V9 OTM45 Antenna System Installation and User Manual

Name：mobile satellite communication terminal

Model Number：V9 OTM45

Revision 1.3

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1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

Safety Considerations

For the following safety considerations, "Instrument" means the 'V9 OTM45' units, components and their cables.
It is necessary to read the instructions carefully before using the V9 OTM45. The V9 OTM45 usage shall be carried out in accordance with the described steps and methods to ensure the safety and accuracy of equipment operation.

Radio

The instrument transmits radio energy during normal operation. To avoid possible harmful exposure to this energy, do not stand or work for extended periods of time in front of its antenna. The long-term characteristics or the possible physiological effects of Radio Frequency Electromagnetic fields have not been yet fully investigated.

Caution

1. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.
2. Before connecting this instrument to the power line, make sure that the voltage of the power source matches the requirements of the instrument.

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The V9 OTM45 is a full satellite earth station system for communication in Ku-band. The satellite parameters shall be selected only according to the specific user conditions required.

The China Starwin V9 OTM45 User Manual provides operational instructions, for the device, which are standard for applications in Ku-band. However, the specific modem and antenna electrical performance parameters need to be taken in account. This manual is intended for technicians responsible for the installing, setting up and operating of the V9 OTM45 and for

system administrators who are responsible for managing the system.

Table of Contents

1   Introducing V9 OTM45 System

The V9 OTM45 is vehicle-mounted mobile satellite product for on the move Ku-band broadband access, developed by China Starwin, which has completely independent intellectual property rights. The use of high-efficiency flat panel antenna and intelligent stable tracking structure always ensures accurate pointing to the satellite under high-speed maneuvering on rugged and bumpy roads. The terminal keeps the uninterrupted broadband communication over satellite in motion under dynamic conditions, providing transmission of data and multimedia, as well as video and voice calls.

The terminal adopts an ultra-low profile design for Out-Cabin Unit, of only 248mm height (Figure 1-1), which can meet the needs of various vehicle models. It provides a highly sensitive and reliable communication system, which can be used anywhere and at any time. The China Starwin V9 OTM45 system provides a moving vehicle by broadband communication with high throughput comparable with wired connectivity.

Starwin OTM technology enhances the accuracy of pointing to satellite and reduces its acquisition time by combining operation of detection digital receiver and high-precision gyroscopes. The V9 OTM45 is self-pointing system, which uses satellite and positioning information to perform precise automatic alignment. The detection digital receiver recognizes and keeps the satellite signal peak value, directing the antenna during vehicle movement without relying solely on information received from GNSS module.
V9 OTM45 enables fast switching between different satellites during the vehicle motion and real time monitoring the system operation through the application software, running at smart phone, palm device or PC.

Figure 1-1: V9 OTM45 Out-cabin Unit

Figure 1-2: V9 OTM45 In-cabin Unit (Antenna Control Unit)

2   Technical Specification

Parameter		Value / Range
Operating Frequency	Rx	10.70~12.75GHz
	Tx	13.75~14.50GHz
LNB LO Frequency		10.6 / 9.75GHz (Automatically switched by Control Software)
Integrated BUC Power		8W
EIRP Typical at Mid-band		42dBW at 14.50GHz (P1dB for Tx pass with 8W BUC)
Antenna Type		Flat Horn Array
Antenna Base Stabilization		Two-axis stabilization
Antenna Gain	Rx	32.00dBi(in range of ±10 degree) 3.69dBi(out range of ±10 degree)
	Tx	33.21dBi(in range of ±10 degree) 3.69dBi(out range of ±10 degree)
Polarization		Linear/Circular (Changed by Control Software)
Rx/Tx Polarization		Changed by Control Software
Typical G/T at 11.2GHz		11dB/K (30° El, 25°C)
Azimuth Range		360° unlimited continuous rotation
Elevation Range		0~90°
Polarization Range		0~270° (Controlled by software)
Tracking Accuracy		≤ 0.3°
Tracking Mode		Inertial measurement combined with signal tracking
Tracking Rate		Azimuth: ≥100°/s; Elevation: ≥80°/s; Roll: ≥80°/s
Max. Angular Acceleration		Azimuth ≥200°/s²; Elevation ≥200°/s²
Capture Time		First boot <120s; Repeat boot <30s
Recapture Time After Loss		Instantaneous capture <2s
Positioning		Built-in GNSS receiver
Network Interfaces		LAN; Wi-Fi IEEE 802.11n (for models with built-in modem)
M&C Interfaces		ACU Front Panel Controls; LAN; Bluetooth
Power Supply		AC: 90~264VAC 50/60Hz
System Power Consumption		≤150W, Average (with 8W BUC)
Out-cabin Unit Dimensions		Length: 975mm; Width: 785mm; Height: 248mm
Out-cabin Unit Weight		27Kg (including mounting plate)
Maximum vehicle speed		380 km/h
Operating Temperature		-40°C~+50°C
Storage Temperature		-40°C~+80°C
Relative Humidity		0%~98%RH
Radom Survival Ice load		13mm

3 Packing List

3.1 Packing configuration

Table 3-1: Standard V9 OTM45 packing configuration:

№	Item Image	Item Name	Quantity	Remarks
1		Out-cabin Unit - Flat Horn Array Antenna System Assembly in Radome	1	Stand
2		In-cabin Unit - Antenna Control Unit (ACU)	1	Stand
3		ACU AC Power Cable – 1.5m	1	Stand
4		Coaxial Cable for Connection ACU and Out-cabin Unit - 2m with F-type male connector at each edge	1	Stand
5		LAN Cable - 5m	1	Equipment commissioning use
6		Bonding adapter plates (Optional)	4	Stand
7		Wooden case	1	Stand

Feasibility of any required customized configuration can be investigated.

3.2 Unpacking and Inspection

Unpack and inspect all hardware to ensure that no parts are damaged during transportation upon receiving the system container.

3.3 Freight Damage

Contact the carrier immediately if any part appears damaged during transportation.

3.4 Material-Missing or Damaged

Contact your dealer or distributor if any part appears missing or damaged, but not in result of transportation.

4 System Description and Operation Principles

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4.1 V9 OTM45 General Structure

V9 OTM45 system includes the following parts:
- Out-Cabin Unit (Figure 4-1)
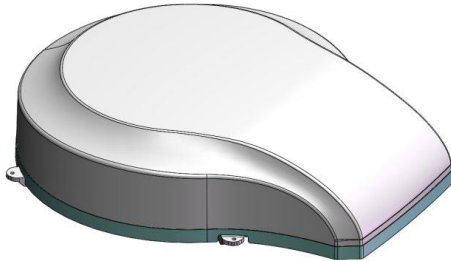- In-Cabin Unit (Figure 4-2)

Figure 4-1: V9 OTM45 Out-Cabin Unit Unit

Figure 4-2: V9 OTM45 In-Cabin Unit

Both system parts are connected by a single coaxial cable, which transfers received signals from Out-cabin Unit to the In-cabin Unit at L-band and transmitted signals in the opposite direction at Intermediate Frequency (IF) band (70 MHz). The same coaxial cable is used to supply DC for powering the Out-cabin Unit.

The V9 OTM45 System general block diagram is shown at Figure 4-3.
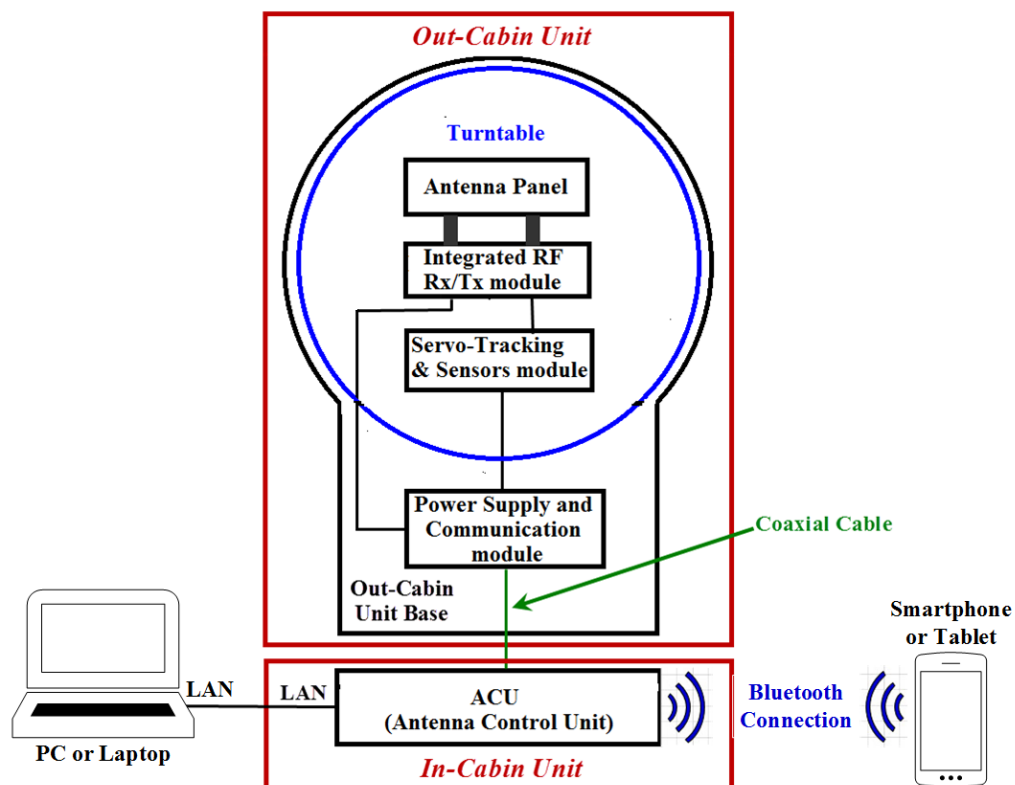
Figure 4-3: V9 OTM45 System General Block Diagram

4.2   Out-Cabin Unit

The Out-cabin unit equipment is installed at the vehicle roof. All Out-cabin unit elements are inside the radome, as shown at Figures 4-4 and 4-5.
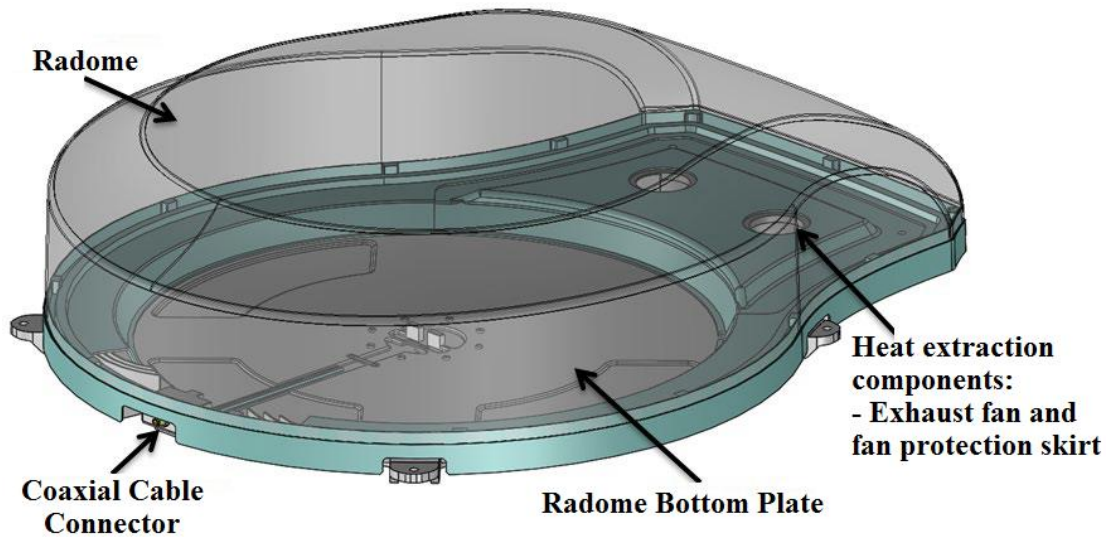
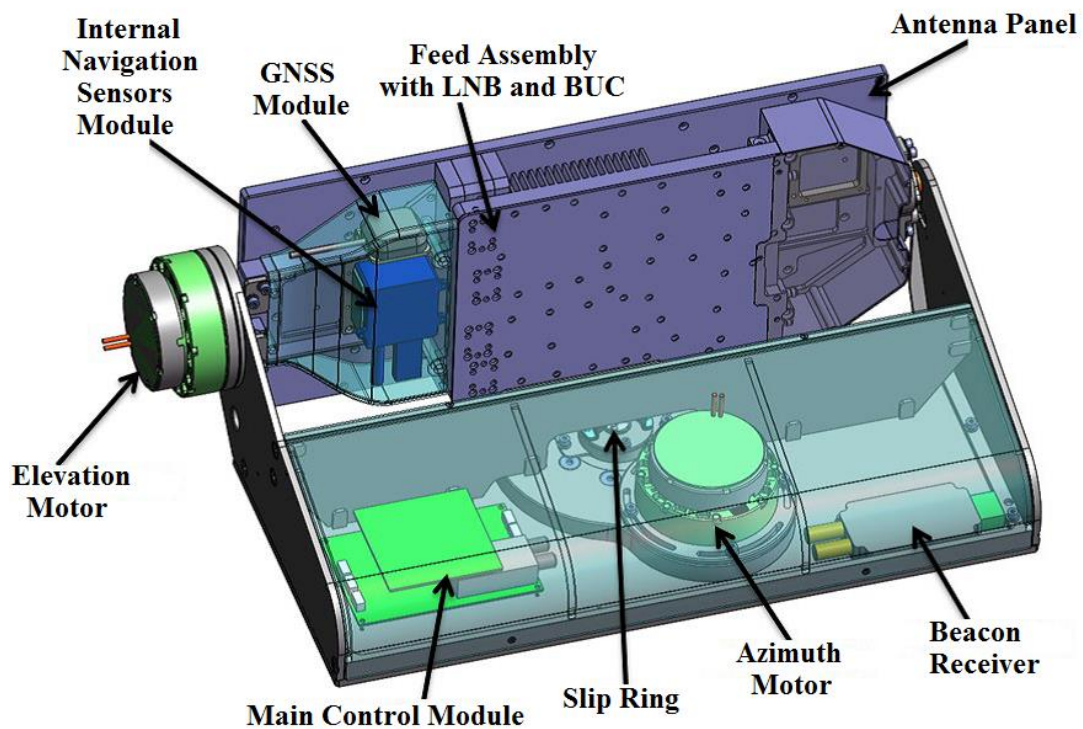**Figure 4-4: Out-cabin Unit Radome Layout**

Figure 4-5: Out-cabin Unit Composing Elements Layout

The detailed Out-cabin unit composing elements list and their functional dedication is represented in Table 4-1.

Table 4-1: Out-cabin Unit Composing Elements List

№	Element Name	Element Functional Dedication
1	Mounting base	Fixes the Out-Cabin Unit at the vehicle roof
2	Radome bottom plate	Protect the Out-Cabin Unit elements from precipitation and dust
3	Exhaust fan with protection skirt	Exhausts the heat out of the Out-Cabin Unit
4	Radome	Protect the Out-Cabin Unit elements from precipitation and dust
5	Antenna panel	Collects and radiates Ku-band electromagnetic waves
6	LNB	Converts the received Ku-band signal to L-band and amplifies it
7	BUC	Amplifies the IF signal and converts it to Ku-band
8	Beacon receiver	Receives the Satellite Beacon signal and detects its strength
9	GNSS module	Receives GNSS signals for positioning information processing
10	Internal navigation module	Processes signals from attitude measurement sensors
11	Elevation motor	Creates torque for antenna movement by Elevation angle
12	Elevation drive	Transmits torque from Elevation motor to antenna
13	Azimuth motor	Creates torque for antenna movement by Azimuth
14	Azimuth drive	Transmits torque from Azimuth motor to antenna
15	Main control module	Processes information from all sensors and controls the motors

Unlike standard VSAT systems, all the above elements are integrated inside the V9 OTM45 Out-cabin Unit.

WARNING: The radome surface must be kept clean for the best equipment performance. Use only non-corrosive light soapy water when cleaning the radome. Prevent the radome surface from scratching. Applying car-polishing wax at the radome external surface can improve water-repellent effect.

4.3 In-cabin Unit (Antenna Control Unit – ACU)

The In-cabin Unit (Antenna Control Unit – ACU) is powered from the in-vehicle Power Supply and allows real-time monitoring and control the V9 OTM45 system operational status by software application, installed on a PC or Laptop connected by LAN cable, as well as on a smartphone or tablet device via Bluetooth wireless link.

Figure 4-6: The In-cabin Unit (Antenna Control Unit – ACU)

5 V9 OTM45 Mounting

5.1 V9 OTM45 Unpacking

WARNING: In order to prevent personnel or equipment from being damaged, at least two people must cooperate when handling V9 OTM45 series antenna unpacking and mounting.

NOTE: The supporting equipment configuration in the packing list corresponds to the specific customer order and the may differ according to the included modem and additional accessories. The system can be supplied with the integrated modem or without it. Customers can use modem, supplied by contracted satellite communication service provider, or purchased from a point of sale. Customers are free to choose. However, the V9 OTM45 system supplier has to be informed about the customer's choice before purchasing to perform corresponding configuration adjustments.
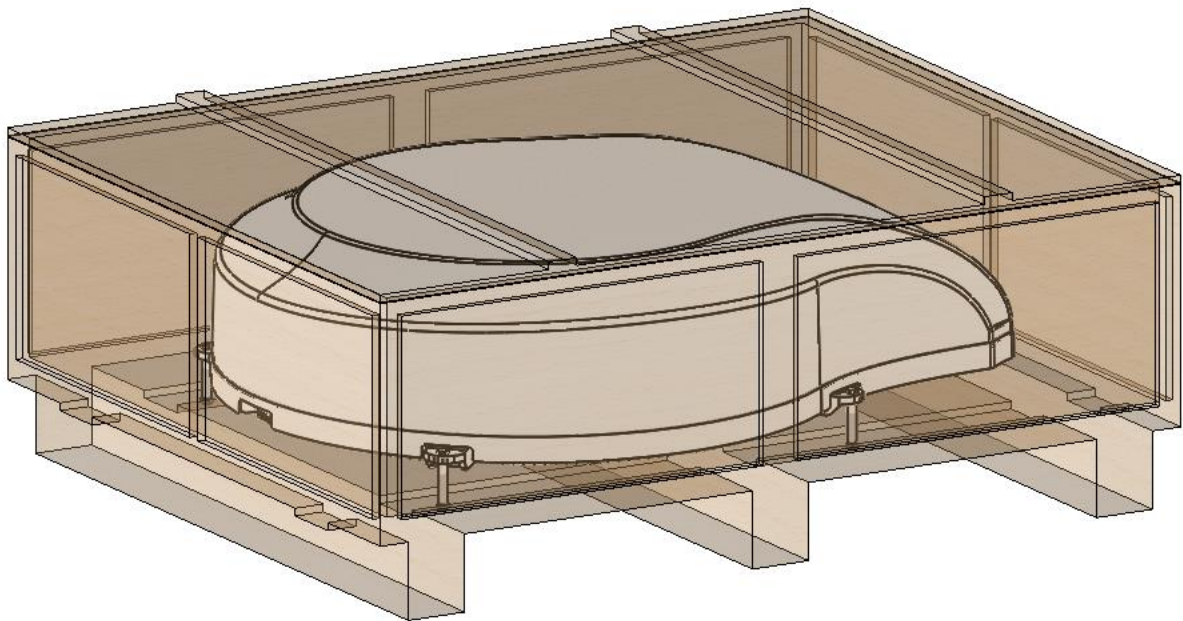
Figure 5-1: Diagram of antenna placement inside the wooden packing case

To unpack the V9 OTM45 proceed by the following steps, shown at Figure 5-2:
- Place the wooden packing case ① on a flat horizontal surface and open the cover ②.
- Remove four nuts ③ and four screws ④ fixing the antenna assembly ⑤ to the wooden packing case ①.
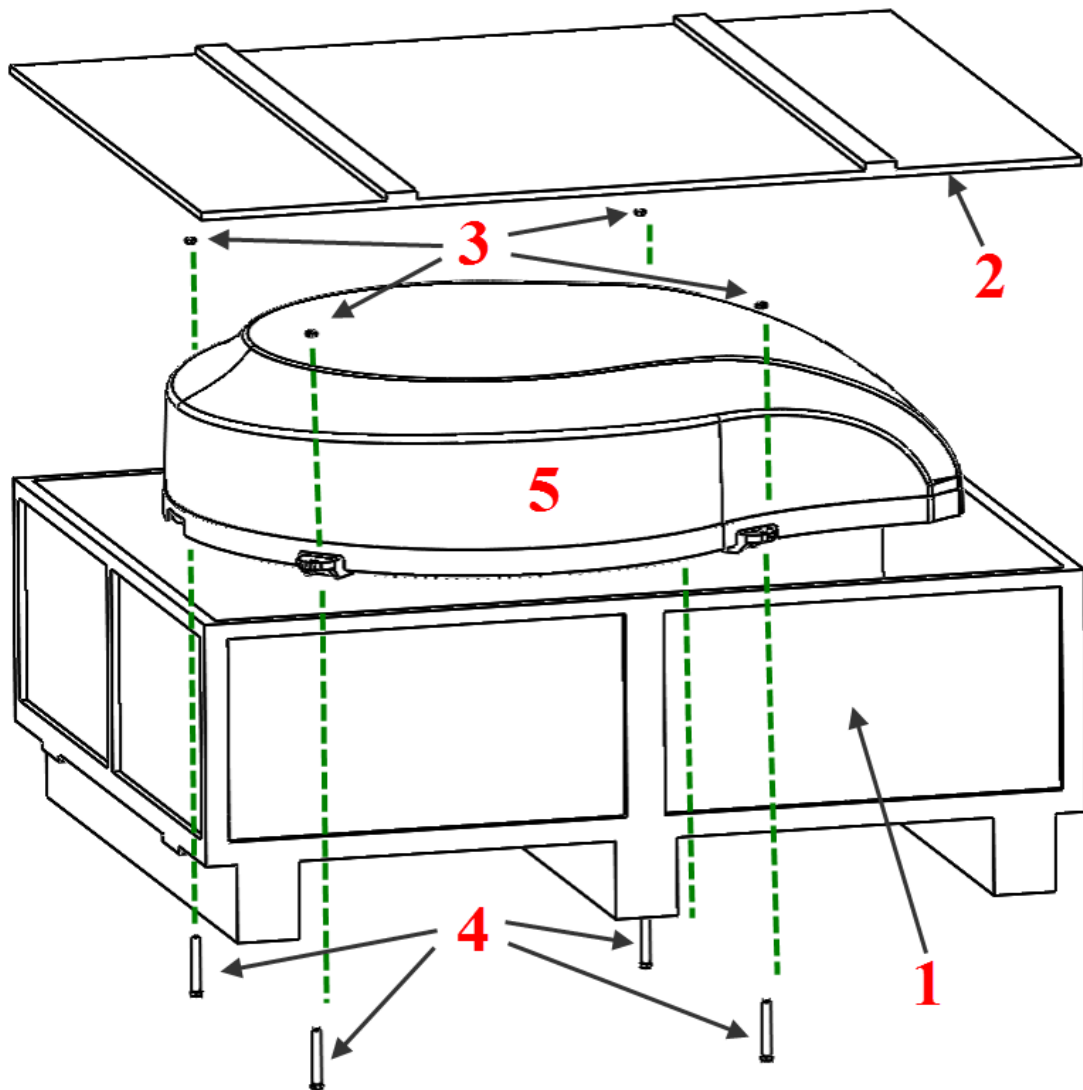- Take out the antenna assembly ⑤ from the wooden packing case ①.

Figure 5-2: Unpacking the V9 OTM45 antenna assembly

Check the antenna and accessories upon unpacking to ensure that they were nor damaged during transportation.

5.2 Mounting Antenna on a Flat Platform

WARNING: Ensure the roof rack or the platform for V9 OTM45 Antenna installation is strong enough to support the equipment weight during the vehicle move at maximum speed.

The platform is prepared and installed by customer on the vehicle roof by welding, screwing or by any other reliable fixation method. Holes for antenna assembly installation on the platform should be drilled according to the installation holes diagram (Figure 5-3) before the platform is fixed at the vehicle roof. The antenna assembly mounts directly to the platform and is secured to it with four M8 screws.

NOTE: Do not bend the bottom plate of the antenna radome during the installation process. If necessary, install additional spacers between the roof rack and the antenna bonding legs. To provide the following proper system operation, the antenna must be kept horizontal during the installation.
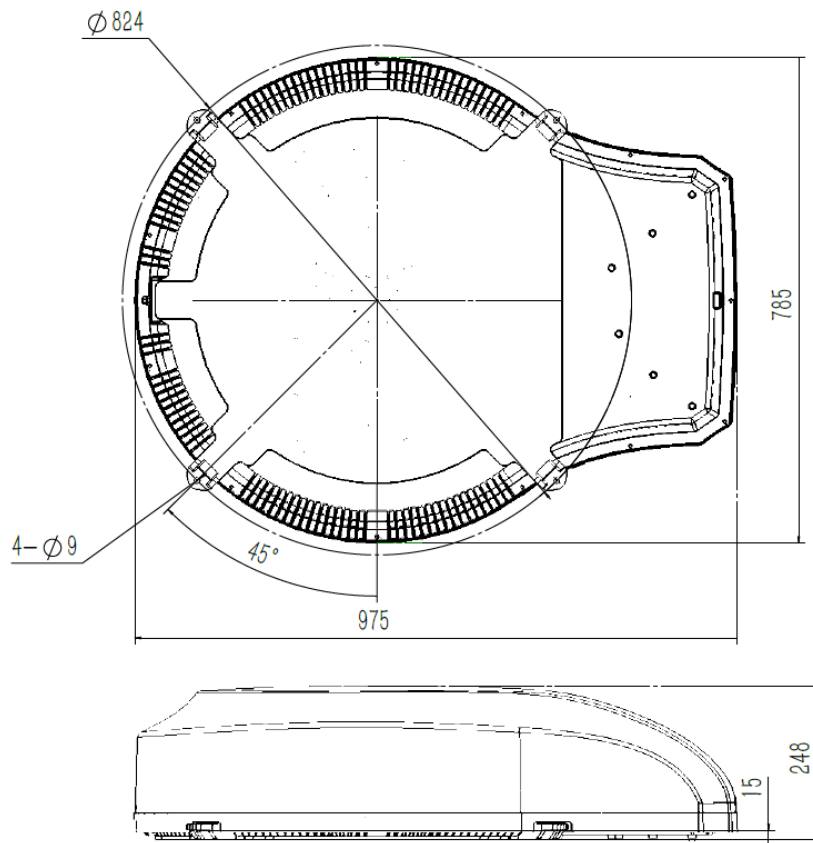
Figure 5-3: Overall Dimensions and Installation Holes Positioning

**NOTE: It is strictly recommended to use thread locking adhesive (like Loctite Threadlocker Blue 242 or its analog) to secure bolts and nuts from accidental loosening from shock and vibration after antenna installation.
Double-check carefully to ensure that the antenna is installed firmly.**

5.3 Mounting Antenna on Vehicle Roof Rails or Roof Rack

Use four M8 screws to connect the antenna to two crossbars made from metal profile as shown at Figure 5-4. Afterwards fix the crossbars with the antenna on roof rails or on roof rack.

NOTE: It is recommended to use thread locking adhesive (like Loctite Threadlocker Blue 242 or its analog) to secure bolts and nuts from accidental loosening from shock and vibration after antenna installation.
Double-check carefully to ensure that the antenna is installed firmly.
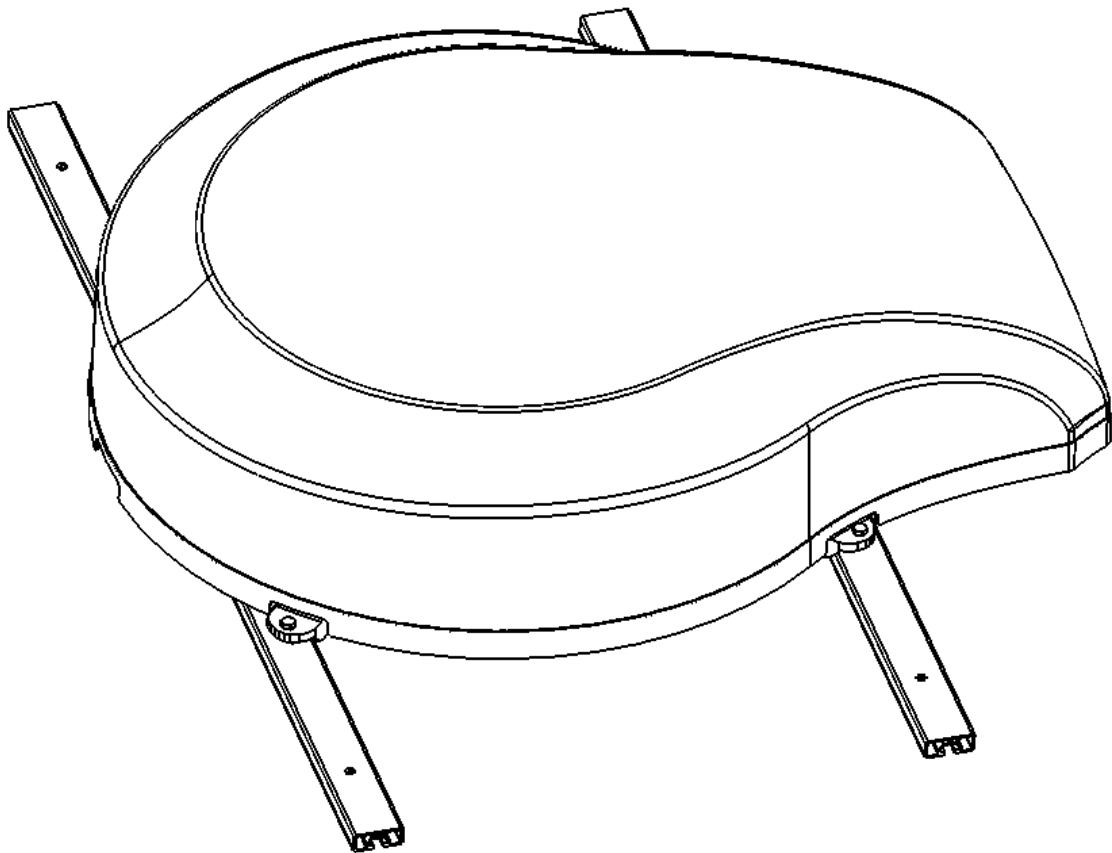
Figure 5-4: Antenna Installation on Vehicle Roof Rails or Roof Rack

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5.4 Mounting Antenna Directly on Vehicle Roof

Connect the four bonding adapter plates to the antenna bonding legs as shown at Figure 5-5. Clean the vehicle roof surface from paint and dust at places where it will contact the bonding adapter plates. Glue the bonding adapter plates to the roof of the car with structural glue.

NOTE: Do not bend the bottom plate of the antenna radome during the installation process. To provide the following proper system operation, the antenna must be kept horizontal during the installation.
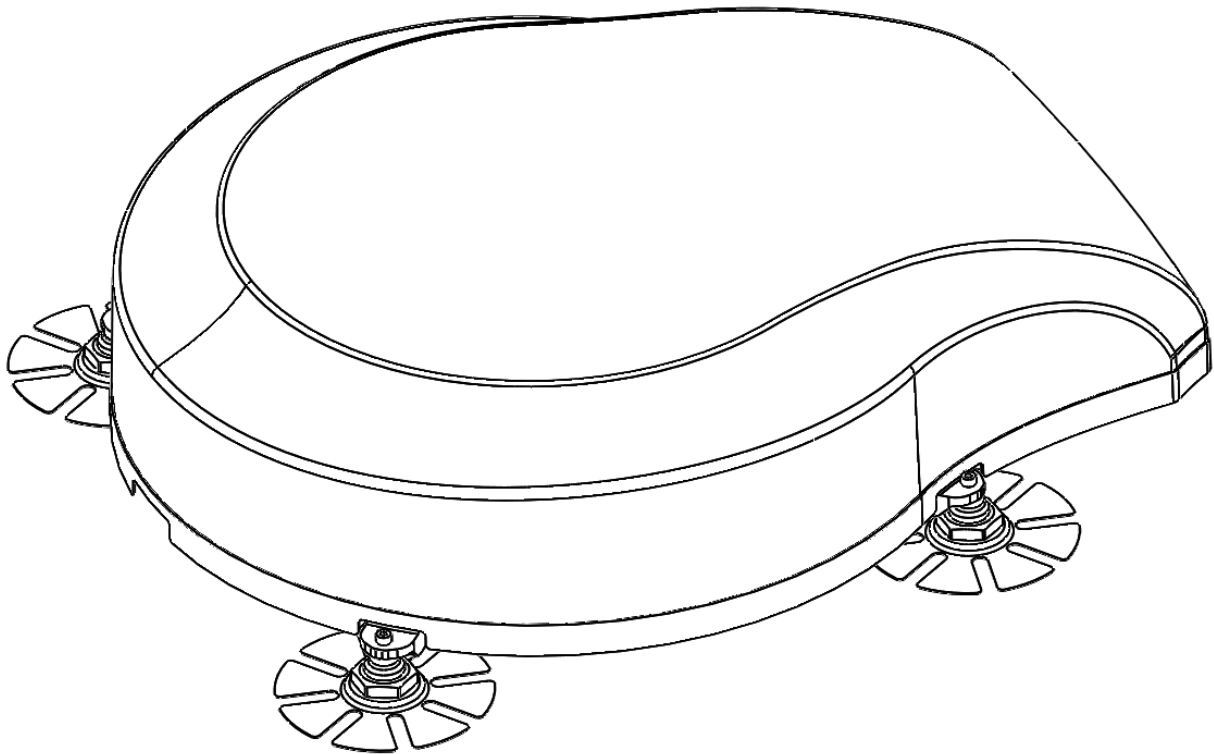
Figure 5-5: Bonding adapter Plates Connection

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5.5 Cables Laying and Connection

NOTE: Turn off all equipment power before connecting any cable.

Table 5-1: Cable Connections List

Module	Connector Type	Connector Mark	Functionality
Out-cabin Unit	F-Type	None	In-cabin Unit (ACU) interface
ACU	Fuse box	FUSE	Fuse holder
ACU	SMA	WIFI-ANT	Wi-Fi antenna interface
ACU	IEC inlet plug	85-264VAC 50/60Hz	AC power input
ACU	RJ45 socket	LAN1	Internal modem LAN
ACU	SMA	Bluetooth-ANT	Bluetooth antenna interface
ACU	F-Type	ANTENA	Out-cabin Unit interface

Proceed the following steps for cables laying and connection:

1. Connect the RG6 coaxial cable to the Out-cabin Unit.

NOTE: There is only one cable connection between the Out-cabin Unit and the In-cabin
      Unit (ACU). This cable connection provides:
          - PoC (Power over Coax) supply from ACU to the Out-cabin Unit,
          - Transfer of receiving L-band signals from Out-cabin Unit to ACU,
          - Transfer of transmitting IF (Intermediate Frequency) signals from ACU
         to Out-cabin Unit.

2. Lead the coaxial cable into the vehicle cabin.

NOTE: Do not pull the cable by its connector.
         Do not bend the cable sharply when pulling it into the vehicle.

3. Install the ACU, Modem and other equipment into a rack, fixed inside the vehicle cabin.

NOTE: Conduct and arrange the cables neatly and securely to prevent their tension or
          shaking during the vehicle movement and to ensure the reliable connections.
          Do not fold or pull the cable forcibly.
          Avoid or minimize the number of cable bends during the installation.
         If any cable bend is required, it should be done by wide arc.
         This is the only way to ensure that there is no cable damage or negative impact on
         the satellite signal.

4. Connect the cable from the Antenna to the ACU "ANTENNA" interface, located at ACU rear panel (Figure 5-6).

Figure 5-6: ACU Rear Panel

NOTE: The ACU can include an integrated modem.
   One of the above options excludes the use of the other one.
   If the ACU adopts the integrated modem, the external network equipment shall be connected to ACU LAN Interface or to ACU Wi-Fi network.
   However, if an external modem is used the ACU "LAN1", and Wi-Fi interfaces are not functional.

NOTE: If ACU contains an integrated modem, ignore the following two steps and proceed to step #7.
   However, if ACU is designated for use with an external modem execute the following steps:

5. Connect the Bluetooth and Wi-Fi antennas to their corresponding interfaces, located at ACU rear panel.
6. Verify the correctness of all cable connections.
7. Verify the cables are not broken, pinched, or have any other damage.
8. Verify all cables are securely connected to the devices.
9. Connects to the ACU chassis through the pintail power cable to provide power to the equipment..
10. Connect the other end to the power cable to the vehicle Power Supply system.

NOTE: Power to the entire system is provided by power cable through AC IN interface, located at ACU rear panel.

6 System Initialization and Operation

6.1 ACU front Panel Controls

ACU front panel controls are shown at Figure 6-1.
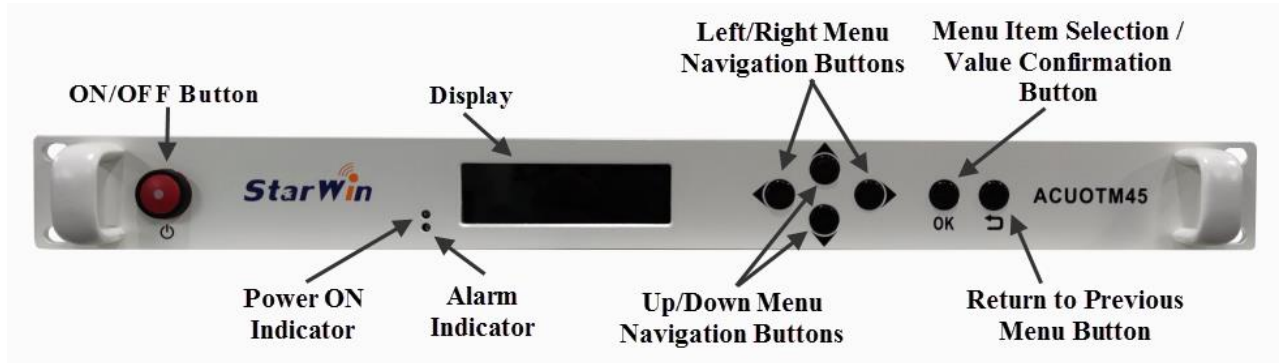
Figure 6-1: ACU Front Panel Controls

6.2 System Initialization

Pressing ON/OFF button at the ACU front panel (Figure 6-1) powers the system.
The Power ON Indicator lights. ACU Display indicates the system initialization process as shown at Figure 6-2.

Figure 6-2: ACU display indication during the system initialization

Upon initialization completion, ACU will display the system management main menu as shown at Figure 6-3.
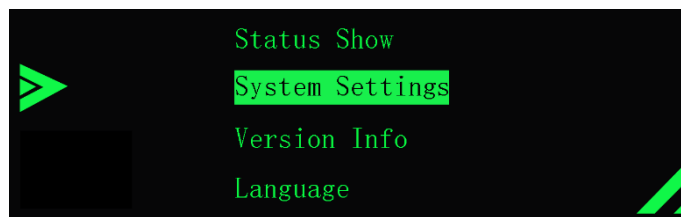
Figure 6-3: System Management Main Menu

There are three options for system Management and Control (M&C):
      1. By ACU front panel controls;
      2. By smart phone or palm device application via Bluetooth connection;
      3. By PC application via LAN or Wi-Fi connection.

NOTE: M&C via Wi-Fi connection is available for ACU with built-in modem only.

6.3 System M&C by ACU Front Panel Controls

The ACU display menu has hierarchical structure, divided into four submenu items: "**Status Show**", "**System Settings**", "**Version Info**" and "**Language**", as shown at Figure 6-3, with corresponding functionality of each of them.

NOTE: Use the Up/Down and Left/Right ACU front panel buttons to navigate through ACU Display menu items.
Use Item Selection/Value Confirmation "OK" button to select a highlighted menu item or parameter for viewing its current status or editing its value.
Use the "Return to Previous Menu" button to exit current menu item to a previous one.

The display cursor sign ▷ indicates which submenu item or parameter value is accessible by pressing the "Navigate to the Right" button.

The display cursor sign ◁ indicates which submenu item or parameter value is accessible by pressing the "Navigate to the Left" button.

For the first time of the system use, it is necessary to set up several its parameters to initiate the antenna operation, satellite searching, pointing and acquisition.

GNSS Information interface:

The system automatically recognizes its geographical position under the "open sky", when it is able to receive GNSS signals. The detailed positioning information is displayed as shown at Figure 6-4.
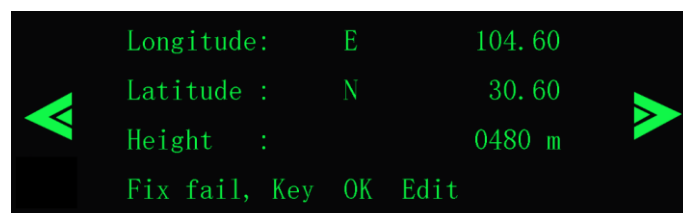
Figure 6-4: Detailed Positioning Information Display

In case when the GNSS receiver fails to provide the positioning information navigate to "**Fix fail**" by means ACU front panel navigation and selection buttons.
Confirm or edit the position displayed at GNSS Information interface by navigating to "**OK**" or "**Edit**" by means ACU front panel navigation and selection buttons.

**NOTE: Use the ACU front panel "Left" and "Right" navigation keys to navigate between System State, GNSS and Satellite Information menu items at the ACU Display.
Use the ACU front panel "OK" key to edit and/or confirm the selection.**

System State Information interface:

System State Information interface includes the current operational status of the system: AGC, SNR, AT STATE, Built-in Modem status and GNSS status as shown at Figure 6-5.
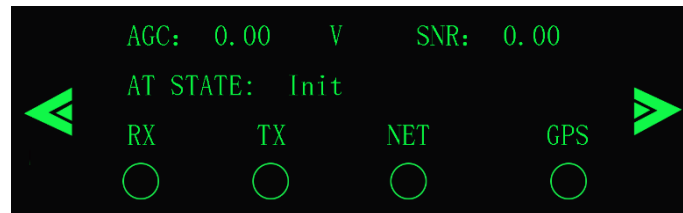

Figure 6-5: Status Show ACU Display Interface

- **AGC** (Automatic Gain Control) displays the received signal level of the internal Beacon/Carrier receiver. Values range: 0 - 10V.
- **SNR** displays the Signal to Noise Ratio, detected by internal Beacon/Carrier receiver. Values range: 0 - 15.
- **AT STATE** displays the current Antenna Tracking state. Available values: **Init** (Initialization), **Search** (Searching), **Lock** (Locked), **Error.**
- **RX, TX, NET:** the green fill of circular points indicates the presence of successful Activity at the corresponding interface of the built-in modem (**RX** - Receiving, **TX** -Transmitting, **NET** - Connection to Network over Satellite).
- **GPS:** the green fill of circular points indicates the successful reception of positioning information by internal GNSS receiver.

Satellite Information interface:

Satellite Information interface displays the information about currently used satellite and received channel as shown at Figure 6-6.
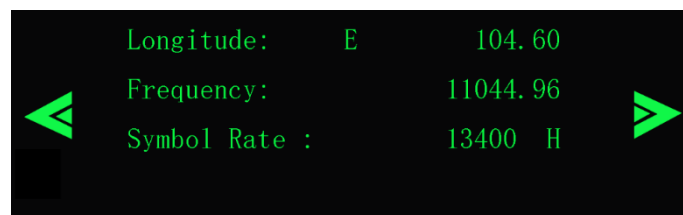
Figure 6-6: Current Satellite Information Display

Select, edit, add or delete the data of a satellite and received channel to be used.
If the external modem is used, enter the related receiving signal parameters values:
- **Longitude:** Satellite position at geostationary orbit.
  Values: E (East) or W (West); Range: 0 - 180°.
- **Frequency:** Receive Frequency in MHz,
- **Symbol Rate:** Channel Symbol Rate in Ksymb/s, followed by Polarization: **V** (Vertical) or **H** (Horizontal).
Confirm the selected, added or edited data by pressing "OK" button.

If the ACU has built-in modem, supporting the OpenAMIP, the related receiving signal parameters values are automatically transferred to ACU from the modem.

NOTE: OpenAMIP is an ASCII-message based protocol that facilitates information exchange between ACU and built-into it Modem.
Some modems support OpenAMIP, but some do not.
If the built-n modem doesn't support OpenAMIP, the information exchange between it and ACU is impossible. In such case ACU will not be able display any modem related information.
Consult modem provider for details.

System Settings menu:

System Settings menu items (Figure 6-7) are used for various operational parameters definition, such as "**Satellite Setting**", "**Protection Function**", "**Modem Setting**" and "**Factory Reset**".
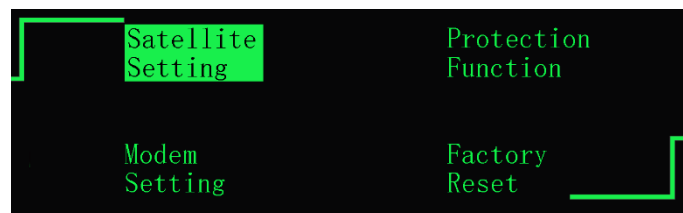
Figure 6-7 System Setting Configuration Display

Satellite Setting interface:

Satellite Setting menu item allows selecting, editing, adding and deleting satellites for system operation and store them in the list. Up to 99 satellites and their related data can be stored in the list.
Navigate and select the required action via submenu items shown at Figure 6-8.
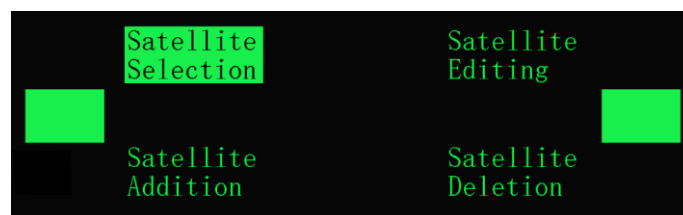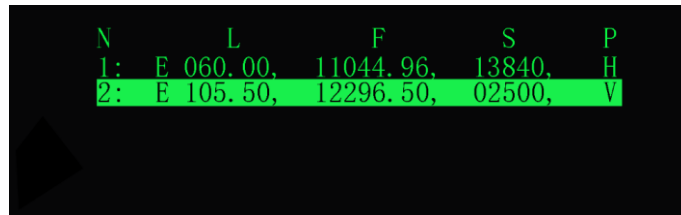
Figure 6-8: Satellite Configuration Submenu Items

Satellite Selection function is assigned for selection of existing record from the list of available satellites to activate it for use by antenna system. To select a record from the list, shown at Figure 6-9, move the highlighting to **Satellite Selection** (Figure 6-8) by pressing ACU front panel "**Up**" or "**Down**" navigation keys and press "**OK**" key for confirmation.

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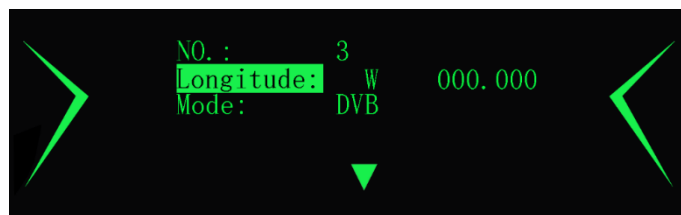
Figure 6-9: Satellite Selection Display

The columns in this item represent:

        N: Number - number of the record;
        L: Longitude - satellite position at geostationary orbit;
        F: Frequency - receive channel frequency;
        S: Symbol rate - symbol rate of the receive channel;
        P: Polarization - polarization of the receive channel.

Satellite Addition function allows adding a new satellite list record.
To add a satellite list record, navigate to the **Satellite Addition** function (Figure 6-8) by pressing ACU front panel "**Up"** or "**Down"** navigation keys and press "**OK**" key for confirmation. Enter the corresponding values of the new satellite as shown at Figure 6-10 and press "**OK**" key for confirmation.

Figure 6-10: Satellite Record Adding or Editing Display

    - **NO.:** - number of the record is added automatically;
    - **Longitude:** - satellite position at geostationary orbit;
    - **Mode:** - the internal receiver operational mode.
        Available values: **Beacon**, **DVB** (TV Carrier), **Signal Carrier** (DVB-S/S2/S2X Constant Coding and Modulation Carrier).

When the **Mode** value is confirmed, the next set of parameters, described above is displayed: **Frequency**, **Symbol rate** and **Polarization**.

Satellite Editing function allows changing parameters of an existing satellite list record. To edit a satellite list record, navigate to the **Satellite Editing** function (Figure 6-8) by pressing ACU front panel "**Up"** or "**Down"** navigation keys and press "**OK**" key for confirmation. Change the corresponding satellite data as shown at Figure 6-10 and press "**OK**" key for confirmation.

Satellite Deletion function is assigned for deletion of an existing record from the list of available satellites. To delete a record from the list move the highlighting to **Satellite Deletion** (Figure 6-11) by pressing ACU front panel "**Up**" or "**Down**" navigation keys and press "**OK**" key for confirmation.
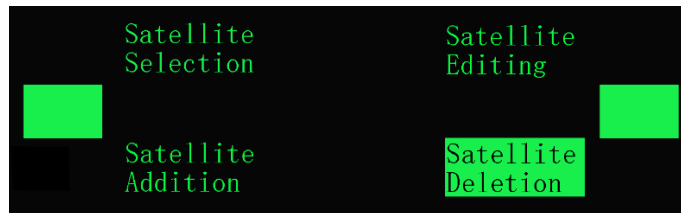
Figure 6-11: Satellite Record Deletion item

Move the highlighting to the required record line (Figure 6-12) by pressing ACU front panel "**Up**" or "**Down**" navigation keys and press "**OK**" key for confirmation.
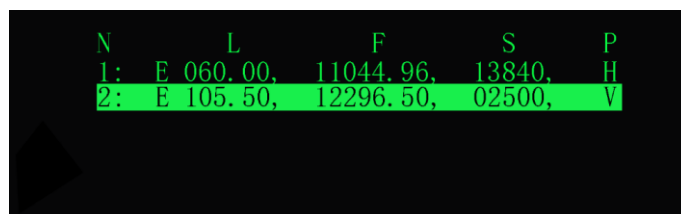
Figure 6-12: Satellite Record Deletion selection

Select the required action, shown at Figure 6-13, by pressing the "**Left**" and "**Right**" navigation keys at the ACU Front Panel and press "**OK**" button for confirmation.
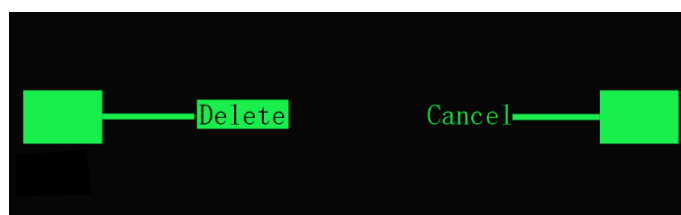
Figure 6-13: Satellite Record Deletion confirmation interface

Protection Function allows the vehicle battery protection from discharging during the motion pause. To configure **Protection Function** select this option from **System Settings** menu moving the highlighting to it by navigation keys at the ACU Front Panel and pressing "**OK**" button for confirmation. Select one of the following options:

Enabled - the battery is completely protected from discharging when the vehicle engine does not run and the ignition key is in ACC (Accessories) position during the motion pause. In such configuration, the V9 OTM45 does not consume power from the vehicle electrical circuit.

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Disabled - the battery power is supplied to V9 OTM45 when the vehicle engine does not run and the ignition key is in ACC (Accessories) position during the motion pause. However, the V9 OTM45 is automatically disconnected from the vehicle electrical circuit when the battery voltage drops down to the defined value in **Voltage Protection** parameter as shown at Figure 6-14.
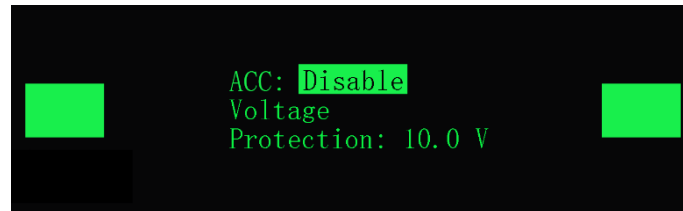
Figure 6-14: "ACC Protection" Value Definition Display

Modem Settings submenu items allow definition of modem related parameters to ensure its correct integration with the system and proper operation. To configure **Modem Settings** select this item from the **System Settings** menu (Figure 6-7), moving the highlighting to it by navigation keys at the ACU Front Panel and pressing "**OK**" button for confirmation.

The **Modem Settings** submenu (Figures 6-15 and 6-16) includes the following parameters: **Modem Mode**, **Auto Beam Switching**, **Beam Locking**, **IP Address**, **Subnet Mask**, **Gateway IP** and **Port Number**.
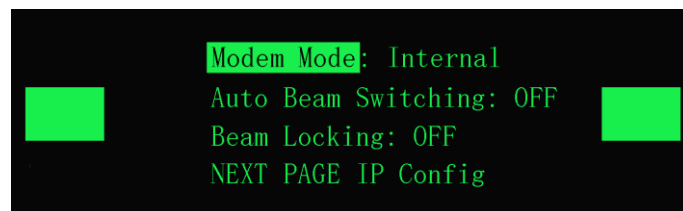
Figure 6-15: Modem Configuration Menu Items Display

Modem Mode value selection should correspond to the modem use case:

- **External:** this value corresponds to the use case of ACU, without a built-in modem. This value selection makes the rest of **Modem Settings** submenu items inactive, since they cannot be configured via the system.

- **Internal:** this value corresponds to use case of ACU with a built-in modem. This value selection stipulates the need of the rest **Modem Settings** menu items changing or confirmation.

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Auto Beam Switching value defines the built-in modem Automatic Beam Switching (ABS) feature behavior:

- **ON** – enables modem **Automatic Beam Switching** (ABS) functionality.
ABS transfers connectivity from the current satellite (beam) to the next in the **Satellite List** while the V9 OTM45 system passes through multiple footprints and loses the receiving signal for a period, defined in the modem parameter "**Out of Network Timer**".
This causes the modem resetting and loading configuration file for operation via the next satellite (beam) in the **Satellite List**.

- **OFF** – disables modem **Automatic Beam Switching** functionality.

Beam Locking value defines the behavior of the modem parameter "**Out of Network Timer**", which starts every time the receiving signal is lost, while the ABS is turned on.

- **ON** - suppresses the "**Out of Network Timer**" activation at the modem while the ABS is turned on. The modem remains locked on the currently operational satellite beam until **Beam Locking** is manually swapped to "**OFF**" or modem will reset. After reset modem starts beam searching with the lowest numbered Satellite (beam) first.

- **OFF** - the "**Out of Network Timer**" in the modem, starts every time the receiving signal is lost, while the ABS turned on. If the receiving signal doesn't return before the defined by the timer period ends up, the turned on ABS functionality becomes active.
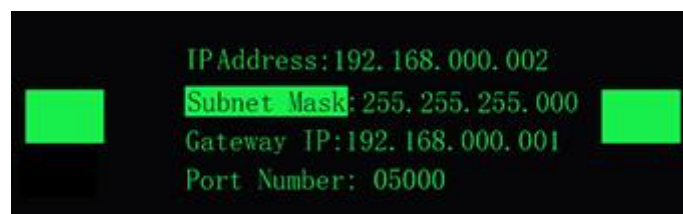
Figure 6-16: Modem Settings Items Display

IP Address, **Subnet Mask, Gateway IP and Port Number** define network parameters of the ACU used for communication with the modem.
These values are relevant only for the built-into ACU modem.

Reset to Factory Defaults submenu item allows cleaning up all values previously stored at ACU.

NOTE: Beware of using this option. Only experienced personnel can use it.
  Confirming selection of this option will delete all values previously stored at ACU.

Version Info menu interface assigned to view the system Hardware and Software versions.
It displays the read-only information as shown at Figure 6-17.
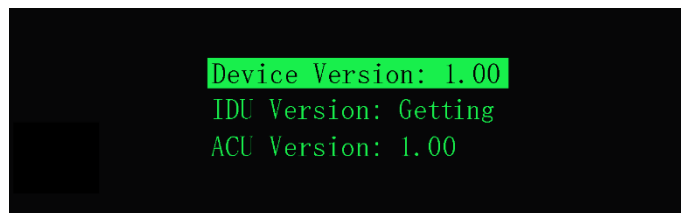
Figure 6-17: Version Information

Device Version indicates the device version number;
IDU version indicates the master control software version number;
ACU version indicates the ACU software version number;

This information is used mainly for equipment troubleshooting.
If the version information is not obtained, the "**Getting**" status will be displayed.
Version Info values are set at the factory and cannot be changed.

Language menu (Figure 6-18) is assigned for ACU Interface Language selection.
Currently only English and Chinese languages supported.
To select the required language move highlighting to it by pressing the "**Left"** and "**Right"**
navigation keys at the ACU Front Panel and press "**OK**" button for confirmation.
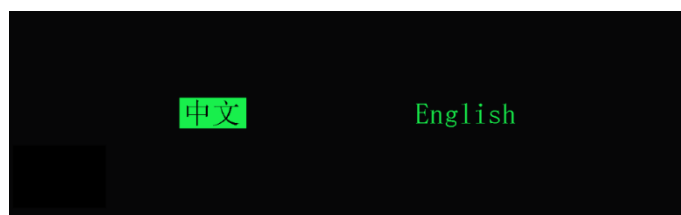
Figure 6-18: Language selection menu

7   V9 OTM45 M&C Application for Windows OS PC

7.1   M&C Application Downloading and Installation

V9 OTM45 M&C Application for PC can operate on PC with installed Windows 7/8/10 operational systems.

Download V9 OTM45 M&C Application software at Web site:
http://www.starwincom.com/Support
Use the password for download, received from support@starwincom.com.

Unzip the downloaded archive **V9 OTM45_M-C_PC Version_R1.zip**
Unzipped archive includes the **V9 OTM45_Host computer** folder as shown at Figure 7-1.

Name ▲	Date modified	Type	Size
OTM45_Host computer	12-Feb-21 21:16	File folder	
OTM45_M-C_PC Version_R1.zip	08-Feb-21 08:55	WinZip File	70,138 KB

Figure 7-1: Unzipped archive V9 OTM45_M-C_PC Version_R1.zip

V9 OTM45 M&C Application software does not require installation. However, for normal V9 OTM45 M&C Application operation **Microsoft NET Framework 4.7.2** should be installed. If **Microsoft .NET Framework 4.7.2** environment is not installed, it can be downloaded at Web site: http://go.microsoft.com/fwlink/?linkid=863262
Upon downloading the file: **NDP472-KB4054531-Web.exe**, run it and follow the installation instructions.
Microsoft .NET Framework 4.7.2 environment can be also installed offline. To do that, open the **V9 OTM45_Host computer** folder shown at Figure 7-1 and unzip the archive **NET47 environment offline installation.zip**, shown at Figure 7-2.

Name ▲	Date modified	Type	Size
soft	12-Feb-21 21:16	File folder	
NET47 environment offline installation.zip	05-Feb-21 11:19	WinZip File	69,838 KB
WindowsFormsApp1.exe - 快捷方式	05-Feb-21 15:51	Shortcut	2 KB

Figure 7-2: Archive with Environment Installation

Open the **NET47 environment offline installation** folder shown at Figure 7-3.

Name ▲	Date modified	Type	Size
NET47 environment offline installation	12-Feb-21 22:38	File folder	
soft	12-Feb-21 21:16	File folder	
NET47 environment offline installation.zip	05-Feb-21 11:19	WinZip File	69,838 KB
WindowsFormsApp1.exe - 快捷方式	05-Feb-21 15:51	Shortcut	2 KB

Figure 7-3: NET47 Environment Installation Folder

Run the **NDP472-KB4054530-x86-x64-AllOS-ENU.exe** file, shown at Figure 7-4, and follow installation instructions.

Figure 7-4: NET47 Environment Offline Installation File

7.2 M&C Application Communication with V9 OTM45

The M&C Application communicates with the V9 OTM45 via the computer network port.

The **V9 OTM45 ACU default IP address is 192.168.16.101**. To communicate with V9 OTM45:
- Navigate to **Control Panel\Network and Internet\Network Connections\Local Area Connection;**
- Select **Internet Protocol Version 4 (TCP/IPv4);**
- Click **Properties** and select **Use the following IP address** as shown at Figure 7-5.
- Set the PC IP address to be at the same subnet with V9 OTM45 default IP address, mentioned above.
- Set **Subnet mask 255.255.255.0** and click **OK** button.
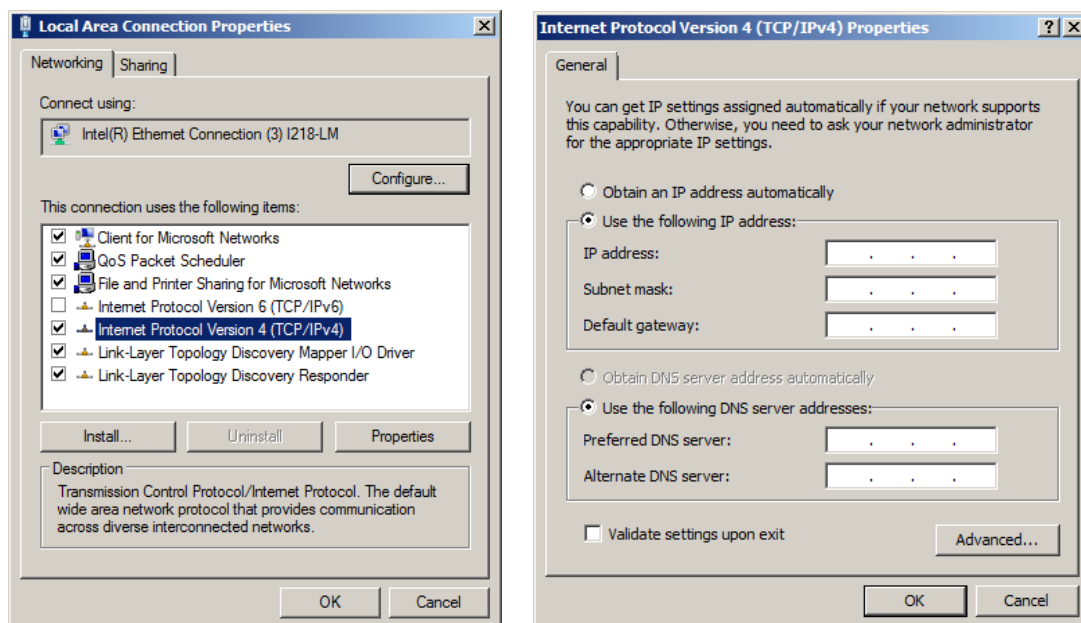
Figure 7-5: PC Network Setting

NOTE: If the V9 OTM45 ACU default IP address is modified, the PC IP Address should be Modified correspondingly.

7.3   Running M&C Application

To run the **V9 OTM45 M&C Application** open the unzipped folder: "**V9 OTM45_Host computer**" shown at Figure 7-6.

Name ^	Date modified	Type	Size
OTM45_Host computer	12-Feb-21 21:16	File folder	
OTM45_M-C_PC Version_R1.zip	08-Feb-21 08:55	WinZip File	70,138 KB

Figure 7-6: Running Environment

Open **soft** folder as shown at Figure 7-7.

Name ^	Date modified	Type	Size
NET47 environment offline installation	12-Feb-21 22:38	File folder	
soft	12-Feb-21 21:16	File folder	
NET47 environment offline installation.zip	05-Feb-21 11:19	WinZip File	69,838 KB
WindowsFormsApp1.exe - 快捷方式	05-Feb-21 15:51	Shortcut	2 KB

Figure 7-7: Running Environment

Run the **V9 OTM45 M&C Application** by double clicking the file: "**Windows FormApp1.exe**".

Name ^	Date modified	Type	Size
update	12-Feb-21 21:16	File folder	
WindowsFormsApp1.exe	05-Feb-21 15:50	Application	6,881 KB
WindowsFormsApp1.exe.config	22-Sep-20 17:06	CONFIG File	1 KB
WindowsFormsApp1.pdb	05-Feb-21 15:50	PDB File	162 KB

Figure 7-8: V9 OTM45 M&C Application program file

7.4 M&C Application Operation Description

Upon running, the M&C Application opens the main interface shown at Figure 7-9.
The M&C Application main interfaced provides the V9 OTM45 operational parameters monitoring and their values updating in real-time.

Upon M&C Application opening, connect to the V9 OTM45 ACU by entering the ACU IP Address, Port Number and clicking the **Connect** button (Figure 7-10).
The default V9 OTM45 ACU IP Address is 192.168.16.101. The default port is 5001.
Upon successful connection, the **Connect** button changes to **Disconnect** and the interface data starts automatically refreshing in real-time.

NOTE: If the default V9 OTM45 ACU IP address and/or Port number were previously modified, enter the modified data to the corresponding application fields.
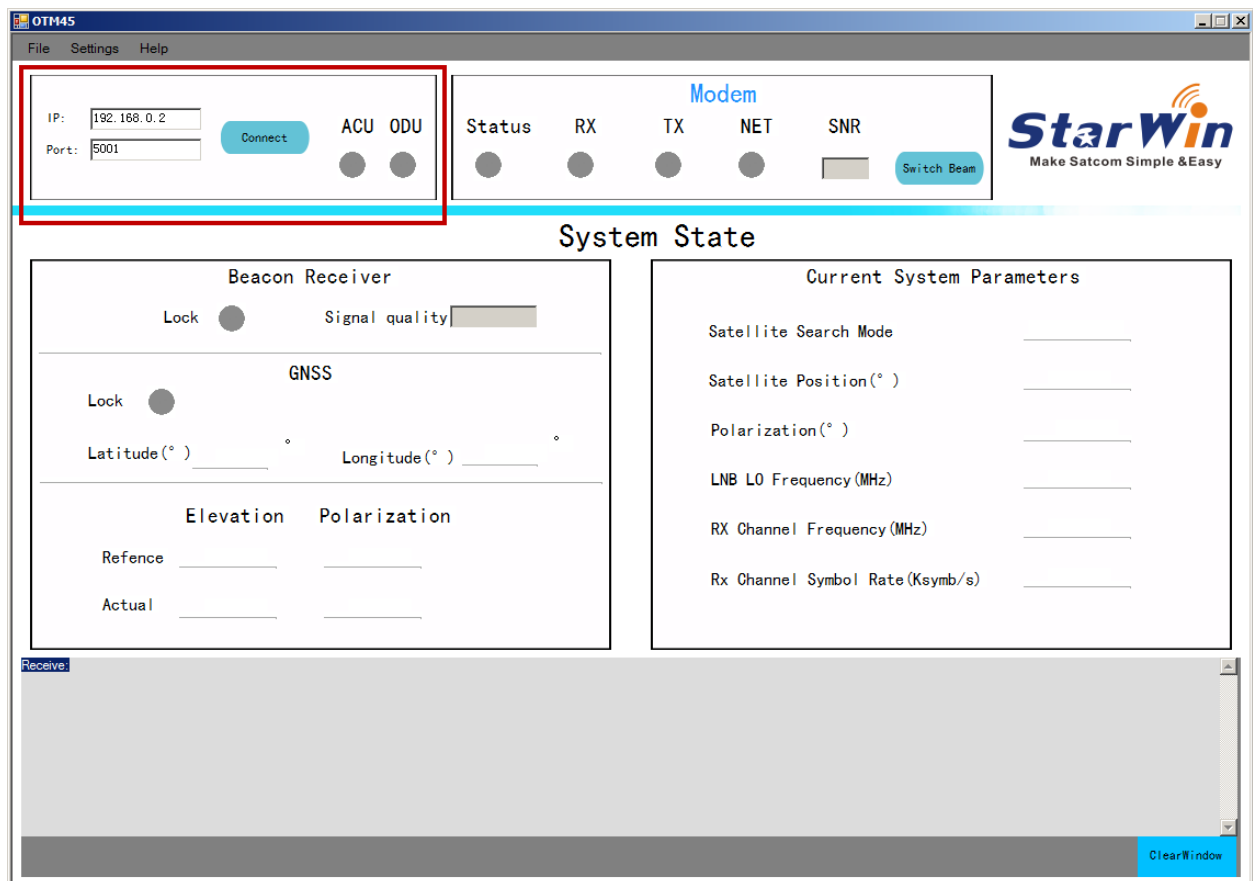

Figure 7-9: ACU IP Address and Port Number in M&C Application

M&C Application interface consists of seven functional sections (Figure 7-9):

1. **Menu bar** at the top of application interface.

2. **Connection** parameters configuration, control and indication section, located at the left side of the application interface under the Menu bar.

3. **Modem** functionality indication and Beam Switching control section, located at the right side of the application interface under the Menu bar.

NOTE: The Modem functionality indication and Beam Switching control section is active for systems with built-in modem ONLY.

4. **System State** real-time monitoring, located in the middle of application interface.

5. **Beacon Receiver** and **GNSS** parameters section, located on the left in the mid of application interface.

6. **Current System Parameters** section, located on the right in the mid of application interface.

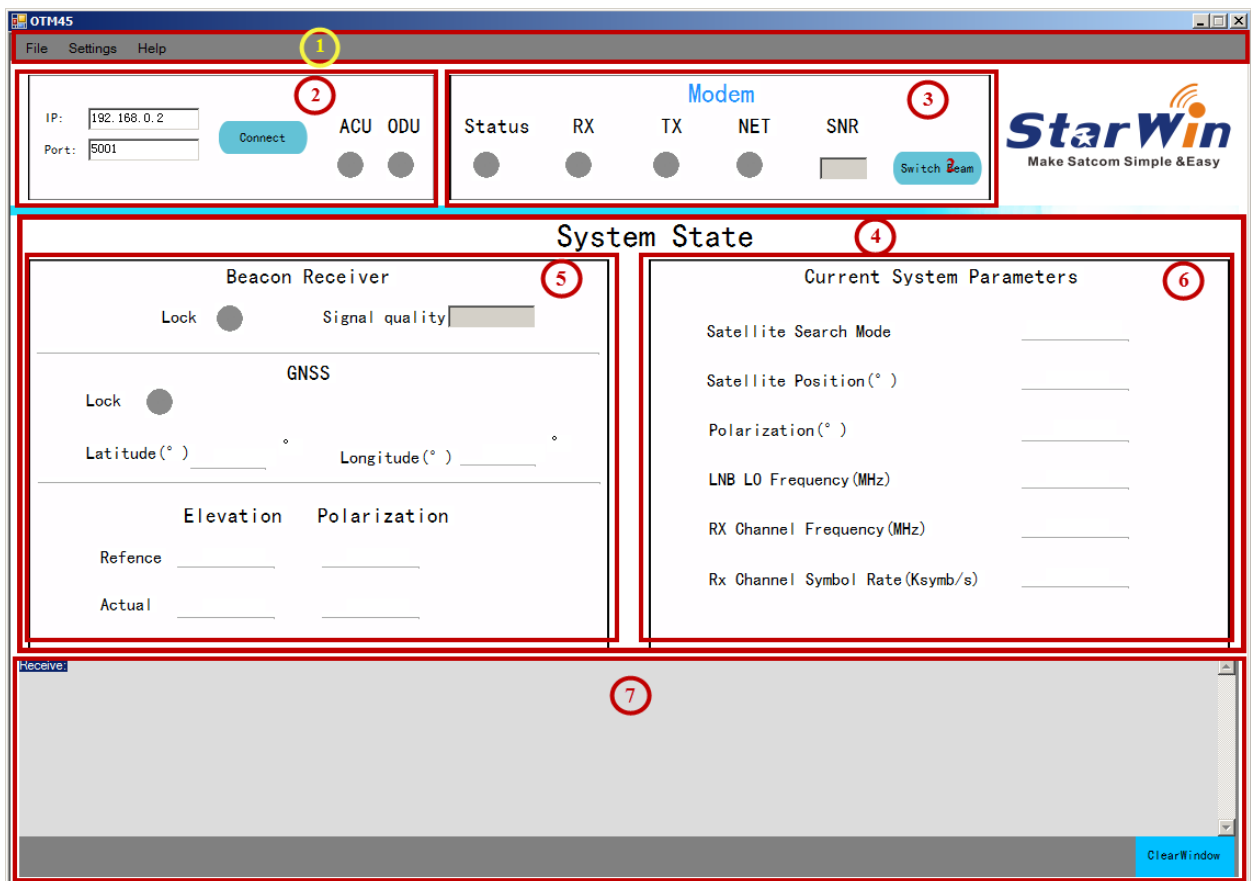7. **Event Log**, located at the bottom of the application interface.

Figure 7-10: M&C Application Main Interface

Menu Bar functions provide:
- Application control,
- System operational parameters configuration,
- System service and maintenance,
- Link for communication with company Technical Support Department,
- Information about the System components Hardware and Software versions,
- Company information.

File submenu includes **Exit** item shown at Figure 7-11, which closes the Application.
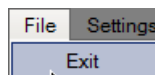

Figure 7-11: File Submenu Exit Item

Settings submenu includes items shown at Figure 7-12: ACU IP Configuration, Search Settings, Modem Settings, Service Mode, Battery Protection Settings.
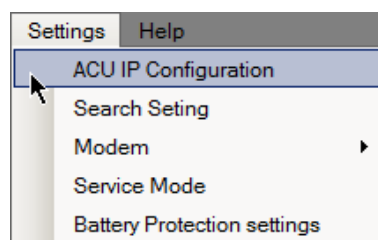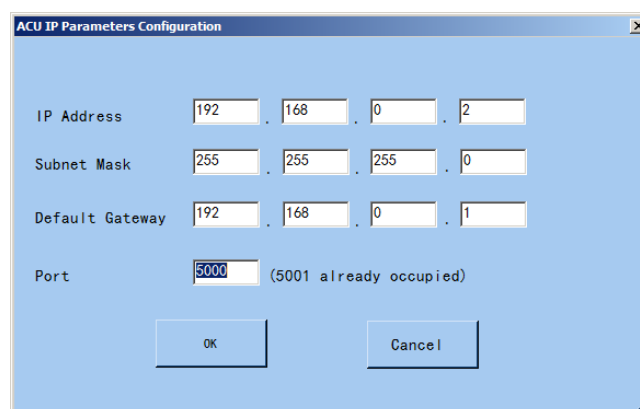

Figure 7-12: Settings Submenu Items

ACU IP Configuration modification (Figure 7-13) may be required when the built-in Modem IP configuration changes. ACU IP parameters have to be at the same IP subnet with built-in Modem to communicate with it.
Set corresponding ACU **IP Address**, **Subnet Mask**, **Default Gateway** and communication **Port** number and click **OK** button to apply the changes.
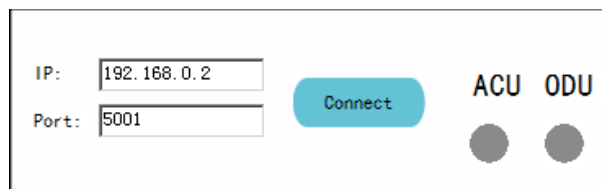

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![StarWin logo]

Figure 7-13: ACU IP Parameters Configuration

NOTE: If the default V9 OTM45 ACU IP address and/or Port number are modified, change
the PC Network configuration correspondingly and update ACU IP address and Port number in M&C Application Connection parameters (Figure 7-14).
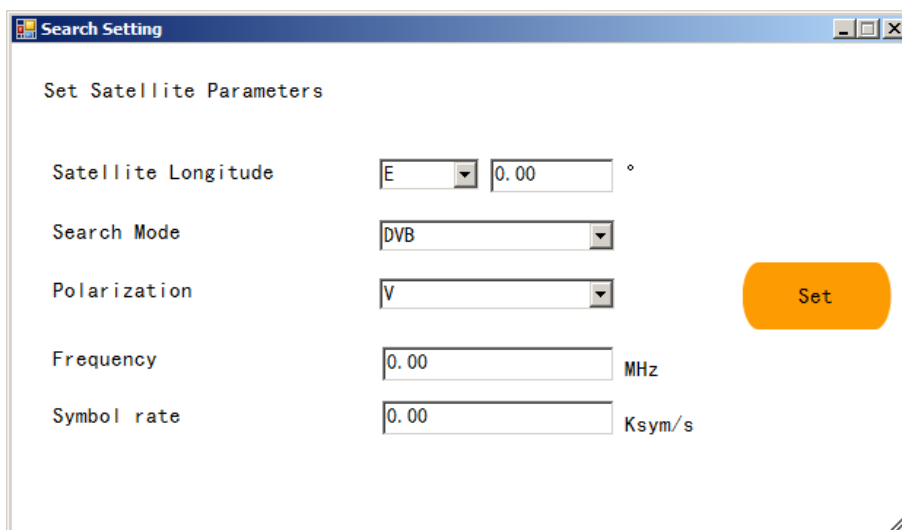

Figure 7-14: ACU IP Address and Port Number in M&C Application

Search Settings submenu item opens the interface form with parameters required for satellite searching (Figure 7-15):
- **Satellite Longitude** - satellite position at geostationary orbit,
  Values: **E** (East) or **W** (West); Range: 0 - 180°.
- **Mode** - the internal receiver operational mode.
  Values: **Beacon**, **DVB** (TV Carrier), **Signal Carrier**
  (DVB-S/S2/S2X Constant Coding and Modulation Carrier).
- **Polarization** - polarization of the receive channel signal.
  Values: **V** (Vertical) or **H** (Horizontal).
- **Frequency** - receive channel frequency in MHz,
- **Symbol rate** – receive channel Symbol Rate in Ksymb/s

Select and enter parameters to initiate the satellite searching, and click **Set** button. The applied settings displayed in **Event Log**, located at the bottom of the M&C Application interface.

Figure 7-15: Satellite Search Settings

Modem selection (Figure 7-16) must correspond to the modem in use, Internal or External.
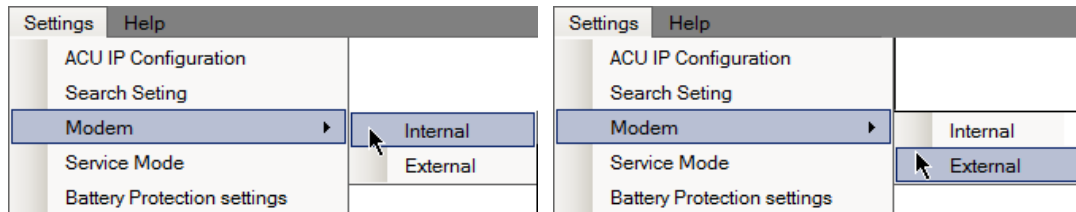

Figure 7-16: Modem Selection

Battery Protection Settings submenu item allows definition of battery protection voltage as shown at Figure 7-17.
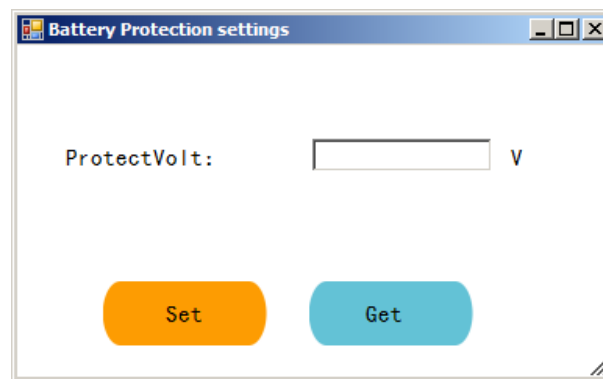

Figure 7-17: Battery Protection Settings

Service Mode submenu item is assigned for use at Factory or by authorized technical personnel ONLY, and therefore is protected by password (Figure 7-18).
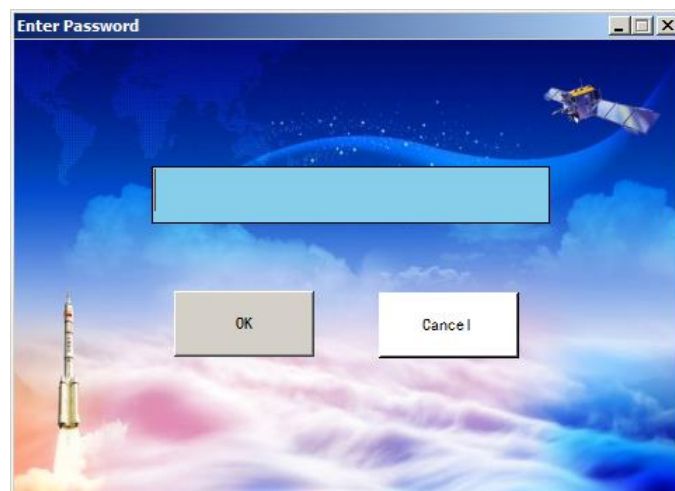
Figure 7-18: Enter Password popup form

Upon entering the correct password, and clicking **OK** button at the **Enter Password** popup form, an additional item **Factory** is displayed in M&C Application interface Menu Bar as shown at Figure 7-19.

Figure 7-19: Factory Item in Menu Bar

Factory item includes Factory Settings, Factory Reset, Upgrade and Debug submenus, as shown at Figure 7-20.
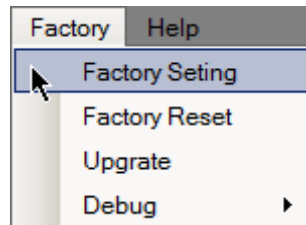

Figure 7-20: Factory Submenu Items

- **Factory Settings** submenu item selection opens form, shown at Figure 7-22, allowing V9 OTM45 component parts Serial Numbers reading and writing, as well

as current ACU and ODU versions numbers display.
To display Serial Numbers click **Get SN** button.
To change a Serial Number perform required changes and click **Set SN** button.
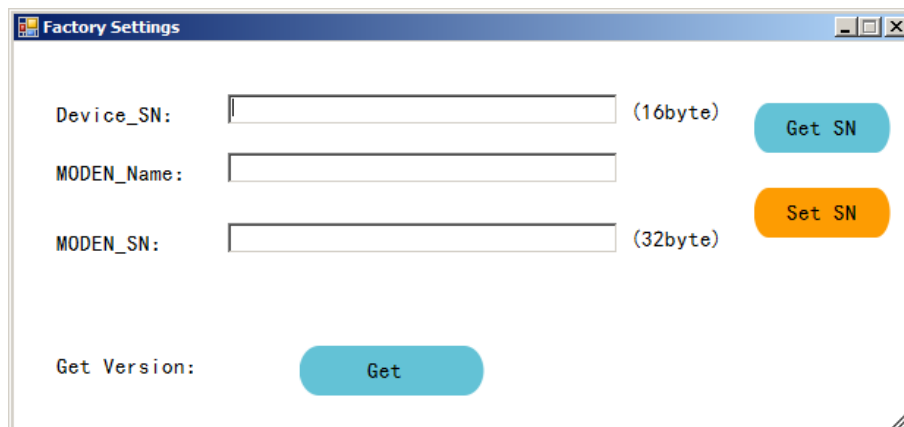To display current versions of ACU and ADU click **Get Versions** button.

Figure 7-22: Factory Settings Form

- **Factory Reset** submenu item selection allows to restore ACU factory settings.

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Upon this item selection "**Confirm recovery?**" popup form with **Yes** and **No** Buttons is displayed (Figure 7-23).
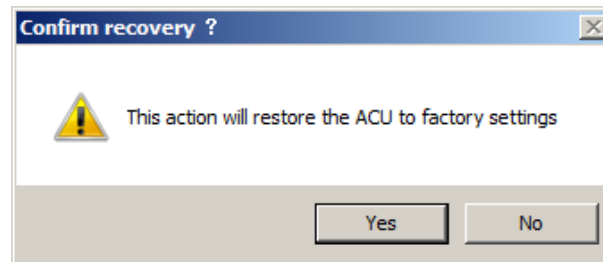

Figure 7-23: Factory Reset Confirmation Popup Form

- **Upgrade** submenu item allows Management Control Units - MCU (ACU or Master Control) software upgrade. The **Upgrade** item selection opens **Flash Update** form, shown at Figure 7-24.
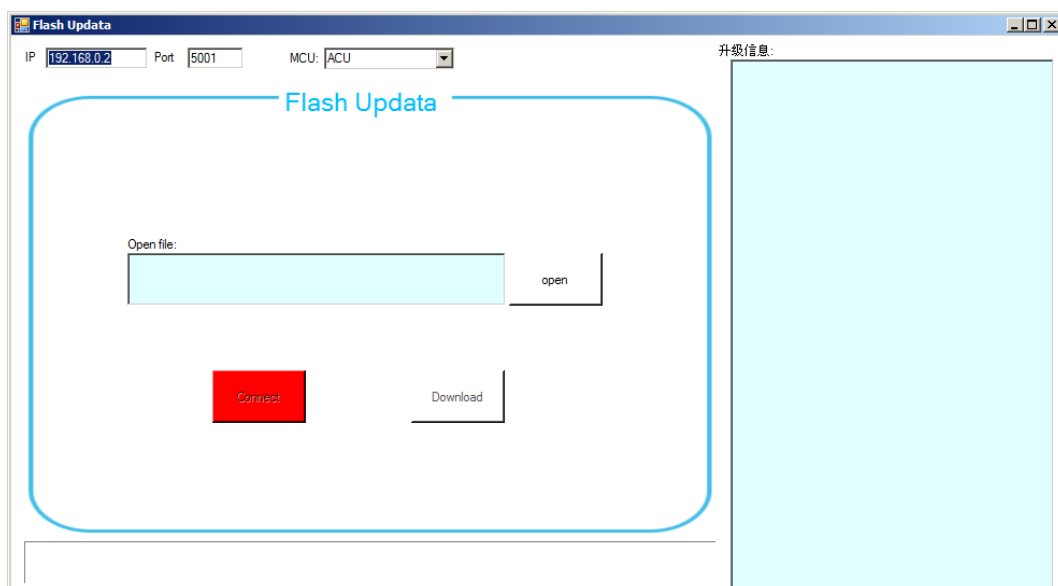
Figure 7-24: Flash Update Form

To perform ACU or Master Control version upgrade:

1. Enter the current ACU IP address and communication port number into corresponding fields of the Flash Update form, if one of them or both differ from their default values (192.168.16.101; 5001), or perform Factory Reset (may require change of the PC IP address).

2. Select the necessary value from the MCU dropdown list.
   There are two types of MCUs: ACU and Master Control.

3. Click Open File button to select the corresponding file, preliminary copied to

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the connected PC. An error popup prompt will appear if a wrong file is opened.

NOTE: Do not make repeated choices after selecting the file.

4. Click **Connect** button. After successful connection, the button changes to **Disconnect** and the corresponding message is displayed in **Upgrade Log** section at the right.

5. Click **Update** button to start the Flash Update process. The process information is displayed in the **Upgrade Log**.

NOTE: Do not click the Update button repeatedly and do not use other functions during the upgrade process.

- **Debug** submenu item Enables (**ON**) and disables (**OFF**) Debugging Mode. In Debugging Mode the real time OpenAMIP communication messages are displayed in Event Log section of M&C Application.

Help submenu includes Support and About items as shown at Figure 7-25.

Support item selection provides the Technical Support Department contact information.

About item selection provides the company information and contacts.

Figure 7-25: Help submenu items

Connectivity control and indication section shown at Figure 7-26 is located on the left of M&C Application interface below the Menu bar. The section includes:

- **ACU IP Address** field defines ACU IP for communication with M&C Application.

- **Port** number field defines ACU communication port through which it will exchange the Data with M&C Application.

- **Connect/Disconnect** command button, managing the connection between the M&C Application and ACU.

- **ACU** connection indicator. The flashing green light indicates normal data exchanges between M&C Application and ACU.

- **ODU** connection indicator. The green flashing light indicates the successful

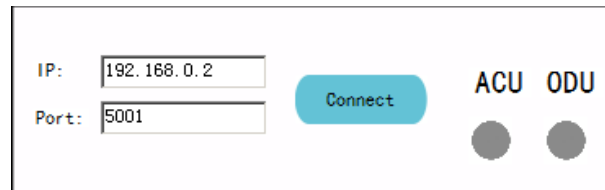communication between ACU and ODU (Out-Door Unit) control board.

Figure 7-26: Connectivity Control section of M&C Application

Modem functionality and Beam Switching section shown at Figure 7-27 is located on the right side of M&C Application interface below the Menu bar. The section displays the built-in modem current functionality:

- **Status**: Indicates built-in modem powering status ON/OFF
- **RX**: Indicates built-in modem receiving status
- **TX**: Indicates built-in modem transmitting status
- **NET**: Indicates the built-in modem successful satellite network connectivity
- **SNR**: Shows received signal to noise ratio of the built-in modem
- **Switch Beam**: Manual Satellite/Beam switching button. Clicking the button, the system switches to the next Satellite/Beam in the list.　The ACU response to this command is displayed in Event Log.
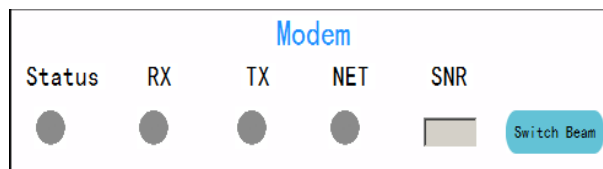

Figure 7-27: Modem functionality and Beam Switching section

System State section shown at Figure 7-28 is located in the mid part of M&C Application interface and is divided to two functional parts **Beacon Receiver/GNSS** and **Current System Parameters**.

Figure 7-28: System State section

Beacon Receiver and GNSS parameters section, located on the left (Figure 7-29), Provides information about Beacon/Carrier and GNSS receivers functionality:

Beacon Receiver:

- **Lock** indicator green color means that the Beacon/Carrier internal receiver locked on the defined beacon signal or DVB carrier.
- **Signal quality** displays the received signal level of the internal Beacon/Carrier receiver. Values range: 0 - 10V.

GNSS:

- **Lock** indicator green color means that positioning information is successfully received from GNSS satellites.
- **Latitude** displays Latitude of the current positioning, received by internal GNSS receiver.
- **Longitude** displays Longitude of the current positioning, received by internal GNSS receiver.
- **Elevation** column represents:
  Reference – calculated (targeted) Elevation angle value of the antenna
  Actual - current real-time antenna Elevation angle value
- **Polarization** column represents:
  Reference – calculated (targeted) antenna Polarization angle value
  Actual - current real-time antenna Polarization angle value

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Figure 7-29: Beacon Receiver and GNSS parameters section

Current System Parameters section, located on the right (Figure 7-30), displays the main System parameters current values:

- **Satellite Search Mode** displays the internal receiver current operational mode.
- **Satellite Position** (°) displays the position of currently operated satellite at geostationary orbit.

- **Polarization** (°) displays the selected Polarization of the receive channel.
- **LNB LO Frequency (MHz)** displays the currently selected LNB LO frequency.
- **RX Channel Frequency (MHz),** displays the currently configured receive channel frequency
- **RX Channel Symbol Rate (Ksymb/s)** displays the currently configured receive channel symbol rate.

Figure 7-30: Current System Parameters section

Event Log section, located on bottom of the application interface (Figure 7-31), displays the messages received from ACU about system functionality and parameters changes.

- **Clear Window** button clicking deletes all messages from Event Log section.
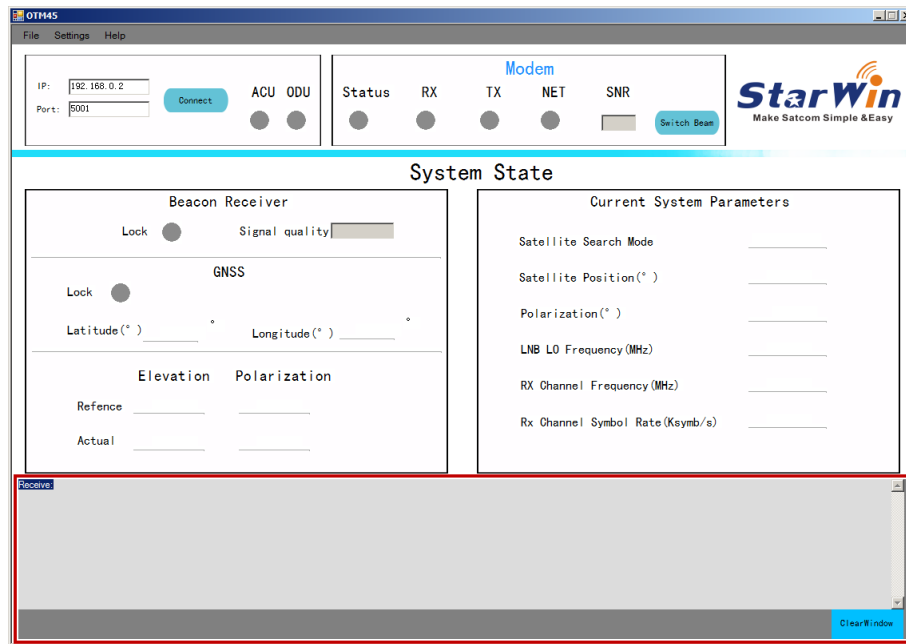
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Figure 7-31: Event Log section

8 System Maintenance

Regular periodic maintenance of the system is required to keep it in best working conditions for a long time. Table 5-1 represents the required periodical maintenance actions.

Table 7-1: Required Periodical Maintenance Actions

Period	System Part	Maintenance Actions
Daily	Antenna Radome	Radome surface damage absence checking
Daily	Antenna Radome	Radome surface cleaning from dust by damp cloth
Daily	Antenna Radome	Wiping rain water, remaining snow and condensed water from radome surface by dry clean cloth
Weekly	Cables	Available damages and fixation loosening checking
Weekly	Cables	Waterproof condition of outdoor connectors and cables checking
Monthly	Antenna	Robustness of the fastening between the antenna and the vehicle body checking
Every 6 months	Components	Damage absence of the equipment parts checking
Every 6 months	Components	Antenna transmission parts lubrication
Every 6 months	Power up	If the equipment is not used for a long time a periodical system powering is required to ensure all elements (indicators, display, fan and other components) are working and provide the proper system operation.
Every 6 months	Static test	System monitoring information check-up to confirm the complete working status
Every 6 months	Static test	Satellite link availability test

Every 6 months	Dynamics test	Normal tracking system functionality testing during vehicle motion
Yearly	Dynamics test	Satellite switching functionality test

9 Technical Service Contact

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10 Production Spec

Product Name:	mobile satellite communication terminal
Model No.:	V9 OTM45
Software	XY-V9-OTM45-202111
Hardware	XY-V9-OTM45-V1.17B
Wi-Fi Specification:	802.11b/g/n Transmit / Receive: 2412~2462MHz
Bluetooth Version:	V4.2 (Single mode only for BLE) Transmit / Receive: 2402~2480MHz
Satellite Specification:	Transmit: 13.75~14.50GHz Receive: 10.70~12.75GHz

GNSS Specification:	GPS, BDS

Statement: There are no restrictions of use in Member States.

EU declaration of conformity

China Starwin Science & Technology Co., Ltd hereby declares that the device is in compliance with the essential requirements and other relevant requirements of RED Directive 2014/53/EU.

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FCC Statement

The device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.

2. This device must accept any interference received, including interference that may cause undesired operation.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

—Reorient or relocate the receiving antenna.

—Increase the separation between the equipment and receiver.

—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

—Consult the dealer or an experienced radio/TV technician for help.

Danger: FCC Radio Frequency Exposure Information

In order to comply with RF exposure requirements, antennas must be installed to ensure a minimum separation distance of 1292cm (antenna main beam) and 44cm (out range of +/-10 degrees off-axis) and must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with accepted multi-transmitter product procedures.

Safety Considerations

For the following safety considerations, "Instrument" means the 'satellite terminal Flat Terminal' units, components and their cables.

It is necessary to read the instructions carefully before using the satellite terminal flat portable terminal. The terminal usage shall be carried out in accordance with the described steps and methods to ensure the safety and accuracy of equipment operation.

Radio

The instrument transmits radio energy during normal operation. To avoid possible harmful exposure, to this energy, do not stand or work for extended periods of time in front of its antenna. The long-term characteristics or the possible physiological effects of Radio Frequency Electromagnetic fields have not been yet fully investigated.

Caution

1. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.

2. Before connecting this instrument to a power source, make sure that the voltage of the power source matches the requirements of the instrument.