User Manual

PROSE RADIANT

PBMU/IM2U+NEU+IRU-O System

Manual Version 1.2

Oct 27, 2023

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Introduction

As the requirement for mobile communication quality keeps enhancing, the operators of wireless network need to pay more attention to improve the network quality and expand the network coverage. Due to the change of electromagnetic environment and increase of mobile subscribers, those existing BTS may be unable to meet the specified performance requirements and the following coverage problems will occur:

1. High call-drop rate
2. Low rate of successful handover
3. Low coverage rate or bad coverage quality
4. Low connection rate
5. Bad conversation quality

To solve all these problems in an all-around way, only adjusting the cell parameters of the BTS is not enough. The adoption of “BTS + Repeaters” is a better solution that has been verified in many sites in village, highway and tourism regions, especially at the edge of a BTS coverage region. And since the repeater requires fewer accessories and no need special equipment-room, operators can get more profit from lower construction and operation cost.

PROSE RADIANT is a multi-standards integration system, which has integrated 4G/5G and support for broadband access to this system. This system mainly consists of four parts. Repeater is especial tailored to provide a comprehensive and flexible coverage solution in complex coverage environments like densely populated residential area, underground areas, tunnels, stations and terminals, Hotels, Meeting rooms and shopping mall and so on. It widely used on the mobile communication networks. The system receives filters, amplifies, and transfers the uplink and downlink radio frequency (RF) signals of the base transceiver station (BTS) to extend and accurately distribute the coverage of the BTS.

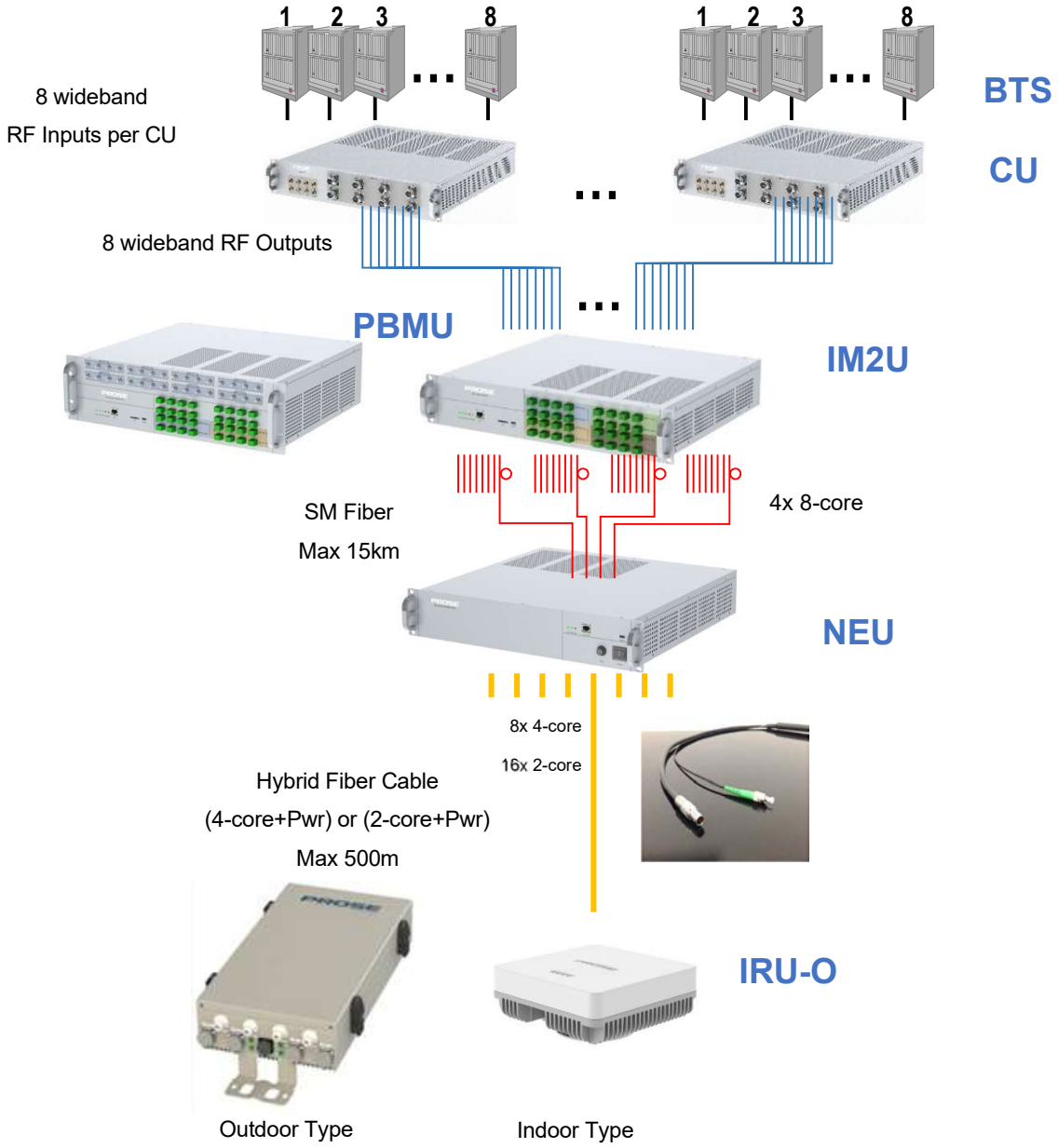


Figure 1-1 Functional Components of PROSE RADIANT

1. Safety instructions

It is important to read safety instructions before installing the equipment. These instructions are supplementary to any local safety regulations in place. In case of any conflict, local safety regulations shall prevail.

Installation personnel should have preliminary knowledge about safety operations and must have received training on PROSE equipment installation, maintenance and operations.

Some important safety instructions are discussed in the chapter. PROSE shall not bear any liabilities incurred by violation of universal safety operation requirements, or violation of safety standards for designing, manufacturing and equipment usage.

1. The equipment must follow system requirements with proper grounding & lightning protection.

2. Power supply voltage must satisfy safety requirements. Anybody who installs or modifies equipment must turn off the power supply first. Only certified maintenance staff are allowed to perform operations with power-on.

3. The equipment radiates electromagnetic waves, which can cause damage to the human body. Proper safety and precautions should be taken. People other than maintenance staff should keep away.

4. Do not expose yourself for long periods of time to the FOR system while in operation because the electromagnetic field emitted by the equipment may do harm to your health.

5. If installed at height (onto the pole), the equipment shall be securely fixed to prevent harm and bodily injury from dropping parts.

6. The equipment must be away from fire, as electronic components may explode upon fire.

7. Static electricity produced by human body can damage sensitive components on the circuit board, such as large integrated circuits (ICs).

8. **Warning:** The equipment contains a battery that only can be replaced by a professional. There is risk of explosion if the battery is replaced by an incorrect type.

9. **WARNING!** This is **NOT** a **CONSUMER** device. It is designed for installation by **FCC LICENSEES** and **QUALIFIED INSTALLERS.**
You **MUST** have an **FCC LICENSE** or express consent of an **FCC** License to operate this device. Unauthorized use may result in significant forfeiture penalties. including penalties in excess of $100.000 for each continuing violation.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and
(2) This device must accept any interference received, including interference that may cause undesired operation.

This equipment complies with FCC/IC RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

10. WARNING: This is NOT a CONSUMER device. It is designed for installation by an installer approved by an ISED licensee. You MUST have an ISED LICENCE or the express consent of an ISED licensee to operate this device.

WARNING: Industrial zone enhancers are NOT consumer devices. They are designed for installation by ISED licensees and qualified installers who have recognized RF training. You MUST be an ISED licensee to install or operate this device.

2. System Introduction

Overview

PROSE's solution of RADiAnt system supports multiple operators deploying multiple mobile technologies. The RADiAnt system operates from 698-3980MHz and extends 4G, 5G and broadband data coverage for indoor applications. It is particularly suited for high-capacity application scenarios such as business towers, shopping malls, offices, airports, stadiums, and other indoor application scenarios.
The RADiAnt is much more than just replacing RF coaxial cables with optical fibers. The core of the system, consisting of the intelligent Multisector Master Unit (IM2U) and the Network Extender Unit (NEU), deals with the signal processing and the conversion of RF signals to optical. The optical signals are transmitted over single mode fiber with low loss and virtually no increased in noise floor. The NEU uses hybrid cable (an integrated power and fiber cable) to connect to the integrated Remote Unit (IRU-O), where each NEU can connect 16 units of IRU-O for SISO, and 16 units of IRU-O for 2x2 MIMO, and 8 units of IRU-O for 4x4 MIMO applications. IRU-O is designed to apply for indoor and outdoor environment. The IRU-O outdoor type meets IP65. It had two types, one is combiner build in type, the other one is without combiner type. The different are the dimension, weight, and output ports definition. If

multiple operators accessing, the Power Balance Master Unit (PBMU) is recommended for power level aligning.

The advantages of the RADiAnt system are:

• Easy and quick to design and deploy Fiber DAS, where RF radiated power is determined only by each IRU-O
• Achieve uniformed coverage, each IRU-O provides constant output power for each band
• Precisely adjust the RF output power level in specific applications
• Zero RF loss in signal transmission
• No PIM and VSWR issues
• One IM2U connects a maximum of 16 NEUs, and one NEU connects up to 16 IRU-Os for 2x2 MIMO solution, supports 4X4 MIMO as well
• Management via OMT or NMS software

Application

DAS vendors are working towards a more flexible ecosystem that allow mobile operator and landlords to maximize their Return on Investment (ROI) from their DAS deployments. PROSE's Smart active DAS is the latest DAS system that is multi-operator, multi-band, and multi-technology operating See Below:

LTE Band 5:869MHz to 894MHz
LTE Band 12:729MHz to 746MHz
LTE Band 13:746MHz to 756MHz
LTE Band 25:1930MHz to 1995MHz
LTE Band 66:2110MHz to 2200MHz
5GNR N41:2496MHz to 2690MHz
5GNR N77:3450MHz to 3550MHz
5GNR N77:3700MHz to 3980MHz

In the NR C-band, the system can support 400 MHz Instantaneous Bandwidth (IBW) and 4T4R with one of the smallest footprints in market. It can support various MIMO configurations (e.g., Single Input, Single Output (SISO), 2x2 MIMO and 4x4 MIMO) with up to eight bands by a low-power iRU.

RADiAnt

The following system diagram shows a typical system connectivity of RADiAnt. The mainly components of RADiAnt are the CU, PBMU, NEU and IRU-O.

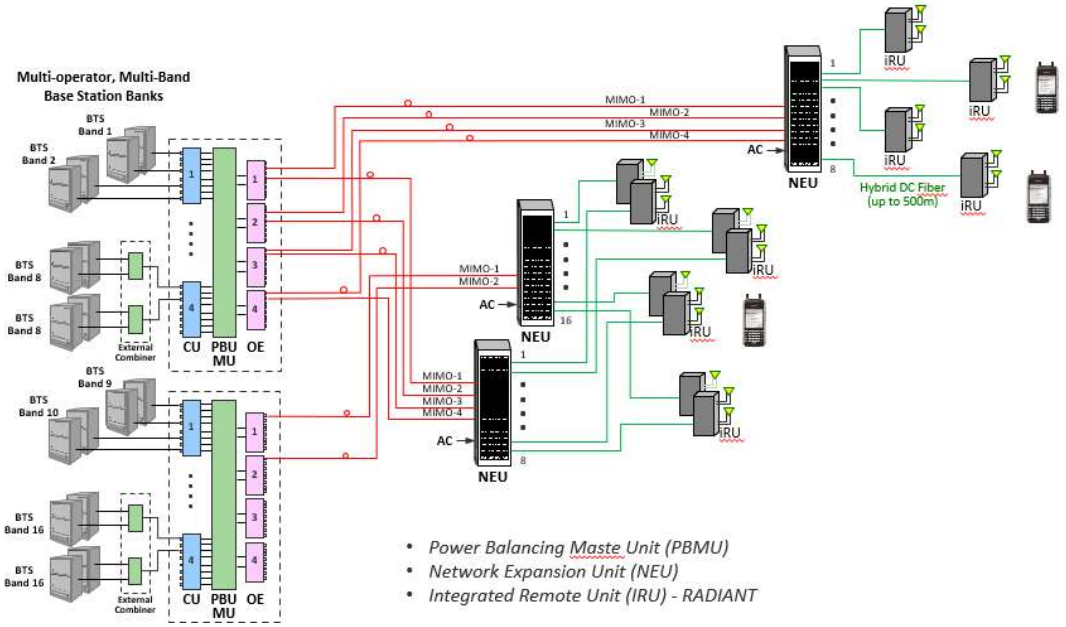


Figure 1-2 System application diagram

2. Product Introduction

Overview

System consists of PBMU/IM2U, NEU and IRU-O.

Interconnection between PBMU/IM2U and NEU is fiber optical cable via optical module.

Interconnection between NEU and IRU-O is fiber & power hybrid cable via optical module.

Optical interface supports 690-3800MHz band.

2.1 Product Outline Drawing and Description

2.1.1 PBMU

2.1.1.1 PBMU Exterior

Figure 2-1 PBMU exterior

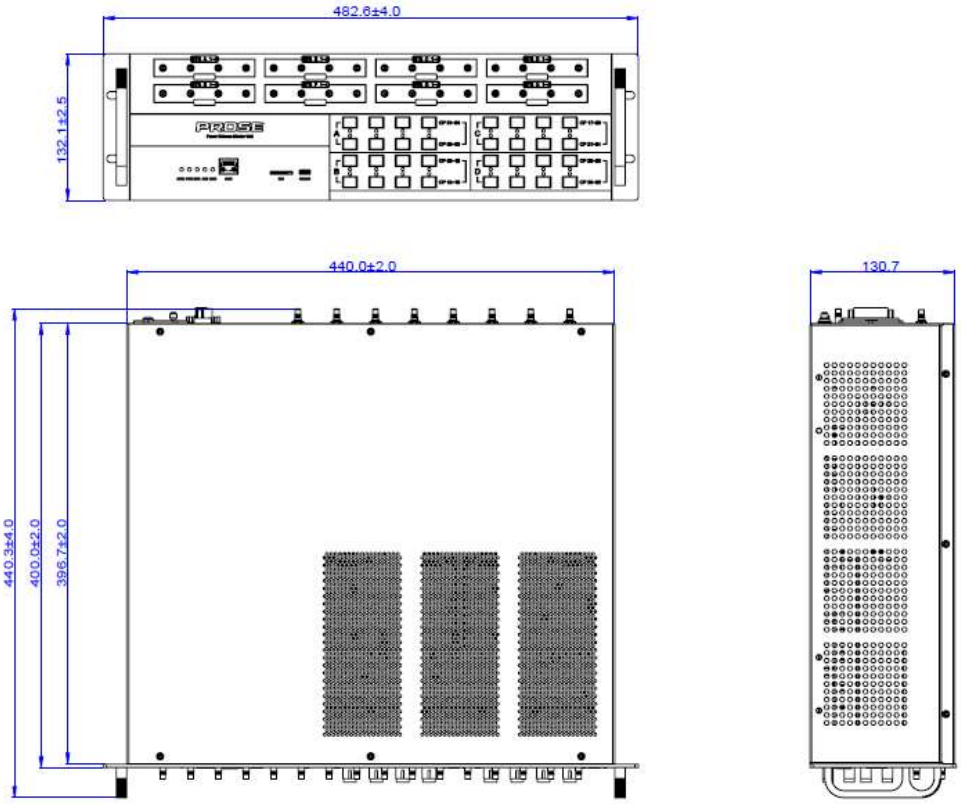


Figure 2-2 PBMU dimensions

2.1.1.2 PBMU Ports

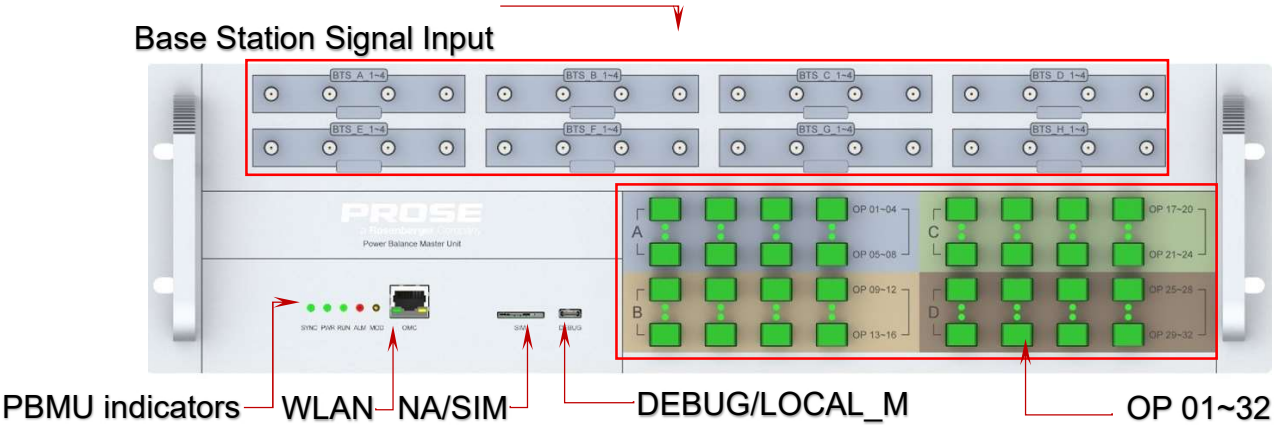


Figure 2-3 (a) Ports in the PBMU front panel

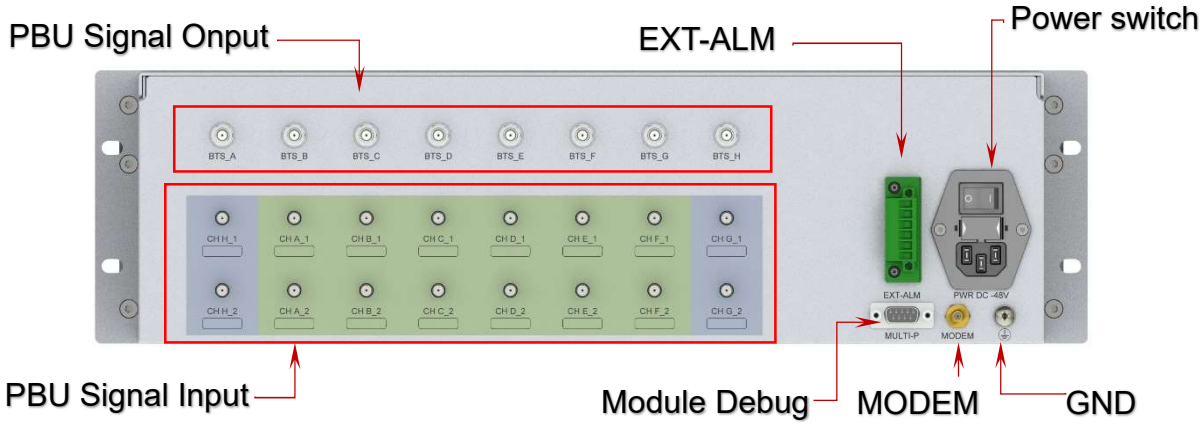


Figure 2-3 (b) Ports in the PBMU real panel 1

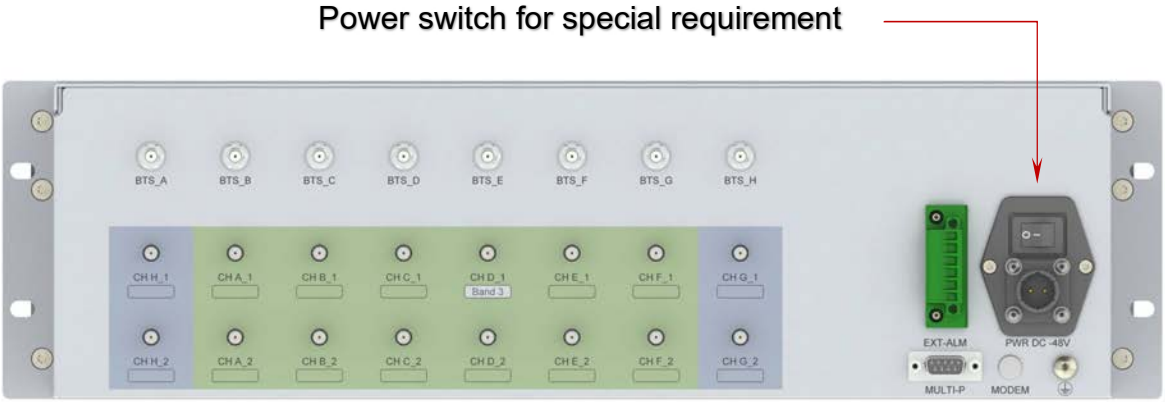


Figure 2-3 (c) Ports in the PBMU real panel 2

Table 2-1 PBMU indicators

Indicator	Color	Status	Meaning
SYNC	Green	Steady off	5G or 4G TDD signals are out of sync
		Steady on	5G or 4G TDD signal synchronization
PWR	Green	Steady on	The power input is available
RUN	Green	Blinking	The software works fine
		Steady on or off	Software operating abnormally or no power
ALM	RED	Steady on	The system has alarm
		Steady off	The system has no alarm
MOD	Green	Blinking	Motherboard MODEM in network
		Steady off	Motherboard MODEM is offline

2.1.1.3 PBMU Configuration

There are several kinds of configurations for PBMU according to customer requirements.

1) The communication ports named with “DUBGE” or “LOCAL_M”.

2) The SIM card slot exist or not.

3) Power supply need backup or not.

4) Power supply port on real panel with two different types as figure 2-3 shown.

5) Port “MODEM” on real panel exist or not.

6) Optical ports quantity 32 or 16 or 8.

2.1.2 IM2U

2.1.2.1 IM2U Exterior

Figure 2-4 IM2U exterior

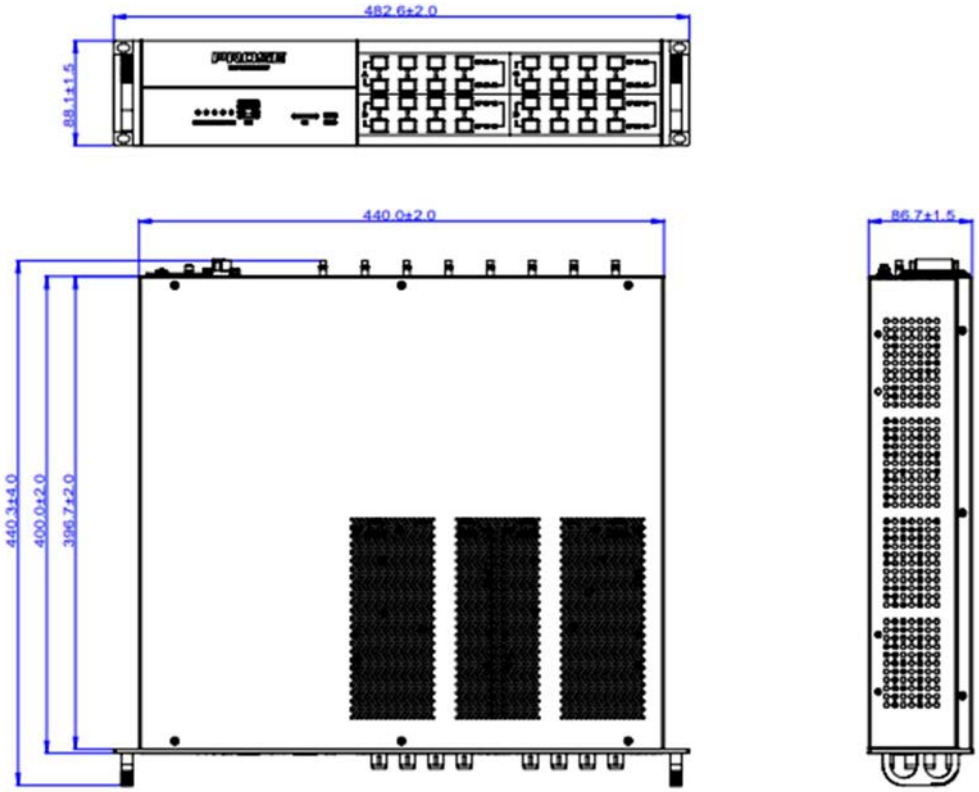


Figure 2-5 IM2U dimensions

2.1.2.2 IM2U Ports

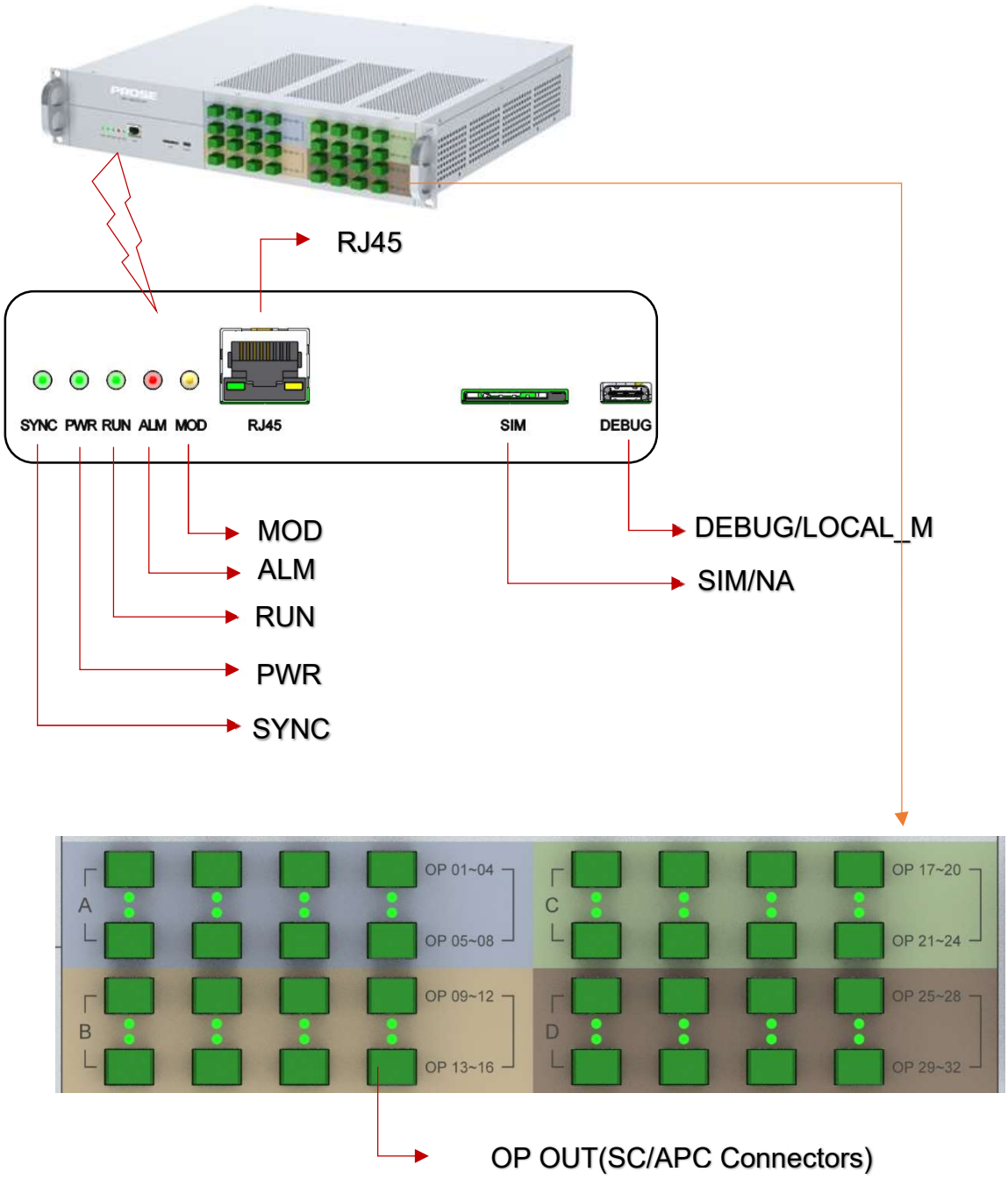


Figure 2-6 Ports in the IM2U front panel

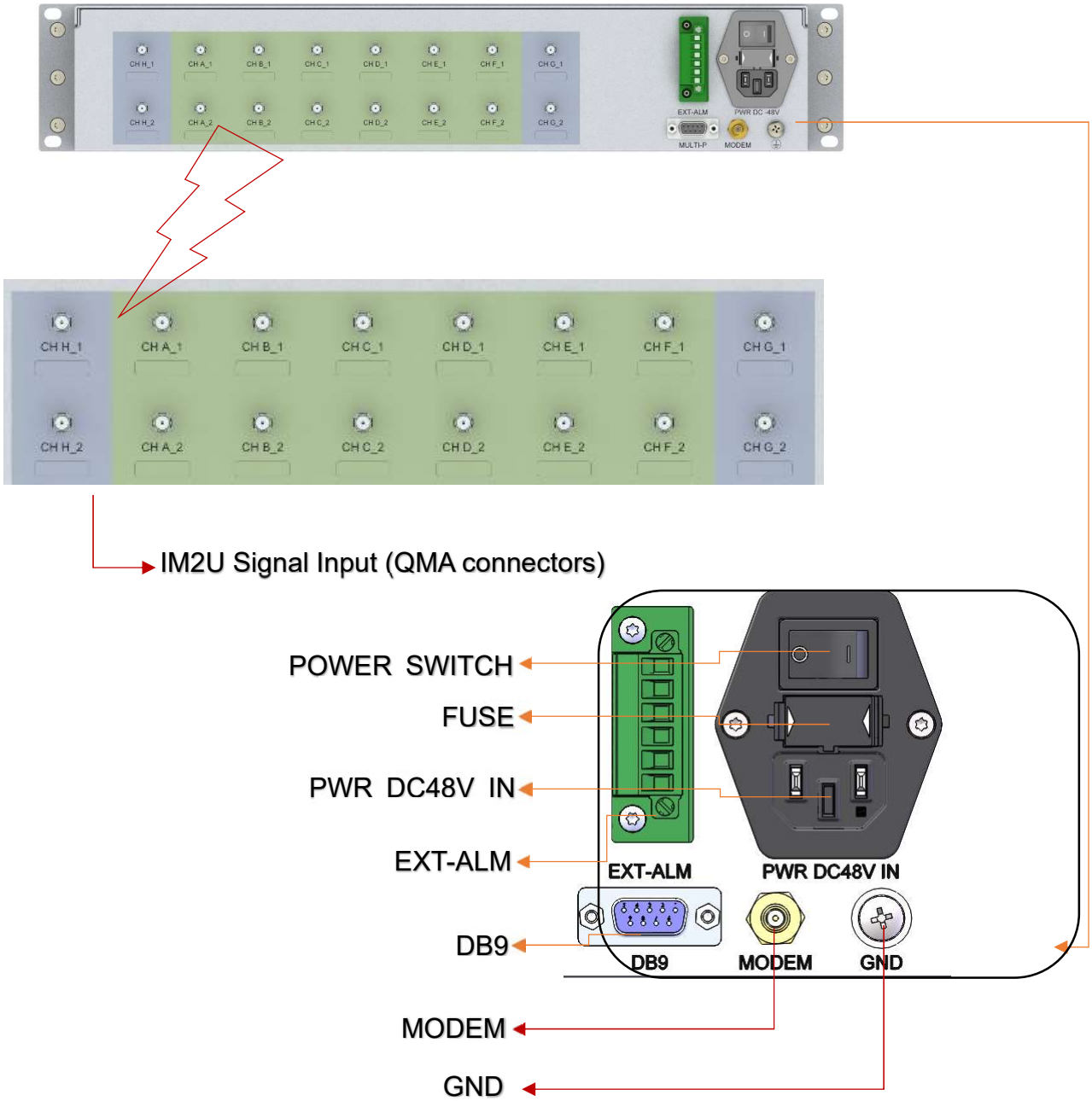


Figure 2-7 Ports in the IM2U rear panel

Table 2-2 Ports and indicators on the IM2U panels

Item	Silkscreen	Remarks
(IM2U) Ports in the front panel	RJ45	Network interface
	SIM	Insert SIM card
	A OP 01~04 OP 05~08	Signal output, connect with optical fiber line
	B OP 09~12	Signal output, connect with optical fiber line

	OP 13~16	
	C OP 17~20 OP 21~24	Signal output, connect with optical fiber line
	D OP 25~28 OP 29~32	Signal output, connect with optical fiber line
Item	**Silkscreen**	**Remarks**
(IM2U) Ports in the rear panel	PWR DC48V IN	DC48V Power input
	GND	NEU equipment grounding
	MODEM	Connect the MODEM
	DB9	DB9
	EXT-ALM	Alarm extension
	CH(A~B)_1 (NR78, Band 28……)	IM2U Signal Input (QMA connectors). Frequency can be configured according to the product before delivery
	CH(A~B)_2 (NR78, Band 28……)	IM2U Signal Input (QMA connectors) Frequency can be configured according to the product before delivery

Table 2-3 IM2U indicators

Indicator	Color	Status	Meaning
SYNC	Green	Steady off	5G or 4G TDD signals are out of sync
		Steady on	5G or 4G TDD signal synchronization
PWR	Green	Steady on	The power input is available
RUN	Green	Blinking	The software works fine
		Steady on or off	Software operating abnormally or no power
ALM	RED	Steady on	The system has alarm
		Steady off	The system has no alarm
MOD	Green	Blinking	Motherboard MODEM in network
		Steady off	Motherboard MODEM is offline

2.1.2.3 IM2U Configuration

There are several kinds of configurations for IM2U according to customer requirements.

1) The communication ports named with “DUBGE” or “LOCAL_M”.
2) The SIM card slot exist or not.
3) Optical ports quantity 32 or 16 or 8.
4) Port “MODEM” on real panel exist or not.

2.1.3 NEU

2.1.3.1 NEU Exterior

Figure 2-8 NEU exterior

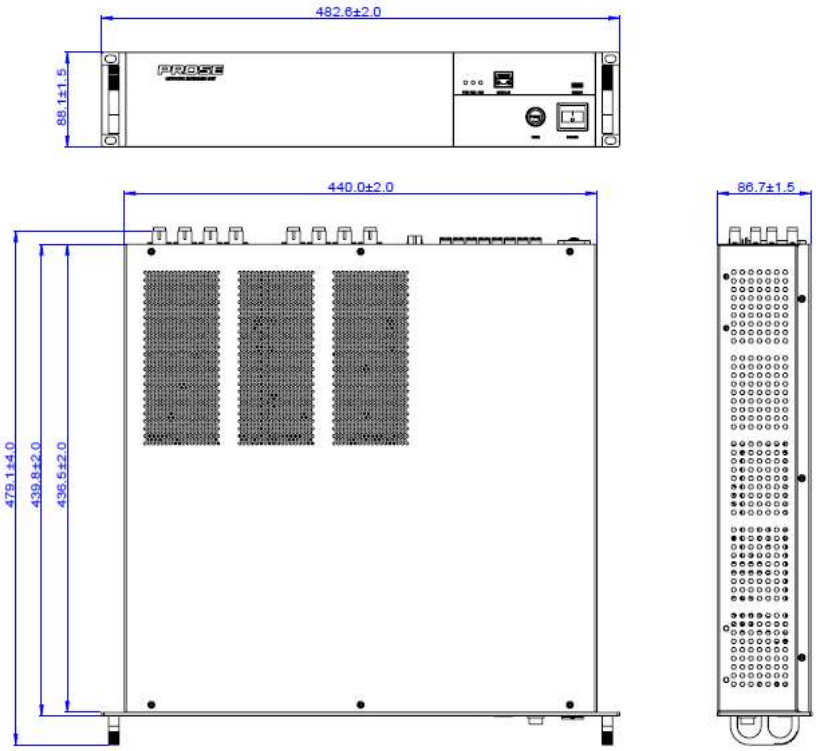


Figure 2-9 NEU dimensions

2.1.3.2 NEU front panel and rear panel

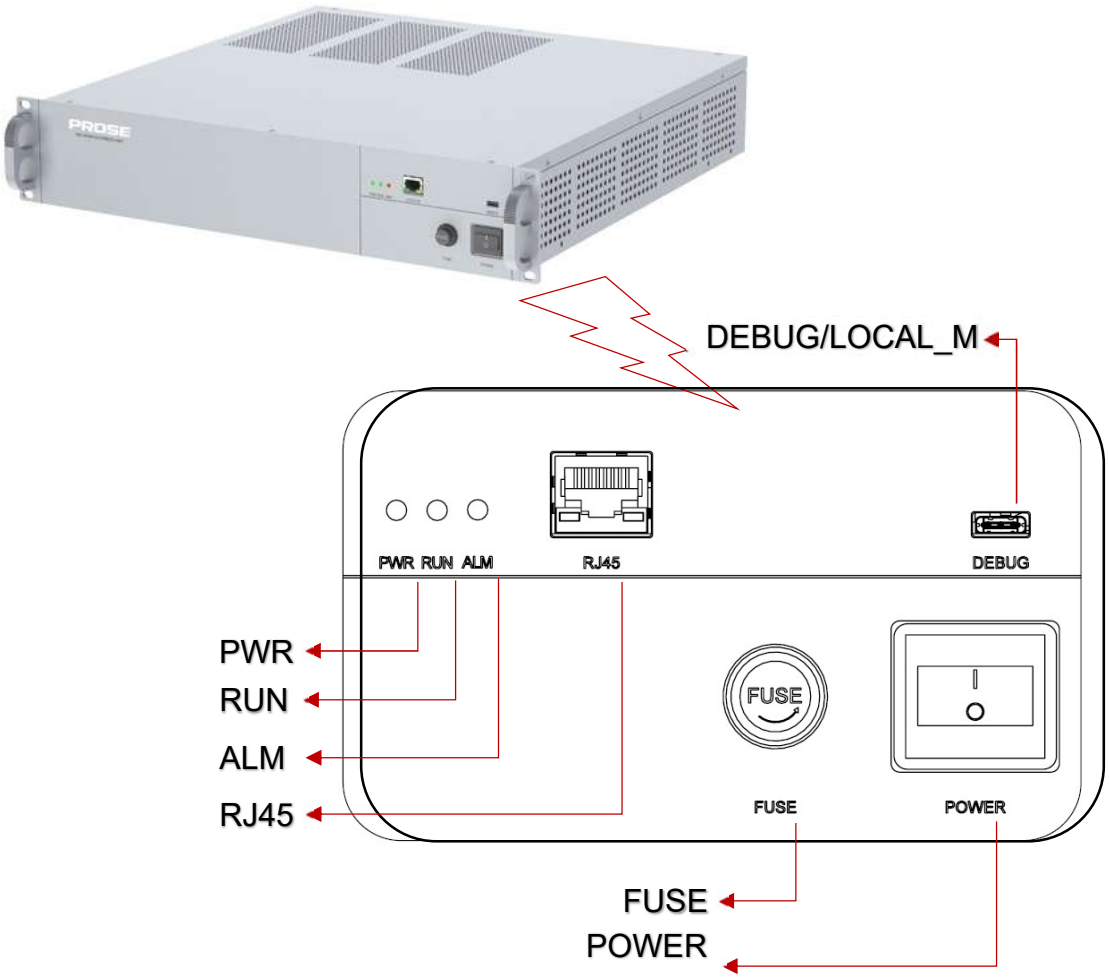


Figure 2-10 Ports in the NEU front panel

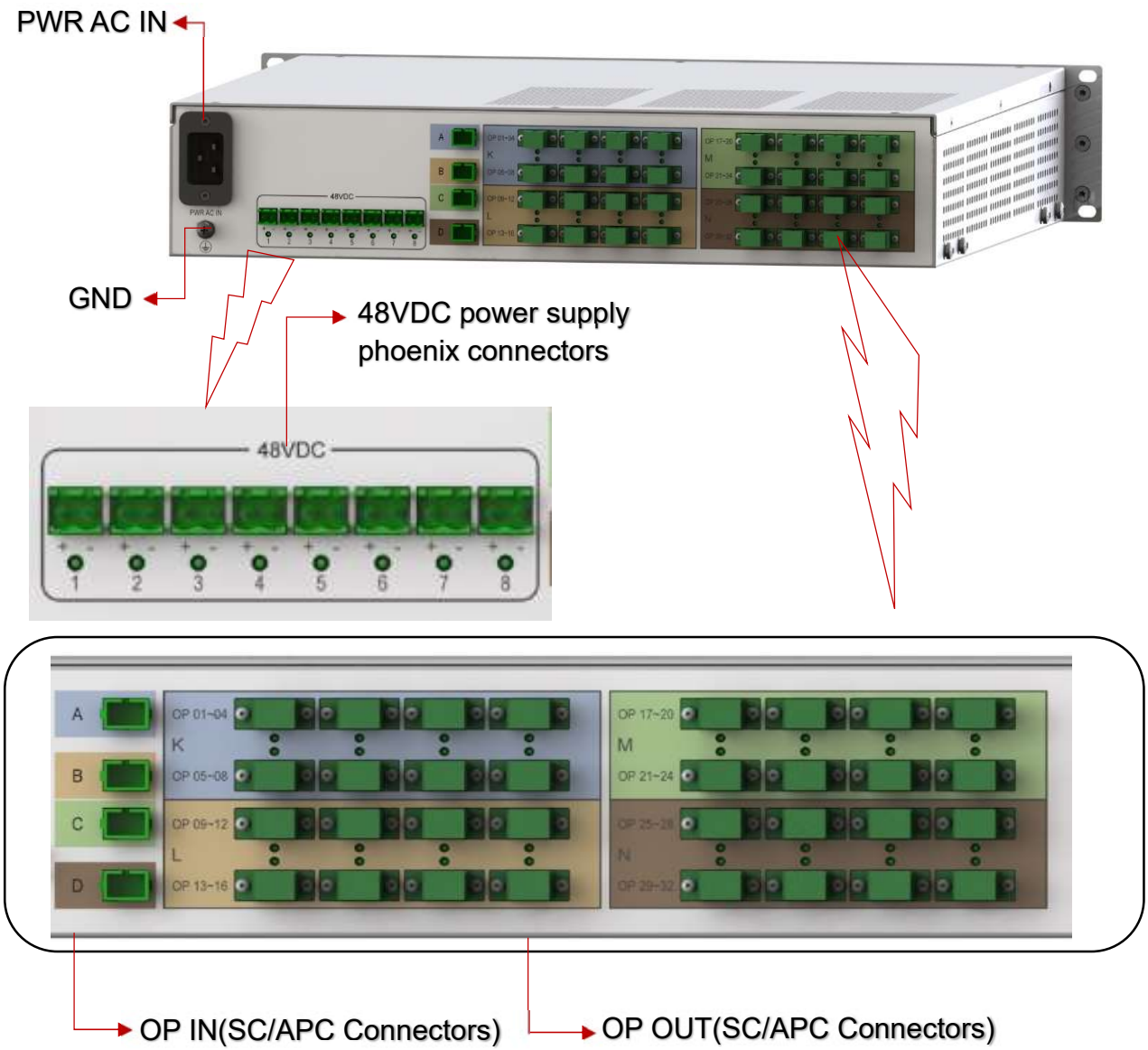


Figure 2-11(a) Ports in the NEU (NEU-4F32F-XX) rear panel

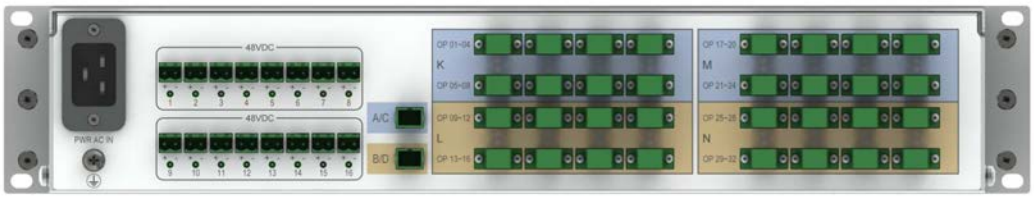


Figure 2-11(b) Ports in the NEU (NEU-2F32F-XX) rear panel

Table 2-4 Ports and indicators on the NEU panels

Item	Silkscreen	Remarks
(NEU) Ports in the front panel	RJ45	Network interface
	DEBUG	Debugging interface
	POWER	Power switch
	FUSE	Overload protection
Item	**Silkscreen**	**Remarks**
(NEU) Ports in the rear panel	PWR AC IN	AC Power input
	GND	NEU equipment grounding
	48 VDC (1~8)	48 VDC power supply for IM2U
	A/B/C/D	4 x Signal input, connect with optical fiber line
	K OP 01~04 OP 05~08	Signal output, connect with optical fiber line
	L OP 09~12 OP 13~16	Signal output, connect with optical fiber line
	M OP 17~20 OP 21~24	Signal output, connect with optical fiber line
	N OP 25~28 OP 29~32	Signal output, connect with optical fiber line

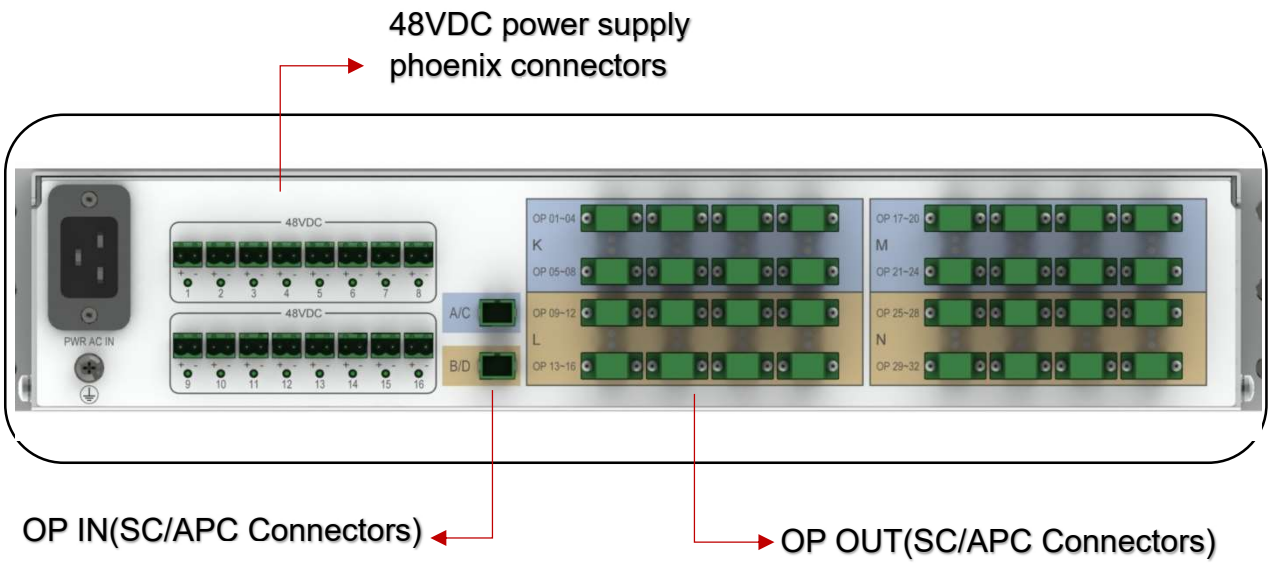


Figure 2-12 Ports in the NEU (NEU-2F32F-XX) rear panel

Table 2-5 Ports and indicators on the NEU panels

Item	Silkscreen	Remarks
(NEU) Ports in the front panel	RJ45	Network interface
	DEBUG	Debugging interface
	POWER	Power switch
	FUSE	Overload protection
Item	**Silkscreen**	**Remarks**
(NEU) Ports in the rear panel	PWR AC IN	AC Power input
	GND	NEU equipment grounding
	48 VDC (1~8)	48 VDC power supply for IM2U
	A/C B/D	2 x Signal input, connect with optical fiber line
	K OP 01~04 OP 05~08	Signal output, connect with optical fiber line
	L OP 09~12 OP 13~16	Signal output, connect with optical fiber line
	M OP 17~20 OP 21~24	Signal output, connect with optical fiber line
	N OP 25~28 OP 29~32	Signal output, connect with optical fiber line

Table 2-6 NEU indicators

ITEM	Indicator	Color	Status	Meaning
NEU Monitoring board	PWR	Green	Steady on	The power input is available
			Steady off	No power input is available
	RUN	Green	Blinking	The software works fine
			Steady on or off	Software operating abnormally or no power
	ALM	Red	Steady on	No alarms are generated
			Steady off	The system has no alarm

2.1.3.3 NEU Configuration

There are several kinds of configurations for NEU according to customer requirements.

1) The communication ports named with “DUBGE” or “LOCAL_M”;

2) DC-48V power supply ports quantity 8 or 16;

3) Optical ports (OP IN) quantity 4 or 2.

2.1.4 IRU-O indoor Type

2.1.4.1 IRU-O indoor Type Exterior

Figure 2-13 IRU-O exterior

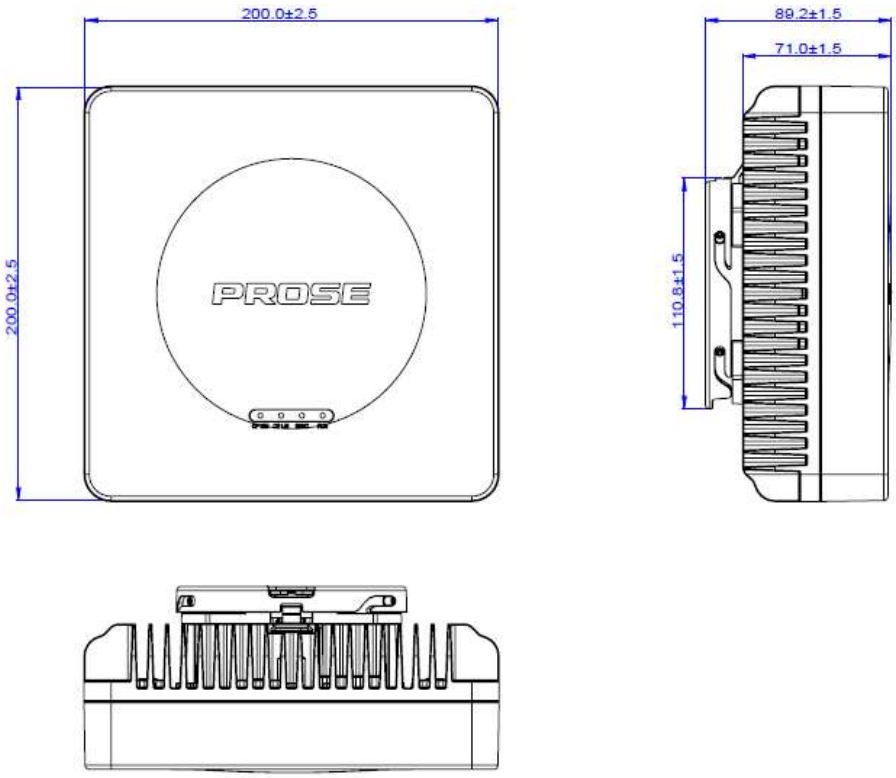


Figure 2-14 IRU-O dimensions

2.1.4.2 IRU-O indoor Type Ports

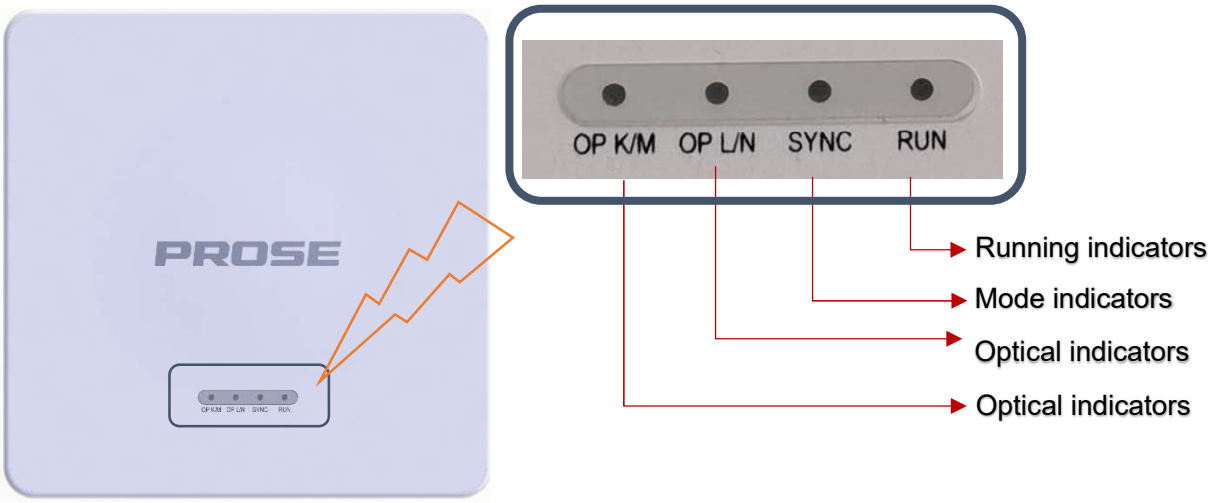


Figure 2-15 Indicators on IRU-O front panel

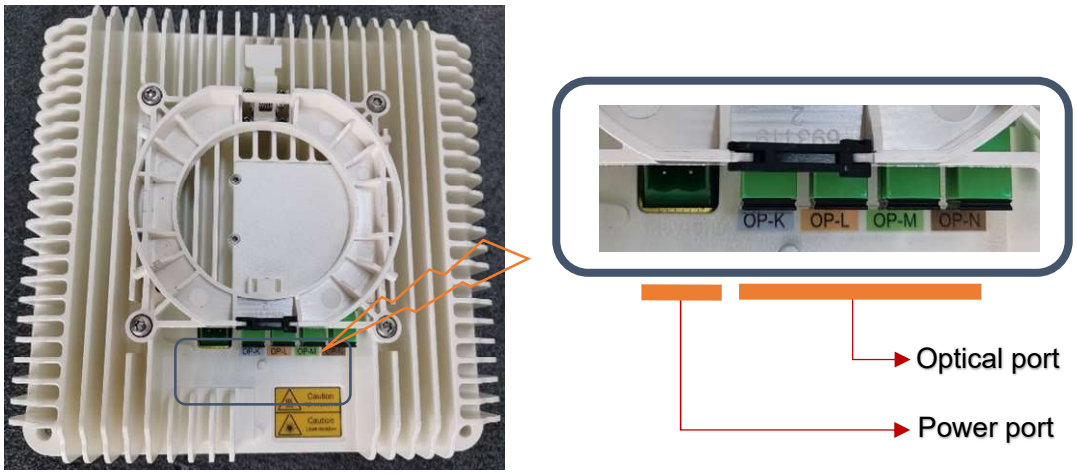


Figure 2-16 Ports on IRU-O (4 optical ports) rear panel

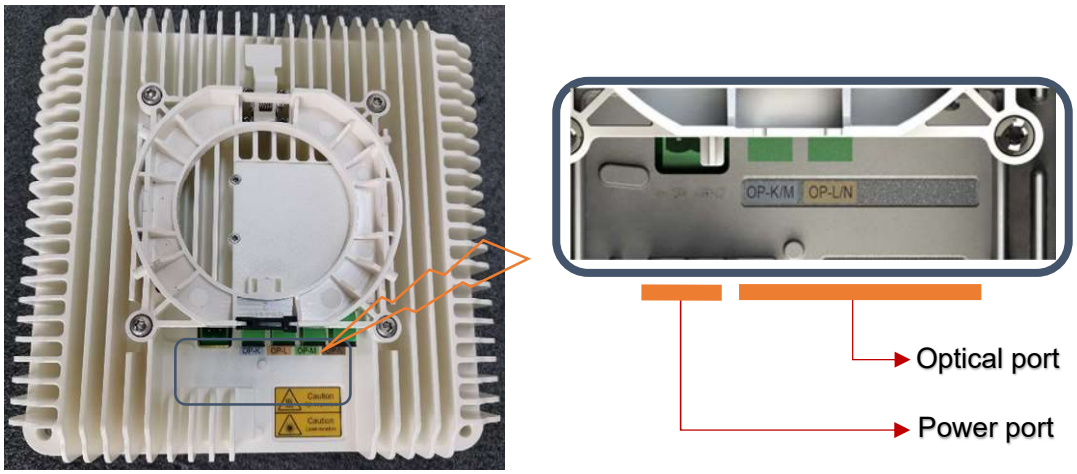


Figure 2-17 Ports on IRU-O (2 optical ports) rear panel

Table 2-7 IRU-O indicators

ITEM	Indicator	Color	Status	Meaning
Ports in the top panel	OP K/M	Green	Blinking quickly (frequency 1s)	The optical power received of port K is normal.
			Blinking Slowly (frequency 4s)	The optical power received of port M is normal.
			Steady on	The optical power received of port K and port M are all normal.
			steady off	The optical power received of port K or port M is abnormal or lower than the detecting range.
	OP L/N	Green	Blinking quickly (frequency 1s)	The optical power received of port L is normal.
			Blinking Slowly (frequency 2s)	The optical power received of port N is normal.
			Steady on	The optical power received of port L and port N are all normal.
			steady off	The optical power received of port L or port N is abnormal or lower than the detecting range
	SYNC	Green	Steady on	IRU-O synchronizes with the BTS successfully in TDD mode working.
			steady off	IRU-O is out of synchronization with the BTS in TDD mode working or no TDD mode.
	RUN	Green	Blinking (frequency 1s)	IRU-O is running normally.
			Steady on	IRU-O is running abnormally.
			Steady off	No power or no running

2.1.4.3 IRU-O indoor Type Configuration

There are 2 kinds of configurations for IRU-O indoor type according to customer requirements with optical port quantity 4 or 2.

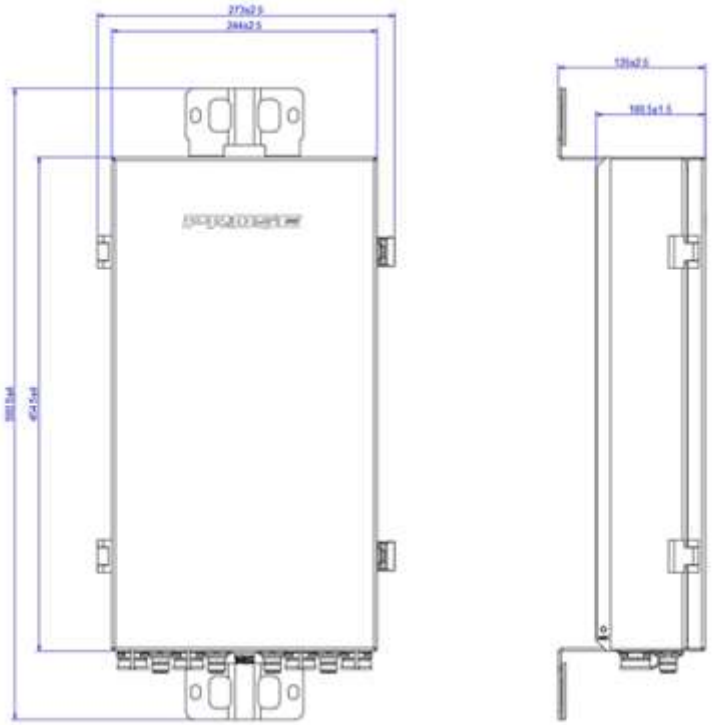
2.1.5 IRU-O outdoor Type

2.1.5.1 IRU-O outdoor Type Exterior

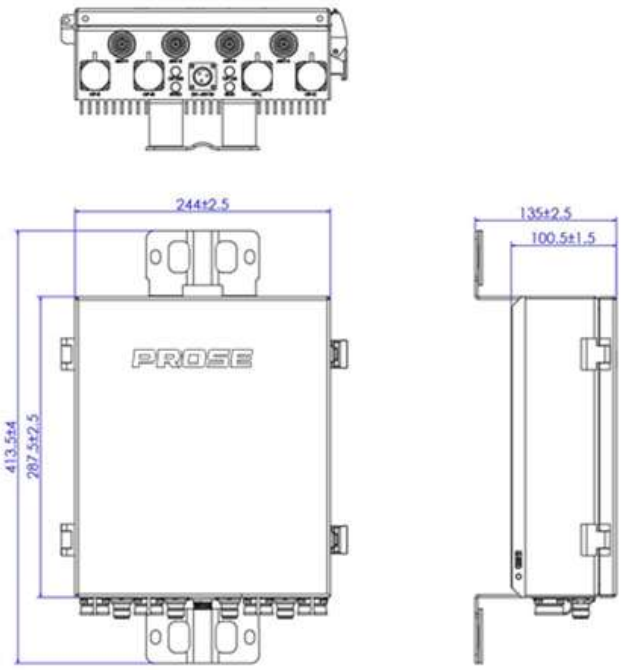
Combiner build in Type with full configuration

Without Combiner Type

Figure 2-18 IRU-O exterior



Combiner build in Type



without Combiner Type

Figure 2-19 IRU-O outdoor Type dimensions

2.1.5.2 IRU-O outdoor Type Ports

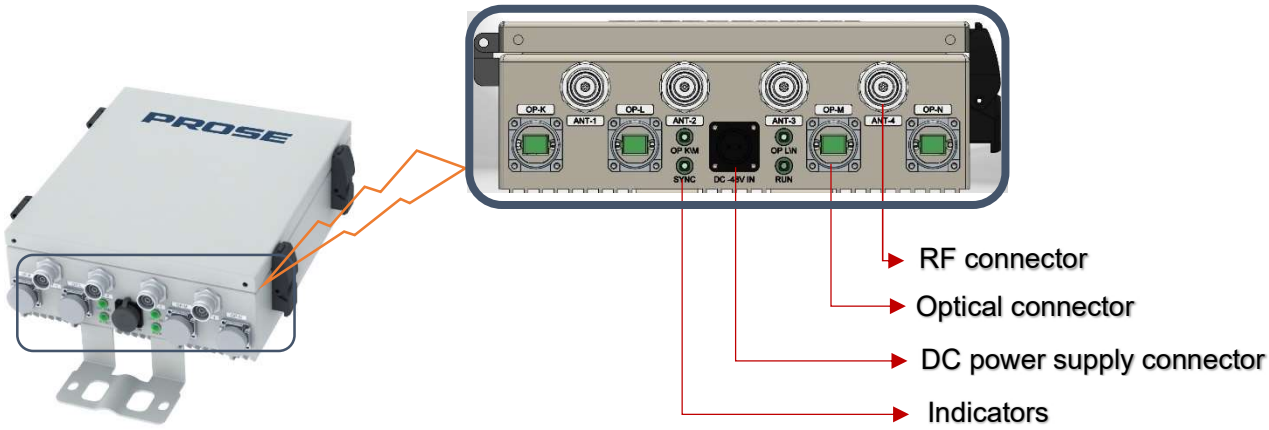


Figure 2-20 Ports and indicators on IRU-O front panel

Table 2-8 IRU-O outdoor Type indicators

ITEM	Indicator	Color	Status	Meaning
Ports in the front panel	OP K/M	Green	Blinking quickly (frequency 1s)	The optical power received of port K is normal.
			Blinking Slowly (frequency 4s)	The optical power received of port M is normal.
			Steady on	The optical power received of port K and port M are all normal.
			steady off	The optical power received of port K or port M is abnormal or lower than the detecting range.
	OP L/N	Green	Blinking quickly (frequency 1s)	The optical power received of port L is normal.
			Blinking Slowly (frequency 2s)	The optical power received of port N is normal.
			Steady on	The optical power received of port L and port N are all normal.
			steady off	The optical power received of port L or port N is abnormal or lower than the detecting range
	SYNC	Green	Steady on	IRU-O synchronizes with the BTS successfully in TDD mode working.
			steady off	IRU-O is out of synchronization with the BTS in TDD mode working or no TDD mode.
	RUN	Green	Blinking (frequency 1s)	IRU-O is running normally.
			Steady on	IRU-O is running abnormally.
			Steady off	No power or no running

2.1.5.3 IRU-O outdoor Type Configuration

There are several kinds of configurations for IRU-O outdoor type according to customer requirements.

1) The RF output port quantity 4 or 2;

2) The optical port quantity 4 or 2;

3) The cabinet has 2 different size.

2.2 Product Specifications

2.2.1 PBMU

	Uplink	Downlink
Frequency	Can be customized	
Gain	-20 ± 2 dB	-20 ± 2 dB
RF Output Power	≤ -25 dBm (RF)	---
Optical Power	---	0 ± 2 dBm (O/P)
Gain Control Range (Power balance per operator)	25 dB / 0.1 dB step	25 dB / 0.1 dB step
Gain Control Range (Power balance per band)	15 dB / 1 dB step	15 dB / 1 dB step
VSWR	≤ 2.0:1	≤ 2.0:1
Max. operation Input Power	---	≤ 20 dBm
Impedance	50 Ω	50 Ω
Optical Wavelength	1310 nm	1550 nm
Power Supply	DC-48V ± 10%	
Power Consumption	≤ 70 W	
Operating temperature range	-10°C to +45°C	
Storage temperature range	-40°C to +85°C	
Relative humidity	10% - 95%	
Ingress protection	IP40 for indoor	
Monitoring and control	LAN-RJ45 (local)	
	4G&5G wireless modem / Ethernet (remote)	
Cooling	Nature cooling	
Dimensions	483 x 400 x 132 mm (3U 19’’ Rack)	
Weight	≤ 13 Kg	
Optical connector	16 sets x SC/APC (4G 2x2 MIMO)	
	8 sets x SC/APC (5G 4x4 MIMO)	
RF connector	IM2U: 16 x QMA-Female PBU: 32 x QMA-Female (8 sets of Tx/RX ports, 4 ports per each set, and each set support one frequency band)	
Installation	19” Rack Mounting	

2.2.2 IM2U

	Uplink	Downlink
Frequency	Can be customized	
Gain	-5 ± 2 dB	-5 ± 2 dB
Ripple in Band	± 3 dB	± 3 dB
RF Output Power	≤ -10 dBm (RF)	---
Optical Power	---	0 ± 2 dBm (O/P)
VSWR	≤ 2.0:1	≤ 2.0:1
Max. Non-destructive Input Power	---	10 dBm
Impedance	50 Ω	50 Ω
Optical Wavelength	1310 nm	1550 nm
Gain Control Range	15 dB / 1 dB step, separate for each path	15 dB / 1 dB step, separate for each path
Power Supply	DC -48V ± 10%	
Power Consumption	≤ 60 W	
Operating temperature range	-10°C to +45°C	
Storage temperature range	-40°C to +85°C	
Relative humidity	10% - 95%	
Ingress protection	IP40 for indoor	
Monitoring and control	LAN-RJ45 (local)	
	4G&5G wireless modem/ Ethernet (remote)	
Cooling	Nature cooling	
Dimensions	483 x 400 x 88 mm (2U 19” Rack)	
Weight	≤ 10 Kg	
Optical connector	8 sets x SC/APC (5G 4x4 MIMO)	
	16 sets x SC/APC (4G 2x2 MIMO)	
RF connector	TX/RX: 16 x QMA-Female	
Installation	19” Rack Mounting	
Environment Protections	RoHS	

2.2.3 NEU

	Uplink	Downlink
Frequency	617 - 3980 MHz	617 - 3980 MHz
System gain	0 ± 2 dB	0 ± 2 dB
Ripple in band	≤ 1.5 dB	≤ 1.5 dB
Optical Output power	9 ± 2 dBm (O/P)	0 ± 2 dBm (O/P)
Optical wavelength	1310 nm	1550 nm
Power supply	AC110~240V, 50/60Hz	
DC power output	43 - 57 VDC	
Power Consumption	≤ 90 W (No-load, without IRU-O connection)	
Operating temperature range	-10°C to +45°C	
Storage temperature range	-40°C to +85°C	
Relative humidity	10% - 95%	
Ingress protection	IP40 for indoor	
Monitoring and control	LAN-RJ45 (local)	
Cooling	Nature cooling	
Function Supported	Over current protection	
	Over temperature protection	
	Overload protection	
	Short circuit protection	
	Low voltage protection	
Dimensions	483 x 440 x 88 mm (2U 19” Rack)	
Weight	≤ 12 Kg	
Fiber optical connectors	32 x SC/APC (to IRU)	
	4 x SC/APC (to IM2U/PBMU)	
Mounting	Wall or rack	

2.2.4 IRU-O indoor Type

	Uplink	Downlink
Frequency	Can be customized	
Gain	31 ± 2 dB	31 ± 2 dB
Antenna Gain	869MHz to 894MHz: 2.63 dBi	869MHz to 894MHz: 2.63 dBi
	729MHz to 746MHz: 3.06dBi	729MHz to 746MHz: 3.06dBi
	746MHz to 756MHz: 3.06dBi	746MHz to 756MHz: 3.06dBi
	1930MHz to 1995MHz: 1.50dBi	1930MHz to 1995MHz: 1.50dBi
	2110MHz to 2200MHz: 5.43dBi	2110MHz to 2200MHz: 5.43dBi
	2496MHz to 2690MHz: 5.14dBi	2496MHz to 2690MHz: 5.14dBi
	3450MHz to 3550MHz:2dBi	3450MHz to 3550MHz:2dBi
	3700MHz to 3980MHz:2dBi	3700MHz to 3980MHz:2dBi
Ripple in band	±3 dB	±3 dB
RF output power	---	24 ± 1 dBm (RF per band per port)
Optical output power	9 ± 2 dBm	---
Gain control range	15 dB / 1 dB step	15 dB / 1 dB step
ALC control	10 dB overdrive protection	10 dB overdrive protection
Intermodulation & Spurious Emission Mask	Meets 3GPP TS 25.106 for UMTS, 3GPP TS 36.106 for LTE, 3GPP TS 38.106 for NR	
Transmission delay	≤ 1 μS	≤ 1 μS
EVM	≤ 3%	≤ 3%
Spurious emissions (Out of band)	≤ -36 dBm/9 KHz ~ 1 GHz	≤ -36 dBm/9 KHz ~ 1 GHz
	≤ -30 dBm/1 GHz ~ 12.75 GHz	≤ -30 dBm/1 GHz ~ 12.75 GHz
Max. non-destructive input power	-10 dBm	---
Impedance	50 Ω	50 Ω
Optical wavelength	1310 nm	1550 nm
Power supply	40 - 57 VDC	
Power Consumption	≤ 90 W	
Operating temperature range	-10 ºC to +45 ºC	
Storage temperature	-40°C to +85°C	
Relative humidity	10% - 95%	
Ingress protection	IP50	
Monitoring and control	remote control via IM2U	
Dimensions	200 x 200 x 71 mm	
Weight	≤ 2.6 kg	
Optical connector	4 x SC/APC (4x4 MIMO port)	
Installation	Ceiling or wall or pole mounting	
Antenna	Omni antenna Integrated	

2.2.5 IRU-O outdoor Type

		Uplink	Downlink
Frequency		Can be customized	
Gain	869MHz to 894MHz	24 ± 1 dB	24 ± 1 dB
	729MHz to 746MHz	24 ± 1 dB	24 ± 1 dB
	746MHz to 756MHz	24 ± 1 dB	24 ± 1 dB
	1930MHz to 1995MHz	24 ± 1 dB	24 ± 1 dB
	2110MHz to 2200MHz	27 ± 1 dB	27 ± 1 dB
	2496MHz to 2690MHz	27 ± 1 dB	27 ± 1 dB
	3450MHz to 3550MHz	27 ± 1 dB	27 ± 1 dB
	3450MHz to 3550MHz	27 ± 1 dB	27 ± 1 dB
RF output power	869MHz to 894MHz	---	18 ± 1 dBm (RF per band per port)
	729MHz to 746MHz	---	18 ± 1 dBm (RF per band per port)
	746MHz to 756MHz	---	18 ± 1 dBm (RF per band per port)
	1930MHz to 1995MHz	---	21 ± 1 dBm (RF per band per port)
	2110MHz to 2200MHz	---	24 ± 1 dBm (RF per band per port)
	2496MHz to 2690MHz	---	23 ± 1 dBm (RF per band per port)
	3450MHz to 3550MHz	---	24 ± 1 dBm (RF per band per port)
	3450MHz to 3550MHz	---	24 ± 1 dBm (RF per band per port)
Ripple in band		± 3 dB	± 3 dB
Optical output power		9 ± 2 dBm	---
Gain control range		15 dB / 1 dB step	15 dB / 1 dB step
ALC control		10 dB overdrive protection	10 dB overdrive protection
Intermodulation & Spurious Emission Mask		Meets 3GPP TS 25.106 for UMTS, 3GPP TS 36.106 for LTE, 3GPP TS 38.106 for NR	
Transmission delay		≤ 1 μS	≤ 1 μS
EVM		≤ 3%	≤ 3%
Spurious emissions (Out of band)		≤ -36 dBm/9 KHz ~ 1 GHz	≤ -36 dBm/9 KHz ~ 1 GHz
		≤ -30 dBm/1 GHz ~ 12.75 GHz	≤ -30 dBm/1 GHz ~ 12.75 GHz
Max. non-destructive input power		-10 dBm	---
Impedance		50 Ω	50 Ω
VSWR		≤ 2.0:1	≤ 2.0:1
Optical wavelength		1310 nm	1550 nm
Power supply		40 - 57 VDC	
Power Consumption		≤ 90 W	

Operating temperature range	-25 ºC to +55 ºC
Storage temperature	-40°C to +85°C
Relative humidity	5% - 98%
Ingress protection	IP65
Monitoring and control	remote control via IM2U/PBMU
Dimensions	580.5 x 273 x 135 mm (Combiner build in Type) 413.5 x 273 x 135 mm (without Combiner Type)
Weight	≤ 11 kg (Combiner build in Type) ≤ 7 kg (without Combiner Type)
Optical connector	4 x SC/APC (4x4 MIMO port)
Installation	wall or pole mounting

3. Installation

3.1 Installation Preparation

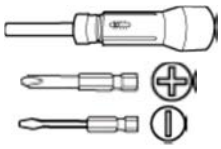
This chapter introduces installation and commissioning flow of the equipment to help installation personnel understand the entire process. Brief introduction to some physical parameters of repeater, such as size, weight, humidity and temperature is also included in this chapter.

3.1.1 Select one site location

1. Make sure access is restricted to qualified personnel
2. Install the product where power supply and feeder cables are accessible.
3. Site location should be far away from heat source and damp environment.
4. Make sure can get the power supply near the site, and the power voltage is stable.
5. Make sure the grounding is well, and lightning protection is good.

3.1.2 Installation tools

You must prepare the following tools and instruments before the installation.

Item	Description	Remark
1	Torque screwdriver kit (Cross head and flat-head M5)	
2	Safety gloves	
3	Safety helmet	
4	Safety goggles	
5	Hammer drill	
6	Rubber Hammer	

7	Marking pen	
8	Wire stripper	
9	Pliers	
10	Measuring tape	
11	Multimeter	
12	Flash lights	
13	Measuring tape	

3.2 Installation steps

3.2.1 Installation

Before any installation, check that the device has no visible damages or defects.

3.2.2 Installation of PBMU

3.2.2.1 Installation Scenarios

A PBMU be installed in cabinet. Installation scenarios must meet heat-dissipation and waterproofing requirements of the PBMU.

3.2.2.2 Installing a PBMU in cabinet

1. Install bracket on the cabinet with the screw. as shown in Figure 3-1. Attention: Please pay attention to mounting of bracket. as shown in Figure 3-2.
2. Push PBMU into the cabinet. as shown in Figure 3-3
3. Use screw to mount PBMU, as shown in Figure 3-4.

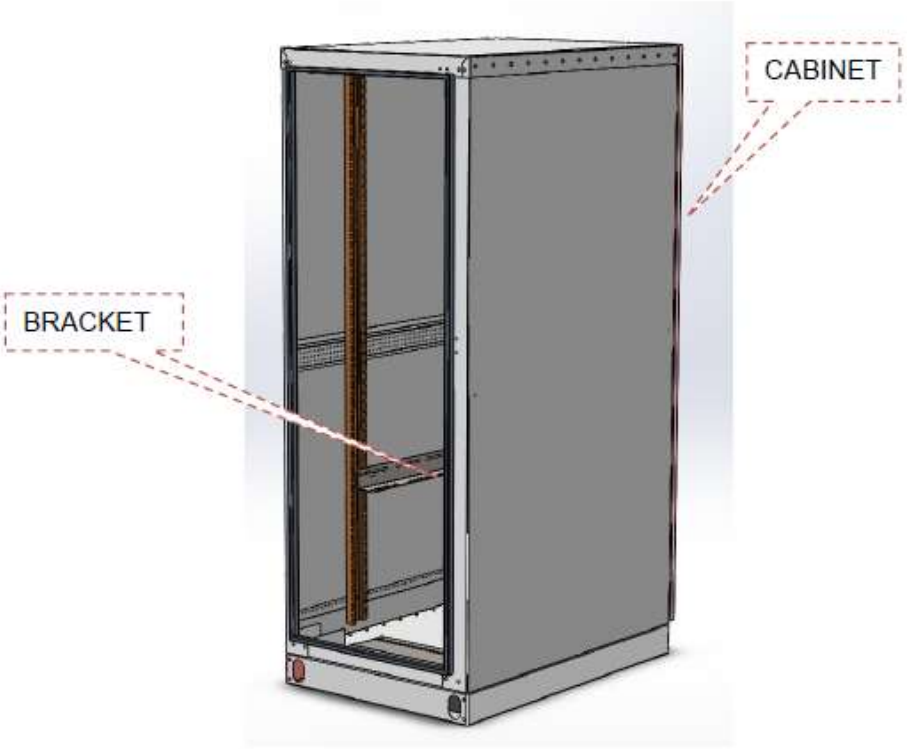


Figure 3-1 pay attention to mounting of bracket.

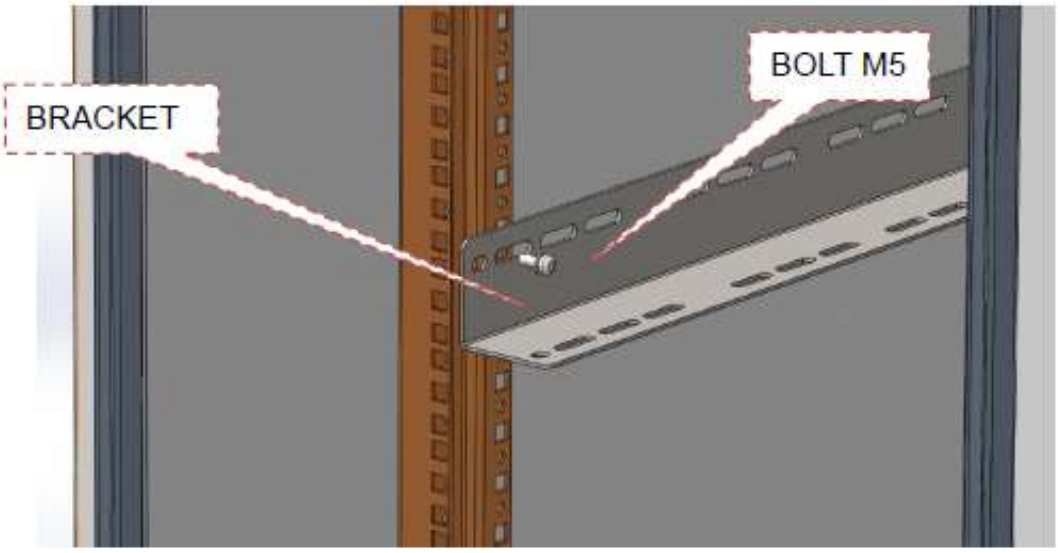


Figure 3-2 Drill holes and Install the Mounting rack on wall

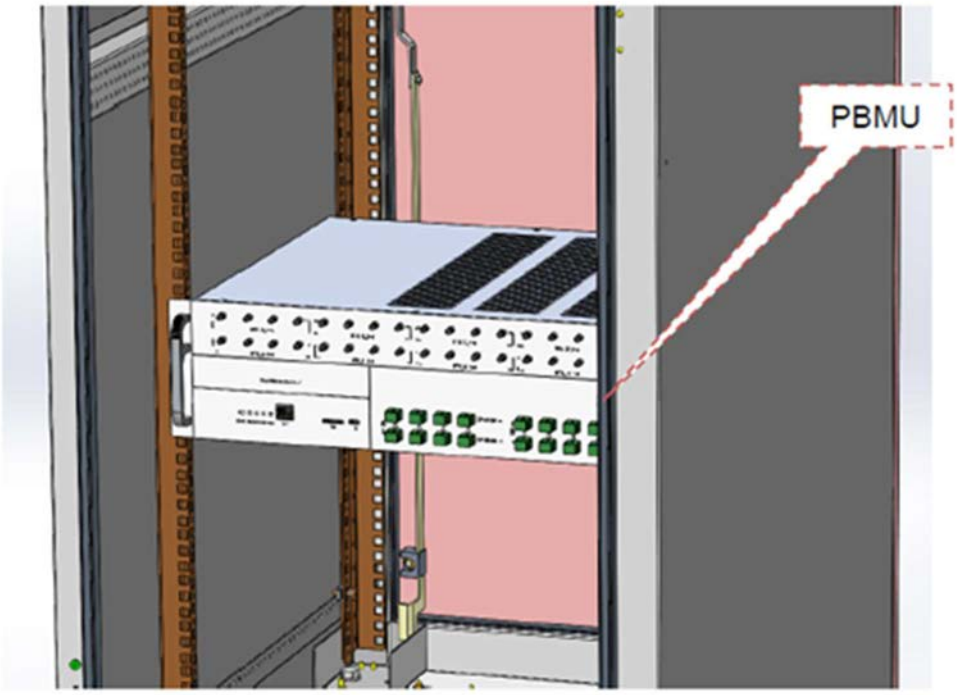


Figure 3-3 Push PBMU into the ca

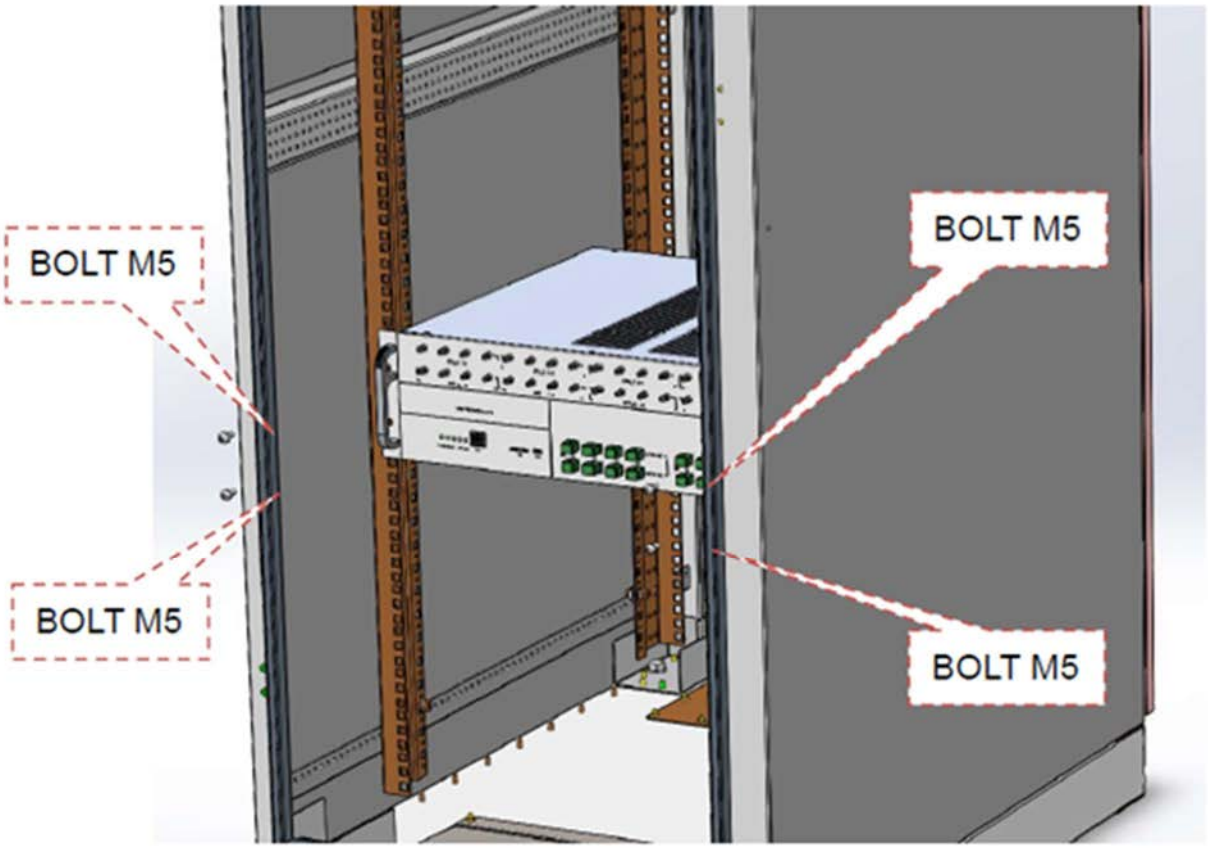


Figure 3-4 Use screw to mount PBMU

3.2.3 Installation of IM2U

3.2.3.1 Installation Scenarios

An IM2U be installed in cabinet. Installation scenarios must meet heat-dissipation and waterproofing requirements of the IM2U.

3.2.3.2 Installing an IM2U in cabinet

1. Install bracket on the cabinet with the screw. as shown in Figure 3-5. Attention: Please pay attention to mounting of bracket. as shown in Figure 3-6.
2. Push IM2U into the cabinet. as shown in Figure 3-7
3. Use screw to mount IM2U, as shown in Figure 3-8.
4. Connect the IM2U to terminal box by patch cord, the patch cord connector type is SC/APC to SC/APC or another type for terminal box
5. Connect the ground cable to ground
6. When connect the power, please check the Power voltage in advance, and need a breaker to protect the IM2U.

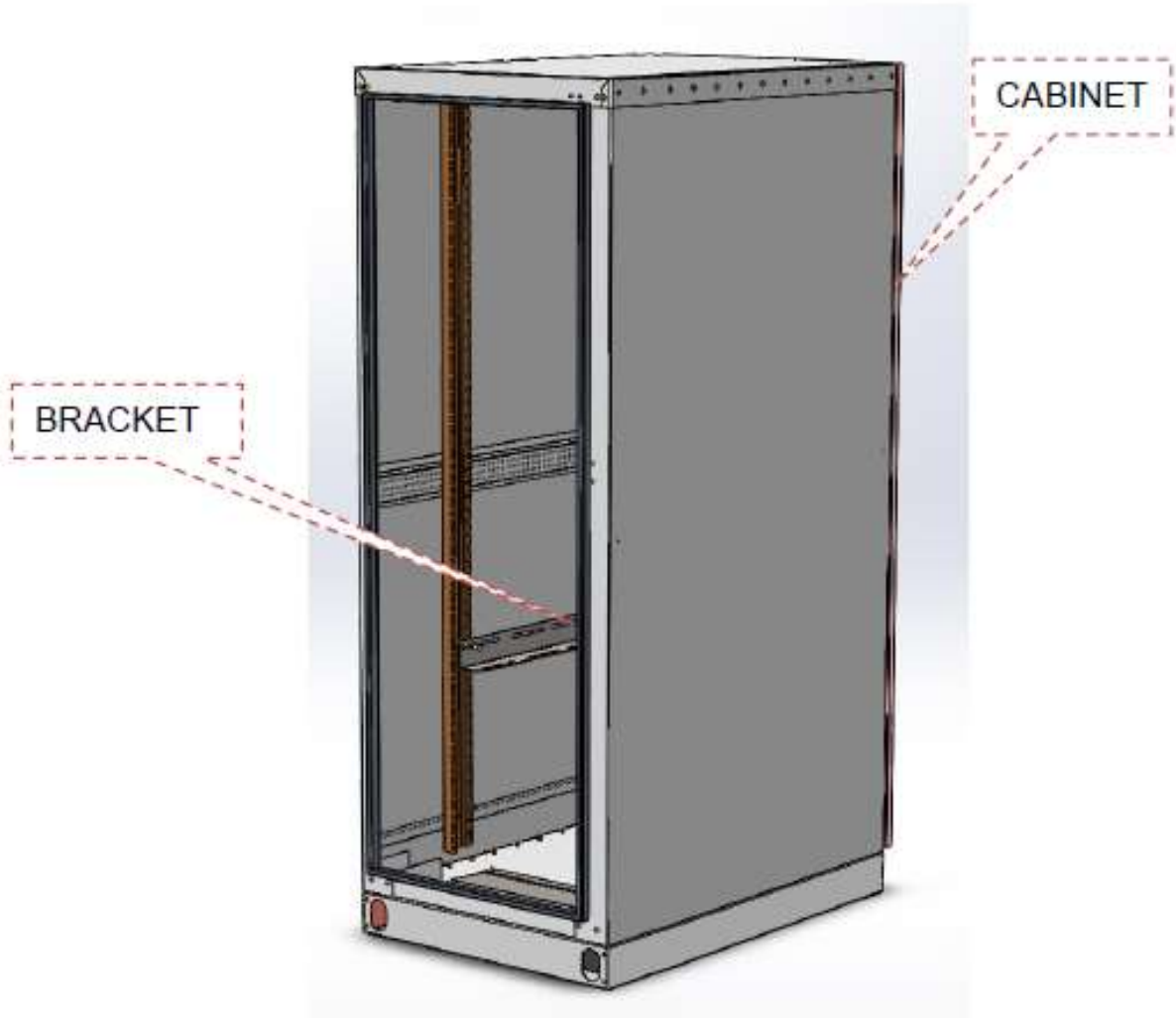


Figure 3-5 pay attention to mounting of bracket.

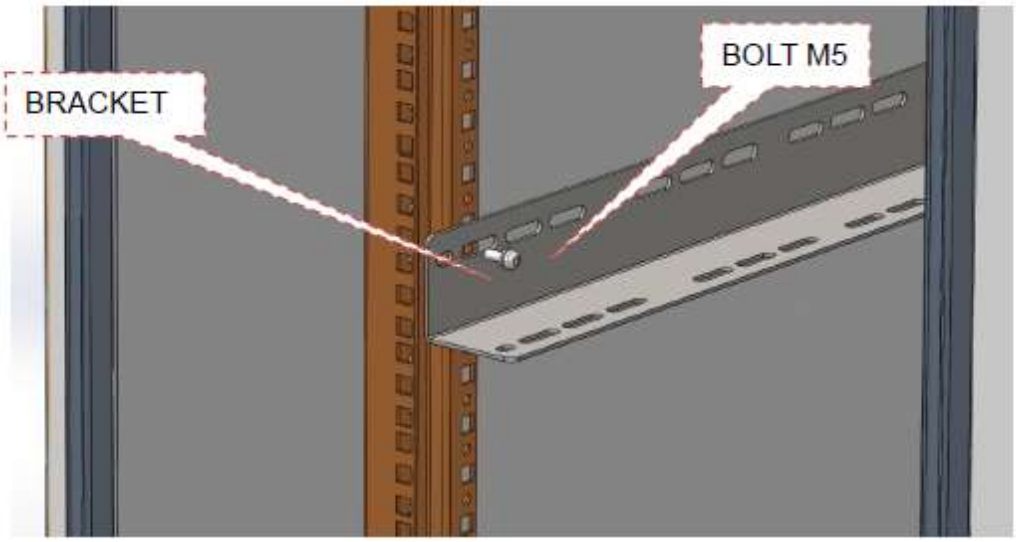


Figure 3-6 Drill holes and Install the Mounting rack on wall

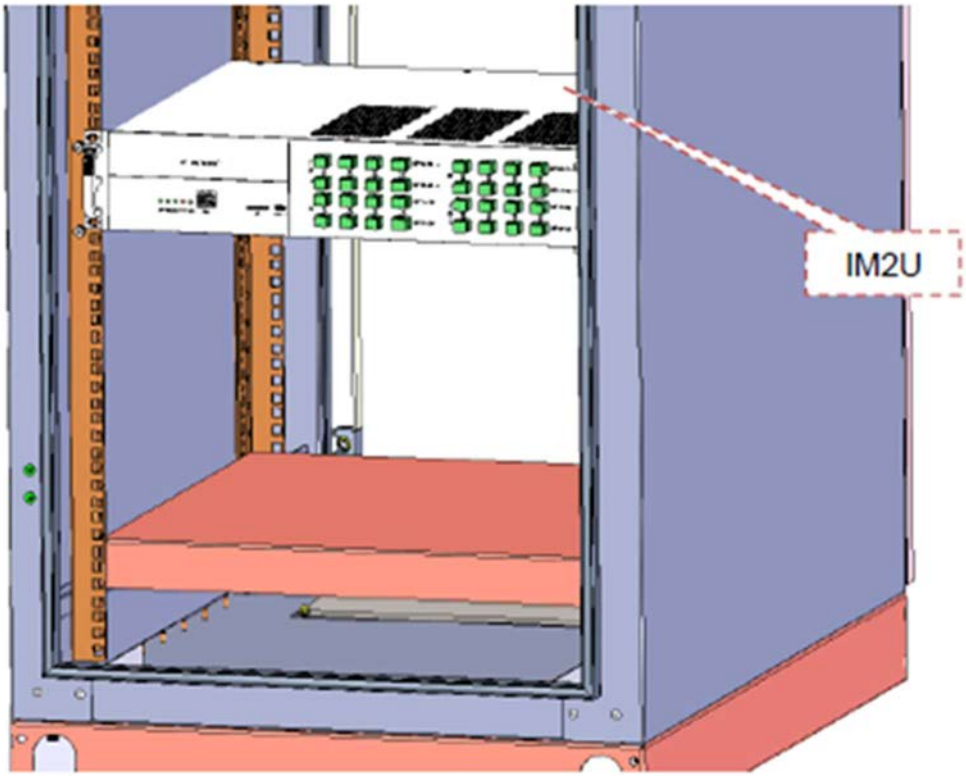


Figure 3-7 Push IM2U into the cabinet.

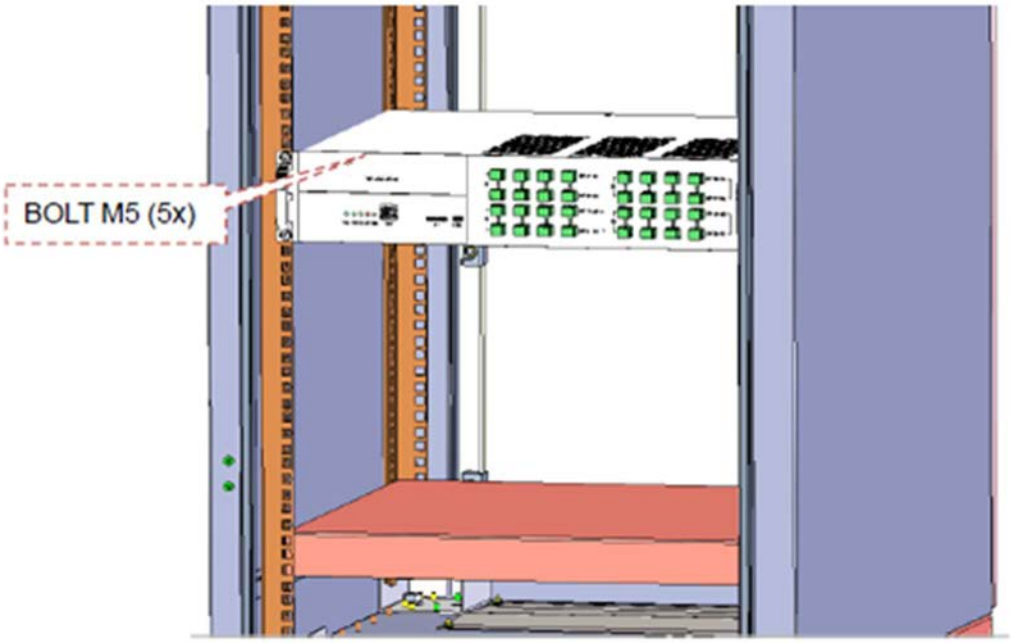


Figure 3-8 Use screw to mount IM2U

3.2.4 Installation of NEU

3.2.4.1 Installation Scenarios

A NEU can be installed on a wall or cabinet. Installation scenarios must meet heat-dissipation and waterproofing requirements of the NEU.

3.2.4.2 Installing an NEU on a wall

1. Check enough space for front and rear door according to Figure 3-9. and make sure the installation location.
2. Fix the mounting rack onto the NEU by tightening with M5x10 reference to Figure 3-10.
3. Choice the hard wall and drawing 4 locating marks for M6x60 expansions bolts reference to Figure 3-11.
4. Drill 4 holes for the expansion bolts reference to the locating mark, put the expansion bolts into the hole and make sure it's tightly reference to Figure 3-12.
5. Fix the NEU onto the mounting rack by tightening the M6x60 expansions bolts using adjustable wrench. Make sure the NEU is tightly fixed to the mounting rack and installation is complete. reference to Figure 3-13.
6. Connect the NEU to terminal box by patch cord, the patch cord connector type is SC/APC to SC/APC or another type for terminal box
7. Connect the ground cable to ground
8. When connect the power, please check the Power voltage in advance, and need a breaker to protect the NEU.

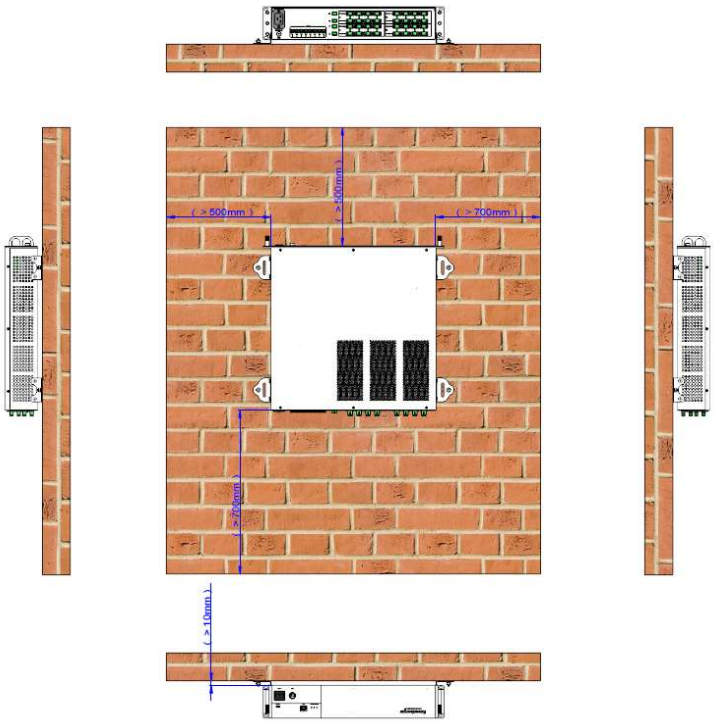


Figure 3-9 Location the holes on the wall

Measure distance between top, bottom, left and right for mounting rack

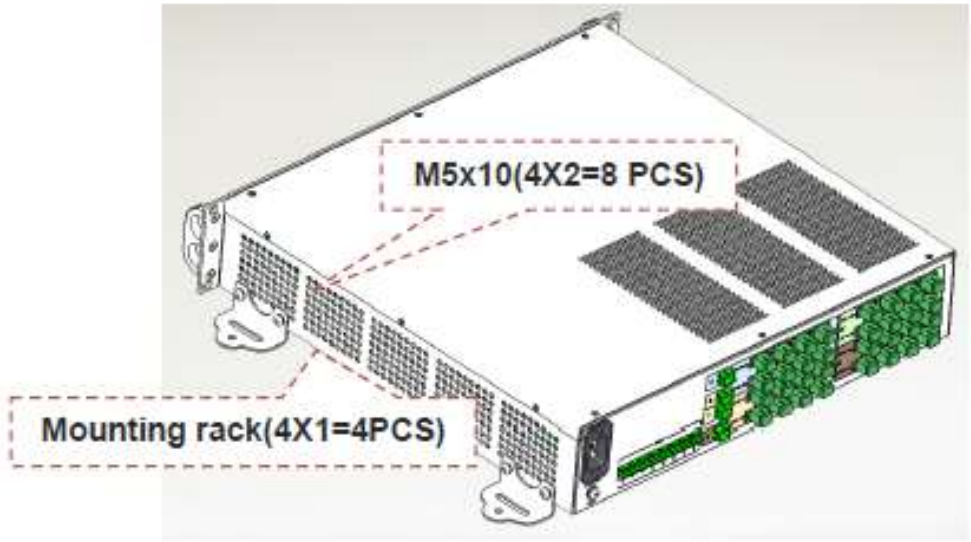


Figure 3-10 Install the mounting support rack

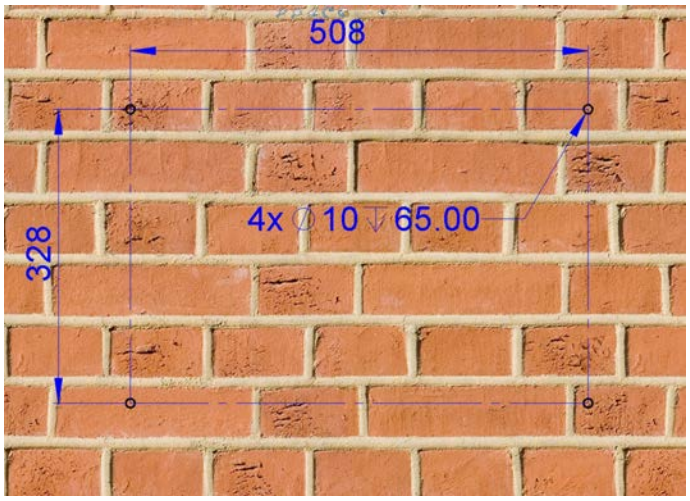


Figure 3-11 Drill holes and Install the Mounting rack on wall

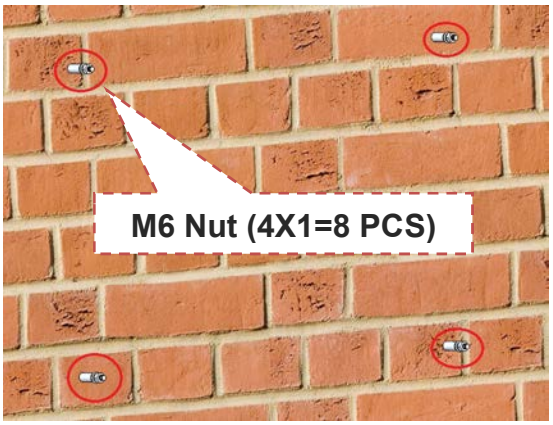


Figure 3.12

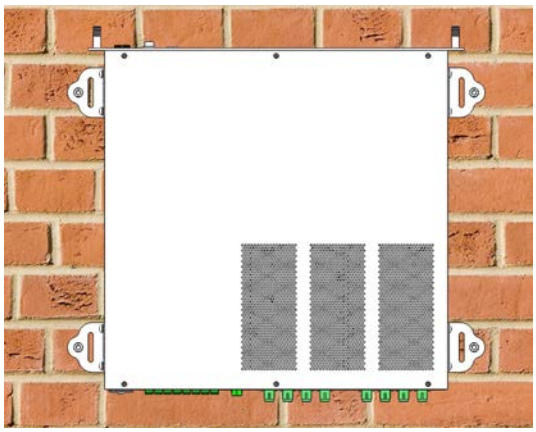


Figure 3.13

3.2.4.3 Installing a NEU in the cabinet.

1. Install bracket on the cabinet with the screw reference to Figure 3-14.

   Attention: Please pay attention to mounting of bracket reference to Figure 3-15.
2. Push NEU into the cabinet reference to Figure 3-16.
3. Use screw to mount NEU reference to Figure 3-17.
4. Connect the NEU to terminal box by patch cord, the patch cord connector type is SC/APC to SC/APC or another type for terminal box
5. Connect the ground cable to ground
6. When connect the power, please check the Power voltage in advance, and need a breaker to protect the NEU.

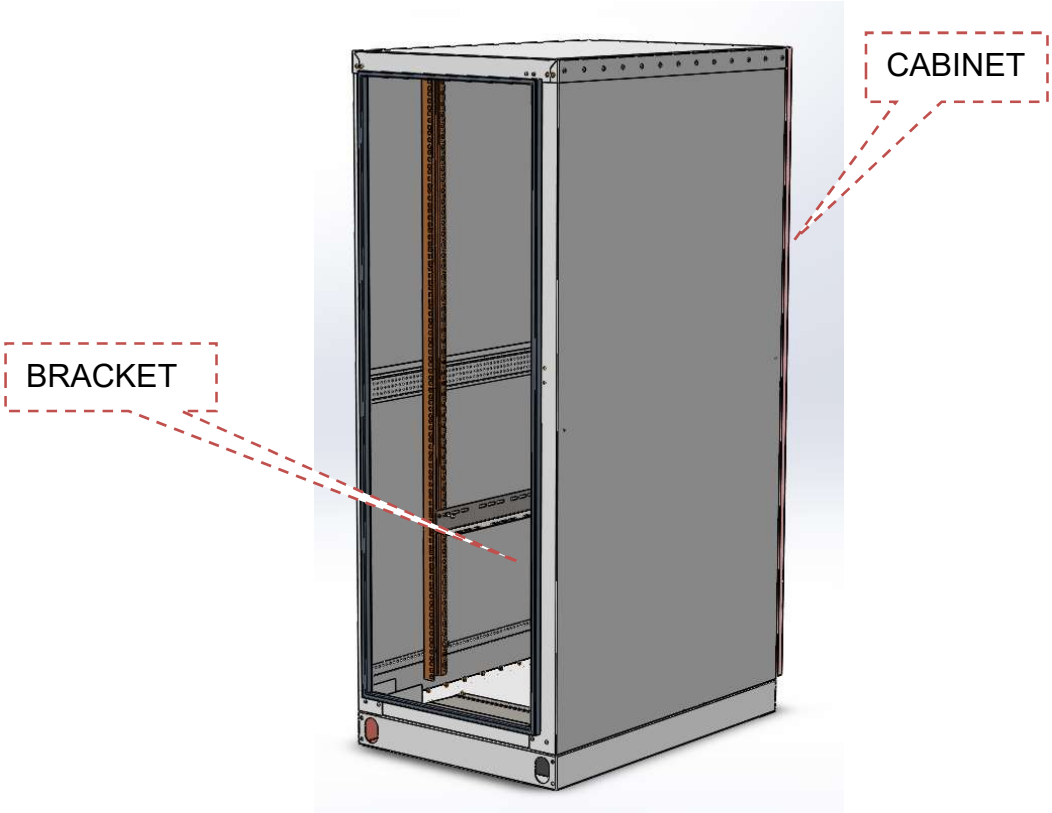


Figure 3-14

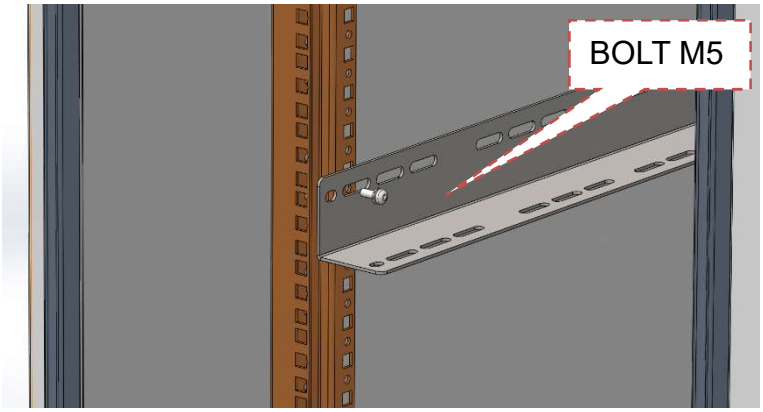


Figure 3-15

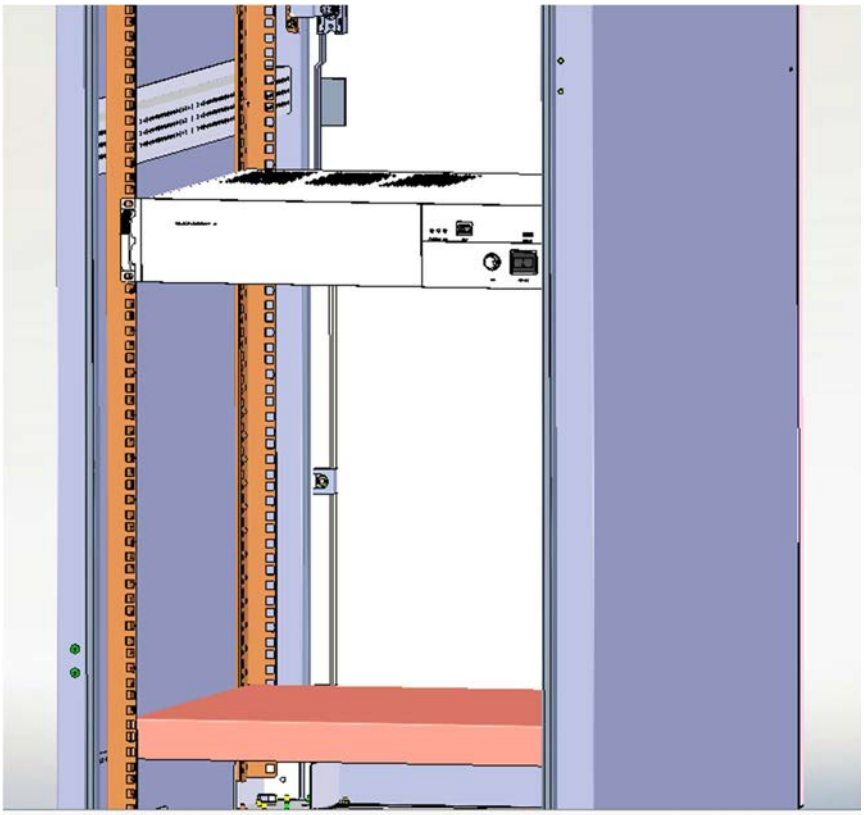


Figure 3-16

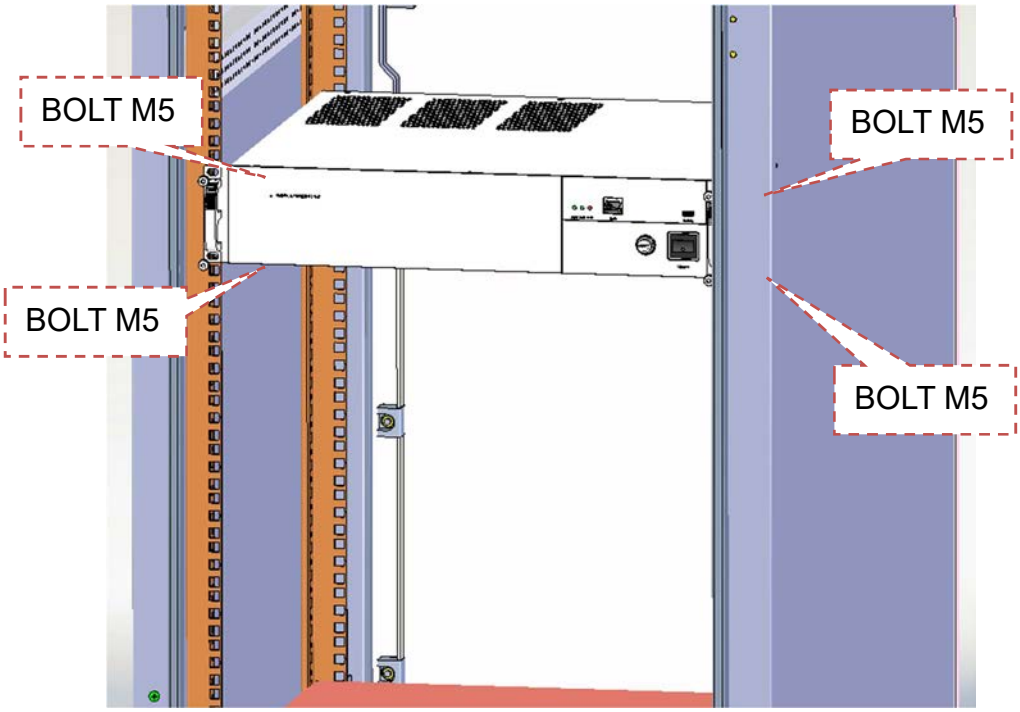


Figure 3-17

3.2.5 Installation of IRU-O indoor Type

3.2.5.1 For Ceiling Applications

For Ceiling A Applications

Step 1. Select an area for installation near ceiling keel. Drill three holes per (Figure 3-18). Route the screw(M4x50) thru the fastener (Figure 3-19). And the screw from top to bottom thru ceiling mounting hole (Figure 3-20). Place bracket over the screw (M4X50), Adjust the bracket to align the edge of the backplane with the edge of the ceiling. And then use torque screwdriver to tighten the screw to the 1.4N.m (Figure 3-21).

Step 2. Connect the power cable and the fiber cable onto the IRU-O module. Align breach of bracket with direction of plug (Figure 3-22). and ensure that the attachment plate is fully inserted into the bracket (Figure 3-23). Rotate clockwise and hear the spring snapping (Figure 3-24). Ensure that the IRU-O module is properly installed.

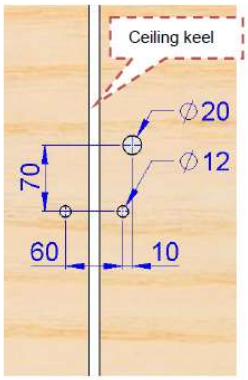


Figure 3-18

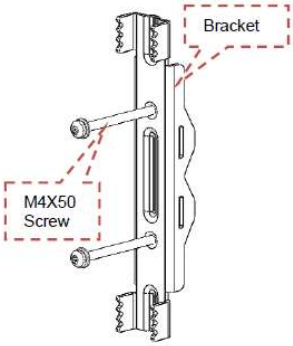


Figure 3-19

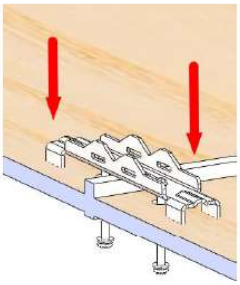


Figure 3-20

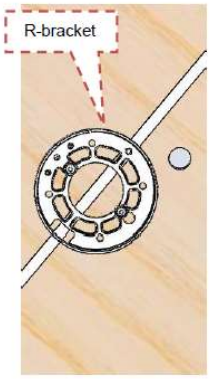


Figure 3-21

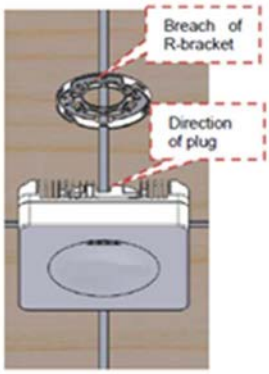


Figure 3-22

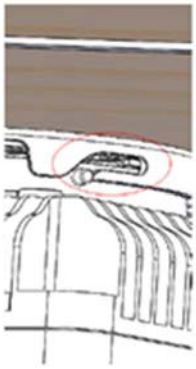


Figure 3-23

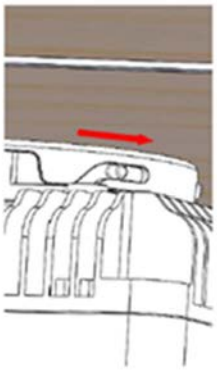


Figure 3-24

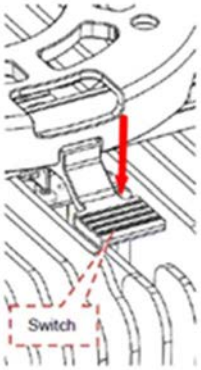


Figure 3-25

For Ceiling B Applications (Accessories for this installation must be purchased separately)

Step 1. Select an area for installation near ceiling. Drill the square holes per (Figure 3-26). Use the Screw(M4X12) to cross the pore plate and IRU-O module (Figure 3-27). Use metal wire mount the beam onto the ceiling keel (Figure 3-28). Use the Screw(M4X12) to tighten the pore plate and beam (Figure 3-29)

Step 2. Connect the power cable and the fiber cable onto the IRU-O module.

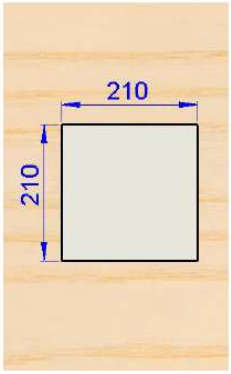


Figure 3-26

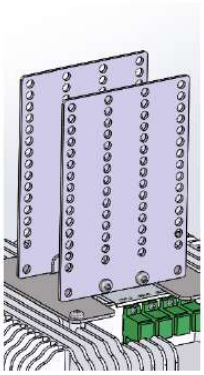


Figure 3-27

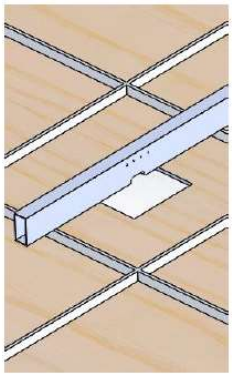


Figure 3-28

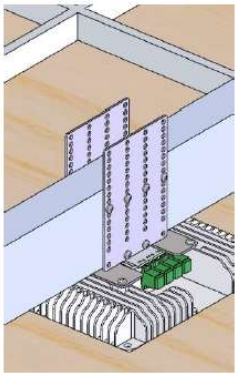


Figure 3-29

3.2.5.2 For Pole or Mast Applications

Step 1. Use the Screw(M4X12) to cross the bracket and fastener, use torque screwdriver to tighten the screw to the 1.4N.m (Figure 3-30). Insert hose clamps thru fastener and around pole (Figure 3-31). Tighten hose clamps to 5.5 Nm torque.

Step 2. Connect the power cable and the fiber cable onto the IRU-O module. Align breach of bracket with direction of plug (Figure 3-32). and ensure that the attachment plate is fully inserted into the bracket. Rotate clockwise and hear the spring snapping (Figure 3-33/34). Ensure that the IRU-O module is properly installed.

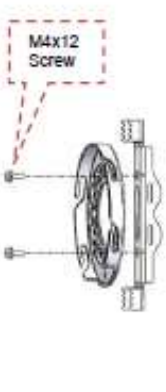


Figure 3-30

Figure 3-31

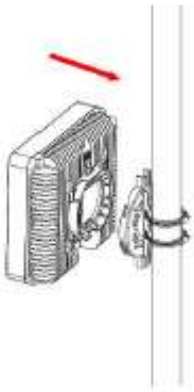


Figure 3-32

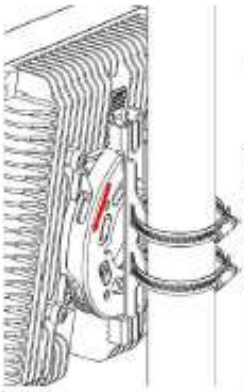


Figure 3-33

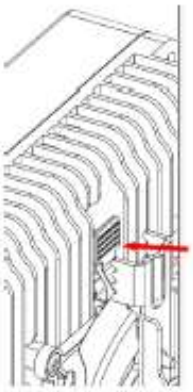


Figure 3-34

3.2.5.3 For Wall Applications

Step 1. Select an area for installation that is at least 2 meter above ground level or floor. Drill four holes per (Figure 3-35). Install expansion bolts into each of the pre-drilled holes (Figure 3-36). Place bracket over the 4 expansion bolts and affix using screw(M4X50) (Figure 3-37).

Step 2. Connect the power cable and the fiber cable onto the IRU-O module. Align breach of bracket with direction of plug (Figure 3-38). and ensure that the attachment plate is fully inserted

into the bracket. Rotate clockwise and hear the spring snapping (Figure 3-39). Ensure that the IRU-O module is properly installed.

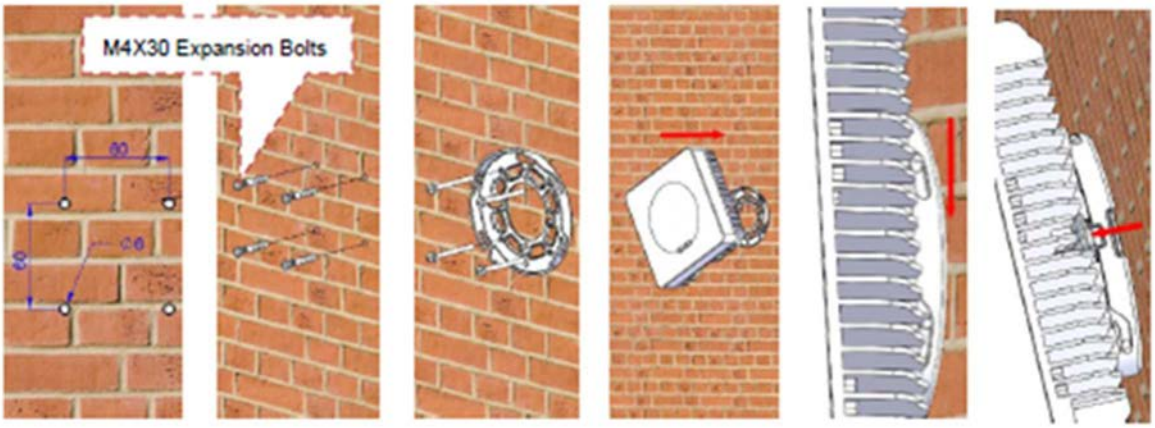


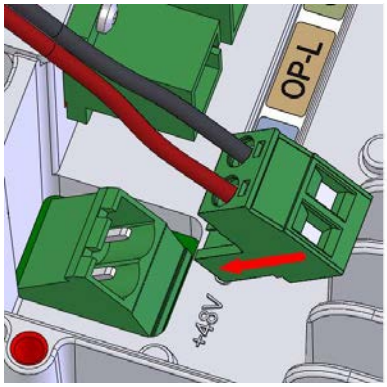
Figure 3-35 **Figure 3-36** **Figure 3-37** **Figure 3-38** **Figure 3-39** **Figure 3-40**

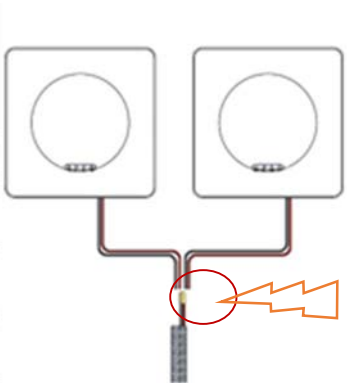
Remove Steps

Hold the IRU-O module in front and back with both hands, use index or middle finger to press the switch and keep the switch open. Rotate the IRU-O module counterclockwise and remove the IRU-O module.

Line Diagram

1. Insert power line plug into socket (Figure 3-41).
2. Insert power line into copper pipe, then press flat copper pipe with vise, finally intertwine copper pipe with electrical tape (Figure 3-42, Figure 3-43, Figure 3-44, Figure 3-45, Figure 3-46, Figure 3-47, Figure 3-48, Figure 3-49).
3. Welding two optical fiber together with equipment.





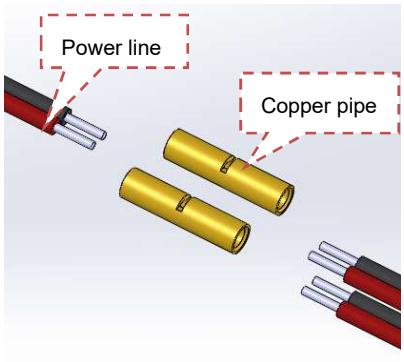


Figure 3-41 **Figure 3-42** **Figure 3-43**

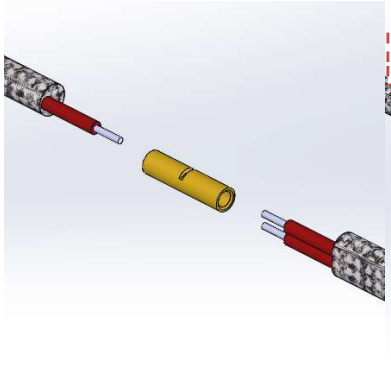


Figure 3-44

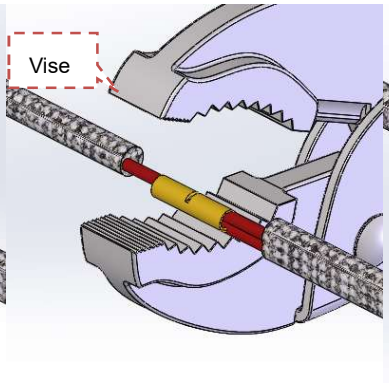


Figure 3-45

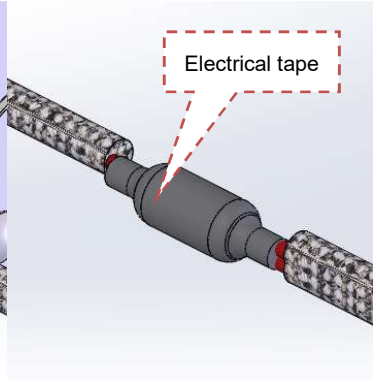


Figure 3-46

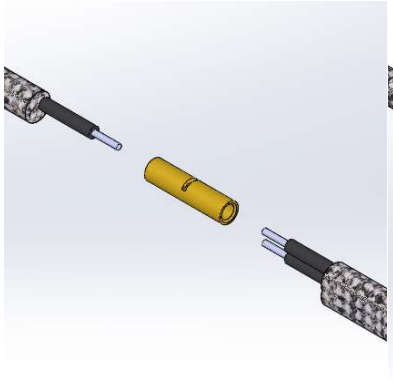


Figure 3-47

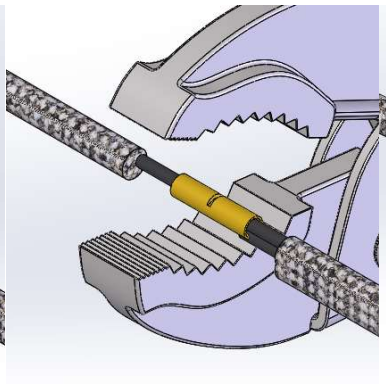


Figure 3-48

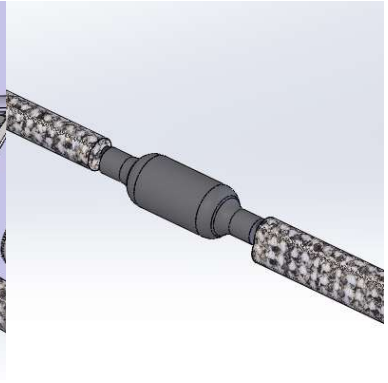


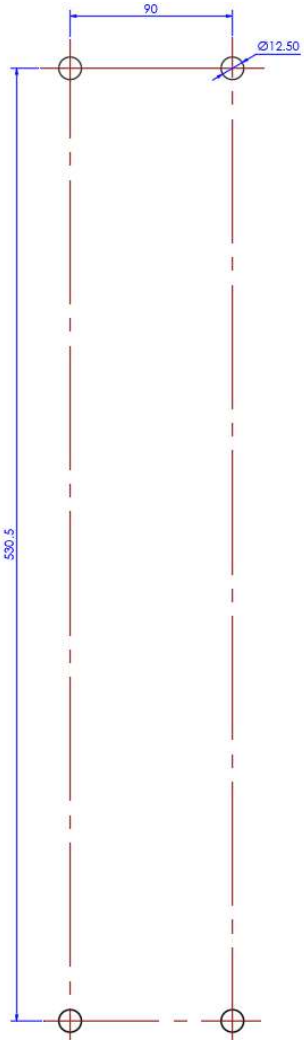
Figure 3-49

3.2.6 Installation of IRU-O outdoor Type

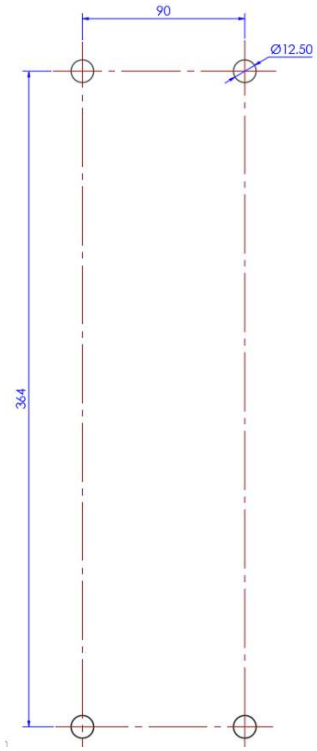
3.2.6.1 Mounting on the wall

Steps:

1. Use the tools to drill the holes on the wall, as shown in Figure 3-50.
2. The M8 expansion bolt put into the hole.
3. Align the holes on the active module bracket with the expansion bolt.
4. Use M8 washer, M8 spring washer and M8 nut to mount Line Amplifier onto the wall, as shown in Figure 3-51.
5. Tightening the M8 Hexagon screw bolts to fasten Line Amplifier on the mounting rack.



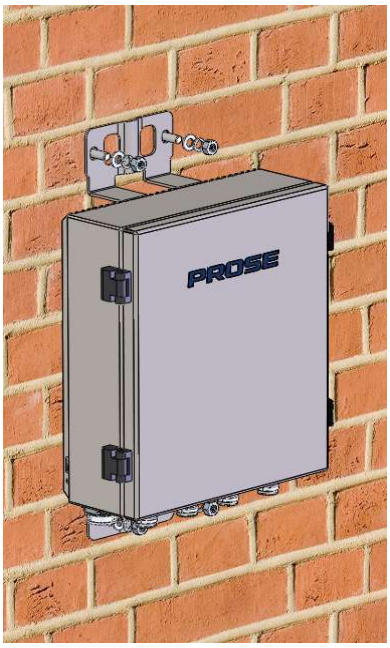
Combiner build in Type



without Combiner Type

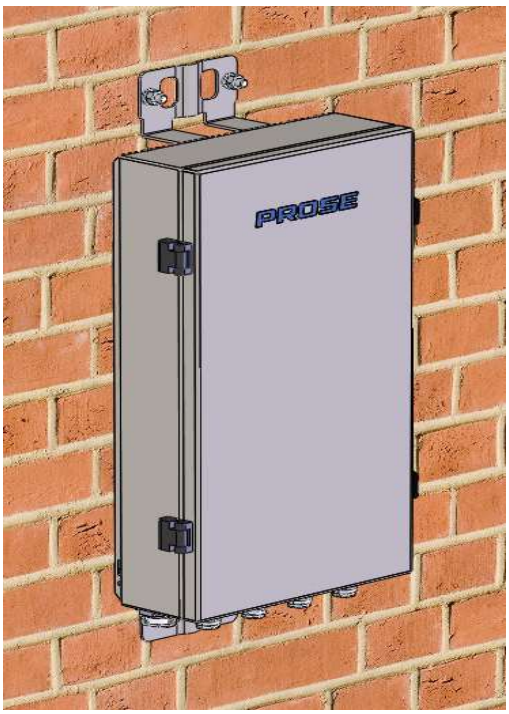
Figure 3-50 Location of four holes on the wall

Combiner build in Type

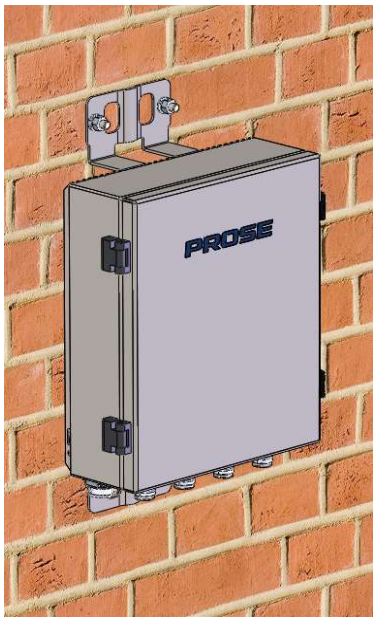


without Combiner Type

Figure 3-51 Mounting the device



Combiner build in Type



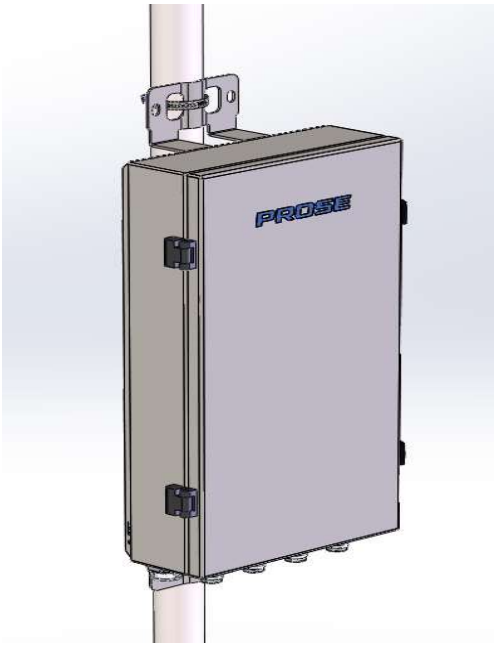
without Combiner Type

Figure 3-52 Finish mounting

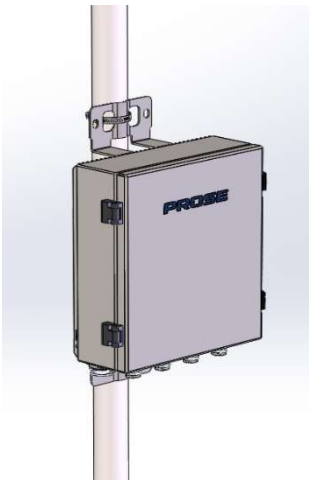
3.6.2.2 Mounting to the Pole

Steps:

1. The diameter of the pole is 30-125mm.
2. Install the Line Amplifier on the pole with the clamp. as shown in Figure 3-53.



Combiner build in Type



without Combiner Type

Figure 3-53 Mounting on the pole

3.3 Installation standard

3.3.1 Device installation

1. The installation position should ensure that there is no interference from strong electric, strong magnetic and corrosive equipment.
2. The installation site should be dry with little dust and good ventilation.
3. The installation should be firm and smooth, and the installation should be fixed with the corresponding installation parts.
4. The mainframe power cable should be installed in the online slot.
5. The ground wire of equipment is earthed to the nearest grounding net from equipment, and the grounding terminal must be welded firmly.

3.3.2 Jumper and connecter

1. It is required that the line should be firm and parallel wiring. The jumper stick to the wall.
2. PVC pipe should be used for jumper running. Keep the line straight horizontally and separate line. Use a plastic pipe card when fixing the wall.
3. The jumper connecter must be installed firmly, and the special head tool should be used correctly Never loosen the joint. Make sure that the contact is good, and the waterproof seal is done.

3.3.3 Power source

1. The power supply of the equipment must be a separate power supply.
2. The power cable should be straight and neat without sharp bending and uneven.
3. The power cable must be put through iron pipe or PVC pipe according to the design requirements. No connection should be made to the power cord through the pipe.
4. Power ground wire and protection ground wire should be laid separately from ac middle.
5. The grounding wire should be connected to the building's integrated grounding grid.
6. Good contact is required, and no looseness is allowed, and the contact surface should be coated with anti-oxidant.

3.3.4 The patch cord

1. The patch cord should be protected by routing pipe, and the part without routing pipe should be tied with Nylon Cable Ties.
2. When fixing the patch cord, it is recommended to wrap the outside of the patch cord around the nylon adhesive tape, and then use the Nylon Cable Ties to fix it.
3. The long patch cord should be coiled in the box or fixed in a circle.
4. The patch cord should be protected by protective sleeve.
5. The patch cord should have a small allowance at the elbow.
6. The patch cord should not be twisted after laying.

3.3.5 Fiber connection between PBMU/IM2U to NEU to IRU-O

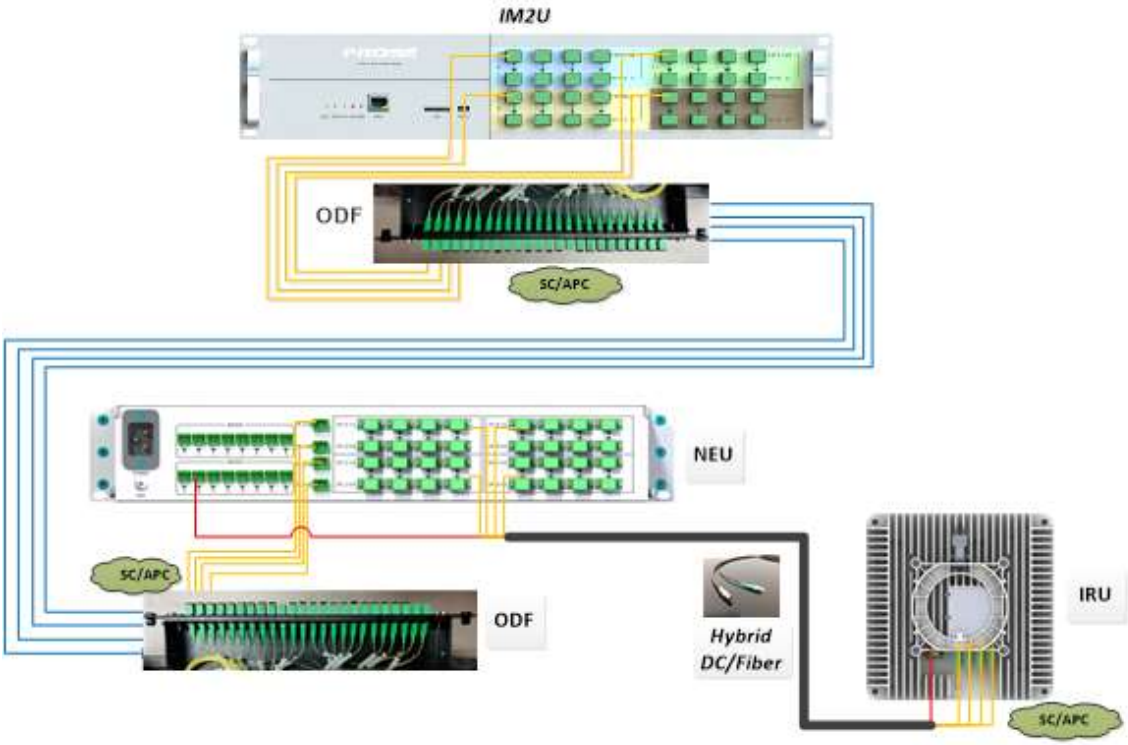


Figure 3-54 Fiber connection between IM2U to NEU to IRU-O

3.3.5 Fiber and RF cable connection

3.3.5.1 Ports introduction

3.3.5.1.1 CU

PROSE developed two kinds of CU (Combiner Unit). One is used with PBMU, the other is used with IM2U. Input power range: 37 – 46 dBm.

CU used with PBMU: 8 input (4.3-10 female) and 8 output (SMA female), support 698-3800 MHz. Each input and output are a group of ports and ports are independent of each other.

Figure 3-55 Front panel of CU

CU used with IM2U: 8 input (4.3-10 female) and 8 output (SMA female), support 698-3800 MHz. Input ports1~4 is a group, Input ports5~8 is the other. One group of ports can only used for one band. For example, input ports1~4 are all used for band 78 (3300-3800 MHz). The input ports1~4 are combined to output ports1~4, ports5~8 are same.

Figure 3-56 Front panel of CU

3.3.5.1.2 PBMU

The QMA ports on the front panel of PBMU are used to combine the signal of the operators. Each set of the ports must be connected to same band. For example, all the four ports of BTS_A can only combine band 78. The eight groups of ports on the front panel correspond to the eight ports on the back panel.

Since each Channel port has a fixed band, which band the BTS ports on the front panel connected to depends on which Channel ports the BTS port on the back panel connected to.

In 4T4R mode, one PBMU can support up to 8 NEUs. There are 4 areas at the front panel of PBMU: A/B/C/D, each area has 8 optic ports. The optic ports at the corresponding location of each area are connected to the same NEU.

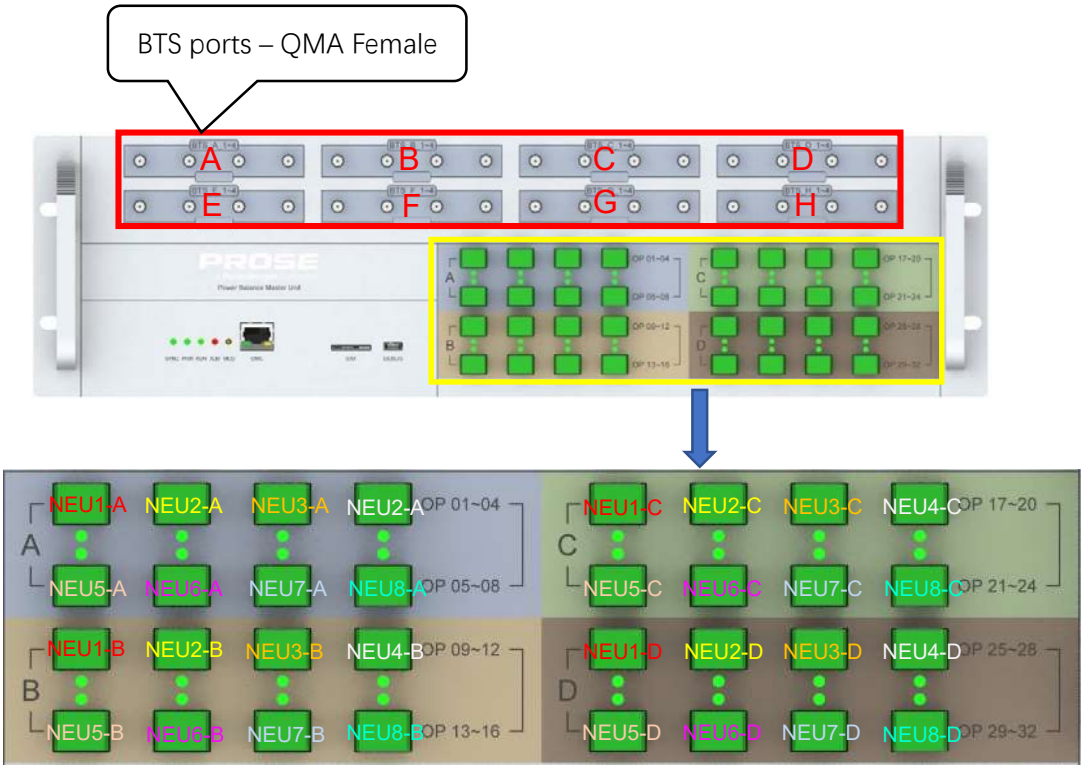


Figure 3-57 Front panel of PBMU

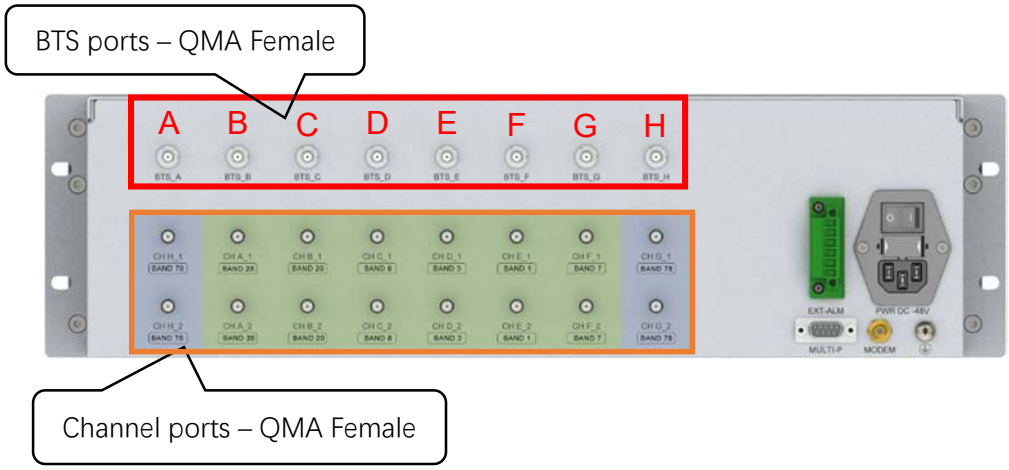


Figure 3-58 Back panel of PBMU

3.3.5.1.3 IM2U

In 4T4R mode, one IM2U can support up to 8 NEUs. There are 4 areas at the front panel of IM2U: A/B/C/D, each area has 8 optic ports. The optic ports at the corresponding location of each area are connected to the same NEU.

The channel ports on the back panel of IM2U are connected with the combiner units which are used to combine the signal of the operators. The frequency bands of all channel ports are fixed.

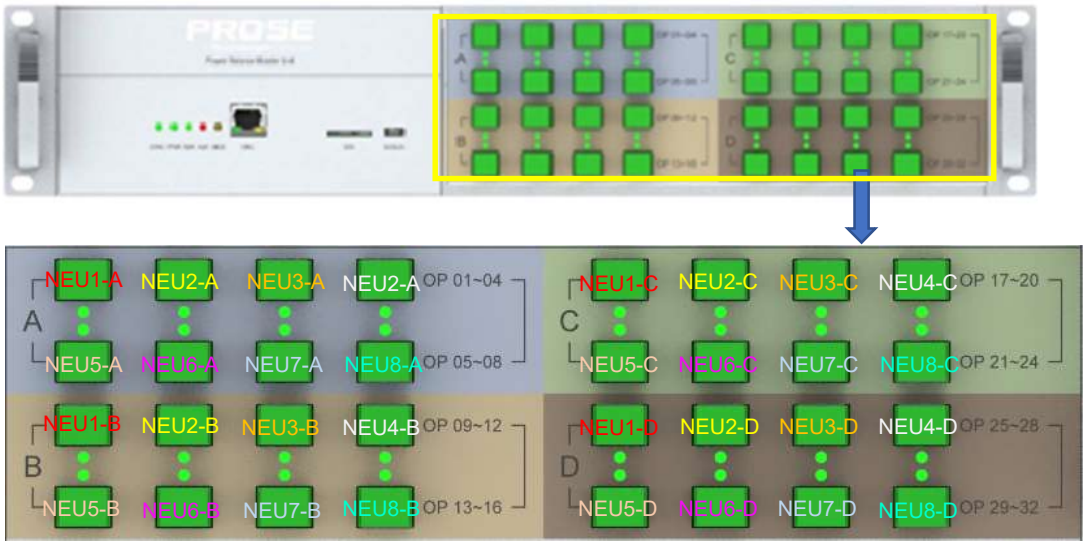


Figure 3-59 Front panel of IM2U

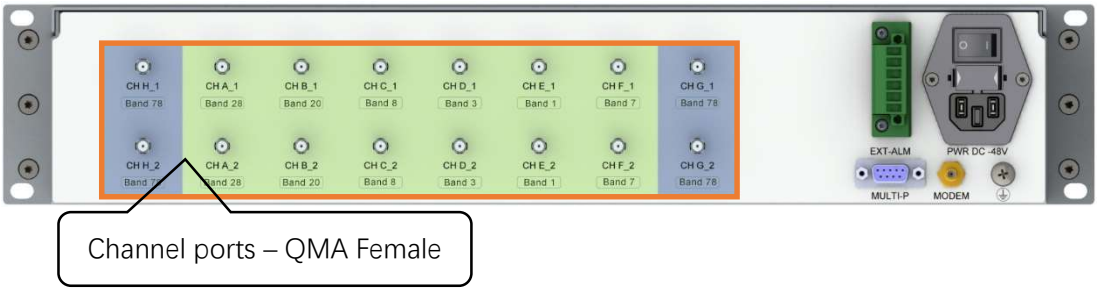


Figure 3-60 Back panel of IM2U

3.3.5.1.4 NEU

In 4T4R mode, one NEU can support up to 8 IRUs. There are 4 areas at the front panel of NEU: K/L/M/N, each area has 8 optic ports. The optic ports at the corresponding location of each area are connected to the same IRU.

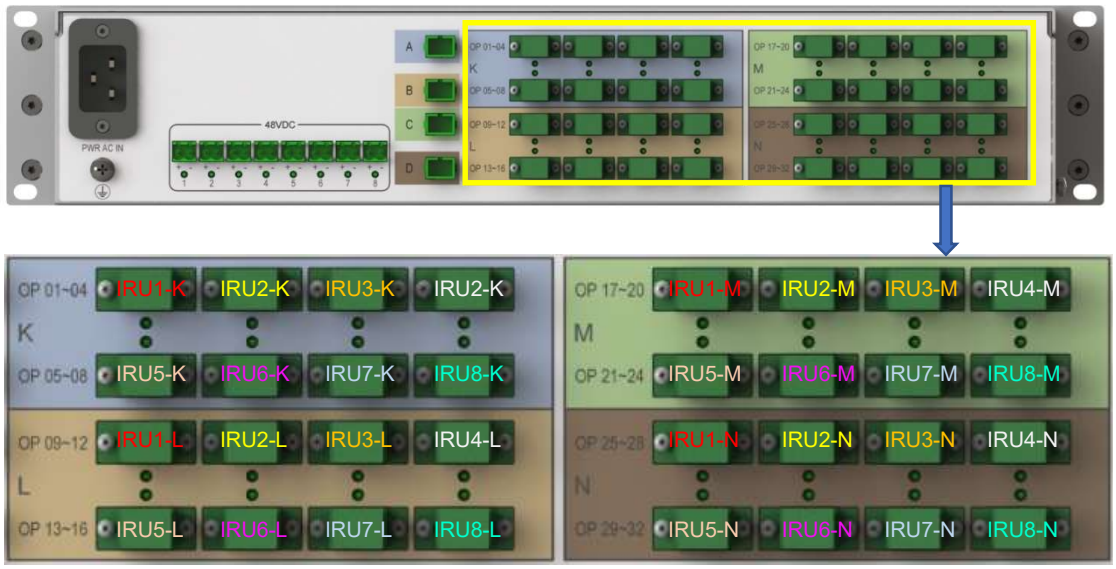


Figure 3-61 Back panel of NEU

3.3.5.1.5 RF Connections between PBMU and BTS

The maximum operation power of each input port on the front panel of the PBMU is 20 dBm. But normally the BTS output power is much higher, so the combiner unit is used to reduce the power to the acceptable range of PBMU.

Here use the connections between BTS-N78-4T4R and PBMU as an example, assume that there are three operators. The ports on the back panel of the PBMU have been connected before delivery (BTS_A/B/C/D are used for N78-4T4R):

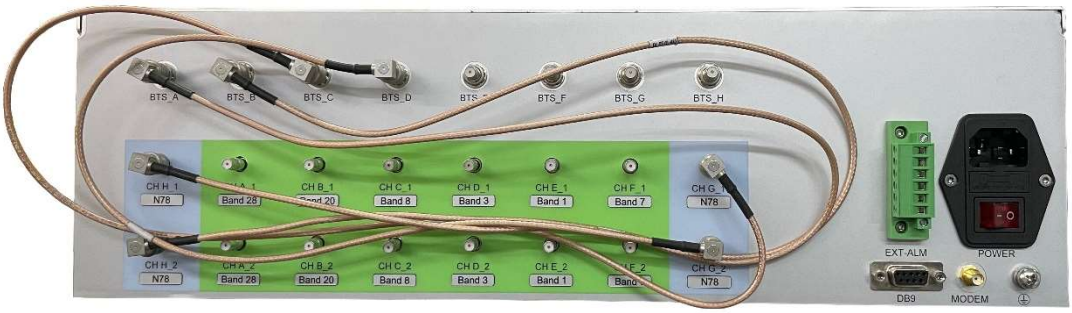


Figure 3-62 Back panel of PBMU

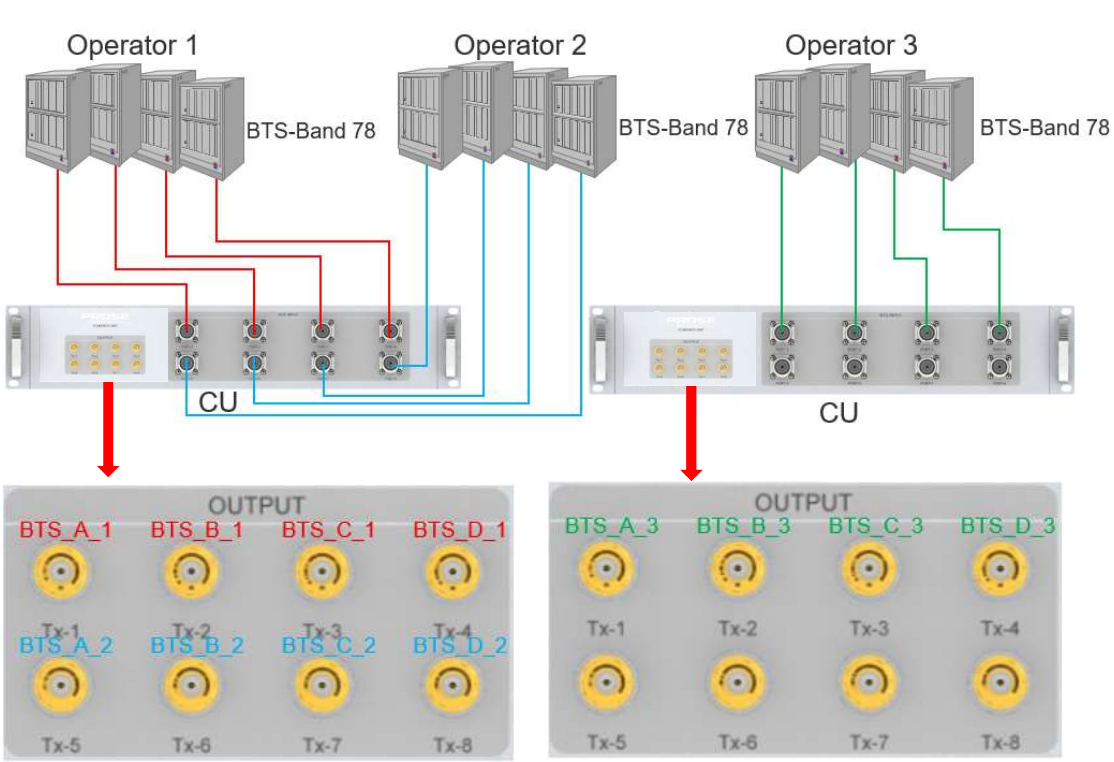


Figure 3-63 Front panel of CU

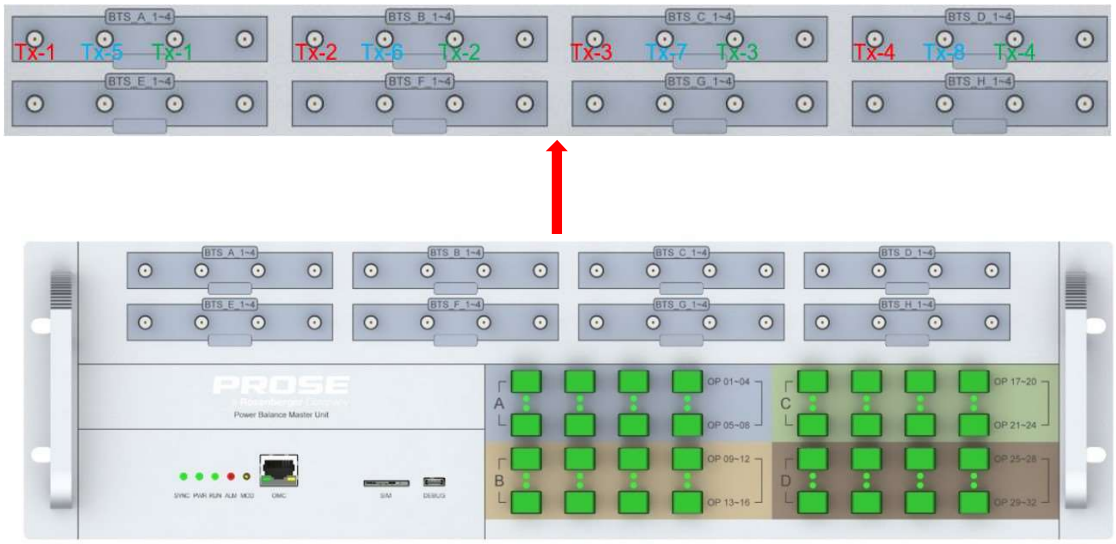


Figure 3-64 Front panel of PBMU

3.3.5.2 RF Connections between IM2U and BTS

The maximum operation power of each input port on the back panel of the IM2U is 10 dBm. But normally the BTS output power is much higher, so the combiner unit is used to reduce the power to the acceptable range of IM2U.

Here use the connections between BTS-N78-4T4R and IM2U as an example, assume that there are three operators:

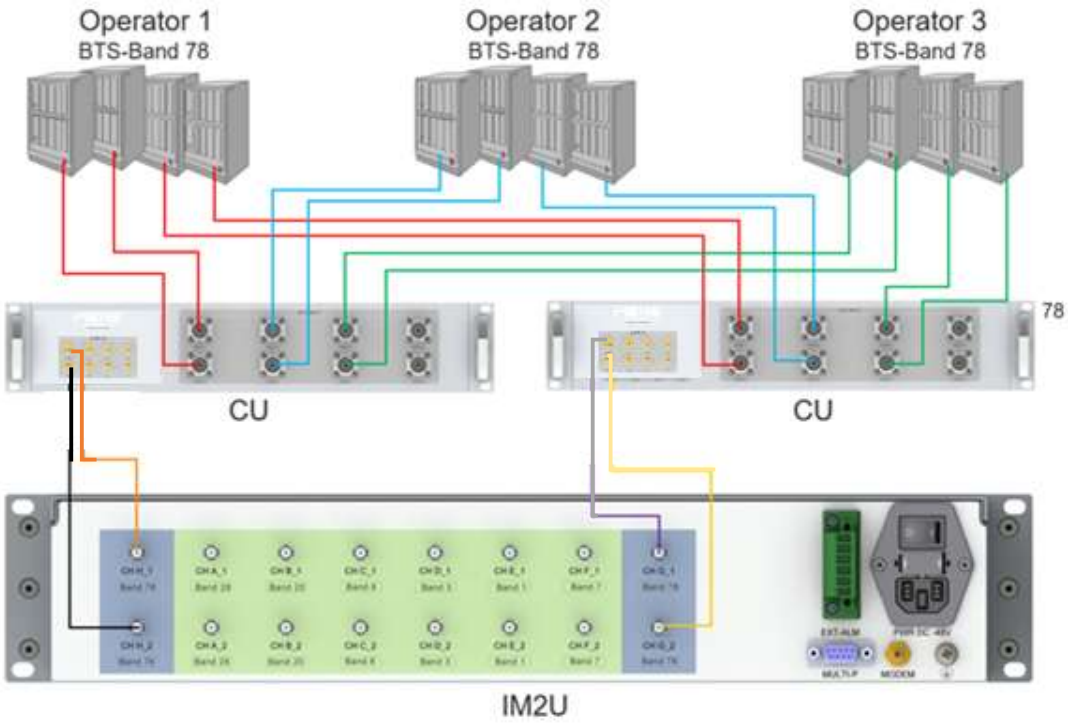


Figure 3-65 RF connection between IM2U and BTS

The unused SMA ports of the CU must be attached with terminal loads:

Figure 3-66 CU terminal load

3.3.5.3 Fiber Connections between PBMU and NEU

Here use the connection between PBMU and NEU1 as an example:

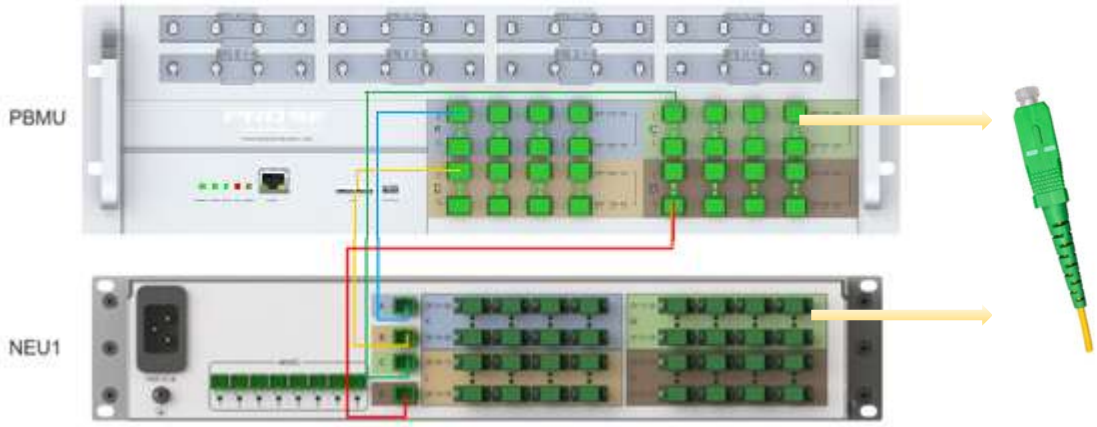


Figure 3-67 Fiber connection between PBMU and NEU

3.3.5.4 Fiber Connections between IM2U and NEU

Here use the connection between IM2U and NEU1 as an example:

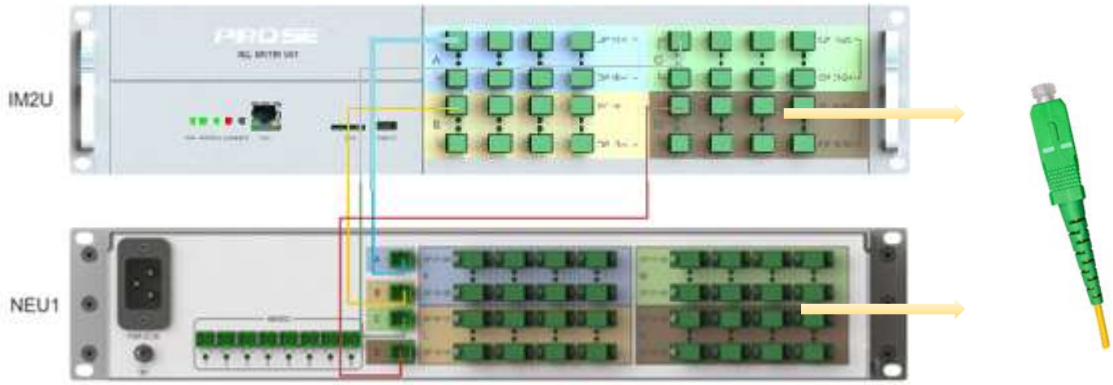


Figure 3-68 Fiber connection between IM2U and NEU

3.3.5.5 Connections between NEU and IRU

Here use the connection between NEU and IRU1 as an example:

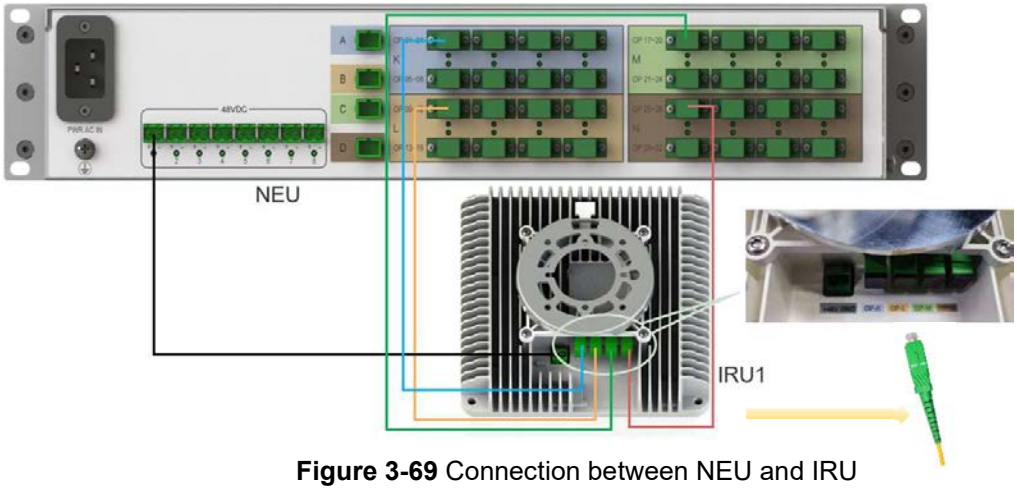


Figure 3-69 Connection between NEU and IRU

4. Device configuration

4.1 PC configuration

Connect the PC with IM2U/PBMU via Ethernet cable.

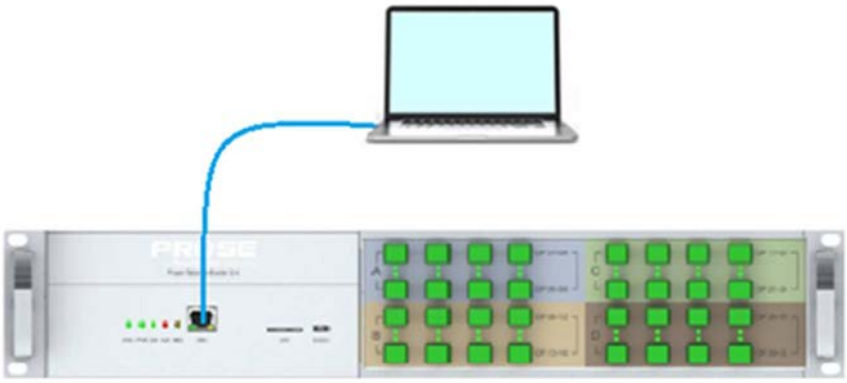


Figure 4-1 Connection PC with IM2U/PBMU

Configure your computer's IPv4 address.

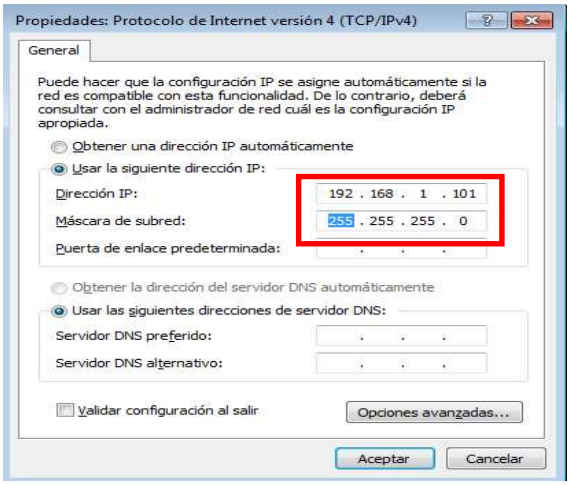


Figure 4-2 Config IPV4 address

Open the browser and enter 192.189.1.100 in the address bar.
Username: admin
Password: 123456

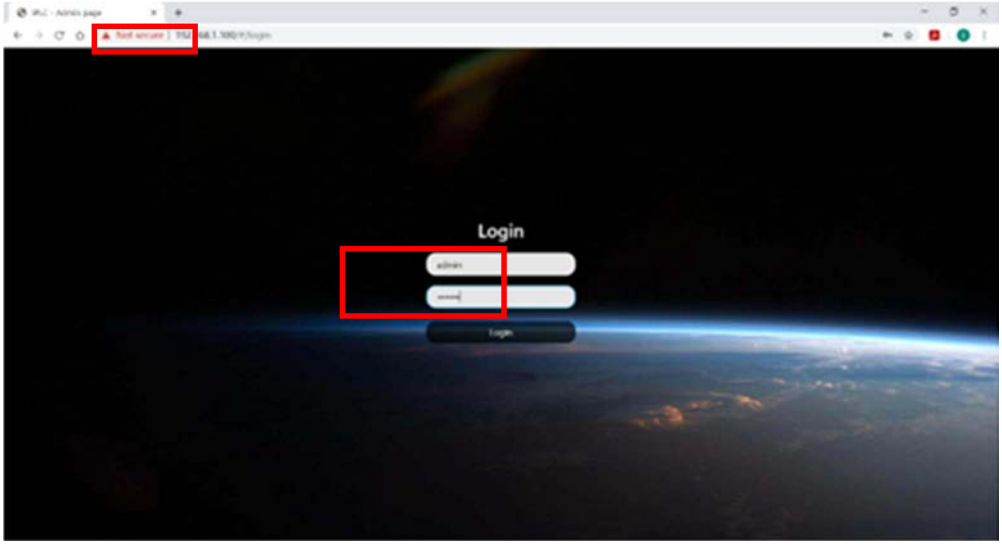


Figure 4-3 Login the OMT

4.2 Parameter description

4.2.1 PBMU

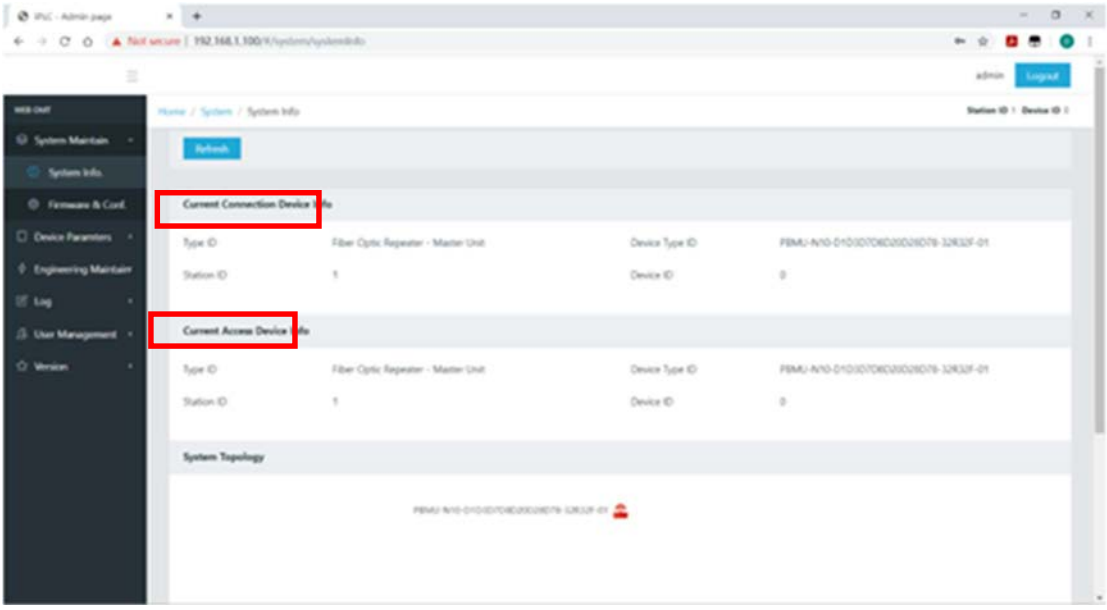


Figure 4-4 Current connection information

Current Connection Device Info.:

It shows the devices that are currently connected with an Ethernet cable.

Current Access Device Info.:

It shows the device whose parameters are actually being viewed.

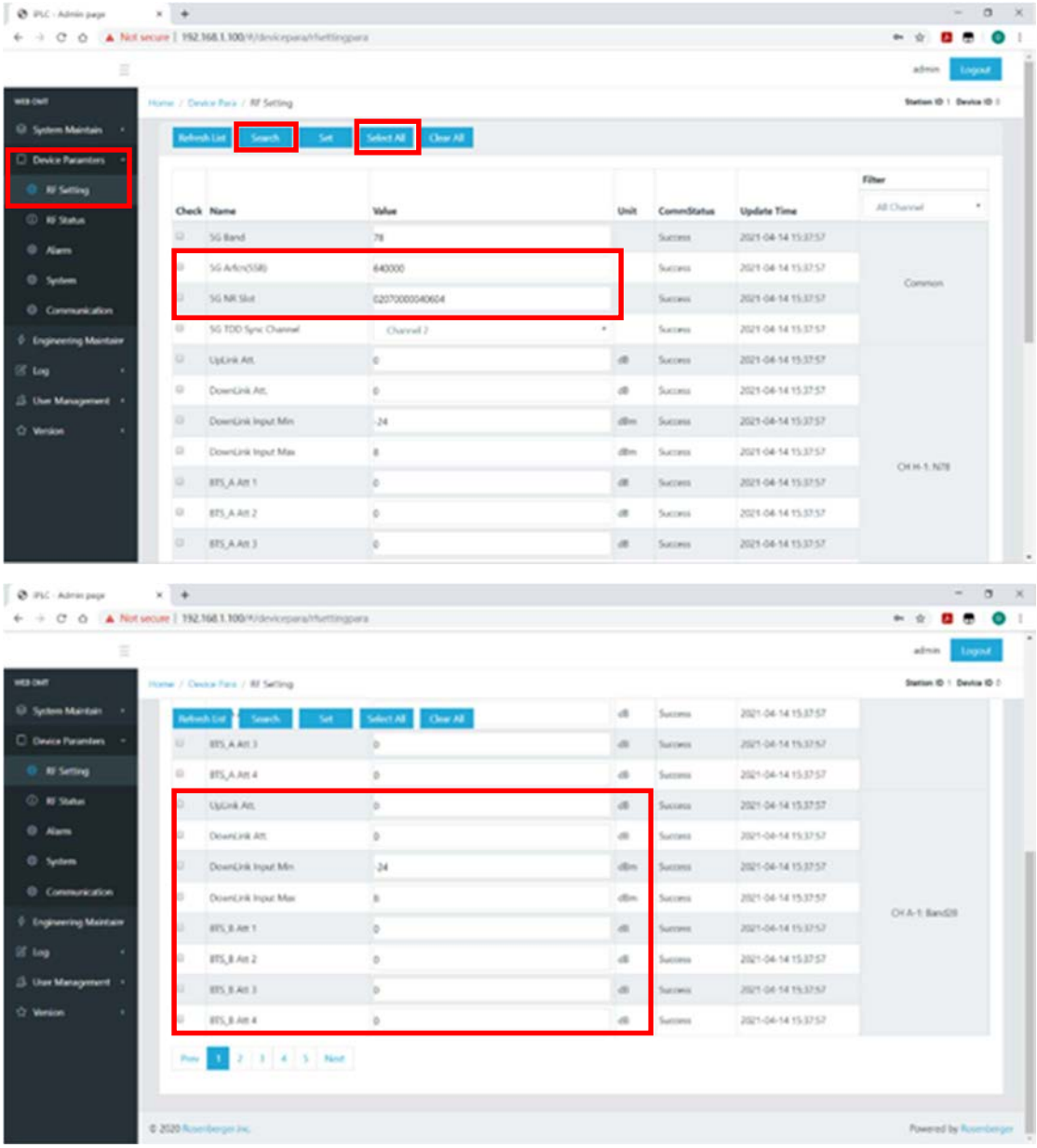


Figure 4-5 Parameter check

Click **Device Parameters**.

Click **Select All**, then **Search**.

Configure **5G ARFCN** and **5G NR Slot** according to the actual configuration of the operator.

Uplink Att.: Set attenuation for uplink, range: 0 ~ 15 dB.

Downlink Att.: Set attenuation for downlink, range: 0 ~ 15 dB.

Downlink Input Min: Set minimum threshold value of downlink. There will be alarm if the actual power is lower.

BTS Att: Set attenuation for downlink RF input of the BTS ports on the front panel of PBMU, range: 0 ~ 15 dB.

Downlink Input Max: Set maximum threshold value of downlink. There will be alarm if the actual power is higher.

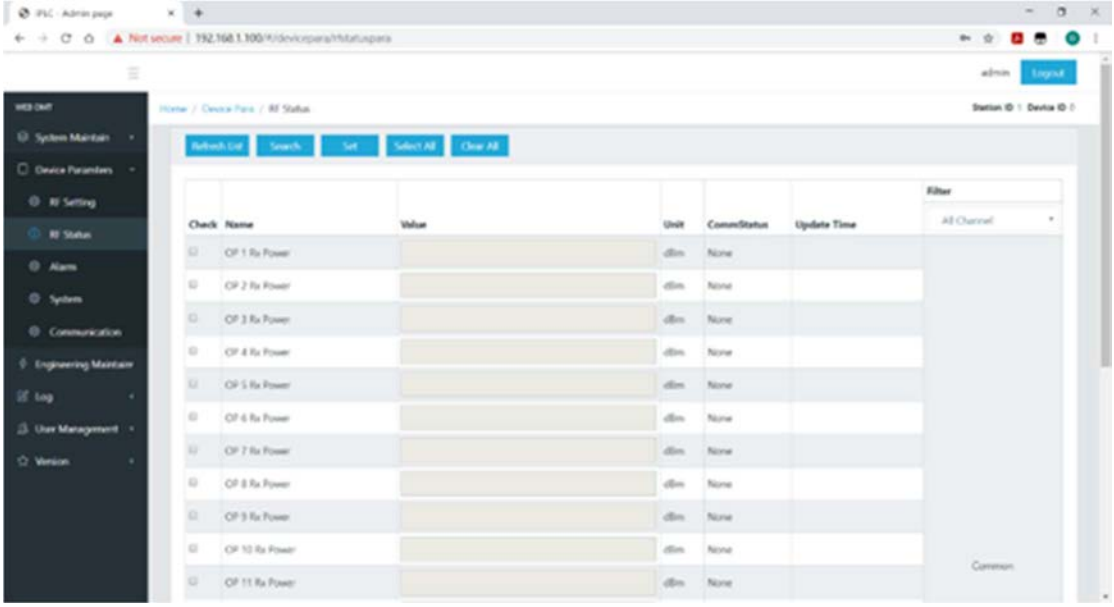


Figure 4-6 Optical RX power check

Optical Rx Power: The optical power received from NEU (normal range: ≥ -2 dBm).

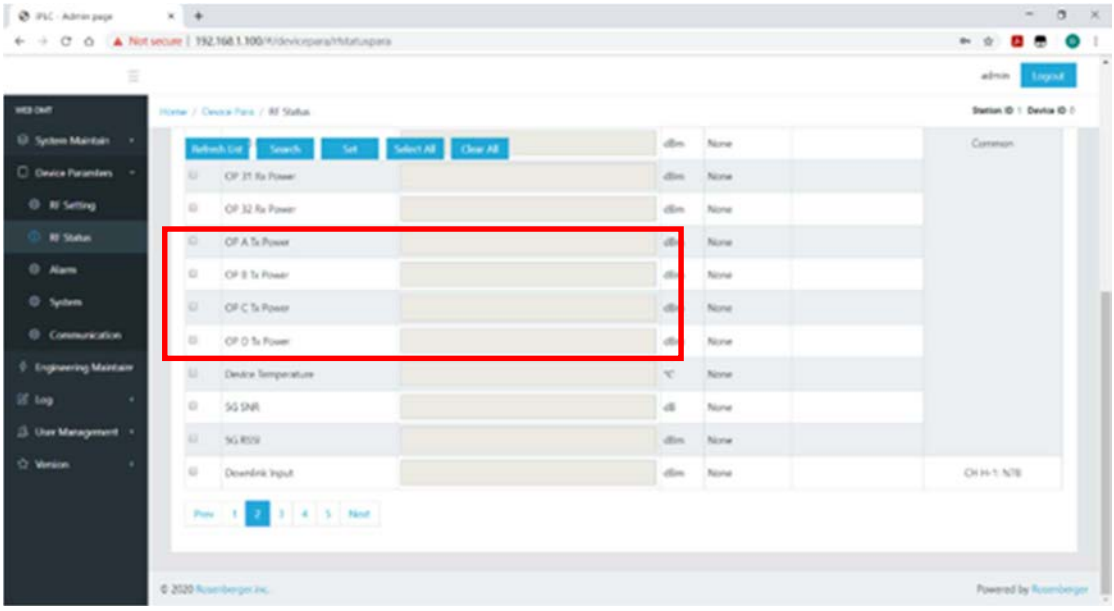


Figure 4-7 Optical TX power check 1

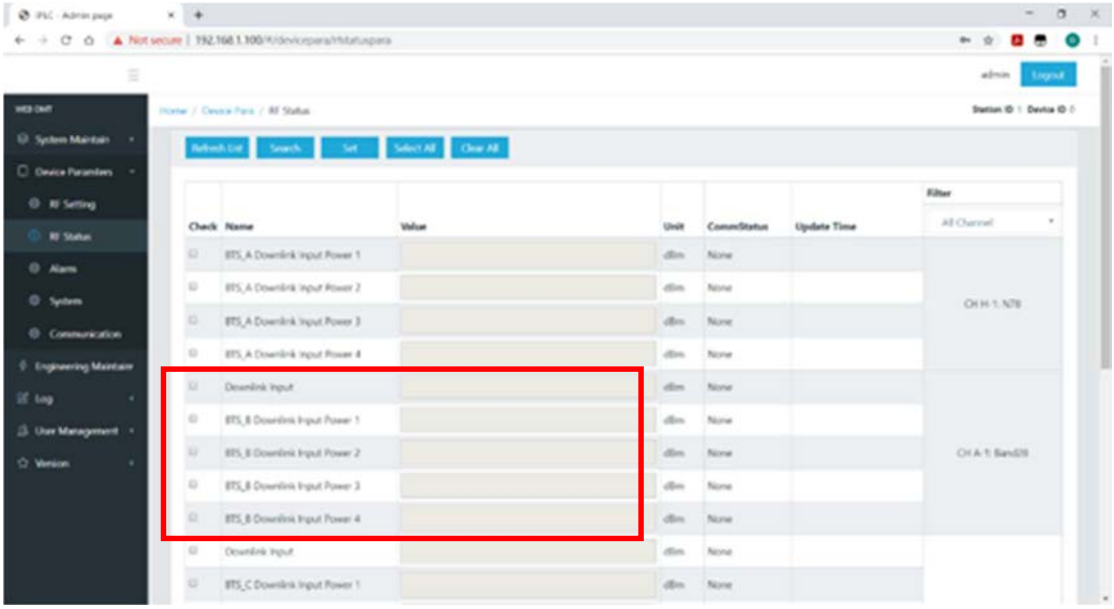


Figure 4-8 Optical TX power check 2

Optical Tx Power: The optical power transmitted by IM2U.
(A_Tx ~ D_Tx: -6 ± 2 dBm)
Downlink Input: The downlink input RF power of the channel ports on the back panel of the PBMU.
BTS Downlink Input Power: The downlink input RF power of the BTS ports on the front panel of the PBMU.

4.2.2 IM2U

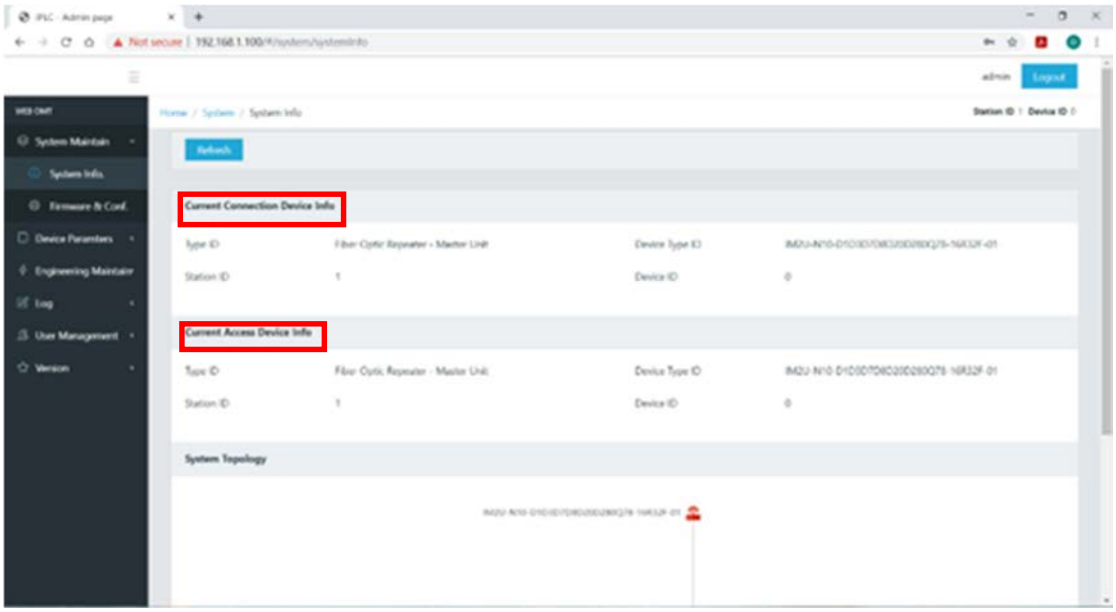


Figure 4-9 IM2U connection

Current Connection Device Info.:

It shows the devices that are currently connected with an Ethernet cable.

Current Access Device Info.:

It shows the device whose parameters are actually being viewed.

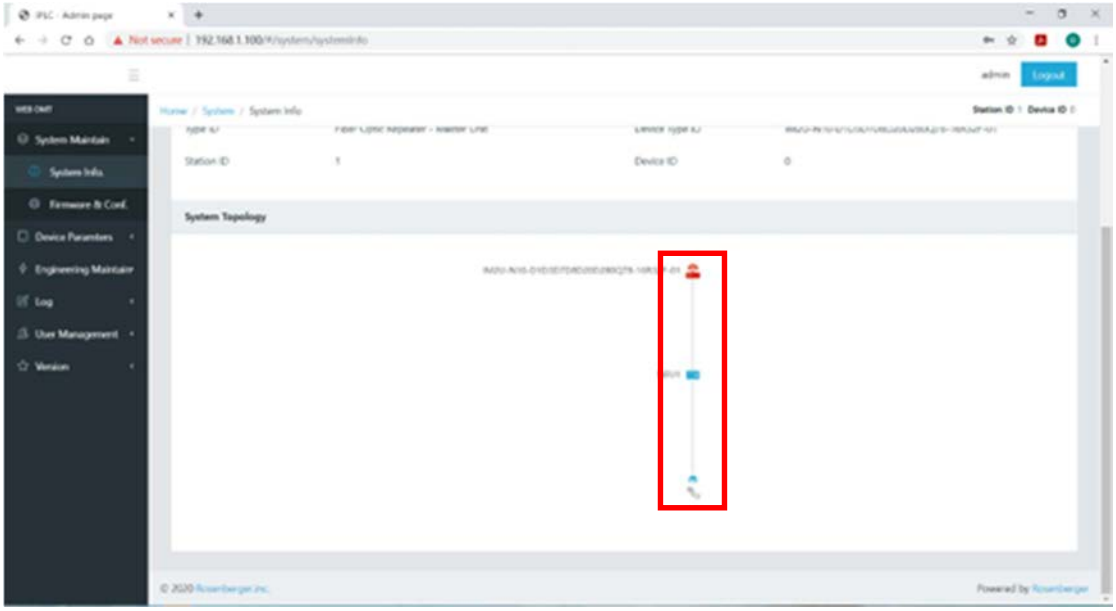


Figure 4-10 system config

Click the icon to switch access to the device.

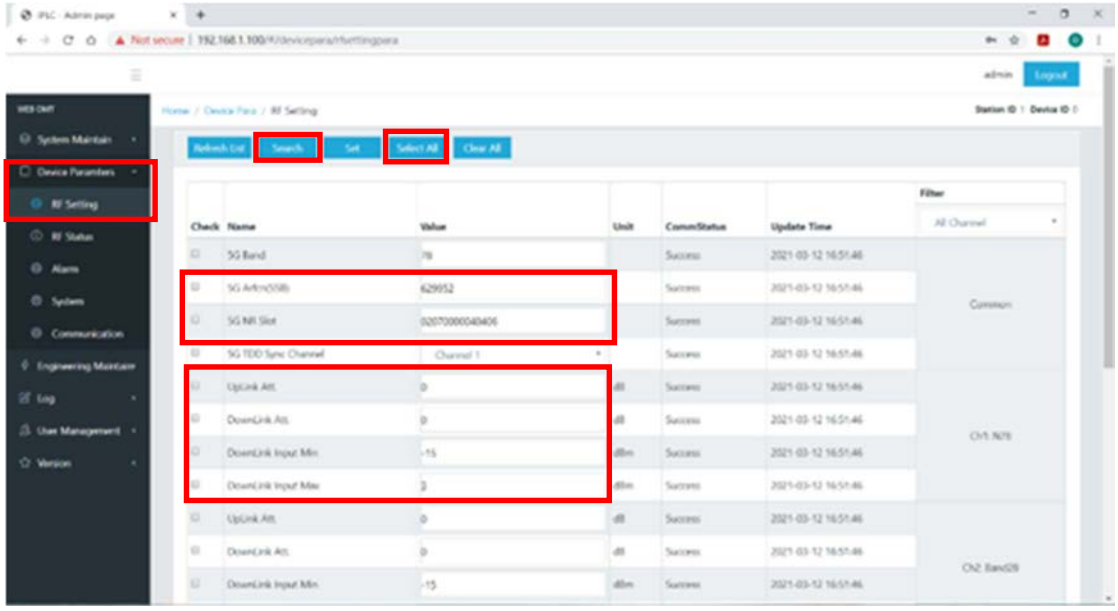


Figure 4-11 IM2U parameter check

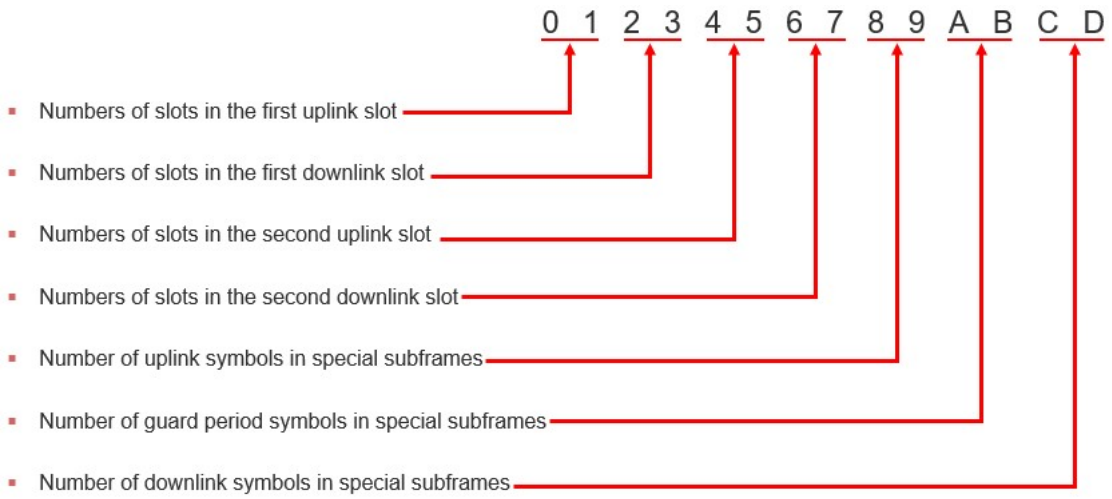
Click **Device Parameters**.

Click **Select All**, then **Search**.

Configure **5G ARFCN** and **5G NR Slot** according to the actual configuration of the operator.

Uplink Att.: Set attenuation for uplink, range: 0 ~ 15 dB
Downlink Att.: Set attenuation for downlink, range: 0 ~ 15 dB
Downlink Input Min: Set minimum threshold value of downlink. There will be alarm if the actual power is lower.
Downlink Input Max: Set maximum threshold value of downlink. There will be alarm if the actual power is higher.

Configuration instruction of **5G NR Slot**:



Note: If NR uplink and downlink are configured as single time slot, the second time slot is configured as 0000.

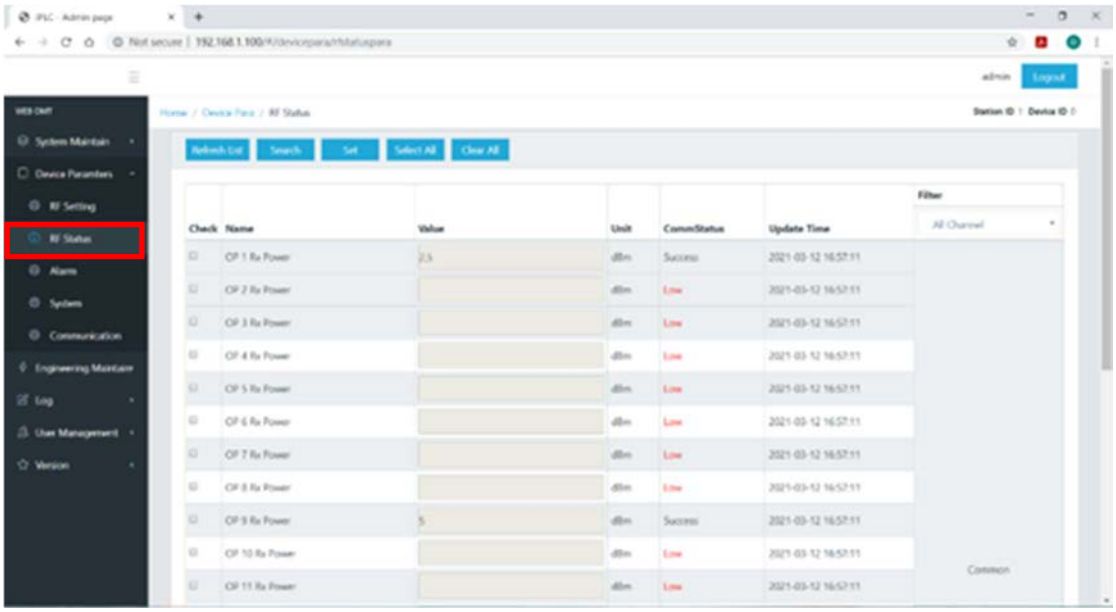


Figure 4-12 IM2U optical RX power check

Optical Rx Power: The optical power received from NEU (normal range: ≥ -2 dBm).

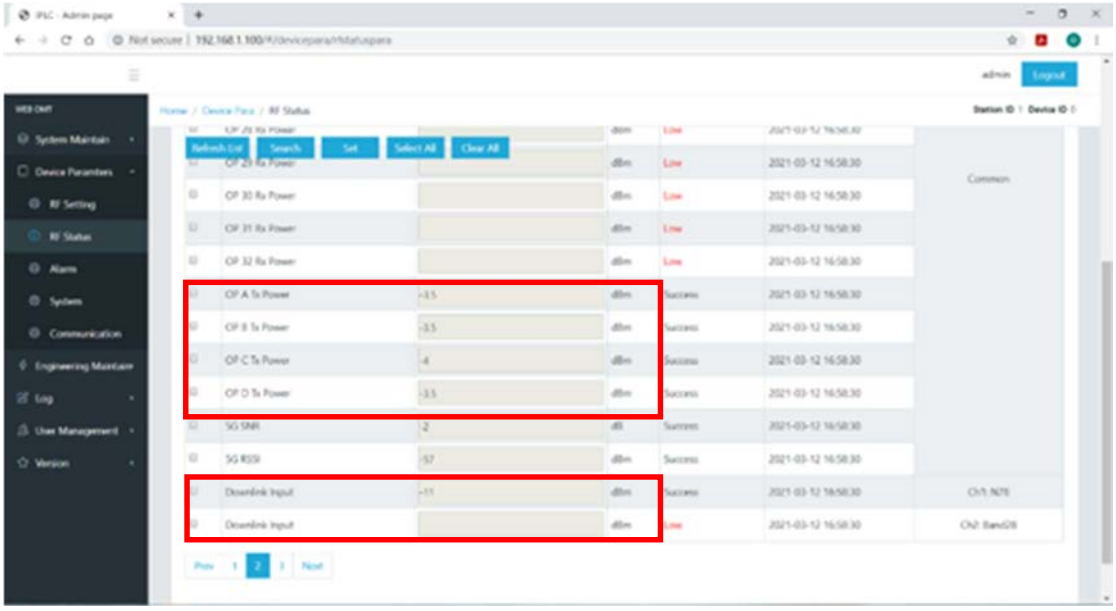


Figure 4-13 IM2U optical TX power check

Optical Tx Power: The optical power transmitted by IM2U.
(A_Tx ~ D_Tx: -6 ± 2 dBm)
Downlink Input: The downlink input RF power received from CU.

4.2.3 NEU

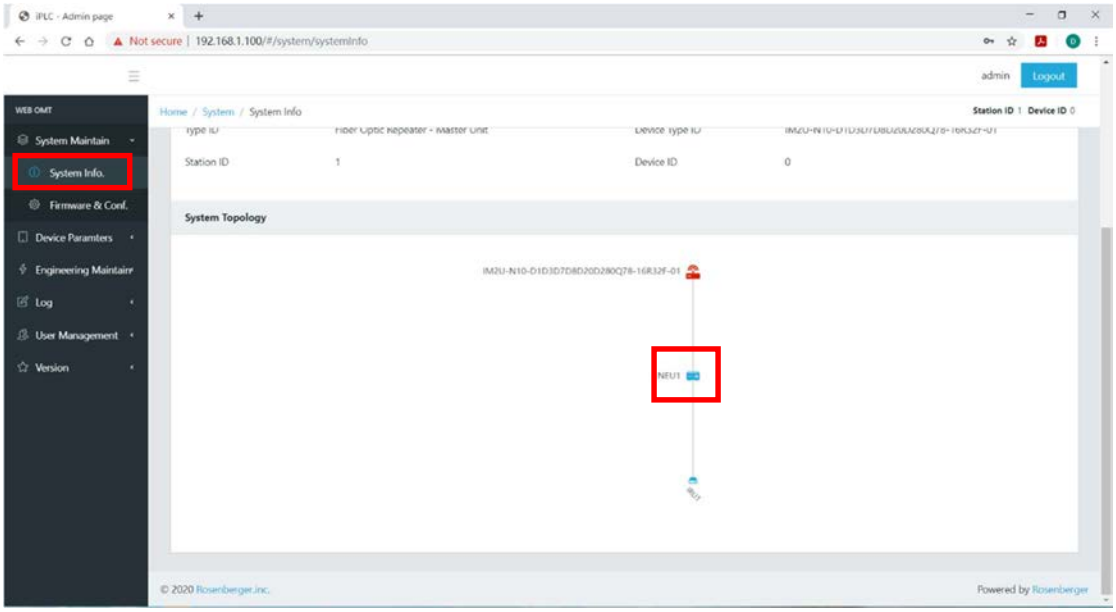


Figure 4-14 System information

Click **System Info.** and switch access to NEU.

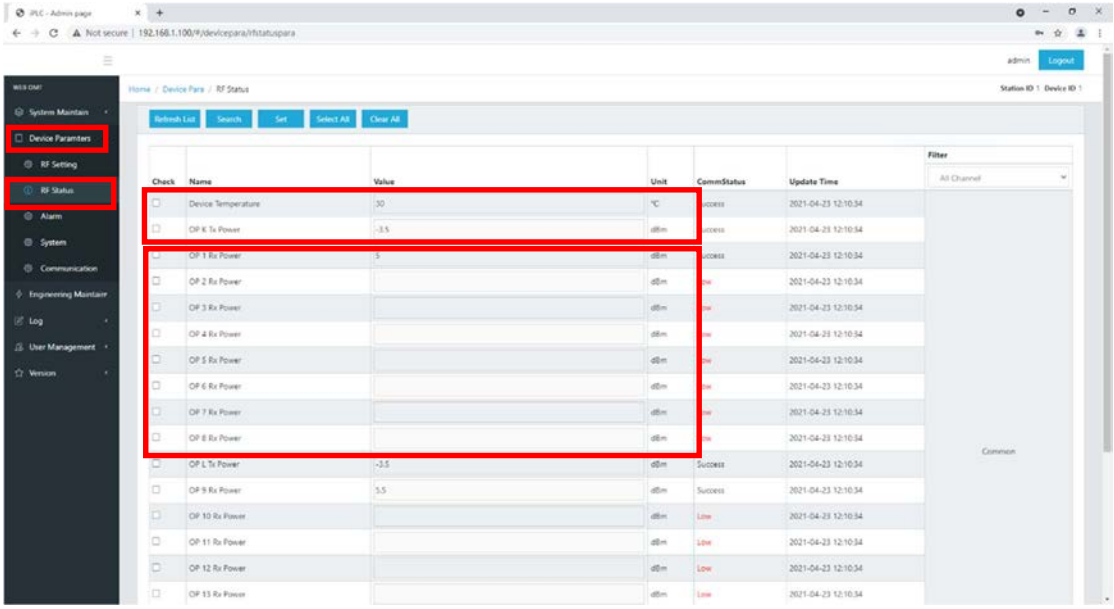


Figure 4-15 NEU parameter check

Device Temperature: The temperature of IRU.
Optical K/L/M/N Tx Power: The optical power transmitted to IRU.
(-6 ± 2 dBm)
Optical Rx Power: The optical power received from IRU.
(Normal value: ≥ -1 dBm)

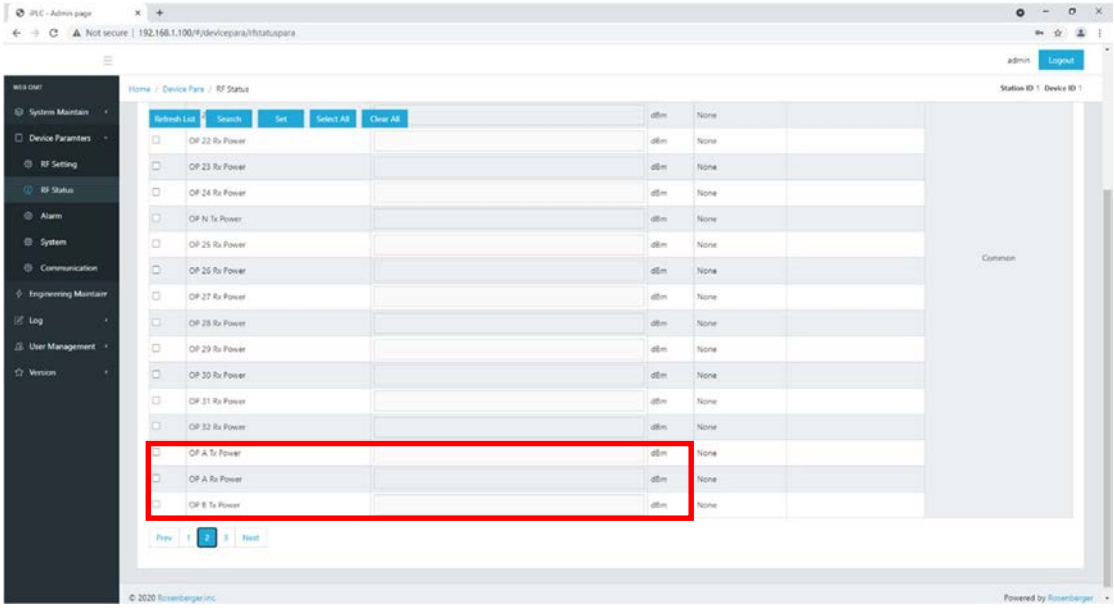


Figure 4-16 NEU optical power check

Optical A/B/C/D Tx Power: The optical power transmitted to IM2U.
(5 ± 2 dBm)
Optical A/B/C/D Rx Power: The optical power received from IM2U.
(-6 ± 2 dBm)

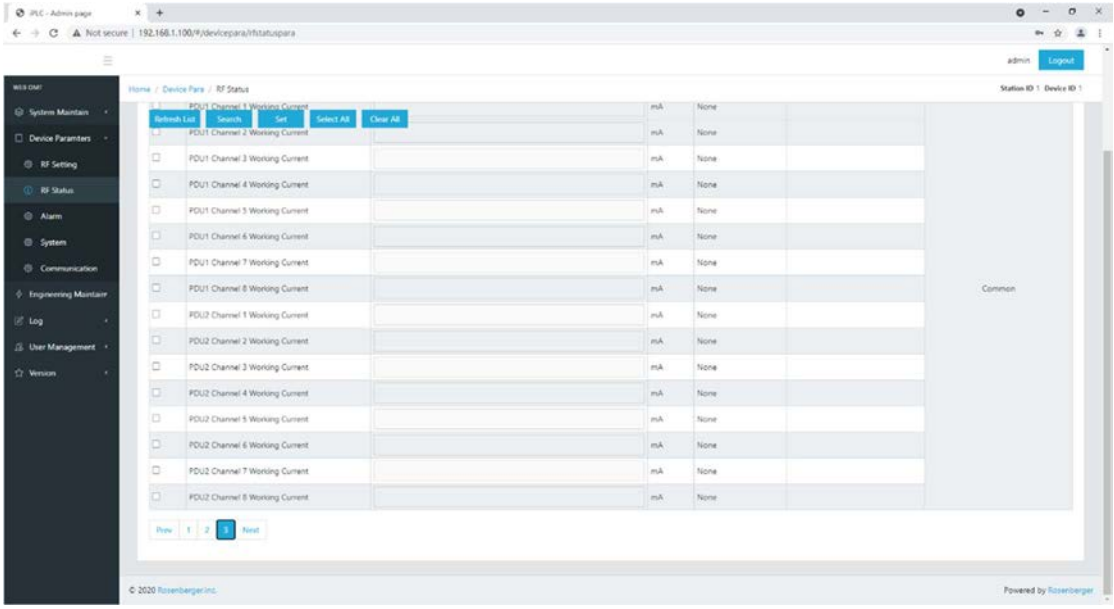


Figure 4-17 NEU optical check

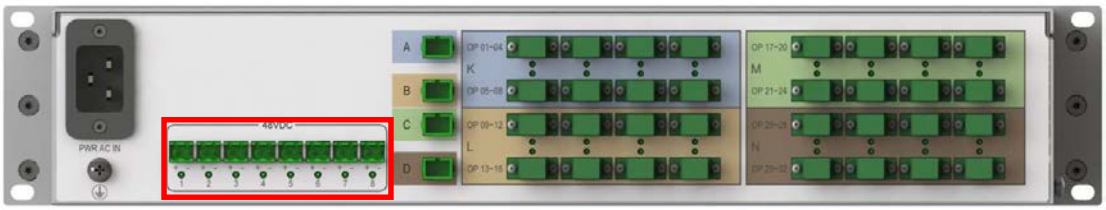


Figure 4-18 PDU ports

PDU Channel Working Current: The working current for every channel on the PDU. Maximum support 8 IRUs (4T4R mode).

4.2.4 IRU-O

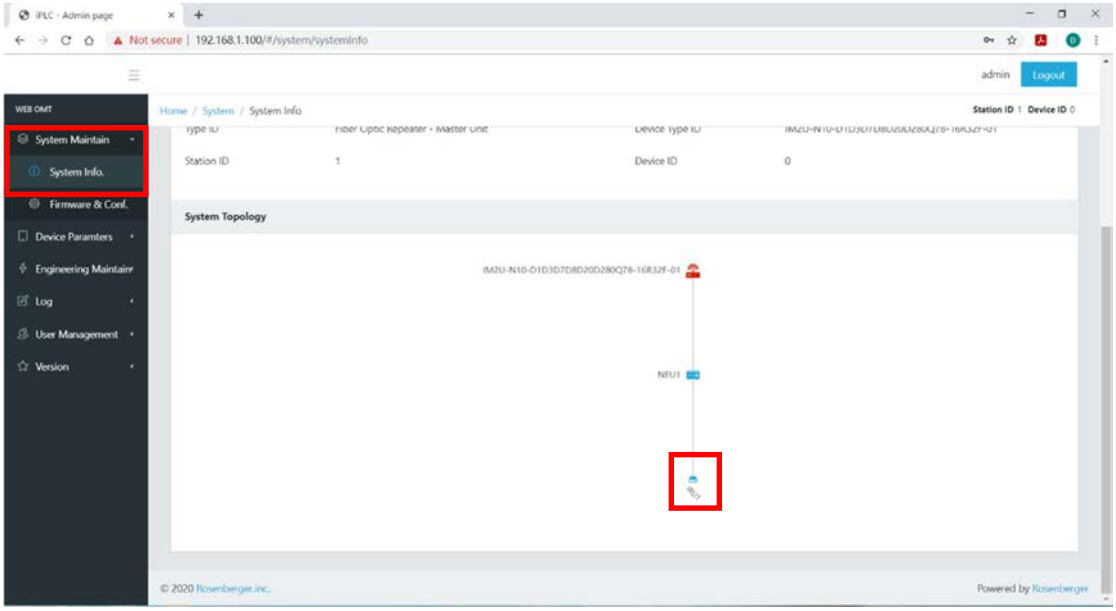


Figure 4-19 IRU in system config

Click **System Info.** and switch access to NEU.

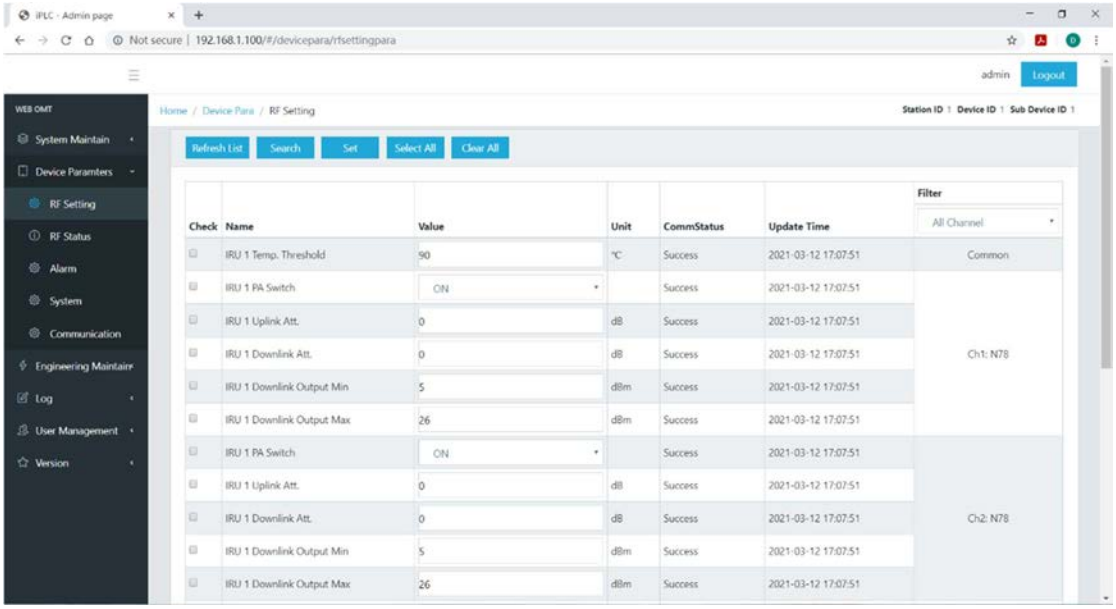


Figure 4-20 IRU parameters

IRU PA Switch: The switch of power amplifier module of IRU.
IRU Uplink Att.: Set attenuation for IRU uplink, range: 0 ~ 15 dB.
IRU Downlink Att.: Set attenuation for IRU downlink, range: 0 ~ 15 dB.
IRU Downlink Output Min: Set minimum threshold value of downlink. There will be alarm if the actual power is lower.
IRU Downlink Output Max: Set maximum threshold value of downlink. There will be alarm if the actual power is higher.

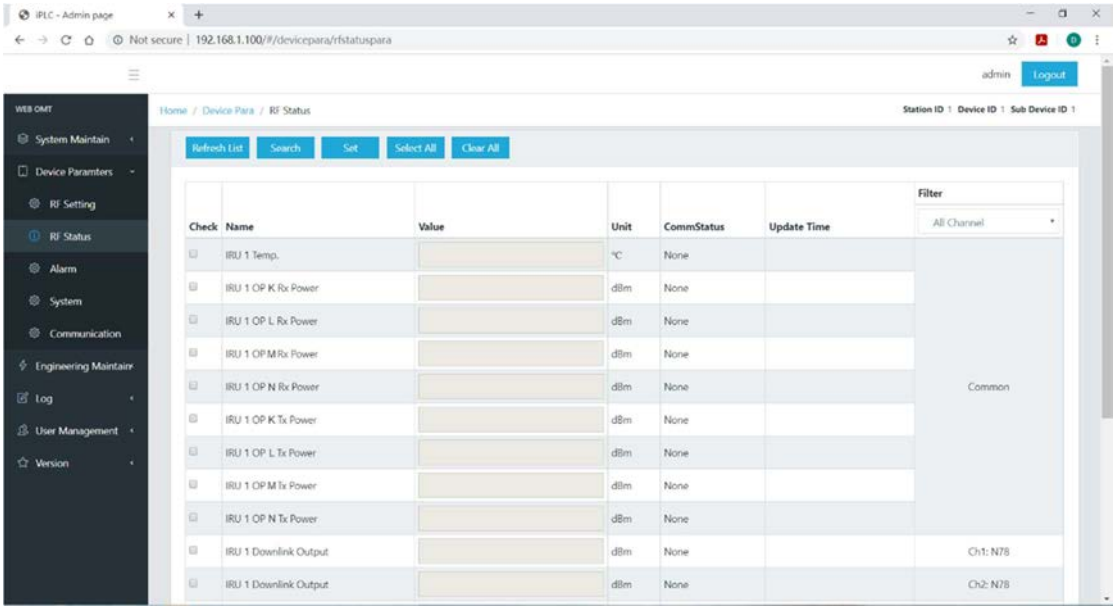


Figure 4-21 IRU status

IRU Temp.: The temperature of IRU.

IRU Optical Rx Power: The optical power received from NEU.

IRU Optical Tx Power: The optical power transmitted to NEU.

Downlink Output: The downlink output of radio frequency for every channel.

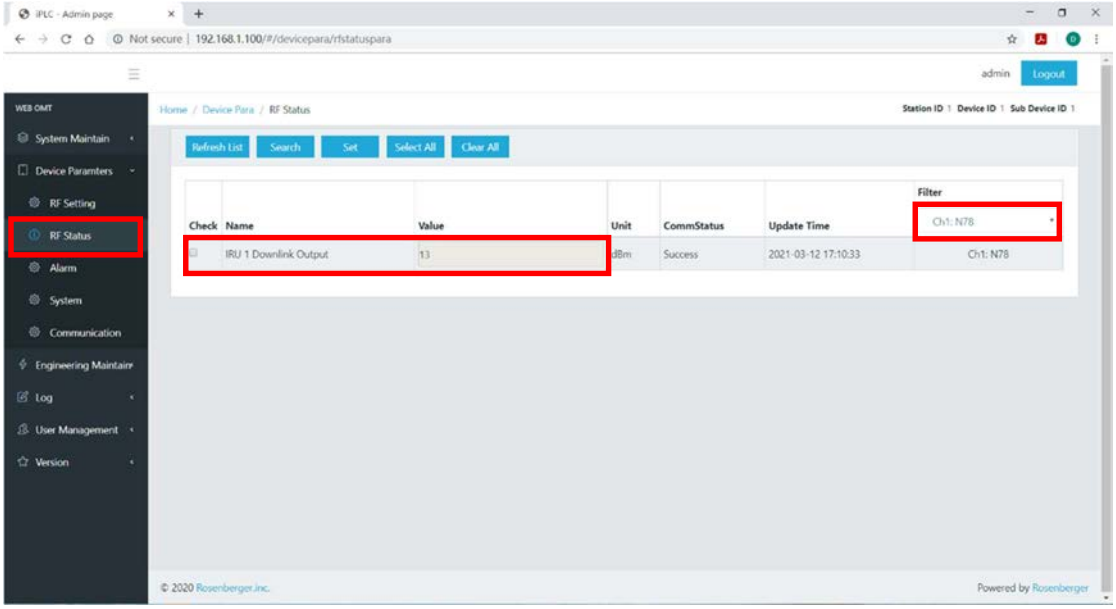


Figure 4-22 IRU RF status

Check the downlink output of the channels at page **RF Status**.

5. Support and service

5.1 Type of Service

We provide Repeater warranty of 24 months that will start from date of delivery at Purchaser warehouse. Any faulty card or entire Repeater will have to be repaired and replaced with new part and this will be covered under the Warranty services. Four types of support and maintenance services will be provided：Remote technical support，on-site technical support，spare parts service and field technical training.

4.1.1 Remote technical support

PROSE can provide technical inquiries and troubleshooting for free by telephone, network, fax or email within twelve hours. We can also share good technology and experience with customs.

4.1.2 On-site technical support

According to the customer’s request, PROSE can promise to arrange visa as fast as possible. After getting visa, we can arrive at the site in one week and solve the breakdown.

4.1.3 Spare parts service

According to the customer’s request, PROSE will provide 1~5% spare parts (decided by different products).

4.1.4 Field technical training

According to the customer’s request, PROSE will provide a field technical training and remote technical training for customer’s technical engineer.

5.2 Contact us

PROSE Technologies LLC
Add: 550 Clark Drive,Mount Olive, NJ 07828