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M/A-COM
M7300 Mobile Radio
with CH-721 Control Head
Motorcycle Installation Manual

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TABLE OF CONTENTS

| | <u>Page</u> |
|--|-------------|
| 1 REGULATORY AND SAFETY INFORMATION..... | 6 |
| 1.1 SAFETY SYMBOL CONVENTIONS..... | 6 |
| 1.2 RF ENERGY EXPOSURE AWARENESS AND CONTROL INFORMATION FOR FCC OCCUPATIONAL USE REQUIREMENTS..... | 6 |
| 1.2.1 Federal Communications Commission Regulations..... | 7 |
| 1.3 COMPLIANCE WITH RF EXPOSURE STANDARDS..... | 7 |
| 1.3.1 Mobile Antennas..... | 8 |
| 1.3.2 Approved Accessories..... | 8 |
| 1.3.3 Contact Information..... | 8 |
| 1.4 OCCUPATIONAL SAFETY GUIDELINES AND SAFETY TRAINING INFORMATION..... | 8 |
| 1.5 COMMON HAZARDS..... | 9 |
| 1.6 SAFE DRIVING RECOMMENDATIONS..... | 10 |
| 1.7 OPERATING RULES AND REGULATIONS..... | 10 |
| 1.8 OPERATING TIPS..... | 11 |
| 2 SPECIFICATIONS..... | 12 |
| 2.1 GENERAL..... | 12 |
| 2.2 TRANSCEIVER..... | 12 |
| 2.3 REGULATORY..... | 13 |
| 3 INTRODUCTION..... | 14 |
| 3.1 GENERAL DESCRIPTION..... | 14 |
| 3.2 RELATED PUBLICATIONS..... | 16 |
| 3.3 REPLACEMENT PARTS..... | 16 |
| 3.4 CONTACTING M/A-COM FOR TECHNICAL ASSISTANCE..... | 17 |
| 4 UNPACKING AND CHECKING THE EQUIPMENT..... | 18 |
| 4.1 GENERAL INFORMATION..... | 18 |
| 4.2 MOBILE RADIO AND CONTROL HEAD..... | 18 |
| 4.3 INSTALLATION KIT..... | 20 |
| 4.4 OPTIONS AND ACCESSORIES..... | 23 |
| 4.5 MATERIALS NOT SUPPLIED..... | 23 |
| 5 PLANNING THE INSTALLATION..... | 24 |
| 5.1 GENERAL INFORMATION..... | 24 |
| 5.2 TOOLS REQUIRED..... | 24 |
| 5.3 LOCATING COMPONENTS..... | 27 |
| 5.4 DC POWER CONSIDERATIONS..... | 28 |
| 6 RADIO MECHANICAL INSTALLATION..... | 29 |
| 6.1 INSTALLING ADAPTER BRACKET..... | 29 |
| 6.2 MOUNTING THE CASE AND CASE/ANTENNA BRACKET TO ADAPTER BRACKET..... | 31 |
| 6.3 INSTALLING THE RADIO IN THE CASE..... | 31 |
| 6.3.1 Install the Radio's Mounting Bracket..... | 31 |
| 6.3.2 Install the M7300 Mobile Radio into Mounting Bracket..... | 32 |
| 7 ANTENNA(S) INSTALLATION..... | 33 |
| 7.1 MOBILE ANTENNA INSTALLATION..... | 33 |
| 7.1.1 Install the Mobile Antenna..... | 33 |
| 7.1.2 Calculating the Antenna Cable Length..... | 33 |
| 7.1.3 Route Cable, Crimp-On TNC RF Connector and Connect It to the Radio..... | 34 |
| 7.2 GPS ANTENNA INSTALLATION (REQUIRED ONLY FOR GPS RECEIVER OPTION)..... | 35 |

TABLE OF CONTENTS (Continued)

| | <u>Page</u> |
|---|-------------|
| 8 CONTROL HEAD MECHANICAL INSTALLATION | 36 |
| 8.1 GENERAL INFORMATION | 36 |
| 8.2 MOUNTING THE CONTROL HEAD | 37 |
| 8.2.1 Selecting a Mounting Location | 37 |
| 8.2.2 Control Head Adapter Bracket (Not Supplied) | 39 |
| 8.2.3 Mounting the CH-721 Control Head | 39 |
| 9 SPEAKER INSTALLATION | 41 |
| 9.1.1 Selecting a Mounting Location | 41 |
| 9.1.2 Mounting the Speaker | 41 |
| 10 CABLE CONNECTIONS | 42 |
| 10.1 RADIO'S DC POWER INSTALLATION | 42 |
| 10.1.1 Overview of On/Off Power Wiring Configurations | 42 |
| 10.1.2 Alternator Whine Reject Filter Installation | 42 |
| 10.1.3 DC Power Cable and Main Fuse Holder Installation | 43 |
| 10.1.4 Control Head-to-Radio CAN Cable Connections | 45 |
| 10.1.5 Control Head Power Cable Installation | 46 |
| 11 MICROPHONE ATTACHMENT | 50 |
| 12 OPTIONAL CABLES | 51 |
| 12.1 M5300/M7300 OPTION CABLE CA-012349-001 | 51 |
| 12.2 SERIAL PROGRAMMING CABLE CA-013671 | 54 |
| 12.3 CH-721 OPTION CABLE CA-011854-001 | 55 |
| 12.4 CH-721 SERIAL PROGRAMMING CABLE CA-104861 | 56 |
| 13 GPS NMEA-FORMATTED SERIAL DATA CONNECTION | 57 |
| 14 INITIAL POWER-UP TEST | 58 |
| 15 PERFORMANCE TESTS | 59 |
| 15.1 CHANGING OPERATING MODE FOR TESTS | 59 |
| 15.1.1 Changing from OpenSky to Conventional | 59 |
| 15.1.2 Changing from Conventional to OpenSky | 60 |
| 15.2 REQUIRED TEST EQUIPMENT | 60 |
| 15.3 TRANSMITTING INTO A DUMMY LOAD | 60 |
| 15.4 TRANSMITTING INTO THE MOBILE ANTENNA | 62 |
| 15.5 TEST PERFORMANCE DATA FORM | 64 |
| 16 COMPLETE THE INSTALLATION | 65 |
| 17 WARRANTY | 66 |

FIGURES

| | <u>Page</u> |
|--|-------------|
| Figure 5-1: Typical Motorcycle Installation (Full View from Rear)..... | 25 |
| Figure 5-2: Typical Motorcycle Installation (Partial View of Radio Case and Brackets from Right Side) | 25 |
| Figure 5-3: M7300 Mobile Radio inside Weather-Resistant Motorcycle Radio Case | 26 |
| Figure 5-4: M7300 Mobile Radio — Front and Rear Views..... | 27 |
| Figure 6-1: Weather-Resistant Motorcycle Radio Case and Bracket Installation | 30 |
| Figure 7-1: Crimping Instructions for TNC RF Connector | 34 |
| Figure 8-1: CH-721 Scan Model Control Head Front Panel | 36 |
| Figure 8-2: CH-721 System Model Control Head Front Panel | 36 |
| Figure 8-3: CH-721 Rear Panel (both control head models)..... | 37 |
| Figure 8-4: Typical CH-721 Control Head Installation on a Motorcycle (Using the Standard U-Shaped Mounting Bracket)..... | 38 |
| Figure 8-5: Optional Control Head Mounting Pedestal (Part Number MACDOS0012)..... | 38 |
| Figure 10-1: CAN Link Connections for a Single Control Head Installation | 45 |
| Figure 11-1: Attaching the Microphone to the CH-721 Control Head..... | 50 |
| Figure 12-1: M5300/M7300 Option Cable CA-012349-001 | 51 |
| Figure 12-2: Programming Cables CA-013671-010 and -020 | 54 |
| Figure 12-3: CH-721 Option Cable CA-011854-001 | 55 |
| Figure 12-4: Programming Cable CA-104861 | 56 |
| Figure 15-1: Wattmeter Connections for Antenna System Tests | 61 |

TABLES

| | <u>Page</u> |
|---|-------------|
| Table 1-1: Recommended Minimum Safe Lateral Distance from Transmitting Antenna..... | 8 |
| Table 4-1: Contents of M7300 Motorcycle Installation Kit MAMW-NZN7X for M7300 Mobile Radio and CH-721 Control Head..... | 20 |
| Table 4-2: Additional Options and Accessories for M7300 Mobile Radios | 22 |
| Table 4-3: Options and Accessories for CH-721 Control Heads..... | 23 |
| Table 12-1: M5300/M7300 Option Cable CA-012349-001 Interconnections..... | 52 |
| Table 15-1: Required Test Equipment | 60 |

1 REGULATORY AND SAFETY INFORMATION

1.1 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. M/A-COM, Inc. 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.

1.2 RF ENERGY EXPOSURE AWARENESS AND CONTROL INFORMATION FOR FCC OCCUPATIONAL USE REQUIREMENTS

Before using the two-way mobile radio, read this important RF energy awareness and control information and operational instructions to ensure compliance with RF exposure guidelines.



This radio is intended for use in occupational/controlled conditions, where users have full knowledge of their exposure and can exercise control over their exposure to remain below RF exposure limits. This radio is **NOT** authorized for general population, consumer, or any other use.



Changes or modifications not expressly approved by M/A-COM, Inc. could void the user's authority to operate the equipment.

This two-way radio uses electromagnetic energy in the radio frequency (RF) spectrum to provide communications between two or more users over a distance. It uses RF energy or radio waves to send and receive calls. RF energy is one form of electromagnetic energy. Other forms include, but are not limited to, electric power, sunlight, and x-rays. RF energy, however, should not be confused with these other forms of electromagnetic energy, which, when used improperly, can cause biological damage. Very high levels of x-rays, for example, can damage tissues and genetic material.

Experts in science, engineering, medicine, health, and industry work with organizations to develop standards for exposure to RF energy. These standards provide recommended levels of RF exposure for

both workers and the general public. These recommended RF exposure levels include substantial margins of protection. All two-way radios marketed in North America are designed, manufactured, and tested to ensure they meet government-established RF exposure levels. In addition, manufacturers also recommend specific operating instructions to users of two-way radios. These instructions are important because they inform users about RF energy exposure and provide simple procedures on how to control it. Refer to the following websites for more information on what RF energy exposure is and how to control exposure to assure compliance with established RF exposure limits:

<http://www.fcc.gov/oet/rfsafety/rf-faqs.html>

<http://www.osha.gov/SLTC/radiofrequencyradiation/index.html>

1.2.1 **Federal Communications Commission Regulations**

Before it was marketed in the United States, the M7300 two-way mobile radio was tested to ensure compliance with FCC RF energy exposure limits for two-way mobile radios. When two-way radios are used as a consequence of employment, the FCC requires users to be fully aware of and able to control their exposure to meet occupational requirements. Exposure awareness can be facilitated by the use of a label directing users to specific user awareness information. The radio has an RF exposure product label. Also, this Installation and Product Safety Manual and the applicable Operator's Manual include information and operating instructions required to control RF exposure and to satisfy compliance requirements.

1.3 COMPLIANCE WITH RF EXPOSURE STANDARDS

The M7300 two-way mobile radio is designed and tested to comply with a number of national and international standards and guidelines regarding human exposure to RF electromagnetic energy. This radio complies with the IEEE and ICNIRP exposure limits for occupational/controlled RF exposure environment at duty-cycle times of up to 50% (50% transmit, 50% receive), and it is authorized by the FCC for occupational use. In terms of measuring RF energy for compliance with the FCC exposure guidelines, the radio's antenna radiates measurable RF energy only while it is transmitting (talking), not when it is receiving (listening), or in a standby mode.

The M7300 two-way mobile radio complies with the following RF energy exposure standards and guidelines:

- United States Federal Communications Commission (FCC), Code of Federal Regulations; 47 CFR § 2 sub-part J.
- American National Standards Institute (ANSI)/Institute of Electrical and Electronic Engineers (IEEE) C95.1-2005.
- Institute of Electrical and Electronic Engineers (IEEE) C95.1-2005.
- IC Standard RSS-102, Issue 2, 2005: "Spectrum Management and Telecommunications Radio Standards Specification. Radiofrequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands).



Table 1-1 lists the recommended minimum safe lateral distances 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. Transmit only when unaware bystanders are at least the uncontrolled recommended minimum safe lateral distance away from the transmitting antenna.

Based on the highest radiated RF power and the highest gain antenna used with M7300 mobile radio in motorcycle installations, the distances listed in Table 1-1 are considered as safe distances for controlled and uncontrolled environments with the M7300 mobile radio transmitting at a maximum 50% duty cycle.

Table 1-1: Recommended Minimum Safe Lateral Distance from Transmitting Antenna

| ANTENNA PART NUMBER (Catalog Number) | DESCRIPTION | RECOMMENDED MINIMUM LATERAL HUMAN BODY DISTANCE FROM TRANSMITTING ANTENNA | |
|--|---|--|--|
| | | CONTROLLED ENVIRONMENT (Centimeters) | UNCONTROLLED ENVIRONMENT (Centimeters) |
| LE-OM806HDBKTNCD5 | 800 MHz Antenna for Motorcycle Installations | 28 | 72 |



NOTE

Although the M7300 mobile radio is a dual-band 700 and 800 MHz mobile radio, as of the publication of this manual, motorcycle installations are limited to the 800 MHz band only.

1.3.1 **Mobile Antennas**

The antenna for the mobile radio must be installed in accordance with Section 7 in this manual and instructions included with the antenna.

Use only the M/A-COM approved/supplied antenna(s) or an approved replacement antenna. Unauthorized antennas, modifications, or attachments can cause the FCC RF exposure limits to be exceeded.

1.3.2 **Approved Accessories**

The radio has been tested and meets FCC RF guidelines when used with M/A-COM accessories supplied or designated for use with it. Use of other accessories may not ensure compliance with the FCC's RF exposure guidelines, and may violate FCC regulations. For a list of approved accessories refer to Section 4 in this manual (begins on page 18) and/or M/A-COM's Products and Services Catalog.

1.3.3 **Contact Information**

For additional information on RF exposure and other information, contact M/A-COM using one of the contact links listed in Section 3.4 on page 17.

1.4 **OCCUPATIONAL SAFETY GUIDELINES AND SAFETY TRAINING INFORMATION**

To ensure bodily exposure to RF electromagnetic energy is within the FCC allowable limits for occupational use. Always adhere to the following basic guidelines:

1. The push-to-talk button should only be depressed when intending to send a voice message.
2. The radio should only be used for necessary work-related communications.
3. The radio should only be used by authorized and trained personnel. It should never be operated by children.

4. Do not attempt any unauthorized modification to the radio. Changes or modifications to the radio may cause harmful interference and/or cause it to exceed FCC RF exposure limits. Only qualified personnel should service the radio.
5. Always use M/A-COM authorized accessories (antennas, control heads, speakers/mics, etc.). Use of unauthorized accessories can cause the FCC RF exposure compliance requirements to be exceeded.

The information listed above provides the user with information needed to make him or her aware of a RF exposure, and what to do to assure that this radio operates within the FCC exposure limits of this radio.

1.5 COMMON HAZARDS



The operator of any mobile radio should be aware of certain hazards common to the operation of vehicular radio transmissions. Possible hazards include but are not limited to:

- **Explosive Atmospheres** — Just as it is dangerous to fuel a vehicle while its motor running, be sure to turn the radio **OFF** while fueling the vehicle. If the radio is mounted in the trunk of the vehicle, **DO NOT** carry containers of fuel in the trunk.

Areas with potentially explosive atmosphere are often, but not always, clearly marked. Turn the radio **OFF** when in any area with a potentially explosive atmosphere. It is rare, but not impossible that the radio or its accessories could generate sparks.
- **Interference To Vehicular Electronic Systems** — Electronic fuel injection systems, electronic anti-skid braking systems, electronic cruise control systems, etc., are typical of the types of electronic devices that can malfunction due to the lack of protection from radio frequency (RF) energy present when transmitting. If the vehicle contains such equipment, consult the dealer for the make of vehicle and enlist his aid in determining if such electronic circuits perform normally when the radio is transmitting.
- **Electric Blasting Caps** — To prevent accidental detonation of electric blasting caps, **DO NOT** use two-way radios within 1000 feet (305 meters) of blasting operations. Always obey the “**Turn Off Two-Way Radios**” (or equivalent) signs posted where electric blasting caps are being used. (OSHA Standard: 1926.900).
- **Radio Frequency Energy** — To prevent burns or related physical injury from radio frequency energy, do **not** operate the radio’s transmitter when anyone near the motorcycle is within the minimum safe distance from the antenna as specified in Table 1-1. Refer to Section 1.2 for additional information.
- **Vehicles Powered By Liquefied Petroleum (LP) Gas** — Radio installation in vehicles powered by liquefied petroleum gas, where the LP gas container is located in the trunk or other sealed-off space within the interior of the vehicle, must conform to the National Fire Protection Association standard **NFPA 58**. This requires:
 - The space containing the radio equipment must be isolated by a seal from the space containing the LP gas container and its fittings.
 - Outside filling connections must be used for the LP gas container.
 - The LP gas container space shall be vented to the outside of the vehicle.

1.6 SAFE DRIVING RECOMMENDATIONS

The American Automobile Association (AAA) advocates the following key safe driving recommendations:

- Read the literature on the safe operation of the radio.
- Use both hands to steer and keep the microphone in its hanger whenever the vehicle is in motion.
- Place calls only when the vehicle is stopped.
- When talking from a moving vehicle is unavoidable, drive in the slower lane. Keep conversations brief.
- If a conversation requires taking notes or complex thought, stop the vehicle in a safe place and continue the call.
- Whenever using a mobile radio, exercise caution.

1.7 OPERATING RULES AND REGULATIONS

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

In the United States, the M7300 mobile radio must be operated in accordance with the rules and regulations of the Federal Communications Commission (FCC). Operators of two-way radio equipment, must be thoroughly familiar with the rules that apply to the particular type of radio operation. Following these rules helps eliminate confusion, assures the most efficient use of the existing radio channels, and results in a smoothly functioning radio network.

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

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



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

1.8 OPERATING TIPS

The following conditions tend to reduce the effective range of two-way radios and should be avoided whenever possible:

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



In areas where transmission or reception is poor, communication improvement may sometimes be obtained by moving a few yards in another direction, or moving to a higher elevation.

2 SPECIFICATIONS¹

2.1 GENERAL

| | |
|---|---|
| Dimensions, Remote-Mount Mobile Radio: (Height x Width x Depth) | 2.0 x 6.9 x 9.2 inches (5.1 x 17.5 x 23.4 centimeters) (Does <u>not</u> include space required for mounting bracket and cables at rear of radio) |
| Dimensions, Control Head: (Height x Width x Depth) | 2.4 x 6.9 x 3.9 inches (6 x 17.5 x 10 centimeters) (Does <u>not</u> include bracket and mounting screws) |
| Dimensions, Motorcycle Radio Case: (Height x Width x Depth) | 4.6 x 10.1 x 17.9 inches (11.7 x 25.7 x 45.5 centimeters) (Does <u>not</u> include space required for brackets, cables, antenna, and key access) |
| Weight, Front-Mount Mobile Radio: | 5.9 pounds (2.68 kilograms), less bracket |
| Weight, Remote-Mount Mobile Radio: | 5.25 pounds (3.69 kilograms), less bracket |
| Weight, Control Head: | 1.25 pounds (0.57 kilograms), less bracket |
| Operating Ambient Temperature Range: | -22 to +140° Fahrenheit (-30 to +60° Celsius) |
| Storage Temperature Range: | -40 to +185° Fahrenheit (-40 to +85° Celsius) |
| Altitude: | 15,000 feet (4572 meters) maximum |
| DC Supply Voltage Operating Range: | +13.6 Vdc ±10% (Normal range per TIA-603) |
| DC Supply Current Requirements: | |
| Receive (includes control head): | |
| With Speaker Muted: | 1.1 amps maximum |
| With 0.5-Watt Speaker Output Power: | 1.5 amps maximum |
| With 10-Watt Speaker Output Power: | 3.5 amps maximum |
| With 15-Watt Speaker Output Power: | 4.0. amps maximum |
| Transmit (includes control head): | |
| With 12-Watt RF Output Power: | 8 amps maximum, 6 amps typical |
| With 35-Watt RF Output Power: | 13 amps maximum, 10 amps typical |
| Quiescent/Off Current: | |
| Mobile Radio: | 100 microamps maximum |
| Control Head: | 100 microamps maximum |

2.2 TRANSCEIVER

Frequency Ranges:

| | |
|---------------|----------------|
| Receive: | |
| 800 MHz Band: | 851 to 869 MHz |
| Transmit: | |
| 800 MHz Band: | 806 to 824 MHz |

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

| | |
|---|--|
| Transmit Output Power: | |
| OpenSky Trunking Protocol (OTP) Mode: | 1.5 to 15 watts |
| EDACS/ProVoice/Conventional Modes: | 5 to 35 watts |
| Channel Spacing: | 12.5 kHz or 25 kHz (mode dependent) |
| Voice and Data Communications Modes: | Half-Duplex |
| Frequency Stability: | ±1.5 ppm with AFC disabled; ±0.5 ppm with AFC |
| Receiver Sensitivity: | |
| 800 MHz OTP Mode: | -111 dBm minimum at 1% BER (static) |
| 800 MHz P25 Mode (TIA-102 Method): | -116 dBm minimum at 5% BER (static) |
| 800 MHz EDACS Mode: | -118 dBm minimum at 12 dB SINAD |
| Receiver Intermodulation Rejection: | 77 dB minimum at 12.5 kHz |
| Audio Frequency Response: | 300 to 3000 Hz |
| Audio Output Power (Control Head): | 15 watts RMS maximum into 4-ohm external speaker; 1 watt into 4-ohm headset |
| Voice-Coding Method: | |
| OTP Mode: | Advanced Multi-Band Excitation Plus (AMBE+™) |
| EDACS, ProVoice and P25 Modes: | Improved Multi-Band Excitation (IMBE™) |
| OpenSky Data Rate: | 9.6 kbps |
| OpenSky Compressed Voice Relative Data Rate: | 2400 bps |

2.3 REGULATORY

| | |
|--|---------------------|
| FCC Type Acceptance: | OWDTR-0051-E |
| Applicable FCC Rules: | Part 15 and Part 90 |
| Industry Canada Certification: | 3636B-0051 |
| Applicable Industry Canada Rules: | RSS-119 |

3 INTRODUCTION

This manual contains M7300 mobile radio and the CH-721 control head installation procedures for motorcycle applications of these products. Procedures cover the mounting and cabling of the equipment, as well as the basic test procedures. In addition, product safety-related information is included.

3.1 GENERAL DESCRIPTION

This installation and product safety manual covers motorcycle applications of the M7300 mobile radio. Instructions for installing and testing the radio are included, along with applicable safety information.

The M7300 mobile radio is a high-performance dual-band digital mobile radio. Shown in Figure 5-4 on page 27, the M7300 radio provides standard and advanced mobile radio communication functions. The radio can operate with the following radio systems/standards:

- OpenSky trunked radio networks using the OpenSky Trunking Protocol (OTP);
- Enhanced Digital Access Communications System (EDACS) trunked radio networks;
- ProVoice trunked radio networks;
- APCO Project 25 Phase I compliant Common Air Interface (P25 CAI) trunked radio networks;
- Conventional FM repeater-based and FM talk-around voice communications in accordance with the TIA/EIA-603 conventional land-mobile radio standard.



NOTE

Although the M7300 mobile radio is a dual-band 700 and 800 MHz mobile radio, as of the publication of this manual, motorcycle installations are limited to the 800 MHz band only.

In motorcycle applications, the M7300 mobile radio is mounted within a weather-resistant case. This case is secured to the motorcycle's frame behind the seat of the motorcycle. The control head is located near the motorcycle operator's position. The radio and case are shown in Figure 5-3 (page 26) and the radio is shown in Figure 5-4 (page 27).

Control heads used with the M7300 mobile radio include the CH-721 Scan and the CH-721 System model control heads. See Figure 8-1 (page 36) through Figure 8-3. Both heads feature a large 3-line graphical vacuum-florescent display, front panel controls and buttons for user control of the mobile radio, an internal high-power audio amplifier to drive an externally-connected speaker, and a front panel microphone connector. The CH-721 System control head also has a 12-button numeric keypad that provides Dual-Tone Multi-Frequency (DTMF) functionality and easier operator system/group selection control at the control head's front panel.

The radio is remotely controlled by a control head via a Controller Area Network (CAN) link between the radio and control head. A 3-wire CAN cable provides the CAN link interconnection between the two units. The CAN link carries digitized microphone and speaker audio, controlling data such as button presses and radio messages, and user data such as that for a mobile data terminal connected to the serial port of the radio or control head. For proper operation, the CAN link must be terminated appropriately on each end.

As shown in Figure 8-3 on page 37, the CH-721 Scan and System model control heads have several connectors located on the head's rear panel. These connectors include a DC power connector, two (2) CAN port connectors used for CAN link interconnections, an external speaker connector, a 9-pin serial port connector for connecting optional equipment such as a mobile data terminal, and a 25-pin accessory connector. Both CH-721 models can interface to an optional Federal Signal Electronic siren/light control system for broadcasting via a public address (PA) speaker.

The radio must be powered by an external +13.6-volt (nominal) DC power source. In motorcycle applications, the motorcycle's electrical system is utilized as the source of DC power. The control head connected to the radio is also powered by the same DC power source, but separately fused. When the control head is powered-up by the operator, it "wakes up" the radio by transmitting data to the radio via the CAN link.

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

For data communications, the radio has an industry-standard 9-pin serial interface port for connecting optional data-type equipment, such as a Mobile Data Terminal (MDT), a laptop PC, an external display, or a key-entry device. This port works seamlessly with equipment from popular manufacturers and off-the-shelf applications. OpenSky employs User Datagram Protocol over Internet Protocol (UDP/IP) data packet transfers, providing "plug and play" connectivity for data-type devices.

800 MHz operating bands of the radio include 806 to 824 MHz repeater input band (mobile transmit) and the 851 to 869 MHz band used for repeater output and talk-around communications.

The radio has an optional built-in Global Positioning System (GPS) tracking receiver. GPS provides quick and accurate unit location information to dispatchers via the radio network. The GPS receiver determines the unit's location and the radio transmits it to the radio network. The GPS antenna is mounted completely separate from the mobile transmit/receive antenna.

The radio and control head exceed tough environmental specifications included within military standard MIL-STD-810F, the radio industry standard TIA/EIA-603, and the radio standard established by the U.S. Forest Service.

An M7300 mobile radio operating on an OpenSky radio network uses Time-Division Multiple-Access (TDMA) digital modulation technology on the radio frequency link. TDMA allows multiple radio users to share a single RF channel. In addition, a single RF channel can support simultaneous digital voice and data communications.

OpenSky employs Advanced Multi-Band Excitation Plus (AMBE+) speech and data compression technology developed by Digital Voice Systems, Inc. When operating on an OpenSky radio network, AMBE+ gives an M7300 radio the ability to provide exceptional voice quality via the limited bandwidth of the radio frequency path, even when the received RF signal is weak (i.e., even in "fringe" areas). AMBE+ is performed by a Digital Signal Processor (DSP) integrated circuit within the radio programmed to perform an AMBE+ compression algorithm during mobile transmissions, and an AMBE+ expansion algorithm during mobile reception.

Speech compression electronic circuitry—be it AMBE+ or another type such as IMBE—is sometimes referred to as "vocoding" circuitry for voice coding, or simply a "vocoder" circuit.

The M7300 mobile radio also supports radio operation on 800 MHz APCO Project 25 Phase I compliant Common Air Interface (P25 CAI) trunked radio networks, and operation in a talk-around mode in accordance with the APCO Project 25 Phase I standard. P25 radio systems utilize Improved Multi-Band Excitation (IMBE) speech/data compression technology, also developed by Digital Voice Systems, Inc.

Like AMBE+ technology, IMBE technology gives the M7300 mobile radio the ability to deliver exceptional voice quality, even in areas where the received RF signal strength is weak. IMBE replicates human speech better than other voice compression technologies, resulting in better voice quality and better speaker recognition. The Telecommunications Industry Association (TIA) funded an independent study to evaluate compression technologies. The findings showed that when compared with other industry-recognized compression technologies, IMBE provided the highest voice quality. In the study, radio users were asked to listen to coded speech produced by four different compression technologies (i.e., vocoder circuits) operating under a variety of conditions. The users rated the speech on a scale of one to five, with five being the best quality. Under each operating condition, IMBE was rated the best.

The M7300 mobile radio can also operate using M/A-COM's digital voice technology called ProVoice. Like P25 radio systems, ProVoice also employs the Improved Multi-Band Excitation (IMBE™) speech/data compression technology.

EDACS and ProVoice trunked radio networks employ analog FM and 2-level Gaussian Frequency-Shift Keying (GFSK) modulation techniques on the RF channels. Data is transmitted on an RF channel at a 9600 baud rate.

For over-the-air secure radio communications, the M7300 mobile radio may be equipped for 64-bit DES (Data Encryption Standard) encryption or 128/256-bit AES (Advanced Encryption Standard) encryption. With encryption, voice and/or user data signals transmitted and received by the radio on an RF channel are digitally encrypted ("scrambled") to virtually eliminate unauthorized monitoring via the RF channel.



Encryption requires an encryption-capable radio.

Cryptographic keys are stored in the radio by the radio system administration personnel. Over-the-Air Rekeying (OTAR) will be supported in the future.



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

3.2 RELATED PUBLICATIONS

The following publications contain additional information about the M7300 mobile radio:

- Quick Guide for OpenSky: MM-014368-001
- Operator's Manual for OpenSky: MM-014716-001 (available at www.macom-wireless.com via a Wireless Information Center login and Tech Link)
- Maintenance Manual: MM-014718-001

3.3 REPLACEMENT PARTS

Replacement parts can be ordered through M/A-COM's Customer Resource Center. To order replacement parts through the Customer Resource Center, call, fax or email our ordering system:

United States and Canada:

- Phone Number: 1-800-368-3277 (toll free)
- Fax Number: 1-800-833-7592 (toll free)
- E-mail: customerfocus@tycoelectronics.com

International:

- Phone Number: 1-434-455-6403
- Fax Number: 1-434-455-6676
- E-mail: InternationalCustomerFocus@tycoelectronics.com

3.4 CONTACTING M/A-COM FOR TECHNICAL ASSISTANCE

Should the mobile radio or control head require repair, or if there are questions or concerns about the installation of this equipment, contact M/A-COM's Technical Assistance Center (TAC) using the following telephone numbers or email address:

- U.S. and Canada: 1-800-528-7711 (toll free)
- International: 1-434-385-2400
- Fax: 1-434-455-6712
- Email: tac@tycoelectronics.com

4 UNPACKING AND CHECKING THE EQUIPMENT

4.1 GENERAL INFORMATION

Required installation materials include those listed in this section. Verify all listed materials are present before beginning the installation.



After removal from the carton, examine all M3200 mobile radio components, the control head, and all other components for broken, damaged, loose or missing parts. If any are noted, contact M/A-COM's Customer Resource Center (see page 16) immediately to discuss and arrange the return of the equipment to M/A-COM 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.

4.2 MOBILE RADIO AND CONTROL HEAD

- Trunk-Mount M7300 Mobile Radio, part number RU-144750-061**
(Catalog numbers MAMW-SDMXA, MAMW-SDMXE and MAMW-SDMXX)



- CH-721 Scan Control Head, part number CU23218-0002** (Catalog number MAMW-NCP9E)



or

- CH-721 System Control Head, part number CU23218-0004** (Catalog number MAMW-NCP9F)



- ❑ **Standard Microphone, part number MC-101616-040**
(Included with catalog number MAMW-NMC7Z)



or

- DTMF Microphone, part number MC-103334-040**
(Included with catalog number MAMW-NMC9C)

(image not available).

or

- Noise-Canceling Microphone, part number MC-103334-050**
(Included with catalog number MAMW-NMC9D)









4.3 INSTALLATION KIT

Table 4-1 below lists the contents of M7300 Motorcycle Installation Kit MAMW-NZN7X. Table 4-2 on page 22 lists part numbers for radio-related options and accessories, and Table 4-3 on page 23 lists options and accessories available for the CH-721 Scan and System model control heads.

Table 4-1: Contents of M7300 Motorcycle Installation Kit MAMW-NZN7X for M7300 Mobile Radio and CH-721 Control Head

| ITEM | QTY. | PART NUMBER | DESCRIPTION | ILLUSTRATION |
|------|--|-------------|---|---|
| 1 | 1  | 188D6464P1 | Case, Weather-Resistant Motorcycle Radio, Black, Lockable (supplied with key) |  |
| 2 | 1  | 188D6437P1 | Bracket, Case/Antenna |  |
| 3 | 1  | 188D6438P1 | Bracket, Adapter |  |
| 4 | 1  | KT23117 | Kit, Remote-Mount Radio Mounting Bracket |  |
| 5 | 1  | 350A1396G1 | Kit, Hardware, for Motorcycle Radio Case |  |
| 6 | 1  | 350A1396G2 | Kit, Hardware, for Motorcycle Radio Case, Brackets, and Antenna |  |
| 7 | 1  | 350A1396G4 | Kit, Hardware, Motorcycle Adapter Bracket Mounting (4 shock mounts) |  |
| 8 | 1  | KT-008608 | Kit, CH-721 Mounting Bracket. Includes (1) U-Shaped Mounting Bracket FM24841-0001, (2) ¼-Inch #8-32 stainless-steel screws, (2) stainless-steel flat washers and (2) stainless-steel lockwashers. |  |

**Table 4-1: Contents of M7300 Motorcycle Installation Kit MAMW-NZN7X
for M7300 Mobile Radio and CH-721 Control Head**

| ITEM | QTY. | PART NUMBER | DESCRIPTION | ILLUSTRATION |
|------|-------------------------------|--|--|---|
| 9 | 1 <input type="checkbox"/> | CA-012365-001 | Cable, M7200/M7300/M5300 DC Power. Includes (1) 20-Foot DC Power Cable with straight connector, (2) waterproof inline HFB-type fuse holders, (1) 3-amp AGC fuse, (1) 15-amp AGC fuse, and (1) 20-amp AGC fuse. |  |
| 10 | 1 <input type="checkbox"/> | CA-012616-001 | Cable, CH-721 DC Power. Includes (1) DC Power Cable with straight connector, (2) waterproof inline HFB-type fuse holders, (1) 3-amp AGC fuse, and (1) 5-amp AGC fuse. This DC Power Cable has a 10-foot 12-AWG red wire (main power input), a 20-foot white wire (switched power input), and a 5-foot black wire (ground). |  |
| 11 | 1 <input type="checkbox"/> | 19A703965P2 | Filter, Alternator Whine Reject |  |
| 12 | 4 <input type="checkbox"/> | 2-320565-2 | Terminal, Ring 12 to 10 AWG, Insulated. |  |
| 13 | 1 <input type="checkbox"/> | CA-009562-030 | Cable, CAN; 30 feet, Right-Angle and Straight Connectors |  |
| 14 | 2 <input type="checkbox"/> | MACDOS0010 <u>or</u> CD-014027-001 | Terminator, CAN; 3-pin (Supplied CAN terminator may be straight or right-angle type.) |  |

**Table 4-1: Contents of M7300 Motorcycle Installation Kit MAMW-NZN7X
for M7300 Mobile Radio and CH-721 Control Head**










| ITEM | QTY. | PART NUMBER | DESCRIPTION | ILLUSTRATION |
|------|--|----------------------|---|---|
| 15 | 1  | LS102824V10 | Speaker, External Mobile; 20-Watt (with 4.6-foot cable) |  |
| 16 | 1  | MAMROS0034- NN006 | Cable, Speaker; 6-Inch, Straight Connector |  |
| 17 | 1  | FM-104859-001 | Cap, Waterproof (For CH-721's DB-9 serial port connector) |  |
| 18 | 1  | FM-104859-002 | Cap, Waterproof (For CH-721's DB-25 accessory connector) |  |

Table 4-2: Additional Options and Accessories for M7300 Mobile Radios

| PART NUMBER | DESCRIPTION | ILLUSTRATION |
|--|---|---|
| LE-OM806HDBKTNCD5 | Antenna, 800 MHz High-Impedance Voltage/End-Fed. |  |
| CA-012349-001 | Cable, M5300/M7300 Option. See Section 12.1 (page 51). | (image not available) |
| MAMROS0055 | Cable, TIA/EIA-232 Serial Programming (6 feet). | (image not available) |
| CN-014756 | Connector, RF; TNC Male Crimp-Type for RG58U, RG58A/U and RGU400 Coaxial Cable. | (image not available) |
| KT-012350-001 (Cat. No. MAMW-NMK5F) | Kit, GPS Receiver for M5300/M7300. | (image not available) |

4.4 OPTIONS AND ACCESSORIES

Table 4-3: Options and Accessories for CH-721 Control Heads

| PART NUMBER | DESCRIPTION |
|------------------|---|
| CA-009562-006 | Cable, CAN; 6 feet, Right-Angle and Straight Connectors |
| CA-011854-001 | Cable, CH-721 Option |
| CA-104861 | Cable, CH-721 Programming |
| MAMROS0075-N1210 | Cable, DC Power; 12-AWG, 10-Foot, Straight Connector |
| MAMROS0075-R1210 | Cable, DC Power; 12-AWG, 10-Foot, Right-Angle Connector |
| MACDOS0012 | Kit, Control Head Pedestal Mounting. Includes Pedestal Mount and Mounting Screws. |
| MACDOS0013-CN004 | Kit, Speaker; 20-Watt (Includes 6-Inch Cable MAMROS0034-NN006 (Straight Connector)) |
| MC-101616-040 | Microphone, Standard with Conxall Flush-Mount Connector (Included with catalog number MAMW-NMC7Z) |
| MC-103334-040 | Microphone, DTMF with Conxall Flush-Mount Connector |
| MC-103334-050 | Microphone, Noise-Canceling with Conxall Flush-Mount Connector |
| 344A4678P1 | Microphone Hanger. (Included with catalog number MAMW-NMC7Z) |
| MACDOS0010 | Terminator, CAN; 3-Pin, Right-Angle Body |

4.5 MATERIALS NOT SUPPLIED

The following is a non-inclusive list of typical materials that are not supplied with a standard radio equipment package, but will be required to complete the radio installation:

- Motorcycle's Radio Bracket (sometimes referred to as an "Interface Bracket") — Typical type shown in Figure 5-2.
- Control Head's Adapter Bracket — See Figure 8-4
- Miscellaneous Hardware for Securing Brackets to Motorcycle
- Nylon Wire/Cable Ties

5 PLANNING THE INSTALLATION

5.1 GENERAL INFORMATION

Figure 5-1 on page 25 illustrates a typical M7300 mobile radio motorcycle installation. Before starting, plan the installation carefully so it will:

- Be safe for the motorcycle operator;
- Allow convenient access by the operator, as applicable (i.e., the control head);
- Neat; and,
- Allows easy service access.



A professional radio installer should perform the installation!



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

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 with Wire Cutter: Thomas & Betts WT-111-M
- Insulated Terminal Crimp Tool with Wire Cutter: Klein 1005
- Fuse Holder Crimp Tool: Thomas & Betts – WT-112M or California Terminal Products No. 1250 or Channelock No. 909
- Ratcheting Coaxial Crimp Tool: Cambridge 24-9960P
- Metric and S.A.E. Socket Set with Sockets to at least ½-Inch, a Nut Driver and an Extension at least 3-Inches Long
- Soft-Jaw Pliers: Tessco 450520 or equivalent
- Various Fasteners (e.g., machine screws and nuts, Tek screws, etc.)
- Tie Wraps: 6-inches or larger
- Torx Screwdrivers, T10 and T20
- Phillips-Head Screwdrivers, #1 and #2
- Flat-Blade Screwdrivers, #1 and #2
- 4-Millimeter Hex Key Wrench
- 1/8-Inch Hex Key Wrench (Allen Wrench)
- Two 5/16-Inch Combination or Open-End Wrenches (Needed for GPS Receiver Option)
- ¾-Inch Hole Saw with Depth Protection: Ripley HSK 19 or Antenex HS34
- Clutch-Type Screw Cordless Gun/Drill with Driver Bits: Makita #6096DWE
- Cordless Electric Drill with Bits
- Deburring Tool (for 3/8-inch and smaller holes)
- Flush-Cut and Large Wire Cutters



A separate list of test equipment is included in Section 15.2 on page 60.

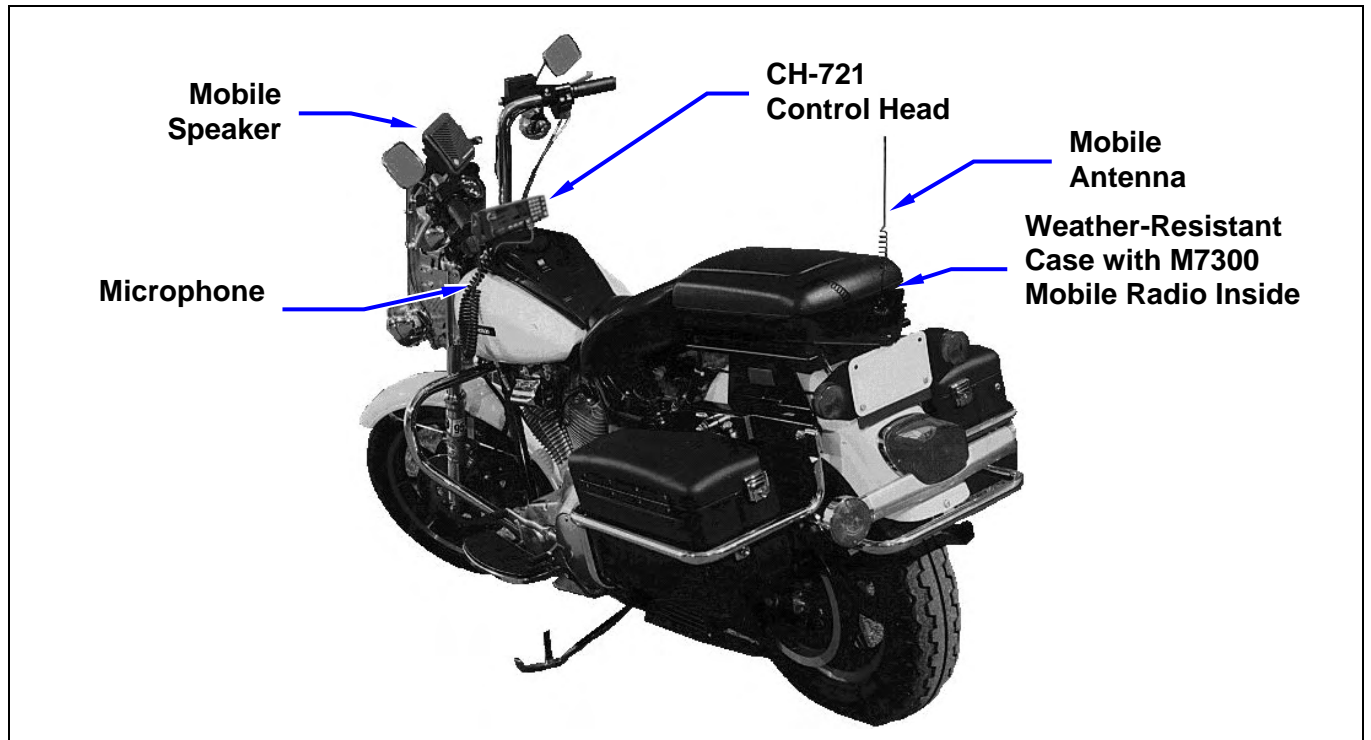


Figure 5-1: Typical Motorcycle Installation (Full View from Rear)

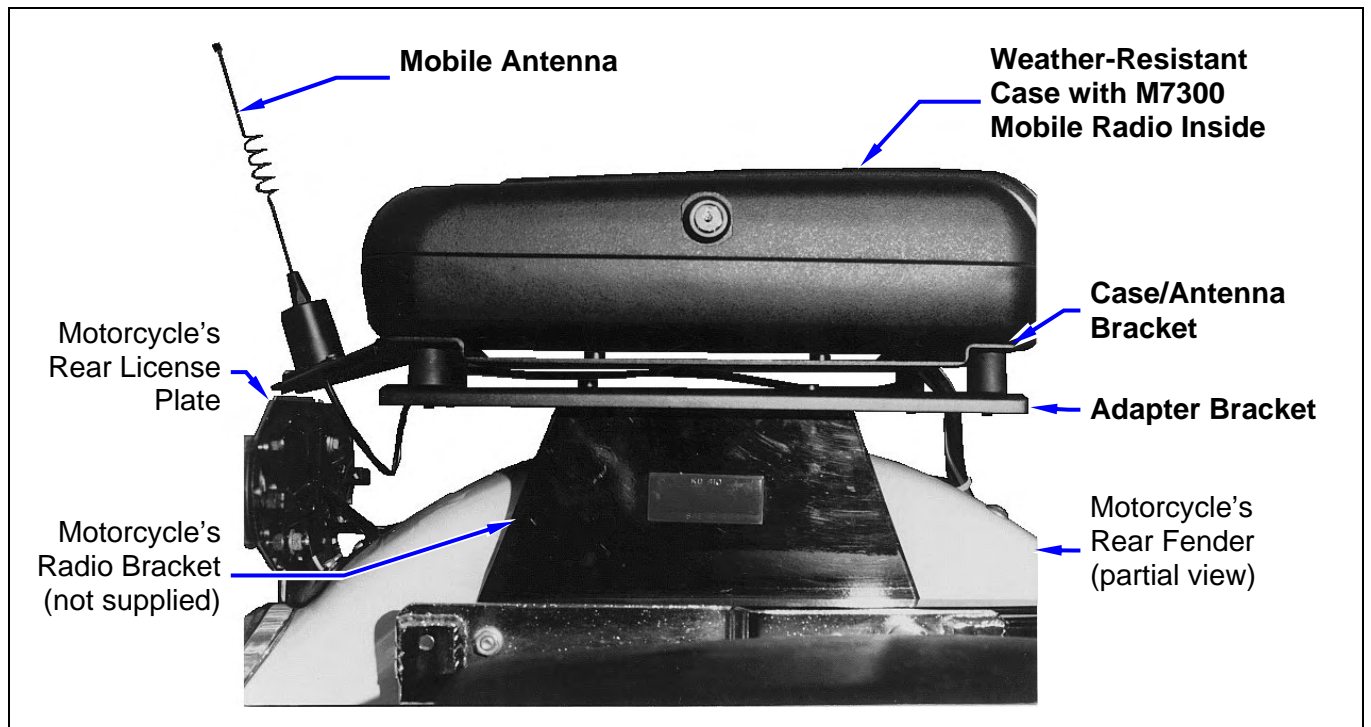


Figure 5-2: Typical Motorcycle Installation (Partial View of Radio Case and Brackets from Right Side)

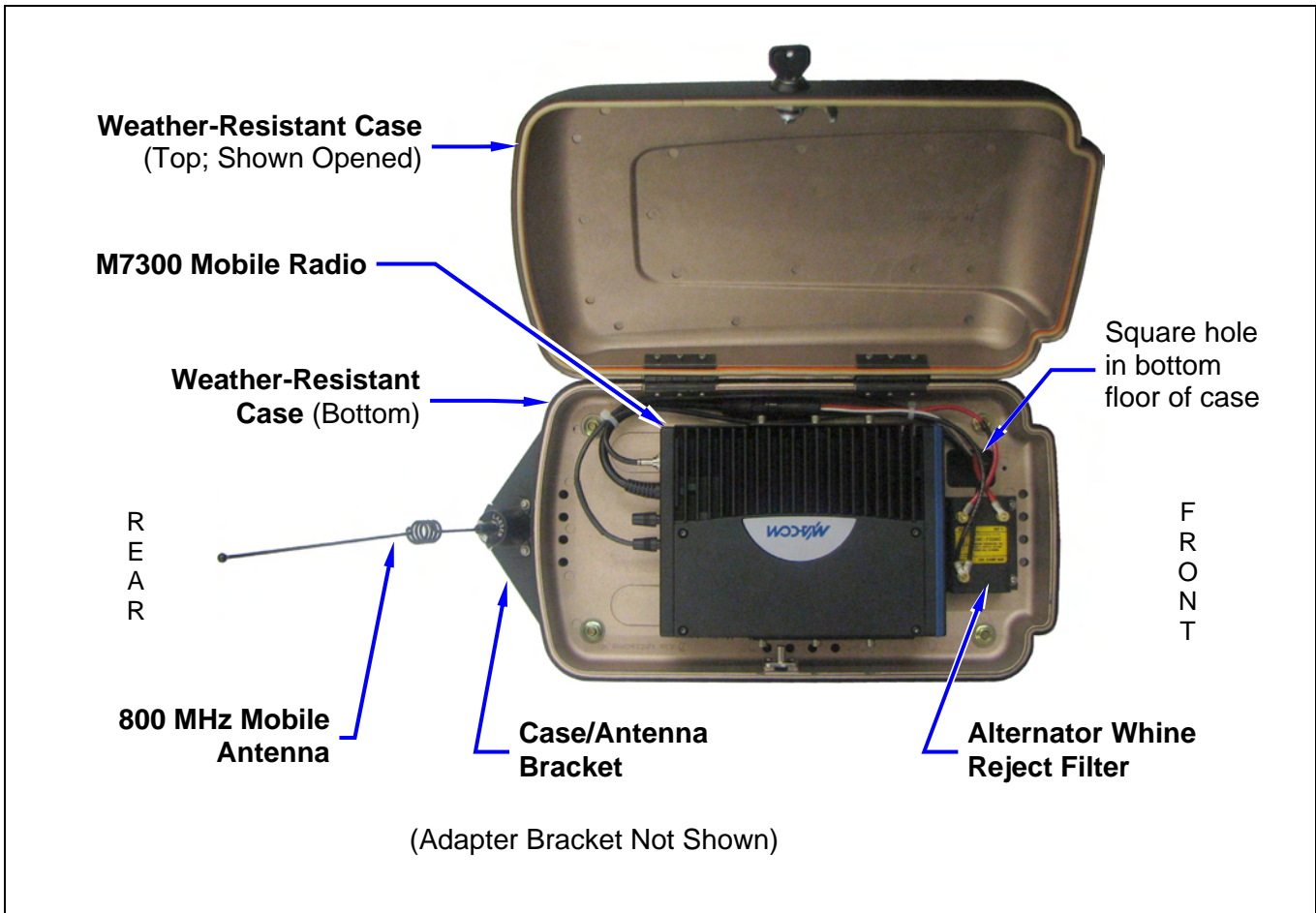


Figure 5-3: M7300 Mobile Radio inside Weather-Resistant Motorcycle Radio Case

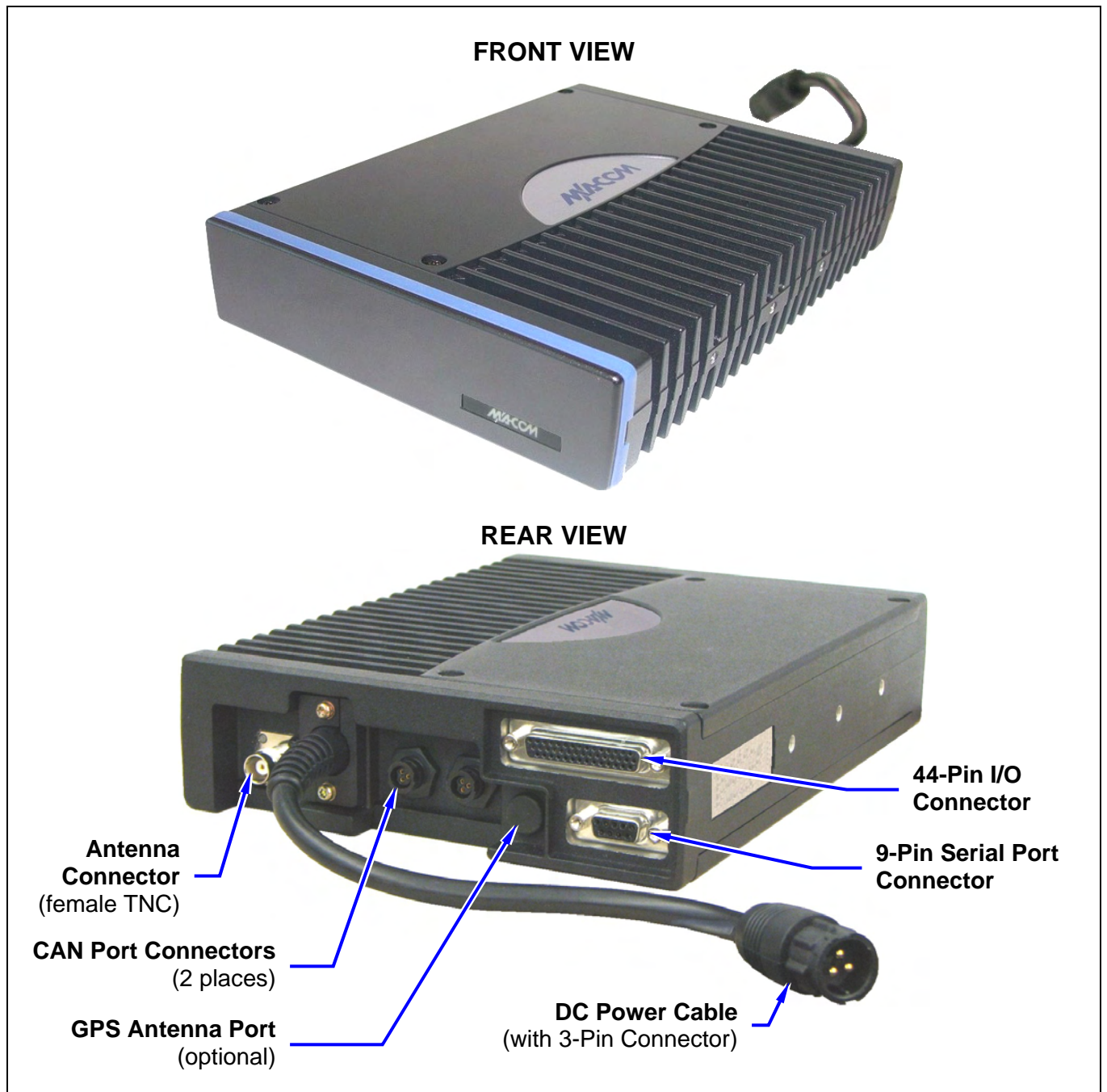


Figure 5-4: M7300 Mobile Radio — Front and Rear Views

5.3 LOCATING COMPONENTS

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

- The M7300 mobile radio and its weather-resistant case must be mounted at the rear of the motorcycle, just above the rear fender. The respective installation procedures are contained in Section 6 of this manual.

- The mobile antenna must be mounted at the rear of the motorcycle on the supplied case/antenna bracket. For specific antenna installation-related information, refer to Section 7 of this manual.
- The CH-721 control head must be mounted at the front of the motorcycle, on the handlebars. The respective installation procedures are contained in Section 8 of this manual.
- Radio and control head dimensions are listed in Section 2.1 on page 12. Several inches of clearance space is required at the back of the control head.
- For other mobile radio related components such as the microphone and speaker, determine the customer's preferences if any, for mounting locations. Comply with these preferences as long as they are consistent with safety recommendations and guidelines presented in this manual, and other generally accepted professional radio installation practices.
- 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.



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



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.



Before drilling holes and/or installing mounting screws, verify these operations will not damage or interfere with any existing vehicle components such as the fuel tank, a fuel line, engine, transmission, 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.

5.4 DC POWER CONSIDERATIONS

Careful consideration must be given to total direct current (DC) power drain on the motorcycle's electrical system (e.g., battery, alternator, wiring, etc.) The motorcycle may be equipped with additional lights, light flashers, siren, public address (PA) system, etc. that, in addition to the mobile radio, place additional drains on the system. Refer to Section 2 on page 12 for the applicable specifications.

6 RADIO MECHANICAL INSTALLATION



NOTE

Unless otherwise noted, all installation procedures in this manual should be performed in the order presented.

6.1 INSTALLING ADAPTER BRACKET

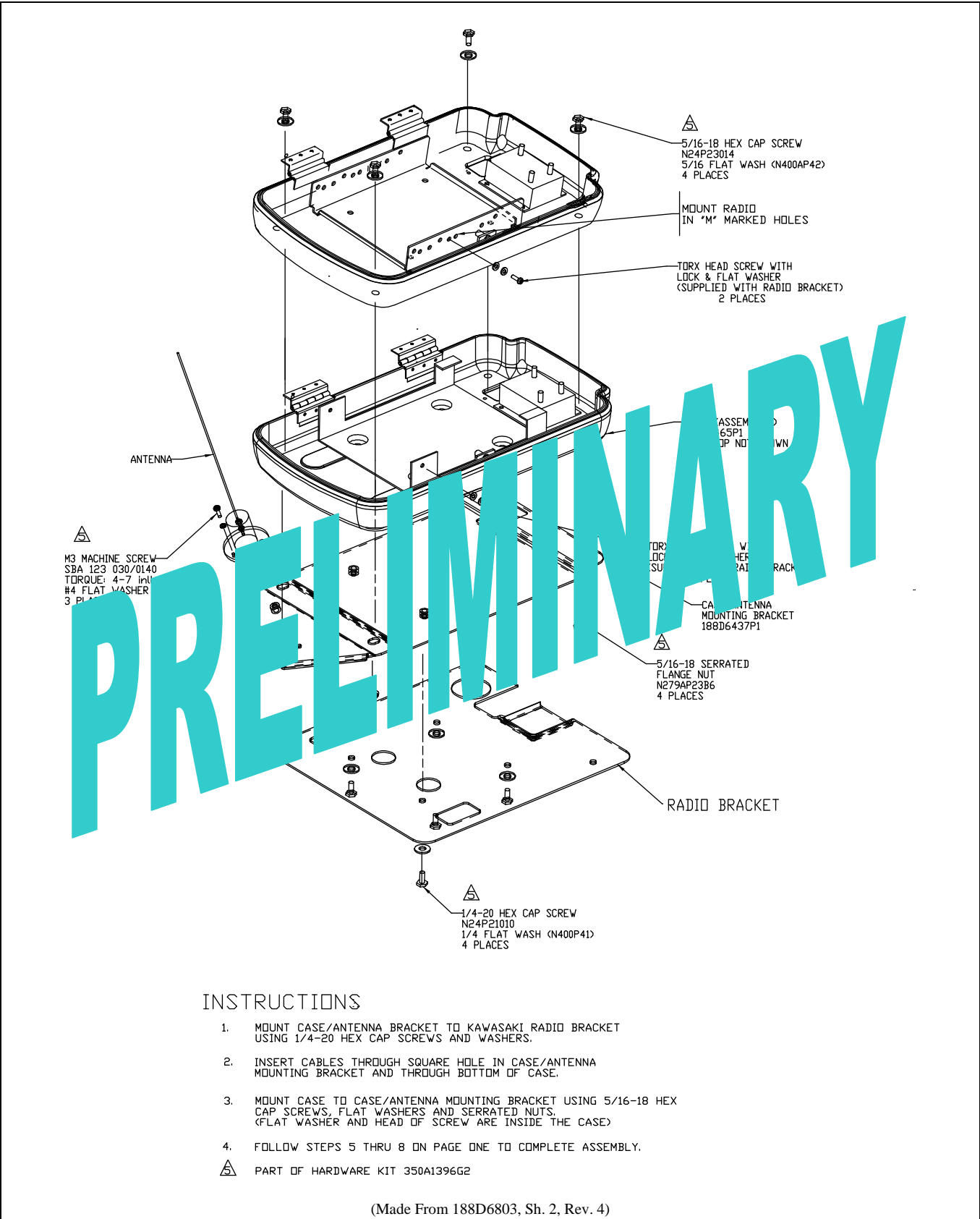
Install the Adapter Bracket by attaching it to the motorcycle's radio bracket as follows:

1. Obtain Adapter Bracket 188D6438P1 (Item 3 in Table 4-1) included in Motorcycle Installation Kit MAMW-NZN7X.
2. Obtain the four (4) resilient mounts in Motorcycle Adapter Bracket Mounting Kit 350A1396G4 (Item 7 in Table 4-1).
3. Attach a resilient mount to each corner of the bracket using four of the eight $\frac{5}{16}$ -inch serrated nuts included in Hardware Kit 350A1396G2 (Item 6 in Table 4-1). See Figure 6-1. Use each mount's shortest stub. Tighten these four (4) nuts securely. A torque of approximately 100 in.-lbs. (11.3 N.m.) is recommended.
4. Using Figure 6-1 and/or as a guide, securely attach the Adapter Bracket to the motorcycle's radio bracket. Use the $\frac{1}{4}$ -20 x $\frac{5}{8}$ -inch-long bolts ("hex cap screws") and $\frac{1}{4}$ -inch flatwashers included in Hardware Kit 350A1396G2. The Adapter Bracket's four (4) large PEM nuts must be facing up and the smaller PEM nut must be facing down. Also, the small PEM nut must be to the left-rear of the motorcycle.

Some motorcycle radio brackets have pre-drilled holes that will match the four (4) PEM nuts in the Adapter Bracket. If so, as illustrated in Figure 6-1, use a $\frac{1}{4}$ -inch flatwasher with each $\frac{1}{4}$ -20 bolt and first pass each bolt through the bracket hole, then into the respective PEM nut in the Adapter Bracket.

Other motorcycle radio brackets have pre-installed PEM nuts that match holes in the Adapter Bracket. If so, as illustrated in , use $\frac{1}{4}$ -inch washers with each $\frac{1}{4}$ -20 bolt and first pass each bolt through the respective hole in the Adapter Bracket, then into the respective PEM nut in the motorcycle's radio bracket.

5. Tighten all four $\frac{1}{4}$ -inch bolts securely. A torque of between 55 and 60 in.-lbs. (6.2 to 6.8 N.m.) is recommended.



INSTRUCTIONS

1. MOUNT CASE/ANTENNA BRACKET TO KAWASAKI RADIO BRACKET USING 1/4-20 HEX CAP SCREWS AND WASHERS.
 2. INSERT CABLES THROUGH SQUARE HOLE IN CASE/ANTENNA MOUNTING BRACKET AND THROUGH BOTTOM OF CASE.
 3. MOUNT CASE TO CASE/ANTENNA MOUNTING BRACKET USING 5/16-18 HEX CAP SCREWS, FLAT WASHERS AND SERRATED NUTS. (FLAT WASHER AND HEAD OF SCREW ARE INSIDE THE CASE)
 4. FOLLOW STEPS 5 THRU 8 ON PAGE ONE TO COMPLETE ASSEMBLY.
- ⚠ PART OF HARDWARE KIT 350A1396G2

(Made From 188D6803, Sh. 2, Rev. 4)

Figure 6-1: Weather-Resistant Motorcycle Radio Case and Bracket Installation

6.2 MOUNTING THE CASE AND CASE/ANTENNA BRACKET TO ADAPTER BRACKET

Mount the motorcycle radio case and the case/antenna bracket to the adapter bracket as follows:

1. Obtain Motorcycle Radio Case 188D6464P1 (Item 1 in Table 4-1) from Installation Kit MAMV-NZN7X.
2. Obtain Case/Antenna Bracket 188D6437P1 (Item 2 in Table 4-1) from Installation Kit MAMV-NZN7X.
3. Set the Case/Antenna Bracket onto the $\frac{5}{16}$ -inch studs of the four (4) resilient mounts. These mounts were attached to the Adapter Bracket in the previous procedure. Pass the studs through the oval-shaped holes in the corners of the Case/Antenna Bracket. The bracket's triangle-shaped antenna mounting surface must face to the rear of the motorcycle.
4. Open-up the case to expose the interior floor in its bottom-half.
5. As illustrated in Figure 6-1, place the case over the Case/Antenna Bracket, and onto the $\frac{5}{16}$ -inch studs, passing the studs through the holes in the floor of the case. The square hole in the bottom floor of the case must be towards the front of the motorcycle, so it is directly over the square hole in the Case/Antenna Bracket.
6. Place a $\frac{5}{16}$ -inch stainless-steel flatwasher onto each of the four $\frac{5}{16}$ -inch studs protruding through the holes in the floor of the case. These flatwashers are included in Hardware Kit 350A1396G2 (Item 6 in Table 4-1).
7. Add four $\frac{5}{16}$ -inch serrated nuts to the studs (each nut's washer side down), and tighten all four nuts securely. A torque of approximately 100 in.-lbs. (11.3 N.m.) is recommended.

6.3 INSTALLING THE RADIO IN THE CASE

6.3.1 Install the Radio's Mounting Bracket

Install the radio's mounting bracket into the weather-resistant motorcycle radio case as follows:

1. Obtain Radio Mounting Bracket FM103111V1 from Remote-Mount Radio Mounting Bracket Kit KT23117 (Item 4 in Table 4-1).
2. If not already, open-up the case to expose the interior floor in its bottom-half.
3. Position the bracket on the case's interior floor, at its mounting location. The large notches in the sides of the bracket must be positioned towards the front of the case. (Some early brackets did not have these notches.) The square hole in the floor is towards the front.
4. Secure the bracket to the case's floor using four M6 x 14 mm bolts and four external-tooth lockwashers included in Hardware Kit 350A1396G1 (Item 5 in Table 4-1).
5. Tighten these four bolts securely. A torque of between 55 and 60 in.-lbs. (6.2 to 6.8 N.m.) is recommended.

6.3.2 Install the M7300 Mobile Radio into Mounting Bracket

Install the M7300 mobile radio into its mounting bracket as follows:

1. Lay the radio down into the mounting bracket with its front surface towards the front of the case. This positions the connectors on the rear panel of the radio towards the rear of the case and motorcycle. See Figure 5-3 and Figure 5-4 on pages 26 and 27.
2. Attach the radio to the bracket using the six (6) M5 x 10 mm stainless-steel socket-head screws, and flatwashers and lockwashers included with the Remote-Mount Radio Mounting Bracket Kit KT23117 (item 4 in Table 4-1).
3. Tighten all six screws using a 4-millimeter hex key wrench until each lockwasher is fully compressed and the radio is firm and flush in between the brackets.