TECHNICAL MANUAL

OPERATOR'S, AVIATION UNIT MAINTENANCE,

AND AVIATION INTERMEDIATE

MAINTENANCE MANUAL

(INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST)

RADIO SET AN/VRC-86(V)1
(NSN 5820-01-320-5166) (EIC: N/A)

RADIO SET AN/VRC-86(V)2
(NSN 5820-01-199-8624) (EIC: N/A)

RADIO SET ANNRC-86(V)3
(NSN 5820-01-320-5165) (EIC: N/A)

HEADQUARTERS, DEPARTMENT OF THE ARMY

1 AUGUST 1992

WARNING

CONTACT WITH HIGH VOLTAGES CAN KILL YOU

SERIOUS INJURY OR DEATH CAN OCCUR IF YOU TOUCH THE RADIO SET AN/VRC-86(V) ANTENNA WHILE IT IS TRANSMITTING. PRECAUTIONS MUST BE FOLLOWED TO ENSURE PERSONNEL SAFETY WHEN THE RADIO SET AN/VRC-86(V) IS TRANSMITTING.

1. DO NOT LEAN AGAINST OR GRASP ANTENNA. WHEN ANTENNA IS OPERATING, SEVERE BURNS MAY RESULT.
2. DO NOT OPERATE TRANSMITTER UNLESS YOU HAVE DETERMINED NO ONE IS WITHIN 20 INCHES OF THE ANTENNA. HIGH LEVELS OF ELECTROMAGNETIC RADIATION EXIST IN AREA.

WARNING

USE ADEQUATE VENTILATION

WHILE USING TRICHLOROTRIFLUOROETHANE, ADEQUATE VENTILATION SHOULD BE PROVIDED. 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.

WARNING

THE PACKED STOWAGE BAG FOR THE OE-480/VRC-86(V) ANTENNA GROUP WEIGHS MORE THAN 50 POUNDS AND REQUIRES A TWO PERSON LIFT.

WARNING

THE MX-10485/VRC-86 ELECTRONICS BOX WEIGHS MORE THAN 50 POUNDS WHEN PACKED FOR STORAGE OR SHIPMENT AND REQUIRES A TWO PERSON LIFT.

WARNING

THE MX-10485/VRC-86 ELECTRONICS BOX WEIGHS MORE THAN 50 POUNDS AND REQUIRES A TWO PERSON LIFT IN ITS NORMAL CONFIGURATION WHICH IS WHEN THE AM-7201/U AMPLIFIER-COUPLER, THE RT-1432/U RECEIVER-TRANSMITTER, AND THE C-11245/U CONTROL-DISPLAY OR Y-INTERCONNECT ARE ALL INSTALLED.

CAUTION

The height of the OE-480/VRC-86(V) Antenna Group is 30 feet. This equipment shall not be installed closer than twice its height from power lines.

SAFETY SUMMARY

The following are general safety precautions that are not related to any specific procedures and therefore do not appear elsewhere in this publication. These are recommended precautions that personnel must understand and apply during many phases of operation and maintenance.

KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must at all times observe all safety regulations. Do not replace components or make adjustments inside the equipment with the power supply turned on. Under certain conditions, dangerous potentials may exist when the power is in the off position, due to charges retained by capacitors. To avoid casualties, always remove power and discharge and ground a circuit before touching it.

DO NOT SERVICE OR ADJUST ALONE

Under no circumstances should any person reach into or enter the enclosure for the purpose of servicing or adjusting the equipment except in the presence of someone who is capable of rendering aid.

RESUSCITATION

Personnel working with or near high voltages should be familiar with modern methods of resuscitation. Refer to FM 21-11 for detailed first aid procedures.

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

Technical Manual

No. 11-5820-927-13&P

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 1 August 1992

Operator's, Aviation Unit Maintenance and Aviation Intermediate Maintenance Manual

(Including Repair Parts and Special Tools List)

RADIO SET ANNRC-86(V)1
(NSN 5820-(01-320-5166) (EIC: N/A)

RADIO SET ANNRC-86(V)2
(NSN 5820-01-199-8624) (EIC: N/A)

RADIO SET ANNRC-86(V)3
(NSN 5820-01320-5165) (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-LM-LT, Fort Monmouth, New Jersey 07703-5007.
In either case a reply will be furnished direct to you.

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* This manual supersedes TM 11-5820-927-13&P, dated 18 October 1989.

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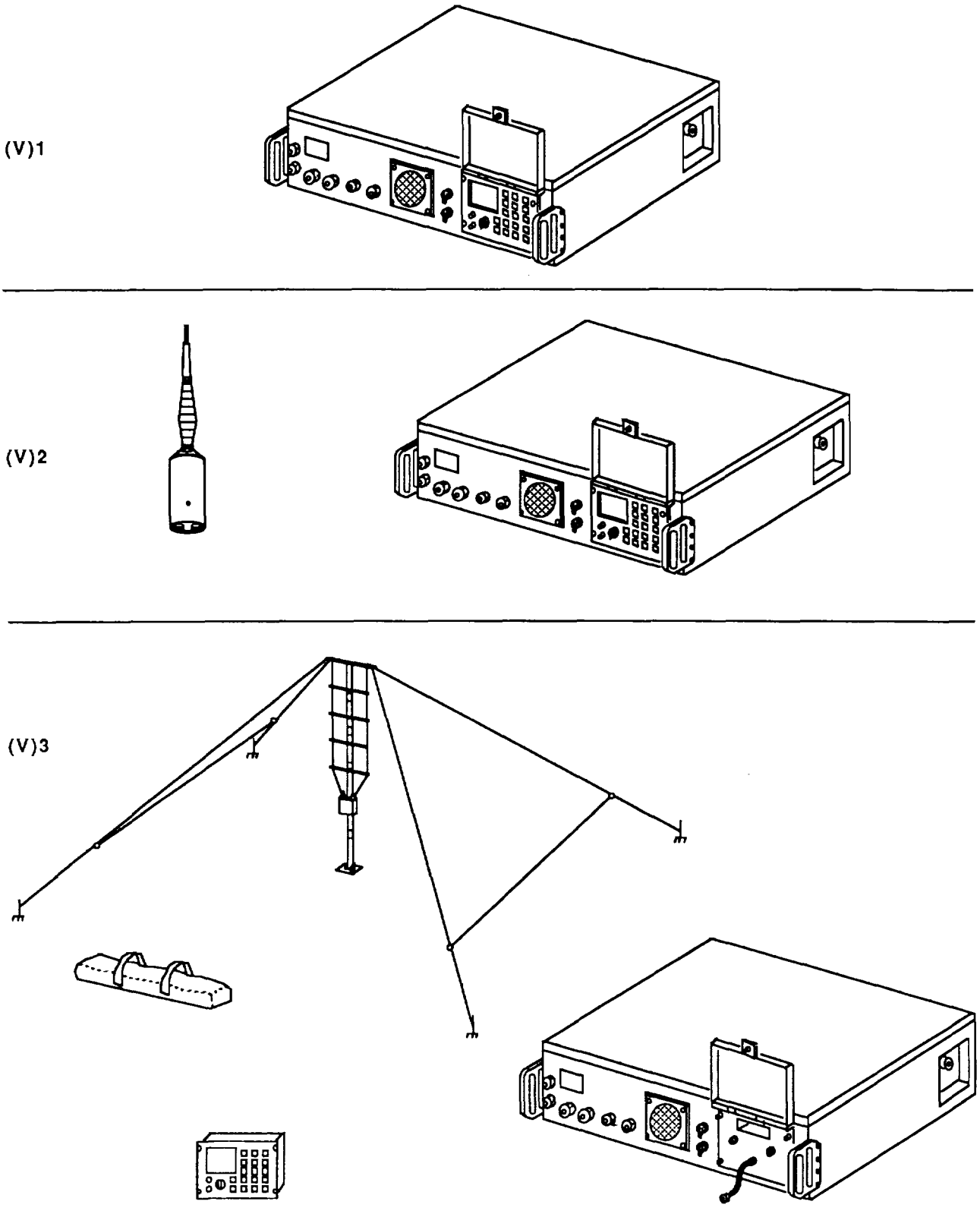


Figure 1-1. Radio Set AN/VRC-86(V)

CHAPTER 1
INTRODUCTION

SECTION I. GENERAL INFORMATION

1-1. Scope

a. ***Type of Manual.*** Operator's, Aviation Unit, and Intermediate Maintenance Manual (organizational and intermediate level).

b. ***Model Number and Equipment Name.*** Radio Set AN/VRC-86(V).

c. ***Purpose of Equipment.*** Used to transmit and receive voice and data between stations beyond the range of line-of-sight radios.

d. ***Configuration.*** Control-Display C-11245/U and receiver-transmitter RT-1432/U serial numbers 1031B through 1178B are not to be used in the AN/VRC-86(V), if units with these serial numbers are found they should be returned immediately.

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

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

1-3. Maintenance Forms, Records, and Reports

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 or DA Pam 738-751, as contained in Maintenance Management Update.

b. ***Reporting of Item and Packaging Discrepancies.*** Fill out and forward SF 364 Report of Discrepancy (ROD) as prescribed in AR 735-11-2/DLAR 4140.55/SECNAVINST 4355.18/AFR 400-54/MCO 4430.J.

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

1-4. Preparation For Storage or Shipment

Administrative storage of equipment issued to and used by Army activities will have bench checkout performed in accordance with the PMCS before storing. When removing the equipment from administrative storage, PMCS should be performed to assure operational readiness. Disassembly and repacking of equipment for shipment or limited storage are covered in chapter 3.

1-5. Destruction of Army Electronics Materiel to Prevent Enemy Use

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

1-6. Official Nomenclature, Names and Designations

COMMON NAME	OFFICIAL NOMENCLATURE
Radio Set	Radio Set AN/VRC-86(V)
Control-Display	Control-Display C- 11245/U
Amplifier-Coupler	Amplifier-Coupler, Radio Frequency AM-7201/U
Receiver-Transmitter	Receiver-Transmitter RT- 1432/U
Antenna Base	Base, Antenna Support AB-131 1/VRC-86
Electronics Box	Box, Electronic Equipment Interfacing MX-1 0485/VRC-86
Y-Interconnect	Y-Interconnect 22373/200-05121-0000
Antenna Group	Antenna Group OE-480/VRC-86(V)
Antenna Coupler	Coupler, Antenna CU-2479/U
Antenna	Antenna AS-4227/VRC-86(V)
RF Cable	Cable, RF Transmission 22373/155-02679-0000
Control Cable	Cable Assembly, Control 22373/155-02678-0000

1-7. Reporting Equipment Improvement Recommendations (EIR)

If your radio set needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Tell us why a procedure is hard to perform. Put it on an SF 368 Quality Deficiency Report (QDR). Mail it to us at Commander, US Army Communications-Electronics and Fort Monmouth, ATTN: AMSEL-ED-PH, Fort Monmouth, NJ 07703-5000. We'll send you a reply.

1-8. Warranty Information

Refer to Warranty Technical Bulletin TB 11-5820-927-10 for warranty information.

SECTION II. EQUIPMENT DESCRIPTION

1-9. Purpose of Radio Set

The radio set is a tactical HF ground communications system used to transmit and receive voice and data between stations that are line-of-sight as well as beyond the range of line-of-sight radios.

1-10. Equipment Characteristics, Capabilities, and Features

Characteristics, Capabilities, and Features

a. Tactical high frequency, radio set.

b. Selectable output levels of 4, 40, and 170 W peak envelope power (PEP).

c. Operates from a nominal 27.5 Vdc power source (range 23 to 30 Vdc).

d. Frequency of operation is from 2.0 to 29.9999 MHz (2000.0 to 29999.9 KHz).

e. Transmit and receive frequencies are programmable in 100 Hz increments on 21 presettable channels, for a total of 280,000 possible frequencies.

f. Emission modes available include upper and lower sideband (USB/LSB), double sideband (DSB), amplitude modulation equivalent (AME), and modulated carrier wave (MCW).

g. Data may be transmitted or received in the USB, LSB, or AME modes.

h. Operable at all times in a half-duplex, push-to-talk mode.

i. Syllabic squelch which reacts to voice components in the received signal is controlled from the control-display panel by the operator, and is adjustable from OFF through eight levels to maximum.

j. Selective Addressing (SELADR) squelch is provided-to eliminate the reception of unwanted RF signals, and atmospheric or man made noise.

k. Capable of retransmission of data or voice.

I. Securable with Parkhill KY 65 and KY 75 equipment for voice and KG 84 for data. Can be used with COMSEC equipment.

m. Capable of scanning channels that have been programmed and stored onto the scan list.

n. Incorporated Built-In-Test (BIT) continuously checks important operating conditions.

o. If BIT detects a fault, the faulty Line Replaceable Unit (LRU) is identified on the cathode ray tube (CRT) display.

p. The CRT display and the control panel can be used with night vision goggles.

q. Interfaces with several different antennas, depending on AN/VRC-86(V) configuration: Antenna Group OE-480/VRC-86(V), Antenna Base AB-1311 /VRC-86 with whip, Broadband Antenna AS-4096/G, Antenna Group AN/GRA-50.

r. Can be used with long wire antenna depending on AN/VRC-86(V) configuration.

1-11. Location and Description of Major LRUs

a. Control-Display. Located in the electronics box in the (V)1 and (V)2 configurations and remotely mounted in the (V)3 configuration. It includes a 17-key keyboard and a 3-inch diagonal CRT display screen on the front panel. The electrical connections are on the back via a single connector for connection to the receiver-transmitter and amplifier-coupler through the electronics box.

b. Amplifier-Coupler. Mounted in the electronics box. It includes connections for the power source, receiver-transmitter, antenna, or antenna base, and testing.

c. Receiver-Transmitter. Mounted in the electronics box. It includes connections to the amplifier-coupler, and the control-display.

d. Antenna Base. Mounted to the vehicle. It contains tuning elements for use only with a vehicular whip antenna. It provides interface to the antenna from the amplifier-coupler.

e. Electronics Box. The electronics box is used to mount and interconnect the amplifier-coupler, the receiver-transmitter, and the control-display or Y-interconnect. It also has controls and connectors for the operator to use. The electronics box is mounted on a shock isolation tray. The electronics box also contains an audio interface to drive an internal speaker and external intercomm interfaces. It also contains a 400 Hz inverter for control-display electro-luminescent lighting.

f. ***Antenna Group.*** Consists of the antenna, antenna coupler, RF and Control cables.

g. ***Antenna.*** The antenna is part of the antenna group and includes the mast, base plate, guy lines, antenna elements, and stowage bag. The antenna group is set up and located away from the electronics box.

h. ***Antenna Coupler.*** The antenna coupler is part of the antenna group. The antenna coupler is mounted on the antenna mast.

i. ***RF Cable.*** The RF cable is part of the antenna group. The 230 foot RF cable is connected between the antenna coupler and the electronics box.

j. ***Control Cable.*** The control cable is part of the antenna group. The 230 foot control cable is connected between the antenna coupler and the electronics box.

k. ***Y-Interconnect.*** The Y-interconnect is located in the electronics box. The Y-interconnect provides test connections and connections between the antenna group and amplifier-coupler.

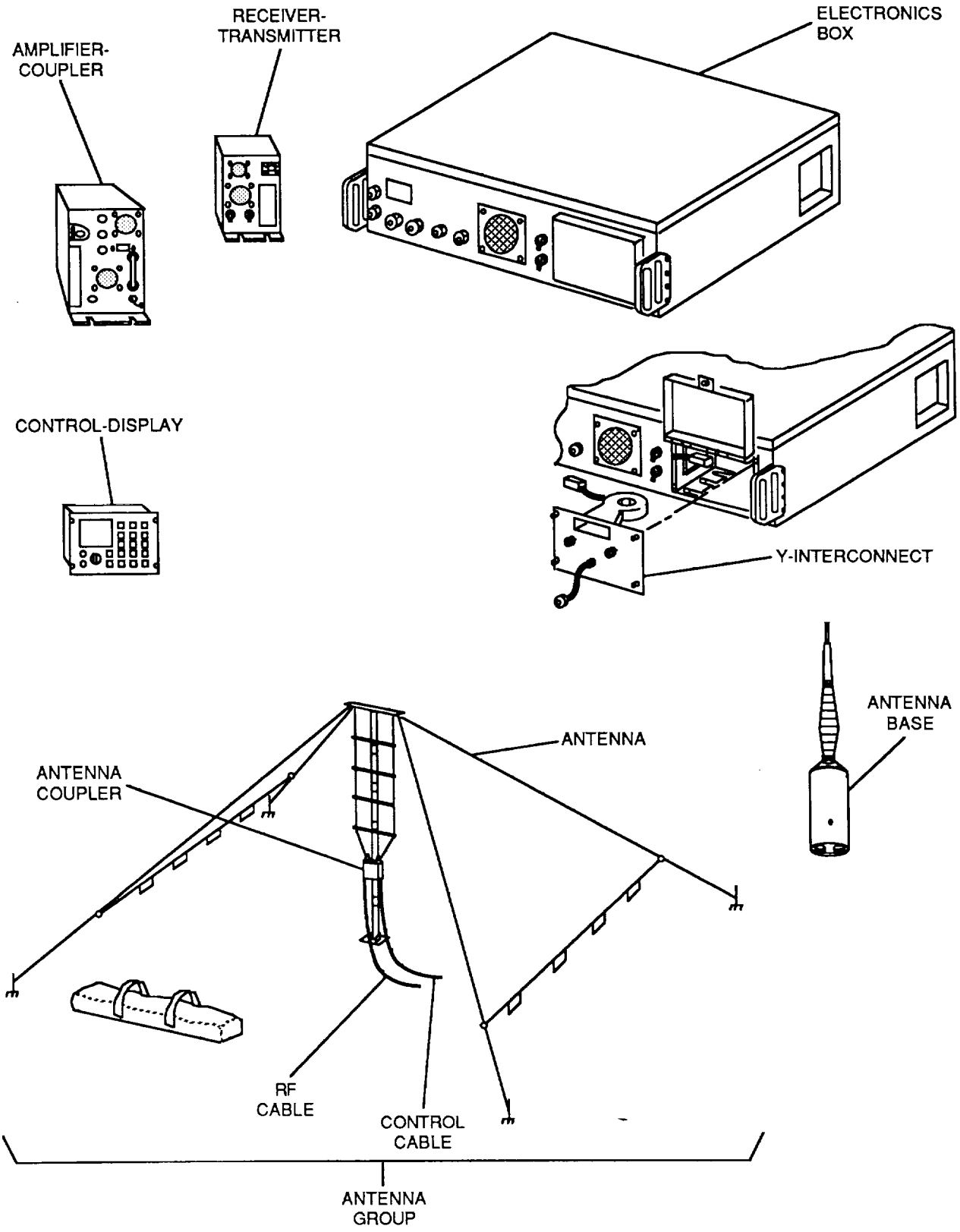


Figure 1-2. Radio Set AN/VRC-86(V) Line Replaceable Units (LRUs)

1-12. Equipment Data.

Table 1-1. Radio Set AN/VRC-86(V) Equipment Data

Characteristic		Specification	
Major Components:	Control-display, amplifier-coupler, receiver-transmitter, antenna base, electronics box, Y-interconnect, antenna, antenna coupler, RF cable and control cable. The amplifier-coupler and receiver-transmitter are all located in the electronics box. The control-display is located in the electronics box in the (V)1 and (V)2 configurations and remotely mounted in the (V)3 configuration. Dimensions shown are with equipment ready for storage.		
Size:	LRU	L x W x H	Cubic Inches
	Control-Display	8.60 in. 5.70 in. 4.50 in.	220.59
	Amplifier-Coupler	16.10 in. 5.40 in. 7.20 in.	625.97
	Receiver-Transmitter	13.60 in. 4.10 in. 5.25 in.	292.74
	Antenna Base	16.92 in. 3.25 in. 3.25 in.	178.72
	Electronics Box	19.46 in. 22.25 in. 7.66 in.	1407.20
	Y Interconnect	6.50 in. 5.73 in. 4.48 in.	166.86
	Antenna (Packed)	90.0 in. X 18.0 in. (dia.)	22902.21
	Antenna Coupler	13.85 in. 8.54 in. 6.10 in.	721.50
	RF Cable	5.0 in. x 22.0 in. (dia.)	7602.65
	Control Cable	5.0 in. x 22.0 in. (dia.)	7602.65

Table 1-1. Radio Set ANNRC-86(V) Equipment Data - Continued

Characteristic	Specification
Weight:	
AN/VRC-86(V) 1:	52.5 lbs.
AN/VRC-86(V)2:	58.0 lbs.
AN/VRC-86(V)3:	165.1 lbs.
Operating Modes:	USB/LSB/AME/DSB/CW
Operating Temperatures:	-40°F to + 160°F
Antenna:	
AN/VRC-86(V)1:	AS-4096/G broadband antenna, AN/GRA-50 doublet or long wire
AN/VRC-86(V)2:	AB-1311/VRC-86 with 15 to 23 foot vehicular whip
AN/VRC-86(V)3:	OE-480/VRC-86(V) antenna group
Tune Time:	50 ms for each previously tuned channel frequency. Multiple tunes are performed automatically normally within 60 seconds, to achieve maximum power transfer to the antenna, the best tune is stored in nonvolatile channel memory
Warm-up Time:	5 sec nominal
Channels:	21 preset
Frequency Range:	2.0 to 29.9999 MHz in 100 Hz increments (280,000 possibilities)
Power Input:	23 to 30 Vdc, 500 W, continuous maximum, 600 W peak maximum
KY 65 Audio, Retransmission or data:	Fixed 0 dBm, 600 ohms, input and output
Handset Audio:	16 mW, 1000 ohms
Microphone Input:	-56 dBm, 150 ohms

Table 1-2. Radio Set AN/VRC-86(V) Component Equipment Data

CONTROL-DISPLAY C-11245/U	
Characteristic	**Specification**
Height:	4.50 in.
Length (including rear connector and bezel):	8.60 in.
Width:	5.70 in.
Weight:	5.0 lbs.
Mounting:	For AN/VRC-86(V)1 and (V)2 configuration, mounted in front panel of electronics box with four quarter-turn fasteners plus hold-down bracket inside box. Mounted remotely for AN/VRC-86(V)3 configuration
Power Input:	Supplied by amplifier-coupler (27.5 Vdc pre-regulated)
CRT Display Size:	3 in. diagonal showing 8 rows of characters
CRT Color:	Green
Panel Lighting:	Electroluminescent, green, 115 Vac, 400 Hz
Audio Volume Control:	16 positions: Minimum, 1-14, maximum
Night Vision Goggles:	Usable with Night Vision Goggles

Table 1-2. Radio Set AN/VRC-86(V) Component Equipment Data - Continued

AMPLIFIER-COUPLER AM-7201/U

Characteristic	Specification
Height:	7.20 in.
Length:	16.10 in.
Width:	5.40 in.
Weight:	15.0 lbs.
Mounting:	Screwed down inside of electronics box
Cooling:	Convection
Power Input:	27.5 Vdc (nominal), 22 A transmit (maximum)/1.0 A receive
Output Power:	4, 40, or 170 W PEP
High Power Lockout:	OFF prevents unauthorized use of high power mode. ON selects high power (170 watts PEP) mode, along with low (4 watts PEP), or medium (40 watts PEP)
Input Impedance:	50 ohms (nominal)
Amplifier Input Level:	-4 dBm PEP (nominal)
Suppression of Harmonics/ Spurious Oscillation:	When frequency is less than cf -100 Hz or when frequency is more than cf +3500 Hz, not less than 30 dB. When frequency is less than cf -3100 Hz or when frequency is greater than cf +5900 Hz, not less than 38 dB. When frequency is less than cf -6100 Hz or when frequency is more than cf +8900 Hz, not less than 43 dB
AME Carrier Noise Suppression:	Greater than 40 dB
VSWR:	1.5 to 1 or less after tuning

Table 1-2. Radio Set AN/VRC-86(V) Component Equipment Data - Continued

AMPLIFIER-COUPLER AM-7201/U - Continued

Characteristic	Specification
Antenna Impedance Range:	
R Component:	0 to 48,000 ohms
X_L Component:	0 to 1,125 ohms
X_C Component:	0 to 1,125 ohms
Total Impedance:	Greater than 5.5 ohms
Q:	Less than 100
Protective Features:	Over voltage in the amplifier-coupler (arcing), or over temperature in power amplifier, or failed transmitter output. System fault message to control-display if amplifier-coupler is unable to tune antenna at a given frequency. High power lockout switch ON: full power output; OFF: Power output limited to medium or low power output

RECEIVER-TRANSMITTER RT-1432/U

Characteristic	Specification
Height:	5.25 in.
Length (with connector):	13.60 in.
Width:	4.10 in.
Weight:	10.0 lbs.
Mounting:	Screwed down inside electronics box
Power Input:	Supplied by amplifier-coupler (27.5 Vdc, 3.0A Peak, 1.75A nominal pre-regulated)

Table 1-2. Radio Set AN/VRC-86(V) Component Equipment Data - Continued

RECEIVER-TRANSMITTER RT-1432/U - Continued

Characteristic	Specification
Receiver:	
Input Impedance:	50 ohms
Frequency Stability:	±20 Hz from 2.0 to 29.9999 MHz (2000.0 to 29999.9 KHz)
Audio Response/Bandwidth:	Not more than 5 dB variation, 350 to 3050 Hz
Audio Distortion	
AM:	Harmonic not more than 12%
SSB:	Third order 25 dB below PEP at 100,000 microvolt
Spurious Response:	Greater than 60 dB down from 0.09 to 600 MHz
Image Response:	Greater than 40 dB down from 0.09 to 600 MHz
Selectivity	
AM:	cf ±2.75 KHz not more than 6 dB variation. Less than cf -20.0 KHz or greater than cf +20.0 KHz not less than 60 dB
SSB:	cf +350 Hz to cf +3050 Hz with not more than 5 dB variation. Less than cf -2150 Hz and greater than cf +5000 Hz, not less than 60 dB rejection (LSB similar)
Sensitivity	
AM:	Not more than 3 microvolts for 6 dB (S+N)/N
SSB:	Not more than 1 microvolt for 10 dB (S+N)/N
AGC:	Not more than 6 dB change for 10 microvolts to 500,000 microvolts input change
Intercom Audio Output:	150 ohms, 0 to 1 mW, 0 to 50 mW, 1 mW fixed, or 50 mW fixed; harness selectable

Table 1-2. Radio Set AN/VRC-86(V) Component Equipment Data - Continued

RECEIVER-TRANSMITTER RT-1432/U - Continued

Characteristic	Specification
Transmitter:	
Output Impedance	50 ohms nominal
Frequency Stability:	±20 Hz from 2.0 to 29.9999 MHz (2000.0 to 29999.9 KHz)
Spectrum Control Audio Response:	cf +350 Hz to cf +3050 Hz with not more than 5 dB variation
Spectrum:	Less than cf -100 Hz or greater than cf +3500 Hz, not less than 30 dB. Less than cf -3100 Hz or greater than cf +5900 Hz, not less than 38 dB. Less than cf -6100 Hz or greater than cf +8900 Hz, not less than 43 dB
Audio Distortion:	In-band intermodulation distortion more than 25 dB below PEP
Carrier Suppression:	Greater than 40 dB
Power Output:	5 dBm maximum PEP
ALC Range:	25 dB minimum
Data Input/Output:	0 dBm, 600 ohms
IM Distortion:	In-band not less than 35 dB below PEP to -4 dBm in cipher or data mode
Speech Processing:	3 dB average power increase of SSB voice modulation

Table 1-2. Radio Set AN/VRC-86(V) Component Equipment Data - Continued

ANTENNA BASE AB-1311/VRC-86

Characteristic	Specification
Length:	16.92 in.
Diameter:	3.25 in.
Weight:	5.5 lbs.
Power Input:	Supplied from amplifier-coupler
Inductance:	30 μh (switched)

ELECTRONICS BOX MX-10485/VRC-86

Characteristic	Specification
Height:	7.66 in.
Length:	19.46 in.
Width:	22.25 in.
Weight:	22.5 lbs.
Mounting:	Shock-mount tray fastened to vehicle
Power Requirements:	27.5 Vdc from ground vehicle, distributes power to LRUs, 500 W (18.2 A) maximum when all LRUs are connected
Connections provided for:	KY-65 (power and audio) Antenna (RF and control) Handset Extension cable for remote control Retransmission or data (same as KY 65)
KY 65 Audio, Retransmission or data:	Fixed 0 dBm, 600 ohms, input and output

Table 1-2. Radio Set AN/VRC-86(V) Component Equipment Data - Continued

ELECTRONIC BOX MX-10485/VRC-86 - Continued

Handset Audio:	16 mW, 1000 ohms
Microphone Input:	-56 dBm, 150 ohms

ANTENNA GROUP OE-480/VRC-86(V)

Characteristic	Specification
Components:	Antenna, AS-4227/VRC-86(V) Antenna Coupler, CU-2479/U Control Cable, 155-02678-0000 RF Cable, 155-02679-0000
Frequency Range:	2.0 to 29.9999 MHz (2000.0 to 29999.9 KHz)
Power Input:	28 Vdc, 0.95 A (provided by electronics box)
Rated Input RF power:	200 Watts PEP, maximum
Tuning Time:	3 seconds, typical 5 seconds, maximum
Tuning Accuracy:	3:1 VSWR, maximum
Input Impedance:	50 ohms nominal
Radiation Pattern:	Provides a non-directional radiation pattern with a high takeoff angle in the 2 to 8 MHz range for Near-Vertical Incident Sky wave (NVIS) propagation used for communication over ranges up to 200 miles. Provides a low takeoff angle in the 8 to 30 MHz range for shorter range ground wave communications and longer range sky wave communications, depending on frequency, time of day, and environmental conditions

Table 1-2. Radio Set AN/VRC-86(V) Component Equipment Data - Continued

ANTENNA AS-4227/VRC-86(V)

Characteristic	Specification
Height:	30 ft. (set up)
Site Area:	131 ft. by 105 ft.
Weight:	43 lbs.
Element Configuration:	Two 180° phase related, ungrounded elements in a bent-horizontal, thick bow-tie design
Radiation Pattern:	Non-directional with respect to azimuth
Setup Time:	15 minutes (one person)

ANTENNA COUPLER CU-2479/U

Characteristic	Specification
Length:	13.85 in.
Width:	8.54 in.
Depth:	6.10 in.
Weight:	9.3 lbs.
Frequency Range:	2.0 to 29.9999 MHz (2000.0 to 29999.9 KHz)
Power Input:	28 Vdc, 0.95 A (provided by electronics box)
Rated RF Input Power:	200 Watts PEP, maximum
Output Configuration:	Two ceramic-insulated balanced outputs isolated from ground

Table 1-2. Radio Set AN/VRC-86(V) Component Equipment Data - Continued

Y-INTERCONNECT

Characteristic	Specification
Length:	6.50 in.
Width:	5.73 in.
Depth:	32.0 in. (Y cable extended)
Weight:	2.3 lbs.
Blower Airflow capacity:	44 CFM, maximum
Power input:	28 Vdc, 0.5 A maximum (provided by electronics box)

1-13. Equipment Configuration Differences

There are three configurations of the AN/VRC-86(V). Each configuration uses different LRUs as described in Table 1-3 and illustrated in Figure 1-3.

Table 1-3. Radio Set AN/VRC-86(V) Configurations

LRU	(V)1	(V)2	(V)3
Control-Display, C-11245/U	X	X	X
Amplifier-Coupler, AM-7201/U	X	X	X
Receiver-Transmitter, RT-1432/U	X	X	X
Electronics Box, MX-10485/VRC-86	X	X	X
Antenna Base, AB-1311/VRC-86		X	
Antenna, AS-4227/VRC-86(V)			X
Antenna Coupler, CU-2479/U			X
Y-Interconnect, 22373/200-05121-0000			X
Control Cable, 22373/155-02678-0000			X
RF Cable, 22373/155-02679-0000			X

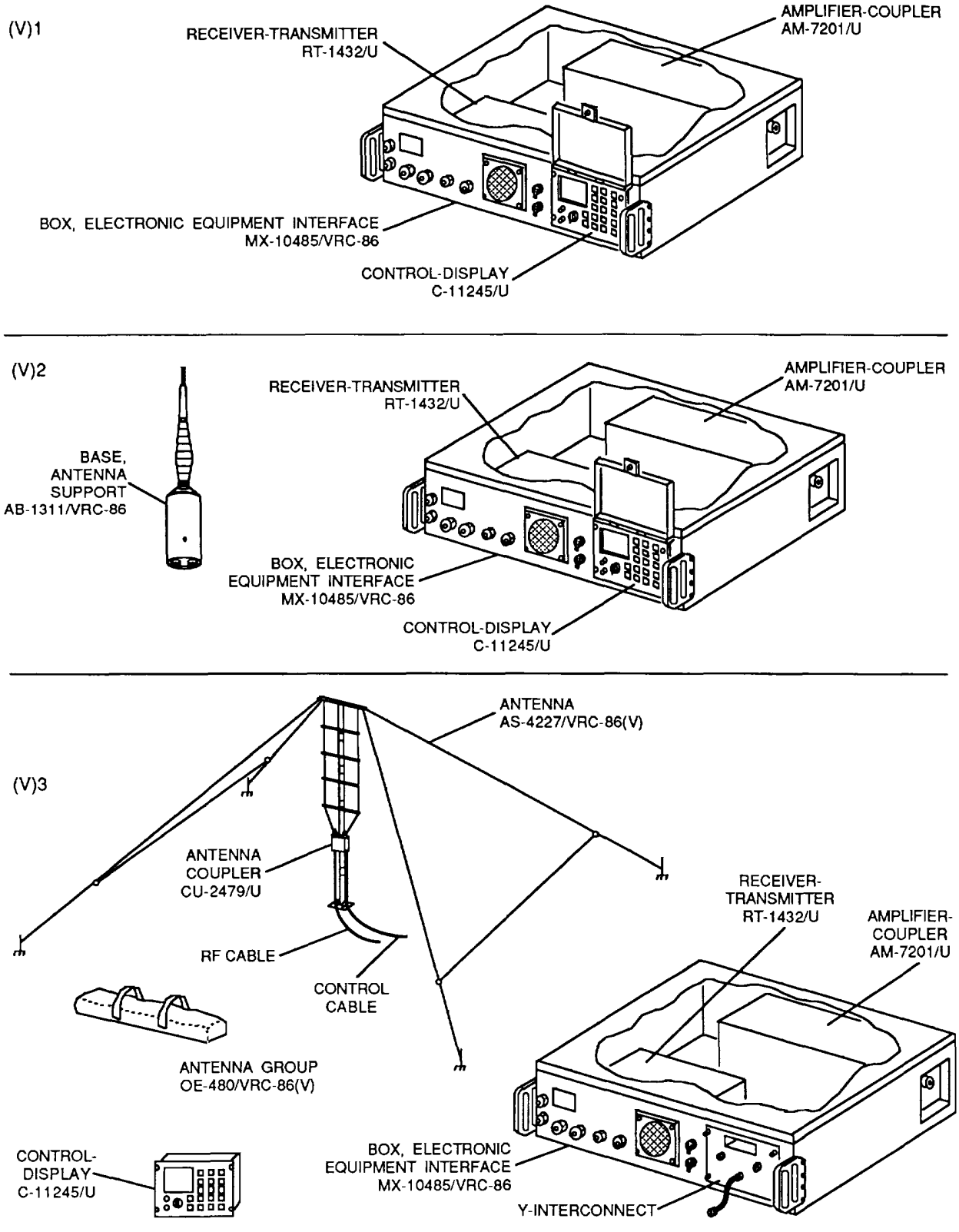


Figure 1-3. Radio Set AN/VRC-86(V) Configurations

SECTION III. PRINCIPLES OF OPERATION

1-14. General

The radio set is a high-frequency and amplitude modulated or single-sideband radio with selectable output power levels of 4, 40, and 170 watts PEP, and operates from a nominal 27.5 Vdc power supply. Frequency of operation is from 2.0 to 29.9999 MHz. Transmit and receive frequencies are programmable in 100 Hz increments on 21 presettable channels, for a total of 280,000 possible frequencies.

The radio set is operable at all times in a half-duplex, push-to-talk mode. Syllabic squelch is used in the radio set. Syllabic squelch is controlled from the control-display panel and is adjustable from OFF through eight levels to maximum. Squelch is broken when voice components are detected in the received signal and is independent of received RF level. Selective addressing (SELADR) squelch is provided to eliminate the reception of unwanted RF signals. When the SELADR feature is operational, the receiver is automatically squelched until the pre-programmed SELADR code is detected. The squelch is then automatically set to off and an audio tone is generated which notifies the operator of the incoming call.

BIT is incorporated into the radio set and includes an operator-initiated BIT as well as continuous monitoring of important operating conditions. If a fault is detected, the faulty unit, either the control-display, amplifier-coupler, or receiver-transmitter is identified on the CRT. Further operator initiated built in test and monitoring functions can be employed to identify and verify antenna coupler failures for the AN/VRC-86(V)3.

1-15. Simplified Block Diagram

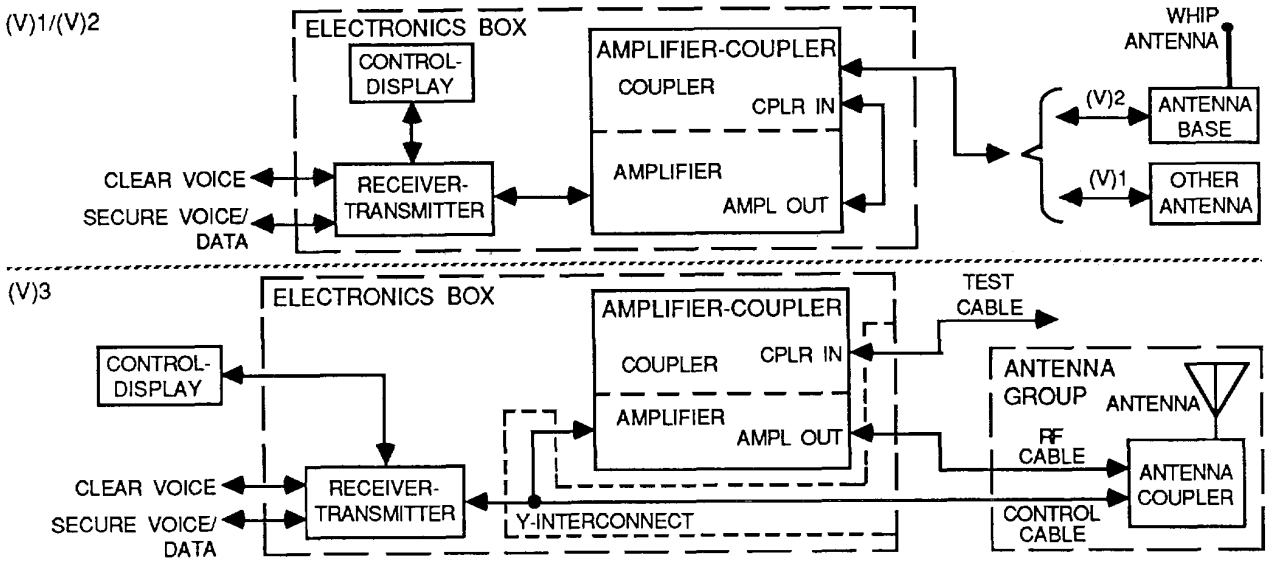


Figure 1-4. Radio Set AN/VRC-86(V) Simplified Block Diagram

a. Control-Display

(1) The control-display provides for complete operator control of the radio set. It includes a 17-key keyboard for setting up the operating parameters, and a 3-inch diagonal CRT screen for displaying those parameters.

(2) The control-display contains BIT capability. When BIT is commanded by the operator, the control-display performs a processor and memory self-test, then tests the CRT screen with an alternating checkerboard pattern.

(3) Other controls provided on the control-display panel are power on/off (OFF), brightness (CRT), audio volume (VOL), channel selector (CHAN), and a variable squelch control (SQL).

b. Amplifier-Coupler

(1) The amplifier-coupler contains a power amplifier capable of amplifying the output of the receiver-transmitter to selected output power levels of 4, 40, or 170 W PEP.

(2) Coupler circuitry matches the amplifier output impedance to the impedance of the antenna for maximum power transfer.

(3) A high power lockout switch on the front panel of the amplifier-coupler prevents unauthorized use of the high power (170W) mode. The OFF position restricts use to low (4W), or medium (40W) power only.

(4) BIT in the amplifier-coupler constantly monitors ALC, temperature in medium and high power modes, bias voltage, reverse power, arcing, and VSWR. When initiated, the amplifier-coupler performs a processor and memory self test. The amplifier-coupler also will monitor its power input from the receiver-transmitter for fault isolation during the system transmitter test.

(5) Initiated BIT also checks the power supplies, preamp gain, power amp output, ALC circuits, forward and reverse power, resistance and phase discriminators.

(6) For the AN/VRC-86(V)3 configuration in the amplifier coupler, the AMPLIFIER OUTPUT (P9722) is disconnected from the COUPLER INPUT (P9726) and applied to the antenna coupler RF input.

c. Receiver- Transmitter

The receiver-transmitter performs the following functions:

(1) Supplies the RF signal to the amplifier-coupler at a level of 0 to 10 dBm.

(2) Translates received RF signals to audio.

(3) Sends audio to an audio interface module which distributes the audio to the handset and local speaker or the COMSEC equipment.

(4) In the transmit mode, the transmitter portion translates through modulation, the audio from the hand set or the COMSEC equipment to the selected RF operating frequency for amplification and transmission by the amplifier-coupler.

(5) The receiver-transmitter interfaces with the amplifier-coupler by means of tuner control and tuner status serial data buses. Antenna tuning information, derived in the amplifier-coupler, is separately stored in the receiver-transmitter for each tuned channel. Once a channel is tuned to a specific frequency, subsequent tuning is not needed.

(6) All keyboard control information from the control-display is sent to the receiver-transmitter by means of a data bus, and status information is returned to the control-display for display by means of a second data bus.

(7) BIT in the receiver-transmitter constantly monitors the synthesizer for an out-of-lock condition, and monitors the integrity of the data bus communication between the control-display and the amplifier-coupler.

(8) Initiated BIT causes the receiver-transmitter to first perform a processor and memory self test which checks the timer, synthesizer, amplifier-coupler and SELADR serial links, and the SELADR board.

(9) The system receiver test occurs during initiated BIT and checks the receiver and squelch circuits using a 2 MHz signal generated by the amplifier-coupler.

(10) The system transmitter test occurs during initiated BIT. This test is performed in conjunction with the amplifier-coupler and does the following at six different frequencies between 2 and 29.9999 MHz.

(a) Checks receiver-transmitter for proper RF output level.

(b) Checks the ALC monitoring in the amplifier-coupler.

(c) Checks the ALC circuitry in the receiver-transmitter.

(d) Performs an open loop exciter ALC test.

(e) Performs a system closed loop ALC medium power test.

d. Antenna Base.

(1) The antenna base is used to tune the excessive capacitive reactance of the short vehicular whip antenna on the vehicle.

(2) The purpose of the antenna base is to improve power transfer efficiency from the amplifier-coupler to the whip antenna at low HF frequencies.

(3) Inductance is switched by frequency information derived from the amplifier-coupler.

(4) Antenna base RF connector (J9821) and control cable connector (J9822) interface with the electronics box.

e. Electronics Box.

(1) The electronics box distributes power to the LRUs within it. The electronics box is ventilated to prevent overheating of internal components.

(2) The electronics box is secured to the shock isolation tray by two pins at the rear of the tray and by two fluted nuts attached to the front of the tray.

(3) The electronics box interfaces with the COMSEC equipment power at connector J9814 and audio at connector J9813.

(4) The handset cable interfaces with the electronics box at connector J9812.

(5) The extension cable for remote control-display interfaces with the electronics box at connector J9817.

(6) Retransmission data cable interfaces with the electronics box at connector J9813.

(7) 27.5 Vdc power interfaces with the electronics box at connector J9811.

(8) The antenna base, the AN/GRA-50 or the AS-4096/G RF connectors interface with the electronics box at connector J9725.

(9) The antenna base control cable connector interfaces with the electronics box at connector J9816.

(10) The long wire antenna interfaces with RF connector J9725 using long wire adapter stored in electronics box.

f. Antenna Group.

Consists of the antenna, antenna coupler, and the RF and Control cables.

g. Antenna.

(1) Consists of the antenna elements, antenna mast, base, stowage bag, and hardware for erecting and supporting the antenna mast.

(2) Inverted V design for concentration of radiation at elevation angles necessary for optimum propagation at normal operating frequencies and distances.

(3) Two 1800 phase related, ungrounded antenna elements connect to the antenna coupler in a bent-horizontal, thick bow-tie design.

(4) Depending on operating frequency, the radiation pattern is generally non-directional with respect to azimuth due to the unique antenna element design. It is free of deep nulls characteristic of end-fire and broadside dipole antennas.

h. Antenna Coupler.

(1) The antenna coupler is a balanced coupler that impedance matches the antenna to provide the most efficient power transfer from the power amplifier output of the amplifier-coupler to the antenna.

(2) After initial tuning, capacitances and inductances in the antenna coupler are selected based on frequency and stored tuning information provided by the receiver-transmitter.

(3) A control cable connector (J104) and an RF cable connector (J114) interface with the Y-interconnect at the electronics box.

(4) Two standoff connectors connect the antenna elements to the antenna coupler.

i. RF and Control Cables.

(1) The RF cable is a 230 foot coaxial cable that transfers the transmitted and received RF signal between the amplifier-coupler and antenna coupler (through the Y-interconnect).

(2) The control cable is a 230 foot multi-conductor cable that transfers tuning control signals between the receiver-transmitter and antenna coupler.

j. Y-interconnect.

(1) The Y-interconnect provides a breakout of control signals between the receiver-transmitter and amplifier-coupler that are routed to the outside of the electronics box for the antenna coupler (J104).

(2) The Y-interconnect routes the RF amplifier output of the amplifier-coupler to the outside of the electronics box for the antenna coupler (J114).

(3) The Y-interconnect provides a cable for reconnecting the RF amplifier output to the coupler input for running BIT.

(4) A cooling fan is mounted on the Y-interconnect to exhaust hot air from the inside of the electronics box.

CHAPTER 2
OPERATING INSTRUCTIONS

SECTION I. DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS

2-1. General

Before attempting to use the radio set, make certain you are familiar with the location and operation of all controls and indicators. Also make sure the cover of the electronics box is in the latched position prior to and during operation. Paragraphs 2-2 and 2-3 will familiarize you with the displays and controls of the electronics box, the control-display, and the amplifier-coupler. Paragraph 2-4 gives you general considerations for operating the HF radio set effectively and efficiently. The (V)1, (V)2, and (V)3 configurations then have their own individual preoperating procedure found in paragraphs 2-5, 2-6, and 2-7, respectively. After following the preoperating procedure for your configuration, continue with paragraph 2-8 for detailed operating procedures common to all configurations of the radio set. Once you are acquainted with operation of the radio set, you can use foldouts FO-5 and FO-6 which are quick reference cards describing basic operation of the radio set. These quick reference cards can be reproduced locally and placed near the radio set for your use.

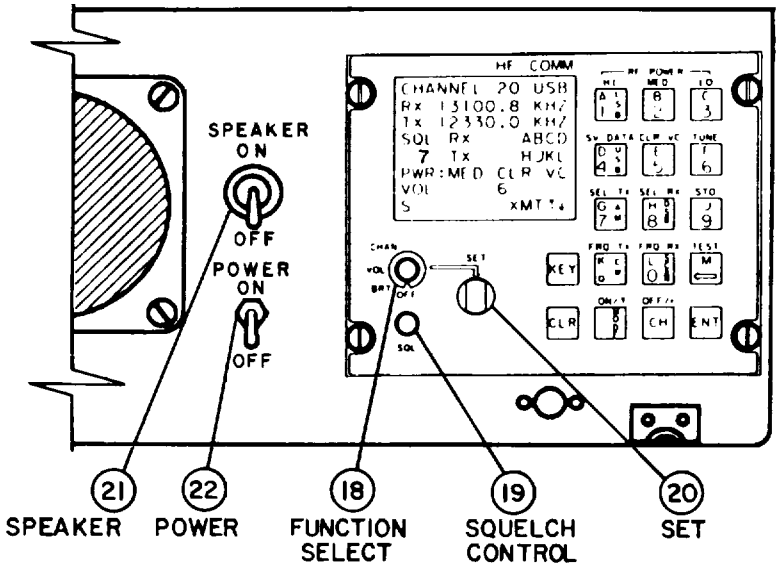
2-2. Controls and Switches

a. **Controls.** Figure 2-1 illustrates the controls used for selecting, viewing, and modifying the various operating limits for the radio set. The Table 2-1 explains the function of each. Figure 2-1 is typical of the AN/VRC-86(V)1 and (V)2 configurations which have the control-display located in the electronics box as shown. The control-display is remotely mounted in the AN/VRC-86(V)3 configuration. The control-display and electronics box function, appearance and operation is otherwise identical for all radio set configurations.

b. **Electronics Box, Control-Display and Handset Switches.** Figure 2-1 illustrates the POWER ON/OFF (22) and SPEAKER ON/OFF (21) switches located between the control-display and the speaker. Also illustrated is the handset PUSH-TO-TALK (23) switch and the FUNCTION SELECT (18), SQUELCH CONTROL (19) and SET (20) controls on the control-display. Table 2-1 explains the function of each.

NOTE

The electronics box POWER ON/OFF (22, Fig 2-1) switch must be set to ON for external power to be input to the radio set.



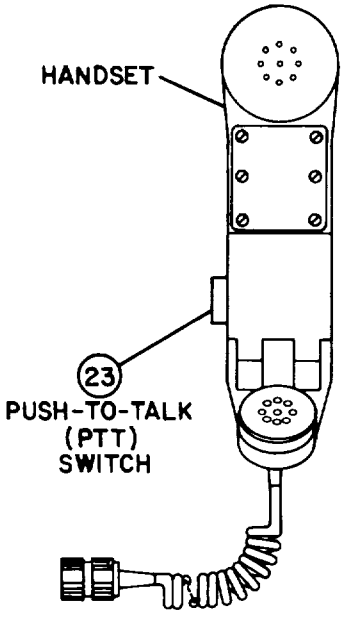


Figure 2-1. MX-10485NVRC-86 Controls and Switches

Table 2-1. Functions of Control Panel Knobs and Switches

Figure 2-1 Item	Item	Function
18	Function Select	Power off (OFF), CRT brightness (BRT), audio volume (VOL) and channel number selection (CHAN). Functions selected by this knob are adjusted with the SET knob.
19	Squelch Control	Continuous rotation in either direction with squelch level displayed in field 14 (figure 2-2) on CRT. Once squelch MAX has been reached in the clockwise direc-tion, further rotation of the knob has no effect. Rotation CCW from squelch OFF selects NET mode, selective address (SEL) mode, and selective address scan (SEL) mode.
20	Set	Single-step, snap-in-place-type switch, with rotation in either direction. CRT brightness, audio volume, or channel number can be increased with clockwise rotation. For CRT brightness and audio volume, the knob has no affect after the limit of that function has been reached. In the channel select mode, the SET knob is continuously active (channel 20 is always one position counter-clockwise from channel 0).
21	Speaker on/off	Turns electronics box speaker ON or OFF.
22	Power on/off	Switches 27.5 Vdc external primary power input ON or OFF.
23	Push-to-Talk (PTT)	Momentary push-button switch. During normal voice communication, pushing button keys the radio set transmitter.

c. Display Fields. Figure 2-2 shows a CRT screen with possible fields displayed. Table 2-2 explains the functions of the fields.

NOTE

All displayed information pertains to the currently displayed channel number as shown in figure 2-2. Instructions for changing fields or information for interpreting other data are given in table 2-2.

NOTE

For clarity, normal video CRT displays are illustrated in this manual with dark letters on a light background. Inverse video is shown with light letters on a dark background. With actual CRT displays, the light/dark relationship is reversed.

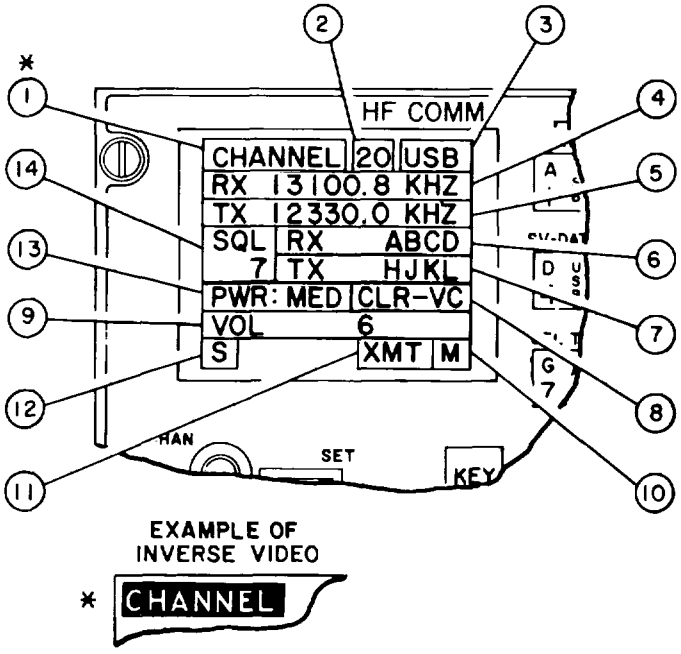


Figure 2-2. Display Field Functions

Table 2-2. Functions of CRT Display Fields

Figure 2-2 Display Field	Field Message	Function
1	CHANNEL	CHANNEL appears in inverse video to indicate that current channel information is not stored. When information is stored, the inverse video disappears.
2	20	Indicates active channel number 0 thru 20.
3	USB	Shows modulation mode, which appears as USB, LSB, AM, DSB, or CW. CW represents MCW and may be used with the handset push-to-talk switch to transmit code.
4	RX 13100.8 KHz	Indicates the receive frequency in kilohertz.
5	TX 12330.0 KHz	Indicates the transmit frequency in kilohertz.
6	RX ABCD	Indicates Receive Selective Address. If SELADR is operational for RX, ON is displayed on the same line with the RX.
7	TX HJKL	Indicates Transmit Selective Address. If SELADR is operational for TX, ON is displayed on the line with the TX.
8	CLR-VC	Indicates modulation source. Possible displays include: VC-DAT (input through J9813) CLR-VC (indicates handset input, J9812)
9	VOL 6	Indicates either a fault or the audio volume level. Displays and indications include: VOL MIN, 1 through 14, MAX (audio volume level) DATA NOT SAVED (unstored channel information) UNTUNED (displayed channel is not tuned) RT:MJR (major receiver-transmitter fault) RT:MNR (minor receiver-transmitter fault) AM:MJR (major amplifier-coupler fault) AM:MNR (minor amplifier-coupler fault)

Table 2-2. Functions of CRT Display Fields - Continued

Figure 2-2 Display Field	Field Message	Function
10	M	Normally will be blank. An M indicates MODE pushbutton has been pressed and USB, LSB, DSB, AM, CW, or SCAN should be selected next. Arrows indicate slewing may be used, or scan flag may be set or cleared.
11	XMT	Display has function indicated: XMT: Transmitter is keyed TEST: BIT mode is selected SCAN: SCAN mode is active STORE: Store function is selected TUNE: Tune mode selected TUNING: Tune mode active ENTRY ERROR: Out of range channel
12	S	Indicates that the currently displayed channel is on the scan list.
13	PWR: MED	Indicates transmitter output power with display of LO, MED, or HI.
14	SQL 7	Shows squelch level displayed as OFF, 1 through 7, to MAX (maximum), in conjunction with squelch knob. Also indicates NET mode, and selective address (SEL) mode.

d. Operating Modes and Pushbutton Functions. Figure 2-3 shows the pushbutton arrangement for the control-display panel. Table 2-3 explains the functions of the pushbuttons on the front panel of the control-display unit. The pushbuttons on the control-display front panel are multi-function. When used in the right combinations and sequences, each pushbutton may be used to accomplish a number of different operations. The letters A to M may be used in designated combinations in groups of four to select specific pre-determined transmit and receive selective address codes. The numbers on the pushbuttons are used to select the operating frequencies and channels. Other functions of the pushbuttons are to select specific modes of operation for the radio set. The detailed operating instructions are contained in Section II. Table 2-3 identifies the pushbuttons and describes the function of each. The function of the function select (18), the squelch control (19), and the set (20) knobs are described in paragraph 2-2.

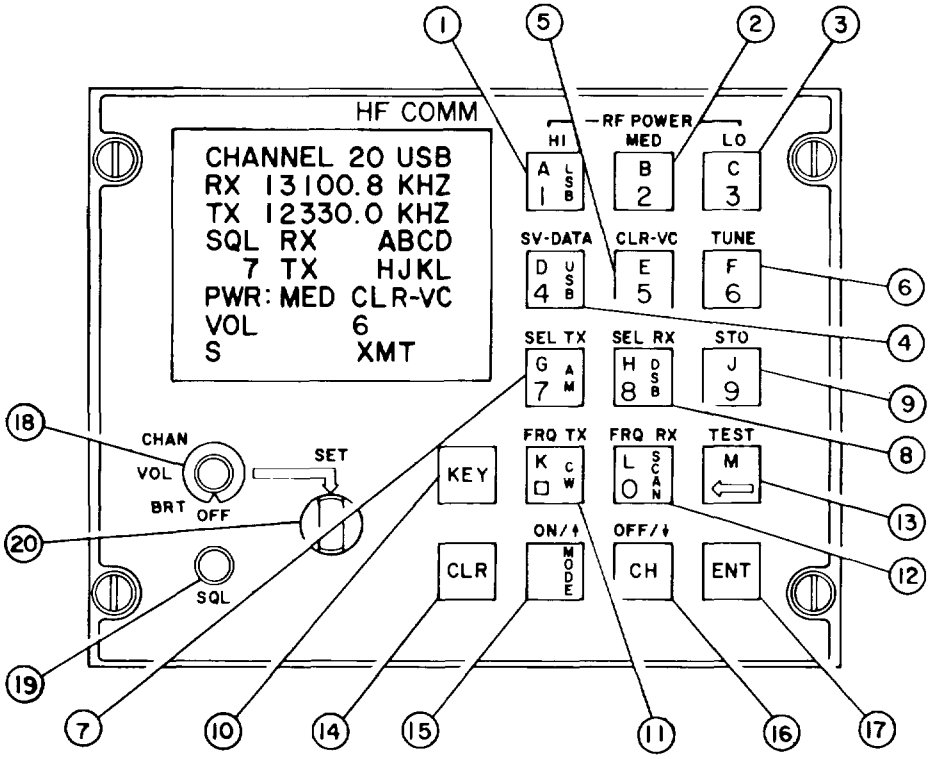


Figure 2-3. C-11245/U Control-Display Panel Pushbutton Layout

Table 2-3. Operating Modes and Pushbutton Functions

Figure 2-3 Item	Control/ Pushbutton	Function
	NOTE Numbers 0 through 9 and alpha letters A thru M are provided on the pushbuttons for entering data. However, most pushbuttons have more than one function. For complete operating instructions, see Section II.	
1	1 A LSB HI	Selects numeric one (1), alpha A, Lower Sideband Modulation, or HI Power Output.
2	2 B MED	Selects numeric two (2), alpha B, or medium power output.
3	3 C LO	Selects numeric three (3), alpha C or low power output.
4	4 D USB SV-DATA	Selects numeric four (4), alpha D or upper sideband modulation (USB). SV-DATA selects the 600-ohm data input (J9813) as the modulation source. The modulation source is not a stored limit.
5	5 E CLR VC	Selects numeric five (5), alpha E, or selects the handset (J9812) (CLR-VC) as the modulation source.
6	6 F TUNE	Selects numeric six (6), alpha F, or the currently displayed channel to be tuned to the antenna. TUNE stores tuning information for future use with no retuning necessary.
7	7 G AM SEL TX	Selects numeric seven (7), alpha G or amplitude modulation (AM). SEL TX is used to select the transmit selective address code to be programmed.

Table 2-3. Operating Modes and Pushbutton Functions - Continued

Figure 2-3 Item	Control/ Pushbutton	Function
8	8 H DSB SEL RX	Selects numeric eight (8), alpha H or double sideband modulation (DSB). SEL RX is used to select the receive selective address code to be programmed.
9	9 J STO	Selects numeric nine (9) or alpha J. STO is used to store currently displayed channel information.
10	KEY	When radio is in the CW mode, this key allows the operator to transmit with coded communication, such as Morse code, rather than transmitting with normal voice communication.
11	• K CW FRQ TX	Selects decimal point (shown on the push-button with a square), alpha K, or carrier wave (CW). FRQ TX is used to select transmit frequency to be entered.
12	0 L SCAN FREQ RX	Selects numeric zero (0), or alpha L. SCAN is used to review/select channels on the stored scan list. FRQ RX selects receive frequency to be entered. Frequencies from 2.0 to 29.9999 MHz may be programmed in 100 Hz steps.
13	M TEST ←	Selects alpha M, or BIT to be initiated. ← (arrow) on M pushbutton is used with the receive frequency mode by displaying a cursor on the CRT over the rightmost number in the frequency displayed. ← allows cursor to be moved to left on the receive frequency so that it can be adjusted with the SET (20) knob or ↑ (15) and ↓ (16) pushbuttons for SSB clarification.

Table 2-3. Operating Modes and Pushbutton Functions - Continued

Figure 2-3 ITEM	Control/ Pushbutton	Function
14	CLR	Clears the function in process in the control-display. Returns the screen to the last stored mode.
15	MODE ON/↑	Shifts the keyboard to the mode function located on the right of the A, D, G, K, and H pushbuttons. It is used to initiate SCAN operations. This pushbutton is also used to increase (upward arrow) channel number or receive frequency.
16	CH OFF/↓	Used to activate channel selection. This pushbutton is also used to decrease (downward arrow) channel number or receive frequency.
17	ENT	Initiates the "ENTER" process when selecting channel data or modes, and causes the new information to become operational.

2-3. Amplifier-Coupler Controls And Indicators

Refer to figure 2-4. Located on the front of the amplifier coupler are three circuit breakers. Circuit breaker (1) is a 5 A circuit breaker which controls power to the control-display. Circuit breaker (2) is a 20 A circuit breaker which controls power to the amplifier-coupler. Circuit breaker (3) is a 5 A circuit breaker which controls power to the receiver-transmitter. Circuit breakers should remain in the closed position (pressed in) to function properly.

Elapsed Time Indicator (4) is a digital display indicating total time period in hours that the system has been under power.

High Power Lockout Switch (5) is a screwdriver-set switch and prevents unauthorized use of high power mode when turned counterclockwise to the OFF position.

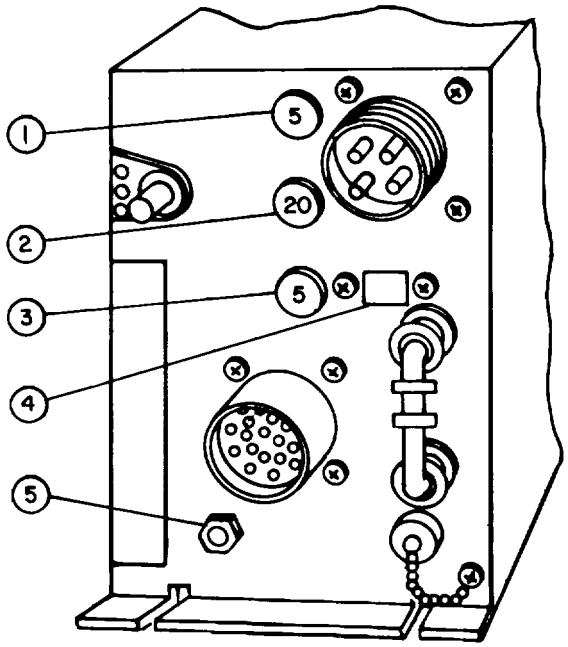


Figure 2-4. AM-7201/U Amplifier-Coupler Controls

SECTION II. OPERATION UNDER USUAL CONDITIONS

2-4. General Considerations for Radio Set Operation

The following sub-paragraphs describe several factors you should consider to efficiently and effectively operate the radio set.

a. General HF Propagation Theory. The primary method of travel or propagation of HF radio waves is via skywaves. Skywaves are radio waves that start out radiating from the antenna into space and are reflected off the ionosphere back to the earth. This is often referred to as "skip." The ionosphere, located in the upper atmosphere is a multi-layered shell of electrically charged particles surrounding the earth. It varies in height above the surface of the earth from approximately 30 to over 400 miles. The height and intensity varies from one location to the next and is also affected by the season of the year and the time of day. It also varies in an 11 year "sunspot cycle" as well as a 27 day "sunspot cycle." This reflecting of signals makes it possible to communicate over very long distances under certain conditions. Ranges are typically in excess of 2,000 miles and it is possible to have ranges over 4,000 miles. Because of variations in the ionosphere, effective HF communication requires an awareness of environmental conditions and requires making operational decisions such as frequency selection.

Because HF radio waves depend upon the ionosphere for reflection, their propagation is affected by changes in the ionosphere. More specifically, it is changes in the density of the electrically charged particles in the ionosphere that affect propagation. Since the ionosphere is formed primarily by the action of the sun's ultraviolet radiation, its thickness changes in relation to the amount of sunlight hitting it. Sunlight-induced ionization increases the particle density during the day and the absence of sunlight reduces the particle density at night. At midday, when the sun's radiation is at its highest, the ionosphere's thickness may expand into as many as four ionized layers. During the night, the ionosphere diminishes, normally merging into one layer.

Solar disturbances including solar flares and magnetic storms can cause propagation of HF radio waves to become quickly and unexpectedly degraded. HF signals can also suffer interference from atmospheric disturbances such as precipitation and thunderstorms. Man-made noise, whether generated intentionally or unintentionally, can also interfere with HF radio communications. Some typical sources of man-made noise are oscillators, communication transmitters, generators, motors and relays.

The net result of all these factors is that, because the ionospheric and atmospheric conditions are constantly changing, the quality of HF communications can vary accordingly. The signal received on the radio set may also be accompanied by a considerable amount of static from atmospheric disturbances. The signal may fade in and out at times because each radio wave hitting the changing ionosphere may be reflected differently. Your reception and transmission success may vary from loud and clear to nonexistent depending on your selection of frequency and the conditions in the atmosphere and the ionosphere.

Further information about radio wave propagation and can be found in FM 11-64, Communication-Electronics Fundamentals: Transmission Lines, Wave Propagation, and Antennas. NVIS propagation is discussed in more detail in FM 24-18, Tactical Single-Channel Radio Communication Techniques.

b. Operating Frequency Selection. Often, only a small portion of the HF band may be useable at any given time. Which portion is useable can vary enough that a frequency may go from useable to unuseable in only a few minutes. Under other conditions, it is possible to find a single frequency which will work both day and night for extended periods (months) of time. Because of this variability, you must coordinate closely with your frequency manager or Signal Officer to insure that you have an authorized frequency that will work for your mission. It is also desireable to coordinate authorization for several alternate frequencies to enhance your chances of having one that works when conditions change. The frequency selection techniques below are to help you target your frequency authorization requests to ranges of frequencies which will give you the greatest chances of mission accomplishment.

Review of frequency selection can also be helpful in troubleshooting communication problems by identifying which problems are most likely due to propagation conditions and which are most likely equipment failures.

One of the most significant things that can be done to assure the best possible HF communications based on existing HF propagation conditions, is to select an optimum operating frequency. One general rule of thumb for the time of day is that higher frequencies (10 to 30 MHz) work best during daylight and lower frequencies (2 to 10 MHz) work best at night. This can best be explained by thinking of the ionosphere as a mirror for the HF radio waves. Just like a mirror reflects light, the electrically charged particles in the ionosphere reflect or bend radio waves back toward earth. Since the density of the ionosphere is increased during the day, the effect is that the ionosphere “mirror” becomes thicker and it will reflect higher frequencies better. At night, when the ionosphere is no longer in the sun, the density of charged particles decreases and the ionosphere reflects only lower HF frequencies.

For any one particular frequency, as the angle at which an HF radio wave hits a layer of the ionosphere is increased, a critical angle will be reached from which the wave will just barely manage to be reflected back to earth. Waves entering at angles sharper than this critical angle will pass through the ionosphere layer and be lost in space or may be reflected off a higher layer of the ionosphere.

Changing the frequency while ionospheric conditions remain the same will also change the critical angle at which the HF radio waves will be reflected back to earth. The highest frequency which is reflected back to earth is called the maximum usable frequency (MUF). The best HF communications are usually obtained using a frequency as close to the MUF as possible since radio waves higher than this frequency are not reflected and radio waves lower than this frequency will be partially absorbed by the ionosphere.

At any time, day or night, there is a “window” of useable frequencies created by the reflecting properties of the ionosphere. At night this “window” will normally be in the lower range of HF frequencies, and during the day it will be in the higher range of frequencies.

The effect of solar disturbances including solar flares and magnetic storms is to change the particle density in the ionosphere. Therefore, the “window” of useable frequencies may begin to close, with radio waves of frequencies in the lower range dropping out first as they are absorbed by the ionosphere.

Another phenomenon which occurs during solar disturbances may allow you to communicate with a station even though the “window” is closed. This is known as scatter propagation, in which a radio wave is broken up in the ionosphere and scatters in various directions.

Because frequency propagation cannot be predicted with total accuracy, ground stations responsible for aircraft HF communications will typically operate on several different frequencies within the HF band. The operator is then able to choose the optimum communication frequency for the existing ionospheric conditions.

It is advisable to program at least three frequencies for each station you plan to contact, in case one frequency suddenly becomes unuseable. During times of solar disturbances, a useable frequency can fade out in less than a minute. And the “window” of useable frequencies can shift rapidly during solar disturbances or during sunset and sunrise when the level of ionization in the ionosphere is changing rapidly.

One useful and simple technique for making on-the-spot checks for propagation conditions is listening. Tune your receiver through a range of frequencies several hundred kilohertz on each side of your authorized frequency. Listen for signals of any type. If possible, identify the source(s) of these signals and their locations (known broadcast stations are good check points for this technique). This will give you a rough idea of whether or not your portion of the band is “open” or propagating, and whether the skip is working over the distances that you intend to communicate.

There are several readily available software packages which provide predictions of HF propagation. Two examples of these are MiniProp and MINIMUF. These programs are similar in nature. Data required by both programs includes latitude and longitude of the stations at each end of the link, the calandar date, and the solar flux value or sunspot number. These last two items can be obtained by listening to the National Institute for Standards and Technology (NIST, formerly National Bureau of Standards) stations WWV or WWVH at 18 minutes after the hour every hour. Frequencies for WWV and WWVH are 2.5, 3.334, 5.0, 7.335, 10.0, 15.0, and 20.0 MHz. The solar flux value may also be obtained by telephoning NIST at (303) 497-3235. There is a direct mathematical relationship between these two numbers. Each of the programs described will calculate one number when given the other.

Outputs of these programs include listings of which ranges of frequencies are likely to work for different times of day, and how well. The details of how this information is presented and used vary from program to program. When using any of these programs, the user should refer to any documentation that comes with the program.

The first program we will review is MiniProp. This program calculates the maximum useable frequency (MUF), the lowest useable frequency refered to as the E layer cutoff frequency (ECOF), and charts these parameters by time of day. It also predicts relative signal strengths for a communications link, calculates optimum takeoff angle (useful for antenna selection), calculates the great circle azimuths between the stations (useful for orientation of directional antennas), the great circle distances between the stations, and the number of hops that the signal will take. There are also several user selectable formats for the output including tables and graphs. Complete documentation on how to use this program is included on the diskette, and can be printed out by the user.

The following are requirement for using this program:

Hardware required: IBM PC or compatible (and printer if hard copy is desired)
Diskettes required: 1
Software required: MS-DOS 2.1 or higher

MiniProp is available from the USACECOM Command and Control Microcomputer Users' Group (C2MUG), Catalog Number 011-002. To obtain a copy of this program, send a soft sector, double sided, double density 5 ¼ inch diskette or a 3 ½ inch diskette along with your order and two self-addressed labels to:

Associate Director, MCS CSE
ATTN: AMSEL-RD-SE-MCS (C2MUG)
Building 138
Fort Leavenworth, KS 66027-5600

Catalogs of other software available for Army use can also be ordered from this address.

The second program we will review is MINIMUF. MINIMUF is a public domain program developed by the Naval Ocean Systems Center. It is distributed by:

National Technical Information Service
U.S. Department of Commerce
Springfield, VA 22161

Order document number NOSC Technical Document 201 (TD 201). The document contains a printed source code listing of the program in BASIC programming language. The program is approximately 80 lines of code. Also included are technical background information and user tips.

c. Single Sideband (SSB) Operation. The following are some operating characteristics that are unique to single sideband (SSB) operation. Familiarity with these characteristics will help you operate in the SSB modes more efficiently and effectively.

When the modulating voice or data input is mixed with the selected RF carrier frequency the result is three separate signals. These are, 1) the amplitude modulated (AM) carrier frequency, 2) a signal above the carrier that is the sum of the carrier frequency plus the audio frequency called upper sideband (USB), and 3) a signal below the carrier that is the difference of the carrier frequency minus the audio frequency called lower sideband (LSB). In the USB mode, the radio set transmits and receives only the sideband above the carrier frequency. Likewise, in the LSB mode, the radio set transmits and receives only the sideband below the carrier frequency. In double sideband (DSB) mode, the radio set transmits and receives the sidebands both above and below the carrier frequency.

When you select your transmit frequency with the radio set in the USB, LSB, or DSB mode, you are actually selecting what would be the AM carrier frequency. This carrier frequency is suppressed and not transmitted in SSB mode, only the selected sideband is transmitted. Likewise, when you tune a SSB signal with this radio set, you select a receive frequency that would be the associated AM carrier frequency.

The nature of HF and SSB communications means you may encounter some unique problems such as echo, fading or frequency changes due to multi-path reception or doppler shift. These problems usually will not disrupt communications.

When the transmitted signal radiates from the antenna, it can take several paths before it reaches the receiver. It can be bounced off the ionosphere, the earth or a mountain. It can also travel directly to the receiver. The trouble is that these signals take different amounts of time to travel along their different paths. For larger differences in travel time it can sound like there is an echo or sound like you or the sender is in a barrel.

If the time difference between two received signals is smaller, the signal arriving at the receiver later can be exactly out of phase with the signal arriving first. This causes the two signals to cancel each other out. While the received signals may both be strong, it will sound like the signal is fading in and out.

The ionosphere is not always stable and a layer can move to cause shifts in the frequency of HF signals that are reflected off of it. This phenomenon is called doppler shift. When the layer is moving toward the earth, the reflected signal gets pushed or compressed resulting in an upward shift in the frequency being received. Likewise, when the layer is moving away, the frequency is shifted downward. In a SSB mode, the signal at the receiver will sound like it is going up and down in pitch or tone.

When you are tuning a SSB signal at your receiver, here are some hints that will help you operate the radio set more effectively. If in USB mode and the voice sounds too high, tune the receive frequency up. If in LSB mode and the voice sounds too high, tune the receive frequency down. An easy way to remember this is - if in UPper sideband and voice is UP too high, tune the received frequency UP. Changing the receive frequency will not change the transmit frequency. An easy way to fine tune the received signal is as follows.

(1) Press the FREQ RX key (12, fig 2-3)

(2) Press the left arrow key (13, fig 2-3) until the right hand number in the RX field (4, fig 2-2) is in inverse video.

(3) Turn the SET knob (20, fig 2-2) left or right as needed to fine tune the received signal to get the best sounding audio.

d. Antenna Site Considerations. An antenna system actually consists of all the components between the RF amplifier-coupler output and the radiator. This means that a long run of coax cable becomes part of the antenna and coax does not make a very good antenna. This is particularly significant when the impedance of the antenna is not matched with that of the transmitter output. That is why it is important to locate the antenna radiator as close as possible to the amplifier-coupler output to make the coax as short as possible and to minimize VSWR. The (V)1 radio set uses a coupler to optimize the impedance match between the transmitter and the antenna. The (V)2 radio set uses a switchable impedance in the antenna base in addition to the coupler for improved matching at lower HF frequencies. The (V)3 radio set, on the other hand, allows placement of the antenna group at distances of up to 200 feet from the electronics box. This is possible because the antenna coupler is located on the antenna mast and matches impedances to make the coax cable between transmitter and radiating elements act only to transfer the RF energy to the antenna coupler.

You should also take steps to provide the best antenna ground plane possible to provide a good counterpoise to the radiator. Earth is not a perfect conductor. The effective ground plane is seldom actually the surface of the earth but a few inches to a few feet below the surface, depending on soil characteristics. Laying a wire or a wire pattern on the ground can help achieve a good ground plane. With the antenna group in the (V)3 configuration, providing a good ground plane is not critical since it is designed to have a balanced output that does not rely on a ground plane.

With all antenna installations you should try to set up the antenna clear of conductive objects, such as power lines, phone wires, and gutters. It is also advisable to avoid setting up near hillsides or buildings as this will degrade the radiation of RF energy in their direction.

For more detailed information on set up and use of antennas refer to FM 11-64, Communications-Electronics Fundamentals: Transmission Lines, Wave Propagation and Antennas.

e. General Antenna Selection Considerations. The AN/VRC-86(V) and its airborne counterpart, the AN/ARC-199 will operate with a wide variety of antennas. Matching antennas to mission requirements is critical to achieving effective communications. The purpose of this section is to cover the antennas commonly issued or used with the AN/VRC-86(V). These are primarily omnidirectional or nearly omnidirectional antennas best adapted for short to medium ranges (O to 200 miles) where little or no skip is a desireable feature. The AN/VRC-86(V) may also be used with directional antennas. Such antennas are primarily for longer range communications (200 to more than 10000 miles) where a skip zone is acceptable. The wide variety of available antennas precludes detailed coverage in this manual. For information on other types of antennas, refer to FM 11-64, Communications-Electronics Fundamentals: Transmission Lines, Wave Propagation and Antennas and the technical publications for the specific antennas involved.

Refer to figure 2-5. Select antennas for all stations in the net using the best equipment available that will conform to the tactical situation.

If mobile-to-mobile communications are required beyond ground wave/line of sight distances, give a high priority to having at least one station in the net equipped with an OE-480/VRC-86(V) or comparable antenna to serve as a relay.

Remember that ground wave/line of sight range does not always extend to 60 miles. It is highly dependent on frequency and terrain, and may be as short as 2 miles under some conditions.

f. Internetting With the Radio Set. Operation of a radio net using older and newer types of radio sets requires consideration of the type of emission and method each radio set uses for tuning. Newer radio sets including the AN/VRC-86(V) use detent or digital tuning, typically in 100 Hz increments and are capable of SSB and compatible AM, voice or CW operation. Older sets are usually continuously tuned and operate on DSB.

In a net using older and newer radio sets, the newer radio set should be the standard to which the old radio sets should tune. The newer radio sets should be set to AM compatible mode for voice interoperation with older radio sets.

For further details on internetting, other operating modes, secure operation, and specific radio set characteristics refer to FM 24-18, Tactical Single-Channel Radio Communications Techniques.

g. General Grounding and Bonding Considerations. Proper grounding and bonding is extremely important to reliable and efficient operation of HF radio communications circuits. Incorrect grounding and bonding can cause the antenna to be tuned inefficiently resulting in loss of radiated power, detuning of the antenna during operation, or arcing that could potentially damage the radio set.

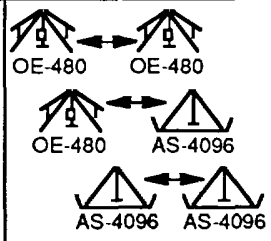
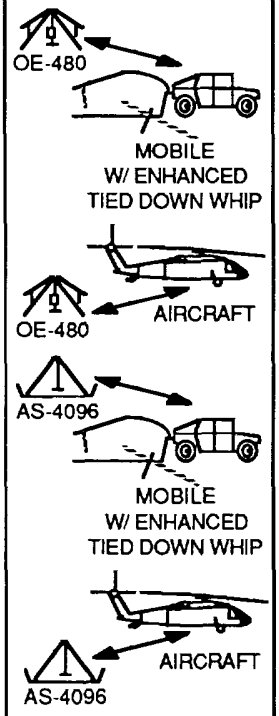
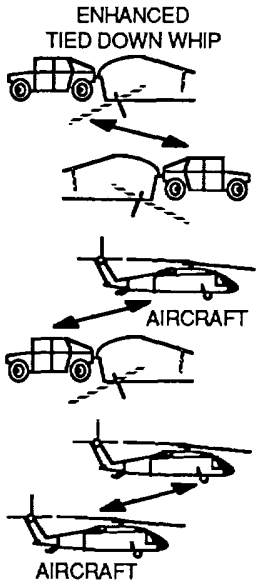
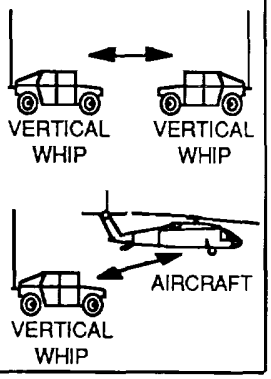
	BEST OVERALL	GOOD OVERALL	FAIR TO MARGINAL OVERALL	POOREST OVERALL
GROUNDWAVE & LINE OF SIGHT 0 - 80 Km	GOOD	GOOD	GOOD	GOOD
NVIS/SHORT SKIP 0 - 300 Km	GOOD	FAIR	MARGINAL	POOR
LONG SKIP 300 - 13000 Km & BEYOND	GOOD	MARGINAL TO POOR	MARGINAL TO POOR	POOR
				

Figure 2-5. Qualitative Antenna Selection Guide

Some guidelines for grounding and bonding are listed below which will help assure reliable and efficient HF radio operation.

(1) Grounding Requirements.

(a) Grounding straps should be as short as possible and should not exhibit an impedance of greater than 2.5 milliohms.

(b) The strap should be installed in such manner as to not interfere with normal operation of shock mounts.

(c) Grounding straps used to ground the radio set to the vehicle should not be braid or wire, but a solid copper strap, one inch wide.

(2) Bonding Connections.

(a) To assure a low resistance connection, non-conducting finishes such as paint, anodizing films, or zinc chromate must be totally removed from the attachment surface to be contacted by the bonding strap. Techniques such as spot-facing or cleaning only small areas of the mating surfaces do not provide adequate RF bonding.

(b) Do not ground electrical wiring directly to magnesium parts.

(3) Corrosion Prevention.

(a) Electrolytic action may rapidly corrode a bonding connection if suitable precautions are not taken. Where contact between dissimilar metals cannot be avoided, the choice of strap and hardware should be such that corrosion is minimized, and the part likely to corrode would be the strap itself. Figures 2-1 through 2-4 show the proper hardware combinations for making a bond connection.

(b) At locations where finishes are removed, apply a conductive protective finish to the completed connection to prevent subsequent corrosion.

(c) Make periodic inspections of all bonds to ensure corrosion is not occuring.

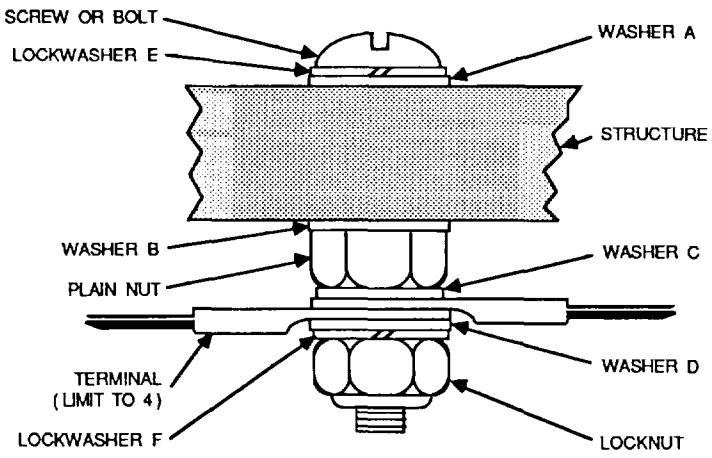
(4) Bonding Strap Attachment.

(a) Avoid the use of solder to attach bonding straps.

(b) Bond tubular members by means of clamps to which the strap is attached.

(c) When bonding straps carry substantial ground return current, make sure that the current rating of the straps is adequate, and that a negligible voltage drop is produced.

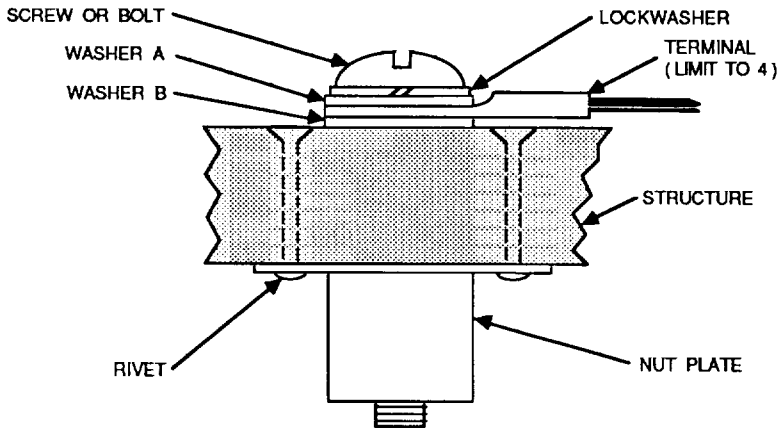
(d) Refer to figures 2-6, 2-7, and 2-8 which illustrate grounding and bonding to some more common surfaces.



STRUCTURE	SCREW OR BOLT AND LOCK NUT	PLAIN NUT	WASHER A	WASHER B	WASHER C & D	LOCK WASHER E	LOCK WASHER F
ALLUMINUM ALLOYS	CAD. PLATED STEEL, STEEL	CAD. PLATED	ALUM. ALLOY	ALUM. ALLOY STEEL	CAD. PLATED	CAD. PLATED STEEL	CAD. PLATED STEEL, ALUM.
MAGNESIUM ALLOYS *							
CAD. PLATED STEEL	CAD. PLATED STEEL	CAD. PLATED	NONE	NONE	CAD. PLATED STEEL	CAD. PLATED STEEL	CAD. PLATED STEEL
CORROSION RESISTING STEEL	CORROSION RESISTING STEEL	COR. RES. STEEL	NONE	NONE	CAD. PLATED STEEL	COR. RESIST STEEL	COR. RESIST STEEL

* AVOID CONNECTING COPPER TO MAGNESIUM

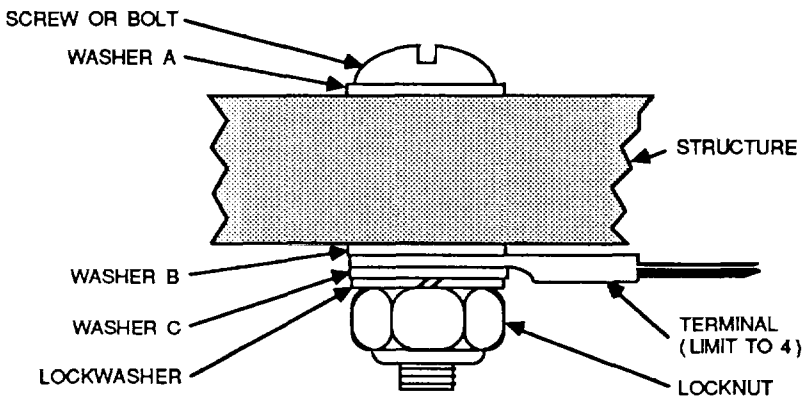
Figure 2-6. Grounding and Bonding to a Stud



STRUCTURE	SCREW OR BOLT AND NUT PLATE	RIVET	LOCKWASHER	WASHER A	WASHER B
ALLUMINUM ALLOYS	CAD. PLATED STEEL	ALUMINUM ALLOY	CAD. PLATED STEEL	CAD. PLATED STEEL	ALUMINUM ALLOY
MAGNESIUM ALLOYS *					
CAD. PLATED STEEL	CAD. PLATED STEEL	COR. RESIST. STEEL	CAD. PLATED STEEL	CAD. PLATED STEEL	NONE
COR. RESIST. STEEL	CAD. PLATED STEEL	COR. RESIST. STEEL	CAD. PLATED STEEL	CAD. PLATED STEEL	NONE

* AVOID CONNECTING COPPER TO MAGNESIUM

Figure 2-7. Grounding and Bonding to a Plate Nut



STRUCTURE	SCREW OR BOLT AND LOCKNUT	LOCKWASHER	WASHER A	WASHER B	WASHER C
ALUMINUM ALLOY	CAD. PLATED STEEL	CAD. PLATED STEEL	CAD. PLATED STEEL	ALUMINUM ALLOY	CAD. PLATED STEEL
MAGNESIUM ALLOYS *					
CAD. PLATED STEEL	CAD. PLATED STEEL	CAD. PLATED STEEL	CAD. PLATED STEEL	NONE	CAD. PLATED STEEL
COR. RESIST. STEEL	COR. RESIST. OR CAD. PLATED STEEL	CAD. PLATED STEEL	COR. RESIST. STEEL	NONE	CAD. PLATED STEEL

* AVOID CONNECTING COPPER TO MAGNESIUM

Figure 2-8. Grounding and Bonding to a Flat Surface

2-5. Preoperating Procedure for ANNRC-86(V)1

Since the AN/VRC-86(V)1 radio set does not have a specific antenna type associated with it, special consideration must be given to antenna grounding and bonding as well as RF transmission lines. It is recommended that the radio set be used with broadband antenna AS-4096/G, antenna group AN/GRA-50, or a long wire. Before operating the radio set, follow the recommendations for using each antenna as described below.

a. ***Grounding and Bonding***. The electronics box should be grounded to the vehicle, shelter, or earth with a conductive solid strap connected to the ground lug on the side of the electronics box. When grounding to earth, the soil around ground spikes and antenna ground return wires should be kept damp with a salt water solution if possible. Dry, loose soil does not provide a good ground. Connections to ground spikes should be made following the general bonding and grounding rules.

b. ***RF Transmission Line***. The RF coax between the coupler output and the antenna elements should be as short as possible. A long transmission line can present an abnormal load to the transmitter and cause the VSWR to be very high. The amplifier-coupler will try to tune the coax and radiating element as if they were all the antenna. This, in effect, makes the transmission line begin to act as an antenna and coax just doesn't make a very good antenna.

c. ***Using Broadband Antenna AS-4096/G***. Refer to figure 2-9. When using the radio set with the AS-4096/G, a ground wire (1) should be added between the ground terminations (2) of the antenna elements. This can be any 16 AWG or larger wire.

d. ***Using Antenna Group AN/GRA-50***. Use the procedures provided with the antenna to set up the antenna group. For best operation, the antenna element length must be set every time the operating frequency at the radio set is changed. The antenna group provides an easy way to adjust for the correct element length by having the frequency imprinted on the element. Simply pull out or reel in the element to set it for the radio set operating frequency.

e. ***Using a Long Wire Antenna.*** Refer to figure 2-10 for the location of the long wire adapter (1) stored inside the electronics box. The adapter is connected to J9725 (2). A wire used as a long wire antenna should be 14 AWG or larger. For the best results as a half-wave antenna, the wire should be cut to the proper length (L) for the operating frequency (f) according to the following formula. A quarter-wave antenna would be half the length of a half-wave antenna.

$$L = \frac{492{,}000}{f}$$

Where:
L is length of wire in feet for a half-wave antenna
f is operating frequency in khz

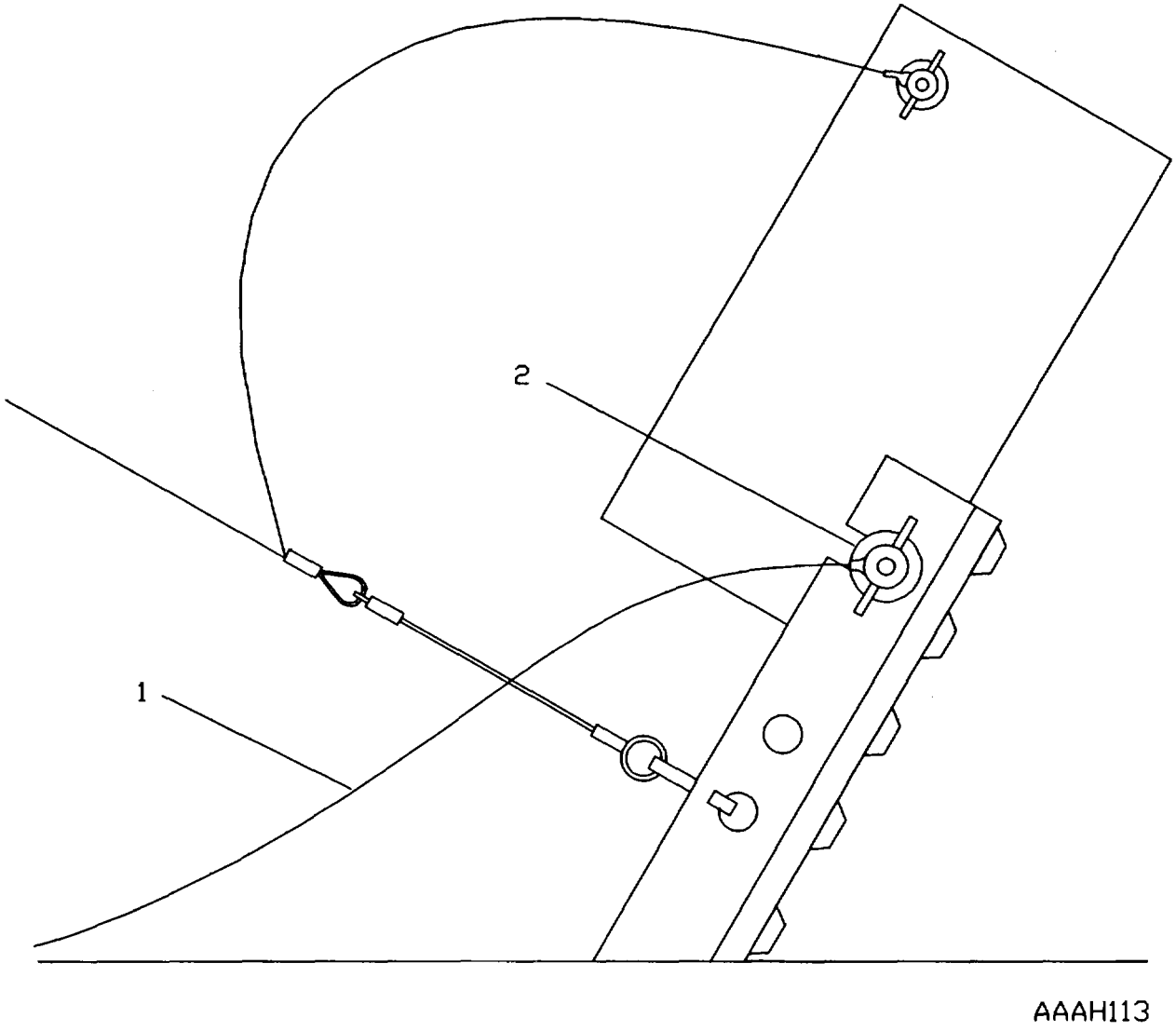


Figure 2-9. Addition of Ground Wire to AS-4096/G Antenna

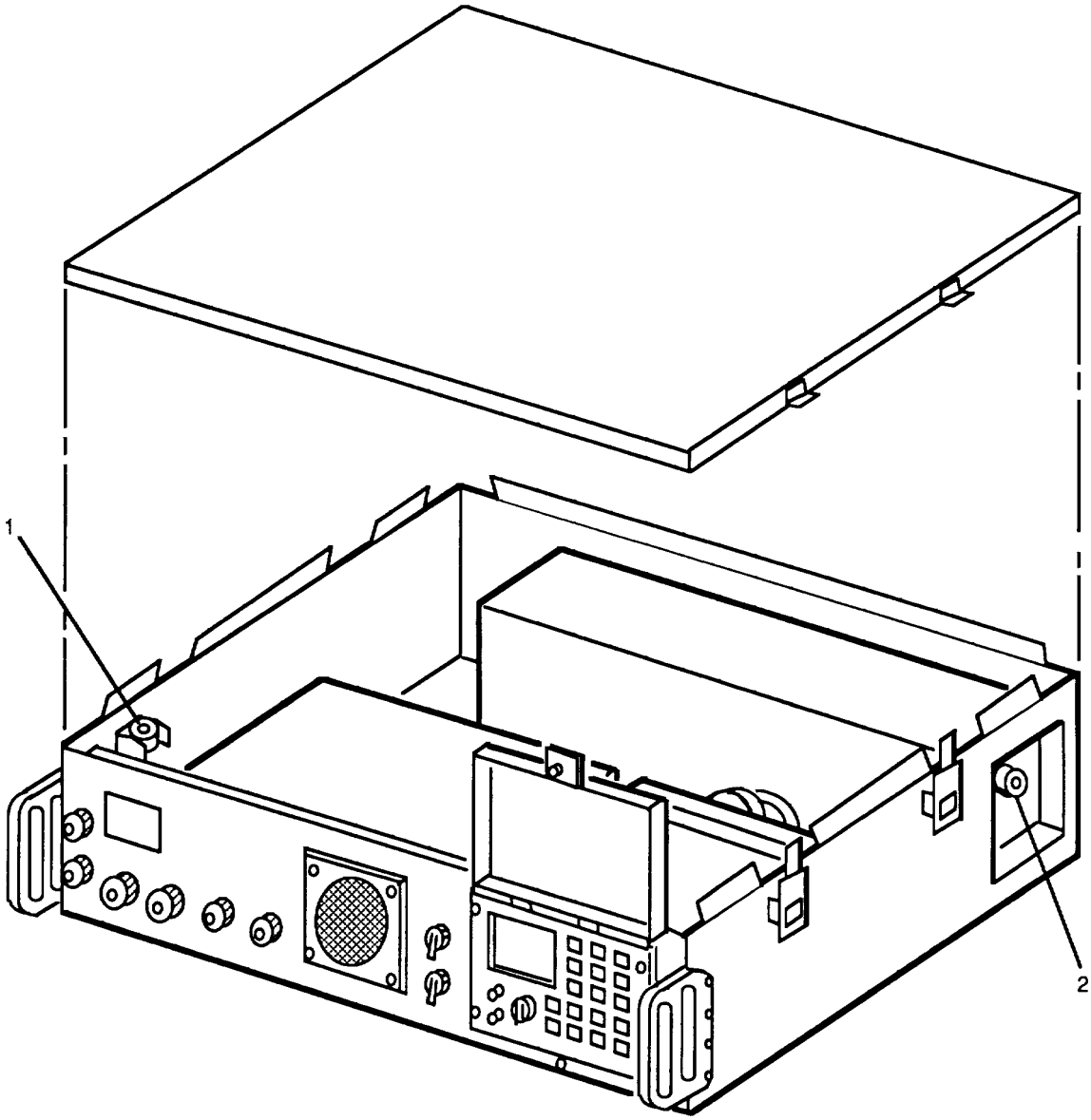


Figure 2-10. Long Wire Adapter Location

2-6. Preoperating Procedure for AN/VRC-86(V)2

The (V)2 configuration is used with the antenna base and a whip antenna.

a. ***Grounding and Bonding***. The electronics box should be grounded to the vehicle, shelter, or earth with a solid conductive strap connected to the ground lug on the side of the electronics box. When grounding to earth, the soil around ground spikes and antenna ground return wires should be kept damp, with a salt water solution if possible. Dry, loose soil does not provide a good ground. Connections to ground spikes should be made following the general bonding and grounding rules.

b. ***Coax Length***. There must be no more than 18 inches of cable between J9725 of the amplifier coupler and J9821 of the antenna base. Because of the considerations listed above, the shield of the coaxial cable does not act like a shield to keep the RF energy inside the cable in this application. Instead, it acts as a radiating element. The more coax you have inside your vehicle, the more antenna you have inside your vehicle. In addition to reducing your communication effectiveness, it can cause interference with or damage to other electronic equipment.

c. ***Whip Antenna Installation***. There are several factors which make proper whip antenna installation more critical with HF radios than with other types of radios. These include both the RF power levels involved and the unique characteristics of the HF radio signals. The radio set operates at power levels approximately six times as high as most common high power VHF tactical radios. In order to radiate RF signals, any antenna must behave electrically like the two halves of a dipole antenna. The transmitter pushes current into one half of the dipole while pulling it out of the other half by applying a positive voltage to one half and a negative voltage to the other half. The signal then switches polarity, and the direction of the current switches, too. This switching happens at the frequency of the RF signal. Since the other ends of the wires are not connected to anything, there is nowhere for the current to go, so it bounces back from the end of the wire towards the transmitter at near the speed of light. Antennas work most efficiently when this return current happens at the same time the transmitter is changing direction (polarity). This phenomenon is referred to as resonance which happens when the length of the antenna elements are electrically at, or close to, multiples of one quarter wave length. Antenna elements shorter than one quarter wavelength are less efficient which means you give up communication effectiveness to obtain mobility.

A whip antenna behaves as one half of a dipole. The other half is formed by anything connected to the shield of the coaxial feed cable. For a whip installation, this is typically the skin and/or the chassis of the vehicle. It also includes the case of the radio, handset wires, power cables, etc. If the radio set is properly bonded to the chassis or skin of the vehicle, the RF energy will be safely distributed over the comparatively large area of the vehicle. If the radio is not properly bonded or grounded, the RF energy may become concentrated in a smaller area such as the case, handset wires, etc. This concentration of RF energy can be great enough to cause RF burn hazzards to personnel and damage to equipment. Even when hazards do not exist, improper bonding or grounding can cause communication efficiency to be greatly reduced.

d. ***Whip Operation Enhancement Techniques.*** If the vehicle is stationary, the performance of whip antennas can be increased by using earth ground to act as the other half of the dipole. To do this, the radio set ANTENNA GROUND is connected to earth ground by a stake. In this configuration, the earth acts as a very large conducting body and the energy is directed safely away from the operator and other personnel. This causes the whip to radiate as if the shield of the coax were tied to an identical whip (the other half of the dipole) which is located where the mirror image of the whip would be if the surface of the earth were a mirror. One of the reasons that a good earth ground provides greater improvement in performance for HF than for VHF radios is the wavelength of the signals. As noted above, antenna elements shorter than one quarter wavelength reduce performance. One quarter wavelength at the lowest operating frequency (2.0 MHz) is 123 feet, which is considerably longer than the maximum dimension of even the largest tactical vehicles. In contrast, one quarter wavelength at the lowest frequency (30 MHz) of a typical VHF radio is 8.2 feet, which makes even a small tactical vehicle a good "ground" half of the antenna. Under conditions of poor earth ground, such as dry or sandy soil, and where ground rods are not available or are otherwise impractical to use, performance can be improved by the use of supplemental ground plane wires radiating away from the stationary vehicle. Supplemental ground plane wires may be used separately, but it is best to use them in conjunction with a ground rod. As long as supplemental ground plane wires are at least one quarter wavelength long at the lowest frequency of operation, length is not critical--the longer the better. Using several wires is also more effective than using only one wire. Making each wire at least 123 feet long will allow one set of wires to be used for the entire frequency range of the radio set. Supplemental ground plane wires should be connected either to a ground stake or directly to the ANTENNA GROUND connection on the radio set. Wires may either be laid on the surface of the ground or buried. When multiple wires are used, it is best to spread them out in as many directions as possible rather than to concentrate them in one general direction. The object is to simulate the large conducting plane surface that would otherwise be provided by the earth, rather than construct resonant quarter wave antenna elements. Best groundwave performance of a whip is obtained with the whip in the vertical position. Groundwave performance is also enhanced by the use of a ground stake and/or supplemental groundplane wires.

The Near Vertical Incidence Skywave (NVIS) performance of a whip antenna can be optimized by tying it in a bent-over position. As in ground wave operation, NVIS operation of a whip is greatly enhanced by the use of ground stakes and/or supplemental ground plane wires. When stationary, it is best to bend the antenna away from the vehicle. When operating with the vehicle in motion, the only choice is with the antenna bent over the vehicle.

e. ***Locating Control-Display in Remote Location.*** The control-display can be removed from the electronics box and located as far as 200 feet away. Refer to paragraph 3-14 for removal and installation procedures for the control-display. A cable must be manufactured locally as illustrated in figure 2-11. This cable is connected to J9817 on the electronics box and J9711 on the control display.

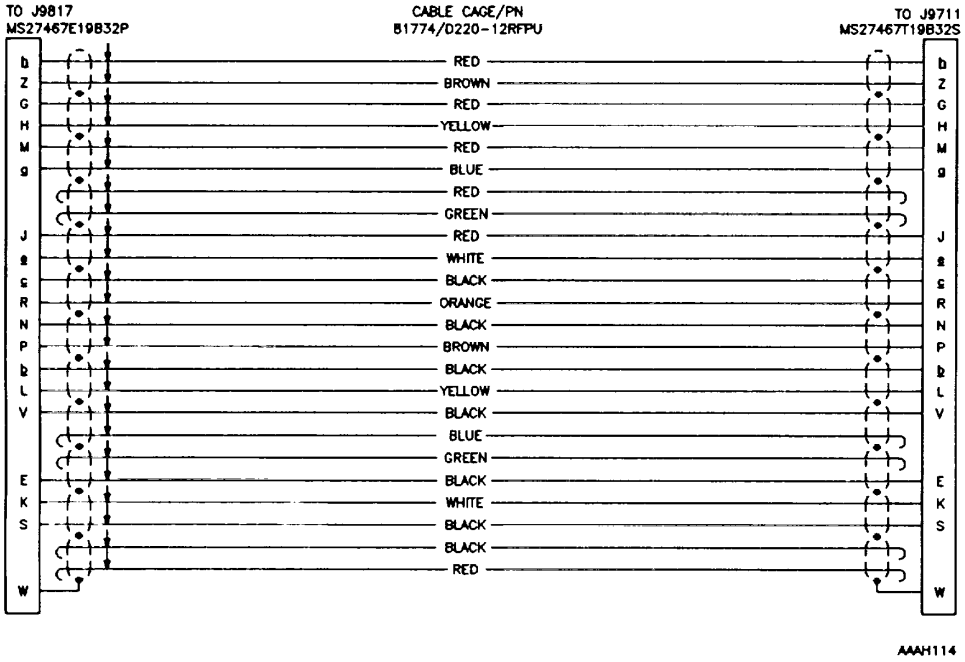


Figure 2-11. Control-Display Extension Cable

2-7. Preoperating Procedure for AN/VRC-86(V)3

a. ***Unique Characteristics of the Antenna Group.*** The inverted V, thick bow-tie is a unique design which provides a non-directional radiation pattern with a high takeoff angle in the 2 to 8 MHz range for Near-Vertical Incidence Sky wave (NVIS) propagation used for communication over ranges up to 200 miles. It also provides a low takeoff angle in the 8 to 29.9999 MHz range for shorter range ground wave communications and longer range sky wave communications, depending on frequency, time of day, and environmental conditions. These take off angle characteristics also make it particularly versatile over a wide range of HF communication applications. Since the antenna coupler is mounted on the antenna mast, essentially all of the RF energy at the output of the amplifier is transferred to the antenna coupler, then matched to the antenna elements for maximum RF energy transfer.

b. ***Grounding and Bonding.*** There is no special grounding or bonding for the antenna group. The antenna mast is staked to the ground and the mast mounted antenna coupler housing is also at ground potential. Both antenna elements are isolated from ground. System ground for the antenna group is obtained through power ground in the control cable and through the shield of the RF coaxial cable.

c. ***Siting Requirements and Considerations for the Antenna Group.*** To obtain the best possible HF performance, locate any AC generator(s) as far away as possible from the electronics box location in one direction and set up the antenna group as far as possible from electronics box location in the opposite direction. An erected antenna group is 30 feet tall and takes up a rectangular ground area 131 feet by 105 feet with the base plate in the center. The base plate should be located a maximum distance of 200 feet from the electronics box location. Select a set up site that will accomodate these requirements.

d. ***Set Up of Antenna Group.*** The antenna group is set up using the following procedures.

(1) Refer to figure 2-12. Position antenna base plate (1) with pivot pipe (2) pointed upwind as applicable and stake in place with two stakes (3) in opposite corners of base plate.

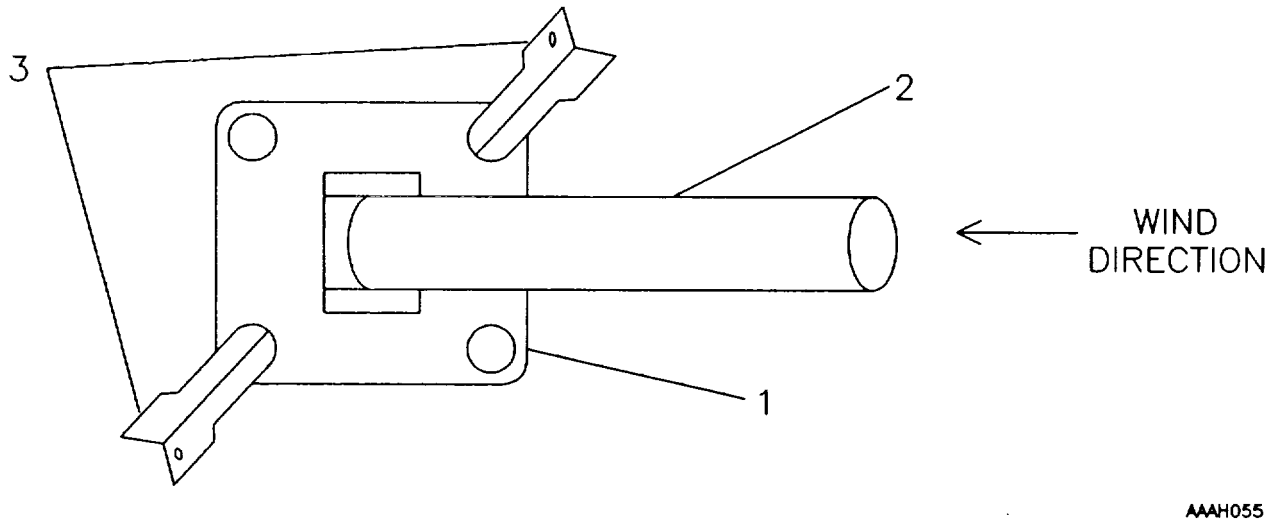


Figure 2-12. Base Plate Positioning

(2) Refer to figure 2-13. The extended rope template assembly is triangular in shape and is used for positioning all four guy line stakes. One corner of the template has a snap hook, the second, a loop, and the third, a crimped sleeve. Place template loop (1) over one of the stakes holding the base plate.

(3) Extend template snap hook to side of baseplate at 90° angle from pivot pipe as shown. Drive stake (2) into ground at this point and attach snap hook to stake. This stake will be removed later.

(4) Extend crimped corner of template and remove slack from lines to position stake (3). Drive one stake at this corner of template.

(5) Move the crimped corner of template and remove slack from lines to position stake (4). Drive one stake at this corner of template.

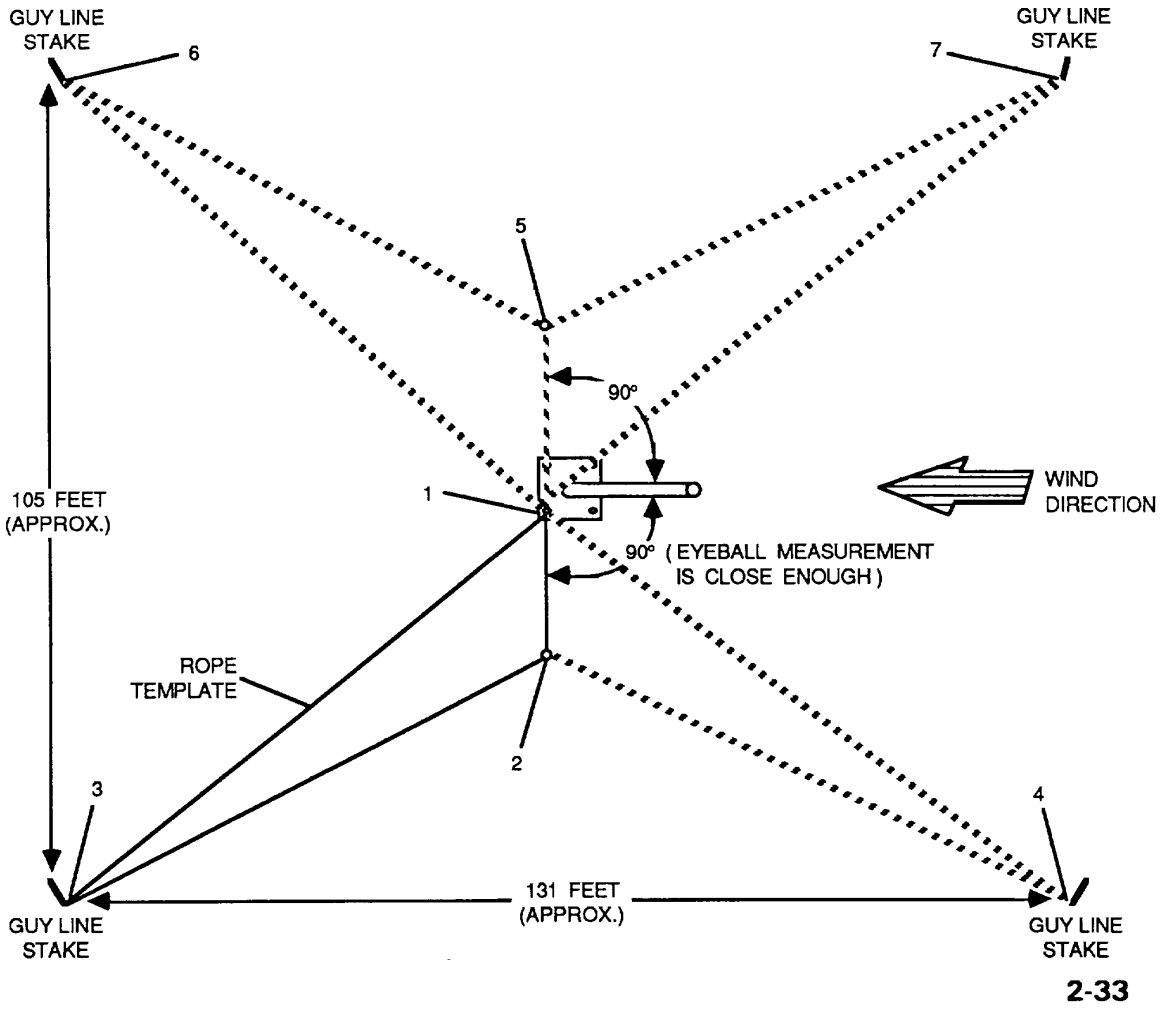


Figure 2-13. Guy Line Stake Layout

(6) Move template snap hook to opposite side of baseplate at 900 angle from pivot pipe. Drive stake (5) into ground at this point and attach snap hook to stake. This stake will be removed later.

(7) Extend crimped corner of template and remove slack from lines to position stake (6). Drive one stake at this corner of template.

(8) Move the crimped corner of template and remove slack from lines to position stake (7). Drive one stake at this corner of template.

(9) Remove template and temporary stakes (2 and 5) driven in steps 3 and 6. Drive these two stakes into two remaining holes in baseplate. Remove template loop from baseplate stake and remove template.

(10) Refer to figure 2-14. The antenna mast sections are numbered and assembled sequentially from 1 to 5 with section 1 at the baseplate and section 5 at the top. Attach top cross bar (1) on section 5 by sliding thin edges between cross bar clamps (2) until center notched part of cross bar is in clamps.

(11) Tighten clamp wingnuts (3).

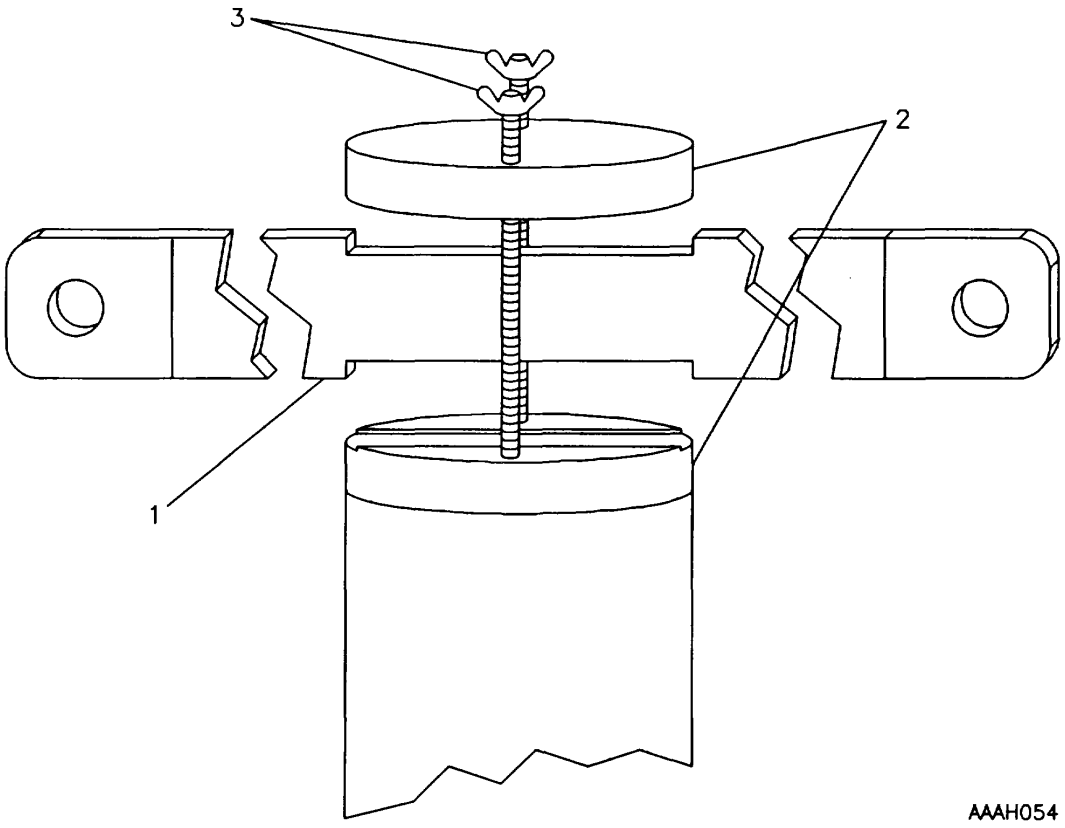


Figure 2-14. Top Cross Bar Assembly

(12) Refer to figure 2-15. On ground, assemble antenna mast sections (1 through 5) with rotating cross bars (7 and 13) and insert locking pin in each section joint and at baseplate (6).

(13) Rotate each cross bar (7) and cross bar (13) to perpendicular with mast.

(14) Slip antenna coupler (8) into brackets on section 2 (2) and pin in place.

(15) An antenna element is installed on each side of the mast. Each antenna element has a triangular shaped part with a single wire downlead. Attach an antenna element snap hook to either side of top cross bar (10).

(16) Lay each antenna element downlead (11) parallel with mast starting at snap hook and along mast toward baseplate.

(17) The other cross bars have a captive mechanism on each end to hold the antenna element downlead. The downlead is inserted in the mechanism by pulling out and holding the cross bar end cap, putting the downlead into the slot, and letting the end cap go back into place. For each antenna element, put free end of elastic cord in cross bar nearest baseplate (13). Put downlead on each side of mast into captive mechanisms of remaining cross bars (7).

(18) Attach an antenna element downlead free end (14) spade lug on coupler standoff (15) that is on same side of mast as downlead. Tighten wingnuts on each standoff.

(19) Connect control cable (16), P104 to coupler, J104 (17). Connect RF cable (18), P114 to coupler, J114 (19). Thread cables through strain reliefs (20).

(20) Refer to figure 2-16. Attach snap hook of adjustable end of one guy line to each of two guy line stakes nearest top of mast (1 and 2).

(21) Adjust guy lines (3 and 4) to be approximately five feet short of full extension and attach free end snap hook of these guy lines to an antenna element insulator on each side of mast as shown. There must be enough length in these guy lines to let the mast pivot up and past vertical. If the terrain is not flat, it may be necessary to make the guy line either longer or shorter.

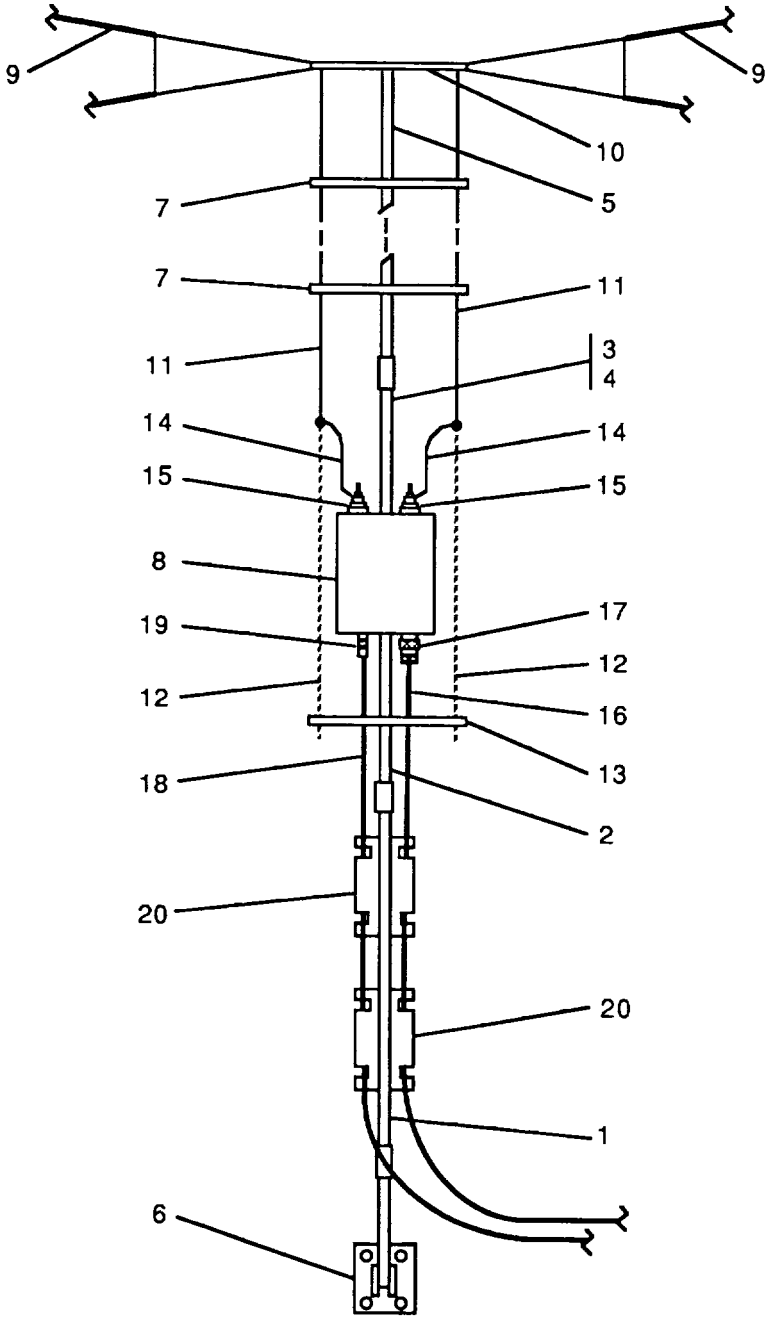


Figure 2-15. Antenna Mast Assembly

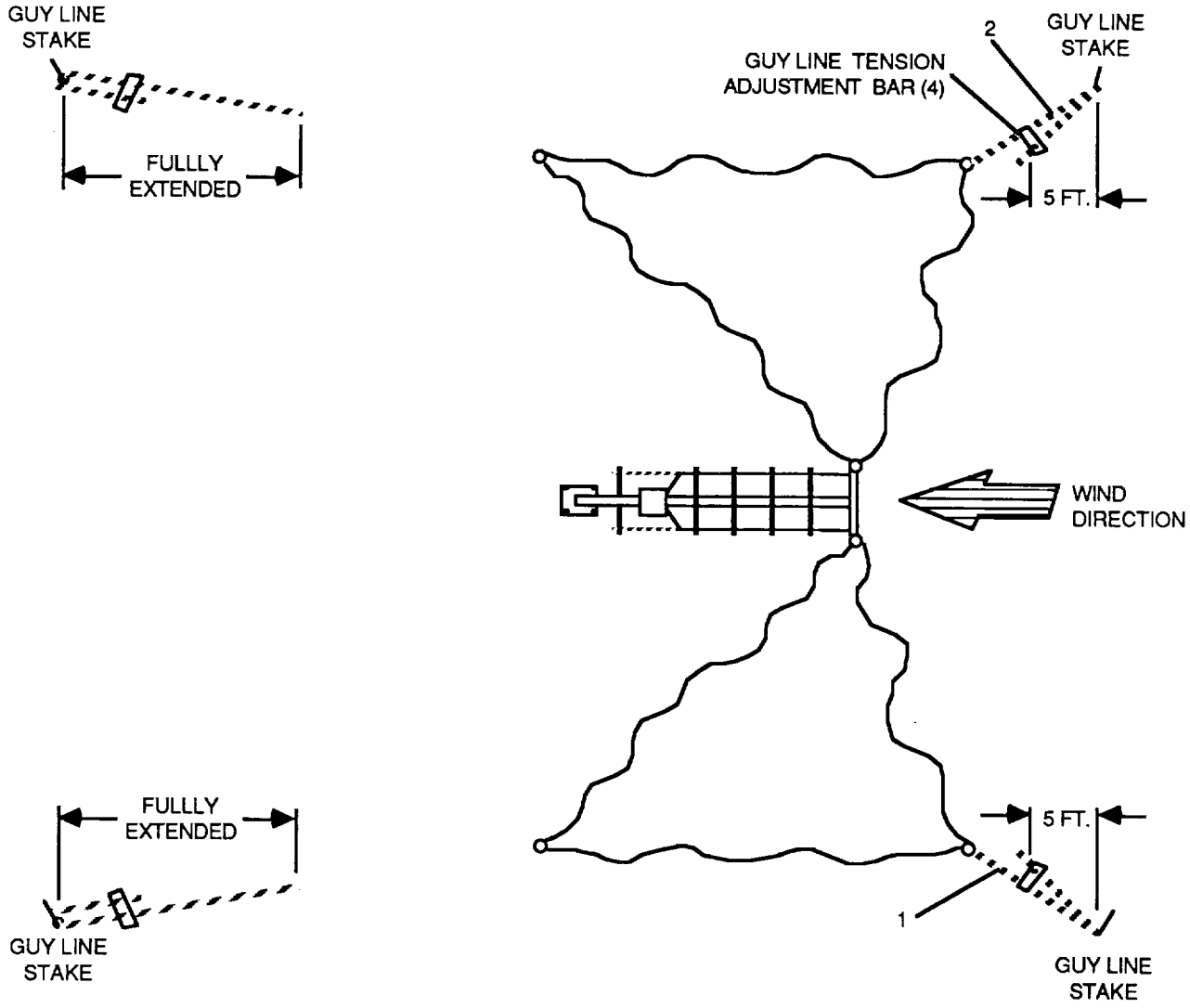


Figure 2-16. Antenna Element Layout

(22) Refer to figure 2-17. Raise and pivot mast past vertical position and allow to hang on guy lines.

(23) Attach remaining two guy line free end snap hooks (1 and 2) to remaining antenna element insulators as shown. Adjust guy line length as necessary to remove slack.

(24) Adjust four guy lines as necessary to put mast upright, and perpendicular and to remove droop from horizontal portion of antenna element. Droop should be less than six inches. Erected antenna group should appear as shown in figure 2-18.

(25) Connect control cable, P103 to Y-interconnect connector J101 or to the extention of that connector such as AN/TSC-61 B antenna entrance panel connector J13. Connect RF cable, P113 to Y-interconnect connector J118 or to the extention of that connector such as AN/TSC-61B antenna entrance panel connector J8.

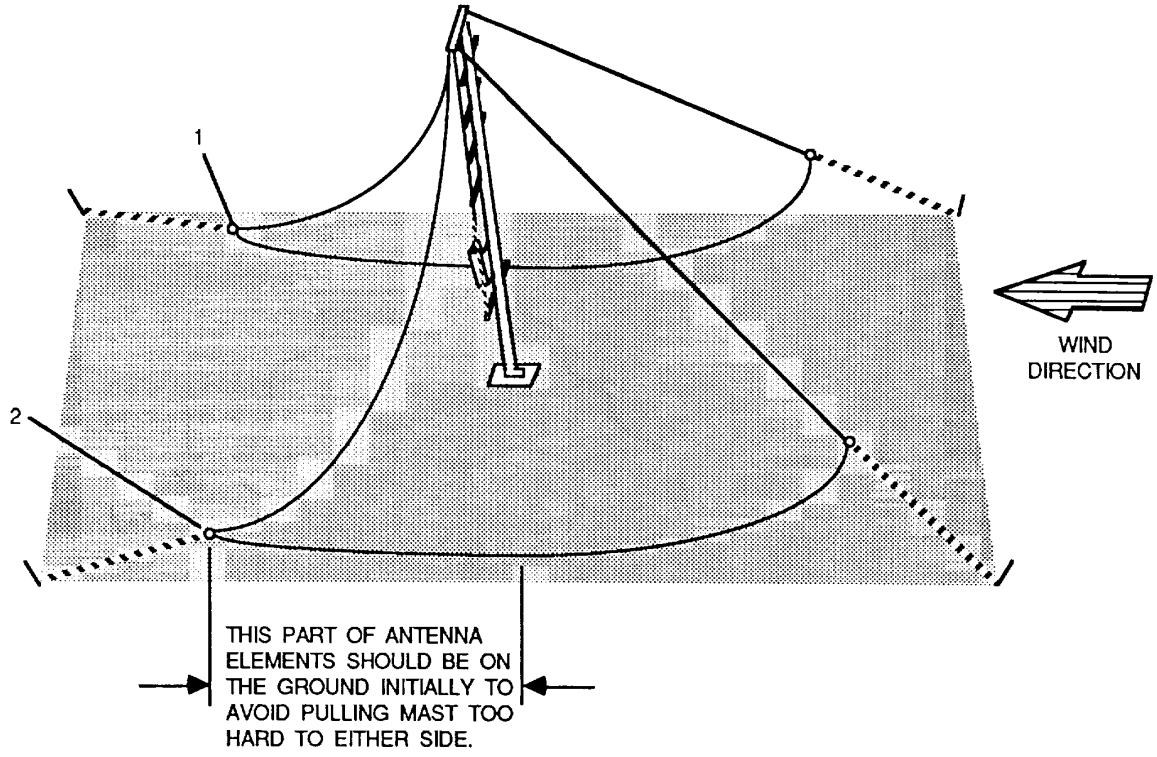


Figure 2-17. Raising Antenna Mast

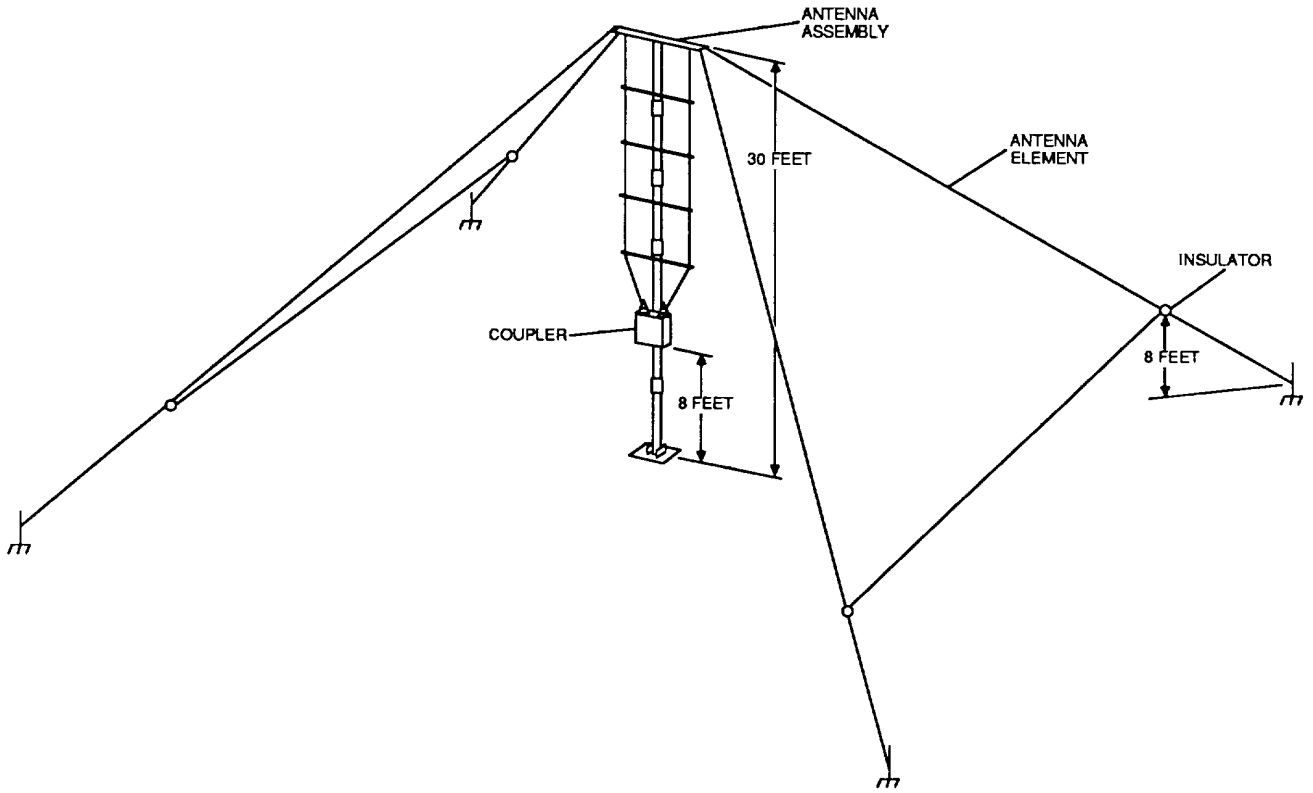


Figure 2-18. OE-480/VRC-86(V) Example Erected Antenna Group

2-8. Detailed Operating Procedures

Before you operate the radio set, be sure you know how to apply power to the radio set from the land based vehicle or shelter. Refer to the vehicle or shelter technical manuals. It is also important that you know the local rules for keying a transmitter. Be sure that radio set is secured and wired properly in the vehicle. Be sure you are familiar with the content of paragraph 2-4, General Considerations for Radio Set Operation and have performed the preoperating produre for your radio set configuration. The (V)1, (V)2, and (V)3 configurations have their own individual preoperating procedures found in paragraphs 2-5, 2-6, and 2-7, respectively.

Apply vehicle power to the radio set. To turn on the radio set, set POWER ON/OFF (22, fig 2-1) to ON and turn the function select knob (18, fig 2-1) clockwise from the OFF position. When the radio set is initially powered up, channel 0 information will be displayed. Channel 0 may be programmed and operated in the same manner as channels 1 thru 20. Set CRT brightness and audio volume to desired levels using the FUNCTION SELECT and SET controls as instructed in table 2-1. To program a channel, set squelch, select channel, set operating limits, store channel information, tune, and test according to procedures given in this paragraph. Field numbers in figure 2-19 correspond to those identified in figure 2-2. To hear audio at the speaker, set SPEAKER ON/OFF (21, fig. 2-1) to ON.

NOTE

All transmitted and received signals should be loud and clear. Data should be transmitted and received accurately. All the following controls and indicators are on the control display LRU unless otherwise noted.

When using the control-display panel shown in figure 2-19, the mode of operation and other channel data may be changed as often as desired until the appropriate terminating pushbutton is pressed. Both the ENT pushbutton (17) and the decimal point pushbutton (11) are., defined as terminating pushbuttons. If the CLR pushbutton (14) is pressed before the terminating pushbutton, the changes entered will be cleared and the CRT display will return to the display present before changes were entered.

CRT display fields, indicated by the number of the field, are shown in figure 2-19. In the channel number (field 2), RX (field 4) and TX (field 5) frequency, and selective address fields, RX (field 6) and TX (field 7), the first character entered is displayed in the position furthest to the right in that field. Later entries shift the earlier entries to the left. After the entry field is full, further entries shift the characters to the left and out of the display field.

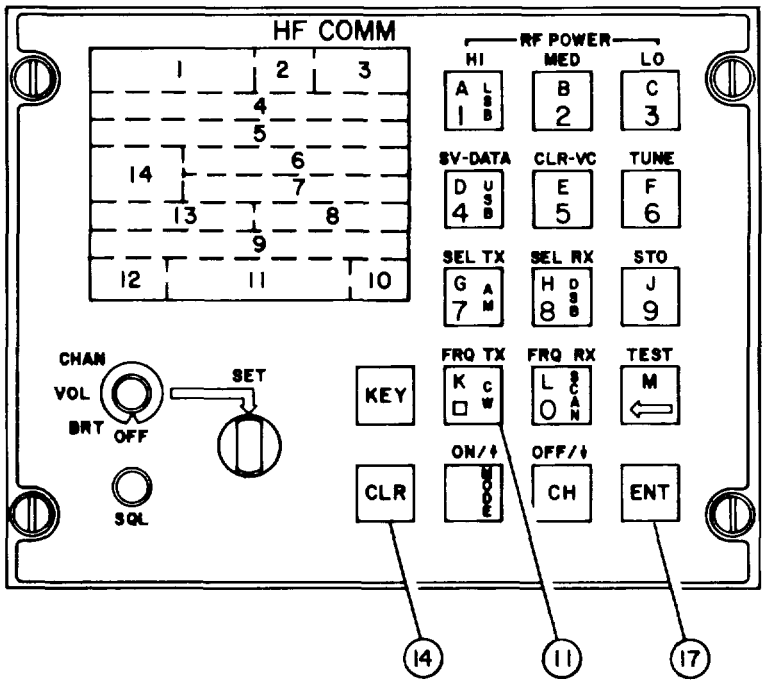


Figure 2-19. C-11245/U Control-Display Panel Identification Fields

NOTE

If entry of an invalid frequency or illegal SELADR code is attempted, the entry field for that data rejects the illegal entry and defaults to the frequency or SELADR code previously displayed. The header for that particular field remains in inverse video until the entry error is corrected. If an error is made while entering data, pressing the CLR pushbutton (14) clears the incorrect data.

a. ***Channel Selection.*** Refer to figure 2-20. There are three methods to choose from when selecting the channel. The channel selected appears on the top line of the data displayed on the CRT screen.

(1) ***Manual tuning.*** Turn the function select knob (18) to CHAN. Rotate the SET knob (20) in a clockwise direction to set the channel number to a higher numbered channel, or counterclockwise to set it to a lower numbered channel.

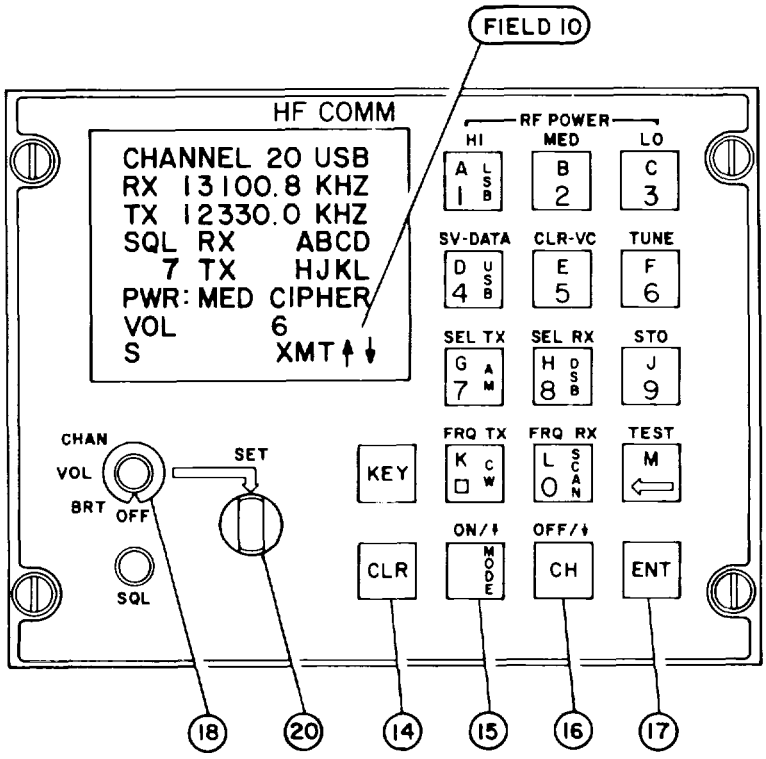


Figure 2-20. C-11245/U Channel Selection, Controls and Indicators

(2) Channel slewing. Press the CH pushbutton (16). Up and down arrows appear in lower right corner in field 10 (figure 2-2) of the CRT screen. To change channel to a higher number, press the up arrow pushbutton (15). To change channel to a lower number, press the down arrow pushbutton (16). The channel changes one number for each keystroke. When the first CH pushbutton is pressed, the display on the CRT screen blanks except for the arrows, the word CHANNEL in inverse video, and the channel number. After channel is selected, press ENT pushbutton (17), and channel information is displayed.

NOTE

If the CLR pushbutton (14) is pressed before the ENT pushbutton (17) is pressed, when using the channel slewing and numbered keys procedures to select a channel, the information displayed is that displayed before the channel change began. These procedures provide a convenient method of selecting channels if the SET knob is damaged or otherwise inoperable.

(3) Using numbered keys. Press CH pushbutton (16), then use numbered pushbuttons to enter channel number. After CH pushbutton is pressed, the display is blank except for the word CHANNEL in inverse video, the channel number, and the arrows. Press ENT pushbutton (17) to display the selected channel information.

b. Receive and Transmit Frequency Select. Refer to figure 2-21.

Frequencies can be selected by either the frequency select or the frequency slewing method.

(1) Receive frequency select.

(a) To initially program or change the receive frequency for the displayed channel, press FRQ RX pushbutton (12), enter operating frequency with decimal point (for example, 13100.8). It is not necessary to enter the decimal point if the sixth digit is 0. When the decimal point pushbutton (11) has been pressed, only the 100-Hz frequency can be changed. When the new frequency is correctly entered, press the ENT pushbutton (17). This makes the new receive frequency operational, but not stored.

(b) When the FRQ RX pushbutton (12) is pressed, arrows appear on the CRT screen. RX and the 100-Hz digit will appear in inverse video. When the first digit of the new frequency is entered, the previous frequency is cleared. After the new frequency is completely entered and the ENT pushbutton (17) is pressed, the display returns to normal, with CHANNEL in inverse video. To remove inverse video, perform STORE operation (Paragraph 2-8.f.).

(c) When entering a new frequency, a minimum of four digits must be entered before the decimal point is entered or an error results. If the frequency number entered is invalid or out of range, ENTRY ERROR will be displayed in field 11 (figure 2-2) after pressing the ENT pushbutton (17). When this occurs, the display returns to the previously entered operating frequency. The operator must then re-enter an allowed frequency.

(2) Frequency slewing (receive only).

(a) The frequency slewing mode allows any digit of the receive frequency, except the 10-MHz digit to be changed as desired.

(b) To use the frequency slewing mode, first press the FRQ RX pushbutton (12). The cursor will appear in the 100-Hz position and arrows will appear in field 10 (figure 2-2). Press either the up arrow pushbutton (15) or the down arrow pushbutton (16) to change the 100-Hz digit as desired. The SET knob (20) may also be used to change any of the digits.

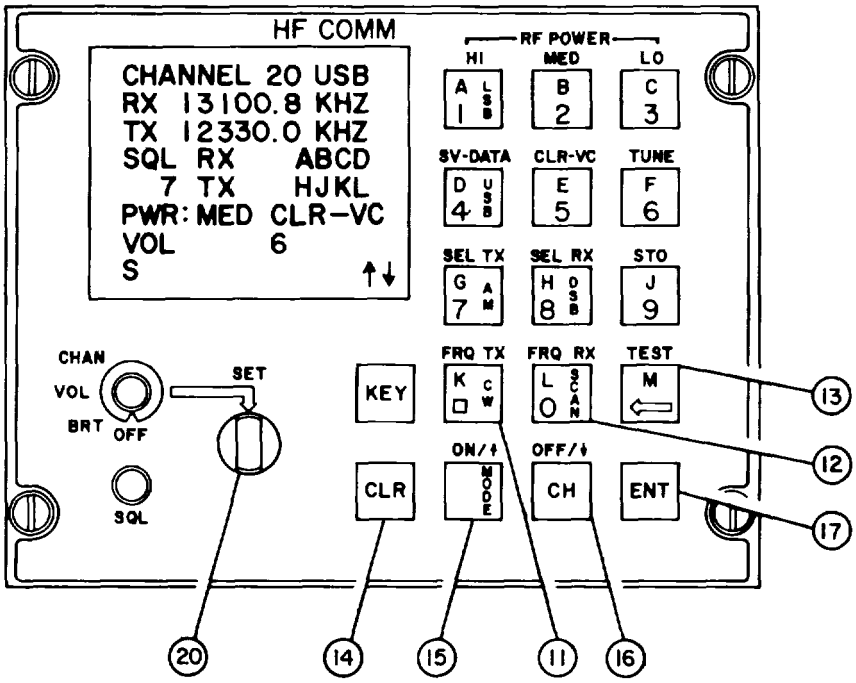


Figure 2-21. C-11245/U Receive/Transmit Channel Selection, Controls

(c) To change a digit in the other positions (except 10-MHz position) press the left arrow pushbutton (13) to move the cursor to the desired position. Then use the up arrow pushbutton (15) or the down arrow pushbutton (16) or the SET knob (20) to change the digit and the received frequency for clarification of signal in SSB mode. When the desired frequency appears on the CRT screen, it can be stored by pressing the ENT pushbutton (17).

NOTE

This method can be used for clarification of SSB signals by using the left arrow button (13) to place the cursor over the RX tenths position and adjusting the received frequency up or down as described while listening to a SSB signal to clarify the signal.

(3) Transmit frequency select.

(a) Transmit frequency is programmed the same way as receive frequency, but using the FRQ TX pushbutton (11) rather than FRQ RX pushbutton (12). When FRQ TX pushbutton is pressed, the transmit frequency field in field 5 (figure 2-2) header appears in inverse video. The receive frequency may be copied to the transmit frequency by pressing the FRQ TX and ENT (17) pushbuttons.

(b) To initially program or change the transmit frequency for the displayed channel, press FRQ TX pushbutton (11), then enter the desired operating frequency with the decimal point (for example, 13100.8). It is not necessary to enter the decimal point if the sixth digit is 0.

When the decimal point pushbutton has been pressed, only the 100-Hz frequency can be changed. When the new frequency is correctly entered, press the ENT pushbutton (17). This makes the new transmit frequency operational, but not stored.

(c) When the FRQ TX pushbutton (11) is pressed, TX will appear in inverse video. When the first digit of the new frequency is entered, the previous frequency is cleared. After the new frequency is completely entered and the ENT pushbutton (17) is pressed, the display returns to normal, except for CHANNEL in inverse video, indicating unstored transmit frequency.

(d) When entering a new frequency, a minimum of four digits must be entered before the decimal point is entered or an error results. If the frequency number entered is invalid or out of range, ENTRY ERROR will be displayed in field 11 (figure 2-2) after pressing the ENT pushbutton (17). When this occurs, the display returns to the previously entered operating frequency. The operator must then re-enter an allowed frequency.

c. Power Level Select. Refer to figure 2-22. To select power level, press pushbutton for HI (1), MED (2), or LO (3), then press ENT pushbutton (17). The power display field in field 13 (figure 2-2), appears in inverse video when a power level pushbutton is pressed, and remains in inverse video until ENT pushbutton is pressed. There is a switch on the front of the amplifier-coupler for high power lockout which can inhibit the high output power mode. Refer to paragraph 2-3. When high power lockout is in effect, and HI (1) is selected, the transmitter is limited to medium power.

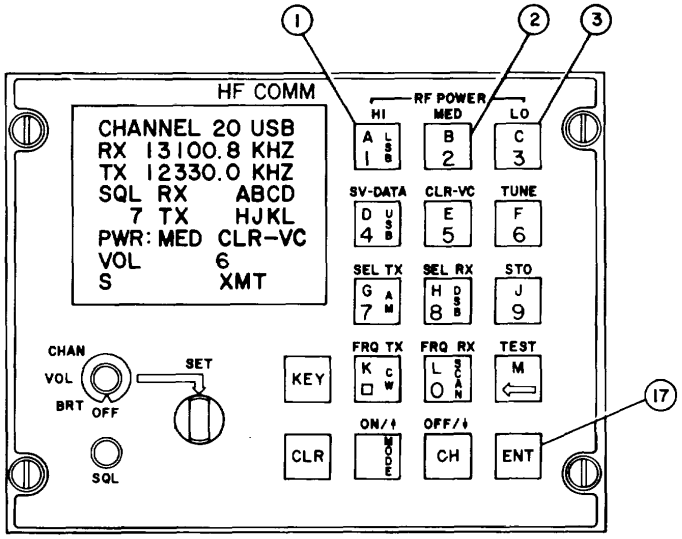


Figure 2-22. C-11245/U Power Level Select, Controls

d. ***Modulation Source Selection.*** Refer to figure 2-23. To select modulation source, press either SV-DATA pushbutton (4) or CLR-VC pushbutton (5), then press ENT pushbutton (17). The SV-DATA pushbutton selects the 600-ohm data input to the radio set (J9813), or the CLR-VC pushbutton selects the 150-ohm compressed audio input (J9812). The source selected appears in field 8 (figure 2-2), in inverse video when SV DATA or CLR-VC pushbutton is pressed, and returns to regular video when ENT pushbutton is pressed. For detailed information about secure voice (SV-DATA) operation, refer to paragraph 2-8.1.

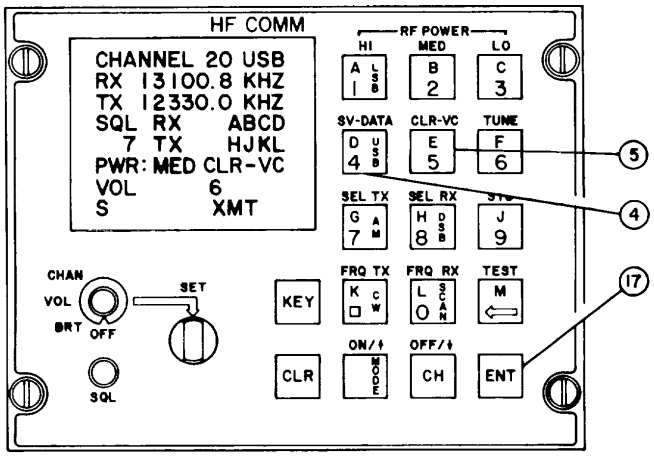


Figure 2-23. C-11245/U Modulation Source Selection, Controls

e. ***Modulation Mode.*** Refer to figure 2-24. To select the modulation mode, press the MODE pushbutton (15). Then press the mode desired, choosing from the LSB pushbutton (1), the USB pushbutton (4), the AM pushbutton (7), the CW pushbutton (11), or the DSB pushbutton (8). Press the ENT pushbutton (17) to enter data. After the selected mode pushbutton is pressed, the modulation mode display field in field 3 (figure 2-2), on the CRT screen appears in inverse video until the ENT pushbutton (17) is pressed. An "M" which appears in field 10 (figure 2-2) to indicate that the mode is being changed, also disappears after the ENT pushbutton (17) is pressed.

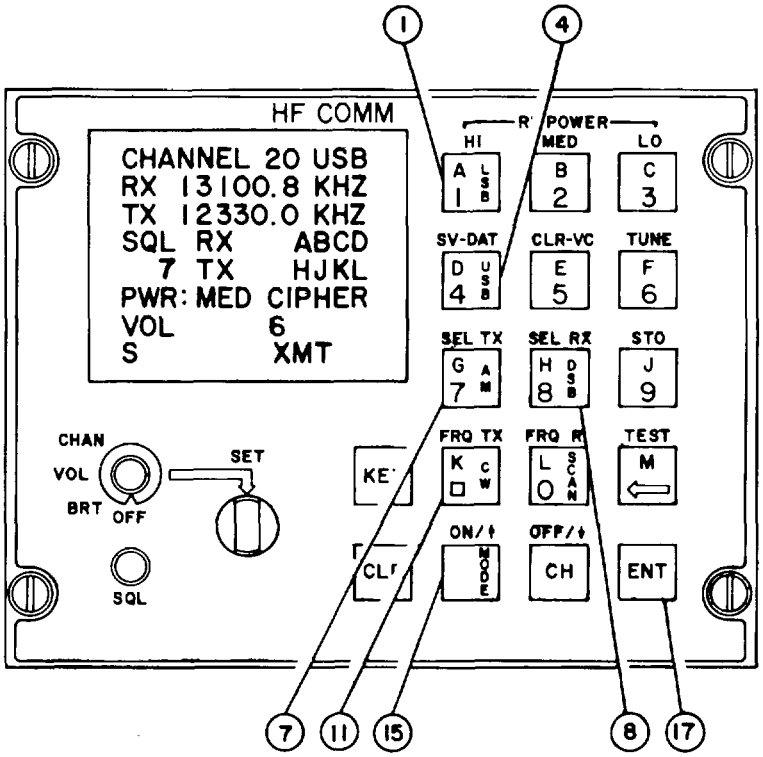


Figure 2-24. C-11245/U Modulation Mode, Controls

f. ***Store.*** Refer to figure 2-25. If new channel data, such as receive frequency, modulation mode, or power level, is entered but not saved, DATA NOT SAVED appears in the fault field in field 9 (figure 2-2), and the word CHANNEL appears in inverse video. Any other fault messages have priority over the DATA NOT SAVED message. To save the new channel information, press the STO pushbutton (9) followed by the ENT pushbutton (17). When the STO pushbutton is pressed, the word STORE appears in field 11 (figure 2-2) in inverse video. When the ENT pushbutton (17) is pressed, STORE is cleared from the display and the word CHANNEL changes to normal video after the store operation is complete.

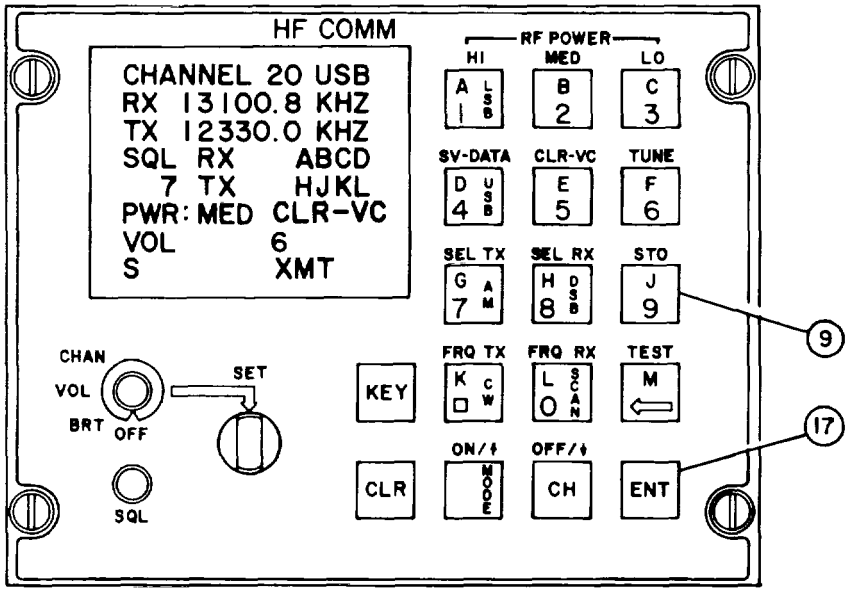


Figure 2-25. C-11245/U Store Function, Controls

g. ***Tune Mode.*** Refer to figure 2-26. The tune mode tunes only the channel currently displayed by pressing the TUNE pushbutton (6) and the ENT pushbutton (17). When the TUNE pushbutton is pressed, TUNE appears on the display in field 11 (figure 2-2). When the ENT pushbutton (17) is pressed, TUNING appears on the display in field 11 (figure 2-2). It remains until tuning is complete. The tune function also performs a store operation.

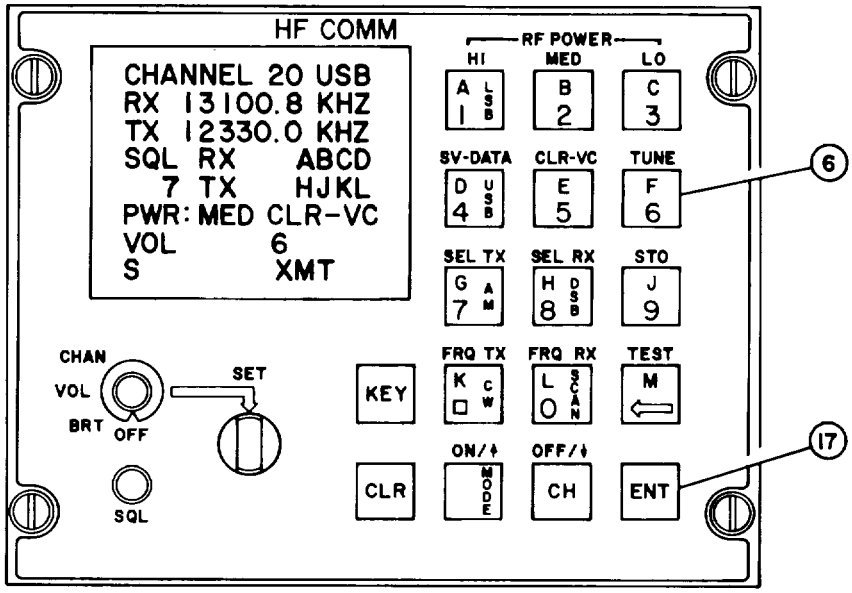


Figure 2-26. C-1 1245/U Tune Mode Function, Controls

h. ***Selective Address Mode.*** Refer to figure 2-27. Selective addresses for receive and transmit, operating instructions are given in the following information. Selective address mode operation is illustrated in figure 2-28.

NOTE

Four different letters must be used in the code, though the arrangement of letters does not matter. For example, the code ABCD is identical to the code BADC, and the letters are displayed in alphabetical order.

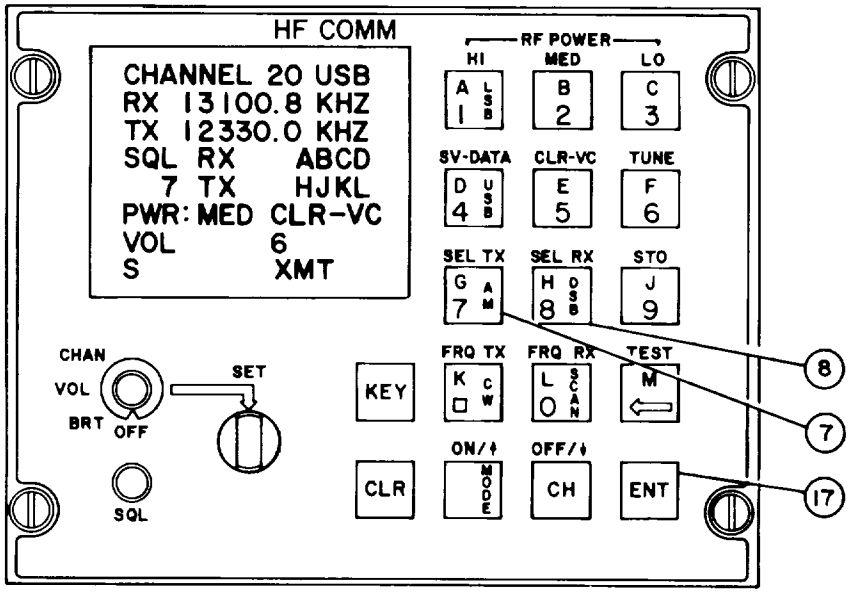


Figure 2-27 . C-11245/U Selective Address Function, Controls

1. ***Selective receive address.*** Refer to figure 2-27. To enter selective receive address, press SEL RX pushbutton (8), then the four letters of the new address from the alphabet letters A thru M on the pushbuttons, then press the ENT pushbutton (17). When the SEL RX pushbutton is pressed, the receive address field header RX goes to inverse video. New code letters also appear in inverse video when entered. After the address has been entered and ENT pushbutton (17) has been pressed, the display returns to normal, except for CHANNEL in inverse video, indicating unstored SELADR code.

2. ***Selective transmit address.*** Refer to figure 2-27. To enter selective transmit address, first press the SEL TX pushbutton (7), then the four letters of the new address from the alphabet letters A thru M on the pushbuttons. Then press the ENT pushbutton (17). When the SEL TX pushbutton is pressed, the transmit address field header TX goes to inverse video. New code letters also appear in inverse video when entered. After the address has been entered and ENT pushbutton (17) has been pressed, the display returns to normal, except for CHANNEL in inverse video, indicating unstored SELADR code.

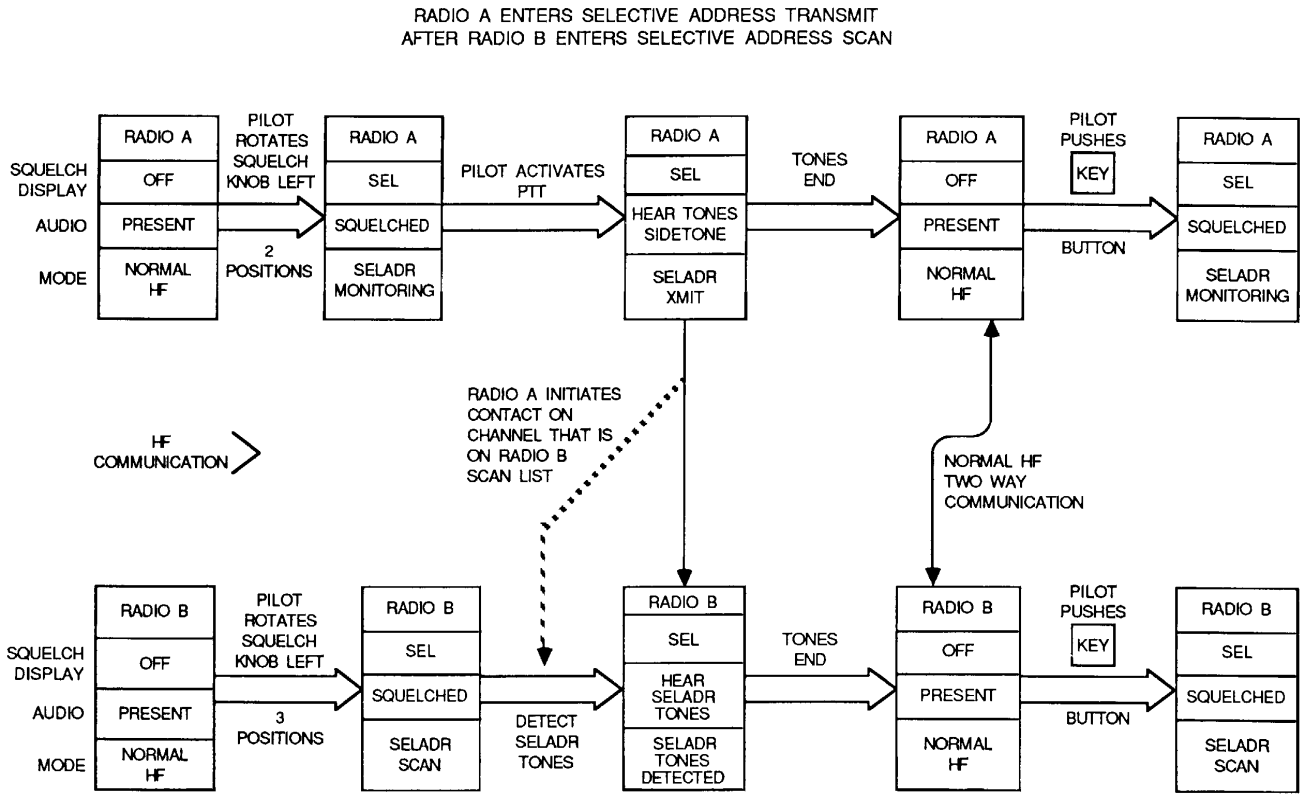


Figure 2-28. Selective Address Mode Operation Diagram

i. ***SELADR On/Off***. Refer to figure 2-29. Select address can be enabled for receive or transmit. Operating instructions are given in the following information.

(1) ***SELADR receive***. Refer to figure 2-29. SELADR receive may be selected by simply turning the SQL (19) squelch knob to the second stop counter clockwise from the OFF position. SELADR receive may also be selected by pressing the SEL RX pushbutton (8). Then press the ENT pushbutton (17).

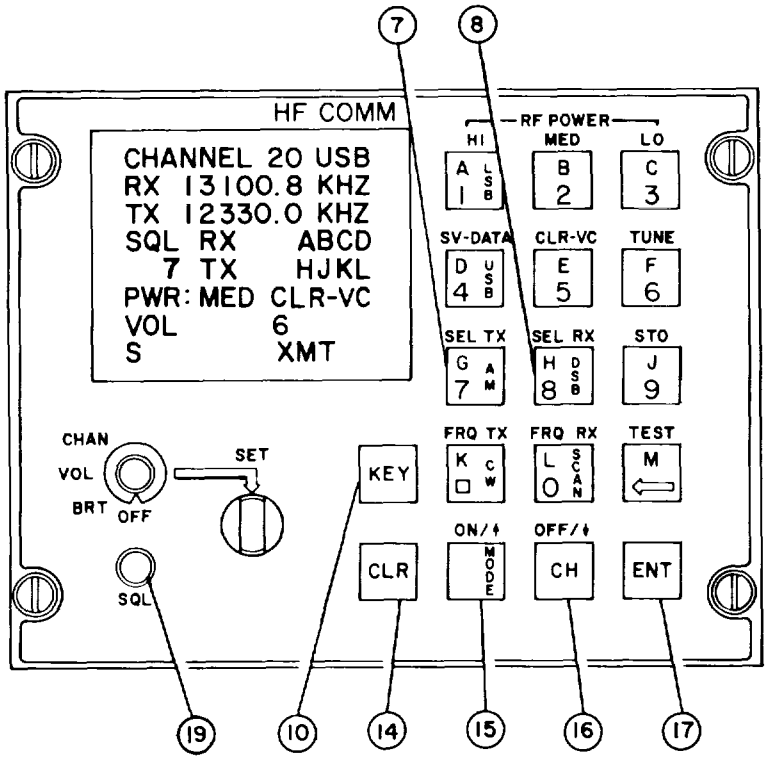


Figure 2-29. C-11245/U SELADR Receive/Transmit Function, Controls

With SELADR enabled, the receiver is fully squelched until the correct SELADR tones are received. To receive the SELADR tones, the radio set must be either tuned to the frequency on which the SELADR tones are to be transmitted, or it must be scanning for that frequency. Reception of a matching, four-tone SELADR code causes the following to occur:

(a) SELADR RX is deactivated;

(b) An audio tone alerts the operator that he is being called;

(c) If the unit previously was scanning, the scanning stops;

(d) Squelch is automatically set to off.

The operator can now transmit and receive in normal radio fashion with no squelch. At end of contact, pressing the KEY pushbutton (10) returns the radio to the SELADR receive mode.

The operator can take the radio set out of the SELADR RX mode by pressing the CLR pushbutton (14).

Pressing CLR returns the radio to normal transmit/receive operation with no squelch. Operating the handset push-to-talk switch (23, figure 2-1) enables SELADR transmit mode.

(2) SELADR transmit. Refer to figure 2-28. To enable the SELADR transmit, press the SEL TX pushbutton (7), and the ENT pushbutton (17). SELADR transmit may also be enabled by first activating SELADR receive or NET mode and then operating the handset push-to-talk (PTT) switch. When SELADR transmit is activated, XMT appears in display field 11 (figure 2-2) and ON appears in display field 7 (figure 2-2). At the same time, the four letter code is automatically transmitted for a predetermined length of time (approximately one second for each channel on the scan list). To transmit the SELADR tones for longer than the predetermined time, press and hold the handset push-to-talk switch while the tones are being transmitted. The tones continue to be transmitted until the microphone key is released. At the end of the tone code transmission, the operator can receive and transmit in normal radio fashion with no squelch. When the contact is complete, pushing the KEY (10) pushbutton will return the radio to the previous SELADR receive or NET monitoring mode. Pressing the CLR key (14) takes the radio set out of the SELADR TX mode.

(3) NET Mode. The NET mode is identical to the SELADR receive mode (reference paragraph i.1) in all respects except one. The tone code which is transmitted and monitored for in the NET feature is a dedicated code and not user selectable. This decreases operator time and attention required to reliably use the NET communication mode. NET mode operation is illustrated in figure 2-30.

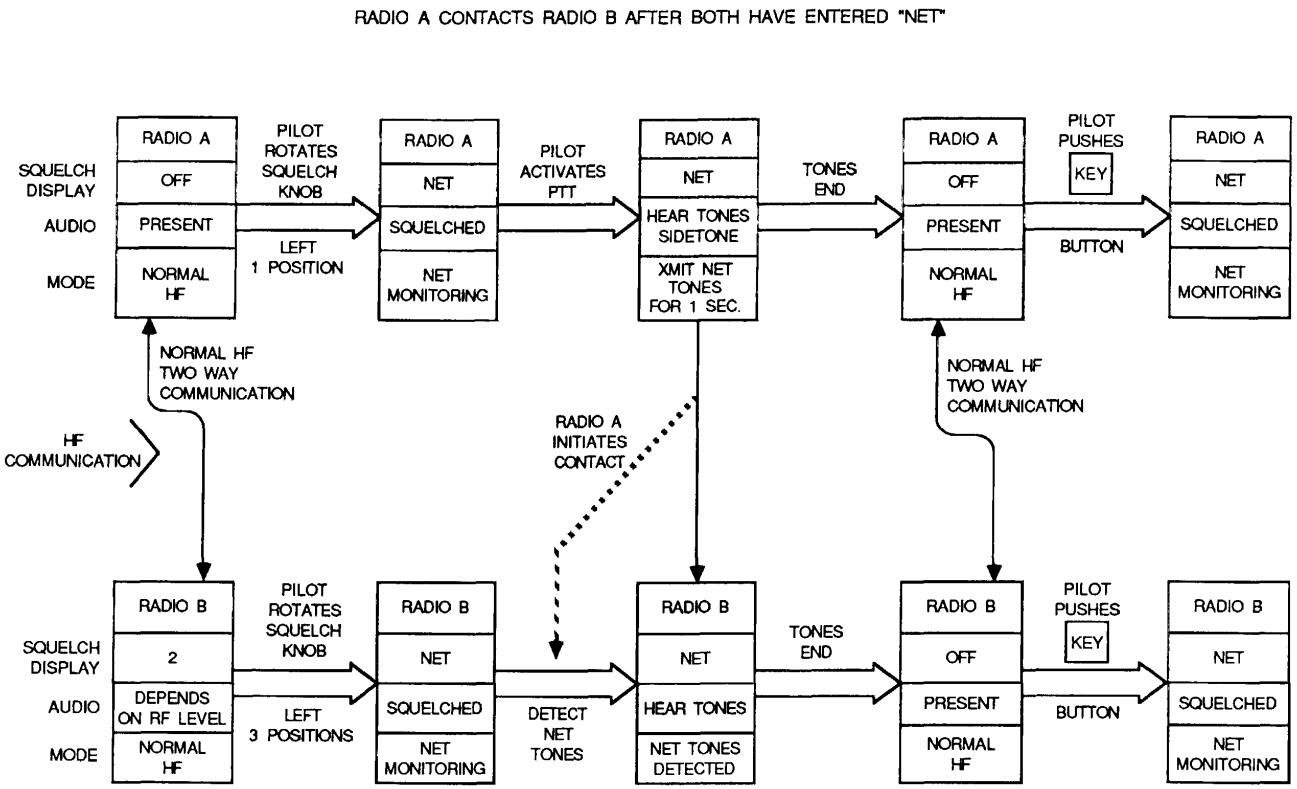


Figure 2-30. NET Mode Operation Diagram

The radio is first put into the NET mode by turning the Squelch knob counter clockwise one stop from the squelch OFF position. The radio will immediately squelch the audio out signal and begin monitoring for the NET tone code (JKLM) on the user selected channel for NET. This is indicated on the CRT screen by the appearance of the word NET directly below SQL in field 14. The selective receive and transmit addresses stored on the channel are still displayed. Monitoring continues indefinitely or until any of the following occur:

(a) Incoming NET contact detected.

(b) Operation of handset push-to-talk (see NET Transmit Operation).

(c) Squelch knob is turned which deselects NET.

(d) CLR pushbutton is pressed.

When an incoming call is detected by the presence of the dedicated NET tone code (JKLM), the radio unsquelches the audio to allow tones to be heard.

At the end of the tone code, the operator can transmit and receive in normal radio fashion with no squelch.

The operator indicates end-of-contact by pushing the KEY pushbutton (10).

The radio then returns to the NET monitoring mode.

(4) NET Transmit Operation.

As in receive operation, the radio is first put in the NET mode by turning the squelch knob to the NET position after channel is selected.

Then key the radio by pressing the handset push-to-talk (PTT) switch.

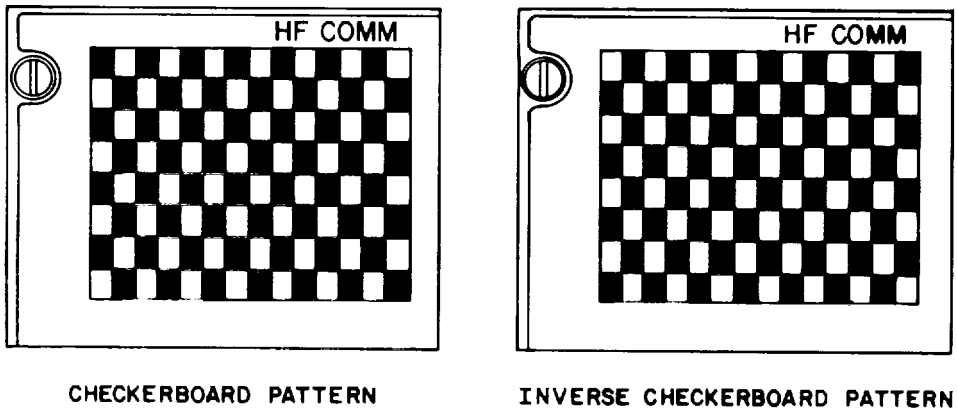
The radio responds by transmitting the dedicated NET tone code for a four second interval. Tone code should be heard in sidetone.

At the end of the tone code transmission the operator can transmit and receive in normal radio fashion with no squelch.

When the contact is complete, pressing KEY pushbutton (10) returns the radio to the NET monitoring mode.

j. ***Test Mode/Display.*** Refer to figure 2-32. Test mode/display is used for run-ning the initiated BIT sequence Operation procedures for the modes are given in the following information. For running BIT with the ANNRC-86(V)3 configuration it will be necessary to disconnect the cable from the RF output (Jl18) and connect the BIT cable to the RF output.

(1) ***Test Mode.*** Press TEST pushbutton (13), followed by ENT pushbutton (17). The CRT screen displays a checkerboard pattern for a few seconds as shown in figure 2-31. Then it shows an inverse checkerboard pattern to test the individual character spaces on the CRT. When this part of the test is completed, the words TEST IN PROGRESS (figure 2-32) are displayed on the CRT. To stop BIT before testing is completed, any pushbutton may be pressed. For consistency, it is recommended that the CLR pushbutton (14) be used to stop the testing.



(Actual display)

Figure 2-31. CRT Display of BIT Test Checkerboard Patterns

NOTE

After BIT is completed, the CRT displays a message which indicates whether the system failed or passed the BIT test. After BIT is completed and the failed or passed display appears, the CLR pushbutton (14) MUST be pressed to return the system to normal operating conditions.

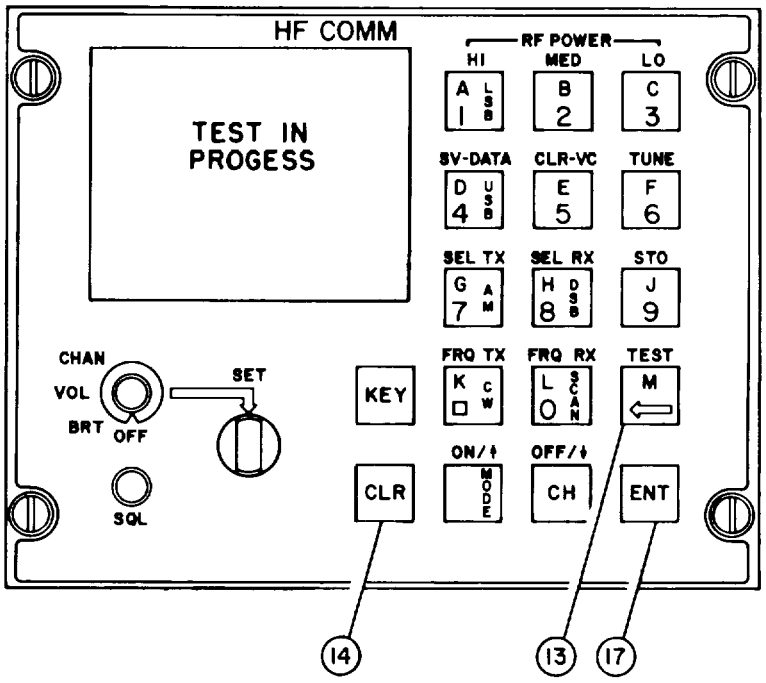


Figure 2-32. C-11245/U Test Mode Function, Controls

(2) Failed test display. Refer to figure 2-33. The failed test display has six lines of data. Explanation of the codes is as follows:

(1) TEST FAIL =Test has failed
(3) FAULT C =Control-Display has failed
(4) FAULT AM =Amplifier-Coupler has failed
X =Displays MJR for major or MNR for minor failures of either the Amplifier-Coupler or the Receiver-Transmitter on the line with the failed unit
(5) FAULT RT= Receiver-Transmitter has failed
(7) PRESS CLR = Exit instructions

NOTE

Major faults indicate that the unit is not usable and should be shut down or used for emergency transmission only. Minor faults indicate a temporary problem or possibly a problem only on a particular frequency. Try a different frequency and check system wiring and antenna connections to clear a minor fault.

The seventh and eighth lines give the test exit instructions (6).

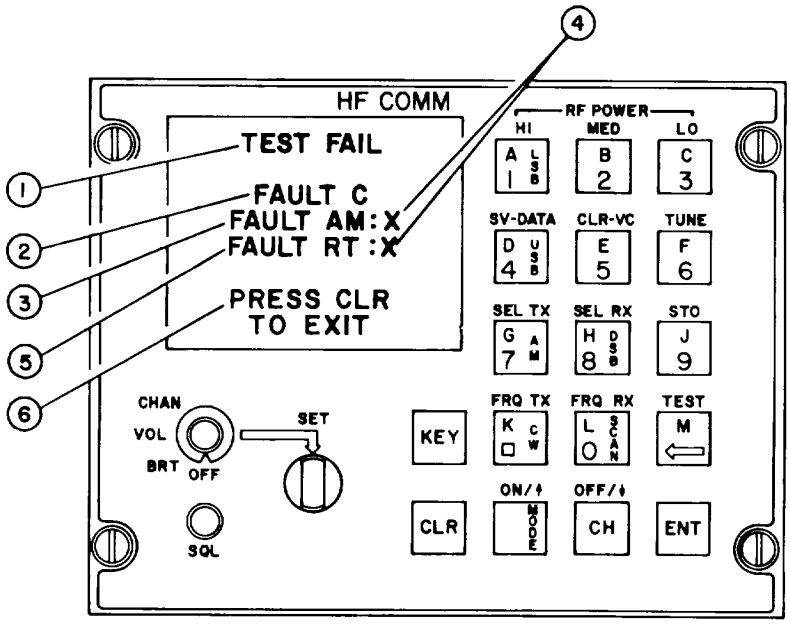


Figure 2-33. Failed Test Display

(3) ***Passed test display.*** Refer to figure 2-34. For a passed test, the CRT screen displays the words TEST PASS, and gives test exit instructions at the bottom of the screen.

(4) ***Antenna Coupler Tests***. For the AN/VRC-86(V)3 configuration, further tests can be performed to isolate failures in the antenna coupler. The procedures for performing these tests are found in chapter 3.

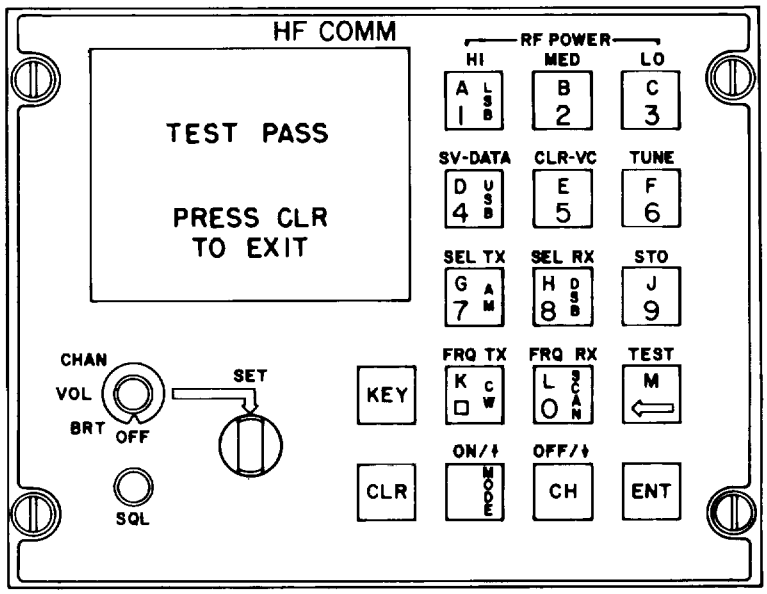


Figure 2-34. Passed Test Display

k. ***Scan Mode***. Refer to figure 2-35. The two operations necessary for scanning are programming channels onto the scan list, and initiating the scan.

(1) ***Programming scan.*** To add or remove a channel from the scan list, press the MODE pushbutton (15) then the SCAN pushbutton (12). The word SCAN is displayed in field 11 (figure 2-2) on the CRT screen and arrows are displayed in field 10 (figure 2-2). To set the scan flag for the displayed channel, press the ON/MODE pushbutton. To clear the scan flag from the displayed channel, press the OFF pushbutton (16). After the scan flag has been set or cleared, press the ENT pushbutton (17). The arrows and the SCAN are cleared from the display. If the scan flag was set, an S is displayed in the lower left corner of the CRT screen in field 12 (figure 2-2), indicating that the displayed channel is on the scan list.

NOTE

The scan flag must be stored immediately after being entered, in order for the channel to be retained on the scan list.

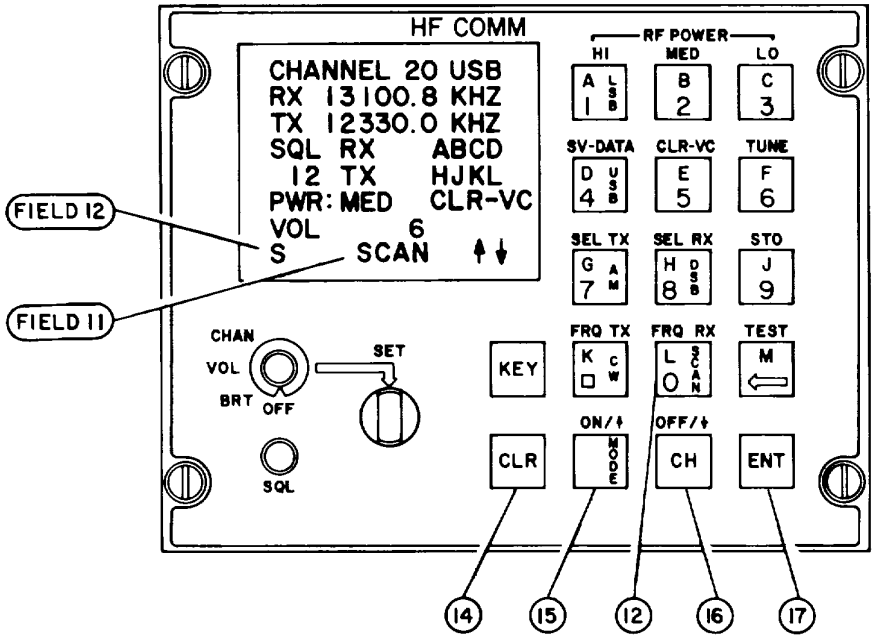


Figure 2-35. C-11245/U Scan Mode Function, Controls and Indicators

(2) ***Executing scan***. To scan all channels which have been stored on the scan list, press the MODE pushbutton (15), the SCAN pushbutton (12), and the ENT pushbutton (17). After ENT has been pressed, the CRT screen is blank except for the word CHANNEL, the channel number, the SQL header and squelch setting, and the word SCAN in field 11 (figure 2-2). The channel number changes as scanning takes place. The radio set will continue to scan the channels on the scan list even if a signal is received. To stop scanning, any pushbutton may be pressed; however, it is recommended that the CLR pushbutton (14) be used. Normal radio operation is restored for the channel which was being displayed in the scan mode when the scanning was stopped.

(3) ***Selective address scan***. The purpose of this mode is to scan two or more selected channels while the radio receiver is squelched. In this mode, the radio is monitoring for the selective address receive code(s) which are programmed on the scanned channels.

This mode may be entered in one of two ways:

(a) Using the SQL squelch knob, select the third position counter clockwise from the squelch OFF position.

(b) Press the following pushbuttons: SEL RX (8)+ ON (MODE) (15) + SCAN (12). The audio will immediately be squelched and the radio will begin scanning the channels previously entered on the scan list (see paragraph k.1.). Scanning will continue indefinitely or until any of the following occur:

(1) A matching four-tone code is detected on one of the scanned channels. In this case, the scan is halted, selective address receive is deactivated, an audio tone alerts the operator of an incoming call, and squelch is returned to normal operation.

(2) Squelch knob is turned or the CLR pushbutton is pressed. In either of these cases, the scan is halted, selective address receive is deactivated and squelch is returned to normal operation.

After the contact is completed the operator may push the KEY (10) pushbutton to reenter the SELADR Scan mode. Otherwise, step 2 above may be used to reenter the SELADR Scan mode. The display during SELADR Scan appears as in figure 2-36 with the CHANNEL word and SCAN in inverse video. The channel number changes as each channel is scanned.

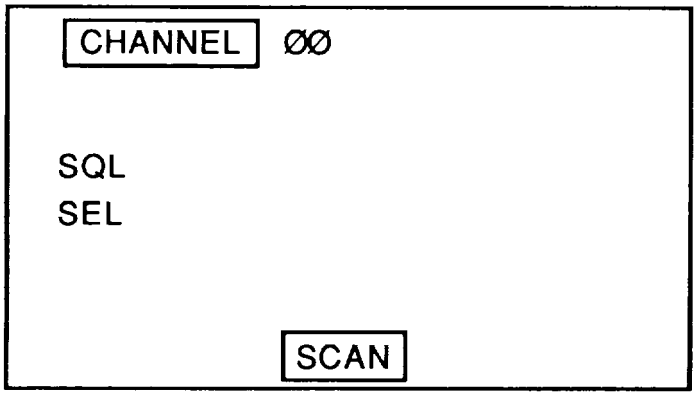


Figure 2-36. SELADR Scan Display

I. ***Secure Voice Operation Mode***. Connect secure voice equipment to the Electronic Equipment Interfacing Box as shown in figure FO-1. The maximum power available from the AN/VRC-86 for the secure voice equipment is 28 Vdc at 3 Amps, if more current is needed, an external power source may be used for the secure voice equipment. The input/output audio levels of the secure voice equipment must be set at 0 dBm.

NOTE

The KY 65 audio input and output levels are preset to 0 dBm. Any other equipment may need to have audio input or output levels manually set to 0 dBm or as necessary to obtain the best audio clarity.

(1) ***Handset***. Disconnect handset from Electronic Equipment Interfacing Box J9812 and connect it to secure voice equipment handset connector (J2) on KY-65. The KY 65 secure voice equipment requires that a handset be used such as the H-250/U or equivalent.

(2) **Operation**. Refer to figure 2-37. Select secure voice mode by pressing SV-DATA pushbutton (4) then ENT pushbutton (17). The display on the CRT screen shows VC-DAT in field 8 (figure 2-2). The operation of the AN/VRC-86(V) is the same as described previously. For further information on operating the secure voice equipment refer to the operator's manual for that equipment. Even when secure voice equipment is connected, the demodulated received audio signal, whether ciphered or not, is what is monitored on the AN/VRC-86(V) speaker and handset output. This signal is also the audio input to the secure voice equipment. Therefore, to be able to communicate using ciphered signals, a handset must be connected to the secure voice equipment. Additionally, this handset can be used for unciphered communications when the secure voice equipment is in bypass mode.

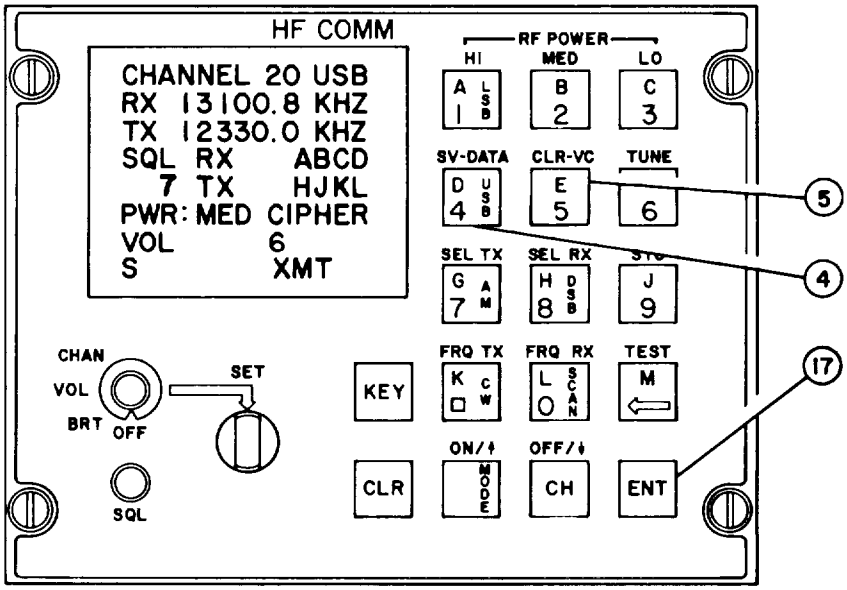


Figure 2-37. C-11245/U Secure Voice Operation, Controls

SECTION III. OPERATION UNDER UNUSUAL CONDITIONS

2-9. Reconfiguration of Radio Set for Emergency Operation

If the antenna base in your (V)2 configuration or the antenna group in your (V)3 configuration of the radio set is damaged and can not be used, you can reconfigure the radio set to the (V)1 configuration and use the AS-4096/G Broadband Antenna, the AN/GRA-50 antenna group, or a long wire antenna. Refer to paragraph 2-4 for general considerations for using these antennas.

Refer to FO-31 for the (V)1 cabling diagram using the AS-4096/G, AN/GRA-50 or other equivalent antenna. Refer to FO-34 to set up for long wire operation. Refer to paragraph 2-5 and perform preoperating procedures for (V)1 before using your reconfigured radio set.

a. ***Reconfiguring (V)3 to Emergency (V) 1***. Refer to FO-33. Perform the following steps at the electronics box to reconfigure your radio set.

(1) Disconnect P100 from J9724, disconnect P9724 from J100, disconnect cable from J118.

(2) Connect P9724 to J9724 and connect BIT test cable to J 1 8.

(3) Connect emergency antenna to J9725.

b. **Reconfiguring (V)2 to Emergency (V) 1**. Refer to FO-32. Perform the following steps at the electronics box to reconfigure your radio set.

(1) Disconnect cable from J9816, disconnect cable from J9725.
(2) Connect emergency antenna to J9725.

CHAPTER 3
AVIATION UNIT MAINTENANCE (AVUM)

SECTION I. REPAIR PARTS, SPECIAL TOOLS, TEST MEASUREMENT AND DIAGNOSTIC EQUIPMENT (TMDE), AND SUPPORT EQUIPMENT

3-1. Common Tools and Equipment

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

3-2. Special Tools, TMDE, and Support Equipment

The only special TMDE required for maintenance is a digital multimeter as described in Section III of Appendix B. Equivalent test equipment may be used.

3-3. Repair Parts

Repair parts are listed and illustrated in Appendix F.

SECTION II. SERVICE UPON RECEIPT

3-4. Unpacking

Before unpacking, check shipping container(s) for obvious damage or mishandling. Carefully unpack system and check each LRU for external damage. Verify all items on packing slip are accounted for. Save all packing materials. Report any damage or unsatisfactory equipment received, using DA PAM 738-750.

a. Packaging.

(1) Electronics Box

(a) 26.0 in. long X 9.5 in. deep X 24.0 in. wide
(b) Packed box weighs 61 lb. max.
(c) Total volume is 5928 cubic in.

(2) Antenna Base

(a) 8.0 in. long X 33.0 in. deep X 8.0 in. wide
(b) Packed box weighs 9 lb. max.
(c) Total volume is 2112 cubic in.

(3) Antenna Coupler

(a) 18.0 in. long X 13.0 in. deep X 9.7 in. wide
(b) Packed box weighs 15 lb. max.
(c) Total volume is 2308 cubic in.

(4) Antenna

(a) 97.0 in. long X 18.0 in. deep X 18.0 in. wide
(b) Packed box weighs 90 lb. max.
(c) Total volume is 31428 cubic in.

(5) Control Cable

(a) 10 in. long x 24.5 in. deep X 26.5 in. wide
(b) Packed box weighs 40 lb. max.
(c) Total volume is 6493 cubic in.

(6) RF Cable

(a) 10 in. long x 24.5 in. deep X 26.5 in. wide
(b) Packed box weighs 40 lb. max.
(c) Total volume is 6493 cubic in.

b. Removing Contents. The following procedure is a typical procedure for unpacking the radio set.

(1) Cut tape along top of shipping carton and fold flaps back.
(2) Lift off urethane top and remove unit from urethane bottom.
(3) Cut and take off static shielding bag from unit.
(4) Store urethane top and bottom in shipping carton for later shipment or storage of unit.

c. Checking Unpacked Equipment. The following procedure is a typical procedure for checking unpacked equipment.

(1) Check to be sure the radio set LRUs are of the latest revision in accordance with DA PAM 750-10 US Army Equipment Index of Modification Work Orders.

(2) Perform PMCS system functional test as described in section III.

3-5. Tools Required For Installation and Setup

All installation tasks can be performed with hand tools provided in tool kit TK-105/G and a hammer as described in Section III of appendix B.

3-6. LRU Location

Typical System Locations are described in paragraph 1-11. Refer to applicable operator's manual for your installation for specific LRU locations.

3-7. LRU Installation

Refer to LRU installation procedures in section V of this chapter. Procedures in section V assume the A-Kit, including wire harness, is correctly installed.

SECTION III. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

3-8. General

Preventive maintenance is the systematic care, servicing, and inspection of equipment to prevent trouble from occurring, to reduce downtime, and to maintain the equipment in a serviceable condition. To be sure that the equipment is always ready for a mission, you must do scheduled Preventive Maintenance Checks and Services (PMCS).

3-9. PMCS Inspections.

a. ***Periodic Inspections***. Periodic inspection of system is specified in vehicle checklists. Perform following PMCS inspections at the intervals stated in checklist for your vehicle type. (If the radio set is not covered in your vehicle checklist, use intervals in PMCS tables.)

b. ***PMCS After Replacing LRU***. These PMCS inspections shall also be performed after replacing any LRU in the system. Remove all power to the system before performing PMCS inspections described in this paragraph. Set FUNCTION SELECT (18, fig. 2-1) to OFF, set POWER ON/OFF switch (22, fig. 2-1) to OFF, and set circuit breaker for radio set to OFF.

c. ***PMCS Table Column Definitions***

(1) Item no. Indicates the LRU, (first digit) and specific task number (second digit). For example, PMCS number 2-6 is step 6 for unit 2.

(2) Interval. Use the intervals stated in checklists for your vehicle. If the AN/VRC-86 is not covered by vehicle checklist, use intervals in this column. Intervals in this column are; B= Before operation, W= Weekly, and M= Monthly.

(3) Item To Be Inspected/Procedure. Detailed PMCS task descriptions appear in this column.

(4) Equipment is Not Ready/Available If. If the system fails any PMCS step take corrective action.

d. ***Availability***. The equipment is not ready/available if the procedure column tells you why your equipment cannot be used.

e. ***Reporting Failures***. If your equipment does not perform as required, refer to Section IV. Report any malfunctions or failures on the proper DA form 2404 or refer to DA Pam 738-750. Deficiencies that cannot be corrected must be reported to higher level maintenance personnel.

Table 3-1. Preventive Maintenance Checks and Services

Item No.	Interval B	W	M	Item to be Inspected Procedure	Eqpt not Rdy/Avail if:
1.				Radio Set AN/VRC-86	
	•	•		1. Visually inspect LRUs for dust, oil, dirt, foreign matter, or dents breaks, or cracks. If necessary, clean all equipment, removing dirt with a mild soap item 5, and a soft rag item 4 Appendix E. Anodized surfaces may be cleaned with denatured alcohol, or ammonia.	
	•	•		2. Check interconnecting cables for splits, cracks, breaks, or other damage.	Cables are cracked, broken, or damaged.
				NOTE If cables must be replaced, notify your supervisor for correct action.	
	•	•		3. Check that connectors are properly installed on each LRU. Pull gently on connector to make sure it will not pull loose from the LRU.	Connector is not properly installed on LRU.
2.				Control Display	
	•	•		1. Visually inspect for dirt, cracks, or broken glass. If CRT screen is dirty, clean with glass cleaner and a lint free cloth item 6, Appendix E.	

Table 3-1. Preventive Maintenance Checks and Services-Continued

Item No.	Interval B	W	M		Item to be Inspected Procedure	Eqpt not Rdy/Avail if:
		•	•	2.	Check that pushbutton markings are clean and legible. Clean with mild soap item 5 and a soft rag item 6, Appendix E.	
		•	•	3.	Check that knobs are tight and turn properly.	Knobs are loose or will not turn. Refer ' to paragraph 3-20.
3.					Antenna Base	
		•	•	1.	Visually inspect for dirt, oil, foreign matter, or dents, breaks, or cracks. If necessary, clean antenna base, removing dirt with a mild soap item 5, and a soft rag item 4, Appendix E.	
		•	•	2.	Check both dust caps are present and in good working condition.	Dust caps damaged or missing.
4.					Antenna Coupler	
		•	•	1.	Visually inspect for dirt, oil, foreign matter, dents, breaks, or cracks. If necessary, clean antenna base, removing dirt with a mild soap item 5, and a soft rag item 4, Appendix E.	Case cracked or connectors damaged.
5.					Antenna	
		•	•	1.	Visually inspect mast sections and antenna base for dirt, oil, foreign matter, dents, breaks, or cracks. Check for missing cross bars or quick-release pins. If necessary, clean antenna base, removing dirt with a mild soap item 5, and a soft rag item 4, Appendix E.	Mast section or antenna base bent, broken or cracked or if quick-release pins or crossbars are missing.

Table 3-1. Preventive Maintenance Checks and Services-Continued

Item No.	Interval B	W	M	Item to be Inspected Procedure	Eqpt not Rdy/Avail if:
		•	•	2. Visually inspect guys and antenna template assemblies for dirt, oil, foreign matter, frays, breaks or broken or missing hardware. If necessary, clean items, removing dirt with a mild soap item 5, and a soft rag item 4, Appendix E.	Antenna guy is broken or missing hardware.
		•	•	3. Visually inspect antenna elements for dirt, frays, breaks or broken or missing hardware or warning labels. If necessary, clean antenna elements, removing dirt with a mild soap item 5, and a soft rag item 4, Appendix E. Replace warning labels if needed.	Antenna element is frayed or broken or hardware is missing.
		•	•	4. Visually inspect stowage bag for dirt, oil, foreign matter, frays, tears or broken or missing hardware. If necessary, clean items, removing dirt with a mild soap item 5, Appendix E and water. Repair stowage bag as necessary.	
6.				Control and RF Cables	
		•	•	1. Visually inspect cables for dirt, oil, foreign matter, frays, splits or damaged or missing connectors or labels. If necessary, clean cable, removing dirt with a mild soap item 5, and a soft rag item 4, Appendix E. Replace labels if necessary.	Connectors are damaged or missing or cable is damaged.

3-10. PMCS System Function Test

References to troubleshooting Section IV are followed by the name of the functional area for troubleshooting enclosed in parenthesis.

a. Control and Display Function.

(1) Apply power to the radio set by setting the power switch to ON and the Control Display Function switch to BRT.

(2) Check CRT for brightness and focus. Verify that the brightness of the display responds to changes in the setting of the brightness. If CRT function is incorrect, refer to Section IV (CRT problems).

(3) Check that the display fields on the CRT are not blank. If they are blank, refer to Section IV (Won't program).

(4) Verify that the backlighting of the keyboard works, and that keys are evenly lit. If backlighting does not work correctly, refer to Section IV (No keyboard lighting).

b. Receiver Function.

(1) Select frequencies such as 2.5, 3.334, 5.0, 7.335, 10.0, 15.0, or 20.0 MHz (2500.0, 3334.0, 5000.0, 7335.0, 10000.0, 15000.0, or 20000.0 KHz, respectively) in order to receive a broadcast station of time and frequency standards.

(2) Set squelch control to OFF.

(3) Select AM mode and wait for reference audio tone modulation from the standards station.

NOTE
Steps 4 and 5 below check the frequency (tuning) accuracy of the AN/VRC-86.

(4) Note the pitch of the audio tone received, then change to USB mode. The tone should not change up or down more than the difference between "ti" and high "do" on a musical scale. If it does, refer to (troubleshooting, garbled receive).

(5) Note the tone of the pitch received in the USB mode, then change to LSB mode. The pitch of the tone should not change up or down more than the difference between "ti" and high "do" on a musical scale. If it does, refer to Section IV (garbled receive).

(6) Vary the squelch setting and verify that the audio can be muted and unmuted depending upon the squelch setting.

(7) Vary the volume control and verify that the volume can be raised and lowered depending upon the volume setting.

(8) Attempt to tune in a station of any kind in each of the following bands:

2.0000 -	3.0999 MHz	(2000.0 -	3099.9 KHz)
3.1000 -	4.8999 MHz	(3100.0 -	4899.9 KHz)
4.9000 -	7.5999 MHz	(4900.0 -	7599.9 KHz)
7.6000 -	11.8999 MHz	(7600.0 -	11899.9 KHz)
11.9000 -	18.0999 MHz	(11900.0 -	18099.9 KHz)
18.1000 -	29.9999 MHz	(18100.0 -	29999.9 KHz)

NOTE

Radio wave propagation conditions may cause signals to be unavailable in some bands at different times during the day and night. However, consistant inability to receive station(s) at least somewhere in each band can indicate an equipment problem.

(9) If the receiver function does not work, refer to Section IV (No receive audio or Background audio preset, no receive signal).

c. BIT Check.

NOTE

If the instructions below are not followed, unauthorized transmissions will result when testing the (V)3 configuration. During BIT, the AN/VRC-86(V) transmits into a dummy load contained in the AM-7201/U. In the normal operating configuration of the (V)3, this portion of the AM-7201/U is bypassed. To prevent unauthorized transmission, the antenna must be disconnected and the cables connected into test configuration.

(1) If you are testing the (V)3 configuration, or any configuration using the CU-2479/U, refer to FO-9. If you are testing any other configuration, procede to step 4.

(2) Disconnect the antenna RF cable from Jl18 of the (V)3 configuration (located on the front panel insert of the Y-lnterconnect assembly).

(3) Connect the BIT test cable to J118.

(4) Press TEST, (13, figure 2-32), ENT (17, figure 2-32) to initiate the automatic built in test sequence. BIT takes more than 2 minutes to run. If TEST PASS is not displayed after 5 minutes, refer to the Section IV (System checkout BIT problem).

(5) Return system to normal operating configuration.

d. Antenna Tuning Test.

(1) Program the radio set with one authorized USB high power transmit frequency in each of the following bands:

2.0000 -	3.0999 MHz	(2000.0 -	3099.9 KHz)
3.1000-	4.8999 MHz	(3100.0 -	4899.9 KHz)
4.9000 -	7.5999 MHz	(4900.0 -	7599.9 KHz)
7.6000 -	11.8999 MHz	(7600.0 -	11899.9 KHz)
11.9000 -	18.0999 MHz	(11900.0 -	18099.9 KHz)
18.1000 -	29.9999 MHz	(18100.0 -	29999.9 KHz)

(2) Transmit on high power to verify that the radio set can tune and will hold tune with modulation for the test frequency in each band. If the radio will not tune or will not hold tune, refer to Section IV (Won't tune, won't hold tune).

e. Communications Check.

NOTE

Successful communications over distances greater than 200 miles provides the best assurance that the radio is functioning correctly. However, failure to communicate at these distances may be due to propagation conditions rather than equipment problems. Failure to communicate at distances between 0 and 200 miles indicates definite equipment problems. Attempting to communicate with stations closer than 5 miles using a power level greater than 4 watts can overload the receiver and cause distortion.

(1) Establish communications with a compatible ground station on an authorized frequency. Check for acceptable signal quality in both directions. If both stations are operating at the same power level, signal quality should be similar in both directions.

(2) If communications cannot be established, or if signal quality is unacceptable, note the symptoms in as much detail as possible and refer to the appropriate part of Section IV (Garbled Receive, Garbled Transmit, No Transmit).

f. (OPTIONAL) SELADR Check.

NOTE

This test is only required if your mission requires the use of the SELADR feature of the AN/VRC-86(V).

(1) Refer to paragraphs 2-8.h, .i for directions on setting up the radio to operate in the SELADR mode.

(2) Program the radio for one SELADR channel on the frequency of a test station which you can receive, and which is broadcasting in the normal (non-SELADR) mode. A standards station such as WWV or a commercial broadcast station may be used as a test station for this test.

(3) Set the radio to the SELADR channel with SELADR on. Verify that the radio remains silent.

(4) Turn SELADR off. Verify that the test station can be heard.

(5) Coordinate with a compatible ground station that has SELADR capability. Program a channel with an authorized transmit frequency and the SELADR code coordinated with the test station.

(6) Verify that communications can be established in the normal mode (SELADR off) with the test station on the same channel to be used for SELADR testing.

(7) Set SELADR on for the test channel and verify that SELADR communications can be successfully initiated in both directions

g. (OPTIONAL) Scan Check.

NOTE

This test is only required if your mission requires the use of the scan feature of the AN/VRC-86(V).

(1) Refer to Paragraph 2-8.k (Scan mode). Program a scan list of several channels, choosing some channels that have active transmissions such as a broadcast station or a standards station, and some that have little or no activity.

(2) Place the radio in the scan mode. Verify that radio set scans all channels on the scan list and skips over all channels that are not on the scan list.

(3) If scan operation is not working properly, refer to Section IV (System checkout BIT problem).

h. (OPTIONAL) SELADR Scan Check.

NOTE

This test is only required if your mission requires the use of the SELADR scan feature of the AN/VRC-86(V).

(1) Refer to paragraph 2-8.k (Selective address scan).

(2) Coordinate with a compatible ground station having SELADR capability to set up a SELADR channel on an authorized transmit frequency of the other station.

(3) Set up a SELADR scan list of 4 channels in your radio that includes the frequency and SELADR code coordinated with the other station. Make sure that the scan list also includes channels with no activity and channels with non-SELADR transmissions (such as broadcast stations).

(4) Have the distant station initiate a SELADR call while your radio is scanning. Verify that your radio only locks on to the SELADR call.

(5) If SELADR scan is not working properly, refer to Section IV (System checkout BIT problem).

i. ((V)3 ONLY) Blower Fan Operation.

(1) Apply power to the radio set. Set POWER ON/OFF to ON.

(2) Verify blower fan is running. If blower fan is not running, replace blower fan (See paragraph 3-23).

SECTION IV. TESTING AND TROUBLESHOOTING

3-11. Scope

Make sure that the electronics box is properly installed and that wiring is correct. Perform system functional test (Section III) and if anything does not work right, proceed as outlined below.

This section contains procedures for troubleshooting problems in the radio set by using three methods. Visual inspection shall be used anytime a failure or fault is suspected. The radio set performs continuous Built-In-Test (BIT) during normal operation and will display faults resulting from continuous BIT on the CRr. Initiated Built-In-Test shall be performed by maintenance personnel either on a periodic basis or upon detection of a fault during operation.

3-12. Troubleshooting Data

WARNING

In all cases throughout troubleshooting procedures, remove power from UUT and Test Set before removal and replacement of LRUs.

There are fold out troubleshooting flowcharts located in the back of this manual. Table 3-2 lists the fold out number of the functional area covered by each flowchart. Troubleshooting methods vary in some functional areas depending on the configuration the radio set you are working on. When a problem is encountered when performing the PMCS System Functional Test, you are refered to this section and a functional area for troubleshooting. Find this functional area and your configuration radio set in Table 3-2 and go to the indicated troubleshooting flowchart. Start at the beginning of the flowchart, perform the indicated actions, answer the questions and follow the directions given.

Table 3-2. Troubleshooting Flowchart Identification

Functional Area Identified in PMCS System Functional Test	Configuration Radio Set	Flowchart To Use
System checkout BIT problem	(V)1, (V)2 (V)3	FO-10 FO-11
CRT problems	(V)1, (V)2 (V)3	FO-12 FO-13
No keyboard lighting	(V)1, (V)2 (V)3	FO-14 FO-15
Garbled receive	(V)1, (V)2 (V)3	FO-16 FO-17
Garbled Transmit	(V)1, (V)2 (V)3	FO-18 FO-19
No Transmit	(V)1, (V)2 (V)3	FO-20 FO-21
Won't tune, won't hold tune	(V)1, (V)2 (V)3	FO-22 FO-23
Transmit power drops when operating	(V)1, (V)2 (V)3	FO-24 FO-25
No receive audio	(V)1, (V)2 (V)3	FO-26 FO-27
Won't program or hold program	All	FO-28
Background audio present, no receive signal	(V)1, (V)2 (V)3	FO-29 FO-30

SECTION V. MAINTENANCE PROCEDURES

3-13. Introduction

The following maintenance procedures include removal and installation, repair, cleaning, and test of LRUs. Tools needed to perform the operations found in this section are accomplished with tools provided in Tool Kit TK-105/G (item 1 Appendix B, Section III).

Repair of the radio set is accomplished by removing and replacing the faulty LRU as described in the following paragraphs. No other repairs are authorized at AVUM.

To perform these maintenance procedures it may necessary to remove the top cover from the electronics box. To remove the top cover of the electronics box, unfasten the two latches that are mounted on each side of the electronics box. Lift the cover off of the box and set the cover aside.

To perform the maintenance procedures on the control-display in (V)1 and (V)2 configuration, it is necessary to raise the control-display cover on the electronics box. This is done by simply turning the wing nut located on the bottom of the control-display cover assembly. The spring loaded cover will then raise to the open position.

The electronics box is itself an LRU. It is necessary to remove the LRU from the electronics box when it is to be handled separately. Cabling diagrams for the electronics box for the different configurations of the radio set are found in the fold out section in the back of this manual as listed below. When re-installing all LRU back into the electronics box, these diagrams are helpful in getting all connectors reconnected properly.

AN/VRC-86(V)1	FO-31
AN/VRC-86(V)2	FO-32
AN/VRC-86(V)3	FO-33

WARNING

High voltage is used in the operation of this equipment. Disconnect power before performing maintenance to avoid serious injury to personnel.

3-14. Removal/Installation of Control-Display

a. Removal from electronics box.

(1) Remove cover of electronics box (not shown).

(2) Turn quarter-turn fastener on control-display cover on front of electronics box. Raise cover to open position (not shown).

(3) Refer to figure 3-1. Remove cable connector from J9711 (5) located on rear of control-display.

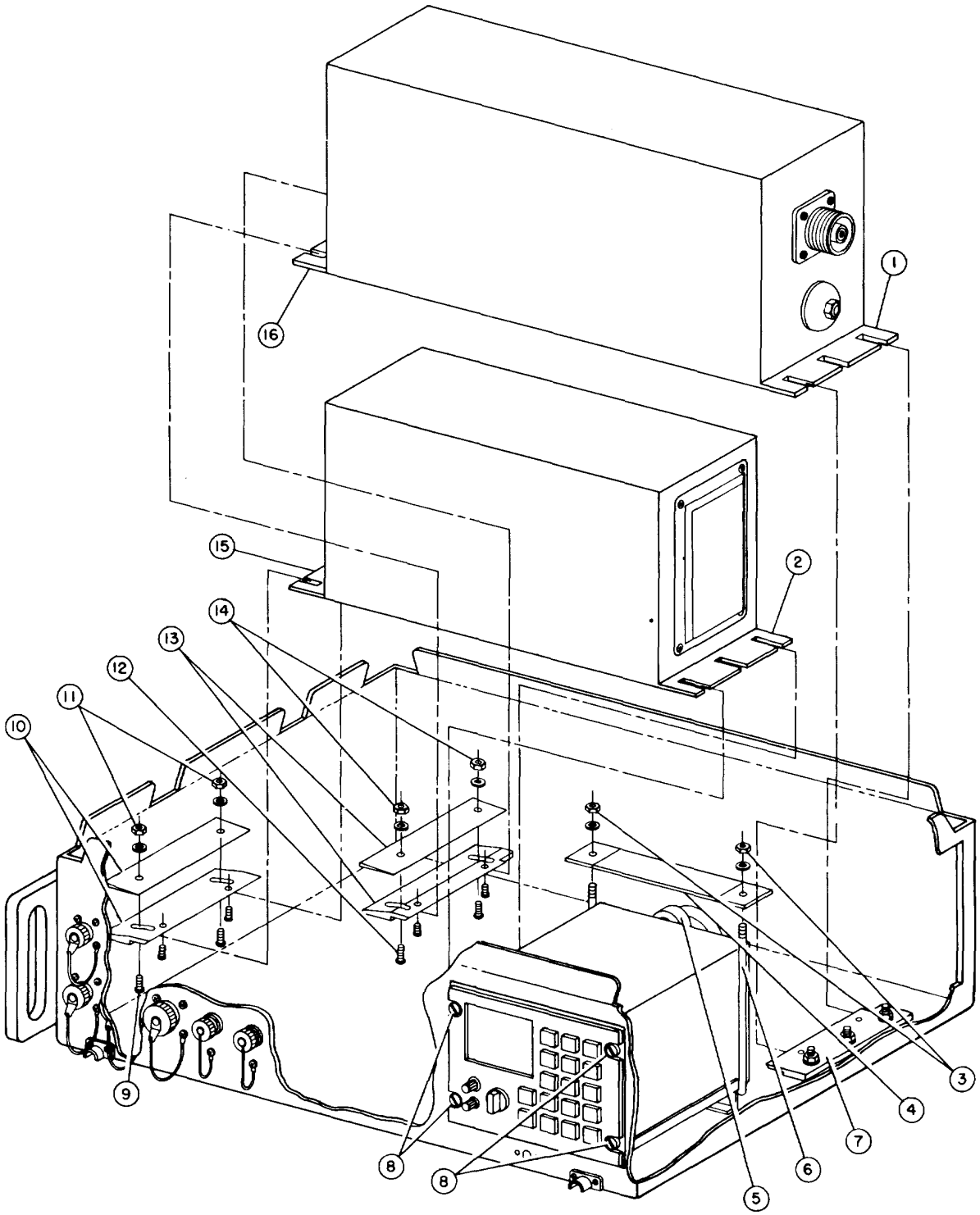


Figure 3-1. MX-10485/VRC-86 Electronics Box

(4) Loosen two nuts (3) attached to U-bolt (6) on top of the hold-down bar (4) located on the rear top of the control-display.

(5) Loosen four captive retaining screws (8) on front panel.

(6) Remove control-display from the mounting location by sliding it out of the front of the electronics box.

b. Installation in electronics box.

(1) Remove cover of electronics box (not shown).

(2) Loosen wing nut located on front cover assembly of electronics box. Raise cover assembly to open position (not shown).

(3) Place control-display in mounting location by sliding it thru the front of the electronics box.

(4) Tighten the four captive retaining screws (8) located on the front panel of the control-display.

(5) Place hold-down bar (4) on U-bolt (6) on top of control-display with two nuts (3).

(6) Secure cable connector to J9711 (5) located on rear of the control-display.

c. Removal from remote mounting location.

(1) Loosen four captive retaining screws on front panel (these are the same as item 8, fig. 3-1).

(2) Slide control-display out of mount to gain access to rear connector J9711 and remove cable connector.

d. Installation in remote mounting location.

(1) Connect cable connector to J9711 on rear of control-display.

(2) Position control-display in mount and tighten four captive retaining screws on front panel (these are the same as item 8, fig. 3-1).

3-15. Removal/Installation of Amplifier-Coupler.

a. Removal.

(1) Remove cover of electronics box.

(2) Refer to figure 3-2. Remove cable connectors from J9725 (1); then, J9726 (5); then, J9721 (10); then, J9724 (9).

(3) For the (V)3 configuration, remove cable connectors from J9722 (8) and J9723 (6) and reinstall connector adapter (7) as described in paragraph 3-21.b.

(4) Remove nut (2) and washer (3) from antenna ground post. Remove grounding strap (4).

(5) Refer to figure 3-1. Loosen the two nuts and washers (14) securing the front hold-down assembly (13).

(6) Slide the entire front hold-down assembly (13) away from the front lip (16) of the amplifier-coupler.

(7) Slide the amplifier-coupler slightly toward the front hold-down assembly (13), freeing it from the rear hold-down assembly (7).

(8) Remove the amplifier-coupler by carefully lifting it out of the electronics box.

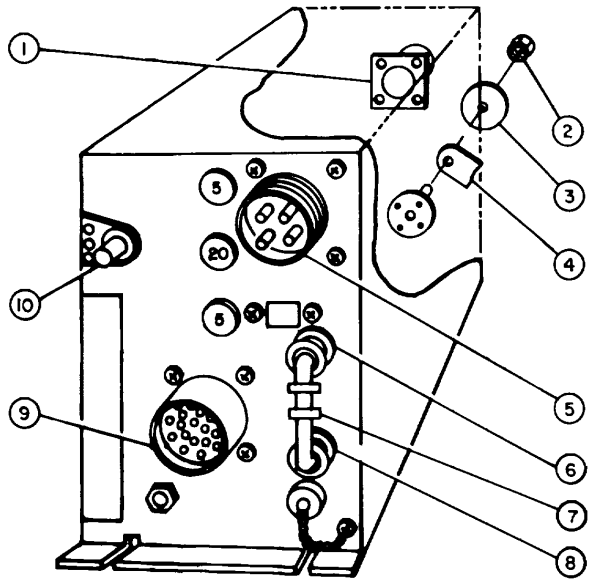


Figure 3-2. AM-7201/U Amplifier-Coupler Connectors and Grounding Strap

b. Installation.

(1) Remove cover of electronics box.
(2) Refer to figure 3-1. Install amplifier-coupler in mounting location by aligning rear lip of amplifier-coupler (1) in front of the rear hold-down assembly (6). Slide rear lip of amplifier-coupler (1) under the top of the rear hold-down assembly (7).
(3) Slide the front hold-down assembly (13) over the front lip (16) of the amplifier-coupler.
(4) Tighten the two nuts and washers (14) to the studs (12) of the front hold-down assembly (13).
(5) Refer to figure 3-2. Place ground strap (4) on antenna ground post, install washer (3) and tighten nut (2).
(6) Attach connectors to J9724 (9); then, J9721 (10); then, J9726 (5); then, J9725 (1).

3-16. Removal/Installation Receiver-Transmitter.

a. Removal

(1) Remove cover of electronics box.
(2) Refer to figure 3-3. Remove connectors from J9732 (1); then, J9731
(3) then, J9733 (2).
(3) Refer to figure 3-1. Loosen two nuts and washers (11) from the front hold-down assembly (10).
(4) Slide entire front hold-down assembly (10) away from front the lip (15) of receiver-transmitter.
(5) Slide receiver-transmitter rear lip (2) free from the rear hold-down assembly (not shown).
(6) Grasp the receiver-transmitter with both hands and lift it from the mounting location in the electronics box.

b. Installation.

(1) Remove cover of electronics box.
(2) Place receiver-transmitter in the mounting location by sliding the rear lip (2)of the receiver-transmitter under the top of the rear hold-down assembly (not shown).
(3) Slide the front hold-down assembly (10) over the front lip of the receiver-transmitter (15).
(4) Tighten the two nuts and washers (11) on the studs (9) of the front hold-down assembly (10).
(5) Refer to figure 3-3. Attach connectors to J9733 (2); then, J9731 (3); then, J9732 (1).

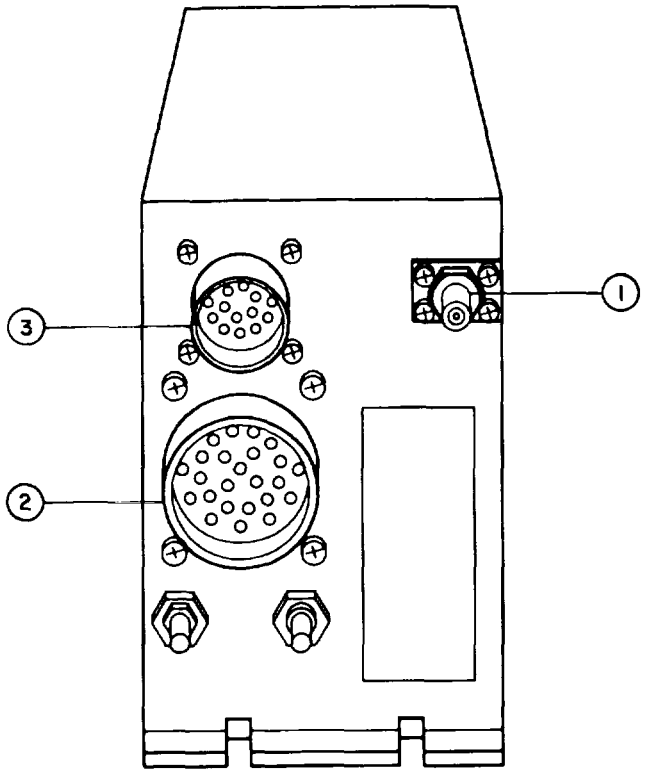


Figure 3-3. RT-1432/U Receiver-Transmitter

3-17. Removal/Installation Electronics Box From Vehicle

a. Removal.

(1) Refer to figure 3-4. Loosen the two knurled nuts (3) that secure the electronics box to the mounting tray.
(2) Remove connectors from J9725 (1), J9812 (4), J9813 (5), J9817 (6), J9811 (7), J9814 (8), J9816 (9), J118 (10), and J101 (11) as required.
(3) Remove ground strap from ANTENNA GROUND below J9725 (1) as required.
(4) Place connector dust covers on each of the front panel mounted connectors and close protective door over control-display or Y-interconnect.
(5) Slide electronics box out of mounting tray.

b. Installation.

(1) Refer to figure 3-4. Place the electronics box in the mounting tray with the two guide pins (2) on the mounting tray inserted in the rear of the electronics box.
(2) Remove connector dust covers from front panel mounted connectors.
(3) Attach cable connectors to J9725 (1), J9812 (4), J9813 (5), J9817 (6), J9811 (7), J9814 (8), J9816 (9), J118 (10) and J101 (11) as required.
(4) Attach ground strap to ANTENNA GROUND below J9725 (1) under washer and nut (items 2 and 1, fig. 3-2).
(5) Place the two mounting tray latch assemblies in position on the electronics box. Tighten the two knurled nuts (3) to secure the electronics box into the mounting tray.

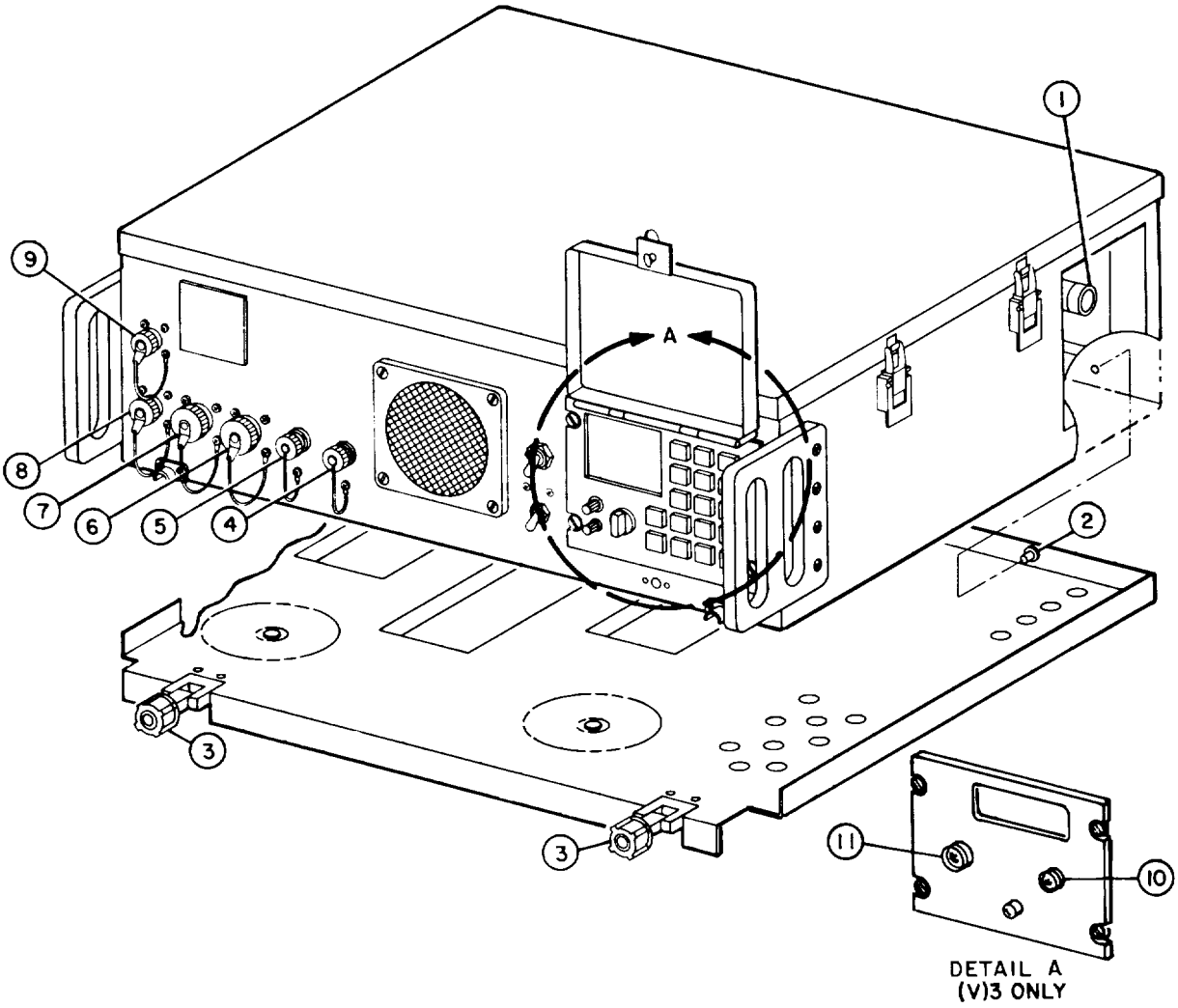


Figure 3-4. MX-10485/VRC-86 Electronics Box Mounting, Typical

3-18. Removal/installation of Antenna Base From Vehicle

a. Removal from vehicle.

(1) Refer to figure 3-5. Unscrew and remove the whip antenna (1) from the antenna base.
(2) Disconnect the cable assemblies from J9822 (2) and J9821 (3) on the antenna base.
(3) Loosen six bolts (4) on vertical flanges (5) of the mounting assembly.
(4) Remove two screws (6) that secure the antenna base to the mounting assembly.
(5) Lift the antenna base out of the mounting assembly.

b. Installation into vehicle.

(1) Loosen six bolts (4) on vertical flanges (5) of the mounting assembly.
(2) Remove two screws (6) from the antenna base.
(3) Slide the antenna base in the mounting assembly and align screw holes.
(4) Install two screws (6) through the mounting assembly and into the antenna base.
(5) Tighten six bolts (4) on vertical flanges (5) of the mounting assembly.
(6) Attach cable assemblies to connectors J9822 (2) and J9821 (3) on the antenna base.
(7) Screw the whip antenna (1) into the top of the antenna base.

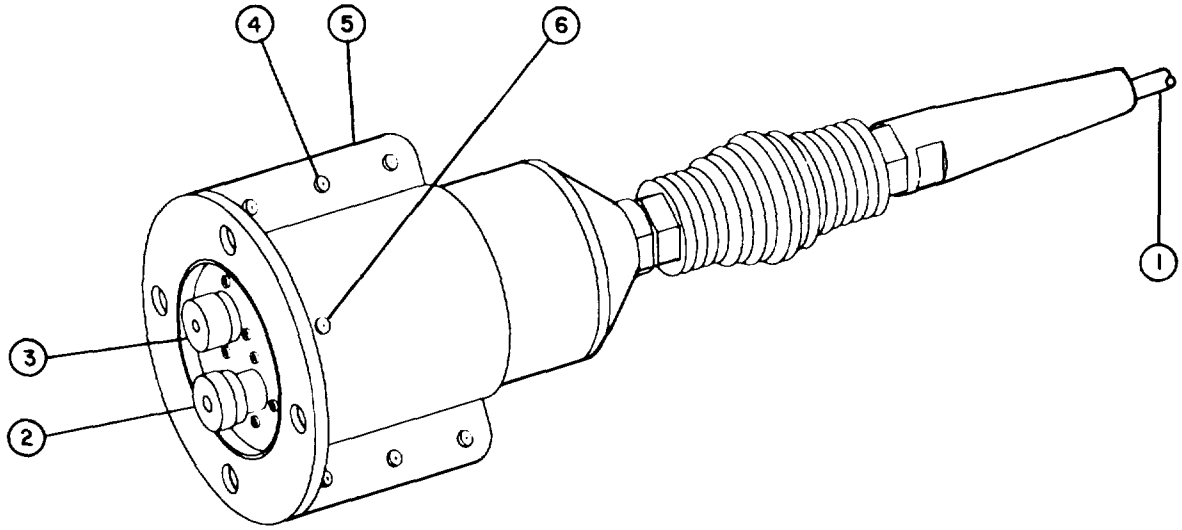


Figure 3-5. AB-1311/VRC-86 Antenna Base, Mounting

3-19. Removal/installation of Antenna Base Shock Spring

a. Removal of Antenna Base Shock Spring.

(1) Remove whip from antenna base and antenna base from vehicle as described in paragraph 3-18.a.
(2) Refer to figure 3-6. Shock spring (3) is threaded on to a stud on the antenna base housing (1). Loosen and remove shock spring (3) with whip adapter (5) from antenna base housing (1). Retain lock washer (2) for installation of new shock spring.
(3) Antenna whip adapter (5) is threaded on to shock spring (3). Loosen and remove whip adapter (5) from shock spring (3). Retain lock washer
(4) for installation of new shock spring.

b. Installation of Antenna Base Shock Spring.

(1) Refer to figure 3-6. Thread antenna whip adapter (5) with lock washer (4) retained in step a.3 above, on to threaded stud of shock spring (3). Tighten until lock washer (4) is fully compressed.
(2) Thread shock spring (3) with whip adapter (5) with lock washer (2), retained in step a.2 above, on to threaded stud on antenna base housing (1) Tighten until lock washer (2) is fully compressed.

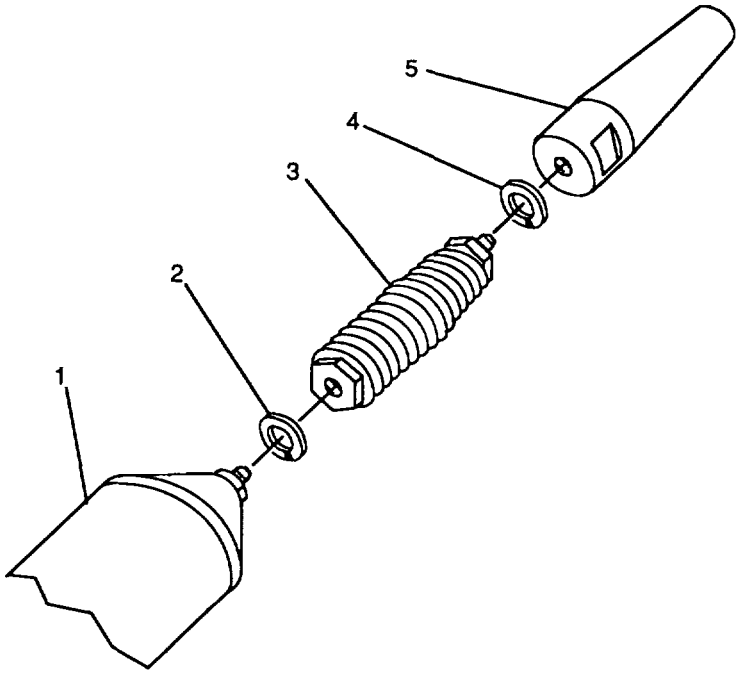


Figure 3-6. AB-1311/VRC-86 Antenna Base Shock Spring

3-20. Removal/Installation of Control-Display Front Panel Knobs

Refer to figure 3-7. The SET knob (1), the FUNCTION SELECT knob (3), and the SQL knob (5) with their respective set screws (2), (4), and (6) are all removed and installed using the same procedure.

a. Removal of knob.

(1) Use spline screwdriver to loosen two set screws in knob.
(2) Gently pull knob from control-display front panel.

b. Installation of knob.

(1) Install knob on control-display front panel.
(2) Using spline screwdriver, tighten two set screws in knob.

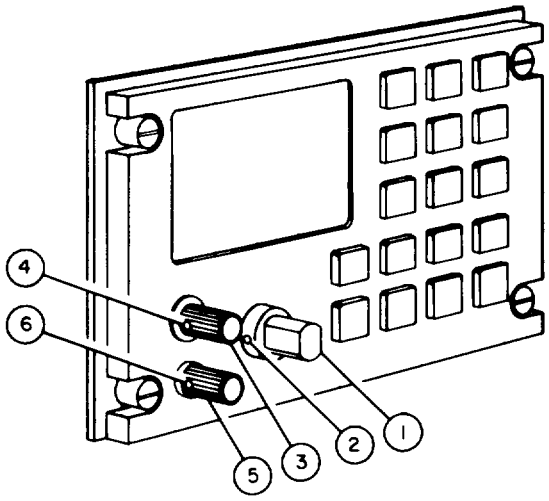


Figure 3-7. C-11245/U Control-Display Panel Knobs

3-21. Removal/Installation of Amplifier-Coupler Connector Adapters

a. Removal.

(1) Refer to figure 3-8. Twist knurled portion of two connector adapters (1 and 3) at connections to amplifier-coupler so that guide pins move from the locked position. Gently pull assembled unit of two connector adapters (1 and 3) and middle connector adapter (2) from amplifier- coupler.
(2) Twist knurled portions of middle connector adapter (2) so that guide pins move from the locked position. Gently pull two connector adapters (1 and 3) from middle adapter (2).

b. Installation.

(1) Slide connector adapter (1) into one end of middle connector adapter (2) so that the guide pin fits into the slot in the middle connector adapter (2). Twist knurled portion of the middle connector adapter (2) until the guide pin locks in place.
(2) Repeat step 1. for connector adapter (3).
(3) Place assembled unit (1, 2, and 3) on amplifier-coupler. Twist knurled portions of connector adapters (1 and 3) until guide pins lock in place.

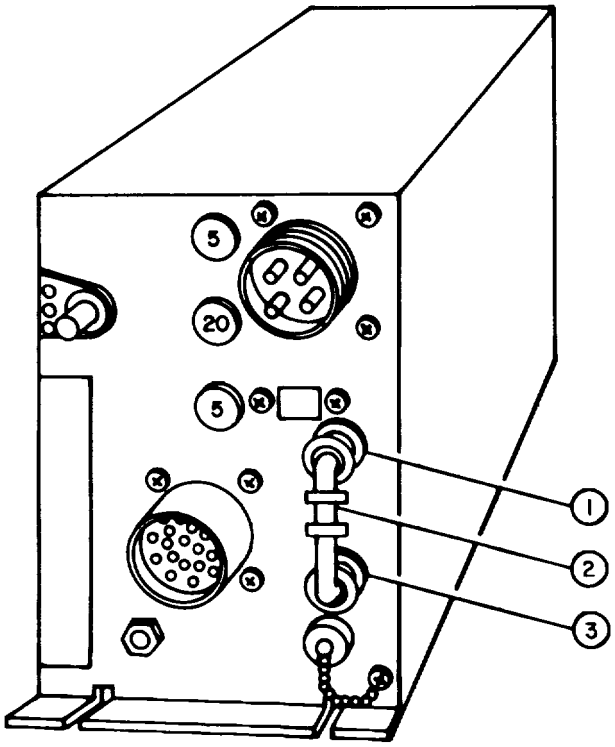


Figure 3-8. AM-7201/U Amplifier-Coupler Connector Adapters

3-22. Removal/Installation of Y-interconnect

a. Removal.

(1) Refer to figure 3-9. Remove electronics box top cover. Disconnect Y- interconnect connector P100 from amplifier- coupler connector J9724 (2).
(2) Disconnect cable connector P9724 from Y-interconnect connector J100 (1).
(3) Disconnect Y-interconnect coax cables from amplifier coupler connectors J9722 (8) and J9723 (9).
(4) Disconnect Y-interconnect fan power connector from electronics box fan power connector (7).
(5) Loosen four captive retaining screws on front panel (6) and remove Y- interconnect from electronics box.

b. Installation.

NOTE

The control-display must be removed from electronics box (paragraph 3-14), electronics box connector P9724 must be disconnected from amplifier-coupler connector J9724, and the BNC jumper between amplifier-coupler connectors J9722 to J9723 (paragraph 3-21) must be removed and one end connected to J9727 before Y-interconnect can be installed. If a fan power connector has not been installed in electronics box, one will have to be installed (paragraph 3-24).

(1) Refer to figure 3-9. Insert free ends of Y-interconnect cables through opening in electronics box.
(2) Position front panel in opening and tighten four captive retaining screws (6) on Y-interconnect front panel.
(3) Connect Y-interconnect fan power connector to electronics box fan power connector (7).
(4) Connect Y-interconnect coax cable from Jl18 to amplifier-coupler connector J9722 (8).
(5) Connect Y-interconnect coax test cable from front panel to amplifier- coupler connector J9723 (9).
(6) Connect electronics box connector P9724 to Y-interconnect connector J1*00o* (1).
(7) Connect Y-interconnect connector P100 to amplifier-coupler connector J9724 (2).

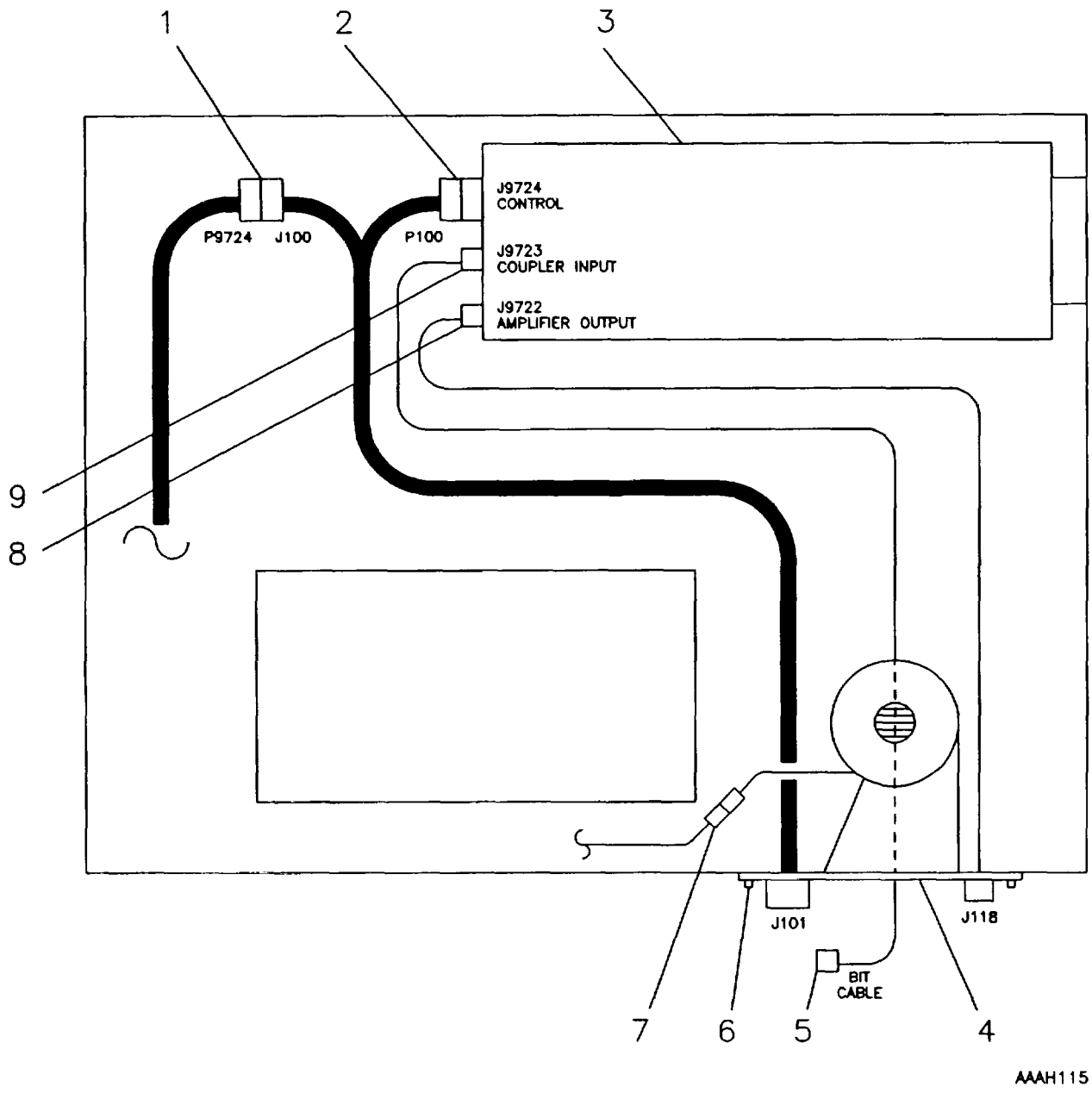


Figure 3-9. Removal and Installation of Y-Interconnect

3-23. Removal/Installation of Y-Interconnect Fan.

a. Removal.

(1) Remove Y-interconnect from electronics box (paragraph 3-22.a).
(2) Refer to figure 3-10. Remove two screws (1), washers (2), and nuts (3) holding fan assembly (4) and protective grate to Y-interconnect.
(3) Remove fan assembly (4) from Y-interconnect (Retain protective grate and mounting hardware).

b. Installation.

(1) Remove Y-interconnect from electronics box (paragraph 3-22.a).
(2) Remove existing fan (paragraph 3-23.a).
(3) Refer to figure 3-10. Position new fan assembly (4) and protective grate as indicated.

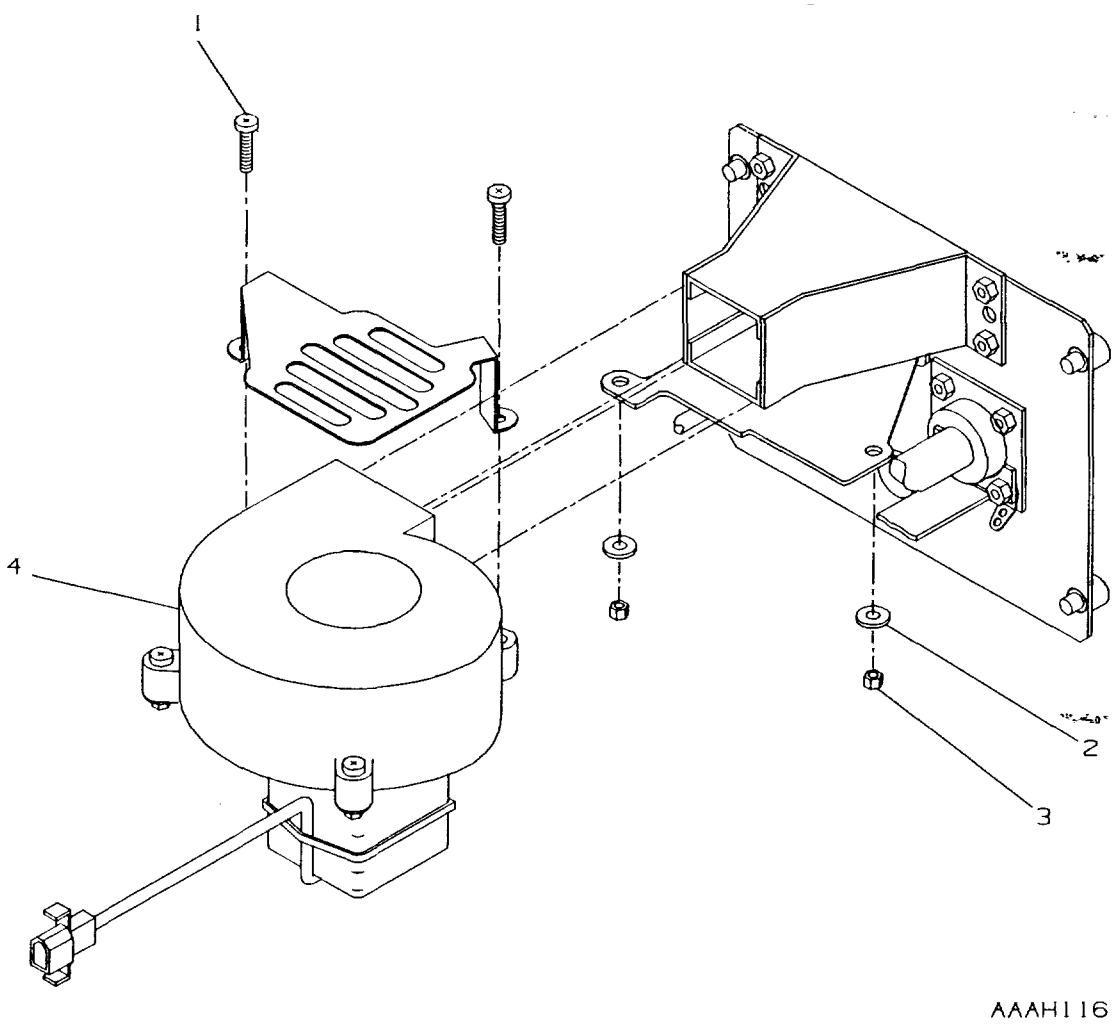


Figure 3-10. Removal and Installation of Fan

3-24. Fabrication and Installation of Fan Power Cable Assembly

a. Fabrication.

(1) Refer to figure 3-11 and table 3-3. Install one connector pin (3) on one end of 15 inches of the black wire (1).
(2) Install one connector pin (3) on one end of 15 inches of the red wire (2).
(3) Insert black wire (1) with connector (3) into connector housing (4), observing proper location as shown.
(4) Insert red wire (2) with connector (3) into connector housing (4), observing proper location as shown.

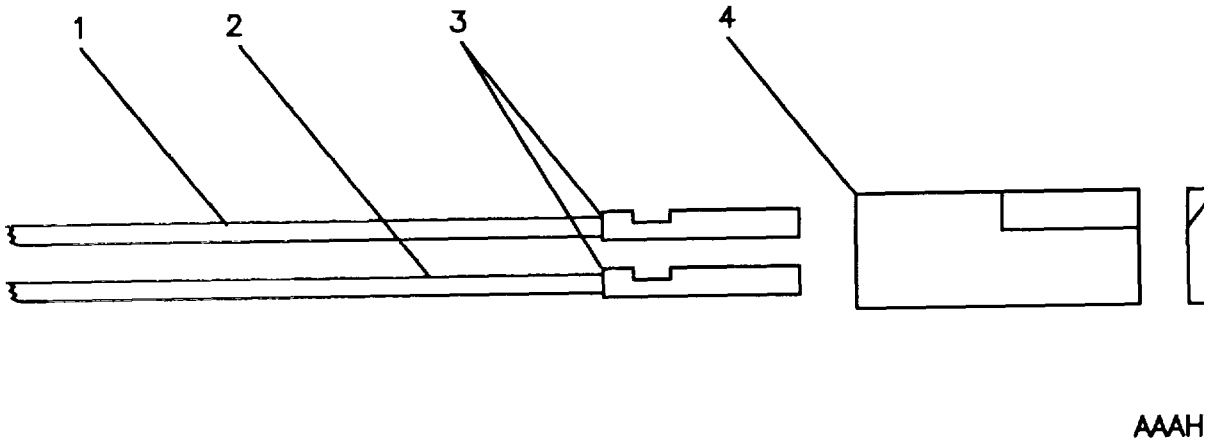


Figure 3-11. Fabrication of Fan Cable

Table 3-3. Fan Cable Parts List

Fig 3-11 Item	Part Number/NSN	CAGE	Description
1	XE22-730BLACK	27478	Wire Teflon, AWG 22, Black
2	XE22-730RED	27478	Wire Teflon, AWG 22, Red
3	5999-00-338-9879	27264	Connector, Pin
4	5935-01-028-9438	27264	Housing, Connector

b. Installation into Electronics Box.

(1) Refer to figure 3-12. Solder red lead of 22373/155-02707-0000 fan cable assembly (1) to E111 (2) on rear of electronics box POWER ON/OFF switch.
(2) Solder black lead of 22373/155-02707-0000 fan cable assembly (1) to ground lug (3) on back of electronics box connector J9817.

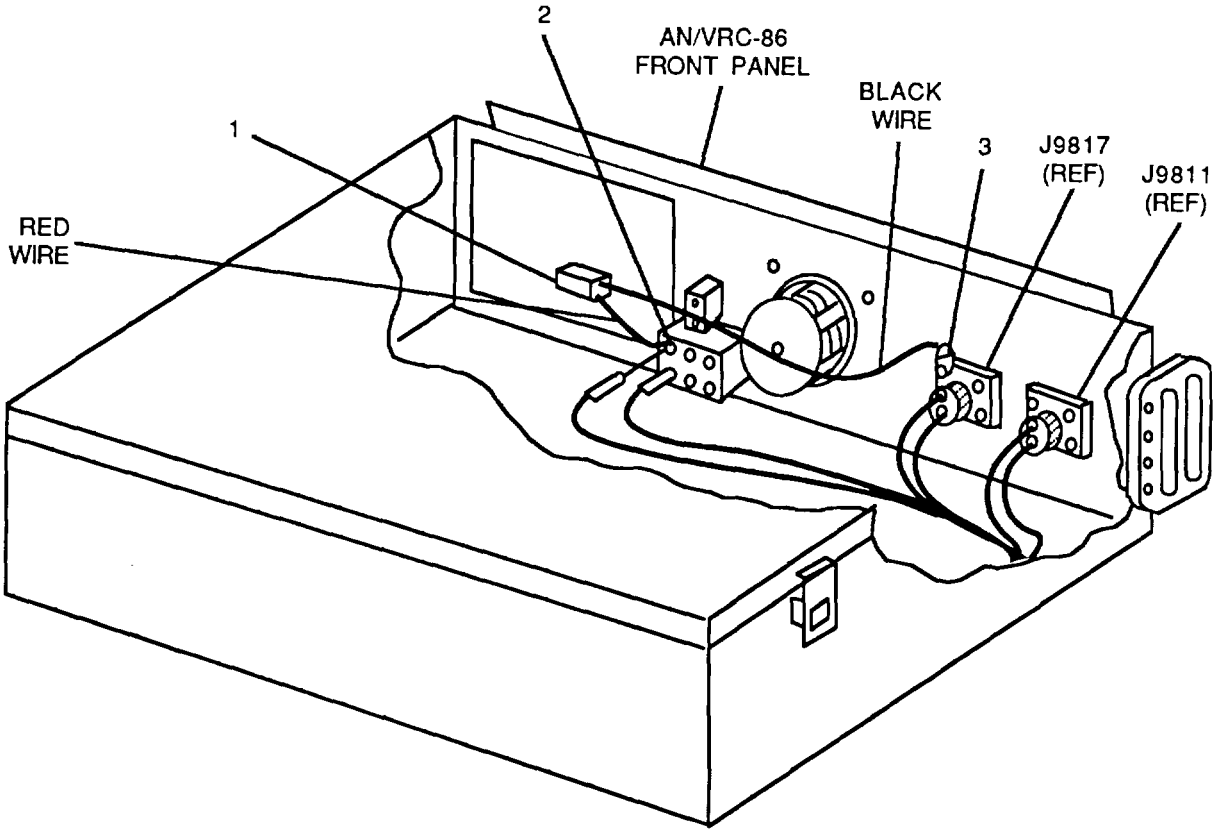


Figure 3-12. Installation of Fan Power Cable

3-25. Touch-up Painting

a. Refer to TB 43-0118 for painting and preserving electronics command equipment, to TM 43-0139 for painting instructions for field use, and appendix E for materials.

b. Remove rust and corrosion from metal surfaces by lightly sanding with fine sandpaper (refer to appendix E). Apply two thin coats of paint on bare metal to prevent corrosion.

Section VI. PREPARATION FOR STORAGE OR SHIPMENT

3-26. Preservation and Packaging

Make sure that radio set LRUs are clean and dry. Pack the radio set LRU, in original cartons, if available. Pack with approved desiccant in each cavity within the urethane foam. Seal box with reinforced paper tape. If original cartons are not available, refer to figure 3-13 and pack LRU using the following procedures.

a. Seal LRU (2) in plastic shipping bag (3).

b. Place foam end cap (6) in shipping carton (7).

c. Insert LRU (2) and foam sides (4 and 5) in shipping carton (7).

d. Place foam end cap (1) over LRU (2).

e. Attach one copy of the shipping document with contract number to the outside of the shipping carton in an envelope or place documentation inside shipping carton.

f. Fold each pair of opposite flaps and staple carton or seal with reinforced paper tape. Seal all edges of shipping carton with reinforced paper tape.

3-27. Administrative Storage

When storage is short term (1 to 45 days) store the radio set indoors in a safe area protected from damage and adverse weather.

3-28. Intermediate and Long Term Storage

For intermediate (46 to 180 days) or long term storage (180 days or more) pack the radio set in accordance with instructions in paragraph 3-26.

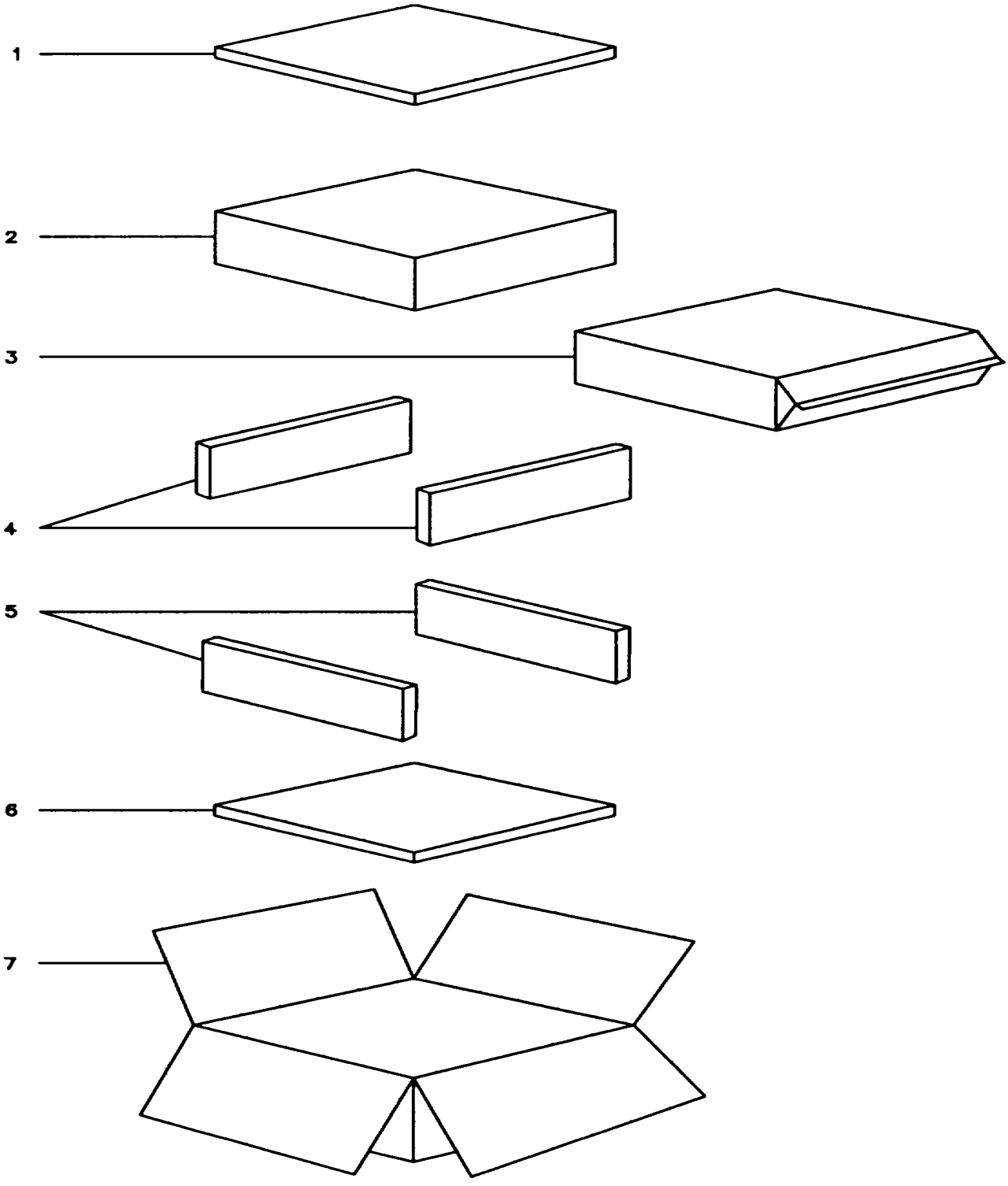


Figure 3-13. Typical Packaging

CHAPTER 4
AVIATION INTERMEDIATE MAINTENANCE (AVIM)

4-1. Warranty Information

The radio set LRUs are covered by the manufacturer's warranty as described in warranty technical bulletin TB 11-5820-927-10. Maintenance and testing is performed at the AVUM level and failed LRUs are shipped to the manufacturer.

4-2. Special Tools, TMDE, and Support Equipment

Special TMDE required for maintenance are a digital multimeter, an RF detector and an AN/GRM-1 14A RF Test Set as described in Section III of Appendix B. Equivalent test equipment may be used.

4-3. Scope of AVIM Testing

LRUs coming into the organization are checked to make sure they will work when put in the vehicle. Refer to Chapter 3, Section II for service upon receipt. To verify the failure of units being sent back to the manufacturer, the built in test (BIT) can be performed as described in in Chapter 2, paragraph 2-5j. When you are sure that an LRU has failed, return it to the manufacturer as instructed in warranty technical bulletin TB 11-5820-927-10.

4-4. Scope of AVIM Maintenance

AVIM maintenance is limited to the troubleshooting and repair of two cables. First is the control cable which is a 230 foot multi-conductor cable. Second is the RF transmission cable which is a 230 foot coaxial cable. Maintenance for the control cable is described in paragraph 4-5. Maintenance for the RF transmission cable is described in paragraph 4-6.

4-5. Control Cable Maintenance

Control cable maintenance consists of inspecting the cable for damaged connectors or cable, performing continuity checks and checking for shorts between individual conductors. Visually inspect the cable for damaged connectors or cable. If a connector is damaged, replace the connector. Refer to figure 4-1 for the control cable wiring diagram. Perform a continuity check of all cable conductors followed by a check for shorts between each individual conductor and all other conductors and shields in the cable. If open conductors are found or conductors are shorted, repair the cable, connector or connections as applicable.

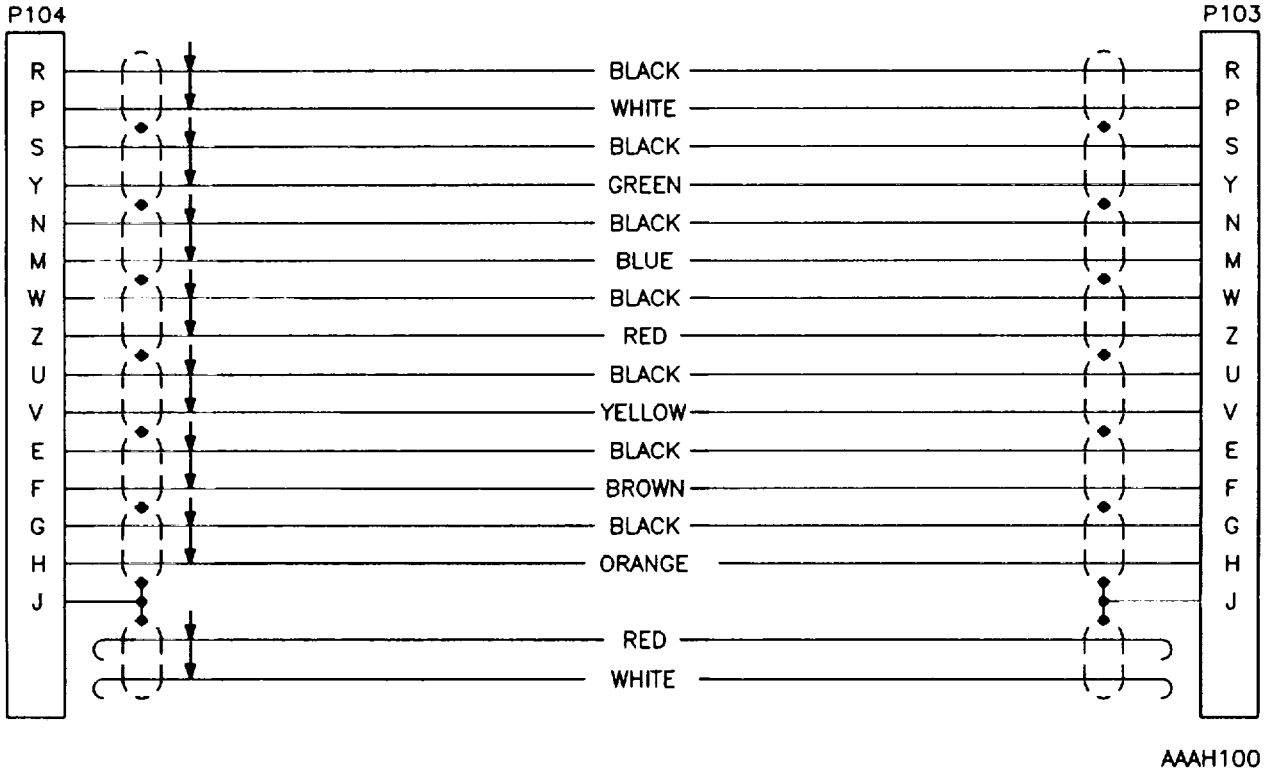


Figure 4-1. Antenna Coupler, Control Cable Drawing

4-6. RF Transmission Cable Maintenance

Visually inspect the cable for damaged connectors or cable. If a connector is damaged, replace the connector.

Follow the steps listed below to test the RF Transmission Cable.

(1) Refer to figure 4-2. Connect the equipment as shown.
(2) Set the oscilloscope controls of the AN/GRM-1 14A for DC coupling, 1 mSEC/DIV sweep, 0.01 Volts/DIV vertical sensitivity.
(3) With no input connected to the SCOPE IN jack, adjust positioning controls to center the trace.
(4) Set signal generator controls of the AN/GRM-1 14A to produce a 30 MHz signal at 0 dBm.
(5) Connect RF detector to the SCOPE IN jack.
(6) Adjust the RF signal level to produce a vertical deflection of the oscilloscope trace of 3 divisions.

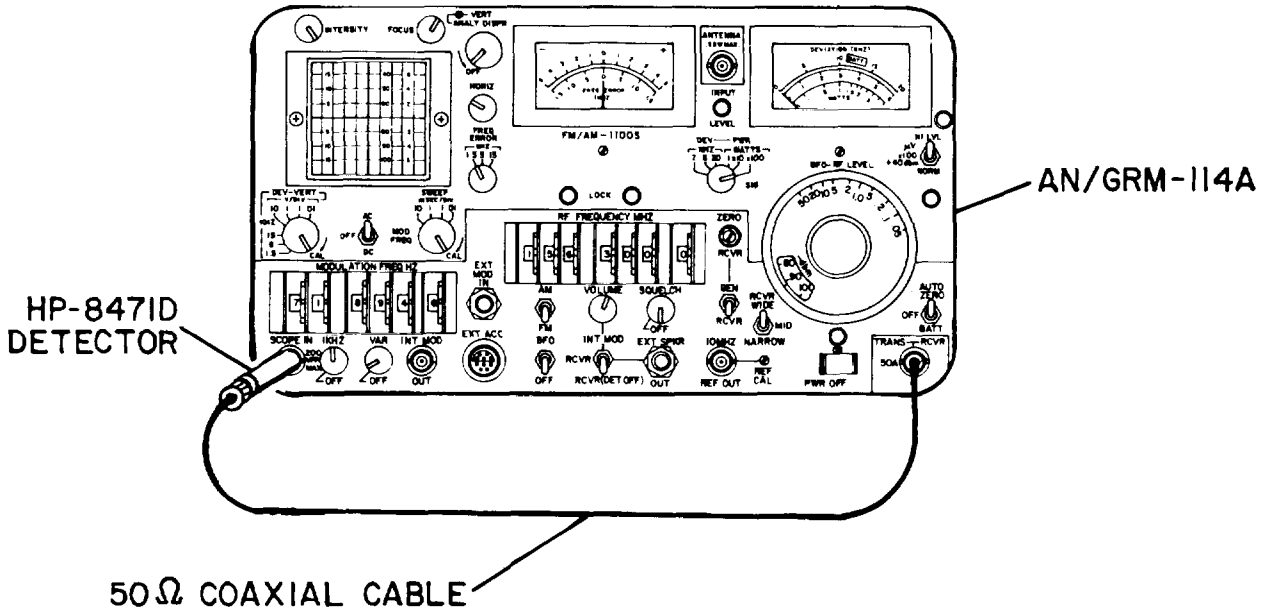


Figure 4-2. RF Transmission Cable, Reference Level Test Setup

NOTE

The detector produces a DC output proportional to the RF input signal level. This DC voltage may be either positive or negative depending on which version of the RF detector you have. The trace will be a straight line, and will be above the center line for positive detectors or below the center line for negative detectors.

(7) Note the setting of the BFO-RF LEVEL control in dBm. This is the reference level for steps that follow.

(8) Disconnect the 50 Ohm coaxial cable from the detector and connect the antenna cable to be tested as shown in figure 4-3.

(9) Adjust the BFO-RF LEVEL control to obtain a vertical deflection of the oscilloscope trace of 3 divisions.

(10) Read and record the new setting (in dBm) of the BFO-RF LEVEL control. Find the difference between this setting and the reference level noted in step 7 above. This difference is the loss of the antenna cable in dB. Repair or replace cable if there is more than 6 dB of loss at 30 MHz.

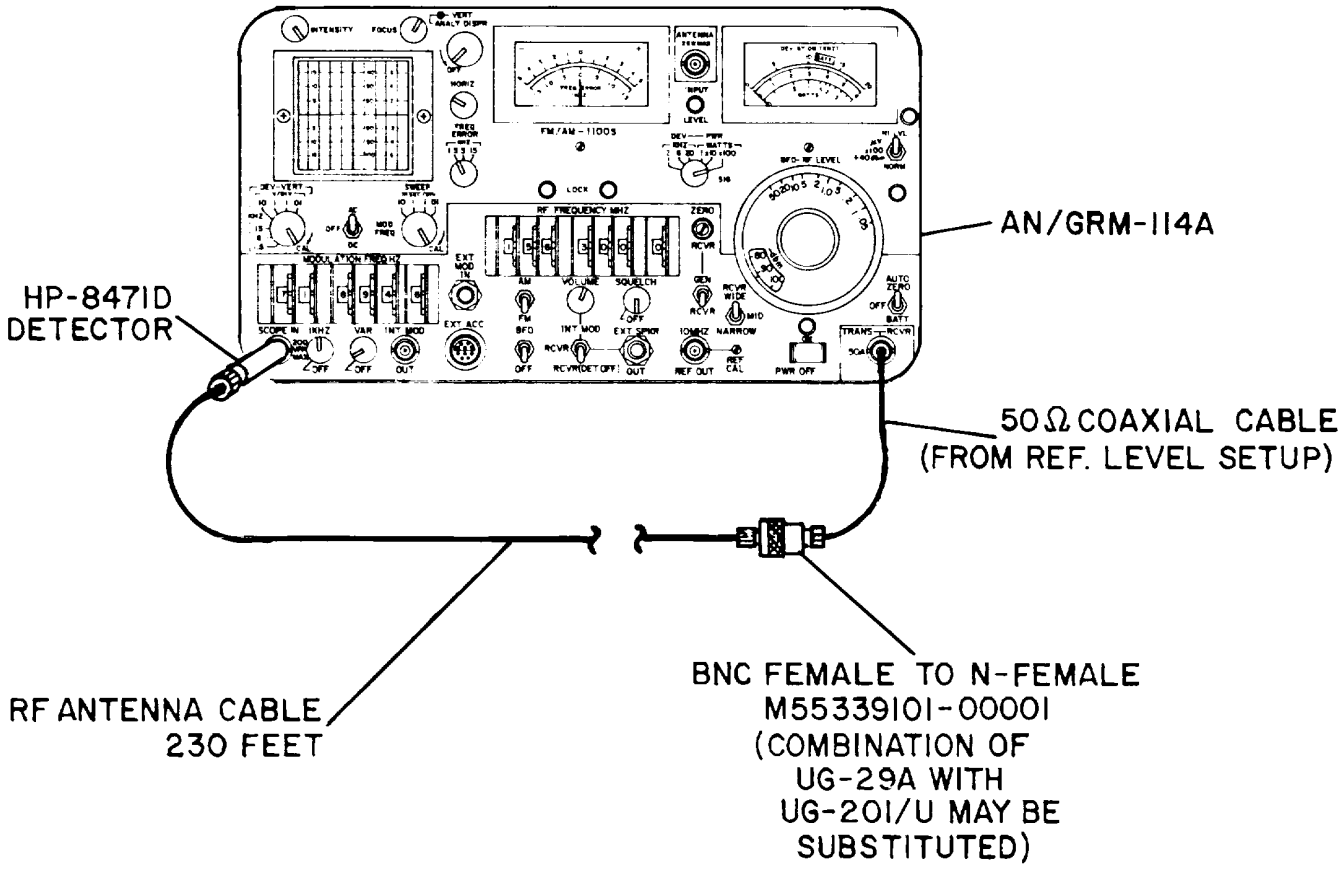


Figure 4-3. RF Transmission Cable, Cable Loss Test Setup

APPENDIX A

REFERENCES

A-1. Scope

This Appendix lists all pamphlets, forms, bulletins, technical manuals and software referenced in this TM.

A-2. Pamphlets

Consolidated Index of Army Publications and Blank Forms ..... DA PAM 25-30
The Army Maintenance Management System.. ..... DA PAM 738-750
The Army Maintenance Management System-Aviation ..... DA PAM 738-751
US Army Equipment Index of Modification Work Orders ..... DA PAM 750-10

A-3. Forms and Records

Quality Deficiency Report..... SF-368
Equipment Inspection and Maintenance Worksheet ..... DA FORM 2404
Recommended Changes of Publications and Blank Forms ..... DA FORM 2028
Recommended Changes to Equipment Technical Manuals ..... DA FORM 2028-2

A-4. Technical Manuals and Technical Bulletins

Painting Instructions for Army Materiel ..... TM 43-0139
Procedures for Destruction of Army Materiel to Prevent
Enemy Use (Electronics Command) . ..... TM 750-244-2
Field Instructions for Painting and Preserving
Communications-Electronics Equipment . ..... TM 43-0118
Operators Organizational, Direct Support, General Support, and
Depot Maintenance Manual Antenna Group AN/GRA-50 ..... TM 11-5820-467-15
Warranty Technical Bulletin for AN/VRC-86(V) ..... TB 11-5820-927-10
General Shop Practice Requirements for the Repair, Maintenance,
and Test of Electrical Equipment ..... TM 43-0158

Communications-Electronics Fundamentals: Transmission Lines,
Wave Propagation and Antennas ..... FM 11-64
Tactical Single-Channel Radio Communications Techniques ..... FM 24-18
First Aid for Soldiers ..... FM 21-11

A-5. Software

MINIMUF ..... NOSC Technical Document 201 (TD 201)
MiniProp ..... C2MUG Catalog Number 011-002

APPENDIX B

MAINTENANCE ALLOCATION CHART

SECTION I. INTRODUCTION

B-1. Maintenance Allocation Chart

a. ***This Maintenance Allocation Chart (MAC)****.* The MAC assigns maintenance functions in accordance with the Three Levels of Maintenance concept for Army aviation. These maintenance levels, Aviation Unit Maintenance (AVUM), Aviation Intermediate Maintenance (AVIM), and Depot Maintenance, are depicted on the MAC as:

(1) AVUM, which corresponds to an O Code in the Repair Parts and Special Tools List (RPSTL)

(2) AVIM, which corresponds to an H Code in the RPSTL

(3) DEPOT, which corresponds to a D Code in the RPSTL

b. ***Maintenance Below*** *Depot.* The maintenance to be performed below depot and in the field is described as follows:

(1) AVUM activities will be staffed and equipped to perform high frequency on-aircraft maintenance tasks required to retain or return aircraft systems to a serviceable condition. The maintenance capability of the AVUM will be governed by the MAC and limited by the amount of complexity of ground support equipment (GSE), facilities required, authorized manning strength, and critical skills available. The range and quantity of spare modules/components will be consistent with the mobility requirements dictated by the air mobility concept. (Assignments of maintenance tasks to divisional company size aviation units will consider the overall size of the maintenance capability of the division, the requirement to conserve personnel and equipment resources, and air mobility requirements.)

(a) Company Size Aviation Units: Perform those tasks which consist primarily of preventive maintenance and maintenance repair and replacement functions associated with sustaining a high level of aircraft operational readiness. Perform maintenance inspections and servicing to include preflight, daily, intermediate, periodic (or phased), and special inspections as authorized by the MAC or higher headquarters. Identify the cause of equipment/system malfunctions using applicable technical manual troubleshooting instructions, built- in-test equipment (BITE), installed aircraft instruments, or test, measurement, and diagnostic equipment (TMDE). Replace worn or damaged modules/components that do not require complex adjustments or system alignment and which can be removed/installed with available skills, tools, and ground support equipment.

Perform operational and continuity checks and make minor repairs to the electrical system. Inspect, service and make operational, capacity, and pressure checks to hydraulic systems. Perform servicing, functional adjustments, and minor repair/replacement to the flight control, propulsion, power train, and fuel systems. Accomplish air frame repair that does not require extensive disassembly, jigging, or alignment. The manufacture of airframe parts will be limited to items which can be fabricated with tools and equipment that can be found currently in air mobile tool and shop sets. Evacuate unserviceable modules/components and end items beyond the repair capability of AVUM to the supporting AVIM.

(b) Less than Company Size Aviation Units: Aviation elements organic to brigade, group, battalion headquarters, and detachment size units are normally small and have less than 10 aircraft assigned. Maintenance tasks performed by these units will be those which can be accomplished by the aircraft crew chief or assigned aircraft repair person and will normally be limited to preventive maintenance, inspections, servicing, spot painting, stop drilling, application of nonstress patches, minor adjustments, module/components fault diagnosis, and replacement of selected modules/components. Repair functions will normally be accomplished by the supporting AVIM unit.

(2) AVIM provides mobile responsive one-stop maintenance support. (Maintenance functions which are not conducive to sustaining air mobility will be assigned to depot maintenance.) AVIM may perform all maintenance functions authorized to be done at AVUM. Repair of equipment for return to user will emphasize support or operational readiness requirements. Authorized maintenance includes replacement and repair of modules/components and end items which can be accomplished efficiently with available skills, tools and equipment. AVIM establishes the Direct Exchange (DX) program for AVUM unit by repairing selected items for return to stock when such repairs cannot be accomplished at the AVUM level. The AVIM level inspects, troubleshoots, performs diagnostic tests, repairs, adjusts, calibrates, and aligns aircraft system modules/components. AVIM units will have capability to determine the serviceability of specified modules/components removed prior to the expiration of the Time Between Overhaul (TBO) or finite life. Modules/components disassembly and repair will support the DX program and will normally be limited to tasks requiring cleaning and the replacement of seals, fittings and items of common hardware. Airframe repair and fabrication of parts will be limited to those maintenance tasks which can be performed with available tools and test equipment. Unserviceable repairable modules/components and end items which are beyond the capability of AVIM to repair will be evacuated to Depot Maintenance. AVIM will perform aircraft weight and balance inspections and other special inspections which exceed AVUM capability. AVIM provides quick response maintenance support, including aircraft recovery, air evacuation, on-the-job training, and technical assistance through the use of mobile maintenance contact teams. AVIM maintains authorized operational readiness float aircraft and provides collection and classification services for serviceable/unserviceable material.

(The aircraft maintenance company within the maintenance battalion of a division will perform AVIM functions consistent with air mobility requirements and conservation of personnel and equipment resources. Additional intermediate maintenance support will be provided by the supporting nondivisional AVIM unit.)

B-2. Use of The Maintenance Allocation Chart (Section II)

(1) The Maintenance Allocation Chart assigns maintenance functions to the lowest level of maintenance based on past experience and the following considerations:

(a) Skills available.

(b) Worktime required.

(c) Tools and test equipment required and or available.

(2) Only the lowest level of maintenance authorized to perform a maintenance function is indicated. If the lowest maintenance level cannot perform all tasks of any single maintenance function (e.g. test, repair), then the higher maintenance level(s) that can accomplish additional tasks will also be indicated.

(3) A maintenance function assigned to a maintenance level will automatically be authorized to be performed at any higher maintenance level.

(4) A maintenance function that cannot be performed at the assigned level of maintenance for any reason may be evacuated to the next higher maintenance level. Higher maintenance levels will perform the maintenance functions of lower maintenance levels when required or directed by the commander that has the authority to direct such tasking.

(5) The assignment of a maintenance function will not be construed as authorization to carry the related parts or spares in stock. Information to requisition or otherwise secure the necessary repair parts will be as specified in the associated Repair Parts and Special Tools List (RPSTL).

(6) Normally there will be no deviation from the assigned level of maintenance. In cases of operational necessity, maintenance functions assigned to a maintenance level may, on a one-time basis and at the request of the lower maintenance level, be specifically authorized by the maintenance officer of the level of maintenance to which the function is assigned. The special tools, equipment, etc., required by the lower level of maintenance to perform this function will be furnished by the maintenance level to which the function is assigned. This transfer of a maintenance function to a lower maintenance level does not relieve the higher maintenance level of the responsibility for the function. The higher level of maintenance will provide technical supervision and inspection of the function being performed at the lower level.

(7) Changes to the MAC will be based on continuing evaluation and analysis by responsible personnel and on reports received from field activities.

B-3. Maintenance Functions

Maintenance function will be limited to and defined as follows:

(1) Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and or electrical characteristics with established standards through examination (e.g. by sight, sound, or feel).

(2) Test. To verify serviceability by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

(3) Service. Operations required periodically to keep an item in proper operating condition, i.e., to clean (includes decontaminate, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases.

(4) Adjust. To maintain within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to specified parameters.

(5) Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

(6) Replace. To remove an unserviceable item and to install a serviceable counterpart in its place. Replacement is authorized by the MAC and is shown as the third position code of the SMR code.

(7) Repair. The application of maintenance services (i.e., inspect, test, service, adjust, calibrate, or replace) or other maintenance actions (i.e., welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to identify troubles, and 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.

B-4. Group Number and Component/Assembly (Column 1 AND 2, Respectively)

(1) Column 1. Group Number. Column 1 lists group numbers, the purpose of which is to identify components, assemblies, and modules with the next higher assembly.

(2) Column 2. Component/Assembly. Column 2 contains the noun names of components, assemblies, and modules for which maintenance is authorized.

B-5. Maintenance Function (Column 3)

Column 3 lists the functions to be performed on the items listed in column 2.

B-6. Maintenance Levels and Worktimes (Column 4)

The maintenance levels AVUM, AVIM, and DEPOT are listed on the MAC with individual columns that include the worktimes for maintenance functions at each maintenance level. Worktime presentations such as 0.1 indicate the average time it requires a maintenance level to perform a specified maintenance function. An "X" in this column indicates depot repair is authorized and repair time is undetermined. Maintenance levels higher than the level of maintenance indicated are authorized to perform the indicated function.

B-7. Tools and Test Equipment (Column 5 and Section III)

Common tool sets (not individual tools), special tools, test, and support equipment required to perform maintenance functions are listed alphabetically in Section III with a reference number to permit cross-reference to column 5 in the MAC. I1n addition, the maintenance level authorized to use the device is listed along with the item National Stock Number (NSN) and, if applicable, the tool number to aid in identifying the tool/device.

B-8. Remarks (Column 6 and Section IV)

Remarks (identified by an alphabetic code in column 6) and other notes (identified by a number in parentheses in the applicable column) are listed in Section IV to provide a ready reference to the definition of the remark/note.

SECTION II. MAINTENANCE ALLOCATION CHART FOR RADIO SET AN/GRC-240 (CONTINUED)

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINT. FUNCT.	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(5) REMARKS
			AVM	AVIM	DEPOT		
00	Radio Set	Inspect	0.5				
	ANNRC-86(V)1, 2, 3	Service	0.5				A
		Test	0.1				B
		Replace	0.4				
		Repair	0.2				C
		Repair			X		
01	Control-Display	Replace	0.1			1	
	C-11245/U	Repair	0.2			1	D
	Part of (V)1, 2, 3	Repair			X		E
02	Amplifier-Coupler	Replace	0.1			1	
	Radio Frequency	Repair	0.1			1	F
	AM-7201/U	Repair			X		E
	Part of (V)1, 2, 3						
03	Receiver-Transmitter	Replace	0.1			1	
	RT-1432/U	Repair			X	1	E
	Part of (V)1, 2, 3						
04	Electronic Equipment	Replace	0.5			1	
	Interface	Repair	0.4			1	G
	MX-10485/VRC-86(V)	Repair			X		E
	Part of (V)1, 2, 3						
05	"Y" Interconnect	Replace	0.1			1	
	300-05121-0000	Repair	0.5			1,2	
	Part of (V)3						
06	Base Antenna Suppot	Replace	0.2			1	
	AB-1311 NVRC-86(V)	Repair	0.2			1,2	
	Part of (V)2						
07	Antenna Group	Replace	0.5			1	
	OE-480/VRC-86(V)	Repair	1.0			1,2,3	C
	Part of (V)3						

SECTION II. MAINTENANCE ALLOCATION CHART FOR RADIO SET AN/GRC-240 (CONTINUED)

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINT. FUNCT.	(4) MAINTENANCE CATEGORY			(5) TOOLS AND TEST EQUIPMENT	(5)
			AVM	AVIM	DEPOT		
0701	Antenna Coupler CU-2479/U	Replace	0.1			1	
		Repair			X		
0702	Antenna AS4227/VRC-86(V)	Replace	0.5			1	
		Repair	1.0				
070201	Mast Assembly 071-015120000	Replace	0.5			1	
		Repair	0.5			1	
070202	Antenna Element 20005098-0000	Replace	0.5			1	
		Repair	0.5			1	
0703	Control Cable Assy 155-02678-0000	Test	0.2			2	
		Replace	0.2				
		Repair		1.0		1	H
0704	RF Transmission Cable 155-02679-0000	Test		0.2		4, 5	
		Replace	0.2				
		Repair		0.5		1	

SECTION III TOOL AND TEST EQUIPMENT REQUIREMENTS

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/ NATO STOCK NUMBER	TOOL NUMBER
1	AVUM	Tool Kit, TK-105/G	5180-00-610-8177	
2	AVUM	Multimeter, Digital AN/PSM-45	6625-01-139-2512	
3	AVUM	Hammer, Hand	5120-00-900-6096	
4	AVIM	Test Set, RF AN/GRM-114A	6625-01-144-4481	
5	AVIM	Detector, RF HP 8471D	5820-01-004-3537	

SECTION IV. REMARKS FOR RADIO SET AN/VRC-86(V)

Reference Code	Remarks
A	Service by cleaning.
B	Built in test (BIT).
C	Repair by replacement of LRUs.
D	Repair is limited to replacement of knobs.
E	Depot repair is authorized.
F	Repair is limited to insuring circuit breaker is closed (pressed in) on front plate of Amplifier-Coupler.
G	Repair is limited to replacement of protective caps, mounting brackets, latches, protective display cover assembly and non-electrical items.
H	Repair by replacing pins/connectors.

APPENDIX C

COMPONENTS OF END ITEM LIST

SECTION I INTRODUCTION

C-1. Scope

This appendix lists components of end items for the AN/VRC-86 to help you inventory items for safe and efficient operation.

C-2. General

Section II. Components of end item. This listing is for informational purposes only, and is not authority to requisition replacements. These items are part of the end item, but are removed and separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Illustrations are furnished to assist you in identifying the items.

C-3. Explanation of Columns

The following provides an explanation of columns found in the tabular listings:

a. ***Column (1)-Illustration Number (Illus Number).*** This column indicates the number of the illustration in which the item is shown.

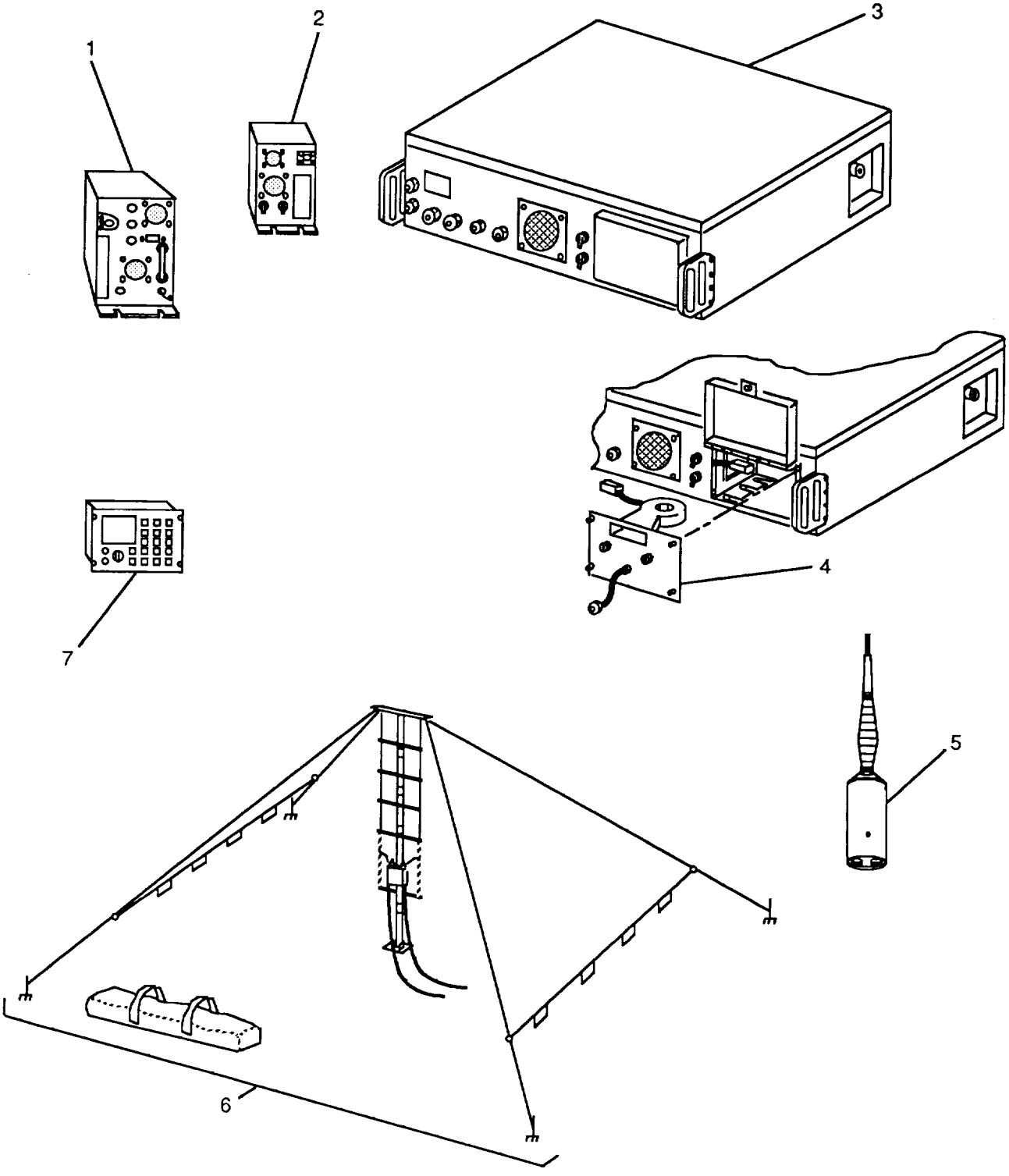
b. ***Column (2)-National Stock Number.*** Indicates the National stock number assigned to the item and will be used for requisitioning purposes.

c. ***Column (3)-Description.*** Indicates the Federal item name and, if required, a minimum description to identify and locate the item. The last line of each item indicates the CAGE (in parentheses) followed by the part number. The "Usable On" code (UOC) appears on the right side of the column. Uncoded items are applicable to all configurations. The UOCs used in this Components of End Items list are as follows:

Code	Used On
JNN	AN/VRC-86(V) 1
FZC	AN/VRC-86(V)2
JNP	AN/VRC-86(V)3

d. ***Column (4)-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 (e.g., EA, IN, PR).

e. ***Column (5)-Quantity required (Oty reqd).*** Indicates the quantity of the item authorized to be used with/on the equipment.


1
2
3
4
5
6
7

SECTION II. COMPONENTS OF END ITEM

(1) ILLUS NUMBER	(2) NATO STOCK NUMBER	(3) DESCRIPTION (FSCM) and Part Number	Usable On Code	(4) U/M	(5) QTY Rqr
1	5821-01-172-2880	Amplifier-Coupler, RF: (mounted in electronics box) (80058) AM-7201/U		EA	1
2	5821-01-172-2924	Receiver-Transmitter: (mounted in electronics box) (80058) RT-1432/U		EA	1
3	5820-01-147-8635	Box, Electronic: (container for amplifier-coupler, receiver-transmitter, and control-display LRUs) (80058) MX-10485/VRC-86		EA	1
4		Y-Interconnect: (mounted in electronics box) (22373) 200-05121-0000	JNP	EA	1
5	5985-01-174-1042	Base, Antenna Support: (mounted to vehicle) (80058) AB-1311/VRC-86	FZC	EA	1
6	5985-01-324-1768	Antenna Group: (set up remotely) (80058) OE-480/VRC-86(V)	JNP	EA	1
7	5821-01-172-2879	Control-Display: (mounted in electronics box or remotely) (80058) C-11245/U		EA	1

APPENDIX D

ADDITIONAL AUTHORIZATION LIST

SECTION I. INTRODUCTION

D-1. Scope

This appendix lists additional items you are authorized for the support of AN/VRC-86.

D-2. General

This list identifies the items that do not have to accompany the AN/VRC-86 and that do not have to be turned in with it. These items are all authorized to you by CTA, MTOE, TDA, or JTA.

D-3. Explanation of Listing

National stock numbers, descriptions, and quantities are provided to help you identify and request additional items you require to support this equipment. The items are listed in alphabetical sequence by item name under the type document (i.e.; CTA, MTOE, TDA, or JTA) which authorizes the item(s) to you. The Usable on Code (UOC) is on the right side of column 2. Uncoded items are applicable to all configurations. The UOCs used in this Additional Authorization List are as follows:

Code	Used On
JNN	ANNRC-86(V) 1
FZC	ANNRC-86(V)2
JNP	AN/VRC-86(V)3

SECTION II. ADDITIONAL AUTHORIZATION LIST

FOR

AN/VRC-86

(1) NATIONAL STOCK NUMBER	(2) DESCRIPTION (CAGEC) AND PART NUMBER		(3) U/M	(4) QTY Auth
	MTOE AUTHORIZED ITEMS			
5985-00-199-8831	Antenna Element MS-116-A (80063	FZC	EA	3
5985-00-115-7149	Antenna Element MS117A (82204)	FZC	EA	1
5985-00-238-7474	Antenna Element MS-118-A (80063)	FZC	EA	1
5985-00-892-0758	Antenna Group AN/GRA-50 (80063)	JNN	EA	1
5965-01-247-4723	Handset H-250/U (66274)		EA	1
5985-01-264-1725	Antenna, Broadband AS-4096/G (80058)	JNN	EA	1

APPENDIX E

EXPENDABLE SUPPLIES AND MATERIALS LIST

SECTION I. INTRODUCTION

E-1. Scope

This appendix lists expendable supplies and materials you will need to operate and maintain the AN/VRC-86. These items are authorized to you by CTA 50-970, Expendable Items (except Medical, Class V, Repair Parts, and Heraldic Items).

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 TRICHLOROTRIFLUORO-ETHANE 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.

E-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. For example, "Use detergent, general (item 5, appendix D).

b. ***Column (2) - Level.*** This column identifies the lowest level of maintenance that requires the listed item. AVUM - Aviation Unit Maintenance AVIM - Aviation Intermediate Maintenance D - Depot 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 Commercial And Government Entity (CAGE) in parenthesis 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 2-character alphabetical abbreviation (i.e.; ea, in., and 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 NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
1	AVUM	9505-01-054-2676	wire, nonelectric (96906) MS20995C32	lb
2	AVUM	8010-00-616-9143	enamel, black (81348) TT-E-527	pt
3	AVUM	5350-00-598-5537	paper, abrasive (58536) A-A-1202	hd
4	AVUM	7920-00-148-9666	rag, wiping (58536) A-A-531	be
5	AVUM	7930-00-357-7386	detergent, general (81348) P-P-1747	bt
6	AVUM	7920-00-205-3570	rag, wiping (58536) A-A-531	be
7	AVUM	6850-00-105-3084	cleaning, compound (81349) MIL-C-81302	pt
8	AVUM		polyurethane, olive drab (22373)001-00044-0036	gl

APPENDIX F

OPERATOR'S AVIATION UNIT AND INTERMEDIATE MAINTENANCE

REPAIR PARTS AND SPECIAL TOOLS LIST

SECTION I. INTRODUCTION

F-1. Scope

This manual lists and authorizes spare and repair parts; special tools; special test, measurement, and diagnostic equipment (TMDE); and other special support equipment required for performance of aviation unit and aviation intermediate maintenance of the AN/VRC-86(V)1, AN/VRC-86(V)2 and AN/VRC-86(V)3. It authorizes the requisitioning, issue, and disposition of spares, repair parts, and special tools as indicated by the source, maintenance, and recoverability (SMR) codes.

F-2. General

This Repair Parts and Special Tools List is divided into the following sections:

a. ***Section II. Repair Parts List.*** A list of spares and repair parts authorized by this RPSTL for use in the performance of maintenance. The list also includes parts which must be removed for replacement of the authorized parts. Parts lists are composed of functional groups in ascending numeric sequence, with the parts in each group listed in ascending item number sequence. Figure numbers are listed directly beneath the group header.

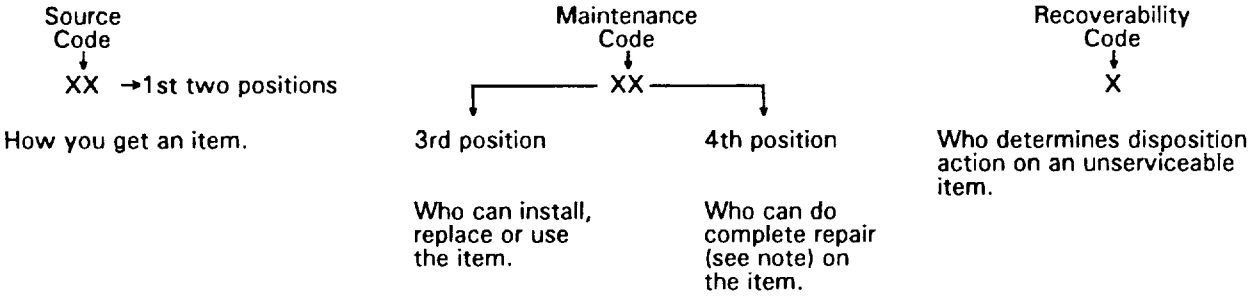
b. ***Section III. Special Tools List.*** Not applicable**.**

c. ***Section IV. Cross - Reference Indexes.*** A list, in National item identification number (NIIN) sequence, of all National stock numbered items appearing in the listing, followed by a list in alphameric sequence of all part numbers appearing in the listings. National stock numbers and part numbers are cross-referenced to each illustration figure and item number appearance. The figure number and item number index lists figure and item numbers In numeric sequence and cross-references National stock number, commercial and Government Entity Code, and part numbers.

F-3. Explanation of Columns (Section II and III)

a. ***Item No. (Column (1)).*** Indicates the number used to identify items called out in the illustration.

b. ***SMR Code (Column (2)).*** The source, maintenance, and recoverability (SMR) code is a five-position code containing supply/requisitioning information, maintenance category authorization criteria, and disposition instruction, as shown in the following breakout:



NOTE

Complete repair: Maintenance capacity, capability and authority to perform all corrective maintenance tasks of the "Repair" function in a use/user environment in order to restore serviceability to a failed item

(1) Source code. The source code tells you how to get an item needed for maintenance, repair or overhaul of an end item/equipment. Explanations of source codes follows:

Code	***Explanation***
PA PB PC PD PF PG	Stocked items; use the applicable NSN to request/requisition items with these SOURCE codes. They are authorized to the category indicated by the code entered in the third position of the SMR code. **NOTE** Items coded PC are subject to deterioration
KD KF KB	Items with these codes are not to be requested/requisition individually. They are part of a kit which is authorized to the maintenance category indicated in the third position of the SMR code. The complete kit must be requisitioned and applied.
MO-Made at org/AVUM category MF-Made at DS/AVIM category MH-Made at GS category ML-Made at Specialized Repair Activity (SRA) MD-Made at Depot	Items with these codes are not to be requested/requisition individually. They must be made from bulk material which is identified by the part number in the description and usable on code (UOC) column and listed in the Bulk Material group of the repair list. If the item is authorized to you by the third position of the SMR code, but the source code indicates it is made at a higher category, order the item from the higher category of maintenance.

AO-Assembled by org/AVUM category
AF-Assembled by DS/AVIM category
AH-Assembled by GS category
AL-Assembled by SRA
AD-Assembled by Depot

Items with these codes are not to be requested/ requisitioned individually. The parts that make up the assembled item must be requisitioned or fabricated and assembled at the category of maintenance indicated by the source code. If the third position code of the SMR code authorizes you to replace the item, but the code indicates the item is assembled at a higher category, order the item from the higher category maintenance.

XA - Do not requisition an “XA” coded item. Order its next higher assembly.
XB - If an “XB” item is not available from salvage, order it using the CAGE and part number given
XC - Instillation drawing, diagram, instruction sheet, field service drawing, that is identified by manufacturers part number
XD - Items not stocked. Order an “XD” coded item through normal supply channels using the CAGE and part number given, if no NSN is available.

NOTE

Cannibalization or controlled exchange, when authorized, may be used as a source of supply for items with the above source codes, except for those source coded "XA" or those aircraft support items restricted by requirements of AR 750-1.

(

(2) Maintenance Code. Maintenance codes tell you the category of maintenance authorized to USE and REPAIR support items. The maintenance codes are entered in the third and fourth positions of the SMR code as follows:

(a) The maintenance code entered in the third position tells you the lowest maintenance category authorized to remove, replace, and use an item. The maintenance code entered in the third position will indicate authorization to one of the following categories of maintenance.

Code	***Application/Explanation***
C-	Crew or operator maintenance done within organizational or aviation maintenance.
O-	Organizational or aviation unit category can remove, replace, and use the item.
F-	Direct support aviation intermediate category can remove, replace, and use the item.
H-	General support category can remove, replace, and use the item.
L-	Specialized repair activity can remove, replace, and use the item.
D-	Depot category can remove, replace, and use the item.

(b) The maintenance code entered in the fourth position tells whether or not the item is to be repaired and identifies the lowest maintenance category with the capability to do complete repair (i.e., perform all authorized repair functions). This position will contain one of the following maintenance codes.

NOTE

Some limited repair may be done on the item at a lower category of maintenance, if authorized by the Maintenance Allocation Chart (MAC) and SMR codes.

Code *Application/Explanation*

O- Organizational or aviation unit is the lowest category that can do complete repair of the item.
F- Direct support aviation intermediate is the lowest category that do complete repair of the item.
H- General support is the lowest category that do complete repair of the item.
L- Specialized repair activity (designate the specialized repair activity) is the lowest category that do complete repair of the item.
D- Depot is the lowest category that do complete repair of the item.
Z- Nonreparable. No repair is authorized.
B- No repair is authorized. (No parts or special tools are authorized for the maintenance of a "B" coded item). However, the item may be reconditioned by adjusting, lubricating, etc., at the user category.

(3) Recoverability code. Recoverability codes are assigned to items to indicate the disposition action on unserviceable items. The recoverability code is entered in the fifth position of the SMR Code as follows:

Recoverability codes ***Application/Explanation***

Z- Nonreparable item. When unserviceable, condemn and dispose of the item at the category of maintenance shown in the third position of SMR Code.
0- Reparable item. When uneconomically reparable, condemn and dispose of the item at organizational or aviation unit category.
F- Reparable item. When uneconomically reparable, condemn and dispose of the item at direct support or aviation intermediate category.
H- Reparable item. When uneconomically reparable, condemn and dispose of the item at general support category.
D- Reparable item. When beyond lower category repair capability, return to depot. Condemnation and disposal of item not authorized below depot category.
L- Reparable item. Condemnation and disposal not authorized below specialized repair activity (SRA).
A- Item requires special handling or condemnation procedures because of specific reasons (e.g., precious metal content, high dollar value, critical material, or hazardous material, or hazardous material). Refer to appropriate manuals/directives for specific instructions.

c. CAGE (column (3)). The Commercial and Government Entity Codes (CAGE) is a 5-digit code which is used to identify the manufacturer, distributor, or Government agency, etc., that supplies the item.

d. Part Number (Column (4)). Indicates the primary number used by the manufacturer (individual, company, firm, corporation, or Government activity), which controls the design and characteristics of the item by means of its engineering drawing, specifications, standards, and inspection requirements to identify an item or range of items.

NOTE

When you use a NSN to requisition an item, the item you receive may have a different part number from the part ordered.

e. Description and Usable on Code (UOC)(Column(5)). This column includes the following information.

(1) The Federal item name and, when required, a minimum description to identify the item.

(2) The statement "END OF FIGURE" appears just below the last item description in column (5) for a given figure in both sections II and III.

f. Oty (Column (6)). Indicates the quantity of the item used in the breakout shown on the illustration figure, which is prepared for a functional group, subfunctional group or an assembly. A "V" appearing in this column in lieu of a quantity indicates that the quantity is variable and the quantity may vary from application to application.

F-4. Explanation of Columns (Section IV)

a. National Stock Number (NSN) Index.

(1) Stock number column. This column lists the NSN by National item identification number (NIIN) sequence. The NSN consists of the last nine digits of the NSN. When using this column to locate an item, ignore the first four digits of the NSN. When requisitioning items use the complete NSN (13 digits).

(2) Fig. column. This column lists the number of the figure where the item is identified/located. The illustrations are in numerical sequence in sections II and III.

(3) Item column. The item number identifies the item associated with the figure listed with the figure listed in the adjacent Fig. column. This item is also identified by the NSN listed on the same line.

b. Part Number Index. Part numbers in this index are listed by part number in ascending alphameric sequence.

(1) CAGE column. *This* column lists the Commercial and Government Entity Codes (CAGE).

(2) Part number column. This column indicates the part number assigned to the item.

(3) Stock number column. This column list the National stock number for the associated part number and manufacturer identified in the part number and CAGE columns to the left.

(4) Fig. column. This column list the number of the figure where the item is identified/located in sections II and III.

(5) Item column. The item number is that number assigned to the item as it appears in the figure referenced in the adjacent figure number column.

F-5. Special Information

a. National Stock Numbers. National stock numbers (NSN's) that are missing from P source coded items have been applied for and will be added to this TM by future change/revision when they are entered in the Army Master Data File (AMDF). Until the NSN's are established and published, submit exception requisitions to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-MM, Fort Monmouth, NJ 07703-5006 for the part required to support your equipment.

b. Usable On Code. The usable on code appears in the lower left corner of the Description column heading. Usable on codes are shown as "UOC: ....." in the Description Column (justified left) on the first line applicable item description/nomenclature. Uncoded items are applicable to all models. Identification of the usable on codes used in the RPSTL are:

Code	Used On
JNN	AN/VRC-86(V) 1
FZC	AN/VRC-86(V)2
JNP	AN/VRC-86(V)3

F-6. How to Locate Repair Parts

a. When National stock number or part number is not known.

(1) First. Using the table of contents, determine the assembly group or subassembly group to which the item belongs. This is necessary since figures are prepared for assembly groups and subassembly groups, and listings are divided into the same groups

(2) Second. Find the figure covering the assembly group or subassembly group to which the item belongs.

(3) Third. Identify the item on the figure and note the item number.

(4) Fourth. Refer to the Repair Parts List for the figure to find the part number for the item number noted on the figure.

(5) Fifth. Refer to the Part Number Index to find the NSN, if assigned.

b. When National stock number or part number is known.

(1) ***First.*** Using the index of National stock numbers and part numbers, find the pertinent National stock number. The NSN index is in National item identification number (NIIN) sequence (para 4a(1)). The part numbers in the part number index are listed in ascending alphameric sequence (para 4b). Both indexes cross-reference you to the illustration figure and item number of the item you are looking for.

(2) ***Second.*** After finding the figure and item number, verify that the item is the one you're looking for, then locate the item number in the repair parts list for the figure.

F-7. Abbreviation

Not Applicable.

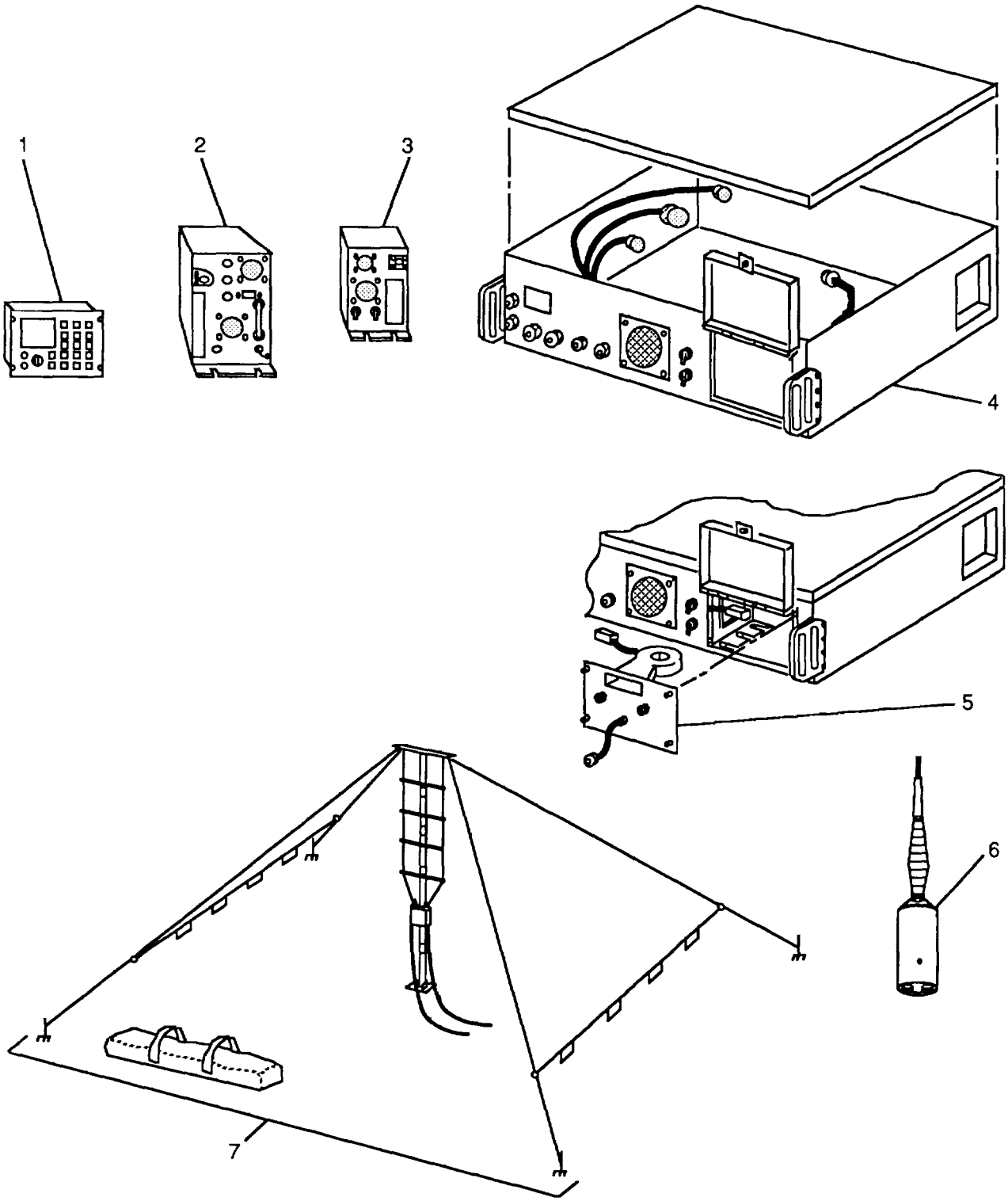


Figure F-1. Radio Set AN/VRC-86(V)

(1) ITEM NO	(2) SMR CODE	(3) CAGEC	(4) PART NUMBER	(5) DESCRIPTION AND USABLE ON CODES (UOC)	(6) QTY
				GROUP 00 RADIO SET AN/VRC-86(V)	
				FIGURE F-1	
1	PAODD	80058	C-11245/U	CONTROL-DISPLAY.....	1
2	PAODD	80058	AM-7201/U	AMPLIFIER-COUPLER,R	1
3	PAODD	80058	RT-1432/U	RECEIVER-TRANSMITTE	1
4	PAOOF	80058	MX-10485/VRC-86	BOX,ELECTRONIC EQUI	1
5	PAOOO	22373	200-05121-0000	Y INTERCONNECT ..... UOC:JNP	1
6	PAOOO	80058	AB-1311/VRC-86	SUPPORT, ANTENNA..... UOC:FZC	1
7	PBODD	80058	OE-480/VRC-86(V)	ANTENNA GROUP ..... UOC:JNP	1
				END OF FIGURE	

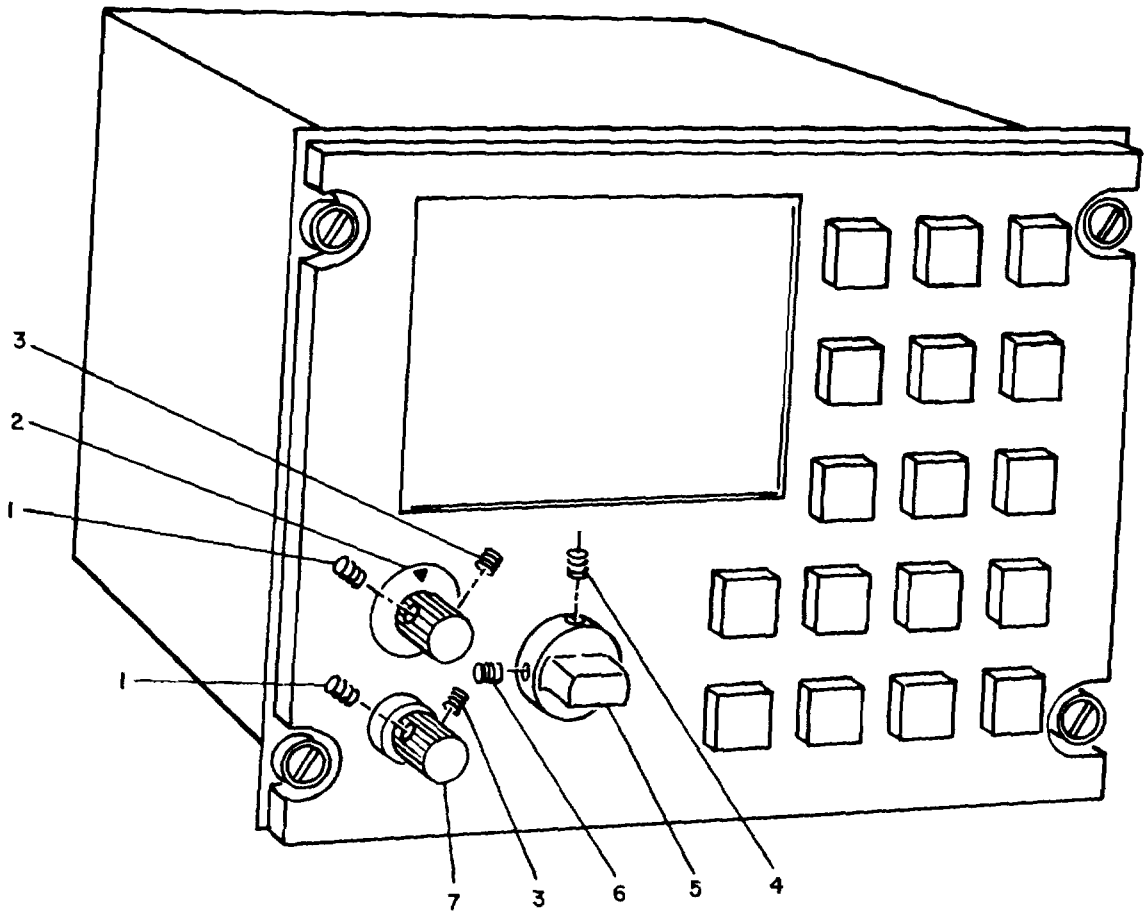


Figure F-2. Control-Display C-11245/U

(1) ITEM NO	(2) SMR CODE	(3) CAGEC	(4) PART NUMBER	(5) DESCRIPTION AND USABLE ON CODES (UOC)	(6) QTY
				GROUP 01 CONTROL-DISPLAY C-11245/U	
				FIGURE F-2	
1	PAOZZ	8R709	36047-406	SETSCREW.....	2
2	PAOZZ	22373	076-01361-0001	KNOB	1
3	PAOZZ	22373	089-06204-0004	SETSCREW	2
4	PAOZZ	22373	089-06204-0008	SETSCREW	1
5	PAOZZ	22373	076-01363-0001	KNOB	1
6	PAOZZ	8R709	44546-406	SETSCREW	1
7	PAOZZ	22373	076-01362-0001	KNOB	1
				END OF FIGURE	

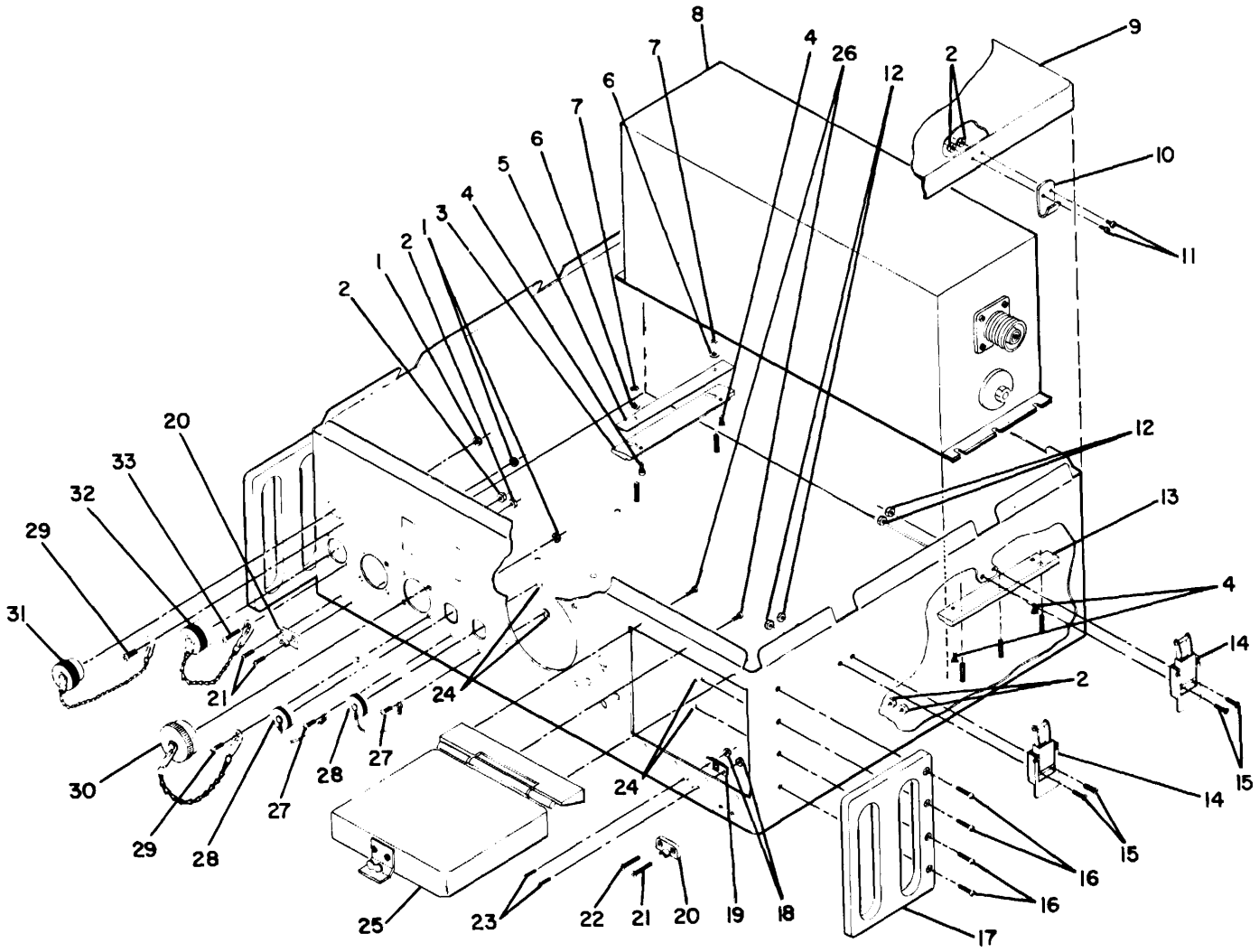


Figure F3. Electronic Equipment Interface Box
MX-10485NRC-86 (Sheet 1 of 2)

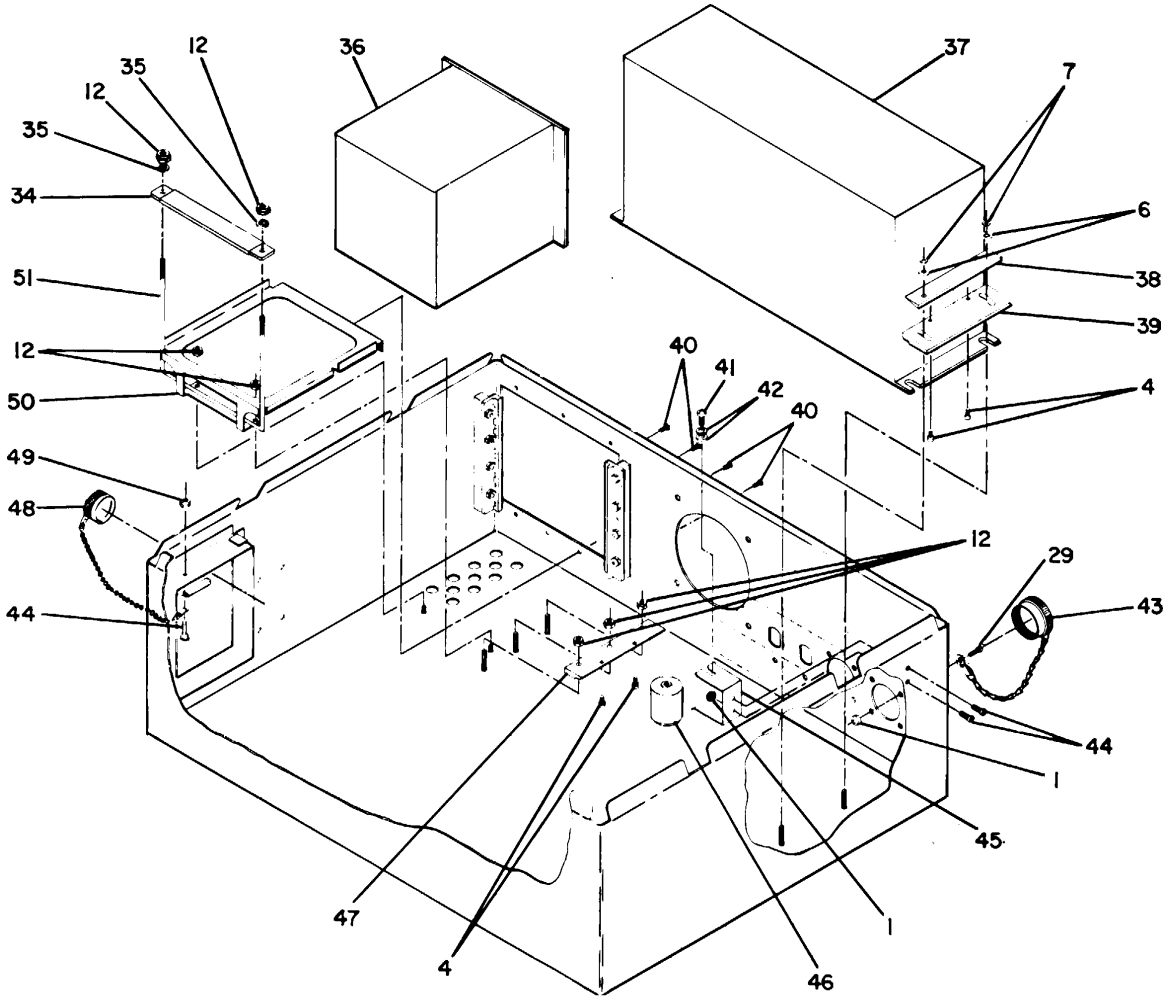


Figure F-3. Electronic Equipment Interface Box MX-10485/VRC-86 (Sheet 2 of 2)

(1) ITEM NO	(2) SMR CODE	(3) CAGEC	(4) PART NUMBER	(5) DESCRIPTION AND USABLE ON CODES (UOC)	(6) QTY
				GROUP 04 ELECTRONIC EQUIPMENT INTERFACE BOX MX-10485/VRC-86	
				FIGURE F-3	
1	PAOZZ	22373	089-02188-0022	NUT,SELF-LOCKING	18
2	PAOZZ	22373	089-02148-0032	NUT,SELF-LOCKING,HE	1
3	XBOZZ	22373	047-06431-0011	HOLD DOWN FRONT	1
4	PAOZZ	22373	089-05903-0003	SCREW MACHINE	8
5	XBOZZ	22373	047-06671-0011	WEDGE	1
6	PAOZZ	22373	089-08017-0037	WASHER LOCK	5
7	PAOZZ	22373	089-02194-0022	NUT SELF LOCKING	4
8	PAODD	80058	AM-7201/U	AMPLIFIER-COUPLER,R	1
9	XBOZZ	22373	047-06330-0002	COVER, GROUND ELECT RICAL	1
10	PAOZZ	22373	090-00454-0003	STRIKE	4
11	PAOZZ	22373	089-6348-0006	SCREW MACHINE	8
12	PAOZZ	22373	089-02191-0022	NUT SELF LOCKING	15
13	XBOZZ	22373	047-06416-0002	HOLD DOWN REAR	1
14	PAOZZ	22373	090-00454-0002	CATCH	4
15	PAOZZ	22373	089-06348-0007	SCREW MACHINE	8
16	PAOZZ	22373	089-06350-0009	SCREW,MACHINE	8
17	XBOZZ	22373	047-06493-0001	HANDLE	2
18	PAOZZ	22373	089-02185-0022	NUT SELF LOCKING HE	2
19	PAOZZ	22373	092-00027-0000	RECEPTACLE TURNLOCK	1
20	XBOZZ	22373	090-00167-0000	HOOK SUPPORT	2
21	PAOZZ	22373	089-06012-0008	SCREW,MACHINE	3
22	PAOZZ	22373	089-06012-0011	SCREW MACHINE	1
23	XBOZZ	22373	089-06159-0007	SCREW MACHINE	2
24	PAOZZ	22373	089-02148-0032	NUT SELF LOCKING	1
25	PAOZZ	22373	200-03129-0000	COVER ASSEMBLY	1
26	PAOZZ	22373	089-05882-0007	SCREW,MACHINE	3
27	PAOZZ	22373	089-06350-0007	SCREW MACHINE	2
28	PAOZZ	25330	GC800	COVER,ELECTRICAL	2
29	PAOZZ	22373	089-06344-0008	SCREW,MACHINE	19
30	PAOZZ	07418	SE91FA20C-3-4	COVER,ELCTRICAL	1
31	PAOZZ	07418	SE91FA06C-3-4	COVER ELECTRICAL	1
32	PAOZZ	07418	SE91FA20C-3-4	COVER ELECTRICAL	1
33	PAOZZ	22373	089-06344-0013	SCREW MACHINE	1
34	XBOZZ	22373	047-07255-0002	BAR HOLD DOWN	1
35	PAOZZ	22373	089-08027-0030	WASHER FLAT	2
36	PAODD	80058	C-11245/U	CONTROL-DISPLAY	1
37	PAODD	80058	RT-1432/U	RECEIVER-TRANSMITTE	1
38	XBOZZ	22373	047-06670-0011	WEDGE	1
39	XBOZZ	22373	047-06432-0011	HOLD DOWN FRONT	1
40	PAOZZ	22373	089-06368-0005	SCREW MACHINE	4
41	XBOZZ	22373	089-05910-0007	SCREW MACHINE	1
42	PAOZZ	22373	089-08029-0030	WASHER,FLAT	2
43	PAOZZ	07418	SE90A24C-3-4	COVER,ELCTRICAL	1
44	XBOZZ	22373	089-06344-0005	SCREW MACHINE	3
45	XBOZZ	22373	047-07442-0001	RETAINER	1
46	PAOZZ	22373	076-01136-0002	ADAPTER CONNECTOR	1

(1) ITEM NO	(2) SMR CODE	(3) CAGEC	(4) PART NUMBER	(5) DESCRIPTION AND USABLE ON CODES (UOC)	(6) QTY
47	XBOZZ	22373	047-06417-0001	HOLD DOWN REAR	1
48	PAOZZ	74868	82-130	COVER,ELECTRICAL CO	1
49	PAOZZ	22373	089-02140-0000	NUT SELF LOCKING	1
50	XBOZZ	22373	047-06479-0002	RACK CONTROL HEAD	1
51	PAOZZ	22373	047-07254-0001	BOLT,U .	1

END OF FIGURE

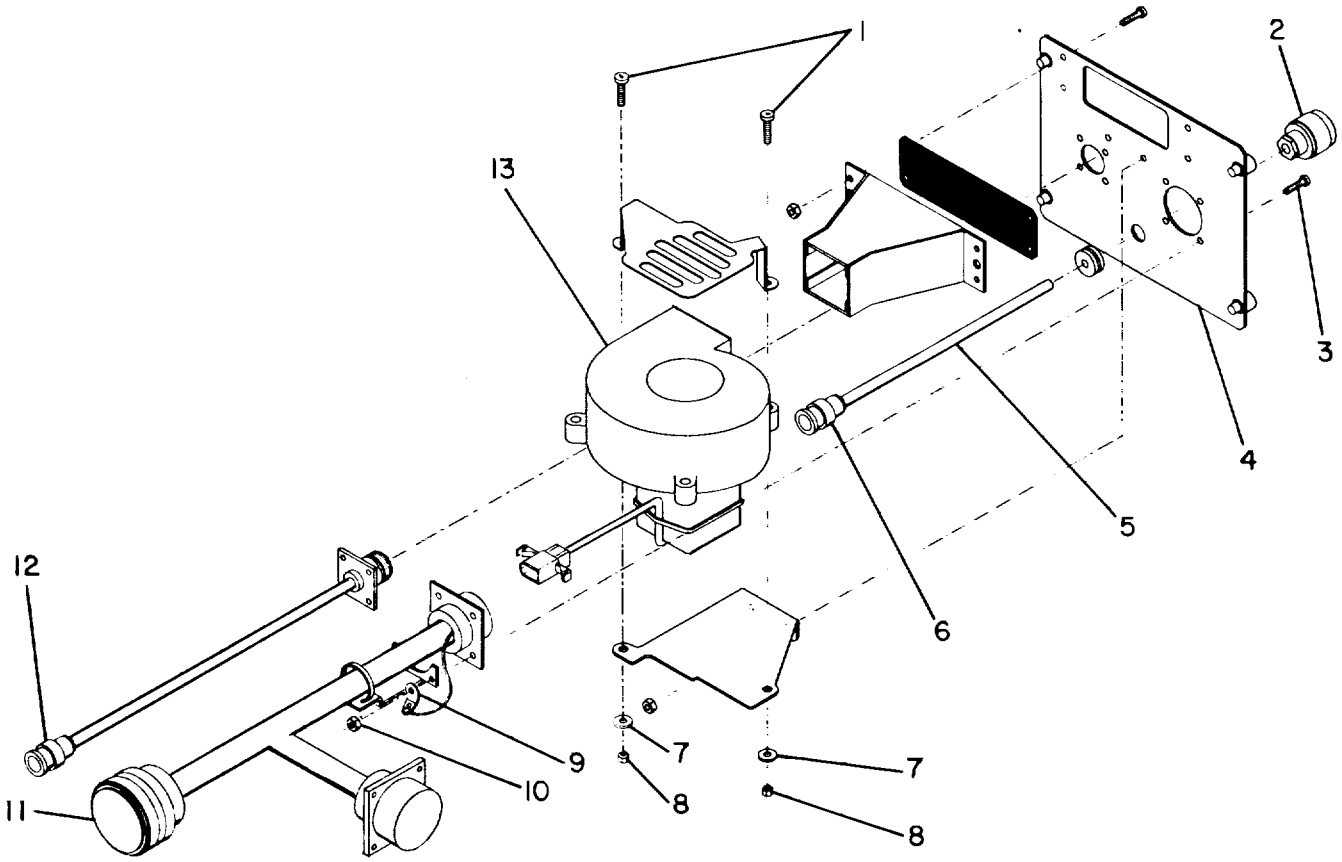


Figure F-4. Y-Interconnect (200-05121-0000)

(1) ITEM NO	(2) SMR CODE	(3) CAGEC	(4) PART NUMBER	(5) DESCRIPTION AND USABLE ON CODES (UOC)	(6) QTY
				GROUP 05 Y-INTERCONNECT (200-05121-0000) FIGURE F-4	
1	PAOZZ	96906	MS51947-32B	SCREW,MACHINE ..... UOC:JNP	4
2	PAFZA	80058	UG-536C/U	CONNECTOR,PLUG,ELEC..... UOC:JNP	1
3	PAOZZ	80205	NAS600-42B	SCREW,MACHINE ..... UOC:JNP	14
4	XBOZZ	22373	047-08961-0004	PLATE,ADAPTER ..... UOC:JNP	1
5	XBOZZ	80058	RG-223/U	CABLE,RADIO FREQUEN ..... UOC:JNP	1
6	PAFZZ	24931	28P-129-2	CONNECTOR,PLUG,ELEC..... UOC:JNP	1
7	PAOZZ	22373	089-08027-0030	WASHER,FLAT	4
8	PAOZZ	96906	MS210042-06	NUT,SELF-LOCKING ..... UOC:JNP	4
9	XBOZZ	18310	707-1604	TERMINAL,LUG..... UOC:JNP	1
10	PAOZZ	08928	SN-40NM-24	NUT,SELF-LOCKING..... UOC:JNP	14
11	PAOFF	22373	155-02682-0000	CABLE BREAKOUT..... UOC:JNP	1
12	PAOZZ	22373	155-02698-0000	CABLE,RF INTERCONNE ..... UOC:JNP	1
13	PAFZZ	22373	148-05085-0051	FAN ASSEMBLY..... UOC:JNP	1
				END OF FIGURE	

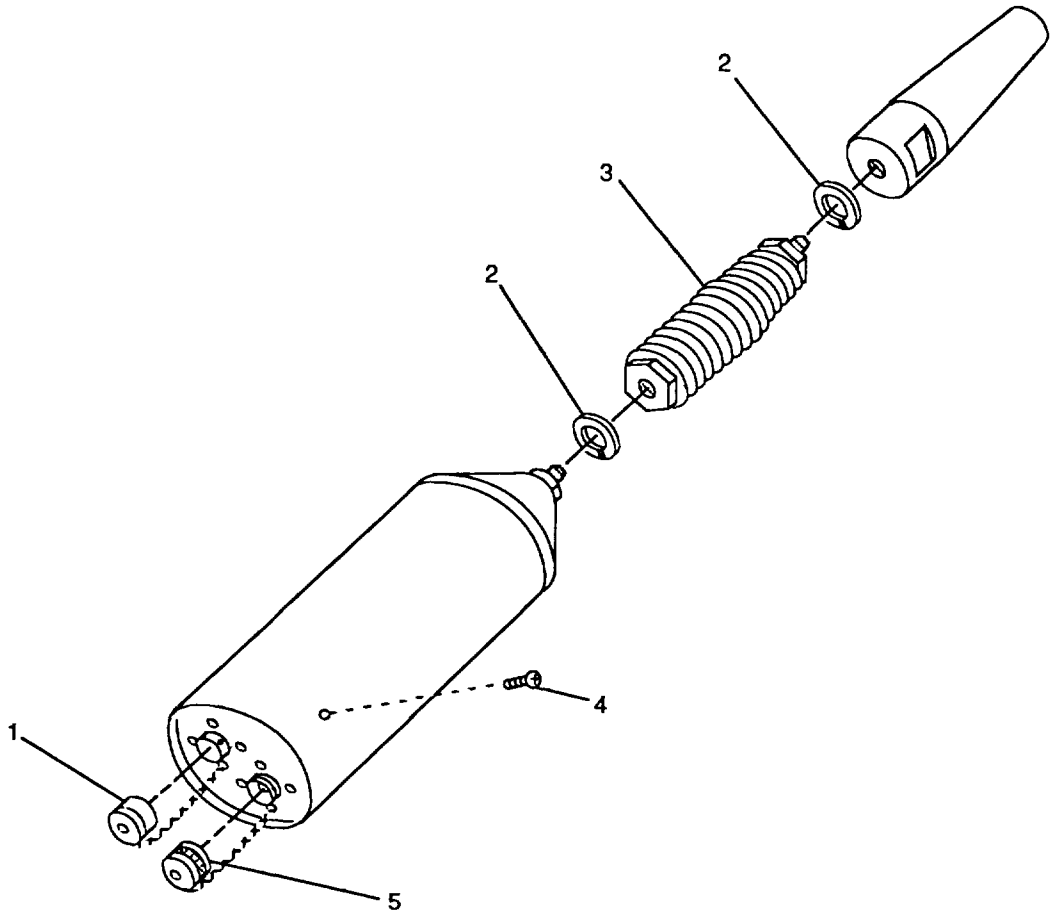


Figure F-5 . Antenna Support Base AB-1311NRC-86

(1) ITEM NO	(2) SMR CODE	(3) CAGEC	(4) PART NUMBER	(5) DESCRIPTION AND USABLE ON CODES (UOC)	(6) QTY
				GROUP 06 ANTENNA SUPPORT BASE AB-1311/VRC-86 FIGURE F-5	
1	XBOZZ	06234	660013B1155-06	COVER,ELECTRICAL CO ..... UOC:FZC	1
2	XBOZZ	96906	MS35337-84	WASHER, SPLIT-LOCK..... UOC:FZC	1
3	XBOZZ	02833	ASC-3A	SPRING, SHOCK..... UOC:FZC	1
4	PAOZZ	22373	089-05882-0004	SCREW ASSEMBLED WAS	1
5	XBOZZ	05209	12-90-1	COVER,ELECTRICAL CO ..... UOC:FZC	1
				END OF FIGURE	

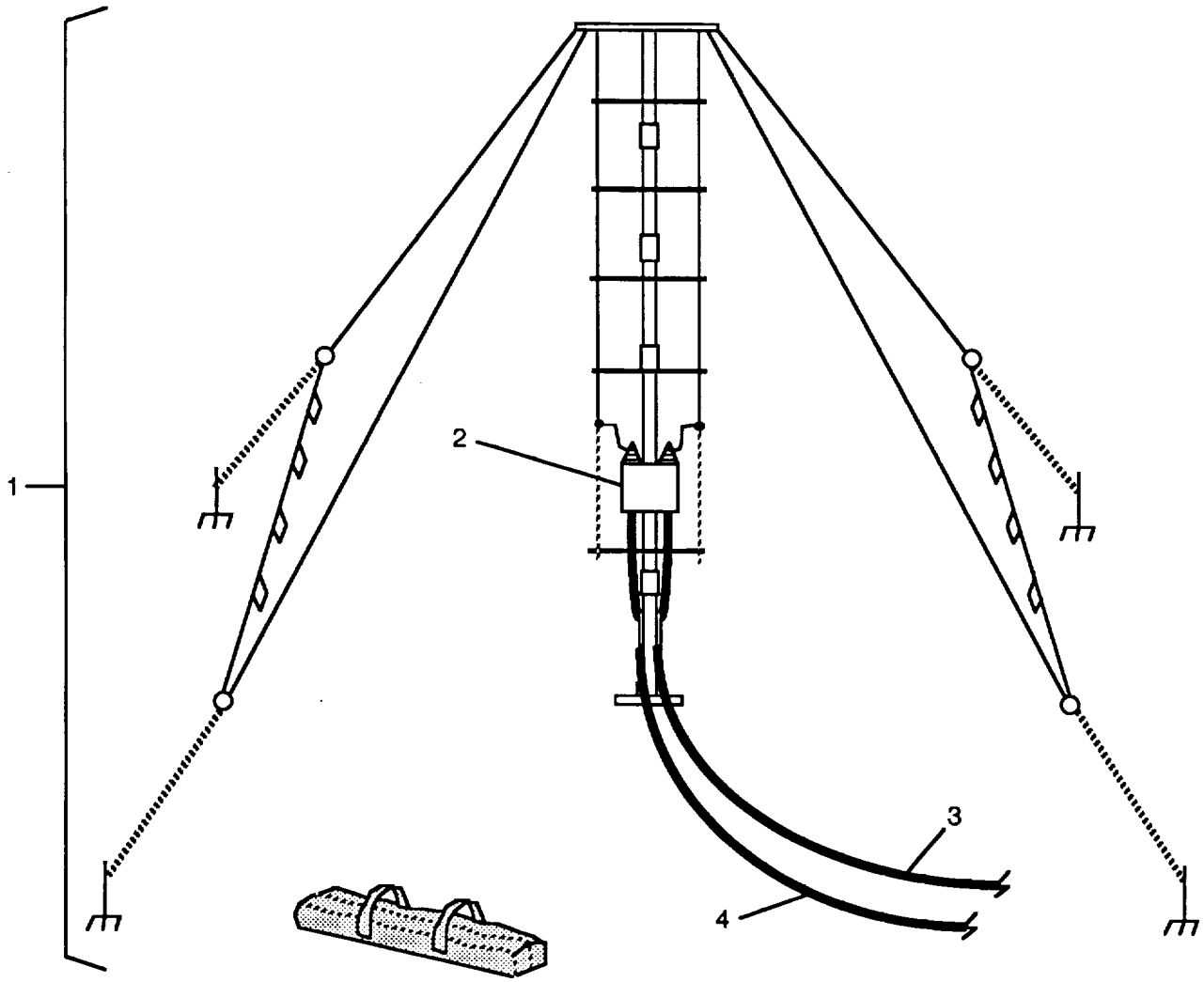


Figure F-6 . Antenna Group OE-480NRC-86(V)

(1) ITEM NO	(2) SMR CODE	(3) CAGEC	(4) PART NUMBER	(5) DESCRIPTION AND USABLE ON CODES (UOC)	(6) QTY
				GROUP 07 ANTENNA GROUP OE-480/VRC(V)	
				FIGURE F-6	
1	PBOOO	80058	AS-4227/VRC-86(V	ANTENNA ..... UOC:JNP	1
2	PAODZ	80058	CU-2479/U	COUPLER,ANTENNA ..... UOC:JNP	1
3	PAOFF	22373	155-02678-0000	CABLE ASSY, CONTROL ..... UOC:JNP	1
4	AFOFF	22373	155-02679-0000	CABLE RF TRANSMISSI ..... UOC:JNP	1
				END OF FIGURE	

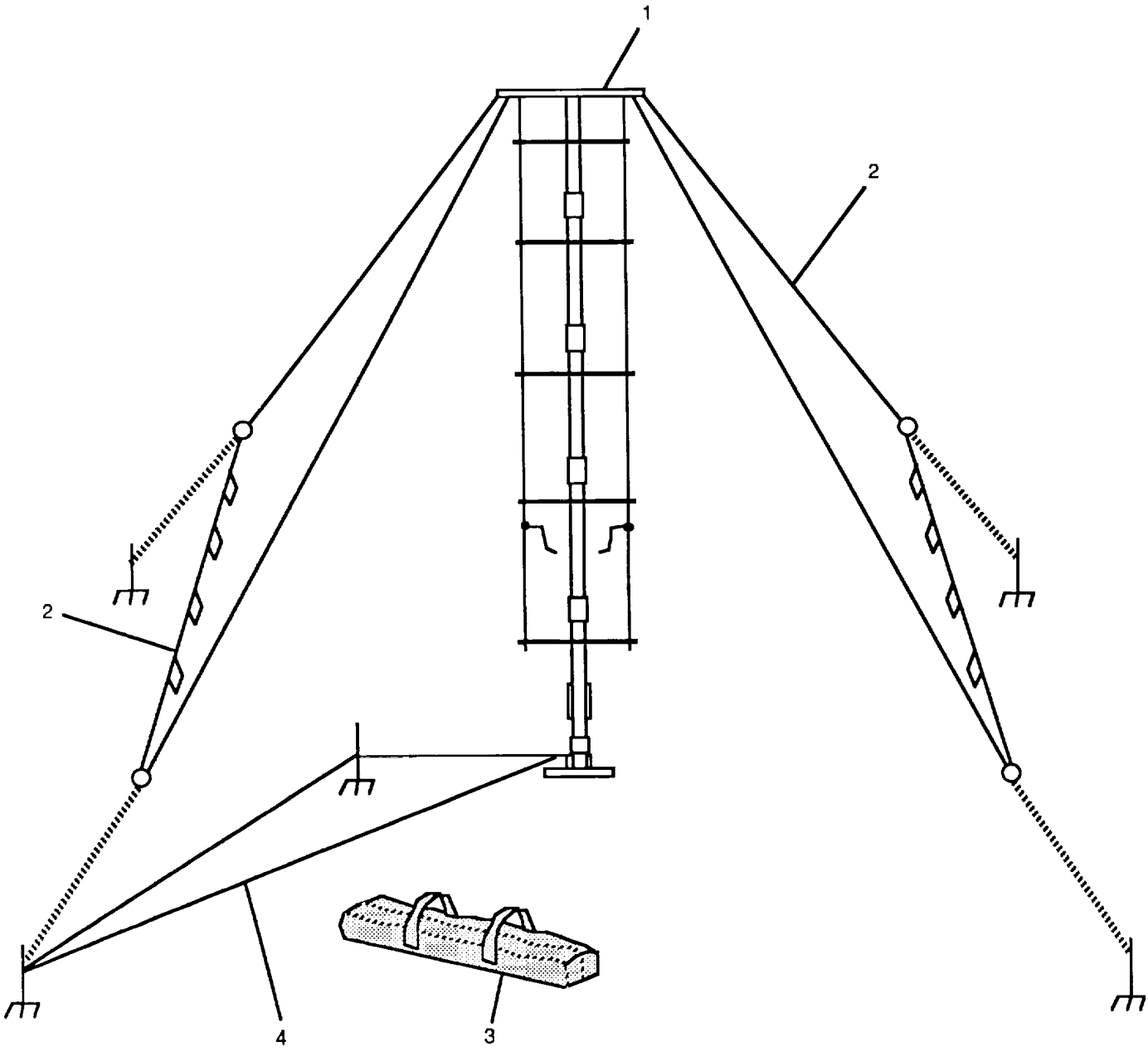


Figure F-7 . Antenna AS-4227/VRC-86(V)

(1) ITEM NO	(2) SMR CODE	(3) CAGEC	(4) PART NUMBER	(5) DESCRIPTION AND USABLE ON CODES (UOC)	(6) QTY
				GROUP 0702 ANTENNA AS-4227/VRC-86(V) FIGURE F-7	
1	XBOOO	22373	071-01512-0000	MAST ASSEMBLY ..... UOC:JNP	1
2	PAOOO	22373	200-05098-0000	ANTENNA ELEMENT ..... UOC:JNP	1
3	PAOZZ	22373	071-00080-0000	MAST STOWAGE BAG ..... UOC:JNP	1
4	XBOZZ	22373	200-05137-0000	ANTENNA TEMPLATE AS..... UOC:JNP	1
				END OF FIGURE	

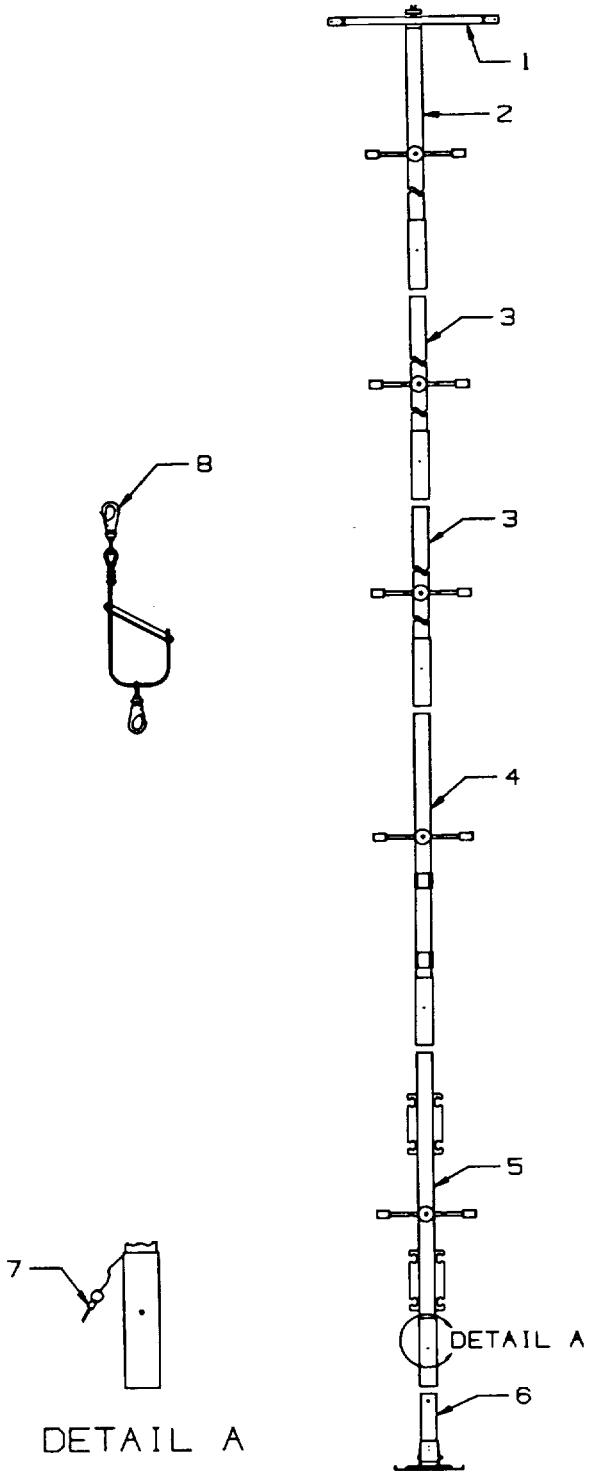


Figure F-8 . Mast Assembly (071-01512-0000)

(1) ITEM NO	(2) SMR CODE	(3) CAGEC	(4) PART NUMBER	(5) DESCRIPTION AND USABLE ON CODES (UOC)	(6) QTY
				GROUP 070201 MAST ASSEMBLY (071-01512-0000) FIGURE F-8	
1	PAOZZ	22373	200-05125-0000	SUPPORT BAR ASSEMBL ..... UOC:JNP	1
2	PAOZZ	22373	200-05123-0003	TUBE MAST ASSEMBLY ..... UOC:JNP	1
3	PAOZZ	22373	200-05123-0002	TUBE MAST ASSEMBLY ..... UOC:JNP	2
4	PAOZZ	22373	200-05123-0001	TUBE MAST ASSEMBLY ..... UOC:JNP	1
5	PAOZZ	22373	200-05123-0000	TUBE MAST ASSEMBLY ..... UOC:JNP	1
6	XBOZZ	22373	200-05127-0000	BASE ASSEMBLY ..... UOC:JNP	1
7	XBOZZ	16258	SLS4R25	PIN,BALL-LOCKING ..... UOC:JNP	1
8	XBOZZ	22373	200-05126-0000	GUY ASSEMBLY ..... UOC:JNP	1
				END OF FIGURE	

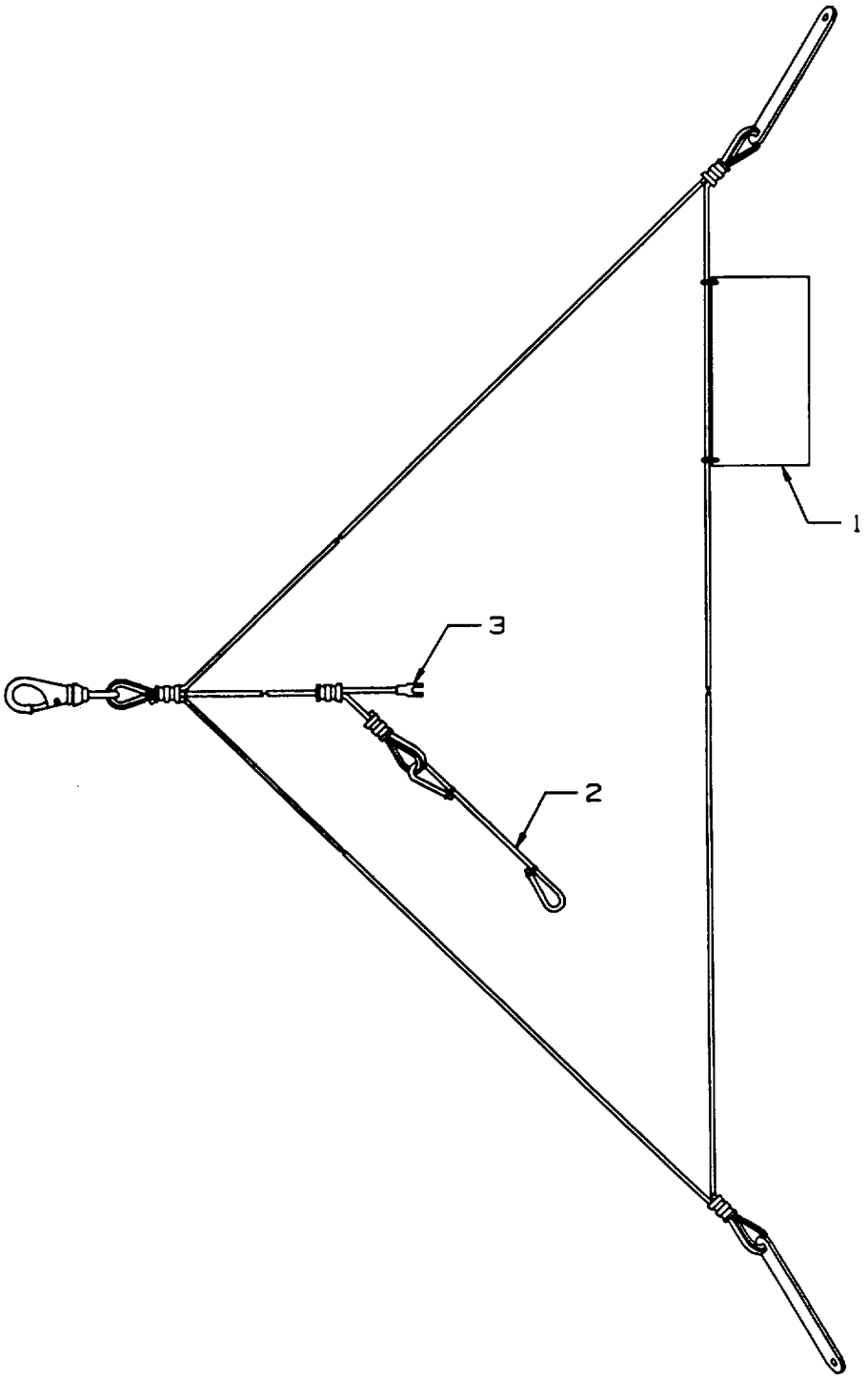


Figure F-9 . Antenna Element (200-05098-0000)

(1) ITEM NO	(2) SMR CODE	(3) CAGEC	(4) PART NUMBER	(5) DESCRIPTION AND USABLE ON CODES (UOC)	(6) QTY
				GROUP 070202 ANTENNA ELEMENT (200-05098-0000) FIGURE F-9	
1	XBOZZ	22373	057-05391-0001	TAG,CAUTION..... UOC:JNP	4
2	XBOZZ	02670	M-3	CORD,SHOCK..... UOC:JNP	36
3	PAOZZ	6383	P10-1OFF	LUG ..... UOC:JNP	1
				END OF FIGURE	

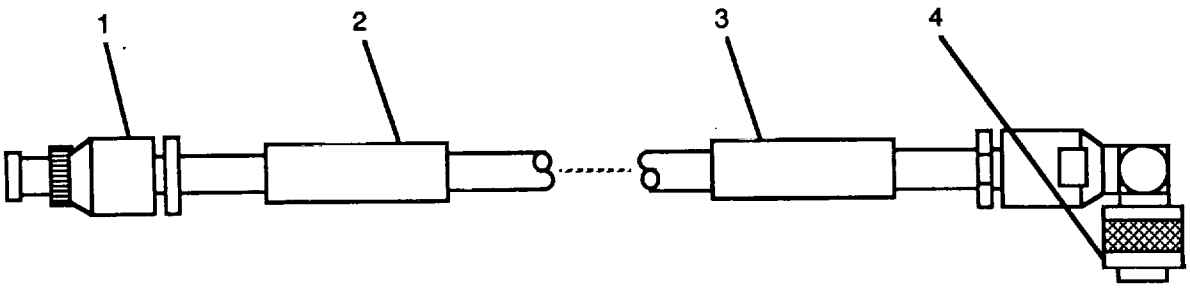


Figure F-10 . Cable Assembly, Control (155-02678-0000)

(1) ITEM NO	(2) SMR CODE	(3) CAGEC	(4) PART NUMBER	(5) DESCRIPTION AND USABLE ON CODES (UOC)	(6) QTY
				GROUP 0703 CABLE ASSEMBLY, CONTROL (155-02678-0000) FIGURE F-10	
1	PAFZZ	96906	MS3116E16-99S	CONNECTOR,PLUG ELEC..... UOC:JNP	1
2	PAFZZ	07148	S2305-15-2.0-4	ADAPTER,BACK SHELL..... UOC:JNP	1
3	XBOZZ	22373	057-05402-0007	TAG, IDENTIFICATION ..... UOC:JNP	1
4	XBOZZ	22373	057-05402-0006	TAG,IDENTIFICATION ..... UOC:JNP	1
5	PAFZZ	95354	PT08SE16-99P	CONNECTOR,RECEPTACL ..... UOC:JNP	1
				END OF FIGURE	

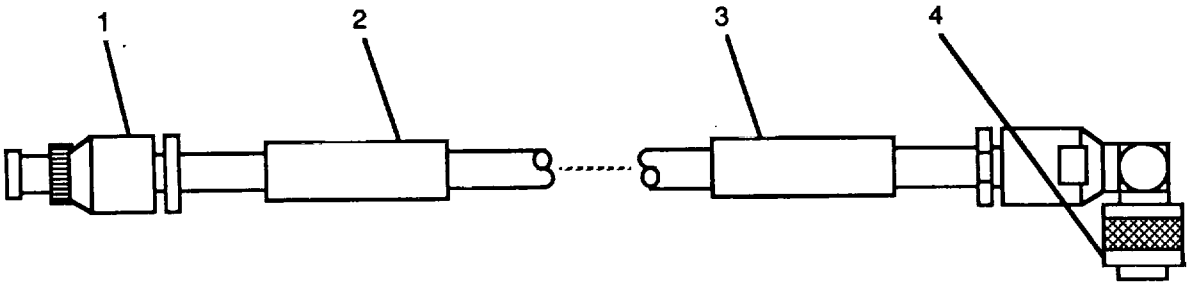


Figure F-11 . Cable Assembly, RF (155-02679-0000)

(1) ITEM NO	(2) SMR CODE	(3) CAGEC	(4) PART NUMBER	(5) DESCRIPTION AND USABLE ON CODES (UOC)	(6) QTY
				GROUP 0704 CABLE ASSEMBLY, RF	
				(155-02679-0000	
				FIGURE F-11	
1	PAFZZ	05209	4-10-36	CONNECTOR,PLUG,ELEC..... UOC:JNP	1
2	XBOZZ	22373	057-05402-0009	PLATE,IDENTIFICATIO ..... UOC:JNP	1
3	XBOZZ	22373	057-05402-0008	TAG, IDENTIFICATION ..... UOC:JNP	1
4	PAFZZ	05209	7-30-67	CONNECTOR,PLUG,ELEC..... UOC:JNP	1
				END OF FIGURE	

CROSS- REFERENCE-INDEXES
NATIONAL STOCK NUMBER INDEX

STOCK NUMBER	FIG.	ITEM	STOCK NUMBER	FIG.	ITEM
5935-00-615-2670	F-3	48			
5935-00-660-4296	F-4	2			
5935-00-786-0122	F-4	6			
5935-00-828-1877	F-11	4			
5820-01-147-8635	F-1	4			
5821-01-172-2879	F-1	1			
	F-3	36			
5821-01-172-2880	F-1	2			
	F-3	8			
5821-01-172-2924	F-1	3			
	F-3	37			
5305-01-313-5793	F-2	3			
5305-01-314-0028	F-2	4			
5355-01-314-4657	F-2	2			
5355-01-314-4658	F-2	5			
5355-01-314-8146	F-2	7			
5985-01-320-5185	F-6	2			

CROSS-REFERENCE INDEX
PART NUMBER INDEX

CAGEC	PART NUMBER	STOCK NUMBER	FIG.	ITEM
80058	AB-1311/VRC-86		F-1	6
80058	AM-7201/U	5821-01-172-2880	F-1	2
			F-3	8
80058	AS-4227/VRC-86(V		F-6	1
02833	ASC-3A		F-5	3
80058	C-11245/U	5821-01-172-2879	F-1	1
			F-3	36
80058	CU-2479/U	5985-01-320-5185	F-6	2
25330	GC800		F-3	28
02670	M-3		F-9	2
96906	MS210042-06		F-4	8
96906	MS3116E16-995		F-10	1
96906	MS35337-84		F-5	2
96906	MS51947-32B		F-4	1
80058	MX-10485/VRC-86	5820-01-147-8635	F-1	4
80205	NAS600-42B		F-4	3
80058	OE-480/VRC-86(V)		F-1	7
95354	PT08SE16-99P		F-10	5
06383	P10-IOFF		F-9	3
80058	RG-223/U		F-4	5
80058	RT-1432/U	5821-01-172-2924	F-1	3
			F-3	37
07418	SE90A24C-3-4		F-3	43
07418	SE91FA06C-3-4		F-3	31
07418	SE91FA20C-3-4		F-3	30
			F-3	32
16258	SLS4R25		F-8	7
08928	SN-40NM-24		F-4	10
07148	52305-15-2.0-4		F-10	2
80058	UG-536C/U	5935-00-660-4296	F-4	2
22373	047-06330-0002		F-3	9
22373	047-06416-0002		F-3	13
22373	047-06417-0001		F-3	47
22373	047-06431-0011		F-3	3
22373	047-06432-0011		F-3	39
22373	047-06479-0002		F-3	50
22373	047-06493-0001		F-3	17
22373	047-06670-0011		F-3	38
22373	047-06671-0011		F-3	5
22373	047-07254-0001		F-3	51
22373	047-07255-0002		F-3	34
22373	047-07442-0001		F-3	45
22373	047-08961-0004		F-4	4
22373	057-05391-0001		F-9	1
22373	057-05402-0006		F-10	4
22373	057-05402-0007		F-10	3
22373	057-05402-0008		F-11	3
22373	057-05402-0009		F-11	2
22373	071-00080-0000		F-7	3
22373	071-01512-0000		F-7	1
22373	076-01136-0002		F-3	46

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PART NUMBER INDEX

CAGEC	PART NUMBER	STOCK NUMBER	FIG.	ITEM
22373	076-01361-0001	5355-01-314-4657	F-2	2
22373	076-01362-0001	5355-01-314-8146	F-2	7
22373	076-01363-0001	5355-01-314-4658	F-2	5
22373	089-02140-0000		F-3	49
22373	089-02148-0032		F-3	2
			F-3	24
22373	089-02185-0022		F-3	18
22373	089-02188-0022		F-3	1
22373	089-02191-0022		F-3	12
22373	089-02194-0022		F-3	7
22373	089-05882-0004		F-5	4
22373	089-05882-0007		F-3	26
22373	089-05903-0003		F-3	4
22373	089-05910-0007		F-3	41
22373	089-06012-0008		F-3	21
22373	089-06012-0011		F-3	22
22373	089-06159-0007		F-3	23
22373	089-06204-0004	5305-01-313-5793	F-2	3
22373	089-06204-0008	5305-01-314-0028	F-2	4
22373	089-06344-0005		F-3	44
22373	089-06344-0008		F-3	29
22373	089-06344-0013		F-3	33
22373	089-06348-0007		F-3	15
22373	089-06350-0007		F-3	27
22373	089-06350-0009		F-3	16
22373	089-06368-0005		F-3	40
22373	089-08017-0037		F-3	6
22373	089-08027-0030		F-3	35
			F-4	7
22373	089-08029-0030		F-3	42
22373	089-6348-0006		F-3	11
22373	090-00167-0000		F-3	20
22373	090-00454-0002		F-3	14
22373	090-00454-0003		F-3	10
22373	092-00027-0000		F-3	19
05209	12-90-1		F-5	5
22373	148-05085-0051		F-4	13
22373	155-02678-0000		F-6	3
22373	155-02679-0000		F-6	4
22373	155-02682-0000		F-4	11
22373	155-02698-0000		F-4	12
22373	200-03129-0000		F-3	25
22373	200-05098-0000		F-7	2
22373	200-05121-0000		F-1	5
22373	200-05123-0000		F-8	5
22373	200-05123-0001		F-8	4
22373	200-05123-0002		F-8	3
22373	200-05123-0003		F-8	2
22373	200-05125-0000		F-8	1
22373	200-05126-0000		F-8	8
22373	200-05127-0000		F-8	6

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PART NUMBER INDEX

CAGEC	PART NUMBER	STOCK NUMBER	FIG.	ITEM
22373	200-05137-0000		F-7	4
24931	28P-129-2	935-00-786-0122	F-4	6
8R709	36047-406		F-2	1
05209	4-10-36		F-11	1
8R709	44546-406		F-2	6
06234	660013B11S5-06		F-5	1
05209	7-30-67	5935-00-828-1877	F-11	4
18310	707-1604		F-4	9
74868	82-130	5935-00-615-2670	F-3	48

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FIGURE AND ITEM NUMBER INDEX

FIG.	ITEM	STOCK NUMBER	CAGEC	PART NUMBER
F-1	1	5821-01-172-2879	80058	C-11245/U
F-1	2	5821-01-172-2880	80058	AM-7201/U
F-1	3	5821-01-172-2924	80058	RT-1432/U
F-1	4	5820-01-147-8635	80058	MX-10485/VRC-86
F-1	5		22373	200-05121-0000
F-1	6		80058	AB-1311/VRC-86
F-1	7		80058	OE-480/VRC-86(V)
F-2	1		8R709	36047-406
F-2	2	5355-01-314-4657	22373	076-01361-0001
F-2	3	5305-01-313-5793	22373	089-06204-0004
F-2	4	5305-01-314-0028	22373	089-06204-0008
F-2	5	5355-01-314-4658	22373	076-01363-0001
F-2	6		8R709	44546-406
F-2	7	5355-01-314-8146	22373	076-01362-0001
F-3	1		22373	089-02188-0022
F-3	2		22373	089-02148-0032
F-3	3		22373	047-06431-0011
F-3	4		22373	089-05903-0003
F-3	5		22373	047-06671-0011
F-3	6		22373	089-08017-0037
F-3	7		22373	089-02194-0022
F-3	8	5821-01-172-2880	80058	AM-7201/U
F-3	9		22373	047-06330-0002
F-3	10		22373	090-00454-0003
F-3	11		22373	089-6348-0006
F-3	12		22373	089-02191-0022
F-3	13		22373	047-06416-0002
F-3	14		22373	090-00454-0002
F-3	15		22373	089-06348-0007
F-3	16		22373	089-06350-0009
F-3	17		22373	047-06493-0001
F-3	18		22373	089-02185-0022
F-3	19		22373	092-00027-0000
F-3	20		22373	090-00167-0000
F-3	21		22373	089-06012-0008
F-3	22		22373	089-06012-0011
F-3	23		22373	089-06159-0007
F-3	24		22373	089-02148-0032
F-3	25		22373	200-03129-0000
F-3	26		22373	089-05882-0007
F-3	27		22373	089-06350-0007
F-3	28		25330	GC800
F-3	29		22373	089-06344-0008
F-3	30		07418	SE91FA20C-3-4
F-3	31		07418	SE91FA06C-3-4
F-3	32		07418	SE91FA20C-3-4
F-3	33		22373	089-06344-0013
F-3	34		22373	047-07255-0002
F-3	35		22373	089-08027-0030
F-3	36	5821-01-172-2879	80058	C-11245/U
F-3	37	5821-01-172-2924	80058	RT-1432/U

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FIGURE AND ITEM NUMBER INDEX

FIG.	ITEM	STOCK NUMBER	CAGEC	PART NUMBER
F-3	38		22373	047-06670-0011
F-3	39		22373	047-06432-0011
F-3	40		22373	089-06368-0005
F-3	41		22373	089-05910-0007
F-3	42		22373	089-08029-0030
F-3	43		07418	SE90A24C-3-4
F-3	44		22373	089-06344-0005
F-3	45		22373	047-07442-0001
F-3	46		22373	076-01136-0002
F-3	47		22373	047-06417-0001
F-3	48	5935-00-615-2670	74868	82-130
F-3	49		22373	089-02140-0000
F-3	50		22373	047-06479-0002
F-3	51		22373	047-07254-0001
F-4	1		96906	MS51947-32B
F-4	2	5935-00-660-4296	80058	UG-536C/U
F-4	3		80205	NAS600-42B
F-4	4		22373	047-089&1-0004
F-4	5		80058	RG-223/U
F-4	6	5935-00-786-0122	24931	28P-129-2
F-4	7		22373	089-08027-0030
F-4	8		96906	M5210042-06
F-4	9		18310	707-1604
F-4	10		08928	SN-40NM-24
F-4	11		22373	155-02682-0000
F-4	12		22373	155-02698-0000
F-4	13		22373	148-05085-0051
F-5	1		06234	660013Bl155-06
F-5	2		96906	MS35337-84
F-5	3		02833	ASC-3A
F-5	4		22373	089-05882-0004
F-5	5		05209	12-90-1
F-6	1		80058	AS-4227/VRC-86(V
F-6	2	5985-01-320-5185	80058	CU-2479/U
F-6	3		22373	155-02678-0000
F-6	4		22373	155-02679-0000
F-7	1		22373	071-01512-0000
F-7	2		22373	200-05098-0000
F-7	3		22373	071-00080-0000
F-7	4		22373	200-05137-0000
F-8	1		22373	200-05125-0000
F-8	2		22373	200-05123-0003
F-8	3		22373	200-05123-0002
F-8	4		22373	200-05123-0001
F-8	5		22373	200-05123-0000
F-8	6		22373	200-05127-0000
F-8	7		16258	SLS4R25
F-8	8		22373	200-05126-0000
F-9	1		22373	057-05391-0001
F-9	2		02670	M-3
F-9	3		06383	P10-l0FF

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FIGURE AND ITEM NUMBER INDEX

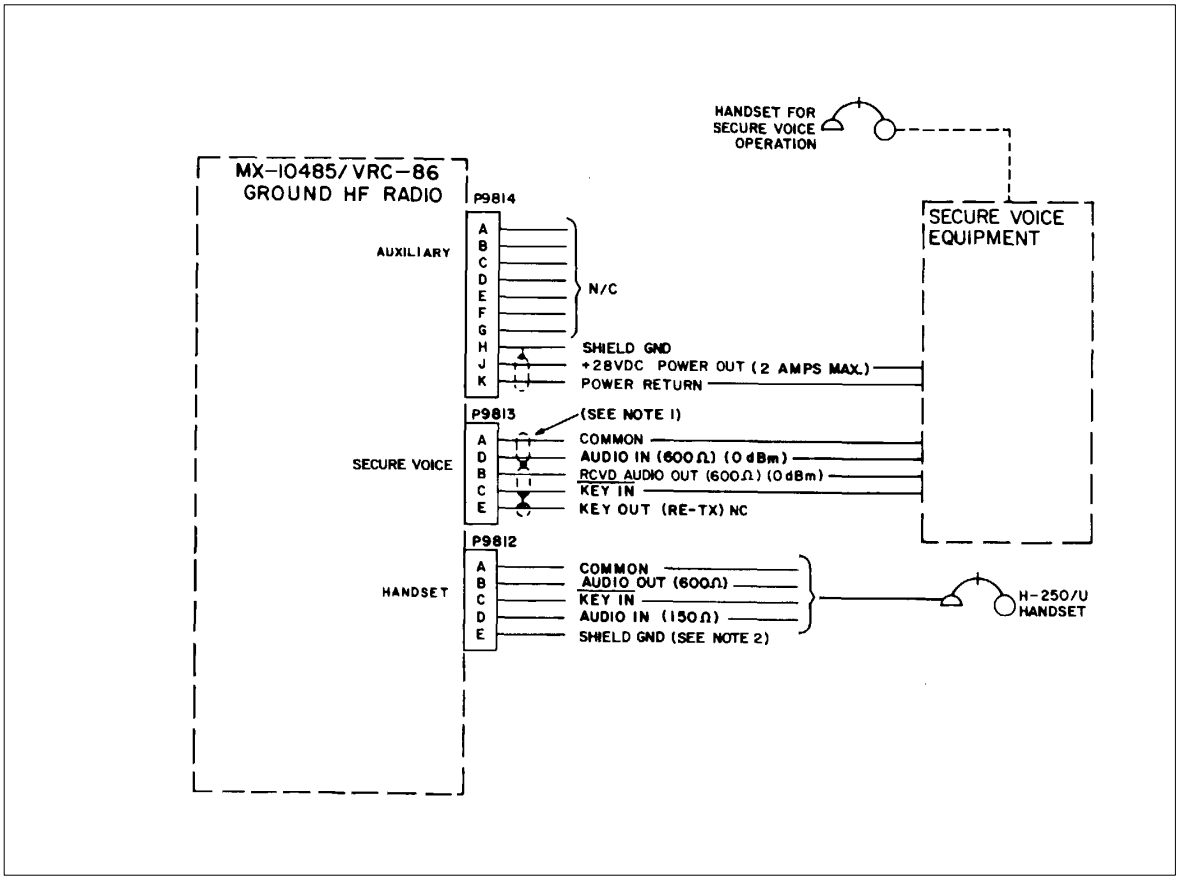
FIG.	ITEM	STOCK NUMBER	CAGEC	PART NUMBER
F-10	1		96906	MS3116E16-995
F-10	2		07148	52305-15-2.0-4
F-10	3		22373	057-05402-0007
F-10	4		22373	057-05402-0006
F-10	5		95354	PT08SE16-99P
F-11	1		05209	4-10-36
F-11	2		22373	057-05402-0009
F-11	3		22373	057-05402-0008
F-11	4	935-00-828-1877	05209	7-30-67

GLOSSARY

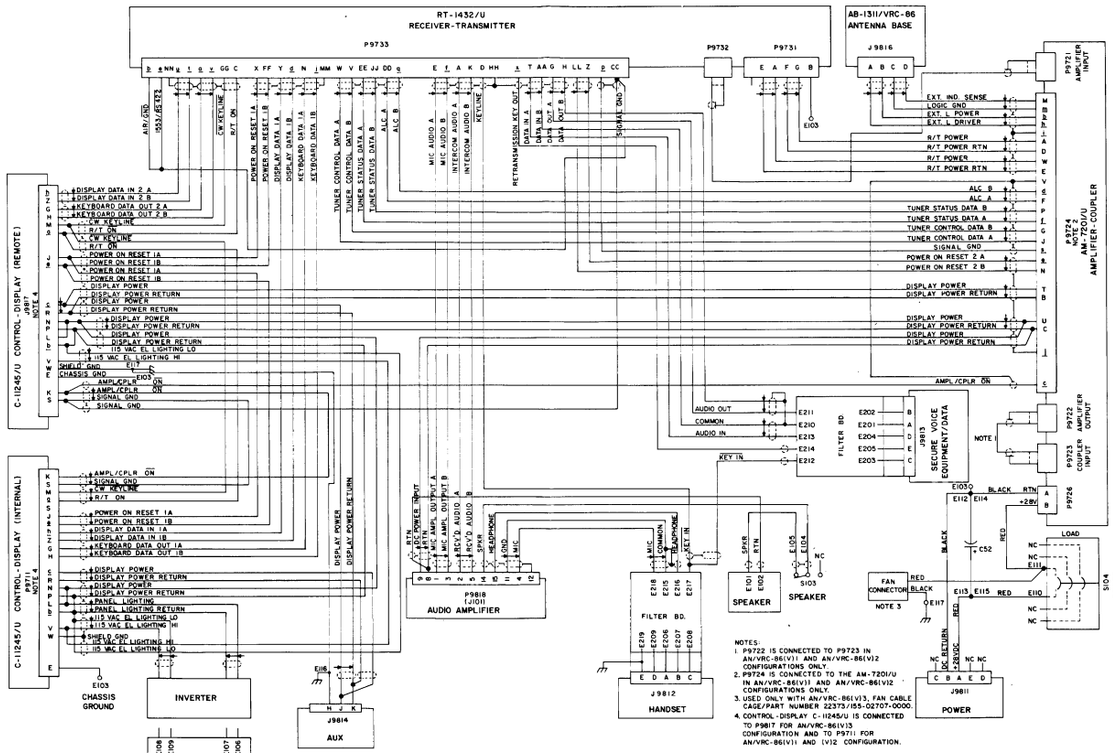
SECTION I. ABBREVIATIONS

ABBREVIATION	DEFINITION
±	Plus or Minus
A	Amps(s)
AGC	Automatic Gain Control
ALC	Automatic Level Control
AME	Amplitude Modulation Equivalent
AVIM	Aviation Intermediate Maintenance
AVUM	Aviation Unit Maintenance
BIT	Built-In Test
CRT	Cathode Ray Tube
CW	Carrier Wave (Modulated Carrier Wave--MCW)
CCW	Counter Clockwise
cf	Carrier Frequency
dB	Decibels
dBm	Decibels referenced to 1 milliwatt
DISREP	Discrepancy in Shipment Report
DSB	Double Sideband
ECOF	E Layer Cutoff Frequency
EIR	Equipment Improvement Recommendations
F	Fahrenheit
Hz	Hertz
in.	Inch(es)
KHz	Kilohertz
lbs.	Pounds
LRU	Line Replaceable Unit
LSB	Lower Sideband
MAC	Maintenance Allocation Chart
MCW	Modulated Carrier Wave
MHz	Megahertz (equals 1,000 kilohertz)
ms	Millisecond
MTBF	Mean Time Between Failure
MUF	Maximum Useable Frequency
NOE	Nap-of-the-Earth
NVIS	Near Vertical Incident Skywave
PEP	Peak Envelope Power
pf	Picofarads (One hundred thousandth of a microfarad)
PMCS	Preventive Maintenance Checks and Services
PTT	Push To Talk
RIW	Reliability Improvement Warranty
RPSTL	Repair Parts and Special Tools List
ROD	Report of Discrepancies
SELADR	Selective Addressing
(S + N)/N	Signal Plus Noise to Noise
SSB	Single Side Band
TMDE	Test, Measurement and Diagnostics Equipment

ABBREVIATION	DEFINITION
µh	Microhenries
UOC	Usable on Code
USB	Upper Sideband
UUT	Unit Under Test
Vac	Volts Alterating Current
Vdc	Volts Direct Current
VSWR	Voltage Standing Wave Ratio
W	Watt(s)

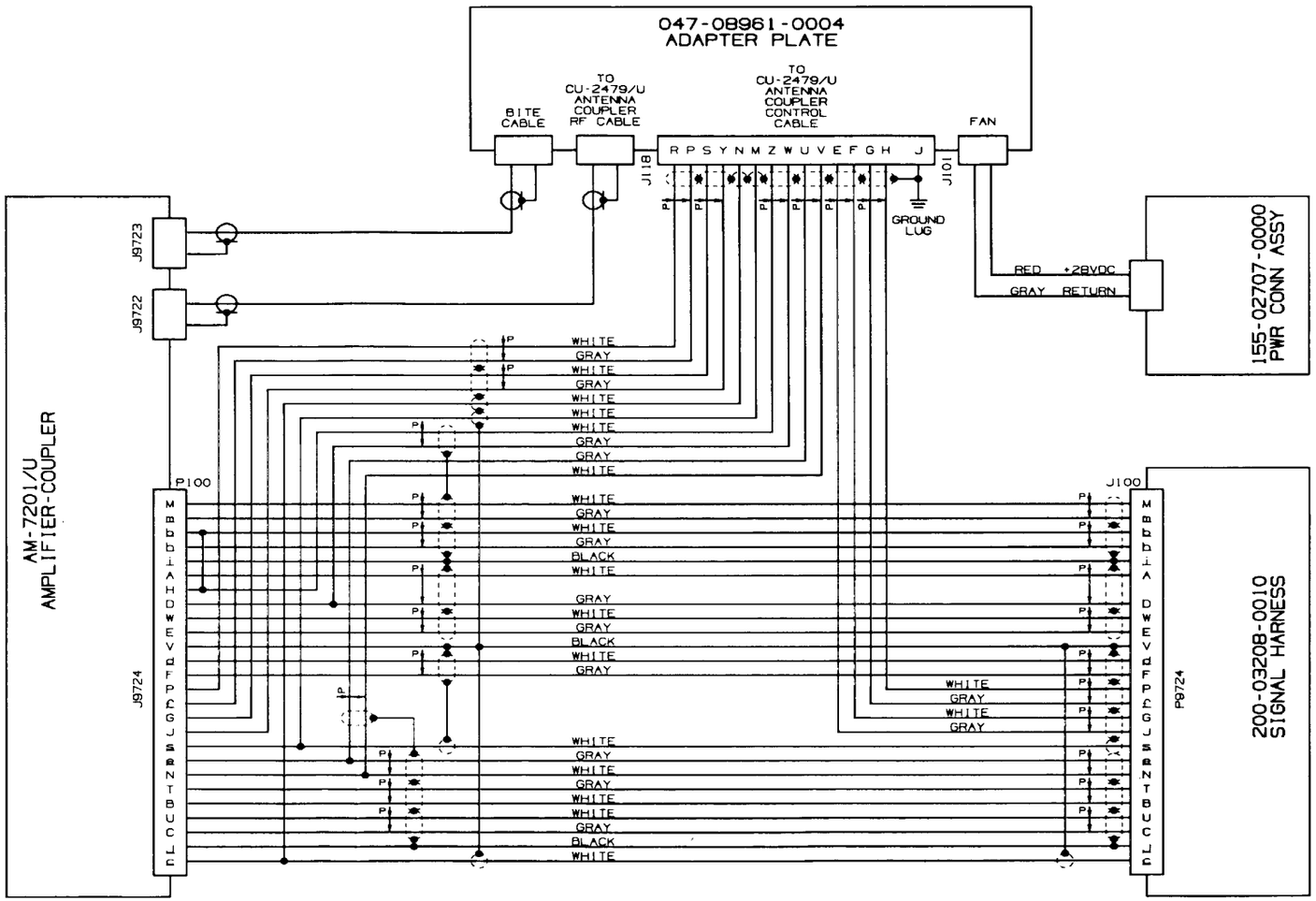


FO-1 Secure Voice Wiring Diagram



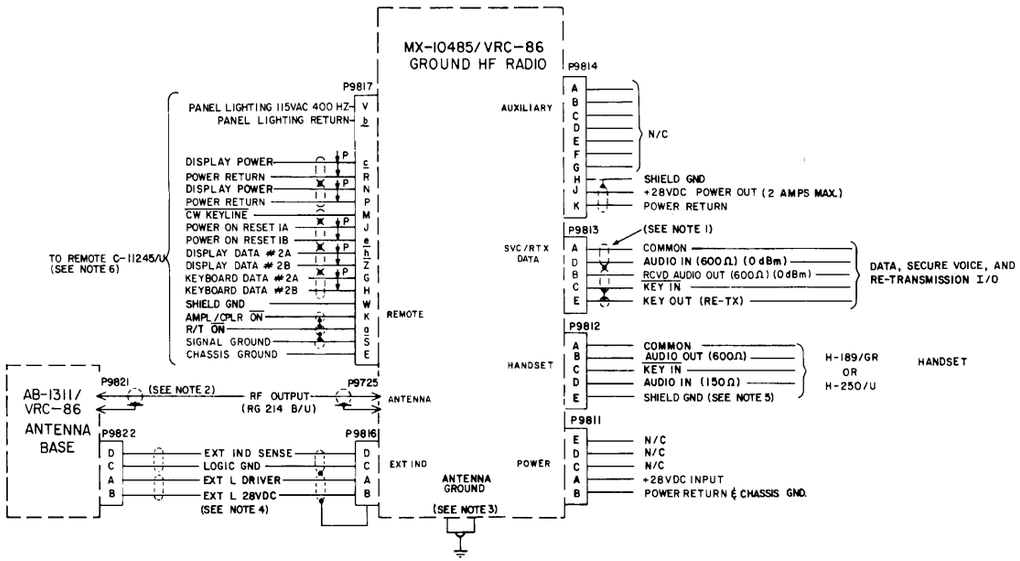
FO-2 . MX-10485/VRC-86 Internal Wiring Diagram

FO-3/(FO-4 blank)



FO- 3 Y-Interconnect Wiring Diagram

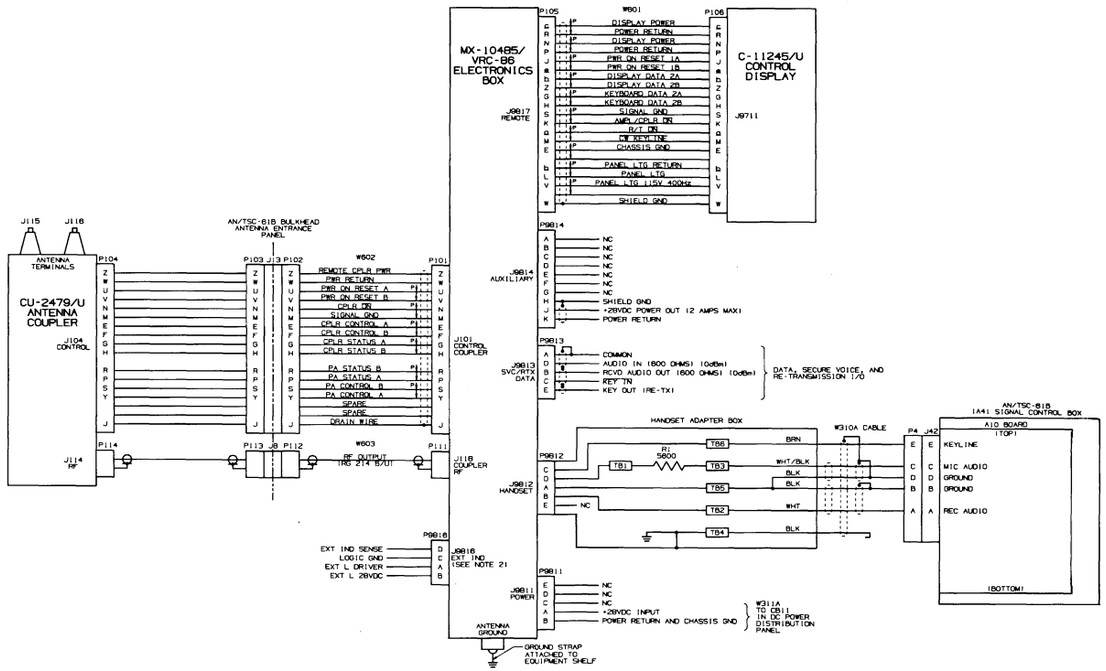
FO-5/(FO-6 blank)



NOTES:

1. TERMINATE SHIELDS ON P9813 AT CHASSIS GROUND OF EXTERNAL DEVICE OR USE AN EMI BACKSHELL WITH P9813 TO PROVIDE PERIPHERAL BONDING OF THE SHIELDS.
2. IDEAL LENGTH OF RF OUTPUT CABLE IS 6 INCHES; MAXIMUM 12 INCHES. LENGTH OVER 6 INCHES WILL SIGNIFICANTLY DEGRADE THE PERFORMANCE OF THE UNIT. DEGRADATION IS PROPORTIONAL TO LENGTHS OVER 6 INCHES.
3. ATTACH A SOLID PIECE OF 1 INCH WIDE, 0.015 INCH THICK COPPER STRAP FROM THE ANTENNA GROUND TO VEHICLE CHASSIS.
4. FOR NVIS OPERATION WITH WHIP ANTENNA; BEND WHIP OVER AND GROUND TIP OF ANTENNA TO VEHICLE, AND DISCONNECT CONTROL CABLE (P9816 TO P9822) TO AB1311/VRC-86.
5. IF AN EXTENSION CABLE IS USED WITH THE HANDSET, THEN THE EXTENSION CABLE SHOULD CONSIST OF 2 SHIELDED TWISTED PAIRS WITH THE SHIELDS CONNECTED TO PINE.
6. SHIELDED WIRES USED IN THE REMOTE C-11245 CABLE SHALL HAVE THE SHIELDTERMINATED WITH AN EMI BACKSHELL TO PROVIDE PERIPHERAL BONDING OF THE SHIELD.

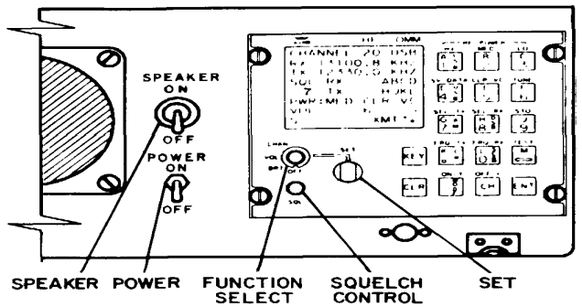
FO-4 (Sheet 1 of 2) . Radio Set External Wiring Diagram



FO-4 (Sheet 2 of 2) . Radio Set External Wiring Diagram

FO-9/(FO-10 blank)

AN/VRC-86(V) HF RADIO SET OPERATING PROCEDURES



GENERAL INFORMATION

Refer to Figure 1. Most functions of the radio set are operated by the FUNCTION SELECT, SQUELCH CONTROL, and SET switches on the C-11245/U. Other pushbutton keys are used in the setting of operating parameters. These keys have nomenclatures both on and above them. Keys to be pressed in the following procedures are enclosed in square brackets (i.e. [ENT]). Always press keys in the order shown. When an operating parameter is changed, the affected part of the display will appear in inverse video until [ENT] is pressed which completes the entry. Pressing [CLR] will cancel an entry. When the number symbol is shown in brackets, i.e. [####], an alpha or numeric entry is required. Refer to TM 11-5820-927-13&P for detailed operating procedures.

TURNING ON THE RADIO SET

The AN/VRC-86(V) requires a nominal 28 VDC at 22 A max. Ensure power cable is connected to connector J9811 on the AN/VRC-86(V). If the OE-480/VRC-86(V) antenna group is used, ensure RF cable is connected to J104 and control cable is connect to J118 on front of AN/VRC-86(V)3 electronics box. If the AS-4096/G antenna is used, ensure RF cable is connected to J9725 on the side of the AN/VRC-89(V)1 electronics box. Connect the handset to J9812 or connect secure voice/data equipment to J9813.

TO TURN ON THE RADIO SET, set the POWER switch to ON and turn the FUNCTION SELECT knob clockwise from the OFF position. Channel 0 will be displayed initially. The radio set can be shut off by returning either of these switches to OFF.

SETTING THE BRIGHTNESS LEVEL

TO SET THE BRIGHTNESS level of the display screen set FUNCTION SELECT to BRT and adjust the level with the SET knob.

SETTING THE VOLUME LEVEL

TO SET THE VOLUME level, set FUNCTION SELECT to VOL and adjust the level with the SET knob to get the desired volume level which is displayed on the screen. The speaker is turned on and off with the speaker switch.

SETTING THE SYLLABIC SQUELCH LEVEL

To set the syllabic squelch level, adjust the SQUELCH knob to the desired syllabic squelch levels OFF, 1, 2, 3, 4, 5, 6, 7, or MAX as displayed on the screen. Set squelch to OFF for data communications.

NOTE

The SQUELCH knob can be rotated counter-clockwise from the OFF position to enter the net, selective address or selective address scan modes. When these modes are activated, syllabic squelch is deactivated and only the proper electronic call sign will cause the radio to break squelch. These extremely useful modes are described later.

SELECTING A CHANNEL

TO SELECT A CHANNEL 0 through 20, press [CHAN], [##] (desired channel), or set FUNCTION SELECT to CHAN and turn SET to display the desired channel. When the radio set is turned on, channel 0 is displayed.

NORMAL CHANNEL SETUP

Once the desired channel is selected and displayed, new operating parameters can be set or changed as follows.

TO SET RECEIVE OR TRANSMIT FREQUENCY when the same, press [FRQ RX], [#####.#], [ENT], [FRQ TX], [ENT]. The last [.#] is not needed when the frequency is #####.0. Use [←] to place cursor on RX .# position and use SET to clarify SSB reception.

TO SET MODULATION MODE such as upper side-band, press [MODE], [USB], [ENT].

TO SET TRANSMIT POWER such as high power, press [HI], [ENT].

TO SELECT SECURE VOICE/DATA MODE, press [SV-DATA], [ENT]. VC-DATA is displayed on the screen and J9813 is the active input/output jack and levels are fixed at 0dB.

TO SELECT CLEAR VOICE MODE, press [CLR-VC], [ENT]. CLR-VC is displayed on the screen and J9812 is the active input/output jack.

TO PUT THE CHANNEL ON THE SCAN LIST , PRESS [MODE], [SCAN], [ON], [ENT]. (Using scan mode is described in the next section.)

TO TAKE THE CHANNEL OFF THE SCAN LIST, press [MODE], [SCAN], [OFF], [ENT].

TO STORE CHANNEL PARAMETERS IN NON- VOLATILE MEMORY, press [STO], [ENT].

TO TUNE THE COUPLER FOR CHANGED FREQUENCY PARAMETERS, press [TUNE], [ENT]. (Tuning the channel is needed if UNTUNED appears on the screen.) The coupler tuning for the channel is now stored in non-volatile memory when the channel is tuned in and the radio will never have to be tuned for the channel again. This means when the channel is selected in the future, the radio is already tuned and is ready for use immediately when the new channel is selected even when the radio set is turned off and back on again.

USING NORMAL CHANNEL SCAN MODE

The radio set can sequentially scan channels that have been placed on the scan list (see NORMAL CHANNEL ETUP above).

TO INITIATE A CHANNEL SCAN, press[MODE], [SCAN], [ENT].

TO STOP A CHANNEL SCAN, press [CLR] of the handset PTT.

SELECTIVE ADDRESS SQUELCH FUNCTIONS

Only the AN/VRC-86(V) ground based and AN/ARC-199 airborne radio sets have the unique capability of selective addressing. What this means is that these radio sets can be set up to break squelch when an electronic call sign of coded tones is received. The tones are determined by entering four letters A through M in the channel setup as described below. The radio sets can also be setup to work in a net call situation. The selective address features of a network of AN/VRC-86(V) and/or AN/ARC/ARC-199 radio sets have powerful tactical applications. For detailed information on the operation of selective address functions, refer to TM 11-5820-927-13&P, Operator's, Aviation Unit, and Intermediate maintenance Manual for AN/VRC-86(V). All radios in a network should be programmed with the same selective address channels.

TO ENTER A SELECTIVE TRANSMIT ADDRESS, press [SEL TX], [####] (any four unique letters A through M), [ENT].

TO ENTER A SELECTIVE RECEIVE ADDRESS, press [SEL RX], [####] (any four unique letters A through M), [ENT]. Normally, the selective receive address is the same as the selective transmit address.

TO ENABLE SELECTIVE ADDRESS TRANSMIT MODE, press [SEL RX], [ENT]. The selective address code will be transmitted when [ENT] is pressed. Pressing [CLR] disables the selective address transmit mode.

TO ENABLE SELECTIVE ADDRESS RECEIVE MODE, rotate the SQL knob counter-clockwise two positions from OFF to display SEL or press [SEL RX], [ENT]. The radio set will not break squelch until the tone of the selective address displayed for the channel are received.

TO INITIATE SELECTIVE ADDRESS SCAN, rotate the SQL knob counter-clockwise one position from SQL. Channels that have been placed on the scan list will then be scanned for receiving their selective receive address tones.

NET SQUELCH FUNCTIONS

A network composed of only AN/VRC-86(V) and/or AN/ARC-199 radio sets can also be set up that break squelch on a net call when a NET electronic call sign is received.

TO ENABLE NET OPERATION , rotate the SQL knob counter-clockwise one position from OFF to display NET. The radio set will not break squelch until the tones for the code of a NET call are received. In the NET mode, the code is HKLM regardless of the selective address shown for the displayed channel.

TO TRANSMIT A NET CALL coded tone on the display channel, rotate the SQL knob to display Net and press the handset PTT.

BUILT IN TEST FUNCTION

The radio set has an extensive built in test (BIT) function that can be initiated which checks many of the radio set operating parameters and displays the results o the screen. For detailed information on the operation of BIT and screen displays, refer to TM 11-5820-927-13&P, Operator's, Aviation Unit, and Intermediate Maintenance Manual for AN/VRC-86(V).

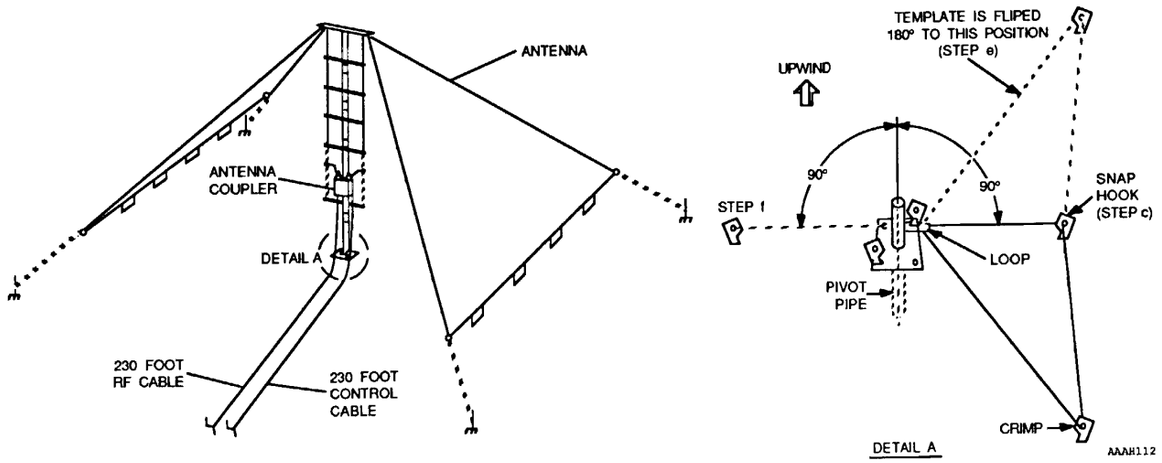
Note

If the antenna RF connection is at J9725 on the side of the radio set, BIT can be initiated without any further preparation. If the RF connection is at J104 on the front of the radio set, disconnect the RF connection and connect the test cable to J104 before initiating BIT. When you are through running BIT return the antennae connections to their original configuration.

TO INITIATE BIT, press [TEST], [ENT].

CAGE/Part Number 22373/006-020188-0001

OE-480/VRC-86(V) ANTENNA GROUP SET UP PROCEDURE



NOTE

An erected OE-480NRC-86(VI Antenna Group is 30 feet tall and takes up a rectangular area 131 feet by 105 feet with the base plate in the center. The base plate should be a maximum distance of 200 feet from the electronics box location. Select a set up site that will accomodate these requirements. Refer to TM 11-5820-927-13&P for detailed set up procedures.

a. Refer to figure detail A for steps a through i. Position antenna base plate with pivot pipe pointed upwind as applicable and stake in place with two stakes in opposite corners of base plate.

b. The extended rope template assembly is triangular in shape and is used for positioning all four guy line stakes. One corner of the template has a snap hook, the second, a loop, and the third, a crimped sleeve. Place template loop over one of the stakes holding the base plate.

c. Extend template snap hook to side of baseplate at 90° angle from pivot pipe. Drive stake into ground and attach snap hook to stake. This stake will be removed later.

d. Extend crimped corner of template and remove slack from lines to position stake. Drive first stake at this corner of template.

e. Flip template 180° to other side of base plate. Extend crimped corner and remove slack from template lines to position second stake. Drive second stake at this corner of template.

f. Move template snap hook to opposite side of baseplate at 90° angle from pivot pipe. Drive another stake into ground and attach snap hook to stake. This stake will be removed later.

9. Extend crimped corner of template and remove slack from lines to position third stake. Drive third stake at this corner of template.

h. Flip template to other side of base plate. Extend crimped corner and remove slack from template lines to position fourth stake. Drive fourth stake at this corner of template.

i. Unhook template snap hook and remove temporary stakes driven in steps c and f. Drive these two stakes into two remaining holes in baseplate. Remove template loop from baseplate stake. Remove and store template.

j. The antenna mast sections are numbered and assembled sequentially from 1 to 5 with section 1 at the baseplate and section 5 at the top. Attach top cross bar on section 5 by sliding cross bar between cross bar clamps until center notched part of cross bar is in clamps. Tighten clamp wingnuts.

k. On ground, assemble antenna mast sections with rotating cross bars face up and insert locking pin in each section joint and at baseplate.

l. Rotate each cross bar to perpendicular with mast.

m. Slip antenna coupler into brackets on mast section 2 and pin in place.

n. An antenna element is installed on each side of the mast. Each antenna element has a triangular shaped part with a single wire downlead. Attach an antenna element snap hook to either side of top cross bar.

o. The other mast cross bars have a captive mechanism on each end to hold the antenna element downlead. The downlead is inserted in the mechanism by pulling out on and holding the cross bar end cap, putting the downlead into the slot, and letting the end cap go back into place. Lay each antenna element downlead parallel with mast starting at snap hook and along mast toward baseplate.

p. For each antenna element, put free end of elastic cord in cross bar nearest baseplate. Put downlead on each side of mast into captive mechanisms of remaining cross bars.

q. Attach an antenna element downlead free end spade lug on coupler standoff that is on same side of mast as downlead. Tighten wingnuts on each standoff.

r. Connect control cable 155-02678-0000, P104 to coupler, J104. Connect RF cabble 155-02679-0000, P114 to coupler, J114. Thread cables through strain reliefs.

s. Attach snap hook of adjustable end of one guy line to each of two guy line stakes nearest top of mast.

t. Adjust guy lines to be approximately five feet short of full extension and attach free end snap hook of these guy lines to an antenna element insulator on each side of mast. There must be enough length in these guy lines to let the mast pivot up and past vertical. If the terrain is not flat, it may be necessary to make the guy line either longer or shorter.

u. Raise and pivot mast past vertical position and allow to hang on guy lines.

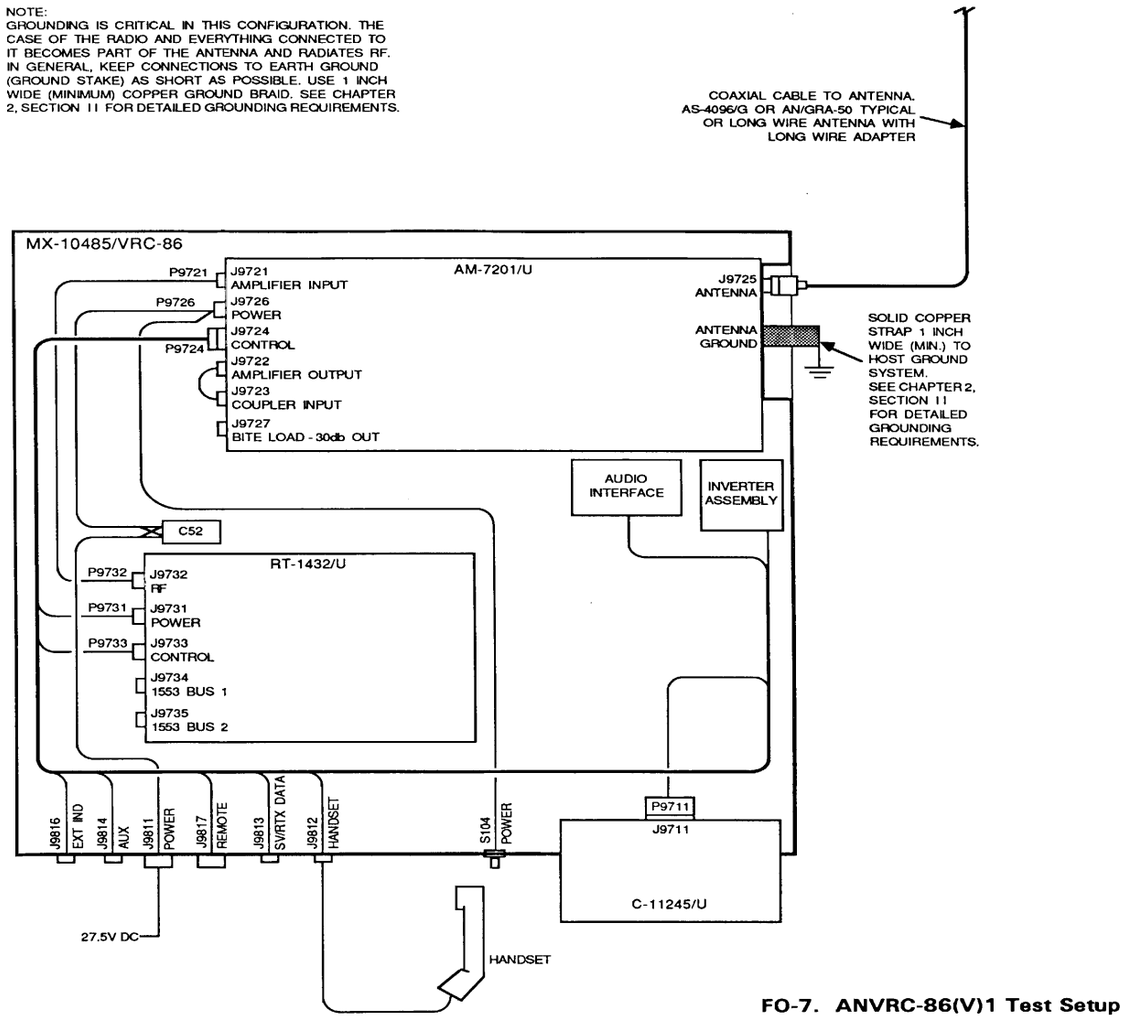
v. Attach remaining two guy line free end snap hooks to remaining antenna element insulators as shown.

w. Adjust four guy lines as necessary to put mast upright, and perpendicular and to remove droop from horizontal portion of antenna element. Antenna element droop should be less than six inches. Erected Antenna Group should appear as shown in figure.

x. Connect control cable 155-02678-0000, P103 to Y- interconnect connector J101 or to extention of that connector. Connect RF cable 155-02679-0000, P113 to Y-interconnect connector JI18 extention of that connector.

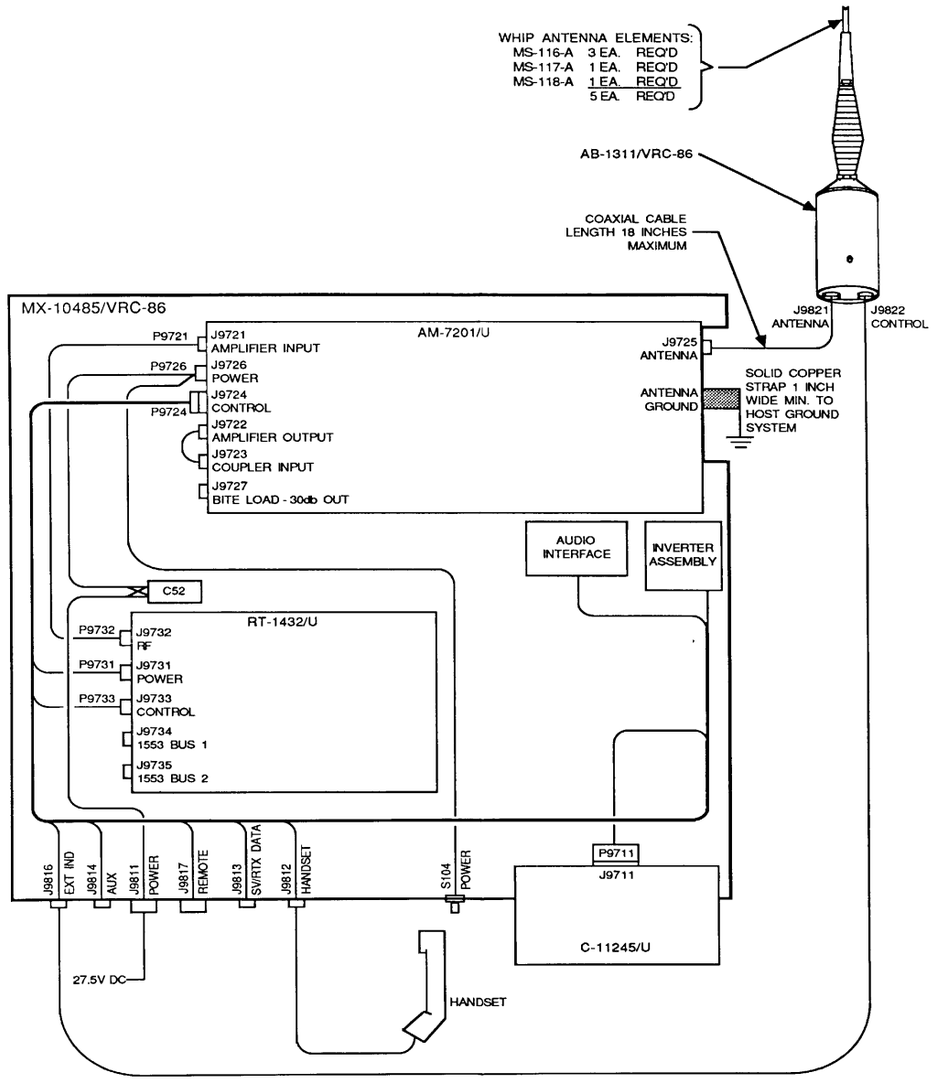
CAGE/Part Number 22373/006-02023-0000

FO-6. Operator's Quick Reference Card, Antenna Group Set Up FO-13/(FO-14 blank)



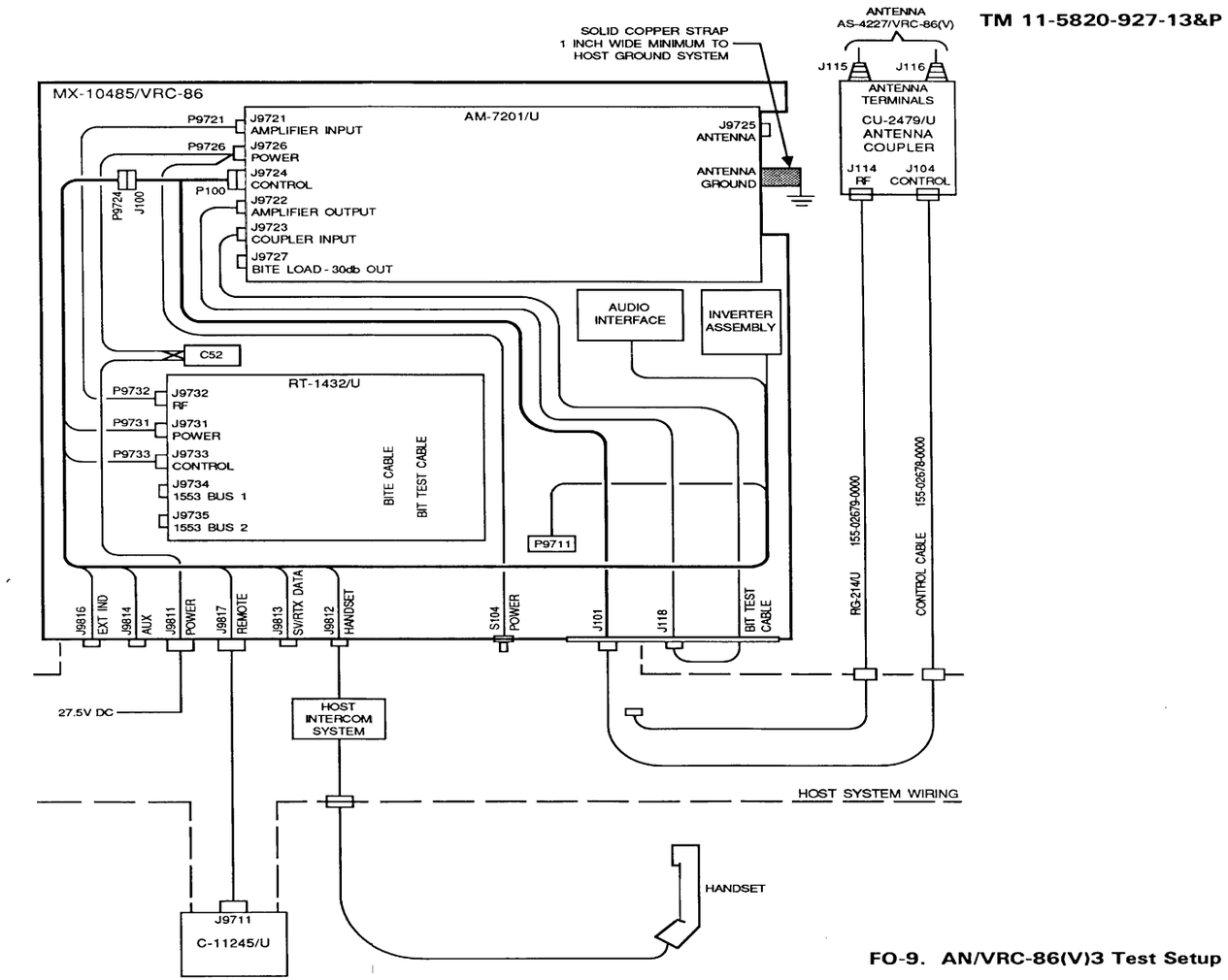
FO-7. ANVRC-86(V)1 Test Setup

FO-15/(FO-16 blank)



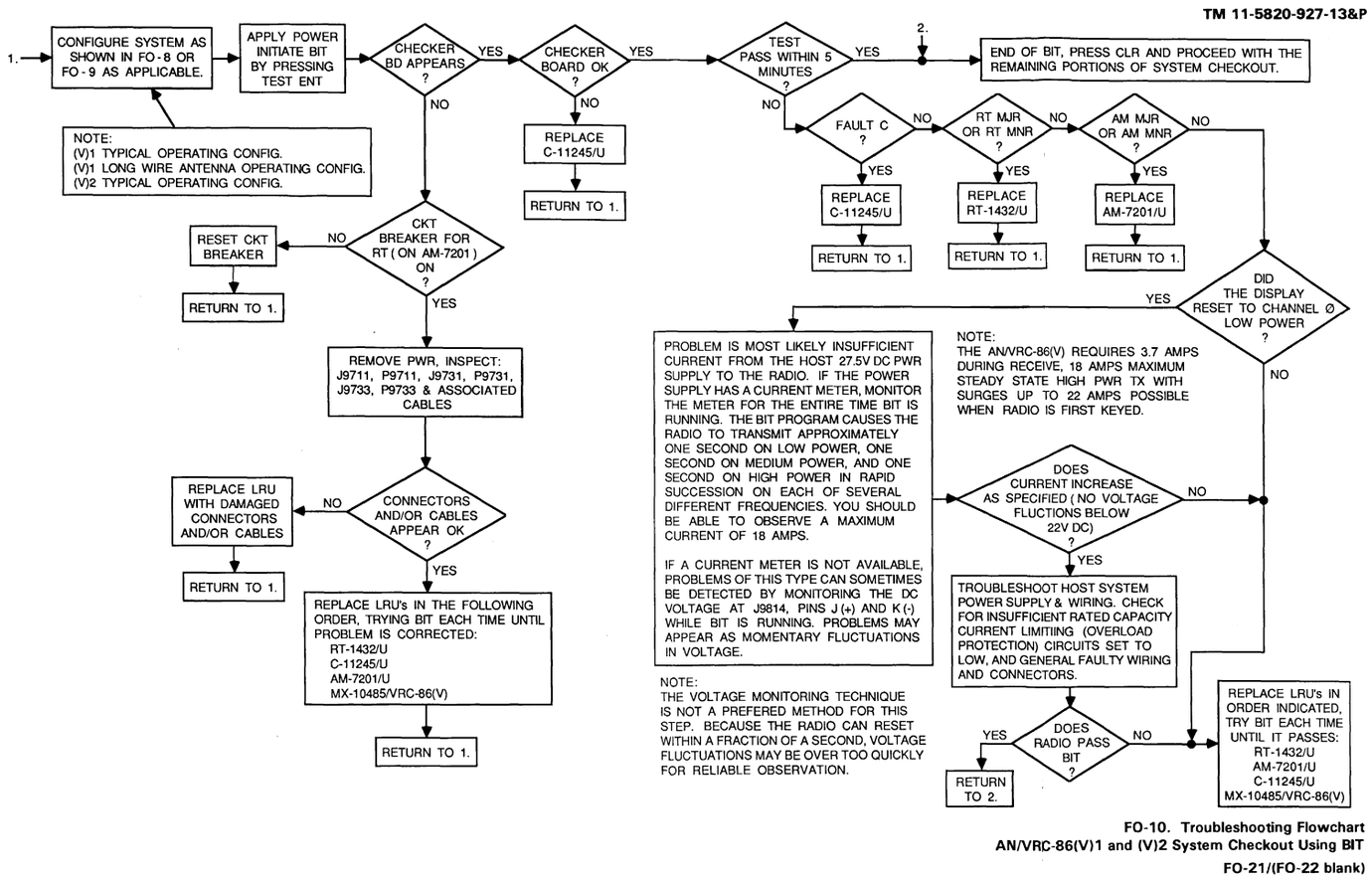
FO-8. AN/VRC-86(V)2 Test Setup

FO-17/(FO-18 blank)



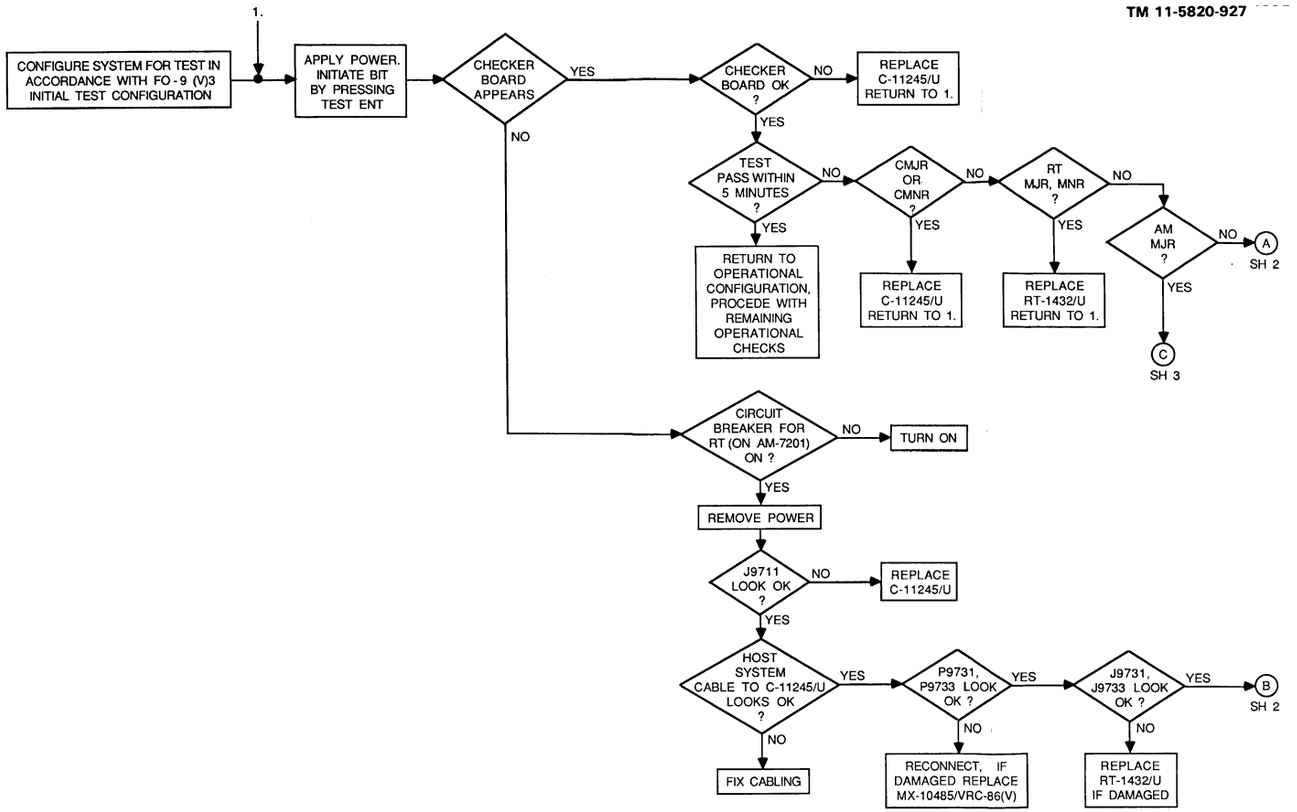
FO-9. AN/VRC-86(V)3 Test Setup

FO-19/(FO-20 blank)

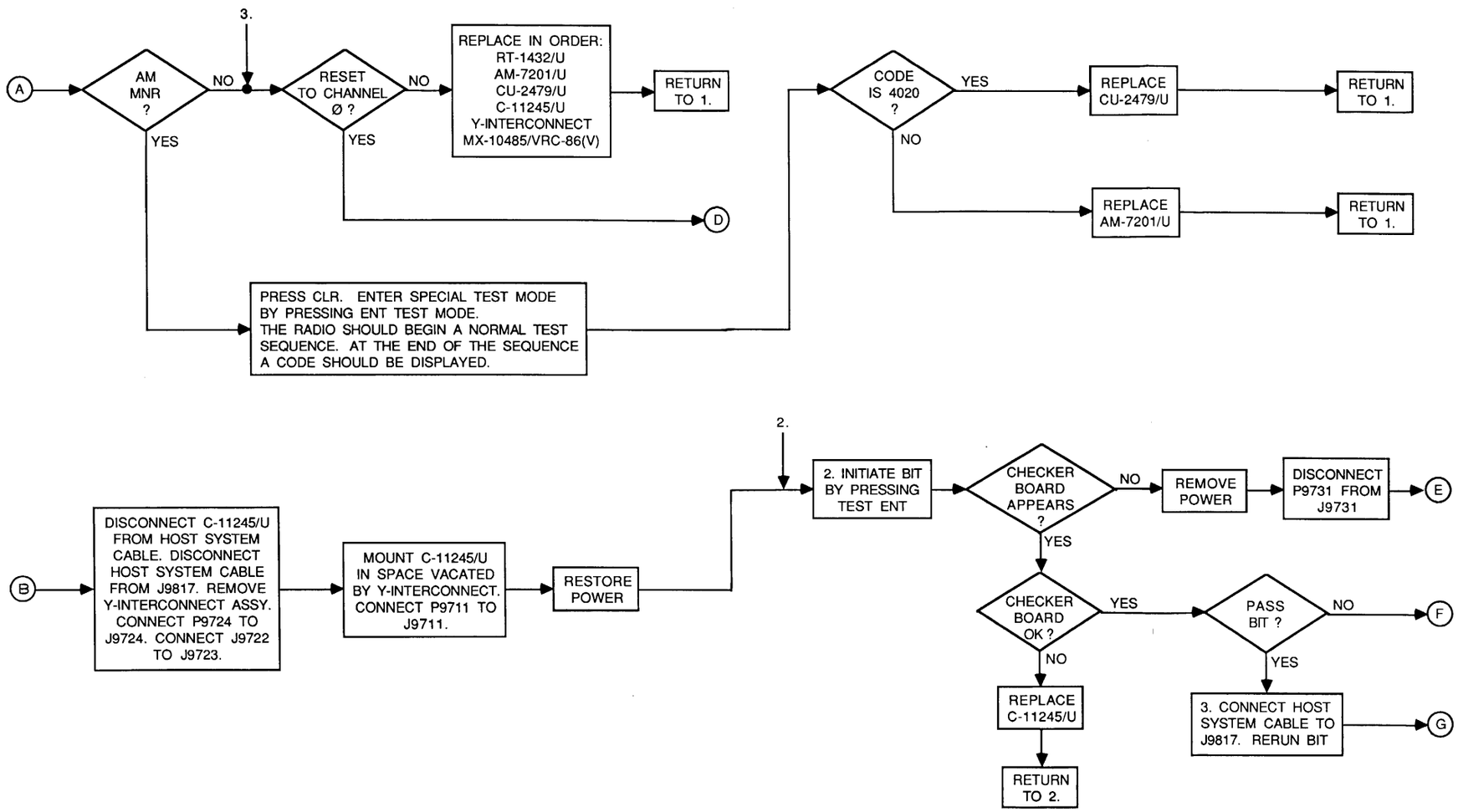


FO-10. Troubleshooting Flowchart
AN/VRC-86(V)1 and (V2) System Checkout Using BIT

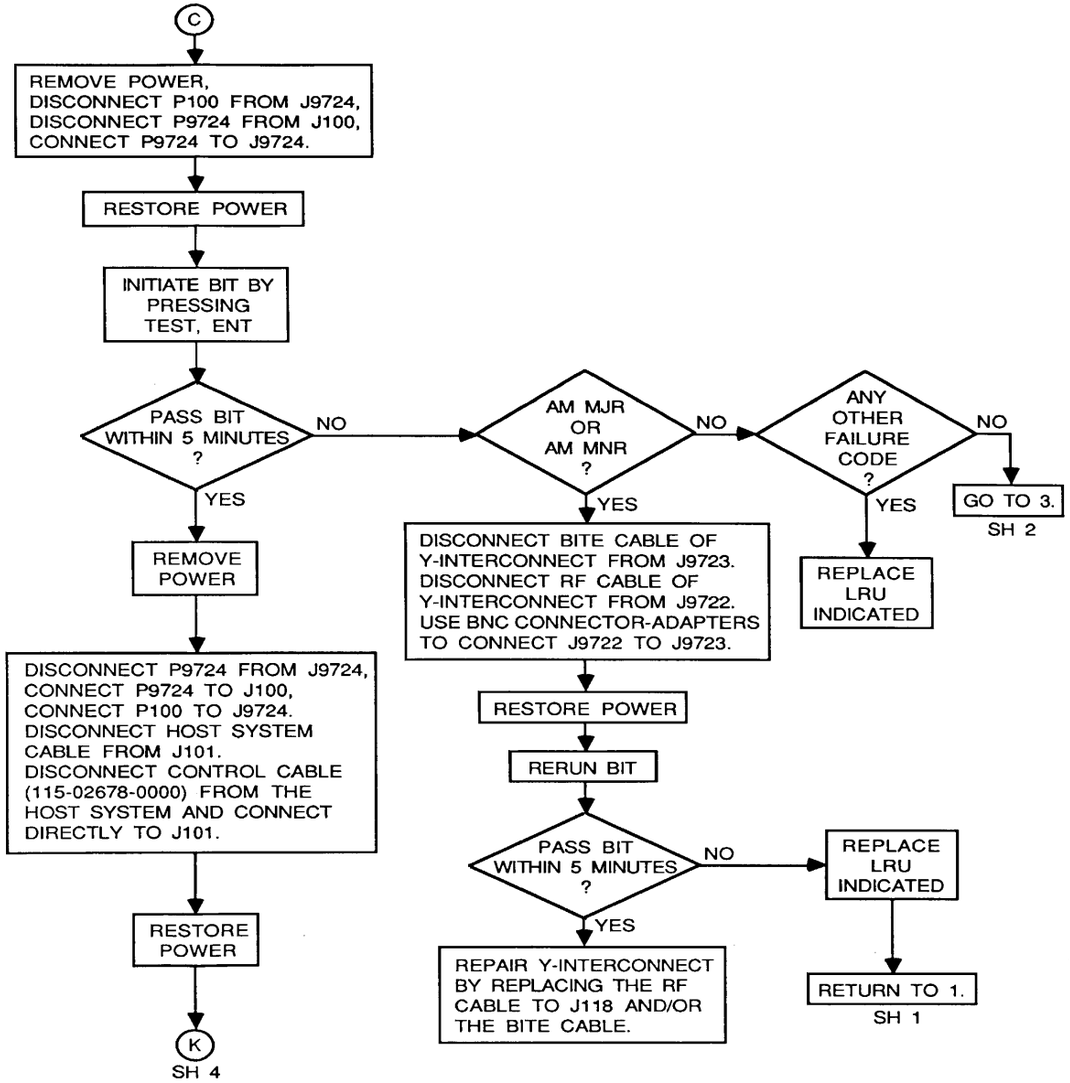
FO-21/(FO-22 blank)



FO-11. (Sheet 1 of 8). Troubleshooting Flowchart
AN/VRC-86(V)3 System Checkout Using BIT
FO-23/(FO-24 blank)

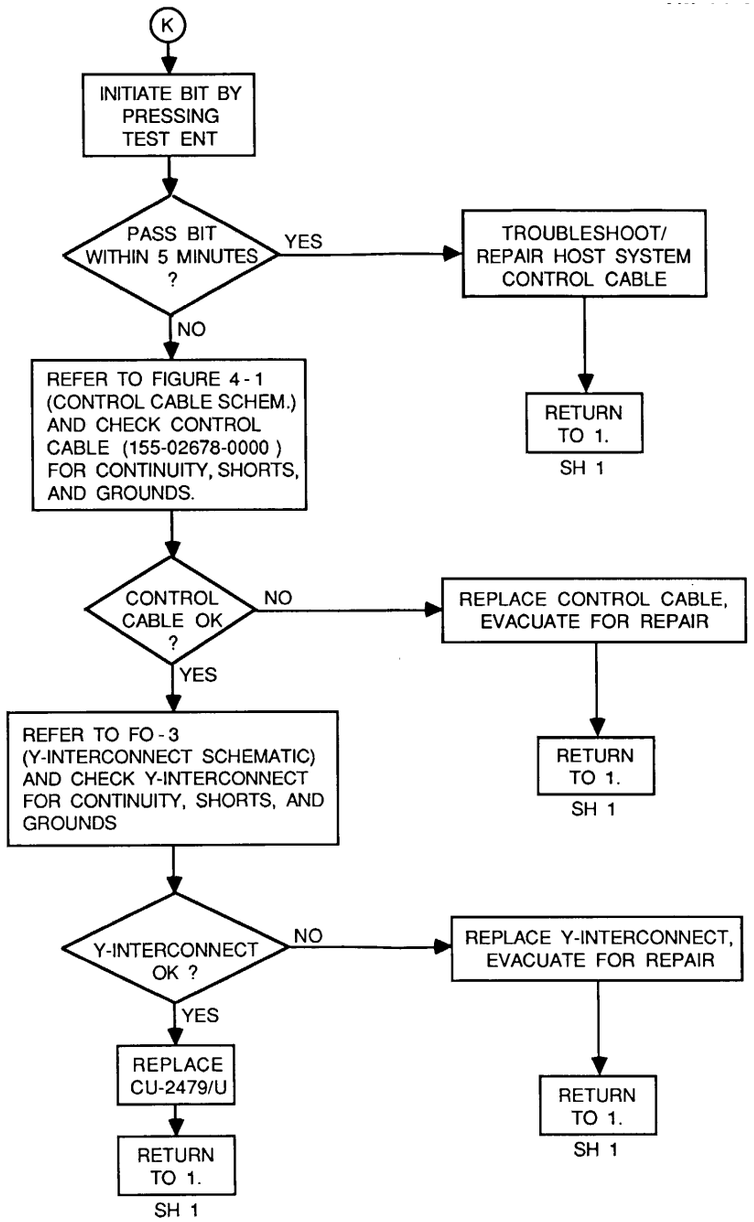


FO-11 (Sheet 2 of 8). Troubleshooting Flowchart
ANIVRC-86(V)3 System Checkout Using BIT
FO -25/ (FO-26 blank)



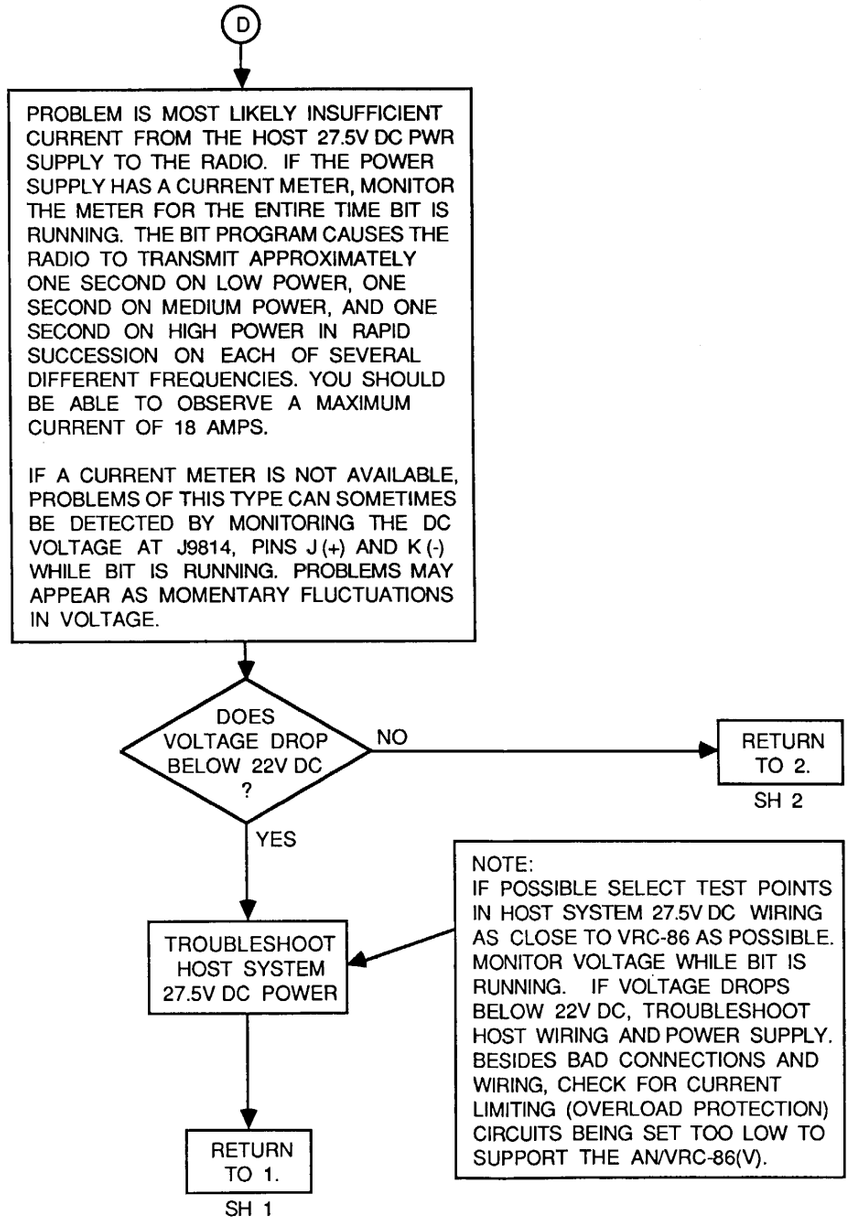
FO-11 (Sheet 3 of 8). Troubleshooting Flowchart AN/vrc-86(V) 3 System Checkout Using BIT

FO -27/ FO-28 blank)

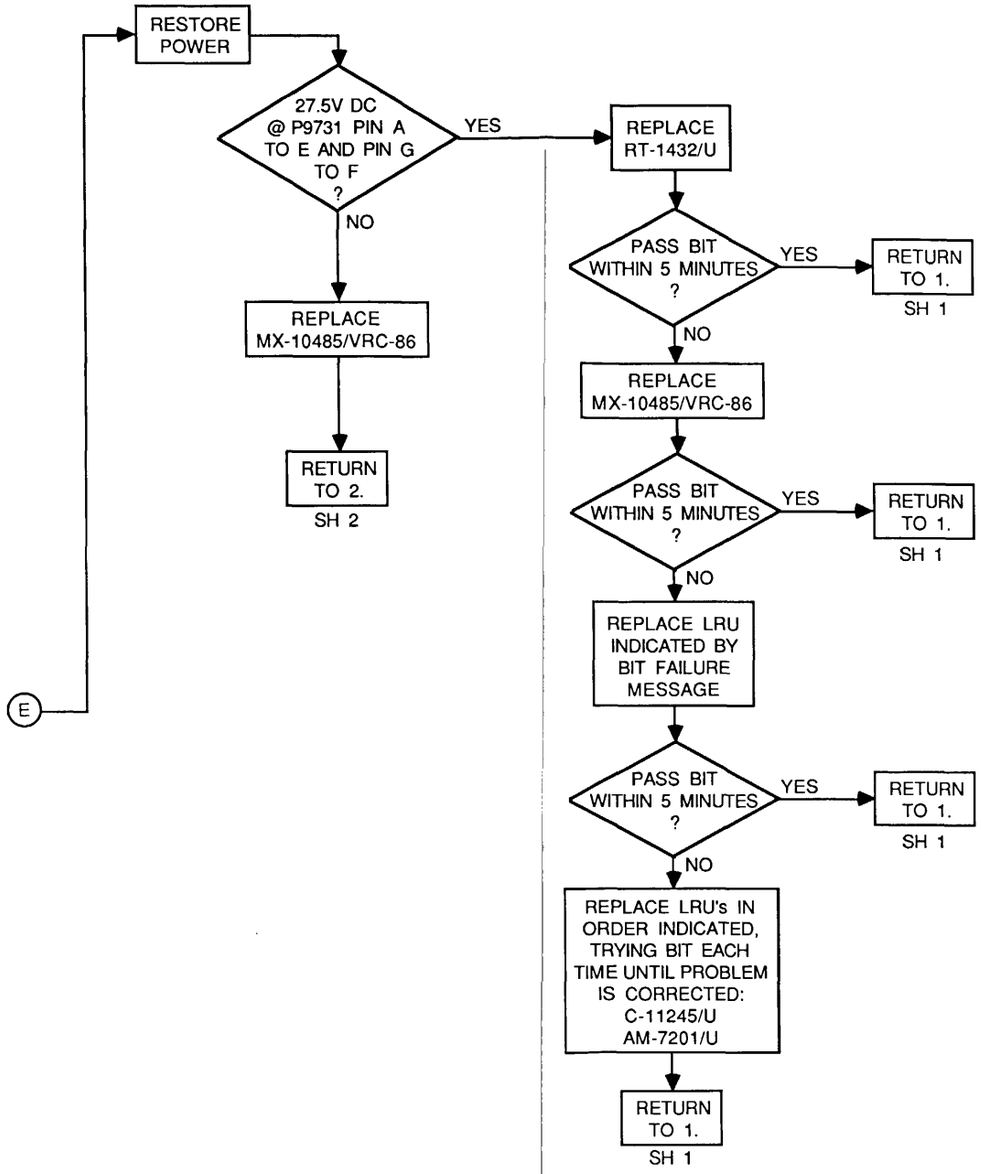


FO-11 (Sheet 4 of 8) . Trouble Flowchart AN/VRC -86 (V) 3 System Checkout Using BIT

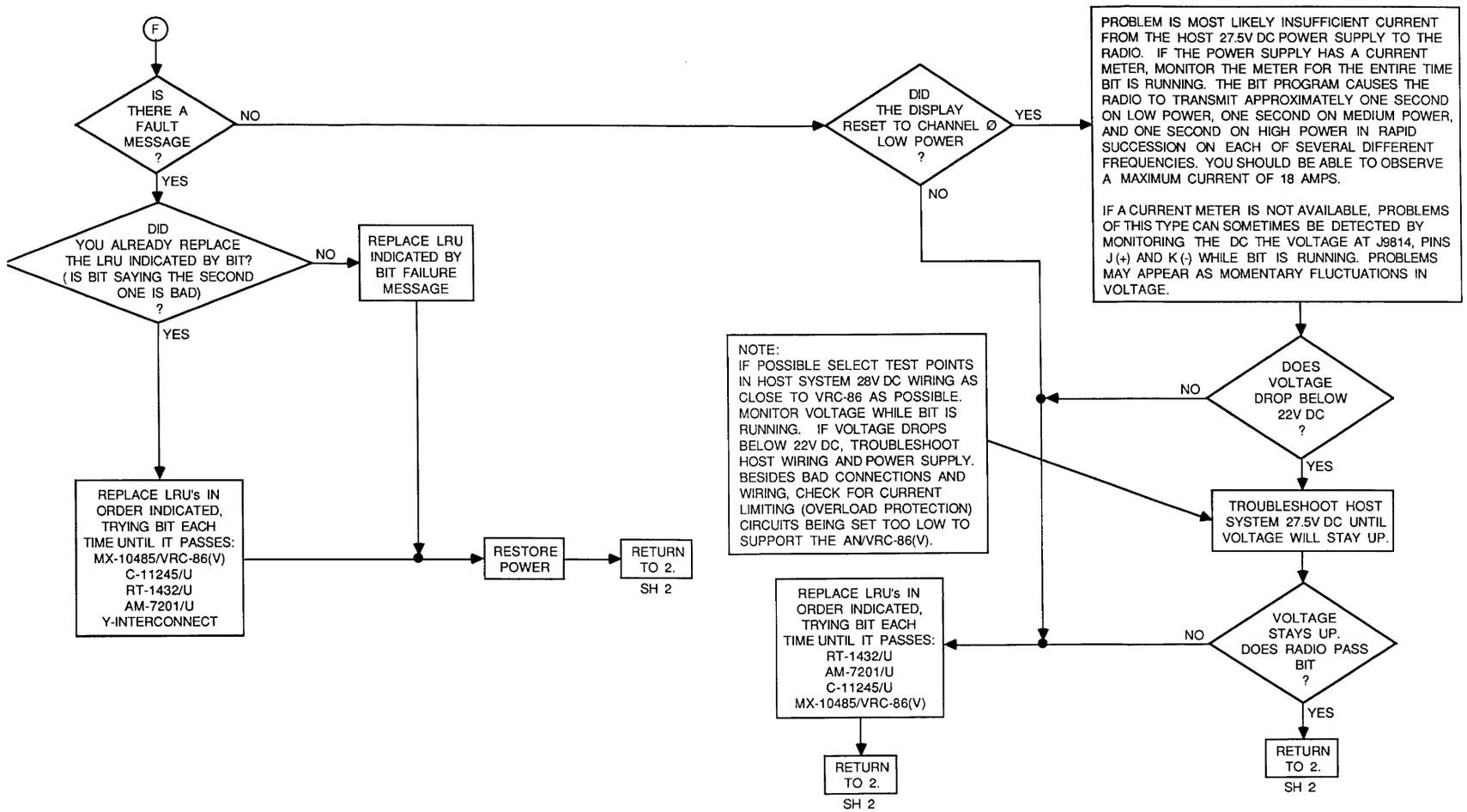
***FO-25/(FO-26* blank)**



FO-11 (Sheet 5 of 8) . Trouble Flowchart AN/VRC -86 (V) 3 System Checkout Using BIT

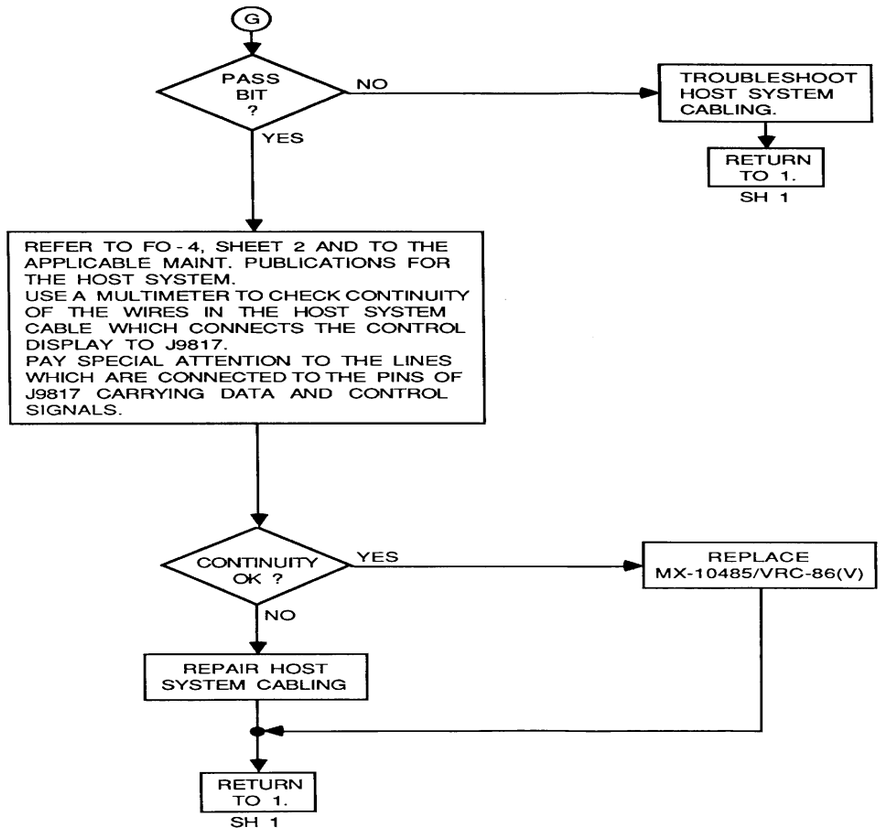


FO-11 (Sheet 6 of 8) . Trouble Flowchart AN/VRC -86 (V) 3 System Checkout Using BIT

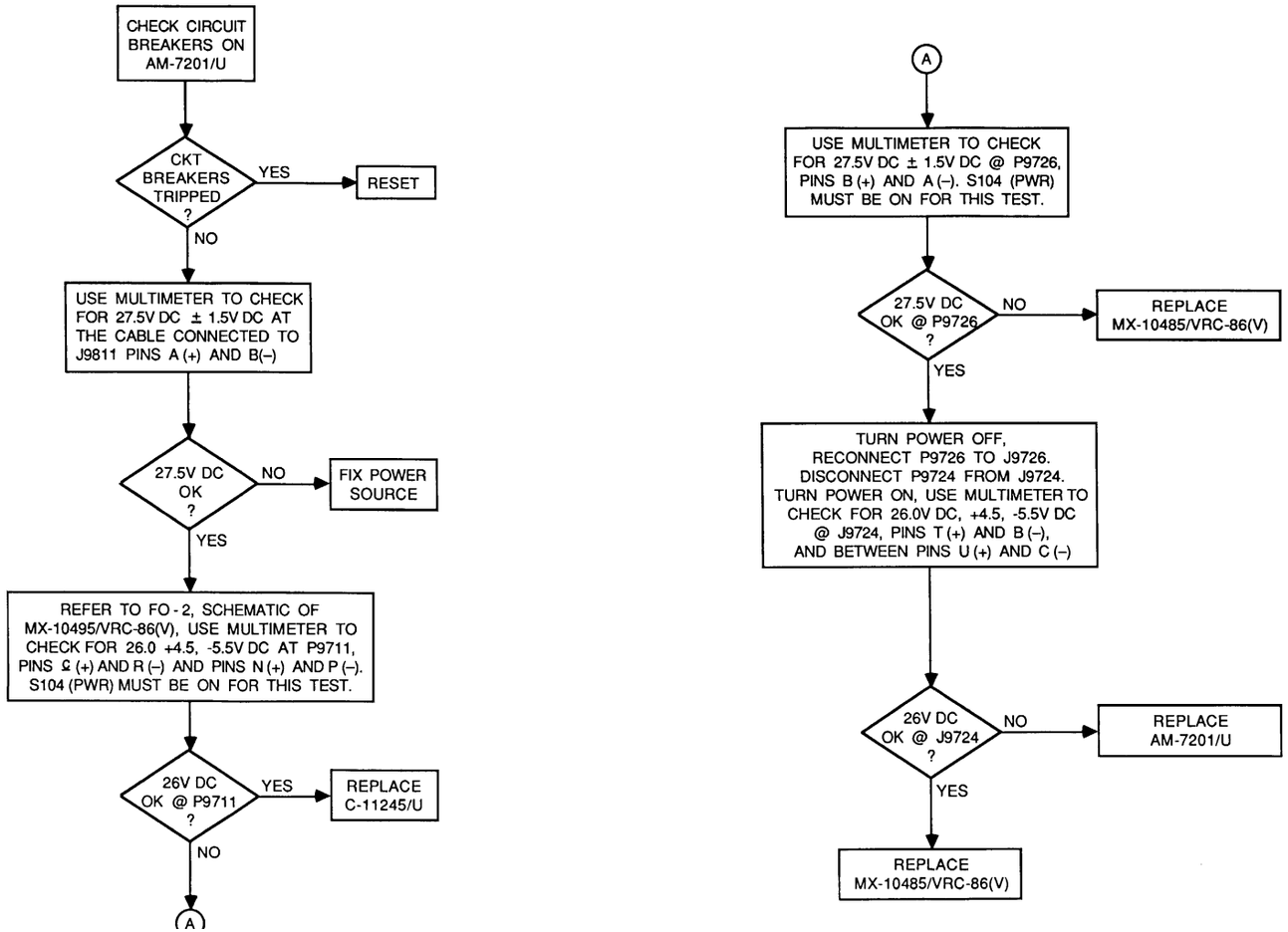


FO-11 (Sheet 7 of 8). Troubleshooting Flowchart
ANN/RC-86(V)3 System Checkout Using BIT

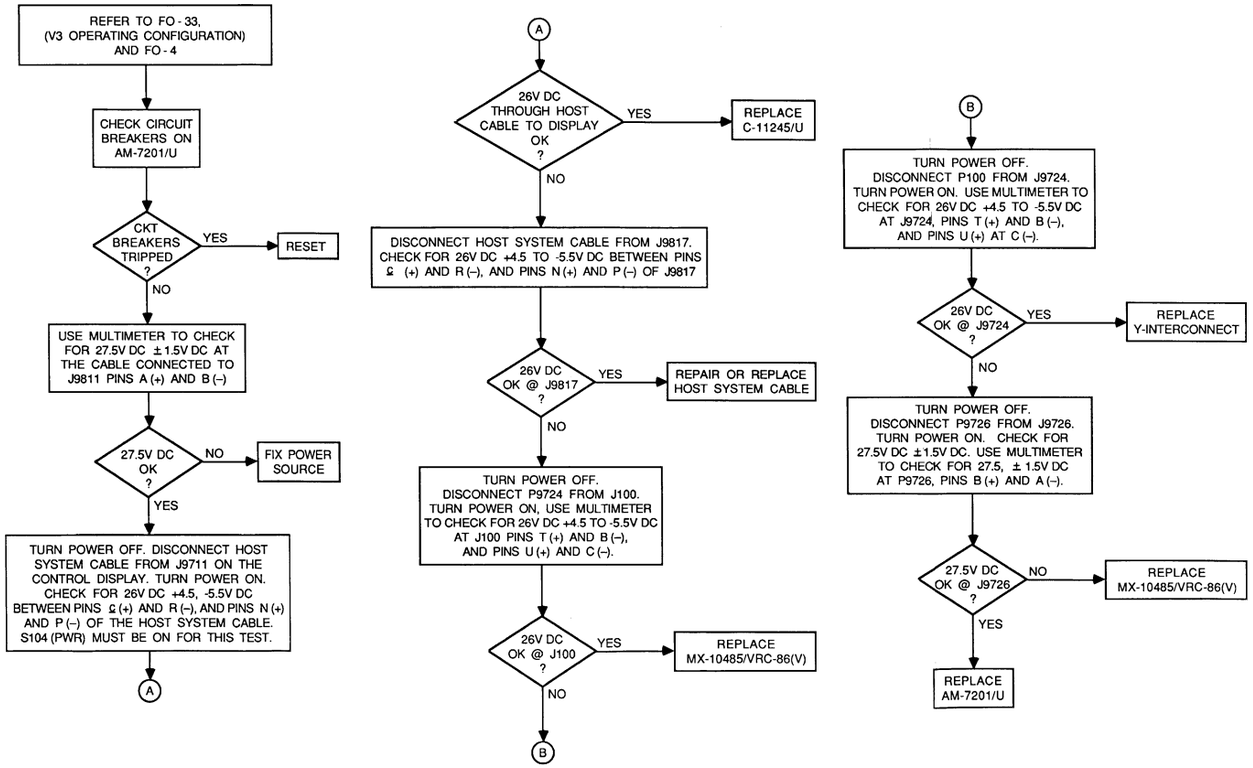
FO-35/(FO-36 blank)



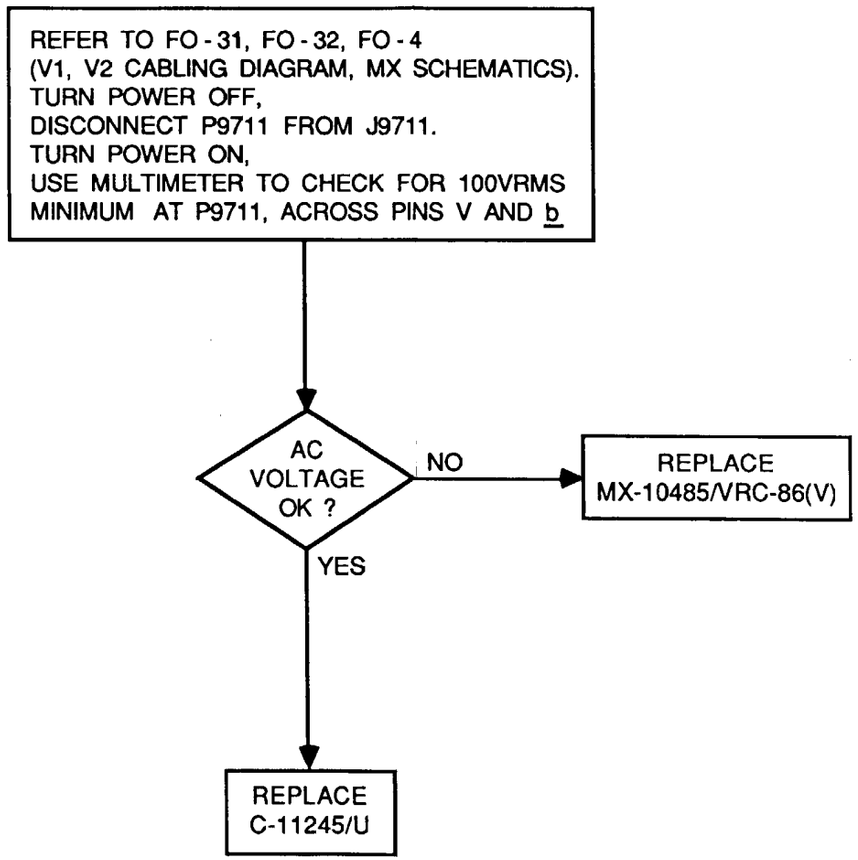
FO-11 (Sheet 8 of 8). Troubleshooting Flowchart AN/VRC-86(V)3 System Checkout Using BIT



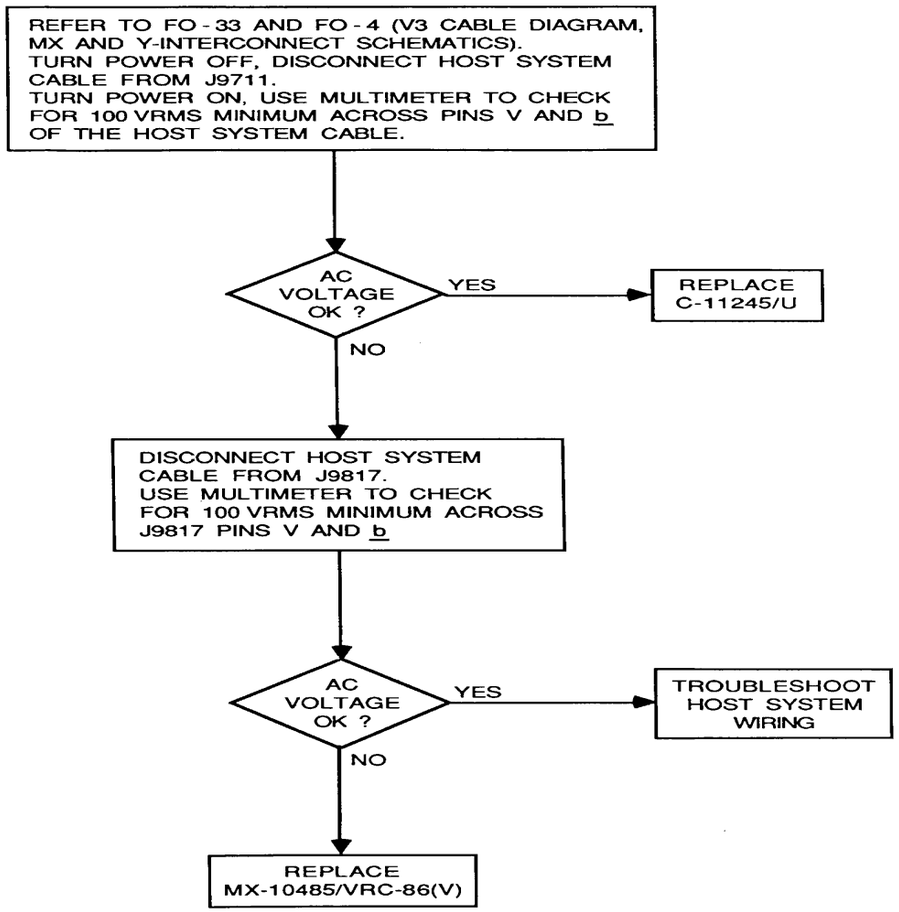
FO-12. Troubleshooting Flowchart AN/VRC-86(V)1 and (V)2 Display Blank



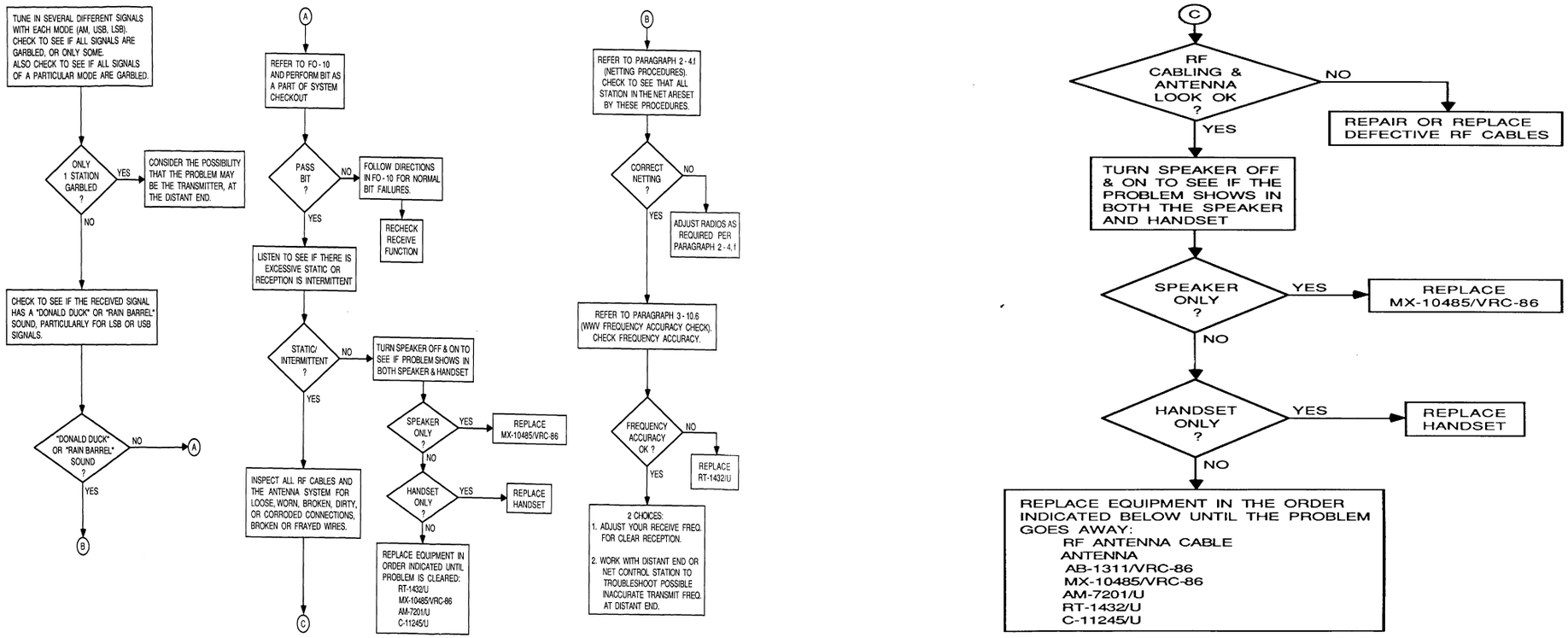
FO-13. Troubleshooting Flowchart AN/VRC-86(V)3 Display Blank



FO-14. Troubleshooting Flowchart AN/VRC-86(V)1 and (V)2 Keyboard Lighting Out

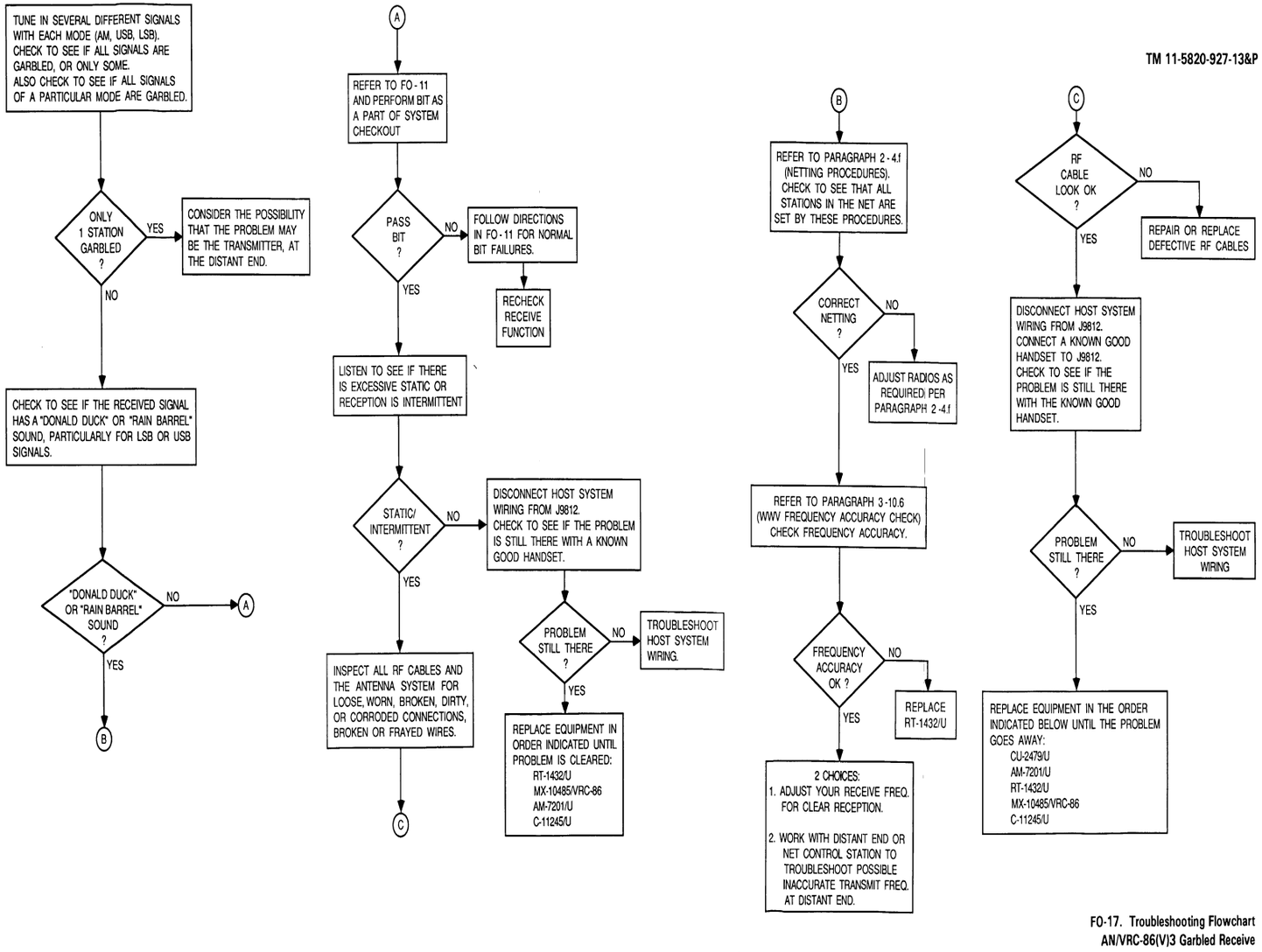


FO-15. Troubleshooting Flowchart AN/VRC-86(V)3 Keyboard Lighting Out



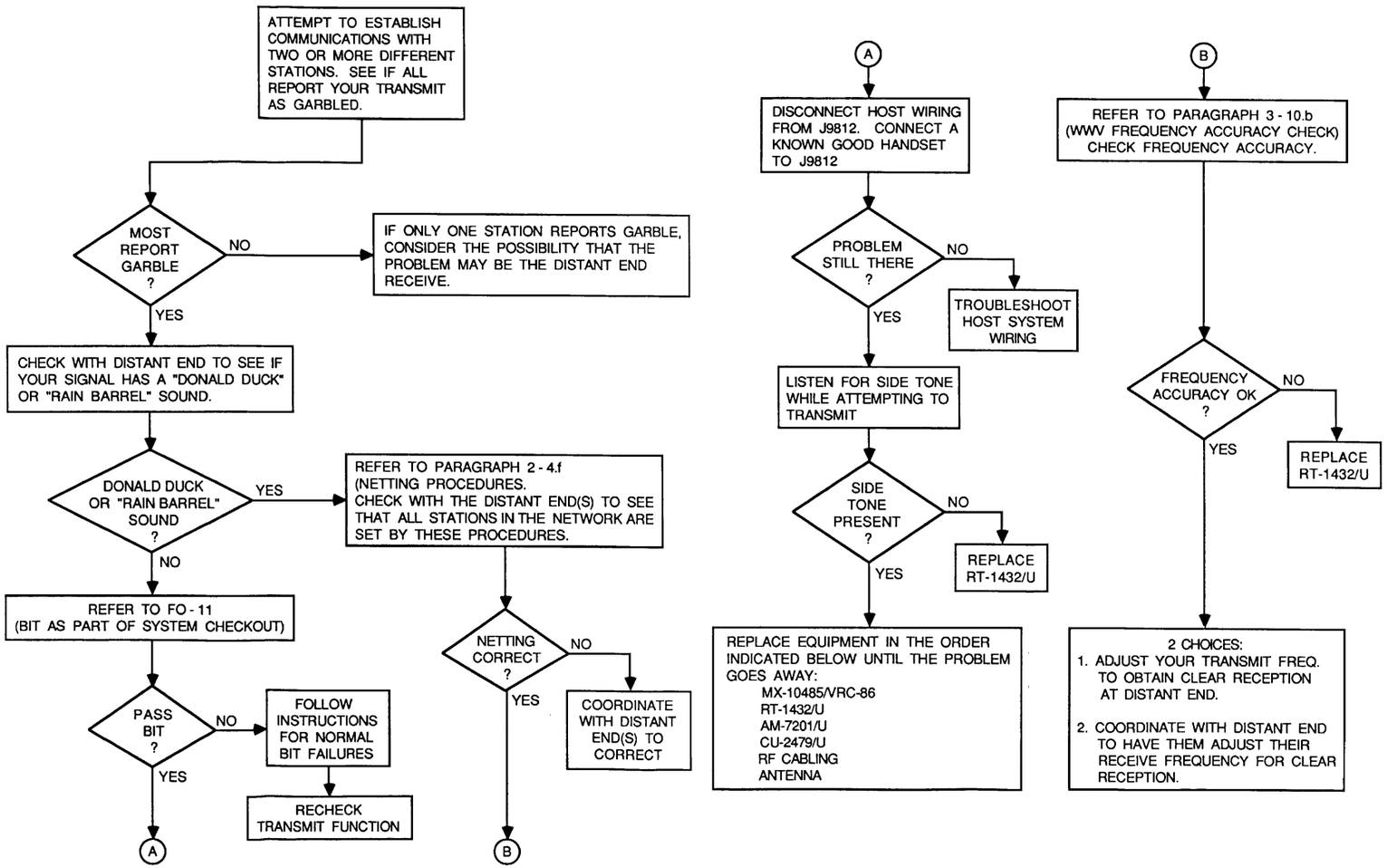
FO-16. Troubleshooting Flowchart AN/VRC-86(V)1 and (V)2 Garbled Receive

FO-47/(FO-48 blank)



FO 17. Troubleshooting Flowchart AN/VRC-86(V) 3 Garbled Receive

TM 11-5820-927-13&P



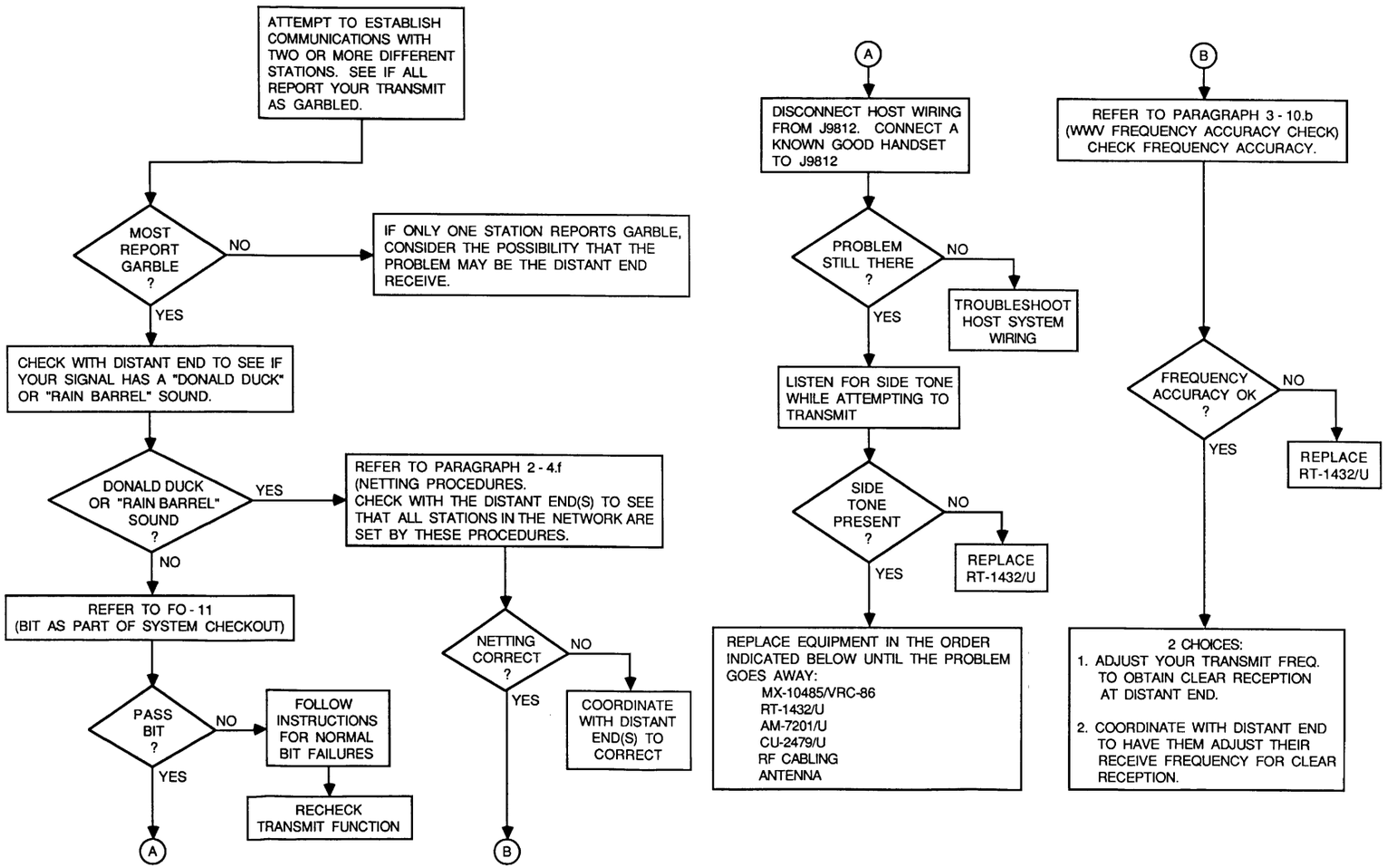
FO-19. Troubleshooting Flowchart AN/VRC-86(V)3 Garbled Transmit

FO-53/(FO-54 blank)

FO-18. Troubleshooting Flowchart AN/ VRC-86 (V) 1 and (V) 2 Garbled Transit

FO-51/(FO -52 blank)

TM 11-5820-927-13&P

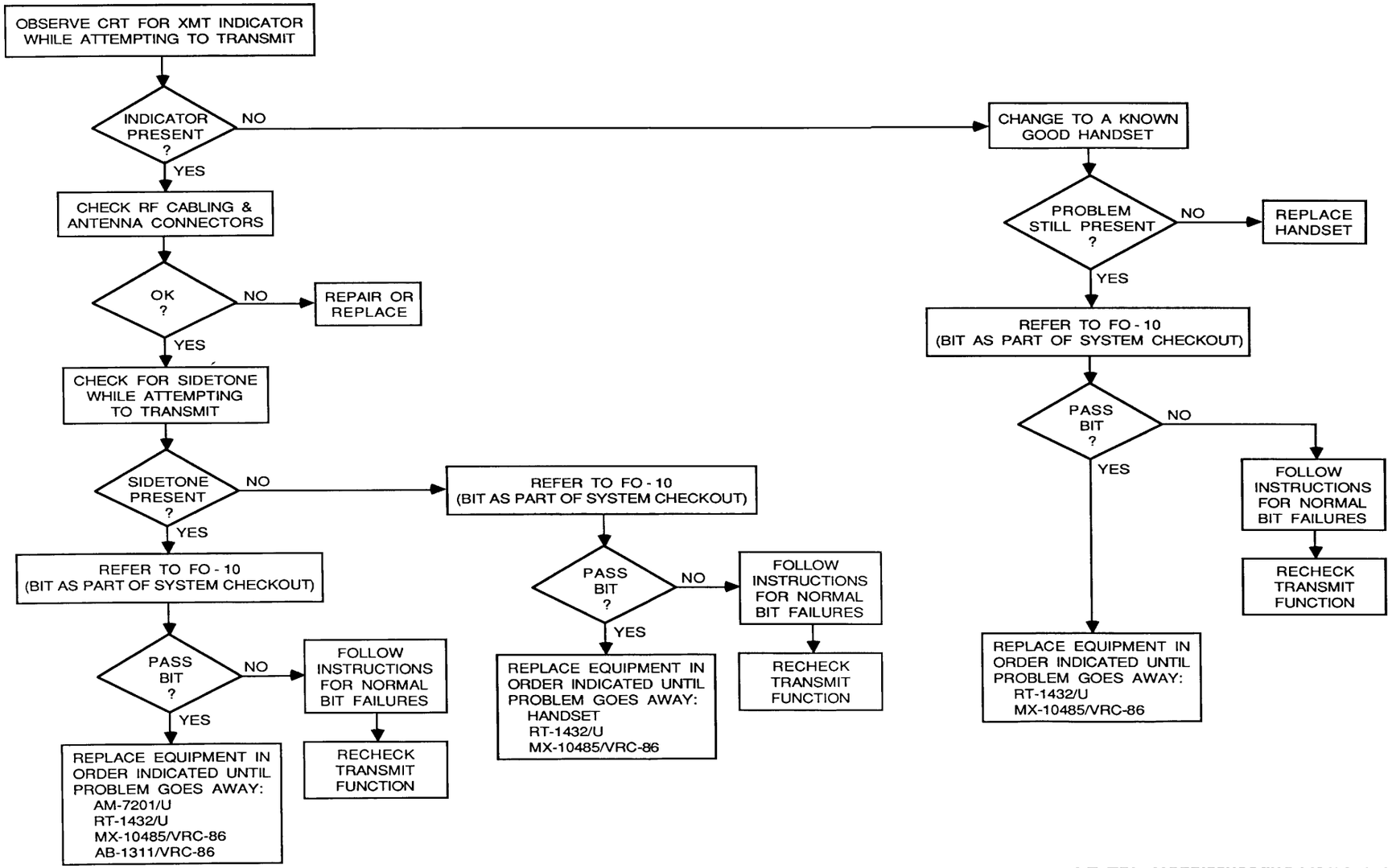


FO-19. Troubleshooting Flowchart AN/VRC-86(V)3 Garbled Transmit

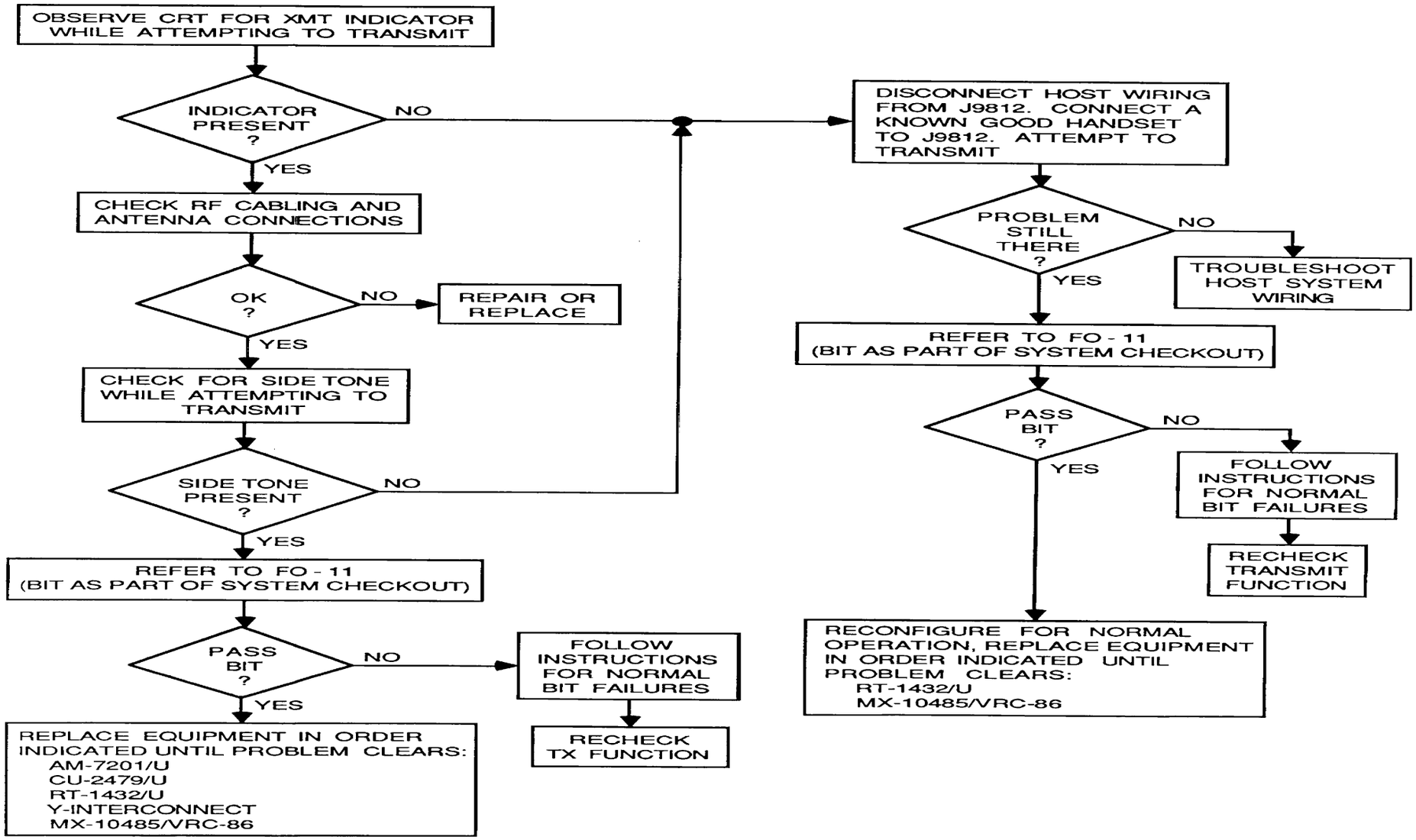
FO-53/(FO-54 blank)

FO-19. Troubleshooting Flowchart AN/ VRC-86 (V) 1 and (V) 2 Garbled Transit

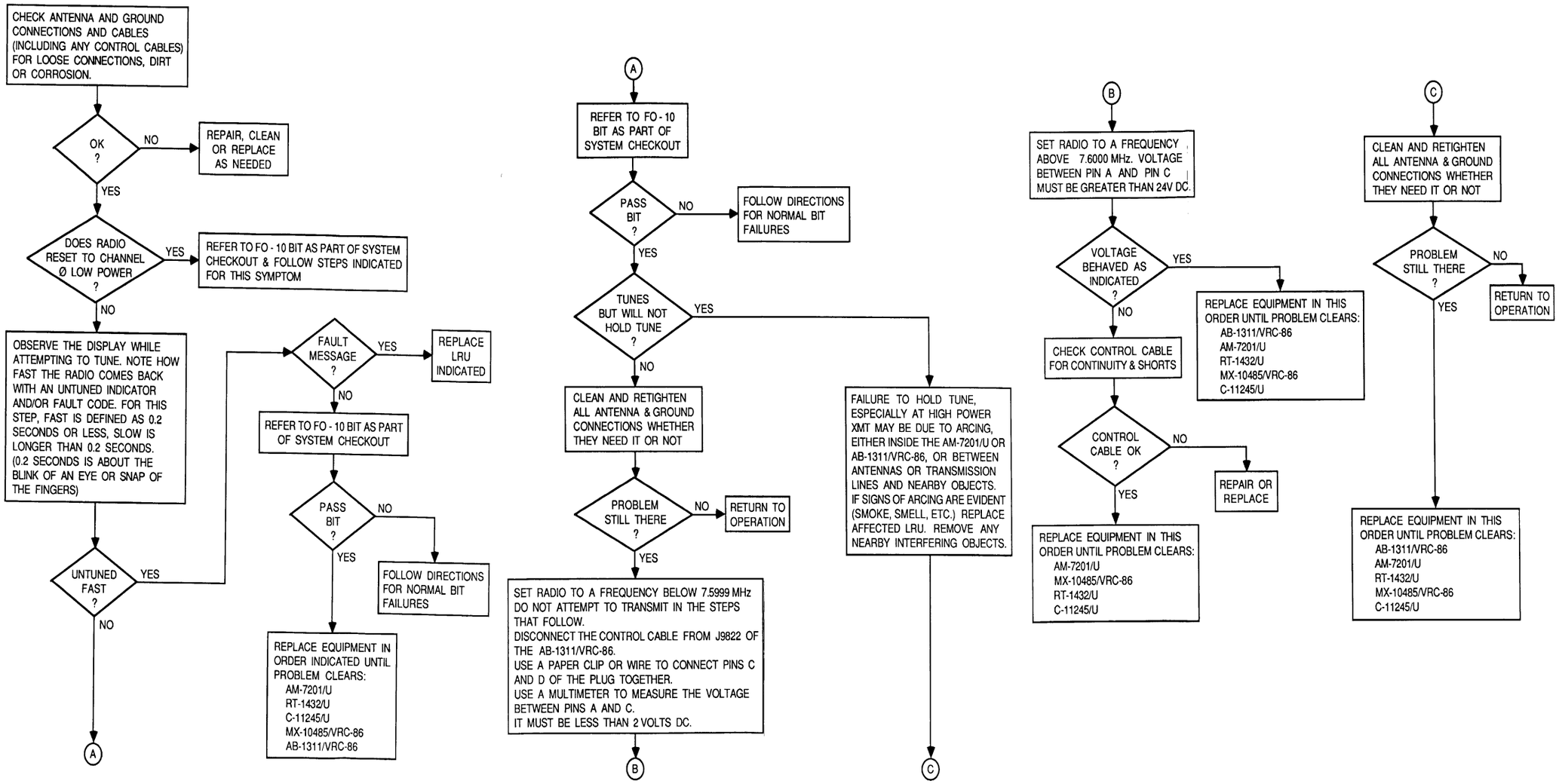
FO-53/ (FO-54 blank)



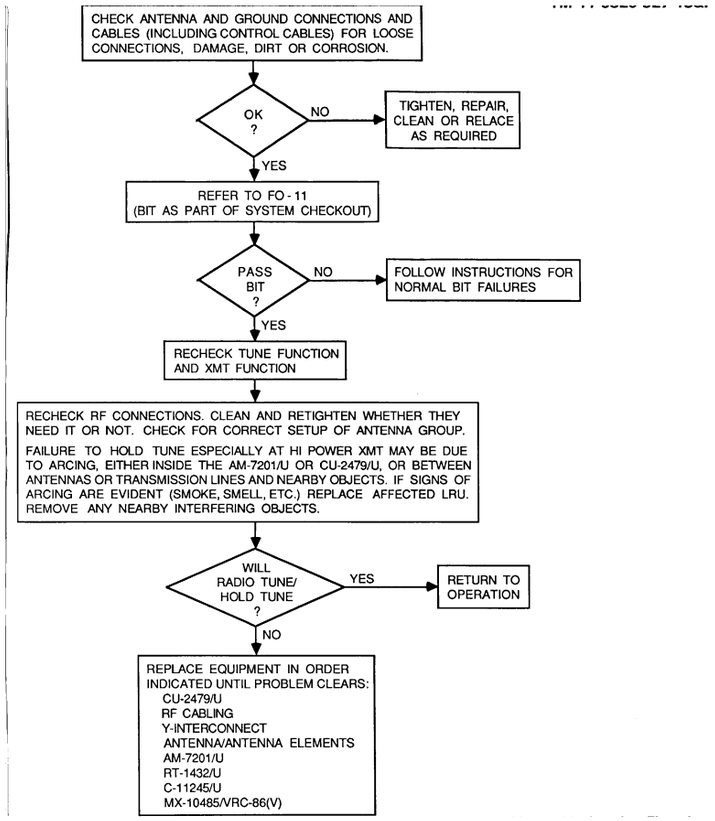
FO-20. Troubleshooting Flowchart AN/ VRC-86 (V) 1 and (V) 2 No Transmit



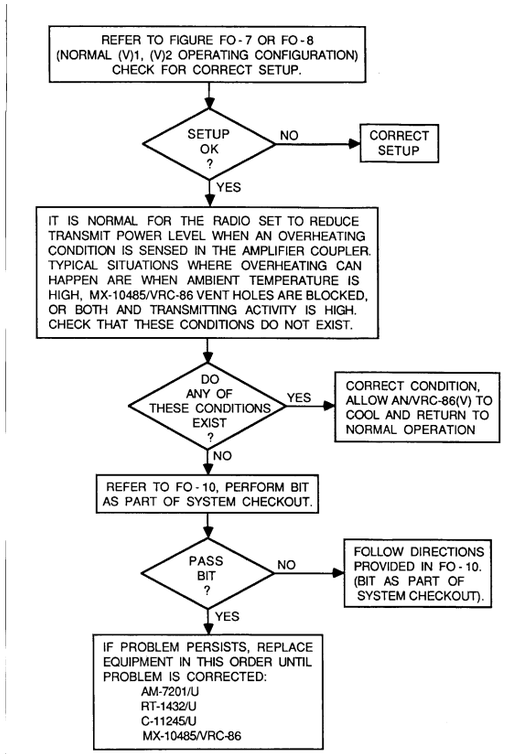
FO-21. Troubleshooting Flowchart AN/ VRC-86(V)3 No Transmit



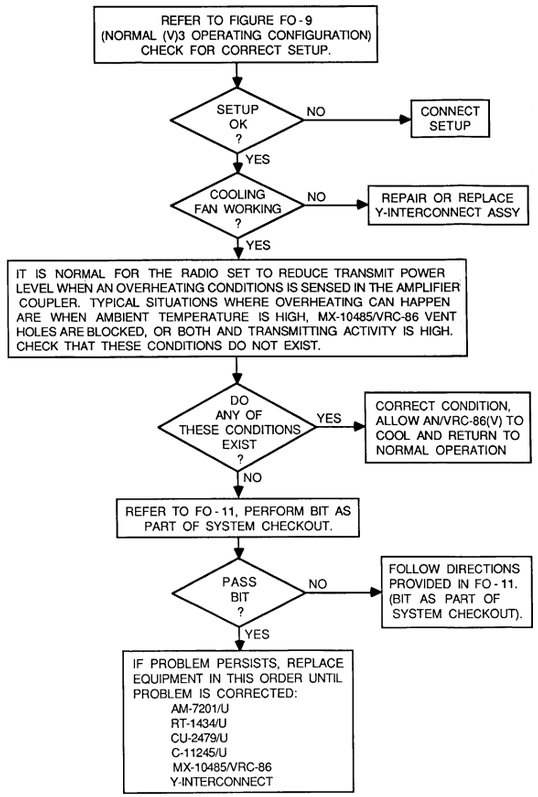
FO-22. Troubleshooting Flowchart AN/ VRC-86 (V) 1 and (V) 2 Will Not Tune or Hold Tune



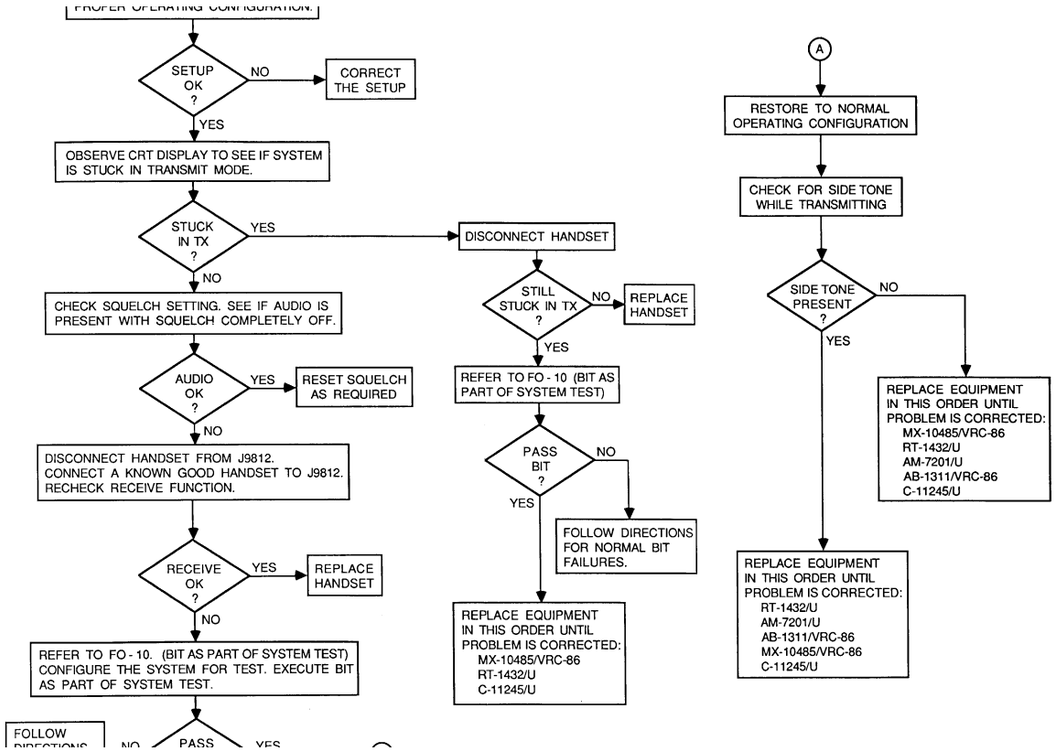
FO-23 Troubleshooting Flowchart AN/VRC-86(V)3 Will Not Tune or Hold Tune



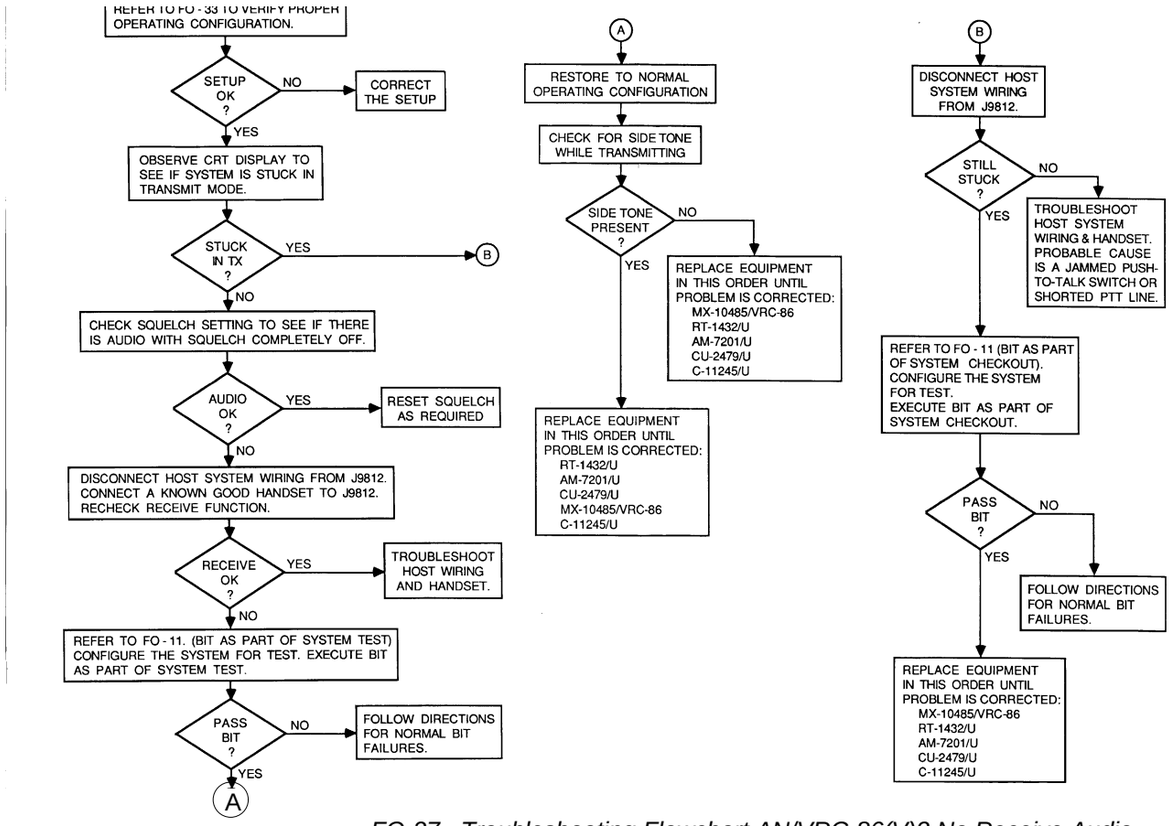
FO-24. Troubleshooting Flowchart AN/VRC-86(V)1 and (V)2 Transmit Power Reduces During Operation



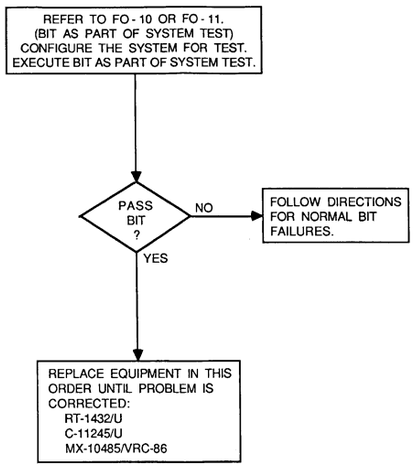
FO-25. Troubleshooting Flowchart AN/VRC-86(V)3 Transmit Power Reduces During Operation



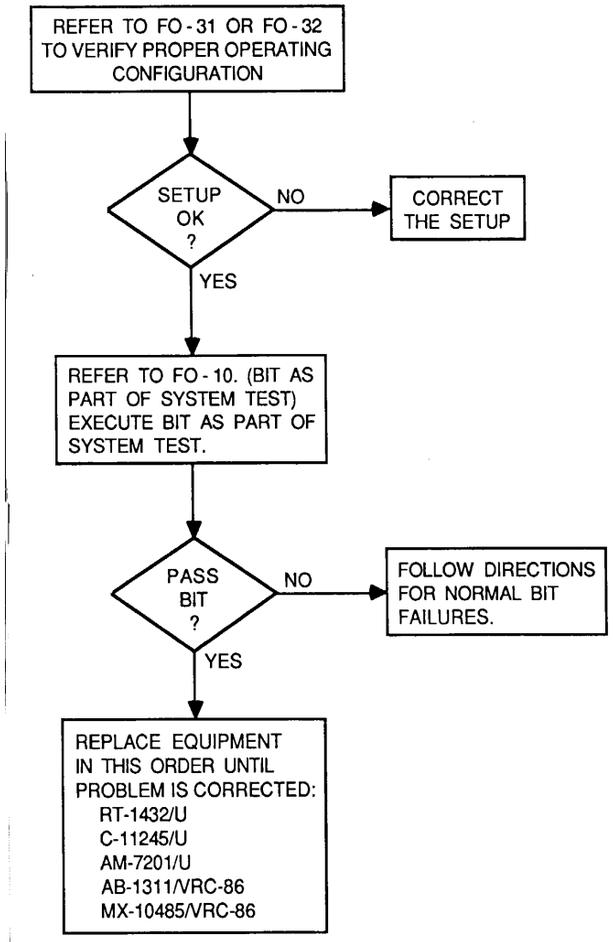
FO-26. Troubleshooting Flowchart AN/VRC-86(V)1 and (V)2 No Receive Audio



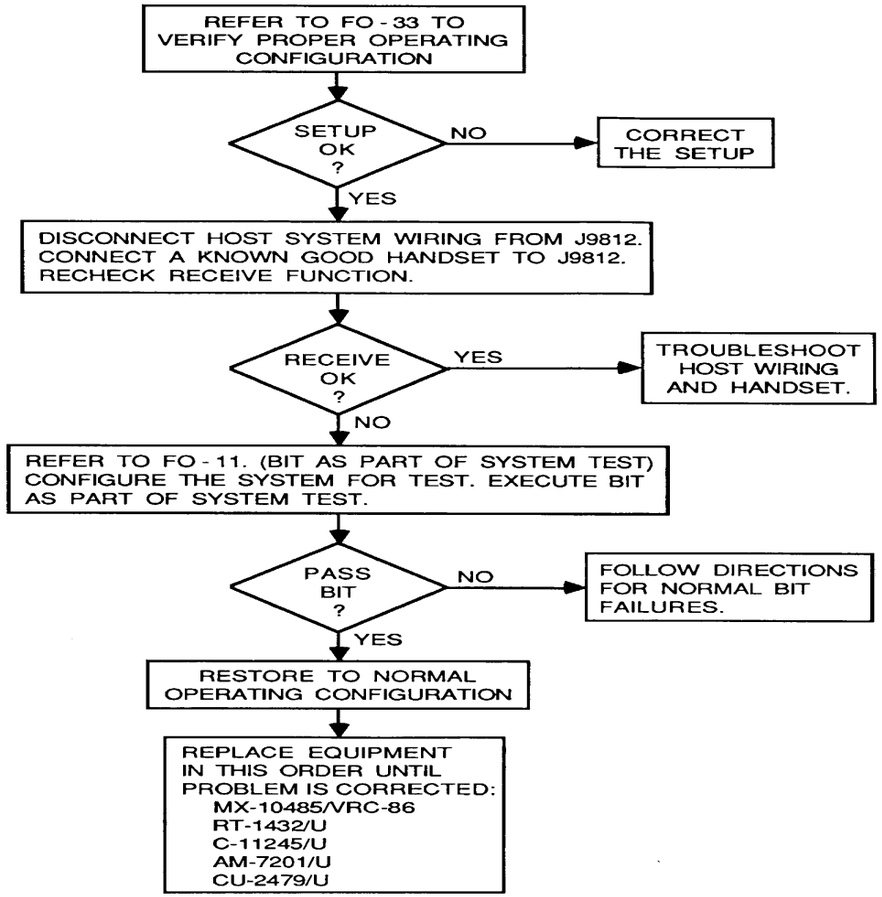
FO-27. Troubleshooting Flowchart AN/VRC-86(V)3 No Receive Audio



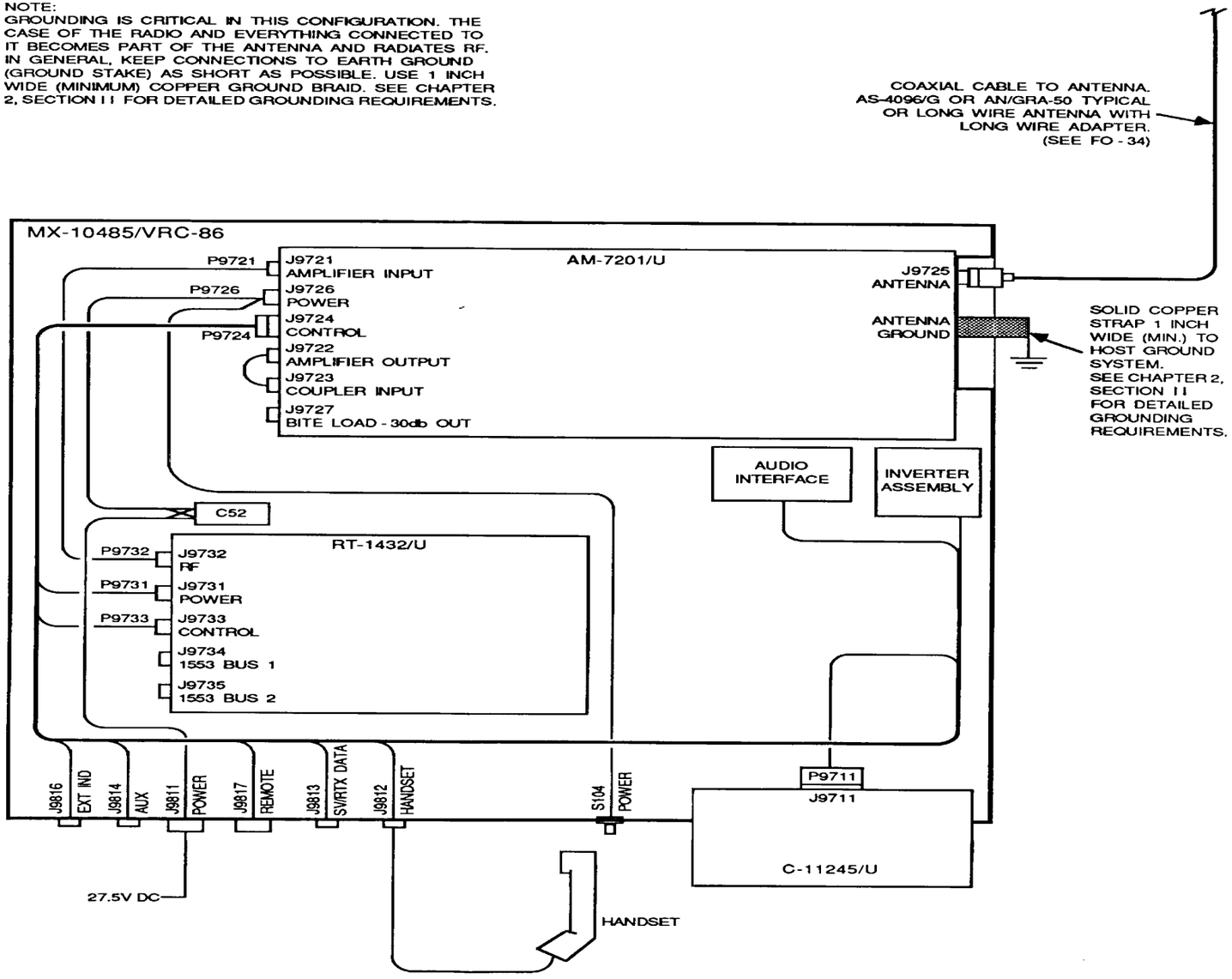
FO-28. Troubleshooting Flowchart Radio Set Won't Program or Hold Program



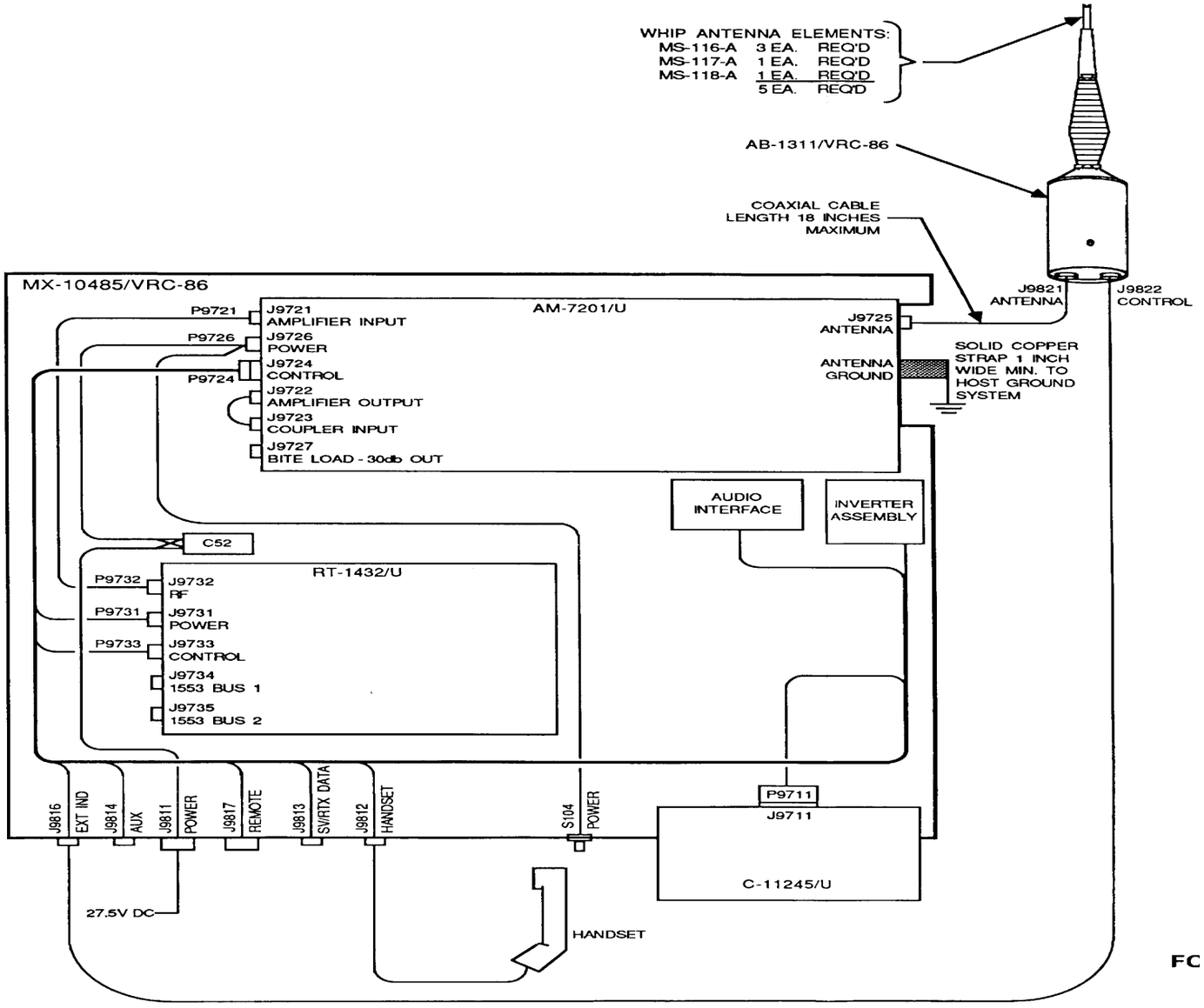
FO-29. Troubleshooting Flowchart AN/VRC-86(V)1 and (V)2 Background Audio Present, No Receive Signal



FO-30. Troubleshooting Flowchart AN/VRC-86(V)3 Background Audio Present, No Receive Signal

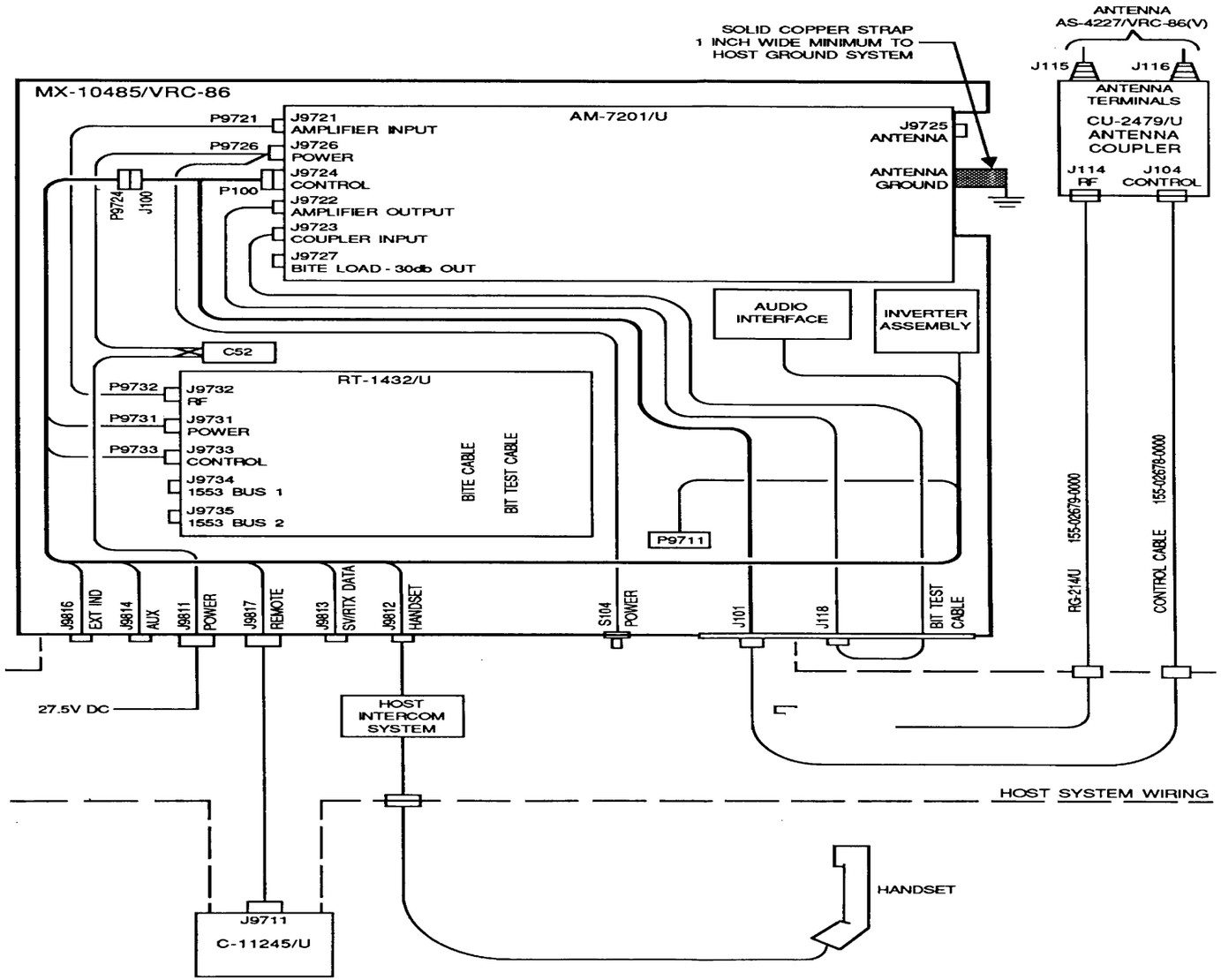


FO-31. Cabling Diagram, AN/VRC-86(V)1 Configuration

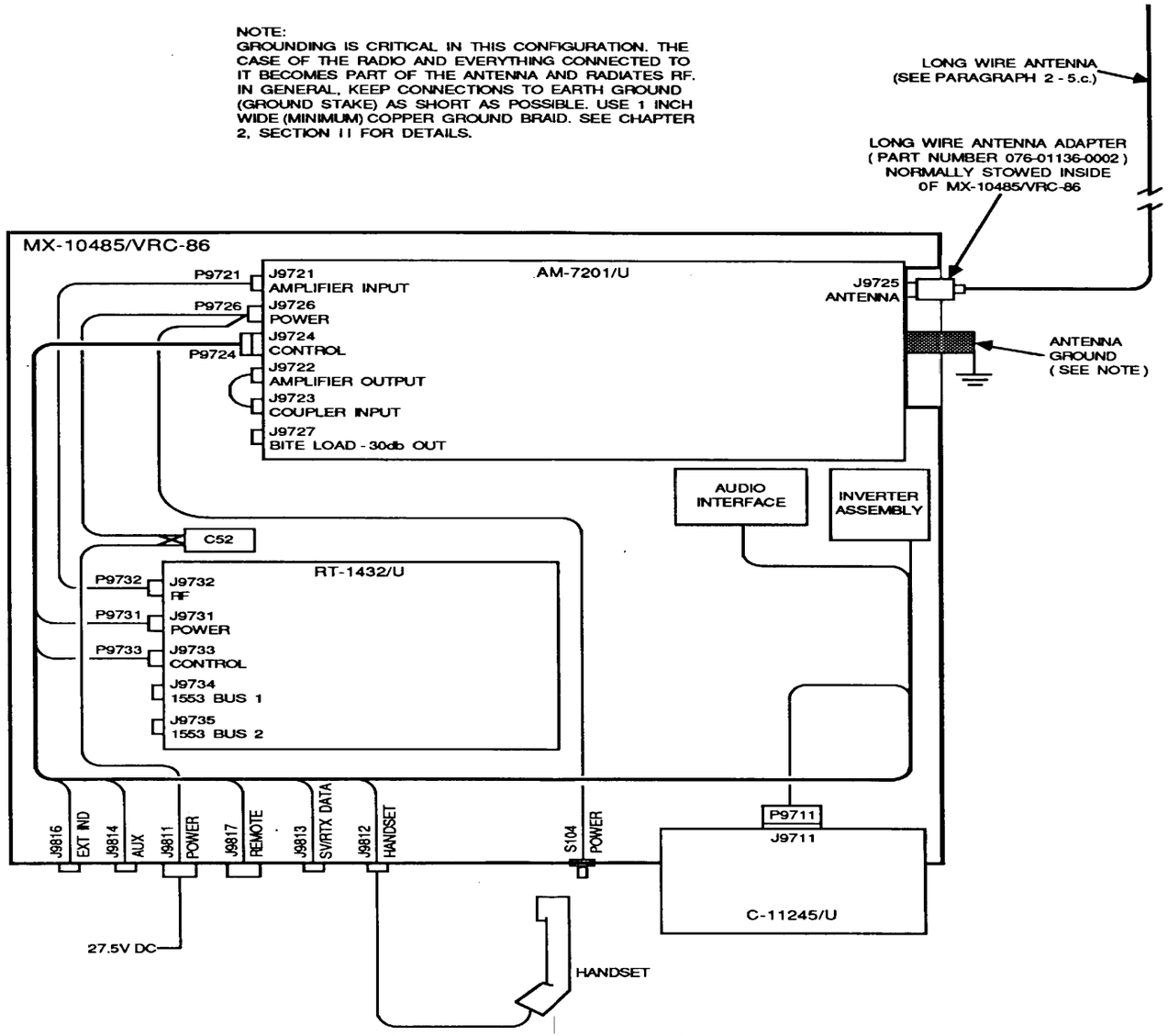


FO-32. Cabling Diagram, AN/VRC-86(V)2 Configuration

FO-79/(FO-80 blank)



FO-33. Cabling Diagram, AN/VRC-86(V)3 Configuration



FO-34. Cabling Diagram, Long Wire Operation

TEAR ALONG PERFORATED LINE

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 11-5825-270-10	23 Jul 81	Radio Frequency R-2176/FRN

BE EXACT. . .PIN-POINT WHERE IT IS

PAGE NO.	PARA-GRAPH	FIGURE NO	TABLE NO.

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

SIGN HERE:

DA FORM 1 JUL 79 2028-2

PREVIOUS EDITIONS ARE OBSOLETE.

P.S.—IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

By Order of the Secretary of the Army:

GORDON R. SULLIVAN
General, United States Army
Chief of Staff

Official:

MILTON H. HAMILTON
Administrative Assistant to the
Secretary of the Army
02059

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US GOVERNMENT PRINTING OFFICE: 1992-0-612-084 (60334)

CONVERSION TO METRIC MEASURES

SYMBOL	GIVEN	MULTIPLY BY	TO OBTAIN	SYMBOL
		LENGTH		
in	inches	2.54	centimeters	cm
ft	feet	30.48	centimeters	cm
yd	yards	0.9144	meters	m
mi	miles	1.609	kilometers	km
NM	nautical miles	1.853	kilometers	km
		AREA		
in^2	square inches	6.452	sq centimeters	cm^2
ft^2	square feet	0.0929	sq meters	m^2
yd^2	square yards	0.8361	sq meters	m^2
mi^2	square miles	2.590	sq kilometers	km^2
		MASS (WEIGHT)		
oz	ounces	28.35	grams	g
lb	pounds	0.4536	kilograms	kg
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL
pt	pints	0.47	liters	L
qt	quarts	0.95	liters	L
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.0283	cubic meters	m^3
yd^3	cubic yards	0.7646	cubic meters	m^3
		TEMPERATURE		
°F	Fahrenheit temp.	5/9 (°F -32)	Celsius temp.	°C

PIN: 068335-000