



## Mobile Satellite Radio Installation Guide





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# Introduction

The purpose of this guide is to provide assistance to personnel installing the MSATe mobile satellite radio equipment. The guide starts off by providing installation-specific information on each component of the radio. Installation tips are then offered for fixed-site and vehicular scenarios. A section on commissioning instructions follows. The guide concludes with a troubleshooting section.

## INSTALLATION WARNING



**Warning:** This product is to be installed by Authorized Service Personnel. Damages resulting in the failure to conform to the instructions found herein, as well as standard installation practices, will be the responsibility of the installer. Failure to follow the guidelines in this installation manual will void all warranties related to the MSATe Mobile Satellite Radio.

## MSATE MOBILE SATELLITE RADIO

The MSATe mobile satellite radio is comprised of three core component parts: the transceiver unit (the small black box), the antenna system (white dome) and the handset.



Figure 1 – MSATe Mobile Satellite Radio Components

# Transceiver Unit

The TU provides the interface for the handset and antenna unit (AU) and manages the communications over the Ligado network. It also distributes power to the handset and Antenna Unit (AU).

An optional external speaker may be connected to the TU for remote monitoring. Serial and Ethernet ports are provided for external interfacing, debugging, software upgrading and future expansion capabilities. (See figure)

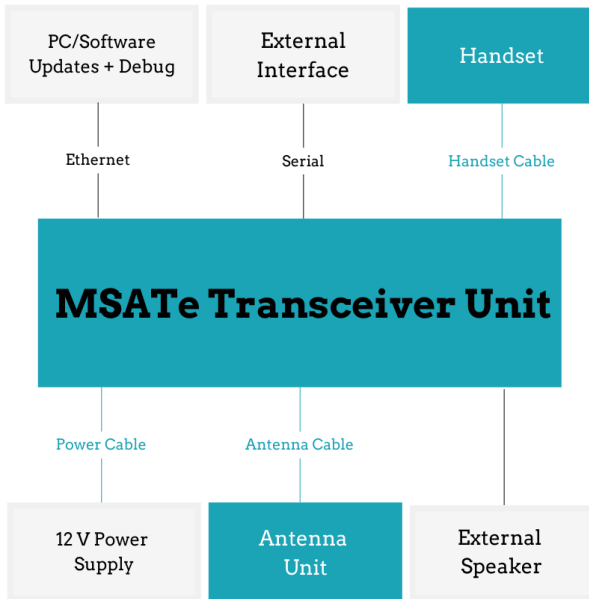


Figure 2 - System Overview

## Transceiver Unit Ports

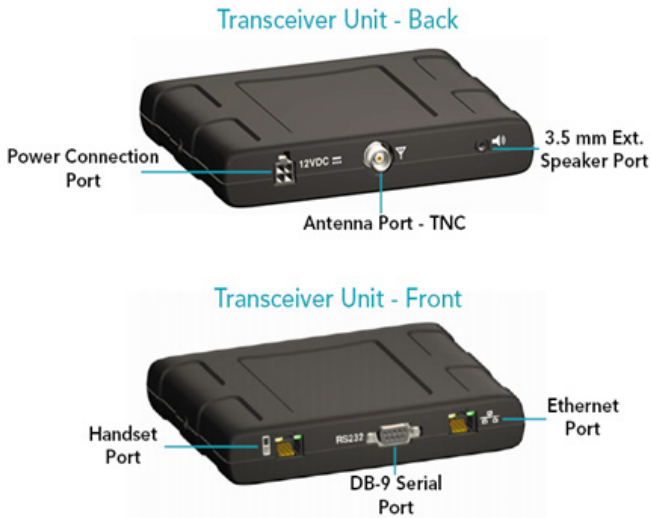


Figure 3 - Transceiver Unit Port Diagram

### POWER PORT

The power port is the connection from the power supply (vehicle battery or some other 12 VDC power source) to the TU. The power cable has a +12V power line, a +12V ignition sense line. (See Figure 4)

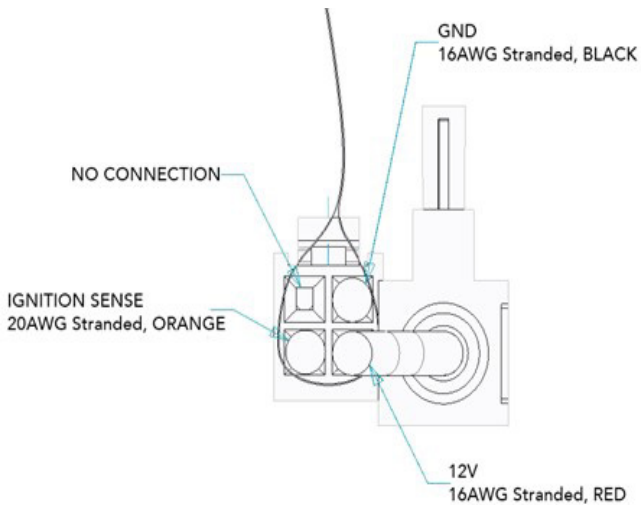


Figure 4 – Power Port Cable Color Reference

### RJ 45 ETHERNET PORT

The RJ 45 Ethernet port is available for software upgrades and future expansion of functionality. The port supplies standard Ethernet line levels and supports all defined control line signaling. The pinout of the port supports a direct straight-through connection to a PC with a standard Ethernet cable. The PC shall be supplied with a dynamic local IP address using a standard DHCP exchange.

PIN	
1	RX+
2	RX-
3	TX+
6	TX-

Table 1 - Ethernet Port Pinout

## SERIAL PORT

The serial port is a female DB-9F RS 232 and can be used for NMEA output (GPS) and crossbanding and for dial-up data services where subscribed.

PIN	DATA (CURRENTLY NOT SUPPORTED)	GPS	CROSSBAND
1	CD (Carrier Detect)		COR (Carrier Operated Relay)
2	RD (Receive Data)	RD (Receive Data)	
3	TD (Transmit Data)		
4	DTR (Data Terminal Ready)		
5	GND (Signal Ground)	GND (Signal Ground)	GND (Signal Ground)
6	DSR (Data Set Ready)		
7	RTS (Request To Send)		PTT (Push To Talk)
8	CTS (Clear To Send)		CTT (Clear To Transmit)
9	RI (Ring Indicator)		

Table 2 - Serial Port Pinout

## ANTENNA PORT

The antenna port is a 50 Ohm female TNC. This line carries RF, signaling, and DC power for the antenna.

**Note: Grounding the center conductor while power is applied to the transceiver can cause the transceiver's fuse and/or a fuse in the vehicle to blow. No modifications should be made to the RF cable under any circumstance.**





Figure 5 - Antenna Port Detail

#### HANDESET PORT

The RJ45 handset port is used to connect the handset to the TU. The connector type is a modular 8 position and 8 conductor RJ45. The pinout is as follows:

PIN NUMBER	SIGNAL NAME
1	Audio TX + Microphone
2	Audio TX - Microphone
3	Data TX - TU Send
4	Data RX - TU Receive
5	+ 12 VDC
6	Ground
7	Audio RX + Speaker
8	Audio RX - Speaker

Table 3 - Handset Connector Pin Out

#### EXTERNAL SPEAKER PORT

A 3.5 mm mono connection is provided for a 4W 80hm speaker.

### System Power Requirements

There is only one power connection for the entire radio. This must be connected to a 12 VDC power supply.

Power requirements and consumption are as follows:

POWER REQUIREMENTS	VOLTAGE
Voltage Input Minimum	12 V DC
Voltage Input Maximum	15.6 V DC
Total Current for AU, TU & Handset (Max.)	6A
Required Fuse	7.5A

Table 4 - System Power Requirements

## STANDARD CABLE CONNECTIONS

In addition to the DC power connection, an optional ignition sense connection must be made, or it will not work properly. This is done using the three-wire power cable. In the case of a vehicle installation, the power source is typically the vehicle battery. Cables should be routed appropriately, and cable ties and clamps should be used as required to ensure that vibration and/or rubbing of the cables does not occur.

## POWER CABLE ASSEMBLY

A 6m power cable with a +12V power line and a +12V ignition sense line is included with the Transceiver Unit. The fuse is a standard 7.5A automotive mini blade fuse.

**NOTE: To protect against the risk of fire, always replace fuses with the same type and rating.**

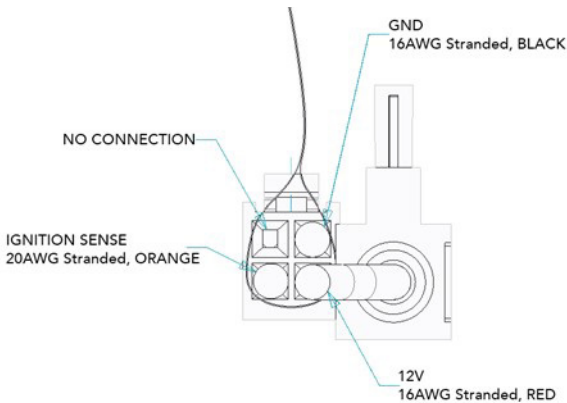


Figure 6 – Power Port Cable Color Reference

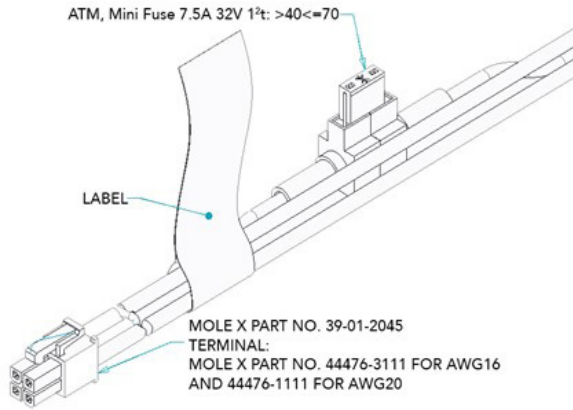


Figure 7 – Power Cable Assembly

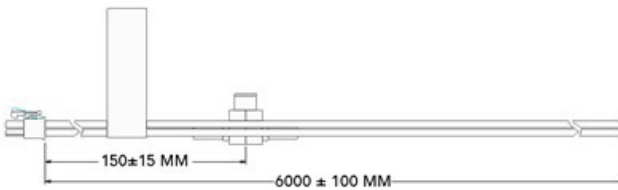


Figure 8 – Power Cable Measurements

#### IGNITION SENSE (ORANGE WIRE)

Route and connect the orange wire (ignition Sense) to a switched 12 VDC source, such as ignition switch or fuse block. Extend use of ignition sense in accessory position (ACC) by the end user may lead to a discharged car battery.

**NOTE:** Ensure that the connection is switched to source-OFF when ignition is off or in start and ON only when ignition switch is in ACCESSORIES or RUN position.

## Installing the TU - Fixed and Mobile

### BASIC INSTALLATION PROCEDURE

While the installation of the MSATe mobile satellite radio is straightforward, it is essential that the installation be done correctly. The basic installation procedure is as follows:

- I. Decide where you are going to install the antenna, TU, and handset.
- II. Ensure that the TU is located inside the vehicle or a building and that it is attached to something structurally sound. Loose mounts that vibrate will degrade performance.
- III. Determine the cabling required for the installation of each component.
- IV. Perform the installation of the antenna, TU, and handset.
- V. Connect the antenna and the handset to the TU.
- VI. Connect the power to the TU.
- VII. Power up and commission the radio.

### GENERAL INSTALLATION

- For ease of service, route the radio cables and power cables together.
- Always disconnect the negative side of the vehicle battery prior to any electrical work.
- Whenever routing cable through holes drilled in metal or through bulkheads, use grommets and RTV sealant to weatherproof all holes drilled on the outside of the vehicle.
- Use cable ties every 30 – 45 cm (12-18”).
- The TU can be mounted in either the horizontal or vertical position.
- The main power line should be connected directly to the vehicle battery (or 12 VDC power supply). If you must connect it to another circuit, ensure sufficient amperage is available. In the case of a fixed-site installation, tie the Battery and Ignition Sense wires together on the 12 VDC power source.
- The ground line should be connected directly to the vehicle's battery ground.
- Install the TU in a protected but ventilated area (inside building or vehicle). Allow at least one (1) inch space around all surfaces, except for the surface attached to the mounting bracket to provide adequate cooling. Ensure that the location is accessible for

- servicing.
- The TU is not waterproof.
  - Always provision the wiring into the TU with a drip loop.
  - With the exception of the TU to Antenna cable, do not route the cables outs.

## TU Mounting Bracket Information

**NOTE: Use care when drilling through the body of a vehicle to avoid puncturing critical items.**

The bracket is connected to the TU with two (2) provided screws. There is a 5mm gap between the TU and the bracket.

Instructions for the installer:

- The mounting bracket should be used for mounting the TU.
- Mount the mounting bracket onto a flat surface using at least four (4) screws (not supplied). Use screws with diameter between 3 to 4.5 mm. Vibration resistant screws or lock washers should be used.
- Choose any suitable holes and slots on the base of the mounting bracket for mounting the screws. If space is available on the mounting surface, the screws should be spaced as far as possible towards the corners of the mounting bracket to provide good stability.
- Place the TU on the mounting bracket so that the holes on the side flanges of the mounting bracket are aligned with the threaded inserts on the TU. Use only the two screws and spring washers provided to secure the TU to the mounting bracket. Not using the supplied bracket screws could result in damage to the TU (especially if screws are too long).

## MOUNT BRACKET HOLE DIMENSION

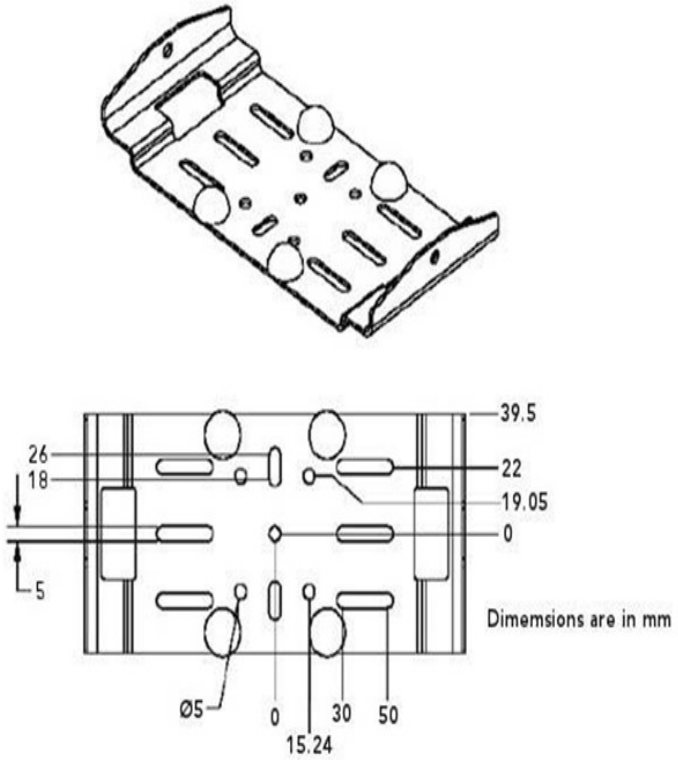


Figure 9 – Transceiver Unit Mounting Bracket Dimensions

## TRANSCEIVER UNIT DIMENSIONS WITH MOUNTING BRACKET

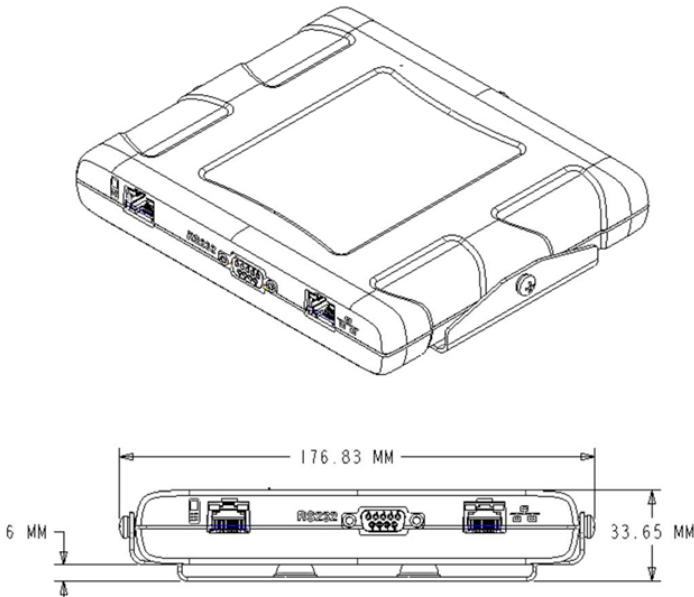


Figure 10 – Transceiver Unit with Mounting Bracket

## Installing the Antenna Unit (AU)

The antenna unit is composed of the antenna element array, necessary high power and low noise amplifier systems and a tracking system.

Two AU versions exist: a 2-axis unit intended for land-mobile and fixed-site installations and a 3-axis unit for the maritime environment.

Connection to both AUs is made by a TNC connector. The single coaxial cable carries RX, TX, power, and tracking information.

### Antenna Cable Lengths and Types

The radio has been type approved for use with the following cable lengths and types:

CABLE LENGTH	CABLE TYPE
6 m (20ft)	RG223/U
18 m (60 ft)	LMR240 (Equiv.)
45.7 m (150 ft)	LMR600 (Equiv.)

Table 5 - Antenna Cable Lengths and Types

## Vibrations

The antennas (2 and 3-axis versions) are designed to meet the following operating vibration levels in any of three perpendicular directions measured at the mounting base of the radome i.e. at the flange of the standard mounting pole described above:

### Radome Vibration

1.05 Grms with the following spectral density

5-20 Hz.....0.02G<sup>2</sup>/Hz

20-150 Hz..... -3dB/octave

And further,

### Single Frequency Vibration

5-10 Hz with amplitude 2.54mm

10-15 Hz with amplitude 0.76mm

15-25 Hz with amplitude 0.40mm

25-33 Hz with amplitude 0.23mm

Vibration levels in a typical installation are usually much less than the above-mentioned values. It is, however, the responsibility of the installer to verify that the cited levels are not exceeded in any mode of operation of the vehicle/vessel. In case of abnormal vibration, typically at a resonance frequency, measures must be taken in order to displace the resonance frequency or to dampen the vibration amplitude.



## Installing the 2-Axis Land Mobile Antenna



**WARNING:** Avoid exposure to microwave radiation. Keep a safe distance of minimum one (1) meter (39 inches) to the side and above the antenna. Always power the MSATe down prior to disconnecting or connecting the antenna. The antenna port is a 50 Ohm female TNC. This line carries RF, signaling, and DC power for the antenna.

**NOTE: Grounding the center conductor while power is applied to the transceiver can cause the transceiver's fuse and/or a fuse in the vehicle to blow. No modifications should be made to the RF cable under any circumstance.**

Keep a clear line-of-sight to the satellite. Preferably, avoid all obstructions within three (3) meters of the antenna. Obstructions less than 15 cm (6 inches) in diameter can be ignored beyond this distance.

If the antenna is being mounted on a vehicle it is important to ensure there is a clear line-of-site to the satellite(s) in all directions. After the radio is commissioned and operational it is recommended that the signal strength be checked while the vehicle is slowly driven in a 360° circle. The signal strength should not vary significantly or be degraded in any particular direction.

Do not locate the antenna close to interfering signal sources or receivers. It is recommended that no other antennas be located within three (3) meters of the MSATe antenna. If there is other equipment installed near the MSATe satellite radio it is recommended to operate all equipment simultaneously and verify there is no co-interference.

### Mobile Installation

#### MAGNETIC (TEMPORARY) MOUNTING OPTION

For temporary use – or where drilling of holes is to be avoided – a Magnetic Mount Installation Kit is offered. Ligado Product no: 101212 (SpaceCom reference part no: SPAC-AC-1016).



**WARNING:** [Insert warning about magnets and pacemakers/medical devices if required]. Three (3) magnetic mounts each with an adhesive force of at least 420 N (Newton) are required to secure the antenna.

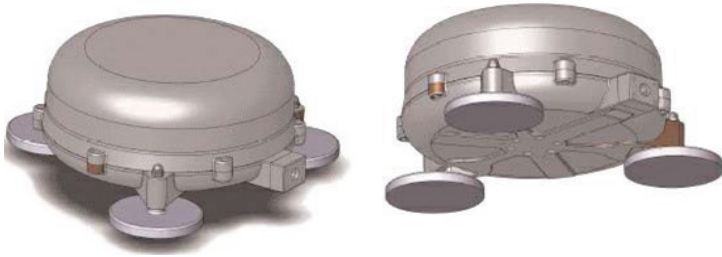


Figure 11 – 2 Axis Antenna with Magnetic Mounts

The Magnetic Mount consists of 3 individual high intensity magnets with rubber coating. Each magnet having a stainless-steel M5 center bolt.

There are 3 “legs” on the antenna where the magnets are bolted in place. Note the position of the three nylon rubber washers just below and above each “leg,” the stainless-steel washer above the upper washer and the M5 protective nut on top. Use torque of 2.5 Nm.

Now place the antenna with magnets on the roof of the car.

When installing the antenna cable, it’s important to protect against moisture using self-amalgamating tape wrapped around the coaxial connector or similar. Also, carefully secure the cable run from the antenna at short intervals. An unsupported length of cable will vibrate when driving and could over time result in a faulty connection.

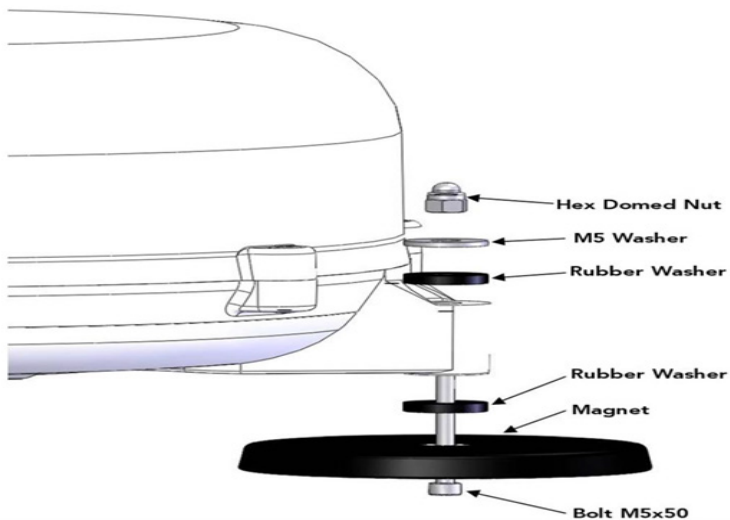


Figure 12 – 2-Axis Antenna with Magnetic Mounts

#### Dismounting:

To dismount the antenna, clasp the antenna near one of the magnets and lift up. When one magnet is loose, the other two will come loose with little effort.

If the magnetic force is so large that the antenna cannot be dismounted as described, it may be necessary to unscrew the antenna first and remove the magnets separately.

#### PERMANENT INSTALLATION ON A VEHICLE

1. Always install antenna in a horizontal position, even if the surface – roof of vehicle – is not horizontal.

The antenna has three drainage holes at the radome base.

2. Always install the antenna so clearance between the radome base with drainage holes and mounting surface is no less than 5mm and preferably 10mm, refer to figure 18.

In order to fulfill the above criteria 1. and 2., a set of bolts and washers is defined for each individual installation, refer to figure 18.

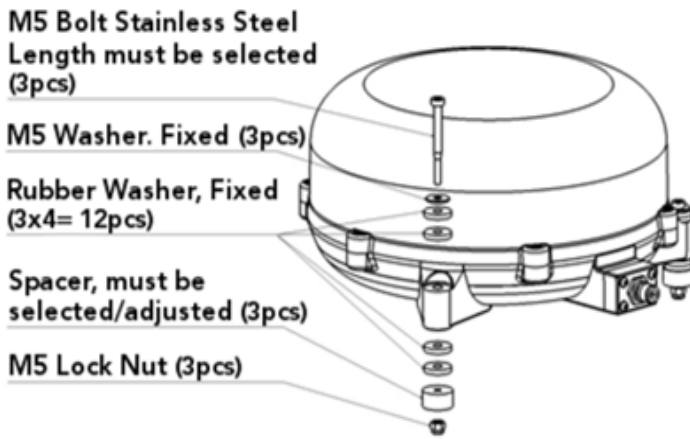


Figure 13 - Antenna with Permanent Mount

The M5 stainless-steel washers are always used and positioned as shown in figure 17.

The rubber washers are always used and positioned as shown in figure 17. The spacers are always used and positioned as shown in figure 17.

The 3 spacers will have identical length if the antenna is installed on a non-tilting surface but may require individual length adjustment if the surface is tilting. The M5 stainless-steel bolts will have identical length if the three spacers are identical and may require individual length adjustment if spacer length is different.

An Installation Kit is included with every antenna. It contains the washers that are always used, three standard 10mm plastic spacers used for a typical installation on a non-tilting surface and standard length M5 stainless-steel bolts – Note length may have to be adjusted to accommodate a tilting surface.

#### DRAINAGE OF THE ANTENNA

In order to keep the height of the antenna as small as possible and in order to avoid the complex and often unreliable complete sealing of the antenna, a simple mechanism in the form of three holes in the radome (plastic enclosure) bottom is used. The holes are made so that water – raindrops - are not likely to enter the radome and simultaneously water that incidentally has entered the radome or moisture condensed inside the radome is drained out simply by gravity. Correct function of

the drainage system will only be ensured by following criteria outlined above, refer to figure 18.

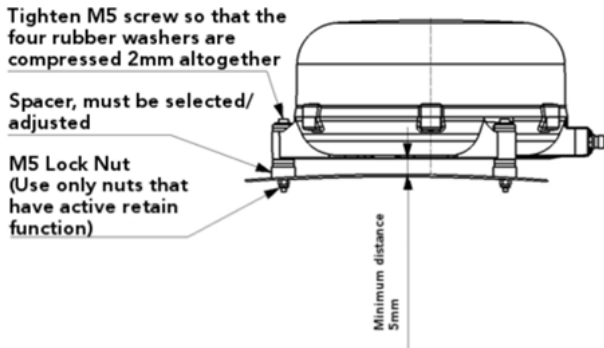


Figure 14 – Antenna Drainage

### ANTENNA CABLE

When installing the antenna cable, it is important to protect against moisture by wrapping self-amalgamating tape (or similar) around the coax connector. Also, be careful with the cable routing from the antenna and secure it at short intervals. An unsupported length of cable will vibrate when driving or get entangled with e.g. overhead trees. This could affect the lifetime of the cable.

### CLEANING

The antenna can be cleaned and washed together with the vehicle (hosing down or driving through a car wash). When using a pressure washer, do not direct the jet towards the antenna from short distance. Avoid pressure washing at maximum pressure; the sealing gasket may not withstand such high-pressure jets.

Never direct a water jet towards the drainage holes at the radome underside. Too much water may be forced up the drainage holes.

## Fixed-Site Installation

### CHOOSING A LOCATION

It is important to choose a location for the antenna that will have a clear line-of-sight to the satellite(s). Preferably, avoid all obstructions within three (3) meters of the antenna.

Installation during windy conditions may be dangerous. The owner and installer assume all responsibility to ensure that the equipment is properly installed with adequate structural stability of mounting surface to withstand all loads (wind, weight, ice, etc.) and is properly sealed to avoid leaks.

**DO NOT ATTEMPT TO INSTALL OR DISMANTLE THE EQUIPMENT NEAR ANY TYPE OF POWER LINE.**

Safety Rules:

- Select your installation site with safety as well as performance in mind.
- Plan your installation carefully before beginning. Perform as many tasks as possible while on the ground.
- If any part of the equipment (i.e. antenna assembly) comes into contact with a power line, do not try to remove it yourself. Contact your local power company.
- When installing an antenna assembly, do not use a metal ladder.
- If the antenna assembly starts to drop, get away from it and let it fall.
- Verify that the antenna is properly grounded.

### LIGHTNING ARRESTORS

The applicable electrical code(s) may require that lightning arrestors capable of supporting L- band transmissions be installed on all cabling between the fixed-site antenna and the structure which the equipment is housed in. It is also suggested that any structure containing the radio be equipped with a lightning rod connected to the ground. The professional doing the fixed-site installation is responsible for determining all such requirements with the customer and installing the equipment such that it complies with all applicable standards.

### PERMANENT (MAST) MOUNTING AT FIXED SITE

For permanent mounting of the special Pole Mount Installation Kit is available. Ligado Product no: 101213 (SpaceCom reference part no.: SPAC-AC-1017). Designed for easy installation, it ensures proper drainage

of the antenna, galvanic insulation and can withstand rigid mechanical stress.



Figure 15 – 2-Axis Antenna with Optional Pole Mount

THE KIT CONSISTS OF THE FOLLOWING COMPONENTS:
1pcs. Mounting Pole, Part No: SPAC-M00423
1pcs. Rubber Gasket, Part No: SPAC-M00425
6pcs. Plastic Bushings, Part No: SPAC-M01515 - for Radome Type C9
6pcs. Washer, Part No: SPAC-M90-10062
6pcs. Screw M6x40, Part No: SPAC-M90-10205 - for Radome Type C9
2pcs. U-bolt, Part No: SPAC-M00428
2pcs. U-bolt, Part No: SPAC-M00429
8pcs. Nut M8, Part No: SPAC-M90-10105
8pcs. Washer, Part No: SPAC-M90-10136
2pcs. Flange, Part No: SPAC-M00430
1pcs. Plug for Mounting Pole, Part No: SPAC-M01620
1pcs. Screw M4x22, Part No: SPAC-M90-10068

Table 6 – Fixed Site Pole Mount Components

## MOUNTING INSTRUCTIONS

The Pole Mount is made from stainless-steel. The antenna is placed on the triangular top and the pole fixed using the U-clamps (to a short mast or similar).

Begin by mounting the antenna on top of the pole with 3 pcs. M6 x 60mm bolts. The 6 pcs. rubber washers are used just below and above the antenna "legs" and the 10 mm spacer gives clearance for the radome base drainage holes.

The 44 mm U-clamps are placed around the pole mount, leaving the 52 mm U-clamps for the mast. Small tolerances in the mast diameter can be compensated by simply bending the U-clamps slightly.

When installing the antenna cable, it is important to protect against moisture, using self-amalgamating tape wrapped around the coaxial connector.

Secure the cable run from the antenna at short, regular intervals. An unsupported length of cable will vibrate in strong winds and could over time could result in a faulty connection.



Figure 16 – 2-Axis Antenna with Optional Pole Mount



## Installing the Maritime Antenna

When installing a Maritime Antenna on a vessel the following important guidelines must be followed in order to ensure that the antenna will operate trouble-free throughout its service life. Any installation must comply with all applicable maritime and Coast Guard codes and regulations.

### MARITIME POLE MOUNT KIT

The Maritime Pole Mount Kit, Ligado Product No. 101208 can be used to mount the maritime vessel. For details on mounting components see below, the parts are described in the Pole Mount Kit Component Description section.



Figure 17 – Maritime Antenna with Optional Pole Mount

**MARITIME POLE MOUNT KIT COMPONENT DESCRIPTION:**

<b>Mounting Pole</b> <b>Part No.</b> <b>SPAC-M00423</b>	This is a piece of standard tubing with a mounting flange welded onto it. The component is made from a stainless-steel alloy that is easy to cut, machine and weld. It is part of the ventilating system for the dome. The standard length is 400mm and must not be shortened in maritime applications. Shorter versions for non-maritime applications may be supplied on special request
<b>Rubber Gasket</b> <b>Part No.</b> <b>SPAC-M00425</b>	This is used to prevent water or dust from entering the area around the center hole in the bottom of the dome. The center hole is part of the ventilating system for the dome and <b>MUST NOT BE BLOCKED</b> . The gasket will also protect the connector from water and dust.
<b>Bushings</b> <b>Part No.</b> <b>SPAC-M01515</b>	This is used to ensure <b>NO</b> electrical contact between the chassis of the antenna inside the dome and the mounting pole. SPAC-M01515 has a 4.5mm thick flange.
<b>Washers</b> <b>Part No.</b> <b>SPAC-M90-10062</b>	This is used to protect the plastic bushings SPAC-M01515 or SPACM00227 when the screws SPAC-M90-10205 or SPAC-M90-10102 (see below) are tightened to the specified torque. The washers <b>MUST</b> be used.
<b>Screws</b> <b>Part No.</b> <b>SPAC-M90-10205</b>	M6 (metric), 40mm long stainless-steel screws. These screws are used (refer to figure 19) for fastening the antenna to the pole mount flange, so that the installation will endure vibrations and heavy loads due to wind or surges from rough sea. Be aware when using these screws, it is imperative that the bushings fitted is of the SPAC-M01515 type. These screws are to be tightened to a specific torque (refer to figure 19). <b>DO NOT CHANGE THE LENGTH OF THE SCREWS.</b>

<b>Clamps</b> <b>Part No.</b> <b>SPAC-M00428</b>	This is used to fasten the flanges SPAC-M00430 to the mounting pole, (refer to figure 19).
<b>Clamps</b> <b>Part No.</b> <b>SPAC-M00429</b>	This is used to fasten the mounting pole to any post with a diameter between 35 and 50mm, (refer to figure 19).
<b>Flange</b> <b>Part No.</b> <b>SPAC-M00430</b>	This is used for linking the clamp holding forces.
<b>NUTS</b> <b>PART NO.</b> <b>SPAC-M90-10105</b>	M8 (metric) self-locking nuts are used for the clamp arrangement. Nuts are to be tightened to the specified torque (refer to figure 19).
<b>PLUG</b> <b>PART NO.</b> <b>SPAC-M01620</b>	This is used for partly closing the bottom of the Mounting Pole so that no surge of water will fill the tube or damage any part of antenna. Any condensation within the antenna and/or tube will drain out by the plug, it will also prevent the coaxial cable from vibrating in tube.
<b>SCREW, M4X22</b> <b>PART NO.</b> <b>SPAC-M90-10068</b>	This is used to secure the plug.

Table 7 - Maritime Pole Mount Kit Component Description

## INSTALLING THE MARITIME POLE MOUNT

Installation of the 3-axis antenna on the mast is done according to figure 18. The diameter of the post shall preferably be between 35 and 50mm using the standard clamp supplied in the kit. Note the TORQUES for

bolts and nuts.

A small loop should be made on the co-axial cable near the plug SPAC M00233 in order to pull the cable about 15cm up through the mounting pole, when the antenna is installed or removed.

If a long (e.g. 3m) post is used on board a ship it is recommended that this is fastened to the ship using standard clamps rather than welding. This will enable the post to be laid down in case removal of the antenna is required.

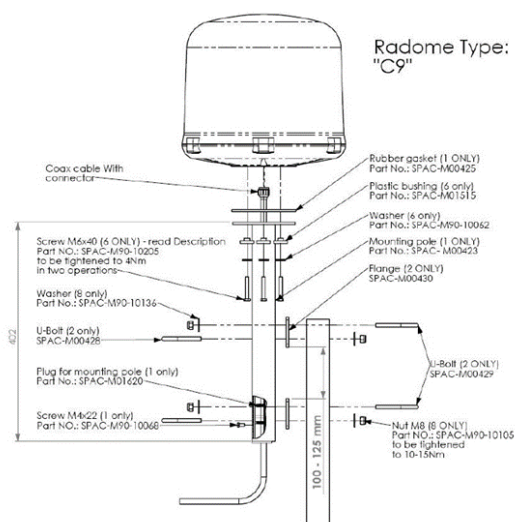


Figure 18 – Maritime Antenna Installation

## Installing the Handset

The handset can be mounted using a standard-sized microphone clip mount (included). Select a mounting position for the handset. The handset should be placed in a location which is easy for the user to see and reach (arm's length) and which does not impede the user's movements or vehicle operation.



Figure 19- Handset Layout

The handset comes equipped with 2.05m (6.7ft) coiled type cable. It is rated for 7.6m (25 ft) of cable. CAT5 or better is recommended.

HANDESET CABLE PART	LENGTH
Handset Side: Straight	0.2m (8")
Coiled	0.3m (1ft)
TU Side: Straight	1.55m (5ft)

Table 8 - Handset Cable Part

The handset supports the use of a headset via a standard 3.5mm, 4 pole and headset jack. The handset comes equipped with a removable anti-dust cover for the headset connector. (Note: the headset jack is not compatible with all headsets including most Apple headsets).

HANSET PIN	MAPPING
Tip	Speaker Left
Ring 1	Speaker Right
Ring 2	Ground
Sleeve	Mic

Table 9 - Handset Pin and Mapping

For detailed instructions on how to use the Handset menus and functions, please refer to the MSATe User Guide.

## Commissioning Procedure

In order for the unit to operate on the Ligado MSAT Network, it must first be commissioned– authorized for use. This task is generally only performed by qualified service personnel.

- If the unit has never been commissioned, it will power up in dealer mode. You can also access this function even after the unit has been commissioned if you are authorized to do so.
- Power up the radio and press the 5 key within 1 second of the appearance of the “SEARCHING” message on display.
- You are prompted to enter the DEALER PASSWORD (authorized personnel will have this password). Type it in and press OK.
- You are then prompted to select the antenna type: TRACKING (for mobile applications) or OTHER (for future applications). Use the arrow keys to scroll to the appropriate option and press SELECT.
- You are then prompted for each of the Commission Parameters: Control Channel Frequency (CFC), Pilot Channel Frequency (PFC), and Security Access Code (SASK). In each case, you are asked to type in the parameter and then press STORE to go onto the next parameter.
- After you enter the set of values, a CONTINUE? Prompt asks you if

you want to proceed with commissioning. Press YES to continue or NO to cancel the commissioning process. If you choose to proceed, two screens are displayed in succession:

- COMMISSIONING indicates the general commissioning process is underway.
- COM: PVT indicates the Performance Verification Test is underway.

If the entire commissioning process is successful a COM: SUCCESS screen is displayed. Control then reverts to the initial Idle Mode screen.

If commissioning is not successful, you will receive a failure message (Network indicates that commissioning has failed, refer to Error Code Diagnostics on the following pages). Contact your Service Provider for assistance.

## Error Code Diagnostics

The following error messages may be displayed on the handset.

ERROR CONDITION	DEFINITION	ACTION
<b>SHUTDOWN SEE DEALER</b>	The radio has been shut down by the network.	Contact your Service Provider.
<b>COM: NO RESP - RETRY?</b>	Signifies that the network did not respond to the commissioning procedure initiated by the user.	Ensure that you have a clear view of the southern sky and select YES to re-initiate the commissioning procedure. Contact your Service Provider if the radio fails to commission after several attempts.

ERROR CONDITION	DEFINITION	ACTION
<b>COM: FAILURE RETRY?</b>	The commissioning process failed.	Select YES to re-initiate the commissioning procedure. Contact your Service Provider if the radio fails to commission after several attempts.
<b>INVALID SASK</b>	Signifies the user has entered an invalid SASK while in the process of initiating the commissioning procedure.	Check that you correctly entered the SASK. If the problem persists, contact your Service Provider to obtain the proper SASK value.
<b>SEARCHING...</b>	If signal strength bars are seen, the radio is in the process of connecting to the MSAT network. If signal strength bars are not seen, the radio cannot receive a satellite signal.	If the condition persists, check the radio has a clear view of the southern sky and that the antenna is connected and is functioning (e.g. can hear the servo motor in the antenna).
<b>WAIT...</b>	Signifies that the radio has not received a response to the PTT request from the MSAT network and is attempting several retries.	Continue to press the PTT key – If the call is successful, USER ON will be displayed. In the event a call fails, a PTT FAIL message will appear requiring the user to release the PTT key and try again.
<b>PTT FAIL</b>	Signifies the radio failed to receive a response to the PTT request from the MSAT network.	Release the PTT key and try again. If this message continues, contact Ligado Customer Technical Support 1-800-216-6728.



ERROR CONDITION	DEFINITION	ACTION
<b>PRESSPT</b>	Signifies the PTT key has been pressed then released just before the radio received the confirmation from the network.	Press and hold the PTT key in order to talk.
<b>INVALID DN</b>	Signifies the user has entered a Directory Number (DN) that is not a member of the private mode talkgroup currently active on the radio.	Ensure a valid DN is entered in tag position 00.
<b>NO TG</b>	No talkgroups have been downloaded to the radio.	If this condition persists, contact Ligado Customer Technical Support.
<b>BLOCKED</b>	Signifies that the radio's antenna signal to the satellite is blocked.	Ensure that the antenna has a clear line-of-sight to the satellite.
<b>X-OVER FAILURE</b>	Signifies that the user has initiated a manual beam cross-over to a beam that is not accessible. Following the appearance of the failure message the user will be returned to the beam options list.	Ensure that the appropriate adjacent satellite beam is chosen when initiating a manual beam cross-over.
<b>RF POWER FAILURE</b>	The radio detected a problem with its RF transmissions and disabled the transmitter.	Power cycle the radio. If this condition persists, contact Ligado Customer Technical Support.
<b>ANT FAILURE</b>	This indicates the radio has detected a fault in the antenna and has shut it down.	Power cycle the radio – if this problem persists, contact Ligado Customer Technical Support.

ERROR CONDITION	DEFINITION	ACTION
<b>WARNING! OVERHEAT</b>	Signifies that the radio is overheating – This message will appear at 10 second intervals until the temperature is reduced. If the temperature continues to increase, then the radio will shutdown.	Move the radio to a cooler place, if the radio powers off, allow it to cool down before re-initiating the power-up sequence.
<b>INVALID PASSWORD</b>	Signifies the user has entered the wrong Dealer or SYSTEM Menu password.	Enter the correct password – If the password is unknown, the unit will need to be sent in for repair.
<b>WRONG LOCK CODE</b>	Signifies the user has entered the wrong Handset Lock Code.	If you cannot remember the lock code (default is 0000), enter the SYSTEM password (default 1234), when prompted to enter the code.

Table 10- Error Code Diagnostics

## Troubleshooting the Installation

Steps to Basic Troubleshooting:

When troubleshooting, always record as much information as possible. Start by asking the person who encountered the problem to describe the problem, the events leading up to the problem and any troubleshooting work that may have been done already. This information will be valuable when discussing the problem with others and will help to debug similar problems in the future.

### 1) Characterize the problem

Equipment performance:

- Did the unit power up successfully?

- What is shown on the handset display?
- Were any error codes displayed?
- Are you able to establish communications with another user?
- What is the received communications quality like?
- What does the transmitted communications quality sound like to other users?

Environmental conditions:

- Record information about the location and the line-of-sight to the satellite.
- Are there any blockages?
- What are/were the weather conditions when the problem is/was encountered?
- Is there any pattern as to when the problems occur (i.e. always when it rains, always at 9 a.m., in the summertime but not the wintertime etc.)?
- How long has the problem existed? When did it first show up?
- Is it intermittent; or is it always present?

## **2) Eliminate operator error**

- Is the user familiar with the operation of the equipment?
- Have they used it successfully in the past?
- What was happening prior to the problem?

## **3) Is the problem really with the equipment?**

### **4) Check the installation**

- What is the integrity of the installation?
- Are the cable connections secure?
- Are the cables damaged in any way? Is the antenna system damaged?
- Is the TU damaged?
- Has any electrical or construction work been done near the TU, antenna, or handset?
- Is the power supply working properly?

## 5) Troubleshoot by component

Does the problem sound TU-related, antenna-related, handset-related or external equipment-related? Swap out a suspect component into a known working system (i.e. if the TU is suspect, try it out with a known working antenna and handset). It is highly recommended that a complete working satellite radio (TU, Handset, and AU) be part of any troubleshooting kit.

### TROUBLESHOOTING SOME TYPICALLY ENCOUNTERED PROBLEMS

#### 1) MT will not power up

- Start by checking that the power supply is working properly.
- Check the power level supplied by the cable going into the TU.
- Check that the power cable is securely connected to the TU.

#### 2) Commissioning Fails

- Is there sufficiently high enough signal strength?
- Check the antenna for line-of-sight.
- Check that the correct SASK, PFC & CFC are entered.
- Check the TU ESN – is this the correct TU?
- Check that the account is active and that the unit is in ready to commission status.

#### 3) Signal Strength low/intermittent/none

- Check the antenna cable connection to both the TU and antenna.
- Check that the cable is not damaged in any way (pinched, cut etc.).

# MSATe Technical Specifications

<b>Weight</b>	TU = 1.43 lbs./0.65 Kg Handset = 0.6 lbs. Land Mobile Antenna = 4.6 lbs./2.09 Kg Maritime Antenna = 10.3 lbs./4.67 Kg
<b>Dimensions</b>	TU = (W) 6.5" x (H) 1.1" x (D) 5.6" / (W) 16.5 cm x (H) 2.8 cm x (D) 14.2 cm Handset = (W) 2.7" x (H) 1.4" x (D) 6.6" / (W) 6.86 cm x (H) 3.56 cm x (D) 16.76 cm Land Mobile Antenna = (D) 9.8" x (H) 3.9" / (D) 24.89 cm x (H) 9.9 cm Maritime Antenna = (D) 11" x (H) 11" / (D) 27.94 cm x (H) 27.94 cm
<b>Power</b>	Input voltage: 12 to 15.6 VDC Input current: 6 Amps max.
<b>Fuses</b>	Fuse: ATM, Mini Fuse 7.5A, 32V, 1 <sup>2</sup> t: >40<=70 (Littelfuse part num. 029707.5) CAUTION: For continued protection against risk of fire, replace with only the same type and rating of fuse.
<b>Humidity</b>	98% at 100.4°F (38°C)
<b>Operating Temperature</b>	TU = -22°F (-30°C) to +131°F (+55°C) Handset = -4°F (-20°C) to +158°F (+70°C) Antenna = -22°F (-30°C) to +109°F (+43°C)
<b>Storage Temperature</b>	TU = -40°F (-40°C) to +185°F (+85°C) Handset = -67°F (-55°C) to +185°F (+85°C) Antenna = -67°F (-55°C) to +185°F (+85°C)
<b>Dust</b>	In accordance with SAE J1455 section 4.7
<b>Rain</b>	Antenna = Precipitation rate of 2"/hour

Table 11 - Technical Specifications