RRU3800F080 User Guide

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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.

This equipment complies with FCC radiation exposure limits set forth for a uncontrolled environment. This equipment should be installed and operated with minimum distance 11m between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. This equipment complies with IC RSS-102 radiation exposure limits set forth for a uncontrolled environment. This equipment should be installed and operated with minimum distance 11m between the radiator and your body.

Cet é quipement est conforme aux limites d'exposition aux radiations IC CNR-102 é tablies pour un

environnement uncontrô lé. Cet é quipement doit ê tre installé et utilisé avec une distance minimale de 11 m entre

le radiateur et votre corps.

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

(1) This device may not cause interference.

(2) This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

(1) L'appareil ne doit pas produire de brouillage;

(2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Contents

Documentation Information

This section introduces the target readers, conventions and revision history.

Target Readers

This document applies to the following readers:

- Technical support engineers

- Maintenance engineers

- Installation/commissioning engineers

Documentation Conventions

Icon Conventions

Icon	Description
Tip	Indicates information that can help you make better use of your product.
Note	Indicates references that can further describe the related topics.
Caution	Indicates situations that could cause data loss or device damage.
Warning	Indicates situations that could cause minor personal injury.
Danger	Indicates situations that could cause major personal injury or even death.

Notation Conventions

Convention	Description
""	The quotation marks enclose the name of a software interface element. For example, click "OK".
Bold	The text in boldface denotes the name of a hardware button. For example, press the **PTT** key.
->	The symbol directs you to access a multi-level menu. For example, to select "New" from the "File" menu, we will describe it as follows: "File -> New".

Revision History

Document Version	Product Version	Release Date	Description
00	V1.0	11-2018	Initial release.

1. Product Overview

Radio Remote Unit (RRU) extends the RF module in the BS to the far-end RF unit through optical fibers to complete baseband signal and RF signal processing. The RRU and Base Band Unit (BBU) jointly compose a BS.

Main features of the RRU:

- Receiving downlink baseband data sent from the BBU, and sending uplink baseband data to the BBU to implement communication with the BBU.

- Receiving the RF signal from the antenna feeder system, changing the received signal to intermediate frequency signal through down conversion, performing amplification and analog-to-digital conversion (A/D conversion) for the signal, completing downlink signal filtering and digital-to-analog conversion (D/A conversion), and sending the RF signal to the transmit frequency band through up-conversion.

- Providing the received signal and transmitted signal multiplexing function of RF channel to enable the received signal and transmitted signal to share one antenna channel, and providing the filtering function of received signal and transmitted signal.

2. Packing List

The packaging box contains the following items. If any items are missing or damaged, please contact Hytera or your local distributor.

Item	Quantity	Item	Quantity
Main unit	1	Document suite	1 set
Mounting kits	1 set	/	/

Note

The pictures in the manual are used for reference only. Please refer to the actual product.

3. Familiar with the Product

3.1 RRU Appearance

The RRU is designed in the modular structure. The external interfaces and indicators of the RRU are located at the bottom and the right side of the module respectively. The figure below shows the appearance of the RRU.
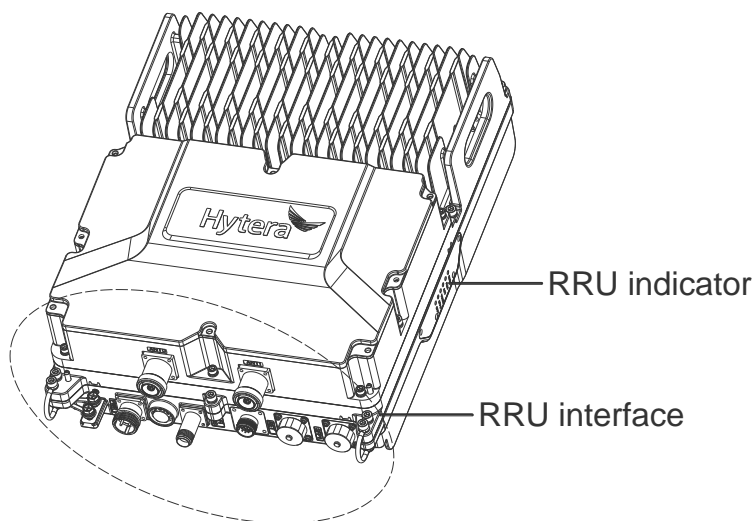
3.2 RRU Interfaces

The figure below shows the positions of interfaces at the bottom panel of the RRU.
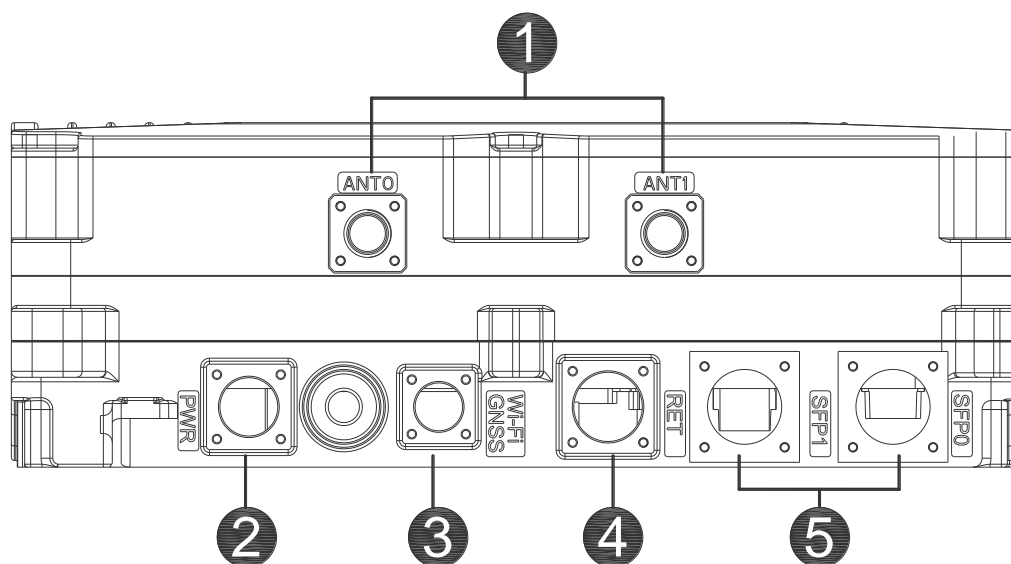
No.	Identifier	Connector	Description
1	ANT0/ANT1	DIN	Two antenna connectors, used to transmit and receive the RF signal.

| No.	Identifier	Connector	Description
2	Power Indicator	/	Power interface, used to connect to the external power system. Supporting the -48V DC input.
3	GNSS	N-F (GNSS)	GNSS interface, used to connect to the GPS/Beidou Navigation Satellite System.
4	RET	Aviation connector	Dry contact interface, connected to the external monitoring device through the monitoring cable. Supporting up to 115,200 bps.
5	SFP0/SFP1	SFP/SFP+female type	CPRI interface, connected to the BBU or lower-level RRU through the optical fiber.

3.3 RRU Indicators

The RRU is provided with six indicators, which are used to indicate the RRU operating status. The RRU indicators are located on the right panel of the RRU, as shown below.
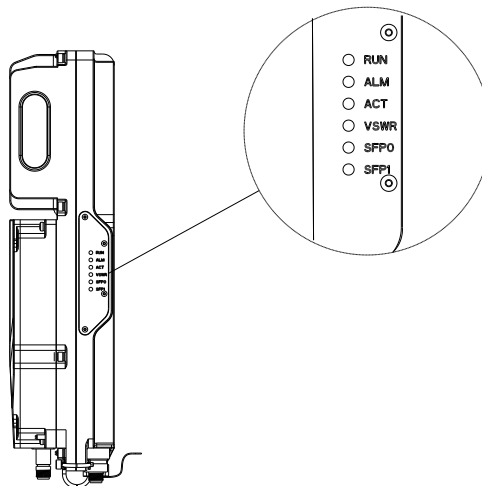
LED Indicator	Color	Status	Description
RUN	Green	Steady off	No power input or device failure
		Steady on	Power input available, but the device fails
		Blinking slowly (on for 1s and off for 1s)	The device is running normally.
		Blinking quickly (on for 0.125s and off for 0.125s)	The device is loading software or the device is not operating.
ALM	Red	Steady off	The device does not report any alarm.
		Steady on	The device reports an alarm, and the board needs to be replaced.
		Blinking	The device reports an alarm arising from the related interface failure.
ACT	Green	Steady on	No service is operating on the device.
		Blinking	Service is operating on the device.
VSWR	Red	Steady off	The device does not report the Voltage Standing Wave Ratio (VSWR) alarm.
		Blinking slowly	Exception of one or multiple channels is detected after the cell is established.
		Blinking rapidly	One or more ports report the VSWR alarm during startup.
SFP0/SFP1	Green	Steady off	The CPRI fiber link is abnormal.
		Steady on	The CPRI fiber link is normal.
		Blinking	Data is being transmitted on the CPRI link.

4. Product Installation

4.1 Safety Information

Before performing any operation, read the following precautions and operation instructions carefully to ward off potential risks.

Regulations and Specifications

Observe local regulations and specifications when installing the equipment.

Power supply

⚠️ **Danger**
- Direct contact or indirect contact (through moist objects) with the high voltage or mains electricity may result in an electric shock.
- Nonstandard or incorrect operations may lead to accidents such as a fire or electric shock.

- Never wear conductive articles such as watches, bracelets or rings during operation.

- Do use dedicated tools during high voltage or AC operations.

- Take necessary measures to prevent entry of moisture into the device operating under a moist environment.

- Make sure the lightning-proof grounding is implemented for the device to prevent it from being damaged by lightning strikes.

- Disconnect the device from the power supply before installing or removing it.

- Check the cable and the label on it to ensure correct connection.

- Make sure that the device is well grounded before connecting it to the power supply.

- Disconnect the device from the power supply if you find water or other liquids in the device.

- Make sure the power switch is toggled to the "Off" position before installing the device.

Working at Height

Work at height refers to work performed at a height more than 2 m above the ground. Pay attention to the following items during the work at height.

- Stop the work at height in case of hazardous conditions such as thunder and lightning, rain, snow, gale above scale 6, and steel pipe with rainwater.

- Define a hazardous zone on the work site at height, set an obvious sign, and prevent unauthorized persons from entering the area.

- Do not pile scaffolds, gangplanks or other sundries on the lower ground of the work area at height. Ground workers are not allowed to stay under the work area at height or pass through it.

- People who work at height should not throw objects to the ground from the high altitude or to the high altitude from the ground. Instead, they should use strong ropes, hanging baskets, overhead vehicles, or cranes to transport objects.

- Take sound safety actions such as wearing the hamlet and safety belt properly.

- Do wear heat-retaining clothes when working in cold areas.

- Make sure that the ladder is safe for use, and overload is strictly prohibited.

- People who work at height should handle and use all instruments and tools with care to avoid falling to injure others.

- Do not frolick when working at height or sleep in the work area at height.

Personnel

The person who performs equipment operations must have acquired the basic knowledge of safety operations, received professional training, and obtained the corresponding operation qualifications.
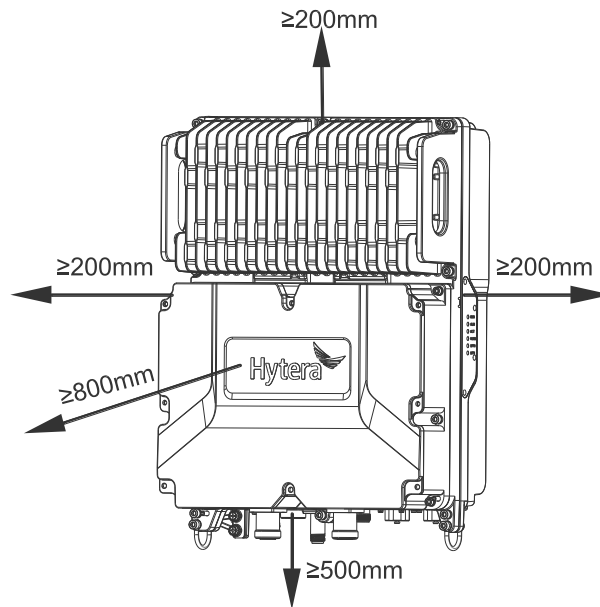
4.2 Installation Flow

The figure below shows the RRU installation flow.
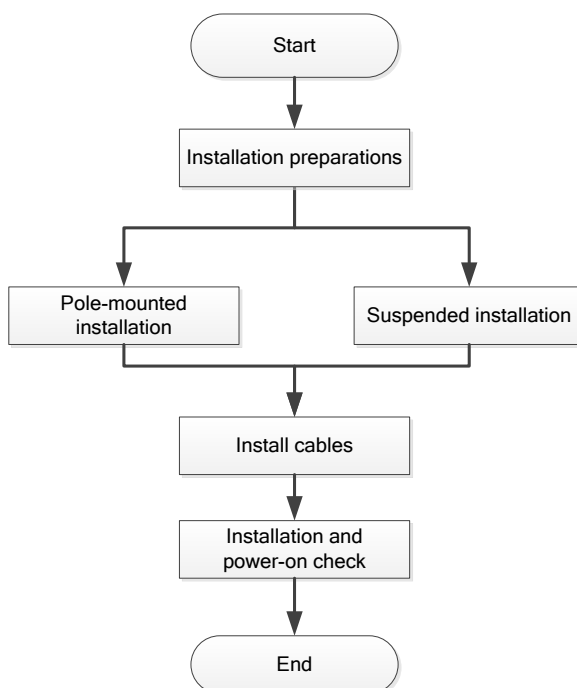
4.3 Installation Preparations

4.3.1 Environment Requirements

Space Requirements

- Keep a space of at least 200 mm above the RRU.

- Keep a space of at least 500 mm below the RRU.

- Keep a space of at least 200 mm at the left and right sides of the RRU.

- Keep a space of at least 800 mm in front of the RRU.

- Install the RRU vertically at the correct position.

Grounding Requirements

- Be sure to ground the equipment before installing it; disconnect the ground wire finally when removing the equipment.

- Do not destroy the grounding conductor.

- Do not operate the equipment when the grounding conductor is not installed.

- Connect the equipment to the protection ground permanently. Before operating the equipment, check its electrical connection and make sure that the equipment has been grounded reliably.

4.3.2 Instruments and Tools

Prepare the following instruments and tools before the installation:

| Conventional tools	Phillips screwdriver, slot type screwdriver, adjustable spanner, inner hexagon spanner, cross torque screwdriver, combination wrench, rubber hammer, and torque sleeve
Protective tools	Antistatic wrist strap, safety belt, safety helmet, safety rope, antiskid gloves
Cable making tools	Cable peeler, crimping pliers, wire nippers
Measurement instruments and tools	Multimeter, tape, level ruler
Auxiliary tools	Fixed pulley, step ladder, marker, hammer drill, insulation tape, cable tie (anti-ultraviolet cable tie), label, screw assembly, expansion screw assembly, tool knife, heat gun, waterproof tape

4.3.3 Materials

Unpack for inspection according to the equipment list prior to installation, and make sure that the materials are complete and intact.

4.4 Installing the Device

Pole-mounted installation and suspended installation can be adopted for the RRU. The user can independently determine the mounting type of the RRU according to the actual requirement.

4.4.1 Mounting Kits

Mounting kits include the hanging part, backboard, lock catch, and M6 screw, as shown below.
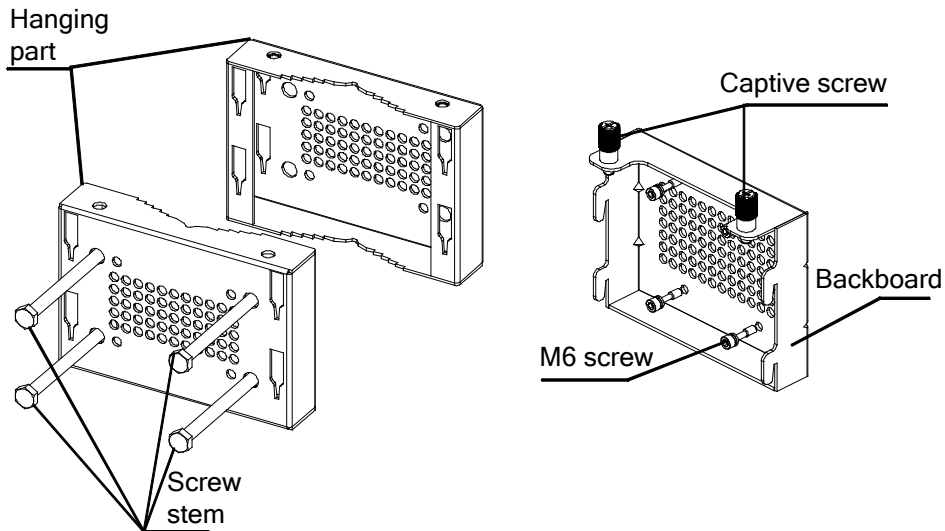
4.4.2 Installing the RRU

Pole-mounted installation
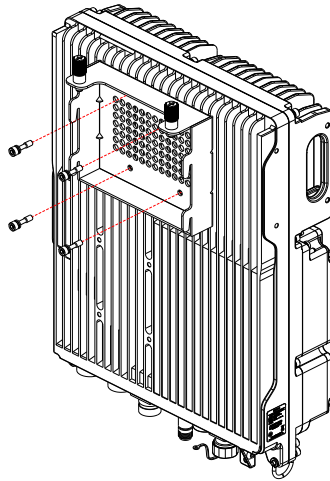
1. Mark the position of the RRU mounting kit on the pole.

2. Insert the pole into two hanging parts, insert the four screw stems into the through holes of hanging parts, and use a torque wrench to tighten four nuts to make them clamp the hanging parts onto the pole body, as shown below.
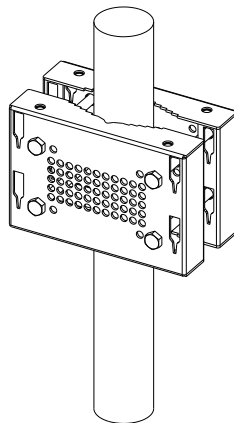
3. Use four M6 screws to lock the RRU backboard onto the RRU cavity back, as shown below.

4. Insert the RRU backboard into the slot of the hanging part, and tighten the captive screws on the RRU backboard, as shown below.
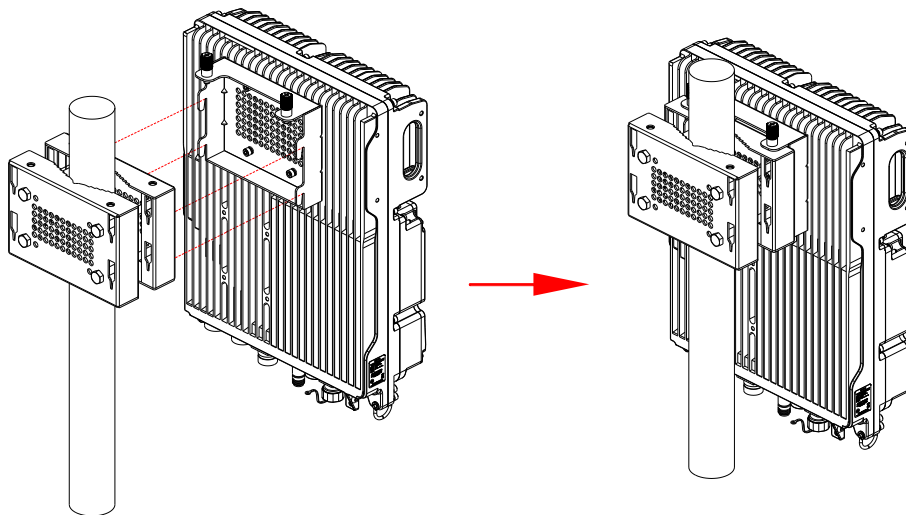
Suspended installation

1. Make the hanging parts cling to the wall, use a level ruler to level the installation position, and use a marker to mark the locating points, as shown below.
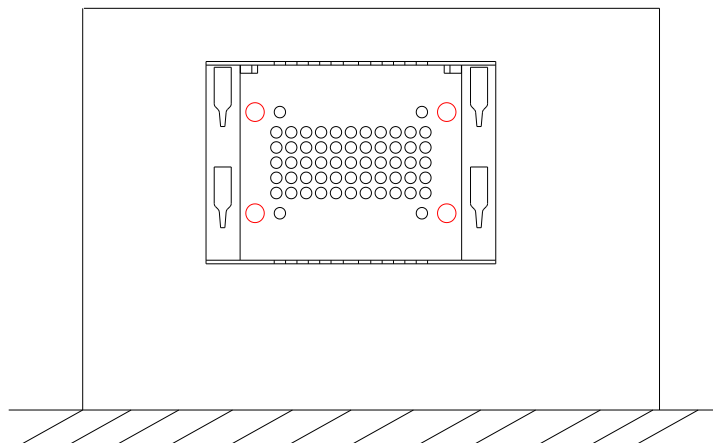
2. Drill holes at the locating points, and install the expansion bolts, as shown below.

a. Use a hammer drill to drill a hole on the vertical wall at the locating point.

b. Tighten the expansion bolt slightly, and place it in the hole vertically.

c. Use a rubber hammer to knock the expansion bolt till the expansion tube enters the hole completely.

d. Slightly tighten the expansion bolt clockwise.

e. Loosen the expansion bolt anticlockwise, and take out the bolt, spring washer, plastic tube, and flat gasket in turn.

3. Use the expansion bolt, spring washer and flat gasket to fix the hanging part to the locating hole, and tighten the expansion bolt, as shown below:

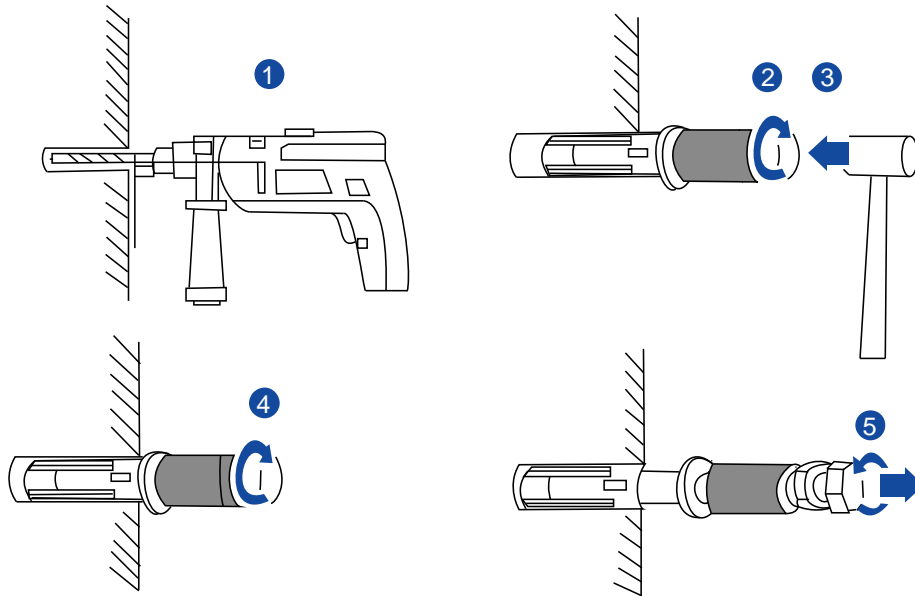4. Use four M6 screws to lock the RRU backboard onto the RRU cavity back, as shown below.
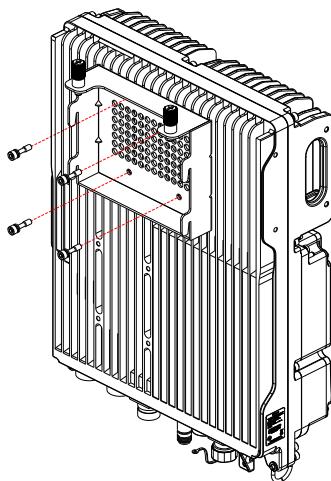
5. Insert the RRU backboard into the slot of the hanging part, and tighten the captive screws on the RRU backboard, as shown below.
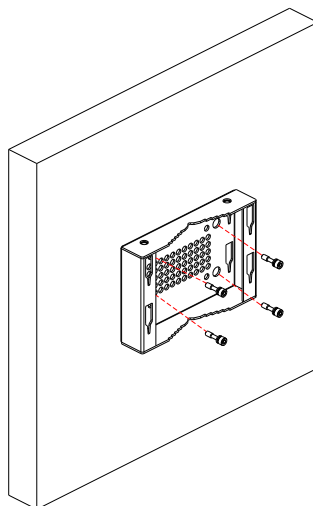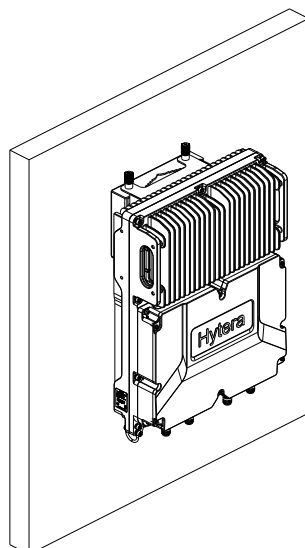

4.5 Installing Cables

4.5.1 Cabling Requirements

Lay cables according to the related cabling requirements to prevent inter-signal interference.

Safety requirements

- Avoid sharp objects or wall burrs as laying out cables. Use bushings to protect cables when they cannot be avoided.
- Stay away from the heat source as laying out cables, or add thermal insulation materials between the cables and the heat source.

Binding requirements

- Bind the cables of the same type together.

- The bound cables should be kept close to each other and look straight and tidy, without sheath damage.

- The cable ties should face the same direction; the cable ties at the same position should be at the same level.

- After cables are installed, make sure to stick labels at two ends, intermediate connection positions, and turning points of cables.

- Lay out different types of cables separately. Prevent laid cables from twisting or crossing each other.

Power cord laying requirements

- The power cord laying positions should comply with the engineering design drawing requirements.

- If the power cord length is not enough during laying, replace the power cord. Do not make joint or welding spot along the power cord.

- Avoid circling or twisting when laying the power cord.

PGND cable laying requirements

- Do not lead in the PGND cable from the outdoor overhead layer. It must be buried underground in the whole course or routed indoors.

- Do not bind the PGND cable and signal wire together or make them intertwined, and keep a distance between them to avoid mutual interference.

- All the accessible conductive metal parts in the device enclosure must be connected to the protection ground terminal reliably.

Fiber laying requirements

- Do not bind the fiber at the fiber bending position.

- Do not pull the fiber forcefully or use a foot or other heavy objects to press the fiber, and prevent the fiber from coming into contact with sharp objects, lest the fiber would be damaged.

- When routing optical fibers, wind excess fibers on a special device, e.g., a fiber reel.

- For the optical fiber jumper, the fiber must be bound with cable ties. If the fibers need to be fixed on a cabinet or device, use cable ties for the optical fiber. Ensure that the fibers can be pulled freely in the cable ties but cannot be bent to form a right angle.

- Use uniform force when winding fibers. Do not force to bend fibers lest they would be damaged.

- Be sure to put on a dust cap when the fiber connector is not in use.

4.5.2 Cable Connection Diagram

The figure below shows the RRU cable connection diagram.
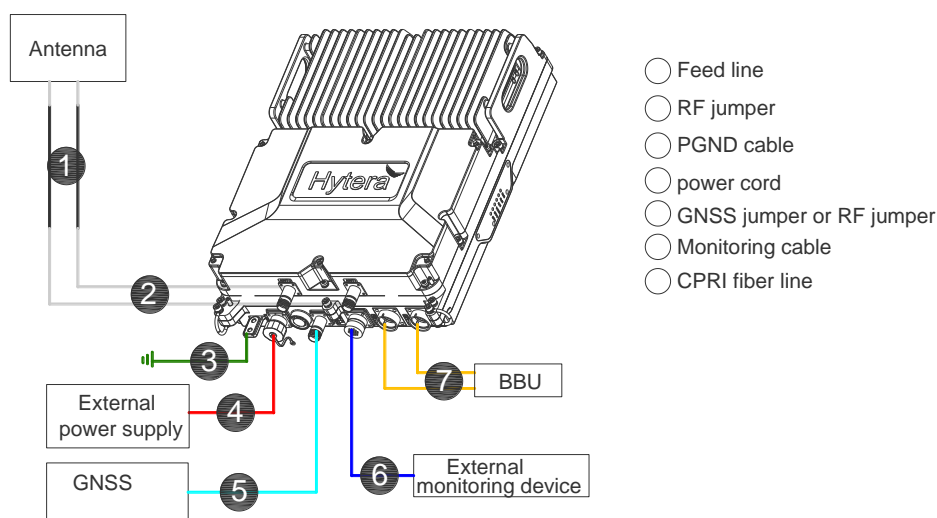
4.5.3 Installing PGND Cable

1. Cut a proper length of cable to make a RRU PGND cable according to the actual routing path, and install an OT terminal at each end of the cable.

    The metal wire cannot be exposed when the PGND cable is prepared on the field, as shown below.
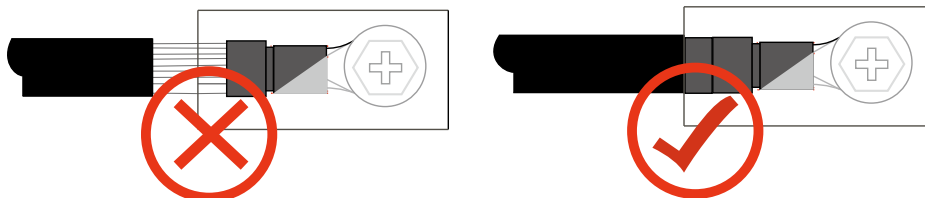
2. Connect the OT terminal of the RRU PGND cable to the grounding port at the RRU bottom, and the OT terminal at the other end to the external grounding bar.

3. Stick a label to the installed cables.

4.5.4 Installing RF Jumper

1. Connect the DIN connector to the antenna interface of the RRU, and use a torque wrench to fasten the interface, as shown below:

2. Connect the other end of the RRU RF jumper to the feeder end of antenna.

3. Take waterproof measures for the connection port of the RRU RF jumper.

    a. Wind three layers of waterproof tapes. Wind to the connector top from 50 mm at the bottom of the RF jumper connector. First wind layer by layer from bottom up, then wind layer by layer from top down, and finally wind layer by layer from bottom up. Cut off the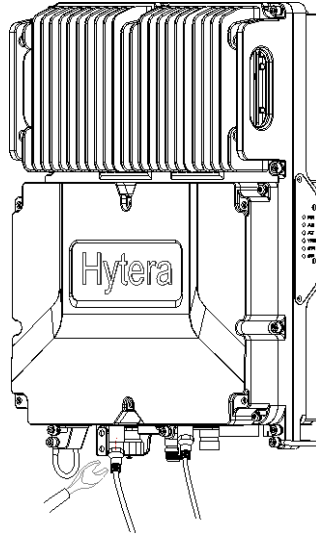 tape after the three layers are wound. After each layer is wound, use a hand to pinch the tape at the bottom to ensure waterproof effect.

    b. Wind PVC insulation tape by three layers. Wind to the connector top from 30 mm at the lower part of waterproof tape. First wind layer by layer from bottom up, then wind layer by layer from top down, and finally wind layer by layer from bottom up. Cut off the tape after the three layers are wound. After each layer is wound, use a hand to pinch the tape at the bottom to ensure waterproof effect.

    c. Bind a cable tie at 3 mm–5 mm from the end on the PVC insulation tape to prevent tape aging.

4. Check the dust cap of the antenna joint, and take waterproof measures for the dust cap by referring to the previous step.

5. Lay cables according to the specifications, and bind and fix them with cable ties.

6. Stick a label to the installed cables.

4.5.5 Installing RRU Power Cord

1. Connect the connector at one end of the RRU power cord to the RRU power interface, and the connector at the other end to the corresponding connection position of the external power supply equipment.

2. Lay cables according to the specifications, and bind and fix them with cable ties.

3. Stick a label to the installed cables.

4.5.6 Installing CPRI Fiber

The CPRI fiber is used to connect the BBU and RRU and transmit CPRI signal.

1. Install an optical module on the RRU, as shown below.
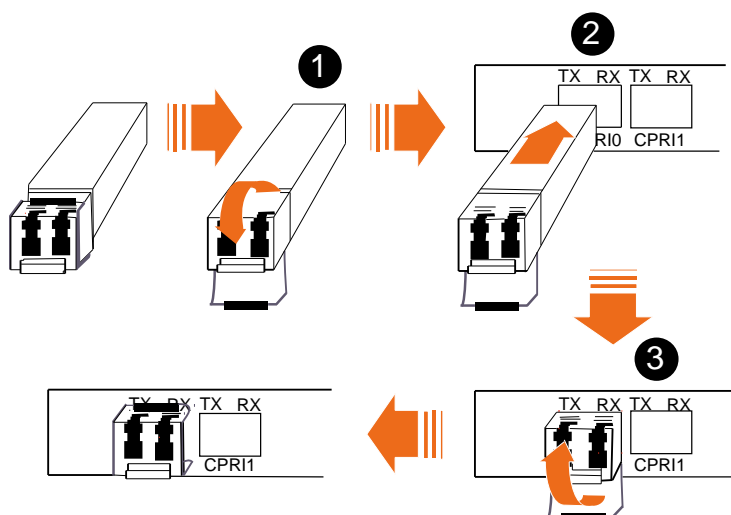
    a. Fold down the suspension link of optical module.

    b. Insert the optical module into the optical interface.

    c. Fold up the suspension link of optical module.

2. Connect the pigtail of CPRI fiber to the optical module at the RRU side, and the other end to the optical module at the BBU side. The following figure shows the diagram of inserting the CPRI fiber into the optical module.
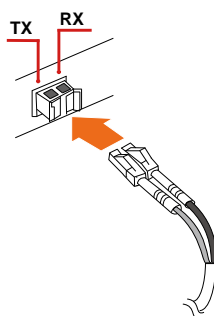
3. Lay cables according to the specifications, and bind and fix them with cable ties.

4. Stick a label to the installed cables.

4.5.7 Installing Monitoring Cable

1. Remove the dust cap from the RET interface of the RRU.

2. Connect the connector at one end of the RRU monitoring cable to the RET interface of the RRU, and the connector at the other end to the external monitoring device.

3. Lay cables according to the specifications, and bind and fix them with cable ties.

4. Stick a label to the installed cables.

4.5.8 Installing GNSS Jumper

1. Remove the dust cap from the GNSS interface of the RRU.

2. Install the GNSS jumper.

    ➢ When installing the GNSS jumper, connect the connector at one end of the GNSS jumper to the GNSS interface, and the connector at the other end to the GNSS lightning arrester interface.

    ➢ When installing the, connect the connector to the GNSS interface.

3. Lay cables according to the specifications, and bind and fix them with cable ties.

4. Stick a label to the installed cables.

# 4.6 Installation and Power-on Check

4.6.1 Installation Check

Check the installation result according to the table below.

No.	Item
1	The device installation position must strictly comply with the design drawing requirements and installation space requirements, and a maintenance space must be reserved.
2	The RRU is securely installed.
3	A dust cap is installed at the RF port without RF cable installed, and waterproof measures are taken for the dust cap.
4	Whole sections of materials must be adopted for all the power cords and PGND cables,

No.	Item
	without short circuit and reverse connection; no wires are damaged or broken.
5	Power cords and ground wires should be bound separately from other cables.
6	The connectors of all the cables must be intact and connected firmly and reliably; the cables are not damaged or broken.
7	The labels are correct, clear and complete; the labels at two ends of various cables, feeders and jumpers are correct.

4.6.2 Power-on Check

The figure below shows the RRU power-on check flow.
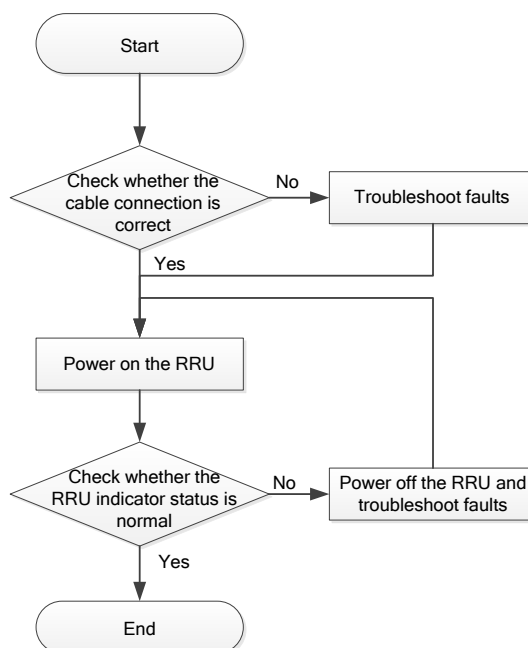
Normal statuses of the RRU indicators: The RUN indicator blinks in green, and the ALM indicator is steady off.

5. Operation and Maintenance

5.1 Powering On RRU

Requirement

- The RRU hardware and cables have been installed.

- The supply voltage of the RRU power input port is in the range of -38.4 V to -60 V DC.

Procedure

1. Set the corresponding air switch on the matched power equipment of the RRU to "ON", and power on the RRU.

2. Check the indicator status of the RRU device several minutes later.

3. Perform operation of the next step according to the indicator status.

   - The power-on process ends if the RRU operates normally.

   - If the RRU fails, set the corresponding air switch on the matched power equipment of the RRU to "OFF", eliminate the failure, and continue with steps 1–3.

5.2 Powering Off RRU

Set the corresponding air switch on the matched power equipment of the RRU to "OFF".

6. Troubleshooting

Symptom	Cause Analysis	Solution
The unit cannot be powered on.	The power cord is not connected or contact with the socket is too loose.	Connect the power cord properly and ensure good contact.
The green RUN indicator is steady on.	There is power input, but the module fails.	Eliminate the module failure or directly replace the module.
The green RUN indicator is steady off.	There is no power input, or the module fails.	Check whether the power cord is connected normally, or eliminate the module failure. Directly replace the module when necessary.
The red ALM indicator is steady on.	There is an alarm, and the module fails.	Directly replace the module.
The red ALM indicator blinks.	The alarm arises from the related interface failure.	Check the related interface.
The red VSWR indicator blinks quickly.	One or more ports report the VSWR alarm during startup of the RRU.	Check whether the antenna feeder system is connected normally.
The red VSWR indicator blinks slowly.	One or multiple channels are abnormal after the cell is established.	Check whether the antenna feeder system is connected normally.
The SFP indicator is steady off.	The CPRI fiber link fails.	Check whether the fiber connection is normal and whether the optical module is inserted properly.

If the problem persists, please contact Hytera.

7. Care and Cleaning

To guarantee optimal performance and a long service life of the product, please follow the tips below to perform routine maintenance and cleaning work better for it.

⚠️**Caution**

Be sure to power down the product before cleaning it.

Maintenance

● When an external interface will not be used, install a waterproof rubber plug at the external interface, lest the waterproof and dustproof performance of the product would be affected.

● Do not use a hard object to pierce, knock or scratch the product; do not throw the product or exert intensity vibration on it.

● Do not store the product in an environment with substances corroding electronic circuits.

● Keep the product dry.

● Do not keep the product in a place at a too high temperature. High temperature will shorten the service life of electronic device, destroy the battery, and deform or melt some plastic parts.

● Do not keep the product in a place at a too low temperature. When the device temperature rises to the normal temperature, moisture will be generated inside to damage the circuit board.

Cleaning

● Clean up the dust on the product surface and charging pole piece with a clean and dry lint-free cloth or a brush regularly.

● If the product casing gets dirty, use neutral detergent and non-woven fabric to clean it. Do not use chemical agents such as stain removers, alcohol, sprays or oil preparations that may damage the product surface and casing. After cleaning, make sure that the product becomes dry thoroughly before use.

8. Technical Specifications

Item		Specification
General	Frequency range	Band26 ● RX: 814MHz to 849MHz ● TX: 859MHz to 894MHz
	Transmission distance	● Single cascade: >10km ● Multi-level cascade: >40km
	Operating voltage	-48V DC
	Extreme operating voltage	-38.4V to -60V DC
	Antenna configuration	2T2R
	Operating Bandwidth	35MHz
	Carrier bandwidth	1.4MHz/3MHz/5MHz/10MHz/15MHz
	Rated power	40W
	Operating temperature	-40°C to +55°C, can start at -40°C
	Storage temperature	-40°C to +85°C
	Operating humidity	5% to 100% RH
	Dustproof and waterproof	IP66
	Volume	<23L
	Weight	26.5kg
Receiver	RX sensitivity	● 1.4MHz: ≤-110dBm ● 3MHz: ≤-106.5dBm ● 5MHz/10MHz/15MHz: ≤-105dBm
	In-channel selectivity	● 1.4MHz: ≥19.9dB (wanted signal: -106.9dBm; unwanted signal: -87dBm) ● 3MHz: ≥18.1dB (wanted signal: -102.1dBm; unwanted

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Item		Specification
		signal: -84dBm)
		● 5MHz: ≥19dB (wanted signal: -100dBm; unwanted signal: -81dBm)
		● 10MHz/15MHz: ≥21.5dB (wanted signal: -98.5dBm; unwanted signal: -77dBm)
	Adjacent channel selectivity	● 1.4MHz: ≥43.8dB (wanted signal: +6dB; unwanted signal: -49dBm)
		● 3MHz: ≥43dB (wanted signal: -+3dB; unwanted signal: -49dBm)
		● 5MHz/10MHz/15MHz: ≥43.5dB (wanted signal: +1dB; unwanted signal: -49dBm)
	Blocking	● 1.4MHz: ≤-109dBm (E-UTRA unwanted signal: -43dBm; CW wanted signal: -15dBm)
		● 3MHz: ≤-105.5dBm (E-UTRA unwanted signal: -43dBm; CW wanted signal: -15dBm)
		● 5MHz/10MHz/15MHz: ≤-104dBm (E-UTRA unwanted signal: -43dBm; CW wanted signal: -15dBm)
	Intermodulation response rejection	● 1.4MHz: ≤-109dBm (-52dBm)
		● 3MHz: ≤-105.5dBm (-52dBm)
		● 5MHz/10MHz/15MHz: ≤-104dBm (-52dBm)
	Spurious emission	● ≤-57dBm/100kHz (9kHz to 1GHz）
		● ≤-47dBm/MHz (1GHz to 12.75GHz）
Transmitter	Output power	2x40W
	Transmit vector error	● <4.5%@64QAM
		● <12.5%@16QAM
		● <17.5%@QPSK
	Transmit frequency error	±0.05ppm

Item		Specification
	Occupied bandwidth	1.4 MHz/3MHz/5MHz/10MHz/15MHz
	Adjacent Channel Power Ratio	≤-50dB
	Out-of-band spurious emission	● ≤-36dBm/1kHz (9kHz–150kHz) ● ≤-36dBm/10kHz (150kHz–30MHz) ● ≤-36dBm/100kHz (30MHz–1GHz) ● ≤-30dBm/1MHz (1GHz–12.75GHz)

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9. Abbreviations

Abbreviation	Full Name
B	
BBU	Base Band Unit
G	
GNSS	Global Navigation Satellite System
R	
RRU	Radio Remote Unit