TM9100 mobiles

110 Watt Mobile Installation Guide

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Preface

Scope of Manual

This manual describes how to install a Tait TM9155R mobile, including microphone, antenna, emergency switch, and external alert device.

The installation of accessories is described in the installation instructions provided with the equipment, and the relevant section in the service manual.

Enquiries and Comments

If you have any enquiries regarding this manual, or any comments, suggestions or notifications of errors, please contact Technical Support, Tait Electronics Ltd, Christchurch, New Zealand (refer to "Contact information" on page 2).

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Associated Documentation

- TM9100 User's Guide (MMA-00001-01)
- TM9100 Service Manual (MMA-00017-01)
- Technical notes are published from time to time to describe applications for Tait products, to provide technical details not included in manuals, and to offer solutions for any problems that arise.

All available TM9100 product documentation is provided on the CD supplied with the service kit[1]. Updates may also be published on the Tait support website.

Document Conventions

Within this manual, four types of alerts are given to the reader: Warning, Caution, Important and Note. The following paragraphs illustrate each type of alert and its associated symbol.

Warning!! **This alert is used when there is a potential risk of death or serious injury.**

Caution **This alert is used when there is the risk of minor or moderate injury to people.**

Important This alert is used to warn about the risk of equipment damage or malfunction.

Note This alert is used to highlight information that is required to ensure procedures are performed correctly.

1. Technical notes are only available in PDF format from the Tait support website. Consult your nearest Tait Dealer or Customer Service Organization for more information.

1 Introduction

The Tait TM9155R mobile is a P25-compliant radio in the VHF (136-174 MHz) frequency range with 110 W transmit power output. It consists of a standard TM9100 mobile enclosed in a strong chassis on top of which is an external RF amplifier. The TM9155R comes complete with remote control head, microphone, and install kit. An optional base plate and cover provide secure 'quick-release' mounting and additional protection against water and physical impact. The TM9155R is already fitted with an Ignition Sense kit.

The TM9155R is designed to be trunk-mounted, with the remote control head mounted in the vehicle cabin.

2 Safety Warnings

This section contains important information on the safe installation of the radio. You must read this information before starting the installation.

You must also read and observe the safety information on radio operation provided in the product safety and compliance information booklet and the TM9100 user's guide.

RF Exposure Hazard

To comply with FCC RF exposure limits:

- VHF radios must be installed using an antenna mounted centrally on the vehicle roof, with a gain of 2.15 dBi or 5.15 dBi.

The antenna must not be mounted at a location such that any person or persons can come closer than 44 inches (1.1 m) to the antenna.

Safe Radio Mounting

Warning!! **Mount the radio securely so that it will not break loose in the event of a collision. An unsecured radio is dangerous to the vehicle occupants.**

- Do not mount the radio vertically.

Correct Fuse Rating

Warning!! **Danger of fire. The radio's protection mechanisms rely on the correct fuses on both the negative and positive power supply leads being present. Failure to fit the correct fuses may result in fire or damage to the radio. The correct fuse type is:**

- **30A fuse (Tait IPN 265-00012-00)**

Interference with Vehicular Electronics

Warning!! **Some vehicular electronic devices may be prone to malfunction due to the lack of protection from RF energy when your radio is transmitting.**

Examples of vehicular electronic devices that may be affected by RF energy are:

- electronic fuel injection systems
- electronic anti-skid braking systems
- electronic cruise control systems
- indicators.

If the vehicle contains such equipment, consult the vehicle manufacturer or dealer to determine whether these electronic circuits will perform normally when the radio is transmitting.

Preparation when Drilling Holes

Warning!! **When drilling holes in the vehicle, check that drilling at the selected points will not damage existing wiring, petrol tanks, fuel lines, brake pipes, or battery cables.**

Vehicles Powered by Liquefied Petroleum Gas

Warning!! **Radio installation in vehicles powered by LPG (liquefied petroleum gas) with the LPG container in a sealed-off space within the interior of the vehicle must conform to the National Fire Protection Association Standard NFPA 58. This standard states that the radio equipment installation must meet the following requirements:**

- The space containing the radio equipment shall be isolated by a seal from the space containing the LPG container and its fitting.
- Outside filling connections shall be used for the LPG container and its fittings.
- The LPG container space shall be vented to the outside of the vehicle.

Radio Installation in Gas or Fuel tankers

Special conditions must be observed when installing a radio on gas and fuel tankers. Consult your radio provider or Tait-accredited service center for more details.

Negative Earth Supply

The radios are designed to operate only in a negative earth system.

3 Preparing the Installation

This section contains the following information to assist you in preparing for the actual installation:

- regulations
- installation tools
- checking the equipment for completeness
- programming settings

3.1 Regulations

MPT 1362 Code of Practice

TM9100 mobile radios should be installed in accordance with the MPT 1362 Code of Practice.

Vehicle Manufacturer's Installation Guidelines

Follow your vehicle manufacturer's guidelines for installing mobile radios. For more information, contact the vehicle manufacturer's dealer or refer to the vehicle manufacturer's website, for example, http://service.gm.com/techlineinfo/radio.html (General Motors) or http://www.fordemc.com/docs/download/Mobile_Radio_Guide.pdf (Ford).

3.2 Installation Tools

The following tools are required to install the radio:

- drill and drill bits
- Pozidriv screwdriver
- RF connector crimp tool
- fuse crimp tool
- in-line RF power meter capable of measuring forward and reflected power at the operating frequency of the radio.

3.3 Checking the Equipment for Completeness

Unpack the radio and check that you have the following:

- RF amplifier and radio body
- Base plate
- Cover
- Control head (with fitting instructions)
- Microphone
- Remote cable
- Install kit

Before installing, make sure that cable lengths are sufficient.

3.4 Programming Settings

Make sure that the radio has been correctly programmed before installing it.

Note The radio can only be programmed via the control head microphone socket, not via the sockets on the dual RJ-45 head.

In particular, programming must have:

- Selected the B1 band.
- Enabled the check box 'Configure as 110 W mobile'. This modifies the setting of a number of items, including the power output to the external RF amplifier.
- Configured the channels that the radio will operate on.
- Configured the AUX_GPI3 line for ignition sense. To do this, program it as an input, select the action 'Power Sense (Ignition)' and specify that the active state is 'High'. For more information, refer to the online help of the application software.
- Configured any inputs and outputs on the auxiliary connector that will be used for external devices or signals

Important Incorrect programming settings can result in damage to the external RF amplifier.

For details, see the programming software online Help.

4 Installing the Radio

This section explains how to install and check the radio and its associated equipment. It contains the following information:

- Selecting the Mounting Position
- Installing the Antenna
- Connecting the Power Cable to the Power Source
- Installing the Remote Control Head
- Installing the Microphone
- Connecting to the Ignition Signal
- Connecting a Remote Speaker
- Connecting to an Emergency Switch and/or External Alert Devices
- Mounting the Radio
- Checking the Installation

4.1 Selecting the Mounting Position

Inspect the vehicle and determine the safest and most convenient position for mounting the radio. Tait recommends the use of an equipment mounting tray designed for the vehicle. These are available from manufacturers such as Havis-Shields (www.havis.com), Jotto Desk (www.jottodesk.com), Gamber Johnson (www.gamberjohnson.com), and Stewart Products (www.stewartproducts.com).

Make sure that there is sufficient clearance for the heatsink and for the cables. Check cable lengths.

Important Do not mount the radio in areas where it can be sprayed by a high-pressure cleaning device or temporarily submerged from an accumulation of water or other liquids.

4.2 Installing the Antenna

This section provides information on installing an external antenna within the RF exposure limits.

Install the external antenna (not supplied) according to the antenna manufacturer's instructions. Good quality 50 Ω coaxial cable must be used, such as RG58 or UR76.

Important Route the cable in a manner that minimizes:

- coupling into the electronic control systems of the vehicle
- coupling of electric vehicle systems, such as alternators, into the radio.

Avoid sharp bends in the cable. These distort the cable and alter its electrical characteristics.

ATTENTION!

Warning!! **RF exposure hazard**

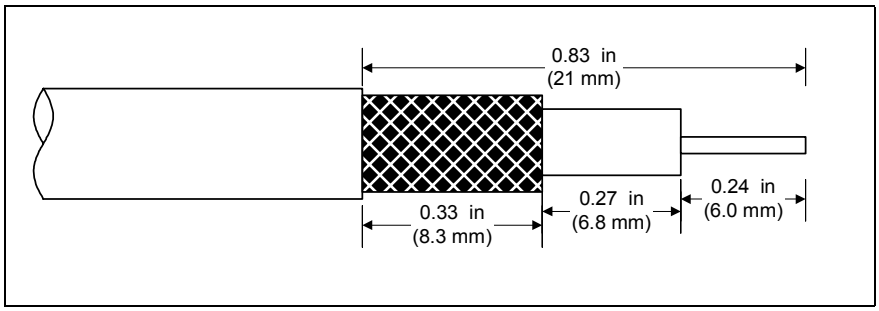
To comply with FCC RF exposure limits, mount the antenna at a location such that no person or persons can come closer than 44 inches (1.1 m) to the antenna.

- VHF radios must be installed using an antenna mounted centrally on the vehicle roof, with a gain of 2.15 dBi or 5.15 dBi.

Terminating the Antenna Cable

1. Run the antenna cable (not supplied) from the antenna to the radio mounting location and cut it to length, allowing approximately 8 inches (20 cm) excess at the radio end.
2. Strip the end of the coaxial cable as shown in Figure 4.1. Fit the right angle N-type antenna connector (supplied) to the antenna cable.

Figure 4.1 Stripping the antenna cable



4.3 Connecting the Power Cable to the Power Source

Power is supplied to the 110 W mobile via a cable with a DB25 connector (provided). This plugs into the external RF amplifier, which provides power to the back of the radio body via an internal loom.

Important This radio is designed to operate from a nominal 12V negative ground supply and may draw up to 30A of current. The radio will tolerate a supply voltage range of 10.8V to 16.6V at the radio.

Selecting the Power Source

In passenger vehicles, the radio is always connected directly to the battery.

In trucks, where direct connection to the battery is often not possible, the radio can be connected to a suitable terminal inside the fuse box that is connected directly to the battery.

24V-to-12V Converter

In vehicles with a supply voltage larger than 16.0V, such as many trucks, it is essential to provide a suitably rated 24V-to-12V converter. This will isolate the radio from excessive battery voltage and provide the correct DC operating conditions. Note that most 24V-to-12V converters already fitted are not rated sufficiently.

Standby Current

When using the ignition signal to turn off the radio, the standby current is reduced to <3mA. Otherwise, the standby current is 50mA.

Connecting the Power Cable

Important Although it is possible to connect the radio in line with the vehicle ignition, this is not recommended, as it may draw too much current and damage the vehicle wiring and steering column or ignition switch. This may also cause the supply voltage of the radio to drop below the specified level.

Important Disconnecting the vehicle's battery may cause problems with some electronic equipment, such as vehicle alarms, engine management systems, and in-car entertainment systems. Check that the vehicle owner has the necessary information to make all electronic equipment function correctly after battery reconnection.

Important If the battery is not disconnected, exercise extreme caution during the installation and install the fuses only when the installation is ready to be checked. For more information, refer to "Checking the Installation" on page 22.

1. Disconnect the vehicle's battery unless specifically prohibited from doing so by the customer, vehicle manufacturer, agent, or supplier.

Important Route the cable in a manner that minimizes coupling of electric vehicle systems such as alternators into the radio.

Important Protect the power cable from engine heat, sharp edges and from being pinched or crushed.

2. Run the supplied power cable (or one with a higher current rating) between the radio's mounting position and the vehicle battery (12 V) and cut it to length, allowing approximately 8 inches (20 cm) excess at the radio end.

3. Cut the negative (black) and the positive (red) wires where the in-line fuse holders will be placed (as close to the power source as possible).

Important Do not install the fuses until the installation is ready to be checked. For more information, refer to "Checking the Installation" on page 22.

4. Insert each end of the negative wire into each of the fuse crimp-terminals and crimp them to force the metal contacts onto the wires.

5. Push the two crimp-terminals into the clear plastic fuse cover. Close the cover while the next steps are completed.

6. Repeat steps 4 and 5 for the positive wire.

7. Connect the negative wire to the battery ground terminal.

8. Connect the positive wire to the battery positive terminal.

Important Do not install the fuses until the installation is ready to be checked. For more information, refer to "Checking the Installation" on page 22.

4.4 Installing the Remote Control Head

1. Choose a suitable location for the control head.

2. Mount the Control Head according to the instructions supplied (IPN: 402-00015-00). Make sure that you follow the warnings and cautions in these instructions.

Note The remote control head back (TMAA03-03) has already been fitted to the Control Head and the dual RJ-45 torso interface (TMAC34-1T) has already been fitted to the radio body.)

3. Run the remote head cable (TMAA04-01) from the control head location to the radio mounting location.

4.5 Installing the Microphone

This section describes the radio's microphone connector and the information required to connect the microphone and install the microphone clip.

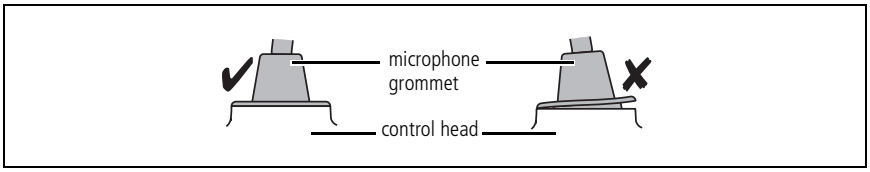
Important The microphone grommet must be installed whenever the microphone is plugged into the microphone socket:

- to prevent damage to the microphone socket when there is movement of the microphone cord, and
- to ensure that the control head is sealed against water, dust and other environmental hazards.

Connecting the Microphone

1. Plug the microphone into the microphone socket.
2. Slide the grommet along the microphone cord and push two adjacent corners of the grommet into the microphone socket cavity.
3. Squeeze the grommet and push the remaining corners into position.
4. Check that the grommet is seated correctly in the cavity.

Figure 4.2 Correct microphone and remote cable grommet seating



Installing the Microphone Clip

Install the microphone clip in the most convenient location using the screws provided. The microphone must be within reach of the user but in such a position that the PTT (press-to-talk) key cannot be inadvertently activated or jammed.

Warning!! **Safe microphone mounting**

- Mount the microphone where it will not interfere with:
  - the deployment of passenger airbags
  - the vehicle operator controls
  - the vehicle operator's view.

Important Only install the microphone clip provided. If a non-standard microphone clip is used, the correct operation of the microphone hookswitch cannot be guaranteed.

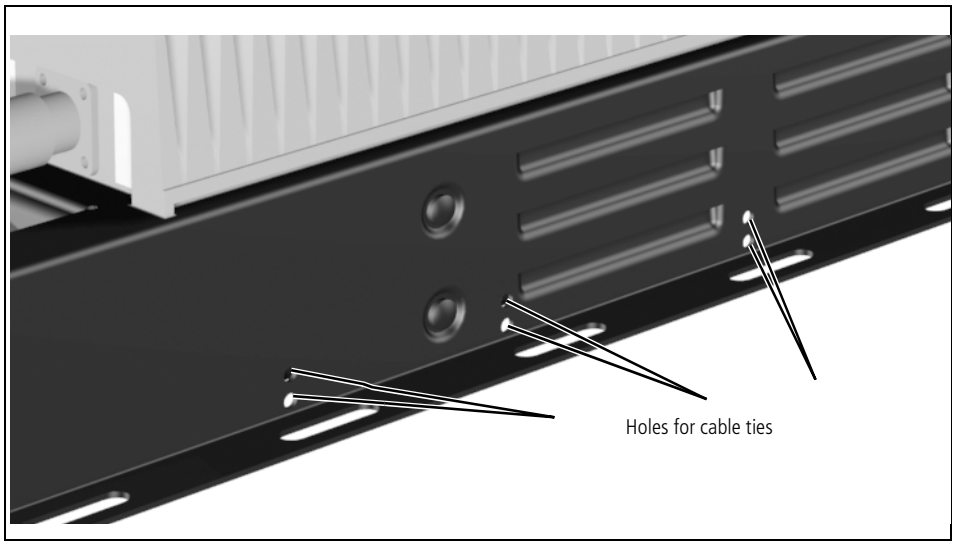
4.6 Connecting to the Ignition Signal

Ignition Sense allows the radio to be turned on and off with the ignition key of the vehicle. The TM9155R is already fitted with an ignition sense kit, however it must be programmed for ignition sense operation.

If Ignition Sense operation is desired:

1. Make sure that the AUX GP13 line has been programmed for ignition sense.
2. Run the yellow wire from the back of the mobile body (underneath the 110W RF Amplifier) to a 12V signal controlled by the ignition key.
3. Secure the cable with cable ties using the small holes in the side of the chassis.

Figure 4.3 Holes for cable ties



Note The logic thresholds for AUX GPI3 are based on 3V3 levels. However, AUX GPI3 can be connected directly to a +13.8V ignition signal.

4.7 Connecting a Remote Speaker

If a high-power remote speaker is required, Tait recommends using:

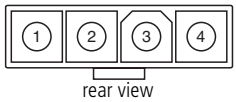
- TMAA10-03 high-power remote speaker for 25 W radios.

Installation instructions (IPN 402-00010-00) are provided with the speaker.

If a different speaker is used, receptacles for the speaker pins of the power connector are provided with the installation kit.

1. Run the speaker cable to the radio, then (underneath the RF amplifier) alongside the ignition sense cable to the back of the radio body.
2. Secure the speaker cable with cable ties using the small holes in the side of the chassis (see Figure 4.3 on page 17), as was done for the ignition sense cable.
3. Connect the speaker to pins 2 (SPK–) and 3 (SPK+) of the radio body's power connector (see Table 4.1).

Table 4.1 Radio body power connector—pins and signals

Pinout	Pin	Signal name	Description	Signal type
	1	AGND	Earth return for radio body power source	Ground
	2	SPK–	External speaker output. Balanced load configuration	Analog
	3	SPK+	External speaker output. Balanced load configuration	Analog
	4	13V8 BATT	DC power input for radio body and control head	Power

4.8 Connecting to an Emergency Switch and/or External Alert Devices

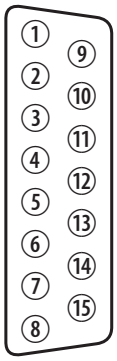
The auxiliary connector can be used to connect external devices and signals that are typically connected to a radio. These devices and signals include:

- an emergency switch to power up the radio (if required) and then enter emergency mode
- external alert devices.

If you want to connect an external device or signal, first check Table 4.2 to see whether the signal is already used by the 100 W RF amplifier.

If the signal is available, disconnect the loom between the RF amplifier and the radio body. Open up the auxiliary connector (DB15) and wire in the desired signal.

Table 4.2 Auxiliary connector (radio)—pins and signals

Pinout	Pin	Signal name	Description	Signal type
 rear view	12	AUX GPI1[1]	General purpose digital input. Programmable function	Digital, 3V3 CMOS.
	5	AUX GPI2		
	4	AUX GPI3	General purpose input (ignition sense)	3V3 levels. Protected for +13.8V.
	10	AUX GPIO4	Programmable function and direction Pads available to fit a higher power driver transistor on GPIO4 line	Digital, 3V3 CMOS input; open collector output with pullup
	2	AUX GPIO5[1]		
	9	AUX GPIO6[1]		
	1	AUX GPIO7[1]		
	11	AUX TXD	Asynchronous serial port - Transmit data	Digital, 3V3 CMOS
	3	AUX RXD	Asynchronous serial port - Receive data	Digital, 3V3 CMOS
	7	AUD TAP IN	Programmable tap point into the Rx or Tx audio chain. DC-coupled	Analog
	13	AUD TAP OUT	Programmable tap point out of the Rx or Tx audio chain. DC-coupled	Analog
	14	AUX MIC AUD	Auxiliary microphone input. Electret microphone biasing provided. Dynamic microphones are not supported	Analog
	6	RSSI	Analog RSSI output	Analog
	8	+13V8 SW	Switched 13.8V supply. Supply is switched off when radio body is switched off	Power
	15	AGND	Analog ground	Ground

1. Used by the 100W RF amplifier

Emergency Switch

The radio allows for connection of an emergency switch to any input line to enter the emergency mode. If the switch is connected to the AUX GPI2 input line, the radio can also use 'emergency power sense' to power up the radio to enter the emergency mode.

Note The selected input line must be programmed to 'Enter Emergency Mode' and active to 'Low'. To use 'emergency power sense', hardware link LK3 must be fitted (factory default), and AUX GPI2

must be used. For more information, refer to the service manual and the online help of the programming application.

Connect a normally open switch between the pin of the input line (pin 5 for AUX GPI2) and pin 15 (AGND) of the auxiliary connector.

External Alert Device

The radio allows for output to external alert devices using the digital GPIO lines of the auxiliary connector and the internal options connector.

AUX GPIO4 can be fitted with a power MOSFET (Q707) to directly connect external alert devices (e.g. flashing light, buzzer, horn relay) to the radio. Also, resistor R768 must be removed.

Important While the MOSFET is rated at 12 A (with heat sink), the maximum allowable current of the connector and radio's earthing system is 2 A. Therefore, a horn must not be connected directly to the radio. A horn relay must be used.

Note The selected output line must be programmed to 'External Alert 1 or 2', active to 'Low', and signal state to 'Momentary'.

Connect the external alert device to the pin of the output line (pin 10 for AUX GPIO4) and pin 8 (+13V8 SW) of the auxiliary connector (or a different positive battery connection).

This means that the negative side of the alert device must be connected to AUX GPIO4 and the positive side to pin 8 (+13V8 SW). The external alert device must be capable of accepting a voltage of between 10 V and 18 V.

4.9 Mounting the Radio

Once the cables are all in position, you attach them to the radio and secure it in its mounting location. The procedure varies, depending on whether you are using the base plate and cover.

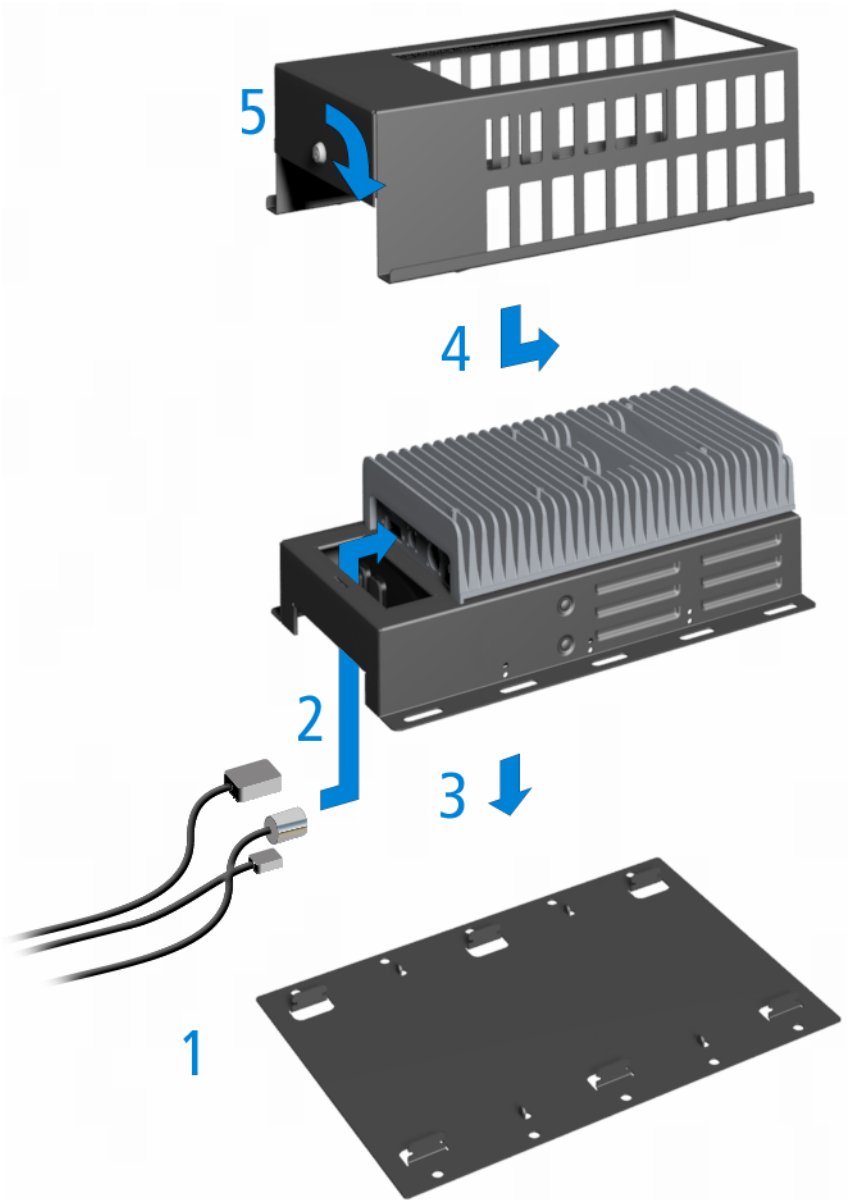
Warning!! **Mount the radio securely so that it will not break loose in the event of a collision.**

To mount the radio without using the base plate and cover:

1. Locate the 110W Mobile chassis in the mounting location and drill mounting holes.
2. Connect the Control Head cable, Antenna cable and External Speaker (if installed). Lastly, connect the power cable.
3. Fix the 110W Mobile chassis securely to the mounting surface.

To mount the radio using the base plate and cover:

1. Fix the base plate securely to the mounting surface.
2. Connect the Control Head cable, Antenna cable and External Speaker (if installed), to the 110W Mobile. Lastly, connect the power cable.
3. Place the 110W Mobile onto the base plate.
4. Fit the cover over the 110W Mobile and then slide it forward 5mm (1/4") to engage with the base plate.
5. Using the key supplied, turn the lock to lock the cover in place.



4.10 Checking the Installation

Warning!! **Danger of fire. The radio's protection mechanisms rely on the correct fuses on both the negative and positive power supply leads being present. Failure to fit the correct fuses may result in fire or damage to the radio. Make sure that you use 30 A fuses. For part numbers, refer to "Checking the Equipment for Completeness" on page 10.**

1. Insert the fuses into the power leads.
2. Turn the ignition on. If necessary, switch on the radio at the control head.
3. Confirm that it is operational, but do not transmit.
4. Connect an in-line power meter between the radio and the antenna.
5. Transmit and measure the forward and reflected power levels.

   The antenna system should achieve a VSWR of better than 2:1. If VSWR is poor (3:1 or worse), the External RF Amplifier will reduce its RF power output.
6. If the VSWR is not better than 2:1, check the installation. If necessary, start reducing the length of the antenna in steps of 0.1 inches to 0.2 inches (2 to 5 mm). Measure the power levels at each step. For wide-band use, tune for best performance at the top of the band.

Important Some antennas are pre-tuned and must not be cut. Check with the manufacturers' instructions.

7. Once the VSWR is within tolerance, make a call to another party on the radio.

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General

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