HARRIS®
assuredcommunications®

Maintenance Manual

14221-1100-5000
Rev. B, Oct/12

UNITY® XG-100P

Full-Spectrum Multiband Portable Radio

MANUAL REVISION HISTORY

REV.	DATE	REASON FOR CHANGE
—	Jun/11	Initial release.
A	Dec/11	Revised Safety and Regulatory Information section, Specifications section, Catalog and Part Numbers section, and Tests and Alignment section.
B	Oct/12	Revised Specifications section, tables in the Catalog and Part Numbers section, and encryption key management procedures.

Harris Corporation, Public Safety and Professional Communications (PSPC) Business, continually evaluates its technical publications for completeness, technical accuracy, and organization. You can assist in this process by submitting your comments and suggestions to the following:

Harris Corporation
PSPC Business
Technical Publications
221 Jefferson Ridge Parkway
Lynchburg, VA 24501

fax your comments to: 1-434-455-6851
or
e-mail us at: PSPC_TechPubs@harris.com

ACKNOWLEDGEMENT

This device is made under license under one or more of the following US patents: 4,590,473; 4,636,791; 5,148,482; 5,185,796; 5,271,017; 5,377,229; 4,716,407; 4,972,460; 5,502,767; 5,146,497; 5,164,986; 5,185,795; 5,226,084; 5,247,579; 5,491,772; 5,517,511; 5,630,011; 5,649,050; 5,701,390; 5,715,365; 5,754,974; 5,826,222; 5,870,405; 6,161,089; and 6,199,037 B1. DVSI claims certain rights, including patent rights under aforementioned U.S. patents, and under other U.S. and foreign patents and patents pending. Any use of this software or technology requires a separate written license from DVSI.

CREDITS

NOTICE!

This product conforms to the European Union WEEE Directive 2002/96/EC. Do not dispose of this product in a public landfill. Take it to a recycling center at the end of its life.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

LIST OF TABLES

1 SAFETY AND REGULATORY INFORMATION

1.1 SAFETY SYMBOL CONVENTIONS

The following safety symbol conventions are used in this manual to alert the user to general safety precautions that must be observed during all phases of operation, service, and repair of this product. Failure to comply with these precautions or with specific warnings elsewhere violates safety standards of design, manufacture, and intended use of the product. Harris assumes no liability for the customer's failure to comply with these standards.

The WARNING symbol calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING symbol until the conditions identified are fully understood or met.

The **CAUTION** symbol calls attention to an operating procedure, practice, or the like, which, if not performed correctly or adhered to, could result in damage to the equipment or severely degrade equipment performance.

The **NOTE** symbol calls attention to supplemental information, which may improve system performance or clarify a process or procedure.

The **ESD** symbol calls attention to procedures, practices, or the like, which could expose equipment to the effects of **E**lectro-**S**tatic **D**ischarge. Proper precautions must be taken to prevent ESD when handling circuit boards or modules.

1.2 IMPORTANT SERVICE INFORMATION

IMPORTANT!

PLEASE READ

To preserve the watertight integrity of the Unity XG-100P portable radio, it must be serviced by a service center authorized and certified by Harris to perform the necessary tests to verify the radio's watertight integrity. For a list of service centers authorized and certified to service the radio, contact the Technical Assistance Center (TAC) using contact information listed in on page 17.

The Unity XG-100P portable radio, under warranty, ***MUST*** be serviced by a service center authorized by Harris to service the immersion-rated radios. If service is performed by the user or by any service center not authorized by Harris for this purpose, the warranty will be ***VOID***. The standard product warranty on the Unity XG-100P portable radio is three (3) years parts and labor. Harris recommends testing the radio's immersibility once a year. Test must be performed by a qualified and approved service center with access to the specialized equipment required.

If the radio is out of warranty, it is still recommended that a service center authorized by Harris service immersion-rated radios to maintain the watertight integrity of the radio.

1.3 OPERATING TIPS AND ADDITIONAL PRECAUTIONARY INFORMATION

1.3.1 General Information

Antenna location and condition are important when operating a portable radio. Operating the radio in low lying areas or terrain, under power lines or bridges, inside of a vehicle, or in a metal framed building can severely reduce the range of the unit. Mountains and buildings can also reduce the range of the unit.

In areas where transmission or reception is poor, some improvement may be obtained by ensuring that the antenna is vertical. Moving a few yards in another direction or moving to a higher elevation may also improve communications. Vehicular operation can be aided with the use of an externally mounted antenna. The following conditions tend to reduce the effective range of two-way radios and should be avoided whenever possible:

- Operating the radio in areas of low terrain, or while under power lines or bridges.
- Obstructions such as mountains and buildings.

Battery condition is another important factor in the trouble free operation of a portable radio. Always properly charge the batteries.

1.3.2 Efficient Radio Operation

For the most efficient portable radio operation, hold the radio approximately two inches from your mouth and speak into the microphone at a normal voice level.

Keep the antenna in a vertical position when receiving or transmitting a message.

Do not hold the antenna when receiving a message and, especially, do not hold when transmitting a message.

WARNING

Do NOT hold onto the antenna when the radio is powered on!

1.3.3 Antenna Care and Replacement

WARNING

Do not use the portable radio with a damaged or missing antenna. Doing so can damage the radio. A minor burn may result if a damaged antenna comes into contact with the skin. Replace a damaged antenna immediately.

WARNING

Use only the supplied or approved antenna. Unauthorized antennas, modifications or attachments could damage the radio unit and may violate FCC regulations. Refer to the options and accessories list for antennas approved for use with this radio.

1.3.4 Electronic Devices

CAUTION

RF energy from the portable radio may affect some electronic equipment. Most modern electronic equipment in cars, hospitals, homes, etc. is shielded from RF energy. However, in areas that instruct two-way radio equipment be powered OFF, always observe the rules. ***If in doubt, turn the radio OFF!***

1.3.5 Other Common Transmitter Hazards

1.3.5.1 Commercial Aircraft

Always turn OFF portable radios before boarding aircraft!

Use a portable radio on the ground only with crew permission.

DO NOT use the radio in flight!!

1.3.5.2 Electric Blasting Caps

To prevent accidental detonation of electric blasting caps, DO NOT use two-way radios within 1000 feet (305 meters) of blasting operations. Always obey the "*Turn Off Two-Way Radios*" (or equivalent) signs posted where electric blasting caps are being used. (OSHA Standard 1926.900).

1.3.5.3 Potentially Explosive Atmospheres

Areas with potentially explosive atmosphere are often, but not always, clearly marked. These may be fueling areas, such as gas stations, fuel or chemical transfer or storage facilities, and areas where the air contains chemicals or particles, such as grain, dust or metal powders.

Sparks in such areas could cause an explosion or fire resulting in bodily injury or even death.

Turn the radio OFF when in any area with a potentially explosive atmosphere. It is rare, but not impossible, that the radio or its accessories could generate sparks.

1.3.5.4 Interference to Vehicular Electronic Systems

Electronic fuel injection systems, electronic anti-skid braking systems, electronic cruise control systems, etc., are typical of the types of electronic devices that can malfunction due to the lack of protection from radio frequency (RF) energy present when transmitting. If the vehicle contains such equipment, consult the dealer for the make of vehicle and enlist his aid in determining if such electronic circuits perform normally when the radio is transmitting.

1.3.6 Specific Absorption Rate (SAR) and RF Exposure Limits

Important information on Specific Absorption Rate (SAR) and RF exposure limits is contained in *Product Safety Manual*, publication number 10515-0372-4000. This publication is included with the radio when it ships from the factory. Please review and follow this information carefully before transmitting from the radio. See Section 3.2 on page 17 for additional information.

1.4 OPERATING RULES AND REGULATIONS

Two-way radio systems must be operated in accordance with the rules and regulations of the local, regional, or national government.

In the United States, the Unity XG-100P portable radio must be operated in accordance with the rules and regulations of the Federal Communications Commission (FCC). Operators of two-way radio equipment must be thoroughly familiar with the rules that apply to the particular type of radio operation. Following

these rules helps eliminate confusion, assures the most efficient use of the existing radio channels, and results in a smoothly functioning radio network.

When using a two-way radio, remember these rules:

- It is a violation of FCC rules to interrupt any distress or emergency message. The radio operates in much the same way as a telephone "party line." Therefore, always listen to make sure the channel is clear before transmitting. Emergency calls have priority over all other messages. If someone is sending an emergency message – such as reporting a fire or asking for help in an accident, do not transmit unless assistance can be offered.
- The use of profane or obscene language is prohibited by Federal law.
- It is against the law to send false call letters or false distress or emergency messages. The FCC requires keeping conversations brief and confined to business. Use coded messages whenever possible to save time.
- Using the radio to send personal messages (except in an emergency) is a violation of FCC rules. Send only essential messages.
- It is against Federal law to repeat or otherwise make known anything overheard on the radio. Conversations between others sharing the channel must be regarded as confidential.
- The FCC requires self-identification at certain specific times by means of call letters. Refer to the rules that apply to the particular type of operation for the proper procedure.
- No changes or adjustments shall be made to the equipment except by an authorized or certified electronics technician.

Under U.S. law, operation of an unlicensed radio transmitter within the jurisdiction of the United States may be punishable by a fine of up to $10,000, imprisonment for up to two (2) years, or both.

1.5 RADIO FREQUENCY INTERFERENCE INFORMATION

1.5.1 FCC Part 15 Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

1.5.2 Industry Canada Statement

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

2 SPECIFICATIONS

2.1 GENERAL

Dimensions, Radio with Battery: (Height x Width x Depth)	7.63 x 2.81 x 1.94 inches (194 x 71.4 x 49.2 mm) (includes knobs but not antenna)
Dimensions, Antenna Length	
136 to 870 MHz Antenna 12082-0250-01	Approximately 9.5 inches (241 mm)
136 to 870 MHz Antenna 12082-0250-02	Approximately 8.9 inches (226 mm)
160 to 870 MHz Antenna 12082-0295-01	Approximately 6.2 inches (157.5 mm)
Weights (Unpacked)	
Radio with Battery and Antenna:	24.8 ounces (703 grams)
Radio Only:	16.8 ounces (476.3 grams)
Battery Only:	6.4 ounces (181.4 grams)
Antenna Only:	1.6 ounces (45.4 grams)
Battery Technology:	Lithium-Ion Polymer (Li-Poly) Rechargeable
Battery Life:	> 12 hours with a Fully-Charged 3600 mAH Li-Poly Rechargeable Battery at a Duty Cycle of 5% Transmit, 5% Receive, and 90% Standby
Battery Voltage	
Nominal:	7.5 Vdc
Operating Range:	5.8 to 8.4 Vdc (See Section 7.4.1 on page 35 for additional battery specifications.)
Current Demand:	
Receive at 7.5 Vdc	
With Speaker Muted:	0.22 amps typical
With 500 mW Speaker Output Power:	0.3 amps typical; 0.4 amps maximum
Transmit at 7.5 Vdc	
5 Watts RF, UHF Band:	2.0 amps typical; 2.5 amps maximum
6 Watts RF, VHF Band:	2.2 amps typical; 2.5 amps maximum
2.6 Watts RF, 700 MHz Band:	1.7 amps typical; 1.9 amps maximum
3 Watts RF, 800 MHz Band:	1.8 amps typical; 2.1 amps maximum
Quiescent Current (Radio Off) at 7.5 Vdc:	Less than 1 milliamp
Displays	
Top Display:	128 x 32 pixels, 0.91-inch
Front Display:	176 x 200 pixels, 2.2-inch, Transflective Liquid-Crystal Display (LCD), 16-bit Color Capability, White LED Backlights
Top Tx/Rx Indicator:	Tri-Color LED
Keypad:	4 x 3 Keypad, 5-Way Navigation Keypad, 2 Soft-Keys, White LED Backlights
Buttons/Switches:	On/Off/Volume Knob, Large PTT Button, Red Emergency Button, 16-Position Top-Mounted Rotary Knob, 2-Position Concentric Switch, 3-Position (ABC) Concentric Switch, 3 Programmable Side Buttons

2.2 TRANSCEIVER

2.2.1 General

Frequency Ranges

VHF Band:	136 to 174 MHz (See footnote [1])
UHF Bands:	380 to 520 MHz (See footnotes [1] and [2])
700 and 800 MHz Bands	762 to 870 MHz (See footnote [3])

Frequency Stability: ±0.5 ppm from -20 to +60° Celsius

Channel Spacing (Bandwidth): 12.5 kHz or 25 kHz (mode dependent; see footnote [1])

Channel Tuning Increment: 2.5 kHz, 3.125 kHz or 12.5 kHz (band dependent)

Channel Capacity: 12,500 (1,250 per mission plan)

Mission Plans (Personalities): 10 maximum

Zones (Systems) per Mission Plan: 512 maximum

Voice and Data Communications Mode: Half-Duplex

2.2.2 Transmitter

Power Ranges

VHF Band:	1 to 6 watts
UHF Bands:	1 to 5 watts
700 MHz Bands:	0.5 to 2.6 watts
800 MHz Bands:	0.5 to 3 watts

Spurious and Harmonics: -70 dBc

FM Hum and Noise

VHF Band:	-45 dB at 12.5 kHz; -51 dB at 25 kHz (see footnote [1])
UHF Bands:	-47 dB at 12.5 kHz; -54 dB at 25 kHz (see footnote [1])
700 and 800 MHz Bands:	-44 dB at 12.5 kHz; -50 dB at 25 kHz

Frequency Modulation (FM) Limiting

Wideband Channels (25 kHz)	5 kHz (see footnote [1])
NPSPAC Channels	4 kHz (see footnote [1])
Narrowband Channels (12.5 kHz)	2.5 kHz (see footnote [1])

Audio Response: +1 to -3 dB

Audio Distortion: < 1.25%

P25 Modulation Fidelity: < 1%

P25 Adjacent Channel Power

All Bands Other Than 700 MHz Band:	> 67 dBc
700 MHz Band at 9.375 kHz Offset:	> 40 dBc

[1] The Unity XG-100P portable radio is compliant with all applicable FCC narrowbanding mandates below 512 MHz.
[2] Per FCC regulations, the lowest allowed UHF band transmit frequency for LMR operations is 406.1 MHz.
[3] 700 MHz mobile receive band is 764 to 767 MHz and 769 to 776 MHz.
700 MHz mobile transmit band is 764 to 767 MHz, 769 to 776 MHz, 794 to 797 MHz, and 799 to 806 MHz.

2.2.3 Receiver

Sensitivity at 12 dB SINAD (Minimum)

VHF Band:	-121.1 dBm minimum
UHF Band:	-123.0 dBm minimum
700 and 800 MHz Bands:	-121.4 dBm minimum

Sensitivity at 5% BER (Minimum)

VHF Band:	-121.0 dBm minimum
UHF Bands:	-122.9 dBm minimum
700 and 800 MHz Bands:	-121.4 dBm minimum

Signal Displacement Bandwidth 2 kHz typical, 5 kHz maximum for a wideband (25 kHz) channel

Adjacent Channel Rejection

VHF Band:	66.2 at 12.5 kHz; 77.8 dB at 25 kHz
UHF Bands:	62.2 at 12.5 kHz; 73.7 dB at 25 kHz
700 and 800 MHz Bands:	62.0 at 12.5 kHz; 72.7 dB at 25 kHz

Intermodulation Rejection: 74 dB minimum

Spurious and Image Rejection

VHF Band:	70 dB
UHF Bands:	75 dB
700 and 800 MHz Bands:	70 dB

FM Hum and Noise

VHF Band:	-53.8 dB at 12.5 kHz; -54.8 at 25 kHz
UHF Bands:	-43.7 dB at 12.5 kHz; -49.1 at 25 kHz
700 and 800 MHz Bands:	-42.8 dB at 12.5 kHz; -48.2 at 25 kHz

Typical Analog Squelch Threshold: -124 dBm with 1 kHz tone at 3 kHz deviation

2.2.4 Audio

Audio Frequency Response: 300 to 3000 Hz (transmit and receive)

Speaker Audio Output Power: 500 mW internal speaker; 1200 mW external speaker

Speaker Audio Output Distortion: < 1.1% at 500 mW output power

Headset Speaker Connection: Balanced/Differential connection via radio's Universal Device Connector (UDC); volume controlled

Headset Speaker Amp Output Impedance: 8 ohms nominal

Headset Speaker Audio Output Power: 1000 mW typical at maximum volume setting

External Microphone Connection: Via radio's UDC

External Microphone Input Sensitivity: 12 mV RMS for typical speech at 94 dB SPL

External Microphone Maximum Input Level: 4000 mV peak-to-peak

External Microphone DC Bias: 3000 mV open circuit; 1500 mV with 460 µA load

External Microphone Input Impedance: 1800 ohms minimum

External Microphone Audio Response: ±1 dB from 300 Hz to 3000 Hz

2.2.5 Digital and Encryption Operations

P25 Voice-Coding Method:	Improved Multi-Band Excitation (IMBE®)
P25 Data Rate:	9600 bps
P25 Modulation:	C4FM
Encryption Algorithms:	AES and DES-OFB, and DES-CFB
Encryption Key Storage:	128 keys, 64 keys per keyset (32 AES and 32 DES keys per keyset)
Encryption Key Loading Method:	Key Loader or Over-The-Air Rekeying (OTAR)

2.3 ENVIRONMENTAL

Ambient Temperature Ranges	
Operating:	-4 to +140° Fahrenheit (-20 to +60° Celsius)
Storage/In Transit:	-22 to +158° Fahrenheit (-30 to +70° Celsius)
Altitude, Maximum	
Operating:	15,000 feet (4572 meters)
Storage/In Transit:	40,000 feet (12,192 meters)
Ruggedness Rating:	MIL-STD-801C, D, E, and F
Immersion/Submersible Rating:	MIL-STD-801C, D, E, and F Method 512.4/1 (1 meter for 30 minutes, non-operating exposure)

2.4 REGULATORY

FCC Type Acceptance:	AQZ-XG-100P00
Applicable FCC Rules:	Part 80 and Part 90
Industry Canada Certification:	122D-XG100P00
Applicable Industry Canada Rules:	RSS-119

3 INTRODUCTION

This manual contains service-related information for the Unity XG-100P portable radio. For additional service-related information not included in this manual, consult with the Harris Technical Assistance Center (TAC).

3.1 PRODUCT DESCRIPTION

The Unity XG-100P portable radio is a full-spectrum multiband portable radio for the VHF, UHF, 700 MHz, and 800 MHz land-mobile radio frequency bands. Detailed specifications are listed in Section 2 of this manual. The XG-100P radio supports:

- APCO Project 25 Phase I compliant P25 trunked communication standard;
- APCO Project 25 Phase I compliant P25 conventional communication standard;
- Software-upgradable to APCO P25 Phase 2 communication standard (future option);
- Conventional FM repeater-based and FM talk-around voice communication in accordance with the TIA/EIA-603 conventional land-mobile radio standard (i.e., analog conventional communication);
- 256-Bit Advanced Encryption Standard (AES) voice encryption (optional);
- Digital Encryption Standard Output Feedback (DES-OFB) voice encryption (optional);
- Digital Encryption Standard Cipher Feedback (DES-CFB) Encryption (optional);
- Over The Air Rekey (OTAR) operations (optional);
- Global Common Key References (CKR); and,
- 128-key storage for encrypted voice communications (2 keysets with up to 32 AES and 32 DES keys in each keyset).

Figure 3-1: Unity XG-100P Portable Radio—Front-Button Side View

Additional XG-100P radio features include but are not limited to:

- Harris' proprietary background noise suppression technology in any communication mode and when using the radio's built-in microphone or an external microphone;
- Exceeds the tough MIL-STD-810F military standards for ruggedness and immersion capability;
- Built-in Global Positioning System (GPS) receiver for position and speed tracking and accurate time;
- Built-in Bluetooth® wireless interface for connection of optional accessories and programming equipment;
- Universal Device Connector (UDC) interface for connection of optional accessories and USB-linked programming equipment;
- Universal Serial Bus (USB) interface at UDC to support programming and diagnostic operations;
- Tough 0.9-inch high-resolution top display;
- Tough 2.2-inch transreflective color LCD front display with white LED backlighting and intuitive graphical user interface;
- Easy-to-use navigational keypad with soft-keys;
- Large 16-position top-mounted rotary knob with 3-position bank selector switch for quick selection of pre-programmed groups/channels;

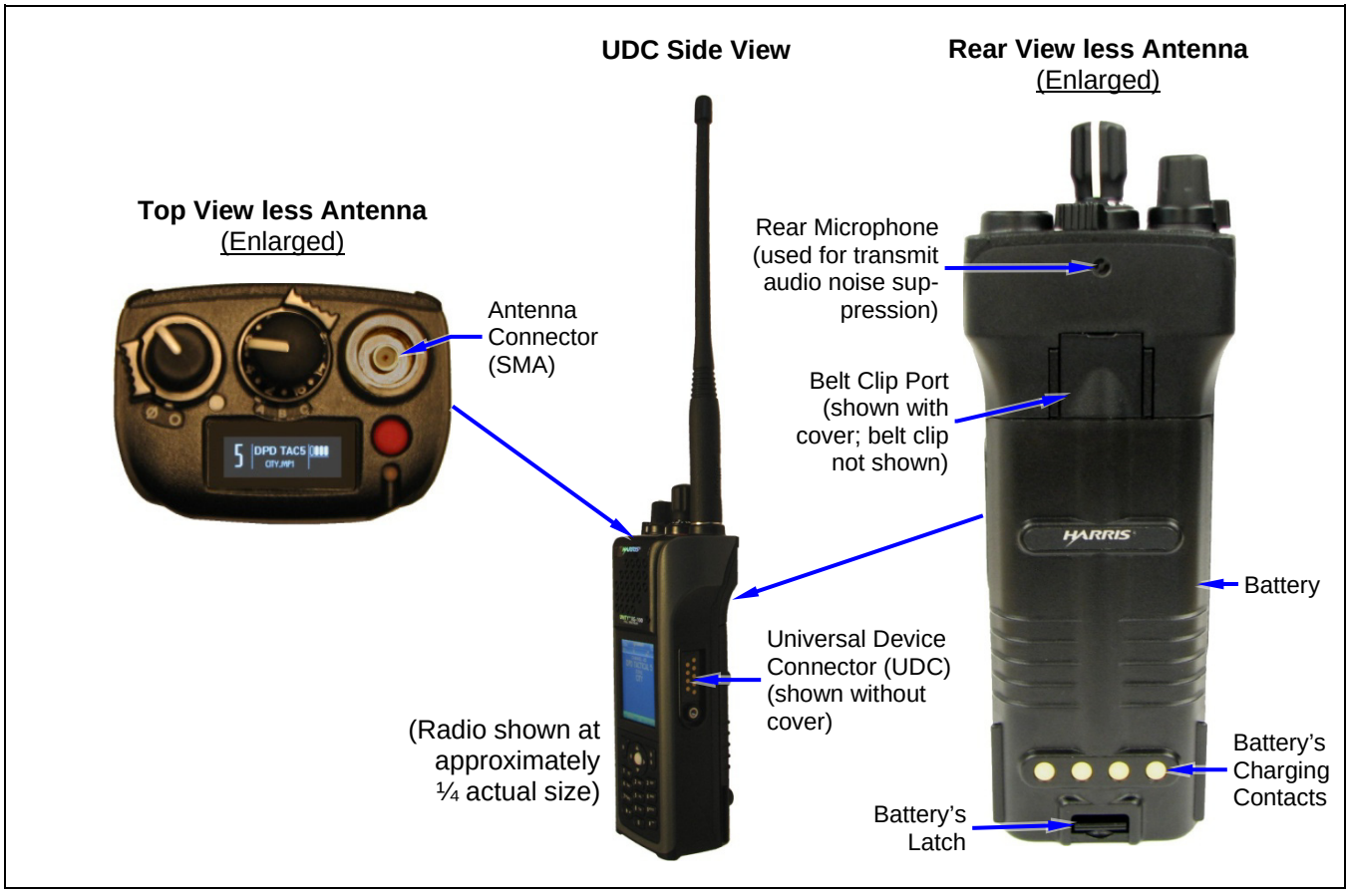


Figure 3-2: Unity XG-100P Portable Radio—UDC Side, Top, and Rear Views

- 2-position top-mounted switch (function programmable);
- Three (3) programmable side buttons;
- Emergency button;
- Stores up to 10 personalities/mission plans;
- Up to 1250 conventional channels per personality/mission plan;
- Up to 512 zones/systems per personality/mission plan;
- Quick mission plan change/activation via radio's front panel menu-driven interface;
- Programmable wideband or narrowband operation on a per-channel or system/zone basis;
- Quick channel edit capability via radio's front panel interface (password protectable);
- Continuous Tone-Code Squelch System (CTCSS or Channel Guard), Digital-Coded Squelch (DCS or Digital Channel Guard), and MDC-1200 analog ID signaling;
- Scan and Dual-Priority Scan;
- Preemptive priority scanning; and,
- Radio programming and feature management via Harris' Radio Personality Manager (RPM)

Figure 3-3: Unity XG-100P Portable Radio—Operating Controls and Displays

3.2 RELATED PUBLICATIONS

The following publications contain additional information about the Unity XG-100P portable radio, and related products:

- XG-100P Portable Radio Product Safety Manual: 10515-0372-4000
- XG-100P Portable Radio Quick Reference (Operating) Guide: 10515-0372-4100
- XG-100P Portable Radio Operator's Manual: 10515-0372-4200
- XG-100P Portable Radio Software Release Notes: MS-018736-001
- LMR CPA-to-RPM Converter Tool Software Release Notes: 14221-2100-8010
- Key Manager and Key Admin Overview and Operation Manual: MM1000019423
- Key Manager and Key Loader Overview and Operation Manual: MM1000019424
- Battery Charger Operation Guide: 10515-0372-4010
- Smart Battery Charger Operation Guide: 10515-0387-4100
- 6-Bay Li-Ion/Polymer Battery Charger Operator's Manual: 14221-1100-2000
- 6-Bay Li-Ion/Polymer Battery Charger Installation Guide: 14221-1100-4000
- Unity VC4000 Vehicular Charger Operator Manual: 14221-1600-2030

The product safety manual and the quick reference guide are included with the radio equipment package when the radio ships from the factory. All publications listed above are available at www.pspc.harris.com via an Information Center login and Tech Link.

3.3 REPLACEMENT PARTS

Replacement parts can be ordered by Customer Care. To order replacement parts through Customer Care, call, fax or e-mail our ordering system:

United States:

- Phone Number: 1-800-368-3277 (toll free)
- Fax Number: 1-321-409-4393
- E-mail: PSPC_CustomerFocus@harris.com

International:

- Phone Number: 434-455-6403
- Fax Number: 321-409-4394
- E-mail: PSPC_InternationalCustomerFocus@harris.com

3.4 TECHNICAL ASSISTANCE

If any of the radio equipment requires repair, or if there are questions or concerns about the installation of this equipment, contact the Harris Technical Assistance Center (TAC) using the following telephone numbers or e-mail address:

- United States and Canada: 1-800-528-7711 (toll free)
- International: 1-434-385-2400
- Fax: 1-434-455-6712
- E-mail: PSPC_tac@harris.com

4 CATALOG AND PART NUMBERS

Catalog and part numbers for the Unity XG-100P portable radio and related accessories are listed in the following tables. The *Products & Services Catalog* and the *Parts and Accessories Quick Reference Guide* are available at www.pspc.harris.com via an Information Center login and Tech Link.

NOTE

All XP-100F catalog number package listed in the following table include *Quick Reference (Operating) Guide* publication number 10515-0372-4100, *Product Safety Manual* publication number 10515-0372-4000, and (Pre-Installed) Radio Software SK-018326-001.

WARNING

FM intrinsically-safe radio part number 12082-1000-11 must be used with an instrically-safe battery and accessories. Otherwise, intrinsic safety is not maintained. Refer to Section 7.5 on page 39 for additional information.

Table 4-1: Unity XG-100P Portable Radios and Accessories

CATALOG NUMBER	PART NUMBER	DESCRIPTION
XP-100F	12082-1000-01	Radio, XG-100P Portable: 136 to 870 MHz, Unencrypted, Immersible.
XP-100F-IS	12082-1000-11	Radio, XG-100P Portable: 136 to 870 MHz, Unencrypted, Immersible, FM Intrinsically-Safe.
XP-100F-D01	12082-1000-01	Radio, XG-100P Portable: 136 to 520 MHz, Unencrypted, Immersible.
XP-100F-D01-IS	12082-1000-11	Radio, XG-100P Portable: 136 to 520 MHz, Unencrypted, Immersible, FM Intrinsically-Safe.
XP-100F-D02	12082-1000-01	Radio, XG-100P Portable: 136 to 174 and 762 to 870 MHz, Unencrypted, Immersible.
XP-100F-D02-IS	12082-1000-11	Radio, XG-100P Portable: 136 to 174 and 762 to 870 MHz, Unencrypted, Immersible, FM Intrinsically-Safe.
XP-100F-D03	12082-1000-01	Radio, XG-100P Portable: 380 to 870 MHz, Unencrypted, Immersible.
XP-100F-D03-IS	12082-1000-11	Radio, XG-100P Portable: 380 to 520 and 762 to 870 MHz, Unencrypted, Immersible, FM Intrinsically-Safe.
XPNC8A	12082-0250-01	Antenna: Helical, 136 to 870 MHz, 9.4-inch
XPNC8B	12082-0250-02	Antenna: Helical, 136 to 870 MHz, Flexible, 9-inch
XPNC8C	12082-0295-01	Antenna: Helical, 160 to 870 MHz, Flexible, 6-inch
XPPA3A	12082-0300-01	Battery: Lithium-Ion Polymer (Li-Poly) Rechargeable, 3600 mAh, Immersible
XPPA3C	12082-0304-01	Battery: Lithium-Ion Polymer (Li-Poly) Rechargeable, 3100 mAh, Immersible, FM Intrinsically-Safe
XPPA7Y	BKB191210/36	Battery: Nickel-Metal Hydride (NiMH) Rechargeable, 2400 mAh, Immersible, FM Intrinsically-Safe
XPPA2H	BT-013259-001	Battery Clamshell: For Six (6) AA Alkaline Batteries (batteries not included)
XPCH4A	12082-0312-01	Battery Charger: 1-Bay, Smart, Multi-Chemistry

Table 4-1: Unity XG-100P Portable Radios and Accessories (Continued)

CATALOG NUMBER	PART NUMBER	DESCRIPTION
XPCH4B	12082-0314-01	Battery Charger: 6-Bay, Li-Poly and Li-Ion Rechargeable
XPAE4A	12082-0315-01	Kit, Wall-Mount: For 6-Bay, Li-Poly and Li-Ion Battery Charger
XPCH4J	12082-0318-01	Battery Charger: Unity VC4000 Vehicular Charger
XPPS9S	PS-007810-001	Kit, Power Adapter: For VC4000 Vehicular Charger
XPCJ3A	12082-0410-A1	Cable: USB Programming
XPCJ3B	12082-0400-A1	Cable: Key Verification Loads (KVL) Key Loading
XPCJ4A	12082-0445-A1	Cable: Data Interface, PPP/RS-232/SLIP
XPHC3A	12082-0500-01	Case/Holster: Leather, Full; Elastic Cord, Two D-Rings and Belt Loop
XPHC3B	12082-0501-01	Case/Holster: Leather, Half; Elastic Cord, Two D-Rings and Belt Loop
XPHC3C	12082-0502-01	Case/Holster: Leather, Full; Elastic Cord, 2.5-Inch Belt Loop with D-Clip
XPHC3D	12082-0502-02	Case/Holster: Leather, Full; Elastic Cord, 3-Inch Belt Loop with D-Clip
XPHC3E	12082-0507-01	Case/Holster: Leather, Half; Elastic Cord, 2.5-Inch Belt Loop with D-Clip
XPHC3F	12082-0507-02	Case/Holster: Leather, Half; Elastic Cord, 3-Inch Belt Loop with D-Clip
XPHC3G	12082-0510-01	Case/Holster: Nylon, Full; T-Strap, Two D-Rings
XPHC3H	12082-0512-01	Case/Holster: Nylon, Full with Front Window; T-Strap, Two D-Rings
XPHC3L	12082-1290-01	Clip, Belt: Metal
XPHC3U	12082-3230-01	Loop, Belt: Leather with D-swivel
(none)	12082-1398-01	Cover, UDC. Includes seal and attachment screw (included with radio)
(none)	12082-1520-03	Kit, Knob Replacement
XPAE6G	12082-0650-01	Microphone, Palm: 2-Wire, Black
XPAE6M	12082-0650-02	Microphone, Palm: 2-Wire, Beige
XPAE6H	12082-0650-03	Microphone, Mini-Lapel: 3-Wire, Black
XPAE6N	12082-0650-04	Microphone, Mini-Lapel: 3-Wire, Beige
XPAE3Z	LS103239V1	Earphone, Speaker-Microphone
XPAE9N	12082-0600-01	Speaker-Microphone, Immersion Rated to 1 Meter, Ruggedized, FM Intrinsically-Safe.
XPAE4B	12082-0600-02	Speaker-Microphone, Immersion Rated to 1 Meter and Ruggedized, with Emergency Button
XPAE6K	12082-0681-01	Speaker-Microphone with Bluetooth
XPHC3K	12082-0504-01	Strap, Shoulder: Nylon, 1.5-Inches Wide with Gripping Shoulder Pad, Adjustable Length (approximately 2.5 to 4.5 Feet)
XPHC3J	12082-0505-01	Strap, Shoulder: Leather, 1.25-Inches Wide (no shoulder pad), Adjustable Length (approximately 4.5 to 5.0 Feet)
ST-018326-001	SK-018326-001	Software: Unity XG-100P Portable Radio Software Distribution Kit

Table 4-2: Unity Radio Programming Software and Cables

CATALOG NUMBER	DESCRIPTION
TQS3385	Software: Radio Programming Package. This package includes Radio Personality Manager (RPM) part number SK-104768-001 which supports Unity XG-100P radio trunked and conventional system programming, and additional programming software used for programming other Harris radio equipment.
TQS3389	Software: Conventional Radio Programming Package. This package includes Conventional Radio Personality Manager (RPM) part number SK-012177-001. (Does not support trunked system programming.)
TQS3416	Software: Key Manager. This package includes the Key Administrator application (media kit SK102979V1) and the Key Loader application (media kit SK102981V1) on CD ROM media, along with the respective manuals and software release notes.
ST-018325-001	Software Distribution Kit: Land Mobile Radio Communications Planning Application (LMR CPA) to Radio Personality Manager (RPM) Converter Tool (Includes LMR CPA-to-RPM Software SK-018325-001 R1C (or later), Software Release Notes publication 14221-2100-8010, and Software Licensing Agreement publication MS-018419-001.)
XPCJ3A	Cable: USB Programming (Part number 12082-0410-A1)
XPCJ3B	Cable: KVL Key Loading (Part number 12082-0400-A1)
(none)	Cable: KVL 3000+ Programmable Adapter (Part Number 14002-0143-01)

NOTE

Radio Personality Manager (RPM) release R7A or later is required for Unity radio programming. Refer to the Operator's Manual for the specific version required with installed radio software.

Table 4-3: XG-100P Portable Radio Service Accessories

PART NUMBER	DESCRIPTION
BKB191230/7	Battery Eliminator
TS-011826-001 (or MATQ-03424)	Audio Test Box
12082-0435-A1	Audio Test Cable
12082-0445-A1	PPP/RS-232 Cable

5 OPERATING INFORMATION

Complete operating information for the Unity XG-100P portable radio is contained in Quick Reference Guide publication number 10515-0372-4100 and Operator's Manual publication number 10515-0372-4200. The Quick Reference Guide is included with the radio equipment package when the package ships from the factory. These publications are available on-line; refer to Section 3.2 on page 17 for additional information.

6 PROGRAMMING THE RADIO

6.1 PERSONALITY/MISSION PLAN PROGRAMMING

6.1.1 General Information

Harris Radio Personality Manager (RPM) is a Microsoft® Windows®-based software application used to program Harris radios operating in conventional, P25 conventional, P25 trunking, EDACS®, EDACS IP and ProVoice radio systems. The RPM application is used to create and modify radio personalities, which become mission plans when written to the Unity XG-100P portable radio. It can also be used to update radio firmware (i.e., operating system software). RPM supports many Harris radios such as the P7100, P7200, P7300 and XG-100P portable radios, and the M7100, M7200, M7300 and Unity XG-100M mobile radios. RPM's catalog numbers are listed in Table 4-2 on page 20.

CAUTION

Do **not** use LMR CPA (Land Mobile Radio Communications Planning Application) programming software SK-018325-001 (any release) to program a Unity XG-100P radio with release 2.0 or later firmware. Release R1C of SK-018325-001 is a converter tool that can be used to convert LMR CPA plan files to RPM personality/mission plan files. SK-018325-001 R1C is included with software distribution kit ST-018325-001. Refer to Software Release Notes publication 14221-2100-8010 for additional information.

Personality/mission plans are downloaded from the Personal Computer (PC) running RPM to the radio. Using RPM, they can also be extracted (read) from the radio, modified as needed, and then re-written (programmed) to the radio. They contain data that configure the radio for unique customer requirements such as radio frequency sets, unit and group trunk mode identification, etc. The technician can program personalities/mission plans into the radio or can read them from the radio and save them to a hard drive or other computer storage media.

Applicable catalog and part numbers are listed in Table 4-2 on page 20. For additional information about RPM, refer to its built-in help and/or RPM software release notes, publication number MS-012550-001.

With the Unity XG-100P portable radio, either a USB cable link or a Bluetooth wireless link can be used during RPM programming.

6.1.2 Establishing a USB Cable Connection with a Radio

1. Obtain USB Programming Cable 12082-0410-A1. The respective catalog number is listed in Table 4-2 on page 20.
2. Power-up the PC that has RPM installed on it and start Windows.
3. If the radio is on, turn it off.

4. Connect the cable's radio connector to the Universal Device Connector (UDC) located on the side of the radio. Be sure to slip the cable's connector tab into the notch above the UDC before tightening the cable connector's knob to lock it to the UDC. Do not over-tighten the knob.
5. Connect the cable's standard USB connector to a USB port of the PC.
6. Turn the radio on.
7. If prompted with a Found New Hardware wizard, accept all prompts to allow the installation of the USB driver software.

NOTE

Programming via a USB cable requires installation of USB driver software. This driver allows the radio to communicate with the PC via a standard USB port connection. This driver is included with the RPM installation software package, on the package's installation CD ROM media. The driver must be selected for copying to the PC when the RPM application is installed, but it is not installed until after a radio is connected to the PC and the respective prompts are accepted.

8. Continue by programming the radio with the RPM application as required. Section 6.1.4 describes how to extract a mission plan from a radio (i.e., read a personality/mission plan) and Section 6.1.5 describes how to program a personality/mission plan to a radio.

6.1.3 Establishing a Bluetooth Wireless Connection with a Radio

If the PC with the RPM software application has Bluetooth capability, a wireless Bluetooth data link can be used to program the radio with the RPM application. The total number of radios that can be simultaneously connected to RPM via Bluetooth is limited only by the number of COM ports available for the PC's Bluetooth radio/adapter.

NOTE

The radio's Bluetooth operation and/or menu can be enabled and disabled via RPM. If Bluetooth operation has been disabled, the radio cannot be connected via a Bluetooth connection. In this case, a USB cable connection is required to re-enable Bluetooth via RPM personality/mission plan changes and a subsequent download via the USB Programming Cable. To enable and disable Bluetooth within a personality, use RPM's Bluetooth Settings dialog box (access via Personality Data Tree > Options > Bluetooth Settings).

1. Verify the PC's Bluetooth wireless adapter (internal or external) is powered-up. For example, some notebook/laptop PCs have switches which power their internal wireless adapters on and off.
2. If not already, enable/activate the PC's Bluetooth software and set it to discovery mode.
3. Power-up the radio.
4. Wirelessly "pair" (connect) the radio and PC as follows:
   a. At the radio, select the SETTINGS menu then the BLUETOOTH submenu.
   b. Enable Bluetooth by setting ENABLED to YES.
   c. Select PAIRING MGMT (Pairing Management).
   d. If no Bluetooth devices are currently configured for connection, no devices are listed and ADD NEW appears in the lower-right corner of the display. In this case, select ADD NEW and wait for the radio to scan for devices.
   e. If Bluetooth devices are currently configured for connection, the devices are listed in the PAIRED DEVICES list and OPTIONS appears in the lower-right corner of the display.

f. Select the PC with RPM via its computer name and then press the center/enter key of the radio's 5-way navigational keypad.

g. At the PC, when prompted about the Bluetooth connection, verify an identical pass key is displayed at the PC and radio, and then accept this prompt.

NOTE

If no paired connection can be established, delete and then add the device using the OPTIONS menu's DELETE (or DELETE ALL) and ADD NEW functions.

h. At the radio, accept the pairing prompt to complete the pair. Bluetooth 2.0 devices require a PIN number; when prompted enter this number at the radio.

i. Optional: At the radio, in the OPTIONS menu, use the INFO function to verify the radio-to-PC connection.

5. Continue by programming the radio with the RPM application. Section 6.1.4 describes how to extract a mission plan from a radio (i.e., read a personality/mission plan) and Section 6.1.5 describes how to program a personality/mission plan to a radio.

6.1.4 Extracting (Reading) a Mission Plan from a Radio(s)

The radio can store up to ten (10) different mission plans. Each mission plan can be extracted (read) from the radio by the RPM application, edited with RPM as a personality, and then re-written to the radio and/or saved to computer storage media such as the PC's hard disk drive. Alternately, within the RPM application, a new mission plan can be created or made from an existing personality, and then rewritten to the radio as a mission plan.

To extract a mission plan from one or more radios:

1. Establish a USB or a Bluetooth connection between the radio and PC using the procedures in Sections 6.1.2 or 6.1.3 respectively.
2. Start the RPM application by clicking its icon on the Windows desktop, or by clicking Start > (All) Programs > Harris Radio Personality Manager > Radio Personality Manager. Refer to the RPM application's built-in help for programming information.
3. In RPM, click on the icon in the toolbar, or from the Radio menu, select USB/Bluetooth Connection > Unity Product Management. The Unity Product Management dialog box opens. Example dialog boxes are shown in Figure 6-1 and Figure 6-2.

NOTE

In the Unity Product Management dialog box, the connected radio's information appears in the Radio Information section, missions plans stored in the selected radio appear in the Discovered Mission Plans section, and currently open personalities/mission plans are displayed in the Program Mission Plans section.

4. If the radio is currently connected to the PC via a USB cable, it is automatically added just after the Unity Product Management dialog box opens. In this case, skip to step 8.
5. For a Bluetooth-connected radio, click the dialog box's (Bluetooth) button/icon. The Radio Connection Configuration dialog box opens.
6. Select the required COM port number for the Bluetooth connection.

NOTE

If the COM port number is not known, obtain it from the Ports (COM & LPT) section of the Microsoft Windows Device Manager, or from the configuration section of the PC's Bluetooth adapter software. For Bluetooth connections, more than one COM port may be available.

7. Click the Radio Connection Configuration dialog box's Add Radio button.

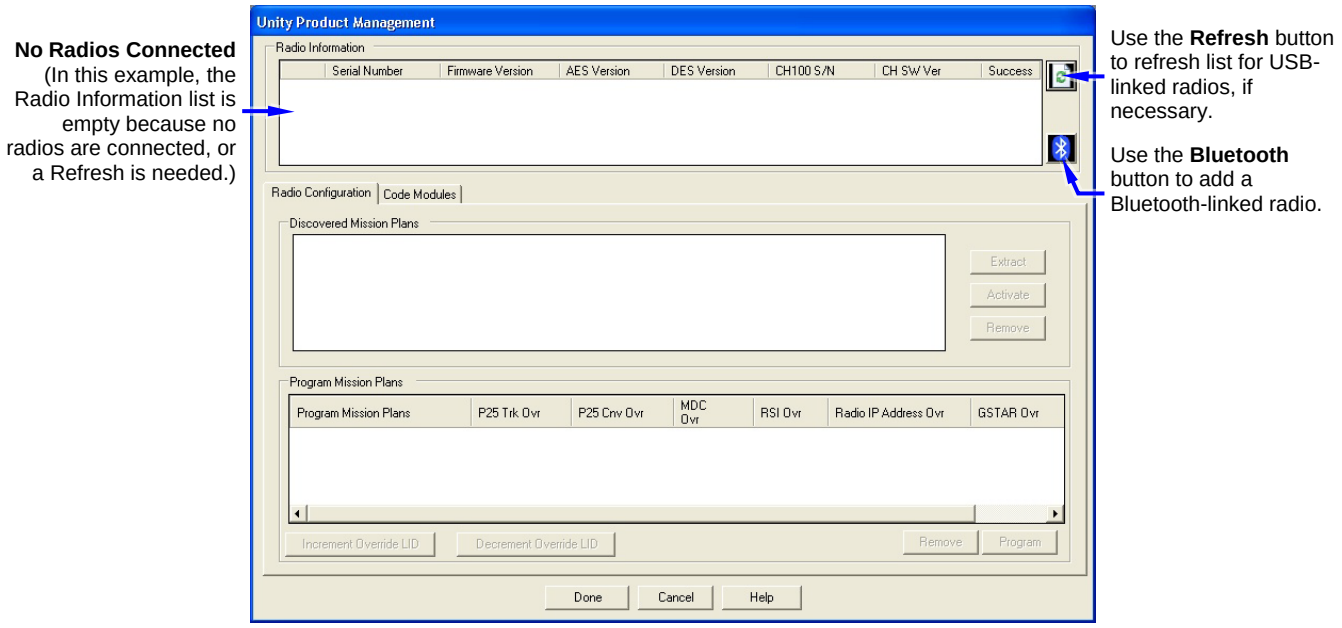


Figure 6-1: Unity Product Management Dialog Box (Example with no Radios Connected)

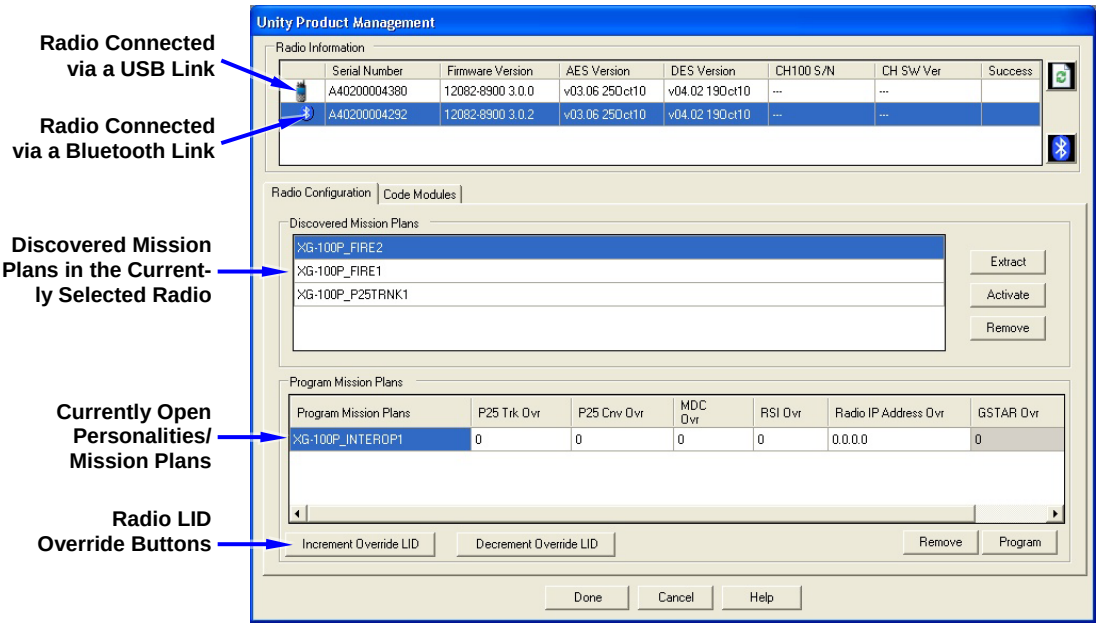


Figure 6-2: Unity Product Management Dialog Box (Example with two Radios Connected)

8. Optional: To add additional radios, perform steps 5 through 7, using a different COM port number for each radio. The total number of radios that can be added (i.e., connected for programming via RPM) is limited only by the number of available COM ports.
9. If more than one radio has been added, select the desired radio for mission plan extraction by clicking on its row (i.e., Serial Number, etc.) in the dialog box's Radio Information section. The row highlights, and the Discovered Mission Plans section in the Radio Configuration tab updates accordingly.
10. In the dialog box's Radio Configuration tab, select the desired mission plan(s) for extraction from the Discovered Mission Plans list, and then click the Extract button. Select multiple mission plans by holding the PC keyboard's <Ctrl> key or <Shift> key, and clicking on the mission plan names. Upon successful extraction of the mission plan(s), a confirmation message box appears.
11. Click this message box's OK button to continue.
12. Click the Unity Product Management dialog box's Done button. Each extracted mission plan opens as a new personality window within RPM. Otherwise, click the dialog box's Cancel button to exit this dialog box and return to RPM's normal personality screen.
13. Make personality/mission plan modifications as required. For additional information on using RPM, refer to its built-in help and/or the respective Software Release Notes document.
14. Recommended but not required: Save the personality, using a unique filename, if necessary.
15. Optional: Write the modified personality/mission plan back to the radio using the procedure in the following section.

6.1.5 Programming (Writing) Personalities/Mission Plans to a Radio

To program a personalities/mission plans to a radio:

1. Establish a USB or a Bluetooth connection between the radio and PC using the procedures in Sections 6.1.2 or 6.1.3 respectively.
2. Start the RPM application by clicking its icon on the Windows desktop, or by clicking Start > (All) Programs > Harris Radio Personality Manager > Radio Personality Manager. Refer to the RPM application's built-in help for programming information.
3. Open the personalities that must be programmed (i.e., written) to the radio. If a personality/mission plan needs to be sourced from a different radio and it is not currently stored on the PC's hard disk (or other media), first extract the personality/mission plan from the source radio, edit it as necessary using RPM, and save it.
4. In RPM, click on the  icon in the toolbar, or from the Radio menu, select USB/Bluetooth Connection > Unity Product Management. The Unity Product Management dialog box opens. Example dialog boxes are shown in Figure 6-1 and Figure 6-2.
5. If the radio is currently connected to the PC via a USB cable, it is automatically added just after the Unity Product Management dialog box opens. In this case, skip to step 9.
6. If the radio is currently connected via Bluetooth, click the dialog box's  (Bluetooth) button/icon. The Radio Connection Configuration dialog box opens.
7. Select the required COM port number for the Bluetooth connection.

NOTE

If the COM port number is not known, obtain it from the Ports (COM & LPT) section of the Microsoft Windows Device Manager, or from the configuration section of the PC's Bluetooth adapter software. For Bluetooth connections, more than one COM port may be available.

8. Click the Radio Connection Configuration dialog box's Add Radio button.
9. Optional: To add additional radios, perform steps 6 through 8, using a different COM port number for each radio. The total number of radios that can be added (i.e., connected for programming via RPM) is limited only by the number of available COM ports.
10. Select the desired radio for mission plan programming by clicking on its row (i.e., Serial Number, etc.) in the dialog box's Radio Information section. Only one radio should be selected at a time during program operations. The row highlights, and the Discovered Mission Plans section in the Radio Configuration tab updates accordingly.
11. If a value override (such as the radio's P25 trunked logical ID number) is needed to any of personalities/mission plans listed in the dialog box's Program Mission Plans section, click in the respective cell and enter the required value. Repeat as necessary for other overrides.

    The Increment Override LID and Decrement Override LID buttons can be used to simultaneously increase/decrease the P25 trunked, P25 conventional, and MDC-1200 LIDs with one click.
12. In the dialog box's Program Mission Plans section, select the desired mission plan(s) for programming by clicking on its name in the Program Mission Plans column. Select multiple mission plans by holding the PC keyboard's <Ctrl> key or <Shift> key, and clicking on the mission plan names.
13. Click the Program button. RPM displays status message boxes as the data is written to the radio. If a mission plan of the same name is already programmed into the radio, a yes/no over-write confirmation message box displays. In this case, click the Yes button to over-write, or No to cancel. At the radio, an INSTALL IN PROGRESS message is displayed.

6.1.6 Removing a Mission Plan via RPM

A mission plan stored in the radio can be removed (deleted) via RPM's Unity Product Management dialog box. Simply establish a connection to the radio, select the radio, select the desired mission plan's name in the dialog box's Discovered Mission Plans section, and click the Remove button. RPM displays status message boxes as the mission plan is removed from the radio. If necessary, select multiple mission plans for deletion by holding the PC keyboard's <Ctrl> key or <Shift> key, and clicking more than once.

6.1.7 Activating a Mission Plan via RPM

Normally, a particular mission plan stored in the radio is activated for use via the radio's keypad (PROGRAM menu). However, a mission plan can also be activated via RPM's Unity Product Management dialog box. Simply establish a connection to the radio, select the desired mission plan's name in the dialog box, and click the Activate button. After a short period, the selected mission plan activates at the radio.

NOTE

If a mission plan is activated that has Bluetooth operation turned off, the computer-to-radio wireless connection will be lost. In this case, after a short period, a respective message will display.

6.2 FLASH PROGRAMMING RADIO FIRMWARE

The radio's firmware can be flash programmed via RPM's Unity Product Management dialog box.

CAUTION

Before flash programming a radio, consult with the Harris Technical Assistance Center (TAC) and/or respective Software Release Notes as necessary. TAC contact information is included on page 17 of this manual. Software Release Notes are available at www.pspc.harris.com via a PSPC Systems Information Center login and Tech Link.

6.2.1 Obtaining a Radio's Current Firmware Versions

The radio's operating system firmware version, AES encryption firmware version, and DES encryption firmware version can be obtained either from the RPM's Unity Product Management dialog box or directly from the radio's UTILITY menu (abbreviated UTIL when not selected).

6.2.1.1 Obtaining Firmware Versions Directly from Radio

To obtain the firmware versions directly from the radio, enter the UTILITY menu and select RADIO INFO. The current operating system firmware version is reported in the SOFTWARE field. The AES and DES code versions are reported in the AES and DES fields respectively.

6.2.1.2 Obtaining Firmware Versions via RPM

To obtain the firmware versions via RPM, follow this procedure:

1. Establish a USB or a Bluetooth connection between the radio and PC. See Sections 6.1.2 or 6.1.3 as necessary.
2. Open RPM's Unity Product Management dialog box.
3. If the radio does not automatically appear in the Radio Information list, click the (Refresh) or (Bluetooth) button/icon to add the radio to the Radio Information list.
4. Read the radio's firmware versions in the Radio Information list.

6.2.2 Flash Programming a Radio

6.2.2.1 Flashing Operating System Firmware

Firmware is loaded into the radio before it ships from the factory. Therefore, typically this procedure can be bypassed. However in some cases, before the radio is deployed for use, the firmware must be updated by flash-loading new firmware. Follow this procedure to flash program new firmware to a radio:

1. Establish a USB or a Bluetooth connection between the radio and PC. See Sections 6.1.2 or 6.1.3 as necessary.
2. Open RPM's Unity Product Management dialog box.
3. If the radio does not automatically appear in the Radio Information list, click the (Refresh) or (Bluetooth) button/icon to add the radio to the Radio Information list.
4. If the personalities/mission plans currently stored in the radio must be maintained and they are not stored separately on a computer, extract (read) and save them as described in Section 6.1.4.
5. Click the dialog box's Code Modules tab. Verify the Firmware option is selected. If not, click on that option to select it.

6. Use the Browse button and the accompanying dialog box to browse to and select the proper firmware file (uses a "**dss**" file extension). After selecting the file, click the Open button to return to the Code Modules tab.
7. Click the Program button to write the selected firmware to the radio. Installation prompts will appear within RPM and on the radio as the firmware is written to the radio. This process takes between 6 and 7 minutes. Next, the radio re-boots and displays a "first run" prompt, followed by an "invalid system" prompt.
8. Flash/Re-flash required encryption modules into the radio as described in Section 6.2.2.2.
9. Re-program required personalities/mission plans into the radio as described in Section 6.1.5.

6.2.2.2 Flashing AES and DES Encryption Firmware (Encryption Modules)

AES and/or DES encryption firmware may or may not be loaded into the radio before it ships from the factory. If necessary, follow this procedure to flash program this firmware to a radio:

1. Establish a USB or a Bluetooth connection between the radio and PC. See Sections 6.1.2 or 6.1.3 as necessary.
2. Open RPM's Unity Product Management dialog box.
3. If the radio does not automatically appear in the Radio Information list, click the (Refresh) or (Bluetooth) button/icon to add the radio to the Radio Information list.
4. Click the dialog box's Code Modules tab.
5. Select the Encryption Module option.
6. Use the Browse button and the accompanying dialog box to browse to and select the proper encryption firmware file (uses an "**ess**" file extension). Refer to the respective Software Release Notes as necessary. After selecting the file, click the Open button to return to the Code Modules tab.
7. Click the Program button to write the selected firmware to the radio.

6.3 ADDING SOFTWARE FEATURE PACKAGES TO THE RADIO

6.3.1 Displaying Currently Enabled Software Feature Packages

To display the currently enabled software feature packages:

1. In the radio's UTILITY menu, select the FEATURE INFO. The FEATURES tab displays.
2. Press the ▼ (down) key of the radio's 5-key navigation keypad to view the list of the radio's currently-enabled software features packages.
3. Press the ◄ (left) or ►(right) key to select the FEATURES DATA tab and display the radio's existing feature code number in a hexadecimal format. Scrolling back up with the ▲ key may be necessary.
4. Press the BACK soft key twice to return to main menu.

6.3.2 Enabling Software Feature Packages

To enable software feature packages:

1. Contact the Harris Technical Assistance Center (TAC) to obtain a new software feature data string for new (and existing) features. TAC contact information is listed on page 17. Be prepared to report the radio's serial number, new feature(s) needed, and the respective customer information.

2. If it is running, exit the RPM programming software.
3. Start the Radio Maintenance Utility application by clicking Start > (All) Programs > Harris Radio Personality Manager > Radio Maintenance Utility.
4. Select the XG100P tab.
5. Use the Read Feature Data from Radio function to read the existing feature data string from the radio.
6. Click the Feature Data Edit button and replace the existing feature data string with the new feature data string supplied by TAC. If necessary, refer to the application's built-in help for additional information.
7. Click the OK button.
8. Use the Write Feature Data to Radio function to send the new feature data string to the radio. The radio briefly displays an "install" prompt and the utility displays a Command Response dialog box.
9. Verify the dialog box reports the feature data transfer is complete.
10. Click the dialog box's OK button, and exit the utility.

6.4 ENCRYPTION KEYS

The Unity XG-100P supports Type-3 DES-OFB, Type-3 DES-CFB, and 256-bit AES-256 encryption algorithms. Encryption keys can be managed with the Harris Key Manager software application, or using a Motorola KVL type keyloader.

6.4.1 Key Management with the Harris Key Manger

The Harris Key Manager software application assists in the management and distribution of encryption keys for high-security P25 and EDACS radio systems. Key Manager is used to manage encryption keys for many Harris radios and most Harris system-level components such as dispatch consoles. It allows the user to load EDACS DES, P25 DES, P25 AES, and ProVoice AES keys. Key Manager consists of two applications: Key Administrator and Key Loader. The Key Administrator is typically referred to as "Key Admin." See Table 4-2 on page 20 for the respective catalog and media kit numbers.

For detailed information on using the Key Manager software, refer to *Key Manager and Key Admin Overview and Operation Manual, MM1000019423* and/or *Key Manager and Key Loader Overview and Operation Manual, MM1000019424*.

6.4.1.1 Loading UKEKs with Key Loader and RPM (for OTAR-Enabled Systems)

In a P25 radio system, each encryption-capable radio is considered an Over-The-Air-Rekeying (OTAR) client. OTAR clients require a Unique Key-Encrypting-Key (UKEK), which permits secure communications on an individual basis with the network-based Key Management Facility (KMF) server. The UKEK is used to decrypt Key Encryption Keys (KEKs). Once a radio's OTAR options are properly configured and the OTAR UKEK is loaded, OTAR operations may begin. The radio receives Traffic Encryption Keys (TEKs) via OTAR from the radio network. TEKs are used to encrypt and decrypt voice and data traffic in a P25 trunked device.

UKEKs are loaded into Harris OTAR clients (target radios) using the Key Loader application. Key Loader is a part of Key Manager. UKEKs are typically loaded in the clear (unencrypted), as they are the first keys established in the radio.

Encryption keys for communicating on P25 trunked radio networks are created by the radio network's Crypto Officer. Field personnel (e.g., "trusted technicians") typically do not have key creation privileges.

To load UKEKs with the Key Loader and RPM applications:

1. Obtain USB Programming Cable 12082-0410-A1. The respective catalog number is listed in Table 4-1 on page 18.
2. Obtain the UKEK file and Storage Location Number (SLN) Binding Report information from the Crypto Officer (CO).


NOTE

Both AES and DES UKEKs can be contained within the same UKEK file.

3. Connect the cable's radio connector to the Universal Device Connector (UDC) located on the side of the radio. Be sure to slip the cable's connector tab into the notch above the UDC before tightening the cable connector's knob to lock it to the UDC. Do not over-tighten the knob.
4. Power-up the PC that has RPM and Key Loader applications installed on it, and start Windows.


NOTE

The Unity drivers must be installed before UKEKs can be loaded into the radio. The Unity drivers may be found on the Key Loader CD ("unity setup.exe") or on the Key Admin CD ("unity setup.exe").

5. Connect the cable's standard USB connector to a USB port of the PC.
6. Load the UKEK file from the Crypto Officer onto the PC.
7. Run the RPM application and setup the radio's personality according the SLN Binding Report information.
8. Setup the talk groups and the SLN mappings (Talk Group ID to SLN). This includes mapping SLNs to the "System" keys (PSTN, All Call, etc.).
9. Select the P25 OTAR Options and set the following:
   a) Set the OTAR Message Number Period (MNP) as defined by the System Administrator.
   b) Set the radio's Individual RSI (from the SLN Bindings Report).
   c) Set the KMF's RSI (from the SLN Bindings Report).
10. Select Radio > Program or click on the Program icon and write the personality to the radio.
11. Run the Key Loader application.
12. Open the UKEK file loaded in step 6.
13. Select the Target Device type (Auto-Detect is preferred) and click the Load button.
14. When prompted, enter your user name and password and click OK.

    The Key Loader reads the target device's identifying information, retrieves a UKEK of the proper algorithm type from the UKEK file, and downloads the UKEK to the target device at the proper SLN and keyset with the proper key ID.
15. Click the Finish button to exit the Key Loader application. New UKEKs have now been loaded and the radio is now ready to accept TEKs via OTAR with the trunked radio network.

6.4.1.2 Creating Keys with Key Admin (for Non-OTAR-Enabled Systems)

Radios operating in an analog conventional and/or some P25 conventional radio systems cannot utilize OTAR operations to receive encryption keys. Keys must be created and loaded into radios using Key

Manager's Key Admin and Key Loader applications. Keys are created and stored in a Distribution Key File with Key Admin. Next, Key Loader is used to load keys from the Distribution Key File to radios. Typically these operations are performed only by the Crypto Officer (CO) or trusted technicians. Keys stored in a Distribution Key File cannot be edited.

For detailed information on using the Key Manager software, refer to *Key Manager and Key Admin Overview and Operation Manual, MM1000019423* and/or *Key Manager and Key Loader Overview and Operation Manual, MM1000019424.* These publications are available at www.pspc.harris.com via an Information Center login and Tech Link.

To create keys with the Key Admin application:

1. Obtain the Master Key File and open it to the PC with the Key Manager application.
2. At the PC, start the Key Admin application by clicking its icon on the Windows desktop, or by clicking Start > (All) Programs > Harris Key Manager > Harris Key Admin.
3. Use Key Admin's New Master Set or Load Existing Set functions to create a key set. Refer to the application's built-in help for more information on creating keys.
4. Continue by creating a Distribution Key File. This action writes the keys to the Distribution Key File.
5. Continue by loading keys to radios per the following procedure.

6.4.1.3 Loading Keys with Key Loader (for Non-OTAR-Enabled Systems)

Key Loader is a part of the Harris Key Manager application. It can be used by the Crypto Officer (CO) or a trusted technician to load the encryption keys into the radio:

1. Open the Distribution Key File the PC with the Key Manager application.
2. Obtain USB Programming Cable 12082-0410-A1. The respective catalog number is listed in Table 4-1 on page 18.
3. Connect the radio to the PC using this cable.
4. Power-up the radio.
5. At the PC, start Key Loader by clicking its icon on the Windows desktop, or by clicking Start > (All) Programs > Harris Key Manager > Harris Key Loader.
6. At the Key Loader's Welcome dialog box, click the Next button.
7. Enter the password for the Distribution Key File and click the Authenticate button.
8. Click Next and then click Next again.
9. Wait for the Key Loader to read the Distribution Set and then click Next again.
10. Select the required port from the drop-down list (typically USB) and click Next again.
11. Select the Unity XG-100P radio by clicking its serial number in the drop-down list and then click the Load button.
12. Click the Finish button.
13. If other radios must be loaded, repeat from step 3.


NOTE

For information on creating and loading keys or key groups with a KVL type keyloader, refer to the XG-100P operator's manual.

6.4.2 Zeroizing Keys Stored in the Radio

6.4.2.1 Zeroizing via the Radio's Keypad

Follow this procedure to zero-out all encryption keys and keysets stored in the radio via the radio's keypad. This action also removes all keysets stored in the radio:

1. At the radio's main menu, use the 5-way navigator control to select SECURITY. Alternately, simply press the keypad's 3 key.
2. Navigate to select ZEROIZE KEYS.
3. Navigate to and select YES to confirm.
4. Select OK. All encryption keys and keysets stored in the radio are immediately deleted from the radio.

7 MAINTENANCE INFORMATION

7.1 GENERAL INFORMATION

The Unity XG100P portable radio, under warranty, **must** be serviced by a service center authorized by Harris to service immersion-rated radios. Service performed by any non-authorized service center and/or any non-authorized personnel will void the radio's warranty.

Technicians servicing this radio should be concerned with isolating the problem to either a hardware or a software problem. Hardware repair of this radio is limited. Radio problems resulting from software errors can usually be corrected by reloading the radio's personality/mission plan and/or flash code, or by re-configuration.

Improperly servicing the radio may void its RF integrity and cause it to violate FCC rules and regulations. Do not service this radio unless it can be fully tested as described in this manual.

For technical assistance, contact the Technical Assistance Center using the contact information listed in Section 3.4.

7.2 GENERAL GUIDELINES ON CARING FOR THE RADIO EQUIPMENT

- Keep the exterior of the radio, battery, antenna, and radio accessories clean. To remove dust and dirt, use a soft clean damp cloth. Also use mild soap if necessary.

Do **not** use alkaline, acid, alcohol, or petroleum-based cleaners to clean the radio or its accessories. Use a clean soft damp cloth with a mild soap for cleaning.

- To ensure efficient power transfer from the battery to the radio, verify the electrical contacts on the battery and the radio are free of dust and dirt before attaching the battery to the radio. If necessary, carefully wipe the contacts clean using a soft clean dry cloth. Use caution as to not damage the contact pins or contact perimeter gasket on the rear of the radio.
- To ensure efficient operation of the radio's transceiver, always verify the antenna connector located on the top of the radio and the connector on the base of the antenna are clean and free of dust and dirt before mating the two together. If necessary, before mating, clean these connector surfaces with a small clean soft-bristle non-metallic brush.
- To ensure proper operation of accessories connected to the radio, verify the electrical contacts of the radio's Universal Device Connector (UDC) and the respective contacts of the accessory are free of dust and dirt before mating the two together. If necessary, before mating, clean these contacts with a small clean soft-bristle non-metallic brush.
- When the UDC is not in use, cover it with the protective cover to prevent the build-up of dust or water particles on the UDC.

CAUTION

Do **not** carry the radio by its antenna. Do **not** carry the radio by any accessory or the cord of any accessory connected to the radio's UDC.

7.3 PREVENTIVE MAINTENANCE

To ensure high radio operating efficiency and to prevent mechanical and electrical failures, routine preventive maintenance should be performed at regular intervals. Harris recommends performing preventive maintenance on an annual basis, or more often in harsh environments. This maintenance should include but not be limited to:

- Cleaning the radio and its accessories in accordance with the guidelines presented in Section 7.2.
- Inspecting the general condition and operation of the control knobs on the top of the radio. Inspection should include checking for any bent control shaft.
- Inspecting the radio's front display lens for proper operation and/or any cracks or other damage.
- Inspecting the radio's top display lens for proper operation and/or any cracks or other damage.
- Inspecting the radio's front panel keys for proper operation and/or any damage.
- Inspecting the radio's side panel buttons for proper operation and/or any damage.
- Inspecting the condition of the radio's front and rear panel microphones for proper operation.
- Inspecting the radio's Universal Device Connector (UDC) for any damage.
- Inspecting the radio's antenna connector for any damage.
- Inspecting the condition of the perimeter gasket around the radio's battery electrical contacts. Do **not** attempt to repair this gasket.
- Checking the condition of all batteries used with the radio. Refer to Section 7.4 for additional information.
- Checking the condition of the antenna used with the radio. If any significant damage is found, replace it with a new antenna. Do **not** attempt to repair a damaged antenna.
- Verifying overall radio operation by performing an operational check.

NOTE

If any damage is found, return the radio to Harris for service. Contact the Harris Technical Assistance Center for addition details. TAC contact information is included in Section 3.4.

CAUTION

The Unity XG100P portable radio, under warranty, **must** be serviced by a service center authorized by Harris to service immersion-rated radios. Service performed by any non-authorized service center and/or any non-authorized personnel will void the radio's warranty.

7.4 BATTERY CARE

7.4.1 Li-Poly Rechargeable Batteries 12082-0300-01 and 12082-0304-01

Batteries 12082-0300-01 and 12082-0304-01 are Lithium-ion Polymer (Li-Poly) rechargeable batteries. Battery 12082-0304-01 is an FM3611-rated intrinsically-safe battery. Both batteries are each equipped with an internal "fuel gage" and authentication circuits. These circuits communicate with both the charger and the radio to provide an accurate measurement of battery charge state. General electrical specifications include:

Table 7-1: General Electrical Specifications for Li-Poly Rechargeable Batteries

PARAMETER	RATING
Nominal Voltage:	7.4 Volts dc
Operating Voltage Range:	5.8 to 8.4 Volts dc
Fully Charged Voltage:	8.4 Volts dc
Low-Voltage Trip Point:	4.8 Volts dc
Discharge Profile:	4 amperes continuous for a minimum of 20 minutes
Capacity of Battery 12082-0300-01:	26 Watt-Hour (3.6 Amp-Hour) with fresh charge
Capacity of Battery 12082-0304-01:	24 Watt-Hour (3.1 Amp-Hour) with fresh charge

WARNING

Do not disassemble or modify a rechargeable battery. These batteries are equipped with built-in safety and protection features. Should these features be disabled or tampered with in any way, the battery pack can leak electrolyte, overheat, emit smoke, burst, and/or ignite.

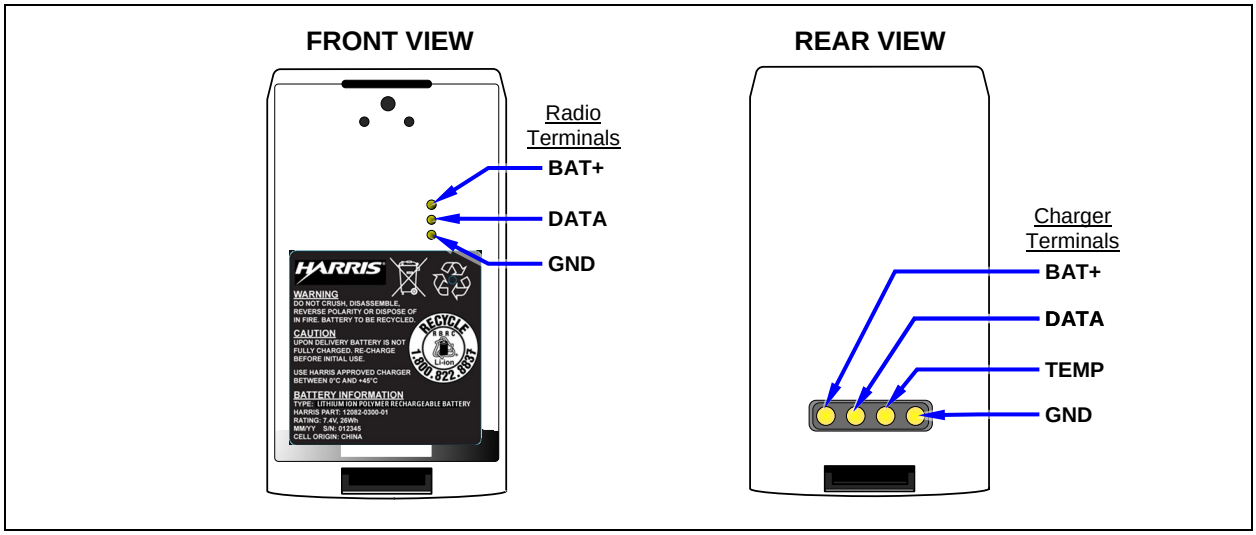


Figure 7-1: Li-Poly Rechargeable Battery (Front and Rear View)

7.4.2 Battery Charge Level and Voltage Indications

7.4.2.1 Displayed Icons

Relative battery charge level is always indicated by a small battery icon located in the upper-right corner of the radio's front display, as illustrated in Figure 7-2. The level is also indicated in the top display.

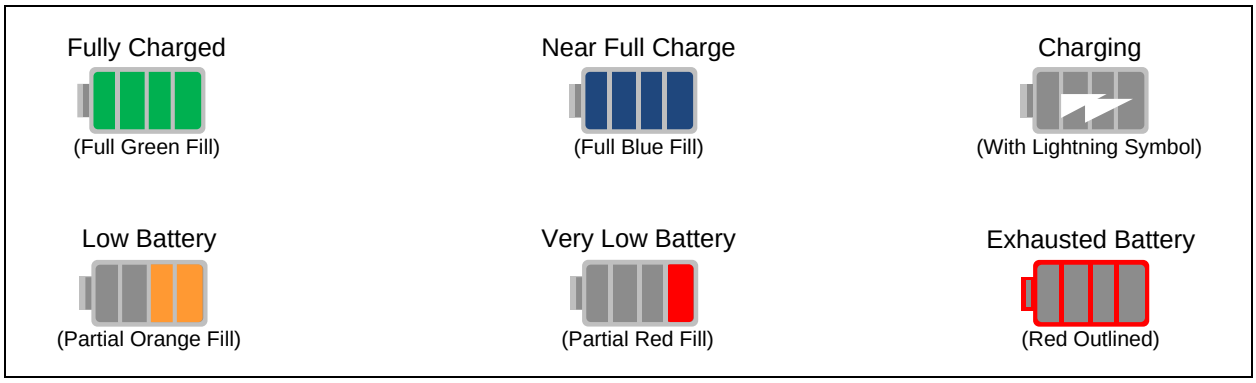


Figure 7-2: Battery Charge Level Icons used in the Front Display

7.4.2.2 Detailed Battery Information from the Utility Menu

Detailed battery information can be obtained via the radio's UTILITY menu (abbreviated UTIL when not selected). Select BATTERY INFO to display battery voltage, capacity, chemistry, charging/discharging, charge cycle count, battery part number, and other information. Press the ▼ (down) or ▲ (up) keys to scroll though the list. Use the BACK soft-key to exit.

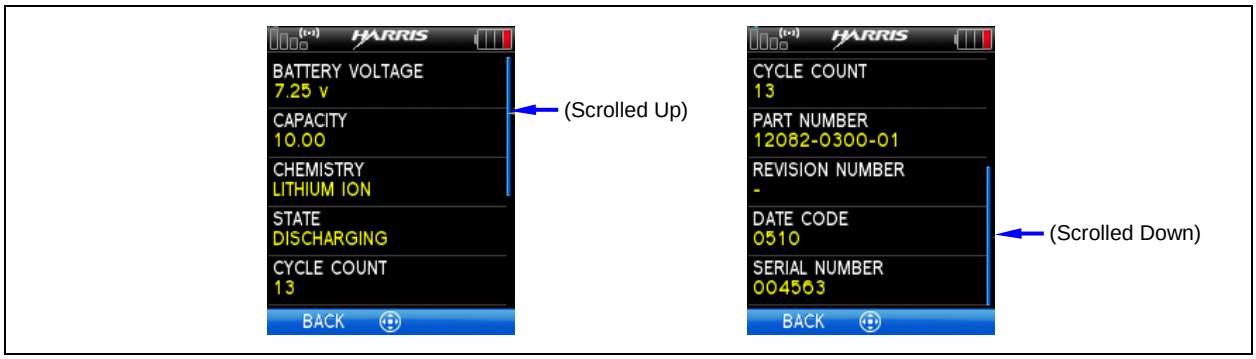


Figure 7-3: Detailed Battery Information from the Utility Menu (Example Information Shown)

NOTE

If only the battery's voltage is reported in the Battery Info screen, either there is a data communication problem between the radio and the battery, or the battery is not a "smart" battery.

7.4.3 Li-Poly Battery Charging

Lithium-ion polymer battery charging is a two-step process entailing a constant-current phase followed by a constant-voltage phase. During the constant-current phase, the charger presents a fast-flashing (approximately 120 pulses-per-minute) green charge status indicator. The constant-current charging phase ends when the battery's voltage reaches approximately 8.35 Volts, and the charger then transitions to the constant-voltage charging phase. This phase indicated by a slow-flashing (approximately 30 pulses-per-minute) green charge status indicator. At the constant-current to constant-voltage transition, the battery is approximately 80% charged. The constant-voltage charging phase is considered a trickle-charge phase. At

the end of the constant-voltage phase, the charge status indicator lights steady green (without flashing) to indicate the battery is fully changed. Charge current completely ceases when the battery is fully charged.

A li-poly rechargeable battery should be fully charged before placing it into service. This is especially important if the battery has been stored for a long period of time. Refer to Section 7.4.5 for additional information.

NOTE

Unlike other rechargeable battery technologies, li-poly rechargeable batteries do not suffer from a decreased capacity after repeated charge and discharge cycles. This capacity decrease is sometimes referred to as "memory-effect." Therefore, li-poly rechargeable batteries do not require conditioning.

A single-bay and a 6-bay battery charger are available, as listed in Table 4-1 on page 18. In each charger, a battery can be charged while it is attached to the radio, or by itself. The single-bay charger is a multi-chemistry chargers; it can charge lithium-ion polymer (li-poly), lithium-ion, nickel-cadmium, and nickel-metal hydride rechargeable batteries. The 6-bay charger can only charge lithium-ion polymer and lithium-ion rechargeable batteries.

Follow these guidelines:

- Only charge li-poly batteries in the approved battery chargers, as specified in the respective charger's operator manual.
- Always follow instructions included in the battery charger's operating manual.
- Fully charge a li-poly battery before placing it to service.
- Never leave a li-poly battery sitting in a powered-up charger for more than a few days.
- Avoid high temperatures during battery charging.
- Discontinue charging if the charger and/or battery is overheating.
- If any faults are encountered while charging the battery pack, consult the charger's operator manual to determine the cause and possible corrective action.

Refer to Section 7.4.5 on page 38 for battery storage recommendations.

7.4.4 Attaching and Removing the Battery

7.4.4.1 Attaching the Battery to the Radio

1. Obtain a freshly-charged battery.
2. If the radio is not turned off, do so by rotating its on/off/volume control fully counterclockwise to the detent position.
3. Firmly grasp the radio in one hand and the battery in the other hand. Position both so they are rear-facing.
4. Slip the top of the battery fully into the top of the radio's battery cavity. If the radio has the optional belt clip attached, it may be necessary to slightly bend the clip up away from the cavity.
5. Press the bottom of the battery into the cavity until a gentle click is sensed. This indicates the battery is latched to the radio.

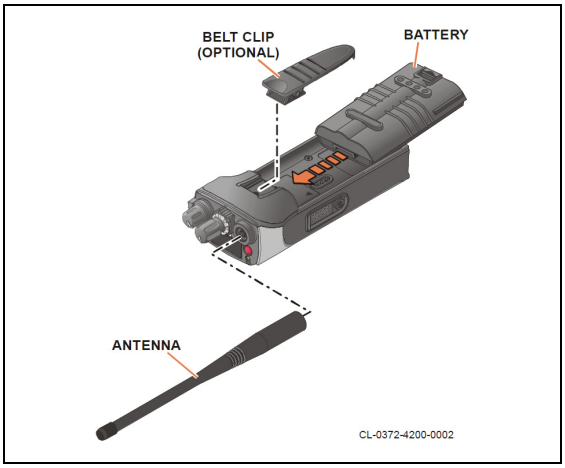


Figure 7-4: Attaching the Battery, Antenna, and Belt Clip

6. Turn the radio on and test for proper operation by observing for a power-up beep and/or active display.

7.4.4.2 Removing the Battery from the Radio

1. If the radio is not turned off, do so by rotating it's on/off/volume control fully counterclockwise to the detent position.
2. Firmly grasp the radio in one hand in an inverted (bottoms-up) and rear-facing position.
3. Using a finger, push the battery latch down until the bottom of the battery moves out away from the bottom of the radio.
4. While holding the radio firmly with one hand, use the other hand to remove the battery from the radio's battery cavity.

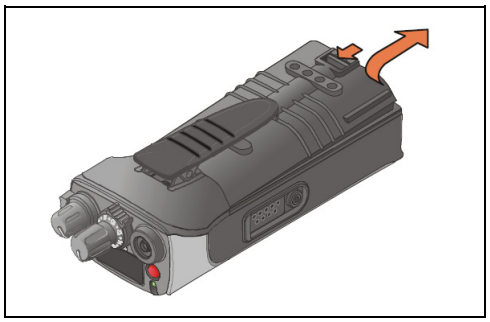


Figure 7-5: Removing the Battery

5. Store the battery in a safe place, and/or place it in a charger for charging.

7.4.5 Storing Lithium-Ion Polymer Rechargeable Batteries

If a lithium-ion polymer rechargeable battery is expected to be idle for a month or more, it should be properly prepared before storage. All batteries experience some capacity loss during storage. The shelf life for li-poly batteries is approximately three (3) months. A capacity loss which occurs during storage is permanent and it cannot be reversed. Li-poly batteries should be purchased and used immediately. They should not be stock-piled without a rotating stock plan. Storage recommendations include:

- Do not store a li-poly battery in a full-charged state. Before storing, discharge a li-poly battery to approximately 40% of its rated capacity. If a li-poly battery is not discharged prior to storage, its overall capacity may be reduced. Battery discharge can be accomplished using the discharge feature of an iTECH iQ^{five} or Cadex conditioner.
- Store a li-poly battery in a cool, dry area between 32° to 86° F (0° to 30° C). Refrigeration is recommended. Do not store a li-poly battery in a freezer. Before refrigerating, seal a battery in a plastic bag to protect it from condensation.
- Never leave a li-poly battery sitting in a powered-up charger for more than a few days.
- Fully charge a li-poly battery before placing it back into service.

Refer to Section 7.4.3 on page 36 for additional information on battery charging.

7.4.6 Battery Disposal and Recycling

7.4.6.1 Rechargeable Lithium-Ion Polymer Batteries

Unlike other battery technologies, the XG-100P's lithium-ion polymer rechargeable battery does not have special disposal requirements. At the end of its useful life, simply send the battery to a battery disposal or recycling center. Always follow all state and local regulations/guidelines regarding battery disposal and/or recycling.

The XG-100P's lithium-ion polymer rechargeable battery is recyclable. At the end of its useful life, under various state and local regulations/guidelines, it may be illegal to dispose of this battery into the municipal waste stream. Check with the local solid waste officials for details on recycling options or proper disposal. U.S. and Canadian users may call Toll Free 1-800-8-BATTERY® (1-800-822-8837) for related information and/or procedures.

WARNING

Never dispose of any battery by burning/incinerating. A battery may explode and/or produce toxic or explosive gases when burned/incinerated.

7.4.6.2 Alkaline Batteries used in Battery Clamshell XPPA2H

Battery Clamshell catalog number XPPA2H (part number BT-013259-001) holds six (6) AA alkaline batteries. This clamshell is intended for emergency situations in which AC power has or will not be available for extended periods of time.

Alkaline batteries should be disposed of or recycled in accordance with state and local regulations/guidelines. For additional information in the U.S. and Canada, call Toll Free 1-800-8-BATTERY® (1-800-822-8837).

NOTE

Do not use standard AA rechargeable batteries in Battery Clamshell XPPA2H. This clamshell does not have any charging contacts.

7.5 SERVICING INTRINSICALLY SAFE RADIOS

Unity XG-100P portable radio part number 12082-1000-11 is rated "Intrinsically Safe" by the Factory Mutual Research Corporation (FMRC) and Canadian Standards Association (CSA). These units must be serviced by FM/CSA-certified service centers to retain the Intrinsically Safe certification. All Harris-owned service centers are FM/CSA certified. Other service shops may or may not be certified by the rating agencies.

WARNING

FM intrinsically-safe radio part number 12082-1000-11 must be used with an instrically-safe battery and accessories. Otherwise, intrinsic safety is not maintained. Refer to Section 7.5 on page 39 for additional information.

7.6 TESTS AND ALIGNMENT

WARNING

Improperly servicing the radio may void its RF integrity and cause it to violate FCC rules and regulations. Do not service this radio unless it can be fully tested as described in this manual.

Tests presented in this section are the minimum tests to verify the radio can communicate with another radio in conventional non-trunking mode. The tests do not verify the communication systems protocols and user parameters. The procedures developed by the field technician to test the programmed parameters of the radio depend on knowledge and skills obtained from the communication system manuals, training and experience. If one has questions or needs clarification of observations, please contact the responsible person. The order of contact should be the communications systems responsible person, the local Harris service provider, then Harris.

NOTE

Transmitter Frequency Test and Alignment should be performed at least annually to ensure proper operation. Refer to Sections 7.6.6.1 and 7.6.6.2 respectively.

The Unity Portable is compliant with all applicable FCC narrowbanding mandates below 512 MHz. In certain applications, wideband operation is disabled via a software feature package (i.e., feature encryption).

For technical assistance, contact the Harris Technical Assistance Center using the contact information listed in Section 3.4.

NOTE

Test procedures presented in this manual support the following radio hardware and software versions:

- RF Hardware 12082-2010-07
- Digital Hardware 12082-4100-06 and -07
- Software 12082-8900 Release 2.0.x (and later) / SK-018326-001 R2B (and later)

To determine these hardware versions, in the UTILITY menu, select RADIO INFO.

For earlier hardware and/or software versions, consult with the Harris Technical Assistance Center. TAC contact information is included in Section 3.4 on page 17.

7.6.1 Test Equipment

Table 7-2 on page 41 lists test equipment required for Unity XG-100P portable radio tests and alignments covered in this section.

7.6.2 Minimum Qualifications of the Service Technician

Before continuing, it is assumed the service technician meets the following qualifications:

- Is familiar with the operation of the utilized RF communications test set.
- Has knowledge of the safety issues dealing with the protection of oneself, the test equipment and the radio.
- Is familiar with the operation of the Unity XG-100P portable radio. The operator's manual should be consulted for radio user operation during tests.

- Has knowledge and experience in performing standard tests on portable radios.
- Has knowledge and experience in creating and programming a personality/mission plan into a radio.

Table 7-2: Test Equipment for Tests and Alignments

EQUIPMENT TYPE	TYPE / MODEL NUMBER(S)
RF Communications Test Set	Aeroflex 2975, Aeroflex 3920, or Aeroflex 3500 (or equivalent)
RF Adapter: Quick-Connect SMA Male-Female	RF TEC Mfg., Inc. RTM-CSMAP-AD18 (Push-On) or RTM-CSMAP-AD18T (Slide-On) www.rftec.com
RF Cable: SMA Male to Type-N Male (36 inches long)	Pasternack Enterprises PE3662-36 http://www.pasternack.com/ (or equivalent)
Battery Eliminator	Harris BKB191230/7
Power Supply	Adjustable Regulated DC-Output Power Supply capable of adjustment from 6 to 9 Vdc; 3-amps minimum; Agilent E3634A (or equivalent)
Digital Multimeter with Probes	Fluke 87-Series with Standard Test Probes (or equivalent)
Radio Programming Software	Radio Personality Manager (RPM) Release R7A or later (See Table 4-2 on page 20 for additional information.)
Personal Computer (PC)	Laptop or desktop PC which meets or exceeds minimum requirements of RPM Release R7A. Refer to Software Release Notes document MS-012550-001 for additional information.
USB Programming Cable	Harris 12082-0410-A1 (See Table 4-2 on page 20 for additional information.)
Audio Test Box*	Harris TS-011826-001 (or MATQ-03424)
Audio Test Cable*	Harris 12082-0435-A1
BNC Male-to-BNC Male Coax Cable* (36 inches long)	Pasternack Enterprises PE3067-36 (or equivalent)

* The last 3 listed items are **not** required to perform the following tests/alignment: Transmitter Frequency Test, Transmitter Frequency Alignment, Transmitter Power Levels Test, Transmitter P25 (C4FM) Modulation Pattern Test, and Receiver P25 (C4FM BER) Sensitivity Test.

NOTE

The RF communications test set should have a frequency stability equal to or better than 0.05 ppm. If not, an external timebase reference which meets or exceeds this specification must be applied to the test set's external timebase reference input.

7.6.3 Test Personality/Mission Plan

Unity XG-100P portable radio tests and alignments require a test personality/mission plan. Create this personality/mission plan and program it into the radio per the procedure that follows. Also refer to RPM's built-in help as necessary:

General Settings:

1. Using RPM, create a test personality.
2. Use the Unity Portable Options dialog box to enter a Maintenance Password. Access this dialog box by double-clicking on Unity XG100 Portable Options in the Options limb of RPM's Personality Data Tree. Make a note of the entered maintenance password for later use. If required, at the radio, this password will allow adjustment of the radio's Temperature-Compensated Crystal Oscillator (TCXO), and allow performance of several P25 (C4FM) related tests.
3. Set a Channel Edit Password. At the radio, this password will allow editing of a channel's programmed parameters, such as transmit frequency, receive frequency, transmit power level, etc. Make a note of this password for future use.

Create the Analog Conventional Test System/Zone:

4. Within this personality, create a new analog conventional "system" (i.e., a "zone" from the radio's perspective) using RPM's Add New System function/dialog box.
5. Configure this new system with at least the analog conventional test channels listed in Table 7-3. The frequencies can be changed to compensate for any local RF interference.

Table 7-3: Analog Conventional Test Channels

TX FREQ. (MHz)	RX FREQ. (MHz)	TX POWER	VOICE MODE	BAND-WIDTH	RECOMMENDED LONG NAME	RECOMMENDED SHORT NAME	OTHER SETTINGS
136.000	136.000	Low	Analog	Wide	136 MHZ A	136MHZ A	Leave at RPM Defaults
174.000	174.000	Low	Analog	Wide	174 MHZ A	174MHZ A	
380.000	380.000	Low	Analog	Wide	380 MHZ A	380MHZ A	
520.000	520.000	Low	Analog	Wide	520 MHZ A	520MHZ A	
794.0125	764.0125	Low	Analog	Wide	TX794 RX764 A	764MHZ A	
824.9875	869.9875	Low	Analog	Wide	TX825 RX870 A	R870MHZA	
869.9875	869.9875	Low	Analog	Wide	869.9875 A	870MHZ A	

6. In the System Setup dialog box, click the General tab, click on this system's name to select it, then click the TX Power Levels button and set all power level settings as indicated in Figure 7-6. From the default settings, only VHF Low and UHF Low need to be changed (from Low to Very Low).

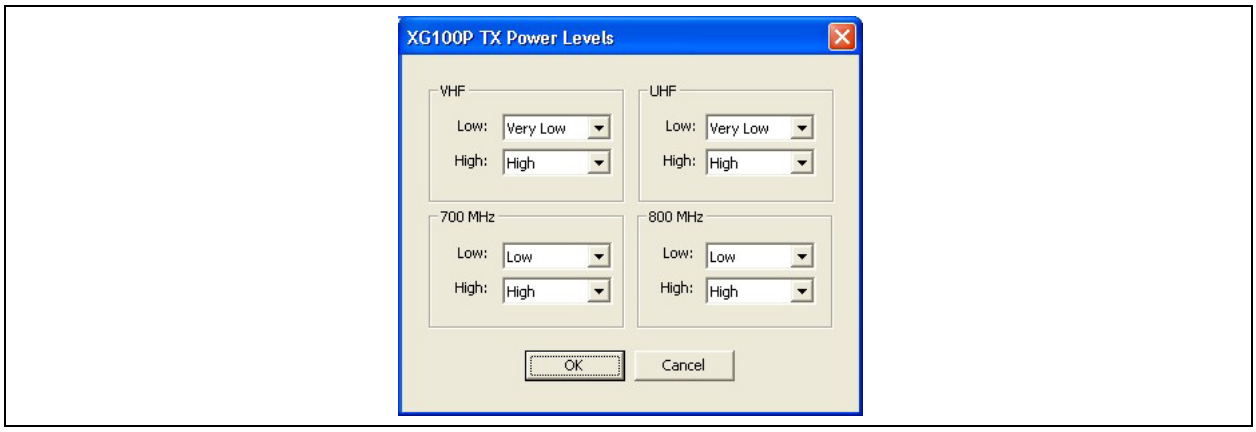


Figure 7-6: Setting Tx Power Levels for Test Channels

Create the P25 Conventional Test System/Zone:

7. Within this personality, create a new P25 conventional "system" (i.e., a "zone" from the radio's perspective) using RPM's Add New System function/dialog box.
8. Configure this new system with at least the P25 conventional test channels listed in Table 7-4. The frequencies can be changed to compensate for any local RF interference.

Table 7-4: P25 Conventional Test Channels

TX FREQ. (MHz)	RX FREQ. (MHz)	TX POWER	VOICE MODE	BAND-WIDTH	RECOMMENDED LONG NAME	RECOMMENDED SHORT NAME	OTHER SETTINGS
136.000	136.000	Low	P25	C4FM	136 MHZ P25C	136P25C	Leave at RPM Defaults
174.000	174.000	Low	P25	C4FM	174 MHZ P25C	174P25C	
380.000	380.000	Low	P25	C4FM	380 MHZ P25C	380P25C	
520.000	520.000	Low	P25	C4FM	520 MHZ P25C	520P25C	
794.0125	764.0125	Low	P25	C4FM	TX794 RX764 P25C	764P25C	
824.9875	869.9875	Low	P25	C4FM	TX825 RX870 P25C	870P25C	
869.9875	869.9875	Low	P25	C4FM	869.9875 P25C	870P25C	

9. In the System Setup dialog box, click the General tab, click on this system's name to select it, then click the TX Power Levels button and set all power level settings as indicated in Figure 7-6. From the default settings, only VHF Low and UHF Low need to be changed (from Low to Very Low).

Save a Program to Radio:

10. Save this personality, program it to the radio, and set it as the active mission plan. Refer to the respective subsections in Section 6.1 and/or RPM's built-in help as necessary.

7.6.4 Bench Setup

This bench setup procedure is required by several test procedures that follow:

1. Power-up all test equipment and allow at least a 30-minute warm-up time.
2. Adjust the bench power supply for 7.5 volts DC and set its current limit to 3 amps.

3. Connect Battery Eliminator BKB191230/7 to the power supply. Observe polarity when making these connections. There is a reverse protection diode in the eliminator. There should be no current flow from the power supply. Do not add any length to the eliminator's cables unless the wire size is significantly larger than the eliminator's cable.
4. Ensure the radio is turned off and install the battery eliminator to the radio.
5. Connect the antenna connector of the radio to the T/R port of the RF communications test set using the SMA RF adapter and short length of quality RF cable. See Table 7-2 for recommended adapter and cable types. Ensure the adapter does not put significant stress on the radio's antenna connector.
6. Power-up the radio.
7. Verify the current is approximately 220 milliamps when the receiver is muted and the display is on. Refer to the specifications in Section 2.1 (page 10) for currents during other operating conditions.
8. Use the radio's PROGRAM menu (abbreviated PRGM before selection) to activate the test mission plan. Section 7.6.3 (page 42) includes details about creating and programming the test personality/mission plan into the radio.
9. Use the radio's ZONE menu to select the zone with the analog conventional test channels listed in Table 7-3.

7.6.5 Synthesizer Performance Test

This test verifies the lock range of the synthesizer circuits and it allows additional time for the temperature of the radio to stabilize.

1. Setup the radio and test equipment per the bench setup procedure in Section 7.6.4 (page 43).
2. Select the 136.000 MHz analog conventional test channel.

NOTE

Setting the RF communications test set's RF signal generator on-frequency is **not** necessary when performing this procedure. The test set's T/R port is simply used as a 50-ohm load for the radio's antenna port.

3. Wait at least two (2) seconds.
4. Verify an alarm message is not displayed on the radio. In this case, receiver synthesizer lock is confirmed.
5. Key the radio by depressing its PTT button and verify it is transmitting per a lit red indicator on the top of the radio and/or a red transmit forward power icon ( ) near the top of the front display. This icon indicates transmit forward power.
6. Verify an alarm message is not displayed on the radio. In this case, transmit synthesizer lock is confirmed.
7. Unkey the radio.
8. Repeat the previous steps on at least all test channels listed in Table 7-3. The lack of an alarm message on all listed channels verifies the radio's synthesizer can lock at each end of each RF band, transmit and receive.

NOTE

Failure on any channel indicates a defect in the radio. In this case, the radio must be returned to Harris for service!

7.6.6 Transmitter Performance Tests and Alignment

Use the procedures in this section to check the XG-100P radio's transmitter frequency, and if required, align its Temperature-Compensated Crystal Oscillator (TCXO). Modulation related tests are also included.

Before testing, the following information should be reviewed and followed to ensure measurement accuracy is maintained, as well as unnecessary adjustments are not performed.

NOTE

The radio's TCXO (Temperature Compensated Crystal Oscillator) is a highly accurate and stable crystal reference oscillator which should not normally require re-alignment. The use of a recently-calibrated RF communications test set and/or frequency counter is recommended. **The utilized test equipment should have a specified frequency accuracy equal to or better ±0.05 ppm.**

NOTE

This frequency test and alignment should be performed with the radio and test equipment at room temperature between 68 and 77° Fahrenheit (20 to 25°C).

NOTE

Power-up all test equipment and allow at least a 30-minute warm-up time.

Operation in a P25 system and narrowband analog systems requires a much tighter frequency specification than those of previous type analog radio systems. If one looks at requirements for the bands of operation that the Unity radio operates in, the UHF and 700 MHz bands have tighter requirements than other bands. However, the use of P25 puts the same channel requirements across the bands. The technician must be diligent when making frequency measurements, and even more so when frequency alignment is required. For field-grade measurements/tests, it is acceptable to use test equipment with a maximum frequency error that is only five (5) times better the radio equipment being tested. However, when adjustments are needed, lab-grade test equipment with a maximum frequency error that is at least ten (10) times better than the radio is recommended.

NOTE

Transmitter Frequency Test and Alignment should be performed at least annually to ensure proper operation. Refer to Sections 7.6.6.1 and 7.6.6.2 respectively.

The Unity Portable is compliant with all applicable FCC narrowbanding mandates below 512 MHz. In certain applications, wideband operation is disabled via a software feature package (i.e., feature encryption).

Before making adjustments, it is advisable to check the timebase of RF communications test set or counter against another known good standard, or have the test equipment utilize an external high stability frequency standard stabilized by GPS satellite reception.

Maximum errors for the test channels are stated in Table 7-5. When testing, the errors stated for ±0.5 ppm will compensate for equipment errors as well as the temperature curve of the radio's reference oscillator. With lab-grade test equipment, errors in the ±0.25 ppm range are expected for room temperature. If frequency alignment is necessary, errors in the ±0.1 ppm range should be used for alignment. As a reminder, if alignment is necessary, use a calibrated ±0.05 ppm timebase and measurement resolution to the nearest Hz.

7.6.6.1 Transmitter Frequency Test

1. Setup the radio and test equipment per the bench setup procedure in Section 7.6.4 (page 43).
2. **Power-up the radio and allow at least a 15-minute warm-up period.**
3. Select an analog conventional test channel that does not have any signaling modulation, such as CTCSS (Channel Guard) or CDCSS (Digital Channel Guard).
4. Configure the RF communications test set to measure the transmit frequency. If a separate RF frequency counter is used, protect its input by using a 20 dB RF attenuator between the radio and counter. The attenuator should have a minimum 10-watt power rating.

Do **not** connect an attenuator directly to the radio's SMA connector. This could mechanically overstress this radio connector. Always use a high-quality flexible RF cable between the radio's SMA connector and the attenuator.

5. Key the radio by depressing its PTT button and verify it is transmitting per a lit red indicator on the top of the radio and/or a red transmit forward power icon ( ) near the top of the front display.
6. Cover the front and rear microphones with fingers and do not speak to ensure there is no modulation.
7. Measure and record the transmitter frequency. The transmit frequency should be within stated tolerance.

Table 7-5: Transmit Frequency Errors

TEST TX FREQUENCY (MHz)	MAXIMUM TRANSMIT FREQUENCY ERROR (Hz)	MINIMUM TX FREQUENCY (MHz)	MAXIMUM TX FREQUENCY (MHz)
±0.5 ppm Error Across the Temperature Range of -4 to +140° Fahrenheit (-20 to +60° Celsius)			
136.000	±68 Hz	135.999932	136.000068
174.000	±87 Hz	173.999913	174.000087
380.000	±190 Hz	379.999810	380.000190
520.000	±260 Hz	519.999740	520.000260
794.0125	±397 Hz	794.012103	794.012897
869.9875	±435 Hz	869.987065	869.987935
Generally Accepted ±0.25 ppm Error at Room Temperature 68 to 77° F (20 to 25°C)			
136.000	±34 Hz	135.999966	136.000034
174.000	±44 Hz	173.999956	174.000044
380.000	±95 Hz	379.999905	380.000095
520.000	±130 Hz	519.999870	520.000130
794.0125	±199 Hz	794.012301	794.012699
869.9875	±218 Hz	869.987282	869.987718
±0.1 ppm Error at Room Temperature 68 to 77° F (20 to 25°C)			

Table 7-5: Transmit Frequency Errors

TEST TX FREQUENCY (MHz)	MAXIMUM TRANSMIT FREQUENCY ERROR (Hz)	MINIMUM TX FREQUENCY (MHz)	MAXIMUM TX FREQUENCY (MHz)
136.000	±14 Hz	135.999986	136.000014
174.000	±17 Hz	173.999983	174.000017
380.000	±38 Hz	379.999962	380.000038
520.000	±52 Hz	519.999948	520.000052
794.0125	±79 Hz	794.012421	794.012579
869.9875	±87 Hz	869.987413	869.987587


CAUTION

When an antenna is connected to the radio, do **not** transmit on any test frequency unless authorized to do so.

8. Unkey the radio by releasing its PTT button.
9. Key the radio and observe the transmit frequency for changes or shifting during this step. Change the power supply voltage by approximately 0.5 volts DC above and below the 7.5-volt DC setting. Do this for several seconds. The transmit frequency should not change with either voltage change.
10. Unkey the radio.


NOTE

If the transmit frequency changes because of a power supply voltage shift, the radio should be returned to Harris for service. If the transmit frequency is out of tolerance, TCXO tuning is necessary, as described in the following section.

11. Return the power supply to 7.5 volts DC.
12. If no other test and/or alignments will be performed, disconnect all test equipment and remove the test personality/mission plan from the radio. The test personality/mission plan **must** be removed from the radio before it is returned to normal service; see Section 6.1.6 on page 26 for details.


CAUTION

Do **not** return the radio to service if any test frequency transmission exceeds the respective limits listed in Table 7-5.

7.6.6.2 Transmitter/TXCO Frequency Alignment

1. Setup the radio and test equipment per the bench setup procedure in Section 7.6.4 (page 43).
2. Setup the test equipment to accurately measure a 136 MHz radio transmission.
3. In the radio's UTILITY menu (abbreviated UTIL when not selected), select the TCXO TUNING function.
4. When prompted, use the radio's keypad to enter the password and then select OK. The password is the Maintenance Password defined in the personality/mission plan. After entering the correct password, the TCXO SETTING function appears. Record the number.

5. While observing the measured transmit frequency of the radio, press the ◄ (left) and ► (right) keys of the radio's 5-key navigation keypad to change the number until the frequency is within the limits specified in Table 7-5 for 136 MHz.
6. Save the value into radio memory by pressing the SAVE soft-key. Use the navigational keypad to select YES to apply and save the TCXO alignment change.
7. Retest to confirm the transmit frequency is within tolerance for the ±0.1 ppm portion of Table 7-5. Repeat the steps until satisfactory results are obtained. The steps on the TCXO tuning may not allow setting within the tight tolerance. If so, set the value in TCXO SETTING as close as possible to the programmed transmit frequency.

NOTE

If the transmit frequency cannot be aligned to within the applicable limits listed in Table 7-5, the radio should be returned to Harris for service.

8. If no additional test and alignments will be performed, disconnect all test equipment and remove the test personality/mission plan from the radio. The test personality/mission plan **must** be removed from the radio before it is returned to normal service; see Section 6.1.6 on page 26 for details.

7.6.6.3 Transmitter Power Levels Test

The XG-100P radio has multiple transmitter power levels. The radio user can toggle between two (2) user-selectable power levels via the radio's shortcut menu and 6 key. The shortcut menu is accessed by pressing the center button of the radio's 5-key navigation keypad. In the shortcut menu, the user-selected transmit power levels are labeled LOW and HIGH. The selected channel's present power level is indicated by an icon near the upper-left corner of the front panel display. Two small blue squares indicate high power level and one small blue square indicates low power level.

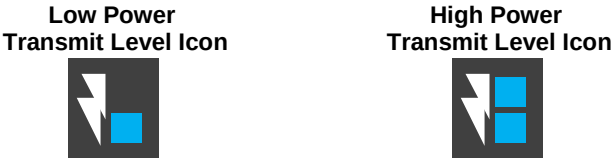


Figure 7-7: High and Low Transmit Power Level Icons

The actual values of the user-selected power levels are established within the RPM software. To access other power level values, it is necessary to reprogram the radio using the TX Power Levels button on RPM's System Setup dialog box (General tab). The values of power are correlated to calibrated points that may be outside of the band of normal frequencies. On some 700 MHz low-power channels, the radio automatically restricts itself to the low power level. See the FCC Part 90 rules for those channels/frequencies. Table 7-6 lists the expected power levels and parameters for channels at RF band extremes. It is advisable to look for catastrophic failure and not exact levels.

Follow this procedure to check the XG-100P radio's transmitter output power levels. These levels are factory-adjusted—they cannot be adjusted in the field:

1. Setup the radio and test equipment per the bench setup procedure in Section 7.6.4 (page 43).
2. Zero out (i.e., account for) all loss in utilized test cable(s), attenuator, adapter(s), etc. Refer to the RF communications test set's documentation and the equipment's RF loss data as necessary.
3. Select an analog conventional test channel.

4. Key the radio by depressing its PTT button and verify it is transmitting per a lit red indicator on the top of the radio and/or a red transmit forward power icon ( ) in the display.
5. Measure radio's RF power output and direct current input. The measured RF power output should be within limits stated in Table 7-6 for the selected frequency/channel and the selected power level, which should presently be low per Table 7-3. If not, check cable connections, etc., and re-test if necessary. Refer to Section 2.1 for current input demand.
6. Unkey the radio by releasing its PTT button.
7. Access the shortcut menu by pressing the center button of the radio's 5-key navigation keypad, then press the 6 key to toggle the transmit power level to high. Verify the high power icon displays.
8. Key the radio by depressing its PTT button and verify it is transmitting per a lit red indicator on the top of the radio and/or a red transmit forward power icon in the display.
9. Measure the radio's RF power output and direct current input. Current should not exceed 2.5 amps. The RF power level results should be within limits listed in Table 7-6 for the frequency and selected power level. If not within limits, check cable connections, etc., and re-test if necessary.
10. Repeat this process for all test frequencies and power levels.
11. If no additional tests are to be performed, disconnect all test equipment and remove the test personality/mission plan from the radio. The test personality/mission plan **must** be removed from the radio before it is returned to normal service; see Section 6.1.6 on page 26 for details.

Do not return the radio to service if any measured transmit power level exceeds the respective limits listed in Table 7-6.

Table 7-6: Transmitter Power Test—Maximum Errors

TEST TX FREQUENCY (MHz)	TX POWER LEVEL SETTING	TOLERANCE (dB)	LIMITS	
			MINIMUM TX POWER (Watts)	MAXIMUM TX POWER (Watts)
136.000	Low (1 Watt)	±0.5	0.89	1.12
	High (6.3 Watts)	-0.2/+0.5	6.00	7.08
174.000	Low (1 Watt)	±0.5	0.89	1.12
	High (6.3 Watts)	-0.2/+0.5	6.00	7.08
380.000	Low (1 Watt)	±0.5	0.89	1.12
	High (5.2 Watts)	-0.2/+0.5	5.00	5.89
520.000	Low (1 Watt)	±0.5	0.89	1.12
	High (5.2 Watts)	-0.2/+0.5	5.00	5.89
794.0125	Low (0.5 Watt)	±0.5	0.44	0.56
	High (2.6 Watts)	-0.2/+0.5	2.51	2.95
824.9875	Low (0.5 Watt)	±0.5	0.44	0.56
	High (3.2 Watts)	-0.2/+0.5	3.00	3.50
869.9875	Low (0.5 Watt)	±0.5	0.44	0.56
	High (3.2 Watts)	-0.2/+0.5	3.00	3.50

7.6.6.4 Preparation for Audio Test and UDC Sense Test

1. Setup the radio and test equipment per the bench setup procedure in Section 7.6.4 (page 43).
2. Turn the radio off.
3. Connect the radio's Universal Device Connector (UDC) to Audio Test Box TS-011826-001 (or MATQ-03424) using Audio Test Cable 12082-0435-A1. Audio connections to the radio are done via this test box and cable. The Audio Test Cable mates to the 15-pin D-subminiature connector on one end of the test box. Refer to Figure 7-8. Typically, to connect the box to the test set, a BNC male-to-BNC male coax cable is required.
4. Set the test box's DEVICE # switch to position 12. This position simulates no external device attached.
5. Power-up the radio. It should power-up normally.
6. Press and release the top side button of the radio to disable squelch. Noise should be heard in the radio's speaker and the volume control should vary the volume level of the noise. Press and release the top side button again and the noise should mute.
7. With the bench power supply at 7.5 volts, the radio's battery charge level icon should indicate with one (1) red bar. See the "very low battery" icon in Figure 7-2 on page 36.
8. Raise the bench power supply to approximately 8 volts. The battery charge level icon should indicate with all bars in blue, indicating a near full charge condition. See the "near full charge" icon in Figure 7-2 on page 36.

9. Observing the bench supply voltage and listening for tones from the radio, reduce the power supply voltage towards 6 volts. At approximately 6.3 volts, the radio will emit the low battery tone and show the exhausted battery icon in its display.
10. Return the bench power supply to 7.5 volts.
11. Configure the RF communications test set to measure the selected channel's transmit parameters.
12. Key the radio via its PTT button and speak into the front microphone. The test set should indicate the radio is transmitting and voice deviation is coming from the front microphone. Unkey the radio.
13. Operate the test box's PTT toggle switch by pushing it to either the PTT or the LOCK positions. The radio should not key. Return the switch to the center position.

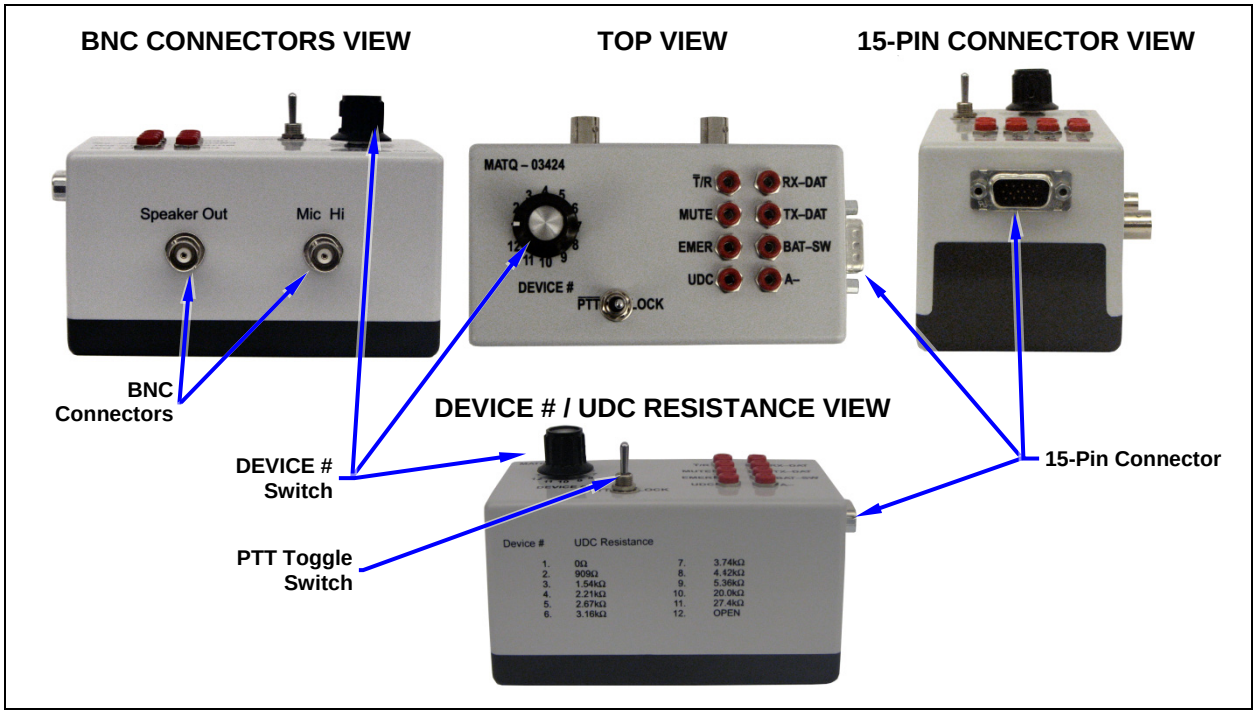


Figure 7-8: Audio Test Box TS-011826-001 (and MATQ-03424)

14. Set a digital multimeter to measure volts and then connect its negative lead to the test box's A- jack.
15. Connect the multimeter's positive lead to the test box's BAT-SW jack.
16. Verify the meter indicates zero volts DC.
17. Move the multimeter's positive lead to the test box's UDC jack.
18. Verify the meter indicates 3.0 ±0.1 volts DC.

NOTE

The test box's UDC jack is connected to the Cable Detect pin of the radio's UDC. The Cable Detect pin senses if an external accessory is connected. An open condition (test box's DEVICE # switch to position 12) is normal. The external sense resistor for standard audio accessories is 0 Ω, which is position 1 of the test box's DEVICE # switch. These two external resistance values are the only two applicable for performing XG-100P radio audio tests needed for procedures in this manual.

19. Rotate test box's DEVICE # switch to position 10. This simulates the encryption keyloader cable.

20. After a short time (about 3 seconds) the radio's display should change and indicate a key fill is in progress. The UDC voltage should be 2.00 ±0.1 volts DC.
21. Rotate test box's DEVICE # switch to position 1. The UDC voltage should be 0 volts DC.
22. Move the multimeter's positive lead to the test box's BAT-SW jack.
23. Verify the multimeter indicates 5.0 ±0.2 volts DC. This radio DC output can supply DC power to a UDC-connected accessory.
24. With the multimeter's positive lead, gently probe the center pin of the test box's Mic Hi BNC jack.
25. Verify the multimeter indicates 3.0 ±0.2 volts DC. This voltage is used to bias an external microphone.

NOTE

If this DC bias voltage affects the RF communications test set's audio function generator during TX audio tests, a series-connected 150 µF capacitor will need to be added in the Mic Hi circuit of the test box.

26. Key the radio using radio's PTT button and speak into the front microphone.
27. Verify the test set indicates the radio is transmitting and voice deviation is coming from the front microphone.
28. Unkey the radio.
29. Key the radio using the test box's PTT toggle switch by pushing the switch to either the PTT or the LOCK positions and then speak into the radio's front microphone.
30. Verify the test set indicates the radio is transmitting but without voice deviation. This indicates radio expects transmit/mic audio from an external source; this is tested in a later procedure.
31. Unkey the radio.

7.6.6.5 Transmitter Analog Modulation Tests

This test verifies the radio's analog transmit deviation does not exceed specifications at the test frequencies shown in Table 7-7. Deviation limits are different based upon channel bandwidth. The test personality/mission plan must be modified with new frequencies and bandwidth settings shown in the table. Use this test to check the radio's analog conventional modulation sensitivity, modulation distortion, modulation limiting, and modulation symmetry.

This test also verifies the external microphone audio path of the radio's UDC. To test the internal microphone audio, a sound pressure test box is required, which is beyond the scope of this manual. In most cases, a quality comparison test with other radios is sufficient for verifying proper operation of the radio's internal microphone.

Table 7-7: Transmit 60% System Deviations and Maximum Deviations

TEST TX FREQUENCY (MHz)	CHANNEL BANDWIDTH	60% SYSTEM DEVIATION (± kHz Peak)	MAXIMUM DEVIATION (± kHz Peak)
136.025	Wide (25 kHz)	3.0 ±0.1	4.4 ±0.4
	Narrow (12.5 kHz)	1.5 ±0.1	2.2 ±0.2
173.975	Wide (25 kHz)	3.0 ±0.1	4.4 ±0.4
	Narrow (12.5 kHz)	1.5 ±0.1	2.2 ±0.2
380.025	Wide (25 kHz)	3.0 ±0.1	4.4 ±0.4
	Narrow (12.5 kHz)	1.5 ±0.1	2.2 ±0.2
519.975	Wide (25 kHz)	3.0 ±0.1	4.4 ±0.4
	Narrow (12.5 kHz)	1.5 ±0.1	2.2 ±0.2
794.0125	Narrow (12.5 kHz)	1.5 ±0.1	2.2 ±0.2
815.0125	Wide (25 kHz)	3.0 ±0.1	4.4 ±0.4
	NPSPAC	2.4 ±0.1	3.55 ±0.35
860.0125	Wide (25 kHz)	1.5 ±0.1	4.4 ±0.4
	NPSPAC	2.4 ±0.1	3.55 ±0.35


NOTE

Programming each channel for a low transmit power level is recommended. If not, use the shortcut menu to set the power level to low before keying the radio during the test.

1. Complete the Preparation for Audio Test and UDC Sense Test in Section 7.6.6.4.
2. Turn the radio off and leave the audio test cable and box connected.
3. Set the test box's DEVICE # switch to position 1.
4. Power-up the radio and select an analog conventional test channel with the desired bandwidth, per Table 7-7. This channel must not have any signaling modulation such as CTCSS (Channel Guard) or CDCSS (Digital Channel Guard).
5. Configure the RF communications test set to provide a 1 kHz tone to the Mic Hi input (BNC connector) of the test box at a level of 10 mV rms.
6. Configure the test set for an on-frequency FM deviation measurement.
7. Key the radio with the test box's PTT toggle switch. The test set should indicate that the radio is transmitting and it is being modulated by the 1 kHz tone.
8. Adjust the level of the 1 kHz tone to produce the 60% deviation level for the channel. See Table 7-7. The tone level at the Mic Hi jack should be between 5 and 15 mV rms.
9. Using the test set's oscilloscope, observe the demodulated audio. It should be a clean sine wave free of observable noise and/or any distortion.
10. Measure the distortion. It should be less than 1.25%. Measuring distortion on other test channels/frequencies is not necessary.

11. Increase the 1 kHz tone by 20 dB (i.e., increase the test set's audio output voltage level by 10 times).
12. Verify the measured deviation is within the respective Maximum Deviation limits listed in Table 7-7. For example, for the 136.025 MHz wide band test channel, the deviation should be between 4.0 and 4.8 kHz.
13. Verify the demodulated audio waveform at the test set is a clean sine wave with no signs of limiting.
14. Using the test set's audio deviation meter, compare the positive peak deviation to negative peak deviation. The difference should not exceed 100 Hz.
15. Unkey the radio by returning the test box's PTT toggle switch to the center position.
16. Repeat this test for all test frequencies.
17. Disconnect the audio test cable from the radio's UDC.
18. Wait approximately five (5) seconds.
19. Key the radio by depressing its PTT button and speak into the front panel microphone in a normal voice level.
20. Using the test set's oscilloscope, verify demodulated speech audio is present.
21. If no additional tests are to be performed, disconnect all test equipment and remove the test personality/mission plan from the radio. The test personality/mission plan must be removed from the radio before it is returned to normal service; see Section 6.1.6 on page 26 for details.

Do **not** return the radio to service if any measured parameter exceeds the respective limits.

7.6.6.6 Transmitter CTCSS/CDCSS Modulation and Composite Deviation Test

Follow this test procedure to verify Continuous Tone-Coded Squelch System (Channel Guard) and Continuous Digital-Coded Squelch System (Digital Channel Guard) encode operation. Parameters tested include deviation of each type of system for each channel bandwidth, the frequency of CTCSS tone generated by the radio, the accuracy of the generated CDCSS code, and the composite deviation with voice test tone applied. It is assumed the technician has knowledge of CTCSS tone frequencies and CDCSS codes. Table 7-8 gives the limits for the tests.

Table 7-8: Transmit CTCSS/CDCSS and Composite Deviations

CHANNEL BANDWIDTH	CTCSS/CDCSS DEVIATION ± kHz Peak	COMPOSITE DEVIATION (± kHz Peak)
Wide (25 kHz) 150 MHz, 450 MHz, 800 MHz	0.5 – 1.0	4.0 - 4.8
Narrow (12.5 kHz) 150 MHz, 450 MHz, 700 MHz	0.35 – 0.5	2.0 -2.4
NPSPAC (25 kHz) 800 MHz	0.4 – 0.8	3.2 – 3.9

1. Complete the Transmitter Analog Modulation Tests procedure in Section 7.6.6.5.
2. Re-connect the audio test cable and test box to the radio's UDC.
3. Set the test box's DEVICE # switch to position 1.

4. Select any analog conventional test channel with CTCSS or CDCSS enabled.
5. Configure the RF communications test set to measure the expected CTCSS/CDCSSS tone/code.
6. Remove any audio signal injected into the test box.
7. Key the radio with the test box's PTT toggle switch.
8. Using the test set, measure the deviation and demodulated CTCSS tone frequency or CDCSS code. The deviation should be within the limits stated for CTCSS/CDCSS deviation in Table 7-8. Also, the tone/code should be the tone/code programmed into the radio for this test channel. For CTCSS, the measured tone frequency should be within ±0.25 Hz of the programmed CTCSS tone frequency.
9. Unkey the radio by returning the test box's PTT toggle switch to its center position.
10. Return the test audio connection to the test box and set the 1 kHz audio signal level to approximately 80 mV rms.
11. Key the radio with the test box's PTT toggle switch.
12. Using the test set, measure the deviation and demodulated CTCSS tone frequency or CDCSS code. The deviation should be within the limits stated for composite deviation in Table 7-8. Also, the tone/code should be the tone/code programmed into the radio for this test channel.
13. Unkey the radio
14. Repeat tests with different CTCSS tones, different CDCSS codes, and different channel bandwidths.
15. If no additional tests are to be performed, disconnect all test equipment and remove the test personality/mission plan from the radio. The test personality/mission plan **must** be removed from the radio before it is returned to normal service; see Section 6.1.6 on page 26 for details.

7.6.6.7 Transmitter P25 (C4FM) Modulation Pattern Test

Follow this test procedure to check the transmitter's P25 (C4FM) modulation pattern:

1. Setup the radio and test equipment per the bench setup procedure in Section 7.6.4 (page 43).
2. Select a P25 conventional test channel listed in Table 7-4. Make a mission plan and/or zone change as necessary.
3. Configure the test set for an on-frequency peak positive FM deviation measurement.
4. Configure the test set deviation meter's audio bandwidth response with a high-pass frequency at $\leq$ 15 Hz and low-pass frequency at $\geq$ 3 kHz.
5. Disable the meter's de-emphasis function.
6. In the radio's UTILITY menu (abbreviated UTIL when not selected), select TESTS. If this selection is not available (i.e., if it is dimmed-out), the currently selected channel is not programmed for P25 (C4FM) operations.
7. When prompted, use the radio's keypad to enter the password and then select OK by pressing the center/enter key of the 5-way navigational keypad. The password is the Maintenance Password defined in the personality/mission plan.
8. Select PATTERN TEST, then TX PATTERN, via the navigational keypad's center/enter key.
9. Verify the radio's antenna port is properly terminated (i.e., connected to the test set's T/R port).
10. In the pop-up menu, scroll down and select C4FM HIGH PAT. Upon selection, the radio immediately begins transmitting, as indicated by the lit red indicator on the top of the radio and a red transmit forward power icon ( ) in the display.

11. Verify the deviation measured by the test set is between 2545 Hz and 3111 Hz.
12. With STOP TEST selected, press the center/enter key of the 5-way navigational keypad to stop the radio transmission. The radio stops transmitting.
13. Select TX PATTERN again.
14. In the pop-up menu, scroll down and select C4FM LOW PAT. Upon selection, the radio immediately begins transmitting, as indicated by the lit red indicator on the top of the radio and a red transmit forward power icon ( ) in the display.
15. Verify the deviation measured by the test set is between 849 Hz and 1037 Hz.
16. With STOP TEST selected, press the center/enter key of the 5-way navigational keypad to stop the radio transmission. The radio stops transmitting.
17. Return the radio to Harris for service if it does not pass this test procedure.

7.6.7 Receiver Performance Tests

Unless otherwise stated, all receiver performance test procedures presented in this section should be performed in the order presented.

7.6.7.1 Receiver Setup and Internal Speaker Quick Test

This test procedure sets up the radio and test equipment for radio receiver testing. It also verifies the radio's speaker will pass a basic quality test by comparing speaker audio to the expected sounds. True sound tests, which are beyond the scope of this manual, must be done with a sound pressure test box and meters per respective test standards.

1. Setup the radio and test equipment per the bench setup procedure in Section 7.6.4 (page 43).
2. Turn the radio off.
3. Connect the radio's Universal Device Connector (UDC) to Audio Test Box TS-011826-001 (or MATQ-03424) using Audio Test Cable 12082-0435-A1. Audio connections to the radio are done via this test box and cable.
4. Set the test box's DEVICE # switch to position 12. This position simulates no external device attached.
5. Connect the test box's Speaker Out BNC connector to the test set's audio input used for making receive audio (SINAD) measurements.

NOTE

The test box contains a speaker load and a 1:1 audio transformer to couple the differential speaker output at the radio's UDC connector to the test box's unbalanced Speaker Out BNC connector. The test box's Speaker Out output must only be connected to a high-impedance load (of any test equipment). Loading this output with a speaker could damage the test box.

CAUTION

Keying the radio during receiver testing should not damage the RF communications test set if the test set's T/R port is being utilized. If a separate RF signal generator or if the duplex output/signal generator output port of the test set is used, then damage to the test set could occur.

If using a separate RF signal generator, it is advisable to use an external 20 or 30 dB attenuator between the radio's antenna port and the RF generator's output port to prevent damage to the generator if the radio is accidentally keyed. If an external attenuator is used, all RF signal level measurements must be adjusted accordingly when making RF signal level measurements.

6. Power-up the radio and allow at least a 5-minute warm-up period.
7. Select any analog conventional test channel listed in Table 7-3. Make a mission plan and/or zone change as necessary.
8. Set the RF communications test set on frequency with an RF output level of -47 dBm (1000 µV). This is considered a full-quieting RF signal.
9. Modulate the RF output with a 1 kHz tone with a 60% rated system deviation. See Table 7-7 for values for each bandwidth. This is considered a full-quieting RF signal.
10. Verify the radio is receiving the full-quieting RF signal by rotating the volume control for a comfortable level. There should not be any noise or distortion in the speaker audio. If speaker audio is not present, recheck connections and/or radio and test equipment configurations.
11. While observing the power supply's current meter and listening to the radio's speaker audio, rotate the volume control to maximum for a short time and then return it to a comfortable level of about five (5) volume bars on the display. When at maximum volume, the power supply current should have peaked between 0.5 and 0.9 amps. Also, the level of the speaker audio should have been loud and somewhat distorted sounding.
12. At the comfortable volume level, listen to the speaker while slowly increasing and decreasing the test set's test tone frequency between approximately 300 and 4.2 kHz. Using 100 Hz incremental steps is adequate. The speaker audio should be clear without speaker rattle. The level of audio will seem loudest between approximately 400 and 500 Hz and it will taper off rapidly below 300 Hz and above 3.6 kHz. Setting the volume control too high will cause significant distortion between 400 and 500 Hz; this is normal. Passing this step verifies the speaker is in good order, with receive audio response as expected.
13. Return the radio to Harris for service if it does not pass this test procedure. Otherwise, return the test tone to 1000 Hz and continue with the test in the next section.

7.6.7.2 Receiver Audio Output Level and Distortion Test

Receiver audio output and distortion levels should always be verified as being good **before** performing receiver 12 dB SINAD sensitivity or other related receiver tests. This ensures the radio's audio circuits have sufficient output capability and minimal distortion. The receiver audio amplifier of the XG-100P radio is specified for 1.2 watts into an external speaker, while the internal audio is specified at 0.5 watts. The volume control of the radio is stepped. Being able to step to an exact output level is impractical, so some settings are approximations.

1. Complete the Receiver Setup and Internal Speaker Quick Test presented in 7.6.7.1.

2. Set the test box's DEVICE # switch to position 1. After a few seconds, the radio will assume a standard audio accessory, such as a speaker-microphone, is connected to its UDC and the radio will begin routing receive speaker audio to the test box instead of to its internal speaker.
3. Set the radio's volume control so the highest three (3) volume bars in the display are not filled, and all other volume bars are filled.
4. Verify power supply current is approximately 0.6 amps. If not, there may be a problem in the radio's audio amplifier circuits or the test box is not correctly connected to the RF communications test set.
5. Observe the receiver audio level and distortion level measured at the RF communications test set. Typical distortion is less than 1.1%. The level should be above 3.1 Vrms (8.8 Vp-p). If distortion is higher, reduce the volume control to produce a level where the audio distortion is less than 1.1 % but the level is still above 3.1 Vrms (8.8 Vp-p).
6. Reduce the volume control for a 2.0 Vrms (5.66 Vp-p) reading at the test set. This is 0.5 Watt into the test box's 8-ohm speaker load. Verify power supply current is between 0.28 and 0.4 amps.
14. Using the test set's audio analyzer, measure the distortion level of the 1 kHz tone from the radio. It should be less than 1.1%. Failure indicates a receiver audio quality problem.
15. Return the radio to Harris for service if it does not pass this test. Otherwise, continue with the test in the next section.

7.6.7.3 Receiver 12 dB SINAD Sensitivity and Displacement Bandwidth Tests

Use this test procedure to determine the XG-100P radio receiver's 12 dB SINAD sensitivity level. SINAD can be measured using a constant-output method (vary the RF level to produce the SINAD test level) or constant-input method (maintain the specified RF level and the SINAD test level is measured). The method used in this test procedure is the constant-output method so the required level for the displacement bandwidth test can be obtained in a single process.

1. Complete the Receiver Audio Output Level and Distortion Test presented in Section 7.6.7.2. The radio must pass a receive audio distortion test before testing receiver SINAD.
2. Set the RF communications test set to measure receiver SINAD.
3. Disable the radio's squelch function by pressing the top user-programmable (yellow) button on the side of the radio. Squelch enable/disable is the default function for this button when the radio is operating in analog conventional mode.
4. Reduce the test set's RF generator RF output level to produce 12 dB SINAD (10 to 14 dB is acceptable). The RF level must be less than the 12 dBm sensitivity specification listed in Section 2.2.3 for the respective test channel's RF band.
5. Record this RF level as the radio's 12 dB SINAD sensitivity level: _____.
6. Increase the signal generator's RF output level by 6 dBm from the measured 12 dB SINAD sensitivity level. This is the same as multiplying the RF output voltage of the signal generator by two. For example, if the measured 12 dB SINAD level was -123 dBm (0.16 µV), increase the RF output level to -117 dBm (0.32 µV).
7. Verify the test set's SINAD meter is reading higher than 12 dB and noise on the signal received by the radio is less.
8. Slowly <u>decrease</u> the generator's RF output <u>frequency</u> below the test frequency until the SINAD meter drops back to a 12 dB indication. Record this frequency as F_{LOW}: _____

9. Return the RF frequency to the test frequency and then slowly increase the generator's RF output frequency above the test frequency until the SINAD meter again drops back to a 12 dB indication. Record this frequency as F_{HIGH}: _____

10. Calculate the frequency differences by the following:

    a. F_{DIFF1} _____ = F_{HIGH} – test frequency

    b. F_{DIFF2} _____ = test frequency - F_{LOW}

11. The smaller of F_{DIFF1} or F_{DIFF2} is the signal displacement bandwidth of the receiver. It should meet the receiver specifications. This value must be greater than 40% of the rated system deviation: >2 kHz for 5 kHz (25 kHz wideband channel) and >1 kHz for 2.5 kHz (12.5 kHz narrowband channel). If the receiver fails the signal displacement bandwidth test, the radio should be returned to Harris for service.


NOTE

Generally the signal displacement bandwidth should be less than the system deviation, or 5 kHz and 2.5 kHz respectively. While not a specification, it gives reasonable expectation that the receiver will pass its adjacent channel selectivity specification.

12. Return the test set's RF generator frequency to the on-channel test frequency.

13. Repeat the SINAD sensitivity level test on other test frequencies in each radio RF band.

14. Repeat the displacement bandwidth test on a narrow bandwidth channel. It is not necessary to repeat the displacement bandwidth test in other RF bands.

15. Return the radio to Harris for service if it does not pass tests in this procedure. Otherwise, continue with the test presented in the following section.

7.6.7.4 Receiver Noise Squelch Test

Follow this test procedure to check the receiver's noise squelch operation:

1. Select any analog conventional test channel listed in Table 7-3. Make a mission plan and/or zone change as necessary.

2. On this channel, complete a 12 dB SINAD sensitivity test as described in Section 7.6.7.3. Leave the radio and all test equipment interconnected and configured per that procedure.

3. Turn the RF communications test set's RF output level off, or set it as low as possible.

4. Set the test set's RF signal generator on frequency.

5. Set the radio's volume control to a mid-range position.

6. If the radio is not squelched, enable squelch by pressing the top user-programmable (yellow) button on the side of the radio once. Squelch enable/disable is the default function for this button when the radio is operating in analog conventional mode.

7. Verify the radio is squelched (i.e., receiver audio muted).

8. Slowly increase the generator's RF output level to determine the SINAD level at squelch opening (i.e., the SINAD level when receiver audio unmutes). The TX/RX indicator on the top of the radio should light green when the receiver unsquelches. Be sure to observe the measured value at the SINAD meter, not the test set generator's RF output level. Radio volume control adjustments may also be necessary. The SINAD level should be approximately 6 dB SINAD or below 10 dB SINAD. This measurement is very erratic and often interpreted by the tester.

9. Increase the generator's RF output level at least another 6 dB (i.e., double the RF output voltage).

10. While observing the test set's SINAD meter, slowly decrease the RF output level to determine the SINAD level at squelch closing (i.e., the SINAD level when receiver audio mutes). Again, be sure to observe the measured value at the SINAD meter, not the test set generator's RF output level. The TX/RX indicator on the top of the radio should turn off when the receiver squelches. The SINAD level will be unstable, but in the area of 3 dB SINAD when the receiver squelches. This indicates less of an RF signal is required to squelch the receiver than to unsquelch it.
11. Verify the difference between the measured squelch opening and squelch closing SINAD levels is between 1 and 3 dB. This is the squelch hysteresis. It may be necessary to vary the generator's RF output level up and down several times around these squelch threshold points to verify measurements.
12. Return the radio to Harris for service if its receiver fails the noise squelch test. Otherwise, continue with the test in the next section.
13. If no additional tests are to be performed, disconnect all test equipment and remove the test personality/mission plan from the radio. The test personality/mission plan **must** be removed from the radio before it is returned to normal service; see Section 6.1.6 on page 26 for details.

7.6.7.5 Receiver CTCSS/CDCSS Decode Tests

Follow this test procedure to verify Continuous Tone-Coded Squelch System (Channel Guard) and Continuous Digital-Coded Squelch System (Digital Channel Guard) decode operations:

1. Complete the Receiver Noise Squelch Test presented in Section 7.6.7.4.
2. At the radio, select an analog conventional test channel that has CTCSS or CDCSS pre-programmed.
3. Press the CH INFO button and observe/verify the RX CG mode (CTCSS or CDCSS) and the particular RX TONE (for CTCSS) or RX CODE (for CDCSS).

NOTE

In lieu of a test channel pre-programmed with a particular CTCSS/CDCSS tone/code, the radio's edit channel option can be used to edit an existing test conventional channel by enabling CTCSS/CDCSS, and setting the tone/code as required. This is accomplished via the EDIT CHAN soft-key and the Maintenance Password set for the current personality/mission plan.

4. Set the RF communications test set as follows:
   a. RF signal generator frequency to the test frequency;
   b. RF signal generator RF output level at the previously measured 12 dB SINAD sensitivity level;
   c. 1 kHz test tone at 60% system deviation (see Table 7-7 as required);
   d. CTCSS/CDCSS tone/code to the same tone/code as the radio's test channel; and,
   e. CTCSS/CDCSS tone/code deviation to 0.5 kHz for a wideband channel, 0.35 kHz for narrowband channel, or 0.4 kHz for a NPSPAC channel.
5. Verify the 1 kHz tone is sounding from the radio's speaker.
6. Change the test set's function generator away from the tested CTCSS/CDCSS tone/code. Receiver audio should mute and the TX/RX indicator on the top of the radio should extinguish.
7. Repeat this test for other CTCSS tones, other CDCSS codes, and other channel bandwidths. Specific CTCSS tones and CDCSS codes are listed in the RPM programming software's help screens.
8. Return the radio to Harris for service if the radio fails a tested CTCSS tone or CDCSS code.

9. If no additional tests are to be performed, disconnect all test equipment and remove the test personality/mission plan from the radio. The test personality/mission plan **must** be removed from the radio before it is returned to normal service; see Section 6.1.6 on page 26 for details.

7.6.7.6 Receiver P25 (C4FM BER) Sensitivity Test

Follow this test procedure to check the radio's P25 receiver sensitivity:

1. Setup the radio and test equipment per the bench setup procedure in Section 7.6.4 (page 43).
2. Select a P25 conventional test channel listed in Table 7-4. Make a mission plan and/or zone change as necessary.
3. In the radio's UTILITY menu (abbreviated UTIL when not selected), select TESTS. If this selection is not available (i.e., if it is dimmed-out), the currently selected channel is not programmed for P25 (C4FM) operations.
4. When prompted, use the radio's keypad to enter the password and then select OK by pressing the center/enter key of the 5-way navigational keypad. The password is the Maintenance Password defined in the personality/mission plan.
5. Select IBER TEST, then MODULATION, via the navigational keypad's center/enter key.
6. In the pop-up menu, select START C4FM FAST.
7. Set the test set's RF output level to the 5% BER sensitivity level specified in Section 2.2.3 for the respective test channel's RF band.
8. Modulate the test set with a standard 1011 P25 (C4FM) test pattern/tone.
9. Verify a 1 kHz tone is sounding from the radio's speaker per the received 1011 test pattern/tone. If not, check volume control setting, RF cable connections, test set RF output frequency, test set modulation pattern, etc.
10. Verify the displayed BER is less than 5.1%. If "> 0.000%" displays, the radio is not receiving any C4FM signal and/or it has not locked onto the received signal; in this case, check RF cable connections, test set RF output frequency, test set modulation pattern, etc.
11. To end this test, select STOP BER TEST by pressing the center/enter key, or by simply pressing the CANCEL soft-key.
12. Return the radio to Harris for service if its receiver fails this sensitivity test.

7.6.8 Test Closure

Completing the previous series of tests should give confidence that the radio can at least communicate to another radio in conventional non-trunking mode and meet minimum acceptable specifications. To complete a full battery of tests would require adherence to the Telecommunication Industry Association standards and procedures. These are beyond the scope of normal field testing for maintenance.

To further test the radio, it can be programmed with specific frequencies and/or for operation on a radio system of concern. Next, radio operation can be verified using one or more channels/groups assigned for radio communications testing within the radio system. Keep in mind that one can interfere with the operation of a communication system, and that same system could interfere with measurements.


NOTE

The test personality/mission plan **must** be removed from the radio before it is returned to normal service; see Section 6.1.6 on page 26 for details.

7.7 TROUBLESHOOTING

7.7.1 Using the Built-In Self Test

The radio has a built-in self-test that automatically tests several important radio functions. Tested functions include Bluetooth, Audio, GPS, Battery, and USB. To run the self-test:

1. If not already attached, attach an antenna and a battery to the radio and power it up.
2. From the radio's main menu, go in to the UTILITY menu (abbreviated UTIL when not selected).
3. Select SELF TEST. The radio begins the test. During the audio portion of the test, several volume-controlled tones of varying frequencies sound from the speaker. After several seconds, test results are displayed.
4. If any test failed, a failure prompt will appear. In this case, press the center/enter key of the 5-way navigational keypad to list test results.
5. Press the ▼ (down) or ▲ (up) keys to scroll through the list of test results.
6. For a failed test, additional information can be obtained by selecting it in the list and pressing either the center/enter key or the INFO soft-key.

If any test fails, contact the Technical Assistance Center for additional information. TAC contact information is included on page 17.

7.7.2 Displayed Error Messages

Table 7-9 lists error messages that may be displayed by the radio, the reason, and solution.

Table 7-9: Displayed Error Messages, Reasons, and Resolutions

SCREEN/ MENU	DISPLAYED ERROR MESSAGE	REASON	RESOLUTION
Top-Level Screen	**OTAR REKEY FAILED**	Self-explanatory.	Attempt OTAR operation again.
	OTAR ZEROIZE FAILED	Self-explanatory.	Attempt OTAR operation again.
	INVALID OTAR KEYSETS	OTAR configuration failed because keysets were improperly configured.	Zeroize keys and reload UKEK, then retry OTAR operation. See Section 6.4 which begins on page 29 for additional information.
	INVALID KEYSTORE ZEROIZE NEEDED	Corrupt key database.	Zeroize database.
	SYNTH OUT OF LOCK	DSP synthesizer out of lock.	Channel will reselect automatically to attempt to obtain synth lock.
	SYNTH OUT OF LOCK POWER CYCLE RADIO	DSP synthesizer out of lock. Unable to restore by reselecting channel.	Unable to obtain synthesizer lock. Power cycle and contact Harris if problem persists.
Bluetooth Pairing Screen	**PAIRING FAILED**	Bluetooth pairing failed.	Ensure device is discoverable and attempt to re-pair the device.
	PIN CODE MUST HAVE AT LEAST 4 DIGITS	Entered PIN was too short.	Enter at least four digits.

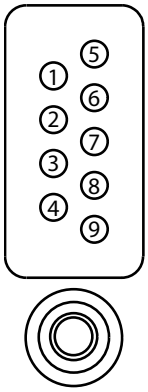
Table 7-9: Displayed Error Messages, Reasons, and Resolutions

SCREEN/ MENU	DISPLAYED ERROR MESSAGE	REASON	RESOLUTION
Channel Edit Screen	**EDIT FAILED**	Unable to modify P25 Channel.	Power cycle and try again--contact Harris if problem persists.
	INVALID RX FREQUENCY	Entered Rx frequency is invalid.	Ensure frequency follows band spacing rules.
	INVALID TX FREQUENCY	Entered Tx frequency is invalid.	Ensure frequency follows band spacing rules.
Mission Plan List Screen	**EMERGENCY ACTIVE FILL DISABLED**	Cannot activate mission plans in emergency mode.	Disable emergency mode to activate a new mission plan.
Install Operations	**INSTALL NOT ALLOWED**	Error during install process.	Transfer file again and reattempt install. Contact Harris if problem persists.
	EXTRACTION FAILED	Extraction of compressed file failed.	Transfer file again and reattempt install. Contact Harris if problem persists.
	REMOVE FAILED	Removal of existing SW failed.	Attempt install again and contact Harris if problem persists.
Mission Plan In Progress Screen	**PLAN FAILED**	Mission plan activation failed.	Use RPM to ensure plan validity. Contact Harris if failures persist.
Security Menu	**ZEROIZE FAILED**	DSP could not zeroize.	DSP problem—power cycle and contact Harris if problem persists.
	NO KEYS TO ZEROIZE	Key database empty.	Nothing to zeroize.
Utilities Menu	**INCORRECT PASSWORD**	Maintenance password invalid.	Enter valid maintenance password.
Channel Info Screen	**INCORRECT PASSWORD**	Channel edit password invalid.	Enter valid channel edit password.

7.8 UNIVERSAL DEVICE CONNECTOR (UDC) PIN-OUT

As illustrated in Figure 3-2 on page 15, the radio's UDC is located on the side of the radio, below the antenna and red emergency button. It is the connection point for optional accessories such as speaker-microphones. It also provides connections for USB-linked programming equipment, and key loaders. The UDC's pin-out is illustrated in the following table:

Table 7-10: UDC Pin-Out

UDC DIAGRAM	PIN	NAME	INPUT/ OUTPUT	NOTES
	2	ACC_SPKR_M	Output	Differential volume-controlled speaker audio output for driving a speaker in an external accessory such as a speaker-mic or headset. 1-watt output (typical) at full volume into an 8-ohm load.
	7	ACC_SPKR_P		
	3	ACC_CBL_DETECT	Input	Accessory connection sense input. A resistor in the external accessory completes a voltage-divider circuit, allowing the radio to determine what type of accessory is connected to the UDC.
	4	ACC_PWR	Output or Input	Low-power output and sense input of USB interface. 5.25 volts, 50 milliamps maximum.
	8	ACC_MIC_USBM	Bidirectional (during programming) or Inputs (when accessory connected)	When an accessory with a microphone is connected, pin 6 is the PTT input from the accessory (external accessory grounds this to key the radio), and pin 8 is the mic audio input from the accessory. When a programming cable is connected, pins 4, 5, 6 and 8 are the USB interface link.
	6	ACC_PTT_USBP		
	9	ACC_RXD	Input	Receive data input for TTL-level diagnostic serial port. For factory use only.
	1	ACC_TXD	Output	Receive data input for TTL-level diagnostic serial port. For factory use only.
	5	(Ground)	—	Ground/Reference.

NOTE

When the UDC is not in use, install its cover (part number 12082-1398-01) over it. Tighten the cover's screw securely to ensure the cover fully seals to the connector, but do not overtighten. The cover is included with the radio when the radio ships from the factory.

(This Page Intentionally Blank)