THALES

OPERATION AND MAINTENANCE INSTRUCTIONS WITH ILLUSTRATED PARTS BREAKDOWN

ORGANIZATIONAL LEVEL

AN/PRC-148(V)(C)

MULTIBAND INTER/INTRA TEAM RADIO

(INCLUDES SINCGARS, HAVEQUICK, ANDVT, RETRANSMISSION)

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CONFIGURATION NOTICE: This document contains technical information pertinent to the THALES PRC6991 MULTIBAND RADIO SET. The information contained herein is for the support of the THALES PRC6991 MULTIBAND RADIO SET.

OCTOBER 9, 2002

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SAFETY SUMMARY

The following are general safety precautions that are not related to any specific procedure, and do not appear elsewhere in this manual. These Safety Summaries are recommended precautions that all personnel must understand and apply during any given phase of operation and maintenance. Each chapter has other specific warnings and cautions.

KEEP AWAY FROM LIVE CIRCUITS

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

VOLTAGES WITHIN THIS EQUIPMENT ARE HIGH ENOUGH TO ENDANGER LIFE.

(Applies to battery chargers only)

Covers are *not* to be removed except by persons qualified and authorized to do so and these persons should always take extreme care once the covers have been removed.

HAZARDS OF ELECTROMAGNETIC RADIATION TO ORDNANCE (HERO)

DO NOT operate the radio within 10 feet (3 meters) of any type of fuzed ordnance. Operating the radio in close proximity to ordnance MAY induce or otherwise couple currents and/or voltages of magnitudes large enough to initiate electroexplosive devices or other sensitive explosive components of weapon systems, ordnance, or explosive devices.

CAUTION - LITHIUM ION BATTERIES

Li-ion batteries have a very high energy density. Exercise precaution when handling and testing. Do not short circuit, overcharge, crush, mutilate, nail penetrate, apply reverse polarity, expose to high temperature or disassemble. High case temperature resulting from abuse of the cell could cause physical injury.

FOREWORD

NOTE: THIS MANUAL CONTAINS INFORMATION THAT IS CURRENT AS OF THE DATE SHOWN ON THE FRONT COVER. ADDITIONAL FUNCTIONALITY IS BEING DEVELOPED FOR THE RADIO AND THE APPEARANCE OF OPERATING SCREENS IS SUBJECT TO CHANGE FROM THOSE SHOWN HEREIN.

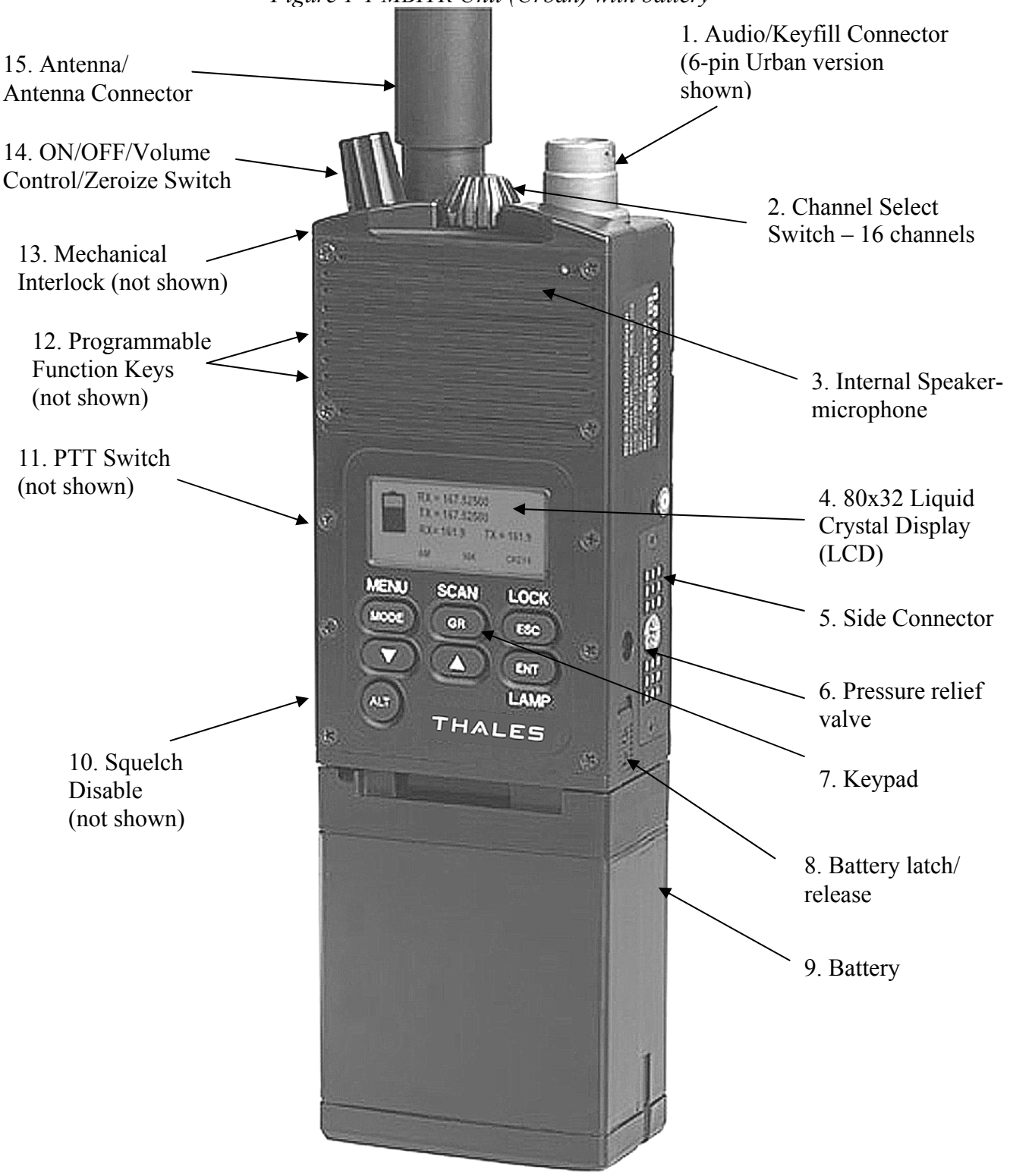
The radio operation (man-machine interface) shown in this manual reflects radio software Revision U, Version 2.28 and PC Programmer Revion D, Version 1.03. Some screens may not correspond to those in earlier radio software or PC Programmer versions.

Conventions used in this manual: Words and symbols shown in brackets [ ] correspond to the markings shown on the radio keys.

This manual for the Multiband Inter/Intra Team Radio (MBITR) and its associated accessories meets the technical content requirements of Contract USZA22-97-D-0019, Statement of Work, Attachment 1, COTS Manual Evaluation Checklist and MIL-HDBK-1221.

a. Chapter 1 - General Information. This chapter provides general information for the MBITR including equipment description and purpose.
b. Chapter 2 – Operating Instructions. This chapter provides complete operating instructions for the MBITR.
c. Chapter 3 - Principles of Operation. This chapter provides a basic theory of operation for the MBITR.
d. Chapter 4 - Maintenance. This chapter provides instructions required for on-equipment and off-equipment preventive and corrective maintenance of the MBITR.
e. Chapter 5 - Illustrated Parts Breakdown (IPB). The IPB provides an illustrated parts list for the MBITR.
f. Chapter 6 – Vehicle Adapter. This appendix provides information on the MBITR Vehicle Adapter.
g. Chapter 7 – Special Power Adapter Interface (SPAI). This appendix provides information on the SPAI.
h. Chapter 8 – Battery Chargers. This appendix provides information on the single unit and six unit battery chargers.
i. Chapter 9 - Definitions - The glossary provides a definition of the special terms and abbreviations used in the technical order.
j. Alphabetical Index - The index provides cross-references to applicable paragraphs, figures or tables.

Figure 1-1 MBITR Unit (Urban) with battery



CHAPTER 1 GENERAL INFORMATION

1.1 MBITR Description

The Multiband Inter/Intra Team Radio standard system, hereinafter referred to as the MBITR or AN/PRC-148, consists of the following equipment:

- Multiband Inter/Intra Team Radio (MBITR) Receiver-Transmitter Unit, also referred to herein as the "RTU"
- Rechargeable lithium-ion batteries (2)
- Battery holder for non-rechargeable batteries (2)
- Receiver-transmitter holster
- Accessory carrying bag
- Antenna complement
  - 30-90 MHz and
  - 30-512 MHz
- Audio device/Keyfill adapter (maritime version only).

1.1.1 Receiver-Transmitter Unit

The MBITR is a portable, battery operated transceiver (see Figure 1-1) capable of providing both secure and non-secure communications. There are two versions: the Maritime version (AN/PRC-148 (V) 1(C)) is immersible in 20 meters of salt water for 2 hours, the Urban version (AN/PRC-148 (V) 2(C)) is immersible in 2 meters of salt water for 30 minutes. The MBITR operates in clear (analog) and secure (digital) voice and secure (digital) data. The radio includes an NSA-approved cryptographic module for Type 1 encryption of voice or data, an 80 x 32 pixel graphics display (4, Figure 1-1), a backlit keypad (7, Figure 1-1), an internal speaker/ microphone (3, Figure 1-1), a side connector (5, Figure 1-1), a squelch disable button (10, Figure 1-1), a dual purpose audio/key fill connector (1, Figure 1-1), an antenna connector (14, Figure 1-1), and a battery connector. The Basic MBITR operates over a 30-512 MHz frequency range with either frequency modulated (FM), amplitude modulated (AM), or shaped binary phase shift keying (SBPSK) radio frequency (RF) output, with a user-selectable power output from 0.1 to 5 watts. The radio can interoperate with both 12 kbps (FED-STD-1023) and 16 kbps (VINSON-compatible) equipment. The Basic radio is software upgradeable to add any or all of the following capabilities: SINCGARS, HAVEQUICK, ANDVT, and retransmission.

1.1.1.1 Physical characteristics

Table 1-1 Physical Characteristics

Characteristic	Measurement
Weight	2.2 lb., including battery and antenna
Dimensions	2.625"W x 7.75"H x 1.50"D, including battery
Power output	Programmable on a channel by channel basis to 0.1, 0.5, 1, 3 or 5 watts (FM or narrowband FM), 1 or 5 watts (AM), and 1, 3, or 5 watts (SINCGARS).

1.1.1.2 Operating Characteristics.

The MBITR has the following operating characteristics:

a. Can store up to 100 preset channels organized in 10 groups of 16 channels each,
b. Is SINCGARS voice and SIP data interoperable,
c. Is HAVE QUICK I/II interoperable,
d. Is ANDVT interoperable,
e. Can transmit voice in a whisper mode, and
f. Can transfer configuration information to other MBITRs by means of a cloning cable.

1.1.2 Batteries

The MBITR has both rechargeable and non-rechargeable battery power sources.

1.1.2.1 Rechargeable Battery Pack

The MBITR (AN/PRC-148) standard equipment includes two each rechargeable lithium-ion battery packs. Each battery pack consists of a self-contained unit capable of quick replacement on the radio by the operator. The battery connects to the MBITR through a reliable, easily operated bayonet twist-on mechanism. At ambient temperature (21° C), the battery can provide over eight hours of battery life at the 5 watt transmit power level with an 8:1:1 (Stby: Rx: Tx) duty cycle. Some degradation of performance may occur across temperature extremes (high or low). Lithium-ion batteries may be disposed of locally, without environmental damage, at the end of their service life. Each rechargeable battery pack is provided with a twist-on battery cover to protect the battery terminals from impact damage and from moisture when the battery is not attached to the radio. **The cover should be attached if the battery is likely to be immersed in water.** (See paragraph 4.4 for information on battery maintenance.) The PRC6991ABS(BBS)-BAS, or basic, configuration includes one lithium-ion battery pack.

1.1.2.2 Battery Holder (Non-rechargeable)

The MBITR (AN/PRC-148) standard equipment includes two each battery holders that allow the use of military standard or commercially available disposable, non-rechargeable lithium batteries (BA-5123/U or Duracell commercial model DL-123A or DL-2/3A). The battery holder is approximately the same size and shape as the rechargeable battery pack, uses the same bayonet twist-on connection to the radio, and provides over eight hours of battery life at 5 watt transmit power level with an 8:1:1 (Stdby:Rx:Tx) duty cycle. The PRC6991ABS(BBS)-BAS configuration does not include battery holders.

1.1.3 Holster and Accessory Carrying Bag

The MBITR comes with a holster case with belt loops and clips that can be used to carry the RTU (with attached battery) on a pistol belt, rucksack, or load carrying equipment. The MBITR also has an accessory carrying bag that can hold the RTU, spare battery, the antenna complement, the audio adapter device, and one of the available audio accessories.

1.1.4 Antennas

Two antennas are supplied with the MBITR: a 30-90 MHz blade antenna and a 30-512 MHz whip antenna. The antennas are attached via a TNC connector on the top of the RTU. A protective screw-on cap (p/n 2100420-501) is attached to the connector at the base of each antenna to protect

the connector from dirt and moisture when the antenna is not attached to the radio. The caps should be attached if the antennas may be immersed in water.

1.1.4.1 30-90 MHz Blade Antenna

The 30-90 MHz blade antenna is capable of operating from 30 to 90 MHz with a minimum gain of -10 dBi.

1.1.4.2 30-512 MHz Broadband Antennas

The helical whip broadband antenna covers the 30-512 MHz frequency band. The broadband antenna has a minimum gain of -30 dBi at the low end and a typical gain of -10dB above 50 MHz.

1.1.5 Audio/Keyfill Adapter Device

The maritime version has a 10-pin deep submersible audio connector. The radio is supplied with an audio/keyfill connector adapter device (P/N 3600190-501) that allows the use of military standard (U-283/U) six-pin connectors, such as that required for keyfill devices. When the adapter is attached to the radio, the complete assembly is only immersible to 2 meters

1.2 Accessories

The MBITR communications system has a selection of accessories not supplied as part of the basic MBITR. These include several audio accessories, band-specific antennas, a vehicle adapter, a Special Power Adapter Interface (SPAI) with a cable for DC input to the SPAI, battery chargers, a PC-based (Windows) radio programmer, and interface cables for digital data operation, GPS data, radio cloning, and retransmission.

1.2.1 Audio Accessories

There are several different audio accessories available for the radio that provide reliable operation in all operating modes and across the entire MBITR frequency band:

- a maritime headset with the 10-pin submersible connector (p/n 1600503-5),
- an urban headset with the U-283/U six-pin connector (p/n 1600567-1 and alternate part 1600504-1),
- a conventional speaker-microphone (p/n 1600469-4), and
- a commercial lightweight headset (p/n 1600551-2).

NOTE: *There were performance issues in AM, HAVEQUICK, and SINCGARS (audio interference) with earlier combinations of radio hardware, radio software and the Maritime and Urban Headsets. These performance issues have been corrected for the following (or later) revisions: urban radio hardware – Revision H, Mod 3; maritime radio hardware – Revision G, Mod 3; radio software – revision T, Version 2.27; maritime headset (1600503-5) - Rev H or M1; urban headset (1600504-1) - Rev M1. All versions of the Urban Headset 1600567-1 work in all modes of radio operation.*

NOTE: *Due to the nature of the audio accessory, no sidetone capability is available in the Handheld Speaker/Microphone, p/n 1600469-4.*

1.2.2 Antennas

There are two high performance antennas available: a 116-174 MHz antenna (P/N SS-1600293-1) that provides improved performance (gain) in the upper VHF band and a 400-512 MHz antenna (P/N SS-1600294-1) that provides improved performance (gain) in the UHF band.

1.2.3 Vehicle Adapter

The MBITR Vehicle Adapter (not currently available) is used to expand the capabilities of the MBITR by:

- Including a 12-32 VDC power supply for operation with most vehicle electrical systems,
- Charging the radio's battery while the radio is inserted in the vehicle adapter, and
- Allowing rapid insertion and removal of the radio by using the radio side connector for interface.

Additional information on the vehicle adapter characteristics, installation, and operation is found in CHAPTER 6 of this manual.

1.2.4 Special Power Adapter Interface (SPAI)

The SPAI (4101310-501) is used with the Special Operations Power Supply (SOPS) to recharge the MBITR rechargeable batteries and power the MBITR. The SPAI is supplied with an input cable (3400460-501) that connects to external 12-32 volt DC power sources.

Additional information on the SPAI characteristics and operation is in CHAPTER 7 of this manual.

1.2.5 Battery Chargers

There are three battery chargers available for use with the MBITR: a single unit charger and two different six-unit chargers. All are intended for use in a protected environment. The single unit charger (P/N 1600426-1) and one of the six-unit chargers (P/N 1600426-3) operate on 90 to 260 VAC power only. One of the six-unit chargers (P/N 1600426-2) can operate on either 90 to 260 VAC or 10 to 32 VDC power. Each battery charger charges the battery to full charge within three hours, automatically adjusting to the appropriate settings when the battery is inserted. The battery chargers communicate with the circuitry in the battery to monitor charge current, temperature, and voltage to prevent improper charging. Indicator LED's on the chargers provide status. Because the chargers are exchanging information with the battery during charging, leaving the radio powered ON during charging will result in data transfer conflicts between the radios, battery, and charger. The charge information in the battery will be corrupted and will result in false readings on the radio display after being removed from the charger. Additional information on the battery charger characteristics and operation is found in CHAPTER 8 of this manual.

1.2.6 PC-based Radio Programmer

The PC programmer (MA6941F) consists of a Windows-based software program and an RS-232 compatible cable (P/N 3500393-501) that connects from a computer serial port to the MBITR side connector to load the radio with its operating parameters. Some parameters are programmed globally to all channels within the radio and others are programmed on a channel by channel basis. Parameters that can be programmed through the radio programmer include the following:

- Channel, Group and Scan Plan labels,
- Enable/disable keypad programming capability,

- Assign programmable side key functions,
- Operating frequencies (receive and transmit),
- Squelch tones (receive and transmit),
- Transmit power level,
- Receive squelch threshold,
- Encryption mode,
- Transmit timeout,
- Display backlight timeout,
- Microphone HIGH/LOW gain,
- Traffic clock rate,
- COMSEC key variable selection,
- Fade bridging,
- Repeater delay,
- Initial crypto synchronization,
- Add/remove channels from a group,
- Add/remove channels from a Scan plan,
- Emergency channel information,
- SINCGARS parameters,
  - SINCGARS Channel,
  - Single channel frequency,
  - Frequency offset, and
  - SINCGARS data rate
- HAVEQUICK parameters,
  - Operating Frequency (Single Channel Mode only),
  - Frequency Hopping Net Selection,
  - Operational day, and
  - Word of Day segments (WOD) and Multiple WOD (MWOD) segments.

A separate manual is included with each PC Programmer that provides detailed software installation and operation instructions.

1.2.7 Cables

There are additional cables available for use with the MBITR:

- Cloning cable (P/N 3500395-501) that allows the transfer of radio programming information from one radio into another radio,
- Digital data cable (P/N 3500396-501) that allows the MBITR to be connected to a digital data device for receipt and transmission of digital data (can also be used for Bit Error Rate (BER) testing),
- GPS cable (P/N 3500465-501) that allows the radio to be connected to a Precision Lightweight GPS Receiver (PLGR) for transfer of global positioning information (can also be used to load Time of Day (TOD) for HAVEQUICK),
- PDC cable (P/N 3500466-501) that allows the radio to be connected to a ViaSat VDC 400 Personal Data Controller (PDC) card for exchange of data,
- PDC Cable (P/N 3500545-501) that allows the radio to be connected to a ViaSat VDC-200 Compact Data Controller for exchange of data,
- SINCGARS Data Adapter Cable (p/n 3500562-501) that allows the radio to be used in place of a SINCGARS manpack radio for data transmission, and

- Retransmission cable (P/N 3500485-501) that allows two radios to be connected together to receive and retransmit voice or data traffic (retransmission mode).

1.3 Transceiver Characteristics

The radio is tunable over a frequency range of 30-512 MHz, in either 5 or 6.25 kHz tuning steps, using 25.0 kHz channel bandwidth, 12.5 kHz when set for narrowband operation, and 5 kHz bandwidth when set for ANDVT. The radio automatically selects the correct tuning step size.

1.3.1 Transmitter Characteristics

The transmitter output consists of a single channel modulated carrier. The modulating source is analog or digitized voice and data signals at 12 and 16 kbps in 25 kHz channel spacing.

1.3.1.1 Programmable Transmit Time-out Timer

The radio has a programmable transmit time-out timer, with available settings of 30, 60, 90, and 120 seconds and infinite (no timeout).

1.3.1.2 Transmit Squelch Tones

When operating in clear FM, the radio is capable of transmitting standard EIA Continuous Tone Controlled Squelch System (CTCSS) squelch tones or the 150 MHz military squelch tone superimposed on the transmit carrier. The CTCSS tones available are as follows:

Table 1-2 Continuous Tone Controlled Squelch System (CTCSS) Available Tones (in Hz)

NONE/OFF		67.0	69.3	71.9	74.4	77.0	79.7	82.5	85.4	88.5	91.5
94.8	97.4	100.0	103.5	107.2	110.9	114.8	118.8	123.0	127.3	131.8	136.5
141.3	146.2	150.0	151.4	156.7	162.2	167.9	173.8	179.9	186.2	192.8	203.5
210.7	218.1	225.7	233.6	241.8	250.3						

NOTE: Whenever the 150.0 Hz tone is selected, the transceiver performance is adjusted to meet military standards for interoperability with legacy radios.

1.3.2 Receiver Characteristics

1.3.2.1 Clear Bypass Reception

For emergency situations, or when a radio has inadvertently lost encryption key, the radio circuitry is capable of receiving clear messages while set for secure mode operation.

1.3.2.2 Receive Squelch Tones

When operating in FM, the radio is capable of receiving standard EIA CTCSS squelch tones and the 150 MHz military squelch tone superimposed on the transmit carrier. The receive CTCSS tones are the same as those listed for transmit.

1.4 Communication Security (COMSEC)

The following describes the COMSEC characteristics of the MBITR, which is capable of secure communication by use of an NSA approved cryptographic module.

1.4.1 Compatibility

When operating in the 16 kbps secure voice mode, the radio is VINSON compatible. When operating in the 12 kbps secure voice mode, the radio is FED-STD-1023 compatible.

1.4.2 Tone Squelch Disable

When operating in the secure mode, the radio disables the transmission of any tone squelch (i.e., CTCSS) signals.

1.4.3 Encryption Device Keying

Encryption key fill is accomplished through the audio/keyfill connector. The Urban MBITR uses a standard U-283/U six-pin connector that is fully compatible with the following key fill devices: KYK-13, KYX-15 and KOI-18 (common fill devices as described in CSESD-11I), and the AN/CYZ-10 (data transfer device (DTD) (as described in NSA 0N433965). The Maritime MBITR has a ten-pin connector that requires the use of the (supplied) ten-to-six pin adapter for the connection of the key fill devices.

1.4.4 TEMPEST

The MBITR and the SPAI conform to TEMPEST requirements for secure voice and data operation.

1.4.5 Algorithms

The MBITR is capable of using Saville and Padstone algorithms, selectable on a channel by channel basis.

1.4.6 Cryptographic Key Storage

The MBITR can store five traffic encryption keys (TEKs) and one key encryption key (KEK) when using the Saville algorithm or five TEKs when using the Padstone algorithm. TEKs are used to encrypt/decrypt secure message traffic. KEKs are used in Over-The-Air-Rekey (OTAR) (see paragraph 2.2.3.2.9) for the reception of new TEKs.

1.4.7 Zeroization

The MBITR can zeroize all encryption keys simultaneously through the panic zeroize control (see paragraph 2.1.1.3). The radio also allows selective zeroization of individual encryption keys through the front panel keypad.

1.4.8 Key Retention

To allow replacement of low batteries, the MBITR retains crypto key for at least 45 seconds after battery removal.

CAUTION

Be sure to turn the radio OFF before removing the battery. Failure to do so may cause loss of key and/or programming.

1.4.9 Fade Bridging

The MBITR provides fade bridging that is programmable, via the keypad or the PC programmer, from 0 to 4 seconds in one-second increments. Fade bridging allows the encryption recovery to "freewheel" during momentary signal loss so that encryption synchronization is not interrupted.

1.4.10 Initial Synchronization

The MBITR has initial synchronization that is programmable at NONE, 256 msec, 384 msec, and 1.06 second. Initial synchronization controls the length of the cryptographic preamble to increase the probability of initial cryptographic synchronization by the receiving radio over noisy channels.

1.5 SINCGARS Transmission Security (TRANSEC)

NOTE: SINCGARS operation is only available in those radios with the optional SINCGARS capability enabled. Use the "OPTIONS ENABLED" menu (paragraph 2.2.3.4.4) to check. The following describes the TRANSEC capabilities of the MBITR with SINCGARS option.

1.5.1 Frequency Range

When operating in the SINCGARS mode, the available MBITR operating frequency range is 30 to 87.995 MHz.

1.5.2 Operating Modes

The MBITR with SINCGARS functionality includes the operating modes of the Basic radio and those modes of operation listed below.

1.5.2.1 SINCGARS Single Channel (SC) Compatibility

The MBITR with SINCGARS functionality provides Single Channel (SC) clear FM analog voice operation, FM encrypted digital voice in 16 kbps CVSD mode, and over-the-air FM transfer of encrypted digital data. The SC Data Mode implements the SINCGARS Standard Data Mode (SDM) and Enhanced Data Mode (EDM).

1.5.2.2 SINCGARS Frequency Hopping (FH) Compatibility

The MBITR with SINCGARS functionality provides Frequency Hopping (FH) Plain Text Digital Voice operation, FH FM encrypted digital voice in 16 kbps CVSD mode, and, using the SINCGARS and SINCGARS SIP waveforms, FH over-the-air FM transfer of encrypted digital data. The FH Data Mode implements the SINCGARS SDM and EDM.

1.5.2.3 Half Duplex Operation

When operating in the SINCGARS mode, the MBITR is not capable of half-duplex operations, where receive and transmit operations are performed on different frequencies.

1.5.3 Squelch Tones

The SINCGARS MBITR supports the 150 Hz squelch tone. The radio does not support CTCSS operation when in SINCGARS mode of operation.

1.5.4 SINCGARS Electronic Counter Counter-Measures (ECCM) Remote Fill (ERF)

The MBITR is capable of "receive only" SINCGARS ECCM Remote Fill (ERF).

1.5.5 Encryption Device Keying

TRANSEC key fill is accomplished through the audio/keyfill connector. The Urban MBITR uses a standard U-283/U six-pin connector that is fully compatible with the ECCM fill device (MX-18290/VRC) and the AN/CYZ-10 DTD. The Maritime MBITR has a ten-pin connector that requires the use of the (supplied) ten-to-six pin adapter for the connection of the key fill devices.

1.6 HAVEQUICK I/II Transmission Security

NOTE: HAVEQUICK operation is only available in those radios with the optional HAVEQUICK capability enabled. Use the "OPTIONS ENABLED" menu (paragraph 2.2.3.4.4) to check.
The following describes the TRANSEC capabilities of the MBITR with HAVEQUICK option.

1.6.1 Frequency Range

When operating in the HAVEQUICK I/II mode, the available MBITR operating frequency range is 225 to 399.975 MHz.

1.6.2 Interoperability

The HAVEQUICK I/II MBITR is interoperable in both single channel and ECCM modes with the AN/PRC-113 in clear and secure voice.

1.6.2.1 HAVEQUICK I/II Frequency Hopping (FH) Voice

Using the HAVEQUICK I/II waveforms, the MBITR provides Frequency Hopping (FH) AM clear analog voice operation and FH AM encrypted digital voice in 16 kbps CVSD mode.

1.6.3 Over-the-Air Time of Day

The MBITR can receive and transmit HAVEQUICK Time of Day (TOD) in single channel mode.

1.6.4 Squelch Tones

The HAVEQUICK I/II mode does not support Continuous Tone Controlled Squelch System (CTCSS) operation or the 150 Hz squelch tone (used for SINCGARS interoperability).

1.6.5 COMSEC Compatibility

When operating in the HAVEQUICK I/II mode, the MBITR can operate in the VINSON COMSEC mode at 16 kbps. (HAVEQUICK I/II does not support 12 kbps operation.)

1.6.6 Net Support

The HAVEQUICK MBITR supports the following HAVEQUICK I/II nets:
- HAVEQUICK I Sectorized A-nets,
- HAVEQUICK I A-nets,
- HAVEQUICK I B-nets,
- HAVEQUICK I training nets,
- HAVEQUICK II NATO nets,
- HAVEQUICK II non-NATO nets, and
- HAVEQUICK II training nets.

1.7 ANDVT Operation

Note: Some uses of the MBITR with ANDVT channels require the use of a directional antenna with a minimum gain of 9dBi.
NOTE: ANDVT operation is only available in those radios with the optional ANDVT capability enabled. Use the "OPTIONS ENABLED" menu (paragraph 2.2.3.4.4) to check.

The following describes the additional characteristics of the MBITR with ANDVT option.

1.7.1 Frequency Range

When operating in the ANDVT mode, the MBITR operating frequency range is contiguous from 30.0 to 512.0 MHz.

1.7.2 Channel Bandwidth

The MBITR receiver/transmitter has a channel bandwidth of 5 kHz in ANDVT mode.

1.7.3 Interoperability

The ANDVT MBITR is interoperable in mode and frequency with the Advanced Narrowband Digital Voice Terminal (ANDVT), KY-99, KY-99A, PSC-5, and AN/PRC-117F.

1.7.4 Operating Modes

The MBITR in ANDVT mode supports the following operating modes.

1.7.4.1 Encrypted Digital Voice

The Receiver/Transmitter provides encrypted digital voice in 2400 bps LPC-10 mode that is modulated using Shaped Binary Phase Shift Keying (SBPSK). Digital voice squelch is based on the presence of a digital clock at the appropriate clock rate and cryptographic synchronization.

1.7.4.2 Digital Data

The Receiver/Transmitter provides over-the-air transfer of encrypted digital data at 2400 bps mode that is modulated using SBPSK. The Receiver/Transmitter is capable of interoperating with data terminal devices over an RS-232 interface at a synchronous data speed of 2400 bps. (The MBITR with the current (ver. 2.28) version software is not interoperable in data mode with the AN/PRC-117F – this capability will be in a future version.)

1.7.4.3 Simplex Operation

The Receiver/Transmitter is capable of simplex operation, where receive and transmit operations are performed on the same frequency.

1.7.4.4 Half Duplex Operation

The Receiver/Transmitter is capable of half-duplex operations, where receive and transmit operations are performed on different frequencies.

CHAPTER 2 OPERATING INSTRUCTIONS

Section I. CONTROLS AND INDICATORS

2.1 Controls, Indicators, and Connectors

2.1.1 Controls

The MBITR controls consist of the following: a backlit keypad (shown in Figure 2-1), a push-to-talk (PTT) switch, ON/OFF/Volume control/Panic zeroize rotary switch, a 16-position channel select rotary switch, a squelch override button, and two programmable function keys. The other controls and connectors are shown in Figure 2-2 and Figure 2-3.

2.1.1.1 Keypad

There are seven keys on the keypad, as shown in Figure 2-1. The three keys on the top row are *CONTROL* keys and the remaining four keys are *AUXILIARY CONTROL* keys. The Control keys allow the operator to change MBITR modes and channels with a minimum number of MBITR key operations. The Auxiliary Control keys allow access to additional MBITR functions as well as to confirm any Control key selections. Most keys have two functions: the second or *ALTERNATE* function is accessible by pressing and holding the ALT key while another key is pressed and released. The *PRIMARY* function is indicated by the marking on the key tops while the alternate function is printed on the MBITR case, either above the key (top row) or below the key (bottom row).

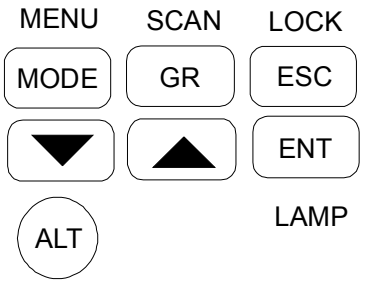


Figure 2-1 MBITR Keypad

Table 2-1 Key Assignments Table

KEY	FUNCTION	ALT FUNCTION
ALT	Press and hold to access ALT functions	Not Applicable
MODE	Opens Mode Select screen	Opens Programming Menus screen
GR	Opens Group Select screen	Opens Scan Operation screen
ESC	Closes current screen; returns to previous screen	Lock / Unlock keypad
▼	Decrement selection or value	Highlights character to left of current selection
▲	Increment selection or value	Highlight character to right of current selection
ENT	Confirm operation or selection	Backlight On / Off

2.1.1.2 Push-to-talk Switch

A push-to-talk (PTT) switch (7, Figure 2-2) is located in the middle of the left side of the radio. (All positions are given as if the display is facing the radio operator.) By pressing the UP or DOWN arrow keys on the keypad while pressing the PTT switch, the user can change the output power level setting. For the new setting to go into effect, the user must release the PTT and then press it again or rekey the audio accessory (if operating with External Audio).

2.1.1.3 ON/OFF/Volume Control/ Panic zeroize

ON/OFF/Volume control/Panic zeroize (6, Figure 2-3) is controlled by a mechanical rotary switch located on the left top of the radio. There is a mechanical interlock switch (5, Figure 2-2) located on the side of the radio immediately below the ON/OFF switch that the user must slide down and hold in order to turn the switch to the panic zeroize position.

2.1.1.4 16-Position Channel Select Rotary Switch

The channel select rotary switch (5, Figure 2-3) is located on the top middle of the radio. The specific channels associated with each position of the rotary switch are determined by the group selected by the operator (see paragraph 2.2.1 for information on channels and groups).

2.1.1.5 Squelch Disable Button

The squelch disable button (8, Figure 2-2) is located on the left side of the radio below the PTT switch. It toggles between squelched and unsquelched operation. By pressing and holding the button for a few seconds, the user activates the Squelch Opening Threshold Level Setting screen (Figure 2-14) on the display. The Squelch Level for the currently selected channel can be changed using the [▲] and [▼] keys on the keypad.

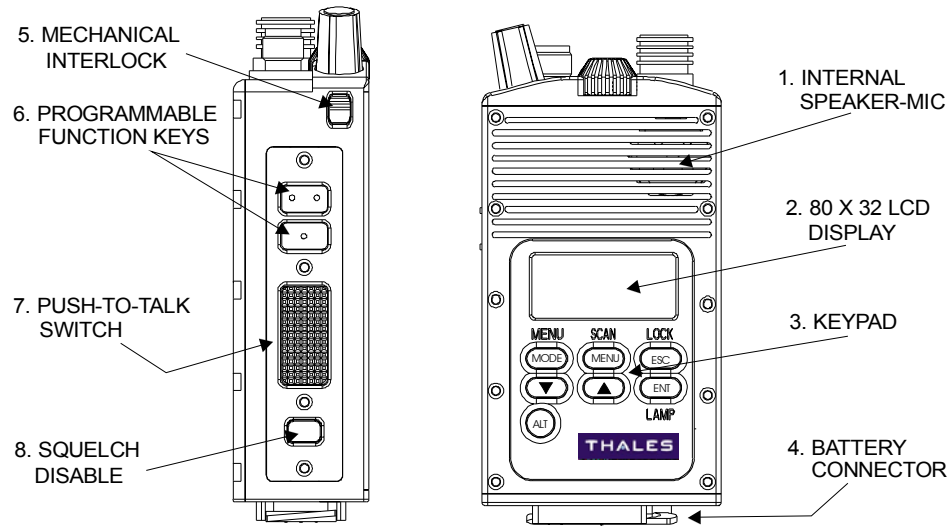


Figure 2-2 MBITR Controls and Connectors (Sheet 1)

2.1.1.6 Programmable Function Keys

The two programmable function keys (6, Figure 2-2) can be assigned different functions using the PC Programmer. Available functions are: Enable/Disable of Situational Awareness (SA),

Enable/Disable of Scan, Enable/Disable of backlighting, Enable/Disable of AM Swept Tone Beacon, Toggle through scan plans, Toggle through groups, Display/Clear SA positional information, Select between internal, external, and sidetone audio, Switch between Singel Channel and Frequency Hopping modes (SINCGARS and HAVEQUICK channels only), Display/Clear the clock and date. The keys can also be disabled. The PC Programmer manual contains additional details.

2.1.2 Indicators

2.1.2.1 Liquid Crystal Display (LCD)

The MBITR has an 80 x 32 pixel liquid crystal display (2, Figure 2-2) that uses both characters and graphics to provide the operator with radio operating and programming information. The display backlighting is activated by pressing the [ALT] and [ENT] ([LAMP]) keys. The intensity of the backlighting can be changed by continuing to hold the [ALT] and [ENT] keys after turning on the backlight. The backlighting is night vision goggle (NVG) compatible.

2.1.2.2 Clear Indicator

Operation in Plain Text (PT), or clear, mode is visually indicated on the display (9, Figure 2-5) and audibly indicated by pip tones at the beginning of each transmission or reception.

2.1.3 Connectors

2.1.3.1 Side Connector

The side connector (2, Figure 2-3) is a multi-pin connector located on the right side of the radio. This connector is used for multiple functions, including interfacing with the Vehicle Adapter and the Radio Programmer, Cloning, and Data Mode cables. **To prevent damage to the radio while powered on, the side connector MUST be disabled before the radio is immersed in water** (see paragraph 2.2.3.3.1).

2.1.3.2 Audio/Key Fill Connector

The urban MBITR audio/key fill connector (1, Figure 1-1) is a standard U-283/U six-pin audio connector. This connector is used for encryption key fill and to interface with standard audio accessories (such as the H/250 handset). The maritime MBITR uses a ten-pin deep submersible audio connector (MKS-310-BCR)(4, Figure 2-3) and requires a ten-to-six pin adapter device (part number 3600190-1, supplied as part of the radio) to interface with standard audio accessories and key fill devices. The pinouts for each connector are shown in Figure 2-4.

2.1.3.3 Antenna Connector

The antenna connector (7, Figure 2-3) is a TNC female type connector on the top of the radio. It is recommended that an antenna ALWAYS be connected to the radio when transmitting. An antenna should be connected whenever the radio is immersed.

2.1.3.4 RF Connector

The RF Connector (1, Figure 2-3) is used for the RF connection to the Vehicle Adapter.

2.1.3.5 Battery Connector

The battery interfaces with the MBITR through a reliable, easily operated bayonet twist-on mechanism (4, Figure 2-2). The battery connection includes a release latch (3, Figure 2-3).

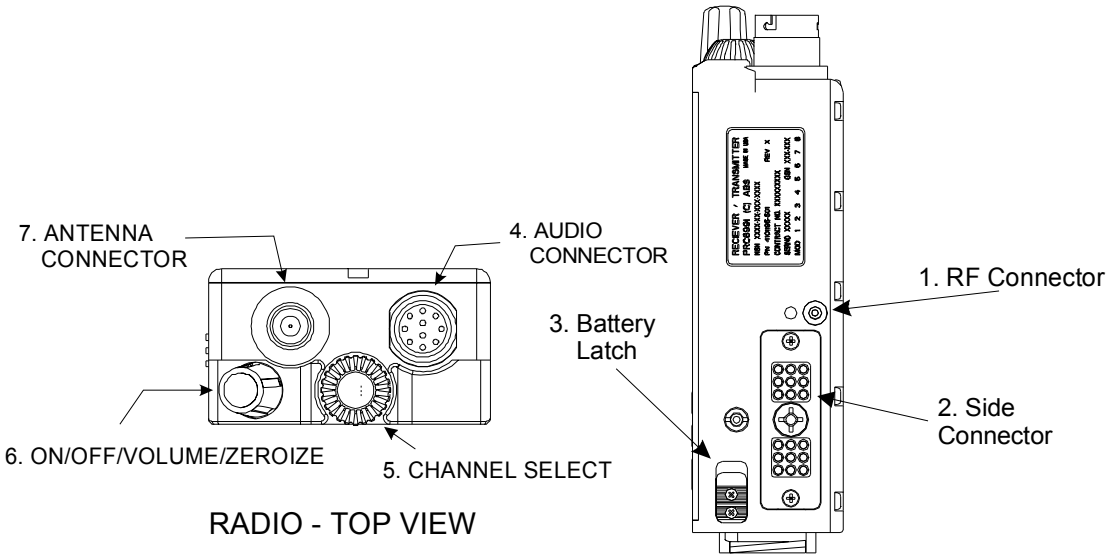


Figure 2-3 MBITR Controls and Connectors (Sheet 2)

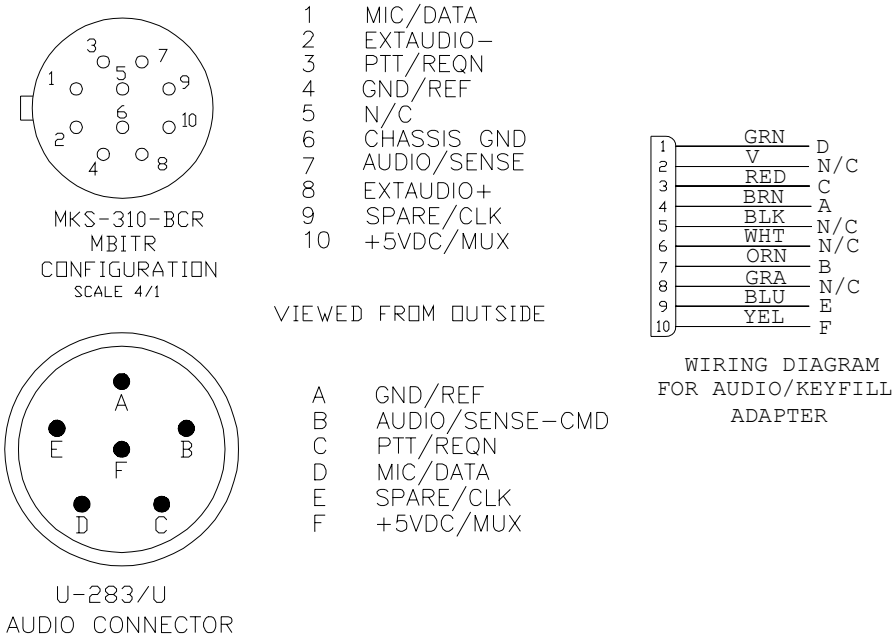


Figure 2-4 MBITR Audio/Keyfill Connector Pin-Out

Section II. OPERATION

2.2 Operating Procedures

2.2.1 MBITR Channels and Groups

The MBITR has a total of 100 programmable channels. Each channel may be programmed for a different frequency (for both receive and transmit) as well as other communications parameters. Each channel may be identified by a 7 character alphanumeric label or by its default channel number (00 to 99) if no label has been programmed.

The MBITR programmed channels can be assigned to groups of up to 16 channels each (to correspond to the 16 positions on the Channel Select rotary switch). When a channel is assigned to a group, it is "mapped" to a Channel Select switch position. Channels can be assigned to more than one group. If a channel is NOT assigned to any group, the radio cannot access that channel. The radio can store up to ten (10) groups of channels. These groups may be assigned names of up to 3 characters. The user may select only **ONE** Group at any given time for MBITR operations. This Group will be referred to as the MBITR's "SELECTED GROUP." When compiling a list of channels to a group, channels are assigned by their default channel numbers.

2.2.2 Display Menus

2.2.2.1 DEFAULT Display Organization

When the radio is first powered up, it performs a Power-On Self-Test (POST) and displays "TESTING". When POST is completed, the display shows "THALES MBITR" and the software version. **NOTE**: If the radio fails POST, run the Built-In Test (paragraph 2.2.3.4.1) to identify the cause of failure. This display is then automatically replaced by the default standby display screen (see Figure 2-5). The display includes a battery "fuel gauge" indicator, the group label for the selected group, the selected channel label, the channel modulation type (AM, FM, or PSK), and the security mode (PlainText (PT) or CipherText (CT). The display can also contain:

- a flashing "ERROR" indicator when an operational fault occurs,
- a flashing "UNLCK" indicator when the synthesizer is not locked on a frequency,
- a flashing "ALARM" indicator when a crypto fault occurs,
- a flashing "NOPWR" indicator for no RF output power,
- a flashing "TEMP" indicator for an over-temperature condition,
- a flashing "TRSEC" indicator if SINCGARS FH is selected, but no TRANSEC information (hopset/ lockout set) is loaded,
- a flashing "NOTOD" indicator if HAVEQUICK I/II FH is selected, but no TOD (Time of Day) is loaded,
- a flashing "NOWOD" indicator if HAVEQUICK I/II FH is selected, but no WOD (Word of Day) is loaded,
- an "External Audio enabled" icon when the radio is set for external audio,
- a "Side Connector enabled" icon when the radio side connector is enabled,
- a "Half-duplex mode" icon that automatically appears when different receive and transmit frequencies are programmed for the selected channel,
- a "DATA" mode indicator when the radio is in digital data mode,
- a "RETRANS" indicator when the expedient retransmission mode is activated,

- a "SCAN" icon when the Scan function is active,
- an "SA" indicator for Situation Awareness enabled (radio must be in CT mode),
- a TRANSEC SINCGARS (SG) or HAVEQUICK (HQ) indicator with either a Single Channel (SC) or Frequency Hopping (FH) indicator (NOTE: Since SINCGARS and HAVEQUICK are limited to FM and AM frequencies, respectively, the display DOES NOT include Modulation Type when TRANSEC channels are displayed,
- a “LNE” indicator when SINCGARS Late Net Entry is activated,
- an "Emergency Beacon" icon when the radio is set for swept tone emergency beacon mode,
- an "Open Squelch" icon when the squelch disable button is pressed, and
- a “keypad locked” icon when the [ALT] and [ESC] keys are pressed, locking the keypad to prevent inadvertent keystrokes. The keypad can be unlocked by pressing [ALT] and [ESC] again.

All other (function) displays are accessed from the default display. These functions are invoked by MBITR key or switch operations or, in some cases, automatically by the MBITR, as in the Scan Mode. There are three groups of function screens that support the user interface: Operations screens, Function screens, and Programming screens, as described below.

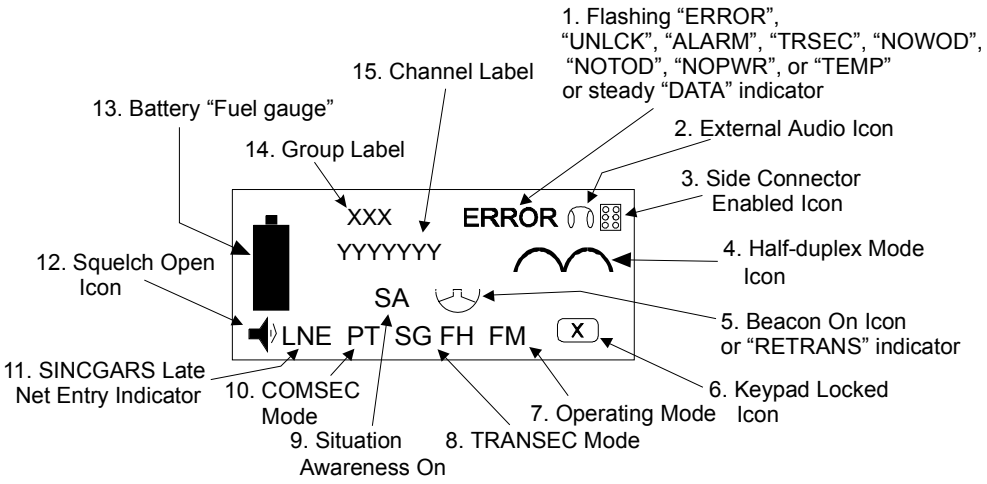


Figure 2-5 Default Display Screen

2.2.2.2 Alternate DEFAULT Display (Basic)

When the default display (Figure 2-5) is open, the user can switch to an alternate display by pressing [ENT]. The alternate display (Figure 2-6) for Basic channels shows the receive (RX) frequency (1) and CTCSS tone (3) and transmit (TX) frequency (2) and CTCSS tone (4) of the current channel. Press [ENT] or [ESC] to return to the default display.

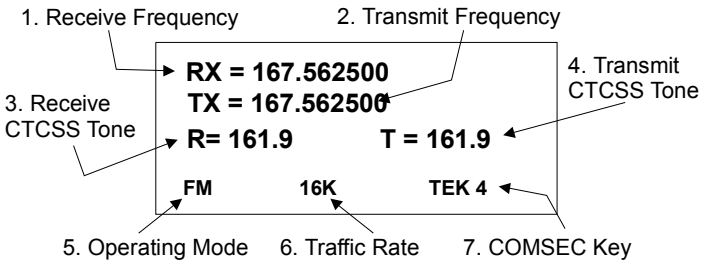


Figure 2-6 Basic Alternate Default Display

2.2.2.3 Alternate DEFAULT Display (SINCGARS)

For SINCGARS channels, there are different alternate displays for the Single Channel and Frequency Hopping modes. The Single Channel (SC) display includes the SINCGARS channel (1), Single Channel frequency (2), COMSEC key (3), data rate (4), modulation type (5), and frequency offset (6). The Frequency Hopping (FH) display includes the SINCGARS channel (1), SINCGARS Net ID number (2), COMSEC key (3), data rate (4), modulation type (5), and SINCGARS Net time (6),.

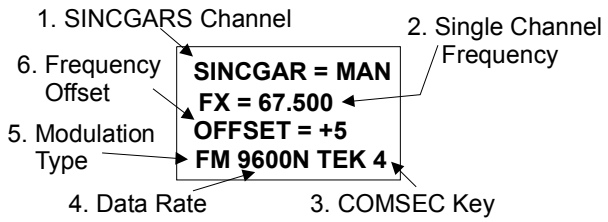


Figure 2-7 SINCGARS Alternate Display (SC)

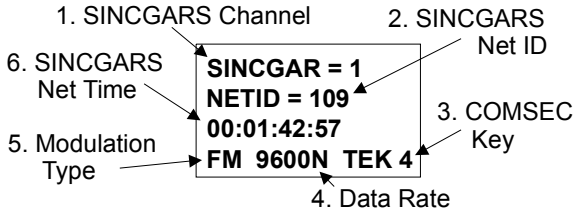


Figure 2-8 SINCGARS Alternate Display (FH)

2.2.2.4 Alternate DEFAULT Display (HAVEQUICK)

For HAVEQUICK channels, there are different alternate displays for the Single Channel and Frequency Hopping modes. The Single Channel (SC) display includes the HAVEQUICK Single Channel frequency (1), modulation type (2), traffic rate (3), and COMSEC key (4). The Frequency Hopping (FH) display includes the HAVEQUICK Net (1), modulation type (2), traffic rate (3), and COMSEC key (4).

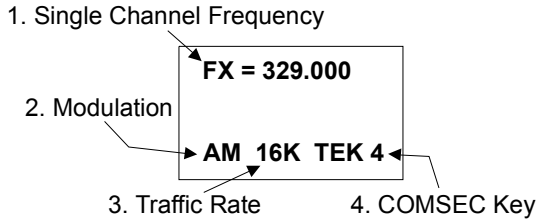


Figure 2-9 HAVEQUICK SC Alternate Display

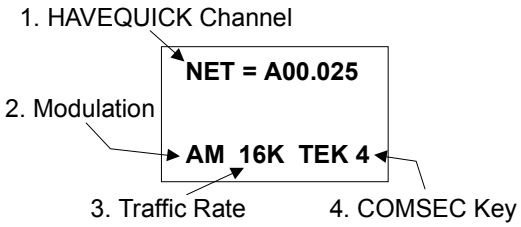


Figure 2-10 HAVEQUICK FH Alternate Display

2.2.2.5 Alternate DEFAULT Display (ANDVT)

For ANDVT channels, the alternate display (Figure 2-11) includes the receive (1) and transmit (2) frequencies, the delay (3) (period of time before the modulated signal is transmitted, the modulation type (4) (PSK), the data rate (5) (2.4 kbps), and the COMSEC key (6).

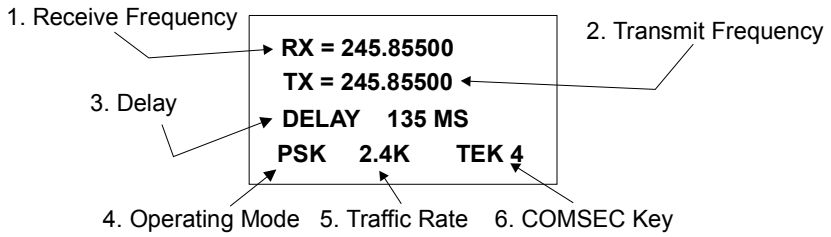


Figure 2-11 ANDVT Alternate Display

2.2.2.6 OPERATIONS Screens

The Operations screens are required for basic operation of the MBITR. These include the Receive (RX) status, Transmit (TX) status/Power, and Squelch adjust screens. These screens are displayed in response to PTT or Squelch switch operations on the MBITR. These screens display the receive signal level when traffic is being received, the squelch level when squelch is being set, or the transmit power level when the radio PTT is pressed.

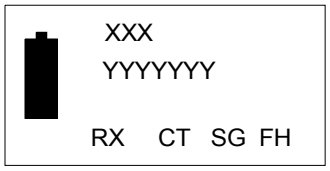


Figure 2-12 Receive Screen

When a signal is being received, the standby screen changes to the Receive screen (Figure 2-12). (Note that the SC/FH indicator is only present on channels programmed as SINCGARS or HAVEQUICK.)

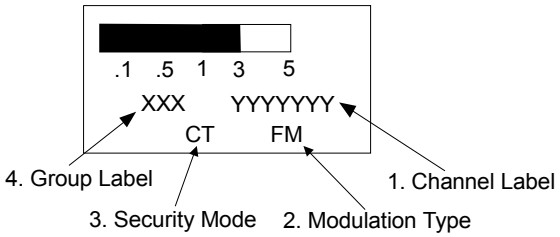


Figure 2-13 Transmit Screen

The radio displays the Transmit screen (Figure 2-13) whenever the radio is keyed, either from the PTT switch or from an external device, and power can be adjusted while keyed. To adjust the power level, press the [▲] or [▼] keys while the radio is keyed. To have the new power level activated, the radio must be unkeyed and then rekeyed.

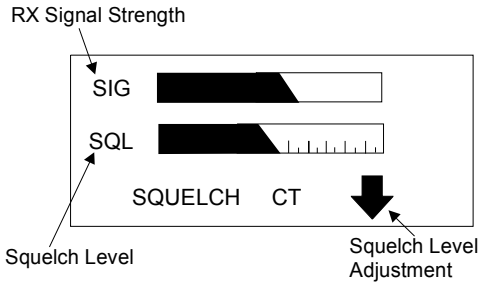


Figure 2-14 Squelch Adjust Screen

To adjust the squelch level, press and hold the Squelch Disable button (below the PTT switch) for a few seconds. The Squelch Adjust screen (Figure 2-14) will be displayed. To increase or decrease the squelch opening threshold, press the [▲] or [▼] keys, as was done for transmit power. To have the new level go into effect and be retained in the channel configuration, the user must press [ENT].

2.2.2.7 FUNCTIONS Screens

The Function screens (Mode Select and Group Select) are actually a subset of the Operations screens and are displayed in response to MBITR front panel switch operations. They present the

operator with a small menu of options to select using the [▲] and [▼] keys. These selections must then be confirmed with an additional press of the [ENT] key. These Function changes are made with the MBITR online and immediately affect the way the MBITR is operating, e.g., Clear mode to Secure mode changes. They are also single level menu operations that require a minimum of switch operations to complete.

2.2.2.7.1 MODE Select

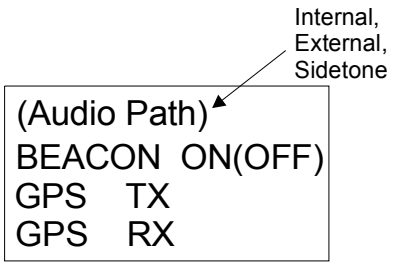


Figure 2-15 Mode Select Screen

To select the MBITR Operating Mode, press the [MODE] key on the front panel keypad. The menu of available parameters (Figure 2-15) appears on the display. The currently selected parameter is outlined. To move the selection outline, use the [▲] or [▼]. To change the selected parameter, press [ENT] to enable the change mode (the selection will be shown in reverse video (white on black)) and use the [▲] or [▼] to toggle the selection value. Press [ENT] to confirm the change and move the outline to the next line. The first line selects the audio path: internal audio, external audio, or external audio with sidetones enabled (INT/EXT AUDIO, SIDETONE). Select external audio when using a separate audio accessory. Selecting SIDETONE enables external audio with feedback during transmit. Otherwise, use internal audio. Internal audio should be selected when the radio is to be immersed unless an immersible headset is attached to the radio. The second line selects the emergency beacon operation (ON or OFF) and, when set to ON, opens the beacon activation screen for selecting the beacon channel. The next line selects display of the transmit (TX) of GPS/Situational Awareness data. The last line selects display of the received (RX) GPS/Situational Awareness data. At any point, the [ESC] key may be pressed to exit the menu without changing the currently selected (outlined) parameter.

2.2.2.7.2 Emergency Beacon

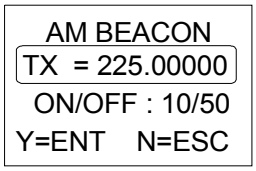


Figure 2-16 Emergency Beacon Select

When BEACON is set to ON, pressing [ENT] opens the Emergency Beacon menu (Figure 2-16). When the selection outline is around the "TX=" line, the user can scroll through the three available emergency channels with the [▲] and [▼] keys: military or civilian emergency beacon, or a non-standard frequency emergency channel. The military and civilian emergency beacon frequencies (121.5 and 243 MHz) are pre-programmed into the radio. The user must program the non-standard emergency channel information before this channel can be used. (See paragraph 2.2.3.3.8 for emergency channel programming information.) Press [ENT] to confirm and activate the Emergency Beacon and return to the Mode Select screen.

The Emergency Beacon operation is separate and distinct from the channel selected using the top-mounted rotary switch. When the Emergency Beacon is activated, the user can still transmit and receive on the regular selected channel. The radio will receive whenever not actually transmitting on the Emergency Beacon. To interrupt the Emergency Beacon transmit, press [ESC]. This cancels the Emergency Beacon operation and allows normal use of the radio.

2.2.2.7.3 GPS Transmit/Receive

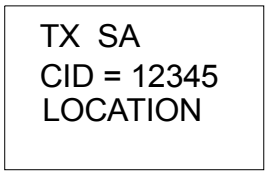


Figure 2-17 GPS Transmit

NOTE: The radio must be in CT mode to transmit or receive GPS information.

Pressing [ENT] with GPS TX selected opens the GPS transmit information screen. If a PLGR is attached, the GPS TX screen will display the Combat ID (CID) and current location (using the Military Grid Reference System (MGRS) notation). If no PLGR is attached, the display will read "LOCATION UNKNOWN". If message traffic with GPS information included has been received, selecting the GPS RX screen will display the received location information. There are two screens of information for each CID – press the [ENT] key to show the second screen. The radio can display GPS data from the last ten unique radio receptions. Toggle through the ten unique receptions, designated by their Combat ID, by using the up and down arrow keys. Press [ESC] twice to return to the Default Display screen.

2.2.2.7.4 GROUP Select

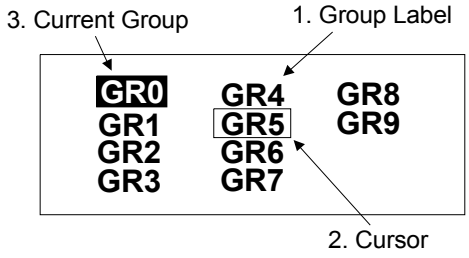


Figure 2-18 Group Select Screen

Press the [GR] key to open the GROUP Select menu (Figure 2-18). This menu displays the Group Labels for all 10 groups. The label of the currently selected group is shown in reverse video (white on black). To select a new group, press the [▲] or [▼] keys to move the selection outline. The selection outline will scroll through the first column to the top of the next column and from the last group to the first group. When the outline is on the desired group, press [ENT] to select the new group and return to the default screen.

2.2.3 PROGRAMMING Menu

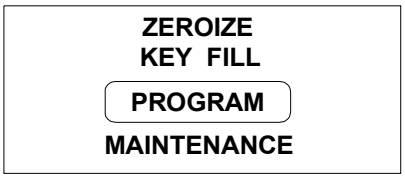


Figure 2-19 Main Menu Screen

The Programming screens are available through a menu structure and do not require user access during normal MBITR operations. These functions are for advanced channel and modes programming and restrict the MBITR operation (no Receive operations during programming). The Main Menu screen (Figure 2-19) is accessed by pressing [ALT] and [MODE].

2.2.3.1 Zeroize

The INFOSEC firmware allows the user to selectively zeroize individual COMSEC keys, individual TRANSEC hopsets, all COMSEC keys, all TRANSEC hopsets, or all radio parameters. ZEROIZE is one of the selections on the Main Menu.

2.2.3.1.1 Zeroize Screen

Figure 2-20 Initial ZEROIZE Screen

The initial ZEROIZE screen (Figure 2-20) permits the operator to select either CLEAR ALL, ZERO COMSEC, ZERO TRANSEC, or SET DEFAULTS functions.

2.2.3.1.2 CLEAR ALL Screen

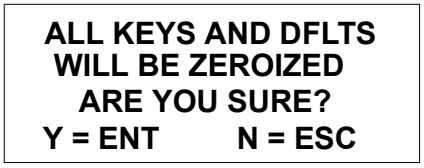


Figure 2-21 CLEAR ALL Screen

The CLEAR ALL screen (Figure 2-21) will zeroize all the COMSEC and TRANSEC key variables and will reset the radio to the factory defaults (Table 2-2). Press [ESC] to return to the Initial ZEROIZE Screen.

Table 2-2 Factory Default Values

Parameter	Value
Frequency	167.5625 MHz
Modulation	Alternating (by channel) AM and FM
Power	5 watts
Squelch Tone	None
Encryption	Plain

2.2.3.1.3 COMSEC Zeroize Screen

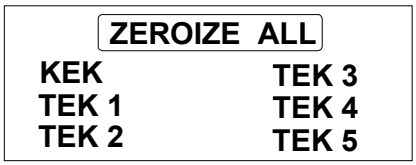


Figure 2-22 COMSEC Zeroize

Move the selection outline to ZERO COMSEC and press [ENT] to proceed with COMSEC zeroize (Figure 2-22). Use [▲] or [▼] to move the selection outline and [ENT] to confirm the selection. For selective zeroize, move the selection outline to the key location to be zeroized (either the Key Encryption Key (KEK) or Traffic Encryption Key (TEK) 1-5) and press [ENT]. Press [ESC] to return to the Initial ZEROIZE Screen.

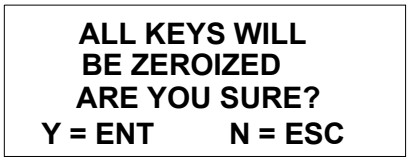


Figure 2-23 COMSEC Zeroize All

When ZEROIZE ALL is selected, the confirmation screen (Figure 2-23) will be displayed. Press [ENT] to immediately zeroize ALL COMSEC keys. The [ESC] key returns to Figure 2-22. When Zeroize All is successful, the display will revert to the Default Display (Figure 2-5) with the crypto alarm active (if mode is set to CT).

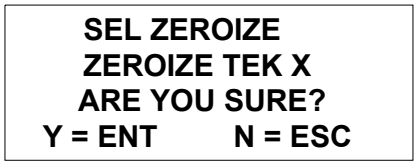


Figure 2-24 COMSEC Selective Zeroize

When an individual key location is selected, the confirmation screen (Figure 2-24) is displayed. Press [ENT] to zeroize the selected key. The [ESC] key returns to the COMSEC Zeroize Screen (Figure 2-22) with the same key selected. When Selective Zeroize is successful, the radio display returns to the COMSEC Zeroize screen with ZEROIZE ALL selected.

2.2.3.1.4 TRANSEC Zeroize Screen

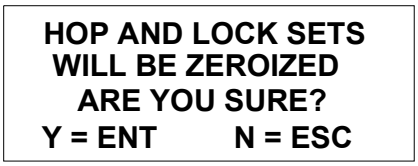


Figure 2-25 TRANSEC Zeroize Screen

Move the selection outline to TRANSEC and press [ENT] to proceed with TRANSEC zeroize (See Figure 2-25). Press [ENT] to immediately zeroize ALL TRANSEC hopsets and lockout sets (SINCGARS) and Word of Day data (HAVEQUICK) and revert to the Default Display (Figure 2-5). The [ESC] key returns to Figure 2-25.

2.2.3.1.5 Set Defaults Zeroize Screen

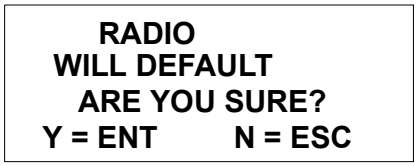


Figure 2-26 Radio Parameters Zeroize Screen

Set Defaults resets all global, group, and channel settings to the factory default values. Move the selection outline on the Radio Parameters Zeroize Screen to SET DEFAULTS and press [ENT] to proceed with the Set Defaults operation (See Figure 2-26). Press [ENT] to confirm resetting all radio parameters to factory default settings. Press [ESC] to return to the Initial ZEROIZE Screen.

2.2.3.2 Key Fill.

NOTE

Before beginning any Key Fill operation, ensure that the SIDE CONNECTOR is ENABLED and the radio is set for INTERNAL AUDIO.

2.2.3.2.1 General Key Fill Operation.

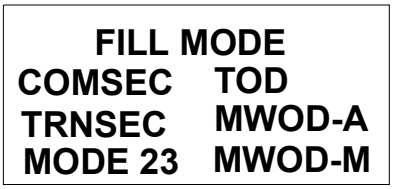


Figure 2-27 Key Fill Main Screen

The user must select Key Fill from the Main Menu (Figure 2-19) to display the main Key Fill screen (Figure 2-27). Select one of the key fill modes and then connect a key fill device (KOI-18, KYK-13, KYX-15, AN/CYZ-10, or MX-18290/VRC), either directly to the audio/keyfill connector on the Urban version or using the supplied audio adapter on the Maritime version.

NOTE: One of the Key Fill Mode screens MUST be selected BEFORE connecting the key fill device.

After turning off and/or removing the key fill device, press [ESC] to exit Key Fill mode.

The available fill modes are defined below: (*Note that SINCGARS and HAVEQUICK II operation require the corresponding software option in order to be active*.)

COMSEC: Enables the COMSEC key load function into the location selected.

TRNSEC: Enables the SINCGARS hopset load function into the channel selected from 1 through 6 and MAN (manual) or the lockout set into LOUT.

MODE 23: Enables both the COMSEC key load and TRANSEC hopset/lockout set load functions into all channels. (Requires use of AN/CYZ-10 Data Transfer Device).

TOD: Enables the HAVEQUICK I/II Time of Day load functions (load, transmit, emergency initialize).

MWOD-A: Enables the HAVEQUICK I/II Multiple Word of Day load from an external fill device (e.g., KYK-13.)

MWOD-M: Enables a manual load of the HAVEQUICK I/II data from the keypad and display.

2.2.3.2.2 COMSEC Key Fill Operation

Figure 2-28 COMSEC Keyfill

NOTE: If the crypto alarm sounds when "COMSEC FILL" is selected, press the PTT once or twice to clear the alarm.

When "COMSEC FILL" is selected, the screen shown in Figure 2-28 appears on the display, with KEY outlined and TEK X next to it (where X can be 1 through 5). The operator selects which key is to be filled by pressing [ENT] to enable changes (selection changes to reverse video (white on black)) and using the [▲] or [▼] keys to scroll through the key locations (the radio has 5 (Saville or Padstone) locations for Traffic Encryption Keys (TEKs)) (there is also a key location reserved for a Saville Key Encryption Key (KEK), which is used for Over-The-Air-Rekey (OTAR).) Only Saville is available for the KEK location. The display will read KEK when the Saville KEK location is selected. When the correct key location is shown, the user presses [ENT] to confirm the selection and then uses the [▼] key to advance to the encryption algorithm field. The operator presses [ENT] to enable changes and then selects which algorithm (Padstone or Saville) is assigned to the key location by using the [▲] or [▼] keys). When the correct algorithm is displayed, the user presses [ENT] to confirm the selection. An encryption algorithm is assigned to a key fill location prior to loading a key into that location. Whenever that particular key is selected for use, the assigned algorithm is also selected (see Key Selection below). To successfully load key, the key location and algorithm must be selected and match information contained within the key being loaded or, in the case of "short" key, match the provided defaults. When the desired key location and algorithm are displayed, the operator presses the PTT switch to load key. The radio signals the keyfill device to begin to output the key. One of the following scenarios are possible: (1) Key is successfully loaded, (2) key is not successfully loaded, or (3) an invalid key is recognized (e.g., a Saville traffic key in location 1) and the radio alarms.

2.2.3.2.2.1 Scenario 1-Key loaded successfully

The display reverts to the key selection screen with the next key location automatically selected. The display automatically advances through locations TEK 1 through TEK 5 and KEK.

2.2.3.2.2.2 Scenario 2-Key not loaded successfully

If a key does not load successfully (due to such causes as not having a key loaded in the keyfill device or a bad connection between the keyfill device and the radio), the display will revert to the key selection screen (Figure 2-28) with the same key location displayed. Check that the keyfill device has a key loaded and that there is a good connection to the radio.

2.2.3.2.2.3 Scenario 3-Alarm Screen

If the key is recognized as an invalid key, the radio will register an alarm (see Default Display, Figure 2-5). The operator must press the PTT to clear the alarm.

When the alarm is cleared by pressing PTT, the process restarts with the COMSEC key fill screen. If the operator continually (more than three times in a row) experiences Scenario 2-Alarm, then either the key fill device is bad, the MBITR is bad, the key fill device has a bad key or no key, or the key fill device is turned off. The operator should turn off and remove the key fill device. Both the MBITR and the key fill device should be checked by the appropriate repair facility.

2.2.3.2.3 TRANSEC (SINCGARS) Key Fill Operation

Figure 2-29 TRANSEC Fill Screen

The MBITR can provide anti-jam protection for transmissions through the use of a transmission security (TRANSEC) frequency hopset and frequency hopping algorithm. Select TRANSEC FILL and press [ENT] to display Figure 2-29. Then connect an Electronic Counter Counter-Measures (ECCM) fill device (MX-18290/VRC) to the audio/keyfill connector (use the audio/keyfill adapter on the maritime version).

2.2.3.2.3.1 Loading FH Frequency Sets

To load one of the SINCGARS hopsets (frequency sets), use the [▲] or [▼] keys to change the third line of the display to CH 1-6 or MAN, corresponding to SINCGARS channels 1-6 and Manual. Press the radio PTT switch.

2.2.3.2.3.2 Loading Lockout Set

To load the SINCGARS lockout set, use the [▲] or [▼] keys to change the third line of the display to LOUT, select the lockout set location on the ECCM fill device, and press the radio PTT switch.

2.2.3.2.4 MODE 2/3 Key Fill Operation

Figure 2-30 MODE 2/3 Key fill

Mode 2/3 Key fill is a method for loading all COMSEC keys and TRANSEC (SINCGARS) hopsets and lockout sets at one time. The device used for performing this key fill method is the AN/CYZ-10, Data Transfer Device (DTD), a hand held device used for display, key preparation, key transmission, key reception, key storage, and key accountability functions. The DTD should be set up for ICOM (Integrated COMSEC) fill. Then follow the instructions on the DTD screen. The DTD will display "Successful Transfer" when the COMSEC keys and SINCGARS loadset are loaded in the MBITR. Complete operating instructions for the DTD are contained in 0N477340, Data Transfer Device Users' Manual.

2.2.3.2.5 HAVEQUICK I/II TOD Fill

Figure 2-31 TOD Selection Screen

Time of Day (TOD) Fill is used to load a HAVEQUICK time of day, transmit a time of day, or perform an Emergency Initialization. To load, first ensure the radio is set to a HAVEQUICK SC channel. Then select TOD from the main keyfill menu and press [ENT]. The TOD selection screen (Figure 2-31) will open. Use the [▲] or [▼] keys to select one of the options and press [ENT].

Figure 2-32 TOD Fill Screen

If "PLGR TOD" is selected, the TOD Fill screen (Figure 2-32) will open. Enable the HAVEQUICK data port on the PLGR by setting HAVEQUICK to ON. The Time Figure of Merit (TFOM) must be less than or equal to 7 and the PLGR must be operating in either CONT or FIX modes. (See PLGR (AN/PSN-11) Operation manual for more information.) Attach the PLGR to the side connector (using a GPS cable, p/n 3500465-501) on the radio and press the radio PTT switch to load the Time of Day.

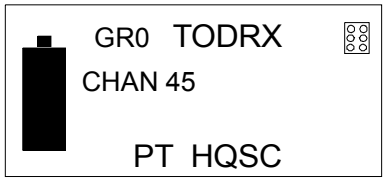


Figure 2-33 TOD RX Screen

If "RX TOD" is selected, the default screen with a flashing "TODRX" message will open (Figure 2-33). The radio is now ready to receive a transmitted Time of Day message. When a TOD message is received, the "TODRX" message will disappear. Pressing [ESC] will also remove the message.

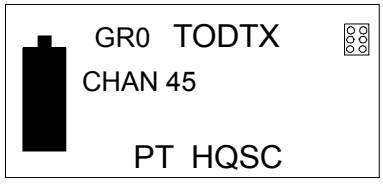


Figure 2-34 TOD TX Screen

If "TX TOD" is selected, the default screen with a flashing "TODTX" message will open (Figure 2-34), if the radio contains a HAVEQUICK TOD. Pressing the PTT will transmit the TOD.

If "EMER INIT" (Emergency Initialization) is selected, the radio is directed to start/restart its HAVEQUICK TOD clock and act as if the time has been received externally. The restart time will be: HOURS = 00, MINUTES = 00, SECONDS = 00, DAY = 0XX (if a day between 01 and 31 has been entered, otherwise = 000), YEAR = 80.

2.2.3.2.6 HAVEQUICK I/II MWOD-A Fill

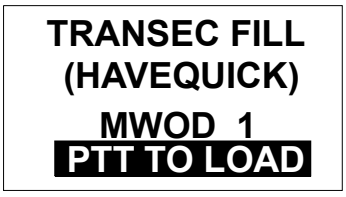


Figure 2-35 MWOD-A Screen

The MWOD-A (Multiple Word of Day) fill selection is used to load the HAVEQUICK I/II MWOD from an external device (such as a KYK-13 or KOI-18). When the fill screen (Figure 2-35) opens, the default location is MWOD 1. Use the [▲] or [▼] keys to scroll through the MWOD values (1-6) to the desired initial location. Press the radio PTT to load the first MWOD set. If the load is

successful, the MWOD value on the screen will increment by one. Continue pressing the PTT until all the MWOD sets are loaded.

2.2.3.2.7 HAVEQUICK I/II MWOD-M Fill

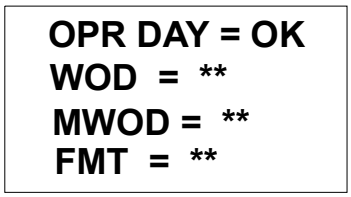


Figure 2-36 MWOD-M Screen

The MWOD-M (Multiple Word Of Day - Manual) screen allows the user to load HAVEQUICK I/II data through the keypad and display. When MWOD-M is selected on the keyfill screen, the first screen that opens (Figure 2-36) is for the selection of individual parameters. "OK" indicates there is already a valid entry for that parameter; "**" indicates that an entry is required.

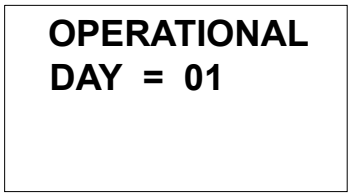


Figure 2-37 OPR DAY Screen

Selecting OPR DAY allows the user to add the Operational Day setting. When the OPR DAY screen (Figure 2-37) opens, press [ENT] to enable the change mode (ones digit will be in reverse video). Use the [▲] or [▼] keys to select the desired value and [ALT] with the [▲] or [▼] keys to move to the tens digit. Allowed values are 01 to 31. (NOTE: The Operational Day will advance at midnight (HAVEQUICK time) to the next value.)

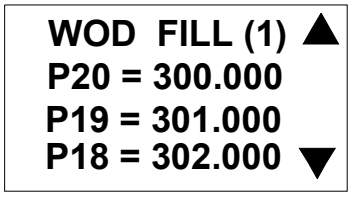


Figure 2-38 WOD FILL Screen

Selecting WOD allows the user to add the HAVEQUICK I Word of Day. The WOD FILL screen (Figure 2-38) opens with P20 outlined. Press [ENT] to enable the change mode and change the values as on previous screens. Allowed values are 225.000 to 399.975. (NOTE: P20 entry must end in 00, 25, or 50.) In order to use a HAVEQUICK I Training Net, the P20 entry must be 300.0XX and a valid HAVEQUICK I training net (see paragraph 2.2.3.3.5 for training net requirements) is selected. Scrolling up from the P20 line reverts to the MWOD-M screen (Figure 2-36); scrolling down from the P18 line opens the second WOD FILL screen (for P17 through P15). Scrolling down from P15 on this screen reverts to the MWOD-M screen.

Selecting MWOD allows the user the add the HAVEQUICK II Multiple Word of Day (Figure 2-39). Use the [▲] or [▼] keys to select MWOD 1-6 and press [ENT] to select one of the MWOD locations. The next screen (Figure 2-40) opens with P20 outlined. Press [ENT] to enable the change mode and change the values as on previous screens. Allowed values are 225.000 to 399.975. (NOTE: P20 entry must end in 00, 25, or 50.) In order to use a HAVEQUICK II Training Net, the P20 entry must be 300.0XX and a valid HAVEQUICK II training net (see paragraph 2.2.3.3.5 for training net requirements) is selected.

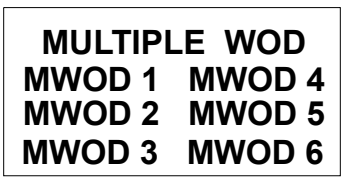


Figure 2-39 MWOD FILL Screen (1)

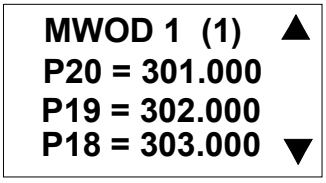


Figure 2-40 MWOD FILL Screen (2)

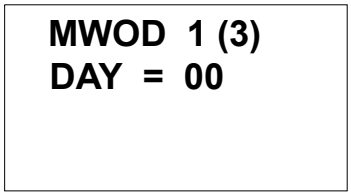


Figure 2-41 WOD FILL Screen (3)

Scrolling up from the P20 line reverts to the MWOD screen (Figure 2-39); scrolling down from the P18 line opens the second MWOD FILL screen (for P17 through P15). Scrolling down from P15 on the second screen opens the MWOD Day of the Month screen (Figure 2-41). Allowed values are 00 to 31. (Entering 00 disables that MWOD.) An MWOD will not be selected unless the MWOD Day of the Month equals the Operational Day. When the radio is in HAVEQUICK II mode, there must be an MWOD with the Day of the Month equal to the Operational Day. The Operational Day automatically advances at midnight (HAVEQUICK time) and there must be an MWOD with Day of the Month equal to the new Operational Day.

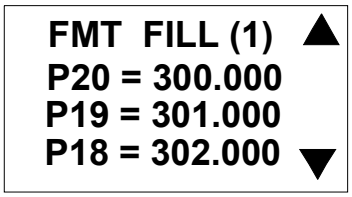


Figure 2-42 FMT FILL Screen

Selecting FMT allows the user to add the HAVEQUICK I/II Frequency Management Training frequencies. The FMT FILL screen (Figure 2-42) opens with P20 outlined. Press [ENT] to enable the change mode and change the values as on previous screens. Allowed values are 225.000 to 399.975 (in 25 kHz increments). Scrolling up from the P20 line reverts to the MWOD-M screen (Figure 2-36); scrolling down from the bottom line opens the second FMT FILL screen, and continuing to scroll down through subsequent screens opens additional FMT FILL screens (six screens in total for values P20 through P05). Scrolling down from the last FMT FILL screen reverts to the MWOD-M screen.

2.2.3.2.8 Key Selection

The INFOSEC firmware controls the encryption key selection. The user can select either plain (PT) or cipher (CT) operation for individual channels (Figure 2-52), as long as a key is loaded in the TEK location assigned to the selected channel (see Basic Channel Programming Options). If ciphertext is selected and no key is loaded into the assigned TEK location, the radio will alarm. Note that selecting key selects the algorithm (Saville or Padstone) assigned to that key (see COMSEC Key Fill Operation). (See 2.2.2.7.1, MODE Select for additional information.)

2.2.3.2.9 Over-The-Air-Rekey (OTAR)

The MBITR can receive, but not transmit, over-the-air-rekey (OTAR). The following instructions are given for transmitting/receiving OTAR using a DTD (AN/CYZ-10) and SINCGARS to transmit the rekey data. Other equipment (e.g., KYX-15) may also be used; consult the SINCGARS operating manual for instructions. In order for the rekey to be successful, the MBITR must be set to the Ciphertext (CT) mode with the same TEK selected as that being used by the transmitting radio. Prior to attempting OTAR, verify that there is secure voice communication between the MBITR and the transmitting radio on the "old" TEK.

a. Preparation:
   1. Load the DTD with the KEK and the new TEK.
   2. Load the MBITR with the KEK and the old TEK.
   3. Load the SINCGARS with the old TEK and the new TEK.

b. On the DTD:
   1. Turn on and select the "Fill" application. Use the 'Utility" function, if necessary, to select the K15 (KYX-15 emulation) protocol.
   2. Press "N" to select the "Net" function.
   3. Press "A" to select the "SARK-AK" function.
   4. Press "CLR" key.
   5. Select the KEK on the DTD screen and press "ENTER".
   6. Press "E".
   7. DTD will briefly display "1 KEK selected" and then display "Select TEK".
   8. Press "CLR".
   9. Select the new TEK on the DTD screen and press "ENTER".
   10. Press "E".
   11. Press "E" again.
   12. Connect the DTD to the SINCGARS (or other sending radio) and press "SEND".
c. The new TEK is transferred. Verify that communications on the old TEK is not possible. Switch the transmitting radio to the new TEK and confirm voice communications.
d. Once successful communications are established with the new TEK, the operator should perform a Variable Update (VU) on the KEK stored in the DTD. The KEK in the MBITR is updated automatically after successful receipt of an OTAR.

2.2.3.2.10 Electronic Remote Fill (ERF)

The MBITR can receive, but not transmit, SINCGARS Electronic Remote Fill (ERF) data. ERF is used to send additional FH data (hopsets and lockout sets) during net opening or to update FH data during net operations . The Net Control Station (NCS) will initiate ERF. The following instructions are for MBITR users:

a. When notified by the NCS of ERF, leave the radio in the current operating configuration.
b. If a hopset is received, the screen will change to Figure 2-44. Use the [▲] or [▼] to select the SINCGARS channel location (1-6) and press [ENT] to store the data.
c. If a lockout set is received, the screen will change to Figure 2-43. The lockout set storage location (1-8) is pre-determined by the Network Controller. Press [ENT] to store the lockout set data.

Figure 2-44 Hopset ERF

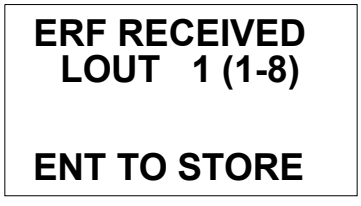


Figure 2-43 Lockout Set ERF

2.2.3.3 Programming

Figure 2-45 Initial Programming Screen

A typical programming screen or menu may contain one or more Sub Menu selections or Field / Item selections. The main menu screen is shown in Figure 2-19. Select PROGRAM and press [ENT] to open the initial programming screen, illustrated in Figure 2-45. The PROGRAM Menu has four available choices: GLOBAL, RADIO CONFIG, EMERGENCY, and GROUP.

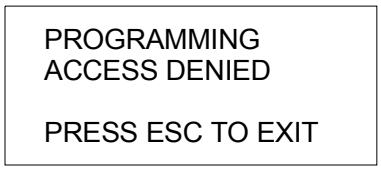


Figure 2-46 Restricted Access Screen

The operator's access to radio programming, and other functions such as Zeroize, can be selectively restricted by the PC Programmer. If a function is disabled for keypad access, the screen in Figure 2-46 will appear when the operator selects that function.

2.2.3.3.1 Global Programming Options

Table 2-3 Global Options

Label	Parameter	Value
TX TIMEOUT	Transmit Timeout (in seconds)	30, 60, 90, 120, INF
BL TIMEOUT	Display Backlight Timeout (in seconds)	10, 20, 30, 40, INF (no timeout)
SET CLOCK	Sets the internal real time clock that is used for frequency hopping operation.	Days (two digit Julian date) and time (in hours and minutes)
SIDE/MIC LVL	Enables or disables Side Connector;	Enable/Disable
	Selects MIC sensitivity for normal (low) or whisper (high) gain. The MIC LOW setting provides normal gain and includes whisper mode at the two lowest settings. MIC HIGH sets the gain to a level higher than the MIC LOW whisper mode setting across all volume settings.	LOW/HIGH

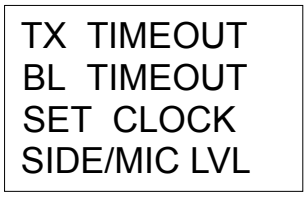


Figure 2-47 Global Programming Screen

The Global Programming Screen (Figure 2-47) opens with SIDE/MIC LVL outlined. The other global parameters are selected by pressing the [▲] or [▼] keys. Pressing [ENT] with any parameter selected accesses a value selection screen with the current selection shown in reverse video. Figure 2-48, Figure 2-49, Figure 2-51, and Figure 2-50 show the different value screens. Pressing the [▲] or [▼] keys will move the highlighting to a new value. To select the new value, press [ENT]. To exit the menu structure, press the [ESC] key.

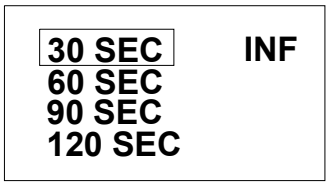


Figure 2-48 Transmit Timeout Screen

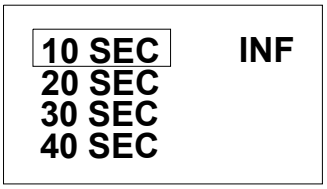


Figure 2-49 Backlight Timeout Screen

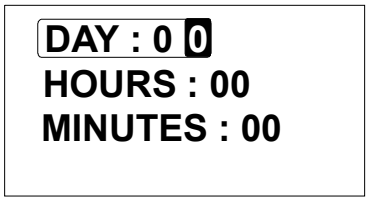


Figure 2-50 Set Clock Screen

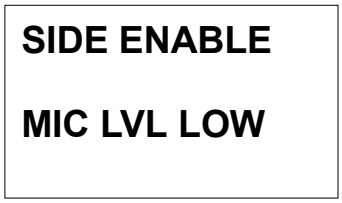


Figure 2-51 Side Connector Enable

2.2.3.3.2 RADIO CONFIG

The RADIO CONFIG screen (Figure 2-52) allows the user to program the general channel values (channel number, encryption mode, channel label, and output (TX RF) power) and select the operating mode (the type of radio operation to be programmed in a channel). The screen opens with the Channel Number outlined. To change the units digit, press [ENT] to show the units digit in reverse video (white on black) and use the [▲] or [▼] keys to scroll up or down. To move to the next digit to the left, press [ALT] and [▲] and then scroll up or down using the [▲] or [▼] keys. To move to the encryption mode setting, press [ENT]. To change the setting, press [ENT] again and use the [▲] or [▼] keys to toggle between PLAIN and SECURE. To move to the Channel Label, press [ENT]. To change the label, press [ENT] again. The rightmost character is now in reverse video. To select a new character, scroll up or down using the [▲] or [▼] keys through the 36 alphanumeric characters. When the desired character is displayed, press [ALT] and [▼] to move the highlighting to the next character. When all the characters of the new label have been selected, press [ENT] to confirm and move the outline to the output power setting. Press [ENT] again to change to reverse video and press the [▲] or [▼] keys to scroll through the available power settings. Press [ENT] to confirm and move to the operating mode [OPER MODE] selection. Press [ENT] to enable the change mode and use the [▲] or [▼] keys to scroll through the different operating modes: Basic (AM or FM), SINCGARS, ANDVT, and HAVEQUICK I/II. *SINCGARS, ANDVT, and HAVEQUICK I/II require optional software.* Select the radio operating mode and press [ENT] to confirm. To scroll through the selections or move to the next screen, press [▼] (see Figure 2-53). To scroll

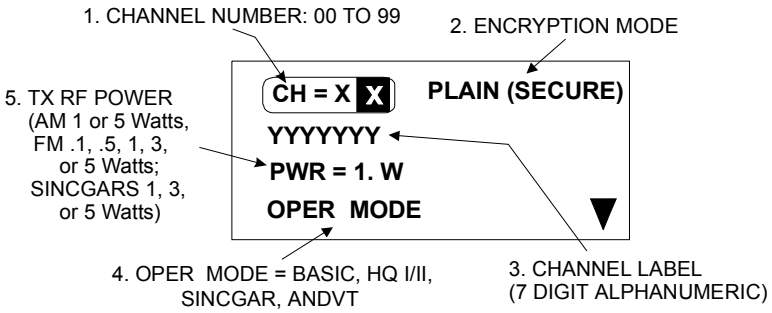


Figure 2-52 RADIO CONFIG Screen

up the screen to previous selection or to return to this screen from the following screen, use the [▲] key. On the following screens, only the programmable parameters available for the selected operating mode are displayed; other parameters are blanked out.

2.2.3.3.3 Basic Channel Programming Options

The Basic Channel Programming screens (two screens) allow the user to set channel-specific parameters from the front keypad and display. The actual programmable parameters displayed will vary depending on the individual channel configuration (operating mode). If a parameter is not available in a certain configuration, that selection will be blanked out on the display. Individual channels can be programmed for:

Table 2-4 Channel Options (Basic)

Parameter	Value
RX / TX	Receive/Transmit Frequency 30-512 MHz
R / T	Receive/Transmit Squelch (CTCSS) tones - see paragraph 1.3.1.2 (FM only)
Modulation type	AM (Amplitude Modulation)(25 kHz), FM (Frequency Modulation)(25 kHz), or NB (Narrowband FM)(12.5 kHz)
COMSEC key	Select key location TEK 1-5 (Saville or Padstone)
Initial Synchronization	OFF/ 256 msec / 384 msec/ 1.06 second
Traffic Rate	12 or 16 kbps
Fade Bridge (in seconds)	1.0, 2.0, 3.0, 4.0, 0.0
Repeater Delay (in seconds)	.2, .4, .6, .8, 1, NONE
Squelch Level	6, 8, 10,12, 14, 16 dB (above background)

The Basic Channel Programming Screen (Figure 2-53) opens with the RX (receive) frequency outlined. To change the frequency, press [ENT] to highlight the rightmost significant digit of the frequency with reverse video. To change the units digit, scroll up or down using the [▲] or [▼] keys. To change the first digit of the frequency, press [ALT] and [▲] to move the reverse video highlighting and then scroll up or down using the [▲] or [▼] keys. Change the remaining digits of the frequency by pressing [ALT] and [▲] and then scrolling up or down using the [▲] or [▼] keys. Note that the TX frequency changes as the RX frequency is changed. To confirm the new frequency and move the selection outline to the TX (transmit) frequency, press [ENT]. Press [ENT] again to enable the change mode. By pressing the [▲] or [▼] keys to change the displayed values, and [ALT] and [▲] to move the highlighting, program in a new TX frequency. Note that when the TX frequency is changed, the RX frequency does NOT change. Press [ENT] to move to the RX CTCSS selection and [ENT] again to enable the change mode. For programmable parameters that have a limited number of choices (squelch tone, modulation, encryption key location, receive and fade delay, synchronization, and traffic rate), scroll through a list of the available choices by pressing the [▲] or [▼] keys. When the desired choice is displayed on the screen, press [ENT] to move to the next parameter. Alternately, if you do not

want to change a selection, press the [▼] to move to the next line (or the next screen) or [▲] to move to the previous line (or previous screen).

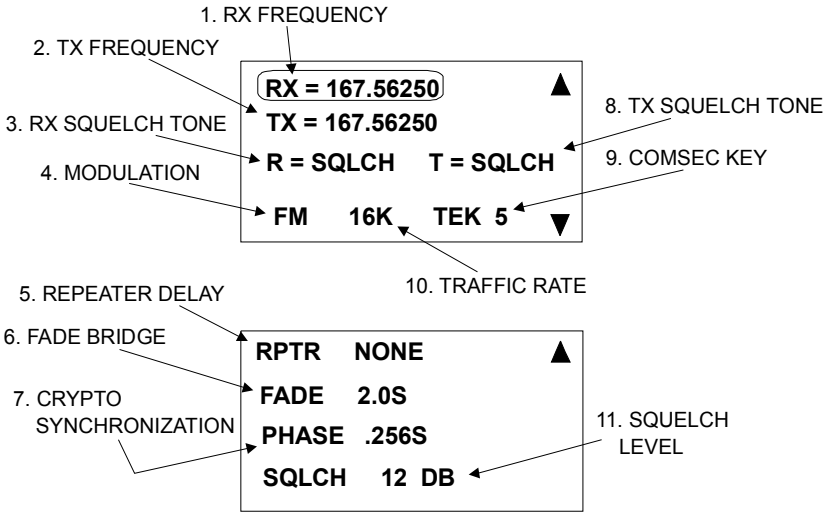


Figure 2-53 Basic Channel Programming Screens

2.2.3.3.4 SINCGARS Channel Programming Options

The SINCGARS Channel Programming screens (two screens) allow the user to set channel-specific parameters from the keypad and display. Individual channels can be programmed for:

Table 2-5 Channel Options (SINCGARS)

Parameter	Value
SINCGARS	SINCGARS Channel: 1-6, MAN, CUE
ECCM	Electronic Counter Counter-Measures Mode: SC (Single Channel) or FH (Frequency Hopping)
FX	Single Channel Frequency: 30.000 MHz to 87.975 MHz in 25 kHz steps
OFFSET	Frequency offset (in kHz) (single channel): -10, -5, 0, +5, +10
NET ID	Communications Net Identification Number: 000 to 999
DATA	Data Transmission Rate: 600, 1200, 1200N, 2400, 2400N, 4800, 4800N, 9600N, 16000, PCKT (Packet), or RS232
TEK	COMSEC key location: TEK 1-5
FADE	Fade Bridge (in seconds): 1.0, 2.0, 3.0, 4.0, 0.0

The SINCGARS Channel Programming Screen (Figure 2-54) opens with the SINCGARS channel selection outlined. To change the selected channel, press [ENT] to highlight the channel number and scroll up or down using the [▲] or [▼] keys. To confirm the new channel and move the selection outline to the ECCM mode, press [ENT]. The remaining parameters are changed similarly. Note that modulation Type (FM) cannot be changed.

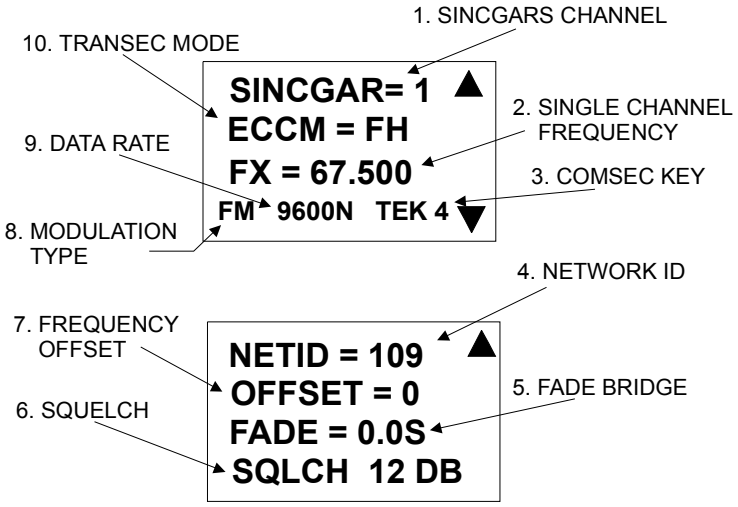


Figure 2-54 SINCGARS Channel Screens

2.2.3.3.5 HAVEQUICK Channel Programming Options

The HAVEQUICK Channel Programming screens (two screens) allow the user to set channel-specific parameters from the front keypad and display. If ECCM = SC, the first line will show FX = ; if ECCM = FH, the first line will show NET =. Individual channels can be programmed for:

Table 2-6 Channel Options (HAVEQUICK)

Parameter	Value
FX	HAVEQUICK Single Channel Frequency; 25 kHz tuning steps must end in 00, 25, 50, or 75
NET (Alternate)	HAVEQUICK I and II Nets; must end in 00, 25, or 50
ECCM	Electronic Counter Counter-Measures Mode: SC (Single Channel) or FH (Frequency Hopping)
TEK	COMSEC key location: TEK 1-5
RPTR	Repeater Delay (in seconds): Disabled in HAVEQUICK I/II
FADE	Fade Bridge (in seconds): 1.0, 2.0, 3.0, 4.0, 0.0
PHASE	Initial Crypto Synchronization Preamble Length: OFF/ 256 msec / 384 msec/ 1.06 second
SQLCH	Squelch Level: 6, 8, 10,12, 14, 16 dB (above background)

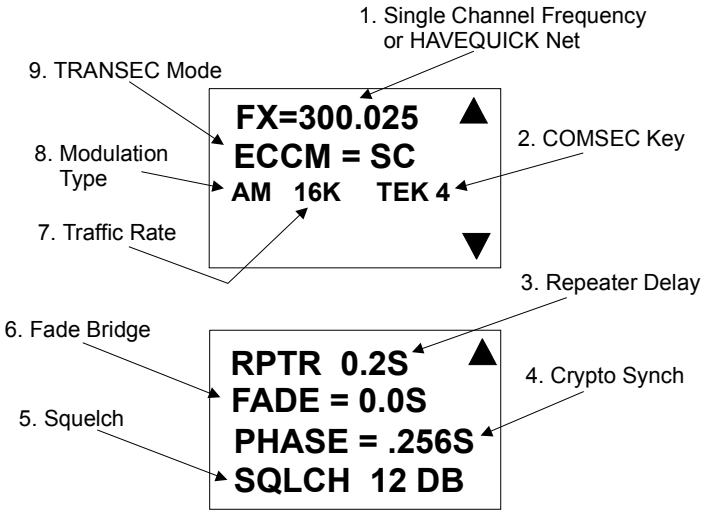


Figure 2-55 HAVEQUICK Channel Screens

The HAVEQUICK Channel Programming Screen (Figure 2-55) opens with the HAVEQUICK Net (NET) or Single Channel Frequency (FX) outlined. To change the selected net or frequency, press [ENT] to highlight the rightmost digit and scroll up or down using the [▲] or [▼] keys. To move to the next digit, hold down the [ALT] key and press the [▲] or [▼] key. When the new frequency or net is keyed in, press [ENT] to confirm the information and move the selection

outline to the ECCM mode. The remaining parameters are changed similarly. Note that Modulation Type (AM) and Traffic rate (16K) cannot be changed.

To use the HAVEQUICK Training Nets, NET must be set to A00.000 – A00.400 for HAVEQUICK I or A00.025 – A01.525 for HAVEQUICK II. P20 of the WOD (for HAVEQUICK I) or MWOD (for HAVEQUICK II) must be set to 300.0xx.

2.2.3.3.6 ANDVT Channel Programming Options

The ANDVT Channel Programming screens (two screens) allow the user to set channel-specific parameters from the keypad and display. Individual channels can be programmed for:

Table 2-7 Channel Options (ANDVT)

Parameter	Value
RX / TX	Receive/Transmit Frequency 30-512 MHz
DELAY	135, 295, 600, 895, 1200 (msec).
Modulation	PSK (Phase Shift Keying) (Fixed)
Data Rate	2.4 kbps (Fixed)
COMSEC Key	TEK 1-5
Repeater Delay (in seconds)	.2, .4, .6, .8, 1, NONE
Fade Bridge (in seconds)	1.0, 2.0, 3.0, 4.0, 0.0
Training Frames	Number of frames = 6, 9, 12, 15, 30, 60.
Squelch Level	6, 8, 10,12, 14, 16 dB (above background)

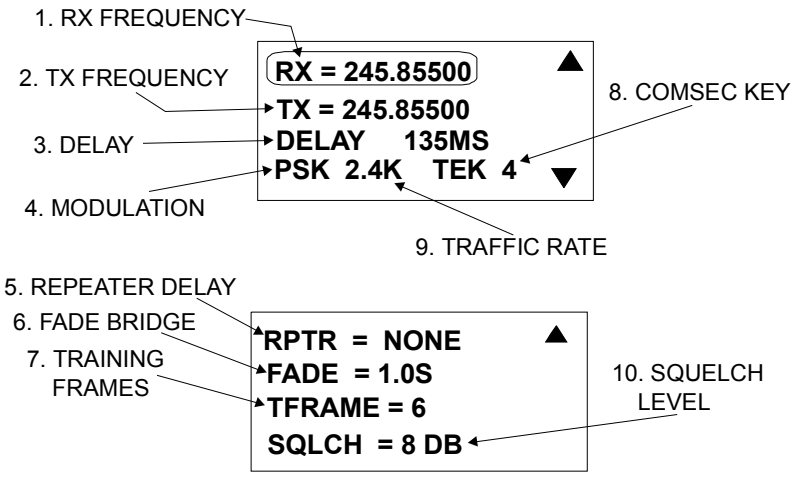


Figure 2-56 ANDVT Channel Screens

The ANDVT Channel Programming Screen (Figure 2-56) opens with the RX (receive) frequency outlined. The RX and TX frequency programming are identical in operation with the Basic

Channel. Other parameters are programmed similarly. Delay is the time between the transmit carrier going active without modulation and the carrier having modulation applied. A training frame is a 32-bit pattern of alternating "0s" and "1s". Training frames are used to improve the chances of initial signal acquisition by providing a repetitive pattern for synchronization and mode identification. Using the maximum setting of 60 frames will extend the turnaround time of communications due to the increased header times.

2.2.3.3.7 Group Programming Options

Table 2-8 Group Options

Parameter	Value
Group Number	One digit: 0-9
Group Label	Three characters: A-Z, 0-9, @, ?, >, <, ;, :, and blank
Channel Number	00-99
Channel Select Switch Position	1-16

The Group Programming Screen (Figure 2-57) displays the current Group Number, Group Label, the current Channel Number, and the corresponding Channel Select switch position. The GROUP programming screen allows the user to add and remove individual channels from a group, assign a selected channel to a selected channel switch position, and change a group label. The screen opens with "GR = " outlined or selected. Pressing the [▲] or [▼] keys will increment or decrement the Group Number. To move to the first character of the group label (GR2 on the sample screen), press [ENT]. Press [ALT] and [▲] to select the second character, and [ALT] and [▲] again to select the third character. To change any of the selected characters, press the [▲] or [▼] until the desired character appears on the screen. To select the tens digit of the channel number (CH=49), press the [ENT] key, then [▼] to move the selection outline, and then [ENT] again. To change this digit, use the [▲] or [▼]. Press [ALT] and [▲] to move to the units digit and use the [▲] or [▼] to change the selected digit. When the user changes the rotary switch position, the channel number and switch position shown on the display will also change. To add or change a channel in the current group, place the rotary switch on the desired location, set the desired channel, and move the selection outline to ENABLED (using the [▲] or [▼] keys to move the selection outline). Press [ENT] and then [▲] or [▼] to toggle between ENABLED (which adds the channel in the current switch position) and DISABLED (which removes the channel and makes the current switch position EMPTY). To exit the Group Programming Screen, press the [ESC] key twice.

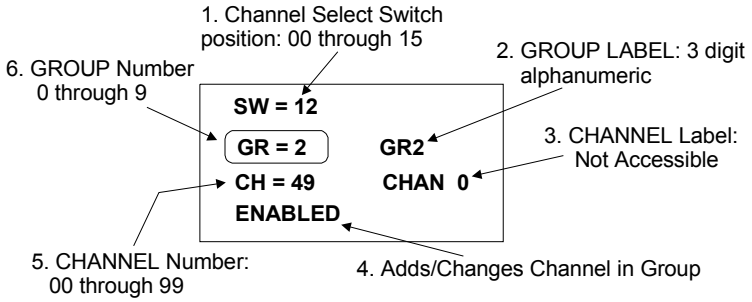


Figure 2-57 Group Programming Screen

2.2.3.3.8 Emergency Programming Options

The Emergency Programming screen (Figure 2-59) is accessed from the main function menu (Figure 2-19). This screen allows the user to select either the user-programmable emergency beacon channel (Figure 2-60) or situation awareness (Figure 2-58) programming. The user-programmable parameters for the emergency beacon channel are: transmit frequency and transmit on/off times. The transmit frequency is limited to the range of 116.00-149.975 MHz or 225.00-399.975 MHz. The transmit on/off times can be set to a maximum of 30 seconds each. For situation awareness, the user can set the Combat Identification (CID) and enable the radio to transmit and receive GPS data through the situation awareness mode of operation. **NOTE:** In addition to enabling TX SA and RX SA, the radio must be in CT mode for Situation Awareness to be active.

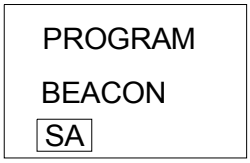


Figure 2-59 Emergency Programming Screen

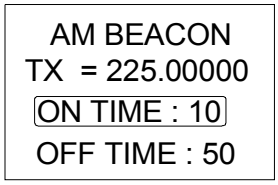


Figure 2-60 Beacon Programming

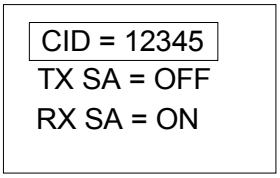


Figure 2-58 SA Programming

2.2.3.4 Radio Maintenance Operation

The available radio maintenance operations allow the user to activate Built-In-Test (BIT) functions, check the internal real-time clock, check the enabled radio options, or display elapsed operating time. The initial Radio Maintenance Screen (Figure 2-61) is reached from the Main Menu Screen (Figure 2-19).

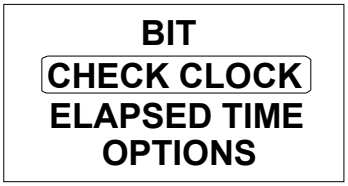


Figure 2-61 Radio Maintenance Screen

2.2.3.4.1 Built-In Test

The Built-In-Test function allows the user to run a self-test of the primary radio boards: Control CCA, Keyfill, Power Amplifier, and Synthesizer. Selecting BIT and pressing [ENT] begins the test. The screen displays "Performing Tests" while BIT is running. At the test conclusion (10-15 seconds), the screen will show the test results (PASS or FAIL) for each board.

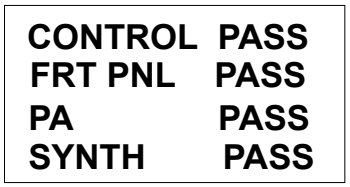


Figure 2-62 Built-In-Test Screen

2.2.3.4.2 Check Clock

The Check Clock Screen allows the user to check the internal real-time clock. The time is displayed in hours:minutes:seconds:tenths of seconds. The Julian day value is from 00 to 99.

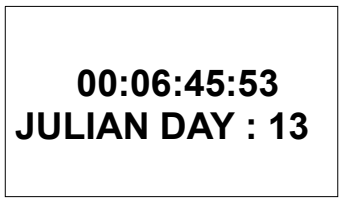


Figure 2-63 Check Clock Screen

2.2.3.4.3 Elapsed Time

The Elapsed Time Screen shows the total time the radio has been in Transmit mode (PTT pressed), Receive mode (actively receiving radio signals with audio output), and Standby mode (powered on but neither transmitting nor receiving). The time is shown in hours:minutes.

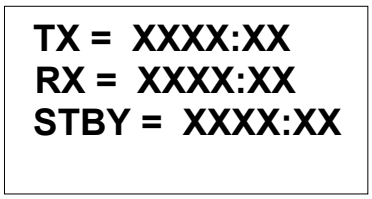


Figure 2-64 Display Elapsed Time Screen

2.2.3.4.4 Options

The Options Screen displays the enabled radio operating software options. The available options are Basic, Retrans, SINCGARS, ANDVT, and HAVEQUICK I/II (HQII). This screen is for information only. The user cannot change the enabled options.

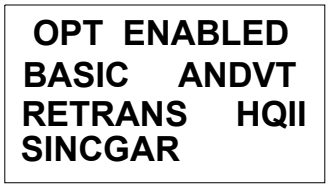


Figure 2-65 Options Enabled Screen

2.2.4 SCAN

The SCAN, or channel monitoring, function allows the radio to monitor traffic on multiple channels. SCAN can monitor clear channels and secure channels with different TEKs and different traffic rates (either 12 or 16 kbps). SCAN does NOT monitor frequency hopping channels. If a frequency hopping channel is included in a SCAN Plan, that channel is skipped during scanning. If SCAN is selected while the radio is set to a frequency hopping channel, SCAN will not initiate. If a Scan Plan contains both Basic and ANDVT channels, the radio will scan either Basic or ANDVT channels, depending on which type is the Home Channel when Scan is initiated.

2.2.4.1 Definitions

2.2.4.1.1 Home Channel

The Current Selected Channel becomes the “HOME” channel from which all other channels are scanned. Normal receive and transmit operations may only be performed from the Home channel.

2.2.4.1.2 Normal SCAN

In Normal SCAN mode, the radio scan function sequentially checks each channel in the current selected Scan Plan for radio signals. If a signal is detected, the radio pauses on that channel until 2 seconds after activity ceases (to allow the user an opportunity to answer). If the user presses the PTT switch during the 2 second “hold” period, the radio will automatically transmit on the received scan channel.

2.2.4.1.3 Priority Monitor

In Priority Monitor mode, the radio alternates between the Scan Plan channels and either one or two Emergency Monitor (Priority) channels in the following sequence (Priority channels are PR1 and PR2): PR1-PR2-CH1-PR1-PR2-CH2-PR1-PR2-CH3-PR1 . . . . ..

2.2.4.2 Scan Operation

Open the initial SCAN operation screen (Figure 2-66) by pressing [ALT] and [GR] from the default display (Figure 2-5). The display has four choices: SCAN (enable), PRI (Priority selection), SPLAN (select a scan plan), and CONFIG (program a scan plan). Press [▲] or [▼] and then [ENT] to select one of the choices. Press [ESC] to return to the Main Menu.

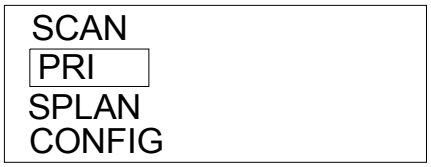


Figure 2-66 SCAN Operation Screen

2.2.4.2.1 Active SCAN Screen (SCAN)

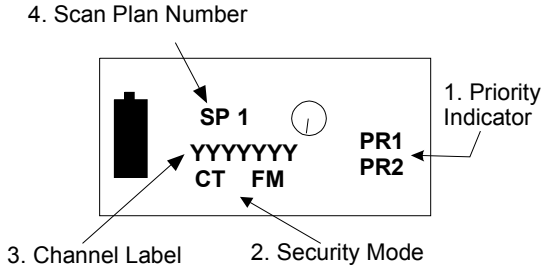


Figure 2-67 Active SCAN Screen

The screen for Active Scan (Figure 2-67) shows the channel and Scan Plan label for the Home Channel (the channel selected by the channel select switch). If the Priority Channel Scan has been activated (see following paragraph), the display will include PR1 and/or PR2. If a signal is detected on one of the channels being scanned, the radio will stop scanning and remain on the received channel as long as a signal is present. The channel label on the display is updated to reflect the active channel. The radio will remain on the received channel for approximately 2 seconds after a signal ends to allow the operator to respond to the received traffic. The Scan function can be stopped (and the display returned to the default screen (Figure 2-5)) by pressing the [ALT] and [GR] or [ESC] keys.

2.2.4.2.2 Priority Channel Assignment Screen (PRI)

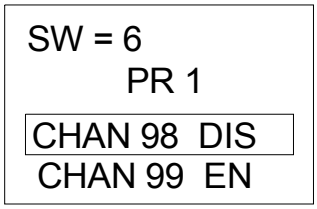


Figure 2-68 Priority Channel Assignment

The Priority Channel Assignment Screen (Figure 2-68) allows the user to select the Priority 1 and Priority 2 channels from the channels already programmed in the selected scan plan. To select, move the outline to either the first or second channel label (PR 1 or PR 2) and turn the channel select knob on top of the radio. The channel label associated with that switch position will appear on the display. When the desired channel is displayed, press [ENT] to switch to reverse video. Use the [▲] or [▼] keys to toggle between EN (enabled) and DIS (disabled). Press [ENT] again to confirm the selection and move the outline to the next selection. When finished, press [ESC] to the Scan Operation screen (Figure 2-66) with the enabled priority selections displayed. The default Priority channels are the last two channels in the radio.

2.2.4.2.3 Select SCAN Plan (SPLAN)

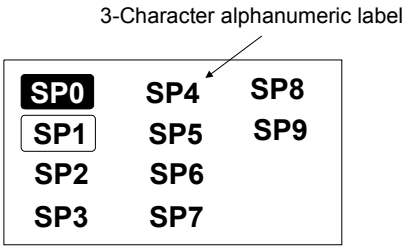


Figure 2-69 Select SCAN Plan

The Select Scan Plan screen (Figure 2-69) opens with the selected Scan Plan highlighted in reverse video. To select a different Scan Plan, use the [▲] or [▼] keys to move the selection outline. Press [ENT] to select the new Scan Plan and return to the Scan Operation screen (Figure 2-66).

2.2.4.2.4 Configure SCAN Screen (CONFIG)

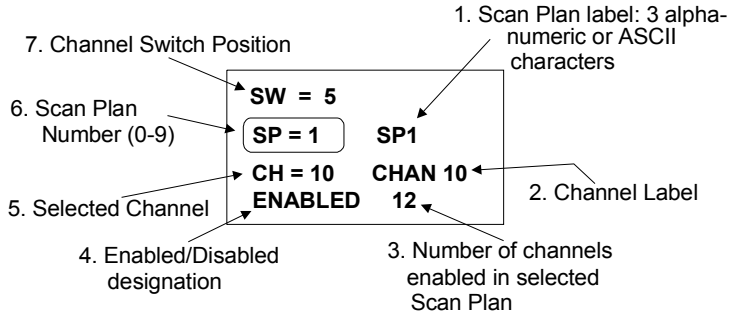


Figure 2-70 Configure SCAN Screen

This screen (Figure 2-70) opens with "SP = " outlined or selected. Press [ENT] to enable the change mode and press [▲] or [▼] to increment or decrement the Scan Plan number. To confirm the change and move to the Scan Plan label, press [ENT] and then [▼]. To change the label, press [ENT] to highlight the first character and press [▲] or [▼] to change. Press [ALT] and [▲] to select the second character, and again to select the third character. Use [▲] or [▼] to change the selected character. To confirm the change and move to the channel number, press [ENT] and [▼]. The channel selection is used to both add and remove channels from a Scan Plan and assign the selected channel to a selected channel switch position. By changing the position of the channel select rotary switch, the "Switch Position" on the screen will change. The selected channel will be "mapped" to the displayed switch position. When the selected channel is outlined, press [ENT] to highlight the tens digit and press [▲] or [▼] to change. Press [ALT] and [▲] to select the units digit. As the channel number is changed in the CH= X display, the label displayed in the CHAN position also changes. Press [ENT] to confirm the channel number and press [▼] to move the selection outline to the Enabled/Disabled position,. Press [ENT] again to enable the change mode and [▲] or [▼] to toggle between ENABLED (included in the selected Scan Plan) and DISABLED (excluded from the selected Scan Plan). Press [ENT] to confirm the change. To exit the Configure SCAN Screen, press [ESC].

2.2.5 Cloning Operation

NOTE

COMSEC/TRANSEC keys cannot be transferred via the cloning mode. HAVEQUICK Operational day, WOD, MWOD, and FMT are transferred.

NOTE

Ensure that both radios are set for INTERNAL AUDIO and SIDE CONNECTOR ENABLED.

The cloning function enables one radio to transfer its programmed data into another radio.

To clone programmed information from one radio to another, connect the SEND end of the cloning cable (3500395-501) to the side connector of the Sending radio (the radio set with the information to be cloned) and the RECEIVE end of the cloning cable to the side connector of the Receiving radio (the radio set to receive the information). Turn on power to both radios (if they are not already both powered on). The cloning cable detects which radio is the Sending radio.

After the initial power-up screen (see paragraph 2.2.2), the following screens will appear:

Sending Radio	Receiving Radio
CLONING PTT TO SEND	CLONING RECEIVE RDY

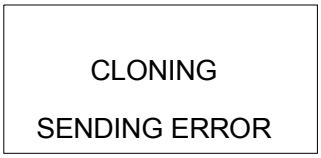
The Sending radio has a timeout period of approximately 20 seconds during which it attempts to establish the connection to the Receiving radio. At the end of the timeout period, if connection is not made, the Sending radio will display an error message.

Press PTT on the Sending radio and the screens should appear as below:

Sending Radio	Receiving Radio
CLONING SENDING DATA	CLONING RECEIVING

When cloning is successfully completed, the receiving radio will reboot and resume normal operation. If the receiving radio is NOT disconnected from the cloning cable or powered off within 15-20 seconds, it will again display the "RECEIVE RDY" message. Press [ESC] to clear the cloning screen from the SEND radio and return to the default display.

If cloning is unsuccessful, or if the connection with the receiving radio is not made within the timeout period, the SEND radio will display the following error message:



2.2.6 Digital Data Operation

NOTE

Ensure the channel is set for encrypted mode (CT) and that the SIDE CONNECTOR ENABLED.

In order to send or receive digital data, the radio MUST be operating in the encrypted mode AND operating in AM or FM 25 kHz bandwidth (not narrowband (NB)). The radio can also operate in digital data mode when SINCGARS Single Channel or Frequency Hopping channels are selected. If the data cable is connected when the radio is set for clear operation, the ERROR message will flash on the screen and an audio alarm will sound.

To configure the radio for digital data operation, first select the encrypted operating mode (see Figure 2-15). Then attach the PDC Data Cable (3500466-501) to the radio side connector and to the 25-pin flat serial connector of the ViaSat VDC-400 Personal Data Controller (PCMCIA card). The digital data cable has a switch on the side connector that allows either voice or data operation. When data operation is selected, the display screen appears as shown in Figure 2-71.

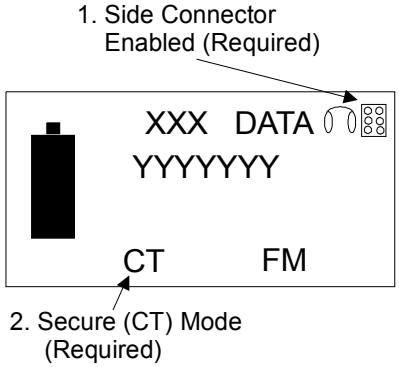


Figure 2-71 Data Operation Screen

When data operation has been selected, all operational control of the radio is transferred to the data terminal device. The radio cannot receive or transmit voice traffic. When voice operation is selected, the radio operates as if the cable was not connected.

The PDC Data Cable (3500545-501) operates in a similar manner with the ViaSat VDC-200 Compact Data Controller.

The digital data cable (3500396-501), which connects to a standard 25-pin serial connector, can provide similar capability with selected data terminal software. However, the primary use is in testing radio Bit Error Rate (BER) in data operation.

2.2.7 Expedient Retransmission

The MBITR has the capability for "expedient retransmission" when operating in the Basic or ANDVT mode. Note that both radios must be "Basic" or both radios must be "ANDVT". Using two radios (Radio A and Radio B) and an expedient retransmission cable (3500485-501), the retransmission configuration is bi-directional (i.e., can receive and retransmit voice or data, clear or secure traffic on two different frequencies (receive on A and retransmit on B or receive on B and retransmit on A)).

The radio setup for retransmission is flexible. The retransmission channel(s) on each radio can be programmed for either simplex (same receive and transmit frequency) or half-duplex (different receive and transmit frequency) operation. The amount of separation between the receive and transmit frequencies (to prevent accidental keying) is dependent on several factors: the actual frequencies selected, the use of filters or a diplexer, and the use of receive CTCSS tones. (NOTE: CTCSS tones are only functional in PT mode.) The current retransmission cable is 10 feet in length. Planned receive and transmit frequencies for retransmission should be tested BEFORE being used in the field.

To activate the retransmission mode, with both radios powered up, connect each end of the retransmission cable to one of the radio side connectors. (Check that the side connector is "ENABLED" on both radios.) Retransmission is completely bi-directional, so the cable is identical at each end. Each radio displays "RETRANS" on the default screen (Figure 2-72).

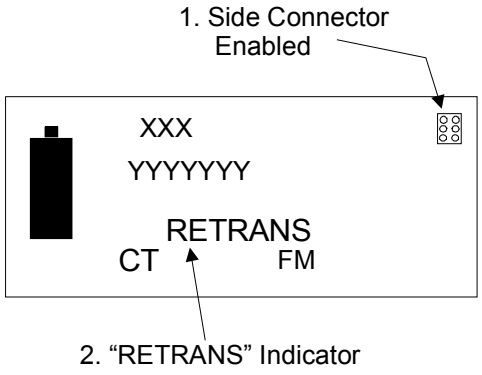


Figure 2-72 RETRANS Enabled

The radios can be set for clear (PT) or secure (CT) mode: connecting the retransmission cable will force the radios into a "RETRANS" CT mode that does not require a COMSEC key to be loaded. This allows the radios to handle both clear and secure messages. The radios can be set to any modulation type that the basic (fixed frequency) radio supports, keeping in mind that a received secure AM or FM signal cannot be retransmitted in NB since NB only supports clear. The over-the-air rate (12k or 16k) must be programmed in the channel and must be the same in both radios. The radio does not auto detect the different rates. The global setting "TX TIMEOUT" should be enabled to prevent the radios from locking into a transmit loop.

CHAPTER 3 PRINCIPLES OF OPERATION

Section I. FUNCTIONAL SYSTEM(S) OPERATION

3.1 General

This section describes the theory of operation of the radio set. From both technical and operational standpoints, the radio set is designed to be a component of a communications system. A radio set must function in conjunction with other similar AM and FM radios to perform its purpose: two-way communication. However, it does not depend on other radios for its proper functioning or performance.

3.2 Functional System(s) Operation

Paragraphs 3.2.1 through 3.2.6 provide a limited system description of the radio set. The block diagram (Figure 3-1) shows the interrelationship between the main elements of the radio set.

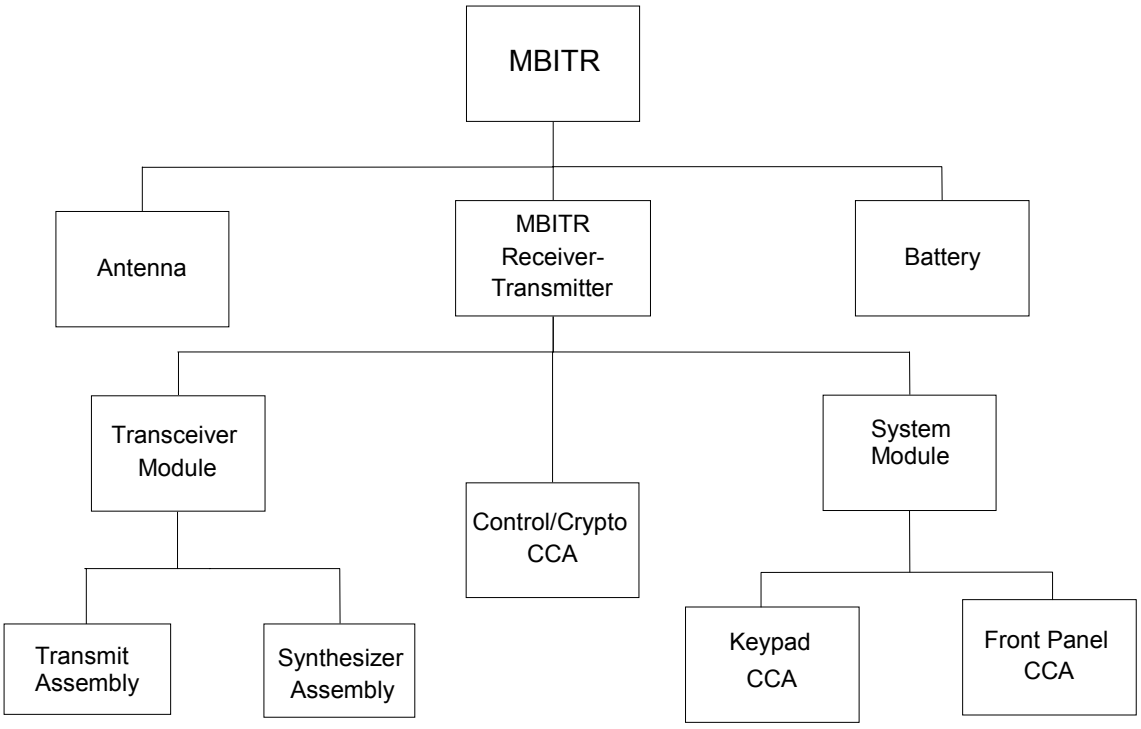


Figure 3-1 Radio Set, Simplified Block Diagram

3.2.1 Transceiver Module

The transceiver module, which mates with the radio set chassis to complete the MBITR assembly, covers the entire 30-512 MHz frequency range. The transceiver module is made up of two circuit card assemblies: the Transmit Assembly and the Synthesizer Assembly. The transceiver provides frequency and changeover control for either transmitting or receiving a signal, as well as the modulator and power amplifier for the MBITR.

3.2.1.1 Transmit Assembly

The Transmit Assembly includes the receiver-transmitter back cover and the Transmit CCA, which contains the radio transmitter output and receiver front-end circuits. These include the transmitter selectable low-pass filters, the low noise RF amplifier, the receive filters, and the output amplifier.

3.2.1.2 Synthesizer Assembly

The Synthesizer Assembly includes RF shields and the Receiver/Synthesizer CCA, which contains the frequency synthesizer circuits, the different oscillators (reference, VCO, and local), the analog-to-digital and digital-to-analog converters, and the receive demodulation circuits. These include the receive signal mixers, the different frequency synthesizers, and the synthesizer tuning loops.

3.2.2 Control/Crypto CCA

The Control/Crypto CCA uses a Field Programmable Gate Array (FPGA) and multiple Digital Signal Processors (DSPs) to control the selection of transmit and receive signal processing in both the clear and encrypted modes. The control/crypto CCA provides operator interface via the PTT switch.

The Control/Crypto CCA contains the on-board NSA approved COMSEC device that is used to provide encryption and decryption of digitized voice signals (VINSON coded or FED-STD-1023). The COMSEC device stores the key data information that is used to provide the crypto capability within the MBITR.

The Control/Crypto CCA uses individual, separated power circuits for clear and encrypted signals. Since key data is lost when power to the MBITR is removed, there are hold-up capacitors (located on the Front Panel CCA) that provide a short period of power backup before clearing the crypto key data after the battery is removed. Key data may be cleared manually by means of the panic zeroize, which clears all keys, or selectively by using the Zeroize menu. The panic zeroize function can be performed with or without the MBITR being turned on.

3.2.3 Radio Systems Module

The radio systems module consists of the keypad CCA, the Front Panel CCA, the LCD module, and the chassis assembly. The systems module, together with the control/crypto CCA and the transceiver module, makes up the MBITR Receiver-Transmitter Unit (RTU).

3.2.3.1 Front Panel CCA

The Front Panel CCA is the primary interface between the radio and the external world. Incoming audio signals can come from any one of three sources: (1) an internal microphone, (2) an external microphone (side connector), and (3) the top audio connector. The user can also provide input to the radio via the keypad, the programmable function switches, and the squelch disable button

3.2.3.2 Chassis Assembly

The MBITR chassis assembly includes the chassis casting, the side connector flexi cable, the battery flexi cable, the mode switch, channel select switch, and power/volume switch flexi cable, the power/volume switch, the audio accessory connector, the antenna connector, and the channel select switch.

3.2.4 Rechargeable Lithium Ion Battery

The rechargeable lithium ion (Li-Ion) battery provides attachable battery power to the MBITR (see Figure 1-1). The Li-Ion is a renewable energy source that can be recharged by the single and multiple battery chargers or the SPAI. It provides 8 hours of operation with a 1:1:8 transmit to receive to standby (on but neither receiving nor transmitting) ratio duty cycle at 21° C.

CAUTION

Lithium batteries are potentially hazardous if misused or tampered with before, during, or after discharge. Observe the precautions listed in the Safety Summary of this manual. Do not attempt to charge batteries outside the temperature range of 0° to +45° C.

3.2.5 Non-Rechargeable Battery Holder

The non-rechargeable battery holder allows the user to power the radio with commercial/ Government inventory disposable lithium manganese dioxide battery cells (commercial identification Duracell DL-123A or DL-2/3A, Government designation BA-5123/U). The battery holder holds up to 12 individual battery cells. It is nearly identical in shape and function to the rechargeable lithium ion battery pack and provides 8 hours of battery life with a 1:1:8 transmit to receive to standby ratio duty cycle at 21° C.

Section II. FUNCTIONAL OPERATION OF ELECTRONIC CIRCUITS

3.3 30-512 MHz Transceiver Module

The 30-512 MHz transceiver module (see Figure 3-2 for block diagram) consists of two circuit card assemblies (CCAs): the receiver/synthesizer CCA and the transmit CCA.

The transceiver module implements a nominal 5 watt FM synthesized transceiver. It is divided into bandpass filter and antenna switching, receiver, transmitter, synthesizer, digital interface, and miscellaneous functions.

The transceiver module has two receiver-transmitter frequency (RF) connections, one for a top panel TNC antenna socket and one for the MBITR side connector. Switching between them is implemented within the module by a pin diode switch.

Immediately after this relay is a receive/transmit switch, which is used to select either the receive side tunable bandpass filters (for receive) or the transmit low pass filter bank.

3.3.1 Receiver/Synthesizer CCA

The following functions are located on the Receiver/Synthesizer Board:

- Reference Oscillator
- Synthesizer/VCOs
- Local Oscillators
- IF Chain
- EEPROM Calibration Data.

3.3.2 Transmit CCA

The following functions are located on the Transmit Board:

- RF Power Amp
- Transmit Harmonic Filters
- Transmit/Receive Switch
- Receive Bandpass Filter
- Low Noise Amp (LNA)
- EEPROM Calibration Data.

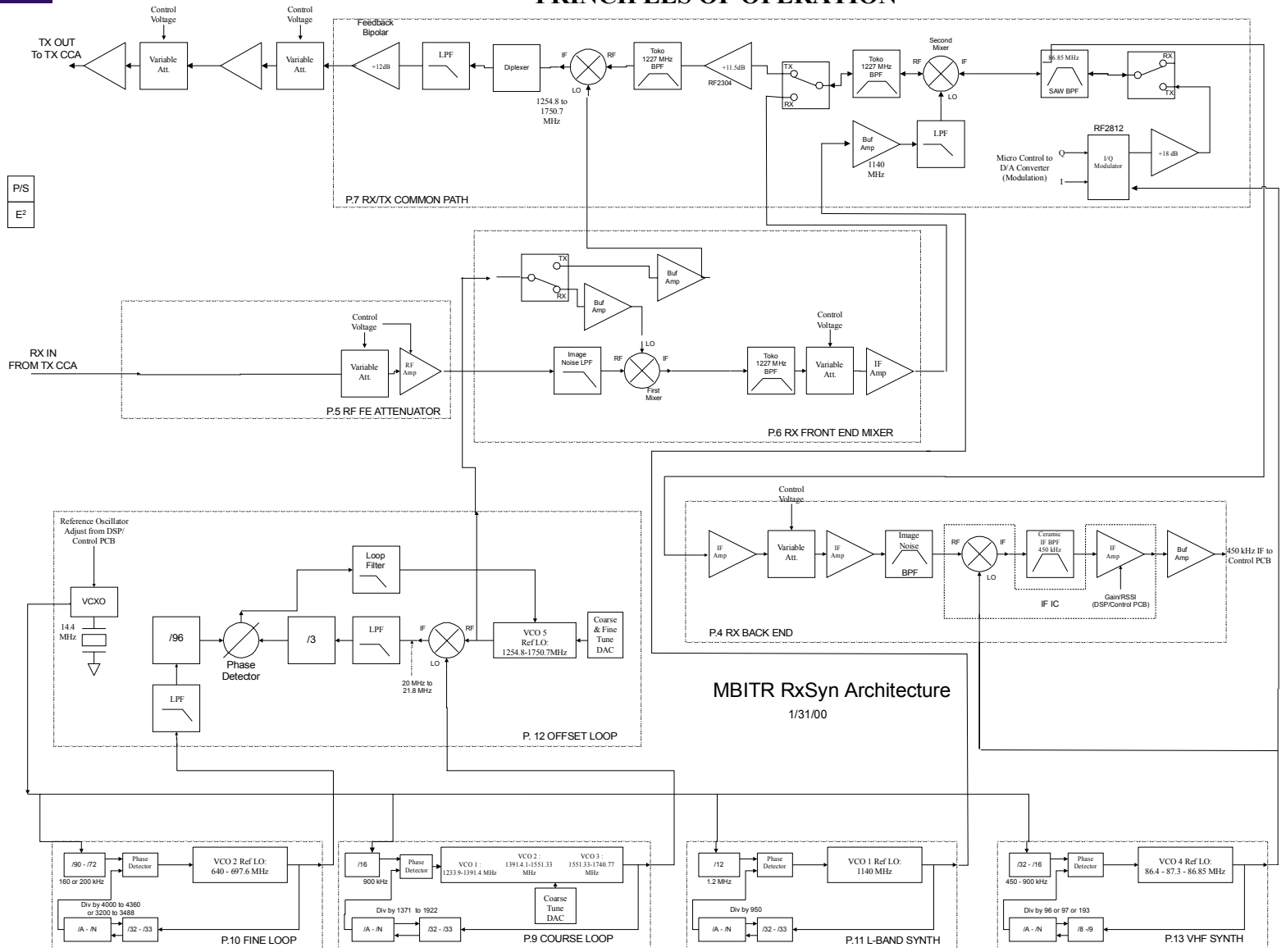


Figure 3-2 Transceiver Module Block Diagram

3.4 Control/Crypto Circuit Card Assembly (CCA)

Refer to Figure 3-3 for the block diagram for the control/crypto CCA. As shown, the control/crypto CCA consists of the following functional elements:

3.4.1 Microcontroller

- Mode Selection
- Key Selection
- Algorithm Selection
- Selective Zeroization
- Providing for TRANSEC key, Hop Set, and Lockout Set transfer and storage
- Global, Channel, and Calibration programming Interface
- Interface to allow re-programming of the operational firmware
- RED and BLACK DSP Status and Control Interface.

3.4.2 Cryptographic Module

- Initialization
- Encryption
- Decryption
- Error Detection
- Cryptovariable Fill, and Key Management
- Cryptographic Algorithm
- Cryptographic Synchronization
- COMSEC Alarm and Alarm Checks.

3.4.3 RED DSP

- Pre-Emphasis
- Transmit Audio Bandpass Filter
- CVSD Encoding
- CVSD Decoding
- De-Emphasis
- Receive Audio Bandpass Filter
- Warning and Alarm Tone Generation
- Data Interface Processing.

3.4.4 BLACK DSP

- Synthesizer Control
- Transceiver Control
- Demodulation
- Bit Synchronization
- Clock Recovery
- Implements the TRANSEC algorithm (KGV-10) and provides the TRANSEC functionality for frequency hopping.
- CTCSS Tone Generation
- CTCSS Tone Detection
- Modulation.

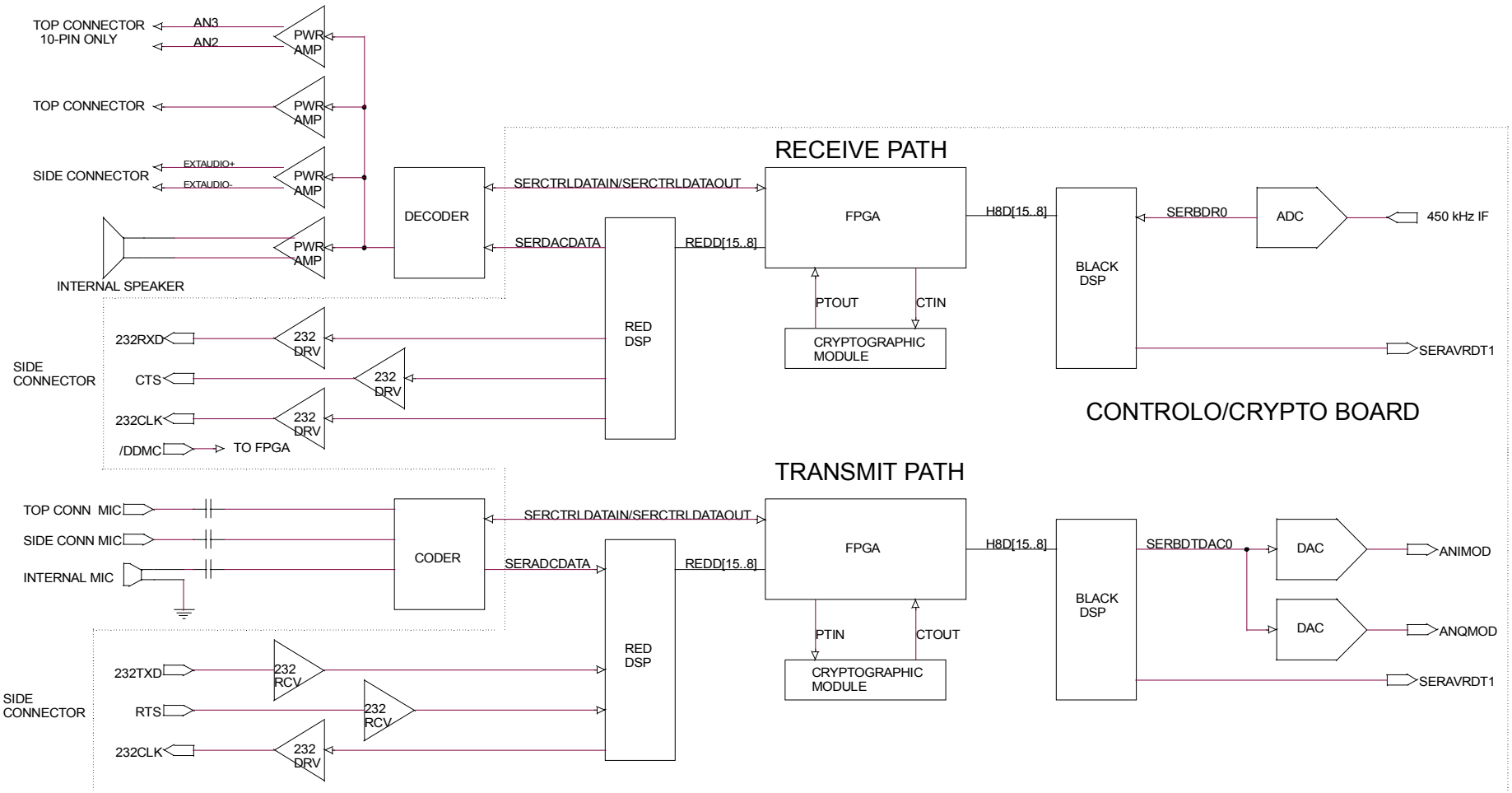


Figure 3-3 Control/Crypto Block Diagram

3.4.5 FPGA

- CODEC Control Interface
- Clock Division
- PTT Switch Interface
- Clear/Secure Bypass Logic
- Bus Arbitrator
- Microcontroller I/O Expansion
- RED DSP interface
- BLACK DSP interface
- Serial to Parallel and Parallel to Serial Conversion.

3.4.6 Power management

- Power Supply Isolation
- Power Supply Protection
- Power Switching
- Power Transient Detectors.

The Control/Crypto CCA provides regulated DC power, control logic, volume control, and the transmit modulation buffer for the MBITR. The Control/Crypto CCA internally interfaces with the transceiver module and front panel CCA within the MBITR. The Control/Crypto CCA interfaces with the keypad and the control switches (ON/OFF/Panic zeroize, volume, PTT, and squelch override) via the Front Panel CCA.

3.5 Front Panel CCA

The front panel CCA, which includes the Graphics Display LCD, is mounted between the RTU front cover and the Control/Crypto CCA. (See Figure 3-4 for the block diagram.) The LCD is an 80 x 32 graphics display.

The following functions are located on the Front Panel Board:

- Liquid Crystal Display
- Bypass Indicator
- Keypad
- Key Fill Microcontroller
- Key Fill Multiplexer
- Cryptographic Module Power Supply
- Audio Processing
- Microphone Pre-Amplifier
- Microphone A/D Converter
- Receive Audio D/A Converter
- Receive Audio Power Amplifier
- Capacitive Power Back-up for Key Retention
- Volume Switch Decoder
- Channel Switch Decoder
- Keypad Interface
- LCD Interface.

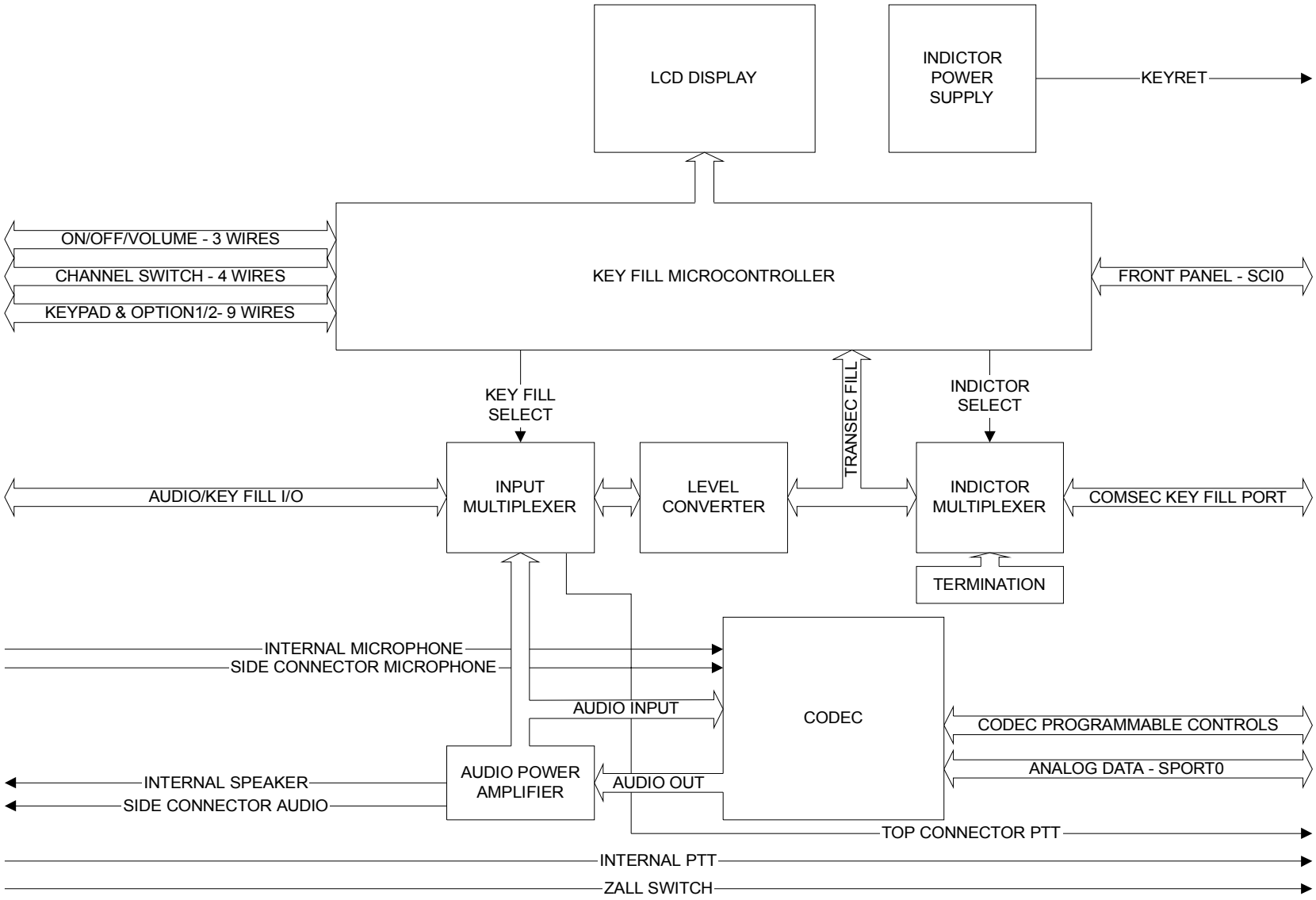


Figure 3-4 Front Panel Block Diagram

The input from the internal microphone or the side connector goes directly to a CODEC on the Front Panel, which consists of microphone preamplifiers for the three audio inputs (internal, audio connector, and side connector microphone), an Analog to Digital Converter, and a Digital to Analog Converter. The input from the top audio connector is multiplexed to the audio I/O path and the key fill path before going to the CODEC. The default connection is the audio I/O path. The Input Multiplexer is controlled by the Key Fill Microcontroller. The A/D converter digitizes the audio and passes the output to the RED DSP on the Control/Crypto CCA.

3.6 Chassis Assembly

The following functions are located on the chassis:

- RF Connector
- Side Connector
- Audio Connector (with Multiplexed Key Fill I/O)
- ON/OFF/Volume/Zeroize Switch (with mechanical interlock)
- Channel Select Switch
- Built-in Speaker Microphone
- Internal PTT Switch
- Squelch ON/OFF Switch
- Battery Release Catch

Section III. FUNCTIONAL OPERATION OF MECHANICAL ASSEMBLIES

Not Applicable.

CHAPTER 4 MAINTENANCE

4.1 General.

This chapter provides operator maintenance instructions for the MBITR radio. This includes operational checkout, inspection and preventive maintenance, troubleshooting, and removal/replacement procedures.

4.2 Operational Checkout.

The radio has a Power-On-Self-Test (POST) function that checks basic radio functions every time the radio is powered up. The user-initiated Built-In Test (BIT) is the first step in the radio operational checkout procedures. The BIT results screen (see Figure 2-62) displays the results of the self-test of the four major circuit cards: Control/Crypto, Front Panel, Power Amplifier, and Receiver-Synthesizer.

The potential radio faults associated with a failure of each section of the BIT test are described in the following table.

Table 4-1 Built-In Test Results

TEST	RESULT	POTENTIAL FAULT
Control :	FAIL - Control/Crypto board failed	1. Red DSP, 2. Black DSP, 3. Microcontroller 4. FPGA, or 5. ADC
Front Panel:	FAIL - Front Panel board failed	1. Keyfill microcontroller
Power Amp:	FAIL - Power Amp/Transmit board failed	1. Transmit AVR
Synth:	FAIL - Receiver/Synthesizer board failed	1. Receive AVR

4.3 Radio Preventive Maintenance

The radio does not require any scheduled periodic maintenance. However, the radio should be occasionally inspected for external damage, such as bent connectors, and wear items, such as loose attaching hardware (screws and setscrews). The radio should be cleaned periodically, particularly after exposure to salt water, sand, or mud. The user should rinse exposed contacts, such as the side connector, battery connector, and audio connector with fresh water and then dry with low pressure air, if available. Small pieces of dirt and debris may infiltrate the grill of the internal speaker and should be flushed out with fresh water. The user should also check the pressure relief valve on the Urban MBITR (Figure 1-1) to ensure it is not blocked by dirt or other material.

4.4 Battery Preventive Maintenance

Lithium-ion batteries will self-discharge over time. Excessive discharging can effect (reduce) the maximum potential capacity of the batteries. In order to prevent the effect of excessive self-discharge, it is recommended that lithium-ion batteries that are not in regular use (e.g., in

storage) be periodically charged to full capacity. The recommended interval for periodic charging is twelve (12) weeks.
If the battery has been charged while attached to a "powered-on" radio, the radio may exhibit a problem communicating with the rechargeable lithium-ion battery. The "fuel gauge" display for a fully charged battery may show only a partially full or empty battery. If this occurs, it can usually be corrected by fully discharging the battery (e.g., by operating the radio until the radio shuts down) and then placing the discharged battery in the charger to complete a charge cycle (LED turns green).

4.5 Troubleshooting

There are only a limited number of equipment failures that can be corrected by the operator. The following table describes them.

Table 4-2 Operator Troubleshooting Guide

Symptom	Probable Cause	Corrective Action
Radio does not operate	• Battery not properly connected • Battery dead	• Remove and re-install battery • Replace battery
Cannot communicate with other radio users in clear mode	• Radios set to different frequencies • Radios are set with different CTCSS tones • Radios set to different modulation types (AM/FM)	• Set all radios to the same frequency (can be accomplished by cloning from master radio or loading from PC Programmer). • Set receive and transmit CTCSS tones the same in all radios
Cannot communicate with other radio users in secure (COMSEC) mode	• Radios set to different COMSEC keys • Radios are set with different data rates (12 or 16 kbps) • Radios set to different COMSEC algorithms • Crypto sync period is too short	• Reload COMSEC keys • Check data rate on selected channel • Reload COMSEC keys • Check crypto sync period on selected channel
Cannot communicate with other radio users in frequency hopping (FH) SINCGARS mode	• Radios using different hopsets • Radios' real time clocks have different times	• Reload hopsets • Check internal clock times
Cannot communicate with other radio users in frequency hopping (FH) HAVEQUICK mode	• Radios on different nets • Radios using different WOD (Word of Day) • Radios have different TOD (Time of Day)	• Check nets in use • Reload WOD • Check internal clock times; reload TOD.
Background noise or other traffic on radio	• Other users are on the same frequency	• Set receive and transmit CTCSS tones in all radios

Symptom	Probable Cause	Corrective Action
Limited talk range	• Obstacles (buildings, heavy foliage) are obstructing the signal • Battery power is low • Wrong antenna	• Move away from the obstructions; increase the height of the radio, if possible. • Check battery “fuel gauge”; replace battery if low. • Check antenna.
Radio display has flashing “ERROR” message	• Operational error in the radio • DATA Mode selected while radio is set for "PT".	• Check for low battery power - press and release PTT, then check "fuel gauge". • Set radio for "CT" operation before connecting DATA cable.
Radio display has flashing “ERROR” message in HAVEQUICK mode	• Incorrect HAVEQUICK configuration, such as: • HAVEQUICK I net selected with no WOD loaded • MWOD loaded but operational day and MWOD days do not match	• Check that correct HAVEQUICK I/II data is loaded. Use KEY FILL screens to check. Reload using KEY FILL screens and/or KYK-13/KOI-18.
Radio has flashing “ALARM” message	• Crypto alarm in the radio	• Press PTT to clear alarm; check that key is loaded into selected crypto position.
Radio has flashing “UNLCK” message	• Radio synthesizer out of lock	• Wait one or two seconds or change to different channel; • Turn the radio off for five seconds and then turn it back on.
Radio has flashing “TRSEC” message when SINCGARS channel selected	• TRANSEC (SINCGARS) operation selected without frequency hopsets loaded	• Load frequency hopsets
Radio has flashing “NOTOD” message when HAVEQUICK channel selected	• HAVEQUICK channel selected without Time of Day (TOD) loaded	• Load TOD from PLGR or receive over-the-air TOD • Select EMERGENCY INITIALIZATION. (See paragraph 2.2.3.2.5)
Radio has flashing “NOWOD” message when HAVEQUICK channel selected	• HAVEQUICK channel selected with no WOD, MWOD, or day-of-month loaded.	• Load WOD, MWOD, and/or DOM. (See paragraphs 2.2.3.2.6 and 2.2.3.2.7)
Radio display "locks up"; cannot turn off radio using the ON/OFF switch.	• Microprocessor error in the radio	• Turn ON/OFF switch to OFF; remove the battery for a count of five: re-attach battery and turn radio on.

Symptom	Probable Cause	Corrective Action
Radio does not recognize that cloning cable (or other cables, such as Retrans) is connected	• Side connector disabled	• Enable side connector (Global programming, paragraph 2.2.3.3.1)
Radio does not respond to PTT for keyfill and/or cloning	• Radio set for external audio	• Set radio for internal audio operation (Mode select, paragraph 2.2.2.7.1)
Interference between radios during retransmission	• Transmitting radio received on receiving radio (co-site interference)	• Increase distance between radios • Increase frequency separation between receive and transmit radios . • Use frequency-specific filters or diplexers.
Radio "drops" (loses) COMSEC key when changing batteries	• Radio not shut off before removing battery ("hot swapping" battery).	• Shut off radio before removing battery.

4.6 Removal/Replacement Procedures - Operator.

(See Figure 5-2.) The first step for any remove/replace procedure is to power down the equipment. Prior to removing or installing any MBITR assembly, remove all accessories (antenna, microphone, etc.). Removal/replacement procedures that are authorized to be performed by the operator are given in the following paragraphs.

CAUTION

Before performing removal/replacement procedures, make sure the radio is powered down and the battery is removed from the radio. Failure to do so could result in equipment damage.

4.6.1 Audio Accessory Removal/Replacement (Urban version).

Remove/replace the audio accessory as follows:

a. Disconnect the audio accessory (e.g., handset), from the audio accessory connector on the top of the receiver-transmitter by grasping the connector plug, pressing down, and twisting the plug one-quarter turn counterclockwise.

b. Replace the audio accessory with a known good one.

4.6.2 Audio Accessory Removal/Replacement (Maritime version).

Remove/replace the audio accessory as follows:

a. Disconnect the audio accessory (e.g., handset), from the audio accessory connector on the top of the receiver-transmitter by unscrewing the knurled ring on the connector plug counter-clockwise until it is loose and pulling the cable connector straight up from the radio.

b. Replace the audio accessory with a known good one. Before pressing the accessory cable end onto the radio connector, ensure the keyways are aligned.

4.6.3 Antenna Removal/Replacement.

Remove/replace antenna as follows:

a. Disconnect the antenna from the antenna connector at the top of the receiver-transmitter by first grasping the antenna at the base and turning counterclockwise until unthreaded. Then remove the antenna from the connector.

b. Replace the antenna with a known good antenna. Turn antenna clockwise to thread it into position. The antenna should be hand-tightened only.

4.6.4 Battery Removal/Replacement.

Remove/replace battery as follows:

CAUTION

Turn off power before removing the battery by setting the volume switch to the OFF position. Failure to do so may affect (zeroize) the COMSEC keys loaded in the radio, corrupt the programmed configuration, and may damage the radio circuitry.

a. Disconnect the battery from the receiver-transmitter by sliding the battery latch up, towards the top of the receiver-transmitter, grasping the battery on the bottom of the receiver-transmitter, and turning the battery approximately one quarter turn counterclockwise to unlock it from its position.

b. Replace the removed battery with a known good battery. Connect the battery to the receiver-transmitter by placing the battery at a 60^{o} angle to the bottom of the receiver-transmitter, and turning the battery clockwise to lock it in position. Make sure the battery latch at the base of the receiver-transmitter locks into place.

NOTE

If the battery has been charged while attached to a "powered-on" radio, the radio may exhibit a problem communicating with the rechargeable lithium-ion battery. The "fuel gauge" display for a fully charged battery may show only a partially full or empty battery. If this occurs, it can usually be corrected by fully discharging the

battery (e.g., by operating the radio until the radio shuts down) and then placing the discharged battery in the charger to complete a charge cycle (LED turns green).

4.7 Watertight Integrity

The receiver-transmitter is not authorized for disassembly. However, in the event of a combat situation where it becomes necessary for partial disassembly of the RTU, the watertight seals will be compromised. In these cases, the RTU must be returned to the depot for proper re-assembly and verification that watertight integrity has been restored.

CHAPTER 5 ILLUSTRATED PARTS BREAKDOWN

Section I. INTRODUCTION

5.1 General.

The Illustrated Parts Breakdown (IPB) lists, illustrates, and describes the parts used in the MBITR Maritime (AN/PRC-148(V)1(C)) and Urban (AN/PRC-148(V)2(C)) versions, manufactured by Thales Communications, Inc., Clarksburg, Maryland. Table 5-1 lists available items of equipment that are not supplied as part of the basic AN/PRC-148 system.

5.2 Maintenance Parts List.

The Maintenance Parts List (MPL), (Section II), consists of the complete systems divided into main groups. The main groups are broken down into assemblies, subassemblies, and details. The next higher assembly (NHA) is indicated for each separately illustrated item. Each assembly and subassembly listed is followed immediately by its component parts. In general, the assemblies and parts installed at the time the end item was manufactured are listed and identified in the manual. When an assembly/part is installed during modification, and the original does not have continued application, only the preferred item is listed. Interchangeable and substitute assemblies and parts are not listed in this manual.

a. Figure and Index Number Column. This column lists the figure and index number of each part illustrated in the related figure. The index numbers are in numerical sequence and identify each part number shown in the related figure. Assemblies which have detail parts indexed are not indexed unless the assembly is illustrated completely assembled on the same illustration, or it is identified as an assembly by bracketing or circling of components. When a group of parts (bolt, washer, and nut) is used at a specific location for attachment purposes, one index number assigned is sufficient. The index number appears on the same line as the first part composing the group.

b. Part Number Column. This column lists the contractor's part number (drawing number), including dash numbers, assigned to each part. Vendor part numbers are listed when parts are identical to the contractor used part. Those parts which have Government Standards numbers assigned have the Government Standards number listed. Parts altered or selected for special fit, tolerance, etc., from vendor, commercial, or Government Standards part number of the altered or selected part follow the part description in the Description column.

c. CAGE Column. This column contains a five-digit code number following the part number denoting the procuring vendor. The source of vendor code numbers is the CAGE for Manufacturer Cataloging Handbook H4-1, H4-2, and H4-3. When a CAGE for the appropriate manufacturer or Government agency is not published in the H4 handbook, the word "none" will appear in this column.

d. Description Column. This column contains the description of all items appearing on the MPL. The indentation headed "1" through "7" consists of the contractor's drawing title. The description contains modifiers necessary to identify the particular item. Descriptions that are

indented and marked with a " • " are part of the first unindented part above it. Additional information following the item description may include the following: a list of alternate part numbers to give stock ordering information; exceptions to the Usable On Code for the item; and references to preceding and subsequent figures concerning assemblies and subassemblies. This data is considered an integral part of the item description assuring the correctness of repair maintenance procedures.

e. Units Per Assembly. This column contains the number of units required per assembly and/or subassembly. If more than one assembly is required, the total number of assemblies is listed. When an assembly or subassembly is listed more than once, the total number of units per assembly or subassembly appears the first time and REF for subsequent listings.

f. Source, Maintenance, & Recoverability (SM&R) Code Column. This column shows the manufacturer-recommended SM&R Code. These codes are assigned in accordance with the guidance of Joint Regulation AR 700-82/OPNAVINST 4410.2/AFR 66-45/MCO 4400.120.

5.3 Numerical Index.

The Numerical Index (Chapter 5, Section III) is compiled in accordance with the numerical part number filing system described in paragraph a.

a. Part Number Column. This column contains all the part numbers that appear in the Maintenance Parts List and part numbers that have been assigned to detail parts assembled into the end article. The order of procedure establishing the precedence in which the part numbers are listed is explained below. The order of precedence in the first position of each part number is Letters A through Z, Numerals 0 through 9.

NOTE

Alphabetical O's are considered as numerical zeroes in all positions in each part number.

The order of precedence in the second and succeeding positions in each part number is as follows:

(1) Space (blank column).
(2) Diagonal (/).
(3) Period (.).
(4) Dash (-).
(5) Letters A through Z.
(6) Numerals 0 through 9.

The following is a sample of part numbers arranged in alphabetical-numerical sequence used in the Numerical Index.

AN931-4-13	B2	16.W2
A2460	S/1	16W060
A317	1140	32P010.1

A32	121873	32P0101
B12	128	39A45

b. Figure and Index Number Column. For each part number, the figure or figure and index number refers to the MPL where the parts relationship is shown. When an assembly or part has not been assigned an index number, the figure and index number of the preceding part in the MPL is used with the letter "F" before the figure, such as F7-7. The letter "F" denotes "follows".

5.4 Electrostatic Discharge (ESD) Sensitive Devices.

a. This manual describes parts and assemblies sensitive to damage by ESD.
b. The MPL contained within this manual with ESD sensitive parts are identified by the following symbol (ESD).
c. These symbols are placed in the extreme right of the description column for the item identified as ESD sensitive.

5.5 CAGE Code Summary.

CAGE Code	Manufacturer
23386	Thales Communications, Inc.

Table 5-1 MBITR Accessory Equipment
(not included with the basic radio system)

Description	Part Number	Application
Single Unit Battery Charger	1600426-1	Charges one lithium-ion battery at a time; uses AC input power only.
Six Unit Battery Charger (AC/DC)	1600426-2	Charges six lithium-ion batteries simultaneously; uses either AC or DC input power
Six Unit Battery Charger (AC only)	1600426-3	Charges six lithium-ion batteries simultaneously; uses AC input power only.
Vehicle Adapter	MA6942A	Provides interface to vehicle power and vehicle-mounted antenna
Special Power Adapter Interface (SPAI) Assembly	4101310-501	Charge battery and power radio from SOPS (Special Operations Power Supply): solar panels, hand-cranked generator
SPAI Power Cable	3500460-501	Connects SPAI to various DC input sources
SPAI Alternate Cable Kit	1100533-501	Connects SPAI to (1) auto 12 VDC outlet, (2) BA-5590 adapter, (3) alligator clips.
Cloning Cable	3500395-501	Used to transfer programmed information from one radio to another. COMSEC information cannot be read out from a radio.
Digital Data Cable	3500396-501	Used to connect the radio to a digital data device (such as a PC). Also used for radio Bit Error Rate testing.
GPS Cable	3500465-501	Used to connect a PLGR (AN/PSN-11) to the radio side connector.
PDC Data Cable (VDC-400)	3500466-501	Used to connect a ViaSat Personal Data Controller (VDC-400) to the radio side connector.
PDC Data Cable (VDC-200)	3500545-501	Used to connect a ViaSat Compact Data Controller (VDC-200) to the radio side connector.
SINCGARS Data Adapter Cable	3500562-501	Used to connect radio side controller to SINCGARS-compatible data devices.
Retransmit Cable	3500485-501	Used to connect two radios (side connector to side connector) for expedient retransmission.
Expedient Retransmission Kit	1100540-501	Includes retransmit cable, selected bandpass filters, and antenna cables.
PC Programmer	MA6941F	Includes software, cable, and user manual. Used to load or edit radio programmable parameters from a PC
PC Programmer Cable	3500393-501	Supplied as part of the PC Programmer. Connects radio to PC serial port.
Antenna, 116-174 MHz	SS-1600293-1	Provides improved performance (gain) in upper VHF band
Antenna, 400-512 MHz	SS-1600294-1	Provides improved performance (gain) in UHF band

Description	Part Number	Application
Speaker Microphone	1600469-4	Handheld speaker microphone with volume control; 6-pin audio connector
Maritime Headset	1600503-5	20 meter immersible headset with 10-pin audio connector
Urban Headset	1600567-1 (Alt. 1600504-1)	2 meter immersible headset with 6-pin audio connector
Commercial Lightweight Headset	1600551-2	Alternative urban headset; 6-pin audio connector

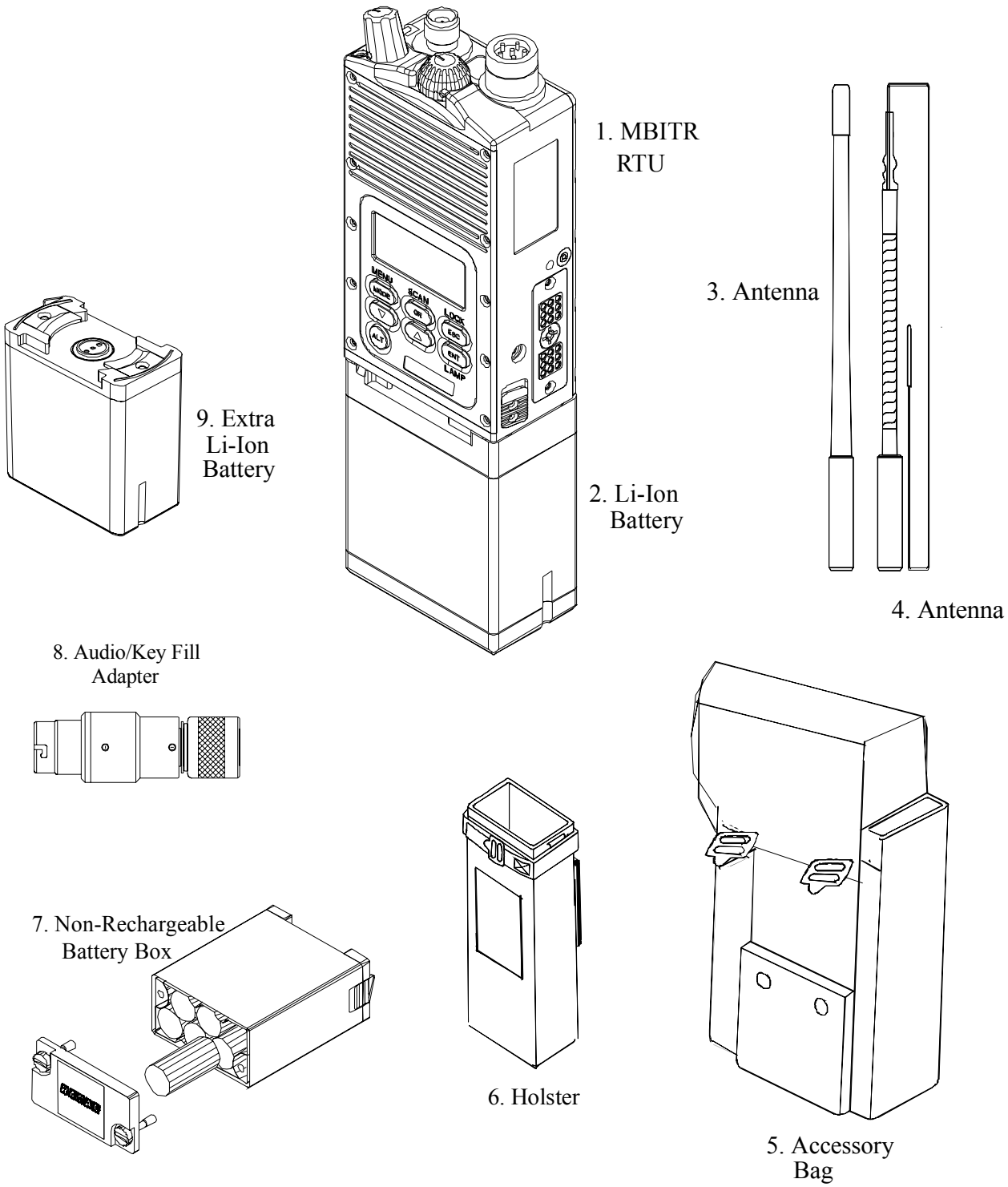


Figure 5-1 Multiband Inter/Intra Team Radio System (AN/PRC-148(V)(C))

Table 5-2 Multiband Inter/Intra Team Radio System, 20 meter (AN/PRC-148 (V)1(C))

Figure & Index No.	Part Number	CAGE	Description 1 2 3 4 5 6 7	Units per Assy	SMR Code
5-1-1	4101104-501	23386	Unit Assy Multiband Inter/Intra Team Radio (MBITR), 20 meter	1	PAODD
5-1-2 & 5-1-9	1600515-X	23386	Battery, Li-Ion Rechargeable	2	PAOZZ
5-1-3	3100662-501	23386	Antenna, 30-512 MHz	1	PAOZZ
5-1-4	3100661-501	23386	Antenna, 30-90 MHz	1	PAOZZ
5-1-5	1600495-1	23386	Carrying Case, MBITR	1	PAOZZ
5-1-6	1600494-1	23386	Holster, MBITR	1	PAOZZ
5-1-7	4101240-501	23386	Battery Holder	2	PAOZZ
5-1-8	3600190-1	23386	Audio/Keyfill Adapter (Maritime version only)	1	PAODD
Not illus.	3400577-1	23386	Operator Card	1	PAOZZ
Not illus.	84329	23386	Operator Manual	1	PAOZZ
Not illus.	84335	23386	CD-ROM Training and Operator Manual	1	PAOZZ

NOTE: The above parts list applies to the AN/PRC-148(V)1(C) system (Thales part number PRC6991ABS-SYS). Thales also has a similar system (part number PRC6991ABS-BAS) that includes one (1) rechargeable battery (p/n 1600515-X) and does not include any battery holders (p/n 4101240-501). Additional rechargeable batteries and battery holders may be purchased on an individual basis.

The 1600515-X part number indicates the availability of batteries of different capacities.

Table 5-3 Multiband Inter/Intra Team Radio System, 2 meter (AN/PRC-148 (V)2(C))

Figure & Index No.	Part Number	CAGE	Description 1 2 3 4 5 6 7	Units per Assy	SMR Code
5-1-1	4101195-501	23386	Unit Assy Multiband Inter/Intra Team Radio (MBITR), 2 meter	1	PAODD
5-1-2 & 5-1-9	1600515-X	23386	Battery, Li-Ion Rechargeable	2	PAOZZ
5-1-3	3100662-501	23386	Antenna, 30-512 MHz	1	PAOZZ
5-1-4	3100661-501	23386	Antenna, 30-90 MHz	1	PAOZZ
5-1-5	1600495-1	23386	Carrying Case, MBITR	1	PAOZZ
5-1-6	1600494-1	23386	Holster, MBITR	1	PAOZZ
5-1-7	4101240-501	23386	Battery Holder	2	PAOZZ
Not illus.	3400577-1	23386	Operator Card	1	PAOZZ
Not illus.	84329	23386	Operator Manual	1	PAOZZ
Not illus.	84335	23386	CD-ROM Training and Operator Manual	1	PAOZZ

NOTE: The above parts list applies to the AN/PRC-148(V)2(C) system (Thales part number PRC6991BBS-SYS). Thales also has a similar system (part number PRC6991BBS-BAS) that includes one (1) rechargeable battery (p/n 1600515-1) and does not include any battery holders (p/n 4101240-501). Additional rechargeable batteries and battery holders may be purchased on an individual basis.

The 1600515-X part number indicates the availability of batteries of different capacities.

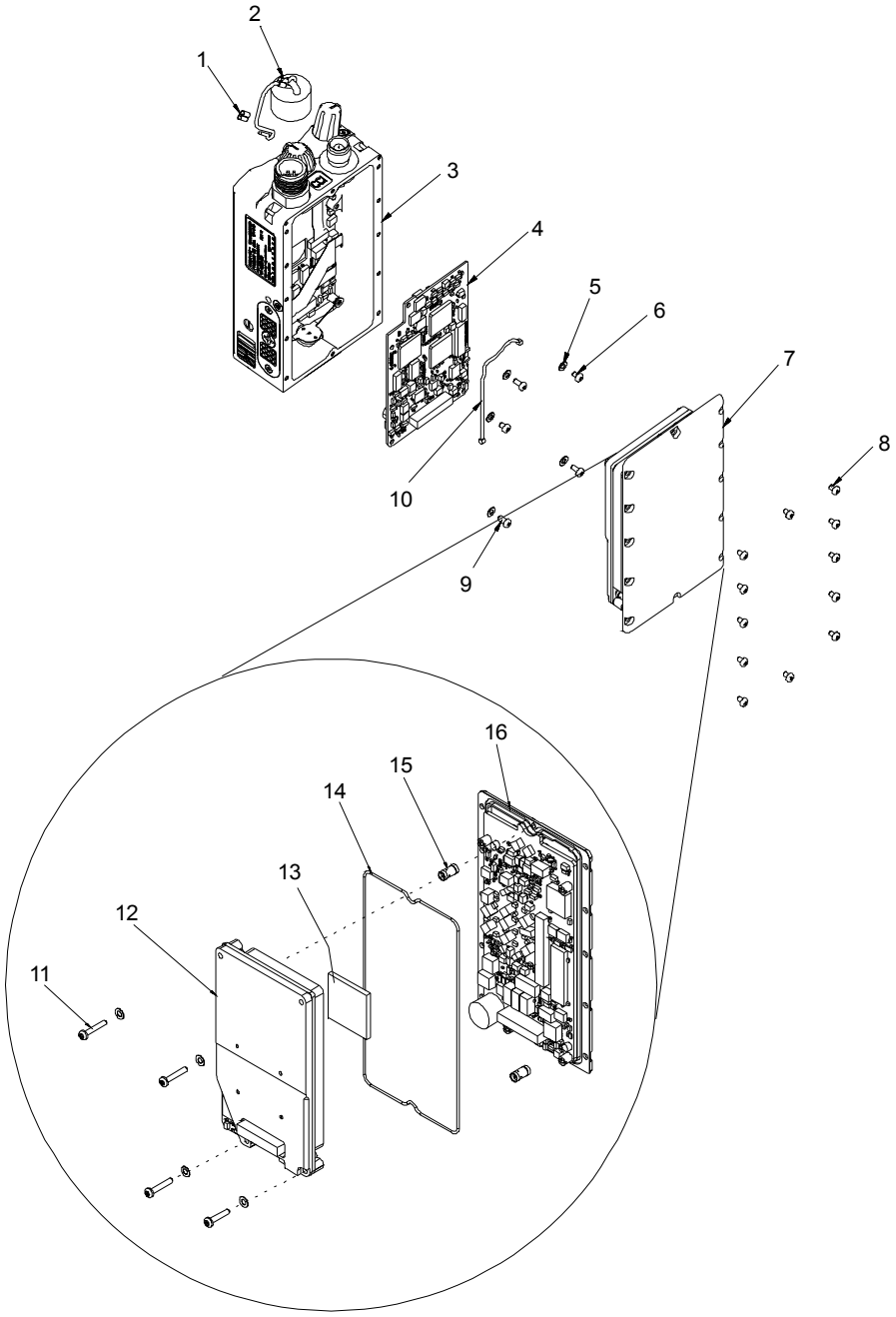


Figure 5-2 MBITR Receiver-Transmitter Unit (RTU)

NOTE

Figure 5-2 shows the component parts of both the Maritime and Urban versions of the MBITR. The actual part numbers of these two versions are listed in Tables 5-4 and 5-5, respectively.

Table 5-4 MBITR Unit, 20 Meter (4101104-501)

Figure & Index No.	Part Number	CAGE	Description 1 2 3 4 5 6 7	Units per Assy	SMR Code
5-2-1	70211	23386	Splice - Open Barrel	1	PAOZZ
5-2-2	3600188-1	23386	Cap, Dust, Connector	1	PAOZZ
5-2-3	4101141-501	23386	Module Assy, Systems, 20 M	1	PADDD
Not illus.	4101162-501	23386	• Front Panel CCA, 20M (ESD)	1	PADZZ
Not illus.	4101150-501	23386	• Keypad CCA (ESD)	1	PADDZ
Not illus.	1600482-1	23386	• Module, LCD	1	PADDZ
5-2-4	4101146-501	23386	Control/Crypto CCA (ESD)	1	PADDD
5-2-5	SS-2400543-2	23386	Washer, Crinkle, Special	5	PADZZ
5-2-6	77600	23386	Screw, Pan Head, .086-56x.125 SS	2	PADZZ
5-2-7	4101143-501	23386	Module, Transceiver, 30-512 MHz	1	PADDD
5-2-11	77897	23386	• Screw, Flat Head, .086-56x.50	4	PADZZ
5-2-12	4101354-501	23386	• Rcvr/Synth Assy (ESD)	1	PADZZ
5-2-13	2400916-5	23386	• Rubber Silicon Strip	1	PADZZ
5-2-14	3400614-1	23386	• Cover Gasket	1	PADZZ
5-2-15	61540	23386	• Connector, Male-Female Adapter	2	PADZZ
5-2-16	4101300-501	23386	• Transmit Assy (ESD)	1	PADZZ
5-2-8	79191-256-125	23386	Screw, Pan Head, .086-56x.125 Black	12	PADZZ
5-2-9	77601	23386	Screw, Pan Head, .086-56x.188 SS	3	PADZZ
5-2-10	7742	23386	Cable Assy, R/A	1	PADZZ

Table 5-5 MBITR Unit, 2 Meter (4101195-501)

Figure & Index No.	Part Number	CAGE	Description 1 2 3 4 5 6 7	Units per Assy	SMR Code
5-2-1	70211	23386	Splice - Open Barrel	1	PAOZZ
5-2-2	3600188-1	23386	Cap, Dust, Connector	1	PAOZZ
5-2-3	4101194-501	23386	Module Assy, Systems, 2 M	1	PADDD
Not illus.	4101162-502	23386	• Front Panel CCA, 2M (ESD)	1	PADZZ
Not illus.	4101150-501	23386	• Keypad CCA (ESD)	1	PADDZ
Not illus.	1600482-1	23386	• Module, LCD	1	PADDZ
5-2-4	4101146-501	23386	Control/Crypto CCA (ESD)	1	PADDD
5-2-5	SS-2400543-2	23386	Washer, Crinkle, Special	5	PADZZ
5-2-6	77600	23386	Screw, Pan Head, .086-56x.125 SS	2	PADZZ
5-2-7	4101143-501	23386	Module, Transceiver, 30-512 MHz	1	PADDD
5-2-11	77897	23386	• Screw, Flat Head, .086-56x.50	4	PADZZ
5-2-12	4101354-501	23386	• Rcvr/Synth Assy (ESD)	1	PADZZ
5-2-13	2400916-5	23386	• Rubber Silicon Strip	1	PADZZ
5-2-14	3400614-1	23386	• Cover Gasket	1	PADZZ
5-2-15	61540	23386	• Connector, Male-Female Adapter	2	PADZZ
5-2-16	4101300-501	23386	• Transmit Assy (ESD)	1	PADZZ
5-2-8	79191-256-125	23386	Screw, Pan Head, .086-56x.125 Black	12	PADZZ
5-2-9	77601	23386	Screw, Pan Head, .086-56x.188 SS	3	PADZZ
5-2-10	7742	23386	Cable Assy, R/A	1	PADZZ

CHAPTER 6 MBITR VEHICLE ADAPTER

6.1 General

The MBITR Vehicle Adapter (MA6943) allows the MBITR to be readily mounted in a variety of vehicles. The Vehicle Adapter :

- Has a 12-32 VDC power supply for operation with most vehicle electrical systems,
- Has RF output of 5 or 20 watts
- Provides connections for:
  - Detachable Control Head
  - Headset
  - Multifunction (equivalent to radio side connector)
  - Intercom
  - External Connector to RF Power Amplifier
  - External connector to Speaker
  - Antenna
  - Power
- Charges the radio's battery while the radio is inserted in the vehicle adapter, and
- Allows rapid insertion and removal of the radio.

6.2 Physical Characteristics

6.2.1 Equipment Description

The MBITR Vehicle Adapter consists of the following components:

- Vehicle Adapter Chassis Unit
- Power cable
- Remote Control Unit

6.2.1.1 VA Chassis Unit

The VA chassis contains a sleeve for the insertion of the MBITR with a locking cam to fasten the radio into position once it is fully inserted. The radio must be inserted with the side connector facing inward (toward the audio and multi-pin connectors). The sleeve is protected from the intrusion of foreign objects by a door that swings into the opening when no radio is installed. The chassis front panel has a U-283/U six pin audio connector and a multi-pin connector for attachment of accessories such as a GPS receiver or data device. The multi-pin connector has the same physical interface characteristics as the MBITR side connector. The chassis has rear connectors for the external speaker, RF power amplifier, power input, intercom, and antenna cable.

6.2.1.2 Power Cable

The power cable is a 12 foot long shielded cable that connects the VA to vehicle power. The power cable contains an in-line fuse.

6.2.1.3 Remote Control Head

The detachable Remote Control Head (RCH) for the VA is the primary user interface. It includes all the keypad functions of the radio, an 80 x 32 Liquid Crystal Display, volume control

and channel select toggle switches, and PTT and squelch keys. The Control Head can be left attached to the VA or can be used remotely via the 12 foot cable that connects it to the VA front panel.

6.2.2 Weight

The weight of the vehicle adapter chassis (less the installation kit) is less than 11 pounds.

6.2.3 Dimensions

The maximum external dimensions of the vehicle adapter are: Length : 12.5 in., Width : 7 in., Height : 3.75 in.

6.2.4 Temperature

The operating and storage temperatures for the VA are:

Parameter	Value
Operating Temperature	-31° C to + 60° C
Storage Temperature	-33° C to + 71° C
Charging Temperature	0° C to + 45° C

6.3 Electrical Characteristics

The VA requires an input supply voltage of 12-32 VDC. If the MBITR is set to transmit at less than 3 watts RF output, DC power is supplied from the VA through the MBITR side connector. For RF output settings of 3 or 5 watts, power is supplied by the MBITR charged battery.

The VA includes a battery charging system that can recharge the MBITR rechargeable lithium-ion battery (Thales p/n 1600515-X) within four hours. **NOTE**: The VA will only recharge the Li-ion battery at temperatures between 0° and 45° C.

6.4 Installation

6.4.1 Mechanical Installation

The VA requires a minimum installation space of : Length – 15 in., Width – 8.5 in., Height – 5 in. The VA power cable limits the mounting location to a point within 8 to 10 feet of the vehicle power distribution panel.

6.4.2 Electrical Connections

The VA power cable runs from the unit through the vehicle firewall to the vehicle battery. The power cable includes an internal fuse that MUST be used between the power cable and the positive battery terminal. Failure to do so can result in severe equipment damage.

6.5 Operation

The VA supports the use of an external audio device through the U-283/U connector and can support digital data operation through the use of the radio multi-pin connector on the back panel, a digital data cable, and an external data terminal. Actual radio operation is controlled through the Remote Control Head (RCH). The display and keypad on the RCH perform the same radio operation functions described in Chapter 2, OPERATING INSTRUCTIONS, with the following exceptions:

- Volume Knob – replaced by a rocker key marked (+) and (-), alternate function is external speaker off or on;
- Channel Knob – replaced by a rocker key marked with (▲) and (▼); programming function is UP and DOWN arrow, alternate function is LEFT and RIGHT arrow;
- Squelch Control Key – used to enable and disable the squelch function of the MBITR;
- PTT Key - used in place of radio sidemounted PTT..

6.6 Maintenance

The user can remove and replace the MBITR receiver-transmitter unit, the RCH and RCH cable, the power cable, and the vehicle adapter unit.

6.7 Illustrations

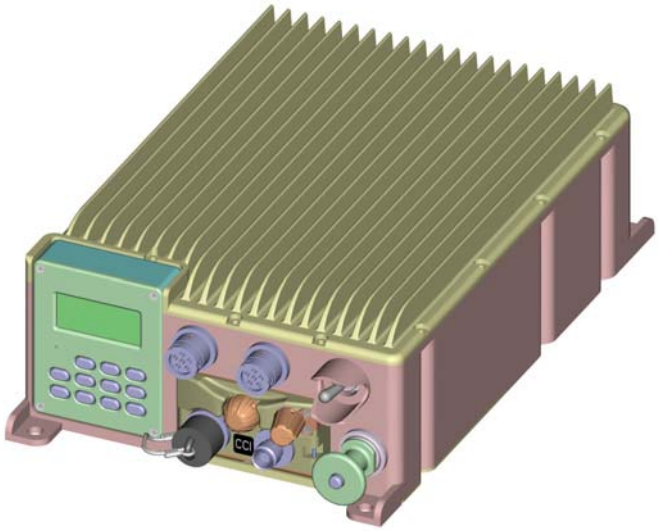


Figure 6-2 MBITR Vehicle Adapter

Figure 6-1 RCH

6.8 Parts List

Table 6-1 Parts List, MA6943

Item Number	Description	Part Number
1	Vehicle Adapter Chassis	4101524-501
2	Remote Control Head (RCH)	4101531-501
3	RCH Cable	3500363-501
4	DC Input Cable	4500156-501

CHAPTER 7 SPECIAL POWER ADAPTER INTERFACE (SPAI)

7.1 General

The MBITR Special Power Adapter Interface (SPAI) is used with the power sources found in the Special Operations Power Supply (SOPS) assembly, the SOPS OP 177(V)1/U. The SOPS assembly provides power for field recharging of nickel-cadmium and lead acid batteries used to power military communications/electronic equipment assigned to Army SOF units. It includes three power sources: a hand cranked generator (G-67B/G); rigid solar cell panels; and an AC to DC Power Converter. Also provided is a SOPS Power Supply Adapter (PSA) that provides an interface between the SOPS power source and the batteries. The MBITR SPAI, like the SOPS PSA, provides an electrical/mechanical interface between the SOPS power sources and the MBITR rechargeable lithium ion battery pack. The MBITR SPAI is used to augment, not replace, the SOPS PSA. Through the DC Input Cable, the SPAI is also capable of accepting various 12-32 VDC power inputs in order to operate the MBITR and charge the MBITR battery pack. The SPAI DC Input Cable, which has an in-line fuse, is terminated at one end with flying leads to allow interoperation with multiple DC sources.

7.2 Physical Characteristics

Volume: less than 13.75 cubic inches. The width and depth are the same as the MBITR RTU.
Weight: less than 16 ounces.
Connectors: Top – Same twist-on connector as the rechargeable battery
Bottom – Same twist-on connector as the bottom of the radio
Side – MS/3112ES5 Cannon plug connector for directly attaching SOPS equipment.

7.3 Electrical Characteristics

The SPAI can operate on a DC power input of 12-32 volts. The SPAI will maintain normal operations (radio transmitting while charging the battery) at power as low as 80 Watts when applied through the High Current Input signal. The SPAI will maintain limited operations (Receiving/Transmitting or charging the battery) at current less than 2.0A when power is applied through the Low Current Input signal. In transmit mode while charging a battery, the SPAI provides a maximum of 40 Watts to the radio and a maximum of 15 Watts to the rechargeable battery when powered through the High Current Input signal. When powered through the Low Current Input signal, the SPAI provides power to either operate the radio in transmit or charge the battery while operating the radio in receive.

7.3.1 Electrical Protection

The SPAI and SPAI DC Input Cable interfaces are protected against any failures on interconnecting cables or terminations and are protected against electrostatic discharge. The SPAI or SPAI DC Input Cable will not be damaged by any of the following conditions of use when applied for an indefinite period of time:

- Reverse input of the supply voltage

- Short circuit to ground or a short circuit in either the battery or Receiver/Transmitter
- Excessive temperatures, if natural cooling is prevented
- Over-voltage input of the supply voltage

7.4 Operation

See Figure 7-1. **NOTE: The radio should be OFF until all connections to the SPAI and power source are made.** The SPAI is first connected to the radio and/or battery using the top and/or bottom connector of the SPAI. The SPAI can be used to charge the MBITR battery with only the battery connected, power the radio with only the radio connected, or can have both the radio and battery connected and charge the battery while the radio continues to operate. **NOTE**: *If the SPAI is used to charge a battery without having a radio connected, one of the battery caps should be installed on top of the SPAI.* Then the SPAI side connector is connected directly to any one of the components of the SOPS assembly (solar panels, hand-cranked generator, or AC to DC Power Converter). As long as the SOPS component is generating current, the SPAI will charge the battery or power the radio. If there is not sufficient current to both charge the battery and power the radio, the radio receive/transmit capability will take precedence. The SPAI can also be connected to other DC power sources, such as a car battery, using the SPAI DC Input cable.

7.4.1 Indicators

The SPAI has a multihued LED indicator to provide charge status to the user. The SPAI has a label defining the following status indications.

LED	Status	Description
Yellow	Charging	The fuel gauge is not full and the charge current is above 100mA for temperatures between -10°C to +40°C
Yellow Flash	Cold (Trickle) Charge	The fuel gauge is not full and the charge current is below ~200mA and above 10mA (if 10mA can be detected) for temperatures between -10°C to +40°C
Green	Charge Complete	The fuel gauge is full
Red	Out of Temp	The temperature is above +40°C or below -10°C
Red Flash	Overdischarge (Low voltage) Charge	The fuel gauge is not full and the battery voltage is < ~7.5V for temperatures between -10°C to +40°C. Charge current is limited to ~120 mA
Red/Green Flash	Fault	The fuel gauge is not full and the charge current is below 10mA for temperatures between -10°C to +40°C and any other fault condition that can be detected
Off	Off	Indicator if no battery is attached, no external DC is provided, or if any of the above conditions aren't met

7.5 Performance

The SPAI will charge a fully discharged MBITR lithium ion battery within 3.0 hours at a nominal battery temperature (+21°C). The battery is charged to within 90% of capacity in the first two hours. The SPAI is capable of charging over a temperature range -10°C to +40°C. However, the charge time will vary depending on the response of the lithium ion chemistry.

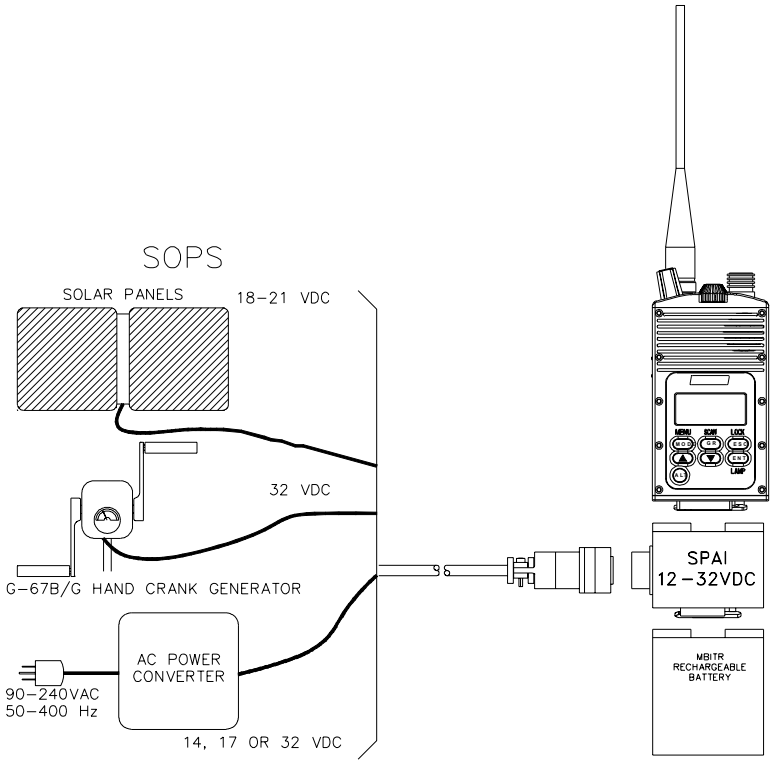


Figure 7-1 SPAI Connections

CHAPTER 8 BATTERY CHARGERS

8.1 General

There are three different versions of MBITR battery chargers: single unit, AC power only; six unit AC power only; and six unit AC/DC power. The MBITR battery chargers are also capable of recharging the batteries used on other Thales radios: the Racal 25, MSHR, and 20 meter MSHR.

8.2 Physical Characteristics

8.2.1 Weight and Dimensions

The Charger weights and dimensions are shown below:

Table 8-1 Battery Charger Weights and Dimensions

Charger Configuration	Part Number	Weight (excluding power cord)	Size (excluding power cord)
Single Unit Charger	1600426-1	1.5 lb.	5.5” wide x 8” deep x 4.5” tall
Six Unit Charger (AC/DC)	1600426-2	16 lb.	18.5” wide x 12” deep x 7” tall
Six Unit Charger (AC Only)	1600426-3	14 lb.	18.5” wide x 12” deep x 7” tall

8.2.2 Temperature

The Chargers’ operating and storage temperature ranges are shown below:

Table 8-2 Operating and Storage Temperatures

Operational Temperature Range	0°C (+32°F) to +45°C (+113°F)
Storage (Non-operational) Temperature Range:	-40°C (-40°F) to +85°C (+185°F)

Attempting to charge batteries outside the operating temperature range can result in damage to both the chargers and batteries.

8.3 Electrical Characteristics

8.3.1 Single Unit Charger.

The single charger (Figure 8-1) is able to operate from universal power sources, defined as 90 to 265 VAC, 50-400 Hz. The charger requires no modification or adjustment in order to operate from any voltage within this range. When using the single charger, make sure the battery is firmly seated in the charger.

8.3.2 Six (6) Unit Chargers.

There are two versions of the six-unit charger (Figure 8-2) available. Both versions of the charger are able to operate from universal power sources defined as 90 to 265 VAC, 50-400 Hz. One model of the charger can also operate from 10 to 32 VDC as well. The charger requires no modification or adjustment in order to operate from any voltage within this range. A separate input is used to supply AC and DC input power.

8.4 Performance

Battery charge time can be affected by various conditions, such as the charger input current. When inserting a battery, make sure it is firmly seated in the charger. If a battery is attached to a radio while in the charger, the radio should be OFF. The battery chargers communicate with the circuitry in the battery to monitor charge current, temperature, and voltage to prevent improper charging. Indicator LED's on the chargers provide status. Because the chargers are exchanging information with the battery during charging, leaving the radio powered ON during charging will result in data transfer conflicts between the radios, battery, and charger. The charge information in the battery will be corrupted and will result in false readings on the radio display after being removed from the charger.

Table 8-3 Charger Performance

Charger Configuration	Capacity	Charge Time
Single Station AC	One battery pack	Three hours
Six Station AC	Six battery packs simultaneously	Three hours (for all six batteries)
Six Station AC/DC	Six battery packs simultaneously	Three hours (for all six batteries)

8.5 Operating Indications

All versions of the chargers use LEDs to indicate the current charging status and/or charging problems. The meaning of the LED's is as follows:

Table 8-4 Charge Status Indicators

Indicator	Charge State	Status
Red	Charger OFF	High Temp Exceeded
Flashing Red	Low Rate Charge	Over-discharged Battery[1]
Flashing Yellow	Low Rate Charge	Under-temperature Battery[2]
Yellow	Full Rate Charge	Normal Charge
Green	Charger OFF[1] Trickle Charge[2]	Charge Completed Successfully
Flashing Red/Green	Charger OFF	Charge Error

[1] Applicable to Li+ Batteries Only.
[2] Applicable to NiMH and NiCd Batteries Only.

If a battery is inserted in the charger while attached to a radio and the radio is ON, the radio fuel gauge may indicate that the battery is fully charged before the charger indicates full charge.

CAUTION

Do not insert a new battery in the charger until the LED is turned off.

The battery can be charged while attached to a radio. However, the radio MUST be powered OFF. (See paragraph 4.4 for additional information.)

8.6 Illustrations

Figure 8-1 MBITR Single Charger

Figure 8-2 MBITR Multi-Charger

CHAPTER 9 DEFINITIONS

9.1 Definitions

9.1.1 Active Channel

The Selected Channel is receiving a signal that is of sufficient strength to overcome the programmed squelch level.

9.1.2 Channel

(100 per radio) a memory location with defined: receive, transmit, squelch, modulation, and power settings.

9.1.3 CTCSS Tone

Standard EIA Continuous Tone Controlled Squelch System (CTCSS) squelch tones. Subaudible tones superimposed on the radio carrier frequency. When the radio is set to a channel that is programmed for receive CTCSS, the radio will not open squelch unless the required tone is present in the received signal.

9.1.4 Electronic Remote Fill

Electronic remote fill (ERF) is a means by which the SINCGARS net control station transmits hopsets and/or lockout sets to net member radios.

9.1.5 Fade Bridge

Fade bridging allows the encryption clock recovery to "freewheel" during momentary signal loss so that encryption synchronization is not interrupted. The secure radio can be programmed to provide fade bridging from 0 to 4 seconds in one second increments.

9.1.6 Hopset

Set of frequencies that the radio hops on (changes frequency) during FH operation. The radio changes frequency more than 100 times per second.

9.1.7 Initial Synchronization

Initial synchronization controls the length of time that the radio sends out an encryption synchronization pattern.

9.1.8 Lockout Set

Set of frequencies that are not used for transmission or reception during frequency hopping.

9.1.9 Multiple Word of Day (MWOD)

A HAVEQUICK II Multiple Word of Day consists of a set of up to six WODs with a day of the month associated with each set.

9.1.10 Offset

Used to change a SC operating frequency by adding or subtracting 5 or 10 kHz. Can be used to reduce effects of interference.

9.1.11 Open Channel

The squelch level is overridden and the radio is in a constant receive state.

9.1.12 Priority Scan

The priority channel(s) are sampled preferentially during scanning.

9.1.13 Repeater Delay

When operating with a signal repeater, the radio can be programmed to disable reception for a brief delay after the PTT is released at the end of a transmission. This prevents reception of the signal being re-transmitted by the repeater.

9.1.14 Scan Revert Channel

When the PTT is pressed during or following receipt of a message on a scan channel, this is the transmit channel that will be used.

9.1.15 Selected Channel

The Channel/Frequency currently loaded into the radio for Receiving/Transmitting operations.

9.1.16 Time of Day (TOD)

The HAVEQUICK TOD provides the synchronization necessary for communicating in the anti-jamming mode by allowing frequency hopping at the same instant in time.

9.1.17 Transmit (TX) Timeout

The radio can be programmed to automatically end transmission after a pre-determined length of time in transmit mode. The radio gives a warning tone and visual indication immediately before ending transmission. The visual indication ("TIME" on the front display) continues until the radio exits transmit mode or the radio is unkeyed, whichever comes first.

9.1.18 Word of Day (WOD)

The HAVEQUICK I WOD configures the frequency hopping pattern and hop rate. The WOD consists of six segments entered in P20 through P15 and may vary in length from one to all six.

9.1.19 Working Group

The MBITR’s current selected group

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