

WEH37-TM24B

(User Manual)

Revision History

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

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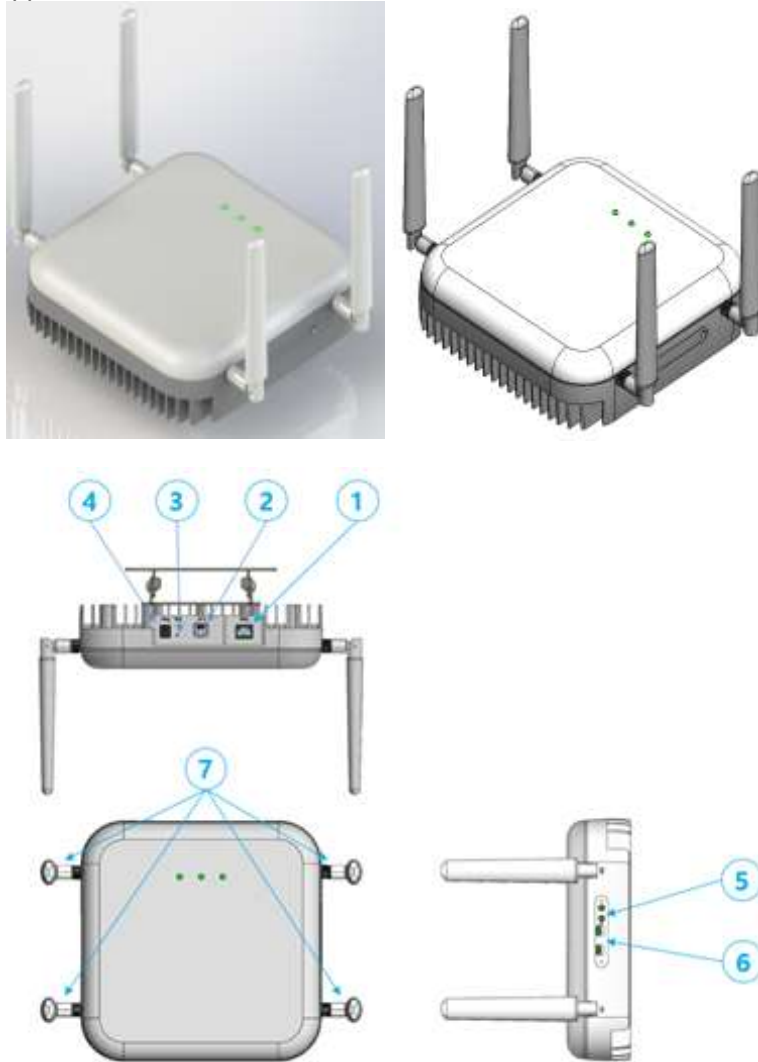
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I. Overview of O-RU

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°C	
Power Consumption	< 40W	
Cooling	Natural Convection Cooling	
Humidity	Storage 5 ~ 95%	
IP level	IP30	

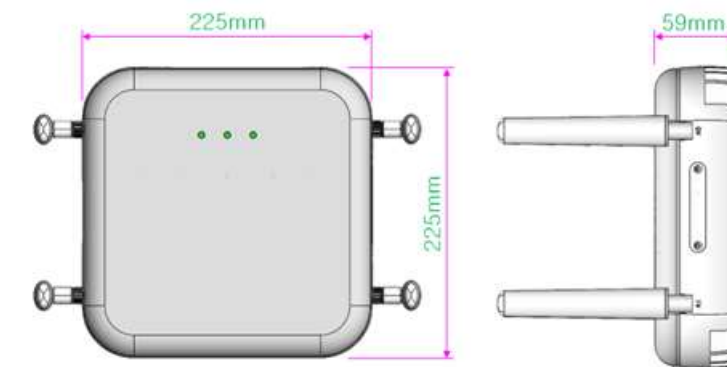
E. RF Specification

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 ($\mu = 1$)	

Antenna Gain	5.8dBi	Due to Peak
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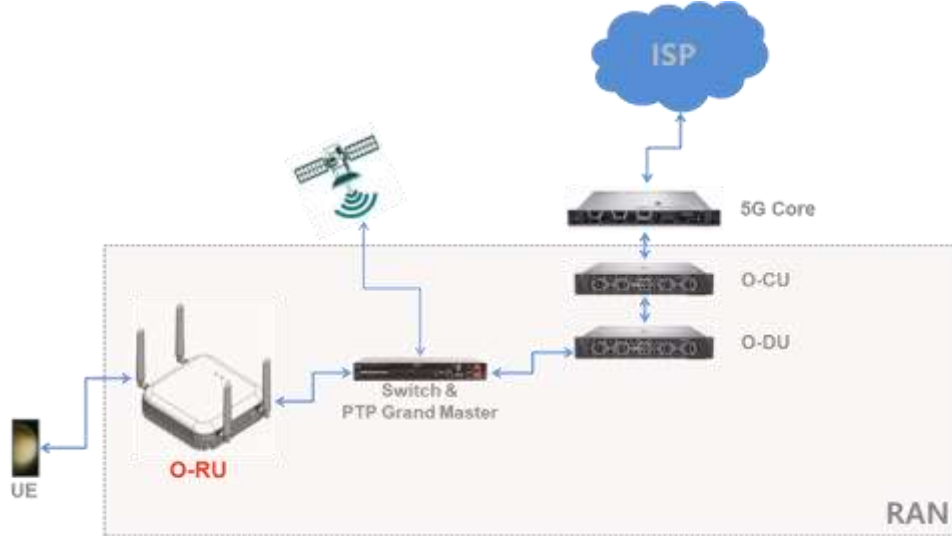
F. Mechanical Specification

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	

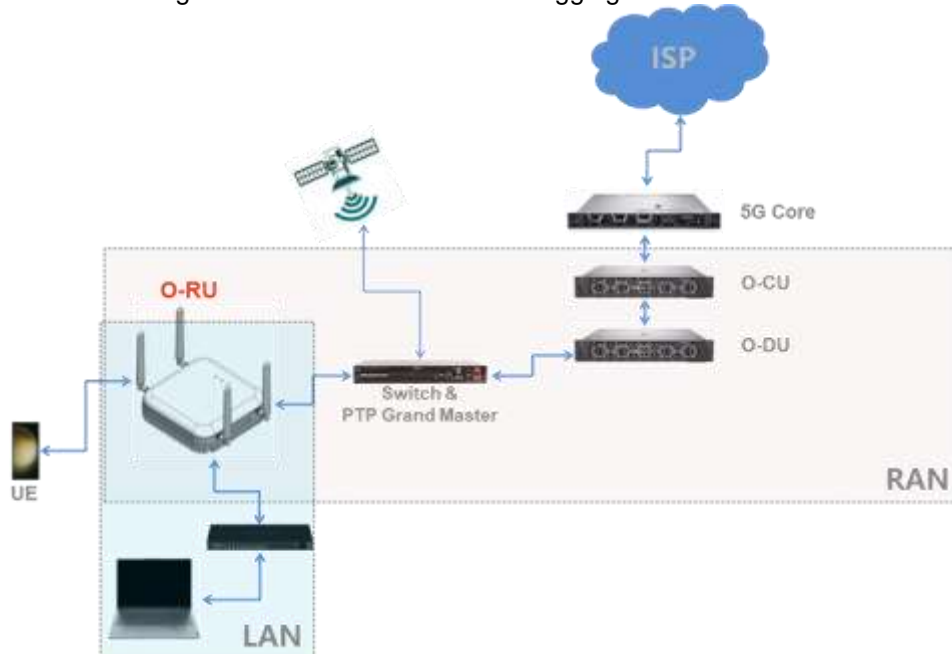


II. Network configuration

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

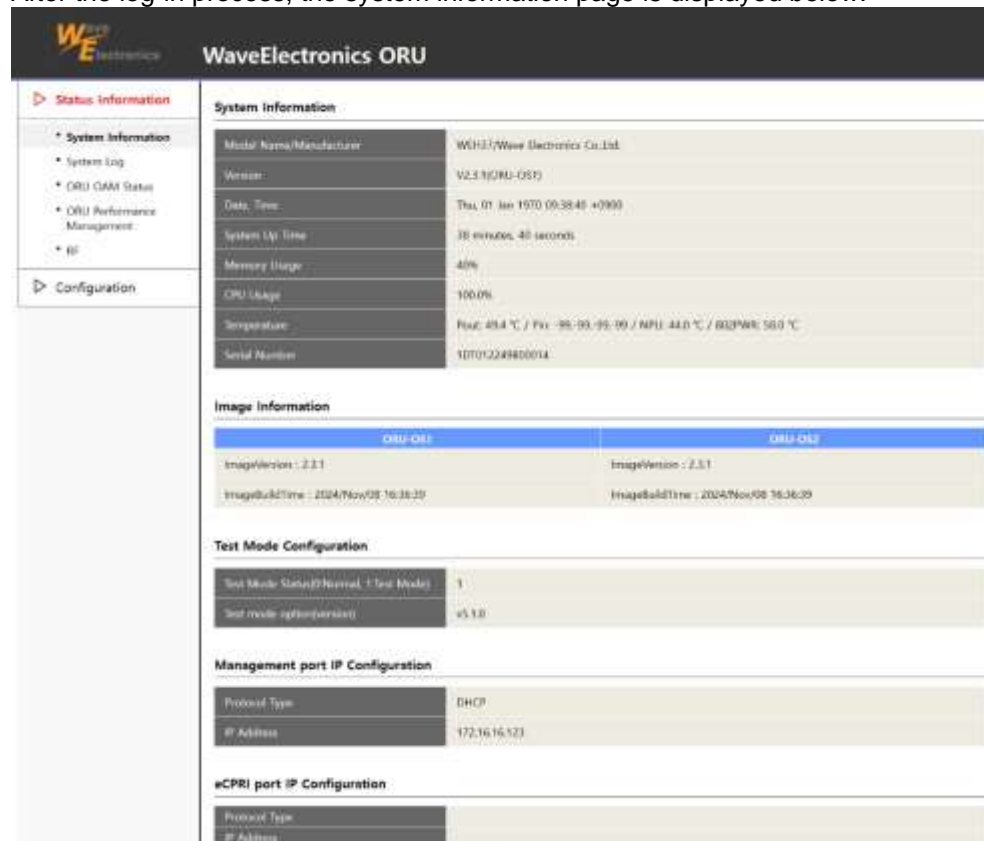
ID/PW: admin/admin



The login page features the WaveElectronics ORU header with a refresh button. Below is a login form with fields for ID and Password, and a Login button. At the bottom, there is a footer with a copyright notice: Copyright © 2023. Wave Electronics Co., Ltd. All rights reserved.

C. Dashboard

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



The dashboard displays system information, image information, test mode configuration, and management port IP configuration. The left sidebar shows navigation options: Status Information, System Information, System Log, ORU GMM Status, ORU Performance Management, and IP. The main content area is divided into sections: System Information, Image Information, Test Mode Configuration, Management port IP Configuration, and eCPRI port IP Configuration.

System Information	
Model Name/Manufacturer	WEH37/Wave Electronics Co., Ltd.
Version	V2.3.1(ORU-OS1)
Date, Time	Thu, 01 Jan 1970 09:38:48 +0900
System Up Time	38 minutes, 48 seconds
Memory Usage	40%
CPU Usage	100.0%
Temperature	Proc: 49.4 °C / Pwr: -95.00 ~ -95.00 / NPU: 44.0 °C / B32PWR: 58.0 °C
Serial Number	1D7012249400014

Image Information	
ORU-OS1	ORU-OS2
ImageVersion : 2.3.1	ImageVersion : 2.3.1
ImageBuildTime : 2024/Nov/08 16:36:39	ImageBuildTime : 2024/Nov/08 16:36:39

Test Mode Configuration	
Test Mode Status(Normal, 1:Test Mode)	1
Test mode option(version)	v5.1.0

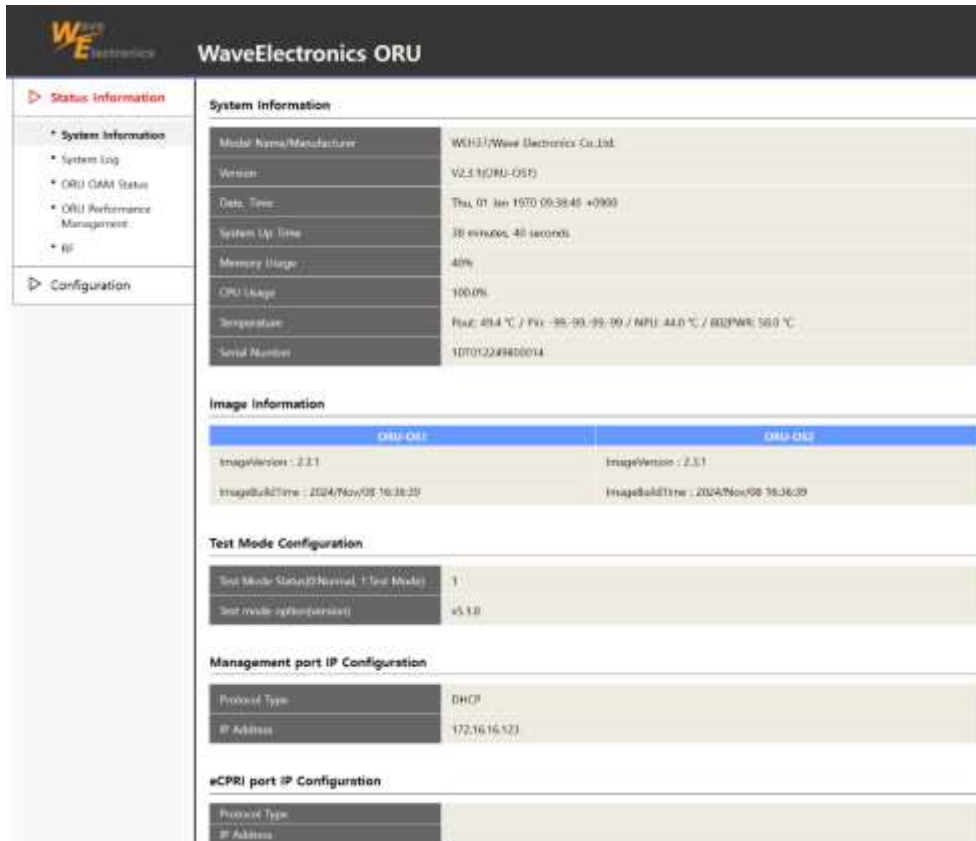
Management port IP Configuration	
Protocol Type	DHCP
IP Address	172.16.16.123

eCPRI port IP Configuration	
Protocol Type	
IP Address	

V. Status Information Menu

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

A. System information sub menu



The screenshot shows the WaveElectronics ORU web interface. The left sidebar has a 'Status Information' menu item selected. The main content area displays the following information:

System Information	
Model Name/Manufacturer	WEH37/Wave Electronics Co.,Ltd
Version	V2.3.1(ORU-OS1)
Date, Time	Thu, 01 Jan 1970 09:38:49 +0900
System Up Time	38 minutes, 48 seconds
Memory Usage	40%
CPU Usage	100.0%
Temperature	Proc: 49.4 °C / Fw: -95.00 ~ 95.00 / NPU: 44.0 °C / B03PWE: 58.0 °C
Serial Number	1D7012249400014

Image Information	
ORU-OS1	ORU-OS2
ImageVersion : 2.3.1	ImageVersion : 2.3.1
ImageBuildTime : 2024/Nov/08 16:36:29	ImageBuildTime : 2024/Nov/08 16:36:29

Test Mode Configuration	
Test Mode Status(Normal, 1:Test Mode)	1
Test mode option(version)	v5.1.0

Management port IP Configuration	
Protocol Type	DHCP
IP Address	172.16.16.523

eCPRI port IP Configuration	
Protocol Type	
IP Address	

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.

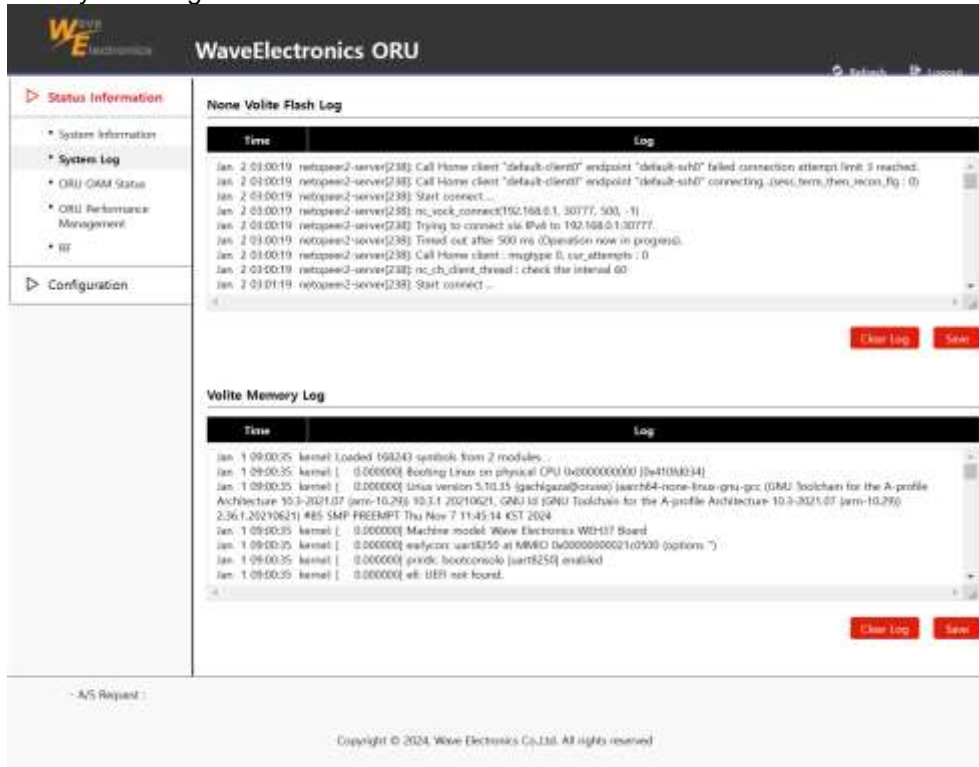
Ex) ORU-OS2 is operated after the SW upgrade if the current ORU-OS is operated with ORU-OS1.

Management port IP Configuration/eCPRI port IP Configuration

Display the address of Management port and eCPRI port.

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

B. System Log sub menu



WaveElectronics ORU

Status Information

- System Information
- System Log**
- ORU OAM Status
- ORU Performance Management
- RF

Configuration

None Volite Flash Log

Time	Log
Jan 2 01:00:19	netopeer2-server[238]: Call Home client "default-client" endpoint "default-uh0" failed connection attempt limit 3 reached.
Jan 2 01:00:19	netopeer2-server[238]: Call Home client "default-client" endpoint "default-uh0" connecting... (user, term, then, rcon, flg: 0)
Jan 2 01:00:19	netopeer2-server[238]: Start connect...
Jan 2 01:00:19	netopeer2-server[238]: nc_vsock_connect(192.168.0.1, 30777, 500, -1)
Jan 2 01:00:19	netopeer2-server[238]: Trying to connect via IPv6 to 192.168.0.1:30777.
Jan 2 01:00:19	netopeer2-server[238]: Trying out after 500 ms (operation now in progress).
Jan 2 01:00:19	netopeer2-server[238]: Call Home client - msgtype 0, cur_attempts: 0
Jan 2 01:00:19	netopeer2-server[238]: nc_ch_client_thread: check the internet 60
Jan 2 01:01:19	netopeer2-server[238]: Start connect...

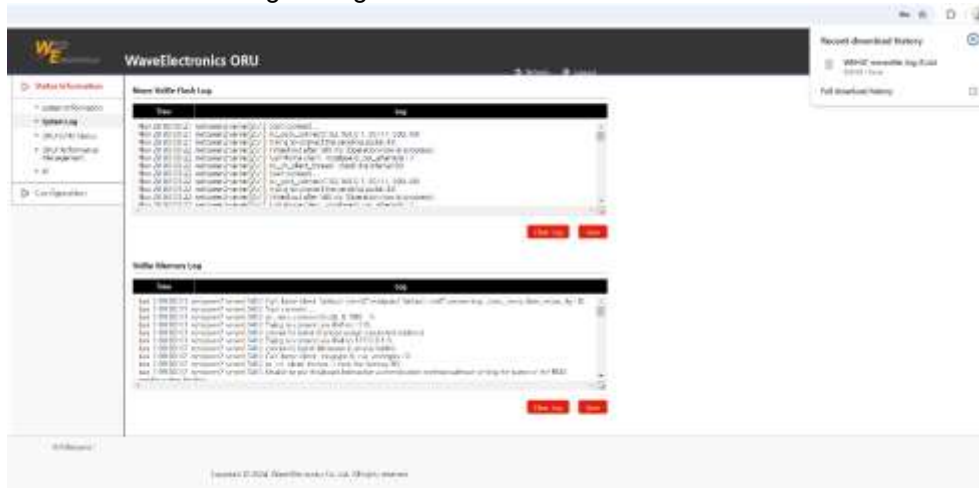
Volite Memory Log

Time	Log
Jan 1 09:00:35	kernel: Loaded 168243 symbols from 2 modules.
Jan 1 09:00:35	kernel: [0.000000] Booting Linux on physical CPU (0x000000000) [hw410A034]
Jan 1 09:00:35	kernel: [0.000000] Linux version 5.10.15 (gachigazal@cruse) (aarch64-none-linux-gnu-gcc (GNU Toolchain for the A-profile Architecture 10.3-2021.07 (arm-10.25) 10.3.1 20210621, GNU ld (GNU Toolchain for the A-profile Architecture 10.3-2021.07 (arm-10.25) 2.36.1.20210621) #65 SMP PREEMPT Thu Nov 7 11:45:14 KST 2024
Jan 1 09:00:35	kernel: [0.000000] Machine model: Wave Electronics WEH37 Board
Jan 1 09:00:35	kernel: [0.000000] earlycon: uart8250 at MMIO 0x0000000021c09300 (options: ")
Jan 1 09:00:35	kernel: [0.000000] printk: bootconsole [uart8250] enabled
Jan 1 09:00:35	kernel: [0.000000] efi: UEFI not found.

~A/S Request 1

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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.



WaveElectronics ORU

Status Information

- System Information
- System Log**
- ORU OAM Status
- ORU Performance Management
- RF

Configuration

None Volite Flash Log

Time	Log
Jan 02 00:00:00	netopeer2-server[238]: Call Home client "default-client" endpoint "default-uh0" failed connection attempt limit 3 reached.
Jan 02 00:00:00	netopeer2-server[238]: Call Home client "default-client" endpoint "default-uh0" connecting... (user, term, then, rcon, flg: 0)
Jan 02 00:00:00	netopeer2-server[238]: Start connect...
Jan 02 00:00:00	netopeer2-server[238]: nc_vsock_connect(192.168.0.1, 30777, 500, -1)
Jan 02 00:00:00	netopeer2-server[238]: Trying to connect via IPv6 to 192.168.0.1:30777.
Jan 02 00:00:00	netopeer2-server[238]: Trying out after 500 ms (operation now in progress).
Jan 02 00:00:00	netopeer2-server[238]: Call Home client - msgtype 0, cur_attempts: 0
Jan 02 00:00:00	netopeer2-server[238]: nc_ch_client_thread: check the internet 60
Jan 02 00:01:00	netopeer2-server[238]: Start connect...

Volite Memory Log

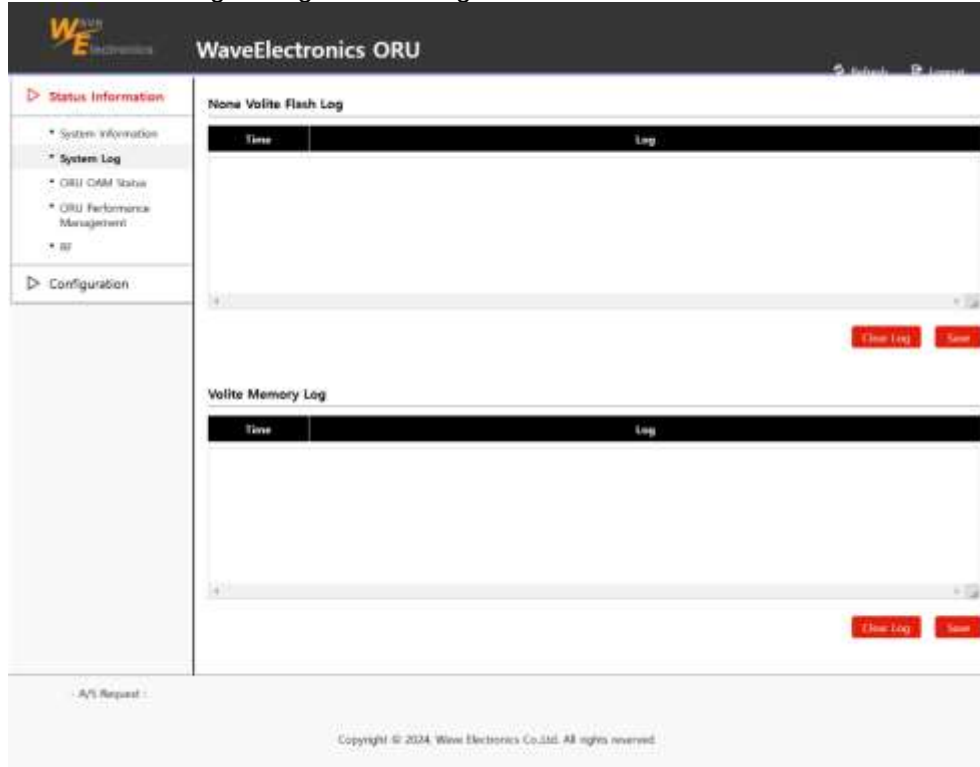
Time	Log
Jan 01 09:00:35	kernel: Loaded 168243 symbols from 2 modules.
Jan 01 09:00:35	kernel: [0.000000] Booting Linux on physical CPU (0x000000000) [hw410A034]
Jan 01 09:00:35	kernel: [0.000000] Linux version 5.10.15 (gachigazal@cruse) (aarch64-none-linux-gnu-gcc (GNU Toolchain for the A-profile Architecture 10.3-2021.07 (arm-10.25) 10.3.1 20210621, GNU ld (GNU Toolchain for the A-profile Architecture 10.3-2021.07 (arm-10.25) 2.36.1.20210621) #65 SMP PREEMPT Thu Nov 7 11:45:14 KST 2024
Jan 01 09:00:35	kernel: [0.000000] Machine model: Wave Electronics WEH37 Board
Jan 01 09:00:35	kernel: [0.000000] earlycon: uart8250 at MMIO 0x0000000021c09300 (options: ")
Jan 01 09:00:35	kernel: [0.000000] printk: bootconsole [uart8250] enabled
Jan 01 09:00:35	kernel: [0.000000] efi: UEFI not found.

Download History

File Name	Size	Download
WEH37-NoneVolite-Log.txt	100 KB	Download

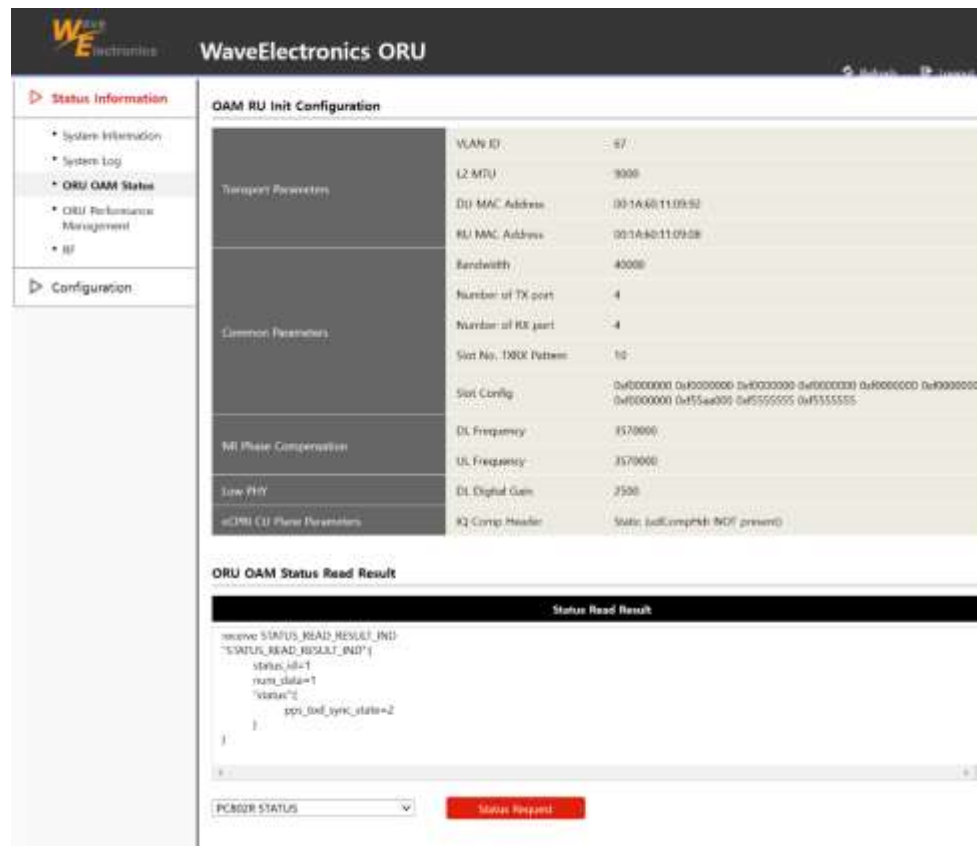
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In case of deleting the log via “clear log” button



The screenshot shows the WaveElectronics ORU interface. On the left, the 'Status Information' menu is expanded, showing 'System Log' as the selected option. The main area displays two log sections: 'None Volite Flash Log' and 'Volite Memory Log'. Each section has a table with 'Time' and 'Log' columns. Below each table, there are 'Clear Log' and 'Save' buttons. The footer indicates 'Copyright © 2024 Wave Electronics Co., Ltd. All rights reserved.'

C. O-RU OAM status sub menu



The screenshot shows the WaveElectronics ORU interface with the 'O-RU OAM status' sub-menu selected. The main area displays the 'OAM RU Init Configuration' table, which lists various parameters and their values. Below this, the 'ORU OAM Status Read Result' section shows a 'Status Read Result' table with a single row containing the status read result. The 'Status Read Result' table has a 'Status Read Result' column. The 'Status Read Result' column contains the following data:

Status Read Result
<pre> receive STATUS_READ_RESULT_IND { "STATUS_READ_RESULT_IND" status_id=1 num_data=1 "Status" ppr_bwd_sync_status=2 } </pre>

At the bottom, there is a dropdown menu labeled 'PC802R STATUS' and a 'Status Request' button.

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.

ORU OAM Status Read Result

Status Read Result

```

status_id=0
num_data=1
"status":{
  oam_agent_state=2
}

```

PC802R STATUS
Status Request

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

Normal operation status displays pps_tod_sync_state as 1.

ORU OAM Status Read Result

Status Read Result

```

status_id=1
num_data=1
"status":{
  pps_tod_sync_state=1
}

```

PPS TOD SYNC STATUS
Status Request

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

Normal ECPRI service status displays ecprl_link_state as 1.

ORU OAM Status Read Result

Status Read Result

```

status_id=2
num_data=1
"status":{
  ecprl_link_state=1
}

```

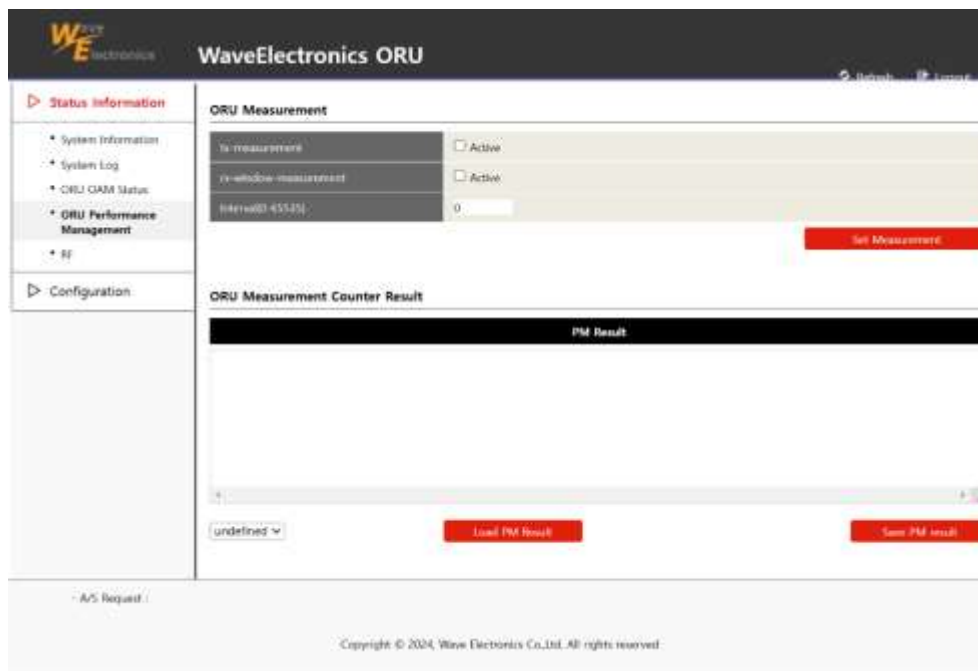
PVT_STATUS: Monitoring the internal temperature of the PC802R.

ECPRI_PACKET_PROCESSOR_STATUS: Monitoring packet counts of ecprl_tx_pkt, non_ecprl_rx_pkt, ecprl_rx_pkt per 4 pvt and non_ecprl_tx_pkt.

ORU_SW_VERSION_INFO: Monitoring hash ID of ORU related SW.

ECPRI_RS_FEC_STATUS

D. ORU Performance Management sub menu

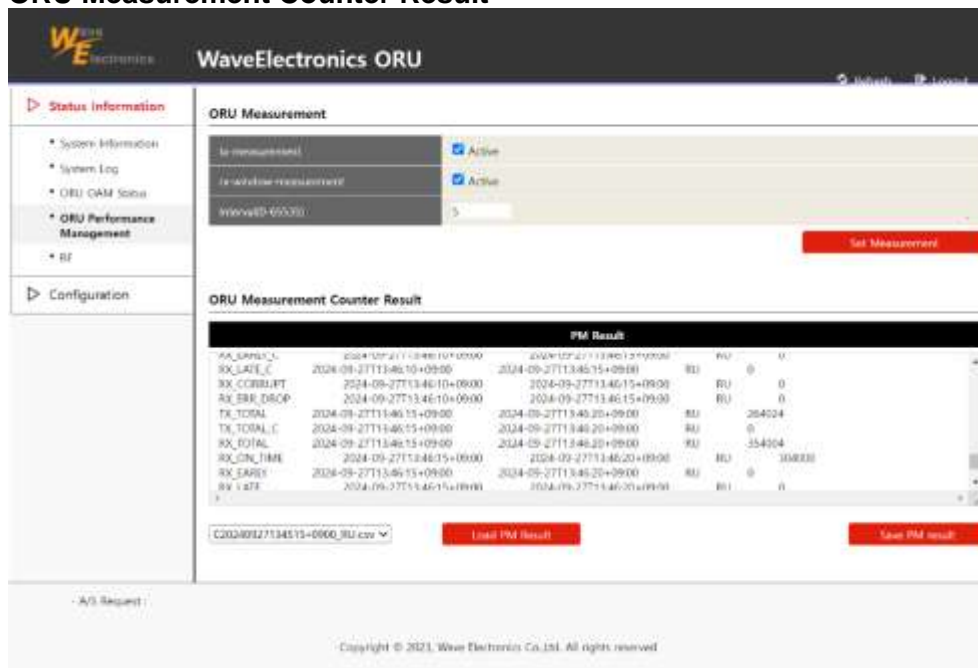


ORU Measurement

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.

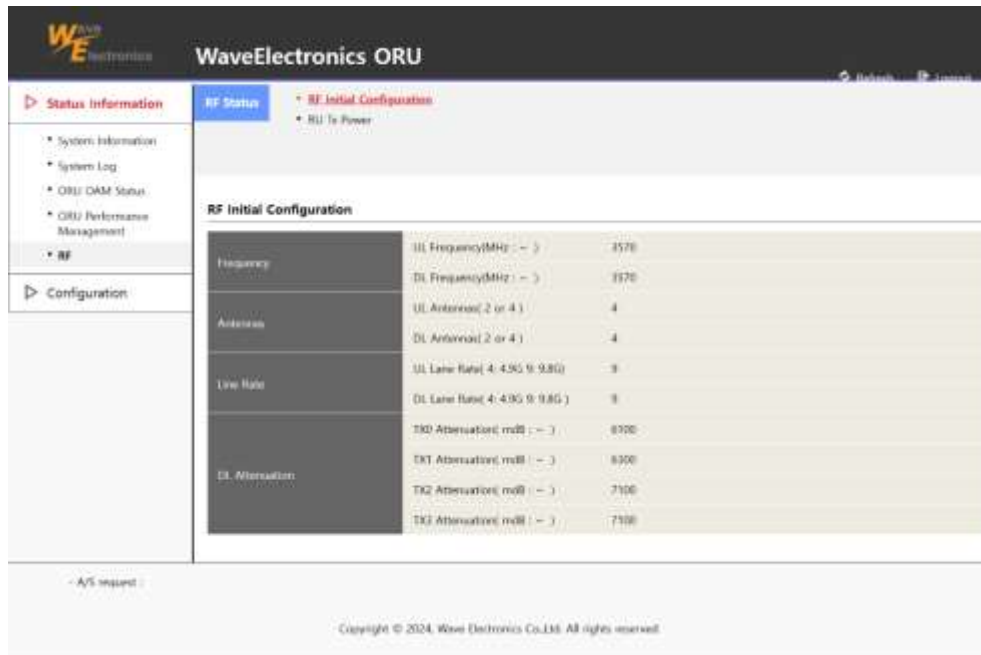
ORU Measurement Counter Result



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



WaveElectronics ORU

RF Initial Configuration

Parameter	Value
Frequency	UL Frequency(MHz) : 3570 DL Frequency(MHz) : 3570
Antennas	UL Antennas(2 or 4) : 4 DL Antennas(2 or 4) : 4
Line Rate	UL Lane Rate(4:4.9G,9:9.8G) : 9 DL Lane Rate(4:4.9G,9:9.8G) : 9
DL Attenuation	TX0 Attenuation(mdB) : 6300 TX1 Attenuation(mdB) : 6300 TX2 Attenuation(mdB) : 7100 TX3 Attenuation(mdB) : 7100

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RF Initial Configuration

The following RF Initial Configuration information is displayed.

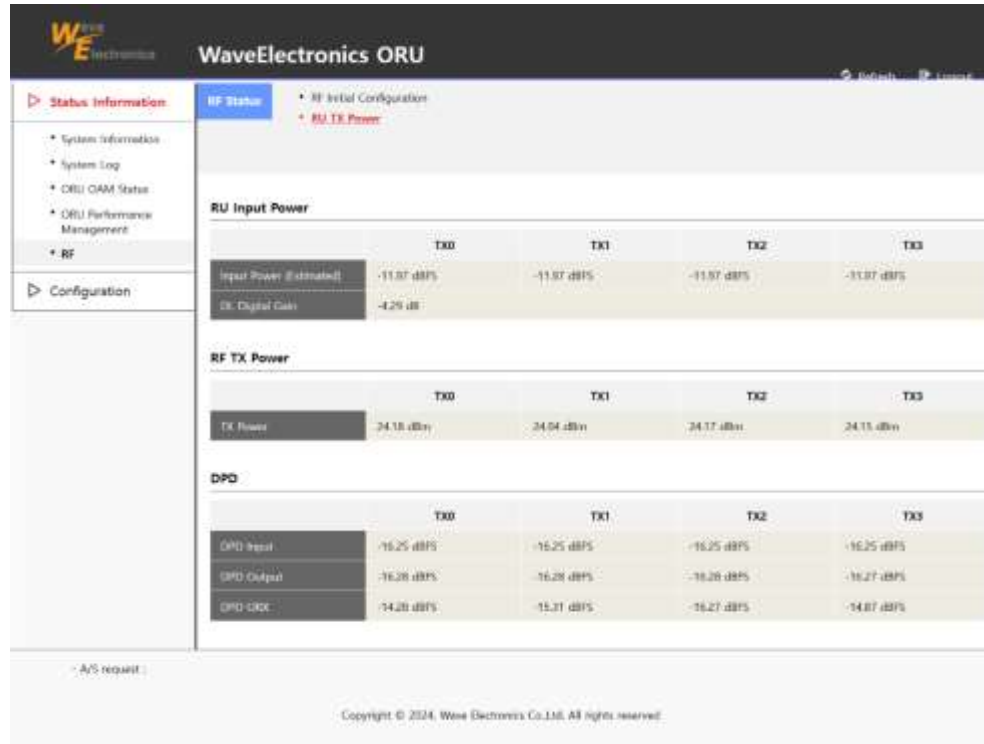
Frequency: Displays UL/DL Frequency (Unit: MHz)

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



WaveElectronics ORU				
Status Information		RF Status		
<ul style="list-style-type: none"> System Information System Log ORU OAM Status ORU Performance Management 		<ul style="list-style-type: none"> RF Initial Configuration RU TX Power 		
RU Input Power				
	TX0	TX1	TX2	TX3
Input Power (Estimated)	-11.97 dBFS	-11.97 dBFS	-11.97 dBFS	-11.97 dBFS
DL Digital Gain	-4.29 dB			
RF TX Power				
	TX0	TX1	TX2	TX3
TX Power	24.18 dBm	24.04 dBm	24.17 dBm	24.15 dBm
DPD				
	TX0	TX1	TX2	TX3
DPD Input	-16.25 dBFS	-16.25 dBFS	-16.25 dBFS	-16.25 dBFS
DPD Output	-16.28 dBFS	-16.28 dBFS	-16.28 dBFS	-16.27 dBFS
DPD ORX	-14.28 dBFS	-15.31 dBFS	-16.27 dBFS	-14.87 dBFS

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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.

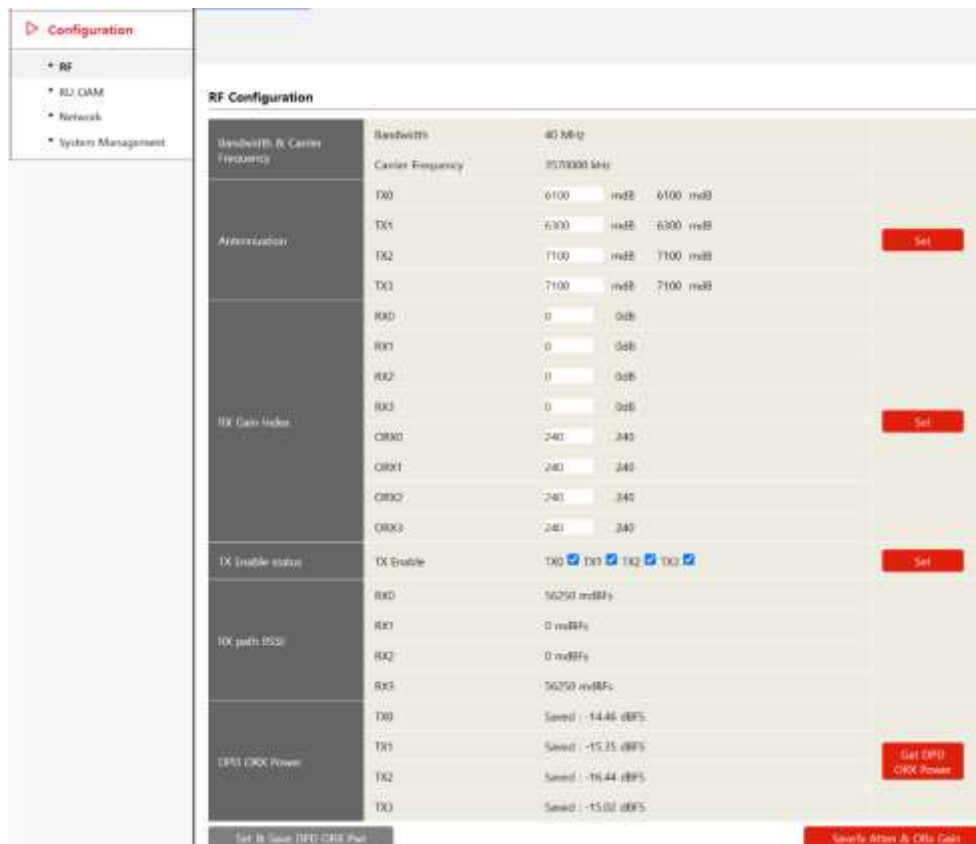
DPD Output: Displays the DPD Output Power per Tx path.

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

VI. Configuration Menu

Supports configuration functionalities.

A. RF sub menu



Bandwidth & Carrier Frequency		Bandwidth	40 MHz
		Carrier Frequency	8570000 kHz
Attenuation	TX0	6100	6100
	TX1	6300	6300
	TX2	7100	7100
	TX3	7100	7100
RX Gain Index	RX0	0	0
	RX1	0	0
	RX2	0	0
	RX3	0	0
	ORX0	240	240
	ORX1	240	240
	ORX2	240	240
	ORX3	240	240
TX Enable status	TX0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	TX1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	TX2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	TX3	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
RX path RSSI	RX0	-56.750	mdBFS
	RX1	0	mdBFS
	RX2	0	mdBFS
	RX3	-56.750	mdBFS
DPD ORX Power	TX0	Saved : -14.46	dBFS
	TX1	Saved : -15.35	dBFS
	TX2	Saved : -16.44	dBFS
	TX3	Saved : -15.02	dBFS

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.

Configuration

- RF
- EU DAB
- Network
- System Management

RF Configuration

Bandwidth & Carrier Frequency	Bandwidth	40 MHz		
	Carrier Frequency	1570000 kHz		
Antennas	TX0	6400 mdB	6100 mdB	Set
	TX1	6300 mdB	6300 mdB	
	TX2	7100 mdB	7100 mdB	
	TX3	7100 mdB	7100 mdB	
RX Gain Index	RX0	0 dB		Set
	RX1	0 dB		
	RX2	0 dB		
	RX3	0 dB		
	ORX0	240	240	
	ORX1	240	240	
	ORX2	240	240	
TX Enable status	TX Enable	TX0 <input checked="" type="checkbox"/> TX1 <input checked="" type="checkbox"/> TX2 <input checked="" type="checkbox"/> TX3 <input checked="" type="checkbox"/>		Set
RX path RSC	RX0	16250 mdBfs		
	RX1	0 mdBfs		
	RX2	0 mdBfs		
	RX3	16250 mdBfs		
DPD ORX Power	TX0	Saved : -14.46 dBFS	Current : -14.25 dBFS	Get DPD ORX Power
	TX1	Saved : -15.35 dBFS	Current : -15.25 dBFS	
	TX2	Saved : -16.44 dBFS	Current : -16.22 dBFS	
	TX3	Saved : -15.02 dBFS	Current : -14.84 dBFS	

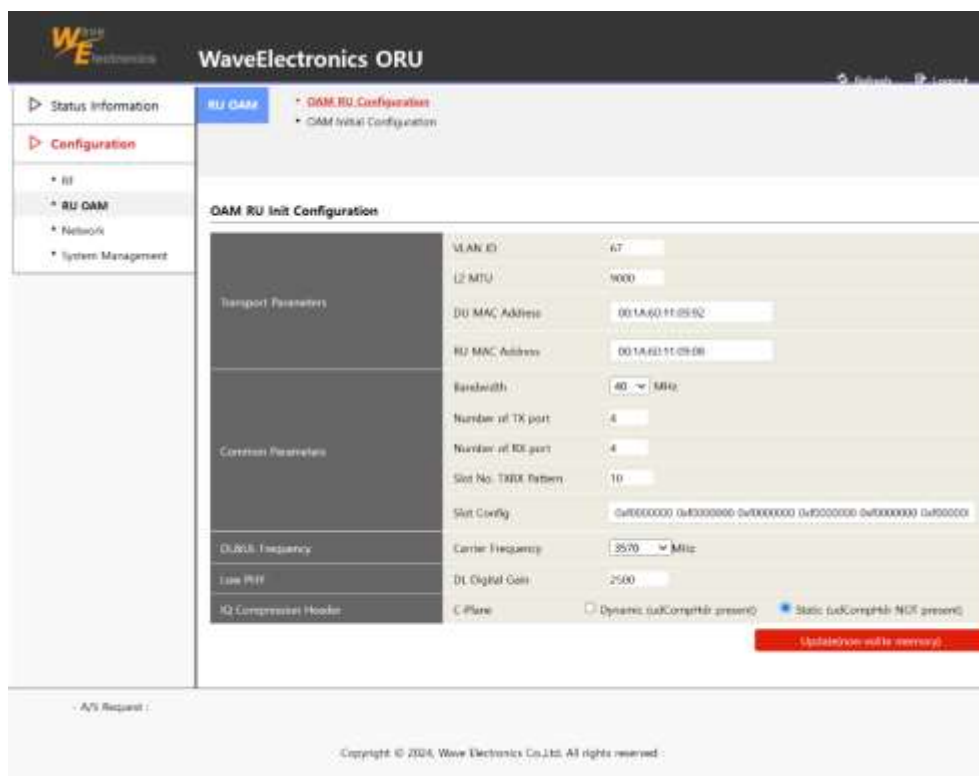
Set & Save DPD ORX Pwr
Save Tx Atten & ORx Gain

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.

B. RU OAM sub menu

a. OAM RU Configuration



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 C-Plane.

Press the 'Update (non-volatile memory)' to save the modified configuration.

Advice: These parameters are applied after rebooting process.

Slot-config value:

Ex) Slot number 5 / DDSU / 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

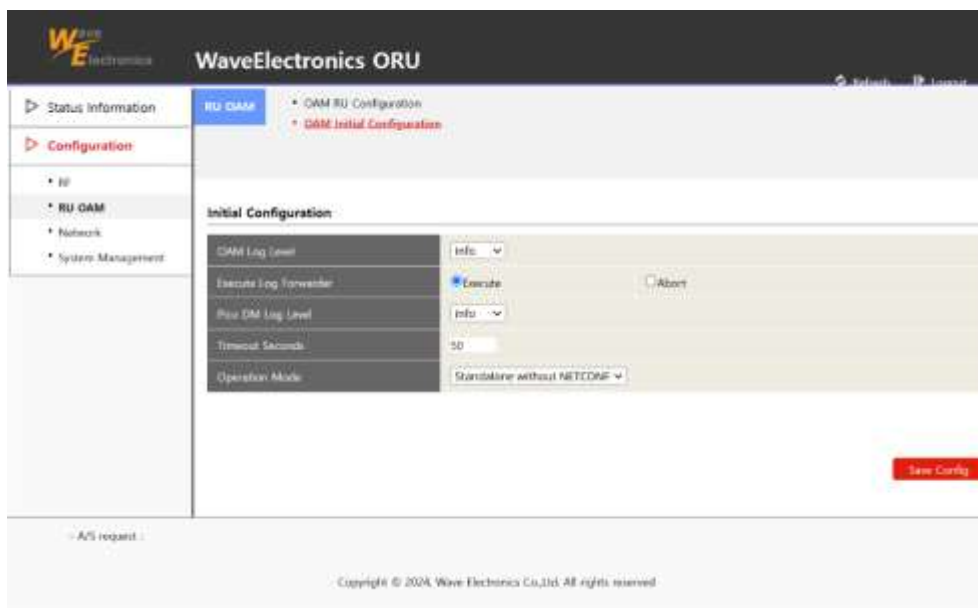
0xf0000000 0xf0000000 0xf0000000 0xf5a00000 0xf5555555

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)

S Slot: 0xf5a00000 → 0'b1111 0101 1010 0000 0000 0000 0000 0000 (D: 1 ~ 10, S: 11 ~ 12, U: 13 ~ 14 symbol)

b. OAM Initial Configuration



Initial Configuration

OAM Log Level: Choose the OAM Log Level (Debug, Info, Warn, Error).

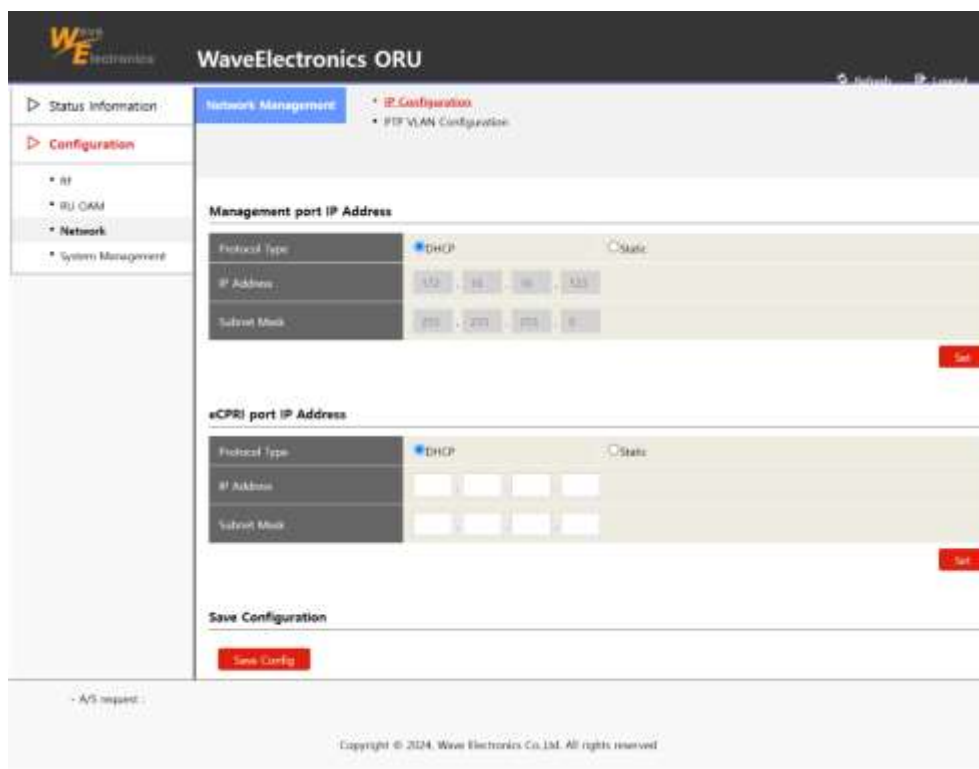
Execute Log Forwarder: Choose the checkbox whether to execute log forwarder or not.

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.

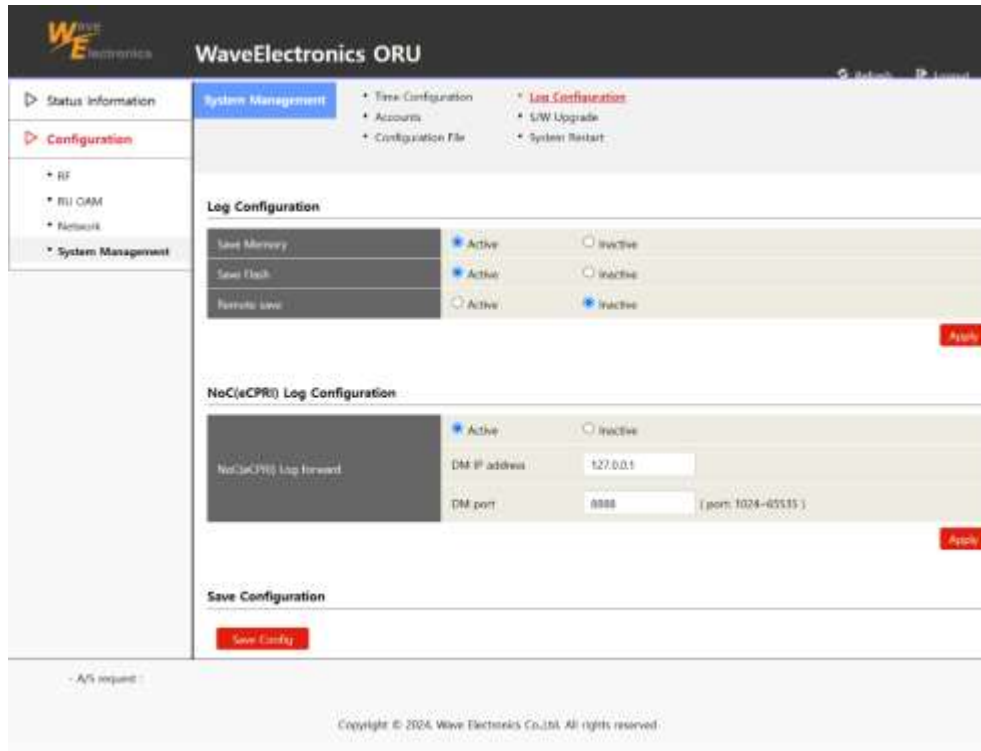
b. PTP VLAN Configuration



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



The screenshot shows the WaveElectronics ORU web interface. The left sidebar contains a menu with 'Status Information', 'Configuration', and 'System Management'. The 'Configuration' section is expanded, showing 'RF', 'RFI CAM', 'Network', and 'System Management'. The 'System Management' section is further expanded, showing 'Time Configuration', 'Accounts', 'Configuration File', 'Log Configuration', 'S/W Upgrade', and 'System Restart'. The 'Log Configuration' section is active, displaying a table with three rows: 'Save Memory', 'Save Flash', and 'Parallels save'. Each row has radio buttons for 'Active' and 'Inactive'. Below this is the 'NoC(eCPRI) Log Configuration' section, which includes a 'NoC(eCPRI) Log Forward' checkbox, a 'DM IP address' field (set to 127.0.0.1), and a 'DM port' field (set to 8080). At the bottom, there is a 'Save Configuration' section with a 'Save Config' button. The footer contains the text 'Copyright © 2024, Wave Electronics Co., Ltd. All rights reserved.'

Log Configuration

Configure 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

The screenshot displays the WaveElectronics ORU web interface. The top header includes the WaveElectronics logo and the title 'WaveElectronics ORU'. A left sidebar contains navigation links: 'Status Information', 'Configuration', 'RF', 'RU OAM', 'Network', and 'System Management'. The 'System Management' section is expanded, showing sub-links: 'Time Configuration', 'Accounts', 'Configuration File', 'Log Configuration', 'S/W Upgrade', and 'System Restart'. The 'Accounts' link is highlighted. The main content area is titled 'User account settings' and contains a form with the following fields: 'Current user ID', 'Insert new user ID', 'Current password', 'Insert new password', and 'Confirm new password'. A note states 'The password should be more than 5 characters.' At the bottom right of the form are 'Cancel' and 'Apply' buttons. The footer includes a copyright notice: 'Copyright © 2018, Wave Electronics Co., Ltd. All rights reserved.'

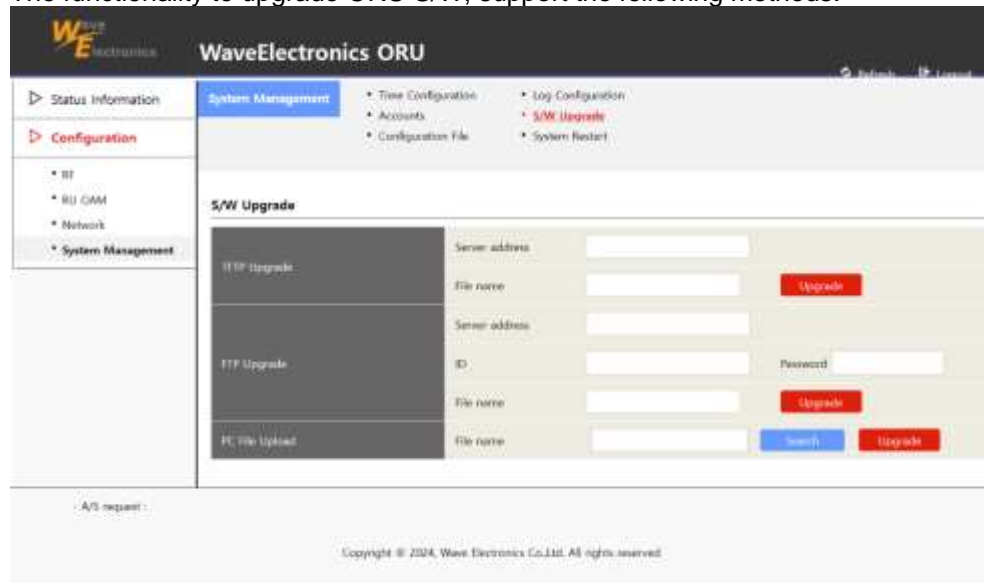
Available to configure following materials about WEB UI user account.

Change password.

Add another account.

d. S/W Upgrade

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



The screenshot displays the WaveElectronics ORU web interface. The 'System Management' menu is active, showing options like Time Configuration, Accounts, Configuration File, Log Configuration, S/W Upgrade, and System Restart. The 'S/W Upgrade' section is expanded, showing three methods: TFTP Upgrade, FTP Upgrade, and PC File Upload. Each method has a form with input fields for server address, file name, ID, and password, and buttons for 'Upgrade' and 'Search'.

TFTP upgrade: 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.

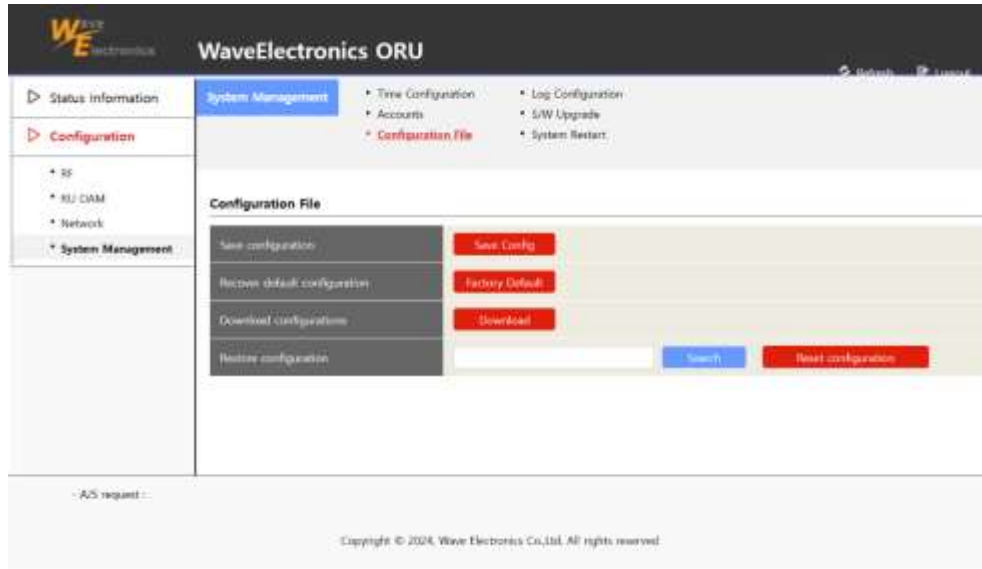
update-image.sh web -f /tmp/upload.bin -aq

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.

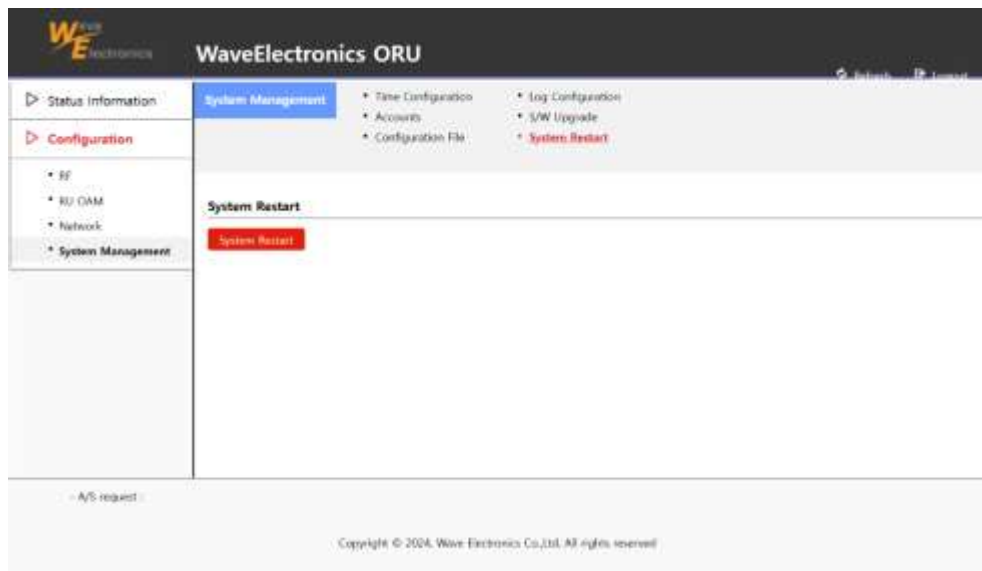
Save configuration: Save current configurations.

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.

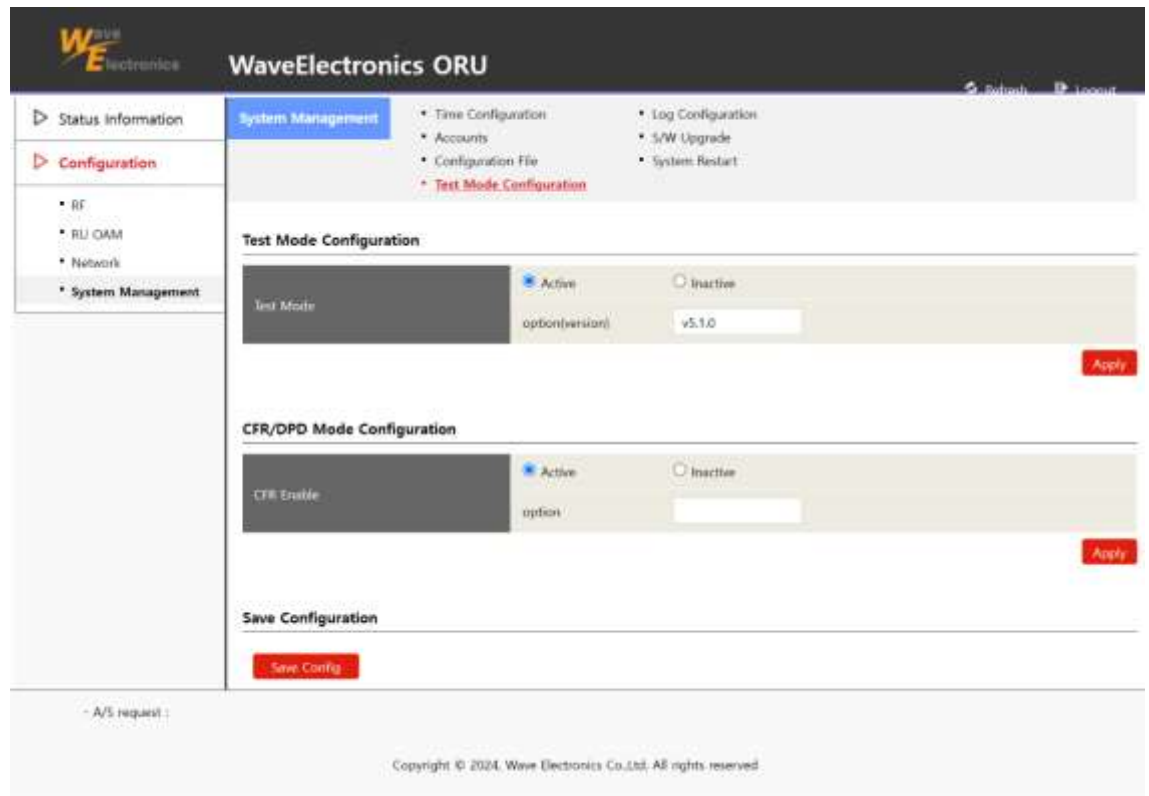
g. Test Mode

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



The screenshot shows the WaveElectronics ORU web interface. The left sidebar contains navigation links: Status Information, Configuration, RF, RU OAM, Network, and System Management. The main content area is titled 'WaveElectronics ORU' and includes a 'System Management' section with links to Time Configuration, Accounts, Configuration File, Test Mode Configuration, Log Configuration, S/W Upgrade, and System Restart. The 'Test Mode Configuration' section has a 'Test Mode' toggle set to 'Active' (with 'Inactive' as an option) and a version field set to 'v5.1.0'. Below this is the 'CFR/DPD Mode Configuration' section with a 'CFR Enable' toggle set to 'Active' (with 'Inactive' as an option) and an empty 'option' field. At the bottom, there is a 'Save Configuration' section with a 'Save Config' button. The footer indicates 'Copyright © 2024, Wave Electronics Co., Ltd. All rights reserved.'

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
```

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

Wave Electronics

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

Suwon-si, Gyeonggi-do

16506

Telephone number or internet contact information