Marine Satellite Systems and Services

VSAT Manual

Ri-Series | DSi-Series

29.03.19 ID: 0117

EPAK® VSAT Serial Number

The serial number (standard format: XY12345) 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.

Figure 1 - *Serial number on antenna*

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1 Introduction

EPAK VSAT series are digital 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 antenna control unit (ACU), which offers a user-friendly interface and easy connections to the variety of satellite modems and gyrocompasses. In addition, the ACU has an embedded self-diagnosis function and can be remotely accessed via the TCP/IP protocol.
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 web while the vessel is anchored or even while cruising in open seas under rough conditions.
EPAK's VSAT 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, pedestal parts and radome in house. All their 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.

The satellite tracking system is protected by a UV-stabilized and maritime climate proof radome and is easy to handle and maintain. High-speed tracking sensors developed for this system, using high-tech components of the electronic signal processing, provide the topmost and dynamic tracking accuracy of the satellite. With the help of this technology, EPAK-SatCom guarantees an unmatched tracking rates ensuring a highly dynamic system performance.

In order to accomplish the utmost and most dynamic tracking accuracy of the satellite, EPAK developed the patented EBF tracking sensor, interacting with state of the art components to reach a unique performance.

EPAK's major principle is to provide high tracking stability, prime quality, easy handling and easy maintenance, in order to guarantee the best Internet connection for letting you surf without limits, just like at home.

The reception of satellite signals in different regions depends on the footprints of the satellites. It can be affected by rain, snow, dense clouds and strong movements in areas of weak signals. There is no warranty for reception of certain transponders.

1.1 Safety Recommendations

- During transmission the antenna radiates microwave power which can be hazardous. Make sure the minimum safety distance as specified at ODU is kept when the antenna is transmitting.
- The mounting minimal distance from the antenna unit to other radiation sources, e.g. radar equipment or other transmitting antennas, is 2.5 m (8 ft).
- If the satellite antenna is not installed below the radar antenna, simultaneous operation of both systems may damage the satellite antenna.
- Do not use the control unit outdoors.
- During a thunderstorm, disconnecting all cables which are connected to the antenna is recommended.
- If the negative pole of the antenna unit's power supply has no connection to the ship's ground (protective earth), the antenna unit's ground point should be connected directly to the ship's ground (protective earth).
- 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 turned on.
- Do not turn the antenna on before the radome is fitted correctly. The electronics can be damaged by the reflected sun.
- Do not touch the rotary joint.
- Do not open the sealed electronic box, as this will void the warranty.

2.1 Easy Installation and Minimal Maintenance

The installation of EPAK VSAT systems is just a simple process compared to existing VSAT antennas. Once the system is set up and connected, the user just needs to set up the satellite profile depending on the ship network configuration (the profile can also be preconfigured by the EPAK office before shipping). Once all setup is done, antenna will automatically adjust all the parameters (sensor, gyro, elevation etc.) and lock onto the correct satellite automatically.

Customers can easily change satellite and network settings via web access to the ACU. The antenna is shipped to the customer with all target satellites information stored, so the customer can track the satellites just after installation.

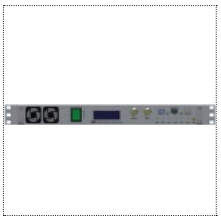
EPAK's VSAT systems are designed in a way that replacement and repair of wear and tear parts is easy and minimum attention to maintain the system is necessary. Also, EPAK's thorough inspection process before shipment guarantees the solid product reliability.

In order to get the intended maximum performance of the VSAT connection, it is recommended to plan the entire installation first to avoid mistakes or damages to the boat or the VSAT system. Please read the installation instructions carefully before starting the installation.

2.2 System Components

Each VSAT system is supplied with the following components:

Antenna Unit
(with serial number)



Antenna Control Unit

4 Mounting Screws
(M8)

VSAT Quickstart

2.3 Installation Overview

The installation work has to be done in the following order:

- ✓ Select location.
- ✓ Check the mounting surface for stability.
- ✓ Check cable path (keep in mind that the maximum length depends on the used cable type).
- ✓ Check the position of power distributor.
- ✓ Drill holes and lay cable.
- ✓ Install antenna unit.
- ✓ Seal all installation openings to make them waterproof.
- ✓ Connect cables.

For the installation the following additional tools are required:

Electric Drill;
Screwdriver

One 4 mm and One
8.5-9 mm Drill Bits

Hexagon Socket
Screw Key Size 6

Size 13 Screw Wrench

2.4 Selecting Location

The best location for the VSAT system is a raised position on your vessel, to provide an unobstructed view from the antenna to the satellite with the respective elevation angle. Please note that the elevation angle depends on the geographical location and the selected satellite.

For the best signal quality and to preserve the antenna, please observe the minimum safety distance of 2-3 m (8-12 ft) to radar equipment and other transmitting antennas. This includes mobile communication units as well.

If there is a radar, the ideal location to mount the antenna is outside the radar's beam pattern. Please note that a strong mounting surface is needed. Avoid direct waves and water on the radome.

The following illustrations show the importance of a proper location for the antenna unit.

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

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

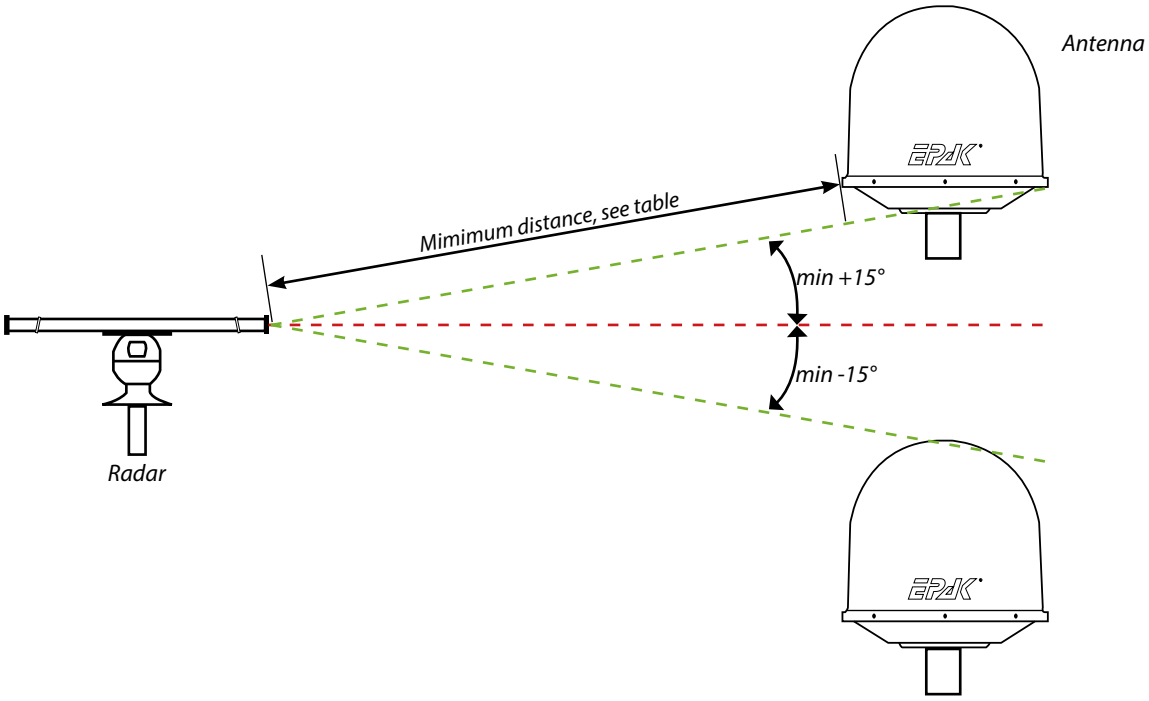
Best location: when possible, place the antenna on the top of the boat.

2.5 Mounting Surface

The mounting surface must be horizontal, solid, steady and flat. The weight of the antenna unit can range from 37 kg (81.6 lbs) up to 120 kg (264.6 lbs) (depending on the model) and must not be exposed to punctual material stressing. The surface has to be strong enough to carry the antenna unit, even during the most challenging maritime conditions.

2.6 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.



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 tables 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) damage distance	S-band (~ 10 cm / 3 GHz) damage distance
Radar power	**Minimum distance VSAT antenna to Radar at 15° 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

Minimum distance between antenna and radar at 15° vertical separation

The presence of one or more S or X-band radars within a radius up to 100 m 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.

It is strongly recommended that interference free operation is verified experimentally before the installation is finalized.

2.7 Planning Cable Paths

Before starting the installation, please check which walls are suitable and if existing openings can be used for the cables.

Please note that all cable openings have to be sealed.

2.8 Power Supply

The antenna unit is powered by the ACU using 24 V DC. The ACU is powered by a built in power supply, which is working on 90-264 V AC @ 47-63 Hz. The maximum power consumption is 550 W (when using a 25 W BUC). The circuit has to be properly fused.

Please ensure that the power distributor is non-active while working on the vessel's supply in order to not short circuit the system.

If the negative side of the antenna outdoor unit's supply voltage has no connection to the boat ground (protective earth), ensure a potential equalization between boat ground and the ground point of the antenna unit is made.

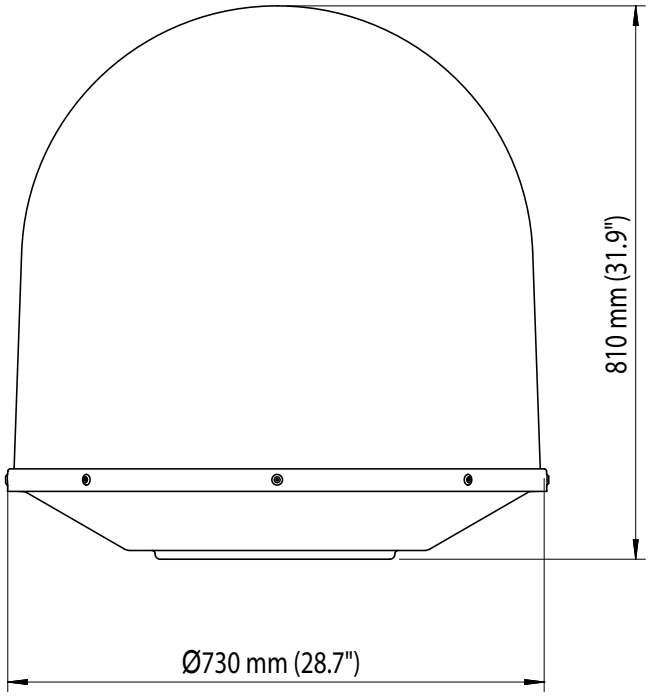
2.9 Drilling

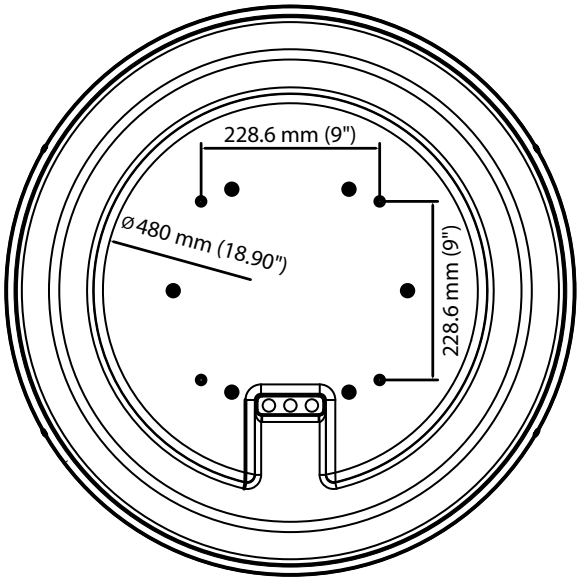
For an ideal mounting of the antenna all possible drilling patterns are prepared with a pre-drilled hole of 2 mm in the bottom of the radome.

Please refer to the included template for the drilling measurements. The drilling should have a diameter of Ø 8.5 – 9 mm for the included M8 screws. It is recommended to start with a smaller hole, using a Ø 3.5 – 4 mm drill to avoid any damage to the mounting surface. To mount the antenna, only use the included M8 mounting screws.

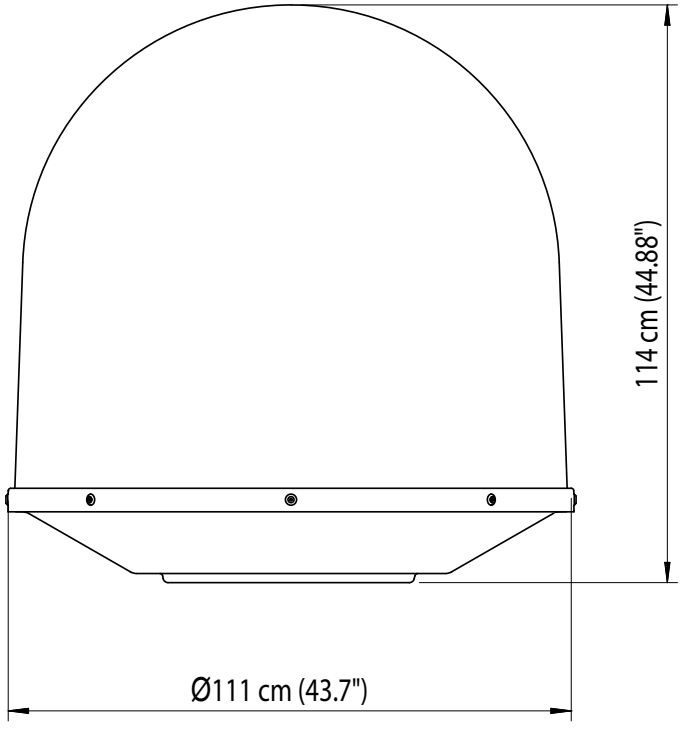
For a good and steady mounting of the antenna the drilling pattern 228.6 mm x 228.6 mm is recommended. For the drilling picture 134.2 mm x 77.5 mm you will find tapped holes at the bottom plate of the antenna, so no nuts are necessary.

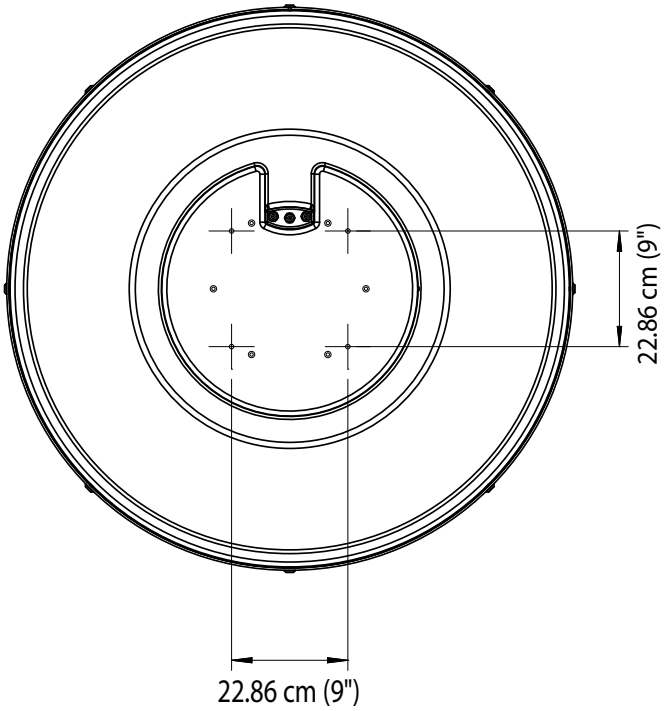
2.9.1 Dimensions and Drilling Patterns for 60 cm EPAK VSAT Antennas



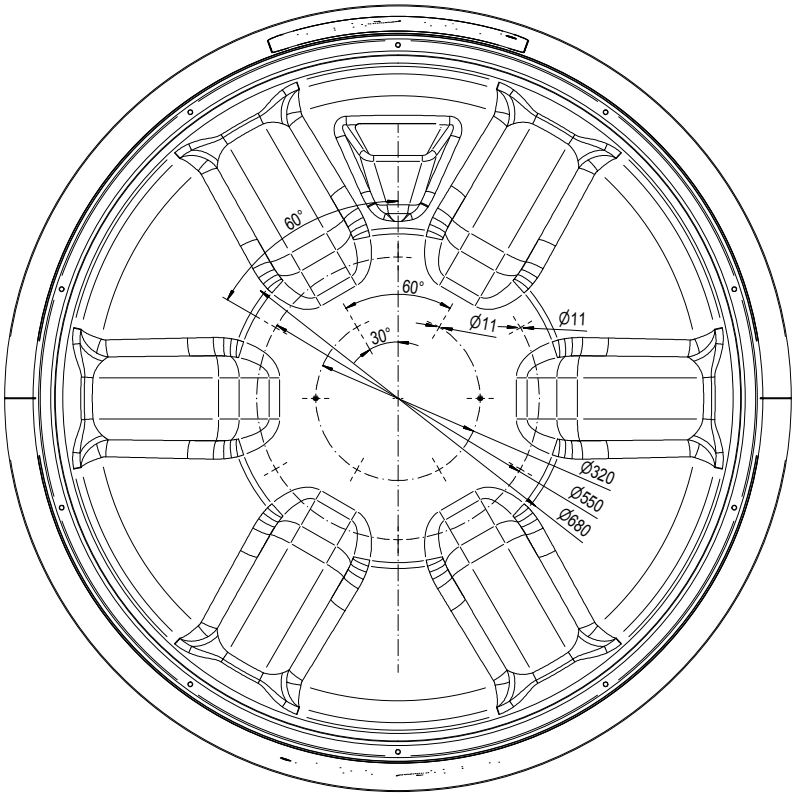


2.9.2 Dimensions and Drilling Patterns for 90 cm EPAK VSAT Antennas





2.9.3 Dimensions and Drilling Patterns for 130 cm EPAK VSAT Antennas



2.10 Antenna Outdoor Unit

The ODU consists of a stabilized antenna pedestal, an antenna reflector, a feed assembly with a Low Noise Block Converter (LNB), a polarization motor mounted onto the stabilized pedestal, a Ku-band Block Up Converter (BUC) and a radome assembly.
The radome provides the environmental enclosure for the antenna pedestal assembly inside. This keeps wind, water and salt-water spray off the antennaannetna pedestal assembly and prevents damage and corrosion which will shorten the expected equipment's life span.

Three coaxial cables (RX, TX, DC Power) are connected between the Outdoor Unit (ODU) and the Antenna Control Unit (ACU). The RX cable provides a control voltage for antenna switching on/off plus inter-communication between ACU and ODU to ensure proper system operation. Further it carries the IF signals (950-2150 MHz) from the antenna assembly directly to the ACU. Via the TX cable the transmit IF (950-1700 MHz) incl. up-converter reference clock and up to 48V DC BUC power are supplied. DC power for the antenna pedestal is brought to the ODU via the DC power cable.

2.11 Mounting the Antenna Unit

The antenna unit has to be mounted on a solid and steady surface. Make sure that all cable lengths are sufficient. The antenna unit must have a clear line of sight to the satellite and there should be no interfering fields (especially mobile communication antennas) nearby. Place the antenna unit on the pre-drilled holes and fasten it with the included screws and washers. The screws have to be mounted in from below through the base plate of the radome.

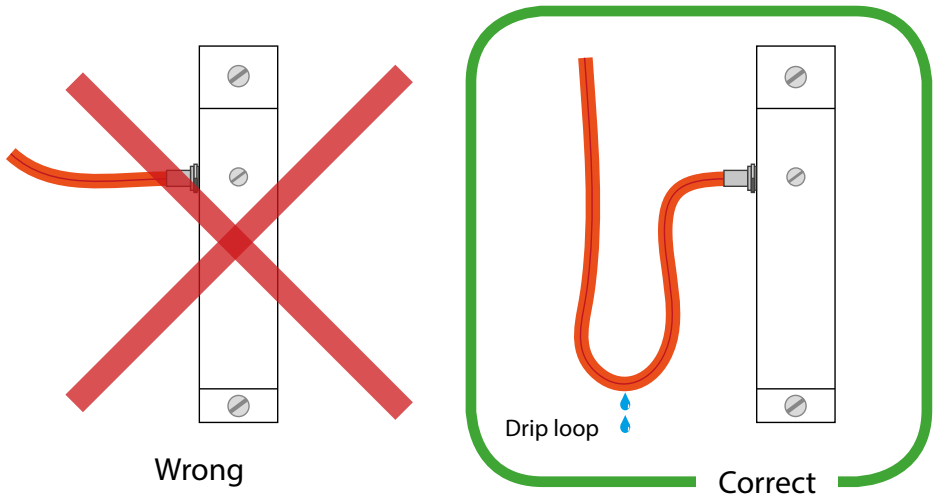
Close all drilled holes with waterproof sealing material to avoid any water penetration.

2.12 System Cable Connections

Power off the circuit on which you are working in order to avoid a short circuit of the system.

- The antenna cables (Power, RX and TX) must be connected to the control unit and the antenna unit.
- The modem cables (RX, TX and WAN) must be connected to the ACU and the modem (DSi9 Ka has no RX).
- The ACU has to be connected to 230 V AC 50 Hz from the UPS.
- The power supply of the modem has to be connected to the UPS.
- Connect the users network to the front or back LAN connector of the ACU.

See system overview and illustration details, chapter 6.2 at the end of the manual.
Lead the cable through the drilled holes and seal it with waterproof sealing material. Furthermore, drip loops should precede the entry point from the exterior to avoid any water penetrating.



Find a suitable location for indoor unit within cable lengths. Ensure that the display of the control unit can be easily read and the buttons are accessible. Also, allow sufficient room for the cables behind the control unit.

The antenna unit is separated from the power supply network/system by the control unit and only has electric power when the control unit is turned on.

3.1 Antenna Control Unit

The EPAK VSAT system is operated by the control unit. See below for a short overview of the key functions:

ACU KEYS:

Power Switches on and off the power for the whole unit.

Browse Short press will browse through all available menus, step by step or cancel an operation.

Enter Short press will select/confirm what is written in the display.

ACU INDICATORS:

ODU Status of power connection to antenna (Outdoor Unit):
- ● ODU is powered.
- ● Short or other error.
- ○ ODU is not connected.

BUC* Status of transmit unit (Block Up Converter):
- ● BUC is working.
- ● Short or other error.
- ● Transmit is switched off, BUC or Modem error.
- ○ TX is not connected to the antenna.

CPU EPAK control software is running.

LOCK Antenna has locked on correct satellite.

LAN A PC or router is connected to the ACU.

WAN Modem is online.

ACU INTERFACES:

WAN Connection to the modem.

LAN Connects a PC or router to the ACU.

Service USB A connection for USB stick and USB B port for serial connection.

NMEA RS232/RS422 connection for ship compass.

OpenBMIP OpenBMIP serial communication with X7 velocity modem.

The RX modem port is not in use for selected "Single-IFL-" Ka-systems.

The ACU is fitted in a standard 19-inch rack and allows the user to control and monitor the antenna pedestal through dedicated function buttons and a LCD display. It should be mounted in the front of the equipment rack where it is easily accessible.
It is recommended that the Antenna Control Unit is mounted near the point where the data communication status can be checked while controlling the antenna functions. The ACU is connected via two coaxial cables (RX & TX) and one LAN cable to the satellite modem and via one cable (NMEA) to the ships compass. Through its interfaces to the antenna unit, satellite modem, ship's gyro and BUC the ACU is enabled to provide a user-friendly control centre to operate the entire system easily from one single location.

3.2 Preparing the Network Behind the ACU

The following table contains the standard configuration of the LAN interfaces:

	LAN1	LAN2
ACU's IP Address	192.168.1.254	192.168.2.254
Subnet mask	255.255.255.0	255.255.255.0
DHCP active	✔	✔
DHCP range	192.168.1.1 - 192.168.1.200	192.168.2.1 - 192.168.2.200

If you connect your PC or any other network device on a LAN interface without using DHCP, set the IP address to an address different to the ones shown above and set the "Default Gateway" and "Primary DNS-Server" to the IP address of the respective LAN interface.

Example

- Connection of a router / PC to LAN2 with static IP configuration, settings on your router / PC
  IP address: 192.168.2.1
  Subnet mask: 255.255.255.0
  Default Gateway: 192.168.2.254
  Primary DNS-Server: 192.168.2.254

  Other configurations are possible upon request.

3.3 System Power Requirements

The ACU requires 90-264 V AC @ 47-63 Hz, 1 phase. The maximum power consumption is 550 W (when using a 25 W BUC). The ACU supplies 30 V DC power to the ODU through the DC power cable and up to 48 V DC BUC power through TX cable.

4.1 Two Tracking Systems Combined for Better Performances

To guarantee highest network availability for broadband services in difficult conditions, EPAK has developed the Evolution Series, a satellite tracking system that combines the patented EBF (Electronic Beamforming) gyro with a 3D gyro module.
The combination of these tracking systems significantly increases the accuracy and connection stability, resulting in a seamless and uninterrupted signal - regardless of weather conditions.

- The EBF gyro tracking provides the highest accuracy. With an update rate of 80 times per second, the RX pattern is rotating electronically much faster and without moving the entire reflector as done at nowadays conical scan antennas; the main advantage is that in the meanwhile the TX lobe is pointed to the satellite centre at all times.
- The 3D gyro provides stability and high reliability for a fast recovery if the EBF tracking has been interrupted by a signal blockage caused by obstacles between the antenna and the satellite.

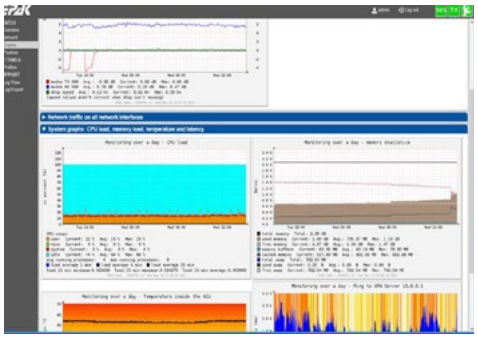
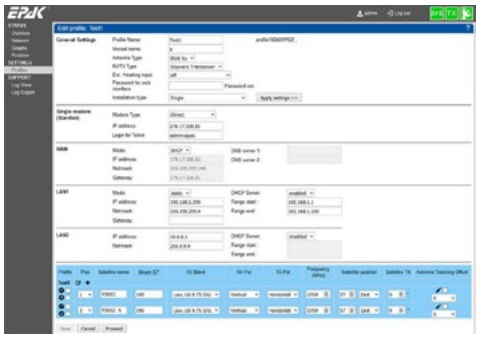
4.2 Various Modem Interfaces

EPAK's VSAT systems provide various types of modem interfaces including iDirect INFINITI 5000, iDirect evolution X3/X5/X7, iDirect Velocity X7, STM Satlink 1000/2000/1910, Advantech S4100, S5100, VR7000, Hughes HX200, Comtech CDM-570/840, Gilat SkyEdge II C4, Paradise PD25L , Paradise Datacom Q-Flex, UHP 1000 / UHP 2000 through various supported types of interfaces and protocols (OpenAMIP, SNMP, telnet, WebGUI, serial console). The most protocols include GPS information, TX mute and satellite lock. EPAK continuously develops new drivers according to customers needs.

4.3 Web Interface

EPAK VSAT antennas feature an embedded webserver to provide a web user interface, to manage and control the antenna system. The connection interface is provided by any PC connected to the ACU (either through a local network connection or via remote tunnel when online). Users can simply use their web browser to access this functionality without additional software installation.

EPAK provides customers with an extensive tool to create and manage satellite profiles.
The web-interface also gives access to information about the status of the Antenna Control Unit, the antenna itself, GPS position, modem, the vessel's heading & speed as well as the received signal strength. It also provides a detailed overview of the network and system information and it allows the user to configure the modem, IP address etc.

4.3.1 Connecting to the ACU

By default the ACU offer on each of its LAN interfaces DHCP leases. The IP addresses are in the range 192.168.X.0/24, where X is the number of the LAN port:

Interface	IP range	netmask	default gateway
Lan1	192.168.1.1 - 192.168.1.253	255.255.255.0	192.168.1.254
Lan2	192.168.2.1 - 192.168.2.253	255.255.255.0	192.168.2.254

Note: Windows sets the IP address to 169.X.X.X if it can not get a DHCP lease within a certain timeout. This is not a valid IP address in the ACU network. In this case you can try to set the IP manually. As soon as the **WAN** LED on the front panel of the ACU is on, it

should be possible to connect to the Internet via the ACU gateway. The ACU will act as a regular router. For older network interfaces with 100 MBit/s a connection via cross-link cable may be necessary.

4.3.2 Access the ACU

Via Web interface:

All ACUs offer a web interface for basic monitoring and configuration tasks. The web interface does not publish all information and configuration parameters, but will be enhanced in future releases.
From the local network, the web interface can be reachable on the gateway address:

Interface	Address of web interface
Lan1	http://192.168.1.254
Lan2	http://192.168.2.254

Via SSH:

To make changes on the operating system, an `ssh` connection is needed. `ssh` can be used over a built in shell under Linux or MAC or is available over the free program PuTTY under Windows.

To copy files to the ACU, WinSCP for Windows and `scp` over a shell for Linux can be used.

Each LAN interface is preconfigured with the IPs: 192.168.X.254/24; where **X** is the number of the LAN interface.

There are two logins to get access to the ACU.
On the one hand the main login "supdate" to get generally access to the ACU and on the other hand the root-login to get superuser permissions.

Login as supdate	Login as root
User: supdate	User: su
Password: epaksatcom	Password: See in your documents

It is not allowed to log in directly as superuser/root via SSH. However, the user supdate is allowed to get superuser permissions by evoking the `su` command.

Linux/Mac:

```
user@host> ssh -p 19283 supdate@192.168.1.254
pw: epaksatcom
supdate@ACU-serial (shipname)> su
```

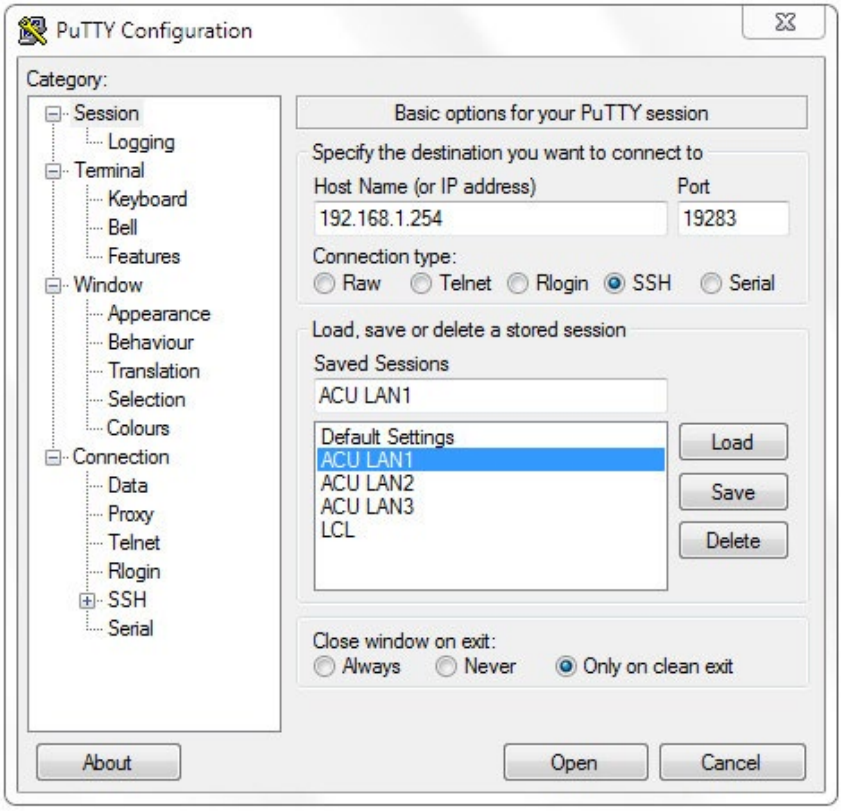
-p This is the port number for `ssh`. The standard was changed from 22 to 19283.

Windows:

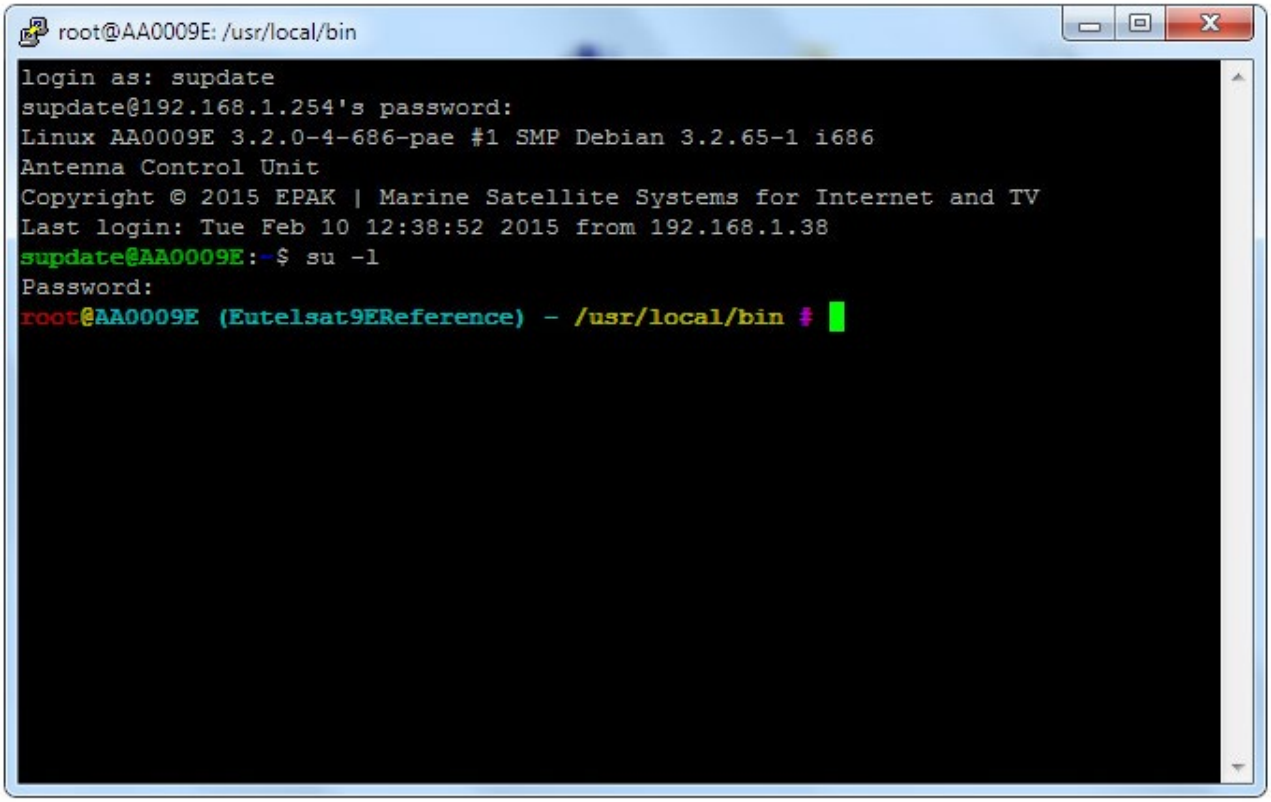
After launching the program, the following data has to be inserted, as shown in the picture on the left.

Hostname: 192.168.1.254 (Port LAN1 of the ACU) or 192.168.2.254 (Port LAN2 of the ACU)
Port: 19283
Connection Type: SSH

When the "Open" button is clicked the connection begins and it is now possible to login to the ACU as shown in the next page.



ACU SSH access via PuTTY – Terminal window



1. **Login as "supdate".**
2. **Enter the password.**
3. **Enter "su" command.**
4. **Enter root password.**

4.4 Remote Access Interface

Any mobile device which supports a browser (Android, iOS,Windows) can be used to access the web page of the ACU by connecting it to the onboard network.
The web page can be accessed even remotely from anywhere in the world when having an active internet connection (while the VSAT is online). Security is provided by an internal firewall, configurable only via command line (expert knowledge required).

4.5 Supports Various BUCs and Easy to Replace

EPAK VSAT antennas support various types of BUCs from 2 W to 25 W (40 W for 130 cm antenna). All suitable BUCs can be mounted on our antennas pedestal easily.

4.6 Supports Customized Satellite Library

Different satellite profiles are created and uploaded to the antenna, depending on customer needs. The customized satellite library is provided to each customer, can be loaded on every antenna before the shipping and is editable by customer in the future. The antenna can directly search and track the target satellite without any additional satellite information setting.
EPAK provides support for the configuration of the satellite profiles.

4.7 All Parameters Backup & Restore Functionality

All parameters can be stored at the internal memory of ACU. Saved backups can be downloaded to a connected PC via Web interface.
After the final set up, you should back up the parameters in order to restore the status of the saved final setting anytime.

4.8 Unlimited Azimuth Motion Range

The unique slip ring and a rotatory joint design eliminates the cable wrap issues and offers an unlimited azimuth capability to ensure clear and interruption-free data transmission.

The durability of the rotatory joint can be decreased if it transfers high BUC power. Therefore, instead of using a rotatory joint to transfer BUC power and RF signal at the same time, EPAK VSAT systems have adopted the high quality, durable slip ring to transfer BUC power separately.

4.9 Improved Hardware Reliability Against Rough Sea Condition

The hardware of EPAK VSAT antennas was designed considering the Environmental Test Standards from the initial design phase. After several verification tests, the hardware could be finalized to survive the roughest vibration and shock conditions. Only the products which have passed through EPAK's rigid ET standards can be launched to the market, and all EPAK products reliability has been proven in the market as a result of this effort.

4.10 Fast Booting Speed

EPAK provides 16 GB SSD high speed drive which allows the system to boot fast within a few seconds. Furthermore, EPAK has an extra 8 GB SD card which can hold large amount of log data and can be accessed whenever is needed.

4.11 Monitoring EPAK Network Devices

The EPAK engineering team monitors systems 24/7 for irregularities and intends to solve occurring issues remotely via secure VPN tunnel, without causing interruptions to the system online status. General updates and firmware maintenance of the system are promptly done by EPAK's team when necessary. Finally, the monitoring tool which EPAK provides gives access to the customer for monitoring their own VSATs remotely. Free online remote support is provided even after warranty expires, as a special service to EPAK clients.

4.12 DVB/DVB-S2 Detection Capability

EPAK VSAT antennas are capable of detecting DVB-S/DVB-S2 signals as well as SCPC carriers as tracking sources and for satellite identification. This helps to detect the correct satellite before the modem gives confirmation, which reduces system time to get online .

Further, the modem lock indicator can be derived from the ACU to enable identification of proprietary non-standard carriers.

4.13 Dual Band Converter

EPAK's new generation of 90 cm series antennas can be converted from Ku- to Ka-Band and from Ka- to Ku-Band with few easy steps.

4.14 Radome

The radome of our VSAT systems is made of special plastic for a minimum attenuation of RF signals and is covered with a special UV-stable coating.

5 Appendix

5.1 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 detach 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 additional paint, wax, preservative, solvent, chemicals or adhesive labels. Do not use alcohol or dilution or similar products to clean the radome. Any kind of additional coating will void warranty claims. 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.

5.2 Troubleshooting

Display	Problem	Solution
no dish	Control unit cannot communicate with E-Box	• Check antenna to control unit cable • Check antenna unit's power supply (12V ..36V) • Test rotary joint for fault
Standby	Antenna has no power OR antenna could not find satellite for 15 mins.	• Check the error message seen before (lowVsup or No dish) • Recheck antenna's power supply
ErrorCom	Communication error with antenna unit	• Turn unit off and after 3 seconds on again
LowVsup	Power supply too low (< 11.5 Volt)	• Check if power supply connection to antenna unit is too low (<11.5V) (loose cable..) or any voltage drop • Check if voltage supply is continuous or it drops/varies sometimes • Check for high resistance/load • Check voltage on slip ring • If there is sufficient voltage & low load, then the E-Box is faulty
no Data	The satellite position requested by the receiver in AutoSat mode is not stored in antenna unit	• Check the DiSEqC™ adjustment of the receiver • Add satellite and store position (see chapter 5.1)
Err HR Err HW	Read / Write error of horizontal unit	Turn the unit off and on again. In case the error reoccurs, call for technical assistance. In case of errors regarding limit switches: Check all moving parts for non-blocking functionality. Err ULS / Err LLS: • Check lose cable connection • fault in sensor, plug or cable -> exchange sensor / cable • Magnet is missing or screw is not correctly positioned -> check using limit switch tester
Err VR Err VW	Read / Write error of vertical unit	
Err SR Err SW	Read / Write error of signal processing unit	
Err PR Err PW	Read / Write error of polarisation unit	
Err VCO	Error during satellite inspection	
Err EEP	Error during storage	
Err IIC	Error in internal communication	
Err Trck	Error in tracking module	
Err ULS Err LLS	Error in upper / lower limit switch	
Err ELS Err WLS	Error in eastern / western limit switch	
Err Comp	Compass error	
Err Save	Error while saving satellite	• Repeat search and store. Make sure the boat is not moving and has no blockage • Try to save the satellite in different scan-bands • If issue persists, after multiple retries, then replace E-Box
Err Skew	Cable connection from E-Box to Skew-Box may be defective	• Check the connection between E-Box and Skew-Box
Wait GPS	Antenna is waiting for valid GPS data OR Problem with GPS reception at current location	• GPS signal is jammered by another signal source • GPS receiver is defective
<Short!>	There is a short circuit in the connection between control unit and antenna	• Check RX cable connection to antenna and rotary joint inside the antenna
TX off alternating with Satellite name	No reception of the stored satellite	• Check if something obstructs the sight to the satellite. Reception can be interrupted by passing boats

scannin9 alternating with complete	No receivable satellite signal in the entire search range OR LNB defective OR LNB cable is defective	• Check for line-of-sight issues • Check, by using footprint cards (e.g. www.satbeams.com), whether the boat is inside the coverage area (footprint) • Check antenna to control unit cable • Check power to LNB • Verify tracking frequencies
update reco	Saved satellite data is not completely similar to the real data measured by the antenna	• Update the stored satellite or delete and make new setup
Blocked	No reception of the stored satellite	• Check for line-of-sight issues
No Data	Saved satellite data is not completely similar to the real data measured by the antenna	• Read the current frequencies via progsoft and verify if a valid frequency is present for the current scnband. If not, try to make a new setup with another scnband. • Verify latest frequencies via lyngsat and reprogram antenna

6.1 Overall Configuration

EPAK's marine VSAT systems are comprised of two major equipment assemblies: the outdoor unit (ODU) and the indoor unit (IDU). The components of each group are listed below.
The ODU is comprised solely of the antenna radome mounted on the ship's upper deck or at a location which has the most non-obstructed line-of-sight view to the satellite. It is important to minimize blockages by mast structures or funnel as well as interferences with ship's navigation and communication systems such as marine radars, radio and magnet compass etc. The IDU shall be mounted in indoor locations of the ship.

Outdoor unit (ODU)

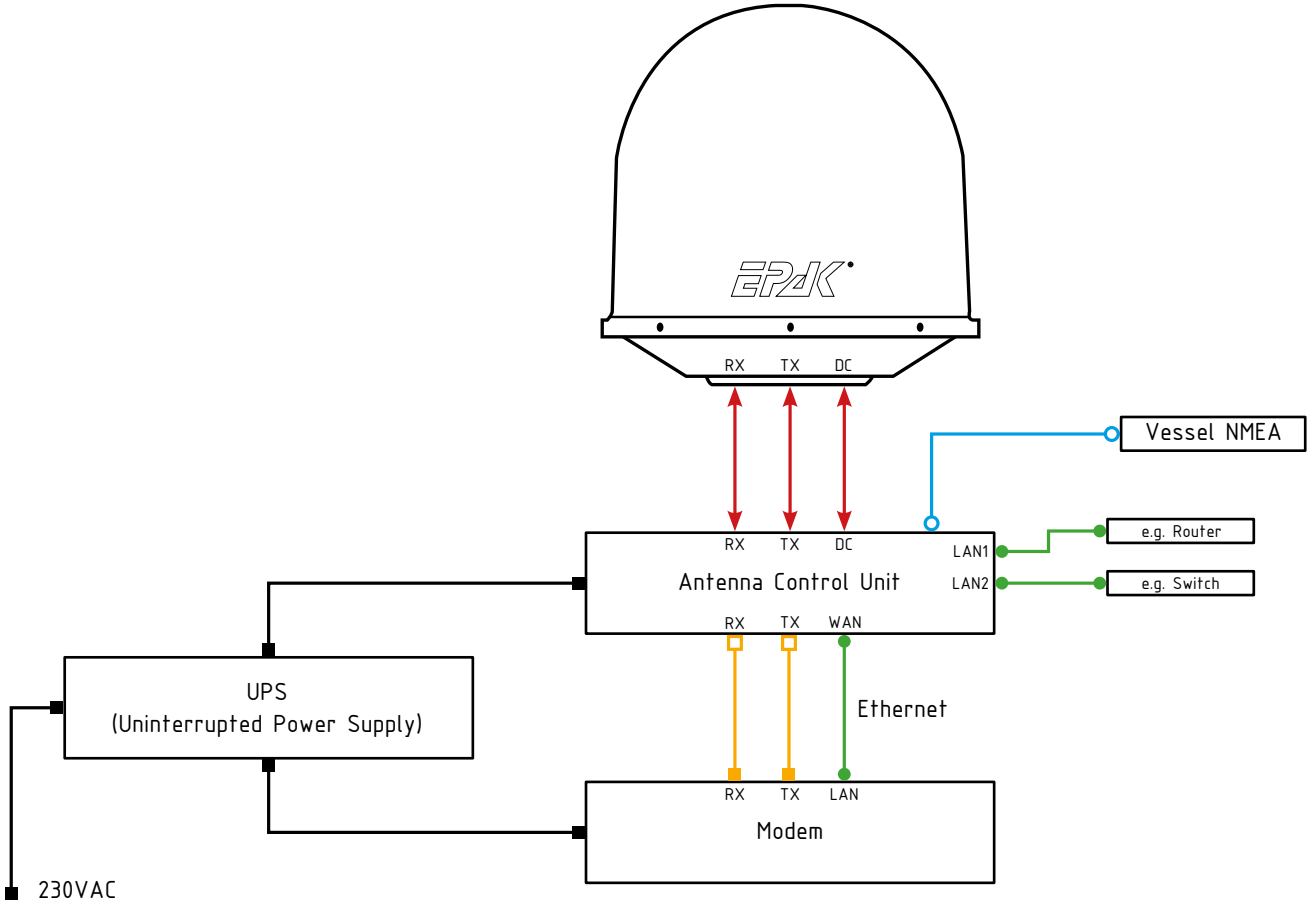
1. Stabilized antenna pedestal incl. electronic control modules
2. Antenna reflector
3. Feed assembly
4. Ku/Ka-band BUC/LNB
5. Inbuilt GPS receiver
6. Radome assembly

Indoor unit (IDU)

1. Antenna Control Unit (ACU)
2. Satellite modem (optionally supplied by EPAK)
3. Router / Network Hub (optionally supplied by EPAK)
4. Computers (not supplied by EPAK)
5. IP Phones (optionally supplied by EPAK)
6. Video conference equipments (not supplied by EPAK)
7. Streaming equipments (not supplied by EPAK)

6.2 System Overview

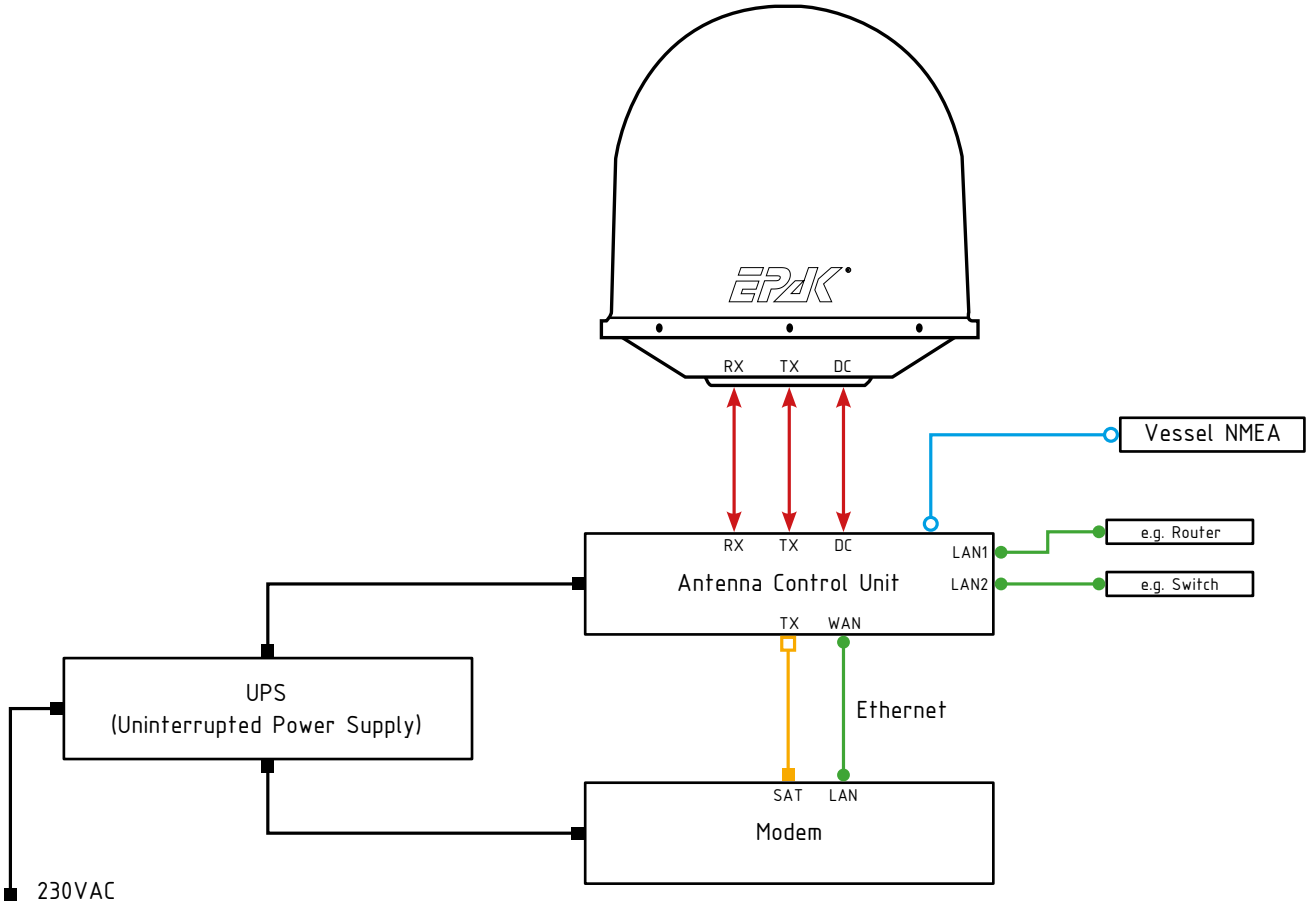
6.2.1 System Overview for Ku-band and Double-IFL Ka-band



Cable type:

- Double shielded coax cable (ECOFLEX 10) with N-plugs
- Double shielded coax cable (RG6) with F and TNC-plugs
- Ethernet patch cable with RJ45 plugs
- RS422/RS232 (9 Pin Sub-D)
- Power cord (included)

6.2.2 System Overview for Single-IFL Ka-band

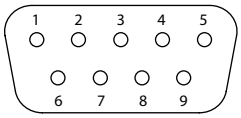


Cable type:

- Double shielded coax cable (ECOFLEX 10) with N-plugs
- Double shielded coax cable (RG6) with F and TNC-plugs
- Ethernet patch cable with RJ45 plugs
- RS422/RS232 (9 Pin Sub-D)
- Power cord (included)

6.3 NMEA Connector Scheme

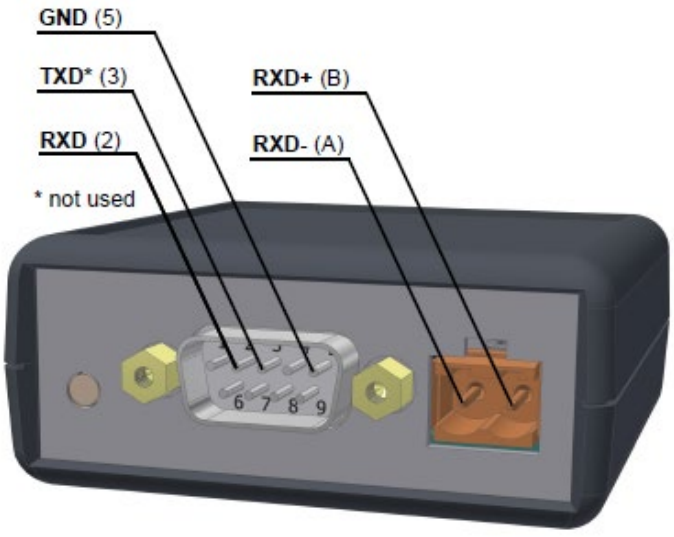
Connect an USB-RS422 converter to an NMEA compass serial signal for the EPAK Antenna Control Unit

	Pin number	Pin description	Connect to
 *backside D-Sub 9 connector*	3	RX+	TX+ NMEA Bus
	4	RX-	TX- NMEA Bus
	5	GND	GND NMEA Bus

Both transmit lines TX+ and TX- of the NMEA bus from the ship side need to be connected with the receive lines RX+ and RX- of the D-Sub 9 connector. If there is a line for ground you can connect it with pin number 5 (optional).
The power LED will start flashing permanently as soon as you connected the USB-RS422 adapter with a USB connector. If data is received the LED labeled RX is also flashing.

Lindy USB-RS422 converter

6.3.1 NMEA Box Pinout



6.4 Regulations

ETSI EN 302 340 V1.1.1
ETSI EN 301 489-1 V1.9.2
ETSI EN 301 489-20 V1.2.1
ETSI EN 301 444 V1.2.2
IEC 60945
IEC 60721-4-6

6.5 Standard BUC for Ku Systems

EPAK's VSAT system in Ku-Band are equipped with a standard 8W BUC. BUCs are also available in 16 W, 25 W and 40 W (only for DSi13).

NJRC 8 W BUC (Standard)

Item		Requirement specification
Manufacturer / Product name		NJRC / Ku-band 8 W transmitter
Model No.		NJT5118NM
Output Interface		Waveguide, WR75 (with Groove)
Input Interface		N-Type, female (50 ohm) [N-type IF Connector Model] F-Type, female (75 ohm) [F-type IF Connector Model]
Output Power @ 1 dB G.C.P.		+39 dBm min. over temperature
ACPR		-28 dBc typ. @ Pout = +38 dB
Linear Gain		65 dB nom., 59 dB min.
Requirement for External Reference	[Frequency]	10 MHz (sine-wave)
	[Input Power]	-5 to +5 dBm @ Input port
	[Phase Noise]	-125 dBc/Hz max. @ 100 Hz -135 dBc/Hz max. @ 1 kHz -140 dBc/Hz max. @ 10 kHz
L.O. Phase Noise		-60 dBc/Hz max. @ 100 Hz -70 dBc/Hz max. @ 1 kHz -80 dBc/Hz max. @ 10 kHz -90 dBc/Hz max. @ 100 kHz -100 dBc/Hz max. @ 1 MHz
Receive Band Noise Density		-156 dBm/Hz max. @10.95 to 12.75 GHz, , @ Pout ≤ +39 dBm
Input V.S.W.R.		2 : 1 max.
Output V.S.W.R.		2 : 1 max.
Power Requirement		+18 to +60 V DC power
Power Consumption		79 W typ., 90 W max.
Mute		Shut off the HPA in case of L.O. unlocked or no 10 MHz reference signal.
Temperature Range (ambient)		-40°C to +55°C (operating) -40°C to +75°C (storage)
Dimension & Housing (without Interface Connectors)		219.5 mm (L) x 175 mm (W) x 99 mm (H) [8.64" (L) x 6.89" (W) x 3.90" (H)]
Weight		3.2 kg (7.0 lbs)

NJRC 16 W BUC (Extended)

Item	Requirement specification	
Manufacturer / Product name	NJRC / Ku-band 16 W transmitter	
Model No.	NJT8319	
Output Interface	Waveguide, WR75 (with Groove)	
Input Interface	N-Type, female (50 ohm) [N-type IF Connector Model] F-Type, female (75 ohm) [F-type IF Connector Model]	
Output Power @ 1 dB G.C.P.	+42 dBm min. over temperature	
ACPR	-28 dBc typ. @ Pout ≤ +41 dBm	
Linear Gain	65 dB nom., 59 dB min.	
Requirement for External Reference	[Frequency]	10 MHz (sine-wave)
	[Input Power]	-5 to +5 dBm @ Input port
	[Phase Noise]	-125 dBc/Hz max. @ 100 Hz -135 dBc/Hz max. @ 1 kHz -140 dBc/Hz max. @ 10 kHz
L.O. Phase Noise	-60 dBc/Hz max. @ 100 Hz -70 dBc/Hz max. @ 1 kHz -80 dBc/Hz max. @ 10 kHz -90 dBc/Hz max. @ 100 kHz -100 dBc/Hz max. @ 1 MHz	
Receive Band Noise Density	[Universal Ku-band]	Tx: 14.0 to 14.5 GHz -156 dBm/Hz max. @10.95 to 12.75 GHz Tx: 13.75 to 14.0 GHz -156 dBm/Hz max. @10.95 to 12.25 GHz -125 dBm/Hz max. @12.25 to 12.75 GHz
	[Standard Ku-band]	Tx: 14.0 to 14.5 GHz -156 dBm/Hz max. @10.95 to 12.75 GHz
Input V.S.W.R.	2 : 1 max.	
Output V.S.W.R.	2 : 1 max.	
Power Requirement / Consumption	+36 to +60 V DC Power	
Power Consumption	140 W typ. @ No If signal 160 W typ., 180 W max. @ Pout = +42 dBm	
Mute	Shut off the HPA in case of L.O. unlocked or no 10 MHz reference signal, or Over temperature	
Temperature Range (ambient)	-40°C to +75°C (Operating Guarantee) -40°C to +55°C (Performance Guarantee) -40°C to +75°C (Storage)	
Dimension & Housing (without Interface Connectors)	180 mm (L) x 130 mm (W) x 80 mm (H) [7.09" (L) x 5.12" (W) x 3.15" (H)]	
Weight	2.4 kg (5.3 lbs)	

NJRC 25 W BUC

Item	Requirement specification	
Manufacturer / Product name	NJRC / Ku-band GaN 25 W transmitter	
Model No.	NJT8370	
Output Interface	Waveguide, WR75 (with Groove)	
Input Interface	N-Type, female (50 ohm) [N-type IF Connector Model] F-Type, female (75 ohm) [F-type IF Connector Model]	
Saturation Output Power	+44 dBm min. @ +25°C +43 dBm min. over temperature	
ACPR	-30 dBc typ., -26 dBc min. @ Pout = +42 dBm	
Linear Gain	72 dB nom., 66 dB min.	
Requirement for External Reference	[Frequency]	10 MHz (sine-wave)
	[Input Power]	-5 to +5 dBm @ Input port
	[Phase Noise]	-125 dBc/Hz max. @ 100 Hz -135 dBc/Hz max. @ 1 kHz -140 dBc/Hz max. @ 10 kHz
L.O. Phase Noise	-60 dBc/Hz max. @ 100 Hz -70 dBc/Hz max. @ 1 kHz -80 dBc/Hz max. @ 10 kHz -90 dBc/Hz max. @ 100 kHz -100 dBc/Hz max. @ 1 MHz	
Receive Band Noise Density	[Universal Ku-band]	Tx: 14.0 to 14.5 GHz -156 dBm/Hz max. @10.95 to 12.75 GHz Tx: 13.75 to 14.0 GHz -156 dBm/Hz max. @10.95 to 12.25 GHz -125 dBm/Hz max. @12.25 to 12.75 GHz
	[Standard Ku-band]	Tx: 14.0 to 14.5 GHz -156 dBm/Hz max. @10.95 to 12.75 GHz
Input V.S.W.R.	2 : 1 max.	
Output V.S.W.R.	2 : 1 max.	
Power Requirement / Consumption	+36 to +60 V DC Power	
Power Consumption	120 W typ. @ No If signal 180 W typ. @ Pout = +39 dBm 200 W typ., 230 W max. @ Psat	
Mute	Shut off the HPA in case of L.O. unlocked or no 10 MHz reference signal, or Over temperature	
Temperature Range (ambient)	-40°C to +75°C (Operating Guarantee) -40°C to +60°C (Performance Guarantee) -40°C to +75°C (Storage)	
Dimension & Housing (without Interface Connectors)	180 mm (L) x 130 mm (W) x 80 mm (H) [7.09" (L) x 5.12" (W) x 3.15" (H)]	
Weight	2.5 kg (5.5 lbs)	