
PrimAer 39GHz

Operating Manual



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Contents

Chapter 1 Safety & Certification Notice	8
1.1 FCC Warning Statements	9
1.1.1 FCC Part 15.105 statement.....	9
1.1.2 FCC Part 15.21 statement.....	9
1.1.3 Health and Safety Warnings.....	9
1.2 Certification Notice	11
Chapter 2 System Overview	12
2.1 System Overview	13
2.1.1 Overview	13
2.1.2 PrimAer 39 Design Consideration.....	13
2.2 System Network Configuration	14
Chapter 3 System Configuration	15
3.1 DU Function and Configuration	17
3.2 SU Function and Configuration	19
3.3 Rectifier Function and Configuration	22
Chapter 4 System Specification	24
4.1 System Specification	25
4.1.1 Downlink Specification.....	25
4.1.2 Uplink Specification.....	25
4.2 Instrumental Specification.....	26
4.2.1 Structure and Type.....	26
4.2.2 Material and Components.....	26
4.3 Electrical Specification	26
4.4 Environmental Specification	27
Chapter 5 System Installation.....	28
5.1 Kits & Tools	29
5.2 DU Installation.....	35
5.2.1 Product Installation.....	35
5.2.2 Ground Cable Connection	38
5.2.3 Antenna Tilt.....	38
5.3 SU Installation	39
5.3.1 Product Installation.....	39

5.3.2 Ground Cable Connection	43
5.3.3 Antenna Tilt.....	43
5.4 Rectifier Installation	44
5.4.1 Product Installation.....	44
5.4.2 Ground Cable Connection	48
5.5 DU/SU/Rectifier Connection	48
5.5.1 DU/SU/Rectifier Connection	48
5.5.2 Other Installation Scenarios.....	58
 Chapter 6 Local GUI(Graphical User Interface)	59
 6.1 GUI Configuration	60
6.1.1 Initial Main Screen	60
6.1.2 DU Main Screen Configuration.....	64
6.1.3 SU Main Screen Configuration	68

Figures

<i>Figure 1. Network Configuration.....</i>	<i>15</i>
<i>Figure 2. DU Figure</i>	<i>17</i>
<i>Figure 3. DU Port Configuration</i>	<i>18</i>
<i>Figure 4. SU Figure.....</i>	<i>19</i>
<i>Figure 5. SU Port Configuration</i>	<i>20</i>
<i>Figure 6. SU_C & SU_E Distinction (Cascade & End).....</i>	<i>21</i>
<i>Figure 7. Rectifier Figure.....</i>	<i>22</i>
<i>Figure 8. Rectifier Port Configuration</i>	<i>23</i>
<i>Figure 9. Required Space for DU Installation</i>	<i>35</i>
<i>Figure 10. DU Anchor Bolt Assembly for Wall Installation</i>	<i>35</i>
<i>Figure 11. DU Wall Installation Assembly</i>	<i>36</i>
<i>Figure 12. DU Pole Installation Assembly</i>	<i>37</i>
<i>Figure 13. DU Ground Cable Connection</i>	<i>38</i>
<i>Figure 14. DU Tilt</i>	<i>39</i>
<i>Figure 16. Required Space for SU Installation</i>	<i>40</i>
<i>Figure 17. SU Anchor Bolt Assembly</i>	<i>40</i>
<i>Figure 18. SU Wall Installation Assembly</i>	<i>41</i>
<i>Figure 19. SU Pole Installation Assembly.....</i>	<i>42</i>
<i>Figure 20. SU Ground Cable Connection</i>	<i>43</i>
<i>Figure 21. SU Tilt.....</i>	<i>44</i>
<i>Figure 22. Required Space for Rectifier Installation</i>	<i>45</i>
<i>Figure 23. Rectifier Anchor Bolt Assembly</i>	<i>45</i>
<i>Figure 24. Rectifier Wall Installation Assembly</i>	<i>46</i>
<i>Figure 25. Rectifier Pole Installation Assembly</i>	<i>47</i>
<i>Figure 26. Rectifier Ground Cable Connection</i>	<i>48</i>
<i>Figure 27. Optic Cable Connection</i>	<i>49</i>
<i>Figure 28. DU Optical Cable Connection.....</i>	<i>50</i>
<i>Figure 29. SU_C Optical Cable Connection</i>	<i>51</i>
<i>Figure 30. SU_E Optical Cable Connection</i>	<i>52</i>
<i>Figure 31. DU/SU Cable Connections from Rectifier</i>	<i>53</i>
<i>Figure 32. DU & SU Input Port Pinout.....</i>	<i>54</i>
<i>Figure 33. Rectifier DC & AC Cable Connections</i>	<i>55</i>
<i>Figure 34. Rectifier DC Output Port Pinout</i>	<i>56</i>
<i>Figure 35. Rectifier Battery Port Pinout.....</i>	<i>56</i>
<i>Figure 36. Rectifier AC Port Pinout</i>	<i>57</i>
<i>Figure 37. Standing Pole or Mounting Tripod Pole.....</i>	<i>58</i>
<i>Figure 38. Initial GUI Main Screen.....</i>	<i>60</i>
<i>Figure 39. Initial GUI Main Screen.....</i>	<i>64</i>
<i>Figure 40. SU Main Screen.</i>	<i>68</i>

Used Abbreviations

DU	Donor Unit
SU_C	Service Unit_Cascade
SU_E	Service Unit_End
GUI	Graphical User Interface
SISO	Single Input Single Output
MIMO	Multiple Input Multiple Output
ALC	Auto Level Control
AGC	Auto Gain Control
EVM	Error Vector Magnitude
3GPP	3rd Generation Partnership Project
DIFM	Donor InterFace Module
DAOM	Donor Analog Optic Module
EMS	Element Management System
SIFM	Service InterFace Module
SAOM	Service Analog Optic Module
NC	Not Connect

Chapter 1

Safety & Certification Notice

-
- 1.1 FCC Warning Statements**
 - 1.2 Certification Notice**

Safety & Certification Notice

1.1 FCC Warning Statements

1.1.1 FCC Part 15.105 statement

- This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

1.1.2 FCC Part 15.21 statement

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

1.1.3 Health and Safety Warnings

PrimAer 39 should only be operated by approved or certified integrator(or 'Integrator'). The integrator who is tasked with handling, installation, operation, and servicing of PrimAer 39 System must follow the instructions in the Manual prior to handling.

- To avoid any injury, the integrator must turn off the main power switch before installing the system or performing any maintenance related work.
- PrimAer 39 is not a field service unit. The only access compartment is to insert a USIM for modem or resetting the Ethernet port.
- Due to power dissipation, the remote unit may reach very high temperatures. Do not operate this equipment on or close to any flammable or combustible materials. Always use caution when servicing the unit.
- This product should only be used for the purpose specified by FRTek. Do not alter or make any modifications or fit any spare parts which are not sold or recommended by FRTek. This could cause

fires, electric shock, or other injuries.

- Read and follow all the warning labels attached to the unit. Make sure that all warning labels are visible and are kept in a legible condition.
- The network provider needs to ensure that PrimAer 39 is operated within the FCC OET Bulletin 65 standards regarding RF Emissions to avoid health hazards associated with radiation from the antennas in the unit. Suggested remedies are “RF hazard” type signs.
- Do not use any solvents, chemicals, or cleaning solutions containing alcohol, ammonia, abrasives, or any corrosive type products on the unit.
- This device is part of an Industrial Signal Booster/Distributed Antenna System that supports FR2 5G NR modes for the n260 band.. Professional installation required.



Warning

The antenna (or antennas) must be installed so as to maintain at all times a distance minimum of at least 48 cm between the radiation source (antenna) and any individual. This device may not be installed or used in conjunction with any other antenna or transmitter.



Warning

Follow all general and regional installation and safety regulations relating to performing work on high voltage installations. Also, follow regulations and guidelines covering correct use of tools and personal protective equipment.



Warning

Use of unauthorized antennas, cables, and/or coupling devices not conforming with ERP/EIRP and /or indoor-only restrictions is strictly prohibited.

Home/ personal use are prohibited



Warning

Please be informed that the external temperatures of the unit can be extremely high.



Warning

Product contains “Laser Radiation”. Do not look directly into the laser or with any optical instruments.



Warning

Condensation : Silica gel is applied inside the initial packaging. Please apply silica gel when packaging is required to avoid condensation. (During operation, internal condensation is prevented

by turning the power ON)

- **[FCC] BOOSTER WARNING LABEL**

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

1.2 Certification Notice

For Pluggable Equipment, the socket-outlet shall be installed near the equipment and shall be easily accessible.

- **FCC** : This equipment complies with the applicable sections of Title 47 CFR Parts 15,30
- **UL** : This equipment complies with UL Standard for safety for information technology equipment, including electrical business equipment.
- **FDA/CDRH** : This equipment uses a LASER according to FDA/CDRH Rules. This product conforms to all applicable standards of 21 CFR Chapter 1, Subchapter J, Part 1040.

Designed to comply with IP66 standard, test data available upon request.



Note

ACCESS RESTRICTED LOCATION: Equipment location should comply with the following:

- access should only be granted to **AUTHORIZED PERSONNEL** or **CERTIFIED USERS** who have been trained on the installation and operation of PrimAer 39
- FRTek recommends that the equipment be mounted at least 20ft above the ground

Chapter 2

System Overview

-
- 2.1 System Overview**
 - 2.2 System Network Configuration**

System Overview

2.1 System Overview

2.1.1 Overview

PrimAer 39 is a 5G repeater system that can provide and/or enhance high quality telecommunications service both in-building & outdoors. PrimAer 39 System can provide mmWave 39GHz frequency band coverage to all venues.

PrimAer 39 system provides coverage for in-building and outdoor environments. A "proper RF design" will provide a more accurate representation of the expected coverage.

This system can service mmWave 39GHz frequency band service and can be used for public and private facilities.

39GHz Wireless Optic DAS system installation location:

- Shopping mall
- Hotel
- Campus
- Airport
- Subway
- Stadium and convention center

System frequency band :

- mmWave 39GHz SISO/MIMO (37.6GHz ~ 40.0GHz)

PrimAer 39 system is configured with a Donor Unit (DU), a Service Unit (SU_C: Cascading unit or SU_E: End unit), and a Rectifier. 1 DU can operate up to 4 Service Units connected in a cascade configuration.

2.1.2 PrimAer 39 Design Consideration

PrimAer 39 model name and configure is as below.

Item	Model No.	FCC ID	Type
Donor Unit	FR-R5G39AO38ADU	2AFEG-R5G39AO38ADU	Outdoor Enclosure type
Service Unit	FR-R5G39AO33ASUC	2AFEG-R5G39AO33ASUC	

(Cascade)			
Service Unit (End)	FR-R5G39AO33ASUE	2AFEG-R5G39AO33ASUE	
Rectifier	FR-ERECD48A	-	

PrimAer DU receives the 39GHz 5G signal from the gNB over the air. The DU then amplifies the signal and provides 5G service to the SU. The SU then extracts the TDD sync signal received from the gNB and sends to each unit.

For outdoor usage, the DU, SU, and Rectifier are designed within IP66 specification so that dust, pollutants, and insects cannot penetrate.

Item	DU	SU(Cascade)	SU(End)	Rectifier
Input Power	DC -53.3V 2.44A (-48 ~ -53.3V) (from Rectifier)	DC -53.3V 2.44A (-48 ~ -53.3V) (from Rectifier)	DC -53.3V 2.44A (-48 ~ -53.3V) (from Rectifier)	AC 100V ~ 6.8A, 240V ~ 2.85A
Interface(Input)	RF	Optic	Optic	-
Interface(Output)	Optic	RF	RF	Power
Service	mmWave 39GHz 5G NR			-
Type	In-building / Outdoor	In-building / Outdoor	In-building / Outdoor	In-building / Outdoor

2.2 System Network Configuration

PrimAer 39 network configuration shown below.

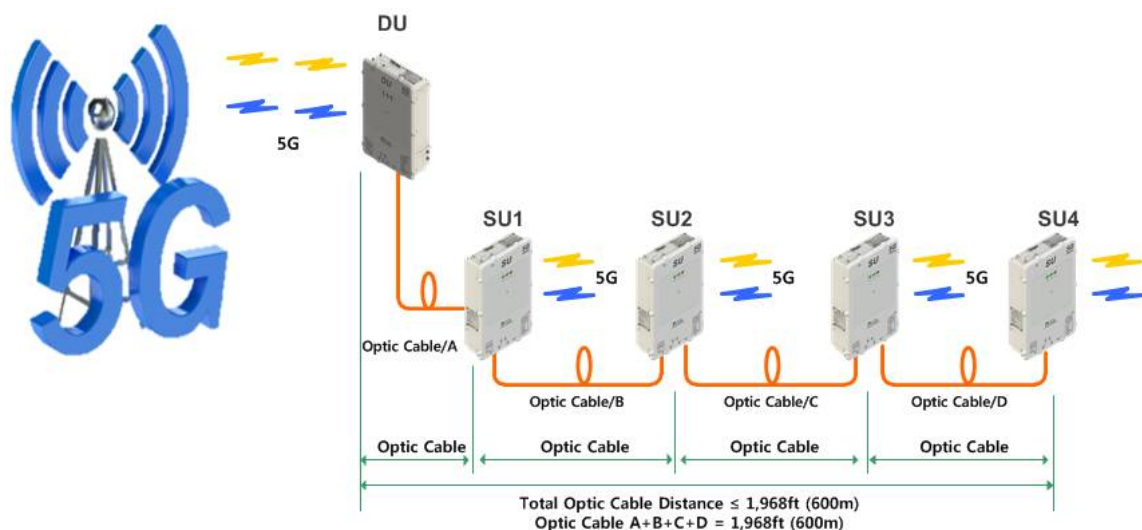


Figure 1. Network Configuration

PrimAer 39 receives a 39GHz mmWave signal over the air from a 5G gNB to the DU. The DU then converts the mmWave signal to IF over fiber and amplifies the signal. The SU then converts the IF to 5G mmWave signal for service.

PrimAer 39 is comprised of 3 units, the DU, SU, and Rectifier. The Rectifier supplies DC power to the DU and SU through a power cable. Also, the DU and SU's are connected with a single fiber-optic cable, and multiple SU's can also be connected in series with a single fiber-optic cable.

The DU can support antenna beam steering $\pm 50^\circ$ (Up/down/left/right) through the GUI.

The DU and SU have internal Cross Polarized Antennas that support MIMO.

Chapter 3

System Configuration

-
- 3.1 DU Function and Configuration**
 - 3.2 SU Function and Configuration**
 - 3.3 Rectifier Function and Configuration**
-

System Configuration

3.1 DU Function and Configuration

The DU is in a single enclosure with a mounting bracket on the back enabling wall or pole attachment. The DU receives a MIMO 5G gNB signal over the air, converts it to an optical signal, and sends it to the SU via Fiber-Optic cable. (Downlink). It also converts the optical signal received from the SU via fiber-optic cable and converts this back to 39GHz 5G RF which is sent to the gNB through the internal antenna. (Uplink).

The DU is comprised of an antenna, DIFM, DAOM, and EMS board. The rectifier powers the DU through the power port with -53.3V DC power.

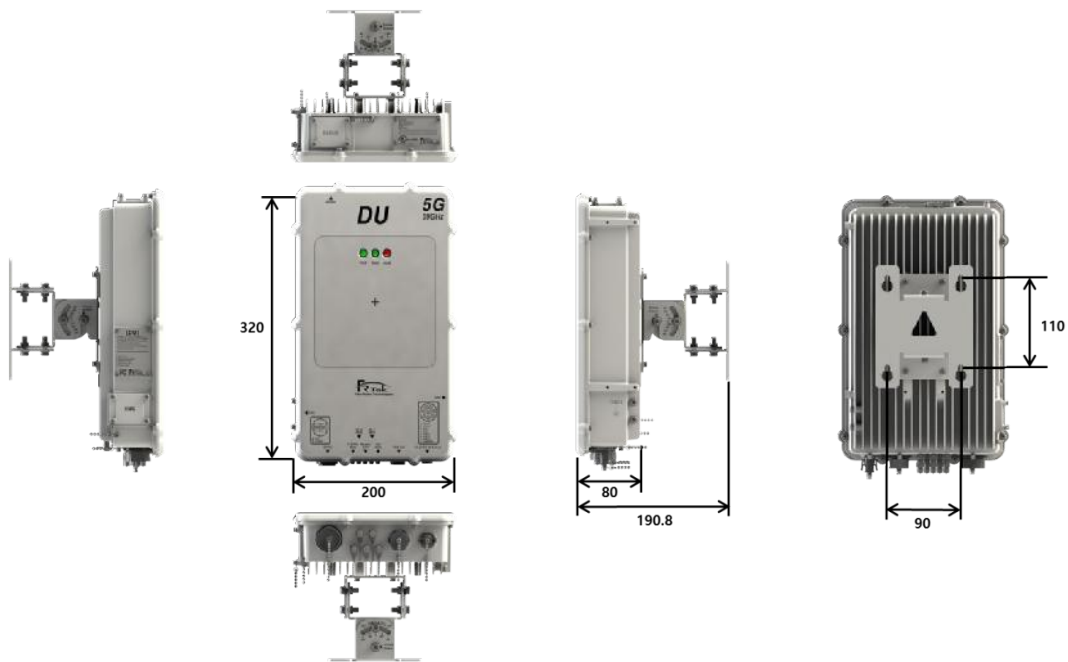


Figure 2. DU Figure

Item	Content	Remark
Size	200 x 320 x 190.8mm (7.87 x 12.59 x 7.51")	Including bracket

Weight	Approx. 5.66kg (12.4lb)	Including bracket
Input Interface	Internal Antenna	19.37 dBi (Max.)
Output Interface	Optic	1 Port

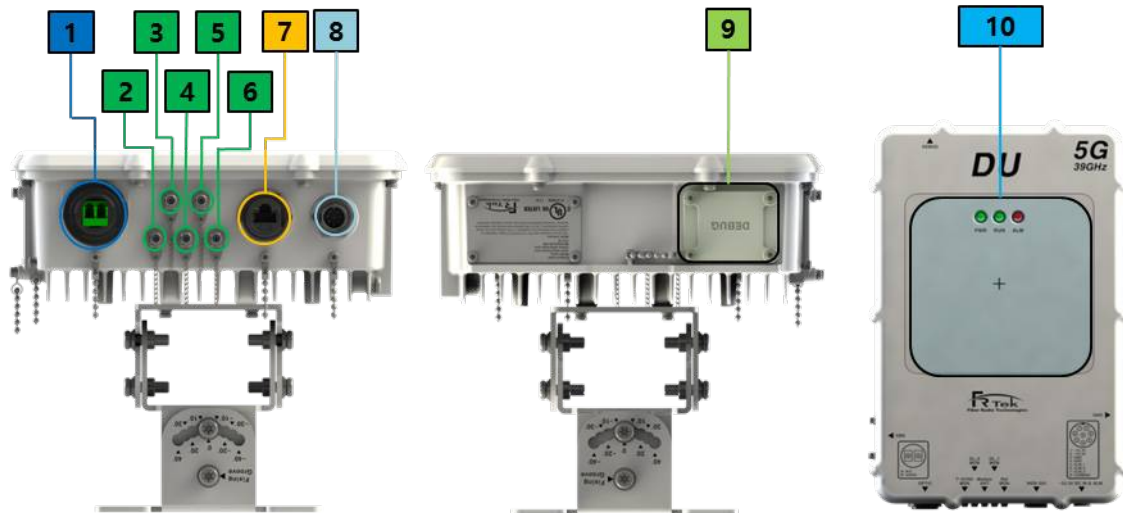


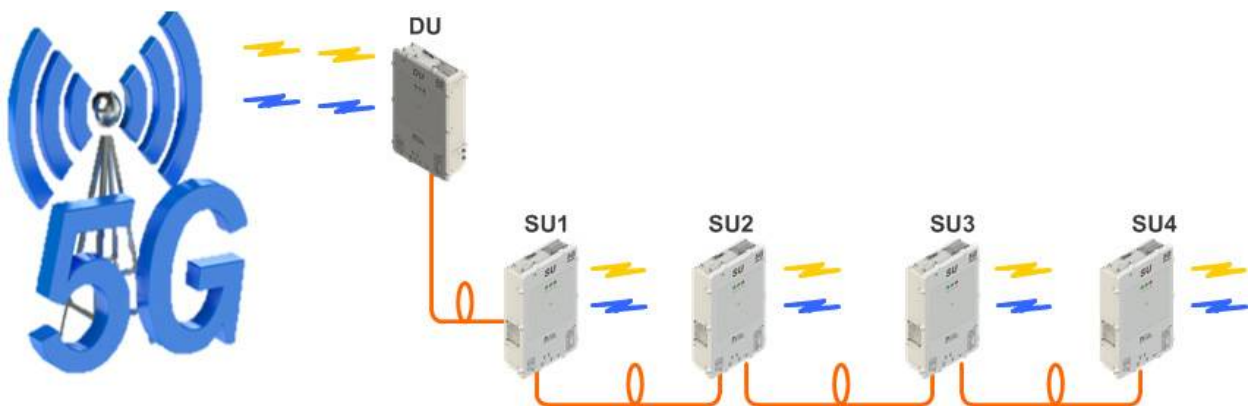
Figure 3. DU Port Configuration

No	Content
①	Port that transmit/receives optic signal
②	Port to monitor T-SYNC
③	Port to monitor Downlink SISO Path RF signal
④	Antenna port to transmit external signal from the Modem
⑤	Port to monitor Downlink MIMO Path RF signal
⑥	Port to monitor internal 122.88MHz Reference signal
⑦	Port to connect WEB GUI
⑧	Port to supply -53.3V(-48V ~ -53.3V) power from the Rectifier
⑨	Port to connect Local GUI (Not used after installation)
⑩	Internal Antenna (centered on +), transmit/receive RF wireless signal & status lights

3.2 SU Function and Configuration

The SU is in a single enclosure with a mounting bracket on the back enabling wall or pole attachment. The SU receives an optical signal from the DU via Fiber-Optic cable, converts it to a 39GHz RF signal, and sends the 5G signal through the antenna. (Downlink). It also converts the 39GHz RF signal received from the UE into an optical signal and sends it to the DU through Fiber-Optic cable. (Uplink)

When cascading there is the SU_C that connects between the DU and SU_E, the figure and configuration is the same. Cascade can be up to 4 SUs, but the SU_E can only be at the end of the chain.



The SU is comprised of an antenna, SIFM, and SAOM module. The rectifier powers the SU through the power port with -53.3V DC power

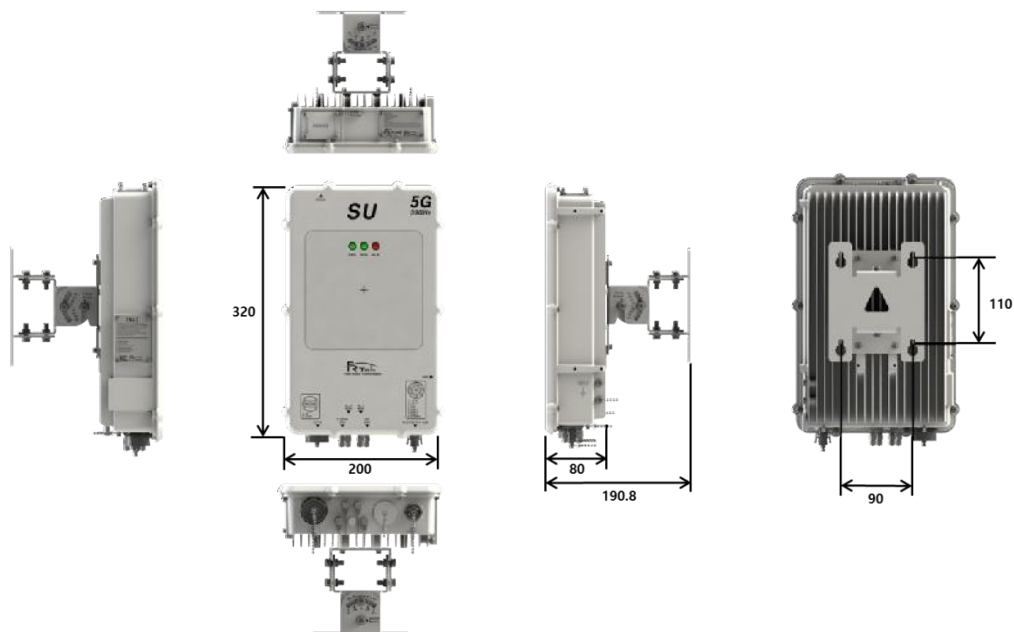


Figure 4. SU Figure

Item	Content	Remark
Size	200 x 320 x 190.8mm (7.87 x 12.59 x 7.51")	Bracket included
Weight	Approx. 5.68kg (12.5lb)	Bracket included
Input Interface	Internal Antenna	19.37 dBi
Output Interface	Optic	1-2 Ports

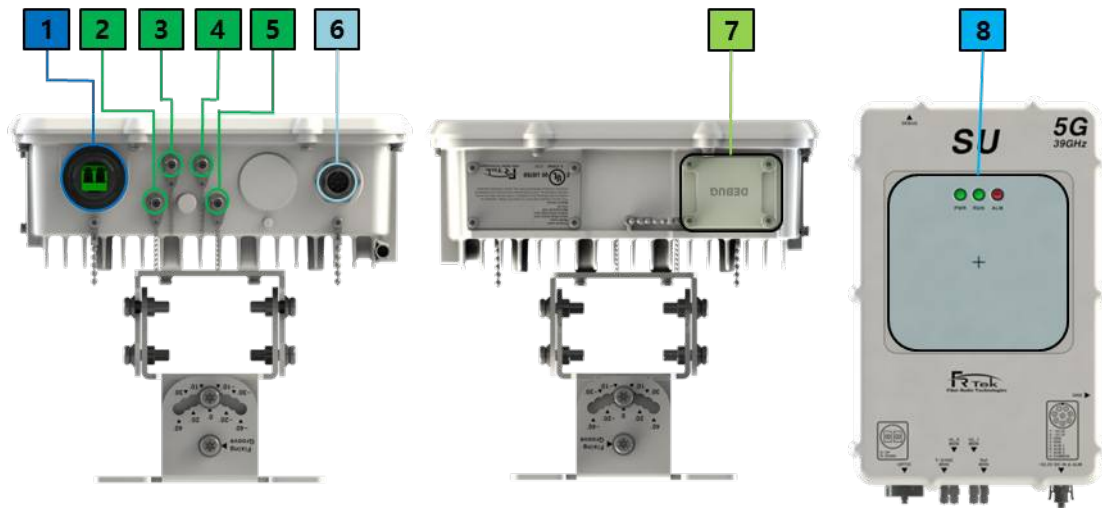


Figure 5. SU Port Configuration

Item	Content
①	Port to transmit/receive optic signal
②	Port to monitor T-SYNC
③	Port to monitor Downlink SISO Path RF signal
④	Port to monitor Downlink MIMO Path RF signal
⑤	Port to monitor internal 122.88MHz Reference signal
⑥	Port to supply -53.3V(-48V ~ -53.3V) power from the Rectifier
⑦	Port to connect Local GUI (Not used after installation)
⑧	Internal Antenna (centered on +), transmit/receive RF wireless signal & status lights

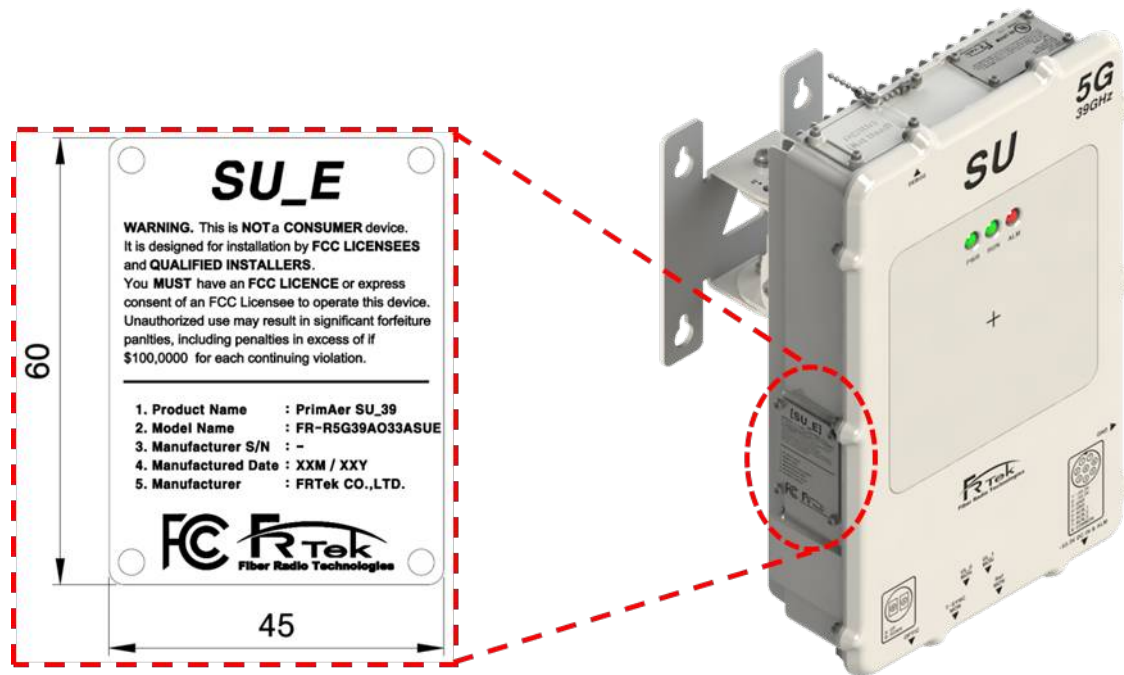


Figure 6. SU_C & SU_E Distinction (Cascade & End)

The difference between the SU_C and the SU_E is the optical switch in the SU_C. The SU_E can only be used at the end of the series and is marginally less expensive. (The SU_C can be used at the end as well). The SU_C and the SU_E are distinguishable with the label on the side of the unit as shown above.

3.3 Rectifier Function and Configuration

The Rectifier is the power supply for the DU and SU. The Rectifier is in a single enclosure with a mounting bracket on the back enabling wall or pole attachment.

It receives input AC 100 ~ 240V power, and outputs DC -53.3V(-48V ~ -53.3V) voltage to total of 5 ports (Port 1 ~ 4, Battery connection port). It supplies power to the DU, SU, and optional battery backup through a power cable.

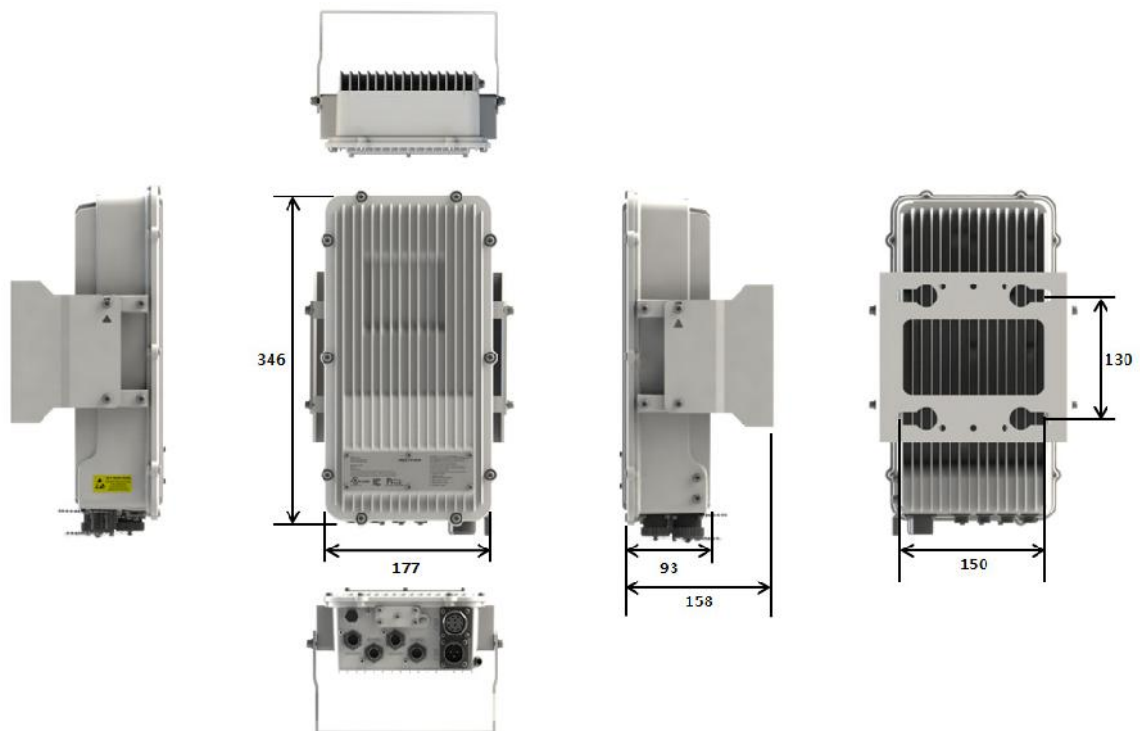


Figure 7. Rectifier Figure

Item	Content	Remark
Size	177 x 346 x 161mm (6.97 x 13.62 x 6.34")	Including bracket
Weight	Approx. 5.4kg (11.9lb)	Including bracket
Input Interface	AC 100V ~ 6.8A, 240V ~ 2.85A	
Output Interface	DC -53.3V 2.44A (Port 1~4) DC +53.3V 2A (Battery)	DC -48V ~ -53.3V

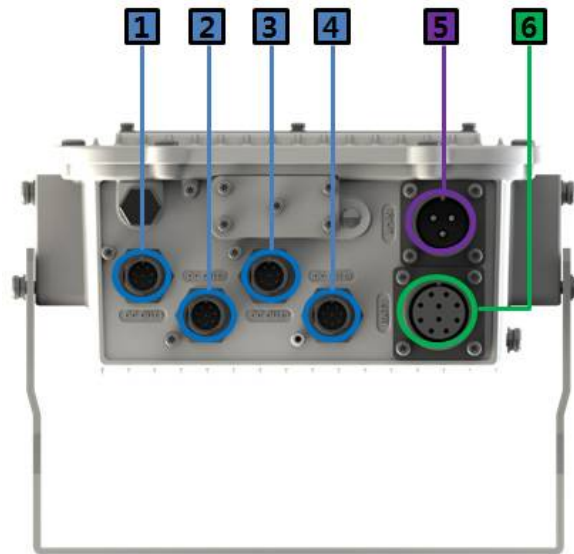


Figure 8. Rectifier Port Configuration

No	Content
①	DC -53.3V(-48V ~ -53.3V) output port 1
②	DC -53.3V(-48V ~ -53.3V) output port 2
③	DC -53.3V(-48V ~ -53.3V) output port 3
④	DC -53.3V(-48V ~ -53.3V) output port 4
⑤	AC 100 ~ 240V input port
⑥	Battery connection port

Chapter 4

System Specification

-
- 4.1 System Specification**
 - 4.2 Instrumental Specification**
 - 4.3 Electrical Specification**
 - 4.4 Environmental Specification**

System Specification

4.1 System Specification

PrimAer 39 is a 2X2 MIMO Repeater for 5G NR service, and is designed to operate within an 1,000MHz bandwidth (N260) of the 39GHz frequency band. This system satisfies the following functions and performance characteristics, and if not specially mentioned, satisfies 3GPP performance standard.

- This system's DU transmits/receives RF signal over the air with the gNB, and the SU provides RF coverage which is not serviced by the gNB.

4.1.1 Downlink Specification

Item	Specification	
	DU DL (Input Part)	SU DL (Output Part)
Input Frequency	BW 1GHz among 37.6GHz~40GHz	IF $\pm$ 500MHz
Output Frequency	IF $\pm$ 500MHz	BW 1GHz among 37.6GHz~40GHz
Input Level	-71.5dBm ~ -46.5dBm	-
Output Level (EIRP)	-	SISO : +38.5dBm MIMO : +41.5dBm
EIRP Tolerance	-	$\pm$ 3dBm
Antenna Gain	19.37 dBi	19.37 dBi
System Delay	Below 0.5us (DU to 1 SU)	
EVM	$\leq$ 8 %(64QAM) – 3GPP standard	
MIMO	2x2 MIMO support ($\pm$ 45° polarization wave antenna)	
Beam Steering Angle	Up to $\pm$ 50° (Up/Down/Left/Right)	

4.1.2 Uplink Specification

Item	Specification	
	DU UL (Output Part)	SU UL (Input Part)
Input Frequency	IF $\pm$ 500MHz	BW 1GHz among 37.6GHz~40GHz
Output Frequency	BW 1GHz among 37.6GHz~40GHz	IF $\pm$ 500MHz
Input Level	-	-71.5dBm
Output Level (EIRP)	SISO : 38.5dBm MIMO : 41.5dBm	-

EIRP Tolerance	$\pm 3\text{dBm}$	-
System Delay	Below 0.5us (DU to 1 SU)	
EVM	$\leq 8\%$ (64QAM) – 3GPP standard	
MIMO	2x2 MIMO support ($\pm 45^\circ$ polarization wave antenna)	
Beam Steering Angle	Up to $\pm 50^\circ$ (Up/Down/Left/Right)	

4.2 Instrumental Specification

4.2.1 Structure and Type

Unit Name	Type	Option
DU	Enclosure type	In-building/Outdoor
SU_Cascade		
SU_End		
Rectifier		

- The PrimAer 39 units should be installed in a place that can be readily accessed for maintenance.
- PrimAer 39 is designed to IP66 standards.

4.2.2 Material and Components

- The enclosure, components, PCB, solders, cables, etc applied for each unit of PrimAer 39 comply with RoHS (Restriction of hazard materials).

4.3 Electrical Specification

- The power from the Rectifier operates normally on commercial power (AC100 ~240V/60Hz).
- It has over-power, over-voltage protection functionality built in.
- In case of black out, the equipment RF setting value automatically returns to the previous status prior to the black out.
- The equipment grounds are located on both sides of the enclosure.
- The components used in PrimAer 39 satisfy the EMI terms of FCC regulation Title 47, Part 15, Subject J, Class A.
- The enclosure needs to be grounded using a #6AWG wire

Unit	Operating Voltage Range	Output Voltage/Current Range	Remark
------	-------------------------	------------------------------	--------

Rectifier	AC 100V ~ 240V 60Hz (57 ~ 63Hz)	Port 1: -53.3V/2.44A Port 2: -53.3V/2.44A Port 3: -53.3V/2.44A Port 4: -53.3V/2.44A Battery: +53.3V/2A	DC Out Range -48V ~ -53.3V
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4.4 Environmental Specification

Items	Condition of application	Performance Requirements
Storage Environment	• Temperature: -40 ~ +85°C • Humidity: 5 ~ 95%	No change of system function
Operation Environment	• Temperature: -40 ~ +55°C • Humidity: 0 ~ 90%	- Output change : within $\pm 3\text{dB}$ - No abnormalities on enclosure inside/outside

Chapter 5

System Installation

-
- 5.1 Tools**
 - 5.2 DU Installation**
 - 5.3 SU Installation**
 - 5.4 Rectifier Installation**
 - 5.5 DU/SU/Rectifier Connection**

System Installation

This manual provides detailed instructions on the installation of PrimAer 39. The user needs to understand the manual and should be certified on PrimAer 39. This chapter explains how to connect all necessary cables and how to install each piece of equipment. (DU, SU, and Rectifier).

5.1 Kits & Tools

PrimAer 39 is provided with below listed equipments and components. (Quantity differs according to order)

<DU>

No.	Kits	No.	Kits
1	DU	2	Wall Mount Bracket (DU/SU) Preassembled with DU
			
3	Torx Pin Sems Screw (SUS) 1) M4 X 10L, 4EA 2) M6 X 20L, 8EA	4	Optical Mating Connector
			

<SU_C>

No.	Kits	No.	Kits
1	SU_C	2	Wall Mount Bracket (DU/SU) Preassembled with SU_C
			
3	Torx Pin Sems Screw (SUS) 1) M4 X 10L, 4EA 2) M6 X 20L, 8EA	4	Optical Mating Connector
			

<SU_E>

No.	Kits	No.	Kits
1	SU_E	2	Wall Mount Bracket (DU/SU) Preassembled with SU_E
			
3	Torx Pin Sems Screw (SUS) 1) M4 X 10L, 4EA 2) M6 X 20L, 8EA	4	Optical Mating Connector
			

<Rectifier>

No.	Kits	No.	Kits
1	Rectifier	2	Wall Mount Bracket (Rectifier)
			
3	Torx Pin Sems Screw (SUS) (For Rectifier) M5 X 12L, 4EA	All components for Rectifier are preassembled	
			

<Cable>

No.	Kits	No.	Kits
1	DC Power Cable	2	Rectifier AC Cable
	* Cable length of the DC power cable is less than 6m 		

When PrimAer 39 is purchased with the Pole Bracket Option, the additional equipments and components are listed below. (Quantity differs according to order)

<Pole Mount Bracket>

No.	Kit	No.	Kit
1	Pole Mount Bracket	2	Torx Pin Sems Screw (SUS) M6 X 20L, 4EA
			

Other Tools/Supplies recommended for installation are below.

No.	Tools	No.	Tools
1	Hole Torx Drivers, 4 Types (5 point Star Bix Tamper-Proof) (1) M3: T10H (2) M4: T20H (3) M5: T25H (4) M6: T30H	2	Screw Driver No. 3 (+)
			
3	Insulated Driver	4	Hammer Drill
			
5	Concrete Drill Bit (8mm)	6	Hand Safety Gloves
			
7	Rubber Hammer	8	HEX, Direct Screw (Self Tapper)

			(Diameter: 5.5~6mm, Length: 40~80mm)
			
9	Plastic Wall Plug (Size according to Hex screw)	10	∅ 6.5mm Plain Large Washer
			
11	Level	12	Tape Measure
			
13	Ground Wire Line	14	LC-APC type Optic Fiber
			
15	ESD Gloves	16	6AWG Lug Crimper
			
17	SUS BAND - 4 required (*Size according to Pole diameter)		
			

Item		Torque Spec
Screw	M3	4.34~6.08 lbf-in
	M4	9.55~12.15 lbf-in
	M5	21.70~25.17 lbf-in
	M6	36.02~40.36 lbf-in
	Steel Band Fixing Screw	48.5 lbf-in
Others	SMA Type Connector	1Nm=8.85 lbf-in
	SMA CAP(Term)	3.47~5.21 lbf-in

The PrimAer 39 is suitable for installation under these environments:

- Network Telecommunication Facilities
- Locations where the NEC(National Electrical Code) applies
- OSP (Outside Plant)

The PrimAer 39 is suitable for installation under these grounding environments :

- CBN (Common Bonding Network)
- IBN (Isolated Bonding Network)


Warning

System ground must be connected to a building-installed ground point for proper protection..


Warning

The unit should be placed on the height that is not accessible to the general public

5.2 DU Installation

5.2.1 Product Installation

The DU can be installed on the wall or pole mounted using brackets/clamps.

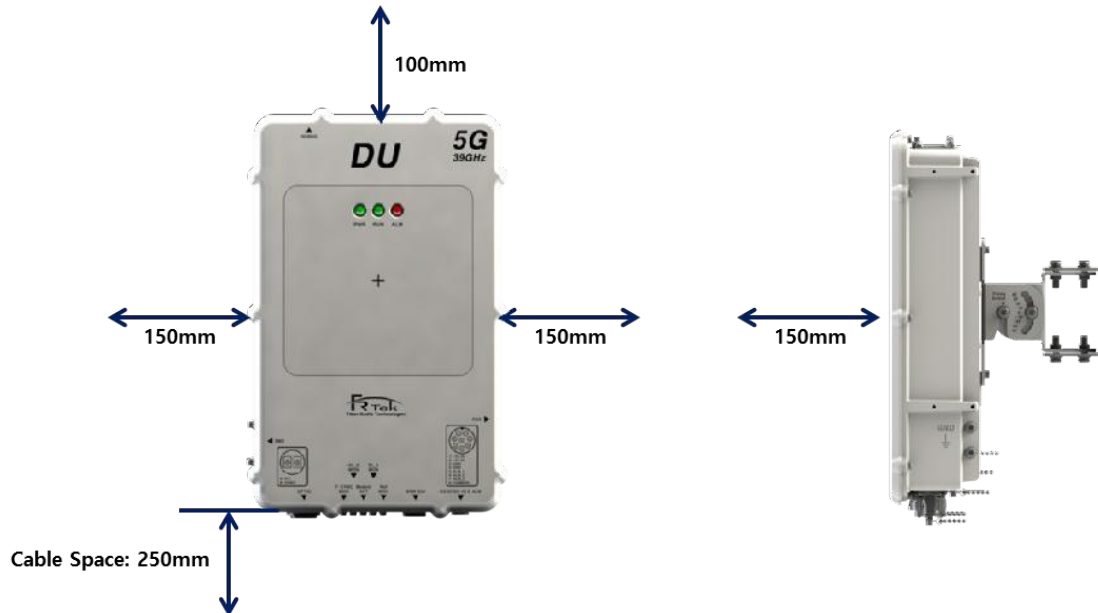


Figure 9. Required Space for DU Installation

The DU mounting bracket allows for tilting vertically and horizontally. It requires a minimum of 3.9"(100mm) space from top, 5.9"(150mm) space from both sides, and 9.8"(250mm) space from below for cables connection. It also requires a minimum of 5.9"(150mm) space from the front side.

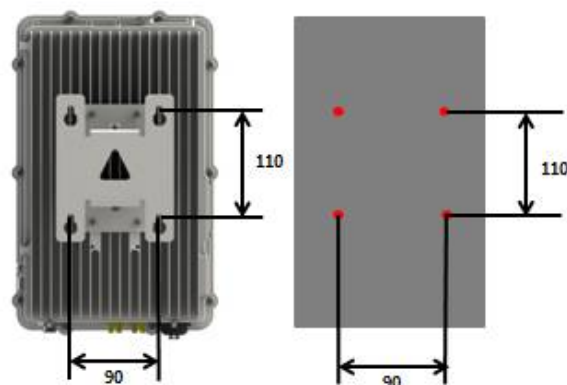


Figure 10. DU Anchor Bolt Assembly for Wall Installation

Above picture is a simple drawing for the anchor bolt installation. The Assembly order is shown below.

1. Mark position on the wall. Horizontally 90mm and vertically 110mm.
2. Use hammer drill & concrete 8mm drill bit to drill a hole with a depth of 40mm or more on the marked positions.
3. Remove dust from the holes.
4. Use rubber hammer to insert anchors into the holes drilled on the wall.

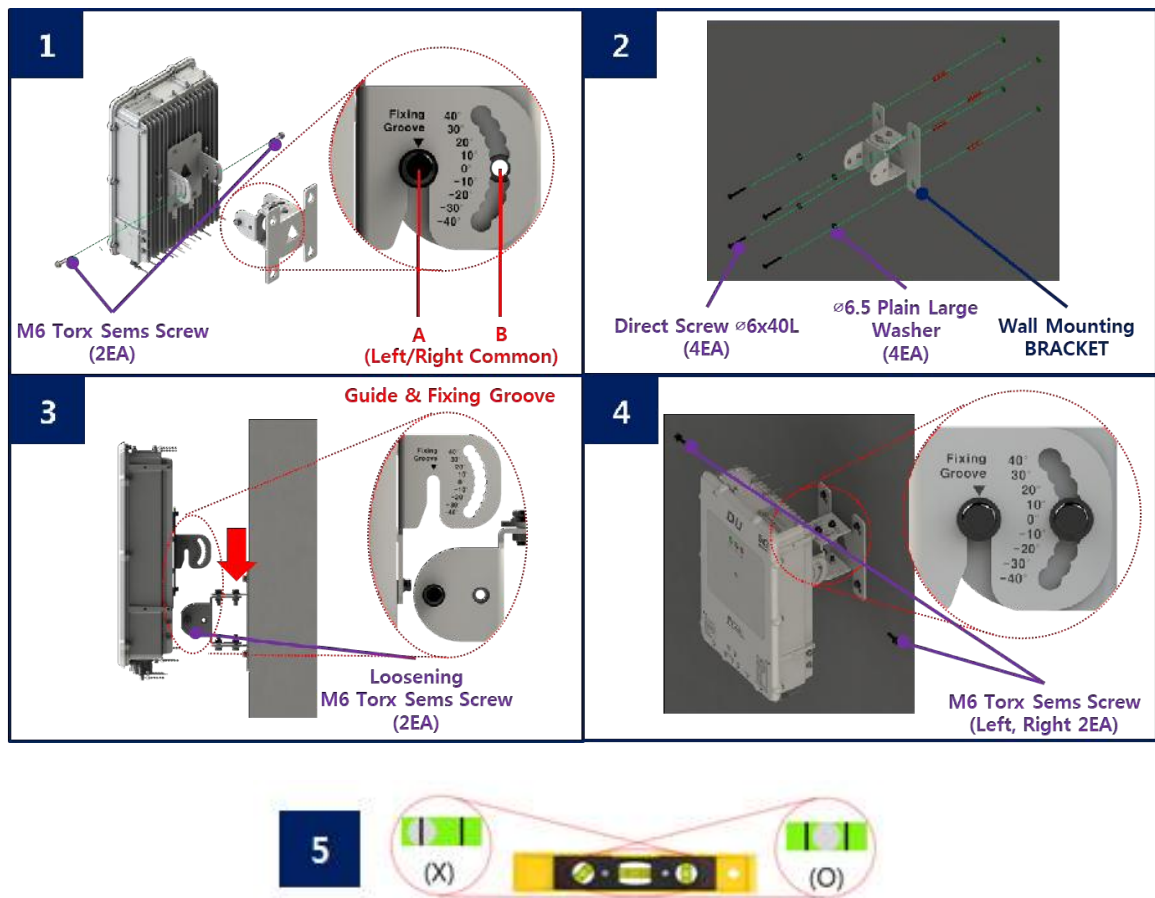


Figure 11. DU Wall Installation Assembly

Above picture is an assembly drawing of the DU wall installation. The Assembly order is shown below.

1. Temporarily remove M6 Torx Sems Screw (2ea) of "B" to separate Wall Mount Bracket from the DU. (Unscrew M6 Torx Sems Screw (2ea) of "A" only enough for the Wall Mount Bracket to be separated)
2. Place the Wall Mount Bracket and the $\phi 6.5$ Plain Large Washers(4ea) on the Anchor Bolt and assemble using HEX, Direct Screws(4ea).

3. Place the DU into the slots as shown in the "Guide & Fixing Groove" picture.
4. Reinsert/tighten the M6 Torx Sems Screw (2ea) of "B" and tighten the M6 Torx Sems Screw (2ea) of "A".
5. Verify that the unit is level to ensure that the horizontal/vertical angles are correct.

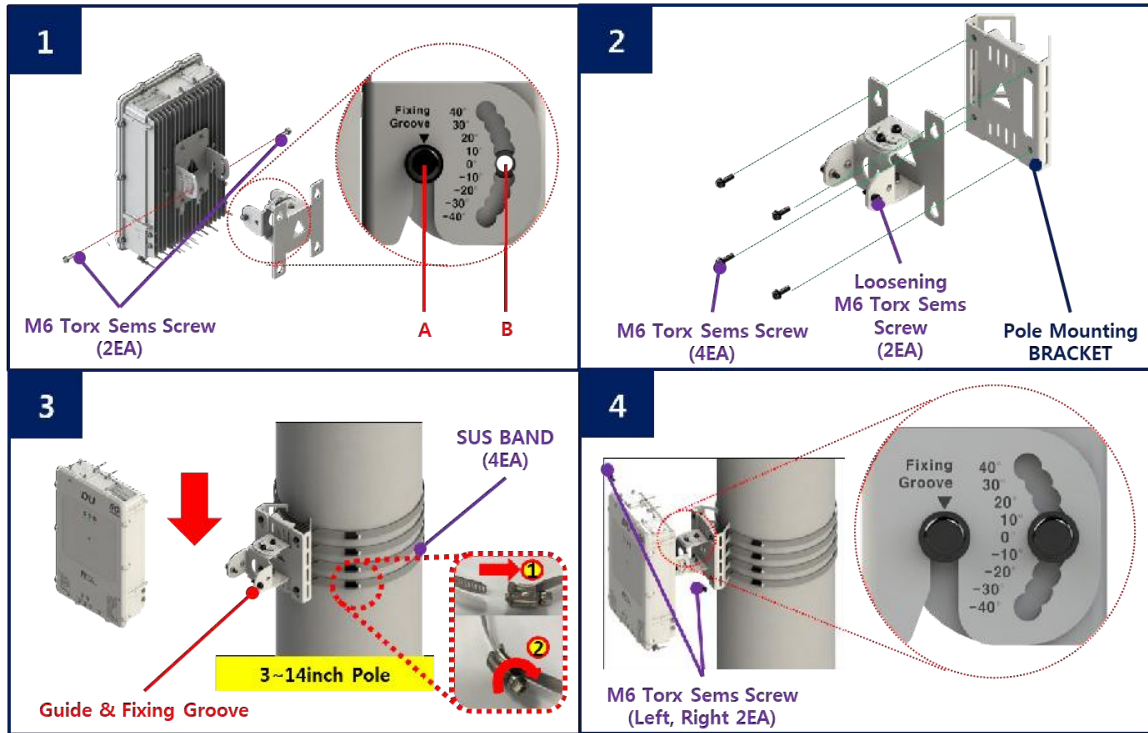


Figure 12. DU Pole Installation Assembly

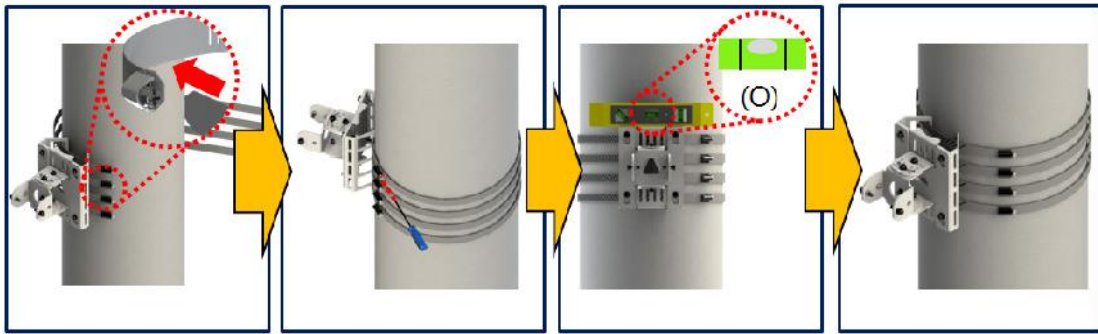
Above picture is an assembly drawing of the DU pole installation. Assembly order is shown below.

1. Temporarily remove M6 Torx Sems Screw (2ea) of "B" to separate Wall Mount Bracket from the DU. (Unscrew M6 Torx Sems Screw (2ea) of "A" only enough for the Wall Mount Bracket to be separated)
2. Use M6 Torx Sems Screw (4ea) to assemble the Wall Mount Bracket and Pole Mount Bracket.
3. Use a phillips driver to assemble the Bracket and stainless steel pipe clamp Bands (SUS, 4ea not included) on the pole.

Secure the DU into the slots as shown in the "Guide & Fixing Groove" picture. (Will work on poles of 3~14" diameter)

Stainless steel pipe clamp band should be assembled as shown below.

(Verify that the unit is level to ensure that the horizontal/vertical angles are correct.)



4. Reinsert/tighten the M6 Torx Sems Screw (2ea) of "B" and tighten the M6 Torx Sems Screw (2ea) of "A".

5.2.2 Ground Cable Connection

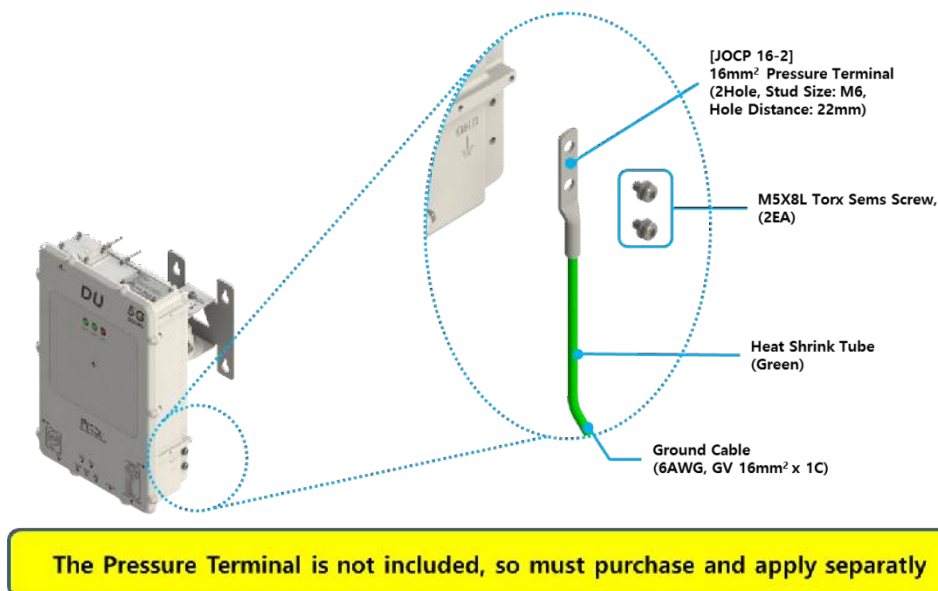
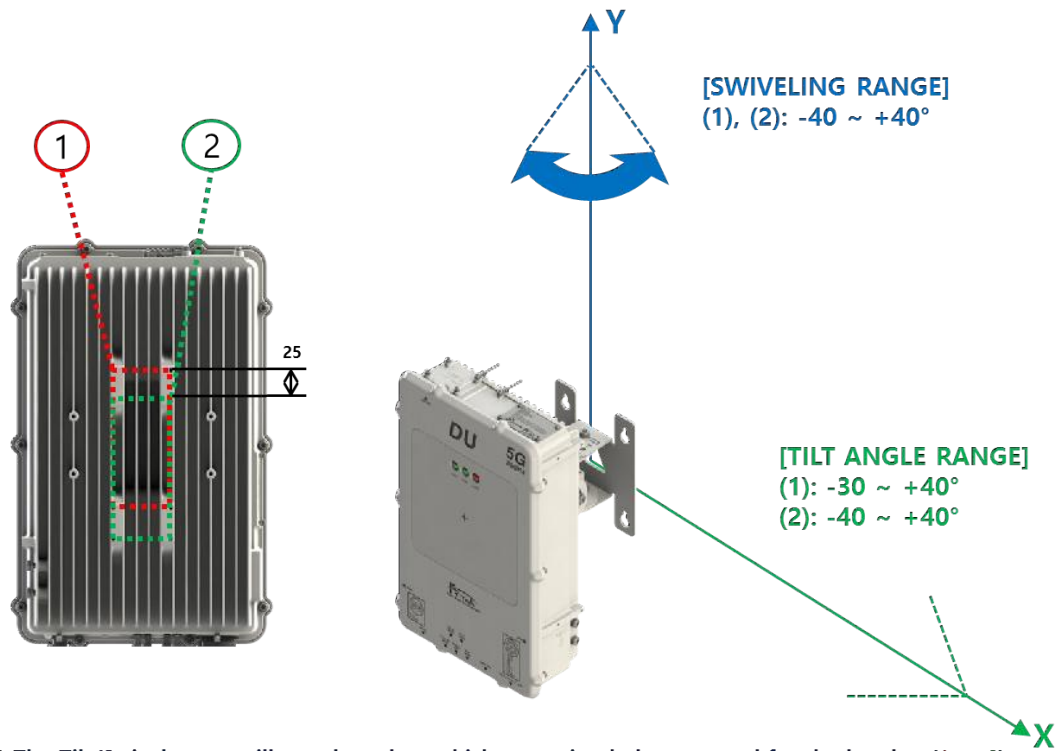


Figure 13. DU Ground Cable Connection

In order to protect the DU, connect enclosure grounding with building grounding in order to prevent DU from electrical danger.

5.2.3 Antenna Tilt

The DU transmits and receives 5G signal from the gNB to provide service in poor coverage areas. Since the DU has an *"Internal Antenna"*, so does not require any additional antenna installation. It can be tilted up/down and left/ right, using the provided mounting bracket.



* The Tilt/Swivel range will vary based on which mounting holes are used for the bracket (1 or 2)

Figure 14. DU Tilt

The above diagram shows the DU rotation angle, up/down/left/right. The DU should be placed and installed (in-building/outdoors) in an optimal location to transmit/receive 5G signal from the gNB and can be tilted as depicted picture.

5.3 SU Installation

5.3.1 Product Installation

The SU can be installed on the wall or pole mounted using brackets/clamps.

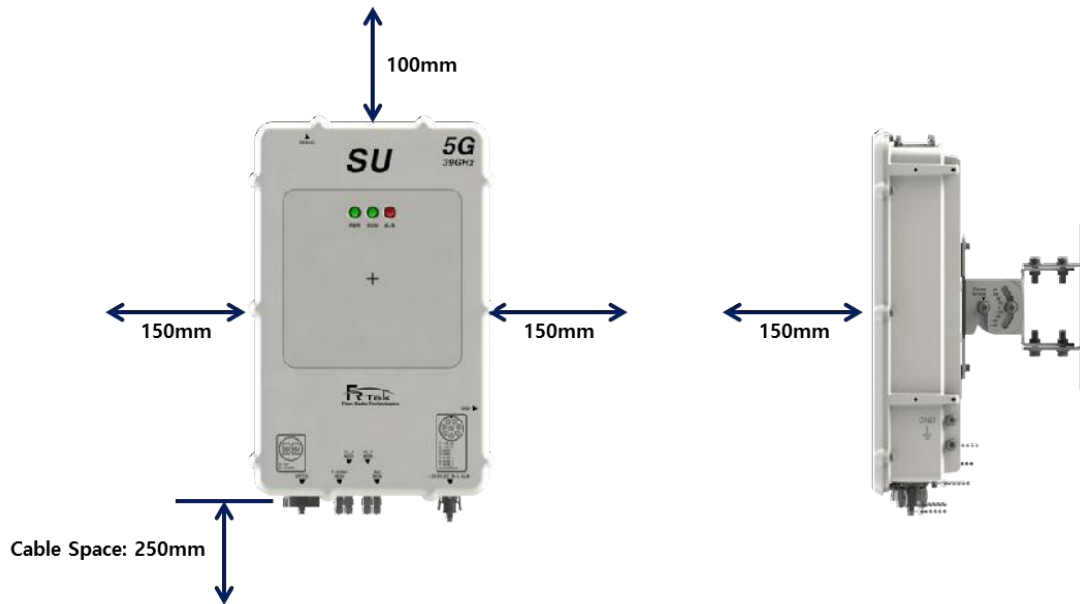


Figure 15. Required Space for SU Installation

The SU mounting bracket allows for tilting vertically and horizontally. It requires a minimum of 3.9"(100mm) space from the top, 5.9"(150mm) space from both sides, and 9.8"(250mm) space from bottom for cables connection. It also requires a minimum of 5.9"(150mm) space from the front side.

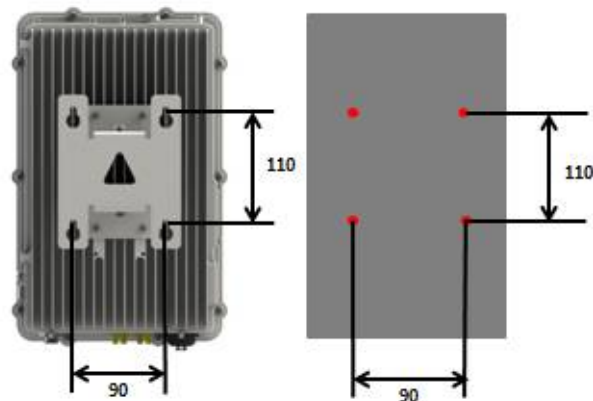


Figure 16. SU Anchor Bolt Assembly

Above picture is a simple drawing for the anchor bolt installation. The Assembly order is shown below.

1. Mark position on the wall. Horizontally 90mm and vertically 110mm.
2. Use hammer drill & concrete 8mm drill bit to drill a hole with a depth of 40mm or more on the marked positions.

3. Remove dust from the holes.
4. Use rubber hammer to insert anchors into the holes drilled on the wall.

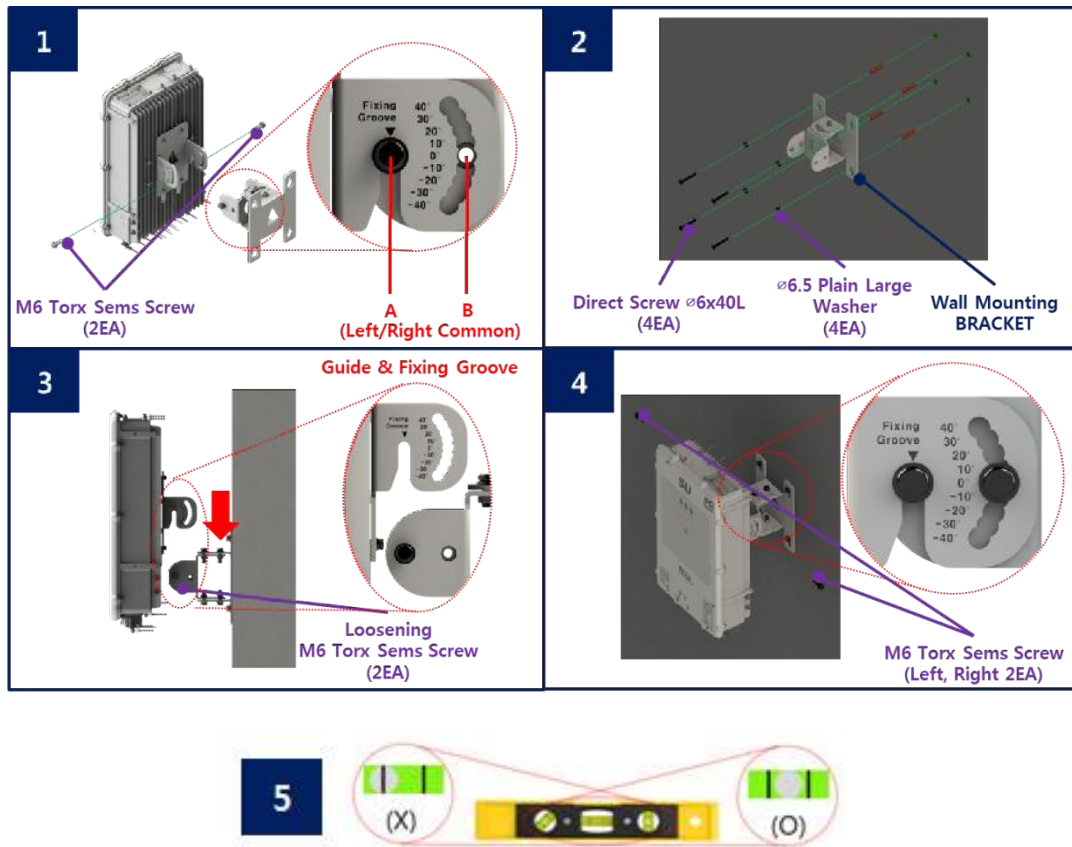


Figure 17. SU Wall Installation Assembly

Above picture is an assembly drawing of the SU wall installation. The Assembly order is shown below.

1. Temporarily remove M6 Torx Sems Screw (2ea) of "B" to separate Wall Mount Bracket from the DU. (Unscrew M6 Torx Sems Screw (2ea) of "A" only enough for the Wall Mount Bracket to be separated)
2. Place the Wall Mount Bracket and the $\phi 6.5$ Plain Large Washers(4ea) on the Anchor Bolt and assemble using HEX, Direct Screws(4ea).
3. Place the SU into the slots as shown in the "Guide & Fixing Groove" picture.
4. Reinsert/tighten the M6 Torx Sems Screw (2ea) of "B" and tighten the M6 Torx Sems Screw (2ea) of "A".
5. Verify that the unit is level to ensure that the horizontal/vertical angles are correct.

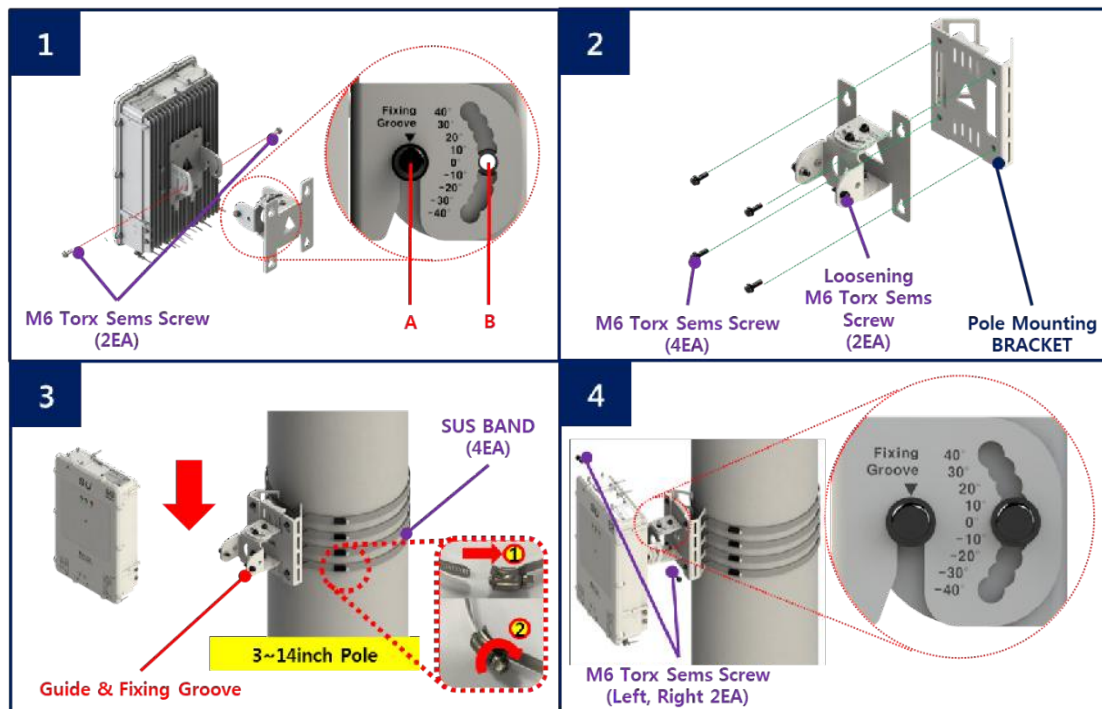


Figure 18. SU Pole Installation Assembly

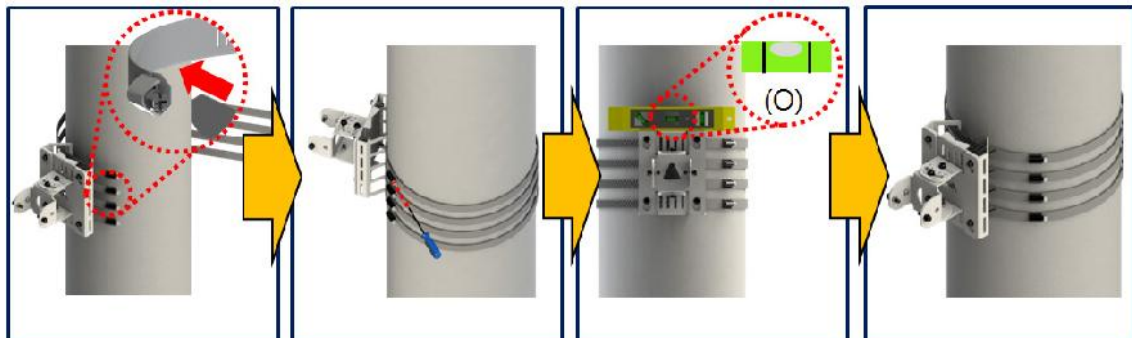
Above picture is an assembly drawing of the SU pole installation. Assembly order is shown below.

1. Temporarily remove M6 Torx Sems Screw (2ea) of "B" to separate Wall Mount Bracket from the DU. (Unscrew M6 Torx Sems Screw (2ea) of "A" only enough for the Wall Mount Bracket to be separated)
2. Use M6 Torx Sems Screw (4ea) to assemble the Wall Mount Bracket and Pole Mount Bracket.
3. Use a phillips driver to assemble the Bracket and stainless steel pipe clamp band (SUS, 4ea not included) on the pole.

Secure the SU into the slots as shown in the "Guide & Fixing Groove" picture. (Will work on poles of 3~14")

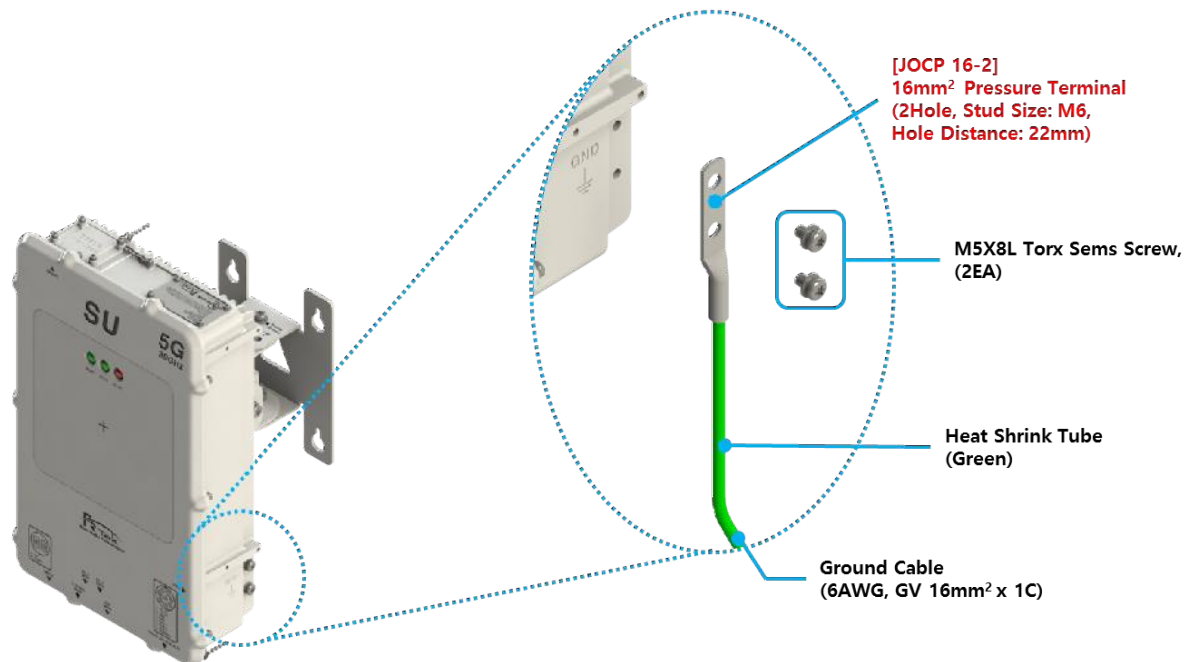
Stainless steel pipe clamp bands should be assembled as shown below.

(Verify that the unit is level to ensure that the horizontal/vertical angles are correct)



4. Reinsert/tighten the M6 Torx Sems Screw (2ea) of "B" and tighten the M6 Torx Sems Screw (2ea) of "A".

5.3.2 Ground Cable Connection



The Pressure Terminal is not included, so must purchase and apply separately

Figure 19. SU Ground Cable Connection

In order to protect the SU, connect enclosure grounding with building grounding in order to prevent SU from electrical danger.

5.3.3 Antenna Tilt

The SU provides coverage to areas where the gNB has inadequate service. Since the SU has an "Internal Antenna", it does not require additional antenna installation. It can be rotated and tilted up, down, left, and right using the provided mounting bracket.

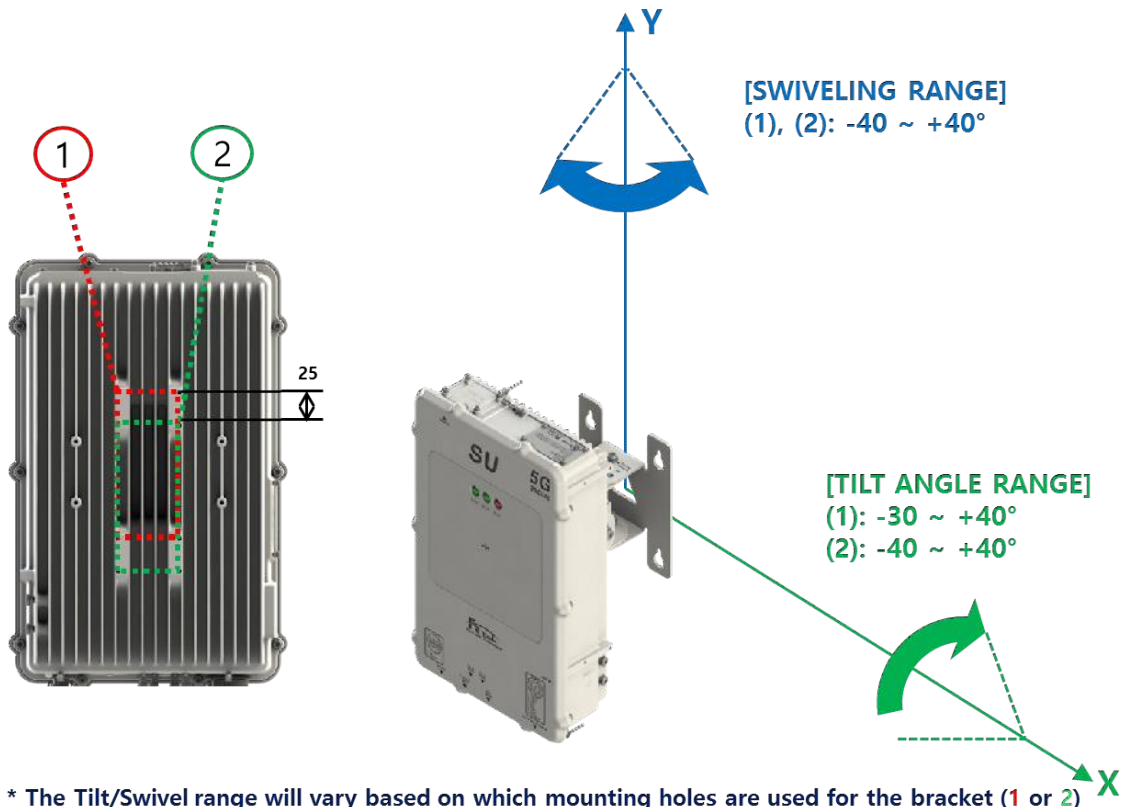


Figure 20. SU Tilt

The above diagram shows the SU rotation angle, up/down/left/right. The SU should be placed and installed (in-building/outdoors) in an optimal location to transmit/receive 5G signal from the gNB and can be tilted as depicted picture.

5.4 Rectifier Installation

5.4.1 Product Installation

The Rectifier can be installed on the wall or pole mounted using brackets/clamps.

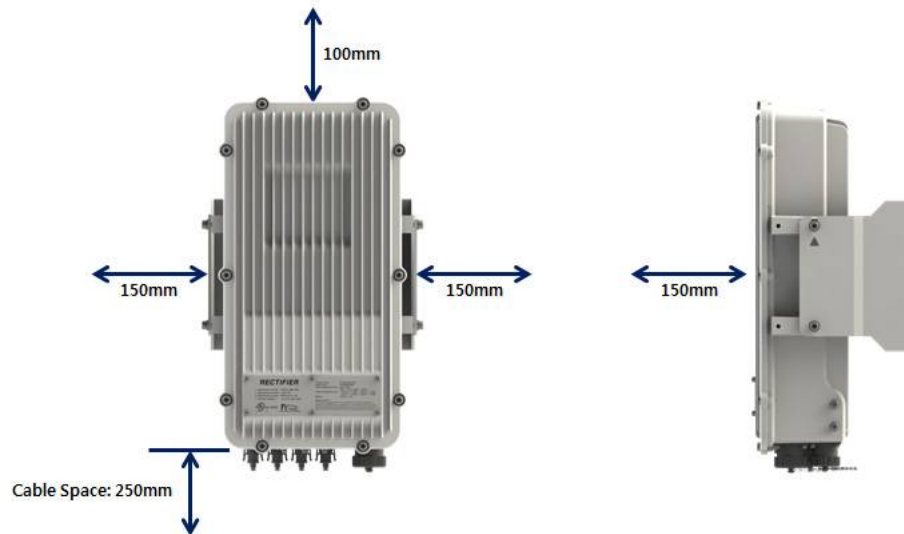


Figure 21. Required Space for Rectifier Installation

For ease of installation, the Rectifier requires more than 5.91 inch (150mm) space in front, above, right and left of the equipment and 9.84 inch (250mm) clearance below the equipment for cable connections.

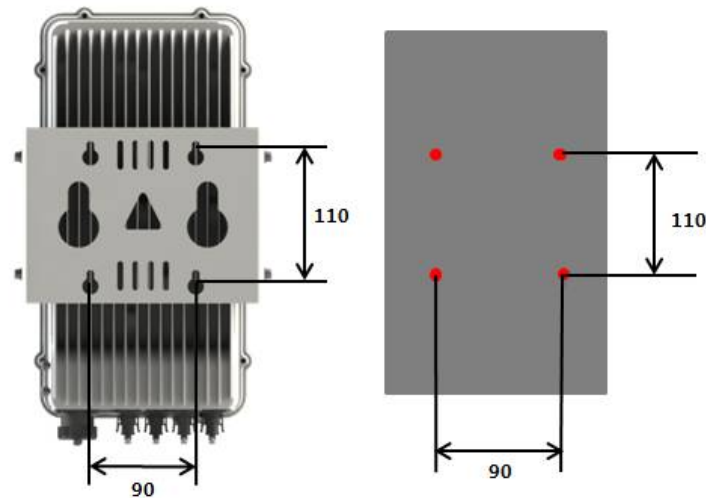


Figure 22. Rectifier Anchor Bolt Assembly

Above picture is a simple drawing for the anchor bolt installation. The Assembly order is shown below.

1. Mark position on the wall. Horizontally 90mm and vertically 110mm.
2. Use hammer drill & concrete 8mm drill bit to drill a hole with a depth of 40mm or more on the marked positions.
3. Clear all obstructions in the holes.
4. Use a Rubber Hammer to insert anchors into the drilled holes on the wall.

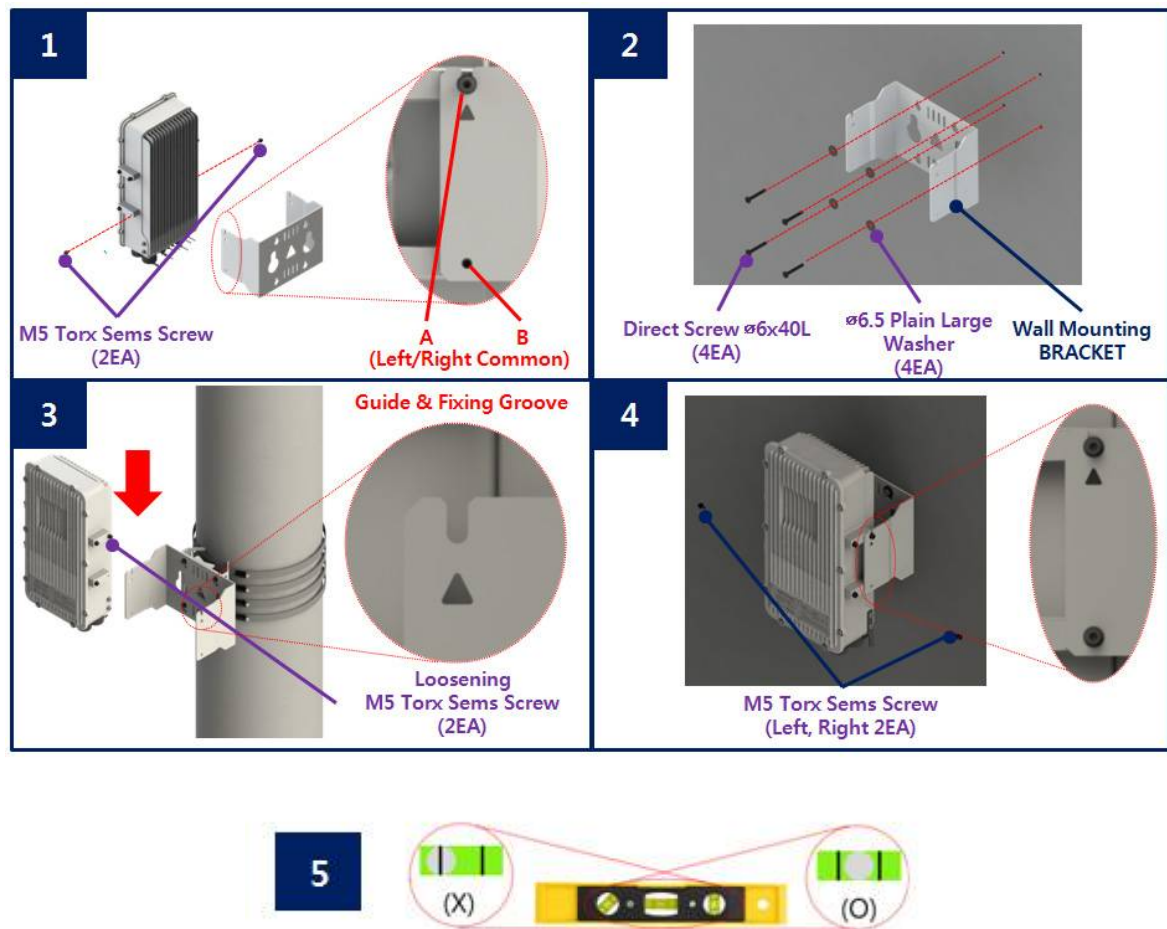


Figure 23. Rectifier Wall Installation Assembly

Above picture is an assembly drawing of the Rectifier wall installation.

Assembly order is as shown below.

1. Temporarily remove M5 Torx Sems Screw (2ea) of "B" to separate Wall Mount Bracket from the Rectifier.
(Unscrew M5 Torx Sems Screw (2ea) of "A" only enough for the Wall Mount Bracket to be separated)
2. Place the Wall Mount Bracket and the ø6.5 Plain Large Washers(4ea) on the Anchor Bolt and assemble using HEX, Direct Screws(4ea).
3. Mount the Rectifier according to the "Guide & Fixing Groove" picture.
4. Reinsert/tighten the M5 Torx Sems Screw (2ea) of "B" and tighten the M5 Torx Sems Screw (2ea) of "A".
5. Check that the unit is level to ensure the horizontal/vertical angles are correct.

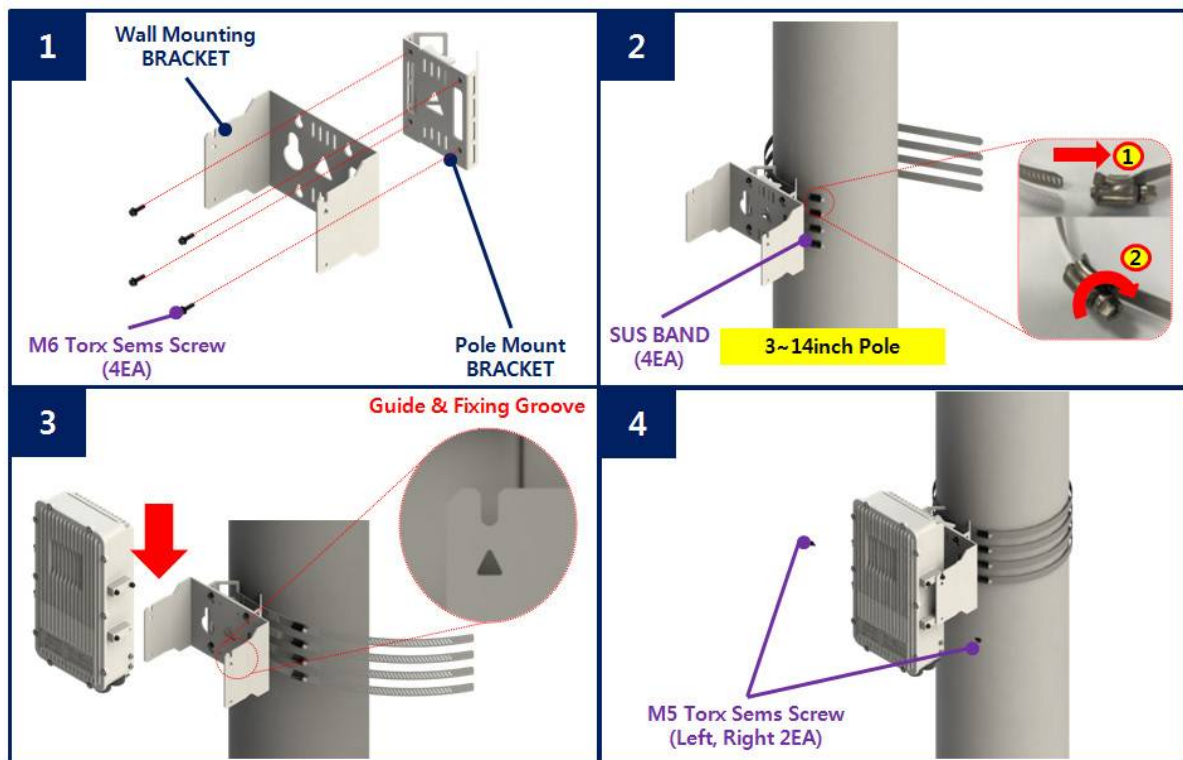


Figure 24. Rectifier Pole Installation Assembly

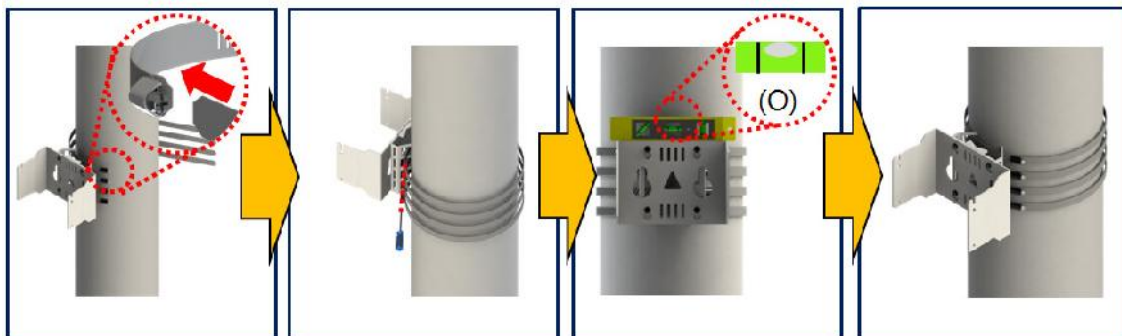
Above picture is an assembly drawing of the Rectifier pole installation. Assembly order is shown below.

1. Separate the Wall Mount Bracket from the Rectifier and assemble to Pole Mount Bracket using M6 Torx Sems Screw (4ea)

2. Use Phillips driver to assemble the Bracket and Stainless Steel Pipe Clamp Bands (SUS, 4ea not included) on the pole.

The bands should be attached as shown in the diagram above.

(Confirm that the unit is level to ensure that the horizontal/vertical angles are correct.)



3. Secure the Rectifier into the slots as shown in the "Guide & Fixing Groove" picture. (Will work on poles of 3~14" diameter)

4. Insert/tighten the M5 Torx Sems Screw (2ea)

5.4.2 Ground Cable Connection

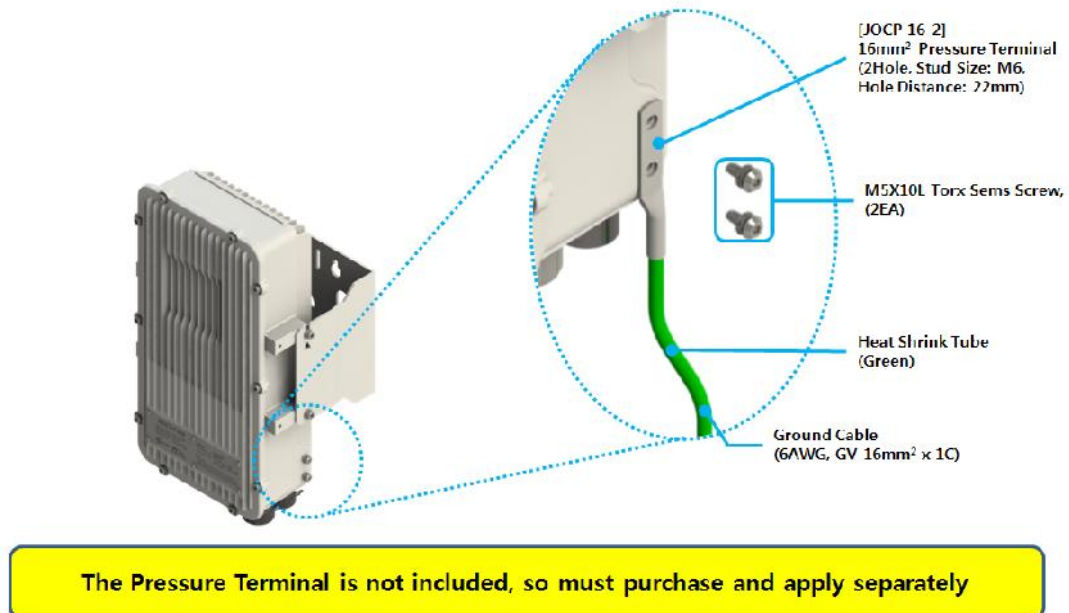


Figure 25. Rectifier Ground Cable Connection

In order to protect the Rectifier, connect enclosure grounding with building grounding in order to prevent Rectifier from electrical danger.

5.5 DU/SU/Rectifier Connection

5.5.1 DU/SU/Rectifier Connection

The DU and SU are connected with a Fiber-Optic cable. The Rectifier is connected with the DU and SU with a power cable. Each cable connection method is as below.

For the DU, do not plug fiber into PORT A

For the SU E, do not plug fiber into PORT B

Through the entire circuit, the B goes to A, and the A goes to B

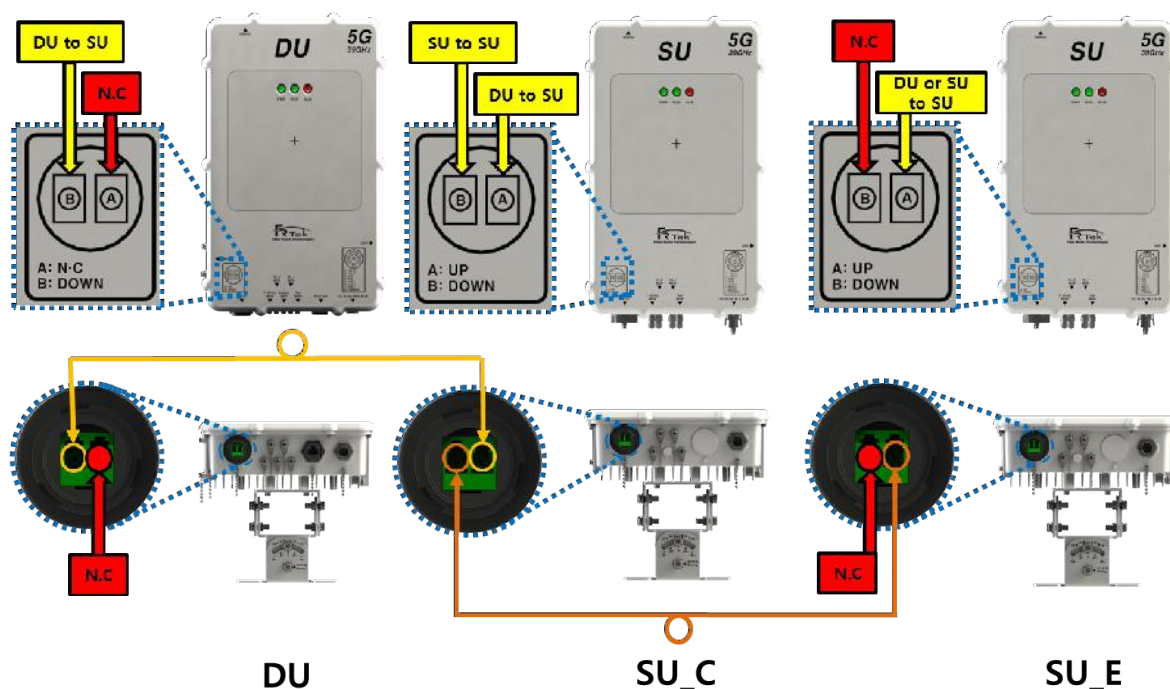
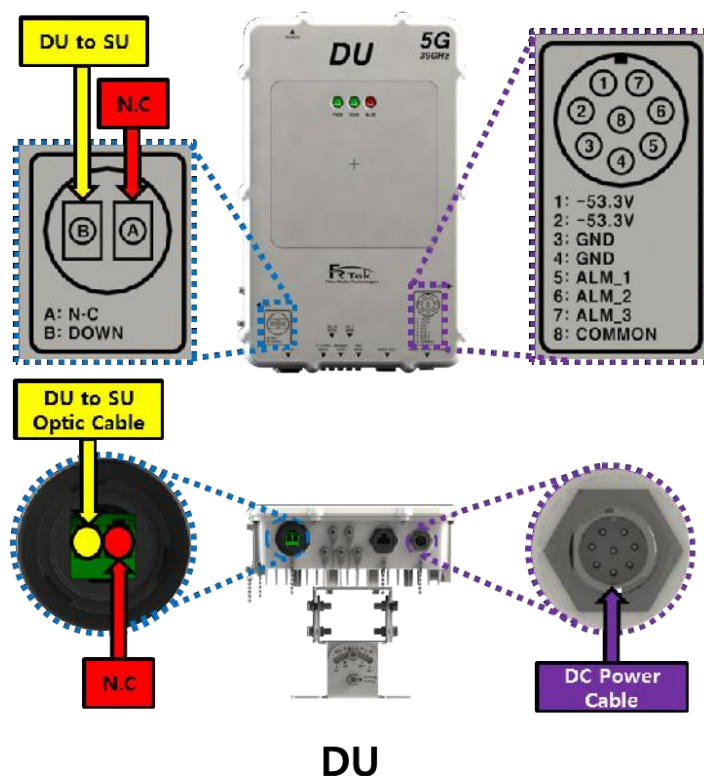


Figure 26. Optic Cable Connection



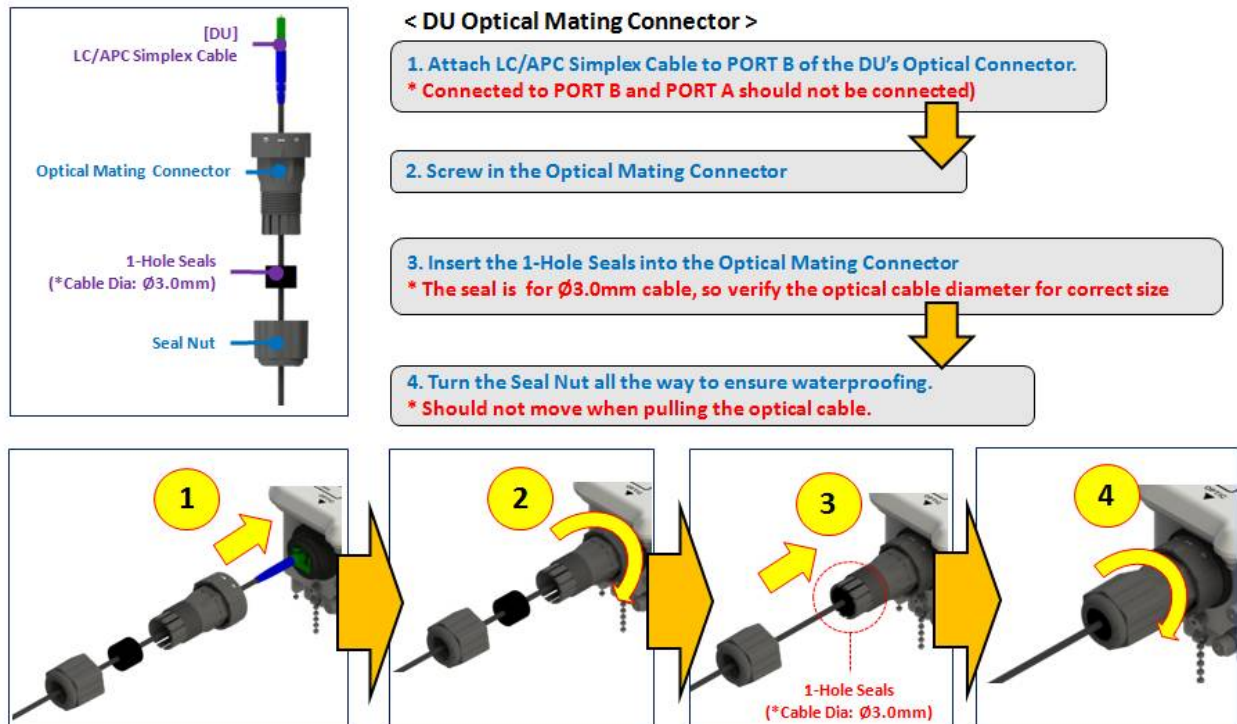
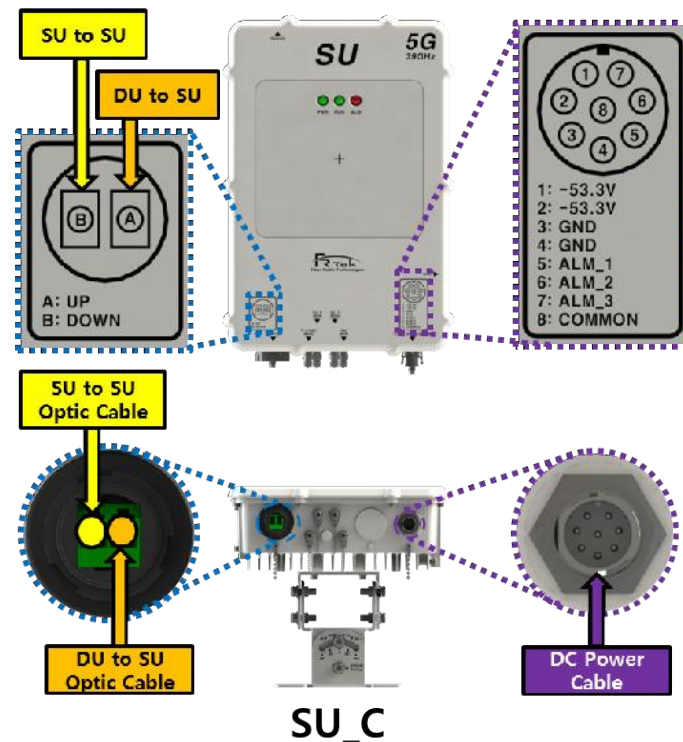


Figure 27.DU Optical Cable Connection

Since the DU can be placed either in-building or outdoors, waterproof connectors must be used.



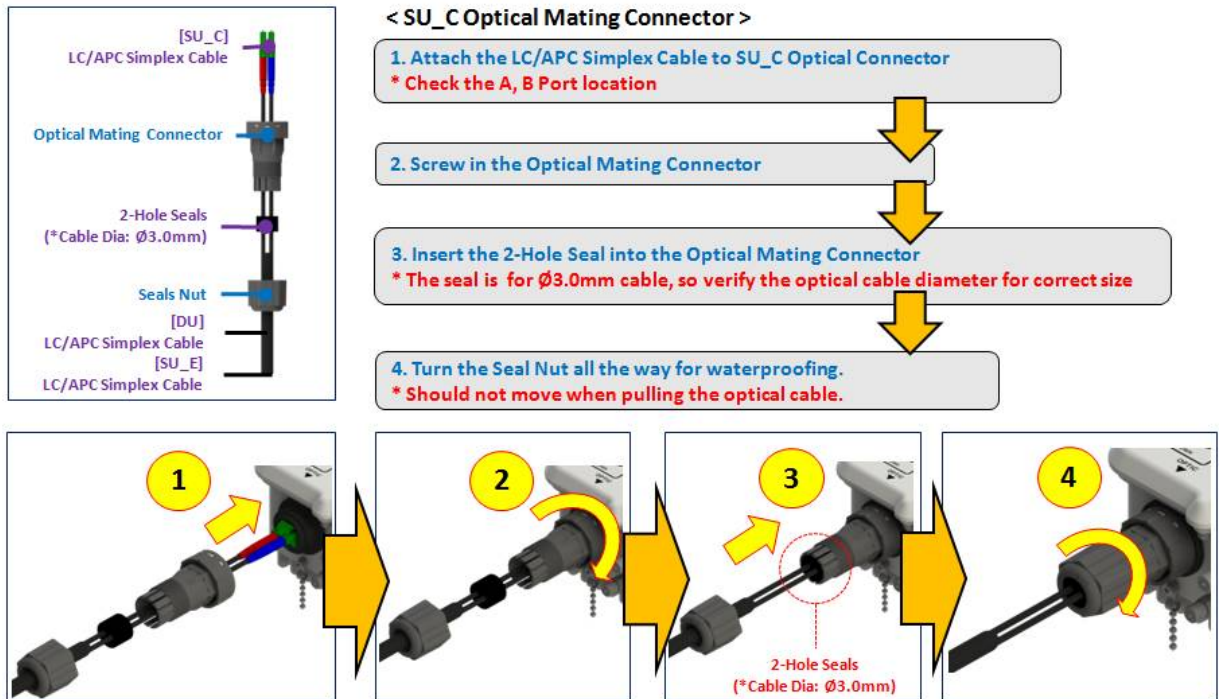
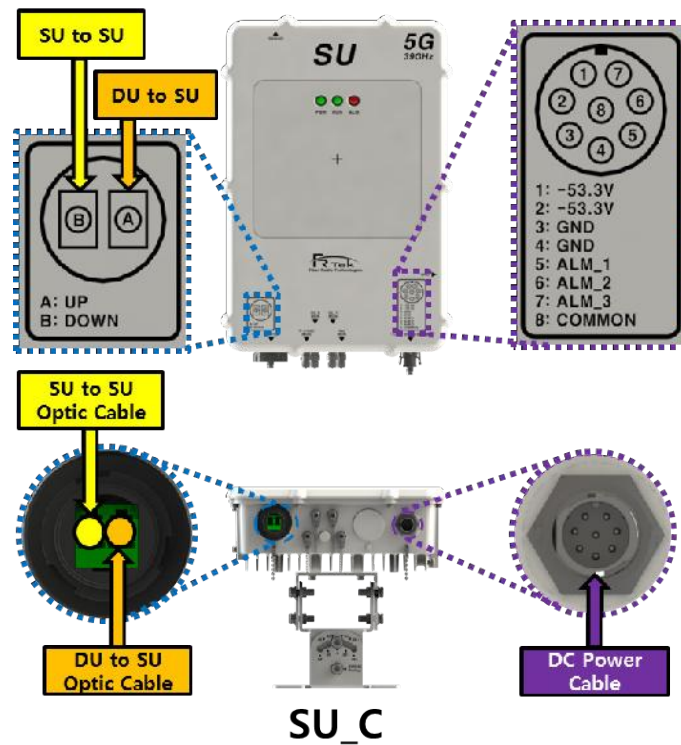


Figure 28.SU_C Optical Cable Connection



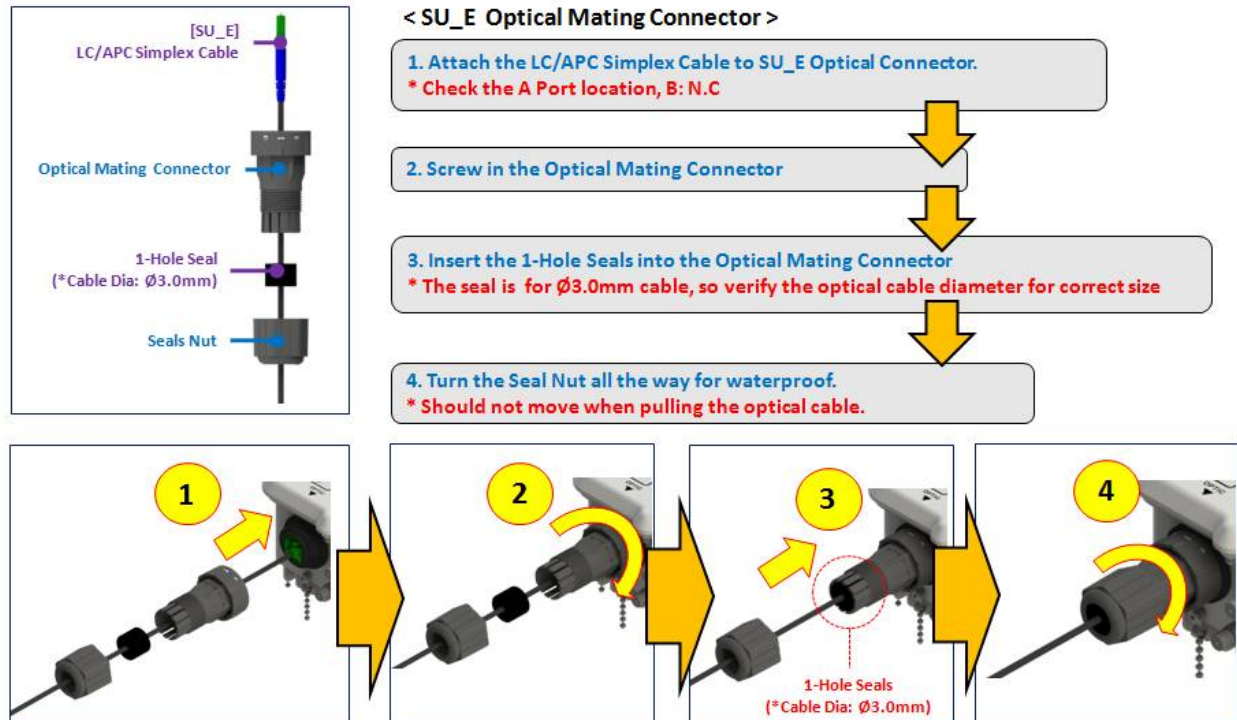
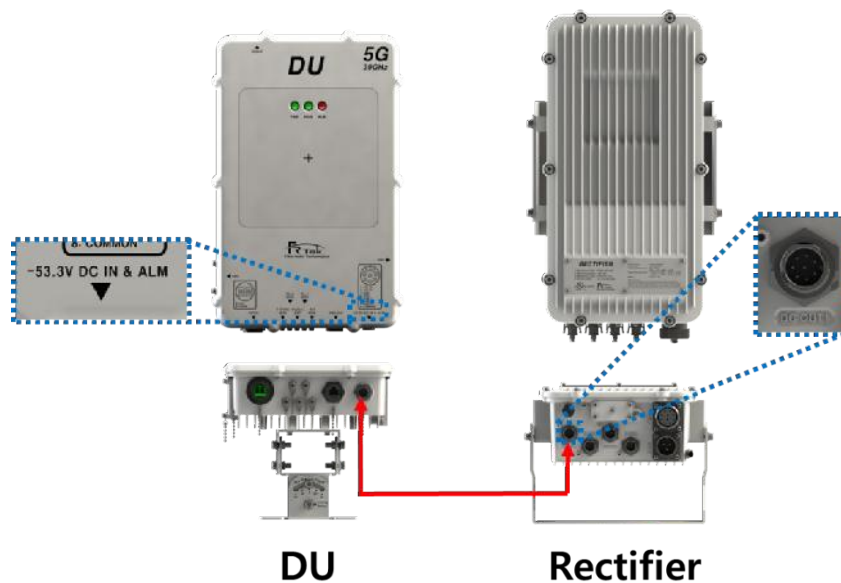


Figure 29.SU_E Optical Cable Connection

Since the SU can be placed either in-building or outdoors, waterproof connectors must be used.



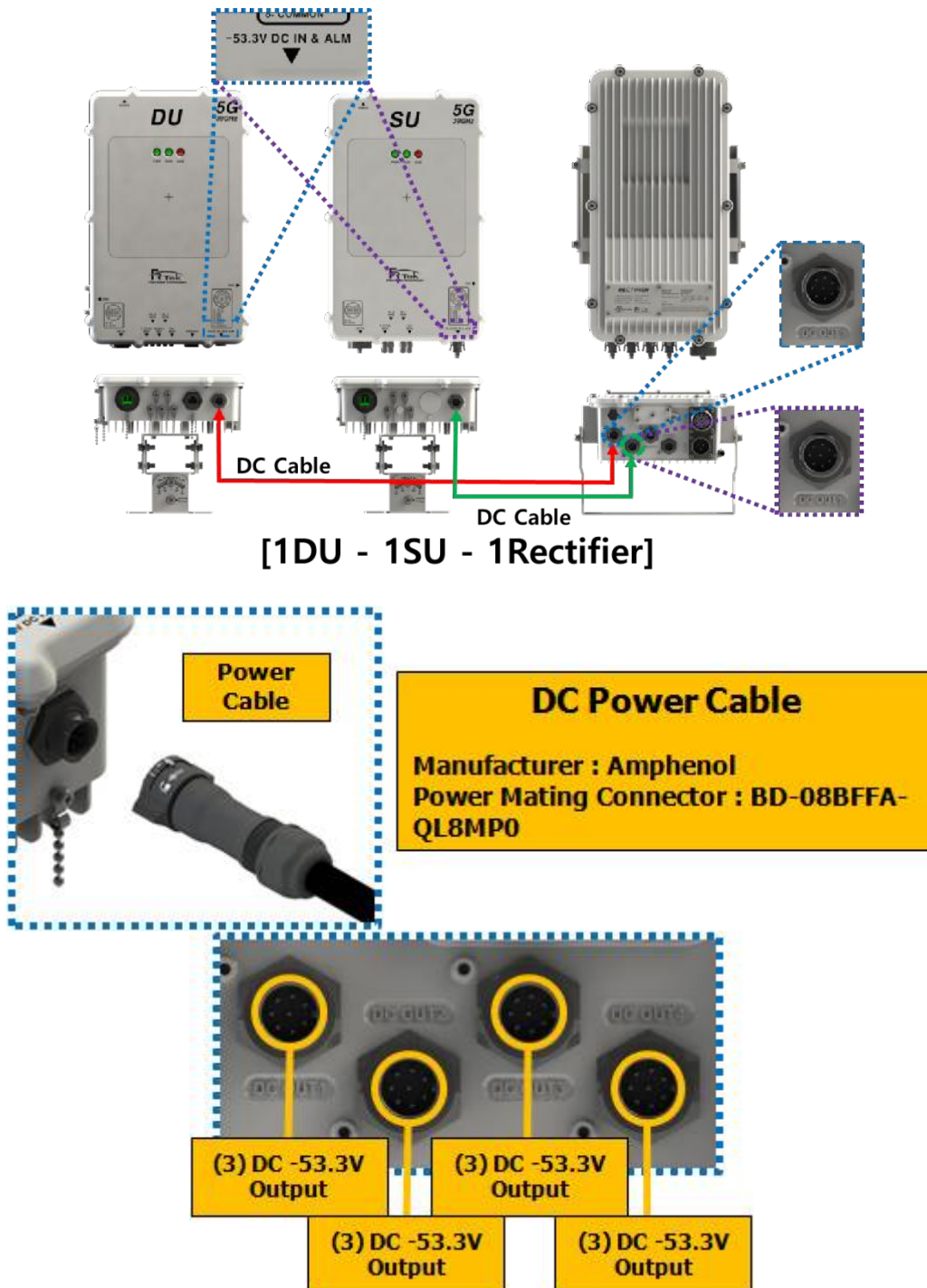
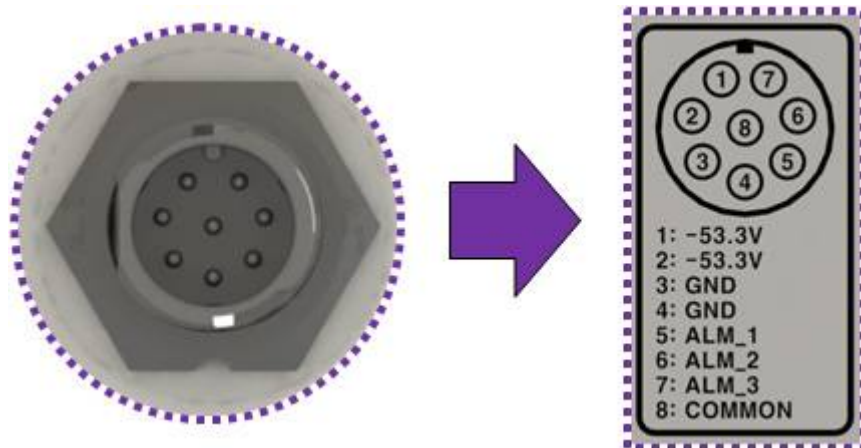


Figure 30.DU/SU Cable Connections from Rectifier



DC Power Connector

Manufacturer : Amphenol
Power Mating Connector : BD-08PMMS-QC8001

Figure 31.DU & SU Input Port Pinout

No	Content
①	DC -53.3V (-48V ~ -53.3V)
②	DC -53.3V (-48V ~ -53.3V)
③	Ground
④	Ground
⑤	Battery DC Alarm
⑥	Battery AC or Temp Alarm
⑦	Battery BAT Alarm
⑧	Battery Common

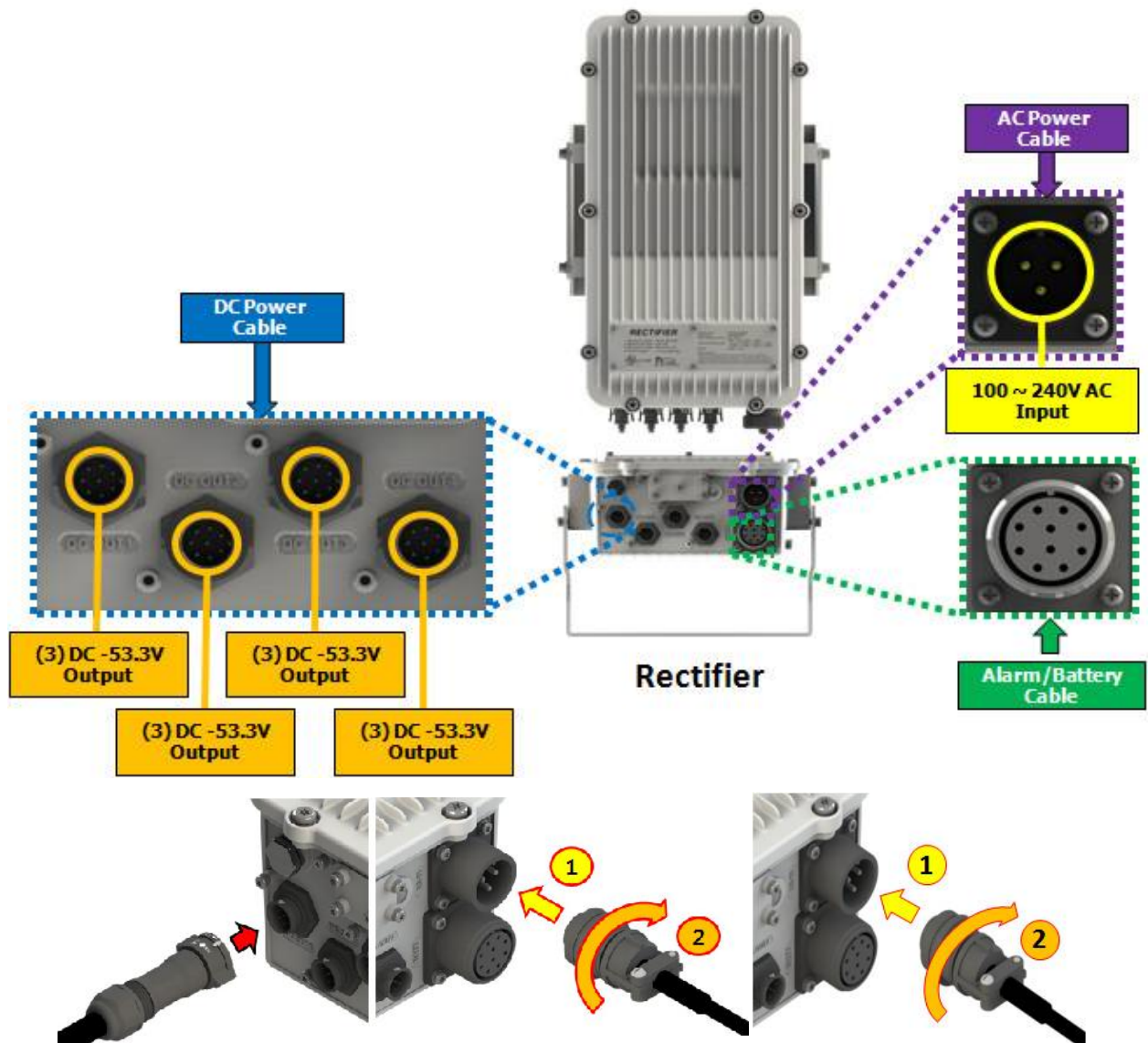


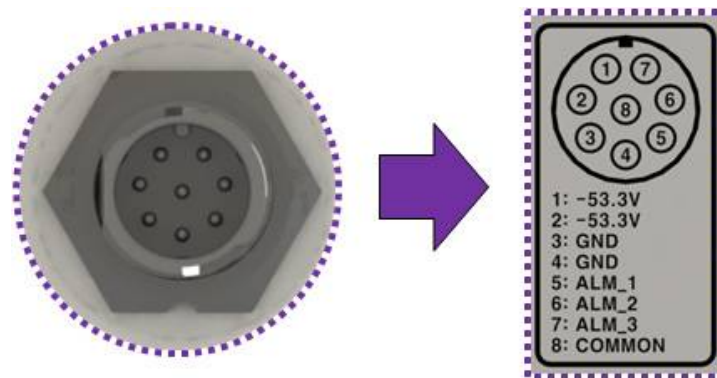
Figure 32. Rectifier DC & AC Cable Connections

Connect the AC input power cable to the Rectifier AC-IN port, and connect the DU, SU (Cascade), SU (End) cable for DC input to the Rectifier DC OUT port 1~4.

Since the Rectifier is an outdoor unit, waterproof connectors must be used.

* Rectifier AC power cable connector : MS3102A-16-10P

* DC power cable connector : BD-08BFFA-QL8MP0



DC Power Connector

Manufacturer : Amphenol
Power Mating Connector : BD-08PMMS-
QC8001

Figure 33.Rectifier DC Output Port Pinout

No	Content
①	DC -53.3V (-48V ~ -53.3V)
②	DC -53.3V (-48V ~ -53.3V)
③	Ground
④	Ground
⑤	Battery DC Alarm
⑥	Battery AC or Temp Alarm
⑦	Battery BAT Alarm
⑧	Battery Common



Battery Connector

Manufacturer : YONGJIN ELECOMM
Power Mating Connector : YJ3102C 18-1S

Figure 34.Rectifier Battery Port Pinout

No	Content
A	Batt+
B	Batt+
C	Batt+
D	Contact Comm
E	Battery Alarm_1
F	Batt-
G	Batt-
H	Batt-
I	Battery Alarm_2
J	Battery Alarm_3

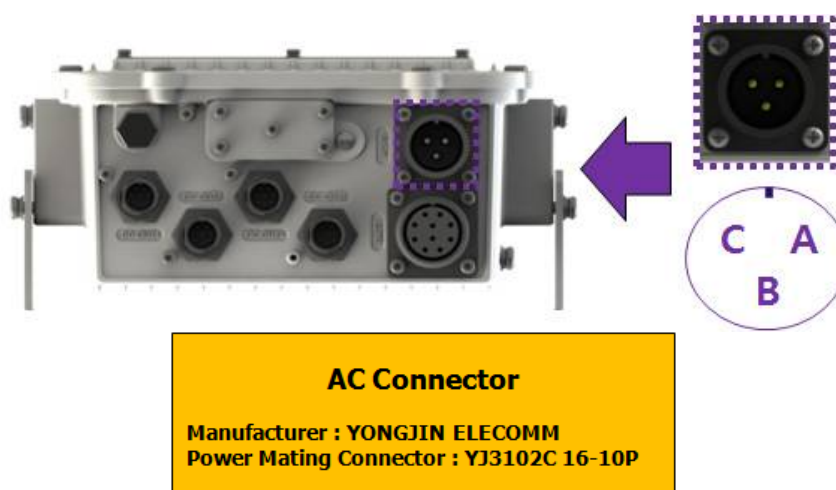


Figure 35.Rectifier AC Port Pinout

No	Content
A	Live
B	FG
C	Neutral

5.5.2 Other Installation Scenarios

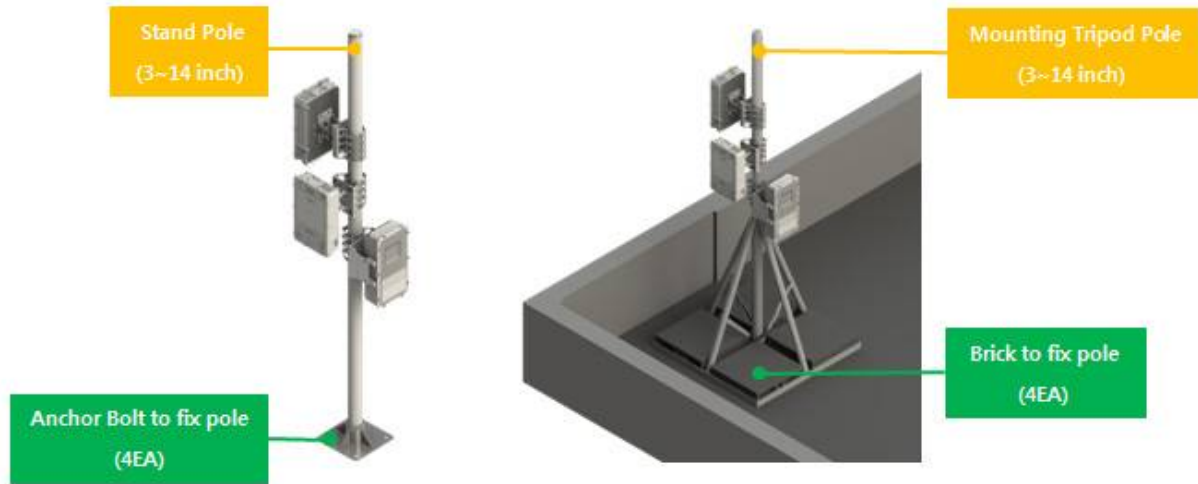


Figure 36. Standing Pole or Mounting Tripod Pole

When Wall or Electrical Pole installation is not available for the DU, SU, and Rectifier, then can use a Standing Pole or Mounting Tripod Pole for installation. The poles must be at least 3" in diameter.

Chapter 6

Local GUI(Graphical User Interface)

6.1 GUI Configuration

Local GUI(Graphical User Interface)

"Chapter 3 is used to provide information on product setting and product information to users operating 39GHz 5G Wireless Optical DAS, and the repeater administrator who will use the operation manual has specialized knowledge of the relay system and Experience in construction and operation is required.

- GUI program is an operating program designed to control and monitor the system.
- The GUI program communicates using the USB-B type port configured in the CPU of each device.
- Through the main screen of each unit, the user can monitor and control the operation status of the entire system.

6.1 GUI Configuration

6.1.1 Initial Main Screen

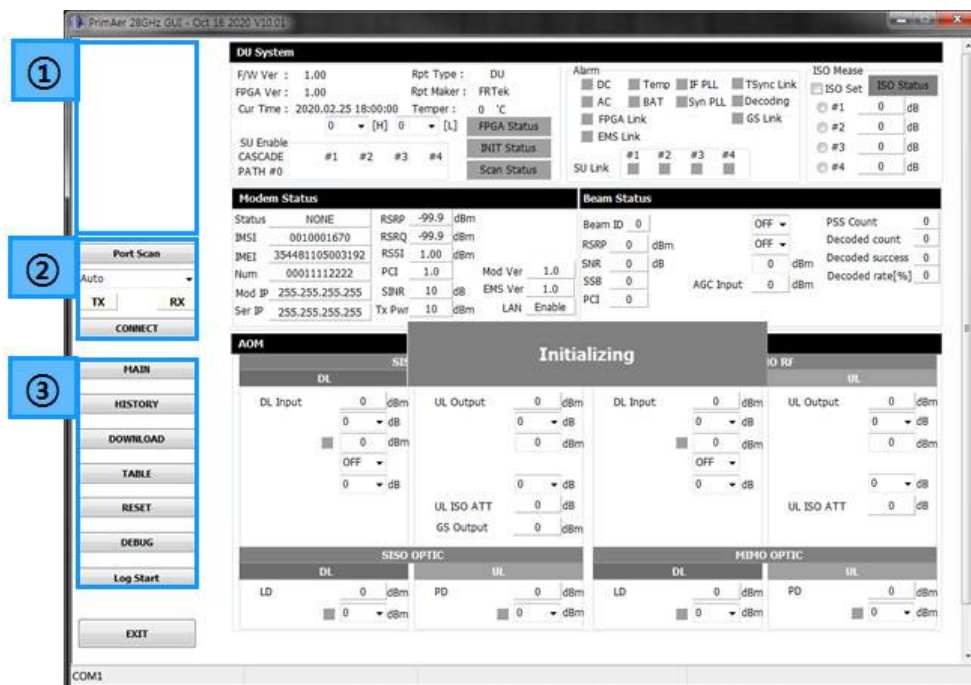


Figure 37. Initial GUI Main Screen.

① Tree List

In this item, you can check all equipment of the currently configured system. In addition, it is possible to monitor whether an alarm has occurred in each unit in real time through the alarm of each unit item.

② GUI Connection

In this item, Unit and PC can be connected. After clicking 'Auto', select the comport where the unit and PC are connected, and click CONNECT to connect to the GUI.

③ Function List

In this item, additional functions implemented in Local GUI can be used. Alarm History function, firmware download function, table creation/management function, CPU RESET function, Debug function, and Log function can be used.

- HISTORY : This is the item that can check the Alarm History of each unit.
- DOWNLOAD : is an item that can download the firmware of each unit.
- TABLE : It is an item that can create/manage a table organized by each unit.
- RESET : This item can reset the CPU board of each unit.
- DEBUG : CPU and Array Ant for each unit. It is an item that can check debug messages between modules in real time.
- Log Start : It is an item that can record time log of important items configured in each unit's GUI through Excel.

④ DU System

This item is the item that can check the system information and alarm of DU, and the items of information that can be checked are as follows.- F/W Ver : MCU Firmware Version

- FPGA Ver : FPGA Firmware Version
- Cur Time : Current Time

- Rpt Type : Repeater Type
- Rpt Maker : Repeater Maker
- Cur Temper : Current Temperature
- Temperature H : Temperature Upper Setting
- Temperature L : Temperature Lower Setting
- SU Enable : This item sets the cascade connection between DU and SU and between SU and SU.
- SU Link : This item can check the cascade connection status between DU and SU and between SU and SU.
- DL/UL Test : This item can check the cascade connection status between DU and SU and between SU and SU.
- FPGA Status : This item can check internal FPGA booting and connection status when DU is ON.
- INT Status : Initialize Status, This item can check MCU booting and connection status when DU is ON.
- DC Alarm : This is an alarm item to monitor the status of -53.5V of DC input power of DU.
- Temp Alarm : DU internal temperature
- TSYNC Link Alarm : This is an alarm item to monitor the TDD SYNC signal extraction status from an external base station signal.
- AC Alarm : This is an alarm item to monitor the status of 100 ~ 240V of AC input power of the rectifier.
- BAT Alarm : This is an alarm item to monitor the normal operation of the battery.

⑤ MVBX Status

This item can monitor base station information SSP, SNR, and RSRP in real time.

⑥ AOM

This item is the 'LD' alarm and 'LD' alarm that can monitor the transmit/receive strength and status of the RF part of the Analog Optic Module inside the DU and the DL/UL real-time RF output of the SISO Path/MIMO Path of the Optic part, and the converted analog optical signal. PD' alarm is configured, and ATT control, ALC Limit Level setting, ALC On/Off, Shutdown Level setting, and Shutdown On/Off can be set.

- DL Output: This item monitors the DL output of AOM SISO RF and AOM MIMO RF in real time.

- DL ATT: This item controls DL Atten of AOM SISO RF and AOM MIMO RF.
- ALC Limit Level: This item sets the Auto Limit Control limit level of AOM SISO RF DL/UL and AOM MIMO RF DL/UL.
- ALC On/Off: This item controls On/Off of Auto Limit Control function of AOM SISO RF DL/UL and AOM MIMO RF DL/UL.
- UL Output: This item monitors the UL output of AOM SISO RF and AOM MIMO RF in real time.
- UL ATT: This item controls UL Atten of AOM SISO RF and AOM MIMO RF.
- SD Level: This item sets the shutdown level of AOM SISO RF UL and AOM MIMO RF UL and displays the alarm.
- SD On/Off: This item controls On/Off of Shutdown operation of AOM SISO RF UL and AOM MIMO RF UL.
- UL ISO ATT: This item controls Isolation Atten of AOM SISO RF UL, AOM MIMO RF UL.
- LD: It is an item to monitor LD Power of AOM SISO OPTIC DL and AOM MIMO DL in real time.
- LD Lower: This item sets the lower limit value of LD Power of AOM SISO OPTIC DL, AOM MIMO DL, and displays Alarm.
- PD: This item monitors the LD Power of AOM SISO OPTIC UL and AOM MIMO UL in real time.
- PD Lower: This item sets the lower limit value of PD Power of AOM SISO OPTIC UL, AOM MIMO UL and displays Alarm.

6.1.2 DU Main Screen Configuration



Figure 38. Initial GUI Main Screen.

① DU System

In this category, you can monitor and control the firmware version of the DU, the temperature status in the enclosure, the SU Cascade setting, various alarms of the DU, the isolation check function, etc., and the initial state of the FPGA, Array Ant, and the operation of the Beam Scan function. Items that can be monitored are implemented.

Items	Description	Remark
F/W Ver	CPU version	Status
FPGA Ver	FPGA version Display	Status
Cur Time	Current Time Display	Status
Rpt Type	Repeater Type Display	Status
Rpt Maker	Repeater Maker Display	Status
Temper	Repeater Temperature Display	Status
Temperature [H],[L]	Repeater Temperature Alarm의 Upper, Lower Control	Status/Control
SU Enable	SU Cascade Control	Status/Control

FPGA	FPGA Status	Status
Init	Array Ant. Status	Status
Scan	Beamforming Function Status	Status
DC	Alarm occurs when DC input is abnormal	Alarm
Temp	Alarm occurs at the upper and lower limit of temperature	Alarm
IF PLL	Alarm occurs when IF PLL is abnormal	Alarm
TSync Link	Alarm occurs in case of Tsync error	Alarm
AC	Alarm occurs when rectifier AC input is abnormal	Alarm
BAT	Alarm occurs when the rectifier battery is abnormal	Alarm
Syn PLL	Alarm occurs in case of sync PLL error	Alarm
Decoding	Alarm occurs when the decoded rate is abnormal	Alarm
FPGA Link	Alarm occurs when FPGA is defective	Alarm
GS Link	Array Ant. Alarm occurs when not connected	Alarm
EMS Link	Alarm occurs when EMS is not connected	Alarm
SU Link	Alarm occurs when SU is not fastened	Alarm
ISO Set	Isolation check function control and monitoring	Status/Control

② Beam Status

In this item, items that can monitor and control the signal of the base station selected by Array Ant. and the AGC function through the beamforming function of the DU are implemented.

Items	Description	Remark
Beam ID	Monitoring of the direction of the base station signal selected by Array Ant.	Status
RSRP	RSRP monitoring of signals input to Array Ant.	Status
SNR	SNR monitoring of signals input to Array Ant.	Status
SSB	SSB monitoring of signals input to Array Ant.	Status
PCI	PCI monitoring of the base station selected by Array Ant.	Status
GS On/Off	Array Ant. On/Off control	Control
AGC On/Off	Array Ant. AGC On/Off control	Control

AGC Level	AGC upper limit control	Control
AGC Input	RSRP monitoring of signals input to Array Ant.	Status
PSS Count	PSS monitoring of signals input to Array Ant.	Status
Decoded count	Monitoring the number of analysis of signals input to Array Ant.	Status
Decoded success	Monitoring the number of successful analysis of signals input to Array Ant.	Status
Decoded rate[%]	Monitoring success probability of analysis of signals input to Array Ant.	Status
RSRP Req	RSRP value polling control of signal input to Array Ant.	Control
PLL Relock	PLL Relock function control	Control
Beam Scan	Beamforming function control	Control

③ AOM

In this category, monitoring and control of RF items of DU optical module (DAOM), optical module ATT maximum 25dB control, Array Ant. An item that can control ATT up to 20dB is implemented.

Items	Description	Remark
DL Input	DAOM DL input monitoring	Status
DL ATT	DAOM DL ATT control	Control
ALC Level	DAOM DL ALC upper limit control and alarm generation	Alarm/Control
ALC On/Off	DAOM DL ALC On/Off control	Control
Front End ATT	Array Ant. RX ATT control	Control
UL Output	DAOM UL output monitoring	Status
UL ATT	DAOM UL ATT control	Status
ISO Level	DAOM DL/UL Isolation monitoring	Status
Front End ATT	Array Ant. TX ATT control	Control
UL ISO ATT	DAOM UL Isolation ATT monitoring	Status
GS Output	Array Ant. TX Level monitoring	Status
LD	Optical transmission intensity monitoring	Status
LD Lower	Alarm generation and lower limit control at optical transmission lower limit	Alarm/Control
PD	Optical reception intensity monitoring	Status

PD Lower	Alarm generation and lower limit control at light reception lower limit	Alarm/Control
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6.1.3 SU Main Screen Configuration

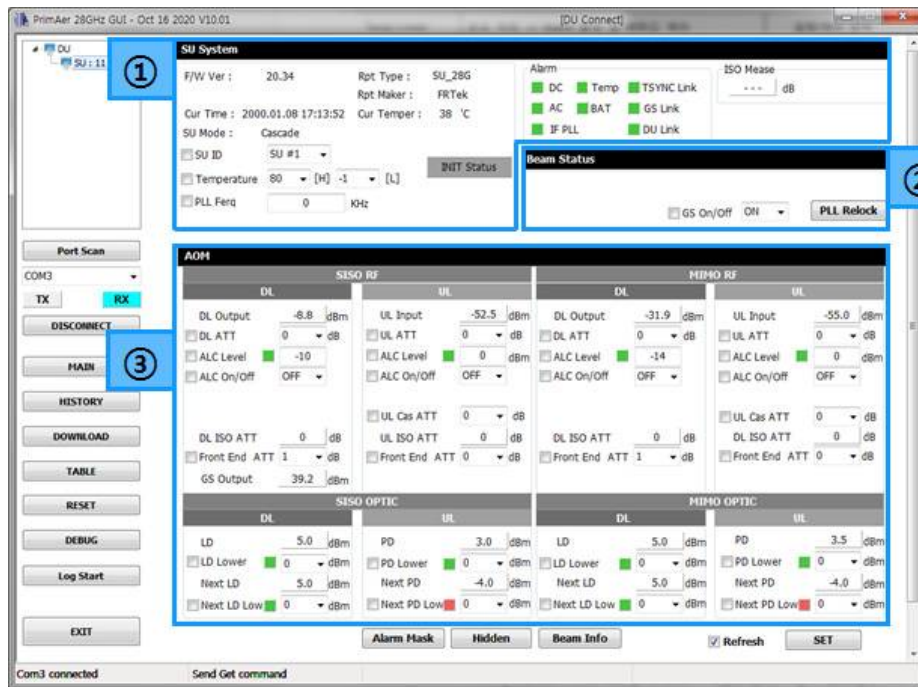


Figure 39. SU Main Screen.

① SU System

In this item, you can monitor and control the firmware version of the SU, the temperature status in the enclosure, the SU ID setting, various alarms of the SU, and the isolation check function, and the item that can monitor the initial state of the Array Ant. is implemented.

Items	Description	Remark
F/W Ver	CPU Version Display	Status
Cur Time	Current Time Display	Status
Rpt Type	Repeater Type Display	Status
Rpt Maker	Repeater Maker Display	Status
Cur Temper	Repeater temperature Display	Status
SU Mode	SU Cascade, End Unit Monitoring	Status
SU ID	SU ID Control	Control
Temperature [H],[L]	Control of the upper and lower limits of the repeater temperature alarm	Control
PLL Freq	PLL Frequency Control	Control

Init	Array Ant. Status monitoring	Status
DC	Alarm occurs when DC input is abnormal	Alarm
Temp	Alarm occurs at the upper and lower limit of temperature	Alarm
TSync Link	Alarm occurs in case of Tsync Fail	Alarm
AC	Alarm occurs when rectifier AC input is abnormal	Alarm
BAT	Alarm occurs when the rectifier battery is abnormal	Alarm
GS Link	Array Ant. Alarm occurs when not connected	Alarm
IF PLL	Alarm occurs when IF PLL is abnormal	Alarm
DU Link	Alarm occurs when DU is not connected	Alarm
ISO Mease	Isolation check Monitoring	Status

② Beam Status

In this topic, Array Ant. Items that can control On/Off and PLL Relock functions are implemented.

Items	Description	Remark
GS On/Off	Array Ant. On/Off Control	Control
PLL Relock	PLL Relock Control	Control

③ AOM

In this section, the monitoring and control of the RF items of the SU optical module (SAOM) and the optical module ATT maximum 25dB control, Array Ant. An item that can control ATT up to 20dB is implemented.

Items	Description	Remark
DL Output	SAOM DL Input Monitoring	Status
DL ATT	SAOM DL ATT Control	Control
ALC Level	SAOM DL ALC upper limit control and alarm generation	Alarm/Control
ALC On/Off	SAOM DL ALC On/Off Control	Control
DL ISO ATT	SAOM DL Isolation ATT Monitoring	Status
Front End ATT	Array Ant. TX ATT Control	Control

GS Output	Array Ant. TX Level monitoring	Status
UL Input	SAOM UL Input monitoring	Status
UL ATT	SAOM UL ATT Control	Status
ALC Level	SAOM UL ALC upper limit control and alarm generation	Alarm/Control
ALC On/Off	SAOM UL ALC On/Off Control	Control
UL Cas ATT	SAOM UL Cascade ATT Control	Control
UL ISO ATT	SAOM UL Isolation ATT monitoring	Status
Front End ATT	Array Ant. RX ATT Control	Control
LD	Optical transmission intensity monitoring	Status
LD Lower	Alarm generation and lower limit control at optical transmission lower limit	Alarm/Control
PD	Optical reception intensity monitoring	Status
PD Lower	Alarm generation and lower limit control at light reception lower limit	Alarm/Control
Next LD	Next SU optical transmission intensity monitoring	Status
Next LD Lower	Next SU Optical transmission low limit alarm generation and low limit control	Alarm/Control
Next PD	Next SU optical reception intensity monitoring	Status
Next PD Lower	Next SU Optical reception low limit alarm generation and low limit control	Alarm/Control

PrimAer 39 Operating Manual

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