





# VCS-M

VSAT Crossover System for MOSCOS

April 30, 2021

Version 1.0



# Congratulations on becoming KNS Satellite System Owner!

This KNS dual satellite antenna system has been designed and manufactured to provide you the most in performance, cost efficiency, and convenience. It is our dream that you will always be connected either for business or pleasure and enjoy a valuable experience.

This KNS's operating manual has been developed as a guide to get the most delight and benefits from your VSAT crossover antenna system. This operation manual includes information about KNS VCS (VSAT Crossover System) equipment, installation, operating procedures, performance, and suggestions for its servicing and care.

KNS recommends you to read this operation manual from cover to cover, and refer to it frequently.

Our worldwide dealer organization and customer service department stands ready to serve you. The following service are offered by KNS dealers:

- ✓ Factory Trained personnel to provide you with respectful expert service.
- ✓ Factory approved service equipment to provide you systematic and accurate workmanship.
- ✓ A stock of authentic KNS service parts on hands when you need them.



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# SECTION 1 - GENERAL

## 1. Introduction

VCS (VSAT Crossover System) take advantage of high-tech satellite antenna system to manage the dual KNS VSAT antenna systems more effectively and harmoniously at the same time to provide constant connectivity even though one of the antenna system is not able to work due to blockage, malfunction, and mechanical failure. When one of the antennas is unable to work, antenna B (back up) system will instantly take over the control of the system to afford uninterrupted connectivity to keep you connected in any weather condition at anywhere in the world.

The VCS comes with two antenna unit



### Compatible antenna models

- MK4 Series
- C Series
- MK3M Series
- M4M
- 10ULVM

## 2. Features and Benefits of KNS VSAT Crossover System

- **Automatic switching system:** Automatic switching of two antennas by VCS algorithm.
- **Modem Ethernet interface for ABS (Auto Beam Switching):** Enables modem to communicate with two ACUs. The time to permit the Auto beam switching when blockage occurs.
- **Web interface reflecting UX:** Check all the status and settings of VCS and information of both antennas and external devices.
- **Maintenance available using Update**
- **Dashboard Front Panel:** Check system progress with 15 LEDs and switch L-Band and reference frequency with one button.
- **RX and TX monitoring port (SMA type):** Creates easy accessibility to connect your signal analyzer.
- **Possibility of RF attenuator control (for matching both antenna signal levels):** One typical factor causing signal level unmatched is the difference of cable length from radio room to each antenna. To eliminate this, an attenuator controller is included in VCS to match the signal level difference by adjusting the attenuation level.
- **Internal 10MHz circuit built in(Optional):** VCS built-in generator module creates a 10 MHz signal to both LNB and BUC. This 10MHz signal will be combined with a modem L-Band signal and sent to the current activated antenna.
- **Modem 10MHz reference signal detection:** Modem 10MHz reference frequency detection indicator allows to monitor 10MHz signal in real time.
- **Modem lock status indicator included**
- **Ext 10 MHz Port:** Used for external 10MHz reference frequency supply
- **EMC Function:** VCS will cut off the 10MHz signal supply when 24VDC provided to the EMC port. (10MHz signal is being supplied when 0VDC provided)

### 3. Technical Specification

#### 3.1 Mechanical Specification

No.	List	Specification
1	Size [W x L x H]	19" 1U rack size [48cm (W) x 31cm (L) x 4.4cm (H)]
2	weight	3.036Kg

#### 3.2 RF Specification

No.	List	Specification	
1	L-Band Path	RX IN-A to RX Out	-7dB ≥
		RX IN-B to RX Out	-7dB ≥
2	10MHz Modem [RX Out]	RX IN-A to RX Out	0dBm ± 2
		RX IN-B to RX Out	0dBm ± 2
3	10MHz Internal	RX IN-A	0dBm ± 2
		RX IN-B	0dBm ± 2
4	10MHz External	RX IN-A	0dBm ± 2
		RX IN-B	0dBm ± 2
5	Monitoring	RX IN-A to RX TP	-18dB ~ -26dB
		RX IN-B to RX TP	-18dB ~ -26dB
6	Attenuation	Range	31.25dB
		Step	0.25dB
7	L-Band Path	TX IN to TX Out-A	-7dB ≥
		TX IN to TX Out-B	-7dB ≥
8	10MHz Modem [TX Out]	TX IN to TX Out-A	0dBm ± 2
		TX IN to TX Out-B	0dBm ± 2
9	10MHz Internal	TX Out-A	0dBm ± 2
		TX Out-B	0dBm ± 2
10	10MHz External	TX Out-A	0dBm ± 2
		TX Out-B	0dBm ± 2
11	Monitoring	TX IN-A to RX TP	-18dB ~ -26dB



			TX IN-B to RX TP	-18dB ~ -26dB
12		Attenuation	Range	31.25dB
			Step	0.25dB

### 3.3 Electric Specification

No.	List	Specification
1	Input Power	85 ~ 264VAC (or 120~370VDC) 50/60Hz
2	Current	0.49A Max. @ 110VAC 0.25A Max. @ 220VAC
3	Operating Internal Max Power	24V DC, 2.5A
4	Operating Temperature	-20°C~55°C
5	Storage Temperature	-40°C~ 70°C
6	Humidity	Up to 100% @ 40°C

### 4 Component Lists

No.	Size	Description	Q'ty	Remark
1	110 cm	AC Power Cord	1EA	CEE7/USA
2	100 cm	RJ-45	1EA	VCS to Switch/Router
3	110 cm	IF cable	2EA	VCS to ACU (RX/TX)

#### **Required components**

- 1) Switch/Router (4 or more ports available)
- 2) Satellite Modem

#### **Optional components**

- 1) UPS (Uninterrupted Power Supply) unit is recommended.

## Section 2 – INSTALLATION

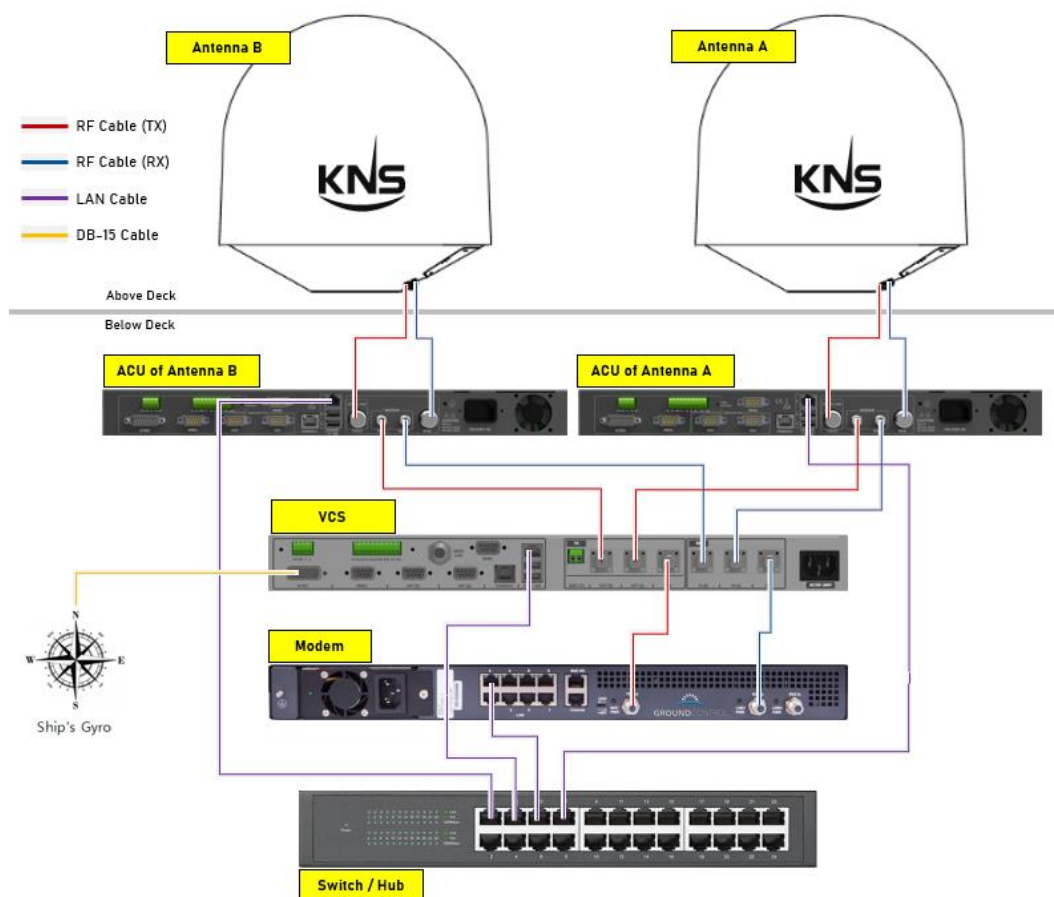
VCS (VSAT Crossover System) should be installed in a 19" rack, along with any other associated communication equipment such as ACU and satellite modem in the radio room which has dry and cool condition.

The VCS module will be delivered with the KNS's control software pre-installed and will automatically operate on power up.

Follow the installation steps and refer to the Dimension drawing/Configuration diagram to install the VCS system correctly.

### 1. Configuration Diagram

Refer to the configuration diagram below and install correctly.

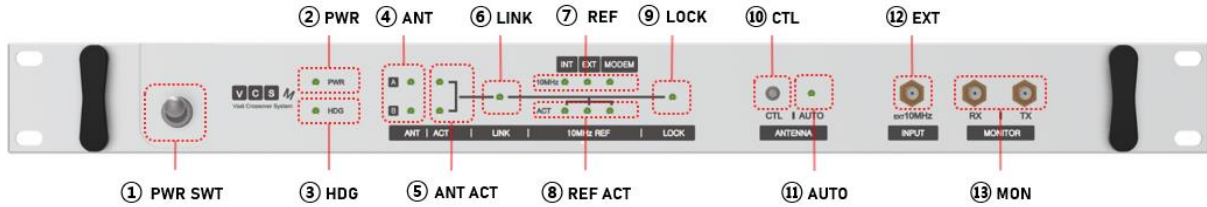


#### Required Components

- 1) Modem (Typical installation based on iDirect X7 modem)
- 2) Switch/Router (4 or more port switch/hub)

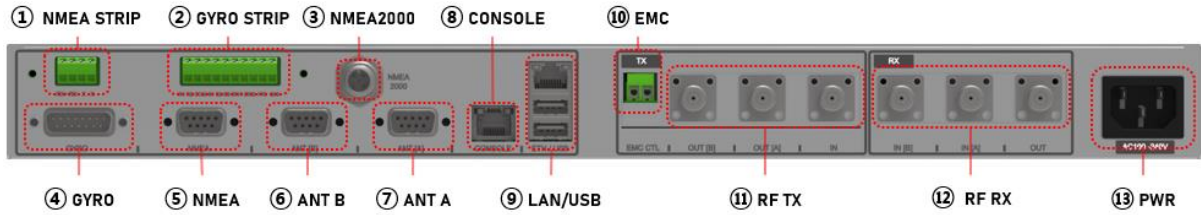
## 2. Visual Explanation

[Front View]



No	Group	Units Name	Interface	Description
1	PWR SWT	Power Switch	Switch	Power on/off switch
2	PWR	PWR	LED	Power status indicator
3	HDG	HDG	LED	Heading status indicator
4	ANT	ANT A	LED	The operation and mode status of the antenna indicator
		ANT B	LED	
5	ANT ACT	ACT A	LED	L-Band selection indicator
		ACT B	LED	
6	LINK	LINK	LED	Link status indicator
7	REF	10MHz INT	LED	10MHz reference frequency detection indicator
		10MHz EXT	LED	
		10MHz MODEM	LED	
8	REF ACT	ACT INT	LED	10MHz reference frequency selection indicator
		ACT EXT	LED	
		ACT MODEM	LED	
9	LOCK	LOCK	LED	Lock status indicator
10	CTL	CTL	Button	L-Band and 10MHz reference frequency selection button
11	AUTO	AUTO	LED	Auto selection indicator
12	EXT	INPUT EXT 10MHz	SMA	Extern 10MHz port
13	MON	MONITOR RX	SMA	TX/RX monitoring port
		MONITOR TX	SMA	

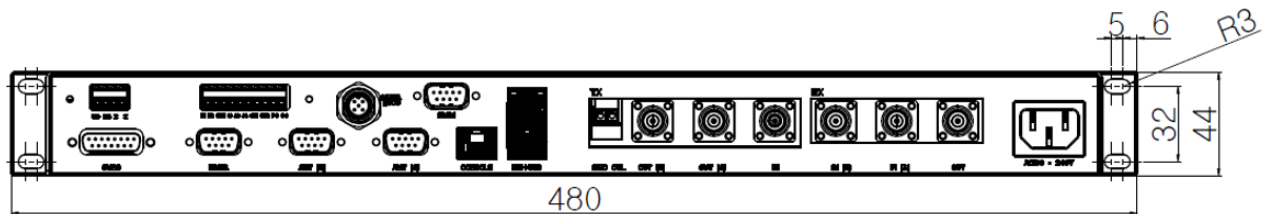
[Rear View]



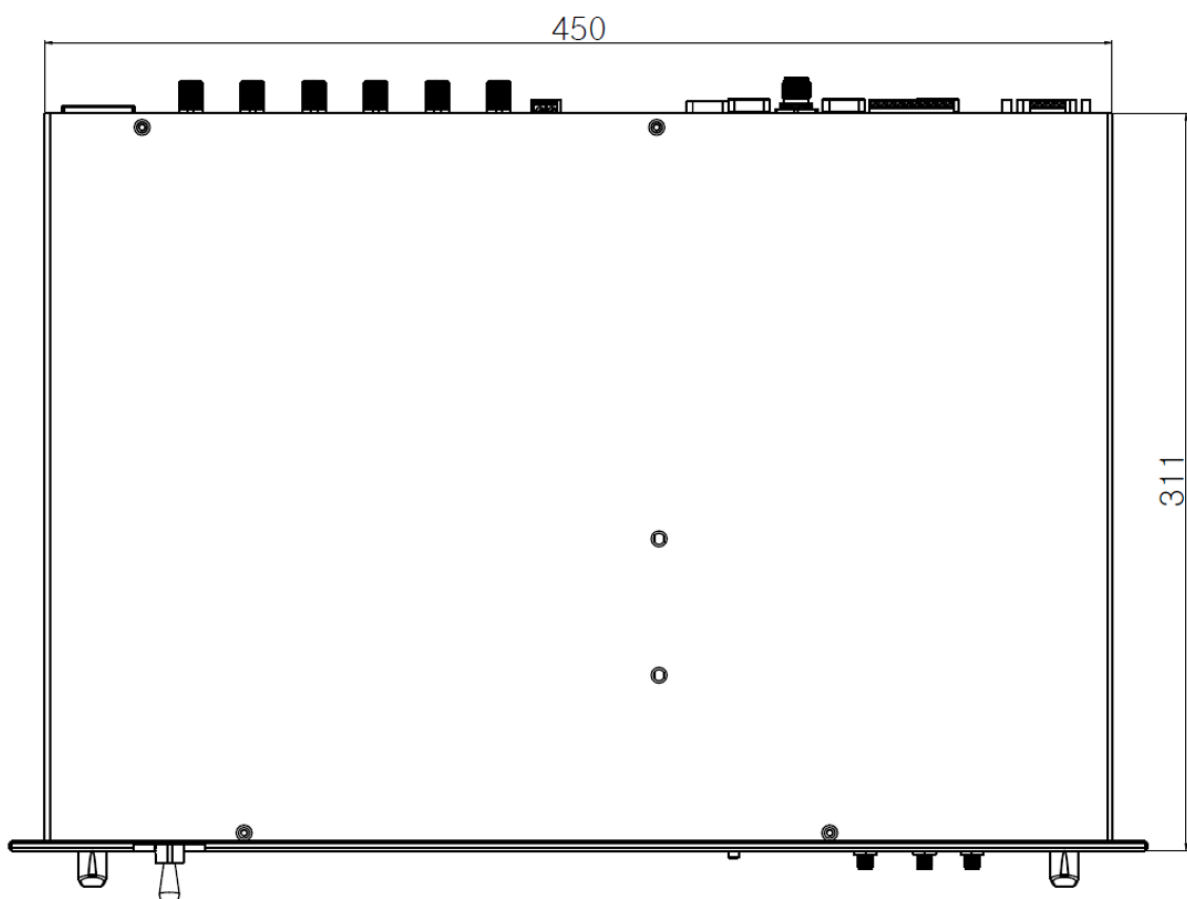
No	Group	Units Name	Interface	Description
1	NMEA STRIP	NMEA STRIP	Strip	NMEA Strip connector
2	GYRO STRIP	GYRO STRIP	Strip	IO and GYRO Strip connector
3	NMEA2000	NMEA2000	5POS	NMEA2000 5pos circular connector
4	GYRO	GYRO	DB-15	Sync, step and NMEA0183 input
5	NMEA	NMEA	DB-09	Antenna GPS output and external GPS input
6	ANT B	ANT [B]	DB-09	Antenna monitoring and control data communication
7	ANT A	ANT [A]	DB-09	Antenna monitoring and control data communication
8	CONSOLE	CONSOLE	RJ45	For modem lock status and GPS output
9	ETH/USB	ETH	RJ45	Two antennas monitoring and control, modem and ABS communication
		USB	USB2.0	-
10	EMC	EMC CTL	Strip	Control the 10MHz signal supply
11	RF TX	OUT [B]	N Type	TX out port to the Antenna B
		OUT [A]	N Type	TX out port to the Antenna A
		IN	N Type	TX in port from modem
12	RF RX	IN [B]	N Type	RX in port from Antenna B
		IN [A]	N Type	RX in port from Antenna A
		OUT	N Type	RX out port to the modem
13	PWR	AUTO	IEC C14	AC power input port

### 3. Dimension Drawing

[Rear View]



[Top View]



## 4. Installation Steps

The KNS VSAT crossover system will be delivered fully assembled. Please double check that there are no missing parts and that no damage has occurred during transportation.

To start, install the VSAT crossover system panel in a 19" rack near the two antenna control units (ACU) and satellite modem.

### 4.1 Connecting Power

- ① Connect the AC power cord to "POWER" input port in the VCS panel.

### 4.2 Connecting ACU of antenna A and VCS

- ① Connect the IF (F-type) cable from "TX IN" port on the ACU 1 panel to the TX "OUT [A]" port on the VCS panel.
- ② Connect the IF (F-type) cable from "RX OUT" port on the ACU 1 panel to the RX "IN [A]" port on the VCS panel.
- ③ Connect the RJ-45 cable from "Ethernet" port on the ACU 1 panel to the "Any port" on the Switch or Router.
- ④ Connect the DB-09 serial cable (Female type) from "AUX" port on the ACU 1 panel to the AUX "A" port on the VCS panel. **(optional)**

### 4.3 Connecting ACU of antenna B and VCS

- ① Connect the IF (F-type) cable from "TX IN" port on the ACU 2 panel to the TX "OUT [B]" port on the VCS panel.
- ② Connect the IF (F-type) cable from "RX OUT" port on the ACU 2 panel to the RX "IN [B]" port on the VCS panel.
- ③ Connect the RJ-45 cable from "Ethernet" port on the ACU 2 panel to the "Any port" on the Switch or Router.
- ④ Connect the DB-09 serial cable (Female type) from "AUX" port on the ACU 2 panel to the AUX "B" port on the VCS panel. **(optional)**

### 4.4 Connecting VCS and Switch/Router

- ① Connect the RJ-45 cable from "Ethernet" port on the VCS panel to the any port on the Switch/Router.

### 4.5 Connecting VCS and Satellite Modem

- ① Connect the IF (F-type) cable from "TX" port on the modem to the "TX IN" port on the VCS panel.
- ② Connect the IF (F-type) cable from "RX" port on the modem to the "RX OUT" port on the VCS panel.

### 4.6 Connecting Switch/Router and Modem

- ① Connect the RJ-45 cable from "Any port" on the Switch/Router to the "LAN" port on the Modem.

## 4.7 Connecting Ship Gyro

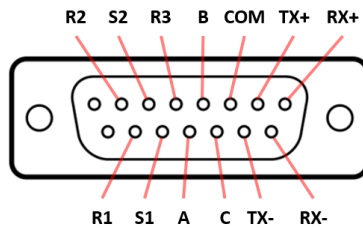
Connect the ship gyro input port on the VCS through one of three types of ship gyro input ports: DB-15 gyro connector, I/O and gyro strip connector, NMEA strip connector.

### ⚠ WARNING

- ◆ *Once Ship gyro is connected to the VCS, it is no longer required to connect gyro to ACUs (both ACU automatically receive the ship's gyro information from VCS).*
- ◆ *Do not use the NMEA strip connector and I/O and Gyro strip connector at the same time. This may damage the VCS.*

### 4.7.1 GYRO Port (DB-15)

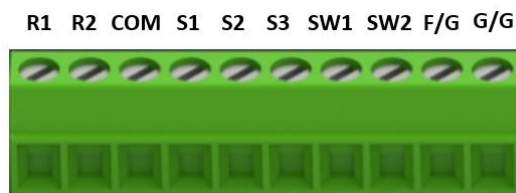
DB-15 gyro connector: use this connector to connect the ship's gyro (Sync gyro, step by step, and NMEA0183) to the VCS. Connect the ship's gyro to the VCS using a DB-15 (Female type) connector. The layout of the DB-15 is shown below.



<Layout of the DB-15 connector>

### 4.7.2 GYRO Strip Connector

the gyro strip connector receives analog gyro output signal such as Synchro and step by step.



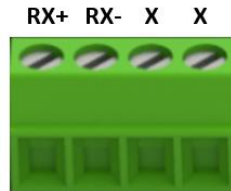
<Layout of the I/O and Gyro strip connector>

SW1 and SW2 of the I/O & gyro connector can control the TX mute function of the modem by “contact closure” when the antenna is in the blockage or the

preset block area (refer to the KNS ACU manual operation section).

#### 4.7.3 NMEA Strip Connector

NMEA strip connector: if the ship's gyro is in NMEA type, the user may use the NMEA strip connector. X1, X2, NO are not available.



<Layout of the NMEA strip connector>

#### 4.7.4 NMEA2000 Connector (Male)

5pos circular connector: use this connector to connect the ship's gyro (NMEA2000) to the VCS.



<5pos Circular Connector >



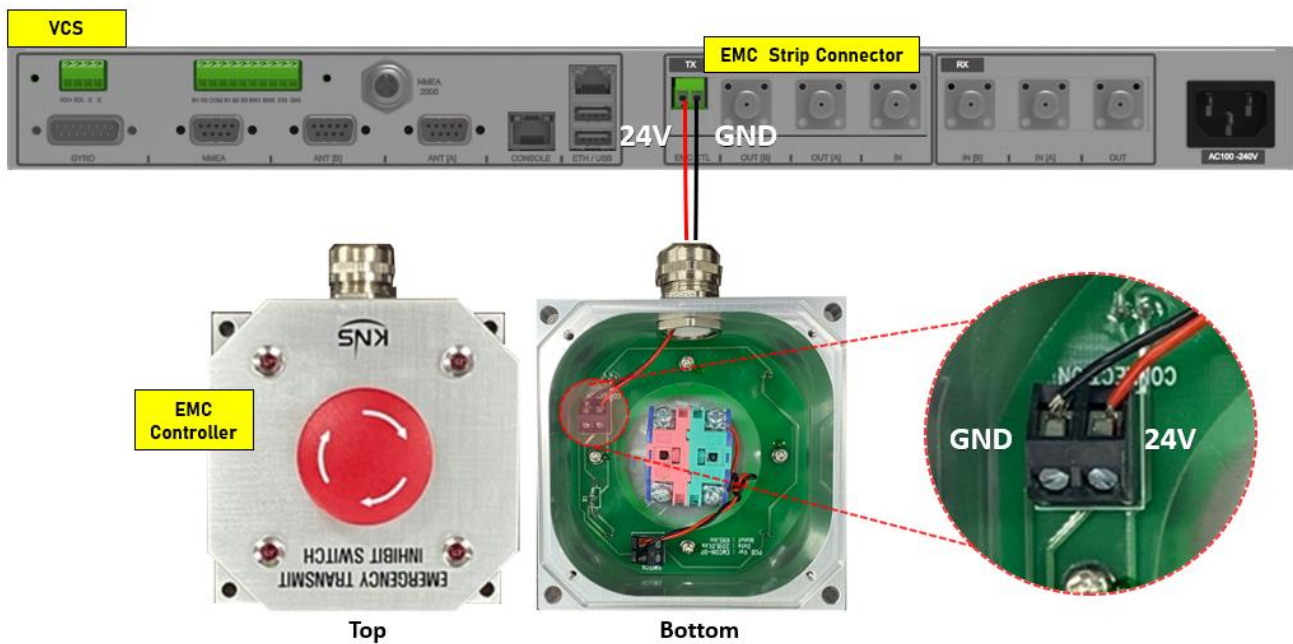
## 4.8 Connecting EMC Control (Optional)

### 4.8.1 EMC Controller (Not included)

- ① Turnover of the EMC controller.
- ② Loosen bolt on the strip connector.
- ③ Insert power cable to the 24V terminal
- ④ Insert ground cable to the ground terminal
- ⑤ Tighten the screws to secure them in place

### 4.8.1 EMC Strip Connector

- ① Loosen bolt on the strip connector.
- ② Insert power cable to the 24V terminal
- ③ Insert ground cable to the ground terminal
- ④ Tighten the screws to secure them in place

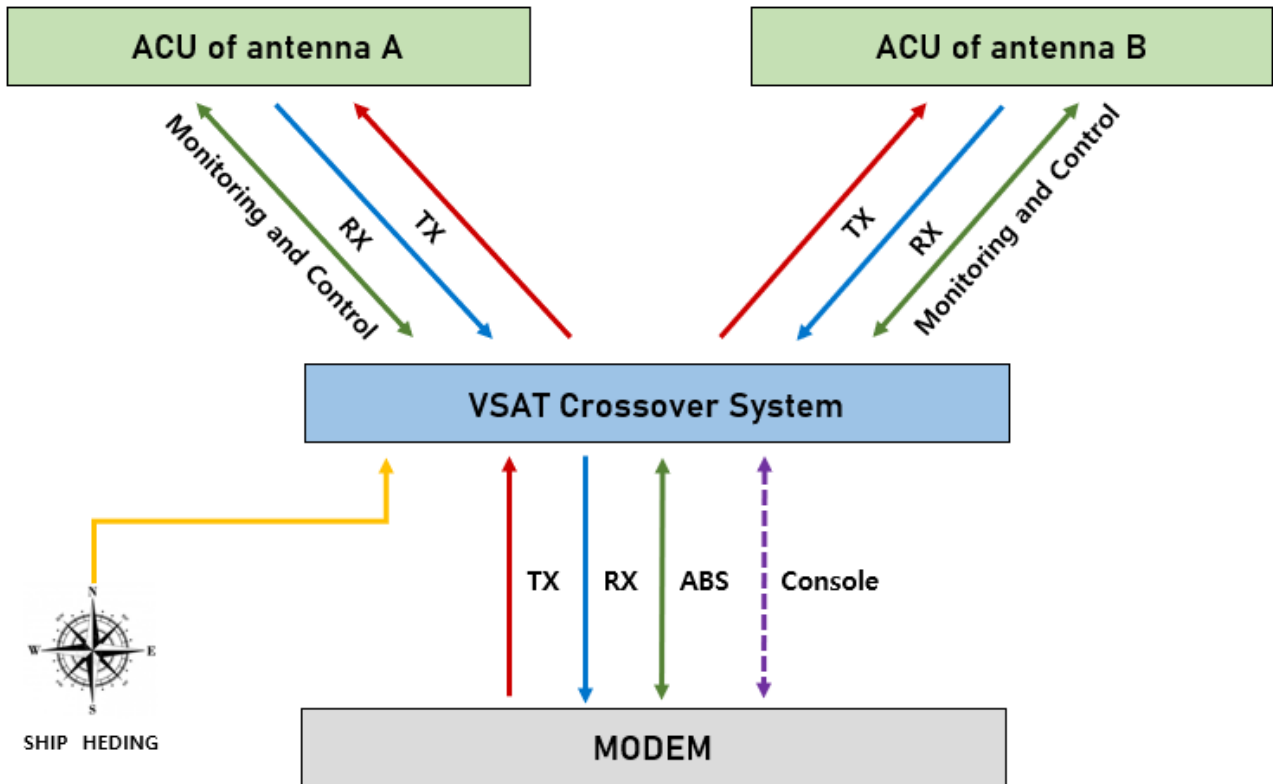


<EMC Controller Connection Diagram>

## Section 3 – OPERATION

### 1. Data Flow Diagram

The VCS monitors the connected antennas A and B in real time, displays the status, and switches to communicate with the modem.



<VCS Data Flow Diagram>

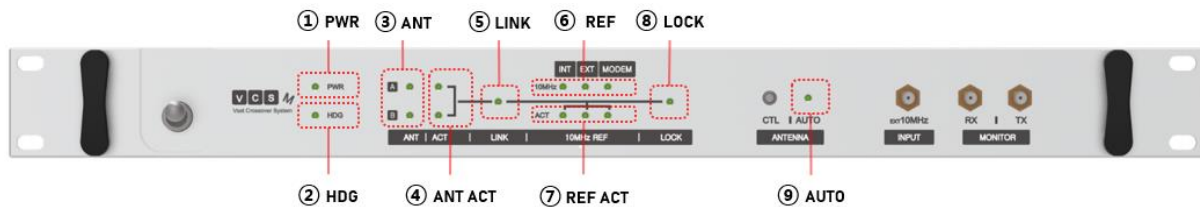
Connected to the vessels Gyro Compass, Modem, Switch/Router, and ACUs, it is necessary to configure various parts of the system to match the specific vessel conditions. This section, describes the various initialization and calibration procedures. The procedures should be completed in order described.

Ensure that you are familiar with the KNS VCS equipment (see Section 1), before commencing the initialization procedure. In this section, the manual also describes a basic guide to the operation of the system.

## 2. Front Panel

### 2.1 LED Indicators

Before supplying power to the VCS, supply power to both ACUs. After powered on, all LEDs on the dashboard will blink twice and the system will start up. After this, the LED indicates the overall status of the system.



Check progress and problems with each LED status. See the table below for details.

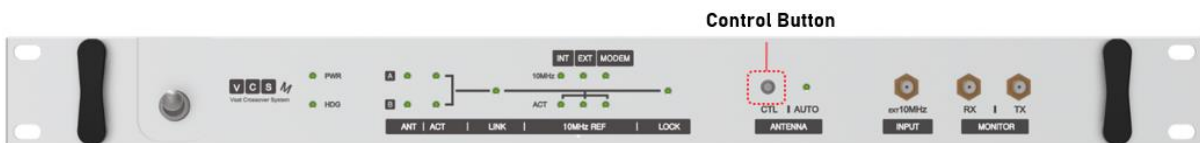
No	Group	Name	Status	Description
1	PWR	PWR	Off	The power is off.
			On	The operating system is running.
			Blink 2Hz	Ready for operation of the operating system.
2	HDG	HDG	Off	Gyro data is not valid.
			On	Gyro data is valid.
			Blink 5Hz	Gyro setting is Sync & Step, and initial value input is required.
3	ANT	ANT A ANT B	Off	The power of antenna is off.
			On	Tracked.
			Blink 2Hz	Initializing or searching state.
			Blink 5Hz	Searching failed or standby state.
4	ACT	ACT A	Off	Antenna A's L-Band path is disabled.
			On	Antenna A's L-Band path is active.
		ACT B	Off	Antenna B's L-Band path is disabled.
			On	Antenna B's L-Band path is active.
5	LINK	LINK	Off	Antenna's NIM tuner status is unlocked.
			On	Antenna's NIM tuner status is locked.
6	REF	INT	Off	Internal 10Hz not detected.
			On	Internal 10Hz detected
		EXT	Off	External 10Hz not detected.
			On	External 10Hz detected
		MODEM	Off	Modem 10Hz not detected.

			On	Modem 10Hz detected
7	REF ACT	INT	Off	Internal 10Hz not selected.
			On	Internal 10Hz selected.
			Blink 5Hz	Internal detected and selected, muted by EMC Control setting.
		EXT	Off	External 10Hz not selected.
			On	External 10Hz selected.
			Blink 5Hz	External detected and selected, muted by EMC Control setting.
		MODEM	Off	Modem 10Hz not selected.
			On	Modem 10Hz selected.
			Blink 5Hz	Modem detected and selected, muted by EMC Control setting.
8	LOCK	LOCK	Off	Modem status is unlocked.
			On	Modem status is locked.
9	AUTO	AUTO	Off	Auto mode is off.
			On	Auto mode is on.

If the ship's gyro mode is Synchro & Step type, the user has to input the ship's current heading angle into the VCS. Otherwise VCS will not operate properly. Always check whether HDG LED blinks quickly after power on.

## 2.2 Button

There is one button on the front panel and there are three types of events. Select L-Band and 10Hz reference frequency and initialize network information.



Event	Description
Click	The L-Band setting cycles as shown below. <pre> graph LR   Mute --&gt; AntennaA[Antenna A]   AntennaA --&gt; AntennaB[Antenna B]   AntennaB --&gt; AutoMode[Auto Mode]   AutoMode --&gt; Mute </pre>
Deep-click	The 10Hz reference frequency setting cycles as shown below. (Keep push for more than 1.5 seconds)

	<pre> graph LR     Internal --&gt; External     External --&gt; Modem     Modem --&gt; Internal     </pre>
System Reset (0.382 later)	LOCK LED blinks and the VCS Network information is initialized to default. And restart, takes about 30 seconds. (Keep push for more than 8 seconds)

### 3. Web Interface

Monitoring and setting is possible through the web

#### 3.1 Connection

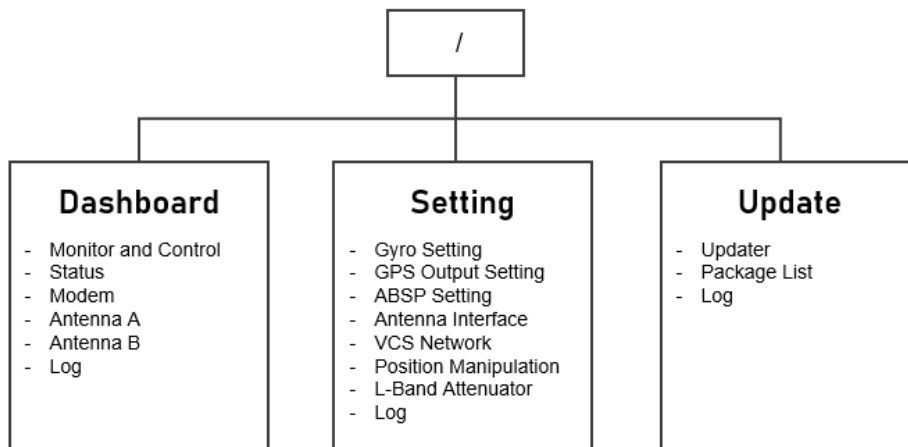
This is the default network information of VCS. Connect to the network and the address below.

Internet Protocol Version	IPv4
IP address	192.168.1.5
Subnet mask	255.255.255.0
Gateway	192.168.1.1

#### <VCS Default Network Information>

#### 3.2 Site Tree

The VCS website has three pages. The related functions are placed on each page. Dashboard page shows VCS operation status, modem, antenna A and B, and other external equipment status. The Setting page contains the necessary settings for installation. The Update page has a function to update the latest version and change to an existing package.



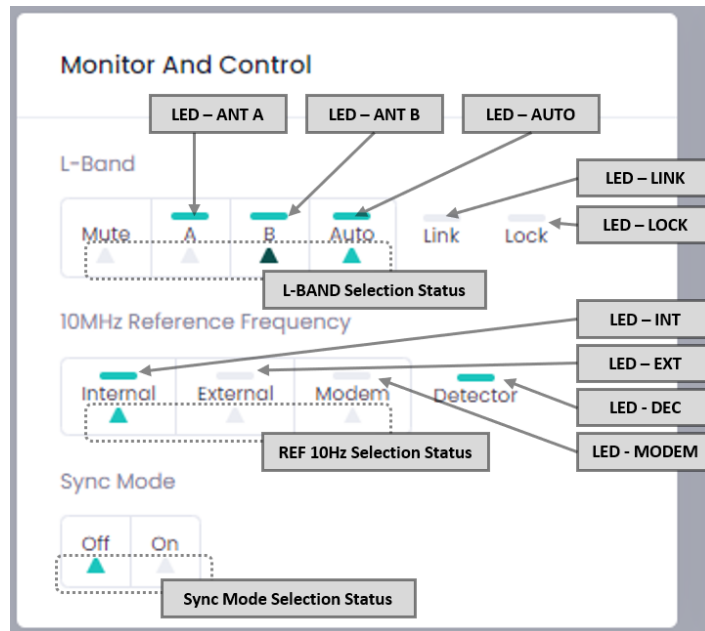
#### <Site Tree>

### 3.3 Dashboard Page

#### 3.3.1 Monitor and Control

Dashboard page allows users to control L-Band and 10MHz Reference Frequency and monitor the overall status. In L-Band, Auto Mode automatically selects the optimal path by collecting and analyzing data from two antennas inside the system in real time.

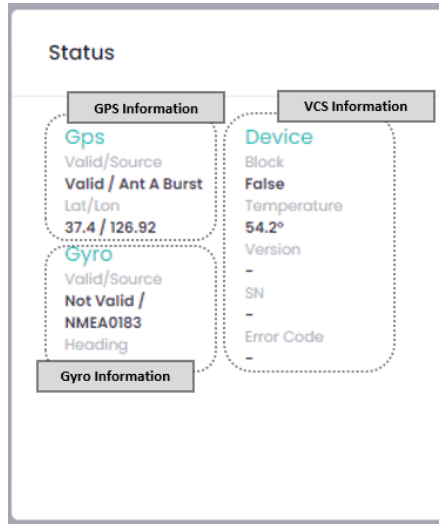
In 10MHz Reference Frequency, each 10MHz is detected and displayed by LED. Users can select 10MHz to output to BTN. Check whether the selected 10MHz is the final output from the Detector. Sync Mode is a function of the mutual operation of two antennas. In the case of high-speed ships, activation is recommended.



No	UI	Image	Description
1	BTN		When the user clicks on the BTN, the function is selected and displayed in the SEL of UI. The selected result is automatically saved.
2	LED		Disable
			Activation
3	SEL		Disable
			Activation
			Activated in Auto mode

### 3.3.2 Status

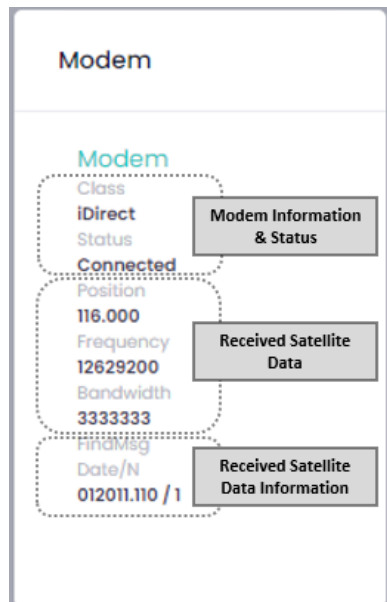
Status displays the status of external equipment including VCS and received data. Displayed devices are VCS, GPS, and GYRO.



<Status UI >

### 3.3.3 Modem

Modem displays the class and connection status, received major satellite information, and reception information.

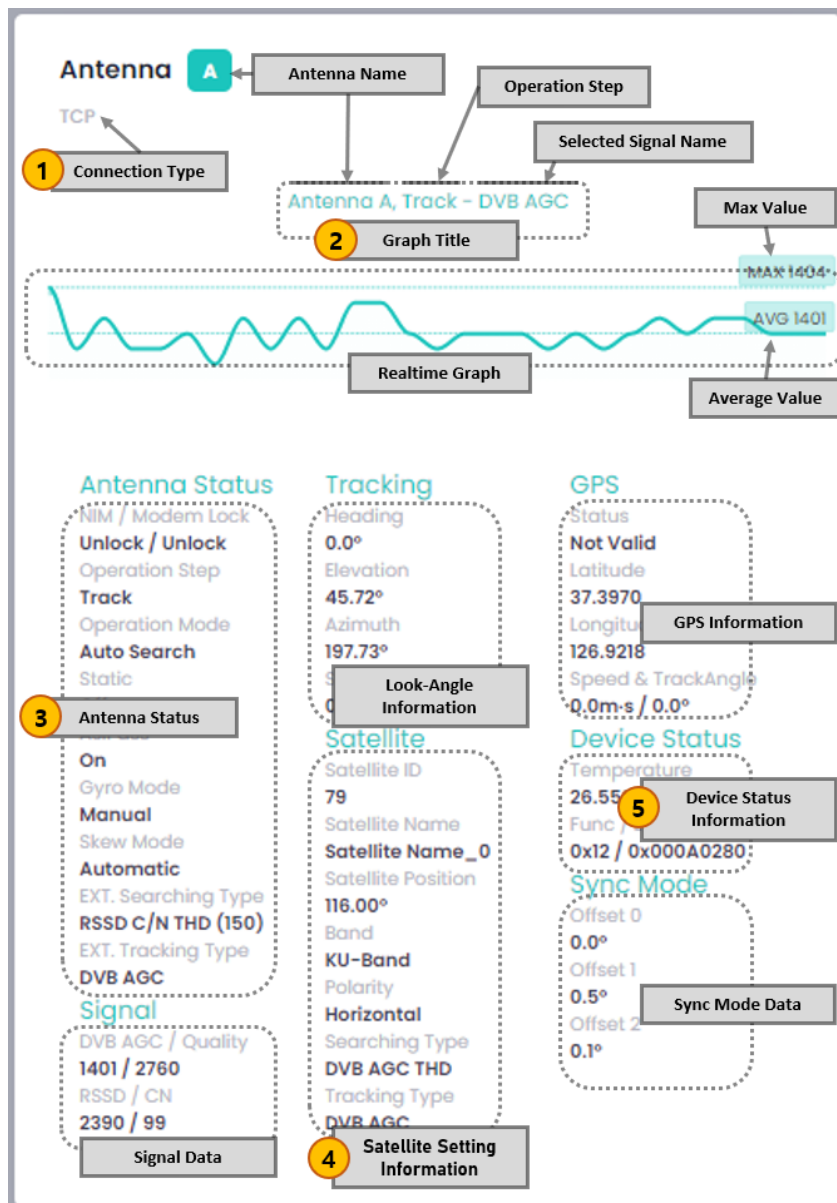


<Modem UI>

### 3.3.4 Antenna A / Antenna B

Displays antenna information in real time.

- ① Connected interface type (TCP/Serial)
- ② Antenna name and data source for displayed graph.
- ③ The overall status of the antenna.
- ④ Modem satellite information received from VCS
- ⑤ Antenna status and error information



<Antenna UI>



### 3.4 Setting Page

Setting page allows the user to set the necessary settings for installation such as Gyro, GPS, ABSP, and Network. It is automatically saved when you click the apply button of all setting functions.

#### 3.4.1 Gyro Setting

Gyro Setting is a setting function for transmitting the heading value to the antenna, and supports NMEA2000, NEMA0183, Synchro & Step. The NMEA2000 is standard and uses 250 kbps on the CAN bus. Also, NMEA0183 is standard and uses ASCII Serial Communication Protocol. Sync & Step is an internal NMEA conversion function of VCS and receives NMEA0183 format data through the set and input synchro, Step, pulse, voltage, current and contact analog signals.

Type	Option	Description
NMEA2000		-
NMEA0183	Baud rate	4800/9600/19200/38400/57600/115200
Synchro & Step	Synchro	1:1, 36:1, 90:1, 180:1, 360:1
	Step by Step	90:1, 180:1, 360:1
	Direction	Normal, Reverse
	Frequency	50~60Hz, 400~500Hz
	Converter	the ship's current heading angle input
External	-	NMEA Port input heading data
User	-	Fixed to user-set value.
Auto	-	Automatic switching after checking valid input among NMEA2000 and NMEA0183

#### <Gyro Option Table>

External is received through the rear NMEA port and is in NMEA0183 format. User is set to user's setting value. Auto is NMEA2000. NMEA 0183 are sequentially checked for validity but NMEA2000 has priority. When the Type changes, the options for the Type are displayed.

### 3.4.2 GPS Output Setting

In the GPS output setting, set the format and baud rate set for each port. GPS information is output at 1 second intervals.

Name	Option	Description
NMEA	Format	RMC, GGA, GLL
	Baud rate	4800/9600/19200/38400/57600/115200
Console	Format	RMC, GGA, GLL
	Baud rate	4800/9600/19200/38400/57600/115200

### 3.4.3 ABSP Setting

The ABSP (Auto Beam Switching Protocol) setting is for the antenna to track satellites using satellite information transmitted by the modem.

Set the class of modem to be used and the connection type, and set the LNB LO Frequency of the antenna.

ABSP Setting

Use: Enable

Modem Class: iDirect

LNB Band1 Lo: 10000

LNB Band2 Lo: 10750

LNB Band3 Lo: 11300

LNB Band4 Lo: 9750

RollOff: 0.2

RF Terminal ID: 0

External Lock Source: Ethernet

Console TTL Type: Inverted TTL

Apply

RF Terminal ID is the 'rftermtype' value sent when connecting to VCS and modem. If set to 0, initialization message is not transmitted when modem is connected.

```
IDIRECT:ident rftermtype=<int>,  
acuvendor=<string>, aimserialnum=<string>,  
aimtype=<string>, aimswwrev=<string>,  
bimserialnum=<string>, bimtype=<string>, bimswrev=<string>,  
LNB-LPN=<string>, LNB-LSN=<string>, L-MID=<string>, LNB-FID=<string>
```

### <ABS initialization message>

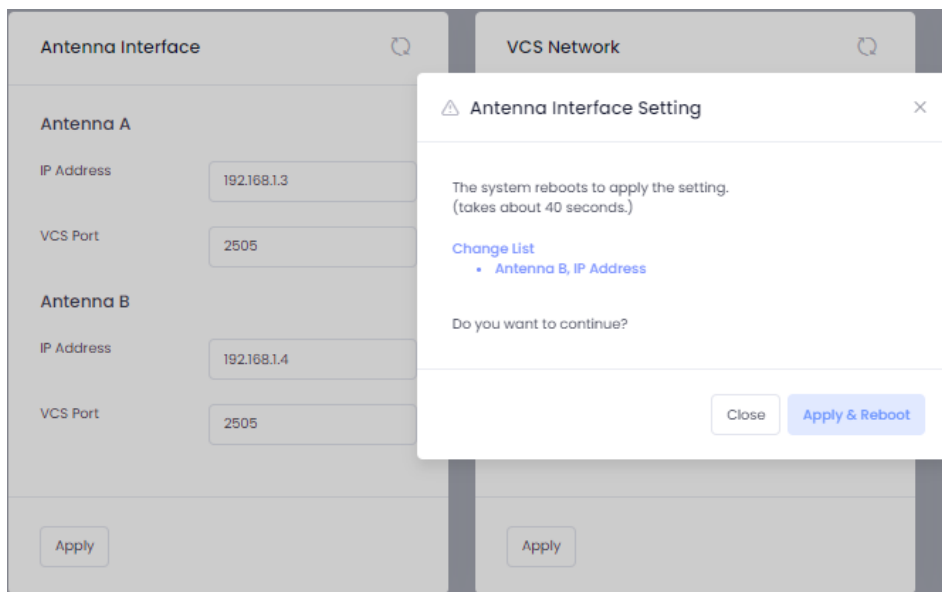
External Lock Source selects which port will receive value which is used for lock status received by the modem.

#### 3.4.4 Antenna Interface

In Antenna Interface, the IP addresses and VCS ports of antennas A and B are set for communication between the VCS and the antenna.

#### 3.4.5 VCS Network

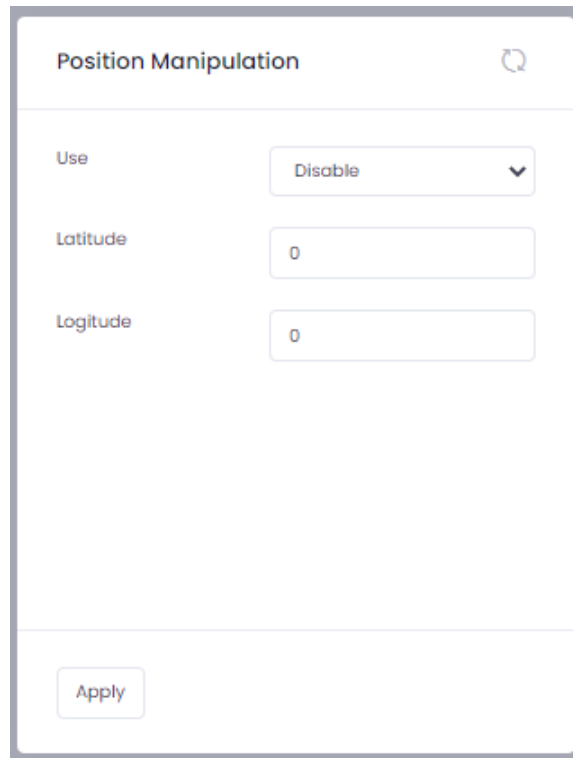
In VCS Network, Set IPv4 of VCS and ABS Port of modem. The settings of Antenna Interface and VCS Network must be carefully, so if you click the Apply button, the changes will be displayed in a pop-up notification window.



<Antenna Interface & VCS Network Setting UI>

### 3.4.6 Position Manipulation

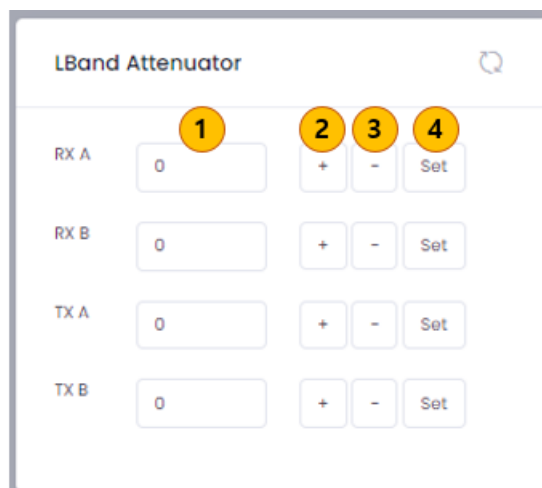
Position Manipulation is used to test the modem's beam switching. When enabled, it transmits to the modem at the set latitude and longitude.



The screenshot shows a configuration window titled "Position Manipulation" with a refresh icon in the top right. It contains three input fields: "Use" is a dropdown menu currently set to "Disable"; "Latitude" is a text input field containing the number "0"; and "Longitude" is a text input field containing the number "0". An "Apply" button is located at the bottom left of the window.

### 3.4.7 L-Band Attenuator

In the L-Band paths, antenna A and B have 4 attenuators for each TX and RX. It ranges from 0dB to -31.25dB and can be set to 0.25dB at a time.



The screenshot shows a configuration window titled "L-Band Attenuator" with a refresh icon in the top right. It features four rows of controls for RX A, RX B, TX A, and TX B. Each row has a text input field containing "0", followed by three buttons: a "+" button, a "-" button, and a "Set" button. Yellow circles with numbers 1, 2, 3, and 4 are overlaid on the input fields and the +, -, and Set buttons of the first row (RX A) respectively.

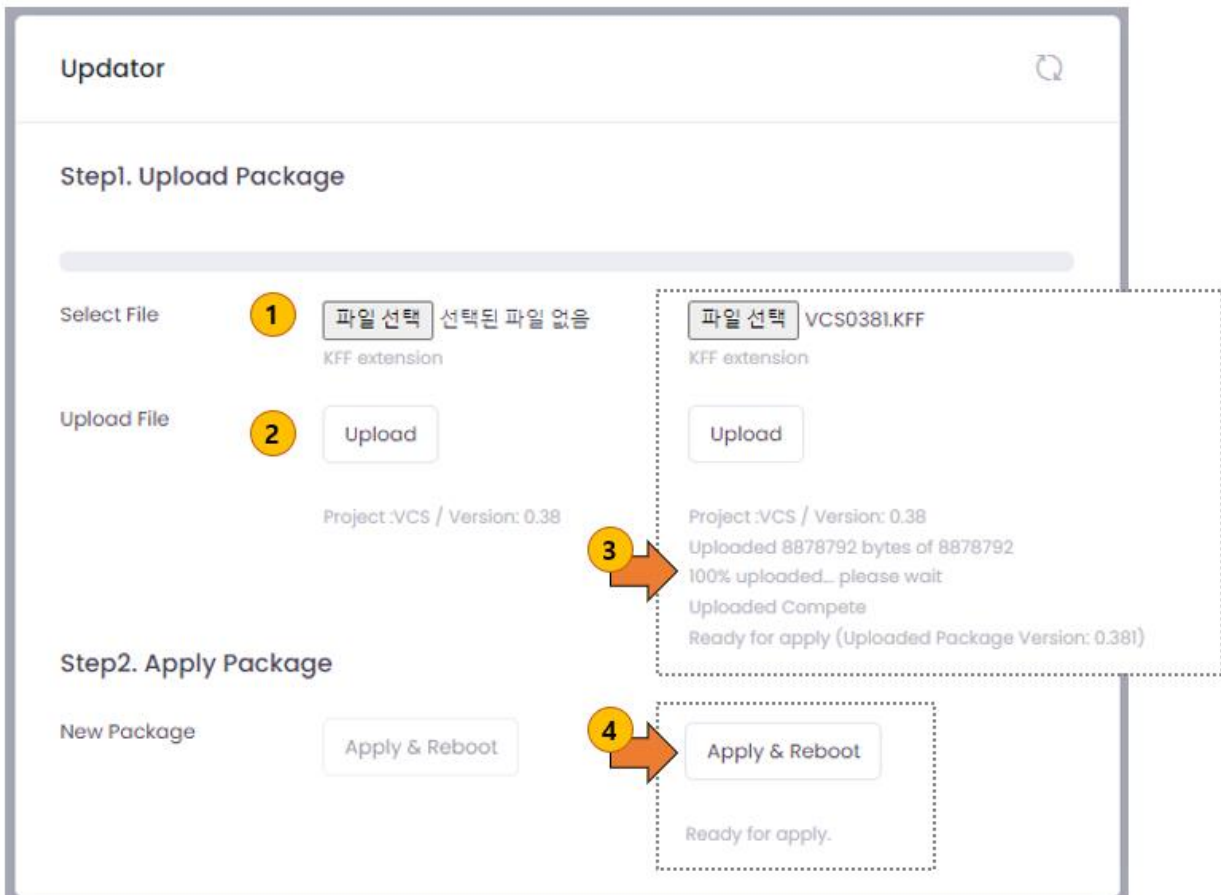
- ① Current value
- ② 0.25dB increase from current value. (+0.25dB)
- ③ 0.25dB decrease from current value. (-0.25dB)
- ④ Set with the value of ①

## 3.5 Update Page

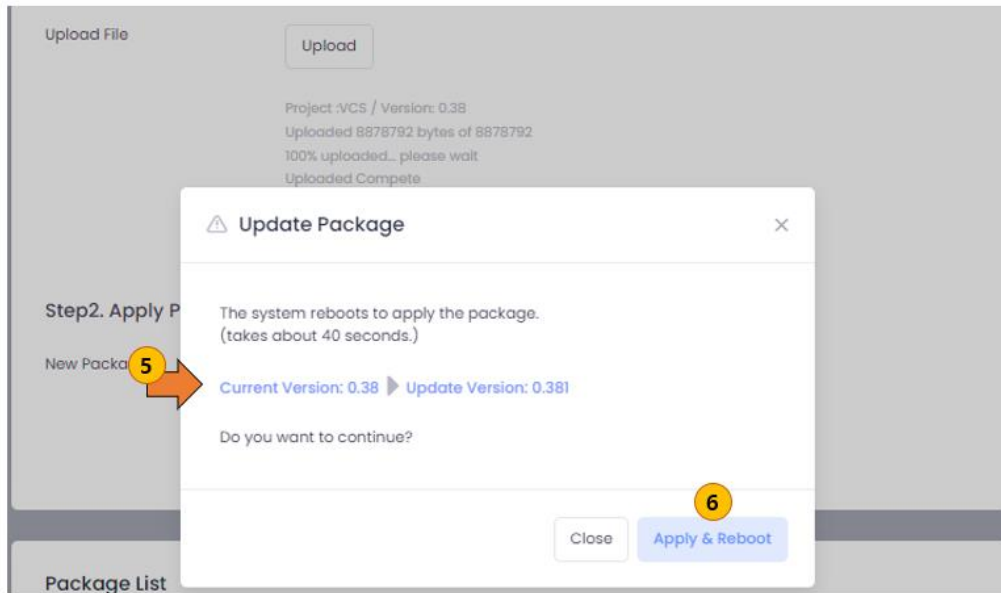
### 3.5.1 Updater

The VCS update process is as follows.

- ① Select the package file. (extension \*.KFF)
- ② Click the 'Upload' button.
- ③ Displayed upload log and information of package file. And 'Apply & Reboot' is activated.
- ④ Click the 'Apply & Reboot'

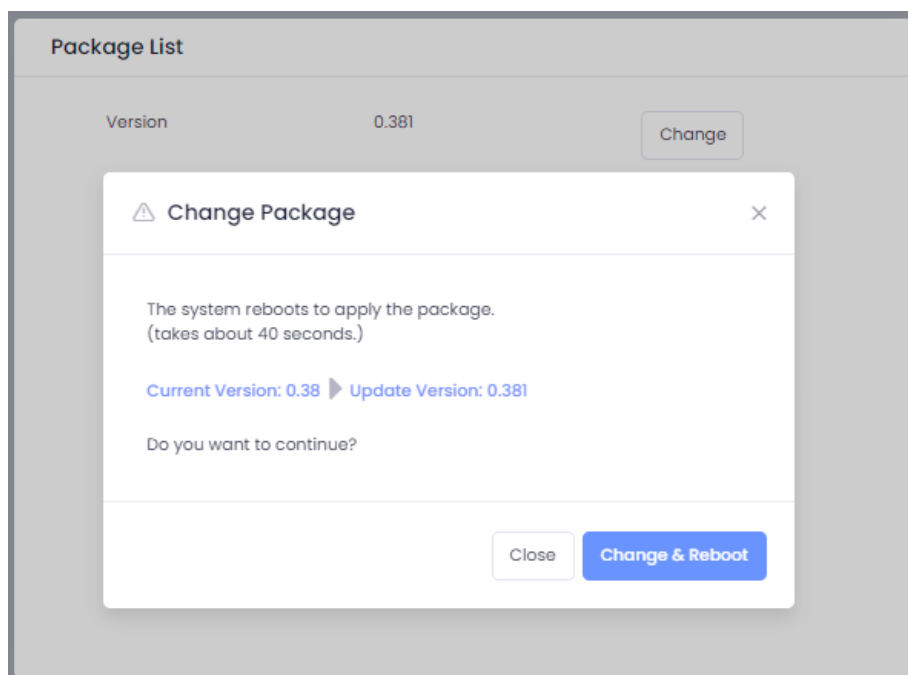


- ⑤ The current version of the VCS and the version to be applied are displayed in the pop-up window.
- ⑥ After checking, click 'Apply & Reboot' button to complete the update.



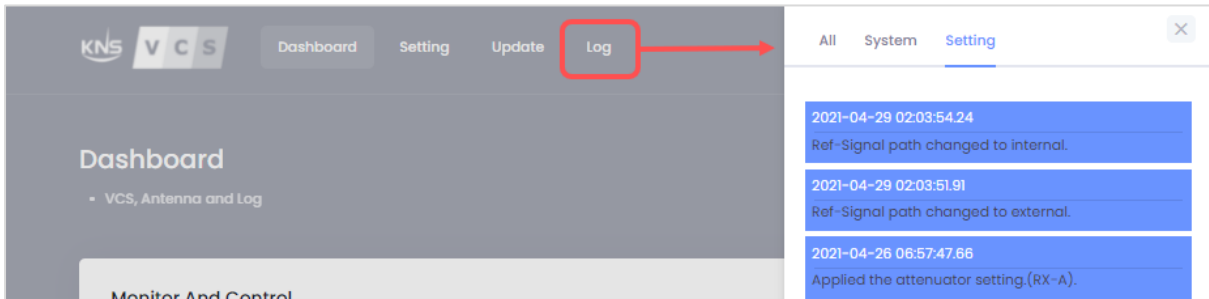
### 3.5.2 Package List

The package list shows up to 6 packages updated to date. Click the 'Change' button of a version in the list to install the version.

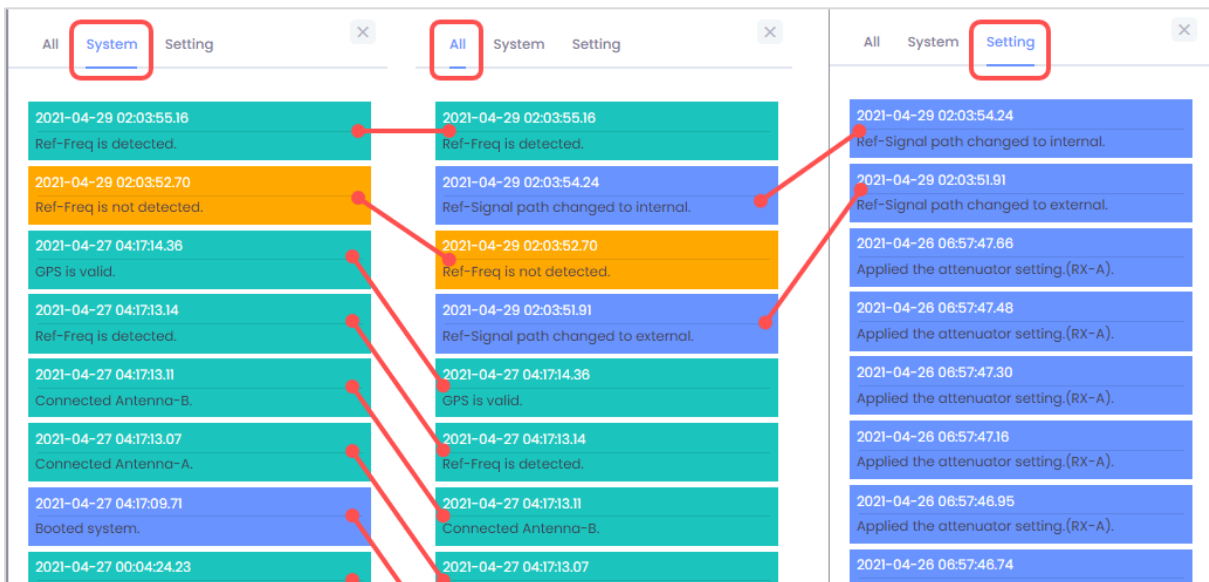


### 3.6 Log

The log is a pop-up window on the right.



The log menu consists of 'All', 'System', and 'Setting'. 'System' displays a log of internal operations and changes during monitoring. 'Setting' are displayed in the log set by the user. 'All' shows both 'System' and 'Setting' based on the timeline.



<Log UI>

## Appendix A

### Check List

Installation and operation

- All assembly screws locked in place
- Lock nuts on the adjustable weights are tighten
- All the connectors are tightly inserted
- All the wires and cables are firmly tied down
- All cables are identified
- VCS installation left in a tidy state
- VCS interface is up and running correctly
- The two ACU systems automatically re-receives the data when the VCS module is turned off and on again
- On board maintenance crew members are trained in the system operation and have a latest operation manual
- Customer approval of initialization
- Inform the staff after completion of task





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