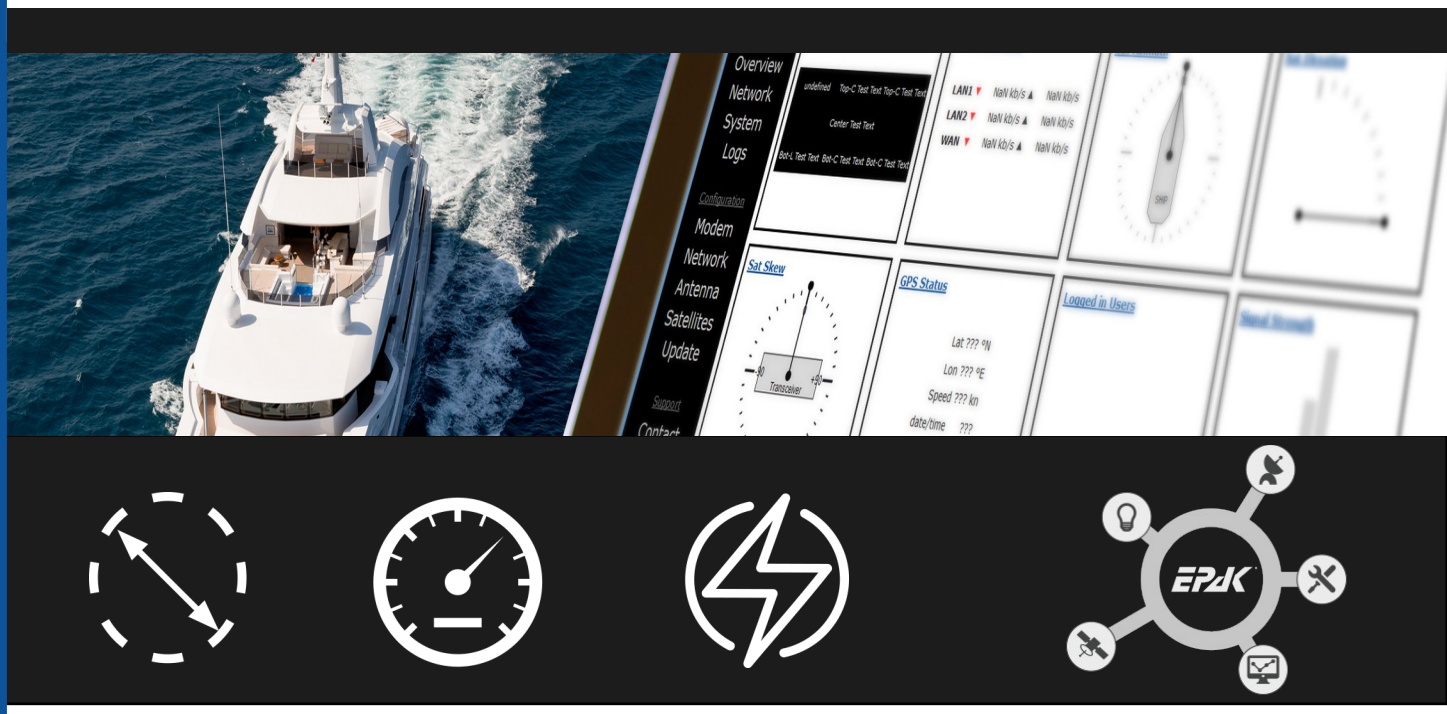
# Installation and User Manual

## Maritime VSAT systems




**DSi6Ku Pro**

**DSi9Ku Pro**

**DSi9 Ka Pro**

**DSi13Ku Pro**

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Please keep your serial number ready.

**VSAT Serial Number**

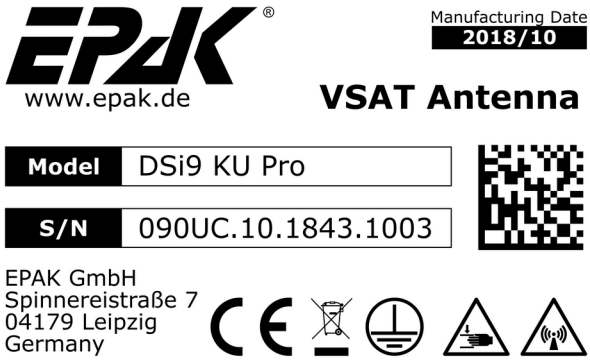


*Figure 1: Antenna label with serial number*

The serial number (standard format: 090UC.10.1843.0000) will be required for all service requests regarding this product.

You can find the serial number of your EPAK VSAT system both engraved on the chassis of the antenna (Figure 1) and on the delivery note sent to you with the system.

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# Table of Contents

# 1 Introduction

### Intended readers

This is an installation and user manual for the EPAK VSAT systems PRO Series, intended for installers of the system and service personnel. Personnel installing or servicing the system must be properly trained and authorized by EPAK. It is important that you observe all safety requirements listed in the beginning of this manual, and install the system according to the guidelines in this manual.

### Product description

EPAK VSAT antennas are automatic satellite tracking systems for internet access made for maritime applications. Earth Stations on Vessels (ESV) are used to enable broadband access, data communication, and telephony via satellite links, operating in the fixed satellite service while the vessels are travelling near the coast or on the high seas. EPAK's VSAT systems are designed to track those satellites with great precision in real-time response to the ship's motions even in rough sea conditions and ensure a seamless availability of the broadband internet connection on the move.

Such VSAT systems consist of two major units, the antenna Outdoor Unit (ODU) and the Indoor Unit (IDU). The ODU is protected by a UV-stabilized, maritime climate-proof, and easy to maintain radome. The antenna uses a 3-axis motion system, with automatic skew adjustment. This feature in combination with state-of-the art tracking technology (twin RF tracking receiver + 6D inertial + GNSS & NMEA - optional) guarantees an unmatched tracking speed up to 50°/s. The IDU consists of the Antenna Control Unit (ACU) and satellite modem. The ACU is a device that communicates with the Antenna, the modem and optionally with the heading data from the vessel.

This unit provides an easy to use web-interface for configuring the antenna, checking the antenna's current status and configuring your network.

EPAK systems can be easily configured in a variety of ways using different LNBs, BUCs and modems to accomplish individual application needs. To guarantee the highest performance and reliability, EPAK designs and engineers all of its antennas' major RF components, control boards, mechanical parts and radome in house. All the components are optimized for rough marine applications. From small vessels up to super yachts, no matter whether sailing or motor yachts, EPAK VSAT series are eminently suitable for all types of vessels.

EPAK's VSAT systems are designed to meet the satellite operators requirements of every ESV for receiving and transmitting the data via Ku or Ka-band. Once the connection to a satellite is established, the system will stay connected due to a 360° high-speed tracking system. That guarantees a non-stop connection to the internet while the vessel is anchored or even while cruising in open seas under rough conditions. The antennas are available in dish sizes in the range of 60cm, 90cm and 130cm (DSi6, DSi9 and DSi13 respectively).

EPAK also offers several additional options to accommodate special requirements. The Diversity Kit assures the avoidance of blind spots by combining the free line of sight ranges of two antennas in one bundle. This will prevent any loss of satellite signal through blockages. Additionally EPAK also offers a vessel management router for network control, WiFi services and Voip/Voice connections.

### Your safety

All personnel who operate equipment or do maintenance as specified in this manual must know and follow the safety precautions. The warnings and cautions that follow apply to all parts of this manual.

# 2 Safety Recommendations & Precautions

## 2.1 Microwave radiation hazard

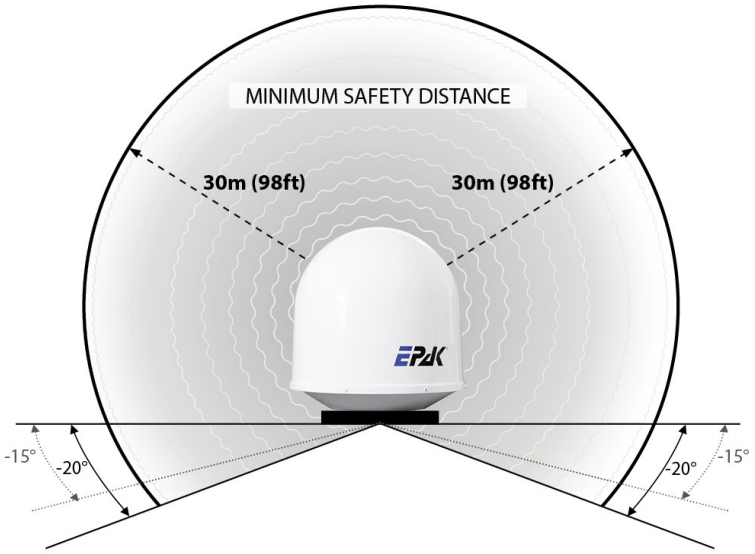



*Figure 2.1: Microwave radiation safety distance*

***Ensure that all personnel stay outside of the safety distance during antenna operation.***

During operation the antenna uses high-powered BUCs in order to establish a two-way communication with the satellite. The resulting radiation is hazardous. The label on the radome depicts the safety distance for the maximum BUC power usable for the respective dish configuration.

The FCC specifications specify a limit value for the power density of 1.0 mW / cm² as a general limit for the Ku and Ka frequency range. In a professional environment, this limit is higher at 5 mW / cm².

The values calculated below use the limit value of 1 mW / cm². They are always rounded up to the next possible value divisible by 5. The maximum antenna gain of the system is used for the calculation.The safe distance mentioned below only applies to the area in the main beam direction (direction in which the antenna is transmitting, eg azimuth: 360 °; elevation: -10 ° to 90 °). From this it follows that it is largely safe “under the antenna”. Please check the table below for the safe distances according to the dish size and BUC used.

| Antenna Type | BUC | Minimum Safe Distance |
|---|---|---|
| **DSi6 KU** | 8W | 20m |
| | 16W | 30m |
| **Dsi9 KU** | 8W | 30m |
| | 16W | 40m |
| | 25W | 50m |

| Antenna Type | BUC | Minimum Safe Distance |
|---|---|---|
| **DSi9 KA** | 3W | 35m |
| | 5W | 45m |
| | 10W | 65m |
| **DSi13 KU** | 8W | 40m |
| | 16W | 60m |
| | 25W | 75m |
| | 40W | 95m |
| | 60W | 115m |

## 2.2 Radar interference

- The antenna must be mounted as far away as possible from the ship's radar and high power radio transmitters as they can affect the antenna performance. To avoid the worst interference, the antenna should be mounted at a different vertical level – either 15° above or 15° below the radar. Kindly note the recommended minimum distances between the ODU and X-band/S-Band radars in the table 4.2.3.
- After the installation is completed all other electronic systems, i.e. GPS, Radar, VHF, FM, AM etc., should be tested for full functionality while the antenna is switched on.

## 2.3 Exposure to rain / moisture

- Do not open sealed electronic components on the ODU and the ACU. Doing that will void the warranty of the equipment.
- The ACU and the satellite modem must always be kept indoors. Exposure to rain, sunlight or moisture may damage the equipment.

## 2.4 Necessity of grounding the equipment

Grounding of the equipment is necessary to avoid potential differences between the ship's ground potential and the equipment's. The antenna's ground connection shall be connected directly to the ship's ground to avoid undesired current flow. For details refer to paragraph 4.9 Grounding.

## 2.5 Power supply

The ACU requires 90-264V AC @ 47-63 Hz Input voltage & frequency. The ACU then supplies DC power to the Antenna. Use of an online UPS is mandatory for EPAK systems, otherwise the warranty becomes void. For more details see 4.8.

## 2.6 Maintain ambient temperature for IDU

Proper cooling and ventilation is required for all indoor equipment. The ACU can be stored at a temperature between -40°C to 85°C. During operation, the ambient temperature must be maintained between -20°C to 55°C. Frequent imbalances in the environment can damage the IDU electronics.

## 2.7 Maintain ambient temperature for ODU

Operating temperature for the ODU ranges from -30°C to 55°C, while the storage temperature range is between -30°C to 85°C. When temperatures fall below -30°C, the antenna system must be kept on to avoid damage to electronic parts at re-start. Alternatively an antenna heating system should be used.

## 3 System Components List

In our standard delivery, you will find the following system components.

| Component | Details |
|---|---|
| **ODU**<br>  | **Description**<br>• Stabilized Antenna Pedestal with electronic control modules<br>• Feed-assembly<br>• Ku band BUC & LNB<br>• Inbuilt GPS receiver<br>• Radome assembly<br><br>**Features**<br>• 3-axis motion system + auto skew adjustment<br>• Range movement from -15° to +120°<br>• Tracking speed up to 50°/s |
| **ACU (IDU)**<br>  | **Description**<br>• Antenna Control Unit<br>• Power cable and Ethernet cable<br><br>**Functionality**<br>• Configuring satellite & beams<br>• Monitoring live status of the antenna<br>• Providing Internet access & voip services to the vessel |
| **Mounting screws**<br>  | DSi6 / DSi9 4 mounting screws<br><br>DSi13 : 12 mounting screws |
| **VSAT manual**<br>  | VSAT manual for easy operation & configuration of the system.<br><br>Up-to-date documents are available for download on www.epak.de/en. |

**Add-ons (Optionally supplied by EPAK)**

| Component | Description |
|---|---|
| **Satellite Modem** | **Supported modem types:**<br>• iDirect modems - Evolution, Velocity platform<br>• Hughes HX200<br>• ViaSat SBT-M<br>• Comtech CDM-250/840<br>• Gilat series - Capricon, Gilat SkyEdge-II Pro<br>• Paradise PD25L, Datacom Q-Flex<br>• SpaceBridge modem<br>• Tooway<br>• Romantis / Eastar UHP 1000 / UHP 2000 |

| | |
|---|---|
| | • others on request |
| **Vessel Management Router**  | • Network monitoring & control<br>• Traffic prioritization<br>• Hotspot management<br>• Managing Crew calling services<br>• Web Filtering |
| **PBX equipment** | Handling SIP service for making low cost Voip calls |
| **IP Telephones** | For making VoIP calls |
| **UPS** | Online UPS system |
| **Cables** | 2x Double shielded coax cable (ECOFLEX10 or 15) with N-Plugs<br>2x Double shielded coax cable (RG6) with F and TNC-plugs |

# 4 Installation Procedure

The installation of our systems is easy compared to existing VSAT systems. This section gives a guideline and answers all your questions on how and where to install the ODU and IDU. It is highly recommended to plan your installation according to this in-order to prevent mistakes and damages to the vessel or the VSAT system.

## 4.1 Tools required for Installation

Following tools are required for installation.

| | | | |
|---|---|---|---|
|  |  |  |  |
| electric drill; screwdriver | 4 mm and 8.5-9 mm drills | Hexagon socket screw key size 6 | size 13 screw wrench |

## 4.2 Select Antenna location

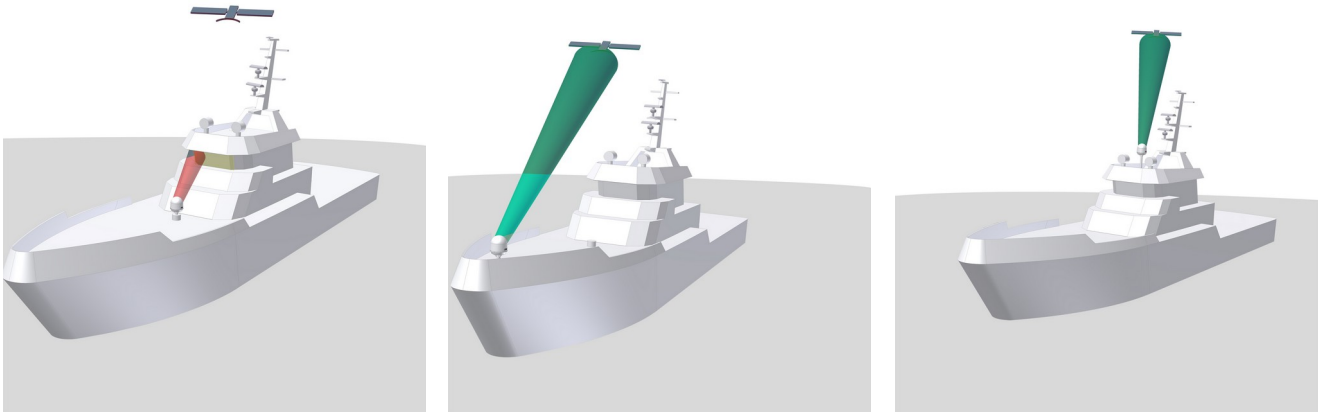
The antenna's selected mounting position should have the following characteristics.

### 4.2.1 Free line-of-sight towards satellite

The antenna needs a free line-of-sight to the satellite for uninterrupted operation. Any obstacles can reduce service availability and tracking performance. Please note that the free line-of-sight depends on the vessel geolocation and the selected satellite. The best location for the antenna is on a raised platform or on one end of the vessel as shown in Figure below.

### 4.2.2 Mounting surface requirements

The pedestal/mast must be rigid enough to carry the antenna's weight as well as eliminating the vibrations of the antenna/vessel while tracking/being on the move.



Bad location: in such a situation it is very likely to incur a wide blind spot.

Better: by setting the antenna to one end of the ship, the obstacle can be overcome.

Best location: if possible, place the antenna on top of the boat.

*Figure 4.1: Finding the best location for the antenna*

### 4.2.3 Radar interferences

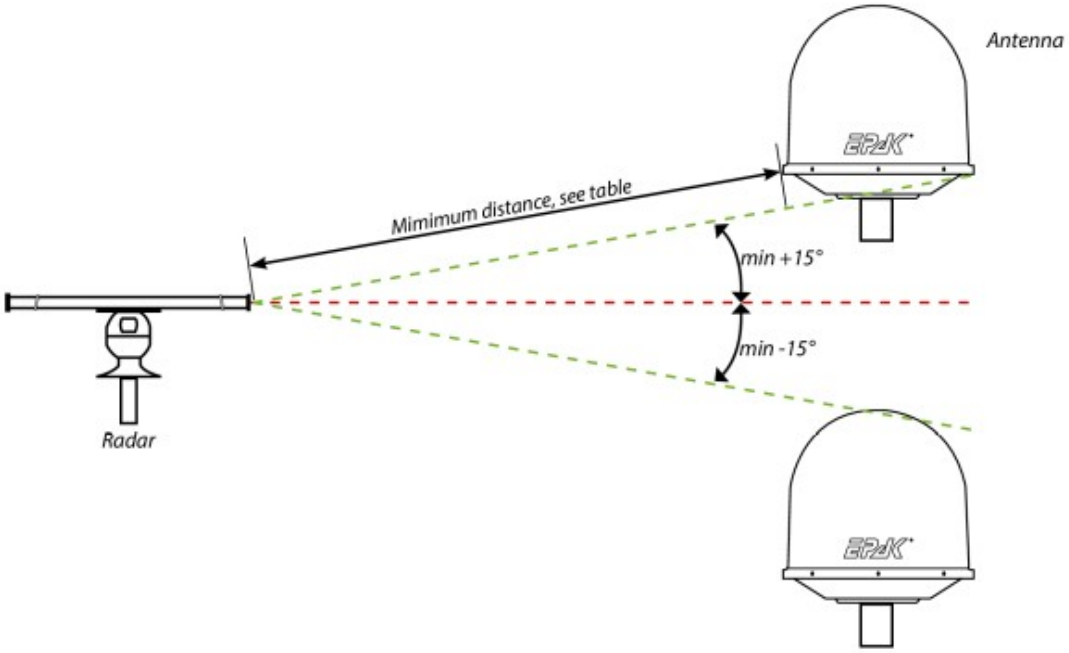



*Figure 4.2: Minimum safe distance from radar*

It is very important to not install the antenna near the radar. Radars and satellite antenna's operate in the microwave region of the electromagnetic spectrum. A radar placed close to the ODU can degrade the antenna's performance. Thus it is necessary to maintain the minimum distance between the two equipments.

The minimum acceptable separation between a radar and the antenna is determined by the radar wavelength/frequency and the power emitted by the radar. The table below show some "rule of thumb" minimum separation distances for radar power at X and S band. As long as the minimum distance listed below is applied, antenna damage is normally avoided.

| | X- Band (~3 cm/ 10 GHz) min distance | S-Band (~10 cm/ 3 GHz) min distance |
|---|---|---|
| **Radar Power** | Minimum distance between VSAT and Radar with 20° vertical separation | |
| 0-20 kW | 1.0 m | 2.0 m |
| 20-50 kW | 2.0 m | 4.0 m |
| 50 kW+ | 3.5 m | 7.0 m |

The presence of one or more S or X-band radars within a radius up to 100m may cause a minor degradation of the Ku-band connection. The degradation will be most significant at high radar pulse repetition rates. Especially in poor receiving conditions (objects blocking the signal path, heavy rainfall or icing, low satellite elevation and violent ship movements) the small extra degradation due to the radar(s) could cause poor connection quality.

## 4.3 Planning the cable paths

Please check which walls are suitable and if existing openings can be used for the cables. Laying the cables is usually done by an electrician in the dockyard with proper certificates to alter the ships installations or the ships structure. If you're in charge of laying the cables, make sure it is done in accordance with the following rules:

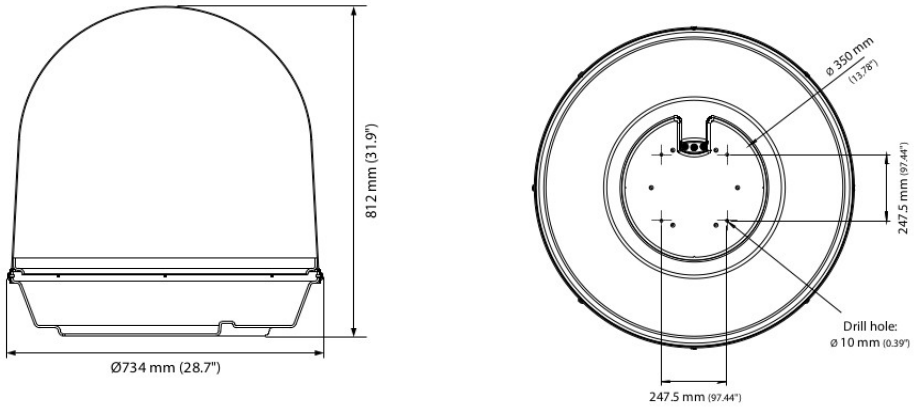
- Use suitable coax cables: double shielded EcoFlex 10 or 15 is recommended. EPAK warranty does not cover decreased performance due to improper wiring.
- The maximum recommended cable length for EcoFlex10 is 50 m and Ecoflex15 is 80 m. Make sure that the cable length does not exceed this value. If maximum cable length is too short for your installation, favour higher grade cables over in-line amplifier.
- Avoid placing RF cables too close to other cables which might carry "noise".
- Fit and secure cables properly. Use shrink tubing with heat activated adhesive to seal connectors.
- Avoid sharp bends and kinks on cables.
- To connect antenna and ACU, use cables in one piece; do not extend cables, do not split cables.
- Use only high quality RF connectors.

## 4.4 Drilling

For an ideal mounting of the antenna all possible drilling patterns are prepared with a pre-drilled hole of 2 mm in the bottom of the radome. Please refer to the included templates for the drilling measurements. Installation should be done with the supplied M10x35 screws. They can be used for a mounting plate thickness of up to 15mm. For thicker plates from 15mm to 30mm use M10x50 screws.

*Note: Using longer screws than recommended could potentially cause damage to the system.*

**Dimensions and drilling patterns**




Click for full view or refer to page 31

*Figure 4.3: Dimensions 60 cm antenna dome (front and bottom)*

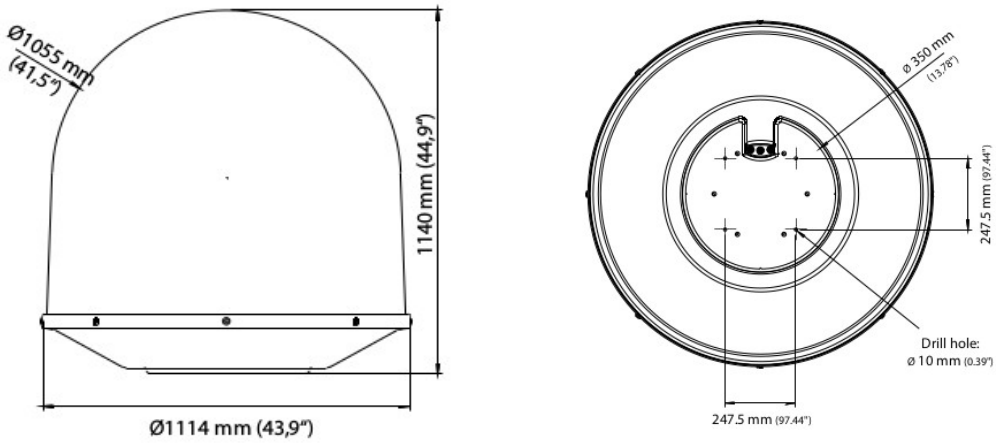



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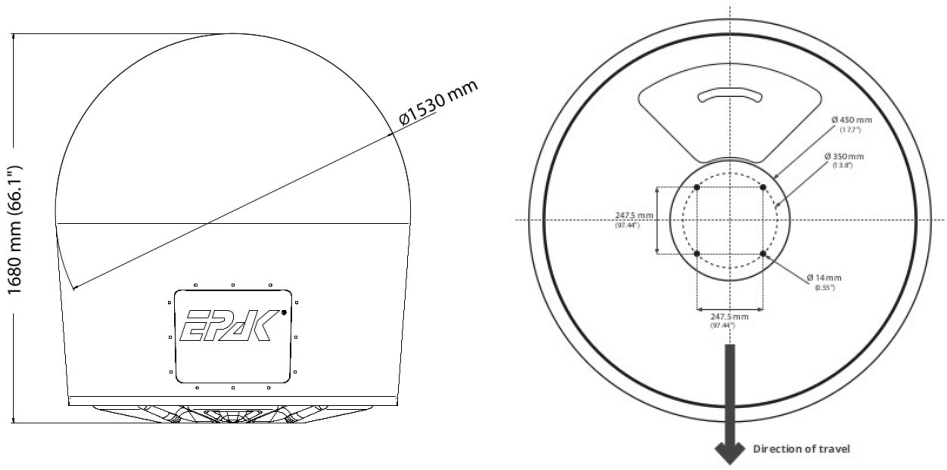
*Figure 4.4: Dimensions 90 cm antenna dome (front and bottom)*




Click for full view or refer to page 33

*Figure 4.5: Dimensions 130 cm antenna dome (front and bottom)*

## 4.5 Installing the Antenna

Before installing the antenna, please take the following precautions:

**Caution:**

- The radome has to be properly fixed on the antenna before installing it on the platform.
- For safety during transport, the antenna has locks for the movement in skew, elevation, roll and azimuth. **Do not open these transportation locks before installation.**

**Procedure:**

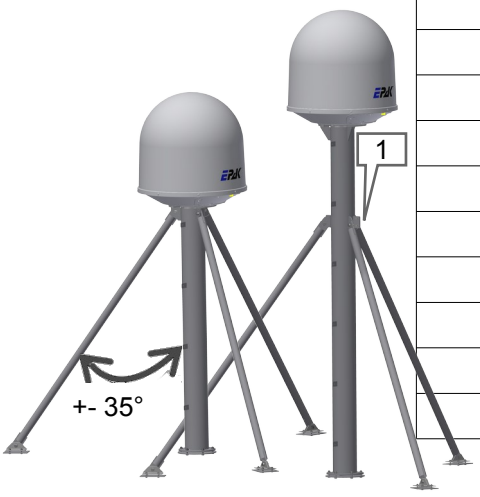
- Ensure that the mounting base is solid and steady.
- The antenna unit must have a clear line of sight to the satellite and there should be no interference.
- Make sure that the cable lengths are sufficient to reach the mounting platform. Recommended maximum length is 50 m for ECOFLEX10 cables, and 80m for ECOFLEX15 cables.
- Prepare the mast / mounting pedestal with the drilling measurements shown in section 4.3.
- Now, attach a 4-part sling around the antenna to lift and place the unit on the pre-drilled holes and fasten it with the included screws. The screws have to be mounted from below and through the base plate of the antenna.
- Connect both the coaxial cables (RX and TX) at the base of the antenna.
- Close all drilled holes with waterproof sealing material to avoid any water penetration.
- Finally, open all the transportation locks according to our manual before operating the antenna.

## 4.6 Installation on a mast

The below table shows the minimum dimensions for the mast when mounting an EPAK DSi9 VSAT. Note that the values are only guidelines. Always consider the environment and characteristics of the ship before deciding on the mast dimensions.

**Mast without braces**

| Max. free mast length (steel, m) | Outer diameter (mm) | Wall Thickness (mm) | Weight (kg/m) |
|---|---|---|---|
| 0.6 | 220 | 5 | 26.5 |
| 0.8 | 250 | 5 | 30.2 |
| 1.0 | 270 | 5 | 32.7 |




**Mast with 3 braces**

| Max. free mast length (steel, m) | Outer diameter Mast (mm) | Wall Thickness Mast (mm) | Outer Diameter Braces (mm) with 5mm thickness |
|---|---|---|---|
| 1.2 | 140 | 10 | 50 |
| 1.2 | 200 | 5 | 50 |
| 1.6 | 140 | 10 | 70 |
| 1.6 | 200 | 5 | 70 |
| 2.0 | 160 | 10 | 70 |
| 2.0 | 200 | 5 | 70 |
| 2.5 | 180 | 10 | 80 |
| 2.5 | 220 | 5 | 80 |
| 3.5[1] | 245 | 6 | 80 |

1 Braces meet at 2.5m and mast extends beyond

## 4.7 Removing Transport Lock of the Antenna

After the system has been securely placed on the mounting platform, only then proceed to remove the transportation lock. It is important to note that the transportation lock must be removed before powering on the system, otherwise this will impose strain on the mechanics of the antenna.

Four handles are used to lock the skew, elevation, roll and azimuth movement of the antenna. A visible red dot on the handle indicates that the handle is locked. A green dot indicates that it is open. To open or close, pull the handle towards you and turn until it locks in the new position. Confirm by checking movement of the antenna.

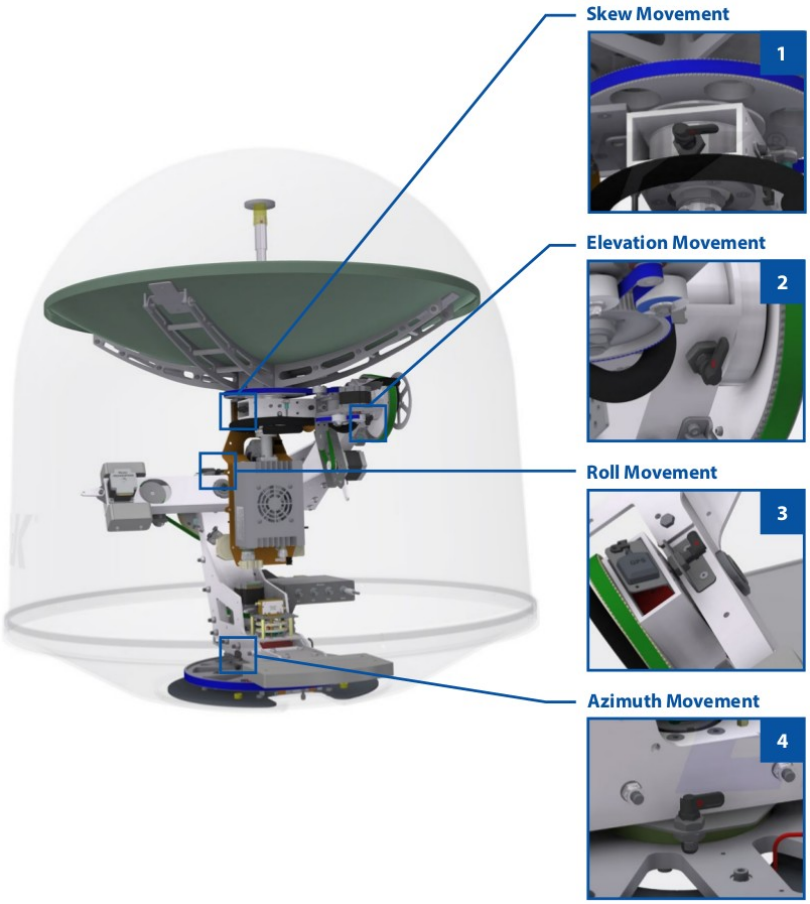
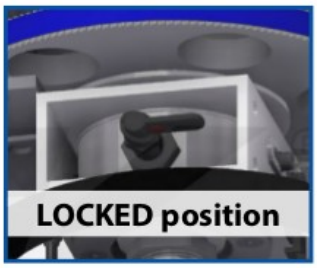
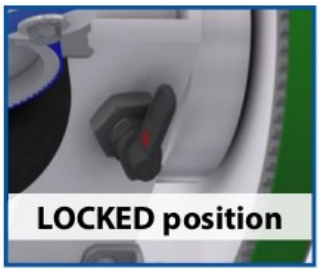


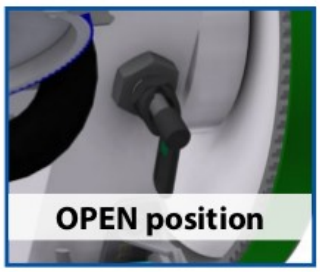

*Figure 4.6: Position of transport locks*





**Step 1** Release the **skew** movement by turning the handle into upward position as shown in the figure.




**Step 2** Release the **elevation** movement by turning the handle to downward position as shown below.



**Step 3** Release the **roll** movement by turning the handle to the right as shown in the figure below



**Step 4** Release **azimuth** movement by turning the handle left as shown below.

*Figure 4.7: Transportation lock open-closed*

## 4.8 Installing the Indoor Unit

Before installing the IDU, find a suitable location for the equipment within cable lengths. Ensure that the display of the control unit can be easily read and the front-panel is accessible. Also, allow sufficient room for connecting the cables behind the control unit. Check the following diagram to find the dimensions of the unit.

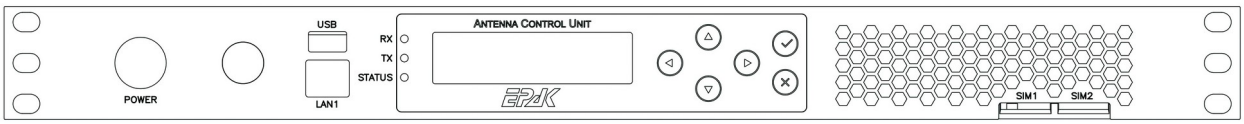



*Figure 4.8: ACU Front view*

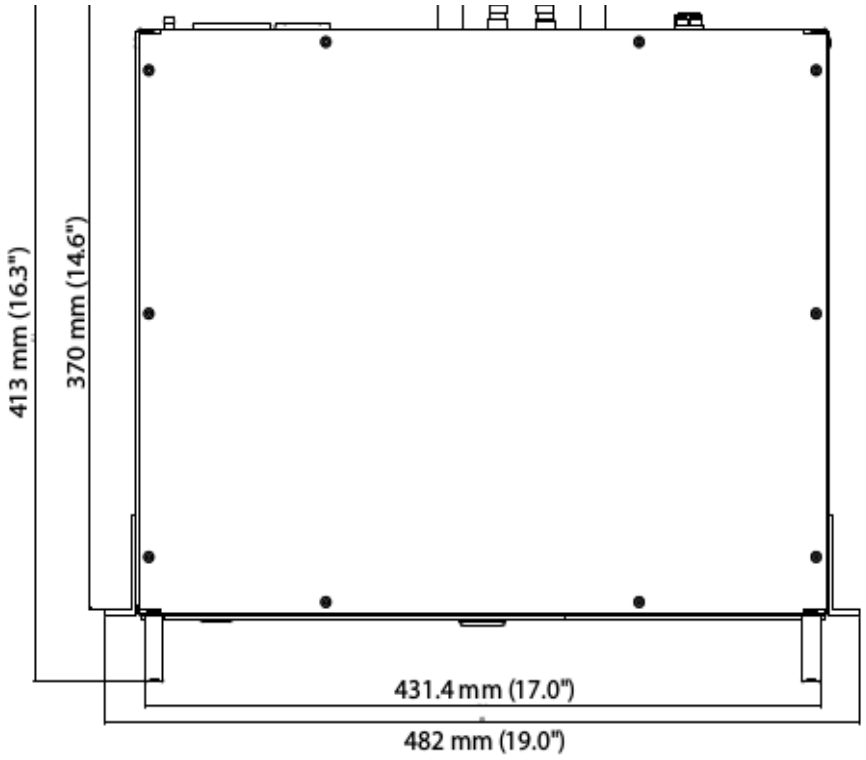



*Figure 4.9: ACU top view*

The following points need to be considered during installation of the IDU

- All IDU components (ACU+Modem) should be mounted in a professional 19" server rack. For the installation, operation and maintenance enough space should be available at the front and also some space must be allowed behind the unit for the cables.
- Proper cooling and ventilation is required for all IDUs. The ACU should be stored within a temperature range of -40°C to 85°C. During operation, the ambient temperature must be maintained between -20°C to 55°C.
- Fresh air intake is from the front of the ACU, and warm air is dispensed out the back. Therefore, Both front and back panel of the ACU must be kept clear to allow ventilation. Otherwise, overheating might cause system shutdown.
- Either the UPS is provided by EPAK or a compatible UPS (on-line/double-conversion type) has to be installed by the ship owner for powering the IDU.

## 4.9 Power supply for VSAT system

The ACU requires 90-264V AC @47-63 Hz, 1 phase. However, as the power supplied by vessel generators can fluctuate considerably, an online type UPS is compulsory for EPAK VSAT system otherwise the warranty becomes void. The ACU supplies the ODU with 48V DC power and the BUC with either 24V or 48V depending on the model. There is also a switched AC outlet at the back of the ACU which can be used for the modem's power supply.

By default the ACU is equipped with a 2.5A fuse. This is suitable for operation with 230V. A spare 5.0A fuse is provided alongside the ACU, which should be used instead, in the rare case that the antenna system should be operated with 110V.

**Caution:** Grounding of the equipment is necessary to avoid potential differences between the ship's ground potential and the equipment's. The antenna's ground connection can be connected directly to the ship's ground to avoid undesired current flow. For details refer to paragraph 4.9 Grounding.

## 4.10 Antenna Grounding

When grounding the antennas, there are two different scenarios.

**Case 1:** Potential of the antenna **corresponds** to that of the platform/mast/hull

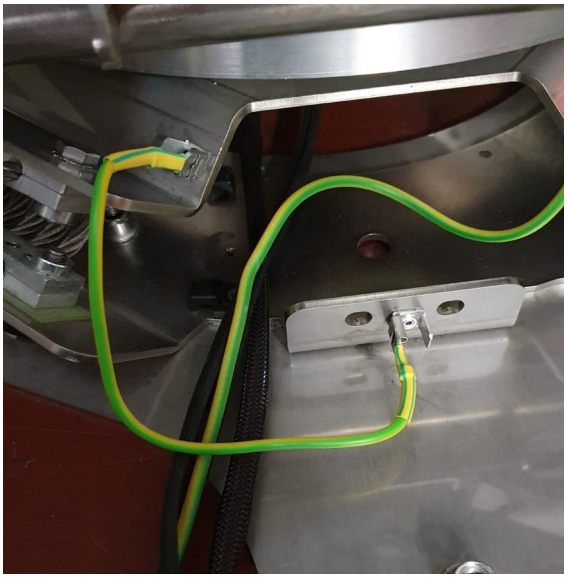
**Case 2:** Potential of the antenna **does not correspond** to that of the platform/mast/hull

Case 1 is the standard scenario for all 60cm and 90cm antennas. If you require a galvanic separation (case 2) for your 60cm or 90cm EPAK antenna, please indicate this in your order.

In order to avoid galvanic corrosion, the hull of a ship is sometimes electrically decoupled from the rest of the electronics. The hull of a ship is therefore at a very unique potential. In this case this potential must not be connected within the antenna system.

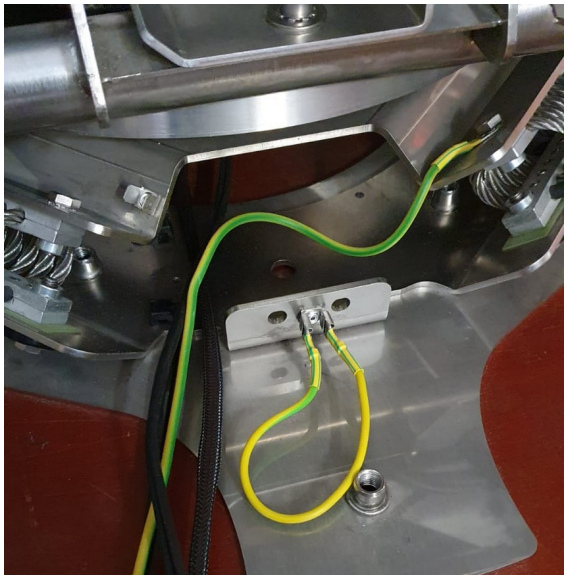
**Case 1: same potential**

An electrical connection should be established between terminal/terminal plate, the base plate and the antenna chassis.



**Case 2: different potential**

An electrical connection between terminal/terminal plate and the antenna chassis should be established. The base plate is pulled to the potential of the hull of the ship via the screw connections to the podium/mast/hull. The base plate remains electrically isolated from the rest of the antenna.



## 4.11 System Cable Connections

Please note the following points before making the connections.

- Ensure to power off the circuit which you are working on to avoid any short.
- Drip-loops should precede the entry point as shown in below diagram. This will avoid any water to seep into the ACU.
- The ACU has to be connected to 230V AC 50Hz from a online type UPS, otherwise the warranty on EPAK system will be void.
- After the ODU and IDU are installed, proceed to connect the ACU and ODU as follows:

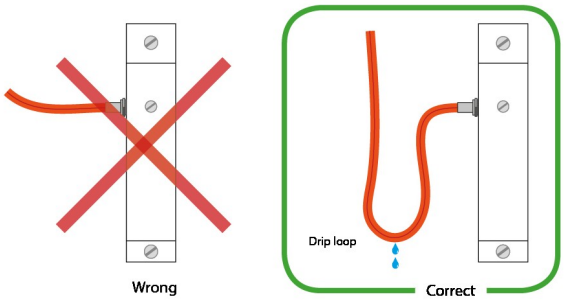



*Figure 4.10 Cable connection with drip loop*

- The two antenna cables (RX+power and TX) must be connected to the ACU and the ODU.
- The modem cables (RX, TX and WAN) must be connected to the ACU.
- The ACU must be connected to 230V/50Hz AC from our recommended UPS.
- Vessel network or switch can be connected to Lan1 /Lan2 of ACU.
- The modem must be powered by the ACU with provided power cable.
- The user can also connect the ship's gyro information (optional) via the NMEA connector at the back-panel of the ACU.

Note:
The frequency range of the TX and RX channels is between 10 MHz and 2150 MHz. The ACU forwards 10 MHz reference signals output by the modem to the BUC and/or LNB. If an external reference is required but not provided by the modem, an additional diplexer must be used.

## 4.12 Wiring VSAT Ku-Band Systems

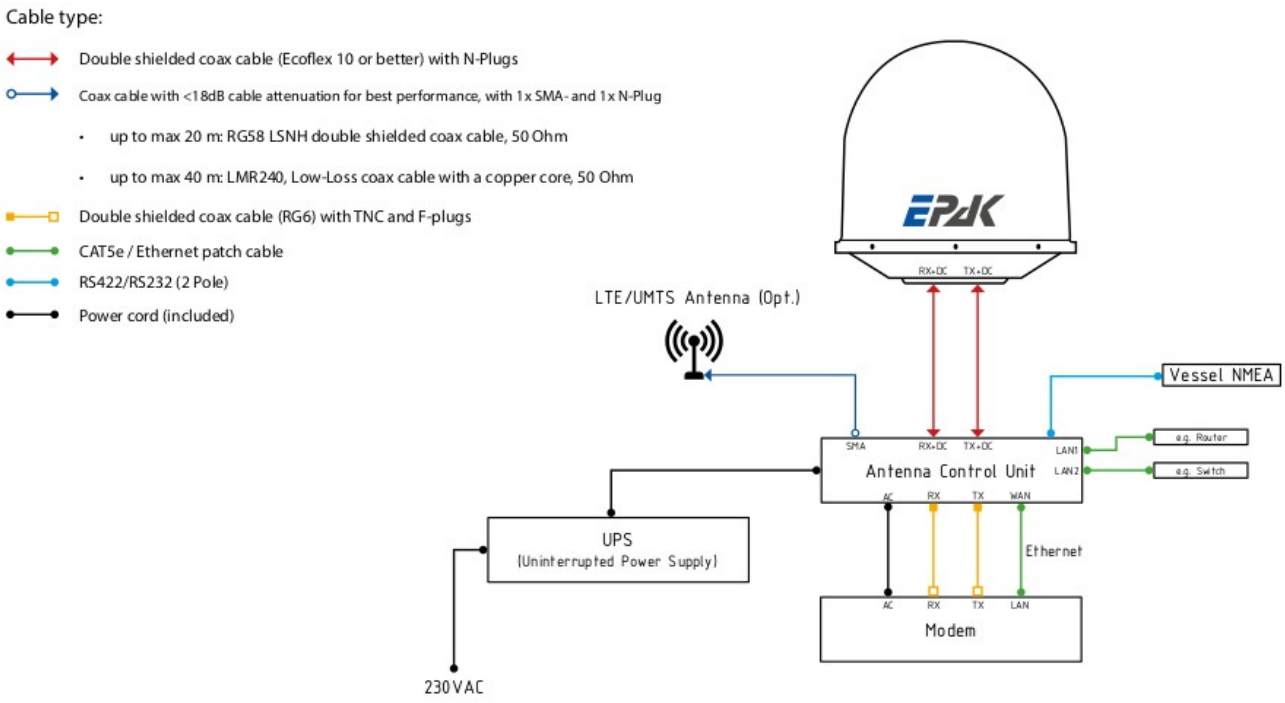



*Figure 4.11: Wiring scheme VSAT Ku-Band Systems*

# 5 Operating the VSAT system

Once the Antenna and ACU have been installed safely and all the system cabling is connected, you can power-on the system. Please refer to the power supply requirements of this document to check the requirements. If there is already a pre-configured satellite, after powering-on the antenna will automatically adjust all its parameters (sensor, gyro, elevation, skew etc) and lock onto the satellite automatically. However, the user can also easily configure the desired parameters from the ACU's web-interface.

The ACU has to be mounted into a standard 19-inch rack. All EPAK VSAT systems provide a web interface for basic monitoring and configuration, which can be accessed by connecting to any one of its LAN interfaces. Therefore, it is recommended to mount the ACU where the antenna status can be checked.

The ACU is connected to the ODU via 2 coaxial cables RX and TX. The RX cable carries the receive signal in IF, and the DC power supply for the antenna. The TX cable carries the transmit signal in IF, reference signal for the BUC and power for the BUC.

The ACU is connected via two coaxial cables (RX & TX) and one Ethernet cable to the satellite modem. The ACU forwards the IP traffic from the modem to its own LAN interfaces.

You can also connect the ship's compass to the NMEA interface of the ACU for accurate heading information. This heading information is optional, so if it is not connected,the antenna relies on the heading data obtained from the GPS receiver fixed to the antenna.

Please check the description given below for a short overview of the key functions of the ACU.

## 5.1 ACU panel

The EPAK VSAT system is operated by the control unit. See below a short overview of its front and back panel and its corresponding functionality.

**Front-panel keys:**

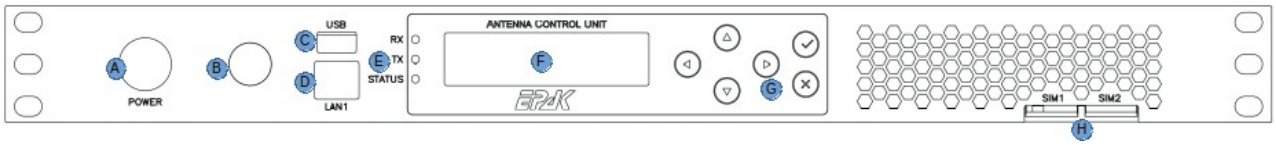



*Figure 5.1: ACU Front view*

| | |
|---|---|
| A: Power Switch | E: Status LEDs |
| B: Service Port | F: Display |
| C: USB port | G: Input buttons |
| D: LAN1 connection | H: SIM card slots- SIM1, SIM2 |

| | | |
|---|---|---|
| A | Power Switch | Switch the ACU on or off.<br>Hold this button for 2s to force the ACU to shut down. |
| B | Service Hatch | The Service hatch covers a micro-USB port and a RF port (to check received signal spectrum) .Only to be removed by service technicians or if you are instructed by a technician to do so. |
| C | USB Port | This port is used to mount a USB drive. |
| D | LAN1 Port | This port can be connected to your local network, a network switch or a PC |

| | | |
|---|---|---|
| E | Status LEDs | Shows a quick view of the status of the RX, TX and Network status |
| F | Display | Displays the current status of the ACU and antenna. |
| G | Input Buttons | The input keys lets you navigate the menu and access quick settings. |
| H | Sim Slots | The user can insert standard SIM cards in SIM1 or SIM2 |

**Back-Panel Schematic:**

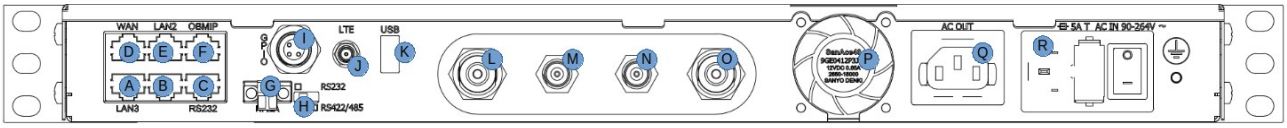



*Figure 5.2: ACU rear view*

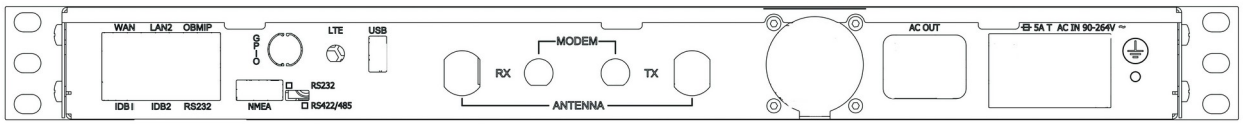
| | | |
|---|---|---|
| A: LAN3 Connector | G: NMEA Connector | M: Modem RX |
| B: unused port | H: NMEA Protocol Select | N: Modem TX |
| C: Serial Connector RS232 | I: GPIO Connector (opt.) | O: Antenna TX |
| D: WAN Connector | J: LTE Antenna connector | P: Fan Outlet |
| E: LAN2 Connector | K: USB Port | Q: Slave Mains Power Connector |
| F: OpenBMIP Connector | L: Antenna RX | R: Mains Power Input and Switch |

| | | |
|---|---|---|
| A | LAN3 Connector (RJ45) | This port can be connected to your local network, a network switch or a PC. |
| B | Unused port | -- |
| C | Serial Connector RS232 (RJ45) | Connect this port to a RS232 device which should be controlled by the ACU.<br>Use this port only if you are instructed to do so by a technician. |
| D | WAN Connector (RJ45) | Connect this port to the WAN port of your modem. |
| E | LAN2 Connector (RJ45) | Connect this port to your local network, a network switch or a PC. |
| F | OpenBMIP Connector (RJ45) | Use this port to connect a modem which supports OpenBMIP.<br>Use only if you are instructed to do so by a technician. |
| G | NMEA Connector (two pole) | Use this port to connect (if available) the ACU to your vessels compass. Observe correct polarity. |
| H | NMEA Protocol Select Switch | Set this switch according to the used NMEA protocol on your vessel (RS232 or RS422/RS485).<br>Change only if you are instructed to do so by a technician. |
| I | GPIO Connector | Optional connector to extend the ACUs connectivity by two general purpose inputs or outputs. |
| J | LTE Connector | Connect the LTE antenna to this port |
| K | USB Port | Use this port to communicate serially with the ACU |
| L | Antenna RX (N) [1] | Connect the RX cable from the antenna to this port. |
| M | Modem RX (TNC) | Connect to the RX port of your modem. |
| N | Modem TX (TNC) | Connect to the TX port of your modem. |
| O | Antenna TX (N)[1] | Connect the TX cable from the antenna to this port. |
| P | Fan Outlet | The ACU is a high power device, make sure that the fan outlet is |

| | | |
|---|---|---|
| | | never obstructed. |
| Q | Slave Mains Connector | Connect the power supply of your modem to this port. |
| R | Mains Switch & Mains Input & Fuse Holder | Switches the ACU off completely.<br>Connect the ACU to a 110V or 230V AC outlet.<br>Access this hatch to replace a broken fuse. |

[1] Those connectors carry the supply for the BUC and antenna. Do not connect or disconnect while the ACU is turned on!

## Access to the Webinterface:




**Connect a computer to this port if you need to access the ACU via network.**

Access: Lan2 with ethernet cable
Address: 192.168.2.254
Username: admin
Password: <last 5 digits of ACU serial number>

Please contact itservice@epak.de for remote support.

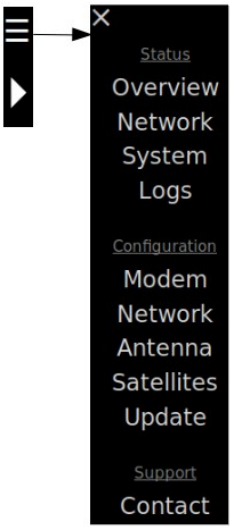
## 5.2 Accessing the ACU

All EPAK VSAT systems provide a web interface for basic monitoring and configuration. The connection interface is provided by any PC connected to the ACU (through a local network connection). Users can simply use their web browser to access this functionality without additional software installation.

| | LAN1 | LAN2 |
|---|---|---|
| **ACU IP address** | 192.168.1.254 | 192.168.2.254 |
| **Subnet Mask** | 255.255.255.0 | 255.255.255.0 |
| **DHCP range** | 192.168.1.1 - 192.168.1.200 | 192.168.2.1 - 192.168.2.200 |

Enter the supplied username and password to gain access to the features. If you do not have the login details, please contact your administrator or EPAK IT service. In case your system has not been configured yet, use the following credentials:

Username: admin
Password: <last 5 digits of ACU serial number>

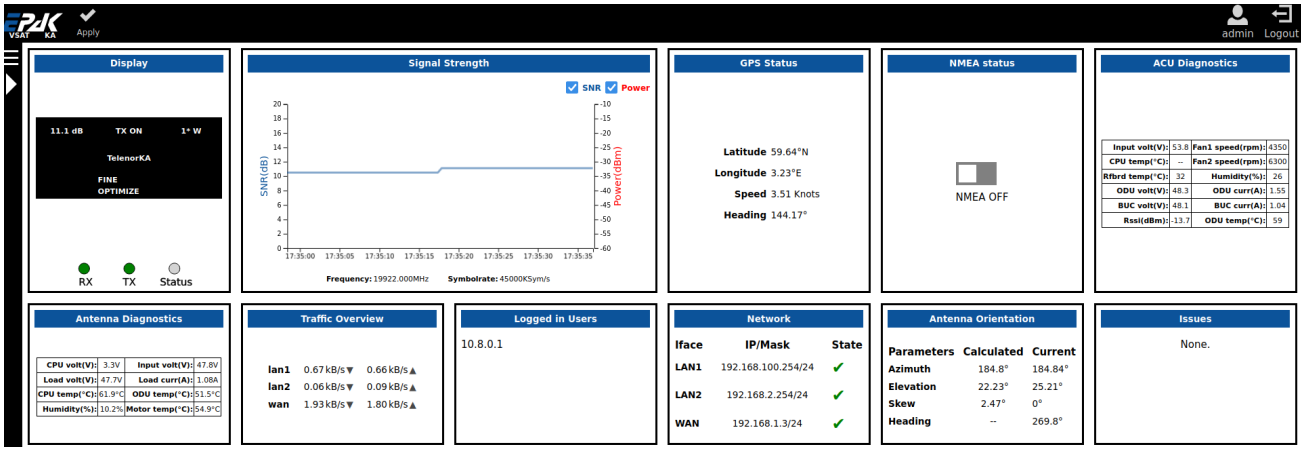

### Navigation Menu

Upon successful login, the user overview page will be displayed on the screen. On the left hand side of the screen, you can see the Navigation menu. This menu shows the sections where you can view the ACU status and change various configurations of the system. Selecting the *Overview* link will bring you back to the Home (*Overview*) page.

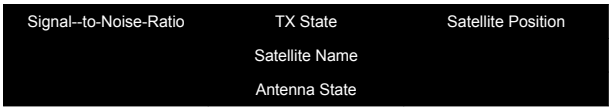
### System Status

In this section you can view various system states and monitor the health of the system. This page shows the live status of ACU and antenna. You can access the Navigation Menu and the Display customization menu on the left hand side of this screen.

### 5.2.1 Status -> Dashboard



**Display:**
The user is able to view live details about the received signal, like the received SNR in dB, the Tx state of the antenna (Muted / unmuted) , the orbit position of the satellite, the satellite name and the current state of the antenna (Power on / Searching / Optimize / Fine Optimize).




**Status LEDS:**
There are 3 LEDs on the ACU front-panel. The first RX LED represents the Receive Status of the Antenna (Green – RX lock, Blue – No RX lock, white/off – No connection to antenna). The second LED **represents** the transmit status in the ACU ( green – BUC on and transmitting, blue – BUC on but not transmitting, white – BUC powered off ). The last LED show the system errors ( Red – error in ACU, white /off – no errors).

**Signal Strength:**
The user can view the live Signal to Noise ratio (dB), signal power (dBm), the freqeuncy and symbol rate of the received signal.

**GPS Position:**
This widget shows the GPS position, vessel speed and the heading according to the GPS antenna mounted on the ODU.

**ACU Diagnostics:**
The ACU diagnostics report shows the live report of following ACU parameters: input voltage measured from the PSU line **(Input Volt**), speed in rpm of backside fan (**fan1 speed**), temperature of 12V converter (**T12 Temp**), speed in rpm of board fan (**fan2 speed**), the Central Processing Unit temperature in Celcius (**CPU Temp**), 12V converter current in Ampere (**I12 current)**, air temperature inside ACU in Celcius (**Rfbrd temp**), relative percentage humidity inside ACU (**Humidity**).

**Antenna Diagnostics:**
The Antenna Diagnostics widget show the live report of the following Antenna parameters: The ODU voltage in Volts (**ODU Volt**), the current consumption of the antenna (**ODU curr**), the BUC voltage in Volts (**BUC volt**), the BUC current consumption in Ampere (**BUC curr**), the received signal strength in dbm (**Rssi**) and the temperature measured at the ODU regulator (**ODU temp**).

**Traffic Overview:**
This widget shows the network bandwidth of each interface of the ACU.

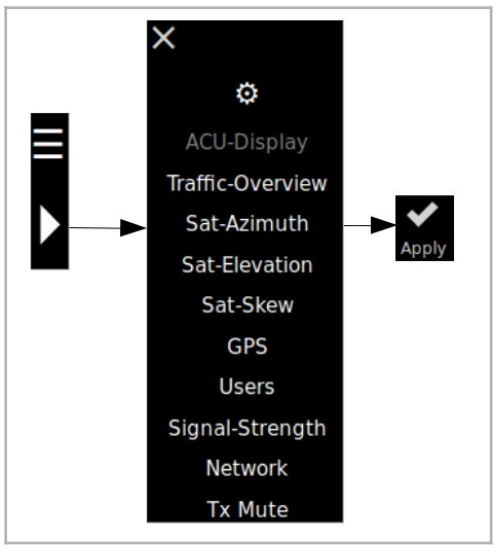
**Antenna Orientation:**
This widget shows the expected (Calculated) and current Azimuth, Elevation, Skew and Heading of the antenna.

**Logged in Users:**
This widget shows the IP addresses of all the users currently logged in to the system.

**Network:**
Here you can check the IP addresses of all the network interfaces.

**Transmit Path**
The user can control the transmit path of the ACU with this widget. TX mute off will enable the transmission of TX signal, while TX mute will disable the TX transmission

**NMEA status**
The user has the option to enable / disable transmission of NMEA data from the vessel to the antenna.

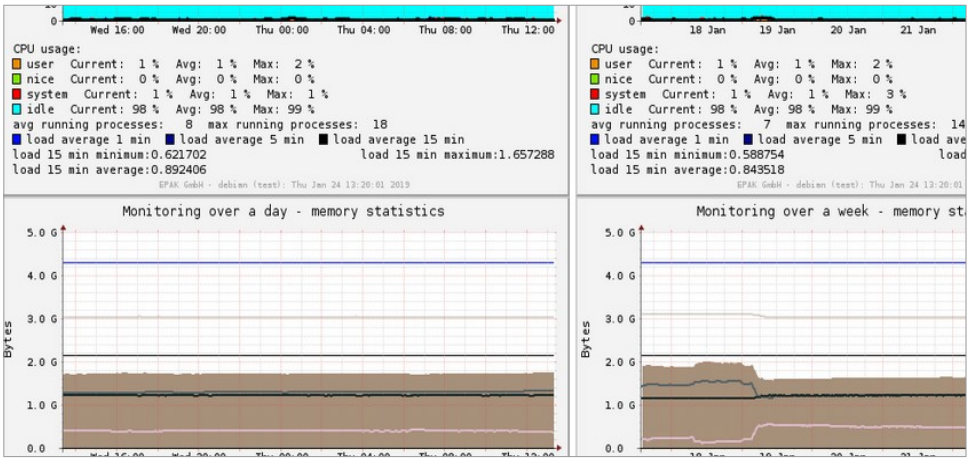


It is possible to customize the overview page. To proceed, click on the arrow icon as shown on the right. You can simply show/hide each widget by clicking on the links. After making changes, please click on “**Apply**” at the top of the page to save your custom view.

### 5.2.2 Status -> Network

The Network Page shows the network traffic on each network interface on hourly and monthly basis. You can also check the live network traffic on the dynamic graphs on the right-hand side of the screen.

### 5.2.3 Status -> System




This page is useful to monitor functionality of the system. It shows the graphs of CPU load, the memory statistics, the system temperature and the used disk space. The graphs show data over a day, over the last week and over the last month.

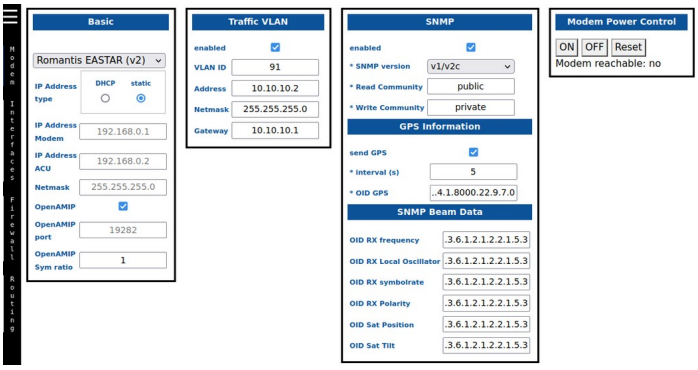
## 5.3 System Configuration

This section is used to configure the ACU network interfaces, add the modem configuration, configure the network priority settings, add the satellite information, control the Antenna’s mode of operation and control and update the ACU software.

### 5.3.1 Configuration -> Network

**Modem**

In the *Modem* section, you can select the modem type, the IP address type (static/DHCP) and the IP address of the modem. The system selects a default IP address for you. However, please change the IP address based on the option file or configuration file of your current modem.



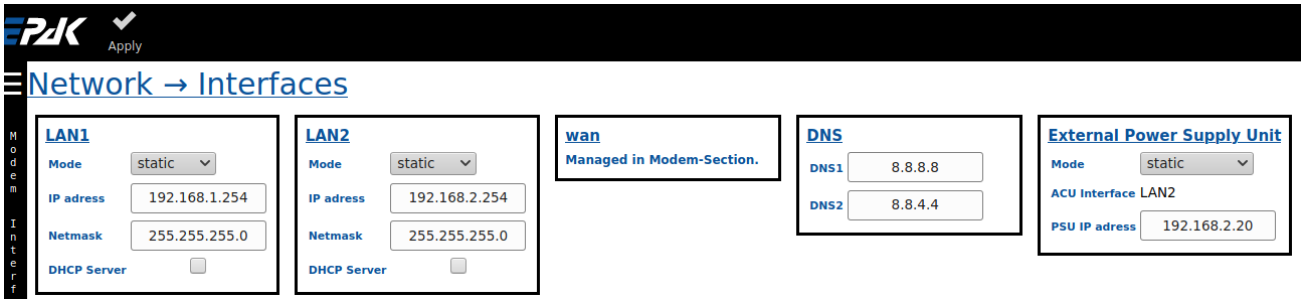
You can also select the OpenAMIP configuration if your modem supports this protocol. If you do not find the correct modem type in this list, please contact EPAK for more details.

If your current modem has a traffic VLAN IP address, please fill in the details for this as well.

For SNMP supported modems, the SNMP version, read/write community and GPS (only for mobile units) are necessary. The other OIDs can be entered optionally.

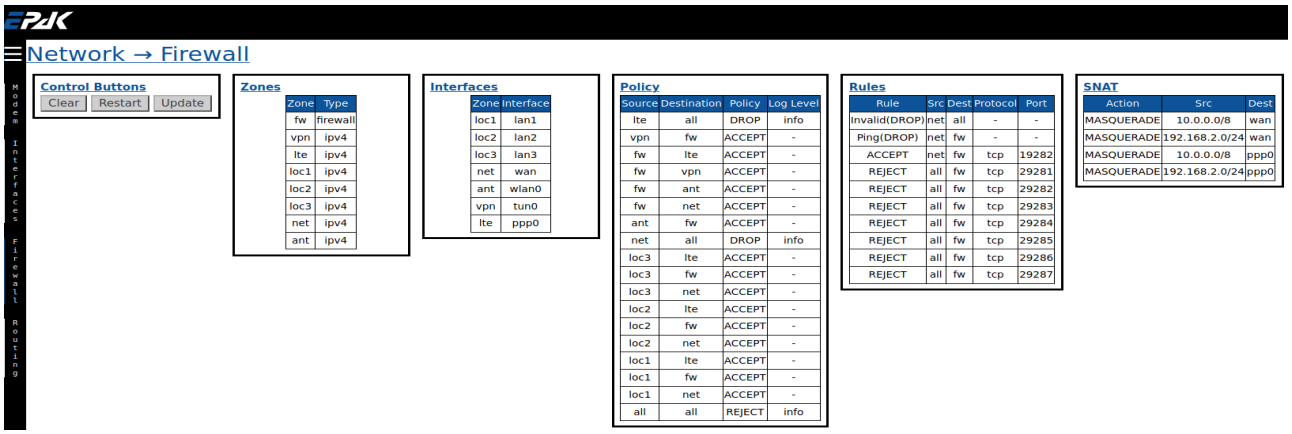
**Interfaces**

In the *Interfaces* section, you can configure the IP addresses of each Network interface and also select 2 DNS servers for your system. If an external power supply unit (PSU) is connected to the ACU to power the BUC, then the user can add its IP address and save the configuration by clicking on "Apply" at the top-left side of the page. An external PSU is only required for 40W and above BUC wattage.



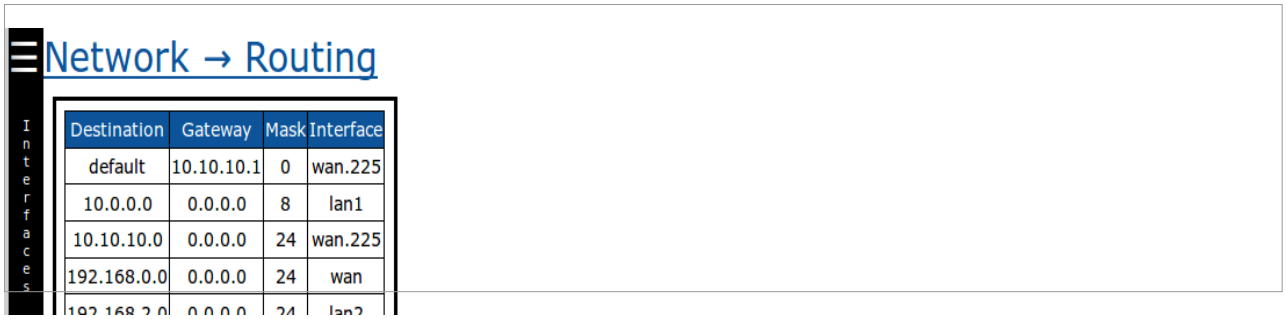

**Firewall**

To view the current firewall configuration, please click on "*Firewall* " on the left hand side of the page. Here you can see the firewall rules, policy, zones and interfaces. Currently these rules can only be viewed and not edited.



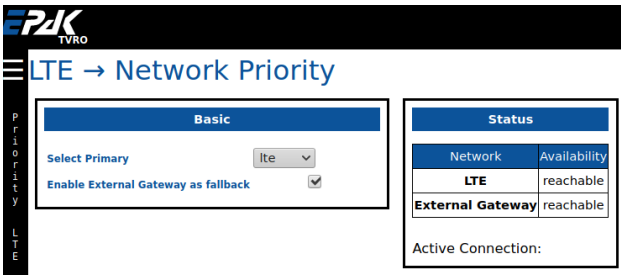

**Routing**

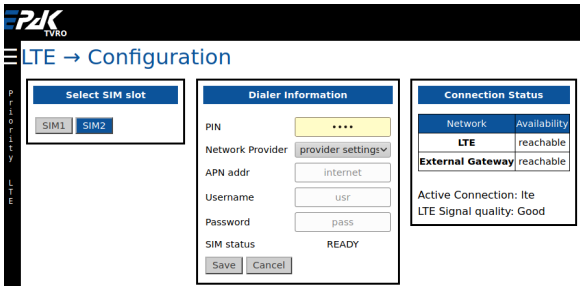
To view the current network routing, click on "*Routing*" in this section. Normally the modem is used as a default gateway.



### 5.3.2 Configuration -> Priority

The user can configure network priority settings and LTE connection settings in this section. In the *Network→Priority* section select the Primary network – LTE or VSAT. When one is selected as primary, then by default the other will be the fallback network. The user can choose to enable / disable the fallback. Click on "Apply" at the top to save your changes. As a priority, the ACU will try to connect to the primary selected network. If no internet connection is detected on the primary, and if the fallback is enabled, then the ACU will connect to the fallback network.




The user can configure the LTE settings in the *Network→ LTE* section. The ACU has 2 slots for data SIMs from multiple providers. Select the one which should be activated. In the Dialer Information box, enter your SIM PIN if it needs to unlocked. Select the *Network Provide*r settings – auto / manual. Some SIMs require different APN, Username and password settings. Please check if the current settings match yours. To make any changes to the dialer information, please choose "*manual*" for the Network Provider and *Save* the changes. Once the Dialer Information is complete, the LTE will be connected automatically.

### 5.3.3 Configuration -> Antenna

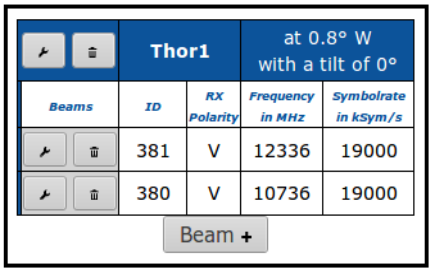
In this Section, the user has the option to choose mode of operation, change the antenna's control and enable or disable the external Power Supply Unit (PSU) if connected. If the modem supports openamip protocol, then switch to **"Change Mode: openamip**" on this page. The user can then view the frequency, satellite position, polarity and other parameters selected by the modem.

If the modem does not support openamip protocol, then the user can switch to "**Change Mode : beam**". On this page, the user can see a list of beams for every configured satellite. To select a new beam, click on one of the beams shown on this page and the antenna will automatically repoint to this new beam.

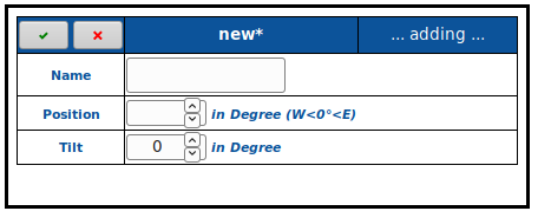
The user can also select the antenna's control on this page. If the antenna is required to automatically track the satellite, then switch to "**Change Control: auto**". If the user requires the antenna to be pointed manually (with automatic tracking off) then select "**Change Control: manual**". Then the user can control the antenna 's elevation, azimuth and skew from the widget **"Manual Control".** The minimum possible movement in any direction is 0.01°. The antenna's position can be monitored from the "**Antenna Parameters**" widget.
If an external power supply unit (to power the antenna's BUC) is connected and configured to the ACU, then it can be enabled or disabled from the **Control External PSU** widget. **Enable** will power on the BUC and **Disable** will power off the BUC. If a PSU is not configured for your system, then as a default, the control will stay on **Disable**.

### 5.3.4 Configuration -> Satellite

The user can view and configure new satellites in this section. Each widget on the page represents a satellite and its beams. The user can edit or delete each entry of this section. To confirm the changes, please click on the check "✔" button and to roll-back click on cancel "✖" button.



You can also add new Satellites in this section.

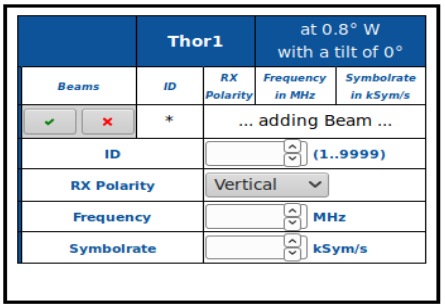



Click on the 


button on your screen, then enter the satellite name, the position and tilt if any. To save your entry, click on the check "✔" button and to undo your changes click on cancel "✖" button.

***Note***- If the satellite is in the West orbit, you must enter a negative number in the Position field. eg. 22West will be -22.

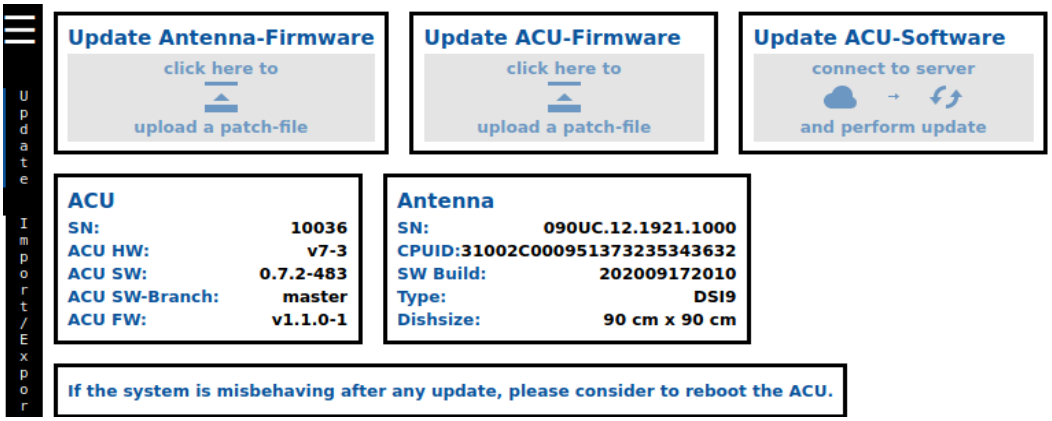
To add new beams for a satellite, click on "Beam+" button and enter the beam ID, receive polarity, receive RF frequency and symbol rate in ksym/s. The beam ID can be any number between 1 to 9999. To save your entry, click on the check "✔" button and to undo your changes click on "✖" button.




### 5.3.5 Configuration -> Versions

**Update Section**

This section is used for updating the antenna firmware or updating the ACU Software version. The user can see an overview of the ACU software and hardware version, and the antenna information. To update the antenna's firmware or the ACU software, please contact the EPAK IT team.



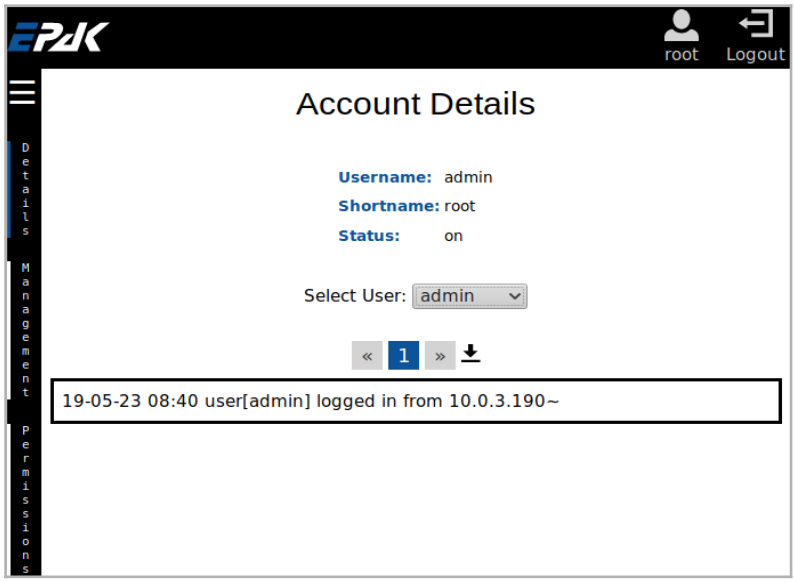

**Import/Export Section**

In this section, the user can choose to "Export" or "Save" the existing Network configuration, the configured satellites or beams. The "Export" button will download the choosen configuration into the user's PC, and the "Save" button will create a backup on the ACU.


All the current backups are listed under the Restore window. The user can choose to restore them by clicking on the desired backup file and then confirm the restoration. The user can also delete the back-up file by clicking on the corrosponding delete button. Under the "Import" window, the user can also import a downloaded configuation file.

## 5.4 Account Details

To see details about your account, click on the user-icon on the top-right side of your screen. You will be redirected to your account details. Here you can view your username, shortname and status. You can also view you recent login history on this page. If you are the “admin” user, you can view the login history for other users as well.




### User Management

The user management page is accessible by clicking on the user button on the left side of the screen. In this section you can view the current login-name, short-name, other account creation details. Here you can also change password and short-name. The admin user can add, delete, enable/disable a new user.

### User Permissions

The permissions page is limited to use by the admin user. It is accessible by clicking the permissions button on the left side of the screen. The admin user can set the page permissions for each page for every user in this section. To save the changes, click on the “*Apply*” button at the top of this page.

## 5.5 Service Activation

Once the antenna has locked on to the correct satellite, the antenna transmit path needs to be calibrated on first use. This has to be done in coordination with your service provider. So, to continue with this process, please contact us or your service provider directly, so that they can perform P1db compression test and activate your internet services.

## 5.6 Maintenance

The EPAK VSAT system is easy to maintain. The following instructions are sufficient to sustain an optimal performance of the antenna unit:

- Clean the radome once a month using fresh water and a mild detergent to remove dirt and salt deposits.
- Do not operate the antenna without the radome.
- Do not clean the radome with a high-pressure washer or high pressured water from a hose.
- Check cable connections to be tight and free of corrosion. Clean the cables regularly.

The radome has a protective layer of UV-stabilized and maritime climate-proof coating. Do not apply any wax, preservative, solvent, chemicals or adhesive labels. Do not use alcohol or dilution or similar products to clean the radome. In case any solvent comes in contact with the radome by accident, rinse the area

immediately with water and, if necessary, with a mild detergent. A guarantee for UV and colour stability as well as fracture strength can only be given within the warranty of the supplier / dealer.

### 5.7 Individual dome painting

Customers may wish to paint the domes in order to match the vessel colour. The paint and primer must be free of any metallic components (like zinc). Any painting may impact the RF performance. The thickness of the paint affects the attenuation of the signal. The thinner the paint is applied the better. Ideally the dome should not be painted at all.

## 6 Hardware configuration

The EPAK antenna can be paired with various types of hardware to accommodate your requirements for internet speed and connectivity. Please check this section for more information on the types of BUCs and LNBs used.

### 6.1 BUCs

Our systems use BUCs with LOF 12.8 GHz (Ku band) which is PLL stabilized and externally referenced.

Optionally available for configuration are 8W, 16W, 25W and 40W (only for Dsi13).

| Configuration | DSi6Ku | DSi9Ku | DSi13Ku |
|---|---|---|---|
| **8W** BUC | ● | ● | ● |
| **16W** BUC | ● | ● | ● |
| **25W** BUC | - | ● | ● |
| **40W** BUC | - | - | ● |

### 6.2 LNBs

EPAK systems are compatible with all universal LNB with LOF at 9.75 / 10.6 GHz.

### 6.3 Supported Modem Types

EPAK's VSAT systems provides compatibility with various modems including iDirect Evolution X3/X5/X7, iDirect Velocity X7, Spacebridge, Hughes HX200, Comtech CDM-570/840, Gilat SkyEdge II C4, Paradise PD25L , Paradise Datacom Q-Flex, UHP 1000 / UHP 2000 while supporting communication through protocols like OpenAMIP, SNMP or via telnet, WebGUI or serial console. EPAK continuously develops new drivers according to customers needs.

### 6.4 NMEA Connector

Optionally the user can connect the vessel's gyro compass to the NMEA port at the back-panel of the ACU. Please check for correct polarity. Kindly refer to Figure 5.2 "ACU rear view" in this document for more details. The user can also select the NMEA protocol (RS232 or RS444/RS485) depending on what is available.

# 7 Datasheets

Please find the technical specifications of the ACU, antenna and BUCs in this section.

## 7.1 ACU

| Antenna Control Unit | |
|---|---|
| Dimensions | 48 cm x 4.45 cm x 47.8 cm(18.9" x 1.75" x 18.82") (19" Rack 1HU size) |
| Weight | 5.1kg (11.24lbs) |
| Gyro Interface | NMEA0183 / NMEA 2000 (via RS422 or RS485 or RS232) / SIMRAD RGC11 |
| Input voltage, frequency | 90 ~ 264V AC, 47~63Hz |
| External I/O | RS232, RS422, Ethernet, USB, GPIO |
| Local user Interface | OLED display, directional pad, 2 push keys |
| Modem interface | Ethernet port + serial (optional) |
| Modem Protocols | openAMIP / SNMP / Telnet / open BMIP |
| Remote access | TCP / IP |
| Operating temperature | -20°C to 55°C |
| Storage temperature | -40°C to 85°C |
| Humidity | According to IEC 60945 |
| IP class | IP 30 |
| Compass safe distance | 0.5m according to IEC 60945 |
| Position acquisition | supplied by ODU |
| Supported modems | idirect series, Hughes HX200, ViaSat SBT-M, Comtech CDM-250/840, Gilat Skyedge II C4, Paradise PD25L, Datacom Q-Flex, Spacebridge, Romantis / Eastar UHP 1000 / UHP 2000, others on request |
| | |
| **Cables & connectors** | |
| ACU to Antenna | 2x Double shielded coax cable (ECOFLEX 10) with N-plugs |
| ACU to Modem | 2x Double shielded coax cable (RG6) with F and TNC-plugs |
| | 1x Ethernet patch with RJ45 plugs |
| ACU to Network | Ethernet patch with RJ45 plugs |

## 7.2 Antenna

**DSi6 Ku Pro**
**DSi9 Ku Pro**
**DSi9 Ka Pro**
**DSi13 Ku Pro**

Please refer to datasheets, available on our website. https://www.epak.de/en/support/download-area

# 8 Glossary

| | |
|---|---|
| ACU | Antenna Control Unit. Used to control the antenna and provide the vessel with internet access. |
| Azimuth | The horizontal angle a parabolic antenna must be rotated to, in order to point to a specific satellite in the orbit. It is defined with respect due to north for convenience. |
| BUC | A Block Up Converter is used in the transmission (uplink) of satellite signals. It converts a band of frequencies from a lower frequency to a higher one. Modern BUCs convert from L band to Ku or Ka band (depending on the type). |
| Elevation | The vertical angle that a parabolic antenna has to set to point to a specific satellite in the orbit. Elevation is zero when the antenna points to the horizon. |
| GPS | Global Positioning System |
| IDU | Indoor Unit |
| Ka-Band | The Ka-band covers the frequencies of 29.5–30 GHz, i.e. wavelengths from slightly over one centimetre down to 0.75 centimetres. The Ka-band is part of the K-band of the microwave band of the electromagnetic spectrum. |
| Ku-Band | The frequency range from 10.7 to 18GHz. |
| LNB | A Low Noise Block is used for reception (downlink) of satellite signals. It down-converts a block of high range frequencies to lower range. So LNBs convert Ka or Ku Band frequencies to L Band. |
| NMEA | Communication standard for marine instruments |
| ODU | Outdoor Unit (Antenna) |
| openAMIP | Open Antenna-Modem Interface Protocol |
| Skew | Skew is the tilt of the LNB in order to align the planes of polarization of antenna & the satellite. |
| UPS | Uninterrupted Power Supply. Online type is recommended for EPAK systems. |
| SNR | The ratio of signal power to noise power, expressed in dB. The higher the SNR, better the signal quality. |
| VSAT | Very Small Aperture Terminal. It is a two-way satellite ground station or a stabilized maritime VSAT antenna with a dish antenna that is smaller than 3 meters. |

Drilling Pattern DSi6

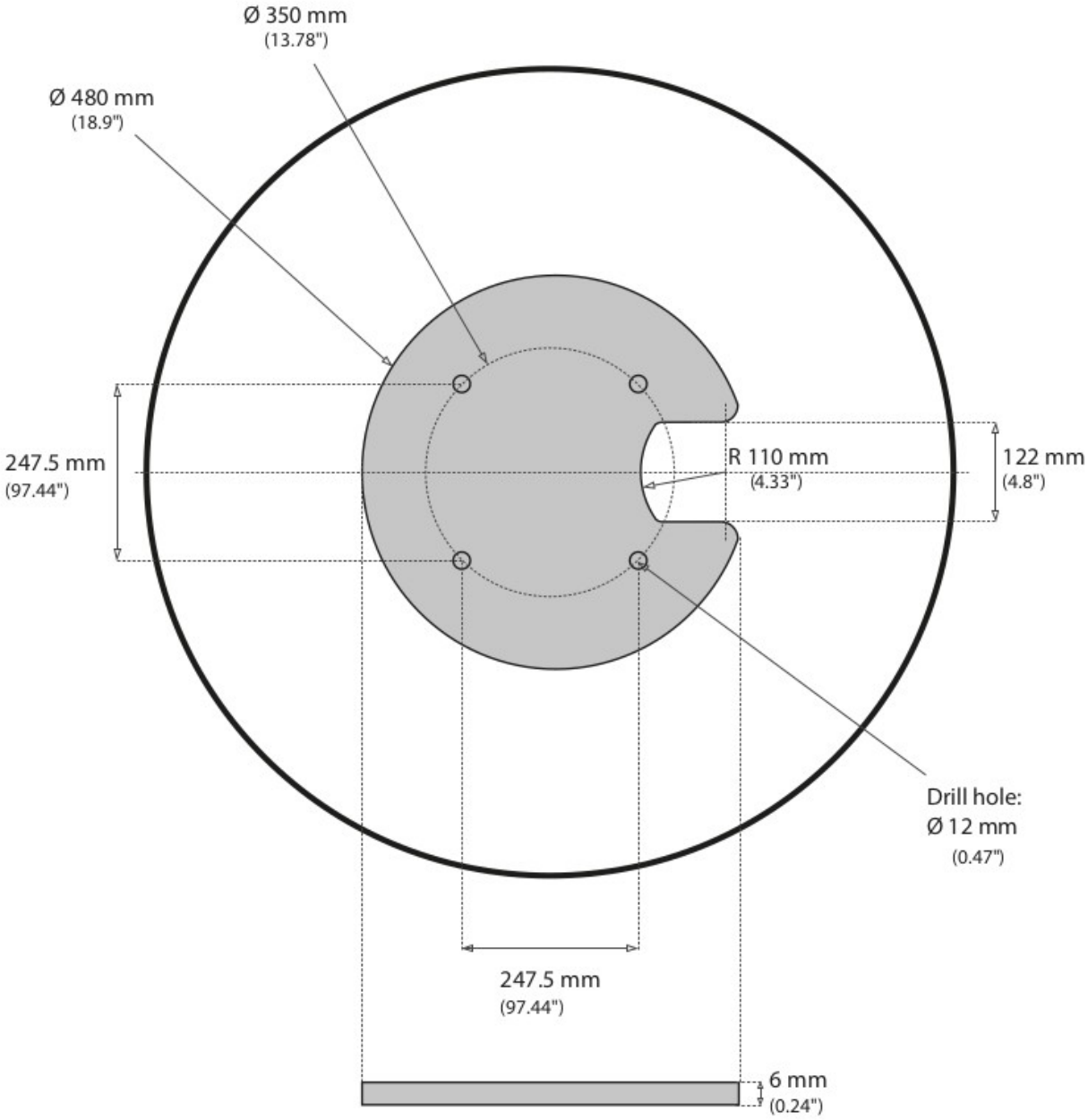



*Figure 8.1 Drilling Pattern 60cm VSAT*

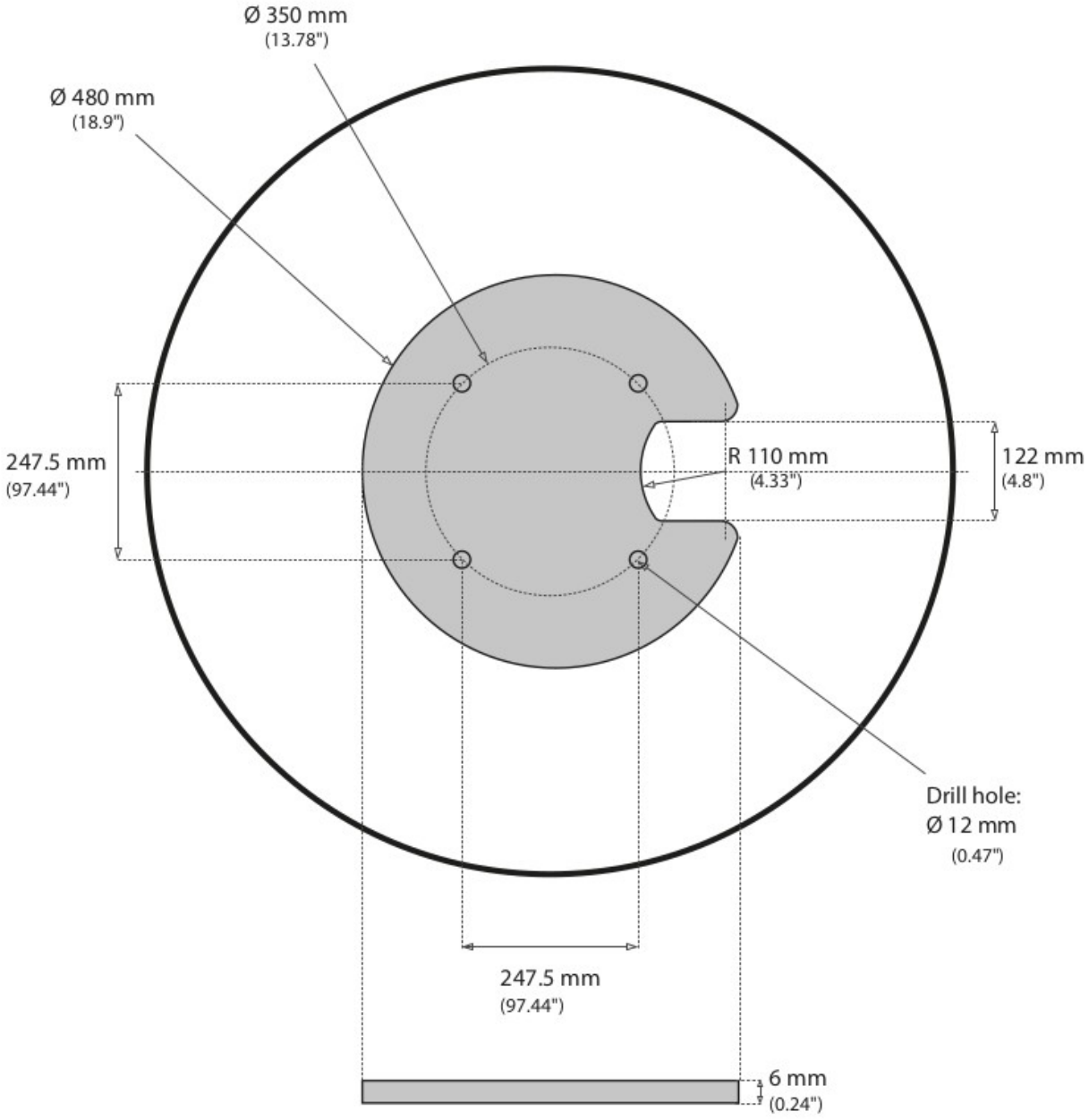



*Figure 8.2 Drilling Pattern 90cm VSAT*

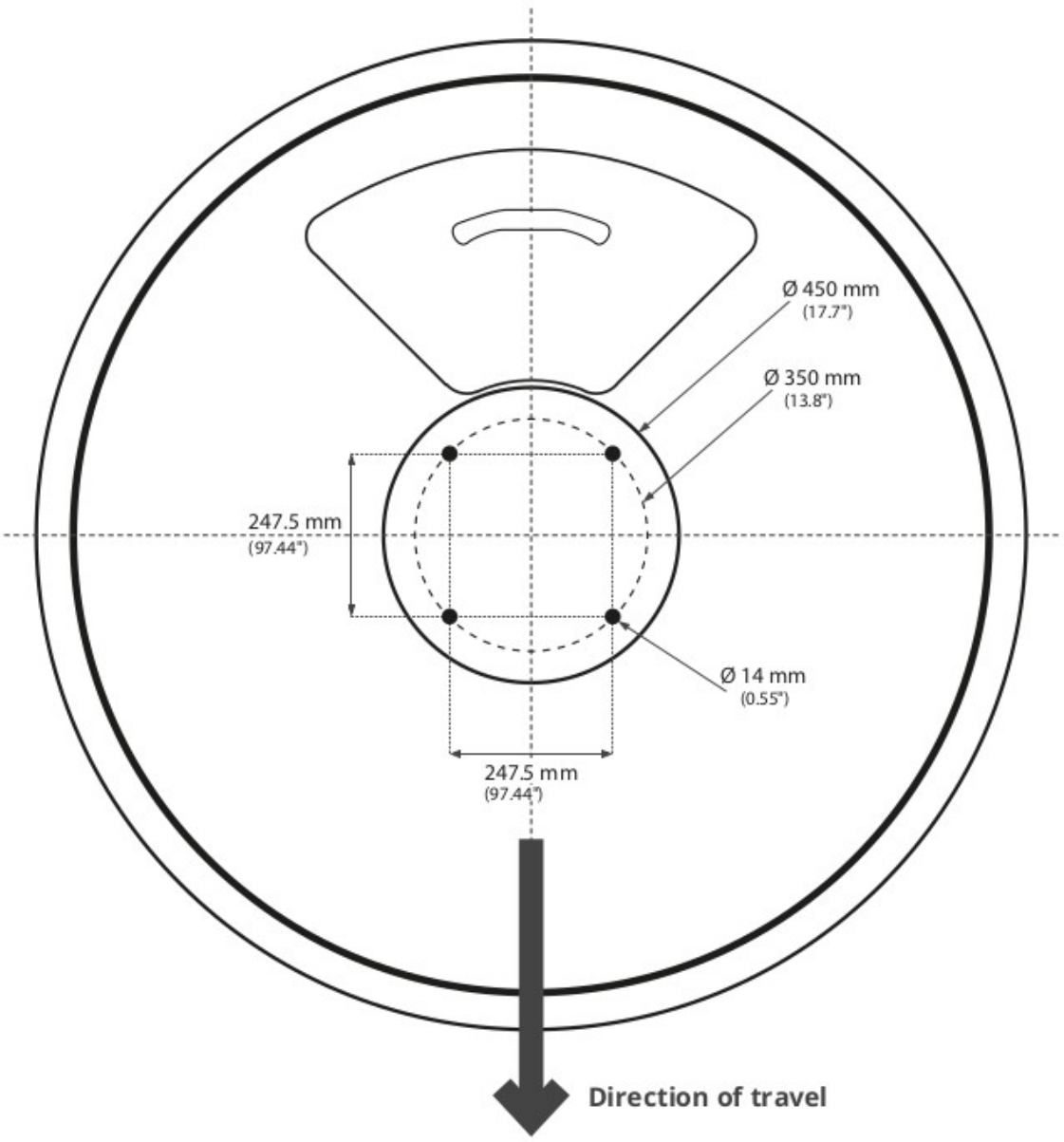



*Figure 8.3: Drilling Pattern 130cm VSAT*

# Picture Index