

OVERVIEW

This document describes the procedure for installing the M/A-COM OpenSky® Model M-803 Dash-Mount Mobile Radio in a vehicle, such as an automobile, truck, or van. This is a general guide only, and assumes that the installation will be performed by a professional radio installer.



MATERIALS

The M-803 Dash-Mount Radio is designed to mount under or onto the dash inside the passenger compartment of a vehicle. The installation kit (M/A-COM Part No. MAMROS0017) needed to install the Radio is described below. The following table describes the different accessories that are included in the kit:

Table I – Installation Kit Items

Item	Qty	Part Number	Description
1	1	1000003774	Dash-Mount Bracket
2	1	1000005187-0001	Unity Gain Antenna, Quarter-wave
3	1	1000005809-0002	Fuse Kit, 15A
4	1	1000005824-0002	DC Power Cable (3m)
5	1	1000005828-0002	Speaker Cable Assembly
6	1	1000005928-0001	Microphone Head
7	1	1000005975-0002	Microphone Cable Assembly
8	1	AD00006	Pkg. of 4 Screws, #8-32 PAN HD, Black
9	1	M5240	CAN Terminator, 3-Pin
10	1	CTC-000261	Speaker
11	1	MAMROS00023	GPS Antenna Kit*

* GPS Antenna Kit is only included if the corresponding radio is equipped with an optional GPS Unit.

INSTRUCTIONS

Upon removing all items from the box and verifying that all have been included, follow the following steps to install the M-803 Dash-Mount Radio. Refer to Figure 1 for location of connectors on the Radio.

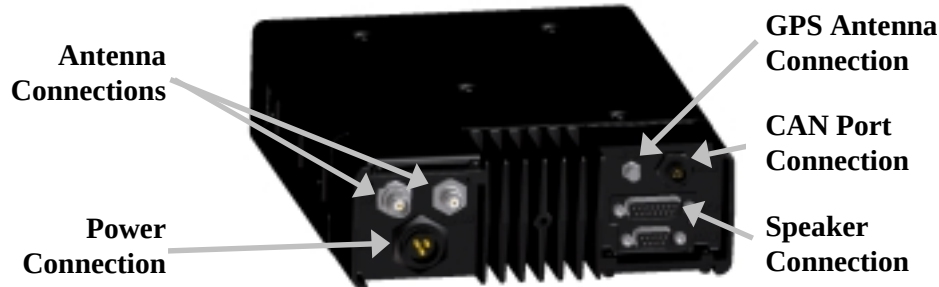


Figure 1 Rear Panel

Actions	Notes
1. Plan the mounting locations of all components (Radio, Speaker, Microphone, and Antenna), and determine the routes for all wiring and cables.	Determine the customer's preferences, if any, for location of components. Comply with these preferences insofar as they are consistent with safety, manufacturer specifications, and generally accepted professional practices. Make certain that drilling holes or inserting screws will not damage or interfere with any existing vehicle components or wiring. Follow all manufacturer requirements and guidelines for the location of components.
2. Mount the bracket in the interior of the vehicle.	Mount the Bracket (Item 1) under or on top of the dash according to the available space in the vehicle. Screws for mounting the Bracket to the dash are not included, as all installations are different. The Bracket must be firmly held to the surface in order to prevent unreasonable vibration from damaging the Radio or loosening connections. For mounting on the transmission hump, select appropriate hardware such as a mounting wedge (not included in the Radio Installation Kit).
3. Mount the Radio onto the Bracket.	Install the Mobile Radio into the Bracket using the 4 screws (Item 8) and tighten with a screwdriver until the bracket is firm and flush to the surface of the Radio.



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Actions	Notes
4. Assemble the Microphone Cable Assembly onto the Microphone Head.	Connect the Microphone Cable Assembly (Item 7) to the Microphone Head (Item 6) by sliding the 2-pin connector of the cable into the cavity of the Microphone Head. Make sure the tab on the 2-pin connector is on the same side as the cable release hole on the back of the Microphone Head. You will hear a click if properly inserted.
5. Install the Microphone Assembly into the Mobile Radio.	Plug the 14-pin connector of the Microphone Cable (Item 7) into the mating connector on the face of the Mobile Radio by aligning the connector appropriately and pushing. You will again hear a click if properly inserted.
6. Mount the Microphone Clip in the interior of the vehicle.	The Microphone Clip is included in the package with the Microphone Head (Item 6). Ensure that the Microphone Clip is connected to the vehicle's chassis ground by either screwing the mounting screws directly into the chassis or by providing a jumper wire to a lug that is attached to the Clip. The Radio has a monitor function that can be used when the Microphone is cradled in the Clip.
7. If an optional CH-103 Control Head is not being used with the M-803 Mobile Radio, a CAN Terminator needs to be installed.	Install the CAN Terminator (Item 9) onto the 3-pin connector at the rear of the Radio by aligning the connector appropriately and twisting the outer housing clockwise until it stops.
8. Mount the Speaker in the interior of the vehicle and connect it to the Radio.	Install the Speaker (Item 10) in an area of the front or rear dash that will allow for proper listening range for voice operation. Use the hardware and mounting bracket supplied with it. Refer to the Speaker manufacturer's instructions included in the Speaker Assembly kit for additional installation guidance. Install the Speaker Cable Assembly (Item 5) onto the 15-pin connector at the rear of the Radio using a screwdriver. Do not over-tighten the screws. Connect the 2-pin connector on the Speaker (Item 10) to the mating connector on the Speaker Cable Assembly (Item 5). Route the excess

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9. Mount the Antenna at a suitable location on the vehicle, and route the Antenna Cable inside the vehicle for connection to the Radio. NOTE <i>Improper installation of the antenna may lead not only to poor radio performance, but to harmful exposure as well. See Antenna Mounting Configurations below.</i>	cable out of the way of casual contact. The Antenna (Item 2) that is included in the kit must be mounted by drilling a hole. The optimal position of the antenna is in the direct center of the roof of the vehicle. Refer to <i>Antenna Mounting Configurations</i> for requirements necessary to follow when selecting the proper mounting area for the antenna. Also, refer to the antenna manufacturer's mounting and testing instructions included in the Antenna Assembly kit for installation guidance once the mounting area is determined. Route the cable from the Antenna (Item 2) to the rear of the Radio out of the way of casual contact. Install the Mini-UHF connector of the cable to the mating connector at the rear of the cable by tightening until finger-tight. It is important that this connector is tight to prevent RF leakage from occurring, but not too tight that damage occurs. Do not connect the antenna cable to the Radio until satisfactory completion of testing into a dummy load (refer to <i>Testing Into a Dummy Load</i>).
10. If an optional GPS unit is included in the Radio, the GPS Antenna needs to be connected to the Radio.	Connect the SMA connector of the GPS Antenna (Item 11) cable to the SMA connector on the rear of the Radio and route the cable out of the way of casual contact. The GPS Antenna is to be mounted on the roof of the vehicle with one of the 3 mounting configurations: Show-Mount, No Show-Mount, and Magnetic Mount. The Antenna must be kept at least 1 foot from any other antenna mounted on the vehicle and have at least 6 inches of ground plane beneath it.
11. Prepare for connecting the power to the Radio through the vehicle's firewall.	Plan the cable route carefully, using an existing access hole through the engine firewall if possible. Alternatively, drill a new hole approximately 3/8" in diameter and install a rubber grommet to protect the cable.



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12. The Fuse for Radio power must be installed in-line with raw battery voltage.

Strip one end of the wire included in the Fuse Kit (Item 3) and crimp the terminal lug onto it. Cut the wire to a length of about 6 inches and strip the end to a length indicated by the gauge on the fuse holder. Insert this end into the fuse holder until the wire cannot go any further and crimp the connection to the fuse holder. Use heat-shrink tubing to protect the connection from foreign materials. Connect the remaining wire in a similar fashion to the other end of the fuse holder.

Connect the terminal to the vehicle's battery in the engine compartment. Route the wire through a wire loom and pass it through the firewall using a grommet to ensure the wire is not damaged.

13. Prepare the ground and sense connections prior to applying power to the Radio.

Connect the DC Power Cable (Item 4) to the 3-pin connector at the rear of the Radio. Locate a chassis ground close to the Radio and strip back any jacket insulation around the wires to allow for the shortest distance of the black wire. Cut the negative (black) wire as short as possible, strip it, and crimp the terminal to it. Screw it into the chassis ground, ensuring a reliable metal-to-metal contact.

Connect the sense (white) wire of the DC Power Cable (Item 4) to an appropriate terminal to connect to a fused ignition sense in the fuse box and route the excess wire out of the way of casual contact.

14. Apply the DC power connection to the Radio.

Using a pigtail, butt-splice, or solder-sleeve, connect the positive (red) wire of the DC Power Cable (Item 4) to the fuse wire (Item 3) and route the excess wire out of the way of casual contact.

NOTE

Unlike many mobile radios, the OpenSky® Mobile Radio powers up immediately upon application of DC power.

15. Test the output of the installed Radio into a dummy load to verify that it meets specifications.

Refer to *Testing Into a Dummy Load* under **Testing** below for the procedure.

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16. Connect the Antenna and test the Radio's forward and reflected power to verify transmission performance.	Refer to <i>Testing With the Antenna</i> under Testing below for the procedure.
17. Complete the installation by organizing, securing, and checking all cables and components.	Take whatever steps are practical to make the installation neat and functional for the Radio's user. Organize and secure all cables; make sure all connections are tight.

TESTING

This section sets forth procedures to verify the performance of the installed radio. Testing uses a wattmeter (or, alternatively, a VSWR meter) to measure RF power.

There are three procedures in this section: **Changing Operating Modes**, **Testing Into a Dummy Load**, and **Testing With the Antenna**. Note that while the radio's normal operating mode for voice or data communications is OpenSky® Trunking Protocol (OTP), the radio must be operating in OpenSky® Conventional FM (OCF) mode for testing. Follow the procedure under **Changing Operating Modes** to switch between the OCF and OTP modes.

Note also that the accuracy of test results depends on a radio power source in the range of 13.8–16 volts DC at greater than 8 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.

Test Equipment	Comments
Wattmeter	Bird Electronic Corporation Model 43 or equivalent, with N-Series female connectors on both the input and output sides As an alternative to using a wattmeter, a Voltage Standing Wave Ratio (VSWR) meter, Bird Electronic Corporation Model 4391A or equivalent, can be used to carry out the required RF (radio frequency) power testing.
Slug	For use with the wattmeter; rated power of 25 watts and frequency range appropriate to the 800 MHz output of the OpenSky® radio (Bird Electronics Element APM-25E (25 watts, 400–1000 MHz) or equivalent)

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Coaxial Cable Jumper	Cable with Mini-UHF male connector on one end and N-Series male connector on the other end, approximately three feet in length (Pasternack Enterprises PE3282-36 or equivalent)
N-Series to Mini-UHF Adapter	N-Series male to Mini-UHF female (Pasternack Enterprises PE9064 or equivalent)
Dummy Load	RF terminator rated at 50 ohms resistance and greater than 50 watts power, with N-Series male connector (Pasternack Enterprises PE6106 or equivalent)
Antenna	See the following section.

Antenna Mounting Configurations

This radio has been tested and complies with the FCC RF exposure limits for Uncontrolled Exposure and Occupational exposure. The difference is in the minimum safe distance that people must be away from the antenna when transmitting RF energy. To assure optimal radio performance and that human exposure to RF electromagnetic energy is within the guidelines, transmit only when people are at least the minimum distance away from a properly installed antenna. Table II lists the minimal distances.

Table II - M-803 Mobile Radio Minimum Safe Distances

Rated Power of OpenSky M-803 Mobile Radio	Antenna Gain	M/A-COM Recommended Antenna	Minimum Distance from Transmitting Antenna for Uncontrolled Exposure	Minimum Distance from Transmitting Antenna for Occupational Exposure
45 dBm max, 43 dBm nominal	0 dB	Maxrad #Z322 Unity Gain, Quarter-Wave, Rooftop	68.5 cm (27 inches)	30.6 cm (12 inches)
45 dBm max, 43 dBm nominal	3 dB	Antenna Specialists #ASPA1860M 3dB, Rooftop; #ASP915 3dB, Elevated-Feed, Various Mounts	97.6 cm (38.4 inches)	43.2 cm (17 inches)

There are various vehicles that have various physical dimensions that are not standard, so selection of an antenna location is not trivial. Using Table II as a guide for determining the best possible mounting configuration in order to reduce human exposure, there are three possible locations on a vehicle where the antenna can be mounted, described as follows:

Rooftop Center The center of the roof of a vehicle is the optimal location for the rooftop antenna. The mounting area under the antenna must be a flat, metallized ground plane, and it must be located directly in the center of the roof. If other obstructions, such as a light bar or another antenna, prevent the antenna from being mounted in the direct center of the roof, the antenna should be mounted, preferably, a minimum of one foot away from the obstruction, but in the middle of the roof with respect to the left and right sides of the vehicle.

Trunk-Lid Center Certain vehicles do not allow for the antenna to be placed in the center of the roof. In this case, the next optimal location for the antenna is in the center of the trunk lid. Again, the mounting area under the antenna must be a flat, metallized ground plane, and it must be located directly in the center of the trunk lid. There are no other preferable solutions for mounting this antenna if other obstructions prevent the antenna from being mounted in the direct center of the trunk lid.

Trunk-Lip Center Some antennas have a feature that allows them to be mounted on the lip of the trunk lid. In this case, the antenna is mounted on the top lip and in the direct center of the trunk lid. Again, there are no other preferable solutions for mounting this antenna if other obstructions prevent the antenna from being mounted in the direct top center of the trunk lid.

Changing Operating Modes (Preliminary)

Actions	Notes
1. Press the UP ARROW button on the navigation pad repeatedly until the message "MODE" appears on the unit's display, then press the SELECT button.	The buttons controlling the radio's operating parameters are on the left side of the front of the radio.
2. Press the RIGHT ARROW button on the navigation pad repeatedly until the message "OCF" appears, then hit the SELECT button.	Select the desired operating mode, where the mode is one of the following: • "OCF"—To perform testing • "OTP"—To operate the radio for normal voice or data communications

Actions	Notes
3. Press the RIGHT ARROW button once to confirm the selection, then press the SELECT button to select the mode.	The radio is now in OCF mode.

Testing Into a Dummy Load

Actions	Notes
1. Connect the wattmeter to the radio for testing according to Figure 2 , using the dummy load in place of the antenna.	The dummy load connects to the output side of the wattmeter, in place of the antenna cable (see Figure 2).
2. Apply power to the radio and switch to OCF mode, if necessary.	The radio must be operating in OCF mode in order to continue with the testing procedure. If the radio does not display "OCF" during startup indicating that it is initializing in OCF mode, use the procedure under <i>Changing Operating Modes</i> above.
3. Position the slug to measure forward RF power output.	Rotate the slug, if necessary. The arrow on the face of the slug must point from the radio toward the dummy load to measure forward power.
4. Measure the radio's RF power output.	Key the microphone and note the wattmeter reading. De-key the microphone.
5. Compare the wattmeter reading with the target RF power output range specified in the <i>Notes</i> column, opposite.	15–21 watts TARGET VALUE RANGE

Actions	Notes
6. Record the wattmeter reading for RF power output into a dummy load, or take remedial action and measure the output again.	If the wattmeter reading is within the target range, record the value in the appropriate space on the data collection sheet at the end of this guide. If the wattmeter reading is outside the target range, recheck the power source and all connections and measure the RF output power again. If this fails to produce a reading within the target range, replace the radio and repeat this procedure.

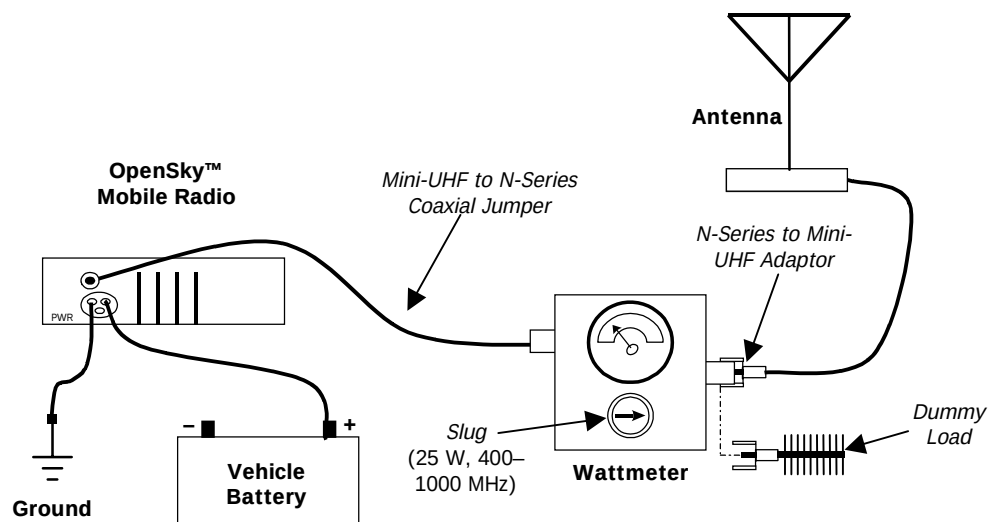


Figure 2—Wattmeter Connection

Testing With the Antenna

Actions	Notes
1. Connect the wattmeter to the radio and antenna for testing according to Figure 2 .	Remove the dummy load, if necessary, and connect the antenna lead to the output side of the wattmeter (see Figure 2).
2. Apply power to the radio and switch to OCF mode, if necessary.	The radio must be operating in OCF mode in order to continue with the testing procedure. If the radio does not display "OCF" during startup indicating that it is initializing in OCF mode, use the procedure under <i>Changing Operating Modes</i> above.
3. Position the slug to measure forward RF power output.	Rotate the slug, if necessary. The arrow on the face of the slug must point from the radio toward the antenna to measure forward power.
4. Measure the radio's forward RF power output.	Key the microphone and note the wattmeter reading. De-key the microphone.
5. Compare the wattmeter reading with the target RF power output range specified in the <i>Notes</i> column, opposite.	15–21 watts TARGET VALUE RANGE

Actions	Notes
6. Record the wattmeter reading for forward power, or take remedial action and measure the output again.	If the wattmeter reading is within the target range, record the value in the appropriate space on the data collection sheet below. If the wattmeter reading is outside the target range, verify that the radio's operating voltage is within the specified range, recheck all connections, and measure the forward power again. If this fails to produce a reading within the target range, check all cabling and connections, and repeat the testing procedure to this point. In the event the wattmeter reading still falls outside the target range, replace the antenna, make sure all connections are seated firmly, and repeat the testing procedure.
7. Position the slug to measure reverse, or reflected, RF power.	Rotate the slug. The arrow on the face of the slug must point from the antenna toward the radio to measure reverse, or reflected, power.
8. Measure the reverse, or reflected, RF power.	Key the microphone and note the wattmeter reading. De-key the microphone.
9. Compare the wattmeter reading with the target RF power output range specified in the <i>Notes</i> column, opposite.	2 watts or less TARGET VALUE RANGE
10. Record the wattmeter reading for reverse power, or take remedial action and measure the output again.	If the wattmeter reading is within the target range, record the value in the appropriate space on the data collection sheet at the end of this guide. If the wattmeter reading is outside the target range, make sure the antenna installed is consistent with the radio's specified frequency range. Recheck all antenna connections, and measure the reverse power again. If this fails to



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11. Return the radio to OTP mode for normal communications.

produce a reading within the target range, replace the antenna and repeat the entire testing procedure.

Any value exceeding the maximum allowable reflected power value will result in a diminished radio output signal.*

Use the procedure under *Changing Operating Modes* above. The radio is now ready for normal communications.

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* The standard measure for comparing forward and reflected power is the Voltage Standing Wave Ratio (VSWR). Use the values recorded for the installed radio's forward and reflected power to compute the VSWR, if desired, using the following formula: $VSWR = 1 + \sqrt{PR/PF}$, where PR = reverse power and PF = forward power. This value is expressed as a ratio to the ideal value of 1, for instance, 1.2:1.



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Clip  Here

Enter the information requested on this data collection sheet. Clip this form and file it as a permanent record of the tested performance of the installed radio.

Mobile Radio
Serial Number

Mobile Radio
Model and Rev

Antenna Make and Model

Date of Test
(mm/dd/yyyy)

Company Performing Installation

Technician Performing Test

tyco / Electronics



watts
Power Into a Dummy Load

watts	watts
Forward Power With Antenna	Reflected Power With Antenna