HARRIS
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Installation Manual
14221-1510-4440
Rev. B, Mar/14

XG-25M Mobile Radios

50-Watt VHF, 136 to 174 MHz
14015-0010-01

50-Watt UHF, 378 to 470 MHz
14015-0030-01

35-Watt Dual-Band, 700/800 MHz
14015-0020-01

Includes Remote-Mount and Front-Mount Applications

MANUAL REVISION HISTORY

REV.	DATE	REASON FOR CHANGE
–	May/13	Original release.
A	Oct/13	Added CH-25 Remote-Control Conversion Kit and the respective remote-mount vehicle installation instructions. Revised Radio Programming section and information on Front Panel Programming Cable.
B	Mar/14	Added 378 - 470 MHz UHF radio and UHF antennas. Updated Optional Cables section.

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Harris Corporation
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ACKNOWLEDGEMENT

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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.

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1 SAFETY SYMBOL CONVENTIONS

The following conventions are used in this manual to alert the user to general safety precautions that must be observed during all phases of operation, installation, 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 Corporation 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.

2 SPECIFICATIONS[1]

2.1 GENERAL

Dimensions (Height x Width x Depth)

Front-Mount Radio with CH-25:	2.8 x 7.24 x 7.9 inches (7.1 x 18.4 x 20 centimeters) (Includes knobs but not space required for mounting bracket and cables at rear of radio)
Remote-Mount Radio:	2.8 x 7.24 x 7.2 inches (7.1 x 18.4 x 18.3 centimeters) (Does not include space required for mounting bracket and cables at rear of radio)
CH-25 Control Head and Cable: (Head with Remote Control Interface and Cable)	2.8 x 7.24 x 2.8 inches (7.1 x 18.4 x 7.1 centimeters) (Does not include space required for mounting bracket and cables at rear of head)

Weight:

Front-Mount Radio with CH-25:	5.91 pounds (2.68 kilograms); does not include bracket
Remote-Mount Radio:	3.70 pounds (1.68 kilograms); does not include bracket
CH-25 Control Head and Cable:	3.62 pounds (1.64 kilograms); includes remote control cable; does not include bracket

Operating Ambient Temperature Range:	-22 to +140° Fahrenheit (-30 to +60° Celsius)
Storage Temperature Range:	-40 to +176° Fahrenheit (-40 to +80° Celsius)

Altitude

Operating:	15,000 feet (4572 meters) maximum
Transport/Storage:	50,000 feet (15240 meters) maximum

DC Supply Voltage Operating Ranges

For Full Performance:	+13.6 Vdc ±10% (Normal range per TIA-603)
Overall Operating Range:	+13.6 Vdc ±20%

Power Transients/Surge:	Per ISO7637-2

DC Supply Current Requirements

Receive

With Speaker Muted:	1.4 amps maximum
With 15-Watt Ext. Spkr. Output Power:	4.0 amps maximum

Transmit

VHF Radio at 50 Watts:	15 amps maximum, 11 amps typical
UHF Radio at 50 Watts:	15 amps maximum, 13 amps typical
700/800 MHz Radio at 35 Watts:	15 amps maximum, 12 amps typical

Quiescent/Off Current:	2 milliamps maximum
Environmental:	Meets or exceeds MIL-STD-810G Standard[2]; IEC 60529 Standard (IP54); U.S. Forest Service Vibration (10 to 60 Hz) USDA LMR Standard, Section 2.15; TIA-603-C Shock Standard (1-meter drop) Paragraph 3.3.5.3

[1] These specifications are primarily intended for the use of the installation technician. See the appropriate Specifications Sheet for the complete specifications.

[2] Also meets or exceeds equivalent superseded MIL-STD-810D, -E and -F.

2.2 TRANSCEIVER

Frequency Ranges

VHF Radio:	136 to 174 MHz (transmit and receive)
UHF Radio:	378 to 470 MHz (transmit and receive)
700/800 MHz Radio	
700 MHz Band Receive:	764 to 776 MHz
700 MHz Band Transmit:	764 to 776 MHz and 794 to 806 MHz
800 MHz Band Receive:	851 to 870 MHz
800 MHz Band Transmit:	806 to 825 MHz and 851 to 870 MHz

Transmit Power

VHF Radio:	10 to 50 watts (programmable range)
UHF Radio:	5 to 50 watts (programmable range)
700/800 MHz Radio, 700 MHz Band	0.3 to 35 watts (programmable range); see NOTE below.
700/800 MHz Radio, 800 MHz Band	1 to 35 watts (programmable range)

NOTE

The 700/800 MHz XG-25M radio is aligned for a maximum transmit power of 35 watts across the entire 700/800 MHz frequency band. However, FCC licensed systems, verify the radio's 700 MHz channels are limited to 30 Watts or per license requirements via the radio's personality programming.

NOTE

The UHF XG-25M radio is aligned for a maximum transmit power of 50 watts across its entire 378 - 470 MHz operating band. However, for equipment operating in accordance with FCC 47CFR80 rules (i.e., Maritime Services), it is the responsibility of the licensee to ensure the radio is installed and aligned per license requirements.

Antenna Port Impedance:	50 ohms
Channel Spacing:	12.5 kHz or 25 kHz (mode dependent)[3]
Voice and Data Communications Modes:	Half-Duplex
Frequency Stability:	
VHF Radio:	±2 ppm
UHF and 700/800 MHz Radios:	±1.5 ppm
Receiver Sensitivity	
VHF and UHF Radios	
Analog Mode:	better than -119 dBm (0.25 µV) at 12 dBm SINAD
P25 Mode (TIA-102 Method):	better than -116 dBm (0.35 µV) at 5% static BER
700/800 MHz Radio	
Analog Mode, 700 MHz Band:	better than -116 dBm (0.35 µV) at 12 dBm SINAD
Analog Mode, 800 MHz Band:	better than -119 dBm (0.25 µV) at 12 dBm SINAD
P25 Mode (TIA-102 Method):	better than -116 dBm (0.35 µV) at 5% static BER
Audio Frequency Response:	300 to 3000 Hz (transmit and receive)
Microphone Input Sensitivity:	82 ±28 mV rms (typical)

[3] VHF radio is compliant with applicable FCC narrowbanding mandate below 512 MHz.

Microphone Audio Frequency Response:	±0.5 dB from 100 Hz to 3000 Hz
Microphone Connector:	12-pin locking connector located on front panel
Speaker Audio Output Power	
Internal Speaker:	3 watts RMS (8-ohm speaker)
External Speaker (Optional):	15 watts RMS into a 4-ohm speaker
Speaker Audio Output Distortion	
Internal Speaker:	< 3% at 3 watts RMS audio output
External Speaker (Optional):	< 3% at 15 watts RMS audio output

2.3 REGULATORY

2.3.1 General

FCC Type Acceptance	
VHF Radio:	OWDTR-0075-E
UHF Radio:	OWDTR-0077-E
700/800 MHz Radio:	OWDTR-0076-E
Industry Canada Certification	
VHF Radio:	3636B-0075
UHF Radio:	3636B-0077
700/800 MHz Radio:	3636B-0076
Applicable Industry Canada Rules:	RSS-119

2.3.2 FCC Part 15

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.

2.3.3 Industry Canada

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.

3 INTRODUCTION

This manual contains installation procedures for the XG-25M mobile radios and related options and accessories. Procedures cover the mounting and cabling of the radio equipment, as well as basic in-vehicle radio tests.

3.1 GENERAL DESCRIPTION

The XG-25M mobile radio is a high-performance digital mobile radio. It can operate in Project 25 (P25) trunked, P25 conventional, EDACS/ProVoice trunked, and analog conventional modes. The radio is available in three (3) different RF bands as follows:

- 136 to 174 MHz 50-Watt VHF radio;
- 378 to 470 MHz 50-Watt UHF radio; and,
- 700/800 MHz 35-Watt dual-band radio.

The XG-25M is typically installed in a front-mount configuration; see Figure 3-1 below. However, an optional field-applied remote-mount kit is available that supports a remote-mount radio configuration. This is accomplished via separation of the control head from the radio using remote interface hardware and a 30-foot cable included in the kit; see Figure 3-2.

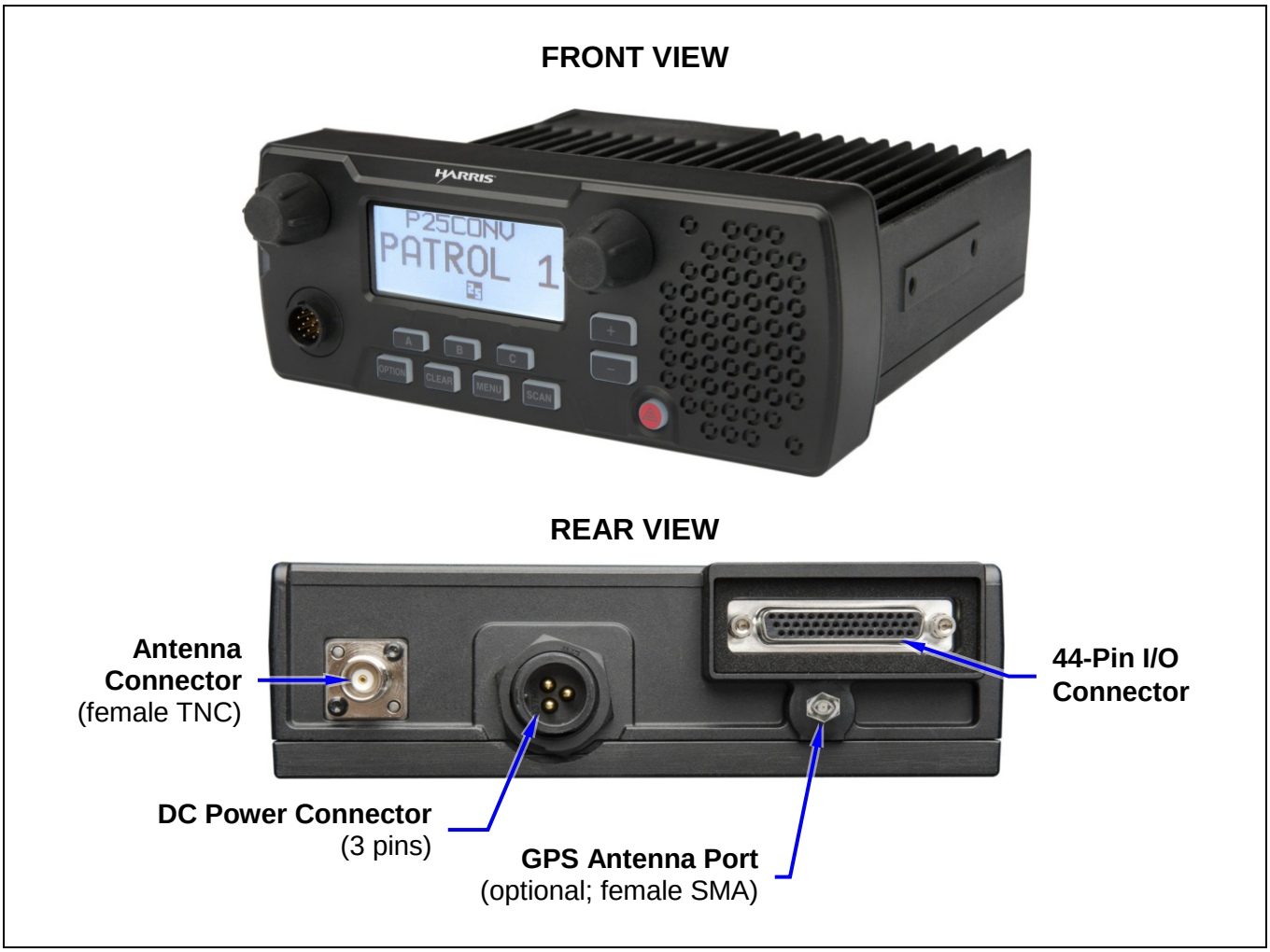


Figure 3-1: Front-Mount XG-25M Mobile Radio (Front and Rear Views)

Figure 3-2: Remote-Mount XG-25M Mobile Radio (With Optional Remote-Mount Kit Applied)

The XG-25M radio is designed to operate in a mobile environment, typically within a motor vehicle. It must be connected to an external transmit/receive antenna such as one mounted to the vehicle's rooftop or trunk lid. Several different types of external-mount antennas are approved and available for use with the radio, as listed in Table 4-4 (page 15).

The radio provides half-duplex voice and data communications. Voice communications are accomplished via a "push-to-talk" (PTT) type microphone and an external speaker connected to the radio.

The radio features a large text and graphics-based liquid-crystal display (LCD), and front panel controls for user control of the radio.

The XG-25M must be powered by an external +13.6-volt (nominal) DC power source. In mobile applications, the motor vehicle's electrical system is utilized as the source of DC power. Specifications are included in Section 2 of this manual. In the remote-mount application, the control head does not require its own DC operation power source; it receives DC operating power from the radio via the remote control cable.

The XG-25M may be equipped with an optional built-in Global Positioning System (GPS) tracking receiver. The GPS antenna can be integrated into the mobile transmit/receive antenna (i.e., a "combination" antenna). Alternately, the GPS antenna can be located/mounted completely separate from the mobile transmit/receive antenna.

The XG-25M exceeds many tough environmental specifications included within military standard MIL-STD-810G, the radio industry standard TIA/EIA-603, and the radio standard established by the U.S. Forest Service.

The radio supports operation on APCO Project 25 compliant Common Air Interface (P25 CAI) radio networks, and operation in a talk-around mode in accordance with the APCO Project 25. P25 Phase 1 radio systems utilize Improved Multi-Band Excitation® (IMBE) speech and data compression technology. P25 Phase 2 radio systems utilize Advanced Multi-Band Excitation Plus 2® (AMBE+2®) speech and data compression technology. Both of these compression technologies were developed by Digital Voice Systems, Inc.

Harris recommends the buyer use only an authorized representative to install and service this product. The warranties provided to the buyer under the terms of sale will be null and void if this product is installed or serviced improperly, and Harris will have no further obligation to the buyer for any damage caused to the product or to any person or personal property.

3.2 RADIO PROGRAMMING

Unless otherwise stated, all radio installation and test procedures presented in this manual assume the radio has been programmed by radio network administration personnel before it is delivered to radio installation personnel. Programming instructions are beyond the scope of this manual.

Radio Personality Manager (RPM) software application TQS3385 (part number SK-104768-001) is used to program the XG-25M mobile radio for trunked radio systems. TQS3385 can also be used to program the radio for analog conventional and P25 conventional operations. For additional information, refer to RPM's built-in online help and/or RPM Software Release Notes, publication number MS-012550-001.

Conventional RPM software application TQS3389 (part number SK-012177-001) is used to program the XG-25M mobile radio for analog conventional and P25 conventional operations. Trunking mode programming is disabled in TQS3389. For additional information, refer to RPM's built-in online help and/or Conventional RPM Software Release Notes, publication number MS-012761-001.

Both RPM applications can also be used to flash program new operating software (i.e., firmware) into an XG-25M mobile radio. Refer to the radio's maintenance manual for additional information.

Both RPM applications also support other radios such as the M7100, M7200, M7300, and Unity XG-100M mobile radios, and the P7100, P7200, P7300, Unity XG-100P, XG-75P and XG-25P portable radios.


NOTE

RPM Release R9A or later is required to program the VHF radio.

RPM Release R11A or later is required to program the UHF radio.

RPM Release R10A or later is required to program the 700/800 MHz radio.

The XG-25M mobile radio can be programmed via a serial port at the 44-pin connector on the rear panel of the radio or via a serial port at the front panel microphone connector. Programming instructions are beyond the scope of this manual.

For programming via the rear panel serial port, Option Cable 14002-0174-08 must be used to connect the radio's rear panel 44-pin connector to the computer with RPM. A 9-pin DB-style connector of the Option Cable is used for connection to the computer's serial port.

For programming via the mic connector serial port, Front Panel Programming Cable 14015-0200-01 must be used to connect the radio's mic connector to a serial port of the computer with RPM. The 9-pin DB-style connector of the Option Cable is used for connection to the computer's serial port.


NOTE

Programming via the mic connector's serial port using Front Panel Programming Cable has certain limitations! Refer to Section 11.3 on page 55 for additional information.

3.3 RELATED PUBLICATIONS

The following publications contain additional information about the XG-25M mobile radio:

- Quick Guide: 14221-1510-1000
- Operator's Manual: 14221-1510-2000
- Product Safety Manual: 14221-1510-4000
- CH-25 Remote-Control Conversion Kit Product Manual: 14221-1510-4450
- Maintenance Manual, VHF: 14221-1510-5000
- Maintenance Manual, UHF: 14221-1510-5400
- Maintenance Manual, 700/800 MHz: 14221-1510-5020

The *Product Safety Manual* and a *Quick Guide* (for radio operators) are included with each mobile radio equipment package when it ships from the factory. The *Quick Guide* and the *Operator's Manual* are available at www.pspc.harris.com without a login. Obtaining a *Maintenance Manual* or this *Installation Manual* from that web site requires an Information Center log-in, then browsing to Tech Link's Technical Manual Library.

3.4 REPLACEMENT PARTS

Replacement parts can be ordered via our Customer Care center. To order replacement parts, call, fax or e-mail:

United States:

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

International:

- Phone Number: 1-434-455-6403
- Fax Number: 1-321-409-4394
- E-mail: PSPC_InternationalCustomerFocus@harris.com

3.5 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 UNPACKING AND CHECKING THE EQUIPMENT

4.1 MATERIALS

A typical set of materials for an XG-25M mobile radio installation includes:

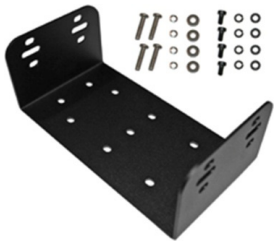
- **XG-25M Mobile Radio** — See Table 4-1 below for catalog and part number.
- **Installation Kit DM-ZN9X** — See Table 4-2 below for kit contents.
- **Optional: CH-25 Remote-Control Conversion Kit DM-ZN9Z** — See Table 4-3 on page 14.
- **One or Two Antennas** — See Table 4-4. (A second antenna or a "combination" antenna is required if the optional GPS receiver is installed and used.)
- **Microphone** — See Table 4-4 for microphone part numbers.

Table 4-1: XG-25M Mobile Radio Catalog and Part Number

CATALOG NUMBER*	RADIO PART NUMBER	DESCRIPTION
DM-MV1B	14015-0010-01	XG-25M VHF (136 to 174 MHz) 50-Watt Radio w/ CH-25 Control Head
DM-MU1B	14015-0030-01	XG-25M UHF (378 to 470 MHz) 50-Watt Radio w/ CH-25 Control Head
DM-M78B	14015-0020-01	XG-25M Dual-Band 700/800 MHz 35-Watt Radio w/ CH-25 Control Head

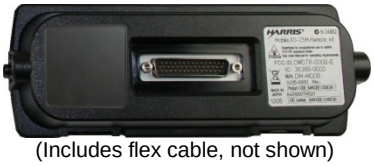
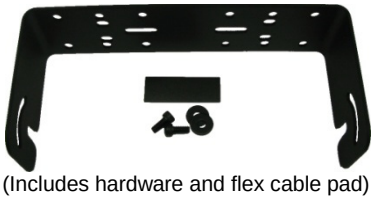
* In addition to the radio and control head, each catalog package also contains a *Product Safety Manual* and a *Quick Guide*.

Table 4-2: Installation Kit DM-ZN9X

ITEM	QTY.	PART NUMBER	DESCRIPTION	ILLUSTRATION
1	1 ❑	14015-0201-01	Kit, Mounting Bracket	
2	1 ❑	CA-012365-001	Cable, DC Power. Includes 10-AWG, 20-Foot DC Power Cable with straight connector, (2) waterproof HFB fuse holders, (1) 20-amp AGC fuse, (1) 15-amp AGC fuse, and (1) 3-amp AGC fuse	
3	1 ❑	FM-104859-004	Cover, Waterproof	

Do **not** use the 20-amp fuse included with DC Power Cable CA-012365-001. The radio's main power must be protected with the 15-amp fuse included with the cable. Refer to Section 14 for additional information.

Table 4-3: CH-25 Remote-Control Conversion Kit DM-ZN9Z (Kit 14015-0203-28 with Manual)

ITEM	QTY.	PART NUMBER	DESCRIPTION	ILLUSTRATION
1	1 ❑	14015-0100-01	Interface, CH-25 Remote	 (Includes flex cable, not shown)
2	1 ❑	14015-0100-02	Interface, Mobile Radio Unit (MRU) Remote	
3	1 ❑	14015-0203-31	Cable, Remote Control, 30-Foot	
4	1 ❑	14015-0203-32	Kit, Bracket, CH-25 Remote	 (Includes hardware and flex cable pad)
5	1 ❑	14221-1510-4450	Product Manual for Conversion Kit	

NOTE

Detailed instructions on applying the above kit to a front-mount XG-25M mobile radio are included in *Product Manual* publication number 14221-1510-4450. That manual and the 14015-0203-28 kit are included with catalog number DM-ZN9Z. The respective vehicle installation procedures begin in Section 7 (page 33) of this manual.

4.2 MATERIAL INSPECTION

CAUTION

After removal from the carton, examine the radio and other components for broken, damaged, loose or missing parts. If any are noted, contact the Customer Care center (see page 12) immediately to discuss and arrange the return of the equipment to Harris for replacement. Any unauthorized attempts to repair or modify this equipment will void the warranty and could create a safety hazard.

Upon removing items from the carton and verifying that all equipment is accounted for, proceed with the installation.

CAUTION

Mounting of the radio and/or antenna in ways other than those described in this manual may adversely affect performance, violate FCC rules on RF exposure, and even damage the unit, posing a potential safety hazard.

Table 4-4: Additional Options and Accessories for XG-25M Mobile Radios

PART NUMBER	DESCRIPTION
AN-125001-001	Antenna Mount: Standard Rooftop, NMO Mounting Base, 15-foot (4.6-meter) RG-58 A/U (or equivalent) Low-Loss RF Cable, Male TNC RF Connector
AN-125001-002	Antenna Mount: Standard Rooftop, NMO Mounting Base, 15-foot (4.6-meter) RF-195 (or equivalent) Low-Loss RF Cable, Male TNC RF Connector
AN-125001-003	Antenna Mount: Thick Rooftop, NMO Mounting Base, 15-foot (4.6-meter) RG-58 A/U (or equivalent) Low-Loss RF Cable, Male TNC RF Connector
AN-125001-004	Antenna Mount: Thick Rooftop, NMO Mounting Base, 15-foot (4.6-meter) RF-195 (or equivalent) Low-Loss RF Cable, Male TNC RF Connector
AN-125001-005	Antenna Mount: GPS Combo, Standard Rooftop, NMO Mounting Base, 17-foot (5.1-meter) RG-58 A/U (or equivalent) Low-Loss RF Cable, Male TNC RF Connector; 17-foot (5.1-meter) RG174/U (or equivalent) GPS RF Cable with Male SMA RF Connector (attached); 2.7 to 3.3 Vdc or 4.8 to 5.2 Vdc Bias
AN-125001-006	Antenna Mount: GPS Combo Rooftop, NMO Mounting Base, 17-foot (5.1-meter) RF-195 (or equivalent) Low-Loss RF Cable, Male TNC RF Connector; 17-foot (5.1-meter) RG174/U (or equivalent) GPS RF Cable with Male SMA RF Connector (attached); 2.7 to 3.3 Vdc or 4.8 to 5.2 Vdc Bias
AN-125001-007	Antenna Mount: Magnetic, NMO Mounting Base, 15-foot (4.6-meter) RG-58 A/U (or equivalent) Low-Loss RF Cable, Male TNC RF Connector
AN-125001-008	Antenna Mount: Magnetic, NMO Mounting Base, 15-foot (4.6-meter) RF-195 (or equivalent) Low-Loss RF Cable, Male TNC RF Connector
AN-225002-001	Antenna Element: 136 to 174 MHz, 0 dBd Gain, NMO, Factory-Tuned
AN-225002-003	Antenna Element: 136 to 174 MHz, 3 dBd Gain, NMO, Field-Tuned*
AN-225002-004	Antenna Element: 136 to 174 MHz, 2.4 dBd Gain, NMO, Field-Tuned*
AN-225006-001	Antenna Element: 132 to 960 MHz, 0 dBd Gain, NMO, Field-Tuned*
AN-225003-001	Antenna Element: 378 to 430 MHz, 0 dBd Gain, NMO, Factory-Tuned
AN-225003-004	Antenna Element: 378 to 430 MHz, 0 dBd Gain, NMO, Factory-Tuned, Low-Profile
AN-225003-005	Antenna Element: 378 to 430 MHz, 2 dBd Gain, NMO, Factory-Tuned, Low-Profile, No Ground-Plan (NGP)

Table 4-4: Additional Options and Accessories for XG-25M Mobile Radios

PART NUMBER	DESCRIPTION
AN-225004-001	Antenna Element: 450 to 512 MHz, 0 dBd Gain, NMO, Factory-Tuned
AN-225004-004	Antenna Element: 450 to 512 MHz, 0 dBd Gain, NMO, Factory-Tuned, Low-Profile
AN-225004-005	Antenna Element: 450 to 512 MHz, 2 dBd Gain, NMO, Factory-Tuned, Low-Profile, No Ground-Plan (NGP)
AN-225001-001	Antenna Element: 700/800 MHz, 3 dBd Gain, NMO, Factory-Tuned
AN-225001-002	Antenna Element: 700/800 MHz, 3 dBd Gain, NMO, Factory-Tuned, Elevated-Feed
AN-225001-003	Antenna Element: 700/800 MHz, 3 dBd Gain, NMO, Factory-Tuned, Elevated-Feed No Ground Plane
AN-225001-004	Antenna Element: 700/800 MHz, 2 dBd Gain, NMO, Factory-Tuned, Low-Profile
AN-225001-005	Antenna Element: 700/800 MHz, 5 dBd Gain, NMO, Factory-Tuned
AN-025187-001	Antenna, GPS Receive Only, Roof-Mount, 17-foot (5.2-meter) RG174/U (or equivalent) RF Cable with Male SMA RF Connector (attached); 2.7 to 3.3 Vdc or 4.8 to 5.2 Vdc Bias
AN-025187-003	Antenna, GPS Receive Only, Magnetic-Mount, 17-foot (5.2-meter) RG174/U (or equivalent) RF Cable with Male SMA RF Connector (attached); 2.7 to 3.3 Vdc or 4.8 to 5.2 Vdc Bias
14002-0174-08	Cable, Option. See page 50.
14015-0200-01	Cable, Front Panel Programming. See page 55.
14015-0200-02	Cable, Desk Mic Adapter. See page 56.
CA-013671-020	Cable, Serial Data (20 feet). See page 54.
CN-014756	Connector, RF; TNC Male Crimp-Type for RG-58A/U, RG-58/U, RGU/400, YR29586-9, YR29586-10 and Pro-Flex™ Plus 195 Coaxial Cable
MC-101616-060	Microphone, Standard
MC-014121-003	Microphone, Desk
LS102824V10	Speaker, External Mobile; 20-Watt (with 4.6-foot cable). See Section 9 on page 48.

* Element must be trimmed to proper length in order to minimize antenna system VSWR.

5 PLANNING THE INSTALLATION

5.1 GENERAL INFORMATION

Before starting, plan the installation carefully so it will meet the following requirements:

- The installation is safe for the operator and passengers within the vehicle.
- The equipment is installed away from the airbag deployment areas.
- The installation allows for convenient access by the operator, as applicable.
- The equipment is protected from water damage.
- The installation is neat and allows easy service access.
- The mobile radio is mounted in a location assuring the vehicle occupants' safety and out of the way of passengers and auto mechanics.

A professional radio installer should perform the installation!

5.2 TOOLS REQUIRED

The following tools are recommended to complete the installation. Where specific vendor names and model or part numbers are given, equivalent substitutes may be used:

- Non-Insulated Crimp Tool: Thomas & Betts WT-111-M
- Insulated Terminal Crimp Tool: Klein 1005
- Fuse Holder Crimp Tool: Thomas & Betts – WT-112M or California Terminal Products No. 1250 or Channelock No. 909
- 3-Blade Coax Cable Stripper for RG-58 Cable similar to Tyco Electronics 1490490-1 (includes blades)
- Ratcheting Hex-Crimp Tool for 50-Ohm TNC and BNC RF Connectors and RG-58 Cable similar to Tyco Electronics 58433-2 (includes Crimper 354940-1 and Die Set 58436-1) or Emerson Network Power 24-9960P
- Non-Metallic Fish Tape, 25-Foot: Klein-Lite 50156
- Various Socket and Driver Sets
- Soft-Jaw Pliers: Tessco 450520 or equivalent
- Phillips-Head Screwdrivers, #1 and #2
- Flat-Blade Screwdrivers, ⅛ and ¼-inch tips
- 3-Millimeter Hex Key Wrench
- 4-Millimeter Hex Key Wrench
- $^{5}/_{16}$-Inch Combination or Open-End Wrench (Only Needed for GPS Receiver Option)
- ¾-Inch or ⅜-Inch Hole Saw with Depth Protection: ¾-Inch = Ripley HSK 19 or Antenex HS34; ⅜-Inch = Antenex HS38
- Clutch-Type Cordless Drill with Drill Bits and Driver Bits
- Deburring Tool (for ⅜-inch and smaller holes)
- Flush-Cut and Large Wire Cutters
- Various Fasteners (e.g., machine screws and nuts, Tek screws, etc.)
- Tie Wraps: Nylon, 6-inches or larger

A separate list of test equipment is included in Section 15.1 on page 60.

5.3 LOCATING COMPONENTS

Plan the mounting locations of all components (radio, antenna, and cables) and determine the routes for all wiring and cables. Particularly consider the connection of the radio for planning purposes.

- Determine the customer's preferences, if any, for location of components. Comply with these preferences as long as they are consistent with safety recommendations and guidelines presented in this manual, the Product Safety Manual, and other generally accepted professional radio installation practices.
- The front-mount radio may be mounted below or above the vehicle's dash, or at some other location per customer requirements, available space, and/or mounting surface strength. Dimensions for the radio are listed in Section 2.1 on page 6. As noted in that section, these dimensions do not include space required at the rear of the radio for cables. Several inches of clearance space is required.
- For a remote-mount radio installation, the radio is typically located in the motor vehicle's trunk, or some other preferably unoccupied section in a vehicle, such as a fire truck's equipment shelf. The control head is typically located under the vehicle's dash panel. Dimensions for the radio, control head, and hand-held controller are listed in Section 2.1 on page 6. As noted in that section, these dimensions do not include space required at the rear of the radio and control head for cables. Several inches of clearance space is required at the back of the control head, and at least six (6) inches is recommended at the back of the radio. In addition, several inches of clearance space is required at each side of the radio for access to the screws that secure the radio to its mounting bracket.
- When selecting a mounting location, verify sufficient clearance behind the radio can be maintained so cables will not be stressed, crushed, twisted, or bent at severe angles. Also, the front and sides of the radio must have clearance for air circulation, access to mounting screws, mounting hardware, etc.
- Verify the drilling of holes and the insertion of screws will not damage or interfere with any existing vehicle components (for example, a fuel tank, fuel lines, the transmission housing, etc.), or any existing vehicle wiring.
- For antenna location and installation-related information, refer to Section 6.

CAUTION

The radio must be kept out of direct sunlight and away from heat sources. Adequate free-air ventilation must be provided to its cooling fins. The radio will automatically reduce its transmit RF output power when its ambient temperature exceeds approximately +140° Fahrenheit (+60° Celsius).

CAUTION

All cables should have a service loop near each connector end. Do not bend the cables at severe angles near the connector end. Above all, after all components are installed, verify no cable is under any tension. Failure to do so may lead to damaged cables, causing intermittent radio operation or complete radio failure.

6 ANTENNA INSTALLATION

6.1 ANTENNA MOUNTING LOCATIONS

WARNING

Review all Regulatory and Safety Information presented in the radio's Product Safety Manual. A transmitting antenna must be installed in accordance with the guidelines presented in both the Product Safety Manual and this manual. The Product Safety Manual is included in the radio equipment package when the package ships from the factory.

As a guide for determining the best possible mounting location in order to reduce human exposure to radio frequency (RF) electromagnetic energy during transmit mode, refer to the following:

- For a 50-Watt VHF Radio: See Figure 6-1 (page 20)
- For a 50-Watt UHF Radio: See Figure 6-2 (page 22)
- For a 35-Watt 700/800 MHz Radio: See Figure 6-3 (page 24)

NOTE

Also refer to the respective Recommended Minimum Safe Lateral Distance table presented in the Product Safety Manual. These tables list the recommended minimum safe distance for a controlled environment and for unaware bystanders in an uncontrolled environment, from transmitting antennas (i.e., monopoles over a ground plane, or dipoles) at rated radio power for mobile radios installed in a vehicle.

Antennas must be mounted in one of four (4) possible locations on the vehicle. Figure 6-1 and Figure 6-3 shows the recommended locations and antenna part numbers. Also, see Table 4-4 for additional information. Always follow the antenna manufacturer's instructions when mounting an antenna.

6.1.1 Direct Center or Center-Rear of Rooftop

The center of the vehicle's roof is the best location for a rooftop-mount antenna (location ❶ in the following figures). For optimal performance, the mounting area under the antenna must be flat with a minimum radius of six (6) inches of metal ground plane. It must be located directly in the center of the roof to minimize human exposure to RF electromagnetic energy. Other obstructions such as a light bar or another antenna may prevent the antenna from being mounted in the direct center of the roof. In this case, the antenna should be mounted a minimum of one foot away from and behind the obstruction but in the middle of the roof with respect to the left and right sides of the vehicle (location ❷ in the following figures).

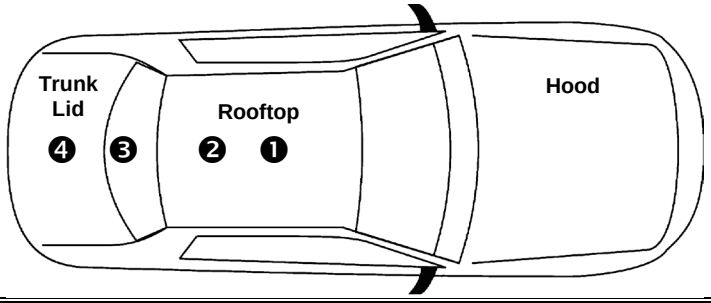
6.1.2 Center of Trunk Lid

Certain vehicles do not allow for the antenna to be placed in the center or center-rear of the roof. In this case, the next best location for the antenna is in the direct center of the trunk lid (location ❹ in the following figures). In this case, an elevated-feed-point antenna is recommended. Although this type of antenna does not require a metal ground plane, it must be located directly in the center of the trunk lid to minimize human exposure to RF electromagnetic energy.

6.1.3 Rear Deck Lid for Stand-Alone GPS Receive Antenna

If the XG-25M mobile radio does not use a GPS combination-type antenna and it is equipped with a GPS receiver, a stand-alone GPS receive antenna must be separately located and mounted. The vehicle's rear deck lid (location ❸ in the following figures) is the recommended mounting location for this case. This locates the GPS antenna inside the vehicle.

TOP VIEW OF A TYPICAL VEHICLE



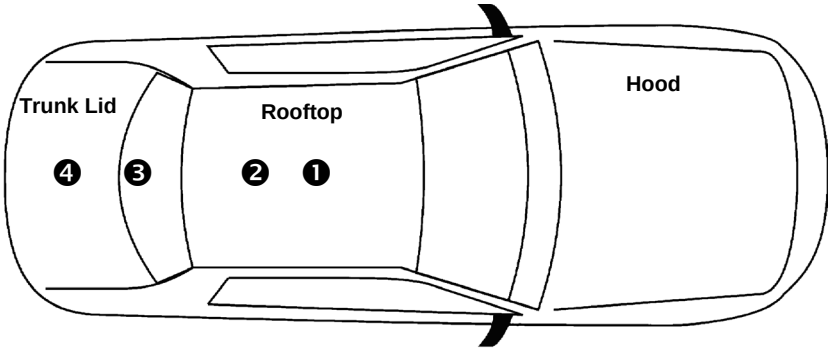
VHF Applications

ANTENNA PART NUMBER	ANTENNA DESCRIPTION*	LOCATION(S)			
		❹	❸	❷	❶
AN-125001-001 (mount) with AN-225002-001 (element)	136 to 174 MHz, Standard Rooftop-Mount, 0 dBd Gain				✓
AN-125001-001 (mount) with AN-225006-001 (element)	132 to 960 MHz, Standard Rooftop-Mount, 0 dBd Gain, ¼-Wavelength, Field-Tuned				✓
AN-125001-001 (mount) with AN-225002-003 (element)	136 to 174 MHz, Standard Rooftop-Mount, 3 dBd Gain				✓
AN-125001-001 (mount) with AN-225002-004 (element)	136 to 174 MHz, Standard Rooftop-Mount, 2.4 dBd Gain				✓
AN-125001-003 (mount) with AN-225002-001 (element)	136 to 174 MHz, Thick Rooftop-Mount, 0 dBd Gain				✓
AN-125001-003 (mount) with AN-225006-001 (element)	132 to 960 MHz, Thick Rooftop-Mount, 0 dBd Gain, ¼-Wavelength, Field-Tuned				✓
AN-125001-003 (mount) with AN-225002-003 (element)	136 to 174 MHz, Thick Rooftop-Mount, 3 dBd Gain				✓
AN-125001-003 (mount) with AN-225002-004 (element)	136 to 174 MHz, Thick Rooftop-Mount, 2.4 dBd Gain				✓
AN-125001-005 (mount) with AN-225002-001 (element)	136 to 174 MHz, GPS Combo Standard Rooftop-Mount, 0 dBd Gain				✓
AN-125001-005 (mount) with AN-225006-001 (element)	132 to 960 MHz, GPS Combo Standard Rooftop-Mount, 0 dBd Gain, ¼-Wavelength, Field-Tuned				✓
AN-125001-005 (mount) with AN-225002-003 (element)	136 to 174 MHz, GPS Combo Standard Rooftop-Mount, 3 dBd Gain				✓
AN-125001-005 (mount) with AN-225002-004 (element)	136 to 174 MHz, GPS Combo Standard Rooftop-Mount, 3 dBd Gain				✓
AN-125001-007 (mount) with AN-225002-001 (element)	136 to 174 MHz, Magnetic-Mount, 0 dBd Gain				✓
AN-125001-007 (mount) with AN-225006-001 (element)	132 to 960 MHz, Magnetic-Mount, 0 dBd Gain, ¼-Wavelength, Field-Tuned				✓
AN-125001-007 (mount) with AN-225002-003 (element)	136 to 174 MHz, Magnetic-Mount, 3 dBd Gain				✓
AN-125001-007 (mount) with AN-225002-004 (element)	136 to 174 MHz, Magnetic-Mount, 2.4 dBd Gain				✓
AN-025187-001	GPS Receive Only, Roof-Mount	✓	✓	✓	
AN-025187-003	GPS Receive Only, Magnetic-Mount	✓	✓	✓	

* See Table 4-4 on page 15 for detailed antenna descriptions.

Figure 6-1: Recommended VHF Antenna Mounting Locations with Antenna Part Numbers

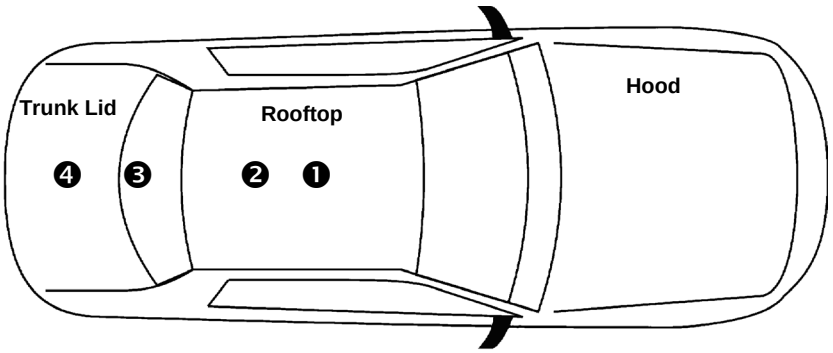
TOP VIEW OF A TYPICAL VEHICLE



UHF Applications

ANTENNA PART NUMBER	ANTENNA DESCRIPTION*	LOCATION(S)			
		❹	❸	❷	❶
AN-125001-001 (mount) with AN-225006-001 (element)	132 to 960 MHz, Standard Rooftop-Mount, 0 dBd Gain, ¼-Wavelength, Field-Tuned				✓
AN-125001-001 (mount) with AN-225003-001 (element)	378 to 430 MHz, Standard Rooftop-Mount, 0 dBd Gain	✓		✓	✓
AN-125001-001 (mount) with AN-225003-004 (element)	378 to 430 MHz, Standard Rooftop-Mount, 0 dBd Gain, Low Profile	✓			✓
AN-125001-001 (mount) with AN-225003-005 (element)	378 to 430 MHz, Standard Rooftop-Mount, 2 dBd Gain, Low Profile, NGP	✓		✓	✓
AN-125001-001 (mount) with AN-225004-001 (element)	450 to 512 MHz, Standard Rooftop-Mount, 0 dBd Gain	✓			✓
AN-125001-001 (mount) with AN-225004-004 (element)	450 to 512 MHz, Standard Rooftop-Mount, 0 dBd Gain, Low Profile	✓			✓
AN-125001-001 (mount) with AN-225004-005 (element)	450 to 512 MHz, Standard Rooftop-Mount, 2 dBd Gain, Low Profile, NGP	✓		✓	✓
AN-125001-003 (mount) with AN-225006-001 (element)	132 to 960 MHz, Thick Rooftop-Mount, 0 dBd Gain, ¼-Wavelength, Field-Tuned				✓
AN-125001-003 (mount) with AN-225003-001 (element)	378 to 430 MHz, Thick Rooftop-Mount, 0 dBd Gain	✓		✓	✓
AN-125001-003 (mount) with AN-225003-004 (element)	378 to 430 MHz, Thick Rooftop-Mount, 0 dBd Gain, Low Profile	✓			✓
AN-125001-003 (mount) with AN-225003-005 (element)	378 to 430 MHz, Thick Rooftop-Mount, 2 dBd Gain, Low Profile, NGP	✓		✓	✓
AN-125001-003 (mount) with AN-225004-001 (element)	450 to 512 MHz, Thick Rooftop-Mount, 0 dBd Gain	✓			✓
AN-125001-003 (mount) with AN-225004-004 (element)	450 to 512 MHz, Thick Rooftop-Mount, 0 dBd Gain, Low Profile	✓			✓
AN-125001-003 (mount) with AN-225004-005 (element)	450 to 512 MHz, Thick Rooftop-Mount, 2 dBd Gain, Low Profile, NGP	✓		✓	✓
AN-125001-005 (mount) with AN-225006-001 (element)	132 to 960 MHz, GPS Combo Standard Rooftop-Mount, 0 dBd Gain, ¼-Wavelength, Field-Tuned				✓
AN-125001-005 (mount) with AN-225003-001 (element)	378 to 430 MHz, GPS Combo Standard Rooftop-Mount, 0 dBd Gain	✓		✓	✓
AN-125001-005 (mount) with AN-225003-004 (element)	378 to 430 MHz, GPS Combo Standard Rooftop-Mount, 0 dBd Gain, Low Profile	✓			✓
AN-125001-005 (mount) with AN-225003-005 (element)	378 to 430 MHz, GPS Combo Standard Rooftop-Mount, 2 dBd Gain, Low Profile, NGP	✓		✓	✓

TOP VIEW OF A TYPICAL VEHICLE



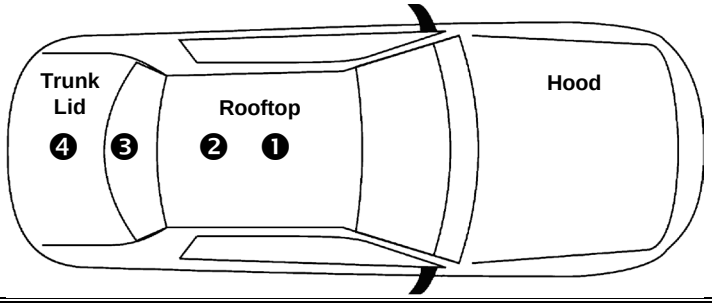
UHF Applications

ANTENNA PART NUMBER	ANTENNA DESCRIPTION*	LOCATION(S)			
		❹	❸	❷	❶
AN-125001-005 (mount) with AN-225004-001 (element)	450 to 512 MHz, GPS Combo Standard Rooftop-Mount, 0 dBd Gain	✓			✓
AN-125001-005 (mount) with AN-225004-004 (element)	450 to 512 MHz, GPS Combo Standard Rooftop-Mount, 0 dBd Gain, Low Profile	✓			✓
AN-125001-005 (mount) with AN-225004-005 (element)	450 to 512 MHz, GPS Combo Standard Rooftop-Mount, 2 dBd Gain, Low Profile, NGP	✓		✓	✓
AN-125001-007 (mount) with AN-225006-001 (element)	132 to 960 MHz, Magnetic-Mount, 0 dBd Gain, ¼-Wavelength, Field-Tuned				✓
AN-125001-007 (mount) with AN-225003-001 (element)	378 to 430 MHz, Magnetic-Mount, 0 dBd Gain	✓			
AN-125001-007 (mount) with AN-225003-004 (element)	378 to 430 MHz, Magnetic-Mount, 0 dBd Gain, Low Profile	✓			
AN-125001-007 (mount) with AN-225003-005 (element)	378 to 430 MHz, Magnetic-Mount, 2 dBd Gain, Low Profile, NGP	✓			
AN-125001-007 (mount) with AN-225004-001 (element)	450 to 512 MHz, Magnetic-Mount, 0 dBd Gain	✓			
AN-125001-007 (mount) with AN-225004-004 (element)	450 to 512 MHz, Magnetic-Mount, 0 dBd Gain, Low Profile	✓			
AN-125001-007 (mount) with AN-225004-005 (element)	450 to 512 MHz, Magnetic-Mount, 2 dBd Gain, Low Profile, NGP	✓		✓	✓
AN102800V1 (Discontinued)	136 to 941 MHz, Standard Rooftop-Mount, ¼-Wave, 0 dBd Gain				✓
AN-025187-001	GPS Receive Only, Roof-Mount	✓	✓	✓	
AN-025187-003	GPS Receive Only, Magnetic-Mount	✓	✓	✓	

* See Table 4-4 on page 15 for detailed antenna descriptions.

Figure 6-2: Recommended UHF Antenna Mounting Locations with Antenna Part Numbers

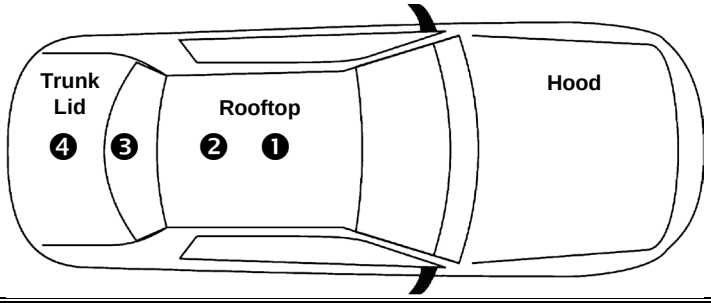
TOP VIEW OF A TYPICAL VEHICLE



700/800 MHz Applications

ANTENNA PART NUMBER	ANTENNA DESCRIPTION*	LOCATION(S)			
		❹	❸	❷	❶
AN-125001-002 (mount) with AN-225006-001 (element)	132 to 960 MHz Standard Rooftop-Mount, 0 dBd Gain, ¼-Wavelength, Field-Tuned	✓			✓
AN-125001-002 (mount) with AN-225001-001 (element)	700/800 MHz Standard Rooftop-Mount, 3 dBd Gain	✓			✓
AN-125001-002 (mount) with AN-225001-002 (element)	700/800 MHz Elevated-Feed Standard Rooftop-Mount, 3 dBd Gain	✓		✓	✓
AN-125001-002 (mount) with AN-225001-003 (element)	700/800 MHz Elevated-Feed No Ground Plane Standard Rooftop-Mount, 3 dBd Gain	✓		✓	✓
AN-125001-002 (mount) with AN-225001-004 (element)	700/800 MHz Low-Profile Standard Rooftop-Mount, 2 dBd Gain	✓			✓
AN-125001-002 (mount) with AN-225001-005 (element)	700/800 MHz Standard Rooftop-Mount, 5 dBd Gain				✓
AN-125001-004 (mount) with AN-225006-001 (element)	132 to 960 MHz Thick Rooftop-Mount, 0 dBd Gain, ¼-Wavelength, Field-Tuned	✓			✓
AN-125001-004 (mount) with AN-225001-001 (element)	700/800 MHz Thick Rooftop-Mount, 3 dBd Gain	✓			✓
AN-125001-004 (mount) with AN-225001-002 (element)	700/800 MHz Elevated-Feed Thick Rooftop-Mount, 3 dBd Gain	✓		✓	✓
AN-125001-004 (mount) with AN-225001-003 (element)	700/800 MHz Elevated-Feed No Ground Plane Thick Rooftop-Mount, 3 dBd Gain	✓		✓	✓
AN-125001-004 (mount) with AN-225001-004 (element)	700/800 MHz Low-Profile Thick Rooftop-Mount, 2 dBd Gain	✓			✓
AN-125001-004 (mount) with AN-225001-005 (element)	700/800 MHz Thick Rooftop-Mount, 5 dBd Gain				✓
AN-125001-006 (mount) with AN-225006-001 (element)	132 to 960 MHz Thick Rooftop-Mount, 0 dBd Gain, ¼-Wavelength, Field-Tuned	✓			✓
AN-125001-006 (mount) with AN-225001-001 (element)	700/800 MHz GPS Combo Rooftop-Mount, 3 dBd Gain	✓			✓
AN-125001-006 (mount) with AN-225001-002 (element)	700/800 MHz GPS Combo Elevated-Feed Rooftop-Mount, 3 dBd Gain	✓		✓	✓
AN-125001-006 (mount) with AN-225001-003 (element)	700/800 MHz GPS Combo Elevated-Feed No Ground Plane Rooftop-Mount, 3 dBd Gain	✓		✓	✓
AN-125001-006 (mount) with AN-225001-004 (element)	700/800 MHz GPS Combo Low-Profile Rooftop-Mount, 2 dBd Gain	✓			✓
AN-125001-006 (mount) with AN-225001-005 (element)	700/800 MHz GPS Combo Rooftop-Mount, 5 dBd Gain				✓
AN-125001-008 (mount) with AN-225001-001 (element)	132 to 960 MHz Magnetic-Mount, 0 dBd Gain, ¼-Wavelength, Field-Tuned	✓			✓

TOP VIEW OF A TYPICAL VEHICLE



700/800 MHz Applications

ANTENNA PART NUMBER	ANTENNA DESCRIPTION*	LOCATION(S)			
		❹	❸	❷	❶
AN-125001-008 (mount) with AN-225001-001 (element)	700/800 MHz Magnetic-Mount, 3 dBd Gain	✓			✓
AN-125001-008 (mount) with AN-225001-002 (element)	700/800 MHz Magnetic-Mount Elevated-Feed, 3 dBd Gain	✓		✓	✓
AN-125001-008 (mount) with AN-225001-003 (element)	700/800 MHz Magnetic-Mount Elevated-Feed No Ground Plane, 3 dBd Gain	✓		✓	✓
AN-125001-008 (mount) with AN-225001-004 (element)	700/800 MHz Magnetic-Mount Low-Profile, 2 dBd Gain	✓			✓
AN-125001-008 (mount) with AN-225001-005 (element)	700/800 MHz Magnetic-Mount, 5 dBd Gain				✓
AN102800V1 (Discontinued)	136 to 941 MHz Standard Rooftop-Mount, ¼-Wave, 0 dBd Gain				✓
AN-025187-001	GPS Receive Only, Roof-Mount	✓	✓	✓	
AN-025187-003	GPS Receive Only, Magnetic-Mount	✓	✓	✓	

* See Table 4-4 on page 15 for detailed antenna descriptions.

Figure 6-3: Recommended 700/800 MHz Antenna Mounting Locations with Antenna Part Numbers

6.2 ANTENNA INSTALLATION PROCEDURES

NOTE

An antenna **must** be installed before completing the radio installation.

Table 4-4 (page 15), Figure 6-1 and Figure 6-3 list the mobile radio antennas available for use with the respective radio. As presented in the previous section, various mounting locations exist. Optimal performance is achieved via a rooftop antenna mounted in the direct center of the motor vehicle's roof.

6.2.1 Installing NMO Antenna Mounts AN-125001-001, -002, -003 and -004

These NMO style antenna mounts can each be used with several different antenna elements. Only limited access under the mounting location is typically required. The installation procedure is presented in Section 6.2.1.3.

6.2.1.1 Standard NMO Antenna Mounts AN-125001-001 and AN-125001-002

This These standard ¾-inch NMO antenna mounts requires a ¾-inch hole in a relatively flat area of the vehicle body, with a vehicle metal thickness of between 0.020 and 0.040 inches. AN-125001-002 has a very-low-loss coax cable (LMR/RF-195 or equivalent).

6.2.1.2 Thick-Roof NMO Antenna Mounts AN-125001-003 and AN-125001-004

This thick-roof NMO antenna mount uses either a ⅜-inch or a ¾-inch mounting hole in a relatively flat area of the vehicle body, with a vehicle metal thickness of between 0.040 and 0.1875 inches ($^{3}/_{16}$-inch maximum thickness). AN-125001-004 has a very-low-loss coax cable (LMR/RF-195 or equivalent).

NOTE

For thick-roof NMO antenna mount AN-125001-003 or AN-125001-004, using a ⅜-inch mounting hole requires better access to the underside of the mounting location than if a ¾-inch hole is used. This is because, in the case of a ⅜-inch hole, the antenna mount's bushing assembly must be inserted from the underside of the mounting surface.

When using a ¾-inch mounting hole to mount thick-roof NMO antenna mount AN-125001-003 or AN-125001-004, the thickness of the mounting surface must be at least ⅛-inch (0.125-inch minimum thickness). This requirement is due to the thickness of the alignment ring used to center the bushing assembly within the ¾-inch mounting hole.

6.2.1.3 Installation Procedure for Mounts AN-125001-001 through -004

1. Select the antenna mounting location in accordance with the information presented in Section 6.1 of this manual. If necessary, contact the Technical Assistance Center for assistance. See page 12 for TAC contact information.
2. Verify no obstructions exist immediately below the respective mounting location on the underside of the vehicle body, such as vehicle ribbing/body framing, a wiring harness, air bag equipment, etc. Also verify there is a sufficient access path and clearance for the mount's coax cable. If there is an obstruction or insufficient clearance, select another nearby mounting location.
3. Measure and mark the center point of the selected antenna mounting location. Be sure to center the mark from side-to-side of the vehicle.

4. Obtain a hole saw specifically designed for drilling NMO mounting holes of the required diameter. (e.g., Antenex/Laird Technologies model HS34 or equivalent for a ¾-inch hole; Antenex/Laird Technologies model HS38 or equivalent for a ⅜-inch hole).

5. If the vehicle's headliner panel, carpet, seats, or otherwise, is below the mounting location, move or remove the headliner panel, etc. as necessary to protect it. Alternately, apply a heat-resistant mask material (such as a fiberglass mat or thin sheet metal with masked edges) as required to "catch" the metal shavings and the metal plug (if any) produced by the hole saw. The plug (if any) may be relatively hot if/when it drops out of the saw upon completion of the hole drilling process. ⅜-inch diameter hole saws generally produce only shavings, not plugs.

6. With the hole saw and a drill, drill a hole at the marked hole center point. Position the drill square to (i.e., 90 degrees from) the vehicle mounting surface so paint immediately outside of the perimeter of the hole is evenly removed.

Excessive use of the hole saw and/or failure to position the drill "square" with (i.e., at a 90-degree angle from) the vehicle mounting surface may result in damage to the metal mounting surface, in the area immediately outside of the perimeter of the hole.

7. Ensure the saw removed the paint immediately around the hole as the drilling operation completes. If not, do so by reinserting the saw completely into the hole and spinning it as required. This allows proper grounding via the mount's lock nut on the top of the mounting surface. On the bottom of the mounting surface, the "teeth" of the mount's bushing assembly may not provide a good ground due to thick vehicle undercoating, thick primer, oxidation/rust, etc.

8. **For a ¾-inch hole**, feed the unterminated end of the mount's coax cable into the hole from the top surface of the vehicle until the mount's bushing assembly is in position to drop into the hole. The bushing should be tilted at a slight angle and fed into the hole. The threaded shank of the mount's bushing assembly will not fall through a ¾-inch hole.

   For a ⅜-inch hole, feed the threaded shank of the mount's bushing assembly into the hole from the underside of the mounting surface. Hold it into position until the lock nut is installed.

9. If installing a thick-roof antenna mount (⅜-inch shank) into a ¾-inch hole, place the alignment ring onto the threaded shank of the mount. This ring has an approximate ¾-inch outside diameter.

10. A tube of synthetic lubricant is included with the antenna mount. Apply this lubricant to the mount's rubber O-ring. Do **not** get any lubricant on the center contact of the mount's bushing assembly.

11. As illustrated in Figure 6-4 and Figure 6-5, add the O-ring (C) and lock nut (D) to the top of the mount's bushing assembly (A). With the O-ring in the groove in the underside of the lock nut, thread the lock nut onto the bushing assembly. Be sure the O-ring remains in the groove before tightening the lock nut.

12. Using a $^{15}/_{16}$-inch open-end wrench, tighten the lock nut until it fully compresses the O-ring and makes good contact with the vehicle mounting surface. The groove's ridges on the bottom of the lock nut must make full contact with the unpainted metal surface of the vehicle.

13. Install the antenna element per the procedure in Section 6.2.4.

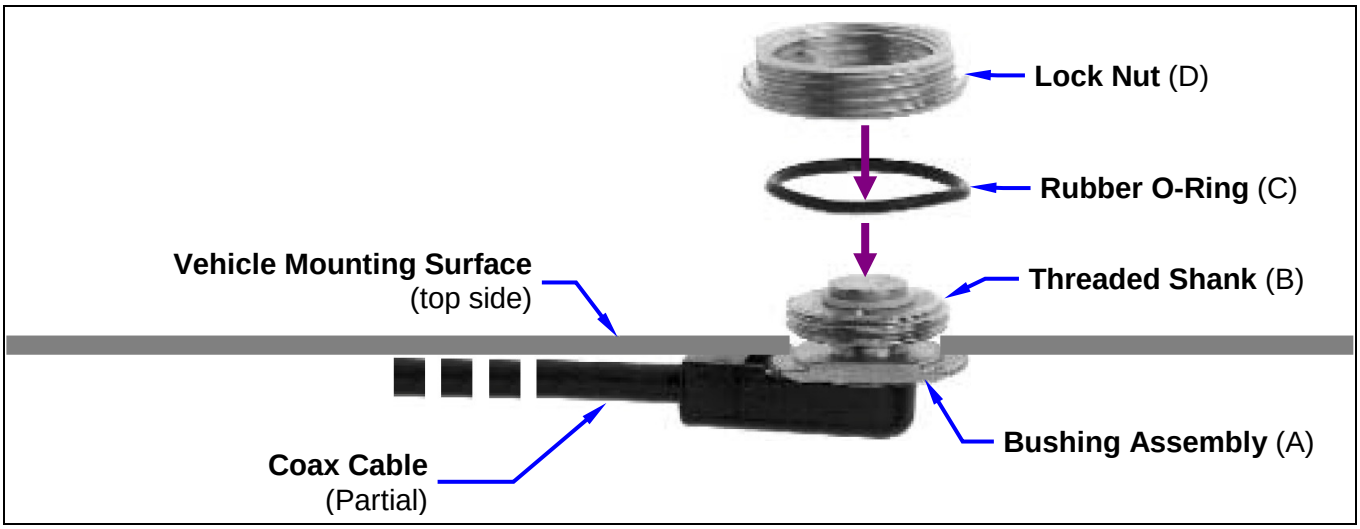


Figure 6-4: Installing a Standard ¾-Inch NMO Antenna Mount (e.g., AN-125001-001 or AN-125001-002)

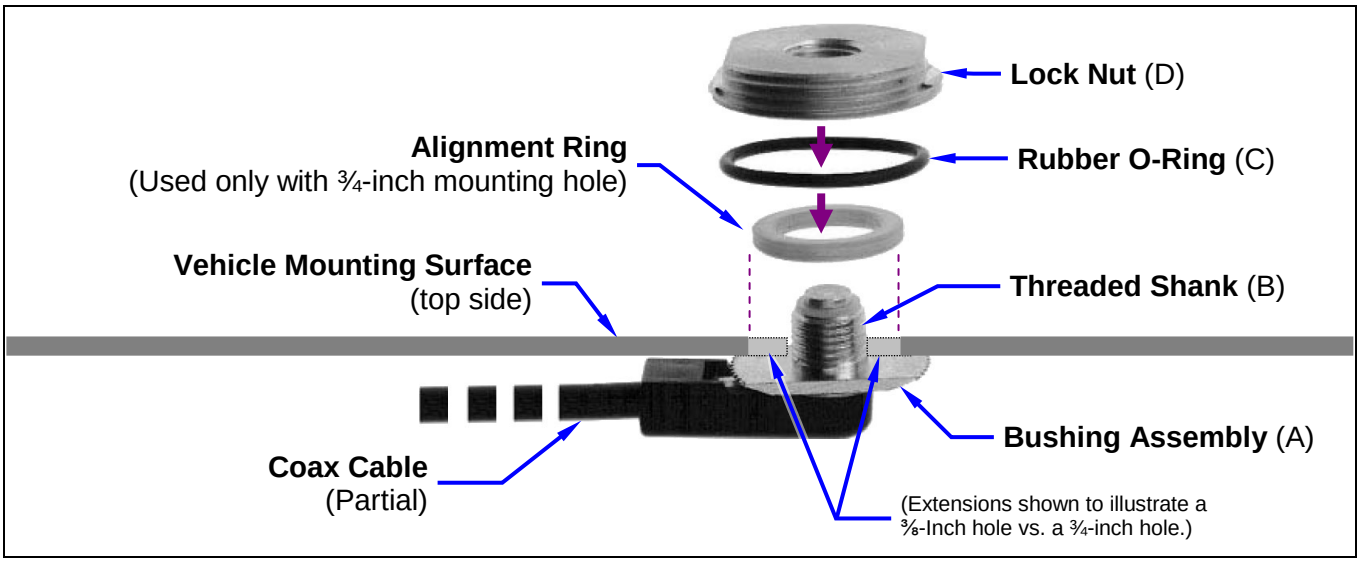


Figure 6-5: Installing a Thick-Roof NMO Antenna Mount (e.g., AN-125001-003 or AN-125001-004)

6.2.2 Installing NMO Magnetic Antenna Mounts AN-125001-007 and AN-125001-008

1. Thoroughly clean the bottom of the magnetic mount and the selected vehicle mounting surface by removing all dust, dirt, etc.
2. Carefully place the magnet mount onto the metal surface of the vehicle at the selected location. The coax cable exiting the mount's base should be orientated towards the point at which it will enter into the interior of the vehicle. Do not try to reposition it by sliding it on a painted metal surface.
3. Route the mount's coax cable to the radio location, passing it by the trunk lid's perimeter gasket, door perimeter gasket, etc., as necessary.
4. Install the antenna element per the procedure in Section 6.2.4.

CAUTION

To remove a magnetic antenna mount, hold it at the bottom of its base and tilt it at an angle to release the magnetic attraction force. **Do not pull on the mount's coax cable. Do not drag the mount across the mounting surface.**

6.2.3 Installing All Other Antenna Mounts

For any other type of antenna mount not covered in the previous sections, such as GPS combination antennas, install the mount in accordance with the installation instructions included with the mount.

6.2.4 Attaching NMO Antenna Elements

1. Clean the top surface of the NMO mount and the surface of the vehicle immediately around the mount.
2. Place the gasket included with the antenna element (not pictured in Figure 6-4 or Figure 6-5) around the mount and against the surface of the vehicle. If a lubricant or sealant was included with the gasket, apply it to the gasket before placing the gasket.
3. Apply the antenna element to the top of the mount and tighten it in a clock-wise direction (as viewing from the top). Use an appropriate wrench if required. Do **not** over-tighten.
4. Install a placard (not supplied) on the vehicle's dash panel, in accordance with the following **CAUTION**. Place the placard in plain view of the vehicle operator's position.

CAUTION

Before entering any automatic vehicle ("car") wash equipment, remove the antenna element from the antenna mount, and secure the element in a safe location inside the vehicle. This will prevent the wash equipment from damaging the element and/or mount. After exiting the wash equipment, thoroughly dry the top of the mount before re-installing the element.

5. Continue with the connection procedure presented in the next section.

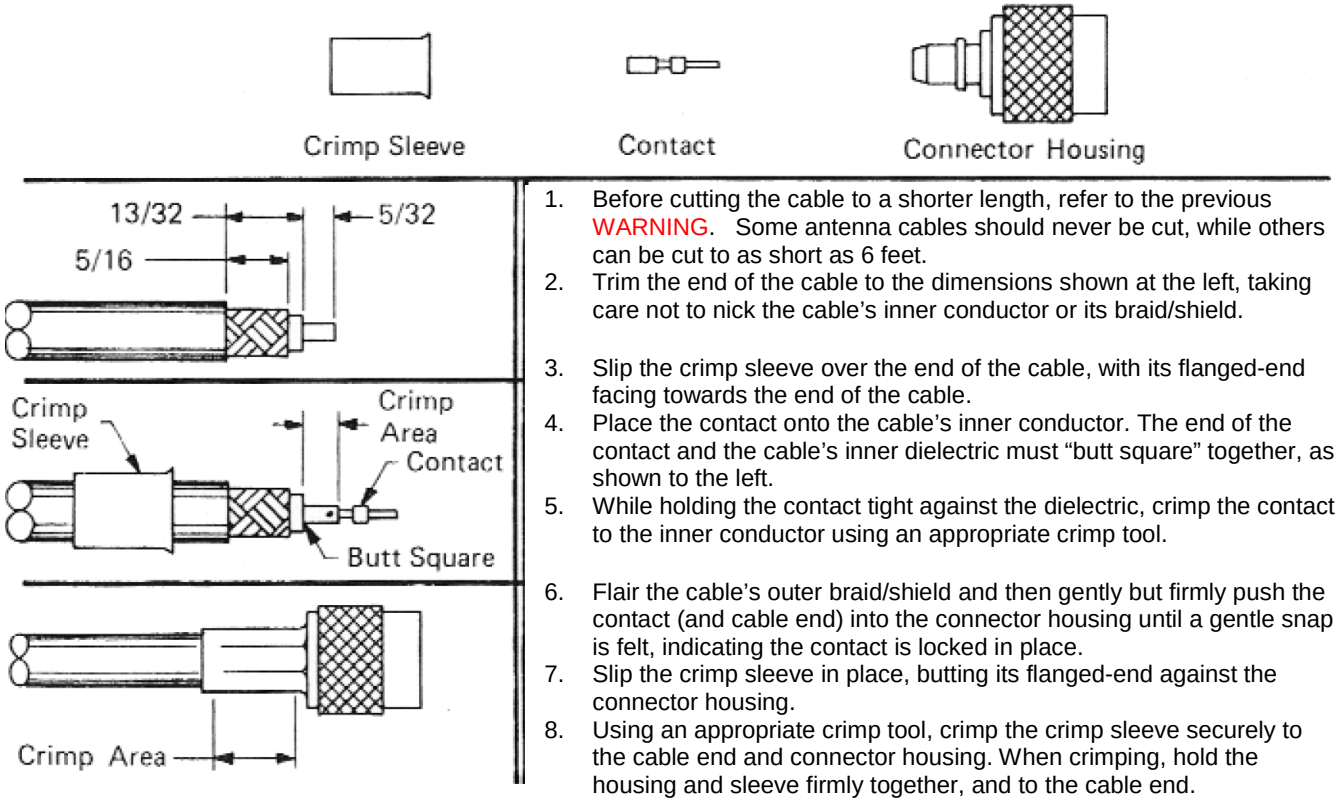
6.2.5 Installing the Coax Cable and TNC RF Connector

1. Route the coax cable from the antenna mount to the location where the mobile radio will be installed. Remove headliner panel, interior panels, etc., as necessary. The cable must be kept out of casual contact from persons within the vehicle. Tie and stow the cable as necessary to protect it from possible chafing. Observe and follow this **WARNING**:

WARNING

Do not cut an antenna cable any shorter than six (6) feet (1.83 meters), as measured from the base of the antenna mount to the TNC connector that mates to the radio.

2. Using an appropriate crimp tool, crimp the supplied TNC RF connector to the end of the antenna cable. For crimping instructions, see Figure 6-6 or the instructions supplied with antenna mount.
3. The antenna cable is connected to the radio's TNC receptacle-type (female) RF connector per a procedure presented later in this manual. The cable and its TNC connector must be protected from damage, dirt, and/or metal shavings which may be generated during the mechanical and electrical installation of the radio. Temporarily tying the connector and cable-end within a small plastic bag is recommended.



1. Before cutting the cable to a shorter length, refer to the previous WARNING. Some antenna cables should never be cut, while others can be cut to as short as 6 feet.
2. Trim the end of the cable to the dimensions shown at the left, taking care not to nick the cable's inner conductor or its braid/shield.
3. Slip the crimp sleeve over the end of the cable, with its flanged-end facing towards the end of the cable.
4. Place the contact onto the cable's inner conductor. The end of the contact and the cable's inner dielectric must "butt square" together, as shown to the left.
5. While holding the contact tight against the dielectric, crimp the contact to the inner conductor using an appropriate crimp tool.
6. Flair the cable's outer braid/shield and then gently but firmly push the contact (and cable end) into the connector housing until a gentle snap is felt, indicating the contact is locked in place.
7. Slip the crimp sleeve in place, butting its flanged-end against the connector housing.
8. Using an appropriate crimp tool, crimp the crimp sleeve securely to the cable end and connector housing. When crimping, hold the housing and sleeve firmly together, and to the cable end.

Actual Size; Dimensions are in Inches

(Made From VS-AN-025167-010 Rev. A)

Figure 6-6: Crimping Instructions for TNC RF Connector

NOTE

When performing the Performance Test procedures presented in Section 15, the following antenna elements must be field-tuned (trimmed/cut) for maximum performance/minimum reflection:

- Part number **AN-225002-003** (136 – 174 MHz, 3 dBd) — For length cutting information, see the instructions included with the element.
- Part number **AN-225002-004** (136 – 174 MHz, 2.4 dBd) — For length cutting information, see the instructions included with the element.
- Part number **AN-225006-001** (132 – 960 MHz, 0 dBd) — For length cutting information, see the charts in Figure 6-7 on page 32, and/or the instructions included with the element.

Other antenna elements used with the radio are factory-tuned and therefore they do **not** require tuning in the field.

6.2.6 Install GPS Antenna (Required Only if Radio has GPS Receiver Option)

If the XG-25M radio is equipped with the GPS receiver option, the GPS receiver requires connection to an externally-mounted GPS antenna. The GPS antenna must be kept at least six (6) inches away from any other antenna mounted on the vehicle and it must have at least six inches of surface ground plane beneath it.

NOTE

Connection to a GPS antenna is only required if the (optional) GPS receiver is installed in the radio and if its functions will be utilized/required. Refer to Section 12 for additional information.

NOTE

A combination ("combo") antenna kit includes a GPS antenna built into the base of the mobile antenna. Refer to Table 4-4 (page 15) for available combo antennas.

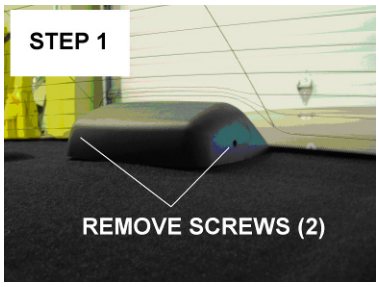
6.2.6.1 General Installation Procedure

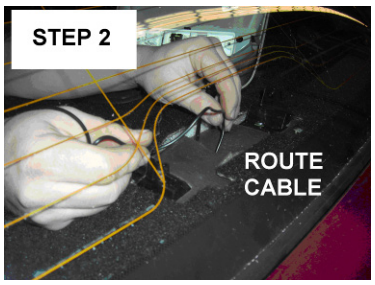
1. After selecting a mounting location, refer to the antenna manufacturer's mounting and testing instructions for installation guidance. Install the antenna in accordance with these instructions. If necessary, contact the Technical Assistance Center. See page 12 for TAC contact information. **Do not alter the GPS antenna cable length; tie and stow excess cable as necessary.**
2. Route the cable from the antenna base to the location of where the radio will be installed. Remove headliner panel, interior panels, etc., as necessary. The cable must be kept out of casual contact from persons within the vehicle. Tie and stow it as necessary to protect it from possible chafing.
3. The antenna cable is connected to the radio's SMA receptacle-type (female) RF connector per a procedure presented later in this manual (i.e., procedure on page 58). The cable and its (male) SMA connector must be protected from damage, dirt, and/or metal shavings which may be generated during the mechanical and electrical installation of the radio. Temporarily tying the connector and cable-end in a small plastic bag is recommended.

6.2.6.2 Installation Procedure for Inside-Rear-Deck Mounting in Ford Crown Vic

The following GPS antenna installation procedure is recommended for inside-rear-deck mounting of GPS receive-only antennas, such as AN-025187-001 or AN-025187-003, in a Ford Crown Victoria. Other vehicle makes/models may use similar installation scenarios:

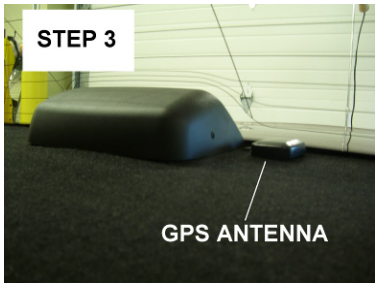
1. Carefully remove the center rear brake light assembly by removing the screws on each side of the assembly. Lift and set it aside.
2. Route the cable from the GPS antenna through the rear deck, next to the cable assembly for the rear brake light.





3. Position the antenna near the rear glass.

   For an antenna that is not a magnetic-mount, secure it to the deck near the rear glass in accordance with the instructions provided with the GPS antenna.



4. Reassemble the rear deck brake light assembly while using caution to not to crimp/pinch the GPS coaxial cable. A small relief notch may need to be cut in the housing of the light assembly cable passage.
5. The cable and its (male) SMA connector must be protected from damage, dirt, and/or metal shavings which may be generated during the mechanical and electrical installation of the radio. Temporarily tying the connector and cable-end in a small plastic bag is recommended.
6. Route the cable to the area near where the radio will be installed. Tie and stow the antenna cable as necessary to prevent cable chafing or damage from moving items, like the trunk lid's hinges and springs. The antenna cable is connected to the radio's SMA receptacle-type (female) RF connector per a procedure presented later in this manual (i.e., procedure on page 58).

NOTE

Do **not** alter the length of cable from the GPS antenna. The SMA connector on the end of the antenna cable is not field-replaceable.

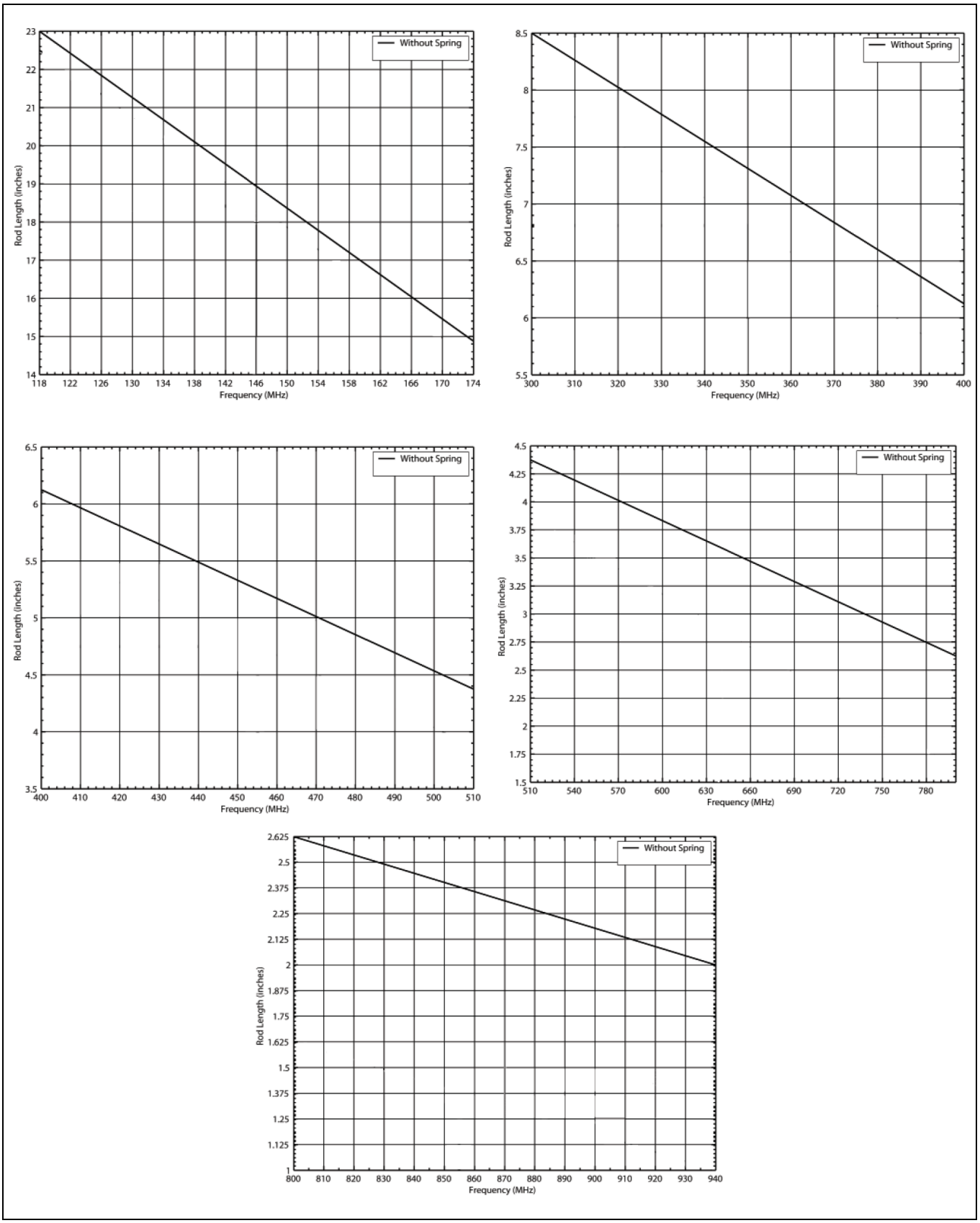


Figure 6-7: Cutting Charts for Antenna Element AN-225006-001

7 RADIO INSTALLATION

7.1 MOUNTING THE RADIO

7.1.1 General Information

The Mounting Bracket Kit for the radio includes a heavy-gauge steel U-shaped mounting bracket. The radio should be attached to a mounting surface using this bracket. The bracket can be mounted above or below the radio. Kit contents are shown in Figure 7-2, and bracket dimensions are shown in Figure 7-3.

Both the radio and the mounting bracket have multiple holes in both sides for adjusting the radio within the bracket. The radio has four (4) threaded mounting holes, two (2) per side, and the mounting bracket has twelve (12) corresponding holes, six (6) per side. The radio must be secured to the bracket using the four M5 socket-head screws included in the Mounting Bracket Kit (2 screws per side). The radio can be positioned straight in the bracket (i.e., parallel with the bottom surface of the bracket), or it can be tilted up or down at an angle of approximately 15 degrees maximum. When positioned straight in the bracket, the radio extends approximately 2 inches (5 centimeters) from the front and rear edges of the bracket. In the rear, additional clearance must be included for cables.

- **Front-Mount Radio:** For a front-mount radio installation, the design allows a front-to-rear tilting of the radio within the bracket for the best viewing angle, and a front-to-rear position offset. Typically, either titling, or offset, or both, may be applied to a front-mount radio installation to position the front-mount radio for best operator viewing and control access.
- **Remote-Mount Radio:** For a remote-mount radio installation, the radio bracket tilt and the offset design are generally not put to use, as neither would be necessary. The radio is simply centered within the bracket and parallel with the mounting surface.


NOTE

The optional CH-25 Remote-Control Conversion Kit includes a mounting bracket for the control head. That bracket allows the head's tilt to be adjusted for best operator viewing and control access. Control head installation procedures are included in Section 8 that begins on page 43.

Observe the follow with respect to clearances at the front of the radio:

- **Front-Mount Radio:** For a front-mount radio, the area directly at the front of the radio must be completely clear of all objects (e.g., gear shift, other radio equipment, etc.) so the operator can easily access and view the radio.
- **Remote-Mount Radio:** For a remote-mount radio, the area directly at the front of the radio must have clearance for the installation and removal of the Remote Control Cable. At least 6 inches (15.2 centimeters) of space is recommended.

The radio's mounting bracket must be attached to a secure metal surface that meets or exceeds the minimum 1/16-inch-thick steel sheet metal requirement in accordance with the following **WARNING**. For example, it can be attached directly to the bottom of the dash if the gauge of the sheet metal is high and the surface is firm and flat, or it can be attached to the transmission hump, etc., if a mounting wedge (not included) is utilized. The radio weighs approximately 6 pounds (2.7 kilograms).

WARNING

At a minimum, the mounting surface should be 16-gauge (approximately 1/16-inch thick) steel sheet metal. Mounting to plastic or other material with low tensile and shear strength could lead to an unsafe and/or failed mounting condition, turning the radio and its mounting bracket into a projectile during a high-shock incident such as a motor vehicle accident. If the selected mounting surface does not meet the minimum 16-gauge steel sheet metal requirement, the surface should be reinforced with a metal backing plate (not supplied) or it should be reinforced using some other approved mounting method.

CAUTION

In addition to improving safety of the installation, firm mounting also prevents unreasonable vibration that could damage the radio, adversely affect transceiver performance and/or cause its cable connections to loosen. An improperly mounted radio may experience degradation in the quality of voice and data communications.

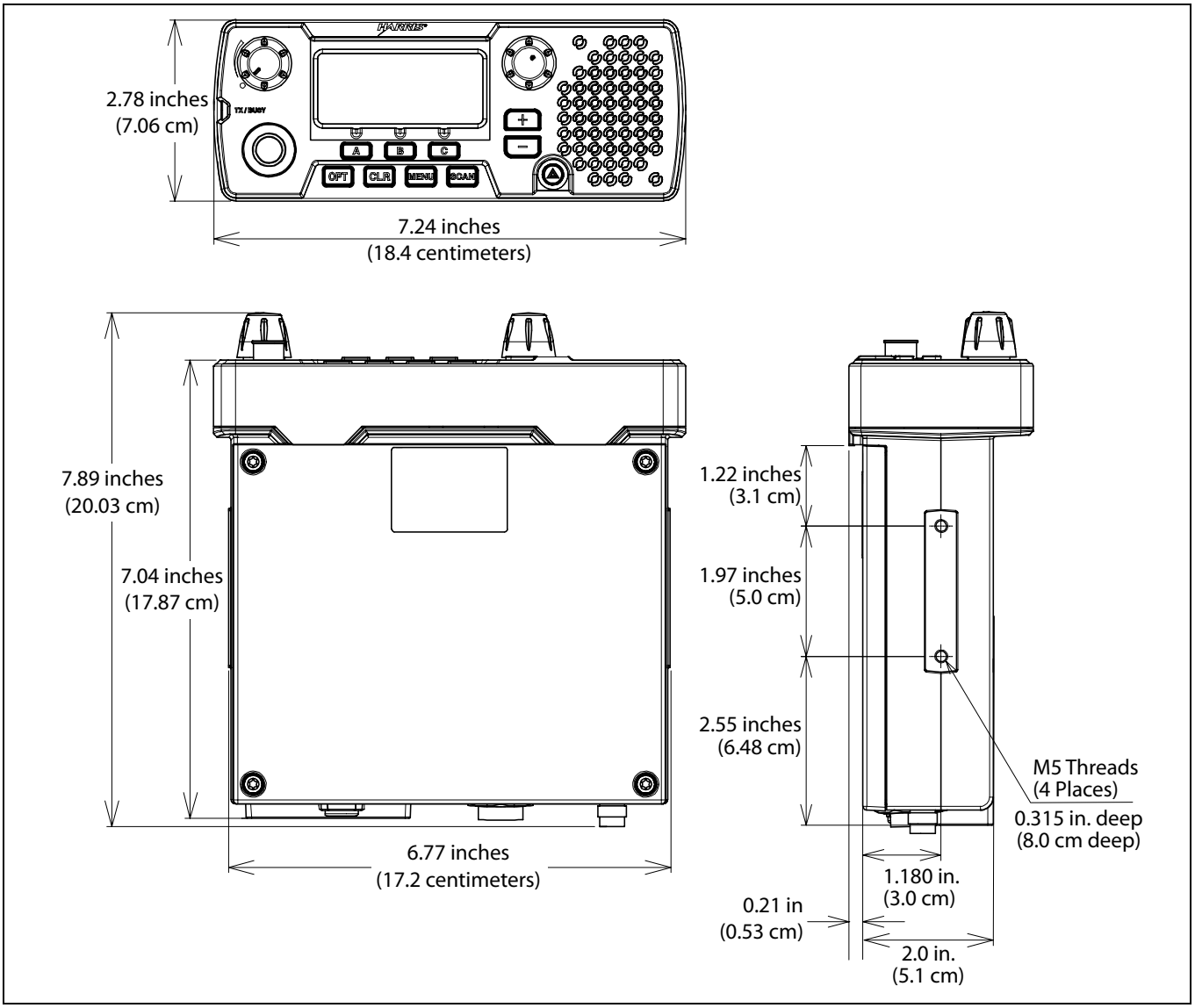


Figure 7-1: XG-25M Front-Mount Radio Dimensions (less Bracket and Cables)

7.1.2 Remote-Mount Radio Installations Only: Application of the CH-25 Remote-Control Conversion Kit

For a remote-mount radio installation, the CH-25 Remote-Control Conversion Kit must be applied to the existing front-mount radio, to convert it to a remote-mount radio with a separate control head. To accomplish this, complete the procedures presented in the kit's *Product Manual*, publication number 14221-1510-4450. That manual is included with the kit.

Instructions included in Product Manual 14221-1510-4450 include procedures on updating the radio and control head software/firmware if necessary. The manual also includes instructions on removing the control head from the existing front-mount radio, attaching the radio's remote interface to the front of the radio thus converting it to a remote-mount radio, and attaching the control head's remote interface to the back of the control head.

After completing the conversion, continue with the radio's mounting bracket installation.

7.1.3 Mounting Bracket Installation

The radio's mounting bracket is included with the Mounting Bracket Kit 14015-0201-01. Kit contents are shown in Figure 7-2. This kit is Item 1 listed in Table 4-2 (page 13).

When selecting a mounting location for the radio, verify sufficient clearance can be maintained around the radio for installation and service access. A minimum clearance of approximately four (4) inches (10 centimeters) is recommended at the rear, left and right sides of the radio. As previously stated, for a front-mount radio, the area directly at the front of the radio must be completely clear of objects so the operator can easily access and view the radio's front panel. For a remote-mount radio, clearance at the front of the radio must be sufficient for removal and attachment of the Remote Control Cable.

As shown in Figure 7-3, the bracket is both left-to-right and front-to-rear symmetrical. It has eleven (11) holes for securing it to a mounting surface. At least four (4) of these holes must be used to secure the bracket to the mounting surface. Four 1-inch-long #10-32 stainless-steel self-tapping screws are included in the Mounting Bracket Kit for this purpose. However, some other type of hardware (not supplied) may be used, such as #10-32 stainless-steel self-locking hardware (i.e., machine screws with washers and locking nuts), or self-drilling screws. Self-drilling screws such as "TEK" screws do not require drilling of a pilot hole prior to installation. Do **not** use common self-threading sheet metal screws because they will loosen over time with vehicle vibrations.

The following mounting procedure is recommended:

1. Determine the best radio-to-bracket position and angle by test-fitting the radio into the mounting bracket at the selected vehicle mounting location. Slide the radio between the sides of the bracket and temporarily secure it to the bracket with several of the M5 socket-head screws from the bracket kit. Make any positional adjustments as necessary.
2. At the rear of the radio, verify sufficient clearance is available for cables and service access.
3. If the mounting surface is not flat (such as the top of a transmission hump), construct a suitable mounting wedge as necessary, and attach the wedge to the surface using an approved attachment method. Never mount the bracket directly to a non-flat surface.
4. On the mounting surface, mark the selected location for the bracket, and then remove the radio from the bracket.
5. Clean and remove any foreign material from the mounting surface.

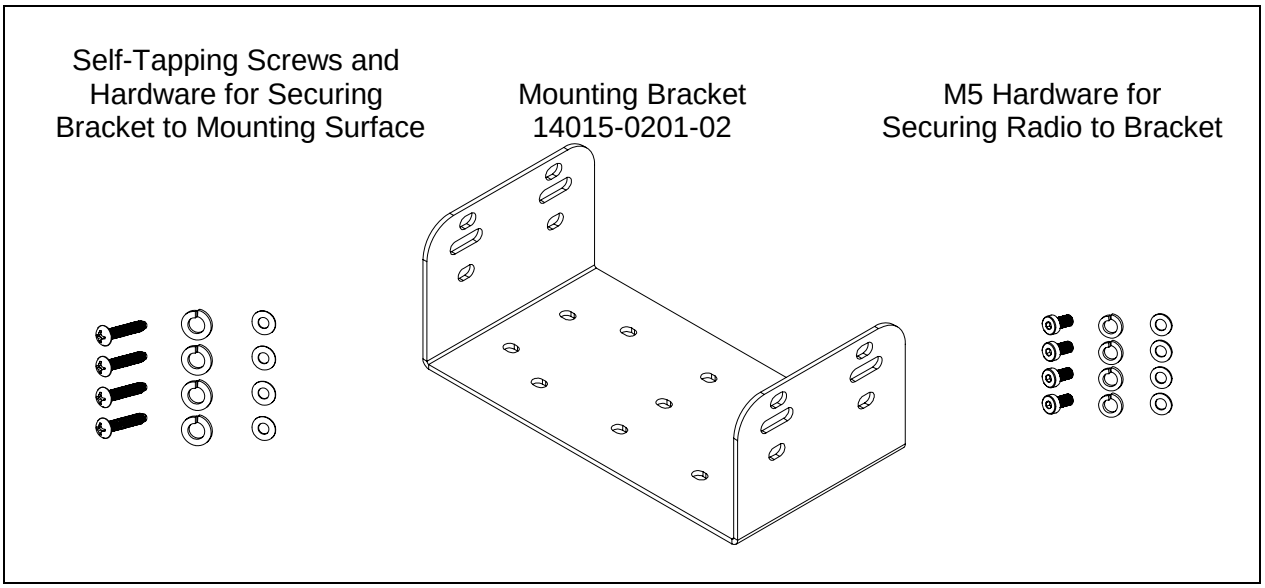


Figure 7-2: Mounting Bracket Kit 14015-0201-01

6. Using the bracket as a template, and/or the dimensional information shown in Figure 7-3, mark and drill at least four (4) mounting holes into the mounting surface as required per the type of hardware used.

CAUTION

Before drilling holes and/or installing mounting screws, verify these operations will not damage or interfere with any existing vehicle component (the fuel tank, a fuel line, the transmission housing, existing vehicle wiring, etc.). Always check to see how far the mounting screws will extend below the mounting surface prior to installation. Always deburr drilled holes before installing screws.

7. Temporarily remove the bracket and deburr all of the newly drilled holes.
8. If necessary, apply an approved paint or rust-inhibitor at the holes in the mounting surface.
9. Set the bracket back into place.
10. Install and tighten the mounting screws/hardware.
11. Verify the bracket is firmly secured to the mounting surface. A secure mount prevents unreasonable vibration, which could damage the radio and/or cause its cable connections to loosen.
12. If the rear of the radio is easily accessible when the radio is positioned in the selected position within the bracket, it is recommended that the radio be temporarily inserted into the bracket. Otherwise, do not mount the radio into the bracket at this time, because several cable connections must be made at the rear of the radio.

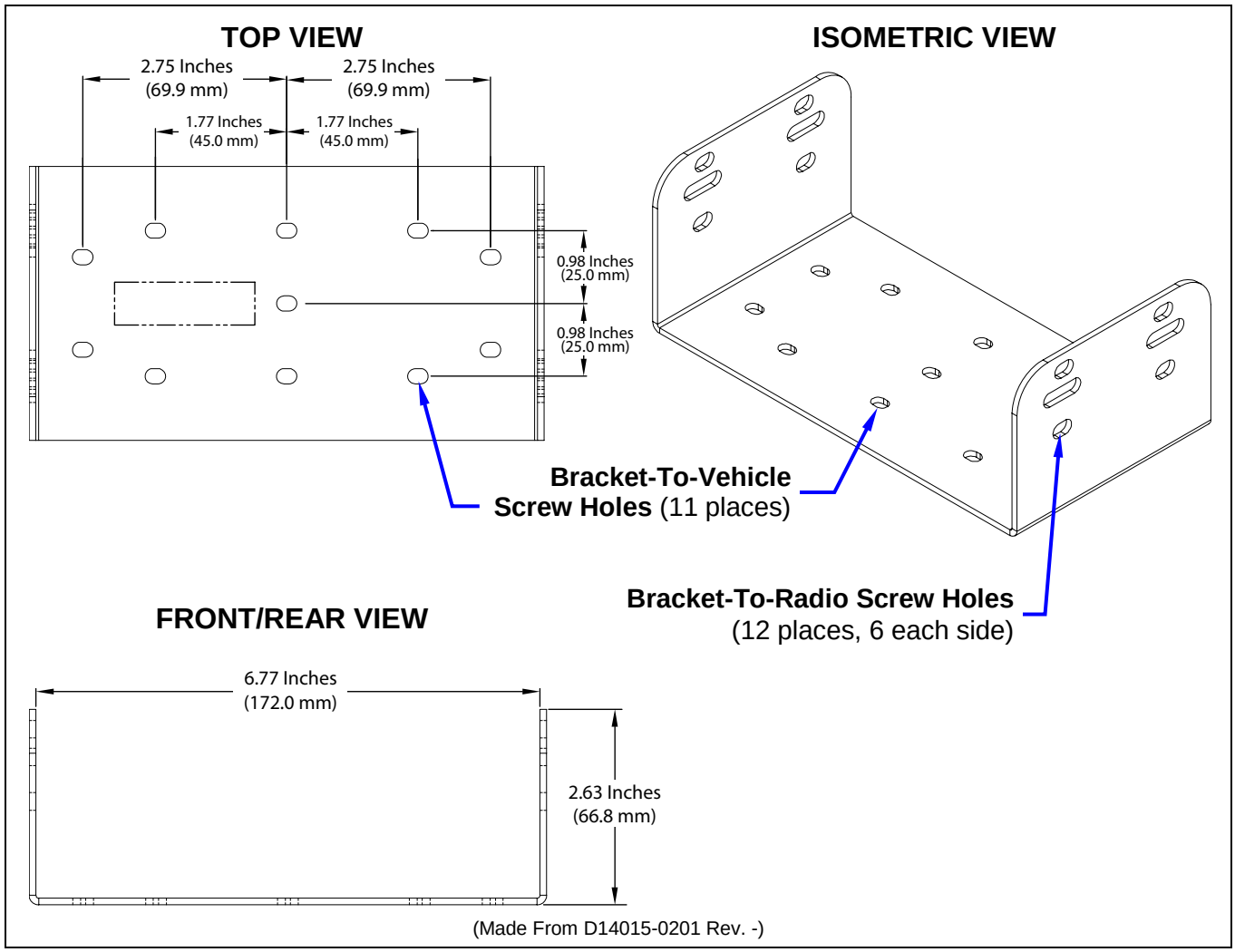


Figure 7-3: Mounting Bracket 14015-0201-02 Dimensions (Radio Not Shown)

7.1.4 Inserting the Radio into the Mounting Bracket

The radio should now be inserted into the mounting bracket according to this procedure:

1. Lay the radio into the mounting bracket with the front of the radio facing in the correct direction (usually towards the rear of the vehicle).
2. Secure the radio to the bracket using the four (4) M5 x 10 mm stainless-steel socket-head screws, flat washers, and lockwashers. Each screw should have a lockwasher against the screw head and a flatwasher against the mounting bracket. This hardware is included with the Mounting Bracket Kit. The kit's contents are shown in Figure 7-2. The kit is Item 1 listed in Table 4-2 (page 13).
3. Tighten all screws using a 3-millimeter hex key wrench until each lockwasher is fully compressed and the radio is firm and flush between the brackets.
4. Check the mounting area for proper clearance for cable service looping and for air circulation, plus an area to secure and rest the excess cable lengths.

NOTE

Proper mounting is one factor that ensures optimal radio performance. An improperly mounted radio may experience degradation in the quality of voice and data communications.

7.2 DC POWER CABLE INSTALLATION

7.2.1 Overview of On/Off Power Wiring Configurations

The following power wiring configurations are supported:

- **Radio and control head turn on and off automatically with vehicle's ignition switch/key** — This configuration allows the on/off state of the vehicle's ignition switch/key to control the on/off power state of the radio and control head. The white wire of the radio's DC Power Cable is connected to a fused switched power source, typically identified as vehicle "Accessory" power. This source must switch on (up to positive (+) battery voltage potential) when the vehicle's ignition switch/key turns on, and it must switch off (to near zero volts) when the ignition switch/key turns off. The required fuse rating is 3 amperes. When using this configuration, the on/off/volume control must be left in the **on** position for automatic power-up/down to function properly.
- **Radio and control head turn on and off with a manual switch** — This configuration is used when, for example, the radio and control head have to remain on even when the ignition key must be removed from the vehicle and a separate on/off switch is acceptable. The white wire of the radio's DC Power Cable is connected to one side of a manually-controlled switch, and the other side of this switch is connected to unswitched and fused vehicle power. The required fuse rating is 3 amperes. When using this configuration, the on/off/volume control must be left in the **on** position for automatic power-up/down to function properly.
- **Radio and control head turn on with its on/off/volume control ("hot wired")** — This configuration allows radio and control head on/off power control only via its on/off/volume control. It may be desired if, for example, the radio and head have to remain on even when the ignition key must be removed from the vehicle and a separate on/off switch is not desired and/or not acceptable. The white wire of the radio's DC Power Cable must be connected to unswitched and fused vehicle power. The required fuse rating is 3 amperes.

Unlike some remote-mount mobile radio installations, a remote-mount XG-25M radio installation's control head does not require its own DC power cable and fuse (i.e., separate from the radio). The head receives DC operating power from the radio via the Remote Control Cable.

In all of the above listed cases, the radio's main DC power input (red wire) must be connected through an in-line fuse to unswitched vehicle DC power. The red wire must be connected to raw battery power (positive battery terminal) via the supplied fuse.

7.2.2 DC Power Cable and Main Fuse Holder Installation

The radio's DC Power Cable has a 3-pin connector, a 20-foot red wire (for the main power connection), a 20-foot white wire (for the switched power source connection), and a 4-foot black wire (for the ground connection). It is supplied with waterproof fuse holders, two AGC-type fuses, and non-insulated ring terminals. The following installation procedures are recommended:

7.2.2.1 Black Wire Connection (Ground Wire)

1. Connect the radio's DC Power Cable to the radio by mating its 3-pin connector to the radio's 3-pin power cable connector as follows: Visually align the key and firmly push and turn the outer locking ring clockwise until it stops. A click will be sensed to confirm proper mating.

2. Prepare to connect the cable's black wire to vehicle ground by locating an area of vehicle metal within approximately two (2) feet of the radio. This surface **must** have a solid and stable connection to vehicle ground. If not, add grounding strap(s) as necessary.
3. Strip the area of any paint or dirt to expose a bare metal surface, approximately ¾-inch square.
4. Drill a hole in the approximate center of the bare metal surface, and deburr it. A ⅜-inch non-insulated ring terminal is supplied with the cable to make this ground connection. Therefore, hole diameter should be appropriate for the utilized grounding screw/bolt size and type used to connect the ring terminal to the bare metal surface. This hardware is not supplied.
5. Cut the black wire to the required length plus some additional length for a service loop, then strip insulation back approximately ¼-inch.
6. Crimp a ⅜-inch non-insulated ring terminal (supplied with the cable) to the end of the black wire.
7. Attach the ring terminal and black wire to the bare metal surface using stainless-steel self-locking hardware (i.e., machine screws with washers and locking nuts) or other appropriate hardware to ensure a reliable terminal-to-metal contact. Tighten securely.
8. Apply an approved paint or rust-inhibitor over the remaining exposed bare metal surface and around the ring terminal.

7.2.2.2 Red Wire and Main Fuse Holder Connection (Radio's Main Power Wire)

1. Continue installation of the radio's DC Power Cable by routing its 20-foot 10-AWG red wire to the location of the vehicle's battery (or its main DC bus bar or stud). Remove interior panels, door kick panels, etc., and route the wire through existing channels in the vehicle body as necessary. Protect the wire from possible chafing where necessary. Tie and stow the wire as necessary.


NOTE

Remote-Mount Radio — In a typical vehicle installation of a remote-mount radio, as a time-saving measure, the majority of the length of the Remote Control Cable between the remote-mount radio and the control head can be simultaneously routed together with the red and white wires of the radio's DC Power Cable. Also, the Option Cable from the back of the radio can also be simultaneously routed with most of the length of these two wires and the Remote Control Cable. Detailed installation procedures for the Remote Control Cable are included in Section 8.5 which begins on page 45.


CAUTION

Plan the routing of the 10-AWG red wire carefully, using an existing access hole in the vehicle's firewall if possible. Alternately, drill a new hole approximately ½-inch in diameter and install a small rubber grommet (not supplied) to protect the wire from chafing at the hole's sharp metal edge. **To prevent fumes from entering the passenger compartment, this hole/grommet/wire combination must also be sealed with a silicon-based sealer before completing the installation.**


CAUTION

Do **not** install any wiring or fuse holder over or in the near vicinity of the vehicle's engine. Excessive engine heat can cause permanent damage to these components and can lead to intermittent electrical connection to the battery.

Before making connections to the battery's positive post, carefully disconnect the battery's negative (ground) cable(s). This will prevent tools or other metallic objects which come in contact with the battery's positive terminal from shorting to vehicle ground, causing sparks or even a fire or an explosion! When disconnecting the negative cable(s), cover/insulate the positive post(s) if it is not already so a tool cannot short between the posts. Some vehicles, such as those with diesel engines have more than one battery; in this case, disconnect the negative cables at all batteries.

Radio fuses should not be installed until all wiring is complete. This will prevent the radio from powering up prematurely and/or causing an in-rush of current that could lead to shorting of the battery, sparks, or even fire.

2. Obtain the orange waterproof (HFB type) fuse holder included with the DC Power Cable.
3. **Observe and follow the previously presented WARNING!**
4. Cut the red wire to the required length for connection to the battery's positive (+) battery terminal (or the main DC bus bar or stud).
5. Prepare to splice the fuse holder into the red wire by cutting it again, at approximately three (3) to six (6) inches from the end.
6. Strip all three (3) wire ends back approximately ⅜-inch, place a fuse holder shell on each wire, and securely crimp a fuse holder terminal to each wire end. Before crimping, verify fuse holder shells are oriented in the correct directions (i.e., with each large end towards the wire end).
7. Label this fuse holder and red wire appropriately (e.g., "VHF Radio Main Power: 15-AMP FUSE").
8. **Do NOT install a fuse into the fuse holder at this time.**
9. Crimp an appropriate electrical terminal to the short red wire. A corrosion-resistant ⅜-inch ring terminal is included with the cable for this purpose, but another size corrosion-resistant terminal type (not supplied) may be used if required.
10. Connect the ring terminal directly to the battery's positive post (or if present, to a stud on the battery's main/non-switched power distribution terminal block).

7.2.2.3 White Wire Connection

A review of the information presented in Section 7.2.1 (page 38) may be beneficial at this time. As required per the chosen power-up configuration, connect the white wire by following one of the three procedures presented in the respective sub-section that follows.

7.2.2.3.1 Radio and Control Head Turn On and Off with Vehicle's Ignition Switch/Key

With this wiring configuration, the radio and control head automatically turn on and off with the vehicle's ignition switch/key. The white wire is sometimes referred to as the "white ignition switch wire" or the "ignition sense input wire." In this configuration, the white wire connects to a switched power source, typically identified as "Accessory" power, that switches on and off with the vehicle's ignition switch/key. When using this configuration, the on/off/volume control must be left in the **on** position for automatic power-up/down to function properly.

NOTE

The white ignition sense wire must be connected to a fused power source that switches from approximately zero volts to approximately +13.6 volts when the vehicle's ignition switch/key is turned from the OFF position to the ACCESSORY and RUN positions. Use of a switched power source that is subject to voltage changes as a result of other actions, such as opening a vehicle door, may result in undesirable radio power cycles.

1. Locate the vehicle's switched ignition or "Accessory" power connection point that will be used for the switched ignition 12-volt DC power source. This point is typically located at or near the vehicle's fuse panel. It may be necessary to consult the vehicle manufacturer's wiring diagram.
2. Route the white wire of the radio's DC Power Cable from the back of the radio to the area near this connection point. Protect the wire from possible chafing as necessary.
3. Obtain the other waterproof (HFB-type) fuse holder included with the radio's DC Power Cable.
4. Cut excess length from the white wire and splice the fuse holder into it, near the location of the connection point.
5. Using an appropriate electrical terminal, connect the white wire to the switched power connection point. An open-barrel spade terminal is included with the cable for this purpose, but another type of terminal (not supplied) may be used as required.
6. Obtain the 3-amp AGC-type fuse included with the cable, and install it into the fuse holder.
7. Tie and stow all wiring as necessary so it remains out of the way of casual contact and wire chafe is avoided.

7.2.2.3.2 Radio and Control Head Turn On and Off with a Manual Switch

With this wiring configuration, the radio and control head are manually turned on and off via an on/off switch mounted separately from the radio and head, not through the vehicle's ignition switch/key. This configuration is used when, for example, the radio/control head must remain on even when the ignition key must be removed from the vehicle and a separate on/off switch is acceptable and/or required. In this configuration, the white wire connects to a fused switched power source such as that provided by a toggle switch mounted on the vehicle's dash panel. When using this configuration, the on/off/volume control must be left in the **on** position for automatic power-up/down to function properly.

1. Route the white wire of the radio's DC Power Cable from the back of the radio to an area near the location of the panel-mounted on/off switch. Protect the wire from possible chafing as necessary.
2. Cut a short section (6 to 8 inches) off the end of the white wire and strip the ends.
3. Obtain the other waterproof (HFB-type) fuse holder included with the radio's DC Power Cable, and crimp one half of it to one end of the short section of wire.
4. Using an appropriate electrical terminal, connect this short white wire to unswitched 12-volt DC power source at or near the vehicle's fuse box.
5. Cut another section of white wire from the cable. This wire must be long enough to reach from the fuse holder to the location of the panel-mounted on/off switch.
6. Strip one end of this wire and crimp the other half of the waterproof fuse holder to this wire end.
7. Strip the other end of this wire and, using an appropriate electrical terminal, connect it to the common terminal of the switch.
8. Connect the white wire of the power cable to the load (switched) side of the switch.
9. If not already, mount the switch to the vehicle's dash panel, or other customer-selected location.

10. Obtain the 3-amp AGC-type fuse included with the cable, and install it into the fuse holder.
11. Tie and stow these wires as necessary so they remain out of the way of casual contact and wire chafe is avoided.
12. Label this power switch accordingly. For example: "**RADIO ON/OFF**."

7.2.2.3.3 Radio and Control Head are "Hot Wired"

In the "hot-wired" configuration, the radio and control head are turned on and off only by the head's on/off/volume control. In this configuration, the white wire must be connected to **unswitched and fused 12-volt** vehicle power. Follow the procedure presented in Section 7.2.2.3.1, except connect the white wire to **unswitched** battery power instead of switched ("Accessory") power. Be sure to fuse this connection with the provided in-line fuse holder and 3-amp AGC fuse.

8 CH-25 REMOTE CONTROL HEAD INSTALLATION

NOTE

Procedures in this section must be performed only for a remote-mount radio installation.

For a front-mount radio installation, advance to Section 9 or 10 now.

8.1 APPLICATION OF THE REMOTE-CONTROL CONVERSION KIT

Before beginning vehicle installation of the CH-25 control head, the CH-25 Remote-Control Conversion Kit must be applied to the front-mount radio to convert it to a remote-mount radio with a separate control head. To accomplish this, complete the procedures presented in the kit's *Product Manual*, publication number 14221-1510-4450.

Instructions included in that manual include procedures on removing the control head from the existing front-mount radio, attaching the radio's remote interface to the front of the radio thus converting it to a remote-mount radio, and attaching the control head's remote interface to the back of the control head.

8.2 REFLASHING THE RADIO (IF REQUIRED)

CAUTION

It is critical that the correct minimum version of firmware is loaded into the front-mount XG-25M mobile radio prior to starting the physical conversion/separation process. A remote-mount XG-25M will not recognize the remote-control CH-25 head and the two will be completely non-functional with an older firmware version. Refer to *Product Manual* publication number 14221-1510-4450 for complete details. That manual is included with CH-25 Remote-Control Conversion Kit DM-ZN9Z

8.3 INSTALLING THE REMOTE-MOUNT RADIO

After completing the procedures in *Product Manual* 14221-1510-4450, install the remote-mount radio into its mounting bracket by following the procedure in Section 7.1.4 (page 37).

Also connect/re-connect the 3-pin connector of the DC Power Cable to the 3-pin power connector on the rear of the radio. The respective cable installation procedure are included in Section 7.2 (page 38).

8.4 CONTROL HEAD MECHANICAL INSTALLATION

After the CH-25 Remote-Control Conversion Kit is applied and the radio is installed into its mounting bracket, continue by installing the control head, as described in the following subsections:

8.4.1 Selecting the Mounting Location

When selecting a location for the control head, first review and observe the safety and operator-convenience related information presented in Section 5.1 on page 17. Always consider and include clearance for the microphone's connector that must mate to the mic connector on the front panel of the head, and clearance for the connector of the Remote Control Cable's that mates to the connector on the rear panel of the head. The control head can be mounted in, under, or on top of a mounting surface (typically the vehicle's dash) as space permits.

The size and weight of the control head necessitate less stringent mounting requirements than the radio. However, like the radio, the control head must be mounted to a mechanically-rigid surface. It must not vibrate when the vehicle is in motion and it must remain stable during normal operations by a radio operator (i.e., button presses, knob rotation, excessive tugs on the mic cord, etc.). If the control head is

mounted to a plastic or similar-type dash panel, either fender washers or a field-fabricated metal backing plate should be utilized on the opposite side of the panel from the bracket.

8.4.2 Installing the Mounting Bracket and Control Head

Follow this procedure to mechanically install the control head's mounting bracket and attach the head to it:

1. Obtain the mounting bracket from the conversion kit. The bracket is illustrated in Table 4-3 on page 14. Also, Figure 8-1 on page 44 shows the bracket and a remote-mount control head.

NOTE

The control head can be attached above its mounting surface, like on the top of a dash panel. In that case, the bracket is located below the head, as shown in Figure 8-1. Alternately, the head can be attached below its mounting surface, such as underneath a dash panel. In that case, the bracket is located above the head.

Figure 8-1: Control Head Mounting Bracket (shown positioned below head)

2. Using the mounting bracket as a template, mark and drill mounting holes into the mounting surface as required. When positioning the bracket, note that the chamfered edge-slots on each end of the bracket must face in the same direction as the control head's display will need to face. In a typical vehicle installation, this is towards the rear of the vehicle.

CAUTION

Before drilling holes and/or installing mounting screws, verify these operations will not damage or interfere with any existing vehicle component (the fuel tank, a fuel line, the transmission housing, existing vehicle wiring, etc.). Always check to see how far the mounting screws will extend below the mounting surface prior to installation. Always deburr drilled holes before installing screws.

3. If necessary, deburr the newly drilled holes.

4. Set the bracket back on the mounting surface, positioning it so its chamfered edge-slots are facing in the same direction as the head's display will need to face.
5. Install and tighten the mounting screws. Screws for mounting the bracket to the mounting vehicle's surface are not included, as all installations differ. Self-threading screws are recommended. Use of self-drilling screws may cause damage to some mounting surfaces, such as a plastic dash panel.
6. Verify the bracket is held firmly to the mounting surface. Firm mounting prevents unreasonable vibration, which could damage the control head and/or cause its cable connections to loosen. Bracket attachment must survive all expected radio operator actions such as hard button-press actions and excessive tugs on the mic cord.
7. Install the control head into the bracket by sliding the short pegs protruding from the left and right sides of the head into the chamfered edge-slots on each end of the bracket.
8. At each end of the bracket, start a socket-head cap (Allen) head screw with a flat washer by inserting the screw (with washer) through the arched hole in the bracket and then into the threaded hole in the side of the control head. This hardware is included with the Mounting Bracket Kit. Start both screws, with one washer each. Turn each screw in clockwise direction to start it into the threaded hole.
9. Tilt the head in the bracket to the required angle for best viewing by the operator at his/her normal position, and then fully tighten both screws using a 4-millimeter hex key (Allen) wrench. Recommended torque is 8.7 inch-pounds (10 kgf-cm). Do not over-tighten.

Each cap screw should not be installed/re-used more than eight (8) times, because thread locking strength may suffer after this number of re-installations. Replace the cap screws with new cap screws if their locking strength is in question and/or after exceeding eight (8) installations.

8.5 INSTALLING THE REMOTE CONTROL CABLE

Follow this procedure to install the Remote Control Cable:

1. Obtain Remote Control Cable 14015-0203-31. The cable is included in CH-25 Remote-Control Conversion Kit DM-ZN9Z. It is 30 feet (9.1 meters) long.
2. Connect one of the Remote Control Cable's 44-pin connector to the 44-pin connector on the front of the radio. Before connecting either connector, note the following:

   As illustrated in Figure 8-2, the cable of the Remote Control Cable exits each D-shaped connector of the cable in opposite directions with respect to the D shape of each connector. At one connector, it exits to the right and at the other connector, it exits to the left (assuming the D-shapes are orientated in the same direction as shown in the figure). Also, from an electrical stand-point, both connectors have identical pin-outs.

   As shown in Figure 8-3 on page 46, this allows the Remote Control Cable to be reversed (radio<>head) to reverse the left/right orientation of the cable in relation to the left/right sides of the radio and head. This may be advantageous for some installations where, for example, cable clearances are tight on one side of the radio and/or head, or cable routing and service loop routing benefits from one direction over another.

   Be sure to leave a service loop in the cable so when radio removal is necessary, movement will not be unnecessarily limited.

Figure 8-2: D-Shaped Connectors of Remote Control Cable

CAUTION

Always use a flat-blade screwdriver with a ¼-inch tip to tighten and loosen the jackscrews of these two connectors.

Do **not** exceed 6.0 inch-pounds of torque (6.9 kgf-cm) when tightening the jackscrews.

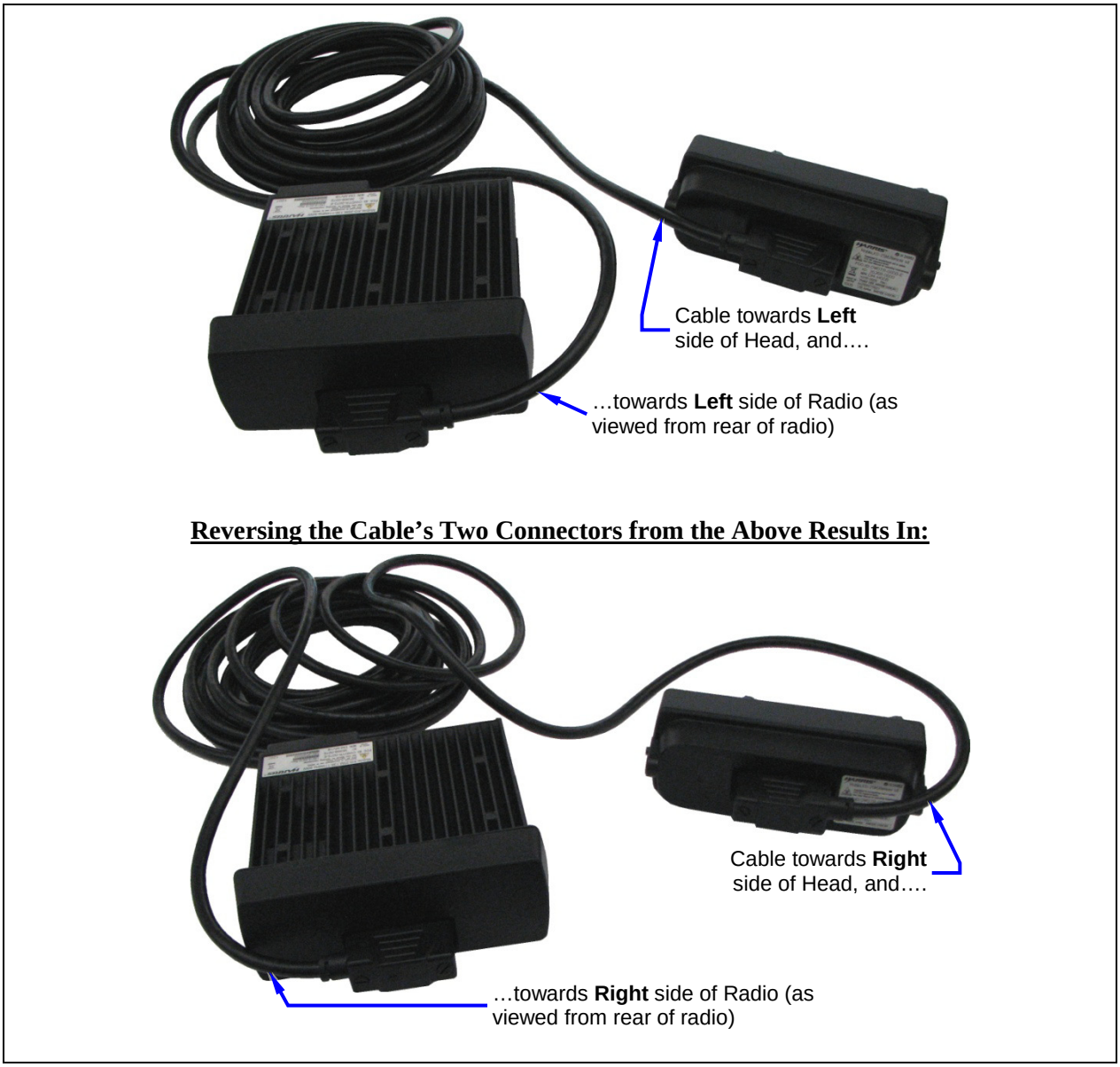


Figure 8-3: Left Side/Right Side Remote Control Cable Orientation

3. Route the cable through the vehicle's interior to near the location of the control head. Remove interior panels, door kick panels, etc., and route the cable through existing channels in the vehicle body as necessary.
4. Connect the other 44-pin connector of the Remote Control Cable to the 44-pin connector on the rear panel of the control head. Tighten the jackscrews securely, but do not over-tighten them. Be sure to leave a service loop in the cable so when control head removal is necessary, movement will not be unnecessarily limited.
5. Tie and stow all excess cable length so it will be out of casual contact with vehicle occupants. Be sure to protect it from wire chafe where necessary.
6. Re-install all previously removed interior panels, door kick panels, etc.

9 EXTERNAL SPEAKER INSTALLATION (OPTIONAL)

The XG-25M mobile radio has an internal (built-in) speaker in the front panel of the control head. This speaker's audio output power level is rated at 3 watts maximum. It is driven by an audio amplifier located inside the radio.

The radio has another internal speaker audio amplifier. This amplifier can drive an optionally-installed external speaker at up to 15 watts. When the external speaker is on/enabled, the radio's internal speaker remains off/disabled (muted).

If an external speaker is required, install it according to the below procedure. Total available cable length for an external speaker is approximately 10 feet (308 centimeters). Therefore, to include service loops in these cables, the speaker must be mounted within approximately 9.5 feet (290 centimeters) of the radio. This requirement assumes standard cabling is used.

1. Obtain Speaker LS102824V10. This speaker is rated for audio levels up to 20-watts.
2. Obtain Option Cable 14002-0174-08.
3. Select a location for the speaker that will allow for proper listening range with a moderate volume setting.
4. Install the speaker using the hardware and mounting bracket supplied with it. Route the speaker cable to the rear of the radio.
5. Connect the Option Cable to the DB-44 connector on the rear of the radio. Tighten the cable's two (2) jackscrews securely. See Section 11.1 for additional information on this cable.
6. Mate the Option Cable's 2-pin connector (identified P2) to the 2-pin connector on the end of the speaker cable. A mild click will be sensed to confirm proper mating.
7. Route the cables out of the way of casual contact. Tie and stow as necessary.


NOTE

To support the external speaker, the radio must have the EXT SPKR (External Speaker) function programmed to a radio button and/or menu. With this programming, the external speaker can be toggled on and off by pressing the button programmed with this function, or by selecting the function on a menu. When the external speaker is on, the radio's internal speaker remains off/disabled.

10 MICROPHONE ATTACHMENT

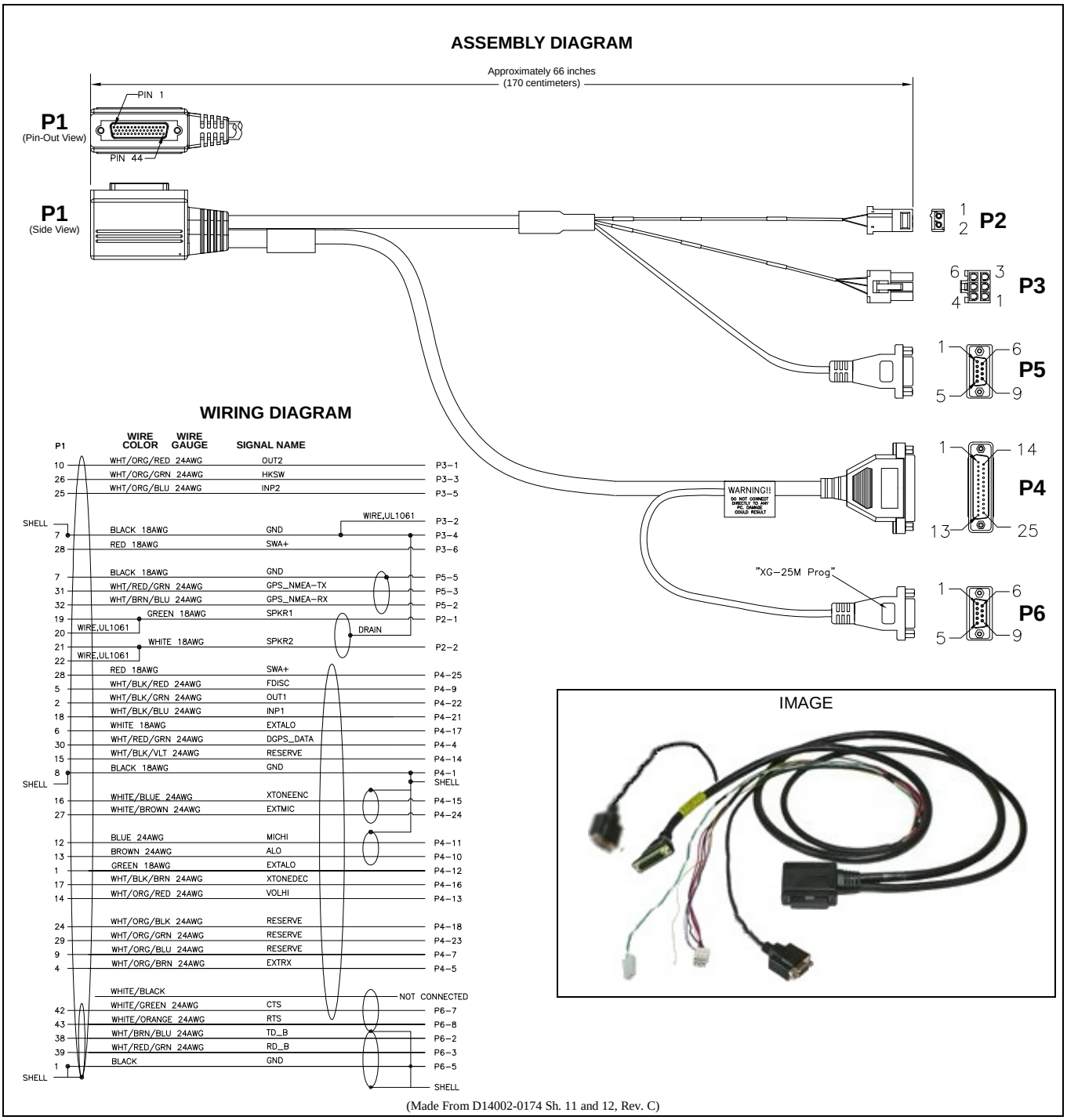
Each microphone for an XG-25M radio has a 12-pin connector that mates with the mic connector on the front panel of the radio's control head. A microphone clip is included with each microphone. The radio can be configured to provide a monitor function when the microphone is cradled in the clip. Connect the mic and install the clip as follows:

1. Position the mic's connector just in front of the radio's mic connector so it can engage straight into the mic connector. The small notch on the end of the mic's connector must be positioned straight up so it engages with the key in the connector of the radio.
2. Mate the two connectors by pressing them fully together. A click should be sensed when the connectors latch together.
3. Using the microphone clip as a template, drill mounting holes in the surface of the selected location.
4. Select a mounting surface location that has clearance for the mic when it is clipped to the clip, and then attach the microphone clip to the surface. Use self-locking hardware (i.e., machine screws with washers and locking nuts), self-drilling screws, or other appropriate hardware as necessary. Tighten securely. The microphones have integrated hookswitches. Therefore, the microphone clip does <u>not</u> need to be grounded.
5. Clip the microphone to the clip.

11 OPTIONAL CABLES

11.1 OPTION CABLE 14002-0174-08

Option Cable 14002-0174-08 connects to the 44-pin I/O connector on the rear of the radio. It breaks out into several smaller standardized connectors, allowing straightforward access to external interfaces provided by the radio. The cable is shown in Figure 11-1 below. The cable's 44-pin D-subminiature connector that mates with the connector on the rear of the radio is identified P1.



(Made From D14002-0174 Sh. 11 and 12, Rev. C)

Figure 11-1: Option Cable 14002-0174-08

CAUTION

Observe caution before connecting any external device to the radio via its 44-pin I/O connector. If an external device has its own DC power source/cable (i.e., if it is powered separately from the radio), both the radio **and** the external device must be properly grounded **before** connecting the two units and before making a positive (+) power connection to either unit. Otherwise, fuse(s) inside the radio may fail (open) and/or other equipment damage could occur.

Connector P2 is the cable's 2-pin connector that provided connections for an optional speaker. Connection is not required if only the radio's internal speaker will be used.

Connector P3, the cable's 6-pin connector, is a connector for basic accessories (e.g., hookswitch, etc.).

Connector P4, the cable's D-subminiature 25-pin connector, provides audio and data connections for optional equipment.

Connector P5, a D-subminiature 9-pin connector, provides NMEA-formatted GPS serial data connections for the external computer processing the NMEA-formatted GPS data received by the radio's internal GPS receiver. See Section 12 on page 57 for additional information. This is serial port A of the radio.

Connector P6 provides a serial data interface used for radio programming. Like P5, this is a D-subminiature 9-pin connector. This is serial port B of the radio.

Table 11-1: Option Cable 14002-0174-08 Interconnections

44-PIN I/O CABLE CONNECTOR P1 PIN	SIGNAL NAME	TO/FROM	DESCRIPTION
19	SPKR1	P2 pin 1	Speaker Audio Outputs 1 and 2 (differential). This output can be used to drive an optional external/remote speaker connected to the radio. Enable/Disable this and the radio's internal speaker via Radio Personality Manager (RPM). By default, only the internal speaker is enabled.
20			
21	SPKR2	P2 pin 2	
22			
10	OUT2	P3 pin 1	Digital Output 2 for auxiliary control. Open-collector, 10 milliamps / 16 volts maximum. External pull-up resistor needed if required by the external device's input during the high/off state. Use P3 pin 2 or 4 for ground. Configure via the "External Output Control Line 2" in RPM's External I/O dialog box. For example, an external logging recorder's record enable/disable input can be controlled by setting "External Output Control Line 2" to "Extern. Tx Indicator."
7	GND	P3 pins 2 & 4	Chassis Ground.
26	HKSW	P3 pin 3	Digital Input for Hookswitch. Active = Ground. Inactive = Open.
25	INP2	P3 pin 5	Digital Input 2. Active = Ground. Inactive = Open. Use P3 pin 2 or 4 for ground. Configure via the "Auxiliary Input 2" in RPM's External I/O dialog Box.
28	SWA+	P3 pin 6	Switched A+ Output. Approximately 12 volts DC.
8	GND	P4 pin 1	Chassis Ground.
30	DGPS_ DATA	P4 pin 4	NMEA-Formatted GPS Receiver Module DGPS Correction Data Serial Data Input. ±15-volt RS-232 input level.

Table 11-1: Option Cable 14002-0174-08 Interconnections

44-PIN I/O CABLE CONNECTOR P1 PIN	SIGNAL NAME	TO/FROM	DESCRIPTION
4	EXTRX	P4 pin 5	External Rx Audio Input (from external/2nd receiver; summed; typically not used).
9	(reserved)	P4 pin 7	Pin is not used.
3	(reserved)	P4 pin 8	Pin is not used.
5	FDISC	P4 pin 9	Buffered Filtered Discriminator Audio Output (typically not used). A fixed-level audio output with DC bias. Approximately 200 mV rms into a 600-ohm load at rated deviation. Does not contain signaling (e.g., CTCSS). Mutes when speaker mutes. Use a 33 µF / 50 V (or greater) AC-coupling capacitor to couple to a 600-ohm load. Use P4 pin 12 for ground.
13	ALO	P4 pin 10	MICHI is a microphone audio input, the same as the front/main mic. 82 mV rms produces SRD. 600-ohm input impedance. Typically not used. ALO is ground/return for MICHI.
12	MICHI	P4 pin 11	
1	SUPGND	P4 pin 12	Low-power audio output for an optional external amplifier and speaker. VOLHI is a single-ended AC-coupled audio signal. Use SUPGND as return/ground for VOLHI. Rated audio signal level is approximately 500 mV rms.
14	VOLHI	P4 pin 13	
15	(reserved)	P4 pin 14	Pin is not used.
16	XTONEENC	P4 pin 15	External Tone Encode Audio Input. Reference input audio level is 220 mV rms. 47k ohm input impedance.
17	XTONEDEC	P4 pin 16	External Tone Decode Audio Output.
6	EXTALO	P4 pin 17	Reference/Ground for external audio (EXTMIC).
24	(reserved)	P4 pin 18	Pin is not used.
23	(reserved)	P4 pin 19	Pin is not used.
18	INP1	P4 pin 21	Digital Input 1. Active = Ground. Inactive = Open. Use P4 pin 1 for ground. Configure via the "Auxiliary Input 1" in RPM's External I/O dialog box.
2	OUT1	P4 pin 22	Digital Output 1 for auxiliary control. Open-collector, 10 milliamps / 16 volts maximum. External pull-up resistor needed if required by the external device's input during the high/off state. Use P4 pin 1 for ground. Configure via the "External Output Control Line 1" in Radio Personality Manager's (RPM's) External I/O dialog Box.
29	(reserved)	P4 pin 23	Pin is not used.
27	EXTMIC	P4 pin 24	External/Auxiliary Mic Audio Input. Reference input audio level is 82 mV rms. 2.2k ohm input impedance. Use P4 pin 17 for ground.
28	SWA+	P4 pin 25	Switched A+ DC Power Output. Typically, this output is not used.
32	GPS_NMEA_RX	P5 pin 2	NMEA-Formatted GPS Receiver Position Data Serial Data Output. ±5-volt minimum RS-232 output level; ±5.4-volt typical.

Table 11-1: Option Cable 14002-0174-08 Interconnections

44-PIN I/O CABLE CONNECTOR P1 PIN	SIGNAL NAME	TO/FROM	DESCRIPTION
31	GPS_NMEA_TX	P5 pin 3	NMEA-Formatted GPS Receiver Module Initialization Data Serial Data Input. ±15-volt RS-232 input level.
7	GND	P5 pin 5	Ground for GPS Serial Data Signals.
33	MIC_NOISE	(none)	Background noise microphone input (MIC_NOISE) and input ground/reference (MIC_NOISE_ALO). As of the publication of this manual, this input/function is not supported. 600-ohm input impedance. MIC_NOISE_ALO is connected to ground.
36	MIC_NOISE_ALO	(none)	
38	TD_B	P6 pin 2	Transmit Data (radio output), Receive Data (radio input), Clear-To-Send (radio input), and Ready-To-Send (radio output), and Ground/-Reference lines for serial port B. This radio programming port is active when the front panel mic connector's sense pin is not grounded. **NOTE:** Rev. – cables did not have the CTS and the RTS handshake lines available at P6 pins 7 and 8.
39	RD_B	P6 pin 3	
42	CTS_B	P6 pin 7	
43	RTS_B	P6 pin 8	
1	GND	P6 pin 5	
11, 34, 35, 37, 40, 41 and 44	(reserved)	(none)	These pins are not used.

11.2 SERIAL DATA CABLE CA-013671-020

Serial Data Cable CA-013671-020 (20 feet long) can be used to extend data connections from the radio to data communications equipment such as a Mobile Data Terminal (MDT) or a GPS NMEA-format device. The cable's assembly and wiring diagrams are shown in Figure 11-2 below.

The cable's male DB-9 connector (J1) mates to a female DB-9 serial port connector of Option Cable 14002-0174-08, either connector P5 or P6.

The cable's female DB-9 connector (J2) mates to a PC's male DB-9 serial port connector. If the utilized PC is not equipped with a DB-9 serial port connector, the use of a suitable adapter is required, such as USB-to-RS-232 Adapter Cable CN24741-0001. As of the publication of this manual, CN24741-0001 is available via the Customer Care center; refer to Section 3.4 on page 12 for contact information.

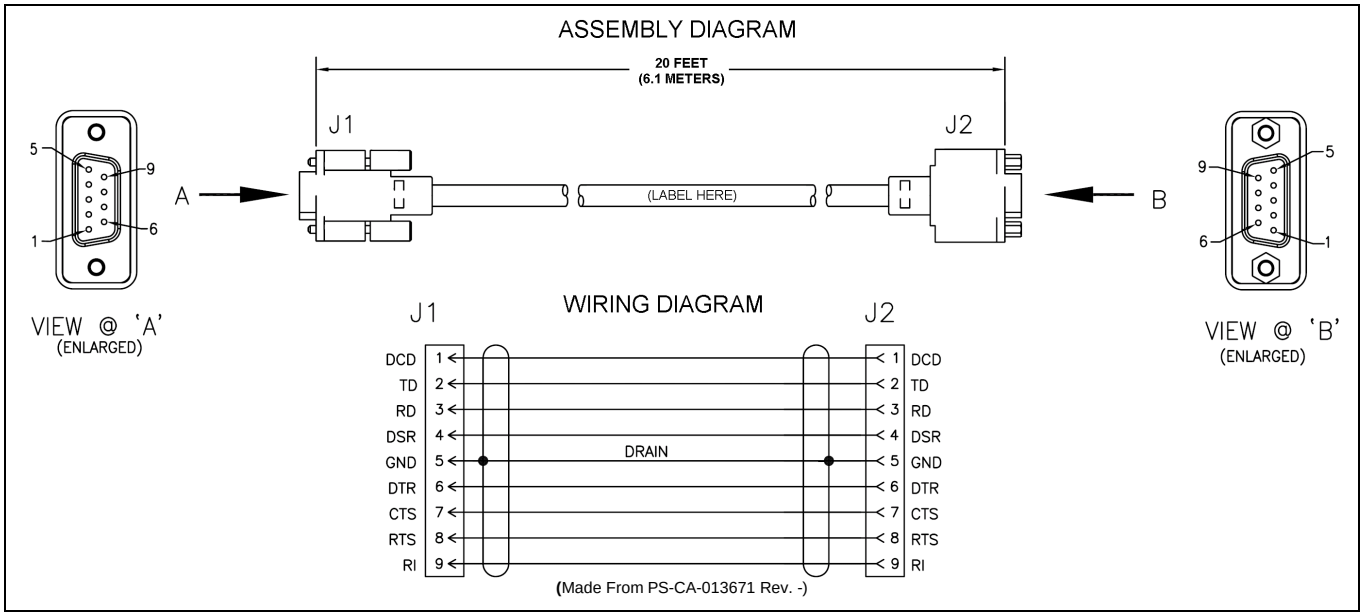


Figure 11-2: Serial Data Cable CA-013671-020

11.3 FRONT PANEL PROGRAMMING CABLE 14015-0200-01

Front Panel Programming Cable 14015-0200-01 can be used to program and configure the radio via the microphone connector on the front panel of the radio. The cable's assembly and wiring diagrams are shown in Figure 11-3 below. The terminals/pins of the mic connector include those of a serial programming port. The radio auto-senses between a serial device connected to the serial programming port of the mic connector and the serial programming port of the rear panel connector.

NOTE

If using **ECP Release R16B08 or earlier or XGP Release R1A34 or earlier**, the radio cannot be flashed and its personality cannot be programmed using the Front Panel Programming Cable. Refer to TAC's Important Product Notification (IPN) Volume 5 Number 6 for additional information.

The cable's circular (LTW) connector mates to the radio's mic connector, and its female DB-9 connector mates to a male DB-9 serial port connector of a computer (or USB adapter). If the utilized PC is not equipped with a male DB-9 serial port connector, the use of a suitable adapter is required, such as USB-to-RS-232 Adapter Cable CN24741-0001. As of the publication of this manual, CN24741-0001 is available via the Customer Care center; refer to Section 3.4 on page 12 for contact information.

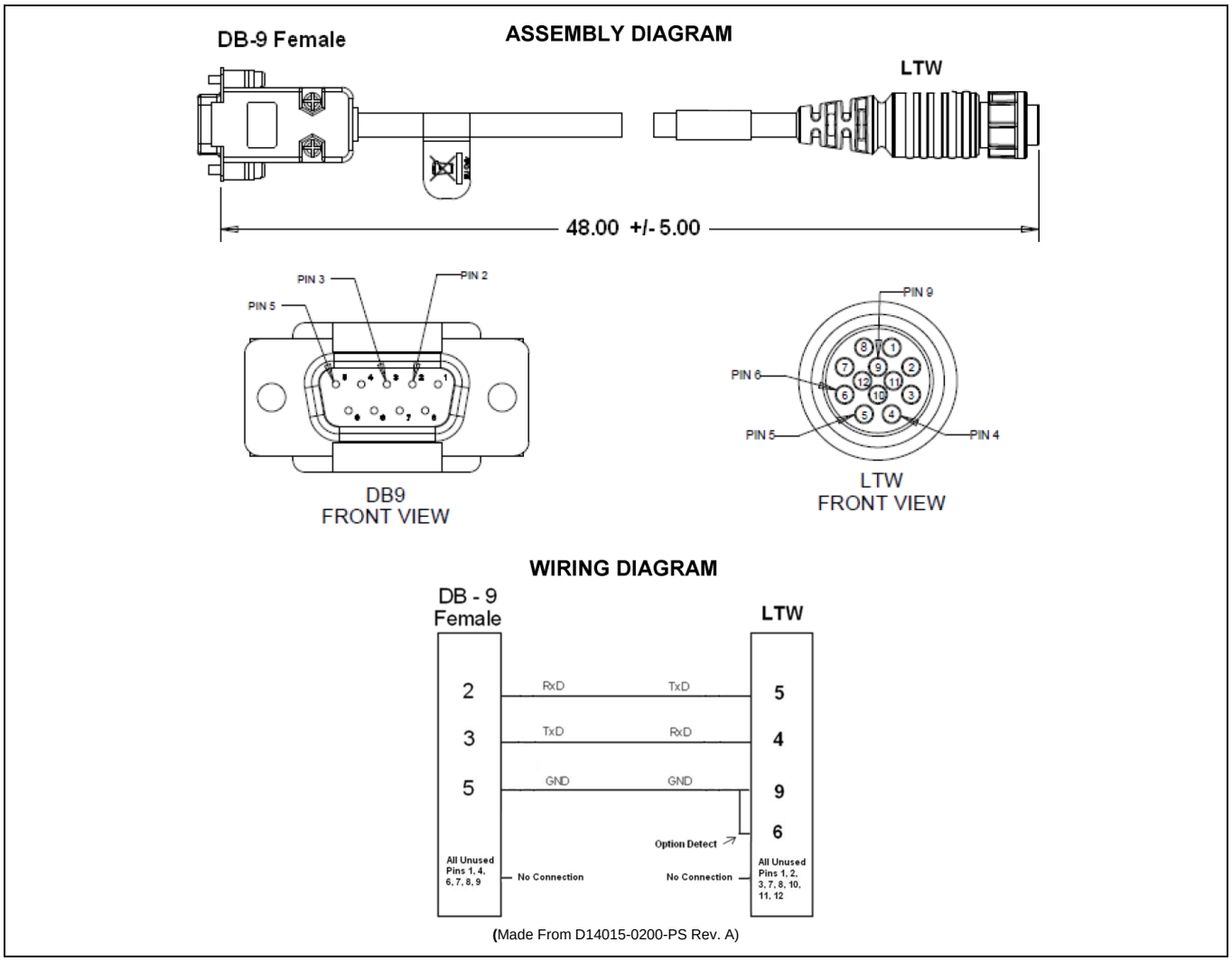


Figure 11-3: Front Panel Programming Cable 14015-0200-01

11.4 DESK MIC ADAPTER CABLE 14015-0200-02

Desk Mic Adapter Cable 14015-0200-02 can be used to connect a desk microphone, such as part number MC-014121-003. This cable interconnects the radio's front panel mic connector to the desk mic's DB-9 connector. Cable assembly and wiring diagrams are shown in Figure 11-4 below.

The cable's circular (LTW) connector mates to the radio's mic connector, and its female DB-9 connector mates to the male DB-9 connector of the desk mic.

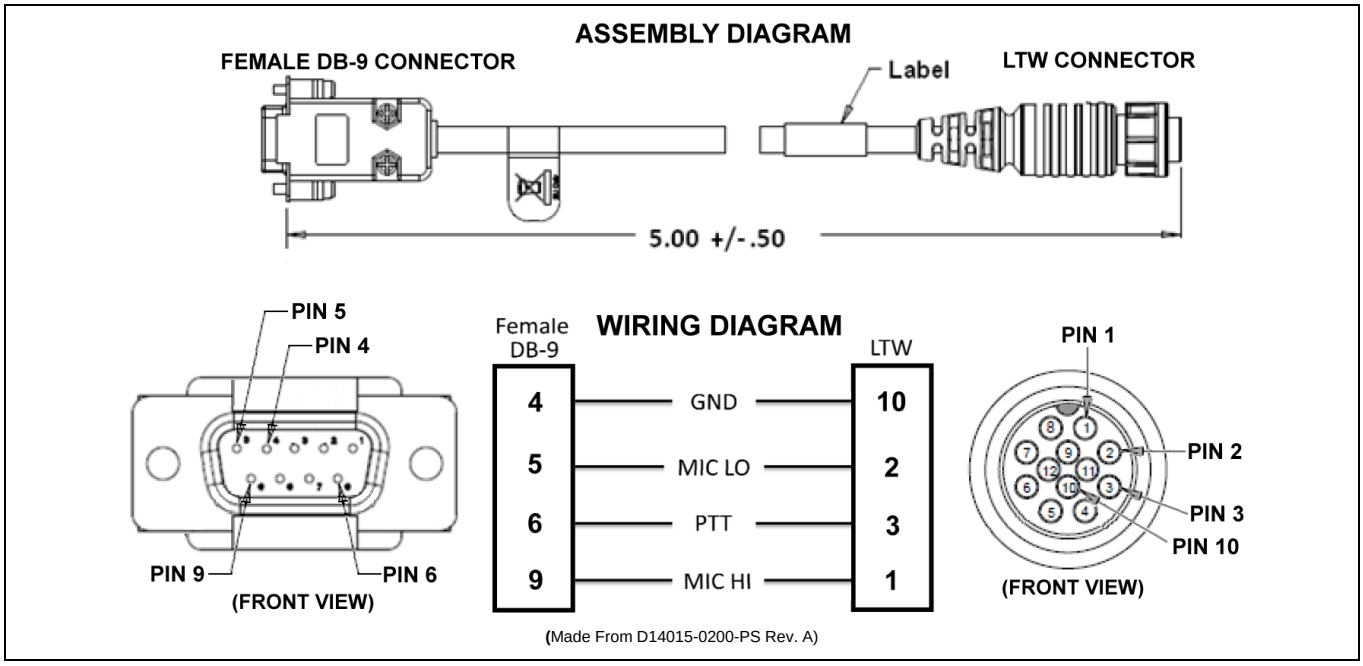


Figure 11-4: Desk Mic Adapter Cable 14015-0200-02

12 GPS NMEA-FORMATTED DATA CONNECTION

To obtain GPS NMEA-formatted serial data from the radio, the radio must be equipped with the GPS receiver option, and Option Cable 14002-0174-08 is required. For radios equipped with a GPS receiver, follow this procedure to complete the GPS NMEA-formatted serial data connections:

1. Obtain Option Cable 14002-0174-08. Each "leg" of this cable is approximately 65 inches long (166 centimeters).
2. Connect the cable's 44-pin D-subminiature (DB-44) male connector to the DB-44 female connector on the rear panel of the radio. Tighten the two jackscrews with a small flathead screwdriver. Do not over-tighten.
3. Connect the cable's DB-9 female connector identified as P5 to the computer's serial port DB-9 male connector—either directly or extended via cable CA-013671-020 (a 20-foot-long cable); see Section 11.2. Tighten the screws firmly, and then route the cabling as required. If the computer is not equipped with a DB-9 serial port connector, the use of a suitable adapter is required, such as USB-to-RS-232 Adapter Cable CN24741-0001.
4. Follow the manufacturer's instructions on processing the NMEA-formatted GPS data from the radio.

NOTE

If the Option Cable 14002-0174-08 is not available, a 3-wire serial cable can be field-fabricated. On the radio end, this cable must interface to the three GPS-related signals of the radio's 44-pin I/O Cable connector (pins 7, 31, and 32). See Table 11-1 for additional information.

Industry software to process GPS information through this interface is not supported by Harris.

13 MOBILE DATA CONNECTION

If the radio installation must support mobile data communications of a computer running Mobile Data Terminal (MDT) or similar software, follow this procedure to connect the computer to the radio:

1. Obtain Option Cable 14002-0174-08. Each "leg" of this cable is approximately 65 inches long (166 centimeters).

NOTE

If the MDT requires a Clear-To-Send (CTS) and/or a Ready-To-Send (RTS) handshake lines, use Option Cable 14002-0174-08 **Rev. A or later**. Earlier cables did not have the CTS and RTS interconnections to connector P6 of the cable.

2. Connect the cable's 44-pin D-subminiature (DB-44) male connector to the DB-44 female connector on the rear panel of the radio. Tighten the two jackscrews with a small flathead screwdriver. Do not over-tighten.
3. Route the "leg" of this cable that has the two DB connectors (i.e., DB-25 connector P4 and DB-9 connector P6) to the area near the serial port of the MDT computer. Protect the cable from possible chafing and tie-and-stow it as necessary.

NOTE

If the cable's "leg" length is not long enough to reach the computer, obtain cable CA-013671-020 (or equivalent) and use it to extend the connection from the DB-9 connector P6. Cable CA-013671-020 is a 20-foot-long standard DB-9 serial data cable.

4. Connect the female DB-9 connector (P6) to the computer. If the computer is not equipped with a DB-9 serial port connector, use a suitable adapter, such as USB-to-RS-232 Adapter Cable CN24741-0001.

NOTE

Before data communications can occur on a P25 system, the respective data option must be enabled. Contact the Technical Assistance Center (TAC) for additional information. TAC contact information is included on page 12.

14 INITIAL POWER-UP TEST

1. At the radio's main waterproof (HFB-type) fuse holder installed near the vehicle battery, insert the **15-amp** fuse that was included with the radio's DC Power Cable.
2. Tie and stow all fuse holders at this location to prevent excess vibration/movement.
3. Carefully reconnect the vehicle's battery ground cable.
4. If not already, temporarily connect the mobile antenna cable from the vehicle-mounted mobile antenna to the female TNC RF connector on the rear panel of the radio. This is a temporary connection until test procedures in Section 15 are complete.
5. If the radio is equipped with the GPS receiver option, permanently connect the antenna cable from the GPS antenna (or mobile/GPS combo antenna) to the female SMA connector on the rear panel of the radio. The male SMA connector on most GPS antenna cables has a $^{5}/_{16}$-inch hex collar, so the use of a wrench of this same size is normally required for tightening. However, some may have collars with only knurled surfaces, so a standard wrench or torque wrench cannot be used. In either case, do not over tighten the connector and do not twist the cable when tightening.
6. If the installation is wired so the vehicle's ignition key/switch turns the radio on and off, turn the switch to the Accessory or Run position.
7. If the radio is not already powered up, do so by rotating its on/off/volume control clockwise out of the detent position.
8. Verify the radio has powered-up by observing its display. If the display is not functioning, refer to Section 7.2.1 as necessary.

As long as the software configuration parameters have been loaded, successful installation is almost immediately realized:

- After a short boot-up sequence, the radio displays login information and/or a talk group.
- If no errors are displayed, the installation is most-likely properly wired.
- If an error is displayed, recheck all cable connections, verify all fuses are properly installed, and verify battery power on the load side of the fuses, etc. If problems persist, contact the Technical Assistance Center (see page 12).
- Consult the Operator's Manual for operational information.

Refer to Section 15 for performance test information.

15 PERFORMANCE TESTS

This section includes procedures to verify the performance of the installation's mobile antenna system. There are three (3) procedures in this section:

- Changing Operating Mode for Tests
- Testing by Transmitting into a Dummy Load (a 50-Ohm RF Terminator)
- Testing by Transmitting into the Mobile Antenna

The accuracy of test results depends upon a DC power source in the range of 13.6 volts DC ±10%. The current capacity of the power source must be greater than 15 amps. Make sure the vehicle's battery is fully charged by running the engine for a few minutes before the test, and keep the engine running during the test procedures. **Abide by the following WARNING!**

If the vehicle's engine must remain running, the vehicle location should be well ventilated so exhaust fumes from the engine do not cause harm!

If a vehicle equipped with this radio requires jump-starting, the radio installation's main fuse should be removed from the holder prior to jump-starting. Doing so will prevent damage to the radio system.

Prior to installation, the radio's power level should be configured appropriately. The wide range of power levels indicated in the following procedures takes into account such things as: customer's requirements; measurement errors, especially to include uncalibrated equipment; cabling losses; and voltage and temperature variations. By no means should the result from Performance Testing in this section be construed as the exact power level output from the radio, as the level is set and more accurately measured in the factory. The levels obtained in these test procedures determine a successful installation only.

15.1 REQUIRED TEST EQUIPMENT

Table 15-1: Test Equipment Required for Performance Tests

TEST EQUIPMENT	MODEL / PART NUMBER & DESCRIPTION
Average-Responding Wattmeter (for conv. measurements)	Bird Electronic Corp. Model 43 (or equivalent) with Type N female connectors at input and output ports.
or	
Digital Wattmeter	Bird Electronics Corp Model 5000-XT with Wideband Power Sensor 5017, 25 MHz to 1000 MHz Range.
Wattmeter Element (Typically Not Required if Using a Digital Wattmeter)	For VHF Radio: Bird Electronic Corp. Element 100C (100-Watt max.) 100 - 250 MHz frequency range (or equivalent). For 50-Watt UHF Radio: Bird Electronic Corp. Element 100D (100-Watt max.) 200 – 500 MHz frequency range (or equivalent). For 700 & 800 MHz Radio: Bird Electronic Corp. Element 50E (50-Watt max.) 400 - 1000 MHz frequency range (or equivalent).
RF Coaxial Jumper Cable	Pasternack Enterprises PE3661-36 (or equivalent) 50-Ohm Coaxial Cable with TNC male connector and Type N male connector, approximately three (3) feet in length. The utilized cable **must** have VSWR below 1.5:1 within the RF passband.
N-to-TNC RF Adapter	Pasternack Enterprises PE9090 (or equivalent) Type N male to TNC female adapter. Required to connect the cable of the vehicle-mounted antenna to the wattmeter.
50-Ohm RF Terminator ("Dummy Load")	Pasternack Enterprises PE6167 (or equivalent) 50-ohm RF terminator rated at 50 watts or greater, with Type N male connector.
Vehicle-Mounted Antenna	Tests are performed with the vehicle-mounted antenna per the installation described in Section 6 of this manual.

15.2 TRANSMITTING INTO A 50-OHM DUMMY LOAD

1. Turn off the radio.
2. Using the Type N male to TNC male RF coaxial jumper cable, connect the radio's antenna connector to the wattmeter's input connector. Refer to Figure 15-1 as necessary.
3. Connect the 50-ohm dummy load to the wattmeter's output connector, in place of the antenna cable from the vehicle-mounted antenna.
4. Turn on the radio and set it to the required operating mode (based upon available radio programming and test equipment).
5. Set the radio to a test conventional channel that is approximately in the middle frequency range of the radio installation's antenna element.
6. Position the wattmeter's element to measure forward RF output power. Rotate it if necessary. The arrow on the face of the element must point away from the radio and towards the dummy load for forward power measurements.
7. Set the wattmeter to measure average RF power.


NOTE

It is recommended that a test talk group/channel be allocated for this testing. This same group should be used during the antenna test procedure which is presented in the subsequent section.

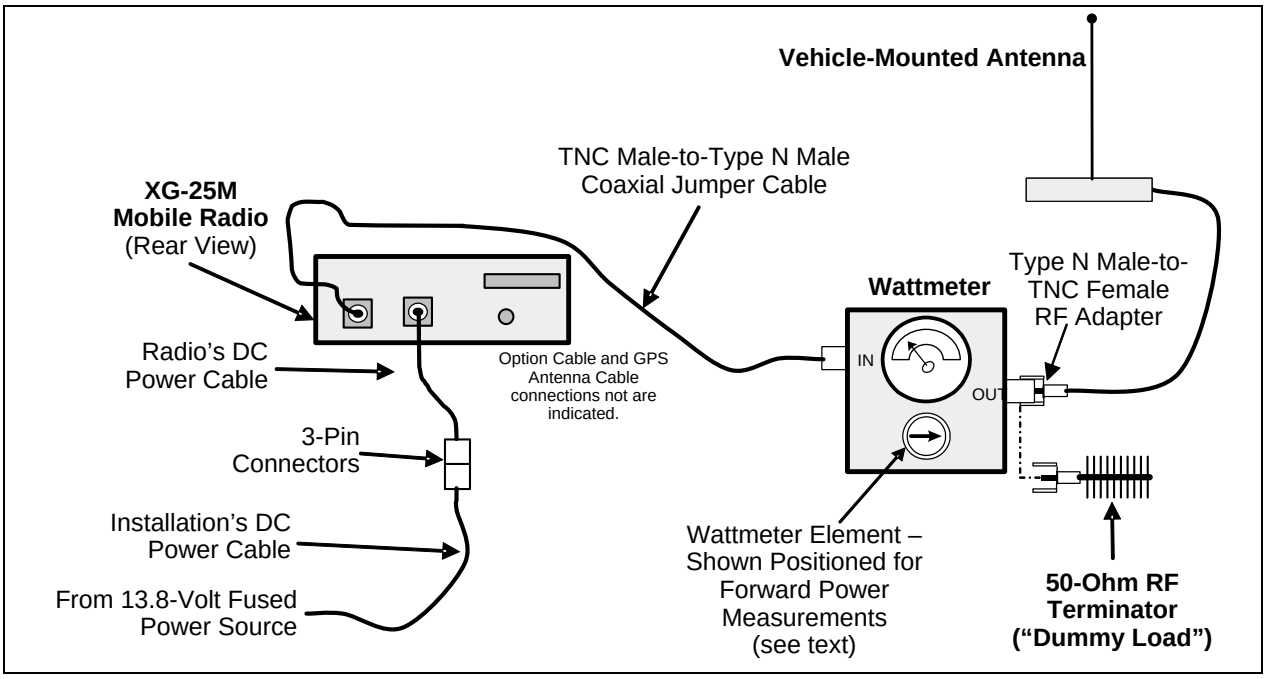


Figure 15-1: **Wattmeter Connections for Antenna System Tests**

8. Key the radio's transmitter via the microphone's PTT button.
9. Verify the measured transmit output power is within the respective range listed in Table 15-2. The respective power setting listed in this table assumes the radio is currently configured at the maximum transmit power level.

Table 15-2: Transmit Power Ranges with Radio Maximum Power Levels

RADIO MAXIMUM TRANSMIT POWER	APPLICABLE RF BANDS	MINIMUM MEASURED TRANSMIT OUTPUT POWER (Watts) (-1 dB)	TRANSMIT OUTPUT POWER SETTING (Watts)	MAXIMUM MEASURED TRANSMIT OUTPUT POWER (Watts) (+1 dB)
50 Watts	VHF and UHF	39.8	**50**	63
35 Watts	700 MHz	23.8	**30** (see **NOTE**)	37.7
	800 MHz	27.8	**35**	44.1

NOTE

The 700/800 MHz XG-25M radio is aligned for a maximum transmit power of 35 watts across the entire 700/800 MHz frequency band. However, FCC licensed systems, verify the radio's 700 MHz channels are limited to 30 Watts or per license requirements via the radio's personality programming.

NOTE

The UHF XG-25M radio is aligned for a maximum transmit power of 50 watts across its entire 378 - 470 MHz operating band. However, for equipment operating in accordance with FCC 47CFR80 rules (i.e., Maritime Services), it is the responsibility of the licensee to ensure the radio is installed and aligned per license requirements.

NOTE

Transmit only for as long as needed to take the measurement, then immediately disable the transmission.

10. **If the wattmeter reading is within that range,** record the measured level in the appropriate space on the data collection form near the end of this manual.

    If the wattmeter reading is outside that range, verify the radio's power supply voltage (i.e., battery voltage) is within the specified range, recheck all connections, and measure the RF output power again. If this fails to produce a reading within the range, replace it and repeat this procedure. If problems persist, contact the Technical Assistance Center (see page 12).

15.3 TRANSMITTING INTO THE MOBILE ANTENNA

1. Turn off the radio.
2. Connect the antenna cable from the vehicle-mounted antenna to the wattmeter as shown in Figure 15-1.
3. Turn on the radio and set it to the required operating mode (based upon available radio programming and test equipment).
4. Set the radio to a test conventional channel that is approximately in the middle frequency range of the radio installation's antenna element.

NOTE

It is recommended that a test conventional channel be allocated for this testing. Otherwise, interference with other radio users in the system may occur. **Also, during transmissions, always observe the RF exposure-related safety information presented in XG-25M radio's Product Safety Manual.**

5. Position the wattmeter's element to measure forward RF output power. Rotate it if necessary. The arrow on the face of the element must point away from the radio and towards the antenna for forward power measurements.
6. Set the wattmeter to measure average RF power.
7. Key the radio's transmitter via the microphone's PTT button.
8. Verify the measured transmit output power is within the respective range listed in Table 15-2. The respective power setting listed in this table assumes the radio is currently configured at the maximum transmit power level.

NOTE

Transmit only for as long as needed to take the measurement, then immediately disable the transmission.

9. **If the wattmeter reading is within the range,** record the level in the appropriate space on the data collection form near the end of this manual.

    If the wattmeter reading is outside the range, verify the radio's power supply voltage (i.e., battery voltage) is within the specified range, recheck all connections, and measure the forward power again. If the installation employs a ¼-wave unity-gain antenna, observe the following **NOTE.** If these checks/corrections fail to produce a reading within the range, check all cabling and connections and repeat the testing procedure to this point. In the event the wattmeter reading still falls outside the

range, replace the antenna, make sure all connections are seated firmly, and repeat the testing procedure. If problems persist, contact the Technical Assistance Center (see page 12).

NOTE

If the radio installation employs a ¼-wave unity-gain antenna (part number AN-225006-001), the driven element (i.e., whip) of the antenna must be trimmed to the proper length in order to minimize antenna system VSWR. Refer to the instructions included with the antenna for trimming instructions.

10. Position the wattmeter's element to measure reverse (reflected) RF power from the antenna. The arrow on the face of the element must point away from the antenna and to the radio to measure reverse power.
11. Key the radio's transmitter via the microphone's PTT button.
12. For a good mobile radio installation, an antenna system VSWR of between 1.2:1 and 1.5:1 is reasonable. If the utilized wattmeter/power-meter cannot directly measure and display VSWR, use the following formula to calculate the reverse power at a 1.5:1 VSWR level:

    $\mathbf{P_{reflected\ (Watts)} = P_{forward\ (Watts)} * 0.04}$, where $\mathbf{P_{forward\ (Watts)}}$ is the measured forward power.

    For example: For a $P_{forward}$ of 30 Watts, $P_{reflected}$ = 30 * 0.04 = 1.2 Watts. See Table 15-3 for more examples.

Table 15-3: Example Measured Forward Power Levels to Reflected Power Levels for a 1.5:1 VSWR

RADIO MAXIMUM TRANSMIT POWER	APPLICABLE RF BANDS	MEASURED TRANSMIT FORWARD POWER $P_{forward}$		REFLECTED POWER AT A VSWR = 1.5:1 $P_{reflected}$	
		Watts	dBm	Watts	dBm
35 Watts	700 MHz	23.8	43.8	0.95	29.8
		30.0	**44.8**	**1.20**	**30.8**
		37.7	45.8	1.51	31.8
	800 MHz	27.8	44.4	1.11	30.5
		35.0	**45.4**	**1.40**	**31.5**
		44.1	**46.4**	1.76	32.5
50 Watts	VHF and UHF	39.8	46.0	1.59	32.0
		50	**47.0**	**2.00**	**33.0**
		63	48.0	2.52	34.0

NOTE

Transmit only for as long as needed to take the measurement, then immediately disable the transmission.

NOTE

The formula to convert from watts to dBm is: **(Power in dBm) = 10 * Log(Power in milliwatts)**, where **Log** is the base 10 logarithm.

13. **If the wattmeter reading is within the range,** record the value in the appropriate space on the TEST PERFORMANCE DATA FORM on page 67, and then advance to the next step in this procedure.

Notes for Troubleshooting Bad VSWR/Reverse Power Readings:

- Make sure the installed antenna element is consistent with the specified frequency range of the radio by checking the antenna element's datasheet VSWR spec, etc.
- Verify the NMO antenna base is properly installed and tight on the NMO antenna mount.
- Verify the antenna element is properly installed and tight on the NMO antenna base. Some elements use a small set screw in the base to secure the element to the base.
- Ensure field-dressed coax cables are properly crimped, including the coax center conductor to the connector pin, and the coax shield to the connector's body.
- At the radio's antenna port connector, verify the antenna coax cable's RF connector is tightened in accordance with manufacturer's guidelines.
- Expect more losses depending on the cable length and RF frequency.
- Expect more reflected power, if measurement is made inside a metallic structure.
- Consider overall measurement accuracy/errors.
- Recheck all antenna connections, and measure the reverse power again. For example: If the installation employs a ¼-wave unity-gain antenna, observe the NOTE that immediately follows step 9. If these checks/corrections fail to produce a reading within the range, replace the antenna and repeat the entire antenna test procedure. Any value exceeding the maximum allowable reflected power value will result in a diminished RF output signal.
- It is understandable that the user may not have a full control over the test environment. If this is the case, and after the above recheck the readings are still outside the expected range, use the following alternative method to ensure the installation is done correctly.

    1. Measure the output RF power of the radio directly from the radio.
    2. Connect the antenna cable to the radio.
    3. Remove the radio installation's antenna element from the mount (base) and using a suitable NMO adapter so the antenna mount can be connected to the wattmeter/power meter.
    4. Measure the RF power at the antenna mount.
    5. Use the cable loss data in Table 15-4 to calculate the approximate cable losses. After all losses are accounted for, measurements should be within ±1 dB of the original output RF power measurement.

Table 15-4: Antenna Mounts' Cable RF Loss (in dB of Loss per Foot)

ANTENNA MOUNT PART NUMBER	At 200 MHz (use for VHF)	700 MHz (use for UHF and 700 MHz)	900 MHz (use for 800 MHz)
AN-125001-001	0.049	0.155	0.2
AN-125001-003			
AN-125001-007			
AN-125001-002	0.051	0.098	0.111
AN-125001-004			
AN-125001-008			
AN-125001-005	0.049	0.151	0.172
AN-125001-006	0.033	0.105	0.118

- If problems persist, contact the Technical Assistance Center (see page 12).

14. Disconnect the coaxial cable jumper and wattmeter.
15. Permanently connect the cable from the vehicle-mounted antenna to the radio's antenna cable by mating the two TNC connectors together. Use two pairs of soft-jaw pliers to gently tighten this connection. Do not over tighten and do not twist either cable.
16. Make several test calls on the radio system to verify operation of the mobile radio. Before making the calls, select other talk groups or conventional channels, as required to verify operation.

NOTE

To prevent RF leakage and ensure peak performance, make sure the RF connectors are tight, but do not over-tighten so connector damage will not occur.

WARNING

Improper installation of the RF cables may lead not only to poor radio performance but also to harmful exposure to RF electromagnetic energy.

Testing is complete. The radio is now ready for normal communications.

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15.4 TEST PERFORMANCE DATA FORM

Clip ✂ Here

Enter the information requested on this data collection form. Clip this form and file it as a permanent record of the tested performance of the XG-25M mobile radio installation.

Mobile Radio Serial Number	*Antenna Make and Model Numbers*

/ /		
Date of Test (mm/dd/yyyy)	*Company Performing Installation*	*Technician Performing Test*

Watts	Watts	Watts
Power into a Dummy Load	*Forward Power with Antenna*	*Reflected Power with Antenna*

16 COMPLETE THE INSTALLATION

Double-check the following items before considering the installation completed:

- Verify all newly installed mechanical hardware is mounted securely and all respective mounting hardware is tight.
- Verify all electrical interconnections are connected properly and the associated connector attachment hardware is tight. Pay special attention to all RF antenna cables!
- Verify all related fuses are correctly installed and properly rated.
- Verify all electrical cables and wiring are tied, stowed, and protected so they are out of the way of casual contact, away from sources of extreme heat, and wire chafing cannot occur. Pay special attention to all RF antenna cables!
- To prevent fumes from entering the vehicle's passenger compartment, seal the hole/grommet/wire combination at the firewall with a silicon-based sealer.
- Verify all vehicle components are properly reinstalled such as kick panels, headliners, and seats.
- If the installation includes a separately-mounted on/off power switch for manually turning the radio (and possibly other systems) on and off, verify it is labelled accordingly. For example: "**Radio ON/OFF**."
- Remove all tools and unused hardware from the vehicle.
- Verify the test performance data has been recorded on the data collection form shown in this manual.

17 WARRANTY REGISTRATION

Please register this product within ten (10) days of purchase. Registration validates the warranty coverage, and enables Harris to contact you in case of any safety notifications issued for this product.

Registration can be made on-line at http://www.pspc.harris.com/Service/CustomerService.aspx.

18 WARRANTY

A. Harris Corporation, a Delaware Corporation, through its RF Communications Division (hereinafter "Seller") warrants to the original purchaser for use (hereinafter "Buyer") that Equipment manufactured by or for the Seller shall be free from defects in material and workmanship, and shall conform to its published specifications. With respect to all non-Seller Equipment, Seller gives no warranty, and only the warranty, if any, given by the manufacturer shall apply. Rechargeable batteries are excluded from this warranty but are warranted under a separate Rechargeable Battery Warranty (ECR-7048).

B. Seller's obligations set forth in Paragraph C below shall apply only to failures to meet the above warranties occurring within the following periods of time from date of sale to the Buyer and are conditioned on Buyer's giving written notice to Seller within thirty (30) days of such occurrence:

1. for fuses and non-rechargeable batteries, operable on arrival only.
2. for parts and accessories (except as noted in B.1 and B.5), ninety (90) days.
3. for mobile and portable radios ("Subscriber Units"), twenty-four (24) months.
4. for Unity® model Subscriber Units, thirty-six (36) months.
5. for Six-Bay battery Chargers (12082-0314-xx and CH-104570-xxx), one (1) year.
6. for all other equipment of Seller's manufacture, one (1) year.

C. If any Equipment fails to meet the foregoing warranties, Seller shall correct the failure at its option (i) by repairing any defective or damaged part or parts thereof, (ii) by making available at Seller's factory any necessary repaired or replacement parts, or (iii) by replacing the failed Equipment with equivalent new or refurbished Equipment. Any repaired or replacement part furnished hereunder shall be warranted for the remainder of the warranty period of the Equipment in which it is installed. Where such failure cannot be corrected by Seller's reasonable efforts, the parties will negotiate an equitable adjustment in price. Labor to perform warranty service will be provided at no charge during the warranty period only for the Equipment covered under Paragraph B.3, B.4 and B.5. To be eligible for no-charge labor, service must be performed at Seller's factory, by an Authorized Service Center (ASC) or other Servicer approved for these purposes either at its place of business during normal business hours, for mobile or personal equipment, or at the Buyer's location, for fixed location equipment. Service on fixed location equipment more than thirty (30) miles (48 km) from the Service Center or other approved Servicer's place of business will include a charge for transportation.

D. Seller's obligations under Paragraph C shall not apply to any Equipment, or part thereof, which (i) has been modified or otherwise altered other than pursuant to Seller's written instructions or written approval or, (ii) is normally consumed in operation or, (iii) has a normal life inherently shorter than the warranty periods specified in Paragraph B, or (iv) is not properly stored, installed, used, maintained or repaired, or, (v) has been subjected to any other kind of misuse or detrimental exposure, or has been involved in an accident.

E. The preceding paragraphs set forth the exclusive remedies for claims based upon defects in or nonconformity of the Equipment, whether the claim is in contract, warranty, tort (including negligence), strict liability or otherwise, and however instituted. Upon the expiration of the warranty period, all such liability shall terminate. The foregoing warranties are exclusive and in lieu of all other warranties, whether oral, written, expressed, implied or statutory. NO IMPLIED OR STATUTORY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE SHALL APPLY. IN NO EVENT SHALL THE SELLER BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL, SPECIAL, INDIRECT OR EXEMPLARY DAMAGES.

This warranty applies only within the United States.

Harris Corporation
RF Communications Division
221 Jefferson Ridge Parkway
Lynchburg, VA 24501
1-800-368-3277

Harris Corporation
RF Communications Division
1680 University Avenue
Rochester, NY 14610
1-585-244-5830

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