INSTALLATION GUIDE

OVERVIEW

This document describes the procedure for installing the M/A-COM OpenSky® Model VR-803 Vehicular Tactical Network (V-TAC) 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.

DISCLAIMER

THE INSTALLATION INSTRUCTIONS PROVIDED IN THIS MANUAL ARE FOR REFERENCE, AND DO NOT CREATE A WARRANTY OF ANY KIND AS TO THE FUNCTIONALITY OF THE INSTALLED PRODUCT. THE ONLY WARRANTIES THAT APPLY TO THIS PRODUCT ARE THOSE SET FORTH IN THE SALES AGREEMENT.

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MATERIALS

There are three main components to the VR-803 V-TAC: the Full-Duplex Mobile Radio Unit (MRU); the Vehicular Repeater Base Unit (VRB); and the RF Combiner. The V-TAC is designed to mount on the floor or on a tray in the trunk or unoccupied section of a vehicle. The V-TAC is designed to be operated with an externally-mounted antenna. The Installation Kit (M/A-COM Part #MAMROS0019) needed to install the V-TAC is described below. The V-TAC is intended to be used with a CH-103 Control Head with Installation Kit, sold separately.

Table I lists the accessories that are included in the kit. Table II lists additional options and accessories that may be purchased separately. (Note: The Installation Kit does not include an antenna. An antenna must be purchased separately, and the V-TAC may not be installed unless an antenna is to be installed at the same time.)

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Table I – Installation Kit Items

Item	Qty	Part Number	Description
1	1	MAMROS0044	Base Bracket Kit
2	2	MAMROS0046	Extension Bracket Kit
3	1	MAMROS0068-0003	Fuse Kit, 3A
4	2	MAMROS0068-0015	Fuse Kit, 15A
5	3	MAMROS0051	DC Power Cable, M-803 (20 ft)
6	1	MAMROS0052	Multi-Cable Assembly
7	1	MAMROS0054	V-TAC Control Interface Assembly
8	1	MAMROS0078-TMB12	RF Cable, TNC to Mini-UHF, Blue
9	1	MAMROS0078-TMG12	RF Cable, TNC to Mini-UHF, Green
10	1	MAMROS0078-TTR12	RF Cable, TNC to TNC, Red
11	1	MAMROS0078-TTX12	RF Cable, TNC to TNC, Yellow
12	1	MAMROS0066	CAN Terminator, 3-Pin
13	1	MAMROS0060	Antenna Connector, TNC

Table II - Additional V-TAC Options and Accessories

Part Number	Description
(TBD)	GPS Upgrade Option
MAMROS0023	GPS Antenna Kit, Show/No-Show/Magnet Mount
MAMROS0033	Antenna Kit, Unity Gain, Rooftop
MAMROS0031	Antenna Kit, 3dB, Rooftop
MAMROS0024	Antenna Kit, Elevated 3dB, Trunk Mount
MAMROS0039	SMR/GPS Antenna Kit, 3dB, Rooftop
MAMROS0026	SMR/GPS Antenna Kit, Elevated 3dB, Trunk Mount
MAMROS0042	SMR/GPS Antenna Kit, Elevated 3dB, Mirror Mount
MAMROS0055	RS-232 Serial Computer Cable (6 ft)

INSTRUCTIONS

Upon removing all items from the box and verifying that all have been included, proceed with the following steps to install the VR-803 V-TAC. Refer to Figure 1 for location of connectors on the V-TAC.

IMPORTANT

Mounting of the V-TAC and Antenna in ways other than those described below may adversely affect performance, violate FCC rules on RF Exposure, and even damage the V-TAC.

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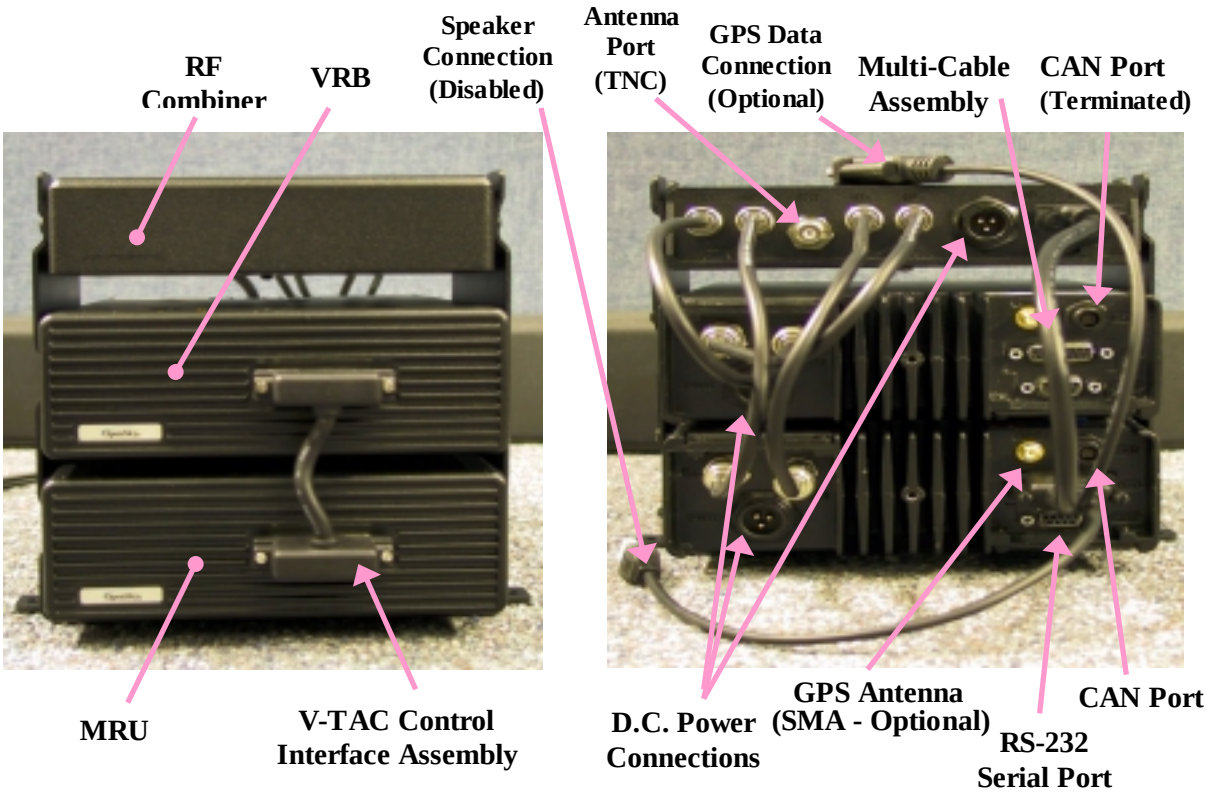

Figure 1 - Front and Rear Views of VR-803 V-TAC

Actions	Notes
1. Plan the mounting locations of all components (V-TAC, Antenna, and Cables) 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.

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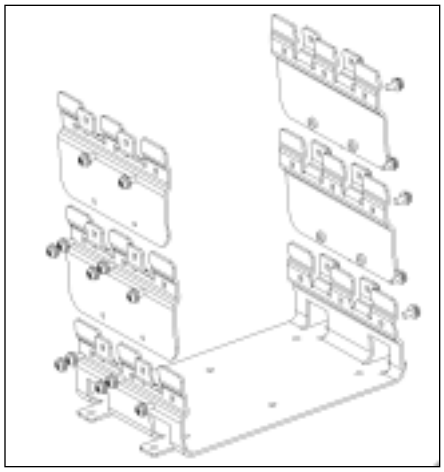
Actions	Notes
2. Mount the bracket in the interior of the vehicle. **WARNING** *The VR-803 V-TAC must be kept away from sources of heat. Adequate ventilation must be provided to the rear fins of the MRU and VRB. The V-TAC reduces its RF output power when its ambient temperature exceeds +60ºC.*	♦ As an assembled unit, the V-TAC weighs over 20 lbs. It is unadvisable for the V-TAC to be hung from a surface; rather, the V-TAC is best mounted onto a firm, flat surface. ♦ Mount the Base Bracket from the Base Bracket Kit (Item 1) on top of the floor of the trunk according to the available space in the vehicle or on the surface of a trunk tray. ♦ Screws for mounting the bracket are not included, as all installations are different, but at least 6 screws are required. Steel #10 screws are recommended. ♦ Screws for mounting the MRU into the Base Bracket are included. ♦ The Bracket must be firmly held to the surface in order to prevent unreasonable vibration from damaging the V-TAC or connections from loosening.
3. Create a support bracket by installing the Extension Brackets onto the Base Bracket. 	♦ Install two Extension Brackets from the Extension Bracket Kit (Item 2), one on either side, onto the Base Bracket using 2 screws from the kit. Tighten with a screwdriver until the Extension Bracket is firm and flush to the Base Bracket. ♦ The Extension Bracket can only be installed onto the Base Bracket one way. See the exploded view on the left for proper alignment. ♦ Install the other two Extension Brackets, one on either side, onto the Extension Brackets just assembled. ♦ The Extension Bracket can only be installed onto another Extension Bracket one way. See the exploded view on the left for proper alignment. ♦ Tighten with a screwdriver until the Extension Bracket is firm and flush.
4. Mount the individual components into the support bracket.	♦ It is easy to mistake the VRB for the MRU, because they are manufactured into the same chassis. There are two features,

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Actions	Notes
	however, to distinguish the two units: ➢ Each unit has a different product label. ➢ The MRU has a red and green color-coding for the antenna ports, while the VRB has a yellow and blue color-coding. ➢ See the picture on the left for locations of the labels.
NOTE *Optimal performance of the Radio is based upon proper mounting techniques. An improperly mounted V-TAC may experience degradation in the quality of communication with the OpenSky® network.*	♦ Install the MRU into the lowermost bracket spot using 6 screws (Item 10), 3 per side, and tighten with a screwdriver until the bracket is firm and flush to the surface of the MRU. ♦ Install the VRB into the middle bracket spot using 6 screws (Item 10), 3 per side. **Do not tighten these screws** until the VTAC Control Interface Assembly is installed (Step 7). ♦ Install the RF Combiner into the uppermost bracket slot using 4 screws (Item 10), 2 per side, and tighten with a screwdriver until the bracket is firm and flush.
5. The CAN Port needs to be terminated properly. **NOTE** *The Control Head must be installed and connected to the MRU before power to the V-TAC is applied.*	♦ Install the CAN Terminator (Item 12) onto the smaller 3-pin connector at the rear of the VRB by aligning the connector appropriately, pushing, and twisting the outer housing clockwise until it stops. ♦ The CAN Port of the MRU is where the CAN Cable of the CH-103 Control Head is to be connected. See the Installation Guide for the CH-103 for more details.
6. The control connection between the MRU and RF Combiner needs to be made.	♦ Install the male15-pin, 2-row connector of the Multi-Cable Assembly (Item 6) onto the female mate at the rear of the MRU. ➢ Secure the connection by screwing the jackscrews until they are firmly in place. Do not over-tighten. ♦ Install the male15-pin, 3-row connector of the Multi-Cable Assembly onto the female mate at the rear of the RF Combiner.

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	➢ Secure the connection by screwing the jackscrews until they are firmly in place. Do not over-tighten.
NOTE *The Multi-Cable Assembly (Item 6) supports multiple configurations of the M-803 Radio Product Family. For the V-TAC configuration, the 2-pin speaker connection must be left unconnected. Instead, the speaker connection must come from the CH-103 Control Head. The speaker output from the Multi-Cable Assembly is disabled in the V-TAC.*	♦ The Multi-Cable Assembly supports an interface for optional GPS in the V-TAC. The 9-pin female connection in the Multi-Cable Assembly can be connected through an RS-232 Serial cable to a COM Port of a computer to access the GPS's NMEA output. ➢ To connect this interface, mate the male 9-pin connector of the optional serial cable to the female connector of the Multi-Cable Assembly and tighten the jackscrews until firm. ➢ Industry software to process GPS information through this interface is not supported by M/A-COM.
7. The control connection between the MRU and VRB needs to be made. **WARNING** *Early versions of this assembly have been constructed with a cable joining the two multi-pin connectors (shown in Figure 1). For this type of assembly, slight squeezing pressure must be applied between the connectors to reduce the strain when installed and to ensure the screws do not cross-thread.*	♦ Install the V-TAC Control Interface Assembly (Item 7) onto the connectors on the front panels of the MRU and VRB. ➢ Screw the four screws of the Interface Assembly with a screwdriver until they stop. Do not over-tighten. ➢ The mounting screws of the VRB were left loose in order to accommodate proper alignment of the Interface Assembly. ➢ Tighten the 6 mounting screws of the VRB with a screwdriver until the bracket is firm and flush to the surface of the VRB.
8. The RF connections among all three units must be made. **WARNING** *Improper installation of the RF Cables may lead not only to poor radio performance, but also to harmful exposure. See* Antenna Mounting Configurations.	♦ The RF Cables are color-coded for proper assembly. Assemble them as follows: ➢ Connect the Mini-UHF end of the blue-coded RF Cable (Item 8) to the Mini-UHF connector on the VRB, and connect the TNC end to the blue-coded connector on the RF Combiner. ➢ Connect the Mini-UHF end of the green-coded RF Cable (Item 9) to the Mini-

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	UHF connector on the MRU, and connect the TNC end to the green-coded connector on the RF Combiner. ➢ Connect one of the TNC ends of the red-coded RF Cable (Item 10) to the TNC connector on the MRU, and connect the other end to the red-coded connector on the RF Combiner. ➢ Connect one of the TNC ends of the yellow-coded RF Cable (Item 11) to the TNC connector on the VRB, and connect the other end to the yellow-coded connector on the RF Combiner. ➢ Use a pair of pliers to snug the connections. Do not over-tighten.
WARNING *To prevent RF leakage and ensure peak performance, make sure that the TNC and Mini-UHF connectors are tight, but not too tight that damage occurs.*	
9. Mount the Antenna at a suitable location on the vehicle, and route the Antenna Cable inside the vehicle for connection to the Radio.	♦ The Antenna is not included in the kit, as several types of antennas can be used with the V-TAC. ♦ The Antenna **must** be installed before completion of the V-TAC installation. ♦ The optimal type of antenna to use is the rooftop mount. For best performance, the rooftop mount should be placed in the direct center of the roof of the vehicle. ♦ Various mounting configurations are offered for antennas available through M/A-COM. Check with OpenSky® Customer Service for more information. ♦ Refer to *Antenna Mounting Configurations* 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 to the rear of the V-TAC out of the way of casual contact. ♦ A Mini-UHF connector is generally included with the Antenna Kit, but connection to the V-
IMPORTANT *Do not permanently connect the antenna to the V-TAC until satisfactory testing into a dummy load is completed. Refer to* Testing into a Dummy Load *for further information.*	

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Actions	Notes
	TAC must be TNC. Therefore, included in the Installation Kit is a TNC Connector (Item 13).
WARNING *To prevent RF leakage and ensure peak performance, make sure that the TNC connector is tight, but not too tight that damage occurs.*	♦ Crimp the TNC Connector onto the Antenna cable by following the directions included in the Antenna Kit. ♦ Screw the TNC Connector of the Antenna Cable to the TNC Antenna Port connection (coded with the color white) of the RF Combiner, tightening until finger-tight. ♦ This will be a temporary connection until the V-TAC and Antenna can be tested after the V-TAC installation is complete. The antenna needs to be connected in case of accidental tranmission of the V-TAC occurs.
10. If an optional GPS unit is included in the V-TAC, the GPS Antenna needs to be connected.	♦ Screw the SMA plug of the GPS Antenna cable to the SMA receptacle on the rear of the MRU, tightening until finger-tight. ♦ Route the remaining cable out of the way of casual contact. ♦ Various mounting configurations are offered for GPS antennas available through M/A-COM. Check with OpenSky® Customer Service for more information. ♦ The GPS Antenna must be kept at least 6 inches from any other antenna mounted on the vehicle and have at least 6 inches of ground plane beneath it.
WARNING *To prevent RF leakage and ensure peak performance, make sure that the SMA connector is tight, but not too tight that damage occurs.*	
11. Prepare for connecting the power to the V-TAC 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.
12. The Fuses for the individual units in the V-TAC must be installed in-line with raw battery voltage.	♦ Strip one end of the wire included in the 3A Fuse Kit (Item 3) and crimp a terminal lug (not included) onto it which will mount directly to the positive battery post. ♦ 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.

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Actions	Notes
IMPORTANT *The Fuse must not be installed in the Fuse Holder until all wiring is complete. This will prevent the V-TAC from powering up prematurely and causing an in-rush of current that could lead to shorting of the battery, sparking, or even fire.*	♦ Open the fuse holder and remove the fuse. ♦ Insert the stripped wire into the fuse holder and push out the holder socket. ♦ Crimp the socket onto the wire at the crimp end and pull the wire so that the socket seats back into the 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. ♦ Mark or label the wire to indicate that the in-line fuse is 3 Amps. ♦ Route the wire at the other end through a wire loom and pass it through the firewall, using a grommet to ensure that the wire is not damaged. ♦ Repeat the procedure above for the two 15A fuse kits (Item 4). Mark or label these wires to indicate the in-line fuses are 15 Amps.

IMPORTANT *Labeling of the fuse wires is important so that proper connection of the three units of the V-TAC is obtained. The RF Combiner uses less current than the MRU and VRB and is therefore rated at a lower current. Connecting either the VRB or MRU to the 3A fuse will result in an over-current event and cause the V-TAC to fail.*

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Actions	Notes
13. Connect the DC Power Cables and prepare the ground connections prior to applying power to the V-TAC. **NOTE** *The white wire of the DC Power Cable is connected to fused ignition sense of the vehicle only in the Dash-Mount M-803 Radio. It is not necessary to connect the white wires of the three DC Power Cables of the V-TAC to ignition sense. The Control Head wakes up the V-TAC when power is applied. However, connection of the ignition sense for the V-TAC may be needed in the future in configurations that do not use the Control Head (e.g., data-only applications). It is recommended that the white wire be coiled and placed aside rather than cut from the cable assembly.*	♦ Connect one of the DC Power Cables (Item 5) to the 3-pin power connector at the rear of the MRU. ♦ Connect a second DC Power Cable (Item 5) to the 3-pin power connector at the rear of the VRB. ♦ Connect the third DC Power Cable (Item 5) to the 3-pin power connector at the rear of the RF Combiner. ♦ Mark or label each DC Power Cable on both ends with the name of the unit it is connected to. ♦ Locate a chassis ground close to the V-TAC and strip away any paint or dirt to expose raw metal. The location of this connection should be as close to the V-TAC that the installation will allow. ♦ Cut the negative (black) wire as short as possible on each DC Power Cable, strip them, and crimp terminal lugs to them. ♦ Drill an appropriately sized hole for the terminal into the cleared-out chassis location and de-burr the hole. ♦ Screw all three lugs into the chassis ground. Separate each lug with star washers and ensure a reliable metal-to-metal contact.

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Actions	Notes
14. Apply the DC power connection to the Radio.	♦ Route the positive (red) wires of all three DC Power Cables through the vehicle, following standard routing practices. ♦ Cut the wires to the proper lengths to be able to connect to the Fuse Wires, which have been routed through the firewall. **Make sure that the labeling of the wires is maintained before cutting.** ♦ Using a pigtail, butt-splice, or solder-sleeve, connect the red wire from the DC Power Cable of the RF Combiner to the 3A Fuse Wire (Item 3). ♦ Using a pigtail, butt-splice, or solder-sleeve, connect the red wire from the DC Power Cable of the MRU to one of the 15A Fuse Wires (Item 4). ♦ Using a pigtail, butt-splice, or solder-sleeve, connect the red wire from the DC Power Cable of the VRB to the other 15A Fuse Wires (Item 4). ♦ Route the excess wire out of the way of casual contact. ♦ Re-install the 3A fuse into the holder of the 3A Fuse Wire and ensure a tight connection. ♦ Re-install the 15A fuses into the holders of the 15A Fuse Wires and ensure tight connection. ♦ Verify that power is applied to the V-TAC by checking the display on the Control Head. If the display is not lit, press the on/off button for 2 seconds until an asterisk appears on the display and the display turns on.
NOTE *Unlike many mobile radios, the OpenSky® M-803 Radio Products power up immediately upon application of DC power to the state of last control.*	
15. Verify that the output of the V-TAC into a dummy load meets specifications.	♦ Refer to *Testing into a Dummy Load* under **Testing** below for the procedure.
16. Re-connect the Antenna and test the forward and reflected power of the V-TAC to verify transmission performance.	♦ Refer to *Testing with the Antenna* under **Testing** below for the procedure.

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Actions	Notes
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 but not over-stressed.

TESTING

This section sets forth procedures to verify the performance of the installed V-TAC. 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 normal operating mode of the V-TAC for voice or data communications is OpenSky® Trunking Protocol (OTP), the radio must be operating in OpenSky® Conventional FM (OCF) mode for testing. The reason for this is that OTP uses a Time Domain-Multiple Access (TDMA) protocol in which transmit power is difficult to measure with standard equipment. Conventional FM mode allows for 100% duty-cycle transmissions. Follow the procedure under **Changing Operating Modes** to switch between the OCF and OTP.

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® V-TAC [Bird Electronics Element 25E (25 watts, 400–1000 MHz) or equivalent].

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Test Equipment	Comments
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

IMPORTANT

This radio has been tested and complies with the FCC RF exposure limits for Uncontrolled Exposure (General Population) and Occupational Exposure. 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 safe distance away from a properly installed, externally mounted antenna.

The antennas listed in Table II have all been approved for use with the V-TAC. Table III lists the minimum safe distances for approved antenna types.

Table III - VR-803 V-TAC Minimum Safe Distances

OpenSky® VR-803 Rated Power	Antenna Gain	M/A-COM Recommended Antenna	Minimum Distance from Transmitting Antenna for Uncontrolled Exposure	Minimum Distance from Transmitting Antenna for Controlled Exposure
45 dBm (max)	0 dB	Maxrad #Z322 Unity Gain, ¼-Wave, Rooftop	69 cm (27 in.)	31 cm (12 in.)
45 dBm (max)	3 dB	Ant. Specialists #ASPA1860M 3dB, Rooftop; #ASPA915 3dB, Elevated-Feed, Various Mounts	98 cm (39 in.)	43 cm (17 in.)

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The M-803 may be mounted in a wide range of vehicles with varying, non-standard physical dimensions, so selection of an antenna and its location is not trivial. Only install antennas where a minimum safe distance (MSD) can be maintained in a measured, visual line of sight from the antenna location to any location where a person may be located under normal operating conditions. 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 preferably mounted 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)

Operating the V-TAC is accomplished through the CH-103 Control Head. Follow the actions below to change modes in order to test the Antenna.

Actions	Notes
1. Press the **UP ARROW** button on the navigation pad of the Control Head repeatedly until the message “MODE” appears on the unit’s display, then press the **SELECT** button.	♦ The buttons controlling the operating parameters are on the left side of the front of the Control Head.

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Actions	Notes
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 V-TAC for normal voice or data communications
3. Press the **RIGHT ARROW** button once to confirm the selection, then press the SELECT button to select the mode.	♦ The V-TAC is now in **OCF** mode.

Testing into a Dummy Load

Actions	Notes
1. Connect the wattmeter to the Antenna Port of the RF Combiner 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 V-TAC through the Control Head and switch to OCF mode, if necessary.	♦ The V-TAC **must** be operating in OCF mode in order to continue with the testing procedure. If the Control Head does not display "OCF" during startup indicating that it is initializing in OCF mode, use the procedure under *Changing Operating Modes* 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 V-TAC toward the dummy load to measure forward power.
4. Measure the RF power output from the V-TAC.	♦ Key the microphone on the Contro Head and note the wattmeter reading. De-key the microphone.
5. Compare the wattmeter reading with the target RF power output range specified in the *Notes* column, opposite.	**15–21 watts** TARGET VALUE RANGE

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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 V-TAC and repeat this procedure.

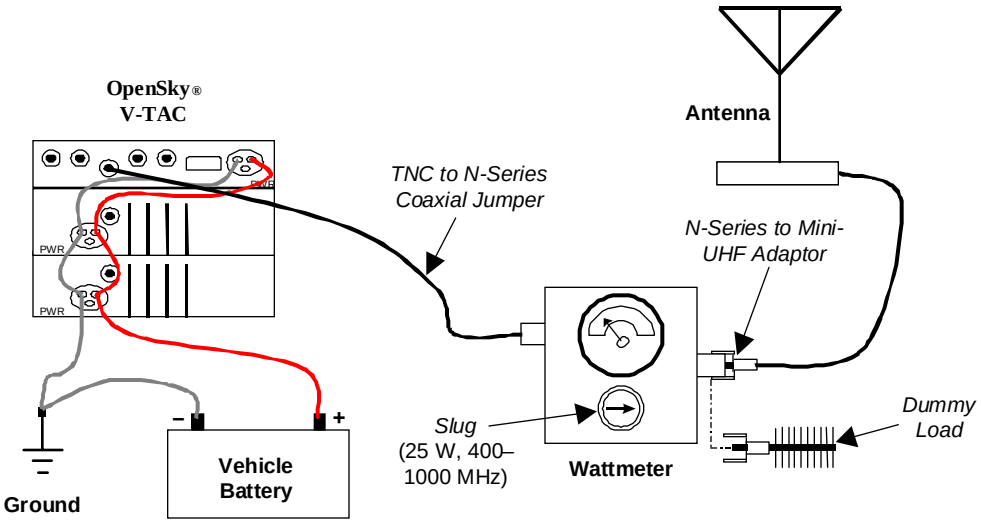

Figure 2 – Wattmeter Connection

Testing with the Antenna

Actions	Notes
1. Connect the wattmeter to the V-TAC 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 V-TAC and switch to OCF mode, if necessary.	♦ The V-TAC **must** be operating in OCF mode in order to continue with the

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Actions		Notes
		testing procedure. If the Control Head does not display "OCF" during startup indicating that it is initializing in OCF mode, use the procedure under *Changing Operating Modes* 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 V-TAC toward the antenna to measure forward power.
4.	Measure the forward RF power output of the V-TAC.	♦ 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 *Notes* column, opposite.	**15–21 watts** TARGET VALUE RANGE
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 operating voltage of the V-TAC 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 V-TAC 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.

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Actions	Notes
9. Compare the wattmeter reading with the target RF power output range specified in the *Notes* 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 specified frequency range of the V-TAC. Recheck all antenna connections, and measure the reverse power again. If this fails to 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 RF output signal*.
11. Return the V-TAC to OTP mode for normal communications.	♦ Use the procedure under *Changing Operating Modes* above. The V-TAC is now ready for normal communications.

* The standard measure for comparing forward and reflected power is the Voltage Standing Wave Ratio (VSWR). Use the values recorded for the installed unit's forward and reflected power to compute the VSWR, if desired, using the following formula: $VSWR = 1 + \sqrt{P_R / P_F}$, where P_R = reverse power and P_F = 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 V-TAC.

MRU Serial Number	*VRB Serial Number*	*RF Combiner Serial Number*	*Antenna Make and Model*

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

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watts	watts	watts
Power Into a Dummy Load	*Forward Power With Antenna*	*Reflected Power With Antenna*