RF-7800H-MP
HF MANPACK RADIO

**FIELD
REFERENCE
GUIDE**

HARRIS®

RF-7800H-MP TACTICAL HF RADIO

FIELD REFERENCE GUIDE

This manual is based on Firmware Version 1.3

HARRIS®

SAFETY GUIDELINES

⚠	**WARNING** - Do not crush, disassemble, reverse polarity or install incorrectly, incinerate, or mutilate the lithium-ion battery. Do not expose to fire or temperatures above 160 °F (71 °C). The battery can vent, rupture, or explode, releasing toxic material which may cause injury or death to personnel. In case material is released or spilled, evacuate and allow vapors to dissipate. Increase ventilation and DO NOT inhale vapors. Notify safety personnel of release or spills.
⚠	**CAUTION** - ACID CONTAMINATES LITHIUM-ION BATTERIES. Every effort must be made to keep lithium-ion batteries isolated from lead-acid batteries because lead-acid batteries contain sulfuric acid. DO NOT use the same tools and materials such as screwdrivers, wrenches, hydrometers, and gloves for both types of batteries. Any trace of acid or acid fumes will permanently damage lithium-ion batteries on contact.
⚠	**WARNING** - Use only battery chargers approved by Harris, and never attempt to modify the battery or charger. Doing so may result in damage to the battery, the radio, or cause personal injury to the user.
⚠	**WARNING** - RF shock could occur from coming into contact with the antenna while radio is transmitting.
⚠	**WARNING** - The radio could be transmitting even though the Push-To-Talk (PTT) button has not been pressed. This is possible in data communications, Internet Protocol (IP) connections, while performing Third Generation HF protocols (3G) Link Quality Analysis (LQA), or automatic position reports. RF shock could occur from coming into contact with the antenna while radio is transmitting.
⚠	**WARNING** - Do not dispose of lithium or lithium-ion batteries in uncontrolled trash.
⚠	**WARNING** - Do not extend antennas or drive vehicles under low hanging power lines. Contact with power lines could result in personnel injury or death.

WARNING - Operating RF transmitting devices such as radios and cellular phones in or around fuel, weapons, or ordinance could cause serious injury or death.

Make sure guidelines specified in NAVSEA OP 3565 for Hazard of Electromagnetic Radiation to Ordnance (HERO), Hazard of Electromagnetic Radiation to Fuel (HERF), and Hazard of Electromagnetic Radiation to Personnel (HERP) are followed while operating this radio.

The RF system must be turned off within a Safe Separation Distance (SSD) of the HERO Unsafe or Unreliable Ordnance, HERO Susceptible Ordnance, and HERO Safe Ordnance.

When in the presence of equipment being refueled, the system must be turned off within an SSD of fueling operations involving motor vehicle gasoline (MOGAS), aviation gasoline (AVGAS), or JP-8 fuel. No SSD needs to be maintained for fueling operations involving JP-5 or diesel fuel.

TABLE OF CONTENTS

INTRODUCTION

This reference guide is intended to support basic field user operations on the RF-7800H-MP Advanced Tactical HF Radio, referred to throughout this guide as the RF-7800H-MP or radio. This guide also makes the following assumptions:

- The operator has been trained on the radio and is familiar with its basic features.
- Radio has been programmed from the Communications Planning Application (CPA).

Operation of these radio modes is described in this guide:

- Fixed Frequency (FIX)
- Automatic Link Establishment (ALE)
- Third Generation HF (3G), including Adaptive Wideband
- 3G+
- Frequency Hopping (HOP)

Refer to RF-7800H-MP Operation Manual (10515-0413-4200) for detailed information.

Items Included With the Radio

GPS ANTENNA KIT
(12006-0017-02)

BATTERY BOX
(12043-4800-01)

HF RADIO ASSEMBLY
(12097-1000-03)
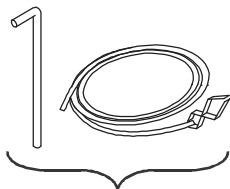
GROUND STAKE KIT
(10303-1008-01)

MODIFIED
H-250/U HANDSET
(10075-1399)
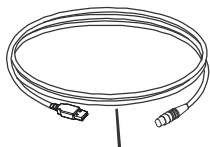
USB PROGRAMMING
CABLE (12043-2750-A006)
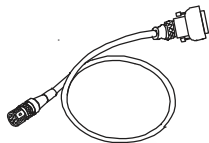
ASYNC DATA CABLE
(10535-0775-A006)

E-PUBLICATIONS CD
(10515-0413-6000)

FIELD REFERENCE
GUIDE
(10515-0413-4100)

OPERATOR CARD
(10515-0413-4000)

CL-0413-4200-0001D

Items Included With the Radio (Continued)

ANTENNA BASE
(10372-0277)

ANTENNA BAG
(CW-503/PRC-25)

COLLAPSIBLE WHIP
(AT271A/PRC-25)

BASE WHIP
ADAPTER ASSEMBLY
(10372-1260-01)

DIPOLE ADAPTER
ASSEMBLY
(10372-1270-01)

RF HAZARD LABEL
(12097-3026-01)

OE-505 WHIP
ANTENNA KIT
(10372-0240-02)

RF HAZARD LABEL
INSTRUCTION SHEET
(10515-6642)

TACTICAL CHAT
(RF-6551H)

RF-7800H CPA
(RF-7800H-SW001)
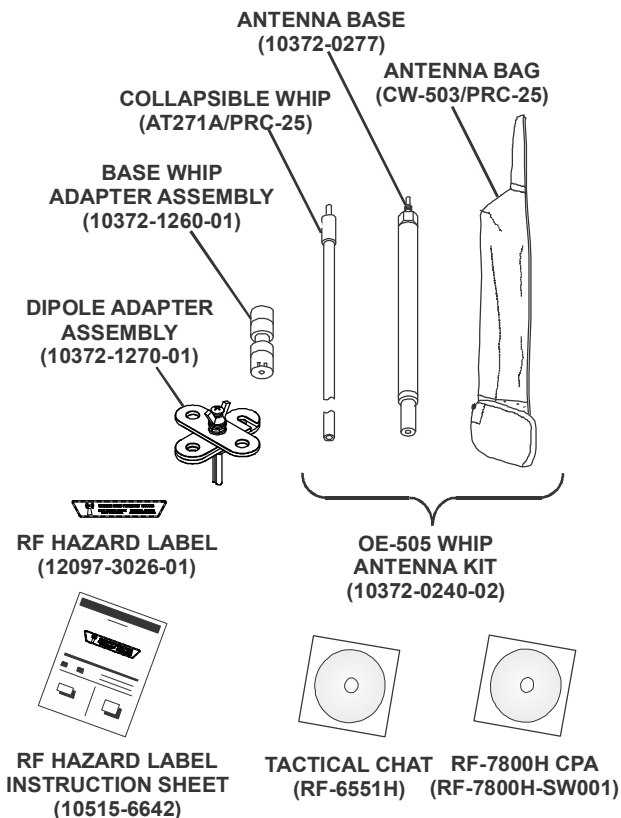
CL-0413-4200-0066B

SYSTEM SETUP PROCEDURE

a. Look at battery orientation label inside battery box.

b. Place battery in battery box with connector facing upwards and oriented on side indicated by the label.

c. Place radio on top of battery aligning rear connector and battery connector.

d. Latch the side clasps.

e. Connect antenna to J7 HF/VHF ANT (do not overtighten).

   The OE-505 includes whip adapter, base, and collapsible whip that must be first assembled. Configurations can consist of (but not limited to):

   • OE-505 Whip Antenna with dipole adapter if dipole or inverted vee antenna is desired (refer to adapter Instruction sheet 10515-6648).

   • OE-505 Whip Antenna by itself.

   • Cable from user supplied antenna.

f. Connectors are labeled on front panel. Connect as required:

   1. Handset to J1 AUDIO.
   2. Global Positioning System (GPS) antenna to J2 GPS.
   3. Remote/data cable to J3 DATA.
   4. USB programming cable to J5 USB.

COLLAPSIBLE WHIP

ANTENNA BASE

GROUND STAKE KIT

BASE WHIP ADAPTER

HANDSET

HF RADIO CHASSIS

BATTERY*

SIDE CLAMPS

BATTERY BOX

*ITEMS NOT INCLUDED
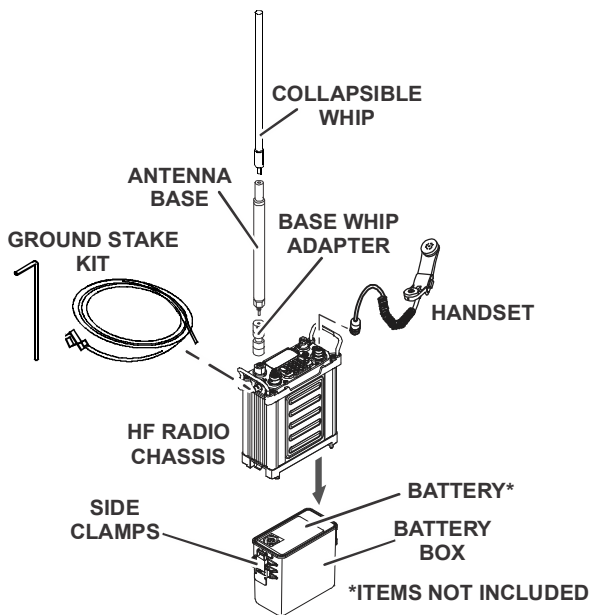
CL-0413-4100-0002A

CONTROLS, INDICATORS, CONNECTORS
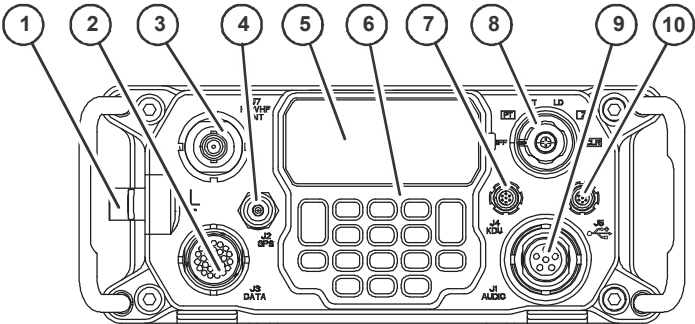
FRONT VIEW
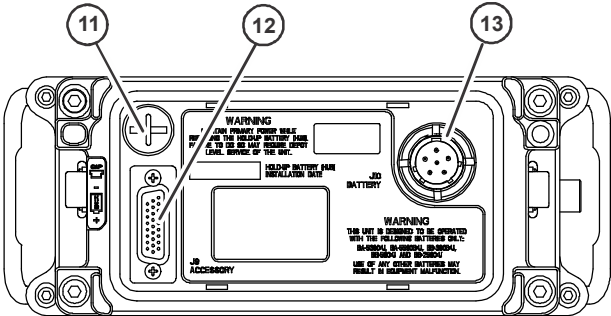
REAR VIEW (BATTERY REMOVED)

CL-0413-4100-0003A

Key	Control/ Indicator	Function
1	Ground Post	Provides a grounding reference for connecting a grounding source to the RF-7800H-MP.
2	J3 DATA	Provides a connection for Data Terminal Equipment (DTE) data, Point-to-Point (PPP) communication, and auxiliary audio.
3	J7 HF/VHF ANT	Provides a 50-ohm antenna port for either a BNC connector or a whip antenna.
4	J2 GPS	Provides a connection for the remote Global Positioning System (GPS) antenna.
5	LCD	Displays the operational and programming displays.
6	Keypad	Keypad
	0 ⟳	**[0]** (⟳)- Shows alternate screens for a given radio mode.
	1 ABC **CALL**	**[CALL]** - Dependent on radio mode selected: • Fixed Frequency (FIX): initiates a hail. • Automatic Link Establishment (ALE): initiates an ALE call. • Frequency Hopping (HOP): transmits or sends a response to a Synchronous (SYNC) request. • Third Generation HF (3G): initiates a 3G call. • 3G+: initiates a 3G or ALE call.
	2 DEF **LT**	**[LT]** - Provides access to the display backlight control menus.
	3 GHI **MODE**	**[MODE]** - Allows the operator to change the operating radio mode to FIX, ALE, HOP, 3G or 3G+.

Key	Control/ Indicator	Function
	4 JKL **SQL**	**[SQL]** - Toggles programmed squelch on or off for the type of channel modulation currently used.
	5 MNO **ZERO**	**[ZERO]** - Not used.
	7 STU **OPT**	**[OPT]** - Provides access to the option menus which are mode dependent.
	8 VWX **PGM**	**[PGM]** - Provides access to the programming menus.
	CLR	**[CLR]** - Used to cancel an operation, back up through a menu chain, or clear a message displayed on the front panel. This key is also used to terminate a link in ALE and 3G/3G+ radio modes. In ALE and FIX radio modes, this key also stops and starts scanning.
	ENT	**[ENT] -** Used to accept a choice from a menu. Also used on the preset screens to select item.
	+ **VOL** **−**	**[VOL +/-] -** Increases/decreases the volume.
	+ **PRE** **−**	**[PRE +/-]** - Scrolls through the presets.

Key	Control/ Indicator	Function
	6 PQR **9 YZ?** ◄ ►	▲, ▼, ◄, ► - Scrolls through the menus.
7	J4 KDU	Provides connection for external Keypad Display Unit (KDU).
8	Function Switch	Box switches require a pull to turn action.
	OFF	Turns RF-7800H-MP OFF.
	PT	Places the radio in Plain Text (PT) (Clear voice, digital voice or data) (requires a pull-to-turn action)
	CT	Places the radio in Cipher Text (CT) (digital voice or data).
	LD	Load. Places the radio into menus for installing/uninstalling firmware.
	Z	Zeroize. Zeroizes the radio, including the encryption keys. (Requires a pull-to-turn action.)
	CLR	Clear. (Requires pull to turn) Disconnects Hold-Up Battery (HUB) and zeroizes radio. This also provides improved HUB life while the radio is in storage.
9	J1 AUDIO	Provides a connection for an audio handset which uses a six-pin connector.
10	J5 USB	Provides connection for USB.
11	HUB	Provides access to the HUB.
12	J9 ACCESSORY	Provides a connection for a power amplifier.
13	J10 BATTERY	Battery connector.

Front Panel Display

RADIO MODE:
FIX, ALE, 3G, 3G+, HOP

SQ - SQUELCH ON

BAT - BATTERY METER
VOL - VOLUME METER DISPLAYS
FOR 4 SECONDS WHEN VOLUME
IS CHANGED

PT - PLAIN TEXT
CT - ENCRYPTED

T - TRANSMITTING
R - RECEIVING

R BAT▮▮▮▢   FIX SQ PT M01 S369+

MESSAGE
WAITING

INDICATES THAT
ADDITIONAL SCREENS ARE
AVAILABLE USING
↻ [0] KEY

RECEIVED SIGNAL
OR TRANSMIT
POWER

CL-0413-4100-0004

PROGRAMMING ENCRYPTION

Encryption programming allows the RF-7800H-MP to communicate securely, after choosing the proper key. Use the following as basic examples. Keys can also be loaded via CPA.

Entering a New Key, Citadel, or AES, Encryption

a. Choose **[PGM] > COMSEC > KEYS > ENTER.**

b. Select a key type:

1. **CITADEL I (MK-128)**
2. **AES-256**
3. **AES-128**

c. At **KEY TO ENTER**, use the alphanumeric keys to enter a desired key name (TEK).

d. If the key already exists, you will get an overwrite message.

e. Use the alphanumeric keys to enter:

1. 32-digit key for Master Key 128-bit (MK-128) or Advanced Encryption Standard 128-bit (AES-128)
2. 64-digit key for Advanced Encryption Standard 256 bit (AES-256)

f. If an MK-128 key was used, you can also enter a 12-digit Analog Voice Security (AVS) key in addition to the MK-128 key.

Updating a Key

a. Choose **[PGM] > COMSEC > KEYS > UPDATE > KEY TYPE**. A confirmation screen appears.

    b. Scroll through the key types and keys, then select the key to update.

    c. Select **Y** to accept. The maximum number of updates is 99. A message appears if the key update failed.

GENERAL OPERATIONS

Starting Up the RF-7800H-MP

    a. Rotate the function switch from **OFF** to the pull to turn **PT** or **CT** position.

    b. Wait about 30 seconds for the radio to initialize. A system preset screen should appear.

Radio Lock

    a. Choose **[OPT] > RADIO > RADIO LOCK** menu choices.

    b. Scroll to the desired **ON** or **OFF** setting and press **[ENT]**.

    c. When set to **ON**, key press sequence of **[1]**,**[3]**,**[7]**,**[9]** is required to unlock the radio. This can only be done on keypad and not on a remote Keypad Display Unit (KDU).

    d. To exit, press **[CLR]** several times or press **[OPT]**.

Toggle Squelch On or Off

From the system preset screen or channel preset screen, press **[SQL]** to toggle squelch on or off.

Backlight

    a. Press **[LT]**.

    b. To adjust the brightness, use ▼ or ▲ to scroll through the range, numbered 0-7.

c. Use ◄ or ► to advance to the **CONTRAST** field. Adjust the contrast using ▼ or ▲ to scroll through the range, 20% to 100% (in 10% increments). Press **[ENT]**.

d. Adjust the **LIGHT OPERATION VALUE** using ▼ or ▲ to scroll through the ranges (**ON, OFF, MOMENTARY**).

e. Press **[LT]** or **[ENT]** to return to the previous screen.

Zeroize Functions

NOTE

Accidental use of zeroize will make the radio inoperable.

a. Pull and turn function switch to **Z**. The RF-7800H-MP immediately begins a zeroize of all programming and **ZEROIZE IN PROGRESS** is displayed.

b. When zeroize is complete, **ZEROIZE COMPLETE** is displayed.

If the function switch is moved to **Z** while the RF-7800H-MP has no power source connected (batteries disconnected), the zeroize occurs the next time the radio is powered on.

Option Menu

The options menu allows changes to the currently used net preset. Press **[OPT]** to access the following:

- **GPS-TOD** - Displays GPS Time of Day (TOD) status.
- **RETUNE** - Retunes either the internal antenna coupler in a manpack configuration, or the external coupler if configured into a system with an external coupler.

- **RADIO** - Set or view TX POWER, SQUELCH LEVEL, FM SQUELCH TYPE, INTERNAL COUPLER, RADIO SILENCE, BEAT FREQUENCY OSCILLATOR (BFO), RX NOISE BLANKING, RADIO LOCK, or RADIO NAME.

- **SCAN** - In fixed frequency, enable or disable scanning.

- **ALE** - When in ALE, ALE options appear, allowing you to send or view Link Quality Analysis (LQA), SCORES, TX_MSG, or RX_MSG.

- **3G** - When in 3G/3G+, 3G options appear, allowing you to set, send or view LQA, SCORES, UNSYNC, TOD, TODROLE, SCHED, or LINKED.

- **GPS-APR** - View and configure GPS Automatic Position Reporting (APR).

- **EXT-ACC** - Displays external accessories in use, such as external antenna coupler or amplifier.

- **TEST** - Runs Self Test and other optional tests.

FIX RADIO MODE

Fix frequency radio mode provides manually changed channelized communications. Use **[0]** (↻) to scroll through the main operating displays of the selected preset.

Fixed Frequency Preset

a. Press **[MODE]** until **FIX** appears on display, then press **[ENT]**.

b. Use **[PRE +/-]** to select a system preset. Keys must be programmed if operating in CT.

c. Observe:

1. **FIX** appears.

2. Correct encryption (**PT** or **CT**),**DATA** (Modem Preset), **VOICE**, **KEY** (**CT** only), and squelch (**SQ**) (if desired) are displayed.

3. **T** appears when transmitting.

4. **R** appears when receiving or when ready to receive.

5. Relative transmit power or receive signal is displayed in bar on right side of display.

6. **BAT** appears with battery level unless volume is being adjusted.

d. Use **[VOL +/-]** to set volume. **VOL** appears along with relative level while volume is adjusted.

Fixed Screens
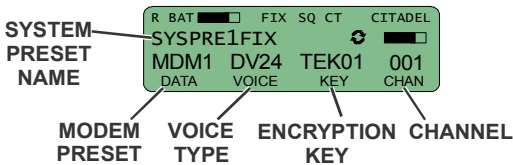
CL-0413-4100-0005-1
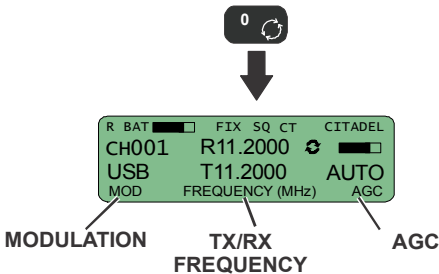
CL-0413-4100-0005-2

Modify Preset

With the system preset screen displayed, press ► to highlight items that can be modified. Modifiable items will be indicated by a dark background. Use the ▼ or ▲ to change value of the selected item. The name of a modified preset appears in brackets (example, **<FIXED>**).

Fix Voice/Data Capability

Encryption	USB	LSB	AME	CW	FM	Data	Voice	Frequency Range (MHz)
PT	x	x	x	x	-	OFF	CLR	1.5-29.9999
	x	x	-	-	-	SERIAL, MIL110B	DV6 [1], ME6 [2], ME12 [4], DV24 [3], ME24 [5], AVS [6],	1.5-29.9999
	x	x	-	-	-	Automatic Repeat reQuest (ARQ), 4285C/U	CLR, AVS	1.5-29.9999
	-	-	-	-	x	Wideband Frequency Shift Keying (WBFSK)	NONE	20-59.9999
	x	-	-	-		Wideband High Frequency (WBHF)	CLR, DV6, ME6, ME12, DV24, ME24	1.5-29.9999
	-	-	-	-	x	OFF	CLR, Continuously Variable Slope Delta (CVSD)	20-59.9999

Encryption	USB	LSB	AME	CW	FM	Data	Voice	Frequency Range (MHz)
Citadel/ Advanced Encryption Standard (AES)	x	x	-	-	-	SERIAL, MIL110B	DV6, ME6, ME12, DV24, ME24	1.5-29.9999
	x	x	-	-	-	ARQ, 4285C/U	NONE	1.5-29.9999
	-	-	-	-	x	WBFSK	NONE	20-59.9999
	x	-	-	-	-	WBHF	NONE	1.5-29.9999
	-	-	-	-	x	OFF	CVSD	20-59.9999

NOTES:

[1] Digital Voice 600 bps (DV6) using Linear Predictive Coding (LPC).

[2] Mixed Excitation Linear Prediction (MELP) 600 bps (ME6).

[3] Digital Voice 2400 bps (DV24).

[4] MELP 1200 bps (ME12).

[5] MELP 2400 bps (ME24).

[6] Analog Voice Security (AVS).

FIX Mode using WBHF

In FIX Radio Mode, WBHF is selectable as a modem type, however, it is not Adaptive Wideband. FIX Mode WBHF does not do any bandwidth, offset, or data rate negotiation. It is based on the user configuration of the modem preset.

NOTE

WBHF is only used for data transmission. It is not available for voice.

If two radios are to connect using WBHF in FIX Mode, they both must be configured for wideband parameters.

a. Go to menu **[PGM] > MODE > PRESET > MODEM > MODEM TYPE** and select **WBHF**.

b. Go to menu **[PGM] > MODE > PRESET > MODEM > BANDWIDTH**. Select the highest bandwidth allowed for this channel based on current frequency allocation. Choices are **3**, **6**, **9**, **12**, **15**, **18**, **21**, or **24 KHz**.

c. Go to menu **[PGM] > MODE > PRESET > MODEM > DATA RATE**. Choices are **75** to **120K** bits per second **(**bps).

d. Go to menu **[PGM] > MODE > PRESET > MODEM > INTERLEAVE**. Choices are **LONG**, **MEDIUM**, **SHORT**, and **ULTRASHORT**.

e. Go to menu **[PGM] > MODE > PRESET > MODEM > PREAMBLE**. Choices are **ULTRASHORT**, **SHORT**, and **LONG**.

f. Go to menu **[PGM] > MODE > PRESET > MODEM > CONSTRAINT LENGTH**. Select the Forward Error Correction (FEC) length as either **7** or **9**.

   • **7** is same as used in MIL-STD-110B.

   • **9** may allow better performance.

If a modem preset has a bandwidth greater than the Max Channel Bandwidth setting, the data rate will be limited to the highest rate available for the channel bandwidth.

ALE RADIO MODE

Automatic Link Establishment (ALE) permits HF stations to call and link on the best HF channel. Each radio in a network is assigned one or more unique addresses. Each address can be up to 15 alphanumeric characters. When not transmitting or linked, the radio constantly scans through its assigned frequencies listening for calls. Each address is assigned to a group of channels called a channel group.

ALE Scanning

NOTE

> If **[CLR]** key is pressed during ALE scanning, the radio stops scanning and will not receive an ALE call on another channel. Press **[CLR]** again to resume scanning.

a. Press **[MODE]** until **ALE** appears on display, then press **[ENT]**.

b. Observe:

   • **SCANNING** appears.

   • Each ALE channel appears briefly on the left.

   • **ALE** appears.

   • **R** appears when receiving or when ready to receive.

   • **BAT** appears with battery level unless volume is being adjusted.

c. Use **[VOL +/-]** to set volume. **VOL** appears along with relative level while volume is adjusted.

ALE - AUTOMATIC LINK ESTABLISHMENT

R BAT ▮▮▯ ALE SQ CT CITADEL
CH01 *SCANNING*

ALE CHANNELS BEING SCANNED
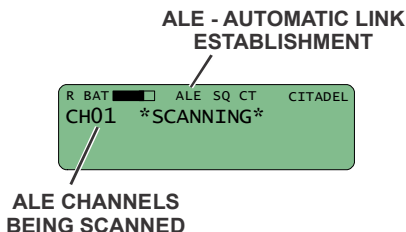
CL-0413-4100-0006

ALE Individual Call

a. Press **[CALL]** to display **CALL TYPE** of **AUTOMATIC** or **MANUAL**.

b. Use ▼ or ▲ to select **AUTOMATIC** and press **[ENT]**.

c. Use ▼ or ▲ to select **INDIVIDUAL** and press **[ENT]**.

d. Use ▼ or ▲ to select the individual address and press **[ENT]**. (Screen below shows ALE when linked.)

LINKED

SYSTEM PRESET NAME

R BAT ▮▮▯ ALE SQ CT CITADEL
SYSPRE2ALE ⬭ ⟳ ▮▯
MDM1 DV24 TEK01 001
DATA VOICE KEY CHAN

MODEM PRESET **VOICE TYPE** **ENCRYPTION KEY** **CHANNEL**
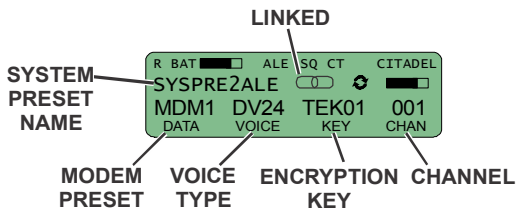
CL-0413-4100-0007

ALE Net Call

   a. Press **[CALL]** to display call type of **AUTOMATIC** or
       MANUAL.

   b. Use ▼ or ▲ to select **AUTOMATIC** and press **[ENT]**.

   c. Use ▼ or ▲ to select **NET** and press **[ENT]**.

   d. Use ▼ or ▲ to select the net address and press **[ENT]**.

Place ALE ANY, ALL, or Group Call

These calls are placed in the same manner as ALE Individual Call,
p26. Refer to the RF-7800H-MP Operation Manual (10515-0413-
4200) for description of these address types.

Terminate ALE Link

   a. To terminate the ALE link, press **[CLR]** from the preset
       screen.

   b. The radio displays the **TERMINATE LINK** menu. To
       terminate the link, scroll to **YES** and press **[ENT]**.

Placing an ALE Call to a Non-Programmed Net

The calling station must call on one manual channel at a time that
is being scanned by the receiving station. This is a hit and miss
technique, but can be very effective in calling outside the
immediate net hierarchy. To place an ALE call to a non-
programmed net:

   a. Press **[CALL]** to display **CALL TYPE** of **AUTOMATIC** or
       MANUAL.

   b. Use ▼ or ▲ to select **MANUAL** and press **[ENT]**.

   c. Use ▼ or ▲ to select **INDIVIDUAL** and press **[ENT]**.

d. Press **[0]** (↻) and type in the desired individual address to call and press **[ENT]**.

e. Enter the desired channel to call and press **[ENT]**.

f. The RF-7800H-MP begins transmitting to the selected address.

As the radio scans and listens for calls and sounds, it acquires Link Quality Analysis (LQA) information for station addresses outside the programmed net. These non-programmed net station addresses are referred to as OTHER addresses. Once the radio acquires an OTHER address, menus are made visible to allow calls to be placed to them and viewing of their channel LQA scores. OTHER address information is lost when the radio is power cycled, unless they are added to the programmed net.

Perform LQA Exchange
In an LQA exchange, selected station or net transmits back to initiating station.

a. Choose **[OPT]** > **ALE > LQA > EXCHANGE** menu choices.

b. Use ▼ or ▲ to scroll through the individual, net, or other addresses and press **[ENT]**.

    The radio tries to exchange with the selected station(s) on all frequencies in the channel group associated with the address.

Perform LQA Sound
In an LQA sound, only the sending station transmits.

a. Choose **[OPT]** > **ALE > LQA > SOUND** menu choices.

b. Use ▼ or ▲ to scroll through the self addresses and press **[ENT]**.

You need to be aware of which self address was associated with the individuals or net addresses during programming.

View LQA Scores

a. Choose **[OPT]** > **ALE > SCORES > REVIEW** menu choices.

b. Use ▼ or ▲ to scroll through the individual or other addresses and press **[ENT]**.

c. Use ▼ or ▲ to scroll through the channels and available scores.

d. Press **[CLR]** repeatedly or **[OPT]** to return to ALE scanning.

Zeroize LQA Scores

Choose **[OPT]** > **ALE > SCORES > ZERO_SCORES** and press **[ENT]**. The radio briefly responds with **ALE LQA SCORES ZEROIZED** to confirm that the scores have been zeroized.

Transmit Preprogrammed AMD Message

NOTE

Automatic Message Display (AMD) messages use a maximum of 90 characters and are not encrypted.

a. Choose **[OPT]** > **ALE > TX_MSG > TX MESSAGE TO SEND** menu choices.

    b. Use ▼ or ▲ to scroll through the preprogrammed Automatic Message Display (AMD) messages and press **[ENT]**.

    c. For **SEND TX MESSAGE?**, use ▼ or ▲ to select **YES** and press **[ENT]**.

    d. For **CALL TYPE**, use ▼ or ▲ to select either **AUTOMATIC** or **MANUAL** and press **[ENT]**.

    e. For **ADDRESS TYPE**, select **INDIVIDUAL** or **OTHER** and press **[ENT]**.

       Press **[0]** (↻) instead of **[ENT]** to enter Individual Addresses that are not preprogrammed.

    f. Use ▼ or ▲ to scroll through the programmed individual addresses and press **[ENT]**. The AMD message will then be transmitted to that individual address.

View a Received AMD Message

    a. Choose **[OPT]** > **ALE > RX_MSG** menu choices.

    b. Use ▼ or ▲ to scroll through the received AMD messages and press **[ENT]**.

    c. Use ▼ or ▲ to view an entire AMD message that is too long to view on the front panel at one time.

    d. Press **[CLR]** repeatedly to return to the ALE scanning screen.

ALE AMD In-Link Calls

The In-Link Call simplifies the sending of AMD messages within an ALE link because there is no need to specify the destination address when placing the call.

a. Choose **[OPT]** > **ALE > TX_MSG**. The current **TX MESSAGE TO SEND** setting appears.

b. Use ▼ or ▲ to scroll through the preprogrammed AMD messages and press **[ENT]**.

c. For **SEND TX MESSAGE?,** use ▼ or ▲ to select **YES** and press **[ENT].**

d. For **CALL TYPE**, use ▼ or ▲ to select either **AUTOMATIC** or **MANUAL** and press **[ENT]**.

e. For **ADDRESS TYPE**, select **INLINK** and press **[ENT]**. The radio will begin to transmit the AMD.

f. Once the transmission is complete, the radio displays a **LINKED TO** screen.

ALE Voice/Data Capability

Encryption	USB	LSB	AME	Data	Voice	Frequency Range (MHz)
PT	x	x	x	OFF	CLR	1.5- 29.9999
	x	x	-	SERIAL, MIL110B	DV6, ME6, ME12, DV24, ME24, CLR, AVS	1.5- 29.9999
	x	x	-	ARQ, 4285C/U	CLR, AVS	1.5- 29.9999
Citadel/AES	x	x	-	SERIAL, MIL110B	DV6, ME6, ME12, DV24, ME24	1.5-29.9999
	x	x	-	ARQ, 4285C/U	NONE	1.5- 29.9999

3G/3G+ RADIO MODE

The RF-7800H-MP's third generation HF communication protocol (3G) radio mode provides a subset of the capabilities and protocols defined by STANAG-4538 and includes improvements such as:

- Faster link setup

- Linking at lower Signal-to-Noise Ratios (SNR)

- Improved network channel efficiency

- Link setup signaling and data traffic use the same family of high-performance serial waveforms

- Higher throughput for short and long data messages

- Use of different channel plans for frequency security and close propagation matching

- Pretuning of channels to reduce tune times in linking

Compared to ALE, 3G differences consist of the following:

- Synchronous channel scanning

- Uses Short Message Service (SMS) instead of Automatic Message Displays (AMDs)

- No associated self addresses

- No 1-3 character self address

- No ALL or ANY wildcards

- No maximum channels to scan

- ALE uses channels 000 through 099; 3G uses channels 100 through 162.

- 3G requires TOD server manual time synchronization or Global Positioning System (GPS).

- 3G has Last Ditch Voice (LDV) feature that allows the radio to deliver digital voice across a channel that normally would not support digital voice error free.

3G+ allows the radio to receive and place ALE calls while operating in 3G mode. Only voice operations are supported in 3G+.

3G Scanning

a. Press **[MODE]** until **3G** or **3G+** appears on display, then press **[ENT]**.

b. Observe:

- **SCANNING** appears.
- Each 3G channel appears briefly on the left.
  - 3G, Channels 100 - 162
  - 3G+, Channels 001 - 062
- **3G** or **3G+** appears.
- **R** appears when receiving or when ready to receive.
- **BAT** appears with battery level unless volume is being adjusted.
- **SYNC** status on right side of screen:
  - **AUTO** - TOD synchronization based on GPS time from internal GPS receiver.
  - **MAN** -TOD synchronization received over the air if radio is TOD outstation or internal clock if radio is TOD server.
  - **NONE** -No TOD synchronization from any source.
  - Bar indicates time remaining before radio is no longer in sync.

c. Use **[VOL +/-]** to set volume. **VOL** appears along with relative level while volume is adjusted.

R BAT ■■□ 3G SQ CT   –   +
CH112 SCANNING
DAYNET4538   AUTO
CHANNEL PLAN   SYNC

CHANNELS   **CHANNEL**   **SYNC GRAPH**
BEING SCANNED **PLAN**   **AND STATUS**
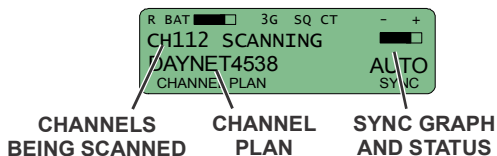
CL-0413-4200-0008

Select TOD Server

⚠️ **CAUTION**

Communication failures may result if two or more
stations attempt to function simultaneously as
TOD servers.

a. Press **[OPT]** to display the **Option Menu**.

b. Use ◄ or ► to select **3G** and press **[ENT]**.

c. Use ◄ or ► to select **TODROLE** and press **[ENT]**. Current
TOD server appears. If no TOD server has been observed,
------- is displayed.

d. Press **[ENT]** to see the TOD role is **BASE** or
OUTSTATION.

e. Use ▼ or ▲ to change the role.

f. Press **[ENT]**. A prompt appears asking you to verify the
TOD role change.

g. Use ▼ or ▲ to select **YES** and press **[ENT]**.

Perform Automatic GPS TOD Synchronization

   a. Power off RF-7800H-MP by rotating the function switch to **OFF**.

   b. Connect GPS antenna to J2 GPS on the front of the RF-7800H-MP.

   c. Rotate function switch to the **PT** or **CT** position depending on desired operation.

   The internal GPS initiates a search for GPS satellites. The RF-7800H-MP continues to search until at least four GPS satellites are acquired. The RF-7800H-MP uses information from the satellites to generate a GPS time reference. Once generated, **AUTO** is displayed above **SYNC** and the sync meter shows a full bar (100% sync).

Perform Manual TOD Synchronization

Manual TOD synchronization may be used instead of GPS TOD synchronization when conditions indicate GPS may be unavailable or intermittent. In a manually synchronized network, the TOD server maintains the network time reference and distributes it to all the outstations to ensure network synchronization for reliable communications.

   a. Press the **[OPT]** to display the **Option Menu**.

   b. Use ◄ or ► to select **3G** and press **[ENT]**.

   c. Use ▼ or ▲ to select **TOD** and press **[ENT]**.

   d. Enter wristwatch time and press **[ENT]**.

NOTE

Outstation time must be within ±7 minutes of TOD server time. It is recommended to maintain and use UTC (also known as Greenwich Mean Time [GMT] or ZULU) for all operations to ensure consistency between radios.

e. Enter a new date if required and press **[ENT]**. If the date is already correct, just press **[ENT]**.

f. Press **[OPT]** to close the options menu and return to the operation screen.

The RF-7800H-MP scans while continuing to display a sync state of **NONE**. When a TOD sync broadcast or a response to a sync request is received the sync state changes to **MAN**, and the sync meter display indicates full (100%) synchronization. The length of time required depends on how frequently TOD sync broadcasts are transmitted from a TOD server station and 3G protocol used.

Switching from Manual to GPS TOD Synchronization

When it becomes necessary to change from using a non-GPS time reference (Manual sync) to using a GPS time reference (auto sync), a 3G **UNSYNC** must be performed in order to force the radio sync state to **NONE**. The radio automatically transitions from **NONE** to auto sync once the GPS reports tracking.

a. Leave the GPS antenna connected to the RF-7800H-MP unless you do not want to use a GPS time reference.

b. Press **[OPT]** to display the options menu.

c. Use ◄ or ► to select **3G** and press **[ENT]**.

    d.   Use ◄ or ► to select **UNSYNC** and press **[ENT]**.

Request TOD Sync from a TOD Server

    a.   Press **[CALL]**.

    b.   Use ▼ or ▲ to select **SYNC REQUEST** and press **[ENT]**.

Place 3G Point-To-Point Call

    a.   Press **[CALL]**.

    b.   Use ▼ or ▲ to select call type of **AUTOMATIC**, **MANUAL**, or **BEST**.

    c.   Press **[ENT]**.

    d.   Use ▼ or ▲ to select address type **STATION** and press **[ENT]**.

    e.   Use ▼ or ▲ to select the station name you wish to call and press **[ENT]**.

Place 3G Net Call

    a.   Press **[CALL]**.

    b.   Use ▼ or ▲ to select call type of **AUTOMATIC**, **MANUAL**, or **BEST**.

    c.   Press **[ENT]**.

    d.   Use ▼ or ▲ to select address type **NET** and press **[ENT]**.

    e.   Use ▼ or ▲ to select the net name you wish to call and press **[ENT]**.

SYNC STATUS

SYSTEM PRESET NAME

R BAT ▮▮▯ 3G SQ CT − +
3GNET1
3GM   ME12 TEK01 001
DATA   VOICE KEY   CHAN

MODEM PRESET **VOICE TYPE** **ENCRYPTION KEY**
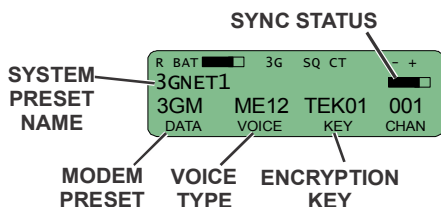
CL-0413-4100-0009A

Place 3G+ Point-To-Point ALE Call

    a. Press **[CALL]**.

    b. Use ▼ or ▲ to select call type of **ALE AUTOMATIC** or **ALE MANUAL**.

    c. Press **[ENT]**.

    d. Use ▼ or ▲ to select ALE address type **INDIVIDUAL** and press **[ENT]**.

    e. Use ▼ or ▲ to select the address you wish to call and press **[ENT]**.

Place 3G+ Net ALE Call

    a. Press **[CALL]**.

    b. Use ▼ or ▲ to select call type of **ALE AUTOMATIC** or **ALE MANUAL**.

    c. Press **[ENT]**.

    d. Use ▼ or ▲ to select ALE address type **NET** and press **[ENT]**.

e. Use ▼ or ▲ to select the address you wish to call and press **[ENT]**.

Terminate 3G/3G+ Link

a. From TOD server or outstation, press **[CLR]** or **[PGM]** to terminate the link. The following could be displayed:

TERMINATE DATA? - Sending and receiving data but no call is pending.

TERMINATE LINK? - Voice link present but no call or data in progress.

TERMINATE CALL? - Call pending or call is in progress but no data transfer is active.

b. Use ▼ or ▲ to select **YES** and press **[ENT]**. The terminating screen is displayed momentarily then the RF-7800H-MP returns to scanning.

Transmit a 3G/3G+ TOD Broadcast Sync

a. Press **[CALL].**

b. Use ▼ or ▲ to select:

BROADCAST SYNC - TOD server transmits a single TOD sync broadcast.

BROADCAST SYNC-ALL - TOD server transmits a TOD sync broadcast on each channel in the current frequency plan.

c. Press **[ENT]**.

NOTE

A **BROADCAST SYNC-ALL** may require more than a minute to complete. You may want to only use when synchronizing an entire radio network. An example would be immediately after deployment when GPS synchronization is unavailable.

Select 3G Channel Plan

a. While in the scanning screen, use ◄ or ► until field under **CHANNEL PLAN** is highlighted.

b. Use ▼ or ▲ to scroll to the desired channel plan.

c. Press **[ENT]** to select the setting.

The RF-7800H-MP momentarily tunes the internal or external antenna coupler (if enabled) on each channel of the channel group corresponding to the channel plan.

d. The RF-7800H-MP displays the name of the selected channel plan and begins scanning the frequencies of the selected plan.

Perform 3G Sound LQA

In an LQA sound, only the sending station transmits. Radios must be synchronized in order to perform a sound.

a. Choose **[OPT]** > **3G > LQA > SOUND** menu choices.

b. Use ▼ or ▲ to scroll through the self addresses and press **[ENT]**.

The RF-7800H-MP transmits a sound transmission on each channel in the current channel plan. Other net members receiving the sound transmission automatically

update their scores for the station transmitting the sound on each channel in which the sound was received.

Perform 3G Exchange LQA

In an LQA exchange, selected station or net transmits back to initiating station.

   a. Choose **[OPT]** > **3G > LQA > EXCHANGE** menu choices.

   b. Use ▼ or ▲ to scroll through the individual, net, or other addresses and press **[ENT]**.

   The radio tries to exchange with the selected station(s) on all frequencies in the channel group associated with the address.

Review 3G LQA Scores

   a. Choose **[OPT]** > **3G > SCORES > REVIEW > IND ADDR**.

   b. Scroll and select station for scores.

   Other channels within the channel plan and their scores can be displayed by pressing ▼ or ▲.

NOTE

   Only channels with scores will be displayed (not necessarily all channels in the channel plan).

   c. Press **[CLR]** repeatedly or **[OPT]** to exit.

3G Zeroize Scores

Choose **[OPT]** > **3G > SCORES > ZERO_SCORES**.

NOTE

Internal or external coupler will need to go through complete retune cycle on each channel.

Schedule a Broadcast Sync

a. Choose **[PGM]** > **SCHED > ADD**.

b. On the offset time screen, enter time offset of the transmission schedule relative to midnight, Universal Time Coordinated (UTC) (0000 Zulu), in hours and minutes (24-hour format), and press **[ENT]**.

c. On the interval time screen, enter time interval between successive TOD sync broadcast transmissions in hours and minutes and press **[ENT]**.

For example, if the operator enters an offset time of 00:15 and an interval time of 00:30, the first TOD sync broadcast will occur on each new UTC day at 0015 UTC; subsequent TOD sync broadcast transmissions will occur every thirty minutes. (00:45, 01:15, 01:45, 02:15, 02:45, etc.)

By selecting **EDIT** or **DELETE** instead of **ADD**, the operator can edit or delete a previously scheduled broadcast.

Last Ditch Voice (LDV)

LDV is only available in 3G radio mode. Upon receiving LDV, a warning tone will be heard in the handset. LDV transmissions are saved and can be played back at a later time. The defaults work for most applications and it is recommended to keep them.

Send LDV Message

To send an LDV message:

a. From the 3G preset screen, use ◄ or ► to scroll to the VOICE field.

b. Use ▼ or ▲ to select LDV.

c. Key the handset and talk. A warning tone will be heard in the handset before the maximum time of 1 minute, 50 seconds is up.

d. Unkey and the message is automatically sent, but may have a delay due to channel conditions.

Retrieve a Saved LDV Message

When an LDV message has been received, a warning tone will be heard in the receiving handset and **Mxx** will appear on the display next to the sync or signal meter (where xx is a number in the range 01-11). The radio only stores one LDV message, so a new incoming LDV will overwrite any previous message.

The indicator may show from M01 - M11, as this indicates the total number of LDV and SMS messages waiting to be read.

a. Use ◄ or ► until **Mxx** is highlighted then press **[ENT]**.

- If there are both LDV and SMS messages waiting to be read, selecting Mxx will take you to the menu that shows **LDV*** and **SMS***. Select **LDV** and proceed to the next step.

- If only an LDV message is waiting, the menu takes you directly to the LDV PLAY menu. **LDV MESSAGE ACTION REPLAY/DELETE** is displayed. Proceed to the next step.

b. Use ▼ or ▲ to select **REPLAY** or **DELETE** and press **[ENT]**. If **REPLAY** is selected, **REPLAYING LDV MESSAGE** is displayed.

c. When message replay is complete, a message appears confirming deletion of the LDV message. Use ▼ or ▲ to select **YES** or **NO** and press **[ENT]**. If **DELETED** is selected, the message will be deleted.

NOTE

If the radio is busy when an LDV message is attempted, **CAN'T REPLAY MESSAGE IN PROGRESS** is displayed.

SHORT MESSAGE SERVICE (SMS)

SMS is available in both 3G and 3G+ radio modes and provides text-based messaging capabilities. SMS usage can also be configured to operate in **PT or CT**, or **CT only**. By default, the radio is set for **CT only**.

Canned Messages

SMS has the Canned Messages feature which allows the user to enter and save text messages for future use. The Canned Messages feature allows up to 10 SMS messages to be stored. Because canned messages are shared between SMS AMD's (ALE messaging), the length of canned messages can only be 90 characters.

SMS messages can be 160 characters. SMS allows you to add to the canned message before sending. The Receive buffer holds up to 10 received SMS messages. When full, new messages overwrite old messages, beginning with the oldest.

Text Prediction

The Text Prediction feature (also referred to as Predictive Text), when enabled, assists the user by inserting characters during typing on the keypad, based on text entry/use patterns.

Sending New SMS Messages

To send an SMS message from the radio front panel:

a. Press **[OPT]**.

b. Use ◄ or ► to select **MSG** and press **[ENT]**.

c. Use ◄ or ► to select **SMS** and press **[ENT]**.

d. Use ◄ or ► to select **NEW** and press **[ENT]**.

e. From **MESSAGE TYPE,** use ▼ or ▲ to select either: **NEW MSG**, **CANNED MSG, LAST SENT MSG,** or **LAST ENTERED MSG.** If no messages have been sent select either: **NEW MSG**, or **CANNED MSG** (if applicable).

f. If this is a new Message (MSG), use the keypad to enter/edit the message text. To access special text symbols and characters when entering text messages, press **[0]** (↻).

Optionally, the user can press **[0]** (↻) a second time to select **TEXT ENTRY MODE.** Use ▼ or ▲ to select **Insert 'I'** or **Overwrite 'O'**. Pressing the same key a third time selects **TEXT PREDICTION** to turn on or off. Use ▼ or ▲ to turn text prediction **ON 'P'** or **OFF**.

g. Press **[ENT]** to send the message.

h. Use ▼ or ▲ to select the desired **SEND TO** destination either, **STATION** or **NET**. Press **[ENT]**.

i.   Use ▼ or ▲ to select the **STATION ADDRESS** or the
     NET ADDRESS where the message will be sent. Press
     [ENT].

j.   "**CHxxx SENDING TO xxxxxxxx**" is displayed while
     message is being sent.

k.   Press **[CLR]** if you want to stop the transmission.
     TERMINATE DATA? will be displayed. Select **YES** or **NO**
     to stop transmission.

Retrieve a Saved SMS Message

When an SMS message has been received, a warning tone will be
heard in the receiving handset and **Mxx** will appear on the display
next to the sync or signal meter (where xx is a number in the range
01-11). The radio only stores 10 SMS messages. If SMS buffer is
full at 10, a new incoming SMS message will delete the first
received message.

NOTE

The indicator may show from M01 - M11, as this
indicates the total number of LDV and SMS
messages waiting to be read.

When a new SMS message is waiting to be read:

a.   Press the **[OPT]** button.

b.   Use ◄ or ► to select **MSG**, then press **[ENT]**.

c.   Use ◄ or ► to select **SMS**, then press **[ENT]**. The menu
     will allow you to select **LDV*** or **SMS*** (where the *****
     indicates there are unread messages). Select **SMS** to
     continue and read the SMS message.

d. Use ▼ or ▲ to browse through the received messages. The top message is the most recent. Highlight the desired message and press **[ENT]**.

e. When message replay is complete, a message appears confirming deletion of the message.

f. Use ▼ or ▲ to select the appropriate **YES** or **NO** and press **[ENT]**. If **DELETED** is selected, the message will be deleted.

Forwarding SMS Messages

This procedure describes how to forward a received SMS message to another station.

a. Press **[OPT]**.

b. Use ◄ or ► to select **MSG** and press **[ENT]**.

c. Use ◄ or ► to select **SMS** and press **[ENT]**.

d. Use ◄ or ► to choose **SELECT**, then use ▼ or ▲ to browse to the received message that will be forwarded. Press **[ENT]**.

e. Use ◄ or ► to select **FORWARD** and press **[ENT]**.

f. The message text may be edited or left as displayed. When the message is ready, press **[ENT]** to send.

g. Use ▼ or ▲ to select the desired **SEND TO** destination either, **STATION** or **NET**. Press **[ENT]**.

h. Use ▼ or ▲ to select the **STATION ADDRESS** or **NET ADDRESS** where the message will be forwarded to and press **[ENT]**.

Resend Last Sent SMS Message

This procedure describes how to forward a received SMS message to another station.

- a. Press **[OPT]**.

- b. Use ◄ or ► to select **MSG** and press **[ENT]**.

- c. Use ◄ or ► to select **SMS** and press **[ENT]**.

- d. Use ◄ or ► to select **NEW**, then press **[ENT]**.

- e. Use ▼ or ▲ to browse through **MESSAGE TYPE** and select **LAST SENT MSG**. Press **[ENT]**.

- f. The message text may be edited or left as displayed. When ready, select the desired message and press **[ENT]** to send.

- g. Use ▼ or ▲ to select the desired **SEND TO** destination either, **STATION** or **NET**. Press **[ENT]**.

- h. Use ▼ or ▲ to select the **STATION ADDRESS** or **NET ADDRESS** where the message will be forwarded to and press **[ENT]**.

Deleting SMS Messages

This procedure describes how to delete a single SMS message or delete all SMS messages from radio memory.

- a. Press **[OPT]**.

- b. Use ◄ or ► to select **MSG** and press **[ENT]**.

- c. Use ◄ or ► to select **SMS** and press **[ENT]**.

- d. To delete a single message:

  - • Use ◄ or ► to choose **SELECT** and use ▼ or ▲ to browse to the message to be deleted. Press **[ENT]**.

- • Use ◄ or ► to select **DELETE** and press **[ENT]**.

- • Select **YES** to delete the message.

   e. To delete all saved messages:

   - • Use ◄ or ► to select **DELETE_ALL** and press **[ENT]**.

   - • Use ▼ or ▲ to browse the Delete selections, select Delete, **ALL RCVD MSGS** and press **ENT]**.

Manually Send a GPS Report

The RF-7800H-MP can send a manual GPS report at any time while the radio is in 3G and Internal GPS is tracking. Manual reports can be transmitted even if automatic reports have been disabled or radio silence is enabled. The destination can be the default Automatic Position Reporting (APR) 3G address, or any other 3G individual or net address programmed into the radio.

A manual report can also include an alert indication for certain software installed at a GPS server. Perform the following procedure to send a manual GPS report:

   a. Press **[CALL]**.

   b. Use ▼ or ▲ to select **SEND GPS REPORTS** and press **[ENT]**.

   c. Use ▼ or ▲ to select the default APR address, or **STATION**, or **NET**, and press **[ENT]**.

   d. Use ▼ or ▲ to select the destination address and press **[ENT]**.

   e. Use ▼ or ▲ to select **YES** or **NO** (in response to sending an alert) and press **[ENT]**. GPS report is then sent.

3GVoice/Data Capability

Encryption	USB	Data	Voice	Frequency Range (MHz)
PT	X	Not Applicable (N/A)	DV6, ME6, DV24, ME12, ME24, AVS	1.5 - 29.9999
	X	N/A	CLR	1.5 - 29.9999
	X	Serial (110A) and 110B, Variable Data Link (XDL), Wideband HF (WBHF)	N/A	1.5 - 29.9999
Citadel/AES	X	N/A	DV6, ME6, DV24, ME12, ME24	1.5 - 29.9999
	X	Serial (110A) and 110B, XDL, WBHF	N/A	1.5 - 29.9999

ADAPTIVE WIDEBAND

Adaptive Wideband (WB) operation offers the following features:

- Operable in 3G mode.

- HF data on bandwidths from 3 kHz to 24 kHz per MIL-STD-188-110C Appendix D, allowing data rates up to 120,000 bps.

- High speed HF E-mail using the WMT.

- Adjustment of bandwidth and data rate is completely automated, requiring no operator intervention.

- Improved data throughput under fair-to-excellent channel conditions, and higher reliability under poor conditions.

- WB data includes PT and CT. CT uses CITADEL and AES encryption keys.

Adaptive WB Operation

Adaptive WB is a feature that uses a data-specific 3G link created by the RF-6760W Wireless Message Terminal (WMT) application. While in 3G mode, the radio will be able to link for 3G Wideband (WB) data. Voice is not supported on an Adaptive WB link, but a voice link is possible as soon as the WMT transaction is completed. 3G NB support is available from 3G scanning when not using the WBHF modem.

Channel selection is made by the radio. The 3G score, in combination with WB spectrum sensing information, is used to select the best channel for WB data. Channel selection for WB call attempts is based on occupancy, available SNR, estimated bandwidth, and the WMT's estimate of the amount of data to be transferred.

Automated data rate, bandwidth, and interleaver selection is accomplished using handshakes. Data rate adjustments are made by the WMT as transmission progresses. WMT will support WB synchronous data transfer to the radio. Actual bandwidths, data rate and interleaver will be shown in the radio display.

Configure Adaptive WB Parameters

The Adaptive WB functionality is intended to be accessible only via the WMT controlling the radio, and programming is normally performed via CPA. Thus, the Adaptive WB display is limited to status messages on the radio front panel. There are, however, a limited set of configuration options accessible via the programming menu screens. To configure Adaptive WB parameters, select an appropriate 3G channel that has already been configured using CPA. Optionally, the following settings may be adjusted directly from the radio front panel.

⚠ CAUTION

Local regulatory authorities may restrict bandwidth availability to less than 24 kHz. Consult your communications manager before configuring wideband channels.

a. Go to menu **[PGM] > MODE > PRESET > CHANNEL > MAXIMUM BANDWIDTH**. Select the highest bandwidth allowed for this channel based on current frequency allocation. Choices are **3**, **6**, **9**, **12**, **15**, **18**, **21**, or **24** kHz.

```
PGM-MODE-PRESET-CHANNEL    077
  MAXIMUM BANDWIDTH
         18KHz
    PRESS ▲▼ TO SCROLL
```
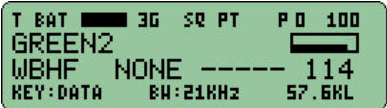
Operational/Status Displays

Refer to Table 1. When an Adaptive WB link is established, most of the action takes place in 3G calling screens. During 3G scanning and after the 3G link is established, the WBHF modem performs spectrum sensing and an on-air handshake operation to establish what part of the channel's allocated bandwidth is usable.

When a 3G call is made for data, the front panel displays "SENDING TO…" until the link is established. For Adaptive WB, this is followed by a popup screen indicating that the wideband handshake is occurring. The handshake may take up to two (2) seconds. After the handshake, the familiar 3G linked (preset) screen is shown. In addition, the negotiated bandwidth, data rate and interleaver are viewable on the bottom line.

Table 1. Adaptive WB Calling Sequence

1. Establishing 3G link
T BAT ▬▬▬ 3G SQ PT CH114 SENDING TO GREEN2
2. Doing Wideband Handshake
R BAT ▬▬▬ 3G SQ PT CH114 NEGOTIATING WB CHANNEL 3G LINKED TO GREEN2
3. Beginning Data Transfer
T BAT ▬▬▬ 3G SQ PT   P D 100 GREEN2 WBHF NONE ————— 114 KEY:DATA   BW:21KHz   57.6KL

The linked radios agree on the bandwidth and the optimized bandwidth is used for the duration of the link.

Interleaver determines the run length for error correction. Longer interleaves give higher levels of correction, but increase the transmission latency. With Adaptive Wideband, the radio will always select LONG interleaver initially. The WMT will automatically adjust the interleaver for the user.
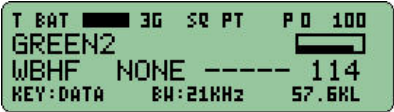
The sequence of status screens while linked in a 3G wideband link operation is shown below.

The first two screens are based on the existing status screens available during a 3G link. The first screen is "Preset View", and the second is "Channel View". Note that the frequency displayed on the Channel View (14.0000 MHz) is the **programmed** frequency (also

known as Radio Display Frequency) of the link channel. This is not affected by bandwidth negotiation.

The **negotiated** bandwidth parameters are displayed in the third status screen. Note in this example that the adjusted frequency (13.9925 MHz) is different than the Radio Display Frequency. Also, the maximum (**MAX**) bandwidth programmed for the channel is 24 kHz, but after interference detection, the current (**CUR**) usable bandwidth is now 21 kHz.

Table 2. Adaptive WB Status Sequence

Preset View
T BAT ■■■ 3G SQ PT P 0 100
GREEN2
WBHF NONE ----- 114
KEY:DATA BW:21KHz 57.6KL
[0 ↻]

Channel View
T BAT ■■■ 3G SQ PT P 0 100
CH114 R14.0000
USB T14.0000 AUTO
KEY:DATA BW:21KHz 57.6KL
[0 ↻]

Negotiated Channel View
T BAT ■■■ 3G SQ PT P 0 100
CUR 21 F13.9925
MAX 24 R 57.6K LONG
BW (KHZ) ADJ.FREQ/RATE INTRLV
[0 ↻]
Returns to Preset View

See the figure below for a description of the Adaptive WB status fields.
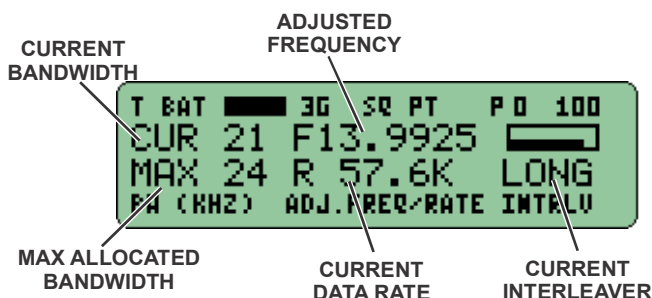
CL-0413-4100-0080

Adaptive WB System Setup

This section covers installation of software and connection of hardware necessary for Adaptive WB operation.

Items Required

- RF-7800H-MP radios with version 1.3 or newer firmware installed.

- PC with at least one free USB host port or serial port.

- RF-6760W Wireless Messaging Terminal (WMT) software version 1.5 or newer.

- Network Radio Driver Install (NRDI), software version 1.6 or newer.

- PC to radio interface cable for Adaptive WB.

Setup Procedure

a. Make sure that WMT (version 1.5 or newer) and NRDI (version 1.6 or newer) is installed on the PC. Refer to the documentation and online Help provided with the applications for operating information.

b. Connect the radio to the PC using the interface cable.

c. Power up the radio and direct Windows to find the USB driver automatically.

d. Launch NRDI and install the Harris radio connection on the virtual serial port. Test the connection from within NRDI, and close NRDI.

e. Launch WMT. Configure WMT network and local station, specifying that the PPP connection to be used for the local radio.

f. WMT is ready to operate with the radio.

Send/Receive a WMT Message

Use this checklist to prepare to transfer a WMT message from one Adaptive WB-enabled RF-7800H-MP to another.

- Both radios are programmed by CPA with valid 3G fill, and include WB channels. Refer to CPA online Help for complete CPA usage.

- Both radios have established Manual or Auto 3G sync.

- Both radios are connected to PCs running WMT with valid configuration.

- Both WMTs are online and idle.

- Both radios are scanning 4538 FLSU.

- An LQA exchange has been performed.

WMT Operation Sequence

1. Operator A composes and sends a new message from WMT A.
2. Radios A and B establish a 3G link.
3. Radios perform a WB handshake.
4. 5066 transfer proceeds to completion.
5. WMT B makes received message available to Operator B.
6. WMT A terminates link once 5066 physical link drops.
7. Radios A and B return to scan.
   - Both WMTs are idle.
   - Received message is available at WMT B.

HOP RADIO MODE

Frequency hopping, also known as Electronic Counter-Counter Measures (ECCM), provides advanced anti-jam protection for communications. In hop radio mode, the transmitter frequency changes so rapidly that it is difficult to intercept or jam the signal.

Hop Screens
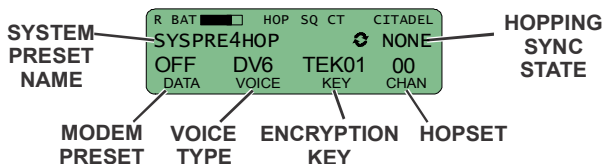
CL-0413-4100-0010A

Hopping Preset

The hop frequency, hop type and any exclusion frequencies must first be programmed into the radio's system preset memory.

a. Press **[MODE]** until **HOP** appears on display, then press **[ENT]**.

b. Use **[PRE +/-]** to select a system preset. Keys must be programmed if operating in CT.

c. Observe:

    1. **HOP** appears.

    2. Correct encryption (**PT** or **CT**),**DATA** (Modem Preset), **VOICE**, **KEY** (**CT** only), and **SQ** (if desired) are displayed.

    3. **T** appears when transmitting

    4. **R** appears when receiving or when ready to receive

    5. **BAT** appears with battery level unless volume is being adjusted.

    6. **SYNC** status on right side of screen:

        (a) **AUTO** - Synchronization is made using GPS satellite time

        (b) **MAN** - Single radio transmits synchronization request and response to allow other radios in the net to achieve synchronization

        (c) **NONE** - Radio is not synchronized

d. Use **[VOL +/-]** to set volume. **VOL** appears along with relative level while volume is adjusted.

Send Synchronization Request

   a. Press **[CALL]**.

   b. Use ▼ or ▲ to select Manual sync type **REQUEST** and press **[ENT]**.

   After the RF-7800H-MP sends a sync request, the RF-7800H-MP waits for a response from the receiving radio (unless the hopset is configured for Autorespond).

   When a Broadcast Sync is requested, no response is expected and no action is required at the receiving radio. For **BROADCAST**, the RF-7800H-MP sending the sync request automatically transmits the sync response, if configured. If not configured, user intervention is required. Upon receiving a sync response, **MAN** appears to indicate a manual sync.

Hail a Hopnet

NOTE

   Only channels 001 to 010 can be set to be used as hailing channels.

   a. Ensure the RF-7800H-MP is in FIX radio mode, and that the channel has been set to **YES** under the **HAIL TX** programming menu. Hail TX must be enabled on all radios expecting to send or respond to the hail.

   b. Select the designated hailing radio preset using **[PRE +/-]**. Normally a frequency is selected that is near the frequencies of operation of the hopping net that will be hailed.

   c. Press **[CALL]**. The RF-7800H-MP displays **SEND HAIL**.

d. Use ▼ or ▲ to scroll to the desired yes or no setting.
    Select **YES** and press **[ENT]** for confirmation to send hail.

e. The RF-7800H-MP will display **HAIL IN PROGRESS**, and
    then **HAIL COMPLETE** when the hail has been sent.
    Press **[ENT]** to return to the preset screen.

    At the receiving radio, you need to press **[ENT]** to
    respond to the hail. Once the hail has been responded to,
    the receiving radio switches to FIX. You need to switch
    back to HOP to continue frequency hopping operation.

    When someone from the hopping net contacts your
    station, coordinate to receive a time sync in order to enter
    the hopping net. Ensure radio TOD is within ±90 seconds
    of the station sending the time sync.

Change Hop Sync Type

a. Connect a GPS antenna to the radio.

b. To change the specific HOP channel sync type, press the
    [PRE+/-] key until the desired channel is displayed.

c. Press **[CLR]**.

d. Use the ▲▼ keys to select unsync on **CURRENT
    CHANNEL** or **ALL CHANNELS**, and press **[ENT]**.

Hopping Voice/Data Capability

Encryption	USB	Data	Voice	Frequency Range (MHz)
PT	X	SERIAL, ARQ	DV6, ME6	1.5 - 29.9999
Citadel/AES	X	SERIAL, ARQ	DV6, ME6	1.5 - 29.9999

RADIO PROGRAMMING

This section provides limited information on front panel programming, which can vary by radio mode. Complete programming structures and descriptions are explained in the RF-7800H-MP Operation Manual (10515-0413-4200).

Global Programming

To program the radio configuration, choose **[PGM] > CONFIG**.

ALE Tips

- Keep channel groups to a nominal size of about 10.
- Do not use max channels to scan a value much higher than the greatest number of channels in any channel group.
- You may want to use daytime and nighttime plans to use fewer channels.
- Do not use channels that may not work for your time of day, communications range, or sunspot number.
- Use a basestation for sounding LQA several times a day.

Programming ALE

Program in order shown:

a. Program ALE channel presets by choosing **[PGM] > MODE > PRESET > CHANNEL**.

   ALE can only be programmed with channels 000-099.

b. Program channel group by choosing **[PGM] > MODE > ALE > CHAN_GROUP**.

c. Program self addresses by choosing **[PGM] > MODE > ALE > ADDRESS > SELF**. One must be 1 -3 characters.

d. Program individual addresses by choosing **[PGM] > MODE > ALE > ADDRESS > INDIVIDUAL**.

e. Program net addresses by choosing **[PGM] > MODE > ALE > ADDRESS > NET**. The net member must contain all radios in the net in identical order for all radios in the net.

f. Configure ALE by choosing **[PGM] > MODE > ALE > CONFIG**.

Configuring Channels, Modems, and Presets

General information is included for programming presets. Program in order shown:

a. For ALE, program channels, channel groups, and addresses per Programming ALE, p62.

b. For FIX channel presets, choose **[PGM] > MODE > PRESET > CHANNEL**.

   Hailing can only be performed from channels 001-010. FIX, SSB and SCAN use channels 000-199.

c. For hop channel presets, use:

   1. For narrowband, choose **[PGM] > MODE > HOP > CHANNEL > ADD > HOP CHANNEL** (Select Channel) **> NARROW**.

   2. For wideband hopping, choose **[PGM] > MODE > HOP > CHANNEL > ADD > HOP CHANNEL** (Select Channel) **> WIDE**.

   3. For list, choose **[PGM] > MODE > HOP > CHANNEL > ADD > HOP CHANNEL** (Select Channel) **> LIST**.

d. Program a modem preset by choosing **[PGM] > MODE > PRESET > MODEM**.

e. Program keys by choosing **[PGM] > COMSEC > KEYS**.

f. Tie the channel and modem presets together with a system preset by choosing **[PGM] > MODE > PRESET > SYSTEM**.

NOTE

All 3G network programming is accomplished through the Communications Planning Application (CPA). 3G uses channels 100-162.

PREVENTIVE MAINTENANCE

- Daily - Run operator initiated Built-In-Test (BIT), check battery box vent, check interconnect cabling and connectors.

  Choose **[OPT] > TEST > BIT**. (To check CT functionality, make sure radio is in CT and that keys are programmed.) Refer to operation manual, 10515-0413-4200 for fault listings/displays.

- Weekly - Check antenna, connectors, and protective caps.

- 12 months - Have maintenance check radio performance.

- 24 Months - Replace HUB with Harris B41-0010-004.

  If using Harris B41-0010-003 or Saft LS 14250, replace HUB twice as often (every 12 months).

  You may want to replace HUB prior to long deployment.

Batteries

- Use one:

  - BB-590/U Nickel Cadmium (Ni-Cd) rechargeable

  - BB-390B/U Nickel Metal Hydride (Ni-MH) rechargeable

  - BB-2590/U or BB-2590/AU Lithium-Ion (Li-ION) rechargeable

  - BA-5590/U Lithium Sulfur Dioxide (Li-SO2) non-rechargeable

  - BA-5390/U Lithium Manganese Dioxide (Li-MnO2) non-rechargeable

- For long-term storage, place the function switch in the Clear (CLR) position to disconnect and extend the life of the HUB.

- Replace the HUB only with the main battery attached to ensure retention of programmed parameters, data, and encryption keys.

TROUBLESHOOTING

Observation	Action
Radio does not power-up; completely dead.	Replace battery with a known good one. Clean battery connector. If radio still does not power-up, Level III Maintenance is required.
No Receive/Transmit audio.	Check volume level. Check squelch level. If using a handset, clean connectors or replace handset.
Intermittent RX audio.	Check squelch level. If using a handset, clean connectors or replace handset.

Observation	Action
Radio stuck at HARRIS logo.	Level III Maintenance required.
GPS Failure	Inspect condition of GPS antenna and connection. Verify clear path to satellite.
Hold Up Battery Low message	Radio requires HUB change (refer to operation manual, 10515-0413-4200). Radio is operable, but will lose programming if main battery dies or is removed.

GLOSSARY

-

3G	Third generation HF communication protocols defined by STANAG 4538, characterized by faster linking and the ability to operate successfully in lower signal-to-noise ratio situations.
3G+	Radio Mode that allows the radio to receive and place ALE (MIL-STD-188-141A/B) calls while operating in 3G mode.

-A-

Adaptive Wideband	A 3G operating feature that allows the radio to negotiate extended bandwidths for data transmissions.
AES	Advanced Encryption Standard
ALE	Automatic Link Establishment - The process of making a point-to-point radio connection without operator involvement using data automatically collected by the system in accordance with a pre-established protocol.
ALE Net Call	A type of ALE call-answer protocol where the caller requests connection to all other radios in the net and the radios respond in a specific sequence so as not to interfere with each other.
ALE Net Address	15-character identifier used to describe the net in the radio to allow the radio to perform an ALE net call.
ALL Call	ALE call made to all stations scanning on a given channel in which no responses are required from the target stations.
AMD	Automatic Message Display - A data mode only used in ALE that uses the ALE modem to transmit and receive short text messages with a very robust ARQ method.

-A-(Continued)

AME	Amplitude Modulation Equivalent. A efficient type of AM where one sideband is removed and the carrier suppressed to improve transmission.
ANY Call	ALE call made to all stations scanning on a given channel in which responses are required from the target stations.
ANT	Antenna
APR	Automatic Position Reporting
ARQ	Automatic Repeat reQuest **-** A data transmission system in which the receive terminal upon detecting a transmission error in a message automatically transmits a request to the originator to re-send the flawed parts of the message. Also, refer to ACK and NACK.
Associated Self	ALE self address used in programming a Net.
Automatic Call	In ALE, the channel with the best score will be selected. In 3G, the channel on which traffic can be delivered with the lowest estimated delay will be selected. In 3G, BEST call will select the channel with the best score.
AVS	Analog Voice Security

-B-

Bandwidth	A range of frequencies occupied by a given signal.
BAT	Battery
BFO	Beat Frequency Oscillator
BIT	A binary digit that can have a value of 0 or 1.
BNC	Bayonet Neill Concelman.
BPS	Bits per Second

-C-

°C	Celsius
Calling Station	The station initiating a call to a target station.

-C- (Continued)

Channel (CH., CHAN)	A programmed combination of frequency and mode of transmission, bandwidth, and AGC value.
Channel Score	ALE rating of overall channel quality
CLR	Clear
COMSEC	Communication Security
Communications Plan	A definition of up to 75 system presets in the operating modes including FIX, ALE, 3G, 3G+, and HOP for data specific to those nets and data common among all the nets. Also referred to as COMM PLAN.
Configuration	The process of setting parameter values which define the current hardware setup and/or operational modes. Also, a collection of all such values at any given time.
CPA	Communications Planning Application
CT	Cipher Text. Function switch position that enables the encryption programmed for the system preset.
CVSD	Continuously Variable Slope Delta **-** Digitalization process for analog voice.
CUR	Current
CW	Continuous Wave **-** Method of sending or receiving Morse Code.

-D-

Data Presets	A named, pre-defined set of modem parameters that allows the radio to be setup using only the name. Also referred to as modem presets.
Default Settings	Transmission parameters established during the setup of the network configuration that remain in effect unless they are explicitly changed.
DTE	Data Terminal Equipment

-D- (Continued)

DV	Digital Voice **-** Analog voice that has been converted into digital data.

-E-

ECCM	Electronic Counter Counter Measures **-** Techniques used to prevent signal detection or jamming of the transmission path.
ECCM Frequency Exclusion	A specific type of exclusion band that applies only to wideband ECCM mode and is given directly to the radio.
ECCM Channel Type	ECCM can operate in one of three modes: wideband, narrowband and list.
ENT	Enter
Exchange	ALE LQA technique which involves two-way messages sent between two stations. Channel rankings are established based on received signal quality.
Exclusion Band	A range of frequency values, stated as a lower and upper exclusive frequency, which must be omitted from all frequency lists in the appropriate scope.

-F-

$°F$	Fahrenheit
F_c	Center frequency. The frequency around which HOPPING occurs.
Fixed Frequency	A single frequency operating mode.
FM	Frequency Modulation

-G-

GMT	Greenwich Mean Time
GPS	Global Positioning System **-** A unique system that uses satellites to provide Time-Of-Day used with frequency hopping and 3G synchronization.
GPS-APR	GPS Automatic Position Reporting

-H-

Hailing	A method by which a station that is not operating in ECCM mode can signal radios in an ECCM net. Hailing consists of transmitting a special signal on a single frequency from SSB mode. The members of the ECCM net are programmed with a list of hail frequencies which the ECCM radios periodically check for hail signalling. When a radio in ECCM mode detects a hail transmission, its operator is notified so that he may choose to change to FIX mode and contact the hailing station.
HF	High Frequency
HOP	Same definition as ECCM. Hop is also a term used to describe the next IP address in an IP route.
Hopnet	Defines the set of ECCM frequencies or hopping characteristics that the radio is allowed to use.
HUB	Hold-Up Battery. Maintains the radio configuration programming and loaded COMSEC fills when the radio's main battery is depleted or removed.
Hz	Hertz

-I-

Individual Address	A maximum 15 character ALE name which one radio uses to refer to another radio (also referred to as a call sign).
Individual Call	ALE call placed to a single target station using an individual address. Each station must be programmed with the address and channel list of the other station before initiating the call.
Interleaving	A form of forward error correction designed to overcome fading and impulse noise.
IP	Internet Protocol.

-I- (Continued)

IP Address	A number made of four 8-bit binary numbers that uniquely identifies a computer on a network.
IP Address - Subnet Mask	A number made of four 8-bit binary numbers that identifies a series of computers by masking part or all of the IP addresses in the subnet (using 255).
ITAR	International Traffic in Arms Regulations

-J-

-K-

KDU	Keypad Display Unit
km (kilo-meter)	1000 meters

-L-

LCD	Liquid Crystal Display
LD	Load
LDV	Last Ditch Voice - Only available in 3G radio mode.
Li-ION	Lithium Ion
Li-MnO$_2$	Lithium Manganese Dioxide
Li-SO$_2$	Lithium Sulfur Dioxide
LPC	Linear Predictive Coding **-** Used to produce Digital Voice.
LQA	Link Quality Analysis **-** The process of determining the quality of a channel by measuring various parameters of the received signal such as signal-to-noise ratio and bit error rate. Typically, LQA information is stored and then used in the ALE and 3G processes.
LSB	Lower Sideband
LT	Light

- M -

Manual Call	A call in which the channel is selected by the user.
Manual Synchronization	A way of synchronizing radios in the net without using GPS Sync. With all radios in wristwatch sync, a signal is sent to the net control station, requesting a special synchronization transmission. The net control station responds by transmitting timing information on the channel that all radios use to synchronize their clocks. The over-the-air timing information must be accepted by the operator before it is put into use by the radio.
Max	Maximum
Max Scan Channels	The largest value of the number of ALE channels scanned by each radio in a net. The number of channels scanned by a radio is the sum of all the ALE channels in all the nets the radio is a member of.
MELP	Mixed Excitation Linear Prediction - A method of digitizing analog voice signals. Speech is more recognizable and works well in poor signals strengths.
MHz	Abbreviation for megahertz, or millions of cycles per second.
MK	Master Key
Mode	The HF signalling method being employed which include SSB\FIX, ALE, 3G and HOP.
Modem	Acronym for MOdulator/DEModulator. This is a type of data communications equipment which converts digital signals into an analog format (modulation) suitable for transmission through various media and reconverts received signals into a digital format (demodulation).

-N-

N/A	Not Available
Net Configuration	Data describing a net including name, description, radio members and their ALE addresses, etc. Nets can exist in multiple plans, but have distinct configurations in each plan.
Net	A group of radios that share common communications parameters, such as frequencies, ALE information, encryption mode and key, etc.
Ni-Cd	Nickel-Cadmium
NRDI	Network Radio Driver Installer

-O-

OPT	Option
Other address	Upon receiving a call or LQA Sound from an ALE address, the radio checks to see if the sound or call came from an address in its individual address table. If the address is not in the individual address table, the radio temporarily stores this address in the OTHER address list, along with its LQA information.

-P-

PC	Personal Computer
Peer IP Address	An IP address sent from the radio to the computer as part of a dynamic address negotiation scheme (as opposed to static [never changing]). This is either a custom IP address, or a WIRELESS setting, and is required for changing 3G nets. Peer IP addresses that are determined via shared communications between the radio and the computer are referred to as negotiated peer IP addresses.
PGM	Program
PPP	Point-to-Point Protocol

-P-(Continued)

PRE	Preset
PT	Plain Text
PTT	Push (or Press)-to-Talk - The button on the handset you press to activate the transmitter for voice transmission.

-Q-

-R-

RAM	Random Access Memory
Radio Presets	A named, predefined set of radio parameters.
Radio Silence	A feature which prevents automatic response to incoming calls or LQA requests.
RF	Radio Frequency
R/T	Receiver/Transmitter
RX	Receive, receiver

-S-

Score	A rating of overall channel quality in ALE and 3G modes determined by link quality analysis.
Self Address	An address used to identify a calling station. A station may have more than one self address. The same character string is used as the individual address when receiving calls as a target station.
SMS	Short Message Service
Sounding	An LQA technique which involves sending a one-way message on all channels programmed for a self address. Target stations establish channel rankings based on received signal quality by receiving the sounding signal and do not have to transmit back a response ensuring security of location.
SNR	Signal to Noise Ratio

-S- (Continued)

SQ, SQL	Squelch - Noise limiting function that requires an incoming signal strength to be above a threshold level to be passed through the receiver.
SSB	Single Sideband
SYNC	Synchronization

-T-

TEK	Traffic Encryption Key - A Key used to encrypt normal radio traffic.
TOD	Time of Day **-** The time used to synchronize radio stations.
T/R	Transmit/Receive
TX	Transmit

-U-

USB	Upper Sideband, Universal Serial Bus
UTC	Universal Time Coordinated

-V-

VHF	Very High Frequency
VOL	Volume

-W-

WB	Wideband
WBHF	Wideband High Frequency
WMT	Wireless Message Terminal

-X-

XDL	High-throughput Data Link protocol (HDL) or Low-latency Data Link protocol (LDL). Together, they are referred to as XDL, where "X" is a variable.

-Y-

-Z-

Z, Zeroize   A command sequence which erases all programmed channel parameters, presets, loaded COMSEC variables and option settings and overwrites them with zeros.

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