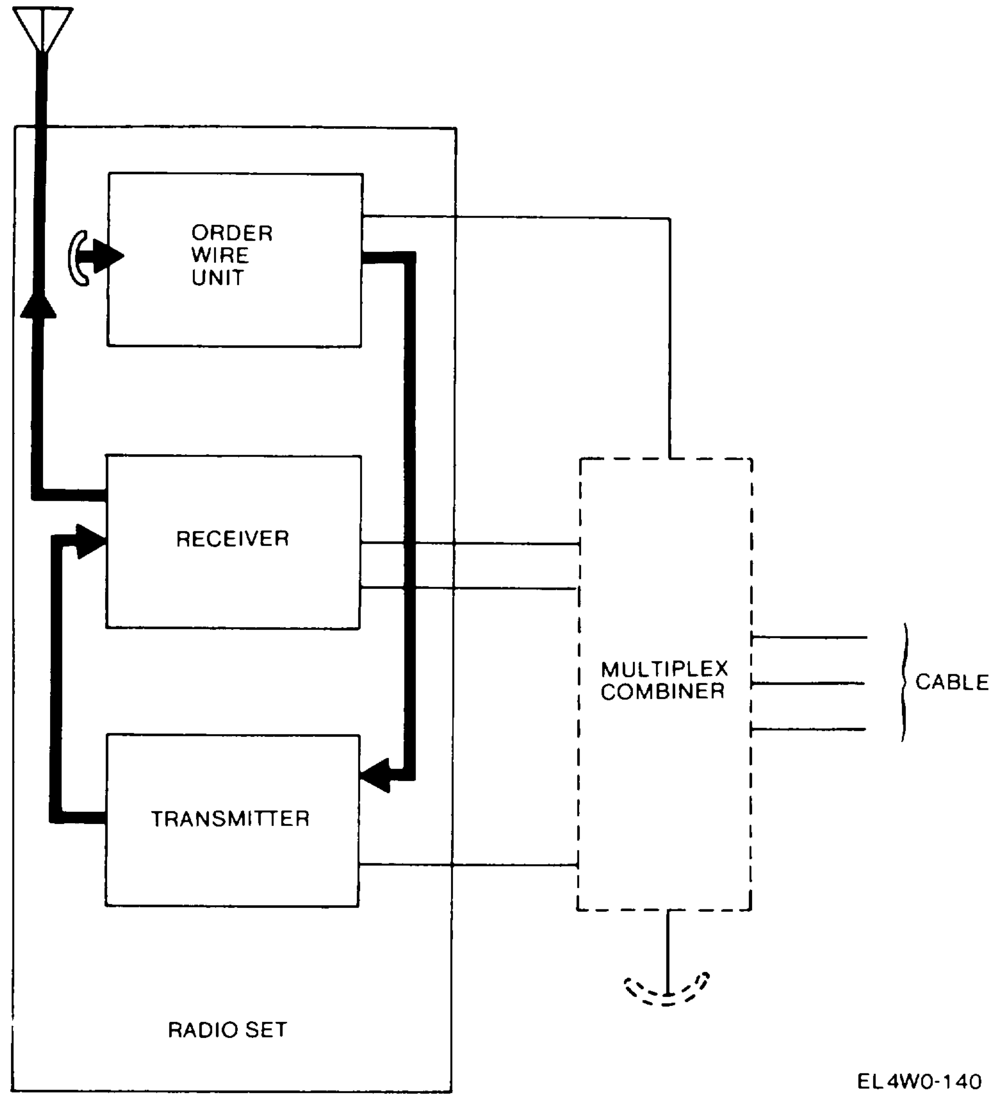
Signals from the telephone transmission cable are reconditioned in the combiner and applied as modulation to the transmitter. They are passed through the receiver to the antenna.

1-19. SYSTEM APPLICATION-Continued



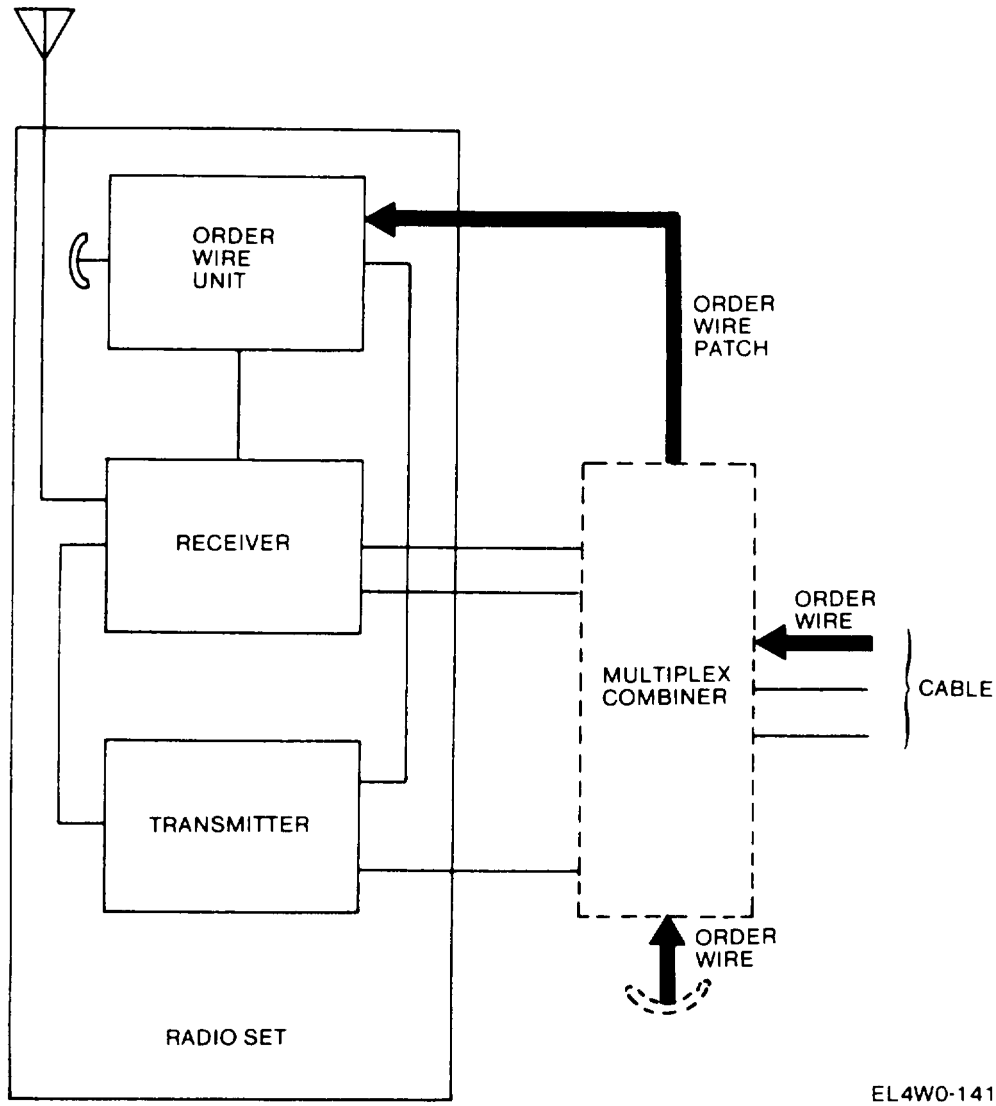
Incoming order wire signals are recovered in the receiver and fed to the order wire unit.

1-19. SYSTEM APPLICATION-Continued



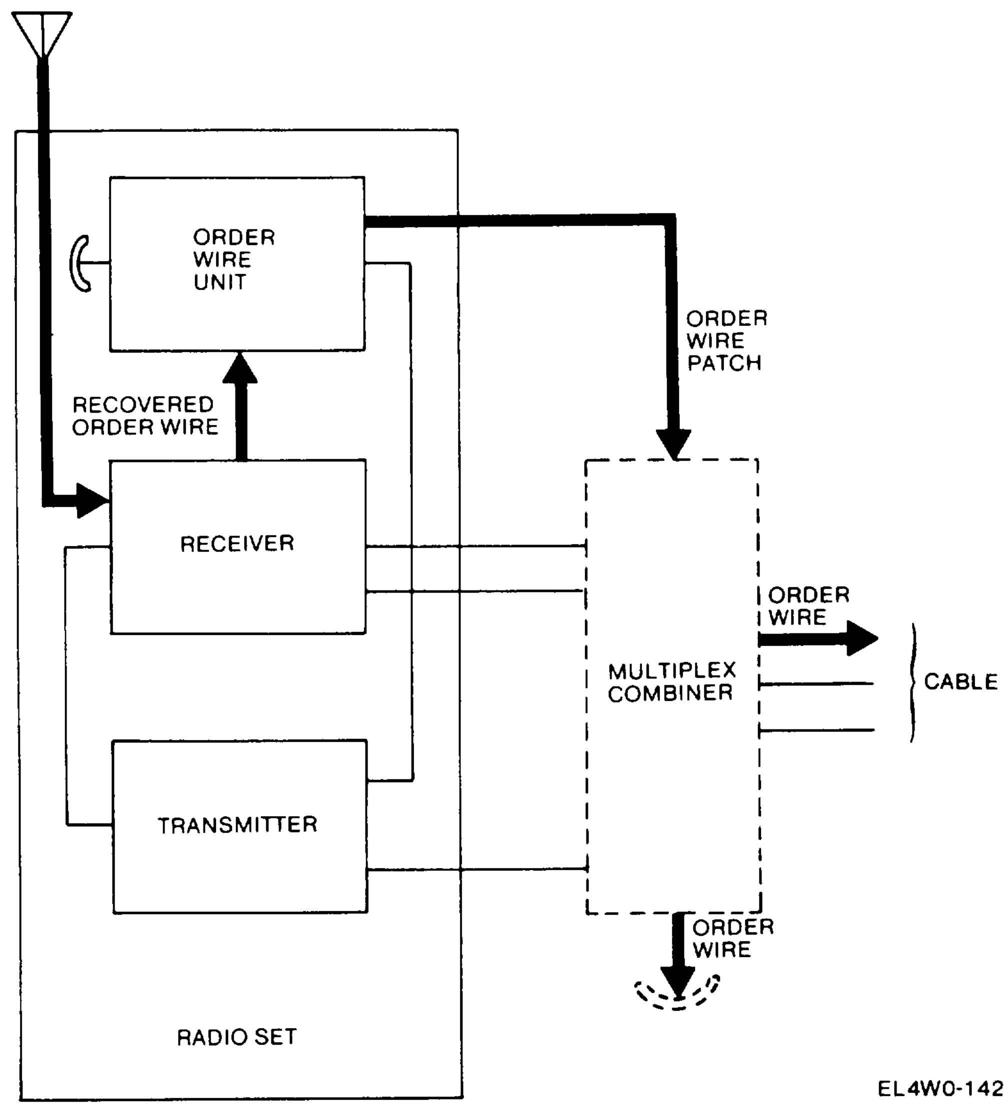
Signals originating at the order wire unit are fed directly to the transmitter and passed to the antenna through the receiver.

1-19. SYSTEM APPLICATION - Continued



Order wire signals may also be originated at a handset associated with the multiplex combiner or at the distant telephone cable. There signals are fed to the order wire unit through an order wire patch connection.

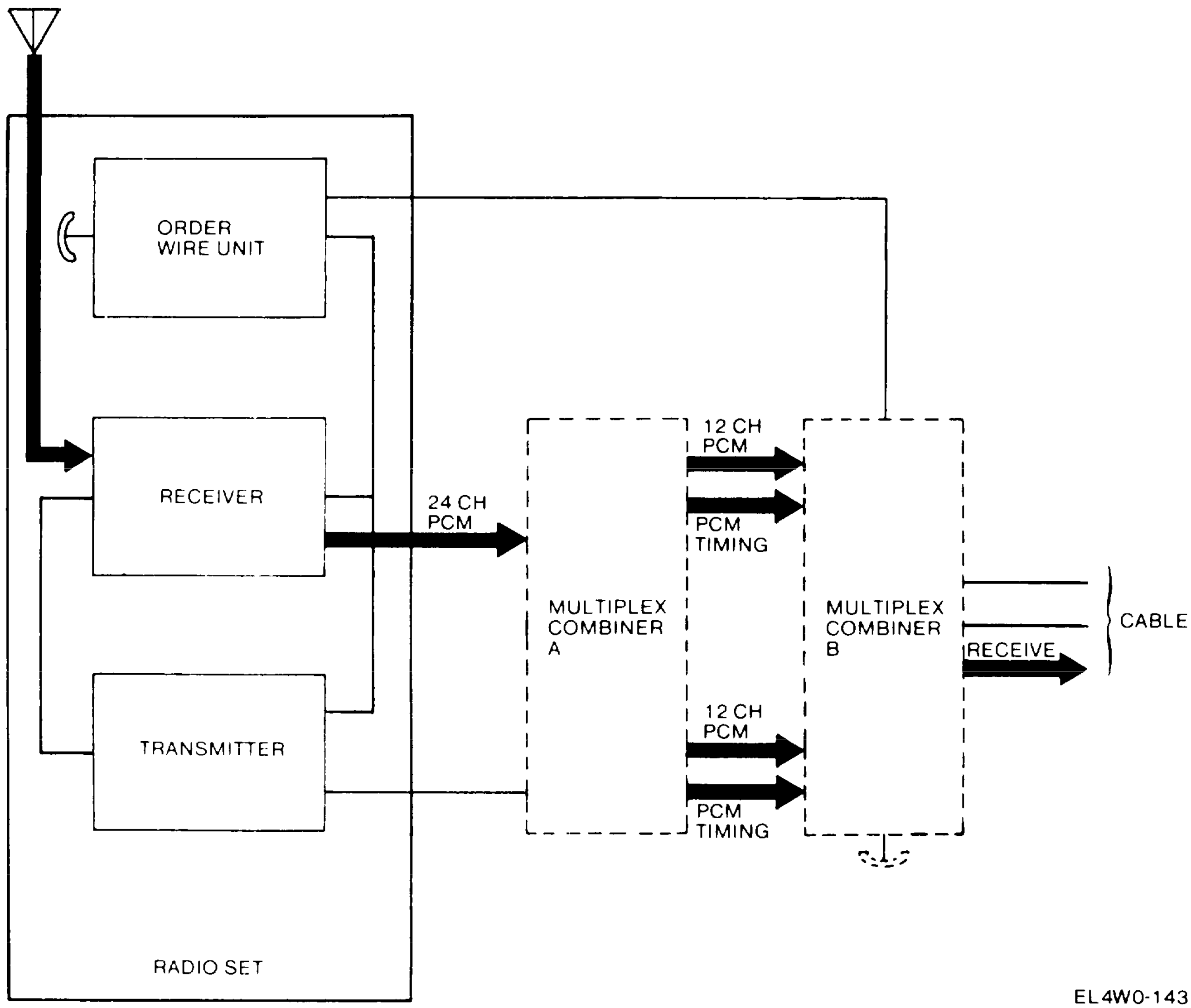
1-19. SYSTEM APPLICATION - Continued



Order wire signals may also be received at a handset associated with the multiplex combiner or at the distant telephone cable. Recovered order wire signals from the receiver are passed to the order wire unit and then fed over an order wire patch connection to the multiplex combiner.

1-19. SYSTEM APPLICATION - Continued

• 24-CHANNEL RADIO-TO-CABLE CONVERSION



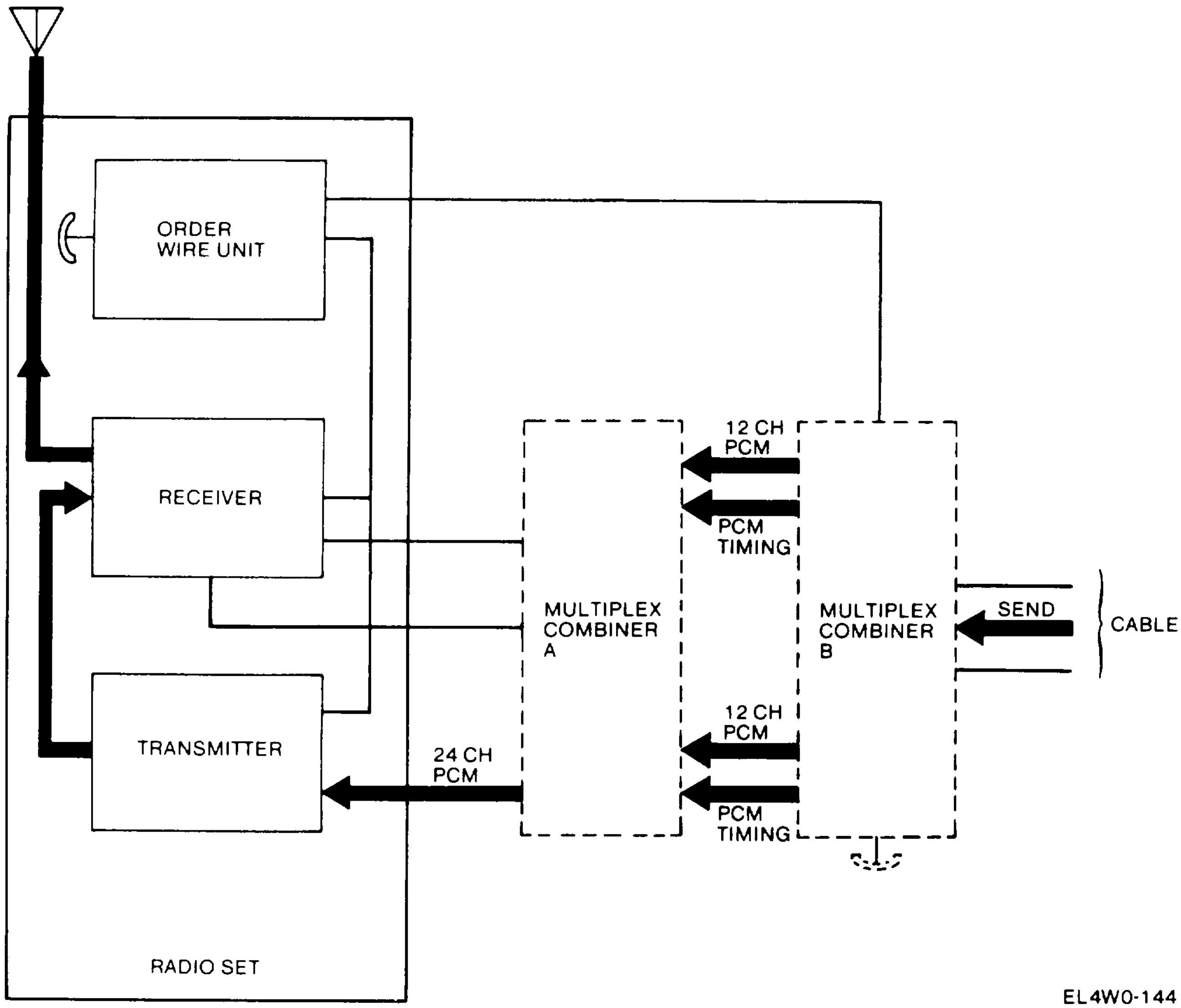
EL4W0-143

24-channel operation requires two multiplex combiners. The second combiner provides pcm signal regeneration and order wire recovery Pcm signals from the receiver are fed to combiner A, where they are regenerated Combiners A feeds these signals and its own timing pulses to combiner B for application to the telephone transmission cable.

NOTE

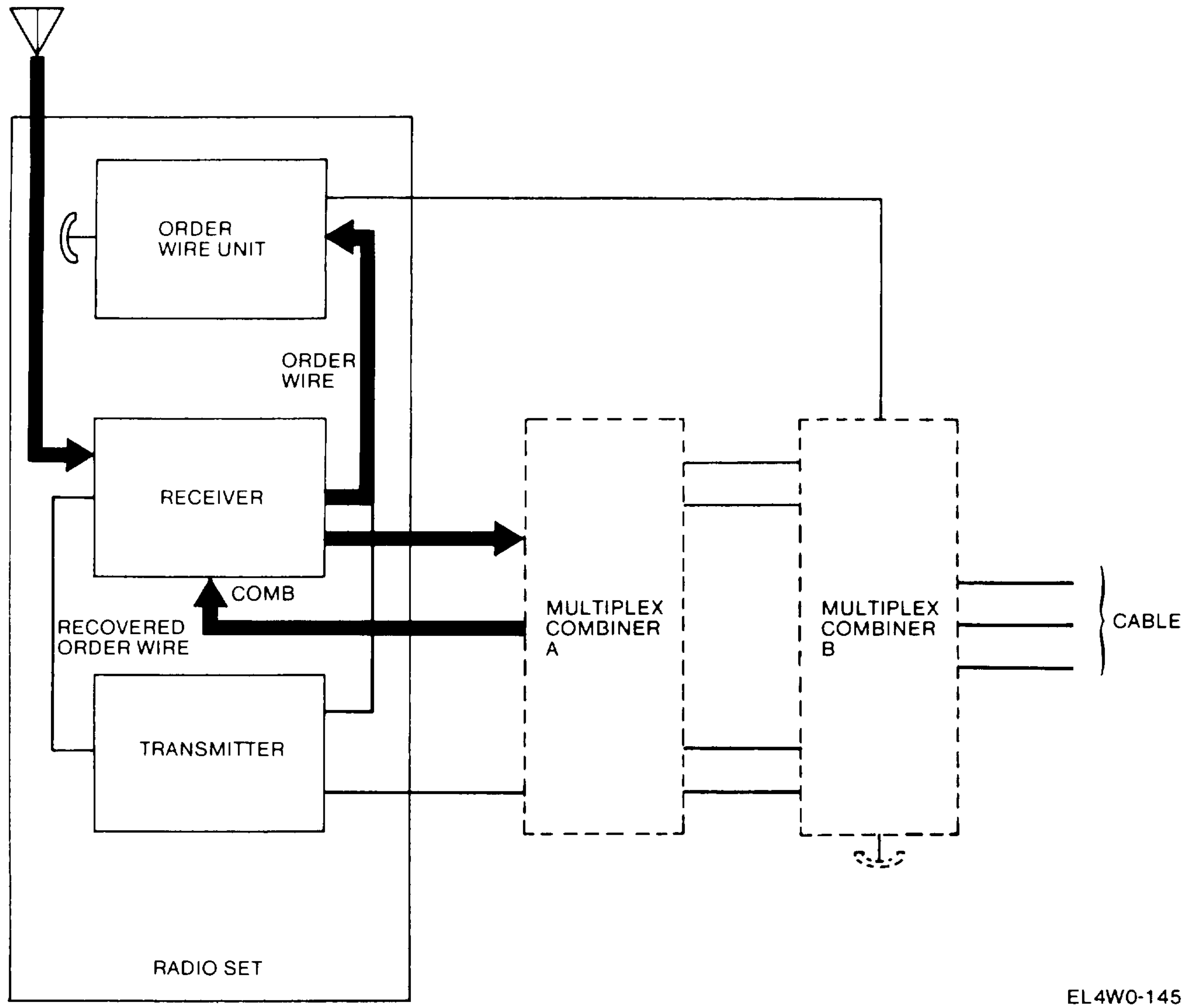
Radio sets using Receiver. Radio R-1329 C(P)GRC-103(V) have the capability of regenerating both 12 and 24 channel pcm without the aid of an external multiplexer/ combiner. In Receiver, Radio R-1329 C(P)/GRC-103(V) regeneration of the 24 channel pcm stream is accomplished within the dual rate pulse form restorer in the receiver itself, thus simplifying system setup for 24 channel operation. As in 12 channel operation, the regenerated 24 channel operation the regenerated 24 channel pcm of 1152 kb/s and its associated timing signal (of 1152 kHz) are available at the PCM and TMG outputs respectively at the rear of the receiver.

1-19. SYSTEM APPLICATION - Continued



Inputs from the cable are passed through combiner B to combiner A and fed to the transmitter, From the transmitter they are sent to the antenna through the receiver.

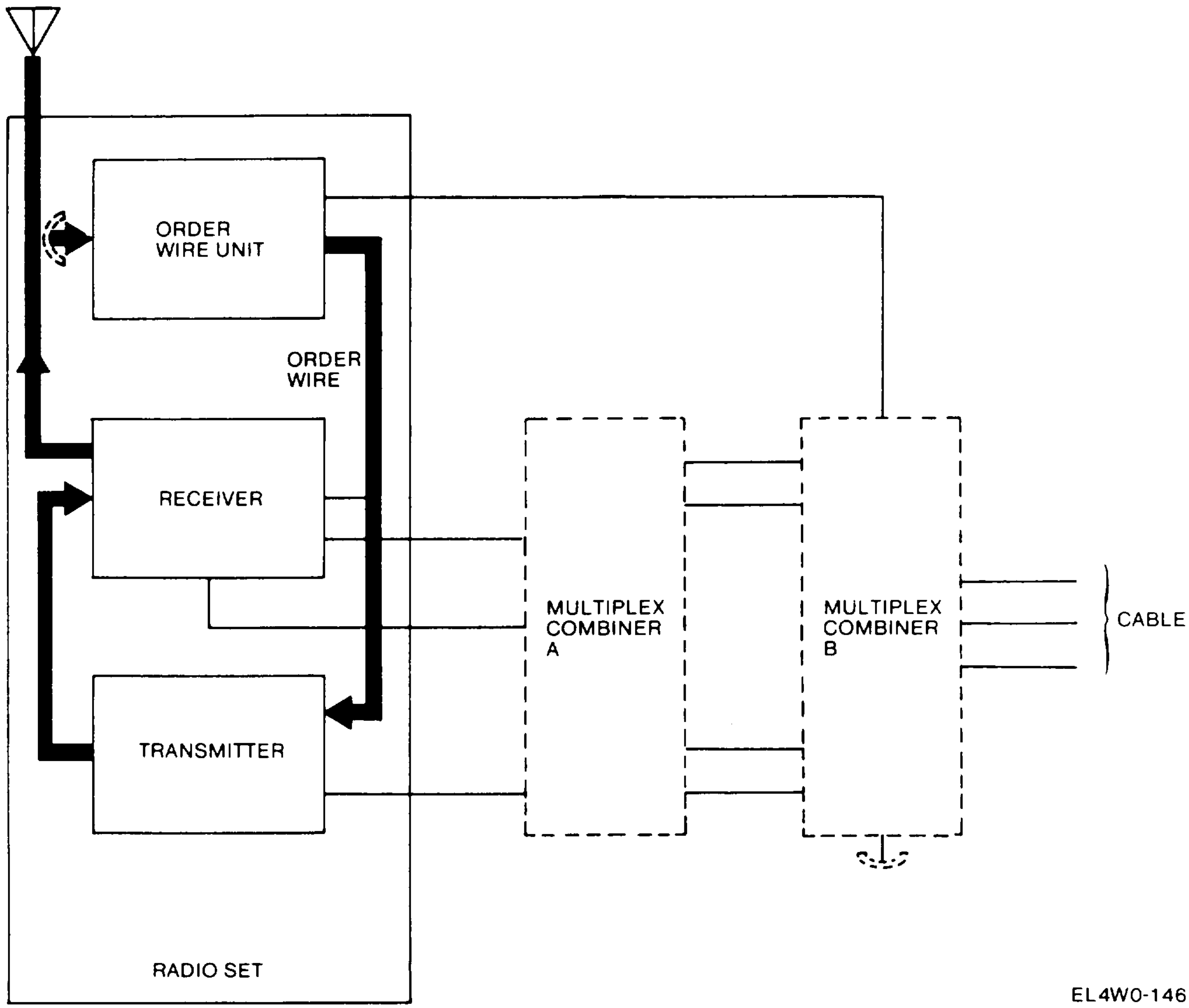
1-19. SYSTEM APPLICATION-Continued



EL4W0-145

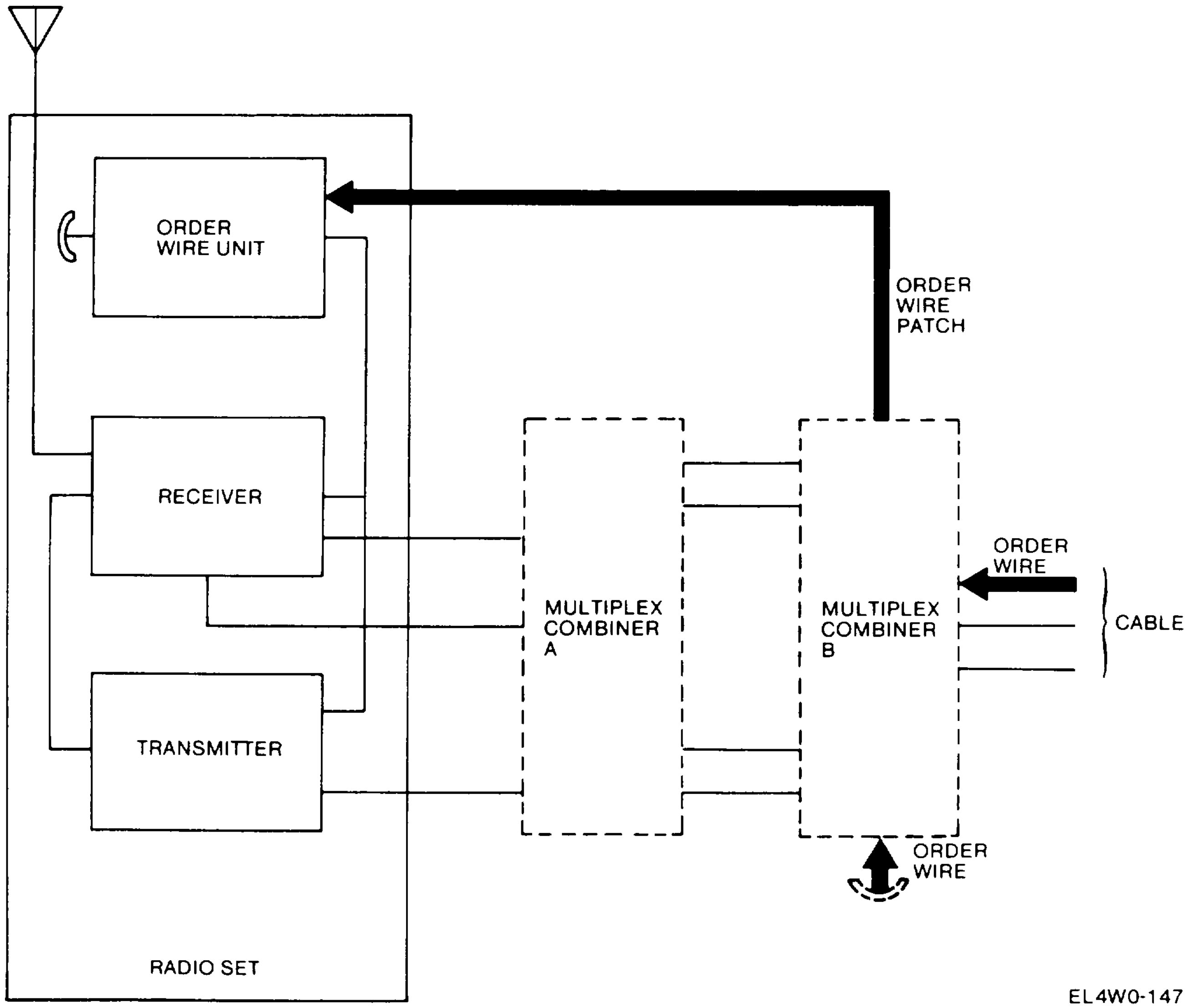
Order wire input is passed through the receiver to combiner A, where it is recovered and sent to the order wire unit through the receiver.

1-19. SYSTEM APPLICATION - Continued



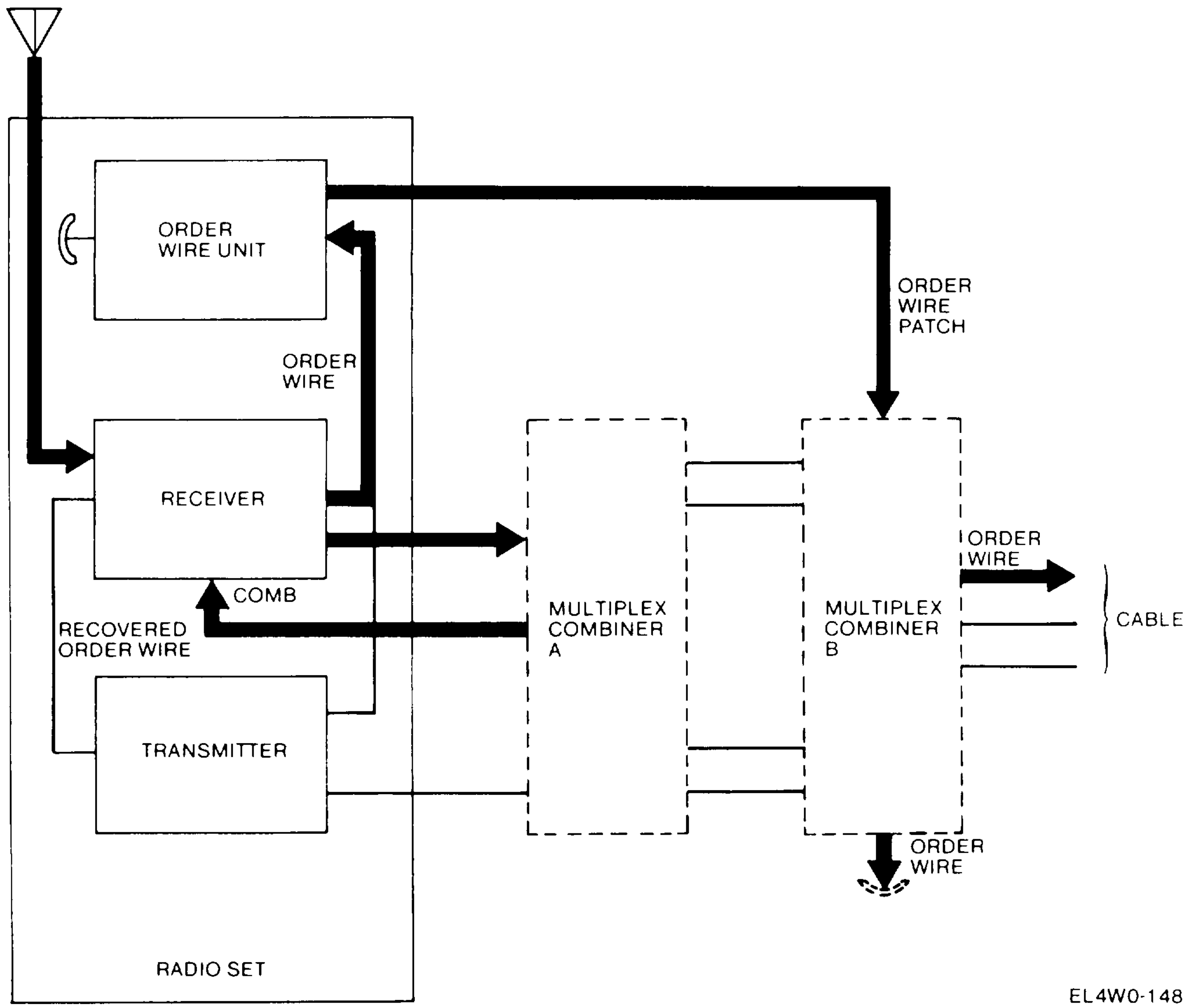
Signals originating at the order wire unit are fed directly to the transmitter and passed to the antenna through the receiver.

1-19. SYSTEM APPLICATION - Continued



Order wire signals may also be originated at a handset associated with combiner B or at the distant telephone cable. These signals are fed to the order wire unit through an order wire patch connection.

1-19. SYSTEM APPLICATION - Continued



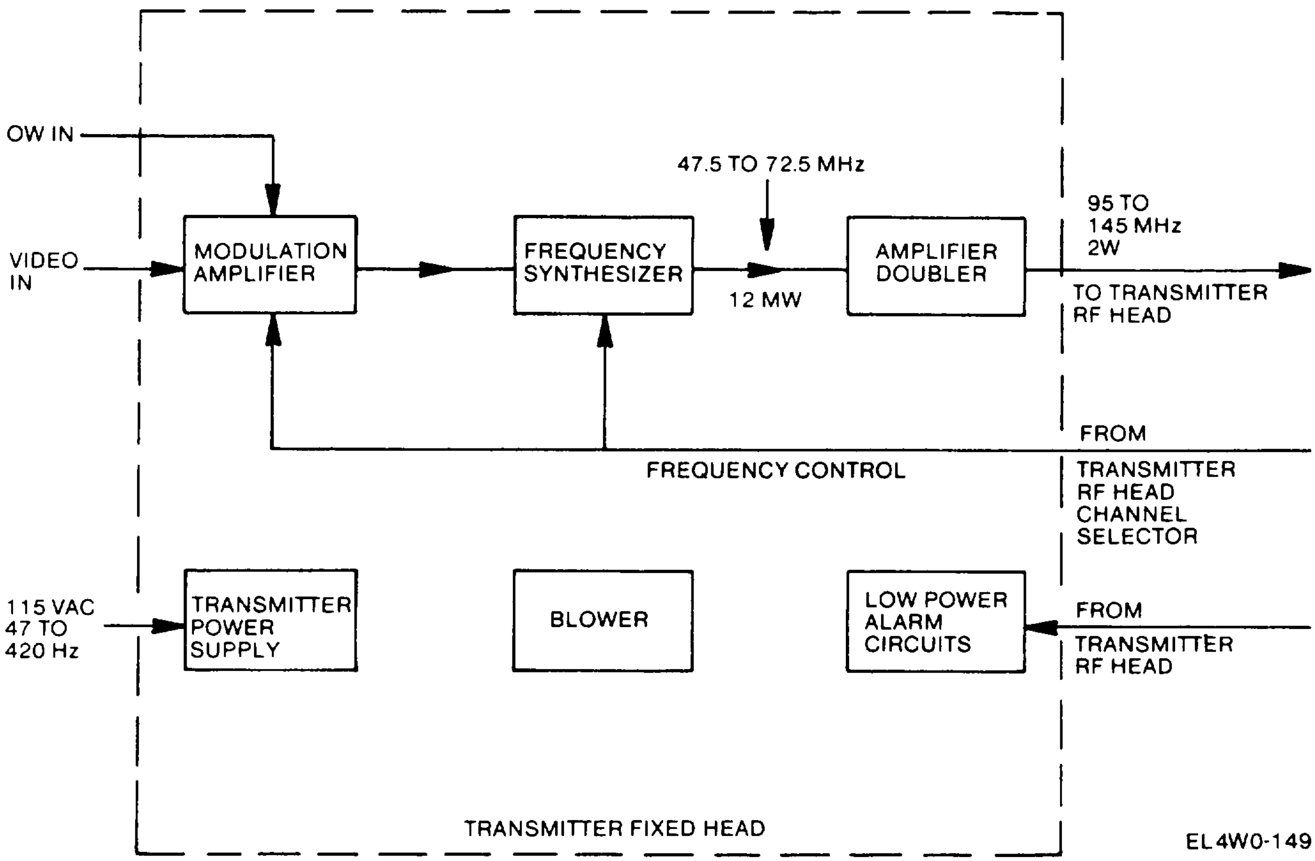
Order wire signals may also be received at a handset associated with combiner B or at the distant telephone cable. Recovered order wire signals from combiner A are fed through the receiver to the order wire unit. From the order wire unit they are sent to combiner B through an order wire patch connection.

1-20. BASIC FUNCTIONS

The radio set is divided into three major functional as well as physical, components: the radio transmitter the radio receiver, and the order wire and signal.

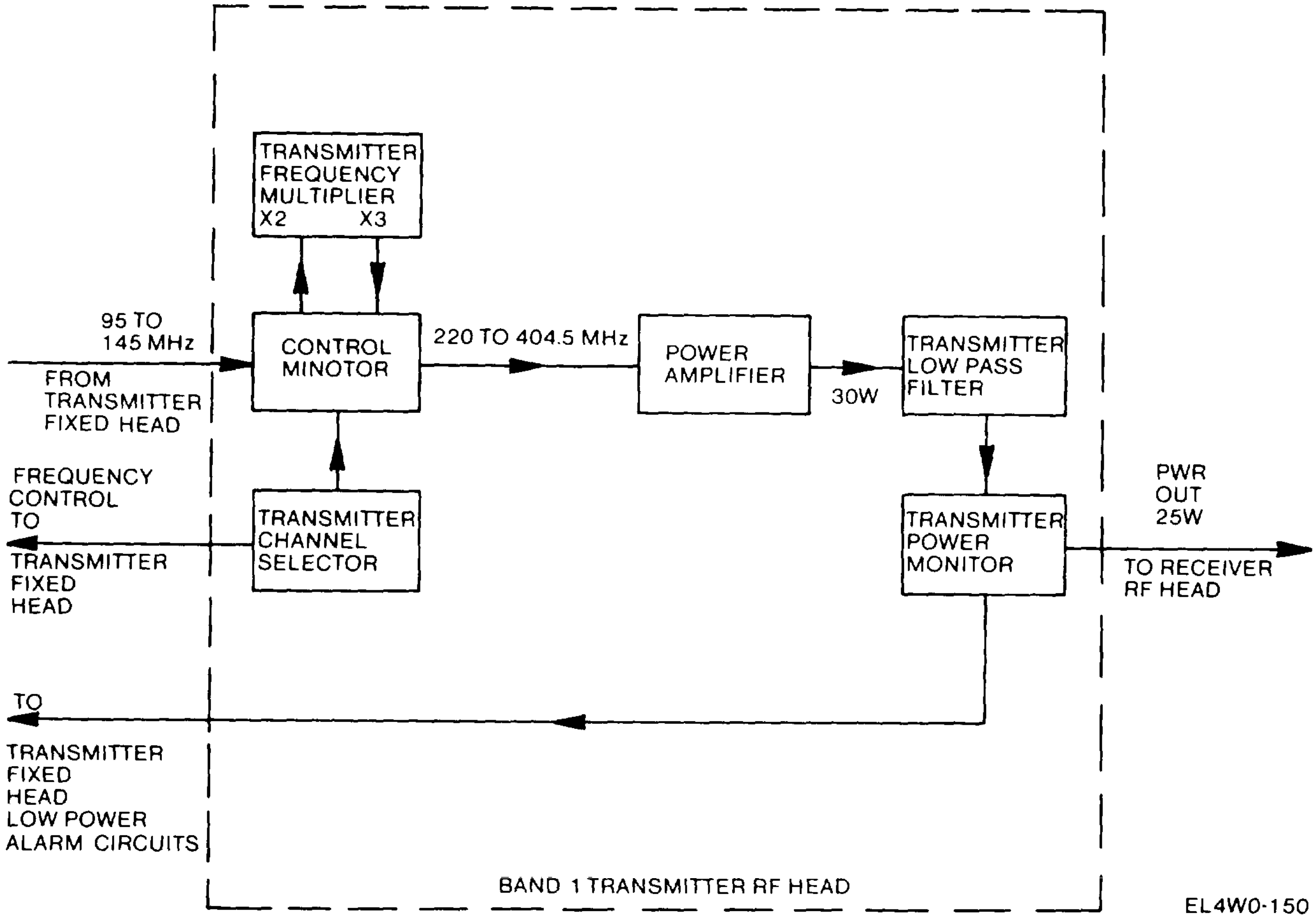
I RADIO TRANSMITTER

The radio transmitter contains the circuits necessary for the transmission of baseband information from telephone equipment as an fm signal. It consists of two components: the radio transmitter (transmitter fixed head) and the amplifier-frequency multiplier (transmitter rf head).



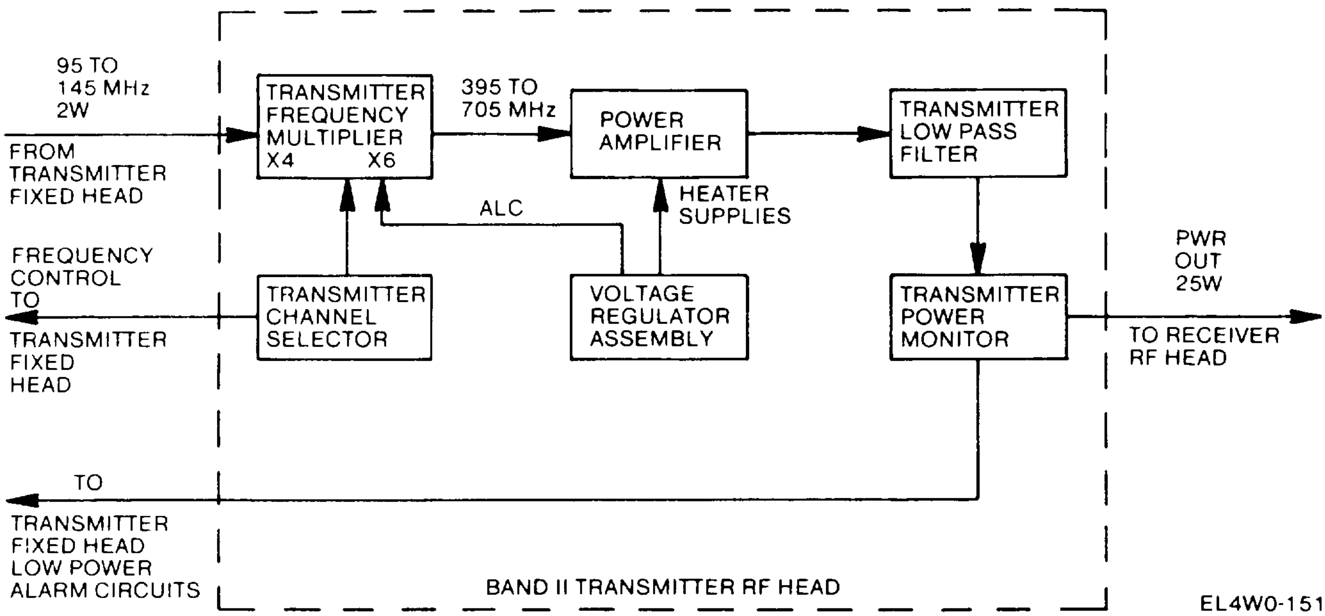
The transmitter fixed head functions in the same way for all bands. It accepts input audio modulation signals from multiplex equipment and order wire signals. These two are combined in a modulation amplifier and applied to a crystal controlled frequency synthesizer to produce an fm output. The frequency synthesizer generates the basic channel frequencies in steps, depending on the multiplication factor used. The desired frequency is selected by the channel selector in the transmitter rf head. The output of the synthesizer is doubled in frequency and amplified to a power of 2 watts. The resulting rf signal is fed to the transmitter rf head.

1-20. BASIC FUNCTIONS - Continued

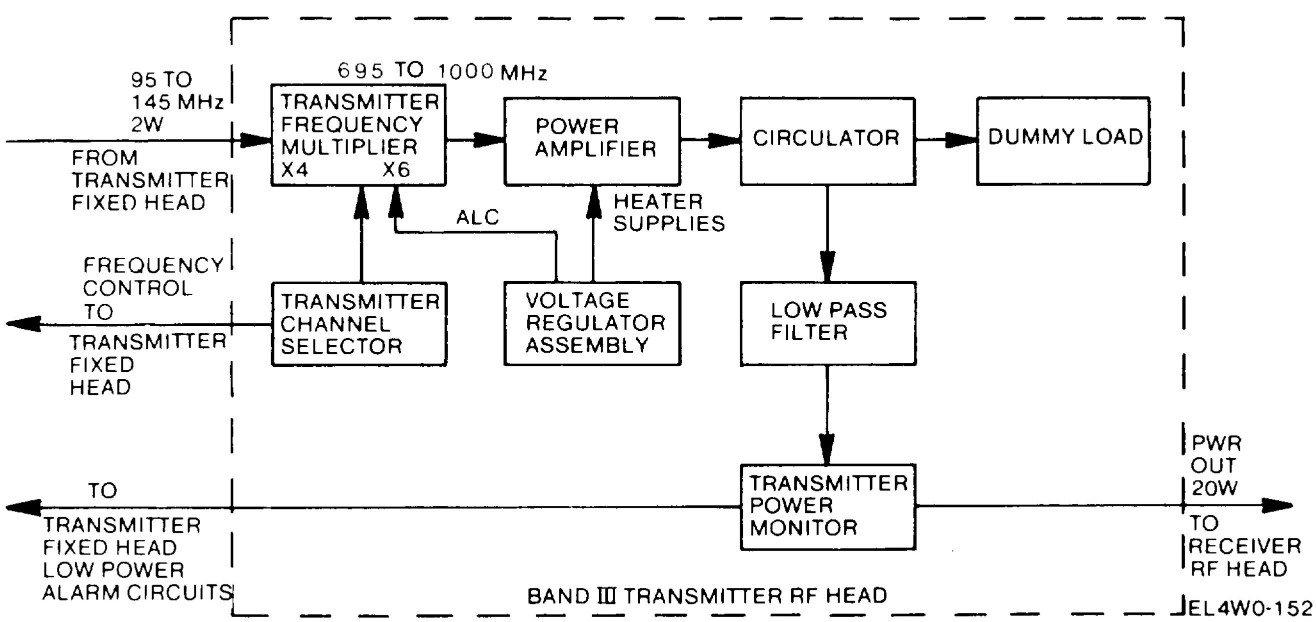


In the Band I transmitter rf head, the rf signal from the transmitter fixed head is fed through control monitor circuits to frequency multipliers which multiply by 2 or 3, depending upon the setting of the channel selector. The output of the frequency multipliers is at the final transmitter frequency. The signal is then amplified in a two-stage power amplifier. After rejection of the harmonics by a low pass filter, it is fed through a power monitor to the antenna through an antenna duplex network in the receiver rf head. The power monitor samples the output, and should it fall below approximately 4 watts, a low power alarm circuit in the transmitter fixed head wiIl energize a buzzer and light a warning lamp.

1-20. BASIC FUNCTIONS - Continued

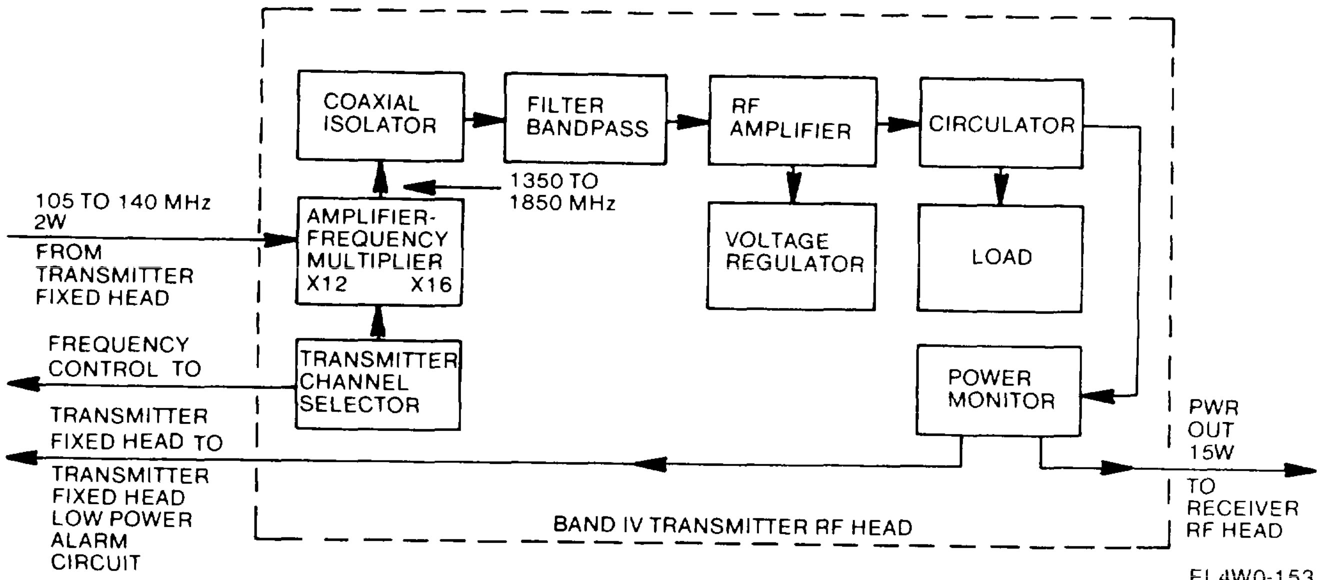


The Band II transmitter rf head functions in the same manner as that for Band I except that it does not contain a control monitor, frequency multiplication is by 4 or 6; and, a voltage regulator is used.



The Band III transmitter rf head functions in the same manner as that for Band I except that it does not contain a control monitor: frequency multiplication is by 6 or 8, and, a voltage regulator, a circulator, and a dummy load are used.

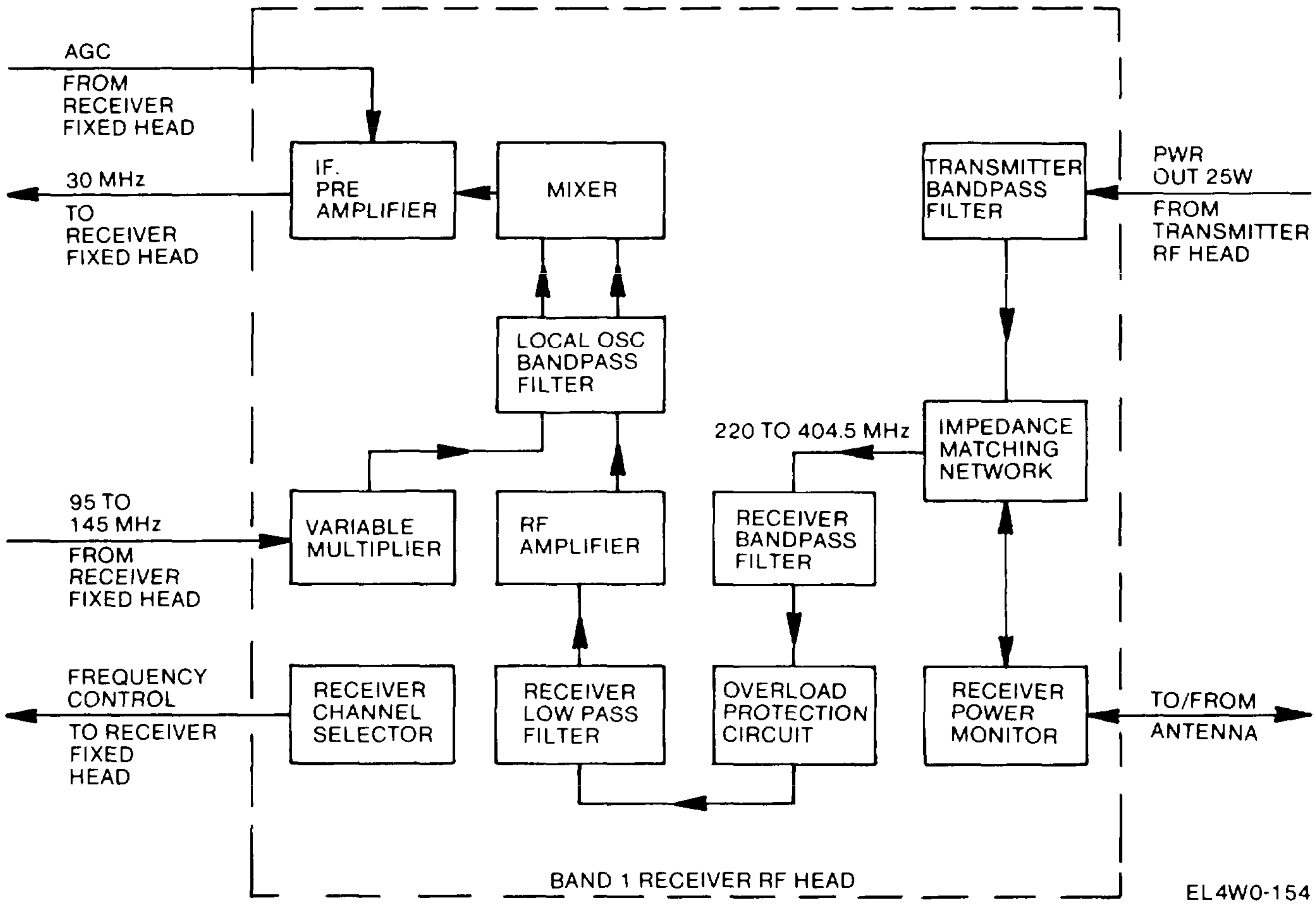
1-20. BASIC FUNCTIONS-Continued



The Band IV transmitter rf head functions in the same manner as that for Band I except that it does not contain a control monitor; frequency multiplication is by 12 or 16; and, a coaxial isolator and band-pass filter, as well as a circulator and dummy load, are employed.

The radio receiver includes all the circuits necessary for the reception and demodulation of the fm signal and, in 12-channel configurations, regeneration of the baseband information. It consists of two components: an amplifier-converter (receiver rf head) and a radio receiver (receiver fixed head).

1-20. BASIC FUNCTIONS - Continued



The Band I receiver rf head contains the antenna duplexing network and the circuits necessary to convert the incoming signal to an intermediate frequency (if,) of 30 MHz for application to the receiver fixed head.

The output of the transmitter rf head is applied to the antenna through a tunable bandpass filter, an impedance matching network and an rf power monitor. The rf power monitor measures the transmitter power to the antenna and transmitter reflected power from the antenna.

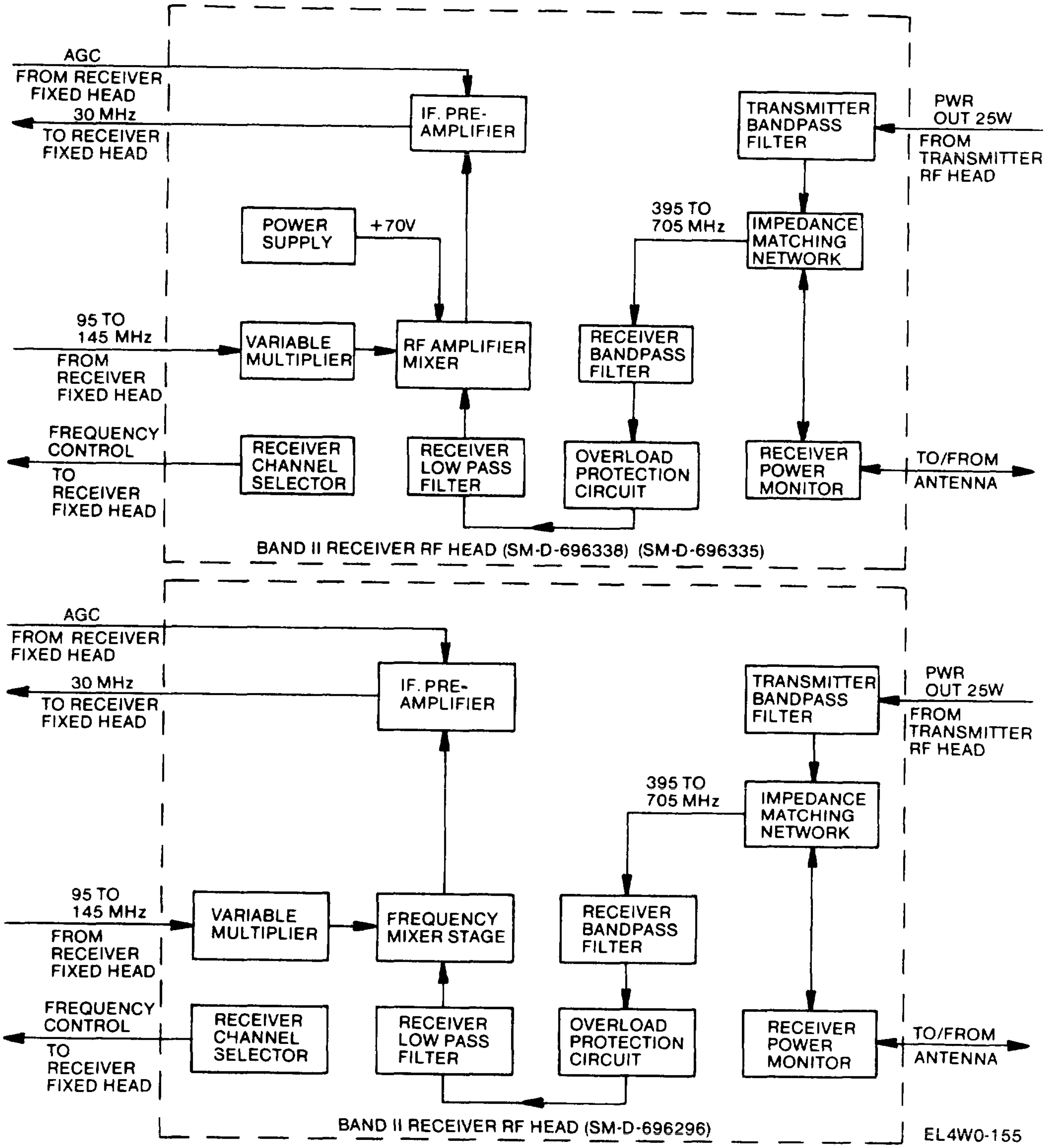
Signals received from the antenna are fed through the rf power monitor, impedance matching network, a tunable bandpass filter, an overload protection circuit, and a low pass filter to a wide-band low noise rf amplifier. The overload protection circuit protects the receiver from the effects of input signals exceeding –10 dBm.

The output of the rf amplier is fed through another tunable bandpass filter to a mixer. At the mixer it is combined with the local oscillator frequency to produce a 30 MHz if. ourput which is amplified in an if. preamplifier and passed to the receiver fixed head.

The local oscillator frequency is generated by crystal-controlled frequency synthesizer circuits and a frequency doubler in the receiver fixed head, followed by frequency multiplication in the receiver rf head.

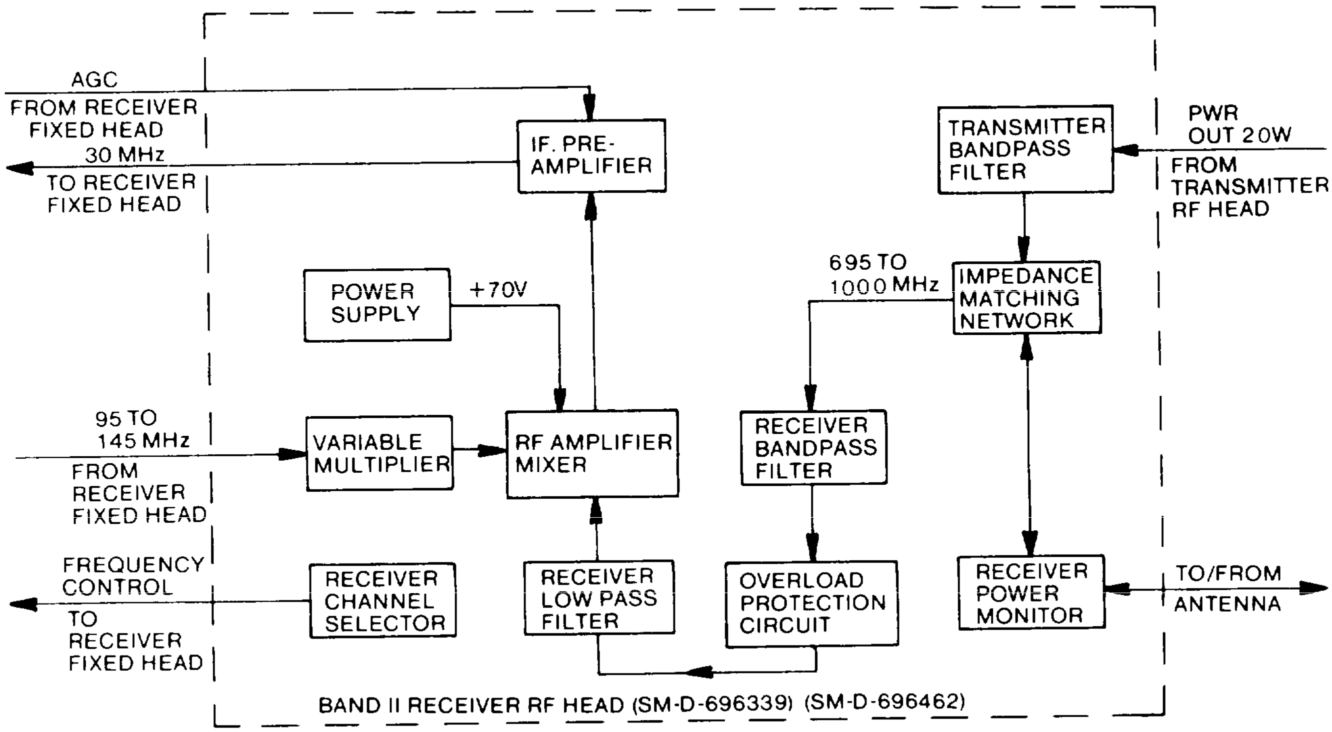
The frequency synthesizer is identical to that used in the transmitter fixed head. It is controlled by the receiver channel selector in a similar way except that the frequency after final multiplication is 30 MHz higher to provide the 30 MHz if.

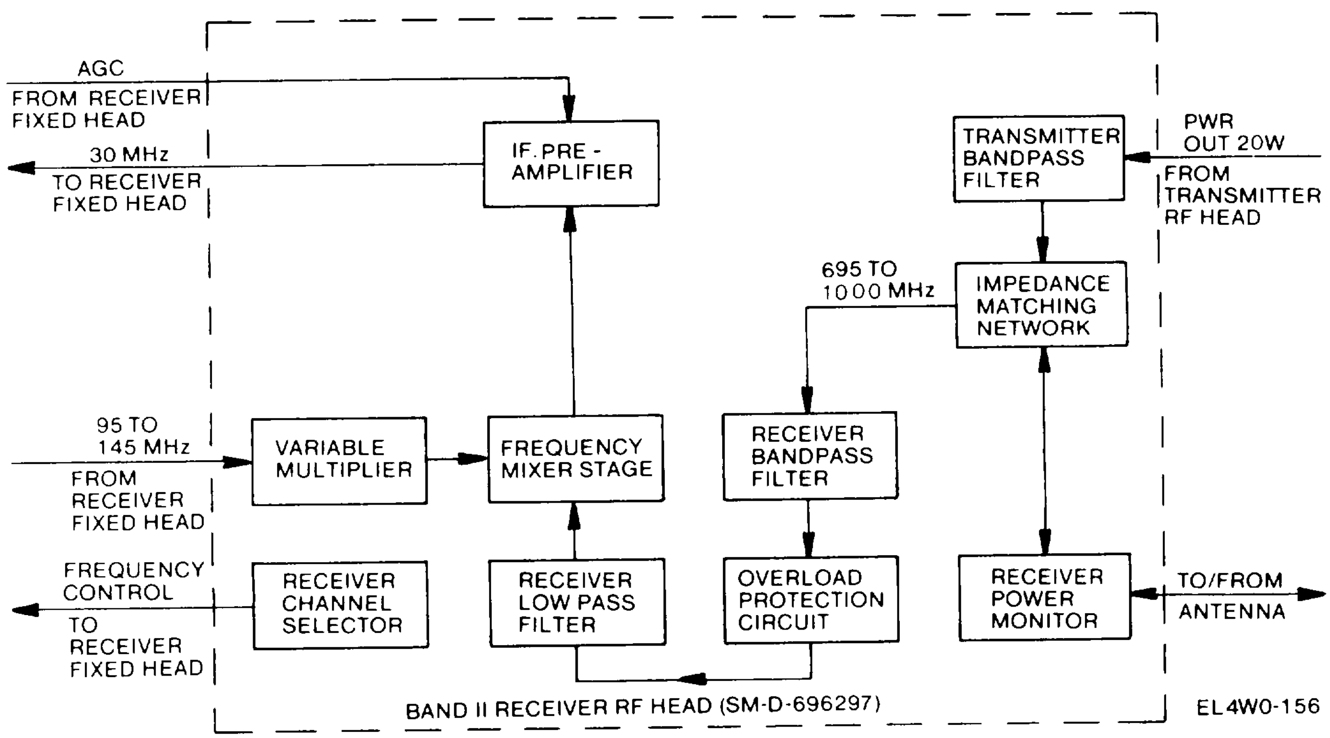
1-20. BASIC FUNCTIONS - Continued



The Band II rf head functions in the same manner as that for Band I except for the frequency mixing stage. The earlier versions of the Band II rf head, SM-D-696339 and SM-D-696335, employ an rf amplifier mixer and power supply. The later version, SM-D-696296, employs a frequency mixer stage.

1-20. BASIC FUNTCIONS - Continued

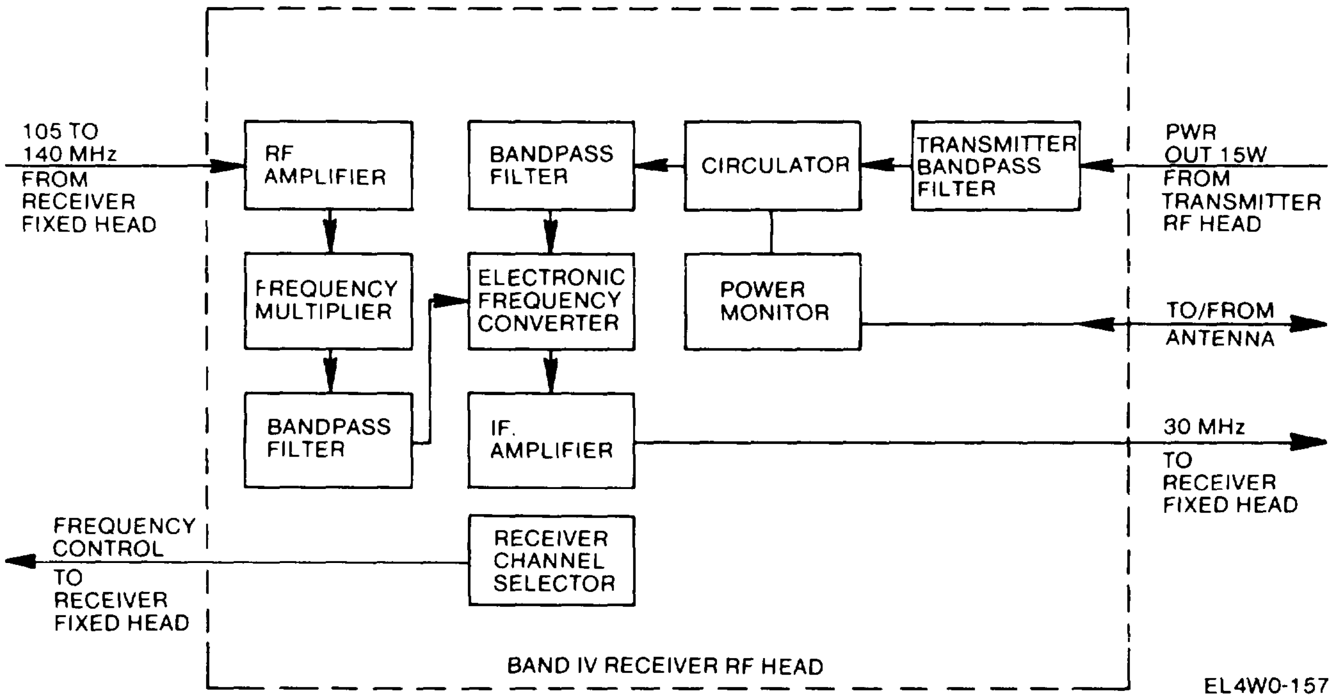




EL4W0-156

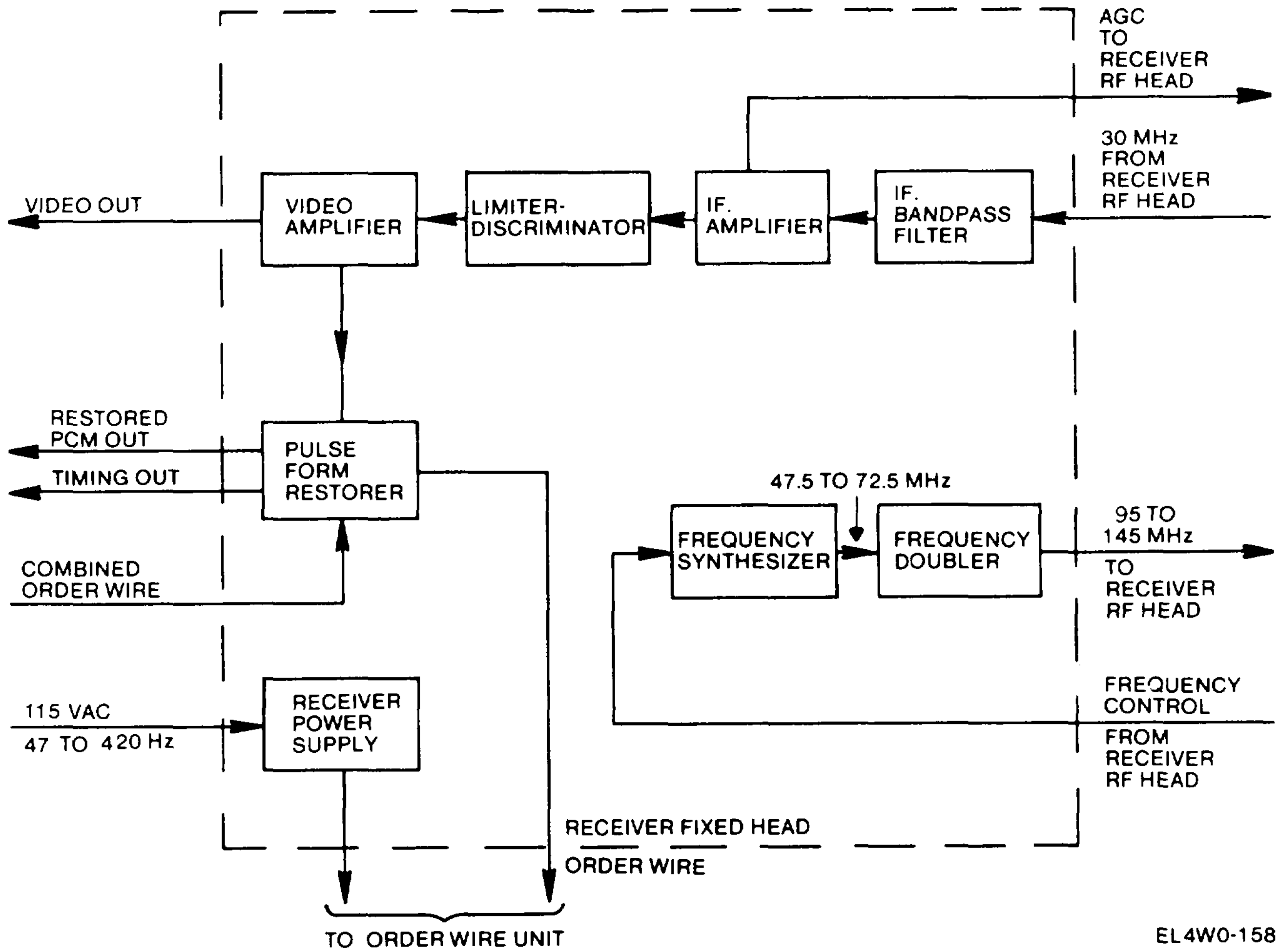
The Band Ill rf head functions in the same manner as that for Band I except for the frequency mixing staqe. The earlier versions of the Band Ill rf head, SM-D-696339 and SM-D-696462, employ an rf amplifier mixer and power supply. The later version, SM-D-696297, employs a frequency mixer stage.

1-20. BASIC FUNCTIONS-Continued



The Band IV rf head functions in the same manner as that for Band I except that it employs a circulator instead of an impedance matching network, the frequency mixing circuitry consists of an rf amplifier, frequency multiplier, bandpass filter and electronic frequency converter, and it has no overload protection circuit.

1-20. BASIC FUNCTIONS - Continued



EL4W0-158

The receiver fixed head amplifies and demodulates the if, output from the receiver rf head. The if. signal from the receiver rf head is fed through an if. bandpass filter to an if, amplifier. The output of the if. amplifier is detected in a limiter discriminator, and the resulting signal is amplified in a video amplifier. A low level video output is provided. An additional output from the video amplifier is fed to pulse from restorer circuits.

For radio sets using Receiver, Radio R-1329(P)/GRC-103(V), R-1329A(P)/GRC-103(V), or R-1329B(P)/GRC-103(V), the pulse form restorer provides a regenerated 12-channel pcm output, a 576-kHz timing pulse output, and an order wire output. The order wire signal from a multiplex combiner unit is routed through the pulse form restorer when the receiver is operating in the 24-channel pcm mode.

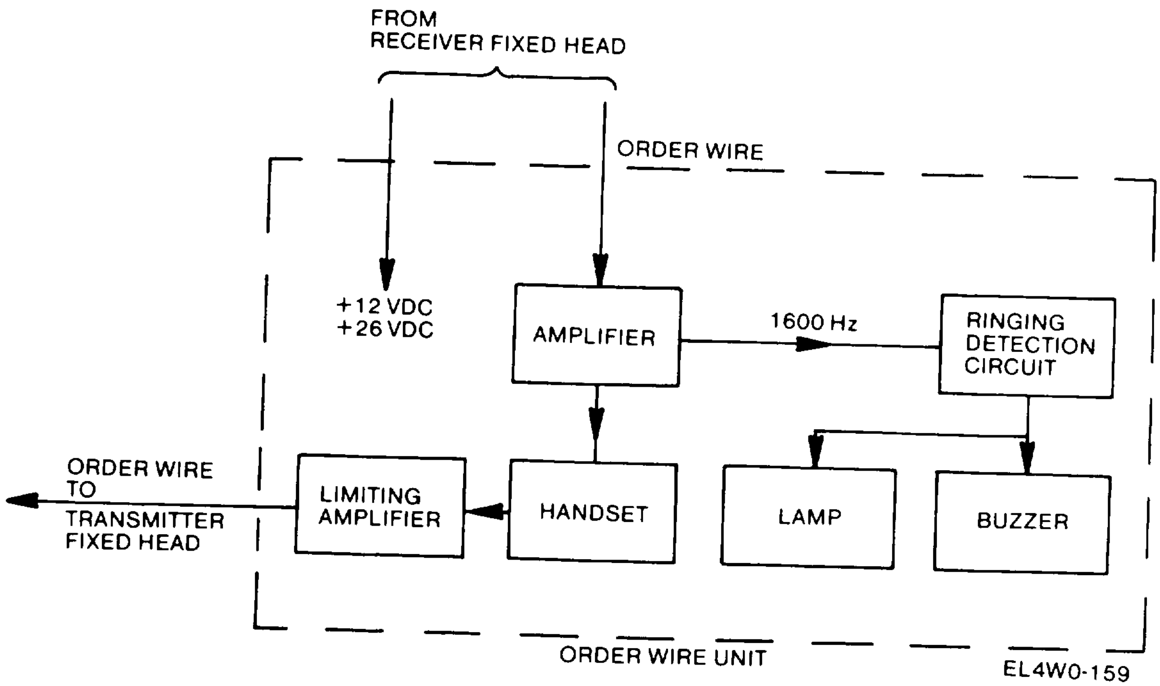
For radio sets using Receiver, Radio R-1329C(P)/GRC-103(V), the pulse form restorer provides both regenerated 12- and 24-channel pcm output, 576 and 1152 kHz timing pulse outputs, and an order wire output. The order wire signal is regenerated by the pulse form restorer circuits in both 576 and 1152 kb/s modes of operation.

The receiver fixed head contains a frequency synthesizer and doubler whose output is provided to the frequency mixing portion of the receiver rf head. The synthesizer is controlled by the receiver channel selector in the receiver rf head.

The receiver fixed head power supply also provides +12 and +26 Vdc to the order wire unit.

1-20. BASIC FUNCTIONS - Continued

c ORDER WIRE AND SIGNAL



The order wire unit amplier circuits provide the proper audio levels to the handset and from the handset to the transmitter fixed head. A 1,600 Hz signaling tone is generated for operation of the call buzzer.

CHAPTER 2
OPERATING INSTRUCTIONS

Section I. DESCRIPTION AND USE OF OPERATOR'S CONTROL AND INDICATORS

2-1. GENERAL

Improper settings of the controls will cause damage to the radio set unless the following precautions are taken:

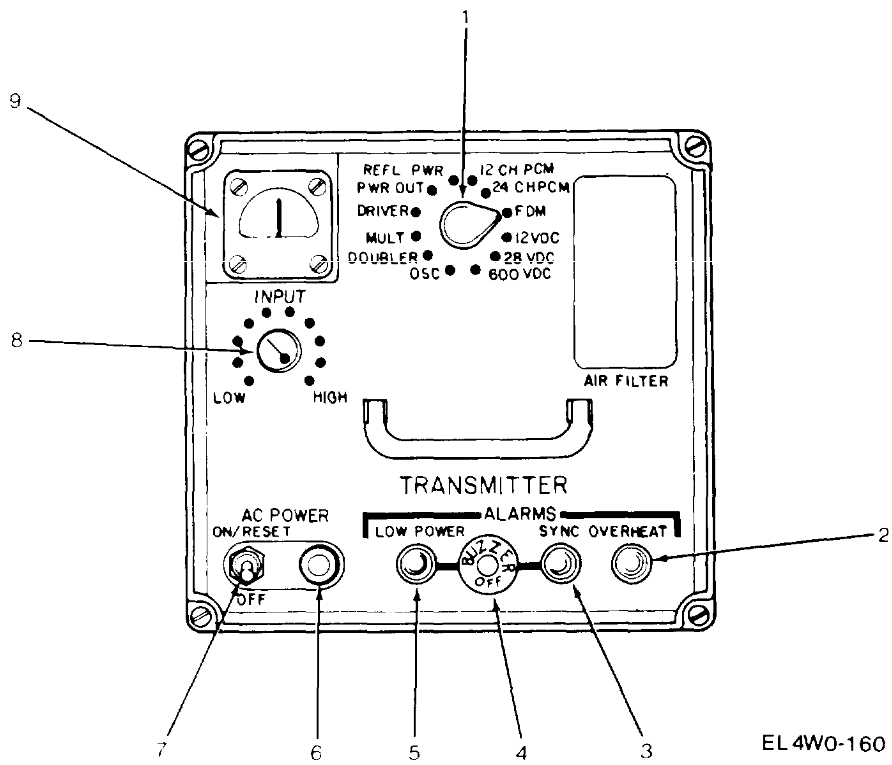
- Make sure that the transimitter frequency is compatible with receiver frequency by using the receiver overload chart as described in appendix E.

- Before placing the radio set into operation, make certain it is properly connected to a primary source and that the potential is not higher than 120 Vac.

NOTE

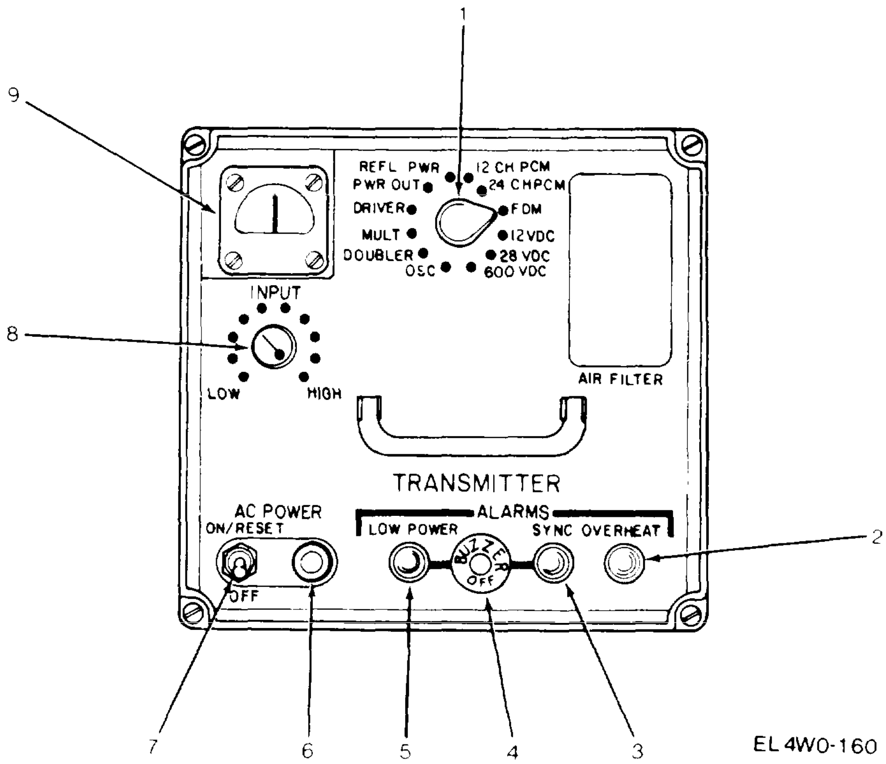
Facilities are included in the radio set for silencing buzzers and dimming alarm lamps during forward area operation. This is accomplished by means of BUZ OFF/ALM NOR switches inside the transmitter and receiver fixed heads and order wire unit.

2-2. RADIO TRANSMITTER CONTROLS AND INDICATORS



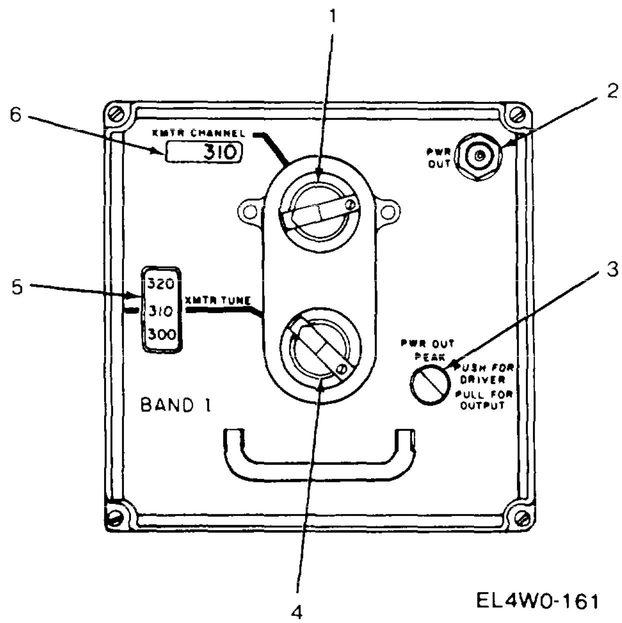
Key	Control of Indicator	Function
1	Meter switch	Connects meter to any one of 12 circuits
	OSC	Output of basic frequency generating circuits
	DOUBLER	Output of transmitter fixed level
	MULT	Input to driver rf amplifier
	DRIVER	Output of driver rf amplifier
	PWR OUT	Output of final rf amplifier
	REFL PWR	Reflected rf power from transmitter section of duplexer
	12 CH PCM	12-channel pcm modulation level
	24 CH PCM	24-channel pcm modulation level

2-2. RADIO TRANSMITTER CONTROLS AND INDICATORS-Continued



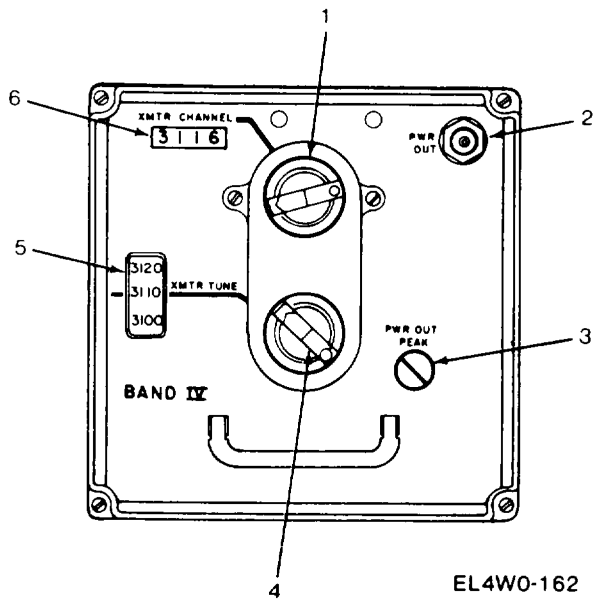
Key	Control or Indicator	Function
1	Meter switch (Cont)	
	FDM	FDM modulation
	12 VDC	12-volt power supply level
	28 VDC	28-volt power supply
	600 VDC	600-volt power supply level
2	OVERHEAT lamp	When lighted (red), indicates temperature of output tube has reached +175°
3	SYNC Lamp	When lighted (red), indicates afc in transmitter basic frequency generating circuits is not locking
4	BUZZER OFF pushbutton	Turns buzzer on and off (can be muted by internal BUZ OFF/ALM NOR a switch
5	LOW POWER lamp	When lighted (red), indicates RF power is below a predermined alarm level
6	AC POWER lamp	Lights (green) when power is on
7	AC POWER switch	Turn transmitter power ON and OFF, RESET power supply after overload.
8	INPUT control	Adjusts video input (LOW or HIGHT) to modulation amplifier
9	Meter	Indicates status of parameter selected at meter switch

2-3. AMPLIFIER-FREQUENCY MULTIPLIER BAND I CONTROLS AND INDICATORS



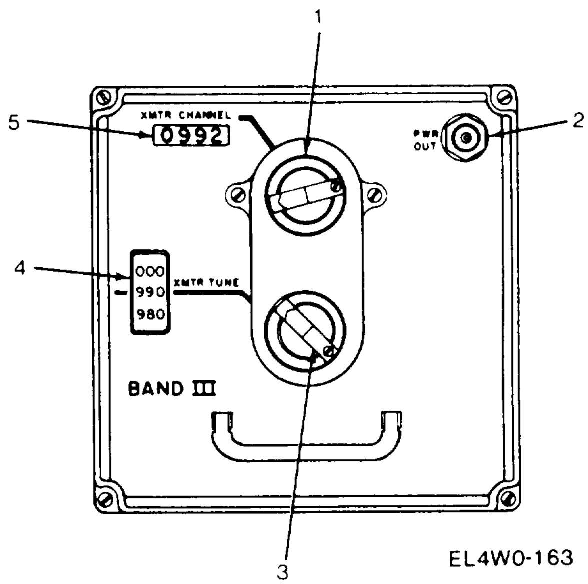
Key	Control of Indicator	Function
1	XMTR CHANNEL control	Selects transmitter channel
2	PWR OUT PEAK connector	Peaks the driver amplifier when the knob is pushed in (PUSH FOR DRIVER) and peaks the final amplifier when the knob is pulled out (PULL FOR OUTPUT.)
4	XMTR TUNE control	Tuner driver and final rf amplifiers
5	XMTR TUNE indicator	Indicates channel to which driver and final rf amplifiers are tuned
6	XMTR CHANNEL indicator	Indicates channel selected

2-4. AMPLIFIER-FREQUENCY MULTIPLIER BANDS II AND III CONTROLS AND INDICATORS



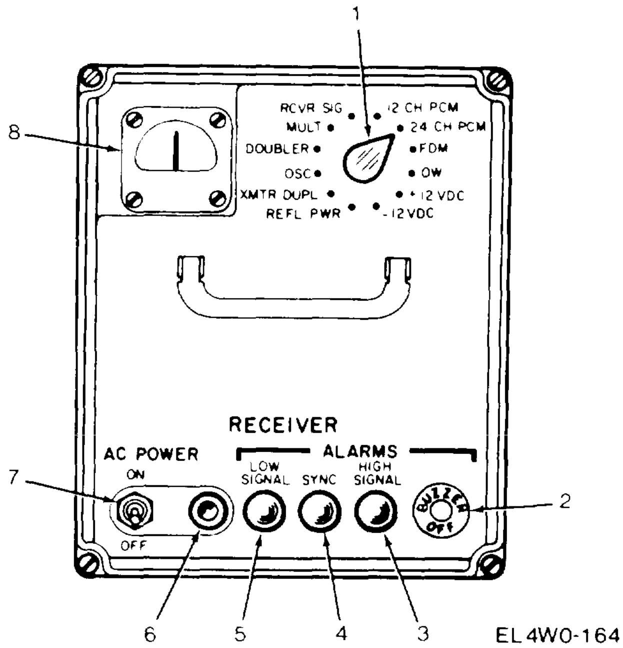
Key	Control of Indicator	Function
1	XMTR CHANNEL control	Selects transmitter channel
2	PWR OUT connector	Connects transmitter output to duplexer in receiver
3	PWR OUT PEAK control	Peaks the driver and final aplifiers simultaneously
4	XMTR TUNE control	Tuner driver and final rf amplifiers
5	XMTR TUNE indicator	Indicates channel to which driver and final amplifier are tuned
6	XMTR CHANNEL indicator	indicates channel selected

2-5. AMPLIFIER-FREQUENCY MULTIPLIER BAND III CONTROLS AND INDICATORS



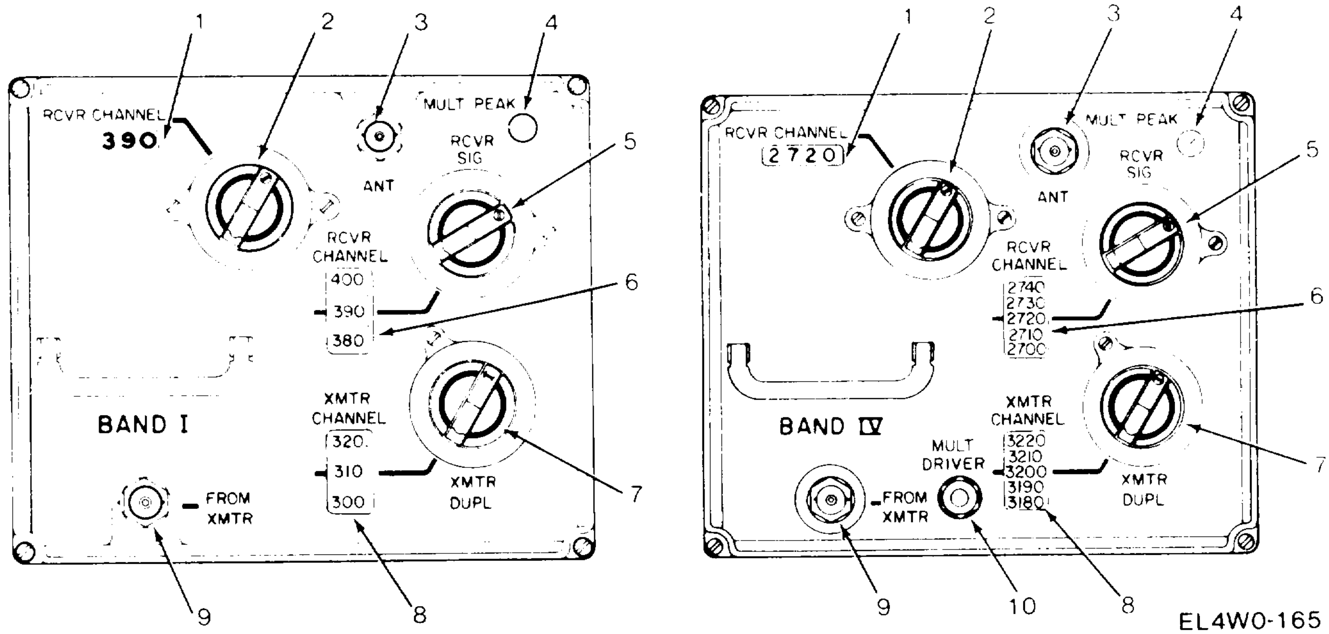
Key	Control or Indicator	Function
1	XMTR CHANNEL control	Selects transmitter channel
2	PWR OUT connector	Connects transmiter output to duplexer in receiver
3	XMTR TUNE control	Tunes driver and final rf amplifiers
4	XMTR TUNE indicator	Indicates channel 10 which driver and final amplifier are tuned
5	XMTR CHANNEL indicator	Indicates channel selected

2-6. RADIO RECEIVER CONTROLS AND INDICATORS



Key	Control or Indicator	Function
'	Meter switch	
	REFL PWR	Reflected rf power level from transmission line and antenna
	XMTR DUPL	Peak tuning of duplexer for maximum transmitter power output
	OSC	Output of basic frequency generating circuits
	DOUBLER	Output of receiver fixed head
	MULT	Output of local oscillator and for BAND IV only, when MULT DRIVER pushbutton on receiver rf head is pressed indicates drive to frequency multipliers
	RCVR SIG	Received rf signal level
	12CH PCM	Regenerated 12-channel pcm level (Receiver, Radio R-1329(P)/GRC-103(V), R-1329A(P)/GRC-103 (V) and R-1329B(P)/GRC-103(V)).
	24 CH PCM	Regenerated 12- and 24-channel pcm level (Receiver, Radio R-1329-C(P)/GRC-103(v)).
	FDM	Received FDM level
	OW	Recovered order wire level
	+12VDC	+ 12-volt power supply level
	–12VDC	– 12-volt power supply level
2	BUZZER OFF pushbutton	Turns buzzer on and off (can be muted by external BUZ OFF/ALM NOR switch)
3	HIGH SIGNAL lamp	When lighted (red), indicates receiver protection switch is activated by an input signal greater than + 10 d Bm
4	SYNC lamp	When lighted (red) indicates afc in receiver basic frequency generating circuits is not locking
5	LOW SIGNAL lamp	When lighted (red) indicates poor signal-to-noise ratio
6	AC POWER lamp	Lights (green) when power is on
7	AC POWER switch	Turns receiver ON and OFF
8	Meter	Indicates status of circuits selected by meter switch

2-7. AMPLIFIER-CONVERTER CONTROLS AND INDICATORS



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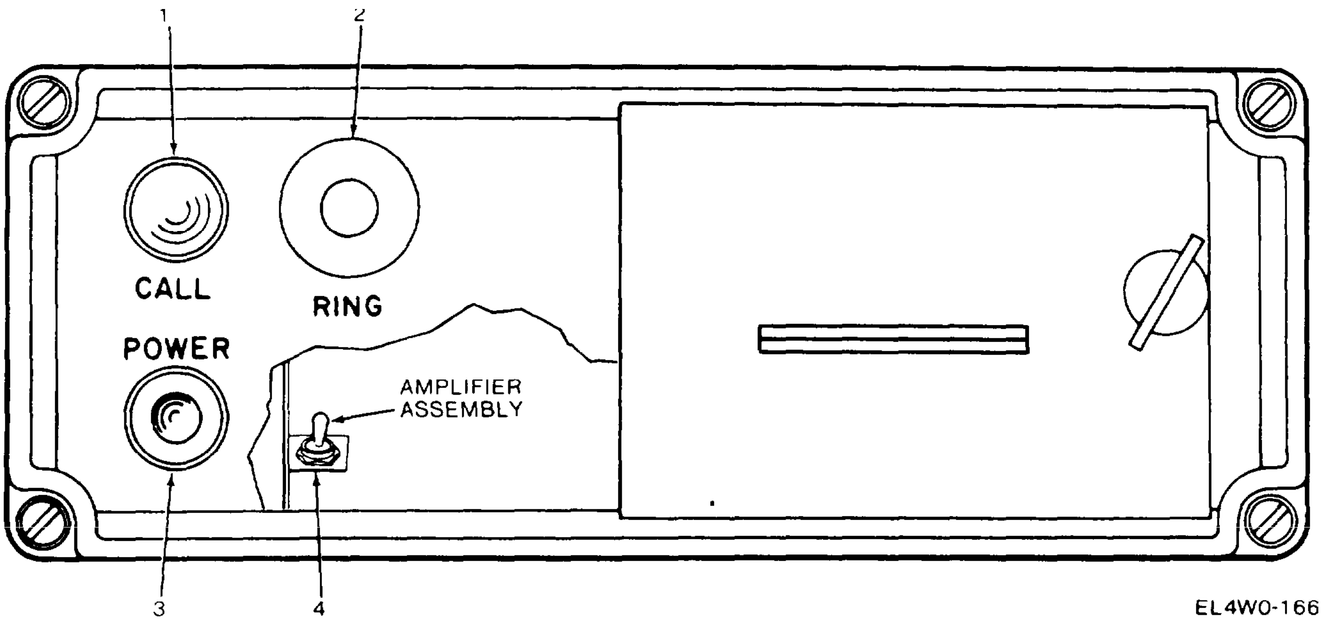
Key	Control or Indicator	Function
1	RCVR CHANNEL indicator	Indicates channel selected
2	RCVR CHANNEL control	Selects receiver channel
3	ANT connector	Connects receiver and transmitter [0 antenna
4	MULT PEAK control	Tunes local oscillator circuits for peak output indication on meter
5	RCVR SIG control	Tunes receiver section of duplexer
6	RCVR CHANNEL indicator	Indicates channel 10 which receiver IS tuned
7	XMTR DUPL control	Tunes transmitter section of duplexer
8	XMTR CHANNEL indicator	Indicates channel to which transmitter section of duplexer IS tuned
9	FROM XMTR connector	Connects transmitter output to duplexer
“Io	MULT DRIVER pushbutton	When pressed monitors drive to frequency multiplexer with meter switch al MULT position

“Band IV only

2-8. ORDER WIRE RECEIVER TRANSMITTER CONTROLS AND INDICATORS



Key	Control or Indicator	Function
1	CALL lamp	Indicates (red) on incoming call
2	RING pushbutton switch	Lights CALL lamp and activates buzzer at distant stations when pressed
3	POWER lamp	Indicates (green) unit is receiving supply voltages
4	FDM/PCM	Sets operation for either FDM/PCM. For this application, the switch is set to PCM.

Section II. OPERATOR'S PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

2-9. GENERAL

Preventive maintenance checks and services (PMCS) are essential to the efficient operation of the radio set and to prevent possible damage that might occur through neglect or failure to observe warning symptoms in a timely manner. Checks and services performed by operators are limited to those functions which can be accomplished from the exterior of the radio set.

. Before you operate, always keep in mind the **CAUTIONS** and **WARNINGS.** Perform your before (B) PMCS.

. While you operate, always keep in mind the **CAUTIONS** and **WARNINGS.** Perform your during (D) PMCS.

l After you operate, be sure to perform you after (A) PMCS.

. If your equipment fails to operate, troubleshoot with proper equipment. Report any deficiencies using the proper forms as specified in DA Pam 738-750.

. If the equipment must be kept in continuous operation, check and service only those items that can be checked and serviced without distrubing operation. Make the complete checks and services when the equipment can be shut down.

. The Procedures column in your PMCS charts instructs how to perform the required checks and services. Carefully follow these instructions and, if tools are needed or the chart so instructs, get unit maintenance to do the necessary work.

l If your equipment must be in operation all the time, check those items that can be checked without distrubing operation. Make the complete checks and services when the equipment can be shut down.

2-10. CLEANING

WARNING

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

Inspect the exterior of all major components. The surfaces should be clean and free of dust, grease, and fungus.

CAUTION

Do not press on meter face (glass) during cleaning

- Remove dust and other loose dirt with cheesecloth
- Remove grease, fungus, and ground-in dirt from the cases; use a cloth dampened (not wet) with cleaning compound.
- Remove dirt from plugs and jacks with a brush
- Clean the front panels, meters, and control knobs; use a soft clean cloth. If dirt IS difficult to remove, dampen the cloth with water; mild soap may be used for more effective cleaning.

WARNING

Compressed air shall not be used for cleaning except where reduced to less than 29 pounds per square inch (psi) and then only with effective chip guarding and personnel protective equipment. Do not use compressed air to dry parts when trichlorotrifluoroethane has been used. Compressed air is dangerous and can cause serious bodily harm if protective means or methods are not observed to prevent chip or particle (of whatever size) from being blown into the eyes or unbroken skin of the operator or other personnel,

- Clean the radio transmitter air filter by blowing air (not exceeding 30 PSI) through it or by dipping It in trichlorotrifluoroethane.

NOTE

The necessity for maintaining a clean filter cannot be overemphasized

OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES

NOTE

Within designated Intervals, these checks are to be performed in the order listed

B-Before A- After M- Monthly
D-During W-Weekly

Item No	Interval B	D	A	W	M	Item to be Inspected	Procedures Check for and have repaired or adjusted as necessary
1						Inspect the equipment for-	Equipment must be complete clean and installed for operation
	•					A Completeness	A Equipment must be complete
	•					B Proper Installation	B Installation IS complete and proper
	•					C Cleanliness	C Equipment is clean dry free of grease dirt, rust, corrosion, and fungus.
	•					D Preservation	D Painted surfaces are free of bare spots rust and corrosion.

2-10. CLEANING - Continued

B-Before A-After M - Monthly
D-During W-Weekly

Item No	Interval B	D	A	W	M	Ite 10 be Inspected	Procedures Check for and have repaired or adjusted as necessary
2	•					PUBLICATIONS: Check that pertinent publications are available.	Operators manual must be complete and in usable condition
3	•					MODIFICATION WORK ORDERS: Check DA Pam 25-30 to determine if new applicable MWO's have been published.	All URGENT MWO'S have been applied to the equipment. All ROUTINE MWO's have been scheduled.
4	•	•				CABLES AND CONNECTORS: Check cables and connectors for cracks and breaks Check connections for tightness	Cables and connectors are intact and connections are secure.
5	•	•				KNOBS DIALS AND SWITCHES: Check the mechanical action of each knob, dial and switch for smothness and freedom from external or internal binding.	Knobs, dials and switches move easily without binding.
6	•	•				AIR FILTER: Check air filter to see that it is clean	Air filter should be clean.
7				•		ANTENNA GUY ANCHORS: Proceed with caution. Check guy anchors for looseness and shifting.	Guy anchors should be secure. Guy stakes should be at a 60° angle, slanted away from the mast Scre-type guy anchors should be al a 45 angle, slanted toward the mast
8				•		ANTENNA GUYS AND MAST: Proceed with extreme caution. Check all guys for proper tension and that the mast is straight and vertical.	Guys should not be slack and mast should be straight.

Section III. OPERATION UNDER USUAL CONDITIONS

2-11. SERVICE ON RECEIPT OF EQUIPMENT

● UNPACKING

The components of Radio Set AN/GRC-103(V)(*) are packed in six cartons. A typical packaging arrangement for the electronics units (cartons 1, 2 and 3) is shown, The antenna and mast components in cartons 4, 5 and 6 do not require inner cartons.

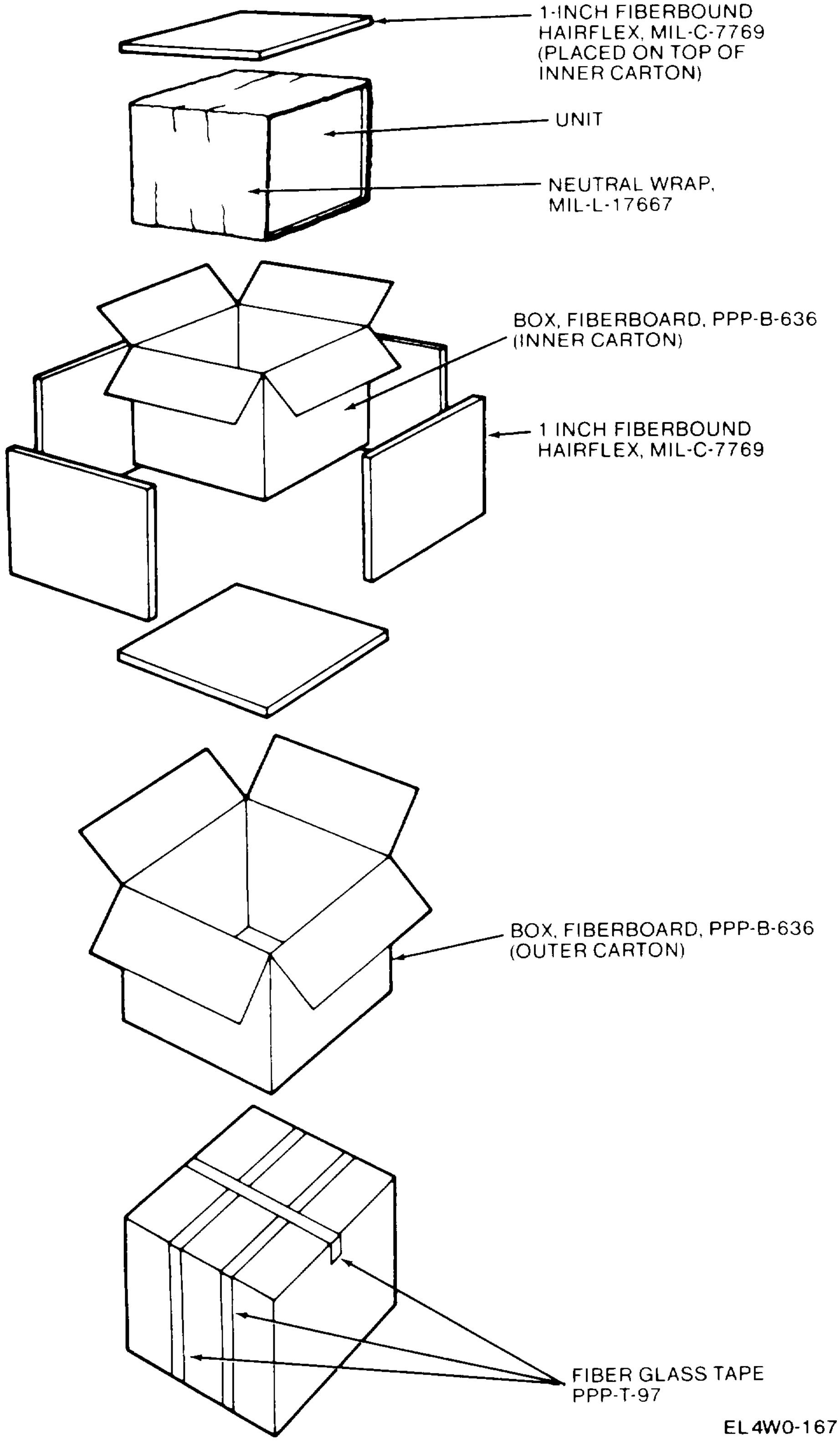
Remove the contents as follows

A Open the outer carton and lift out the inner carton.

B Open the inner carton and carefully lift out the wrapped electronic equipment.

C Remove the neutral wrap from the equipment.

2-11. SERVICE ON RECEIPT OF EOUIPMENT - Continued



Cartons 1,2, and 3, Typical Packaging

2-11. SERVICE ON RECEIPT OF EQUIPMENT - Continued

● CHECKING UNPACKED EQUIPMENT

A Inspect the equipment for possible damage incurred during shipment. If the equipment has been damaged, refer to paragraph 1-2 for applicable forms and records.

B Check to see that the equipment is complete as listed on the packing slip. If a packing slip is not available, refer to appendix C. Report all discrepancies in accordance with DA Pam 738-750, Shortage of a minor assembly or part that does not alter proper functioning of the equipment should not prevent use of the equipment.

c Check the equipment for the following.

1 Loose or broken control knobs.

2 Loose nuts, bolts, etc.

3 Improperly functioning pushbutton or toggle switches.

4 Binding rotating controls.

Carton No	Dimensions (in.)	Volume (cu ft)	Wt {lb)	Contents
1	21 21 by 12 by 16.5	241	71	Receiver, Radio R-1 329(P)/GRC-103(V), R-1329 A(P)/GRC-103(V), R-1329B(P)/GRC-103(V), or R-1329 C(P)/GRC-103(V) with Amplifier-Converter: Band I AM-4316/GRC-103(V) or AM-4316A/GRC-103(V) Band II AM-4317/GRC-103(V) Band III AM-4318/GRC-103(V). OR Band IV Receiver, Radio R-1329 A(P)/GRC-103(V). R-1329B(P)/GRC-103(v), or R-1329 C(P)/GRC-103(V) with Amplifier - Converter AM-4319/GRC-103(V).
2	21 by 12 by 16.5	241	71	Transmitter, Radio T-983(P)/GRC-103(V), T-983A(P)/GRC-103(V), or T-938 B(P)/GRC-103(V) with Amplifier - Frequency Multiplier. Band I AM-4320/GRC-103(V) or AM-4320A/GRC-103(V). Band II AM-4321/GRC-103(V) or AM-4321 B/GRC-103(V). OR Band III Transmitter, Radio T-983 (P)/GRC-103(V) or T-983A(P)/GRC-103(V) with AM-4322/GRC-103(V) or AM 4322A/GRC-103(V). Band IV Transmitter. Radio T-983A(P)/GRC-103(V) or T-983B/GRC-103(V) with Amplifier - Frequency Multiplier 4323/GRC-103(V)
3	21 by 14 by 18	306	26	Receiver-Transmitter, Order Wire RT-773/GRC-103(V) with: Cable Assembly RF CG-3444/U (1 ft 6 in.) (two each) Cable Assembly. RF CG-3444/U (3 ft 6 in.). Cable Assembly. RF CG-1040B/U (4 ft.) Cable Assembly RF CG-3443/U (50 ft or 80 ft). Cable Assembly Special Purpose Electrical Branched CX-10763/GRC-103(V) 3 ft 6 in.). Cable Assembly Special Purpose Electrical CX-10762/U (5 ft) (two each) and Adapter. Connector UG-1375/U.
4	39.5 by 9.25 by 40	846	38	Antennas. AS-1852/GRC-103(V), AS-1853/GRC-103(V), or AS-1854/GRC-103(V) OR
	45 by 42 by 14	1530	45	Antenna AS-3047/GRC-103(V).
5	17.5 by 15.5 by 65	1020	113	Elevator Antenna AB-1072/GRC-103(V) (one each) and Mast Section AB-1071/GRC-103(V)(seven each).
6	21 by 7.5 by 35	319	63	Accessory Kit, Mast MK-1069/GRC-103(V).

2-12. INSTALLATION OF ANTENNA SYSTEM

WARNING

During Installation of this equipment, conform to all safety requirements in TB SIG 291. Injury or DEATH could result from failure to comply with safe practices.

● **GENERAL**

A ANTENNA SYSTEM. The antenna system of Radio Set AN/G RC-103(V)1 consists of Antenna AS-1852/GRC-103(V). Mast AB-952/GRC-103(V) and, when the antenna is raised to 50 feet, Extension Kit, Mast MK-1009/GRC-103(V). The antenna consists of a broadband corner reflector and a dipole element. The mast assembly consists of seven mast sections, a launcher, and erection and guy accessories. The MK-1009/GRC-l03(V) consists of three mast sections, three guy anchors, and guy accessories.

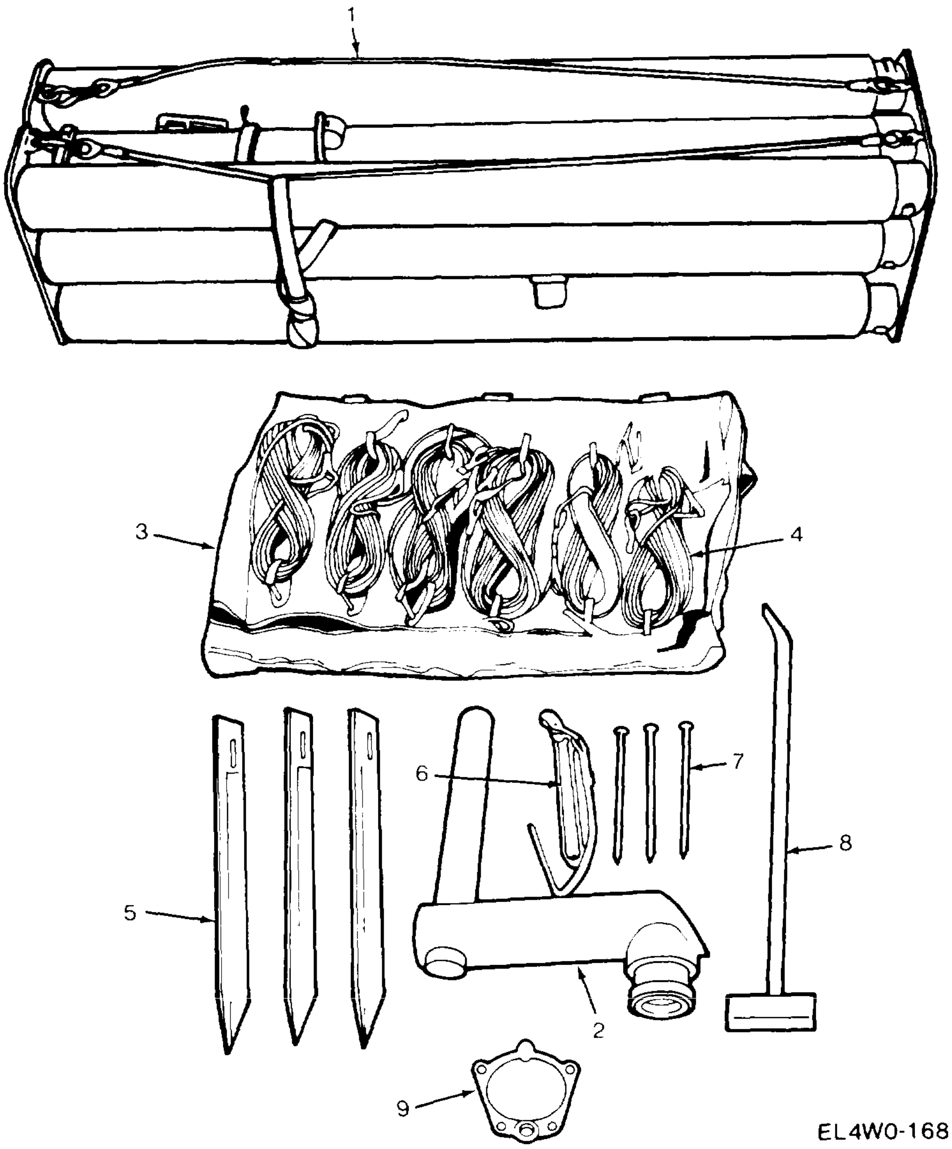
B ANTENNA SITE. Refer to appendix E for information about radio propagation and system planning to help in the selection of the site. The antenna site must be reasonably flat, with a central clear area of approximately 10 square feet. The separation between the mast assembly location and the shelter should not exceed 25 feet. There must be clear aerial paths to the guy stake locations at three points equally, spaced on a 30-foot circle which is centered on the central clear area. The slope of the antenna central clear area should not form an angle of more than 15 to the horizontal.

C GUY ANCHORS. Some ground is too soft or too hard to permit proper installation of the guy anchors supplied. Where necessary, use a rope (at least ½-inch thick), cable, or piece of heavy wire, wrapping it around a fixed object such as a tree stump, tree or rock in soft earth or areas where fixed objects are unavailable, a deadman anchor can be used

D Three 24-inch stakes are supplied as part of the accessories kit. They are to be used as guy anchors in normal soil conditions for a mast height of 35 feet: however, the stakes should be used in shale, sandstone, soft rock, hardpan, ice, permafrost, etc.. when the mast height is to be 50 feet

Three screw anchors are supplied as part of the MK-1009/GRC-103(V) and are to be used as guy anchors in normal soil conditions when the mast height is to be 50 feet.

2-12. INSTALLATION OF ANTENNA SYSTEM - Continued

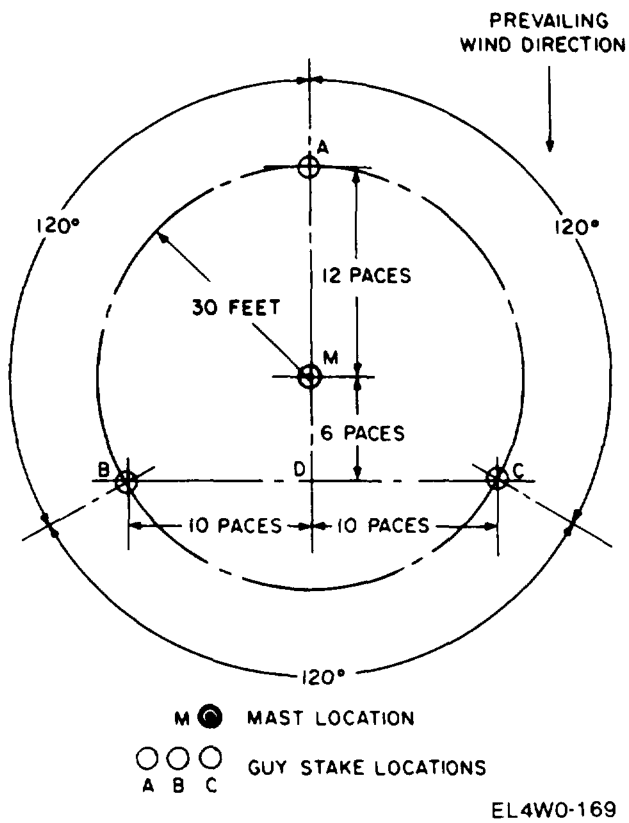


1 Elevator, Antenna AB-1072/GRC-103(V) (12 A1A1); Mast Section AB-1071/GRC-103(VI (seven each) (12A1A21A1 through 1A8).
2 Reflector attachment assembly (12A21A9)
3 Accessories waterproof bag (12A2A1)
4 Guy wires (three red-coded, 12A2MP4, MP5, MP6; three white-coded 12A2MP1, MP2, MP3).
5 Guy stakes, 24 inch (three each) (12A2MP14, MP15, MP16)
6 Strap wrench (12A2MP7)
7 Spikes (three each) (12A2MP11, MP12, MP13)
8 Hammer, hand (12A2MP8)
9 Guy attachment ring (12A2MP17)

Accessory Kit and Antenna Elevator

2-12. INSTALLATION OF ANTENNA SYSTEM - Continued

- **LAYOUT OF ANTENNA SITE**



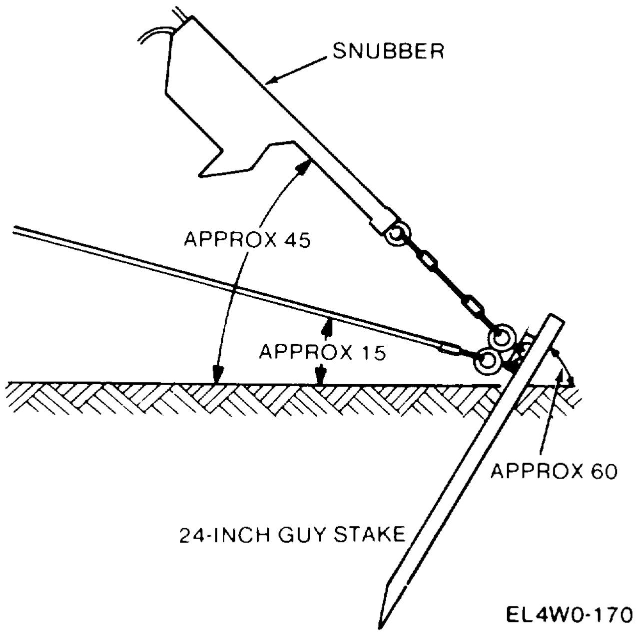
Unload the antenna system in the central clear area, open the accessories kit, as shown, and proceed as follows:

A Place the mast assembly upright at the center of the area selected as the mast location (point M).

B Check the prevailing wind direction

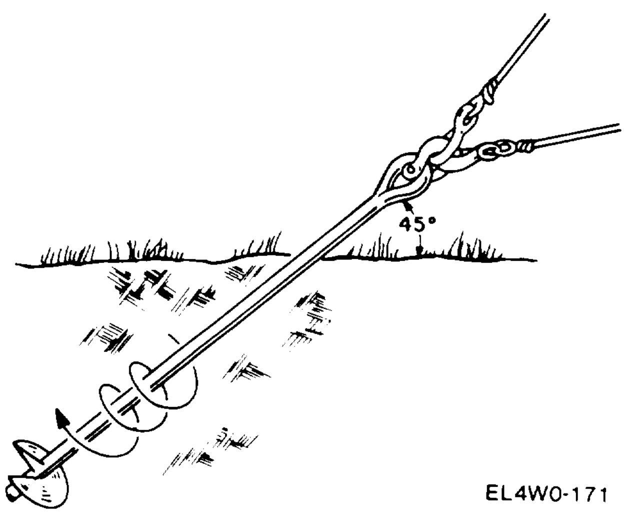
C Pick up the hammer and one guy stake from the accessory kit. Walk 12 paces (30 feet) directly toward the wind (point A) and drive in the stake at an angle of 60 degrees as shown.

2-12. INSTALLATION OF ANTENNA SYSTEM - Continued

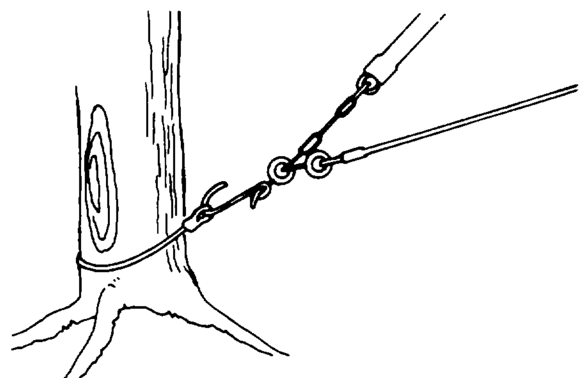


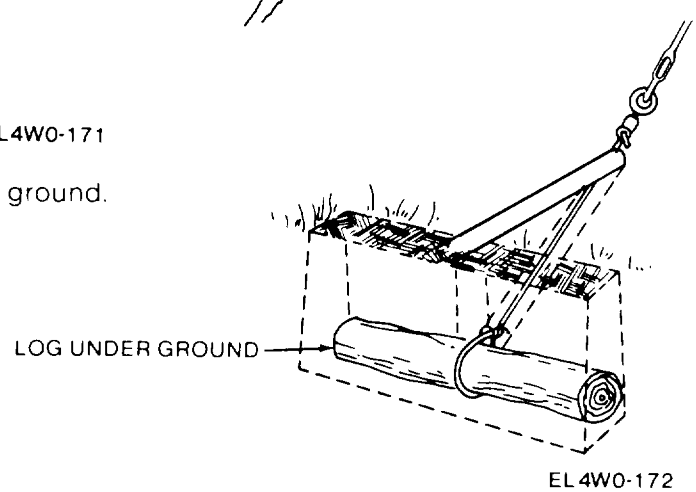
NOTE

Other methods of fastening guy wires are shown as follows:



D Use hammer handle to screw anchor into ground.





E Be sure lock does not slip on trunk.

2-12. INSTALLATION OF ANTENNA SYSTEM - Continued

F Pick up two stakes, walk 6 paces (15 feet) to point D and leave one stake as a marker.

G Turn right 90° and walk 10 paces (25 feet) to point B. Drive in the stake.

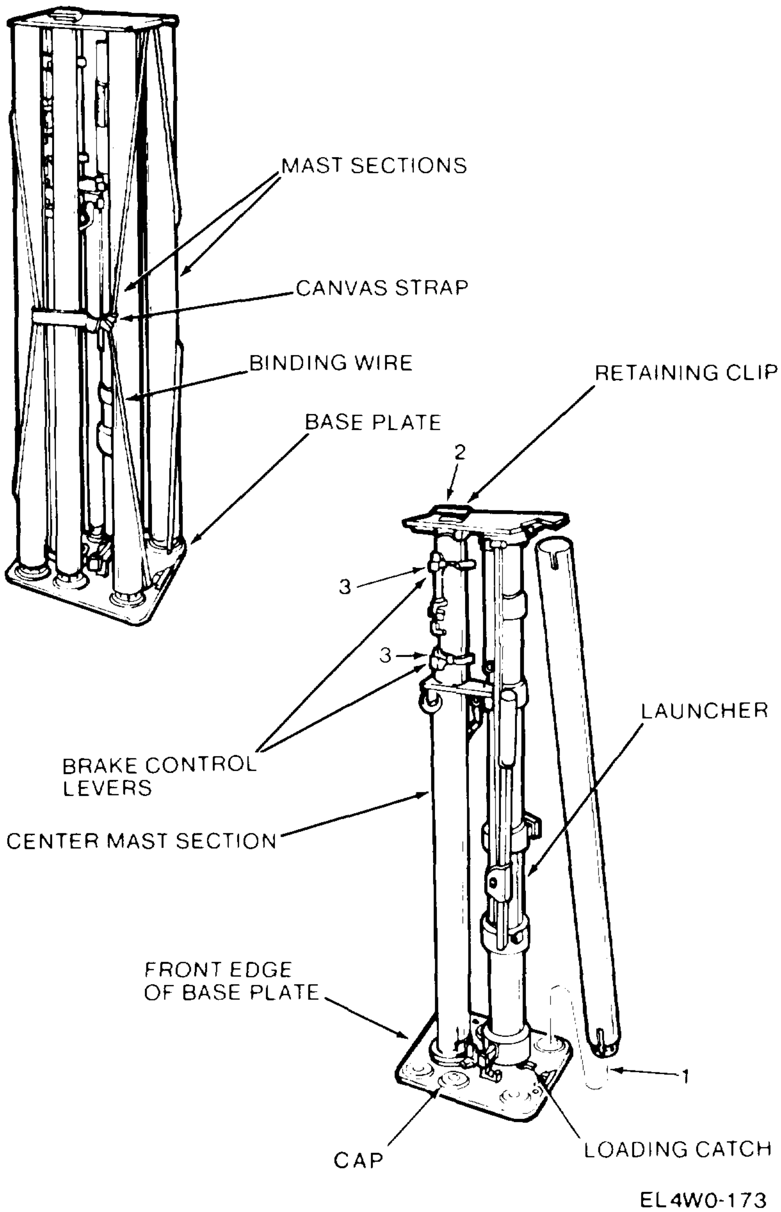
H Return to point D, pick up the third stake, walk 10 paces to point C and drive in the stake.

c ASSEMBLY OF LAUNCHER AND ANTENNA

NOTE

For Band IV antenna, refer to INSTALLATION OF BAND IV ANTENNA.

A Position the mast assembly so that its front faces into the wind. The front edge of the base plate is indicated in illustration.



Removing Mast Sections from Launcher

2-12. INSTALLATION OF ANTENNA SYSTEM - Continued

B Loosen the canvas staps that tension the binding wires, and unsnap the binding wires from the top of the mast assembly.

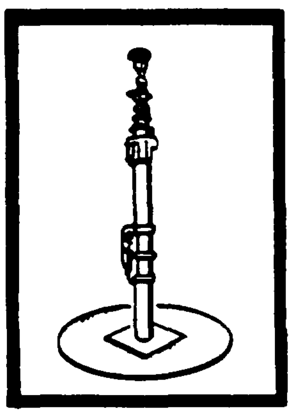
C Raise the top section of the launcher approximately three-fourths of an inch, allowing the loading catch on the base plate to secure it in this higher position. Remove the six mast sections stored around the launcher by raising them one by one and lifting the lower end clear of its cap on the base plate (1). The center mast section remains stored in the erection mechanism.

D Swing aside the stored mast section retaining clip on the top of the launcher (2).

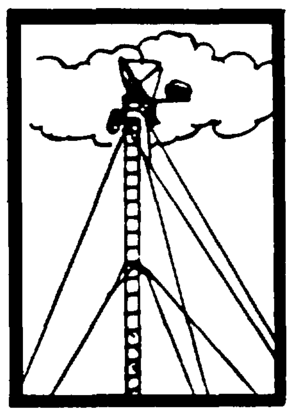
E Set the two brake control levers (3) so that the arrows point upward. If either of the brake rings in the erection mechanism binds, release it by hand.

FIXED OPERATION WITH LONG RANGE ANTENNAS

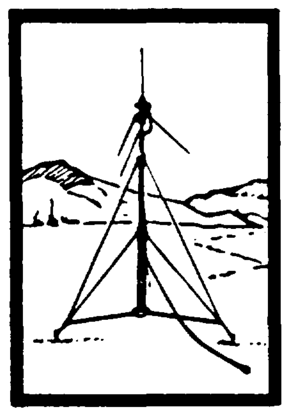
WARNING



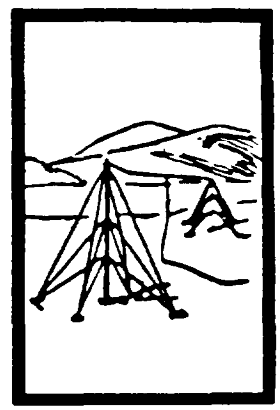
TELESCOPING ANTENNA MAST



TYPICAL TOWER



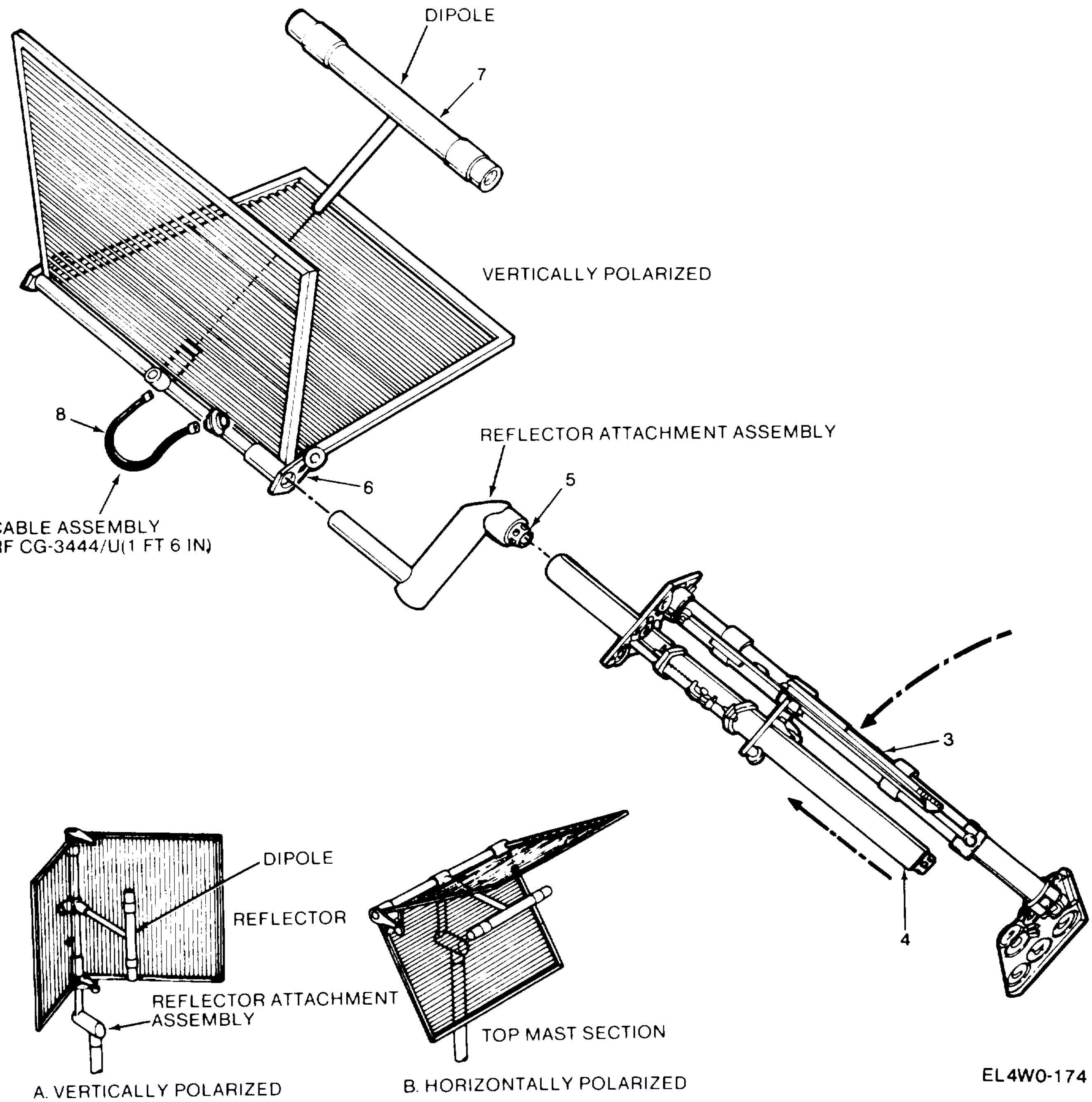
EXTENDED RANGE ANTENNA



DOUBLET ANTENNA

NEVER ERECT THESE LONG RANGE ANTENNAS DIRECTLY UNDER POWER LINES.

2-12. INSTALLATION OF ANTENNA SYSTEM - Continued



Polarization and Mounting Antenna on Mast

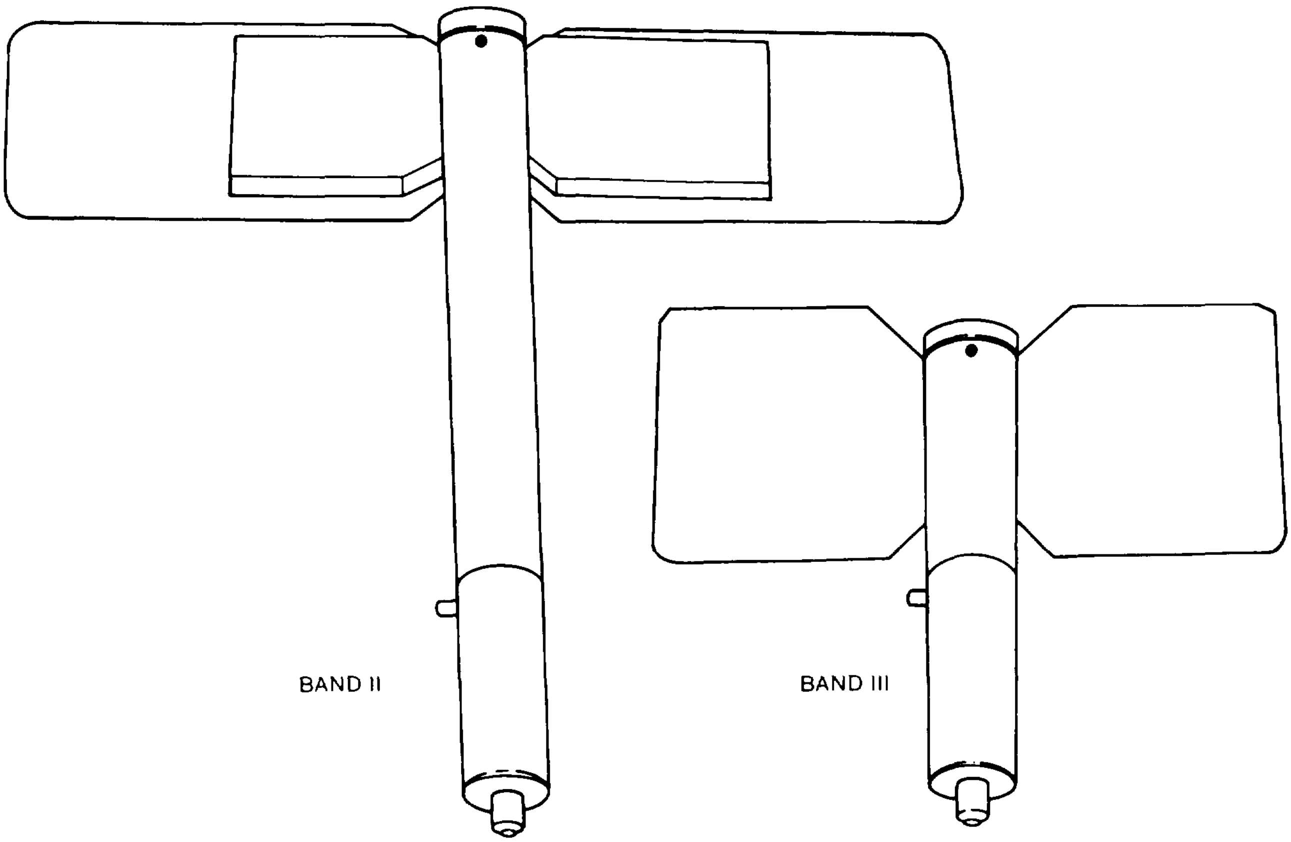
F Push the center mast section upward until it protrudes approximately 18 inches above the top plate of the launcher (4).

G Tilt the launcher sufficiently to permit convenient insertion of the reflector attachment assembly into the top of the center mast section, either vertically or horizontally polarized; then rotate the reflector attachment assembly until the stripes on the mast section and on the reflector attachment assembly line up and the catch locks in place (5).

2-12. INSTALLATION OF ANTENNA SYSTEM - Continued

NOTE

The dipole shown at G is for Band I. The Band II and Band Ill dipoles are shown below Dipole installation instructions in this chapter apply equally to all three dipoles.



H The dipole (7) normally is stored in operating position in the reflector. If the dipole is to be installed, open the reflector and insert the dipole stem into the mounting stub on the reflector, push it in against the spring, and lock it in position by rotating it one-twelfth of a turn clockwise until the yellow stripes on the dipole stem and the mounting stub line up and the catch locks in place. Close the reflector.

I Connect Cable Assembly, RF CG-3444/U (1 ft 6 in.) to the connector at the rear of the dipole and to Adapter, Connector UG-1375/U on the reflector spine (8).

J Open the reflector to the required position (for Band I, II, or Ill) as indicated by the numerals adjacent to the screw fasteners on the hinge plates (6). Lock it in this position with the screw fasteners at each end of the hinge. Make sure that both screw fasteners are seated correctly in their detents.

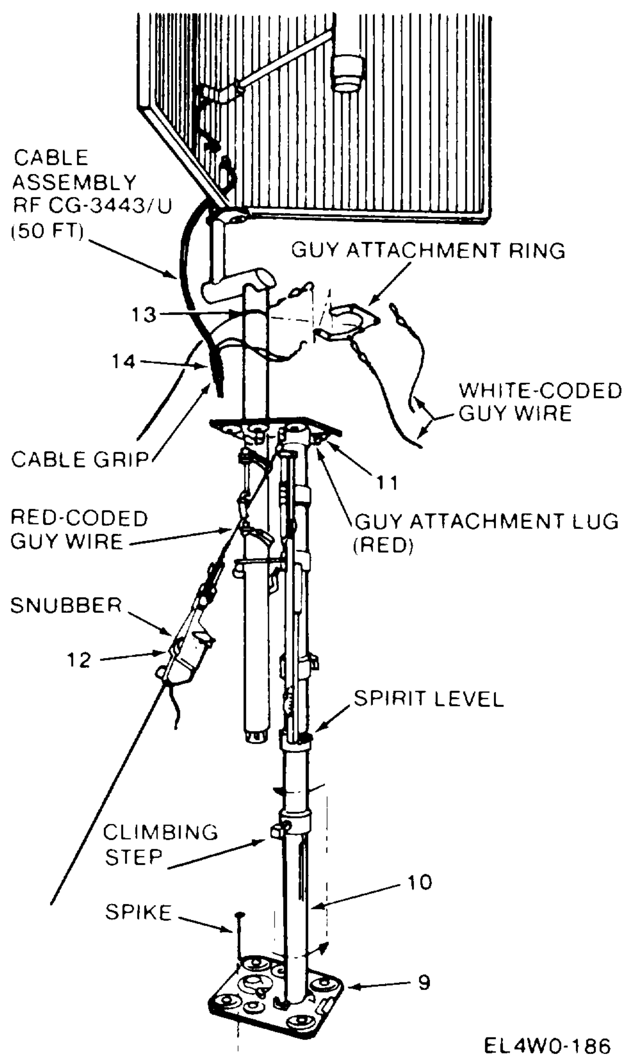
K Tilt the launcher and fit the assembled antenna on the reflector attachment assembly (1), in the appropriate polarization as shown. The yellow stripe on the antenna must line up with the yellow stripe on the reflector attachment assembly so that the dipole is directly over the mast section.

2-12. INSTALLATION OF ANTENNA SYSTEM - Continued

L Connect Cable Assembly, RF CG-3443/U (50 ft) or (80 ft) to the other end of the UG-1375/U.

M Stand the launcher upright, and secure the launcher base plate to the ground by driving the three spikes through the holes identified by yellow bands near the edge of the base plate (9). Use the universal tool that is supplied.

N Grasp the launcher climbing steps, and raise the launcher a few inches. Rotate it through 90' to the right or left (1-0). Raise the launcher an additional 2 feet. The entire yellow stripe on the lower part of the telescope leg is exposed. Rotate the launcher back through 90° until the yellow stripes on the upper and lower parts of the leg are in the line. Lower the launcher until a definite stop is felt, and try to rotate the launcher to be sure that it is locked in position.



Extending Launcher and Attaching Guy Wires

2-12. INSTALLATION OF ANTENNA SYSTEM - Continued

O Snap the free ends of the red-coded guy wires to the bottom holes in the guy stakes. Snap the snubber ends of the red-coded guy wires to the guy attachment lugs (painted red) on the bottom of the launcher top plate (11).

NOTE

The snubbers of the red-coded guy wires are marked with an arrow and the legend TO MAST. In AN/GRC-103(V)1 applications, ignore direction of arrow.

P Tension the red-coded guy wires so that the launcher is vertical by pulling the wires through the snubbers (12). Lock the snubbers. Check to see that the bubble is in the center of the spirit level on the launcher leg. Fine adjustments can be made with the turn-buckles on the snubbers. There should be no appreciable free movement of the upper part of the launcher.

Q Climb up the launcher steps, and fit the guy attachment ring into the gap in the joint between the reflector attachment assembly and the mast section (13). When the antenna height is to be 35 feet, snap the white-coded guy wires into the holes in the guy attachment ring. When the antenna height is to be 50 feet, snap the blue-coded guy wires into the holes in the guy attachment ring. One of the guy wire snaps holds the two sections of the guy attachment ring together.

R Pay out the complete length of each of the guy wires, and attach them to the guy anchors. Attach the white-coded guy wires to the middle holes of the guy stakes and the blue-coded wires to the upper holes. Do not tension the wires.

S Attach the cable grip on Cable Assembly (14), RF CG-3443/U (50 ft), to one of the remaining free holes in the guy attachment ring.

T When a 50-ft mast is to be used, Cable Assembly, RF CG-3443/U (80 ft) must be used for the lead-in between the antenna and the radio set. Instructions in this chapter for the 50-ft length apply equally to the 80-ft length.

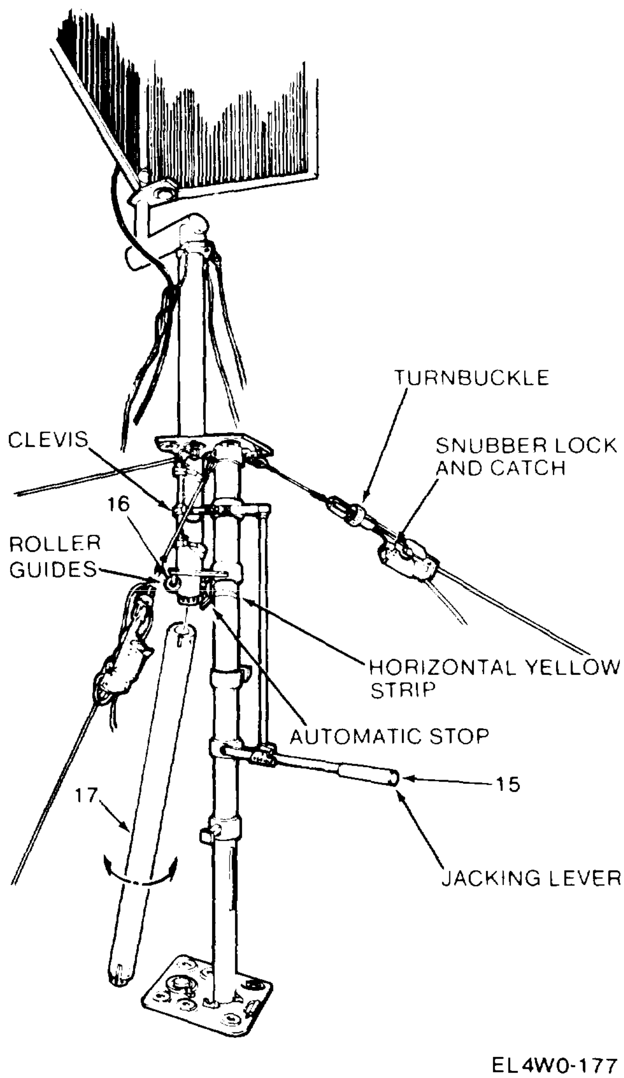
NOTE

Be sure that the antenna system is properly installed before the antenna is fully raised. To check the system connect the lead-in (50 to 80 feet, as applicable) to the ANT. connector on the receiver rf head. Turn on the radio set (paragraph 2-14). If high reflected power is indicated on the receiver meter, the transmitter meter, or both, and adjustment of the XMTRDUPL control does not bring the meter indications within prescribed tolerances, check the entire antenna system for poor connections, broken cables, and similar defects.

U Unpin the jacking lever from its storage position, and pin it to the clevis on the operating road of the lower brake ring (15).

2-12. INSTALLATION OF ANTENNA SYSTEM - Continued

• **RAISING MAST**



Inserting and Raising Mast Sections in Launcher

WARNING

Be extremely careful when erecting the antenna system in winds stronger than 25 miles-per-hour. If the wind is strong, station at least one man to maintain adequate tension on the windward upper guy to keep the mast vertical while it is being raised.

WARNING

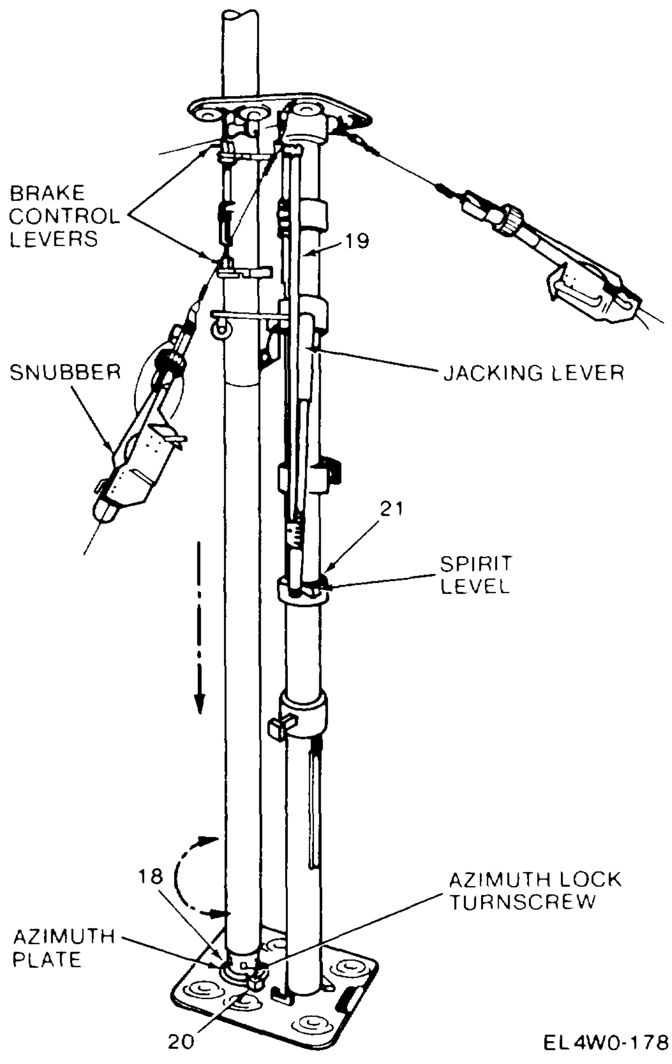
Never place hands or feet between the lowest mast section and the azimuth plate.

2-12. INSTALLATION OF ANTENNA SYSTEM - Continued

A Raise the mast section in the launcher by pumping the jacking lever until an approximately 4-inch long portion of the mast section remains below the tower roller guides (16). Continue raising the mast section slowly until the automatic stop operates and prevents further motion.

B Place another mast section under the mast section just raised, as shown at (17). Push the automatic stop clear, aline the keyways in the socket end of the second mast section with the keys on the plug end of the first mast section, push up on the second mast section, and twist it until the yellow stripes on the two mast sections are in line and the catch locks in place. Check to see that the mast sections are locked, and then repeat above procedure.

C When the antenna height is to be 35 feet, repeat the procedure in B above until the last tube is locked in position, but do not jack it up. Make sure that the yellow stripe at 0° on the azimuth plate is in line with the yellow stripe on the last mast section. Set the two brake control levels so that the arrows point downward. With the lacking lever, lower the mast until the slot in the last section engages with the peg in the azimuth plate (18).



Inserting Final Mast Section and Storing Jacking Lever

2-12. INSTALLATION OF ANTENNA SYSTEM - Continued

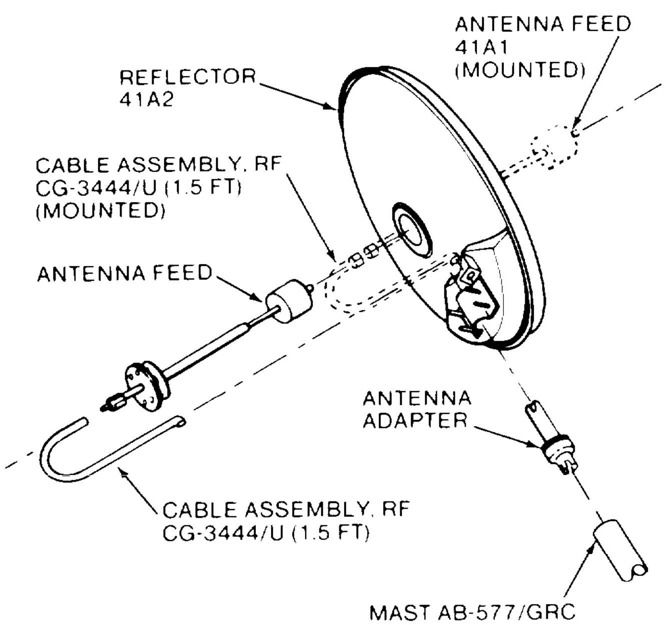
D When the antenna height is to be 50 feet, repeat the procedure in B above until the sixth mast section is locked in position. Jack the mast up until the joint between the fifth and sixth mast sections is just clear of the launcher top plate. Climb up the launcher steps, and flt a guy attachment ring into the gap in the joint between the fifth and sixth mast sections. Snap the white-coded guy wires into the holes in the guy attachment ring. One of the guy wire snaps holds the two sections of the guy attachment ring in place. Connect the middle cable grip of the Cable Assembly, RF CG-3443/U (50 ft) to one of the remaining free holes in the guy attachment ring. Repeat the procedures in A and B above until the last section is locked in position, but do not jack it up. Make sure that the yellow stripe on 0° on the azimuth plate is in line with the yellow stripe on the last mast section. Set the two brake control levels so that the arrows point downward. With the jacking lever, lower the mast until the slot in the last mast section engages with the peg in the azimuth plate (18).

E Tension the guy wires by feeding the wires through the snubbers so that the mast is straight and vertical and the guy wires just tight. Lock the snubbers. Compare the mast with a known vertical object or with a plumb line from the front and one side. Check for straightness by comparison of the guy wires.

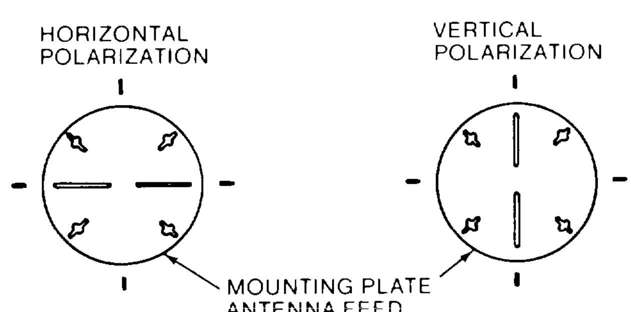
F Remove the pin from the clevis on the operating rod of the lower brake ring, and move the jacking lever to its stored (vertical) position. Wrap the chain around the operating arm hinged to the top of the jacking lever, and insert the pin to lock the lever in the stored position (19).

G Use the supplied strap wrench to orient the mast by rotating the lowest mast section. Aim the open side of the antenna in the assigned direction. The open side of the antenna should be in line with the yellow stripe on the mast section and the 0° reference on the azimuth plate. Note the indication on the azimuth plate opposite the mark on the launcher base plate for reference during more precise orientation of the antenna. A more precise orientation should be made later by maximizing the received signal strength on the radio receiver. Lock the mast in position with the azimuth lock turnscrew at the side of the azimuth plate (20).

H Check the spirit level (21) to see that the launcher is still level. Adjust the red-coded guy wires, if necessary. Use the snubber turn buckles for fine adjustments.



Mounting Band IV on Mast



Band IV Antenna Polarization

EL4W0-179

2-12. INSTALLATION OF ANTENNA SYSTEM - Continued

c INSTALLATION OF BAND IV ANTENNA

A **ANTENNA SYSTEM (BAND IV).** The antenna system of Radio Set AN/GRM-103(V)4 consists of Antenna AS-3047/G RC-103(V) and Mast AB-577/GRC. Antenna AS-3047/GRC-103(V) (unit 41) consists of Antenna Feed SM-D-794136 (41A1), Antenna Reflector SM-D-74137 (41A2), and an antenna mast adapter. The installation of Antenna Reflector 41A2, Antenna Feed 41A1, and the antenna-to-antenna mast adapter is explained below. For assembly and disassembly of Mast AB-577/GRC, refer to TM 11-5820-538-12.

B **REFLECTOR ATTACHMENT.**

1 Assemble the launcher as described in ASSEMBLY OF LAUNCHER AND ANTENNA.

2 Tilt the launcher enough to permit convenient insertion of the reflector attachment assembly into the top of the center mast section. Rotate the reflector attachment assembly until the stripes on the mast section and on the reflector attachment assembly line up and the catch locks in place.

C **MOUNT REFLECTOR ON ATTACHMENT.**

1 Loosn the four clamping screws on the reflector mount.

2 Place the reflector on the reflector attachment assembly, being sure that the locating pin inside the reflector mounting collar is placed into the locating slot of the reflector attachment assembly.

3 Tighten the four clamping screws on the reflector mounting collar.

D **ANTENNA FEED INSERTION.**

1 Remove the feed from its storage.

2 Insert the front end of the feed through the rear of the reflector until the mounting plate comes in contact with the reflector.

E **ANTENNA POLARIZATION.**

1 Rotate the feed for horizontal or vertical polarization as shown.

2 Attach the feed by locking the four ¼-turn fasteners.

3 Connect Cable Assembly, RF CG-3444/U (1 ft 6 in.) to the connector at the rear of the antenna feed and to Adapter-Connector UG-1375/U mounted on the reflector mounting.

2-12. INSTALLATION OF ANTENNA SYSTEM - Continued

• LOWERING MAST

WARNING

Never put hand or feet between the lowest mast section and the azimuth plate.

A Unlock the azimuth plate, and use the strap wrench to rotate (18) the mast so that the yellow stripe on the mast and the 0° mark on the azimuth plate are at the front of the launcher.

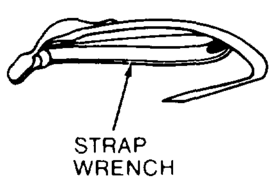
B Slacken the upper guy wires by unlocking the snubber and releasing approximately 6 inches of wire to permit some free vertical movement of the mast.

WARNING

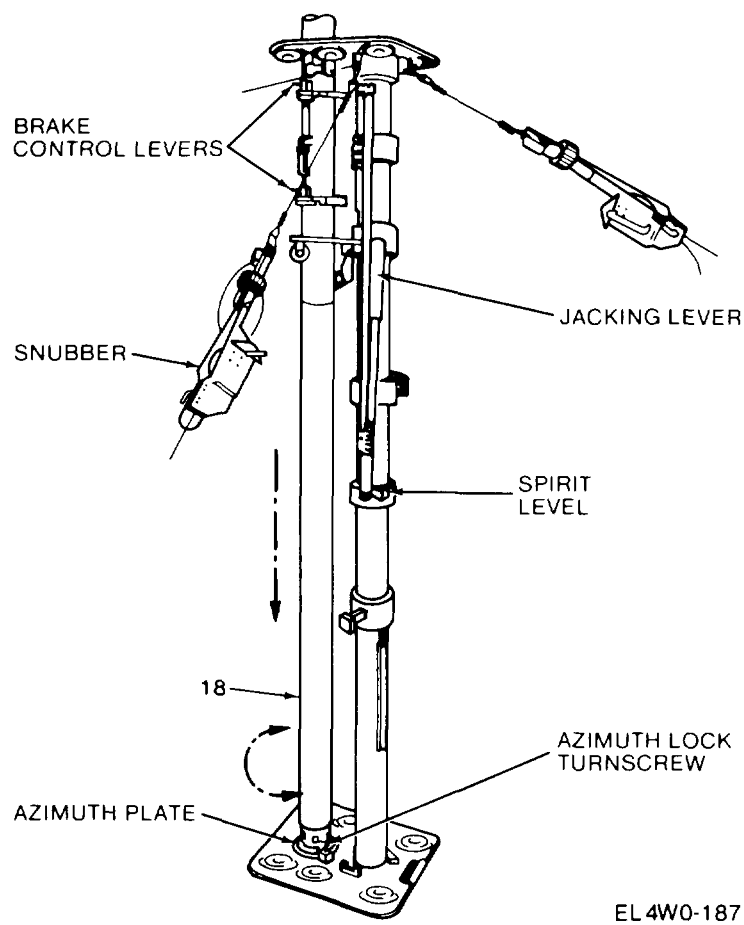
If the wind is strong, station at least one man to maintain adequate tension on the windward upper guy to keep the mast vertical while it is being lowered.

C Unpin the jacking lever from its stored position and pin it in the clevis on the operating rod of the lower brake ring.

D Set the brake control levers so that the arrows point upward. With short strokes of the jacking lever, raise the mast until the joint between the lowest and next lowest mast section is in line with the horizontal yellow strip on the launcher leg,



EL4W0-180



EL4W0-187

2-12. INSTALLATION OF ANTENNA SYSTEM - Continued

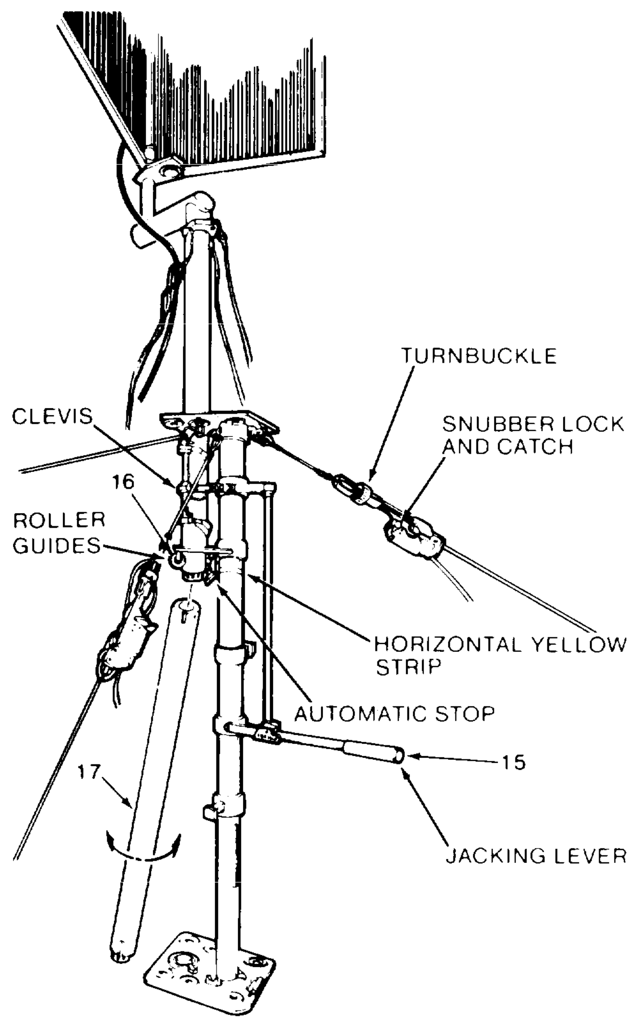
E Depress the catch in the upper end of the lowest mast section and rotate the mast section through one-twelfth of a turn, left or right. Disengage the lowest mast section from the next lowest, and withdraw it from the launcher.

F Set the brake control levers so that the arrows point downward. With full strokes of the jacking lever, lower the mast until the joint between the next pair of mast sections is in line with the horizontal stripe on the launcher. Repeat the procedure in E above.

G If the antenna height is 35 feet, repeat the procedure in F above until the guy attachment ring is approximately 18 inches above the top plate of the launcher.

H If the antenna height is 50 feet, repeat the procedure in F above until the guy attachment ring between the fifth and sixth mast sections is lust above the top plate of the launcher. Unsnap the cable grip and the three white-coded guy wires, and remove the guy attachment ring. Repeat the procedure in F above until the upper guy attachment ring is approximately 18 inches above the top plate of the launcher.

I Disconnect Cable Assembly, RF CG-3443/U (50 ft) from Adapter, Connector UG-1375/U, and unsnap the cable grip. Unsnap the white-coded or blue-coded guy wires, and remove the guy attachment ring.



EL4W0-177

2-12. INSTALLATION OF ANTENNA SYSTEM - Continued

. DISASSEMBLY OF LAUNCHER AND ANTENNA

A Set the brake control levers so that the arrows point upward.

B Loosen the red-coded guy wires, and unsnap them from the top of the launcher

C Remove the pin from the clevis on the operating rod of the lower brake ring, and move the jacking lever to the stored (vertical) position. Wrap the chain around the operating arm hinged to the top of the jacking lever, and insert the pin to lock the lever in the stored position.

D Grasp the launcher climbing steps, and raise the launcher a few inches; then rotate it through 90 to the Ieft or right. Lower the launcher, and rotate it back through 90° so that the lower climbing step rests on its catch on the base plate. Check to see that the outer telescoping tube of the launcher has been stopped by the loading catch on the base plate.

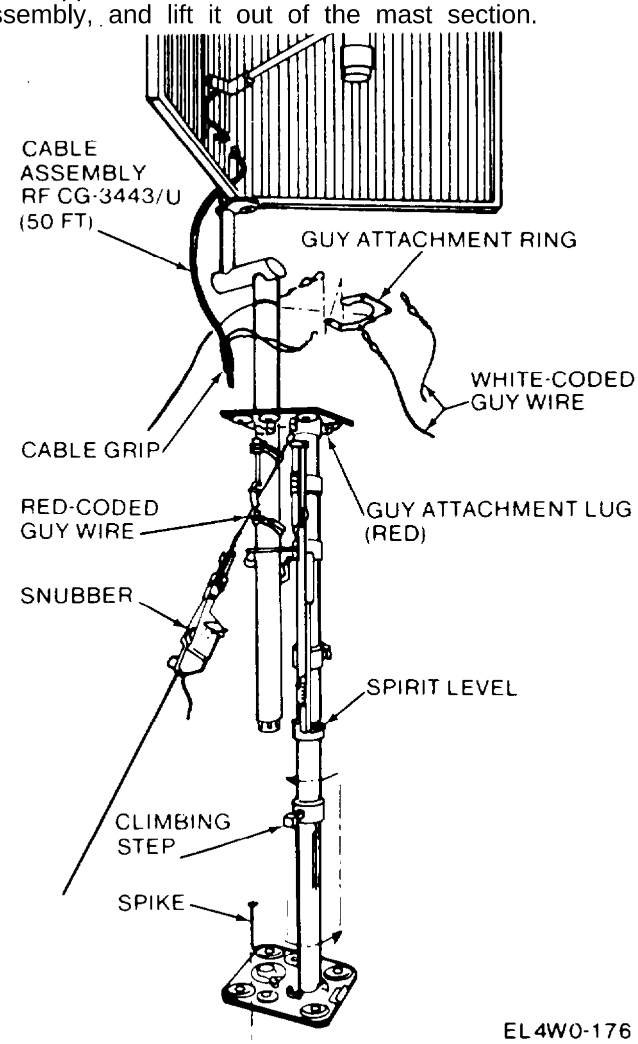
E Rock the launcher to loosen the spikes holding the base plate to the ground. Remove the spikes.

F Tilt the launcher sufficiently to permit removal of the antenna. Remove the antenna.

G Disconnect Cable Assembly RF CG-3444/U (1 ft 6 in.) from the dipole connector and Adapter Connector UG-1375/U.

H Release the screw fasteners on the reflector, fold it to its stored position, and tighten the screw fasteners.

I Depress the catch in the upper end of the mast section that remains in the launcher, rotate the reflector attachment assembly, and lift it out of the mast section.



2-12. INSTALLATION OF ANTENNA SYSTEM - Continued

. PACKING MAST ASSEMBLY

A Set the socket end of a mast section over the cap on the underside of the top of the launcher, and drop its plug end over the corresponding cap on the base plate. Repeat this procedure with the other five mast sections until there is a total of seven mast sections in the launcher (one in the erection mechanism and six around it).

B Release the loading catch on the base plate of the launcher, which will telescope an additional three-fourths inch, and lock the stored mast sections in position. Lower the mast section remaining in the erection mechanism by manually operating the brake rings until the mast section seats in the azimuth plate, rotating the azimuth plate if necessary.

C Swing the retaining clip on the top of the mast assembly over the top of the mast section stored in the erection mechanism.

D Snap the binding wires to their lugs at the top of the mast assembly, and tighten each of the canvas straps around a pair of binding wires.

c PACKING MAST ACCESSORIES KIT

A Gather up all the guy wires, the guy attachment ring, and the guy stakes, spikes, and tools. The accessories kit should contain the items shown under paragraph 2-12, GENERAL. Secure the guy attachment ring by snapping the snap hook of one guy wire through it, wind all guy wires on the snubber brackets, and stow all accessories in the waterproof bag,

B Fasten the bag,

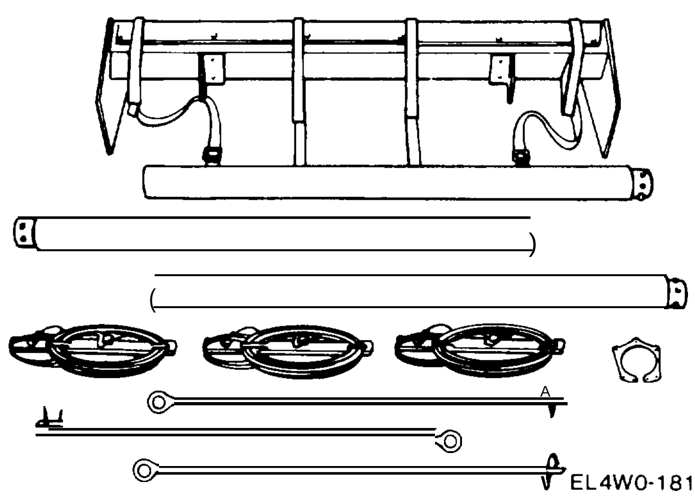
I PACKING EXTENSION KIT, MAST MK-1009/GRC-103(V)

A Collect all the items that are included in the MK-1009/GRC-103(V). Wind the blue-coded guy wires on the snubber brackets. Secure the guy attachment ring by snapping the snap hook of one guy wire through it.

B Stow the three guy wires and the guy attachment ring in Case. Mast Extension Kit CY-6148/ GRC-103(V) storage compartment. Close the compartment by securing the nylon cover stud fasteners.

C Turn the case over so that the storage compartment faces downward. Lay the three guy anchors in the slotted brackets. Secure the anchors by fastening the two short canvas straps.

D Place the three mast sections in position in the case. Secure them with the two long canvas straps.



Extension Kit, Mast MK-1009/GRC-I 03(V)

2-13. INSTALLATION OF RADIO SET

● GENERAL

Radio Set AN/GRC-103(V)(*) may be installed in a variety of configurations, both fixed and vehicular. The equipment should be located in accordance with the specific installation instructions for the shelter or vehicle in which it is to be used. The components of the radio set are shipped with transmitter tubes Installed and ready to operate. No fuses are required.

I CABLE CONNECTIONS

WARNING

The radio set must be grounded to protect personnel and equipment from Iightning and other high-voltage sources.

A After the equipment has been properly installed, interunit and external connections should be made for the desired type of operation as Iisted below:

PCM terminal, 12-channel.
PCM repeater, 12-channel.
PCM terminal, 12-channel radio-to-cable conversion.
PCM terminal, 24-channel.
PCM repeater, 24-channel.
PCM terminal, 24-channel radio-to-cable conversion.

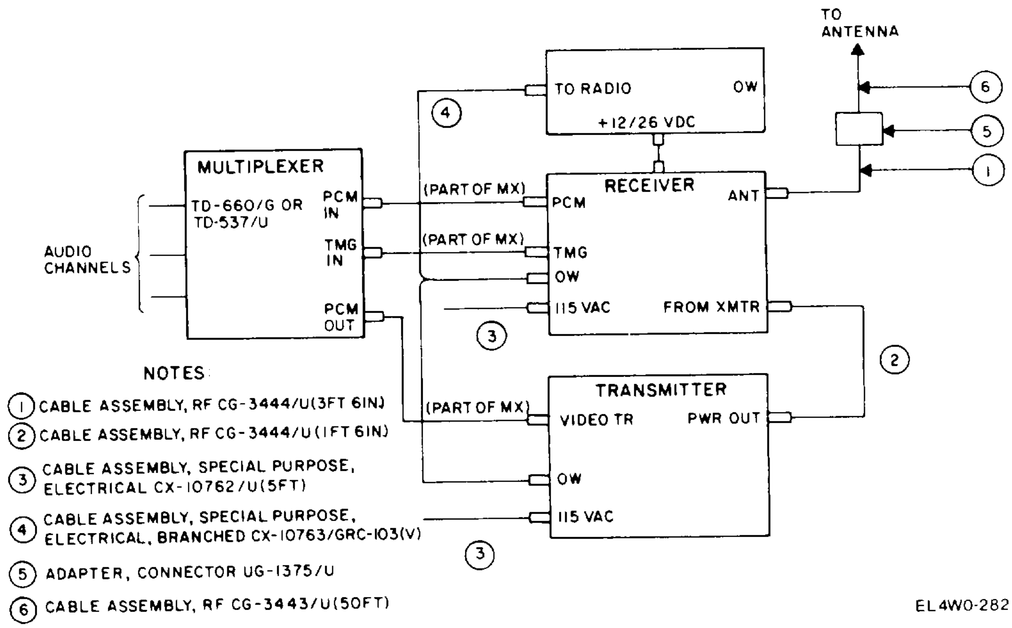
NOTE

For radio sets in which Receiver, Radio R-1329C(P)/GRC-103(V) is used, disregard the instructions for 24-channel pcm terminal, pcm repeater and pcm terminal radio-to-cable conversion contained in diagrams titled R-1329(P)/GRC-103(V) R-1329A(P)/GRC-103(V)/ or R-1329B(P)/GRC-103(V). All information on 12-channel pcm is applicable to radio sets using Receiver, Radio R-1329C(P)/GRC-103(V).

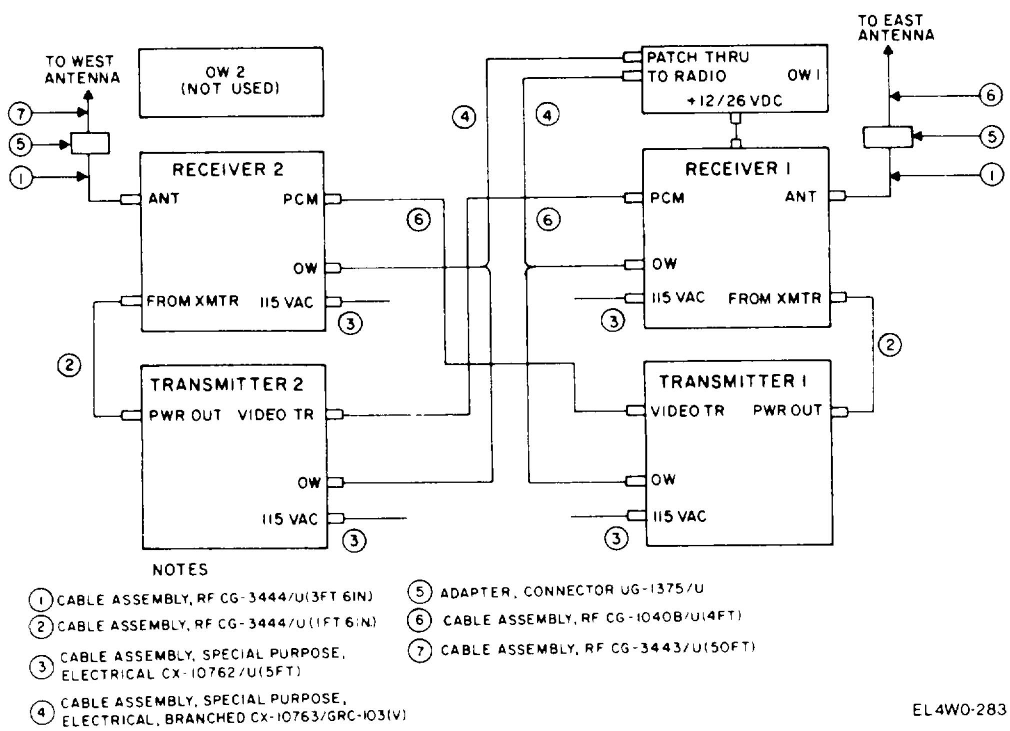
For 24 channel operation by sets using Receiver, Radio R-1329C(P)/GRC-103(V), place the Termination Connector (243-800012-000) on the COMB OW connection at the rear of the receiver portion of the radio. Set the meter switch on the transmitter to 24 CH PCM. Set the meter switch on the receiver to 12 CH PCM. The regenerated 24-channel pcm and its associated timing signal are available at the PCM and TMG outputs at the back of the radio. Connect the 24-channel pcm with its 1152 kHz timing signals to a multiplexer that can either process them directly or split them into two 12-channel pcm signals with two 576 kHz timing signals for processing by subsequent multiplexers.

B Power for the equipment is 115 Vac ±5%, single phase, 47 to 420 Hz. The order wire unit receives +12 Vdc and +26 Vdc power from the receiver (fixed head), All connections are made at the rear of the unit housings except those for rf transmission and reception. Connectors are marked on the rear of the housings and cable designations are shown on the following nine diagrams. Be sure to observe which receiver is being used in 24-channel application as the R-1329C(P)/GRC-103(V) is used differently than the other three types. The drawing titles reflect these types.

2-13. INSTALLATION OF RADIO SET- Continued

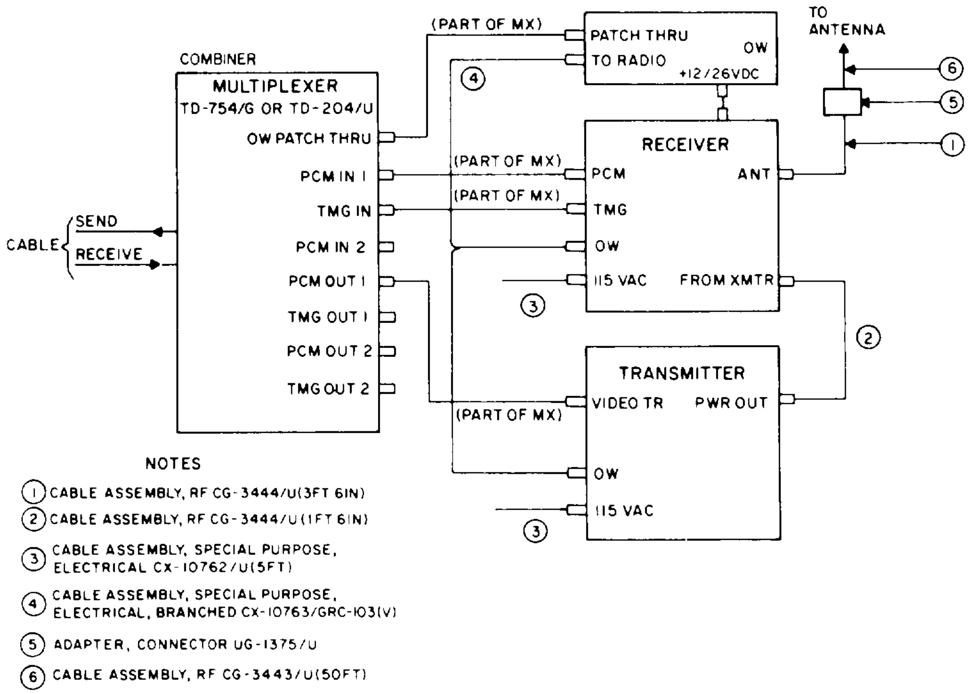


PCM Terminal, 12 Channels



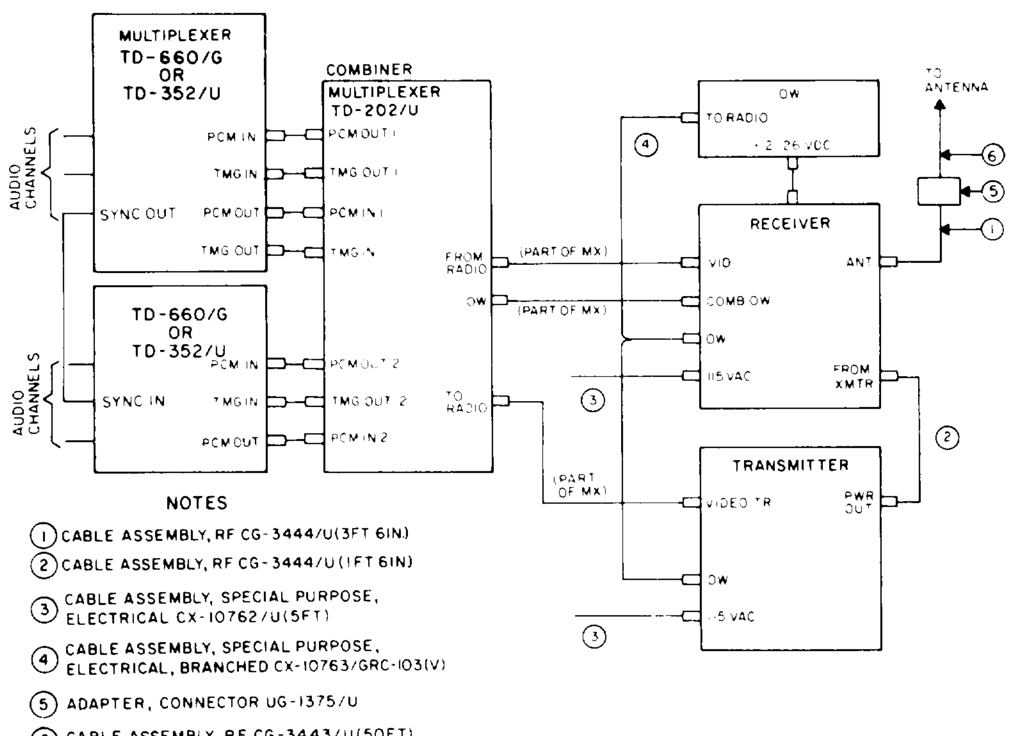
PCM Repeater, 12 Channels

2-13. INSTALLATION OF RADIO SET- Continued



EL4W0-284

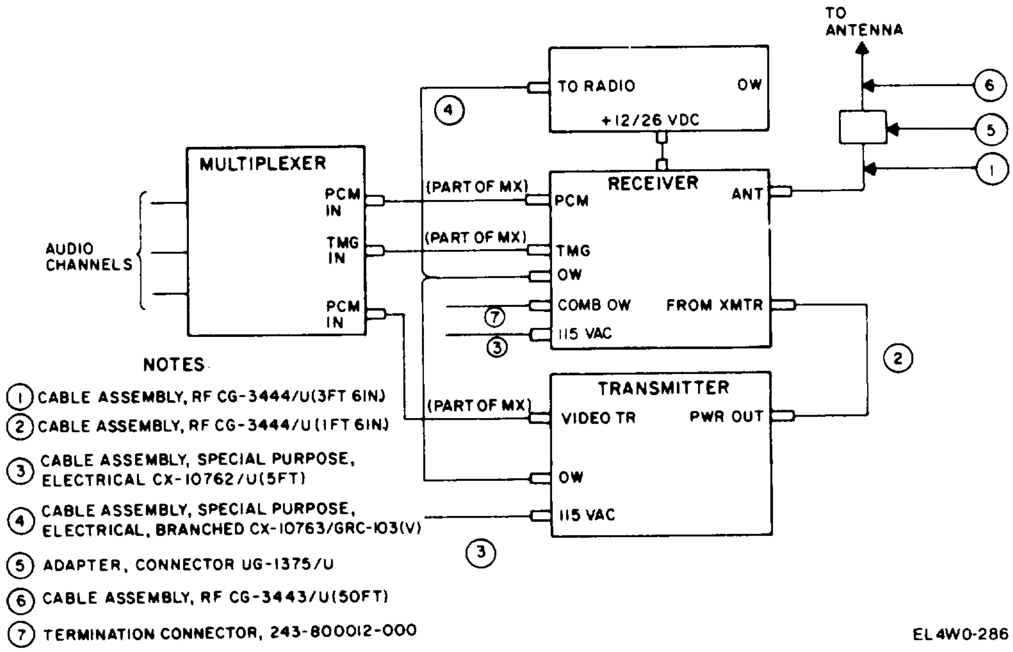
PCM Terminal, 12 Channels, Radio-to-Cable Conversion



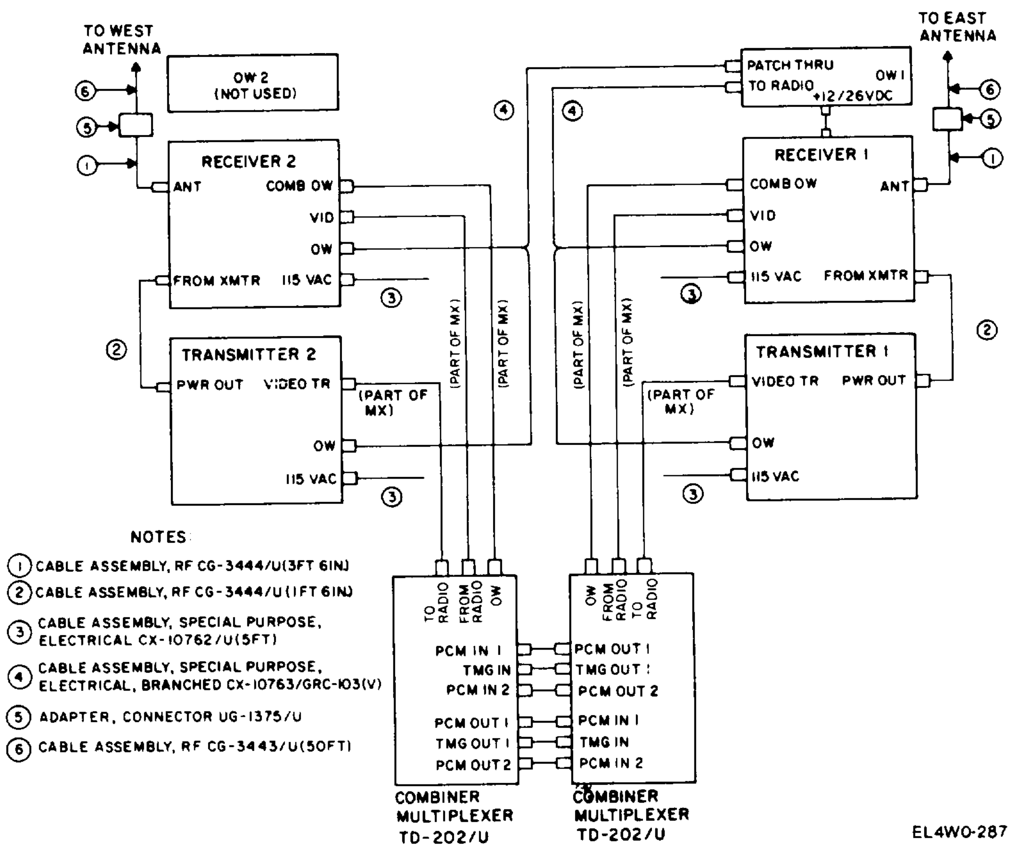
EL4W0-285

PCM Terminal, 24 Channels, for Receiver, Radio R-1329(P)/GRC-103(V), R-1329A(P)/GRC-103(V) or R-1329B(P)/GRC-103(V)

2-13. INSTALLATION OF RADIO SET- Continued

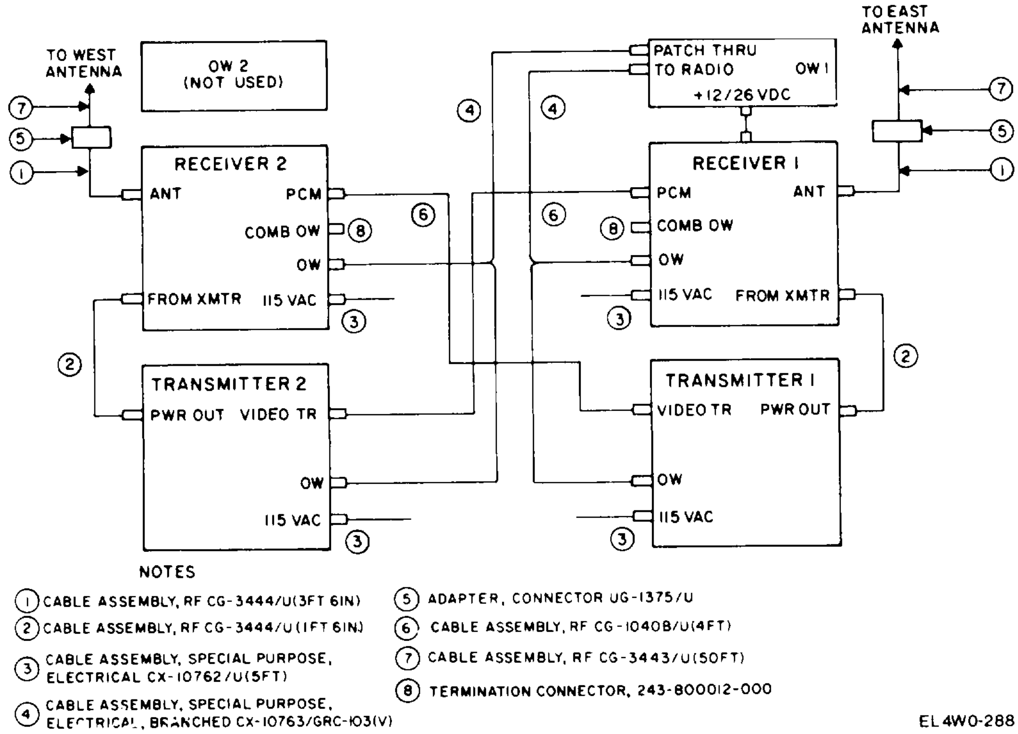


PCM Terminal, 24 Channels, for Receiver, Radio R-1329C(P)/GRC-103(V)

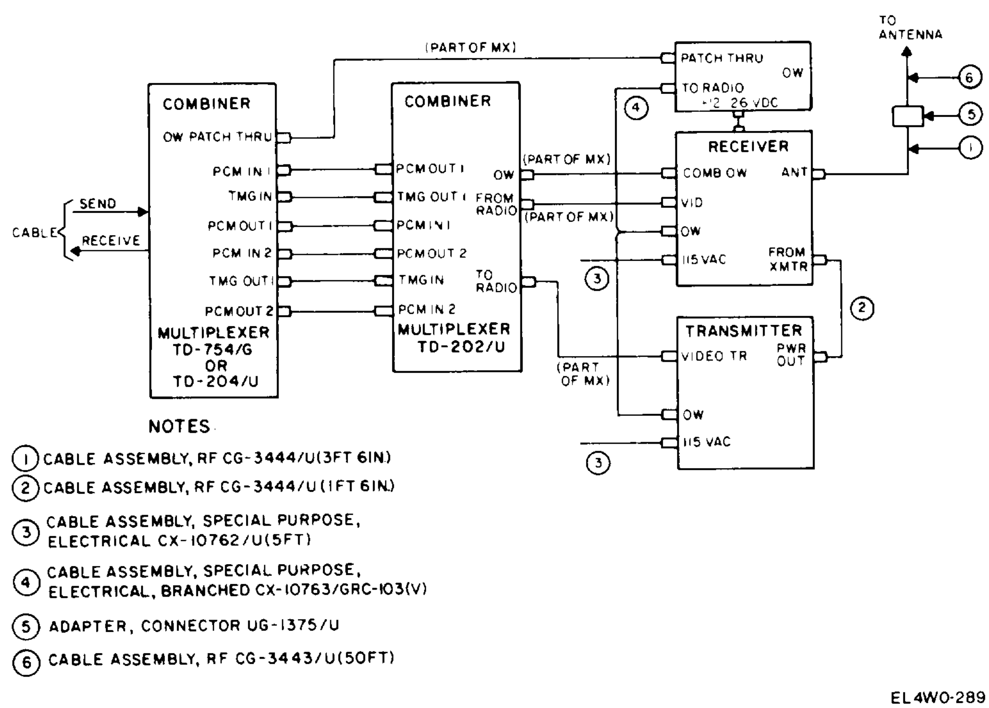


PCM Repeater, 24 Channels, for Receiver, Radio R-1329(P)/GRC-103(V), R-1329A(P)/GRC-103(V) or R-1329B(P)/GRC-103(V)

2-13. INSTALLATION OF RADIO SET- Continued

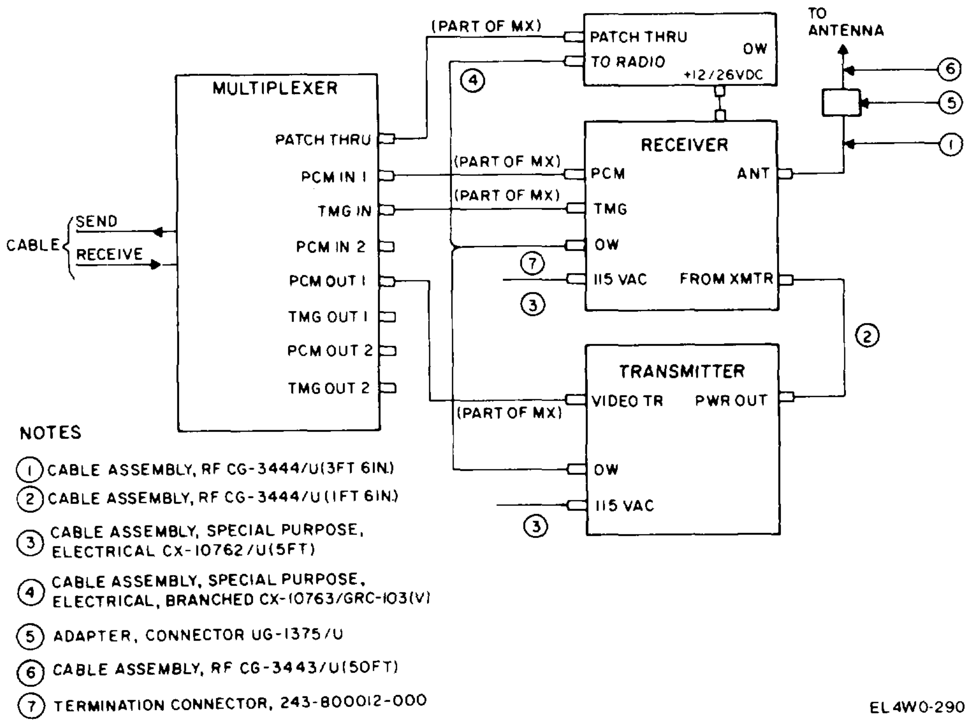


PCM Repeater, 24 Channels, for Receiver, Radio R-1329C(P)/6RC-103(V)



PCM Terminal, 24 Channels, Radio-to-Cable Conversion, for Receiver, Radio R-1329(P)/GRC-103(V) R-1329A(P)/GRC-103(V) or R-1329B(P)GRC-103(V)

2-13. INSTALLATION OF RADIO SET- Continued



PCM Terminal, 24 Channels, Radio-to-Cable Conversion for Receiver, Radio R-1329C(P)/GRC-103(V)

c PRELIMINARY ELECTRICAL CHECKS

A ORDER-WIRE PATCH-THROUGH SWITCH. In order wire patch-through operation, at a radio repeater, the FDM/PCM switch must be switched to PCM. Obtain access to the FDM/PCM switch by loosening the four captive screws securing the front panel to the order wire case and withdrawing the front panel. The switch is mounted on a printed-circuit board in the left-hand compartment of the order wire case.

B BUZZER SILENCING. Facilities are included in the radio set for silencing buzzers and dimming alarm lamps during forward area operation. This is accomplished by means of BUZ OFF/ ALM NOR switches inside the transmitter and receiver fixed heads and the order wire unit. The switches in the fixed heads may be reached by loosening the four captive screws securing the units in their cases and withdrawing them 3 or 4 inches. The switches are in the front upper corner on the right-hand side of the transmitter fixed head, and in the front upper corner on the left-hand side of the receiver fixed head. On the order wire unit, completely loosen the four captive screws securing the front panel to the case. The switch is on the rear of the front panel.

C LOOP TEST. When installation and interconnection of the radio set have been completed, the system should be checked operationally by carrying out the loop testing procedure given in chapter 4 under troubleshooting.

2-14. OPERATING PROCEDURES

Operating procedures are provided for: initial startup, changing channels, listening-watch mode, and shutdown.

CAUTION

Do not turn on the equipment unless all connections are made properly and the radio set output is connected to the antenna or to the dummy load.

NOTE

When the radio set is connected to the antenna, do not set the transmitter AC POWER switch to ON/RESET unless the transmitter XMTR CHANNEL and XMTR TUNE controls are set for the assigned frequency. Failure to observe this precaution will result in transmitting on an unauthorized frequency. If it is necessary to change channels during normal operation, set the transmitter AC POWER switch to OFF. Select the new channel with the XMTR CHANNEL and XMTR TUNE controls; then set the AC POWER switch to ON/RESET. When operating into the dummy load, it is not necessary to observe this precaution.

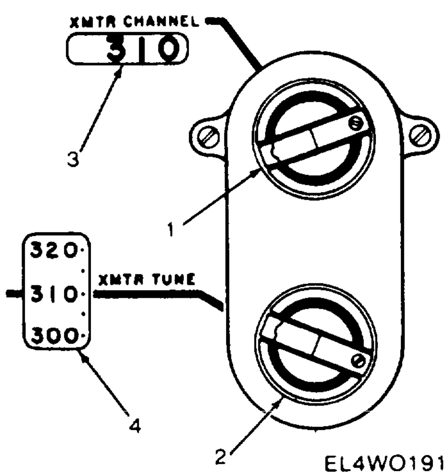
I INITIAL START-UP

A Set the transmitter XMTR CHANNEL control (1) and XMTR TUNE control (2) to the assigned transmitter channel number as shown on their indicators (3 and 4).

B Set the receiver XMTR DUPL control (1) to the assigned transmitter channel number as shown on the XMTR CHANNEL INDICATOR (2).

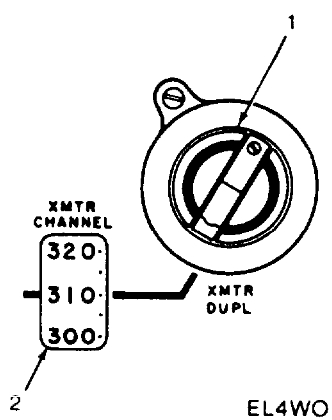
C Set the receiver RCVR channel control (1) and RCVR SIG control (2) to the assigned receiver channel number as shown on their indicators (3 and 4).

A



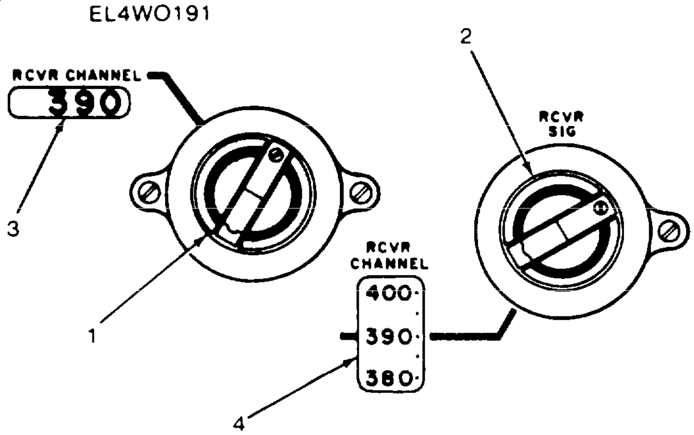
EL4WO191

B



EL4WO192

C



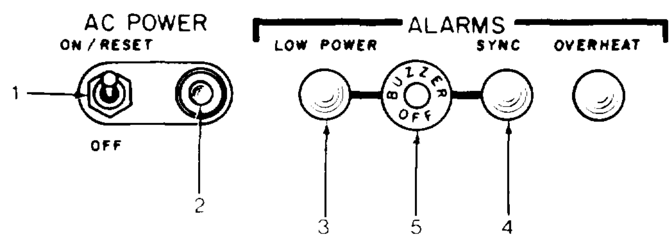
EL4WO193

2-14. OPERATING PROCEDURES -Continued

NOTE

Check to see that the transmitter frequency is compatible with the receiver frequency by using the receiver overload charts as described in appendix E.

D Set the transmitter AC POWER switch (1) to ON/RESET. The centrifugul fan WiIl start, the AC POWER and LOW POWER lamps (2 and 3) WiIl light, the SYNC lamp (4) may light momentarily (lamp goes out within 10 seconds), and the buzzer may sound (press BUZZER OFF pushbutton (5) to silence buzzer).

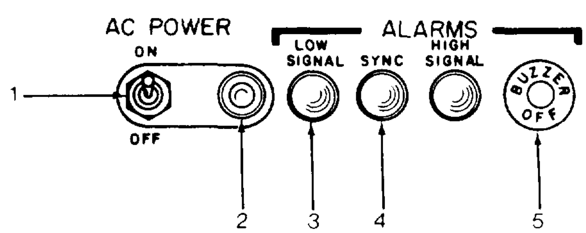


EL4W0-194

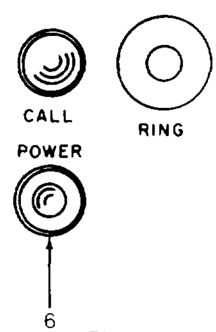
NOTE

On Transmitter, Radi T-983B(P)/GRC-103(V), the centrifugal fan does not start instantaneously if the unit is at room temperature (25° C). Allow a few minutes warm up time. If the transmitter is already warm from operating or because the ambient temperature is very high, or alter natively, if the ambient temperature is very cold, then the fan should start Immediately.

E Set receiver AC POWER switch (1) to ON. The AC POWER and LOW SIGNAL lamps (2 and 3) will light. The SYNC lamp (4) may light momentaily (lamp goes out within 10 second s). The buzzer may sound (press BUZZER OFF pushbutton (5) to release buzzer). The order wire unit POWER lamp (6) WiIl light.



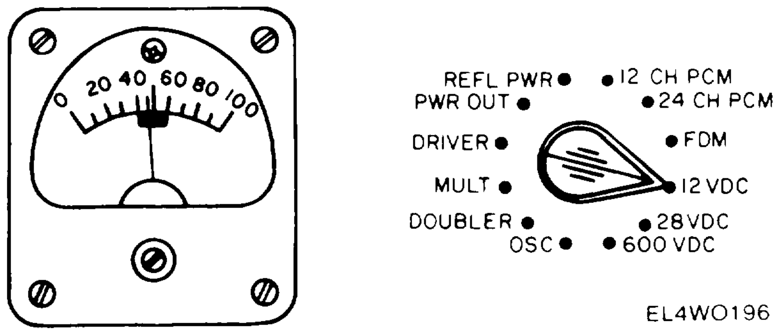
EL4W0-184



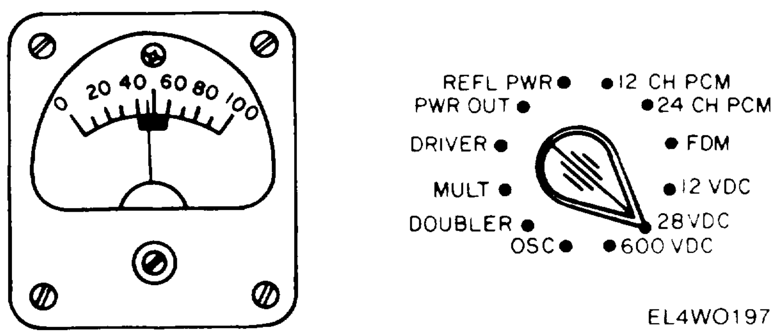
EL4W0-195

2-14. OPERATING PROCEDURES -Continued

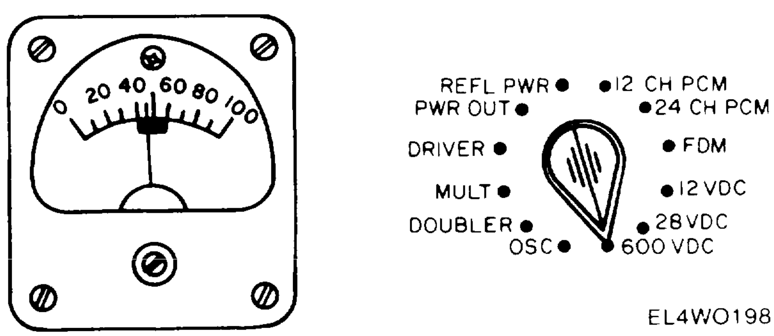
F Set transmitter meter switch to 12 VDC. The meter reads in the green band.



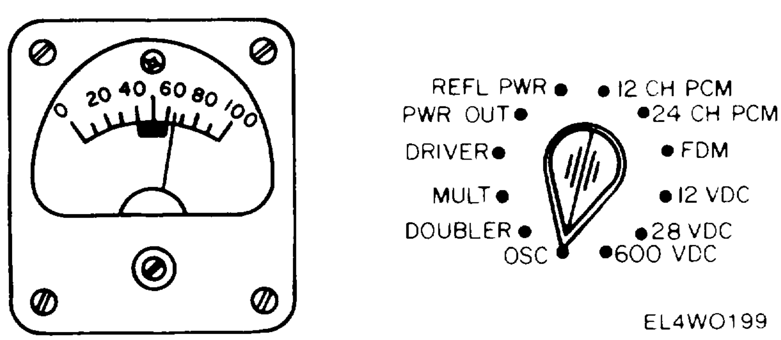
G Set transmitter meter switch to 28 VDC. The meter reads in the green band.



H Set transmitter meter switch to 600 VDC. The meter reads in the green band.

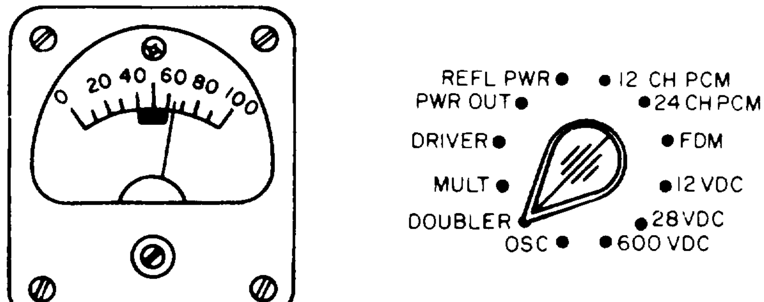


I Set transmitter meter switch to OSC. The meter reads between 25% and 90% of full scale.



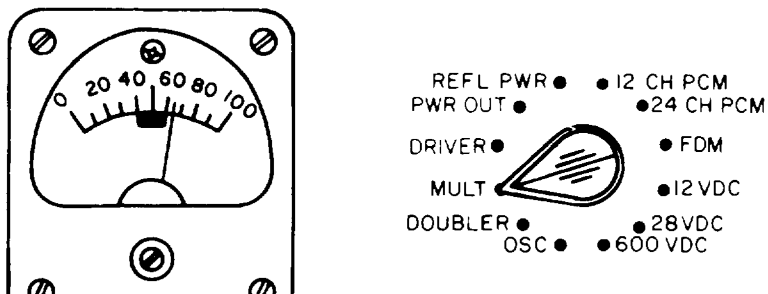
2-14. OPERATING PROCEDURES-Continued

J Set transmitter meter switch to DOUBLER. The meter reads between 25% and 90% of full scale.



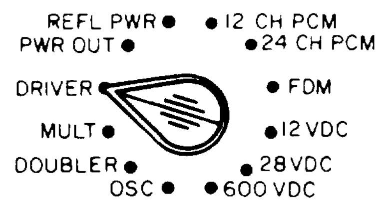
EL4WO200

K Set transmitter meter switch 10 MU LT. The meter reads between 25% and 90% of full scale.



EL4WO201

L Set transmitter meter switch to DRIVER and then for:

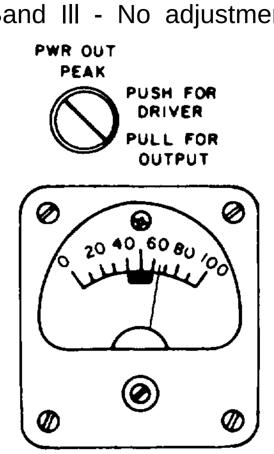


EL4WO202

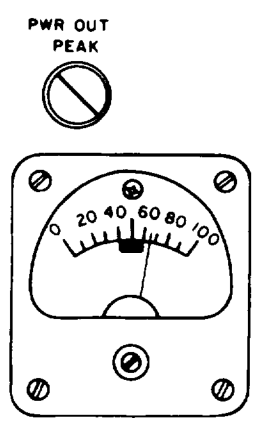
Band I - Push in PWR OUT PEAK knob and tune for maximum meter reading. The meter reads between 25% and 90% of full scale.

Bands II and IV– Tune PWR OUT PEAK knob for maximum meter reading. The meter reads 25% and 90% of full scale.

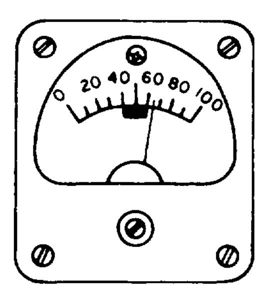
Band III - No adjustment. The meter reads between 25% and 90% of full scale.



EL4WO203



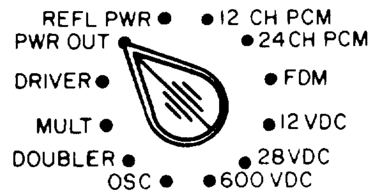
EL4WO204



EL4WO205

2-14. OPERATING PROCEDURES - Continued

M Set transmitter meter switch to PWR OUT and then for:

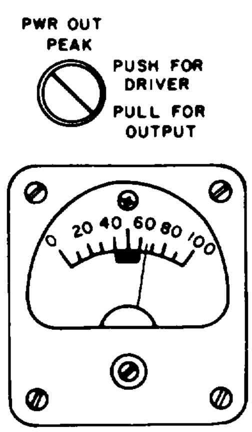


EL4WO206

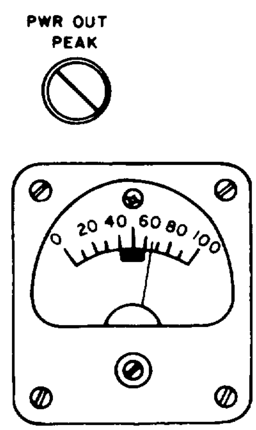
Band I - Pull out PWR OUT PEAK knob. Tune for maximum meter reading. The meter reads between 25% and 90% of full scale.

Band II and IV– Tune PWR OUT PEAK control for maximum reading. The meter reads between 25% and 90% of full scale.

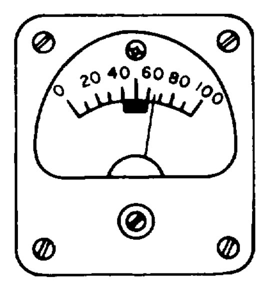
Band III - No adjustment. The meter reads between 25% and 90% of full scale.



EL4WO203

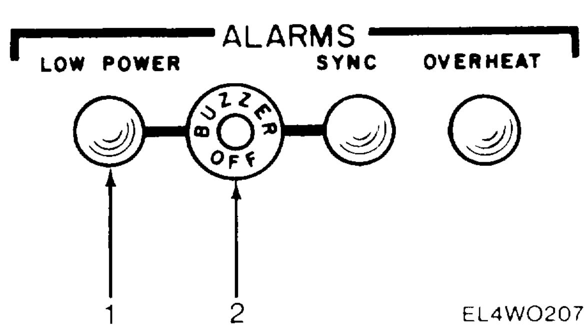


EL4WO204



EL4WO205

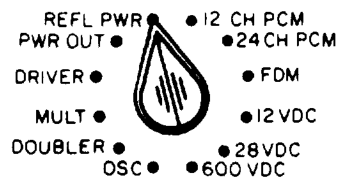
All Bands - The LOW POWER lamp (1) goes out and buzzer may sound. Press BUZZER OFF pushbutton (2) to silence buzzer.



EL4WO207

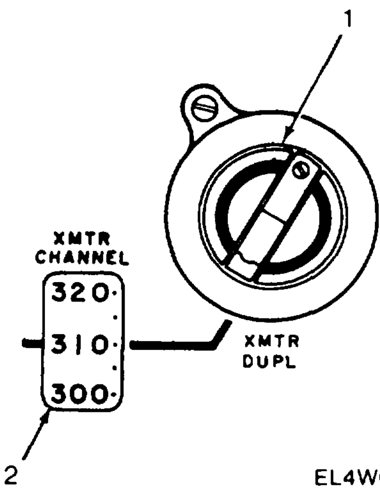
2-14. OPERATING PROCEDURES - Continued

N Set transmitter meter switch to REFL PWR.

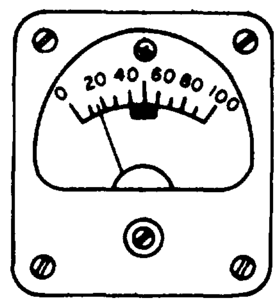


EL4WO208

O Tune receiver XMTR DUPL control (1) for minimum transmitter meter reading. Check to see that receiver XMTR CHANNEL indicator (2) is within 10 channels of the assigned transmitter channel number. The meter reads less than 20% of full scale.

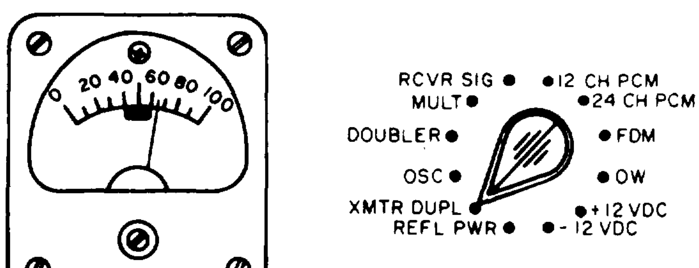


EL4WO192



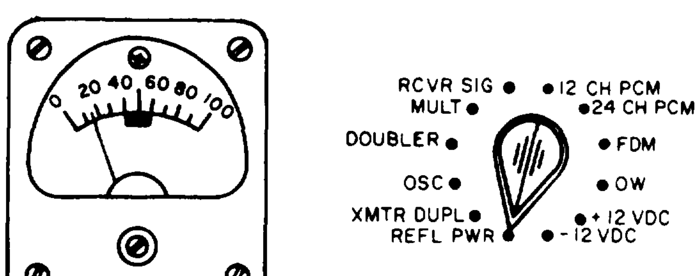
EL4WO209

P Set receiver meter switch to XMTR DUPL. The meter reads between 25% and 90% of full scale.



EL4WO210

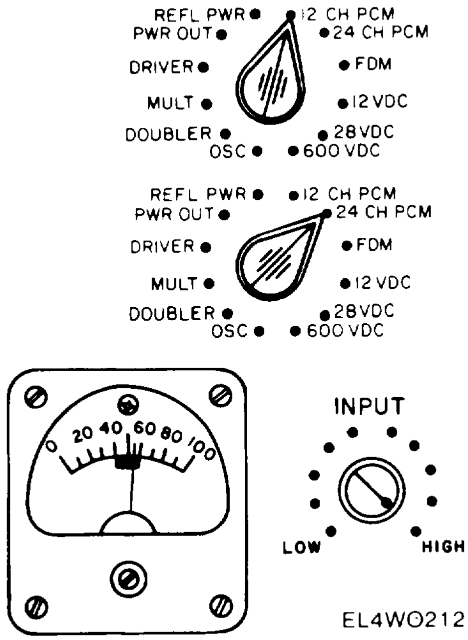
Q Set receiver meter switch to REFL PWR. The meter reads less than 20% of full scale.



EL4WO211

2-14. OPERATING PROCEDURES - Continued

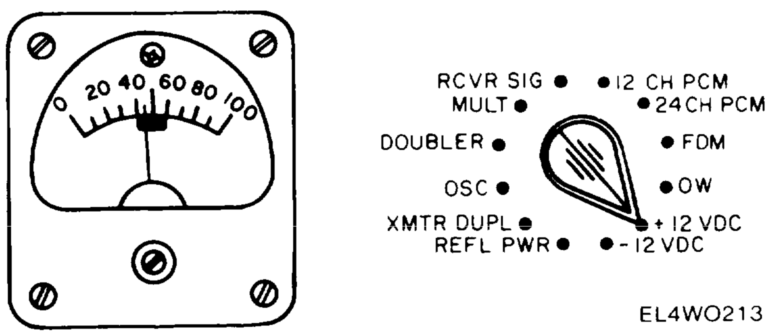
R Set transmitter meter switch to 12 CH PCM or 24 CH PCM, depending upon mode of operation. Adjust transmitter INPUT control until transmitter meter reads in the green band.



EL4WO212

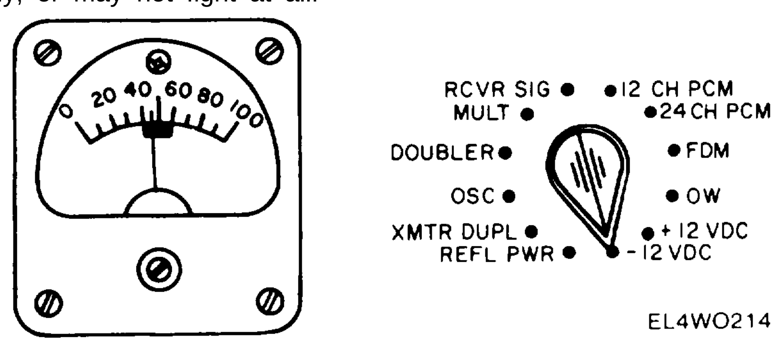
To avoid the possibility of over-modulating the transmitter, be sure to keep the near the low (left) edge of the green band.

S Set receiver meter switch to +12 VDC. The meter reads in the green band



EL4WO213

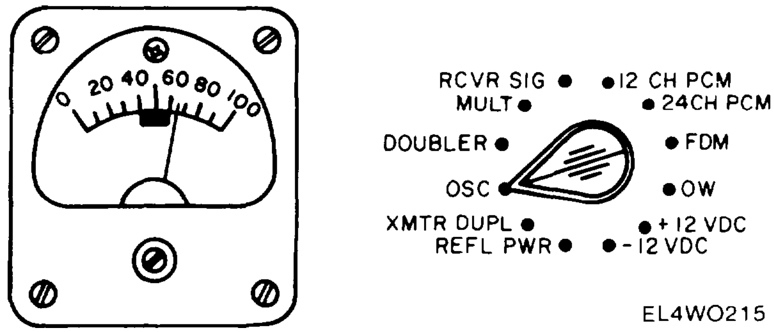
T Set receiver meter switch to –12 VDC. The meter reads in the green band. The SYNC lamp may light momentarily, or may not light at all.



EL4WO214

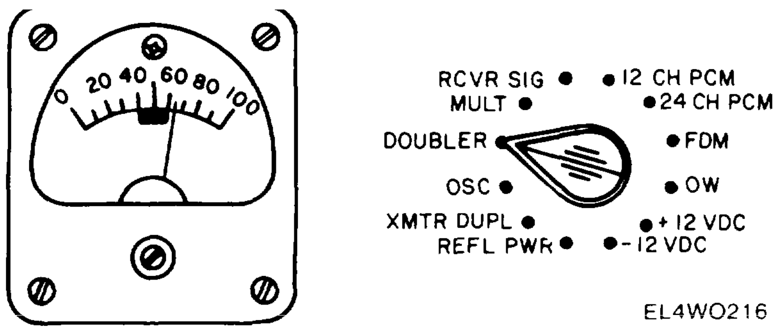
2-14. OPERATING PROCEDURES - Continued

U Set the receiver meter switch to OSC. The meter reads between 25% and 90% of full scale.



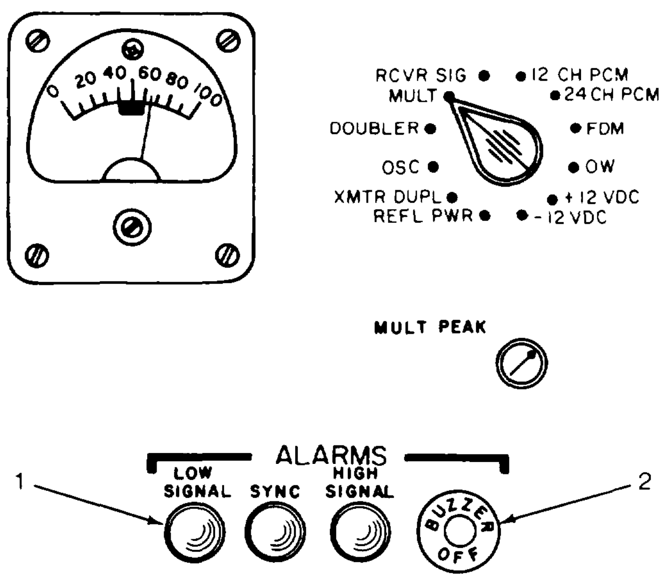
EL4WO215

V Set the receiver meter switch to DOUBLER. The meter reads between 25°/0 and 90% of full scale.



EL4WO216

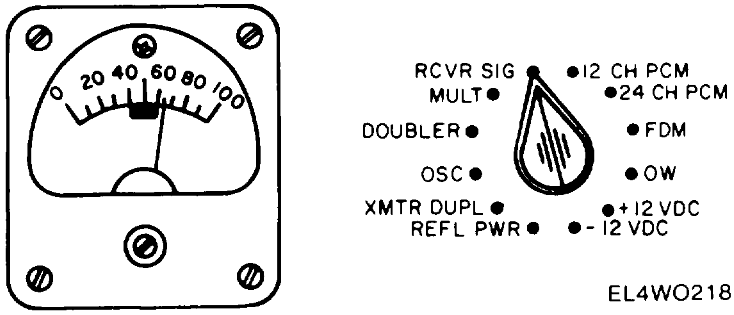
W Set the receiver meter switch to MULT. Adljust MULT PEAK control for maximum meter reading. The meter reads between 25°/0 and 90°/0 of full scale, the LOW SIGNAL lamp (1) goes out if transmitter at next site is transmitting, and the buzzer may sound (push BUZZER OFF push button (2) to silence buzzer).



X Wait until LOW SIGNAL lamp goes out. Loud rushing noise in order wire unit handset disappears.

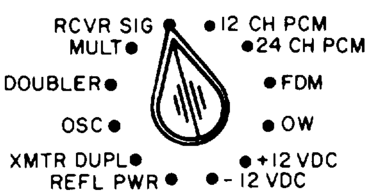
2-14. OPERATING PROCEDURES - Continued

Y Set receiver meter switch to RCVR SIG. The meter reads between 25% and 90% of full scale.

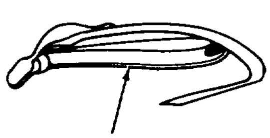


EL4WO218

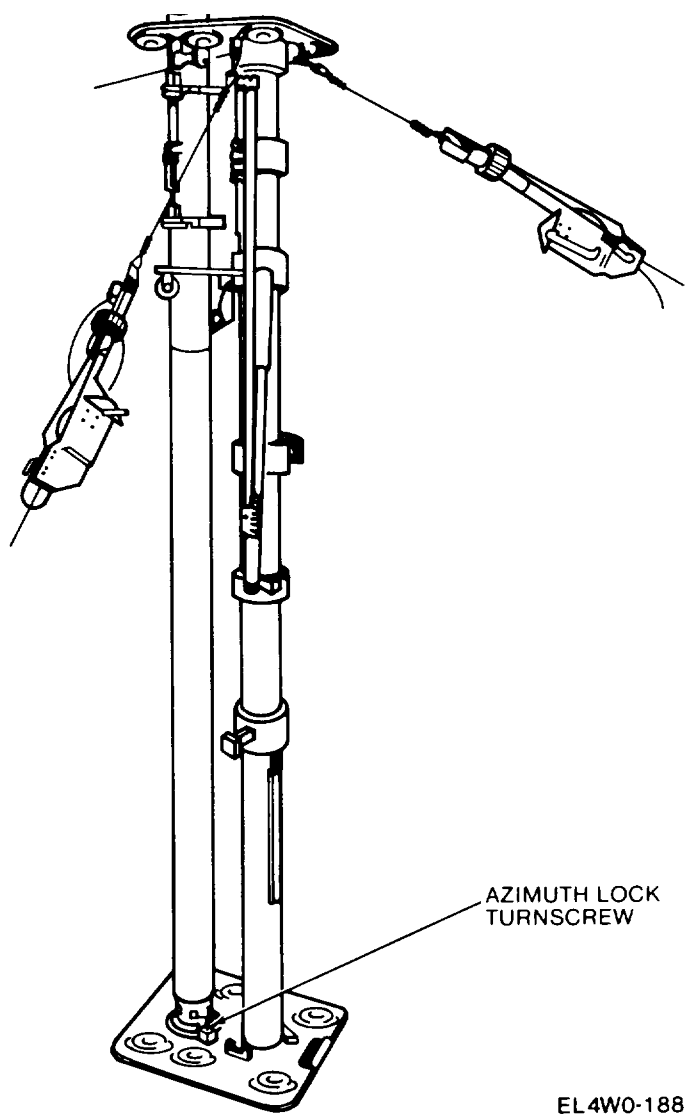
Z With the receiver meter switch at RCVR SIG, release the azimuth lock turnscrew on the antenna base plate. With a strap wrench, rotate the mast until maximum reading is obtained on receiver meter. Tighten azimuth lock turnscrew.



EL4WO219



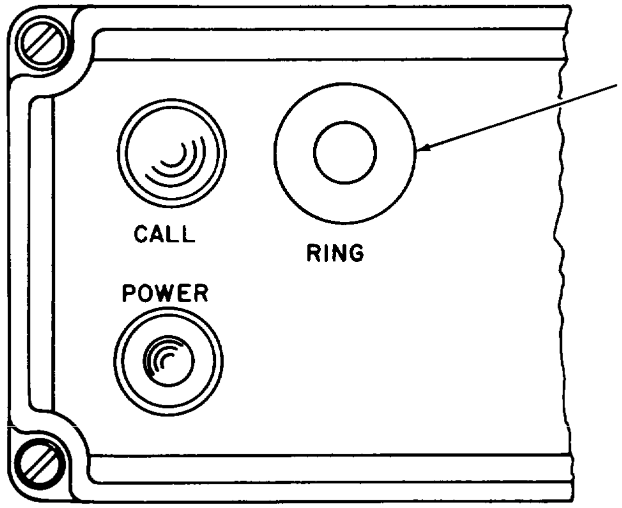
EL4W0-180



EL4W0-188

2-14. OPERATING PROCEDURES - Continued

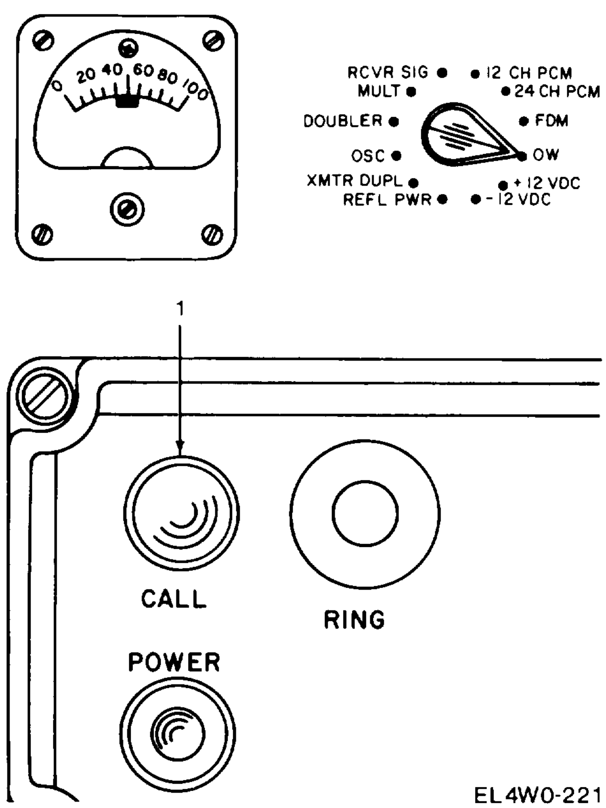
AA Push RING button (1) on order wire unit to contact operator at the next site. A 1,600-Hz signaling tone is heard in the order wire unit handset.



EL4W0-220

AB Press handset switch to talk.

AC Set receiver meter switch to OW. Request an order wire ring from the distant station. The meter reads in the green band, CALL lamp (1) on order wire unit lighter, and the buzzer may sound.



EL4W0-221

2-14. OPERATING PROCEDURES - Continued

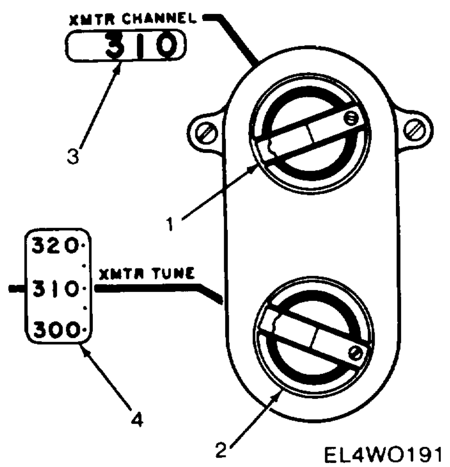
• CHANGING CHANNELS

A Set the transmitter XMTR CHANNEL control (1) and XMTR TUNE control (2) to the assigned transmitter channel number as shown on their indicators (3 and 4).

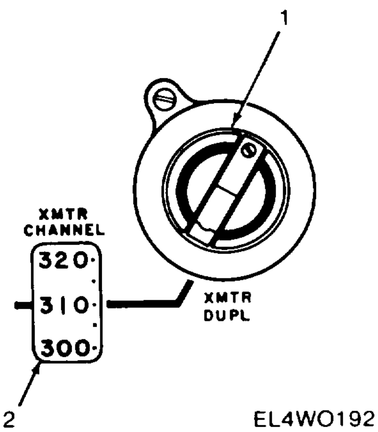
B Set the receiver XMTR DUPL control (1) to the assigned transmitter channel number as shown on the XMTR CHANNEL INDICATOR (2).

C Set the receiver RCVR channel control (1) and RCVR SIG control (2) to the assigned receiver channel number as shown on their indicators (3 and 4).

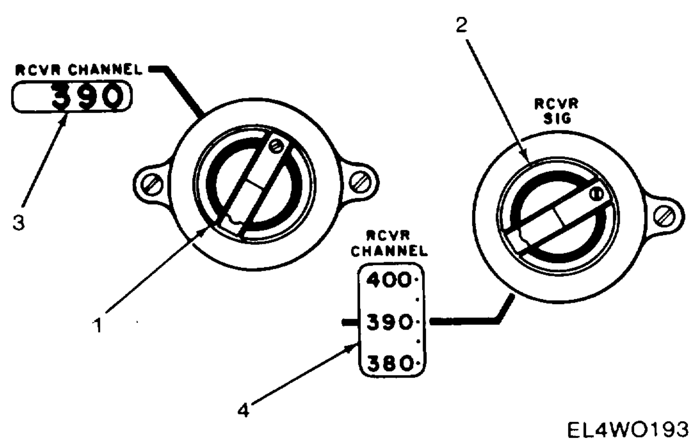
A



B



C

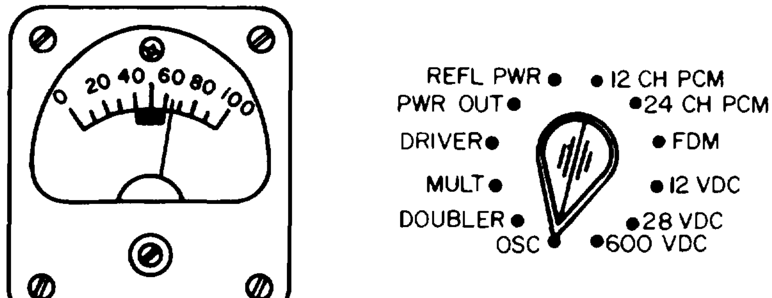


NOTE

Check to see that the transmitter frequency is compatible with the receiver frequency by using the receiver overload charts as described in appendix E.

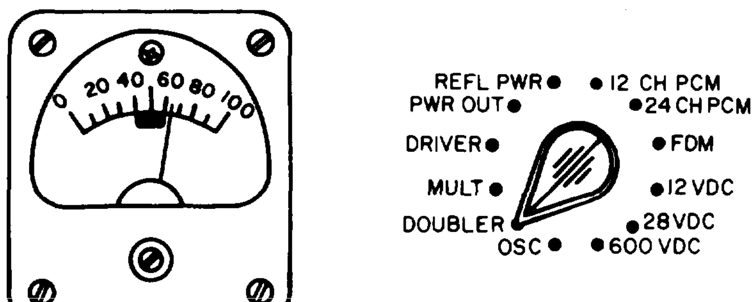
2-14. OPERATING PROCEDURES - Continued

D Set transmitter meter switch to OSC. The meter reads between 25% and 90% of full scale.



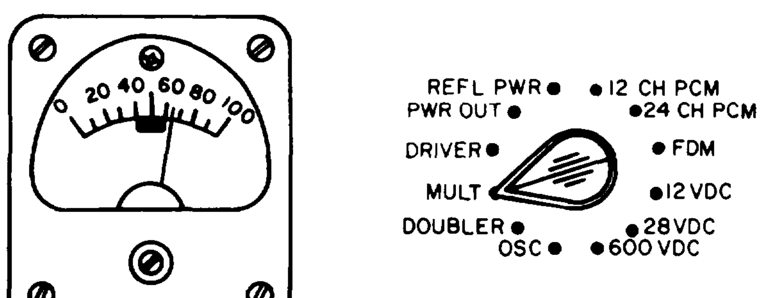
EL4WO199

E Set transmitter meter switch to DOUBLER. The meter reads between 25% and 90% of full scale.



EL4WO200

F Set transmitter meter switch to MU LT. The meter reads between 25% and 90% of full scale.



EL4WO201

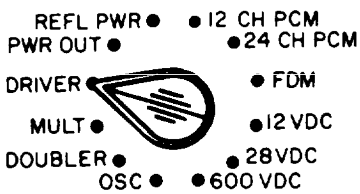
2-14. OPERATING PROCEDURES - Continued

G Set transmitter meter switch to DRIVER and then for:

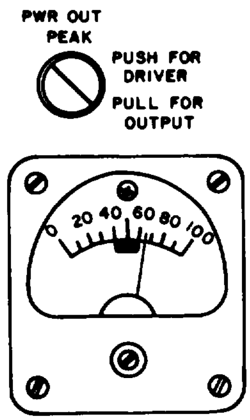
Band I - Push in PWR OUT PEAK knob and tune for maximum meter reading. The meter reads between 25% and 90% of full scale.

Band II and IV– Tune PWR OUT PEAK knob for maximum meter reading. The meter reads between 25% and 90% of full scale.

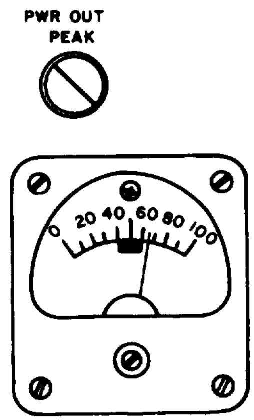
Band Ill - No adjustment. The meter reads between 25% and 90% of full scale.



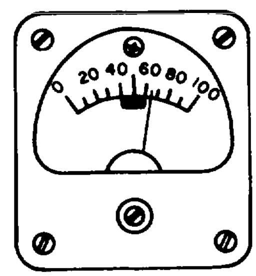
EL4WO202



EL4WO203



EL4WO204



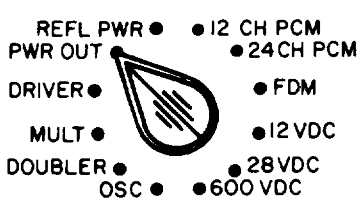
EL4WO205

H Set transmitter meter switch to PWR OUT and then for:

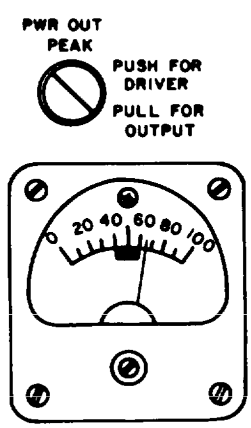
Band I - Pull out PWR OUT PEAK knob. Tune for maximum meter reading. The meter reads between 25% and 90% of full scale.

Band II and IV - Tune PWR OUT PEAK control for maximum reading. The meter reads between 25% and 90% of full scale.

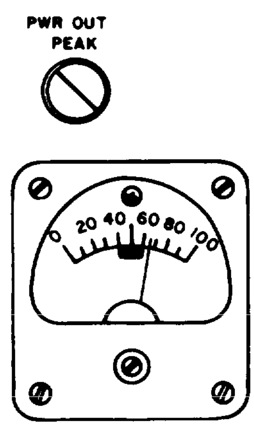
Band Ill - No adjustment. The meter reads between 25% and 90% of full scale.



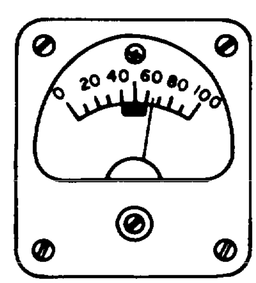
EL4WO206



EL4WO203



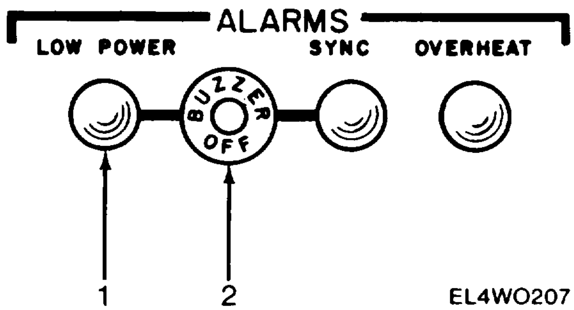
EL4WO204



EL4WO205

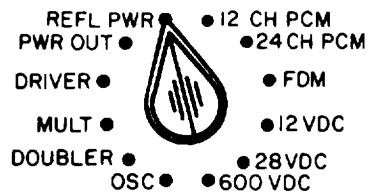
2-14. OPERATING PROCEDURES - Continued

All Bands - The LOW POWER lamps (1) goes out and buzzer may sound. Press BUZZER OFF pushbutton (2) to silence buzzer.



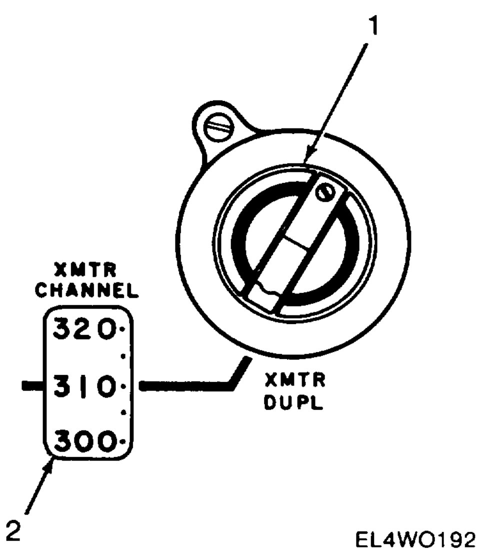
EL4WO207

I Set transmitter meter switch to REFL PWR.

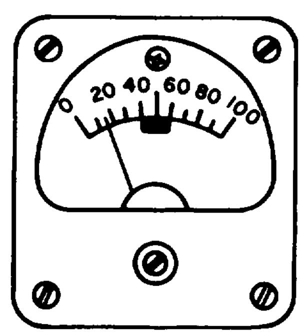


EL4WO208

J Tune receiver XMTR DUPL control (1) for minimum transmitter meter reading. Check to see that receiver XMTR CHANNEL indicator (2) is within 10 channels of the assigned transmitter channel number. The meter reads less than 20% of full scale.



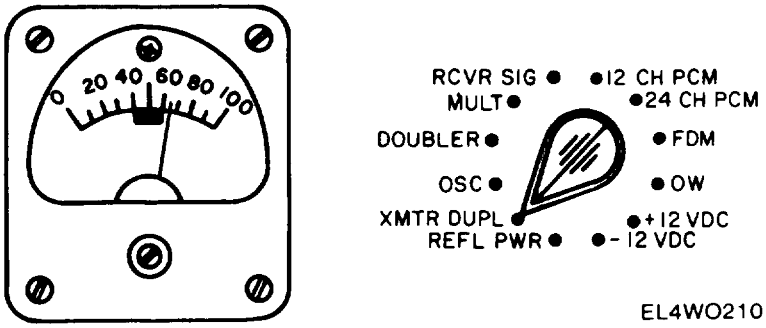
EL4WO192



EL4WO209

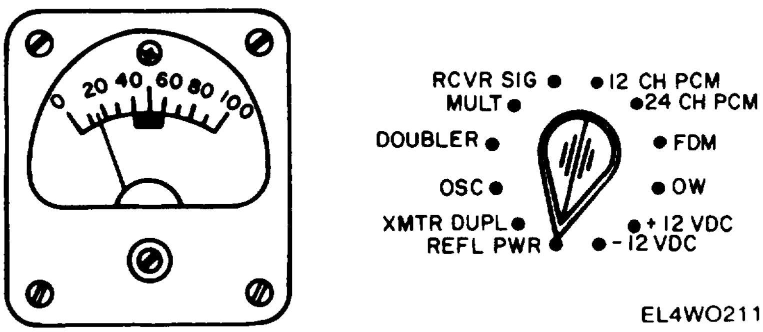
2-14. OPERATING PROCEDURES- Continued

K Set receiver meter switch to XMTR DUPL. The meter reads between 20% and 90% of full scale.



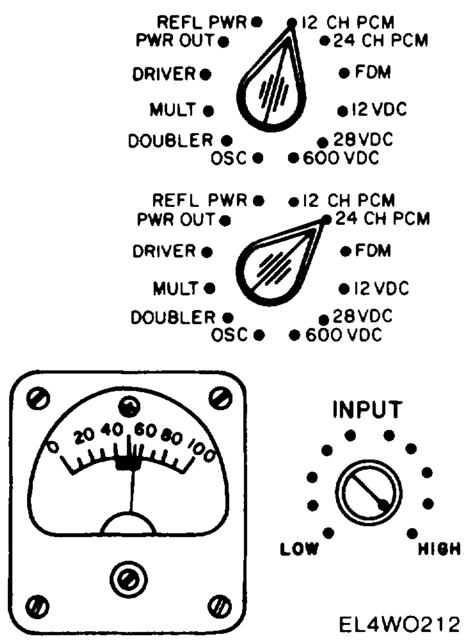
EL4WO210

L Set receiver meter switch to REFL PWR. The meter reads less than 20% of full scale.



EL4WO211

M Set transmitter meter switch to 12 CH PCM or 24 CH PCM, depending upon mode of operation. Adjust transmitter INPUT control until transmitter meter reads in the green band.



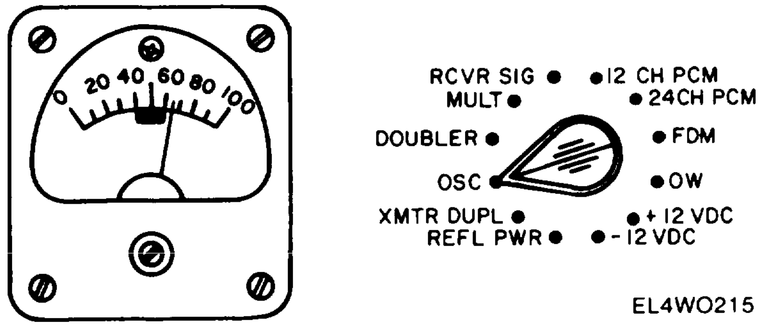
EL4WO212

NOTE

To avoid the possibility of over-modulating the transmitter, be sure to keep the needle near the low (left) edge of the green band.

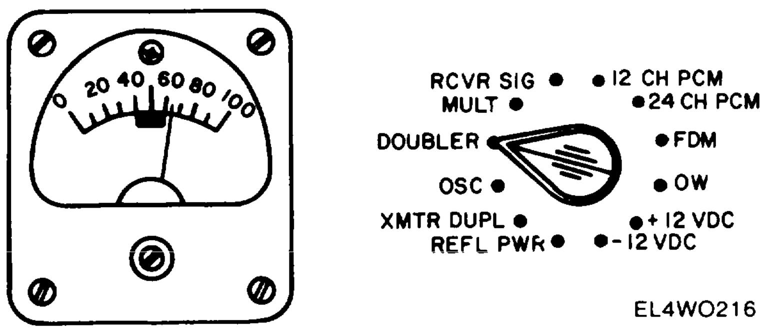
2-14. OPERATING PROCEDURES - Continued

N Set the receiver meter switch to OSC. The meter reads between 25% and 90% of full scale.



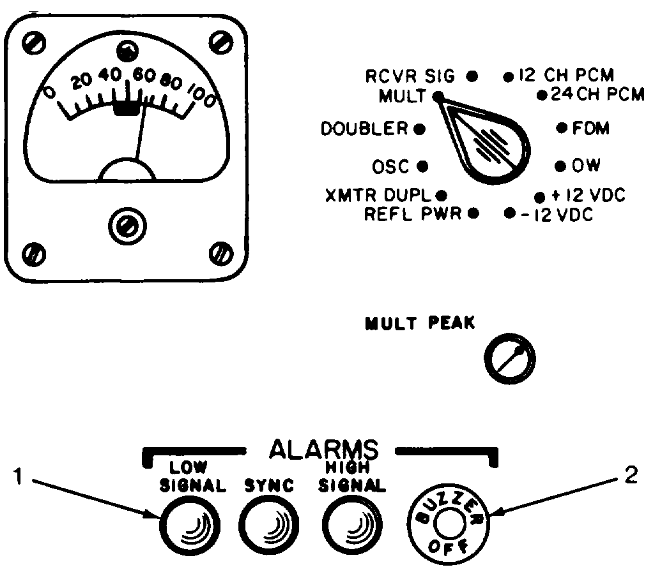
EL4WO215

O Set the receiver meter switch to DOUBLER. The meter reads between 25% and 90% of full scale.



EL4WO216

P Set the receiver meter switch to MULT. Adjust MULT PEAK control for maximum meter reading. The meter reads between 25% and 90% of full scale, the LOW SIGNAL lamp (1) goes out if transmitter at next site is transmitting, and the buzzer may sound (push BUZZER OFF push-button (2) to silence buzzer

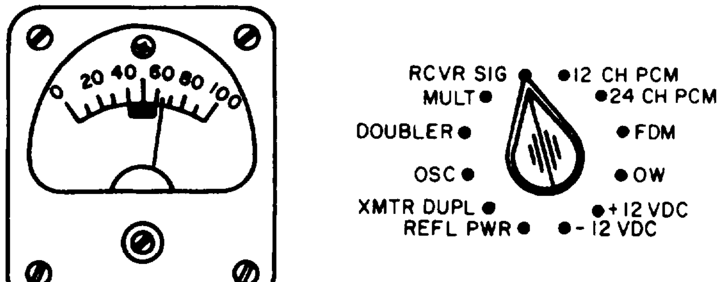


EL4WO217

Q Wait until LOW SIGNAL lamp goes out. Loud rushing noise in order wire unit handset disappears.

2-14. OPERATING PROCEDURES - Continued

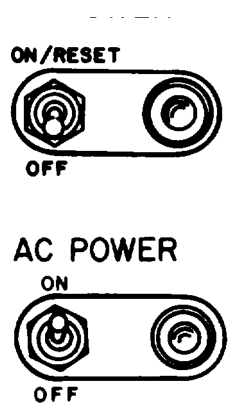
R Set receiver meter switch to RCVR SIG. The meter reads between 25% and 90% of full scale.



EL4WO218

I LISTENING-WATCH MODE

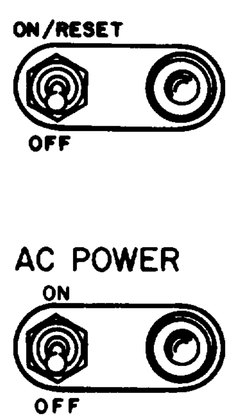
To operate the radio set in the listening-watch mode, set the transmitter AC POWER switch to OFF and the receiver AC POWER switch to ON. This will enable the receiver facility of the order wire sytem.



EL4WO222

. SHUT DOWN

Shut down the radio set by setting the transmitter and receiver AC POWER switches to OFF.



EL4WO223

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

2-15. OPERATION AT LOW TEMPERATURES

The radio set can be operated at low temperatures without special preparations or procedures. Adequate protection should be provided from snow and ice. When the ambient temperature is 30% (–1.11°C) or lower, there will be some increase in the frictional resistance of the controls. No special lubricants are required.

2-16. OPERATION IN TROPICAL CLIMATES

In tropical climates, the equipment may be operated in swampy areas where extreme moisture conditions exist. The high relative humidity causes condensation of moisture on equipment whenever the temperature of the equipment becomes lower than that of the air. Keep the equipment dry, Components not in use are to be stored above ground level, with free circulation of air around them.

2-17. OPERATION IN DESERT CONDITIONS

When the radio set is operated in desert conditions, sand may enter the moving parts. Keep the equipment as free from sand and grit as possible to avoid damage to the precision mechanical parts. The air filter in the transmitter fixed head must be cleaned frequently, at least once a week, and also immediately after a sand or dust storm. Where sand and grit have accumulated after a storm or during regular operation, remove the dust covers and inspect the units. Cleaning should be done with a vacuum cleaner, an air hose (pressure not exceeding 30 pounds per square inch (psi)), or a small brush.

CHAPTER 3
OPERATOR MAINTENANCE

Section I. TROUBLESHOOTING

3-1. GENERAL

Table 3-1 lists the common malfunctions which you may find during the operation of the Radio Set AN/GRC-103(V)1, 2 and 3, and the Extension Kit, Mast MK-1009/GRC-103(V). You should refer to the probable causes (Test/inspection) and perform corrective actions in the order listed.

This manual cannot list all malfunctions that may occur or corrective actions to be performed. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor.

NOTE

Be sure that the operating procedures in Chapter 2 have been followed correctly.

The first thing the operator, who experiences a problem with equipment operation, should do is match the problem with the Malfunction column of Operator Troubleshooting table. Then proceed as instructed in the Test or Inspection and Corrective Action columns.

OPERATOR TROUBLESHOOTING

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION(S)

TRANSMITTER TROUBLESHOOTING

OPERATOR TROUBLESHOOTING - Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION(S)

TRANSMITTER TROUBLESHOOTING - Continued

1. When AC POWER switch is set to ON/RESET, centrifugal fan does not start; AC POWER and LOW POWER lamps do not light; buzzer does not sound.

   Primary power is absent.

   Check 11 5-volt power source and power cable connections.

2. AC POWER lamp does not light when AC POWER switch is set to ON/RESET; centrifugal fan starts, other lamps light; buzzer sounds; OVERHEAT lamp goes out within 10 sees.

   AC POWER lamp is burned out.

   Replace AC POWER lamp (paragraph 3-4).

3. LOW POWER lamp does not light when AC POWER switch is set to ON/RESET; centrifugal fan starts, other lamps light; buzzer sounds; OVERHEAT lamp goes out within 10 sees.

   LOW POWER lamp is burned out.

   Replace LOW POWER lamp (paragraph 3-4).

4. Buzzer does not sound when AC POWER switch is set to ON/RESET.

   Buzzer silenced.

   Push BUZZER OFF button. If buzzer still does not sound, check setting of BUZ OFF/ALM NOR switch (paragraph 2-1 5).

5. OVERHEAT lamp does not go out within 10 seconds after AC POWER switch is set to ON/RESET.

   A Clogged air filter.

   A Change air filter.

   B Blockage in the air duct.

   B Visually check transmitter case air duct for possible blockage.

6. LOW POWER lamp does not go out within 60 seconds after AC POWER switch is set to ON/RESET; meter indication with switch at 600 VDC is normal.

   A Incorrect setting of XMTR TUNE control.

   A Reset XMTR TUNE control.

   B Incorrect tuning of PWR OUT PEAK control.

   B Band 1: Retune PWR OUT PEAK CONTROL.
   Bands II and IV: Retune PWR OUT PEAK control.
   Band III: Not applicable.

OPERATOR TROUBLESHOOTING - Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION(S)

TRANSMITTER TROUBLESHOOTING - Continued

7. Meter indication is below normal with switch at MULT; DOUBLER indication is normal.

A Incorrect setting of XMTR control.

A Reset XMTR TUNE control.

B Incorrect tuning of PWR OUT PEAK control.

B Band I: Retune PWR OUT PEAK CONTROL.
Bands II and IV: Retune PWR OUT PEAK control.
Band Ill: Not applicable.

8. Meter indication is below normal with switch at DRIVER; MULT indication is normal.

A Incorrect setting of XMTR TUNE control.

A Reset XMTR TUNE control.

B Incorrect tuning of PWR OUT PEAK control.

B Band 1: Retune PWR OUT PEAK CONTROL.
Bands II and IV: Retune PWR OUT PEAK control.
Band Ill: Not applicable.

9. Meter indication is below normal with switch at PWR OUT; DRIVER indication is normal; receiver meter indication is below normal with switch at XMTR DUPL.

A Incorrect setting of XMTR TUNE control.

A Reset XMTR TUNE control.

B Incorrect tuning of PWR OUT PEAK control.

B Band 1: Retune PWR OUT PEAK CONTROL.
Bands II and IV: Retune PWR OUT PEAK control.
Band Ill: Not applicable.

10. Applicable meter indication with switch at REFL PWR; receiver meter indication is normal with switch at REFL PWR.

Incorrect setting of XMTR DUPL control.

Reset XMTR DUPL control.

11. Applicable meter indication with switch at REFL PWR; receiver meter indication is also appreciable with switch at REFL PWR.

Poor line connections or damaged transmission line or antenna.

Connect dummy load to ANT. connector on receiver rf head. If meter indications are appreciable, higher category maintenance is required. If meter indications are normal, lower mast (paragraph 2-8). On the antenna reflector, disconnect the CG-3444/U from the UG-1375/U and replace it with the dummy load. If meter indications are still appreciable, check transmission line and connectors. If meter indications are normal, replace dipole and/or CG-3444/U.

OPERATOR TROUBLESHOOTING - Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION(S)

TRANSMITTER TROUBLESHOOTING - Continued

12. Meter indication is below normal with switch at 12 CH PCM or 24 CH PCM (whichever applies to installation); INPUT control is set at HIGH.

    Video signal input is low or absent.

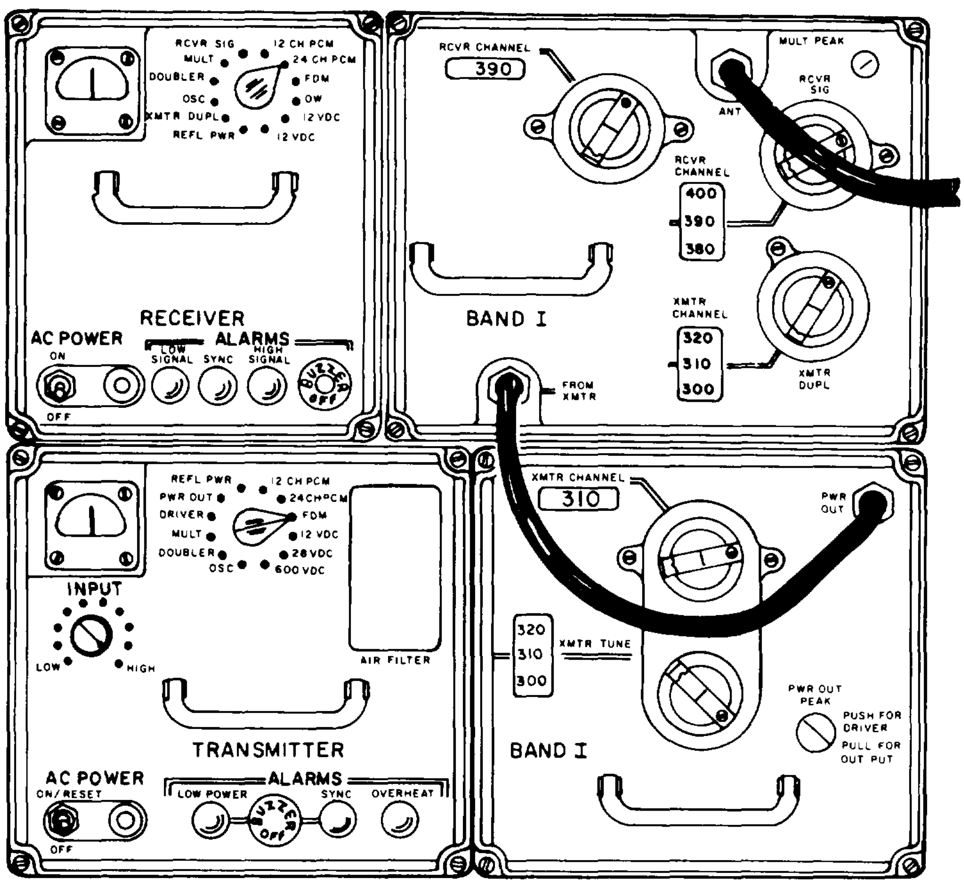
    Check to see if video signal is correct by connecting multiplex equipment back to back. Check video connections.

13. OVER HEAT lamp lights; all other indications are normal.

    Clogged air filter.

    Check filters, ducts, and radiators, and clean out dirt that is obstructing air flow. Replace filter.

RECEIVER TROUBLESHOOTING



EL4W0-224

OPERATOR TROUBLESHOOTING - Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION(S)

RECEIVER TROUBLESHOOTING - Continued

1. When AC POWER switch is set to ON/RESET, AC POWER and LOW SIGNAL lamps do not light; buzzer does not sound.

   Primary power is absent.

   Check 115-volt source and power cable connections.

2. AC POWER Lamp does not light when AC POWER switch is set to ON; other lamps light, and buzzer sounds.

   AC POWER lamp is burned out.

   Replace AC POWER lamp.

3. LOW SIGNAL lamp does not light when AC POWER switch is set to ON; other lamps light, and buzzer sounds.

   LOW SIGNAL lamp is burned out.

   Replace LOW SIGNAL lamp.

4. Buzzer does not sound when AC POWER switch is set to ON; all lamps light.

   A Buzzer silenced.

   A Push BUZZER OFF button. If buzzer still does not sound, check BUZ OFF/ ALM NOR switch (paragraph 2-15).

   B Alarms silenced.

   B Check BUZ OFF/ALM NOR switch (paragraph 2-15).

5. Meter indication is below normal with switch at XMTR DUPL; transmitter meter indication is also below normal with switch at PWR OUT.

   A Incorrect setting of XMTR TUNE control.

   A Reset XMTR TUNE control.

   B Incorrect tuning of PWR OUT PEAK control.

   B Band I: Retune PWR OUT PEAK control.
   Bands II and IV: Retune PWR OUT PEAK control.
   Band Ill: Not applicable.

6. Meter indication is below normal with switch at XMTR DUPL; transmitter meter indication is normal with switch at PWR OUT.

   Incorrect setting of XMTR DUPL control.

   Check transmitter meter indication with switch at REFL PWR. If indication is appreciable, check XMTR DUPL control setting.

OPERATOR TROUBLESHOOTING - Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION(S)

RECEIVER TROUBLESHOOTING - Continued

7. Meter indication is below normal with switch at MULT; DOUBLER indication is normal.

A Incorrect setting of RCVR SIG control.

A Reset RCVR SIG control.

B Incorrect tuning of MULT PEAK control.

B Retune MULT PEAK control.

8. Meter indication is below normal with switch at 12 CH PCM (when radio set is connected for 12-channel pcm operation). Other indications are normal.

A Input level of distant transmitter is below normal.

A Request operation of distant station to adjust INPUT control on distant station transmitter.

B PCM connection not terminated.

B Check connections to multiplex equipment.

9. Meter indication below normal with switch at 24 CH PCM (when radio set is connected), Other indications are normal.

Input level of distant transmitter is below normal.

Request operator of distant station to adjust INPUT control on distant station transmitter.

10. HIGH SIGNAL lamp lights and buzzer sounds; no communications.

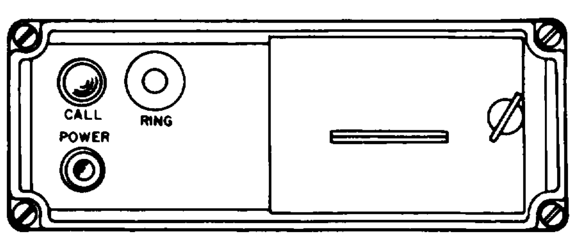
A Receiver tuned too close in frequency to associated transmitter.

A Turn off transmitter. If HIGH SIGNAL lamp goes out, check choice of operating frequencies.

B Interference from nearby high-power transmitter.

B Turn off associated transmitter and disconnect antenna lead-in cable from ANT. connector of receiver rf head. If HIGH SIGNAL lamp goes out, check operating frequencies in local area.

ORDER WIRE UNIT



EL4W0-225

OPERATOR TROUBLESHOOTING - Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION(S)

ORDER WIRE UNIT - Continued

1. POWER lamp does not light when receiver AC POWER Switch is set to ON.

   A POWER lamp is burned out.

   A Replace POWER lamp (paragraph 3-4).

   B Poor cable connections between order wire unit and receiver.

   B Check cable connections.

2. CALL lamp does not light; buzzer sounds; receiver meter indication is normal with switch at OW.

   Call lamp is burned out.

   Replace CALL lamp (paragraph 3-4).

3. CALL lamp lights, buzzer does not sound; receiver meter indication is normal with switch at OW.

   A Buzzer silenced.

   A Check BUZ OFF/ALM NOR switch.

   B Defective buzzer

   B Higher category maintenance is required.

Section II. MAINTENANCE

3-2. INTRODUCTION

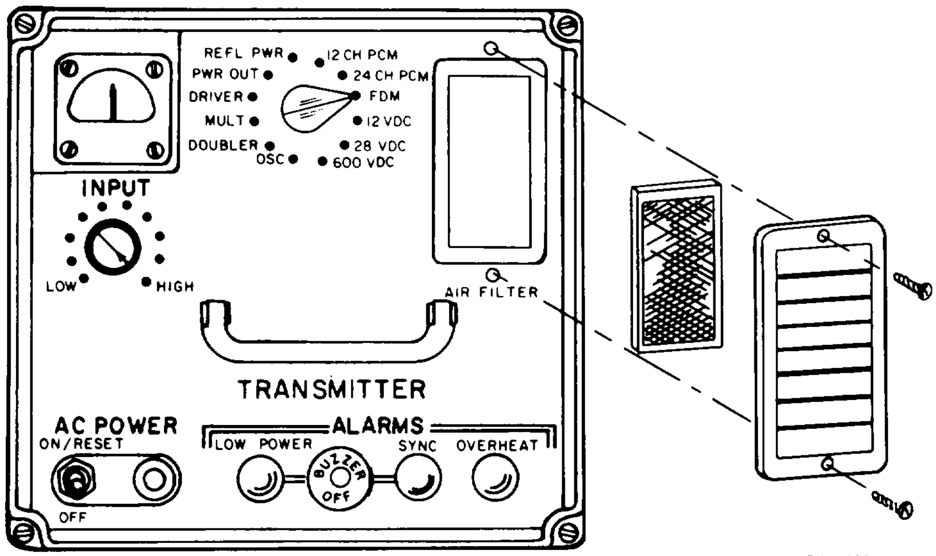
Operator maintenance of the Radio Set and the Antenna System generally consists of inspection to ensure complete, undamaged, clean and operable equipment (refer to PMCS under section V of chapter 2). In addition, certain limited services and repairs are designated, such as replacing an air filter, panel lamps, knobs, cables and complete major assemblies, such as the transmitter, the receiver, the RF heads and the order wire assembly.

No lubrication is required for equipment of the AN/GRC-103(V)(*).

3-3. AIR FILTER REPLACEMENT

A Remove the two machine screws which hold the louvered cover over he air filter on the front of the transmitter.

3-3. AIR FILTER REPLACEMENT - Continued



EL4W0-226

B Remove the dirty filter and replace it with a clean one.

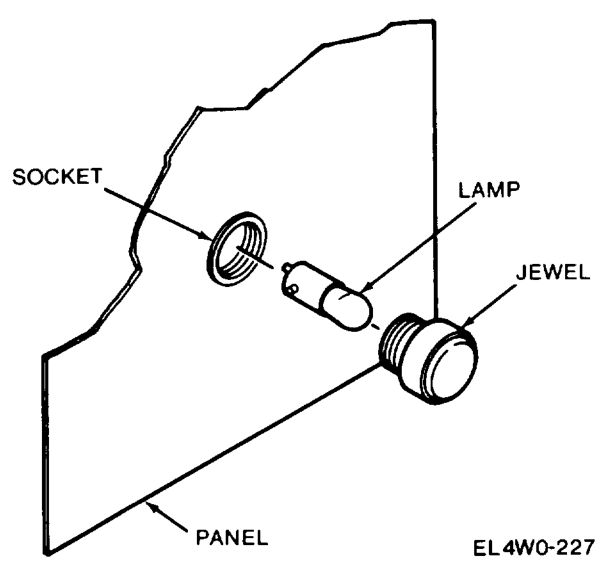
C Replace the cover and fasten it with the two screws.

3-4. PANEL INDICATOR LAMP REPLACEMENT

CAUTION

The AC POWER indicator lamps and the ALARM indicator lamps on the Transmitter, Receiver and Order Wire Unit must be replaced with type no, 327 (28 Volts). Do not use a type no. 328, which is 6 volts because damage to alarm control boards will occur.

Turn the jewel counterclockwise to unscrew it from the panel socket.



EL4W0-227

3-4. PANEL INDICATOR LAMP REPLACEMENT - Continued

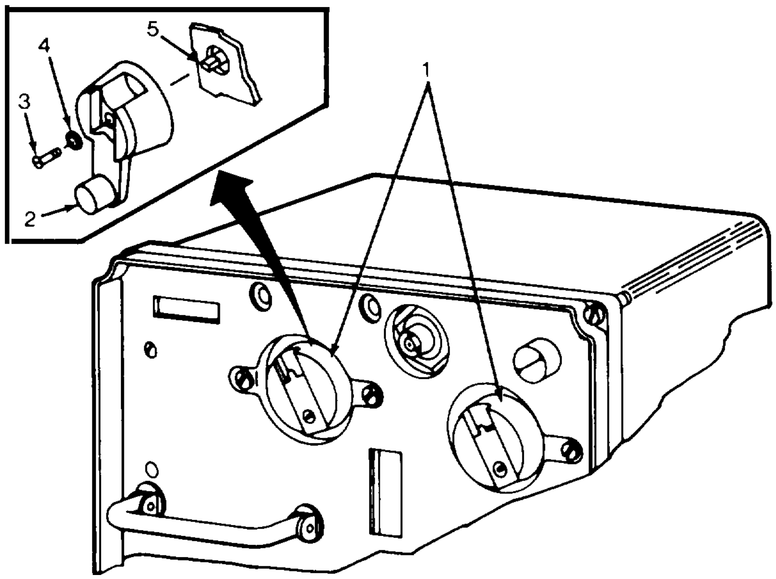
B Twist and pull the bayonet lamp from the socket.

C Push the new lamp into the socket and twist to lock.

D Replace the jewel.

3-5. PANEL HAND-CRANK TYPE KNOB REPLACEMENT

A Open the hand-crank handle (2). The handle is also shown closed in view (1).



EL4WO-228

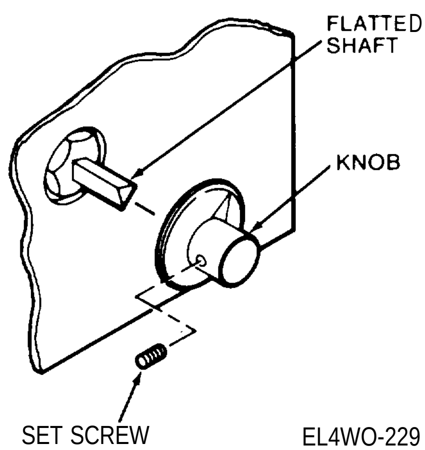
B Remove the self-locking screw (3) and washer (4), and pull the knob off the keyed control shaft (5).

C Aline the replacement knob on the keyed shaft (5), push it firmly until it seats all the way in.

D Replace the washer (4) and self-locking screw (3). Test for smooth turning with no binding or excessive friction.

3-6. PANEL KNOB REPLACEMENT

A Check the set screw for the type and size of hex-head wrench or screwdriver needed to loosen it.



EL4WO-229

3-6. PANEL KNOB REPLACEMENT - Continued

B Loosen the set screw (do not remove), then pull the knob off the shaft.

C Aline the replacement know set screw with the flat of the shaft, push it over the shaft and tighten.

CAUTION

All knobs may not be installed using set screws. Check the method before replacing knobs.

3-7. REPLACEMENT OF MAJOR ASSEMBLIES

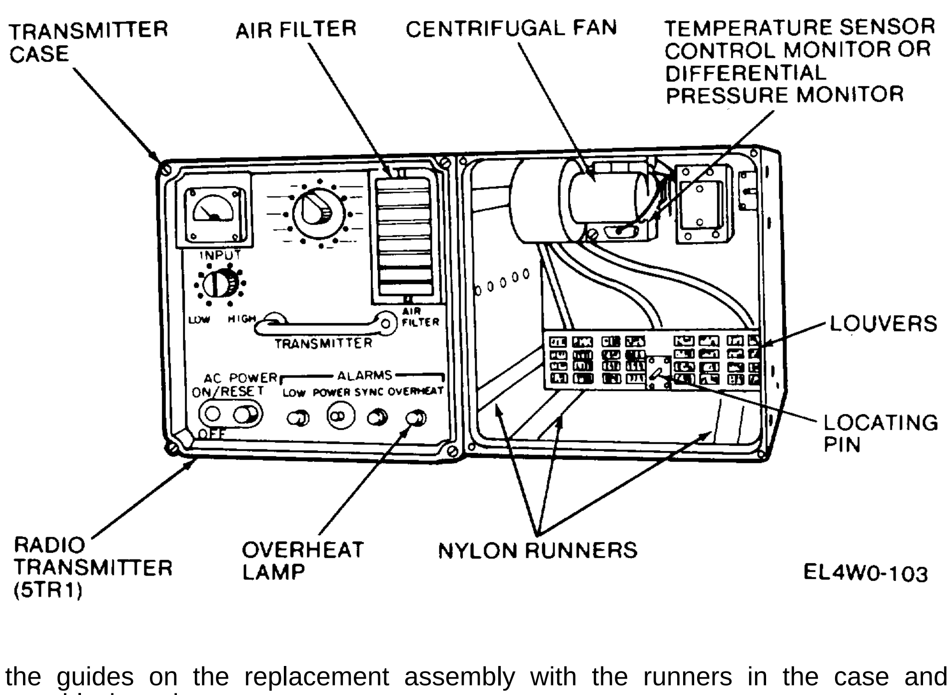
In any configuration, Band I, II, Ill, or IV, Radio Set AN/GRC-103(V)(*) has five major replaceable assemblies. Radio Transmitter 5TR1, Radio Receiver 1RE1, and Receiver-Transmitter, Order Wire RT-773/GRC-103(V) are common to all bands.

The following paragraphs explain major assembly replacement procedures.

3-8. RADIO TRANSMITTER OR TRANSMITTER RF HEAD REPLACEMENT

A Disconnect the rf cable from the front panel (rf head only).

B Loosen the four captive screws at the corners of the assembly and pull it out of the case by the handle on the panel.



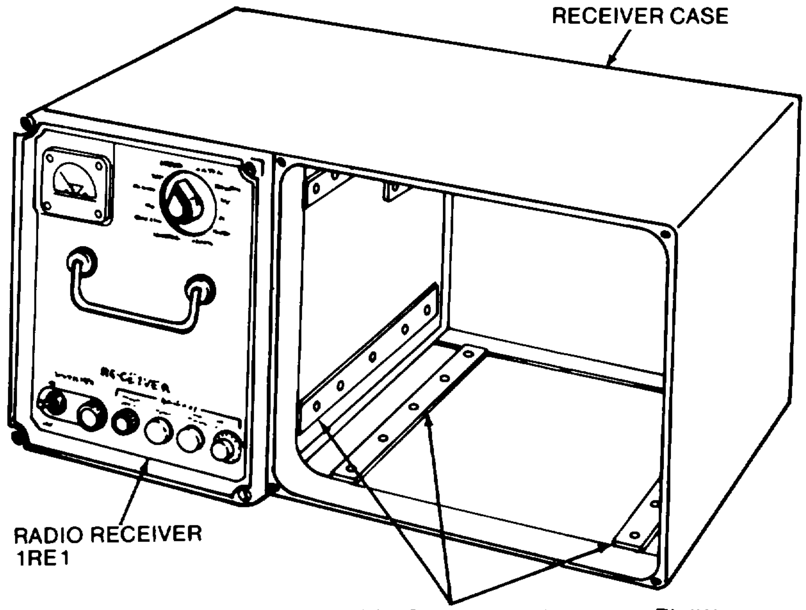
C Aline the guides on the replacement assembly with the runners in the case and carefully slide the assembly into the case.

D Secure the four captive screws and reconnect the rf head cable to the PWR OUT connector.

3-9. RADIO RECEIVER OR RECEIVER RF HEAD REPLACEMENT

A Disconnect the two rf cables from the front panel (rf head only).

3-9. RADIO RECEIVER OR RECEIVER RF HEAD REPLACEMENT- Continued



B Loosen the four captive screws at the corners of the assembly and pull it out of the case by the handle on the panel.

C Aline the guides on the replacement assembly with the runners in the case and carefully slide the assembly into the case.

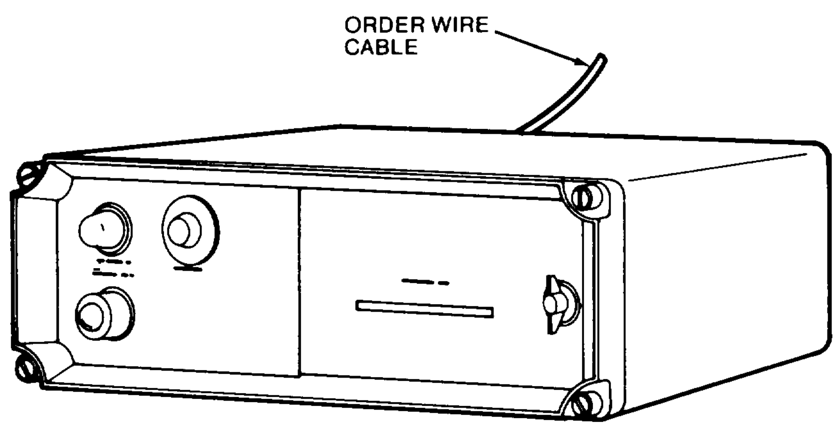
D Secure the four captive screws and reconnect the rf head cables as follows:

1. PWR OUT from transmitter rf head to FROM XMTR on receiver rf head.

2. Antenna cable to ANT on receiver RF head.

3-10. TRANSMITTER/RECEIVER ORDER-WIRE REPLACEMENT

A Disconnect the cable from the rear of the assembly.



B Connect the cable to the replacement assembly.

CHAPTER 4
UNIT MAINTENANCE

Section I. TOOLS AND TEST EQUIPMENT

4-1. COMMON TOOLS AND EQUIPMENT

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

4-2. SPECIAL TOOLS AND TEST EQUIPMENT

The following list identifies the equipment allocated for unit maintenance:

NOMENCLATURE	NSN (If Applicable)
Tool Kit, Electronic Equipment,TK-101 /G	5180-00-064-5178
Tube puller (stored on dust cover of transmitter rf head)	
Torque wrench, Omni-Spectra Model T-4592	
Trichlorotrifluoroethane	6810-00-664-0387
Cleaning cloth	8305-00-205-3496
Heat sink compound (CMC 334-290)	
Multimeter AN/U RM-105	
Cable, Electrical, Special Purpose CX-10879/GRC-103(V)	5995-00-144-0282
Converter, Frequency, Electronic CV-2500/GRC	
Dummy Load, Electrical DA-437/GRC-103(V)	5985-00-089-8990

Section II. UNIT PREVENTIVE MAINTENANCE

4-3. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

Preventive maintenance is the systematic care, inspection, and servicing of equipment to maintain it in serviceable condition, prevent breakdowns, and assure maximum operational capability. Preventive maintenance is the responsibility of all maintenance categories concerned; it includes inspection, testing, and repair or replacement of parts, subassemblies, or units that would probably fail before the next scheduled periodic service. Preventive maintenance checks and services of the radio set at the unit maintenance category are performed at times indicated in the interval column of the PMCS table. Refer to the following notations before using the table.

- Before you operate, always keep in mind the **CAUTIONS** and **WARNINGS.** Perform your before (B) PMCS.
- While you operate, always keep in mind the **CAUTIONS** and **WARNINGS.** Perform your during (D) PMCS.
- After you operate, be sure to perform your after (A) PMCS.
- If your equipment fails to operate, troubleshoot with proper equipment. Report any deficiencies using the proper forms as specified in DA Pam 738-750.
- If the equipment must be kept in continuous operation, check and service only those items that can be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

4-3. PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Continued

Table 4-1. Unit Preventive Maintenance Checks and Services

NOTE

Within designated intervals, these checks are to be performed in the order listed.

B-Before
D-During
A-After
W-Weekly
M-Monthly

Item No.	Interval B	D	A	W	M	Item to be Inspected	Procedures Check for and have repaired or adjusted as necessary
1	•				•	Transmitter	Remove transmitter rf head and Radio Transmitter 5TR1 from case. Inspect chassis and case interiors for corrosion or Intrusion of sand and other dirt. Clean dirt and fungus from case Interiors, chassis surfaces, and connectors Check elapsed time Indicator inside the door on the side of the rf head assembly. Replace tubes and indicator if Indicator shows 5,000 hours or more.
2	•				•	Receiver	Remove receiver rf head and Radio Receiver 1RE1 from case. Inspect chassis and case interiors for corrosion and Intrusion of sand and other dirt. Clean dirt and fungus from case Interiors, chassis surfaces, and connectors.
3	•				•	Order wire unit	Remove front panel from case. Inspect chassis and case interior for corrosion and intrusion of sand and other dirt. Clean dirt and fungus from case Interiors, chassis surfaces, and connectors.
4	•				•	Operational check	Perform the operational check
5	•				•	Antenna system	Check to see that mast is vertical with the spirit level. Check tension of guy wires, and adjust turn buckles or snubbers for mast alinement.
6					•	Preservation	Check all surfaces for fungus, rust, and corrosion. Remove fungus, rust, or corrosion. Spot-paint as necessary
7					•	Modifications	Check to determine whether new applicable MWO'S have been published All URGENT MWO'S must be applied immediately.All NORMAL MWO'S must be scheduled.
8		•			•	Centrifugal fan	Check bearings for noisy operation.
9					•	Mounting	Check to see that all bolts, nuts, and washers are correctly positioned and properly tightened. Check for cracked, bent, or broken brackets
10	•				•	Connections	Check to see that plugs and sockets are clean and Intact.

Section III. OPERATIONAL CHECKOUT

4-4. INTRODUCTION

Use Operation under Usual and Unusual Conditions (sections III and IV of chapter 2) to checkout the equipment.

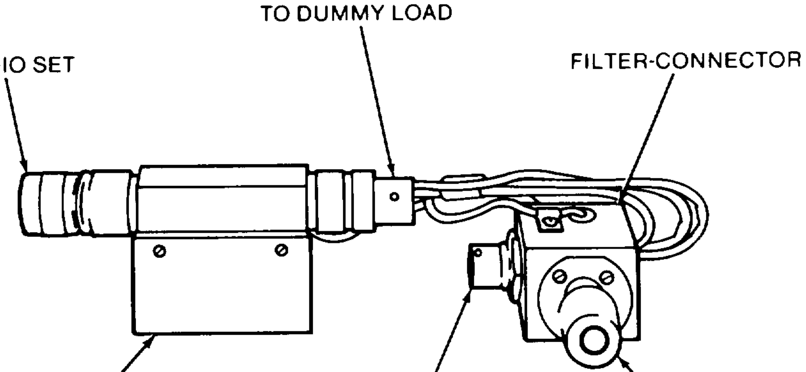
An additional checkout procedure is the loop testing. This will enable unit maintenance personnel to checkout the transmitter and receiver before a mission and during troubleshooting.

4-5. LOOP TESTING

The loop test set consists of a 25-MHz crystal-controlled oscillator and a directional coupler, which includes a frequency mixer.

4-5. LOOP TESTING - Continued

The loop test set is connected between the ANT. connector on the receiver and the dummy load as shown in Loop Test Setup Connections. Power is supplied to the loop test set from the FDM power connector on the rear of the transmitter or Power Supply PP-6917GR. By tuning the transmitter and receiver to frequencies 25 MHz (50 channels) apart, an rf loop is formed, simulating system operation and permitting local checkout of the radio set.



Loop Test Set
(Convetier, Frequency, Electronic Ck2500/611C)

Perform the following procedures. If problems arise, refer to the troubleshooting table in section IV for guidance in locating faulty components.

I LOOP TEST SETUP CONNECTIONS

A Connect the loop test set to the ANT. connector on the receiver rf head.

B Connect Cable Assembly, RF CG-3444/U (3 ft. 6 in.) between the dummy load and the connector on the loop test set.

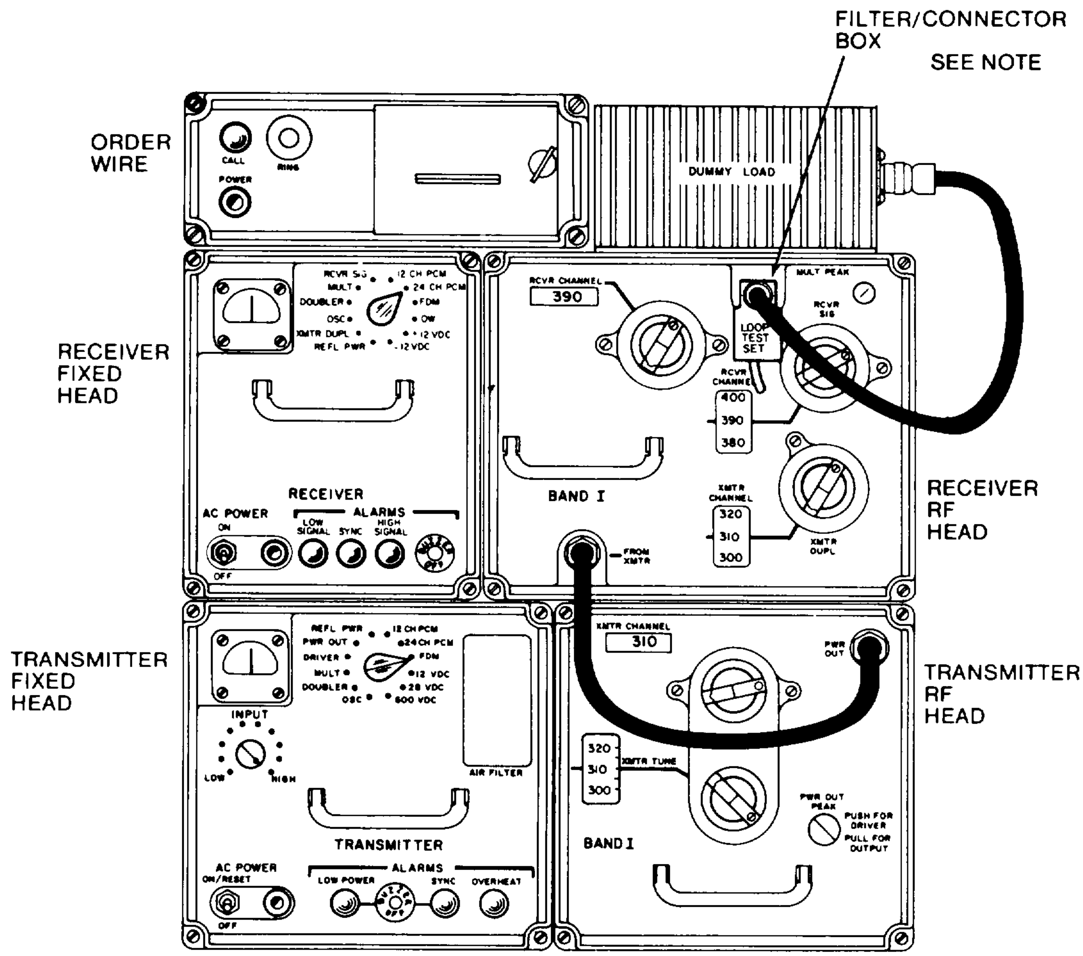
c Connect the filter/connector box on the loop test set to the FDM connector on the rear of the transmitter or to the Power Supply PP-6917/GR that is supplied with the loop test set.

4-5. LOOP TESTING - Continued

NOTE

Set the dial on the PP-6917/GR to midrange. Normally this setting will be sufficient. However, if after receiver alinement, the low signal alarm fails to silence, turn the dial clockwise until the alarm is silent and RCV SIG comes up. Should the alarm fail to silence and RCV SIG remains low, proceed with troubleshooting procedures.

D Make sure that the multiplex equipment is connected in accordance with the assigned mode of operation as explained in paragraph 2-13 of chapter 2.



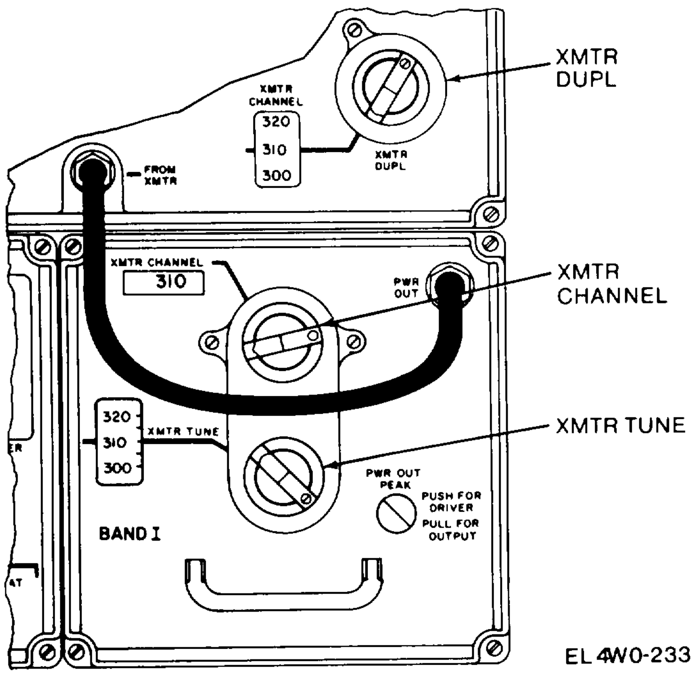
NOTE: LOOP TEST SET IS POWERED BY CONNECTING THE FILTER/CONNECTOR TO THE FDM PLUG AT THE REAR OF THE TRANSMITTER OR TO POWER SUPPLY PP 6617/GRC-103(V).

EL4W0-232

4-5. LOOP TESTING - Continued

. LOOP TEST PROCEDURE

A TRANSMITTER CHANNEL SELECTION. Set the following controls . . .

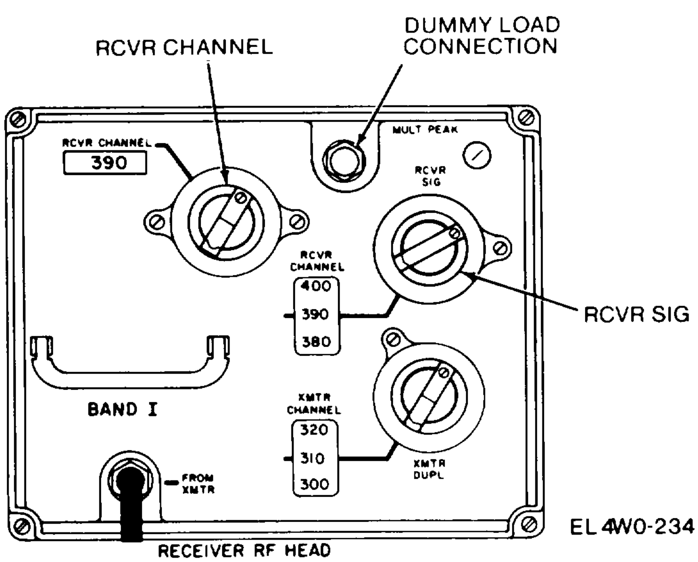


EL 4W0-233

. . . to one of these channels depending upon the band being used.

BAND	CHANNEL
I	65
II	465
III	1,065
IV	2,365

B RECEIVER CHANNEL SELECTION. Set the following controls...



EL 4W0-234

4-5. LOOP TESTING - Continued

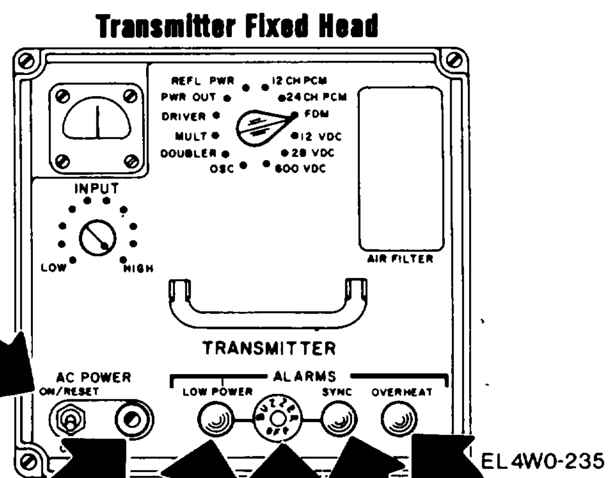
. . .to one of these channels depending upon the band being used.

BAND	CHANNEL
I	115
II	515
III	1,115
IV	2,415

NOTE

If the channels specified in steps A and B above are not available, set the transmitter and receiver to some other channels 25 MHz (50 channels) apart. Refer to the receiver overload charts as described in paragraph E-27. In addition, do not select channel 50, or any channel that is a whole-number multiple of 50 ±2 channels (for example, 50 X 11, ±.2 channels = 548 to 522) or when the transmitter is above the receiver, do not select channels that are 10 channels ±2 channels above an even multiple of 50 (for example, 50 X 11 + 10, ±2 channels = 558 to 562). Spurious harmonics of 25 MHz are generated within the loop test set and will cause interference within the receiver. At 50 channels plus 10 channels the spurious 25 MHz harmonics mixed with the transmitter frequency will produce a 30 MHz difference frequency that will interfere with the receiver.

C APPLYING TRANSMITTER POWER. Set the transmitter AC POWER switch to ON/RESET. The following indications should occur simultaneously:



1 AC POWER lamp on.

2 LOW POWER lamp on.

3 BUZZER may sound; push BUZZER OFF to silence.

4 SYNC lamp may goon momentarily and should extinguish within 10 seconds.

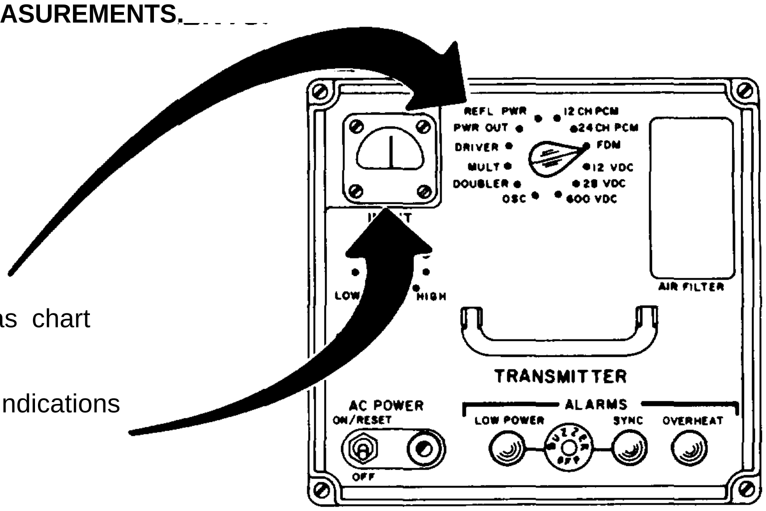
5 On Transmitter, Radio T-983( )/GRC-103(V) and T-983(A)/GRC-103(V), the OVERHEAT lamp goes on; centrifugal fan starts. The lamp will extinguish within 10 seconds.

4-5. LOOP TESTING - Continued

NOTE

On Transmitter, Radio T-983B(P)/GRC-103(V), the centrifugal fan does not start instantaneously when the unit is at room temperature (25°C) and the OVERHEAT lamp does not light. Allow a few minutes warm up time. If the transmitter is already warm from operating or because the ambient temperature is very high, or alternatively, if the ambient temperature is very cold, then the fan will start immediately.

D **TRANSMITTER METER MEASUREMENTS.**



1 Set the meter switch as chart indicates.

2 Observe the meter for indications as follows:

Transmitter Fixed Head

EL4W0-236

METER SWITCH SETTING	METER INDICATION.
12 VDC	In green band.
28 VDC	In green band.
600 VDC	In green band.
OSC	Between 20 and 90% full scale.
DOUBLER	Between 10 and 90% full scale for Bands I, II, Ill, and 20 and 90% full scale for Band IV.
MULT	Between 20 and 90% full scale.

NOTE

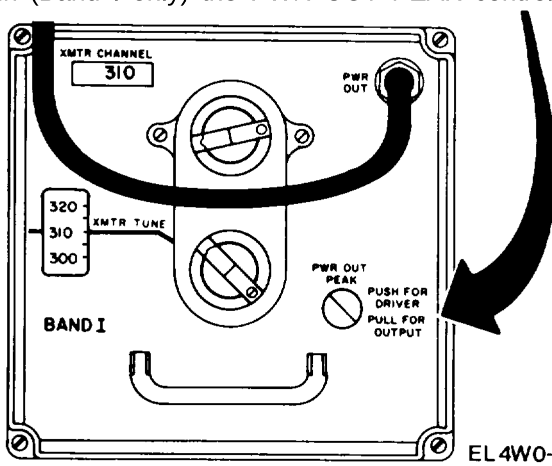
For MULT, the meter indication may not be within these limits until the transmitter is fully timed (step 5).

4-5. LOOP TESTING - Continued

3 DRIVER

c Set the meter switch to DRIVER and tune Bands I, II and IV as follows:

. Push in (Band I only) the PWR OUT PEAK control and tune (turn) for maximum meter indication on the transmitter. (Bands II and IV PWR OUT PEAK control is not pushed in.)



EL4W0-237

l This indication should be between 20 and 90% full scale.

NOTE

For MULT, the meter indication may not be within these limits until the transmitter is fully tuned (step 5).

. Set the meter switch to PWR OUT.

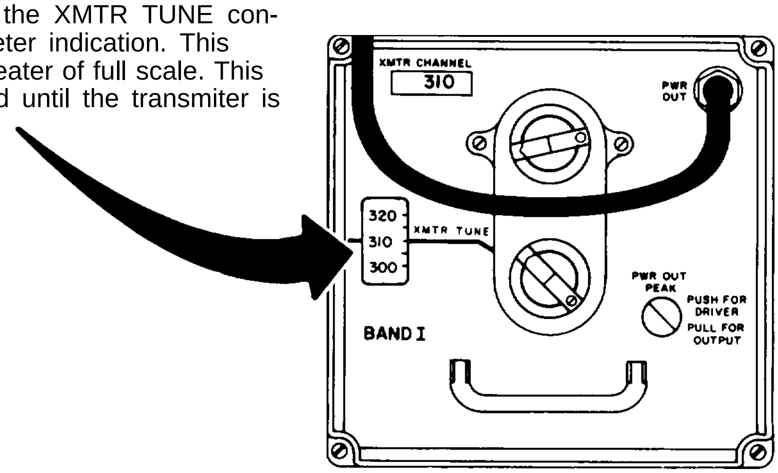
NOTE

During the following tests, the LOW POWER lamp goes out and the buzzer may sound. Push the BUZZER OFF button to silence the buzzer.

. For Band I, pull out the PWR OUT PEAK control and tune (turn) for maximum meter indication. This should be 50% or greater of full scale. This may not be achieved until the transmitter is fully tuned (step E).

. For Bands II and IV, tune the PWR OUT PEAK control (not pulled out) for maximum meter indication. This should be 40% or greater of full scale. This may not be achieved until the transmitter is fully tuned (step E).

. For Band Ill, adjust the XMTR TUNE control for maximum meter indication. This should be 40% or greater of full scale. This may not be achieved until the transmiter is fully tuned (step E).

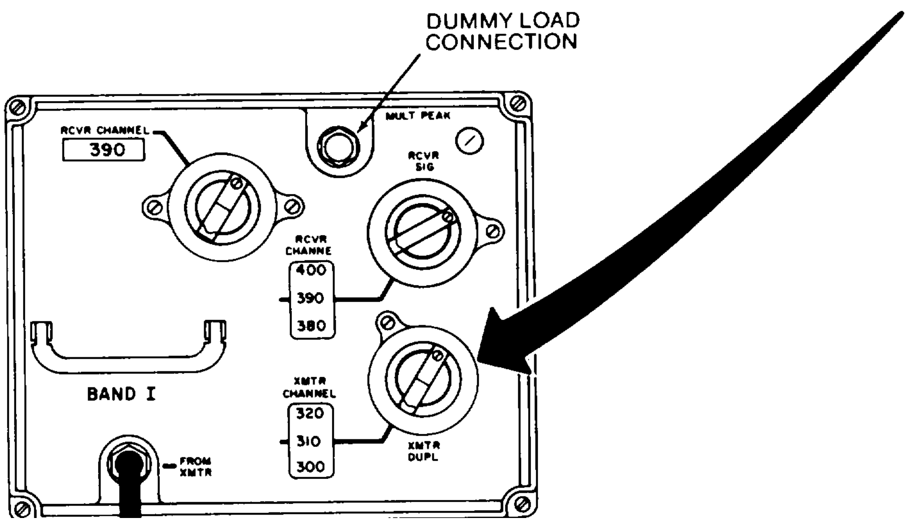


Transmitter RF Head EL4WO-238

4-5. LOOP TESTING - Continued

5 REFL PWR

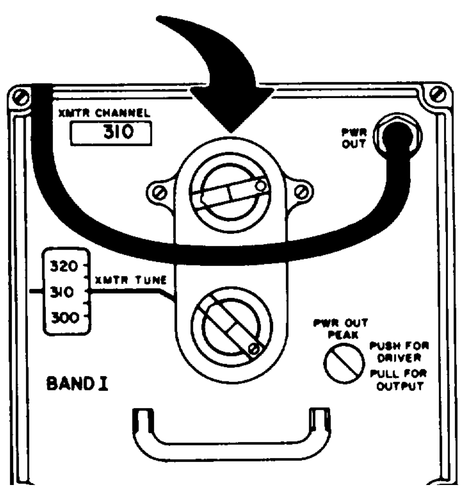
- Set the meter switch to REFL PWR.
- Tune the XMTR DUPL control (on receiver head) for minimum meter indication.
- This indication should be less than 15% full scale for Bands I, II and Ill, and less than 25% for Band IV.



Receiver Rf Head

NOTE

Check that the receiver XMTR CHANNEL indicator is within ±0.5 inch of the center line of the display window.



Transmitter Rf Head

EL4WO-240

4-5. LOOP TESTING - Continued

E RECEIVER TRANSMISSION METER MEASUREMENTS.

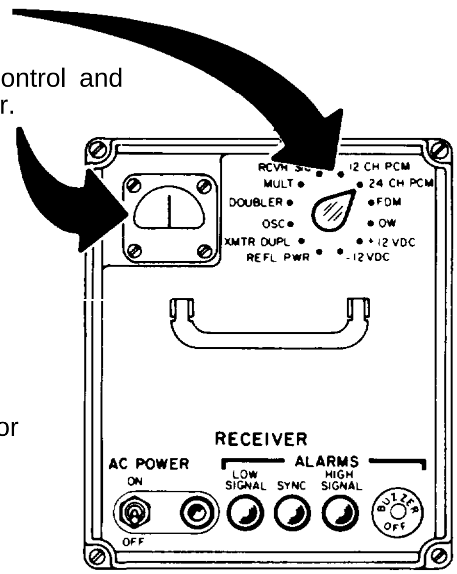
1 XMTR DUPL

. Set the receiver meter switch to XMTR DUPL.

l On Band I transmitter, pull out the PWR OUT PEAK control and readjust for maximum indication on the receiver meter.

l The meter indication should be 50% or greater.

. On Bands II and IV transmitters, readjust PWR OUT PEAK control (not pulled out) for maximum indication on the receiver meter. The indication should be 40% or greater.

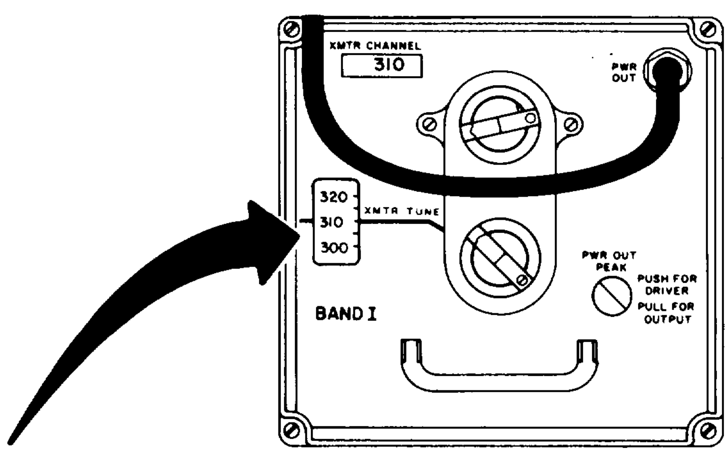


Receiver Fixed Head

EL4W0-241

NOTE

On Bands I, II, and IV, readjustment of the transmitter XMTR TUNE control is permitted in order to maximize the receiver meter indication (meter switched to XMTR DUPL position), provided the XMTR TUNE channel indication remains within ±½ inch of the center line of the display window



Transmitter Rf Head EL4W0-238

. On Band Ill transmitter, readjust the XMTR TUNE control for maximum indication on the receiver meter. The indication should be 40% or greater.

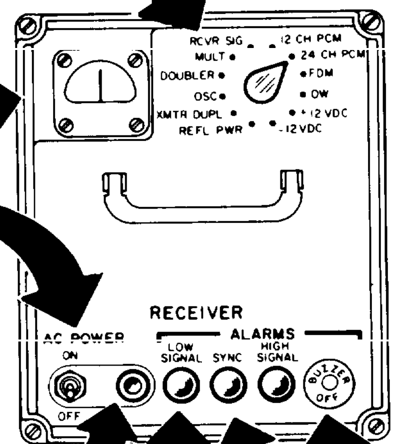
4-5. LOOP TESTING - Continued

2 REFL PWR

l Set the receiver meter switch to REFL

l The receiver meter should indicate less than 15% full scale for Bands I, II and III, and less than 20% for Band IV.

Receiver Fixed Head



EL4W0-242

F APPLY RECEIVER POWER.

1 Set the receiver AC POWER switch ON.

NOTE

The following indications should occur simultaneously:

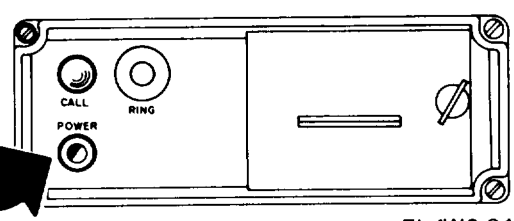
2 AC POWER lamp on.

3 LOW SIGNAL lamp on.

4 SYNC lamp may go on momentarily and should extinguish within 10 seconds.

5 BUZZER may sound; push to silence.

6 Order Wire Assembly POWER lamp on.

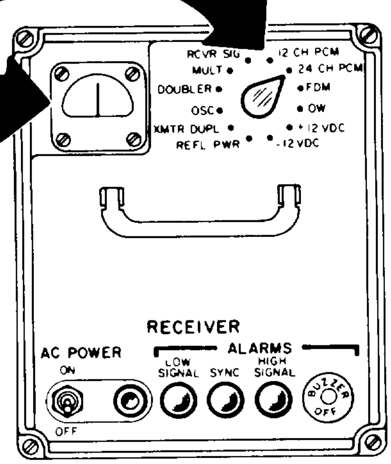


EL4W0-243

G RECEIVER METER MEASUREMENTS.

1 Set the meter switch as chart indicates.

2 Observe the meter for indications as follows:



Receiver Fixed Head

EL4W0-343

4-5. LOOP TESTING - Continued

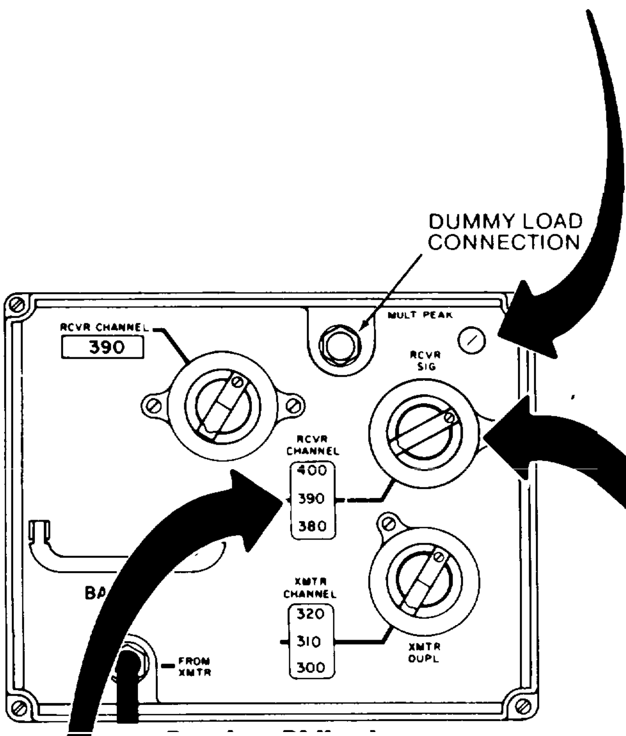
METER SWITCH SETTING	METER INDICATION.
+12VDC	In green band
–12VDC	In green band
OSC	Between 20 and 90% full scale after SYNC lamp goes out.
DOUBLER	Between 20 and 90% full scale after SYNC lamp goes out.

3 Set the meter switch to MU LT.

4 Adjust the MULT PEAK control for maximum meter indication on the receiver.

5 This indication should be 20% full scale or greater for Bands I and IV, or between 20 and 90% full scale for Bands II and Ill.

6 The LOW SIGNAL lamp should go out. If the buzzer sounds, push to silence.



7 Set the receiver meter switch to RCVR SIG.

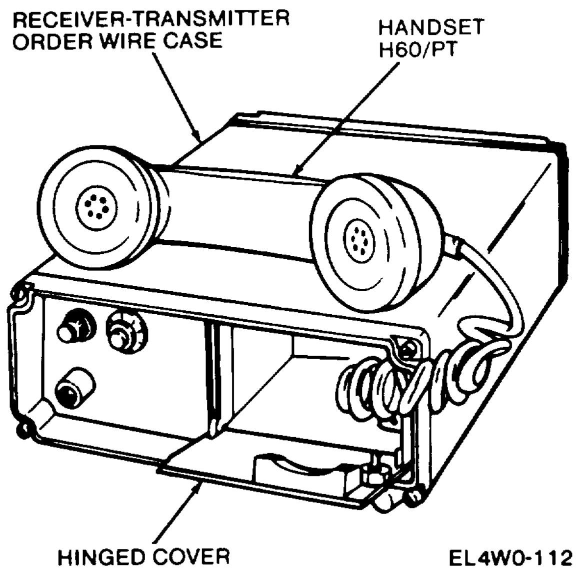
8 Adjust RCVR SIG control for maximum indication on the meter. This is done by tuning the RCVR SIG control for a 10% drop in meter indication on both sides of the peak, then setting the control midway between the drop points.

9 The meter should indicate between 25 and 90% of full scale.

10 The RCVR CHANNEL indicator should remain within ±0.5 inches of the center line of the window.

11 Test the order wire for noise using the handset.

4-5. LOOP TESTING - Continued



12 Depress the press-to-talk (PIT) button and briefly whistle into the mouthpiece. The side tone should be heard in the earphone.

13 Also, press the ring button. A 1600-Hz tone should be heard in the earphone.

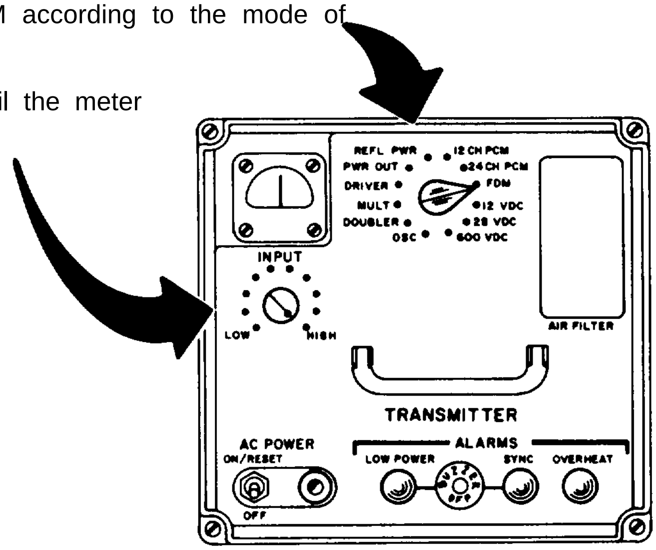
14 Set the meter switch on the receiver to OW and push the RING button on the order wire assembly.

15 The meter on the receiver should indicate between 30 and 70% of full scale. The CALL lamp will be off.

H 12 OR 24-CHANNEL PCM ADJUSTMENT AND CHECKS.

1 On the transmitter assembly, set the meter switch to either 12 CH PCM or 24 CH PCM according to the mode of operation.

2 Adjust the INPUT control until the meter indicates 50% of full scale.



TRANSMITTER FIXED HEAD

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4-5. LOOP TESTING - Continued

3 On the receiver assembly, set the meter switch to either 12 CH PCM or 24 CH PCM to match the transmitter assembly mode of operation.

4 The meter on the receiver assembly should indicate in the green band for 12 CH PCM or between 40 and 65% of full scale for 24 CH PCM.

PRELIMINARY MULTIPLEX EQUIPMENT CHECKS.

1 Perform in accordance with multiplex equipment instruction manuals.

2 Turn off the equipment and disconnect the loop test set.

3 Reconnect the antenna.

Section IV. TROUBLESHOOTING

4-6. GENERAL TROUBLESHOOTINHG INFORMATION

NOTE

Be sure that the operator troubleshooting and maintenance procedures have been performed prior to performing these unit troubleshooting procedures.

Troubleshooting of Radio Set AN/GRC-103(V)(*) is based on an operational checkout (section Ill of this chapter) and the troubleshooting charts in paragraph 4-8. Perform all procedures for operating the equipment until an abnormal condition or result is observed, then locate the malfunction in the troubleshooting charts. Identify the probable cause and perform corrective actions indicated in the adjacent columns. The following paragraph gives useful information on sectionalization of faults. If the corrective actions do not remedy the trouble, higher category maintenance is required.

4-7. SECTIONALIZATION OF FAULTS

- **USE OF LOOP TEST SET**

Trouble may be readily sectionalized to the transmitter or the receiver by use of the loop test-set (paragraph 4-5), which permits local operation of the complete radio set.

- **SECTIONALIZATION WITHIN MAJOR UNITS**

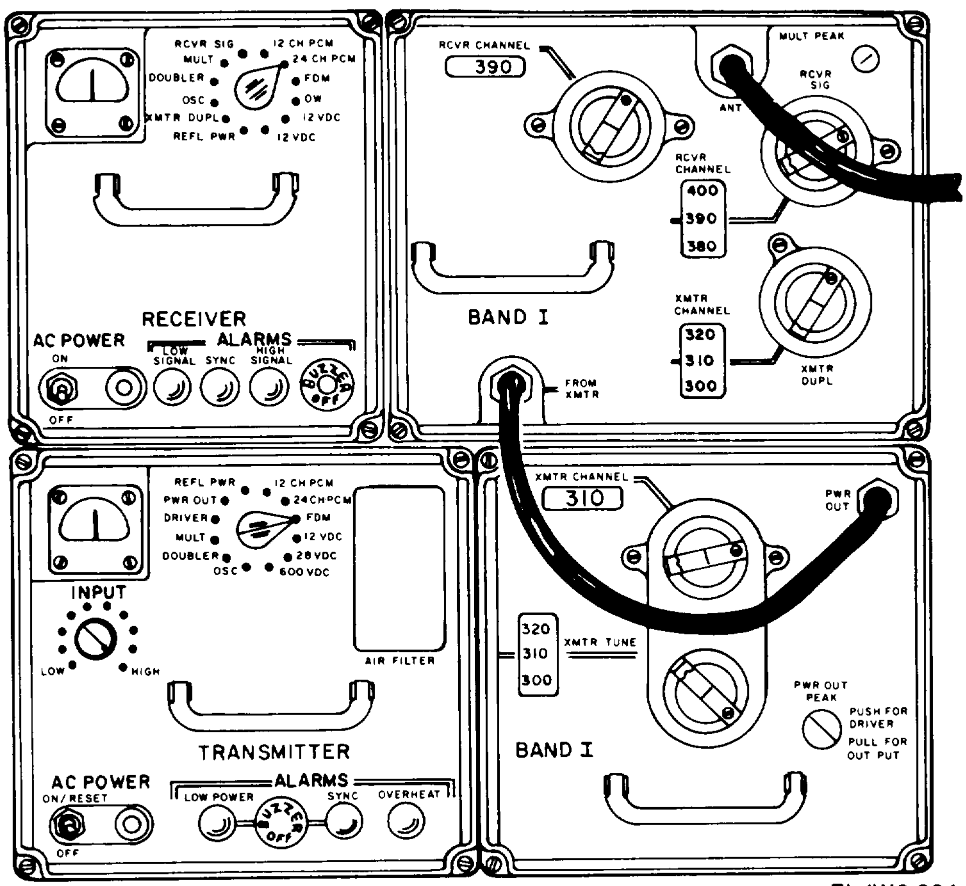
The transmitter and the receiver are largely self-sectionalizing, because most faults will produce an abnormal indication either on the transmitter or receive meter. Meter indications should be studied carefully for guidance in troubleshooting because some of the meter readings on the transmitter and receiver are interrelated. For example, the REFL PWR position on the transmitter meter indicates the tuning of the transmitter portion of the duplexer (part of the receiver), whereas the REFL PWR position on the receive meter indicates the voltage standing wave ratio (VSWR) of the transmission line and the antenna. The XMTR DUPL position on the receiver meter indicates the actual power delivered to the antenna. A high meter reading on the REFL PWR position on the receiver and a high meter reading on the REFL PWR position on the transmitter indicate a damaged or improperly connected transmission line or antenna. A normal meter reading on the receiver REFL PWR position and a high reading on the transmitter REFL PWR position indicate trouble in the transmitter RF head or improper tuning of the transmitter section of the duplexer (part of the receiver).

4-8. TROUBLESHOOTING TABLE

Table 4-2. Unit Troubleshooting

MALFUNCTION
PROBABLE CAUSE(S)
CORRECTIVE ACTION(S)

TRANSMITTER TROUBLESHOOTING



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1. When AC POWER switch is set to ON/RESET, centrifugal fan does not start; AC POWER and LOW POWER lamps do not light; buzzer does not sound.

A Primary power is absent.

A Check 115-volt power source and power cable connections.

B Defective cable W7 or W8.

B Cable W7 or W8.

C Defective power supply 5TR1PS1.

C Replace 5TR1PS1 (paragraph 4-1 2).

D Defective switch 5TR1A1CB1.

D Higher category maintenance is required.

4-8. TROUBLESHOOTING TABLE - Continued

Table 4-2. Unit Troubleshooting- Continued

MALFUNCTION
PROBABLE CAUSE(S)
Corrective ACTION(S)

TRANSMITTER TROUBLESHOOTING - Continued

2. When AC POWER switch is set to ON/RESET, centrifugal fan does not start; AC POWER, LOW POWER and OVERHEAT lamps light; buzzer sounds.

A Defective centrifugal fan 5A2B1.

A Higher category maintenance is required.

B Defective power supply 5TR1PS1.

B Higher category maintenance is required.

3. Buzzer does not sound when AC POWER switch is set to ON/RESET.

Defective buzzer.

Higher category maintenance is required.

4. OVERHEAT lamp does not go out within 10 seconds after AC POWER switch is set to ON/RESET.

A Defective pressure differential monitor (T-983 or T-983A).

A Higher category maintenance is required.

B Defective temperature sensor control monitor (T-983B only).

B Higher category maintenance is required.

5. SYNC lamp does not go out within 10 seconds after AC POWER switch is set to ON/RESET.

A Defective power supply 5TR1PS1.

A Replace 5TR1PS1 (paragraph 4-12).

B Defective electrical frequency synthesizer 5TR1A2.

B Replace 5TR1A2 (paragraph 4-11).

6. Meter indication is below normal with switch at 12 VDC.

Defective power supply 5TR1PS1 or one of the other modules in radio transmitter 5TR1

Replace 5TR1PS1 (paragraph 4-12).

7. Meter indication is below normal with switch at 28 VDC.

Defective power supply 5TR1PS1 or one of the other modules in radio transmitter 5TR1

Replace 5TR1PS1 (paragraph 4-12).

8. LOW POWER lamp does not go out within 60 seconds after AC POWER switch is set to ON/RESET; meter indication with switch at 600 VDC is below normal.

Defective power supply 5TR1PS1.

Replace 5TR1PS1 (paragraph 4-12).

4-8. TROUBLESHOOTING TABLE - Continued

Table 4-2. Unit Troubleshooting -Continued

MALFUNCTION
PROBABLE CAUSE(S)
CORRECTIVE ACTION(S)

TRANSMITTER TROUBLESHOOTING - Continued

9. LOW POWER lamp does not go out within 60 seconds after AC POWER switch is set to ON/RESET; meter indication with switch at 600 VDC is normal.

A Defective driver tube.

A Replace driver tube (paragraph 4-9).

B Defective final tube.

B Replace final tube (paragraph 4-9).

C Band I: Defective power monitor 6AR1A3.
Band II: Defective power monitor 37AR1A2.
Band III: Defective power monitor 38AR1A2.
Band IV: Defective power monitor 40A1A1.

C Higher category maintenance is required.

D Defective control alarm 5TR1A3.

D Replace 5TR1A3 (paragraph 4-12).

E Defective power supply 5TR1PS1.

E Replace 5TR1PS1 (paragraph 4-12).

F Band I: Not applicable.
Band II: Defective voltage regulator assembly 37AR1A1A1.
Band III: Defective voltage regulator assembly 38AR1A1A1.
Band IV: Defective voltage regulator assembly 40A3.

F Band I: Not applicable.
Band II: Replace 37AR1A1A1 (paragraph 4-13).
Band III: Replace 38AR1A1A1 (paragraph 4-13).
Band IV: Replace 40A3 (paragraph 4-13).

10. Meter indication is below normal with switch at OSC.

A Defective electrical frequency synthesizer 5TR1A2.

A Replace 5TR1A2 (paragraph 4-11a).

B Band I: Defective control-indicator 6A3.
Band II: Defective control-indicator 37A2.
Band III: Defective control-indicator 38A2.
Band IV: Defective control-indicator 40A4.

B Band I: Replace 6A3 (paragraph 4-14).
Band II: Replace 37A2 (paragraph 4-13).
Band III: Replace 38A2 (paragraph 4-13).
Band IV: Replace 40A4 (paragraph 4-13).

11. Meter indication is below normal with switch at DOUBLER; with switch at OSC, indication is normal.

Defective amplifier-frequency multiplier 5TR1A4.

Replace 5TR1A4 (paragraph 4-11A).

4-8. TROUBLESHOOTING TABLE - Continued

Table 4-2. Unit Troubleshooting - Continued

MALFUNCTION
PROBABLE CAUSE(S)
CORRECTIVE ACTION(S)

TRANSMITTER TROUBLESHOOTING - Continued

12. Meter indication is below normal with switch at MULT; DOUBLER indication is normal.

Band I: (1) Defective electronic switch 6A1. (2) Defective frequency multiplier assembly 6A2.

Band 1: (1) Replace 6A1 (paragraph 4-1 4).(2) Higher category maintenance is required.

Band II: Defective amplifier-frequency multiplier 37A1.

Band 11: Higher category maintenance is required.

Band Ill: Defective amplifier-frequency multiplier 38A1.

Band Ill: Higher category maintenance is required.

Band IV: Defective amplifier-frequency multiplier 40A2.

Band IV: Higher category maintenance is required.

13. Meter indication is below normal with switch at DRIVER; MULT indication is normal

A Weak or defective driver tube.

A Replace driver tube (paragraph 4-9).

B Band IV: Weak or defective final tube.

B Replace final tube (paragraph 4-9).

C Band IV: Defective rf amplifier 40AR1 or bandpass filter 40FL1.

C Higher category maintenance required

14. Meter indication is below normal with switch at PWR OUT; DRIVER indication is normal receiver meter indication is below normal with switch at XMTR DUPL.

Weak or defective final tube.

Replace final tube (paragraph 4-9).

15. Meter indication is below normal with switch at PWR OUT; DRIVER indication is normal; receiver meter indication is normal with switch at XMTR DUPL.

Band I: Defective power monitor 6AR13.

Band 1: Higher category maintenance is required.

Band II: Defective power monitor 37AR1A2.

Band III: Higher category maintenance is required.

Band Ill: Defective power monitor 38AR1A2.

Band Ill: Higher category maintenance is required.

Band IV: Defective power monitor 40A1A1.

Band IV: Higher category maintenance is required.

4-8. TROUBLESHOOTING TABLE - Continued

Table 4-2. Unit Troubleshooting - Continued

MALFUNCTION
PROBABLE CAUSE(S)
CORRECTIVE ACTION(S)

TRANSMITTER TROUBLESHOOTING - Continued

16. LOW POWER lamp does not go out; meter indication is normal with switch at PWR OUT.

A Defective control alarm 5TR1A3.

A Replace 5TR1A3 (paragraph 4-12).

B Defective power supply 5TR1PS1.

B Replace 5TR1PS1 (paragraph 4-12).

17. Appreciable meter indication with switch at REFL PWR; receiver meter indication is normal with switch at REFL PWR.

Band I: Defective duplexer 2A1A1, power monitor 2A1A5, or Cable Assembly, RF CB-3444/U (1 ft 6 in.).

Band II: Defective duplexer subassembly 33A1A1, power monitor 33A3, or Cable Assembly, RF CG-3444/U (1 ft 6 in.).

Band Ill: Defective duplexer subassembly 34A1A1, power monitor 34A3, or Cable Assembly, RF CG-3444/U (1 ft 6 in.).

Band IV: Defective bandpass filter 39FL3, circulator 39A1HY1, power monitor 39A1A1, or Cable Assembly, RF CG-3444/U (1 ft 6 in.).

Connect the dummy load to the PWR OUT connector on the transmitter rf head. If meter indication remains appreciable, higher category maintenance is required. If meter indication is normal, disconnect the CG-3444/U from the FROM XMTR connector on the receiver RF head and connect it to the dummy load, If meter indication is appreciable, replace the CG-344/U. If meter indication is normal, connect the dummy load to the ANT. connector on the receiver RF head. If meter indication remains appreciable, higher category maintenance is required.

18. Meter indication is below normal with switch at 12 CH PCM or 24 CH PCM (whichever applies to installation); INPUT control is set at HIGH.

A Defective amplifier-monitor 5TR1A5.

A Replace 5TR1A5 (paragraph 4-12).

B Defective INPUT control.

B Higher category maintenance is required.

19. OVER HEAT lamp lights; all other indications are normal.

A Centrifugal fan 5A2B1 has stopped or is moving slowly.

A Higher category maintenance is required.

B Defective pressure differential monitor 5A2A3 (Transmitter T-983 or T-983A).

B Higher category maintenance is required.

C Defective temperature sensor control monitor 5A2A2 (Transmitter T-983B only).

C Higher category maintenance is required.

D Defective meter 5TR1A1M1

D Higher category maintenance is required.

E Defective meter switch 5TR1A1S1.

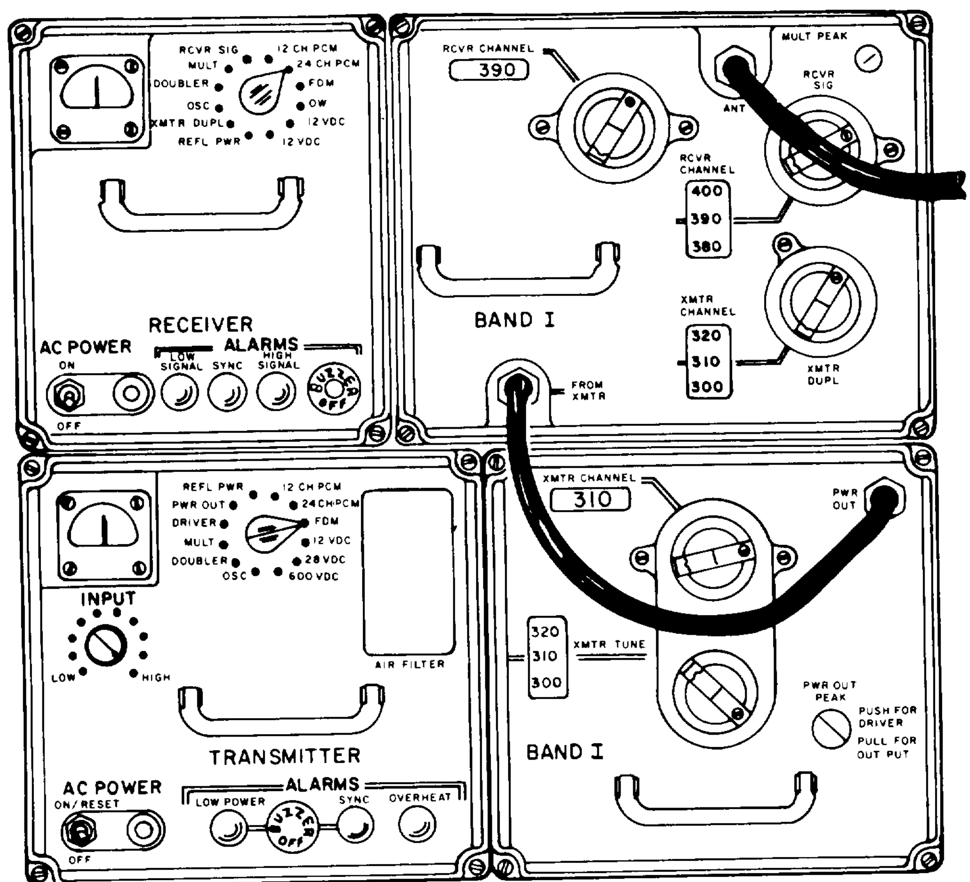
E Higher category maintenance is required.

4-8. TROUBLESHOOTING TABLE - Continued

Table 4-2. Unit Troubleshooting - Continued

MALFUNCTION
PROBABLE CAUSE(S)
CORRECTIVE ACTION(S)

RECEIVER TROUBLESHOOTING



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1. When AC POWER switch is set to ON/RESET, AC POWER and LOW SIGNAL lamps do not light; buzzer does not sound.

   A Primary power is absent.

   A Check 115-volt source and power cable connections.

   B Defective CX-10762/U (5 ft).

   B Replace CX-10762/U.

   C Defective power supply 1 RE1PS1.

   C Replace 1 RE1PS1 (paragraph 4-15).

   D Defective switch 1 RE1A1CB1.

   D Higher category maintenance is required.

4-8, TROUBLESHOOTING TABLE - Continued

Table 4-2. Unit Troubleshooting - Continued

MALFUNCTION
PROBABLE CAUSE(S]
CORRECTIVE ACTION(S)

RECEIVER TROUBLESHOOTING - Continued

2. Buzzer does not sound when AC POWER switch is set to ON; all lamps light.

Defective buzzer.

Higher category maintenance is required.

3. SYNC lamp does not go out within 10 seconds after AC POWER Switch is set to ON.

A Defective power supply 1 RE1 PSI

A Replace 1 RE1 PS1 (paragraph 4-15)

B Defective electrical frequency synthesizer 1 RE1 A2.

B Replace 1 RE1 A2 (paragraph 4-1 1).

4. Meter indication is below normal with switch at +12 VDC

A Defective power supply 1 REI PS1 or one of the other modules in the receiver fixed head.

A Replace 1 RE1 PS1 (paragraph 4-1 5). If trouble not corrected, higher category maintenance is required.

B Defective order wire unit or CX-10763/GRC-l 03(V).

B Disconnect the CX-10763/GRC-l 03(V) from OW connector at rear of transmitter case. If meter indication becomes normal, replace the CX-1 0763/GRC-1 03(V). If meter indication is still below normal, higher category maintenance is required.

C Defective receiver RF head.

C Higher category maintenance is required.

5. Meter indication is below normal with switch at –12 VDC.

A Defective power supply 1 RE1 PS1 , or one of the other modules in radio receiver 1 RE1

A Replace 1 RE1 PS1 (paragraph 4-15), If meter indication is still below normal, higher category maintenance is required.

B Defective receiver RF head.

B Higher category maintenance is required

6. Meter indication is below normal with switch at XMTR DUPL; transmitter meter indication is also below normal with switch at PWR OUT.

Defective final tube.

Replace final tube (paragraph 4-9).

4-8. TROUBLESHOOTING TABLE - Continued

Table 4-2. Unit Troubleshooting - Continued

MALFUNCTION
PROBABLE CAUSE(S)
CORRECTIVE ACTION(S]

RECEIVER TROUBLESHOOTING - Continued

7. Meter indication is below normal with switch at XMTR DUPL; transmitter meter indication is normal with switch at PWR OUT.

Band I: Defective duplexer 2A1 Al, power monitor 2A1 A5, or Cable Assembly RF CG-3444/U (1 ft 6 in.).

Band 1: Replace the CG-3444/U. If REFL PWR meter indication still remains appreciable, higher category maintenance is required.

Band II: Defective duplexer 33A1, power monitor 33A3, or Cable Assembly, RF CG-3444/U (1 ft 6 in.).

Band 11: Replace the CG-3444/U. If REFL PWR meter indication still remains appreciable, higher category maintenance is required.

Band II 1: Defective duplexer 34A1, power monitor 34A3, or Cable Assembly, RF CG-3444/U (1 ft 6 in,).

Band Ill: Replace the CG-3444/U. If REFL PWR meter indication still remains appreciable, higher category maintenance is required.

Band IV: Defective bandpass filter 39FL3, circulator 39A1 HY1, power monitor 39A1 Al, or Cable Assembly, RF CG-3444/U (1 ft 6 in.).

Band IV: Replace the CG-3444/U. If REFL PWR meter indication still remains appreciable, higher category maintenance is required.

8. Meter indication is below normal with switch at OSC.

A Defective electrical frequency synthesizer 1 RE1 A2.

A Replace 1 RE1 A2 (paragraph 4-11 b).

B Band : Defective control-indicator 2A2.
Band 1: Defective control-indicator 33A4.
Band 11: Defective control-indicator 34A4.
Band V: Defective control indicator 39A4.

B Band 1: Replace 2A2 (paragraph 4-1 6).
Band 11: Replace 33A4 (paragraph 4-1 7).
Band II 1: Replace 34A4 (paragraph 4-1 7).
Band IV: Replace 39A4 (paragraph 4-17.

9. Meter indication is below normal with switch at DOUBLER: OSC indication is normal.

Defective amplifier-frequency multiplier 1 RE1 A5.

Replace 1 RE1 A5 (paragraph 4-15e).

4-8. TROUBLESHOOTING TABLE-Continued

Table 4-2. Unit Troubleshooting -Continued

MALFUNCTION
PROBABLE CAUSE(S)
CORRECTIVE ACTION(S)

RECEIVER TROUBLESHOOTING - Continued

10. Meter indication is below normal with switch at MULT; DOUBLER indication is normal,

A Band 1: Defective control-indicator 2A2.
Band 1: Defective control-indicator 33A4.
Band 11: Defective control-indicator 34A4.
Band V: Defective control-indicator 39A4.

A Band 1: Replace 2A2 (paragraph 4-1 6).
Band II: Replace 33A4 (paragraph 4-1 7).
Band III: Replace 34A4 (paragraph 4-1 7).
Band IV: Replace 39A4 (paragraph 4-1 7),

B Band 1: Defective frequency multiplier 2A1A2A1.
Band 11: Defective frequency multiplier group 33A2.
Band III: Defective frequency multiplier group 34A2.
Band IV: Push MULT DRIVER pushbutton on receiver RF head. If there is no meter indication, amplifier 39AR1 defective. If there is meter indication, frequency multiplier 39A3 defective.

B Band 1: Higher category maintenance is required.
Band 11: Higher category maintenance is required.
Band III: Higher category maintenance is required.
Band IV: If there is no meter indication, replace amplifier 39AR1 (paragraph 4-1 7). If there is a meter indication, higher category maintenance is required for frequency multiplier 39A3.

C Defective electrical frequency synthesizer 1 RE1 A2.

C Replace 1 RE1 A2 (paragraph 4-1 1).

11. Meter indication is below normal with switch at RCVR. SIG: MULT indication is normal; LOW SIGNAL lamp does not go out.

Band 1: Defective power supply 2PS1 , frequency mixer stage 2A1 A2A2, radio frequency amplifier 2A1 AR1, or low pass filter 2A1 Al FL1 .

Band 1: Replace 2PS1 (paragraph 4-1 6). If symptoms do not change, higher category maintenance is required.

Band II: Defective power supply 33PS1 , frequency mixer stage 33A7, or low pass filter 33FL1.

Band II: Replace 33PS1 (paragraph 4-1 7). If symptoms do not change, higher category maintenance is required.

Band III: Defective power supply 34PS1 , frequency mixer stage 34A7, or low pass filter 34FL1

Band III: Replace 34PS1 (paragraph 4-1 7). If symptoms do not change, higher category maintenance is required.

Band IV: Defective electronic frequency converter 39A2.

Band IV: Higher category maintenance is required.

4-8. TROUBLESHOOTING TABLE - Continued

Table 4-2. Unit Troubleshooting - Continued

MALFUNCTION
PROBABLE CAUSE(S)
CORRECTIVE ACTION(S)

RECEIVER TROUBLESHOOTING - Continued

12. Meter indication is below normal with switch at RCVR SIG, but LOW SIGNAL lamp does not light; no communications; no order wire noise.

A Defective intermediate frequency amplifier 1 RE1 AR2.

A Replace 1 RE1 AR2 (paragraph 4-1 5).

B Defective bandpass filter 1 RE1 FL1.

B Replace 1 RE1 FL1 (paragraph 4-1 5).

C Band 1: Defective intermediate frequency amplifier 2A1 A2AR1.
Band II: Defective intermediate frequency amplifier 33AR1.
Band Ill: Defective intermediate frequency amplifier 34AR1.
Band IV: Defective intermediate frequency amplifier 39AR2.

C Band 1: Replace 2A1 Al AR1 (paragraph 4-1 6).
Band 11: Higher category maintenance is required.
Band Ill: Higher category maintenance is required.
Band IV: Higher category maintenance is required.

D Defective radio receiver 1 RE1.

D Higher category maintenance required.

E Defective receiver RF head.

E Higher category maintenance required.

13. LOW SIGNAL lamp does not go out; meter indication is normal with switch at RCVR SIG.

Defective video amplifier 1 RE1 AR1.

Replace 1 RE1 AR1 (paragraph 4-1 5).

14. No communications or order wire noise, but meter indication normal with switch at RCVR SIG. LOW SIGNAL lamp is out.

A Defective video amplifier 1 RE1 AR1

A Replace 1RE1AR1 (paragraph 4-1 5).

B Defective electrical frequency limiter-discriminator 1 RE1 A4.

B Replace 1 RE1 A4 (paragraph 4-1 5).

15. Appreciable meter indication with switch at REFL PWR; transmitter meter indication is normal with switch at REFL PWR.

A Band 1: Defective power monitor 2A1 A5.
Band 11: Defective power monitor 33A3.
Band Ill: Defective power monitor 34A3.
Band IV: Defective power monitor 39A1 Al.

A Higher category maintenance is required.

B Band 1: Defective duplexer 2A1 Al.
Band II: Defective duplexer 33A1 .
Band Ill: Defective duplexer 34A1.
Band IV: Defective bandpass filter 39FL3.

B Higher category maintenance is required.

4-8. TROUBLESHOOTING TABLE - Continued

Table 4-2. Unit Troubleshooting - Continued

MALFUNCTION
PROBABLE CAUSE(S)
CORRECTIVE ACTION(S]

RECEIVER TROUBLESHOOTING - Continued

16. Appreciable meter indication with switch at REFL PWR; transmitter meter indication is also appreciable with switch at REFL PWR.

Poor line connections or damaged transmission line or antenna,

Connect dummy load to ANT. connector on receiver RF head, If meter indications are appreciable, higher category maintenance is required. If meter indications are normal, lower mast (paragraph 2-8), On the antenna reflector, disconnect the CG-3444/U from the UG-1 375/U and replace it with the dummy load. If meter indications are still appreciable, check transmission line and connectors. If meter indications are normal, replace dipole or the CG-3444/U.

17. Meter indication is below normal with switch at 12 CH PCM (when radio set is connected for 12-channel pcm operation). Other indications are normal.

A Defective pulse form restorer 1 RE1 A3.

A Replace 1 RE1 A3 (paragraph 4-1 5).

B Defective video amplifier 1 RE1 AR1.

B Replace 1 RE1 AR1 (paragraph 4-1 5).

18. Meter indication below normal with switch at 24 CH PCM (when radio set is connected), Other indications are normal.

Defective video amplifier 1 RE1 AR1.

Replace 1 RE1 AR1 (paragraph 4-1 5).

19. Meter indication below normal with switch at OW when distant station RING button is pressed; no voice communications; CALL lamp does not light, and buzzer does not sound in order wire unit; all other indications are normal.

A Defective pulse form restorer 1 RE1 A3.

A Replace 1 RE1 A3 (paragraph 4-1 5).

B Defective order wire unit at distant station.

B Send message to distant station requesting check of order wire unit at distant station.

C Defective CX-10763/GRC-l 03(V) at distant station.

C Send message to distant station requesting replacementofCX-10763/GRC-103(V).

D Defective radio transmitter 5TR1 at distant station.

D Higher category maintenance is required at distant station,

4-8. TROUBLESHOOTING TABLE - Continued

Table 4-2. Unit Troubleshooting - Continued

MALFUNCTION
PROBABLE CAUSE(S)
CORRECTIVE ACTION(S)

RECEIVER TROUBLESHOOTING - Continued

20. HIGH SIGNAL lamp lights and buzzer sounds; no communications.

Band 1: Defective electronic switch 2A4.

Band 1: Replace 2A4 (paragraph 4-1 6).

Band II: Defective signal level control-monitor 33A5.

Band II: Higher category maintenance is required.

Band Ill: Defective signal level control; monitor 34A5.

Band Ill: Higher category maintenance is required.

Band IV: Defective electronic frequency converter 39A2.

Band IV: Higher category maintenance is required.

21. HIGH SIGNAL lamp lights; all other indications are normal.

Band 1: Defective power supply 2PS1

Band 1: Replace 2PS1 (paragraph 4-1 6).

Band II: Defective signal level control-monitor 33A5.

Band II: Higher category maintenance is required.

Band Ill: Defective signal level control-monitor 34A5.

Band Ill: Higher category maintenance is required.

Band IV: Defective electronic frequency converter 39A2.

Band IV: Higher category maintenance is required.

22. No meter indication with switch in any position; other indications (lamps, buzzer) are normal.

A Defective meter 1 RE1 Al M 1.

A Higher category maintenance is required.

B Defective meter switch 1 RE1 Al S1

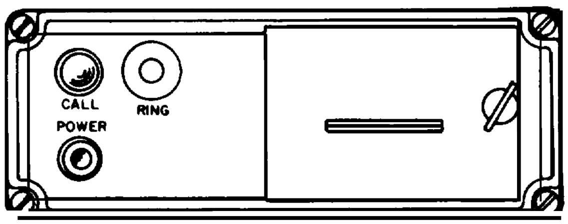
B Higher category maintenance is required.

4-8, TROUBLESHOOTING TABLE - Continued

Table 4-2. Unit Troubleshooting - Continued

MALFUNCTION
PROBABLE CAUSE(S]
CORRECTIVE ACTION(S)

ORDER WIRE UNIT



1. POWER lamp does not light when receiver AC POWER switch is set to ON.

   Defective power supply 1 RE1 PS1.

   Replace 1 RE1 PS1 (paragraph 4-1 5A).

2. CALL lamp lights, buzzer does not sound; receiver meter indication is normal with switch at OW.

   Defective buzzer.

   Higher category maintenance is required.

3. 1,600-Hz signaling tone is not heard in handset receiver when RING button is pressed; no voice communication.

   A Defective telephone signal converter 9A3.

   A Replace 9A3 (paragraph 4-1 8).

   B Defective amplifier assembly 9A4.

   B Replace 9A4 (paragraph 4-1 8).

   C Defective handset.

   C Higher category maintenance required.

   D Defective CX-10763/GRC-l 03(V).

   D Replace CX-10763/GRC-l 03(V).

4. 1,600-Hz signaling tone is not heard in handset receiver when RING button is pressed; voice communication is normal.

   A Defective amplifier assembly 9A4

   A Replace 9A4 (paragraph 4-1 8).

   B Defective telephone signal converter 9A3

   B Replace 9A3 (paragraph 4-1 8).

   C Defective CX-1 0763/G RC-1 03(V)

   C Replace CX-10763/GRC-l 03(V).

4-8. TROUBLESHOOTING TABLE - Continued

Table 4-2. Unit Troubleshooting - Continued

MALFUNCTION
PROBABLE CAUSE(S)
Corrective ACTION(S)

ORDER WIRE UNIT- Continued

5. CALL lamp does not light and buzzer does not sound when distant station RING button is pressed, Receiver meter indication is normal with switch at OW; voice communication is normal,

Defective Receiver-Transmitter, Order Wire RT-773/GRC-103(V).

Higher category maintenance is required.

6. CALL lamp does not light and buzzer does not sound when distant station RING button is pressed. Receiver meter indication is below normal with switch at OW; no voice communication. 1,600-Hz tone is heard in handset at distant station.

A Defective pulse form restorer 1RE1A3.

A Replace 1RE1A3 (paragraph 4-15).

B Defective order wire unit at distant station.

B Send message to distant station requesting check of order wire unit at distant station.

C Defective CX-10763/GRC-103(V) at distant station.

C Send message to distant station requesting replacement of CX-10763/GRC-103(V) at distant station.

D Defective radio transmitter 5TR1 at distant station.

D Higher category maintenance is required at distant station.

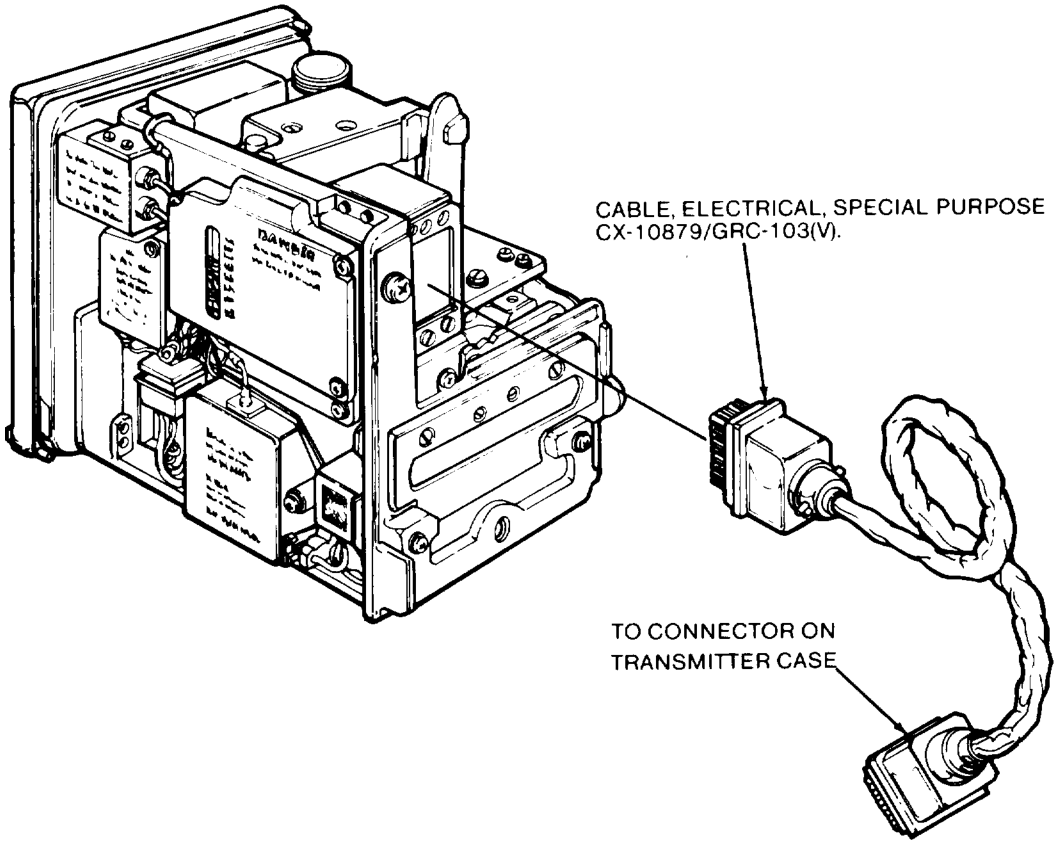
4-9. TUBE FILAMENT TESTING, REPLACEMENT AND ADJUSTMENTS

. IN-CIRCUIT FILAMENT CHECKS

To check the filaments of the transmitter tubes without removing the tubes, proceed as follows:

A Loosen the four captive screws at the corners of the transmitter rf head assembly and pull it out of the case by the handle on the panel (refer to paragraph 3-6).

4-9. TUBE FILAMENT TESTING, REPLACEMENT AND ADJUSTMENTS - Continued



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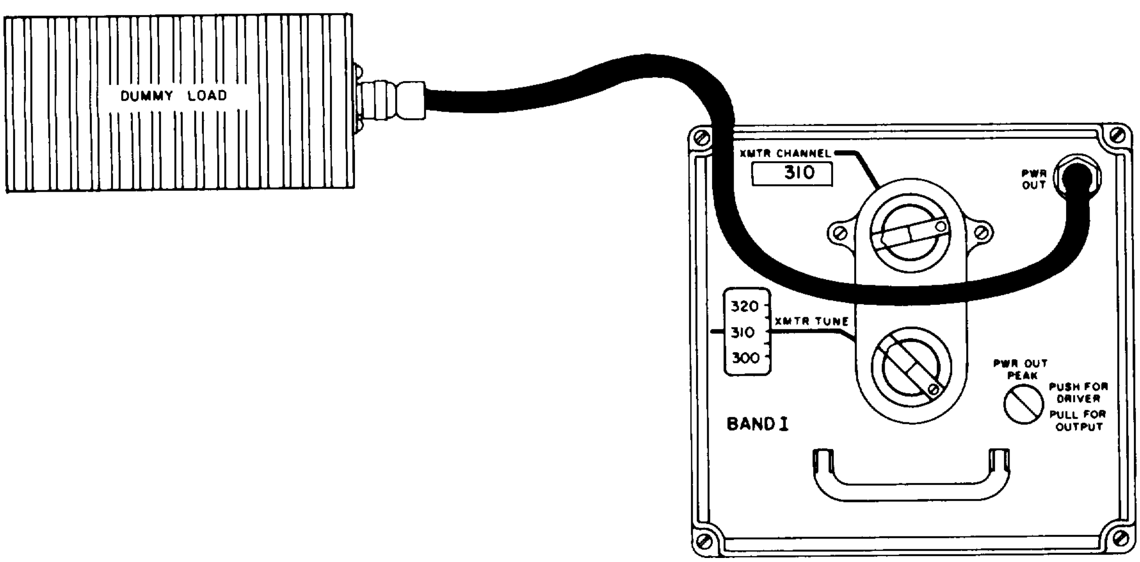
B Connect the transmitter rf head to the connector on the transmitter case by Cable, Electrical, Special Purpose CX-10879/GRC-l 03(V).



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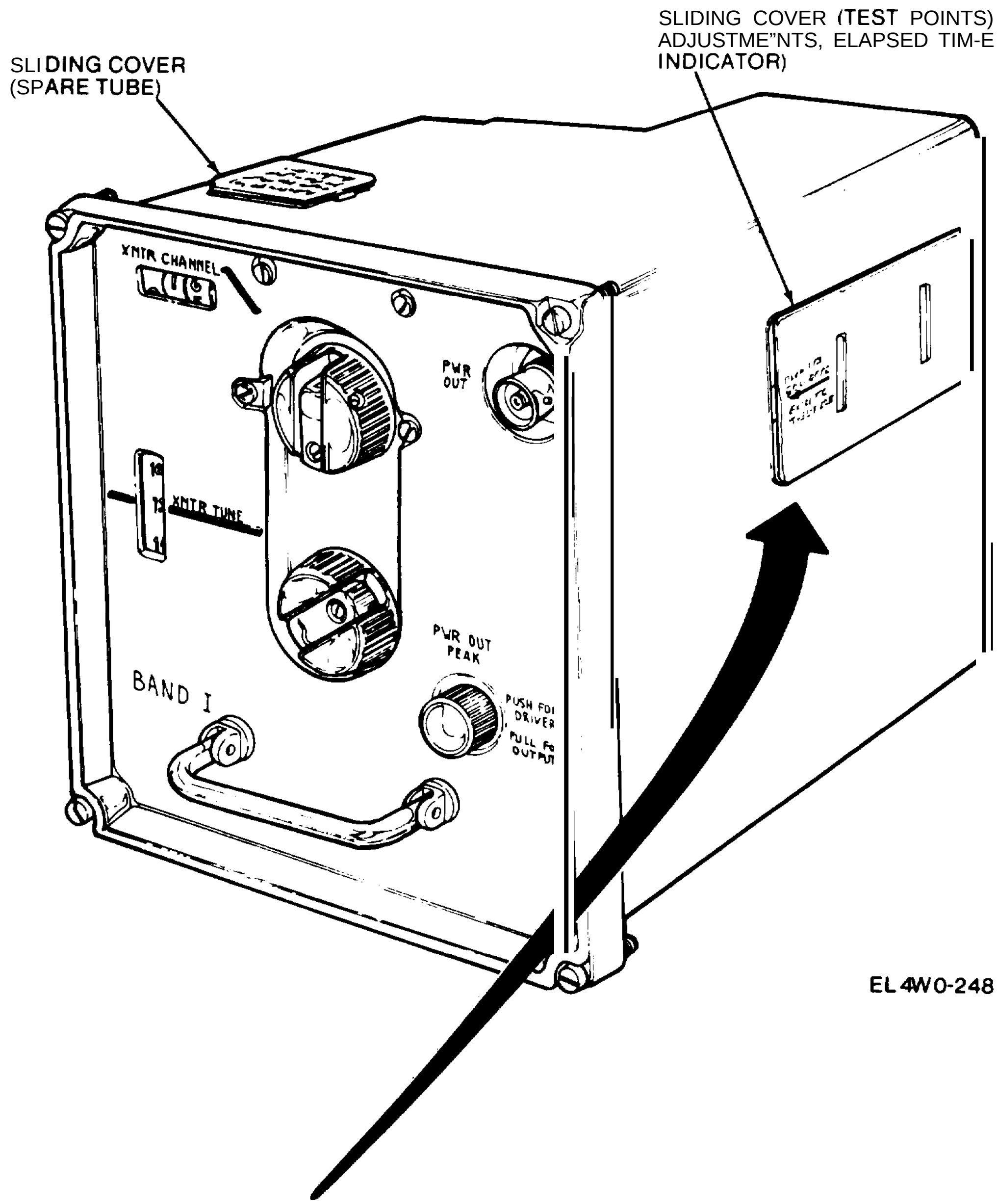
4-9. TUBE FILAMENT TESTING, REPLACEMENT AND ADJUSTMENTS - Continued

C Connect the dummy load to the PWR OUT connector on the front panel of the rf head,

D Turn on and tune the transmitter as explained in paragraph 2-14 of chapter 2.



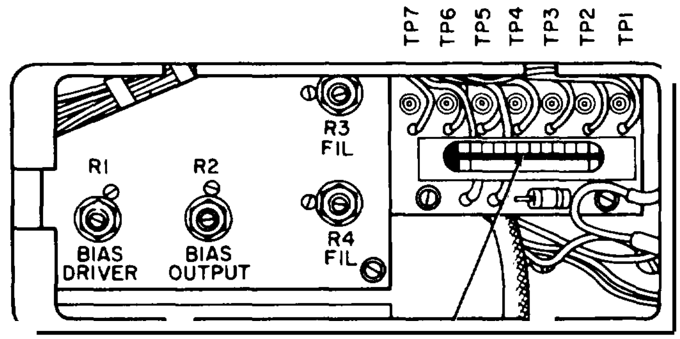
E Remove the cover plate over the test points on the transmitter rf head.

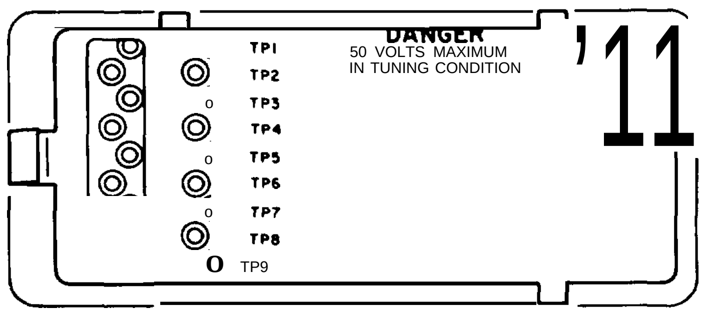
4-9. TUBE FILAMENT TESTING, REPLACEMENT ANO ADJUSTMENTS- Continued

F Set the multi meter range to 10 VDC and test the filaments, one at a time, using the following chart and diagrams. If any reading is zero, replace the tube. If any reading is not between 5.5 and 6.5 volts on the Band I head assembly, make adjustments after the replacement. (Bands II, III, IV have no adjustments).

BAND	METER CONNECTIONS	
	DRIVER AMPL	FINAL AMPL
I	TP3 (–) TP4 (+)	TP2 (–) TP1 (+)
II, III, IV	TP1 (–) TP3 (+)	TP2 (–) TP4 (+)

ZERO READING- REPLACE TUBE





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• TUBE REPLACEMENT

CAUTION

In Band I transmitter rf head AM-4320 B/G RC-103(V) and Band III transmitter rf head AM-4322 A/G RC-103(V), final amplifier tube VI is fitted with a clip-on temperature sensor. Use a lever to exert a steady pull on the extractor tool when removing this tube, to avoid damaging the connecting wires. If the sensor is disconnected or the wires are broken, 600 volts dc will not be supplied to the tube.

NOTE

Whenever a tube has been replaced with the spare provided, the transmitter rf head should be alined by higher category maintenance personnel at the earliest possible date. At the same time, a new tube should be installed in the spare tube compartment. In Bands III and IV, use only number SM-A-794144 tubes. The transmitter tubes are accessible at the rear of the transmitter RF head; access to the spare tube is through a sliding cover on top of the unit.

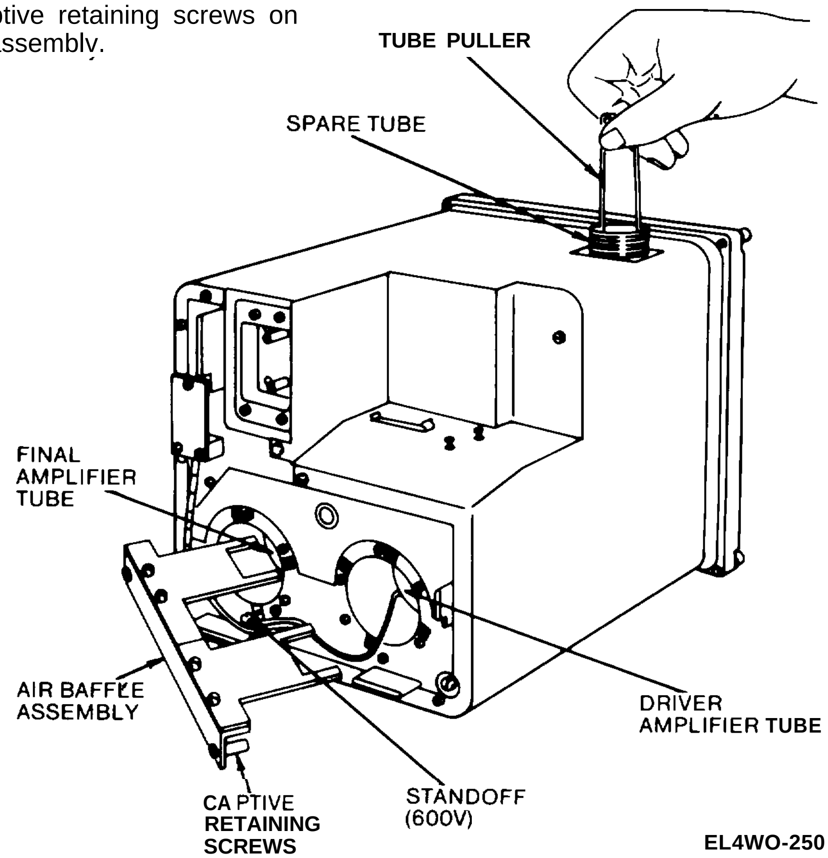
A Remove the transmitter rf head assembly as explained before under tube filament testing.

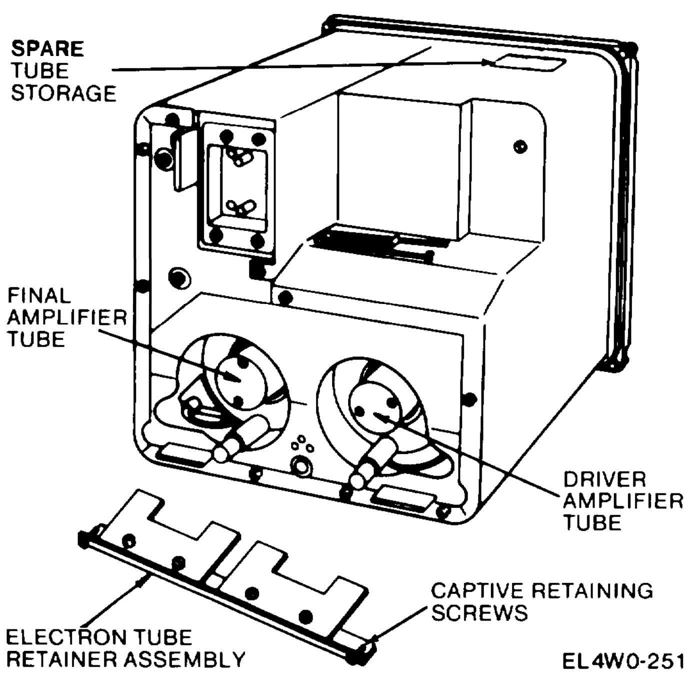
4-9. TUBE FILAMENT TESTING, REPLACEMENT AND ADJUSTMENTS- Continued

NOTE

Tube replacement procedures for Band 1, Bands II and Ill, and Band IV are slightly different, therefore, check the following three diagrams for the appropriate procedure.

B For Band 1, loosen the two captive retaining screws on the air baffle and remove the assembly.

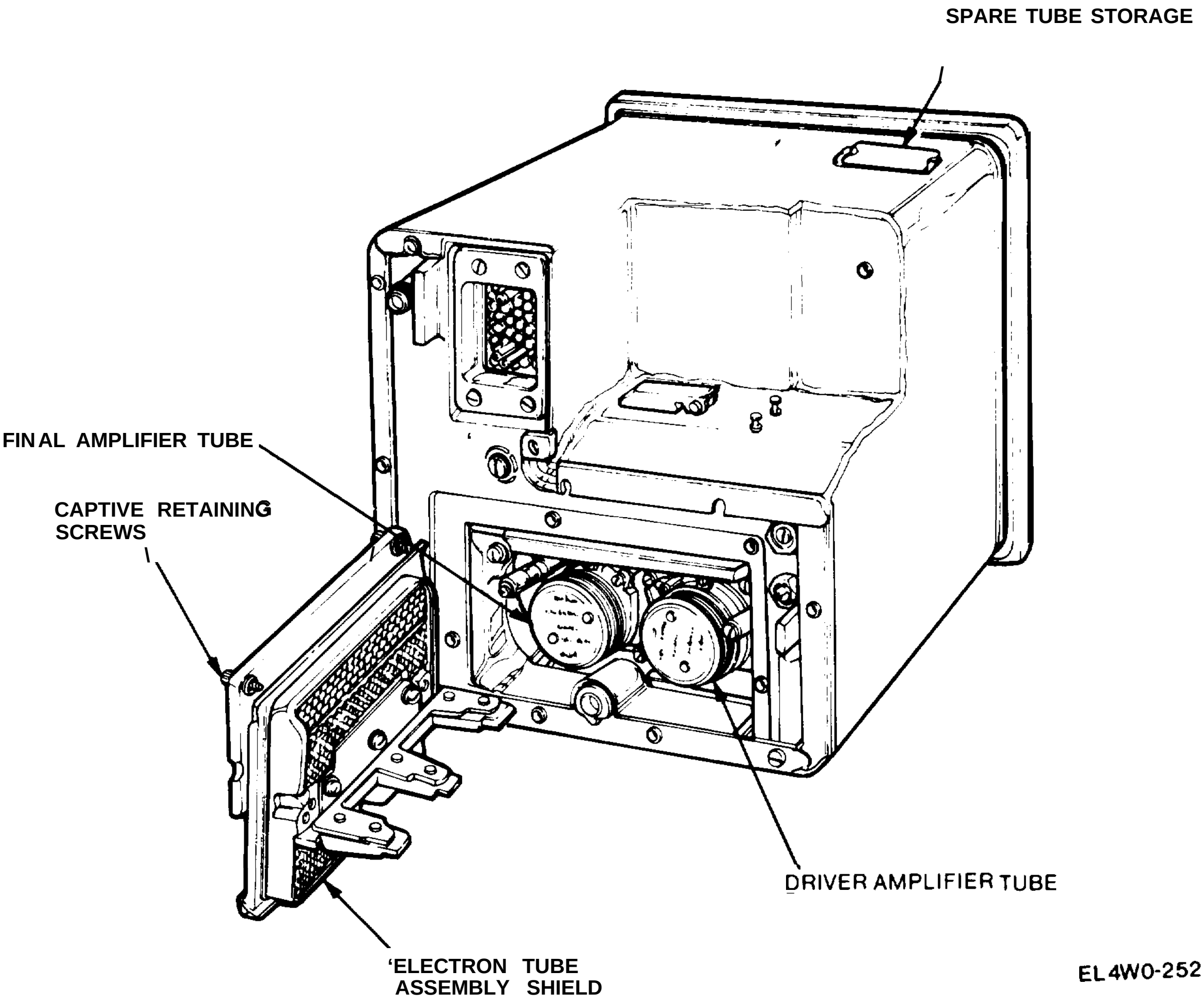




C For Bands II and Ill, loosen the three captive retaining screws on the electron tube retainer assembly.

4-9. TUBE FILAMENT TESTING, REPLACEMENT AND ADJUSTMENTS - Continued

D For Band IV, loosen the six captive screws on the electron tube assembly shield and remove the assembly. Loosen the tube clamp screws (two clamps on each tube) and rotate the clamps away from the rim of the tube.



CAUTION

In Band I transmitter rf head AM-4320 B/GRC-1 03(V) and Band Ill transmitter rf head AM-4322 A/G RC-1 03(V), final amplifier tube VI is fitted with a clip-on temperature sensor. Use a lever to exert a steady pull on the extractor tool when removing this tube, to avoid damaging the connecting wires. If the sensor is disconnected or the wires are broken, 600 volts dc will not be supplied to the tube.

E Insert the tube-puller prongs into the holes in the top of the tube and pull the tube straight out If the tube is a final amplifier tube fitted with a temperature sensor, unclip the sensor from the tube.

F Slide back the cover on the spare tube compartment. Remove the spare tube.

G If the tube to be fitted is to be the final amplifier tube in a Band I Transmitter Rf Head AM-4320 B/G RC-1 03(V) or a Band II Transmitter Rf Head AM-4322 A/G RC-1 03(V), clip the temperature sensor to the tube.

4-9. TUBE FILAMENT TESTING, REPLACEMENT AND ADJUSTMENTS - Continued

H To install the spare tube, press the cathode end into the tube socket. Check to see that the tube is firmly seated in the contact ring,

1 Band I only: Replace and secure the air baffle assembly,

J Bands II and III: Replace and secure the electron tube retainer assembly.

K Band IV. Rotate the clamps to seat on the rim of the tube. Secure the screws on the clamps. Replace and secure the electron tube assembly shield,

• ADJUSTMENTS AFTER TUBE REPLACEMENT

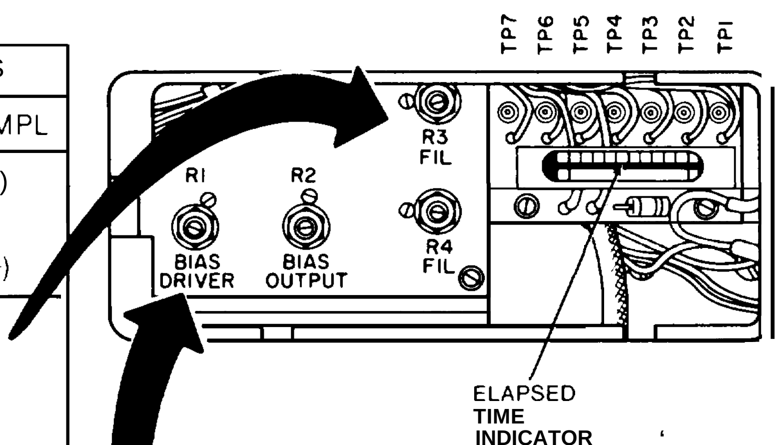
These adjustments are applicable for the Band I transmitter rf head, Whenever a tube is replaced, check and adjust the filament voltage and cathode current as follows:

A Connect the equipment as shown previously under In-Circuit Filament Checks, and make the checks for Band I only.

B If the meter, set to the 10 VDC range, does not indicate between 5,5 and 6,5 volts, make the following screwdriver adjustments to obtain 6.0 volts for both filaments as the chart indicates.

FILAMENT CHART

BAND	METER CONNECTIONS	
	DRIVER AMPL	FINAL AMPL
I	TP3 (–) TP4 (+)	TP2 (–) TP1 (+)
ADJUST	R3 FIL	R4 FIL
SET VOLTAGE	6.0	6.0



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BIAS CHART

BAND	METER CONNECTIONS	
	DRIVER AMPL	FINAL AMPL
I	TP5 (–) TP6 (+)	TP5 (–) TP7 (+)
ADJUST	R1 BIAS DRIVER	R2 BIAS DRIVER
SET VOLTAGE	0,72	0.75

4-9. TUBE FILAMENT TESTING, REPLACEMENT AND ADJUSTMENTS- Continued

C Check the bias voltage on each amplifier with the meter, set to the 2.5 VDC range, connected as the bias chart indicates.

D Bias voltage for the driver amplifier must be between 0.67 and 0.77 volts, and the final amplifier must be between 0.70 and 0.80 volts for satisfactory operation. If they are not within limits, adjust RI and R2 as the chart indicates.

E When finished, close the test point cover plate, disconnect the special purpose cable and dummy load, replace the assembly in the case and reconnect the PWR OUT cable to the FROM XMTR connector on the receiver head assembly. ,

Section V. MAINTENANCE REPAIR PROCEDURES

4-10. GENERAL MODULE REPLACEMENT PROCEDURES

CAUTION

Do not loosen or remove screws marked by red circles. Misalinement of the radio set may result. Be sure connectors are properly mated before tightening module mounting screws. Do not use the retaining screws to force connectors together. Whenever difficulty is met in mating connectors, remove the module and inspect the connectors for possible damage. Do not loosen or tighten the miniature coaxial connectors in the Band II, Ill, and IV rf heads. The locknuts on these connectors should be tightened only by using the approved torque wrench. Be careful when working near rigid coaxial cable in the Band 11, Ill, and IV RF heads. Rigid cable should not be dented, kinked, pinched, or unduly bent.

When trouble has been localized to a module of the radio set, replace the defective part as described in the following paragraphs. Prior to installing the replacement part, always check connectors for bent or otherwise damaged parts.

Refer to Operator/Crew Maintenance Chapter 3 for procedures to remove the major assembly before removing the appropriate module from the assembly.

4-11. REPLACEMENT OF FREQUENCY SYNTHESIZERS

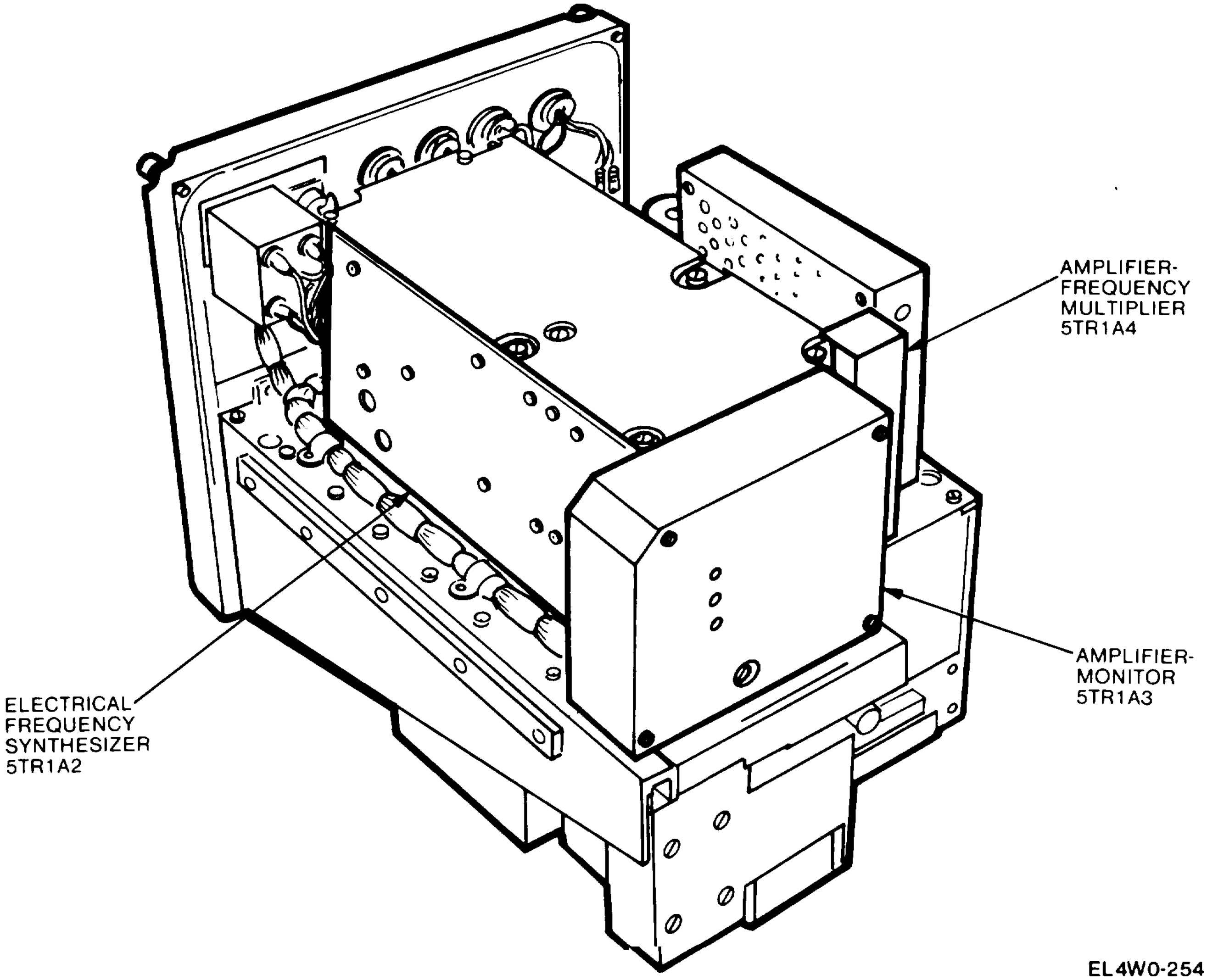
NOTE

To achieve **0.5** MHz rf channel spacing in Band IV, frequency synthesizerSM-D-698415, located in Transmitter, Radio T-983 (P)/GRC-1 03(V) and Receiver, Radio R-1 329(P)/GRC-103(V), must be replaced with frequency synthesizer SM-D-865030. The replacement procedure follows.

- **TRANSMITTER FREQUENCY SYNTHESIZER 5TR1 A2**

A Place radio transmitter 5TR1 bottom side up and locate 5TR1 A2

4-11. Replacement OF FREQUENCY SYNTHESIZERS -Continued



Bottom/Side View

B Loosen the four green-circled screws and lift 5TR1 A2, together with amplifier-monitor 5TR1 A5 and amplifier-frequency multiplier 5TR1 A4, straight up from the chassis to disengage the connectors, If the connectors do not separate easily, pry the chassis and modules apart with a screwdriver but do not pry on the faces of the mating connectors.

C Locate and loosen the two green-circled mounting screws that secure amplifier-monitor 5TR1 A5 to 5TR1 A2 and remove the module.

D Loosen the two green-circled mounting screws that secure amplifier-frequency multiplier 5TR1 A4 to 5TR1 A2 and pull straight away to remove the connectors.

E To install the 5TR1 A2 replacement module, first mount and secure 5TR1 A4 on 5TR1 A2. Then place 5TR1 A2 in position over its chassis connector and press down to engage the connector, Tighten the four mounting screws.

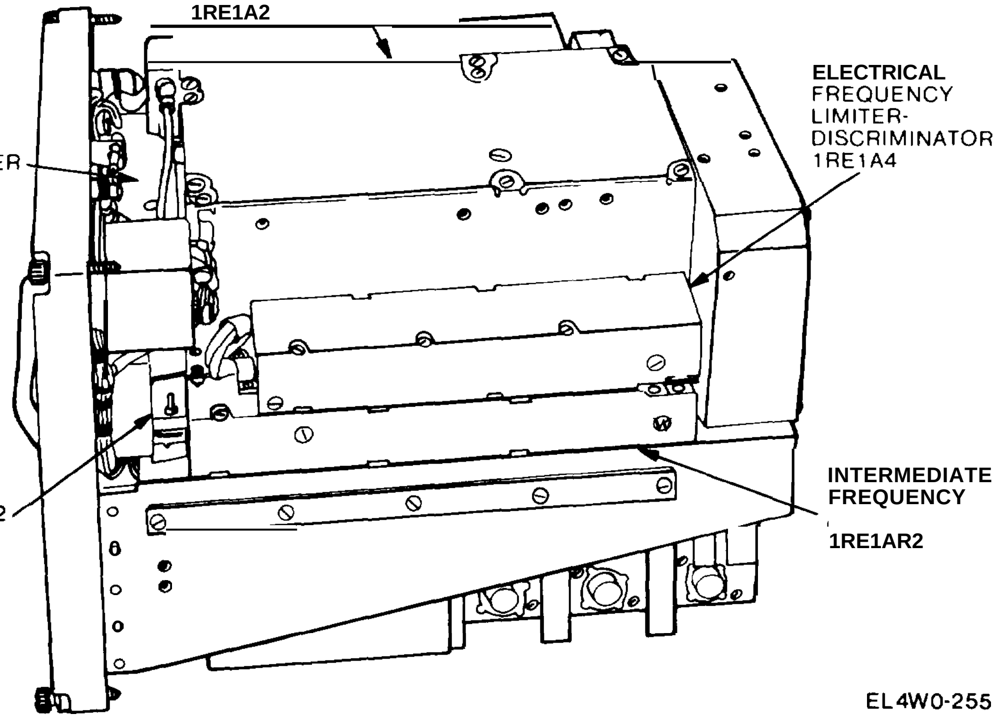
F To reinstall amplifier-monitor 5TR1 A5, place the module in position above its chassis connector, then press down until the connectors are fully engaged. The holes for the mounting screws will not be properly alined unless the connectors are fully engaged.

G Replace the front panel nameplate, which should now read: Transmitter, Radio T-983A(P)/GRC-103(V) or T-983 B(P)/GRC-1 03(V).

4-11. REPLACEMENT OF FREQUENCY SYNTHESIZERS- Continued

• RECEIVER FREQUENCY SYNTHESIZER 1 RE1A2

A Place radio receiver 1 RE1 bottom side up and locate 1 RE1 A2. Disconnect the leads from connector J2 of bandpass filter 1 RE1 FL1 and connector J1 of video amplifier 1 RE1 AR1



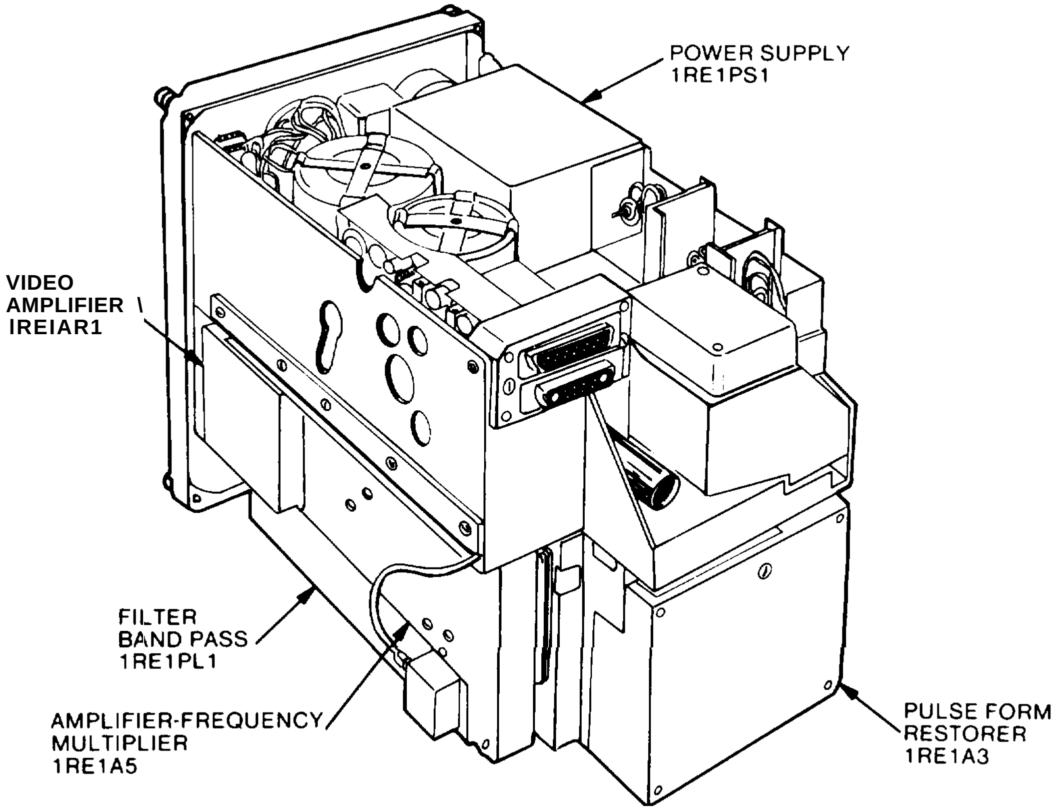
Bottom/Side View

B Loosen the four green-circled screws and lift 1RE1 A2 with the attached modules straight up from chassis to remove the connectors. If the connectors do not separate easily, pry chassis and module apart with a screwdriver but do not pry on the faces at the mating connectors.

C On 1 RE1 A2, locate pulse form restorer 1 RE1 A3, electrical frequency limiter-discriminator 1 RE1 A4, intermediate frequency amplifier 1 RE1AR2, amplifier-frequency multiplier 1RE1A5, and bandpass filter 1 RE1 FL1 Remove each of these modules as follows.

D Locate and loosen the two green-circled screws holding the pulse form restorer 1 RE1 A3 to the frequency synthesizer 1 RE1A2.

4-11. REPLACEMENT OF FREQUENCY SYNTHESIZERS – Continued



Top/Rear/Left Side View

E Loosen the four green-circled mounting screws that secure the frequency limiter/discriminator 1 RE1 A4 and intermediate frequency amplifier 1 RE1 AR2 to the side of frequency synthesizer 1 RE1A2. Pull the two modules away from 1 RE1A2.

F Grasp 1 RE1 A4 and 1 RE1 AR2 at the end where the two modules are connected, and pull them apart. Do not turn or twist the modules.

G Locate and disconnect the PI RF lead at connector J2 of band pass filter 1 RE1 FL1.

H Loosen the green-circled screws that secure the amplifier/frequency multiplier 1 RE1 A5 to the frequency synthesizer 1 RE1 A2.

I Remove 1 RE1 A5 carefully to disengage its connector. If necessary, pry the module away from 1 RE1 A2, but do not pry on the connector faces.

J Loosen the green-circled mounting screw at connector J2 end of the bandpass filter 1 RE1 FL1, and slide the module slightly forward to clear the holding pin on the end of 1 RE1 A2. Remove the filter 1 RE1 FL1.

K Attach and connect the modules to the replacement frequency synthesizer 1 RE1 A2 in the reverse order of removal as follows:

Bandpass Filter 1 RE1 FL1
Amplifier/Frequency Multiplier 1 RE1 A5
Intermediate Frequency Amplifier 1 RE1 AR2
Frequency Limiter/Discriminator 1 RE1A4
Pulse Form Restorer 1 RE1 A3

4-11. REPLACEMENT OF FREQUENCY SYNTHESIZERS- Continued

L To install the 1RE1FL1, slide the hole in the bracket at the connector J1 end over the holding pin protruding from 1RE1A2, then tighten the mounting screw at the opposite end.

M To install the 1RE1A5, position the module correctly to mate with the connector at the side of 1RE1A2, and press straight in to engage the connectors. Tighten the two mounting screws.

N Install 1RE1AR2 and 1RE1A4 by first engaging their connectors, then slide the two modules into position at the side of 1RE1A2. Tighten the four mounting screws.

O To install the 1RE1A3, attach the module to the 1RE1A2 with the two screws (in green-circled locations).

P Place the 1RE1A2 in position over its chassis connector and press down with the 1RE1A3 connector also alined so that connectors are securely engaged. Tighten the four mounting screws.

Q Replace the front panel nameplate which should now read: Receiver, Radio R-1329A(P)/GRC-103(V).

4-12. REPLACEMENT OF MODULES IN TRANSMITTERS [5TR1] T-983[P]/GRC-103[V] T-983A(P)/GRC-103(V) AND T-983B(P)/GRC-103(V).

• REPLACEMENT OF AMPLIFIER/MONITOR 5TR1A5

A Refer to the bottom/side view shown in paragraph 4-11 for location on transmitter chassis.

B Loosen the two green-circled mounting screws that secure 5TR1A5 to electrical frequency synthesizer 5TR1A2. Lift 5TR1A5 straight up from the chassis to disengage the connector. Remove 5TR1A5.

C To install the 5TR1A5 replacement module, place the module in position above its chassis connector, then press down until the connectors are fully engaged. The holes for the mounting screws will not be properly alined unless the connectors are fully engaged.

D Tighten the two mounting screws.

• REPLACEMENT OF CONTROL ALARM 5TR1A3 AND POWER SUPPLY 5TR1PS1

A The electrical frequency synthesizer 5TR1A2 (paragraph 4-11A) and power supply 5TR1PS1 must be removed before the control alarm 5TR1A3 is removed.

B Place radio transmitter 5TR1, bottom side up, and locate 5TR1A2.

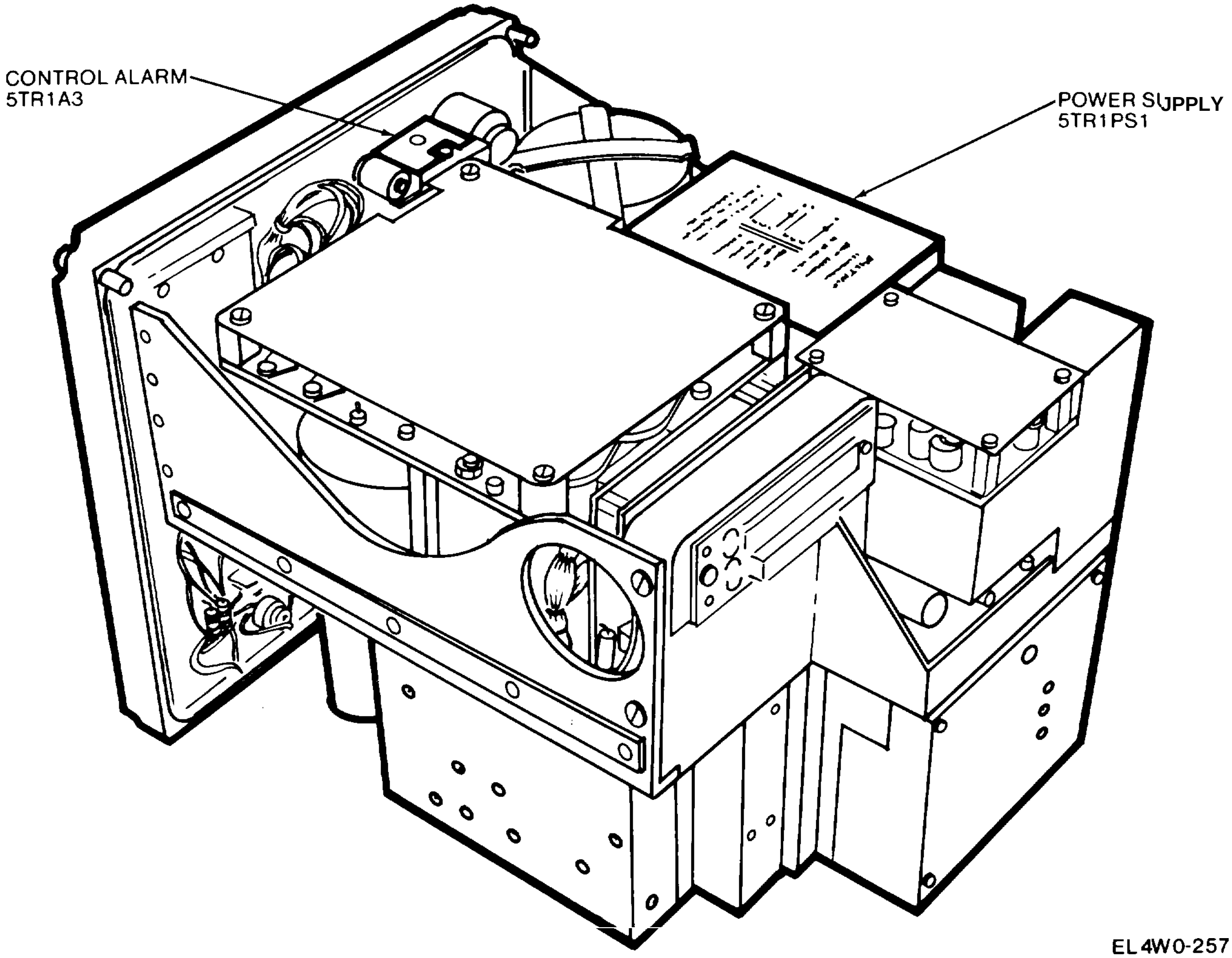
C Loosen four green-circled screws, and lift 5TR1A2, together with amplifier-monitor 5TR1A5 and amplifier-frequency multiplier 5TR1A4, straight up from the chassis to disengage the connectors. If the connectors do not separate easily, pry the chassis and modules apart with a screwdriver but do not pry on the faces of the mating connectors.

D Loosen the eight green-circled screws that secure 5TR1 PS1 to the chassis. Place radio transmitter 5TR1 top side up, and lift 5TR1 PS1 straight up from the chassis until its large multi pin connector is disengaged.

E Locate 5TR1A3, at the rear of the front panel, and disconnect cable plug P2 from connector J1 of 5TR1A3.

F Loosen the two green-circled mounting screws that secure 5TR1A3 to the front panel, and remove the module.

4-12. REPLACEMENT OF MODULES IN TRANSMITTERS (5TR1) T-983(P)/GRC-103(V), T-983A(P)/GRC-103(V) AND T-983 (B)/GRC-103(V). - Continued



Top/Rear View

G To install the 5TR1 A3 replacement module, place it in position at the rear of the front panel, and tighten the two mounting screws. Connect cable plug P2 to connector J1 of 5TR1 A3.

H Reinstall 5TR1 PSI by placing it in position above the chassis; then press straight down until its connector is fully engaged. Turn radio transmitter 5TR1 on its left or right side, and tighten the eight mounting screws securing 5TR1 PSI to the chassis.

I Place 5TR1 bottom side up, and reinstall 5TR1 A2. Position 5TR1 A2 above the chassis, and lower it into place. Press straight down to engage the connectors. When the connectors are fully engaged, tighten the four mounting screws.

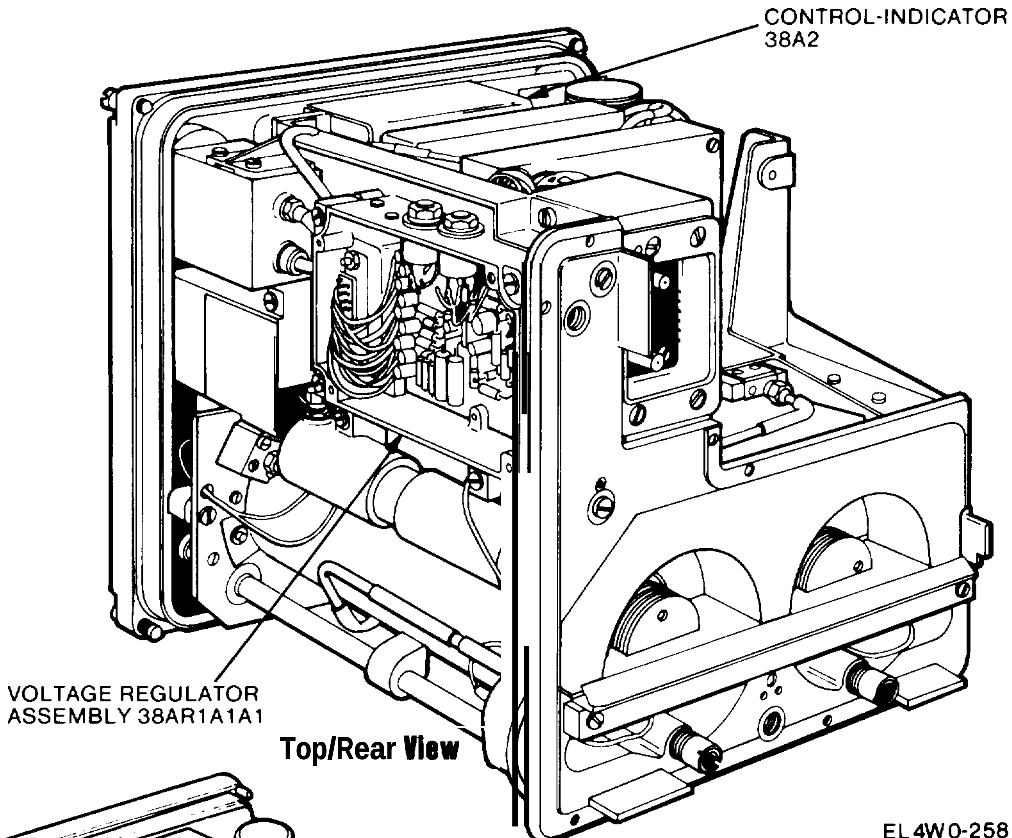
4-13. REPLACEMENT OF MODULES IN AMPLIFIER/FREQUENCY MULTIPLIERS AM-4321 /6 RC-103(V), AM-4321 B/G RC-103(V), AM-4322/GRC-103(V), AM-4322A/6 RC-103(V) OR AM-4323/GRC-103(V)

To replace a module in a Band 11, Ill or IV rf head, first remove the head from the transmitter case, then remove the dust cover, On Bands II and Ill the dust cover is secured with 11 or 12 screws. On Band IV the electron tube assembly shield (paragraph 4-9) must be removed first, followed by the removal of the dust cover. Reinstall the dust cover after replacing a module. On Band IV reinstall the electron tube assembly shield after the dust cover is in place.

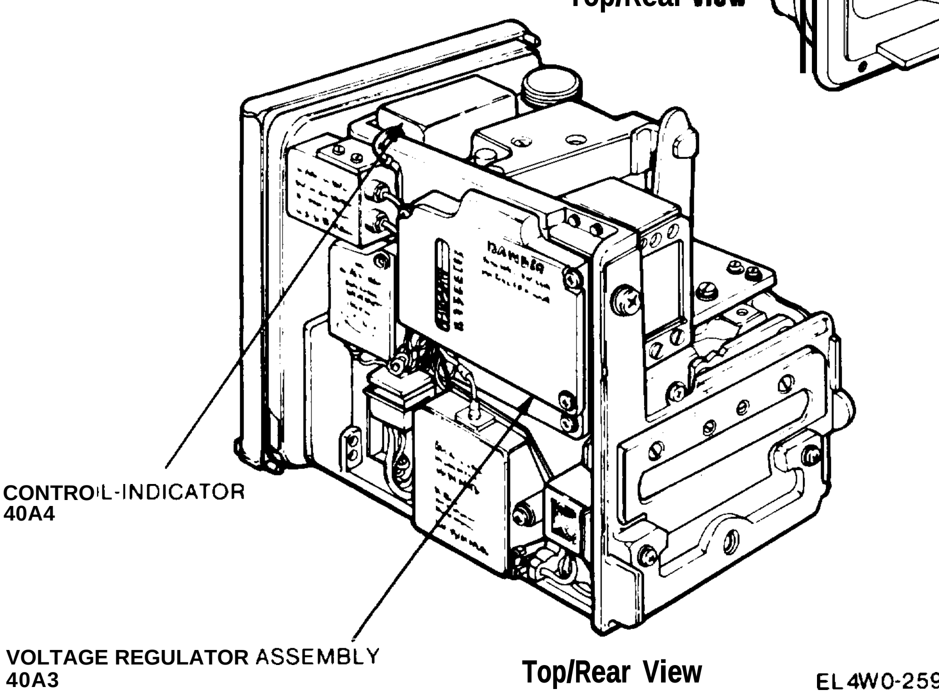
4-13. REPLACEMENT OF MODULES IN AMPLIFIER/FREQUENCY MULTIPLIERS AM-4321/GRC-103(V), AM-4321B/GRC-103(V), AM-4322/GRC-103(V), AM-4322IV6RC-103[VI OR AM-4323/6 RC-103(V) - Continued

● REPLACEMENT OF CONTROL-INDICATOR **37(38)A2** OR 40A4

A Place the rf head top side up and locate the control-l ndicator



Top/Rear View



Top/Rear View

4-13. REPLACEMENT OF MODULES IN AMPLIFIER/FREQUENCY MULTIPLIERS AM-4321 /GRC-103(V), AM-4321 B/GRC-103(V), AM-4322/GRC-103 [V), AM-4322A/GRC-103(V) OR AM-4323/GRC-103(V) - Continued

B Loosen the two screws that secure plug PI of the module to its mating connector, 37(38)AR1Al W1 J3 or 40A1 WI J5, and disconnect the plug.

C Loosen the screw in the center of the front-panel XMTR CHANNEL knob. Remove the knob,

D On the front panel, loosen the four screws that secure the module and remove it

E To install the replacement module, carefully lower it into place until the mounting holes are alined; then tighten the four mounting screws.

F Fit the XMTR CHANNEL knob over the module shaft; secure it in position with the screw provided. Make sure that the back of the knob clears the front panel by one-eighth inch,

G Connect plug P1 to its mating connector and secure it in position with the two screws provided.

- REPLACEMENT OF VOLTAGE REGULATOR ASSEMBLY 37(38)AR1A1 Al OR 40A3

A Place the rf head top side up and locate the voltage regulator assembly,

B Loosen the four green-circled screws that secure the module and pull it directly away from the chassis until the connectors are separated.

C To install the replacement module, position it above its chassis connector and press straight down until the connectors are fully engaged, Tighten the four mounting screws.

4-14. REPLACEMENT OF MODULES IN AMPLIFIER/FREQUENCY MULTIPLIERS AM-4320/GRC-103 [V), AM-4320A/GRC-103(V) OR AM-4320 B/GRC-103(V)

To replace a module in the Band I transmitter rf head, first remove. it from the transmitter case, then remove dust cover 6MP2. The dust cover is secured to the unit with nine screws. Reinstall the dust cover after replacing a module,

- REPLACEMENT OF ELECTRONIC SWITCH 6A1

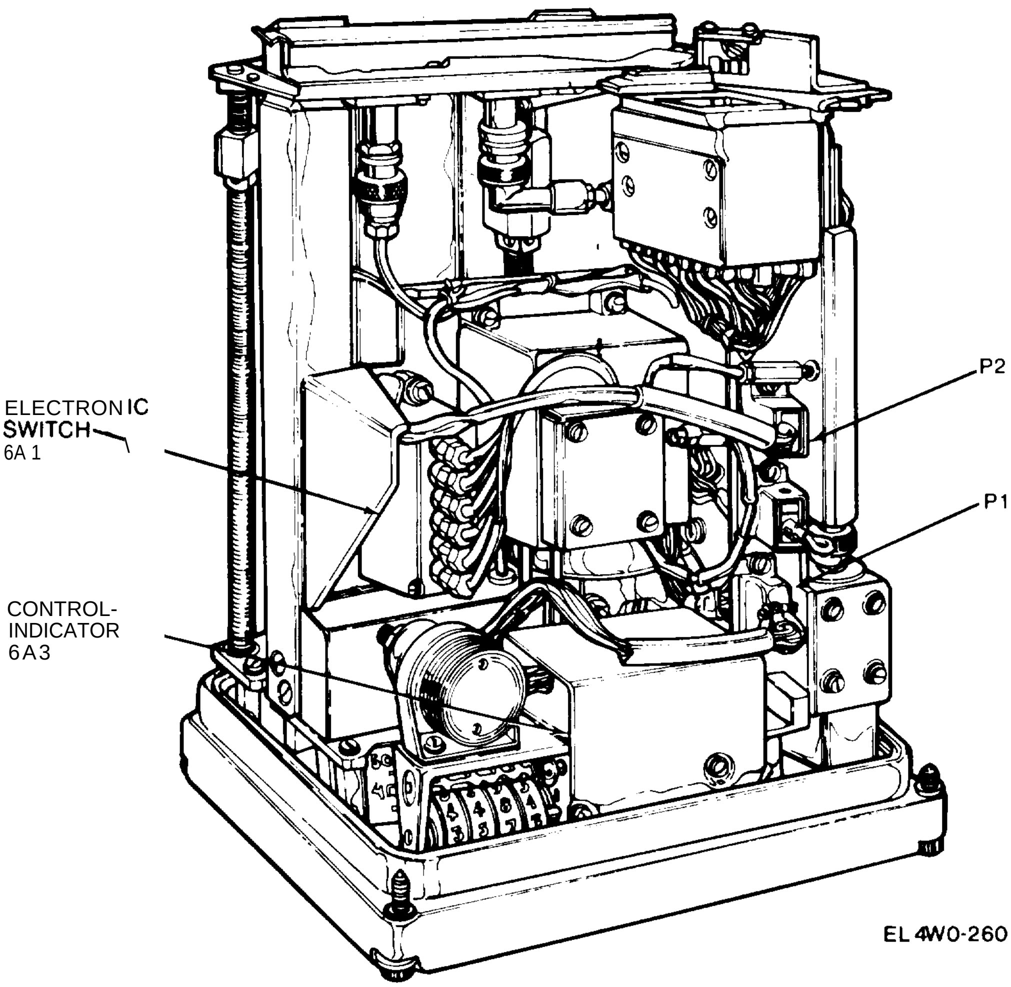
A Place the AM-4320 /G RC-1 03(V) or AM-4320 A/G RC-1 03(V), top side up, and locate electronic switch 6A1.

B Disconnect the six rf leads connected to 6A1. Loosen the two screws that secure plug P2 of the 6A1 lead to its mating connector, and disconnect the plug.

C Loosen the two green-circled mounting screws that secure 6A1 to the chassis, and remove the module.

D To install 6A1 replacement module, position the module over the two mounting holes and tighten the mounting screws. Connect plug P2 to its mating connector 6W1 J1 , and secure the plug in position with the two screws.

4-14. REPLACEMENT OF MODULES IN AMPLIFIER/FREQUENCY MULTIPLIERS AM-4320/GRC-103(V), AM-43201V6RC-10 3(VJ OR AM-4320 B/6 RC-103(V) - Continued



Top View

E Connect the six rf leads to the corresponding connectors of 6A1 as shown in the chart below.

Rf lead	From	To 6A1 connector
P4(XA1J1) P4(2A1J1)	Frequency multiplier assembly 6A2.	J1 OUT
P3(XA1J2) P3(2A1J2)	Frequency multiplier assembly 6A2.	J21N
P2(XA1 J3) P2(2A1J3)	Frequency multiplier assembly 6A2.	J3 OUT
PI (XA1 J4) P1(2A1 J4)	Frequency multiplier assembly 6A2.	J41N
P2(XA1J5) P2(2A1 J5)	Connector-filter assembly 6AR1 A2A3.	J5 IN
P1(XA1 J6) P1(2A1 J6)	RF power level control 6A5.	J6 OUT

4-14. REPLACEMENT OF MODULES IN AMPLIFIER/FREQUENCY MULTIPLIERS AM-4320/GRC-103(V), AM-4320A/GRC-103(V) OR AM-4320 B/GRC-103(V) - Continued

• **REPLACEMENT OF CONTROL-INDICATOR 6A3**

A Place the AM-4320/G RC-1 03(V), AM-4320 A/G RC-1 03(V) or AM-4320 B/G RC-1 03(V), top side up, and locate control indicator 6A3.

B Loosen the two screws that secure plug PI of the 6A3 lead to its mating connector 6W1 J2, and disconnect the plug.

c Loosen the screw in the center of the front panel XMTR CHANNEL knob. Remove the knob.

NOTE

Before installing a replacement module, be sure that one spring tension washer, CMC 335-131, is fitted to the shaft of the replacement module.

D On the front panel, loosen the four screws that secure 6A3, and remove the module.

E To install the 6A3 replacement module, carefully lower it into place until the mounting holes are alined; then tighten the four mounting screws,

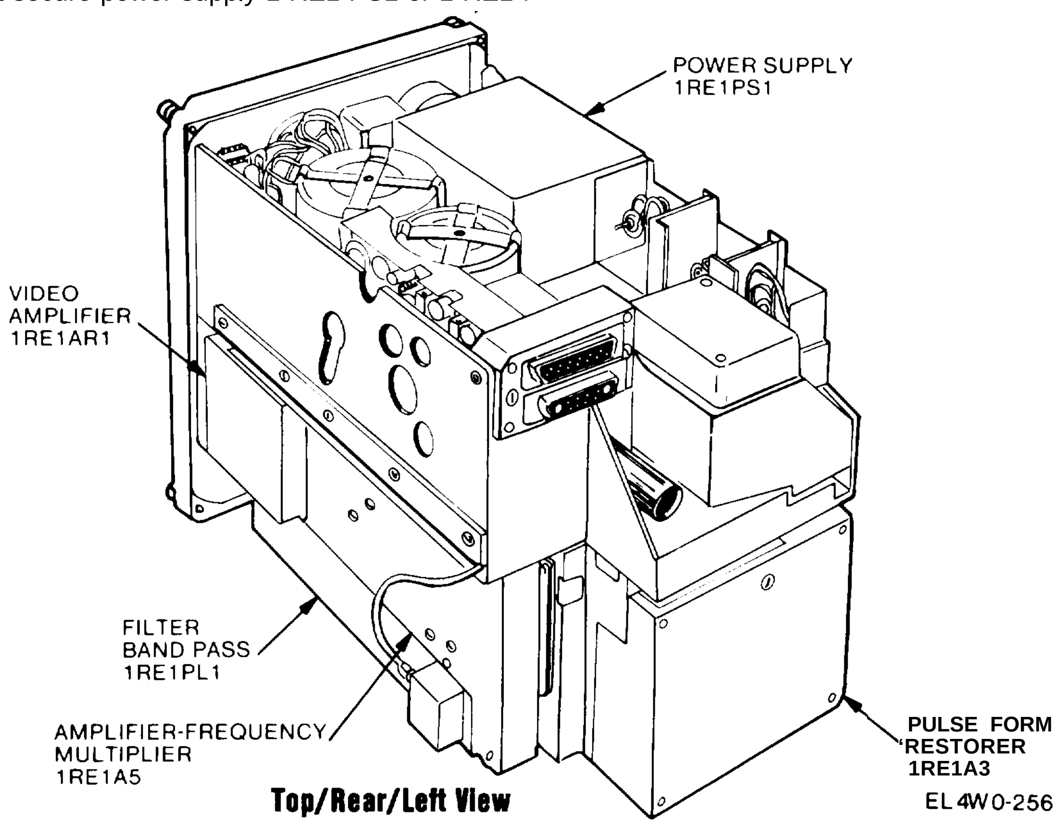
F Fit the XMTR CHANNEL knob over the 6A3 shaft, and secure it in position with the screw provided. Make sure that the back of the knob clears the front panel by one-eighth inch.

G Connect plug PI to its mating connector 1J2, and secure it in position with the two screws provided.

4-15. REPLACEMENT OF MODULES IN RADIO RECEIVER (1RE1) R-1329WGRC-103WI, R-1329A(P)/GRC-103(V), R-1 329 B(P)/GRC-103(V) OR R-1329C(Pj/6RC-103[Vj

• **REPLACEMENT OF POWER SUPPLY 1 RE1 PS1**

A Place the 1 RE1 top side up, and locate and loosen the seven green-circled mounting screws that secure power supply 1 RE1 PS1 or 1 RE1 .



Top/Rear/Left View

4-15. REPLACEMENT OF MODULES IN RADIO RECEIVER (1 RE1) R-1329(P)/GRC-103(V), R-1329A(P)/GRC-103(V), R-1329 B(P)/GRC-103(V) Oii R-1329C(P)/GRC-103(V) - Continued

B Lift 1 RE1 PSI straight up from the chassis until its connector is disengaged. If connector separation is difficult, pry the two assemblies apart at the rear of 1 RE1 with a screwdriver, Do not pry between the faces of the connectors,

C To install the 1 REI PS1 replacement module, place it in position above the chassis; then press straight down until the connectors are fully engaged. Tighten the seven mounting screws.

. REPLACEMENT OF PULSE FORM RESTORER 1 **RE1A3**

A Place the 1 RE1 bottom side up. Locate pulse form restorer 1 RE1 A3 at the rear of the chassis

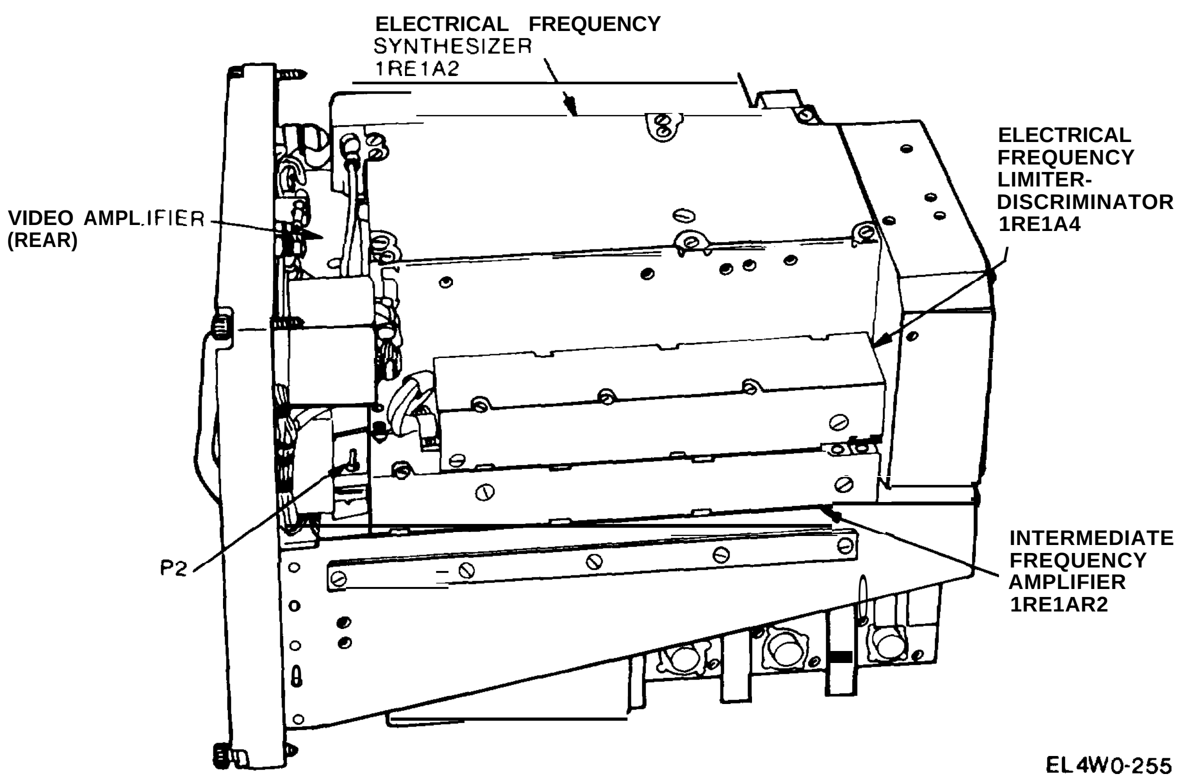
B Locate and loosen the two green-circled screws that secure 1 RE1 A3 to electrical frequency synthesizer 1RE1 A2.

C Pull 1 RE1 A3 directly from the chassis until it is free. Do not turn or twist the module before the connector is free,

D To install the 1 RE1A3 replacement module, position the module above its chassis connector and press straight down until the connectors are fully engaged. The holes for the mounting screws will not be properly alined unless the connectors are fully engaged, Tighten the two mounting screws,

• REPLACEMENT OF FREQUENCY-LIMITER DISCRIMINATOR 1 RE1A4

A Place 1 RE1 bottom side up. Locate and disconnect the P2 RF lead from connector J1 of band-pass filter 1 RE1 FL1 and plug P2 from connector J1 (1 RE1A4P2) of video amplifier 1 RE1 AR1.



Bottom/Side View

4-15. REPLACEMENT OF MODULES IN RADIO RECEIVER (1 RE1) R-1329(P)/GRC-103(V), R-1329A(P)/GRC-103(V), R-1329 B(P)/GRC-103(V) OR R-1329 C(P)/GRC-103(V) - Continued

B Loosen the four green-circled mounting screws that secure 1 RE1 A4 and intermediate frequency amplifier 1 RE1 AR2 to the side of electrical frequency synthesizer 1 RE1 A2. Pull the two modules away from 1 RE1 A2.

c Grasp 1 RE1 A4 and 1 RE1 AR2 at the end where the two modules are connected and pull them apart, but do not turn or twist the modules.

D To install the 1 RE1 A4 replacement module, first engage its connector with the connector of 1 RE1 AR2. Make sure that the connectors of the two modules are fully engaged, then slide the two modules into position at the side of 1 RE1 A2. tighten the four mounting screws.

E Connect the P2 (1 RE1 FL1 J1) RF lead from 1 RE1 AR2 to connector J1 of 1 RE1 FL1 and plug P2 from 1 RE1 A4 to connector J1 (1 RE1 A4P2) of 1 RE1 AR1.

• REPLACEMENT OF INTERMEDIATE FREQUENCY AMPLIFIER 1 RE1 AR2

Place 1 RE1 bottom side up. Remove 1 RE1 AR2 and 1 RE1 A4, and separate the two modules as described in C above.

• REPLACEMENT OF AMPLIFIER-FREQUENCY MULTIPLIER 1 RE1 A5

A Place 1 RE1 bottom side up. Locate and disconnect the P1 RF lead at connector J2 of band pass filter 1 RE1 FL1.

B Loosen the two green-circled screws that secure 1 RE1 A5 to electrical frequency synthesizer 1RE1A2.

c Remove 1 RE1 A5 carefully to disengage its connector. If necessary, pry the module away from 1 RE1 A2, but do not pry on the connector faces.

D To install the 1 RE1 A5 replacement module, position the module correctly to mate with the connector at the side of 1 RE1 A2 and press straight in to engage the connectors. Tighten the two mounting screws.

E Connect the P1 RF lead to connector J2 of 1 RE1 FL1.

• REPLACEMENT OF BAN DPASS FILTER 1 RE1 FL1

A The replacement of bandpass filter 1 RE1 FL1 is a second order removal. Electrical frequency synthesizer 1 RE1 A2 and its attached modules must be removed first.

B Place radio receiver 1 RE1 bottom side up. Locate and disconnect plug P2 from connector J1 (1 RE1 A4P2) of video amplifier 1 RE1 AR1 and P1 RF lead from connector J2 of 1 RE1 FL1.

c Loosen the four green-circled mounting screws that secure 1 RE1 A2 to the chassis. Lift 1 RE1 A2 straight up from the chassis to disengage the connectors. If the connectors are difficult to separate, pry the modules and chassis apart, but do not pry on the faces of the mating connectors.

D Locate and disconnect the P2 RF lead from connector J1 of 1 RE1 FL1.

E Loosen the green-circled mounting screw at the connector J2 end of 1 RE1 FL1, and slide the module slightly forward to clear the holding pin on the end of 1 RE1 A2. Remove 1 RE1 FL1.

F To install the 1 RE1 FL1 replacement module, slide the hole in the bracket at the connector J1 end over the holding pin, protruding from 1 RE1 A2; then tighten the mounting screw at the opposite end.

4-15. REPLACEMENT OF MODULES IN RADIO RECEIVER (1 RE1) 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) - Continued

G Reinstall 1 RE1 A2. Place 1 RE1 A2 with its attached modules in the correct position on the chassis so that the connectors are properly alined. Press straight down to engage the connectors, and tighten the four mounting screws,

H Connect plus P2 from electrical frequency limiter-discriminator 1 RE1 A4 to connector J1 (1 RE1 A4P2) of 1 RE1 AR1 Connect the P1 RF lead from electrical connector assembly 1 RE1 Al Al to connector J2 of 1 RE1 FL1 , and connect the P2 RF lead from intermediate frequency amplifier 1 RE1 AR2 to connector J1 of 1 RE1 FL1.

- **REPLACEMENT OF VIDEO AMPLIFIER 1 RE1 AR1**

A The replacement of video amplifier 1 RE1 AR1 is a second order removal. Electrical frequency synthesizer 1 RE1 A2 and its attached modules must be removed first,

B Place 1 RE1 bottom side up, and remove 1 RE1 A2 as described in B and C of Replacement of Bandpass Filter 1 RE1 FL1 , above.

c Loosen the two green-circled mounting screws that secure 1 RE1 AR1 to the chassis, Lift the module straight up to disengage its connector. Remove 1 RE1 AR1

D To install the 1 RE1 AR1 replacement module, position the module carefully above its mating connector on the chassis and press straight down to engage the connectors. Tighten the two mounting screws.

E Reinstall 1 RE1 A2. Place 1 RE1 A2 with its attached modules in the correct position on the chassis so that the connectors are properly alined. Press straight down to engage the connectors, and tighten the four mounting screws.

F Connect plug P2 from electrical frequency limiter-discriminator 1 RE1 A4 to connector J1 (1 RE1 A4P2) of 1 RE1 AR1. Connect the P1 RF lead from electrical connector assembly 1 RE1 A1 A1 to connector J2 of 1 RE1 FL1.

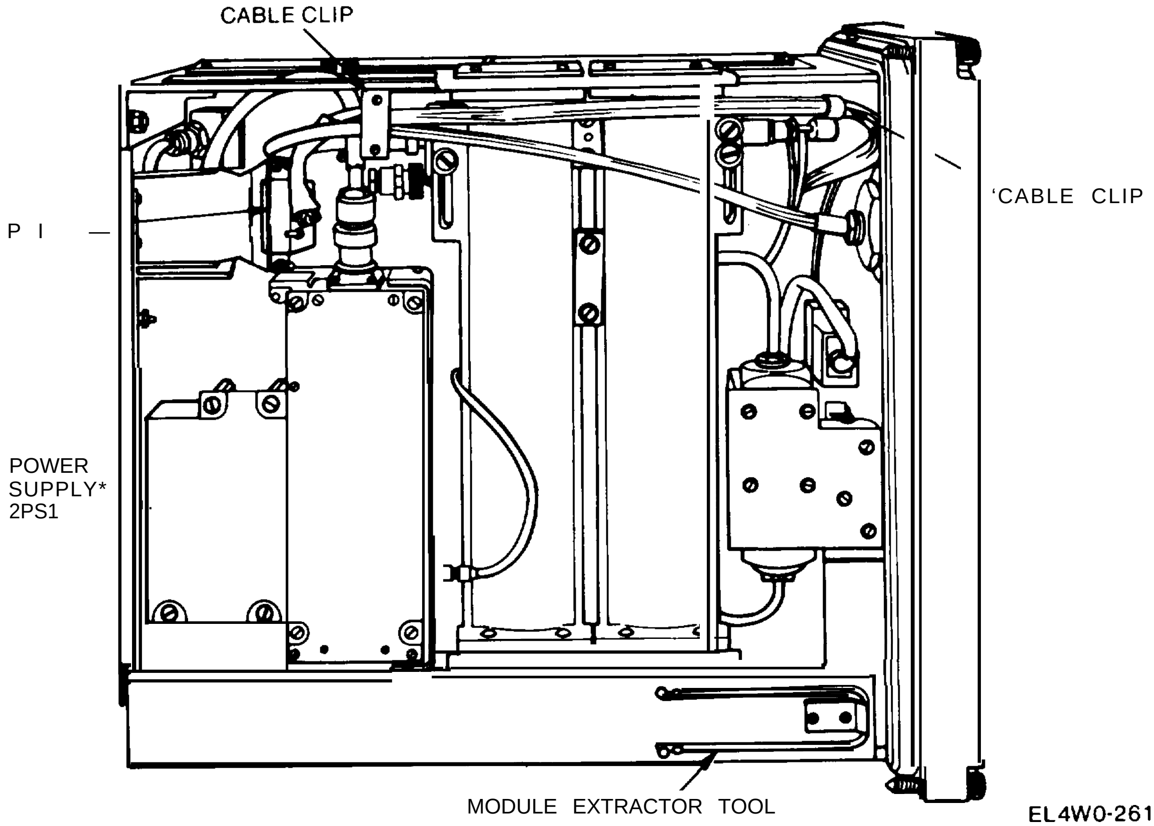
4-16. REPLACEMENT OF MODULES IN AMPLIFIER-CONVERTER AM-4316/GRC-103(V) OR AM-431 6A/GRC-1 03(V)

To replace a module in the receiver RF head, first remove it from the receiver case, then remove dust cover 2MP1 The dust cover is secured to the unit by 12 screws and the hexagonal nuts on the two locating pins. Reinstall the dust cover after replacing the module. Proceed as follows:

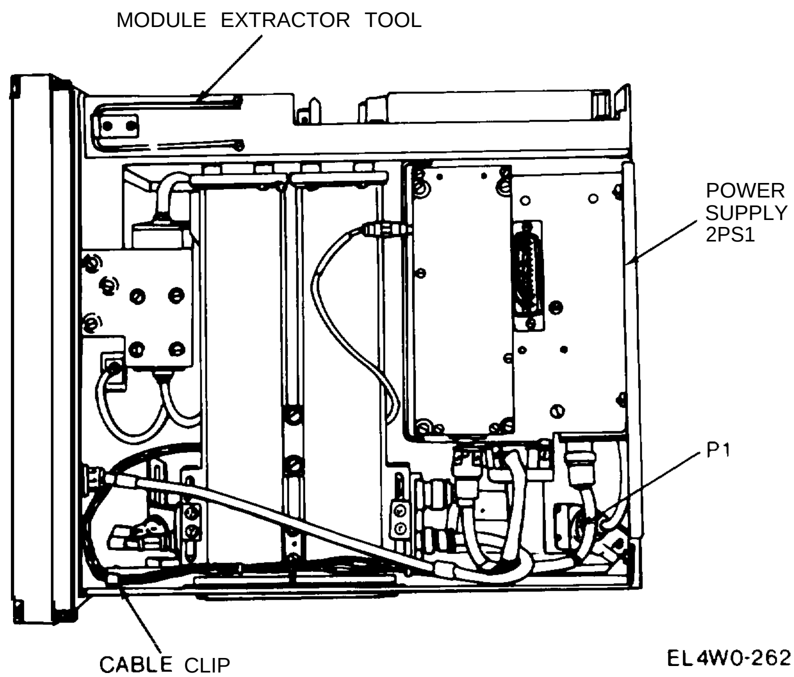
- **REPLACEMENT OF CONTROL-INDICATOR 2A2**

A Place the AM-4316/G RC-l 03(V) or AM-4316 A/G RC-l 03(V) bottom side up, and locate the cable from two screws that secure plug PI of this cable to its mating connector, and disconnect the plug, Remove the screws that secure the cable clips of the cable to the chassis.

4-16. REPLACEMENT OF MODULES IN AMPLIFIER-CONVERTER AM-4316/6 RC-103(V) OR AM-4316A/6 RC-103(V) - Continued



AM-431 6/GRC-103(V) Bottom View

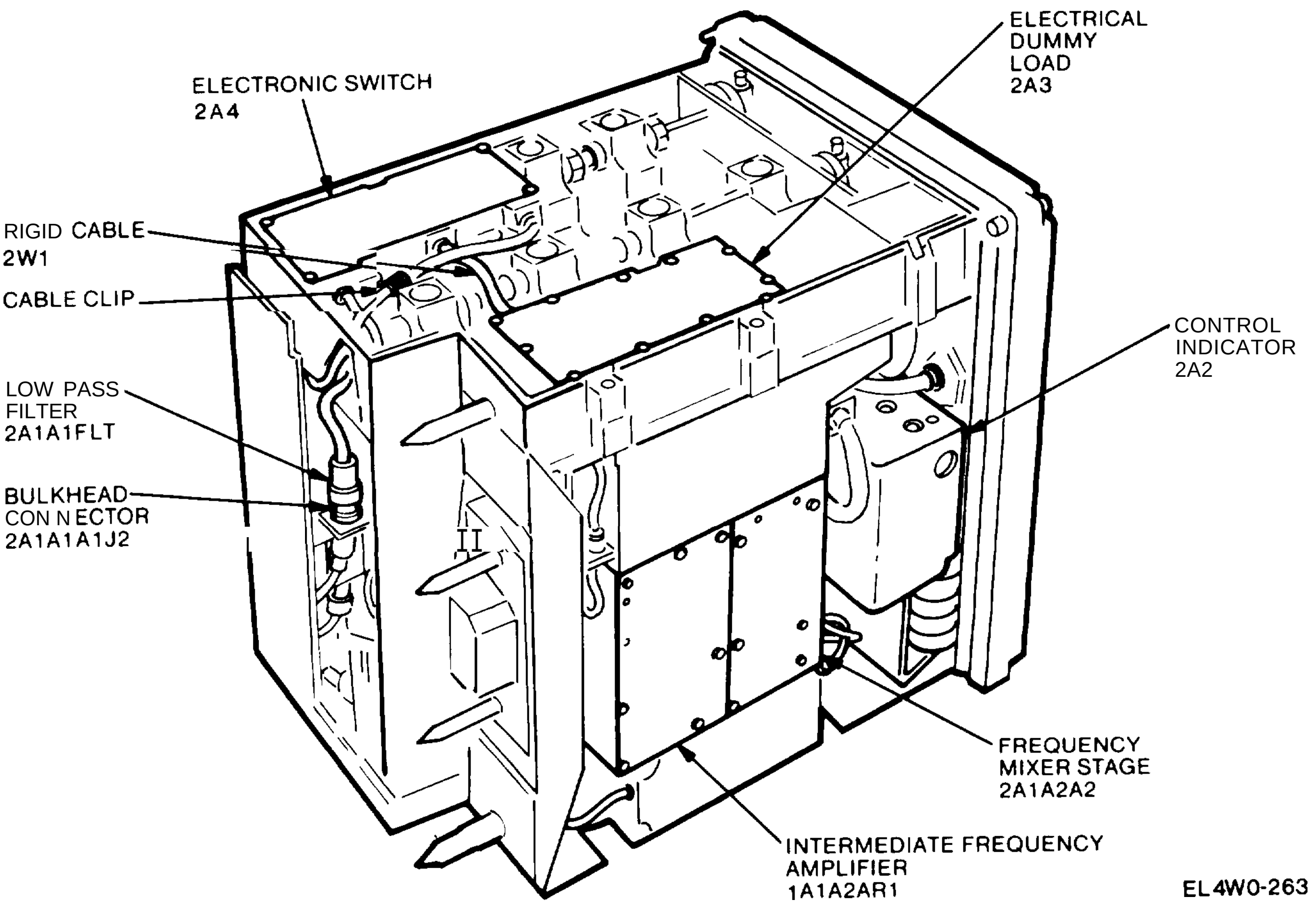


AM-431 6A/6 RC-103(V) Bottom View

4-16. REPLACEMENT OF MODULES IN AMPLIFIER-CONVERTER AM-4316/6 RC-103(V) OR AM-4316A/6 RC-103(V) - Continued

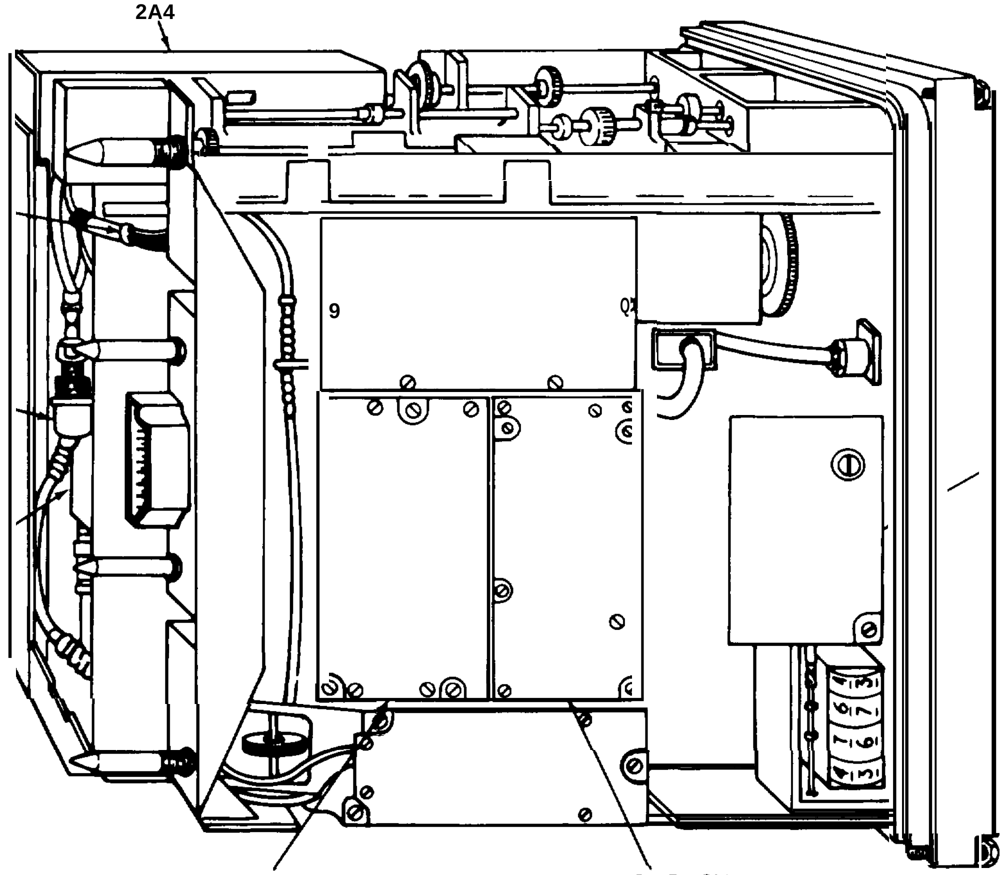
B Turn the AM-4316/GRC-l 03(V) or AM-4316 A/G RC-l 03(V), top side up. Loosen the screw in the center of the front panel RCVR CHANNEL knob, and remove the knob.

C On the front panel of the unit, loosen the four screws that secure 2A2 and remove the module.



AM-431 6/6 RC-103(V)
Top/Rear/Right View

4-16. REPLACEMENT OF MODULES IN AMPLIFIER-CONVERTER AM-4316/6 RC-103(V) OR AM-431 6A/GR C-103(V) - Continued



AM-4316A/6 RC-103(V) Top/Rear/Right View

D To install the 2A2 replacement module, first feed the module cable behind the front panel, then lower the module into place until the mounting holes are alined. Tighten the four mounting screws.

E Fit the RCVR CHANNEL knob over the 2A2 shaft, and secure it in position with the screw provided, Make sure that the back of the knob clears the front panel by one-eighth inch.

F Turn the AM-431 6/GRC-1 030A or AM-4316 A/GRC-I 03(V). bottom side up, and connect plug PI of the 2A2 cable to connector'2Al W4J4. Secure the plug in position with the two screws. Attach the cable to the chassis using the two cable clips.

- **REPLACEMENT OF ELECTRONIC SWITCH 2A4 (AM-4316/GRC-103(V)) OR SIGNAL LEVEL CONTROL-MONITOR 2A4 (AM-4316A/GRC-I 03(V))**

NOTE

Refer to the diagrams shown in previous paragraph.

4-16. REPLACEMENT OF MODULES IN AMPLIFIER-CONVERTER AM-4316/GRC-103(V) OR AM-431 6A/GRC-1 03(V) - Continued

A Face rear of the AM-4316/GRC-l 03(V) or AM-4316 A/GRC-l 03(V), and disconnect the 2A4 RF cables, one from bulkhead connector 2A1A1 Al J2 and the other from connector J1 of low pass filter 2A1 Al FL1. Remove the screw that secures the cable clip of the P2 cable to the chassis.

B Face the right side of the AM-4316/GRC-l 03(V) or AM-4316 A/G RC-l 03(V) and loosen the green-circled mounting screws that secure electronic switch 2A4 (signal level control-monitor 2A4, in receivers equipped with AM-4316 A/GRC-l 03(V)) to the chassis.

NOTE

Electrical dummy load module 2A3 is used in AM-4316 /GRC-l 03(V) only. For AM-431 6A/ GRC-1 03(V), ignore instructions for module 2A3.

C Loosen the four green-circled mounting screws that secure electrical dummy load 2A3 to the chassis (AM-431 6/GRC-1 03(V) only.

D Lift the two modules away from the chassis to disengage the 2A4 connector. Do not twist or turn the modules.

E Using an open-end wrench, loosen and remove connector P2 of rigid cable 2W1 from connector J1 of 2A4. Remove 2A4.

F Before installing the 2A4 replacement module, apply a light coating of heat sink compound to the entire surface of 2A3 that contacts the chassis. Connect connector P2 of the 2W1 rigid cable from 2A3 to connector J1 of 2A4. Tighten with the open-end wrench.

G Carefully place the two modules in position to engage the 2A4 connector, and tighten the three mounting screws of 2A4 and the four mounting screws of 2A3.

H Connect the P2RF lead from 2A4 to connector J1 of 2A1 Al FL1. Use the cable clip to secure the cable to the chassis. Connect the P3 RF lead from 2A4 to bulkhead connector 2A1A1AJ2.

. REPLACEMENT OF POWER SUPPLY 2PS1 (Part of AM-4316 /GRC-l 03(V) only)

NOTE

Refer to the diagrams shown in Replacement of Control-Indicator 2A2.

A Place the AM-4316 /GRC-l 03(V) bottom side up, and locate power supply 2PS1.

B Loosen the four green-circled mounting screws that secure 2PS1 to the chassis. Pull the module straight up to disengage its connector.

C To install the 2PS1 replacement module, carefully place the unit in position on the four mounting posts, press down to engage the connector, and tighten the four mounting screws.

• REPLACEMENT OF INTERMEDIATE FREQUENCY AMPLIFIER 2A1A2AR1

NOTE

Refer to the diagrams shown in Replacement of Control-Indicator 2A2.

A Place the AM-4316/GRC-l 03(V) top side up, and locate 2A1A2AR1.

4-16. REPLACEMENT OF MODULES IN AMPLIFIER-CONVERTER AM-4316/6 RC-103(V) OR AM-4316A/G RC-103(V) - Continued

B Disconnect the PI RF lead from if. connector J2 of frequency mixer stage 2A1 A2A2. Loosen the three green-circled mounting screws that secure 2A1 A2AR1 to the chassis, Use the module extractor tool to pull the module straight up to disengage the chassis connector,

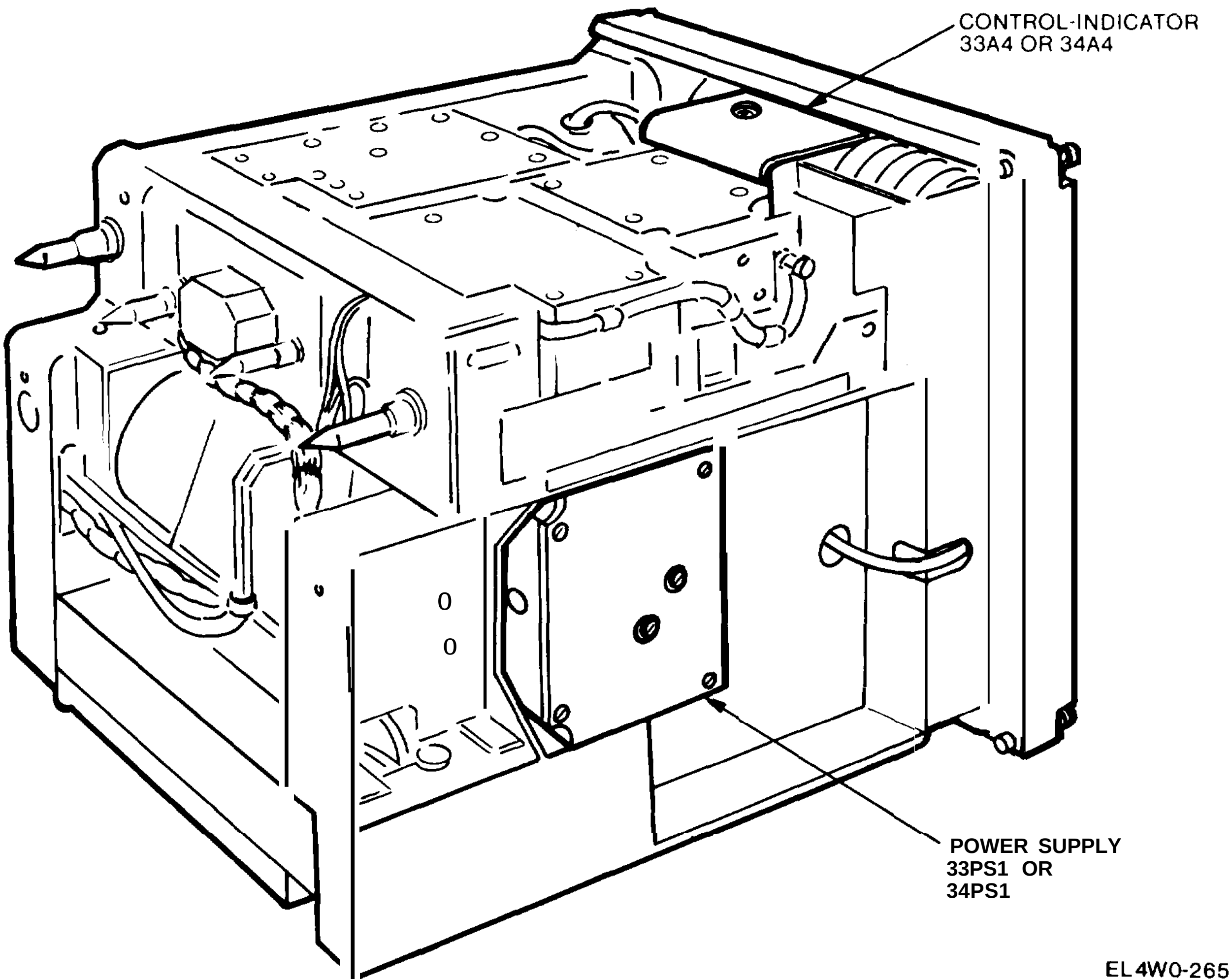
c To install the 2A1 A2AR1 replacement module, carefully lower the unit into place, press down to engage the connector, and tighten the three mounting screws. Connect the P1 RF lead of 2A1 A2AR1 to if. connector J2 of 2A1 A2A2.

4-17. REPLACEMENT OF MODULES IN AMPLIFIER-CONVERTER AM-4317/6 RC-103(V), AM-4318/6 RC-103(V) OR AM-4319/6 RC-103(V)

To replace a module in a Band 11, Ill, or IV receiver rf head, first remove the head from the receiver case, then remove the dust cover. The dust cover is secured to the unit by 12 screws, and by the hex- agonal nuts on the two locating pins. Reinstall the dust cover after replacing the module,

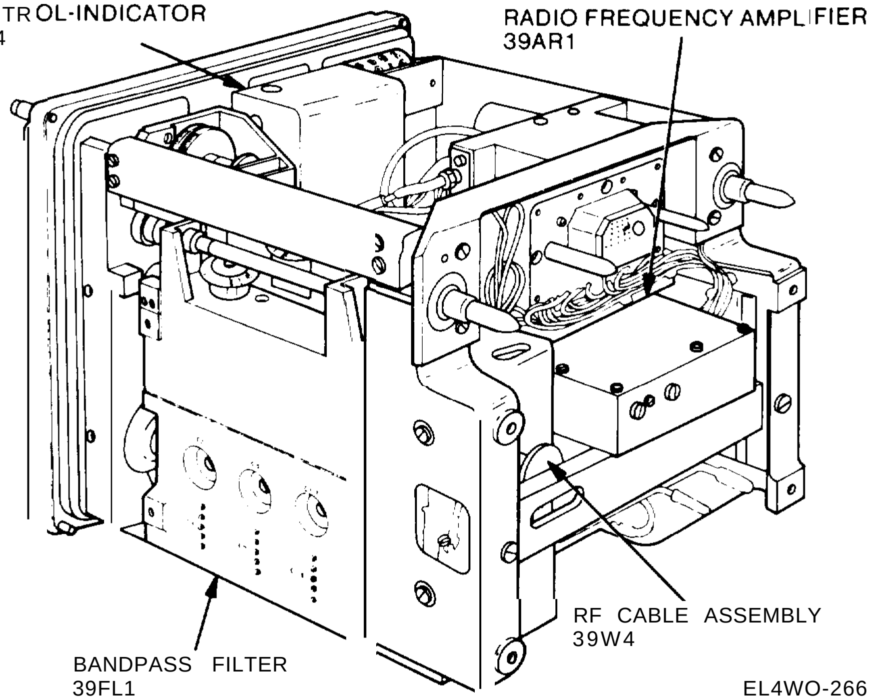
• REPLACEMENT OF CONTROL-INDICATOR 33A4, 34A4 (ON AM-4317 AND AM-4318) OR 39A4 (ON AM-4319)

A Place the rf head (AM-431 7, AM-4318 orAM-4319) top side up and locate the control-indicator using one of the following two diagrams.



AM-431 7/6 RC-103(VJ and AM-4318/6 RC-103(V) Top/near/Left View

4-17. REPLACEMENT OF MODULES IN AMPLIFIER-CONVERTER AM-4317/GRC-103(V), AM-4318/GRC-103(V) OR AM-4319/GRC-103(V) - Continued



AM-4319/6 RC-103(V) Top/Rear/Right View

B Loosen the two screws that secure plug PI of the module to its mating connector, 33(34)A1 WI J5 or 39A1 WI J2, and disconnect the plug.

c Loosen the screw in the center of the front-panel RCVR CHANNEL knob. Remove the knob

D On the front panel, loosen the four screws that secure the module and remove it.

E To install the replacement module, carefully lower it into place until the mounting holes are alined; then tighten the four mounting screws.

F Fit the RCVR CHANNEL knob over the module shaft; secure it in position with the screw provided. Make sure that the back of the knob clears the front panel by one-eighth inch.

G Connect plug PI to its mating connector and secure it in position with the two screws provided.

- **REPLACEMENT OF POWER SUPPLY 33 PSI OR 34 PSI IN AM-431 7/GRC-103(V) OR AM"4318/GRc-I 03(V)**

A Place the rf head left side up. Locate the power supply module.

B Loosen the three green-circled screws that secure the module and pull it directly away from the chassis until the connectors are separated.

C To install the replacement module, position it above its chassis connector and press straight down until the connectors are fully engaged. Tighten the three mounting screws.

- **REPLACEMENT OF RF AMPLIFIER 39AR1 IN AM-4319 /GRC-103(V)**

A Place the rf head top side up and locate the RF amplifier module.

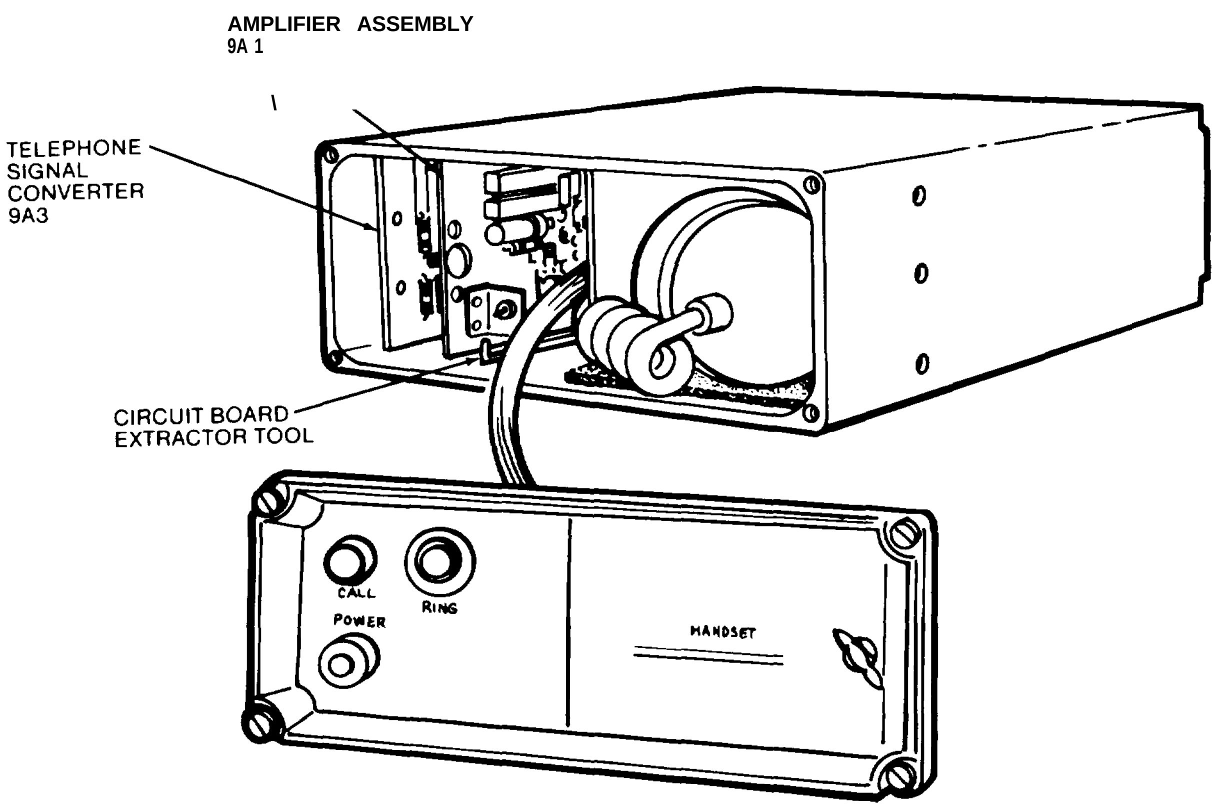
4-17. REPLACEMENT OF MODULES IN **AMPLIFIER-CONVERTER** AM-4317/6 **RC-103(V),** AM-4318/611 **C-103(V)** on **AM-4319/G RC-103(V)** - **Continued**

B Loosen the two green-circled screws that secure the module and pull it directly away from the chassis until the connectors are separated.

c To install the replacement module, position it above its chassis connector and press straight down until the connectors are fully engaged. Tighten the two mounting screws.

4-18. REPLACEMENT OF CIRCUIT BOARDS IN **RECEIVER/TRANSMITTER, ORDER WIRE RT-773/GRC-103(V)**

To replace a circuit board of the order wire unit, first remove the unit front panel from the case. The front panel is secured to the case by four green-circled captive screws. Reinstall the front panel after replacing a circuit board.



EL4WO-267

• REPLACEMENT OF TELEPHONE SIGNAL CONVERTER, BOARD 9A3

A To remove telephone signal converter 9A3, use the circuit board extractor tool stored in the case, and pull 9A3 straight out along its supporting channel guides.

B To install the replacement board, first check to see that the board is right side up, then place the board in its channel guides and press in to engage the connector.

• REPLACEMENT OF AMPLIFIER ASSEMBLY, BOARD 9A4.

Use circuit board extractor tool as described above.

4-19. TOUCHUP PAINTING INSTRUCTIONS

Remove rust and corrosion from metal surfaces by lightly sanding them with fine sandpaper. Brush two thin coats of paint on the bare metal to protect it from further corrosion. Refer to the applicable cleaning and refinishing practices specified in TB 746-10.

Section VI. SHIPMENT, LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

4-20, DISASSEMBLY OF EQUIPMENT

Disassembly procedures for the radio set consist of the procedures given below.

. Set the two AC POWER switches of Radio Set AN/G RC-1 03(V)1 to OFF.

. Disconnect all interunit and external cabling.

. Lower the antenna system. Disassemble it, and pack it as described in paragraphs 2-8 through 2-12.

4-21. REPACKAGING FOR SHIPMENT OR LIMITED STORAGE

The exact procedure for repackaging depends on the material available and the conditions under which the equipment is to be shipped or stored. Adapt the procedures given below whenever possible. For information concerning the original packaging, refer to paragraphs 2-1 and 2-2.

- MATERIAL REQUIREMENTS

The materials listed in the chart below are required for packaging Radio Set AN/G RC-103(V)1.

Material	Quantity
Corrugated cardboard	280 sq. ft.
Fiberbound hairflex, l-inch thick	160 sq. ft.
Adhesive tape	100 ft.

- PACKAGING

The items of Radio Set AN/G RC-103(V)1 are to be packaged as outlined in the chart below. Dimensions of the outer cartons are given in paragraph 2-2. Place the following items in inner cartons.

Carton No.	Carton size	Items
1	18 by 9 by 13 inches.	Receiver, Radio R-1 329(P)/GRC-1 03(V) and Amplifier-Converter AM-431 6/GRC-1 03(V); or Receiver, Radio R-1 329 A(P)/GRC-1 03(V), R-1329 B(P)/GRC-l 03(V) or R-1 329 C(P)/GRC-103(V) and Amplifier-Converter AM-431 6A/GRC-103(V).
2	18 by 9 by 13 inches,	Transmitter, Radio T-983 (P)/GRC-1 03(V) and Amplifier-Frequency Multiplier AM-4320/G RC-1 03(V); or Transmitter, Radio T-983 A(P)/GRC-1 03(V) or T-983 B(P)/GRC-1 03(V) and Amplifier-Frequency Multiplier AM-4320 A/G RC-103(V).
3	18 by 11 by 15 inches.	Receiver Transmitter, Order Wire RT-773/GRC-1 03(V). Dummy Load, Electrical DA-437 /GRC-1 03(V). Cable Assy, RF CG-3444/U (1 ft 6 in.) (two each). Cable Assembly, RF CG-3444/U (3 ft 6 in.). Cable Assembly, RFCG-1040B/U (4 ft). Cable Assembly, RF CG-3443/U (50 ft). Cable Assembly, Special Purpose, Electrical, Branched CX-10763/GRC-l 03(V). Cable Assembly, Special Purpose, Electrical CX-1 0762/U (5 ft) (two each). Adapter Connector UG-1 375/U. Use filler material to cushion each item as required.

4-21. REPACKAGING FOR SHIPMENT OR LIMITED STORAGE - Continued

- **PACKING**

Place each of the three packages into an outer carton using fiberbound hairflex to cushion each side of the inner carton. Secure the outer carton with adhesive tape. Identify the cartons 1 of 6, 2 of 6, and 3 of 6, as indicated in the list in paragraph 2-2. Pack remaining items of the radio set into outer cartons, as indicated in paragraph 2-1, using fiberbound hairflex to cushion each item as required, Mark the cartons 4 of 6, 5 of 6, and 6 of 6 as indicated in the list,

4-22. AUTHORITY FOR DEMOLITION

Demolition of the equipment will be accomplished only upon the order of the commander, The destruction procedures given below will be used to prevent further use of the equipment,

4-23. METHODS OF DESTRUCTION

Use any of the following methods to destroy the equipment,

- **SMASH**

Smash the front and rear panels, controls, tubes, switches, connectors, printed-circuit boards, meters, and handset. Smash the antenna element, the connectors, the grid elements of the corner reflector, the jacking mechanism, and the brake rings of the launcher; use sledges, axes, handaxes, pickaxes, hammers, crowbars, or heavy tools.

- **CUT**

Cut the power, RF, antenna, interconnecting cables and harnesses. Use axes, handaxes, or machetes,

- **BEND**

Bend cases and covers. Bend grid elements of the corner reflector.

WARN NG

Be extremely careful with explosives and incendiary devices. Use these items only when the need is urgent.

- **BURN**

Burn cords, cables, and technical manuals; use gasoline, kerosene, oil, flamethrowers, or incendiary grenades.

- **EXPLODE**

If explosives are necessary, use firearms, grenades, or TNT.

- **DISPOSE**

Bury or scatter the destroyed parts in slit trenches or foxholes, or throw them into streams

APPENDIX A
REFERENCES

A-1 . PAMPHLETS

The Army Maintenance Management Update (TAM MS) ....,. .,. .. DA Pam 738-750

Consolidated Index of Army Publications
and Blank Forms ...., ... DA Pam 25-30

A-2. MODIFICATION WORK ORDER

(Not applicable)

A-3, SERVICE BULLETIN

(Not applicable)

A-4. TECHNICAL BULLETINS

Field Instructions for Painting and Preserving Electronics
Command Equipment .... .TB 746-10

Safety Measures to be Observed when Installing and Using Whip Antennas,
Field Typecasts, Towers, Antennnas, and Metal Poles that areused
with Communication, Radar, and Direction Finder Equipment, ., ., ., ., .,.,.,.., ... **TB 43-0129**

A-5. TECHNICAL MANUALS

Administrative Storage of Equipment .... TM 740-90-1

Operator's and Organizational Maintenance Manual:
Mast, AB-577/GRC (NSN 5820-00-892-3862) and
Extension Kit, Mast MK-806/GRC (5895-00-691 -2344) ., ,.. ,.. ... ... TM 11-5820-538-12

Operator's and Organizational Maintenance Manual:
Multiplexer, TD-202/U (NSN 5805-00-884-21 76),
TD-203/U (5805-00-884-21 77), TD-204/U (5805-00-
900-8200), TD-352/U (5805-00-900-81 99) and TD-353/U
(5805-00-985-91 53), Restorers, Pulse Form, TD-206/G
(5805-00-868-8078) and TD-206B/G (5805-01 -020-2251)
and Converters, Telephone Signal, CV-1 548/G
(5805-00-069-8795) and CV-1548 A/G (5805-00-
069-8795) ....TM 1 I-5805 -367-12

Operator's and Organizational Maintenance Manual:
Multiplexer TD-660/G (NSN 5805-00-930-8079),
TD-660A/G and TD-660B/G (5820-00-928-3382), ,., ,., ,., ., ., ., ., . . . TM 11-5805-382-12

Operator's and Organizational Maintenance Manual
for Multimeters, AN/URM-1 05 and AN/U RM-1 05C
(Including Multimeters, ME-77/U and ME-77 C/U). ,.,, ,.,,.,,,.,,, ,,-. ,.,.,..., . TM 11-6625-203-12

Operator's Organizational, Field and Depot Maintenance
Repair Parts and Special Tools Lists and Maintenance
Allocation Chart: Handsets H-60/PT and H-165/U ., ,., ., ., ,., .,. ., . TM 1 1-5965-224-15P

Procedures for Destruction of Electronic Materiel to
Prevent Enemy Use(Electronics Command) .... TM 750-244-2

APPENDIX B
MAINTENANCE ALLOCATION

Section L INTRODUCTION

B-1. GENERAL

This appendix provides a summary of the maintenance operations for Radio Sets AN/GRC-l 03(V)1 ,2, 3 and 4. It authorizes categories of maintenance for specific maintenance functions on repairable items and components and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations,

B-2. MAINTENANCE FUNCTION

Maintenance functions will be limited to and defined as follows:

A **Inspect.** To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

B **Test.** To verify serviceability and to detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

C **Service.** Operations required periodically to keep an item in proper operating condition, i.e., to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

D **Adjust.** To maintain, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to the specified parameters,

E **Aline.** To adjust specified variable elements of an item to bring about optimum or desired performance.

F **Calibrate.** To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

G **Install.** The act of emplacing, seating, or fixing into position an item, part, module (component or assembly) in a manner to allow the proper functioning of the equipment or system.

H **Replace.** The act of substituting a serviceable like type part, subassembly, or module (component or assembly) for an unserviceable counterpart,

I **Repair.** The application of maintenance services (inspect, test, service, adjust, aline, calibrate, replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

J **Overhaul.** That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army, Overhaul does not normally return an item to like new condition.

K **Rebuild.** Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of material maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours, miles, etc.) considered in classifying Army equipments/components,

B-3. COLUMN ENTRIES

A Column 1, Group Number. Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

B Column 2, Component/Assembly. Column 2 contains the noun names of components, assemblies, subassemblies, and modules for which maitnenance is authorized with reference designation and part number.

C **Column 3, Maintenance Functions.** Column 3 lists the functions to be performed on the item listed in column 2. When items are listed without maintenance functions, it is solely for purpose of having the group numbers in the MAC and RPSTL coincide.

D Column 4, Maintenance Category. Column 4 specifies, by the listing of a "worktime" figure in the appropriate subcolumn(s), the lowest level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance, If the number or complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate "worktime" figures will be shown for each category, The number of task-hours specified by the "worktime" figure represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. Subcolumns of column 4 are as follows:

C. . . . . . . Operator/Crew
0 . . . . . Organizational
F. ., ... Direct Support
H . . . . General Support
D . . . . Depot

Unit, module assembly, subassembly, component to be repaired at Specialized Repair Activities (SRAs) are designated by an "L" under the subcolumn H of column 4.

E Column 5, Tools and Equipment. Column 5 specifies by code, those common tool sets, (not individual tools) and special tools, test, and support equipment required to perform the designated function.

F Column 6, Remarks. Column 6 contains an alphabetic code which leads to the remark in Section IV, Remarks, which is pertinent to the item opposite the particular code.

B-4. TOOL AND TEST EQUIPMENT REQUIREMENTS (SECTION III].

A Tool or Test Equipment Reference Code. The number in this column coincide with the numbers used in the tools and equipment column of the MAC. The numbers indicate the applicable tool or test equipment for the maintenance functions.

B Maintenance Category. The codes in this column indicate the maintenance category allocated the tool or test equipment.

C Nomenclature. This column lists the noun name and nomenclature of the tools and test equipment required to perform the maintenance functions.

D National/NATO Stock Number. This column lists the National/NATO stock number of the specific tool or test equipment,

E Tool Number, This column lists the manufacturer's part number of the tool followed by the Federal Supply Code for manufacturers (5-digit) in parentheses,

0-5. REMARKS (SECTION IV).

A Reference Code. This code refers to the appropriate item in Section II, column 6.

B Remarks. This column provides the required explanatory information necessary to clarify items appearing in Section Il.

SECTION II MAINTENANCE ALLOCATION CHART
FOR
RADIO SET AN/GRC-103(V)1,2,3 AND 4
(System Configuration Section For Radio Set AN/GRC-103(V) Band 1,2,3 and 4)

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQPT.	(6) REMARKS
			C	O	F	H	D		
00	Radio Set	Inspect	0.5						B
	AN/GRC-103(V)1,2,3,4	Test		1.0				1 thru 4	D
		Test			2.5			5 thru 18	A
		Test				2.0		5 thru 18	AD
		Test				4.0 L		5 thru 44	AC
		Test					4.5	5 thru 44	
		Service		0.8				2	
		Adjust		0.3				1 thru 4	N
		Adjust				0.8		5 thru 18	
		Align				1.0		5 thru 18	O
		Align				2.0 L		5 thru 44	AG
		Calibrate				1.0 L		5 thru 44	P
		Calibrate				2.0 L		5 thru 44	
		Repair	0.3					1 thru 4	X
		Repair			0.5			5 thru 18	S
		Repair				3.0		5 thru 18	W
		Repiar				4.0 L		5 thru 44	AH
		Repair					5.0	5 thru 44	
		Overhaul					48.0	5 thru 44	
01	Receiver-Transmitter,	Inspect		0.2				1 thru 4	
	Order Wire	Test			0.5			5 thru 18	A
	(Unit 9)	Test				0.8 L		5 thru 44	AC
	RT-773/GRC-103(V)								
	SM-D-697440								
	(Bands 1,2,3 and 4)	Replace		0.1				1 thru 4	
		Repair		0.5				1 thru 4	S
		Repair			0.3			5 thru 18	X
		Repair				0.5		5 thru 18	M
		Repair				0.8 L		5 thru 44	AH
0101	Panel, Distribution	Test				0.8 L		5 thru 44	AC
	(9A1)								
	SM-D-698209	Replace				0.3		5 thru 18	
		Repair				1.0 L		5 thru 44	AH

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SECTION II MAINTENANCE ALLOCATION CHART
FOR
RADIO SET AN/GRC-103(V)1,2,3 AND 4
(System Configuration Section For Radio Set AN/GRC-103(V) Band 1,2,3 and 4)

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
0102	Panel, Monitor (9A2) SM-D-698210	Test				1.0 L		5 thru 44	AC
		Replace		0.5					
		Repair				1.0 L		5 thru 44	AH
		Repair		0.5					S
0103	Converter, Telephone Signal (9A3) SM-D-698211	Test				1.0 L		5 thru 44	AC
		Replace		0.3				1 thru 4	
		Repair				1.0 L		5 thru 44	AH
0104	Amplifier Assembly (9A4) SM-D-698212	Test				1.0 L		5 thru 44	AC
		Replace		0.3				1 thru 4	
		Repair				1.0 L		5 thru 44	AH
02	Antenna (Unit 11) AS-1852/GRC-103(V) SM-A-763665 (Band 1)	Test			1.0			5 thru 18	I
		Rplace		0.5				1 thru 4	
		Repair		0.8				1 thru 4	R
		Repair			1.0			5 thru 18	AI
		Repair					1.0	5 thru 44	
0201	Reflector Assembly, Antenna (11A1) AS-2150/GRC-103(V) SM-E-696326 (Same as groups 0301 and 0401)	Test			0.5			5 thru 18	I
		Replace		0.5				1 thru 4	
		Repair				1.0		5 thru 18	
03	Antenna (Unit 21) AS-1853/GRC-103(V) SM-A-696325 (Band 2) (Same as Group 02)	Test			1.0			5 thru 18	I
		Replace		1.0				1 thru 4	
		Repair			0.8			5 thru 18	R
		Repair				1.0		5 thru 18	AI
		Repair					1.0	5 thru 44	

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SECTION II MAINTENANCE ALLOCATION CHART

FOR

RADIO SET AN/GRC-103(V)1,2,3 AND 4

(System Configuration Section For AN/GRC-103(V) Band 1,2,3 and 4)

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
0301	Reflector Assembly, Antenna (21A1) AS-2150/GRC-103(V) SM-E-696326 (Same as Group 0201 and 0401)								
04	Antenna	Test			1.0			5 thru 18	I
	(Unit 22)	Replace			1.0			5 thru 18	
	AS-1854/GRC-103(V)	Repair			0.8			5 thru 18	R
	(Band 3)	Repair				1.0		5 thru 18	AI
	(Same as Group 02)	Repair					1.0	5 thru 44	
0401	Reflector Assembly, Antenna (22A1) AS-2150/GRC-103(V) SM-E-696326 (Same as Group 0201 and 0301)								
05	Antenna	Inspect		0.3					B
	(Unit 41)	Test			0.3			5 thru 18	
	AS-3047/GRC-103(V)	Test			0.5			5 thru 18	K
	SM-B-794072	Replace		2.0				1 thru 4	AB
	(Band 4)	Repair		2.0				1 thru 4	RT
	Antenna Feed	Inspect		0.5					B
	(41A1)	Test			0.5			5 thru 18	L
	AS-3415/GRC-103(V)	Test				0.8		5 thru 44	
	SM-D-794136					L			
		Replace		1.0				1 thru 4	
	Antenna Reflector	Inspect		1.0					B
	(41A2)	Test					1.0	5 thru 44	
	AS-3414/GRC-103(V)	Replace		1.0					
	SM-D-794137								
06	Mast	Inspect		0.3					
	(Unit 12)	Test			0.8			5 thru 18	I
	AB-952/GRC-103(V)	Replace		0.5				1 thru 4	
	DL-SM-B-696151	Repair		0.5				1 thru 4	A
	(Bands 1,2 and 3)	Repair			0.5			5 thru 18	Z
	or	Repair					1.0	2,5	
	AB-577								
	TM11-5820-461-								
	(Band 4)								

SECTION II MAINTENANCE ALLOCATION CHART
FOR
RADIO SET AN/GRC-103(V)1,2,3 and 4
(System Configuration Section For AN/GRC-103(V) Band 1, 2, 3 and 4)

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQPT.	(6) REMARKS
			C	O	F	H	D		
0601	Elevator, Antenna	Test			0.8				I
	(12A1)	Replace		0.1				2	O
	AB-1072/GRC-103(V)	Repair			0.8			5 thru 18	
	SM-D-697070	Repair					1.0	2,5	
0602	Kit, Mast Accessories	Test			0.8			5 thru 18	I
	(12A3)	Replace		0.3				1 thru 4	
	MK-1069/GRC-103(V)	Repair		0.5				1 thru 4	AI
07	Mast, Extension Kit	Replace		0.5				1 thru 4	
	MK-1009/GRC-103(V)	Repair		1.0				1 thru 4	
	SM-D-551398								
08	Group Interconnecting Cables	Test						5 thru 18	
		Replace		0.5				1 thru 4	
		Repair				2.0			
0801	Cable Assembly, Special Purpose,	Replace		0.5					
	Electrical, Branched	Repair				2.0			
	(W6)								
	CG-3443/U (80FT-0IN)								
	SM-D-698201								
09	Cable Kit, Direct Support	Inspect		0.3					
	MK-1184/GRC-103(V)	Replace			0.3			5 thru 18	
	(Bands 1,2,3 and 4)	Repair			2.0			5 thru 18	

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SECTION II MAINTENANCE ALLOCATION CHART
FOR
RADIO SET AN/GRC-103(V)1,2,3 AND 4
(System Configuration Section For Radio Set AN/GRC-103(V)1,2,3 and 4)

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
	RECEIVER/TRANSMITTER SECTION								
10	Receiver, Radio (Unit 1) R-1329A(P)/GRC-103(V) SM-D-883585 (Bands 1,2 and 3) or R-1329(P)/GRC-103(V) SM-D-698140 (Bands 1,2 and 3) or R-1329B(P)/GRC-103(V) SM-D-967352 (Bands 1,3 and 4) or R-1329C(P)/GRC-103(V) SM-D-967352 (Bands 1,2,3 and 4) (See Group 10 of Receiver/ Transmitter Section for complete code and maintenance level assignments)								
11	Transmitter, Radio (Unit 5) T-983A(P)/GRC-103(V) SM-D-883587 (Bands 1,2 and 3) or T-983(P)/GRC-103(V) SM-D-698199 (Bands 1,2 and 3) or								

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FOR
RADIO SET AN/GRC-103(V)1,2,3 AND 4
(System Configuration Section For Radio Set AN/GRC-103(V)1,2,3 and 4)

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
	T-983B(P)/GRC-103(V) SM-D-957469 (Bands 1, 3 and 4) (See Group 11 of Receiver/ Transmitter Section for Complete code and maintenance level assignments)								
	AMPLIFIER CONVERTER/AMPLIFIER, FREQUENCY MULTIPLIER SECTION								
	BAND 1								
12	Amplifier-Converter (Unit 2) AM-4316A/GRC-103(V) SM-E-763663 or AM-4316/GRC-103(V) 407-131-2 (See Group 12 of Amplifier Converter/Amplifier Frequency Multiplier Section for complete code and maintenance level assignments)								
13	Amplifier-Frequency Multiplier (Unit 6) AM-4320A/GRC-103(V) SM-E-763664 or AM-4320/GRC-103(V) 407-062-1 or AM-4320B/GRC-103(V) SM-E-978735								

SECTION II MAINTENANCE ALLOCATION CHART
FOR
RADIO SET AN/GRC-103(V)1,2,3 and 4
(System Configuration Section For Radio Set AN/GRC-103(V) Band 1,2,3 and 4)

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
	(See Group 13 of Amplifier Converter/Amplifier Frequency Multiplier Section for complete code and maintenance level assignments)								
	BAND 2								
14	Amplifier-Converter (Unit 33) AM-4317/GRC-103(V) SM-E-696328								
	(See Group 14 of Amplifier Converter/Amplifier Frequency Multiplier Section for complete code and maintenance level assignments)								
15	Amplifier-Frequency Multiplier (Unit 37) AM-4321A/GRC-103(V) SM-E-883583								
	or								
	AM-4321/GRC-103(V) SM-E-696416								
	(See Group 15 of Amplifier Converter/Amplifier Frequency Multiplier Section for complete code and maintenance level assignments)								

SECTION II MAINTENANCE ALLOCATION CHART
FOR
RADIO SET AN/GRC-103(V)1,2,3 AND 4
(System Configuration Section For Radio Set AN/GRC-103(V)1,2,3 and 4)

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
	BAND 3								
16	Amplifier-Converter (Unit 34) AM-4318/GRC-103(V) SM-E-696457 (See Group 16 of Amplifier Converter/Amplifier Frequency Multiplier Section for complete code and maintenance level assignments)								
17	Amplifier-Frequency Multiplier (Unit 38) AM-4322/GRC-103(V) SM-E-696506 or AM-4322A/GRC-103(V) SM-E-978752 (See Group 17 of Amplifier Converter/Amplifier Frequency Multiplier Section for complete code and maintenance level assignments)								

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SECTION II MAINTENANCE ALLOCATION CHART
FOR
RADIO SET AN/GRC-103(V)1,2,3 AND 4
(System Configuration Section For Radio Set AN/GRC-103(V)1,2,3 and 4)

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
	BAND 4								
18	Amplifier-Converter (Unit 39) AM-4319/GRC-103(V) SM-E-794068 (See Group 18 of Amplifier Converter/Amplifier Frequency Multiplier Section for complete code and maintenance level assignments)								
19	Amplifier-Frequency Multiplier (Unit 40) AM-4323/GRC-103(V) SM-E-794070 (See Group 19 of Amplifier Converter/Amplifier Frequency Multiplier Section for complete code and maintenance level assignments) or Amplifier Frequency am-4323A/GRC-103(V) SM-E-993223 (See Group 19 for complete code and maintenance level assignments)								

SECTION II MAINTENANCE ALLOCATION CHART FOR RADIO SET AN/GRC-103(V)1,2,3 AND 4 (Receiver/Transmitter Radio Section)

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
10	Receiver, Radio	Inspect		0.3					B
	(Unit 1)	Test		0.5				1 thru 6	D
	R-1329A(P)/GRC-103(V)	Test			1.0			7 thru 19	A
	SM-D-883585	Test				1.0		7 thru 19	AD
	(Bands 1, 2, and 3)	Test				2.0 L		7 thru 121	AC
	or	Test					4.0	7 thru 121	
		Service		0.5				2	
	R-1329B(P)/GRC-103(V)	Align				1.0		7 thru 19	AA
	SM-D-967352	Align				2.0 L		7 thru 121	AG
	(Bands 1, 3 and 4)	Calibrate				2.0 L		7 thru 121	
	or								
		Replace		0.5				2	
	R-1329C(P)/GRC-103(V)	Repair		0.5				1 thru 6	D
	SM-D-990508	Repair			1.0			7 thru 19	S
	(Bands 1, 3 and 4)	Repair				2.0		7 thru 19	W
		Repair				3.0 L			
	or								
	R-1329(P)/GRC-103(V)	Repair					8.0	7 thru 121	
	SM-D-698140	Overhaul					24.0	7 thru 82	
	(Bands 1, 2 and 3)								
1001	Case, Receiver	Test				1.0		7 thru 19	K
	CY-4638/GRC-103(V)	Replace		0.5				7 thru 19	
	(1A2)	Repair					1.0	7 thru 121	
	SM-E-698142	Repair				1.0		7 thru 19	M
		Repair				1.0 L		7 thru 82	
100101	Distribution Box	Test				0.5		7 thru 19	J
	(1A2A1)	Replace				0.5		7 thru 19	
	SM-D-698198	Repair					1.0	7 thru 121	
1002	Receiver, Radio	Test			0.5			7 thru 19	A
	(1RE1)	Test				1.0		7 thru 19	AD
	SM-E-883584	Test				2.0 L		7 thru 121	AC
	(P/O R-1329A(P)/GRC-103(V)	Test					4.0	7 thru 82	
		Align				1.0		7 thru 19	AA
		Align				2.0 L		7 thru 121	
	or	Calibrate				2.0 L		7 thru 9	

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SECTION II MAINTENANCE ALLOCATION CHART
FOR
RADIO SET AN/GRC-103(V)1,2,3 AND 4
(Receiver/Transmitter Radio Section)

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
	SM-E-967353	Replace		0.5				2	
	(P/O R-1329B(P)/GRC-103(V))	Repair		1.0				5 thru 19	S
		Repair				2.0		5 thru 19	W
	or	Repair				3.0 L		5 thru 121	AH
	SM-D-990509	Repair					4.0	5 thru 121	
	(P/O R-1329C(P)/GRC-103(V))								
	or SM-E-698141								
	(P/O R-1329(P)/GRC-103(V))								
100201	Panel, Monitor	Test				1.0		5 thru 18	BD
	(1RE1A1)	Repair		0.5				1 thru 4	S
	SM-E-698143	Repair				1.0		5 thru 18	T
	IRE1A1A2	Test				1.0 L			
100202	Synthesizer, Electrical	Test				2.0 L		5 thru 44	AC
	Frequency								
	(1RE1A2)	Test			0.8			5 thru 18	A
	SM-D-865030	Test					2.5	5 thru 44	
	(Same as group 110202)	Adjust				0.5		5 thru 18	V
		Adjust				1.0 L		5 thru 44	
	or								
	SM-D-698145	Calibrate				1.0 L		5 thru 44	
	(P/O R-1329(P)/GRC-103)								
		Repair			0.3			5 thru 18	
		Repair				1.5		5 thru 18	W
		Repair				2.5 L		5 thru 44	AH
		Repair					2.5	5 thru 44	
10020201	Modulator-Oscillator	Test				1.0 L		5 thru 44	AC,BD
	(1RE1A2A2)								
	SM-D-698867	Replace				0.3		5 thru 18	
	(Same as group 11020201)	Repair				1.5 L		5 thru 44	AH
		Repair					1.0	5 thru 44	
		Adjust				0.5		5 thru 18	BD

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SECTION II MAINTENANCE ALLOCATION CHART
FOR
RADIO SET AN/GRC-103(V)1,2,3 AND 4
(Receiver/Transmitter Radio Section)

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
	Amplifier-Monitor (1RE1A2A3) SM-D-698156 (Same as part of group 110202)	Test				1.0 L		5 thru 44	AC,BD
		Replace				0.3 L		5 thru 44	
	Interconnecting Box (1RE1A2A11) SM-D-865031 (Same as part of group 110202) or SM-D-698154 (1RE1A2A1) (P/O R-1329(P)/GRC-103)	Test				1.0 L		5 thru 44	AJ,BD
		Replace				0.5 L		5 thru 44	
	Interconnecting Board (1RE1A2A11A11) SM-D-865038 (Same as part of group 110202) or SM-D-698197 (1RE1A2A1A1) (P/O R-1329(P)/GRC-103)	Test				1.5 L		5 thru 44	AK,BD
		Replace				0.5		5 thru 44	
	Frequency Divider (1RE1A2A14) SM-C-865032 (Same as part of group 110202) or SM-D-698575 (1RE1A2A4) (P/O R-1329(P)/GRC-103)	Test				1.0 L		5 thru 44	AC,AJ
		Replace				0.3		5 thru 18	BD
		Adjust				0.5 L			

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FOR
RADIO SET AN/GRC-103(V)1,2,3 AND 4
(Receiver/Transmitter Radio Section)

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
	Divider-Counter, Electronic Digital (1RE1A2A15)	Test				1.0 L		5 thru 44	AC
	SM-C-865044 (Same as part of group 110202) or SM-D-698575 (1RE1A2A5) (P/O R-1329(P)/GRC-103(V))	Replace				0.3		5 thru 18	
	Counter-Electronic, Digital (1RE1A2A16)	Test				1.0 L		5 thru 44	AC, BD
	SM-C-865034 (Same as part of group 110202) or SM-D-698575 (1RE1A2A6) (P/O R-1329(P)/GRC-103(V))	Replace				0.3		5 thru 44	
	Synchronizer, Electrical (1RE1A2A17)	Test				1.0 L		5 thru 44	AC, BD
	SM-C-865035 (Same as part of group 110202) or SM-D-698160 (1RE1A2A7) (P/O R-1329(P)/GRC-103(V))	Replace				0.3		5 thru 18	
	Converter-Storer Signal Data (1RE1A2A18)	Test				1.0 L		5 thru 44	AC,BD, B
	SM-C-865036	Replace				0.3		5 thru 18	
	(Same as part of group 110202) or	Adjust				0.5 L		5 thru 44	BD

SECTION II MAINTENANCE ALLOCATION CHART
FOR
RADIO SET AN/GRC-103(V)1,2,3 AND 4
(Receiver/Transmitter Radio Section)

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
	SM-D-698161 (1RE1A2A8) (P/O R-1329(P)/GRC-103(V))								
	Oscillator, Radio Frequency (1RE1A2Y11) SM-C-865037 (Same as part of group 110202) or SM-D-698163 1RE1A2Y1) (P/O R-1329(P)/GRC-103(V))	Test				1.0 L		5 thru 18	AC
		Replace				0.3 L		5 thru 44	
		Adjust				0.5		5 thru 44	BD
100203	Restorer, Pulse Form (1RE1A3) SM-D-698146 (P/O R-1329A(P)/GRC-103(V), R-1329B(P)/GRC-103(V)), and R-1329(P)/GRC-103) or SM-D-990510 (P/O R-1329C(P)/GRC-103(V)) See group 100209 for complete code and maintenance level assignment	Test				1.5 L		5 thru 44	AC
		Test			0.5			5 thru 18	A
		Adjust				0.8 L		5 thru 44	
		Replace		1.0					
		Repair				2.0 L		5 thru 44	AH
10020301	Modulation Eliminator (1RE1A3A1) SM-D-698164 (P/O SM-D-698146)	Test				1.0 L		5 thru 44	AC,BD
		Adjust				0.5 L		5 thru 44	BD
		Replace				0.5 L		5 thru 44	
		Repair				1.0 L		5 thru 44	AH
10020302	Restorer, Pulse Form (1RE1A3A2) SM-B-698165 (P/O SM-D-698146)	Test				1.0 L		5 thru 44	BD
		Adjust				0.5 L		5 thru 44	BD
		Replace				0.5 L		5 thru 44	

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SECTION II MAINTENANCE ALLOCATION CHART
FOR
RADIO SET AN/GRC-103(V)1,2,3 AND 4
(Receiver/Transmitter Radio Section)

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
		Repair				1.0 L		5 thru 44	AH
10020303	Synchronizer, Electrical (1RE1A3A3) SM-D-698166 (P/O SM-D-698146)	Test				1.0 L		5 thru 44	AC,BD
		Adjust				0.5 L		5 thru 44	BD
		Replace				0.5 L		5 thru 44	
100204	Limiter-Discriminator, Electrical Frequency (1RE1A4) SM-D-698147	Test				1.0 L		5 thru 44	AC
		Test			0.5			5 thru 18	A,BD
		Adjust				0.5 L		5 thru 44	BD
		Replace		0.3				1 thru 4	
		Repair				1.0 L		5 thru 44	AH
	Discriminator Sub-assembly (1RE1A4A1) SM-D-698167	Test				1.0 L		5 thru 44	AC,BD
		Adjust				0.5 L		5 thru 44	BD
		Replace				0.5 L		5 thru 44	
	Limiter, Electrical Noise (1RE1A4A3) SM-D-698168	Test				1.0 L		5 thru 44	AC,BD
		Adjust				0.5 L		5 thru 44	BD
		Replace				0.5		5 thru 44	
	Limiter, Electrical Noise (1RE1A4A4) SM-D-698169	Test				1.0 L		5 thru 44	AC,BD
		Adjust				0.5 L		5 thru 44	BD
		Replace				0.5 L			
	Capacitor Assembly (1RE1A4A5) SM-C-698170	Replace				0.5 L		5 thru 44	BD
		Test				0.5 L			BD

SECTION II MAINTENANCE ALLOCATION CHART
FOR

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQPT.	(6) REMARKS
			C	O	F	H	D		
	Amplifier, Video (1RE1A#AR1) SM-D-698171	TEST				1.0 L		5 thru 44	BD
		ADJUST				0.5 L		5 thru 44	BD
		REPLACE				0.5 L		5 thru 44	
100205	Amplifier, Frequency Multiplier (1RE1A5) SM-D-698148	TEST				1.0 L		5 thru 44	AC
		TEST			1.0			5 thru 18	
		ALIGN				0.5 L		5 thru 44	A, BD
		REPLACE		0.5				1 thru 44	
		REPAIR				1.0 L		5 thru 44	AH
10020201	Amplifier, Frequency Multiplier (1RE1A5A1) SM-D-698172	TEST				1.0 L		5 thru 44	AC,BD
		ALIGN				0.5 L			BD
		REPLACE				0.5 L		5 thru 44	
		REPAIR				1.0 L		5 thru 44	AH
	Filter, Low Pass (1RE1A5FL1) SM-C-698173	TEST				1.0 L		5 thru 44	AC,BD
		ALIGN				0.5 L		5 thru 44	BD
		REPLACE				0.5 L		5 thru 44	
100206	Amplifier, Video (1RE1AR1) SM-B-698003 (P/O R-1329 A(P)/GRC-103(V), R-1329(P)/GRC-103(V)	TEST				1.0 L		5 thru 44	AC
		TEST			0.5			5 thru 18	B,BD
		ALIGN				1.0 L		5 thru 44	
		REPLACE		0.3				1 thru 4	
		REPAIR				1.0 L		5 thru 44	AH
		Repair					1.5	5 thru 44	
	OR								
	SM-C-967354 (P/O R-1329B(P)/ GRC-103(V) and R-1329C(P)/GRC-103(V))								

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SECTION II MAINTENANCE ALLOCATION CHART
FOR

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
	See group 100210 for complete code and maintenance level assignment								
	Monitor, Video (1RE1AR1A2) SM-C-698018	Test				1.0 L		5 thru 44	AC,BD
		Align				0.5 L		5 thru 44	BD
	(Same as part of group 100210)	Replace				0.5 L		5 thru 44	
	Control, Alarm (1RE1AR1A3) SM-C-698006 (P/O R-1329A(P)/ GRC-103(V), R-1329(V)/ GRC-103(V)	Test				1.0 L		5 thru 44	AC,BD
		Align				0.5 L		5 thru 44	BD
		Replace				0.5 L		5 thru 44	
	or SM-C-967355 (P/O R-1329B(P)/ GRC-103(V) and R-1329C(P)/ GRC-103(V)) See part of group 100210 for complete code and maintenance level assignments.								
10020601	Amplifier, Video (1RE1AR1AR1) SM-D-698012 P/O SM-B-698003 and SM-C-967356	Test				1.0 L		5 thru 44	AC,BD
		Align				0.5 L		5 thru 44	BD
		Replace				0.5 L		5 thru 44	
		Repair				1.0 L		5 thru 44	AH
10020602	Filter, High Pass (1RE1AR1FL1) SM-C-698022 P/O SM-B-698003 and SM-C-967356	Test				1.0 L		5 thru 44	AC,BD
		Align				1.0 L		5 thru 44	BD
		Replace				0.5 L		5 thru 44	
		Repair				1.0 L		5 thru 44	

SECTION II MAINTENANCE ALLOCATION CHART
FOR

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
100207	Amplifier, Intermediate Frequency (1RE1AR2) SM-B-697965	Test				1.0 L		5 thru 44	AC,BD
		Test			0.5			5 thru 18	B,BD
		Replace		0.3				1 thru 4	
		Repair				1.0 L		5 thru 44	AH
		Repair					1.5	5 thru 44	
	Detector, Radio Frequency (1RE1AR2A1) SM-D-697974	Test				1.0 L		5 thru 44	AC,BD
		Replace				0.5 L		5 thru 44	
	Amplifier, Intermediate Frequency (1RE1AR2AR1) SM-D-697997	Test				1.0 L		5 thru 44	AC,BD
		Replace				0.5 L		5 thru 44	
	Amplifier, Intermediate Frequency (1RE1AR2AR2) SM-D-697981	Test				1.0 L		5 thru 44	AC,BD
		Replace				0.5		5 thru 44	
	Amplifier, Intermediate Frequency (1RE1AR2AR3) SM-D-697987	Test				1.0 L		5 thru 44	AC,BD
		Replace				0.5 L		5 thru 44	
	Amplifier, Intermediate Frequency (1RE1AR2AR4) SM-D-697990	Test				1.0 L		5 thru 44	AC,BD
		Replace				0.5 L		5 thru 44	
	Amplifier, Intermediate Frequency (1RE1AR2AR5) SM-D-697993	Test				1.0 L		5 thru 44	AC,BD
		Replace				1.0 L		5 thru 44	
	Filter, Band Pass (1RE1FL1) SM-A-698149	Test				0.5 L		5 thru 44	
		Replace				0.5 L		5 thru 44	

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SECTION II MAINTENANCE ALLOCATION CHART
FOR

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
100208	Power Supply	Test			0.5			5 thru 18	A,BD
	(1RE1PS1)	Test				1.0		5 thru 18	AD
	SM-A-698144	Test				2.0 L		5 thru 44	AC
		Adjust				0.5		5 thru 18	N
		Replace		0.5				1 thru 4	
		Repair		0.8				1 thru 4	C
		Repair				1.5 L		5 thru 44	AH,U
		Repair					2.0	5 thru 44	
10020801	Amplifier, Voltage Regulator	Test				1.0 L		5 thru 44	
	(1RE1PS1AR1)	Test				1.0		5 thru 18	AD
	SM-C-698153	Adjust				0,5		5 thru 44	
		Replace				0.5		5 thru 18	
		Repair				1.0 L		5 thru 44	AH
1002080101	Amplifier, Voltage Regulator (1RE1PS1AR1AR1)	Test				0.5 L		5 thru 44	AC,BD
	SM-D-698196	Repair				0.75 L		5 thru 44	AH
		Replace				0.5 L		5,6	
100209	Restorer, Pulse Form (1RE1A3)	Test				1.5 L		5 thru 44	AC
	SM-D-990510 (P/O R-1329C(P)/	Test			0.5			5 thru 18	A
	GRC-103(V)	Adjust				0.8 L		5 thru 44	
	OR	Replace		1.0				2	
		Repair				2.0 L		5 thru 44	
	SM-D-698146 (P/O R-1329A(P)/ GRC-103(V) and R-1329(P)/ GRC-103(V) P R-1329B(P)/ GRC-103(V) See group 100203 for complete code and maintenance level assignment								
10020901	Modulation Eliminator (1RE1A3A1)	Test				1.0 L		5 thru 44	AC,BD
	SM-C-990511	Adjust				0.5		5 thru 44	

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SECTION II MAINTENANCE ALLOCATION CHART
FOR

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
						L			
	(P/O SM-D-990510	Replace				0.5		5 thru 44	
						L			
		Repair				1.0		5 thru 44	AH
						L			
10020902	Restorer, Pulse Form	Test				1.0		5 thru 44	AD,BD
	(1RE1A3A2)					L			
	SM-C-990514	Adjust				0.5		5 thru 44	
	(P/O SM-D-990510)					L			
		Replace				0.5		5 thru 44	
						L			
		Repair				1.0		5 thru 44	AH
						L			
10020903	Synchronizer,	Test				1.0		5 thru 44	AC,BD
	Electrical					L			
	(1RE1A3A3)	Adjust				0.5		5 thru 44	
	SM-C-990517					L			
		Replace				0.5		5 thru 44	
	(P/O SM-D-990510)					L			
		Repair				1.0		5 thru 44	AH
10020904	Synchronizer, Electrical	Test				1.0		5 thru 44	AC,BD
						L			
	(1RE1A3A4)	Adjust				0.5		5 thru 44	
	SM-C-990520					L			
		Replace				0.5		5 thru 44	
						L			
		Repair				1.0		5 thru 44	AH
						L			
100210	Amplifier, Video	Test			0.5			5 thru 18	A,BD
		Test				1.0		5 thru 44	AC
	(1RE1AR1)					L			
	SM-C-967354								
	(P/O R-1329B(P)/GRC-103(V) and								
	R-1329C(P)/GRC-103(V))	Replace		0.5				5 thru 18	
		Repair				1.0		5 thru 44	AH
						L			
	OR	Repair					1.5	5 thru 44	
	SM-B-698003								
	(P/O R-1329A(P)/								
	GRC-103(V)) and R-1329(V)/								
	GRC-103 See group code and								
	maintenance level assignments								

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SECTION II MAINTENANCE ALLOCATION CHART
FOR

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
	Monitor, Video								
	(1RE1AR1A2)								
	SM-C-698018								
	(Same as part of group								
	100206)								
	Control, Alarm								
	(1RE1AR1A3)								
	SM-C-967355								
	(P/O R-1329B(P)/GRC-103(V) and								
	R-1329C (P)/GRC-103(V)								
	OR								
	SM-C-698006								
	(P/O R-1329A(P)/GRC-103(V))								
	and R-1329(P)/GRC-103								
	See part of group100206 for								
	complete code and maintenance								
	level assignments								
11	Transmitter, Radio	Inspect		0.3				1 thru 4	
	(Unit 5)	Test			1.0			5 thru 18	
	T-983A(P)/GRC-103(V)	Test				0.8		5 thru 18	AD
	SM-D-883587	Test				1.0		5 thru 44	AC
	(Bands 1, 2, and 3)					L			
		Replace		0.3				1 thru 4	
	OR	Align				1.0		5 thru 44	
						L			
	T-983B(P)/GRC-103(V)	Service		0.5				1 thru 4	
	SM-D-957469	Align				1.0		5 thru 18	AA
	(Bands 1, 2, 3, and 4)	Repair			1.0			5 thru 18	S
	OR	Repair				2.0		5 thru 18	W
	T-983(P)/GRC-103(V)	Repair				2.5		5 thru 44	AH
						L			
	SM-D-698207	Repair					4.0	5 thru 44	
	(Band 1, 2, and 3)	Repair		0.3				1 thru 4	C
		Overhaul					24.0	5 thru 44	
1101	Case, Transmitter	Test				0.5		5 thru 44	
	(5A2)	Replace		0.5		L		1 thru`4	
	CY-4637/GRC-103(V)	Repair				0.8		5 thru 18	
	SM-E-698207	Repair			0.5			5 thru 18	E
	(P/O T-983A(P)/GRC-103(V)	Repair					2.0	5 thru 44	
	and T-983(P)/GRC-103(V))								
	OR								
	CY-4637A/GRC-103(V)								
	SM-E-957435								

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SECTION II MAINTENANCE ALLOCATION CHART
FOR

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
	(P/O T-983B(P)/GRC-103(V))								
	See group 1103 for complete								
	code and maintenance level								
	assignment								
110101	Distribution Box	Test				0.5		5 thru 18	BD
	(5A2A1)	Replace			0.5			5 thru 18	
	SM-D-698218	Repair				0.8		5 thru 44	
	(P/O T-983A(P)/GRC-103(V)					L			
	and T-983(P)/GRC-103(V)								
	OR								
	SM-E-957434								
	(P/O T-983B(P)/GRC-103(V))								
	See group 110301 for complete								
	code and maintenance level								
	assignment								
110102	Monitor, Pressure								
	Differential	Test				1.0		5 thru 18	BD
	(5A2A2)	Replace				1.0		5 thru 18	
	SM-C-696771								
	(P/O T-983A(P)/GRC-103(V)								
	and T-983(P)/GRC-103								
	OR								
	Control Monitor,								
	Temperature Sensor								
	(5A2A2)								
	SM-D-957433								
	(P/O T-983B(P)/GRC-103(V))								
	See group 110302 for complete								
	code and maintenance level								
	assignment								
1102	Transmitter, Radio	Test				0.8		5 thru 18	AD
	(5TR1)	Test				1.0		7 thru 44	AC
	SM-E-883586					L			
		Replace		0.3				1 thru 4	
		Align				1.0		5 thru 18	AA
		Calibrate				1.5		5 thru 44	
						L			
		Repair		0.3				1 thru 4	S
		Repair			0.5			5 thru 18	W
		Repair				1.0		5 thru 44	AH
						L			
		Repair					1.5	5 thru 44	
110201	Panel, Monitor	Replace				0.4		5 thru 18	
	(5TR1A1)	Repair				0.8		5 thru 18	W, BD

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SECTION II MAINTENANCE ALLOCATION CHART
FOR

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
	SM-E-698213								
110202	Synthesizer, Electrical Frequency (5TR1A2) SM-D-865030 (Same as group 100202)								
11020201	Modulator-Oscillator (5TR1A2A2) SM-D-698867 (Same as group 10020201)								
	Amplifier-Monitor (5TR1A2A3) SM-D-698156 (Same as part of group 100202)								
	Interconnecting Box (5TR1A2A11) SM-D-865031 (Same as part of group 100202) OR (5TR1A2A1) SM-D-698154 (P/O T-983(V)/GRC-103))								
	Interconnecting Board, (5TR1A2A11A11) SM-D-865038 (Same as part of group 100202) OR (5ST1A2A4) SM-D-698157 (P/O T-983(V)/GRC-103))								
	Frequency Divider (5TR1A2A14) SM-C-865032 (Same as part of group 100202) OR (5TR1A2A4) SM-D-698157 (P/O T-983(V)/GRC-103)								
	Divider-Counter, Electronic Digital (5TR1A2A15)								

SECTION II MAINTENANCE ALLOCATION CHART
FOR

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
	SM-C-865033 (Same as part of group 100202) OR (5TR1A2A5) SM-D-698158 (P/O T-983(V)/GRC-103(V))								
	Counter, Electronic, Digital (5TR1A2A16) SM-C-865134 (Same as part of group 100202) OR (5TR1A2A6) SM-D-698575 (P/O T-983(V)/GRC-103(V))								
	Synchronizer, Electrical (5TR1A2A17) SM-C-865035 (Same as part of group 100202) OR (5TR1A2A7) SM-D-698160 (P/O T-983(V)/GRC-103))								
	Converter-Storer, Signal Data (5TR1A2A18) SM-C-865036 (Same as part of group 100202) OR (5TR1A2A8) SM-D-698161 (P/O T-983(V)/GRC-103))								
	Oscillator, Radio Frequency (5TR1A2Y11) SM-C-865037 (Same as part of group 100202) OR (5TR1A2A1) SM-D-698163 (P/O T-983(V)/GRC-103								

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SECTION II MAINTENANCE ALLOCATION CHART
FOR

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
110203	Control, Alarm	Test			0.8			5 thru 18	A, BD
	(5TR1A3)	Test				1,0 L		5 thru 44	AC, BD
	SM-C-698215	Adjust				0.8		5 thru 18	V
		Align				0.8 L		5 thru 44	BD
		Replace		0.3				1 thru 4	
		Repair				1.0 L		5 thru 44	AH
	Control, Alarm (5TR1A3A1)	Test				1,0 L		5 thru 44	BD
	SM-C-698228	Replace				0.5 L		5 thru 18	
110204	Amplifier-Frequency Multiplier	Test				1.0 L		5 thru 44	AC
	(5TR1A4)	Test			1.0			5 thru 18	A
	SM-E-698216	Align				0.8 L		5 thru 44	
		Replace			0.5			5 thru 18	
		Repair				0.8 L		5 thru 44	AH
		Repair				0.8		5 thru 44	
11020401	Amplifier-Frequency Multiplier	Test				1.0 L		5 thru 44	BD
	(5TR1A4A1)	Replace				0.5 L		5 thru 44	
	SM-D-698229	Repair				0.8 L		5 thru 44	AH
110205	Amplifier Monitor Multiplier	Test				1.0 L		5 thru 44	BD
	(5TR1A4A1)	Replace				0.5 L		5 thru 44	
	SM-D-698229	Repair				0.8 L		5 thru 44	AH
110205	Amplifier Monitor	Test			1.0			5 thru 18	A
	(5TR1A5)	Test				0.8 L		5 thru 44	
		Align				0,8 L		5 thru 44	
		Replace		0,3				1 thru 4	
		Repair				0,5		5 thru 18	M
		Repair				0.8 L		5 thru 44	AH

SECTION II MAINTENANCE ALLOCATION CHART
FOR

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
		Repair					1.0	5 thru 44	
11020501	Monitor, Video (5TR1A5A1) SM-D-698230	Test				1.0		5 thru 18	BD
		Replace				0.5 L		5 thru 44	
		Repair				0.8 L		5 thru 44	AH
11020502	Amplifier, Video (5TR1A5AR1) SM-D-698231	Test				1.0 L		5 thru 44	BD
		Replace				0.5 L		5 thru 44	AH
		Repair				0.8 L		5 thru 44	
110206	Power Supply (5TR1PS1) SM-E-698214	Test				1.0 L		5 thru 44	AC
		Test			1.0			5 thru 18	A
		Align				1.0 L		5 thru 44	
		Replace			0.5			5 thru 18	
		Repair				1.0 L		5 thru 44	AH
		Repair					1.5	5 thru 44	
11020601	Power Supply Sub- assembly (5TR1PS1A1) SM-B-698224	Test				0.8 L		5 thru 44	AC,BD
		Replace				0.3 L		5 thru 44	
		Repair				1.0		5 thru 44	AH
11020602	Power Supply Sub- assembly (5TR1PS1A2) SM-D-698225	Test				1.0 L		5 thru 44	
		Replace				0.5 L		5 thru 44	
		Repair				1.5 L		5 thru 44	
11020603	Amplifier, Voltage Regulator (5TR1PS1AR1) SM-C-698226	Test				1.0 L		5 thru 44	AC,BD
		Align				0.8 L		5 thru 44	BD
		Replace				0.5 L		5 thru 44	
		Repair				1.5 L		5 thru 44	M, AH

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SECTION II MAINTENANCE ALLOCATION CHART
FOR

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
	Amplifier, Voltage Regulator (5TR1PS1AR1AR1) SM-D-698232	Inspect				0.5 L			
		Test				0.8 L		5 thru 44	BD
		Replace				0.5 L		5,6	
	Power Supply (5TR1PS1PS1) SM-C-698227	Inspect				0.3 L			
		Test				0.8 L		5 thru 44	BD
		Replace				0.5 L		5 thru 44	
1103	Case, Transmitter (5A2) CY-4637A/GRC-103(V) SM-E-957435 (P/O T-983B(P)/ GRC-103(V)) OR CY-4637/GRC-103(V) SM-E-698207 (P/O T-983A(P)/ GRC-103A(V) and T-983(P)/GRC-103(V)) See group 1101 for complete code and maintenance level assignment								
110301	Distribution Box (5A2A1) SM-E-957434 (P/O T-983B(P)/ GRC-103(V)) OR SM-D-698218 (P/O T-983A(P)/ GRC-103(V) and T-983(P)/GRC-103 See group 110101 for complete code and maintenance level assignment								

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FOR

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
11030201	Control, Temperature (5A2A2A1) SM-C-957447	Inspect				0.5 L		2	
		Test				0.8 L		7, 25	BD
		Replace				0.8 L		2	
		Repair				1.0 L		2,7,25	
11030202	Drive, Control Motor (5A2A2A2) SM-C-957444	Inspect				0.5 L		2	
		Test				0.8 L		7,25	BD
		Replace				0.5 L		2	
		Repair				1.0 L		2,7,25	
11030203	Control, Motor (5A2A2A3) SM-C-957441	Inspect				0.5 L		2	
		Test				0.8 L		9,25	BD
		Replace				0.5 L		2	
		Repair				1.0 L		2,7,25	

SECTION II MAINTENANCE ALLOCATION CHART
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(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
		Test		1.0				1 thru 4	D
12	Amplifier-Converter	Inspect		0.5					
	(Unit 2)	Test			1.0			5 thru 18	A
	AM-4316A/GRC-103(V)	Test				0.8		5 thru 18	
	SM-E-763663	Test				1.0 L		7 thru 44	AC
	or								
		Test					2.0	5 thru 44	
	AM-4316/GRC-103	Align				1.5 L		5 thru 44	
	407-131-1	Replace		0.3				1 thru 4	
		Repair			0.5			5 thru 18	C
	(Band 1)	Repair				0.5		5 thru 18	M
		Repair				2.0 L		7 thru 44	
		Repair					2.0	5 thru 44	
		Overhaul					12.0	5 thru 44	
1201	Tuner, Radio Frequency								
	(2A1)	Test				1.5 L		5 thru 44	AC
	SM-E-763666								
	(P/O AM-4316A/GRC-103(V)	Test			0.5			5 thru 18	A,BD
		Test					1.5	5 thru 44	
		Align				1.0 L		7 thru 44	BD
	or 407-107								
	(P/O AM-43161)/GRC-103	Repair			0.5			5 thru 18	C
		Repair				0.8		5 thru 18	C
		Repair					3.0	5 thru 44	
		Repair				2.0 L		5 thru 44	
120101	Duplexer	Test					0.5	5 thru 44	
	(2A1A1)	Replace					0.5	5 thru 44	
	SM-E-763668	Repair					1.0	5 thru 44	
	(P/O AM-4316A/GRC-103)	Test				1.0/L		5 thru 44	BD
	or 406-153								
	(P/O AM-4316/GRC-103)	Repair				1.0/L		5 thru 44	H
	Indicator,Channel-	Test				0.5/L		5 thru 44	I,K,80
	Frequency	Replace				0.5/L		5 thru 44	
	(2A1A1DS1)								
	SM-C-763686								
	2A1A1A1DS1								
	(333-101-1)								
	P/O AM-4316/GRC-103(V)								
	Indicator , Channel-	Test				0.5/L		5 thru 44	I,K,80
	Frequency	Replace				0.5/L		5 thru 44	

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SECTION II MAINTENANCE ALLOCATION CHART
FOR

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
	(2A1A1DS2) SM-C-763687 or (2A1A1A1DS2) (333-101-2) P/O AM-4316/GRC-103(V)								
	Cavity, Tuned (2A1A1Z1) SM-C-764181 or 2A1A1A1Z1 (455-750) (P/O AM-4316/GRC-103)	Test Replace					1.0 0.5	5 thru 44 5 thru 44	BD
	Cavity, Tuned (2A1A1Z2) SM-C-764182 or (2A1A1A1Z2 (455-751) (P/O AM-4316/GRC-103(V))	Test Replace					1.0 0.5	5 thru 44 5 thru 44	BD
	Cavity, Tuned (2A1A1Z3) 2A1A1A123 (455-752) (P/O AM-4316/GRC-103(V))	Test Replace					1.0 0.5	5 thru 44 5 thru 44	BD
	Cavity, Tuned (2A1A1Z4) SM-C-764184 or 2A1A1A134 (455-753) (P/O AM-4316/GRC-103(V))	Test Replace					1.0 0.5	5 thru 44 5 thru 44	BD
	Cavity, Tuned (2A1A1Z5 and 2A1A1Z6) SM-C-764185 or 2A1A1A1Z5 (455-670) (P/O AM-4316/GRC-103(V))	Test Replace					1.0 0.5	5 thru 44 5 thru 44	BD
		Test			1.0			5 thru 18	A,BD
	Network Impedance, Matching (2A1A1Z7) SM-D-764155 or 2A1A1A1Z1 (P/O AM-4316/GRC-103)	Test Replace				1.0/L 0.5/L		5 thru 44 5 thru 44	

SECTION II MAINTENANCE ALLOCATION CHART
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(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
120102	Converter, Frequency, Electronic (2A1A2) SM-D-763669 or 455-914 (P/O AM-4316/GRC-103)	Repair					1.5	5 thru 44	
		Replace				1.5/L		5 thru 44	
		Test			0.5			5 thru 18	A,BD
		Repair				1.0 L		5 thru 44	
		Test					1.0	5 thru 44	
		Test				1.0 L			
120102	Filter Assembly Band Pass 2A1A1A1 406-137 (P/O AM-4316/GRC-103)	Test					2.0	5 thru 44	
		Repair					4.0	5 thru 44	
12010201	Frequency Multiplier (2A1A2A1) SM-C-763680	Test				1.0 L		5 thru 44	AC
		Test			0.5			5 thru 18	A,BD
		Align				L	0.8	5 thru 44	
		Replace					1.0	5 thru 44	
		Repair					1.0	5 thru 44	
12010202	Mixer Stage, Frequency (2A1A2A 2) SM-C-763681	Test				1.0 L		5 thru 44	AC
		Test			0.5			5 thru 18	A,BD
		Align				0.8 L		5 thru 44	
		Replace			0.5			5 thru 18	
		Repair				1.0 L		5 thru 44	AH
1201020201	Mixer Stage, Frequency (2A1A2A2A1) SM-D-763690	Test				0.5 L		5 thru 44	AC,BD
		Replace				0.5		5 thru 44	
		Repair				0.8 L		5 thru 44	
12010203	Filter, Band Pass (2A1A2A3) SM-E-763682	Test					1.0	5 thru 44	
		Align					0.8	5 thru 44	
		Replace					0.8	5 thru 44	
		Repair					1.0	5 thru 44	
		Test			0.5			5 thru 18	A,BD
		Repair					1.0	5 thru 44	

SECTION II MAINTENANCE ALLOCATION CHART
FOR

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
12010204	Amplifer, Intermediate Frequency	Test				0.5 L		5 thru 44	
	(2A1A2AR1)	Test			0.5			5 thru 18	A,BD
	SM-D-764158 or	Align				0.8 L		5 thru 44	
	455-650	Replace		0.5				1 thru 4	
	(P/O AM-4316/GRC-103(V))	Repair				0.5 L			
1201020 401	Amplifier, Intermediate Frequency (2A1A2AR1AR1)	Test				0.5 L		5 thru 44	BD
	SM-C-764161 or 455-135	Replace				0.5		1 thru 4	
	(P/O AM-4316/GRC-103)	Repair				1.0 L		5 thru 44	
	Wiring Harness, Branched	Test					0.5	7	K
	(2A1A2W3) SM-E-763683	Replace					0.5	5,6	
120103	Connector-Filter Assembly	Test				0.8		5 thru 18	I,K
	2A1A3)	Replace				0.7		5 thru 18	
	SM-C-763670	Repair				0.5			Z
		Test			0.5			7 thru 18	A,BD
	Monitor, Power (2A1A5)	Replace			0.5			7 thru 18	
	SM-A-763671	Test				1.0/L			
120104	Amplifier, Radio Frequency	Test				1.0 L		5 thru 44	AC
	(2A1AR1)	Test			0.5			5 thru 18	A,BD
	SM-C-763672	Align					0.8	5 thru 44	
		Replace			0.3			5 thru 18	
		Repair					1.5	5 thru 44	
12010401	Amplifier, Radio Frequency								
	(2A1AR1AR1)	Test					1.0	5 thru 44	BD
	SM-D-763684	Align					1.0	5 thru 44	BD
		Replace					1.0	5 thru 44	

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(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
120105	Panel, Control	Inspect				1.0 L			
	(2A1A2MP2) SM-D-763674	Replace					0.5	5 thru 44	
		Repair				0.5		5 thru 18	M,Z
		Repair					1.0	5 thru 44	
1202	Control-Indicator	Test			0.8			5 thru 18	A,BD
	(2A2)	Test				1.0 L		5 thru 44	A,C
	SM-E-763667	Align				0.8 L		5 thru 44	
		Replace		0.3				1 thru 4	
		Repair				0.8/L		5 thru 44	C
		Repair					1.5	5 thru 44	
120201	Control-Indicator	Test				1.0 L	1.0	5 thru 44	BD
	Subassembly (2A2A1)	Replace				0.5 L		5 thru 44	
		Repair					0.5		
1203	Control-Monitor, Signal	Test		0.5				5 thru 18	BD
	Level	Replace		0.5				1 thru 4	
	(2A4)	Repair				1.0 L		5 thru 44	
	SM-D-764140	Test				1.0/L			
	Limiter, Signal Level (2A4A1) SM-D-696358	Replace				0.5 L		5 thru 44	
	Control, Alarm (2A4A2) SM-C-764141	Replace				0.5 L		5 thru 44	
13	Amplifier-Frequency	Inspect		0.5					
	Multiplier	Test			1.0			5 thru 18	A
	(Unit 6)	Test				0.8		5 thru 18	AD
	AM-4320A/GRC-103(V)	Test				1.0 L		5 thru 44	AC
	SM-E-763664 (Band 1)	Test					2.0	5 thru 44	
		Service		0.3				1 thru 4	
	or	Align				1.0 L		5 thru 44	
	AM-4320B/GRC-103(V) SM-E-978735	Calibrate				0.8 L		5 thru 44	
	(Band 1)	Replace		0.3				1 thru 4	

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	or	Repair		0.3				1 thru 4	C
		Repair				0.5		5 thru 18	M
	AM-4320/GRC-103(V)					2.0/L		5 thru 44	AH
	407-062-1	Repair					2.0	5 thru 44	
	(Band 1)	Repair			0.5			5 thru 18	E
		Overhaul					12.0	5 thru 44	
1301	Electronic Switch	Test			0.8			5 thru 18	A,BD
	(6A1)	Test				1.0		5 thru 44	AC,BD
	SM-D-763709					L			
		Replace		0.3				1 thru 4	
		Repair				0.8		5 thru 44	
						L			
130101	Electronic Switch	Test				1.0/L	1.0	5 thru 44	BD
	(6A1A1)	Replace				0.5/L		5 thru 44	
	SM-D-763714	Repair				1.0		5 thru 44	
						L			
1302	Frequency Multiplier	Test				1.0		5 thru 44	AC
	(6A2)					L			
	SM-D-763710	Test			1.0			5 thru 18	A
		Replace			0.5			5 thru 18	
		Repair				0.8		5 thru 44	Z
						L			
		Repair					1.0	5 thru 44	
		Align				1.0		5 thru 44	
						L			
130201	Frequency Multiplier	Test				1.0/L		5 thru 44	BD
	(6A2A1)	Replace				0.5		5 thru 18	
	SM-C-763715	Repair				1.0		5 thru 44	
						L			
1303	Control-Indicator	Test				1.0		5 thru 44	AC
	(6A3)					L			
	SM-E-763711	Test					1.0	5 thru 44	
		Replace		0.5				1 thru 4	
		Repair				0.5		5 thru 18	M
		Repair					1.0	5 thru 44	
130301	Decoder-Switch								
	Assembly	Test					1.0	5 thru 44	BD
	(6A3A1)	Replace					0.5	5 thru 44	
	SM-D-763732	Repair					1.0	5 thru 44	

SECTION II MAINTENANCE ALLOCATION CHART
FOR

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQPT.	(6) REMARKS
			C	O	F	H	D		
1304	Amplifier, Radio	Test				1.0		5 thru 44	AC
	Frequency					L			
	(6AR1)	Test				0.5		5 thru 18	AD
	SM-E-763712	Test					1.5	5 thru 44	B
	(P/O AM-4320A/	Align				1.0		5 thru 44	
	GRC-103(V))					L			
		Repair		0.3				1 thru 4	C
	or	Repair			0.5			5 thru 18	E
		Repair				0.5		5 thru 18	M
	SM-E-978738	Repair				1.5		5 thru 44	AH
	(P/O AM-4320B/					L			
	GRC-103(V))	Repair					3.0	5 thru 44	
	or 407-056								
	(P/O AM-4320/GRC-103)								
130401	Amplifier Subassembly,	Test					1.5	5 thru 44	BD
	Radio Frequency	Replace					0.5		
	(6AR1A1)	Repair					1.0	5 thru 44	
	SM-E-763716	Repair				0.5		5 thru 18	M
	(P/O AM-4320A/								
	GRC-103(V))								
	or								
	SM-E-978741								
	(P/O AM-4320B/								
	GRC-103(V))								
	or 407-601								
	(P/O AM-4320/GRC-103)								
	Indicator, Channel-	Test				0.5		5 thru 44	I,BD
	Frequency					L			
	(6AR1A1DS1)	Replace				0.8		5 thru 44	
	SM-D-763722					L			
	or 333-762-1								
	(P/O AM-4320/GRC-103(V))								
130402	Electronic Component	Test					1.5	5 thru 44	BD
	Assembly								
	(6AR1A2)	Repair					1.5	5 thru 44	
	SM-D-763717								
	(P/O AM-4320A/GRC-103(V))								
	or								
	SM-D-978742								
	(P/O AM-4320B/GRC-103(V))								

SECTION II MAINTENANCE ALLOCATION CHART
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(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
	Circuit Card Assembly (6AR1A2A2) SM-C-763723	Test				1.0/L		5 thru 44	BD
		Replace				0.5 L		5,6	
	Connector-Filter Assembly (6AR1A2A3) SM-C-763724	Test				1.0		5 thru 44	K
		Replace				0.5		5 thru 44	
1305	Panel, Control (6MP1) SM-E-763713	Inspect				1.0 L			
		Replace							
		Repair				0.5		5 thru 18	M,Z
		Repair					1.0	5 thru 44	
14	Amplifier Converter (Unit 33) AM-4317/GRC-103(V) SM-E-696328 (Band 2)	Inspect		0.3				1 thru 4	
		Test			1.0			5 thru 18	A
		Test				0.8		5 thru 18	
		Test				1.0 L		5 thru 44	
		Test		0.3				1 thru 4	
		Align				2.0		5 thru 44	
		Replace		0.3				1 thru 4	
		Repair				0.5		5 thru 18	A
		Repair				2.5 L		5 thru 44	AH
		Repair					2.5	5 thru 44	
		Overhaul					12.0	5 thru 44	
		Repair				1.0		5 thru 44	
1401	Duplexer (33A1) SM-E-696329	Test					2.0	5 thru 44	BD
		Repair					2.5	5 thru 44	
		Repair			0.5			5 thru 18	
		Repair	.0			0.5		5 thru 18	
140101	Duplexer Subassembly (33A1A1) SM-E-696347	Test					1.0	5 thru 44	AN
		Test			0.5			5 thru 18	A,BD
		Replace					0.8	5 thru 18	
		Repair				1.0 L		5 thru 44	H
		Repair					2.0	5 thru 44	
		Align					2.0	7 thru 44	
	Indicator, Channel Frequency (33A1A1DS1 and 33A1A1DS2) SM-A-698812	Test				0.5/L		5 thru 44	
		Replace				0.5 L		5 thru 44	

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	Network, Impedance Matching (33A1A1Z1) SM-C-696368	Test					1.0	5 thru 44	
		Replace					0.5	5 thru 44	BD
	Cavity, Tuned (33A1A1Z2) SM-D-696369	Test					1.0	5 thru 44	BD
		Replace					0.5	5 thru 44	
	Cavity, Tuned (33A1A1Z3) SM-D-696370	Test					1.0	5 thru 44	BD
		Replace					0.5	5 thru 44	
	Cavity, Tuned (33A1A1Z4) SM-D-696371	Test					1.0	5 thru 44	BD
		Replace					0.5	5 thru 44	
	Cavity, Tuned (33A1A1Z5) SM-D-696372	Test					1.0	5 thru 44	BD
		Replace					0.5	5 thru 44	
	Cavity,Tuned (33A1A1Z6) SM-D-696373	Test					1.0	5 thru 44	BD
		Replace					0.5	5 thru 44	
	Cavity, Tuned (33A1A1Z7) SM-D-696374	Test					1.0	5 thru 44	BD
		Replace					0.5	5 thru 44	
140102	Gear Assembly, Speed Decreaser (33A1MP1) SM-D-696349	Test					0.8	5 thru 44	I,BD
		Replace					0.8	5 thru 44	
		Repair					1.0	5 thru 44	
140103	Wiring Harness, Branched (33A1W1) SM-E-696350	Test					0.5	5 thru 44	BD
		Repair					0.5	7 thru 44	
14010301	Connector-Filter Assembly (33A1W1A1) SM-C-696375	Test				0.5/L		5 thru 44	
		Replace				0.8		5 thru 44	
		Repair				1.5/L		5 thru 44	

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SECTION II MAINTENANCE ALLOCATION CHART
FOR

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
1402	Frequency Multiplier Group (33A2) SM-D-696330	Test			1.0			5 thru 18	A,BD
		Test				1.0 L		5 thru 44	
		Align				1.0 L		5 thru 44	
		Replace				0.8/L		5 thru 18	
		Repair			1.0			5 thru 18	M
		Repair				1.0 L		5 thru 44	AH
		Repair					2.0	5 thru 44	
140201	Frequency Multiplier (33A2A1) SM-D-696351	Test				1.0 L		5 thru 44	
		Test			0.5			5 thru 18	BD
		Align				1.0 L		5 thru 44	
		Replace				0.8/L		5 thru 44	
		Repair				1.0 L			
		Repair					2.0	5 thru 44	
14020101	Frequency Multiplier (33A2A1A1) SM-D-696376	Test				1.0 L		5 thru 44	BD
		Replace				0.3 L		5 thru 44	
		Repair				0.8 L		5 thru 44	AH
140202	Frequency Multiplier (33A2A2) SM-D-696352	Test				1.0 L		5 thru 44	
		Test			0.5			5 thru 18	ED
		Replace			0.5			5 thru 18	
		Repair				1.0 L		5 thru 44	AH
		Repair					2.0	5 thru 44	
14020201	Frequency Multiplier (33A2A2A1) SM-D-696377	Test				0.8 L		5 thru 44	BD
		Replace				0.5 L		5 thru 44	
		Repair				1.0 L		5 thru 44	AH

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(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
14020202	Filter, Low Pass	Test				1.0		5 thru 44	
	(33A2A2FL1)								
	SM-C-696378)	Replace				0.5 L		5 thru 44	
		Repair				1.0 L		5 thru 44	AH
14020203	Filter, Low Pass	Test				1.0/L		5 thru 44	
	(33A2A2FL2)								
	SM-C-696379	Replace				0.5 L		5 thru 44	
		Repair				1.0 L		5 thru 44	AH
140203	Filter, Bandpass	Test				1.5		5 thru 18	
	(33A2FL1)	Replace				0.8		7 thru 18	
	SM-E-696353	Repair					2.0	7 thru 44	
		Align					2.0	5 thru 44	
14020301	Wiring Harness,	Test				1.0/L		5 thru 44	AN,BD,X
	Branced								
	(33A2FL1W1)								
	SM-D-696380	Repair				0.8 L		5 thru 44	
		Test			0.5			5 thru 18	BD,D
	Power Monitor, RF	Replace			0.5			5 thru 18	
	(33A3)								
	SM-A-696331	Test				1.0 L		5 thru 18	
1403	Control-Indicator	Test				0.8 L		5 thru 18	I
	(33A4)								
	SM-E-696332	Replace		0.5				1 thru 4	
		Repair					1.5	5 thru 44	
		Align					1.0	5 thru 44	
		Test			1.0			5 thru 18	BD
140301	Control Indicator	Test					1.0	5 thru 44	
	Sub Assy	Replace					0.5	5 thru 44	
	(33A4A1)	Repair					1.0	5 thru 44	
	SM-D-696357								

SECTION II MAINTENANCE ALLOCATION CHART
FOR

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
1404	Control-Monitor, Signal Level (33A5) SM-D-696333	Test				2.0 L		5 thru 44	
		Test			0.5			5 thru 18	A,BD
		Replace			0.5			5 thru 18	
		Align				1.0 L		5 thru 44	
140401	Limiter, Signal Level (33A5A1) SM-D-696358	Test				1.0 L		5 thru 44	BD
		Replace				0.5 L		5 thru 44	
		Repair				1.5 L		5 thru 44	
	Control Alarm (33A5A2) SM-C-696359	Test				1.0 L		5 thru 44	BD
		Replace				0.5 L		5 thru 44	
1405	Panel, Control (33A6) SM-D-696334	Inspect				0.5		5 thru 18	
		Replace					1.0	5 thru 44	
		Repair				1.0 L		5 thru 44	
1406	Mixer Stage, Frequency (33A7) SM-D-696296	Test				1.0 L		5 thru 44	
		Align				1.0 L		5 thru 44	
		Replace			0.5			5 thru 18	
		Repair				1.0 L		5 thru 44	AH
		Repair					1.5	5 thru 44	
140601	Mixer Stage Frequency Assembly (33A7A1) SM-D-696492	Test				1.0 L		5 thru 44	BD
		Replace				0.5 L		5 thru 44	
		Repair				1.0 L		5 thru 44	
1407	Amplifier, Intermediate Frequency (33AR1) SM-D-696336	Test				1.5 L		5 thru 44	AN
		Test			0.5			5 thru 18	A,BD
		Replace			0.5			5 thru 18	
		Repair				2.0 L		5 thru 44	AH
		Align				1.0 L		7 thru 44	

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(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
140701	Amplifier-Filter	Test				1.0		5 thru 44	AN
	(33AR1A1)					L			
	SM-C-696363								
		Replace				0.3/L		5 thru 44	
		Repair				2.0		5 thru 44	
140702	Amplifier, Intermediate	Replace				0.5		5 thru 44	
	Frequency								
	(33AR1AR1)	Repair				2.5		5 thru 44	
	SM-C-696364					L			
15	Amplifier-Frequency	Inspect		0.3					B
	Multiplier	Test		0.5				1 thru 4	D
	(Unit 37)	Test			1.0			5 thru 18	A
	AM-4321A/GRC-103(V)2	Test				0.8		5 thru 18	AO
	SM-E-883583	Test				2.0		5 thru 44	
	(Band 2)					L			
	or	Service			0.3			5 thru 18	
	AM-4321/GRC-103V)2	Align				2.0		5 thru 44	B
						L			
	SM-E-696416	Replace		0.3				1 thru 4	
		Repair		0.3				1 thru 4	D
		Repair				2.5		5 thru 44	AH
						L			
		Repair					2.5	5 thru 44	
		Repair		0.5				1 thru 4	
		Overhaul					12.0	5 thru 44	
1501	Frequency Multiplier	Test				1.0		5 thru 44	Y
	(37A1)					L			
	SM-D-865053 or	Test			0.5			5 thru 18	A
		Replace				0.5		5 thru 18	
	SM-D-696417	Align				1.0		5 thru 44	AM
						L			
	(P/O AM-4321/GRC-103(V)2)	Repair				1.5		5 thru 44	
						L			
		Repair					1.5	5 thru 44	
150101	Frequency Multiplier	Test				0.8		5 thru 44	AN,BD
	(37A1A1)					L			
	SM-D-865051 or								
	220-800060-000	Replace				0.5		5 thru 44	
						L			
	(P/O AM-4321/GRC-103(V)2)	Repair				0.5		5 thru 44	AH
						L			

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(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
150102	Frequency Multiplier (37A1A2) SM-D-865052	Test				0.8 L		5 thru 44	BD
	220-80062-000-001	Replace				0.5 L		5 thru 44	
	(P/O AM-4321/GRC-103(V)2)	Repair				0.5 L		5 thru 44	
1502	Control-Indicator (37A2) SM-E-696418	Test				1.0 L		5 thru 44	
		Replace		0.5				5 thru 18	AN
		Repair					1.5	5 thru 44	
		Align					1.0	5 thru 44	
150201	Control-Indicator Subassy (37A2A1) SM-D-696425	Test					0.5	5 thru 44	
		Replace					0.5	5 thru 44	
		Repair					1.0	5 thru 44	
1503	Amplifier, Radio Frequency (37AR1) SM-E-696419	Test				1.0		5 thru 18	AN
		Test			0.5			5 thru 18	A
		Replace			0.8			5 thru 18	
		Align					2.0	5 thru 44	AM
		Repair			0.5			5 thru 18	
		Repair				0.5		5 thru 18	
		Repair				1.0 L		5 thru 44	H
		Repair					3.0	5 thru 44	E
150301	Electronic Component Assembly (37AR1A1) SM-E-696426	Test				1.0 L		5 thru 44	BD
		Replace			1.0			5 thru 18	
		Repair				1.0 L		5 thru 44	AH,XA
		Repair					1.5	5 thru 44	
15030101	Regulator, Voltage-Assy (37AR1A1A1) SM-E-696432	Test				1.0		5 thru 44	A
		Test				2.0 L		5 thru 44	AN
		Replace			0.5			5 thru 18	
		Repair				1.5 L		5 thru 44	AH
	Regulator Voltage-Subassembly (37AR1A1A1A1) SM-D-696439	Test				1.0 L		5 thru 44	BD
		Replace				0.5 L		5 thru 44	

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SECTION II MAINTENANCE ALLOCATION CHART
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(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
	Filter, Low Pass	Test				1.0/L		5 thru 44	
	(37AR1A1FL1)	Replace				0.5		5 thru 44	
	SM-A-696636					L			
	Filter, Radio	Test				0.5		5 thru 44	
	Interference	Replace				0.5		5 thru 44	
	(37AR1A1FL2)					L			
	SM-A-696435								
	Wiring Harness,	Test					0.3	5 thru 44	BD
	Branched	Replace					0.5	5 thru 44	
	(37AR1A1W1)								
	SM-D-696436								
15030102	Connector-Filter	Test					0.5	5 thru 44	BD
	Assembly	Replace					0.5	5 thru 44	
	(37AR1A1W1A1)	Repair					0.8	5 thru 44	
	SM-D-696440								
	Power Monitor, Radio	Test				0.5/L		5 thru 44	
	Frequency	Replace			0.5			5 thru 18	
	(37AR1A2)								
	SM-A-696427								
150302	Amplifier, Radio	Repair					2.0	5 thru 44	
	Frequency	Test					2.0	5 thru 44	BD
	(37AR1AR1)	Replace					1.0	5 thru 44	
	SM-E-696428	Repair					2.0	5 thru 44	
	Indicator, Channel-	Test				0.5		5 thru 18	Q,AM
	Frequency	Replace				0.5		5 thru 18	
	(37AR1AR1DS1)								
	SM-A-698818								
1504	Panel, Control	Inspect					0.8	5 thru 44	I,BD
	(37MP1)	Replace					0.8	5 thru 44	
	SM-E-696420	Repair					1.0	5 thru 44	

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SECTION II MAINTENANCE ALLOCATION CHART
FOR
RADIO SET AN/GRC-103(V)1,2,3, and 4
(Amplifier-Converter/Amplifier-Frequency Multiplier Section for Radio Set AN/GRC-103(V)3)

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
16	Amplifier Converter	Inspect		0.3				1 thru 4	B
	(Unit 34)	Test		0.5				1 thru 4	D
	AM-4318/GRC-103(V)	Test			1.0			5 thru 18	A
	SM-E-696457	Test				0.8		5 thru 18	
	(Bnad 3)	Test				2.0 L		5 thru 44	AO
		Service		0.3				1 thru 4	
		Align				2.0 L		5 thru 44	
		Replace		0.3				1 thru 4	
		Repair		0.3				1 thru 4	C
		Repair				0.5		5 thru 18	M
		Repair				2.5 L		5 thru 44	AH
		Repair					2.5	5 thru 44	
		Overhaul					12.0	5 thru 44	
1601	Duplexer	Test					2.0	5 thru 44	
	(34A1)	Test				1.0		5 thru 18	
	SM-E-696458	Replace					1.0	5 thru 44	
		Repair			0.8			5 thru 18	C
		Repair				0.8		5 thru 18	C
		Repair					2.5	5 thru 44	
160101	Duplexer Subassembly	Test					2.5	5 thru 44	
	(34A1A1)	Replace					0.8	5 thru 44	
	SM-E-696465	Repair				1.0 L		5 thru 44	
		Repair					2.0	5 thru 44	
	Indicator, Channel Frequency (34A1A1DS1) SM-A-698813	Test				0.5		5 thru 18	
		Replace				0.5		5 thru 18	
	Indicator, Channel Frequency (34A1A1DS2) SM-A-698814	Test				0.5		5 thru 18	
		Replace				0.5		5 thru 18	
	Network, Impedance Matching (34A1A1Z1) SM-C-696368	Test					1.0	5 thru 44	
		Replace					0.5	5 thru 44	
	Cavity, Tuned (34A1A1Z2) SM-D-696476	Test					1.0	5 thru 44	
		Replace					0.5	5 thru 44	

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(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
	Cavity, Tuned (34A1A1Z3) SM-D-696477	Test					1.0	5 thru 44	
		Replace					0.5	5 thru 44	
	Cavity, Tuned (34A1A1Z4) SM-D-696478	Test					1.0	5 thru 44	
		Replace					0.5	5 thru 44	
	Cavity, Tuned (34A1A1Z5) SM-D-696479	Test					1.0	5 thru 44	
		Replace					0.5	5 thru 44	
	Cavity, Tuned (34A1A1Z6) SM-D-696480	Test					1.0	5 thru 44	
		Replace					0.5	5 thru 44	
	Cavity, Tuned (34A1A1Z7) SM-D-696481	Test					1.0	5 thru 44	
		Replace					0.5	5 thru 44	
160102	Gear Assembly, Speed Decreaser (34A1MP1)	Test					0.8	5 thru 44	BD
		Replace					0.8	5 thru 44	
160103	Wiring Harness, Branched (34A1W1) SM-E-696467	Test					0.5	5 thru 44	BD
		Repair					1.0	5 thru 44	
16010301	Connector-Filter Assembly (33A1W1A1) SM-C-696375	Test					0.5	5 thru 44	BD
		Replace					0.8	5 thru 44	
		Repair					1.0	5 thru 44	
1602	Frequency Multiplier Group (34A2) SM-D-696459	Test				1.0		5 thru 18	ABD
		Test				1.0 L		5 thru 44	
		Test					2.0	5 thru 44	
		Align				1.0 L		5 thru 44	
		Replace				0.8		5 thru 18	
		Repair				1.0		5 thru 18	M
		Repair				1.0 L		5 thru 44	AH
		Repair					2.0	5 thru 44	

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FOR

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
160201	Frequency Multiplier (34A2Ai) SM-D-696468	Test				1.0 L		5 thru 44	
		Test			0.5			5 thru 18	ABD
		Align				1.0 L		5 thru 44	
		Replace				0.7		5 thru 18	
		Repair				1.0 L		5 thru 44	
		Repair					2.0	5 thru 44	
16020101	Frequency Multiplier (34A2A1A1) SM-D-696482	Test				1.0 L		5 thru 44	BD
		Replace				0.3 L		5 thru 44 5 thru 44	
		Repair				0.8 L		5 thru 44	AH
160202	Frequency, Multiplier (34A2A2) SM-D-696352	Test				1.0 L		5 thru 44	
		Test			0.5			5 thru 18	B
		Replace				0.5		5 thru 18	
		Repair				1.0 L		5 thru 44	AH
		Repair					2.0	5 thru 44	
16020201	Frequency, Multiplier (34A2A2A1) SM-D-696377	Test				0.8 L		5 thru 44	BD
		Replace				0.5 L		5 thru 44	
		Repair				1.0		5 thru 44	AH
16020202	Filters, Low Pass (34A2A2FL1) SM-C-696378	Test				1.0 L		5 thru 44	
		Replace				0,5 L		5 thru 44	
		Repair				1.0		5 thru 44	AH
16020203	Filters, Low Pass (34A2A2FL2) SM-C-696379	Test				1.0 L		5 thru 44	
		Replace				0.5 L		5 thru 44	
		Repair				1.0 L		5 thru 44	

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(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
160203	Filter, Bandpass	Test					1.0	5 thru 44	
	(34A2FL1)	Test					1.5	5 thru 44	
	SM-E-696469	Repair					0.5	5 thru 44	
		Replace					1.0	5 thru 44	
16020301	Wiring Harness,	Replace					0.8	5 thru 44	
	Branched	Repair					2.0	5 thru 44	
	(34A2FL1W1)								
	SM-E-696483								
	Power Monitor, Radio	Test			0.5			5 thru 18	BD
	Freq.	Test				0.5 L		5 thru 44	
	(34A3)								
	SM-A-696331	Replace			0.5			5 thru 18	
1603	Control-Indicator	Test				0.8 L		5 thru 44	
	(34A4)								
	SM-E-696460	Replace		0.5				1 thru 4	
		Repair					1.0	5 thru 44	
		Align				1.0 L		5 thru 44	
		Depot					1.0	5 thru 44	
1604	Control-Monitor, Signal	Test				2.0 L		5 thru 44	
	Level	Test			0.5			5 thru 18	BD
	(34A5)	Replace			0.5			5 thru 18	
	SM-D-696333	Repair				1.5 L		5 thru 44	
		Repair					2.0	5 thru 44	
160401	Limiter, Signal Level	Test				1.0 L		5 thru 44	
	(34A5A1)								
	SM-D-696358	Replace				0.5 L		5 thru 44	
160402	Control Alarm	Test				1.0 L		5 thru 44	BD
	(34A5A2)								
	SM-C-764141	Replace				0.5		5 thru 44	
1605	Panel, Control	Inspect				0.5		5 thru 18	I
	(34A6)	Replace					0.8	5 thru 18	
	SM-D-696461	Repair				1.0 L		5 thru 44	

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(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
1606	Mixer Stage, Frequency (34A7) SM-D-696297	Test				1.0 L		5 thru 44	
		Align				1.0 L		5 thru 44	
		Replace			0.5			5 thru 18	
		Repair				1.0 L		5 thru 44	
		Repair					1.5	5 thru 44	
160601	Mixer Stage Frequency (34A7A1) SM-D-696493	Repair				1.0 L		5 thru 44	
		Replace				0.5 L		5 thru 44	
		Test				1.0 L		5 thru 44	
1607	Amplifier Intermediate Frequency (34AR1) SM-D-696336	Test				1.5 L		5 thru 44	
		Test			0.5			5 thru 18	BD,A
		Replace			0.5			5 thru 18	
		Repair				2.0 L		5 thru 44	AH
		Align				1.0 L		5 thru 44	
160701	Amplifier-Filter (34AR1A1) SM-C-696363	Test				1.0 L		5 thru 44	BD
		Test					1,5	5 thru 44	BD
		Replace				0.3 L		5 thru 44	
		Repair				2.0 L		5 thru 44	AH
160702	Amplifier IF (34AR1AR1) SM-C-696364	Test				1.0 L		5 thru 44	BD
		Test					1.5	5 thru 44	
		Replace				0.3 L		5 thru 44	
		Repair				2.0		5 thru 44	AH
	Filter, Low Pass (34FL1) SM-A-696463	Test				1.0 L		5 thru 44	
		Replace				0.3 L		5 thru 44	

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SECTION II MAINTENANCE ALLOCATION CHART
FOR

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
17	Amplifier-Frequency	Inspect		0.3				1 thru 4	B
	Multiplier	Test		0.5				1 thru 4	D
	(Unit 38)	Test			1.0			5 thru 18	A
	AM-4322/GRC-103(V)	Test				0.8		5 thru 18	
	SM-E-696506	Test				2.0		5 thru 44	
	(Band 3)					L			
		Service			0.3			5 thru 18	
	or	Align				2.0		5 thru 44	
						L			
	AM-4322A/GRC-103(V)	Replace		0.3				1 thru 4	
	SM-E-978752	Repair		0.3				1 thru 4	C
	(Band 3)	Repair				2.5		5 thru 44	AH
						L			
		Repair					2.5	5 thru 44	
		Overhaul					12.0	5 thru 44	
1701	Amplifier, Frequency	Test				1.0		5 thru 44	
	Multiplier					L			
	(38A1)	Test			0.5			5 thru 18	B
	SM-E-696507	Replace			0.5			5 thru 18	
		Align				1.0		5 thru 44	
						L			
		Repair				1.5		5 thru 44	AN
						L			
		Repair					1.5	5 thru 44	
170101	Frequency Multiplier	Test				0.8		5 thru 44	BD
	(38A1A1)					L			
	SM-D-696512	Test					1.0	5 thru 44	BD
		Replace				0.5		5 thru 44	
						L			
		Repair				1.0		5 thru 44	AH
						L			
170102	Amplifier-Frequency	Test				0.8		5 thru 44	BD
	Multiplier					L			
	(38A1A2)	Test					1.0	5 thru 44	
	SM-D-696513	Replace				0.5		5 thru 44	
						L			
		Repair				1.0		5 thru 44	AH
						L			
1702	Control-Indicator	Test				1.0		5 thru 44	
	(38A2)					L			
	SM-E-696508	Test			0.5			5 thru 18	A
		Replace		0.5				1 thru 4	
		Align				1.0		5 thru 44	
		Repair				L	1.0	5 thru 44	

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FOR
RADIO SET AN/GRC-103(V)1, 2, 3 AND 4
(Amplifier-Converter/Amplifier-Frequency Multiplier Section for Radio Set AN/GRC-103(V)3)

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
1703	Amplifier, Radio	Test				1.0		5 thru 18	
	Frequency	Test					2.0	5 thru 44	
	(38AR1)	Test			0.5			5 thru 18	A
	SM-E-696509	Replace			0.8				
	(P/O AM-4322/	Align					2.0	5 thru 44	
	GRC-103(V))	Repair			0.5		2.0	5 thru 18	E
		Repair				0.5		5 thru 18	H
	or	Repair				1.0 L		5 thru 44	E
	SM-E-978758 (P/O AM-4222A/ GRC-103(V))	Repair					3.0	5 thru 44	
170301	Electronic Component Assembly	Test				1.0 L		5 thru 44	N,BD
	(38AR1A1)	Replace			1.0			5 thru 18	E
	SM-E-696515	Repair				1.0 L		5 thru 44	AH
	(P/O AM-4322/ GRC-103(V))	Repair					1.5	5 thru 44	
	or								
	SM-E-978762 (P/O AM-4322A/ GRC-103(V))								
17030101	Regulator Voltage (38AR1A1A1)	Test				0.8 L		5 thru 44	
	SM-E-696432	Replace			0.5			5 thru 18	AH
		Repair				1.5 L		5 thru 44	
		Repair					1.5	5 thru 44	
1703010 01	Regulator, Voltage Subassembly	Test				1.0 L		5 thru 44	BD
	(38AR1A1A1A1)	Replace				0.5 L		5 thru 44	
	SM-D-696439	Repair				1.5 L		5 thru 44	AH
	Filter, Low Pass (38AR1A1FL1)	Test				1.0 L		5 thru 44	
	SM-A-696637	Replace				0.5 L			
	Filter, Radio Interference	Test				0.5		5 thru 44	
	(38AR1A1FL2) SM-A-696435	Replace				L		5 thru 44	

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FOR
RADIO SET AN/GRC-103(V)1, 2, 3 AND 4
(Amplifier-Converter/Amplifier-Fequency Multiplier Section For Radio Set AN/GRC-103(V)3)

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
17030102	Wiring Harness, Branched (38AR1A1W1) SM-D696524	Test					0.3	5 thru 44	BD
		Replace					0.5	5 thru 44	
		Repair					1.0	5 thru 44	
1703010201	Connector-Filter Assembly (38AR1A1W1A1) SM-D-696440	Test					0.3	5 thru 44	BD
		Replace					0.3	5 thru 44	
		Repair					0.8	5 thru 44	
	Power Monitor, Radio Frequency (38AR1A2) SM-A-696427	Test				0.5		5 thru 44	
		Replace			0.5	L		5 thru 18	
170302	Amplifier, Radio Frequency (38AR1AR1) SM-E-696516	Repair					2.0	5 thru 44	
		Test					2.0	5 thru 44	BD
		Replace					1.0	5 thru 44	
		Repair					2.0	5 thru 44	
	Indicator, Channel-Frequency (38AR1AR1DS1) SM-A-698819	Test				0.5		5 thru 18	M,U
		Replace				0.5		5 thru 18	
	Dummy Load, Electrical (38AR1AT1) SM-C-696517	Test				1.0 L		5 thru 44	
		Replace				0.5 L		5 thru 44	
	Circulator (38AR1HY1) SM-A-696518	Test				1.0 L		5 thru 44	
		Replace				0.5		5 thru 18	
1704	Panel, Control (38MP1) SM-E-696510	Inspect					0.8	5 thru 44	BD
		Replace					0.8	5 thru 44	
		Repair					1.0	5 thru 44	

SECTION II MAINTENANCE ALLOCATION CHART
FOR
RADIO SET AN/GRC-103(V)1,2,3 AND 4
(Amplifier-Converter/Amplifier-Frequency Multiplier Section For Radio Set AN/GRC-103(V)4)

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
18	Amplifier, Converter (Unit 39) AM-4319/GRC-103(V) SM-E-794068 (Band 4)	Inspect		0.5					B
		Test		0.5				1 thru 4	D
		Test				1.5 L		5 thru 44	
		Replace		0.3				1 thru 4	
		Repair		0.3				1 thru 4	C
		Repair				1.5 L		5 thru 44	BA
		Repair				1.5		5 thru 44	AR
		Overhaul				2.0		5 thru 44	
		Rebuild				2.5		5 thru 44	
1801	Electronic Component Assembly (39A1) SM-E-794110	Inspect		0.5					B
		Test			0.5			5 thru 18	A,BD
		Repair			0.5			5 thru 18	C
		Repair				0.8 L		5 thru 44	AQ
		Replace					1.0	5 thru 44	AY
		Repair					1.0	5 thru 44	
	Power Monitor, Radio Frequency (39A1A1) SM-A-794138	Inspect			0.3				B
		Test			0.5			5 thru 18	A,BD
		Test				0.5 L		5 thru 44	BD
		Replace			0.5			1 thru 4	C
	Indicator, Channel Frequency (39A1DS1 and 39A1DS2) SM-C0794078	Inspect			0.5				B
		Test				0.5 L		1 thru 4	AX,BD
		Replace				0.5 L		5 thru 44	
	Circulator, 3 Port (39A1HY1) SM-A-794081	Inspect			0.3				B
		Test			0.5			5 thru 44	A,BD
		Test				0.5 L		5 thru 44	
		Replace				0.8 L		5 thru 44	E
180101	Gear Assembly, Speed Decreaser (39A1MP1) SM-C-794082	Inspect				0.5 L			B
		Test				0.5 L		5 thru 44	BD
		Replace					1.0	5 thru 44	
		Repair					1.0	5 thru 44	

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FOR
RADIO SET AN/GRC-103(V)1,2,3 AND 4
(Amplifier-Converter/Amplifier-Frequency Multiplier Section For Radio Set AN/GRC-103(V)4)

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQPT.	(6) REMARKS
			C	O	F	H	D		
180102	Wiring Harness, Branched (39A1W1) SM-E-794085	Inspect		0.3					B
		Test					1.0	5 thru 44	K,BD
		Replace					0.5	5 thru 44	
		Repair			L	1.0 L		5 thru 44	
1801020 1	Connector-Filter Assembly (39A1W1A1) SM-C-794142	Inspect		0.3					B
		Test			0.5				K,BD
		Replace				0.5		5 thru 18	
		Repair				1.0 L		5 thru 44	
1802	Converter, Frequency, Electronic (39A2) SM-D-794073	Inspect			0.3				B
		Test			0.5			5 thru 18	A,BD
		Test				1.0 L		5 thru 44	
		Adjust				1.0 L		5 thru 44	
		Replace			0.5			5 thru 18	C
		Repair				1.5		5 thru 44	
		Repair					2.5	5 thru 44	I
180201	Converter, Frequency, Electronic (39A2A1) SM-D-794093	Inspect			0.3				B,BD
		Replace				0.8 L		5 thru 18	
		Repair				1.0 L		5 thru 18	
1803	Frequency Multiplier (39A3) SM-E-794075	Inspect			0.3				B
		Test			0.5			5 thru 18	A
		Test				1.0 L		5 thru 44	
		Adjust				0.5 L		5 thru 44	AS
		Align				1.0 L		5 thru 44	
		Replace				0.5 L		5 thru 44	E
		Repair				1.5 L		5 thru 44	
		Repair					2.5	5 thru 44	AR
	Network, Impedance Matching (39A3A1) SM-C-794100	Inspect				0.3 L			
		Replace				0.5 L		5 thru 44	

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FOR
RADIO SET AN/GRC-103(V)1,2,3 AND 4
(Amplifier-Converter/Amplifier-Frequency Multiplier Section For Radio Set AN/GRC-103(V)4)

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQPT.	(6) REMARKS
			C	O	F	H	D		
	Amplifier, Direct Current (39A3AR1) SM-B-794102	Inspect				0.5 L		5 thru 44	
		Replace				0.5 L			
1804	Control-Indicator (39A4) SM-E-794074	Inspect		0.5					B
		Test			0.3			5 thru 18	A
		Test				0.8 L		5 thru 44	
		Replace		0.5				1 thru 4	C
		Repair					1.0	5 thru 44	I
		Overhaul					2.0	5 thru 44	
		Rebuild					1.5	5 thru 44	
	Control-Indicator Subassembly (39A4A1) SM-E-947609	Test					0.5	5 thru 44	BD
		Replace					0.5	5 thru 44	
		Repair					1.0	5 thru 44	
	Regulator, Current (39A4VR1) SM-C-947616	Inspect					0.5		B,BD
		Replace					0.5	5 thru 44	
1805	Panel, Control (39A5) SM-D-794076	Inspect		0.3					B,BD
		Replace					0.5	5 thru 44	
		Repair				0.8		5 thru 18	AW
		Repair					1.0	5 thru 44	
		Inspect		0.3					B
		Replace				0.3		5 thru 18	
1806	Amplifier, Radio Frequency (39AR1) SM-D-794077	Inspect			0.5				B
		Test			0.5			5 thru 18	A
		Test				1.0 L		5 thru 44	
		Adjust				1.0 L		5 thru 44	AS
		Replace		0.5				1 thru 4	C
		Repair				1.5 L		5 thru 44	

SECTION II MAINTENANCE ALLOCATION CHART
FOR
RADIO SET AN/GRC-103(V)1,2,3 AND 4
(Amplifier-Converter/Amplifier-Frequency Multiplier Section For Radio Set AN/GRC-103(V)4)

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
180601	Amplifier, Radio Frequency (39AR1AR1) SM-C-794103	Inspect			0.3				B,BD
		Replace				0.8 L		5 thru 44	
		Repair				1.0 L		5 thru 44	
1807	Amplifier, Intermediate Frequency (39AR2) SM-D-69336	Inspect			0.3				B
		Test			0.5			5 thru 18	A
		Test				1.5 L		5 thru 44	
		Adjust				0.5 L		5 thru 44	AS
		Replace			0.5			1 thru 4	C
180701	Amplifier-Filter (39AR2A1) SM-C696363	Inspect			0.5				B
		Test				1.5 L		5 thru 44	
		Replace				0.8 L		5 thru 44	
		Repair				1.0 L		5 thru 44	BA
180702	Amplifier, Intermediate Frequency (39AR2AR1) SM-C-696364	Inspect			0.5				B,BD
		Replace				0.5 L		5 thru 44	
		Repair				1.0 L		5 thru 44	
1808	Filter, Bandpass (39FL1 and 39FL2) SM-D-794079	Inspect			0.5				B
		Test			0.8			5 thru 18	A
		Test				2.0 L		5 thru 44	
		Align				2.0 L		5 thru 44	
		Replace				0.8 L		5 thru 44	E
		Repair					2.0	5 thru 44	AR

SECTION II MAINTENANCE ALLOCATION CHART
FOR
RADIO SET AN/GRC-103(V)1,2,3 AND 4
(Amplifier-Converter/Amplifier-Frequency Multiplier Section For Radio Set AN/GRC-103(V)4)

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
1809	Filter, Bandpass (39FL3) SM-D-794080	Inspect			0.5				B
		Test			0.8			5 thru 18	A
		Test				2.0 L		5 thru 44	
		Align				1.5 L		5 thru 44	
		Replace				0.8 L		5 thru 44	E
		Repair					1.5	5 thru 44	AR
		Overhaul					2.0	5 thru 44	
		Rebuild					2.0	5 thru 44	

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FOR
RADIO SET AN/GRC-103(V)1,2,3, AND 4
(Amplifier-Converter/Amplifier-Frequency Multiplier Section For Radio Set SN/GRC-1-3(V)4)

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
19	Amplifier-Frequency	Inpsect		0.5					B
	Multiplier	Test		0.5				1 thru 4	D
	(Unit 40)	Test				0.8		5 thru 44	
	AM-4323/GRC-103(V)					L			
	SM-E-993223								
	(Band 4)	Replace		0.3				1 thru 4	
	OR								
	AM-4323/GSC-103(V)	Repair				1.5		5 thru 44	
						L			
	SM-E-794070	Repair					2.0	5 thru 44	AR
		Overhaul					2.0	5 thru 44	
		Rebuild					2.5	5 thru 44	
1901	Electronic Component	Inspect		0.5					B
	Assembly	Test			0.5			1 thru 4	A,BD
	(40A1)	Repair			0.5			5 thru 18	C
	SM-E-794113	Repair				0.8		1 thru 44	AQ
						L			
		Replace					1.0	5 thru 44	BC
		Repair					2.0	5 thru 44	
	Power Monitor, Radio	Inspect			3.0				B
	Frequency	Test			0.5			5 thru 18	A, BD
	(40A1A1)	Test				0.5		5 thru 44	BD
	SM-A-794126					L			
		Replace			0.5			1 thru 4	C
	Dummy Load, Electrical	Inspect			0.3				B
	(40A1A2)	Test			0.3			5 thru 18	A
	SM-C-696517	Test				1.0		5 thru 44	
						L			
		Replace			0.5			5 thru 18	C
	Insolator, Coaxial	Inspect			0.3				B
	(40A1AT1)	Test			0.5			5 thru 18	A, BD
	SM-A-955696	Test				0.5		5 thru 44	BD
						L			
		Replace			0.5			1 thru 4	C
	Indicator, Channel-	Inspect			0.5				B
	Frequency	Test				0.5		1 thru 4	D, BD
	(40A1DS1)					L			
	SM-C-794078	Replace				0.5		5 thru 44	
						L			

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FOR
RADIO SET AN/GRC-103(V)1,2,3 AND 4
(Amplifier-Converter/Amplifier-Frequency Multiplier Section For Radio Set AN/GRC103(V)4)

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
	Circulator, 3 Port (40A1HY1) SM-A-794081	Inspect			0.3				B
		Test			0.5			5 thru 18	A,BD
		Test				0.5 L		5 thru 44	BD
		Replace			0.5			5 thru 8	C
190101	Wiring Harness, Branched (40A1W1) SM-E-794128	Inpsect		0.3					B
		Test				1.0		5 thru 18	BD
		Repair				1.0 L		5 thru 44	
		Replace					0.5	5 thru 44	
19010101	Connector-Filter Assembly (40A1W1A1) SM-C-794143	Inspect		0.3					B
		Test			0.5			5 thru 18	K,BD
		Replace				0.5		5 thru 18	
		Repair				1.0 L		5 thru 18	
1902	Amplifier-Frequency Multiplier (40A2) SM-E-974112 (p/o AM-4323/GRC-103(V)) OR SM-E-993221 (P/O AM-4323A/GRC-103)	Inspect				0.3			B
		Test			0.5			5 thru 18	A
		Test				1.0 L		5 thru 44	
		Align				1.0 L		5 thru 44	
		Adjust				0.5 L		5 thru 44	AS
		Replace				1.0 L		5 thru 44	E
		Repair				2.0 L		5 thru 44	
		Repair					2.5	5 thru 44	AR
	Network, Impedance Matching (40A2A1) SM-C-794100	Inspect			0.3				B,BD
		Replace				0.5 L		5 thru 18	
190201	Regulator, Voltage Assembly (40A2AR1) SM-C-955689 (P/O AM-4323/GRC-103(V)) OR SM-C-993224 (P/O AM-4323A/GRC-103(V))	Inspect			0.3				B,BD
		Replace				0.5 L		5 thru 44	
		Repair				0.8 L		5 thru 44	

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FOR
RADIO SET AN/GRC-103(V)1,2,3 AND 4
(Amplifier-Converter/Amplifier-Frequency Multiplier Section For Radio Set AN/GRC-103(V)4)

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
190202	Amplifier, Radio	Inspect				0.5			B
	Frequency	Replace				0.5		5 thru 44	
	(40A2AR2)					L			
	SM-D-955675	Repair				2.0		5 thru 44	
						L			
	(p/o AM-4323/GRC-103)								
	SM-D-993225								
	or								
	(p/o AM-4323A/GRC-103V)								
1903	Regulator, Voltage	Inspect			0.3				B
	(40A3)	Test			0.8			5 thru 18	A
	SM-E-794124	Test				1.5		5 thru 44	
						L			
		Adjust				0.5		5 thru 44	AS
		Replace		0.5				1 thru 4	C
		Repair				1.0		5 thru 44	
						L			
	Regulator Subassembly,	Inspect			0.5				B,BD
	Voltage	Replace				0.5		5 thru 44	
	(40A3A1)								
	SM-D-794130					L			
1904	Control-Indicator	Inspect		0.5					B
	(40A4)	Test			0.3			5 thru 18	A
	SM-E-794109	Test				0.8		5 thru 44	
						L			
		Replace		0.5				1 thru 4	C
		Repair				0.8		5 thru 44	
						L			
		Repair					1.0	5 thru 44	I
		Overhaul					2.0	5 thru 44	
		Rebuild					1.5	5 thru 44	
	Regulator, Current	Inspect					0.5		B,BD
	(40A4VR1)	Replace					0.5	5 thru 44	
	SM-C-947616								
1905	Amplifier, Radio	Inspect			0.5				B
	Frequency	Test			0.5			1 thru 4	A
	(40AR1)	Test				1.5		5 thru 44	
	SM-E-794114					L			
		Align				1.5		5 thru 44	
						L			
		Replace					1.0	5 thru 44	E
		Repair			0.3			1 thru 4	Y
		Repair					1.5	5 thru 44	
		Overhaul					2.5	5 thru 44	
		Rebuild					3.0	5 thru 44	

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FOR
RADIO SET AN/GRC-103(V)1,2,3 AND 4
(Amplifier-Converter/Amplifier-Frequency Multiplier Section For Radio Set AN/GRC-103(V)4)

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
1906	Filter, Bandpass	Inspect			0.5				B
	(40FL1)	Test			0.8			5 thru 18	A
	SM-D-794079	Test				2.0 L		5 thru 44	AN
		Align				2.0 L		5 thru 44	AM
		Replace				0.8 L		5 thru 44	E
		Repair					2.0	5 thru 44	AR
		Overhaul					2.5	5 thru 44	
		Rebuild					2.5	5 thru 44	
1907	Panel, Control	Inspect		0.3					B,BD
	(40MP1)	Replace					0.5	5 thru 44	
	SM-E-794111	Repair				0.8		5 thru 18	AC
		Repair					1.0	5 thru 18	
	Shield, Electrical	Inpsect			0.3				B,BD
	(40MP 3)	Replace			0.3				
	SM-C-794135	Repair					0.5	5 thru 44	I

SECTION III TOOL AND TEST EQUIPMENT REQUIREMENTS FOR

AN/GRC-103(V)1,2,3,4

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
1	0	Multimeter, Digital AN/PSM-45	6625-01-139-2512	
2	0	Tool Kit, Electronic Equipment TK-101/G	5180-00-064-5178	
3	0	Cable Assembly, Special Purpose CX-10879	5995-00-144-0282	
4	0	Converter, Wave Form CV-2500/GR * P/O AN/GRM-95(V)2; AN/TRC-113 & AN/TRC-145	6625-00-179-5217	
5	F, H, L, D	Tool Kit, Electronic Equipment TK-105/G	5180-00-610-8177	
6	F, H, L, D	Tool Kit, Electronic Equipment TK-100/G	5180-00-605-0079	
7	F, H, L, D	Multimeter, Digital AN/USM-486	6625-01-145-2430	
8	F, H, L, D	Generator, Signal AN/USM-206	6625-01-077-8503	
9	F, H, L, D	Generator, Signal SG-1171/U	6625-01-133-6160	
10	F, H, L, D	Test Set, R. F. Power AN/URM-120	6625-00-790-2746	
11	F, H, L, D	Meter, Power ME-441/U	6625-00-436-4883	
12	F, H, L, D	Meter, Modulation ME-57A/U	6625-00-432-7312	
13	F, H, L, D	Counter, Electronic, Digital Readout AN/USM-459	6625-01-061-8928	
14	F, H, L, D	Oscilloscope, Dual Trace OS-261C(V) 1/U	6625-01-119-7314	
15	F, H, L, D	Attenuator 10db, MICROLAB AD-10MN or equivalent		
16	F, H, L, D	Maintenance Kit, Field Cable MK-1184/GRC	5820-00-935-5076	
17	F, H, L, D	Torque Drive, 1/4"	5120-00-923-9620	
18	F, H, L, D	Square Drive, 1/4"	5120-00-879-3547	
19	L, D	Generator, Sweep Wiltron 610D with Wiltron 61084D with Wiltron 6110C	6625-01-041-9399 6625-01-103-2493 6625-01-047-4304	
20	L, D	Source, Signal, R. F., Power Meter Airborne Inst Lab 125A or equivalent	6625-01-068-1212	
21	L, D	Generator, Thermal Noise SG-419()/U	6625-00-853-3866	
22		Test Set, Radio AN/USM-306(V)1	6625-00-459-8568	
23	L, D	Indicator, SWR AN/USM-261	6625-00-935-1473	
24	L, D	Analyzer, Distortion AN/USM-184A	6625-00-802-8718	

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SECTION III TOOL AND TEST EQUIPMENT REQUIREMENTS FOR

AN/GRC-103(V)1,2,3,4

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
25	L, D	Test Facilities Set AN/GRM-95(V)2	6625-01-104-8926	
26	L, D	Voltmeter, Vector ME-512/U	6625-00-929-1897	
27	L, D	Test Set, Insulation Breakdown AN/GSM-6	6625-00-542-1331	
28	L, D	Bridge, Impedance ZM-71/U	6625-00-236-1536	
29	L, D	Counter, Microwave Frequency TD-1225A(V)2/U	6625-01-121-6934	
30	L, D	Generator, Signal, AM/FM SG-1170/U	6625-01-120-3501	
31	L, D	Generator, Signal SG-340A/G	6625-01-098-0465	
32	L, D	Generator, Noise Source, Broad band H.P. 346B OPT 1		
33	L, D	Circulator MELABS Inc-HD-1-450 or E&M Lab Type U-20T or equivalent		
34	L, D	Power Supply LAMBDA Electronics LX-342FM or equivalent		
35	L, D	Power Supply LAMBDA Electronics LP-412FM or equivalent	6130-00-938-2561	
36	L, D	Termination OMNI SPECTRA INC OS20020P, or OS21170 or OS217 or equivalent		
37	L, D	Torque Wrench OMNI SPECTRA INC T-8438 or equivalent	5120-00-169-5776	
38	L, D	Wave-Analyzer BRUEL & K JAER 2107 or equivalent	6625-00-411-9642	
39	L, D	Tunable Bandpass Filter TELONIC TTF-250-53EE or equivalent	5915-01-115-2612	
40	L, D	Dummy Plate SAC-SK-024		
41	L, D	Wattmeter, Thruline AN/USM-298	6625-00-880-5119	
42	L, D	Amplifier, Power ALFRED model 5010		
43	L, D	Generator, Signal SG-213/U	6625-00-872-3215	
44	L, D	Amplifier, I. F. General Radio GR-1236	6625-00-397-4200	

SECTION IV. REMARKS

REFERENCE CODE	REMARKS
A	OPERATIONAL CHECKS ONLY
B	VISUAL AND MECHANICAL (EXTERNAL)
C	BY SELECTED MODULE REPLACEMENT AND ASSEMBLY REPLACEMENT ONLY
D	USING BUILT-IN TEST EQUIPMENT (BITE AND CONVERTER, FREQUENCY CV-2500/GRC
E	BY MODULE REPLACEMENT
F	NO OVERALL TEST: REFER TO TEST PROCEDURES FOR INDIVIDUAL UNITS THAT MAKE UP ITEM
G	REFER TO REPLACEMENT OF INDIVIDUAL UNITS THAT MAKE UP ITEM
H	BY REPLACEMENT OF 2A1A1Z7, 2A1A1A1DS1, AND 2A1A1A1DS2; OR 33A1A1DS1 AND 33A1A1DS2; OR 37AR1DS1 AND 37AR1DS2, 34A1A1
I	MECHANICAL ONLY
J	PART OF "A" MODEL
K	WIRING CONTINUITY CHECK
L	PART OF PLAIN MODEL
M	BY REPLACEMENT OF SELECTED MODULES, CIRCUIT BOARD ASSEMBLIES, AND NONMODULAR PARTS
N	MINOR ADJUSTMENT OF TUBE HEATER AND CATHODE VOLTAGE ADJUSTMENT
O	MINOR ALIGNMENT NOT REQUIRING USE OF TEST FACILITY SET AN/GRM-95
P	CALIBRATION USING TEST FACILITY SET AN/GRM-95
Q	MADE UP OF TWO OR MORE PARTS WHICH CAN BE ASSEMBLED TO FORM THE REQUIRED ASSEMBLY
R	BY REPLACEMENT OF ANTENNA REFLECTORS
S	REPAIR BY REPLACEMENT OF PLUCK-OUT MODULE, CABLES AND KNOBS,LAMPS, AND INDICATOR ON FRONT PANEL
T	BY REPLACEMENT OF CIRCUIT CARD ASSEMBLIES, CONNECTOR ASSEMBLIES, CONTROL ALARM WASHERS, AND SCREWS
U	BY REPLACEMENT OF RF FILTERS AND CIRCUIT BOARDS
V	ADJUSTMENTS NOT REQUIRING USE OF TEST FACILITY SET AN/GRM-95
W	BY REPLACEMENT CIRCUIT BOARDS OR MODULES (NO REPAIRS ARE MADE TO MODULES AND THEIR ASSOCIATED CIRCUIT BOARDS)
X	BY REPLACEMENT OF ASSEMBLIES, COMPONENTS, LENS, AND ANTENNA ELEMENT
Y	BY TUBE REPLACEMENT
Z	BY REPLACEMENT OF SCREWS, WASHERS, CONNECTOR, PLUGS, AND KNOB
AA	ALL ALIGNMENT NOT REQUIRING THE USE OF TEST FACILITY SET AN/GRM-95 AND ASSOCIATE TEST FIXTURES
AB	ALL MODULE ALIGNMENT INCLUDING USE OF TEST FACILITY SET AN/GRM-95 AND ASSOCIATE TEST FIXTURES
AC	TEST INCLUDING THE USE OF TEST FACILITY SET AN/GRM-95 AND ASSOCIATE TEST FIXTURES
AD	TEST NOT REQUIRING USE OF TEST FACILITY SET AN/GRM-95 AND ASSOCIATE TEST FIXTURES
AE	MADE UP OF SEVERAL ASSEMBLIES WHICH CAN BE REPLACED AT DIRECT SUPPORT AND GENERAL SUPPORT
AF	REGULATOR POWER SUPPLY HUM, SYNTHESIZER ALARM ADJUSTMENT, GAIN, ETC.
AG	ALL ALIGNMENT, EXCEPT GEAR TRAINS AND RF CAVITIES

SECTION IV. REMARKS

REFERENCE CODE	REMARKS
AH	BY REPLACEMENT OF MODULES, PRINTED CIRCUIT BOARDS, AND MODULAR AND CIRCUIT BOARD COMPONENTS
AI	BY REPLACEMENT OF MAST SECTION, 12A1A1 THROUGH 12A1A7, GUYS 12A1A2 THROUGH 12A2A7, ELEVATOR ANTENNA 12A1A8, REFLECTOR RODS, REFLECTORS AND CONNECTORS
AJ	
AK	USED ON "A" MODEL SYNTHESIZER ONLY
AL	
AM	
AN	
AO	
AP	
AQ	BY REPLACEMENT OF 40A1DS1 OR 39A1DS1
AR	INCLUDING MECHANICAL DISASSEMBLY, REPAIR AND REASSEMBLY
AS	MINOR ADJUSTMENT REQUIRING USE OF AN/GRM-95
AT	
AU	REPAIR BY REPLACEMENT OF PLUG-OUT MODULE
AV	BY REPLACEMENT OF CABLES, KNOBS, INDICATOR LAMPS
AW	BY REPLACEMENT OF SCREWS, WASHERS, HANDLE, KNOBS, AND OBSERVATION WINDOW ON FRONT PANEL
AX	TESTED AS PART OF OVERALL NEXT HIGHER ASSEMBLY
AY	MADE UP OF SEVERAL ASSEMBLIES WHICH CAN BE REPLACED AT SRA SHOPS ONLY
AZ	ALL ALIGNMENT, INCLUDING GEAR TRAINS AND RF CAVITIES
BA	
BB	
BC	BY PREVENTIVE MAINTENANCE CHECKS
BD	TO BE TESTED INTO NEXT HIGHER GROUP MODULE ASSEMBLY

APPENDIX C

COMPONENTS OF END ITEM LIST

Section I. INTRODUCTION

C-1. Scope

This appendix lists integral components of and basic issue items for the Radio Set AN/GRC-103(V) to help you inventory items required for safe and efficient operation.

C-2. General

This Components of End Item List is divided into the following sections:

a. Section II. Integral Components of the End Item. These items, when assembled, comprise the Radio Set AN/GRC-103(V) and must accompany it whenever it is transferred or turned in. The illustrations will help you identify these items.

b. Section III. Basic Issue Items. These are the minimum essential items required to place the Radio Set AN/GRC-103(V) in operation, to operate it, and to perform emergency repairs. Although shipped separately pocked they must accompany the Radio Set AN/GRC-103(V) during operation and whenever it is transferred between accountable officers. The illustrations will assist you with hard-to-identify items. This manual is your authority to requisition replacement Bll, based on TOE/MTOE authorizotion of the end item.

C-3. Explanation of Columns

a. Illustration. Indicates the figure number of the illustration on which the item is shown.

b. National Stock Number. Indicates the National stack number assigned to the item and will be used for requisitioning.

c. Description. Indicates the Federal item name and, if required, a minimum description to identify the item.

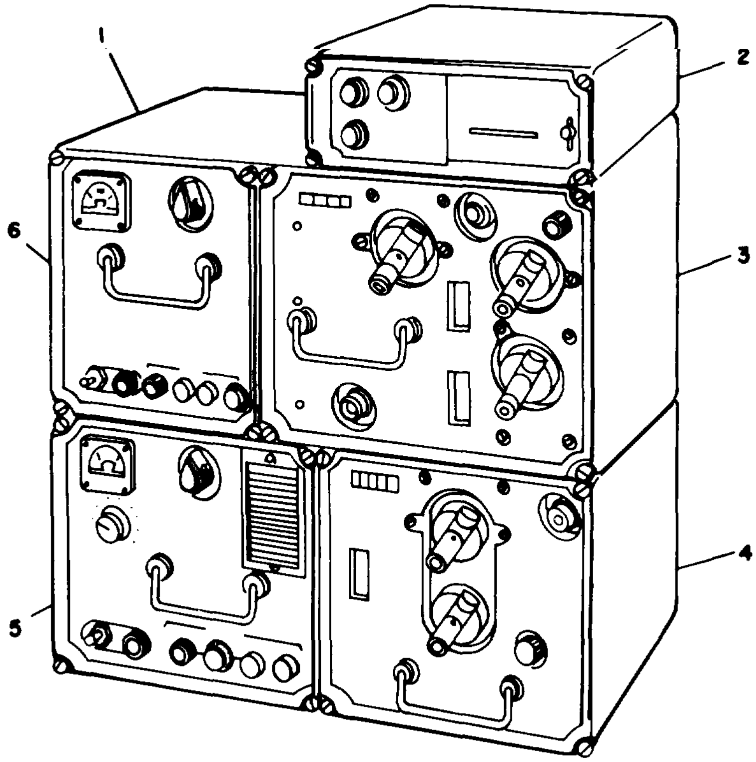
d. FSCM and Part Number. Indicates the primary number used by the manufacturer, which controls the design and characteristics of the item by means of its engineering drawings, specifications, standards, and inspection requirements to identify on item or range of items. Preceding the part number, the Federal Supply Code for Manufacturers (FSCM) is shown in parentheses. If the item you require differs between serial numbers of the same model, effective serial numbers are shown in the lost line of the description. If item required differs for different models of this equipment, the model is shown under the “Usable On” heading in the description column. These codes ore identified in paragraph *e.*

e. Usable on Code. “USABLE ON” codes are included to help you identify which component items are used on the different models. Identification of the codes used in these lists are:

Code	Used on
FLB	AN/GRC-103(V)
FLC	AN/GRC-103(V)
FLD	AN/GRC-103(V)
FLE	AN/GRC-103(V)

f. Unit of Measure (U/M). Indicates the measure used in performing the actual operational/maintenance function. This measure is expressed by a two-character alphabetical abbreviation (for example, ea, in., pr).

g. Quantity Required (Qty Reqd). This column lists the quantity of each item required for a complete major item.



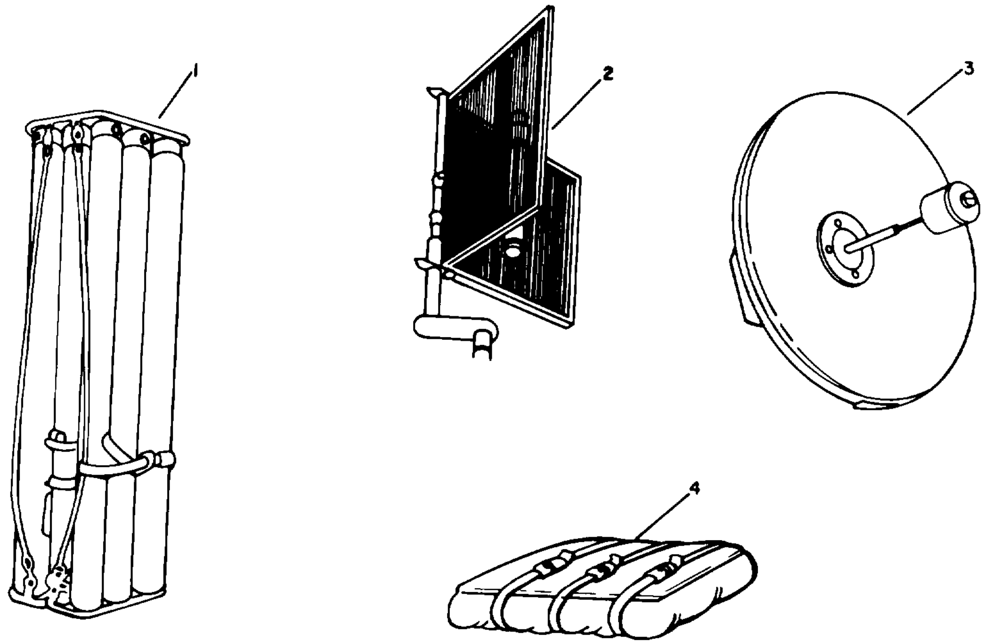
SECTION II COMPONENTS OF END ITEM

(1) ILLUS NO.	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION (FSCM) AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY REQD
1	5820-00-935-4931	RADIO SET AN/GRC-103(V)1 OR	FLB	EA	1
	5820-00-116-6029	RADIO SET AN/GRC-103(V)2 OR	FLC	EA	1
	5820-00-116-6030	RADIO SET AN/GRC-103(V)3 OR	FLD	EA	1
	5820-01-081-8866	RADIO SET AN/GRC-103(V)4	FLE	EA	1
2	5805-00-878-3539	RECEIVER-TRANSMITTER, ORDER WIRE RT-773/GRC-103(V) (80058)		EA	1
3	5820-01-053-6391	AMPLIFIER-CONVERTER AM-4316A/GRC-103(V) (80058)	FLB	EA	1
	5820-01-011-8702	AMPLIFIER-CONVERTER AM-4317/GRC-103(V) (80058)	FLC	EA	1
	5820-01-011-8582	AMPLIFIER-CONVERTER AM-4318/GRC-103(V) (80058)	FLD	EA	1
	5820-01-081-5407	AMPLIFIER-CONVERTER AM-4319/GRC-103(V) (80058)	FLE	EA	1
4	5895-01-101-1442	AMPLIFIER-FREQUENCY MULTIPLIER AM-4320A/GRC-103(V) (80063)	FLB	EA	1
	5895-01-101-1442	AMPLIFIER-FREQUENCY MILTIPLIER AM-4320B/GRC-103(V) (80063)	FLB	EA	1
	5820-01-064-2260	AMPLIFIER-FREQUENCY MULTIPLIER AM-4321( )/GRC-103(V) (80063)	FLC	EA	1
	5895-01-101-1441	AMPLIFIER-FREQUENCY MULTIPLIER AM-4322( )/GRC-103(V) (80063)	FLD	EA	1
	5820-01-082-0814	AMPLIFIER-FREQUENCY MULTIPLIER AM-4323A/GRC-103(V) (80063)	FLE	EA	1
5	5820-01-053-2554	TRANSMITTER, RADIO T-983A(P)/GRC-103(V) (80058) OR	FLB,FLC,FLD	EA	1
	5820-01-085-6084	TRANSMITTER, RADIO T-983B(P)/GRC-103(V) (80058)	FLB,FLD,FLE	EA	1

See page C-3 for illustration for item 6.

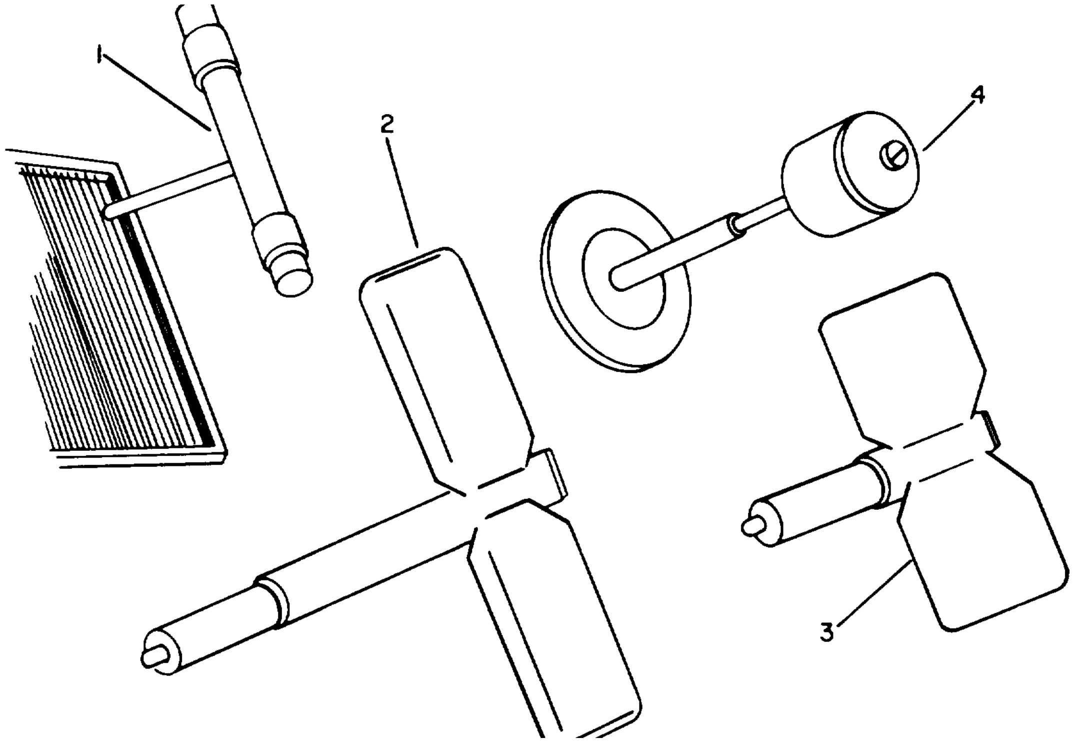
SECTION II COMPONENTS OF END ITEM
SECTION III BASIC ISSUE ITEMS

IS	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION (FSCM) AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY REQD
	5820-01-144-6007	RECEIVER, RADIO R-1329A/GRC-103(V) (90073) OR	FLB,FLC,FLD	EA	1
		RECEIVER, RADIO R-1329B/GRC-103(V) (90073) OR	FLB,FLC,FLD	EA	1
	5820-01-144-6007	RECEIVER, RADIO R-1329C/GRC-103(V) (80058)	FLB,FLD,FLE	EA	1



SECTION II COMPONENTS OF END ITEM

(1) ILLUS NO.	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION (FSCM) AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY REQD
1	5985-00-089-8993	MAST AB-952/GRC-103(V) (80058)		EA	1
2	5985-00-089-8989	ANTENNA AS-1852/GRC-103(V) (80058)	FLB	EA	1
	5820-00-011-8860	ANTENNA AS-1853/GRC-103(V) (80058)	FLC	EA	1
	5820-00-011-8951	ANTENNA AS-1854/GRC-103(V) (80058)	FLD	EA	1
3	5985-01-080-7917	ANTENNA AS-3047/GRC-103(V) (80058)	FLE	EA	1
4	5985-00-089-8988	ACCESSORY KIT, MAST MK-1069/GRC-103(V) (80058)		EA	1



SECTION II COMPONENTS OF END ITEM

(1) ILLUS NO.	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION (FSCM) AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY REQD
1	5985-00-089-8991	DIPOLE ELEMENT AS-2151/GRC (80058)	FLB	EA	1
2	5985-00-470-1374	DIPOLE ELEMENT AS-2195/GRC (80058)	FLD	EA	1
3	5820-00-101-7781	DIPOLE ELEMENT AS-2194/GRC (80058)	FLC	EA	1
4	5820-01-085-3571	ANTENNA FEED AS-3415/GRC (80058)	FLE	EA	1

SECTION III BASIC ISSUE ITEMS

(1) ILLUS NO.	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION (FSCM) AND PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY REQD
		TECHNICAL MANUAL TM 11-5820-540-12		EA	2

APPENDIX D
EXPENDABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

D-1. SCOPE

The appendix lists expendable supplies and materials you will need to operate and maintain the Radio Set AN/G RC-103(V)1, 2, 3 and 4. These items are authorized to you by CTA 50-970, Expendable Items (except Medical, Class V, Repair Parts, and Heraldic Items),

D-2. EXPLANATION OF COLUMNS

A **Column (1) - Item Number.** This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material.

B **Column (2) - Level.** This column identifies the lowest level of maintenance that requires the listed item.

C - Operator/Crew
O - Organizational Maintenance
F - Direct Support Maintenance
H - General Support Maintenance

C **Column (3) - National Stock Number.** This is the National stock number assigned to the item; use it to request or requisition the item.

D **Column (4) - Description.** Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the Federal Support Code for Manufacturer (FSCM) in parentheses followed by the part number.

E **Column (5) - Unit of Measure (U/M).** Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in., pr), If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

SECTION II EXPENDABLE SUPPLIES AND MATERIALS LIST

(1) ITEM NO.	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION PART NO. AND FSCM	(5) UNIT OF MEAS
1	0	7920-00-178-8315	BRUSH, BRISTLE, 2-3/4 inches long (81348)	EA
2	0		BRUSH, PAINT	EA
3	0	8305-00-267-3015	CHEESECLOTH (81348)	YD
4	0	6850-00-105-3084	CLEANING COMPOUND (SOLVENT), TRICHLOROTRIFLUOROETHANE	OZ
5	0	7930-01-055-6121	DETERGENT, GP, LIQ.	GL
6	0		HEAT SINK COMPOUND CMC-334-290	EA

APPENDIX E
RADIO PROPAGATION AND SYSTEM PLANNING

NOTE

The information in this chapter was originally prepared for Band I, 220 to 404.5 MHz; however, it applies equally to Band II, 394,5 to 705 MHz; Band Ill, 695 to 1,000 MHz; and Band IV, 1,350 to 1,850 MHz.

Section I. RADIO PROPAGATION

E-1 . PROPAGATION CHARACTERISTICS

The range from 30 to 300 MHz is called the very-high frequency (vhf) range, The range from 300 MHz to 3,000 MHz is called the ultrahigh frequency (uhf) range, Since the properties and phenomena associated with radio waves in the upper part of the vhf band and the lower part of the uhf band are similar, the term uhf will be used to refer to the total range of frequencies of the AN/GRC-103(V)(*) (220 to 1,850 MHz).

Unless exceptionally good antenna sites on high hills are available at both ends of the transmission path, the useful operating distances between radio sets using the uhf band generally is limited to between 30 and 40 miles. However, meteorological conditions, such as the temperature and humidity of the troposphere, sometimes cause what is termed guided propagation. This phenomenon may greatly extend the distance over which usable signals are received. Such conditions are most frequently encountered when radio sets are near the shore of an ocean or a large lake; they may be present for long or short periods.

E-2. WAVE PROPAGATION PHENOMENA

The troposphere is the normal path of travel for radio waves in the uhf band. The troposphere is the layer of the atmosphere adjacent to the surface of the earth and extends upward approximately 6 miles. The temperature of the troposphere normally decreases approximately 10°C per mile, the temperature at the upper boundary being approximately –50°C. The stratosphere is directly above the troposphere; its temperature remains fairly constant at approximately –50°C. Changes in the temperature and moisture content of the troposphere create wave propagation phenomena such as refraction and reflection. The bending of radio waves around obstacles, called diffraction, may also take place in the troposphere when conditions are suitable.

I REFRACTION (FIGURE E-1)

The temperature, pressure, and humidity of the troposphere all affect the propagation of radio waves. The variation of these quantities with height is expressed by the index of refraction, which decreases linearly with height in a standard atmosphere. (The condition most nearly approximated in the temperature zone of the earth has been accepted as the standard atmosphere. energy emitted from an antenna is a wave, spreading out in three dimensions, which may be represented by a series of concentric spherical wave fronts or by a system of radial lines called rays as shown in figure E-1 Since the index of refraction normally decreases with height, the upper portions of these wave fronts move with higher velocities than the lower portions; the wave path may be represented by rays curved slightly downward toward the earth. As a result, the distance to the radio horizon under normal conditions is about 15 percent greater than the geometrical line-of-sight distance from the antenna to the horizon. This curvature of the rays by the atmosphere is called refraction.

E-2. WAVE PROPAGATION PHENOMENA - Continued

REFLECTION (FIGURE E-2)

Over a line-of -sight path, the radio wave at the receiver R is the vector sum of the radiations arriving by both the direct ahd reflected ray paths. The contribution from the reflected ray path depends primarily on how the earth or sea acts as a reflecting body. Over water and salt flats, for instance, the reflection is essentially 100 percent.

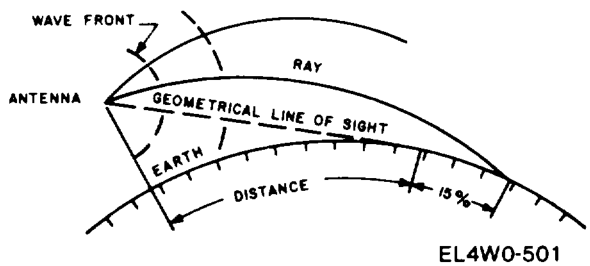


Figure E-1. Refraction

Over land areas with gentle rolling country and some vegetation, the reflection is only about 10 per-

cent. Because the angle of reflection to be considered in radio-relay siting is very small, no attention need to given to polarization effects (paragraph Ef-4). The phase lag of the reflected wave with respect to the incident wave at the point of reflection is 180°. However, since the distance travelled by

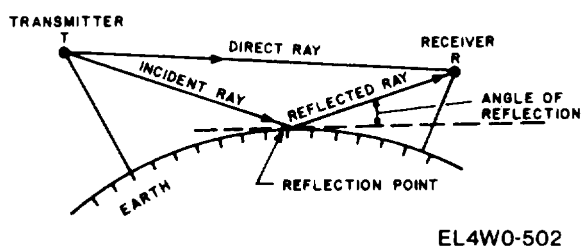


Figure E-2. Reflection

DIFFRACTION (FIGURE E-3)

The mechanism by which radio waves curve around edges and penetrate into the shadow region behind an opaque obstacle is called diffraction. This effect is important because is may allow a considerable extension of the length of a hop in certain special cases (paragraph E-3) and a limited extension of the line-of-sigth path length in other cases.

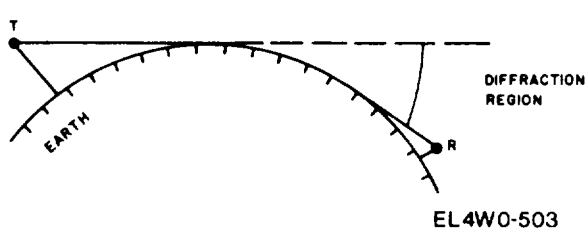


Figure E-3. Diffraction

E-2. WAVE PROPAGATION PHENOMENA- Continued

. RESULTS OF WAVE PROPAGATION PHENOMENA (FIGURE E-4)

As the receiving antenna is raised above ground level, the received signal strength rapidly increases because of diffraction until the grazing line of sight is reached. Above the grazing line of sight, the direct and reflected waves interfere with each other and result in maximum and minimum patterns called Fresnel patterns. The first maximum occurs when the difference in path lengths between the direct and reflected wave is one-half wavelength, because the reflected signal undergoes a 180° phase reversal at the reflecting point. The succeeding maxima are odd multiples of one-half wavelength. The magnitudes of the maximum and minimum fields depend on the magnitude of the reflection coefficient.

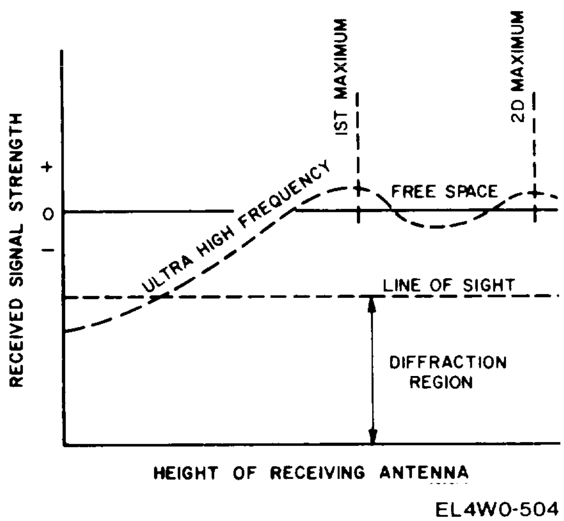


Figure E-4. Results of Wave Propagation Phenomena

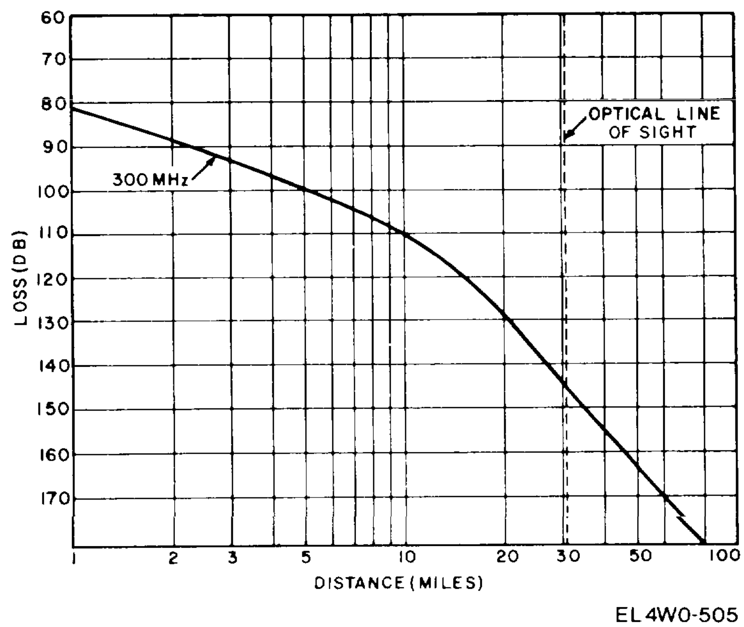


Figure E-5. Graph of loss Against Distance Over Smooth Earth for 45-Foot Antenna Elevations

E-3. PROPAGATION OF RADIO WAVES IN UHF BAND

I SMOOTH EARTH OR WATER (FIGURE E-5)

A Under ideal conditions of smooth earth, the intensity of the transmitted signal, beyond approximately the first mile, diminishes in a regular and uninterrupted manner as the distance from the transmitter is increased. Similar propagation characteristics are found over water, because the surface is smooth enough to approach the ideal.

B Figure E-5 shows the theoretical relationship between loss and distance over smooth earth for either horizontal or vertical polarization (paragraph E-4) with 45-foot antenna elevations. This curve also applies for sea water when using horizontal polarization. The slope of the curve increases at a distance of between 10 and 20 miles because the direct and reflected waves arrive at the receiver with a phase difference approaching 180° The field intensities obtained in practice will be less than those shown, because of irregularities in terrain, the presence of trees, and other factors that cause the actual conditions to differ from the theoretical. With allowance for these factors, the distance range to be expected (paragraph E-15) can be calculated.

E-3. PROPAGATION OF RADIO WAVES IN UHF BAND-Continued

. IRREGULAR TERRAIN (FIGURE E-6)

A Propagation characteristics over irregualr terrain are in marked contrast with those for smooth earth or sea water. Here, the variation of the loss with distance in addition to the free-space loss depends largely on the profile of the terrain between transmitting and receiving antennas. An increase in distance may result in either decreased or increased loss, depending on the particular topography involved. Substantial changes in loss may result from relocating stations, even without any change in the distance between them,

B In figure E-6, A shows, in profile, an assumed transmission path overhills, and B shows the transmission loss likely to be encountered at various points along the path. Two facts about transmission in hilly country are emphasized: first, the choice of antenna sites; second, the lack of a satisfactory general basis for calculating feasible path lengths. The loss may be estimated for a given site involving a path of known profile, and the selection of antenna sites may be based, therefore, on the loss estimated for various available locations, Detailed methods for determining the loss over gently rolling terrain are given in paragraph E-16; over rugged terrain, paragraph E-18.

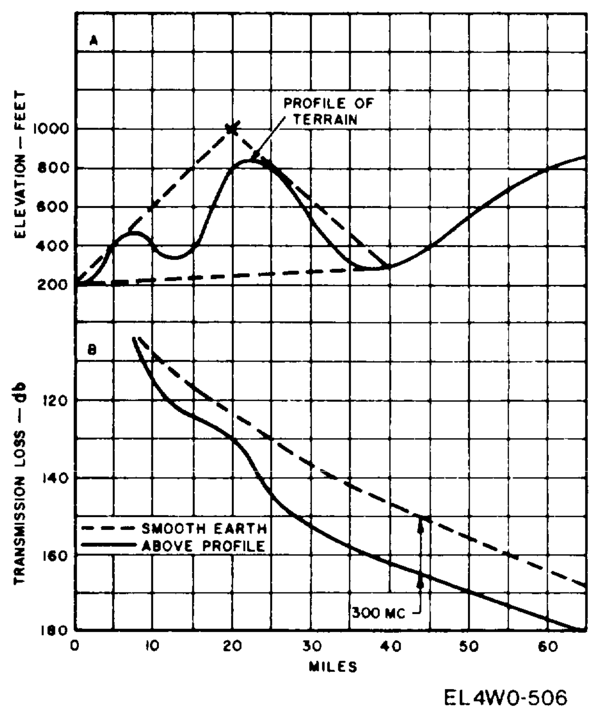


Figure E-6. Profile of Assumed Transmission Path and Associated Loss Against Distance for 100-Foot Antenna Elevations

. VERY HIGH OBSTACLES

A The diffraction of electromagnetic radiation around obstacles has made possible communication over seemingly impossible routes by use of an obstacle gain technique. The signal strengths resulting from obstructed paths are in some cases many times greater than would be expected if the obstacle were not present. However, most paths that include obstacles have losses greater than the free-space loss and should be avoided if possible

E-3. PROPAGATION OF RADIO WAVES IN UHF BAND- Continued

B If an effectively knife-edged obstacle, such as a mountain, is situated between the receiving and transmitting antennas and the terrain between the obstacles and the antenna is only moderately irregular, the radiated field from the transmitting antenna will be diffracted as it passes over the mountain. In addition, the reflected field in, the vicinity of the transmitting antenna will be diffracted in alike manner. If the mountain is high enough and the direct and reflected waves arrive at the receiving antenna in the correct phase relationship (determined by the locations and heights of the two antennas for any given case), the strength of the received signal will be approximately the same as the free-space field intensity would be if a line-of-sight transmission path existed between the antennas.

C In general, the contour of the terrain is the deciding factor as to whether the system will operate satisfactorily. Tests should be made with the actual equipment to determine whether this method can be used at a given Iocation.

E-4. POLARIZATION

I GENERAL

The polarization for an electromagnetic wave, vertical or horizontal, is the direction of the electric field of the wave. In the UHF band, radio waves transmitted from a vertical antenna are regarded as being vertically polarized, and those from a horizontal antenna are regarded as being horizontally polarized (paragraph E-5). Either type of polarization may be used for UHF transmission, but the performance of each will be different under certain situations, In all cases, the horizontal or vertical orientation of the receiving antenna should be the same as that of the transmitting antenna at the distant station. If the orientations are not the same, the loss may be increased by as much as 30 dB.

. ADVANTAGE OF VERTICAL POLARIZATION

Variation in received field intensity caused by reflections from aircraft flying over the transmission path are less apparent with veritcal polarization than with horizontal polarization.

c ADVANTAGES OF HORIZONTAL POLARIZATION

A Horizontal antennas are less likely to pick up man-made interference, which is ordinarily vertically polarized.

B When antennas are located in fairly dense forests, horizontally polarized waves usually suffer lower losses than vertically polarized waves. Also, standing wave effects, which cause relatively large changes in the field intensity of vertically polarized waves for small changes in antenna location among trees or near the edge of a forest, are not as pronounced with horizontal polarization. In very dense jungles, there is no advantage in either type of polarization.

E-5. ADVANTAGES OF FREQUENCY RANGE OF 220 TO 404.5 MHz

. Transmission in the frequency range of 220 to 404,5 MHz, in contrast with the lower frequencies, is favored by the following factors:

A Frequencies in this range are generally free from atmospheric static noise, except during local storms.

B Antennas of one-quarter or one-half wavelength in the UHF band, are smaller and more efficient than those used at lower frequencies.

C Performance of UHF circuits may be Improved substantially, except under certain conditions, by raising antennas to moderate elevations above ground. Therefore, masts of a height practical for tactical work may be used to good advantage. Higher elevations (using hills for antenna sites) provide further Improvement.

D Directional antennas for improving transmission in the desired direction are of relatively small dimensions, and directivity gains equivalent to raising the transmitting power by four times or more are attainable.

E-5. ADVANTAGES OF FREQUENCY RANGE OF 220 T0 4O4.5 MHz - Contlnued

E Good ground connections for the antennas usually are not essential.

l In contrast with the higher (microwave) frequencies, transmission in the frequency range of 220 to 404.5 MHz has the following advantages:

A The free-space loss is lower.

B Diffraction effects provide appreciable over-the-horizon transmission, extending the path length beyond lIne-of-sight distances.

C Scattering and absorption of the signal by fog, rain, or snow is not a serious problem over paths of normal lengths.

D Antenna dimensions are less critical.

E-6. DISADVANTAGE OF FREQUENCY RANGE OF 220 TO 404.5 MHz

Factors that counteract the advantages Iisted in paragraph E-5 are as follows:

. Shadow losses introduced by the earth's curvature and by intervening hills are greater than with lower frequency waves.

l Trees or dense jungles in the vicinity of the antennas cause more loss at higher frequencies than at lower frequencies.

. Fading occurs at times in the UHF band, especially when the radio path is long. Reflections from airplanes in or near the transmission path also can cause severe signal variations.

E-7. USE OF BAND I IN AN/GRC-103(V)

Figure E-7 is a graph comparing free-space loss against distance for various frequencies of the AN/GRC-103(V) (paragraph 1-7). It shows that the lower frequencies give the least attenuation when transmitting over long distances. However, the variation of the antenna gain with frequency must also be considered (paragraph E-13).

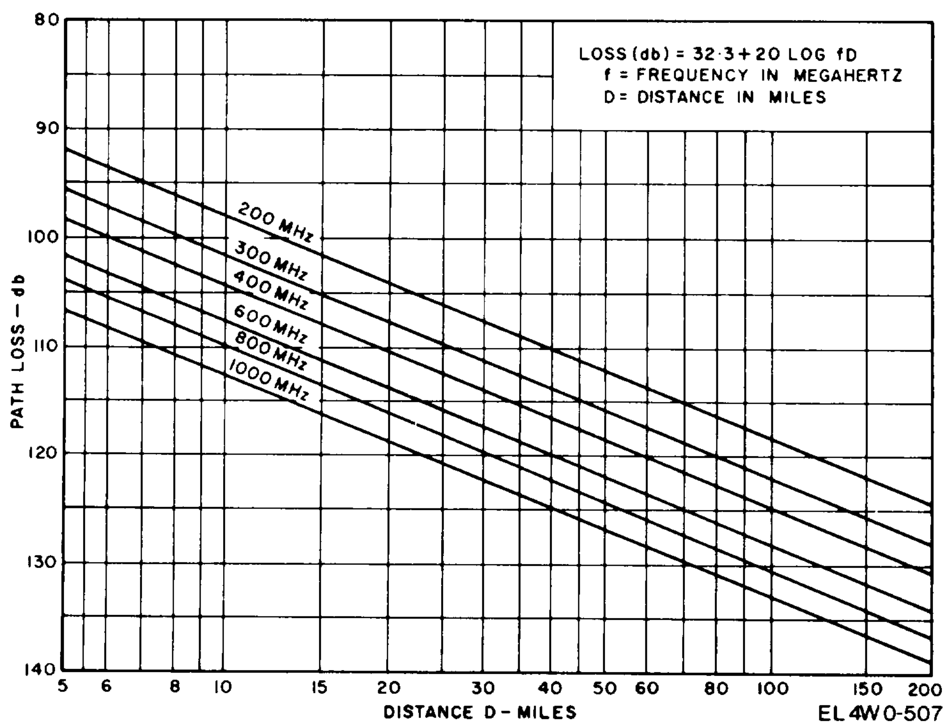


Figure E-7. Attenuation Against Distance in Free Space

Section II. SYSTEM PLANNING

E-8. GENERAL

A A radio system consists of two radio terminals and as many radio-relay sets, also called repeaters, as are needed to span the distance between the two terminals. A route is another term used to designate a radio system. A hop is the distance separating a radio transmitter from the receiver that receives its transmission. A path is the terrain over which the transmissions of a hop travel. The chart below gives typical path lengths for a single hop using the AN/GRC-

Type of path	Antenna heights	Typical path length
Line-of-sight	---	100 miles under favorable conditions.
Over smooth earth	35 feet	25 to 30 miles
Over moderate obstruction (less than 300 feet).	35 feet	10 to 15 miles.

B The procedure to be followed in planning a single-route, radio-relay system is outlined in C through M below. It consists of choosing suitable locations for the repeaters and determing from power-balance calculations (the addition of path losses and gains) whether an adequate signal will be received. When planning a system of interconnecting or parallel routes, the procedure outlined in C through M below should be followed for each route in the system, and the procedures outlined in paragraph E-21 through E-24 should be followed for selecting the frequencies for each receiver and transmitter.

C Determine the terminal points of each radio system in the route. These points are determined approximately by the location of the telephone equipments that connect to the radio terminals. Choose the exact radio terminal sites; siting considerations are given in paragraph E-9.

D For each radio system, draw a sketch on graph paper as shown in figure E-8. Label one terminal point A, and the other terminal point B.

E Draw an arc that has a radius of 30 miles about point A.

F Choose a site with high elevation, on or near the 30-mile radius arc drawn about terminal A and in the approximate direction of terminal B from terminal A.

G Label this site as relay point 1, and draw a profile graph of the ground between terminal point A and relay point 1 (paragraph E-10).

H Use the procedure outlined in paragraphs E-10 and E-11, and determine whether a Ilne-of-sight path exists between terminal point A and relay point 1.

I If the site chosen for relay point 1 does not give a line-of-sight path as determined from the procedure outlined in paragraphs E-10 and E-11, discard this site and choose a new site on or near the 30-mile radius arc drawn about terminal A and in the approximate direction of radio terminal B from radio terminal A. Label the new site as relay point 1.

J If it is impossible to have a line-of-sight path between terminal A and any relay point 1, try to reach the 30-mile point in two jumps or determine the suitability of the path from the power-balance calculations (paragraphs E-12 through E-18).

K When a site has been determined for relay point 1 (D through J above), follow the procedure outlined in paragraphs E-12 through E-18 to determine from the power-balance calculations whether the site for radio relay 1 is adequate. If the power-balance calculations indicate that the site chosen for radio relay 1 is inadequate, this site should be discarded, if practicable, and a new site or series of sites chosen by using the profile graph and then the power-balance calculations. If very high obstacles are encountered, refer to the procedure outline in paragraph E-19.

E-8. GENERAL - Continued

L After the site for radio relay 1 has been determined, draw a 30-mile radius arc about radios relay point 1 (figure E-8) and perform the procedure given in D through K above to determine the site for radio-relay point 2.

M Use the procedure outlined in D through K above to determine the sites for radio-relay points 3, 4, and 5, or as many as needed until radio terminal B is reached.

N Determine the operating frequency and RF channel of each radio transmitter and receiver in the system by using the procedure outline in paragraph E-20 if a single route is being planned, If a multiple route system is being planned, use the procedure outlined in paragraph E-21 E-22, or E-23.

O When planninq a radio system, observe the syste planning considerations given in paragraphs E-24 through E-26.

E-9. SITING CONSIDERATIONS

l ACCESSIBILITY

Whenever possible, a site should be located near good roads to minimize difficulties in supplying the site with water, gasoline, oil, and food.

. OBSTRUCTIONS

Try to avoid operating the radio set near steel bridges, under passes, power lines, or power units as they may cause weak or distorted signals. Better results normally will be obtained when the antennas are high and clear of hills, cliffs, buildings, densely wooded areas, and other obstructions,

l CHOOSING A SITE

Flat ground with good drainage on a hilltop or elevation usually is the most desirable location. If the equipment is part of a communication center but is not installed within the center, locate the equipment nearby.

E-10. PLOTTING PROFILES

l PLOTTING PROFILES ON NONLINEAR GRAPH PAPER

For determining whether a line-of-sight path exists before choosing a site, a profile map of the terrain between the two proposed sites should be drawn as shown in figure E-9. The nonlinear graph paper used for plotting profiles from terrain maps is shown in figure E-10. Either of the two graphs in figure E-10 may be used, depending on the elevations and distances between the two proposed sites. The upper graph is used for elevations up to 5,000 feet and distances up to 125 miles. The lower graph is used for elevations up to 500 feet and distances up to 50 miles. This graph paper is used as follows:

A Determine from the terrain map the scales used for the distances Involved.

B Draw a line on the terrain map between the two proposed sites (E or H figure E-9). Measure the length of this line, and convert it to the distance between the two points.

C Determine the elevation at each site as indicated by the contour lines. Add the height of the antenna mast to this elevation to determine the total elevation. For example, for the path D (H, figure E-9), station N is 1,350 feet high. Adding the antenna height, in this case 50 feet, brings the total elevation to 1,400 feet, This point is marked off on the vertical scale of the graph above the O-mile point (J, figure E-9). Station O has an indicated elevation of 1,400 feet. This height, plus the antenna height of 50 feet, gives a total elevation of 1,450 feet. This is plotted on the vertical scale (J, figure E-9) above the 27-mile point, because 27 miles is the distance between the two proposed sites.

E-10. PLOTTING PROFILES- Continued

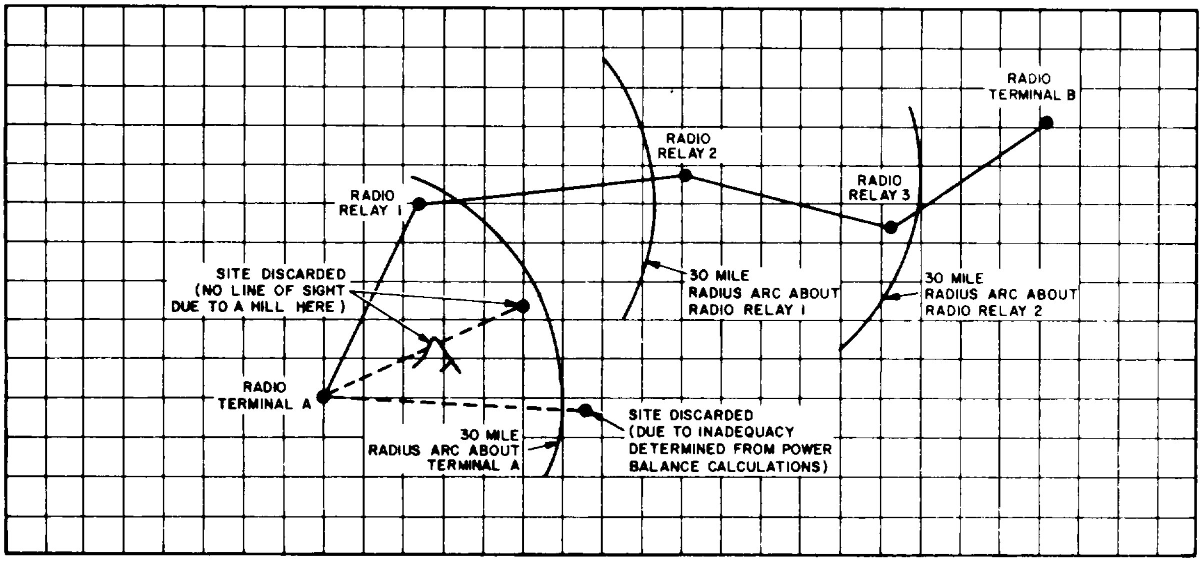


Figure E-8. General Radio-Relay System Planning

D Draw a straight line on the profile chart between the two points, Check this line. and note its lowest point,

E Draw a complete profile of the terrain between the two sites. Follow the line drawn on the terrain map, and pick out high and low points. Plot these points on the graph paper, and join them. All points that are above the straight line on the graph (1, figure E-9) represent intervening obstructing terrain.

F If there are intervening hills between the two proposed sites, as in path C, or if the site line is below the curvature of the earth, as in path B (G, figure E-9), poor communication may result Such paths should not be used. Path D should be used because there are no Intervening obstructing hills, and good communication will be obtained.

G A quicker method of determining line of sight may sometimes be used. After the straight line has been drawn on the profile chart, scan the line and determine the elevation of the lowest point on the line. Next, scan the corresponding line on the contour map, and determine whether any point is at a higher elevation than that of the lowest point of the profile chart line. If there is none, as on path D, a line-of-sight path exists between the end points of the line and it is not necessary to plot the profile of the intervening terrain. If there are elevations above the point of lowest elevation, as on path C, draw a complete profile to determine whether these high points represent obstructions. For example, the point of lowest elevation on the profile chart for path A (F, figure E-9) is 10 feet. On the terrain map, path A passes over a portion of terrain that exceeds 10 feet in elevation. Therefore, the profile chart should be plotted before it is decided that path A will provide a line-of-sight path.

E-10. PLOTTING ROFILES- Continued

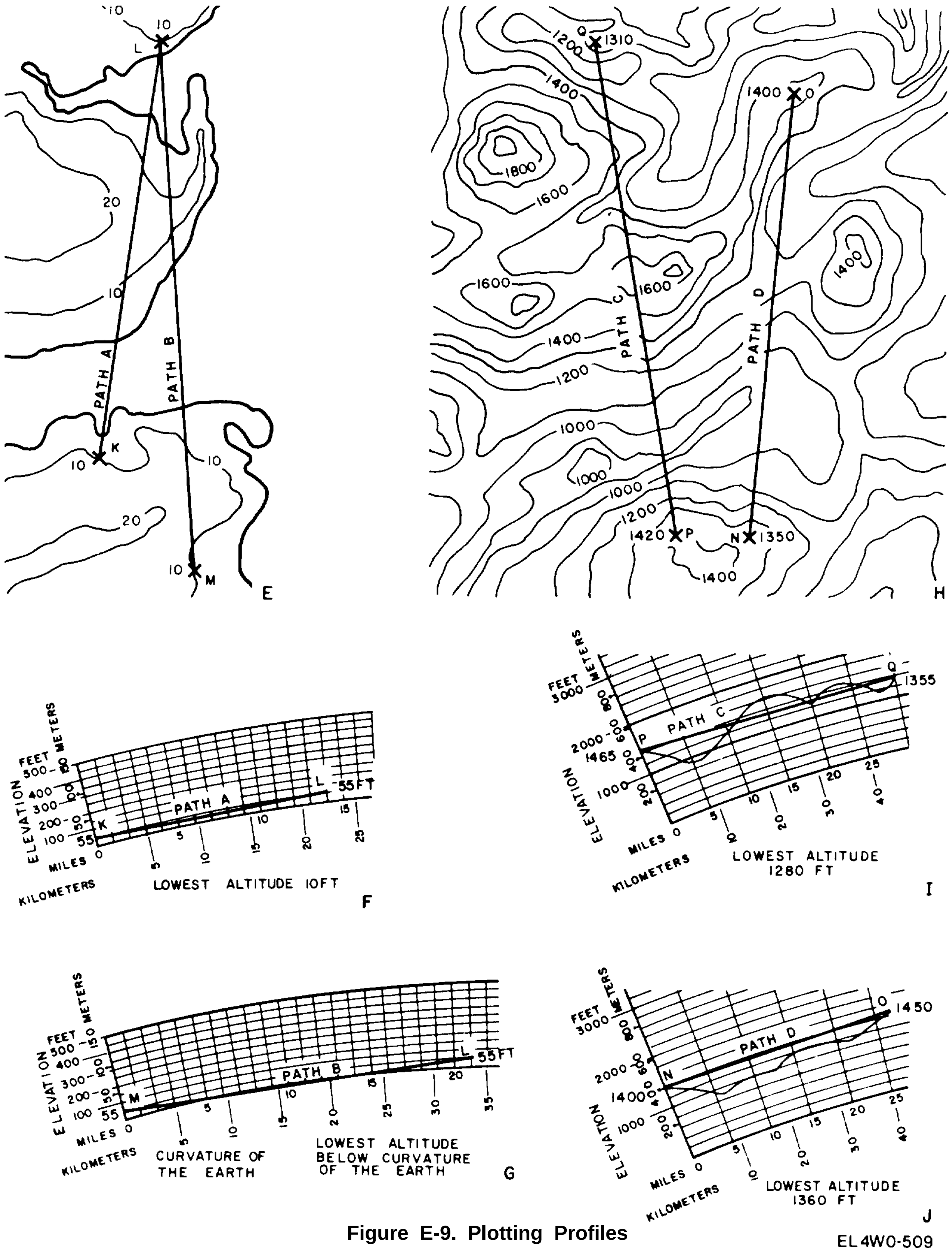


Figure E-9. Plotting Profiles

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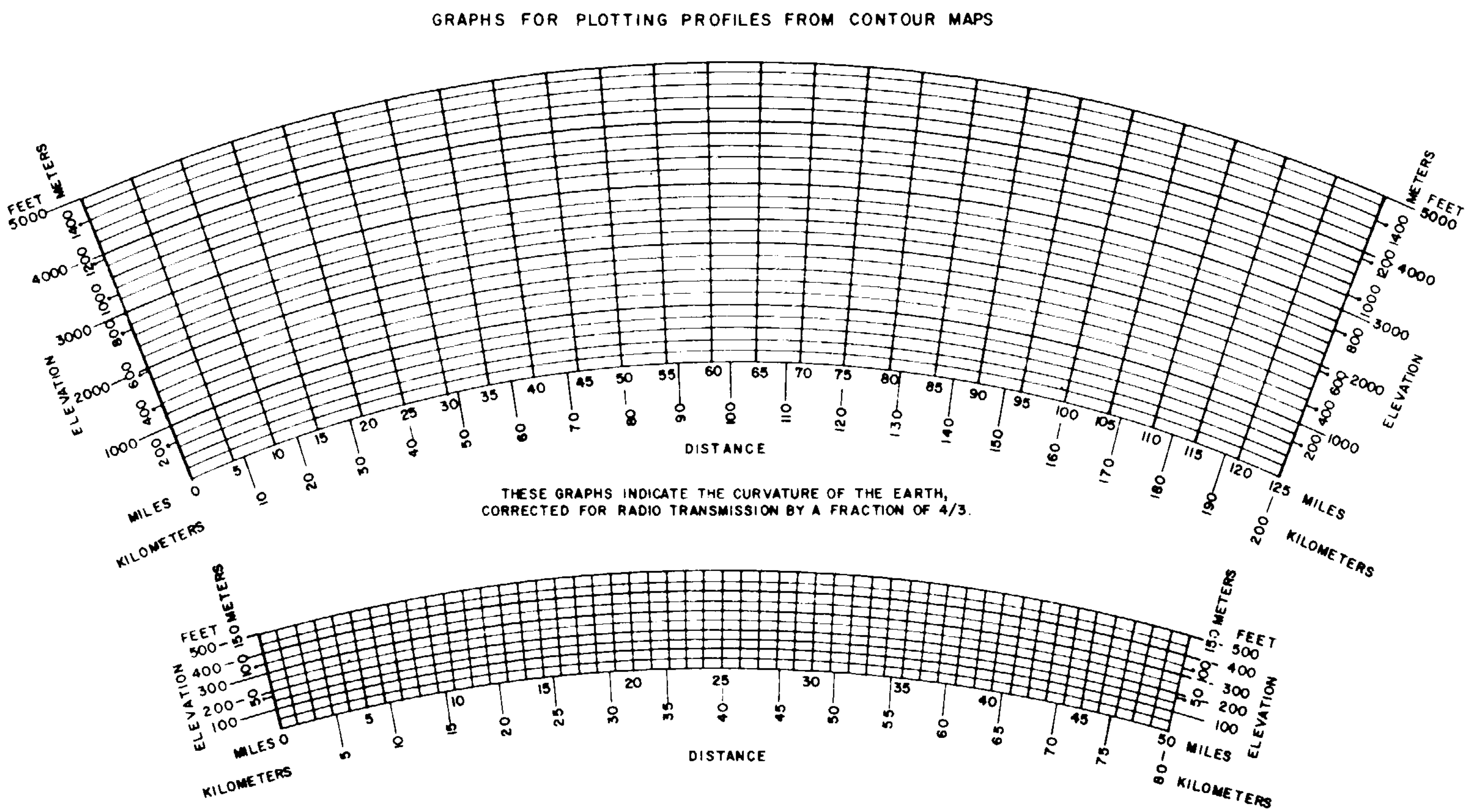

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Figure E-10. Nonlinear Graph Paper

E-10. PL0TTING PROFILES - Continued

H If the proposed site is Intended fo a relay station, the transmission path to each associated relay or terminal station must be considered. The line-of-sight paths should exist in both directions.

I **PLOTTING PROFILES ON LINEAR GRAPH PAPER**

If nonlinear profile graph paper is not available, a profile may be plotted on Iinear graph paper and then corrected for the curvature of the earth and the effects of refaction. Use the following chart:

Correction of elevation for earth curvature

D (miles from reference point)	Elevation correction (ft) (k=1.33)	D (miles from reference point)	Elevation correction (ft) (k=1.33)
2	2	20	200
4	8	22	242
6	18	24	288
8	32	26	338
10	50	28	392
12	72	30	450
14	98	32	512
16	128	34	578
18	162	36	648

Note. The elevation correction in feet equals

$$\frac{D^2}{1.5k}$$

where k is the ratio of the effective radius of the earth to the true radius of the earth and D is the distance in miles from the reference point. For a mean climatic condition, k=1.33. With this value, the elevation correction becomes $D^2/2$.

A Determine from the terrain map the scales used for distances and elevations. Draw a line on the terrain map between the two proposed sites.

B Pick out high and low points along the line, and plot these to scale on the Iinear graph paper. A sample profile is plotted as a broken line curve on this type of graph paper in figure E-11.

C Draw a line on the graph paper between terminal points A and B.

D Correction must be made for the curvature of the earth to obtain a true picture of the line-of-sight. Select a high or low point that is as near as possible to the point halfway between the terminals, in his case R. Next, by means of the figures shown in the conversion chart, correct the heights of all prominent points in both directions from this central point (shown as a solid line curve in (figure E-11). For example, in figure E-11, point P is 6 miles from reference point R. After correction according to the conversion table, P becomes P', 18 feet lower than the original point ($D^2/2=6^2/2=18$ feet).

E Some profile maps will indicate a line-of-sight path with the drawing uncorrected. With the correction, however, intervening objects may be apparent.

E-11. DETERMINING LINE OF SIGHT FROM PROFILE GRAPH

After drawing the profile graph for a particular path and correcting for the earth's curvature, if necessary, check the graph carefully to see that a true line-of-sight path exists. If the path is obstructed, discard the site and choose a new one if possible (paragraph E-8i). If it is impossible to have a Iine-of-sight path, determine the adequacy of the path from the power-balance calculations (paragraphs E-12 through E-18). If very high obstacles are encountered refer to the procedure outlined in paragraph E-19.

E-12. POWER-BALANCE CALCULATION

. The power-balance calculations are made when planning a system to determine that the estimated loss over a particular path does not exceed the allowable loss for the path. Follow the procedure outlined in paragraph E-13 to calculate the allowable loss for a desired path. Follow the procedure outlined in paragraphs E-14 through E-19 to determine the estimated loss over a completed path. If the estimated path loss is greater than the allowable path loss, the path should be changed or the hop length should be shortened to reduce the estimated path loss.

. When the power-balance calculations Indicate that a hop wiIl have too much attenuation, either the hop length should be shortened to reduce the estimated loss for that hop, or an intermediate repeater station should be used, If it is Impossible to shorten the hop length or to add an intermediate repeater station, the hop should be used even though it introduces too much estimated loss. However, in a system where one or more hops have a greater estimated loss than the allowable loss, these hops will limit the operation effectiveness of the radio system, Every effort should be made to reduce the path attenuation while planning and after setting up a radio system.

. Power-balance calculations, which are performed while planning a radio system, give only an approximate indication of the performance of a radio system. For an accurate indication of system performance, the system should be set up and tested if the loss of a particular hop is difficult to determine from power-balance calculations, the hop may be installed and tested.

E-13. CALCULATION OF ALLOWABLE PATH LOSS

A The procedures outlined in B through E below to determine the allowable path loss for a hop is based on the requirement of the AN/GRC-103(V)(*) receiver for a minimum signal input as shown in the chart below. Although the theoretical receiver input for O-dB output signal-to-noise ratio in an unweighed voice channel is –128.5 dBm, the values in the chart give a receiver output with an acceptable error rate in each of the modes of operation shown. The values of nominal allowable loss for a hop are calculated using a transmitter output of +44 dBm (25 watts) and do not include the antenna lead-in cable loss or the antenna gain.

Receiver input levels and path loss

Mode of operation	Minimum receiver input (dBm)	Nominal allowable path loss per hop (d B)
12-channel pcm, up 8 hops	–94 0	1380
24-channel pcm, up 8 hops	–86.0	1300

B Interpolate the loss due to the antenna Iead-in cable, using the selected frequency and the chart below.

RG-326/U antenna Iead-in cable loss

Frequency (MHz)	50-ft cable loss (dB)	80-ft cable loss (dB)
200	050	0.80
400	110	1.76
700	1 50	2.40
1,000	1 75	2.80
1,350	210	350
1,850	250	400

Subtract the antenna lead-in cable loss.

C Add the gain of the antenna in use to the nominal allowable path loss. The chart below gives the antenna gain in different portions of the total frequency range, assuming that the correct dipole is in use.

Antenna gain

Frequency (MHz)	Gain (dB)
220 to 2795	+70
280 to 4395	+73
449 to 8795	+80
880 to 1000	+100
1,350 to 1,850	+180

E-13. CALCULATION OF ALLOWABLE PATH LOSS- Continued

D The nominal allowable path loss figure is calculated with a transmitter output of 25 watts. Any change in the output power should be added to or subtracted from the nominal allowable path loss figure. Use the chart below to determine the value in dB to be added or subtracted for variations in power output.

Power output variation

Output power (watts)	Loss (−) or gain (+) (dB)
6.25 to 7.8	−6
7.9 to 9.9	−5
10.9 to 12.4	−4
12.5 to 15	−3
16 to 19	−2
20 to 24	−1
25 to 31	0
32 to 39	+1
40 to 49	+2
50 to 62	+3

E The form used to compute the allowable path loss is given below. Use this form when following the procedures outlined in A through D above.

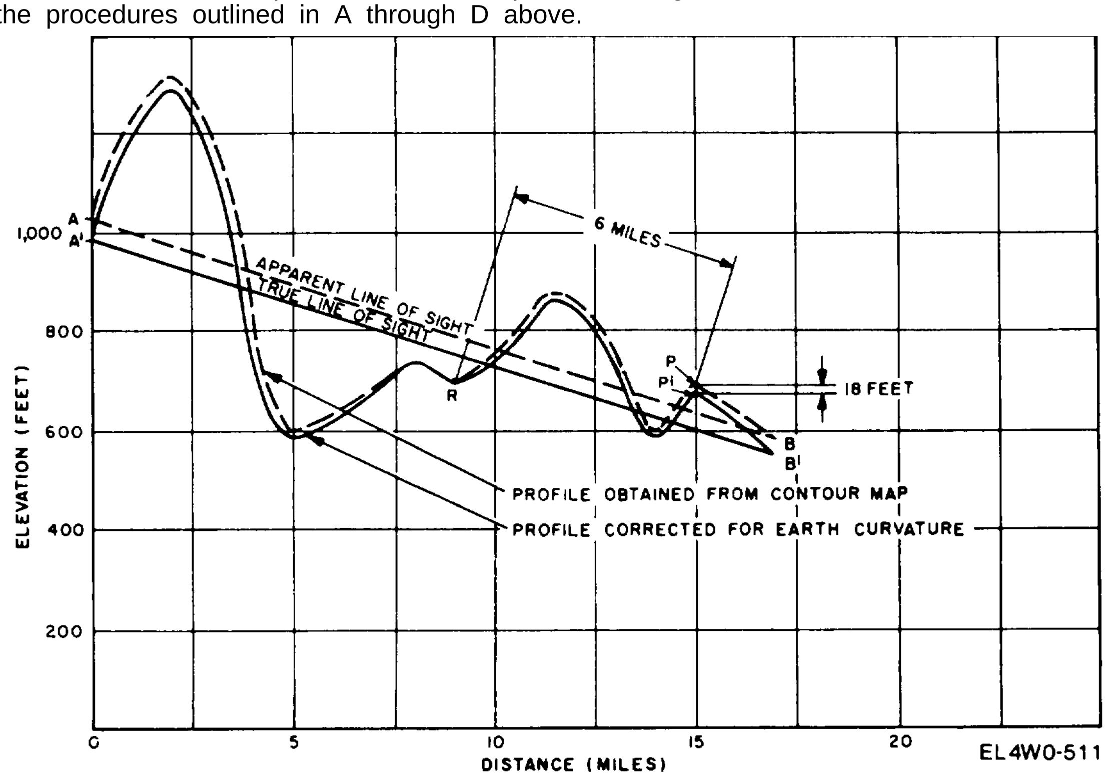

Figure E-11. Plotting Profiles on Linear Graph Paper

Allowable path loss computation

Item no	Item	Correction to nominal allowable loss per hop (dB) Add	Subtract
1	Lead-in cable		
	a. Frequency MHz		
	b. Transmitter ft		− dB
	c. Receiver ft		− dB
2	Antenna gain		
	a. Receiver MHz	+ dB	
	b. Transmitter MHz	+ dB	
3	Transmitter output		
	Power watts	+ dB	− dB
Total		dB	
Nominal allowable path loss per hop		dB	
+ dB − dB = Allowable path loss		dB	

E-14. CALCULATION OF ESTIMATED PATH ATTENUATION

I GENERAL

Various factors and different terrains produce different path attenuation, and no two terrains will produce the same path loss unless these terrains are identical in every respect; however, similar terrains produce very nearly the same loss. To estimate the path loss for a given terrain, therefore, match the terrain to a sample terrain (A through P, figure E-12), and use the estimated path loss of the sample terrain.

. PROCEDURE

A Determine the type of terrain from the profile graph (paragraph E-10).

B Use the chart below as a guide for estimating the path loss for a given terrain.

C Estimate the path loss for the given terrain by using the references in the righthand column of the chart below.

D This estimated path loss should not exceed the allowable path loss (paragraph E-13). If it does, refer to paragraph E-8.

UHF path loss estimation

Item No.	Type of terrain	Profile (fig.E-12)	Method of solution (para)
1	Smooth earth or water	A and B	E-15.
2	Gently rolling terrain.		
	a. Within line of sight	a. C through I	a. E-16
	b. At grazing or moderate distances beyond horizon	b. J and K	b. E-16
	c. Far beyond horizon	c. None	c. E-16
3	Ridge obstructions or obstructions in otherwise gently rolling terrain.	L	E-17.
4	Rugged terrain with many large and abrupt changes in contour	M through P	E-18.
	a. When antennas, with path obstructions disregarded, are not high enough to produce free-space loss.		a. E-18b(4)(a).
	b. When antennas, with path obstructions disregarded, are at least high enough to produce free-space loss.		b. E-18b(4)(b).

E-15. ESTIMATED PATH LOSS OVER SMOOTH EARTH OR WATER

. Follow the procedures in (A) through (C) below to determine the estimated path loss over smooth earth or water. An example is given below.

A Determine the antenna heights (A and B, figure E-12) from the profile graph (paragraph E-10). Where the antennas are placed on a building or a hilltop from which the terrain slopes rapidly to flat land (or water), the antenna heights are taken with respect to the level of the land or the water.

B Find the geometric mean of the two antenna heights by multiplying the two heights together and taking the square root of the result.

C Determine from the appropriate graph or graphs (figures E-13 through E-17) the estimated path loss for the geometric mean of the two antenna heights and the length of the hop. It may be necessary to interpolate for values at intermediate frequencies and heights.

E-15. ESTIMATED PATH LOSS OVER SMOOTH EARTH OR WATER- Continued

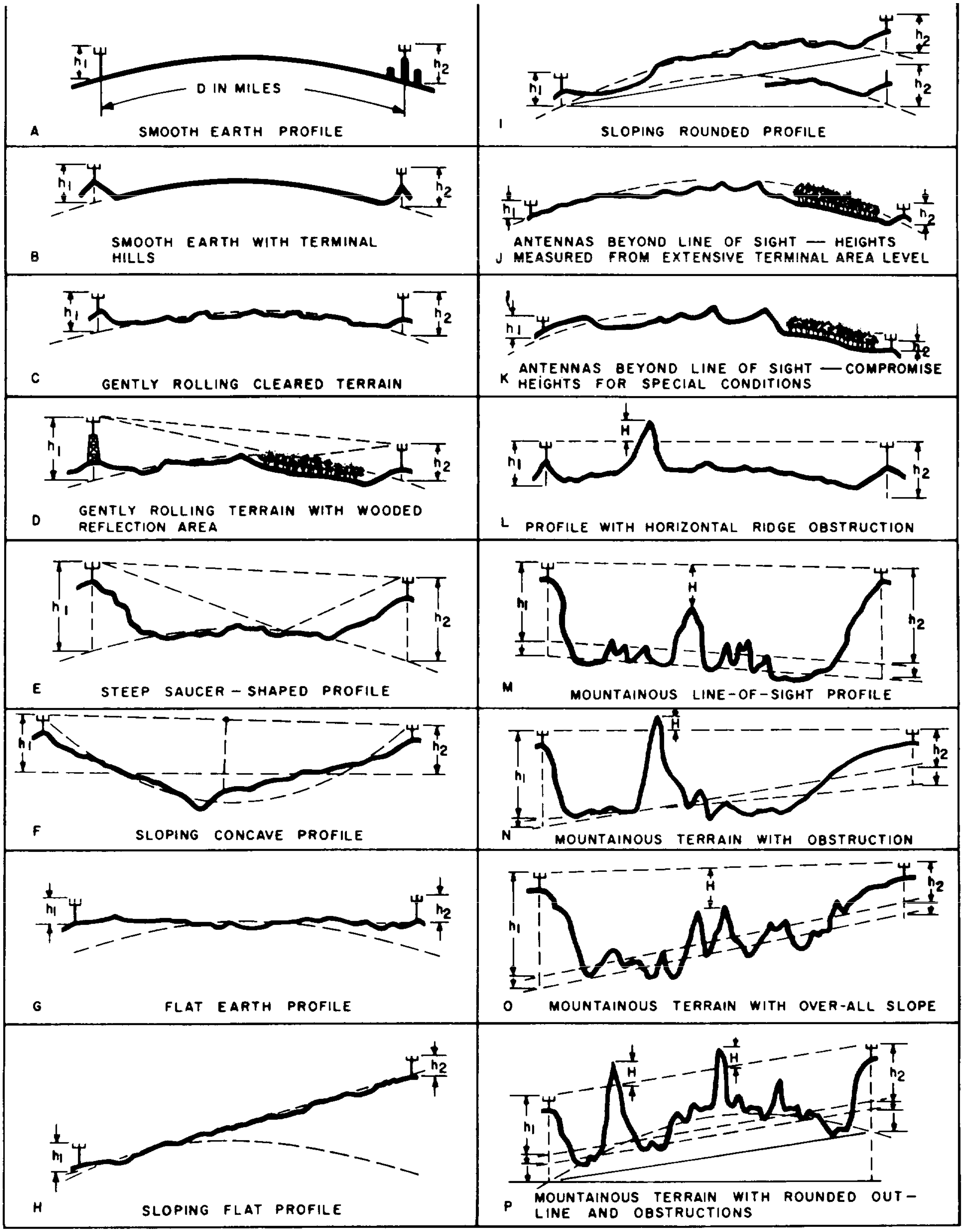

Figure E-12. Typical Path Profiles

E-15. ESTIMATED PATH LOSS OVER SMOOTH EARTH OR WATER - Continued

l For an example of estimating the path loss over smooth earth or water, assume that it is desired to find the path loss of B, figure E-12. Assume that one antenna is on a 35-foot mast on a hill rising 25 feet above a beach and that the other antenna. 40 miles away over a sea water path, is 150 feet above the water level. The path loss at 300 MHz between vertical half-wave dipoles is determined as follows:

A The first antenna height is 25 feet plus 35 feet which equals 60 feet.

B The second antenna height is 150 feet.

C The geometric mean is–

60X150=95 feet

D The path loss at 300 MHz (figures E-13 and E-14) is 147 dB.

E-16. ESTIMATED PATH LOSS OVER GENTLY ROLLING TERRAIN

The methods of estimating the path loss over gently rolling terrain with antennas within line of sight, with antennas at grazing or at moderate distances beyond line of sight, and with antennas at large distances beyond line of sight are listed below.

l ANTENNAS WITHIN LINE OF SIGHT

When estimating the path loss over gently rolling terrain with antennas within line of sight, the smooth earth curves given in figure E-13 through E-17 can be used.

A Find the geometric mean of the antenna heights from the profile graph as described in paragraph E-15. Take antenna heights equal to a height above a curved earth surface placed at the average elevation of the terrain. Spree typical terrains are shown in C through I, figure E-12.

1 In C, figure E-12, the equivalent smooth earth surface is drawn through the uneven terrain in the general midsection fo the path (broken line), and the antenna height is measured above the level of the equivalent smooth earth surface at each end.

2 In D, figure E-12, part of the terrain is shown as thickly wooded, and the average treetop level in this region is used as the equivalent smooth earth level for determining antenna heights. A sparse growth of trees or trees without foliage may be ignored, Because losses occur when antennas operating in the UHF band are placed below treetop level in or near dense woods, this type of installation should be avoided.

3 In E, figure E-12, a saucer-shaped profile with steep sides that extend only a small fraction for the path length is shown. In this example, the heights above the average valley floor are used for the antenna heights as illustrated.

4 Where the profile has more gradually sloping sides that extend for a large fraction of the path length, the average elevation of the reflection area is higher than the valley bottom and an equivalent smooth ground surface of intermediate elevation is used to determine the antenna heights (F, figure E-12).

B Determine from the appropriate graphs (figures E-13 through E-17), the estimated path loss for the geometric mean of the two antenna heights and (he length of the hop. It may be necessary to interpolate for values at Intermediate frequencies and heights.

E-16. ESTIMATED PATH LOSS OVER GENTLY ROLLING TERRAIN - Continued

C In the special case where the slopes shown on the profile graph are so long and gradual as to just overcome the earth's curvature over the path length, the path loss can be determined from figures E-7 and E-18 based on a smooth earth with antenna heights as shown in G, figure E-12. The heights of the antennas should be greater than two wavelengths for accuracy with this smooth earth method, Proceed as follows:

1 Determine the path loss in dB for the length of the hop from figure E-7.

2 Determine the additional (auxiliary) path loss from the value at the bottom of the graph in figure E-18 by using the following formula:

$$\frac{fh_1h_2}{D\times10^6}$$

where f equals operating frequency in megahertz; h, equals height of antenna No. 1 in feet; h² equals height of antenna No. 2 in feet; and D equals length of hop in miles.

3 Use the value obtained in 2 above to find the additional path loss in dB from figure E-18.

4 The total estimated path loss IS then the sum of the values obtained in 1 and 3 above.

D Occasionally a sloping profile is encountered, such as that shown in H or I of figure E-12. The equivalent reflecting surface can be drawn and the net heights determined as shown. The antenna heights are measured perpendicularly to the equivalent reflecting surface. Use the procedure outline in C above (based on smooth earth) to estimate the path loss. For the tilted equivalent reflecting surface (H, figure E-12), the height of the antennas above the equivalent reflecting surface should be two wavelengths or greater for accuracy with this method.

I ANTENNAS AT GRAZING OR AT MODERATE DISTANCES BEYOND LINE OF SIGHT

When the path loss over gently rolling terrain with antennas at grazing or at moderate distances beyond line of sight is being determined, the smooth earth curves shown in figures E-13 through E-17 can be used. Proceed as follows:

A Find the geometric mean of the antenna heights from the profile graph as described in paragraph E-17. Take antenna heights at the height above the average level of the terrain in the first few miles of path from each antenna. Where dense woods extend from within a few hundred feet from the antenna outward for a mile or more along the path, take an antenna height equal to either the height above the treetops or one-half the antenna height above the average height of the nearby ground, whichever is greater. Such conditions are shown in J and K, figure E-I2.

B Determine from the appropriate graphs (figures E-13 through E-17), the estimated path loss for the geometric mean of the two antenna heights and the length of the hop. It may be necessary to Interpolate for values at intermediate frequencies and heights.

C For an example of the procedure in (B) above, refer to K, figure E-12. Assume the antenna at the left is 125 feet high and the antenna at the right is 70 feet above the average cleared level area but is rarely above the dense trees that extend within a few hundred feet of the antenna; then, the net height of the antenna at the right is taken as one-half the height above the average local ground (35 feet). Assume the operating frequency to be 300 MHz and the hop length 30 miles.

1 The geometric mean of the antenna height is—

$125x35=66$ feet.

2 The path loss at 300 MHz (figures E-13 and E-14) equals 145 dB.

E-16. ESTIMATED PATH LOSS OVER 6ENTLY ROLLING TERRAIN - Continued

I ANTENNAS AT LARGE DISTANCES BEYOND LINE OF SIGHT

Path losses at large distances beyond the horizon are less than those calculated on the smooth earth basis and, in general, independent of frequency. Therefore, for such paths, communication should be established and tests made to determine whether the received signal is at a suitable level.

E-17. ESTIMATED PATH L0SS WITH HORIZONTAL RIDGE OBSTRUCTION IN OTHERWISE FIAT OR GENTLY ROLLING TERRAIN

A simplified procedure for estimating the path loss over a horizontal ridge obstruction is given in A through D below. This procedure will give reasonably close results in most situations.

A Assume the horizontal ridge to be absent, and determine the estimated path loss as outlined in paragraph E-16, depending on whether the antennas are within line of sight, at moderate distances beyond line of sight, or at greater distances beyond line of sight.

B Determine the additional loss introduced by the horizontal ridge from (he nomograph in figure E-19. Proceed as follows:

1 Determine the distance, d, (in miles), from the obstruction to the nearer antenna.

2 Draw a line of sight on the profile graph between the two antennas. Determine H (feet), which is the height of the obstruction above the line of sight between the two antennas,

3 on figure E-19, draw a straight line from d to H. This line is indicated as a broken line between the value 10 on vertical line d, MILES and the value 100 vertical line H FEET. Extend the line until it crosses the center uncalibrated vertical line at some point.

4 Draw a second straight line through the point of intersection of the first line with the uncalibrated vertical line ((3) above) and through the point that represents the frequency in MHz on the FREQ-MHz scale. The operating frequency taken in this case is 275 MHz. Extend the second line until it crosses the SHADOW LOSS scale at some point. The value at the intersection of the second line with the shadow loss scale is the shadow loss in dB. This value is shown as approximately 3.6 dB in figure E-19.

5 When two or more sharply defined ridges occur in an otherwise gently rolling terrain, the net effect is approximated by calculating the shadow loss for each ridge separately (assuming the others to be absent), then taking the square root of the product of the squares of the individual losses in dB as the net loss L. The net loss L is obtained by the formula below:

$$L = L_1^2 X\ L_2^2 X\ L \sim^2 X \quad X\ L_n^2$$

C Add the loss obtained in A above to the loss obtained in B above, This is the estimated path loss.

D An example of the procedure in C above assumes a terrain with an intervening horizontal obstruction, as shown in L, figure E-12. Assuming 100-foot antenna heights and 300-MHz transmission over a 30-mile path, the smooth earth loss is 135 dB (figure E-13 and E-14). If the obstructing portion of the ridge height extends 90 feet above the direct line between antennas and the ridge is located 9 miles from the nearer antenna, the shadow loss from figure E-19 is slightly less than 4 dB. Therefore, the total path loss is estimated 139 dB. The estimates of losses in some obstructed paths can be in error by several dB.

E-18 ESTIMATED PATH LOSS OVER RUGGED TERRAIN WITH MANY LARGE, ABRUPT CHANGES IN CONTOUR

. The main problem in estimating the path loss over rugged terrain is the determination of the equivalent reflecting plane. The equivalent reflecting plane can be determined by referring to the typical terrains in M, N, O, and P, figure E-12.

A In M, figure E-12, the equivalent plane is located at the average level of the long hilly expanse extending through the path. Sharp isolated peaks of unusual prominence are not considered in selecting the plane but are tested later as separate obstructions in estimating the path loss (paragraph E-17).

B In N, figure E-12, the long stretch of high land near the antenna at the right blocks and reflects an appreciable portion of the transmitted wave that would otherwise reach the lower valley floor directly. The reflecting plane, therefore, is sloped markedly from right to left. There is some freedom in the final selection for the plane as indicated in N, figure E-12. The center peak is treated as an obstruction in estimating the path loss (paragraph E-17).

C In O, figure E-12, a sloping line drawn in the approximate direction for the average terrain becomes the equivalent reflecting plane. The deep and narrow depressions in the center of the path are not important in defining the equivalent reflecting plane, because most reflections of consequence would, in this case, come from the broader hilltops. When the elevation of the antenna above the plane is small as in the antenna at the right of the profile, differences in the location of the plane can make appreciable changes in the estimated loss. Little can be done to eliminate this possibility of error.

D In P, figure E-12, the terrain, although rough, has a broad bulge in the center which makes the location of the equivalent reflecting plane difficult to determine. Several trail locations should be made to determine the sensitivity of the estimated path loss to changes in the trial location. The best answer is obtained by a study of the results of the computations from these trial locations. In the particular case shown, a curved earth profile formed by tilting the surface of a 4/3-radius earth to an average position gives a result similar to that of the flat earth computation (paragraph E-17).

l The procedure for estimating the path loss over a rugged terrain is as follows:

A Determine the equivalent reflecting plane for the terrain by reference to M, N, O, or P of figure E-12 and to the general procedures outlined in A above,

B Determine the free-space loss for the hop distance and operating frequency from the data in figure E-7.

C Determine the auxiliary loss over the path by using figure E-18 and the procedure in paragraph E-16.

D Determine the shadow loss from any obstructions in the path, The shadow loss is determined by one of two methods, depending on the range of antenna heights, The antenna heights are taken as the respective perpendicular distances from the two antennas to the equivalent reflecting plane,

1 For low antennas (with path obstructions disregarded) that are not high enough to attain free-space loss, the shadow loss for each obstruction is obtained from figure E-19 by using the procedure in paragraph E-17. The antennas are not high enough to give free-space loss when—

$$\frac{fh_1h_2}{D \times 10^6}$$

is less than 0,47. In the above equation, f is the operating frequency (MHz), h, is the height of antenna No. 1 over the equivalent reflecting plane (feet), h_2 is the height of antenna No. 2 over the equivalent reflecting plane (feet), and D is the length of the hop (miles).

E-18. ESTIMATED PATH LOSS OVER RUGGED TERRAIN WITH MANY LARGE, ABRUPT CHANGES IN CONTOUR

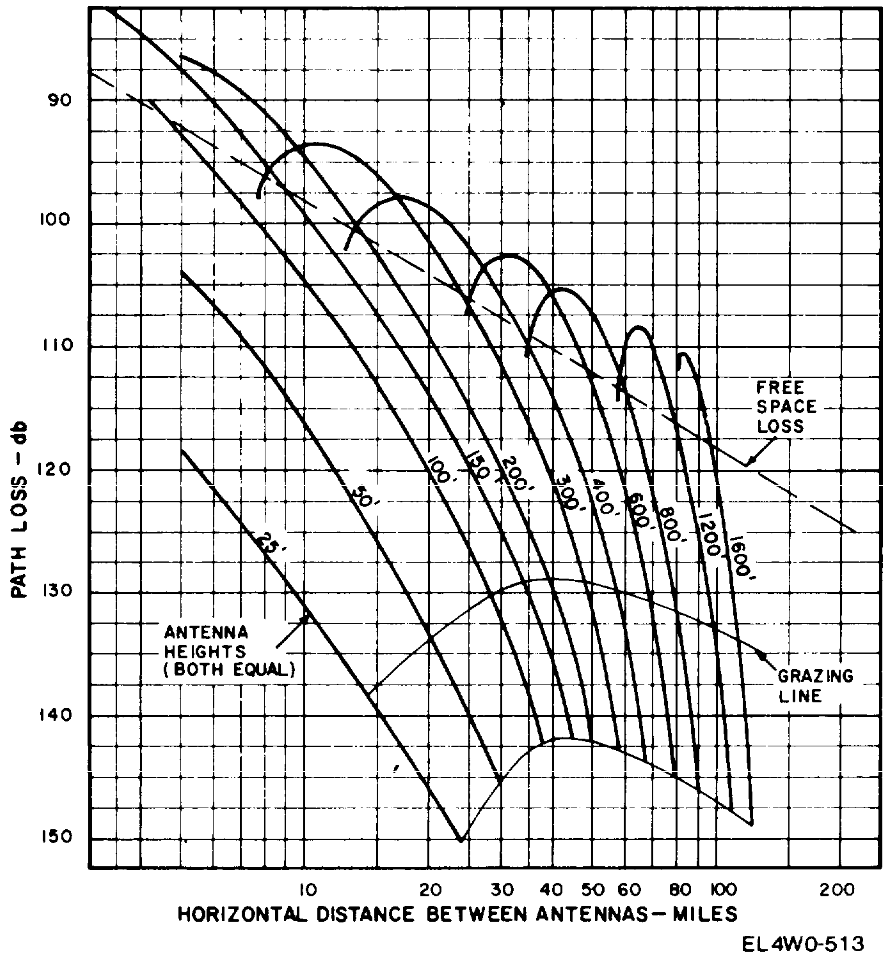

Figure E-13. Path Loss Between Half-Wave Dipoles Over Smooth Curved Earth at 200 MHz

2 For high antennas (with path obstructions disregarded) that are high enough to obtain free-space loss, the shadow loss for each obstruction is obtained from figure E-20 by using the procedure in paragraph E-17. The antennas are high enough to give free-space attenuation when—

$$\frac{fh_1h_2}{D \times 10^6}$$

is greater than 0.47.

E Add the loss value obtained in B through D above, except when the value obtained in C above is negative, in which case it should be neglected. This is the total estimated loss for the path.

E-18. ESTIMATED PATH LOSS OVER RUGGED TERRAIN WITH MANY LARGE, ABRUPT CHANGES IN CONTOUR - Continued

I The following are examples of the procedures outlined above:

A If in N, figure E-12, the antennas have heights of 400 to 250 feet above the equivalent reflecting plane and are separated by 25 miles with a 100-foot obstruction penetrating the line of sight at a point 8 miles from the antenna at the left, the path loss at 300 MHz is determined as follows:

Free-space loss (fig, E-7)=110 dB

$$\frac{fh_1h_2}{D\times10^6}=\frac{(300\times400\times250)}{25\times10^6}=1.2$$

Auxiliary loss (figure E-18)=–6 dB

Smooth earth loss=free-space loss (neglecting auxiliary loss, since it is negative)

Because—

$$\frac{fh_1h_2}{D\times10^6}$$

is greater than 0.47, figure E-20 is used to determine the obstruction shadow loss.

For a 100-foot obstruction at a distance of 8 miles, the shadow loss is found to be 11 dB. This is added to the free-space loss, giving a total estimated path loss of 110 plus 11 which equals 121 dB. The result is only an estimate for a complicated situation and can be in error by 10 dB or more,

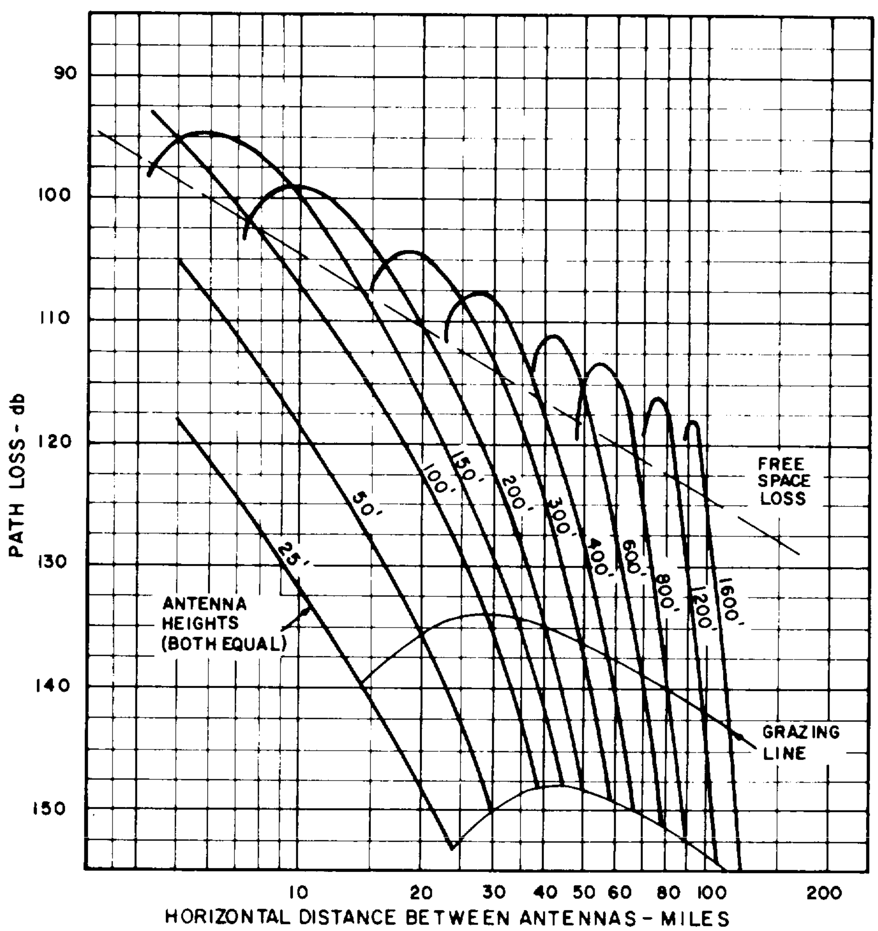

Figure E-14. Path Loss Between Half-Wave Dipoles Over Smooth Curved Earth at 400 MHz

E-18. ESTIMATED PATH LOSS OVER RUGGED TERRAIN WITH MANY LARGE, ABRUPT CHANGES IN CONTOUR - Continued

B If in O, figure E-12, the antenna heights are 140 and 75 feet, the path loss at 300 MHz and 25 miles is determined as follows:

Free-space loss (fig. E-7)=110 dB

$$\frac{fh_1h_2}{D\times10^6}=\frac{(300\times140\times75)}{25\times10^6}=0.126$$

Auxiliary loss (figure E-18)=–12 dB

Smooth earth loss=free-space loss+auxiliary loss
=110+12=122dB

Because—

$$\frac{fh_1h_2}{D\times10^6}$$

is less than 0.47, figure E-19 is used to determine the obstruction shadow loss. However, because the ridge shown in O does not go above the line of sight between the antennas, it is assumed that no shadow loss occurs. If the terrain is similar to either N or P of figure E-12, a shadow loss will occur.

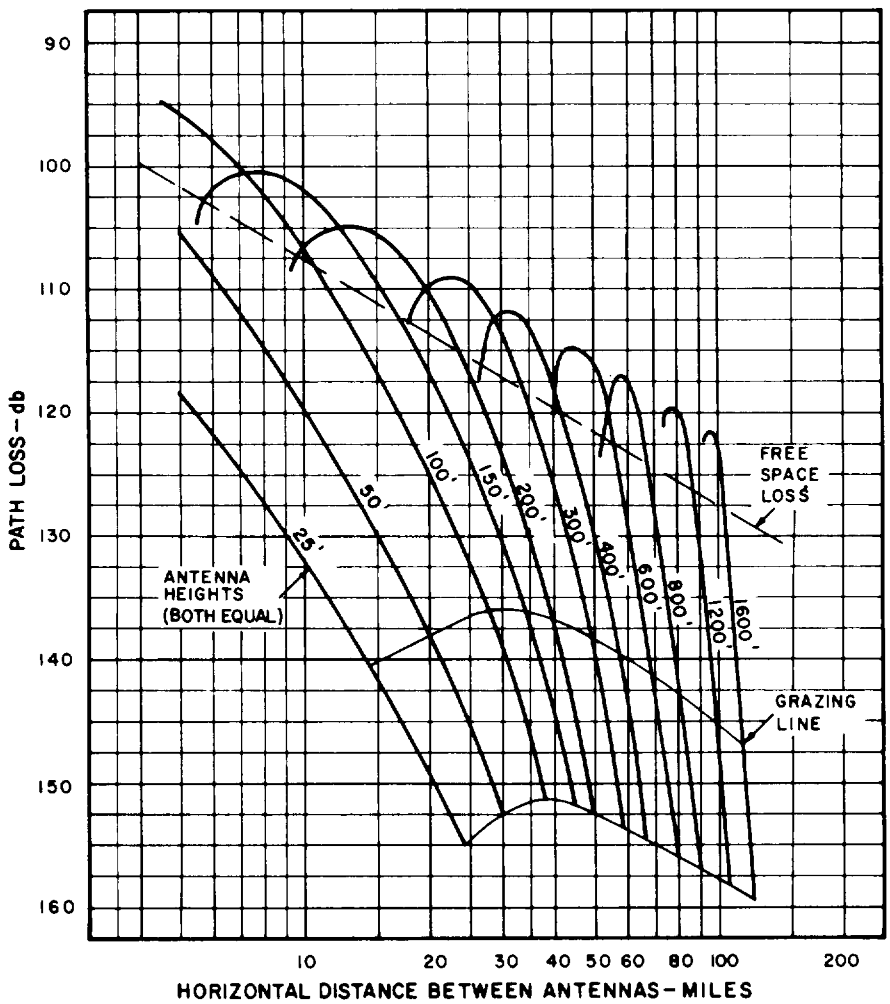

Figure E-15. Path Loss Between Half-Wave Dipoles Over Smooth Curved Earth at 600 MHz

E-19. USE OF OBSTACLES TO OBTAIN LONG TRANSMISSION PATHS

Successful UHF communication over very long paths across mountainous terrain is sometimes possible because of the presence of a large obstacle near the center of the transmission path. The actual contour of the terrain is the deciding factor in whether the system will function satisfactorily. In general, the higher the obstacle, the better the results obtained. To determine whether this method can be used at a given location, tests with the radio set at the actual location should be made.

E-20. SELECTION OF OPERATING FREQUENCIES FOR ISOLATED ROUTE

s GENERAL (FIGURE E-21)

A Suitable equipment and good antenna sites are not enough to insure a satisfactory radio-relay circuit. Operating frequencies must be obtained from the assignment authority; these must be chosen so as to be free from interference.

B The frequency band used in a particular case must fit the type of radio-relay system used, Within a particular band, frequencies for radio-relay use in a given area should be chosen to avoic mutual interference. If there is some freedom of choice, frequencies that are best propagated should be chosen; higher frequencies should be used for short hops and for hops over smooth terrain; lower frequencies should be used for longer hops or for obstructed paths.

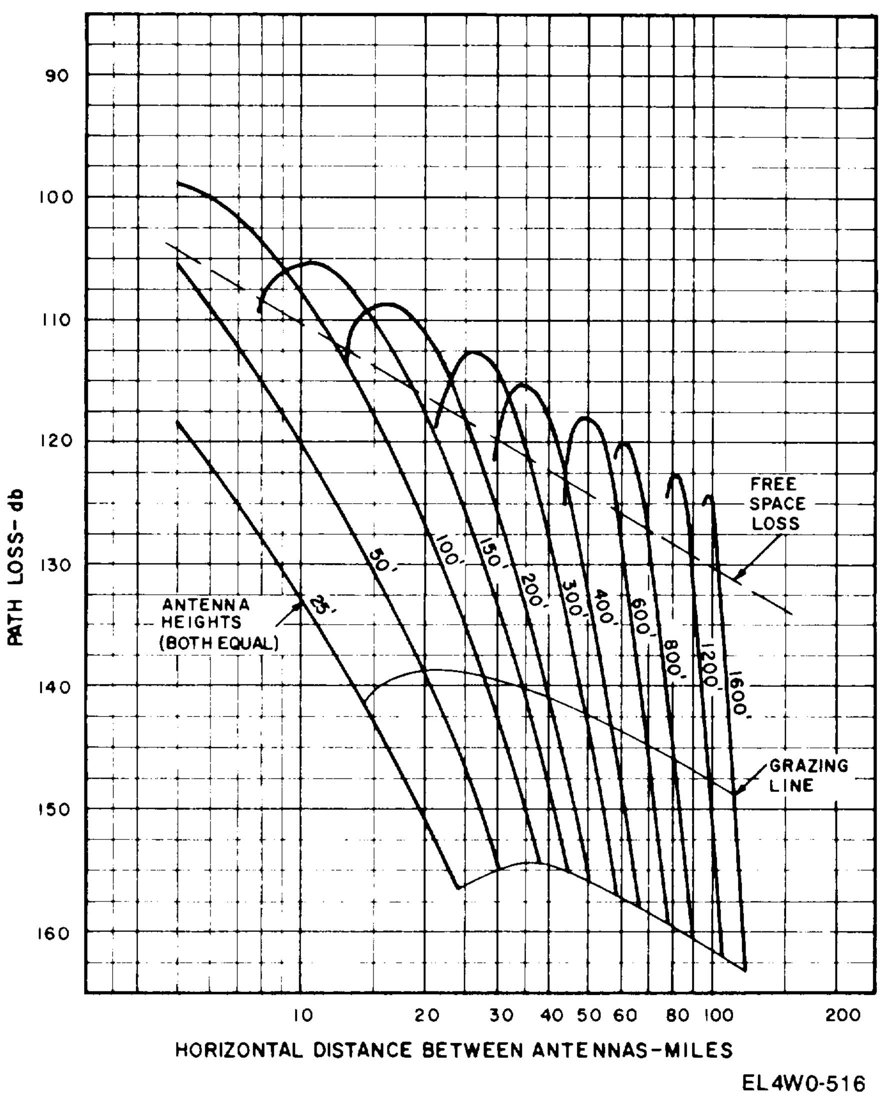

Figure E-16. Path Loss Between Half-Wave Dipoles Over Smooth Curved Earth at 800 MHz

E-20. SELECTION OF OPERATING FREQUENCIES FOR ISOLATED ROUTE - Continued

. Determining Operating Frequency From Channel Number and Channel Number From Operating Frequency

A The AN/GRC-103(V)1 has 370 channels which are 0.5 MHz apart. To find the operating frequency when only the channel umber is known, use the following equation:

$$\text{Frequency (M Hz)} = \frac{\text{Channel No.}}{2} + 200$$

For example, the frequency of channel 73 is—

73/2+200=36.5+200=236.5MHz.

B To find the channel number that corresponds to a given frequency, transpose the equation in (A) above:

Channel No.=2XFrequency (MHz)

For example, the number of the channel that has a frequency of 260 MHz is—2X260 –400=1 20.

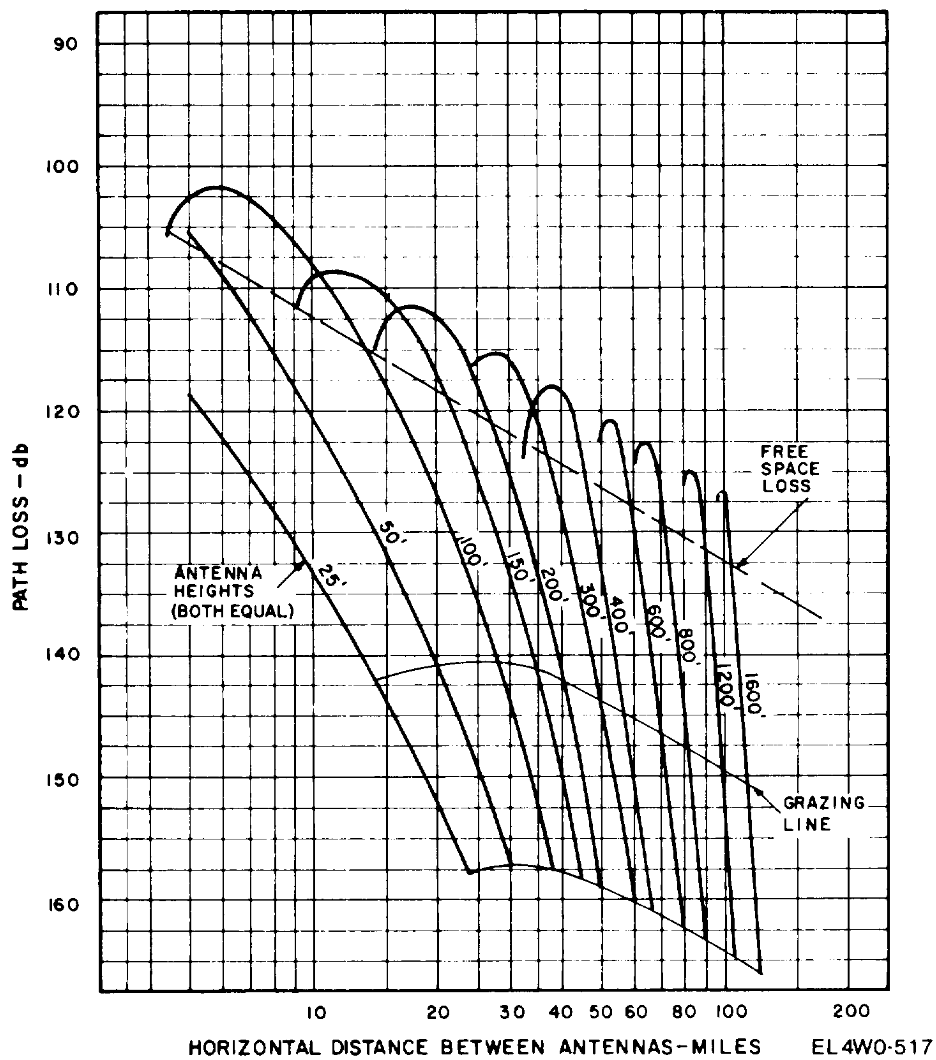

Figure E-17. Pathless Between Half-Wave Dipoles Over Smooth Curved Earth at 1,000 MHz

E-20. SELECTION OF OPERATING FREQUENCIES FOR ISOLATED ROUTE - Continued

. GUARD BANDS

A At UHF, the transmitting frequencies at a station must be well separated from the receiving frequencies to guard against transmitter-to-receiver interference. Accomplish this by setting up an adequate frequency guard band of 16.5 MHz (33 channels) and keeping the transmitting frequencies on one side of the guard band and the receiving frequencies on the other side.

B To insure that an adequate guard band is provided when selecting the transmitting and receiving frequencies, refer to minimum transmitter to receiver channel separation characteristics paragraph 1-18 (Performance of Radio Receivers) and to the receiver overload chart (figure E-31), as discussed in paragraph E-27.

C The receiving frequencies at a station must be well separated from each other to guard against receiver-to-receiver interference. Accomplish this by operating the receivers so that at least three unused frequency channels separate the operating frequency of any two receivers.

.AVOIDING INTERFERENCE

The following method of choosing frequencies will give the greatest freedom of tactical action for an isolated route. (An isolated route is one which does not cross or connect with any other radio-relay routes.) Divide the frequency channels available for use into two blocks that contain equal numbers of channels, and arrange them so that each channel in the lower-frequency block may be paired with a channel in the higher-frequency block, that is, separated from the lower channel by at least 16,5 MHz. At each station, assign the transmit channels from one block and the receive channels from the other block. The arrows in the upper portion of figure E-21 indicate that in any hop, channels in block A are oppositely directed to channels in block B. Arrange the block as shown in the lower portion of figure E-21. This is called the two-block method with wide guard band.

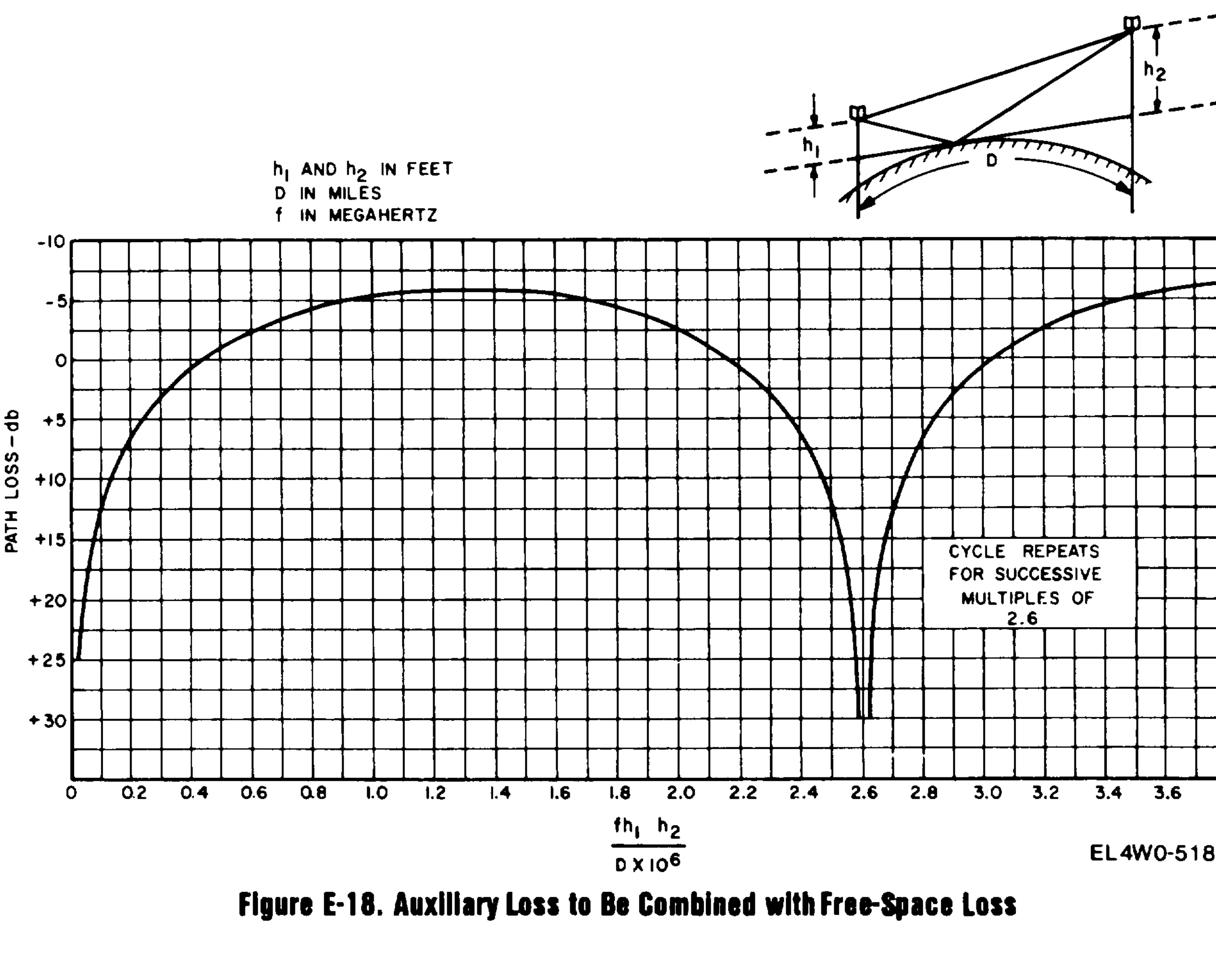

Figure E-18. Auxiliary Loss to Be Combined with Free-Space Loss

E-21 . SELECTION OF OPERATING FREQUENCIES AT MULTIPLE TERMINAL AND REPEATER POINTS

The possibility of cross-modulation must be considered when a number of radio equipments are located at one site. Power from one transmitter entering the antenna of another radio set may result in cross-modulation. New frequencies produced may fall into the rf channel frequency range of a receiver at the same site. Similarly, power from two nearby transmitters may enter the rf stages of a receiver tuned to another frequency, cross-modulate in this receiver, and produce new frequencies in the receiver. Such effects are most likely to be serious when all the frequencies concerned are close; under these conditions, there is little selectivity available to help reject them. A typical case is when two frequencies A and B, produce others, 2A minus B or 2B minus A, which fall in the frequency range near the tuned frequency of the receiver. Additional transmitters operating at a given site increase the possibilities of cross-modulation. A general plan that will guard against the worst cross-modulation effects is to provide frequency separation between transmitting and receiving frequencies at a site by using the methods described in paragraphs E-20 and E-23 through E-26.

E-22. SELECTION OF OPERATING FREQUENCIES FOR PARALLEL SYSTEMS

The usual troubles in parallel systems are the same as those encountered at multiple terminal and repeater points (paragraph E-21). To minimize interference, use the procedure outlined in A through F below for arranging the frequency layout on a UHF route that contains parallel systems.

A Determine the number of RF channels needed for each system on the route by using the two-block procedure (paragraph E-20). Allow for expected traffic growth on the route.

B Make a tentative frequency plan according to the principles given in paragraph E-20.

C Request the necessary RF channels from the assignment authority. The RF channels assigned may differ from those requested.

D Make a frequency plan with the assigned RF channels (paragraph E-20). If there is still trouble, try to obtain frequency assigment changes from the assignment authority,

E As soon as the radio systems are set up, operate them to see whether they are free of interference.

F When a new radio system is set up, try it with the existing sytems to see whether there is mutual interference.

E-22. SECTION OF OPERATING FREQUENCIES FOR PARALLEL SYSTEMS - Continued

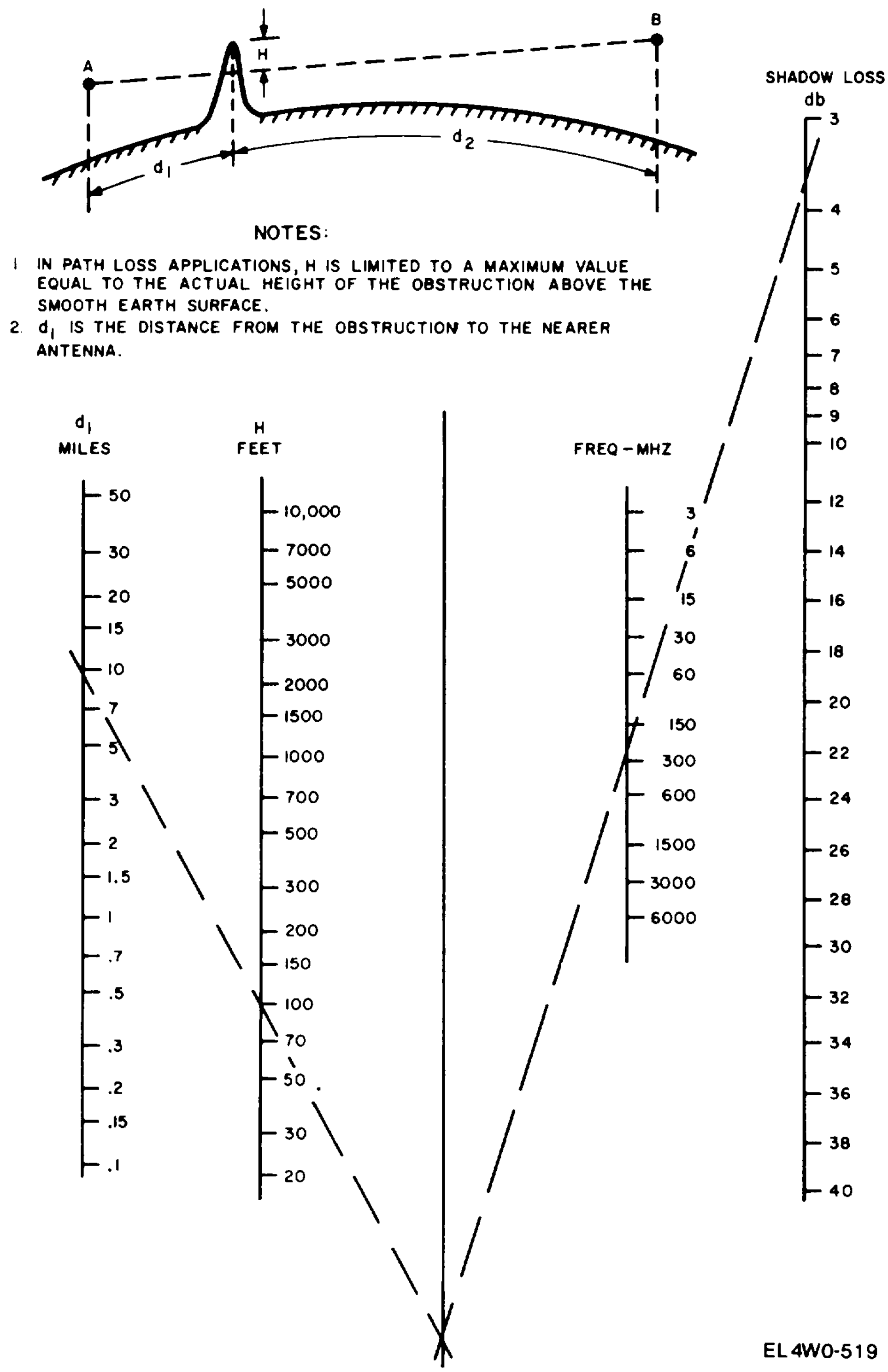

Figure E-19. Shadow Loss Caused by Obstruction, Relative to Smooth Earth

E-22. SECTION OF OPERATING FREQUENCIES FOR PARALLEL SYSTEMS- Continued

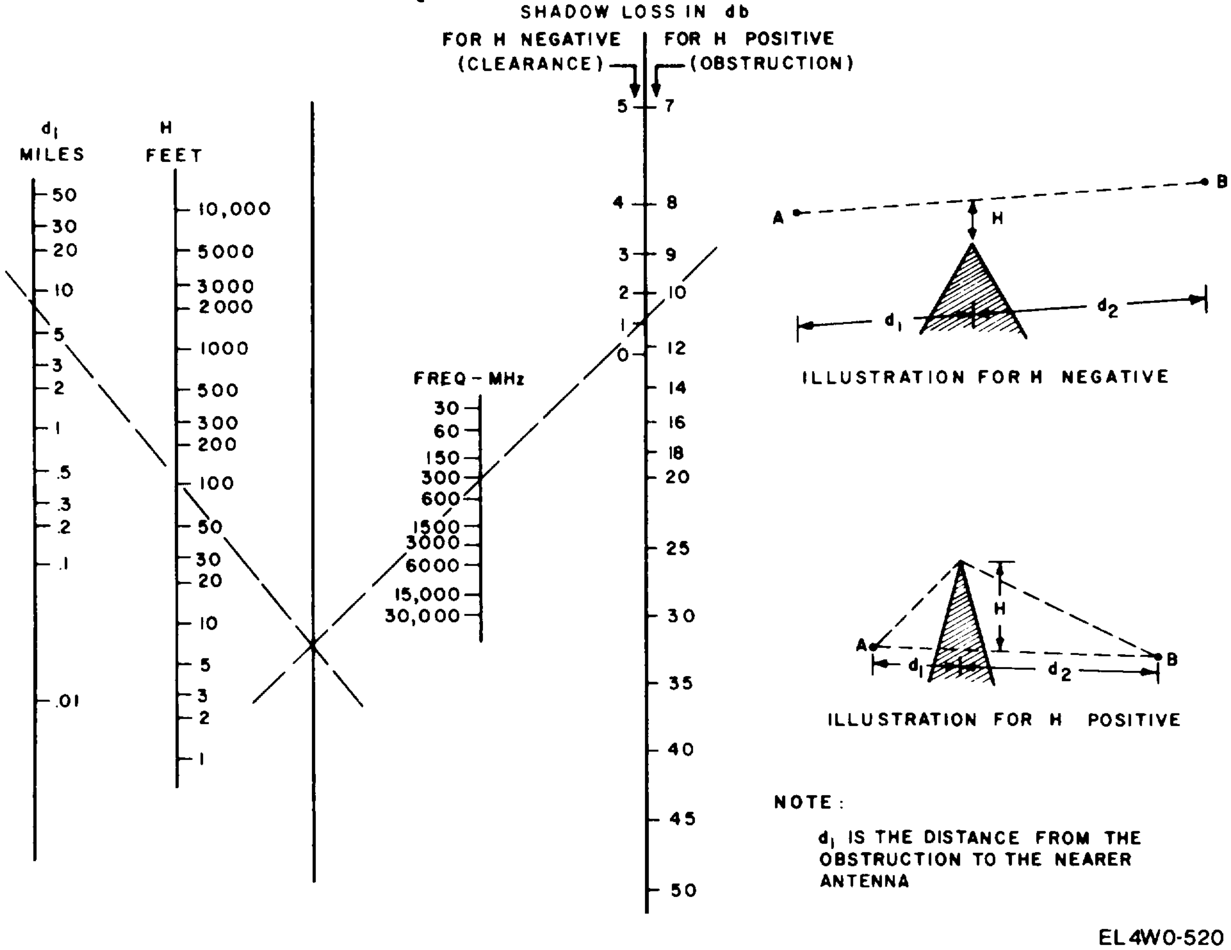

Figure E-20. Shadow Loss Caused by Obstruction, Relative to Free Space

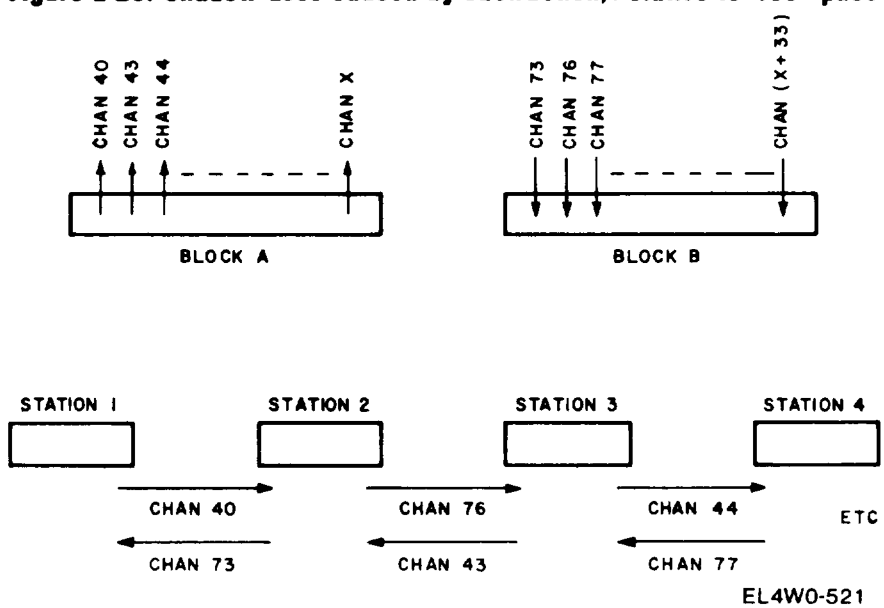

Figure E-21. Two-Block Method of Frequency Selection

E-23. SELECTION OF OPERATING FREQUENCIES FOR INTERCONNECTING OR CROSSING SYSTEMS

When planning a great number of radio systems that interconnect or cross at various points, the two-block method of planning (paragraph E-20) can be used. The difficulty when using the two-block method of planning for interconnecting or crossing systems is that both the transmitting and receiving frequencies planned for a site may fall into the same block and result in transmitter-to-receiver interference at the site. If the frequency channels on one of the routes are reassigned, the difficulty frequently clears up at one station, only to reappear at another station. Expedients can sometimes be worked out, but as soon as the military situation changes, the difficulty is likely to reappear, forcing another set of frequency changes and another set of expedients. Three different plans for solving the difficulties encountered with interconnecting or crossing systems. are given in paragraph E-24. The difficulties of interconnecting or crossing radio systems are shown by the three sample situations below,

l TRIANGLE SITUATION

Figure E-22 shows three radio stations connected by three single-hop radio systems. Assume that only two blocks of frequencies, A and B, are available.

A At station 1, if all the transmitting frequencies are assigned to block A and all the receiving frequencies are assigned to block B, then at stations 2 and 3, transmitting frequencies are in block B and receiving frequencies are in block A.

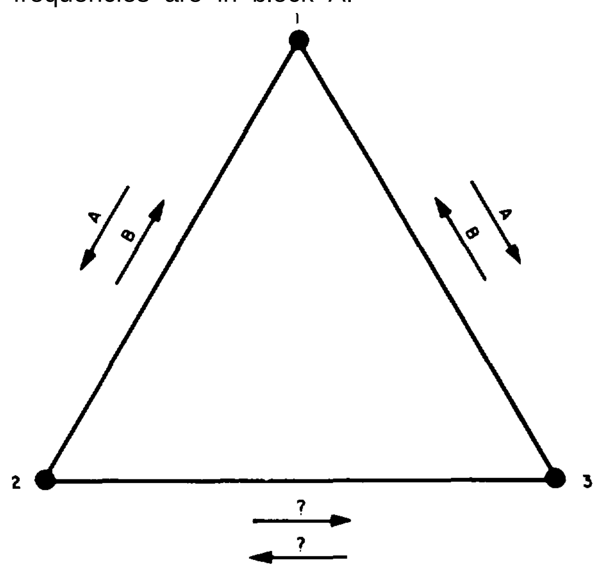

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Figure E-22. Triangle Situation

B With only blocks A and B available, there is no simple way of planning interference-free radio communication between stations 2 and 3.

l ODD-AND-EVEN SITUATION

The odd-and-even situation (figure E-23) is similar to the triangle situation (A above). Figure E-23 shows alternate routes between radio stations 4 and 8. One of the routes contains an odd number of hops and the other an even number.

l REENTRANCE SITUATION

The reentrance situation occurs when the same group of frequencies at a given station is used for transmitting on one route and receiving on another. At this station, the communication network is reentrant. Reentrance can be avoided by replacing a radio system by wire on the route that causes the reentrance, so that the group of frequencies which are reentrant are used only for transmitting, or only for receiving at the station.

E-23. SELECTION OF OPERATING FREQUENCIES FOR INTERCONNECTING OR CROSSING SYSTEMS - Continued

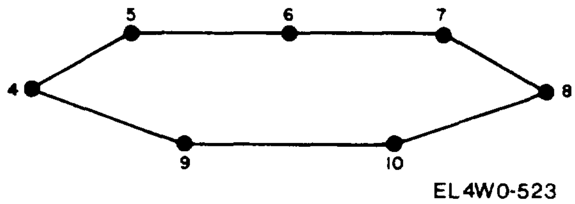

Figure E-23. Odd-And-Even Situation

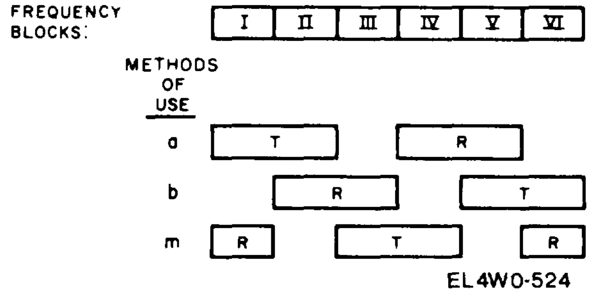

Figure E-24. A, B, M Plan for Frequency Selection

E-24. SOLVING DIFFICULTIES WITH INTERCONNECTING OR CROSSING SYSTEMS

Three plans to solve difficulties with interconnecting or crossing radio systems are given in A through C below. The type of plan for an area should be chosen before making RF channel assignments to particular routes in the area. Planning will be easier if this area includes the whole theater.

I SIX-BLOCK A, B, M PLAN

A **Advantages.** The a, b, m plan divides a broad frequency region (all or a large part of a band allocated) into six frequency blocks of suitable widths. RF channels obtained are divided approximately equally among the blocks. The basic planning is then done in terms of these blocks. This results in the following advantages:

1 Any station can be connected with nearly any other station with a minimum effect on the rest of the network.

2 Planning is simplified.

3 Quick changes are accomplished simply.

4 Guard blocks at one station are used for frequency assignments at some other station, so that none of the frequency space allocated has to be barred from use.

5 Rf channels need not be scattered over the total band,

B **Description.**

1 Block widths, Where the six frequency blocks are contiguous, that is, there is no frequency space between them, the width of each block must be at least as great as the required transmitter-to-receiver frequency separation specified in paragraph 1-18 (Performance of Radio Receivers). Therefore, if any block is not used at a particular station, it will serve as a ide guard band sufficient to prevent transmitter-to-receiver interference at the station. This wide guard band block will be used at other stations in the a, b, m plan.

2 A, b, m blocks. Figure E-24 shows the six frequency blocks I through VI and three methods of using these blocks, namely: a, b, and m. The use of the symbols a, b, and m is helpful in planning. One of these symbols is assigned to each radio station to identify the group of frequencies that may be used to transmit at that station and the group that may be used to receive. Particular transmitting and receiving RF channels for each station are then selected from these respective groups. For example, when method a is used at a particular station, then, as shown in figure E-24, frequencies that lie in block I or II can be used as transmitting frequencies at that station and frequencies that lie in block IV or V can be used as receiving frequencies at that station. When method b is used at a radio station one hop away, frequencies in block II or Ill can be used there as receiving frequencies and those in block V or VI as transmitting frequencies. Therefore, in a single hop between a station labeled a and one labeled b, frequencies in block II can be used to transmit from a to b and those in block V can be used to transmit from b to a. Similarly, if the symbol m is assigned to a third station that is one hop from a on another route, frequencies in block I can be used to transmit from a to m and those in block IV can be used to transmit from m to a.

E-24. SOLVING DIFFICULTIES WITH INTERCONNECTING OR CROSSING SYSTEMS - Continued

3 Application to triangle situation. To solve the triangle situation (figure E-25) write the letters a, b, and m, at the three stations. This procedure automatically results in assigning frequency blocks as shown in figure E-25; then, any available RF channels in those blocks may be assigned as shown, without creating any transmitter-to-receiver inerference. The particular RF channels assigned must be chosen from the available RF channels, so that the rules for separation between receiving frequencies at a station (paragraph E-20) are observed.

4 Assignment of specific RF channels. For an example of how specific RF channels are assigned according to the a, b, m plan, supposed that, in the triangle situation, two parallel radio systems are required in the band of 220 to 404.5 MHz on each hop. Use the symbolic solution shown in figure E-25, and request two channels at least 1.5 MHz apart in each of blocks I to Vl. Assume that Rechannels 42,46,50,56,61, 70, 102, 105, 109, 121, 130, and 134 are assigned. Figure E-26 illustrates how these RF channels are arranged. They can be paired in the two circuits in any manner desire. Again, assume that interference from some unknown source, not traceable, appeared in RF channel 42, so that a substitute channel was needed. Any other available channel could be substituted in block 1, except channels 45 and 47 (which are too close to channel 46), without affecting the rest of the network.

5 Application to odd-and-even situation. Two different methods of assigning a, b, m symbols to solve the odd-and-even situation are shown in figure E-27. When using the a, b, m plan for the odd-and-even situation, write out the frequency block layouts corresponding to each of methods a, b, and m shown. Also, determine at least one other way of assigning a, b, m symbols to solve the odd-and-even situation. The frequency blocks are automatically arranged to avoid difficulty in choosing RF channels for any cross-links that may be desired between two radio systems.

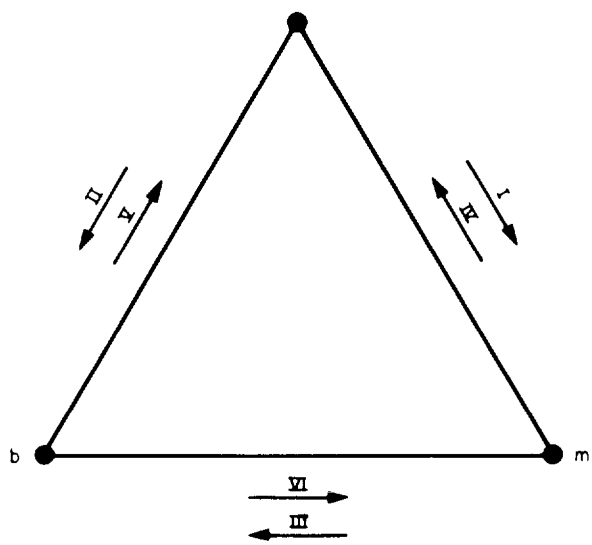

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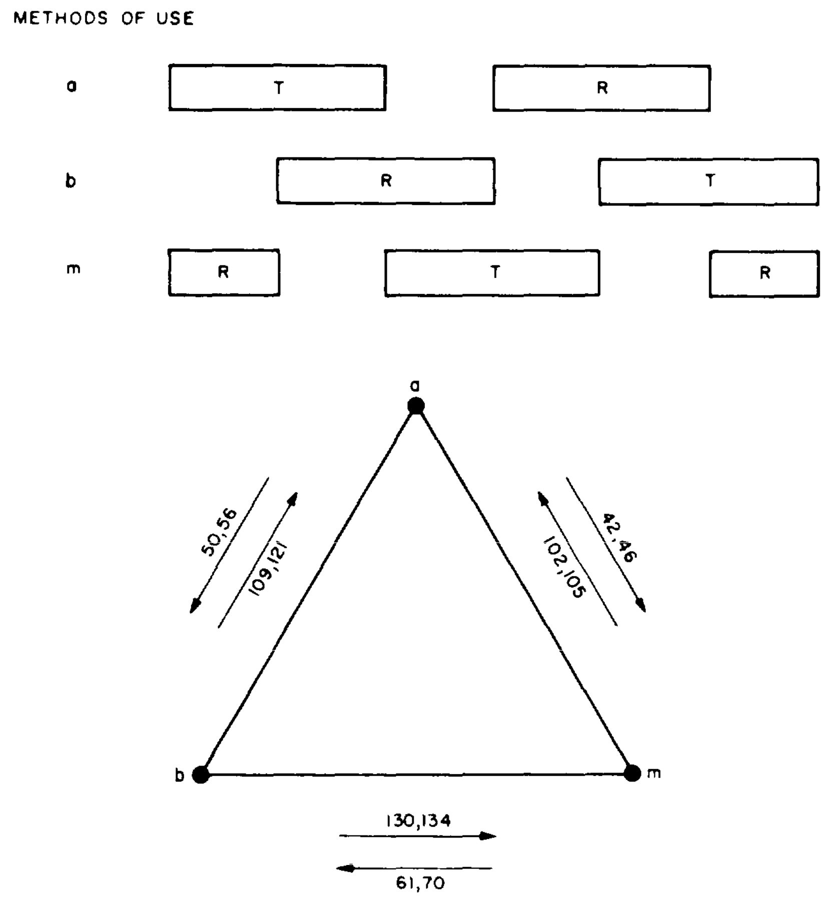
Figure E-25. A, B, M Solution of Triangle Situation

6 Application to large network. As a further example, a large network is shown on figure E-28. Only one of many-possible ways of assigning a, b, m symbols is shown. In practice, some of the hops would be wire, instead of radio, or wire paralleled by a radio system. Also, different kinds of radio sets would be used in various places, and additional hops would probably exist, such as to supply points or to other headquarters.

7 Noncontiguous blocks. The edges of successive frequency blocks need not touch each other. The difference between the top frequency used in any block and the bottom frequency used in the block (which is two blocks above it and separated by one other block) should be at least 16.5 MHz. This method assures the required guard band (paragraph E-20).

E-24. SOLVING DIFFICULTIES WITH INTERCONNECTING OR CROSSING SYSTEMS - Continued

BLOCKS	I	II	III	IV	V	VI
CHANNELS	42,46	50,56	61,70	102,105	109,121	130,134



EL4W0-526

Figure E-26. Sample Channels for Triangle Situation

8 Multiples of six blocks. If adjacent broad bands of frequencies are divided into six blocks each to use the a, b, m plan in each broad band of frequencies, the arrangement for the first six blocks should be repeated in the next six (block VII would be similar to block 1, etc). Follow this method to avoid transmitter-to-receiver interference at the common edge of the two broad bands of frequencies.

9 Application to different types of radio-relay sets. If the frequency widths of the blocks are properly chosen, different types of radio-relay sets can share the blocks.

I DOUBLE A, B, M PLAN

A **Purpose.** If the traffic load on a particular route is so great that, with the RF channels available, use of the a, b, m plan becomes difficult, the double a, b, m plan should be used.

E-24. SOLVING DIFFICULTIES WITH INTERCONNECTING OR CROSSING SYSTEMS - Continued

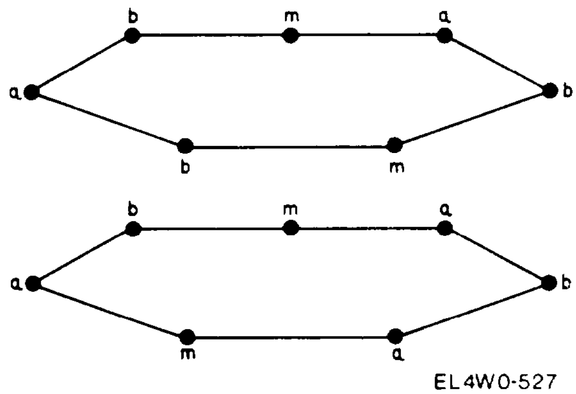


Figure E-27. A, B, M Solution of Odd-And-Even Situation

B **Explanation of Plan.**

1 The double a, b, m plan uses the same six frequency blocks as the single a, b m plan The double a, b, m plan uses methods a, b, and m of employing these blocks and also three more methods, a’, b’, an m’. Figure E-29 owns all six methods and also ows that a station labeled a can communicate with a station one hop away labeled a’ Four of the six frequency blocks can be used for communication between a and a’ (two blocks in each direction). Thus, a heavy traffic route could be made up of radio stations labeled a, a’, a, a’, and so forth. Similarly, b and b’ or m and m’ could be used.

2 Assume that the symbol a is assigned to a particular station designated S. Then, on a heavy traffic route, the station one hop away from S could be assigned the symbol a’. On a lighter traffic route, the station one hop away from S could be assigned the symbol b or m.

3 The series of symbols with nonprime and prime letters (a, a' or b, b' m, m') is not limited to heavy traffic routes only. However, the single a, b, m series or the single a', b', m' series is better for the lighter traffic routes because it permits a greater number of interconnections.

A route can be made up partly of one series of symbols and partly of another, such as a', a,
4 b', m'. Symbol ifts of this kind help in making interconnections.
b’, m’. Symbol ifts of this kind help in making interconnections.

C **Example.** One example of the double a, b, m plan is the case illustrated in figure E-28. If the route from X to Y in this figure were required to carry more traffic than could be handled with available a, b, m frequencies, the double a, b, m plan could be used on this route merely by changing b to m’ at stations Z and W

. X-Y PLAN

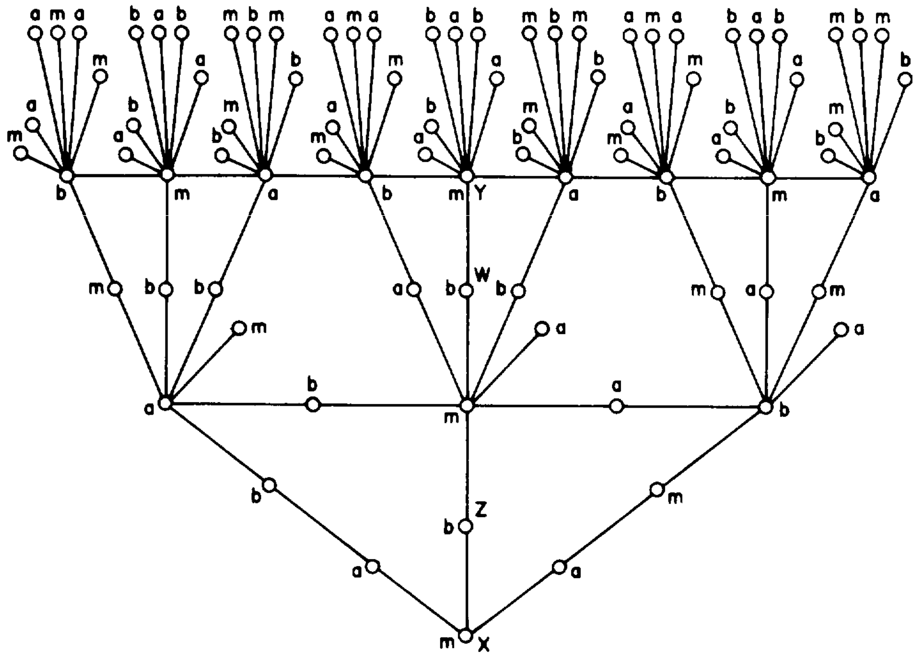
A Purpose. The x-y plan is used when planning a very heavy traffic route. This plan is not as flexible as the previous plans (a, b, m and double a, b, m), and for flexibility, it relies on interconnection with them. Interconnection between the x-y plan and the a, b, m or double a, b, m plan can be determined by the planning officer if needed.

B **Explanation of Plan.**

1 The x-y plan uses the same six frequency blocks as the a, b, m and double a, b, m plans (figure E-30). Stations labeled x and y can communicate with each other (without mutual interference) by using rf channels in four frequency blocks (two in each direction).

2 If adjacent broad bands of frequencies are divided into six blocks each to avoid transmitter-to-receiver interference in using blocks VI and VII. then a station using method x in one of the broad bands of frequencies should use method y in the adjacent broad band, and conversely. This procedure would practically eliminate interconnection possibilities with a, b, m, plans, it both x-y and a, b, m plans were used in both of the broad bands of frequencies. Such a problem could be avoided by placing a guard band between the two broad bands of frequencies and by using method x at the same stations in both bands or by using the x-y plan in only one of the two broad bands of frequencies.

E-24. SOLVING DIFFICULTIES WITH INTERCONNECTING OR CROSSING SVSTEMS - Continued



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NOTES

1. O INDICATES RADIO RELAY STATION (INTERMEDIATE OR TERMINAL).
2. O—O INDICATES A HOP WITH ITS TWO STATIONS.
3. SYMBOLS a, b, m INDICATE THE ASSIGNMENT OF TRANSMITTING AND RECEIVING FREQUENCY BLOCKS AT EACH STATION.
4. SYMBOLS X, Z, W, Y INDICATE A HEAVY TRAFFIC ROUTE.

Figure E-28. Sample A, B, M Solution of Large Network

E-25. ADVANTAGES OF USING CROSS-POMRIZATION, SEPARATE MASTS, AND ANTENNA DIRECTIVITY

. CROSS-POLARIZATION

Sometimes antennas on neighboring antenna masts may be cross-polarized to advantage. Cross-polarization consists of having one antenna polarized in one plane (horizontal or vertical) and the other antenna polarized in the other plane. Cross-polarization results in a greater isolation between antennas on the same or neighboring masts and permits the separation between transmitting and receiving frequencies on these antennas to be much smaller than with noncross-polarized antennas (paragraph E-20).

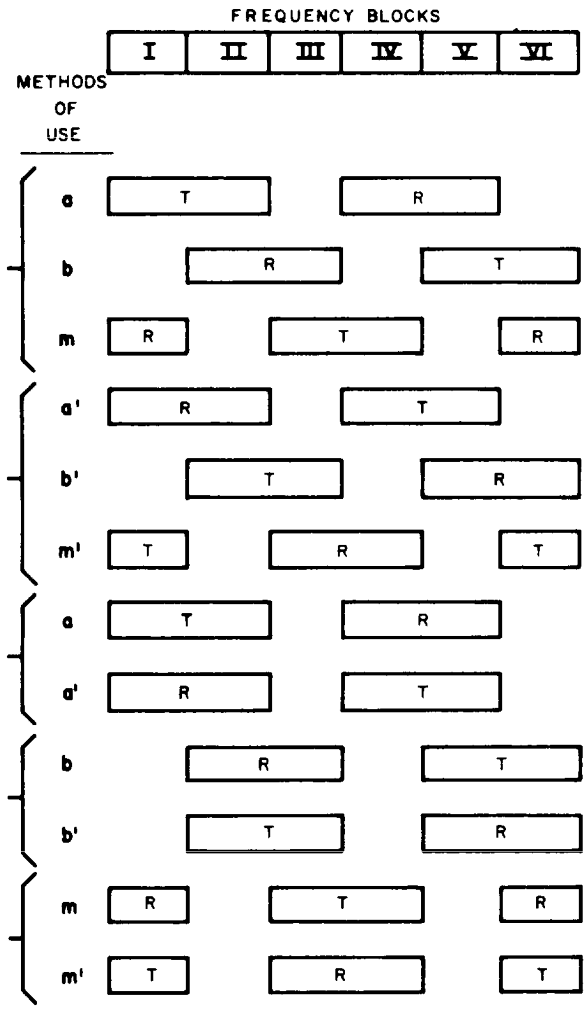
l SEPARATE MASTS

Use of separate masts for transmitters and receivers at a station will reduce the transmitter-to-receiver interference at that station. Roughly, the interfering voltage at the receiver input will be inversely proportional to the distance between antennas, and, therefore, the loss in the unwanted path will increase 6 dB for each doubling of this distance. If separate masts are used, the different antennas can be directed in different directions.

l ANTENNA DIRECTIVITY

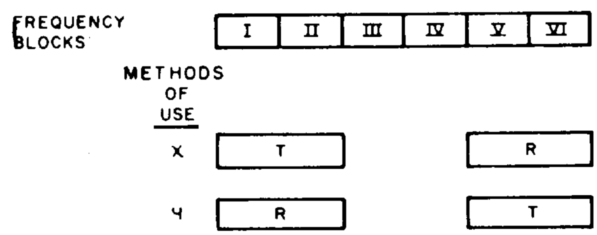
When the receiving and transmitting antennas are mounted on separate masts, the directivity characteristics of the antennas can be used to reduce crosstalk and mutual interference.

E-25. ADVANTAGES OF USING CROSS-POLARIZATION, SEPARATE MASTS, AND ANTENNA DIRECTIVITY



EL4W0-529

Figure E-29. Double A, B, M Plan



EL 4W0-530

Figure E-30. X-Y Plan

E-26. FIELD METHODS FOR MINIMIZING INTERFERENCE

A The antennas at a radio-relay station sometimes can be separated by repeater-spitting to reduce mutual interference. Repeater-splitting means that, at a radio-relay station (assuming east and west directions of transmission and reception), the east-looking and west-looking halves of the station are separated, and connected to each other by coaxial cable. Repeater-splitting requires more personnel than a conventional radio-relay installation and should be avoided if possible.

B If possible, the antennas for different systems at a radio station should be well separated laterally. This separation will reduce mutual interference between these systems.

C At multiple radio-terminal points, radio systems should be separated physically, if possible, by dividing them into groups and placing the groups in different combinations of antennas (parks). For example, at a given station, radio systems on different routes might be placed in different parks.

E-26. FIELD METHODS FOR MINIMIZING INTERFERENCE - Continued

D If physical separation of radio systems does not eliminate mutual Interference sufficiently, the frequencies that are interacting should be separated (see a, b, m, double a, b, m, or x-y plans in paragraph E-24). A procedure to determine which frequencies at a site are mutually interfering is described in E below.

E To determine the mutually interfering frequencies, first determine at which site (receiver) in the radio system the interference is entering the system (1 below). Next, determine which frequencies at that site are causing the interference (2 below).

1 In sequence, turn off each receiver that affects transmissions in the direction in which interference is encountered. Start with the receiver farthest from the end of the telephone system where Interference is observed, and progress toward that end of the system. If the interference is noted at the end of the telephone system that contains telephone terminal A, each receiver affecting B-to-A transmissions is, therefore, turned off in sequence, starting with the receiver at the radio-relay site farthest from telephone terminal A. If turning off a particular receiver causes the interference to disappear, the interference was entering the system at the site of that receiver. Turn on all receivers.

2 If the tactical situation permits, turn each of the transmitters at that site off and on in turn. Maintain order wire communication with the telephone terminal at which the interference is observed. Note which transmitter is off each time the interference disappears; this is the mutually interfering transmitter. The interference may be cleared by shifting the frequency of one or both interfering transmitters or by shifting the receiver frequency.

E-27. RECEIVER OVERLOAD CHARTS (FIGURES E-31 THROUGH E-34)

s GENERAL

The overload charts should be used to determine whether the receiver and transmitter are operating on compatible frequencies, after the frequencies have been assigned by the methods in paragraphs E-20 through E-26. Whenever the receiver channel and transmitter channel chart lines meet in a dark area of the chart, it is an indication that the transmitter output can enter the receiver and degrade its sensitivity or cause Interference. If the chart lines meet in the broad diagonal center section of the chart, enough transmitter power can enter the receiver to operate the receiver overload protection circuit, and automatically route all incoming signals to ground. The charts apply only to a transmitter and a receiver using the same antenna.

I RECEIVER OVERLOAD

When the receiver input signal exceeds +15 dBm, the overload protection circuit operates. With the transmitter and receiver operating on the same antenna system, sufficient attenuation is theoretically achieved when the transmitter frequency is 11 MHz away from the receiver center frequency. A working limit has been set to allow a safety margin in case of misalignmen. This limit for Bands I (see note below), II, and Ill is 25 MHz (50 channels) and for Band IV is 20 MHz (40 channels). It the transmitter and receiver are operated on separate antenna systems, allowing for a minimum isolation of 35 dB between antennas, separation between transmitter and receiver frequencies can be reduced to 6 MHz (12 channels). The isolation can be further improved by using vertical polarization for one antenna and horizontal polarization for the other (paragraph E-25).

NOTE

Above channel 119, receiver sensitivity can be degraded with transmitter-to-receiver channel separation of less than 88 channels (see below).

I BAND I FREQUENCY SENSITIVITY

Difference frequencies between transmitter and local oscillator are of sufficient amplitude to degrade receiver sensitivity, at transmitter-to-receiver channel separations of less than 88 channels. Channel separation between 33 and 88 channels wiII not result in a high signal alarm.

I SPURIOUS OVERLOADS

Multiples of the synthesizer frequency generating circuit output in the transmitter create spurious outputs that can be large enough to disable the receiver. All the receiver spurious responses, with the exception of the image response, are nonlinear functions of the interfering signal level and, therefore, cannot be determined, for levels other than rated transmitter power, by means of the overload charts.

E-27. RECEIVER OVERLOAD CHARTS -Continued

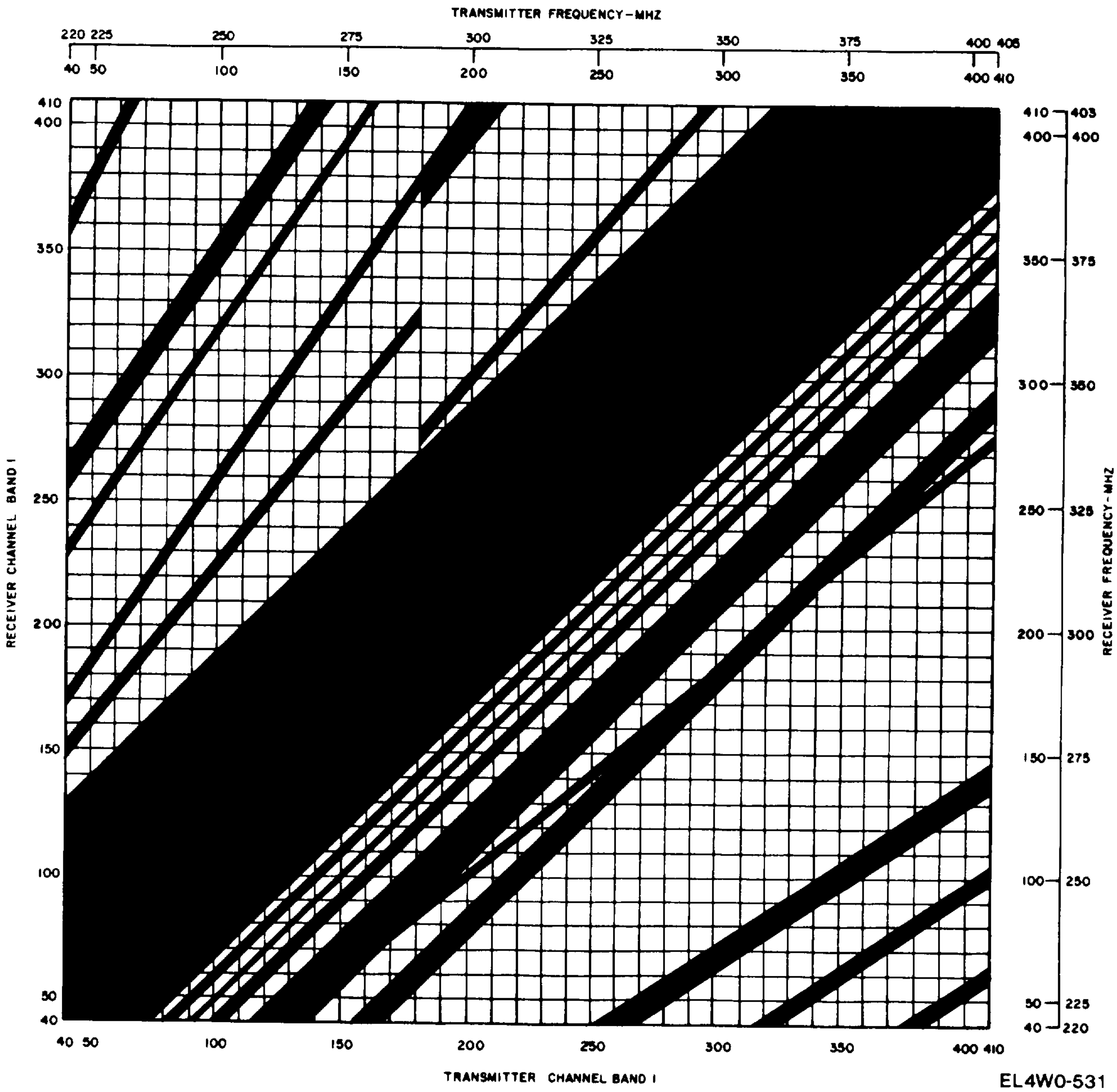


Figure E-31. Receiver Overload Chart, 220 to 405 MHz

E-27. RECEIVER OVERLOAD CHARTS - Continued

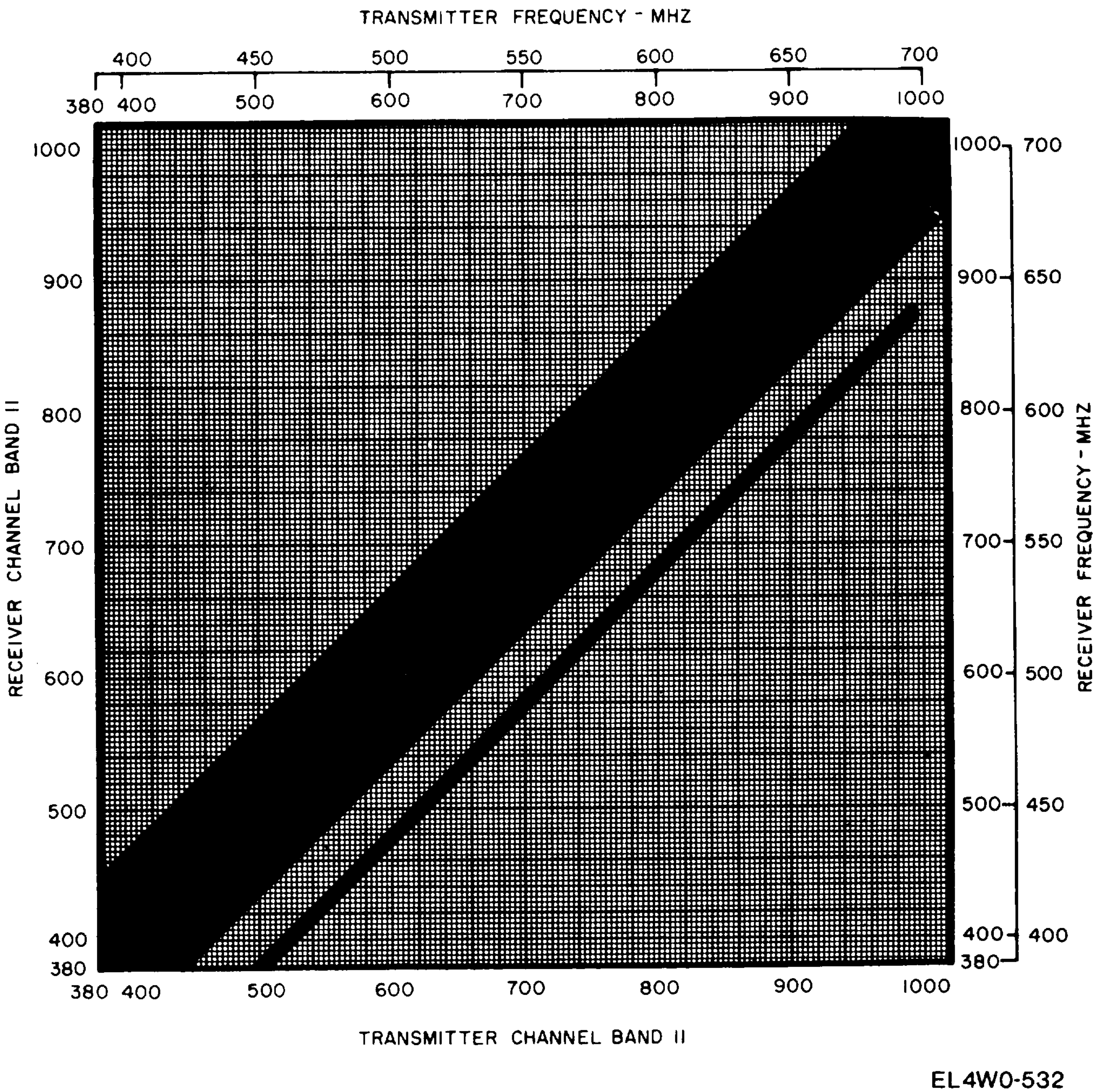


Figure E-32. Receiver Overload Chart, 395 to 705 MHz

E-27. RECEIVER OVERLOAD CHARTS - Continued

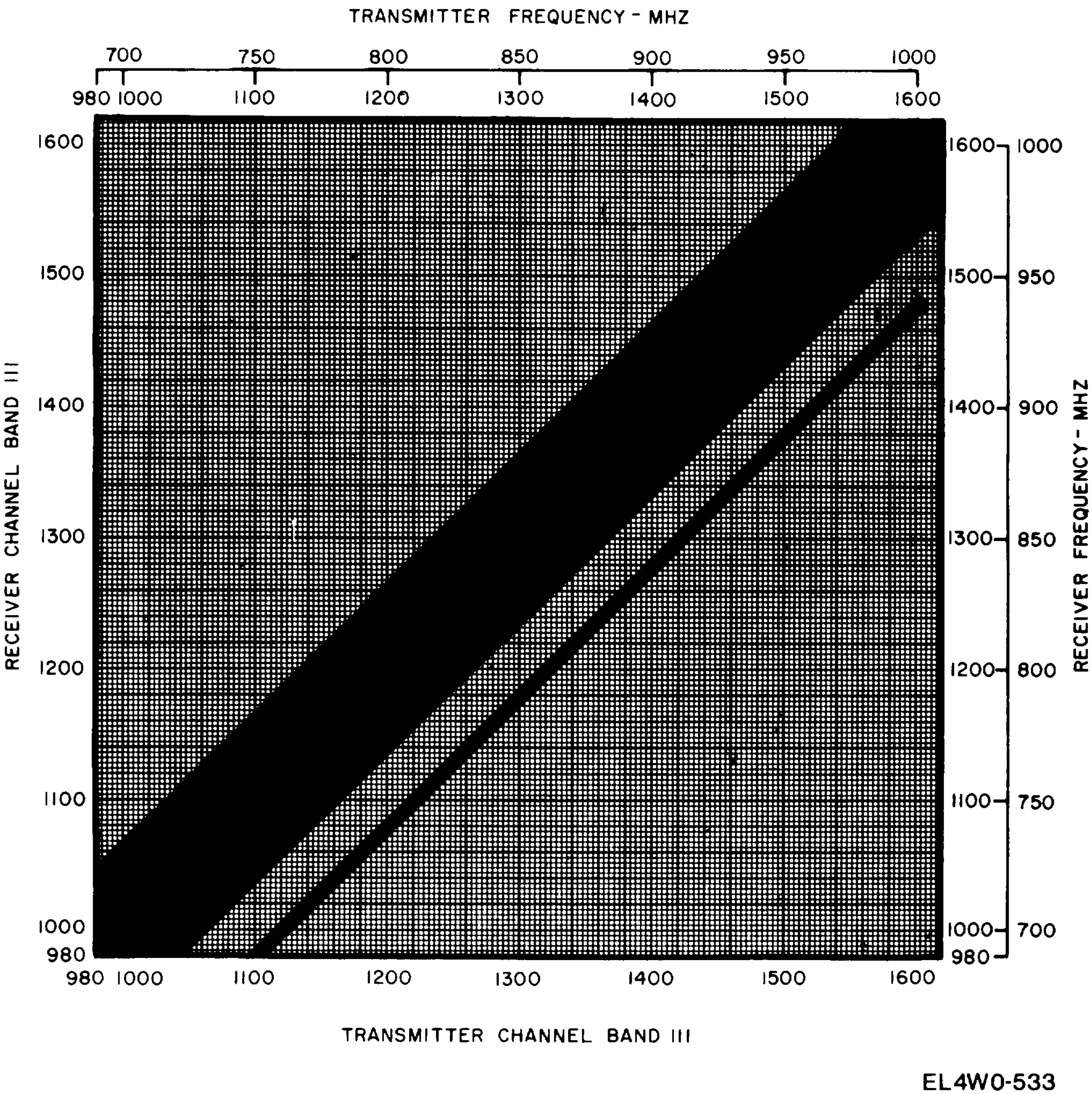


Figure E-33. Receiver Overload Chart, 695 to 1,000 MHz

RECEIVER OVERLOAD CHARTS - Continued

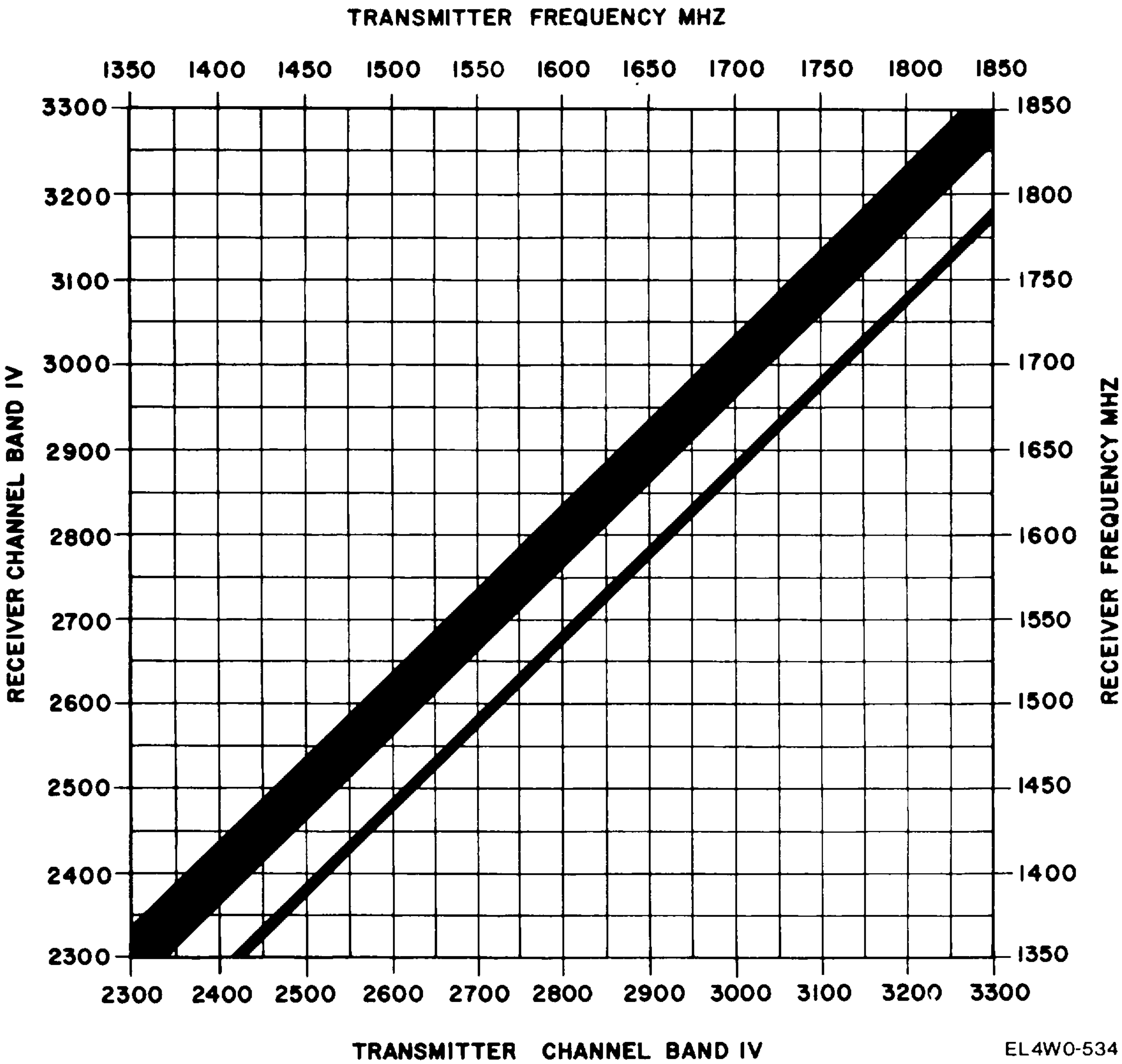


Figure E-34. Receiver Overload Chart, 1,350 to 1,850 MHz

APPENDIX F
AN/GRC-103(V)4 RADIO DIGITAL DATA TRANSMISSION CHECK FOR AN/TRC-173 AND AN/TRC-174 SERIES SHELTERS

F-1. AN/GRC-103(V)4 RADIO DIGITAL DATA TRANSMISSION CHECK

The following procedure is performed to check for problems associated with AN/GRC-103(V)4 digital data transmission in both the AN/TRC-173 and AN/TRC-174 series shelters. The procedure should be performed as a pre-operational check during shelter deployment and after a shelter jump. The complete procedure consists of the performance of a radio loop test to insure proper radio performance, an RF Cable CG-3443/U check by a radio loop test, and a shelter to shelter transmission test. Each test is conducted with an AN/PSM-45 multimeter setup to serve as a visual aid to system operating capability.

NOTE

Check input impedance and continuity of cables before use.

a. On shelter patch panel, patch connect a radio and radio modem video transmit and receive jack.

NOTE

RADIO-1 and RM-1 video transmit and receive jack patch connection is illustrated on Figure F-1.

b. Turn on radio modem. Set data rate of modem for 1152 KBS (thumbwheel setting No. 9).

c. Set AN/PSM-45 multimeter control selection buttons for voltage "V" and "AC" at "200 mV" scale.

d. Connect the multimeter to the shelter radio modem (RM-1, RM-2, or RM-3) data out jack of DVOW patch using cable P/N A3260941, or equivalent.

NOTE

Depending on your patch configuration the DOW patch can also be used; RM-1 data out jack of DVOW patch is illustrated on Figure F-1.

e. Turn multimeter power "ON".

f. Perform loop testing for the radio in accordance with Chapter 4, paragraph 4-5. As final step of loop testing procedure, or during loop testing procedure when a problem obtaining stated readings is noted, monitor the AN/PSM-45 multimeter. Ensure a steady voltage within the range of .1 mV to 1.8 mV is maintained.

(1) If voltage reading is steady and does not fluctuate by more than .1 mV in one minute, data lock is indicated. Digital data is capable of being transmitted (Bit Error Rate (BER) at 10-6 or smaller).

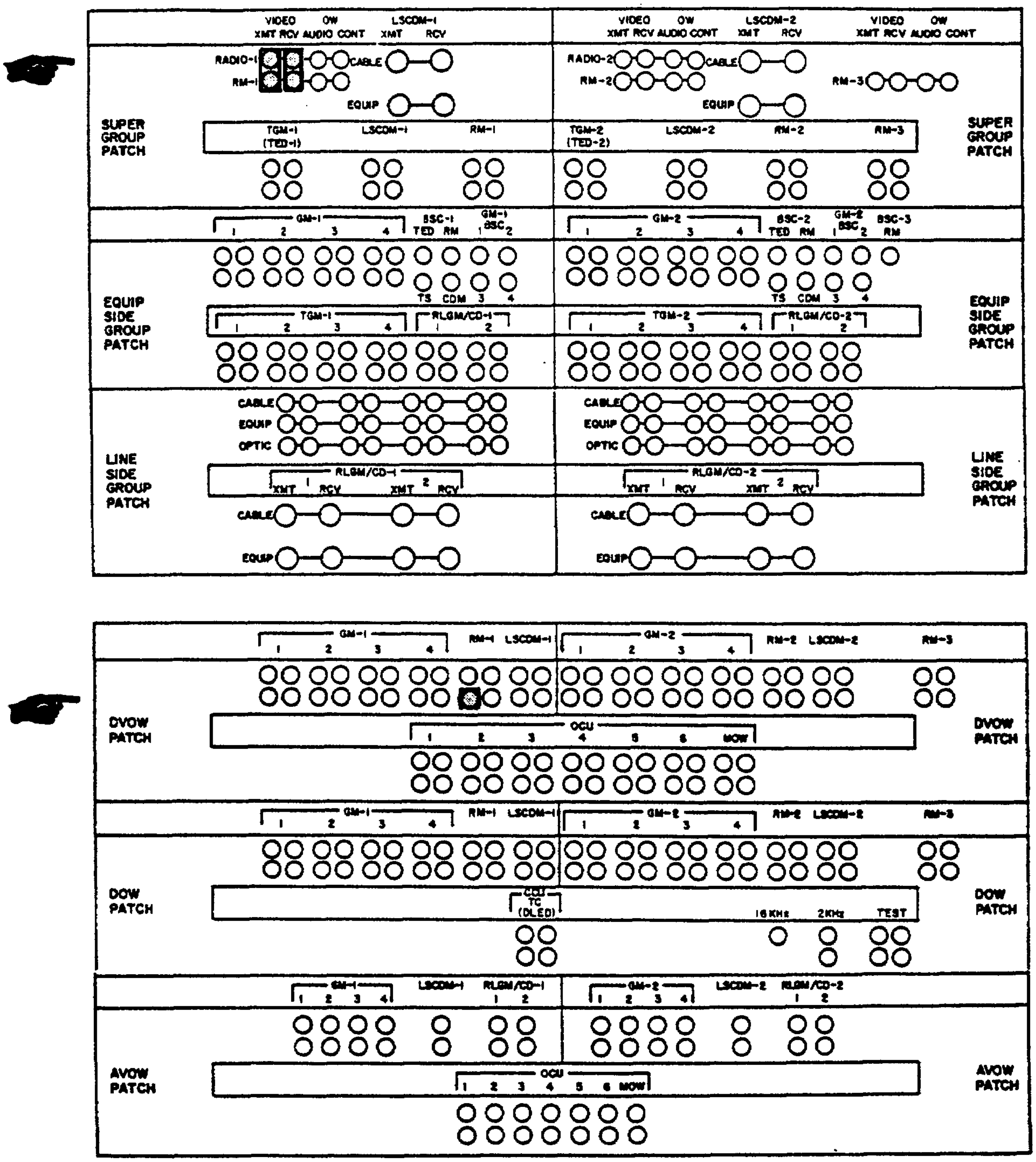


Figure F-1. Shelter Patch Panel Sample Setup

(2) If voltage fluctuates by more than 1 mV and less than 2 mV in one minute, and display bar at bottom of meter window just begins to fluctuate, a marginal data lock is indicated. Marginal data is capable of being transmitted (BER at 10-5 range).

(3) If voltage varies randomly more than 2 mV to 200mV in one minute, and display bar at bottom of meter window fluctuates wildly, loss of data is indicated. Digital data is not capable of being transmitted (BER at 10 -4 or greater).

g. If marginal data lock or loss of data are indicated, perform radio troubleshooting/maintenance in accordance with Chapter 4, Section IV and V procedures. When data lock is indicated, go to step h below.

h. Perform pre-operational check of RF Cable CG-3443/U as follows.

NOTE

Check RF Cable CG-3443/U prior to setup of shelter antenna to avoid installation of a faulty cable.

(1) Connect one end of the RF Cable CG-3443/U to be tested to the GRC/103 radio connector in the shelter VIDEO ENTRANCE BOX.

(2) Connect the other end of RF Cable CG-3443/U to the dummy load using Adapter Connector UG-1375/U and Cable RF Assembly CG-3444/U.

(3) Perform loop testing for the radio in accordance with Chapter 4, paragraph 4-5. Monitor the AN/PSM-45 multimeter during loop testing. Ensure a steady voltage within the range of .1 MV to 1.8 mV is maintained. If voltage reading is not steady and fluctuates by more than MV, replace RF Cable CG-3443/U and repeat loop test. If problem is still unresolved, perform shelter troubleshooting/maintenance procedures. When RF Cable CG-3443/U checks out, disconnect RF Cable CG-3443/U at the dummy load and connect to the shelter antenna following shelter operating setup procedures.

i. Establish radio shot with another shelter. Monitor the AN/PSM-45 multimeter. Ensure a steady voltage reading indicating data lock is maintained as stated in step f above.

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PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 11-5840-340-12	23 Jan 74	Radar Set AN/PRC-76

BE EXACT PIN-POINT WHERE IT IS				IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	
2-25	2-28			Recommend that the installation antenna alignment procedure be changed throughout to specify a 2° IFF antenna lag rather than 1°. REASON: Experience has shown that with only a 1° lag, the antenna servo system is too sensitive to wind gusting in excess of 25 knots, and has a tendency to rapidly accelerate and decelerate as it hunts, causing strain to the drive train. Hunting is minimized by adjusting the lag to 2° without degradation of operation.
3-10	3-3		3-1	Item 5, Function column. Change "2 db" to "3db." REASON: The adjustment procedure for the TRANS POWER FAULT indicator calls for a 3 db (500 watts) adjustment to light the TRANS POWER FAULT indicator.
5-6	5-8			Add new step f.1 to read, "Replace cover plate removed in step e.1, above." REASON: To replace the cover plate.
		F03		Zone C 3. On J1-2, change "+24 VDC to "+5 VDC." REASON: This is the output line of the 5 VDC power supply. +24 VDC is the input voltage.

SAMPLE

PRINTED NAME GRADE OR TITLE AND TELEPHONE NUMBER	SIGN HERE
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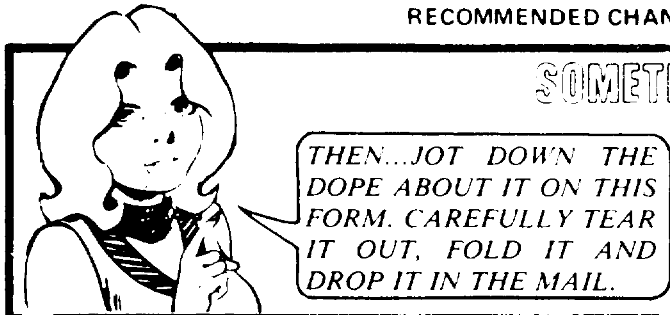

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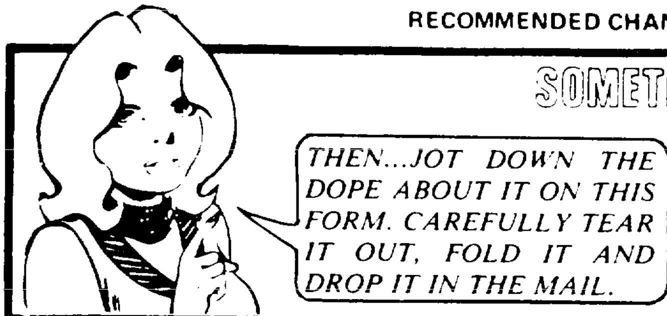

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