PUBLICATION NUMBER: 10515-0033-4200
JUNE 1996
Rev. –

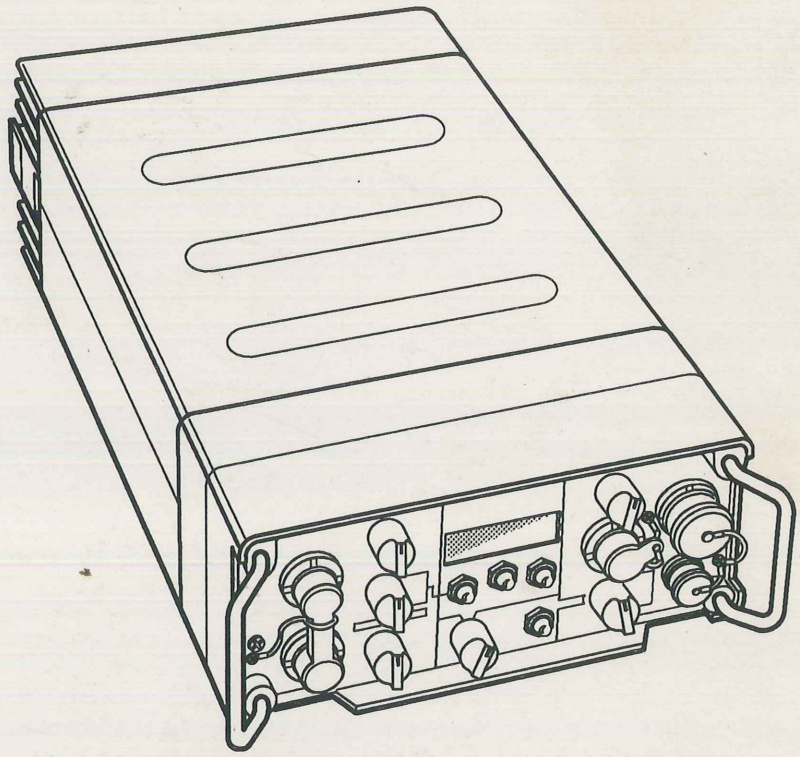
HARRIS

RF COMMUNICATIONS

# AN/PRC-117D(V)2(C)

## FREQUENCY HOPPING VHF/UHF FM/AM MANPACK TRANSCEIVER WITH INTEGRATED COMSEC

## OPERATOR'S MANUAL



HARRIS

## LIMITED ONE YEAR WARRANTY
## HARRIS CORPORATION (RF COMMUNICATIONS DIVISION)

FROM HARRIS TO YOU – This warranty is extended to the original buyer and applies to all Harris Corporation, RF Communications Division equipment purchased and employed for the service normally intended, except those products specifically excluded.

WHAT WE WILL DO – If your Harris Corporation, RF Communications Division equipment purchased from us for use outside the United States fails in normal use because of a defect in workmanship or materials within one year from the date of shipment, we will repair or replace (at our option) the equipment or part without charge to you, at our factory. If the product was purchased for use in the United States, we will repair or replace (at our option) the equipment or part without charge to you at our Authorized Repair Center or factory.

WHAT YOU MUST DO – You must notify us promptly of a defect within one year from date of shipment. Assuming that Harris concurs that the complaint is valid, and is unable to correct the problem without having the equipment shipped to Harris:

- Customers with equipment purchased for use outside the United States will be supplied with information for the return of the defective equipment or part to our factory in Rochester, NY, U.S.A., for repair or replacement. You must prepay all transportation, insurance, duty and customs charges. We will pay for return to you of the repaired/replaced equipment or part, C.I.F. destination; you must pay any duty, taxes or customs charges.
- Customers with equipment purchased for use in the United States must obtain a Return Authorization Number, properly pack, insure, prepay the shipping charges and ship the defective equipment or part to our factory or to the Authorized Warranty Repair Center indicated by us.

CCI Manufacturing
P.O. 10764
Rochester, NY 14610-0764
ATTN: COMSEC Custodian
COMSEC Account # 871581

Harris will repair or replace the defective equipment or part and pay for its return to you, provided the repair or replacement is due to a cause covered by this warranty.

WHAT IS NOT COVERED – We regret that we cannot be responsible for:

- Defects or failures caused by buyer or user abuse or misuse.
- Defects or failures caused by unauthorized attempts to repair or alter the equipment in any way.
- Consequential damages incurred by a buyer or user from any cause whatsoever, including, but not limited to transportation, non-Harris repair or service costs, downtime costs, costs for substituting equipment or loss of anticipated profits or revenue.
- The performance of the equipment when used in combination with equipment not purchased from Harris.
- HARRIS MAKES NO OTHER WARRANTIES BEYOND THE EXPRESS WARRANTY AS CONTAINED HEREIN. ALL EXPRESS OR IMPLIED WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE OR MERCHANTABILITY ARE EXCLUDED.

SERVICE WARRANTY – Any repair service performed by Harris under this limited warranty is warranted to be free from defects in material or workmanship for sixty days from date of repair. All terms and exclusions of this limited warranty apply to the service warranty.

IMPORTANT – Customers who purchased equipment for use in the United States must obtain a Return Authorization Number before shipping the defective equipment to us. Failure to obtain a Return Authorization Number before shipment may result in a delay in the repair/replacement and return of your equipment.

IF YOU HAVE ANY QUESTIONS – Concerning this warranty or equipment sales or services, please contact our Customer Service Department.

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# FREQUENCY HOPPING VHF/UHF FM/AM MANPACK TRANSCEIVER WITH INTEGRATED COMSEC

## OPERATOR'S MANUAL



HARRIS

**HARRIS CORPORATION** RF COMMUNICATIONS DIVISION
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HOME PAGE: http://www.harris.com/rfc/

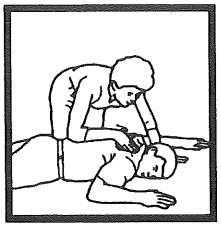
# When an Adult Stops Breathing

**WARNING**

DO NOT attempt to perform the rescue breathing techniques provided on this page, unless certified. Performance of these techniques by uncertified personnel could result in further injury or death to the victim.

### 1 Does the Person Respond?

- Tap or gently shake victim.
- Shout, "Are you OK?"

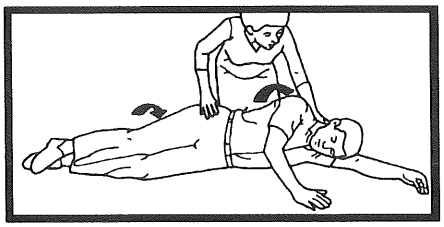


### 2 Shout, "Help!"

- Call people who can phone for help.

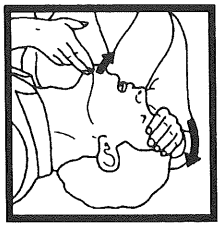
### 3 Roll Person Onto Back

- Roll victim toward you by pulling slowly.



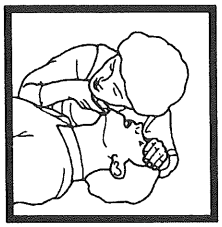
### 4 Open Airway

- Tilt head back and lift chin.



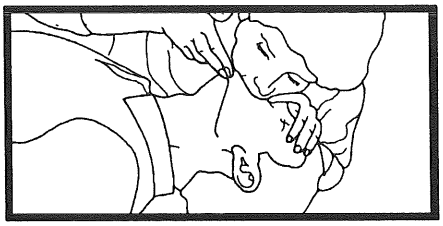
### 5 Check for Breathing

- Look, listen, and feel for breathing for 3 to 5 seconds.



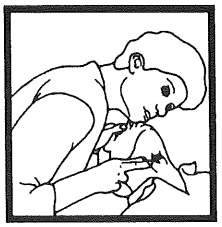
### 6 Give 2 Full Breaths

- Keep head tilted back.
- Pinch nose shut.
- Seal your lips tight around victim's mouth.
- Give 2 full breaths for 1 to 1-1/2 seconds each.



### 7 Check for Pulse at Side of Neck

- Feel for pulse for 5 to 10 seconds.

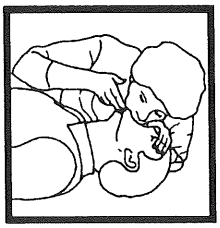


### 8 Phone for Help

- Send someone to call an ambulance.

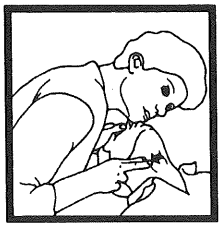
### 9 Begin Rescue Breathing

- Keep head tilted back.
- Lift chin.
- Pinch nose shut.
- Give 1 full breath every 5 seconds.
- Look, listen, and feel for breathing between breaths.



### 10 Recheck Pulse Every Minute

- Keep head tilted back.
- Feel for pulse for 5 to 10 seconds.
- If victim has pulse but is not breathing, continue rescue breathing. If no pulse, begin CPR.



For more information about these and other life–saving techniques, contact your Red Cross chapter for training.

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## List of Abbreviations and Acronyms

| Abbreviation | Term |
|---|---|
| A, AMP | Ampere(s) |
| ac, AC | Alternating Current |
| ACE | Advanced Crypto Engine |
| A/D | Analog-to-Digital Converter |
| ADC | Analog-to-Digital Converter |
| Addr, ADDR | Address |
| ADP | Automated Data Processing |
| ADT | Administrative Delay Time |
| ADU | Automatic Dialing Unit |
| AF | Audio Frequency |
| AFC | Automatic Frequency Control |
| AFSK | Audio Frequency Shift Keying |
| A-G | Air-to-Ground |
| AGC | Automatic Gain Control |
| AIC | Analog Interface Chip |
| ALC | Automatic Level Control |
| ALE | Automatic Link Establishment |
| AM | Amplitude Modulation |
| AMD | Automatic Message Display |
| AME | Amplitude Modulation Envelope |
| Amp, AMP | Amperes |
| ANT | Antenna |
| ANTIVOX | Voice-Operated Transmitter Key Inhibitor |
| API | Analog Phase Interpolation |
| ARQ | Automatic Repeat on Request |
| ASI | Analog Signal Interface |
| ASK | Amplitude Shift Keying |
| ASYNC | Asynchronous |
| Assy(s) | Assembly, Assemblies |
| ATE | Automatic Test Equipment |
| AUD | Audio |
| AUTO | Automatic |
| AUX | Auxiliary |
| AVS | Analog Voice Security |
| AWG | American Wire Gauge |

## List of Abbreviations and Acronyms

| Abbreviation | Term |
|---|---|
| B/A | Buffer Amplifier |
| BC | Broadcast, Binary Counter |
| BCD | Binary-Coded Decimal |
| BD | Baud, Binary Decoder |
| BER | Bit Error Rate |
| BFO | Beat-Frequency Oscillator |
| BIT | Built-In Test |
| BITE | Built-In Test Equipment |
| BPI | Bits Per Inch |
| bps | Bits Per Second |
| BPSK | Binary Phase Shift Keying |
| Btu | British Thermal Unit |
| BW | Bandwidth |
| C | Degreeds Celsius |
| CARC | Chemical Agent Resistive Coating |
| CB | Circuit Breaker |
| CCW | Counterclockwise |
| CDR | Critical Design Review |
| CDRL | Contract Data Requirements List |
| CFE | Contractor-Furnished Equipment |
| CH, CHAN | Channel |
| CI | Configuration Item |
| CKT | Circuit |
| cm | Centimeter |
| CMOS | Complimentary-Metal-Oxide-Semiconductor |
| COMSEC | Communications Security |
| CNV | Crypto-Net Variable |
| CNTL | Control |
| CPU | Central Processing Unit |
| CRC | Cyclic Redundancy Check |
| CRT | Cathode Ray Tube |
| CSM | Crypto Synch Message |
| CTRL | Control |
| CTS | Clear to Send |
| CW | Continuous Wave, Clockwise |

## List of Abbreviations and Acronyms

| Abbreviation | Term |
|---|---|
| D/A | Digital-to-Analog Converter |
| DAC | Digital-to-Analog Converter |
| DAM | Direct Access Memory |
| dB | Decibel(s) |
| dBm | Decibels referenced to 1 milliwatt |
| dc, DC | Direct Current |
| DCD | Data Carrier Detect |
| DE | Data Encryption |
| Demod | Demodulated |
| Diff | Differential |
| Dip, DIP | Dual In-Line Package |
| DMM | Digital Multimeter |
| DP | Double Pole |
| DPDT | Double Pole, Double Throw |
| DPRAM | Dual-Port RAM |
| DPST | Double Pole, Single Throw |
| DSP | Digital Signal Processor |
| DSR | Data Set Ready |
| DTL | Diode Transistor Logic |
| DTM | Data Text Message |
| DV | Digitized Voice |
| DTMF | Dual Tone Multi-Frequency |
| DTR | Data Terminal Ready |
| DUART | Dual Universal Asynchronous Receiver-Transmitter |
| DUSART | Dual Universal Synchronous/Asynchronous Receiver-Transmitter |
| DVM | Digital Voltmeter |
| DVOM | Digital Volt-Ohm Meter |
| EAM | Embedded Adaptive Module |
| EAROM | Electronically Alterable Read Only Memory |
| Eb/No | Energy per Bit in Noise (noise in Hz) |
| ECM | Electronic Counter Measure |
| ECCM | Electronic Counter-Counter Measure |

## List of Abbreviations and Acronyms

| Abbreviation | Term |
|---|---|
| EEPROM, $E^2PROM$ | Electrically Erasable Programmable Read Only Memory |
| EEROM | Electrically Erasable Read Only Memory |
| EIA | Electronics Industry Association |
| EMI | Electromagnetic Interference |
| EOM | End of Message |
| EPROM | Erasable Programmable Read-Only Memory |
| EQ, Equip. | Equipment |
| EXT | External |
| f | Frequency |
| FCC | Federal Communications Commission |
| FD | Full Duplex |
| FED-STD | Federal Standard |
| FDI | Fill Device Interface |
| FEC | Forward Error Correction |
| FET | Field-Effect Transistor |
| F/F | Flip-Flop |
| FFT | Fast Fourier Transform |
| FH | Frequency Hopping |
| Fig. | Figure |
| FM | Frequency Modulation |
| FSK | Frequency Shift Keying |
| F/W, FW | Firmware |
| FWD | Forward |
| g | Gram |
| G-A | Ground-to-Air |
| GF | Government (or customer) Furnished |
| GFE | Government-Furnished Equipment |
| Gnd, GND | Ground |
| GPIB | General Purpose Interface Bus |
| HD | Half Duplex |
| HDBK | Handbook |

## List of Abbreviations and Acronyms

| Abbreviation | Term |
|---|---|
| HDCP | Harris Data Communications Protocol |
| HF | High Frequency |
| HSS | High-Speed Synchronizer |
| HSSB | High Speed Serial Bus |
| HUB | Hold-Up-Battery |
| HWCI | Hardware Configuration Item |
| Hz | Hertz |
| IC | Integrated Circuit |
| ID | Identification |
| IDF | Intermediate Distribution Frame |
| I/F | Interface |
| IF | Intermediate Frequency |
| INT | Interrupt |
| INTLK | Interlock |
| INTR | Interrupt |
| I/O | Input/Output |
| ISB | Independent Sideband |
| J | Joules |
| k | Kilo (thousand) |
| kbyte (also KB) | Kilobyte |
| kHz | Kilohertz |
| km | Kilometer(s) |
| kV | Kilovolt(s) |
| kVA | Kilovolt Ampere(s) |
| KVD | Keyboard Visual Display |
| KVDU | Keyboard Visual Display Unit |
| kW | Kilowatt(s) |
| LBT | Listen Before Transmit |
| LC | Inductive Capacitive |
| LCD | Liquid Crystal Display |
| LD | Lock Detect |

## List of Abbreviations and Acronyms

| Abbreviation | Term |
|---|---|
| LED | Light-Emitting Diode |
| LF | Low Frequency |
| LLSB | Lower Lower Sideband |
| LOS | Line of Sight |
| LP | Low Pass |
| LPC | Linear Predictive Coding |
| LQA | Link Quality Analysis |
| LRU | Line Replaceable Unit |
| LSB | Lower Sideband |
| LSD | Least Significant Digit |
| M | Meter, Mega (one million) |
| m | Milli, one-one thousanth |
| mA | Milliampere(s) |
| Mbyte | Megabyte |
| MDM | MODEM |
| MHz | Megahertz |
| MIC | Microphone |
| MIL-STD | Military Standard |
| mm | Millimeter(s) |
| Mod | Modification, Modulated |
| Mod/Demod | Modulator/Demodulator |
| Modem | Modulator/Demodulator |
| MOS | Metal Oxide Semiconductor |
| MOSFET | Metal Oxide Semiconductor Field Effect Transistor |
| ms, msec | Millisecond |
| MTBCF | Mean Time Between Critical Failure |
| MTBF | Mean Time Between Failure |
| MTBM | Mean Time Between Maintenance |
| MTBR | Mean Time Between Replacement |
| MUF | Maximum Usable Frequency |
| Mux | Multiplex, Multiplexer |

## List of Abbreviations and Acronyms

| Abbreviation | Term |
|---|---|
| **mVac** | Millivolts Alternating Current |
| **mVdc** | Millivolts Direct Current |
| **n** | Nano ($1 \times 10^{-9}$) |
| **NB** | Narrowband |
| **NC, N.C.** | Normally Closed |
| **N/C** | Not Connected |
| **NMOS** | N-channel Metal-Oxide-Semiconductor |
| **NO, N.O.** | Normally Open |
| **No.** | Number |
| **NPN** | N-type, P-type, N-type (transistor) |
| **nsec** | Nanoseconds |
| **W** | Ohms, a unit of resistance measurement |
| **O&M** | Operation and Maintenance |
| **O&R** | Operation and Repair |
| **O.C.** | Open Circuit or Open Collector |
| **OEM** | Original Equipment Manufacturer |
| **Op Amp** | Operational Amplifier |
| **OCXO** | Oven Controlled Crystal Oscillator |
| **p** | Pico |
| **PA** | Power Amplifier |
| **PABX** | Private Automatic Branch Exchange |
| **PCB** | Printed Circuit Board |
| **PCM** | Pulse Code Modulation |
| **PEP** | Peak Envelope Power |
| **pF** | Picofarad ($1 \times 10^{-12}$ Farads) |
| **PIV** | Peak Inverse Voltage |
| **PLL** | Phase-Locked Loop |
| **PNP** | P-type, N-type, P-type (transistor) |
| **P-P** | Peak-to-Peak |
| **PROM** | Programmable Read Only Memory |
| **PS** | Power Supply |

## List of Abbreviations and Acronyms

| Abbreviation | Term |
|---|---|
| Pt Pt, Pt-Pt | Point-to-Point |
| PTT | Push-to-Talk |
| PWB | Printed Wiring Board |
| QTY | Quantity |
| R, RG | Receiver Circuit: Receive, Receive Ground (from teletype) |
| RAD | Random Access Data |
| RAM | Random Access Memory |
| RC | Resistive Capacitive |
| RCU | Remote Control Unit |
| RCV/RX | Receive |
| RCVR | Receiver |
| RD | Read |
| RDY | Ready |
| REC | Receptacle |
| RETX | Retransmit |
| RF | Radio Frequency |
| RFI | Radio-Frequency Interference |
| RLPA | Rotatable Log Periodic Antenna |
| RLSD | Receive Level Sense Detect |
| RMS | Root Mean Squared |
| ROM | Read-Only Memory |
| RST | Reset |
| RTC | Real Time Clock |
| RTN | Return |
| RTS | Request to Send |
| RTTY | Radio Teletype |
| RTU | Remote Terminal Unit |
| S, SG | Send Circuit, Send Ground (to teletype) |
| SA | Spectrum Analyzer |
| SB | Sideband |
| SCR | Silicon Controlled Rectifier |

## List of Abbreviations and Acronyms

| Abbreviation | Term |
|---|---|
| SHLD | Shield |
| SINAD | A ratio of (signal + noise + distortion) to (noise + distortion) used to measure the signal quality of a communication channel. SINAD is commonly used to evaluate the ability of a channel to pass voice traffic. |
| SINCGARS | Single Channel Ground Air Radio System |
| Sip, SIP | Single In-Line Package |
| SMD | Surface-Mount Device |
| SNR | Signal-to-Noise Ratio |
| SOM | Start of Message |
| SP | Single Pole |
| SPDT | Single-Pole, Double-Throw |
| SSB | Single Sideband |
| ST | Single Throw |
| SWR | Standing Wave Ratio |
| SYNC | Synchronous |
| TB | Terminal Board |
| TCXO | Temperature Controlled Crystal Oscillator |
| TDQPSK | Time Differential Quaternary Phase Shift Keying |
| TGC | Transmitter Gain Control |
| T/R | Transmit/Receive |
| TT | Teletype |
| TTL | Transistor-Transistor Logic |
| TT VFT | Teletype Voice Frequency Tone |
| TTY | Teletype |
| TX | Transmit |
| u | Micro ($1 \times 10^{-6}$) |
| UART | Universal Asynchronous Receiver-Transmitter |
| uF | Microfarad ($1 \times 10^{-6}$ Farads) |
| UHF | Ultra High Frequency |
| USART | Universal Synchronous/Asynchronous Receiver-Transmitter |
| USB | Upper Sideband |
| usec | Microseconds |

## List of Abbreviations and Acronyms

| Abbreviation | Term |
|---|---|
| **UUSB** | Upper Upper Sideband |
| **UUT** | Unit Under Test |
| **uW** | Microwave |
| **V** | Volt |
| **VA** | Volt-Ampere |
| **Vac** | Volts, Alternating Current |
| **VCA** | Voltage Controlled Attenuator |
| **VCO** | Voltage Controlled Oscillator |
| **VDC, Vdc** | Volts, Direct Current |
| **VDU** | Video Display Unit |
| **VECT** | Vector |
| **VF** | Voice Frequency |
| **VFO** | Variable Frequency Oscillator |
| **VFR** | Voice Frequency Repeater |
| **VHF** | Very High Frequency |
| **VLF** | Very Low Frequency |
| **VMOS** | V-groove Metal-Oxide-Semiconductor |
| **VOM** | Volt-Ohm-Meter |
| **VOX** | Voice Operated Transmitter |
| **Vpp** | Volts peak-to-peak |
| **VSWR** | Voltage Standing Wave Ratio |
| **W** | Watt(s) |
| **WRL** | Wire Run List |
| **XCVR** | Transceiver |
| **XMT** | Transmit |
| **XMTR** | Transmitter |

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# SAFETY SUMMARY

## 1. INTRODUCTION

All operators and maintenance personnel must observe the following safety precautions during operation and maintenance of this equipment. Specific warnings and cautions are provided in the manual and at the end of this Safety Summary. Warnings, Cautions, and Notes appear before various steps in the manual and will be used as follows:

- WARNING – Used when injury to personnel is possible
- CAUTION – Used when there is a possibility of damage to equipment
- NOTE – Used to alert personnel to a condition that requires emphasis

## 2. PERSONNEL AND EQUIPMENT SAFETY

Basic safety precautions consider factors involved in protecting personnel from injury or death. Electrical, mechanical, electromagnetic radiation (EMR), material, or chemical hazards are the most common types of hazards found in electronic equipment. The following are types of hazards that may exist:

ELECTRICAL – Hazardous voltage and current levels may exist throughout the equipment. Contact with these hazards could cause electrocution, electrical shock, burns, or injury due to involuntary reflexes of the body.

MECHANICAL – Mechanical hazards are created when heavy assemblies and components must be removed and replaced. Moving parts (such as fan blades) and hot surfaces are potential mechanical hazards.

THERMAL – Burn hazards may exist in the equipment that could cause personal injuries and/or serious equipment damage. Internal surfaces of the equipment may be in excess of 65°C, the point at which personnel could be burned. Extreme caution should be used when working with any hot assemblies (for example, power supply or power amplifier assemblies). Physical injury or damage may result to personnel and/or equipment as a result of a reflex action to a burn.

CHEMICAL – Chemicals or materials used for servicing the equipment may present potential hazards. Many chemical agents, such as cleaners and solvents, may be toxic, volatile, or flammable. If used incorrectly, these agents can cause injury or death.

EMR – Overexposure to electromagnetic radiation results from amplified radio frequencies may produce a health hazard.

## 3. OPERATIONAL AND MAINTENANCE SAFETY GUIDELINES

Good safety discipline is critical to prevent injury to personnel. All other safety measures are useless if personnel do not observe the safety precautions and do not follow safety disciplines. Once aware of a hazard, personnel should ensure that all other personnel are aware of the hazard. The following basic safety disciplines are stressed:

a. Read a procedure entirely before performing it. Personnel must always perform each assigned task in a safe manner.

b. Prior to applying equipment power after maintenance, personnel must ensure that all unsecured hand tools and test equipment are disconnected from the serviced/maintained equipment and properly stored.

c. Power to the equipment must be removed before a piece of equipment is removed.

d. Extreme care must be used when adjusting or working on operating equipment. Voltages in excess of 70 V or current sources in excess of 25 A are covered with barriers. Barriers include warning information about the hazard encountered upon barrier removal.

e. Personnel must react when someone is being electrically shocked. Perform the following steps:

   1. Shut off power.

   2. Call for help.

   3. Administer first aid if qualified.

   Under no circumstances should a person come directly in contact with the body unless the power has been removed. When immediate removal of the power is not possible, personnel must use a non-conductive material to try to jolt or pry the body away from the point of shock.

f. Personnel should work with one hand whenever possible to prevent electrical current from passing through vital organs of the body. In addition, personnel must never work alone. Someone must be available in the immediate area to render emergency first aid, if necessary.

g. Lifting can cause injury. Items weighing more than 37 pounds must be lifted by two or more people.

h. Some electrolytic capacitors contain aluminum oxide or tantalum. If connected incorrectly, the capacitor will explode when power is applied. Extreme care must be used when replacing and connecting these capacitors. The capacitor terminals must always be connected using the correct polarity: positive to positive and negative to negative.

The next section contains general safety precautions not directly related to specific procedures or equipment. These precautions are oriented toward the maintenance technician. However, all personnel must understand and apply these precautions during the many phases of operation and maintenance of the equipment. The following precautions must be observed:

### *DO NOT SERVICE EQUIPMENT ALONE*

Never work on electrical equipment unless another person familiar with the operation and hazards of the equipment is near. When the maintenance technician is aided by operators, ensure that operators are aware of the hazards.

### *GROUNDING*

Always ensure that all equipment and assemblies are properly grounded when operating or servicing.

### *TURN OFF POWER AND GROUND CAPACITORS*

Whenever possible, power to equipment should be turned off before beginning work on the equipment. Be sure to ground all capacitors that are potentially dangerous.

### *KEEP AWAY FROM LIVE CIRCUITS*

Operators and maintainers must observe all safety regulations at all times. Do not change components or make adjustments inside equipment with a high voltage supply on unless required by the procedure. Under certain conditions, dangerous potentials may exist in circuits with power controls off, due to charges retained by capacitors.

### *DO NOT BYPASS INTERLOCKS*

Do not bypass any interlocks unnecessarily. If it is necessary to employ an interlock bypass for equipment servicing, use extreme care not to come in contact with hazardous voltages.

### *USE CARE HANDLING HEAVY EQUIPMENT*

Never attempt to lift large assemblies or equipment without knowing their weight. Use enough personnel or a mechanical lifting device to properly handle the item without causing personal injury.

### *HEED WARNINGS AND CAUTIONS*

Specific warnings and cautions are provided to ensure the safety and protection of personnel and equipment. Be familiar with and strictly follow all warnings and cautions on the equipment and in technical manuals.

### *PROTECTIVE EYEWEAR*

All personnel must wear protective eyewear when servicing or maintaining equipment. Protective eyewear must be worn at all times when using tools.

## 4. PROTECTION OF STATIC-SENSITIVE DEVICES

Diode input-protection is provided on all CMOS devices. This protection is designed to guard against adverse electrical conditions such as electrostatic discharge. Although most static-sensitive devices contain protective circuitry, several precautionary steps should be taken to avoid the application of potentially damaging voltages to the inputs of the device.

To protect static-sensitive devices from damage, the following precautions should be observed.

a. Keep all static-sensitive devices in their protective packaging until needed. This packaging is conductive and should provide adequate protection for the device. Storing or transporting these devices in conventional plastic containers could be destructive to the device.

b. Disconnect power prior to insertion or extraction of these devices. This also applies to PWBs containing such devices.

c. Double check test equipment voltages and polarities prior to conducting any tests.

d. Avoid contact with the leads of the device. The component should always be handled carefully by the ends or side opposite the leads.

e. Avoid contact between PWB circuits or component leads and synthetic clothing.

f. Use only soldering irons and tools that are properly grounded. Ungrounded soldering tips or tools can destroy these devices. SOLDERING GUNS MUST NEVER BE USED.

## 5. EXPLANATION OF HAZARD SYMBOLS

The symbol of drops of a liquid onto a hand shows that the material will cause burns or irritation of human skin or tissue.

The symbol of a person wearing goggles shows that the material will injure your eyes.

The symbol of a flame shows that a material can ignite and burn you.

The symbol of a skull and crossbones shows that a material is poisonous or a danger to life.

The symbol of a human figure in a cloud shows that vapors of a material present danger to your life or health.

# AN/PRC-117D(V)2(C)
# FREQUENCY HOPPING VHF/UHF FM/AM MANPACK TRANSCEIVER WITH INTEGRATED COMSEC

# INSTRUCTION MANUAL

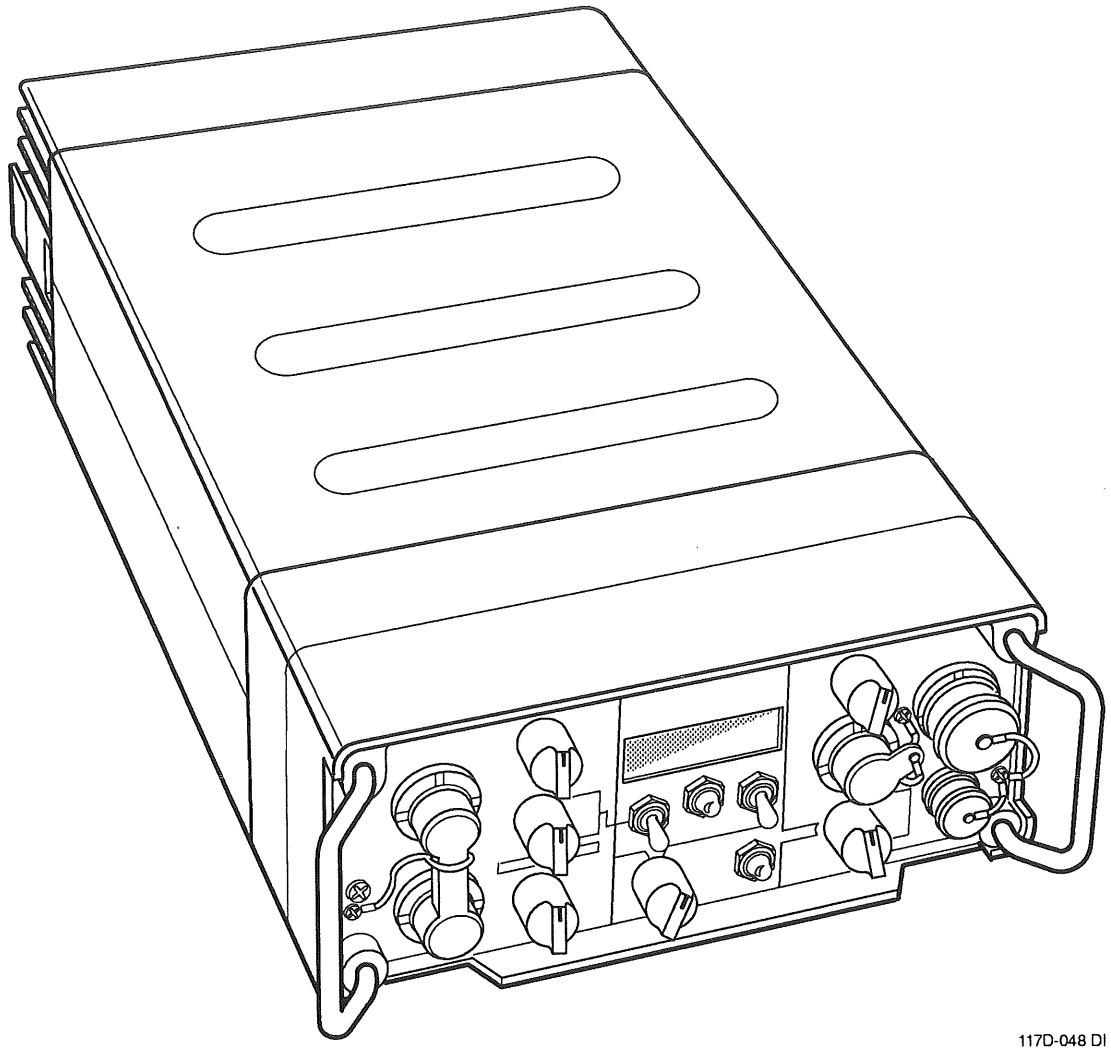



**Figure 1-1. AN/PRC-117D(V)2(C) Frequency Hopping VHF/UHF FM/AM Manpack Transceiver with Integrated COMSEC**

# CHAPTER 1

# GENERAL INFORMATION

## 1.1 SAFETY PRECAUTIONS

### 1.1.1 General

All safety precautions necessary for the protection of personnel and equipment are cross-referenced in the following list. The WARNING or CAUTION is referenced to the paragraph number where it is used in the manual, and a brief subject phrase indicating the content is provided. Read these items in their entirety before performing the referenced procedure.

- WARNING – Paragraph 2.7: Do not touch the antenna during test or transmit.
- CAUTION – Paragraph 2.10.1: The transmitter is active while the handset is keyed.
- CAUTION – Paragraph 2.18: Zeroize erases stored variables.
- WARNING – Paragraph 5.2.1: Harmful voltages are present on antenna during transmission.
- CAUTION – Paragraph 5.3.2.1: Self test could damage a connected RF signal generator.
- CAUTION – Paragraph 5.3.2.2: Self test could damage a connected RF signal generator.
- WARNING – Paragraph 6.2.1: Warning on using optional Lithium battery.
- WARNING – Paragraph 8.2: Warning on using optional Lithium battery.

## 1.2 MAINTENANCE LEVELS

### 1.2.1 Introduction

Harris/RF Communications designs its products and systems to be supported by up to four maintenance levels. See Figure 1-2. Each maintenance level relies on a defined set of support documentation and equipment in order to fulfill its maintenance tasks. The tasks performed at each level grow in complexity as fault isolation is narrowed to the component causing the fault. This concept assists the maintainer by supplying only the information and materials required for that maintenance level. These levels may be combined to sustain any particular user maintenance philosophy.

#### 1.2.1.1 Level I

This level is restricted to fault recognition and detection. Fault isolation is not usually performed at this level. An operator who detects a faulty condition alerts Maintenance Level II for repair.

#### 1.2.1.2 Level II

The maintenance technician repairs the radio system by utilizing a System (Level II) Manual to fault isolate to the faulty unit (for example, receiver-transmitter, power amplifier, antenna coupler, etc.). The faulty Line Replaceable Unit (LRU) is replaced with a spare and sent to Maintenance Level III.

#### 1.2.1.3 Level III

The faulty unit is serviced at a facility that has support equipment available, typically a hot test bed radio system. The suspected faulty unit is inserted into the hot test bed radio system and troubleshot down to the faulty assembly using a Maintenance (Level III) Manual. The faulty Shop Replaceable Unit (SRU) is replaced with a spare and passed to Maintenance Level IV.

#### 1.2.1.4 Level IV

The faulty SRU is returned to Harris/RF Communications for repair. If Level IV maintenance capabilities are available on-site, the maintenance technician can identify the faulty component on the SRU using a Depot Maintenance (Level IV) Manual that outlines the electronic maintenance techniques and test fixtures necessary to repair the SRU.

### 1.2.2 Purpose of this Manual

This manual provides the user with all technical information required to support Level III maintenance as described in Paragraph 1.2.1.3.

The overall intent of this manual is to help the maintainer expedite repair of the unit in a reasonable amount of time, resulting in reduced down-time and increased system availability. Detailed information that will be useful to the maintainer, such as unit configuration, equipment specifications, fault isolation and repair techniques, required tools and test equipment, and functional descriptions of assemblies, is provided.

### 1.2.3 Maintenance Support Packages

Harris/RF Communications designs maintenance packages that support these levels. Packages include the necessary spare parts, training, technical manuals, tools, test equipment, and maintenance aids such as interface cables, extender cards, and test fixtures.

Refer to Chapter 9, Accessories, for more information on support packages designed to enhance the effectiveness of this unit.

### 1.2.4 Scope

This manual contains operation information, functional description, scheduled maintenance, troubleshooting, corrective maintenance, and installation information for the AN/PRC-117D(V)2(C) Frequency Hopping VHF/UHF FM/AM Manpack Transceiver with Integrated COMSEC.

### 1.2.5 Warranty

Harris Corporation guarantees that if the AN/PRC-117D(V)2(C) fails from normal use within three years from the date of shipment due to a defect in workmanship or materials, Harris will repair or replace the AN/PRC-117D(V)2(C) at no charge. Repairs made by Harris to the AN/PRC-117D(V)2(C) under this warranty are warranted to be free from defects in material and workmanship for 60 days from the date of repair.

For information on how to process a claim under this warranty, and on what is not covered by this warranty, refer to the warranty information printed on the inside front cover of this manual.

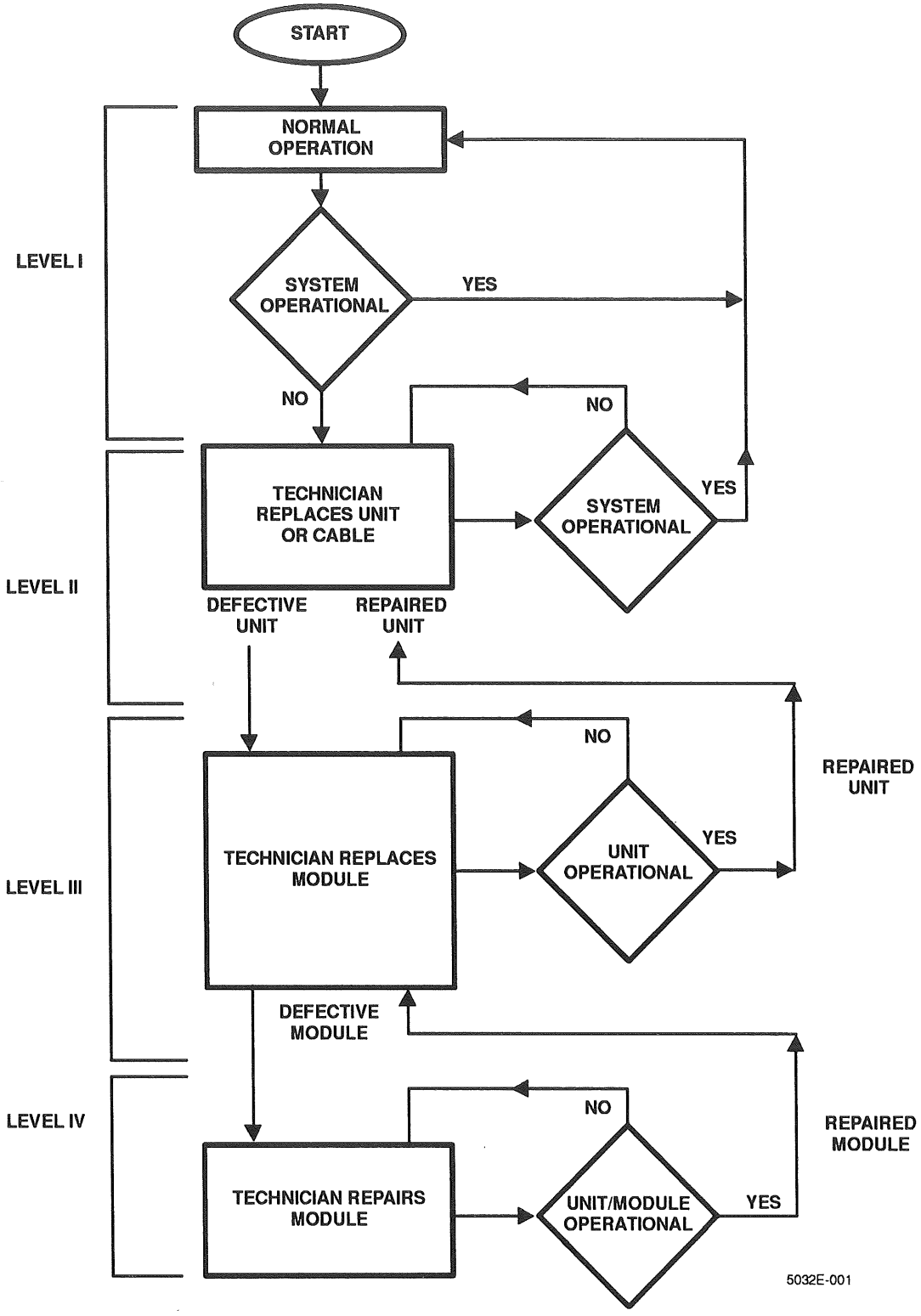



Figure 1-2. Typical Maintenance Flow Chart

## 1.3 SYSTEM DESCRIPTION

### 1.3.1 General

Figure 1-1 shows the AN/PRC-117D(V)2(C) Frequency Hopping VHF/UHF FM/AM Manpack Transceiver with Integrated COMSEC.

The AN/PRC-117D(V)2(C) MANPACK (MANPACK) Transceiver is a manpack transceiver that adds VHF-Hi, UHF, AM, SINCGARS interoperability, and modem capabilities to the functions of the AN/PRC-117B VHF-FM full-band Quick-Look frequency-hopping radio. It operates in the frequency ranges, bandwidth, and modes listed in Table 1-1.

The MANPACK contains a built-in COMSEC capability that is compatible with the VINSON KY-57/58 equipment. The transceiver has eight channels. The MANUAL channel is used for manually selecting programming parameters such as frequency, bandwidth, channel mode, and changes to the XMT POWER control when it is set to low power. Channels 1 - 7 are used for preprogrammed (or stored) programming parameters. In single channel programming, these include frequency selections; in Electronic Counter-Countermeasures (ECCM) operation, these include frequency-hopping codes.

The standard parts of the manpack transceiver are as follows:

- Receiver-Transmitter Assembly – This unit includes all radio receiver, transmitter, control logic, and communication security (COMSEC) capability.
- Handset (P/N H-250/U) – Standard push-to-talk handset common among tactical transceivers.
- Battery Pack (P/N 10012-0300) – Nickel-Cadmium (Ni-Cd) batteries provide +12 V (nominal) to the Receiver-Transmitter Assembly.
- VHF-Low Manpack Blade Antenna (P/N 10012-0201) – 44-inch (1.12 m) blade antenna with flexible neck.
- VHF-Low Manpack Antenna Kit (P/N 10012-0240) – Standard antenna kit including a 10 foot (3.1 m) collapsible whip antenna and flexible base, whip adapter, and canvas antenna bag.
- VHF-Hi/UHF Manpack Antenna (P/N 10369-0205) – Antenna kit for using the radio in the 116 MHz to 420 MHz frequency range.
- Backpack Harness (P/N 10012-0400) – Pack frame for the manpack configuration, similar to the AN/PRC-77 or -25 pack frame design.

Figure 1-3 shows each part of the manpack transceiver.

Table 1-1. Frequency Ranges, Bandwidth, and Operating Modes

| Frequency Range (Bands - in MHz) | Bandwidth (Narrow or Wide) | Modes (AM or FM) | Channel Spacing (in kHz) |
|---|---|---|---|
| 30.000 - 89.975 | WB Only | FM Only | 25 |
| 116.000 - 173.995 | WB Only | AM or FM | 5 or 6.25[1] |
| 225.000 - 419.995 | WB or NB[2] | AM[3] or FM | 5 |

NOTES:
1. 6.25 is the default.
2. Narrowband is automatically selected when the frequency is in the 243.9 to 244.21 MHz portion of the SATCOM region.
3. AM is allowed only when wideband is selected.

### 1.3.2 R/T Assembly

The R/T Assembly is made up of ten removable modules and a front panel assembly, all fitting together in a compact chassis. This arrangement enables quick repair of a faulty radio by module replacement.

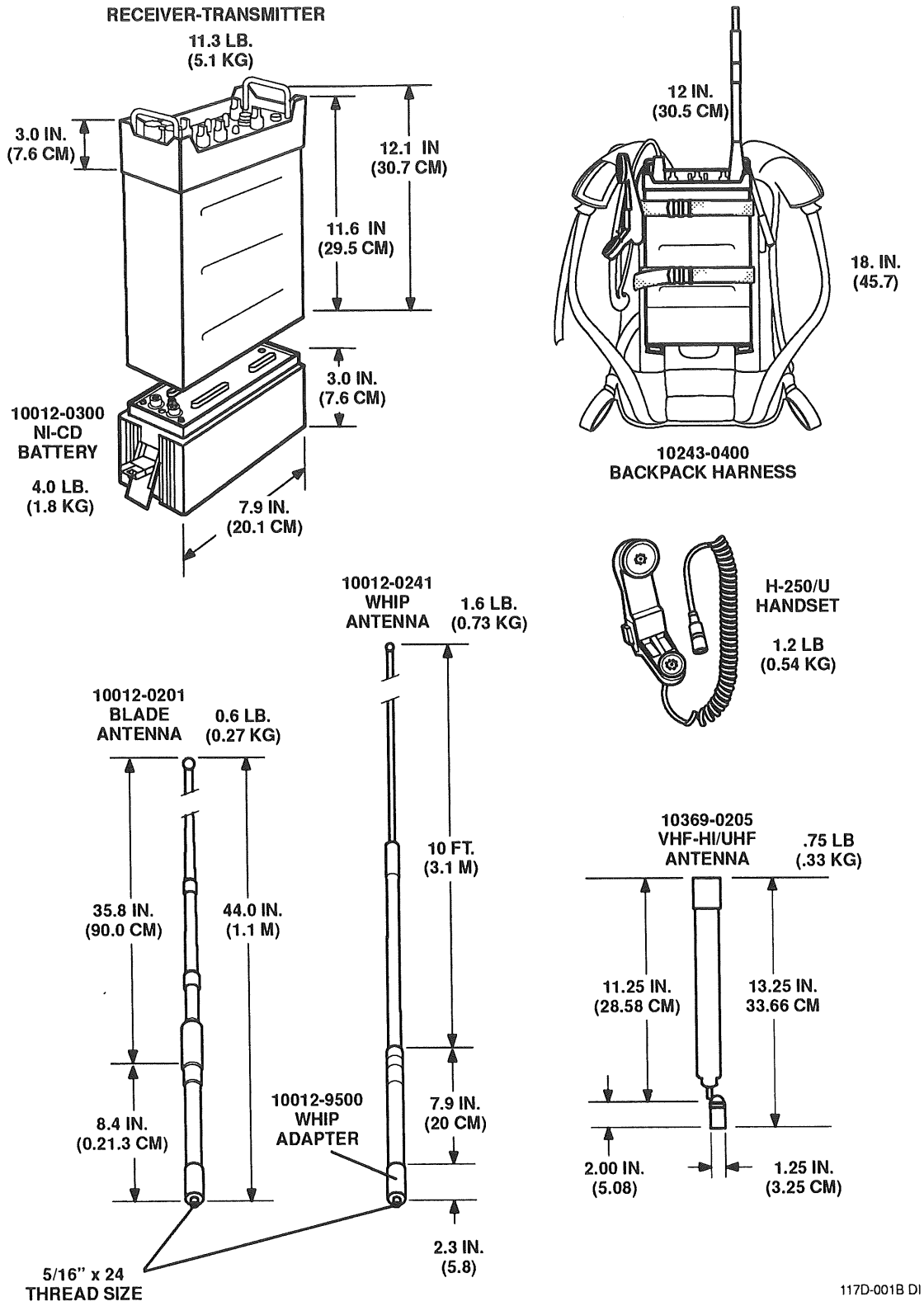



Figure 1-3. Major Items Supplied

## 1.4 IMPORTANT FEATURES

Distinctive operating features of the manpack transceiver include the following:

- Integrated COMSEC capability
- Data capability
- Self-identity test
- Built-in self test
- Fault reporting during operation
- Simplex/half-duplex operation
- SINCGARS interoperability
- Quick-Look: Frequency hopping
- Answer-back scan
- Programmable exclusion frequencies and bands – Future Application. Normal SATCOM (satellite communications) frequency bands are excluded.
- Zeroize feature
- Front panel menu programming
- Automatic SATCOM frequency, mode, and bandwidth calculation

The following paragraphs briefly outline these operating features. Subsequent chapters of this manual describe radio setup and operation for using each feature.

### 1.4.1 Integrated COMSEC Capability

The COMSEC feature allows the transceiver to process signals so that their information content can be extracted only by those authorized and equipped to do so.

The AN/PRC-117D(V)2(C) Manpack Transceiver is fully compatible with TSEC/KY-57 (VINSON) Communications Security Equipment in the voice and data modes. This secure VHF transceiver operates with standard AN/PRC-117A manpacks (with KY-57), AN/PRC-117B manpacks, and AN/VRC-94A vehicular transceivers (with KY-57) in the frequency-hopping mode. It also operates with AN/PRC-77 manpacks and AN/VRC-12 series vehicular radios (with KY-57) in the single channel mode.

The AN/PRC-117D(V)2(C) provides full KY-57 capabilities: five traffic variables, one rekey variable, one scratch pad variable, Saville Advanced Rekey (SARK), zeroize, secure, and plain text retransmission. Standard COMSEC fill devices such as the KOI-18, KYK-13, and KYX-15 are used to load COMSEC variables into the manpack transceiver.

### 1.4.2 Data Capability

The AN/PRC-117D(V)2(C) Manpack Transceiver can be used with data devices that meet MIL-STD-188-114A specifications. Data rates up to 16 kbps are typical in normal operation.

### 1.4.3 Self-Identity Test

The R/T Assembly has a number of configuration options. A radio operator can determine the options available on an individual radio by performing the self-identity test. This is done by pressing and holding the front panel TEST/LOAD pushbutton, then placing the XMT POWER switch in the LOW or HIGH position from the RADIO OFF position.

The LED display first shows the radio model number. An M is displayed after the model number [D(V)2] to indicate if the internal modem is present, an F is displayed if the Quick-Look module is present, and a C is displayed if the COMSEC module is present. After two seconds, the software version is displayed, followed by the radio option number. Compatibility between two or more radios is assured if self-identity numbers are alike.

After two more seconds, the HUB (hold-up-battery) status is displayed. One of four displays is possible:

- HUB Good — The hold-up-battery will maintain crypto variable storage when the main power is disconnected.
- HUB Low — The hold-up-battery is weak and should be replaced by qualified service personnel. Under no circumstances should unauthorized personnel attempt to access this battery.
- No HUB — The hold-up-battery is either too low to register or it is missing. Crypto variable storage is impossible when the main power is turned off.
- COMSEC ∅ — The COMSEC mode control is in the Z ALL or Z 1-5 position. HUB status cannot be checked.

Finally, the status of the radio battery pack is displayed as battery voltage.

Chapter 2 describes and illustrates the self-identity test.

### 1.4.4 Self Test

Self test is a troubleshooting aid which allows operators or maintenance personnel to fully check the radio's performance to the module level. During the brief self test procedure, the radio tests itself, performing numerous tests of internal circuitry.

To initiate radio self test, the radio must be on. The radio mode switch must be in off, tone noise, RXMT, or scan. The display must be off, and the TEST/LOAD pushbutton depressed. Note that the TEST/LOAD pushbutton must be pressed before the display blanks. The display is first tested with all the display elements lit at 50% brightness. The radio then displays the hold-up-battery status if it needs to be replaced and is followed by the battery pack status. If it detects a faulty component or an incompatibility due to system configuration differences, the front panel LED readout displays a fault code that gives the location of the problem area. This facilitates troubleshooting and fault correction, enabling quick return of the radio to service. If all the tests are passed, PASSED is displayed.

Chapter 2 describes self test as part of normal radio start-up procedure. Chapter 5 describes its use in radio troubleshooting.

### 1.4.5 Fault Reporting

In addition to reporting faults during self test, the AN/PRC-117D(V)2(C) also reports any faults that may occur during normal operation.

### 1.4.6 Simplex/Half-Duplex Operation

Each channel (except when set up as Quick-Look or SINCGARS channels) allows either simplex or half-duplex operation. These types of operations differ in the number of frequencies used per channel:

- Simplex – One frequency is used for both receiving and transmitting.
- Half-duplex – Two frequencies are used: one for receiving, another for transmitting.

Simplex operation may be used for both repeater and non-repeater applications. Half-duplex operation is particularly useful through a repeater, although its use is not restricted to repeater operation.

The range of transmit and receive frequencies in half-duplex operation has only one restriction. The two frequencies must be within the same frequency band. For example, a receive frequency in the VHF-Lo band (30-89.975 MHz) can only have a transmit frequency that is also in the VHF-Lo band. The same applies to the VHF-Hi (116-173.995 MHz) and UHF (225-419.995 MHz) bands. Half-duplex with standard transmit/receive offsets is the default setting for SATCOM operation. (See Paragraph 2.9)

### 1.4.7 Quick-Look: Frequency-Hopping

Quick-Look frequency hopping is an advanced method of Electronic Counter-Countermeasure (ECCM). With this feature, automatic ECCM operation is available on programmed channels. To best understand frequency hopping, compare it with standard transmission.

In standard FM or AM transmission, the signal occupies a narrow portion of the frequency spectrum, centered on a single carrier frequency. This easily detected signal can be monitored or jammed, and the transmitter location can be found with radio direction-finding equipment.

In narrowband frequency hopping, no single carrier frequency is used. Instead, the radio uses a full 5-MHz bandwidth. The frequency-hopping transmitter hops around the band in a pseudorandom pattern, spending only a few milliseconds at any one frequency. This makes the frequency-hopping signal difficult to detect, and extremely difficult to monitor, jam, or locate.

Wideband frequency hopping can be programmed for frequency hopping on a preprogrammed, pseudorandom pattern within any of the following frequency ranges: 30 to 89.975 MHz (VHF-Lo), 116 to 173.995 MHz (VHF-Hi), and 225 to 419.995 MHz (UHF). The hopping bandwidth, as well as hopping band location, is front-panel programmable. The hopping bandwidth is set in 5 MHz steps for the following ranges:

- 5 - 60 MHz in VHF-Lo
- 5 - 50 MHz in VHF-Hi
- 5 - 165 MHz in UHF

Figure 1-4 compares these types of transmission as they relate to FM signals in the 30 to 89.975 MHz frequency range.

In order to detect the continuously changing frequency-hopping signal, the receiver must hop at exactly the same rate as the transmitter. Synchronizing characters, sent by the transmitter, coordinate this frequency-hopping.

The R/T Assembly microprocessor controls frequency hopping. The pseudorandom pattern of frequencies is determined, in part, by the setup of the radio. One determining factor is the position of internal jumpers installed on the Signal Synchronizer Module supplied for this option.

Other setup variables that determine the frequency-hopping pattern include the programmed Quick-Look hopping code for the channel and the front panel RADIO mode control position.

Refer to Chapter 2 for information on Quick-Look operation and using and programming Quick-Look channels.

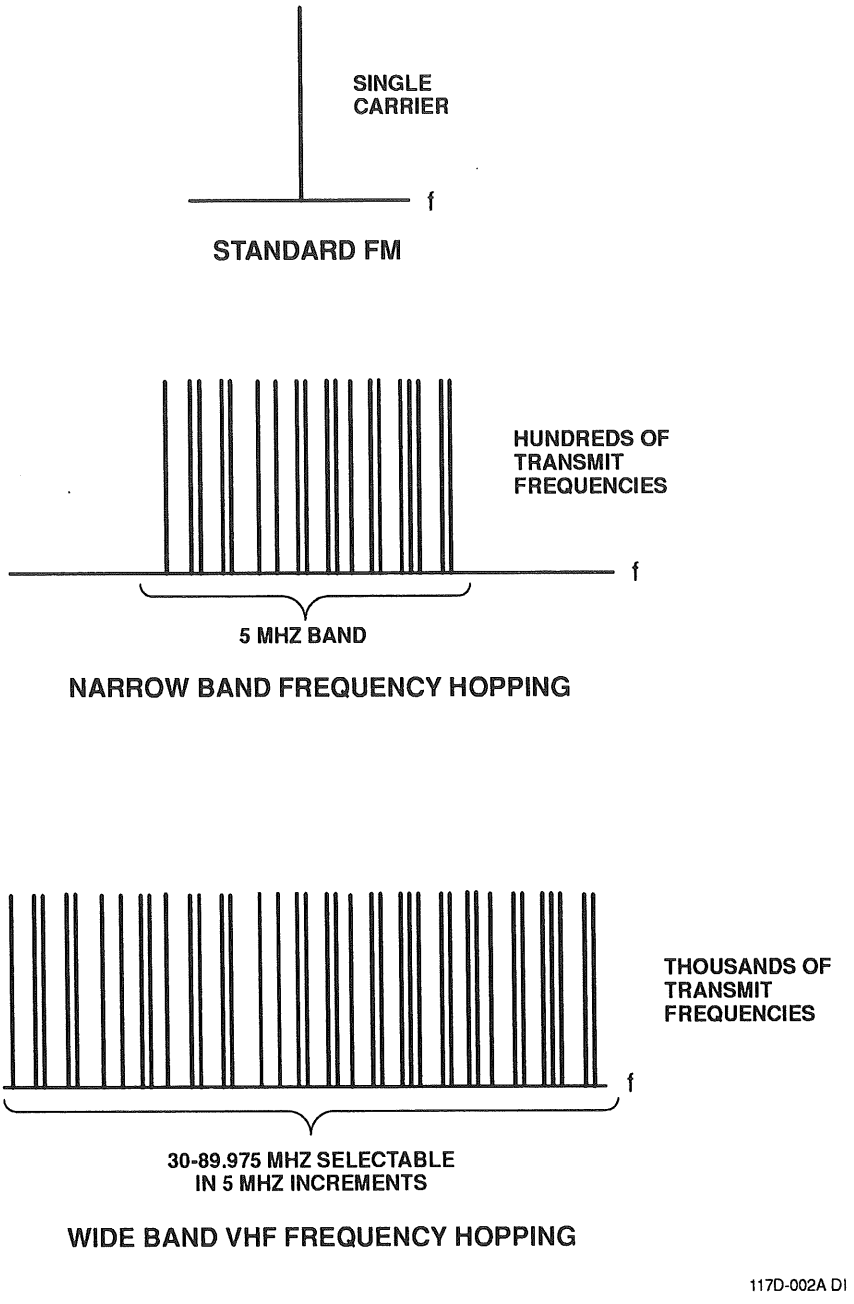



Figure 1-4. Comparison of FM and Frequency-Hopping Signals

### 1.4.8 Answer-Back Scan

While in the SCAN mode, the operator can transmit on the channel that just received the scan call, regardless of where the operator's CHANNEL control is located.

### 1.4.9 Exclusion Programming (Future Application)

By using the RF-3047FPX option, the receiver-transmitter can be programmed to exclude certain frequencies and/or 5-MHz bandwidths from its Quick-Look hopping operation to avoid areas of the spectrum which are noisy or carry sensitive information.

### 1.4.10 Zeroize Feature

The two zeroize features on the AN/PRC-117D(V)2(C) are radio zeroize and COMSEC zeroize. The following paragraphs describe these features.

#### 1.4.10.1 Radio Zeroize

The receiver-transmitter has a radio zeroize feature that allows the operator to change the programmed information of all channels, including crypto variable and exclusion frequency information, to their default values.

#### 1.4.10.2 COMSEC Zeroize

The COMSEC zeroize feature allows the operator to zeroize all of the crypto variables (Z ALL), or to only zeroize the five traffic COMSEC variables (Z 1-5) and scratchpad variable. In either case, the display shows COMSEC 0 when this feature is used.

### 1.4.11 Front Panel Menu Programming

Four sets of menus may be accessed from the front panel for radio programming as follows:

- RADIO OP – Sets the operational parameters for all channels and modes.
- CH SETUP – Sets the parameters for the individual channel selected by the CHANNEL Control.
- SGRS GLB – Sets SINCGARS global Time of Day and Cue Channel, and enables Lockout Set loads.
- SGRS CH – Sets SINCGARS Net Master/Member and enables SINCGARS Transec and Hopset loads.

With the display blank and the RADIO mode control in the PRGRM position, the menus are accessed by pressing TEST/LOAD until RADIO OP, CH SETUP, SGRS GLB, or SCRS CH is shown on the LED display. DISPLAY is pressed to choose among RADIO OP, CH SETUP, SGRS GLB, or SGRS CH. The MHZ toggle selects the parameter, and the KHZ toggle switch selects the choices for the parameter.

### 1.4.12 Automatic SATCOM Frequency, Mode, and Bandwidth Calculation

The AN/PRC-117D(V)2(C) provides automatic calculation of the transmit frequency for a selected receive frequency. The bandwidth and operating modes are also automatically selected.

## 1.5 COMPATIBILITY WITH OTHER RADIOS

The AN/PRC-117D(V)2(C) is fully compatible with all fixed-frequency VHF radio systems such as the:

- AN/VRC-12 Series
- AN/VRC-83
- AN/VRC-94A(V) Series
- AN/PRC-128

- AN/PRC-77
- AN/URC-94
- Harris RF-280
- AN/PSC-3 Series
- AN/PRC-113 Series
- AN/ARC-182
- AN/ARC-164
- Racal Jaguar
- AN/PRC-138

In addition, the AN/PRC-117D(V)2(C) is compatible with the following SINCGARS radios:

- AN/PRC-119A
- AN/ARC-222

Note that radio internal setup for selecting such operating parameters as SQUELCH type and frequency deviation (5 kHz or 8 kHz) directly affects the compatibility of the transceiver with other tactical radios.

The jumper connections on the A4 module determines many of the operating parameters that are important for full compatibility with other types of radios.

## 1.6 OPTIONS

The AN/PRC-117D(V)2(C) is available with a number of options and a variety of optional equipment. Table 1-2 lists some of these available options.

**Table 1-2. Options Available for the AN/PRC-117D(V)2(C) Transceiver**

| Part No. | Option | Description |
|---|---|---|
| AN/PRC-117D SSK | Site Spares Kit | Contains replacement modules to maintain five manpack units in the field |
| BA-5590/U | Disposable Lithium Battery | Provides greater than three times the life of the Nickel-Cadmium battery (10012-0300) (requires the 10012-0330 battery case) |
| RF-289A | VHF Log Periodic Transportable Antenna | Tactical portable log periodic antenna (30 - 90 MHz) |
| RF-290 | VHF Omnidirectional Transportable Antenna | For 30 - 90 MHz broadband operation |
| RF-294-07 | Microphone | Palm-held noise-cancelling microphone |
| RF-294-08 | Headset | Two-earphone headset unit |
| RF-3014-01 | Headset with Boom Microphone – Dynamic Mike Element | High-grade Mil headset |
| RF-3047FPX | Field Programmer – Exclusions | (Future Option) Allows for quick programming of multiple radios |
| RF-3048 | Fill Device Interface | Provides an interface allowing SINCGARS hopset lockout set and TRANSEC key fills from mode 1 SINCGARS fill devices |

**Table 1-2. Options Available for the AN/PRC-117D(V)2(C) Transceiver – Continued**

| Part No. | Option | Description |
|---|---|---|
| RF-3094-01 | Battery Charger/Exerciser | A microprocessor-controlled battery charger and battery checking unit capable of charging seven Nickel-Cadmium (10012-0300) batteries |
| 10012-0330 | Battery Case for BA-5590/U | Provides capability to use BA-5590/U Lithium Disposable Battery with the manpack transceiver (battery not included) |
| 10012-0550 | Battery Charger – Trickle | Provides simultaneous trickle charging of six Nickel-Cadmium (10012-0300) battery packs |
| RF-391 | Vehicular Antenna (116 - 420 MHz) | Wideband vehicular antenna covering the 116 - 420 MHz frequency range |
| AS-3013/VRC | Vehicular Antenna (30 - 90 MHz) | Wideband vehicular antenna covering the 30 - 90 MHz frequency range |
| RF-3060 with RF-3060-01 Extender | SATCOM Antenna | Provides satellite communications capability |
| RF-3061 | Transportable SATCOM Antenna | Provides satellite communications capability (higher gain than RF-3060) |

## 1.7 SPECIFICATIONS

| | |
|---|---|
| **GENERAL** | |
| **Frequency Range:** | |
| **VHF (Low)** | 30.000 to 89.975 MHz |
| **VHF (High)** | 116.000 to 173.995 MHz |
| **UHF** | 225.000 to 419.995 MHz |
| **Channel Spacing:** | |
| **VHF (Low)** | 25 kHz |
| **VHF (High)** | 25 kHz, 6.25 kHz, or 5 kHz |
| **UHF** | 25 kHz, 5 kHz |
| **Modulation:** | |
| **VHF (Low)** | FM (5 or 6.25 kHz deviation) |
| **VHF (High)** | AM (85% ± 15%), FM (5 or 8 kHz deviation) |
| **UHF** | AM (85% ± 15%), FM (5 or 8 kHz deviation), SBPSK |
| **Modes of Operation:** | |
| **VHF (Low)** | Simplex; Half-Duplex;<br>Quick-Look: Frequency-Hopping; SINCGARS Frequency-Hopping<br>Plain Text Voice/Data: Asynchronous up to 16K baud<br>Cipher Text/Voice: Synchronous Data = 16K baud |
| **VHF (High)** | Simplex; Half-Duplex;<br>Quick-Look: Frequency-Hopping;<br>Plain/Cipher Text, same as Low VHF |
| **UHF** | Simplex; Half-Duplex;<br>Quick-Look: Frequency-Hopping;<br>Plain Text Voice/Data: Data = 2.4K or 16K Synchronous; up to 16K Asynchronous<br>Cipher Text Voice/Data: Synchronous data = 16K baud |
| **COMSEC Variables:** | Five (5) Traffic, one (1) rekey variable, one (1) scratchpad variable |
| **Preset Channels:** | 8 programmable |
| **Number of Channels:** | 2,400 (VHF Low)<br>11,600 (VHF High, 5 kHz)<br>9,280 (VHF High, 6.25 kHz)<br>39,000 (UHF) |
| **COMSEC Fill Devices:** | KOI-18, KYK-13, KYX-15 |

| | |
|---|---|
| **Tempest:** | Meets applicable requirements |
| **Power Supply:** | 12 Vdc (nominal) |
| **Temperature Range:** | -40°C to +60°C |
| **Shock/Vibration:** | MIL-STD-810E, Curve W, MIL-S-901D |
| **Immersion:** | 3 ft. (0.9 m) of water, 2 hours |
| **Humidity:** | MIL-STD-810E |
| **Size:** | 3.0 H x 7.9 W x 13.6 D in.<br>(7.6 H x 20.0 W x 34.5 D cm) |
| **Weight:** | 15.25 lbs. (6.9 kg) – includes battery, antenna, and H-250 handset |
| **RECEIVER** | |
| **Sensitivity:** | |
| **VHF (Low)** | –113 dBm FM (8 kHz) for 10 dB SINAD |
| **VHF (High)** | –110 dBm FM (8 kHz) for 10 dB SINAD<br>–104 dBm AM (30%) for 10 dB SINAD<br>–110 dBm AM (70%) for 10 dB SINAD |
| **UHF SATCOM** | –120 dBm FM (8 kHz) for 10 dB SINAD<br>(243-270 MHz) |
| **UHF LOS** | –117 dBm FM (8 kHz) for 10 dB SINAD (225-243, 270-420 MHz) |
| **UHF** | –107 dBm AM (30%) for 10 dB SINAD<br>–113 dBm AM (70%) for 10 dB SINAD |
| **IF Rejection:** | Greater than 80 dB (VHF)<br>Greater than 80 dB (UHF) |
| **Desensitization:** | Less than 3 dB desensitization for an unwanted input signal of 120 dB above 0.5 μV, at a frequency 10% removed from the desired signal. |
| **Image Rejection:** | Greater than 60 dB |
| **Limiting (FM Mode):** | Audio output levels vary not more than 1 dB (maximum) for RF signal levels, from -100 dBm to +5 dBm. |
| **Audio Variation (AM Mode):** | Audio output levels vary not more than 3 dB (maximum) for RF signal levels, from -100 dBm to 0 dBm. (30% Modulation) |

| | |
|---|---|
| **RECEIVER (Cont.)** | |
| **Narrowband Audio Frequency Response:** | Within 3 dB for 300 Hz - 3 kHz audio output<br>Down at least 25 dB at 150 Hz, down at least 8 dB at 6 kHz. |
| **Wideband Data Frequency Response:** | Within 3 dB for 10 Hz - 10 kHz range |
| **Audio Output:** | 0.20 - 20 mW into 600 ohms |
| **Audio Output Level Fixed:** | 220 mV ±10% into 600 ohms |
| **Audio Distortion:** | Less than 5% with RF input signal up to 0 dBm |
| **Squelch (FM Mode):** | OFF: No Squelch<br>NOISE: Unsquelched for sensitivity level RF signals<br>TONE: Levels same as noise, except 150 Hz tone must be present |
| **Squelch (AM Mode):** | OFF: No Squelch<br>HI: Unsquelched for sensitivity level RF signals<br>LO: Unsquelched for levels greater than sensitivity |
| **TRANSMITTER** | |
| **Output Power (into a Nominal 50 Ohm Load):** | |
| **VHF-FM (Low)** | 1 to 10 Watts +2/-1 dB, selectable in 2W increments |
| **VHF-FM (High)** | 1 to 10 Watts +2/-1 dB, selectable in 2W increments |
| **VHF-AM (High)** | 1 to 10 Watts +2/-1 dB, selectable in 2W increments (24.5 Watts PEP) |
| **UHF-AM** | 1 to 10 Watts +2/-1 dB, selectable in 2W increments (24.5 Watts PEP) |
| **UHF-FM-LOS** | 1 to 10 Watts +2/-1 dB, selectable in 2W increments |
| **UHF-TACSAT** | 4 to 20 Watts ±1 dB, selectable in 2W increments |
| **Frequency Stability:** | 1 part in $10^6$ (-40°C to +60°C) |
| **Modulation Types:** | VHF-FM (Low)<br>Wideband FM<br>VHF-FM (High)<br>Wideband FM<br>VHF-AM (High)<br>AM<br>UHF-FM<br>Wideband FM, Narrowband FM<br>UHF-AM<br>AM |
| **UHF-TACSAT** | Narrowband SBPSK (Shaped Bi-Phase Shift Keying) |

# CHAPTER 2

# OPERATION

## 2.1 INTRODUCTION

This chapter contains all information necessary for operation of the AN/PRC-117D(V)2(C) MANPACK Transceiver (MANPACK) radio equipment. This information consists of operator controls and indicators, and operating instructions.

## 2.2 OPERATOR CONTROLS AND INDICATORS

### 2.2.1 General

The AN/PRC-117D(V)2(C) is a manpack transceiver that adds SINCGARS frequency-hopping functions to the AN/PRC-117D(C) VHF-FM full-band frequency-hopping radio with communications security (COMSEC) capability in the voice and data modes.

Since the COMSEC device is integrated into the front panel, the AN/PRC-117D(V)2(C) is handled as a CONTROLLED CRYPTOGRAPHIC ITEM (CCI). All CCI procedures must be followed. Operation is possible with the encryption board removed from the front panel. In that case, any display operation that occurs while the COMSEC mode control is in any position except plain text (P) causes *No Comsc* to display on the LED display. The radio will, however, continue to operate as a frequency-hopping plain text transceiver.

**NOTE**

Only authorized personnel can open the front panel.

This chapter describes the following:

- Transceiver front panel
- Audible tones
- Considerations before using the radio
- Start-up steps for plain text, Quick-Look ECCM, SINCGARS ECCM, or cipher operations
- Self Test
- Radio Setup
- Squelch Operations
- Single Channel Programming
- Using and programming frequencies for Quick-Look ECCM channels
- SINCGARS ECCM Operations
- Selecting crypto variable storage locations
- Loading crypto variables
- Rekey operations (SARK)
- Other net control device operations
- Data capability
- COMSEC zeroize

- Stand Alone COMSEC (SAC) operation
- Using SCAN capabilities
- Retransmit operation

Figure 2-1 shows the front panel controls, indicators, and connectors which are briefly explained in Table 2-1. Detailed procedures are given in the following paragraphs.

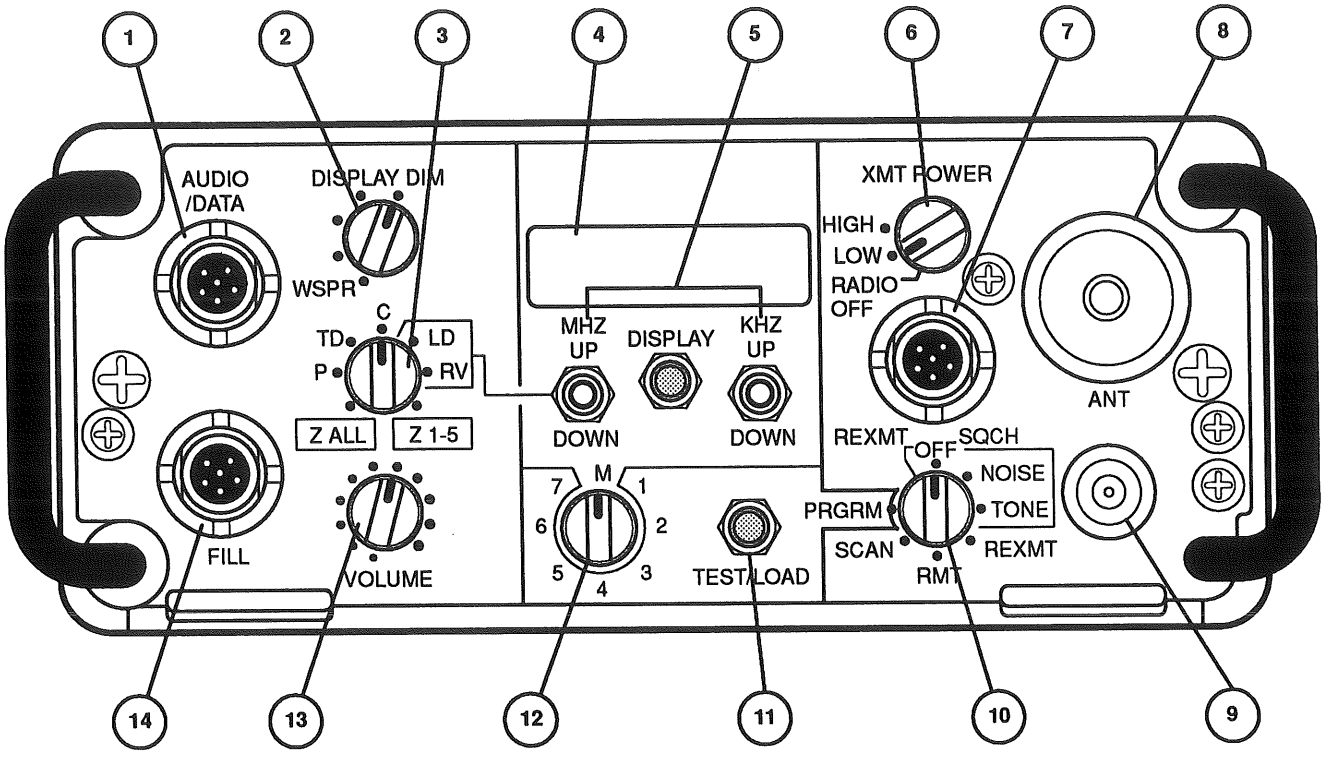



**Figure 2-1. Front Panel Controls, Indicators, and Connectors**

117D-008B JC

**Table 2-1. Front Panel Controls, Indicators, and Connectors**

| Figure 2-1 Number | Controls/Indicators/ Connectors | Function |
|---|---|---|
| 1 | AUDIO/DATA Connector | Connection for handset or data device cable. |
| 2 | DISPLAY DIM/WSPR | Controls on/off status and intensity of LED display. In the WSPR position, the display brightness is off and low level audio signals receive greater amplification. |
| 3 | COMSEC Mode Control: | |
| | P | Plain text operation. |
| | TD | Cipher text operation with 800 ms time delay after push-to-talk (PTT). |
| | C | Cipher text operation. |
| | LD | Load crypto variables. |

Table 2-1. Front Panel Controls, Indicators, and Connectors – Continued

| Figure 2-1 Number | Controls/Indicators/ Connectors | Function |
|---|---|---|
| | RV | Receive crypto variables over the air as part of a manual rekey. |
| | Z ALL | Zeroize all crypto and transec variables, as well as all programmed SINCGARS and radio parameters (frequency and bandwidth information). |
| | Z 1-5 | Zeroize crypto variables 1 to 5, #. |
| 4 | LED Display | Displays current operational and/or programmed information. |
| 5 | Toggle Switches/ DISPLAY pushbutton | Used to select and view all programmed information; active only when display is lit. |
| 6 | XMT POWER | Controls on/off of radio and transmitted power. LOW selects a 1 W transmit power level. HIGH selects a 10 W transmit power level. |
| 7 | REXMT Connector | Connection for REXMT, SAC, SINCGARS RF-3048 Fill Device Interface (FDI), plain text data clock, or remote control cable. |
| 8 | ANT Connector | Connection for antenna base. |
| 9 | ANT BNC Connector | 50-ohm antenna connection (not used in standard configuration). |
| 10 | RADIO Mode Control: | |
| | SQUELCH OFF | Squelch off. |
| | NOISE SQUELCH | Noise squelch. |
| | TONE SQUELCH | Tone squelch (150 Hz). |
| | REXMT | Retransmit operations. |
| | RMT | Front panel under remote control. (Not implemented.) |
| | SCAN | Scan the preset channels. |
| | PRGRM | Program all preset information. |
| 11 | TEST/LOAD | Used in self-identity testing, self test, programming, and radio zeroize operations. |
| 12 | CHANNEL Control | Selects operating single channel or frequency hopping net. |
| 13 | FILL Connector | Connection for standard COMSEC fill devices. |

## 2.3 TRANSCEIVER FRONT PANEL

The transceiver is provided with a mounting post to attach to the Harris Manpack Blade Antenna (10012-0201) or the Manpack Whip Antenna (10012-0241). A 50 ohm BNC antenna connector is provided on the front panel. Audio and data signals are combined on one standard connector labeled AUDIO/DATA. This connector accepts a standard H-250/U style handset and also accommodates MIL-STD-188-114A digital data levels.

The FILL connector accepts crypto variables from standard fill devices, such as the KYK-13, KYX-15, or KOI-18. Another connector, labeled REXMT, supports the retransmission function, remote control, Stand Alone COMSEC (SAC), and SINCGARS TRANSEC fill via the RF-3048 FDI. SAC allows the transceiver to operate as an independent crypto unit which is interoperable with VINSON TSEC/KY-57/8. The REXMT connector also supplies a synchronous 16 kHz clock in plain text data mode.

For retransmission operation, two units are connected together via this connector. A retransmission cable (10012-0717) routes the proper signals between the two radios.

A green LED display, which meets the requirements for night vision goggle compatibility, provides indications of frequency, crypto variables and a variety of messages to indicate current operational and programming status. The display consists of eight alphanumeric characters. When displaying frequency, the three digits closest to the right indicate kHz. The next two digits to the left indicate MHz. The MHZ toggle switch allows up/down selection of frequency in 1 MHz increments. The KHZ toggle switch allows up/down selection of frequency in 25 kHz increments. To prevent accidental frequency changes, the KHZ and MHZ toggle switches are disabled unless the LED display is active and lit.

The LED is lit only under the following conditions:

- When enabled by pushing the DISPLAY pushbutton
- When enabled for menu programming modes
- Briefly, when changing channels to a SINCGARS channel
- While in SCAN mode
- Briefly during self identity and self test
- Briefly to display voltage when power is switched on at the XMT POWER control
- When reporting a fault or protection condition.

The DISPLAY DIM/WSPR control provides four brightness levels: 100%, 50%, 25%, and off. When the DISPLAY DIM/WSPR control is in the WSPR position, the display brightness is off and low level audio signals receive greater amplification.

The VOLUME control provides twelve detent positions for a variety of handset audio settings.

The radio on/off function is combined on the XMT POWER control which turns the radio on and off and controls transmitted power. LOW selects a 1 W transmit power level. HIGH selects a 10 W transmit power level. For longest battery life, the XMT POWER control should be set at HIGH only when necessary.

Mode selection is accomplished with two controls: the RADIO Mode Control and the COMSEC Mode Control rotary switches. The functions of these controls are described in Table 2-1.

Crypto variable storage locations 1 - 6 and # are selected using the MHZ toggle switch when in the LD or RV modes. The variable number is displayed in the leftmost digit of the display. Crypto variable storage locations 1 - 5 and # are zeroized by placing the COMSEC mode control in the Z 1 - 5 position. All seven crypto variable storage locations are zeroized by placing the COMSEC mode control in the Z ALL position.

**NOTE**

Zeroizing crypto variable storage locations requires a pull-to-turn action to prevent accidental activation.

When the RADIO Mode Control is set to PRGRM, the preset single channel frequencies may be loaded into each channel position selected by the channel control. There are seven preset positions plus one manual position. Single channel frequencies are independent of the cipher text/plain text selection and the SINCGARS ECCM parameters. When the COMSEC Mode Control is set to LD, the crypto variables are loaded into storage locations selected by the MHZ toggle switch. When in the PRGRM and LD modes simultaneously, a specific crypto variable may be assigned to each channel, including the manual channel. If no variable is assigned, the default for each channel is crypto variable 1.

The transceiver employs two anti-tamper switches which zeroize all crypto variable storage locations and TRANSEC variable storage locations. The COMSEC anti-tamper switch passively zeroizes variables 1 - 6 and # if the front panel compartment containing the COMSEC circuitry is opened. The TRANSEC anti-tamper switch passively zeroizes all battery backed up microprocessor memory if the radio case is removed.

The LED display field makes use of directional blinking arrows (< or >), decimal points, and fault codes. The blinking arrows point to the display field that can be changed and are identified in Figure 2-2.

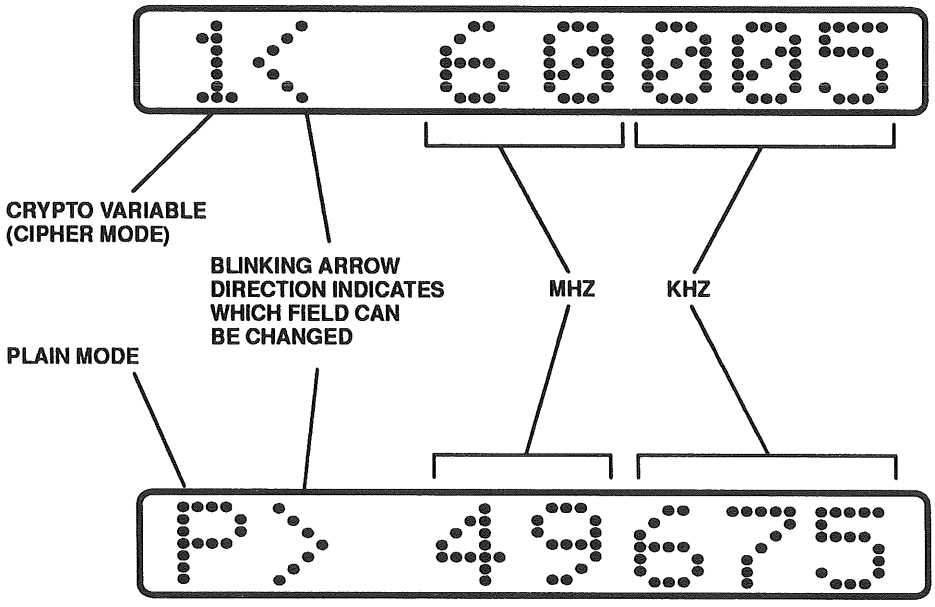



**Figure 2-2. Typical LED Displays**

## 2.4 AUDIBLE TONES

Audible tones, heard in the earpiece of the handset, indicate the manpack transceiver's operating condition. Some tones indicate normal operation, while other tones, or lack of tones, indicate equipment problems. Table 2-2 describes these tones and their meanings.

**Table 2-2. Audible Tones**

| Condition | Tone | Description |
|---|---|---|
| Low Battery | Single beep | Occurs every 5 seconds if battery voltage is less than 11.0 V. |
| | Continuous tone/ Continuous beep | Occurs when handset is keyed if battery voltage is less than 10.5 V. Also beeps once per second in receive. |
| | | The above tones indicate that the battery pack should be changed. |
| Program Mode | Continuous tone | A continuous tone is heard in the handset when programming data. |
| Clear Net Entry | Single beep | In cipher text only, indicates presence of plain text channel signal. |
| Self Test | Single beep | Indicates failure. |
| Cipher TX Ready | Single beep | Occurs after keydown in cipher transmit mode to indicate that transmission can occur. |
| SINCGARS Cue RX | Single beep | Indicates reception of a single channel +50 Hz tone signal on the SINCGARS cue channel. |
| Receiving Plain Text in Cipher Mode | Double beep | Occurs when a plain text signal is received in C or TD. A double beep is heard when the signal is first received and every 10 seconds while the signal is being received. |
| COMSEC Alarm | Continuous tone | This is a parity alarm and occurs under the following conditions:<br>• There is no crypto variable loaded on channel during COMSEC initialization. To clear this tone, change to a channel with a valid crypto variable, select a valid crypto variable, or select a valid crypto variable and key the handset once.<br>• No crypto variable is present when keyed. To clear, change to a channel with a valid crypto variable, or select a valid crypto variable and key the handset once. |
| COMSEC Zeroize | Continuous beep | This is a crypto alarm and occurs if COMSEC mode control is in Z ALL or Z 1 - 5. Indicates cipher information is zeroized. To clear this tone, change COMSEC control out of zeroize position to C or TD and key handset twice. |
| Loading Variables | Single beep | Indicates successful load. |
| | Continuous tone | Indicates bad load. To clear this tone, refer to Paragraph 2.14. |
| No SINCGARS Fill | Continuous tone | Occurs when a SINCGARS channel has not been filled with hopset information. |

## 2.5 CONSIDERATIONS BEFORE USING THE RADIO

Consider the following before operating the manpack transceiver:

- COMSEC initialization
- Self-identity compatibility
- Configuration compatibility
- Status of memory backup battery. Refer to Paragraph 6.4.

**NOTE**

Any time the radio is turned on, it must be COMSEC initialized to operate in any COMSEC mode.

Explanations of these items are included in the following paragraphs.

### 2.5.1 COMSEC Initialization

Each time the power is turned on in any COMSEC mode except P, a continuous beep is heard in the handset. To operate the radio in any mode except P, COMSEC initialization is required.

To initialize the radio, set the COMSEC mode control to TD or C and key the handset twice. If no valid crypto variable is associated with the selected channel, a continuous tone is heard in the handset. If a valid crypto variable is associated with the channel, the beep will stop.

### 2.5.2 Self-Identity Test

The self-identity test shown in Figure 2-3 determines compatibility between two or more radios. It is performed by pushing and holding the front panel TEST/LOAD pushbutton and then switching the XMT POWER control from RADIO OFF to the LOW or HIGH position. LOW selects a 1 W transmit power level and HIGH selects a 10 W transmit power level.

The LED display first shows the radio model number. An F on this display indicates the presence of the A2 Quick-Look module. A C on this display indicates the presence of the COMSEC module. After two seconds, the software version of the A3 PWB (VERA number), the software version of the B3 PWB (VERB number), and then the radio options number are displayed. Compatibility between two or more modules is assured if these self-identity numbers are alike.

If Quick-Look exclusion frequencies or bandwidths are programmed into the radio, they are identified by a fourth LED display which is a five-digit hexadecimal number, unique for any given set of exclusions. In general, radios with different exclusion bandwidths are not compatible, while radios with different exclusion frequencies may retain some compatibility.

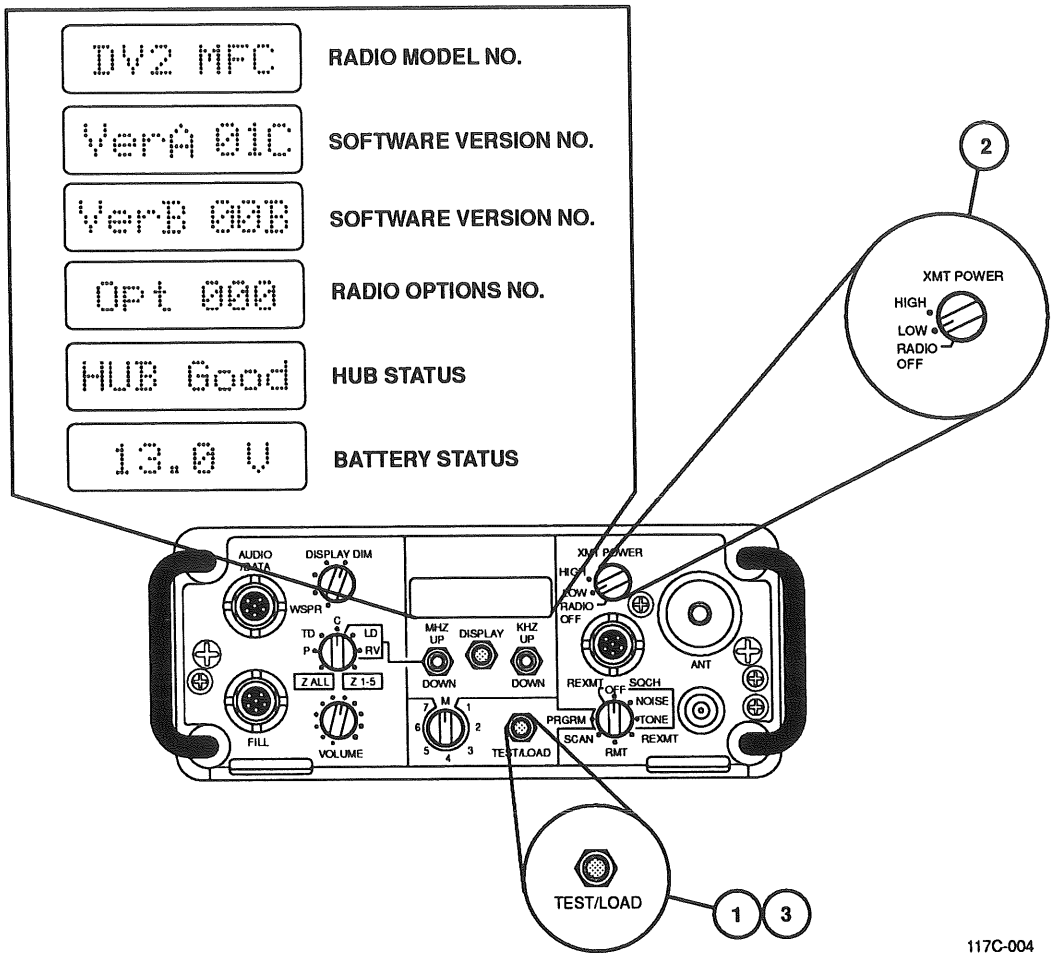
After two or more seconds, the status of the hold-up-battery (HUB) displays. If the HUB is capable of cryptographic storage, *HUB Good* displays. If the HUB is weak and storage of cryptographic variables is in jeopardy, *HUB Low* displays. A display of *No HUB* means that the HUB is either weak, too low to register, or missing, and the unit can not be used for cryptographic storage. If the COMSEC mode control happens to be in Z ALL or Z 1-5 position, the display will read *COMSEC 0*. Change the COMSEC mode control to another position to check the HUB status.

**NOTE**

The HUB is housed in the front panel module and may not be accessed by operators or crew.

Finally, the status of the radio battery is displayed as battery voltage. Chapter 5 describes battery voltage test.

## SELF-IDENTITY TEST




1. Push and hold TEST/LOAD.

   Turn XMT POWER from RADIO OFF to LOW or HIGH.

2. This initiates self-identity. The LED display shows numbers or letters that represent:

   - Radio model
   - Software versions
   - Radio options
   - HUB status
   - Battery status

   NOTE: The letter F in the radio model display indicates the radio has hopping capabilities, and the letter C indicates the presence of the COMSEC module. The letter M in the radio model display indicates that the internal modem is present.

3. Release TEST/LOAD.

   Use self-identity to determine compatibility of radio equipment.

**Figure 2-3. Self-Identity Test**

### 2.5.3 Configuration Compatibility Among Units

The R/T assembly allows a number of configuration options. For full compatibility of radios within a network, set up each radio in exactly the same manner. Depending on the desired mode of operation, consider these setup factors for radio compatibility:

- Programming of frequencies and mode selection. Refer to Paragraph 2.11.
- Programming and operation of SINCGARS nets. Refer to Paragraphs 2.12 - 2.14.
- Jumpers on A5 Audio Module.
- Jumpers on A4 Power Supply Module.
- Jumpers on A2 Signal Synchronization Module.
- Exclusion Programming. Refer to Paragraph 2.11.3.

Optional jumpers on the A4 Power Supply Module select operating parameters such as automatic TONE SQUELCH transmission, frequency deviation, and frequency display recall for programmed channels. Normally, these jumpers are factory-installed, but field modification is possible.

The A2 Signal Synchronizer Module is required for Quick-Look ECCM and SINCGARS frequency-hopping operation. Jumpers on this module determine, in part, the pseudorandom pattern of Quick-Look frequency hopping. To allow Quick-Look ECCM communication, these jumpers must have matching configurations for all radios within the network. Quick-Look ECCM jumpers are normally factory-installed, but field modification is possible.

Jumpers 1 and 2 on the A5 Audio Module must be removed for proper radio operation. They are normally left uninstalled at the factory.

## 2.6 START-UP STEPS

Turn the power on by switching the XMT POWER control from RADIO OFF to the LOW or HIGH position. The HUB is checked first. If the HUB status is good, no display shows on the LED display. If the HUB is weak, too low to register, or missing, *HUB Low* or *No HUB* is displayed. A display of *COMSEC 0* indicates that the COMSEC mode control is in Z ALL or Z 1-5. The status of the radio battery pack is then displayed as battery voltage.

**NOTE**

If A3 or A10 flashes on the LED display, the radio needs servicing and is not usable.

## 2.7 SELF TEST

The self test, shown in Figure 2-4, gives the operator a quick check of proper radio operation. To initiate self test, the XMT POWER control must be in LOW or HIGH position, the LED display must be blank, and the RADIO Mode Control must not be set to PRGRM. After the TEST/LOAD pushbutton has been pushed, the LED display is tested with all the display elements lit at 50% brightness, then the display reverts to the setting selected on the DISPLAY DIM/WSPR control.

**NOTE**

The self test feature is disabled if DISPLAY DIM is set to the OFF or WSPR positions.

The following self tests then occur:

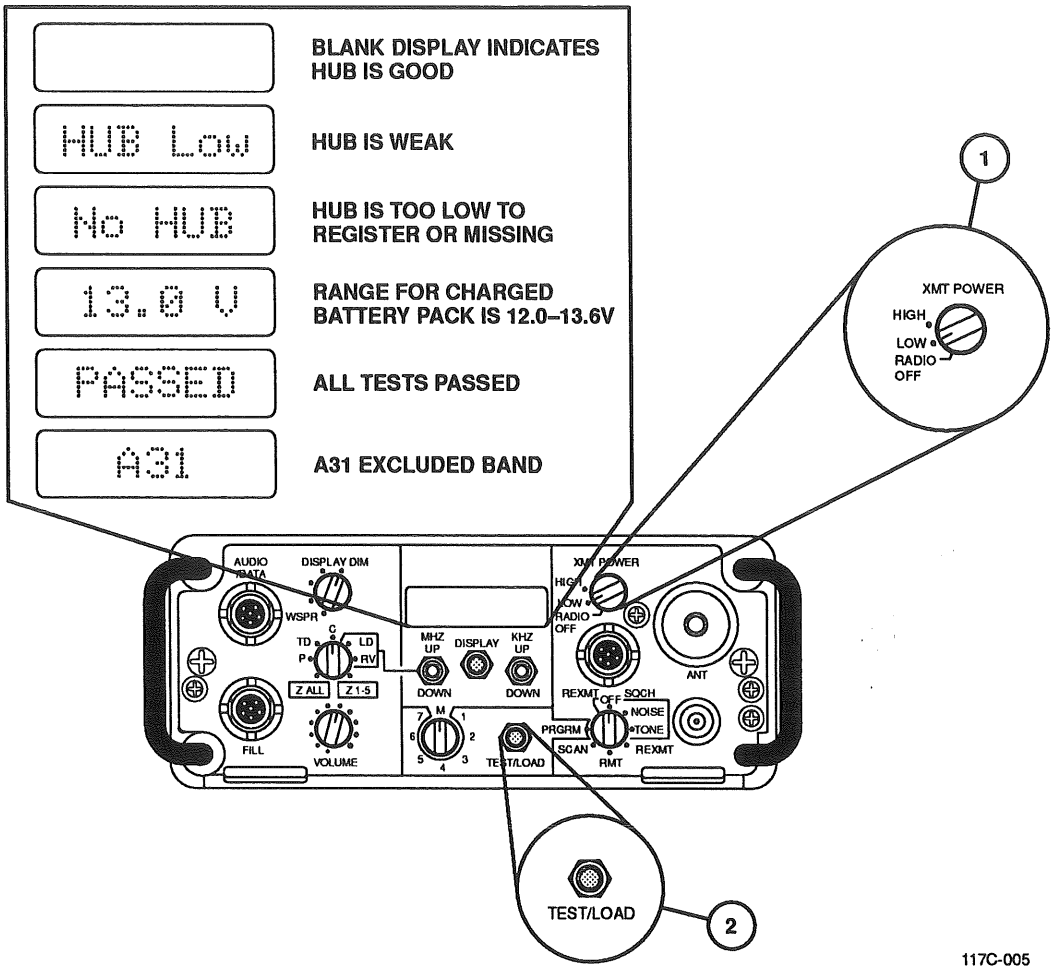
- HUB status. If the HUB status is good, no display shows on the LED display. If it is weak, too low to register, or missing, *HUB Low* or *No HUB* displays.
- Radio battery pack voltage displays. The range for a charged battery is 12.0 - 13.6V.
- Radio modules are checked.
- If all the tests pass, *PASSED* displays on the LED display.
- If a faulty module is present, it displays as a fault code. For example, a display of A04 indicates the A4 Power Supply module needs replacement. Refer to Chapter 5.
- The A31 fault code is an exception. Since frequency and/or bandwidth exclusions can be programmed with the radio, an A31 code indicates that the operator is performing self test on a channel where all bandwidths are excluded. In this case, the operator can change the hopping bandwidth or zeroize the radio to use this channel. Refer to Paragraph 2.11.3.

**WARNING**

Self test causes the radio to place a signal on the air. 10 watts is developed at the antenna. Do not touch the antenna during self test or transmit operations.

Use self test as often as needed during radio operation to check HUB, radio battery pack, and overall radio functions. Self test can be done in any mode except PRGRM or RMT.

## SELF TEST




(1) Turn XMT POWER from RADIO OFF to LOW or HIGH.

To initiate self test, the LED display must be blank.

(2) Push TEST/LOAD.

The LED display shows the display segments and the status of the hold-up-battery, radio battery pack, and radio modules.

- HUB status is checked first.
- Radio battery pack voltage is displayed.
- Radio modules are checked. Fault codes flash on the LED display.

Self test can be used in any radio mode except PRGRM or RMT.

NOTE: Using self test causes the radio to place a signal on the air.

**Figure 2-4. Self Test**

## 2.8 SQUELCH OPERATIONS

There are differences in squelch operation depending upon whether the radio is being operated in plain text, Quick-Look ECCM, SINCGARS ECCM, or cipher text mode. The squelch mode of the radio is determined by the squelch position on the RADIO Mode Control. For squelch operation, the COMSEC mode control can be in any mode position except LD, Z ALL, or Z 1 - 5.

### 2.8.1 Squelch Response for Single Channel Plain Text Operation

For single channel plain text operation, the squelch positions operate as described below and illustrated in Figure 2-5.

- OFF – No squelch is applied. In the absence of a signal, a rushing sound comes from the handset.
- NOISE – The receiver is squelched in the absence of a signal. The receiver unsquelches when the received signal power level is 0.5μV (-113 dBm) or greater.
- TONE – The receiver is squelched unless the received signal has the proper characteristics. The received signal must be modulated by a 150 Hz subcarrier tone. Signal power must be equal to that for NOISE SQUELCH.

If the RADIO Mode Control is in a squelch position and the COMSEC Mode Control is moved to the P position, the LED display will show that the plain text mode has been entered:

***PLAIN!***

### 2.8.2 Squelch Response for Plain-Text Quick-Look ECCM Operation

There are two types of Plain-Text Quick-Look ECCM transmissions, each compatible with the other. The squelch position on the RADIO Mode Control selects one of the following:

- TONE SQUELCH Quick-Look ECCM – RADIO Mode Control in TONE
- NOISE SQUELCH Quick-Look ECCM – RADIO Mode Control in NOISE or OFF

These two frequency-hopping methods differ in one essential way: use of synchronizing characters.

In TONE SQUELCH Quick-Look ECCM, the transmitter sends a burst of synchronizing characters each time the handset is keyed and unkeyed. The handset beeps each time the radio is keyed.

In NOISE SQUELCH Quick-Look ECCM, the timing of this keying burst is somewhat different. The transmitter sends a synchronizing burst when first keyed, but only intermittently thereafter.

Figure 2-6 shows the timing of synchronizing bursts (simplified) for both types of Quick-Look ECCM operation. To understand the advantages of each Quick-Look ECCM type and how radios in a network are synchronized with each Quick-Look ECCM type, compare the timing sequences in this figure.

With NOISE SQUELCH Quick-Look ECCM an initial synchronizing burst establishes the Quick-Look ECCM contact. Once radios in the network are synchronized, resynchronizing is not necessary if radio contact is maintained with only brief intervals between transmissions. This means that synchronizing bursts are infrequent, providing added security. This complicates any attempt to monitor or jam Quick-Look ECCM transmission.

Audio modulation is inhibited during the brief synchronization burst. A beep in the handset (approximate duration: 1/3 second) indicates that the burst is being sent. Because synchronizing bursts are infrequent with NOISE SQUELCH Quick-Look ECCM, faster back-and-forth communication is possible in this mode.

As Figure 2-6 shows, TONE SQUELCH Quick-Look ECCM timing differs significantly from timing for NOISE SQUELCH Quick-Look ECCM. Each time a transmitter is keyed, all radios in the network are resynchronized. This continuous resynchronizing of all network radios means that radios in the network are less dependent on a single synchronizing burst to maintain communication. However, each time a transmitter is keyed, audio modulation is inhibited during the handset beep.

In addition to the initial synchronizing burst, both NOISE SQUELCH Quick-Look ECCM and TONE SQUELCH Quick-Look ECCM modes provide an end-of-message burst, sent each time a transmitter is unkeyed. The end-of-message burst also causes a beep in each receiving handset.

The receiving operator should wait for the end-of-message beep before keying. This is particularly important when in TONE SQUELCH Quick-Look ECCM mode. In this mode, radios require an end-of-message burst before they accept the next synchronizing burst.

**NOTE**

TONE SQUELCH Quick-Look ECCM refers to a synchronization method only. There is no subcarrier tone associated with TONE SQUELCH Quick-Look ECCM operation.

The recommended procedure for Quick-Look ECCM operation is to set all network radios to the same SQUELCH mode. With this coordination, synchronization burst timing consistently follows the appropriate pattern shown in Figure 2-6. Note, however, that radios set for different SQUELCH Quick-Look modes are fully compatible within the network because the end-of-message burst switches all receiving radios in the network to the mode of the transmitting radio. Upon receiving the end-of-message burst, radios automatically assume the proper Quick-Look SQUELCH mode for subsequent transmission and reception.

### 2.8.3 Squelch Response for Plain-Text SINCGARS ECCM Operation

The handset is squelched at all times except when a valid SINCGARS reception is detected. This case is true for SQUELCH OFF, NOISE SQUELCH, and TONE SQUELCH.

### 2.8.4 Squelch Response for Cipher Operation (C,TD)

For cipher text single channel operation, the handset audio is unsquelched upon reception of a valid cipher-text signal. The squelch mode (OFF, NOISE, TONE) is ignored.

For cipher text, Quick-Look ECCM operation, both the Quick-Look and cipher-text synchronization must be correctly received for the handset audio to become unsquelched. The squelch mode selects only the Quick-Look ECCM mode as detailed in Paragraph 2.8.2 and Figure 2-6.

For cipher-text SINCGARS ECCM operation, both the SINCGARS ECCM and cipher-text synchronization must be correctly received for the handset audio to become unsquelched. The squelch mode (OFF, NOISE, TONE) is ignored.

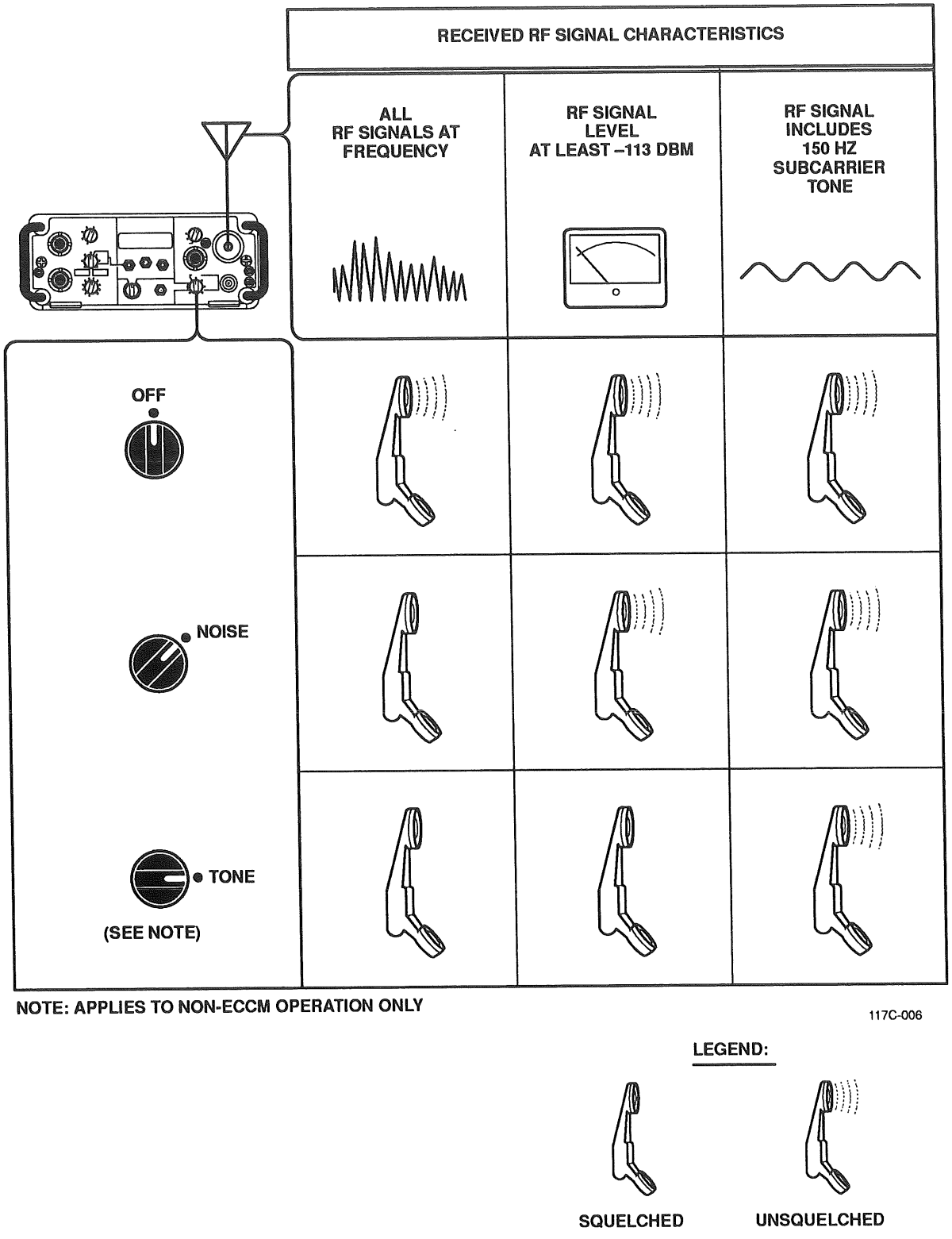



Figure 2-5. Squelch Responses for Plain-Text Operation

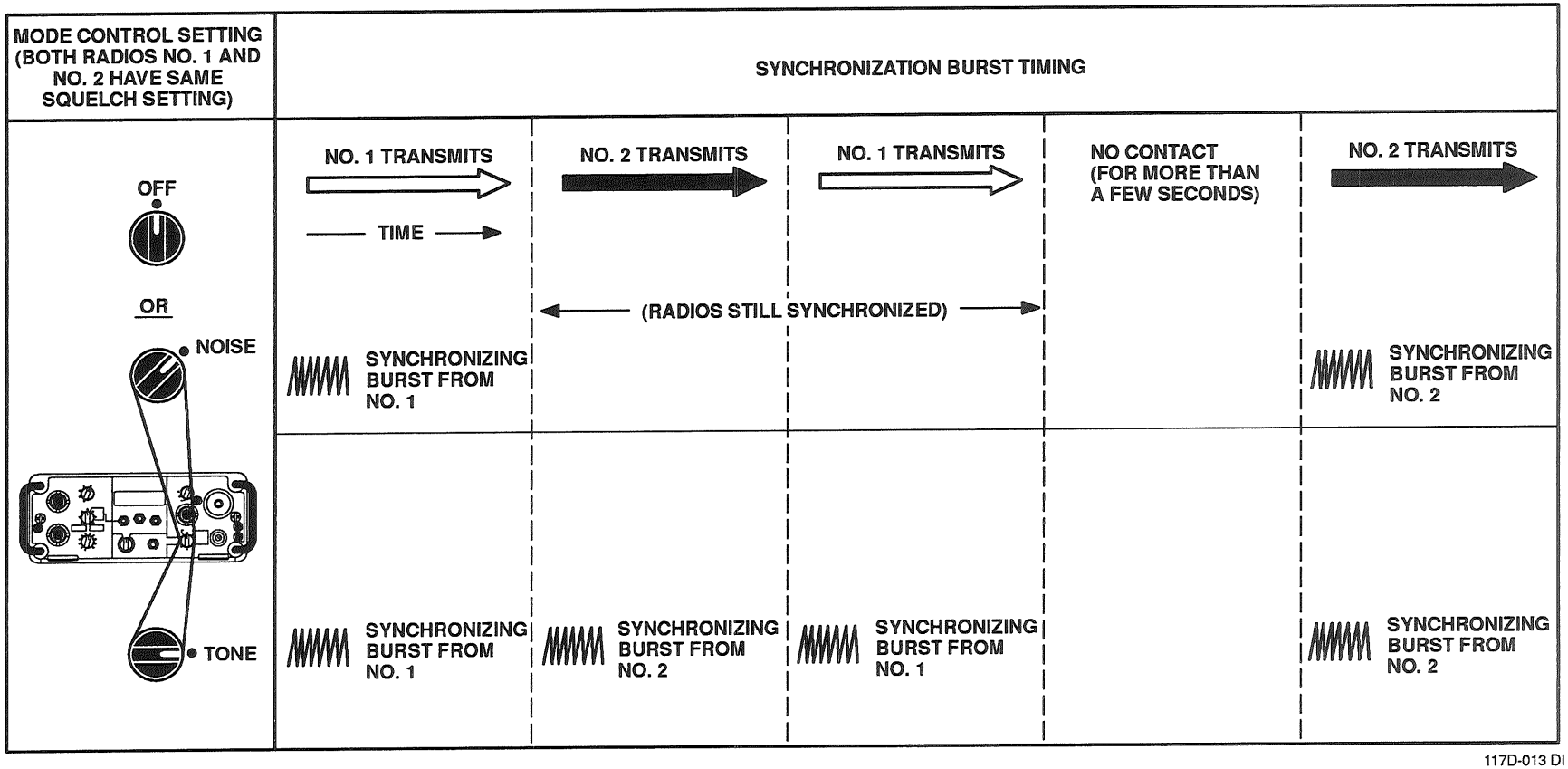



**Figure 2-6. Quick-Look ECCM Squelch Mode Synchronization Burst Timing**

### 2.8.5 Squelch Response for Plain-Text Reception in Cipher-Text Mode

A plain-text signal may be received in single channel cipher-text mode. Handset audio is unsquelched upon detection of a 150 Hz tone encoded signal regardless of the squelch mode. Refer to Paragraph 2.8.1 and Figure 2-5 for TONE SQUELCH reception. A double beep is heard upon unsquelching of the handset and every 10 seconds thereafter while the signal is being received.

In both Quick-Look and SINCGARS ECCM modes, upon reception of plain-text ECCM, synchronization only, two beeps are heard and handset audio is unsquelched. Every 10 seconds thereafter, while ECCM reception is on-going, two beeps are heard.

## 2.9 RADIO SETUP

For full compatibility of radios within a network, set up each radio in exactly the same manner. Front panel menus allow radio setup to be quick and easy. The following sets of menus are available from the front panel:

- RADIO OP – Allows TRANSEC/RADIO zeroize and selects AM squelch level and battery type.
- CH SETUP – Allows selection of the channel type (single channel, Quick-Look ECCM, or SINCGARS ECCM). Turns "star" mode on/off, sets VHF-High channel spacing, and turns modem on/off.
- SGRS GLB – Locally loads a SINCGARS lockout set. Selects SINCGARS cue channel. Sets radio global time-of-day (TOD) clock.
- SGRS CH – Selects whether station is net master or net member. Locally loads SINCGARS TRANSEC key and hopset.

Set the front panel controls as follows to set up or program the radios:

a. Set the XMT POWER, CHANNEL, RADIO Mode, and COMSEC Mode controls to the settings described in each figure.

b. Set the DISPLAY DIM/WSPR Control as desired.

c. Repeatedly push the DISPLAY pushbutton to scroll through menu parameters when at the top level of the menu.

d. Push the MHZ switch down to move from the menu top level to its lower level.

e. Toggle the MHZ switch to scroll through menu parameters when at the lower level of the menu.

f. Push the DISPLAY pushbutton to move from the menu lower level to the top level.

g. Push the KHZ switch to scroll through the range of values for a particular menu parameter.

h. Push the TEST/LOAD pushbutton to store the selected value.

i. When the < and > characters flash in the display, they point to parameters that can be changed.

j. The display goes blank about five seconds after the last operator action, unless TEST/LOAD is pushed.

### 2.9.1 RADIO OP Programming

The RADIO OP menu allows TRANSEC/RADIO zeroize, AM squelch level, and battery selection.

#### 2.9.1.1 RADIO OP – Performing TRANSEC/RADIO Zeroize

There are currently three options available under the RADIO OP menu.

The first option involves selecting the level for AM Squelch. When the RADIO MODE is set to NOISE SQCH, the AM squelch setting determines the receive signal power level at which the radio will unsquelch in Plain Text AM operation. The low setting (AM SQ>Lo) unsquelches the radio at a receive signal power level of approximately 4 dB SINAD, while the high setting (AM SQ>Hi) sets the threshold for unsquelching the radio to approximately 15 dB SINAD. Figure 2-7 describes how to set the AM squelch level for low or high squelch.

The second option is to zeroize the TRANSEC key variables, hopsets, lockout sets, frequencies, Quick-Look hop codes and bandwidths, and net TOD clocks without zeroizing the COMSEC variables. These parameters and the COMSEC variables can also be zeroized using the Z ALL position on the COMSEC Mode Control switch. To accomplish this task, perform the procedure in Figure 2-8.

When the radio is zeroized, the channels are set to their default values.

The third option is battery type selection. This menu choice selects or deselects internal current limit circuitry which provides extra protection when a lithium battery is used. The selections are "Lith" for a lithium battery and "Othr" for the Ni-Cd battery and other power supplies. Perform the steps in Figure 2-9 to select the battery type.

### 2.9.2 CH SETUP Programming

The CH SETUP menu sets the following channel parameters for the currently selected channel (1–7 or M):

- Channel type selection (single channel, Quick-Look ECCM or SINCGARS ECCM)
- Modem selection for standard, differential, or no modem (for SATCOM operation)
- Channel spacing for the VHF-Hi band
- * mode selection for COMSEC operation

#### 2.9.2.1 CH SETUP – Selecting the Channel Type

To select the type of operation for the channel selected at the front panel, perform the procedure in Figure 2-10.

#### 2.9.2.2 CH SETUP – Selecting the Modem

This menu choice enables the SATCOM modem for the selected channel. The modem may be enabled in two different modes of operation, differential phase shift keying (MODM>Dif) or standard (non-differential) phase shift keying (MODM>Std), or it may be turned off (MODM>Off).

**NOTE**

If the internal modem PWB is not installed in the radio, this menu choice does not appear and all channels are defaulted to MODM>Off.

Perform the steps in figure 2-11 to select the modem.

#### 2.9.2.3 CH SETUP – Selecting Channel Spacing for VHF-Hi

This menu choice selects the channel spacing for VHF-Hi (116.000 to 173.995 MHz). The channel spacing can be set to 5 kHz or 6.25 kHz. Perform the steps described in figure 2-12 to set the channel spacing.

#### 2.9.2.4 CH SETUP – Turning * Mode On or Off

This menu selection is for COMSEC operation only. The selections are on and off. Perform the steps in figure 2-13 to turn * mode on or off.

### 2.9.3 SGRS GLB – Setting SINCGARS Global Parameters

The SINCGARS GLB menu is used to accomplish the following:

- Set the day, hour, minute and second of the radio global TOD
- Locally load a SINCGARS lockout set
- Select the SINCGARS cue channel from channels previously configured for single frequency operation.

#### 2.9.3.1 SGRS GLB – Setting the Radio Global Time-of-Day (TOD) Clock

The setting of the radio global TOD clock occurs as four separate parameters in the SINCGARS global menu: Day, Hour, Minute and Second. There is also a NET TOD clock associated with each SINCGARS net. Changing the radio global TOD clock resets all SINCGARS NET TOD clocks within the radio to the value of the radio global TOD clock. To change any of the global TOD settings, perform the procedure in Figure 2-14.

#### 2.9.3.2 SGRS GLB – Locally Load a Lockout Set

To locally load a SINCGARS lockout set into the transceiver, perform the procedure in Figure 2-15.

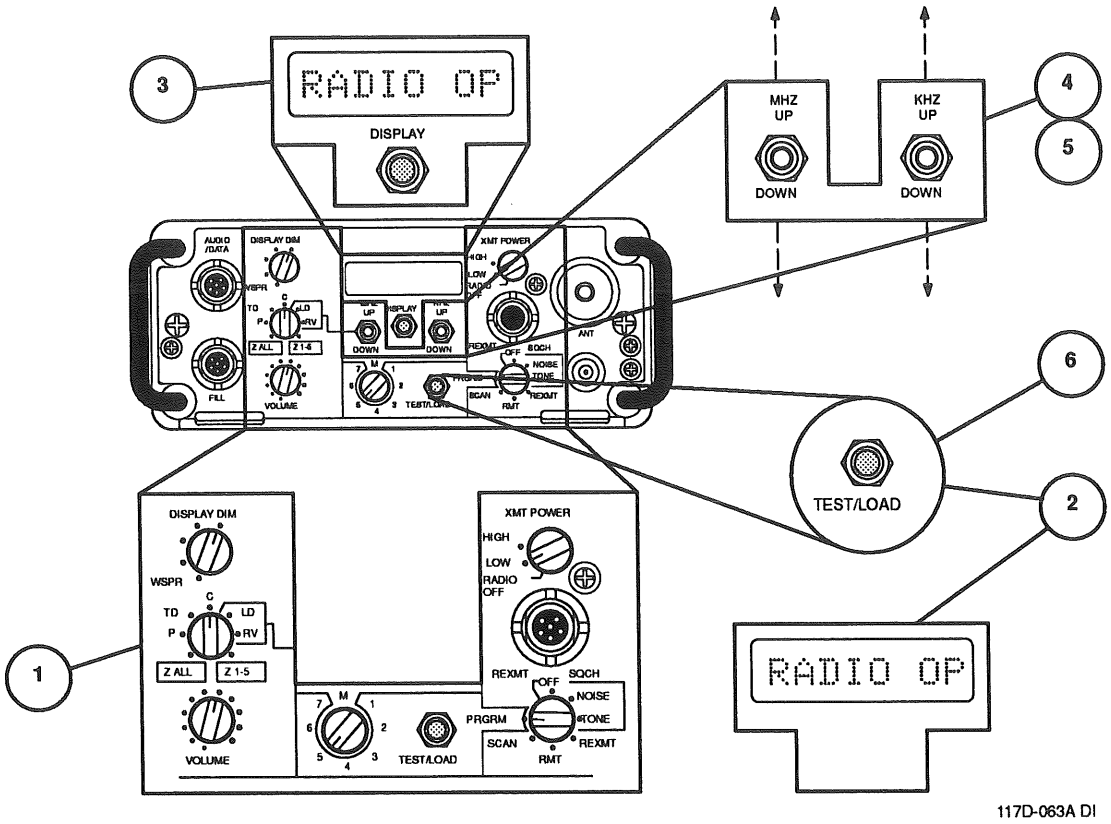
#### 2.9.3.3 SGRS GLB – Selecting the Cue Channel

To configure a channel to be the Cue Channel, perform the procedure in Figure 2-16.

**NOTE**

If a single-frequency channel 1 - 7 is selected as the cue channel, then later configured as a SINCGARS or a Quick-Look channel, the cue channel selection will automatically revert to the manual (M or CH0) channel.

## RADIO OP – SETTING THE AM SQUELCH LEVEL



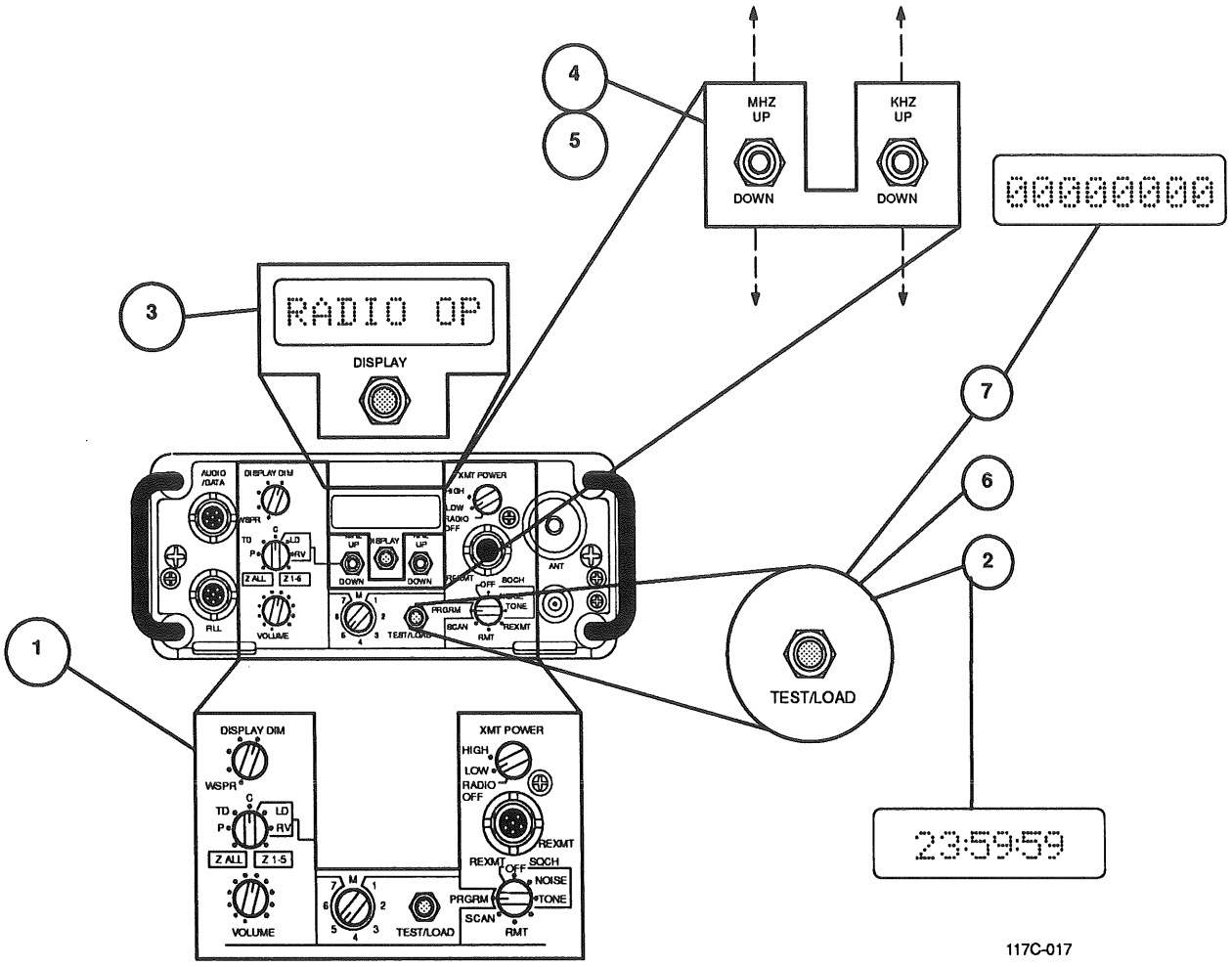

117D-063A DI

1. Set the following controls:
   - XMT POWER – LOW or HIGH
   - CHANNEL – 1–7 or M
   - RADIO Mode – PRGRM
   - COMSEC Mode – P, TD, C, or RV
2. After LED display blanks, push and hold TEST/LOAD until RADIO OP or CH SETUP appears.
3. Push DISPLAY until RADIO OP appears on the LED display.
4. Toggle the MHZ switch UP or DOWN until AM SQ>Hi or AM SQ>Lo displays.
5. Toggle the KHZ switch UP or DOWN to select the desired squelch level (Hi or Lo).
6. Push TEST/LOAD to store the new parameter.

   Note that the TEST/LOAD pushbutton must be pressed before the display blanks.

**Figure 2-7. RADIO OP – Setting the AM Squelch Level**

## RADIO OP – TRANSEC/RADIO ZEROIZE

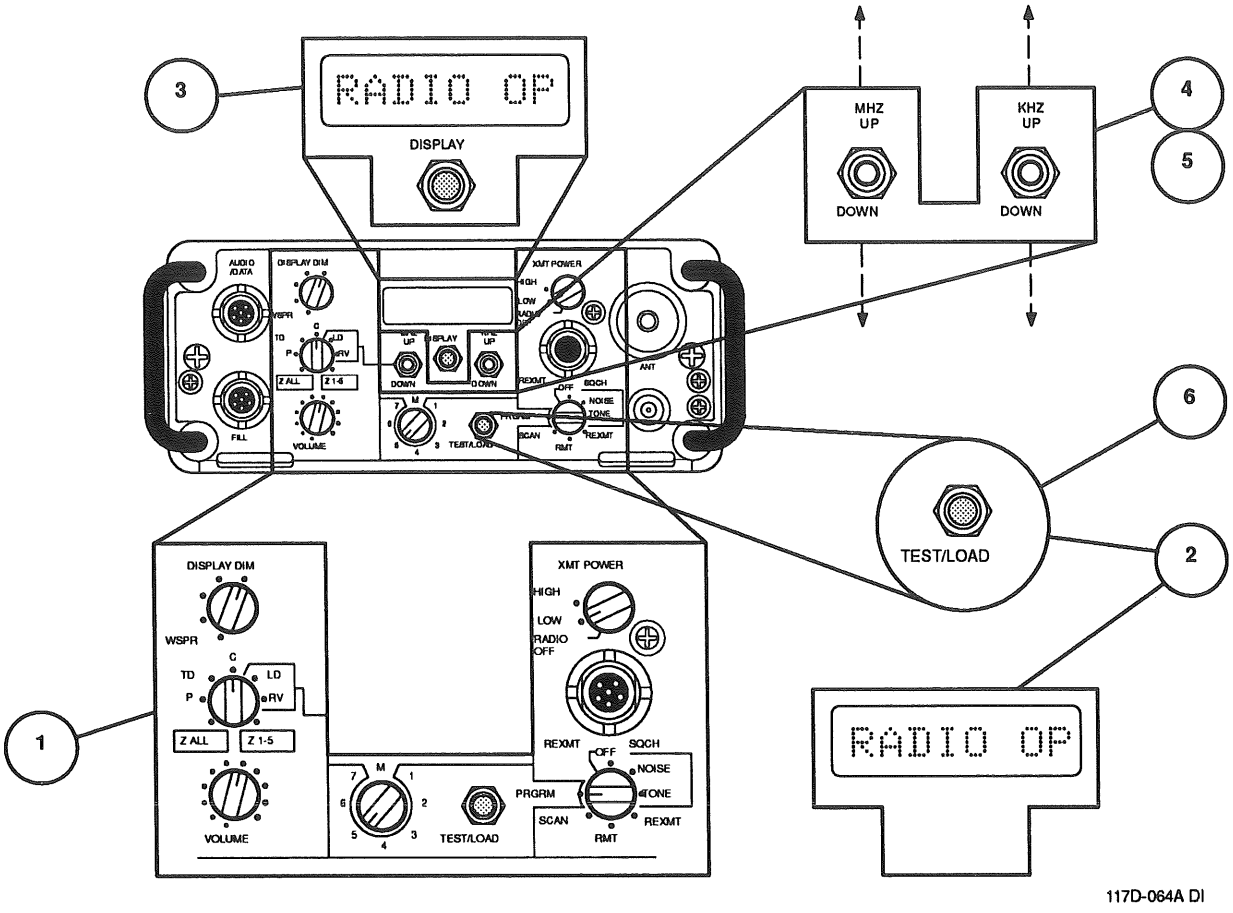



1. Set the following controls:
   - XMT POWER – LOW or HIGH
   - CHANNEL – 1 – 7 or M
   - RADIO Mode – PRGRM
   - COMSEC Mode – P, TD, or C

   Set DISPLAY DIM and VOLUME as desired.
2. Push and hold TEST/LOAD for 2 seconds. The global TOD displays.
3. Push DISPLAY until RADIO OP displays.
4. Toggle the MHZ switch UP or DOWN until ZERO>NO displays.
5. Toggle the KHZ switch UP or DOWN until ZERO>YES displays.
6. Push and hold TEST/LOAD. The LED display goes blank.
   Note that the TEST/LOAD pushbutton must be pressed before the display blanks.
7. Release TEST/LOAD. The LED display changes to 00000000 for approximately 2.5 seconds. The channels are then set to their default values.

**Figure 2-8. RADIO OP – TRANSEC/RADIO Zeroize**

## RADIO OP – SELECTING THE BATTERY TYPE

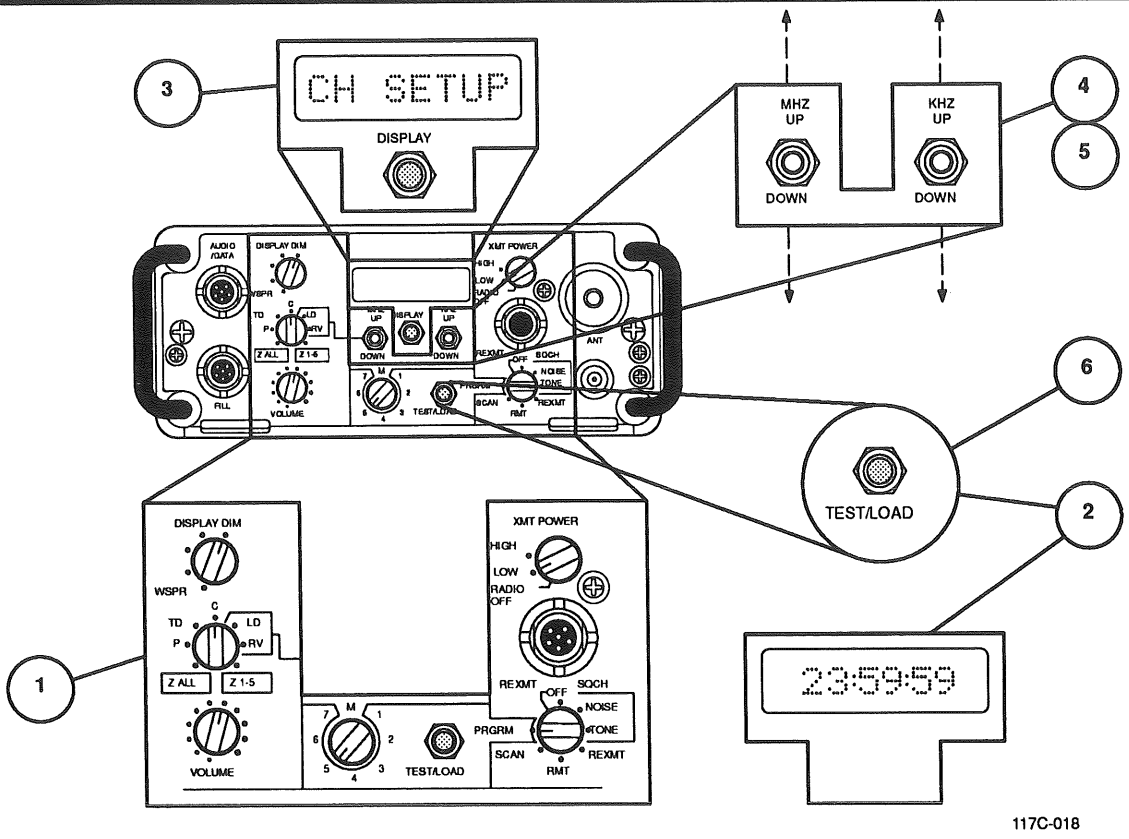



1. Set the following controls:
   - XMT POWER – LOW or HIGH
   - CHANNEL – 1–7 or M
   - RADIO Mode – PRGRM
   - COMSEC Mode – P, TD, C, or RV
2. After LED display blanks, push and hold TEST/LOAD until RADIO OP or CH SETUP appears.
3. Push DISPLAY until RADIO OP appears on the LED display.
4. Toggle the MHZ switch UP or DOWN until BAT>Lith or BAT>Othr displays.
5. Toggle the KHZ switch UP or DOWN to select the desired battery type (Lith or Othr). Lith is for the lithium battery and Othr is for all other batteries and power supplies
6. Push TEST/LOAD to store the new parameter.

   Note that the TEST/LOAD pushbutton must be pressed before the display blanks.

**Figure 2-9. RADIO OP – Selecting the Battery Type**

## CH SETUP – SELECTING THE CHANNEL TYPE




1. Set the following controls:
   - XMT POWER – LOW or HIGH
   - CHANNEL – 1–7
   - RADIO Mode – PRGRM
   - COMSEC Mode – P, TD, or C

   Set DISPLAY DIM and VOLUME as desired.

2. After LED display blanks, push and hold TEST/LOAD until the global TOD appears.

3. Push DISPLAY until CH SETUP appears.

4. Toggle the MHZ switch UP or DOWN until TYP>SNGL, TYP>QKLK, or TYP>SGRS displays.

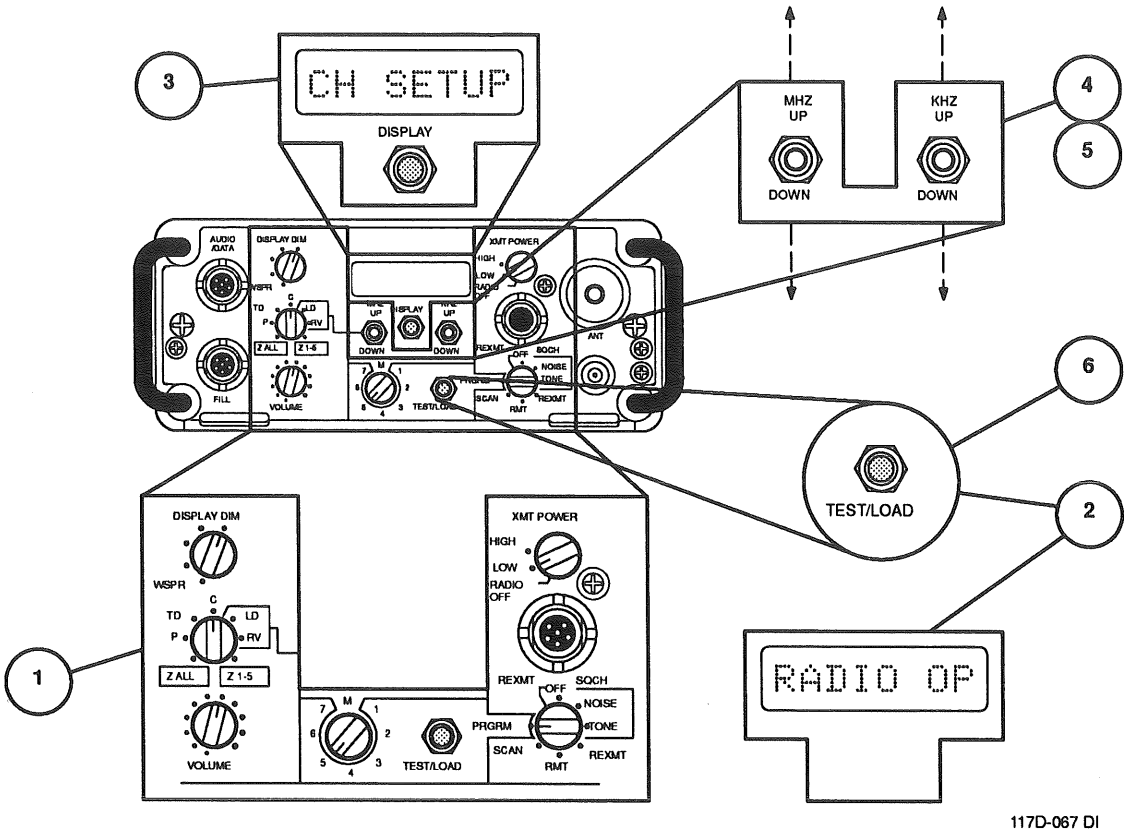
5. Toggle the KHZ switch UP or DOWN to select the desired channel type.

6. Push TEST/LOAD to store the new parameter.

   Note that the TEST/LOAD pushbutton must be pressed before the display blanks.

**Figure 2-10. CH SETUP – Selecting the Channel Type**

## CH SETUP – SELECTING THE MODEM

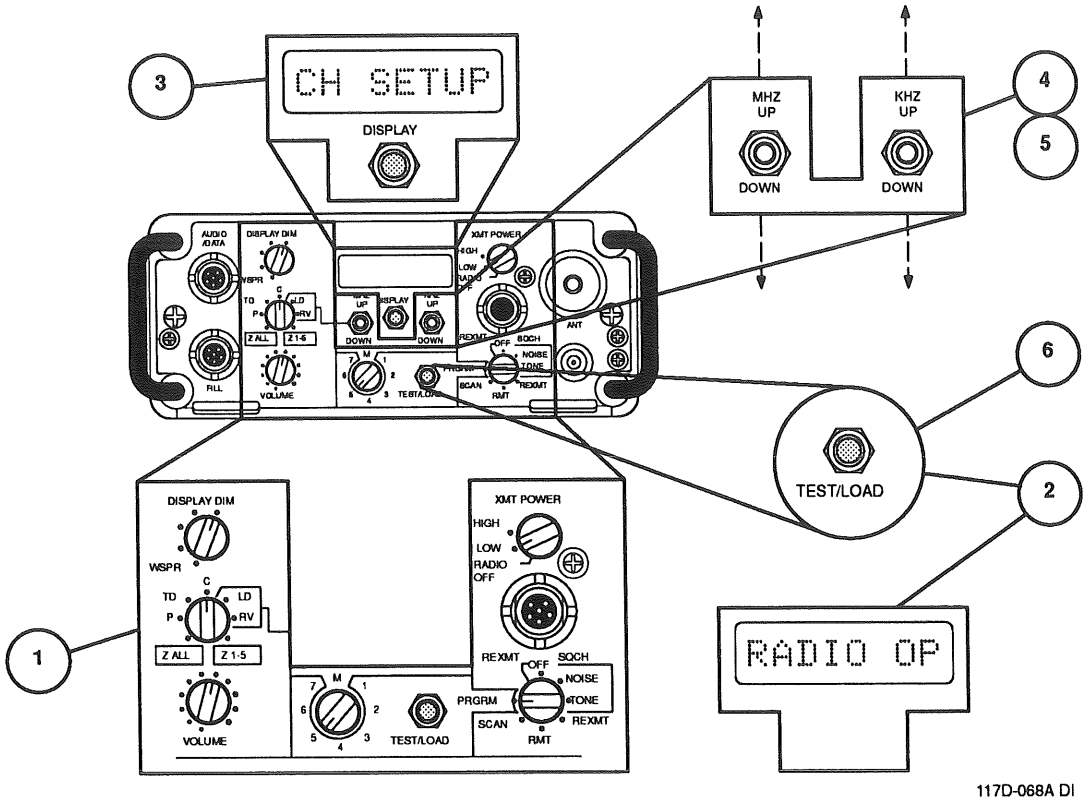



1. Set the following controls:
   - XMT POWER – LOW or HIGH
   - CHANNEL – 1–7 or M
   - RADIO Mode – PRGRM
   - COMSEC Mode – P, TD, C, or RV
2. After LED display blanks, push and hold TEST/LOAD until RADIO OP or CH SETUP appears.
3. Push DISPLAY until CH SETUP appears on the LED display.
4. Toggle the MHZ switch UP or DOWN until MODM>Dif, MODM>Std, or MODM>Off displays.
5. Toggle the KHZ switch UP or DOWN to make the modem selection. Off is used to turn the internal modem off. Dif is for differential SBPSK (Shaped Bi-Phase Shift Keying) mode, and Std is for standard SBPSK mode.
6. Push TEST/LOAD to store the new parameter.

   Note that the TEST/LOAD pushbutton must be pressed before the display blanks.

**Figure 2-11. CH Setup – Selecting the Modem**

## CH SETUP – SELECTING THE CHANNEL SPACING FOR VHF-HI

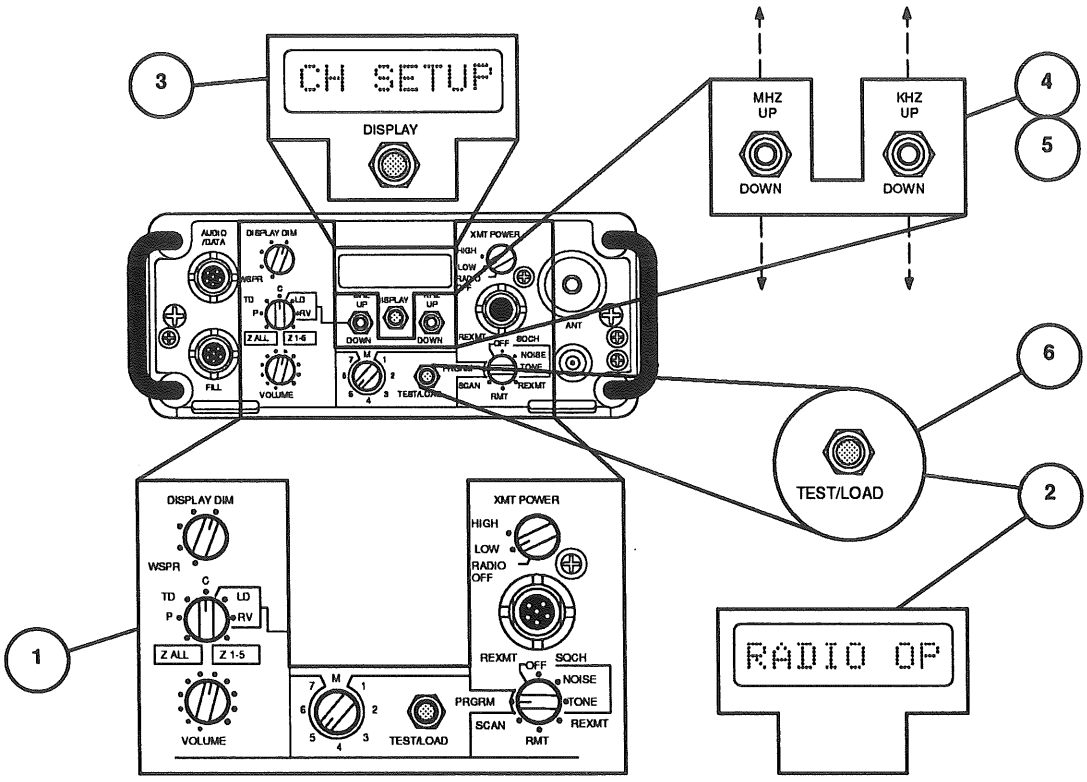



1. Set the following controls:
   - XMT POWER – LOW or HIGH
   - CHANNEL – 1–7 or M
   - RADIO Mode – PRGRM
   - COMSEC Mode – P, TD, C, or RV
2. After LED display blanks, push and hold TEST/LOAD until RADIO OP or CH SETUP appears.
3. Push DISPLAY until CH SETUP appears on the LED display.
4. Toggle the MHZ switch UP or DOWN until SPC>500 or SPC>625 displays.
5. Toggle the KHZ switch UP or DOWN to select the channel spacing for VHF-Hi operation. A value of 500 selects 5 kHz channel spacing and a value of 625 selects a channel spacing of 6.25 kHz.
6. Push TEST/LOAD to store the new parameter.

   Note that the TEST/LOAD pushbutton must be pressed before the display blanks.

**Figure 2-12. CH Setup – Selecting the Channel Spacing for VHF-Hi**

## CH SETUP – TURNING * MODE ON OR OFF

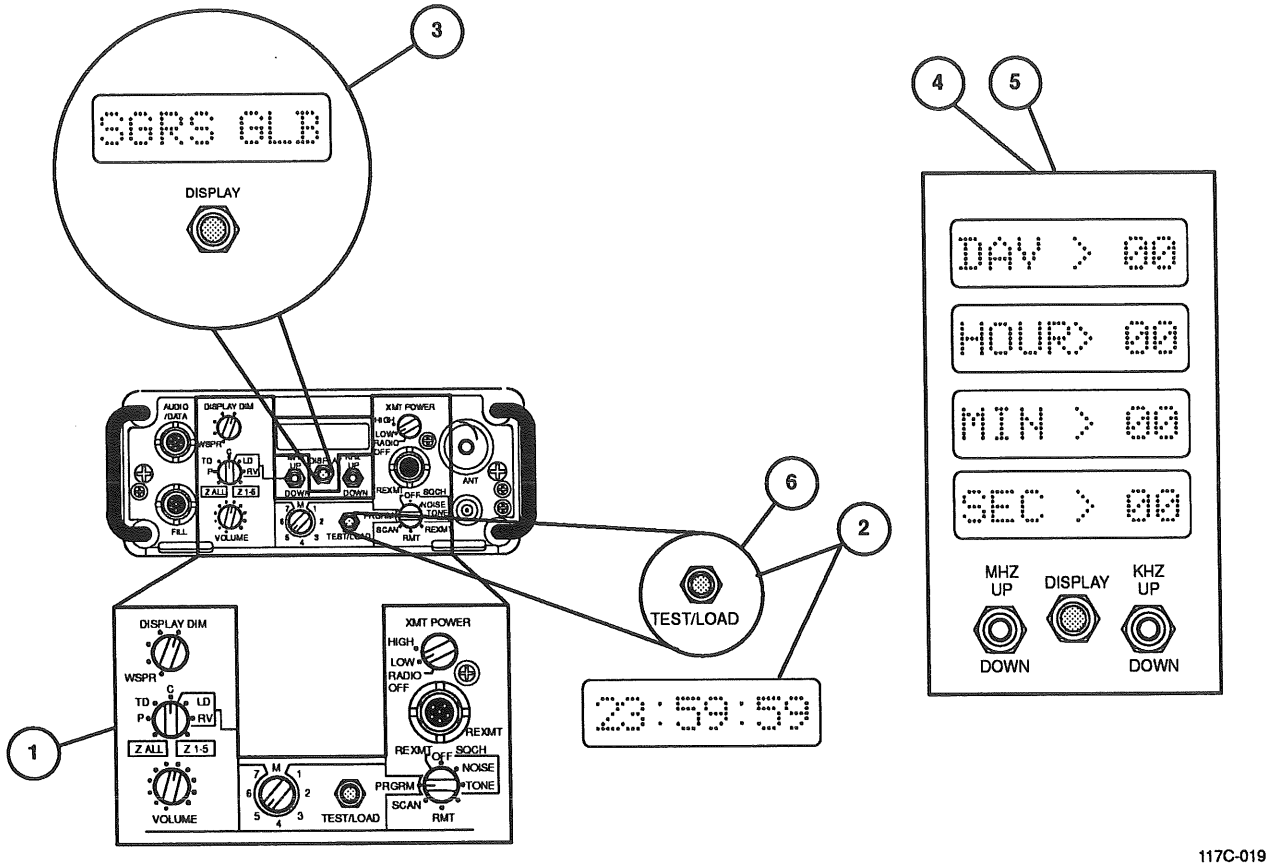



1. Set the following controls:
   - XMT POWER – LOW or HIGH
   - CHANNEL – 1–7 or M
   - RADIO Mode – PRGRM
   - COMSEC Mode – P, TD, C, or RV
2. After LED display blank, push and hold TEST/LOAD until RADIO OP or CH SETUP appears.
3. Push DISPLAY until CH SETUP appears on the LED display.
4. Toggle the MHZ switch UP or DOWN until *>On or *>Off displays.
5. Toggle the KHZ switch UP or DOWN to make the mode selection for COMSEC operation. On enables * mode and Off disables * mode.
6. Push TEST/LOAD to store new parameter.

   Note that the TEST/LOAD pushbutton must be pressed before the display blanks.

**Figure 2-13. CH Setup – Turning * Mode On or Off**

## SGRS GLB – SETTING RADIO GLOBAL TIME OF DAY CLOCK

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(1) Set the following controls:

- XMT POWER – LOW or HIGH
- CHANNEL – 1 – 7 or M
- RADIO Mode – PRGRM
- COMSEC Mode – P, TD, C, or RV

Set DISPLAY DIM and VOLUME as desired.

(2) Push and hold TEST/LOAD for 2 seconds. The global TOD clock displays.

(3) Push DISPLAY until SGRS GLB displays.

(4) Toggle the MHZ switch UP or DOWN until DAY, HOUR, MIN, or SEC displays.

(5) Toggle the KHZ switch UP or DOWN to change the parameter.

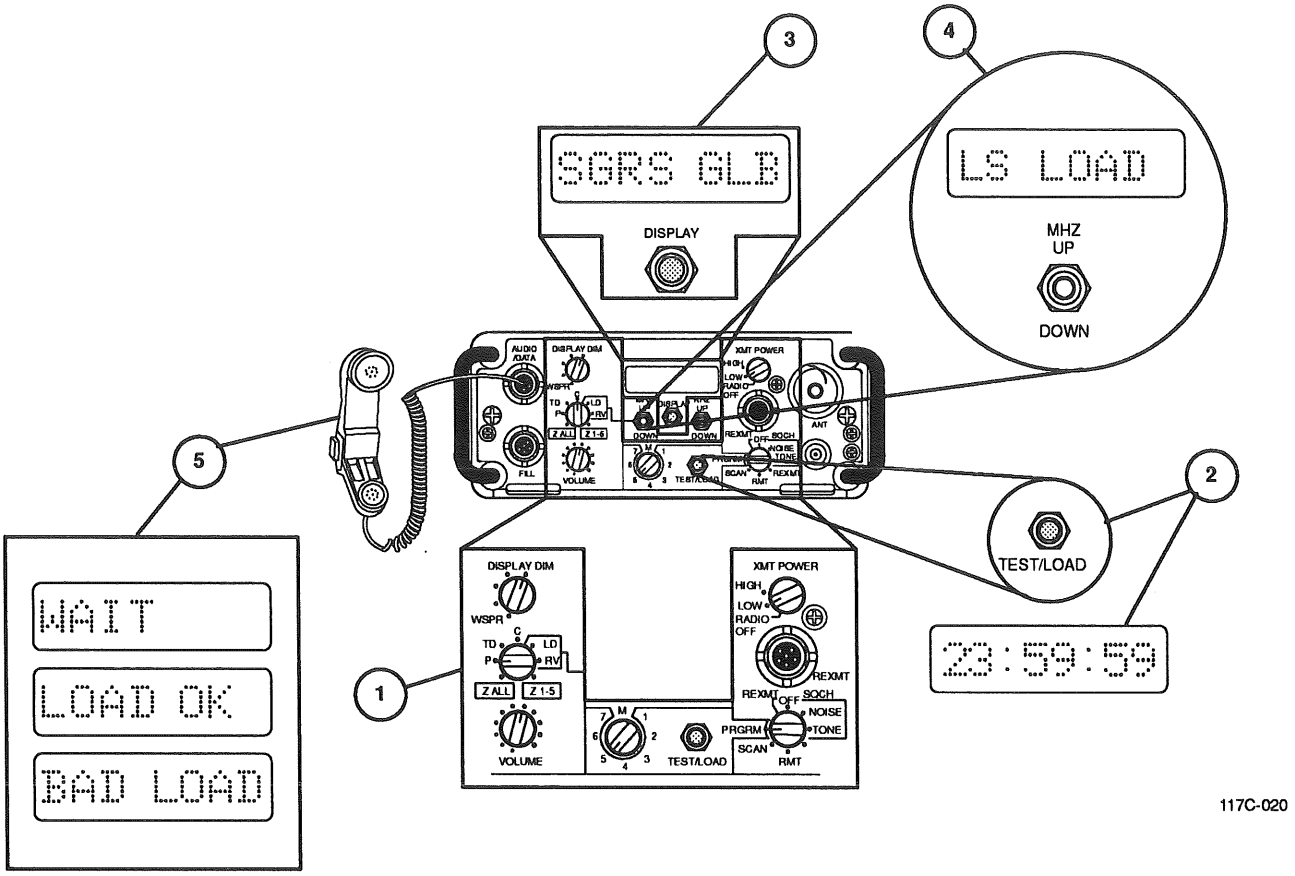
(6) Push TEST/LOAD to store each selected value.

Note that the TEST/LOAD pushbutton must be pressed before the display blanks.

NOTE: Setting the MIN (minutes) parameter changes seconds to 00.

**Figure 2-14. SGRS GLB – Setting Radio TOD Clock**

## SGRS GLB – LOCALLY LOAD A LOCKOUT SET




NOTE:

Connect the FDI to the REXMT connector. Connect the mode 1 fill device to the FDI. A red LED on the FDI indicates that power is on. Initialize the TRANSEC fill device per its instructions.

(1) Set the following controls:

- XMT POWER – LOW or HIGH
- CHANNEL – 1 – 7 or M
- RADIO Mode – PRGRM
- COMSEC Mode – P, C, TD, or RV

Set DISPLAY DIM and VOLUME as desired.

(2) Push and hold TEST/LOAD for approximately 2 seconds. The global TOD clock displays.

(3) Push DISPLAY until SGRS GLB displays.

(4) Toggle the MHZ switch UP or DOWN until LS LOAD displays.

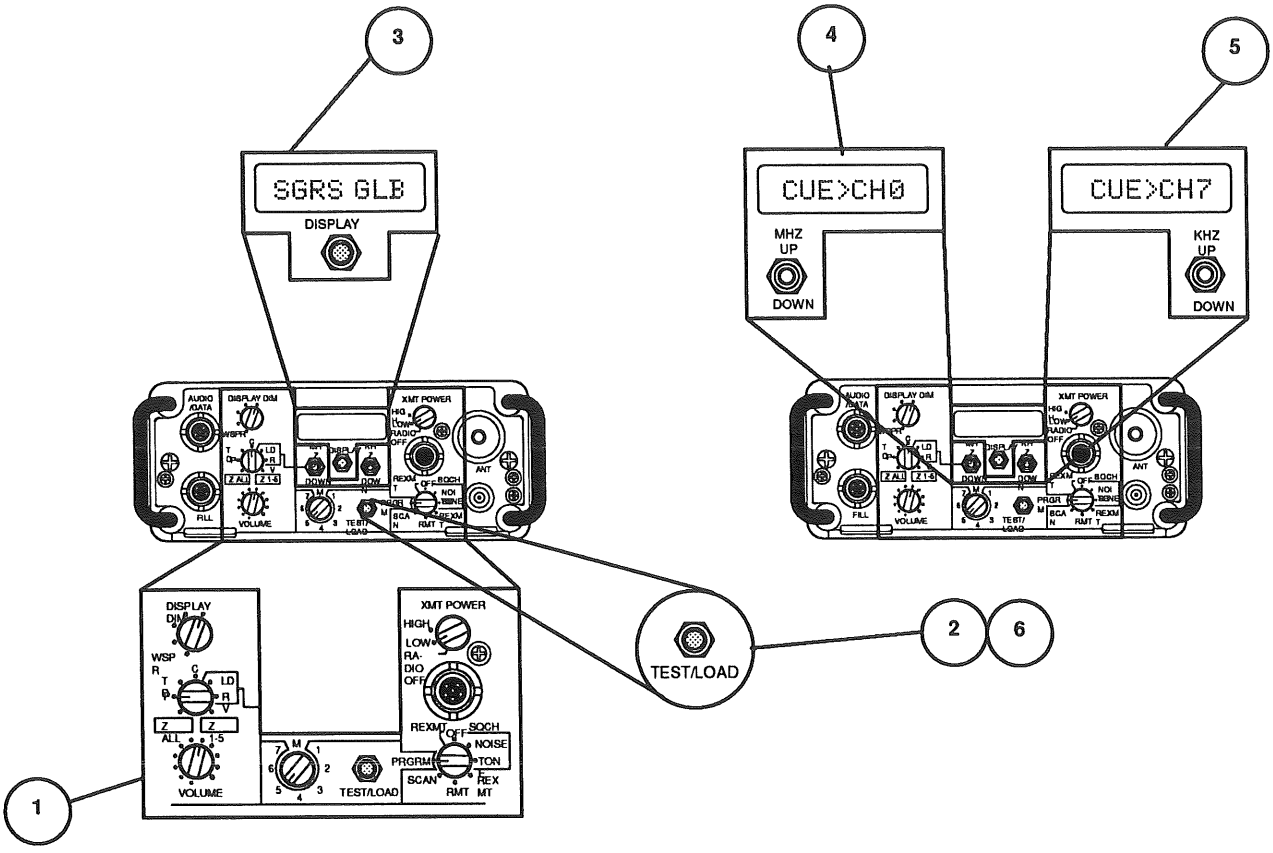
(5) Key the handset and release.

Note that the handset must be keyed before the display blanks.

The display will indicate WAIT, then the identity of the cells being sent (CELL 1 to CELL 3). If the load is successful, LOAD OK displays. If unsuccessful, BAD LOAD displays.

**Figure 2-15. SGRS GLB – Locally Load a Lockout Set**

## SGRS GLB – SELECT CUE CHANNEL




1. Set the following controls:
   - XMT POWER – LOW or HIGH
   - CHANNEL – 1 – 7 or M
   - RADIO Mode – PRGRM
   - COMSEC Mode – P, C, TD, or RV

   Set DISPLAY DIM and VOLUME as desired.

2. Push and hold TEST/LOAD for two seconds. The global TOD clock displays.

3. Push DISPLAY until SGRS GLB appears.

4. Toggle the MHZ switch UP or DOWN until the appropriate selection, CUE>CH0 through CUE>CH7, or CUE>OFF displays.(CH0 refers to the manual channel – M.)

5. Toggle the KHZ switch UP or DOWN until the desired cue channel displays .

6. Push TEST/LOAD to store the channel.

   Note that the TEST/LOAD pushbutton must be pressed before the display blanks.

**Figure 2-16. SGRS GLB – Selecting the Cue Channel**

### 2.9.4 SGRS CH – Setting SINCGARS Channel Parameters

The SINCGARS CH menu is used to perform the following functions for a particular SINCGARS net or channel:

- Select whether a local station is net master or a member of a SINCGARS net/channel
- Locally load a SINCGARS TRANSEC key and hopset for a particular net/channel from either an ICOM or non-ICOM fill device.

#### 2.9.4.1 SGRS CH – Selecting Net Master/Member

To select whether the local station is the master or a member of a SINCGARS net, perform the procedure in Figure 2-17.

#### 2.9.4.2 SGRS CH – TRANSEC Key/Hopset Local Load Procedure

Two types of fill devices are usable with the transceiver and its fill device interface (FDI): ICOM and non-ICOM. With ICOM devices, the TRANSEC key and hopset are loaded in a single operation. With non-ICOM devices, the hopset is loaded first from one fill device storage location, then the TRANSEC key is loaded from a second fill device storage location. The initial steps are the same regardless of which type of fill device is used. Therefore, only one procedure is presented. Perform the procedure in Figure 2-18.

**NOTE**

With ICOM fill devices (e.g., MX-18290/VRC), the hopset and TRANSEC fill devices are loaded in a single operation from a single fill device storage location.

With non-ICOM fill devices (e.g., MX-10579/VRC), the hopset is loaded first, then the TRANSEC key is loaded from a different fill device storage location.

## 2.10 SINGLE (SNGL) CHANNEL PROGRAMMING

Single channel programming can be performed for the manual channel or for channels 1 - 7. The following paragraphs describe the application of single channel programming.

### 2.10.1 Setting Frequency - Manual Channel

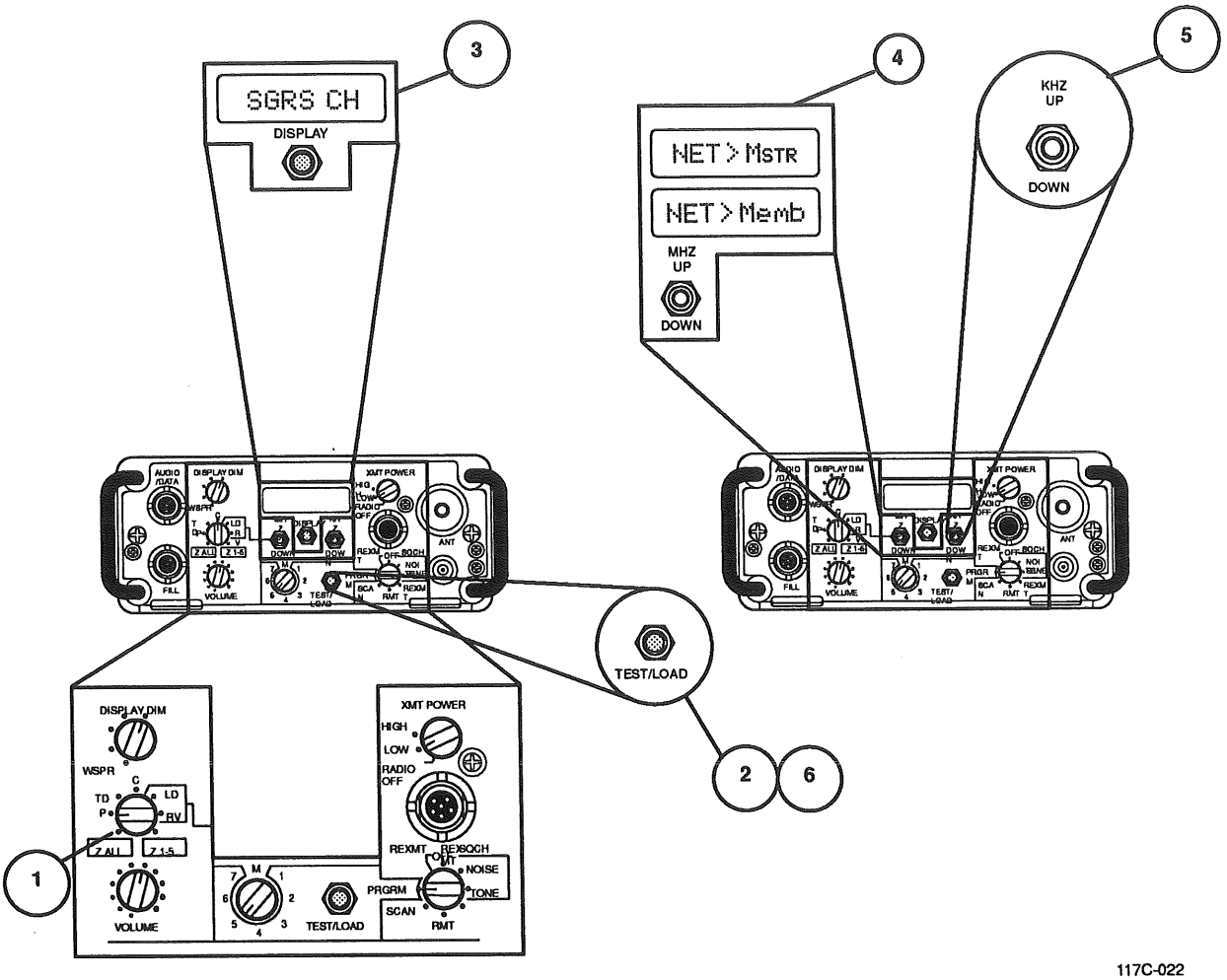
Perform the procedure in Figure 2-19 when selecting a manual channel frequency. For simplex operation (same frequency for both transmit and receive), use steps 1 - 3. For half-duplex operation (receive on one frequency, transmit on another frequency), use steps 1 - 7.

**CAUTION**

The transmitter is active while the handset is keyed during half-duplex manual channel programming.

The MHZ and KHZ toggle switches control the frequency only when the LED display is energized and the directional cursor is pointing to the right. This helps to prevent an accidental change of frequency during operation.

## SGRS CH – SELECT NET MASTER/ MEMBER

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1. Set the following controls:
   - XMT POWER – LOW or HIGH
   - CHANNEL – to the net being set
   - RADIO Mode – PRGRM
   - COMSEC Mode – P, C, or TD

   Set DISPLAY DIM and VOLUME as desired.

2. Push and hold TEST/LOAD for two seconds. The global TOD clock displays.

3. Push DISPLAY until SGRS CH displays.

4. Toggle the MHZ switch UP or DOWN until NET>MSTR or NET>Memb displays.

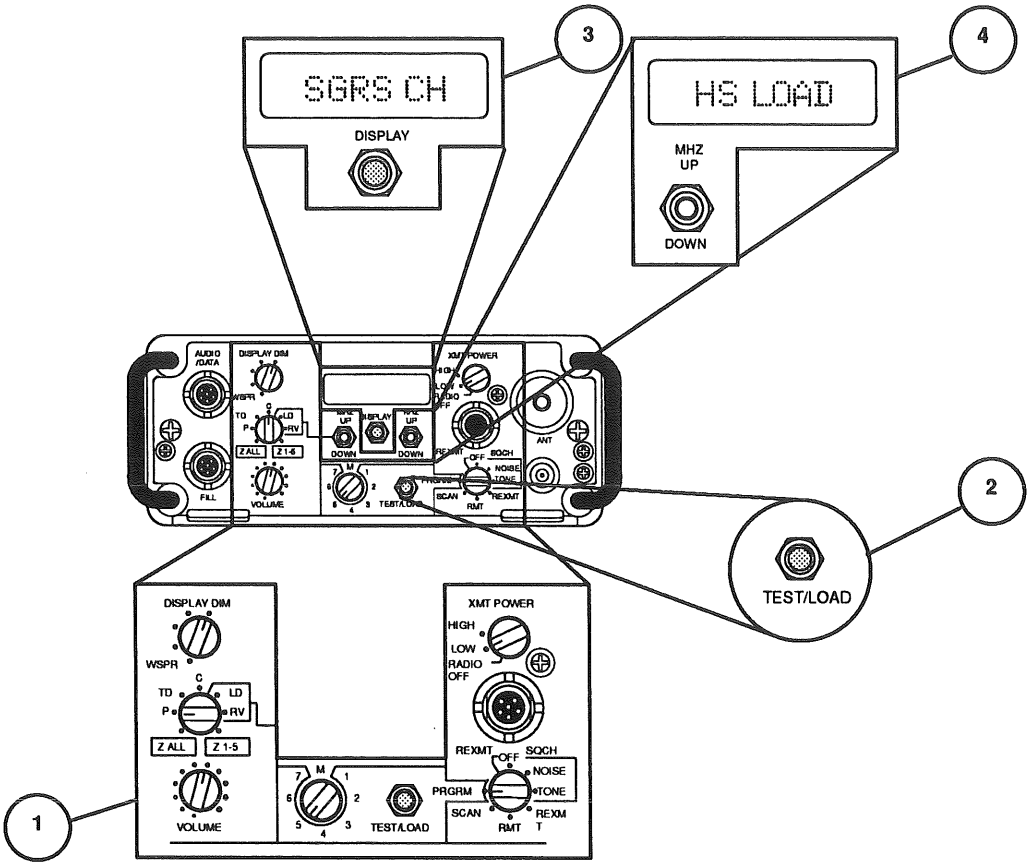
5. Toggle the KHZ switch UP or DOWN to set the proper status for the current net/channel.

6. Push TEST/LOAD to store the status in the radio.

   Note that the TEST/LOAD pushbutton must be pressed before the display blanks.

**Figure 2-17. SGRS CH – Selecting the Net Master/Member**

## SGRS CH – TRANSEC KEY/HOPSET LOCAL LOAD

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NOTE:

Connect the FDI to the REXMT connector. Connect the mode 1 fill device to the FDI. A red LED on the FDI indicates that it is powered on. Initialize the TRANSEC fill device per its instructions.

For an ICOM fill device, set it to the proper hopset/transec storage location. For a non-ICOM fill device, initially set it to the proper hopset storage location.

(1) Set the following controls:

- XMT POWER – LOW or HIGH
- CHANNEL – net being loaded
- RADIO Mode – PRGRM
- COMSEC Mode – P, C, or TD

Set DISPLAY DIM and VOLUME as desired.

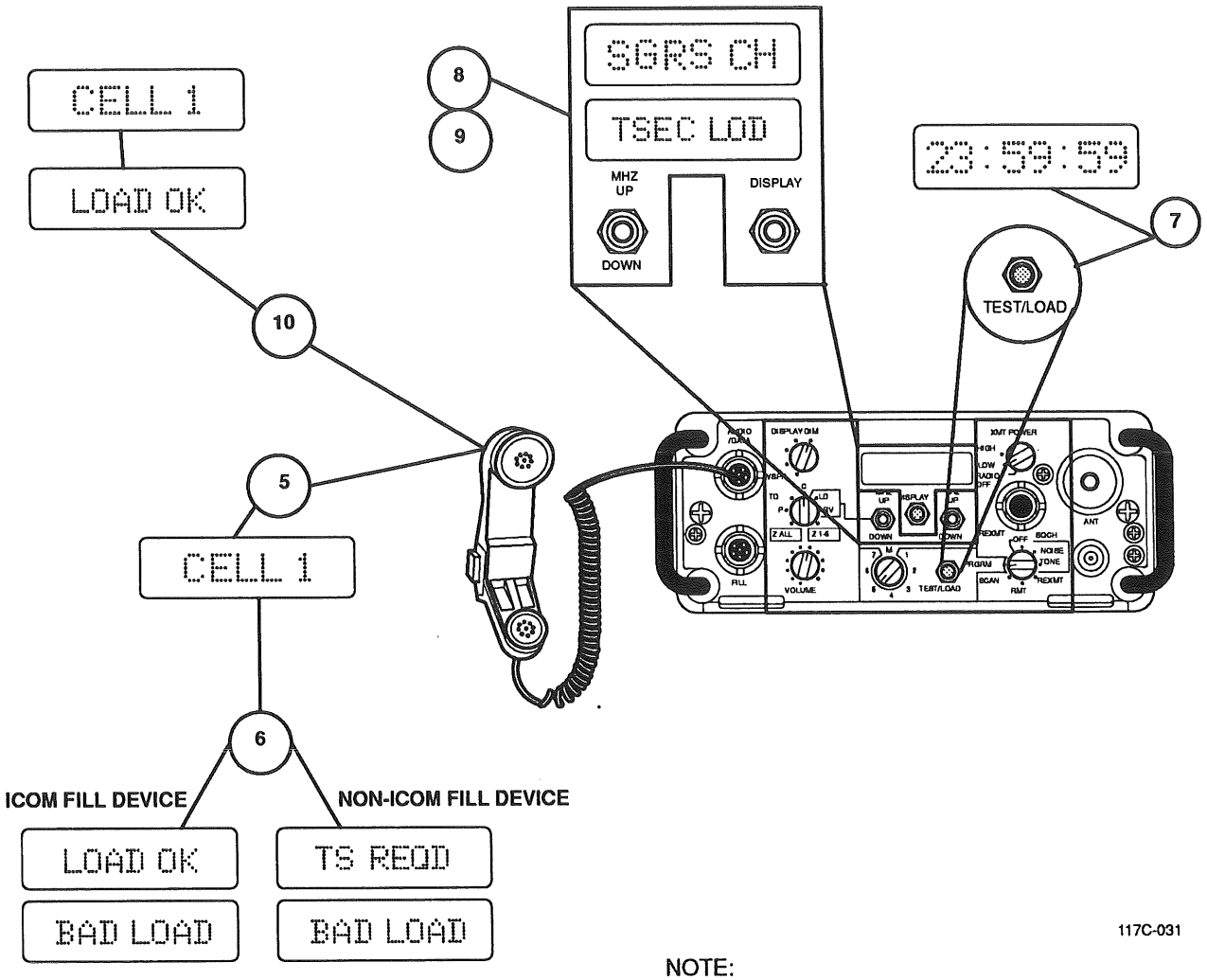
(2) Push and hold TEST/LOAD for two seconds. The global TOD clock displays.

(3) Push DISPLAY until SGRS CH displays.

(4) Toggle the MHZ switch UP or DOWN until HS LOAD displays.

**Figure 2-18. SGRS CH – TRANSEC Key/Hopset Local Load (Sheet 1 of 2)**

## SGRS CH – TRANSEC KEY/HOPSET LOCAL LOAD (CONT.)




NOTE:

Transec keys must be loaded in tandem with hopset fills. Transec keys cannot be loaded as independent operations.

(5) Key the handset and release. Note that the handset must be keyed before the display blanks. For an ICOM fill device, the display indicates CELL #1, etc.

For a non-ICOM fill device, the display indicates TS REQD.

(6) For an ICOM fill device, a good load is indicated by LOAD OK, an improper load is indicated by BAD LOAD.

For a non-ICOM fill device, a good load is indicated by TS REQD, an improper load is indicated by BAD LOAD.

CONTINUE FOR NON-ICOM FILL ONLY:

(7) If display has timed out, push and hold TEST/LOAD for 2 seconds and the TOD displays.

(8) Push DISPLAY until SGRS CH displays.

(9) Toggle the MHZ switch UP or DOWN until TSEC LOD displays. Select the TSK on the non-ICOM fill device.

(10) Key handset and release. Note that the handset must be keyed before the display blanks. First, the hopset cell displays, and then a good load is indicated by LOAD OK.

**Figure 2-18. SGRS CH – TRANSEC Key/Hopset Local Load (Sheet 2 of 2)**

### 2.10.2 Programming Channels 1 - 7 for Single Channel Operation

Perform the procedure in Figure 2-20 when programming frequencies for channels 1 - 7. For simplex operation (same frequency for both transmit and receive), perform steps 1 - 4. For half-duplex operation (receive on one frequency, transmit on another frequency), perform steps 1 - 9.

Figure 2-20 also describes how to recheck the programmed frequency. PRGRM mode must be selected on the RADIO Mode Control. Recall of programmed frequencies can be intentionally prevented by placing a jumper on A4 Power Supply Module. In this situation, *60.000* will display whenever recall is attempted, regardless of the actual programmed frequency. Using this optional jumper prevents unauthorized attempts to display the frequencies programmed. In addition, removal of this jumper and subsequent reinsertion of the A4 module clears radio memory circuitry which had stored the programmed values, again defeating the attempt to display frequencies.

Sensitive frequency, bandwidth, and exclusion information can also be removed from the radio by using the radio zeroize feature. Refer to Paragraph 2.18 and/or 2.9.1.

## 2.11 USING AND PROGRAMMING QUICK-LOOK ECCM CHANNELS

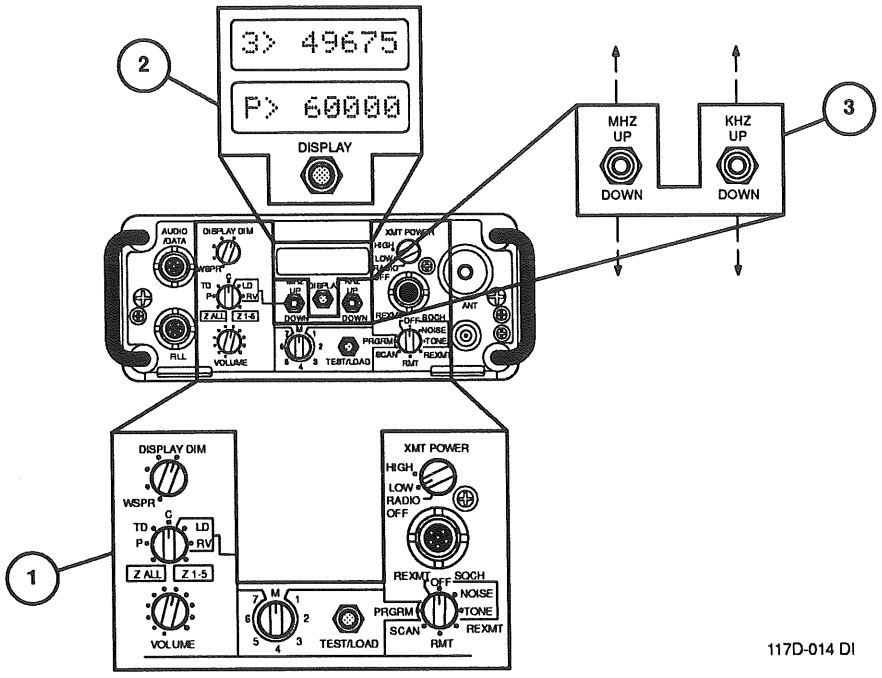
Operating the radio using its Quick-Look ECCM frequency-hopping channels is similar to operating the radio using its standard FM channels. However, there are some differences in radio operating technique due to Quick-Look timing requirements and the need for network synchronization.

Consider the following when using Quick-Look channels:

- When keying the handset, wait for the beep to end before beginning to talk.
- When receiving, wait for the end-of-message beep before keying. This is especially important when using TONE SQUELCH ECCM. Refer to Paragraph 2.8.2.

The SCAN feature of the radio does not detect Quick-Look frequency-hopping signals. In SCAN mode, keying does not initiate frequency-hopping transmission. Refer to Paragraph 2.20.

## SETTING FREQUENCY – MANUAL CHANNEL




**SIMPLEX: STEPS (1) – (3)**
**HALF-DUPLEX: STEPS (1) – (7)**

Begin here for simplex (same transmit/receive frequency) or half-duplex (different transmit/receive frequencies):

(1) Set the following controls:

- XMT POWER – LOW or HIGH
- CHANNEL – M
- RADIO Mode – any position other than RMT, SCAN, or PRGRM
- COMSEC Mode – P, TD, or C
  Initialize COMSEC per Paragraph 2.5.1.

Set DISPLAY DIM and VOLUME as desired.

(2) Push DISPLAY.

Crypto variable storage location and frequency or P (if COMSEC control is in P) and frequency displays. Display must be lit for frequency to be changed.

(3) Select frequency.

Toggle the MHZ and KHZ switches UP or DOWN.

Display blanks automatically after a few seconds.

To recheck the frequency, push DISPLAY.

STOP HERE for simplex operation.

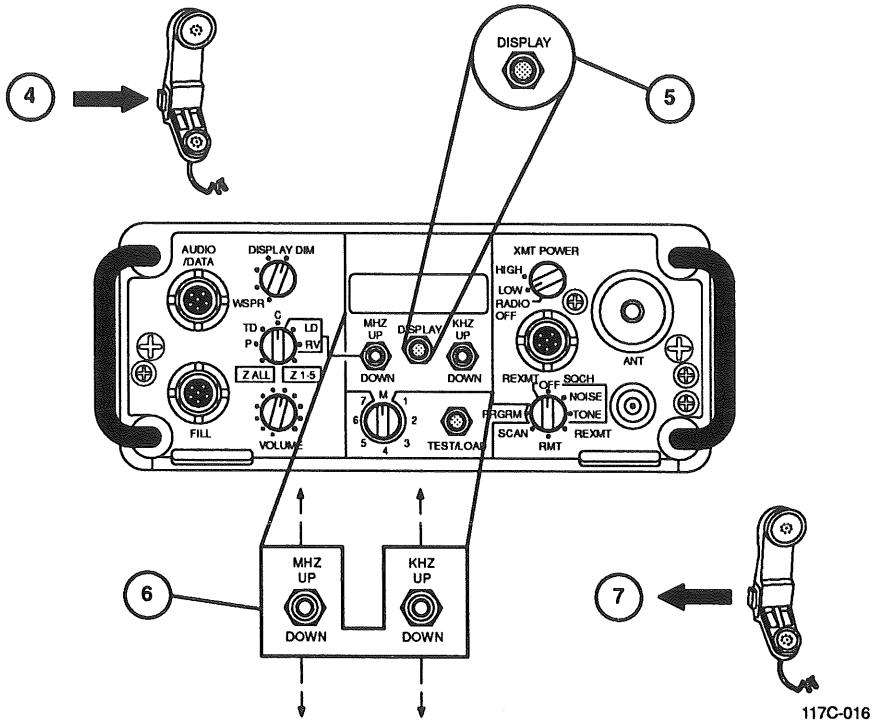
**Figure 2-19. Setting Frequency - MANUAL Channel (Sheet 1 of 2)**

## SETTING FREQUENCY – MANUAL CHANNEL (CONT.)

**HALF-DUPLEX ONLY**

Continue with steps 4 – 7 if transmit frequency differs from receive frequency.

For half-duplex operation on the MANUAL channel, first enter the receive frequency using steps 1 – 3 on previous page. Then install the handset and continue with steps 4 – 7:




4. Key the handset. (Keep keyed until step 7.)

5. Push DISPLAY.

   Current transmit frequency displays.

6. Select the transmit frequency.

   Toggle the MHZ and KHZ switches UP or DOWN.

7. With frequency displayed, push TEST/LOAD.

   The display blanks when TEST/LOAD is pushed, reappears when it is released. Display stays on for 5 seconds, then goes blank.

8. Release the handset key.

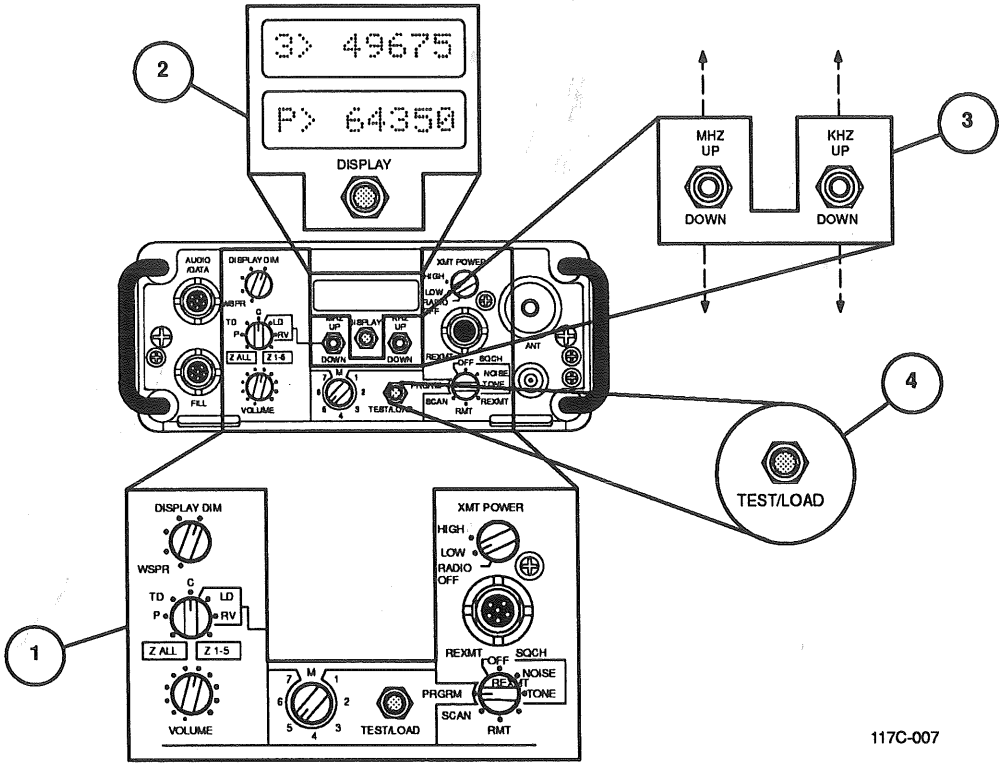
   Display blanks automatically after a few seconds.

   To recheck the receive frequency, push DISPLAY. To recheck the transmit frequency, key the handset, then push DISPLAY.

   NOTE: The transmitter is active while the handset is keyed during half-duplex manual channel programming.

**Figure 2-19. Setting Frequency - MANUAL Channel (Sheet 2 of 2)**

## PROGRAMMING FREQUENCY – SINGLE CHANNEL OPERATION




Begin here for simplex (same transmit/receive frequency) or half-duplex (different transmit/receive frequencies):

(1) Set the following controls:

- XMT POWER – LOW or HIGH
- CHANNEL – 1 – 7
- RADIO Mode – PRGRM
- COMSEC Mode – P, TD, C, or RV (Initialize COMSEC per Paragraph. 2.5.1.)

(2) Set DISPLAY DIM and VOLUME as desired.

Push DISPLAY.

Crypto variable storage location and frequency or P (if COMSEC control is in P) and frequency displays. Display must be lit for frequency to be changed.

(3) Select frequency.

Toggle the MHZ and KHZ switches UP or DOWN.

(4) With frequency displayed, push TEST/LOAD.

The display blanks when TEST/LOAD is pushed, reappears when it is released. Display stays on for 5 seconds, then goes blank.

To recheck the frequency, push DISPLAY. EXCEPTION: If 60.000 displays, an internal jumper prevents recall of frequency.

STOP HERE for simplex operation.

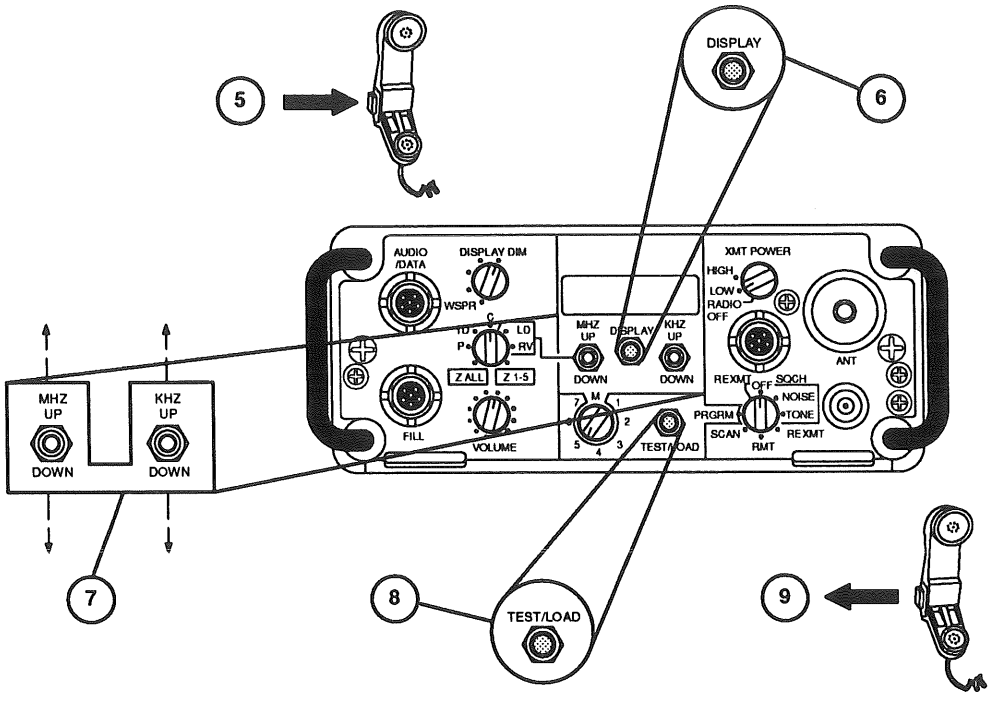
**Figure 2-20. Programming Frequency - Single Channel Operation (Sheet 1 of 2)**

## PROGRAMMING FREQUENCY – SINGLE CHANNEL OPERATION (CONT.)

**HALF-DUPLEX ONLY**

Continue with steps 5 – 9 if transmit frequency differs from receive frequency.

For half-duplex operation on programmed frequency channels, first enter the receive frequency using steps 1 – 4 on previous page. Then install the handset and continue with steps 5 – 9:

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(5) Key the handset. (Keep keyed until step 9.)

(6) Push DISPLAY.

Current transmit frequency displays.

(7) Select the transmit frequency.

Toggle the MHZ and KHZ switches UP or DOWN.

(8) With frequency displayed, push TEST/LOAD.

The display blanks when TEST/LOAD is pushed, reappears when it is released. Display stays on for 5 seconds, then goes blank.

(9) Release the handset key.

Display blank automatically after a few seconds.

To recheck the receive frequency, push DISPLAY.
To recheck the transmit frequency, key the handset, then push DISPLAY.
EXCEPTION: If 60.000 displays, an internal jumper prevents recall of frequency.

NOTE: Whenever the receiver frequency is reprogrammed, the transmit frequency automatically reverts to the new receive frequency.

**Figure 2-20. Programming Frequency - Single Channel Operation (Sheet 2 of 2)**

### 2.11.1 Programming Quick-Look ECCM Channels

Quick-Look channels are programmed with ECCM codes rather than with discrete frequencies.

The Quick-Look bandwidth defaults to a 5 MHz narrowband selected by the first two (MHz) digits of the Quick-Look code, as shown in Table 2-3. The five-digit (2 MHz and 3 kHz) number determines part of the pseudorandom hopping pattern for Quick-Look transmission and reception on this channel. Figure 2-21 illustrates the significance of this programmed code for a Quick-Look channel.

The hopping bandwidth, however, does not have to be tied to the Quick-Look code. The operator can manually change the 5-MHz default Quick-Look band to another bandwidth distinct from the default position. This selection can be made anywhere on the 30 - 90 MHz range, but the bandwidth must always remain a multiple of 5 MHz.

When loading a Quick-Look code, the hopping bandwidth is set to the default for 5 MHz narrow-band hopping. To change the bandwidth of wide-band hopping, push DISPLAY and the current Quick-Look code displays. Push DISPLAY a second time. The current hopping bandwidth displays. Repeatedly pushing DISPLAY toggles between the loaded Quick-Look code and the bandwidth. While the bandwidth is displayed, the MHZ toggle switch moves the lower limit up and down and the KHZ toggle switch moves the upper limit up and down. Each number changes in increments of 5 MHz and will always stay a minimum of 5 MHz apart. When the desired hopping bandwidth is displayed, it is loaded by pushing the TEST/LOAD pushbutton.

An optional second five-digit Quick-Look code can be entered by keying the handset. The five digits of this second code change the number of hopping patterns available. This code can be programmed anywhere in the 30.000 - 89.975 range.

Programming Quick-Look channels with narrow-bandwidth hopping is shown in Figure 2-22. Programming Quick-Look channels with wide-bandwidth hopping is shown in Figure 2-23.

**Table 2-3. MHz Default Quick-Look Bands**

| Quick-Look Frequency Bands (MHz) | |
|---|---|
| 30.000 - 34.975 | 60.000 - 64.975 |
| 35.000 - 39.975 | 65.000 - 69.975 |
| 40.000 - 44.975 | 70.000 - 74.975 |
| 45.000 - 49.975 | 75.000 - 79.975 |
| 50.000 - 54.975 | 80.000 - 84.975 |
| 55.000 - 59.975 | 85.000 - 89.975 |

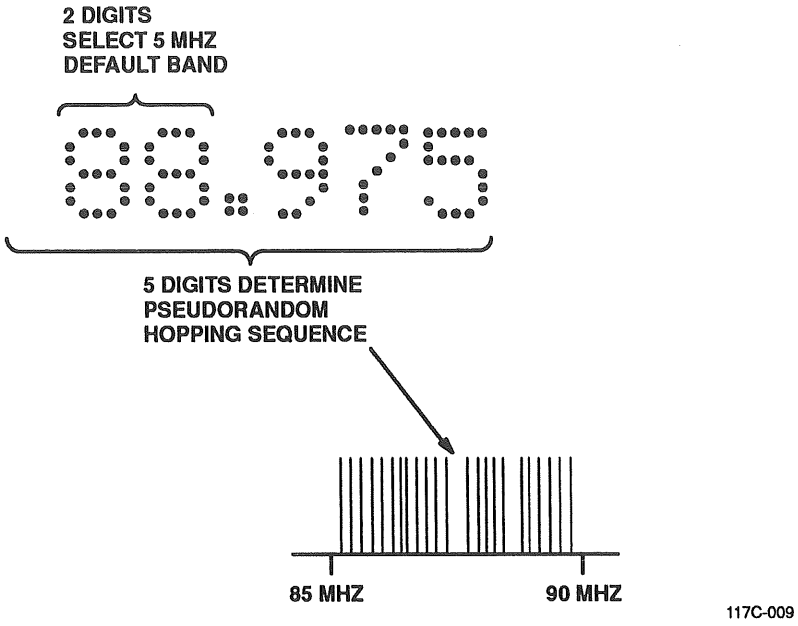



**Figure 2-21. ECCM Channel Frequency Value**

### 2.11.2 Coordinating Radio Setup for Quick-Look ECCM

Quick-Look communication between two or more transceivers requires identical setup conditions. The radios must have the following:

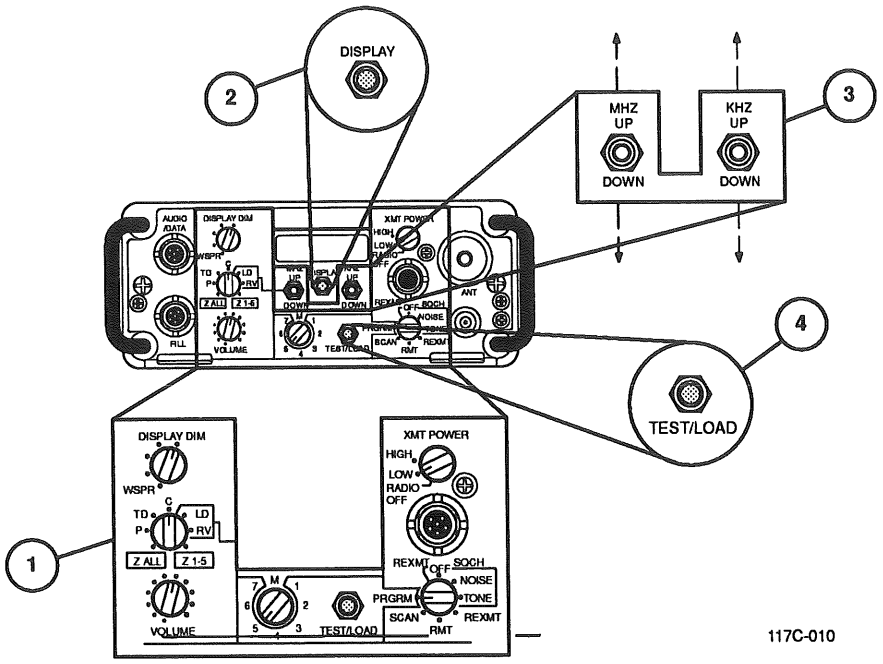
- Identically programmed frequency codes, bandwidths, and optional exclusions. Refer to Paragraph 2.11.1.
- Identical jumper positions on A2 Signal Synchronizer Module.

In addition to these setup conditions, a compatible mode control SQUELCH setting is recommended. Refer to Paragraph 2.8.3.

Double check each of these conditions to coordinate frequency-hopping communication within a radio network.

## PROGRAMMING QUICK-LOOK ECCM CHANNELS (NARROW-BAND)

ECCM channels are programmed with a required 5-digit code (steps 1 – 4 for narrow-band). An optional 5-digit code (steps 5 – 9) changes the number of available hopping patterns.




(1) Make sure channel type is QKLK (see Paragraph 2.8.2) and set these controls:

- XMT POWER – LOW or HIGH
- CHANNEL – 1 – 7
- RADIO Mode – PRGRM
- COMSEC Mode – P, TD, C, or RV (Initialize COMSEC per Paragraph 2.5.1.)

(2) Set DISPLAY DIM and VOLUME as desired.

Push DISPLAY.

Crypto variable storage location or P (if COMSEC control is in P) and 5-digit ECCM code displays. Display must be lit to change 5-digit ECCM code.

(3) Select 5-digit ECCM code.

Toggle the MHZ switch to select the ECCM band and the KHZ switch to determine part of the pseudorandom hopping pattern.

(4) With 5-digit ECCM code displayed, push TEST/LOAD.

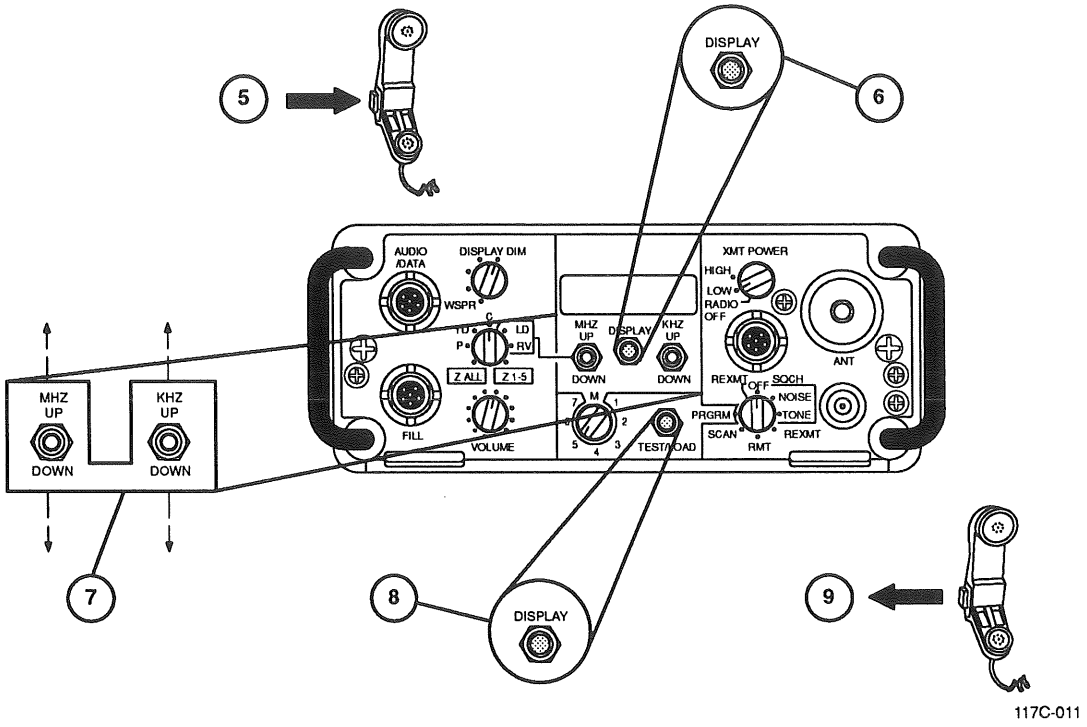
The display goes blank when TEST/LOAD is pushed, reappears when the it is released. Display will stay on for 5 seconds, then goes blank.

> NOTE: The first two digits of the required 5-digit ECCM code determine the default 5 MHz narrow hopping bandwidth.
>
> - Refer to table 2-3 for the 5 MHz default ECCM band.

To recheck the 5-digit ECCM code, push DISPLAY. EXCEPTION: If 60.000 displays, an internal jumper prevents recall of ECCM code.

**Figure 2-22. Programming Quick-Look ECCM Channels with Narrow-Bandwidth Hopping (Sheet 1 of 2)**

## PROGRAMMING QUICK-LOOK CHANNELS (NARROW-BAND) (CONT.)




OPTIONAL 10-DIGIT Quick-Look HOPPING CODE

Continue with steps 5 – 9 to enter a second 5-digit Quick-Look code to extend the hopping code to 10 digits. First enter the required 5-digit ECCM code using steps 1 – 4 on previous page. Then install the handset and continue with steps 5 – 9:

(5) Key the handset. (Keep keyed until step 9.)

(6) Push DISPLAY.

Current optional Quick-Look code displays.

(7) Select the second Quick-Look code anywhere in the 30.000 – 89.975 range. Toggle the MHZ and KHZ switches UP or DOWN.

(8) With second Quick-Look code displayed, push TEST/LOAD.

The display blanks when TEST/LOAD is pushed, reappears when it is released. Display will stay on for 5 seconds, then go blank.

Release the handset key.

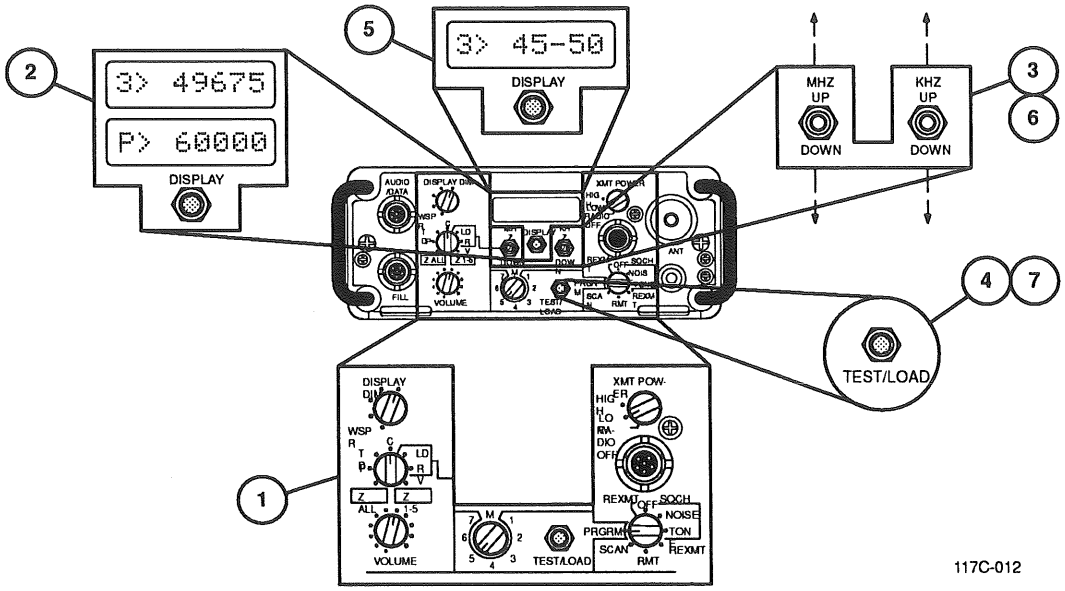
(9) Display blanks automatically after a few seconds.

To recheck the optional Quick-Look code, key the handset then push DISPLAY.
EXCEPTION: If 60.000 displays, an internal jumper prevents recall of optional Quick-Look code.

**Figure 2-22. Programming Quick-Look ECCM Channels with Narrow-Bandwidth Hopping (Sheet 2 of 2)**

## PROGRAMMING QUICK-LOOK ECCM CHANNELS (WIDE-BAND)

Quick-Look channels are programmed with a required 5-digit code (steps 1 – 7 for wide-band). An optional 5-digit code (steps 8 – 13) changes the number of available hopping patterns.




(1) Make sure channel type is QKLK (see Paragraph 2.9.2) and set these controls:

- XMT POWER – LOW or HIGH
- CHANNEL – 1–7
- RADIO Mode – PRGRM
- COMSEC Mode – P, TD, C, or RV Initialize COMSEC per Paragraph 2.5.1.

Set DISPLAY DIM and VOLUME as desired.

(2) Push DISPLAY.

Crypto variable storage location or P (if COMSEC control is in P) and 5-digit Quick-Look code displays. Display must be lit to change 5-digit Quick-Look code.

(3) Select 5-digit Quick-Look code.

Toggle the MHZ and KHZ switches UP or DOWN to select the Quick-Look codes. Bandwidth defaults to 5 MHz narrowband selected by the MHZ digits.

(4) With 5-digit Quick-Look code displayed, push TEST/LOAD.

The display goes blank when TEST/LOAD is pushed, reappears when it is released. Display will stay on for 5 seconds, then goes blank.

(5) To change the bandwidth for wide-band hopping, push DISPLAY twice.

Bandwidth displays. Display must be lit to change bandwidth.

(6) Select bandwidth. Toggle the MHZ switch to select the low end of the band. Toggle the KHZ switch to select the high end of the band.

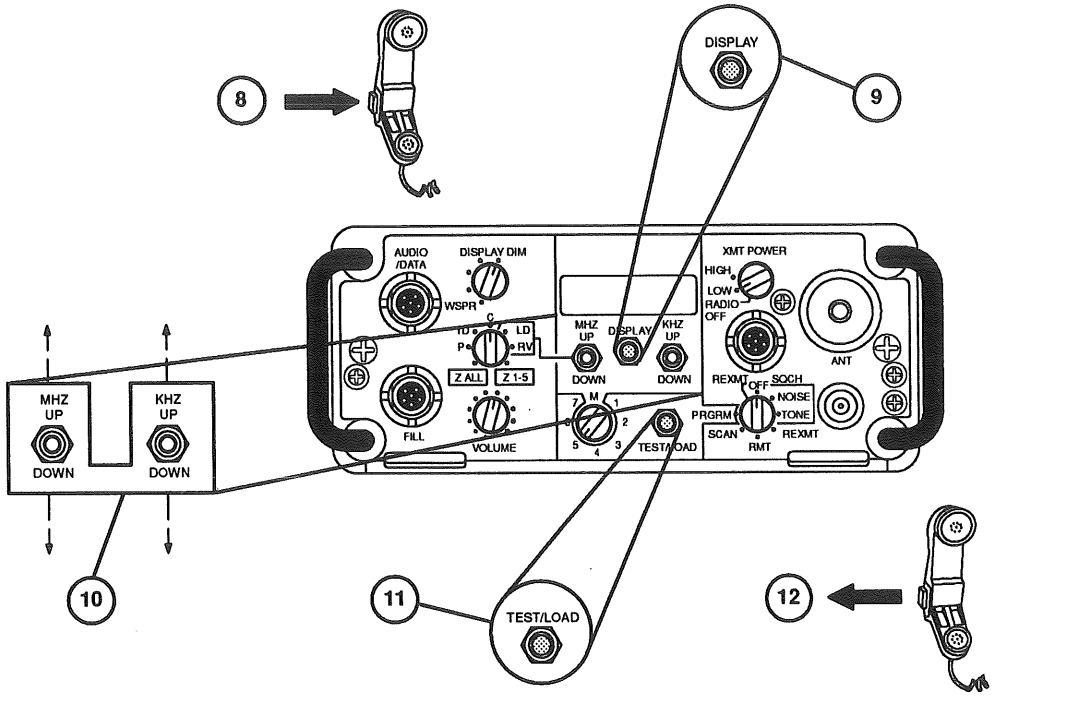
(7) With bandwidth displayed, push TEST/LOAD.

The display blanks when TEST/LOAD is pushed, reappears when it is released. Display will stay on for 5 seconds, then go blank.

To recheck the 5-digit Quick-Look code, push DISPLAY. To recheck the bandwidth, push DISPLAY again.
EXCEPTION: If 60.000 or 60 – 65 displays, an internal jumper prevents recall of Quick-Look code or bandwidth.

**Figure 2-23. Programming Quick-Look Channels with Wide-Bandwidth Hopping (Sheet 1 of 2)**

## PROGRAMMING QUICK-LOOK ECCM CHANNELS (WIDE-BAND) (CONT.)




**OPTIONAL 10-DIGIT Quick-Look HOPPING CODE**

Continue with steps 8 – 13 to enter a second 5-digit Quick-Look code to extend the hopping code to 10-digits. First enter the required 5-digit Quick-Look code selection using steps 1 – 7 on previous page, then install the handset and continue with steps 8 – 13:

(8) Key the handset. (Keep keyed until step 12.)

(9) Push DISPLAY.

Current optional Quick-Look code displays.

(10) Select the second Quick-Look code. Toggle the MHZ and KHZ switches UP or DOWN.

(11) With second Quick-Look code displayed, push TEST/LOAD.

The display goes blank when TEST/LOAD is pushed, reappears when it is released. Display will stay on for 5 seconds, then blank.

(12) Release the handset key.

Display blanks automatically after a few seconds.

(13) Enter hopping bandwidth, using steps 5 – 7.

To recheck the optional Quick-Look code, key the handset then push DISPLAY.
EXCEPTION: If 60.000 displays, an internal jumper prevents recall of optional Quick-Look code.

**Figure 2-23. Programming Quick-Look ECCM Channels with Wide-Bandwidth Hopping (Sheet 2 of 2)**

### 2.11.3 Exclusion Bandwidth Considerations

The RF-3046 Field Programmer - Exclusions (FPX) is used to program a manpack transceiver to exclude certain bandwidths from being used during hopping operations. The radio operator may be unaware of these exclusions and cannot reprogram them without using an RF-3046 FPX.

If the operator selects a Quick-Look channel and attempts to load a hopping bandwidth excluded from hopping operations, the radio appears to be non-operational on that channel and does not respond when keyed. When the RADIO Mode Control is changed out of PRGRM mode into any other operational mode, an A31 fault code is displayed. A31 displays anytime the Quick-Look channel with the excluded bandwidth is selected or if self test is performed while on that channel.

For example, if the operator loads a bandwidth of 30 - 40 MHz and exclusion bandwidths of 30 - 35 and 35 - 40 were previously programmed in the radio, programming is incorrect because there is no available band for the radio to hop in on that channel. In order to use the channel, the operator must select another hopping bandwidth or delete the exclusion information by zeroizing the radio. See Figure 2-8.

### 2.11.4 Clear-Net Entry (Plain Text Mode Only)

During Quick-Look operation in plain text mode, the automatic scanning sequence of the clear-net key responds to an incoming signal from a clear single channel call. When the radio is set to a Quick-Look channel, it automatically scans a specific clear single channel.

Each Quick-Look channel has a single corresponding clear FM channel which is directly opposite the present Quick-Look channel. For example, when set to Quick-Look ECCM channel:

- 5 - the radio scans clear FM channel 1
- 6 - the radio scans clear FM channel 2
- 7 - the radio scans clear FM channel 3

**NOTE**

Clear-Net Entry is not a function in cipher text operation nor when the opposite channel is a SINCGARS channel.

The radio scans the appropriate clear FM channel when it is not actively transmitting or receiving on its selected Quick-Look channel.

#### 2.11.4.1 Clear-Net Entry Setup

Perform the following procedure to set up the clear-net entry feature:

a. Select the clear channel frequency so that it is within the hopping band of the corresponding Quick-Look channel.
b. Set clear channel radios for TONE SQUELCH. These radios must transmit the 150 Hz subcarrier tone required for TONE SQUELCH operation.

#### 2.11.4.2 Clear Channel Signal Detected

When the transceiver detects the clear channel signal, it alerts the operator in two ways:

- A beep is heard in the handset once every four seconds. If the operator does not respond to this signal, the beeping stops after three beeps, but the display stays on. Receiving or transmitting Quick-Look or changing the channel re-enables the handset to beep.
- The front panel displays *Chan 1*, *Chan 2*, or *Chan 3* for the appropriate channel.

To transmit or receive on the clear channel, set the front panel channel control to the number of the clear channel. If the radio is not set in this manner, Quick-Look operation continues.

## 2.12 SINCGARS ECCM OPERATIONS

The main SINCGARS operation menu, described in Paragraph 2.12.1, permits the operator to do the following:

- Identify the COMSEC variable ID for a particular SINCGARS net
- Display the TOD clock for a particular net
- Set the transmit power level
- Activate and deactivate SINCGARS Late Net Entry (LNE) mode
- Perform Quick-Look remote fill (ERF) operations (remote loading of SINCGARS hopsets, lockout sets, and time of day.

**NOTE**

Transmission of an ERF is only possible when the radio is a SINCGARS net master.

The SINCGARS Cold Start ERF Menu, described in Paragraph 2.12.2, is active in the manual channel only and permits the operator to do the following:

- Transmit cold start ERF operations (remotely transmitting hopset, lockout sets, and time of day)
- Receive cold start ERF operations (remotely receiving hopsets, lockout sets, and time of day).

Perform the following procedure when using front panel controls:

a. Repeatedly push the DISPLAY pushbutton to scroll through menu parameters when at the top level of the menu.

b. Push the MHZ switch down to move from the menu top level to its lower level.

c. Use the MHZ switch to scroll through menu parameters when at the lower level of the menu.

d. Push the DISPLAY pushbutton to move from the menu lower level to the top level.

e. Toggle the KHZ switch to scroll through the range of values for a particular parameter.

f. Push the TEST/LOAD pushbutton to load the parameter with the selected value.

g. Push the TEST/LOAD pushbutton to initiate SINCGARS rekeying (Quick-Look Remote Fill) of a remote station and key the transmitter.

When the < and > characters flash in the display, they point to parameters which can be changed.

When the / character appears, it indicates that no currently displayed parameter can be changed.

The display goes blank after approximately five seconds after the last operator action unless the TEST/LOAD pushbutton is pushed.

### 2.12.1 Main SINCGARS Operations Menu

The Main SINCGARS Menu is accessible when the CHANNEL selector is set to any channel programmed for SINCGARS operation. This menu allows the operator to perform the following functions:

- View the current COMSEC variable and SINCGARS net ID number for the selected SINCGARS channel
- Enable or disable SINCGARS Late Net Entry (LNE) mode
- Monitor the net time-of-day (TOD) clock of the selected SINCGARS channel
- Adjust the radio transmit power level
- Accomplish Quick-Look Remote Fill (ERF) transmit and receive operations.

The SINCGARS Cold Start ERF Menu is accessible with the CHANNEL selector set to the manual (M) position. It permits Cold Start Quick-Look Remote Fill operation. This menu is described in Paragraph 2.12.2.

#### 2.12.1.1 Determining the Current COMSEC Variable and SINCGARS Net ID for a Channel

This menu selection permits the operator to monitor the COMSEC variable storage location and late net entry status for the particular channel. Perform the following procedure to access this selection:

a. Apply power to the radio.

b. Set the front panel channel selector to the correct SINCGARS channel.

c. Set the RADIO Mode Control to OFF, NOISE or TONE.

d. Set the COMSEC Mode Control to C, P, or TD.

e. Verify that the front panel display is blank.

f. Push the DISPLAY pushbutton.

The display is in the form *a*/*Fbbb* or *a*/*LFbbb* under the following circumstances:

- *a* represents a number from 1 - 6 or # identifying the storage location of the COMSEC variable or the letter *P* when the radio is in plain text mode.
- The presence of the *L* in the display indicates that Late Net Entry mode is enabled.
- *Fbbb* (*bbb* being three digits) is the SINCGARS net ID.

If there is no hopset on the selected channel, the display will show *FILx*, where *x* represents the selected channel number.

#### 2.12.1.2 SINCGARS Late Net Entry Mode

Late Net Entry mode is a receive function which permits a radio to enter a SINCGARS net when its TOD clock has drifted away from the net TOD. The entering transceiver must be loaded with the proper COMSEC (not necessary in plain text mode) and SINCGARS TRANSEC key variables, SINCGARS hopset and SINCGARS lockout set. To enable or disable SINCGARS LNE mode for a SINCGARS channel, perform the procedure in Figure 2-24.

#### 2.12.1.3 SINCGARS TOD Clock

Perform the procedure in Figure 2-25 to monitor the TOD clock for the selected SINCGARS net.

#### 2.12.1.4 SINCGARS ERF - Hopset and Lockout Set (Receive Mode)

SINCGARS ERF permits a remote net control station to load net members with a new SINCGARS lockout set or a new hopset for a particular net. Only a net master can transmit a SINCGARS ERF, while either a net master or net member can receive it. Perform the procedure in Figure 2-26 to enable reception of a SINCGARS ERF.

#### 2.12.1.5 SINCGARS ERF - Hopset (Transmit Mode)

ERF - Hopset (Transmit Mode) permits the local transceiver to send a SINCGARS lockout set or hopset to remote members of the radio net. Only a net master can transmit a SINCGARS ERF, while either a net master or member can receive it. Perform the procedure in Figure 2-27 to send one or more hopsets.

#### 2.12.1.6 SINCGARS ERF - Lockout Set (Transmit Mode)

ERF, transmit mode, permits the local transceiver to send its SINCGARS lockout set or any of its hopsets to remote members of the radio net. Only a net master can transmit a SINCGARS ERF, while either a net master or net member can receive it. Perform the procedure in Figure 2-28 to send the lockout set.

### 2.12.2 SINCGARS ERF Cold Start Operations

The SINCGARS ERF Cold Start menu is only accessible when the CHANNEL selector is set to the manual (M) channel and another radio channel is set for SINCGARS operation. This menu allows the operator to perform the following functions:

- Cold Start Quick-Look Remote Fill transmit operation sends SINCGARS lockout sets and hopsets to stations which are not currently part of the net.
- Cold Start Quick-Look Remote fill receive operation receives SINCGARS lockout sets and hopsets without currently being part of the net.

#### 2.12.2.1 SINCGARS ERF Cold Start - Hopset and Lockout Set (Receive Mode)

Cold Start ERF operation permits remote reception of SINCGARS hopsets, lockout sets, and time of day.

Perform the procedure in Figure 2-29 to operate Cold Start ERF.

**NOTE**

To successfully send a Cold Start ERF, the transmitting and receiving radios must have the same manual frequency and transec key.

#### 2.12.2.2 SINCGARS ERF Cold Start - Lockout Set (Transmit Mode)

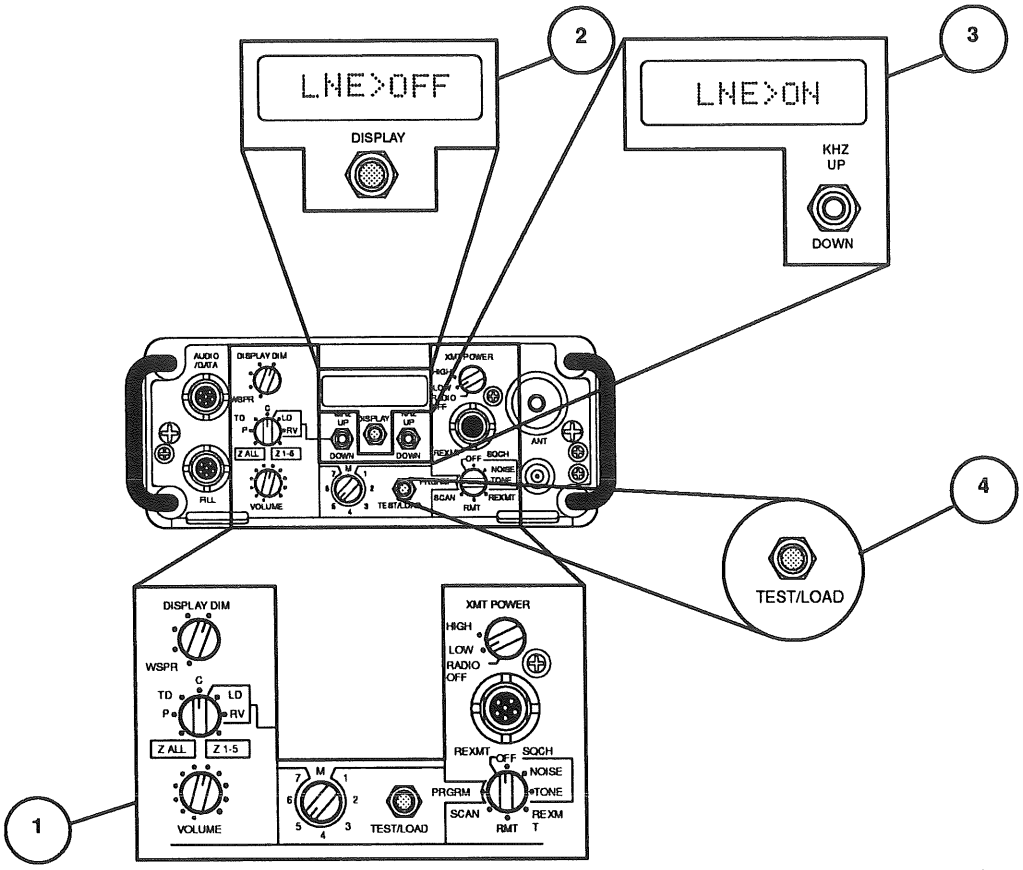
Cold Start ERF operation permits a SINCGARS net member to send lockout sets to stations which are not currently part of the net.

Perform the procedure in Figure 2-31 to send the lockout set.

### 2.13 SELECTING CRYPTO VARIABLE STORAGE LOCATIONS

There are seven crypto variable storage locations that can be associated with each channel on the AN/PRC-117D(V)2(C) manpack transceiver. Locations 1 - 5 are used for storing cryptonet variables (CNV), the sixth is used for the rekey variable (RKV), and the seventh (#) is the scratchpad variable used for Saville Advanced Rekey (SARK) operations. These locations are selected by following the procedure shown in Figure 2-32.

## SINCGARS LATE NET ENTRY




(1) Set the following controls:

- XMT POWER – LOW or HIGH
- CHANNEL – set to SINCGARS channel
- RADIO Mode – OFF, NOISE, or TONE
- COMSEC Mode – C, P, or TD

Set DISPLAY DIM and VOLUME as desired.

(2) Push DISPLAY until LNE>OFF displays.

(3) Toggle the KHZ switch to UP or DOWN to select LNE ON operation.

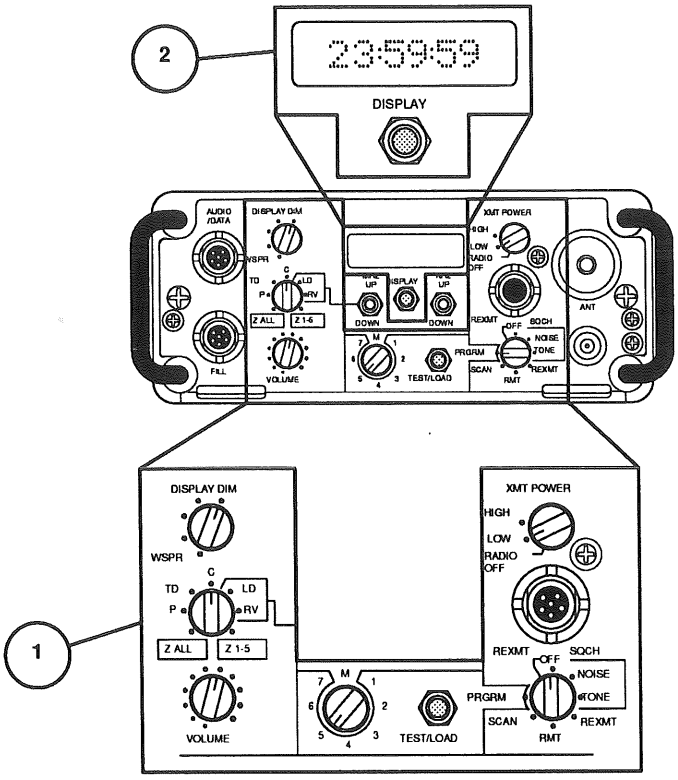
(4) Push TEST LOAD to activate LNE operation.

NOTE:

When the radio receives SINCGARS hopping traffic from the selected net, it automatically synchronizes itself to the net and leaves LNE mode.

**Figure 2-24. SINCGARS Late Net Entry**

## SINCGARS TOD CLOCK




(1) Set the following controls:

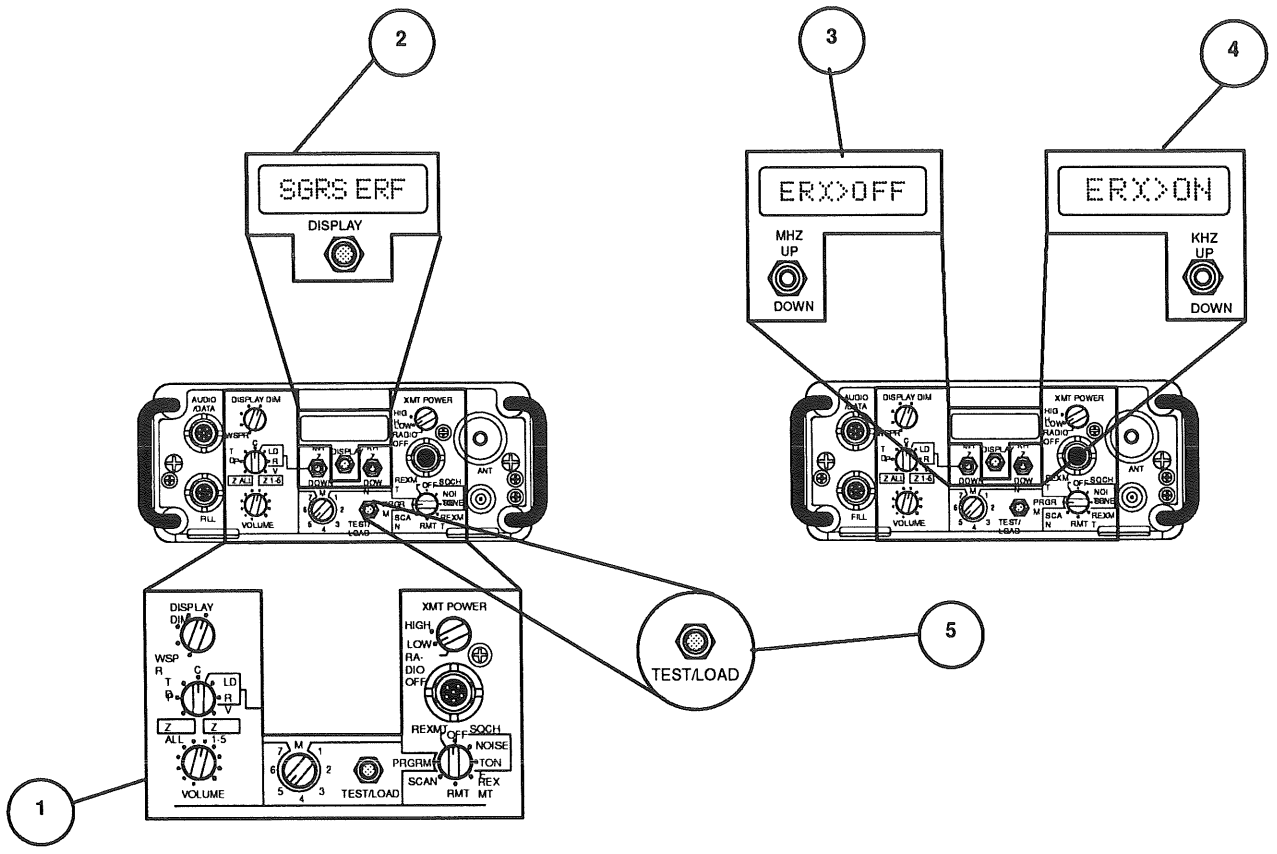
- XMT POWER – LOW or HIGH
- CHANNEL – set to SINCGARS channel
- RADIO Mode – OFF, NOISE, or TONE
- COMSEC Mode – C, P, or TD

Set DISPLAY DIM and VOLUME as desired.

(2) Push DISPLAY until the SINCGARS TOD clock setting displays.

**Figure 2-25. SINCGARS TOD Clock**

## SINCGARS ERF – HOPSET/LOCKOUT SET (RECEIVE MODE)

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(1) Set the following controls:

- XMT POWER – LOW or HIGH
- CHANNEL – set to SINCGARS channel
- RADIO Mode – OFF, NOISE, or TONE
- COMSEC Mode – C, P, or TD

Set DISPLAY DIM and VOLUME as desired.

(2) Push DISPLAY until SGRS ERF appears.

(3) Toggle the MHZ switch UP or DOWN until ERX>OFF appears.

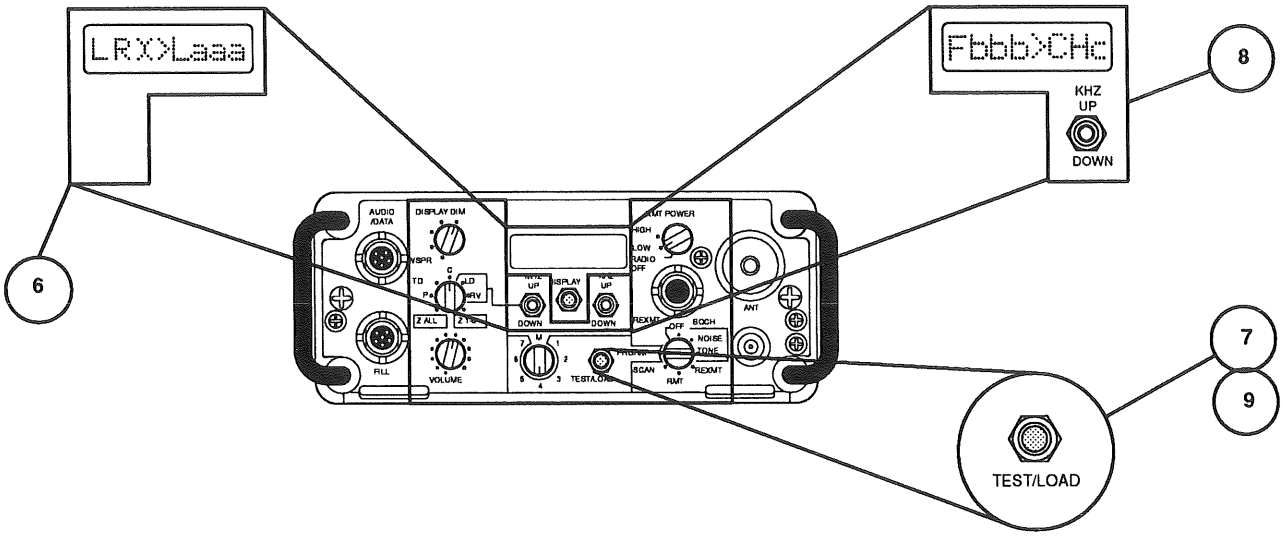
(4) Toggle the KHZ switch UP or DOWN to select ERX>ON.

(5) Push TEST/LOAD to activate ERX mode.

The LED display blanks after about 5 seconds to conserve battery power.

**Figure 2-26. SINCGARS ERF - Hopset and Lockout Set (Receive Mode) (Sheet 1 of 2)**

## SINCGARS ERF – HOPSET/ LOCKOUT SET (RECEIVE MODE) (CONT.)




6 If a lockout set is received, LRX>Laaa displays (*aaa* represents the lockout set).

7 Push TEST/LOAD to store the data.

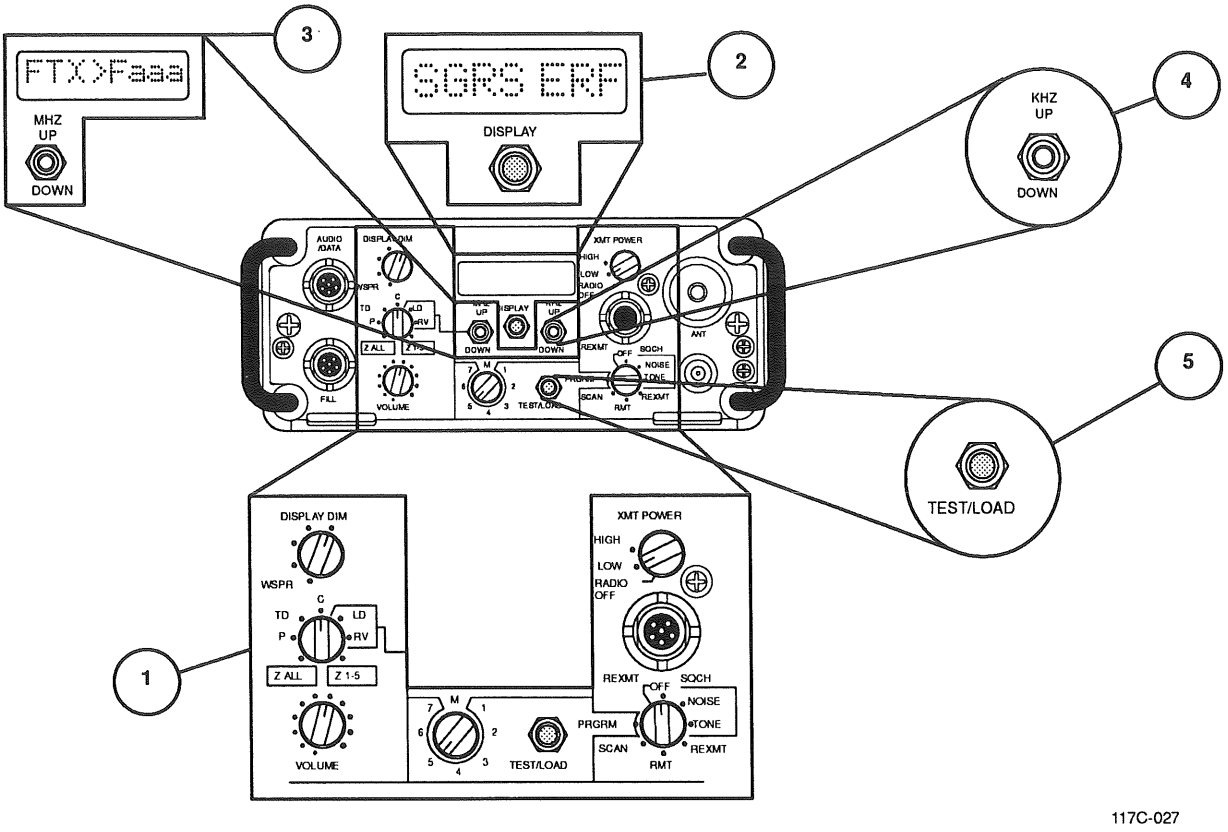
8 If a hopset is received, Fbbb>CHc displays (*bbb* represents the hopset and *c* represents a SINCGARS net/ channel).

Toggle the KHZ switch UP or DOWN to select the desired net/ channel for the hopset.

9 Push TEST/LOAD to store the hopset.

**Figure 2-26. SINCGARS ERF - Hopset and Lockout Set (Receive Mode) (Sheet 2 of 2)**

## SINCGARS ERF – HOPSET (TRANSMIT MODE)

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NOTE:

The radio must be a net master in order to do an ERF transmit.

(1) Set the following controls:

- XMT POWER – LOW or HIGH
- CHANNEL – set to SINCGARS channel
- RADIO Mode – OFF, NOISE, or TONE
- COMSEC Mode – C, P, or TD

Set DISPLAY DIM and VOLUME as desired.

(2) Push DISPLAY until SGRS ERF displays.

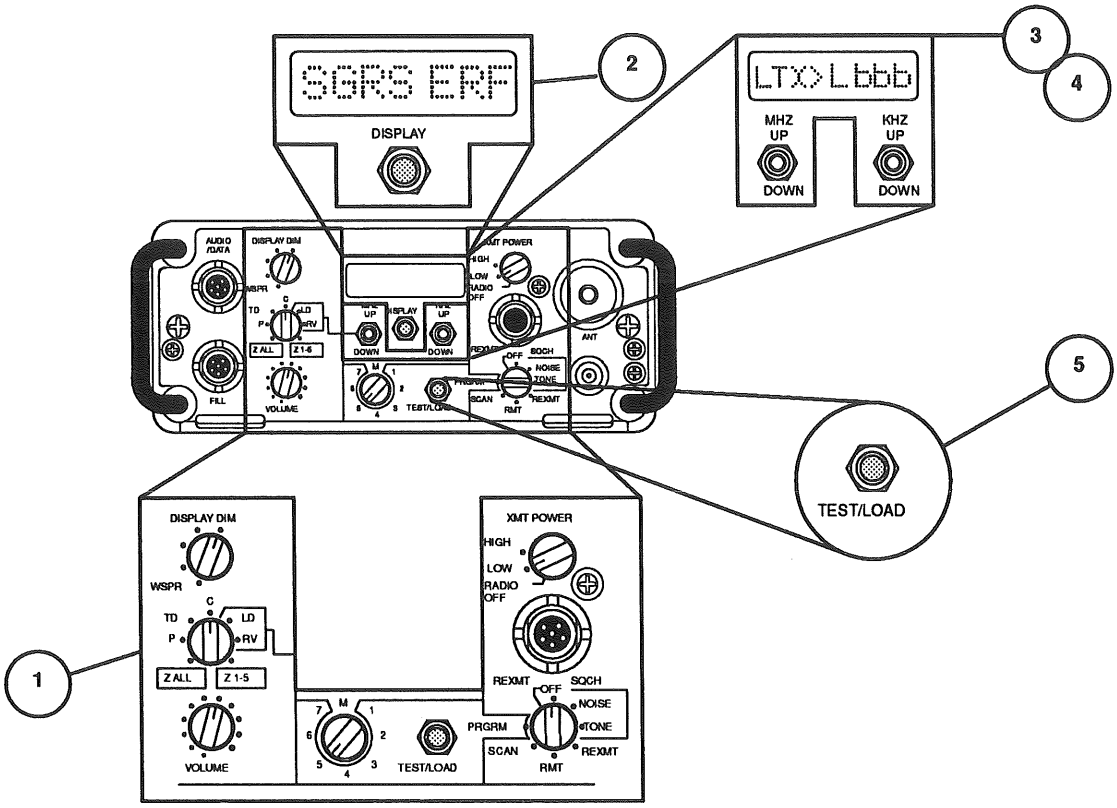
(3) Toggle the MHZ switch UP or DOWN until FTX>Faaa displays.(*aaa* represents the SINCGARS net ID.)

(4) Toggle the KHZ switch UP or DOWN to select the hopset.

(5) Push TEST/LOAD to send the hopset.

**Figure 2-27. SINCGARS ERF - Hopset (Transmit Mode)**

## SINCGARS ERF – LOCKOUT SET (TRANSMIT MODE)




NOTE:

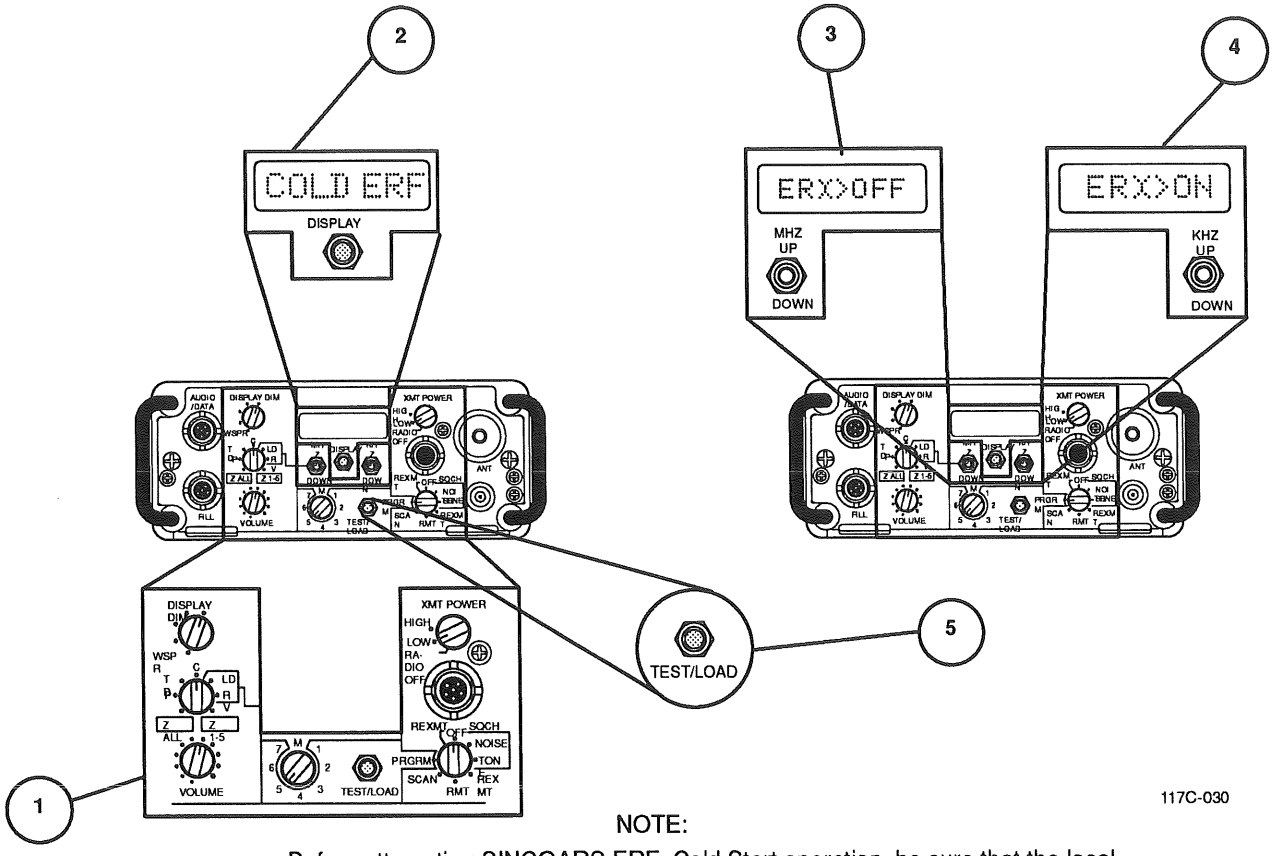
The radio must be a net master in order to do an ERF transmit.

1. Set the following controls:
   - XMT POWER – LOW or HIGH
   - CHANNEL – set to SINCGARS channel
   - RADIO Mode – OFF, NOISE, or TONE
   - COMSEC Mode – C, P, or TD

   Set DISPLAY DIM and VOLUME as desired.
2. Push DISPLAY until SGRS ERF displays.
3. Toggle the MHZ switch UP or DOWN until LTX>Lbbb displays. (*bbb* represents the SINCGARS net ID.)
4. Toggle the KHZ switch UP or DOWN to select the lockout set to be sent to the remote stations.
5. Push TEST/LOAD to key the transmitter and send the lockout set.

**Figure 2-28. SINCGARS ERF - Lockout Set (Transmit Mode)**

## SINCGARS ERF COLD START – HOPSET/LOCKOUT SET (RECEIVE MODE)




NOTE:

Before attempting SINCGARS ERF–Cold Start operation, be sure that the local transceiver's manual channel (M) is set to the proper radio frequency(s) and also has been locally loaded with a usable cold start TRANSEC key/hopset.

(1) Set the following controls:

- XMT POWER – LOW or HIGH
- CHANNEL – M
- RADIO Mode – OFF, NOISE, or TONE
- COMSEC Mode – C, P, or TD

Set DISPLAY DIM and VOLUME as desired.

(2) Push DISPLAY until COLD ERF appears.

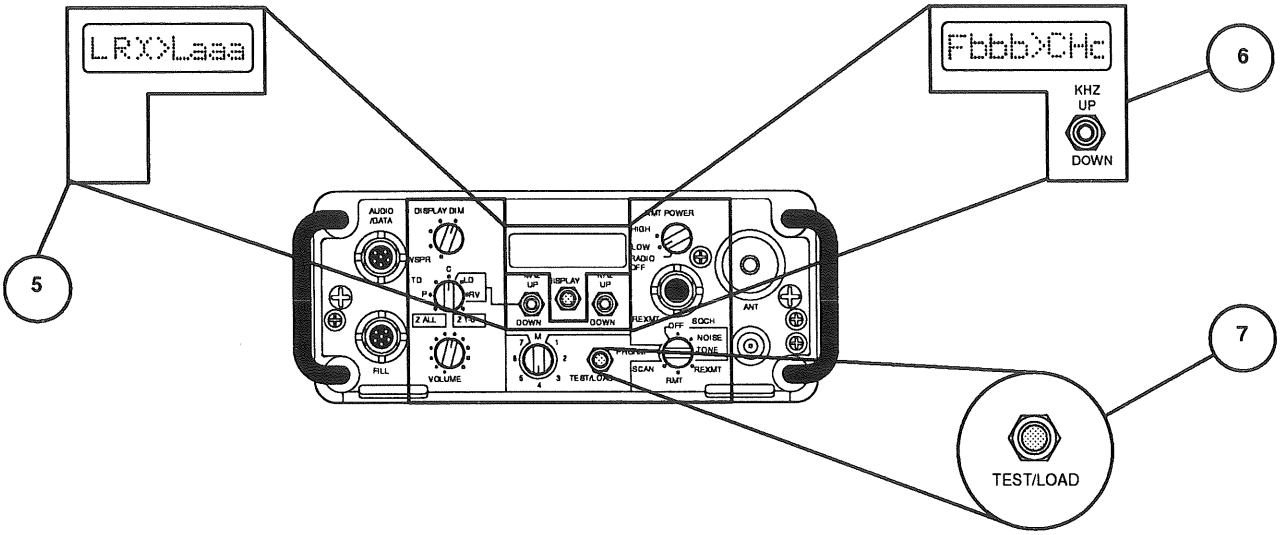
(3) Toggle the MHZ switch UP or DOWN until ERX>OFF appears.

(4) Toggle the KHZ switch UP or DOWN until ERX>ON appears.

(5) Push TEST/ LOAD. If a hopset or lockout set is not received within about 5 seconds, the display will blank, however, the radio remains ready to receive the ERF until a channel change.

**Figure 2-29. SINCGARS ERF Cold Start - Hopset and Lockout Set (Receive Mode) (Sheet 1 of 2)**

## SINCGARS ERF COLD START – HOPSET/LOCKOUT SET (RX MODE) (CONT.)




5 If a lockout set is received, LRX>Laaa displays (*aaa* represents the lockout set).

Push TEST/ LOAD to store the lockout set in the transceiver.

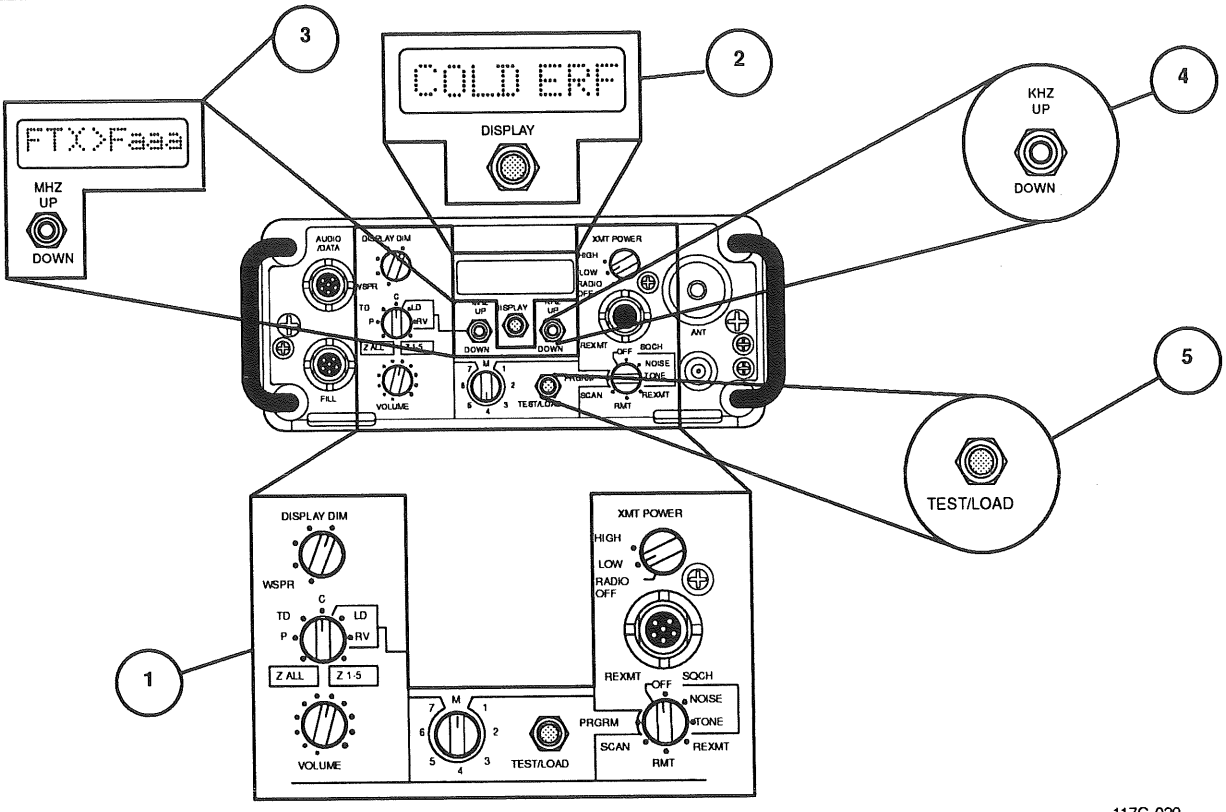
6 If a hopset is received, Fbbb>CHc displays (*bbb* represents the hopset and *c* represents a SINCGARS net/ channel).

Toggle the KHZ switch UP or DOWN to select the SINCGARS net/ channel for the hopset.

7 Push TEST/LOAD to store the hopset.

**Figure 2-29. SINCGARS ERF Cold Start - Hopset and Lockout Set (Receive Mode) (Sheet 2 of 2)**

## SINCGARS ERF COLD START – HOPSET (TRANSMIT MODE)

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NOTE:

Before attempting SINCGARS ERF-Cold Start operation, be sure that the local transceiver's manual channel (M) is set to the proper radio frequency(s) and also has been locally loaded with a usable cold start TRANSEC key/hopset. Be sure that the transmitter is programmed as a net master on the manual channel.

(1) Set the following controls:

- XMT POWER – LOW or HIGH
- CHANNEL – M; frequency as desired
- RADIO Mode – OFF, NOISE, or TONE
- COMSEC Mode – C, P, or TD

Set DISPLAY DIM and VOLUME as desired.

(2) Push DISPLAY until COLD ERF displays.

(3) Toggle the MHZ switch UP or DOWN until FTX>Faaa displays. (*aaa* represents the COMSEC variable storage location or P when the radio is in plain text mode.)

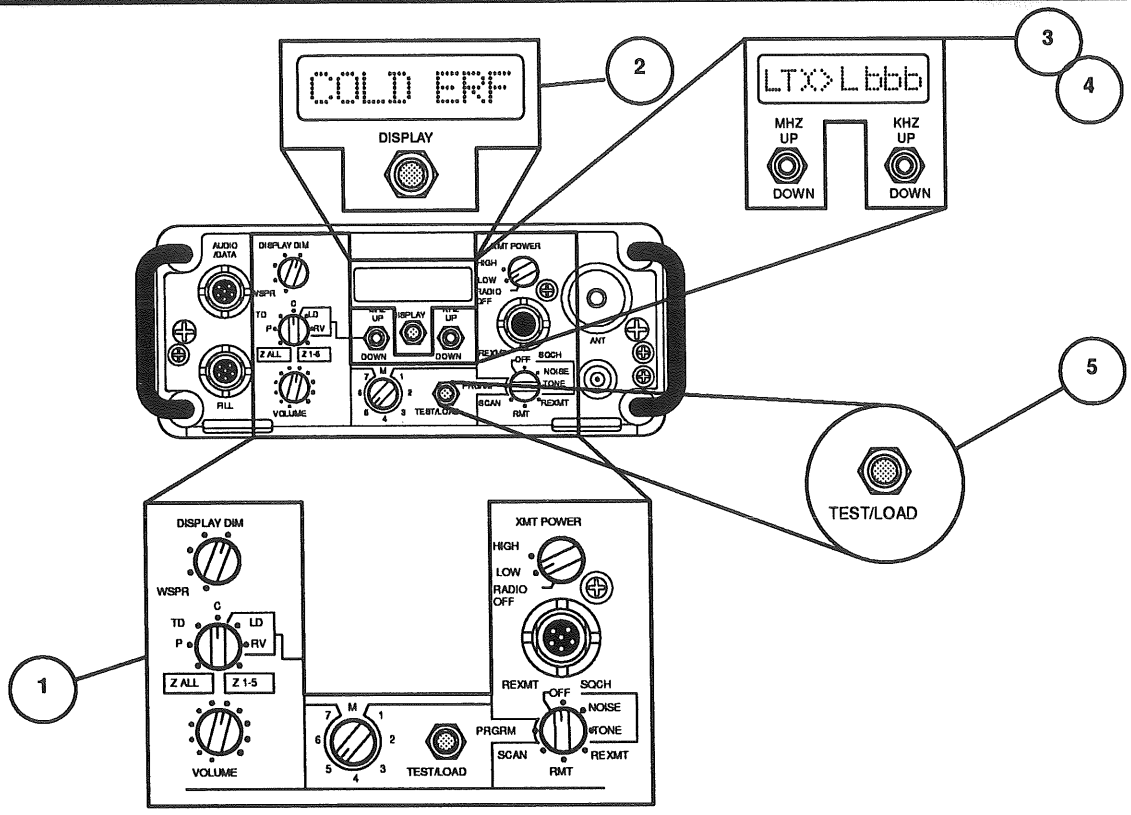
(4) Toggle the KHZ switch UP or DOWN to select the hopset.

(5) Push TEST/LOAD to key the transmitter and send the hopset.

(6) If TSK REQD displays, fill channel M with a hopset via the procedure in Figure 2-13.

**Figure 2-30. SINCGARS ERF Cold Start - Hopset (Transmit Mode)**

## SINCGARS ERF COLD START – LOCKOUT SET (TRANSMIT MODE)




NOTE:

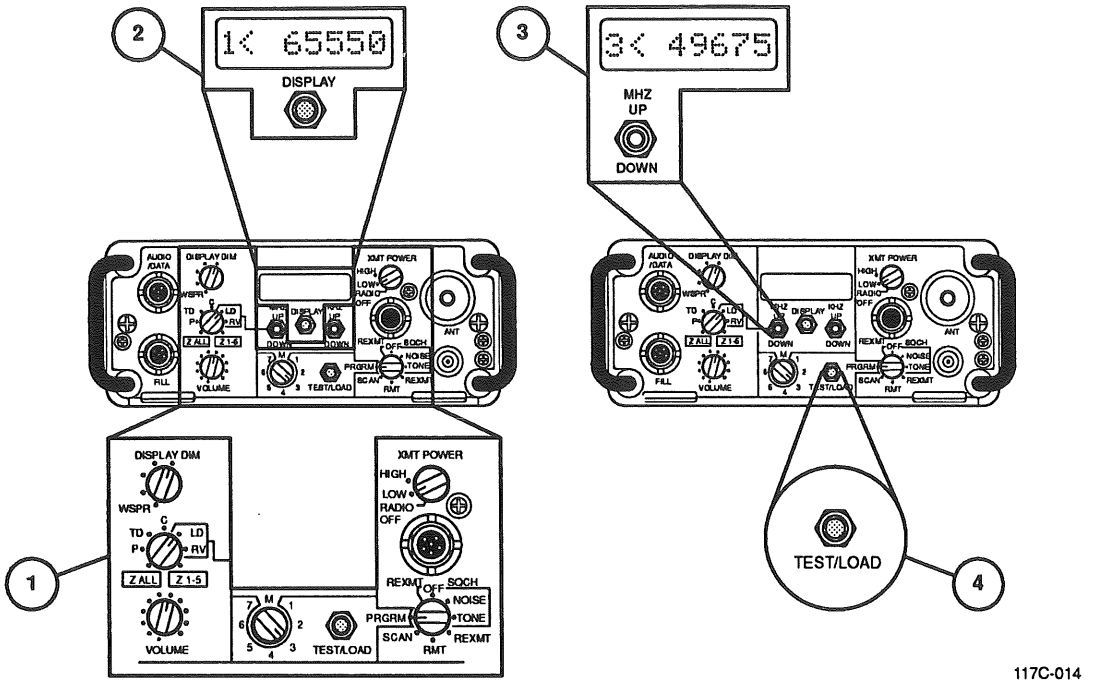
The radio must be a net master in order to do an ERF transmit.

1. Set the following controls:
   - XMT POWER – LOW or HIGH
   - CHANNEL – M, frequency as desired
   - RADIO Mode – OFF, NOISE, or TONE
   - COMSEC Mode – C, P, or TD

   Set DISPLAY DIM and VOLUME as desired.
2. Push DISPLAY until COLD ERF displays.
3. Toggle the MHZ switch UP or DOWN until LTX>Lbbb displays. (*bbb* represents the lockout set.
4. Toggle the KHZ switch UP or DOWN to select the lockout set to be sent to the remote stations.
5. Push TEST/LOAD to key the transmitter and send the lockout set.

**Figure 2-31. SINCGARS ERF Cold Start - Lockout Set (Transmit Mode)**

## SELECTING CRYPTO VARIABLE STORAGE LOCATIONS




(1) Set these controls:

- XMT POWER – LOW or HIGH
- CHANNEL – as desired
- RADIO Mode – PRGRM
- COMSEC Mode – LD
  Initialize COMSEC per Paragraph 2.5.1.

Set DISPLAY DIM and VOLUME as desired.

(2) Push DISPLAY.

Crypto variable storage location and frequency, code or SINCGARS net ID displays. Note that the blinking arrow points to the left. Display must be lit to change crypto variable storage location.

(3) Select crypto variable storage location.

Toggle the MHZ switch UP or DOWN.

(4) With crypto variable storage location displayed, push TEST/LOAD.

The display blanks when TEST/LOAD is pushed, reappears when it is released. Display will stay on for 5 seconds, then go blank.

**Figure 2-32. Selecting Crypto Variable Storage Locations**

## 2.14 LOADING CRYPTO VARIABLE FROM FILL DEVICE

Crypto variables are loaded into the crypto variable storage locations by attaching a fill device to the FILL jack on the manpack transceiver's front panel. The fill procedure depends upon the fill device selected, for example, KOI-18, KYK-13, or KYX-15. Figure 2-33 outlines the steps for selecting a crypto variable storage location and preparing the transceiver to receive crypto variables. If the variable does not load properly, check the loading instructions for the fill device and repeat the loading steps.

To verify fill operation, disconnect the fill device and set the COMSEC mode control to C. Then communicate with a transceiver that is known to be properly loaded.

## 2.15 SARK REKEY OPERATIONS

The AN/PRC-117D(V)2(C) Manpack Transceiver can send and receive keys over the air using the Saville Advanced Rekey (SARK) procedure, compatible with KY-57 Vinson equipment. The following paragraphs describe Rekey Operations.

### 2.15.1 Transmission Rekey

Set these controls to prepare for transmission rekey:

- XMT POWER – LOW or HIGH
- CHANNEL – any channel
- RADIO Mode – OFF, NOISE, TONE
- COMSEC Mode – C or TD

To transmit a key over the air, attach a net control device (KYX-15) to the FILL connector on the front panel. The fill device is then set to transmit the fill information and will handle keying of the radio automatically. Crypto variable storage location 6 must be loaded with an appropriate variable.

### 2.15.2 Manual Reception Rekey

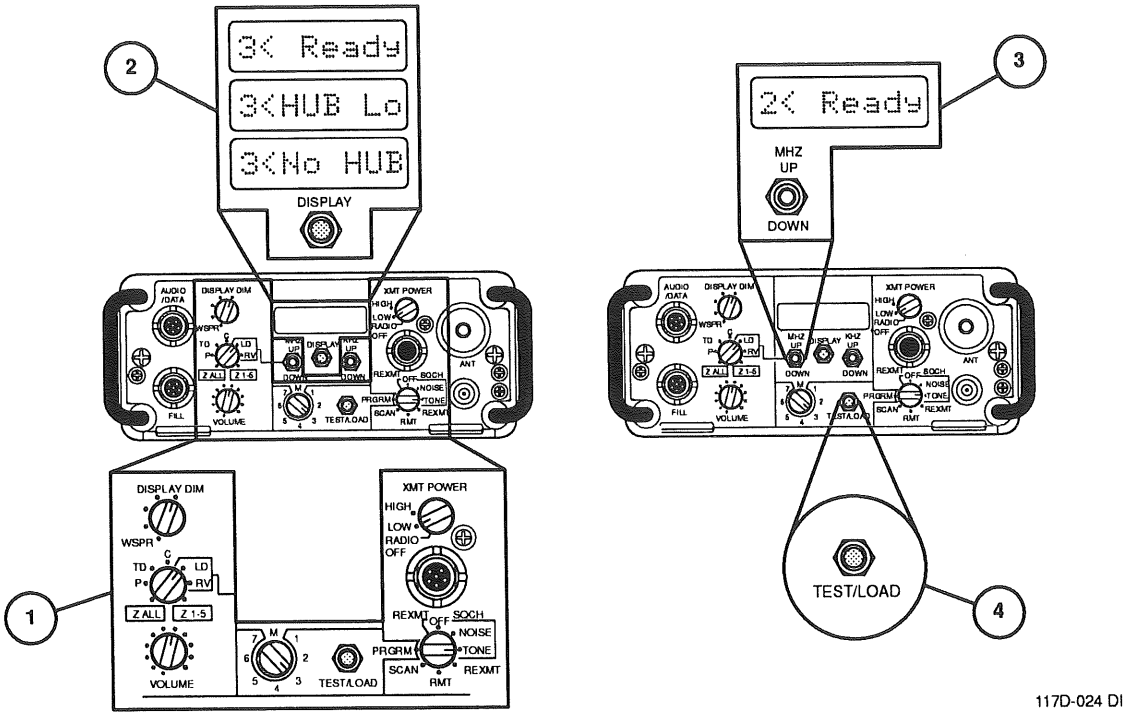
Set these controls to prepare for manual reception rekey:

- XMT POWER – LOW or HIGH
- CHANNEL – any channel
- RADIO Mode – OFF, NOISE, TONE
- COMSEC Mode – RV

When DISPLAY is pushed, the variable storage location number for the channel selected is displayed:


If a different variable storage location is to be used for the received variable, it can be changed by using the MHZ switch and pushing and releasing the TEST/LOAD pushbutton.

## LOADING CRYPTO VARIABLE FROM FILL DEVICE

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(1) Set these controls:

- XMT POWER – LOW or HIGH
- CHANNEL – as desired
- RADIO Mode – OFF, NOISE, TONE, REXMT
- COMSEC Mode – LD
  Initialize COMSEC per Paragraph 2.5.1.

Set DISPLAY DIM and VOLUME as desired.

(2) Push DISPLAY.

The current crypto variable storage location displays with the blinking arrow pointing to it. The display also indicates if the radio is ready to be loaded. A HUB status display appears as a warning if a HUB problem exists.

**NOTE**

A variable may be loaded if a HUB problem exists, however, variables are not saved when the radio is turned off. *No HUB* display indicates that the HUB is too low or missing and loaded variables will be lost if radio power is lost. *HUB Lo* display indicates that the HUB is weak and variables will be retained, but retention is limited.

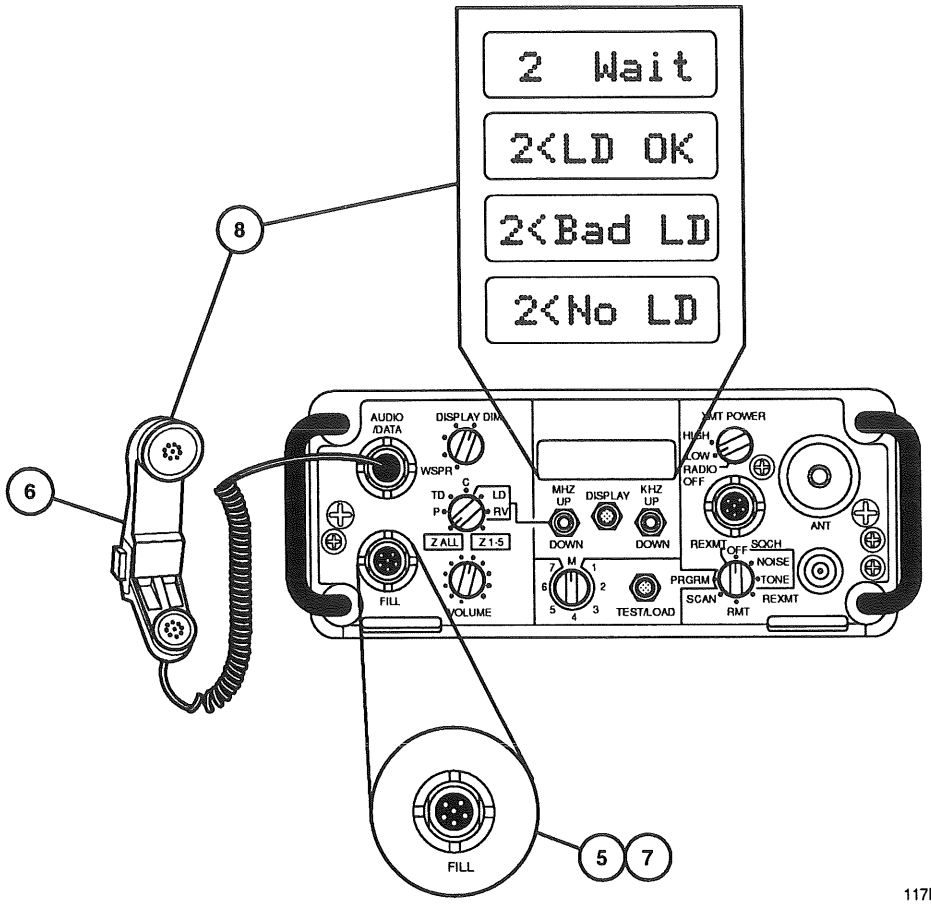
(3) To select another crypto variable storage location, toggle the MHZ switch UP or DOWN. The display must be lit to change the crypto variable storage location.

(4) With crypto variable storage location displayed, push TEST/LOAD.

The display blanks when TEST/LOAD is pushed, reappears when it is released. Display will stay on for 5 seconds, then go blank.

**Figure 2-33. Loading Crypto Variable from Fill Device (Sheet 1 of 2)**

## LOADING CRYPTO VARIABLE FROM FILL DEVICE (CONT.)




(5) Attach fill cable from fill device (KOI-18, KYK-13, or KYX-15) to the FILL connector on the front panel.

(6) Attach handset to the AUDIO/DATA connector.

(7) Follow the load procedure for the applicable fill device.

(8) Key the handset and release.

The display will indicate *Wait* while the transfer is taking place, then *LD OK* if the fill is successful. A beep is also heard in the handset to indicate successful transfer.

**NOTE**

If the variable has not been properly loaded, *Bad LD* is displayed and a continuous tone is heard. If there is no response from the fill device, *No LD* is displayed. Check loading instructions for fill device and repeat above steps. If variable still does not load properly, try a new fill device.

(9) Repeat steps 2 – 8 to load other variables.

**Figure 2-33. Loading Crypto Variable from Fill Device (Sheet 2 of 2)**

## 2.16 OTHER NET CONTROL DEVICE OPERATIONS

Whenever a net control device (KYX-15) is connected to the manpack transceiver, the transceiver is controlled by the device. Follow the procedures for the net control device.

## 2.17 DATA CAPABILITY

The manpack transceiver can be used with data devices that meet MIL-STD-188-114A specifications, such as the RF-3490 Digital Data Buffer/Processor. Operating procedures depend on the data device that is used, but the following paragraphs explain the steps for preparing the transceiver to operate in data plain text and cipher text modes.

### 2.17.1 Data Plain Text Operation

Set these controls for data plain text operation:

- CHANNEL – any channel
- RADIO Mode – OFF, NOISE, TONE
- COMSEC Mode – P

Attach the data device to the front panel AUDIO/DATA connector; the digital data mode control pin E must be grounded. The data is asynchronous. A transmit and receive clock is provided on pin B of the REXMT connector for transmit and receive data, plain text operation.

If the radio is on, the LED display shows that the plain text mode has been entered:

| *PLAIN !* |
|---|

**NOTE**

To use the AN/PRC-117D(V)2(C) in plain text data mode other than 16 kbps, in Quick-Look or REXMT, an external squelch signal (ground applied) must be applied to the DATA IN/ANALOG DATA MODE/EXTERNAL SQUELCH pin F of the AUDIO/DATA connector.

### 2.17.2 Data Cipher Text Operation

Set these controls for data cipher text operation:

- CHANNEL – any channel
- RADIO Mode – OFF, NOISE, TONE
- COMSEC Mode – TD or C

Attach the data device to the front panel AUDIO/DATA connector. Data must be 16 kbps for proper operation. A clock is supplied on the data clock out pin of the AUDIO/DATA connector when transmitting or receiving valid cipher data. The digital data mode control pin E must be grounded.

Analog data can be used by attaching the appropriate device and grounding the analog data mode control pin. Analog data cipher text mode is asynchronous and does not supply a clock.

## 2.18 COMSEC ZEROIZE

The COMSEC zeroize feature allows the operator to erase the stored crypto variables from the AN/PRC-117D(V)2(C) Manpack Transceiver.

Rotating the COMSEC mode control to the Z ALL position zeroizes rekeying variable (RKV) from crypto variable storage location 6 and also zeroizes cryptonet variables (CNVs) from crypto variable storage locations 1 - 5 and #. This action deletes ALL cryptonet variables from the manpack transceiver. No secure communication can be performed with this unit until new cryptonet variables are loaded. Refer to Paragraph 2.14.

With XMT Power turned on, rotating the COMSEC mode control to the Z 1 - 5 position, zeroizes cryptonet variables (CNVs) from crypto variable storage locations 1 - 5 and #. This action does not zeroize crypto variable storage location 6. Secure communication can still be performed by using crypto variable storage location 6. Figure 2-34 illustrates the COMSEC zeroize feature.

**CAUTION**

The COMSEC zeroize feature erases stored variables and should only be used as appropriate.

**NOTE**

With the XMT POWER turned off (RADIO OFF), the Z 1 - 5 acts the same as Z ALL and erases all seven crypto variable storage locations. The display will not light when XMT POWER is turned off.

**NOTE**

Both the Z ALL and Z 1 - 5 positions on the COMSEC mode control are entered by a pull-to-turn action in order to prevent accidental zeroizing of the COMSEC variables.

## 2.19 STAND-ALONE COMSEC (SAC) OPERATION

The Stand-Alone COMSEC (SAC) feature allows the operator to use the manpack transceiver as a COMSEC device similar to a KY 57 to encrypt and decrypt information for transmission and reception to a radio that has no encryption device. During SAC mode, only the front panel of the transceiver is functioning and the receiver and transmitter are disabled. An optional SAC cable is required to enable these operations. The design of the cable will vary according to the radio used.

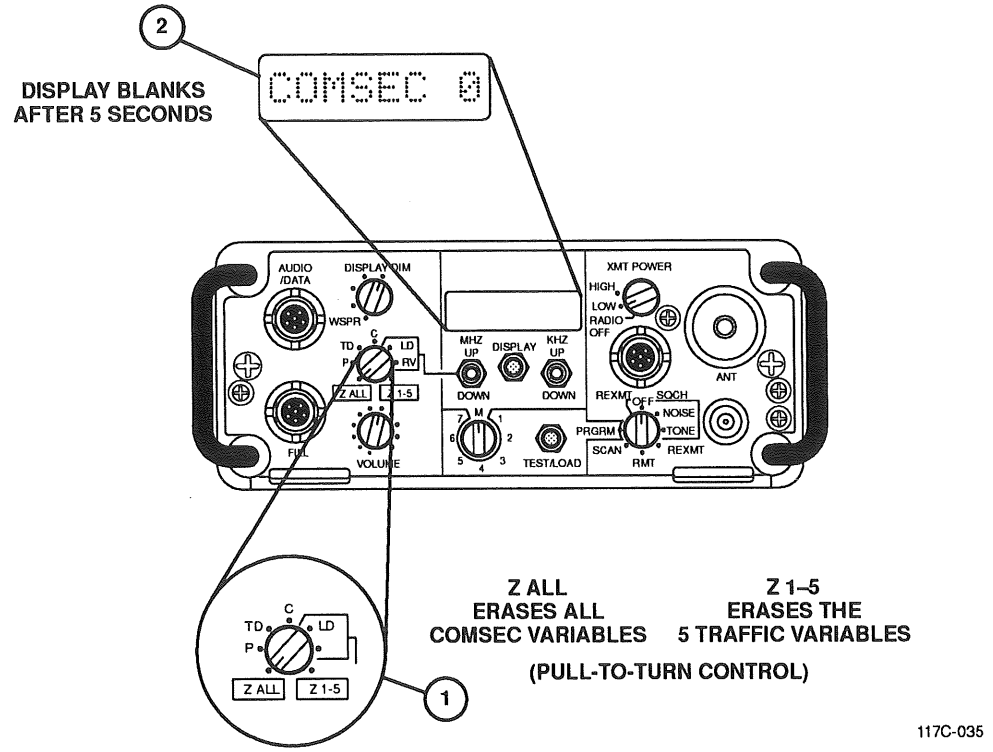
To operate in SAC with another radio, the SAC cable is attached to the REXMT connector of the manpack transceiver and to the appropriate connector on the other radio. Figure 2-35 describes SAC operation.

The procedure to change the crypto variable storage location is the same as shown in Figure 2-32. The radio is put in the PRGRM radio mode and the LD COMSEC mode. The default value of the crypto variable storage location is changed by using the MHZ switch and then pushing TEST/LOAD. The default value is the channel number as selected by the channel control, with channels M and 7 being assigned variable 1.

To change crypto variable storage locations in SAC, the optional SAC cable must be attached to the REXMT connector on the manpack transceiver front panel. When this is done, the LED display signifies that the radio is in SAC:

| 1 < S A C |
|---|

## COMSEC ZEROIZE




**NOTE**

Rotating the COMSEC Mode Control to Z ALL position zeroizes rekeying variable (RKV) from storage location 6 and also zeroizes cryptonet variables (CNVs) from storage locations 1 – 5 and #. This action deletes ALL cryptonet variables from the manpack transceiver. NO secure communication can be performed with this unit.

Rotating the COMSEC Mode Control to Z 1 – 5 position zeroizes cryptonet variables (CNVs) from storage locations 1 – 5 and #. This action does NOT zeroize position 6 as long as the radio is turned on. Secure communication can still be performed by using storage location 6. Set DISPLAY DIM as desired.

(1) To delete ALL of the stored variables, switch the COMSEC mode control to Z ALL (pull-to-turn action).

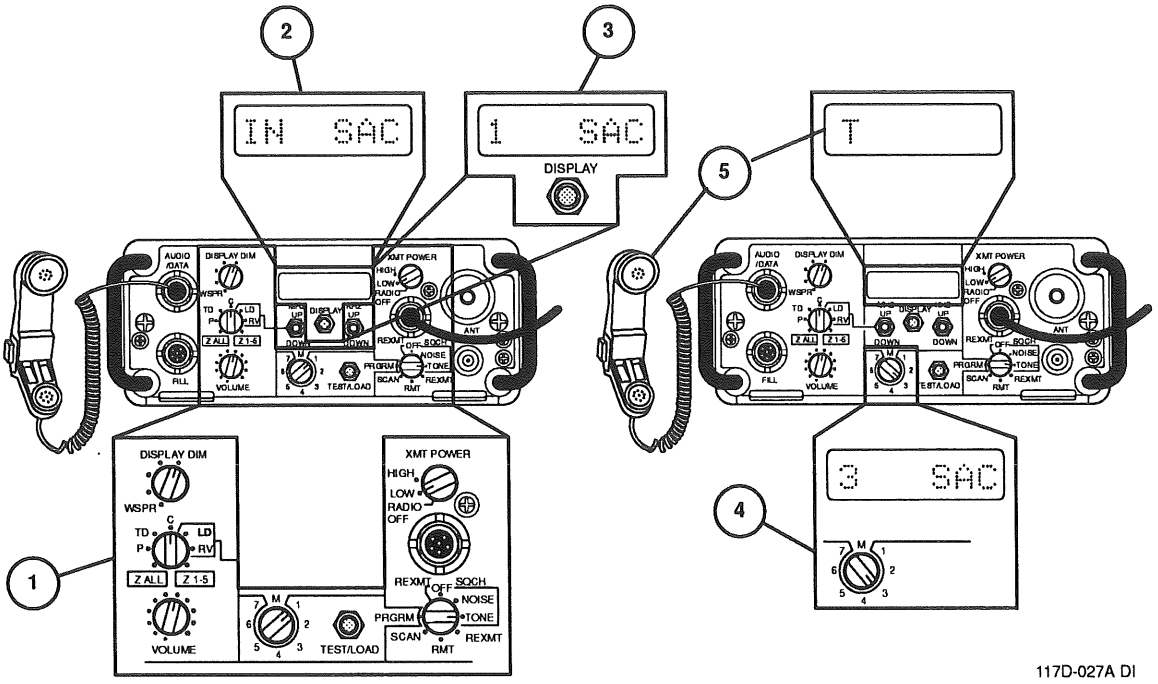
To delete the six traffic variables, switch the COMSEC mode control to Z 1 – 5 (pull-to-turn action).

NOTE: With the XMT POWER turned to OFF, the Z 1 – 5 position acts the same as Z ALL and deletes ALL stored variables.

(2) *COMSEC 0* is displayed. The LED display blanks after 5 seconds if radio power is turned on.

**Figure 2-34. Using COMSEC Zeroize**

## STAND ALONE COMSEC OPERATION




(1) Set these controls:

- XMT POWER – LOW or HIGH
- CHANNEL – as desired
- RADIO Mode – OFF, NOISE, TONE, REXMT
- COMSEC Mode Control – TD, C, or RV
  Initialize COMSEC per Paragraph. 2.5.1.

Set DISPLAY DIM and VOLUME as desired.

(2) Attach the optional SAC cable to the REXMT connector. The LED display shows that the unit is in Stand-Alone COMSEC (IN SAC) operation.

NOTE: If the cable is already attached when the unit is powered up, the *IN SAC* message displays after the normal power up sequence.

(3) Push DISPLAY.

Crypto variable storage location in use displays.

(4) Use the CHANNEL control to select crypto variable storage location or see Figure 2-32. The COMSEC variable storage location matches the CHANNEL control number for channels 1–6. Channels M and 7 are assigned crypto variable storage location 1.

(5) Key the handset.

The SAC transmit indicator (T) is displayed for 5 seconds or until the handset key is released.

NOTE: If the COMSEC mode control is in P or switched to P from another mode and the DISPLAY pushbutton is pushed, the display indicates an *Invalid* operation.

**Figure 2-35. Stand-Alone COMSEC Operation**

## 2.20 USING SCAN CAPABILITIES

Use the SCAN capability to continuously scan radio activity on all eight channels.

Set these controls for SCAN operation:

- XMT POWER – LOW or HIGH
- CHANNEL – any channel (keying is enabled on the selected channel)
- RADIO Mode – SCAN
- COMSEC Mode – P, TD, or C

Set DISPLAY DIM and VOLUME as desired.

Figure 2-36 summarizes the functions of the display during SCAN. As the radio scans, it blinks the decimal point of the LED display.

If a plain text signal is received when the COMSEC mode control is set for P, TD, or C, a P and the channel number is displayed. If a cipher text signal is received and the COMSEC mode control is set for TD or C, a C and the channel number is displayed. A cipher signal cannot be received if the COMSEC mode control is set for P. The MANUAL channel frequency is displayed as Chan 0.

**NOTE**

For best performance in SCAN mode, the transmitting radio should be in TD during cipher operation.

The transceiver locks in the channel, allowing the operator to hear the received signal. The radio continues to lock in a channel as long as the signal is being received. The display blanks after five seconds. When contact is broken, the transceiver continues to scan, beginning with the next channel in sequence.

The radio scans at a rate of approximately ten channels per second. When scanning fewer than eight channels, it may be advantageous to load the same frequencies more than once, using otherwise unused channels to shorten scan response time.

### 2.20.1 Transmitting in SCAN Mode

The radio normally transmits on the channel selected on the front panel. Keying up within three seconds after receiving a scan call initiates the Answer-Back scan feature. This allows transmission in the SCAN mode on the channel that just received the scan call regardless of where the channel control is set. By keying up, the radio is automatically tuned for transmission on this channel. Keying or unkeying the radio causes the LED display to indicate the channel being used for transmission. The transmission of plain or cipher information is dependent on the COMSEC mode control. For example, to answer a plain text signal the COMSEC mode control must be in P.

The radio may or may not be set up to transmit the 150 Hz subcarrier tone for TONE SQUELCH when it is in SCAN mode. An internal jumper selection on A4 Power Supply Module determines whether or not the 150 Hz tone is transmitted in SCAN mode.

When using the SCAN mode, the radio continues scanning in this mode when not transmitting. The radio could lock in a channel different from the one in use, temporarily preventing reception in this mode.

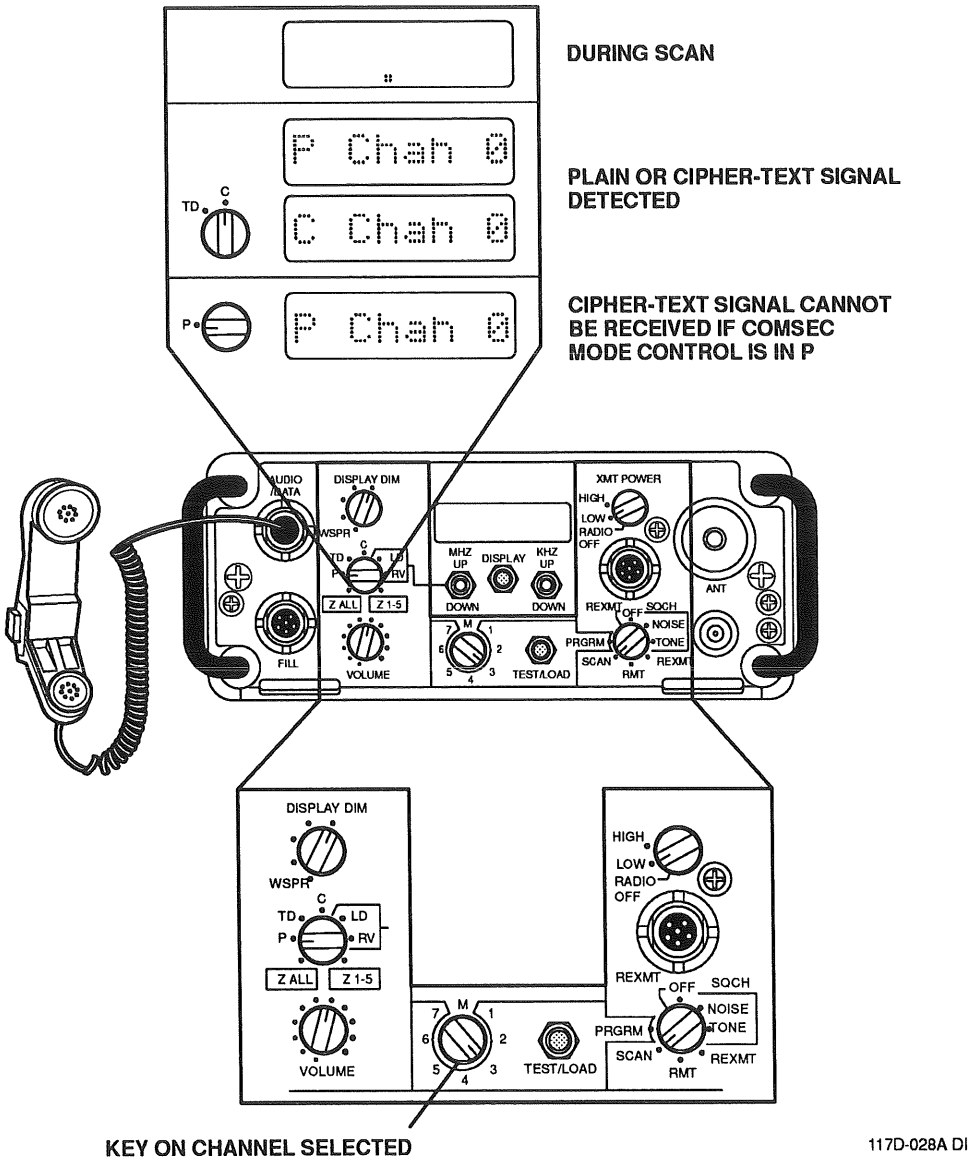



**Figure 2-36. SCAN Setup and Display**

### 2.20.2 Scanning Quick-Look and SINCGARS ECCM Channels

Quick-Look operation is not compatible with SCAN mode operation due to the unique characteristics of the frequency-hopping signal. Therefore, Quick-Look channels cannot be used for frequency-hopping transmission and reception while in the SCAN mode.

**NOTE**

The radio cannot detect Quick-Look transmissions while in SCAN mode, and the radio does not transmit with a frequency-hopping signal when keyed in SCAN mode.

In SCAN mode, the radio treats Quick-Look channels the same as other radio channels and scans the programmed single channel frequency for a signal received on any of the eight preset channels. It transmits when keyed in the channel (within three seconds after receiving the signal), but this transmission is standard FM transmission, not a frequency-hopping transmission.

## 2.21 RETRANSMIT OPERATION

A retransmission or repeater station receives a signal transmitted at one frequency and retransmits it at another frequency, enabling communication over a greater range than is possible using individual radios. A retransmission or repeater station for extending communication range can be set up using two AN/PRC-117D(V)2(C) Manpack Transceivers.

### 2.21.1 Retransmit Setup

Two types of radio operation are available using the retransmit setup:

- Simplex operation (retransmission)
- Half-duplex operation (repeater operation)

Both types of operation use the same equipment and setup. The only difference between retransmission and repeater operation is how the retransmission/repeater station is used by other radios.

Figure 2-37 shows simplex operation. Here, the station uses frequency F1 to communicate with one group of radios, both to receive and to transmit. It uses frequency F2 to communicate with a second group of radios, both receiving and transmitting on this other frequency. The retransmission operation can be summarized as follows:

- Signals received on F1 are retransmitted on F2.
- Signals received on F2 are retransmitted on F1.

Other radios using the retransmission station for simplex operation use simplex channels. The same frequency serves for both transmitting and receiving. Use simplex operation when using Quick-Look channels through a repeater.

Figure 2-38 shows half-duplex operation. Here, the repeater receives on frequency F1 and transmits on frequency F2. With this setup, all radios using the repeater transmit on F1 and receive on F2. Using this arrangement, all units communicate with each other through the repeater.

Radios using the repeater for half-duplex operation use half-duplex channels. All transmitting is on frequency F1. All receiving is on frequency F2.

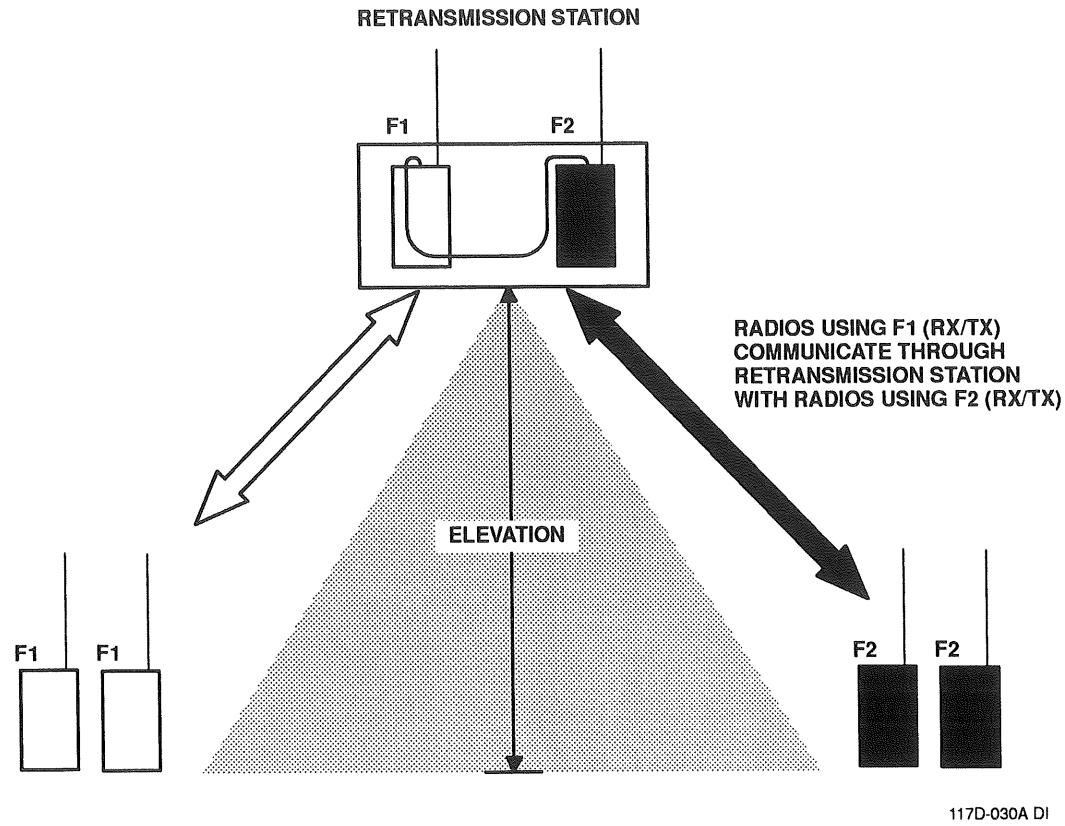



Figure 2-37. Simplex (Retransmission) Operation

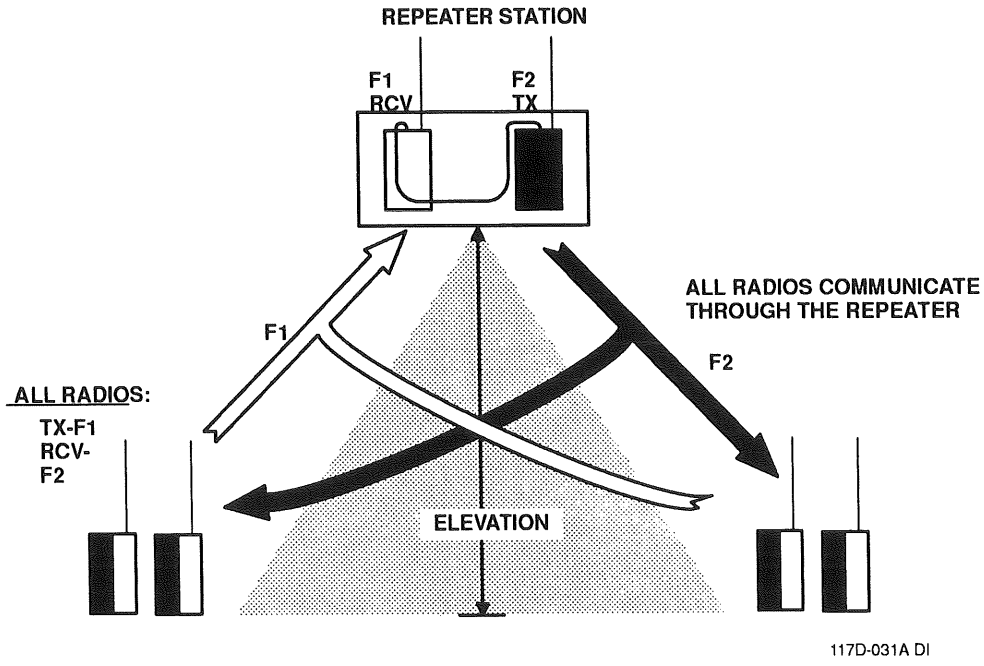



Figure 2-38. Half-Duplex (Repeater) Operation

### 2.21.2 Hardware for Retransmission/Repeater Setup

Equipment setup is the same for both simplex and half-duplex operation:

- Two AN/PRC-117D(V)2(C) Manpack Transceivers with antenna and battery pack
- One REXMT cable

Figures 2-39 and 2-40 show the standard retransmission/repeater control settings and hardware configuration. For optimum signal transmission, the repeater site should be elevated above the level of radios that communicate through the repeater. The REXMT cable connects at the REXMT connector on each radio. Where possible, separate the radio units by the full length of the REXMT cable to prevent receiver desensitization and RF interference between units.

The repeater normally is configured to retransmit in TONE SQUELCH mode. A jumper on A4 Power Supply Module can be moved to change to NOISE SQUELCH during retransmission.

**NOTE**

With frequency-hopping Quick-Look retransmission, all radios using the repeater must be set to TONE SQUELCH mode.

#### 2.21.2.1 Internal Jumpers for Repeater Operation

The E5-E10 jumper on A4 Power Supply Module affects radio operation in REXMT mode. Jumper E5-E10 determines radio squelch response and operation for normal plain text audio transmission.

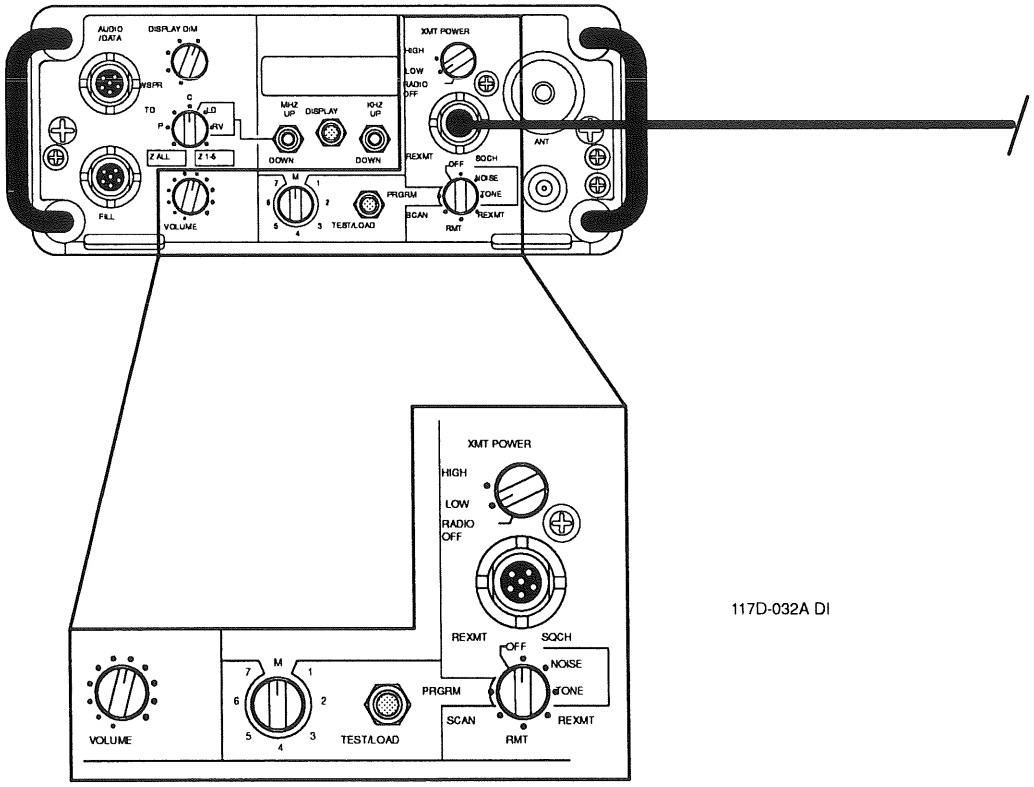



**Figure 2-39. Retransmission/Repeater Control Settings**

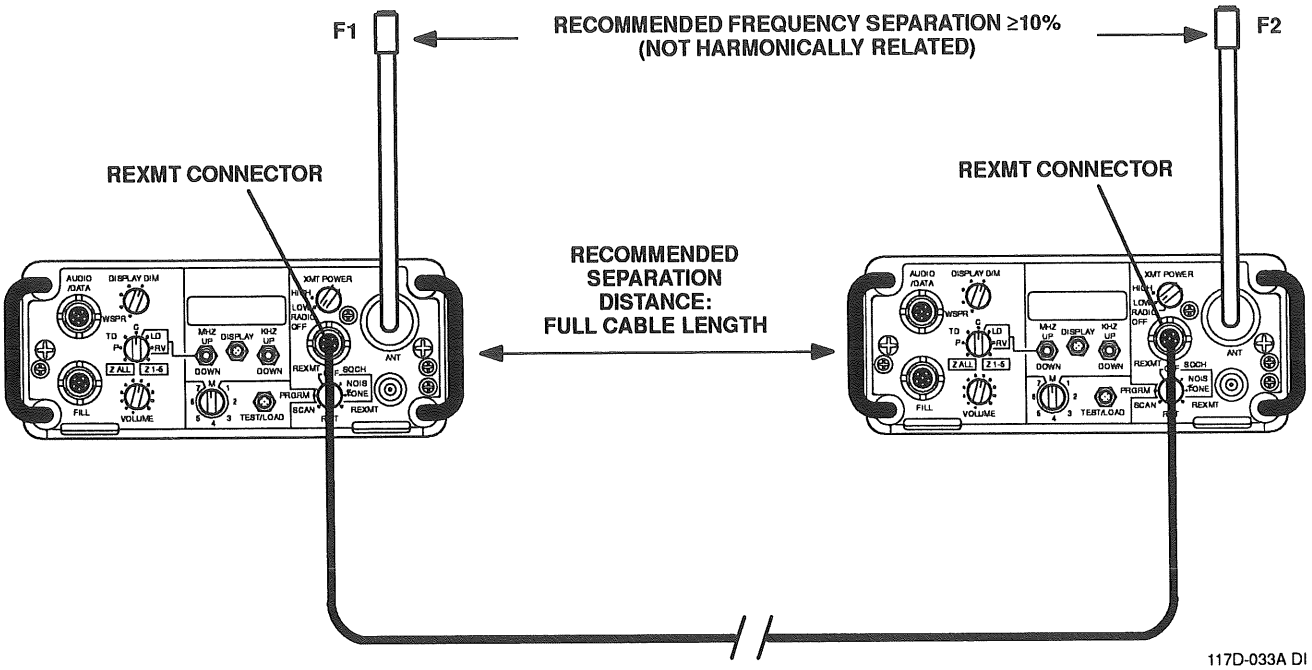



**Figure 2-40. Retransmission/Repeater Hardware Setup**

### 2.21.3 Retransmit Operation

Set the following front panel controls at both R/T assemblies used in setting up the retransmission/repeater station:

- XMT POWER – LOW or HIGH
- CHANNEL – select desired channel
- RADIO Mode – REXMT
- COMSEC Mode – P, TD, or C

Set DISPLAY DIM and VOLUME as desired.

**NOTE**

The XMT POWER setting determines the operating life of the retransmission/repeater. Low battery voltage levels at a retransmission/repeater station can be detected at other radios using the station. Sudden signal loss may indicate the need for replacement at the retransmission/repeater site.

Select the channel depending on whether simplex or half-duplex communication is intended. The other radios that communicate through the retransmission/repeater station determine whether the overall configuration is simplex or half-duplex. When in cipher operation, the radios using the retransmission/repeater station should be in TD mode for best results.

Attach the REXMT cable to the REXMT connector.

If the COMSEC mode control is in P, only plain text information is retransmitted. When the COMSEC mode control is in C or TD, both plain text and cipher text information is retransmitted.

A handset can be attached to the receiving radio to monitor the incoming signals. Any plain text traffic being received can be monitored at the handset. When in a cipher mode (C or TD), the correct crypto variable must be selected for that channel in order to monitor cipher traffic.

With the handset attached, keying the handset causes either plain or encrypted information to be transmitted depending on the position of the COMSEC mode control on the radio originating the transmission, but not through the REXMT cable.

For cipher or plain text data retransmit operation, set the COMSEC mode control to C or TD and all other controls as outlined above. A data device or other device must be connected to the AUDIO/DATA connector grounding the DIGITAL DATA MODE control pin in order to be in DATA mode. All data going through the retransmission/repeater site must be 16 kbps in cipher mode. In plain text mode, the data rate should be 16 kbps. Other data rates are available in plain text data mode, but external circuitry is required to key the transmitting radio if 16 kbps data is not used. This data can be monitored at the receiving radio if a MIL-STD-188-144A data device is attached to the AUDIO/DATA connector.

To monitor data, attach a data device to the front panel AUDIO/DATA connector, grounding the DIGITAL DATA MODE control pin to place the radio in DATA mode. A clock is present on the DATA CLOCK OUT pin when 16 kbps data is sensed. In order to monitor data in a cipher mode, the correct crypto variable must be selected for that channel.

The transceivers being used in the retransmission/repeater site do not have to have crypto variables loaded for proper operation. However, in order to monitor transmissions, the correct variable must be loaded. A summary of retransmit operations is shown in Table 2-4.

**NOTE**

SINCGARS mode plain audio cannot be monitored at the receiving radio.

**Table 2-4. Retransmit Operations Summary**

| Mode | COMSEC Control | DDMC pin | Comments |
|---|---|---|---|
| Cipher Audio | C or TD | open | |
| Plain Audio | P, C, or TD | open | |
| Cipher Data | C or TD | GND or open | DDMC must be GND to monitor. 16 kbps data only. |
| Plain Data (16 kbps) | P, C, or TD | GND | |
| Plain Data (non 16 kbps) | P | GND | Need external circuitry to key transmitting radio. |

### 2.21.4 Frequency Separation

Consider the following when setting each transceiver to a simplex, or Quick-Look, channel:

- F1 and F2 must not be within 10% of each other.
- F1 and F2 must not be harmonics of each other.
- When using Quick-Look operations, separate hopping bands by at least one 5 MHz band.
- F1 and F2 should not be image-related (F1 and F2 frequencies should not differ by exactly 42.8 MHz).

# CHAPTER 3

# FUNCTIONAL DESCRIPTION

## 3.1 INTRODUCTION

The AN/PRC-117D(V)2(C) Manpack Transceiver is made up of nine removable modules and a front panel assembly. This design enables quick repair and return to service of a faulted radio troubleshooting by module replacement. The following paragraphs describe the functions of the manpack transceiver's modules.

## 3.2 SIGNAL PATHS

Figures 3-1 and 3-2 summarize the receive and transmit operation of the manpack transceiver during plain text audio mode. A brief comparison of these figures shows the importance of A3 Microprocessor Module. This assembly not only controls and monitors functions of other R/T assembly modules, but also controls functions on other external assemblies of the radio; for example,VRC-94 Applique.

Most modules and assemblies are common to both transmit and receive paths. The frequency synthesizer modules, for example, control Voltage Controlled Oscillator (VCO) frequencies in both receive and transmit signal paths. A5 Audio Module handles audio/data signals in both receive and transmit directions. The circuitry on these and other modules is switched into or out of the signal path as needed, all controlled by A3 Microprocessor Module. This shared circuitry arrangement helps to reduce the size and weight of the radio.

### 3.2.1 Receive Signal Path

The receive signal path, shown in figure 3-1, begins at one of two antenna ports available on the front panel. The Antenna Tuner/Filter Module A1 provides whip antenna impedance matching and receive signal routing for the selected receive frequency, and low pass filters to reject some of the unwanted interfering signal sources.

The Receiver Module A8 bandpass filters the RF signal through digitally tuned preselectors. The RF signal is then amplified by the noise amplifiers before being converted to the first IF of 109 MHz. The signal passes through a 109 MHz crystal filter and is then converted to a second IF of 10.7 MHz. From here, the signal is filtered by a wide or narrow crystal filter, depending on the operating mode. If the modem is enabled, the second IF is routed to the modem module. Otherwise, the signal is routed to either the AM or FM demodulators. The resulting audio/data is then delivered to the Audio Module A5 for further baseband processing.

A8 Receiver Module filters the received RF signal through tuned preselector circuitry. It then converts the RF signal, first to 21.4 MHz, then to 406.25 kHz IF. A8 Module then demodulates the signal, with the resulting audio/data signal going to A5 Audio Module and to B3 SINCGARS Waveform Processor Module.

Synthesizer Module A7 contains four VCOs to cover all the bands used on the AN/PRC-117D(C). The VCO outputs go into a combiner through the mute circuitry, then to Receive Module A8 as the first LO.

B3 SINCGARS Waveform Processor Module identifies, decodes, processes, and recovers a synchronous serial data clock from received SINCGARS messages. In conjunction with A3 Microprocessor Module, it synchronizes the radio hop frequencies and data clock with the transmitting radio and also identifies message completion. The resulting receive data signal goes to A5 Audio Module for further processing.

A5 Audio Module filters and amplifies the audio/data signal and detects the necessary squelch condition. It filters and amplifies the audio/data signal, detects signal presence (squelch) and routes the audio/data signal and serial clock as directed by A3 Microprocessor Module. Continuously Variable Slope Delta (CVSD) circuitry is provided to convert received SINCGARS data into audio.

A4 Power Supply Module provides audio power amplifer circuitry for the audio/data signal, to give sufficient amplification to drive the handset piece.

The following are among the receive path functions controlled by A3 Microprocessor Module:

- Filter and antenna port selection on Antenna Tuner/Filter Module A1
- First Receive LO frequency setup on the Synthesizer Module A7
- Preselector, IF filter, and detector or demodulator selection on Receiver Module A8
- Filter selection and signal routing on A5 Audio Module
- Decoding circuitry selected on Modem Module A6
- Audio power amplifier gain on A4 Power Supply Module

A2 Signal Synchronizer Module coordinates frequency-hopping Quick-Look reception with A3 Microprocessor Module. Random number generation for SINCGARS ECCM operation also resides on the A2 Module.

#### 3.2.1.1 Receive Path – SCAN Mode

In SCAN mode, the radio scans sequentially through the receive frequencies on each of its eight channels at a period of approximately 0.1 second per channel. When sufficient signal strength is available to break squelch on a receive channel, the receiver circuitry stops scanning and stays on the active channel as long as it receives this signal. After contact is broken, the radio continues scanning, beginning with the next channel.

#### 3.2.1.2 SQUELCH Detection

In plain-text mode, SQUELCH detection circuitry on Audio Module A5 determines whether or not to enable audio output. In FM mode the squelch type is determined by the R/T Assembly front panel RADIO mode control. In plain-text FM, the selectable SQUELCH responses are:

- OFF – No squelch.
- NOISE – The receiver is squelched until there is sufficient carrier signal strength.
- TONE – The receiver, in low band VHF, is squelched until there is both sufficient carrier strength and the received signal has an added 150-Hz subcarrier tone.

In AM mode SQUELCH detection circuitry on the Receiver Module A8 determines whether or not to enable audio output. In plain-text AM, the selectable SQUELCH responses are:

- OFF – No squelch.
- NOISE (AM SQL LO) – The receiver is squelched until there is sufficient carrier signal strength (at the 4 dB SINAD level).
- NOISE (AM SQL HI) – The receiver is squelched until there is sufficient carrier signal strength (at the 15 dB SINAD level).

In cipher-text mode, SQUELCH response is determined by the encryption circuit. For cipher-text non-Quick-Look operation, the radio is automatically set in TONE squelch. For cipher-text Quick-Look operation, the radio operates exactly as it does for plain-text Quick-Look operation so that both TONE squelch and NOISE squelch Quick-Look transmission are possible. Section 3 contains a description of squelch operation.

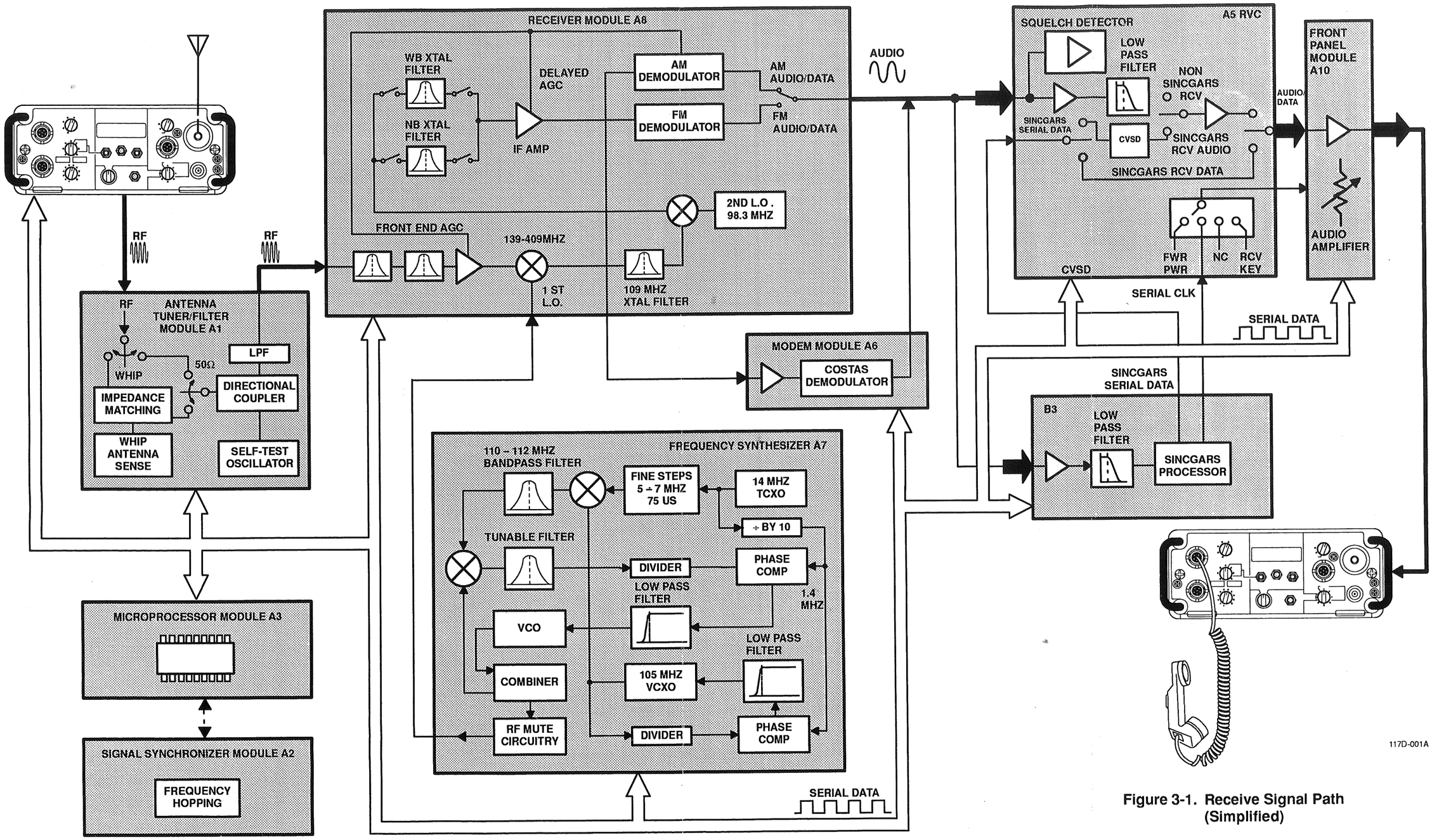



**Figure 3-1. Receive Signal Path (Simplified)**

#### 3.2.1.3 Transmit Signal Path

Keying the radio activates the transmit signal path as shown in Figure 3-2. The front panel assembly pre-amplifies the input audio/data signal which then goes to A5 Audio Module. Here, the signal is routed to the necessary circuitry for processing in preparation for transmission. This processing includes filtering, amplification, addition of the150 Hz subcarrier tone for TONE SQUELCH, and SINCGARS processing, for which the signal is routed to the B3 SINCGARS Waveform Processing Module, processed, and then routed back for further baseband transmit signal processing.

In general, Transmitter Module A9 provides modulation function in AM mode, Synthesizer Module A7 provides modulation function in FM mode, and Modem Module A6 provides modulation function in SBSK mode.

In AM mode the modulating audio/data signal goes on to Transmitter Module A9 through a summing junction, digital-to-analog converter, and a variable voltage attenuator. The signal then goes through a modulator before being applied to either the wideband or SATCOM PA. The modulator senses the various VSWR, temperature, battery, and PA current conditions to control the amount of modulated audio going to the PAs.

Synthesizer Module A7 contains four VCOs to cover all the bands used on the AN/PRC-117D(C). The VCO outputs go into a combiner, through the mute circuitry, then on to Transmitter Module A9 via Modem Module A6.

If the internal modem is selected, the frequency output from Synthesizer Module A7 is modulated by the modulator on the Modem Module A6. If the internal modem is not selected, the frequency output from the Synthesizer Module A7 bypasses the modulator on the modem module.

The synthesizer frequency goes to the Transmitter Module A9 where it is directed to the SATCOM or wideband PAs. In AM, the signal is modulated by the audio from the modulator, and the result goes on to the Antenna Tuner/Filter Module A1.

Antenna Tuner/Filter Module A1 matches the whip antenna impedance to the radio for the transmit frequency selected if the VHF-Lo whip is installed. In high band VHF, UHF, and when the VHF-Lo is not installed, the power is routed through the Antenna Tuner/Filter Module A1 to the 50-ohm front panel ANT connector.

A3 Microprocessor Module controls numerous transmit path functions, including the following:

- Filter and amplifier selection on A5 Audio Module
- SINCGARS TX Waveform generation and processing on B3, if necessary
- Transmit carrier frequency selected on Synthesizer Module A7
- HIGH/LOW power, PA selection, and power cutback on Transmitter Module A9
- Filter and antenna selection on Antenna Tuner/Filter Module A1
- Encoding and modulation circuitry selected on Modem Module A6

The audio power amplifier on A4 Power Supply Module feeds back an audio sidetone to the handset earpiece in plain text operation. This gives the handset a more natural feel and is useful for testing the audio circuitry of the radio. Refer to Chapter 5. This sidetone is not heard in the optional loudspeaker which is muted during transmission.

A2 Signal Synchronizer Module coordinates frequency-hopping transmissions (both Quick Look and SINCGARS) with A3 Microprocessor Module.

### 3.2.2 COMSEC Theory of Operation

In cipher operation, audio from the handset is encrypted in the A10 Front Panel Module, processed by the A5 Audio Module, and sent to the transmitter. In plain text operation, audio from the handset is pre-amplified and

filtered on the A5 Audio Module and sent to the transmitter. In a similar manner, received cipher data is decrypted in A10 Front Panel Module, processed by A5 Audio Module, and sent to the handset while received information is pre-amplified and filtered on A5 Audio Module and sent to the handset in plain text mode. Sidetone is generated in the front panel module for cipher text operation.

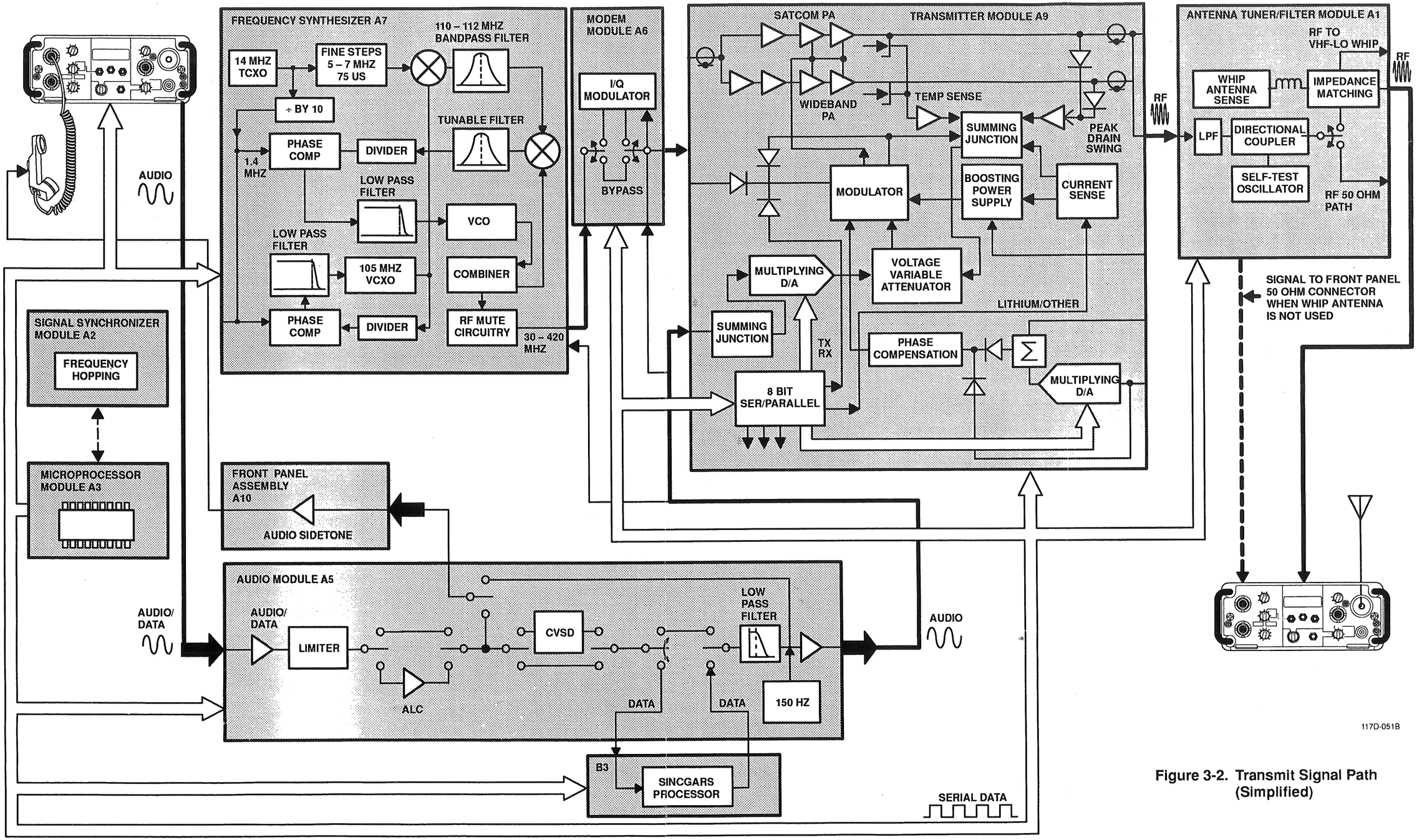
### 3.2.3 Self Test

A3 Microprocessor Module executes the self test routine when the R/T assembly front panel TEST/LOAD pushbutton is pressed (any mode except PRGRM and RMT). Immediately following the self test procedure, the R/T assembly indicates the display test, Hold-up Battery (HUB) status, battery voltage, and the source of any detected fault. Chapter 2 briefly describes using self test during radio operation. Chapter 5 describes using self test for radio troubleshooting. The self test routine momentarily inhibits reception and transmission.

Self test includes checks of the following:

- COMSEC portion of front panel
- Non-COMSEC portion of front panel
- Battery voltage
- Hold-up-battery (HUB) status
- Power supply module voltages
- Front panel encryption assembly
- Frequency synthesizer operation
- Antenna tuner/low pass filter matching module (when manpack antenna is properly connected)
- Receiver sensitivity
- Audio output
- Transmit power output
- Vehicular configuration
- Whip antenna power (when manpack antenna is properly connected)
- Modem
- COMSEC power supply in front panel
- Front panel hybrid
- A3 Microprocessor Module logic and memory circuitry
- B3 SINCGARS Waveform Processor Module logic and memory circuitry

The R/T assembly checks its own modules for self test faults A01 - A10. Refer to Paragraph 5.2 for self test fault conditions.




117D-051B

**Figure 3-2. Transmit Signal Path (Simplified)**

# CHAPTER 4

# SCHEDULED MAINTENANCE

**NOTE**

There are no Level II scheduled maintenance procedures required for the AN/PRC-117D(V)2(C) MANPACK radio.

## 4.1 PREVENTIVE MAINTENANCE

For reliable operation, prevent dirt build-up anywhere in the system. Keep electrical contacts clean and free from corrosion. To clean contacts, use a soft cloth or cotton dipped in alcohol.

Use the protective covers provided for each front panel connector, shown in Figure 4-1. When the handset or antenna is removed, verify that the appropriate protective cover is installed.

### 4.1.1 Replaceable R/T Assembly Front Panel Hardware

Replace any cracked, broken, or badly worn cover, control knob, or protective rubber boot on the R/T Assembly front panel. Use the part numbers shown in Figure 4-1 to reorder these parts. Unscrew rubber boots to remove them from toggle switches and pushbuttons. A thin coat of silicone may be applied to the protective rubber boots to further life expectancy.

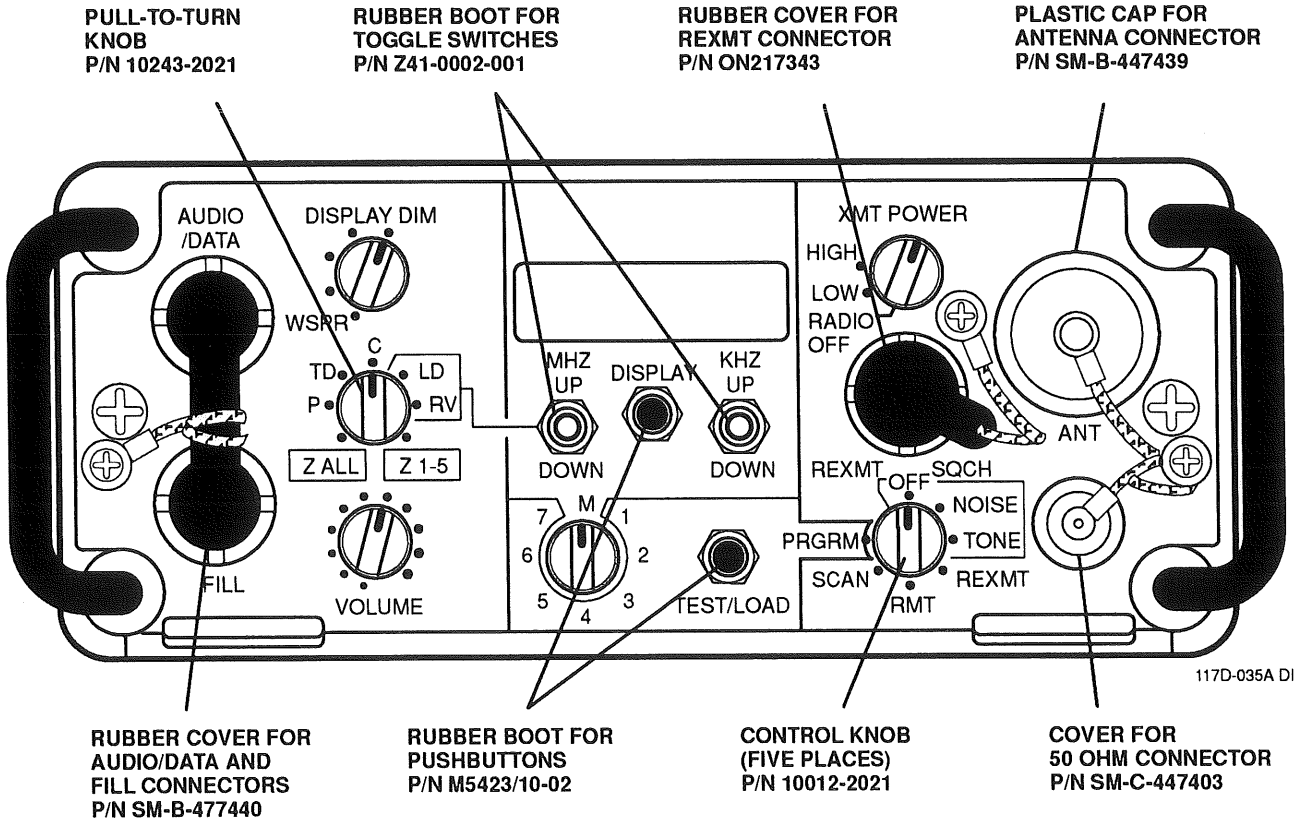



**Figure 4-1. Protective Covers**

# CHAPTER 5

# TROUBLESHOOTING

## 5.1 INTRODUCTION

### 5.1.1 General

This chapter provides troubleshooting data necessary for fault isolation to the Line Replaceable Unit (LRU) level.

### 5.1.2 Scope of this Chapter

See Figure 5-1. The procedures presented in this chapter assume that a Level I fault has led the maintainer to suspect a fault with the radio system. The maintainer begins the troubleshooting process by troubleshooting with Built-In-Test (BIT). If there is a non-BIT fault, the maintainer will use the non-BIT troubleshooting procedures. If there is a BIT fault, the maintainer will use the BIT troubleshooting procedures. When the problem is found and corrected, the radio system is returned to operational readiness.

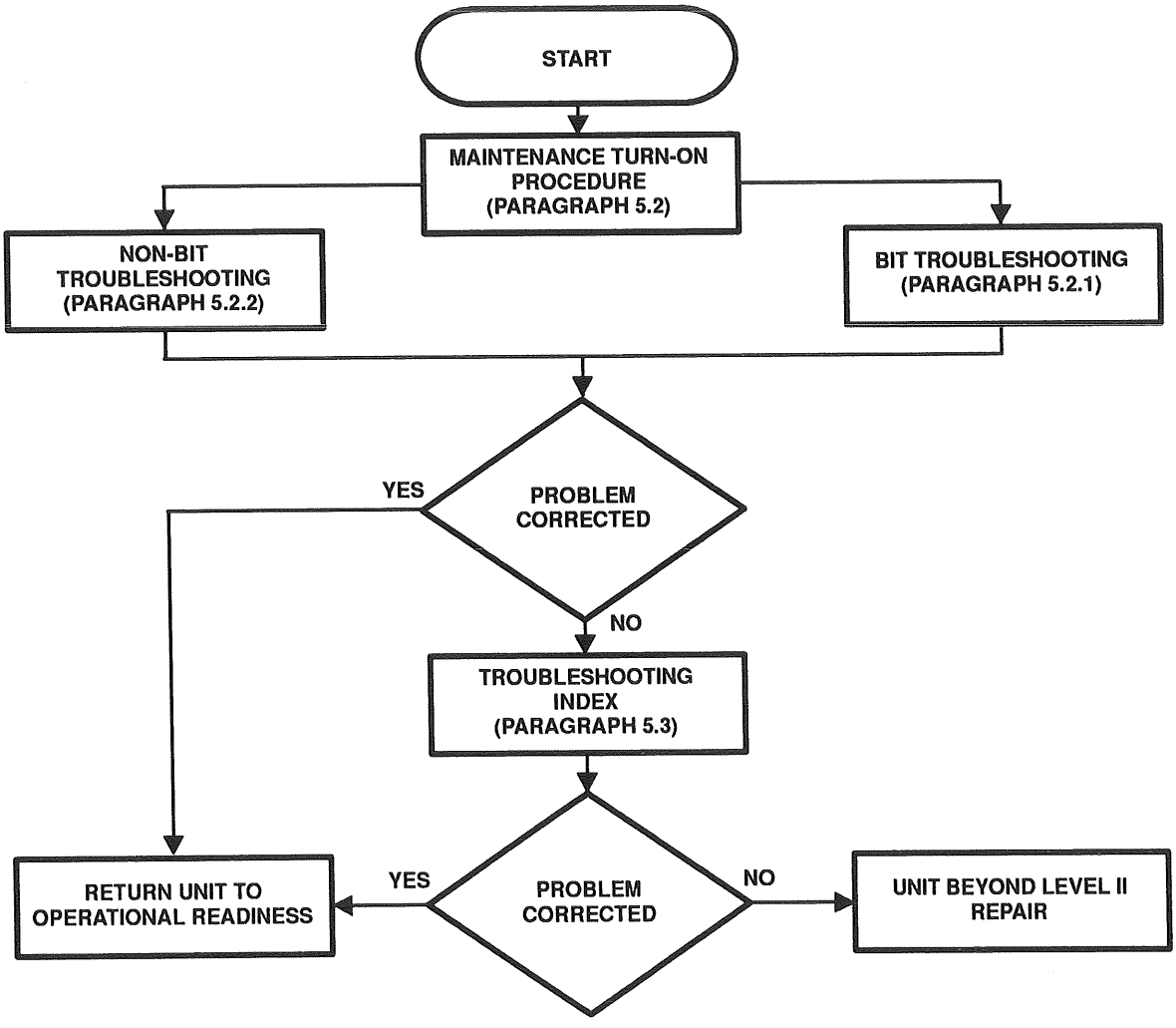



**Figure 5-1. Troubleshooting Process Used in this Chapter**

## 5.2 TROUBLESHOOTING PROCEDURES

Primary troubleshooting does not normally require extensive technical background or sophisticated test equipment. Relying heavily on self test, the procedure for isolating a faulted major assembly is normally within the abilities of the experienced radio operator. Using this procedure, the operator can quickly identify the major assembly or module that is faulted, replace the assembly or module, and return the radio to service.

Self test is the primary tool for R/T Assembly troubleshooting, as described in this manual. The procedures given here cover R/T Assembly repair to the module replacement level only.

### 5.2.1 Troubleshooting With BIT

The self test routine, executed and controlled by the R/T Assembly, performs numerous checks on radio operation and displays the source of a fault condition when one is detected. Use self test when powering up the radio and as often as necessary during operation. Use self test as the first procedure in troubleshooting.

Self test provides automatic checks of the circuits on the modules, which consist of the following:

- COMSEC portion of front panel
- Non-COMSEC portion of front panel
- Battery voltage
- Hold-up-battery (HUB) status
- Power supply module voltages
- Front panel encryption assembly
- A3 Microprocessor Module logic and memory circuitry
- B3 SINCGARS Waveform Processor Module logic and memory circuitry
- Frequency synthesizer operation
- Antenna tuner/low pass filter matching module
- Receiver sensitivity
- Audio output
- Transmit power output
- Whip antenna power
- Modem
- COMSEC power supply in front panel
- Front panel hybrid

In addition to the 10 modules, self test displays an A11 fault if a vehicular fault has occurred.

To initiate self test, power up the transceiver with the 10369-0205 VHF-UHF Antenna or a suitable 50 ohm termination in place. The LED display must be blank for self test. Then push TEST/LOAD. Observe the R/T Assembly display for self-test results. The LED display is tested with all the display elements lit at 50% brightness, then the display reverts to the selected setting on the DISPLAY DIM/WSPR control. The radio then checks the status of the HUB. If the battery is good, there is no display. If it is weak, too low to register, or missing, "HUB Low" or "No HUB" displays. The radio then displays the detected primary power battery voltage. For voltage levels below 11.0 V, this display flashes, indicating that battery replacement is required. If the radio passes self test, "PASSED" displays.

If the radio detects a fault, it displays a fault code of either A01 through A10 or B03. This fault code indicates a faulted assembly or module which is the most likely source of a fault. An A11 fault indicates a problem when the radio is used in a vehicular configuration. Table 5-1 lists the unit identified by each fault code. (Signal Synchronizer Module A2 is not listed in Table 5-1 and not tested during self test.) The handset gives a one-second beep when a fault is detected, enabling the operator to use self test when the LED display is not readily visible. Figure 5-2 summarizes self test responses.

Keep the following considerations in mind when using self test:

- The self test display may indicate a problem with the assembly or module itself, or with internal cable connection to the assembly or module. Use the module as the starting point for troubleshooting.
- Normal transmission and reception are inhibited during self test.
- Self Test is accomplished with the 10369-0205 VHF-UHF Antenna or a 50 ohm termination connected to the BNC antenna port.
- A momentary pulse of rf power is placed on the antenna during the self test sequence as part of the transmitter function verification. This is a normal event in the self test sequence. It is suggested that the transceiver be configured with only the VHF-UHF Antenna to reduce the incidence of a false indication due to coupling between the VHF-LO Whip Antenna and the VHF-UHF Antenna. Mutual coupling during the self test sequence between antennas can increase the probability of a false A01 code reported to the built-in-test routine. Additionally, the operator should be aware to keep a minimum 16-inch distance from the antennas to reduce personal hazards due to high RF fields around the antenna.

**WARNING**

Potentially harmful voltages are present on antenna during transmission. Avoid contact.

- A08 and A05 fault codes displayed can mean that a strong interfering signal is being received at the tested channel frequency. If an A08 or A05 fault is encountered, replace the antenna with a 50 ohm termination and initiate self test again.
- If self test does not appear to return a PASSED indication or fault code, insure the DISPLAY DIM/WSPR control is rotated fully clockwise and try again. If subsequent self test attempts are made without results, refer to the procedures in Paragraph 5.2.2.

**Table 5-1. Self Test Designations**

| Self Test Code | Module or Assembly Identified |
|---|---|
| A01 | Antenna Tuner/Filter Module |
| A02 | Signal Synchronizer Module |
| A03 | Microprocessor Module |
| B03 | SINCGARS Waveform Processor Module |
| A04 | Power Supply Module |
| A05 | Audio Module |
| A06 | Modem Module |
| A07 | Frequency Synthesizer Module |
| A08 | Receiver Module |
| A09 | Transmitter Module |
| A10 | Front Panel Assembly |

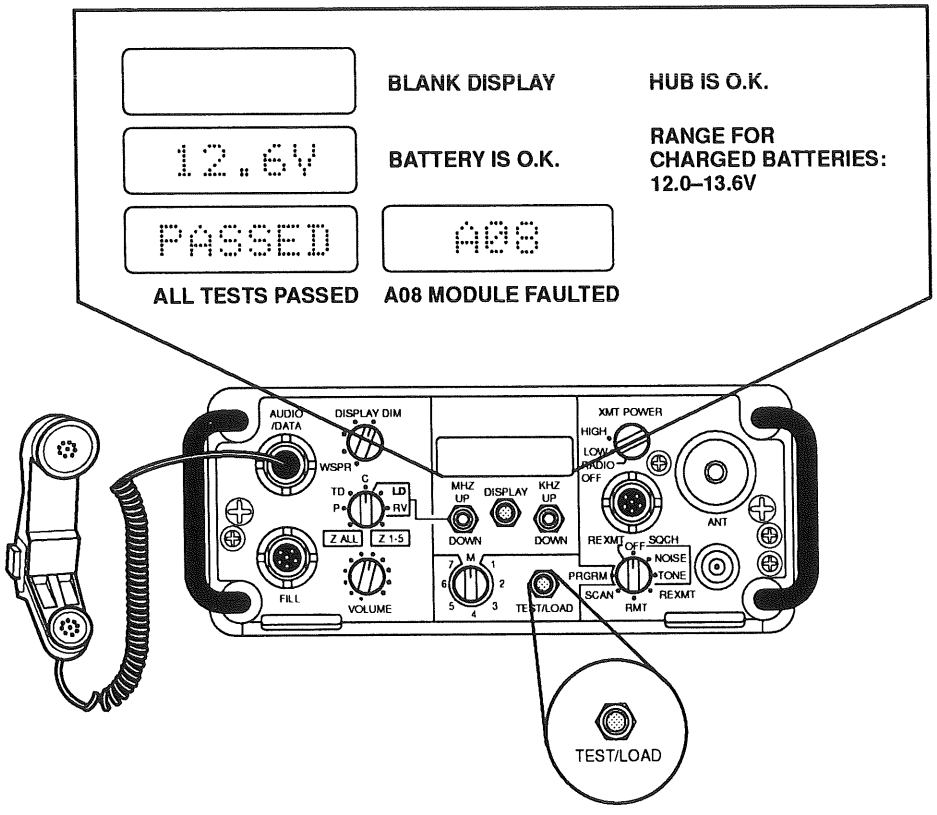



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**Figure 5-2. Self Test Response**

### 5.2.2 Troubleshooting With Non-BIT Fault Isolation

Problems not detected during self test may be the result of incorrect setup. Table 5-2 lists common types of setup problems and their solutions.

If self test does not energize the front panel display, check that the radio is on (XMT POWER control) and that it is in a mode other than PRGRM or RMT. Turn the DISPLAY DIM control fully clockwise and push the TEST/LOAD pushbutton. If self test still does not work, check these possible sources on the problem:

- BATTERY VOLTAGE – Test this by turning the radio off (at XMT POWER control), then back on. Battery voltage should display. If voltage does not display, replace the battery pack with a freshly charged unit. Try this procedure again with the new battery pack.
- MICROPROCESSOR MODULE A3 – Because it controls the front panel display and executes self test, suspect the A3 module if self test does not work as described.
- FRONT PANEL ASSEMBLY – Suspect the ribbon cable connection from this assembly to the A4 module. Recheck all troubleshooting procedures before attempting removal and replacement of the front panel assembly.
- TRANSMITTER MODULE A9 FUSE PROTECTION – Refer to Paragraph 5.3.1.

**Table 5-2. Correcting Setup Problems**

| Problem | Possible Solution | Reference |
|---|---|---|
| No power | Check battery pack connections and voltage | Chapter 6 |
| Very poor sensitivity | Check antenna connection | Chapter 6 |
| No one receives your signal | Check that handset is in the AUDIO/DATA connector<br>Check COMSEC Mode Control position<br>Check for proper COMSEC variable | Chapter 6<br>Chapter 2<br>Chapter 2 |
| Continuous tone in handset | Check RADIO Mode Control position (not in PRGRM?)<br>Check COMSEC Mode<br>Check battery voltage | Chapter 2<br>Chapter 2<br>Chapter 5 |
| Programmed channel (1-7); frequency/Quick-Look code cannot be recalled | Check memory backup battery charge | Chapter 6 |
| Programmed channel (1-7); frequency displays 60.000 upon attempted recall | Recall is purposely inhibited by jumper. Check transmit frequency programming | Chapter 5 |
| Half-duplex operation; reception but no transmission | Check transmit frequency programming | Chapter 2 |

## 5.3 TROUBLESHOOTING SUPPORT DATA

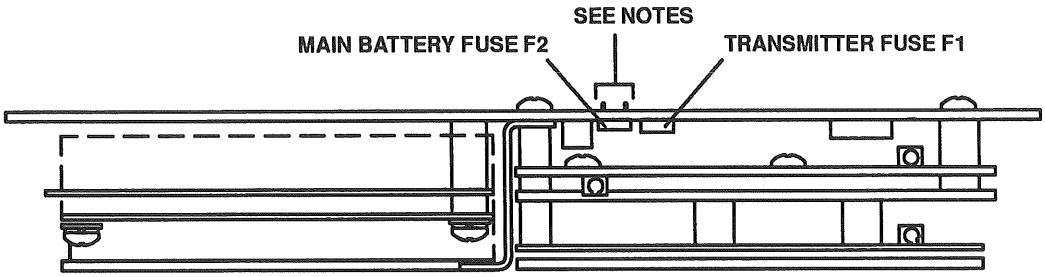
### 5.3.1 Protective Device Index

The R/T Assembly is fused as follows:

- 10 A fuse (F2) on Transmitter Module A9 - Protects the radio from reversed polarity and protects the battery and radio wiring from high current conditions due to faults in the Transmitter Module A9.
- 1 A fuse (F1) on Transmitter Module A9 - Protects the rest of the radio from incidental damage due to high current conditions. F1 is self-resetting when the over current condition is eliminated.

If either fuse or both fuses are blown (open), an indicator lights on the top edge of the Transmitter Module A9 when the power switch is placed in the LOW or HIGH position.

Refer to Figure 5-3 for the locations of these fuses on Transmitter Module A8.




NOTES: 1. USE ALL PRECAUTIONS FOR ELECTROSTATIC SENSITIVE DEVICES (SEE PARAGRAPH 5.1).
2. F2 IS A 10 AMP PICOFUSE™ SOLDERED INTO BIFURCATED TERMINALS PERMANENTLY ATTACHED TO A9A1.

117D-096A

**Figure 5-3. Fuse Locations on Transmitter Module A9**

### 5.3.2 Checking Receiver Sensitivity

Use the tests given in this paragraph to verify proper receiver performance. If necessary, use these procedures after self test and the other troubleshooting steps described in this chapter.

The following test equipment is required:

- Signal generator (HP-8640B, 50-ohm output)
- Distortion analyzer (HP-332)

Sensitivity is a measurement of how well the receiver recovers the desired low-level signal from the surrounding noise. Manpack receiver sensitivity is specified as the following:

- VHF (Low) –113 dBm FM (8 kHz) for 10 dB SINAD
- VHF (High) –110 dBm FM (8 kHz) for 10 dB SINAD
  –104 dBm AM (30%) for 10 dB SINAD
  –110 dBm AM (70%) for 10 dB SINAD
- UHF SATCOM –120 dBm FM (8 kHz) for 10 dB SINAD (243-270 MHz)
- UHF LOS –117 dBm FM (8 kHz) for 10 dB SINAD (225-243, 270-420 MHz)
- UHF –107 dBm AM (30%) for 10 dB SINAD
  –113 dBm AM (70%) for 10 dB SINAD

The signal generator must have 50-ohm output impedance and should be capable of testing the complete 30-420 MHz range of the radio. Always consider test cable losses when performing the following tests.

### 5.3.2.1 Checking Receiver Sensitivity in FM

Figure 5-4 shows a typical setup for checking FM receiver sensitivity. Here, the FM carrier from the signal generator, modulated at 8 kHz deviation by a 1 kHz audio signal, goes to the 50-ohm connector of the radio. The radio demodulates this signal, making the 1 kHz signal available at its audio output. The distortion analyzer measures the relative noise level in the received signal, in units of dB SINAD.

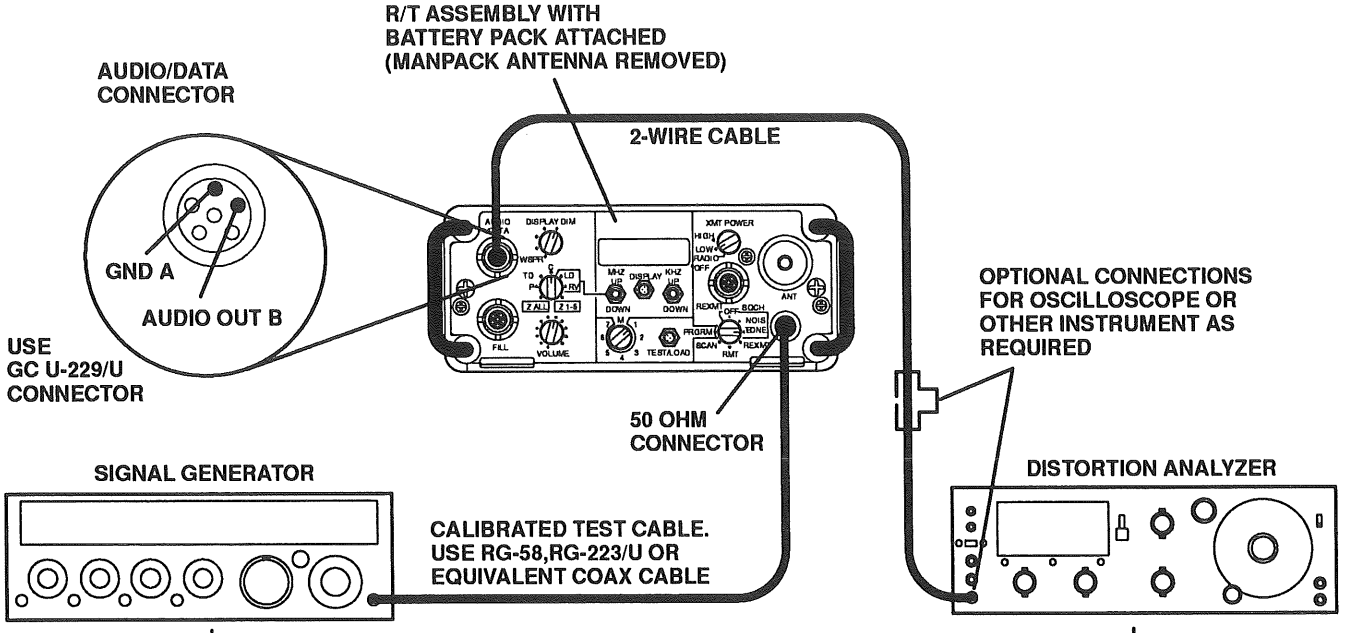
**CAUTION**

Do not initiate self test with the RF signal generator connected to the radio. Self test keys the transmitter at its HIGH output power which could damage a connected RF signal generator. To protect the RF signal generator from accidental self test initiation, connect a 30 dB, >20 W attenuator to the transceiver ANT connector. Be sure to account for the attenuator value during sensitivity evaluation.

The following settings are required for this test:

- XMT POWER – LOW or HIGH
- VOLUME – mid-scale (or comfortable level)
- RADIO Mode – OFF (No SQUELCH)
- COMSEC Mode – P
- CHANNEL Control – M
- Frequency – same as selected on signal generator
- Channel Mode – selected or programmed for FM (toggled after pressing DISPLAY)

Choose at least one frequency in each 10-MHz band. Select frequencies not in use or subject to local interference. Use frequencies that are not harmonics of frequencies in use in the area.




**SETUP:**

- FREQUENCY.
  SAME AS RADIO.
- DEVIATION.
  UP TO 5 KHZ OR 8 KHZ,DEPENDING ON RADIO SETUP.
- MODULATION FREQUENCY.
  1 KHZ (FOR TONE SQUELCH CHECK: 150 HZ)
- OUTPUT LEVEL.
  INITIALLY, SET TO –60 DBM (APPROX. 224 UV) TO ADJUST NULL ON DISTORTION ANALYZER (STEP 2 AT RIGHT). AT STEP 3, SET TO –113 DBM (0.5 UV) FOR SENSITIVITY MEASUREMENT.

**PROCEDURE:**

1. SELECT DISTORTION FUNCTION.
2. ADJUST ANALYZER FREQUENCY CONTROL TO "NULL" 1K COMPONENT OF SIGNAL (WITH SIGNAL GENERATOR AT –60 DBM).
3. ON SIGNAL GENERATOR, SET OUTPUT LEVEL TO–113 DBM (0.5) UV) FOR VHF OR – 120 DBM FOR UHF.
4. SELECT ANALYZER SET LEVEL FUNCTION AND ADJUST METER TO 0 DB (REFERENCE).
5. SELECT ANALYZER DISTORTION FUNCTION. READ SINAD VALUE ON DB SCALE. THE READING MUST BE ≥ 10DB FOR PROPER OPERATION.

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Figure 5-4. Equipment Setup for Checking Receiver Sensitivity in FM

### 5.3.2.2 Checking Receiver Sensitivity in AM

Figure 5-5 shows a typical setup for checking receiver sensitivity. Here, the AM carrier from the signal generator, modulated at 30% AM by a 1 kHz audio signal, goes to the 50-ohm connector of the radio. The radio demodulates this signal, making the 1 kHz signal available at its audio output. The distortion analyzer measures the relative noise level in the received signal, in units of dB SINAD.

**CAUTION**

Do not initiate self test with the RF signal generator connected to the radio. Self test keys the transmitter at its HIGH output power which could damage a connected RF signal generator. To protect the RF signal generator from accidental self test initiation, connect a 30 dB, >20 W attenuator to the transceiver ANT connector. Be sure to account for the attenuator value during sensitivity evaluation.

The following settings are required for this test:

- XMT POWER – LOW or HIGH
- VOLUME – mid-scale (or comfortable level)
- RADIO Mode – OFF (No SQUELCH)
- COMSEC Mode – P
- CHANNEL Control – M
- Frequency – same as selected on signal generator
- Channel Mode – selected or programmed for AM (toggled after pressing DISPLAY)

Choose at least one frequency in each 10-MHz band in the VHF-Hi or UHF frequency range. Select frequencies not in use or subject to local interference. Use frequencies that are not harmonics of frequencies in use in the area.

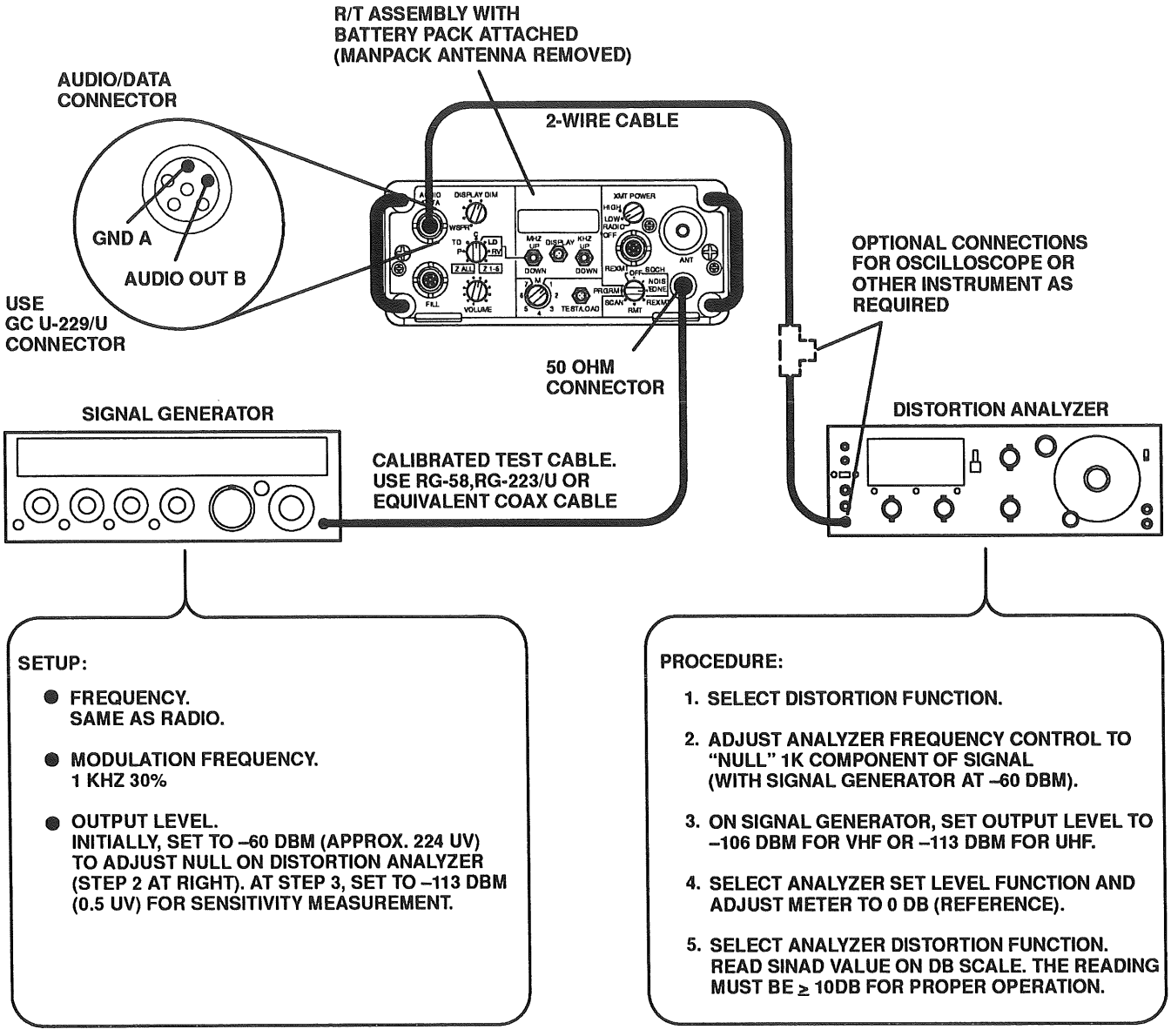



**Figure 5-5. Equipment Setup for Checking Receiver Sensitivity in AM**

### 5.3.2.3 Checking SQUELCH Circuitry in FM

NOISE and TONE SQUELCH modes inhibit the rushing noise (audible when receiving in the OFF SQUELCH mode) when a received signal does not have sufficient strength or proper signal characteristics. The following are three R/T Assembly SQUELCH settings in the FM mode:

- OFF – No squelch is applied. The rushing sound is present when no signal is being received.
- NOISE – In this mode, the received signal must have a minimum level (10 dB SINAD) to unsquelch the receiver.
- TONE – In this mode, the received signal must have the minimum level necessary for NOISE SQUELCH and must be modulated by a 150-Hz subcarrier tone to break squelch. This mode is only available in low band VHF.

Figure 2-8 summarizes receiver response for each of these SQUELCH settings.

To check the SQUELCH response, disconnect the distortion analyzer from the test setup of Figure 5-4. Install the handset at the R/T Assembly front panel AUDIO/DATA connector.

Perform the following procedure to test NOISE SQUELCH:

a. Set the radio to NOISE SQUELCH mode. Set the VOLUME control to mid-position.

b. With the signal generator set up as described in Paragraph 5.3.2.1, slowly vary the signal power level above and below the NOISE SQUELCH threshold of the following values:

- VHF (Low) –113 dBm FM (8 kHz) for 10 dB SINAD
- VHF (High) –110 dBm FM (8 kHz) for 10 dB SINAD
- UHF LOS –117 dBm FM (8 kHz) for 10 dB SINAD (225-243, 270-420 MHz)
- UHF SATCOM –120 dBm FM (8 kHz) for 10 dB SINAD (243-270 MHz)

c. Listen in the handset and detect the level where the receiver is squelched and where it is unsquelched. The receiver should be unsquelched with an input signal level above the following:

- VHF (Low) –113 dBm FM (8 kHz) for 10 dB SINAD
- VHF (High) –110 dBm FM (8 kHz) for 10 dB SINAD
- UHF LOS –117 dBm FM (8 kHz) for 10 dB SINAD (225-243, 270-420 MHz)
- UHF SATCOM –120 dBm FM (8 kHz) for 10 dB SINAD (243-270 MHz)

The receiver should be squelched if the input signal level is below the following:

- -120 dBm for VHF Low and VHF High
- -127 dBm for UHF LOS and UHF SATCOM

Perform the following procedure to test TONE SQUELCH (in low band VHF):

a. On the signal generator, set the power level slightly above the NOISE SQUELCH threshold as determined using the procedures above. For the moment, leave other controls as they were after performing the NOISE SQUELCH testing.

b. Set the radio to TONE SQUELCH. Set the VOLUME control to mid-position.

c. Listen to the handset. At this point, there should be no rushing sound from the handset. The receiver is squelched because the 150-Hz modulating tone is not being received.

d. Set the signal generator modulation to 150 Hz.

e. Change the deviation of the signal generator based on its setting from the above procedures, as follows:

- If original setting was 5 kHz, adjust deviation to 1.875 kHz.
- If original setting was 8 kHz, adjust deviation to 3 kHz.

When the radio detects the 150-Hz tone, it unsquelches the receiver.

#### 5.3.2.4 Checking SQUELCH Circuitry in AM

NOISE SQUELCH modes inhibit the rushing noise (audible when receiving in the OFF SQUELCH mode) when a received signal does not have sufficient strength or proper signal characteristics. The following are four R/T Assembly SQUELCH settings in the AM mode:

- OFF – No squelch is applied. The rushing sound is present when no signal is being received.
- NOISE (AM SQL HI) – In this mode, the received signal must have a minimum level (15 dB SINAD) to unsquelch the receiver.
- NOISE (AM SQL LO) – In this mode, the received signal must have a minimum level (4 dB SINAD) to unsquelch the receiver.
- TONE – Same operation as NOISE in AM mode.

Figure 2-8 summarizes receiver response for each of these SQUELCH settings.

To check the SQUELCH response, disconnect the distortion analyzer from the test setup of Figure 5-4. Install the handset at the R/T Assembly front panel AUDIO/DATA connector.

Perform the following procedure to test NOISE SQUELCH (AM SQL LO):

a. Verify that AM SQL LO is set from the RADIO OPS menu.

b. Set the radio to NOISE SQUELCH mode. Set the VOLUME control to mid-position.

c. With the signal generator set up as described in Paragraph 5.3.2.2, slowly vary the signal power level above and below the NOISE SQUELCH threshold of the following values:

- -104 dBm for VHF-HI
- -107 dBm for UHF

d. Listen in the handset and detect the level where the receiver is squelched (no audio) and where it is unsquelched (audio). The receiver should be unsquelched with an input signal level above the following:

- -104 dBm for VHF-HI
- -107 dBm for UHF

The receiver should be squelched if the input signal level is below the following:

- -120 dBm for VH-HI
- -126 dBm for UHF

Perform the following procedure to test NOISE SQUELCH (AM SQL HI):

a. Verify that the AM SQL HI is set from the RADIO OPS menu.

b. Set the radio to NOISE SQUELCH mode. Set the VOLUME control to mid-position.

c. With the signal generator set up as described in Paragraph 5.3.2.2, slowly vary the signal power level above and below the NOISE SQUELCH threshold of the following values:

- -100 dBm for VHF-HI
- -114 dBm for UHF

d. Listen in the handset and detect the level where the receiver is squelched and where it is unsquelched.

The receiver should be unsquelched with an input signal level above the following:

- -100 dBm for VHF-HI
- -114 dBm for UHF

The receiver should be squelched if the input signal level is below the following:

- -104 dBm for VHF-HI
- -118 dBm for UHF

### 5.3.3 Checking Output Power

Use the following procedures for periodic checks of transmitter output power performance. If necessary, use these procedures after attempting self test and the other troubleshooting steps described in this chapter.

The following test equipment is required:

- Directional wattmeter [Bird Model 43 and 10 W Slugs (20 W or greater for UHF-TACSAT)]
- Dummy load (50 ohm Bird Model 8164)

The radio transmit power level depends on its XMT POWER control setting.

- LOW = 1 W (±1 dB) (4W for SATCOM)
- HIGH = 10 W ⟨±1 dB) (20W for SATCOM)

Test output power using a directional wattmeter in series with a 50-ohm dummy load. Figure 5-6 shows a typical setup for transmitter output power testing. Follow the procedures shown in this figure for both LOW and HIGH settings of the XMT POWER control. Always consider test cable losses when performing transmit power output tests.

Check transmit power with at least one frequency from each of the following bands:

- 30.000 - 49.975 MHz
- 50.000 - 89.975 MHz
- 116.000 - 173.995 MHz
- 225.000 - 419.995 MHz

Full output power values, 1 W and 10 W (4W and 20 W for SATCOM), are rated for a fully charged battery pack (minimum 12.0 V).

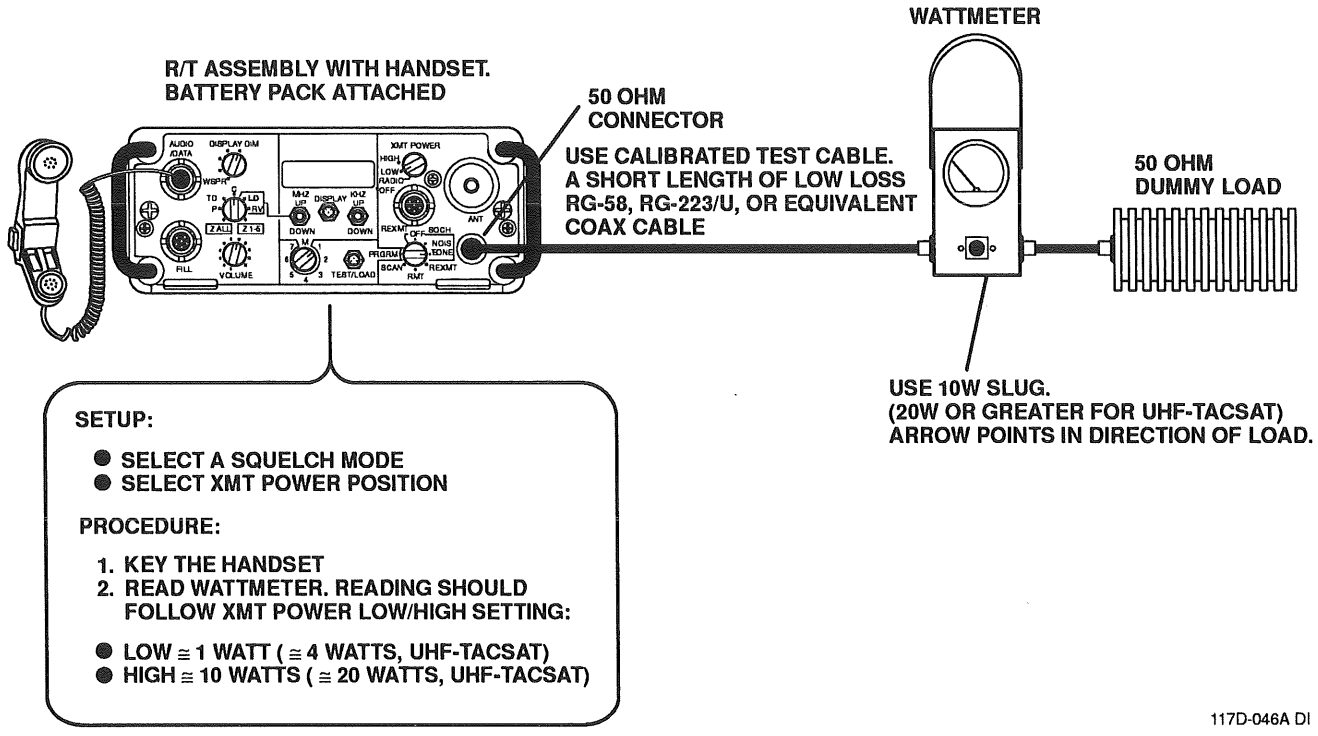



**Figure 5-6. Equipment Setup for Output Power Testing**

## 5.3.4 AUDIO CIRCUITRY AND HANDSET TESTING

Use the following procedures to verify proper operation of audio circuitry. These procedures begin with a brief functional checkout using the handset (Paragraph 5.3.4.1). This simple testing determines whether or not R/T Assembly audio circuitry is operating.

### 5.3.4.1 Checking the Receive Audio Path

Connect the handset to the front panel AUDIO/DATA connector and set the following R/T Assembly controls:

- XMT POWER – LOW or HIGH
- VOLUME – Set to mid-position
- RADIO Mode – Set to OFF (SQUELCH)
- COMSEC Mode – P

The rushing noise indicates that the receive audio path is operable. This indicates that the following R/T Assembly components are functioning:

- Demodulator or detector circuitry on Receiver Module A8
- Audio Module A5
- Audio power amplifier on Power Supply Module A4
- Handset earpiece

Chapter 3 briefly describes the function of these components and their relationship to the receive audio signal path.

### 5.3.4.2 Checking the Transmit Audio Path

Use the same setup given in Paragraph 5.3.4.1 to test the receive audio path.

Key the handset and talk in the mouthpiece while listening for the audio sidetone in the earpiece. When the transmit audio path is operational, this audio sidetone is fed back through the audio power amplifier (A4 module). This indicates that the following components are functioning:

- Handset (mouthpiece and earpiece)
- Front panel assembly preamplifier circuitry
- Audio Module A5
- Audio power amplifier on Power Supply Module A4

# CHAPTER 6

# CORRECTIVE MAINTENANCE

## 6.1 GENERAL

The assembly/disassembly of the AN/PRC-117D(V)2(C) requires no tools. Follow the procedures in Paragraph 6.2.1 to assemble/disassemble the radio.

For full compatibility, all radio units within a net must have the same internal configuration, with identical jumper placement on radio modules. Paragraph 6.3 outlines these compatibility considerations.

Under certain conditions, it may be necessary to recharge the A3 module memory backup battery as part of radio assembly. Paragraph 6.4 describes this procedure.

Although the HUB (hold-up-battery) is not expected to need replacing, a HUB low condition should be reported to qualified service personnel. Under no circumstances should unauthorized personnel attempt to access this battery which is located in the front panel module.

## 6.2 ASSEMBLY AND DISASSEMBLY OF THE RADIO

### 6.2.1 Assembling The Radio

**WARNING**

If the optional BA-5590 Lithium Battery is used, observe the following:

- If the battery becomes hot, a hissing sound is heard, and an irritating smell occurs. Move the equipment to a well ventilated area or leave the area.
- Do not use a Halon type fire extinguisher on a lithium battery fire.
- Do not dispose of lithium batteries in uncontrolled trash. These batteries contain hazardous materials that can contaminate the environment.

Figure 6-1 shows the parts of the manpack transceiver. Figures 6-2 through 6-5 illustrate the recommended sequence for its assembly.

Figure 6-2 recommends testing battery voltage as soon as the battery pack is attached. A charged battery gives a reading of at least 12.0 V. Use this 12.0 V figure as a general guideline. A voltage reading below 12.0 V indicates that the battery requires charging. (Chapter 5 describes battery voltage test.)

Handset connection is shown in Figure 6-3. Note that the AUDIO/DATA connector is used for this connection. The front panel FILL connector is used for standard COMSEC fill devices (KOI-18, KYK-13, KYX-15).

Two antenna connections are provided on the transceiver as shown in Figure 6-4. The top half of the figure shows the connection of a blade or whip antenna to the top ANT connector. These antennas can only be used in VHF-Lo operation (30 - 90 MHz). The bottom half of the figure shows the connection of the VHF-Hi/UHF antenna to the bottom ANT connector (50-ohm).

The 50-ohm connector is used for the VHF-Hi/UHF, UHF LOS (Line of Sight), and SATCOM antennas. In VHF-Lo operation, the 50-ohm connector is energized when the whip antenna is either removed or not firmly attached.

For field use, the radio is designed to be carried in the backpack harness (P/N 10243-0400). This harness is similar in configuration to the AN/PRC-117A/B, AN/PRC-77, and -25 standard pack frames. Both side straps and handle straps secure the transceiver for carrying. Figure 6-5 shows the strap connections for radio mounting in the backpack harness.

### 6.2.2 Disassembling The Radio

Figure 6-1 shows the parts of the manpack transceiver. Figures 6-2 through 6-5 illustrate the recommended sequence for its disassembly.

Handset connection is shown in Figure 6-3. Note that the AUDIO/DATA connector is used for this connection. The front panel FILL connector is used for standard COMSEC fill devices (KOI-18, KYK-13, KYX-15).

Two antenna connections are provided on the transceiver as shown in Figure 6-4. The top half of the figure shows the connection of a blade or whip antenna to the top ANT connector. The bottom half of the figure shows the connection of the VHF-Hi/UHF antenna to the bottom ANT connector (50-ohm).

## 6.3 COMPATIBILITY AMONG UNITS

For full communication, all radios within a net must have identical internal configurations. This means that jumper positions on the following modules must be the same in all units:

- Power Supply Module A4
- Signal Synchronizer Module A2

Optional jumpers on Power Supply Module A4 select such operating parameters as automatic TONE SQUELCH transmission, frequency deviation, and frequency display recall for programmed channels. These jumpers are factory-installed, but field modification is possible.

Jumpers on this module determine, in part, the pseudorandom pattern of frequency hopping. To allow ECCM communication, these jumpers must match exactly for all radios within a network. Quick-Look jumpers are factory-installed, but field modification is possible.

## 6.4 MEMORY BACKUP BATTERY

After a long period of storage or when the radio is new and has never been used, it may be necessary to charge the memory backup battery as described below.

**NOTE**

Do not operate the radio with a discharged memory backup battery. The radio will not retain programmed frequency or code values if this battery is discharged.

A small backup battery is provided on Microprocessor Module A3 inside the radio. This battery maintains memory contents so that programmed frequencies or Quick-Look codes are stored while the radio is off. Memory backup is the only purpose of this battery. It does not provide power for radio operation.

The memory backup battery charges only when the radio is on. Once it is fully charged, the backup battery can typically hold its charge and maintain memory contents for several months if the R/T Assembly is stored at moderate temperatures. Regular use of the radio automatically keeps this backup battery at full charge. If the radio has not been used for a month or more, consider the backup battery discharged. This may be the case if the radio is new or has been in storage.

To charge the memory backup battery, turn the radio on for at least one hour, preferably several hours. This should be done before programming any channel information.

## 6.5 INDEX TO SIGNALS

Table 6-1 lists the input/output signals of the R/T Assembly. Figure 6-9 shows a pinout diagram of these connectors.

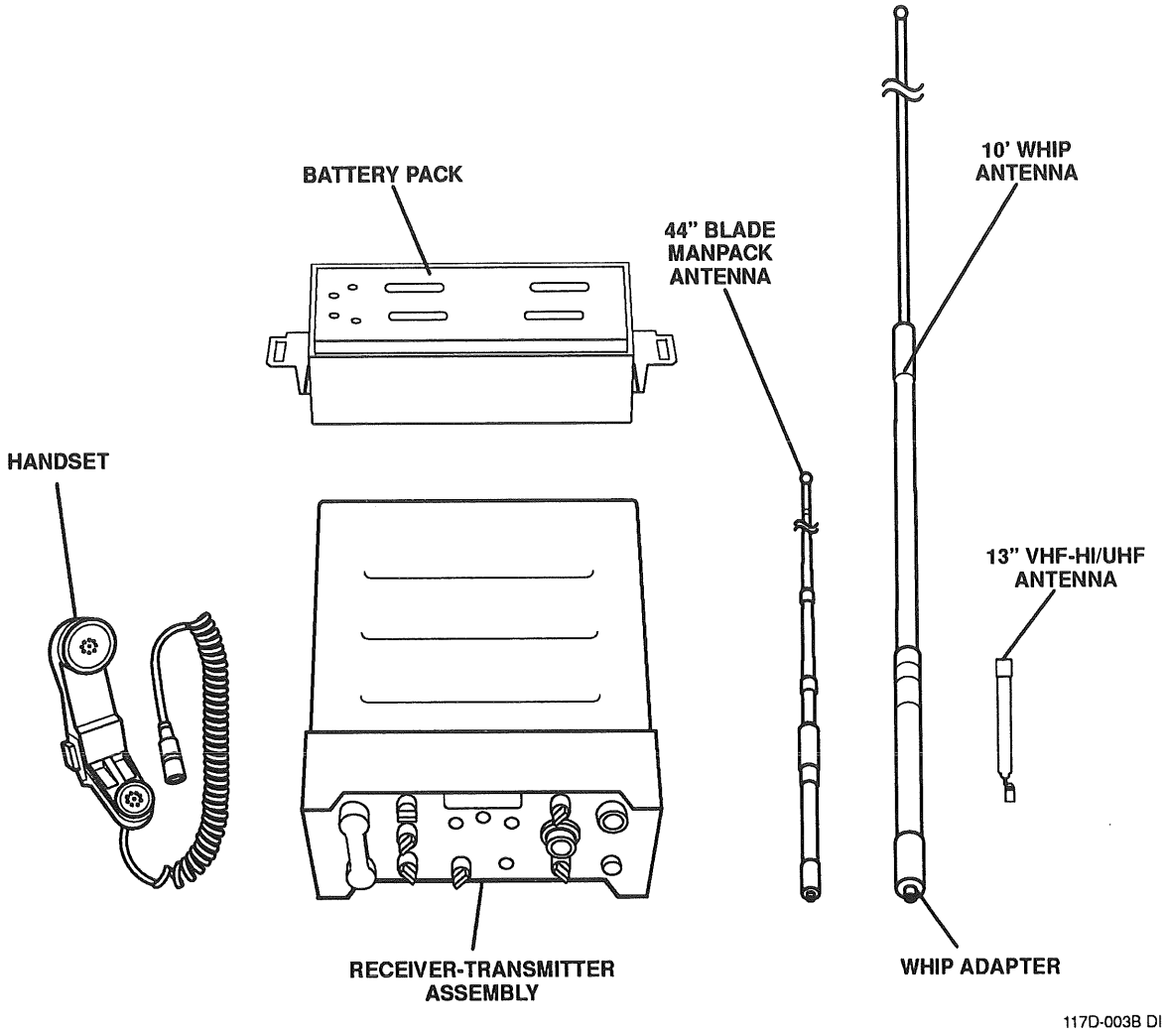
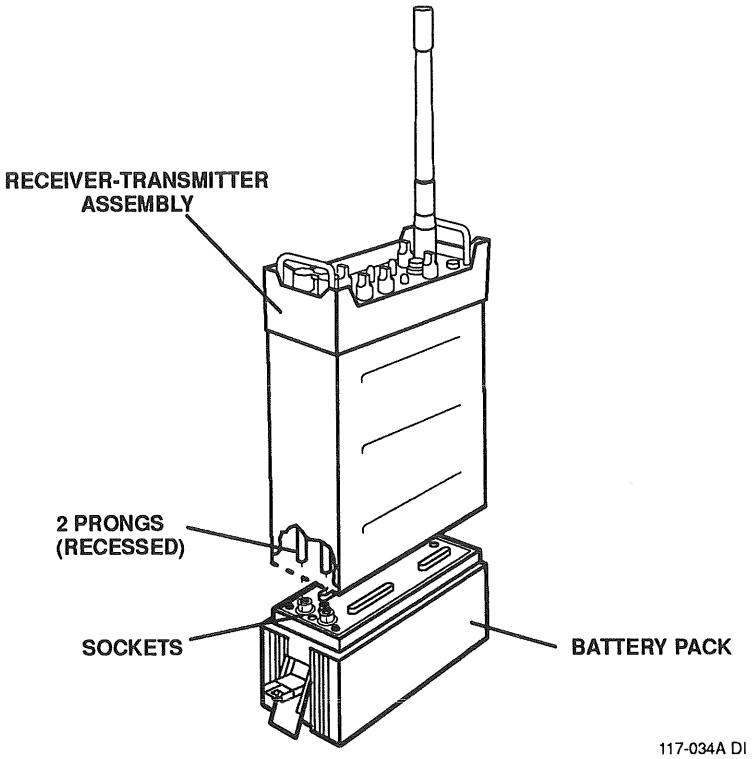



**Figure 6-1. Standard Manpack Parts**




**Attach Battery Pack**

The battery pack fits only one way on the back of the Receiver-Transmitter Assembly. Set the battery pack on a flat surface, face up, and follow these steps:

1. Line up the sockets of the battery pack with the two prongs on the rear of the Receiver-Transmitter.
2. Press the battery pack firmly against the Receiver-Transmitter. **Do not** force. The battery pack fits easily when correctly lined up.
3. Fasten both side clasps to attach the pack.

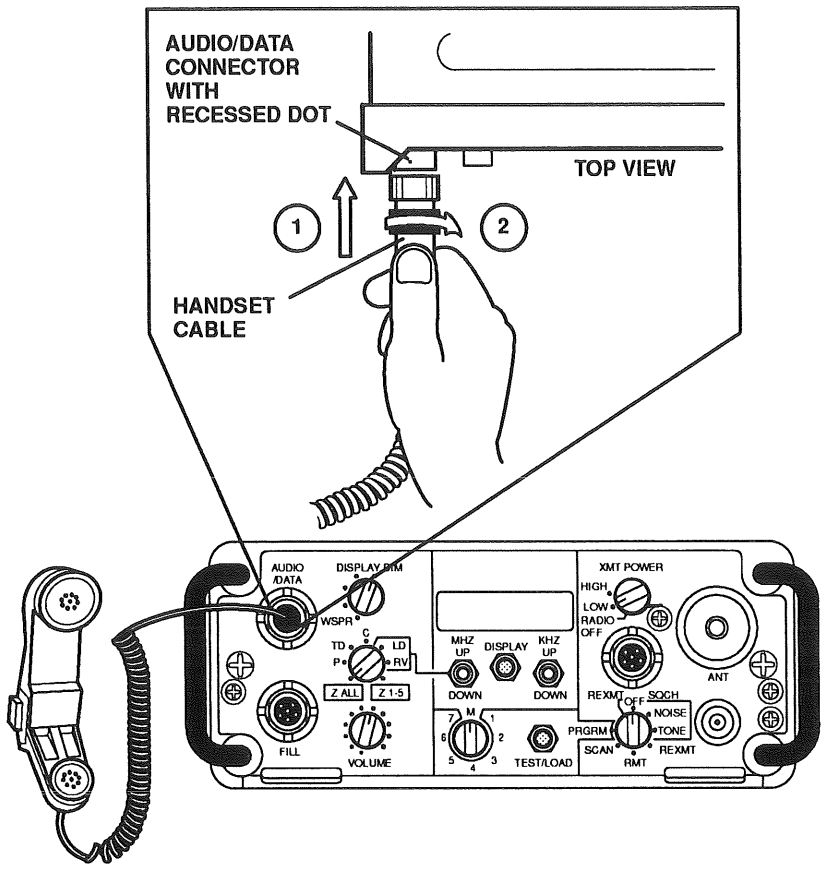
Check battery voltage with this simple test:

4. Turn the XMT POWER control from RADIO OFF to HIGH or LOW. After a brief moment, the LED display shows the battery voltage.

For information on battery voltage levels, see Chapter 5, Maintenance.

NOTE: The battery pack must be attached before the manpack transceiver is exposed to water immersion.

**Figure 6-2. Attaching Battery Pack**

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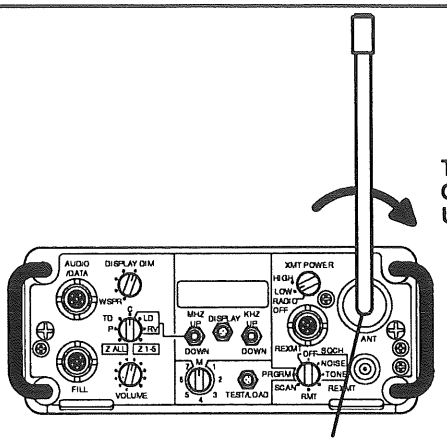
### Connect Handset

The handset cable connects to the AUDIO/DATA connector.

To attach the handset, line up the flat surface of the cable connector with the recessed dot on the AUDIO/DATA connector. Push the connector of the handset cable firmly onto the AUDIO/DATA connector and twist clockwise.

After removing the handset, replace the AUDIO/DATA connector cover. (This helps to keep connector contacts clean.)

**Figure 6-3. Connecting Handset**

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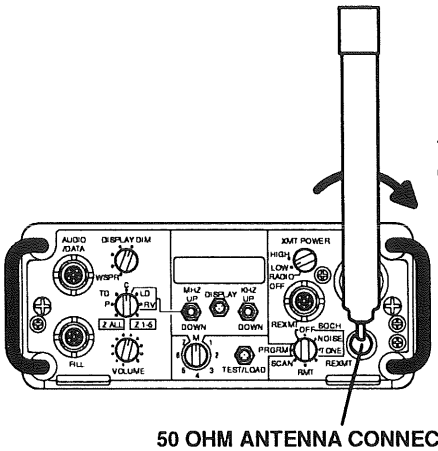
### Connect VHF-Lo Blade or Whip Antenna

Remove the cap from the ANT connector. Engage the antenna base from the VHF-Lo blade or whip antenna securely into this connector.

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### Connect VHF-Hi/UHF Antenna

Remove the cap from the 50 ohm ANT connector. Engage the antenna base from the VHF-Hi/UHF Antenna securely into this connection.

**NOTE**

If both antenna connectors are used, only the blade connector (top) will be active (except during multiband scan) when VHF-Low frequencies are used. If using VHF-Low frequencies, make sure no antenna is connected to the top connector if the 50 ohm connector (bottom) is to be used. Both antennas must be installed for multiband scan (VHF and UHF).

**Figure 6-4. Connecting Blade, Whip, or VHF-Hi/UHF Antenna**

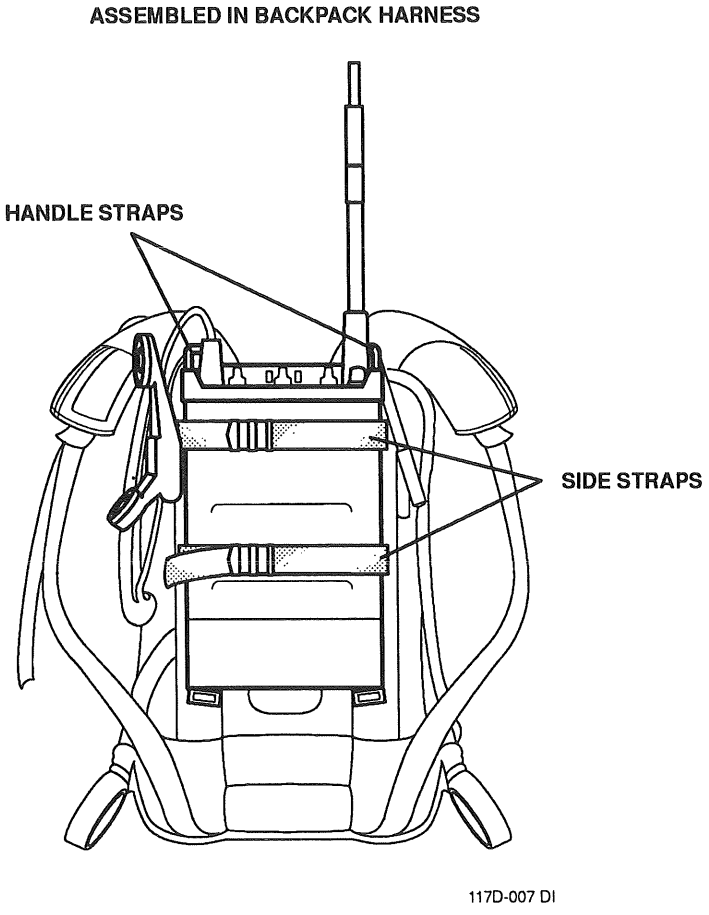
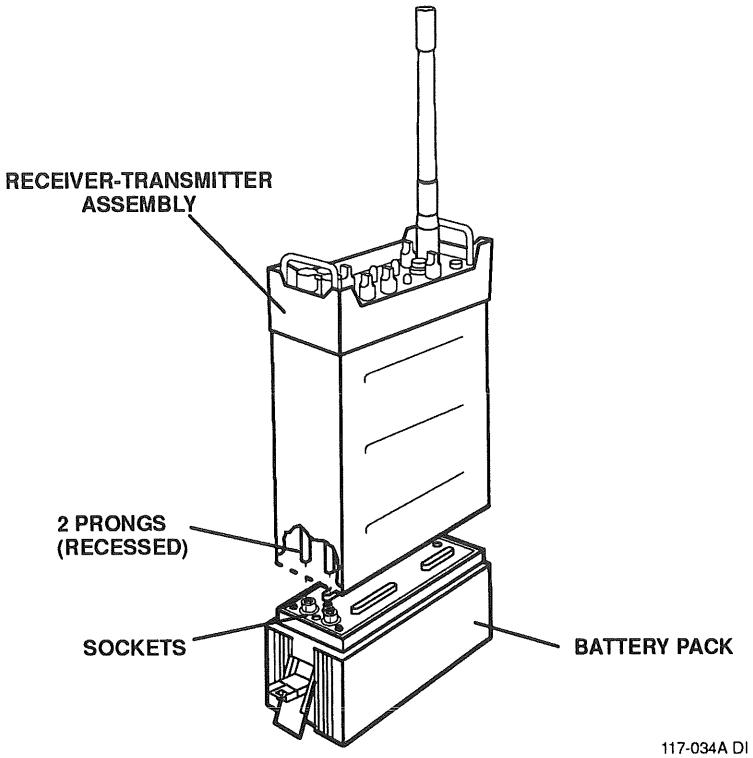



Figure 6-5. Radio Assembled in Backpack Harness

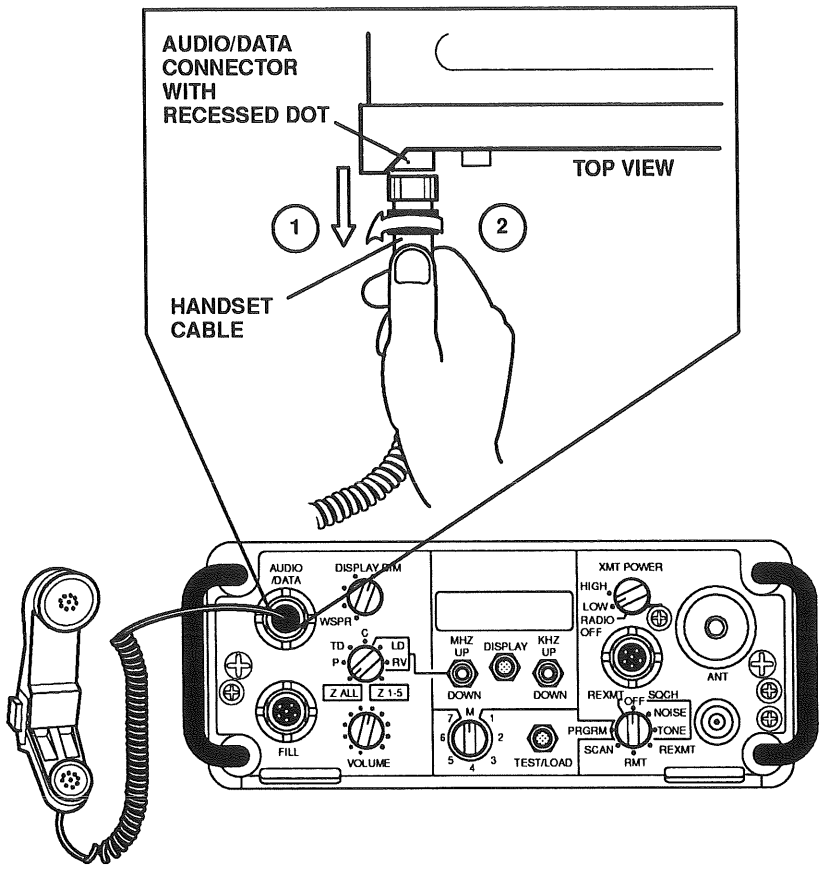



**Battery Pack Removal**

Set the radio unit on a flat surface and follow these steps:

1. Turn the XMT POWER control to RADIO OFF.
2. Release both side clasps to remove the battery pack.
3. Separate the battery pack from the Receiver-Transmitter.

**Figure 6-6. Removing Battery Pack**

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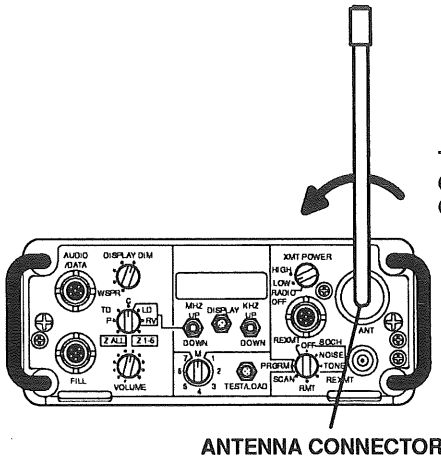
### Disconnect Handset

The handset cable connects to the AUDIO/DATA connector.

To remove the handset, grasp the connector and twist counterclockwise.

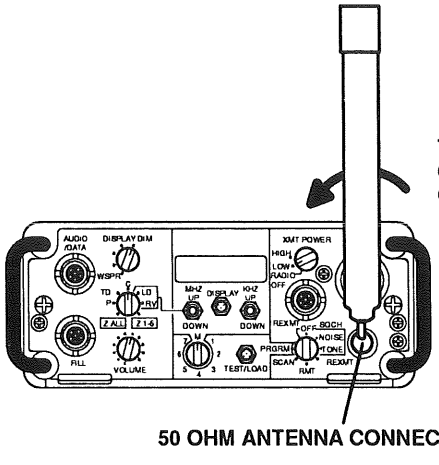
After removing the handset, replace the AUDIO/DATA connector cover. (This helps to keep connector contacts clean.)

**Figure 6-7. Disconnecting Handset**




### Connect VHF-Lo Blade or Whip Antenna

Rotate the antenna base counter–clockwise. Disengage the antenna base from the connector. Replace the cap on the ANT connector.




### Connect VHF-Hi/UHF Antenna

Rotate the antenna base counter-clockwise. Disengage the antenna base from the VHF-Hi/UHF Antenna connector. Replace the cap on the 50 ohm ANT connector.

**NOTE**

If both antenna connectors are used, only the blade connector (top) will be active (except during multiband scan) when VHF-Low frequencies are used. If using VHF-Low frequencies, make sure no antenna is connected to the top connector if the 50 ohm connector (bottom) is to be used. Both antennas must be installed for multiband scan (VHF and UHF).

**Figure 6-8. Removing Blade, Whip, or VHF-Hi/UHF Antenna**

Table 6-1. Index to Signals – R/T Assembly

| Name | Pin | Description |
|---|---|---|
| AUDIO/DATA - J1 | | |
| GROUND | A | |
| AUDIO/DATA OUT | B | Voice mode adjustable audio output (20 mW MAX)<br>Analog data mode fixed audio output (220 mVrms)<br>Digital mode (including SBPSK Modem) 6.75 V data out (MIL-STD-188-114A) |
| KEYLINE | C | Apply ground for PTT (Push-to-Talk) or RTS (Request-To-Send) on SBPSK modem |
| AUDIO IN/DATA CLOCK OUT | D | Voice mode audio input (1 mVrms)<br>Analog data mode input (5 mVrms)<br>Digital mode 6.75 V clock out |
| DIGITAL DATA MODE | E | Apply ground for digital data mode |
| ANALOG DATA MODE/DATA | F | Apply ground for analog data mode |
| IN/EXTERNAL SQUELCH | | Digital mode (including SBPSK Modem) 6.75 V data in (MIL-STD-188-114A) |
| FILL - J2 | | |
| GROUND | A | |
| MULTIPLEX | B | Input control data (with OVERRIDE on J2-F) |
| REQUEST | C | Input/output control signal<br>Active low<br>Generated by receiving input |
| DATA | D | Input/output data<br>Generated by sending unit |
| CLOCK | E | Input/output clock<br>Generated by sending unit |
| OVERRIDE | F | Input control signal<br>Active low |
| REXMIT - J3 | | |
| GROUND | A | |
| AUDIO/DATA OUT/MODEM RCV CLOCK | B | REXMIT audio/data out<br>SAC mode ciphered data out (220 mVrms)<br>Modem mode receive clock (MIL-STD-188-114A)<br>Plain text serial data clock |
| KEYLINE/CIPHER DETECT | C | REXMIT mode apply ground for PTT<br>SAC mode cipher detect out, (0 V = cipher) |

**Table 6-1. Index to Signals – R/T Assembly – Continued**

| Name | Pin | Description |
|---|---|---|
| **REXMIT - J3 (Cont.)** | | |
| AUDIO/DATA IN | D | REXMIT audio/data in<br>SAC mode ciphered data in (350 mVrms) |
| MODE SELECT | E | Apply ground for stand-alone COMSEC mode. (SAC mode causes the RF section to be disabled, input/output of the COMSEC module is routed through the REXMIT connector.) |
| REXMIT KEY/REMOTE SERIAL/MODEM CTS | F | REXMIT/SAC mode keyline out, (0 V = keyed)<br>Remote mode current loop<br>Modem mode CTS (Clear-To-Send) active low (Requires a MIL-188 compatible pull-up) |

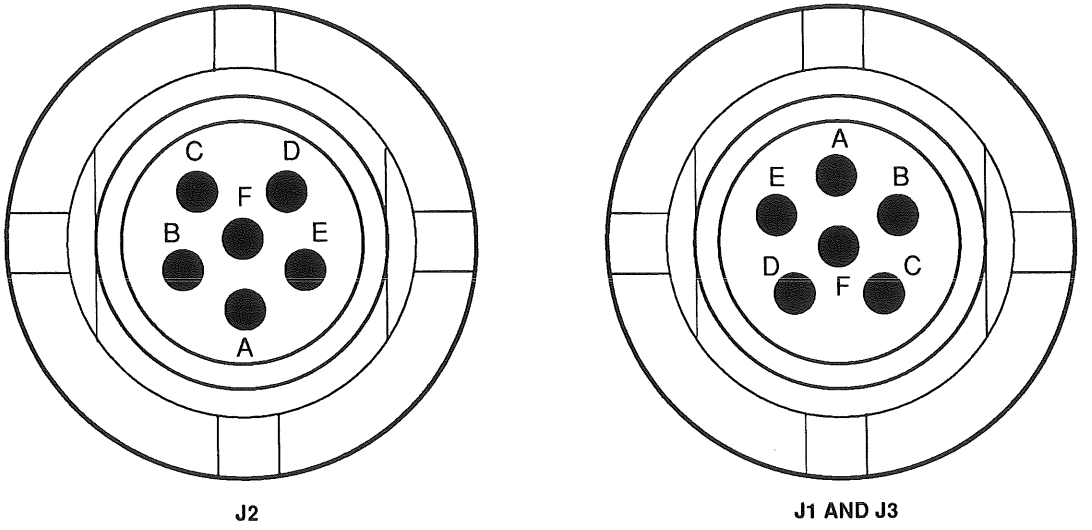



**Figure 6-9. Pinout Diagram of J1, J2, and J3 on the Front Panel**

# CHAPTER 7

# PARTS LIST

## 7.1 INTRODUCTION

This chapter contains radio system parts list information. This information can be used to identify units within the radio system, and to place orders for those units. This chapter is organized as follows:

- Paragraph 7.2 - Line Replaceable Units (LRUs)
- Paragraph 7.3 - LRU Diagrams

## 7.2 LINE REPLACEABLE UNITS

Table 7-1 lists the LRUs that comprise the radio system. Quantity, part number, and figure number references are also provided.

**Table 7-1. Line Replaceable Units**

| Quantity | Name of Unit | Part Number | Figure Number |
|---|---|---|---|
| 1 | Receiver-Transmitter | 10496-1100-001 | 7-1 |
| 1 | Battery Pack | 10012-0300 | 7-2 |
| 1 | Handset | H-250/U | 7-3 |
| 1 | Blade Antenna | 10012-0201 | 7-4 |
| 1 | WHIP Antenna Kit | 10012-0240 | 7-5 |
| 1 | VHF - HI/UHF Antenna | 10369-0205 | 7-6 |
| 1 | Back Pack Harness | 10012-0400 | 7-7 |

## 7.3 LRU DIAGRAMS

Figures 7-1 through 7-7 show the LRUs for the AN/PRC-117D(V)2(C) MANPACK radio.

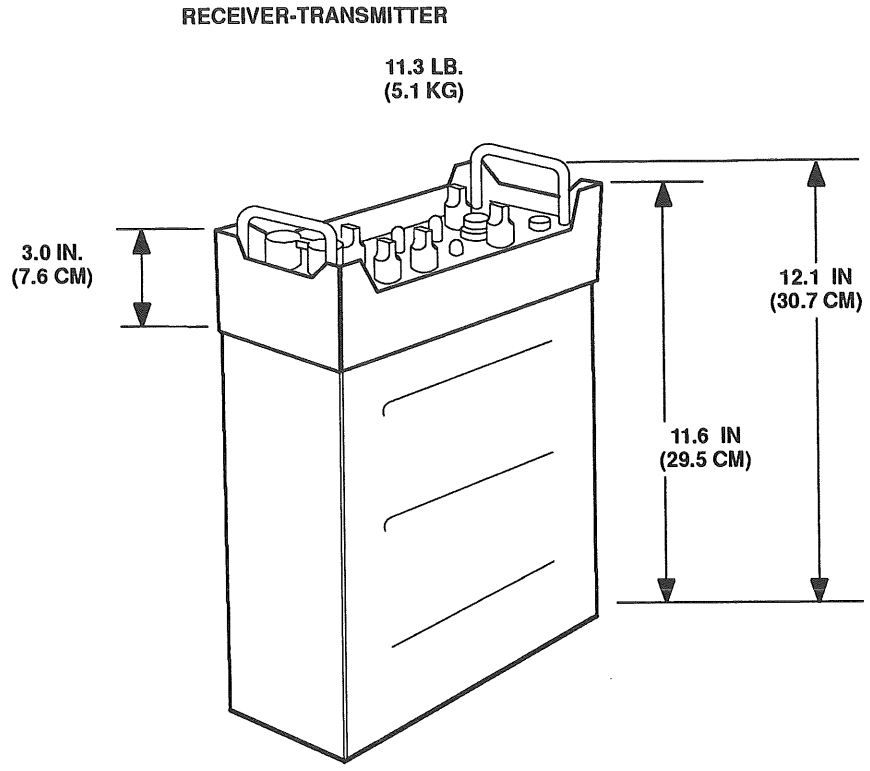



Figure 7-1. Receiver-Transmitter

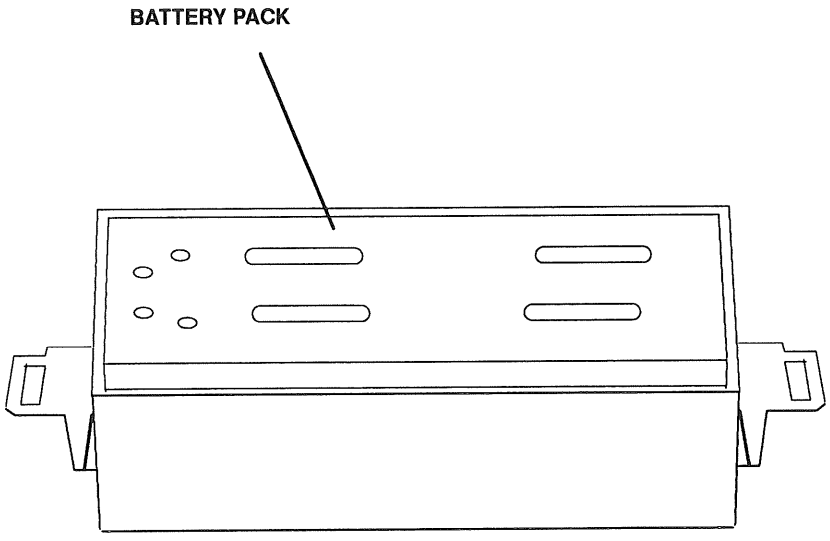
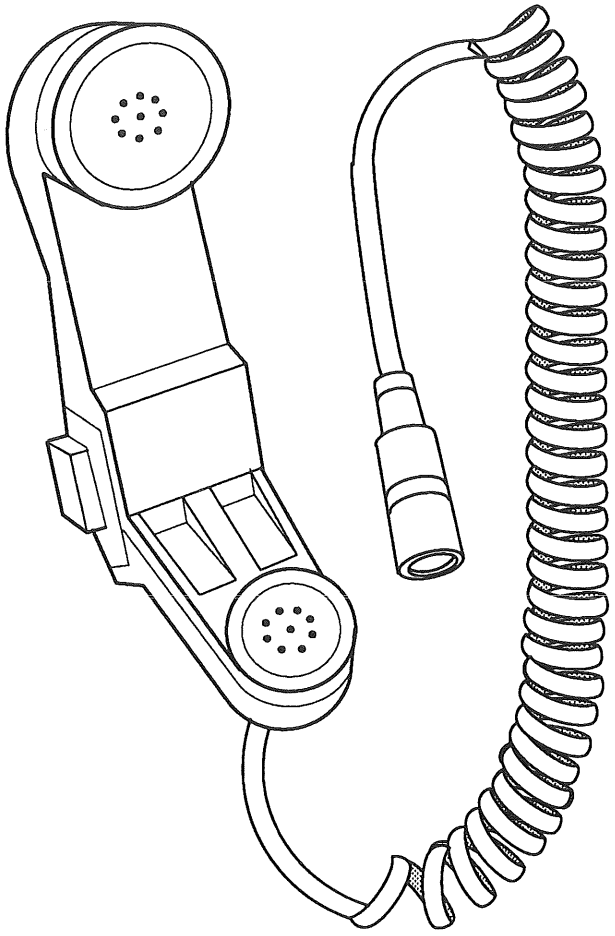



Figure 7-2. Battery Pack



H-250/U
HANDSET

1.2 LB
(0.54 KG)

Figure 7-3. Handset

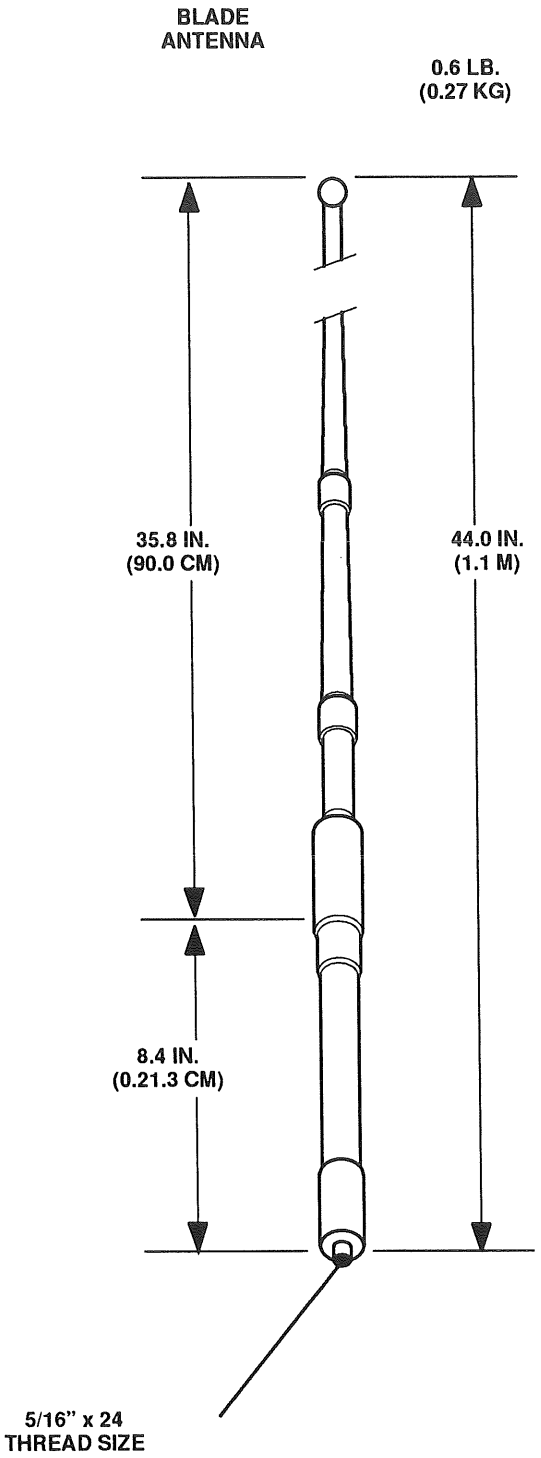



Figure 7-4. Blade Antenna

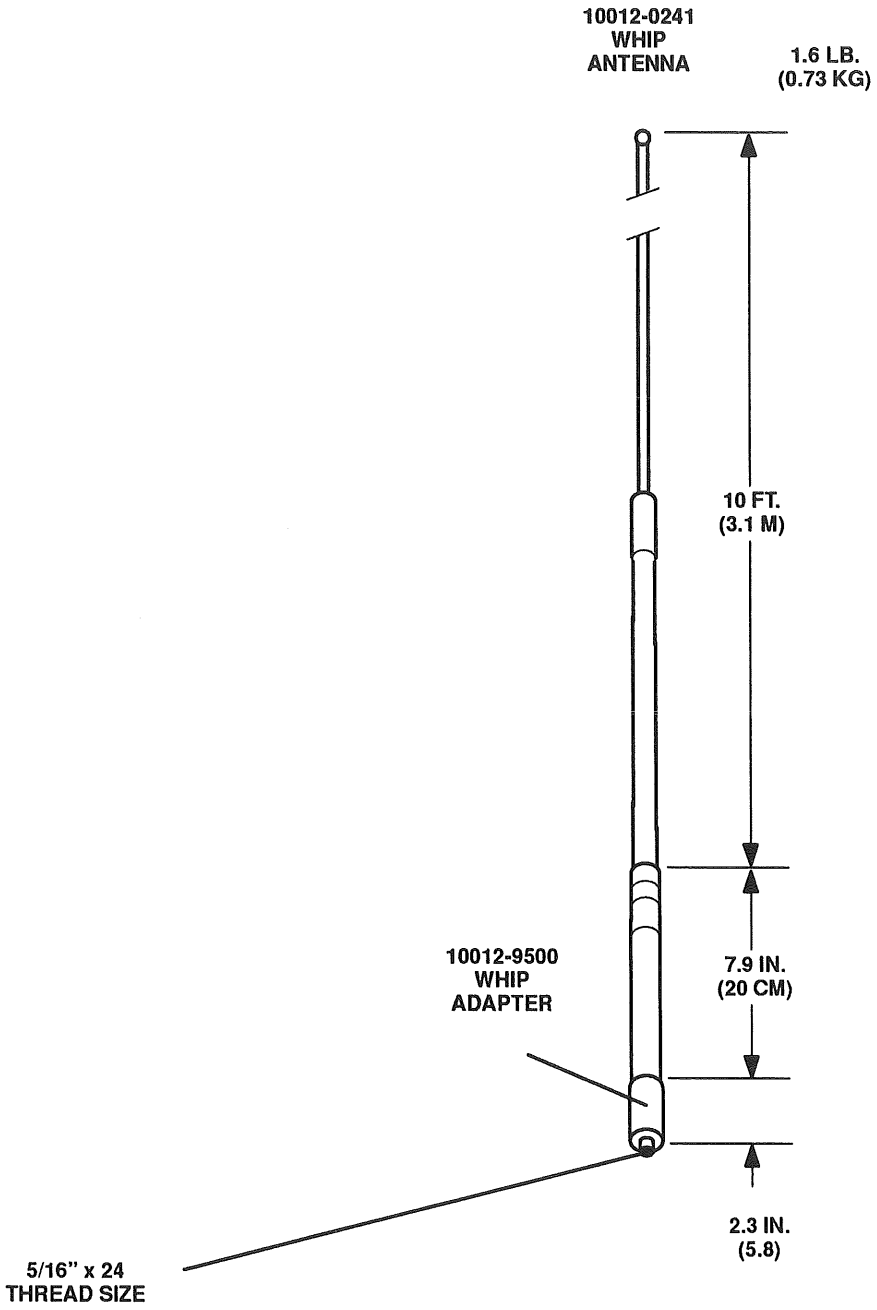



Figure 7-5. WHIP Antenna

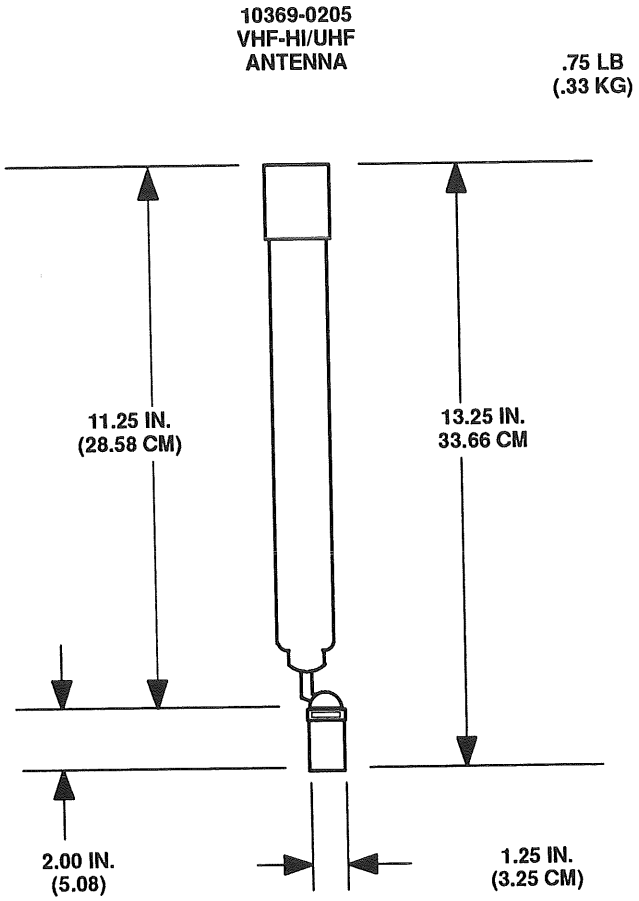
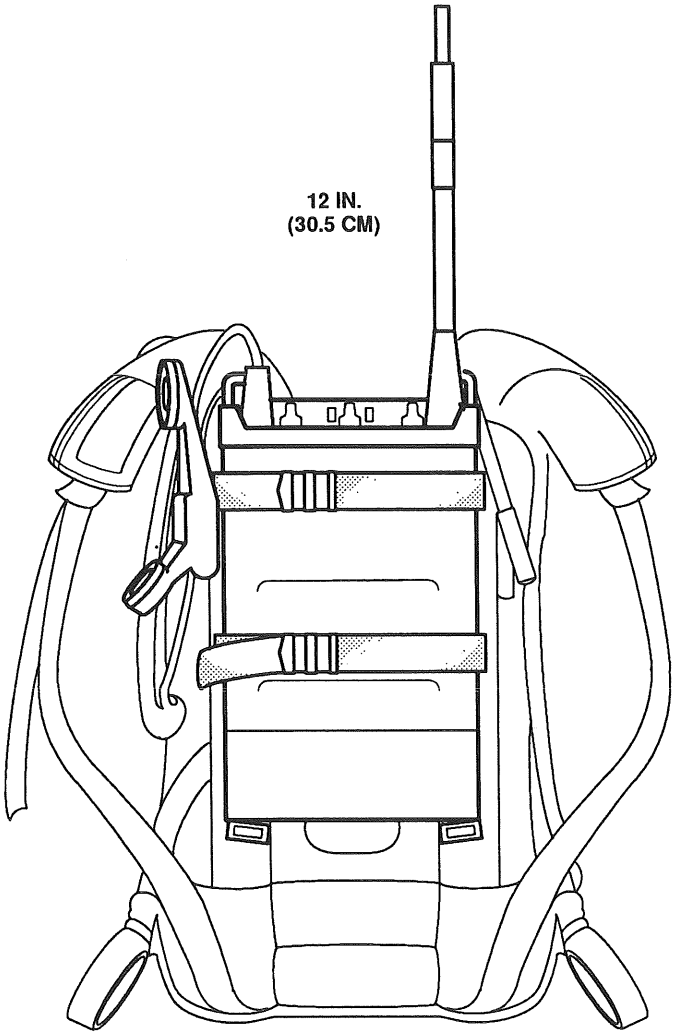



Figure 7-6. VHF - HI/UHF Antenna




10243-0400
BACKPACK HARNESS

Figure 7-7. Back Pack Harness

# CHAPTER 8

# INSTALLATION

## 8.1 GENERAL

The assembly of the AN/PRC-117D(V)2(C) requires no tools. Follow the procedures in Paragraph 6.2.1 to assemble the radio.

For full compatibility, all radio units within a net must have the same internal configuration, with identical jumper placement on radio modules. Paragraph 6.3 outlines these compatibility considerations.

Under certain conditions, it may be necessary to recharge the A3 module memory backup battery as part of radio assembly. Paragraph 6.4 describes this procedure.

Although the HUB (hold-up-battery) is not expected to need replacing, a HUB low condition should be reported to qualified service personnel. Under no circumstances should unauthorized personnel attempt to access this battery which is located in the front panel module.

## 8.2 ASSEMBLING THE RADIO

**WARNING**

If the optional BA-5590 Lithium Battery is used, observe the following:

- If the battery becomes hot, a hissing sound is heard, and an irritating smell occurs. Move the equipment to a well ventilated area or leave the area.
- Do not use a Halon type fire extinguisher on a lithium battery fire.
- Do not dispose of lithium batteries in uncontrolled trash. These batteries contain hazardous materials that can contaminate the environment.

Figure 6-1 shows the parts of the manpack transceiver. Figures 6-2 through 6-5 illustrate the recommended sequence for its assembly.

Figure 6-2 recommends testing battery voltage as soon as the battery pack is attached. A charged battery gives a reading of at least 12.0 V. Use this 12.0 V figure as a general guideline. A voltage reading below 12.0 V indicates that the battery requires charging. (Chapter 5 describes battery voltage test.)

Handset connection is shown in Figure 6-3. Note that the AUDIO/DATA connector is used for this connection. The front panel FILL connector is used for standard COMSEC fill devices (KOI-18, KYK-13, KYX-15).

Two antenna connections are provided on the transceiver as shown in Figure 6-4. The top half of the figure shows the connection of a blade or whip antenna to the top ANT connector. These antennas can only be used in VHF-Lo operation (30 - 90 MHz). The bottom half of the figure shows the connection of the VHF-Hi/UHF antenna to the bottom ANT connector (50-ohm).

The 50-ohm connector is used for the VHF-Hi/UHF, UHF LOS (Line of Sight), and SATCOM antennas. In VHF-Lo operation, the 50-ohm connector is energized when the whip antenna is either removed or not firmly attached.

For field use, the radio is designed to be carried in the backpack harness (P/N 10243-0400). This harness is similar in configuration to the AN/PRC-117A/B, AN/PRC-77, and -25 standard pack frames. Both side straps and handle straps secure the transceiver for carrying. Figure 6-5 shows the strap connections for radio mounting in the backpack harness.

## 8.3 COMPATIBILITY AMONG UNITS

For full communication, all radios within a net must have identical internal configurations. This means that jumper positions on the following modules must be the same in all units:

- Power Supply Module A4
- Signal Synchronizer Module A2

Optional jumpers on Power Supply Module A4 select such operating parameters as automatic TONE SQUELCH transmission, frequency deviation, and frequency display recall for programmed channels. These jumpers are factory-installed, but field modification is possible.

Signal Synchronizer Module A2 is an optional module, required for Quick-Look frequency-hopping operation only. Jumpers on this module determine, in part, the pseudorandom pattern of frequency hopping. To allow Quick-Look communication, these jumpers must match exactly for all radios within a network. Quick-Look jumpers are factory-installed, but field modification is possible.

## 8.4 MEMORY BACKUP BATTERY

After a long period of storage or when the radio is new and has never been used, it may be necessary to charge the memory backup battery as described below.

**NOTE**

Do not operate the radio with a discharged memory backup battery. The radio will not retain programmed frequency or code values if this battery is discharged.

A small backup battery is provided on Microprocessor Module A3 inside the radio. This battery maintains memory contents so that programmed frequencies or Quick-Look codes are stored while the radio is off. Memory backup is the only purpose of this battery. It does not provide power for radio operation.

The memory backup battery charges only when the radio is on. Once it is fully charged, the backup battery can typically hold its charge and maintain memory contents for several months if the R/T Assembly is stored at moderate temperatures. Regular use of the radio automatically keeps this backup battery at full charge. If the radio has not been used for a month or more, consider the backup battery discharged. This may be the case if the radio is new or has been in storage.

To charge the memory backup battery, turn the radio on for at least one hour, preferably several hours. This should be done before programming any channel information.

# CHAPTER 9

# ACCESSORIES

## 9.1 INTRODUCTION

This chapter contains accessory information describing support packages and equipment accessories that are available for the AN/PRC-117C(V)2(C) Manpack Transmitter. These items add capabilities, provide supplemental instruction in operations and maintenance, recommend spares and tools for product preservation and repair, and list associated documentation to enhance the overall mission effectiveness of the power amplifier.

These items may be ordered directly from Harris/RF Communications using the order number provided with each description.

### 9.1.1 Support Packages

Support packages are items that furnish the user with a source of instruction and a means of maintaining equipment integrity. Support packages are considered and generated for each maintenance level. For information regarding maintenance levels, refer to Chapter 1, Paragraph 1.2. A summary of support packages and order numbers is provided in Table 9-1. Refer to the following paragraphs:

- Extended Warranties and Service Contracts – Paragraph 9.1.1.1
- Training – Paragraph 9.1.1.2
- Tools – Paragraph 9.1.1.3
- Test Equipment – Paragraph 9.1.1.4
- Maintenance Aids – Paragraph 9.1.1.5
- Manuals – Paragraph 9.1.1.6
- Spares Kits – Paragraph 9.1.1.7

Table 9-1. Receiver-Transmitter Support Packages

| Support Package | Maintenance Concept Supported | Order Number |
|---|---|---|
| Training Courses | Level I<br>Level II<br>Level III<br>Level II and III (unit only)<br>Level II and III (system) | 10515-0001-0100<br>10515-0001-0200<br>10515-0001-0300<br>10515-0001-0500<br>10515-0001-0600 |
| Tool Kits | Level I<br>Level II<br>Level III<br>Level II and III (unit only)<br>Level II and III (system) | not required<br>10515-0001-1200<br>10515-0001-1300<br>10515-0001-1500<br>10515-0001-1600 |
| Test Equipment Kits | Level I<br>Level II<br>Level III<br>Level II and III (unit only)<br>Level II and III (system) | not required<br>10515-0001-2200<br>10515-0001-2300<br>10515-0001-2500<br>10515-0001-2600 |
| Maintenance Aids | Level I<br>Level II<br>Level III | not required<br>not required<br>10515-0001-3300 |
| Manuals | Level I<br>Level III | 10181-0087, -0088, -0089<br>10181-0086-01 |
| Spares Kits | Level I, II<br>Level II<br>Level III | not required<br>10515-0033-5200<br>10515-0033-5300 |

#### 9.1.1.1 Extended Warranties and Service Contracts

Harris/RF Communications offers extended warranties and service contracts. An extended warranty lengthens the original warranty provided with Harris/RF Communications equipment and systems. Customers who want factory-trained field service personnel to assist in the installation, operation, maintenance, and service of their communications equipment can order a service contract. For more information, call the Harris/RF Communications marketing office (tel: 716-244-5830).

#### 9.1.1.2 Training

Training provides the user with valuable operation and maintenance knowledge gained through instruction and hands-on experience.

When ordering non-English training, please specify at time of order.

- **Level I Training** provides thorough understanding of basic operating functions, equipment inspection procedures, and the use of operator cards.
- **Level II Training** furnishes the skills for performing corrective maintenance, localizing faults to a unit, performance of general scheduled maintenance procedures, use of basic test equipment, and the use of the System (Level II) Manual.

- **Level III Training** equips maintenance personnel with the skills needed to perform corrective maintenance, localize faults to modules, assemblies, and chassis-mounted components, to conduct necessary alignment and adjustments, detailed scheduled maintenance, and to use test equipment, maintenance aids, and the Maintenance (Level III) Manual.
- **Level IV Training** imparts the knowledge to perform corrective maintenance, locate defective components, alignments and adjustments, set up and use advanced support equipment, and use the Depot (Level IV) Manual.
- **Radio System Training** includes a complete training package that supports all major radio system units for Levels I, II, and III.

#### 9.1.1.3 Tools

Tool kits for Maintenance Levels II, III, and IV are available to ensure that common items required to install, maintain, and disassemble/reassemble the unit are available to the maintainer.

- **Level I Tools** are not required.
- **Level II Tools** include items needed to install or remove the unit from the radio system, and to perform general scheduled maintenance.
- **Level III Tools** include items required to perform corrective and scheduled maintenance down to the module or chassis-mounted component.
- **Level IV Tools** include items required to perform component level repair and complete overhaul of the unit.

#### 9.1.1.4 Test Equipment

Test equipment kits for Maintenance Levels II, III, and IV are available to ensure that items required to perform corrective and scheduled maintenance are available to the maintainer.

- **Level I Test Equipment** is not required.
- **Level II Test Equipment** includes items needed to perform corrective and scheduled maintenance, and fault localization to the unit.
- **Level III Test Equipment** includes items required to perform corrective and scheduled maintenance down to the module or chassis-mounted component.
- **Level IV Test Equipment** includes items required to perform component level repair and complete overhaul of the unit.

#### 9.1.1.5 Maintenance Aids

Maintenance aids are special or non-standard tools and test equipment required to perform corrective and scheduled maintenance as specified in the applicable maintenance manual procedures. Special/non-standard tools and test equipment includes items that can only be procured from Harris/RF Communications, such as extender cards, test fixtures, and modified tools.

- **Level I Maintenance Aids** are not required.
- **Level II Maintenance Aids** are not required.

- **Level III Maintenance Aids** include items that support corrective and scheduled maintenance tasks associated with Level III maintenance, such as extender cards, performance fixtures, pressurization kits, and breakout boxes.

- **Level IV Maintenance Aids** include items that support corrective maintenance tasks associated with Level IV maintenance, such as extender cards, extender cables, test fixtures, automatic test equipment, and tools.

#### 9.1.1.6 Manuals

Manuals are an invaluable, comprehensive resource for the installation, operation, and maintenance of the power amplifier. Manuals also provide a listing of the support equipment recommended to optimize the unit's capabilities and minimize equipment down time.

When ordering non-English manuals, please specify at time of order.

- **Level I Manual** is in the form of operator cards that guide the user in the installation and basic operation of the unit. The cards are an abbreviated form of the information provided in the Level II manual, and are used to facilitate usage in the field.

- **Level II Manual** contains system level information regarding installation and operation of each significant piece of equipment in the radio system. It also includes procedures for performing corrective maintenance and fault localization to the unit, as well as general scheduled maintenance.

- **Level III Manuals** provide information required to perform corrective and scheduled maintenance down to the module or chassis-mounted component.

- **Level IV Manuals** document all the necessary procedures, tools, test equipment, and schematic diagrams required to perform component level repair and complete overhaul of the unit.

##### 9.1.1.6.1 Associated Manuals

Manuals that may be referred to in the text of this manual are provided in Table 9-1.

#### 9.1.1.7 Spares Kits

The maintainer uses spare parts kits to return equipment which has malfunctioned to operational readiness in as short a period of time as possible. The kit may include those items that are consumed during corrective and scheduled maintenance tasks, such as solder, tape, tie wraps, grease, etc.

- **Level I Spares Kit** is not required.

- **Level II Spares Kit**, other than complete units, contains items that may be externally accessed from the equipment, and are usually consumable in nature, such as fuses, filters or lamps.

- **Level III Spares Kit** includes those items used to repair the unit by replacing a faulty module, printed wire board (PWB), or chassis mounted component. Both corrective and scheduled maintenance scenarios are considered. Spares kits contain items sufficient in quantity to provide a basic level of coverage for a minimal number of units, typically five or less. For spares support of more than five units, contact Harris/RF Communications directly.

- **Level IV Spares Kit** is currently not available.

### 9.1.2 Equipment Accessories

Equipment accessories are items that are not provided with the receiver-transmitter, but can be procured to increase the application and capabilities of the unit. Table 9-2 lists the accessories available for the manpack transmitter.

**Table 9-2. Manpack Transmitter Accessories**

| Item Name | Description | Part Number |
|---|---|---|
| Receiver-Transmitter Assembly | Includes all radio receiver, transmitter, control logic, and communication security (COMSEC) capability. | 104961–1100-001 |
| Handset | Standard push-to-talk handset common among tactical transceivers | H-250/U |
| Battery Pack | Nickel-cadmium (Ni-Cd) batteries provide +12V (nominal) to the receiver-transmitter assembly | 10012-0300 |
| VHF-Low Manpack Blade Antenna | 44-inch (1.12 m) blade antenna with flexible neck | 10012-0201 |
| VHF-Low Manpack Antenna Kit | Standard antenna kit including a 10 foot (3.1 m) collapsible whip antenna and flexible base, whip adapter, and canvas antenna bag | 10012-0240 |
| VHF-Hi/UHF Manpack Antenna | Antenna kit for using the radio in the 116 MHz to 420 MHz frequency range | 10369-0205 |
| Fill Device Interface | COMSEC Equipment Interface | RF-3048 |
| Site Spares Kit | Contains replacement modules to maintain five manpack units in the field | AN/PRC-117D SSK |
| Disposable Lithium Battery | Provides greater than three times the life of the Nickel Cadmium battery (10012-0330) (requires the 10012-0300 battery case) | BA-5590/U |
| VHF Log Periodic Transportable Antenna | Tactical portable log periodic antenna (30 – 90 MHz) | RF-289A |
| VHF Omnidirectional Transportable Antenna | For 30 – 90 MHz broadband operation | RF-290 |
| Microphone | Palm-held noise-cancelling microphone | RF-294-07 |
| Headset | Two-earphone headset unit | RF-294-08 |
| Headset with Boom Microphone – Dynamic Mike Element | High-grade Mil headset | RF-3014-01 |
| Field Programmer – Exclusions | (Future Option) Allows for quick programming of multiple radios | RF-3047FPX |
| Battery Charger/Exerciser | A microprocessor-controlled battery charger and battery checking unit capable of charging seven Nickel-Cadmium (10012-0300) battery packs | RF-3094-01 |
| Battery Case for BA-5590/U | Provides capability to use BA-5590/U Lithium Disposable Battery with the manpack transceiver (battery not included) | 10012-0050 |

**Table 9-2. Manpack Transmitter Accessories (Cont.)**

| Item Name | Description | Part Number |
|---|---|---|
| Battery charger – Trickle | Provides simultaneous trickle charging of six Nickel-Cadmium (10012-0300) battery packs | 10012-0550 |
| Vehicular Antenna (116 – 420 MHz) | Wideband vehicular antenna covering the 116 – 420 MHZ frequency range | RF-391 |
| Vehicular Antenna (30 – 90 MHz) | Wideband vehicular antenna covering the 30 – 90 MHz frequency range | AS-3013/VRC |
| SATCOM Antenna | Provides satellite communications capability | RF-3060 with RF-3060-01 Extender Kit |
| Transportable SATCOM Antenna | Provides satellite communications capability (higher gain than RF-3060) | |

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