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Wave Electronics WEH37-TM24B 25G SFP+ 1port L2 Ethernet Encapsulation

USER MANUAL

MODEL: WEH37-TM24B

Revision History

Who	Version	Date	Comment
Minhyeok Kwon	0.1	25-11-2024	Initial version

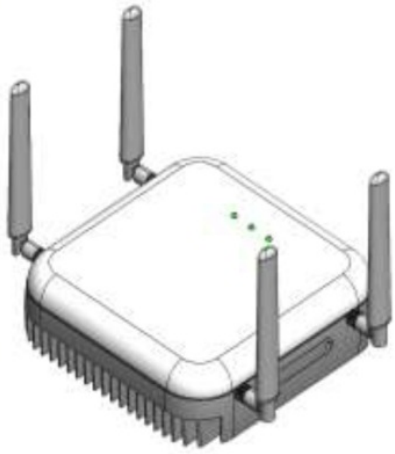
I. Overview of O-RU

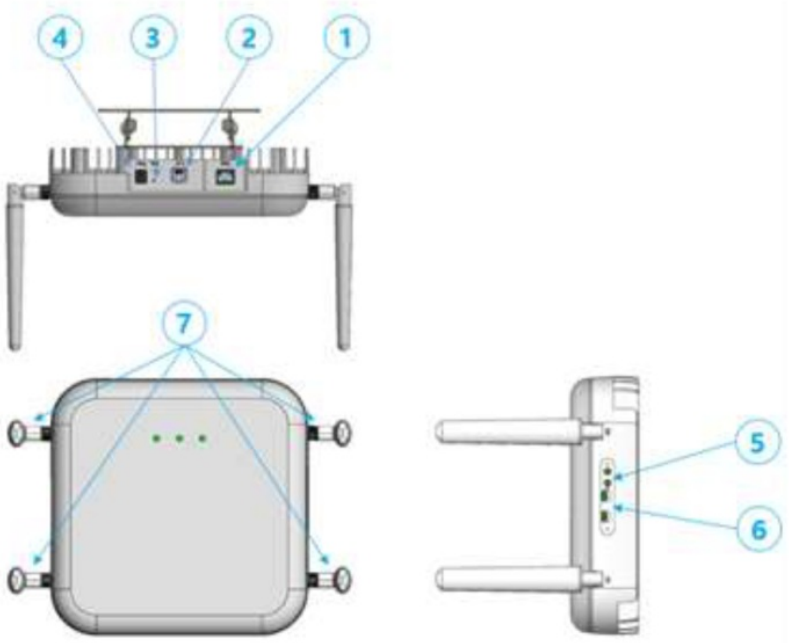
A. Introduction of O-RU

This product is the indoor small-output O-RU device that supports 4T4R in n48

Bandwidth, operated while linked to O-RAN DU and 10Gbps O-RAN eCPRI interface.

B. Outward Appearance





No.	Item	Description	Count	Remarks
1	10G SFP+	10Gbps Optical Port	1	
2	1G Ethernet RJ-45	Management Port	1	Not Use in Operation
3	Reset Button	Reset	1	
4	DC Jack	+12V DC Input	1	Use Adapter
5	MMCX	1PPS Out / 10MHz Out	2	Not Use in Operation
6	USB2.0 Micro B type	Console Port / Factory Use	2	Not Use in Operation
7	Antenna	RF Transmission/Reception	4	

C. Technical Specification

Category		Specification
Product purpose		n48(CBRS) O-RU
Power	Rated Voltage	DC 12V
I/O Port	User Port	A0, A1, A2, A3: Antenna Port 0~3 Opt: SFP+ 10G Pwr: DC IN
	Unused/Administrator's port	Console: USB (micro-B) Factory USB (micro-B) Eth: RJ45 Management 1pps: MMCX-Female 10MHz: MMCX-Female
Functionality	Product Functionality	
	Wireless Functionality	Transmission: 3550 MHz ~ 3700 MHz Reception: 3550 MHz ~ 3700 MHz
Supplies		O-RU Board Adaptor Antenna

D. Environmental Specification

Item	Specification	Remarks
Operating Temperature.	-5 ~ 45℃	
Power Consumption	< 40W	
Cooling	Natural Convection Cooling	
Humidity	Storage 5 ~ 95%	
IP level	IP30	

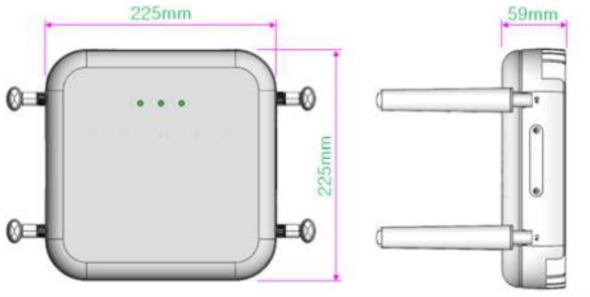
E. RF Specification

Item	Specification	Remarks
Frequency Range	n48	
Service Frequency	3550~3700 MHz	
Number of TRX	4T4R	
Output Power	20dBm@BW 40MHz	@port
	17dBm@BW 20MHz	
	14dBm@BW 10MHz	
ACLR	< - 45dBc	
Frequency Error	±0.1ppm	
Spurious Emission	Category B	
EVM	< 17.5%@QPSK	
	< 12.5%@16QAM	
	< 8%@64QAM	
	<3.5%@256QAM	
Sub Carrier Spacing	30 kHz (μ = 1)	

Antenna Gain	5.8dBi	Due to Peak

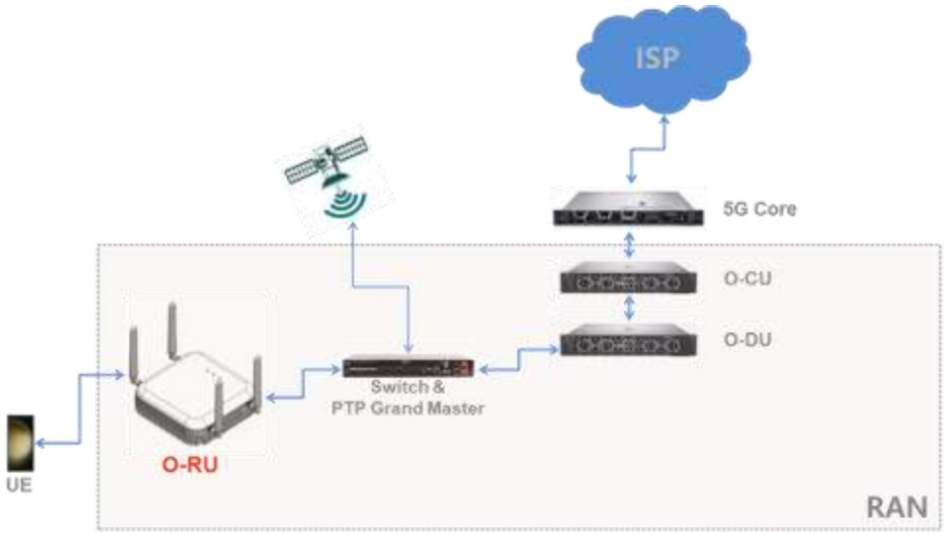
F. Mechanical Specification

Item	Specification	Remarks
Dimension	225(W) x 225(H) x 59(D)mm	Without bracket
Volume	< 3 Liter	
Weight	< 2Kg	with antenna
Installation	Wall, Ceiling	

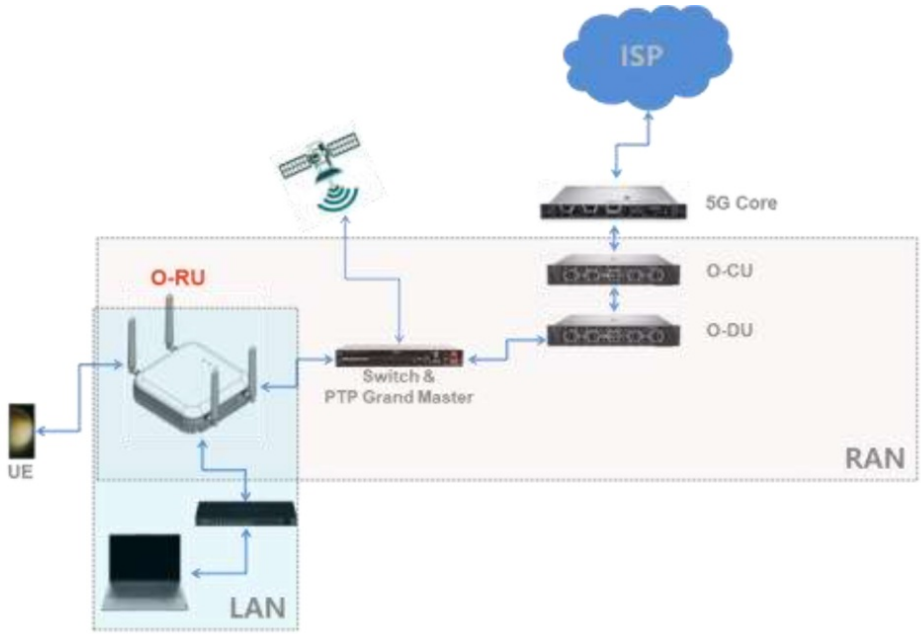


II. Network configuration

A. O-RU network connection with O-DU/O-CU/5G Core Network



B. O-RU LAN configuration for remote control/debugging



III. Cable connection

10G SFP+ port

RJ45 ethernet port

Management port is used for 1000 Base-T Ethernet connection purposes.

DHCP client allocates IP for default configuration. In case DHCP server doesn't exist, fall back address is configured as 172.16.16.123.

Supplies ssh, http connection to monitor device status, configuration and to debug.

Console port: The port to debug the issue in Linux shell, PC connection is available via Micro USB port.

It is available to monitor IP addresses, running processes, and log message for simple debugging purposes.

Application programs such as 'putty' and 'tera term' need to be set as Serial/115200/8 and without flow control.

ID and Password are initialized as admin/admin.

IV. WEB GUI Introduction

A. Access

Check the IP address of eth0 in the console port.

In case of IP allocation via DHCP, look up the IP allocation list of DHCP server and check the ORU MAC

address to inspect the ORU IP address.

Wave Electronics MAC addresses are initialized as 00:1A:60:XX:XX:XX.

Log in page is displayed after entering ORU IP address in the PC web browser connected to ORU. Ex.)

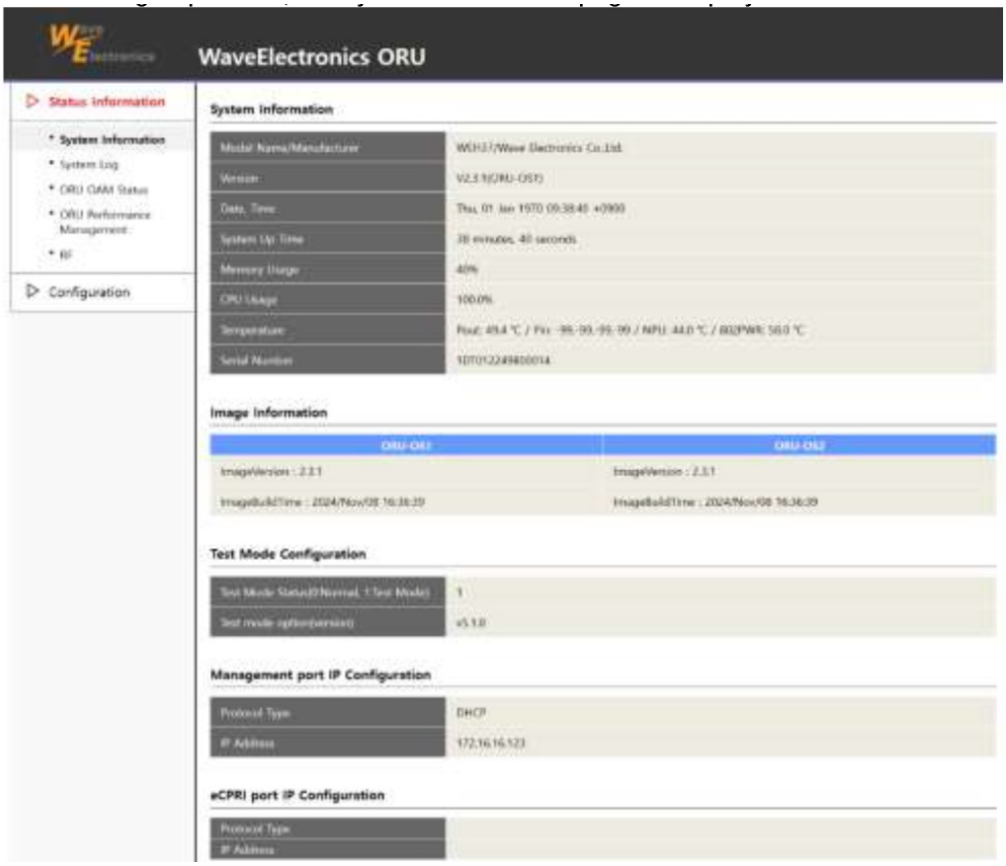
http://172.16.16.123

B. Login

ID/PW: admin/admin

C. Dashboard

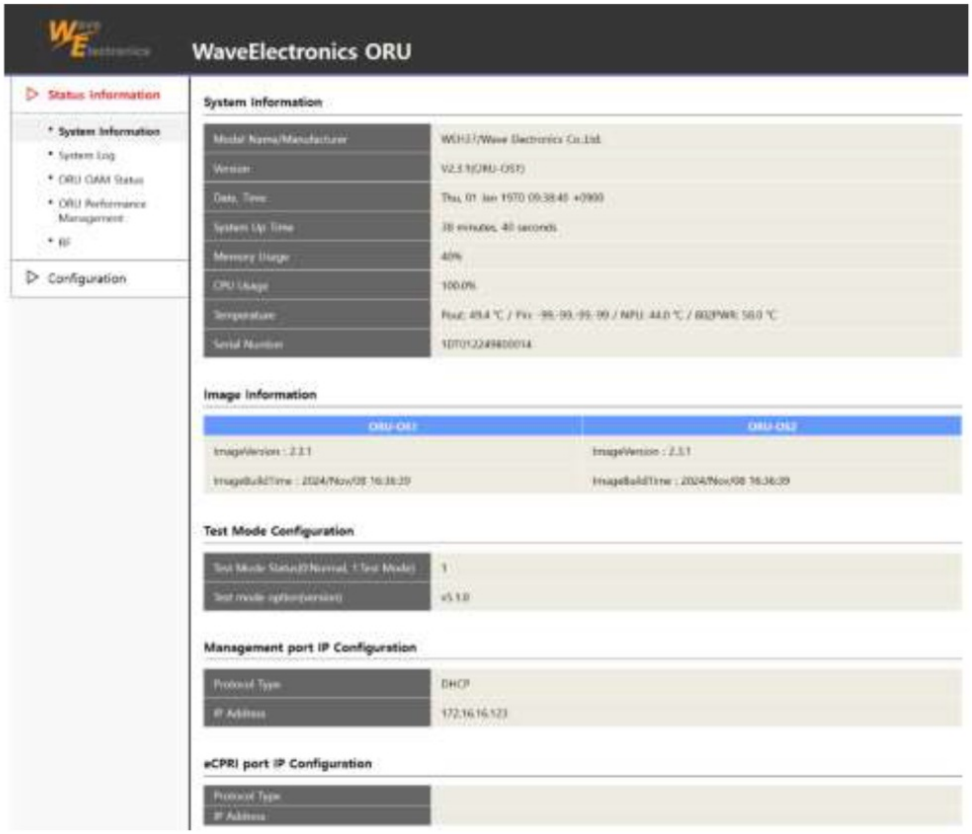
After the log-in process, the system information page is displayed below.



V. Status Information Menu

This menu monitors the system status information. It consists of the following sub menu.

A. System information sub menu



The following information is displayed on this page.

System information

Model Name/ Manufacturer: Displayed as WEH37/Wave Electronics Co.,Ltd.

Version: Display the current version of ORU OS(ROS1/ROS2).

Date, Time: Current Date/Time in the system.

System Up Time: Display the time passed after the booting.

Memory Usage: Display the memory usage.

CPU Usage: Display the CPU usage.

Temperature: Display the current temperature of NPU, NoC (PC802R).

System uptime, CPU/memory usage, temperature are updated in 5 seconds.

NoC: Network on Chip

Image Information

Display the information of ORU-OS saved in the flash memory.

The SW of WEH37 ORU is operated by active/standby method.

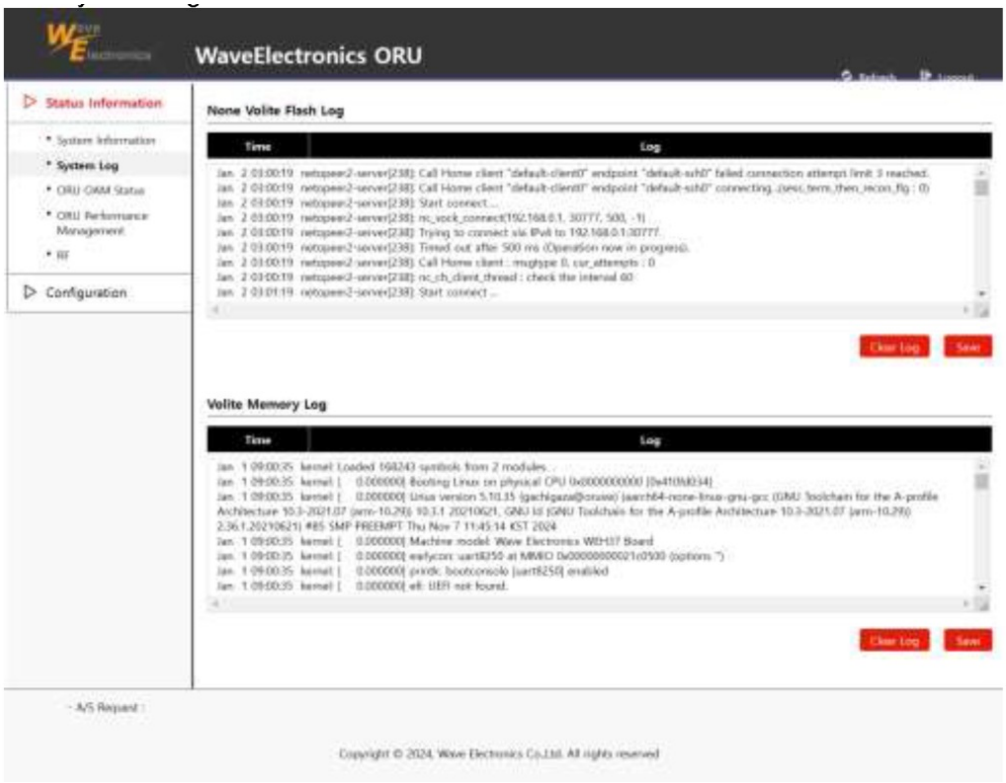
Ex) ORU-OS2 is operated after the SW upgrade if the current ORU-OS is operated with ORU-OS1.

Management port IP Configuration/eCPRI port IP Configuration

Display the address of Management port and eCPRI port.

The default setting value is configurated as DHCP, and it displays the fallback address if DHCP fails.

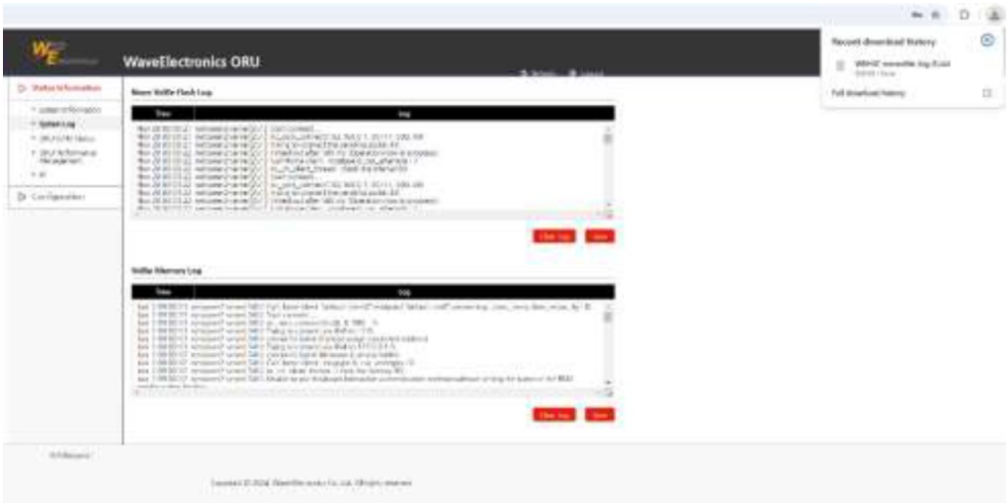
B. System Log sub menu



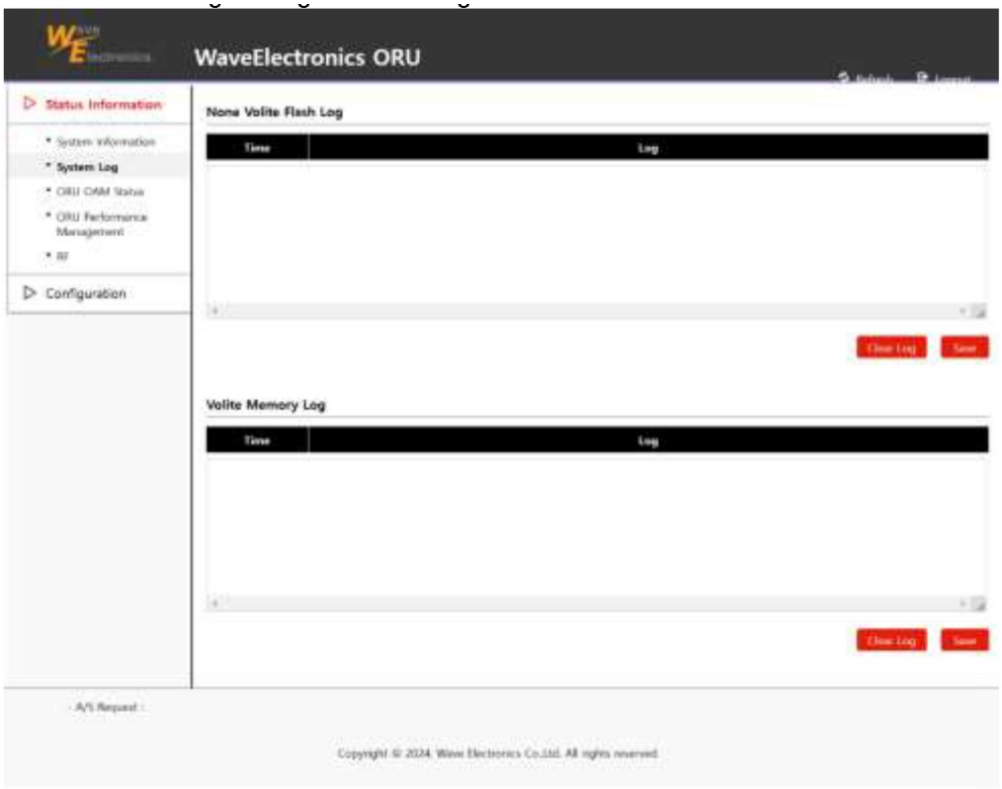
WEH37 ORU supports monitoring system log in non volite/volite areas via syslog.

Two red buttons below each log area functions ‘clear’ or ‘save’ the log.

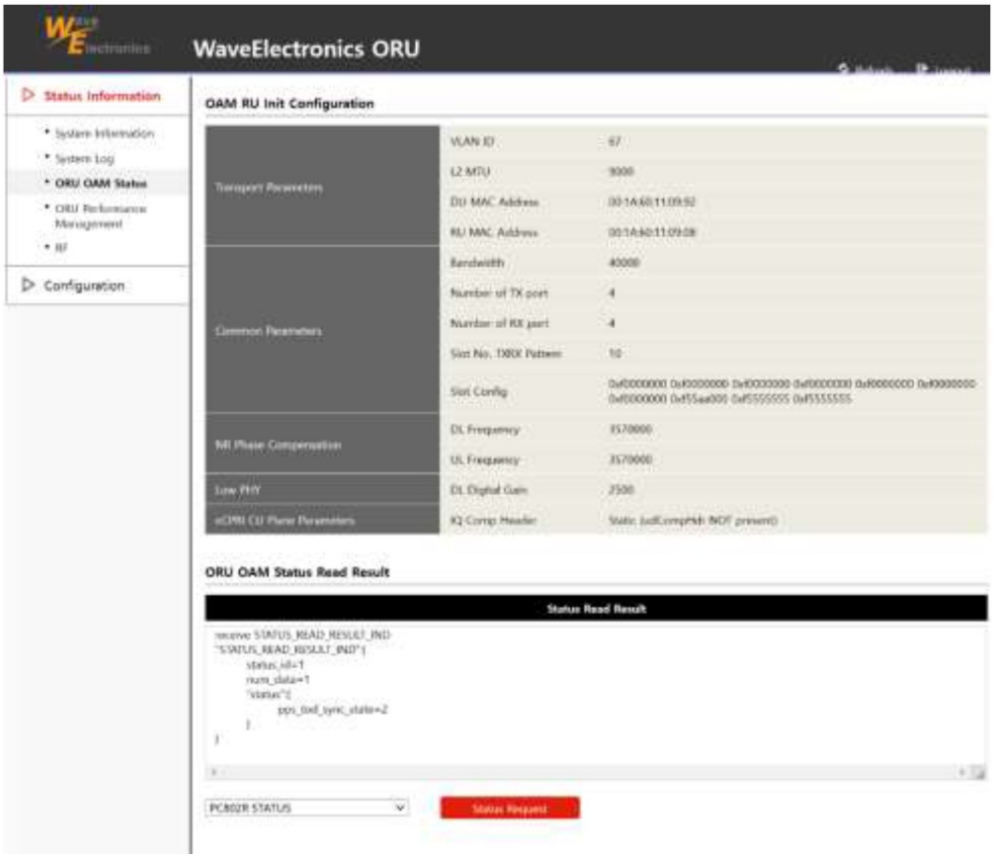
In case of downloading the log to the PC via “save” button



In case of deleting the log via “clear log” button



C. O-RU OAM status sub menu



OAM RF Init Configuration

The following OAM configuration information is displayed.

Transport Parameters: Displays VLAN ID, L2 MTU size, DU/RU MAC address.

Common Parameters: Displays Bandwidth, Number of TX/RX antenna port, Slot number of DL/UL transmission periodicity, Slot configuration.

NR Phase Compensation: Displays DL/UL Frequency.

Low PHY: Displays DL Amplitude Scale for time domain signal amplitude adjustment.

eCPRI CU Plane Parameters: Displays whether IQ Compression Header is Dynamic (udCompHdr present) or Static (udCompHdr NOT present).

ORU OAM Status Read Result

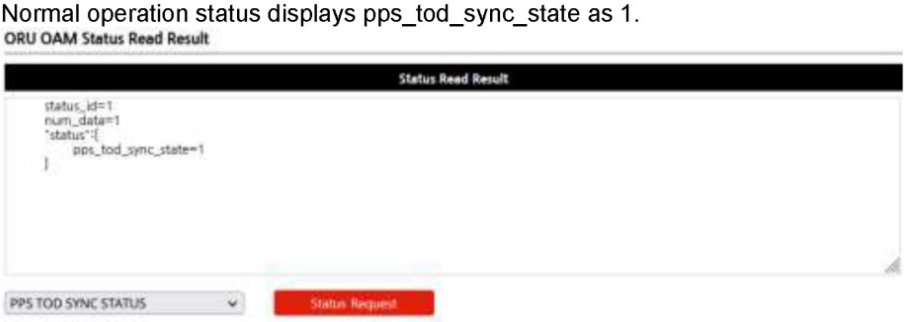
Available to monitor the following OAM Status information.

PC802R_STATUS: 0:IDLE, 1:CONFIGURED, 2:RUNNING

Normal operation status displays oam_agent_state as 2.

PPS_TOD_SYNC_STATUS: Monitoring PPS TOD Sync status. 0:UNLOCKED, 1:LOCKED

Normal operation status displays pps_tod_sync_state as 1.



ECPRI_LINK_STATUS: Monitoring the connection status to DU. 1:LINKED/0:UNLINKED

Normal ECPRI service status displays ecpri_link_state as 1.

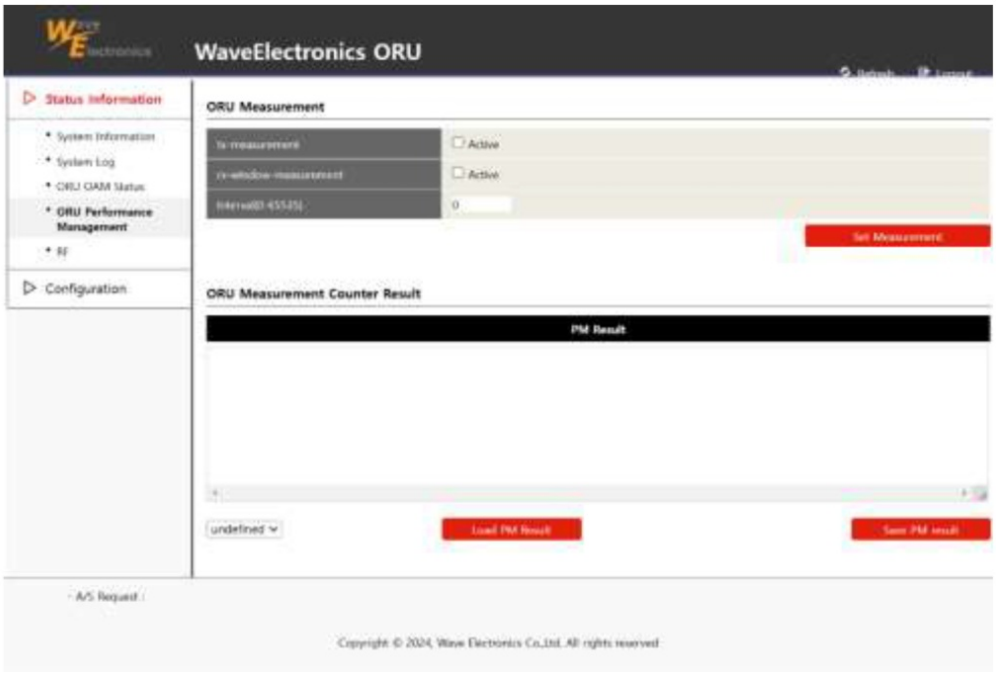
PVT_STATUS: Monitoring the internal temperature of the PC802R.

ECPRI_PACKET_PROCESSOR_STATUS: Monitoring packet counts of ecpri_tx_pkt, non_ecpri_rx_pkt,

ecpri_rx_pkt per 4 pvt and non_ecpri_tx_pkt.

ORU_SW_VERSION_INFO: Monitoring hash ID of ORU related SW.
ECPRI_RS_FEC_STATUS

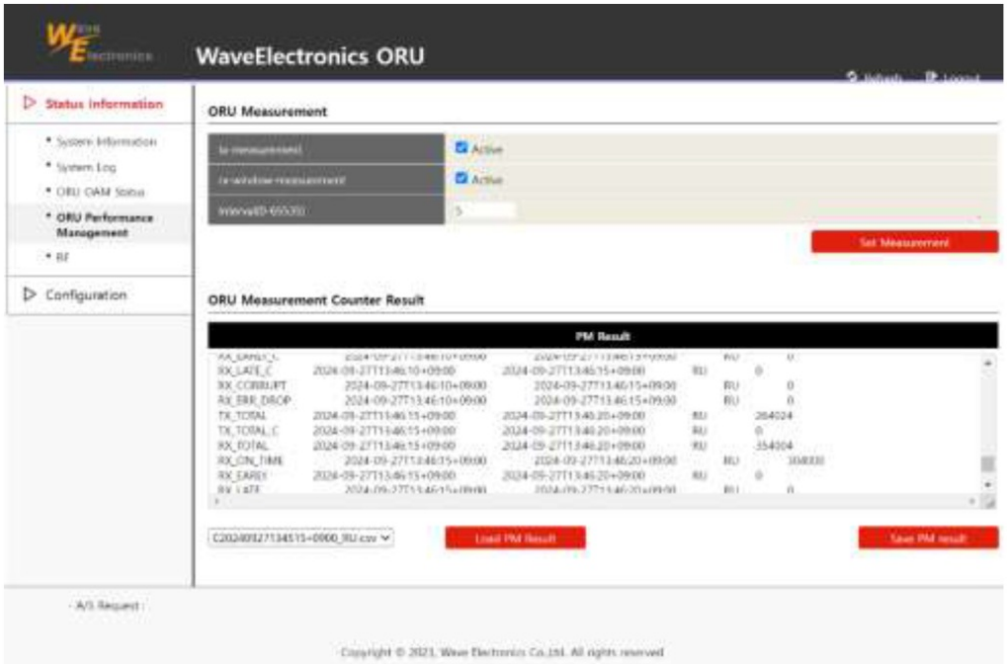
D. ORU Performance Management sub menu



ORU Measurement

Available to configure whether to enable performance management per Tx/Rx or not. Select Active checkbox of each Tx/Rx measurement and configure interval (unit: seconds), then press the ‘Set Measurement’ button to apply the changed configuration.

ORU Measurement Counter Result

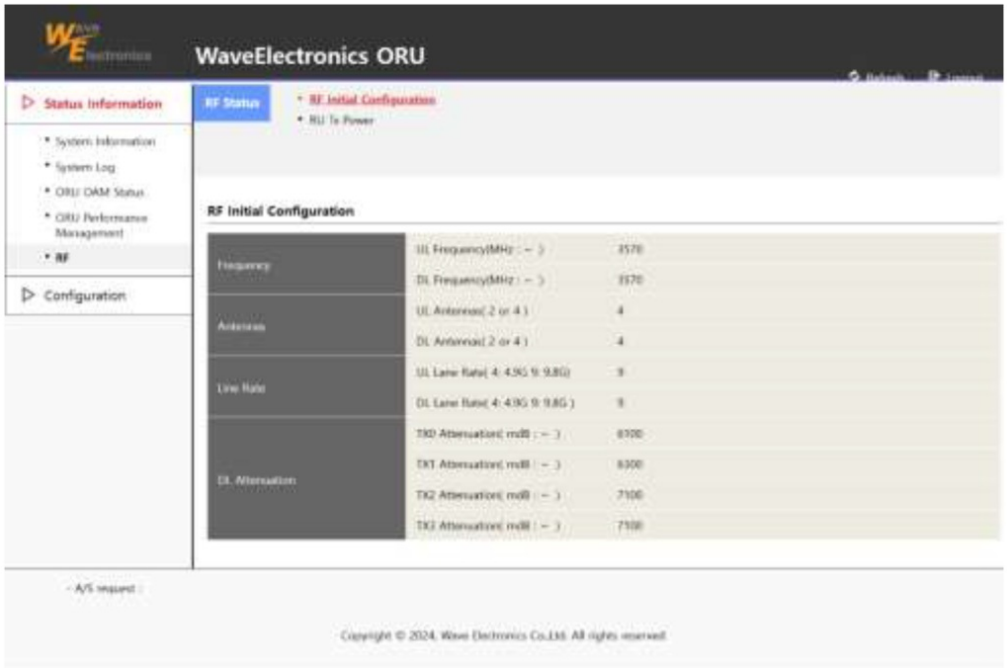


Monitoring the results of ORU Measurement Counter.

Select the csv file from the list and press the ‘Load PM Result’ button to monitor the result. It is also available to save csv file with the ‘Save PM result’ button.

E. RF sub menu

a. RF Initial Configuration



RF Initial Configuration

The following RF Initial Configuration information is displayed.

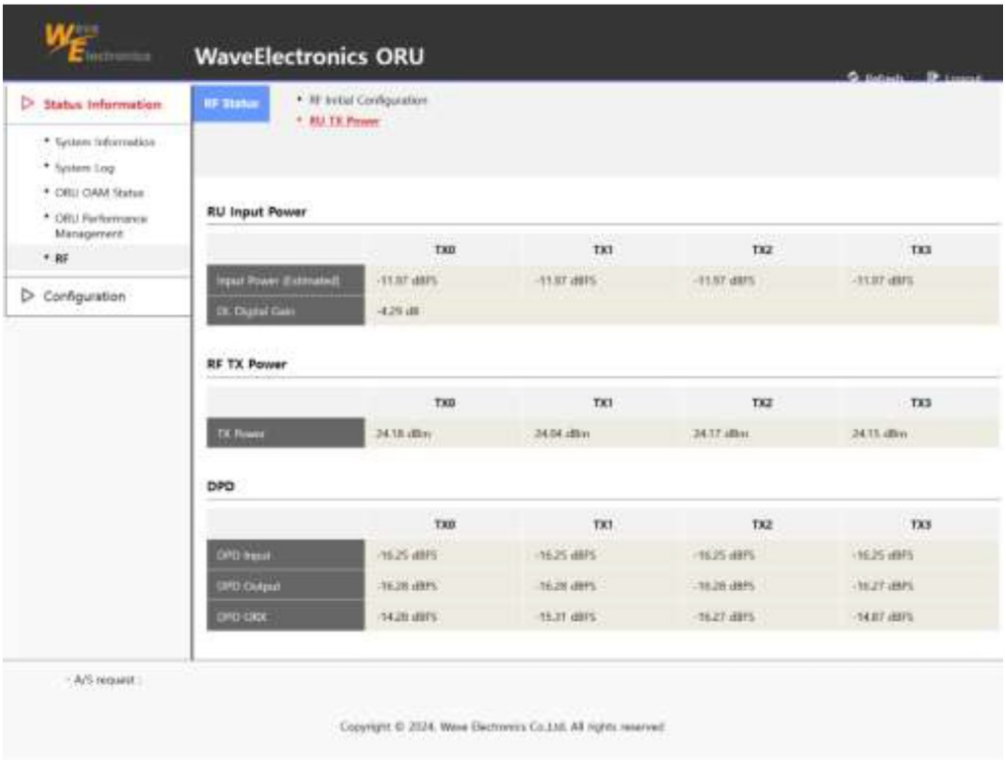
Frequency: Displays UL/DL Frequency (Unit: MHz)

Antennas: Displays the number of UL/DL Antennas

Line Rate: Displays whether the UL/DL Lane rates are 4.9G or 9.8G

DL Attenuation: Displays Tx Attenuation values per each Tx path (TX0~TX3)

b. RU Tx Power sub menu



RU Input Power

Monitoring the following Power information.

Input Power (Estimated): Displays the estimated ORU Input Power

DL Digital Gain: Displays the DL Digital Gain value per Tx path.

RF TX Power

Monitoring the following Power information.

TX Power: Displays the RF Tx Power per Tx path.

DPD

Monitoring the following Power information.

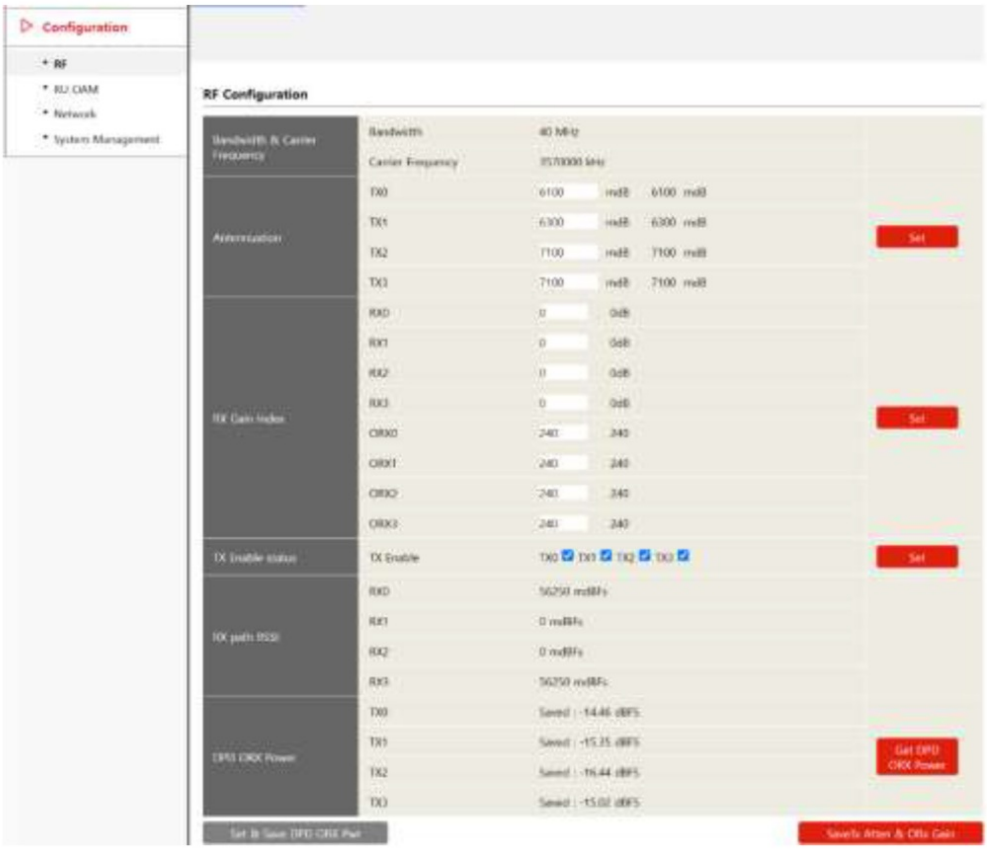
DPD Input: Displays the DPD Input Power per Tx path.

DPD Output: Displays the DPD Output Power per Tx path.
DPD ORX: Displays the DPD ORX Power per Tx Path.

VI. Configuration Menu

Supports configuration functionalities.

A. RF sub menu



RF Configuration
Support RF configuration functionalities for the following parameters.

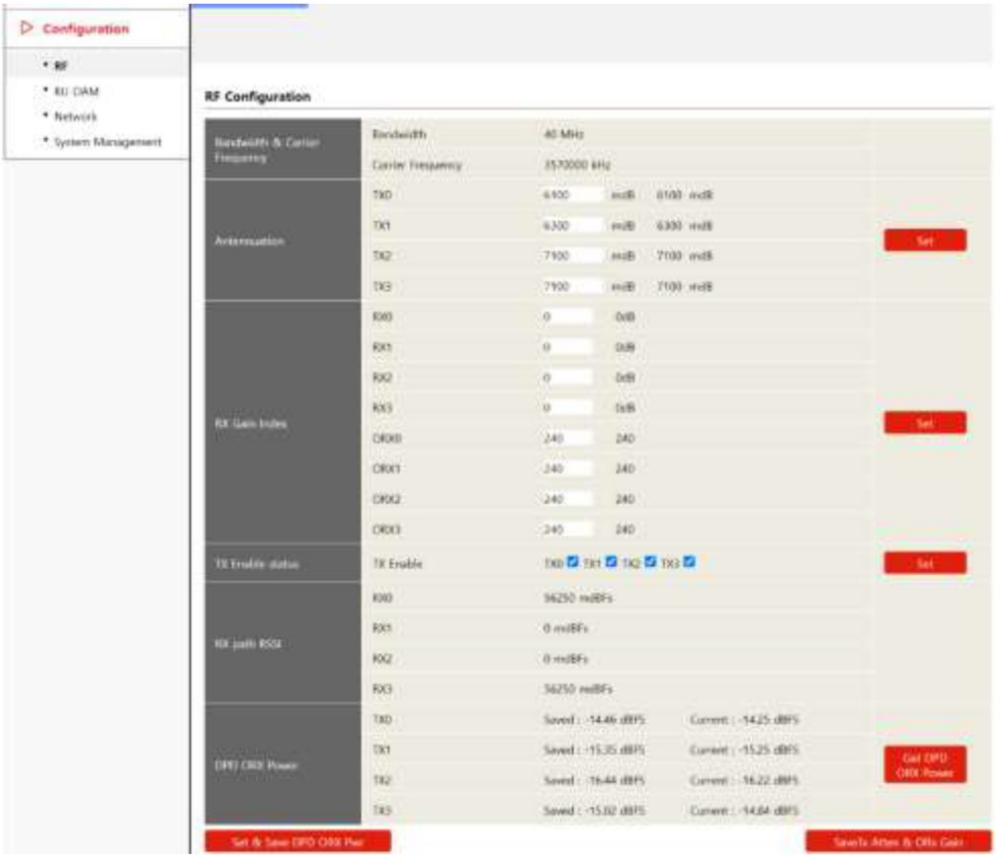
Bandwidth & Carrier Frequency: Displays current Bandwidth (Unit: MHz) and Carrier Frequency (Unit: kHz)

Attenuation: Displays operating Tx Attenuation value per Tx path (Unit: mdB) and saved Tx Attenuation value per Tx path according to operating Carrier Frequency. Available to modify the Tx Attenuation value on the input element and press the ‘Set’ button to apply the change.
RX Gain Index: Displays operating Rx Gain value and ORX Gain value per each path

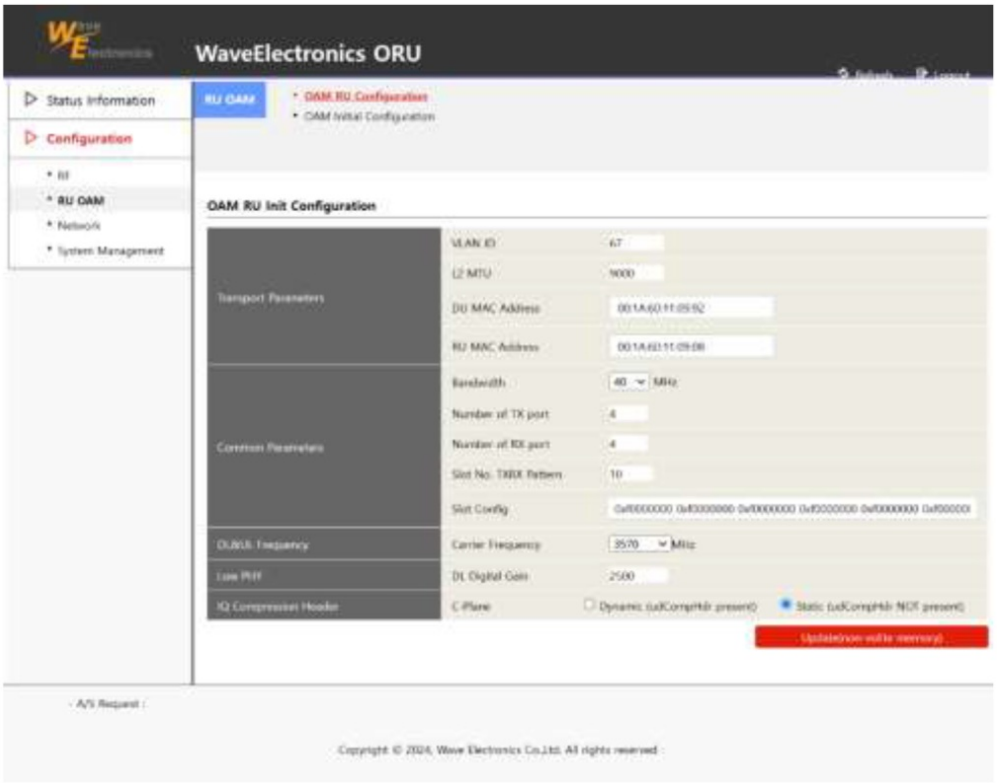
(Unit: dB). Available to modify the Rx Gain and ORX Gain value on the input element and press the ‘Set’ button to apply the change.

TX Enable status: Displays which Tx path is running. Available to change the TX status whether to enable or not. Modify with the checkbox per each Tx path and press the ‘Set’ button to apply the change.
RX path RSSI: Displays current Rx path RSSI (Unit: mdBFs)

DPD ORX Power: Displays the saved DPD ORX reference power per each Tx path. When the DPD starts running, press the ‘Get DPD ORX Power’ button to load current DPD ORX reference power per each Tx path. The following picture describes how this page changes when the ‘Get DPD ORX Power’ is pressed.



The page displays the current DPD ORX reference power per Tx path.
To save the modified parameters to the flash memory, press the ‘Save Tx Atten & ORx Gain’ button to save Tx Atten & ORx Gain values. And press the ‘Set & Save DPD ORX Pwr’ button to save DPD ORX reference power per Tx path.



OAM RU Init Configuration

Transport Parameters: Displays current VLAN ID, L2 MTU, DU MAC Address, RU MAC Address and available to change these parameters.
Common Parameters: Displays current Bandwidth (Unit: MHz), Number of TX Port, Number of RX Port, Slot No. TXRX Pattern, Slot Config and available to change these parameters.
DL&UL Frequency: Displays current Carrier Frequency and available to choose the value. (Unit: MHz)
Low PHY: Displays current DL Digital Gain and available to change the value.
IQ Compression Header: Choose between Dynamic and Static compression method for CPlane.
Press the ‘Update (non-volite memory) to save the modified configuration.
Advice: These parameters are applied after rebooting process.

Slot-config value:

Ex) Slot number 5 / DDDSU / S 10:2:2
- Symbol Sequence: 14 13 12 11 10 9 8 7 6 5 4 3 2 1
- 2 bits per symbol

14	13	12	11	10	9	8	7	6	5	4	3	2	1
00	00	00	00	00	00	00	00	00	00	00	00	00	00

- Value per symbol Value ➔ D symbol: 00, U symbol: 01, F Symbol: 10

0xf0000000 0xf0000000 0xf0000000 0xf5a00000 0xf5555555
D Slot: 0xf0000000 ➔ 0'b1111 0000 0000 0000 0000 0000 0000 0000 (D: 1 ~ 14 symbol)
U Slot: 0xf5555555 ➔ 0'b1111 0101 0101 0101 0101 0101 0101 0101 U: (U: 1 ~ 14 symbol)

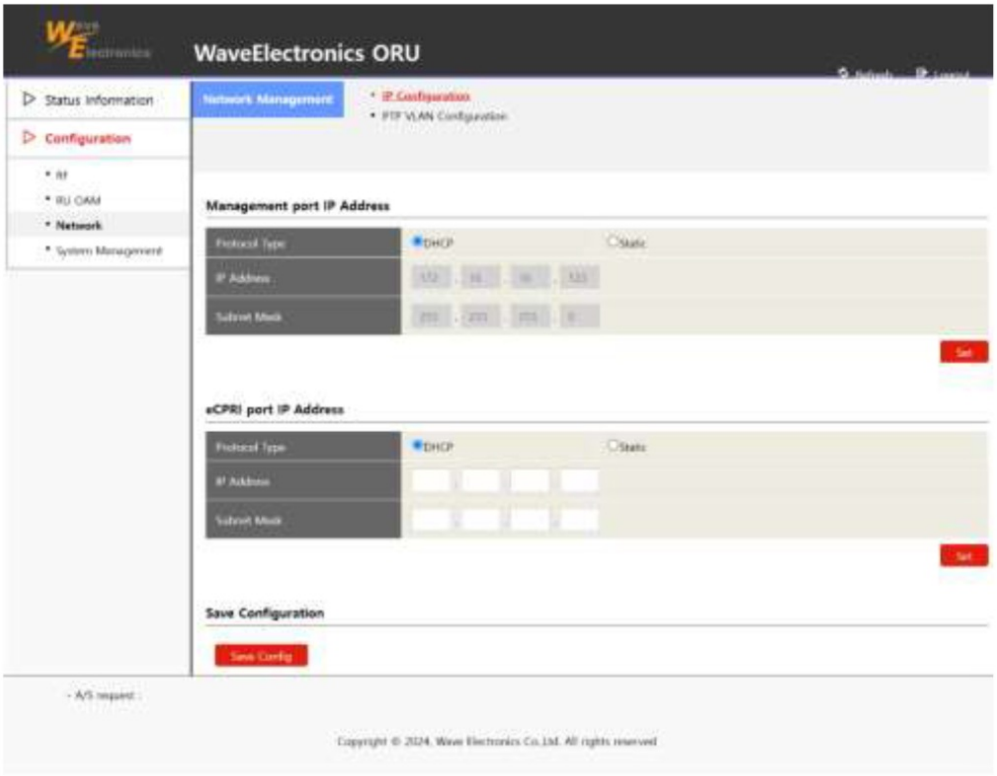
b. OAM Initial Configuration

Initial Configuration

OAM Log Level: Choose the OAM Log Level (Debug, Info, Warn, Error).
Execute Log Forwarder: Choose the checkbox whether to execute log forwarder or not.
Pico DM Log Level: Choose the Pico DM Log Level (Debug, Info, Warn, Error).
Timeout Seconds: Configure the timeout seconds to wait for TOD sync after carrier activation message is sent via OAM Manager. (Default: 50 seconds)
Operation Mode: Choose the Operation Mode between NETCONF and Standalone without NETCONF mode.

C. Network sub menu

a. IP Configuration



Set IP address for Management port and eCPRI port.

DHCP is selected for default value. In case of setting as static, input IP address and subnet

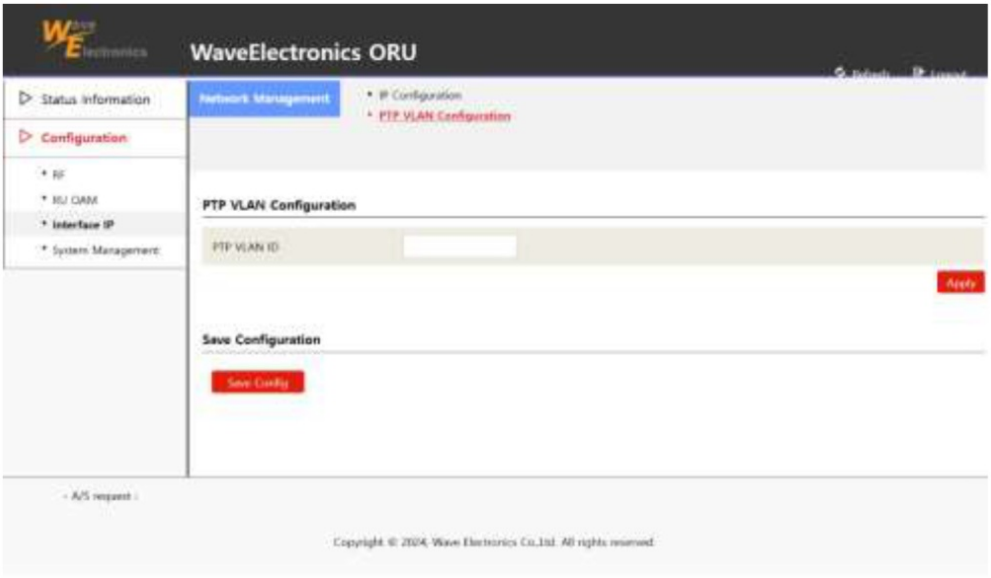
mask then press the ‘Set’ button.

Advice: Web connection will be disconnected after changing the IP address of Management

port. Access with the modified IP address. It is necessary to press ‘Save Config’ button after

applying changes with pressing ‘Set’ button to maintain changes after reboot process.

b. PTP VLAN Configuration



Configure PTP VLAN ID and press the ‘Apply’ button to apply the change.

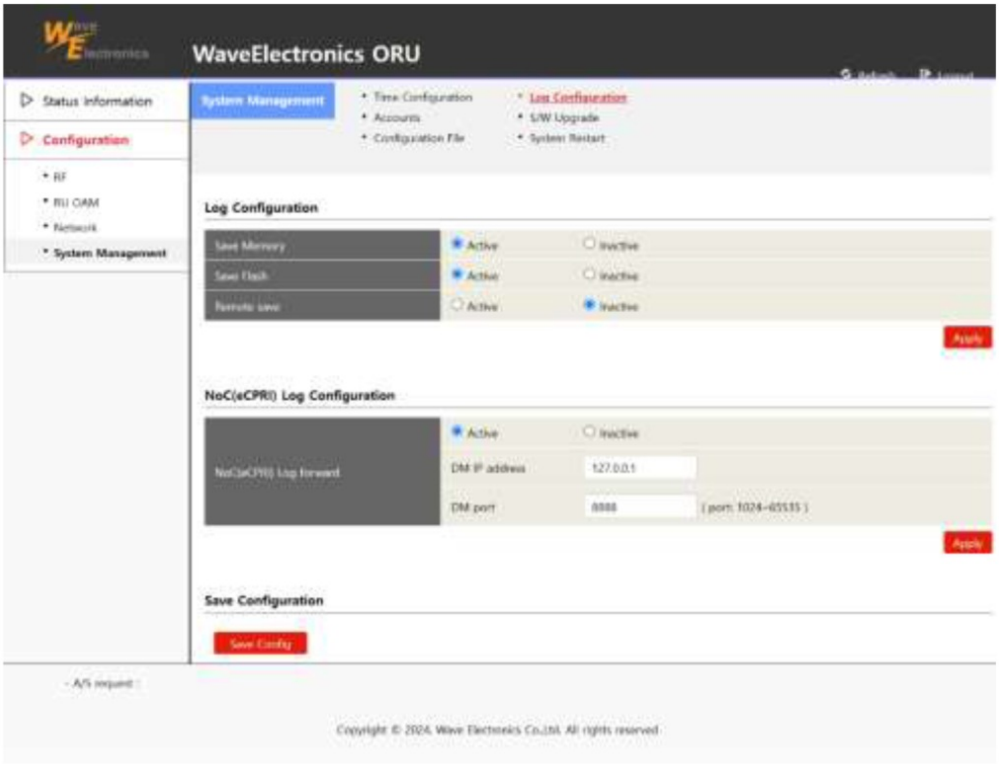
After pressing the ‘Save Config’ button, the PTP VLAN ID will be saved in the SQL DB.

D. System Management sub menu

a. Time Configuration

TBD (Under development)

b. Log Configuration



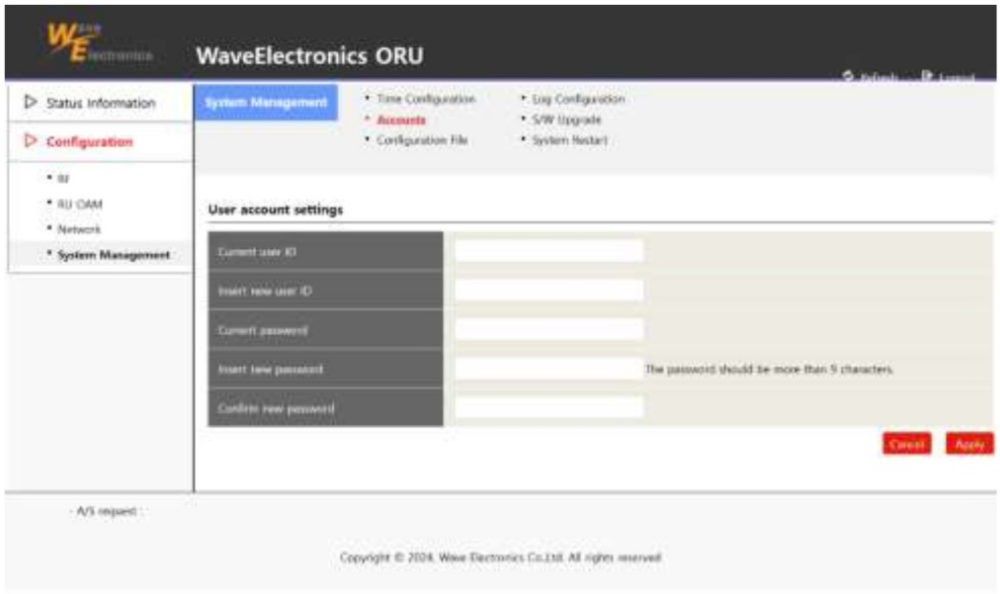
Log Configuration

Configurate whether to save syslog or not.

NoC(eCPRI) Log Configuration

DM program log gathering configuration. Install the DM program on the remote PC, then input the correct IP/Port information. Press the ‘Set’ button to apply the change.

c. Accounts



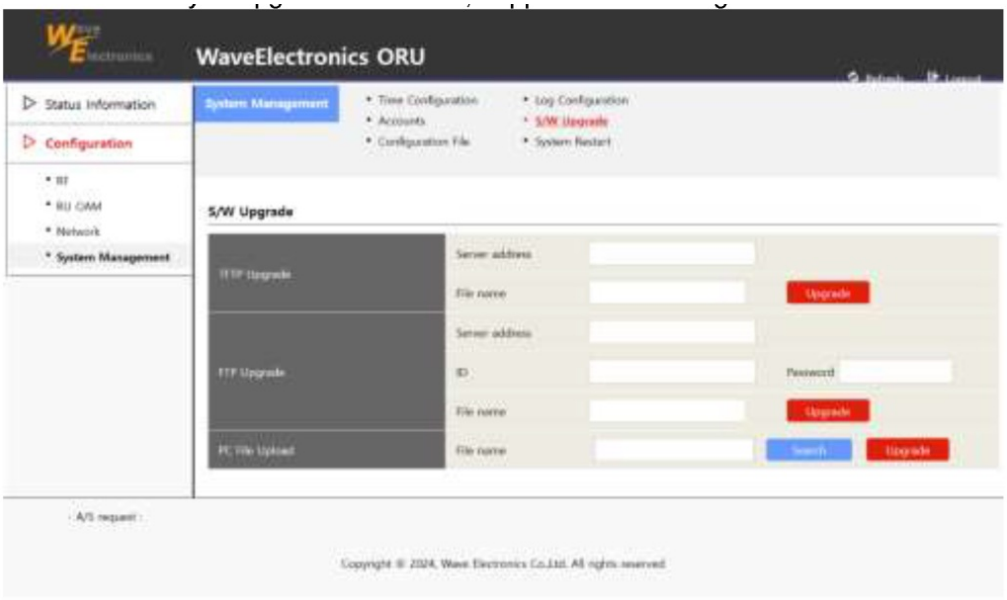
Available to configure following materials about WEB UI user account.

Change password.

Add another account.

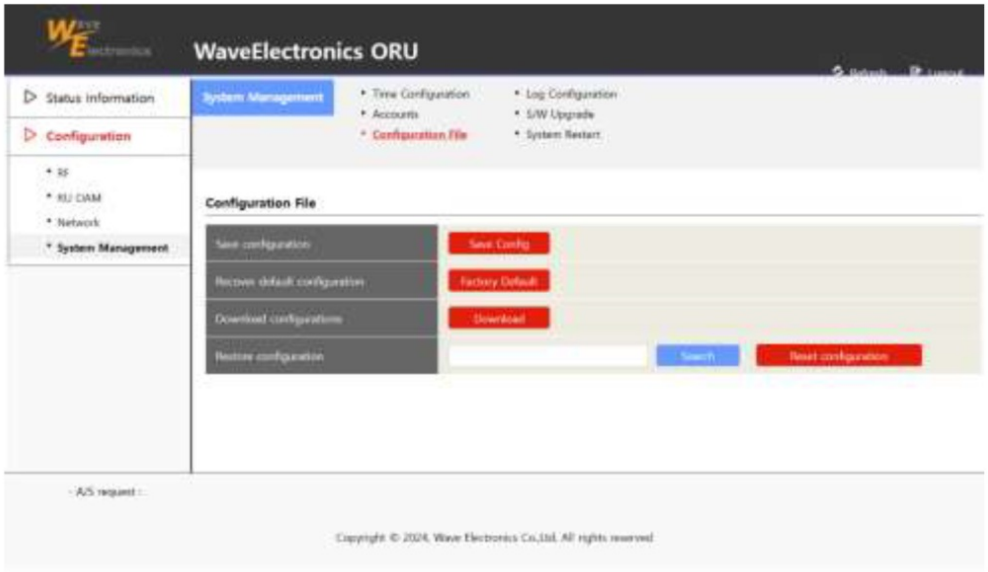
d. S/W Upgrade

The functionality to upgrade ORU S/W, support the following methods



TFTP upgade: Constitute the TFTP server, download and upgrade the saved ORU SW from the server directory. Input the Server IP address and certain ORU SW file name.
FTP upgrade: Constitute the FTP server, download and upgrade the saved ORU SW from the server directory. Input the Server IP address, FTP access ID/Password and certain ORU SW file name.
PC file upload: Do not need to constitute the server, search the ORU S/W file and upgrade the system.
This method is much simpler than others. (Recommended to use) Advice:
Input the following command in console if it fails to upgrade tftp method in WEB UI.
update-image.sh web -f /tmp/upload.bin -aq
Upload the ORU S/W file via sftp and input the following command in console.
(Upload the file in the /tmp directory)
update-image.sh web -f /tmp/ORUOS_weh37_v2.3.1.bin -aq

e. Configuration



Supports the following functionalities.

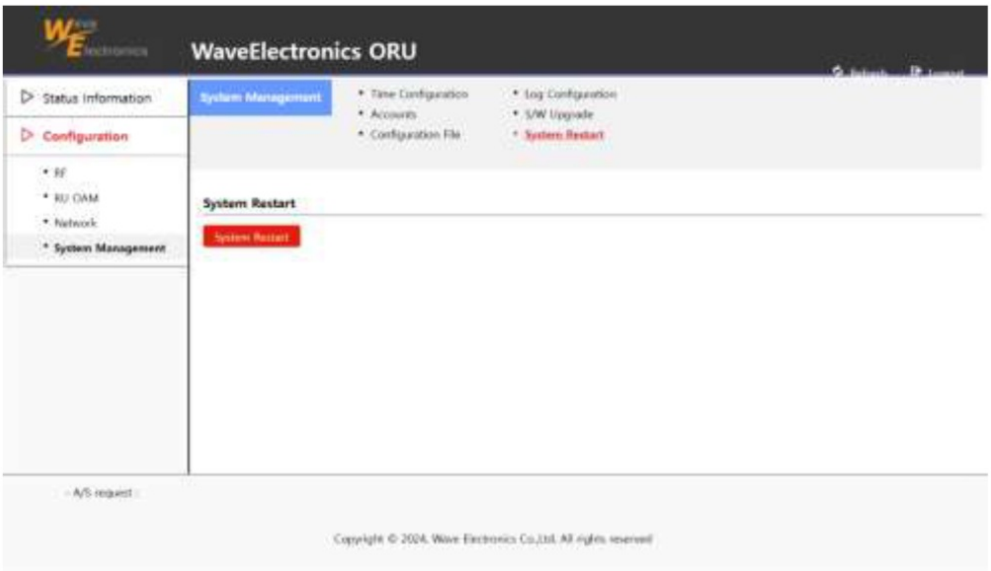
Save configuration: Save current configurations.

Recover default configuration: Initialize the configurations as default, reboot the system.

Backup configuration: TBD (Under development)

Restore configuration: TBD (Under development)

f. System Restart



Reboot the system.

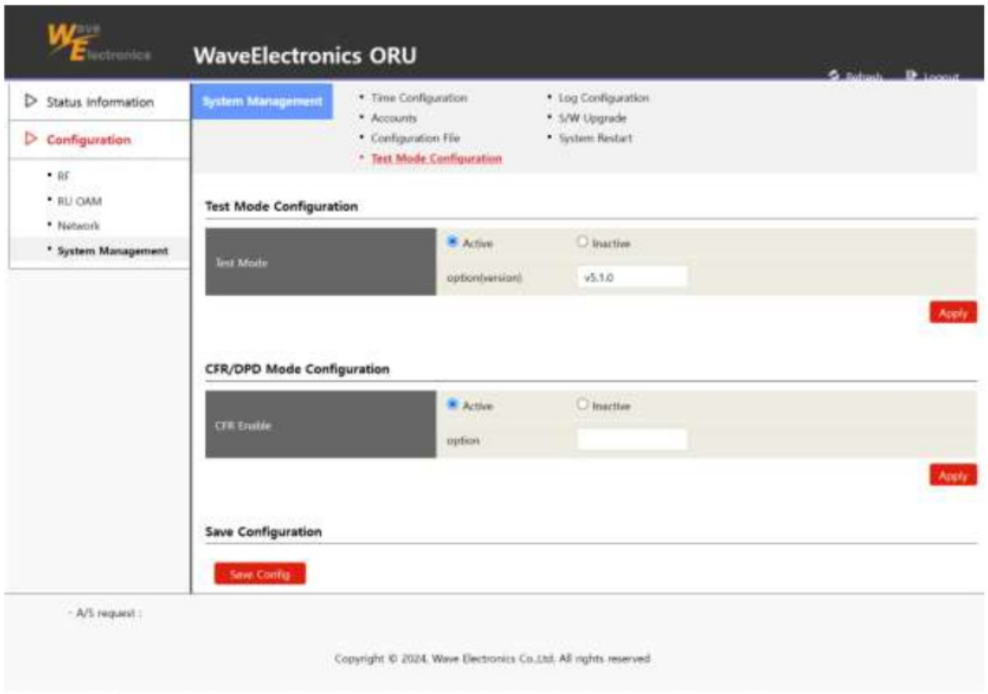
g. Test Mode

Two running modes of device exist (Normal mode/Test Mode), and it could be changed in WEB UI.

The configuration address is hidden.

Input the address directly at the web browser for connection.

Ex) http://172.16.16.117/device/test_mode.asp



Choose between Active and Inactive (Active: Test Mode, Inactive: Normal Mode)

Press the ‘Apply’ button to apply the change.

Press the ‘Save Config’ button to save in the flash memory.

The running mode will be changed after the reboot process.

The same version of the test tool should be in the /etc/test_mode_tool/ directory.

Available to run the test tool in the console.

```
[admin@WEH37 ~]# cd /etc/test_mode_tool/test_tool/
[admin@WEH37 test_tool]# ll
total 52
drwxr-xr-x    3 admin    root             0 Oct 12  2024 .
drwxr-xr-x    4 admin    root             0 Nov 11  2024 ..
drwxr-xr-x   27 admin    root             0 Oct 12  2024 TM_DATA
-rwxr-xr-x    1 admin    root         51176 Oct 12  2024 test_tool
[admin@WEH37 test_tool]# ls TM_DATA/
TM1.1           TM1.1_20M       TM1.1_50M       TM1.1_80M       TM2a            TM3.1a_30k_20MHz  TM3.3
TM1.1_100M      TM1.1_25M       TM1.1_5M        TM1.1_90M       TM3.1           TM3.1a_30k_40MHz
TM1.1_10M       TM1.1_30M       TM1.1_60M       TM1.2           TM3.1a          TM3.1a_30k_50MHz
TM1.1_15M       TM1.1_40M       TM1.1_70M       TM2             TM3.1a_30k_10MHz  TM3.2
[admin@WEH37 test_tool]# ./test_tool
```

FCC Regulatory Statement

Any changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate this equipment. This device must not be co-located or operating in conjunction with any other antenna or transmitter.

The antenna(s) must be installed such that a minimum separation distance of at least 20 cm is maintained between the radiator (antenna) and all persons at all times.

This equipment has been tested and found to comply with the limits for a Class B digital

device, pursuant to part 15 of the FCC Rules.

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

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

Supplier’s Declaration of Conformity

47 CFR § 2.1077 Compliance Information
Unique Identifier: (e.g., Trade Name, Model Number)
Responsible Party – U.S. Contact Information

Specifications:

- Product Purpose: n48(CBRS) O-RU
- Power: DC 12V
- Rated Voltage: A0, A1, A2, A3: Antenna Port 0~3 Opt: SFP+ 10G Pwr: DC IN
- I/O Port: Console: USB (micro-B) Factory USB (micro-B) Eth: RJ45 Management 1pps: MMCX-Female 10MHz: MMCX-Female
- Transmission Frequency: 3550 MHz ~ 3700 MHz
- Reception Frequency: 3550 MHz ~ 3700 MHz
- Number of TRX: 4T4R
- Output Power: 20dBm@BW 40MHz, 17dBm@BW 20MHz, 14dBm@BW 10MHz

- Operating Temperature: -5°C to 45°C
- Power Consumption: Less than 40W
- Cooling: Natural Convection Cooling
- Humidity: Storage 5% to 95%
- IP Level: IP30

Wave Electronics

3F, 152, Gwanggyo-ro, Yeongtong-gu

Suwon-si, Gyeonggi-do

16506

Telephone number or internet contact information

www.wavetc.com

FAQ:

Q: What is the purpose of the O-RU device?

A: The O-RU device is designed to support n48 Bandwidth with 4T4R functionality.

Q: What is the operating temperature range for the device?

A: The operating temperature range is -5°C to 45°C.

Documents / Resources

	Wave Electronics WEH37-TM24B 25G SFP+ 1port L2 Ethernet Encapsulation [pdf] User Manual 2BKZBWEH37-TM24B, 2BKZBWEH37TM24B, WEH37-TM24B 25G SFP 1port L2 Ethernet Encapsulation, WEH37-TM24B, 25G SFP 1port L2 Ethernet Encapsulation, L2 Ethernet Encapsulation, Encapsulation

References

- User Manual

Related Posts

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[Z Wave T500B Z-Wave Thermostat Instructions]

T500B Z-Wave Thermostat Instructions Z-Wave Protocol Implementation Conformance Statement General Information Product Identifier: T500B Brand Name: RCS Product…

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