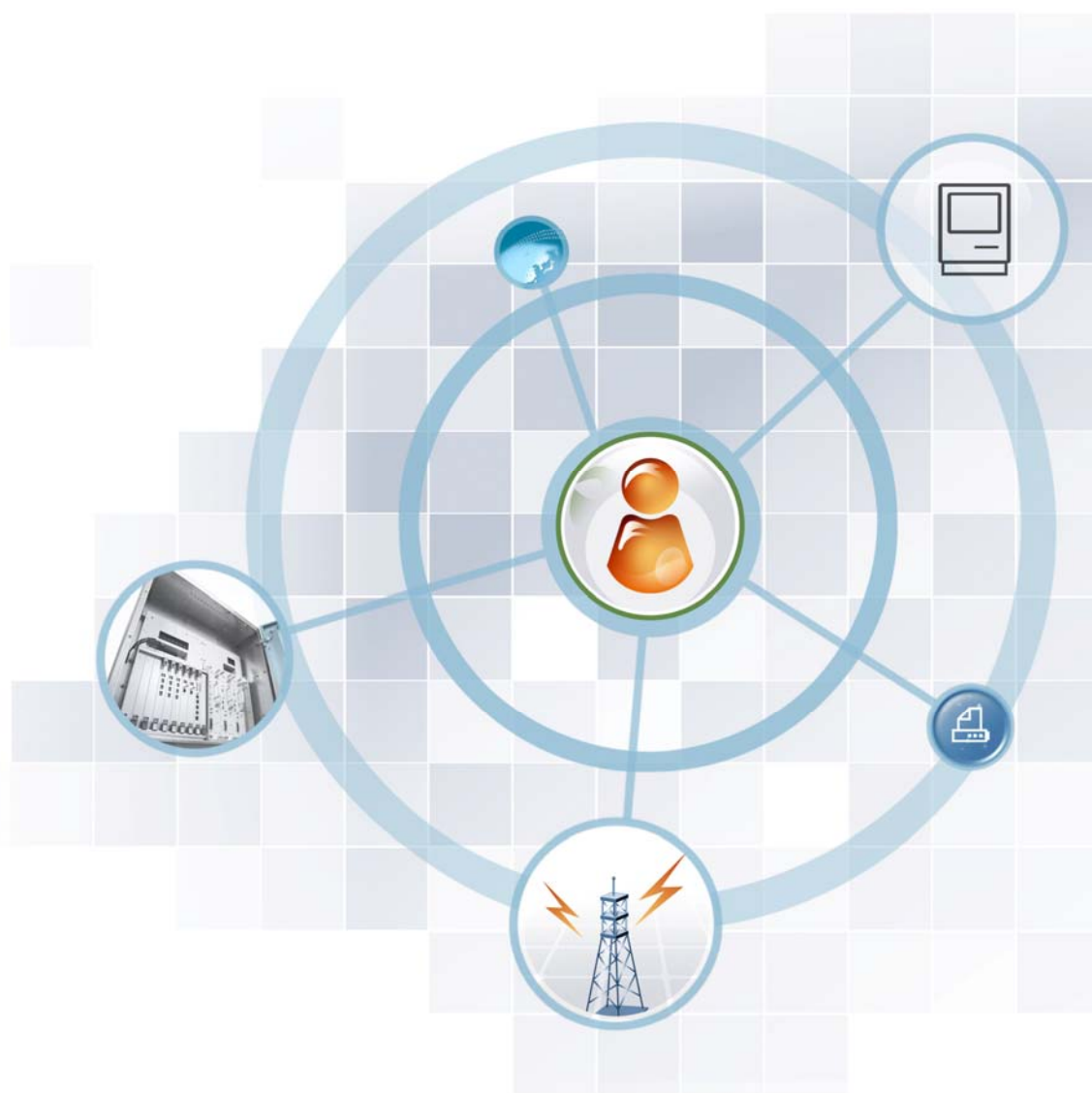


Smart MBS RRH-C2A

Installation Manual



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INTRODUCTION

Purpose

This manual describes procedure and method for installing Smart MBS RRH-C2A.

Document Content and Organization

This manual consists of 2 Chapters, 6 Annex and Abbreviation as follows:

CHAPTER 1. Before Installation

This chapter introduces safety rules that must be understood for installing RRH-C2A and describes the configuration of RRH-C2A.

CHAPTER 2. Installation of RRH-C2A

This chapter describes the procedure to install RRH-C2A.

ANNEX A. Sector Antenna Installation

This annex describes sector antenna configurations and its installation requirements.

ANNEX B. Feeder Line Work

This annex describes cautions and allowed radius of curvature when installing feeder line.

ANNEX C. Assembling connector

This annex describes the procedure of assembling connector.

ANNEX D. Cleaning Optic Connector

This annex describes the procedure of cleaning the optic connector and cleaning tool.

ANNEX E. Pressure Terminal Assembly

This annex describes the procedure of assembling the pressure terminal.

ANNEX F. Standard Torque

This annex describes the standard torque when assembling the fixing materials.

ABBREVIATION

Describes the acronyms used in this manual.

Conventions

The following types of paragraphs contain special information that must be carefully read and thoroughly understood. Such information may or may not be enclosed in a rectangular box, separating it from the main text, but is always preceded by an icon and/or a bold title.



WARNING

WARNING

Provides information or instructions that the reader should follow in order to avoid personal injury or fatality.



CAUTION

CAUTION

Provides information or instructions that the reader should follow in order to avoid a service failure or damage to the system.



CHECK

CHECKPOINT

Provides the operator with checkpoints for stable system operation.



NOTE

NOTE

Indicates additional information as a reference.

Revision History

EDITION	DATE OF ISSUE	REMARKS
1.0	10. 2011.	First Edition

SAFETY CONCERNS

The purpose of the Safety Concerns section is to ensure the safety of users and prevent property damage. Please read this document carefully for proper use.

Symbols

**Caution**

Indication of a general caution

**Restriction**

Indication for prohibiting an action for a product

**Instruction**

Indication for commanding a specifically required action

WARNING

Power and Grounding



Watches, Rings, and Other Metallic Accessories

Do not wear accessories such as watches and rings in order to prevent electrical shock.



Connecting Ground Cable

In cabling, the connection of cables without the connection to the ground cable may cause the damage of the equipment or the bodily injury of the worker.
Connect the ground cable first.

Installation General



Caution for Laser Beam of Optical Module and Cable

The optical module and cable used in the system emit bright laser beams.
Always handle them with care as there is risk of serious injury if the eyes are exposed to the laser beam of the optical cable.



Wearing protection gloves and goggles

Make sure to wear protection gloves and goggles to prevent damages from debris while drilling holes in a wall or ceiling.



CAUTION

Power and Feeder line



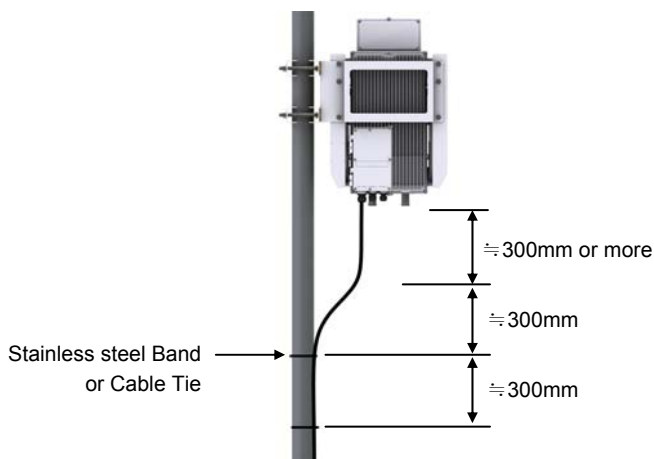
Caution for cleaning the Power Supply

While cleaning the power supply device, take caution that the device does not come in contact with alien bodies that may cause power failure.



Caution for installing the power cable

To maintain cable gland's rain protection performance, 300 mm or more interval should be kept straight. According to the radius of curvature of the cable specification should be considered.



Caution for cutting the power cable

Cut power cable after installing power cable to RRH-C2A power terminal taking into account the radius of curvature according to the cable specifications.

When cutting the cable first, the length difference of cable end can be occurred by cable curvature and the power terminal may cause contact fault.



Caution for connecting power cable to power tap ('2.7.3 Connecting RRH-C2A Power Cable')

- Before connecting power cable to the power tap, connect the appropriate ring lugs to the power cable ends.
- Insert wire of power cable to ring lug head more than 10mm.
- After inserting power cable, fasten the screw by torque 11 kgf.cm.



Caution When Connecting Optical Cables

Before connecting an optical cable, make sure that there is no dust or foreign substance on the cross-section of the connector core. If there is any dust or foreign substance, do not remove it by blowing with your mouth. Remove the dust or foreign substance by referring to the method of cleaning optic connector.



Radius of Curvature of Feeder Line

When installing a feeder line, the radius of curvature of the sections where cables bent should be larger than the allowed radius of curvature. If the radius of curvature for the feeder line installation is less than the allowed radius of curvature, it may affect the performance of the system.



Connection of Feeder Cable Connector

Connecting the feeder cable connector is critical process, so the qualified workers who finished the related education should perform.

Installation General



CAUTION

Caution when losing External Power Cable Support Bracket('2.6 Connecting ground cable')

External Power Cable Support Bracket and two cable tie (stainless steel) for fixing cable are enclosed in RRH-C2A package. Be careful not to lose when unpacking package.



Managing unused port

Finish unused port of UADU by dust-cap, not making the alien substance flowed.

**Finishing Cable Insertion Hole**

Finishing work is required on cable insertion holes (Cable gland, Conduit and etc.) to prevent entering of any foreign substance, external air and moisture.

- Unused cable insertion hole: Finish cable insertion hole using fishing materials such as dust cap, rubber packing and etc.
- Cable-installed insertion hole: After installing cable, finish insertion hole using tape, compressed sponge, rubber packing, silicon, etc. to prevent empty space.

**Do not work by yourself**

Do not work by yourself in any key process.

**Caution for cleaning the Rack**

Make sure that worker does not damage installed cables while cleaning the rack.

**Cautions When Connecting the CPRI Cable**

Failure to observe the CPRI cable connection specified in Table 2.5 may impair the communication between the CDMA terminal.

**RRH-C2A optic cable connection standard**

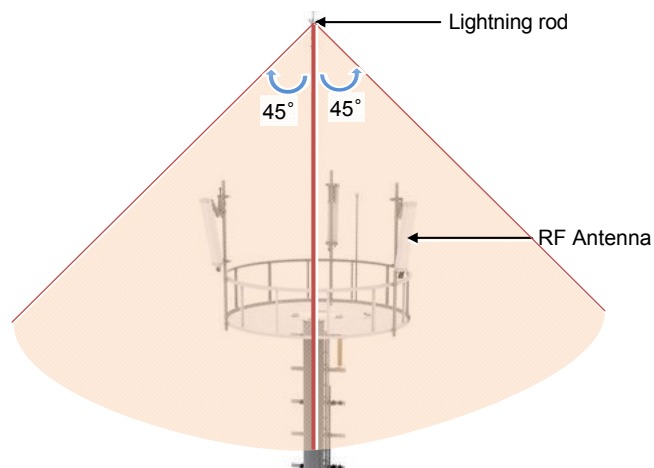
Cable connection standard between UADU CPRI port and RRH-C2A optic port is different according to the count(One or two) of CDMA UADU(Installed in DU cabinet).

Connect the optic cable(Refer to the connection standard of 'table 2.6' and 'table 2.7'). Because false connection can cause the fault of call connection, be cautious.

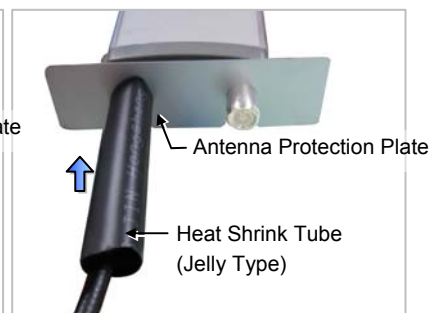
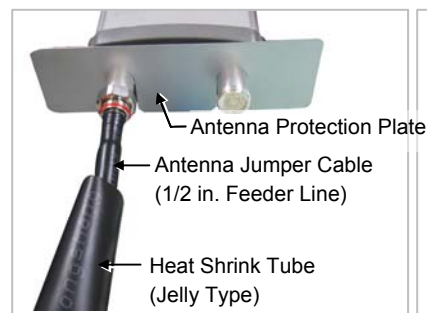
**Caution when Installing the RF antenna**

To protect from lightning, the RF antenna must be installed within the shielding angle as shown below, considering the downward distance and the angle from the tower lightning rod or the antenna pole lightning rod.

- The protection angle of the lightning rod should be 45 degrees.

**Finishing Heat Shrink Tube of a Sector Antenna**

- 1) Insert an antenna protection plate.
- 2) Place the heat shrink tube on the connection point and shrink the heat shrink tube using a heat gun.



- 3) Avoid aiming the heating gun toward the antenna's body as shown in the figure below.



California USA Only



This Perchlorate warning applies only to primary CR (Manganese Dioxide) Lithium coin cells in the product sold or distributed ONLY in California USA
'Perchlorate Material-special handling may apply, See
www.dtsc.ca.gov/hazardouswaste/perchlorate.'

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ANNEX C. Assembling connector

오류! 책갈피가 정의되어 있지 않습니다.

C.1	RJ-45 (Shield type)	오류! 책갈피가 정의되어 있지 않습니다.
C.2	RJ-45 (Normal type).....	오류! 책갈피가 정의되어 있지 않습니다.
C.3	N type-male (LMR-400)	오류! 책갈피가 정의되어 있지 않습니다.
C.4	TNC-male (LMR-400).....	오류! 책갈피가 정의되어 있지 않습니다.
C.5	N type-male (1/2 in. feeder line).....	오류! 책갈피가 정의되어 있지 않습니다.
C.6	Din type-male (1/2 in. Feeder Line).....	오류! 책갈피가 정의되어 있지 않습니다.
C.7	Finishing connector connection with the tape.....	오류! 책갈피가 정의되어 있지 않습니다.
C.8	How to Shrink the Heat Shrink Tube	오류! 책갈피가 정의되어 있지 않습니다.
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오류! 책갈피가 정의되어 있지 않습니다.

ANNEX F. Standard Torque

오류! 책갈피가 정의되어 있지 않습니다.

ABBREVIATION

오류! 책갈피가 정의되어 있지 않습니다.

C ~ U오류! 책갈피가 정의되어 있지 않습니다.

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Figure C.3 Assembling the N type-male connector (LMR-400) (1)오류! 책갈피가 정의되어 있지 않습니다.

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Figure C.9 Assembling the N type-male Connector (1/2 in. Feeder Line) (3).....오류! 책갈피가 정의되어 있지 않습니다.

Figure C.10 Assembling the N type-male Connector (1/2 in. Feeder Line) (4).....오류! 책갈피가 정의되어 있지 않습니다.

Figure C.11 Assembling the Din type-male Connector (1/2 in. Feeder Line) (1)..오류! 책갈피가 정의되어 있지 않습니다.

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Figure C.13 Finishing connector connection with the tape..... 오류! 책갈피가 정의되어 있지 않습니다.

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Figure D.4 Measuring the Optical Output and Connecting the Optic Connector..오류! 책갈피가 정의되어 있지 않습니다.

Figure E.1 Pressure Terminal Assembly (1) 오류! 책갈피가 정의되어 있지 않습니다.

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CHAPTER 1. Before Installation

1.1 System Configuration

RRH-C2A Configuration

The following shows the configuration of RRH-C2A.

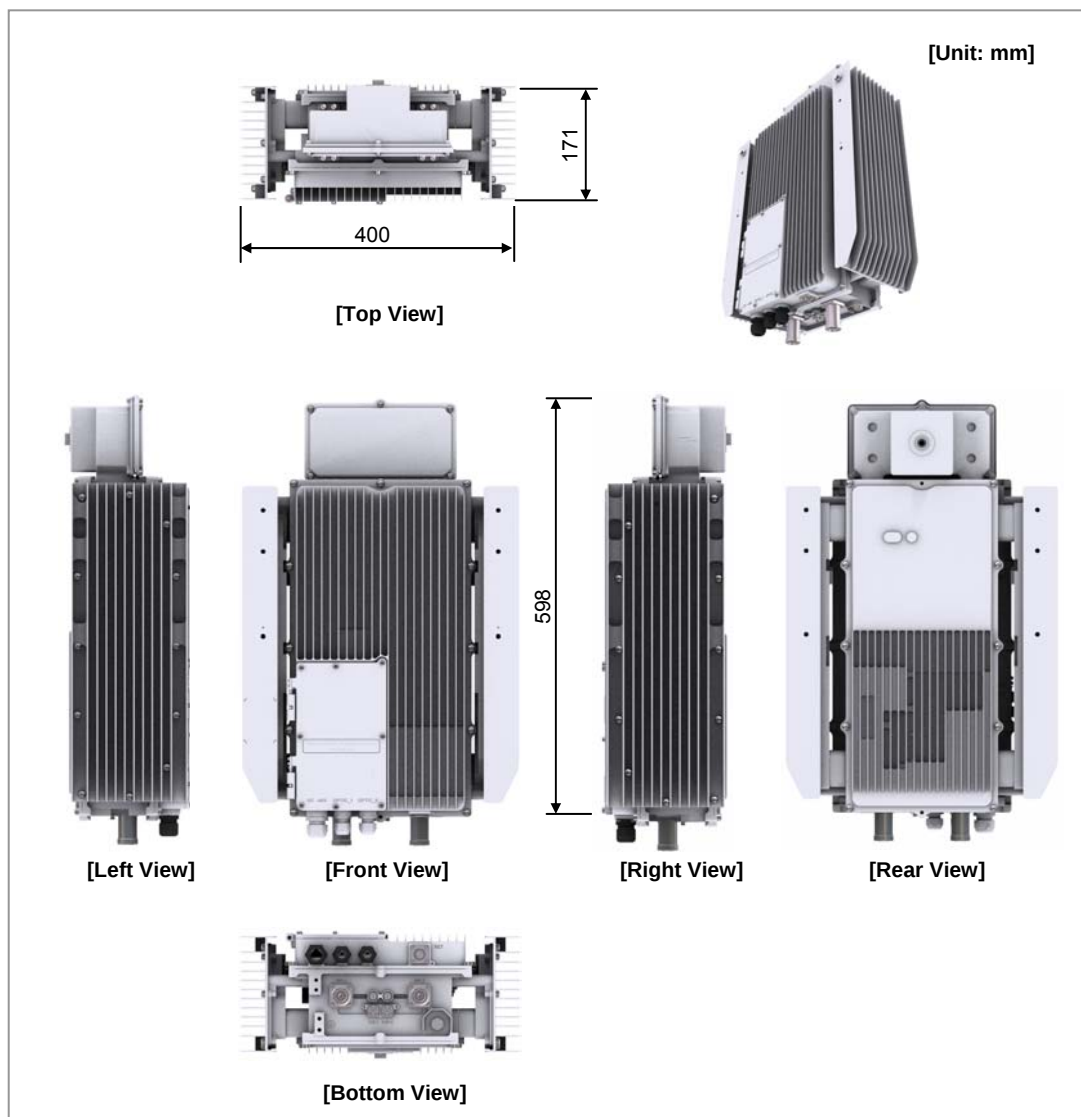


Figure 1.1 RRH-C2A Configuration

External Interfaces of RRH-C2A

The following shows the external interfaces of RRH-C2A.

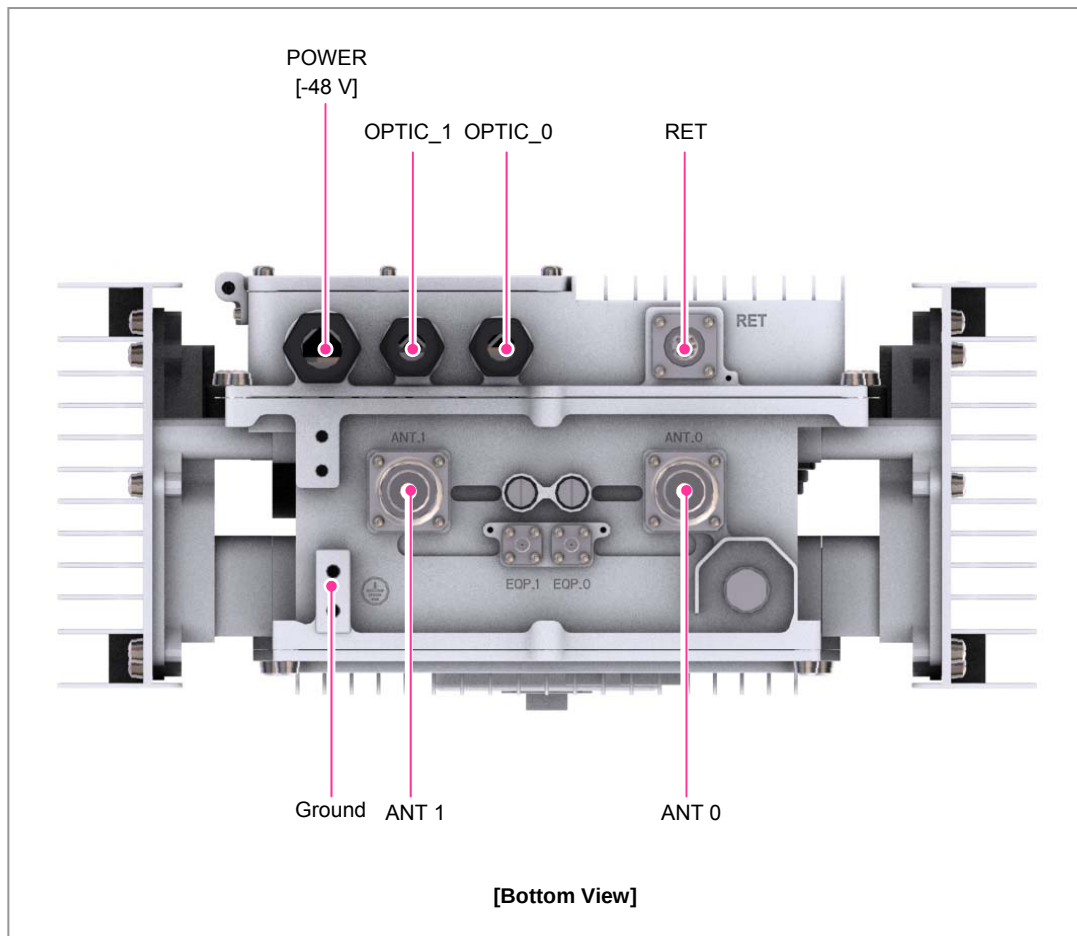


Figure 1.2 External Interfaces of RRH-C2A

1.2 Specifications

Capacity

The following table shows the specifications for RRH-C2A.

Item	Specifications
Air Standard	FDD CDMA
Configuration	2T2R, with internal duplexer and external Tx filter (optional)
Operating Frequency	- Tx : 862~869MHz - Rx : 817~824MHz
Channel Bandwidth	- CDMA : 1.25 MHz
Capacity	- CDMA : 5 carriers
Output Power	100W total (50W+50W)
Multiple Antenna	- CDMA: 1T2R/2T2R
Baseband Interface	2.4576Gbps, Single-mode, Bi-directional, ~10Km CRPI version : 4.0 or above

Input Power

The following table shows the power specifications for RRH-C2A.

Item	Specifications
Input voltage	-48 VDC
Current consumption	9.5 A

Unit Size and Weight

The following table shows the size and weight of RRH-C2A.

Item	Specifications
Size (mm, W × D × H)	- 400 × 171 × 598 (with External Filter) - 400 × 171 × 490 (without External Filter)
Weight (kg)	- 23.5 (with External Filter) - 21 (without External Filter)

Ambient Conditions

This section describes the operating temperature, humidity level and other ambient conditions and related standard of RRH-C2A.

The following table shows the ambient conditions and related standard of RRH-C2A.

Item	Range
Temperature ^{a)}	-40~55°C (-40~131°F) without solar load
Humidity ^{a)}	10~95% The moisture content must not exceed 0.024 kg per 1 kg of air.
Altitude	0~1,800 m (0~6,000 ft)
Vibration	GR-63-CORE Sec.4.4 Earthquake Office Vibration Transportation Vibration
Noise (sound pressure level)	Max. 65 dBA at distance of 1.5 m (5 ft) and height of 1.0 m (3 ft)
Electromagnetic compatibility (EMC)	FCC Title47 Part 15 Class B
US Federal Regulation	FCC Title47 Part90

a) Temperature and humidity are measured at 1.5 m (59 in) above the floor and at 400 mm (15.8 in) away from the front panel of the RRH-C2A.

1.3 Cabling

The following shows the cables connected to RRH-C2A.

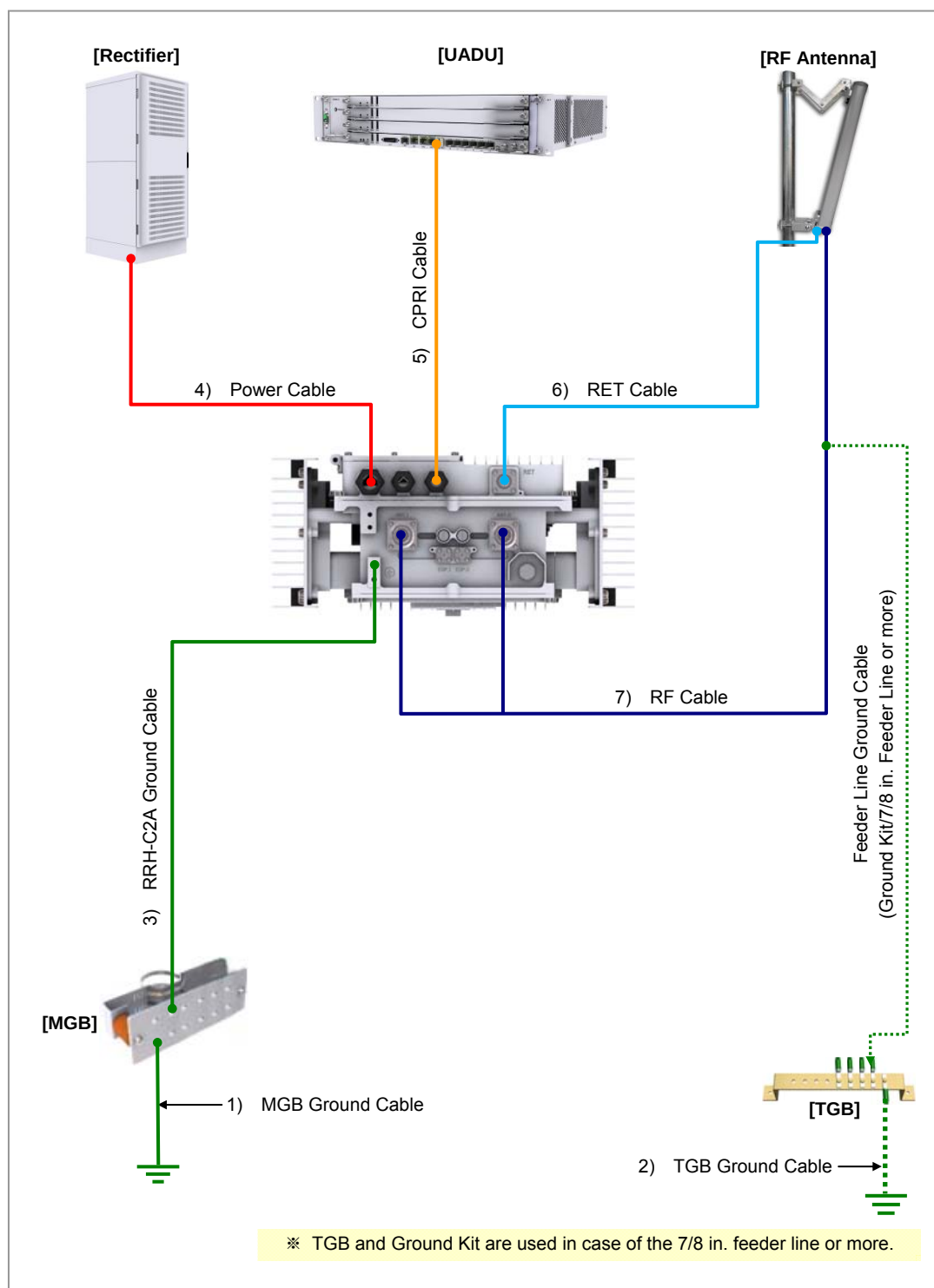


Figure 1.3 Cabling Diagram

Table 1.1 System Cabling

From	To	Cable
Underground Ground	MGB (Main Ground Bar)	1) MGB Ground Cable : AWG4/0, GV 95 mm ² × 1C (However, This can be different, depending on the standard of service provider)
	TGB (Tower Ground Bar)	2) TGB Ground Cable : AWG2, GV 25 mm ² × 1C (However, This can be different, depending on the standard of service provider)
RRH-C2A	MGB	3) RRH-C2A Ground Cable : AWG8, GV 6 mm ² × 1C
	Rectifier	4) Power Cable : AWG10, 4 mm ² × 2C(or AWG8, 6 mm ² × 2C)
	UADU	5) CPRI Cable : Optic Cable (Single Mode)
	RET	6) RET Cable Ass'y (Shield Cable)
	Antenna	7) RF Cable (1/2 in. or 7/8 in. Feeder Line)

1.4 Installation Precaution

The following precaution must be observed to prevent accidents during RRH-C2A installation.

Before Installation

- Install a high voltage warning sign near the area where high voltage cable is located.
- Install a restricted entry warning sign near the potential accident area.
- Cover exposed areas such as junctions, ceilings, footholds etc. with safety rails or fence off the area.
- Study use of the fire alarm and the location of the fire extinguisher and how to use it.
- Check the location of the nearest emergency exit.

During Installation

- Cut all equipment power before installation.
- Always wear protection gloves and goggles when drilling holes into the wall or ceiling. To prevent electric shocks from metallic objects, remove all accessories such as watches or rings.



Wearing protection gloves and goggles

Make sure to wear protection gloves and goggles to prevent damages from debris while drilling holes in a wall or ceiling.



Watches, Rings, and Other Metallic Accessories

Do not wear accessories such as watches and rings in order to prevent electrical shock.



Do not work by yourself

Do not work by yourself in any key process.

Cable Path Inspection

When installing a cable that connects between the rectifier, Main Ground Bar (MGB), and backhaul device, etc. within the system, the cable path length and the cable installation method, etc. must be inspected.

Follow these guidelines when inspecting the cabling path.

- A minimum cable length must be selected provided that it does not affect the cable installation and maintenance.
- The cable must be placed in a location where it will not be damaged by external factors. (Power line, flooding, footpaths, etc.)
- In areas where the cable can be damaged by external factors, ensure that measures are taken to prevent damages to the cable. (Cable tray, ducts, flexible pipe, etc.)

Cable Cutting

Measure the exact distance, carefully checking the route, and cut the cable using a cutting tool.

Follow these guidelines when cutting the cable.

- Cut the cable to the length determined in the Cable Path Inspection step.
- Use a dedicated cable cutting tool.
- Cut the cable at right angles.
- Be careful to keep the cable away from any moisture, iron, lead, dust or other foreign material when cutting. Remove any foreign material attached to the cable using solvent and a brush.

Cable Installation

Cable installation involves running the cable along the cabling path to the target connector of the system or an auxiliary device after cable path inspection and cable cutting have been completed.

Follow these guidelines when installing a cable.

- Be careful not to damage the cable.
- If the cable is damaged, cut out the damaged section before installing.
- Run the cable so that it is not tangled. In particular, when installing a cable from a horizontal section to a vertical section, be careful not to reverse the upper and lower lines of the cable.
- Always use the maximum curvature radius possible, and make sure that the minimum curvature radius specification is complied with.
- If the cable needs to be protected, use a PVC channel, spiral sleeve, flexible pipe, and cable rack, etc.

Table 1.2 Allowed Cable Bend Radius

No	Type		Allowed Cable Bend Radius	Remarks
1	GV/CV/FR-8		8 times of the cable external diameter	0.6/1 KV cable
2	Optic Cable		20 times of the cable external diameter	-
3	UTP/FTP/S-FTP Cable		4 times of the cable external diameter	PVC/LSZH, 4 Pair
4	1/2 in. Feeder Line (Indoor)		32 mm	RFS, LS
5	1/2 in. Feeder Line (Outdoor)		125 mm	RFS, LS
6	7/8 in. Feeder Line (Outdoor)		250 mm	RFS, LS
7	1 1/4 in. Feeder Line (Outdoor)		380 mm	RFS, LS
8	1 5/8 in. Feeder Line (Outdoor)		500 mm	RFS, LS
9	LMR-400		25.4 mm	Installation
			101.6 mm	Repeated
10	RG-316D		15 mm	-
11	Hybrid Cable	External diameter: 25 mm	300 mm	-
		External diameter: 27 mm	330 mm	-
		External diameter: 30 mm	390 mm	-
		External diameter: 32 mm	450 mm	-

* If the allowed cable bend radius is specified by the manufacturer, comply with the bend radius specified.

Cable Binding

Cable binding involves fixing and arranging an installed cable using binding strings, cable ties, binding lines, and ram clamps, etc.

Follow these guidelines when binding a cable.

- Be careful not to damage the cable during binding.
- Use appropriate cable binding tools according to the target location (indoor or outdoor, etc.) and the use of the cable (power supply cable, optical cable, feeder line, etc.).
- Do not let the cutting section of a cable tie and binding line, etc. be exposed to the outside. This may cause damage to cables or personal injury. Make sure that the cutting sections of cables are not exposed to the outside.
- Trim the binding string so that you have about 5 cm of string left from the knot. And insert the remaining string into the knot and make sure the knot does not loosen.
- If there is a potential danger of contact failure in a connector connection due to tension, install the cable in the shortest distance.

Connector Attachment

Connector attachment involves assembling a connector to an installed cable or to a device on the site.

Follow these guidelines when attaching a connector.

- Make sure you are fully aware of the connector assembly method before assembling a connector. Assemble the connector in accordance with its pin map.
- Each connector has a hook to prevent its core positions from being changed.
- Use a heat shrink tube at a connector connection for cables that are installed outdoor, such as feeder lines, to prevent water leakage and corrosion from occurring at the part exposed to the outside.
- Connect each cable of the connector assembly in a straight line.
- Be careful when connecting a cable not to trigger contact failure at a connector connection due to tension.

Identification Tag Attachment

Identification tag attachment involves attaching a butterfly cable tie, nameplate, and label, etc. to the both ends of a cable (connections to a connector) to identify its use and cabling path.

Follow these guidelines when attaching an identification tag.

- When installing a cable outdoor, use relief engraving and coated labels, etc. to prevent markings from being erased.
- Since the form and attachment method for identification tags are different for each provider, consult with the provider before attaching them.



Connecting Ground Cable

In cabling, the connection of cables without the connection to the ground cable may cause the damage of the equipment or the bodily injury of the worker. Connect the ground cable first.



Cable Installation Checklist

When installing, take care not to overlap or tangle the cables; also, consider future expansion. Install the DC power cable and data transmission cable away from the AC power cable to prevent electromagnetic induction.



Cable Works

The cable works require knowledge for the cabling works such as cable installation/binding.

After Installation

- Cover the cable hole on the floor with a solid cover.
- Remove all installation residues; clean the area.



Caution for Laser Beam of Optical Module and Cable

The optical module and cable used in the system emit bright laser beams. Always handle them with care as there is risk of serious injury if the eyes are exposed to the laser beam of the optical cable.



Caution for cleaning the Rack

Make sure that worker does not damage installed cables while cleaning the rack.



Caution for cleaning the Power Supply

While cleaning the power supply device, take caution that the device does not come in contact with alien bodies that may cause power failure.

Damage Prevention

For handling devices sensitive to static electricity, be aware of the followings to avoid damages of various board elements.

- The board should be kept away from materials prone to static electricity such as plastic, acrylic plates, paper, Styrofoam etc.
- The board should be kept in a static electricity prevention storage box.

1.5 Pre-Construction Inspection

To enable straightforward construction, the installer and the department concerned should check the necessary requirements against the Pre-Construction Inspection Checklist. All omissions or problems should be reported to the appropriate department for further analysis and resolution.

The site inspection prior to the system installation should be performed by the installation/construction crew and the service provider. The following details should principally be reviewed and analyzed.

- The appropriateness and efficiency of the system's transportation method and its installation location
- The status of the external interface
- The status of the power capacity and its wiring
- The extendibility of the system
- Whether the site has sufficient space for operation and maintenance

1.6 Installation Tool

The basic tools for installation are listed in the table below. The additional tools required for each site need to be identified and prepared during a site survey before starting installation.

Table 1.3 Basic Installation Tools

No.	Name	Specification
1	Torque driver set	No.0~ + No.3 (M2.6~M6 '+' Driver) 1.0~60 kgf.cm
2	Torque wrench set	M6~M12 10~30 kgf.cm, 100~500 kgf.cm, Replaceable head
3	Torx Driver	T20
4	Nut driver set	6~10 mm
5	Hacksaw Frame/Blade	Normal/HIS
6	Level/Plumb bobs	Normal/500 g
7	Heating gun	50~300°C
8	Solder	30~130 W
9	Power extension cable	30 m
10	Tape measure	5 m/50 m
11	Cable cutter	325 mm
12	Silicon gun/Silicon	Normal/Gray & Colorless
13	Spanner	19 mm, 24 mm, 36 mm
14	Hexagonal wrench bolt	-
15	Hoisting wire	25 m
16	Installation Tools for Stainless Steel Cable Ties	DAS-250 , ties up to 7.9mm width straps.
17	Screw Driver	Pozidriv #2



NOTE

Precautions for use of Installation Tools

The required installation tools may vary depending on the conditions at the site. In addition to the basic tools, a protractor, compass, GPS, ladder, safety equipment, cleaning tools etc. should also be prepared in consideration of the site conditions.



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CHAPTER 2. Installation of RRH-C2A

2.1 Installation Procedure

The following diagram shows RRH-C2A installation procedure.

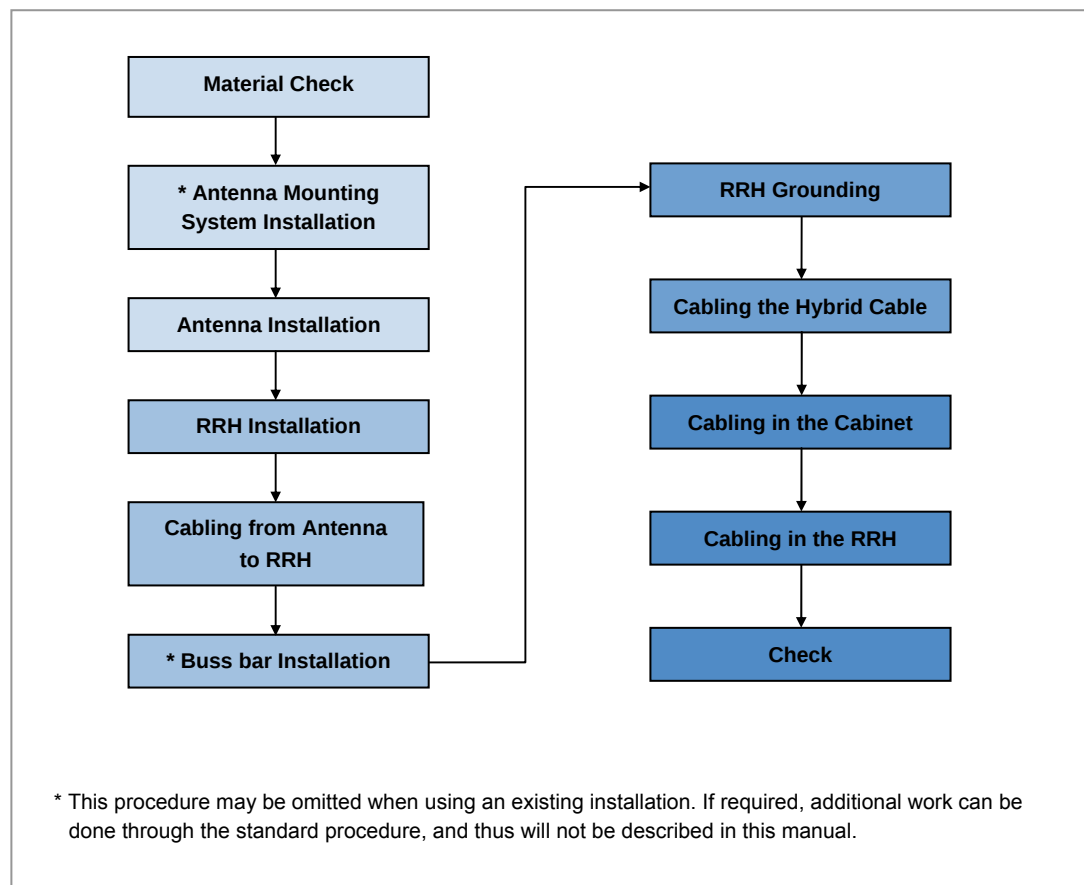


Figure 2.1 System Installation & Cable Connection Procedure

2.2 Foundation Work

2.2.1 Equipment Arrangement

A minimum distance must be secured around the RRH-C2A in each direction for installation and maintenance.

Table 2.1 Recommended Distances for System Arrangement

Item	Recommended Distances
Front/Rear	800 mm or more
Sides	600 mm or more
Clearance between racks	60 mm (when the battery cabinet is on the left and the DU cabinet is on the right)

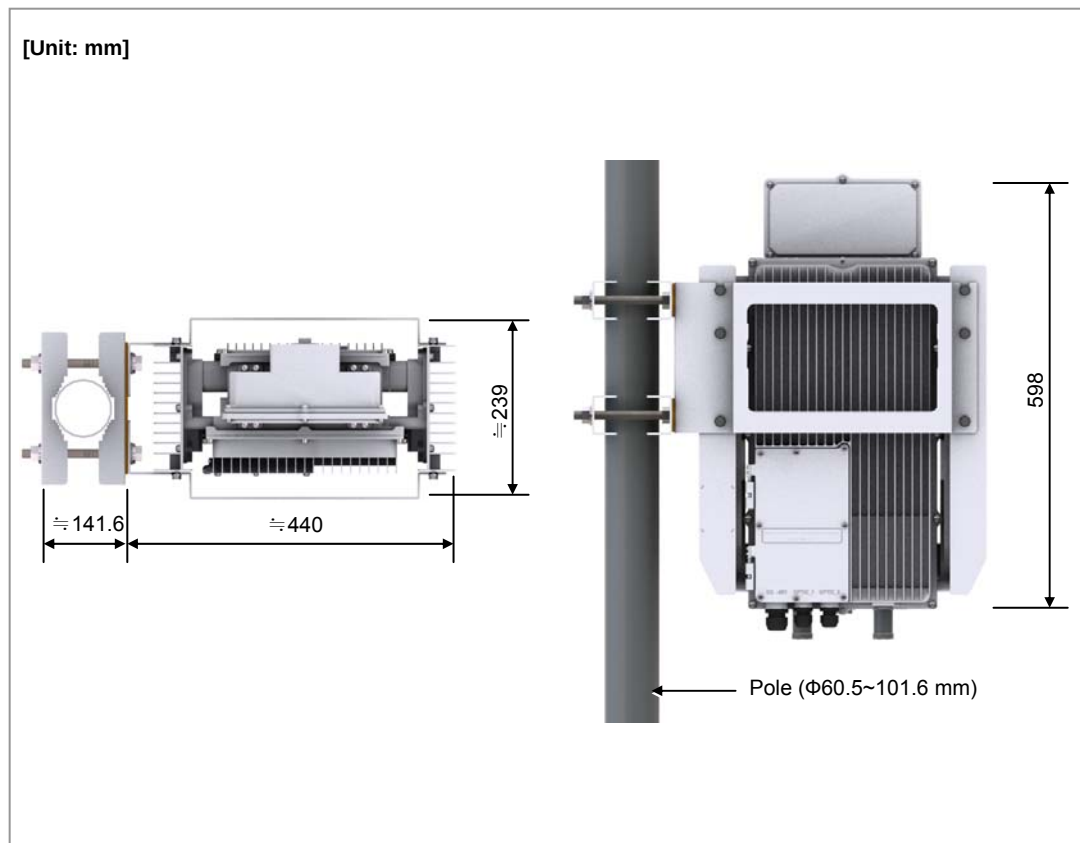


Figure 2.2 RRH-C2A Installation Space (1 sector pole type)



Equipment Installation Space

The figure above illustrates the installation space using a 101.6 mm(90 A) diameter pole. The measures may differ depending on the diameter of the pole.

2.3 Unpacking and Transporting

This paragraph describes the work to unpack cabinets and other components and transport them to the place to be installed. The cabinet is externally packed and cabinet and other components are individually packed.

- The external packing should be unpacked outside of the building. If necessary, it can be unpacked after transporting to the area near installation place.
- Transport the cabinet to the installation place. Be aware of the damage of walls, pillars, and bottom of the passage when transporting the cabinet.
- Transport other components with packing and sort by types.

2.3.1 Importing Items

To import items, be aware of the followings:

- Regarding equipment weight and size, check the path to bring the equipment.
- Lay Iron and veneer boards on stairs or doorsills to make the transportation easy.
- When bring in equipment, beware of damage or impairment of main entrance, walls, pillars, and floors of the station. Prepare protection materials and fix them with a high-strength adhesive.
- Carry boards in packing status, and unpack them when installing or mounting.

Vibration Level for Transportation

- When carrying the system, fasten the system firmly not to exceed the proper vibration level from 1 to 500 Hz.
- When carrying system, use a lift to prevent accidents. However, if the system should be carried by people, enough people are required to carry the system.
- Before moving the system, check the storage place for the system and remove obstacles in advance. While moving system, boards and other devices should not be shocked physically and damaged caused by dust, moisture, and static electricity.

When installing the items imported, abide by the following:

- System should be installed in a location whose access is not easy from outside.

2.3.2 Unpacking Items

The procedure to unpack items is as follows:

- The packing items should be packed until they reach the installation place.
- The items are classified in accordance with each job specification and stored on a place with no interference on working.
- Unpacked systems should be installed immediately. If not installed immediately, the systems should be stored in the installation place temporarily.
- Unpack the inner packaging after each system is placed on its installation location.
- Unpack the inner packaging after each system is placed on its installation location.
- Do not recycle the packaging waste. Dispose of them pursuant to the rules.

2.4 Fixing the System

2.4.1 Fixing Wall Mount

Follow the steps below to fix the RRH-C2A to the wall.

- 1) Fix the RRH mounting bracket to the wall. (A)
- 2) Fix the RRH-C2A to the RRH mounting bracket. (B-D)

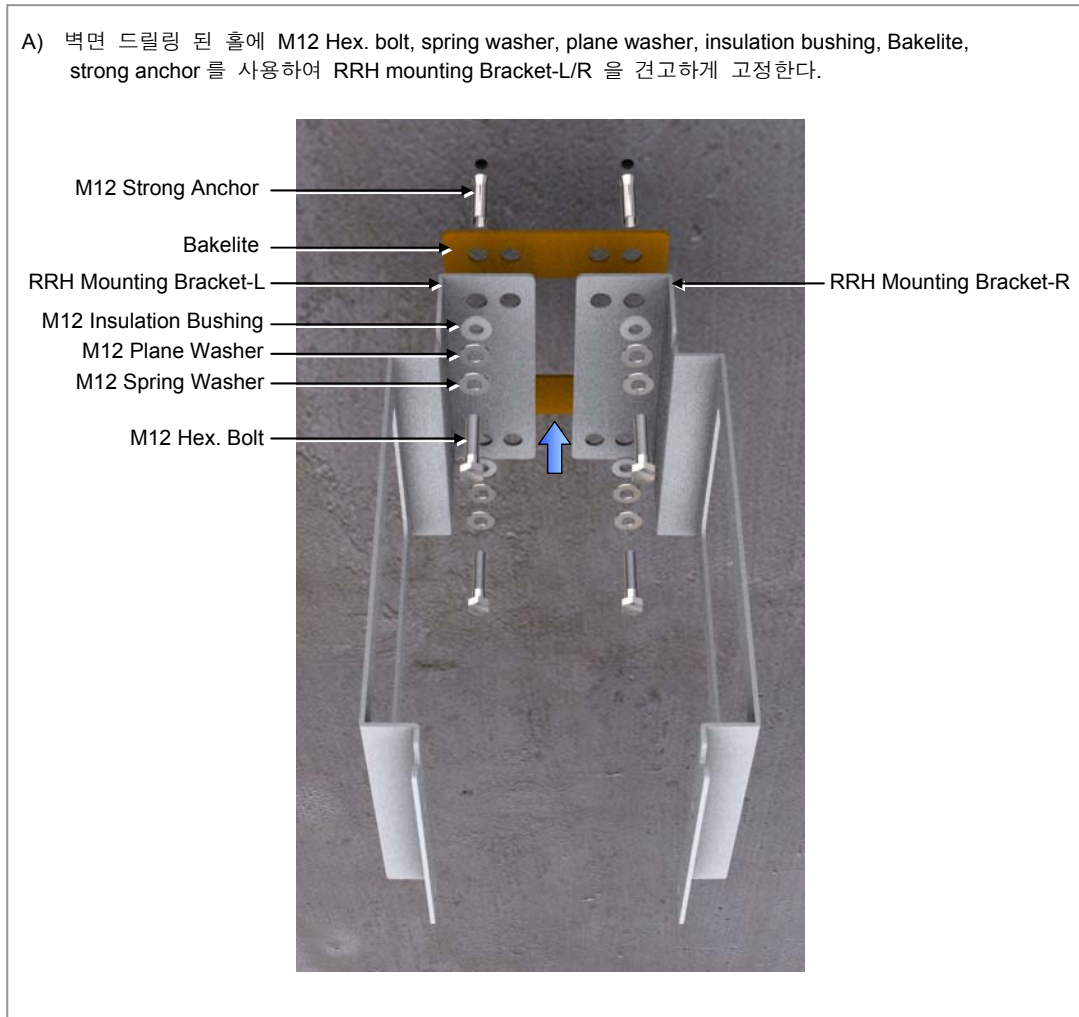


Figure 2.3 Fixing Wall Mount (1)

- B) RRH-C2A 상단 좌/우측 고정 홀에 M8 × 25L Hex. bolt, plane washer, spring washer 를 약 6 mm 가량 남도록 하여 임시로 고정한다.

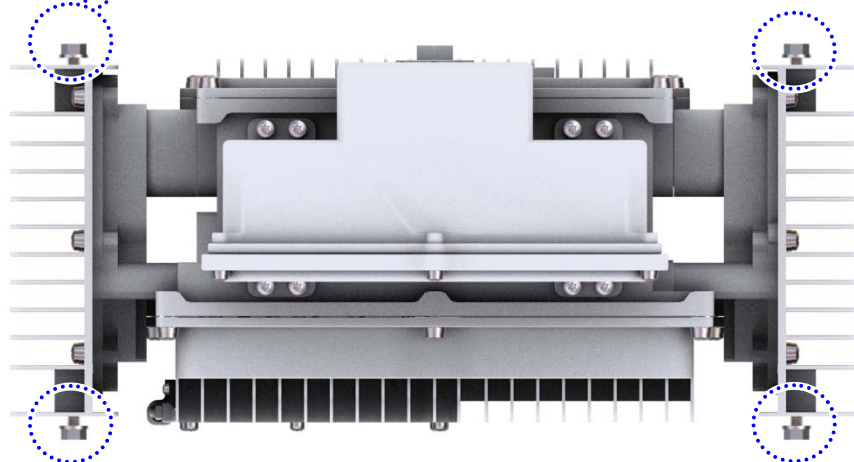
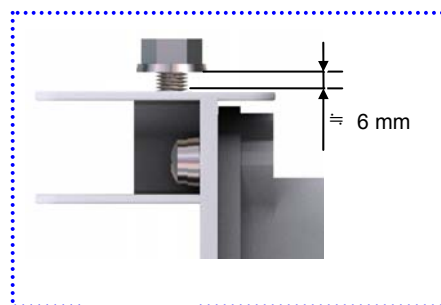
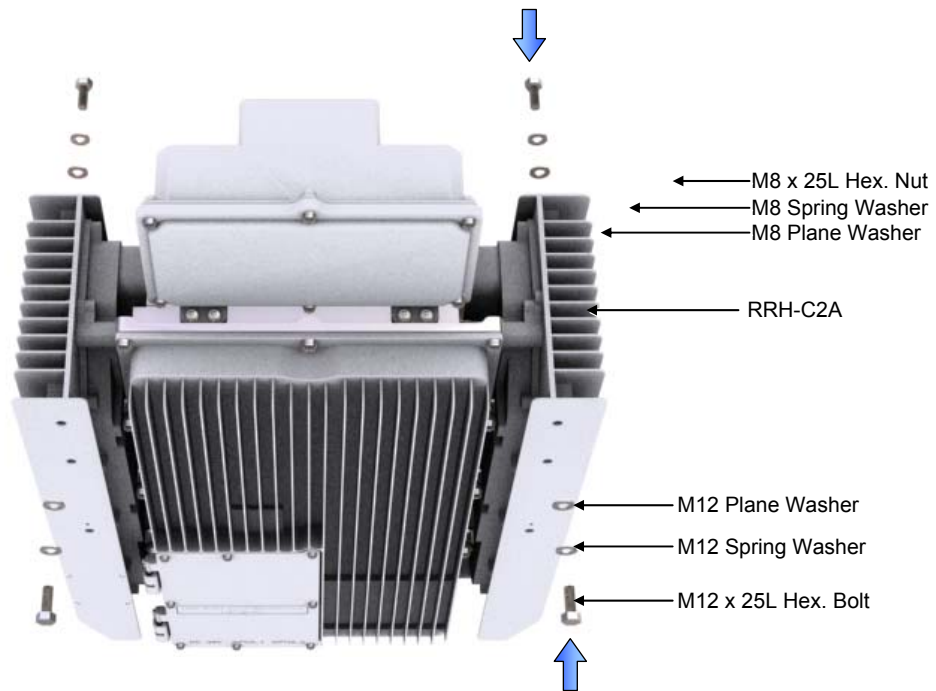


Figure 2.4 Fixing Wall Mount (2)

- C) RRH-C2A 상단 좌/우측 고정된 M8 × 25L Hex. bolt, plane washer, spring washer 를 RRH mounting bracket 상단의 홈에 맞춰서 걸고, 나머지 고정 홀에 M8 × 25L Hex. bolt, plane washer, spring washer 를 사용하여 고정한다.
- D) RRH-C2A 상단 좌/우측에 임시로 고정한 M8 ×25L Hex. bolt 를 견고히 고정한다.

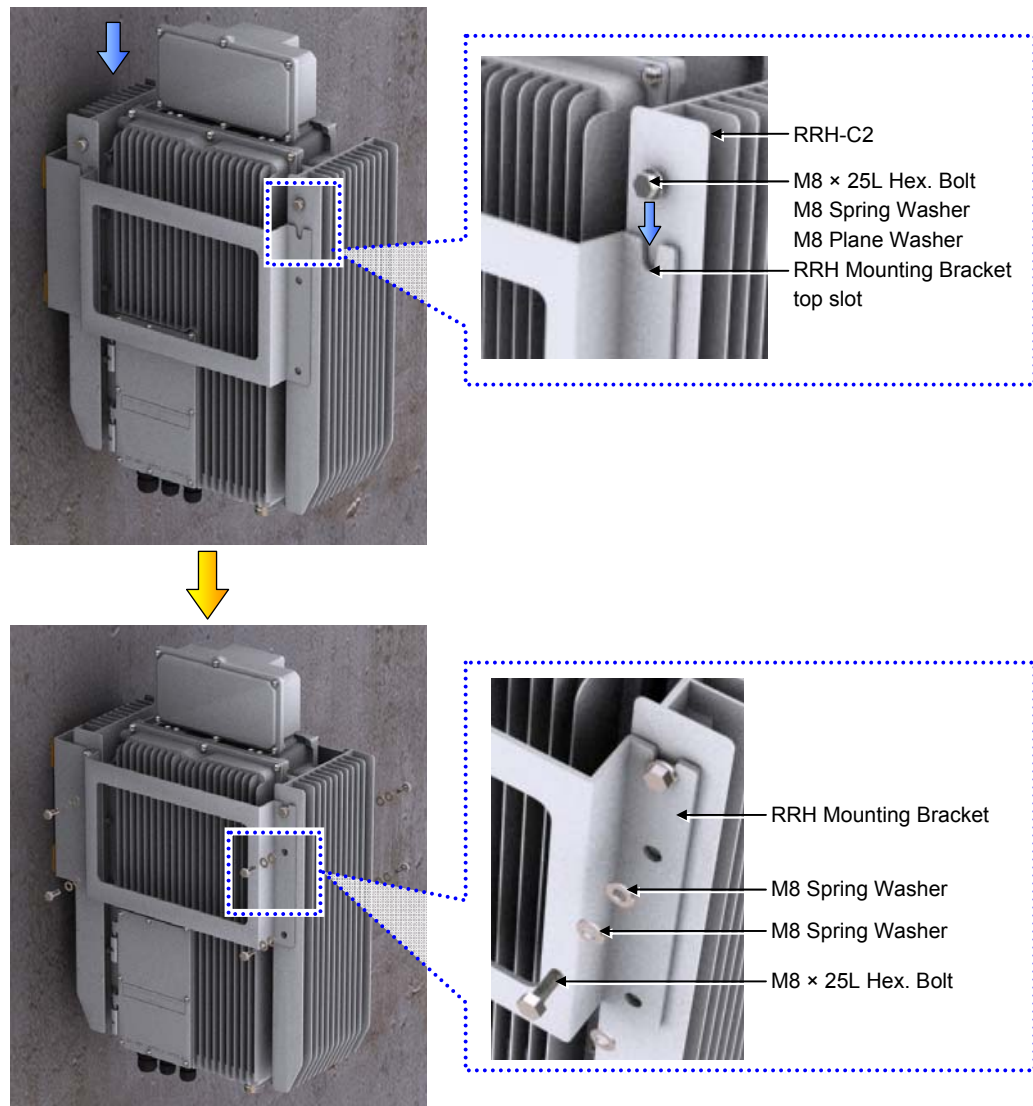


Figure 2.5 Fixing Wall Mount (3)



Cautions When Using Wall Mount Fasteners

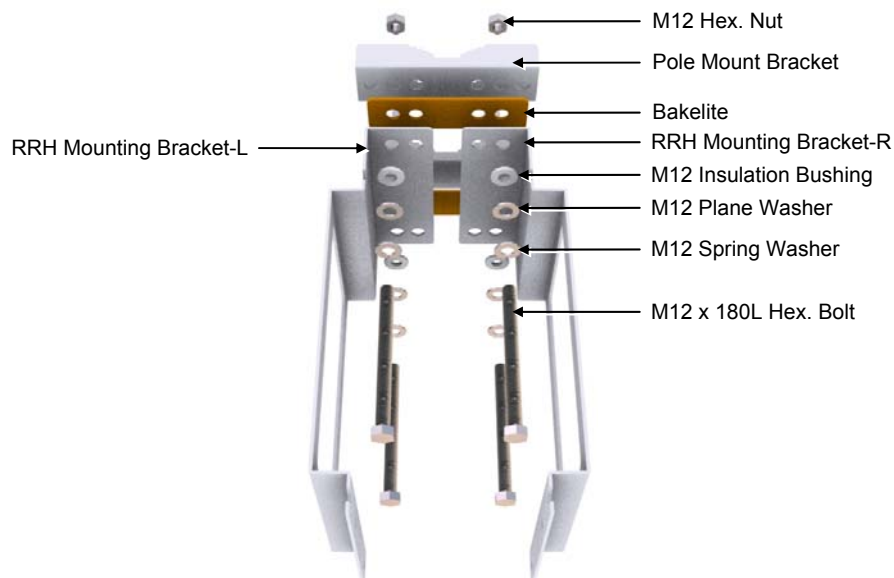
The fasteners used to attach the wall mount, including the anchor bolt, spring washer, plane washer and Hex. nut must be made of stainless steel (STS 304). Otherwise, it may cause corrosion and rust to fixing materials.

2.4.2 Fixing 1 Sector Pole

Follow the steps below to fix the RRH-C2A to the pole.

- 1) Fix the RRH mounting bracket and the pole mount bracket each other. (A)
- 2) Fix the RRH mounting bracket assembly to the pole. (B)
- 3) Fix RRH-C2A to the RRH mounting bracket. (C~E)

A) RRH mounting bracket-L/R, bakelite, pole mount bracket 의 홀 위치를 맞추고, M12 ×180L Hex. bolt, spring washer, plane washer, Insulation bushing, Hex. nut 를 사용하여 견고히 고정한다.



B) 조립된 RRH mounting bracket ass'y 를 pole 고정 위치에 놓고, 반대쪽에서 pole mount bracket 을 M12 x 180L Hex. bolt 에 맞추어 끼운 후 M12 plane washer, spring washer, Hex. nut 를 이용하여 견고하게 고정한다.

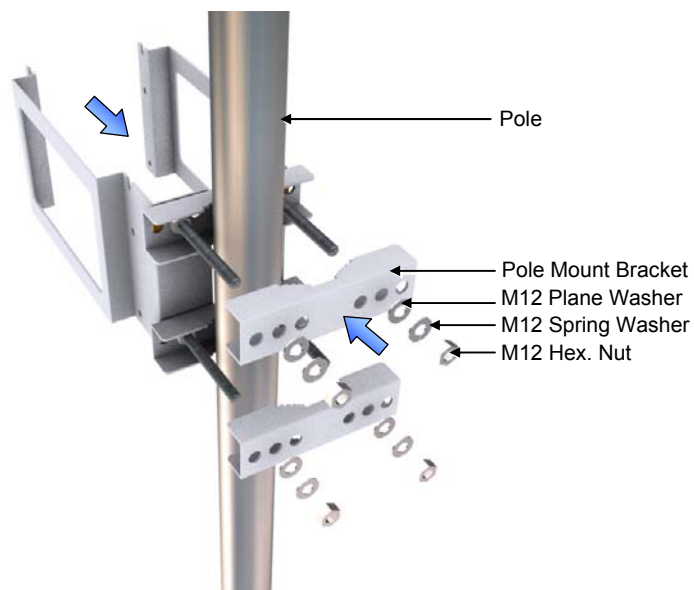


Figure 2.8 Fixing 1 sector pole (1)

C) RRH-C2A 상단 좌/우측 고정 홀에 M8 × 25L Hex. bolt, plane washer, spring washer 를 약 6 mm 가량 남도록 하여 임시로 고정한다.

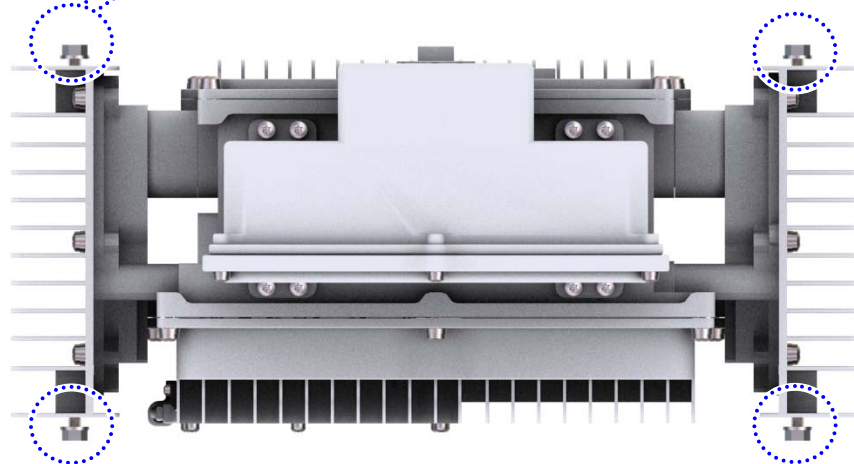
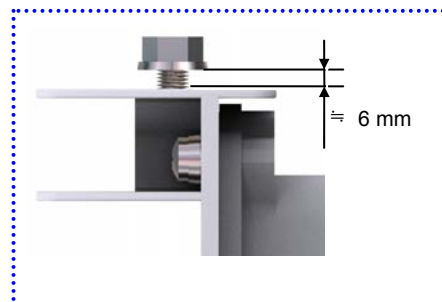
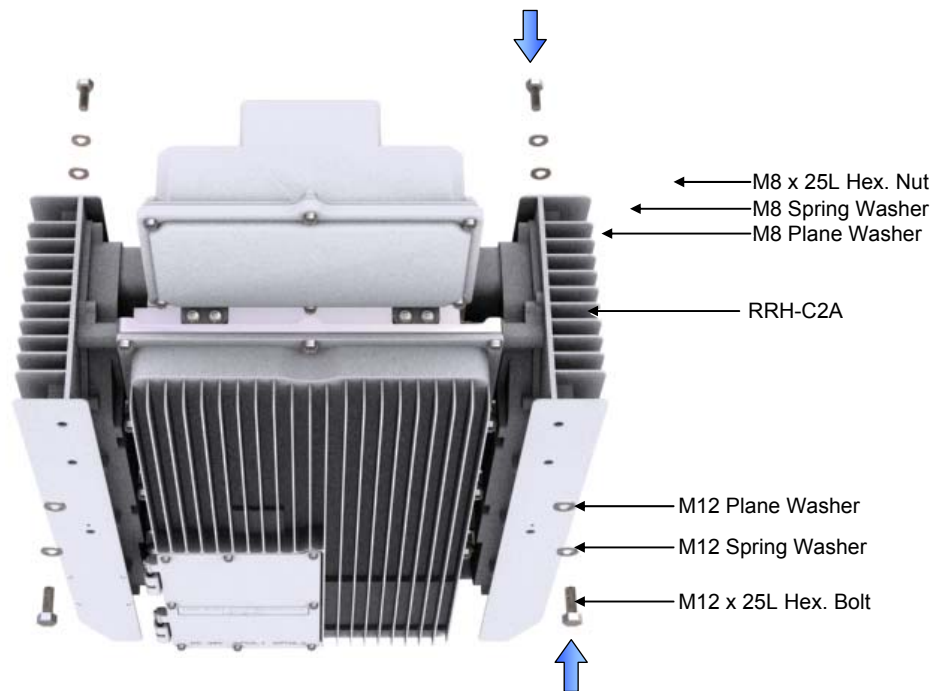


Figure 2.9 Fixing 1 sector pole (2)

D) RRH-C2A 상단 좌/우측 고정된 M8 × 25L Hex. bolt, plane washer, spring washer 를 RRH mounting bracket 상단의 홈에 맞춰서 걸고, 나머지 고정 홈에 M8 × 25L Hex. bolt, plane washer, spring washer 를 사용하여 고정한다.

E) RRH-C2A 상단 좌/우측에 임시로 고정한 M8 ×25L Hex. bolt 를 견고히 고정한다.

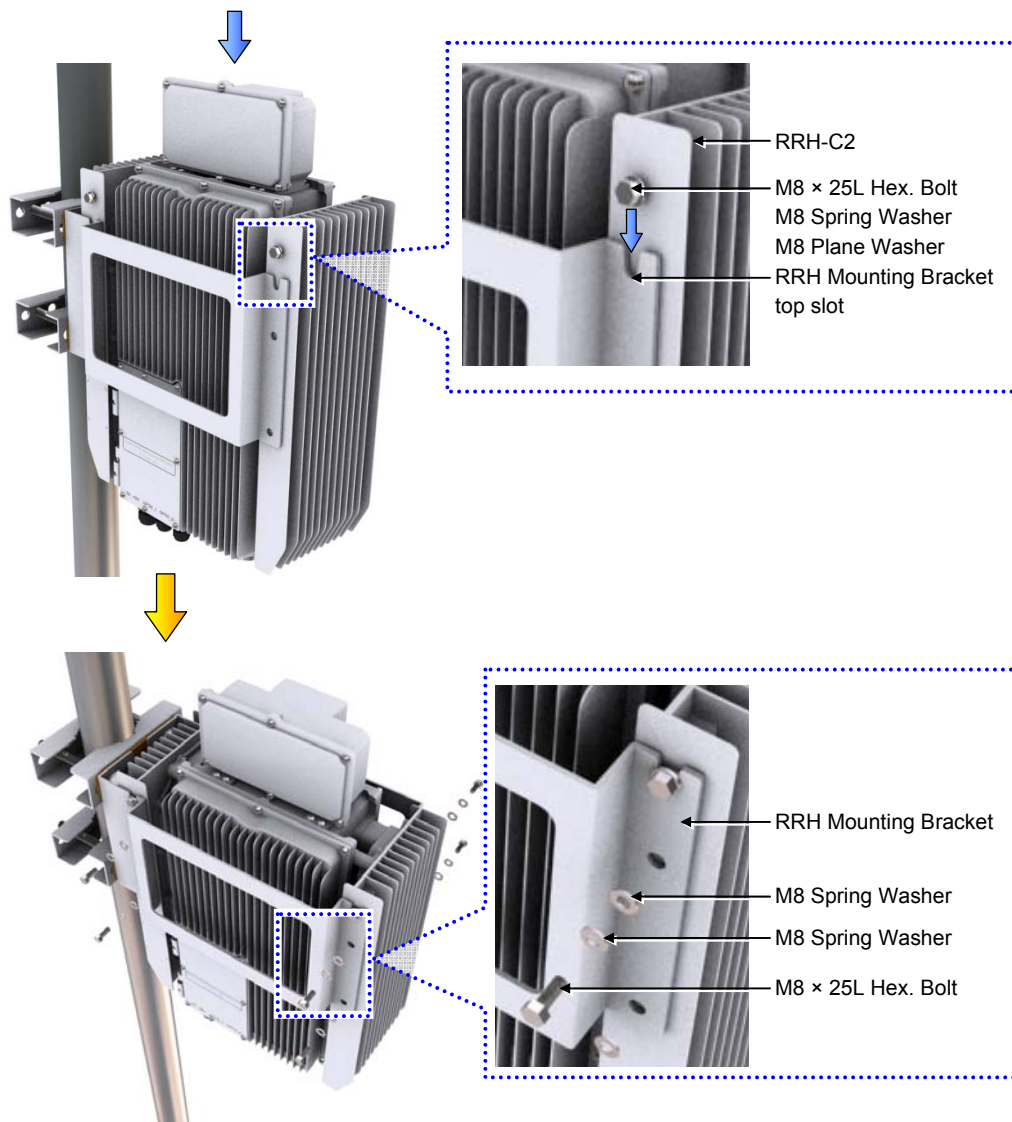


Figure 2.10 Fixing 1 sector pole (3)



CHECK

Cautions When Using Pole Fasteners

The fasteners used to attach the pole, including the hex. bolts, hex. nut, spring washers and plane washers must be made of stainless steel (STS 304).

Otherwise, it may cause corrosion and rust to fixing materials.

2.5 Connecting cable between RRH and Antenna

2.5.1 Connecting Feeder Line

Follows the steps below to connect the feeder line.

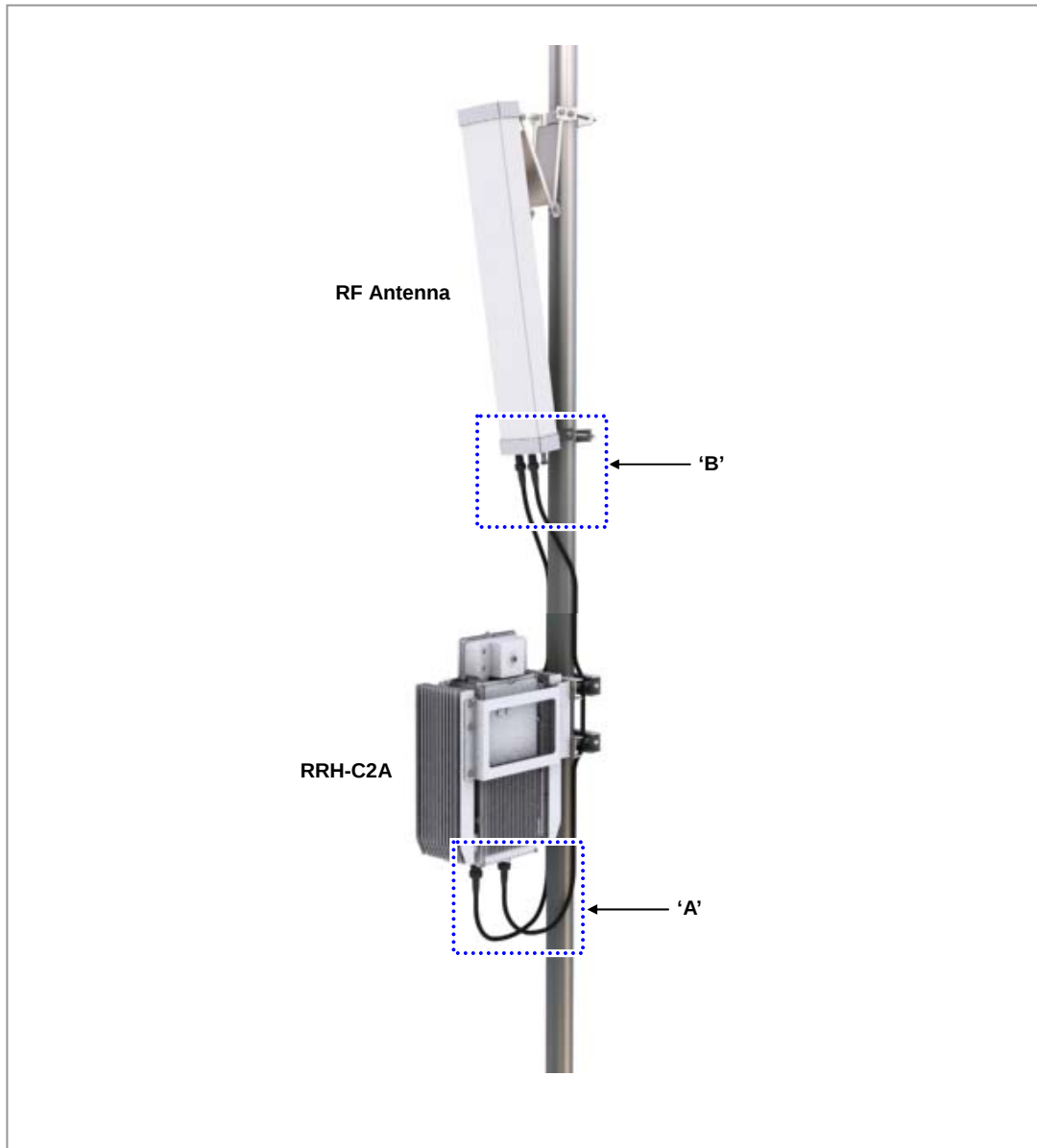


Figure 2.7 RRH-C2A Feeder Line Connection Diagram



CHECK

Caution for connecting Feeder Line Connector

When connecting the feeder line between RRH-C2A RF port and RF antenna, each port and the feeder line connector should be secured by 200 kgf.cm torque to minimize influence of PIMD.

- 1) Install 1/2 inch feeders line from the RF port at the bottom of RRH-C2A to the RF antenna.
- 2) Insert a heat shrink tube (jelly type) to each end of the installed 1/2 inch feeder lines, then connect a din-male connectors to the RRH-C2A's RF port and the RF antenna port.
- 3) After installing the connector, shrink the heat shrink tubes using a heat gun.

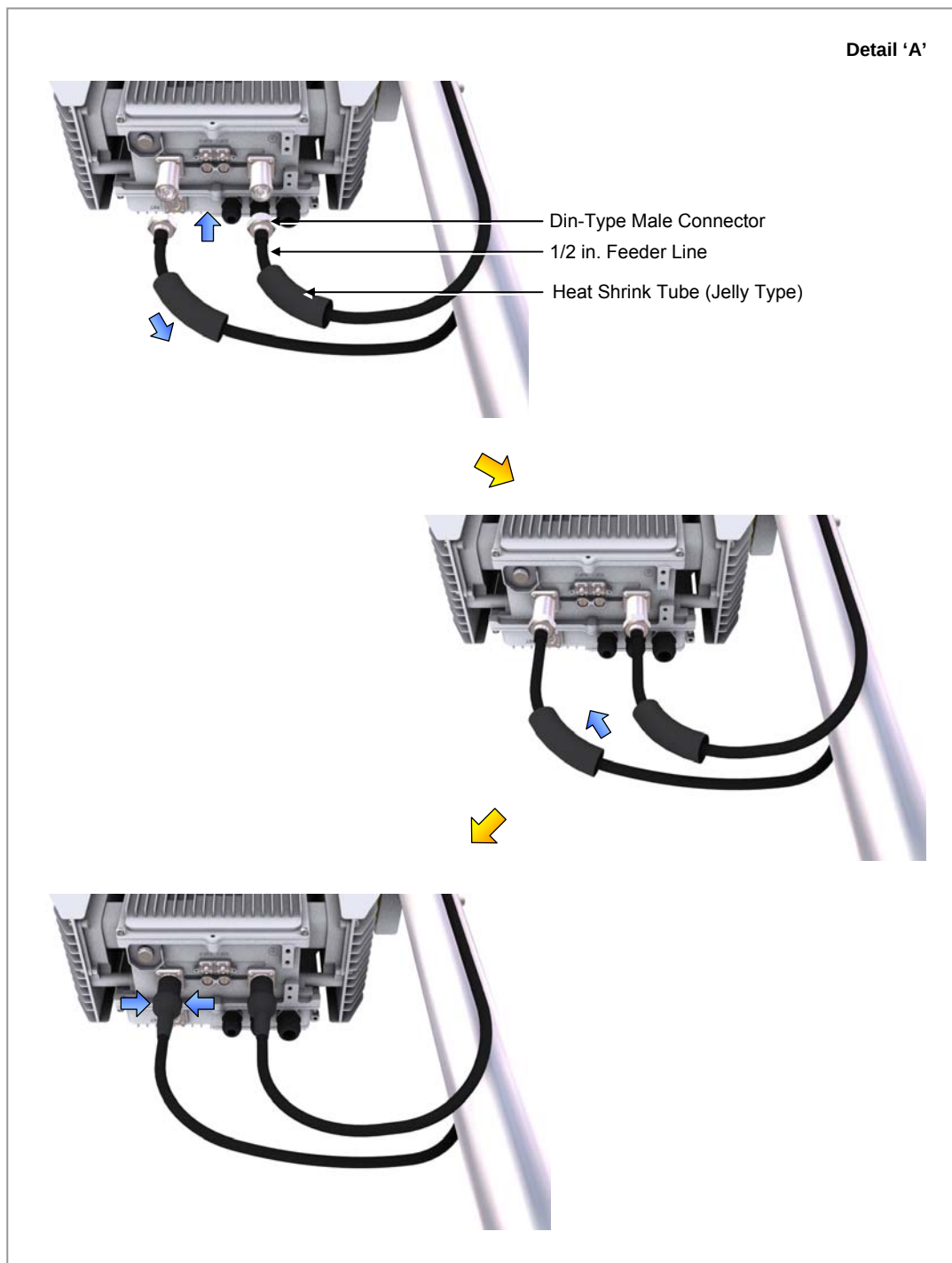


Figure 2.8 Connecting RRH-C2A Feeder Line (1)

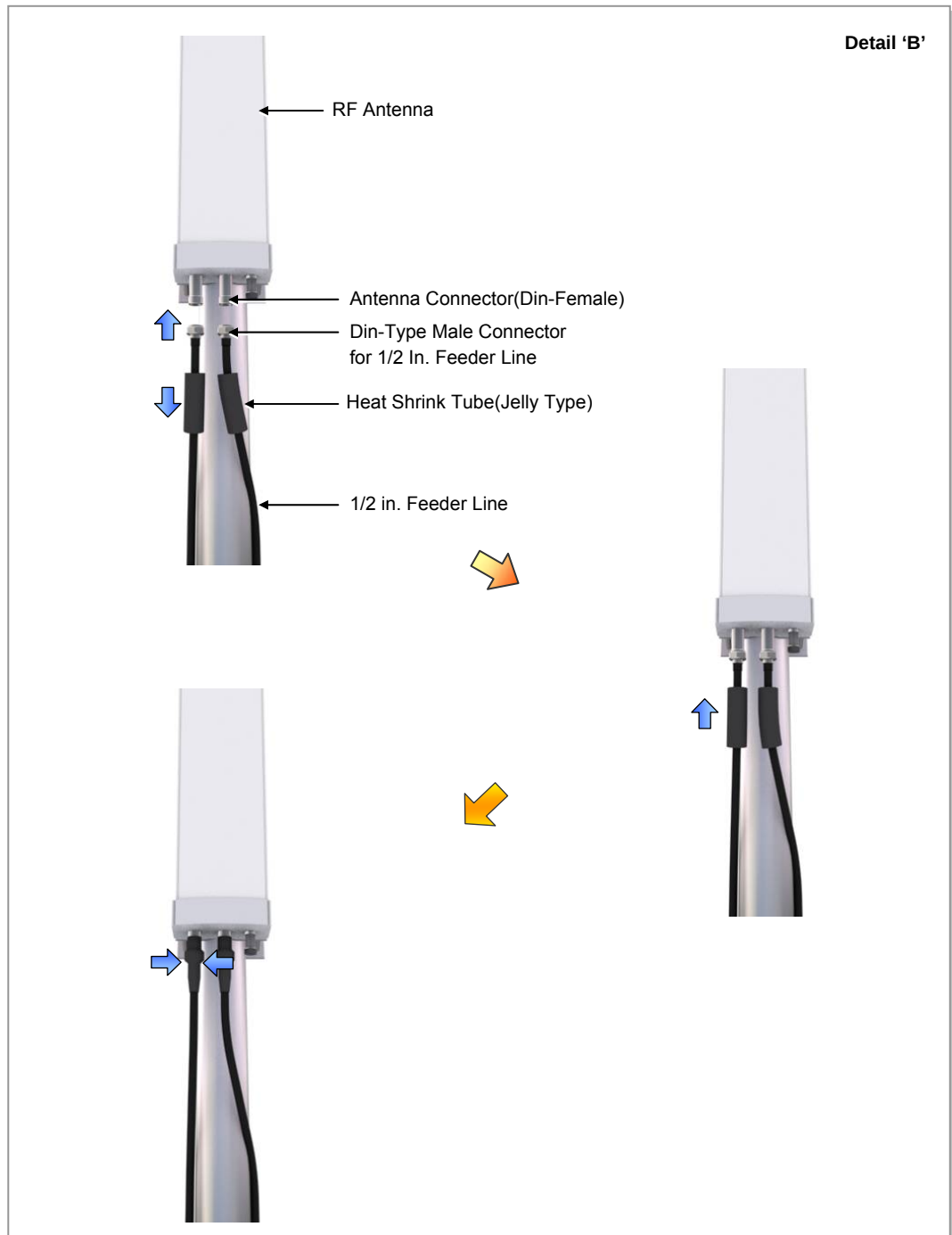


Figure 2.9 Connecting RRH-C2A Feeder Line (2)



CHECK

Caution for connecting Feeder Line Connector

When connecting the feeder line between RRH-C2A RF port and RF antenna, each port and the feeder line connector should be secured by 200 kgf.cm torque to minimize influence of PIMD.

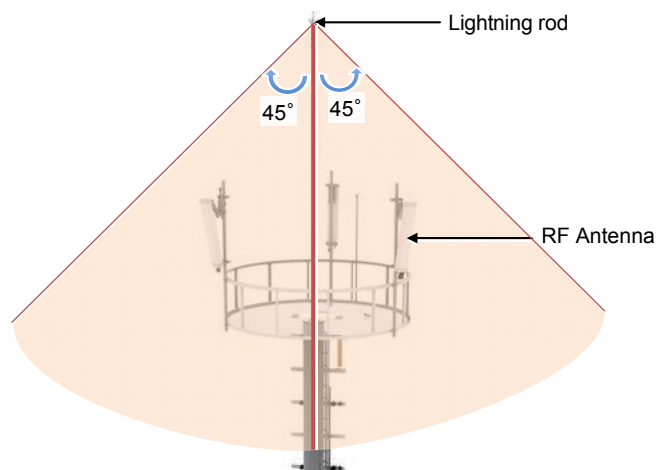


CAUTION

Caution when Installing the RF antenna

To protect from lightning, the RF antenna must be installed within the shielding angle as shown below, considering the downward distance and the angle from the tower lightning rod or the antenna pole lightning rod.

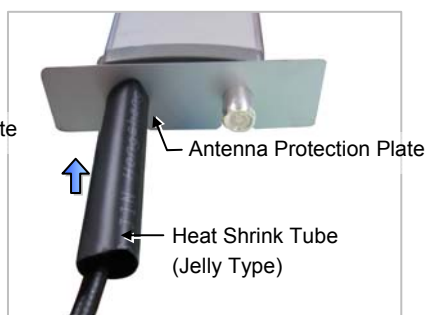
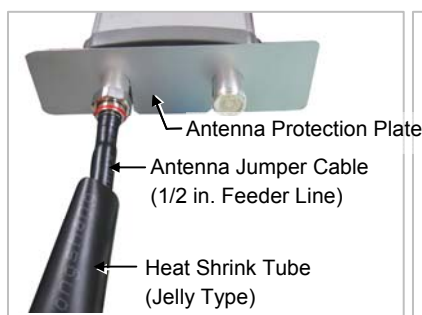
- The protection angle of the lightning rod should be 45 degrees.



CAUTION

Finishing Heat Shrink Tube of a Sector Antenna

- 1) Insert an antenna protection plate.
- 2) Place the heat shrink tube on the connection point and shrink the heat shrink tube using a heat gun.

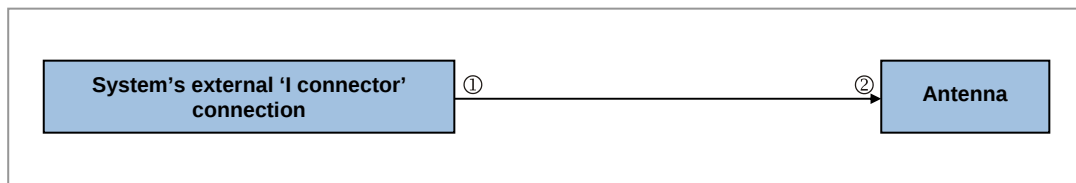


- 3) Avoid aiming the heating gun toward the antenna's body as shown in the figure below.



Checking Feeder line Connection

After connecting the feeder line, perform the continuity test and feeder cable return loss to check if the feeder cable is changed and measure VSWR of antenna and feeder cable.



CHECK

VSWR Standard

The standing wave ratio (VSWR) of the cable and connector between the system's RF port to the antenna port must be smaller than 1.5 dB (return loss: 14 dB). If a separate standard has been established with the carrier, the established standard will take precedence.

Identification tag installation

Attach the identification tag in the below table to the feeder line.

Table 2.2 GPS Identification Tag of Feeder line

Category	Description
Installation position	Attach the identification tag to the both ends of the antenna.
Materials	Use the material of aluminum coated by vinyl for the identification tag.
Fixing method	Fix the feeder cable to the 2 holes on the identification tag with the black cable tie.
Marking	The markings must be prevented from being erased by using relief engraving or coated labels.

2.5.2 Connecting RET cable

Follow the steps below to connect the Remote Electrical Tilting (RET) cable used to control the tilting angle of the antenna from the distance.

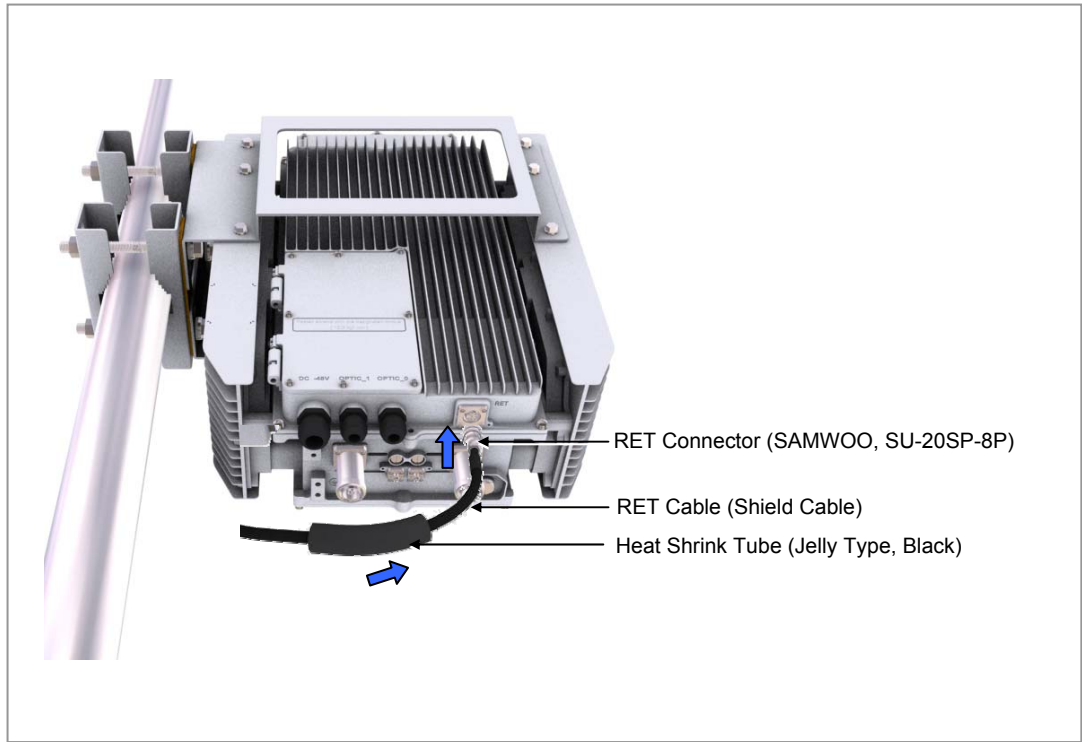


Figure 2.10 Connecting RET cable

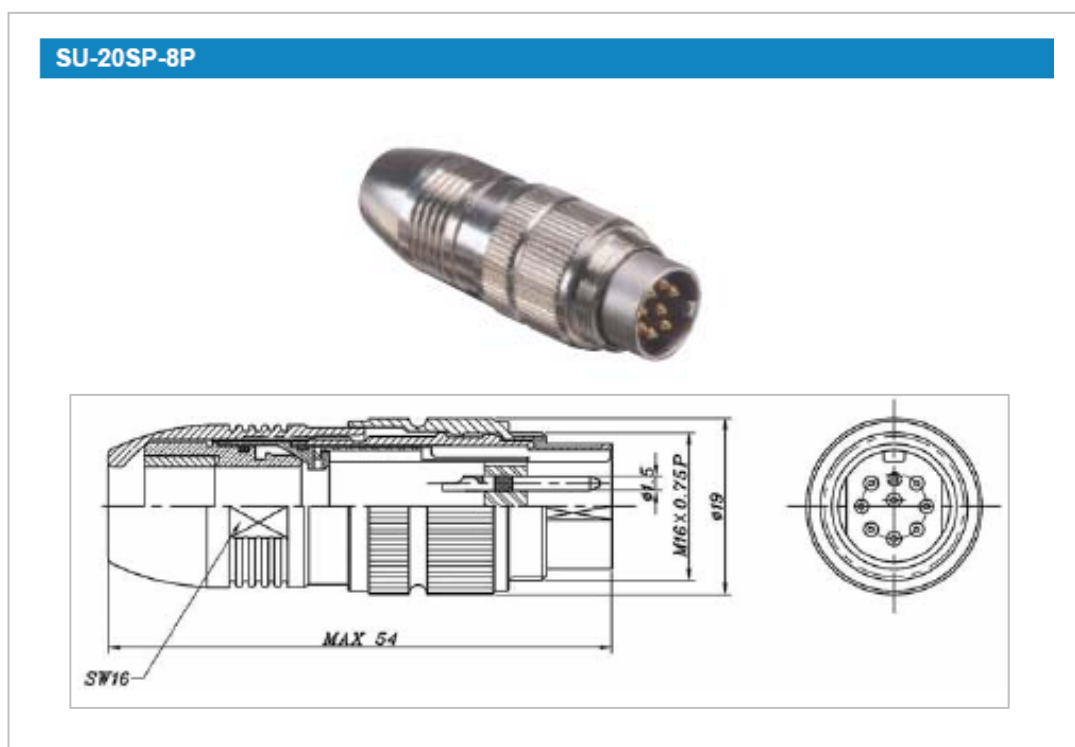


Figure 2.11 RET Cable connector

Table 2.3 RET Cable-Side Connector Pin Map

RET Connector	Samwoo, SU-20SP-8P	
	Pin	Function
	3	RS485B
	4	DGND
	5	RS485A
	6	+28 V
	7	+28 V RTN
	1, 2, 8	NC



CHECK

RET

- When 28 VDC volts are applied, the current supplied to the RET from RRH-C2A must be lower than 1 A.
- The exterior of the RET connector must be made of metal without vent hole or other UL certified material.

2.6 Connecting ground cable

2.6.1 Grounding RRH-C2A

Follow the steps below to connect the RRH-C2A ground cable.

- 1) Install one ground cable (AWG8, GV 6 mm² × 1 C) from MGB to the ground terminal at the bottom of RRH-C2A.
 - 2) Install the 6 mm² pressure terminal and the heat shrink tube at the end of the cable.
 - 3) Place the pressure terminal at one end of the ground cable of RRH-C2A aligning with the fixing holes and fix it using M6 SEMS.
- (When being secured by screw, apply 38.16~46.64 kgf.cm torque.)

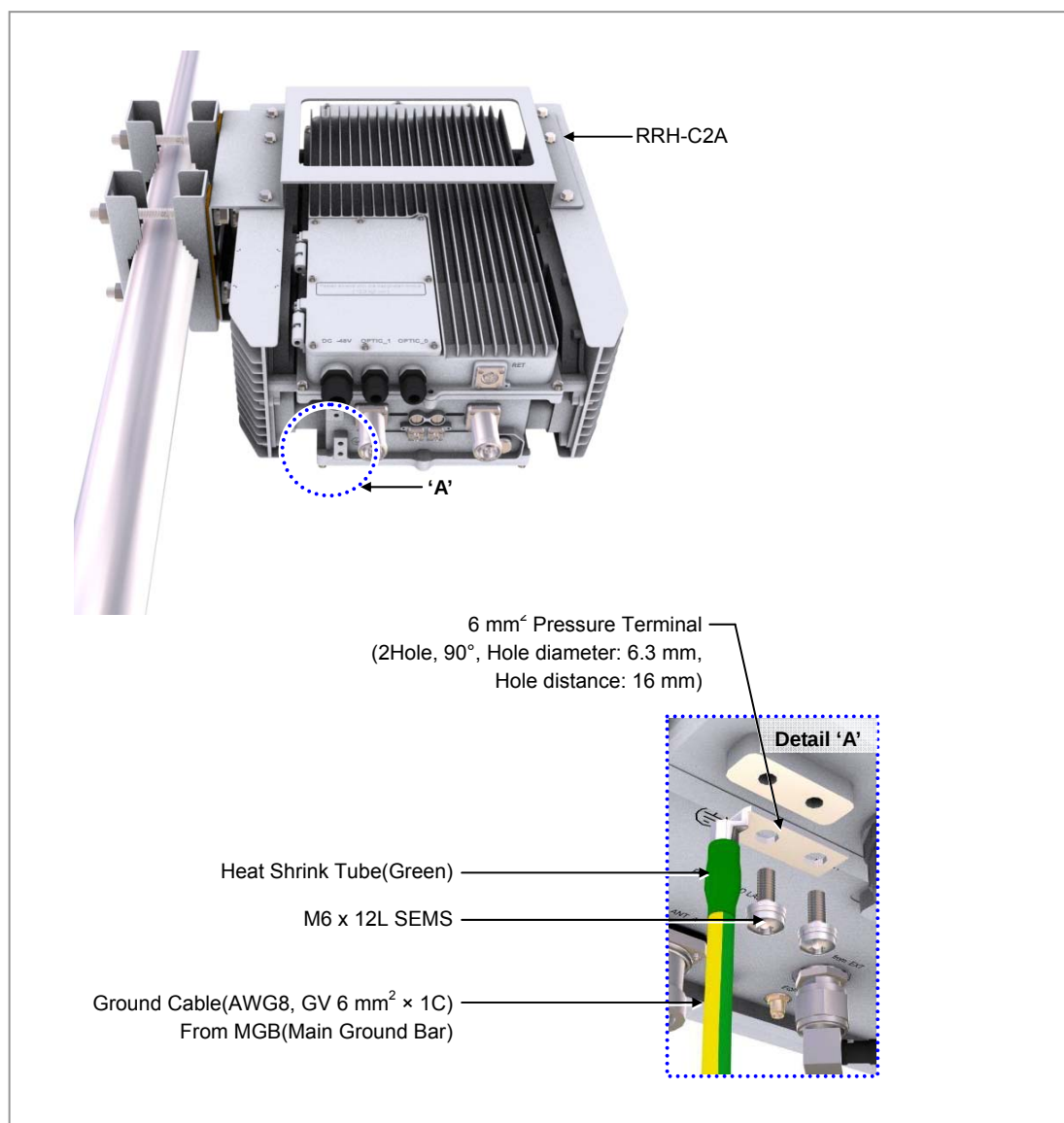


Figure 2.12 Connecting RRH-C2A Ground cable



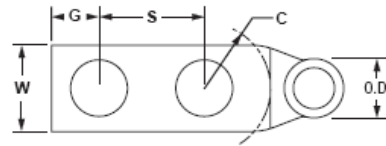
CHECK

Pressure terminal

As for the pressure terminal or the cable, the UL certified products or equivalent should be used.

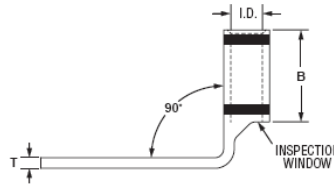
Ex) Manufacturer-Panduit

RRH-C2A: 6 mm² Type Name (LCD8-14AF-L)



When connecting the pressure terminal to a cable, remove the cable sheath where the pressure terminal is connected, and then push the cable all the way to the end of the cable lead-in part.

Check the position of the coaxial cable through the inspection window of the pressure terminal before compressing it with a compressor.



2.7 Connecting Hybrid cable

2.7.1 Installing Hybrid cable

Follow the steps below to install the hybrid cable.

- 1) Unpack the box. (A-D)
- 2) Pull up the tower. (E-F)

- A) Use a crowbar to open the wooden box cover.

After opening the cover, ensure to remove the remaining nails as they may cause injury.



- B) Hold both ends of the hybrid cable and lift it out of the box. Tape the power cable and optic cable separately at 1 m interval. Also, tape the exposed optic connector to prevent damage.

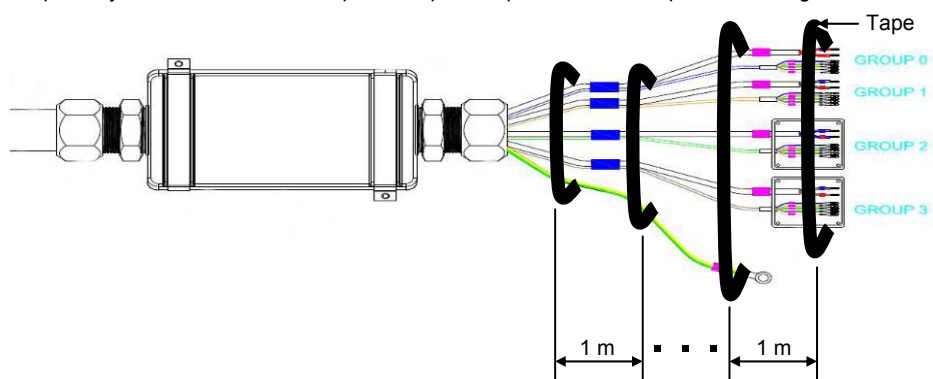


Figure 2.13 Installing Hybrid cable (1)

- C) Take the cable out of the box paying attention not to impact the junction box and the jumper cable. Be careful not to drag the jumper cable on the floor.



Jumper Cable

Junction Box

- D) Lay the hybrid cable on the floor.



Figure 2.14 Installing Hybrid cable (2)

- E) Install pulling wire to the 1m point of (RRH side) hybrid cable's junction box(breakout point) bottom.
Wind the pulling wire by 7 times or more to the 1 m or more length of hybrid cable.

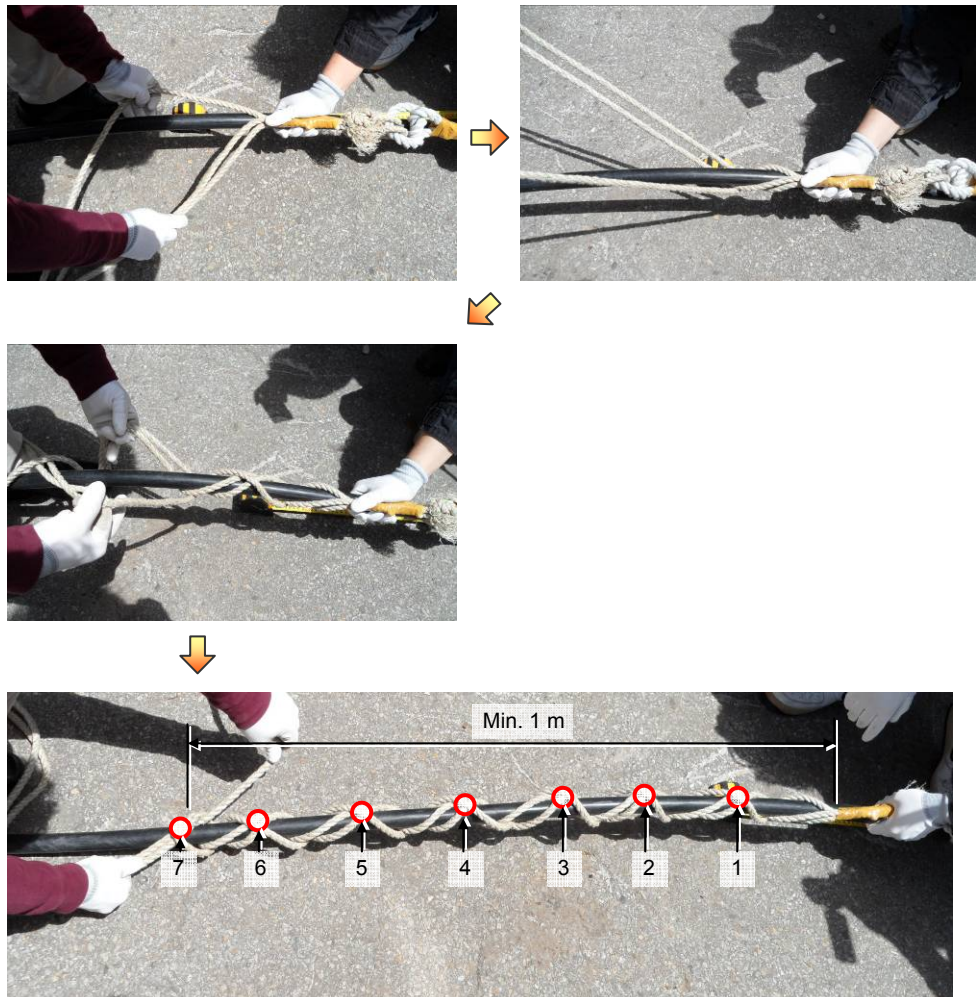
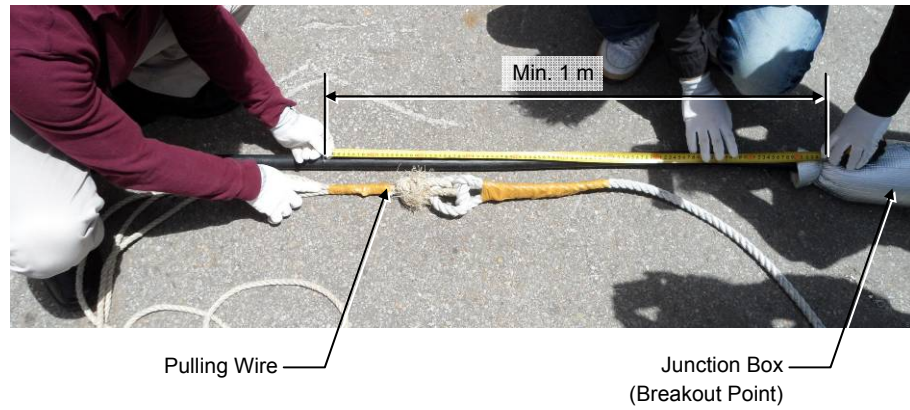


Figure 2.15 Installing Hybrid cable (3)

- F) Fix the cable to the hoisting wire with a cable tie at regular intervals (within 1 m) to prevent impact or tension to the upper side of the junction box when lifting the hoist. Maintain hoisting wire in a straight line, separate the RRH-side cable's curve from the hoisting wire with 150mm or more distance. And fix cable and wire with cable tie. (When lifting the hoist, be careful not to apply tension to other areas of the hybrid cable except where the pulling wire is attached.)

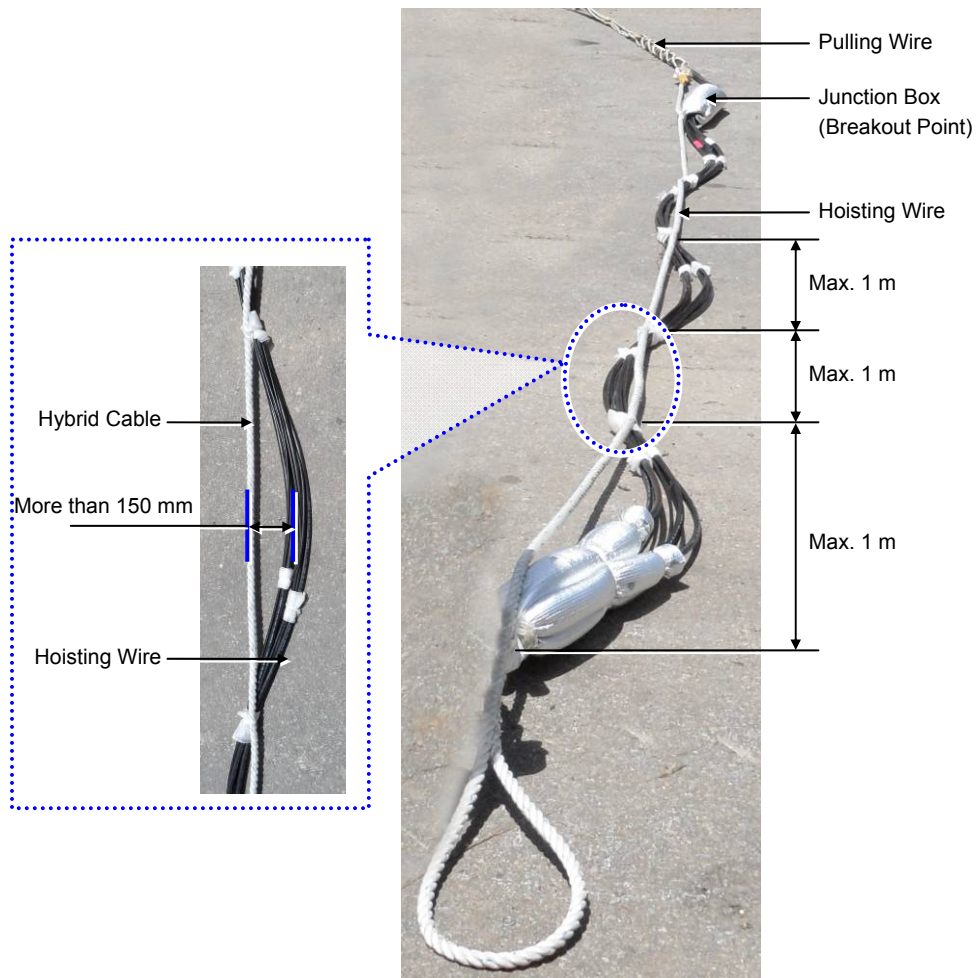


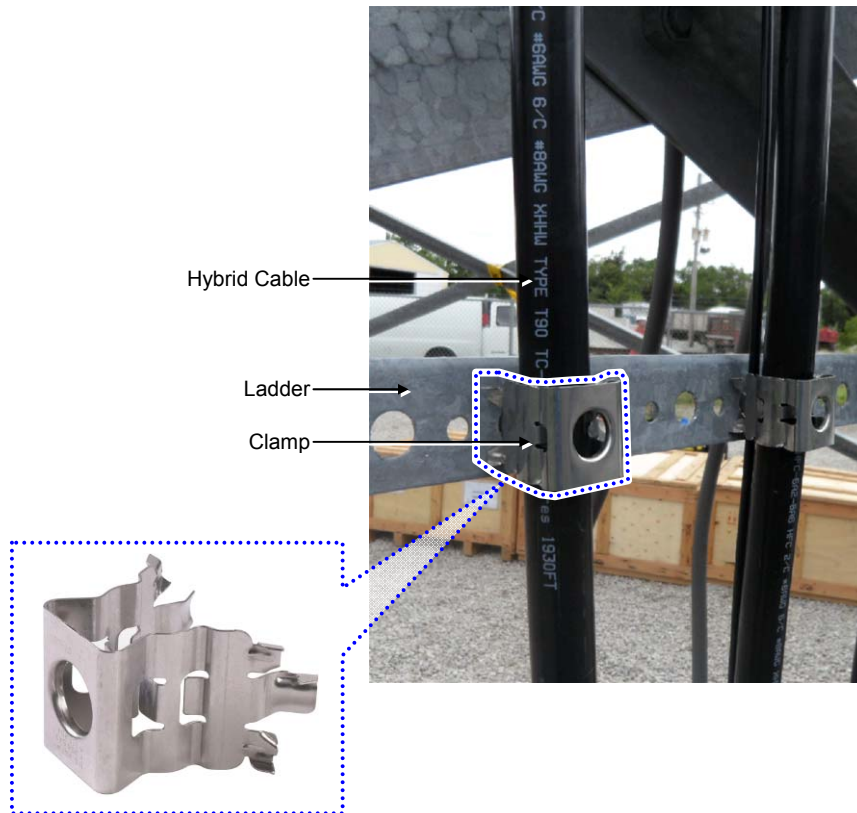
Figure 2.16 Installing Hybrid cable (4)



CHECK

Hybrid cable mounting clamp and installation standards

When fixing hybrid cable to the tower ladder, use the clamp of photo below and fix use of a clamp, and fix cable with fixed-interval of once per 3feet.



2.7.2 Connecting DU Cabinet side cable

If the length of the hybrid cable is inadequate for the installation:

- 1) Measure the hybrid cable's excess length.
(With a white marker pen, mark the area of the cable where the double-layer sheath will be peeled when positioned in the conduit fitting.)
- 2) Using a knife, peel off the heat shrink tube that binds the cables together.
- 3) Pull the peeling wire in the inside of the hybrid cable's double-layer sheath down to the previously marked area.
- 4) Peel off the hybrid cable's sheath.
- 5) Peel off the aluminum foil wrapped around the inner cable.
- 6) For all power cables, leave 1000 mm from where the double-layer sheath has been peeled off and cut the excess length off.
- 7) Unsheathe the end of the power cable wire at 15 mm.
- 8) Using a conduit, insert the hybrid cable's power cable and optic cable together into the cabinet. Be careful not to damage the optic cable's connector.

- 9) From the inside of the cabinet, pull the optic cable to the right side of the system and attach temporarily with a cable tie.
- 10) Using a flat-head screwdriver (-, 1x100), turn the RRH power terminal's screw counter-clockwise twice to 3 times.
- 11) Insert the power cable to the terminal according to its use and polarity, then fasten the screw.
- 12) Bind two cables (-48 V, RTN) at 100 mm from the terminal using a cable tie.
- 13) Bury the optic cable following the system's inner-right wall up to the UADU#0 side and bind using a cable tie.
- 14) Connect the connector of the optic cable to UADU's designated port. (Loop the optic cable's excess length respecting the bending radius ($R=110$ mm), and arrange it at the bottom of the DC power terminal. Be careful not to damage the optic cable during other works.)

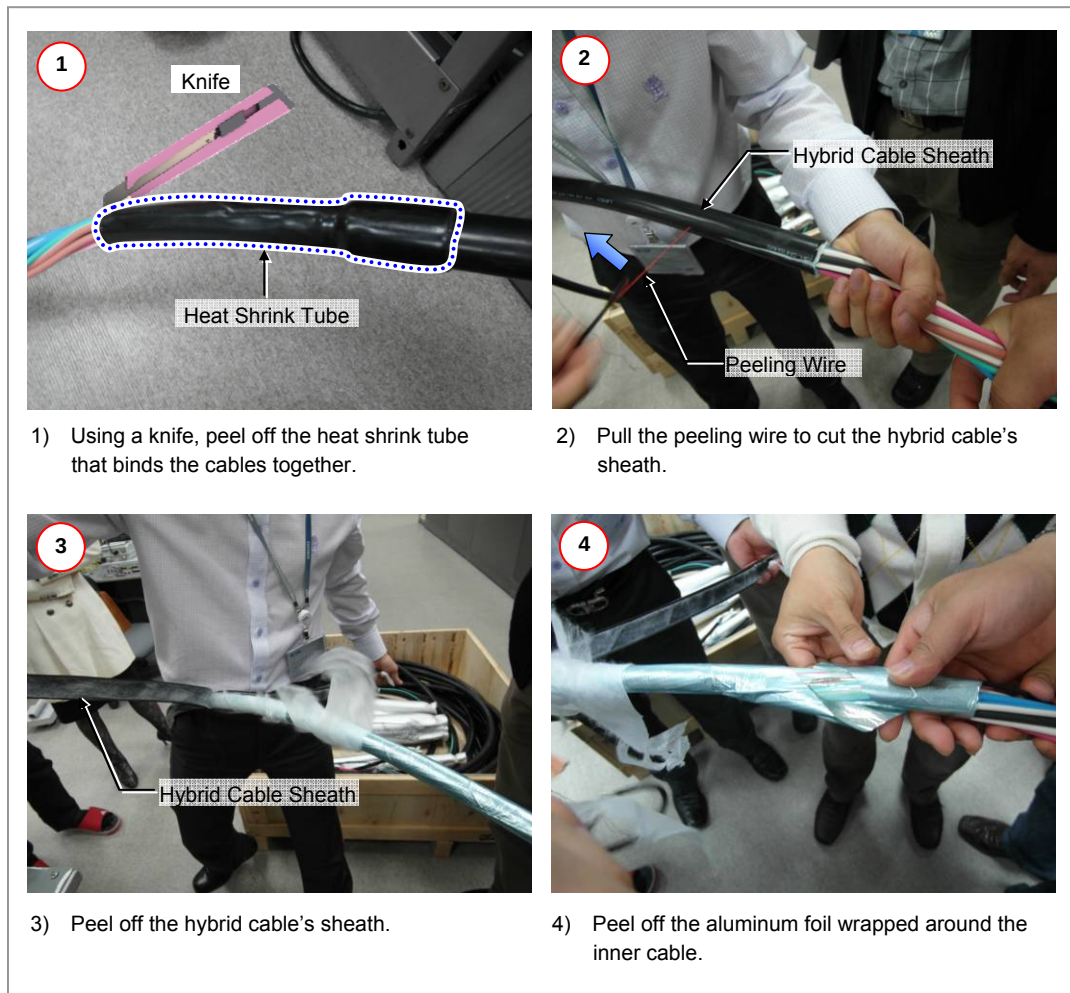


Figure 2.17 Peeling off the Hybrid Cable Sheath

If the length of the hybrid cable is adequate for the installation:

- 1) For all power cables, leave 1000 mm from where the double-layer sheath has been peeled off and cut the excess length off.
- 2) Unsheathe the end of the power cable wire at 15 mm length.
- 3) Using a conduit, insert the hybrid cable's power cable and optic cable together into the cabinet. Be careful not to damage the optic cable's connector.
- 4) From the inside of the cabinet, pull the optic cable to the right side of the system and attach temporarily with a cable tie.
- 5) Using a flat-head screwdriver (-, 1x100), turn the RRH power terminal's screw counter-clockwise 2 to 3 times.
- 6) Insert the power cable to the terminal according to its usage and polarity, then fasten the screw.
- 7) Bind two cables (-48 V, RTN) at 100 mm from the terminal using a cable tie.
- 8) Bury the optic cable following the system's inner-right wall up to the UADU#0 side and bind using a cable tie.
- 9) Connect the connector of the optic cable to UADU's designated port. (Loop the optic cable's excess length respecting the bending radius ($R=110$ mm), and arrange it at the bottom of the DC power terminal. Be careful not to damage the optic cable during other works.)

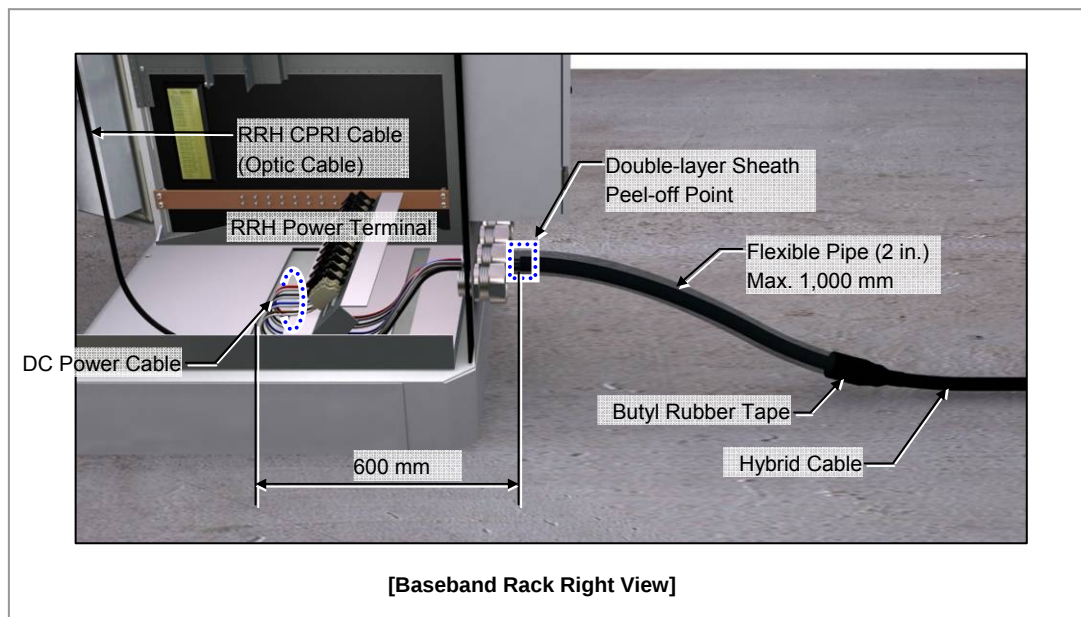


Figure 2.18 Connecting Hybrid cable (1)

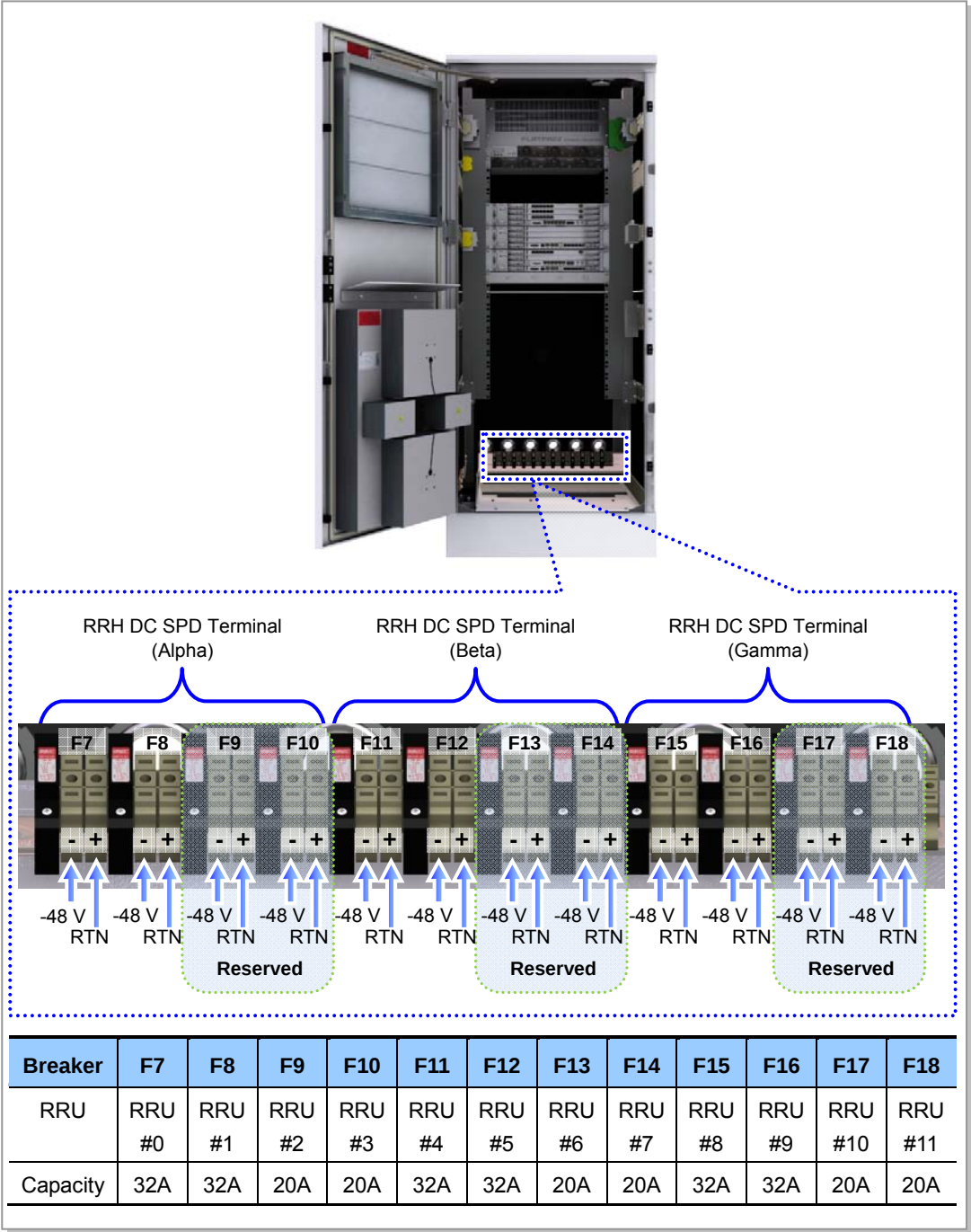


Figure 2.19 Connecting Hybrid cable (2)

Table 2.4 Hybrid Cable Color Map

	Group 0 (1.9 GHz)	Group 1 (800 MHz)	Group 2 (2.5 GHz)	Group 3 (2.5 GHz)
Return	White/Red stripe	White/Black stripe	White/Blue stripe	White/Brown stripe
-48 V	Red	Black	Blue	Brown

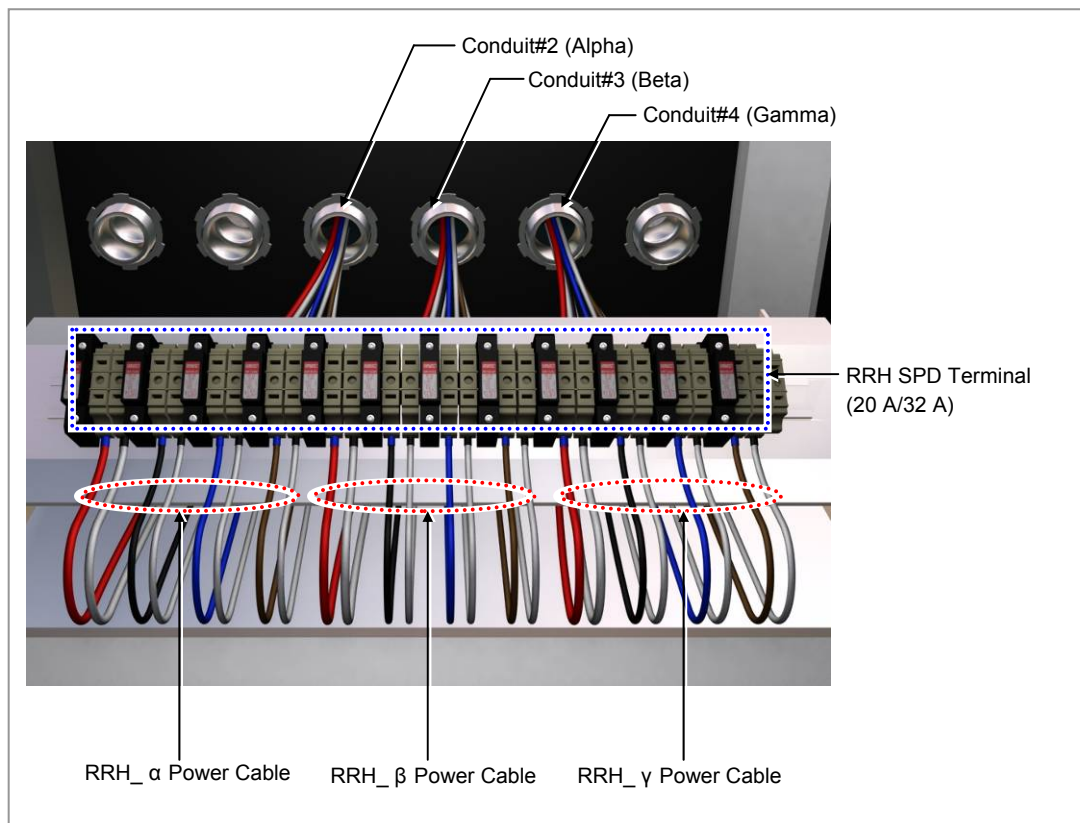


Figure 2.20 Connecting Hybrid cable (3)

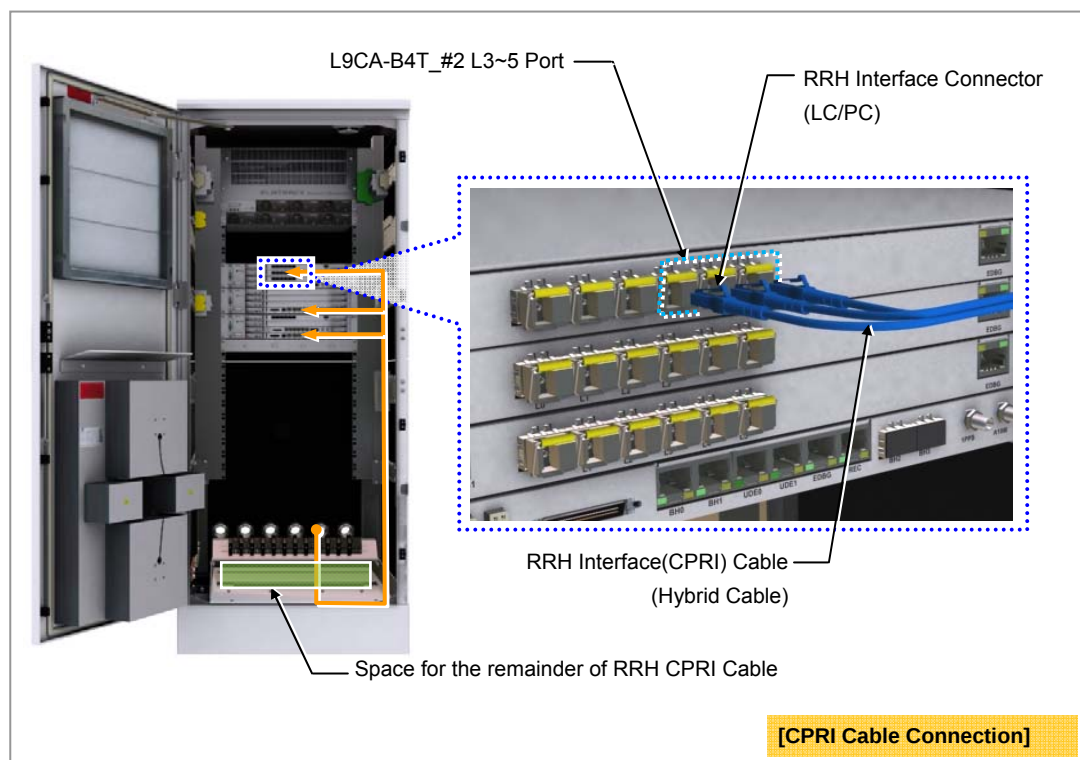


Figure 2.21 Connecting Hybrid cable (4)

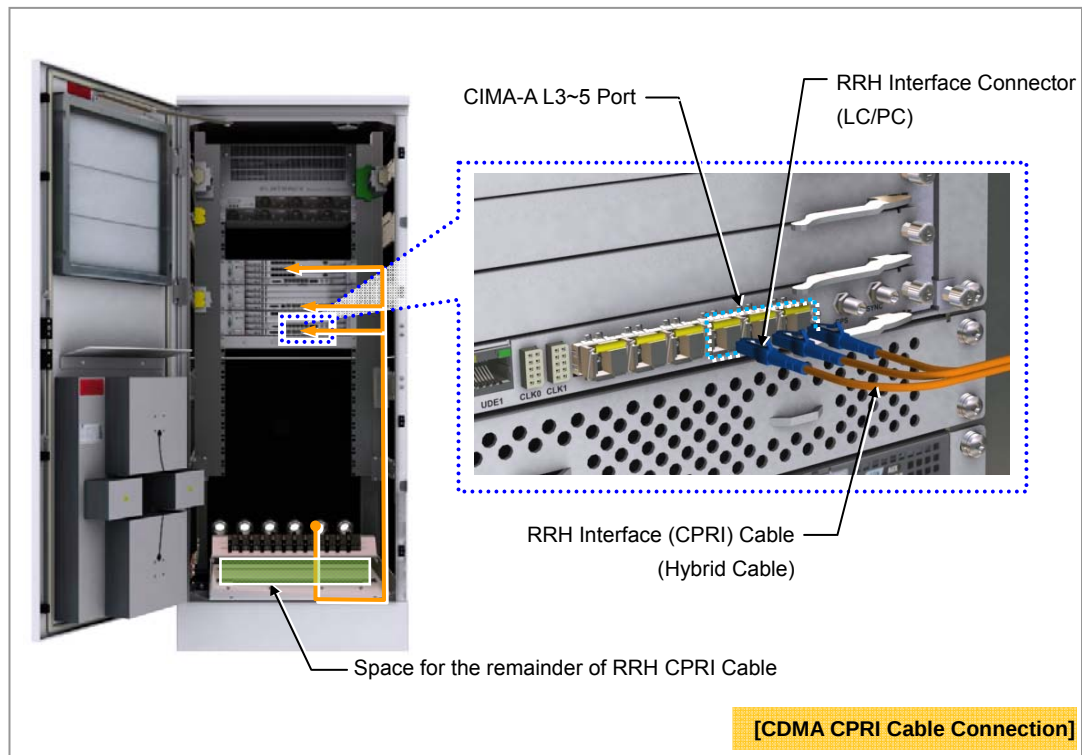


Figure 2.21 Connecting Hybrid cable (5)



Managing unused port

Finish unused port of UADU by dust-cap, not making the alien substance flowed.



Finishing Cable Insertion Hole

Finishing work is required on cable insertion holes (Cable gland, Conduit and etc.) to prevent entering of any foreign substance, external air and moisture.

- Unused cable insertion hole: Finish cable insertion hole using fishing materials such as dust cap, rubber packing and etc.
- Cable-installed insertion hole: After installing cable, finish insertion hole using tape, compressed sponge, rubber packing, silicon, etc. to prevent empty space.

2.7.3 Connecting RRH-C2A Power Cable

When using the power cable (AWG8)

Follow the steps below to connect the power cable to RRH-C2A.

- 1) Unscrew the power window cover fixing screw located at the rear bottom of RRH-C2A using a Torx (T20) screwdriver. (The cover fixing screw is designed to remain attached to the cover.)

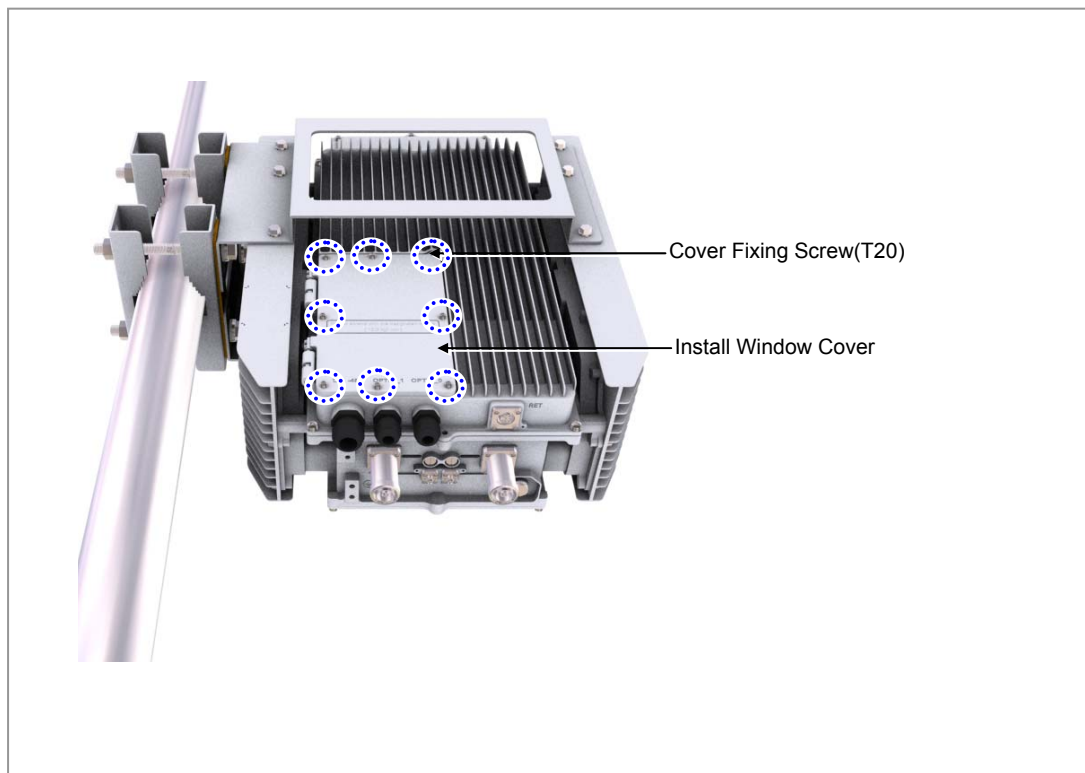


Figure 2.22 Connecting RRH-C2A power cable (1)

- 2) Cut cable installed to the power terminal. Unsheathe outer cable sheath at 30 mm length and peel off the inner wire at 10 mm length. And insert the heat shrink tube of 15 mm length to the wire, then connect the ring lug to the end of each inner wire. Press and fix the ring lug head to the wire. Next locate the shrink tube as in the as in the below figure, then shrink the tube with the heat gun.

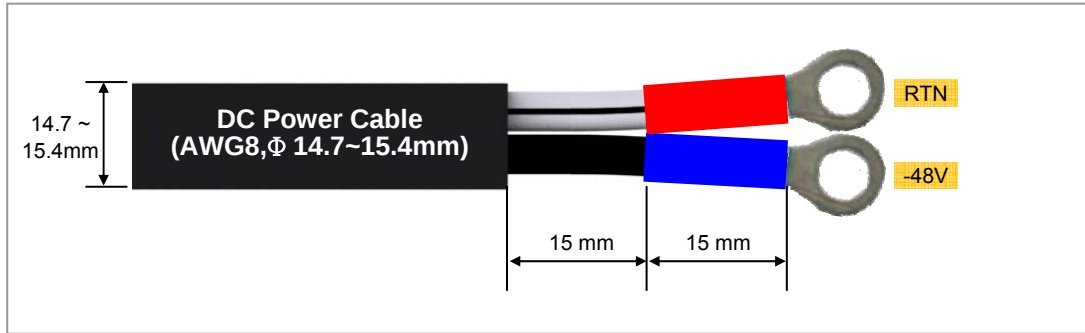
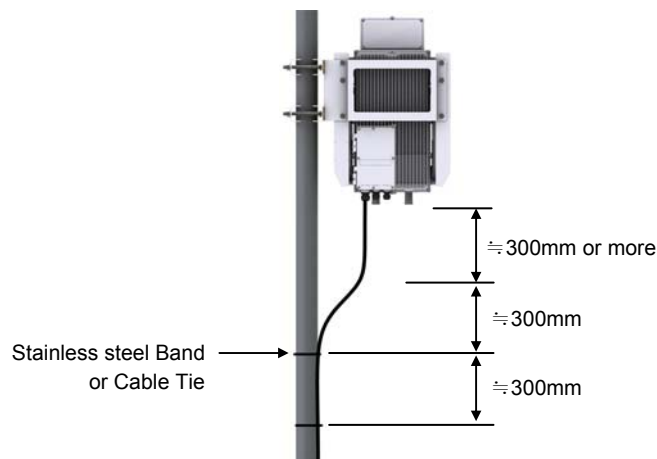


Figure 2.24 Connecting RRH-C2A power cable (AWG8) (3)



Caution for installing the power cable

To maintain cable gland's rain protection performance, 300 mm or more interval should be kept straight. According to the radius of curvature of the cable specification should be considered.



Caution for cutting the power cable

Cut power cable after installing power cable to RRH-C2A power terminal taking into account the radius of curvature according to the cable specifications.

When cutting the cable first, the length difference of cable end can be occurred by cable curvature and the power terminal may cause contact fault.

- 5) Remove the cable gland nut from the power cable input hole located at the bottom of RRH-C2A.
- 6) Insert the cable gland nut to the power cable (Hybrid cable, AWG8, 2C).
- 7) Insert the power cable from the bottom of the equipment through the power cable input hole, then install within the power window. Make sure that the power cable's unsheathed part is inserted only as far as the protruded section inside the rain protection sponge.
- 8) Turn the screws(On the power terminal block) 8 times or more by the opposite direction of clockwise rotation. So, clamp of the bottom must be moved down completely.
- 9) Inset power cable(Sheath is stripped) with the correct polarity, fasten the screw by torque 14 kgf.cm.(Refer to the 'Caution for connecting power cable to terminal block')

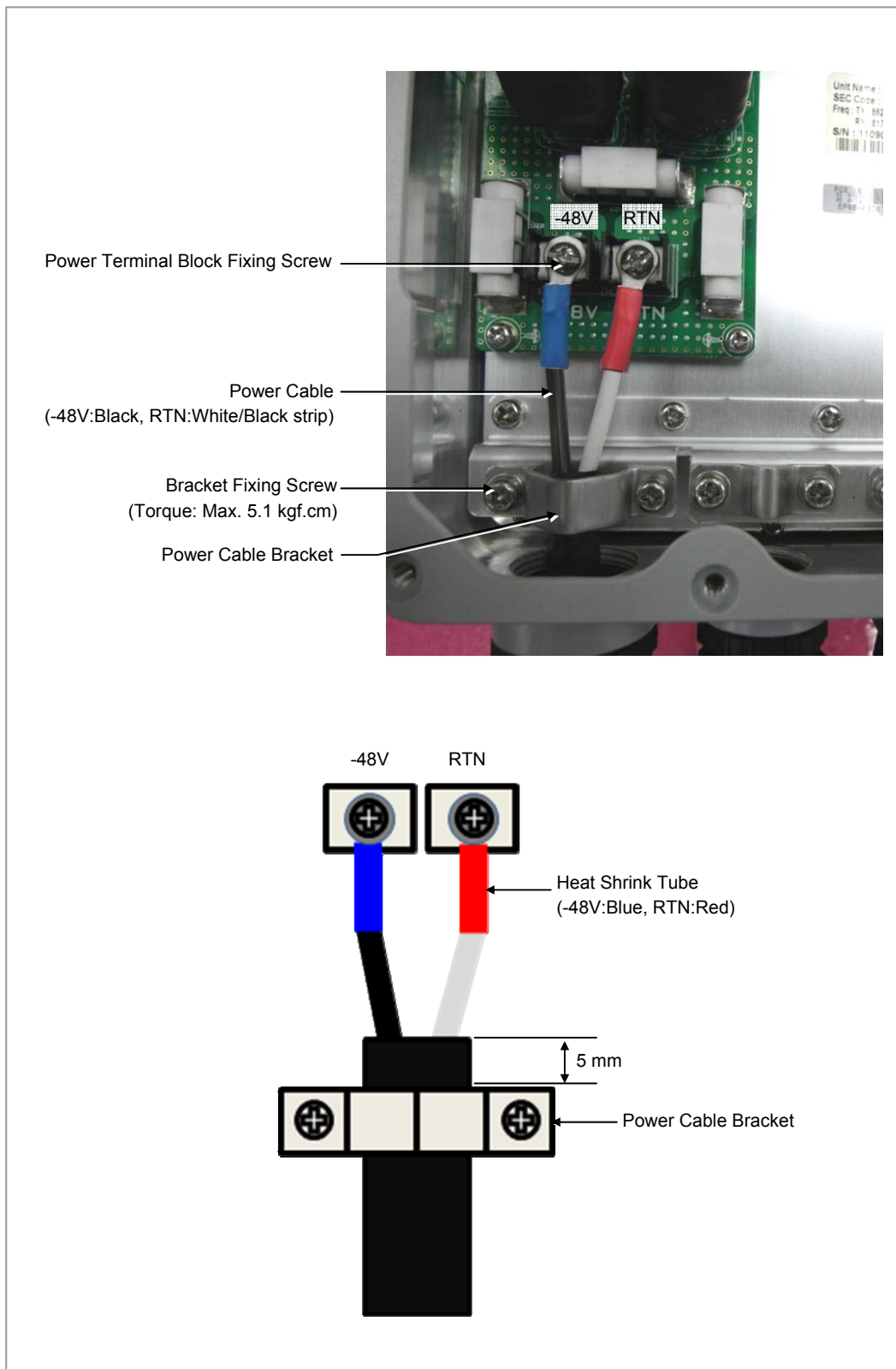


Figure 2.25 Connecting RRH-C2A power cable (AWG8) (4)

- 12) When the power cable connection and attachment are complete, close the power window cover and fix screw (T20) by 12.0 kgf.cm torque.
- 13) Fix external power cable and external power cable support bracket of the RRH-C2A with the stainless steel tie.

**Installing the Circuit Breaker**

To ensure stability in power supply, a circuit breaker must be installed on the power cable connected to the rectifier (or power distributor).

Capacity of -48 VDC circuit breaker is 32 A.

2.7.4 Connecting RRH-C2A CPRI cable

Follow the steps below to connect the CPRI cable for the interface between RRH-C2A and UADU.

- 1) Unscrew the optic window cover fixing screw located at the front bottom of RRH-C2A using a Torx (T20) screwdriver. (The cover fixing screw is designed to remain attached to the cover.)

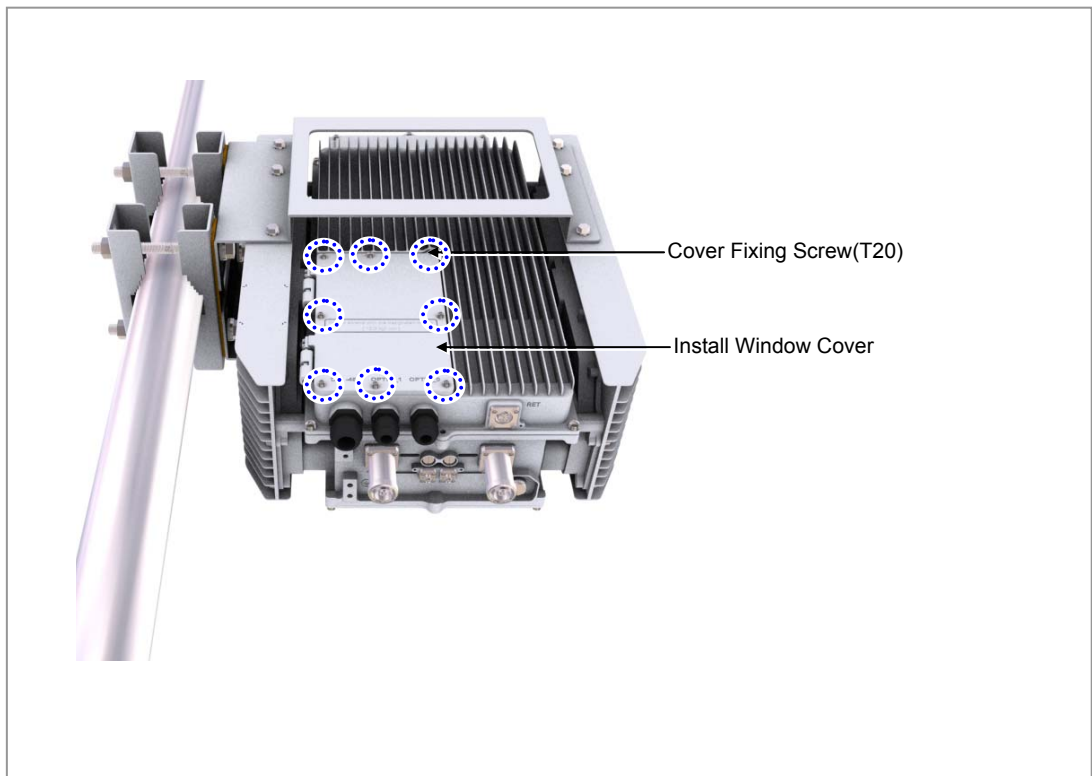
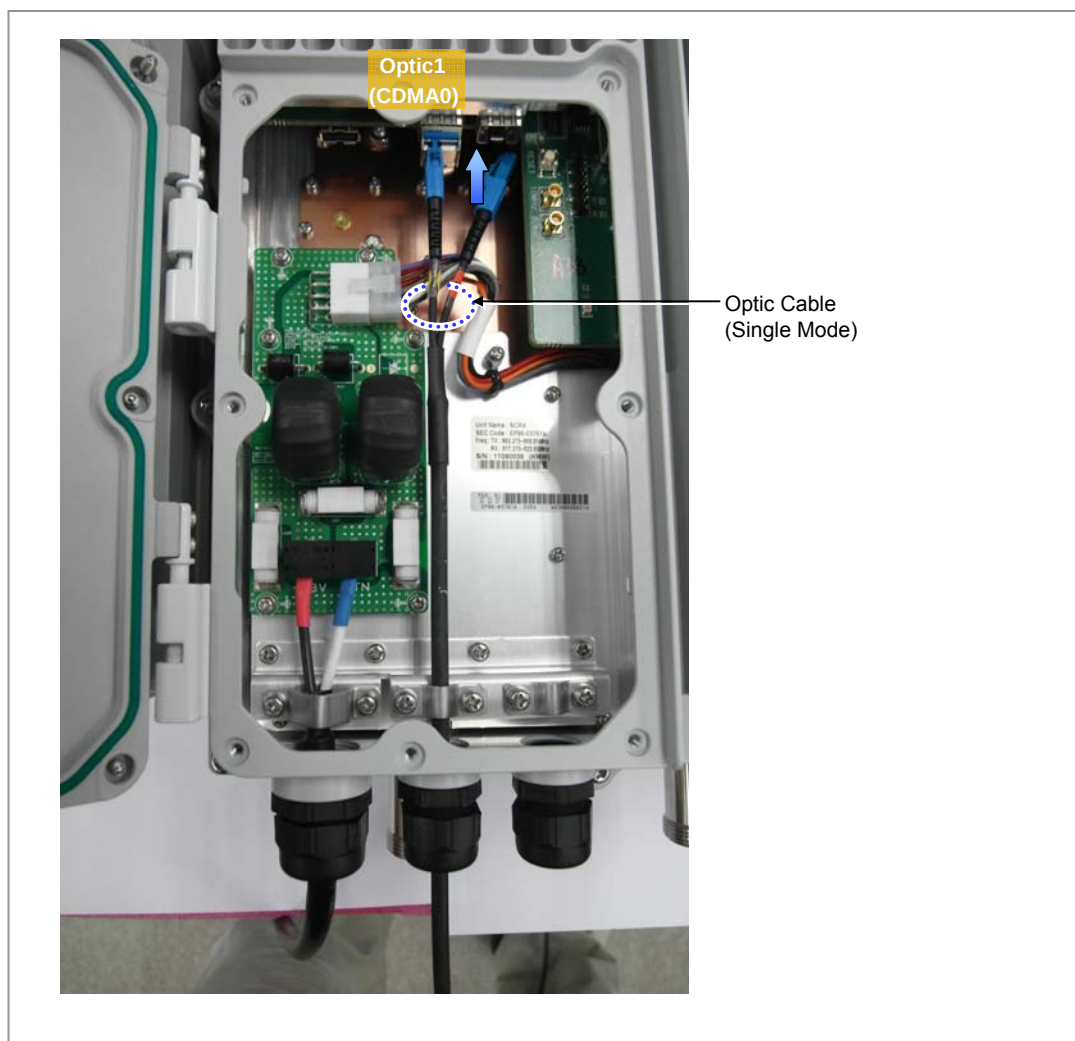


Figure 2.34 Connecting RRH-C2A CPRI cable (1)

- 2) Remove the cable gland nut and rain protection sponge from the optic cable input hole located at the bottom of the equipment.
- 3) Insert the cable gland nut and the rain protection sponge to the optic cable in respective order.
- 4) Insert the optic cable (5 core, 1 pc) from the bottom of the equipment through the optic cable input hole, then bury within the optic window. Insert the optic connector to the SFP module.
(Maintain the optic cable's minimum bending radius of $R=20$ mm to preserve the cable performance and prevent damage.)
- 5) When the connection of the optic connector is complete, allow approx. 10 mm of the optic cable's sheath in the box, insert the rain protection sponge in the gland hole, then fasten the cable gland nut by torque 40.8 kgf.cm.
- 6) When the CPRI cable connection is complete, close the window cover and fasten the screw by torque: 12.0 kgf.cm.



**Cautions When Connecting the CPRI Cable**

Failure to observe the CPRI cable connection specified in Table 2.5 may impair the communication between the CDMA terminal.

**Caution for Laser Beam of Optical Module and Cable**

The optical module and cable used in the system emit bright laser beams. Always handle them with care as there is risk of serious injury if the eyes are exposed to the laser beam of the optical cable.

**RRH-C2A optic cable connection standard**

Cable connection standard between UADU CPRI port and RRH-C2A optic port is different according to the count(One or two) of CDMA UADU(Installed in DU cabinet).

Connect the optic cable(Refer to the connection standard of 'table 2.6' and 'table 2.7'). Because false connection can cause the fault of call connection, be cautious.

**RRH-C2A Optic Cable**

The optic cable consists of 5 cores. The grey cable is the spare cable for replacement in case one of the 4-core optic cables would fail.

2.7.5 Remaining length of Hybrid cable

Follow the steps below to organize the remaining length of the cable after connecting the hybrid cable (power cable, CPRI cable) to RRH-C2A.

- 1) Loop the excess length of the power cable and CPRI cable, and attach to the RRH-C2A fixing pole using a cable tie. Ensure to respect the optic cable's bending radius of (R=110 mm).
- 2) Bind the power cable and CPRI cable together with the feeder line using a cable tie.

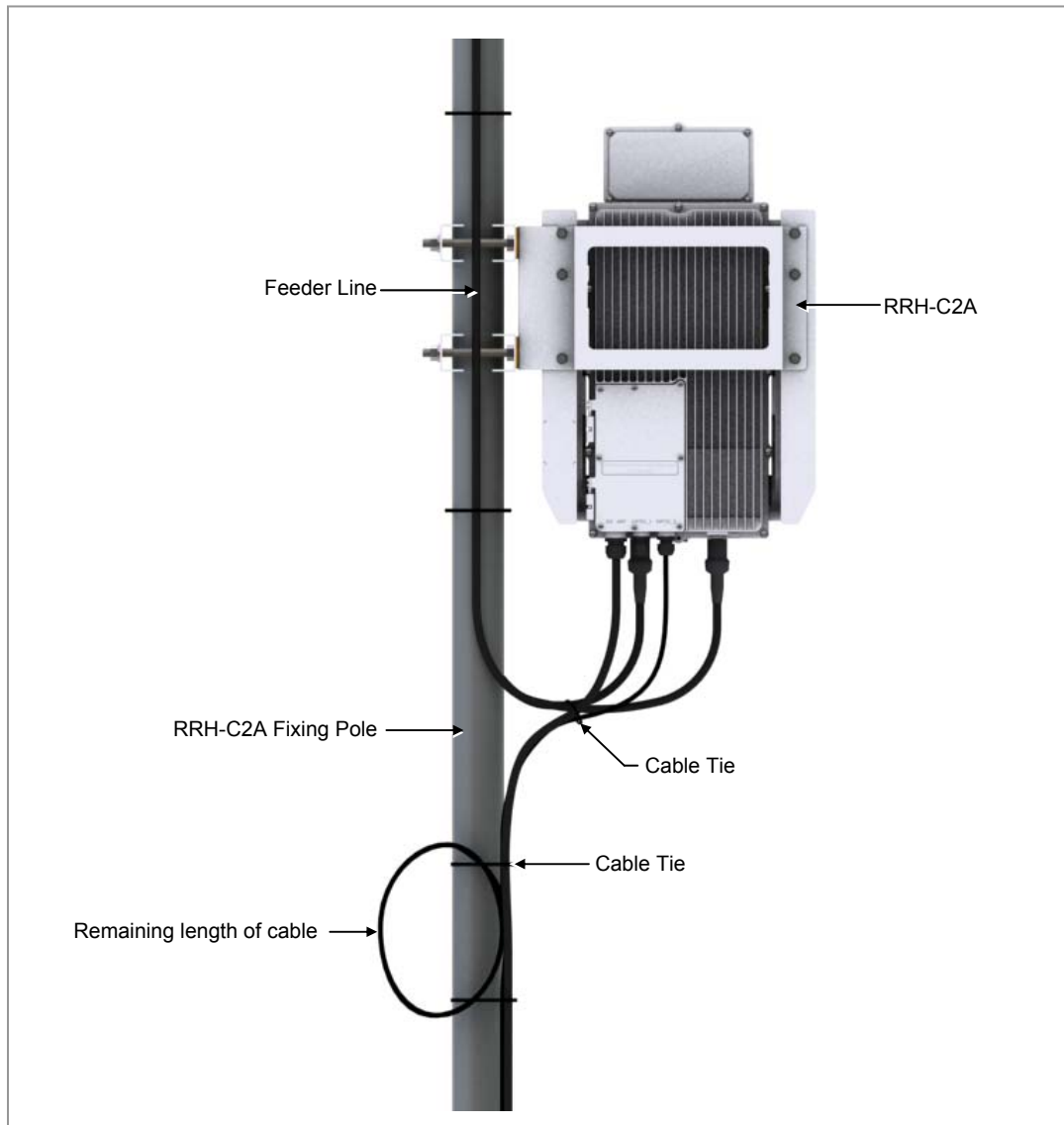


Figure 2.36 Remaining length of Hybrid cable (1)

- 3) Attach the junction box (breakout point) to the pole using a stainless steel band. Tie the cables to the pole 500 mm below and 500 mm above the box. (To stabilize the cables near the junction box's cable input and output holes.)

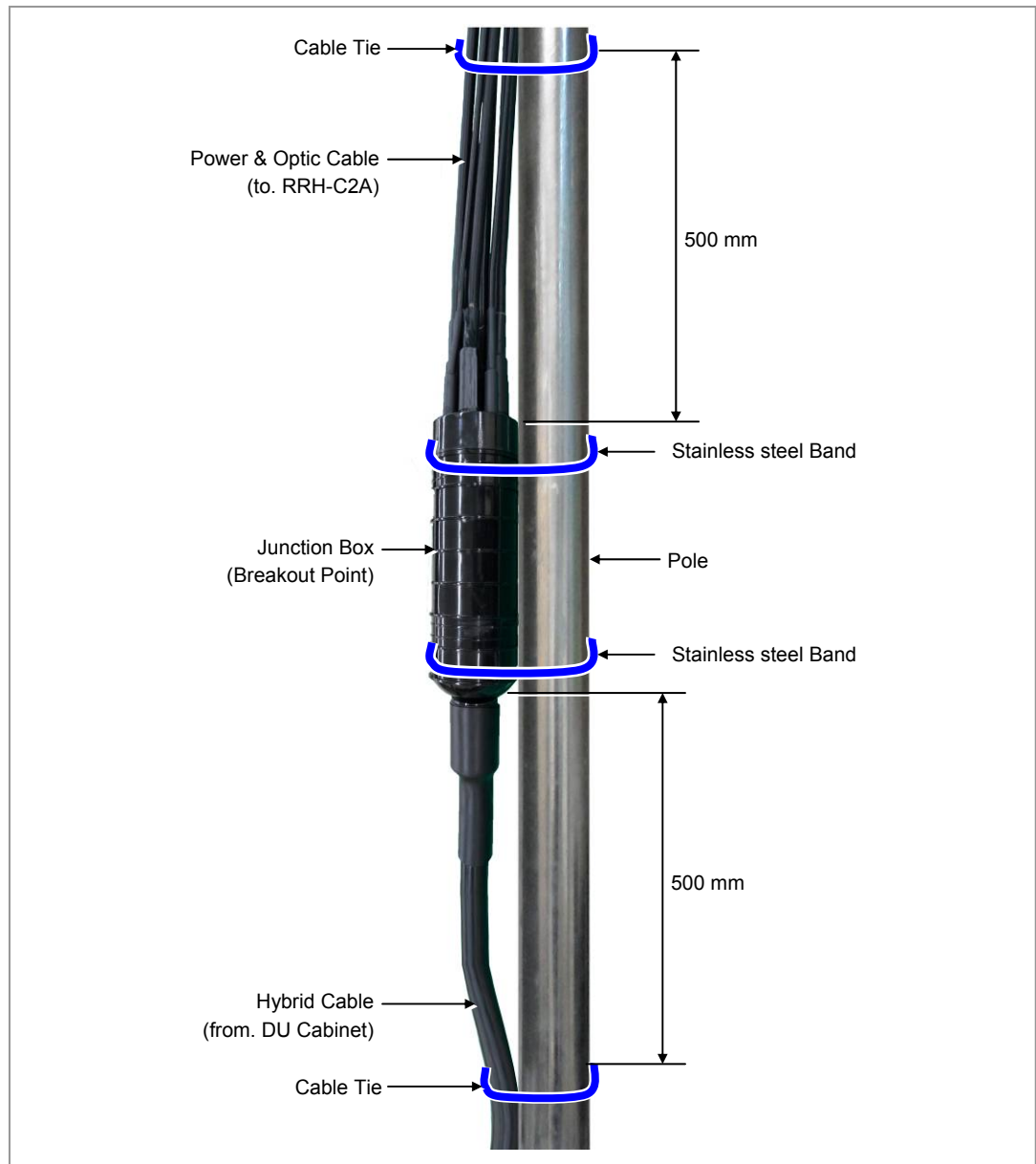


Figure 2.37 Remaining length of Hybrid cable (2)

- 4) Bind the spare cable to the pole with its waterproof cap facing up. Loop the cable's remaining length and bind it to the pole below the cap.

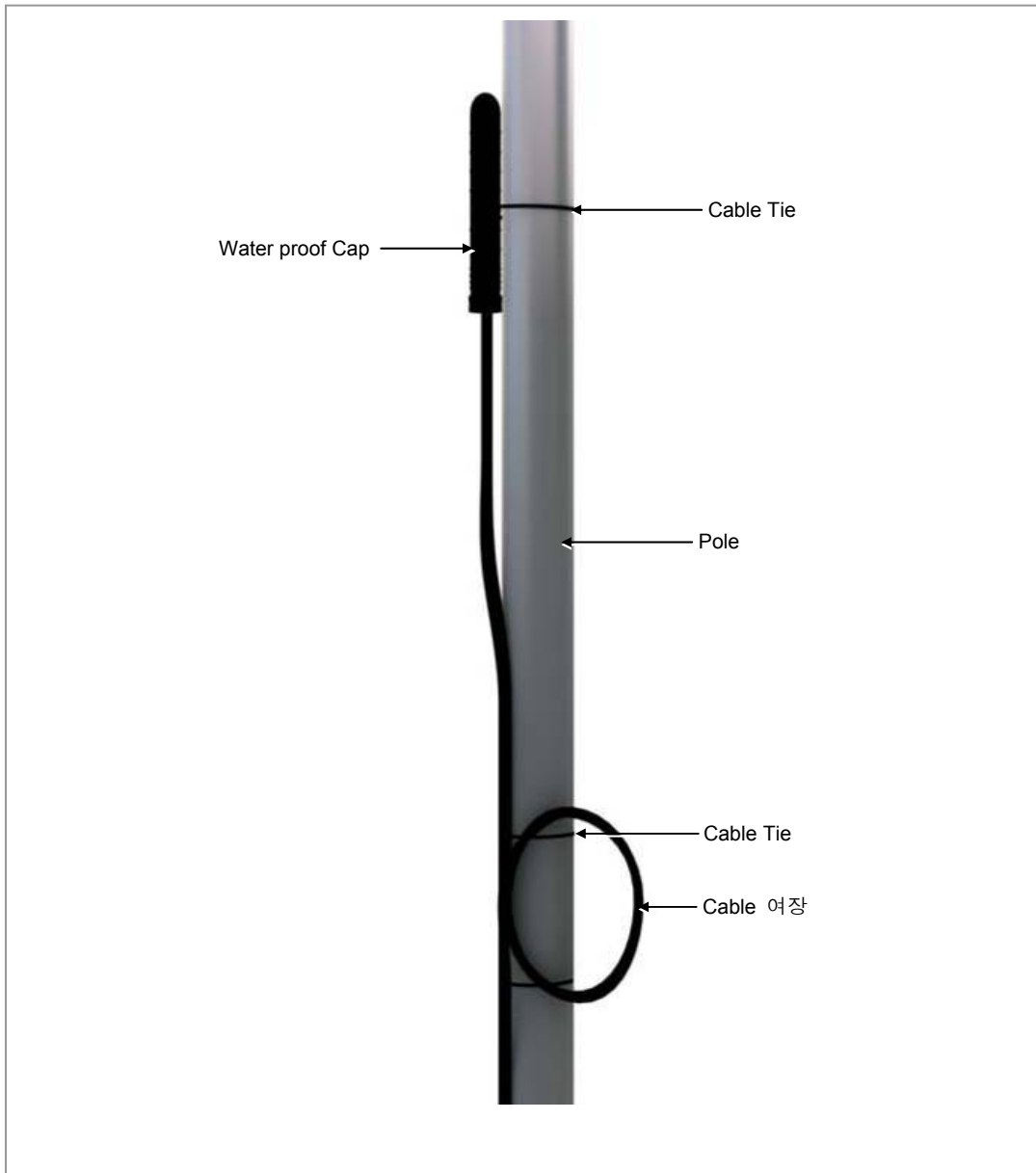


Figure 2.38 Remaining length of Hybrid cable (3)

2.8 Installation Test

If the installation of the system is complete, progress the installation test to check the status of the system. The purpose of this test is to remove problems, which may generate after the service starts, in advance for stable operation of the system. If there is any problem, restore the system and write out the failure table.

The installation test should be progressed in the order of power section test and function test.

Power Section Test

The power section test is progressed as follows:

- 1) Execute the 'off' of the breaker(RRH-C2A power in the DU cabinet is connected).
Make sure that the DC resistance between the -48V/RTN is over tens of kilo ohm ($k\Omega$).
- 2) Make sure that the DC resistance between the RTN of Terminal block-① and RRH-C2A frame is no greater than $10\ \Omega$. The ground cable must be installed at DU cabinet and RRH-C2A
- 3) Execute the 'on' of the breaker(RRH-C2A power in the DU cabinet is connected).
Make sure that the voltage between the RTN of terminal block-①, ② is over -38VDC.
- 4) Execute the 'on' of the breaker(RRH-C2A power in the DU cabinet is connected).
Verify that the LED(Red or green) in the RRH-C2A installation window is lit.
- 5) Fasten the cover fixing screw (T20) using a Torque 12.0 kgf.cm. Close the power window cover and the optic window cover.

Table 2.8 Construction Status Checklist

Category	Check Items	Criteria	Result		Remarks
			Pass	Fail	
System Installation	System fixing status (Vertical and horizontal)	Horizontal and vertical locations			
	System arrangement status	Horizontal and vertical locations			
	Locking status and standard compatibility of bolts/nuts/washers	Visual inspection and magnet test			
	External wiring and other wirings	Visual inspection for twist, array and arrangement			
	System cable installation status	Checking twist, distortion and installation status			
	External connector connection	Visual inspection to check poor contact (Tightening status)			
	Other appurtenant work (Cable duct installation and others)	Visual inspection			
Power Acceptance	Equipment's power cable specification	Visual inspection			
	Rectifier ↔ System	Visual inspection			
	Cabling Status	Visual inspection for twisted or entangled status			
	Damage of cable sheath	Visual inspection			
	System power connector	- Visual inspection to check whether the power connector is connected normally without separation. - Inspection for the power connector shaking status			
	System input voltage (BATT voltage)	Measurement by digital meter (voltmeter)			
External interface	Optic Cabling Status	Visual inspection			
Ground Construction	Ground line standard	Visual inspection			
	Ground bar ↔ System	Visual inspection			
	Ground line cabling status	Cabling status check			
	Termination treatment of the ground line (Pressure Terminal)	Visual inspection			

Table 2.8 Construction Status Checklist (continued)

Category	Check Items	Criteria	Result		Remarks
			Pass	Fail	
Feeder Line status	Feeder Line installation and fixing status	View, consistency, bending			
	ANT installation and connection status	Visual inspection (ANT stick shaking status)			
	Connection and end processing status	View, consistency			
Various TAG Status	Feeder Line tag	Visual inspection (Content: Length, LOSS value, position)			
	Power cable tag	Visual inspection			
	Ground table tag	Visual inspection			
	Attachment status of the label for the real-name construction system - Indoor: wall side of the gate side - Outdoor: inside of the cover of the distribution box	Visual inspection (size, material, etc.)			
	Cable duct, bolt connection status	Visual inspection			
	Feeder line Entrance end processing status (Outdoor)	Visual inspection (Checking back side Connection)			
	Status of inside/outside of the system and vicinity of the base station	Visual inspection			
General Opinion					



ANNEX A. Sector Antenna Installation

A.1 Cautions when Installing a Sector Antenna

Precautions of antenna installation are as follows.

- Sector antennas should be installed vertically. ($\pm 1^\circ$)
- Antenna is the precise material, so be careful not to make damage or form change.
- When moving antenna, use the tool suitable to rating. In addition, use the rated carrying device which is at least 200% or more than antenna considering the stability.
- Be careful not to give too much strength to the antenna.
- If it rains, suspend connecting the feeder cable and antenna.
- Fix it after adjusting the direction of antenna exactly.
- Distance between steel tower and antenna and the distance between send-receive antennas are based on the antenna layout.
- Attach the antenna on the position specified in the drawing.
- Install the antenna not to make a feature change of the antenna considering the direction of the radiation
- When connect the connector to the antenna, not making the alien substance flowed and is not under the influence of PIMD.
- Measure VSWR of all antennas and the value should be within the regulated value.

A.2 Sector Antenna Layout

The method of sector antenna layout is as follows.

- 1) Use the transit to adjust the antenna installation direction exactly.
- 2) Fix the direction of the sector antenna, same as the angle settled when designing the cell after installing the steel tower.
- 3) Arrange the antennas of each sector to the sector directional angle at right angles by adjusting the distance between antenna and steel tower.
In the event of the station whose the direction between sectors is not 120° , install it to make the steel tower and antenna direction different being careful of the tilt and azimuth.
- 4) For circular platform, separate the antenna interval at maximum.

A.3 Sector Antenna Installation

The method of sector antenna installation is as follows.

- 1) Put up an antenna pole and insert the sector antenna into the antenna pole using a fixing clamp.
- 2) Set the antenna's up/down tilt to 0° and fix the fixing clamps at the top and bottom.
- 3) After tightening the fixing clamp, adjust the antenna up/down (tilt) depending on the signal strength. The bolt of the guide clamp must be loosened, so the antenna angle can be adjusted.
- 4) After setting the antenna angle, fasten the bolt of the guide clamp, which was loosened previously. Regarding the nut, the double nut mounting should be used to prevent the nut from coming loose.

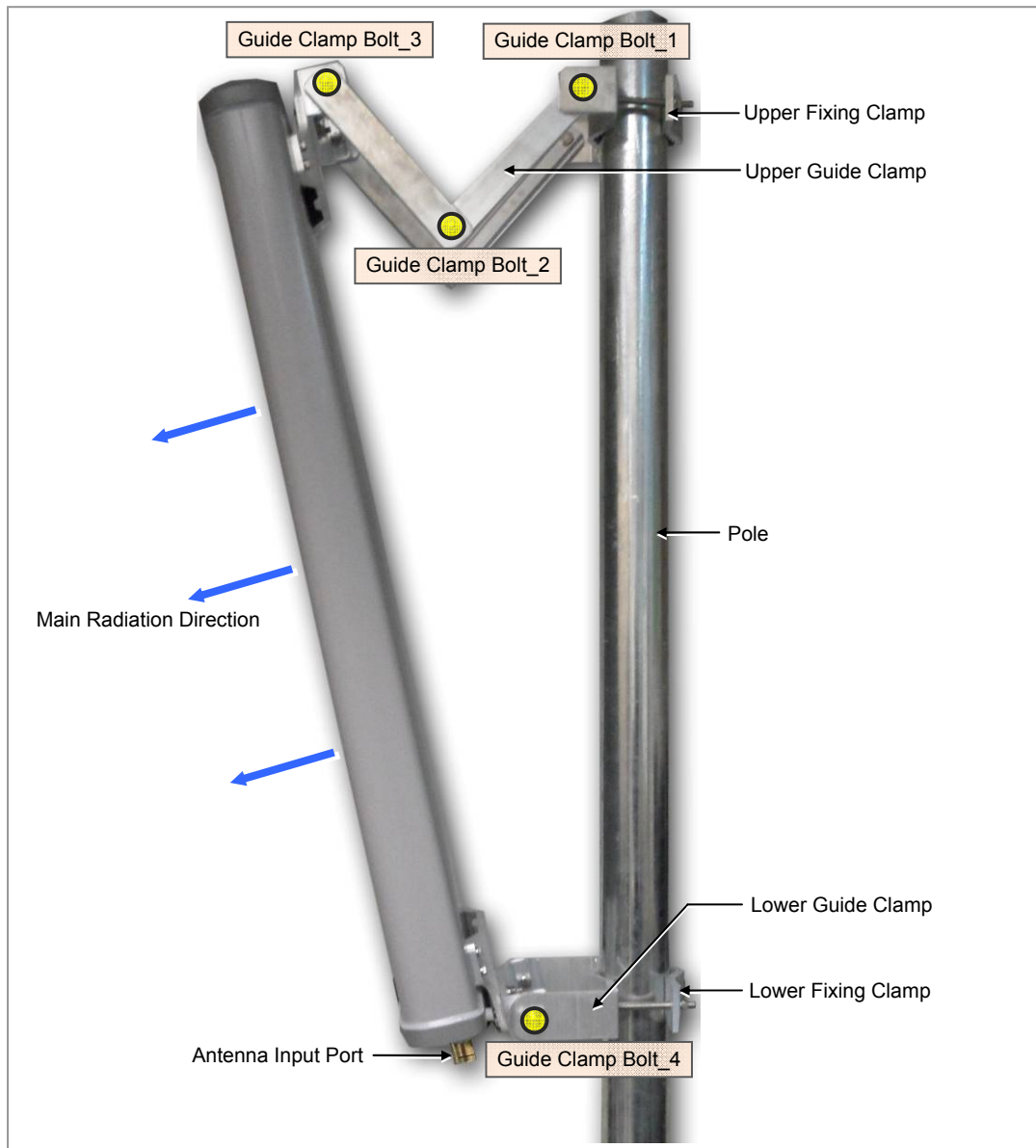


Figure A.1 Sector Antenna



MPE Information

	Warning: Exposure to Radio Frequency Radiation The radiated output power of this device is far below the FCC radio frequency exposure limits. Nevertheless, the device should be used in such a manner that the potential for human contact during normal operation is minimized. In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna should not be less than 500cm during normal operation. The gain of the antenna is 14 dBi. The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
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