SINGLE BAND
4T4R OPENRADIO RRU

RRH-440-05-50

User manual

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Document History

Page No.	Version	Revised By	Details of Change
	1-0-3	Yanni Lin	

List of Abbreviations

Abbreviation	Meaning
3GPP	3rd Generation Partnership Project
AC	Alternating Current
ANT	Antenna
BBU	Baseband Unit
BTS	Base Transceiver Station
CDMA	Code Division Multiple Access
CINR	Carrier to noise ratio
CLI	Command-Line Interface
CPICH	Common Pilot Channel
CPRI	Common Public Radio Interface
CU	Central Unit
DU	Distributed Unit
DC	Direct Current
DL	Down Link
FFT	Fast Fourier Transform
GUI	Graphical User Interface
GSM	Global System for Mobile Communications
IFFT	Inverse Fast Fourier Transform
IP Rating	Level of Protection
IP	Internet Protocol
LAN	Local Area Network
LED	Light-Emitting Diode
LMT	Local Maintenance Terminal
LTE	Long Term Evolution
MIMO	Multiple Input Multiple Output
NMS	Network Management System
NR	New Radio
PSU	Power Supply Unit
PHY	Physical Layer
RAN	Radio Access Network
RF	Radio Frequency
RSRP	Reference Signal Received Power
RSSI	Received Signal Strength Indicator
Rx	Receive
SFP	Small Form-factor Pluggable
Tx	Transmit
UL	Uplink
UMTS	Universal Mobile Telecommunication System
VLAN	Virtual LAN

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WARNING! This is **NOT** a **CONSUMER** device. It is designed for installation by **FCC LICENSEES** and **QUALIFIED INSTALLERS**. You **MUST** have an **FCC LICENSE** or express consent of an FCC Licensee to operate this device. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of $100,000 for each continuing violation.

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.

Note: The grantee is not responsible for any changes or modifications not expressly approved by the party responsible for compliance. Such modifications could void the user's authority to operate the equipment.

WARNING!

Use only authorized and approved antennas, cables and/or coupling devices! The use of unapproved antennas, cables or coupling devices could cause damage and may be of violation of FCC regulations. The use of unapproved antennas, cables and/or coupling devices is illegal under FCC regulations and may subject the user to fines.

Any installation, adjustment, maintenance and repair of the equipment must only be carried out by trained, authorized personnel. At all times, personnel must comply with any safety notices and instructions.

The design of the antenna installation needs to be implemented in such a way so as to ensure RF radiation safety levels and non-environmental pollution during operation.

Note: Antennas, feeders and couplers are not included in the packing list; solution provider should consider these accessories according to site conditions.

WARNING! Antenna gain should not exceed 5 dBi

To comply with FCC RF exposure compliance requirements, each individual antenna used for this transmitter must be installed to provide a separation distance greater than 2.79m or more from all persons during normal operation and must not be co-located with any other antenna for meeting RF exposure requirements.

Warnings and Admonishments

There may be situations, particularly for workplace environments near high-powered RF sources, where recommended limits for safe exposure of human beings to RF energy could

be exceeded. In such cases, restrictive measures or actions may be necessary to ensure the safe use of RF energy.

The equipment has been designed and constructed to prevent, as far as reasonably, practicable danger. Any work activity on or near equipment involving installation, operation or maintenance must be, as far as reasonably, free from danger.

Where there is a risk of damage to electrical systems involving adverse weather, extreme temperatures, wet, corrosive or dirty conditions, flammable or explosive atmospheres, the system must be suitably installed to prevent danger.

Equipment provided for the purpose of protecting individuals from electrical risk must be suitable for the purpose and properly maintained and used. This covers a range of activities including lifting, lowering, pushing, pulling, carrying, moving, holding or restraining an object, animal or person from the equipment. It also covers activities that require the use of force or effort, such as pulling a lever, or operating power tools.

Where some of the abovementioned activities are required, the equipment must be handled with care to avoid being damaged.

Observe standard precautions for handling ESD-sensitive devices. Assume that all solid-state electronic devices are ESD-sensitive. Ensure the use of a grounded wrist strap or equivalent while working with ESD-sensitive devices. Transport, store, and handle ESD-sensitive devices in static-safe environments.

Compliance with RF safety requirements:

RRU products have no inherent significant RF radiation.

The RF level on the downlink is very low at the downlink ports. Therefore, there is no dangerous RF radiation when the antenna is not connected.

Laser Safety

Fiber optic ports of the RRU system emit invisible laser radiation at the 1310/1550 nm wavelength window.

The laser apertures /outputs are the green LC/UPC Bulkhead adapters located on the front panel of the equipment.

The product is Class 1/Hazard level 1.

External optical power is less than 10mW, Internal optical power is less than 500mW.

To avoid eye injury never look directly into the optical ports, patch cords or optical cables. Do not stare into beam or view directly with optical instruments. Always assume that optical outputs are on.

Only technicians familiar with fiber optic safety practices and procedures should perform optical fiber connections and disconnections of RRU devices and the associated cables.

RRU has been tested and certified as a “Class 1” Laser product to IEC/EN 60825-1(2007). It also meets the requirements for a Hazard Level 1 laser product to IEC/EN 60825-2: 2004 to the same degree.

GX complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice NO.50 (2007).

The product itself has been tested and certified as a Class 1 Laser product to IEC/EN 60825-1 (2007). It also meets the requirements for a Hazard Level 1 laser product to IEC/EN 60825-2: 2004 to the same degree.

Care of Fiber Optic Connectors

Do not remove the protective covers on the fiber optic connectors until a connection is ready to be made.

Do not leave connectors uncovered when not connected.

The tip of the fiber optic connector should not come into contact with any object or dust.

1. SCOPE

This user manual describes how to install and use the 4T4RRemote Radio Unit.

1.1. REFERENCE DOCUMENTS

Doc. No.	Document Title
1	4T4R RRU product description

1.2. WARNING

Warning! Any installation, adjustment, maintenance and repair of the equipment must only be carried out by trained, authorized personnel. At all times, personnel must comply with any safety notices and instructions.

1.3. SPECIFICATION

Frequency Range:	869-894MHz
Radio System Type:	Single Radio Access Technology (Single-RAT): LTE
	Multi-Standard Radio (MSR): GSM & LTE
Capacity: (per antenna port)	1 LTE carrier (5MHz, 10MHz, 15MHz, 20MHz)
	2 LTE carriers (5MHz+5MHz, 5MHz+10MHz, 10MHz+10MHz)
	1 GSM carrier+1 LTE carrier (5MHz, 10MHz)
	2 GSM carriers+1 LTE carrier (5MHz, 10MHz)
Modulation Type:	GSM: GMSK, 8PSK
	LTE: QPSK/ 64QAM/256QAM
MIMO:	4T4R
Normal Output Power: (per antenna port)	46dBm

2. INSTALLATION GUIDELINES

This chapter provides the general guidelines for installing the Remote Radio Unit and includes information such as site considerations and installation requirements.

2.1. SITE CONSIDERATIONS

The distance between the GX service antenna and the coverage area should correspond to line of sight (LOS) requirements for maximum coverage area.
The maximum fiber distance is 10km.
The system delay of the optical system must be taken into consideration when there are neighboring BTS sites overlapping in coverage.

2.1.1. INSTALLATION LOCATION

Mounting surface shall be capable of supporting the weight of the equipment.
In order to avoid electromagnetic interference, a proper mounting location must be selected to minimize interference from electromagnetic sources such as large electrical equipment.

2.1.2. ENVIRONMENTAL

Humidity has an adverse effect on the reliability of the equipment. It is recommended to install the equipment in locations having stable temperature and unrestricted air-flow.
The installation location for the system should be well ventilated. The equipment has been designed to operate at the temperature range and humidity level as stated in the product specifications at temperatures ranging from -40~55^{o}C and a relative humidity of maximum 95%.

2.1.3. POWERING

The power supply unit provides power to all modules within the equipment. Depending on the product variant, it is recommended that the PSU operates on a dedicated AC circuit breaker or fused circuit.

2.1.4. GROUNDING REQUIREMENT

Verify that the equipment has been well grounded. This includes remote radio unit, external combiner, antennas and all cables connected to the system. Ensure lightning protection for the antennas is properly grounded.

2.1.5. CABLE ROUTING

Ensure all cables, e.g. power cable, feeder cable, optic fiber, commissioning cable, connecting are properly routed (use drip-loops) and secured so that they are not damaged.

2.1.6. MANUAL HANDLING

During transportation and installation, take necessary handling precautions to avoid potential physical injury to the installation personnel and the equipment.

2.2. INSTALLATION REQUIREMENTS

Working space available for installation and maintenance for each mounting arrangement. Ensure unrestricted airflow.
Ensure grounding connector is within reach of the ground wire.
Ensure a power source is within reach of the power cord and the power source has sufficient capacity.
Where appropriate, ensure unused RF connectors are terminated.
Do not locate the equipment near large transformers or motors that may cause electromagnetic interference.
Reduce signal loss in feeder cable by minimizing the length and number of RF connections.
Ensure the equipment will be operated within the stated environment (refer to datasheet).
Where appropriate, confirm available of suitably terminated grade of RF and optical fiber.
Observe handling of all cables to prevent damage.

2.3. FIBER OPTIC RULES

ATTENTION!

Please also refer to the laser safety section in the document preface material.
Fiber optic cables require proper handling. Do not stretch, puncture, or crush the fiber cable(s) with staples, heavy equipment, doors, etc.
Always maintain the minimum bending radius specified by the cable manufacturer. The minimum bend radius is usually ten times the cable's outer diameter. In the case of single optical fiber that is not in a cable, the minimum bending radius to be observed is 30 mm.
Wave division multiplexing (WDM) units require single-mode fiber
Use minimum splicing/connectors to achieve minimum losses on the fibers.
Use precaution while installing, bending, or connecting fiber optic cables.
Use an optical power meter and OTDR for checking the fiber optic cables.
Make sure the environment is clean while connecting/splicing fiber optic cables.
All fiber optic connections should be cleaned prior to attaching to termination points using a dry cleaning device (i.e., Cletop or equivalent).
Fiber connector protective caps should be installed on all non-terminated fibers and removed just before they are terminated.
Check the fiber optic connections.

3. INSTALLATION INSTRUCTIONS

3.1. PACKING LIST

Table 3.1-1 Packing List

NO	Description	Quantity
1	Single Band 4T4R RRU	1 Pcs

Table 3.1-2 Accessories list

NO	Description	Quantity	Image
1	GND Cable, 6AWG,2m	1 Pcs	
2	Pentagon Wrench, 5mm	1 Pcs	

3.2. TOOLS REQUIREMENT

The requirement for the installation tools as follows:

Table 3.2-1 Installation tools

Tool Type	Usage
Percussion drill 	self-contained, drill the hole of Φ14 mm
Open spanner 	Self-contained, 10 mm and 16 mm
hammer 	Self-contained, use to install the expansion bolt when use wall-mounted
Cross screwdriver 	φ5mm
Pentagonal socket universal wrench set 	Self-contained, use to open the window coverings and fix the mounting bracket（Anti-theft wrench）
 T-wrench	use to open the window coverings

3.3. TIGHTENING TORQUEREQUIREMENT

The requirement for tightening torque is as follows:

Table 3.3-1 Tightening Torque Requirement

Screw	Torque (N·m)	Screw Description
M4	1.6	Power cord terminal screw
M5	2.2	Maintenance window screw
	4.1	Mounting bracket fixing screw
M6	3.7	To fix mounting bracket and chassis, fix grounding terminal
M8	6.9	To fix bracket 1 on multi-band RRU
M10	47	U-bolt and nut, expansion bolt and nut

3.4. DEVICE PORT DESCRIPTION

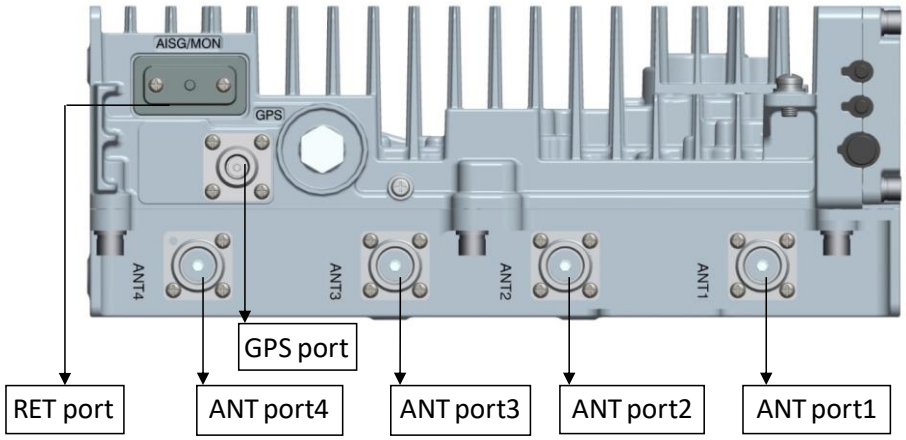


Figure 3.4-1 Port Description of Bottom Side

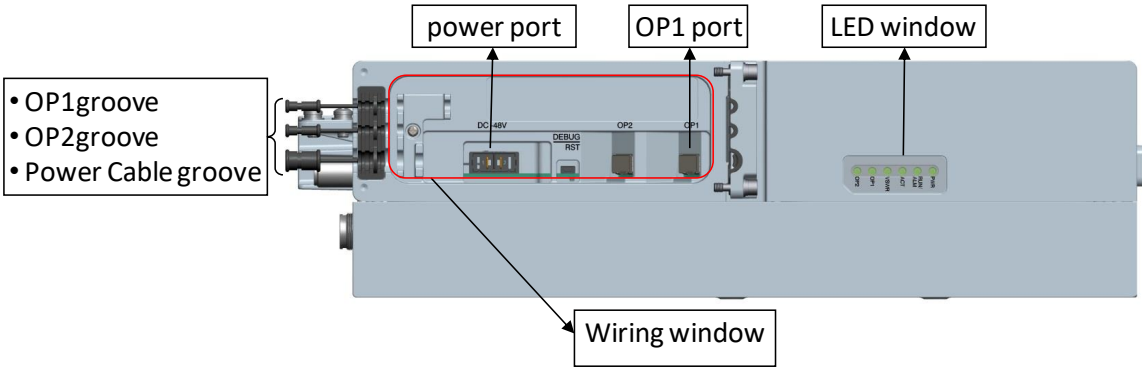


Figure 3.4-2 Port Description of Side Window

Notification: For 2x2-MIMO application, if customer only uses ANT 1 and 2, following points should be noted:

- Unused ANT port (3 and 4) MUST be terminated with a dummy load (≥50W).
- Customer MUST disable ANT port 3 and 4.
- Do the waterproof protection of ANT port 3 and 4.

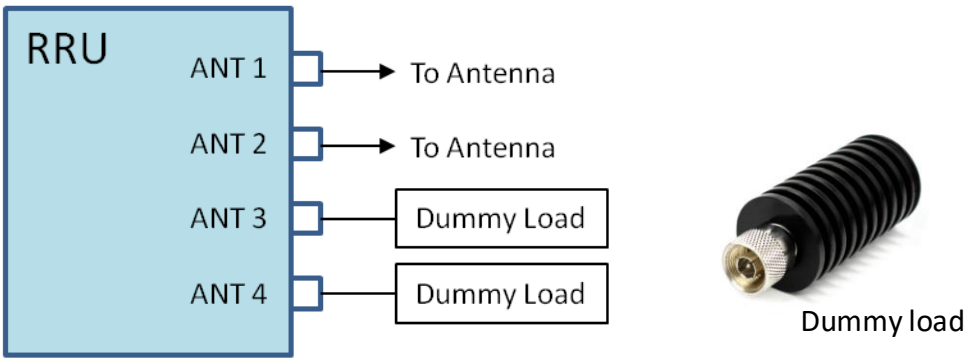


Figure 3.4-3 2T2R Connection

3.5. POWER CABLE PREPARATION GUIDE

Guide of power cable preparation is shown in Figure 3.5-1.

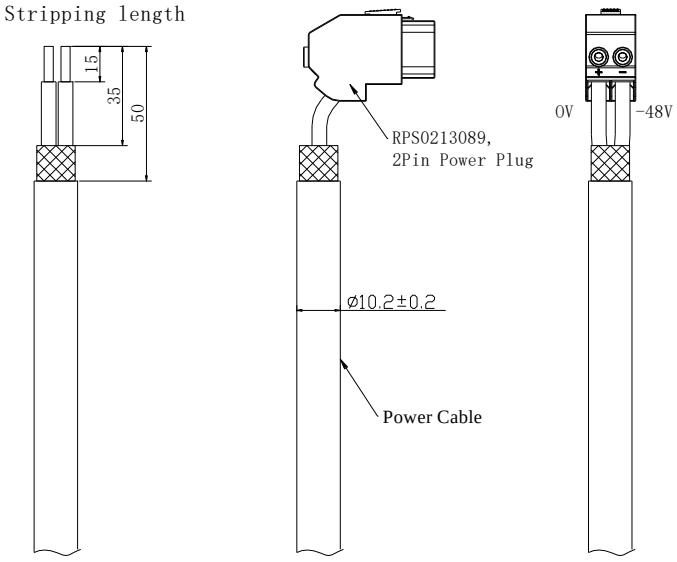


Figure 3.5-1 Power Cable Preparation Guide

- **Power cable requirement**:
  - The power cable should be 12AWG at least.
  - The maximum outer diameter of DC power cable is 10.3mm, otherwise the wiring window cover cannot be closed.

Connect the supplied power cable to the power supply port:

- DC cable specification: 2 x 12AWG
- Power input: -40V to -57.6VDC
- Maximum power consumption: 520W(B5)
- Maximum current consumption: 14.0A(B5).
- * The absolute minimum input voltage that the RU supports is 36.7V DC

After the power cable is connected, the device is normally powered on and initialized (under normal GPS conditions) for about 5 minutes. The voltage at the power connector is not lower than 52.0V without optical fiber connection.

3.6. GROUNDING

The Grounding cable is provided with the screw, which will be installed at the chassis as shown in Figure 3.6-1.

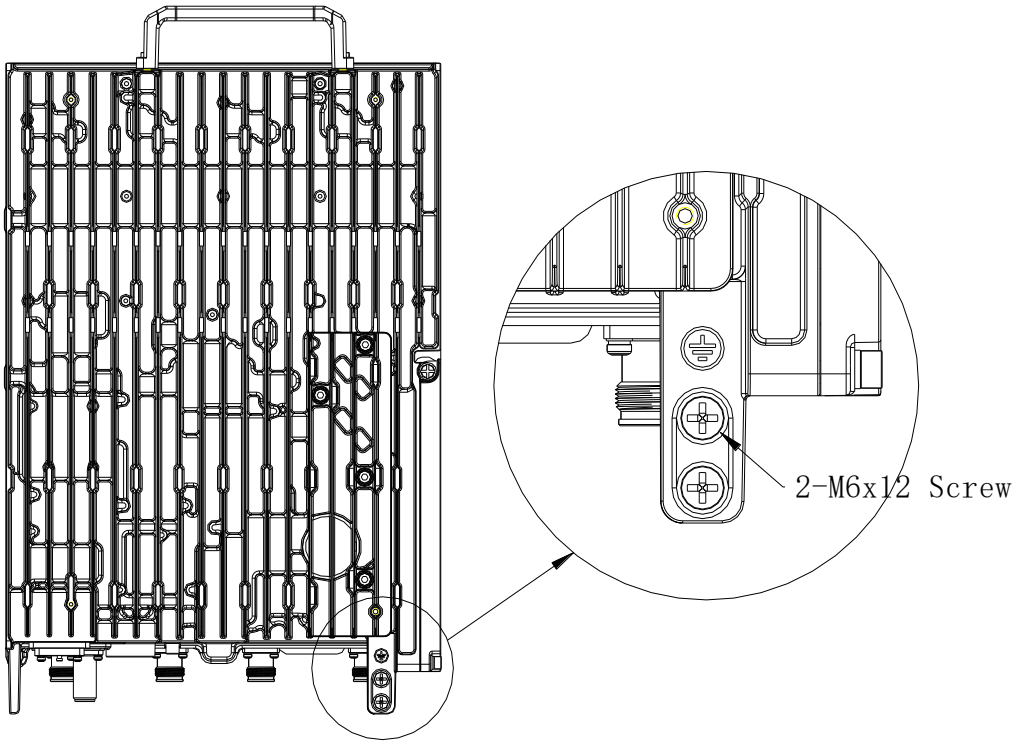


Figure 3.6-1 Grounding Cable Diagram

Recommended GND cable specification: 6AWG

For installation in the seaside or high-salt fog area, it is recommended that the grounding terminal be treated with anti-corrosion treatment after connecting the bottom line, such as encapsulating mud or applying anti-corrosion paint.

3.7. RRU INSTALLATION

3.7.1. INSTALLATION SPACE REQUIREMENTS

In order to ensure the normal operation and heat dissipation requirements of the equipment, the equipment needs the following installation requirements (unit: mm)

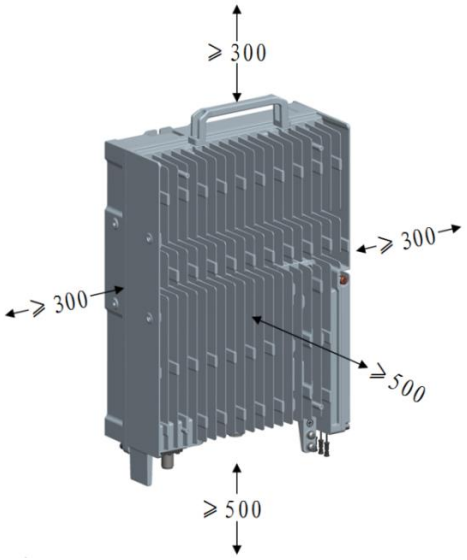


Figure 3.7-1 Wall-Mount Space Requirement

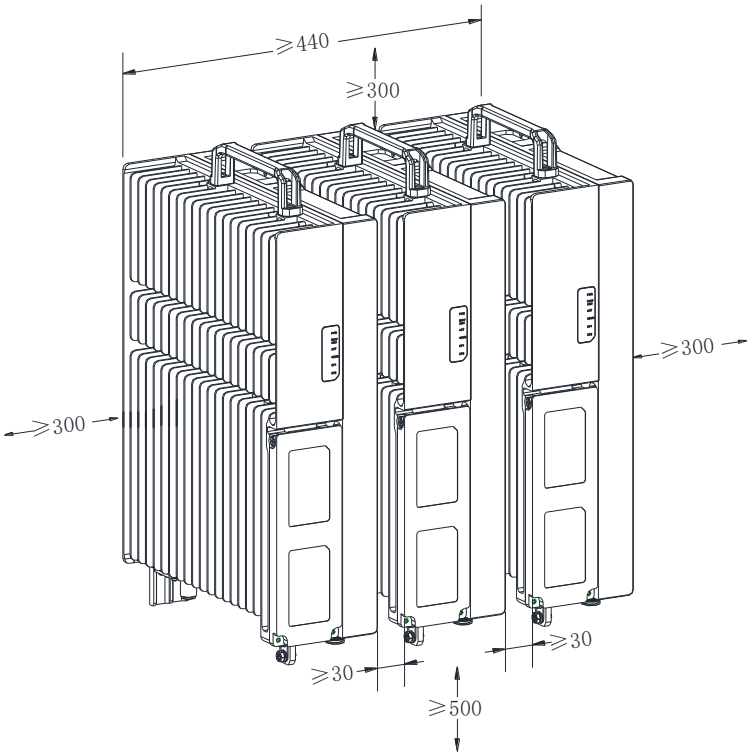


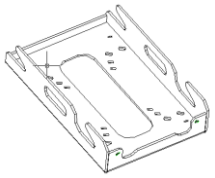
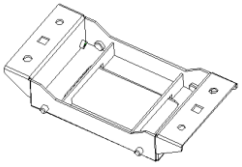
Figure 3.7-2 Blade-Mount Space Requirement

For installation in a confined space or a narrow space, the heat exchange capacity inside and outside the space needs to be considered, and ventilation facilities need to be installed to avoid self-protection of the equipment due to long-term work and air temperature rise. The heat dissipation of the device is 360W.

3.7.2. STANDARD MOUNTING KIT PACKING LIST

The packing list of standard RRU mounting is as below.

Table 3.7-1 Tightening Torque Requirement

NO	Description	Qty.	Image
1	RRU-5821T13-5803, bracket 1	1 Pcs	
2	RRU-5821T13-5814, bracket 2	1 Pcs	
3	U-bolt, M10×85×110 (Optional)	2 Pcs	

3.7.3. INSTALLATION PROCEDURE OF WALL MOUNT

Step 1: take out bracket 1; select the mounting holes to fix bracket 1 according to the installation requirements (front mount or blade mount). See Figure 3.7-3 and Figure 3.7-4

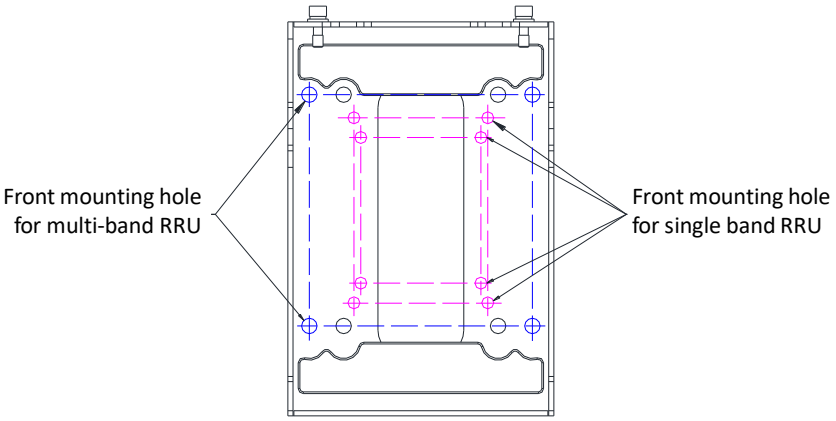


Figure 3.7-3 Bracket 1 Mounting Hole of Front Mount

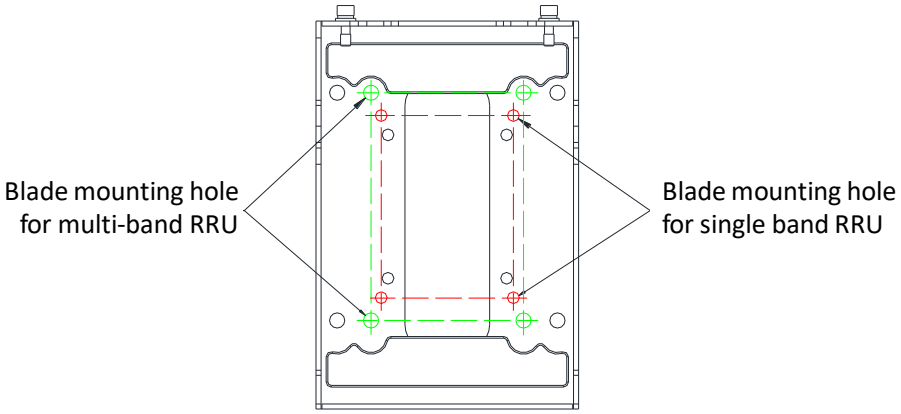


Figure 3.7-4 Bracket 1 Mounting Hole of Blade Mount

Step 2: Use 4 screws (M6 for single band, M8 for multi-band) to fix the bracket 1 on the back or side of RRU as shown in Figure 3.7-5 and Figure 3.7-6.

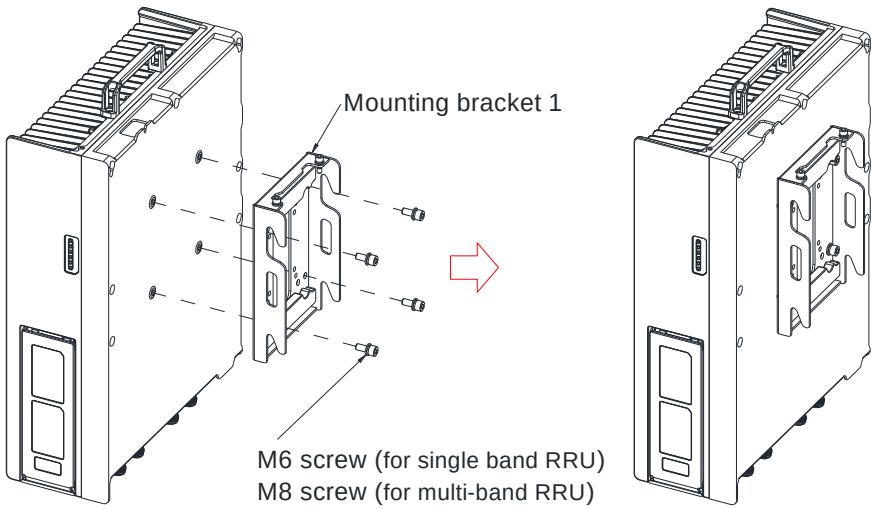


Figure 3.7-5 Fix Bracket 1 on RRU, Front Mount

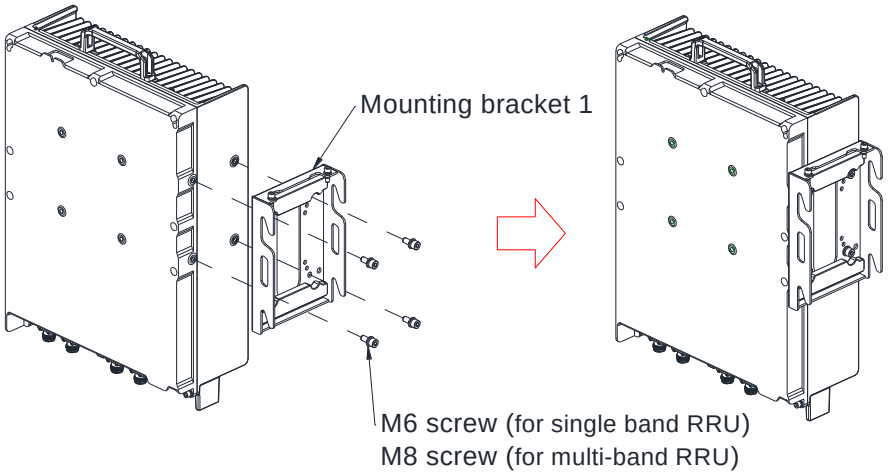


Figure 3.7-6 Fix Bracket 1 on RRU, Blade Mount

Step 3: Take out bracket 2. Drill 4 holes of Φ14 depth 65~75mm according to the position shown in Figure 3.7-7.

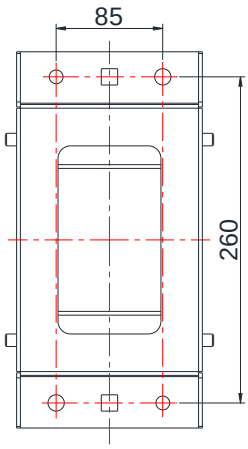


Figure 3.7-7 Drill 4 Holes

Step 4: Use a hammer to knock four M10×110 expansion bolts into the wall, and fix bracket 2 on the wall, as shown in Figure 3.7-8.

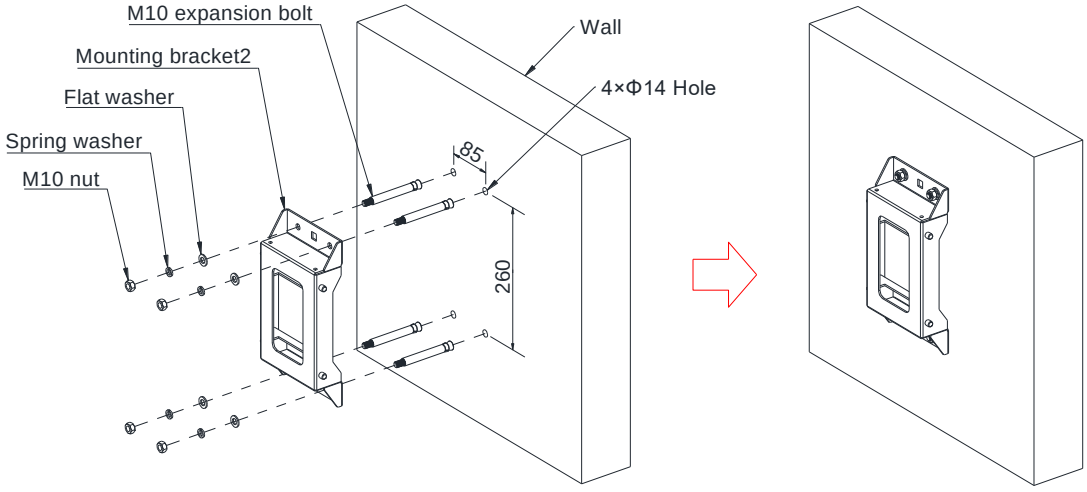


Figure 3.7-8 Fix Bracket 2 on Wall

Step 5: Lift the RRU and insert it into the slot of the mounting bracket from top to bottom, and fasten the M6 screws to fix the RRU. See Figure 3.7-9 and Figure 3.7-10.

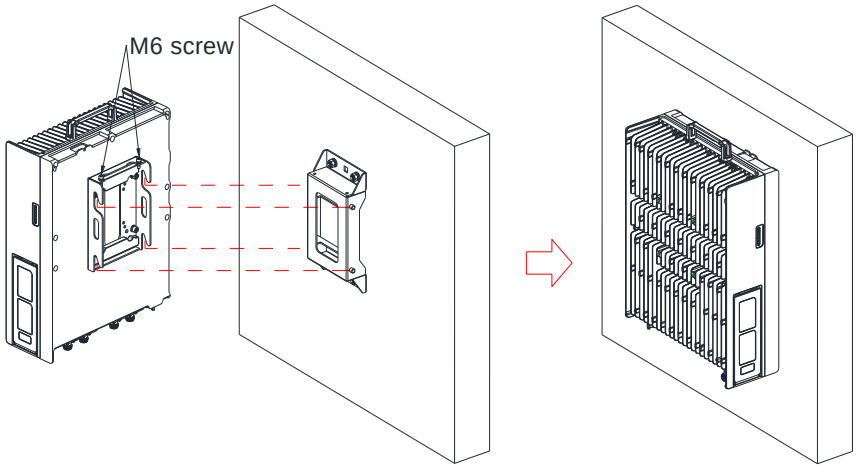


Figure 3.7-9 Fix RRU on Wall, Front Mount

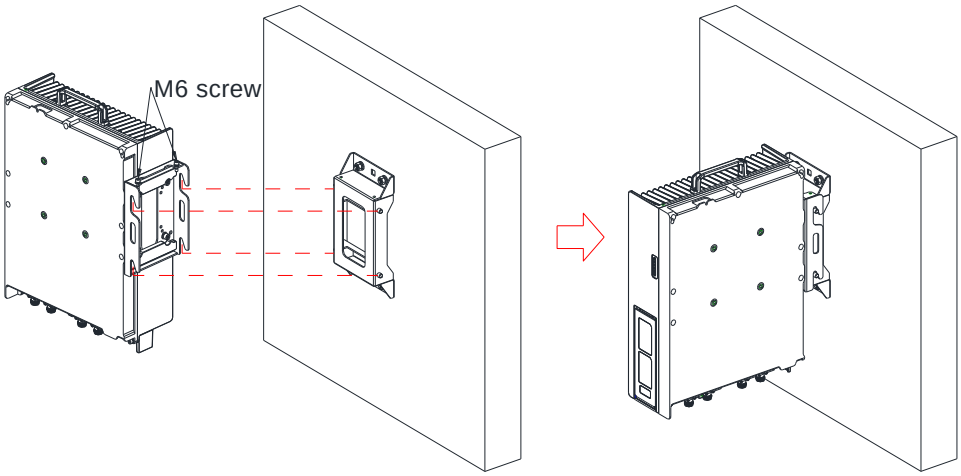


Figure 3.7-10 Fix RRU on Wall, Blade Mount

3.7.4. INSTALLATION PROCEDURE OF POLE MOUNT(45≤ΦD<75MM)

Step 1: Fix bracket 1 on RRU (see Step1-2 in 3.7.3 installation procedure of wall mount).

Step 2: Take out the bracket 2 and fix it on the pole (45 ≤φ D<75mm) with 2 U-bolts.

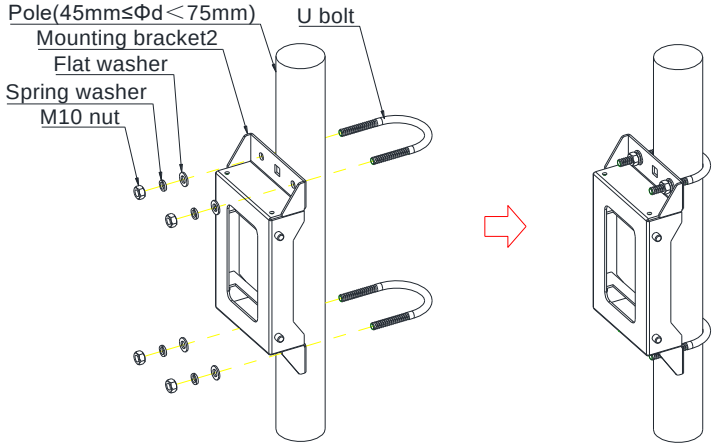


Figure 3.7-11 Fix Bracket 2 on Wall

Step 3: Lift the RRU and insert it into the slot of the mounting bracket from top to bottom, and fasten the M6 screws to fix the RRU. See Figure 3.7-12 and Figure 3.7-13.

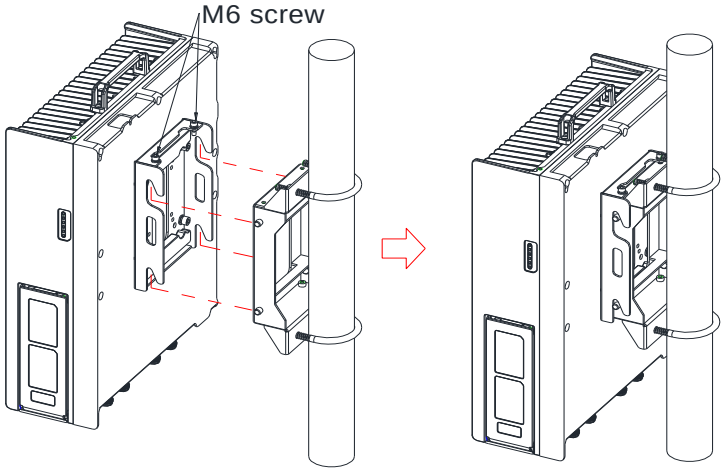


Figure 3.7-12 Fix RRU on Pole, Front Mount

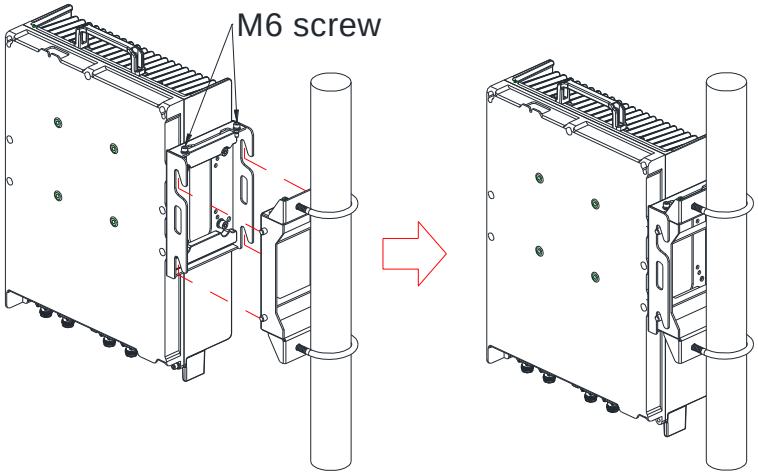


Figure 3.7-13 Fix RRU on Pole, Blade Mount

3.8. OPTICAL MODULEINSTALLATION

Requirement of optical module:
Data Rate: SFP/ SFP+ 10 Gbps
Operating Temperature: -40 to +85 °C or above
Power Consumption: ≤1W
Installation steps:

- **Step1**: Prepare the SFP module and optical fiber.
- **Step2**: Connect optical fiber and SFP module.
- **Step3**: Insert SFP module into port “OP1” on RRU.

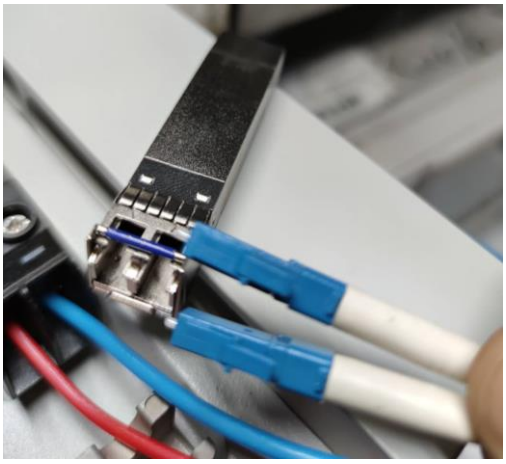


Figure 3.8-1 Optical Module Installation

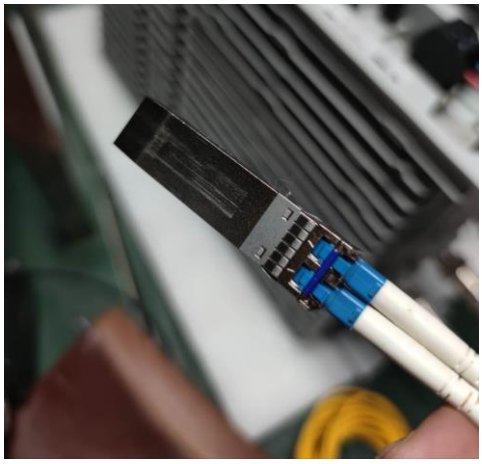


Figure 3.8-2 Optical Module Installation

Figure 3.8-3 Optical Module Installation

There is an installation sketch label in the side window, the connection of optical fiber and DC cable should follow it. See Figure 3.8-4

Figure 3.8-4 Installation Sketch Label

3.9. GPS INSTALLATION

GPS installation includes lightning protection and antenna installation:

Lightning protection:

There is a DC power supply in the GPS feeder, which is sensitive to lightning. It is necessary to add a feeder lightning protection device between the GPS port of the device and the GOS antenna. The lightning protection specification is not less than 20KA. The link method is as follows:

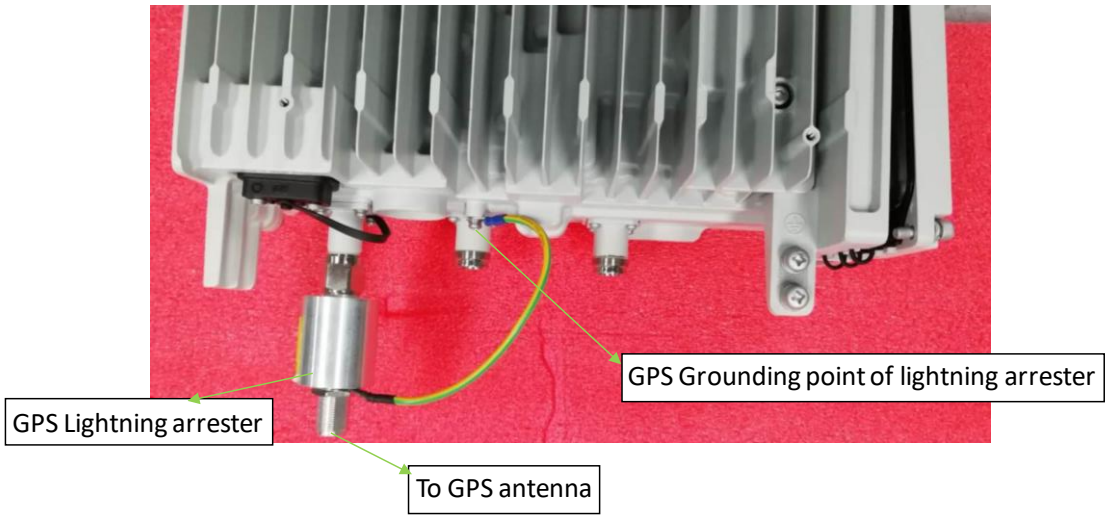


Figure 3.9-1 GPS Installation

The connection of the GPS feeder, including the connection of the lightning arrester and the antenna, needs to be waterproofed, and the protection level needs to be above IP65.

GPS antenna installation:

Fix the GPS module onto a Pole with two M10 bolts and the fasten metal. Then put two nuts on the both ends of the bolt and fasten them as shown in Figure 3.9-2.

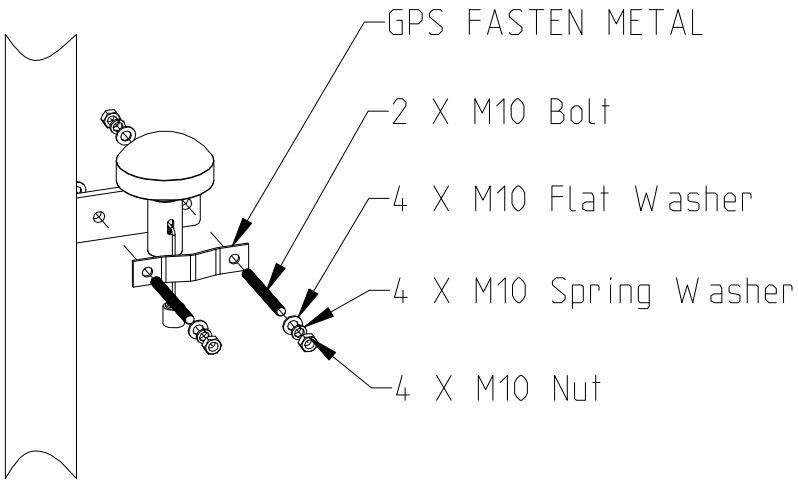


Figure 3.9-2 GPS antenna mounting diagram

- Note1: Inclination of GPS Unit against the vertical direction shall be 4.5 degrees max. as shown in Figure 3.9-3

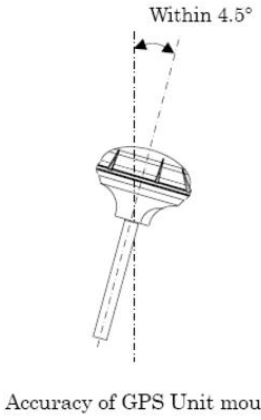


Figure 3.9-3 GPS max degrees

- Note2: There shall be no obstruction at the place of 25 degrees or more from the horizontal surface at the center (excluding antenna), as shown in Figure 3.9-4 and Figure 3.9-5.

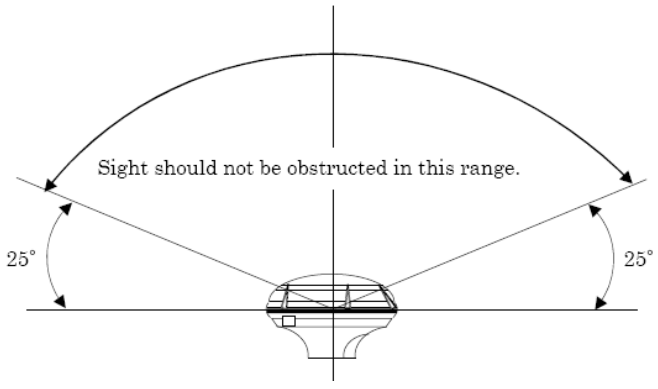


Figure 3.9-4 GPS sight range

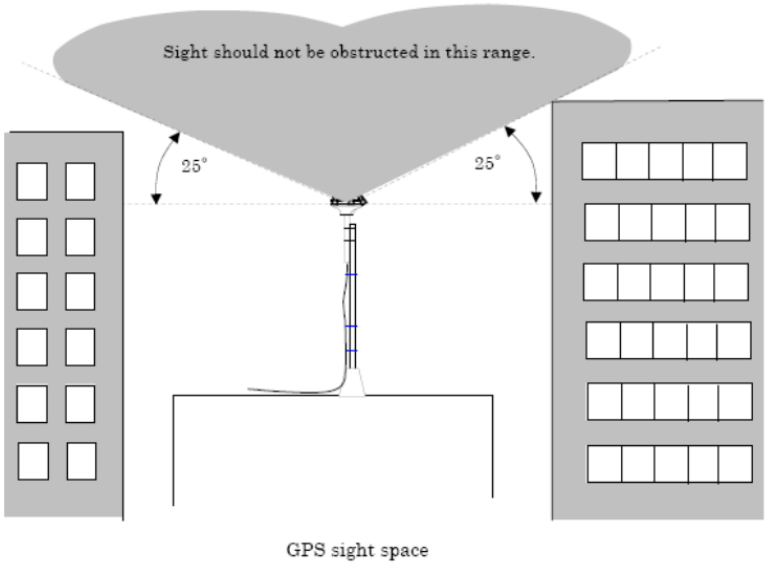


Figure 3.9-5 GPS sight space

- Note3: The GPS antenna cannot be installed within the radiation range of the main antenna, and it should be isolated from the main antenna as much as possible to prevent the main signal from interfering with the GPS.

3.10. AISG AND EXTERNAL ALARM CONNECTION

The extension cable show below is used to connect the antenna AISG port for RET and the external device for alarm monitoring.

Figure 3.10-1 AISG/MON extension cable

Specifications of cable length:

Table 3.10-1 AISG/MON extension cable Length

Device side	Connect side	Length
DB15	AISG port (RET)	3m or 5m
DB15	EXT ALM port (MON)	0.5m

The AISG cable show below is used to connect the antenna AISG port for RET

Figure 3.10-2 AISG cable picture

Specifications of cable length:

Table 3.10-2 AISG cable Length

Device side	Connect side	Length
DB15	AISG port (RET)	3m or 5m

The DB-15 port is as shown below is used to connect to RRU for AISG and external alarm connection.

Figure 3.10-3 DB-15 Interface on RRU

The 2 circulars ports are used to connect to antenna RET port and external alarm monitoring device.

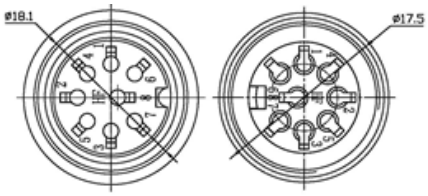


Figure 3.10-4 AISG/MON Port interface.

Remark:

The extension cable is not including in the standard package.

Extension cable Installation steps:

- Step1: Align the connector and insert the cable.
- Step2: Tighten the two screws on the plug.
- Step3: Insert the RET port of the cable in the antenna end connector, then twist the connector tightly

The following figure shows the connection of the RRU with Antenna, GPS and the external alarm monitoring device.

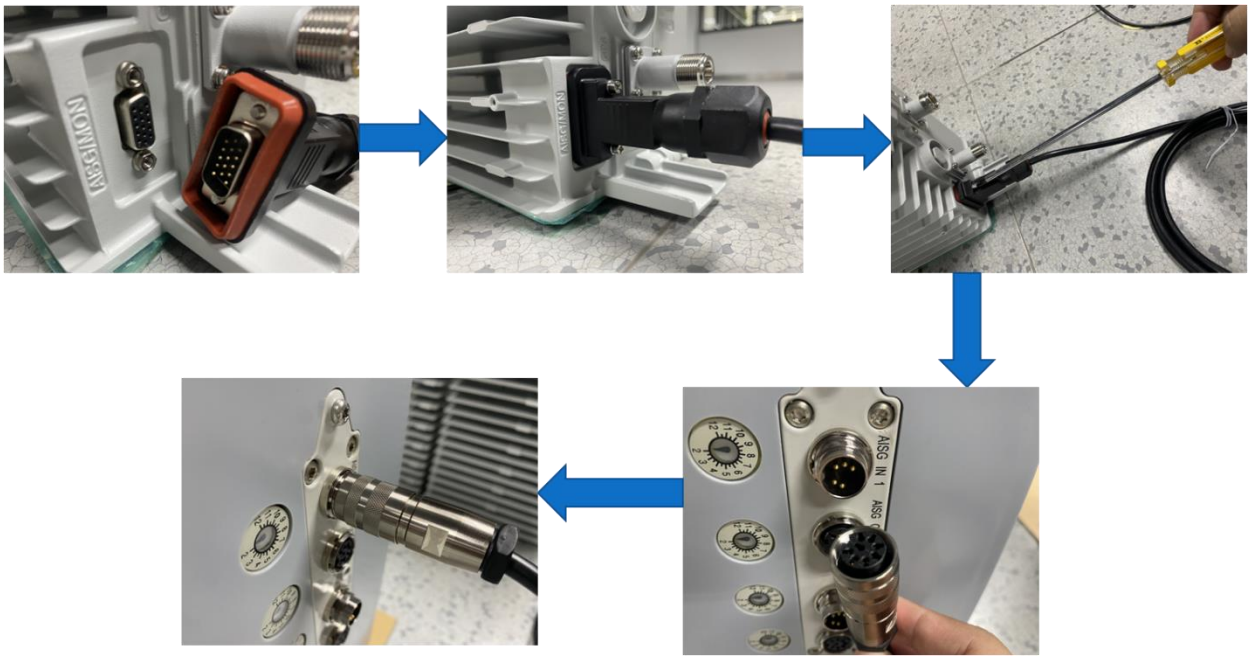


Figure 3.10-5 Extension Cable Connection Steps

3.11. VERIFYING NORMAL OPERATION

Upon powering up the RRU unit:
Verify normal operation:

Table 3.11-1 LED Description

LED	Status	Description
PWR	Green	Power On
	OFF	No input Power
RUN/ALM	Green steady on	No software is running or software is on the initial
	Flashing green (flash/s)	Device operates normally
	Flashing green (flash/0.125s)	device is on the power booting or upgrade the software
	Orange steady on	General alarm
	Flashing orange	Critical or more serious alarm
ACT	Green steady on	PAs operates normally in created cells
	Flashing green (flash/s)	Some PAs is off in created cells
	Off	PAs is off
VSWR	Orange steady on	One or more channels operates abnormal after cells created
	Flashing orange (flash/s)	One or more VSWR alarms were detect when booting
	Off	No VSWR alarm
OP1/OP2	Green	Link is normal
	Orange	Optical module is insert, but no receive or trans abnormal
	Slow Flashing Green	Flashes (rate of flash per second)high bit error or link is on unlock status
	Off	Optical module is not insert

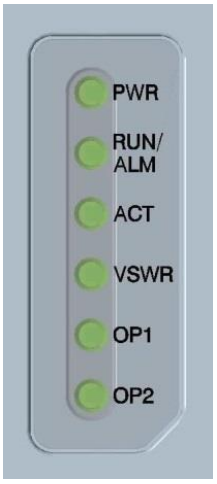


Figure 3.11-1 LED Window

3.12. CLOSE THE SMALL WINDOW COVER

After the power cable and optical fiber confirm that the link is normal, the power-on test status is normal, indicating that the device can work normally, then close the small window cover and tighten it with the T-row wrench provided with the device.

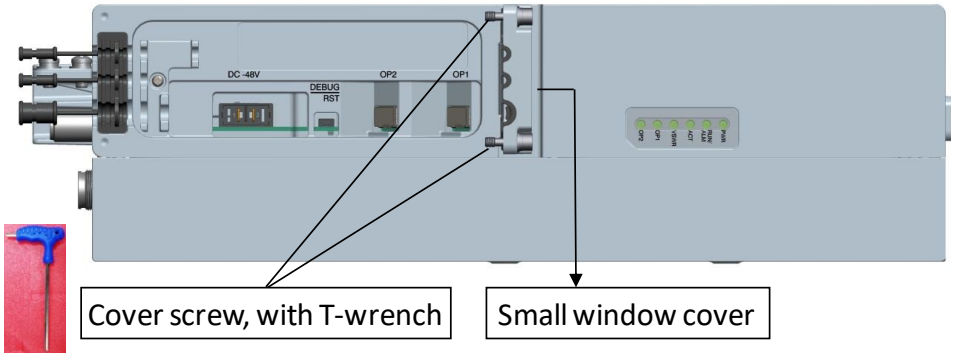


Figure 3.12-1 Close the Window Cover

----END----