



P5G-Indoor O-RU-PR1450 User Guide

User Guide

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1. Foreword

This document is for Pegatron Corporation (hereinafter referred to as Pegatron). The documents of the Business Group 6 - Business Unit 6 - 5G Product Development Center (hereinafter referred to as the 5G Product Development Center). The purpose of this document is to describe the information, installation, configuration and basic operation of the indoor O-RU PR1450.

1.1 Legal notices

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1.2 Safety statements

1.2.1 Usage safety precautions

Do not use this device where flammables or explosives are stored, for example, in a gas station, oil depot, or chemical plant. Otherwise, explosions or fires may occur. In addition, follow the instructions indicated in text or symbols in area used.

- Place this device on a stable surface.
- Keep this device far from electronic devices that generate strong magnetic or electric fields, such as microwave ovens, satellite dish antennas, or large appliances.
- Place this device in a cool and well-ventilated indoor area. Do not expose the device to direct sunlight.
- Do not use this device in an area under or over temperatures ranging from 0°C to 50°C.
- Do not cover this device. Reserve a minimum space of 10 cm around this device for heat dissipation.
- Before connecting and disconnecting cables, ensure that your hands are dry.
- To avoid electric shock, damage, and fire resulting from short-circuiting, do not use the product if wet, with wet hands, or while holding or drinking any liquids.
- Only insert relevant cables or devices into the ports, do not insert metal or other foreign objects.
- Do not place naked flame sources, such as lighted candles, on this device. Keep this device far from sources of heat and fire, such as a heater or a candle.
- Damage caused by user misuse or not following instructions are not covered by warranty.



The power supply cord must be plugged into a socket or outlet that is provided with a suitable earth ground.

1.2.2 Electrical safety precautions

Refer all repairs to qualified service personnel. Do not modify any part of this device, as this will void the warranty.

Disconnect the power to this product and return it for service if the following conditions apply:

1. The product does not function after following the operating instructions outlined in this manual.
2. The product has been dropped or impacted and appears physically damaged. Locate the serial number of the product and record this on your registration card for future reference. Also record the MAC address, located on the product sticker.

1.3 Recommendations

1.3.1 Base Station Backup Battery

It is recommended to use an uninterruptible power supply (UPS) battery backup system to ensure a reliable and stable power supply to avoid hardware damage due to a power outage.

1.4 Country safety statements

1.4.1 Taiwan: National Communications Commission (NCC)

- DO NOT ATTEMPT TO INSTALL/SETUP 5G NR O-RU DEVICE YOURSELF. SUCH ACTION MAY VOID THE WARRANTY. THIS DEVICE IS FACTORY TUNED. NO CUSTOMER CALIBRATION OR TUNING IS REQUIRED. PLEASE CONTACT YOUR TECHNICAL SUPPORT FOR INSTALLATION AND INFORMATION ABOUT THE SETTINGS OF YOUR 5G NR O-RU DEVICE.
- 5G NR O-RU IS NOT ALLOWED TO BE DIRECTLY SOLD TO CONSUMERS
- 本器材限使用下列天線:

■ n48/n78:

Brand	Model	Antenna Type	Freq. range (MHz)	Gain (dBi)
M.gear	C1335-510520-A	Dipole	3300 MHz	3.55
			3400 MHz	3.19
			3500 MHz	3.78
			3600 MHz	4.33
			3700 MHz	3.97
			3800 MHz	3.35

■ n79:

Brand	Model	Antenna Type	Freq. range	Gain
M.gear	C1335-510519-A	Dipole	4400 MHz	6.38
			4500 MHz	6.59
			4600 MHz	6.99
			4700 MHz	6.84
			4800 MHz	6.66
			4900 MHz	6.58
			5000 MHz	6.02

- 本器材須經專業工程人員安裝及設定，始得設置使用，且不得直接販售給一般消費者。
- 電信事業須設置基地臺者設置本基地臺前，應辦理基地臺登錄；已依電信法取得電臺架設許可者，亦同。本基地臺須經本會審驗合格取得電臺執照後，始得使用。

1.4.2 UK: Hazardous substance notice

This product does not contain hazardous substances (as defined in UK Control of Substances Hazardous to Health Regulations 1989 and the Dangerous Substances Regulations 1990). At the end of this product's life cycle, the customer should consult with the system integrator to ensure that the product is disposed of in conformance with the relevant regulatory requirements.

1.4.3 Europe: Directive 2014/53/EU

European Council Recommendation 2014/53/EU details basic restrictions and reference levels on human exposure to electromagnetic fields as advised by the ICNIRP. Adherence to these recommended restrictions and reference levels should provide a high level of protection as regards the established health effects that may result from exposure to electromagnetic fields.

EU Declaration of Conformity (DoC)

Hereby we,

<u>Name of manufacturer:</u>	<u>PEGATRON CORPORATION</u>
<u>Address:</u>	<u>5F, NO. 76, LIGONG ST., BEITOU DISTRICT, TAIPEI CITY 113, TAIWAN</u>
<u>Zip code & City:</u>	<u>TAIPEI CITY</u>
<u>Country:</u>	<u>TAIWAN</u>
<u>Telephone number:</u>	<u>+886.2.8143.9001 #34182</u>

declare that this DoC is issued under our sole responsibility and that this product:

Product description:	<u>5G NR O-RU</u>
Type designation(s)	<u>PR1450-78I</u>
Trademark:	<u>PEGATRON</u>
Batch / Serial number:	<u>PR1450-78E</u>

Object of the declaration (further identification of the radio equipment allowing traceability; it may include a color image for the identification of the radio equipment):



is in conformity with the relevant Union harmonization legislation:

Radio Equipment directive: **2014 / 53 / EU**

and other Union harmonization legislation where applicable:

with reference to the following standards applied:

EN IEC 62368-1:2020+A11:2020

EN301489-1 V2.2.3 , EN301489-50 V1.2.1

EN 55032: 2015 + A11: 2020

EN 55035: 2017+A11 :2020

EN 301 908-1 V15.2.1

EN 301 908-24 V15.1.1

EN 50385:2017

The Notified Body Kiwa Ltd., with Notified Body number 0063 performed:

[choose applicable Modules: B+C or H]

Where applicable:

The issued EU-type examination certificate: [note certificate number]

Description of accessories and components, including software, which allow the radio equipment to operate as intended and covered by the DoC:

.....

Signed for and on behalf of:

TAIPEI CITY, 2025-02-04

Place and date of issue

Flossie Yu, Senior Manager

1.4.4 USA: Federal Communications Commission

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. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio technician for help.



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

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.



Radiation Exposure Statement:

This equipment complies with FCC 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.



Professional installation instruction:

1. Installation personal

This product is designed for specific application and needs to be installed by a qualified personal who has RF and related rule knowledge. The general user shall not attempt to install or change the setting.

2. Installation location

The product shall be installed at a location where the radiating antenna can be kept 20cm from nearby person in normal operation condition to meet regulatory RF exposure requirement.

3. External antenna

Use only the antennas which have been approved by the applicant. The non-approved antenna(s) may produce unwanted spurious or excessive RF transmitting power which may lead to the violation of FCC limit and is prohibited.

4. Installation procedure

Please refer to user's manual for the detail.

5. Warning

Please carefully select the installation position and make sure that the final output power does not exceed the limit set force in relevant rules. The violation of the rule could lead to serious federal penalty.



WARNING: Changes or modifications made to this device not expressly approved by the manufacturer may void the FCC authorization to operate this device.

1.5 Definition of terms and abbreviations

1.5.1 Terms

Diora	RF board model name (Refer to hardware information)
Jura	Main board model name (Refer to hardware information)

1.5.2 Abbreviations

AGC	Auto Gain Control
AP	Antenna Processor (Refer to hardware information)
FS	Full Scale, Definition in O-RAN WG4 CUS specification
NP	Network Processor (Refer to hardware information)
PRB	Physical Resource Block

2. Introduction

The Pegatron PR1450 indoor O-RU is a partially compliant O-RAN Radio Unit, featuring Functional split 7.2 Category-A, along with low-PHY layer and RF processing capabilities.

2.1 Specifications

PR1450: Indoor 5G NR FR1 4T4R ORU



5G NR
SA Sub-6

Split
7.2a

4T4R
2CC

IP50
Enhanced
Temp Range

Energy
Saving

URLLC
mini slot

30/60
KHz SCS

EMC
Class B

Outline

- ASIC (SoC): NXP Layerscape®
- Memory
 - DDR4: 4 GB
 - eMMC: 4 GB
- I/O Interface
 - 1 x 10Gbps SFP+ (Fronthaul)
 - 1 x 1GbE RJ45 (PoE++)
- Dimensions: 260 x 280 x 90 (mm)
- Weight: < 4 kg
- Power Consumption: < **45 W**
- Power Supply
 - DC 12 V
 - POE++ (IEEE 802.3bt3)
- Mounting: Ceiling/Wall Mount

Environment

- Operating:
 - -5 ~ +50 °C
 - 5 ~ 95 % RH
- Storage:
 - -5 ~ +50 °C
 - 5 ~ 95 % RH
- Ingress Protection: **IP50**

Feature

- Radio: 3GPP 5G NR **Rel 16**
- Duplex: TDD
- Frequency Band and Channel BW (by SKU variance)
 - n78 (3.3-3.8 GHz): 10/20/30/40/50/60/70/80/90/100 MHz
 - n48 (3.55-3.7 GHz): 10/20/40 MHz
 - n79 (4.6-4.9 GHz): 10/20/30/40/50/60/70/80/90/100 MHz
 - n41 (2.496-2.69 GHz): 10/20/30/40/50/60/70/80/90/100 MHz
 - n77 (3.7-4.2 GHz): 10/20/30/40/50/60/70/80/90/100 MHz
- Modulation: 256 QAM DL, 256 QAM UL
- Sub Carrier Spacing (SCS): 30 / 60 kHz
- Data Stream: 4T4R MIMO
- Max Output Power: 250 mW (24 dBm) per RF Antenna Port
- Max EIRP: 36 dBm
- Antenna: Internal / External 4x4 MIMO
- Antenna Gain: 6 dBi
- Network Features: SSH via IPv4 / **IPv6**
- Carrier Aggregation: **2CC**
- **URLLC: Mini slot**

Performance (compliance)

- 3GPP: TS38.141 Section 6, 7
- EMC: EN 301489-1/-50, EN55032/55035/61000-4
FCC Part 15 **Class B**
- Safety: IEC/EN 60950-1, CB – IEC/EN 62368-1
- RF: EN 301908-1, EN 301908-24, EN 55385 (MPE)
FCC Part 96 (CPRS), 5G NR JRL

O-RAN Compliance

- Category A, Split 7.2a
- Transport Features
 - L2: Ethernet Encapsulation
 - L3: IPv4, IPv6 (M-Plane)
 - L4: eCPRI transport header
 - Data flow separation via VLAN
 - QoS over Fronthaul
 - Jumbo frame for U-plane
 - APP. Layer fragmentation
- C-Plane:
 - Type 0: RF calibration
 - Type 1: Physical channels
 - Type 3: PRACH channel only
- U-Plane
 - BFP Compression 9-bit IQ
- S-Plane
 - IEEE 1588 v2 (PTP)
- **SyncE**
- M-Plane
 - NETCONF (RFC 6241)
 - Hybrid / Hierarchical mode
 - SFTP for software and file management
 - NETCONF over SSHv2 (RFC 6242)
- E-Plane
 - Fully compliant with O-RAN Energy Saving/E-plane ETSI standards, achieving remarkable result

Figure 2.1-1 PR1450 Indoor ORU specifications

2.1.1 Radio Unit Models

Model	Description
PR1450-78E, PR1450-78I	n78: 3.3 GHz to 3.8 GHz
PR1450-79E, PR1450-79I	n79: 4.6 GHz to 4.9 GHz
PR1450-48E, PR1450-48I	n48: 3.55 GHz to 3.7 GHz

CE declaration RF power:

Frequency range	Maximum RF transmit power
3400~3800 MHz	31.33 dBm

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2.1.2 Noise Figure

Model	Description
PR1450-41E/I	4.76 dB
PR1450-48E/I	5.26 dB
PR1450-78E/I	3.2 dB
PR1450-79E/I	3.2 dB

2.2 List of package contents

2.2.1 Package contents

Table 2.3.1-1 O-RU package content list (Standard)

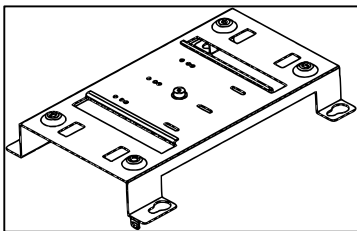
Name of Part	Quantity
O-RU	1

Table 2.3.1-2 O-RU package content list (Optional)

Name of Part	Quantity
Antenna (Only for external antenna SKU)	4
Mounting bracket	1

2.2.2 Mounting bracket

1. Mounting bracket x1



2. Screw package content list:

Table 2.3.2-1 Screw package content list

Name of Part	Quantity
WMEZ-3V0	4
PCA-2	4
SCREW M3.5*20L	4
SCREW M4*6L	4
SCREW M3*8L	8

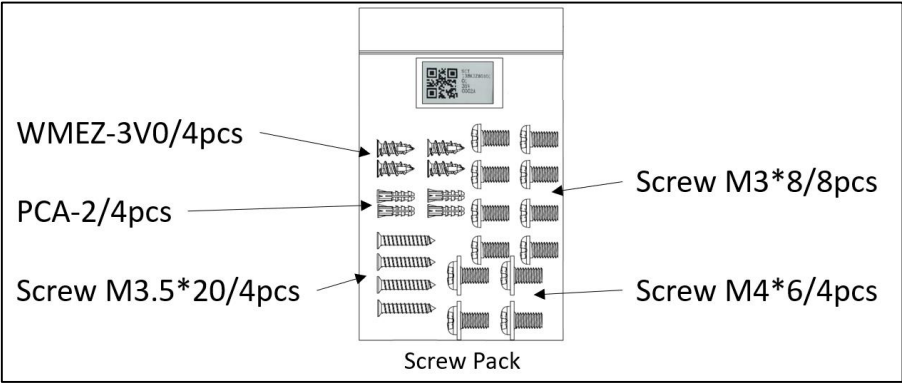


Figure 2.3.2-1: Screw Pack

3. Hardware information

3.1 Form factor

External Antenna SKU: (For internal antenna SKU, everything is identical except for the 4 external antennas are removed.)

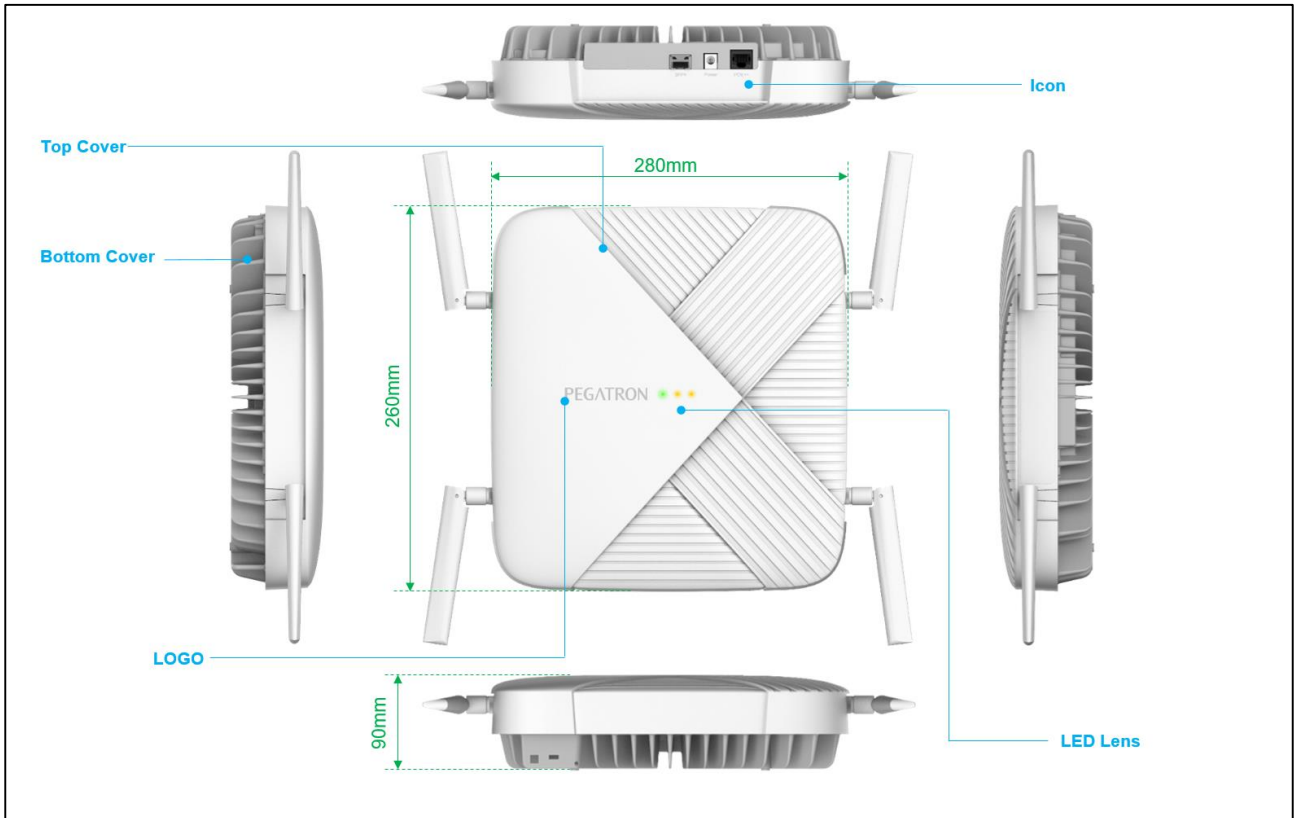


Figure 3.1-1 Form factor.

3.2 Ports and Indicators

3.2.1 Ports (for HW SKU SR1)

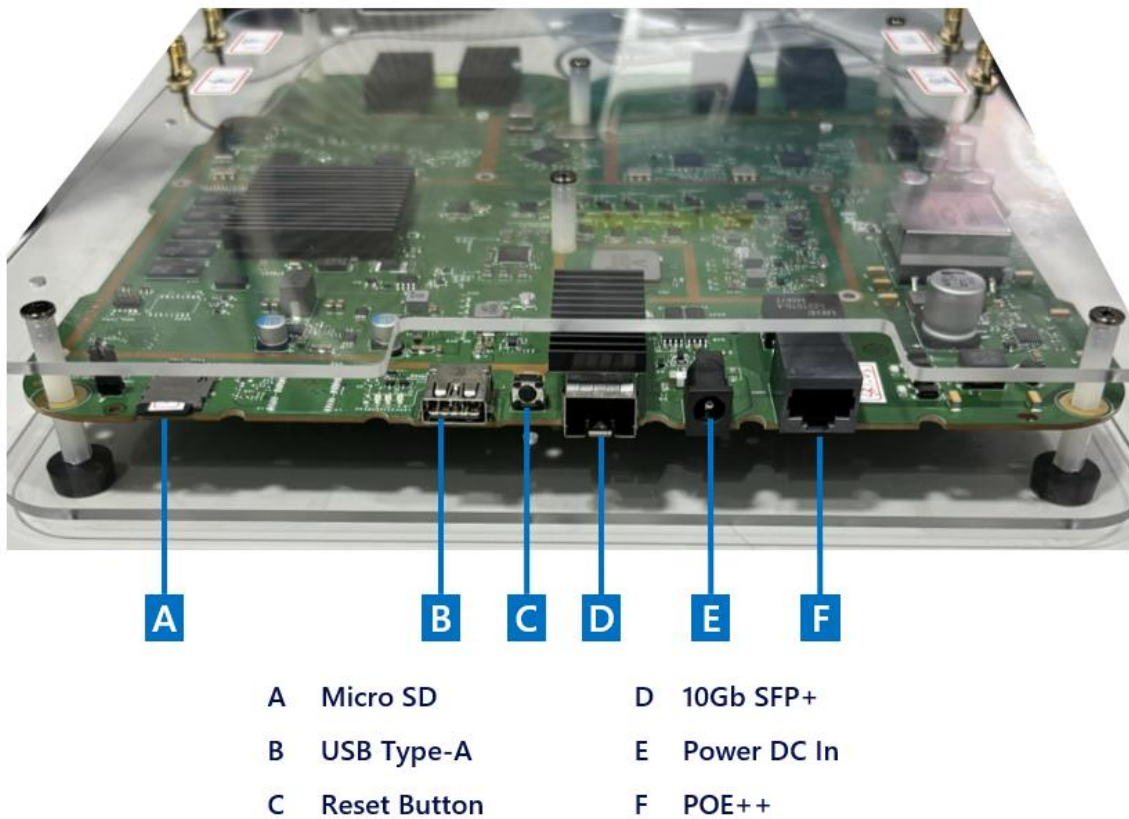


Figure 3.2.1-1 Ports and indicators

- A. Micro SD slot
 - Used for RU FW image storage.
- B. USB
 - Support USB Ethernet adapter. No default IP. When connect to DHCP server and received IP, can use the received IP for SSH login to RU.
- C. Reset button
 - Click 2 seconds, reboot.
 - Click 5 seconds, factory reset. (Please refer to section [Factory reset](#))
- D. SFP+
 - FH CUSM plane usage.
 - Default IP is **192.168.9.9/24**. Interface name is: **fm1-mac9**.
- E. Power DC:
- F. POE++: Power only, no network function.



Figure 3.2.1-2 Antenna number position

3.2.2 Ports (for HW SKU SR3 and newer)

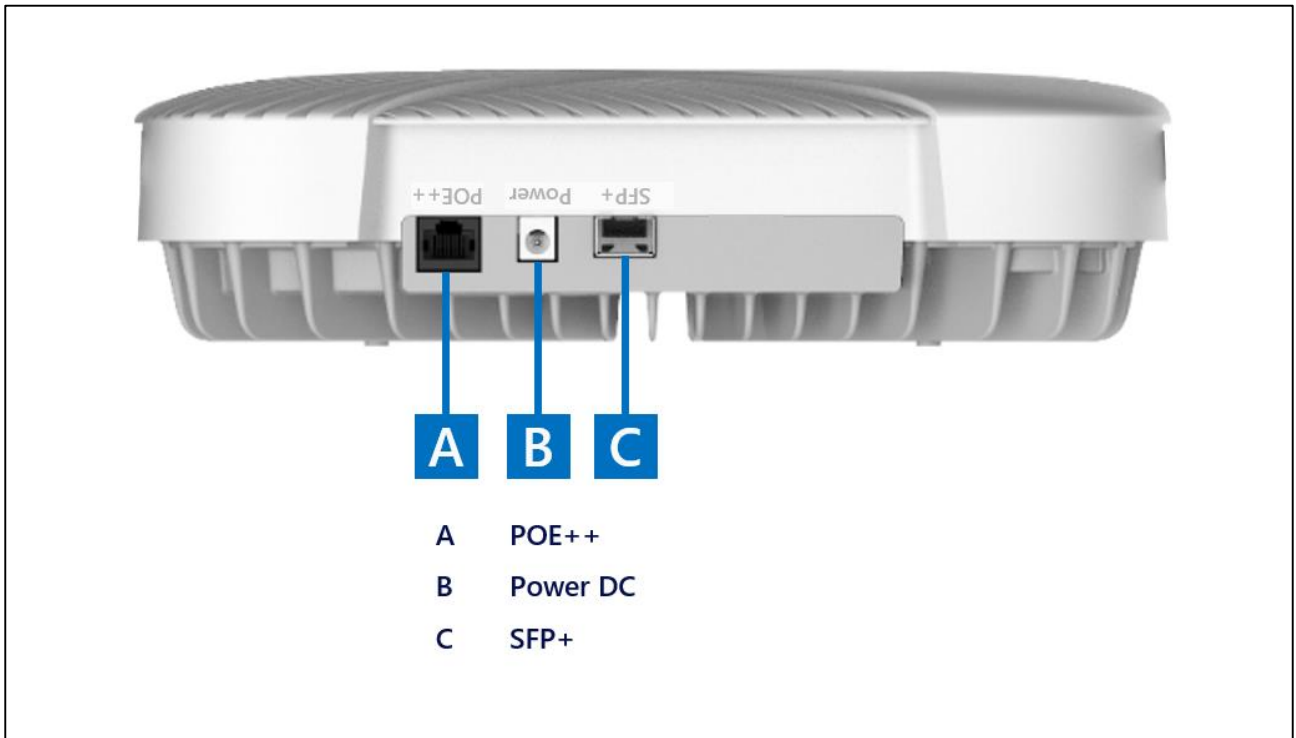


Figure 3.2.2-1 Ports and indicators

- A. POE++: Power only, no network function.
- B. Power DC
- C. SFP+
 - 10Gbps.
 - FH CUSM plane usage.
 - Default IP is **192.168.9.9/24**. Interface name is: **fm1-mac9**.

3.2.2 LED & Antenna Port

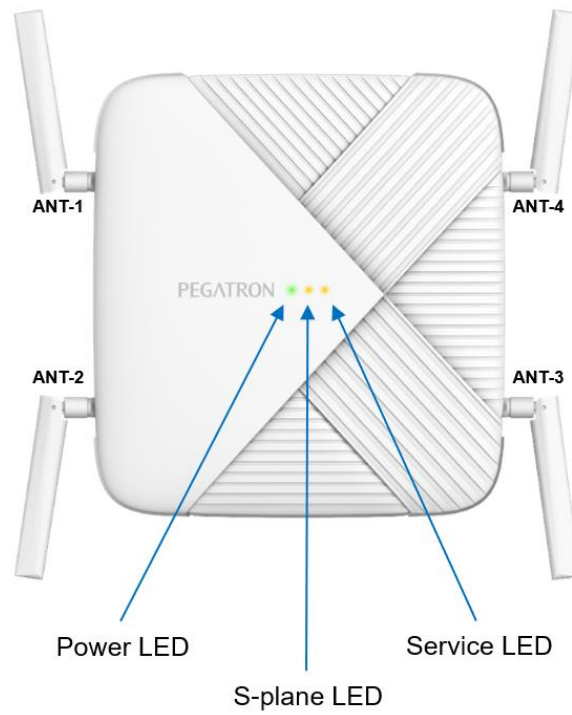


Figure 3.2.2-1 LED Indicators and Antenna Port

Table 3.2.2-1 LED status

LED Indicative	Color	Status	Description	Remark
Power LED [Left of FrontView]	Green	Solid	Power ON	
	Off	Off	Normal, powered off.	
S-plane LED [Middle of FrontView]	Green	Solid	PTP Locked	PTP Locked
		Slow blinking	PTP HOLDOVER	PTP ever locked, but lost PTP packet.
		Fast blinking	PTP FREERUN	Received PTP/SyncE input, but not lock yet.
	Red	Solid	PTP FREERUN	No PTP/SyncE input
		Fast blinking	PTP FREERUN	Only SyncE input
	Off	Off	PTP service not running	N/A
Service LED System/CU-plane Status [Right of FrontView]	Green	Solid	RU is radiating.	CU-plane is correct, and radiating.
		Slow blinking	RU is initializing.	Baseband unit is initializing , config, calibration, sync...
		Fast blinking	RU is ready to radiating.	Baseband unit is running, No CU-plane packet received.
	Red	Solid	RF component boot up fail.	RF component boot up fail.
		Slow blinking	Received data, but it's not correct. Possible reason: Out of receiving window.	Baseband unit is running, CU-plane packet out of window. Inspect Baseband unit's reception report by log. Monitor on-time, early, late packet counting. CP : On-times / Total <95% UP: On-times / Total < 95%
	Off	Off	CU-plane not running.	Baseband unit not running.

3.3 Recommended SFP+ transceivers

Table 3.3-1 Recommended SFP+ transceivers:

Vendor	Description	Vendor P/N
INTEL	Ethernet SFP+ SR Optics	FTLX8571D3BCL
DELL	Ethernet SFP+ SR Optics	LTF8502-BC+-DEN
Eoptolink	Ethernet SFP+ SR Optics	EOLP-8596-02-I
FINISAR	Ethernet SFP+ SR Optics	FTLX8571D3BCL
LUXSHARE	Ethernet SFP+ SR Optics	LUXSHARE-ICT
Cisco	Ethernet SFP+ SR Optics	SFP+10G-SR©
JPC	Ethernet SFP+ SR Optics	TNP199007A00038-7
JPC	Ethernet SFP+ SR Optics	TNP199007A00038-A
FINISAR	Ethernet SFP+ LR Optics	FTLX1471D3BCL
LUXSHARE	Ethernet SFP+ LR Optics	PGN1SSD01-NC-T
Eoptolink	Ethernet SFP+ LR Optics	EOLP-1396-10
Cisco	Ethernet SFP+ LR Optics	SFP+10G-LR(C)
JPC	Ethernet SFP+ LR Optics	TNP14200103A009-A
JPC	Ethernet SFP+ LR Optics	TNP14200103A009-7

3.4 Power supply

3.4.1 DC 12V Power Adapter Recommended Specification

This product is intended to be supplied by an UL Listed Power Adapter, rated 12 Vdc, 4.5A minimum, Tma min. = 50 degree C, altitude of operation min. 3048 meters. If need further assistance, please contact Pegatron for further information.

3.4.2 POE++ Recommended Specification

PR1450 supports POE++ as power input. Table 3.4.2-1 and 3.4.2-2 listed recommended POE++ specifications.



[POE connection] The equipment is to be connected only to PoE networks without routing to the outside plant. For indoor use only, the switch AC power cord and all connected cabled are not designed for outdoor use.



[POE power source] This product is intended to be supplied by a Listed power supply or PoE connector, output rated 41-57 Vdc, min. 1.5A. If need further assistance with purchasing the power source, please contact to "PEGATRON" or agency for further information.

3.5 Hardware installation

3.5.1 Cable connection

Once connected as shown below, refer to section [Getting started](#) to start access.

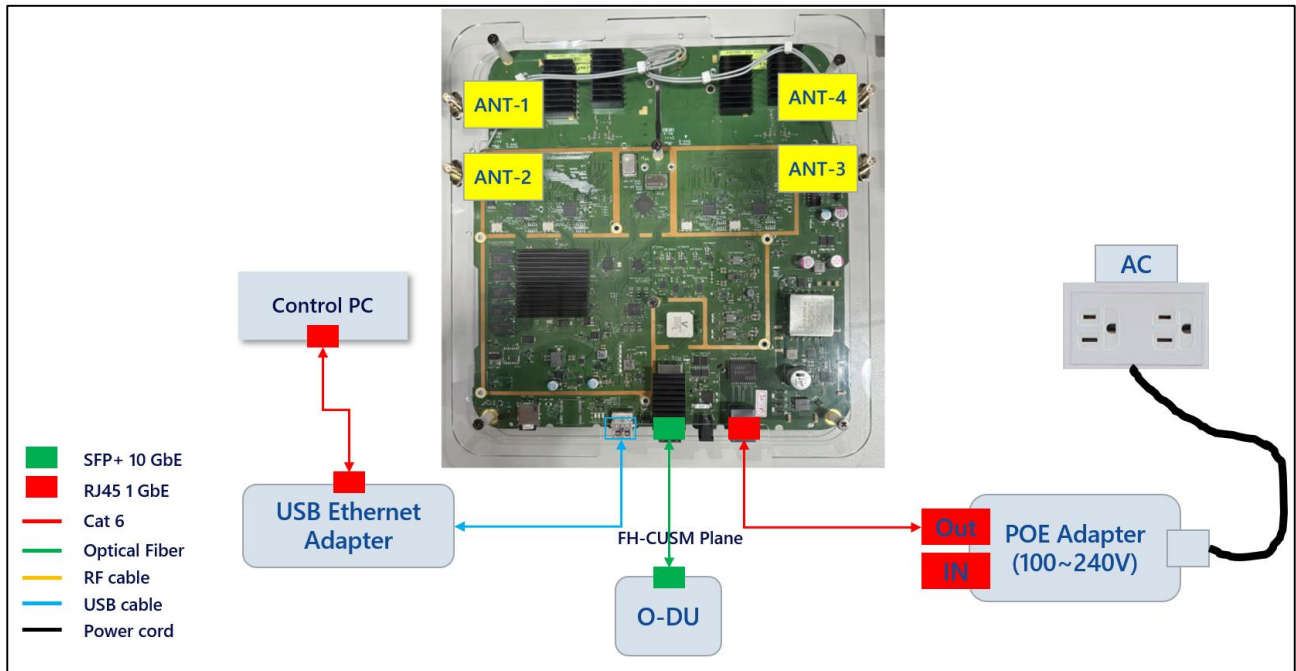


Figure 3.6.1-1 Cable connection (HW SKU SR1)

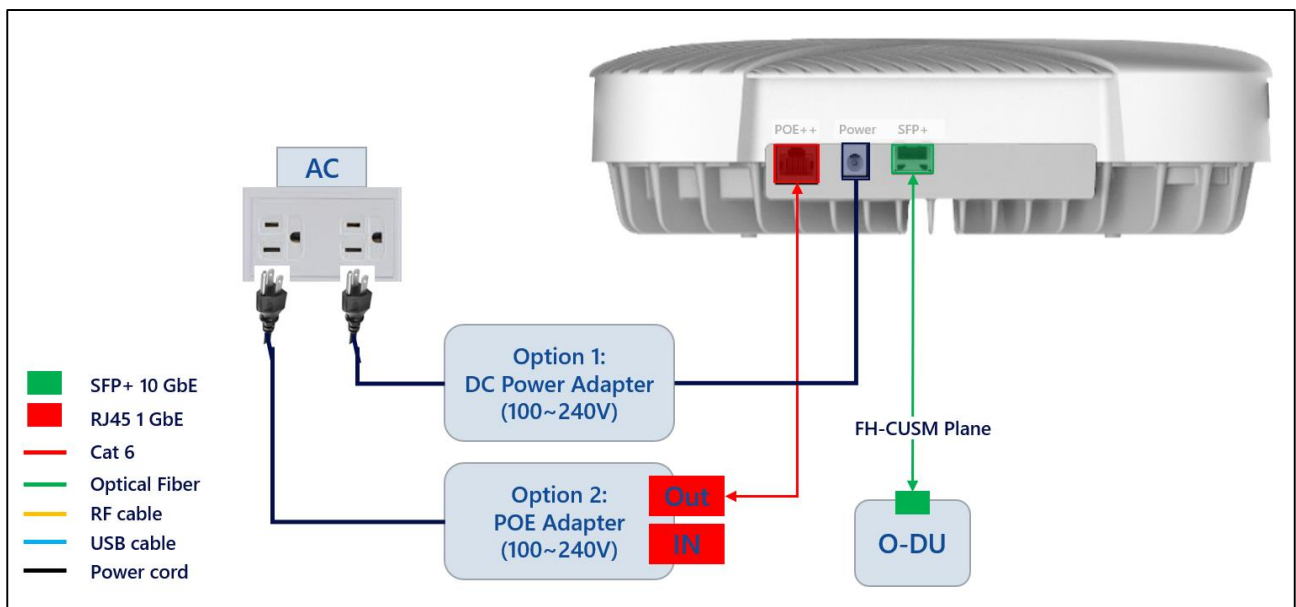
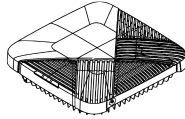
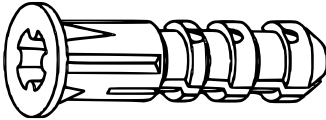
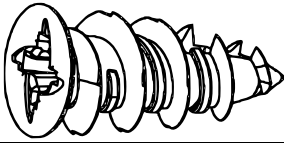
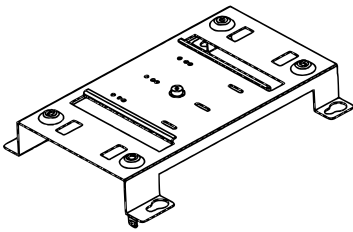
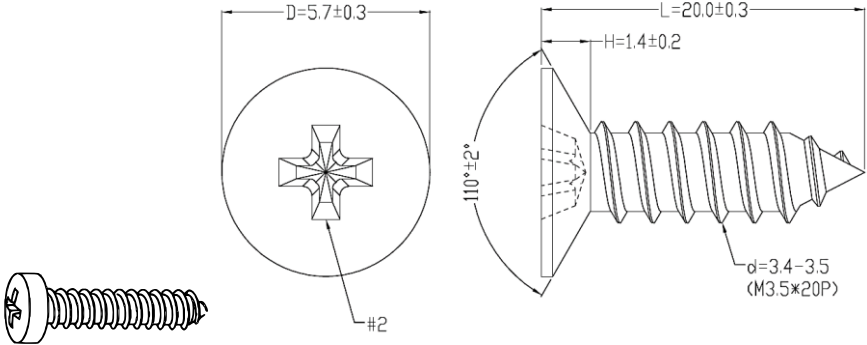
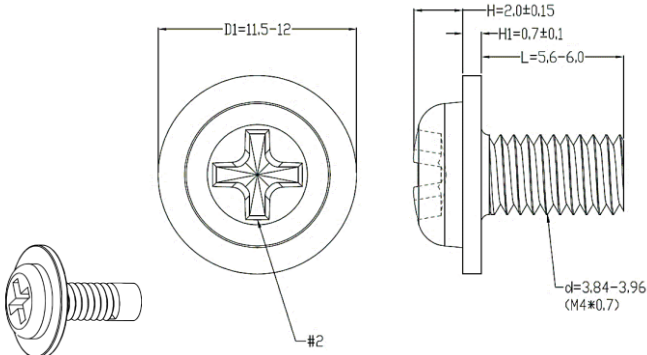
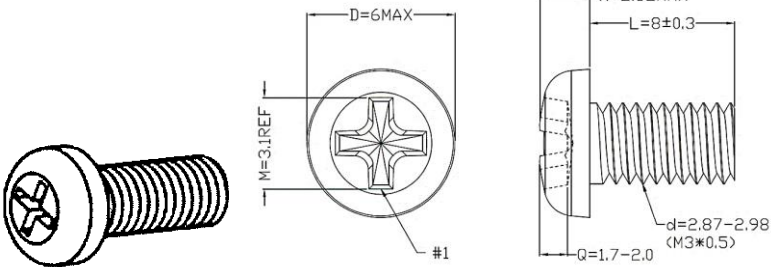


Figure 3.6.1-2 Cable connection (HW SKU SR3 and newer)

3.5.2 Mounting installation

Table 3.6.2-1 Mounting bracket part list

Name of Part	Abridged View
Cell Device	
PCA-2	
WMEZ-3V0	
RU Mounting bracket	
SCREW M3.5*20L	
SCREW M4*6L	

SCREW M3*8L	
-------------	--

3.5.2.1 Wall/Ceiling Mount

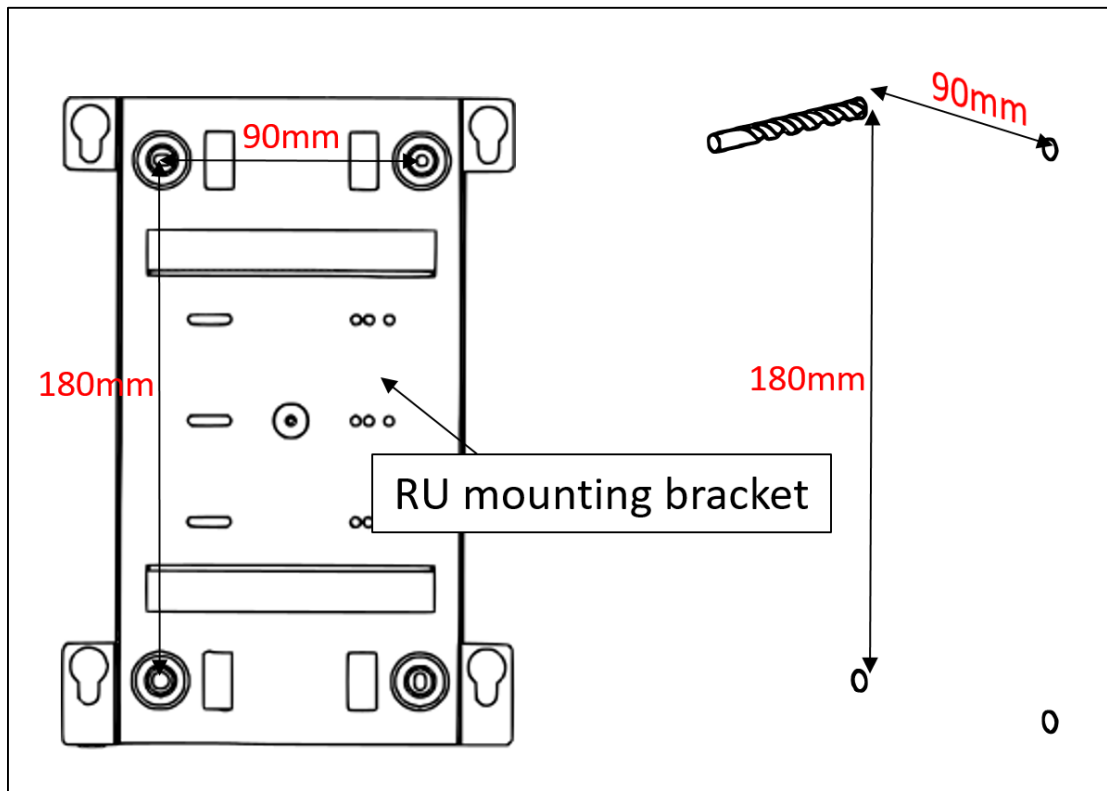
It's suitable for cement, wood and plaster wall/ceiling.

Table 3.6.2.1-1 Wall/Ceiling mount part list

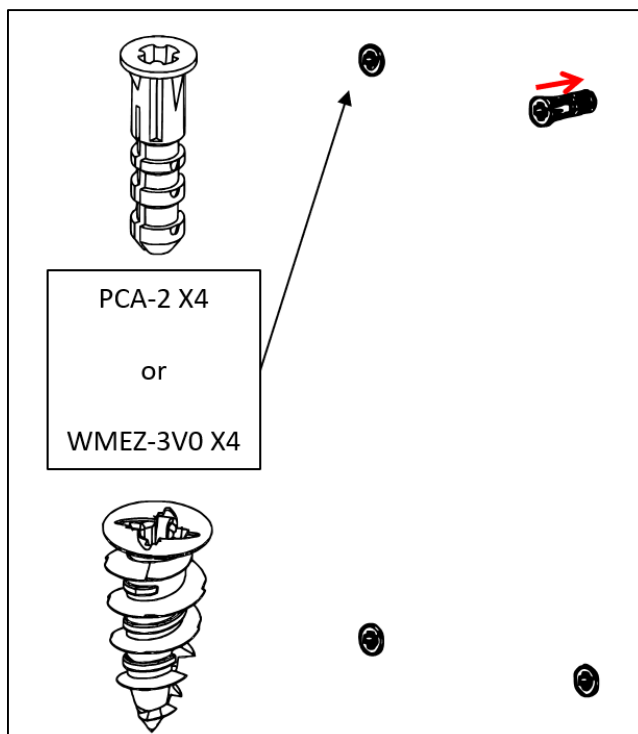
Installation Texture	Name of Part	Quantity
cement wall/ceiling	Cell Device	1
	PCA-2	4
	RU Mounting bracket	1
	SCREW M3.5*20L	4
	SCREW M4*6L	4
	SCREW M3*8L	2
wood wall/ceiling	Cell Device	1
	RU Mounting bracket	1
	SCREW M3.5*20L	4
	SCREW M4*6L	4
	SCREW M3*8L	2
plaster wall/ceiling	Cell Device	1
	WMEZ-3V0	4
	RU Mounting bracket	1
	SCREW M3.5*20L	4
	SCREW M4*6L	4
	SCREW M3*8L	2

Wall/ceiling mount includes Step 1 ~ 6.

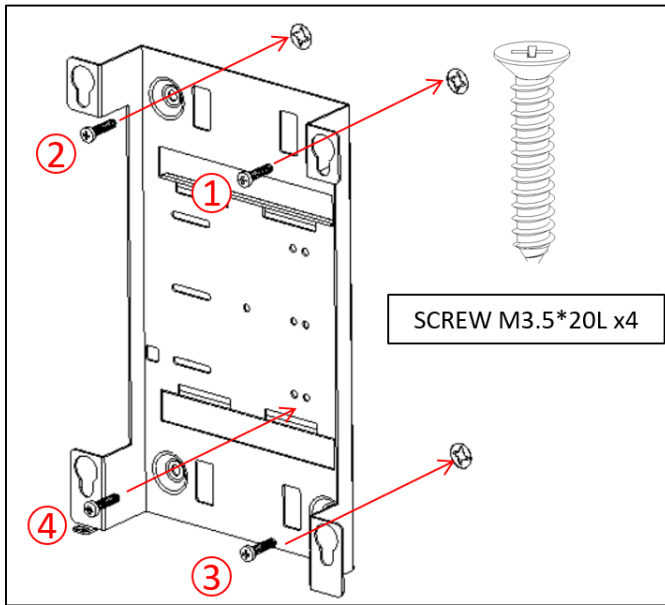
- Step 1: Drill four holes on the wall/ceiling according to the hole position of the RU mounting bracket.



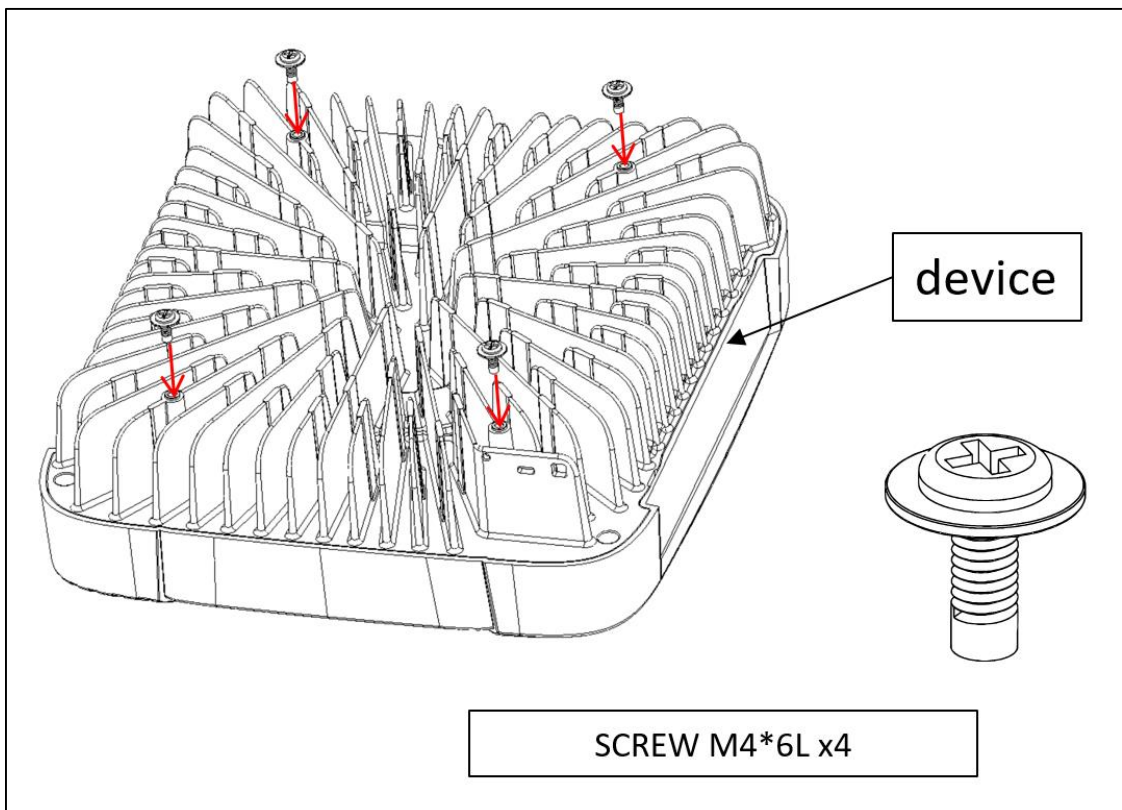
- Step 2: Insert expansion bolt in hole. PCA-2 is used for cement wall/ceiling, WMEZ-3V0 is used for plaster wall/ceiling. If it is installed on wood wall/ceiling, please start operation directly from STEP 3.



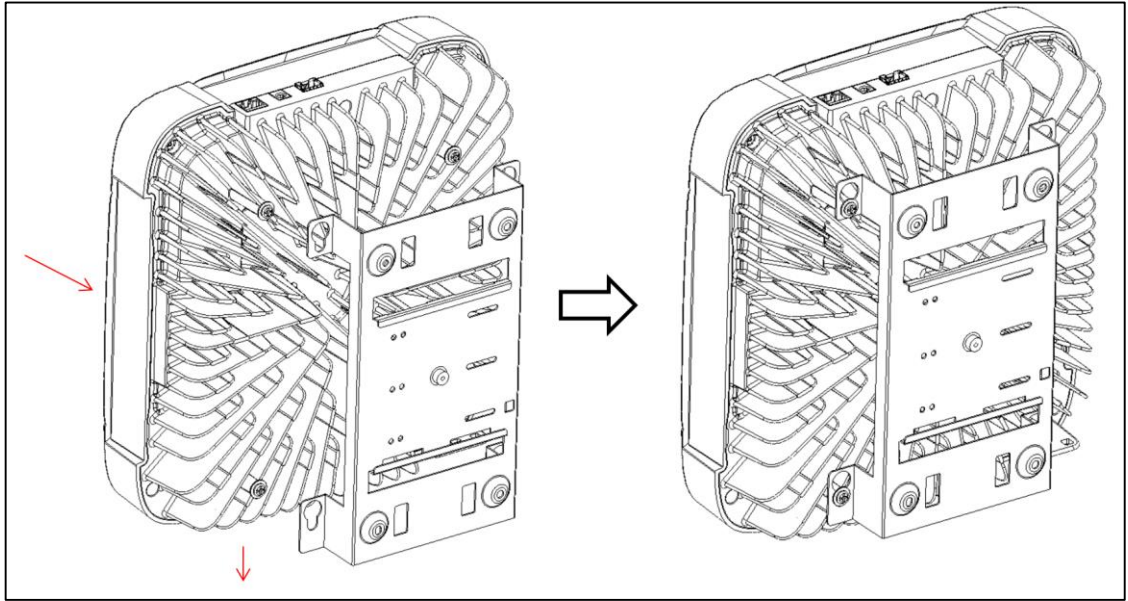
- Step 3: The screws go through the holes of the RU mounting bracket and lock into the expansion bolts in the order 1~4. If it is installed on wood wall/ceiling, please screw the screws directly into the wall/ceiling.



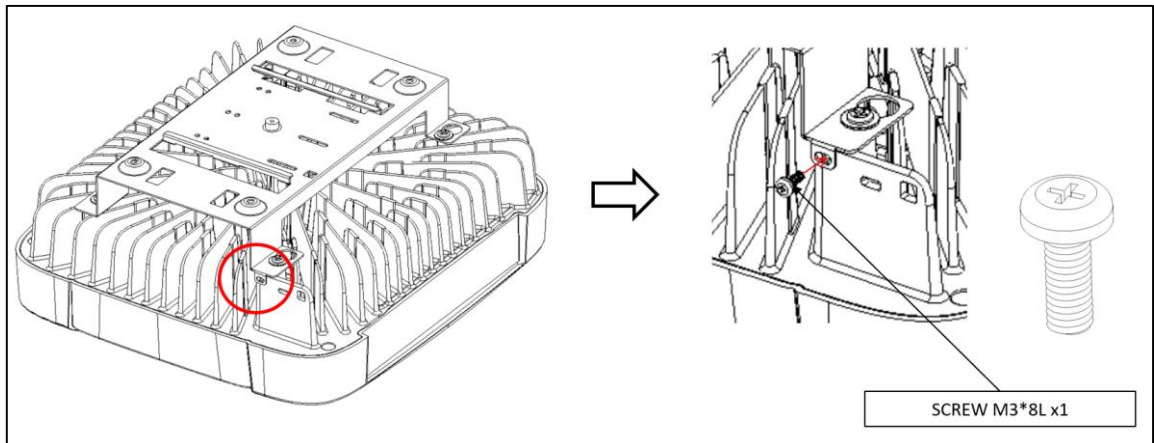
- Step 4: Flip the device to the back and lock the four M4x6 screws.



- Step 5: The four screws on the device correspond to the four holes on the RU mounting bracket, go through and fasten them down, pay attention to the direction of the holes.

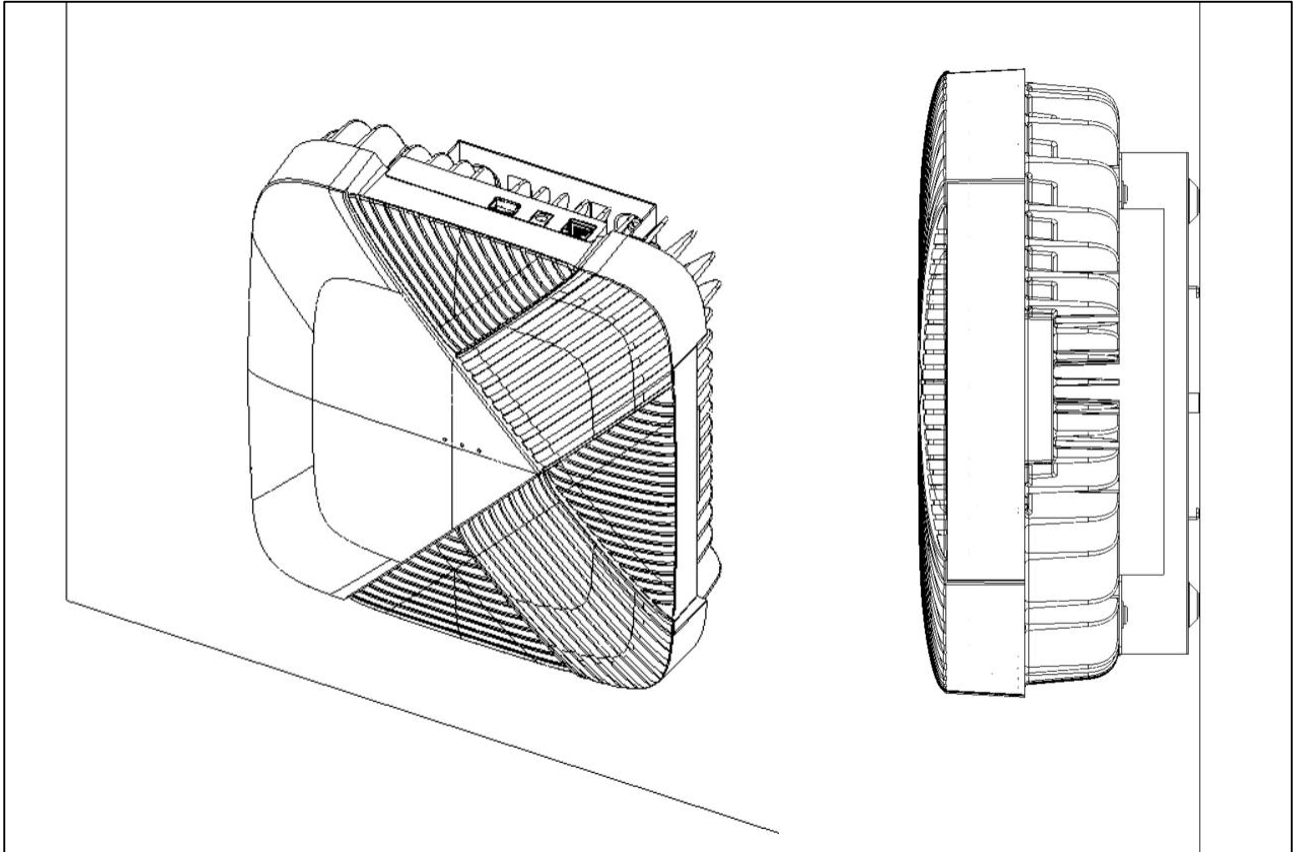


- Step 6: Fasten the screw to fix the device and the RU mounting bracket.

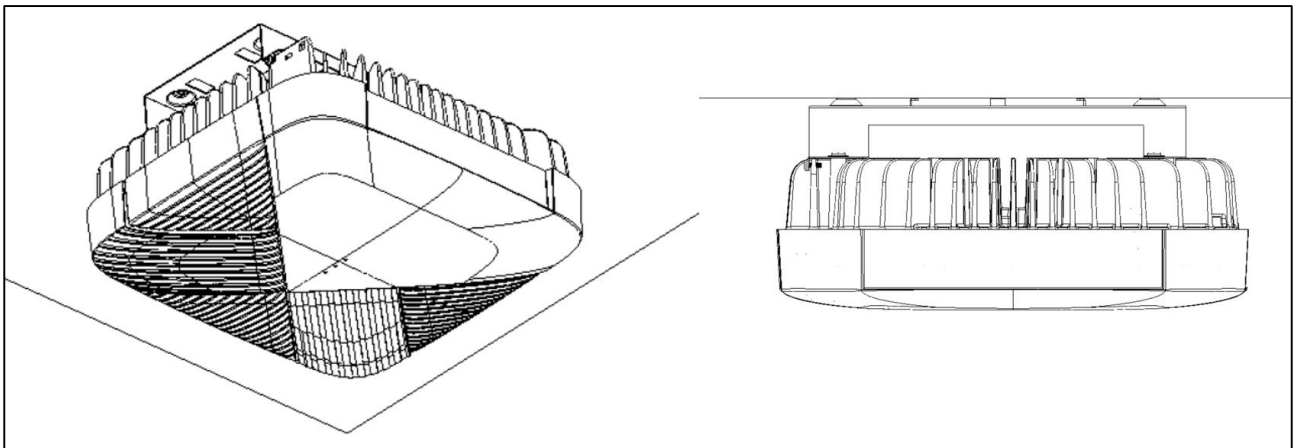


Completed display:

Wall mount



Ceiling mount



4. Software information

4.1 CUS-plane IOT Profiles

O-RAN.WG4.IOT.0-R003-v10.00

Table 4.1-1 A.2.1.1 NR TDD IOT Profile 1 - NR-TDD-FR1-CAT-A-NoBF

Category	Item	Specification requirements	PR1450
General	Radio access technology	NR TDD	TDD
	TDD configuration	Entry 1/2/3/4	TRUE
	Nominal sub-carrier spacing	30 kHz	30 kHz
	SSB sub-carrier spacing	30 kHz	30 kHz
	Nominal FFT size	4096	4096
	Total channel bandwidth	100MHz x 1CC	100MHz x 1CC
	Number of spatial/antenna streams	4	4
	Fronthaul Ethernet link	Entry1: 25Gbps x 1lane	10Gbps x1
		Entry2: 10Gbps x 2lane	
	PRACH preamble format	Entry1: B4	A3, B4, C2
		Entry2: C2	
	RU category	Category A	Category A
	LAA	FALSE	FALSE
Delay management	Network delay determination	Defined Transport Method	TRUE (This is the requirement for O-DU)
	RU adaptation of delay profile information (based on O-DU delay profile and transport delay)	FALSE	FALSE
	O-DU timing advance type	Fixed Timing Advance	Fixed Timing Advance
	T1a_max_up	Less than or equal to 345us	345 us (DU timing window)
	T1a_min_up	More than or equal to 294us	294 us (DU timing window)
	T2a_max_up	More than or equal to 345us	321 us

	T2a_min_up	Less than or equal to 134us	134 us
	Tcp_adv_dl	125 us	125 us
	Ta3_max_up	Less than or equal to 171us	170 us
	Ta3_min_up	More than or equal to 50us	70 us
	Ta4_max_up	More than or equal to 331us	200 us (DU timing window)
	Ta4_min_up	Less than or equal to 50us	10 us (DU timing window)
	T1a_max_cp_ul	Less than or equal to 336us	485 us (DU timing window)
	T1a_min_cp_ul	More than or equal to 285us	295 us (DU timing window)
	T2a_max_cp_ul	More than or equal to 336us	860 us
	T2a_min_cp_ul	Less than or equal to 125us	100 us
	T12_max	160 us	50 us
	T12_min	0 us	0 us
	T34_max	160 us	50 us
	T34_min	0 us	0 us
	Non-delay managed U-Plane traffic	FALSE	FALSE
C/U-Plane transport	Transport encapsulation	Ethernet	Ethernet
	Jumbo frames	FALSE	TRUE (MTU : 9600). Standard frame supported by FPGA software design.
	Transport header	eCPRI	eCPRI
	eCPRI concatenation	FALSE	FALSE
	eAxC ID DU_Port_ID bitwidth	Entry1: 2	4
		Entry2: 4	
	eAxC ID BandSector_ID bitwidth	Entry1: 6	4
		Entry2: 2	
	eAxC ID CC_ID bitwidth	4	4
	eAxC ID RU_Port_ID bitwidth	Entry1: 4	4
		Entry2: 6	
	Fragmentation	Application layer fragmentation	FALSE

	Transport prioritization across C/U/S/M-Plane	Default L2 CoS priority	TRUE (This is the requirement for O-DU)
	Transport prioritization within U-Plane	False (Default U-Plane priority applies)	FALSE
	Separation of C/U-Plane and M-Plane traffic	VLAN ID	TRUE
	Transport-based separation within C/U-Plane traffic	FALSE	FALSE
	UL gain_correction	0dB	Not supported
Beamforming	RU beamforming type	No beamforming	No beamforming
	Beamforming control method	Beamforming ID based (always "0")	No beamforming
IQ compression	U-Plane data compression method	Block floating point	Block floating point
	U-Plane data IQ bitwidth	14	9 bit for compression
	IQ data frame format not including udCompHdr field	TRUE	TRUE
C-Plane	Section Type 0	TRUE	TRUE (This is the requirement for O-DU)
	Section Type 1	TRUE	TRUE
	Section Type 3	TRUE	TRUE
	Section Type 5	FALSE	FALSE
	Section Type 6	FALSE	FALSE
	Section Type 7	FALSE	FALSE
	"symInc" flag	FALSE (always set to '0')	FALSE (always set to '0')
	C-Plane for PRACH formats with preamble repetition	Single C-Plane message	Single C-Plane message
	Section extension 1	FALSE	FALSE
	Section extension 2	FALSE	FALSE
	Section extension 3	FALSE	FALSE
	Section extension 4	FALSE	FALSE
	Section extension 5	FALSE	FALSE
S-Plane	G.8275.1	TRUE	TRUE
	G.8275.2	FALSE	FALSE
	GNSS based sync	FALSE	FALSE
	SyncE	TRUE	TRUE
	Topology configuration	lls-C1 (can also apply lls-C2)	lls-c1/c2/c3

Table 4.1-2 Pegatron E2E (FlexRAN based) delay profile example in xranconf_sub6.xml

Category	Item	Specification requirements	FlexRAN xranconf_sub6.xml example value
RU Window	Tcp_adv_dl	125 us	125 us
	T2a_min_cp_dl	N/A	295 us
	T2a_max_cp_dl	N/A	485 us
	T2a_min_cp_ul	Less than or equal to 125us	100 us
	T2a_max_cp_ul	More than or equal to 336us	336 us
	T2a_min_up	Less than or equal to 134us	170 us
	T2a_max_up	More than or equal to 345us	320 us
	Ta3_min_up	More than or equal to 50us	0 us
	Ta3_max_up	Less than or equal to 171us	170 us
DU Window	T1a_min_cp_dl	N/A	305 us
	T1a_max_cp_dl	N/A	475 us
	T1a_min_cp_ul	More than or equal to 285us	140 us
	T1a_max_cp_ul	Less than or equal to 336us	326 us
	T1a_min_up	More than or equal to 294us	210 us
	T1a_max_up	Less than or equal to 345us	270 us
	Ta4_min	Less than or equal to 50us	0 us
	Ta4_max	More than or equal to 331us	350 us

4.2 M-plane IOT profiles

O-RAN.WG4.IOT.0-R003-v10.00, A.1.2 M-Plane IOT Profile 2 Hybrid-sudo+nms				
Category	Item	Related O-RAN M-Plane/ YANG specification section(s)		PR1450
High Level Description	Architectural models	5.1.2 M-Plane architecture model	Hybrid model IP version	Comply
	IP version	5.1.3 Transport Network	IPv4	Comply
	Hash algorithm for data integrity	5.4 Security	HMAC-SHA2-256	Comply
	Cyphering algorithm	5.4 Security	AES128-CTR	Comply
“Start up” installation	O-RU identification by DHCP option	6.2.2 O-RU identification in DHCP	DHCPv4(Option: 60)	Comply
	VLAN Discovery	6.2.3 Management Plane VLAN Discovery Aspects	support VLAN SCAN	Comply
	IP address assignment	6.2.4 O-RU Management Plane IP Address Assignment	IPv4 configuration using DHCPv4	Comply
	O-RU controller discovery	6.2.5 O-RU Controller Discovery	Entry 1) DHCPv4 option 43 Entry 2) Configured by o-ran-mplane-int.yang	Comply
	DHCP format of O-RU controller discovery	6.2.5 O-RU Controller Discovery	O-RU Controller IP Address	Comply
	NETCONF Call Home	6.3 NETCONF Call Home to O-RU Controller(s)	call home(port4334)	Comply

	SSH/TLS Connection Establishment	6.4 NETCONF Connection Establishment	SSH: password-based authentication	Partial Comply, only SSH supported
	TCP port for SSH/TLS establishment (for test purpose)	6.4.1 NETCONF Security YANG (4) o-ran-mplane-int.yang	SSH: Default (port 830)	Partial Comply, only SSH supported
	NETCONF Authentication	6.4.2 NETCONF Authentication	password-based authentication	Comply
	User Account Provisioning	6.4.3 User Account Provisioning	default sudo	Partial Comply, only sudo supported
	sudo	6.5 NETCONF Access Control	used	Comply
	nms	6.5 NETCONF Access Control	used	Not Comply
	fm-pm	6.5 NETCONF Access Control	not used	Not Comply
	swm	6.5 NETCONF Access Control	not used	Not Comply
	NETCONF capability	6.6 NETCONF capability discovery	yang-library, Writable-running Capability, XPATH capability, Notifications, Interleave capability	Comply
	Watchdog timer	6.7 Monitoring NETCONF connectivity	used	Comply
O-RU to O-DU Interface Management	VLAN tagging for C/U/M-Plane	6.2.3 Management Plane VLAN Discovery Aspects 7.3 C/U Plane VLAN Configuration	used for C/U/M-Plane	Comply
	C/U Plane IP Address Assignment	7.4 O-RU C/U Plane IP Address Assignment	not used	Comply

	Definition of processing elements	7.5 Definition of processing elements	a combination of VLAN identity and MAC address	Comply
	C/U Plane Transport Connectivity	7.6 Verifying C/U Plane Transport Connectivity	Loop-back Protocol (LBM/LBR)	Comply
	O-RU Monitoring of C/U Plane Connectivity	7.10 O-RU Monitoring of C/U Plane Connectivity	not used	Not Comply
Configuration Management	Baseline configuration	9.1 Baseline configuration	2 phases	Partical Comply
Fault Management	subscribe notification	11.3 Manage Alarms Request to NETCONF Clients	default stream	Comply
Synchronization Aspects	Sync Capability Object	13.3 Sync Capability Object	CLASS_B	Comply
Details of O-RU Operations	Activation, deactivation and sleep	15.3.2 Activation, deactivation and sleep	not used	only support active/inactive

4.3 C-plane protocol features

- Section Type 0: Unused Resource Blocks or symbols in Downlink or Uplink
- Section Type 1: Most DL/UL radio channels
- Section Type 3: PRACH and mixed numerology channels (PRACH A3, B4, C2 30 kHz Only)
- DL 20 sections/symbol
- UL 20 sections/symbol
- Stock Data Section A, B, and C (O-RAN.WG4.CONF 3.2.1.1.5)
- TDD Patterns: Per symbol selection or preconfigured TDD pattern
- Symbol base, multiple c-plane per slot.

4.4 U-plane protocol features

- U Plane Compression
 - UL 9bits BFP
 - DL 9bits BFP
- Section Type 1: Most DL/UL radio channels (PUSCH/PUCCH/PDSCH/PDCCH).
- Section Type 3: PRACH.
- Supports Static or Dynamic for udCompHdr.

4.5 S-plane protocol features

- G8275.1 and G8275.2 profile
- Both one-step and two-step
- Topology: LLS-C1, LLS-C2, LLS-C3
- Supports SyncE

4.6 M-plane protocol features

- O-RAN Fronthaul M PLANE
- NETCONF/YANG
- YANG Model Data Store
- O-RAN WG4 MP YANG model (O-RAN.WG4.MP-YANGs-v09.00)
- SW Management
- Configuration Management
- Performance Management
- Log Management
- Fault Management

4.6.1 Supported yang model

Table 4.6-1 Supported Yang model:

Yang Module	Comments
ietf-netconf-acm.yang	Default disable for developing prototype
ietf-netconf-server.yang	● Both listen mode (port 830) and call-home are supported ● DHCP/Option43 for call-home supported ● SSH only, does not support TLS
o-ran-sync.yang	● The default monitor interval is 10s to update the state and trigger notification. ● PTP only in this phase
o-ran-performance-management.yang	● tx-measurement-objects supports the following items: TX_TOTAL: the number of outbound packets (data and control) transmitted within the measurement period. TX_TOTAL_C: the number of outbound control packets transmitted within the measurement period. ● rx-window-measurement-objects supports the following items: ■ RX_ON_TIME: the number of data packets received on time within the reception window. ■ RX_EARLY: the number of data packets received before the reception window. ■ RX_LATE: the number of data packets received after the reception window. ■ RX_CORRUPT: the number of corrupt data packets or whose header is incorrect.

	■ RX_TOTAL: the total number of received packets (data and control) within the measurement period. ■ RX_ON_TIME_C: the number of control packets received on time within the reception window. ■ RX_EARLY_C: the number of control packets received before the reception window. ■ RX_LATE_C: the number of control packets received after the reception window. ● query interval is configurable, and default is 5s
o-ran-software-management.yang	3 slot supported.
o-ran-file-management.yang	Only SFTP with password login is supported; TLS is not supported
o-ran-operations.yang	Only reset RPC is supported
o-ran-trace.yang	● Use Network processor log as content ● TODO: Antenna processor log
o-ran-uplane-conf.yang	Only TX power control, occupied bandwidth, and center frequency are supported in this phase.
o-ran-interfaces.yang	Only supports RU mac-address & MTU configuration in this phase.
o-ran-processing-elements.yang	Only supports o-du-mac-address & vlan-id configurations in this phase.
o-ran-supervision.yang	Start the count down after receiving RPC supervision-watchdog-reset or create-subscription and send notification / supervision-notification after a timeout.
o-ran-fm.yang	
o-ran-troubleshooting.yang	
o-ran-usermgmt.yang	
o-ran-lbm.yang	

4.6.2 Supported alarm list

Mplane Alarm List in O-RAN.WG4.MP.O-R004-v16.00			FW v1.0.2.2
Fault ID	Fault Name	Meaning	Supported
1	Unit temperature is high	Unit temperature is higher than expected.	Yes
2	Unit dangerously overheating	Unit temperature is dangerously high.	Yes
3	Ambient temperature violation	Calculated ambient temperature value goes outside the allowed ambient temperature range.	No

4	Temperature too low	During start-up: The temperature inside the unit is too low. Heating of unit is ongoing. Wait until the alarm is cancelled. During runtime: The temperature inside the module is too low.	Yes
5	Cooling fan broken	Fan(s) do not run.	No
6	No fan detected	Unit cannot identify the used fan type or the fan is not installed at all.	No
7	Tuning failure	A filter has not been able to tune on an appropriate sub-band properly.	No
8	Filter unit faulty	Major failure has been detected by the filter.	No
9	Transmission quality deteriorated	The TX signal quality may be out of specification limits.	No
10	RF Module overvoltage protection faulty	Module's overvoltage protection is broken.	No
11	Configuring failed	Configuration failed because of a HW or SW fault.	No
12	Critical file not found	Critical configuration file is missing.	No
13	File not found	Non-critical configuration file is missing.	No
14	Configuration file corrupted	conflicting or corrupted configuration data.	No
15	Unit out of order	The Unit is out of order because of a software or hardware fault.	No
16	Unit unidentified	The permanent memory in the module is corrupted and the module product code or serial number is missing, or the module product code is unknown.	No
17	No external sync source	The Unit lost lock to all incoming clocks.	Yes
18	Synchronisation Error	Unit is out of synchronisation.	Yes
19	TX out of order	TX path is not usable.	No
20	RX out of order	RX path is not usable.	No
21	Increased BER detected on the optical connection	Increased bit error rate has been detected on the optical link which results in sporadic errors in downlink baseband processing.	No
22	Post-test failed	Power-on self-test failed at start-up.	No
23	FPGA SW update failed	The FPGA software update has failed.	No
24	Unit blocked	Unit is administratively locked.	No
25	Reset Requested	Unit detected a transient problem which significantly affects operation that requires a reset as a recovery.	Yes

26	Power Supply Faulty	Input power to module has fault, unstable or broken.	No
27	Power Amplifier faulty	One or more power amplifiers in module has fault, unstable or broken	No
28	C/U-plane logical Connection faulty	One of logical C/U-plane connection has fault, unstable or broken.	TBD
29	Transceiver Fault	Unit has detected a transceiver fault	No
30	Interface Fault	Unit has detected a fault with one of its interfaces	No
31	Unexpected C/U-plane message content fault	C/U-plane message content was faulty for undetermined reason.	Yes
32	Triggering failure of antenna calibration	O-RU has previously sent a notification antenna-calibration-required and has not received an antenna-calibration-start RPC	No
33	Dying Gasp	O-RU is suffering from an unrecoverable condition such as power failure	No
34	Clock source failure	Clock source has failed	No
35	Lost O-DU ID based Supervision	An O-RU has lost supervision from one O-DU.	No
36	Rx Signal quality deteriorated	The RX signal quality may be out of specification limits.	No
37	High IQ Power	The IQ Power level is higher than alarm threshold.	No
38	VSWR high	VSWR has exceeded threshold limits	No
39	Certificate About to Expire	The X.509 certificate used by O-RU for M plane is about to expire.	No
40	Certificate Expired	The X.509 certificate used by O-RU for M plane has expired.	No

4.6.3 Supported PM counter

Supported PM counter			
Measurement Object Group	Supported Measurement Object	Description	Supported
tx-measurement-object	TX_TOTAL	the number of outbound packets (data and control), transmitted within the measurement period	Yes
	TX_TOTAL_C	the number of outbound control packets, transmitted within the measurement period. This counter is required only if RU supports LAA/LBT capabilities.	Yes
rx-window-measurement-object	RX_ON_TIME	the number of data packets, received on time within the reception window.	Yes
	RX_EARLY	the number of data packets, received before the reception window.	Yes
	RX_LATE	the number of data packets, received after the reception window.	Yes
	RX_CORRUPT	the number of data packets, which are corrupt or whose header is incorrect.	Yes
	RX_DUPL	the number of data packets, which is duplicated with other packets, received within the measurement period.	No
	RX_TOTAL	the total number of received packets (data and control) within the measurement period.	Yes
	RX_ON_TIME_C	the number of control packets, received on time within the reception window.	Yes
	RX_EARLY_C	the number of control packets, received before the reception window.	Yes
	RX_LATE_C	the number of control packets, received after the reception window.	Yes
	RX_SEQID_ERR	the number of data packets, received with an erroneous sequence ID.	No
	RX_SEQID_ERR_C	the number of control packets, received with an erroneous sequence ID.	No
	RX_ERR_DROP	The total number of inbound messages which are discarded by the receiving O-RAN entity for any reason.	No

5. Getting Started

This section describes quick guideline for access, operating this O-RU, including cable connection, networking configuration for access, radio configuration, status checking, log collection and firmware upgrade.

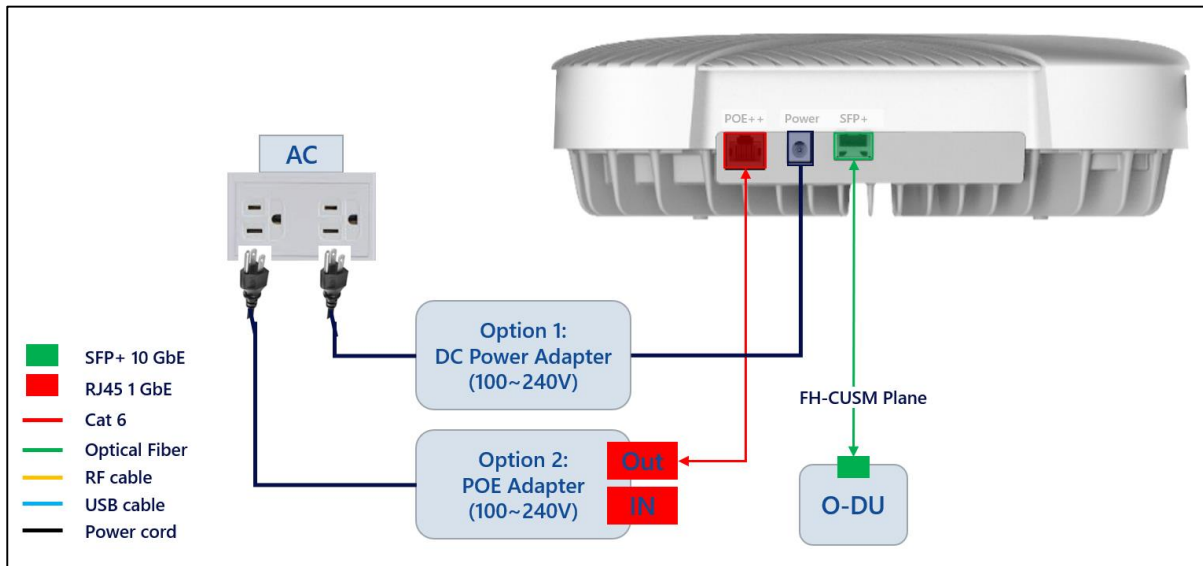


Figure 5-1 Cable connection (HW SKU SR3 and newer)

5.1 Alternative access connection

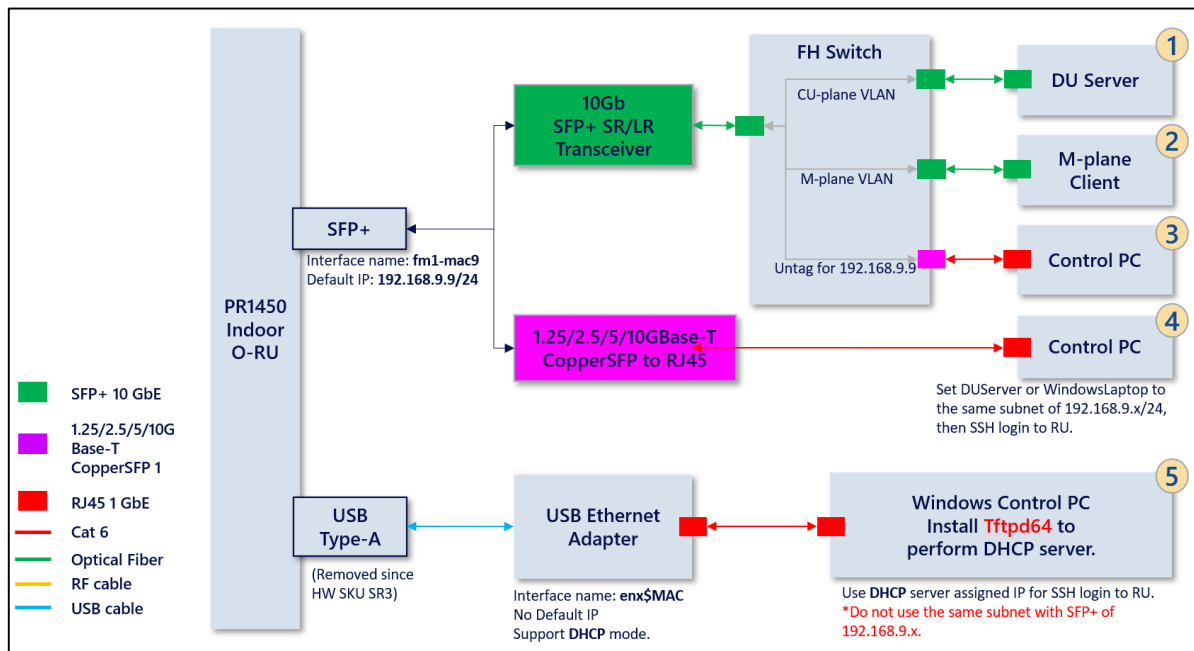


Figure 5.1-1 Alternative access connection

For first time access RU to provision, configure, there are some different ways to access to RU:

1. Insert the 10Gb SFP+ transceiver on the RU and connect to DU. On the DU, configure the IP to subnet 192.168.9.x/24 so that DU can be used for SSH login to RU (default IP of RU will be 192.168.9.9/24). If FH connection goes through a switch, then configure switch port to no VLAN un-tagged.
2. Once connected to the RU via SSH from the DU, the RU's m-plane vlan/ip can be configured and a connection to the RU can be made using a NetConfClient. (Please refer to section [Configure interface](#) for m-plane VLAN/IP configuration)
3. RU insert 10Gb SFP+ transceiver connect to FH switch with no VLAN untagged, Control PC connect to FH switch with **1000Base-T Copper SFP** to RJ45. Configure control PC to subnet 192.168.9.x/24 for SSH login to RU.
4. Alternatively a control PC (IP in 192.168.9.x/24) may be used to re-configure the RU using **1.25/2.5/5/10GBase-T** Copper SFP to RJ45 connector. The default IP of the RU will be 192.168.9.9/24.
5. RU insert USB Ethernet adapter, direct connect to Control PC. Control PC need to execute DHCP server service, suggest to use Windows laptop and install Tftpd64 tool. After DHCP server offer IP to RU, control PC can use offered IP for SSH login to RU.

5.2 Login

5.2.1 Login via SSH

Follow section 5.1 connection, there are several accounts used for access O-RU.

Please refer to below table:

Table 5.2.1-1 Login account list

Type	Account	Password	Permission Description
CLI operation via SSH connection	root	root (Only for DEBUG-Type-FW)	Super user
	padmin	● PEGA@xu42k6xj4 ● Since v1.0.2.3p1, change to “Pega@2025” ■ (New password will be applied after execute “Reset-Default 1”)	Super user
	ruser	Pega#1234	Read only
WebGUI log in	padmin	● Applied since v1.0.2.3p1, change to “Pega@2025” ■ (New password will be applied after execute “Reset-Default 1”)	Super user
	ruser	● pr1450 ● Since v1.0.2.3p1, change to “Pega#1234” ■ (New password will be applied after execute “Reset-Default 1”)	Read only
MPlane Netconf Session connection	oranuser	● pr1450-78i ● Since v1.0.2.3_RC1, change to “pr1450-ru”	sudo permission

Note:

Since FW v1.0.2.3p1, introduced a mechanism of password protection system, using PAM (Pluggable Authentication Module) to prevent brute force attacks, including:

1. After 5 times login fail, system will enter locked state for 5 minutes, not acceptable to login even with correct password.
2. After 5 minutes, system unlock, then every login fail will enter locked state for 5 minutes again.
3. Once login success, will clear 5 times failure count.
4. Reboot will not clear lock timer and failure count.
5. Lock status is based on different account.

SSH Login example:

```
03/12/2024 11:06.58 /home/mobaxterm ssh padmin@192.168.9.9
PR1450
Last login: Sat Nov 9 22:50:49 2024 from 192.168.9.199
PR1450#
```

After login, it will directly enter CLI interface, enter “help” to check command list.

Example: padmin login, (When using ruser which is read-only, it will not show “configure interface/management/radio/ptp” option)

```
PR1450# help

Commands available:
help                Show available commands
logout              Disconnect cli menu
exit                Exit from current mode
history             Show a list of previously run commands
reboot              Reboot system
configure interface Enter config interface mode
configure management Enter config management mode
configure radio      Enter config radio mode
configure ptp        Enter config ptp mode
date                Show current time
ping                Test the reachability of a host
fh_capture           Capture FH eCPRI packets
sysinfo             Extrally get system info of this system
show                 Show information
show fw-version      Show firmware version
show hw-version      Show hardware version
show model-name      Show model name
show serial-number   Show serial number
show sensors          Show sensors temperature
show syslog           Show syslog
show running-config  Show running config
show interface-info  Show current informaton of interface
show m-plane         Show server m-plane
show ptp-status       Show ptp status
show ptp-lock-history Show ptp lock history
show ptp-log          Show ptp log
show rfBoard-version Show RF board version
show radio center-freq Show radio center frequency Hz
show radio compression Show radio TX/RX compression
show radio status     Show RF management service status
show radio delay-profile Show RU delay profile capabilities
show radio band       Show RU Band
show radio du-mac     Show DU MAC
show radio eCpri-vlan Show eCpri VLAN ID
show radio bandwidth  Show radio bandwidth
show radio tx_carrier_gain Show TX carrier gain
show radio n_ta_offset Show Time Advanced Offset
show radio gain-correction Show TX/RX gain correction
show radio tx_rf_gain_max Show Maximum of tx gain setting
show radio gain-manual Show MT3812 TX/RX gain manual Configuration
show radio rx-power-agc Show RX auto gain control(agc)
show radio ant-nums   Show Antenna nums
show radio fs-offset  Show TX/RX FS_Offset (full scale offset) value which defined in O-RAN CUS spec
show radio cali-cfg   Show calibration configuration
show radio console    Show ap console message 10 seconds
show radio prbs        Show number of prb per 30kHz scs
show radio offset-alpha Show ap offset_alpha
show radio offset-beta Show ap offset_beta

PR1450#
```

5.2.2 Login via website

Web GUI is also available. You can use browser in Control PC to open the website.

Please refer to section [Login via Web](#).

5.3 Configuration

This section lists some necessary configuration when deploy O-RU, including CU-plane, S-plane, M-plane, Network interface. There may still have some configuration need to be applied based on your environment, please refer to section 6 CLI Operation for all the configuration.

5.3.1 CU-plane configuration

Here are some basic radio configurations for CU-plane that may need to check in the beginning interoperability testing.

CLI command list:

1. [Center Frequency](#)
2. [Bandwidth](#)
3. [DU MAC address](#)
4. [eCPRI VLAN for CU-plane](#)
5. [eAxC ID](#)
6. [Full scale offset](#)
7. [Tx carrier gain](#)
8. [FS gain correction](#)
9. [Calibration configuration](#)

5.3.2 S-plane configuration

For S-plane, below items should be considered in the beginning deployment.

CLI command list:

1. [ip-setting](#). (Configure Splane interface IP address in case it's g8275.2 profile)
2. [splane-vlan](#). (Configure Splane VLAN setting. **Untagged PTP is allowed by default without any further VLAN configuration.**)
3. [PTP profile \(g8275.1 or g8275.2\)](#)
4. [PTP domain number](#)
5. [PTP GM clock class limit](#)
6. [PTP SyncE On/Off](#)
7. [PTP debug level](#)

Parameter	G.8275.1 Profile	G.8275.2 Profile
1-Step, 2-Step	Both supported by default	Both supported by default
sync_interval	-4	-6
delay_req_interval	-4	-6
announce_interval	-3	0
announce_receipt_timeout	3	2
local_priority	128	128

5.3.3 M-plane configuration

For M-plane configuration, please go to CLI configure interface, and setting mplane interface and VLAN.

Command list:

1. [ip-setting](#)
2. [mplane-vlan](#)

Then, please go to CLI configure management, and setting Call Home IP (If mplane IP setting to Static mode, need to set call home IP.) and vendor class identification (Used for DHCP option 43).

Command list:

1. [call-home-ip](#)
2. [vendor-class-identifier](#)
3. [mplane-running](#)
4. [supervision-handling-mode](#)

Since FW version v1.0.2.2, O-RU supports MPlane VLAN discovery procedure specified in O-RAN.WG4.MP specification. The O-RU will attempt to contact a DHCP server using the full range of VLAN IDs (1-4094).

Command list:

1. [vlan-discovery](#)

After above setup completed, pls refer to [M-Plane Operation](#) section.

5.3.4 Network interface configuration

O-RU has single physical network interface, mainly for FH connection and CUSM-Plane traffic. Based on this physical interface fm1-mac9, system will create alias virtual interface, including cuplane, mplane, splane virtual interface.

Interface name	Type	Default VLAN	Default IP
fm1-mac9	Physical	Untagged	192.168.9.9/24
cuplane	Alias virtual interface	3	N/A
splane	Alias virtual interface	2 (Untagged PTP is allowed by default without any further VLAN configuration)	N/A
mplane	Alias virtual interface	1	N/A

Related configure interface command list:

1. [ip-setting](#)
2. [mplane-vlan](#)
3. [splane-vlan](#)
4. [mtu](#)
5. [route](#)

5.4 Check Status

After configure all the necessary items, use below section to check RU status.

5.4.1 Check version

show fw-version

Use the **show fw-version** to check current RU firmware version.

Example:

```
PR1450# show fw-version
SW_VERSION:1.0.1.1
Revision:c9308f
```

```
PR1450#
```

5.4.2 Check running configurations

show running-config

Use the **show running-config** to check current RU's configuration.

Example:

```
PR1450# show running-config
=====
management
=====
log_size                200M
ssh_version             libssh-0.10.4

call_home_ip            192.168.100.50
call_home_ipv6          ::
call_home_mode          1
vendor_class_identifier  o-ran-ru/PEGA
=====
network
=====
-----< Initial User Setting >-----
fm1_mac9_mac            00:e0:0c:00:ae:07
fm1_mac9_ip             10.1.1.155
fm1_mac9_proto          static
fm1_mac9_mask           255.255.255.0
call_home_ip            192.168.100.50
call_home_ipv6          ::
call_home_mode          1
mplane_ip               192.168.100.200
mplane_proto            static
mplane_mask             255.255.255.0
mplane_vlan_id          100
splane_ip               0.0.0.0
splane_proto            static
splane_mask             0.0.0.0
splane_vlan_id          2
mplane_ipv6             ::
mplane_ipv6_proto       static
mplane_ipv6_prefix      0
vendor_class_identifier  o-ran-ru/PEGA
-----< DHCP or Running Setting >-----
=====

rfmgmt
=====
DU_mac                  00:11:22:33:44:66
vlan_id                 201
frequency               3750000000
frequency_2             3750000000
tx_carrier_gain         240000
nTaOffsetRx            26600
tx_gain_correction_0    5420
tx_gain_correction_1    5420
tx_gain_correction_2    5420
tx_gain_correction_3    5420
rx_gain_correction_0    301
rx_gain_correction_1    301
rx_gain_correction_2    301
rx_gain_correction_3    301
compression_type_tx     STATIC
compression_format_tx   BFP
compression_bit_tx      9
compression_type_rx     STATIC
compression_format_rx   BFP
compression_bit_rx      9
ant_num                 4
tx_rf_gain_max_0        22
tx_rf_gain_max_1        22
ru_op_mode              oran
tx_num_prb_scs30        273
rx_num_prb_scs30        273
l2_mtu                  8000
rf_tx_gain_manual       0
rf_rx_gain_manual       0
rx_power_agc_threshold  -620
rx_power_agc_update_period 4
band                    78
tx_fs_offset            0
rx_fs_offset            8
rf_auto                 disable
cali_cfg                0x300ff

np_ecpri_forwarding
=====
eAxcId  bitmap
UL_0    0x0000  0001
UL_1    0x0001  0010
UL_2    0x0002  0100
UL_3    0x0003  1000
UL_4    0x0004  0001
UL_5    0x0005  0010
UL_6    0x0006  0100
UL_7    0x0007  1000
UL_8    0x2222  0010
UL_9    0x5555  1000
UL_10   0x6666  0001
UL_11   0xaaaa  0100
DL_0    0x0000  0001
DL_1    0x0001  0010
DL_2    0x0002  0100
DL_3    0x0003  1000
DL_4    0x0004  0001
DL_5    0x0005  0010
DL_6    0x0006  0100
DL_7    0x0007  1000
DL_8    0x2222  0010
DL_9    0x5555  1000
DL_10   0x6666  0001
DL_11   0xaaaa  0100
=====

ptp
=====
gm_clock_class_limit    255
startup                 1
PR1450#
```

5.4.3 Check network interface

show interface-info

Use the **show interface-info** to check RU's network interface configuration.

PR1450 supports CUSM-Plane on single FH fiber.

There is multiple alias virtual interface with specified VLAN bundled in single physical FH interface, including:

- CU-plane alias interface
- M-Plane alias interface
- S-Plane alias interface

fm1-mac9 is the original physical interface without any VLAN tag. (Default IP is 192.168.9.9 which already been changed to 10.1.1.155 in below example.)

Example:

PR1450# show interface-info

Interface	Vlan-ID	IPv4 Address	IPv6 Address	MAC Address	MTU	RX Packet	TX Packet	Link
cuplane	3	fail-to-get-ipv4	fe80::2e0:cff:fe00:ae06	00:e0:0c:00:ae:06	8000	0	25	yes
fm1-mac9		192.168.9.9	fe80::2e0:cff:fe00:ae06	00:e0:0c:00:ae:06	8000	1231	1050	yes
mplane	1	fail-to-get-ipv4	fe80::2e0:cff:fe00:ae06	00:e0:0c:00:ae:06	8000	0	24	yes
splane	2	fail-to-get-ipv4	fail-to-get-ipv6	00:e0:0c:00:ae:06	8000	0	0	yes

PR1450(config-interface)#

5.4.4 Check CU-plane status

show radio console [0/1/2/3]

Use the **show radio console [0/1/2/3]** to check RU's CU-Plane status.

It will show C/U-plane packet arrived early/on time/late counters for each Antenna processor (AP).

PwrAvg: average symbol power per second

PwrMax: maximum symbol power in one second

dBFS: IQ digital power in dBFS.

dBm: Tx/Rx power in dBm.

RSSI state: Rx receiving power of 2 RF IC 3812. (Only AP-0 and AP-2.)

Example:

```
PR1450# show radio console 0
Show ap0 console message 10 seconds...Start
AP0 >> [SYS] ----- Data Direction -----
[SYS]                                     Downlink                                     Uplink
[SYS] CPlane Total                       0x000000000000e6b45                    0x0000000000007a8fc
[SYS] CPlane OnTime                      0x000000000000e6b45                    0x0000000000007a8fc
[SYS] CPlane Early                       0x00000000000000000                    0x00000000000000000
[SYS] CPlane Late                       0x00000000000000000                    0x00000000000000000
[SYS] CPlane Corrupt                     0x00000000000000000                    0x00000000000000000
[SYS] UPlane Total                       0x000000000000bb7274                 0x0000000000003f153b
[SYS] UPlane OnTime                     0x000000000000bb7274                 N/A
[SYS] UPlane Early                      0x00000000000000000                 N/A
[SYS] UPlane Late                       0x00000000000000000                 N/A
[SYS] UPlane Corrupt                     0x00000000000000000                 N/A
[SYS] Eth Pkt Good                       0x00d1a426                         0x003fac0f
[SYS] Eth Pkt Drop                       0x00000000                         0x00000000
[SYS] Eth Pkt CRC                       0x00000000                         N/A
[SYS] Trig UL ISR Pkt                   N/A                               0x0039ad02
[SYS] UL Xfer                           N/A                               0x003f153a
[SYS] UL Late                           N/A                               0x00000000
[SYS] UL drop                           N/A                               0x00000000
[SYS] AXIQ status                       0x00000303                         0x00010107
[SYS] ----- Tasks -----
[SYS]                                     UP                                     CP                                     RT
[SYS] Error                               0x00000000                    0x00000000                    0x00000000
[SYS] Heartbeats                         0x0bbec591                    N/A                               N/A
[SYS] Counts                             0x003f153b                    N/A                               0x0039ad05
[SYS] Drops                             0x00000000                    N/A                               0x00000000
[SYS] ----- VSPAs -----
[SYS]                                     0                                     1                                     2
[SYS] Error                               0x00000000                    0x00000000                    0x00000000
[SYS] SYM WR                             0x00000004                    N/A                               0x00000017
[SYS] SYM RD                             0x00000003                    N/A                               0x00000017
[SYS] CMD WR                             0x00000002                    0x00000006                    0x00000006
[SYS] CMD RD                             0x00000002                    0x00000006                    0x00000006
[SYS] ----- Info -----
[SYS]                                     Downlink                                     Uplink
[SYS] RF / fine Gain                       18 / -2.1                         0x44
[SYS] PwrAvg(dBFS/dBm)                    -23.9 / 14.5                     -46.9 / -87.5
[SYS] PwrMax(dBFS)                        -8.9                             -46.4
[SYS] RSSI state                          N/A                               < -58 dBm
[SYS] Showtime 652 seconds
```

5.4.5 Check S-plane status

Show PTP status, including sync-state, lock-state, synce-state, two-step-flag, current-utc-offset, clock-class, clock-accuracy, clock-identity.

Table 5.4.5-1 Clock-class

Clock-class (decimal)	Specification
6	Shall designate a clock that is synchronized to a primary reference time source. The timescale distributed shall be PTP. A clockClass 6 clock shall not be a slave to another clock in the domain.
7	Shall designate a clock that has previously been designated as clockClass 6 but that has lost the ability to synchronize to a primary reference time source and is in holdover mode and within holdover specifications. The timescale distributed shall be PTP. A clockClass 7 clock shall not be a slave to another clock in the domain.
13	Shall designate a clock that is synchronized to an application specific source of time. The timescale distributed shall be ARB. A clockClass 13 clock shall not be a slave to another clock in the domain.
14	Shall designate a clock that has previously been designated as clockClass 13 but that has lost the ability to synchronize to an application specific source of time and is in holdover mode and within holdover specifications. The timescale distributed shall be ARB. A clockClass 14 clock shall not be a slave to another clock in the domain.
52	Degradation alternative A for a clock of clockClass 7 that is not within holdover specification. A clock of clockClass 52 shall not be a slave to another clock in the domain.
58	Degradation alternative A for a clock of clockClass 14 that is not within holdover specification. A clock of clockClass 58 shall not be a slave to another clock in the domain.
187	Degradation alternative B for a clock of clockClass 7 that is not within holdover specification. A clock of clockClass 187 may be a slave to another clock in the domain.
193	Degradation alternative B for a clock of clockClass 14 that is not within holdover specification. A clock of clockClass 193 may be a slave to another clock in the domain.
248	Default. This clockClass shall be used if none of the other clockClass definitions apply.
255	Shall be the clockClass of a slave-only clock.

Table 5.4.5-2 Clock-accuracy

Value (hex)	Specification
0x00 – 0x1F	Reserved.
0x20	The time is accurate to within 25 ns.
0x21	The time is accurate to within 100 ns.
0x22	The time is accurate to within 250 ns.
0x23	The time is accurate to within 1 us.
0x24	The time is accurate to within 2.5 us.
0x25	The time is accurate to within 10 us.
0x26	The time is accurate to within 25 us.
0x27	The time is accurate to within 100 us.
0x28	The time is accurate to within 250 us.
0x29	The time is accurate to within 1 ms.
0x2A	The time is accurate to within 2.5 ms.
0x2B	The time is accurate to within 10 ms.
0x2C	The time is accurate to within 25 ms.
0x2D	The time is accurate to within 100 ms.
0x2E	The time is accurate to within 250 ms.
0x2F	The time is accurate to within 1 s.
0x30	The time is accurate to within 10 s.
0x31	The time is accurate to > 10 s.
0x32 – 0x7F	Reserved.
0x80 – 0xFD	For use by alternate PTP profiles.
0xFE	Unknown.
0xFF	Reserved.

show ptp-status

Example:

```
PR1450# show ptp-status
sync-state: LOCKED
lock-state: LOCKED
synce-state: UNLOCKED
local-port-number: 0
port-state: SLAVE
two-step-flag: TRUE
leap61: FALSE
leap59: FALSE
current-utc-offset-valid: TRUE
ptp-timescale: TRUE
time-traceable: TRUE
frequency-traceable: TRUE
source-port-number: 18
current-utc-offset: 37
priority1: 128
clock-class: 255
clock-accuracy: 0x21
offset-scaled-log-variance: 0xffff
priority2: 255
steps-removed: 255
time-source: 0x20
clock-identity: 00 E0 0C FF FE 00 AE 07
source-clock-identity: 8C 47 BE FF FF B0 5C C0
grandmaster-clock-identity: FC AF 6A FF FE 02 E9 3C
```

PR1450#

5.4.6 Check M-plane status

show m-plane

Use the **show m-plane** command to check M-Plane service is running or not.

Example:

```
PR1450# show m-plane
M-Plane status: active (running)

PR1450#
```

5.4.7 Check RU status

show radio status

Use the **show radio status** to check RU's AP (Antenna Processor) status.

This command will show some radio status information, including:

- 1) AP Management Service Status: It's AntennaProcessor's status, normally should be ORAN.
- 2) AP Sync Status: It's AntennaProcessor's timing sync status, normally should be Lock.
- 3) CALI_ERR: It's calibration status of 4 RF component, normally should be 0, means No Error.
- 4) CALI_ERR_HANDLE: It's calibration error handling status, normally should be 0, means no need to do anything.

Example:

```
PR1450# show radio status
AP Management Service Status: ORAN
1. BOARD_CFG
2. IDLE
3. SYNC
4. SYNC_DONE
5. CAL
6. READY
7. ORAN

AP Sync Status: Lock
1. None
2. Ready
3. Lock

CALI_ERR: [ 0, 0, 0, 0 ]
0. No ERROR
1. CALI_TX_BW_ERR
2. CALI_RX_BW_ERR
4. CALI_TX_LOL_ERR
8. CALI_RX_DC_ERR
16. CALI_TX_IQMC_ERR
```

```
32.    CALI_RX_IQMC_ERR
64.    CALI_TX_DPD_ERR
128.   CALI_TX_PWR_ERR
32768. CALI_RF_LLCP_SWITCH_CRITICAL_ERR
```

CALI_ERR_HANDLE: 0

0. do nothing
1. rumanager stop
2. reset AP and rumanager
3. rumanager stop because of resetting 2 times

PR1450#

5.5 Log collection

There are 3 methods to collect log:

1. Collect log via CLI command (config-management -> syslog-backup). Please refer to section [Syslog backup](#).
2. Collect log via M-Plane. Please refer to section [Log management](#).
3. Collect log via Web GUI. Please refer to section [Logs management](#).

5.6 Firmware upgrade

There are 3 methods to upgrade firmware:

1. Upgrade via CLI command. Please refer to section [Configure management](#).
2. Upgrade via M-Plane. Please refer to section [Software management](#).
3. Upgrade via Web GUI. Please refer to section [Software upgrade](#).

