

PM-nCELL-T5000&RU4460 Series Base Station

Product Manual_V1.0

Version Record

Version No	Date	Author	Modification instructions
V1.0	2024-05-09	Zackie, Jessi, Lu	Initial Version

FCC Statement

Please take attention that changes or modification not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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.

RF Exposure Information

This device has been tested and meets applicable limits for Radio Frequency (RF) exposure. This equipment must be installed and operated in accordance with provided instructions and the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 390 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

This device must be professionally installed.

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1.0 Document Introduction

This document mainly introduces the nCELL-T5000 series base stations from five aspects: product description, configuration management, upgrade management, fault management, and performance management. It aims to guide users to carry out basic operations such as site commissioning, upgrade, and configuration.

2.0 Version Changes

Release Version	Software - BBU	Software - RRU		Accelerator Card	File
V3.10sp03	<i>To be updated</i>	2496-2690			
V3.7SP05	5G NR_ax.tdd.fr1.2.2.3.462_r5 4139_m692_V3.7SP05.pkg	2496-2690	iDAS_DRRU_R518_D1.4 .B13S_77D_20230824.zip	FGAF2.4.0_2 30112_R	
V3.6SP01	5G NR_ax.tdd.fr1.2.2.3.462_r5 4139_m565_V3.6SP01.pkg	2496-2690	iDAS_DRRU_R518_D1.2 .B13S_4F1D_20230601.zip		

3.0 Safety Precautions

3.1 General safety precautions

- ◆ Personnel responsible for the installation, operation, and maintenance of equipment must undergo rigorous training, obtain relevant qualifications, understand various safety precautions, and master the correct operating methods before installing, operating, and maintaining the equipment.
- ◆ During installation, operation, and maintenance of equipment, local laws and regulations must be followed. The safety precautions in the manual serve as supplements to local laws and regulations. Additionally:
- ◆ Only qualified professionals and trained personnel are allowed to install, operate, and maintain equipment.
- ◆ Only qualified professionals are allowed to remove safety facilities and inspect equipment.
- ◆ Operators should promptly report faults or errors that may cause safety issues to the

responsible person.

- ◆ Personnel operating the equipment should have special operation qualifications required by the local country, such as high-voltage operation, working at heights, and special equipment operation qualifications.
- ◆ If any potential harm to personnel or equipment is detected during the installation process, personnel operating the equipment should immediately cease operations, report to the project manager, and take effective protective measures.
- ◆ Installation, use, and operation of outdoor equipment (including but not limited to handling equipment, installing cabinets, and connecting outdoor cables) are strictly prohibited during adverse weather conditions such as lightning, rain, snow, and strong winds.
- ◆ Wearing of watches, bracelets, bangles, rings, and other conductive objects is strictly prohibited during installation, operation, and maintenance.
- ◆ Special insulation tools must be used during installation, operation, and maintenance, such as wearing insulated gloves, safety clothing, helmets, and safety shoes.
- ◆ Before touching any conductor surface or terminal, the voltage at the contact points should be measured using a voltmeter to confirm the absence of electric shock hazards.
- ◆ Ensure all slots have boards or dummy panels in place to prevent dangerous voltages and energy hazards from being exposed, maintain proper airflow, control electromagnetic interference, and avoid dust or other foreign objects falling on backplanes, bottom boards, or boards.
- ◆ After equipment installation, users should conduct routine inspections and maintenance as required in the user manual, replace faulty parts promptly to ensure safe operation of the equipment.
- ◆ Remove all packaging materials from the equipment area after installation, such as cardboard boxes, foam, and plastic.

3.2 Installation environment requirements

- ◆ Ensure that the equipment installation environment (such as voltage, temperature, humidity, altitude, pollution level, overvoltage level, waterproof, dustproof requirements, etc.) is within the specifications of the equipment.
- ◆ Do not place equipment in environments with flammable, explosive gases, or smoke and avoid any operations in such environments.
- ◆ Avoid acidic, alkaline, or other corrosive gases in the installation location.
- ◆ Do not place equipment near heat sources or naked flames, such as electric heaters, microwaves, ovens, water heaters, fires, candles, or other sources that may generate high temperatures, as this may cause the casing to melt or the equipment to overheat, leading to fires.
- ◆ Do not use flammable materials to cover or obstruct equipment during operation. Ensure timely clearance of debris around the equipment, such as paper, cotton fabric, insect/bird nests, unused cables, etc., as failure to do so may obstruct ventilation, causing the casing to deform and resulting in fires.
- ◆ This equipment (or system) must be installed or used in restricted areas.

- ◆ Do not block ventilation holes when the equipment is running. Maintain the distance between the ventilation hole interface and the wall or other objects according to the equipment requirements, typically a minimum distance of 5 centimeters if not specified.
- ◆ This equipment is not suitable for use in places where children may be present.
- ◆ Products with waterproof and dustproof ratings below IP54 are not allowed for outdoor use.

3.3 Indoor installation

- ◆ The equipment installation site should be free from rodent and insect infestation.
- ◆ Fixed installation equipment installed on non-combustible surfaces does not require a fireproof protective shell.
- ◆ Ensure that there is no seepage, dripping, or condensation at the top of the equipment (such as in the case of malfunctioning room air conditioning), which may cause water ingress into the equipment, leading to equipment failure.
- ◆ When fixed equipment has large openings at the bottom, it must be installed on concrete, tile, or non-combustible surfaces.
- ◆ When drilling holes in the wall, ensure that there are no electrical circuits, water pipes, or gas pipes behind the drilling site to avoid personal injury.
- ◆ It is strictly forbidden to place flammable and explosive items above and below the equipment. No objects should be within a 1-meter radius of the product.
- ◆ When installing equipment on the wall, ensure that there are no openings facing upward to prevent water from entering the interface and causing equipment damage.
- ◆ Ensure that the mounting screws are securely fastened. Otherwise, the equipment may fall due to tension after connecting the cables, causing equipment damage or injuring installers.

3.4 Desktop installation

- ◆ Ensure the stability of the desktop or workbench and good grounding.
- ◆ Do not stack items on the equipment.
- ◆ It is strictly forbidden to place cups, beverages, or other liquid-containing utensils near or on the equipment to prevent liquid leakage and potential safety hazards. If foreign objects or liquids enter the equipment, immediately stop using it, disconnect the power, unplug all cables connected to the equipment, and contact the after-sales personnel.
- ◆ For devices with ventilation holes that may be used on soft support materials (such as bedding, blankets, etc.), do not cover the ventilation holes.

3.5 Rack installation

- ◆ Before installing the equipment in the rack, ensure that the rack is securely fixed to avoid instability and collapse, which may cause injuries to installers and damage to the

equipment.

- ◆ Leave a certain gap around the rack.
- ◆ For closed racks, ensure good heat dissipation.

3.6 Outdoor installation requirements

- ◆ Outdoor equipment and cables are strictly prohibited from being installed during adverse weather conditions such as lightning, rain, snow, or wind exceeding level six.
- ◆ Equipment installed in outdoor protective boxes must meet a protection level of IP54 or above.
- ◆ When performing outdoor installation operations, local operating regulations must be complied with.
- ◆ Mark out dangerous prohibited areas on the site and set clear signs to prohibit unrelated personnel from entering.
- ◆ Scaffolding, platforms, and workbenches used for operations must undergo safety checks beforehand to ensure structural integrity and avoid overloading.
- ◆ Try to avoid simultaneous operations on upper and lower levels. If unavoidable, a dedicated protective shed must be installed between the upper and lower levels, and tools or items must not be stacked on the upper level.
- ◆ It is strictly forbidden to joke or sleep in the work area during operations.
- ◆ If the site supervisor or safety officer finds that construction personnel are not following regulations, they must immediately point it out and request correction. If the violation persists, they have the right to stop the operation, and the absent period will be treated as absenteeism. Personnel who violate operational safety regulations and cause accidents will be held responsible, and guardians will bear certain responsibilities.

4.0 Quick Overview

4.1 Quick Overview of Product Models

Product Name	Key Feature	Pic
nCELL-T5000		
nCELL-RU4460	4T4R Digital Radios 40W(46dBm) Output Power 5G NR IP67 Outdoor Rated	

4.2 Quick Site Deployment

4.2.1 Hardware Installation Guide

◆ nCELL-T5000

<https://youtu.be/AP6p4Z8YV7g>

◆ nCELL-RU4460

<https://www.youtube.com/watch?v=RABvD0IsDPM&list=PLTrVqB8-sz0FqclEwjfEmyDYrVK9znP7s&index=10>

4.2.2 Software Deployment Guide

Please refer the chapter: 6.2.1-nCELL-T5000 Series Base Stations Initial Configuration Guide.

5.0 Product Description

5.1 Technical Specifications

5.1.1 Technical Specifications of nCELL-T5000

The nCELL-T5000 is used to realize 5G NR base station processing unit to centrally control and manage the entire base station system. It realizes direct access and data interaction with 5G core network, with NGAP and XnAP interface. Also, the product realizes 5G NR access network protocol stack function, RRC, PDCP, SDAP, RLC, MAC and PHY protocol layer functions, as well as baseband processing functions.

PROCESSOR PARAMETERS	
CPU	CPU Intel® Xeon® D-2177NT Processor 105W (14C/28T) CPU Intel® Xeon® D-2187NT Processor 110W (16C/32T)
Photolithography	14nm
Processor Base Frequency	XeonD-2177NT Processor – 1.9GHz XeonD-2187NT Processor – 2.0GHz
Maximum Turbo Frequency	3.00 GHz
Cache	19 MB
Memory Type	DDR4-2666
Supported ECC Memory	Yes
Maximum Number of Memory Channels	4
Maximum Memory Speed	2667 MHz
Maximum Memory (Depending on Memory Type)	256 GB
Chipset	Intel® Xeon® SoC
Size	482.6 x 420 x 44.5 mm 19.00 x 16.54 x 1.75 in
Weight	7.2 kg 15.87 lbs
Power Supply	450W 1+1 redundant PSUs 100V to 240V AC @50-60Hz -36V to -72V DC
MTBF	150,000 h

FUNCTIONAL INDICATORS	
Standard	3GPP R15/R16*
Server Platform	Xeon D-2177NT Processor Xeon D-2187NT Processor
Maximum Number of Cells	2 (XeonD-2177NT Processor) 4 (XeonD-2187NT Processor)
Carrier Bandwidth	20MHz/40MHz/50MHz/60MHz/80MHz/100 MHz
Subcarrier Spacing	30 kHz
Number of Active Users	800 users per BBU, 400 user single cell
Downlink Peak Rate	1.5 Gbps (DDDSU), 658Mbps (DSUUU)
Uplink Peak Rate	260 Mbps (DDDSU), 669Mbps (DSUUU)
Maximum Number of Data Streams	Downlink 4 streams
	Uplink 2 streams
Number of Concurrently Scheduled	4 users / Slot

Users	
RF Front End	RRU with FPGA/DSP
RF Front End	< 6 GHz
Duplex Mode	TDD, FDD
BS Spatial Layers	4
UE Spatial Layers	2
Fronthaul Bandwidth	10G
Number of Fronthaul Interfaces	4
Return Bandwidth	10G
Number of Return Interfaces	2

ENVIRONMENTAL SPECIFICATIONS		
Temperature	Operation	-5 °C ~ +55 °C +23 °F ~ +131 °F
	Storage	-40 °C ~ +70 °C -40 °F ~ +158 °F
Humidity	Operation	10% ~ 85% RH @40 °C, non-condensing
	Storage	5% ~ 90% RH, non-condensing
Fan	6 fans, adaptive speed	
Shock	Operating time: Half sine 2G, 11ms pulse, 100 pulses in each direction	
	Non-operating: Trapezoid, 25G, 170 inches/sec DeltaV, 3 drop tests in each direction	
Vibration	Non-operating time: 2.2Grms, 10 minutes per axis per direction	
Decibel	Sound pressure < 75 dBA @1m, all fans run at maximum speed	

The integrated fronthaul accelerator card FGAF uses Xilinx's Zynq Ultra Scale+ MPSOC and Kintex Ultra Scale+ FPGA to realize the functions of baseband processing acceleration and data forwarding, and meets the application requirements of high bandwidth, low latency and multi-cell deployment required by the 5G BBU system. Very high integration and ease of use. This card is a single-slot, full-height half-length (FHHL) card, using PCIeGen3x16 interface (supports bifurcation into two sets of Gen3x8 interfaces) to connect to the system, and externally supports 4 SFP+ optical ports.

The card is equipped with a high-precision clock source and clock phase-lock circuit, supports external 1588V2 and GPS input, and can provide stable clock synchronization services to the next-level network node through the SFP+ fronthaul interface.

BASEBAND PROCESSING ACCELERATION PERFORMANCE		
	Throughput Rate	Delay
LDPC Encoding	17.8 Gbps	14μs
LDPC Decoding	8.1 Gbps	16μs

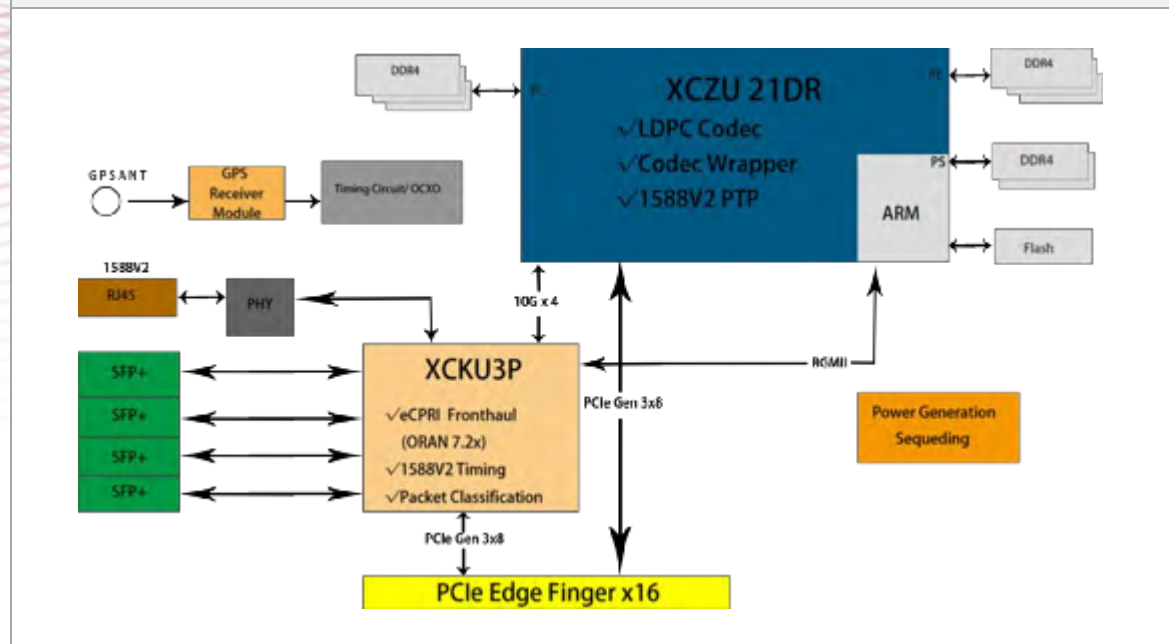
FRONTHAUL DATA FORWARDING PERFORMANCE			
	Downlink Rate	Uplink Rate	Remarks
Single optical port rate	10 Gbps	10 Gbps	Full package mode, 4 concurrent

			ports
Single optical port rate	9 Gbps	9 Gbps	Burst32, large and small packet interval mode, 4 concurrent ports

CLOCK SYNCHRONIZATION PERFORMANCE

Support Standard	Index	Uplink Rate
Grand master	Support clock synchronization of 128 nodes	Number of Slavers
SyncE G.8262	All 4 interfaces support	
Keep ability	1.5μs over 8 Hours	Choose high stability OCXO

SINGLE BOARD FRAME



SINGLE BOARD SPECIFICATIONS

Physical layer acceleration	LDPC codec	Codec encapsulation logic, supports CRC, rate matching and de-rate matching		
Fronthaul	4x10G eCPRI Supports 1588V2	Data aggregation	Data cache	Package classification management
Clock circuit	Onboard OCXO, high-precision phase-locked loop synchronization circuit	Onboard GPS receiver module	Supports external 1588V2 input	

CHIPSET SPECIFICATIONS

Chip Model	Xilinx Zynq Ultra Scale Plus RFSoc XCZU21DR
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	Xilinx Kintex Ultra Scale+ XCKU3P	
System Resource	XCZU21DR	XCKU3P
	- System Logic cells - 930K - CLB LUT - 425K - SDFEC -8 - DSP Slices - 4,272 - BRAM - 38.0Mb - URAM - 22.5Mb	- System Logic cells -365K - CLB LUT - 163K - DSP Slices - 1,368 - BRAM - 12.7Mb - URAM - 13.5Mb - GTY Transceivers - 16
Structure Size	Full-height, half-length (FHHL) x16 PCIe form factor W x H x D: 169.6 x 110.6 mm x 18.6 mm 6.68 x 4.35 x 0.73 in	
PCIe Interface	PCIe Gen3 x16 interface bifurcated to two PCIe Gen3 x8	
Onboard RAM Resources	2xBanks of 512M x 48 –PL 1xBank of 512Mx 32 –PS - Total Capacity 6GB in PL - Total Capacity 2GB in PS	/
Onboard FLASH Resources	1Gb SPI FLASH NOR SLC	256Mb SPI FLASH NOR SLC
Network Interface	4 SFP+ optical ports	
Cooling Method	Module with cooling teeth, cooling through internal air ducts in the case	
Single Board Management	- Single board power-up sequence management and hot reset and shutdown functions - Supports local software upgrade - JTAG daisy-chaining design to support burning and debugging of two devices - On-board RS232 debug port - On-board Ethernet debug port	
Single Board Working Temperature	0 °C ~ +80 °C +32 °F ~ +176 °F	
Single Board Power Consumption	< 35W	
Single Board Clock Synchronization Mode	- Supports external GPS antenna for GPS synchronization - Supports 1588V2 time information input via external Ethernet RJ45 - Optional high stability crystal oscillator for local clock keeping within 8 hours with time accuracy deviation less than ±1.5μs	

5.1.2 Technical Specifications of nCELL-RU4460

The RU4460 is a high output power radio frequency unit (RRU) for 5G NR outdoor base stations. It forms a complete 5G base station together with the baseband unit (BBU), which is used in mobile communication cell cellular networking scenarios.

The platform support fiber optic cable cellular technology with CPRI/eCPRI protocol. The Power amplifier technology uses DPD (digital pre-distortion) technology, compared with analog technology, power consumption has been significantly improved. The platform is ideal for underground tunnel and outdoor overlay deployments for cellular services.

KEY FEATURES

- Support 4T4R, 5G NR Compliant
- Up to 40W (46dBm) Output Power and 100MHz IBW
- Supports Sub-6GHz TDD & FDD and External Alarm

TECHNICAL SPECIFICATIONS

SYSTEM

Bandwidth per Channel (Downlink & Uplink)	≤ 100 MHz (Contiguous)
Digital Bandwidth per Channel (Downlink & Uplink)	3/5/10/20MHz LTE 20/40/50/60/80/100MHz NR

SUPPORTED BANDS

Band Frequency	3GPP Band	Downlink Frequency	Uplink Frequency	Max Bandwidth
2496-2690 TDD	N41	2496-2690	2496-2690	100

INTERFACES

Antenna Interface (All bands)	4.3-10 Female
Optical Connector Type	SFP+, Standard LC
Optical Transmission Rate	9.8304GB/s
Optical Fiber Length	1.4km / 10km / 30km 0.87mi / 6.21mi / 18.64mi
Dry Contact	2 Inputs & 2 Outputs, NO and NC Mode
Maintenance Interface	Ethernet RJ45

ELECTRICAL

Complies with	3GPP TS36.106 3GPP TS25.106
EMC	EN 301489-1 / -50, EN 50121-4, EN 55032, EN 61000-4 series
Safety	EN 60950-1, EN 60950-22, EN 62368-1, EN 50385
Maximum Power Consumption	650W
Power Supply	48VDC ± 20%

ENVIRONMENTAL

Mean Time Between Failure (MTBF)	> 100,000 hours
Operating Temperature	40 °C ~ +55 °C -40 °F ~ +131 °F
Humidity	5% to 100% (Non-Condensing)
Cooling	Passive
Installation	Wall or Pole
Ingress Protection Rating	IP67 (Outdoor)

Complies with	EN 300019-1-1, EN 300019-1-2, EN 300019-1-4
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MECHANICAL	
Size (Width x Height x Depth)	500 x 380 x 142 mm 19.7 x 14.96 x 5.59 in
Weight	23.0 kg 50.71 lbs

5.2 Hardware Description

5.2.1 nCELL-T5000 Hardware Description

The BBU T5000 serves as the baseband unit, primarily responsible for processing digital signals, coordinating the transmission of radio frequency signals, and working in synergy with other elements within the network. Below are the key functionalities of the BBU

Baseband Signal Processing: The BBU is responsible for processing digital signals, including modulation, demodulation, encoding, and decoding, which are critical processing steps for digital signals from user equipment to the base station and vice versa.

Uplink Signal Processing: The BBU is tasked with receiving uplink signals from user equipment, processing them, and decoding them to extract transmitted user information.

Downlink Signal Processing: After processing the uplink signals, the BBU modulates and encodes them before transmitting them to the RRU (Remote Radio Unit) for transmission to user equipment via antennas.

Radio Frequency Link Control: The BBU manages the radio frequency link, including setting RF frequencies, power control, interference management, etc., to ensure the synergy of various elements within the network.

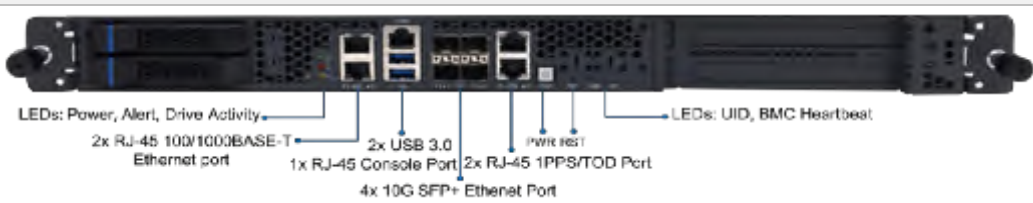
Scheduling and Resource Allocation: The BBU performs scheduling and resource allocation to optimize network performance. Through intelligent scheduling algorithms, it efficiently allocates wireless resources to improve system capacity and coverage range.

Protocol Handling: The BBU handles tasks related to communication protocols, ensuring that various elements within the network communicate according to specified protocols to achieve interoperability.

Clock Synchronization Management: The BBU needs to remain synchronized with the entire network to ensure the synergy between various base stations and network elements. Clock and synchronization management are among its important functions.

Fault Monitoring and Management: The BBU can monitor faults within the network and send corresponding reports as needed. It also supports fault troubleshooting and maintenance work.

Interfaces and Interconnections: The BBU needs to communicate effectively with other base station components (such as RRUs, core networks, etc.) to ensure the synergy of the entire system.

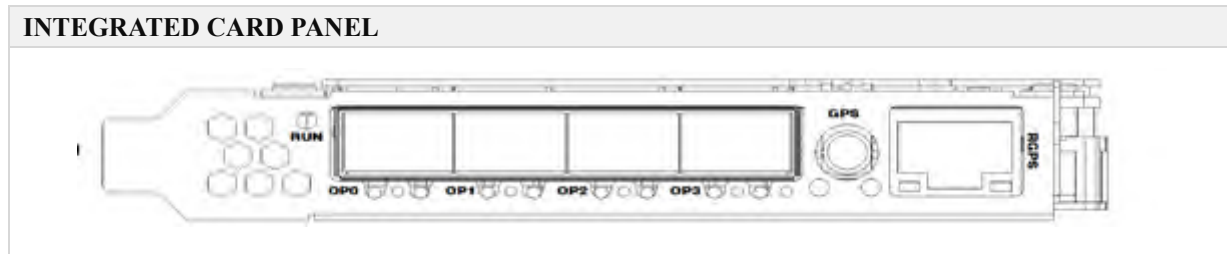
DEVICE INTERFACE	
	
IO Interface	2 x RJ-45 100/ 1000BASE-T Ethernet port
	4 x 10G SFP+ Ethernet port
	2 x RJ-45 1PPS/ TOD port
	1 x RJ-45 console port
	2 x USB 3.0
Back Interface	1 x VGA rear
	1 x Power Plug
	1 x onboard M.2 NVME socket, 2242 M Key
	1 x onboard M.2 NVME socket, 2280 M Key

INTERNAL INTERFACE	
IO Interface	1 x USB 2.0
	1 x COM
	4 x 1PPS SMA input/ output
PCIe	2 x PCIe x16 Gen3 single-slot FHFL interfaces, up to 110W each
	Or
	1 x PCIe x16 Gen3 single-slot FHFL interface, up to 250W 1 x PCIe x8 Gen3 OCP NIC v2
Storage	2 x 2.5" hot-swappable SATA 6 Gb/s
	1 x onboard M.2 NVME socket, 2242 M Key
	1 x onboard M.2 NVME socket, 2280 M Key

INDICATORS					
Screen	Quantity	Function	Light Color	Status	Description
	1	Power Indicator	Green	Off	No power or system boot recognition
				On	Operating system boot normal

	1	Health Indicator	Red	Off	Serious alarm
				On	Normal operation
	1	Hard Drive Indicator	Yellow	Off	Hard drive is not reading or writing data
				Flashing	Hard drive reading or writing data
UID	1	System Service Indicator	Blue	Off	At least one cell is serviceable
				On	All cells are in out-of-service state
HB	1	BMC Indicator	Yellow	Fast Flash	BMC is booting up
				Slow Flash	BMC is running normally
				Off	BMC abnormality

SFP INTERFACE INDICATOR			
Indicator Function	Light Color	Status	Description
Data	Orange	Steady On	No data interaction
		Blink	Data interaction
		Off	SFP not operational
Optical port status	Green	Blink	SFP operational
		Off	SFP not operational



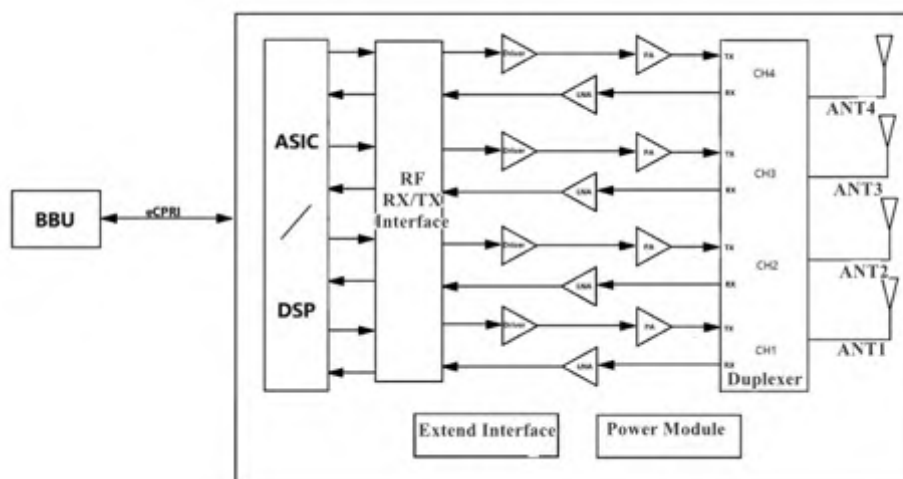
INTEGRATED CARD INDICATOR LIGHT					
Identifier	Quantity	Function	Light Type	Status	Description
RUN	1	Running/Alarm	Bicolor (Green and Orange)	Green steady	Power on, software not running
				Green blinking	Device running normally
				Orange steady	Device has exception or alarm
				Off	No power input or board fault
OP	8	Optical Port Indicator 1(1 per port)	Bicolor (Green and Orange)	Green steady	Optical module not inserted
				Green steady	Optical module inserted

				Orange steady	Optical power receive exception (LOS)
				Orange blinking	Optical link exception (e.g., link failure, high bit error rate)
				Orange off	Optical link normal
		Optical Port Indicator 2(1 per port)	Green	Green steady	Port enabled, but no packet received or transmitted
				Green off	Port disabled
				Green blinking	Packet received and transmitted, blinking frequency proportional to packet rate
RGPS	2	Sync Indicator (built-in RJ45)	One green and one orange	Green blinking	GPS PPS present
				Green steady	GPS PPS locked
				Green off	No PPS
				Orange steady	RGPS power supply enabled
				Orange off	RGPS power supply disabled

5.2.2 nCELL-RU4460 Hardware Description

The RRU serves as the radio frequency remote processing unit, mainly responsible for receiving and transmitting baseband signals, as well as modulating and demodulating radio frequency signals, data processing, power amplification, and other functions.

The functional structure of the RRU is illustrated in the diagram below:



The main functions of the RRU include:

- ◆ **Amplification and conversion of radio frequency signals:** The RRU is responsible for receiving digital signals from the base station main equipment, converting them

into radio frequency signals, and amplifying the signals. This is a crucial step in converting digital signals into RF signals suitable for propagation in the air.

- ◆ **Modulation and demodulation of signals:** The RRU performs modulation and demodulation processes to ensure that signals can be accurately reproduced during transmission. This helps improve communication reliability and quality.
- ◆ **Management of the radio frequency link:** The RRU is responsible for managing the radio frequency link, including frequency setting, power control, and interference management. This helps optimize network performance and ensure the coordination of various base stations.
- ◆ **Antenna interface:** The RRU connects to the antenna system through the antenna interface, transmitting processed RF signals into the air while receiving signals from user equipment.
- ◆ **Adjustment and optimization of RF parameters:** The RRU can dynamically adjust RF parameters according to network requirements and environmental conditions to optimize network performance, improve coverage, and capacity.
- ◆ **Support for multiple antenna technologies:** Some RRUs support MIMO (Multiple Input Multiple Output) technology, which uses multiple antennas to transmit and receive signals, thereby improving system data transmission rates and performance.
- ◆ **Clock and synchronization management:** The RRU needs to remain synchronized with the entire network to ensure the coordination of various network elements. Clock and synchronization management are essential functions of the RRU.
- ◆ **Fault detection and reporting:** The RRU can monitor its own operation status, detect potential faults, and send relevant reports to the base station main equipment for timely fault diagnosis and repair.

INTERFACE	SPECIFICATIONS		
	No.	Silk Mark	Interface Specification

	1	CH1	RF output port 1
	2	CH2	RF output port 2
	3	CH3	RF output port
	4	CH4	RF output port 4
	5	Alarm	External alarm port
	6	PWR	Power interface
	7	RET	Active power supply port
	8	GND	ground connection
	9	WAN	internet access
	10	OPS	Access from the optical port-optical module
	11	OPM	Main light mouth
	12	OPS/OPM/STATUS	LED pilot lamp

Indicator	Color	Status	Description
RUN	Green	Blinking	Device is running normally
	Orange	Steady on	Device is initializing
		Blinking	Device is upgrading/starting up
	Red	Steady	Device has an alarm
OPS	/	Off	Optical module not inserted
	Red	Steady on	Optical port not synchronized
	Green	Steady on	Normal operation
OPM	/	Off	Optical module not inserted
	Red	Steady on	Optical port not synchronized
	Green	Steady on	Normal operation

Packing accessories		
Item	Model	Quantity
HP DC Power Line	SW6.640.4566/DRRU-R2111DCC	1
6AWG Ground Wire	SW6.640.4058A0	1
Mounting Bracket	SW8.038.331A0	1
High Power DAS Mounting Bracket 2	SW8.038.211A4	2
UQ Handle	SW8.333.012A3	2
Hexagonal Combination Screw M6×14	SW8.916.009A0	12
Single Fiber Optic Transceiver Module	MBS-1C41-33	1
Stainless Steel 304 Expansion Bolt	MBS-1C41-27	1
Stainless Steel 304 Flat Washer	M10*90/JB-ZQ4763	4
Stainless Steel 304 Spring Washer	M10/GB97.1-85	2

Stainless Steel 304 Hexagonal Nut	M10/GB93-87	2
Stainless Steel Hexagon Head Bolt Full Thread	M10/GB6170-86	2
Stainless Steel Flat Washer	M12*200/GB/T 5783	2
Stainless Steel Spring Washer	M12/GB97.1-85	2
Stainless Steel I-type Hexagonal Nut	M12/GB93-87	2
HP DC Power Line	M12/GB6170-86	2
6AWG Ground Wire	SW6.640.4566/DRRU-R2111DCC	1

6. Operation and maintenance

6.1 General Management

6.1.1 nCELL-T5000 Series Base Station LMT User Guide

6.1.1.1 LMT Introduction

LMT is a local maintenance tool for base stations. It can be accessed through [https://OAMIP base station maintenance address](https://OAMIP_base_station_maintenance_address). LMT allows you to perform various operations and maintenance tasks on the base station.

6.1.1.2 LMT Functions

LMT is mainly used for assisting in station opening, near-end locating, and troubleshooting. The following are scenarios where LMT is used to perform operation and maintenance on the base station:

- ◆ When the base station is being opened and has not yet been accessed by the NMS, LMT can be used for near-end station opening.
- ◆ When the communication between the base station and the NMS is interrupted, LMT can be used for near-end locating and troubleshooting.
- ◆ When the base station generates an alarm and near-end operations such as replacing boards are required, LMT can be used to assist in locating and troubleshooting the problem.

LMT uses a graphical user interface, which makes it easy for users to perform operations and maintenance on the base station through a web page. It provides the following functions:

- ◆ Executing MML commands
- ◆ Alarm management
- ◆ Equipment maintenance
- ◆ Equipment debugging
- ◆ File management
- ◆ Equipment upgrade

◆ Equipment topology

6.1.1.3 LMT Computer Configuration Requirements

Computers used for LMT must meet the software configuration requirements and connection port requirements.

➤ Software Configuration Requirements

The software configuration requirements for computers using LMT are as follows:

1) Operating System

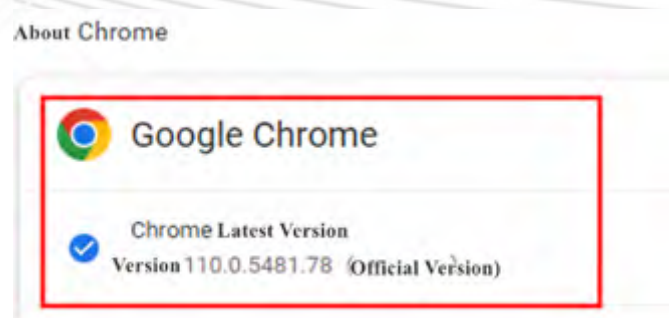
- Microsoft Windows 10
- Microsoft Windows 11

2) Operating System Default Language

Both Chinese and English are supported, with English being the default language.

3) Web Browser

- Chrome browser: The browser version must be updated to at least version 110, such as: Version **110.0.5481.78** (official version)



- Microsoft Edge Browser Version: The browser version must be updated to at least version **110**, Recommended Version Version 110.0.1587.41 (Official Version)



- Firefox Browser Version: The browser version must be updated to at least version **122.0**



➤ LMT Connection Port Requirements

When accessing network elements for operation and maintenance through LMT, if there is a firewall between the PC and the network element or if the product itself has a firewall deployed, some ports need to be opened on the firewall for LMT to function properly. For details, please refer to the following table.

Index	Port Number	Notes
1	TCP 443	BBU http/https
2	TCP 22	
3	TCP 80	
4	TCP 20000	
5	FTP TCP 20,21	Filezilla
6	TCP 2180,2280,2380,2480	RU http
7	TCP 1233,1234,1235,1236	RU https
8	TCP 2122,2222,2322,2422	RU ssh

6.1.1.4 LMT Interface Introduction

Introduce the composition of the LMT interface and the functions of each component. The following figure shows the LMT main page.



a. Main Menu Bar

The LMT Main Menu Bar is described in the following table.

Field name	Notes
Home	Real-time display of base station operation information, cell state, and RRU synchronization information
General Parameters	Including common basic configurations for base station opening
Device	Including RRU, network management, clock and other related configurations
Alarm	Current active alarm query, historical alarm query
Performance	Performance configuration management
Config	Performance configuration management includes mobility management, cell state management, and other configurations
Maintenance	Equipment Maintenance Management, including Querying Operation Logs and Querying UE Information
Debug	Equipment Debugging Management
File	Log File Management
System	System Login Operation Management
Upgrade	Equipment Upgrade Management
Topology	Equipment Topology Management

b. Information Display Area

Serves as the information display area for each node under the main menu. Including MML message area, parameter setting area, topology display, etc.

c. Status Bar

Display the logged-in username and the interface language status.

Click the username in the upper right corner of the page to perform the lock screen/logout operation.

Click the Chinese and English display to switch the interface language.

d. Tool bar

Perform soft reboot, hard reboot, view help manual, page screenshot, full screen interface and other operations.

6.1.1.5 Getting Started with LMT

Logging In and Out of LMT

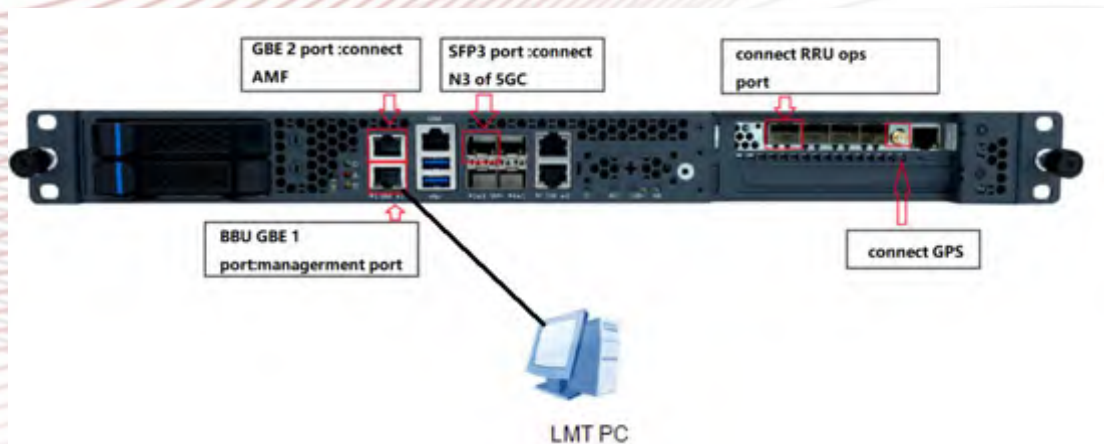
Users can log in to the base station through LMT local login and perform related operations. After the OM channel between the base station and the NMS server is established, LMT can also log in to the base station through the NMS agent to perform related operations.

➤ Operation Steps

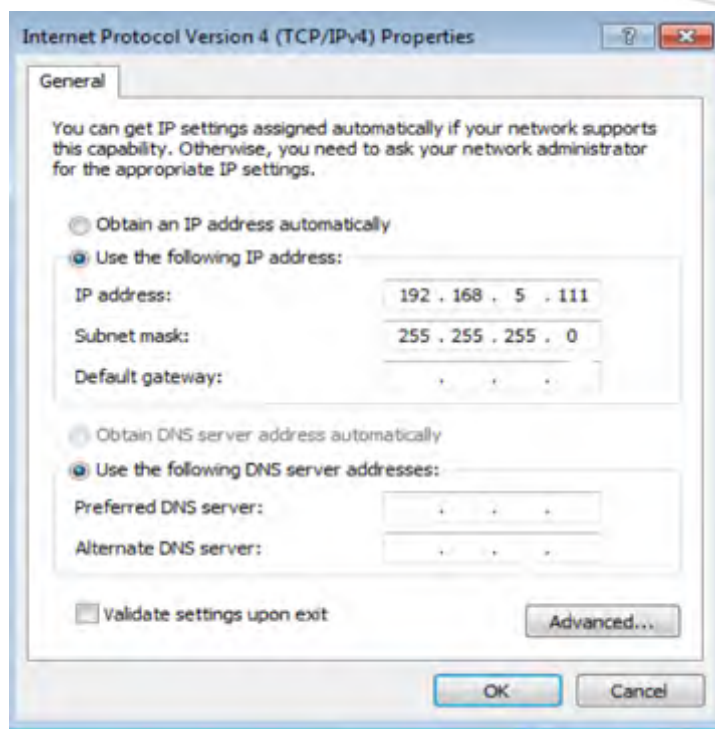
LMT Local Login and Logout of Base Station Operation Steps

Please refer to the following steps for LMT local login and logout of base station operation.

1. Connecting the LMT Computer and the Base Station, for Example, Connecting the PC to the BBU GBE1 Port, as Shown in the Figure Below.



2. Setting the PC IP and OAM (Defend) IP in the Same Network Segment (The default BBU web LMT login management IP is 192.168.5.116). For example, the PC IP is set to 192.168.5.111. Log in to the BBU through the SSH connection method.



3. Enter the base station maintenance IP address in the browser address bar, for example <https://192.168.5.116>, press Enter, and the page will automatically jump to the LMT login interface.

4. Enter your username, password, and verification code, and click the login button to enter the webLMT main interface.

WebLMT login account: admin, password: 123456

5. Exit LMT

- Click the "username" in the upper right corner of the main page.
- Click "Logout" to disconnect the connection between LMT and the base station, back to the login interface of the base station.
- Close the browser to exit LMT

Instruction

If the base station maintenance IP can be pinged, but the LMT page cannot be logged in, the following solutions are available:

Taking IP 192.168.5.116 as an example:

- Clear browsing history.
- Type in the browser address bar: <https://192.168.5.116:20000> ;

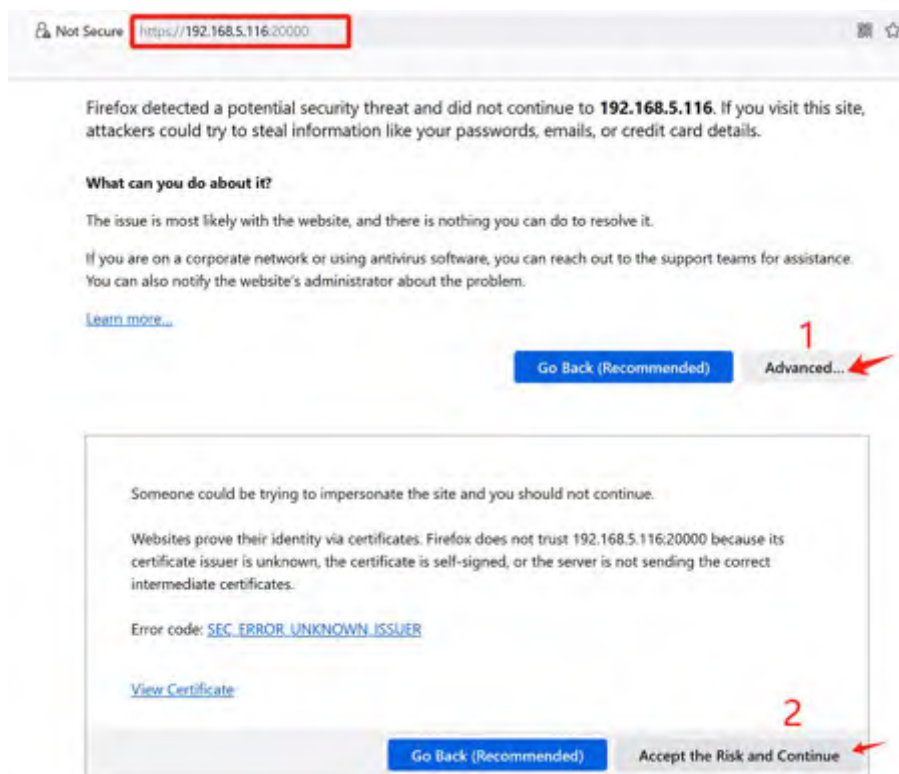
The browser prompts that it is not secure.

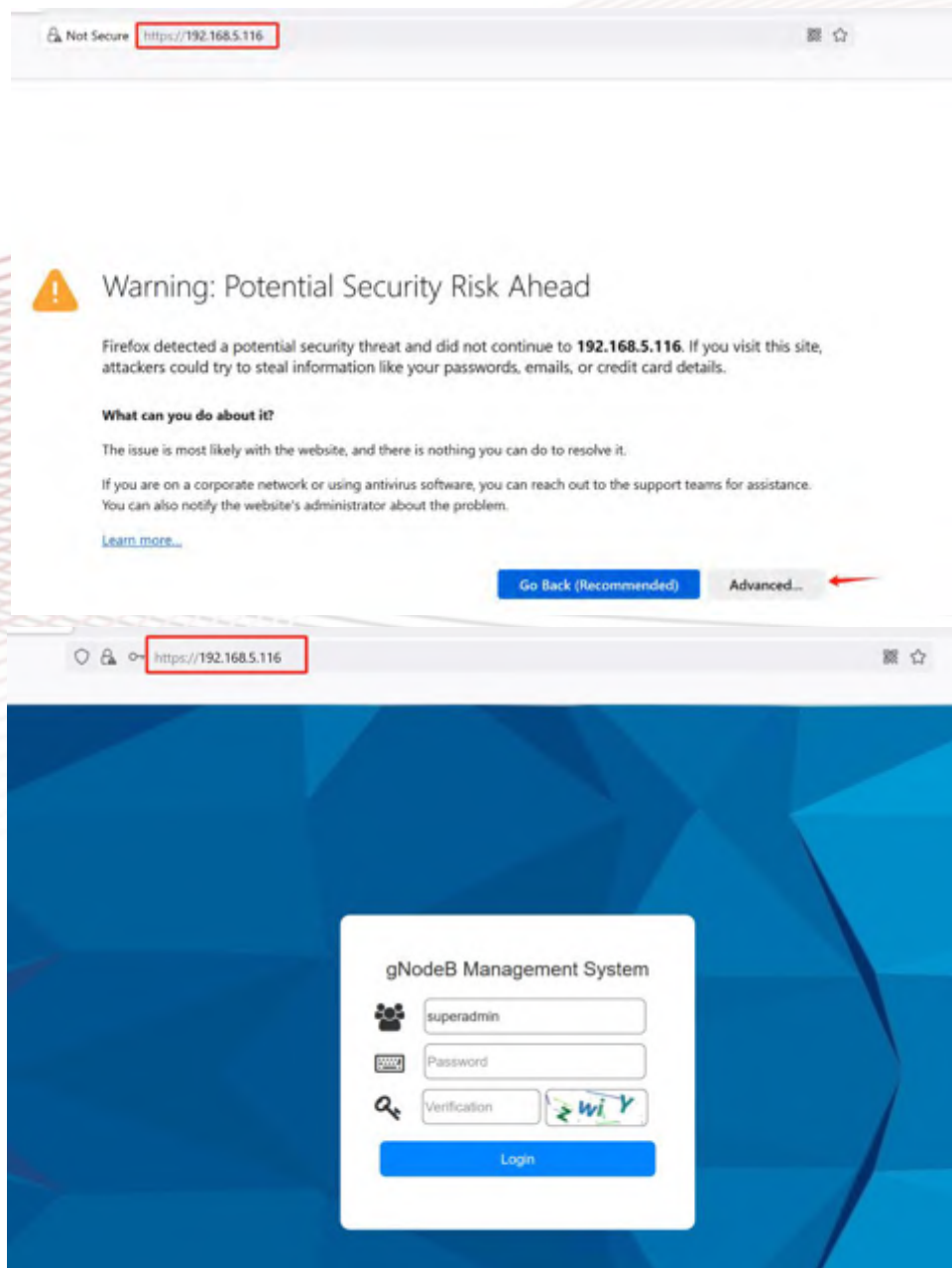
Click Advanced -> Click **Accept Risk** and **Accept**.

- Type in the browser address bar: <https://192.168.5.116> ;

Click Advanced -> Click **Accept Risk** and **Accept**.

The WebLMT login interface is displayed normally.





User permission management

➤ Concepts related to permission management

Concepts related to permission management include:

- ◆ Principles of permission control
- ◆ Operator permissions
- ◆ Operator password
- ◆ Operation time limit

➤ Principles of permission control

To ensure the security of the system operation, the system uses operator identification, operator permission setting, and operation time limit mechanism to perform permission control.

- ◆ Operator identification: refers to the system identifying the operator's identity through the username and password entered during login.
- ◆ Operator permission: refers to the permission set by the system for the operator to perform certain interface operations and MML command operations.
- ◆ Operation time limit: refers to the time period set by the system to allow the operator to perform operations.

➤ Operator permissions

LMT operators are divided into system default operators and external operators.

- ◆ The system default operator account is superadmin with the password superadmin. This account has the highest permissions and cannot be deleted or modified. Some functions are only supported by superadmin, such as restoring factory settings and activating configuration.
- ◆ The system default built-in operator account is admin with the password 123456. This account cannot be deleted but can be modified. It has system command level permissions.
- ◆ External operators are divided into 2 levels with different permissions:
 - Basic Query: Can only complete data viewing operations. Belongs to the query command group.
 - System Command Level: Has all command operation permissions but cannot delete the default user admin. Belongs to all command groups.

➤ Operator password

This section mainly includes operator password definition, initial password setting, and password modification permissions.

- ◆ Operator Password Definition: To ensure system security, each operator account is assigned a password. When entering LMT, the operator must enter the correct username and password to log in to the station after identity verification.
- ◆ Initial Password Setting: The password for admin is set when installing the station application. The password for external operators can be set by the management-level operator or the custom-level operator with the corresponding permission when adding the operator account.
- ◆ Password Modification Permissions: All operators can modify their own passwords. Management-level operators can modify the passwords of all external operators.

➤ Operation time limit

This section mainly includes the definition, control principle, and setting permissions of the operation deadline.

- ◆ Operation Date Deadline Definition:
Refers to the date on which the system allows the operator to perform operations.
If set to unlimited, it indicates that the operator has no date restrictions.

If set to limited, the start and end dates of the operation together determine the date range that the operator can operate.

◆ **Operation Time Deadline Definition:**

Refers to the time period during which the system allows the operator to perform operations.

admin has no time limit, meaning that operations can be performed at any time.

The time limit for external operators is set when adding the operator account.

If set to unlimited, the operator can perform operations at any time.

If set to limited, the start and end times of the operation together determine the time range that the operator can operate.

◆ **Operation Deadline Control Principle:**

The operation deadline adopts a combination of limiting the date and limiting the time period.

The actual time range that the system allows for operation is the intersection of the two factors.

Manage Operator Account

LMT operator account management includes:

Adding external operators

Modifying operators

Deleting operators

The default operator account for the station is **admin** with the password **123456**.

➤ **Adding external operators**

This function is used to add external operator accounts, and at the same time set the account password, operator level, executable command groups, operation deadline and other information.

Operation Method:

System/Security/Add Operator node to add external operator accounts.

➤ **Modifying operators**

This function is used to modify the properties of external operators, including operator password, operator level, operator permissions, and operation deadline information.

Operation Method:

System/Security/Modify Operator node to modify operator properties.

➤ **Deleting operators**

This function is used to delete external operator accounts.

Operation Method:

System/Security/Delete Operator node to delete the specified external operator account.

Manage Operator Passwords

LMT operator password management includes:

Set and query login password policy

Modify operator password

Attentions

Please keep the admin account password properly. If you forget the password, you will not be able to log in. If you forget the admin account password, you can contact the engineer for technical support to help you solve the problem.

➤ **Set Login Password Policy**

Login password policy is the standard and rule for checking the validity of user passwords. Login password policy supports setting the minimum length and complexity of passwords.

Operation Method:

System / Security / Set Password Security Policy node to set LMT login password policy.

➤ **Query Login Password Policy**

To query the standards and rules of the login password policy, so that users can set passwords that meet the standards according to the current password policy.

Operation Method:

System / Security / List Password Security Policy to query login password policy.

➤ **Modify Operator Password**

External operator passwords can be modified by modifying the password option in the operator.

Only superadmin, admin, and custom-level operators with the corresponding permissions have the right to modify external operator passwords.

Operation Method:

System / Security / Modify Operator node to Modify the external operator password.

6.1.1.6 Execute MML Command

MML Command Introduction

Introduction to MML Commands: Functions, Command Format, and Operation Types

➤ **MML Command Functions**

MML commands for network elements are used to implement the operation and maintenance functions of the entire network element, which mainly include the following modules:

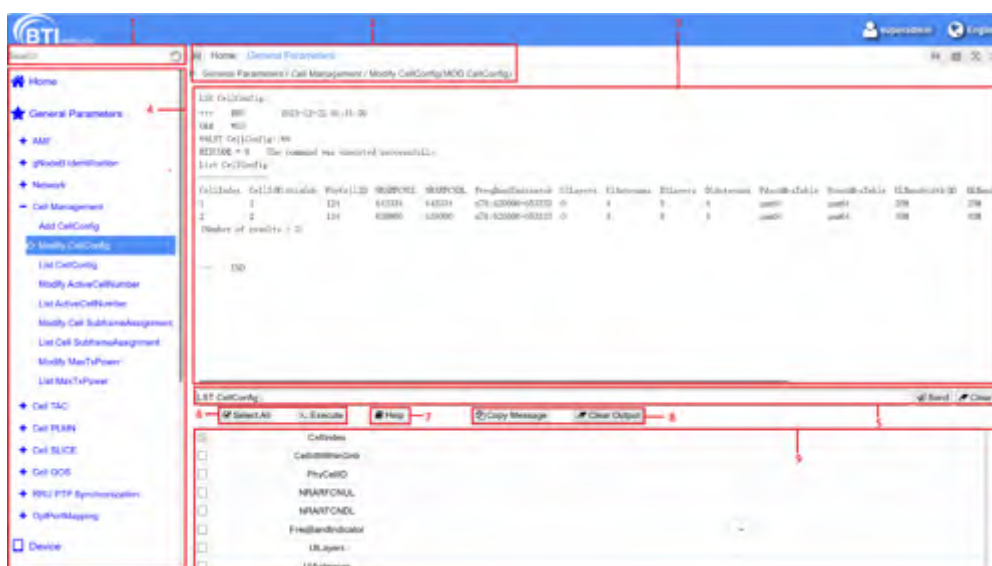
- Configuration Management
- Device Management
- Alarm Management
- File Management
- Upgrade Management

MML commands use the "action+object" format. The main operation types are shown in the following table

Index	Command Abbreviation	Command Full Name	Command Meaning	Function Description
1	ADD	add	Add	Execute the operation to add an object property
2	MOD	modify	modify	Execute the operation to modify an object property
3	RMV	remove	remove	Execute the operation to remove an object property
4	LST	list	Query	Execute the static query operation
5	DSP	display	Query	Execute the dynamic query operation
6	SET	set	Configure	Execute set operation
7	STR	start	Start	Execute the operation of starting a task
8	STP	stop	Stop	Execute the operation of stop a task
9	ACT	activate	Activate	Execute the operation of activating a task
10	CLR	clear	Clear	Execute the operation of clear a task.
11	FOC	force	force	Execute the operation of force a task
12	OPR	operate	operate	Execute the operation of a specific operation
13	RST	reset	reset	Execute the operation of reset
14	ULK	unlock	unlock	Execute the operation of unlock

Introduction the user interface for executing MML commands

Click "MML command" under a certain navigation to enter the MML command line interface. The MML command line interface is shown in the figure below.



The description of each area of the MML command line interface is shown in the following table.

Index	Field Name	Notes
1	search bar	Command search can be performed based on keywords
2	location node	Display the specific navigation path of the current node
3	MML return message area	Display the specific return results of the executed MML
4	Main menu area	Select command groups under different nodes to execute MML commands.
5	Manual command area	Type in and execute a complete MML command
6	MML command execution area	Select all parameters or perform operations
7	Help	The Help button to query help information related to the command
8	Operation result processing area	Perform "copy message" and "clear output" operations on the command return message.
9	Command parameter area	Assigning command parameter, displaying all parameters contained in the current command in the command input box. The gray check box in front of the parameter represents a required parameter.

Execute a single MML command

Introduction how to execute MML commands in the LMT interface

Preconditions

Logged in to the LMT interface

There are two ways to execute MML commands:

- Select a command node on the "MML Navigation Tree"
- Manually enter or paste the MML command script in the "Manual Command" input area

Steps

- Select a command node on the "MML Navigation Tree"
 1. Select the MML command in the "MML Navigation Tree" and click.
 2. Enter the parameter value in the command parameter area.
 3. Click "Execute" to execute this command.
- Manually enter or paste the MML command script in the "Manual Command" input area
 1. In the "Manual command" input area, manually enter the MML command, or paste an MML command script with complete parameter values..
 2. Click "Send" to execute this command.

Execute the batch MML commands

➤ Create MML script files

Method 1: Manually create MML scripts.

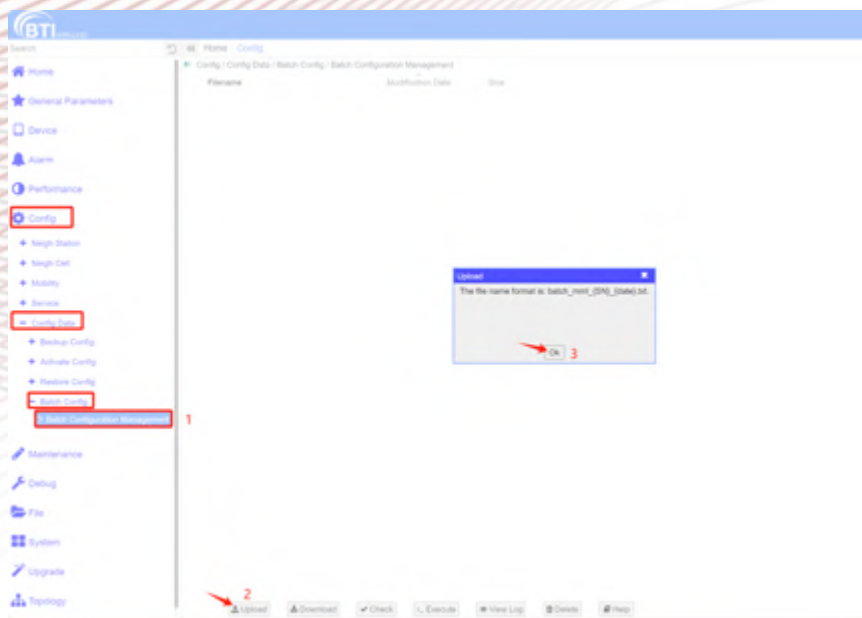
Method 2: Use the provided batch configuration script export tool to create MML scripts. Please contact technical support for installation and usage of the tool.

Please note that the naming format of MML script files is *batch_mml_{SN}_{date}.txt*.

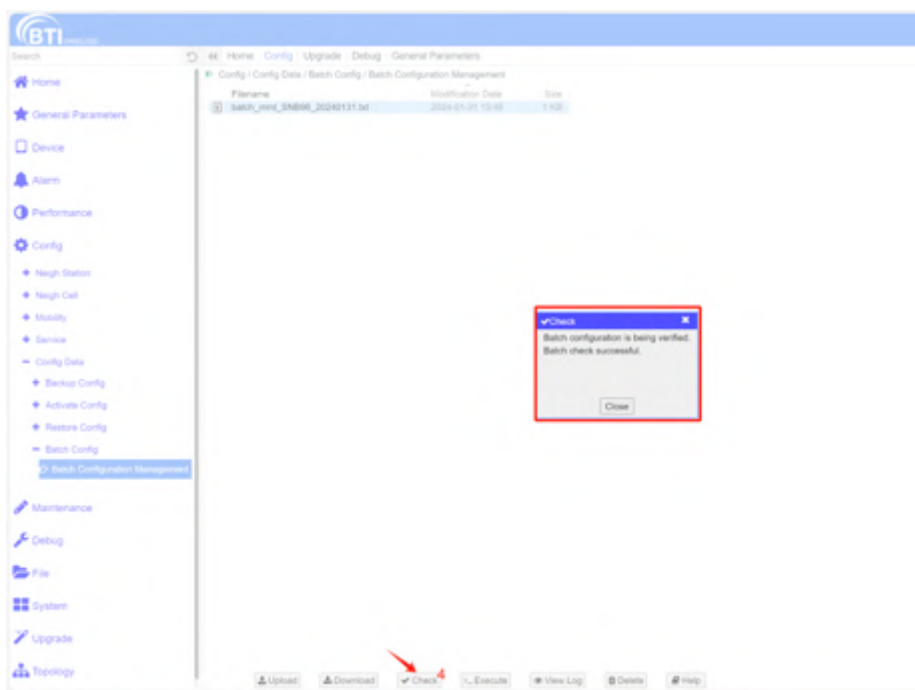
➤ To start executing batch MML command

1) Click the upload button, and the page will automatically prompt you for the file naming format.

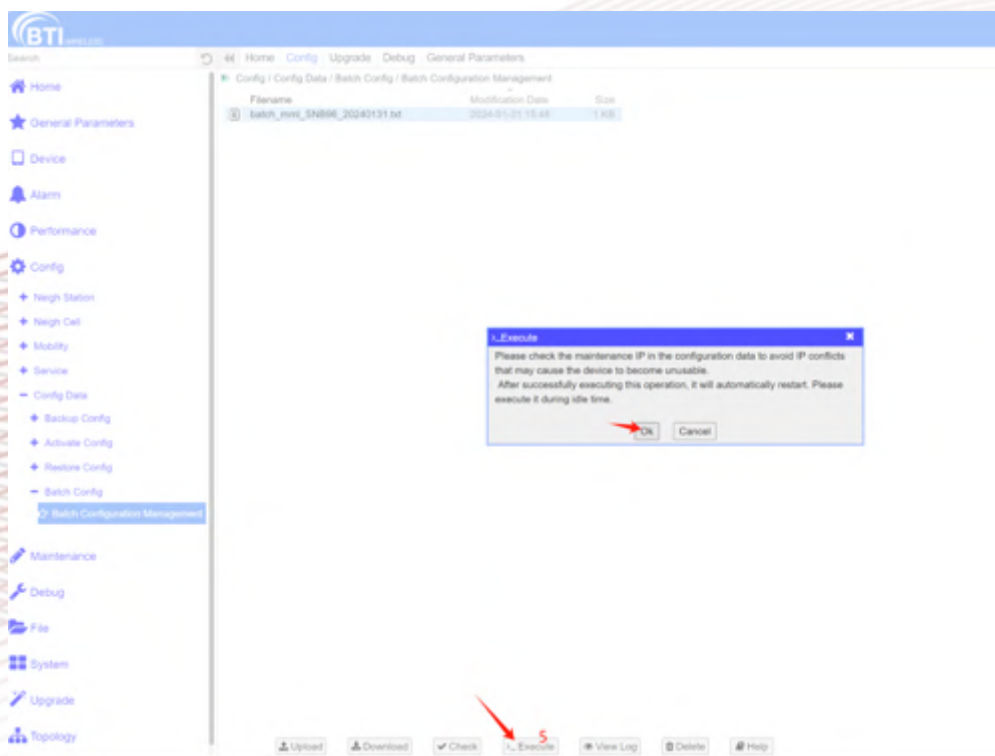
Click the OK button to upload the MML script txt file to be activated



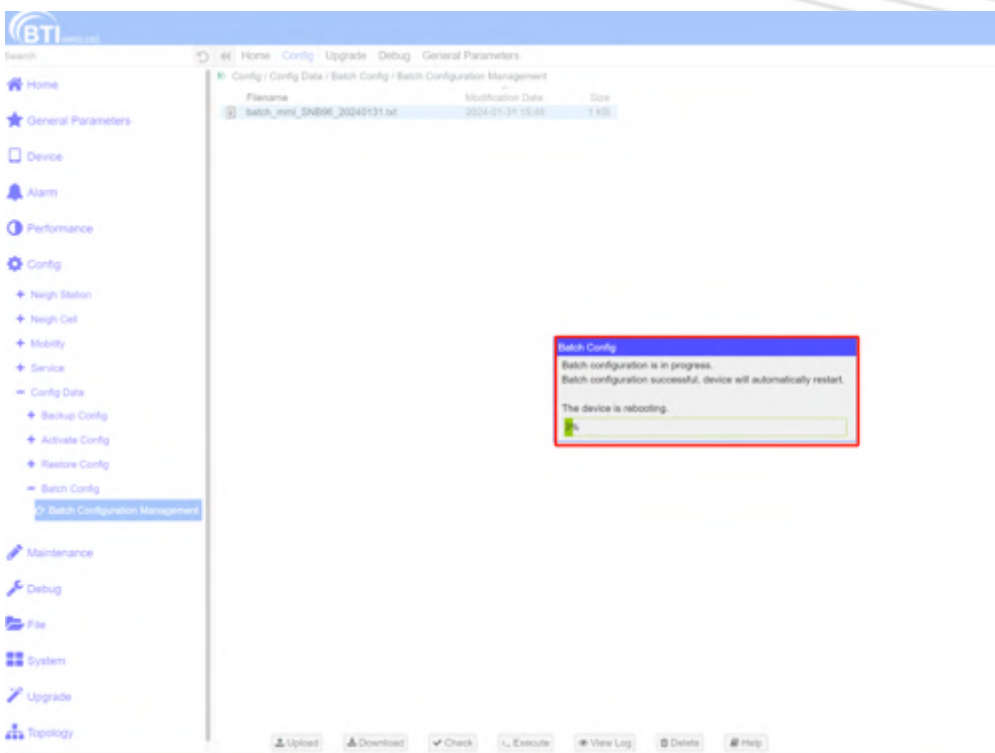
2) After the script is uploaded successfully, click the verification button. If the script content is correct, the page will prompt that the verification is successful

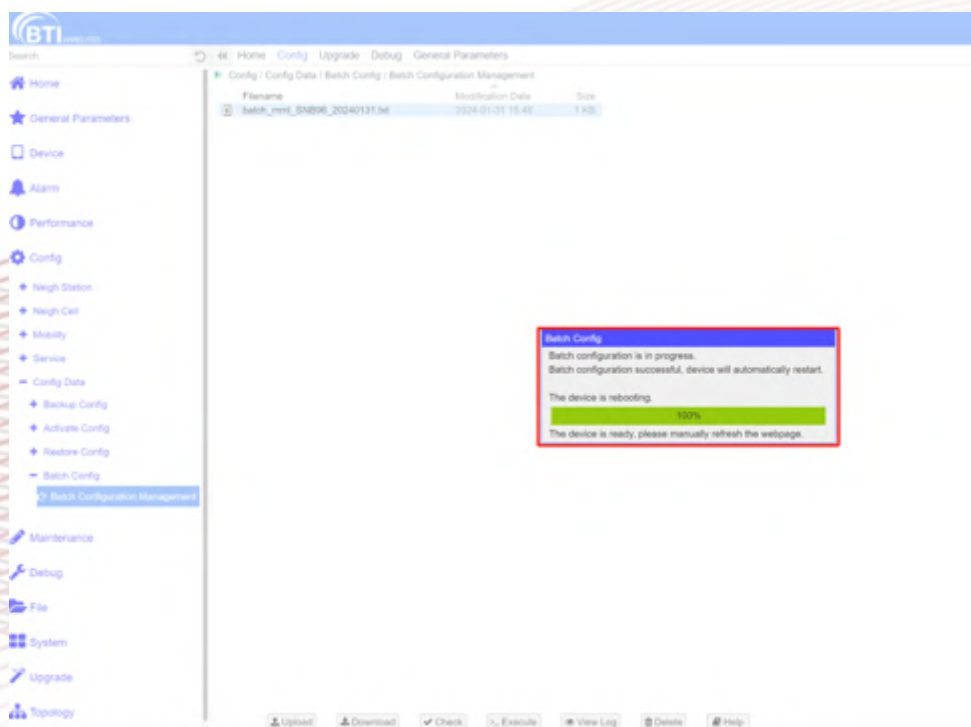


3) Click Execute and confirm



The device will automatically restart after the execution





➤ Check the result

After the base station restarts, use the LST command to check that the modified configuration has been modified successfully.

Instruction

1. After the batch configuration script file is successfully executed, the batch configuration script file will be deleted.
2. Batch configuration only supports MML configuration commands and does not support maintenance commands.
3. After successful batch configuration, the system will automatically trigger a restart.
4. Batch configuration is a time-consuming operation, please do it when you are free.
5. During the batch configuration process, the interface does not support MML configuration commands.
6. Batch configuration does not support modifying RRU configuration parameters.
7. Batch configuration does not support modifying the device serial number.

6.1.1.7 Common operations

Alarm management

➤ Alarm

Alarms are generated due to equipment failure or certain important functional abnormalities, such as a board failure. After a fault alarm occurs, it can be divided into active alarms and historical alarms according to the status of the fault.

- If the fault has not been recovered, the alarm is in the "active" state and is called an active alarm.
- If the fault has been recovered, the alarm will be in the "recovery" state and is called a historical alarm.

Alarm level

The alarm level is used to identify the severity of an alarm.

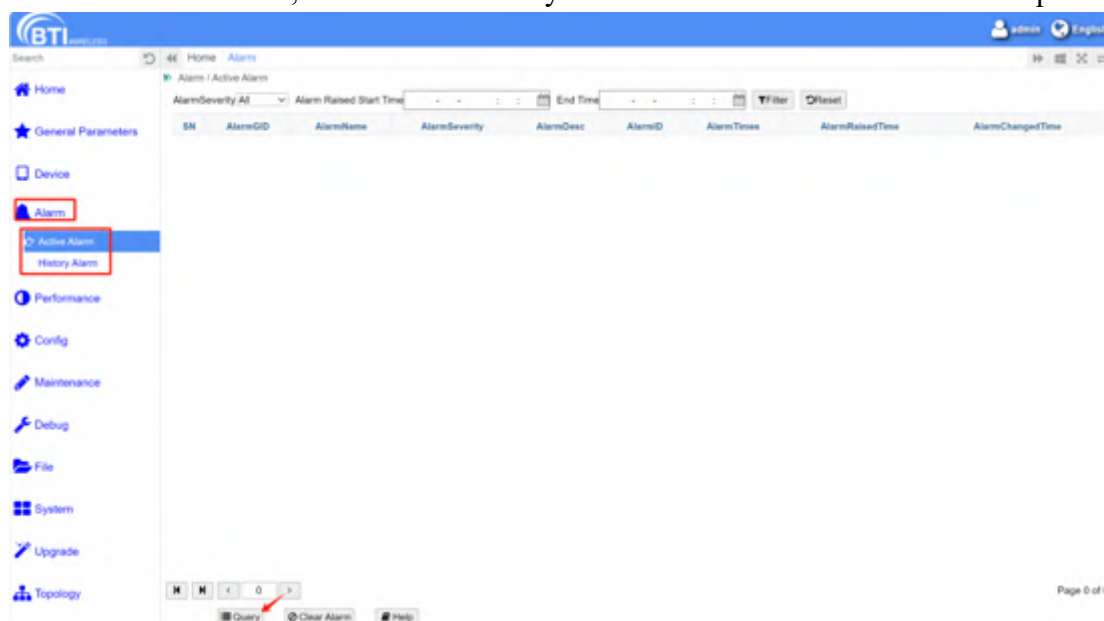
All alarms can be divided into the following four types in order of decreasing severity: critical alarms, major alarms, minor alarms, and warning alarms.

The definitions and handling methods of different alarm levels are shown in the following table

Alarm Level	Definition	Operation Suggestions
Critical	This level of impact on the service provided by the system requires immediate attention. Even if this level occurs during non-work periods, immediate action is required to fix it.	Maintenance is needed to handle immediately, otherwise the system may be in danger of paralysis.
Major	Alarms of this level affect service quality and need to be handled within working hours, otherwise they will affect the implementation of important functions.	Maintenance is needed to handle in time, otherwise it will affect the implementation of important functions.
Minor	Alarms of this level do not affect service quality, but in order to avoid more serious failures, they need to be handled or further observed at the appropriate time.	The purpose of sending this type of alarm is to remind maintenance personnel to promptly eliminate potential faults based on the cause of the alarm.
Warning	Alarms of this level indicate that there may be potential errors affecting the services provided, and corresponding measures are handled according to different errors.	In order to understand of the operating status of the system

➤ View Alarm

Under the Alarm node, base station activity alarms and historical alarms can be queried.



Trace management

Message tracking trace interfaces and signaling and is used for daily maintenance of equipment, fault location, etc.

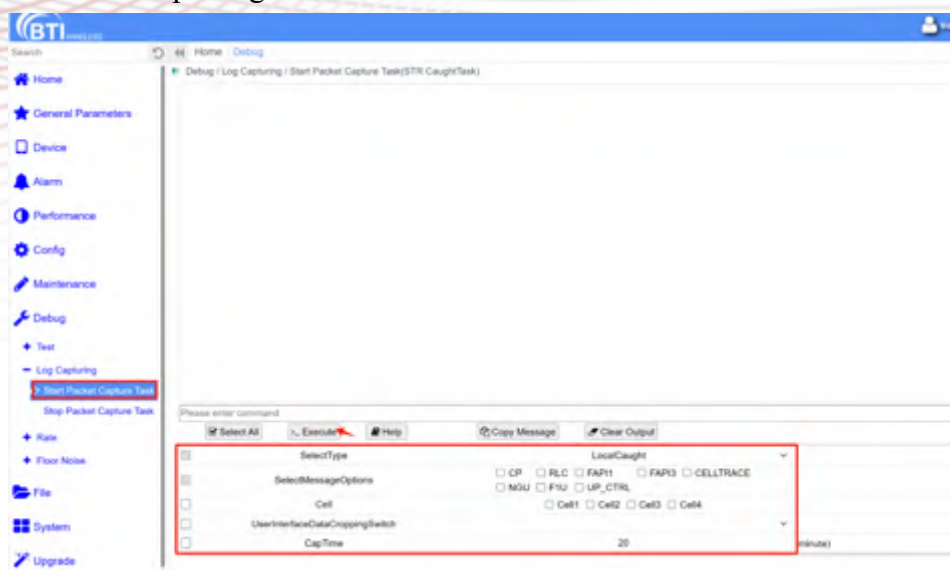
➤ Packet capture method

- **Local Capturing:** The captured packet signaling will be automatically saved in the File Management - Download Packet Capture File interface
- **Transmit Capturing:** The destination IP (the same network segment IP of the local computer) is needed to type in, so that the packet capture signaling will be directly output in the Wireshark installed on the destination machine/IP.

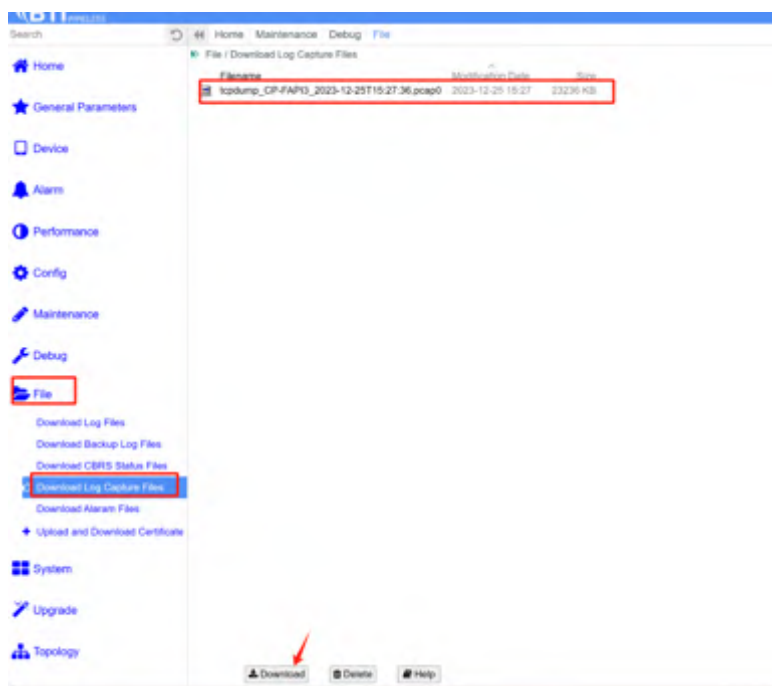
➤ Start packet capture

Please capture packets according to actual problem scenarios:

1、Local Capturing



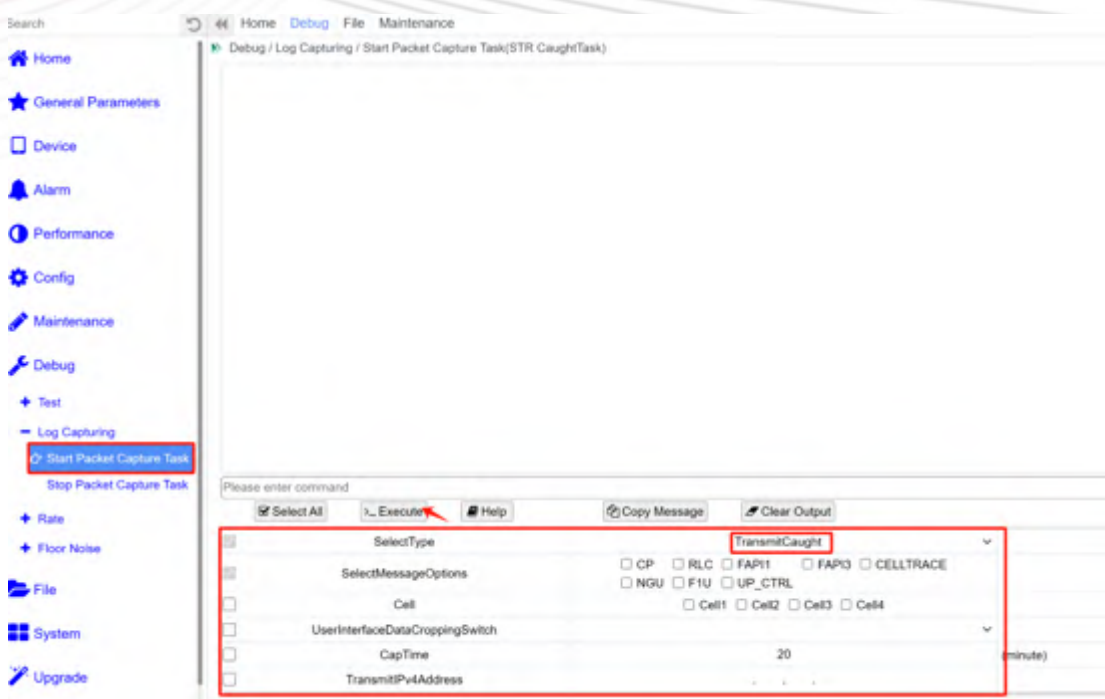
Download local packet capture file





2、Transmit Capturing

Change the packet capture type to TransmitCaught", add the IP address to fill in, correspond to the host in the IP address, and use Wireshark to capture the packet.



Packet capture options:

- **CP**: the control plane, captures sctp/ngap/F1AP and network incoming signaling, the log file is very small.
- **NGU**: the data plane information of the NGU interface between gNB and UPF, the log file is large.
- **F1U**: the data plane information between RLC and PDCP, the log file is large.
- **FAP11**: BBU internal PHY and MAC interaction messages, it can view MAC scheduling and other information, the log file is large
- **FAP13**: BBU internal phy and mac interaction messages, compared with FAP11, can

additionally capture MIB, SIB and MSG2 information, the log file is relatively large.

- **CELLTRACE:** Raw data collection for different types of data trace in MAC slot, the log file is very small.
- **RLC:** Dimension information statistics of the RLC layer data processing process. Information such as the SN of the PDU in the sending and receiving window can be viewed. The log file is large.
- **UP_CTRL:** Signaling of the private interface between CP and UP, the log file is small.

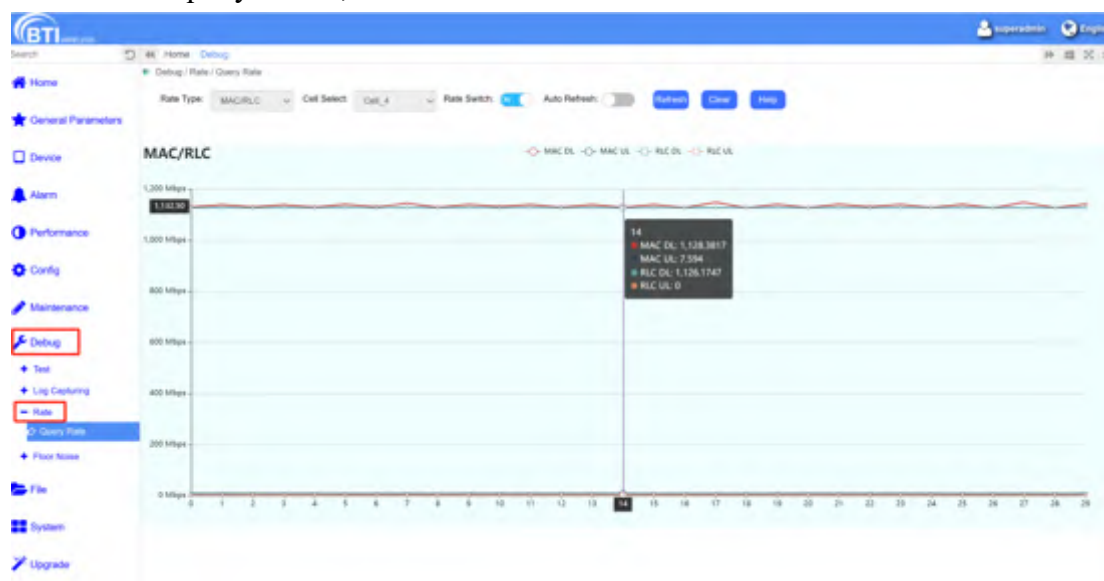
Instruction

- 1、 When capturing the data of the target cell, it needs to ensure the cell is running normally, otherwise the packet capture for the cell will not be performed.
- 2、 When capturing packets locally, split each file into 200MB. Continuous packet capture for a long time will continue to generate multiple capture files. After the packet capture is completed, please download the required files in time and delete the captured packets that are no longer used.
- 3、 After the packet capture is completed, the packet capture file can be downloaded or deleted through the "File Management-Download Capture File" interface.
- 4、 LMT does not support parallel operations when capturing packets, only one packet capture task is allowed to be started at the same time.
- 5、 Local packet capture supports capturing data of all options; forwarding packet capture does not support capturing data of NGU, F1U, UP_CTRL, and VPP options..

Performance monitoring

➤ Monitors cell rate through LMT

1. Login the LMT
2. Go through to Debug / Rate / Query Rate node, select the rate type and the cell, then turn on the rate switch. MAC/RLC and PDCP are the options for the rate type.
3. Click the query button, or switch on the auto refresh.



Instruction

- 1、 The Rate Type and Cell Select need to specify when turn on the rate switch before querying.
- 2、 After the rate switch is turned on, the Rate Type and Cell Select drop-down boxes will be locked; when the rate switch is turned off, the Rate Type and Cell Select drop-down boxes will return to unlock.
- 3、 When the automatic refresh button is turned on, the refresh button will be locked; when the automatic refresh button is turned off, the refresh button will return to unlock.
- 4、 When the "Auto Refresh" button is activated, the rate information will be actively queried every 10 seconds.
- 5、 The x-axis of the abscissa on the graphical interface represents the rate result sampling point, and the y-axis of the ordinate represents the rate value corresponding to each sampling point.
- 6、 Please switch off the rate switch button after the query

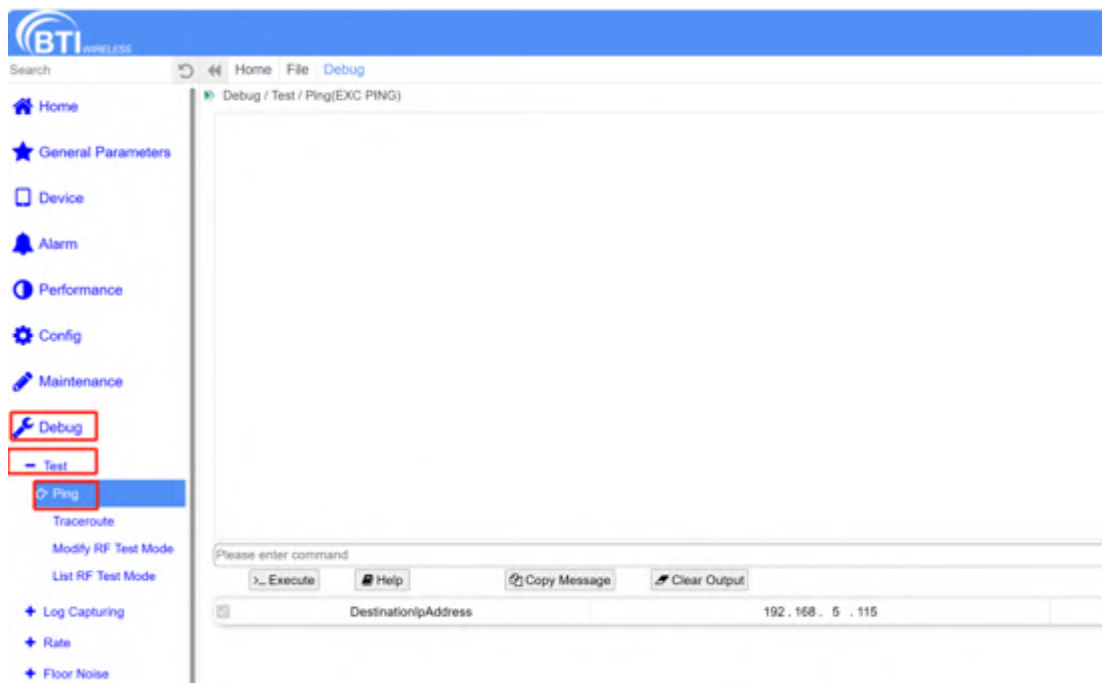
Equipment maintenance and test

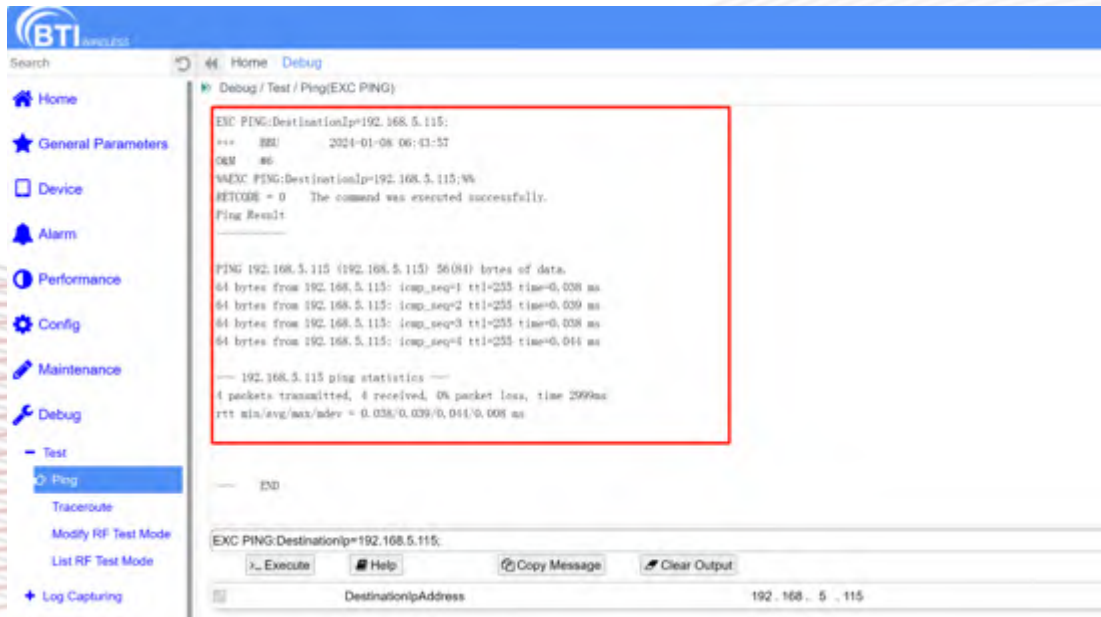
PING

Ping is used to detect network connectivity and analyze network operating speed, and to determine whether the network connection is faulty.

Steps:

Go through to **Debug->Test->Ping** node, enter a valid target IP address and click the Execute button. Then view the execution results in the MML return message area.



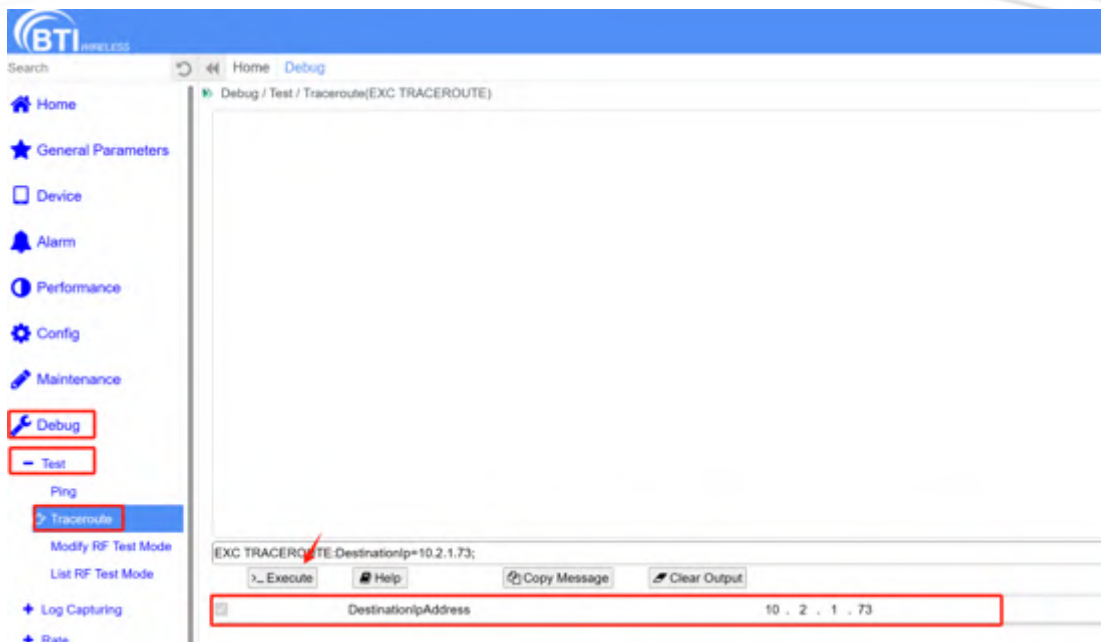


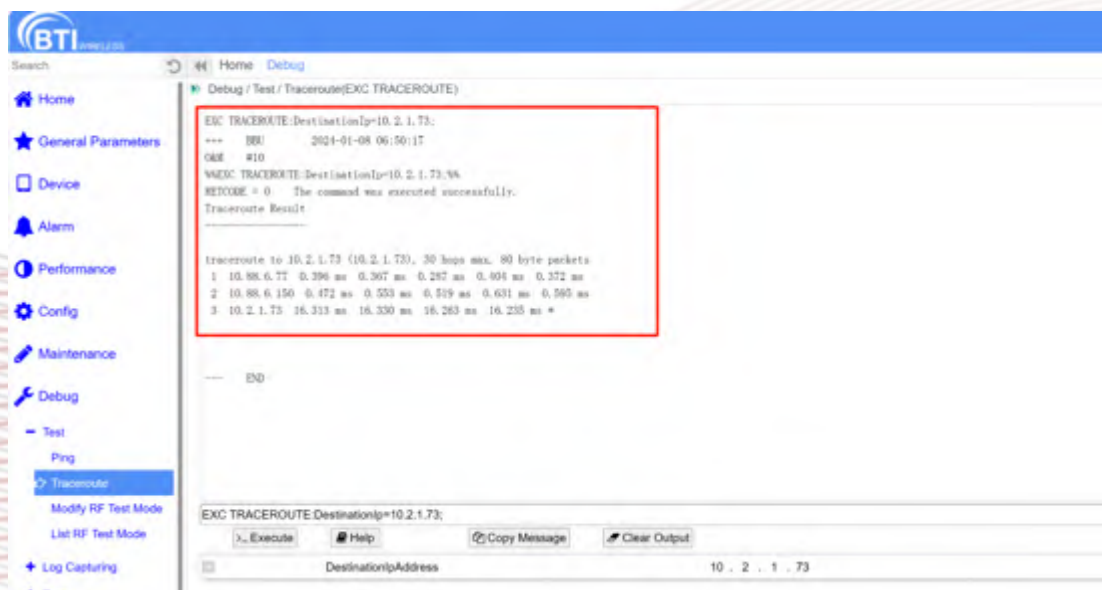
Traceroute

Traceroute is used to locate all routers between the target host.

Steps:

Go through to Debug ->Test ->Traceroute node, enter a valid target IP address and click the Execute button. Then view the execution results in the MML return message area.

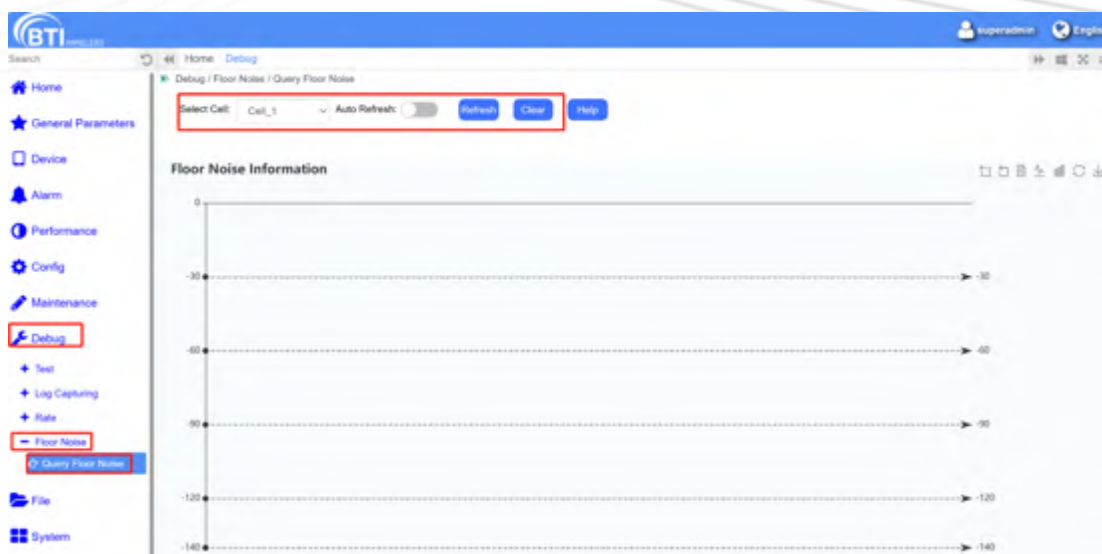




Floor Noise

It is used to query the floor noise information.

Steps:



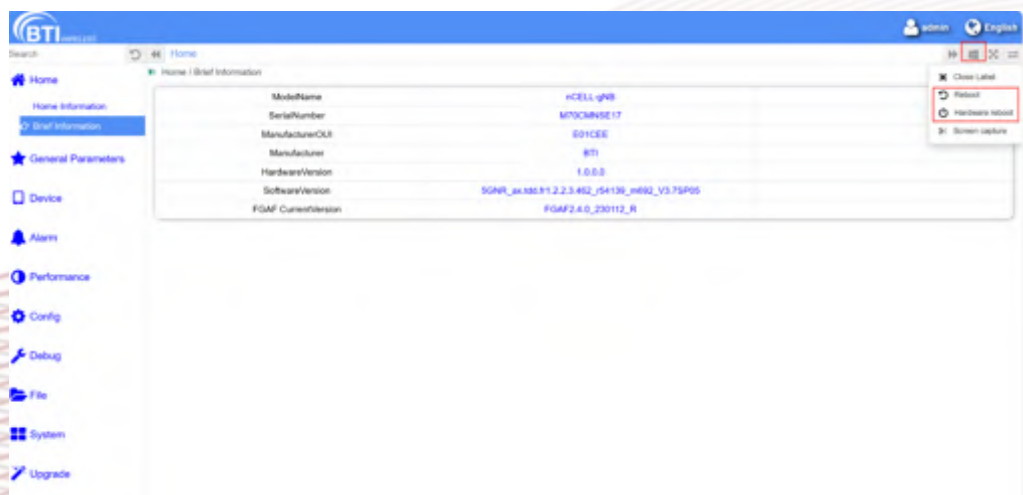
Instruction

- 1、 Select a Cell which is to query the floor noise.
- 2、 When the "Auto Refresh" button is activated, the floor noise information will be queried every 10 seconds.
- 3、 The x-axis of the graphical interface represents the RB number, and the y-axis of the ordinate represents the floor noise value corresponding to the RB number.

Reboot

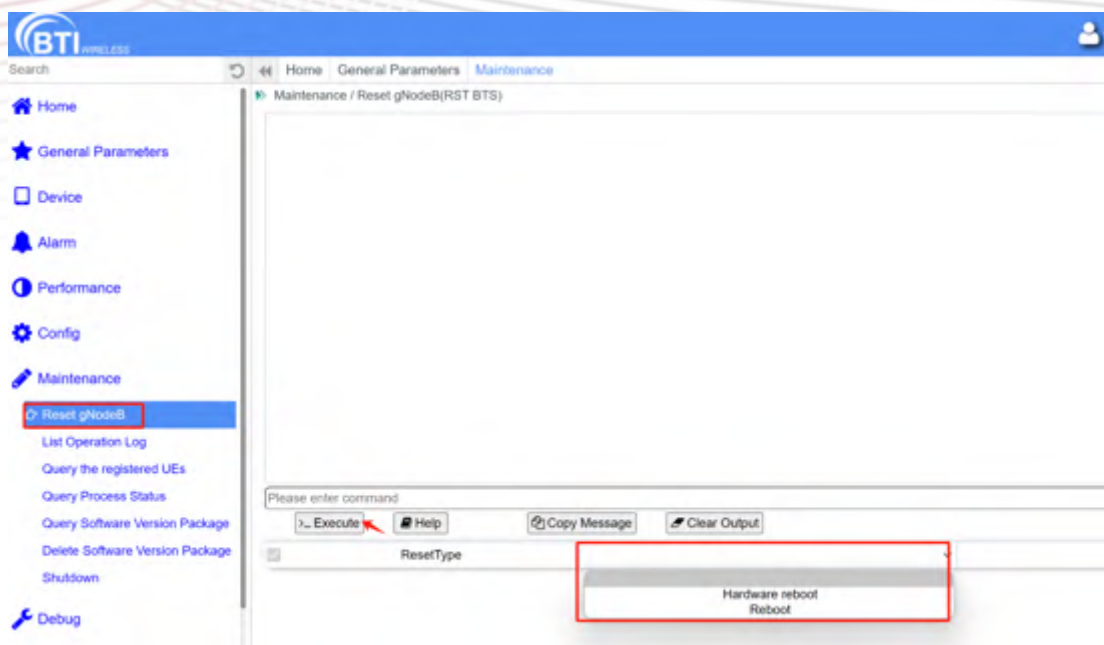
Method 1:

click **Reboot** or **Hardware reboot** on the menu bar in the upper right corner of the LMT interface.



Method 2:

Go through to **Maintenance/Reset gNodeB** node, Hardware reboot or Reboot can be selected as the ResetType option, and click Execute to execute.



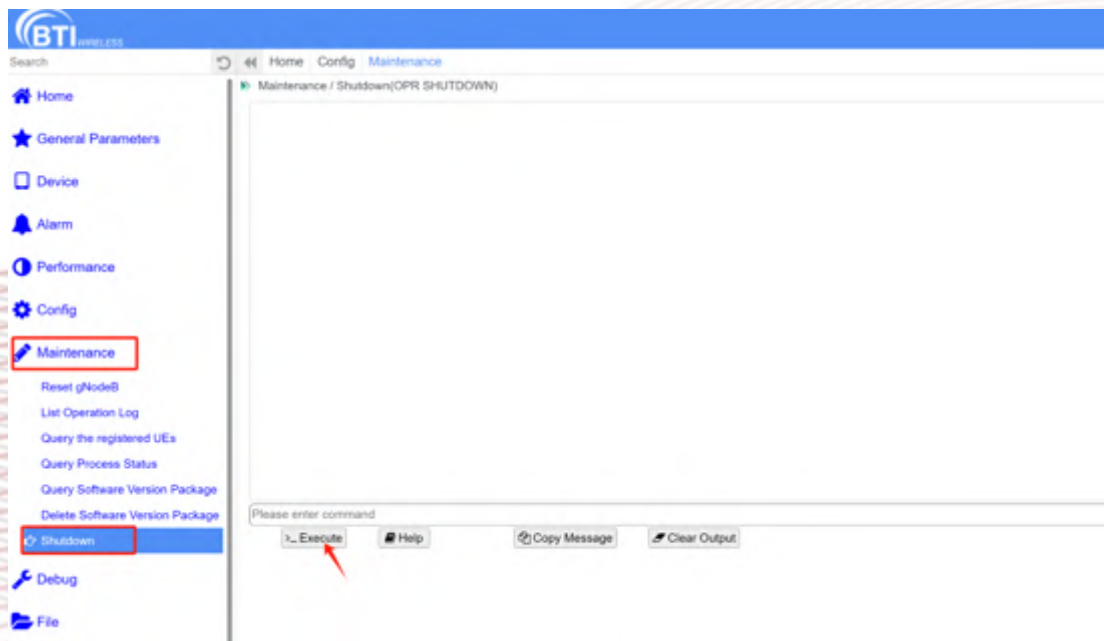
! Attentions

- 1、 When executing "Hardware reboot", the OS will be triggered to perform a reboot and restart all services of the software version.
- 2、 When executing "Reboot" all processes will be stopped and restarted.

Shutdown

It is used to perform shutdown or remote power off.

Go through to **Maintenance->Shutdown** node, execute the command



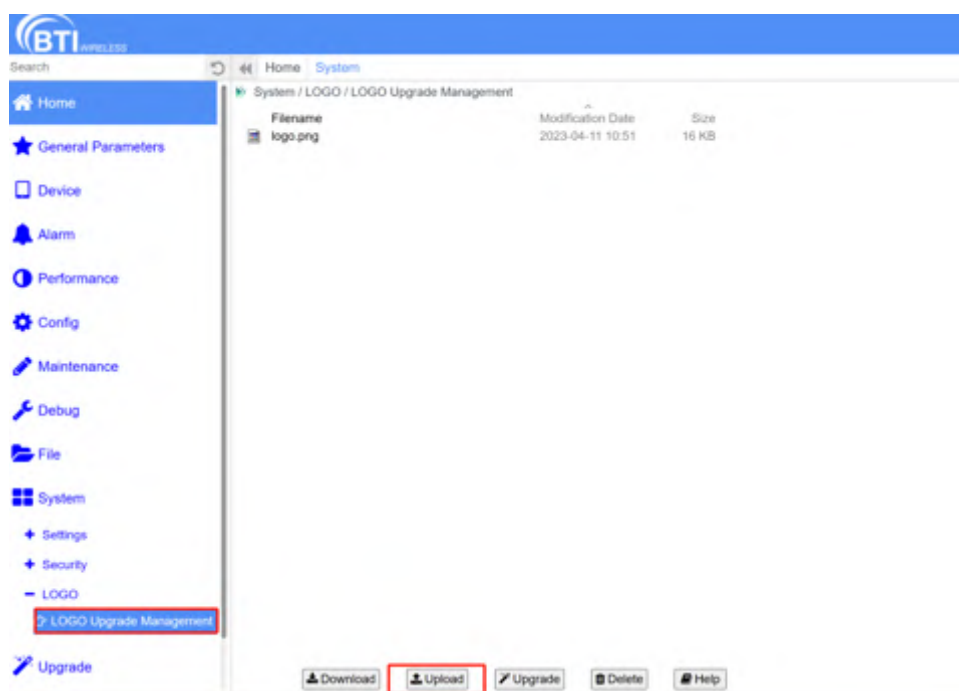
! Attentions

After the Shutdown is executed, the device will shut down in about one minute.

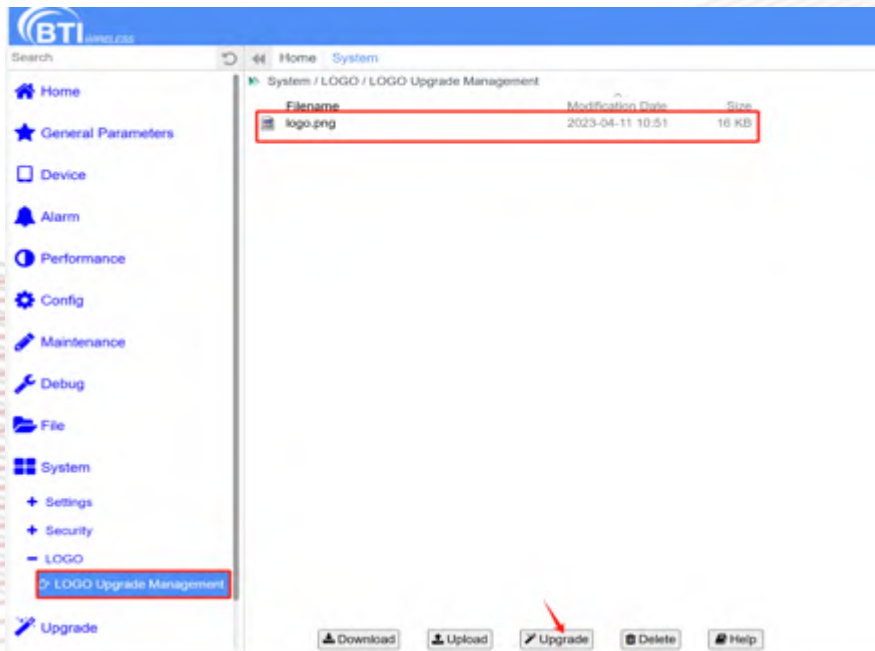
A power cycle will start the device after the Shutdown.

LOGO

Go through to System / LOGO / LOGO Upgrade Management node, select the upload LOGO file



Select the log file and click the “Upgrade” to make it effective



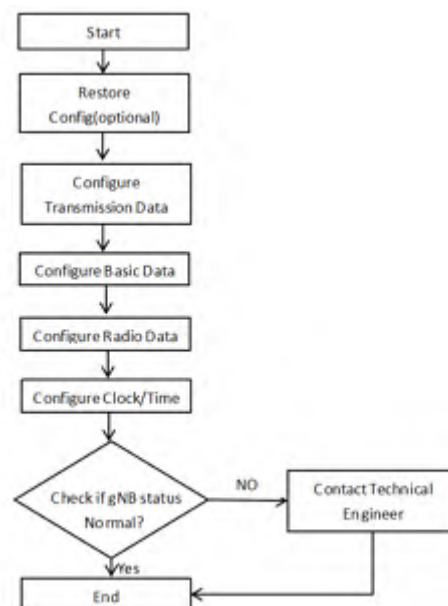
6.2 Configuration Management

6.2.1 nCELL-T5000 Series Base Stations Initial Configuration Guide

This chapter provides a detailed introduction to the initial configuration process of a single gNodeB, including configuring basic data, device data, transmission data, wireless data, and clock data.

6.2.1.1 Initial Configuration Process

Introduce the overall process of initial configuration of a single gNodeB, as shown in the following figure:



6.2.1.2 Restore Config

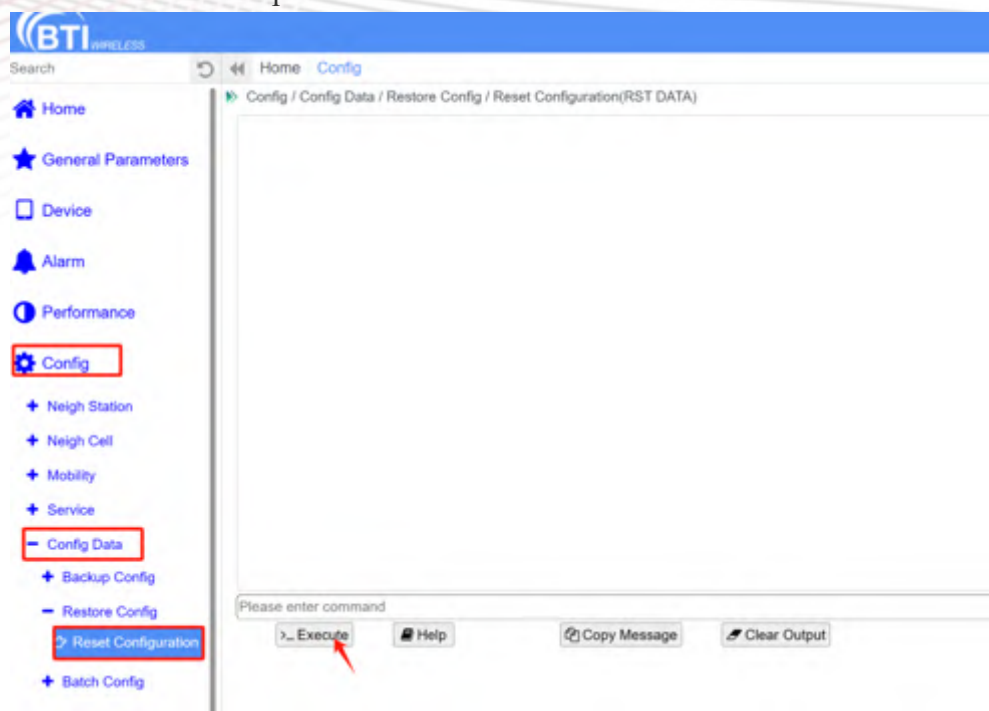
Used to delete user configuration data on the base station and restore it to the initial configuration data after system installation.

Precondition

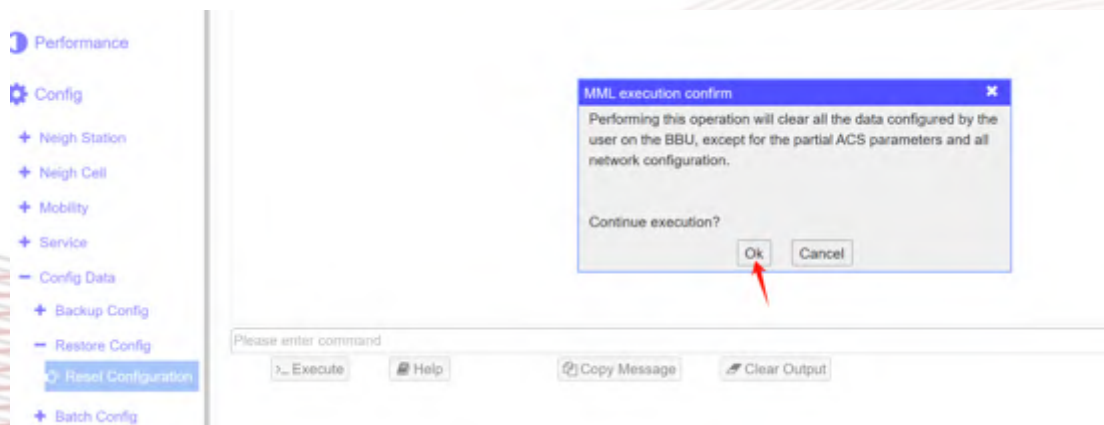
Connect the computer and base station through ethernet cable, and the communication between the web and the base station is normal. Successfully login in the web interface (please refer section 6.1.1.5 for how to login the LMT interface). The default configuration and maintenance IP address for the base station is 192.168.5.100, and the username and password are admin/123456. If a new maintenance IP address is planned, it needs to be accessed through https://OM IP to login.

Operation Details

Under the node: config ->config Data ->Restore Config, select Reset configuration
Then click "Execute" on the operation interface



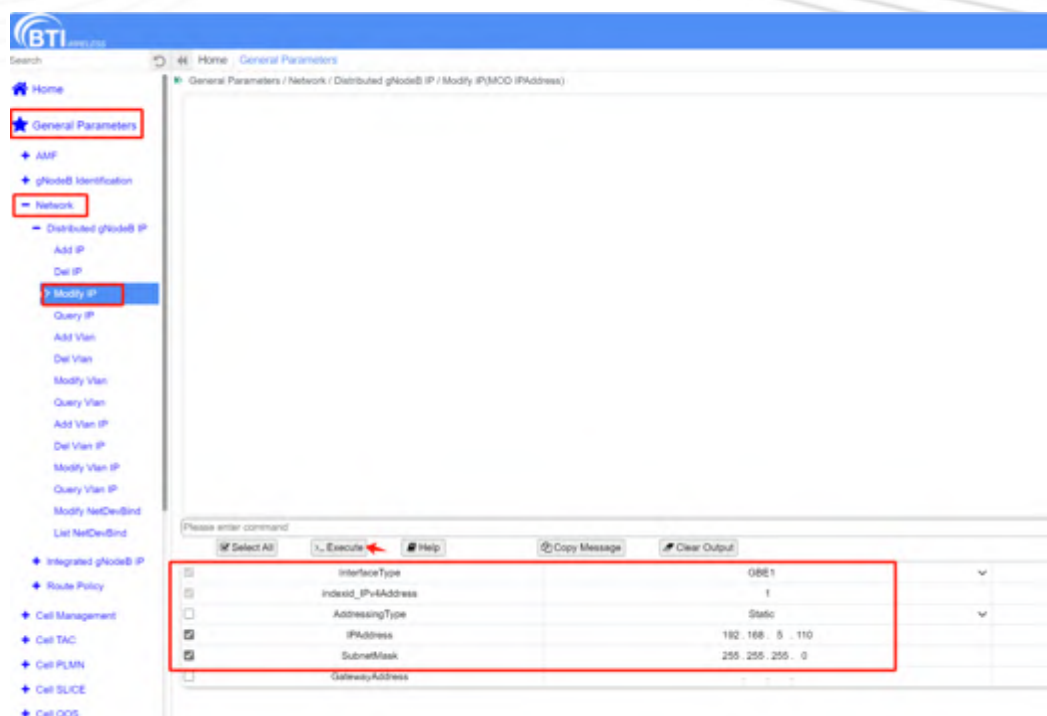
Page prompt: Executing this operation will clear all user configured data on the network element, only keep partial network management parameter configuration and default network configuration. Please select the "OK" button, the actual configuration will be restored to the default configuration after executing the command.

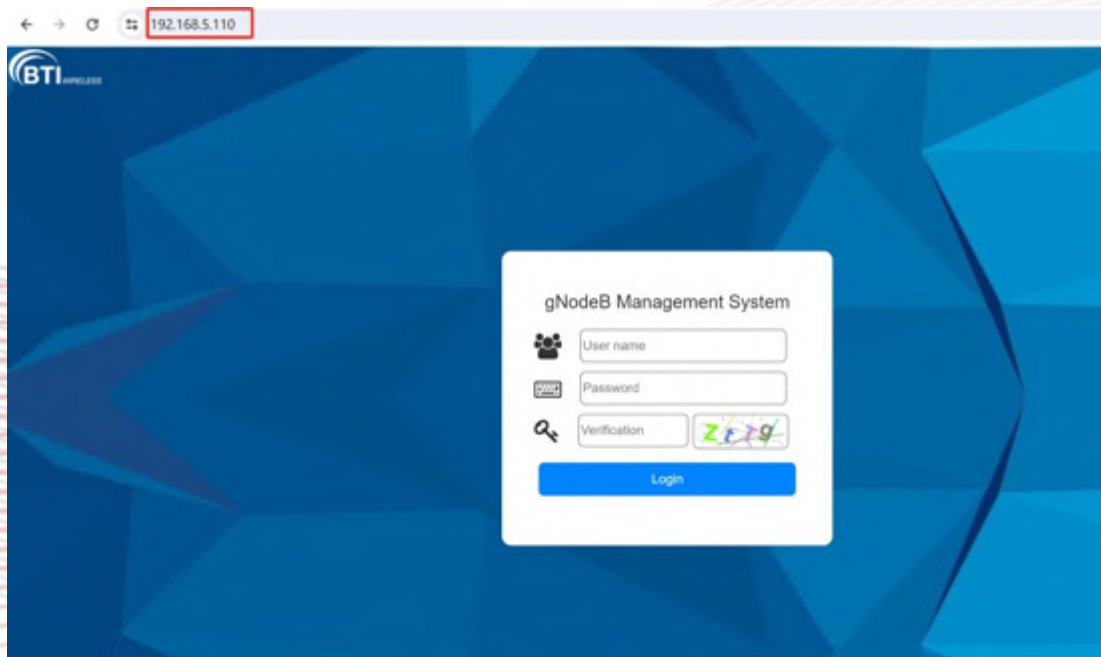


Instruction

After performing the operation to restore the default configuration, the maintenance IP of the base station will become the default IP 192.168.5100. If a new maintenance IP is planned, it needs to be modified in the node of web interface: General Parameters>Network->Modify IP

For example, maintenance transmission goes through GBE1. The method of modifying the maintenance IP is shown in the following figure. Please log in with the new maintenance IP after modify successfully.





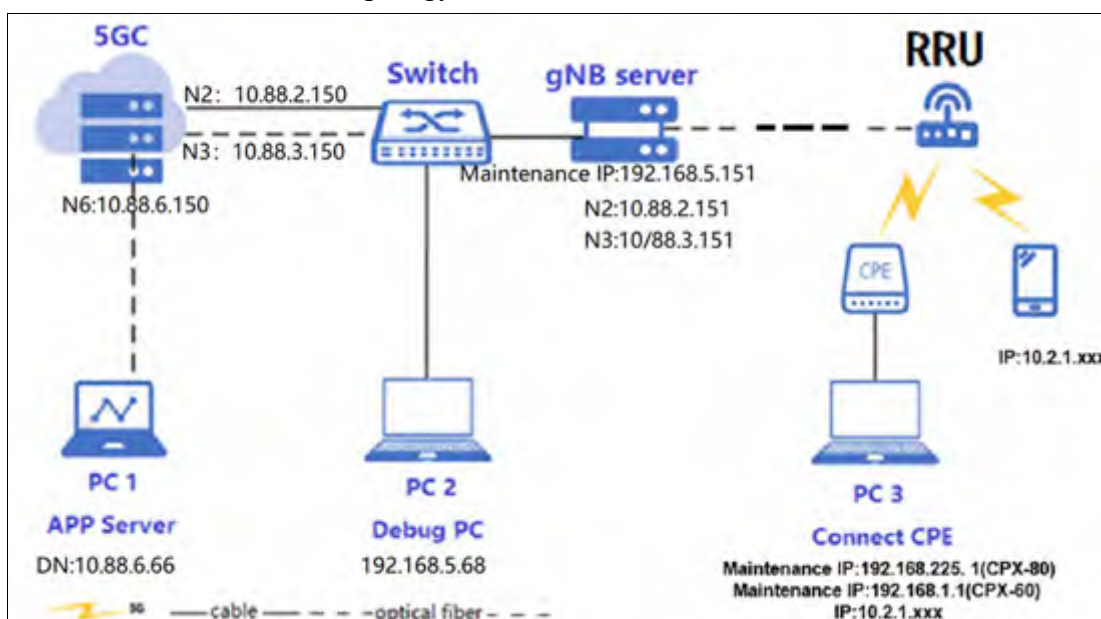
! Attentions

1. In the system version, the minimum configuration data is released with the version. When executing this command, the user configuration data is deleted and restored to the minimum configuration data.
2. 192.168.5.101 is an internal IP of BBU. Please do not use this IP.

6.2.1.3 Configure Transmission Data

Introduce how to configure transmission data of base stations through web interface, including maintenance channel, NG transmissions, and other link transmissions;

Base station transmission topology architecture:



BBU Network Card Interface Panel Description



	NO	Port ID	Port Name	Funciton	Description
Electric Network Card	1	GBE1	enp3s0	enp3s0: maintenance access enp4s0: N2/N3 transmission	Login in web to make network configuration. Including IP、Mask、network card type..etc
	2	GBE2	enp4s0		
SFP Interface	1	SFP1	enp184s0f0	Achieve N2/N3 transmission and other high-speed data transmission through SFP module and optical connections	
	2	SFP2	enp184s0f1		
	3	SFP3	enp184s0f2		
	4	SFP4	enp184s0f3		
Accelerator Card Interface	1	OP1	enp23s0f0	Communication with RRU through SFP module and optical fibers	No need specific configuration
	2	OP2	enp23s0f1		
	3	OP3	enp23s0f2		
	4	OP4	enp23s0f3		

When the planned data is inconsistent with the default system configuration data, log in to the web interface to add or modify parameters such as network card type, IP address, subnet mask, gateway address, etc;

According to the external interface of the base station, at least three IPs need to be planned and configured, and their functions and application network card types are as follows:

IP functional division	Application network port type
Maintenance IP	Low speed requirements for network cards, used for grid cards GBE1 or GBE2
N2 IP	Only transmitting NG signaling, with low requirements for network card speed, used for power grid cards GBE2 or GBE1
N3 IP	Transferring user plane data with high requirements for network card speed, used for SFP interface network cards SFP1~SFP4

Configure Basic Transmission

Network configuration supports IP network adding, deleting, modifying, and querying;

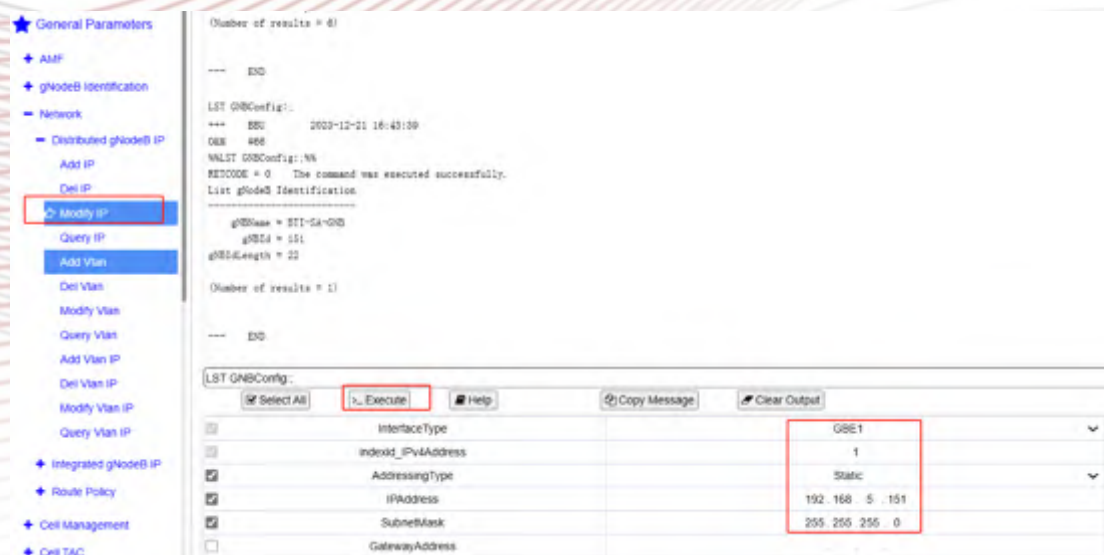
Use Case:

According to the above transmission topology architecture, plan the base station IP configuration, as shown below

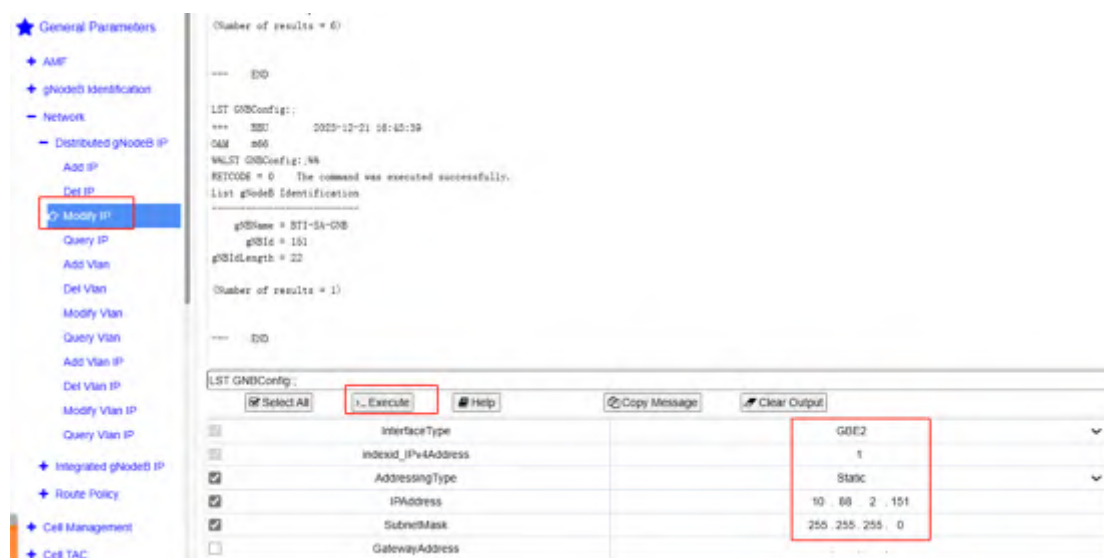
Base Station IP	NIC Type	IP Address
-----------------	----------	------------

Maintenance Access IP	GBE1	192.168.5.151
N2 IP	GBE2	10.88.2.151
N3 IP	SFP4	10.88.3.151

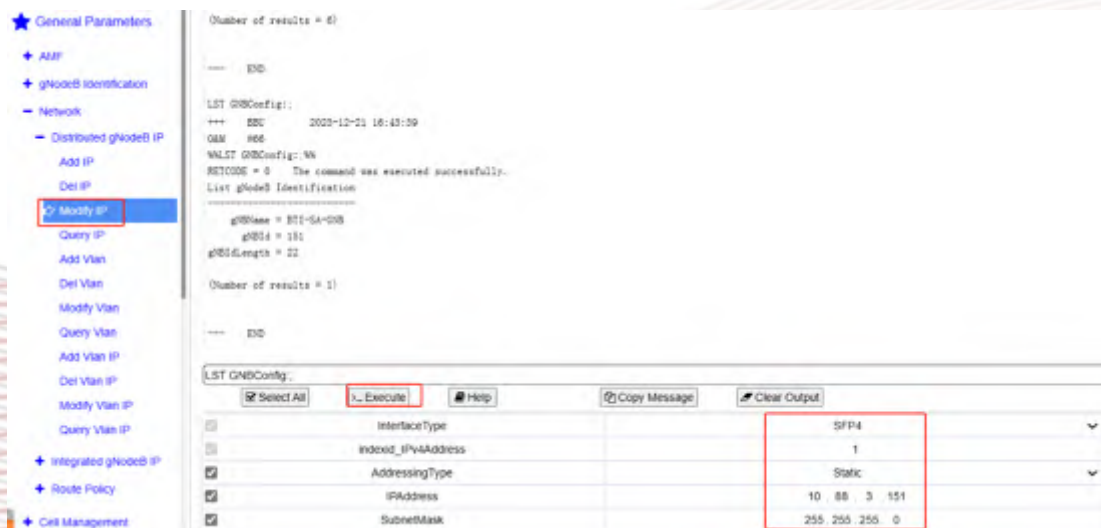
1、Modify Maintenance Access IP as 192.168.5.151、Network Card type as static、subnet mask as 24 bits.



2、Modify the N2 IP address to 10.88.2.151, the NIC type to static, and the subnet mask to 24 bits



3、Modify the N3 IP address to 10.88.3.151, the NIC type to static, and the subnet mask to 24 bits;



Note: Please click the "help" button on the right side of "Execute" to get help for detailed introduction of each parameter;

Configure VLAN and Route

If the transmission networking does not involve VLAN configuration, skip this chapter.

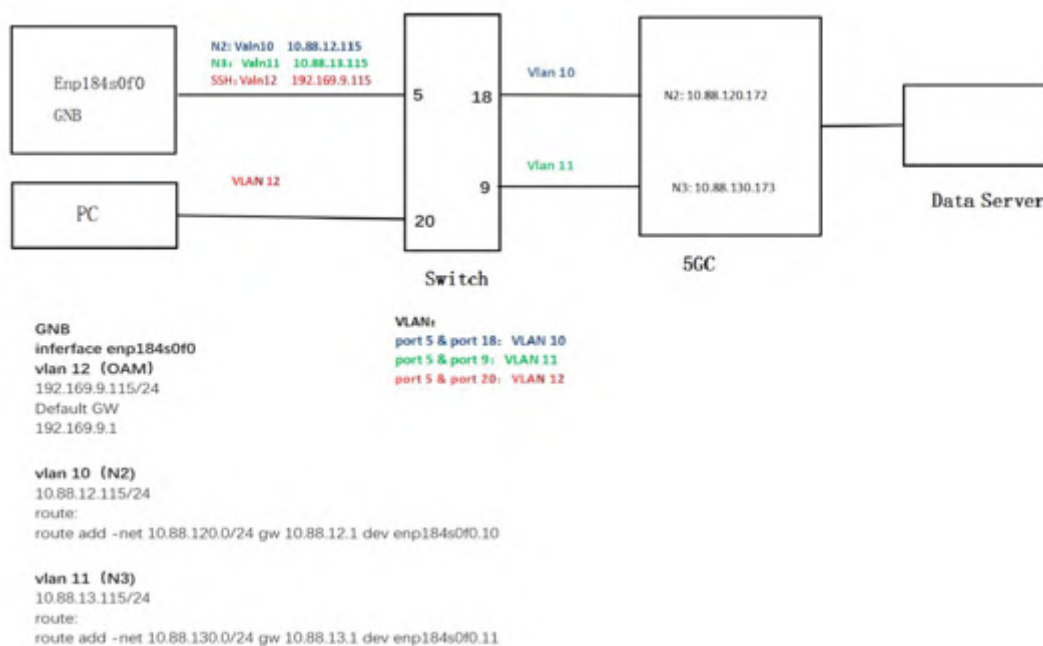
If VLAN transmission is planned, VLAN data and routing needs to be configured. Network configuration supports VLAN and routing addition, deletion, modification, and query functions;

Operation details

Proceed vlan, IP and route configuration under configuration path: General Parameters-> Network-> Distributed gNodeB IP;

Use Case:

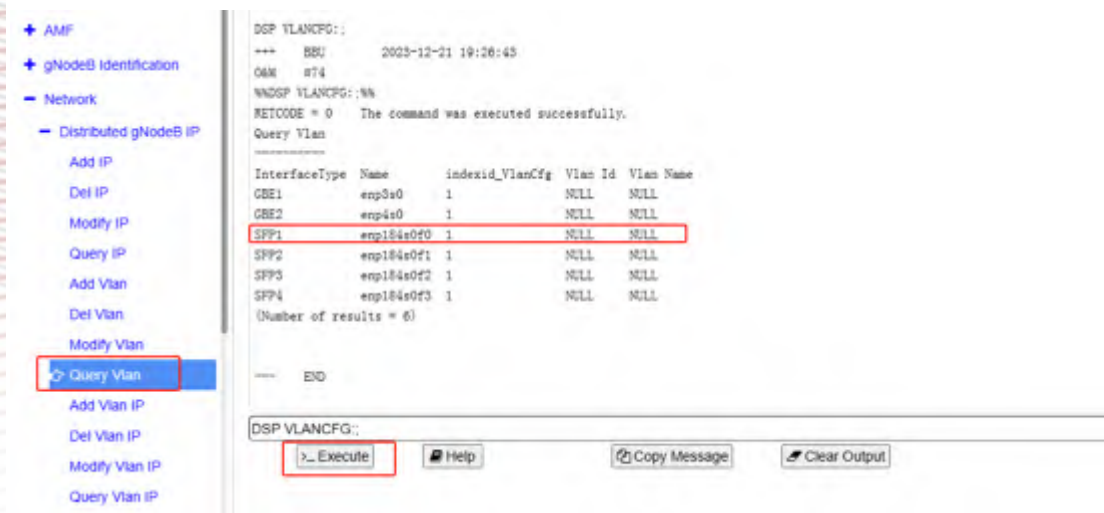
The following describes how to configure VLAN and routing to realize network transmission based on VLAN planning as shown in the figure below;



For example, configure three VLANs on the base station network card enp184s0f0: VLAN10/11/12;

Network Card Name	VLAN ID	VLAN IP	Funciton
enp184s0f0	10	10.88.12.115	N2 Transmission
enp184s0f0	11	10.88.13.115	N3 Transmission
enp184s0f0	12	192.169.9.115	Maintenance Access

Before adding VLAN, query whether there is VLAN configuration. If there is, modify it based on existing vlan configuration . If not, add it.



DSP VLANCFG;

```

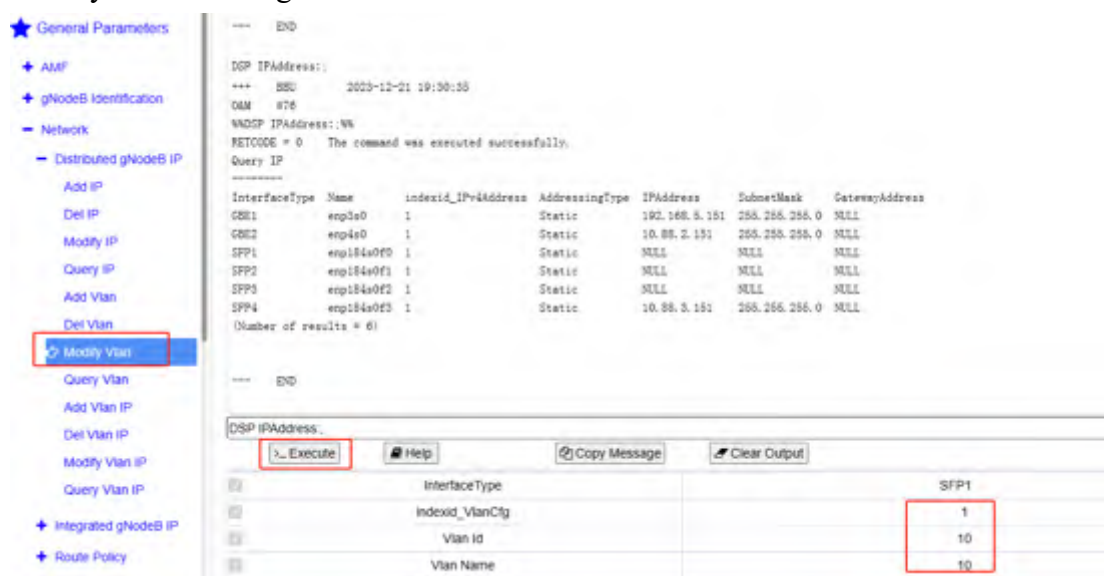
+++ BBU 2023-12-21 19:26:45
OMM #74
VLANCFG: %
RETCODE = 0 The command was executed successfully.
Query Vlan
-----
InterfaceType Name indexid_VlanCfg Vlan Id Vlan Name
GSE1 enp3s0 1 NULL NULL
GSE2 enp4s0 1 NULL NULL
SFP1 enp184s0f0 1 NULL NULL
SFP2 enp184s0f1 1 NULL NULL
SFP3 enp184s0f2 1 NULL NULL
SFP4 enp184s0f3 1 NULL NULL
(Number of results = 6)
-----
END

```

DSP VLANCFG;

Execute Help Copy Message Clear Output

Modify VLAN configuration index 1 to VLAN 10



DSP IPADDRESS;

```

+++ BBU 2023-12-21 19:30:38
OMM #76
IPADDRESS: %
RETCODE = 0 The command was executed successfully.
Query IP
-----
InterfaceType Name indexid_IPv4Address AddressingType IPAddress SubnetMask GatewayAddress
GSE1 enp3s0 1 Static 192.168.8.151 255.255.255.0 NULL
GSE2 enp4s0 1 Static 10.88.2.151 255.255.255.0 NULL
SFP1 enp184s0f0 1 Static NULL NULL NULL
SFP2 enp184s0f1 1 Static NULL NULL NULL
SFP3 enp184s0f2 1 Static NULL NULL NULL
SFP4 enp184s0f3 1 Static 10.88.3.151 255.255.255.0 NULL
(Number of results = 6)
-----
END

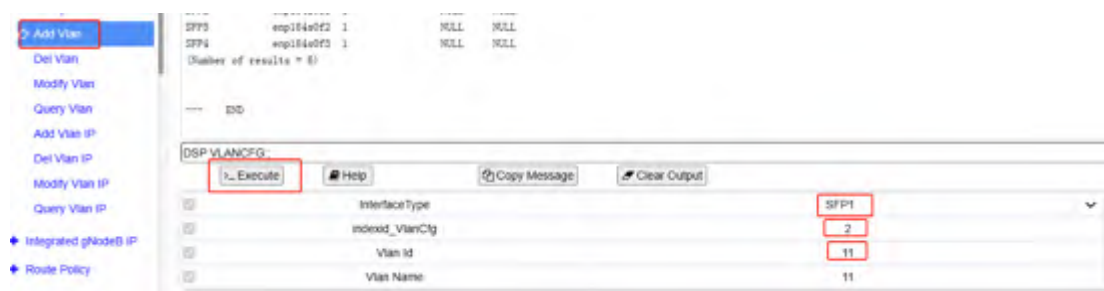
```

DSP IPADDRESS;

Execute Help Copy Message Clear Output

InterfaceType	Indexid_VlanCfg	Vlan Id	Vlan Name
SFP1	1	10	10

Add VLAN 11 and VLAN 12



DSP VLANCFG;

```

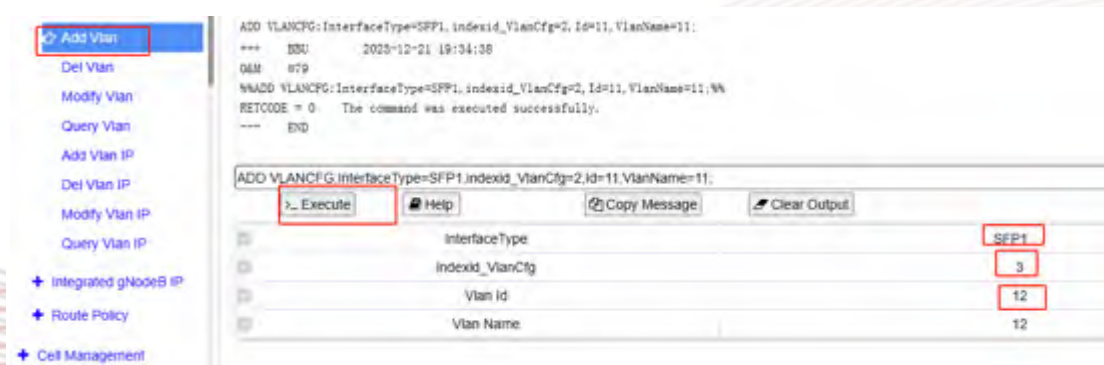
+++ BBU 2023-12-21 19:30:38
OMM #76
VLANCFG: %
RETCODE = 0 The command was executed successfully.
Query Vlan
-----
InterfaceType Name indexid_VlanCfg Vlan Id Vlan Name
GSE1 enp3s0 1 NULL NULL
GSE2 enp4s0 1 NULL NULL
SFP1 enp184s0f0 1 NULL NULL
SFP2 enp184s0f1 1 NULL NULL
SFP3 enp184s0f2 1 NULL NULL
SFP4 enp184s0f3 1 NULL NULL
(Number of results = 6)
-----
END

```

DSP VLANCFG;

Execute Help Copy Message Clear Output

InterfaceType	Indexid_VlanCfg	Vlan Id	Vlan Name
SFP1	2	11	11



ADD VLANCFG:InterfaceType=SFP1,indexid_VlanCfg=2,Id=11,VlanName=11:

```

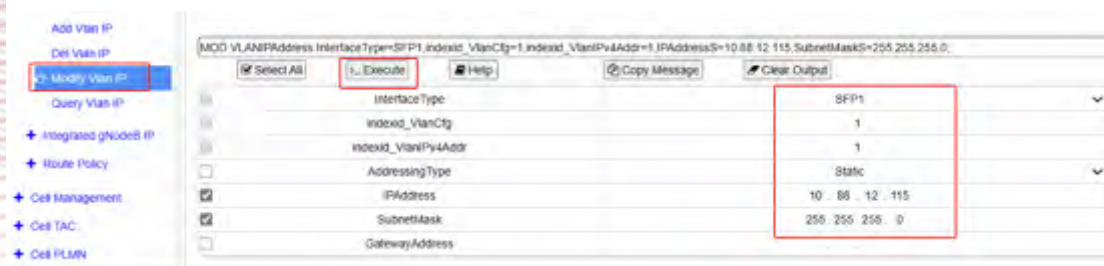
+++  BBU      2023-12-21 19:34:38
DAM  #79
%%ADD VLANCFG:InterfaceType=SFP1,indexid_VlanCfg=2,Id=11,VlanName=11;%
RETCODE = 0   The command was executed successfully.
---  END

```

ADD VLANCFG:InterfaceType=SFP1,indexid_VlanCfg=2,Id=11,VlanName=11:

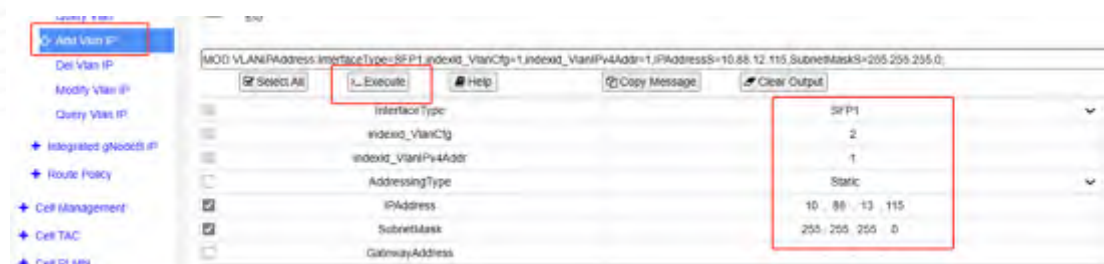
InterfaceType	SFP1
indexid_VlanCfg	3
Vlan Id	12
Vlan Name	12

Configure the IP address for VLAN 10/11/12



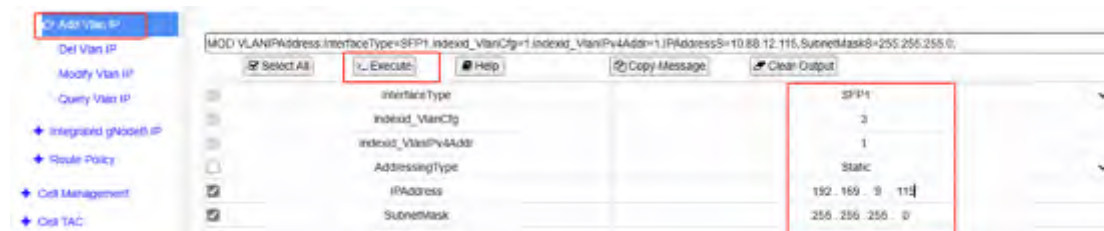
MOD VLANIPAddress:InterfaceType=SFP1,indexid_VlanCfg=1,indexid_VlanIPV4Addr=1,IPAddress=10.88.12.115,SubnetMask=255.255.255.0:

InterfaceType	SFP1
indexid_VlanCfg	1
indexid_VlanIPV4Addr	1
AddressingType	Static
IP Address	10.88.12.115
SubnetMask	255.255.255.0
GatewayAddress	



MOD VLANIPAddress:InterfaceType=SFP1,indexid_VlanCfg=1,indexid_VlanIPV4Addr=1,IPAddress=10.88.13.115,SubnetMask=255.255.255.0:

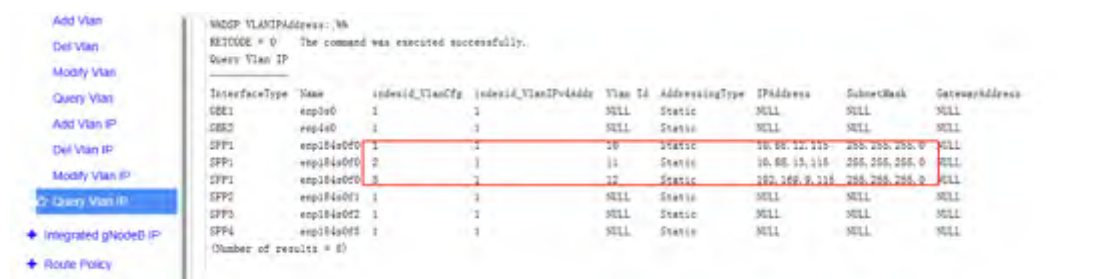
InterfaceType	SFP1
indexid_VlanCfg	2
indexid_VlanIPV4Addr	1
AddressingType	Static
IP Address	10.88.13.115
SubnetMask	255.255.255.0
GatewayAddress	



MOD VLANIPAddress:InterfaceType=SFP1,indexid_VlanCfg=1,indexid_VlanIPV4Addr=1,IPAddress=192.168.9.115,SubnetMask=255.255.255.0:

InterfaceType	SFP1
indexid_VlanCfg	3
indexid_VlanIPV4Addr	1
AddressingType	Static
IP Address	192.168.9.115
SubnetMask	255.255.255.0
GatewayAddress	

Query VLAN IP configuration



%%QUERY VLANIPADDRESS:%%

```

RETCODE = 0   The command was executed successfully.
Query Vlan IP

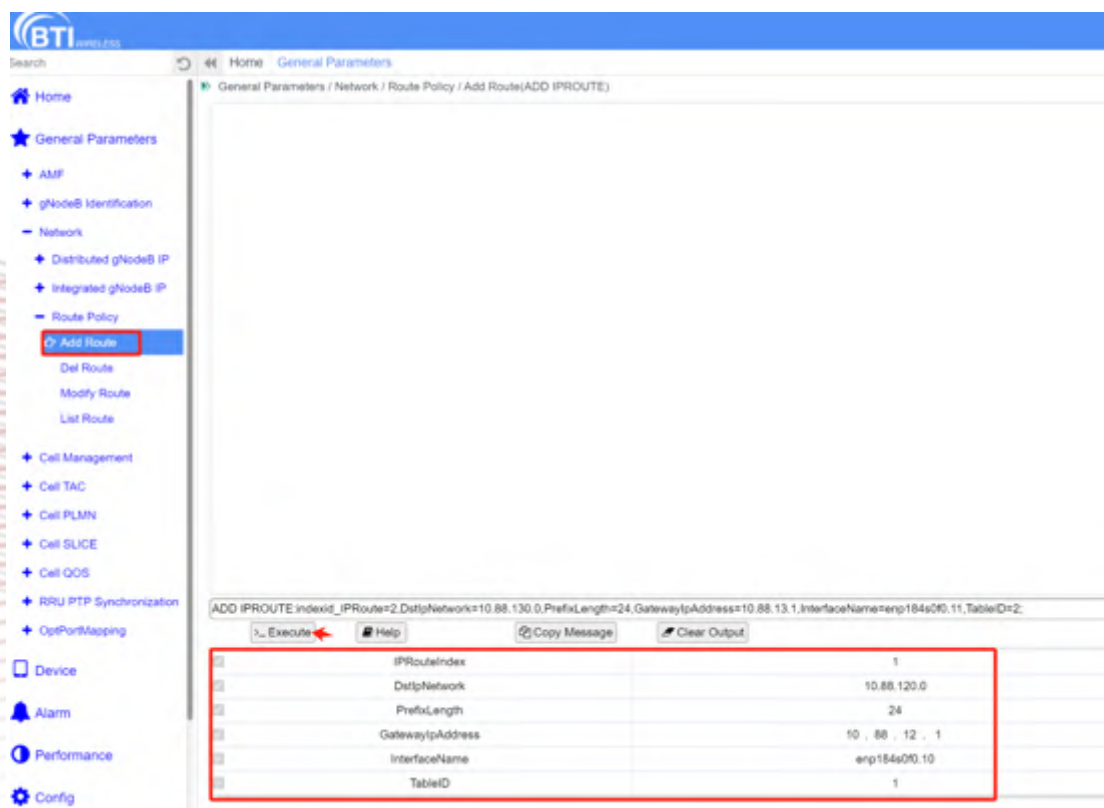
```

InterfaceType	Name	indexid_VlanCfg	indexid_VlanIPV4Addr	Vlan Id	AddressingType	IPAddress	SubnetMask	GatewayAddress
GDE1	exp3s0	1	1	NULL	Static	NULL	NULL	NULL
GDE2	exp4s0	1	1	NULL	Static	NULL	NULL	NULL
SFP1	exp184s0f0	1	1	10	Static	10.88.12.115	255.255.255.0	NULL
SFP1	exp184s0f0	2	1	11	Static	10.88.13.115	255.255.255.0	NULL
SFP1	exp184s0f0	3	1	12	Static	192.168.9.115	255.255.255.0	NULL
SFP2	exp184s0f1	1	1	NULL	Static	NULL	NULL	NULL
SFP3	exp184s0f2	1	1	NULL	Static	NULL	NULL	NULL
SFP4	exp184s0f3	1	1	NULL	Static	NULL	NULL	NULL

(Number of results = 8)

Configure the end to end routing as per those 3 VLAN IP configuration.

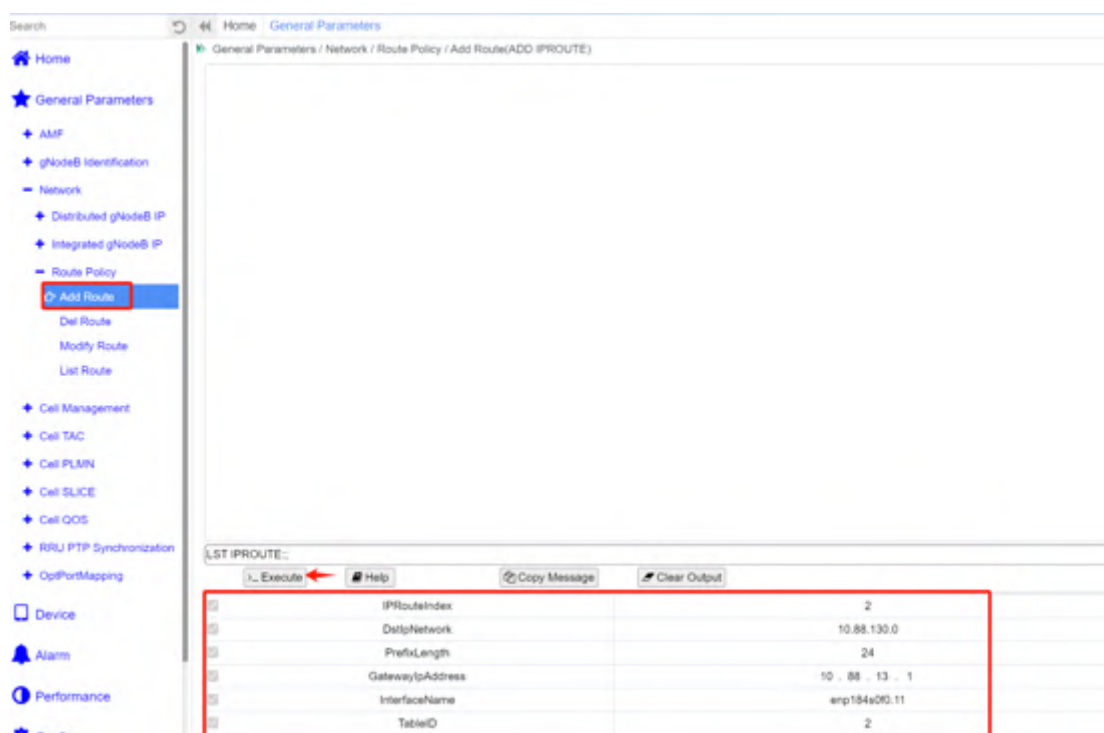
VLAN 10 IP route config: Destination network segment: 10.88.120.0/24, Next hop gateway address: 10.88.12.1, Network card name is enp184s0f0.10 (10 indicates Vlan ID)



ADD IPROUTE:indexid_IPRoute=2,DstIpNetwork=10.88.130.0,PrefixLength=24,GatewayIpAddress=10.88.13.1,InterfaceName=enp184s0f0.11,TableID=2:

IPRouteIndex	1
DstIpNetwork	10.88.130.0
PrefixLength	24
GatewayIpAddress	10.88.13.1
InterfaceName	enp184s0f0.11
TableID	1

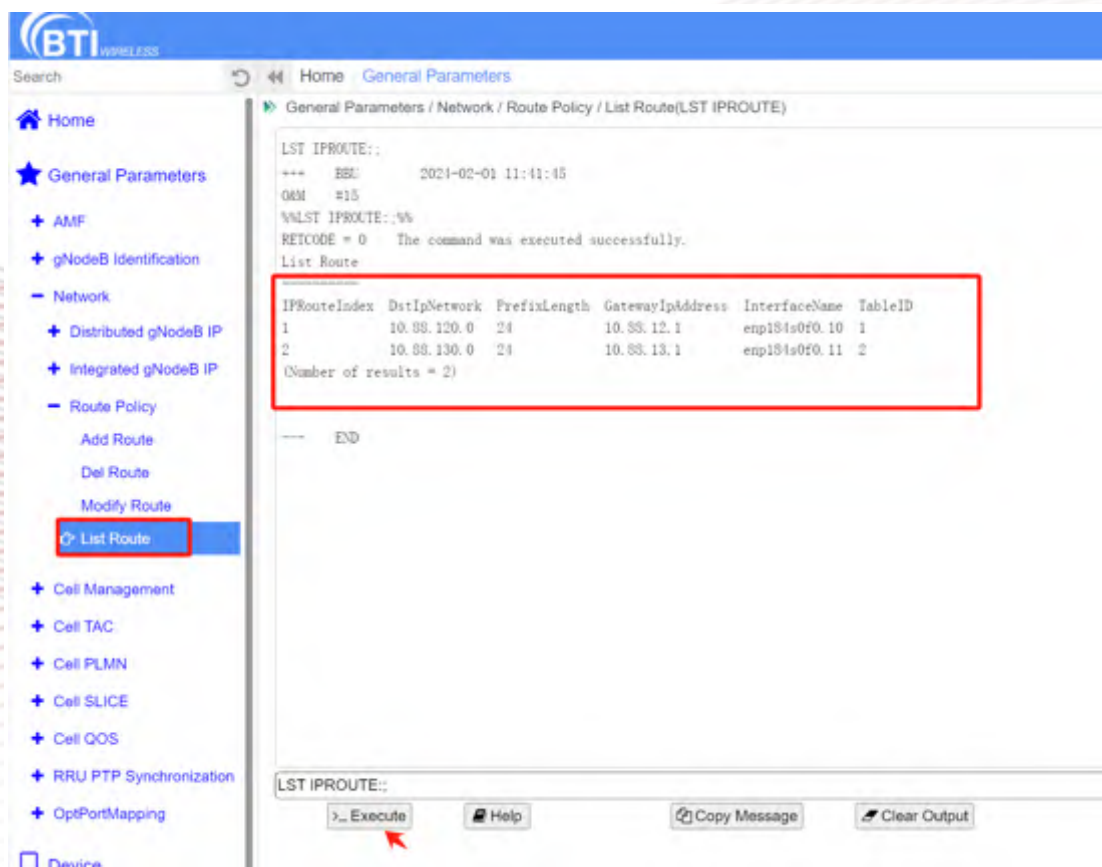
VLAN 11 IP route config: Destination network segment 10.88.130.0/24, Next hop gateway address: 10.88.13.1, network card name is enp184s0f0.11 (11 indicates Vlan ID)



LIST IPROUTE:

IPRouteIndex	2
DstIpNetwork	10.88.130.0
PrefixLength	24
GatewayIpAddress	10.88.13.1
InterfaceName	enp184s0f0.11
TableID	2

List route information after configuration complete :



Configure Vpp Bind

VPP Function Introduction:

VPP (Vector Packet Processing) is a high-performance, scalable 2-4 layer multi platform network protocol stack, which is mainly used to quickly process routing network packets. It runs in multiple Linux user spaces and supports multiple architectures such as x86, ARM, and Power. The main advantages of VPP are its high performance and scalability. By using efficient algorithms and data structures, as well as the parallel processing capability of multi-core CPUs, VPP can process a large number of network packets at a high rate. In short, VPP is a powerful, high-performance, flexible and scalable network packet processing software. It has broad application prospects in cloud computing, data center network, network function virtualization, edge computing, Internet of Things and other fields.

After application in BBU, the downlink receiving and processing capability of the data plane is improved, and the impact on VONR and other high priority small data users is reduced. At the same time, it supports the Web page to modify the backhaul optical port and realize the automatic binding function of the optical port.

The VPP function is enabled by default and SFP3 is bound by default. Query under the node: General Parameters/Network/Vpp Bind/List NetDevBand.

 Instruction

1. The 2187 model supports the VPP function, while the 2177 model does not support the VPP function.
2. If the VPP function is used, the Vpp Bind configuration must be consistent with the actual N3 optical port binding. If the network card used by N3 in the transport network is SFP3, the default value does not need to be modified; If the network card used by N3 in the transmission network is SFP1/SFP2/SFP4, it needs to be modified to the actual optical port.
3. If the VPP function is not used, execute the MOD NetDevBind command and select disable to turn off the function. After the configuration is modified, an automatic restart will be prompted, and the configuration will take effect after restarting.
4. When the VPP function is enabled, if Vpp Bind is configured to bind a network card, that is, the network card is taken over by VPP, and the network card name changes to TenGigabit Ethernet b8/0/x. If a route needs to be added to the network card, the route table ID of the route needs to be set to 254;

⚠️ Attentions

Before using the `vpp` function in the 2187 environment, you need to modify the number of large pages of memory. The steps are as follows:

BBU ssh login in the background, and uses “cat/proc/cmdline” to view the U-boot parameters when the kernel starts.

[illegible]

Modify “hugepages”=4

Execute: `vi /boot/efi/EFI/centos/grub.cfg`

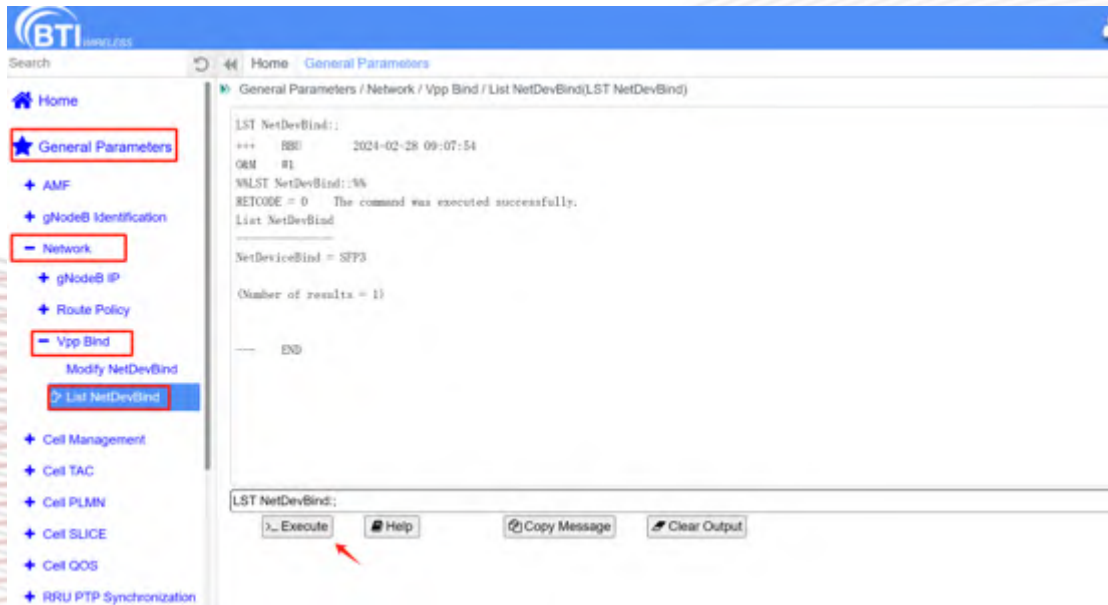
Find `vmLinux-3.10.0-693.2.2.rt56.623.el7.x86_64`, and Modify “`hugepages`” as 4.

[illegible]

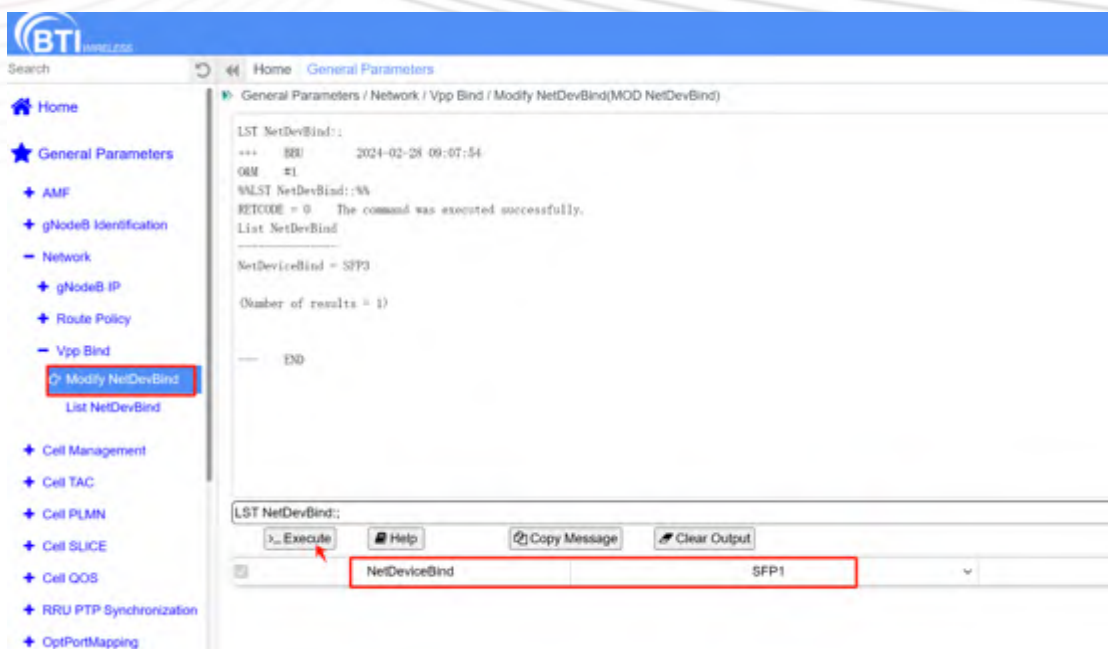
Reboot to take effect after modification.

Use Case:

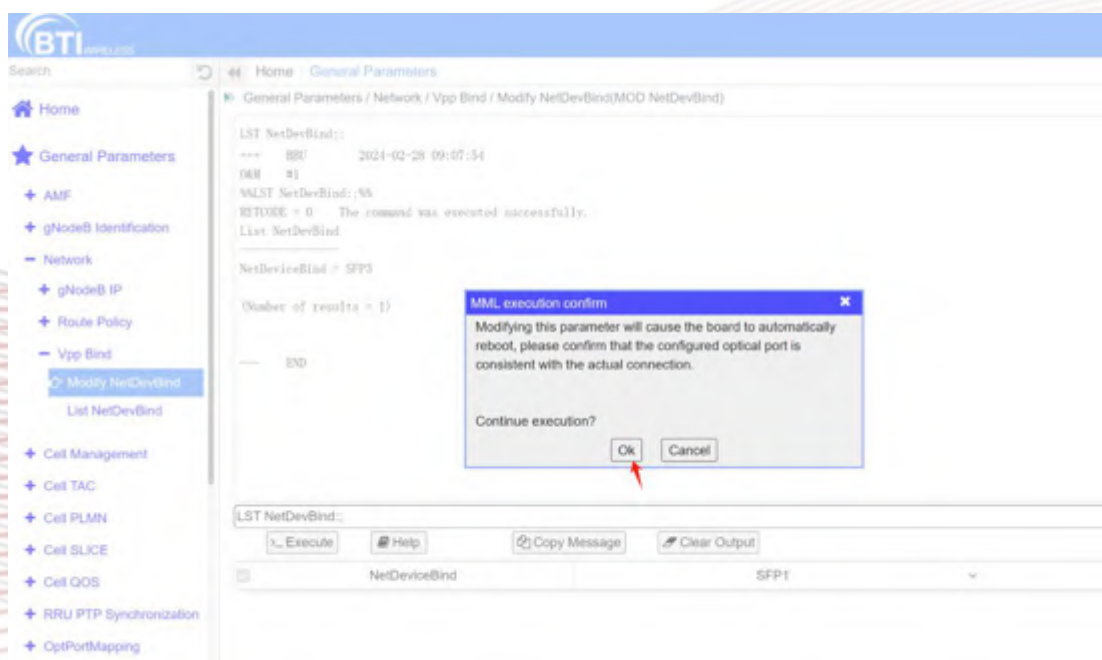
- ## 1、Query the optical port binding configuration



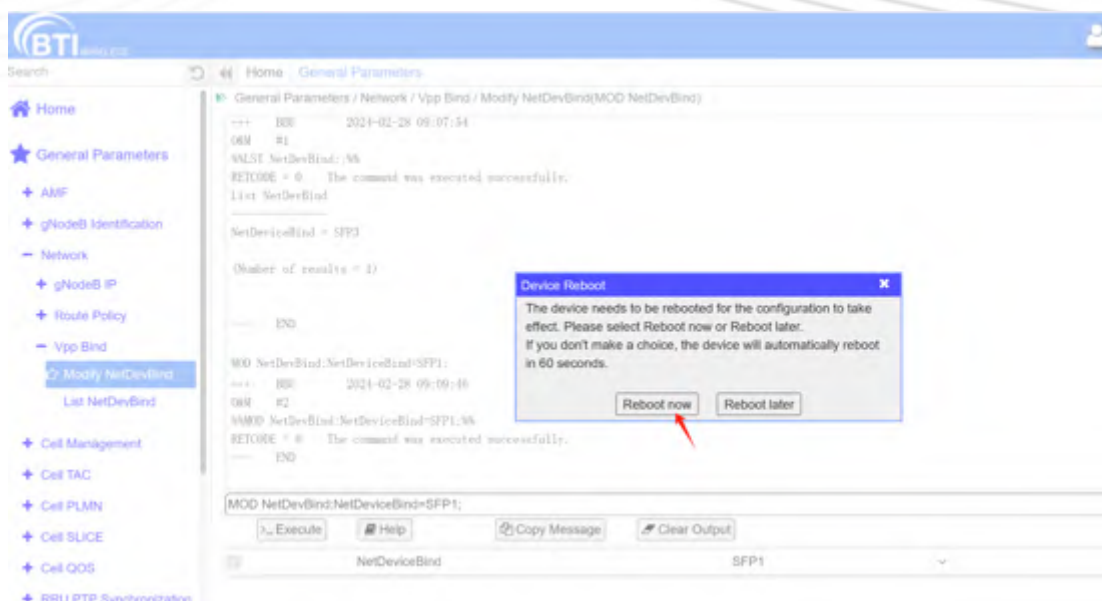
2. Modify the binding of the backhaul optical port to SFP1 (at this time, the actual transmission use of N3 is SFP1)



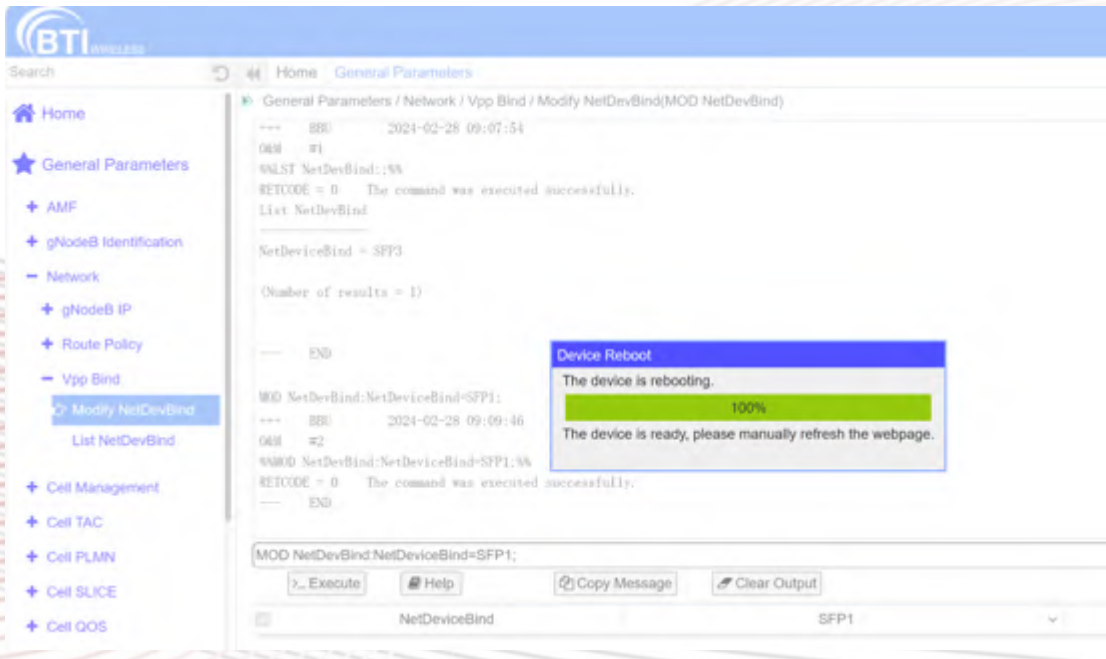
Prompt "Modifying this parameter will cause the board to automatically reboot. Please confirm that the configured optical port is consistent with the actual connection." Click OK



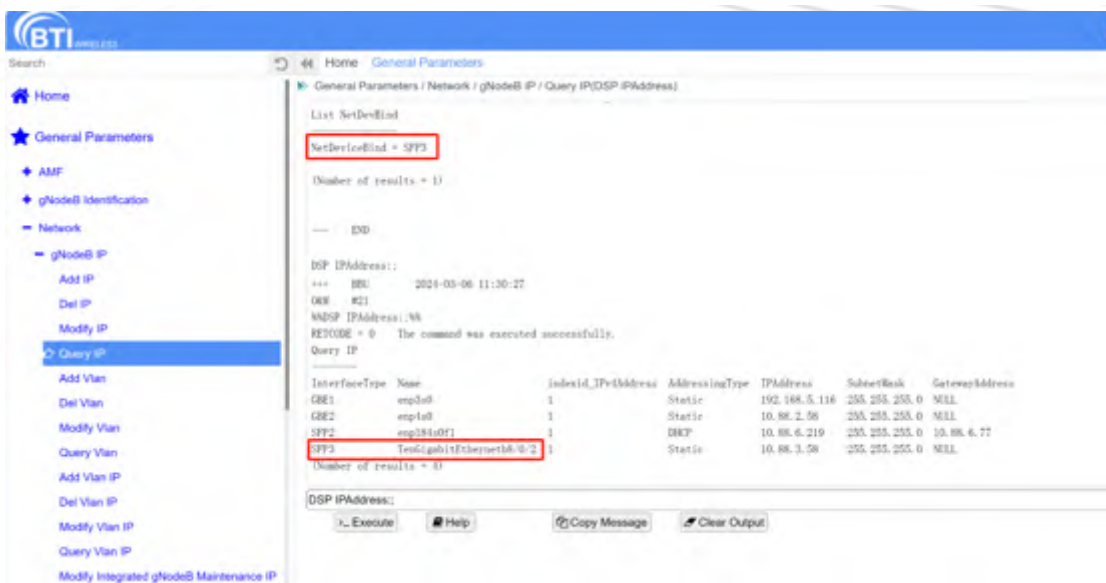
Then prompt "The device needs to be rebooted for the configuration to take effect. Please select to Reboot Now or Reboot Later. If you don't make a choice, the device will automatically reboot in 60 seconds." Click Reboot Now



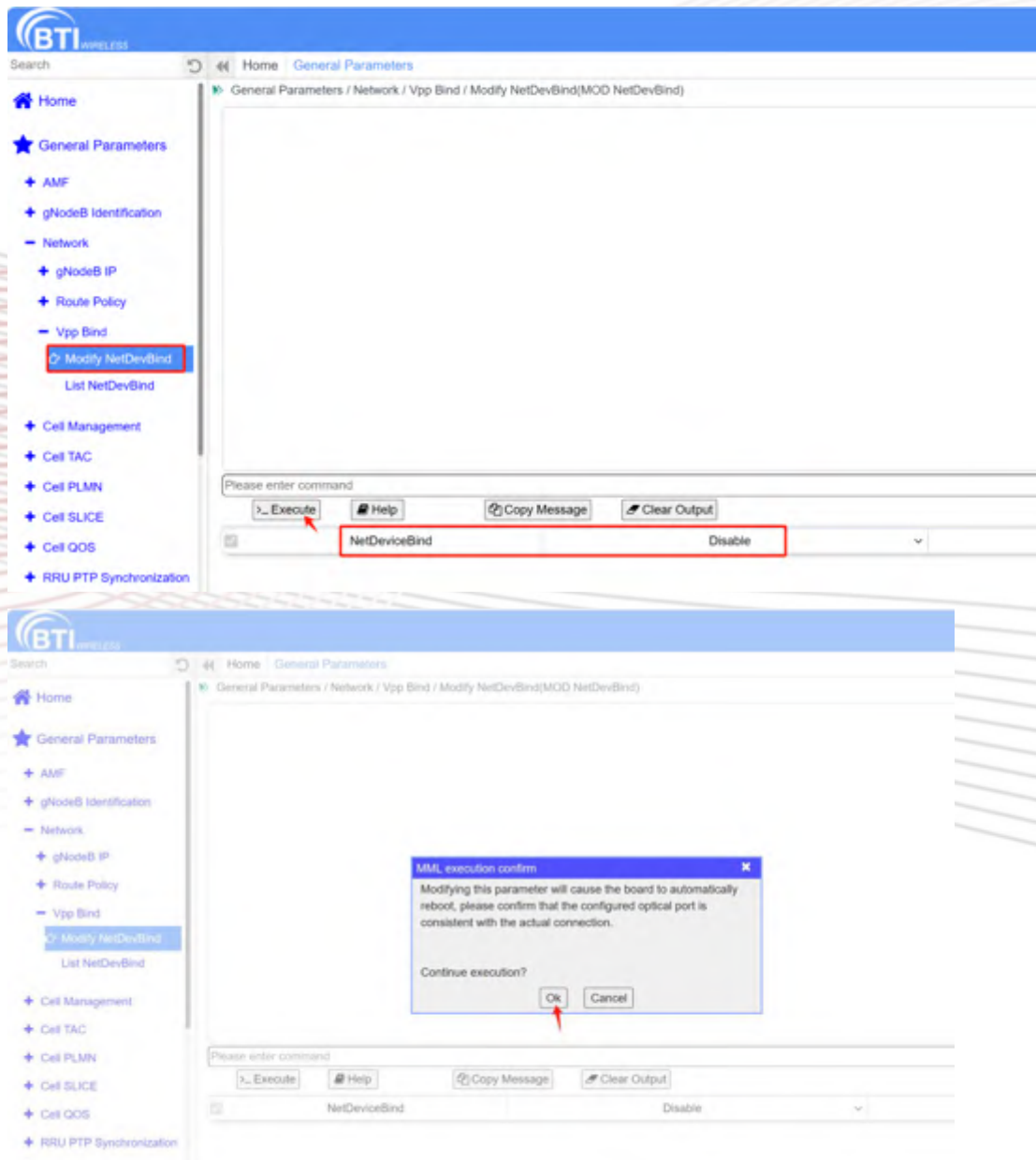
As shown in the figure below, when the progress bar progress is 100%, you can refresh the page and log in again.



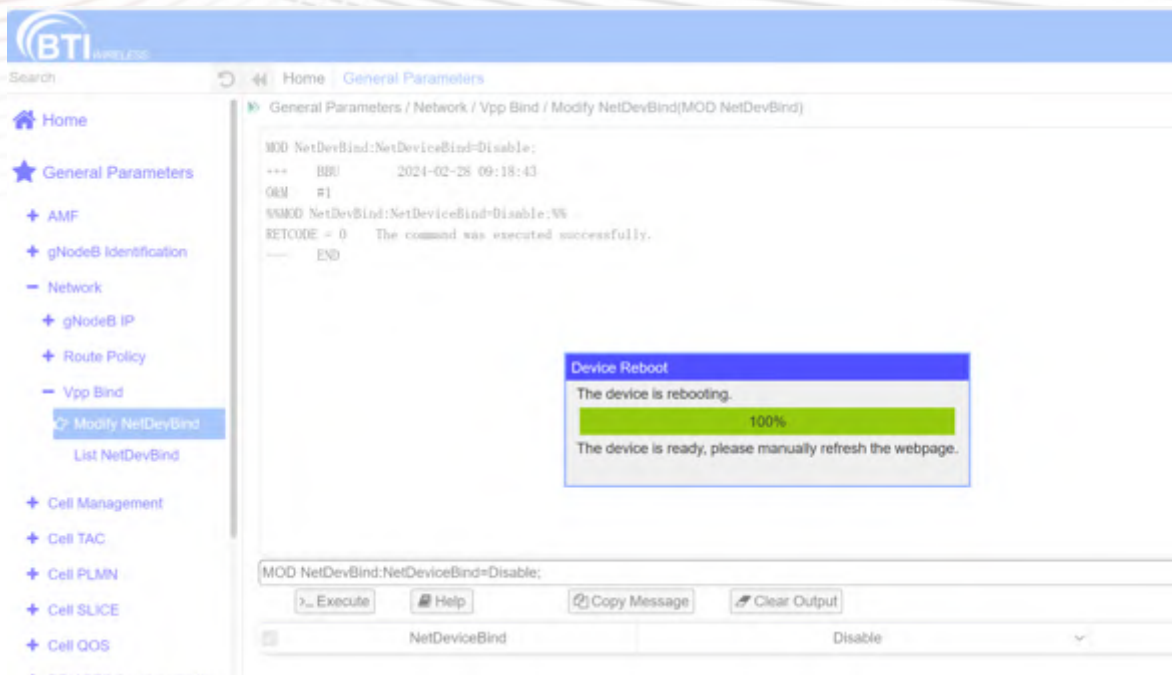
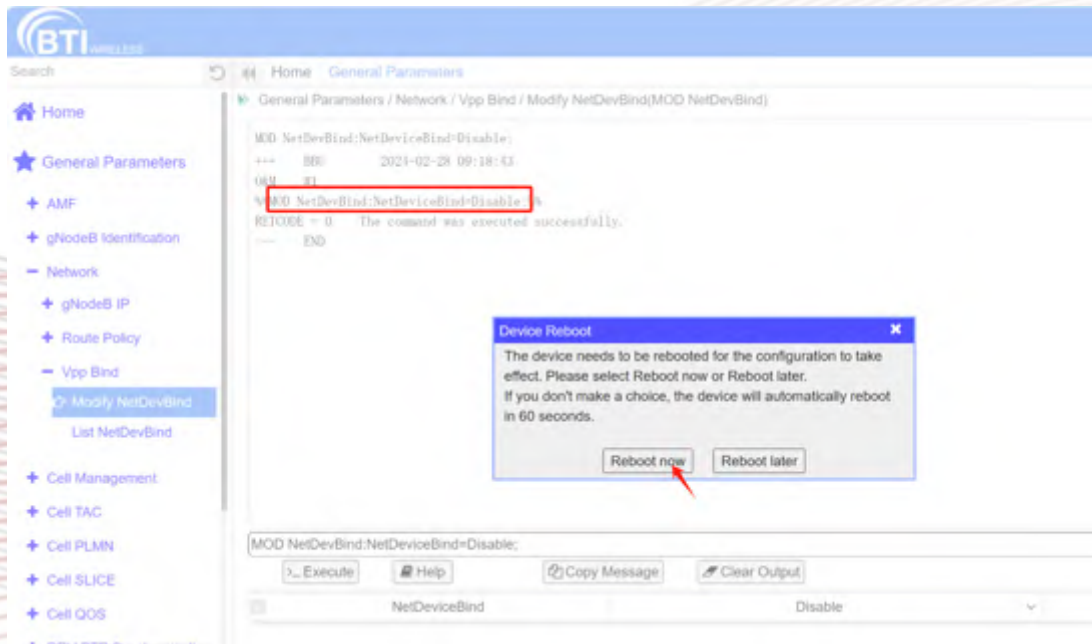
3、When VPP binds SFP3, query whether the name of the SFP3 network card changes to TenGigabit Ethernet b8/0/2



4、Turn off the vpp function and select "Disable" to turn off this function



Then prompt "The device needs to be rebooted for the configuration to take effect. Please select to Reboot Now or Reboot Later. If you don't make a choice, the device will automatically reboot in 60 seconds." Click Reboot Now



Instruction

After completing the data transmission configuration section, ensure that the BTS is maintained normally and can ping the N2/N3 IP address of the core network.

6.2.1.4 Configure Basic Information

Describes how to configure the basic information of gNodeB, including network management, AMF, PLMN information, modifying the base station ID, and configuring TAC information.

Configure Networking Management

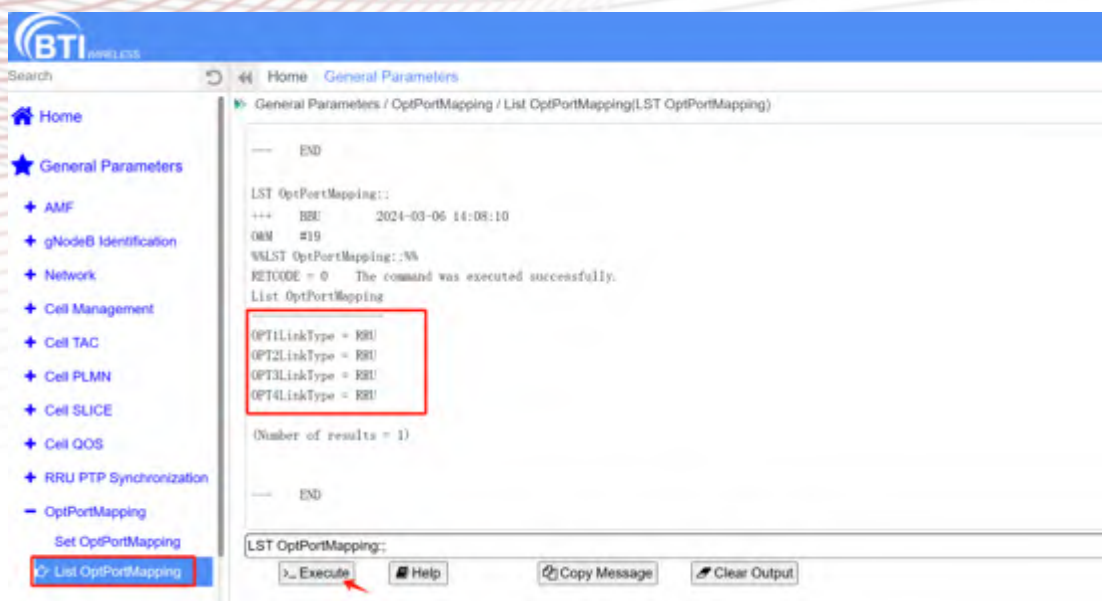
It is used to set the type of peer device which connected to the optical port of accelerator card in BBU. The default value is RRU type and not need to be modified.

Operation details

Query the BBU optical port mapping relationship: click “List OptPortMapping” in node: General Parameters ->OptPortMapping, and then click “Execute”;

Use Case:

Query BBU optical port mapping relationship;



! Attentions

All optical port connection devices of the BBU need to be set and the type must be the same.

Configure AMF

It is used to configure AMF information, and supports adding, modifying, querying, and deleting AMF operations;

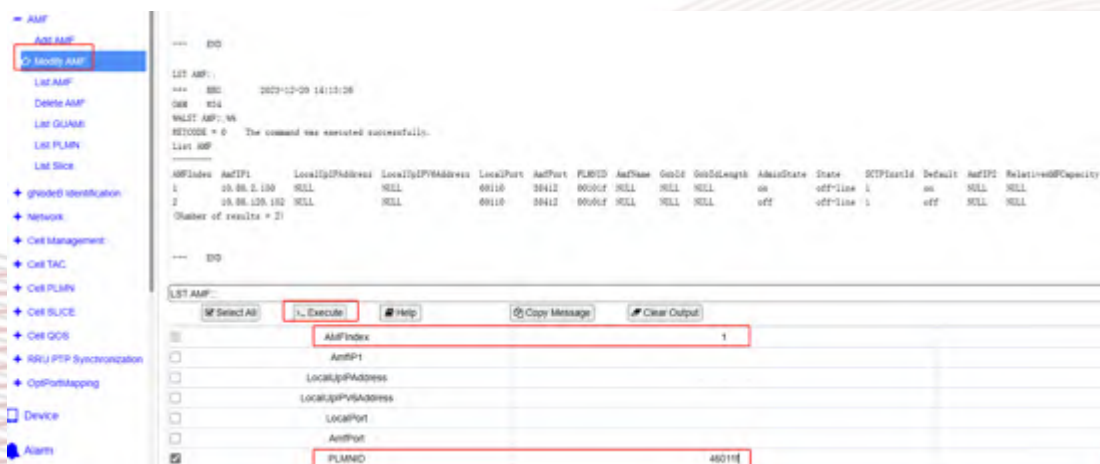
Note: For the initial configuration of the BTS, you can first query the AMF configuration. If the AMF network element is already configured, you can modify the parameters based on the environment needs.

Operation Details

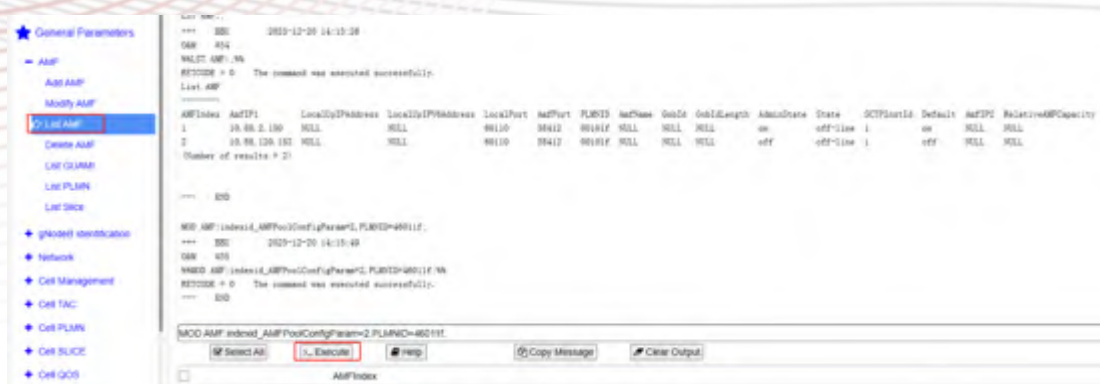
Configure AMF information according to the actual planning under the Node: General Parameters/AMF.

Use Case:

Modify the PLMN information of the first AMF device to 46011f;



Query AMF



Configure PLMN Information

It is used to set the PLMN information of the cell. It supports adding, modifying, querying, and deleting the cell PLMN;

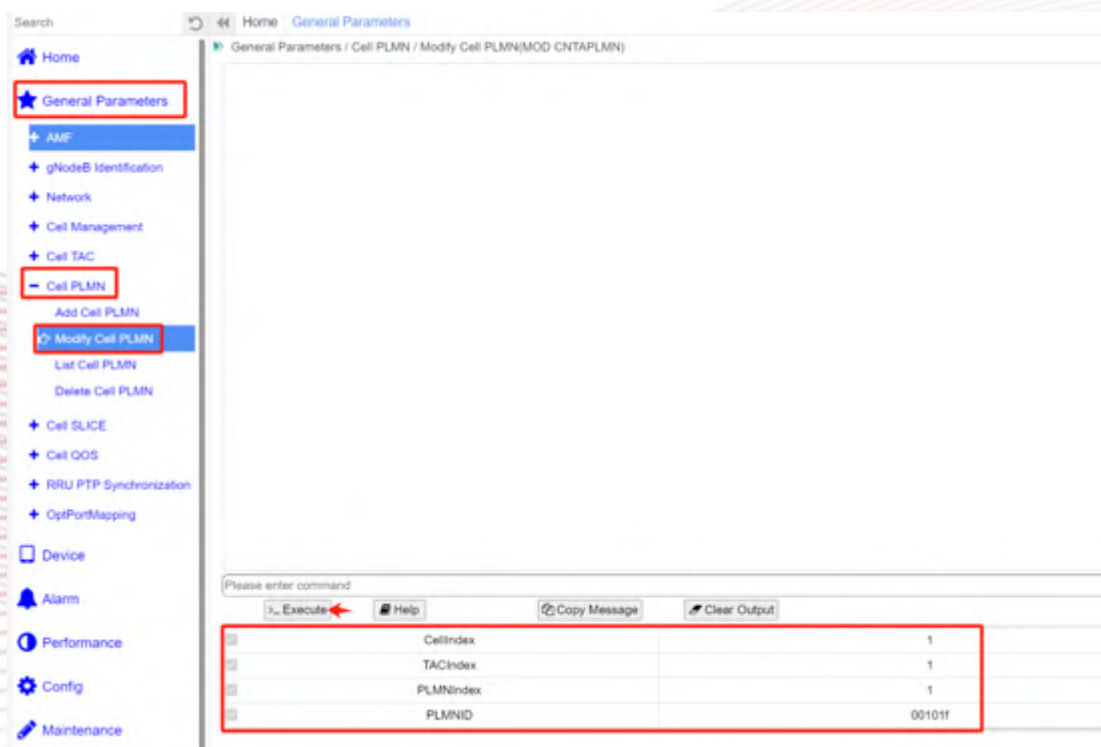
Note: For the initial configuration, you can first query the cell PLMN. The default cell PLMN is 46692. If the PLMN configuration of an existing cell is consistent with the PLMN information, no configuration is required. If the PLMN information is inconsistent, you can modify it based on the actual planning.

Operation details

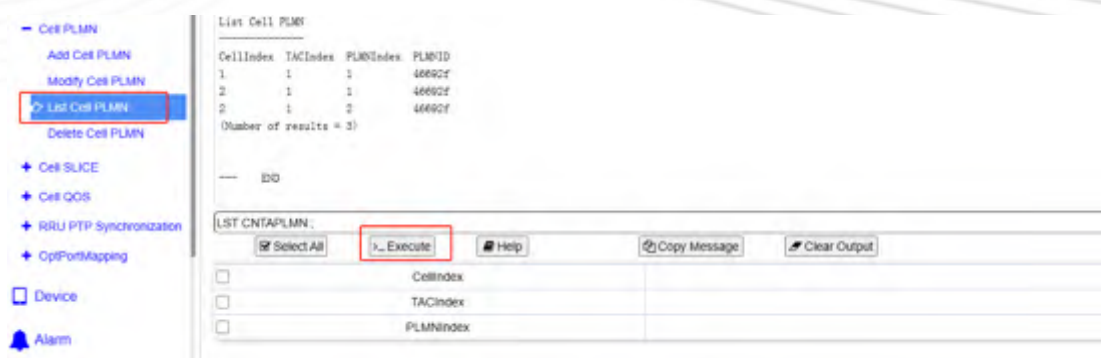
In the node: General Parameters>Cell PLMN, select ADD AMF/Modify AMF/List AMF/Delete AMF according to the configuration requirements, then enter the parameter values to be filled in in the operation box on the right, and finally click "Execute";

Use Case:

Add Cell 1, The TAC index number is 1, and the PLMNID of PLMN index number 1 is 00101f;



Query PLMN of Cell



Configure Base Station Identity

This function is used to configure the parameter of the Base Station ID, and supports modifying and querying the Base Station ID.

Note: For initial configuration, you can first query the identification parameter information of the BTS. If the information is consistent, you do not need to configure it. If the information is inconsistent, you can selectively modify it according to the actual needs.

Operation Details

Configure the Base Station identification parameters in the node: General Parameters>gNodeB Identification;

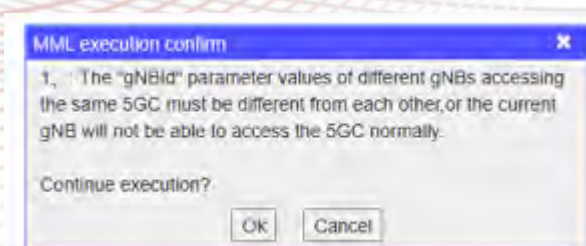
Modifying the Base Station ID is optional;

Use Case:

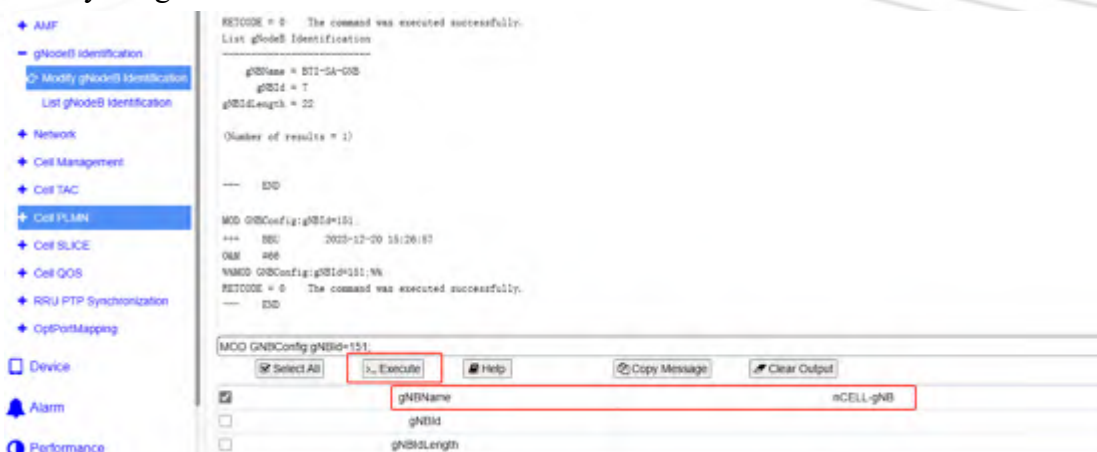
Modify gNBId as151



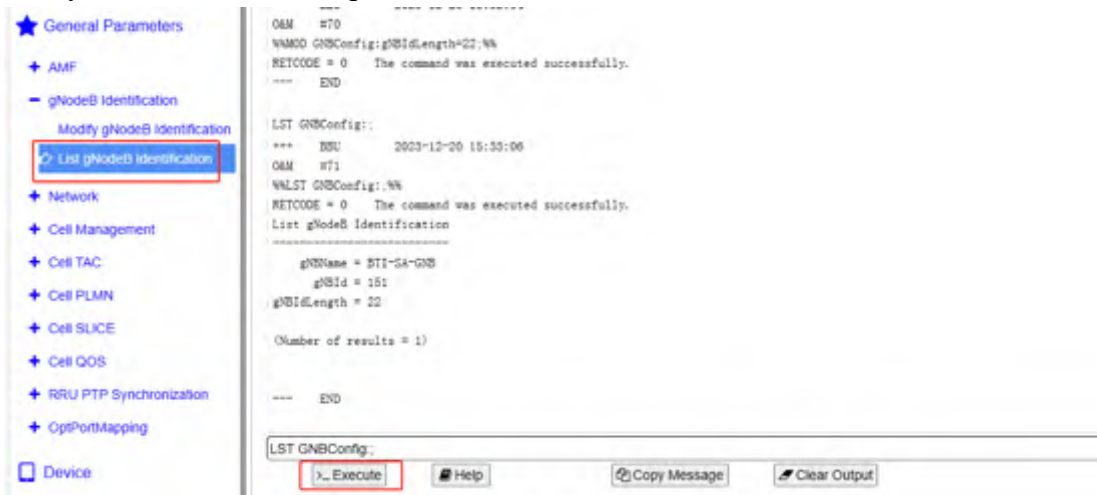
After clicking "Execute", it will prompt "The "gNBId" parameter values of different gNBs accessing the same 5GC must be different from each other, or the current gNB will not be able to access the 5GC normally. Continue execution?" Click "OK" after confirming that there is no conflict with other BTS IDs



Modify the gNB name as: nCELL-gNB



Query the Base Station ID parameter.



! Attentions

The "gNBId" parameter values of different gNBs in the same 5GC must be different, otherwise gNB will not be able to access the 5GC normally.

Configure TAC Information

This function is used to configure TAC information, and supports adding, modifying, querying, and deleting TAC functions;

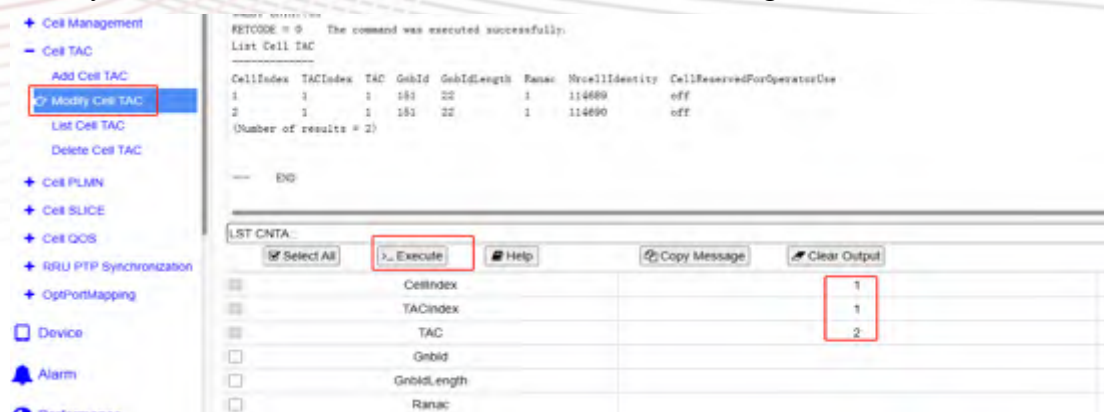
Note: During initial configuration, you can query the TAC first. If the TAC of the existing cell is consistent and the information is consistent, you do not need to configure it. If the information is inconsistent, you can correct it based on the environment configuration.

Operation details

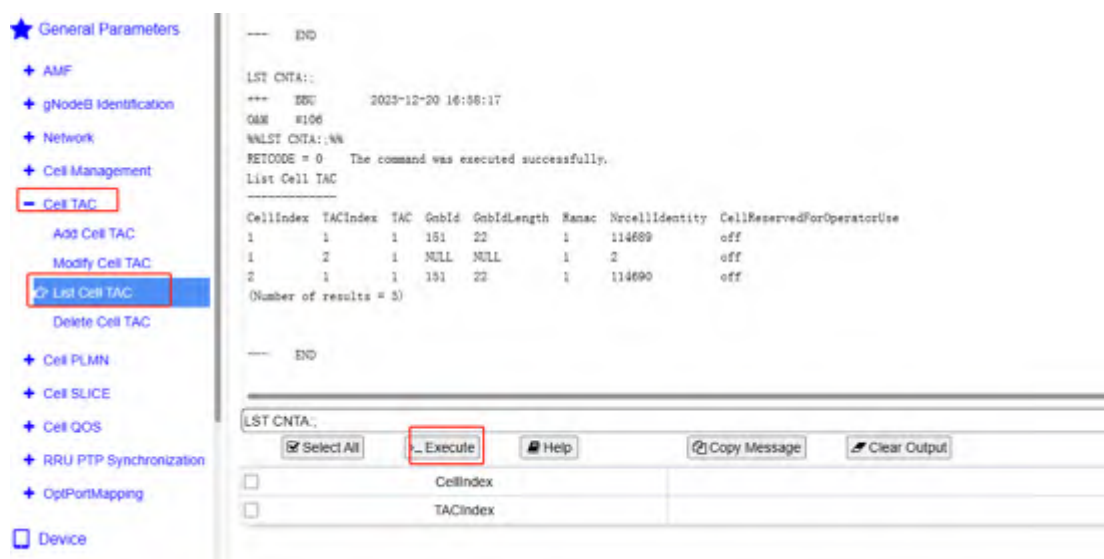
In node: General Parameters ->Cell TAC, you can add, modify, query, and delete cell TACs.

Use Case:

Modify TAC information: cellIndex1, TACIndex1, tracking area code 2;



Query all TAC information as shown below. If need query TAC of a specific cell, need select CellIndex and execute.



6.2.1.5 Configure Radio Data

Configure Cell General Parameter

It's used to configure cell addition, modification, and query; Cell activation number configuration; Modification and query of cell subframe ratio; Modify and query the maximum transmit power of the cell.

Operation details

Configure cell related parameters in the Node: General Parameters>Cell Management.

➤ Modify Cell Configuration

Used to modify cell PCI, frequency point, bandwidth, modulation method and other parameters.

Instruction

- 1) In TDD mode, the value of uplink NRARFCN and downlink NRARFCN must be the same.
- 2) In the cell, the configuration of different band indicators and uplink NRARFCN needs to meet certain constraints. See 3GPP TS 38.101 for details on the use of parameters.

➤ Add Cell Number

The default cell number configuration of the Base Station system is two. D-2187NT supports a maximum of four cells. If the third and fourth cells are needed, add cell configurations under the node: General Parameters/Cell Management/Add CellConfig ;

Instruction

- 1) Executing this command will create CellConfig node and the minimum data of child node.
- 2) After executing this command, use Restart Base Station to trigger the relevant configuration data of CellConfig to take effect.
- 3) Different CPU models support different specifications of CellConfig, including D-2177NT supports a maximum of 2 cells and D-2187NT supports a maximum of 4 cells.

➤ Modify cell active number

The number of active cells needs to be configured according to user requirements.

➤ Modify cell subframe ratio

The following six matching methods are supported Currently:

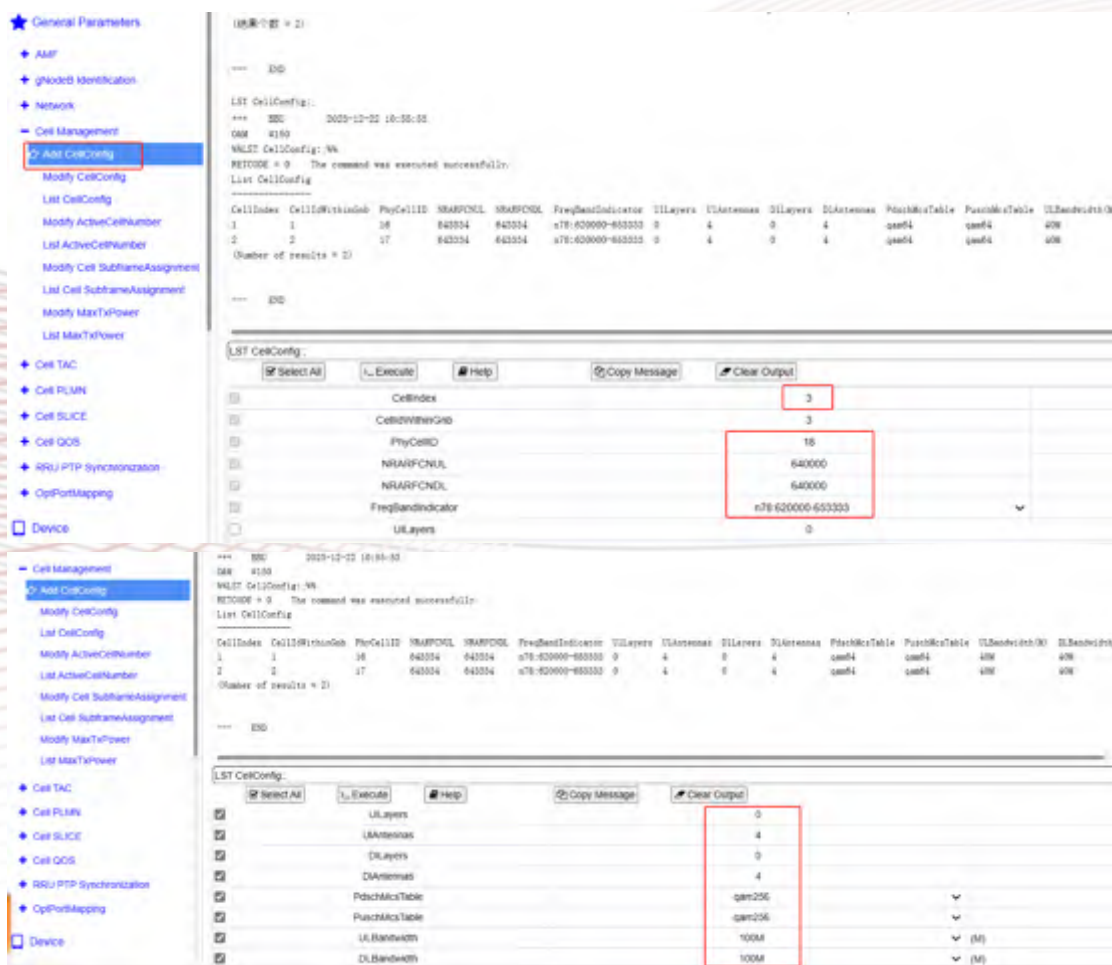
DDDDDDDSUUDDDDDDDDSUU(6:4:4),DDDSUDDDSUDDDSUDDDSU(10:2:2),DDD
SUDDSUUDDDSUDDSUU(10:2:2)&(8:4:2),DDSUUDDSUUDDSUUDDSUU(10:2:2),D
SUUUDSUUUDSUUUDSUUU(10:2:2). Other combination methods are not supported temporarily

➤ Modify cell max transmit power

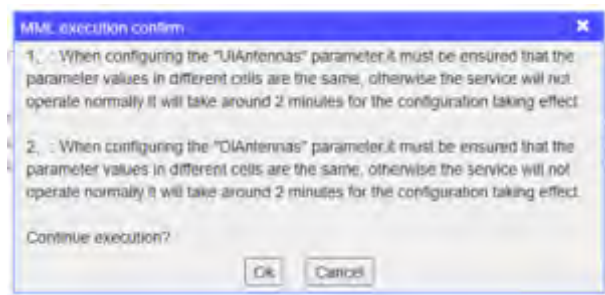
Used to modify the maximum transmit power information of a cell.

Use Case:

1. Add a third cell: the cell ID in the station is 3, PCI 18, and the uplink and downlink center frequency points are 640000, 4T4R, 256QAM, and 100M bandwidth;



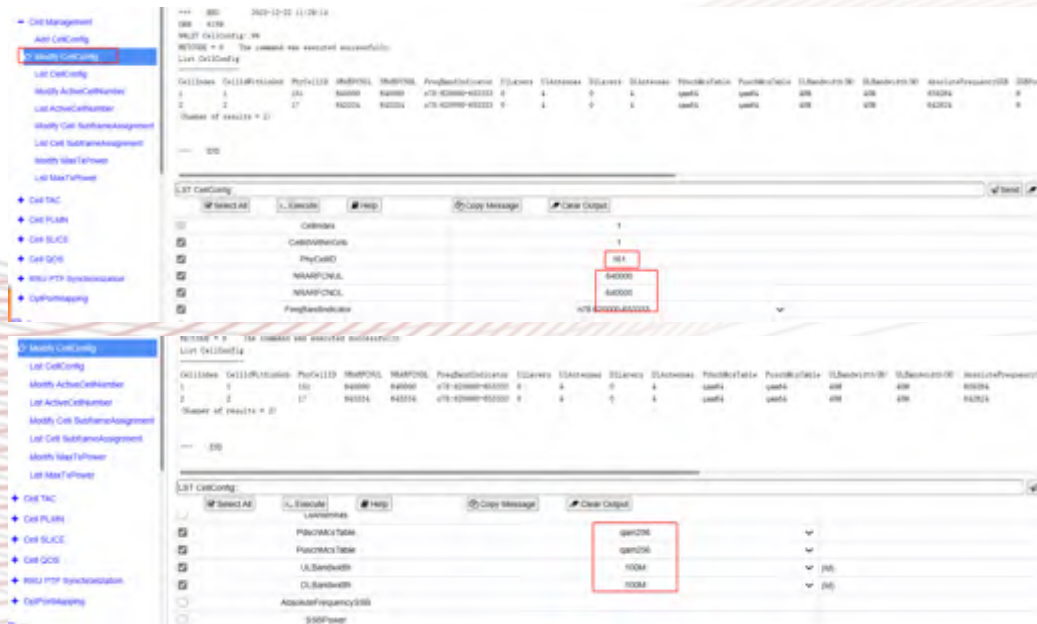
After clicking Execute, the following prompt dialog box will appear. Correct the parameters according to the prompt. Click "OK" after confirming the parameter matching.



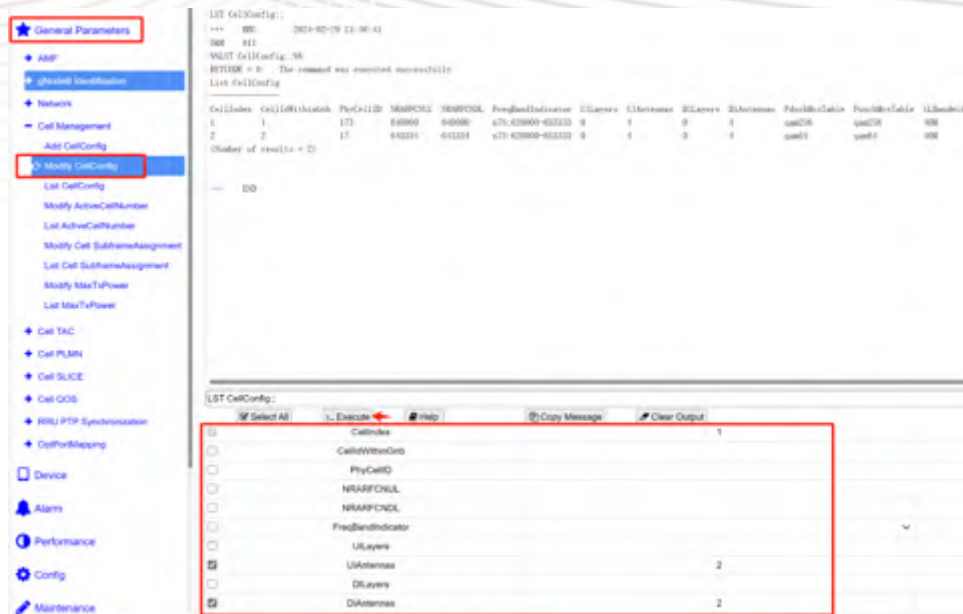
2. Modify the PCI of Cell 1 to 161, the uplink and downlink NRARFCN to 640000, the band indicator to 78, 256QAM, and the bandwidth to 100M;

Instruction

The configuration of uplink and downlink NRARFCN needs to be consistent, and the configuration of band indicator and uplink NRARFCN needs to meet certain constraints, so these two parameters must be modified at the same time.



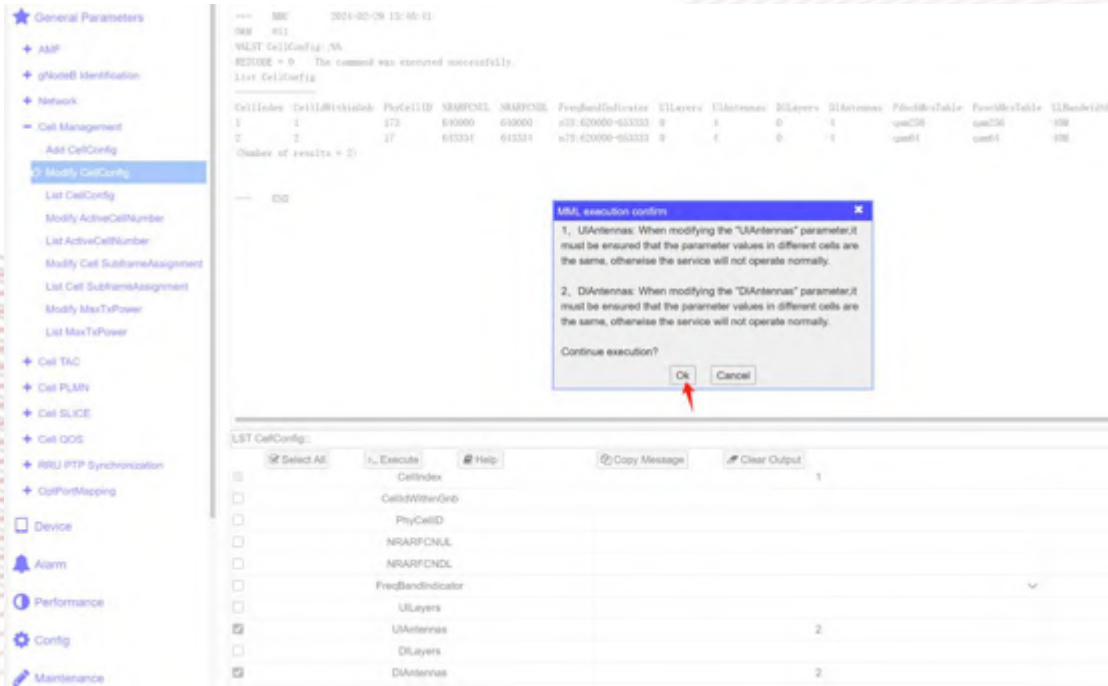
3、Modify cell 1 as 2T2R



The page prompts:

- 1) ul antenna: When modifying the "ul antenna" parameter, it must ensure that the parameter value in different cells are the same, otherwise the service will not operate normally.
- 2) dl antenna: When modifying the "dl antenna" parameter, it must ensure that the parameter value in different cells are the same, otherwise the service will not operate normally.

Continue Execution----- Click OK button



General Parameters

- AMP
- gNodeB Identification
- Network
- Cell Management
- Add CellConfig
- Modify CellConfig
- List CellConfig
- Modify ActiveCellNumber
- List ActiveCellNumber
- Modify Cell SubframeAssignment
- List Cell SubframeAssignment
- Modify MaxTxPower
- List MaxTxPower
- Cell TAC
- Cell PLMN
- Cell SLICE
- Cell QoS
- RRU PTP Synchronization
- CellPortMapping
- Device
- Alarm
- Performance
- Config
- Maintenance

RETUORE = 0 The command was executed successfully.

List CellConfig

CellIndex	CellID@HwIndex	PhyCellID	NRARFCNUL	NRARFCNUL	FreqBandIndicator	ULayers	ULAntennas	DLayers	DLAntennas	PhyCellTable	PhyCellTable	ULBandwidth
1	1	173	640000	640000	n78-620000-653333	0	1	0	1	qmC06	qmC06	100
2	2	17	643334	643334	n78-620000-653333	0	1	0	1	qmC01	qmC01	100

(Number of results = 2)

MOD CellConfig

Select All Execute Help Copy Message Clear Output

CellIndex	CellID@HwIndex	PhyCellID	NRARFCNUL	NRARFCNUL	FreqBandIndicator	ULayers	ULAntennas	DLayers	DLAntennas	PhyCellTable	PhyCellTable	ULBandwidth
1	1	173	640000	640000	n78-620000-653333	0	1	0	1	qmC06	qmC06	100
2	2	17	643334	643334	n78-620000-653333	0	1	0	1	qmC01	qmC01	100

(Number of results = 2)

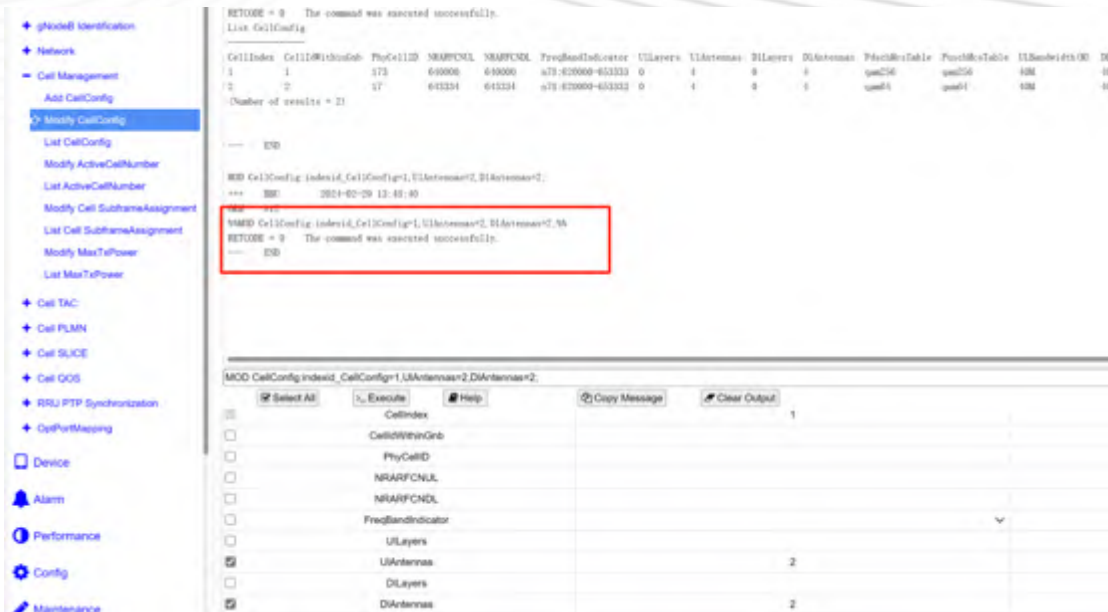
MOD CellConfig indexid_CellConfig=1,ULAntennas=2,DLAntennas=2;

RETUORE = 0 The command was executed successfully.

MOD CellConfig indexid_CellConfig=1,ULAntennas=2,DLAntennas=2,NA

RETUORE = 0 The command was executed successfully.

Modify Successfully.



RETUORE = 0 The command was executed successfully.

List CellConfig

CellIndex	CellID@HwIndex	PhyCellID	NRARFCNUL	NRARFCNUL	FreqBandIndicator	ULayers	ULAntennas	DLayers	DLAntennas	PhyCellTable	PhyCellTable	ULBandwidth
1	1	173	640000	640000	n78-620000-653333	0	1	0	1	qmC06	qmC06	100
2	2	17	643334	643334	n78-620000-653333	0	1	0	1	qmC01	qmC01	100

(Number of results = 2)

MOD CellConfig indexid_CellConfig=1,ULAntennas=2,DLAntennas=2;

RETUORE = 0 The command was executed successfully.

MOD CellConfig indexid_CellConfig=1,ULAntennas=2,DLAntennas=2,NA

RETUORE = 0 The command was executed successfully.

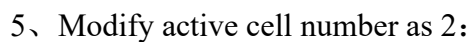
MOD CellConfig indexid_CellConfig=1,ULAntennas=2,DLAntennas=2;

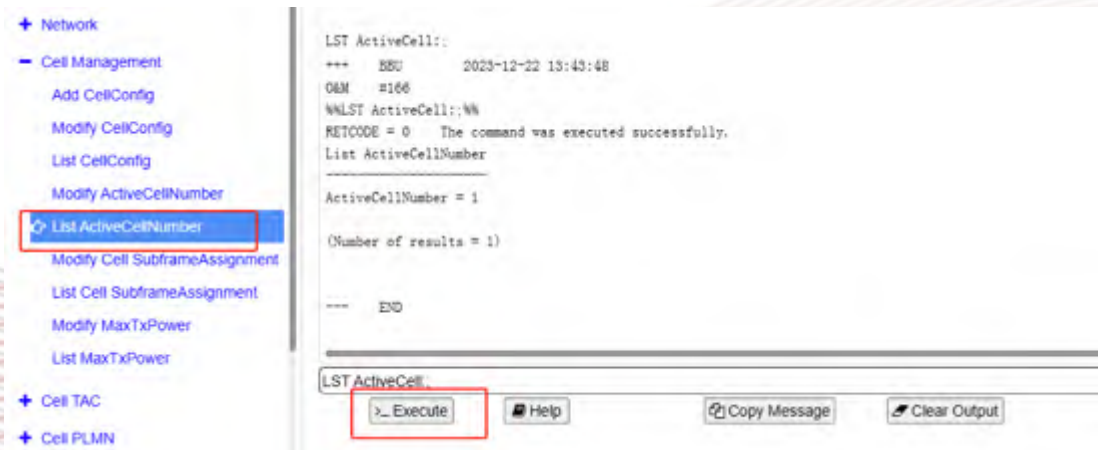
RETUORE = 0 The command was executed successfully.

MOD CellConfig indexid_CellConfig=1,ULAntennas=2,DLAntennas=2;

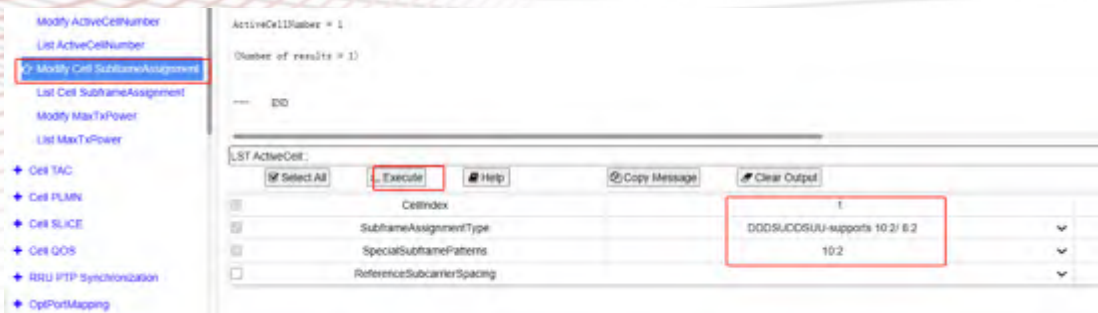
RETUORE = 0 The command was executed successfully.

Note: If the cell is configured as 2T2R, the number of receiving antennas should be changed to 3.

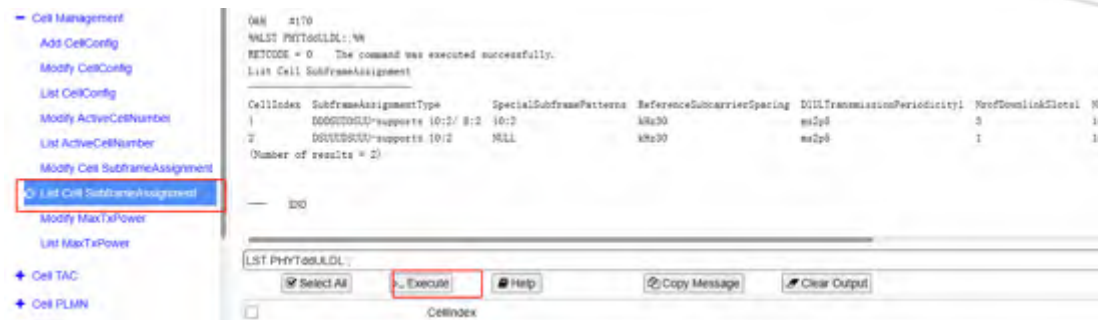




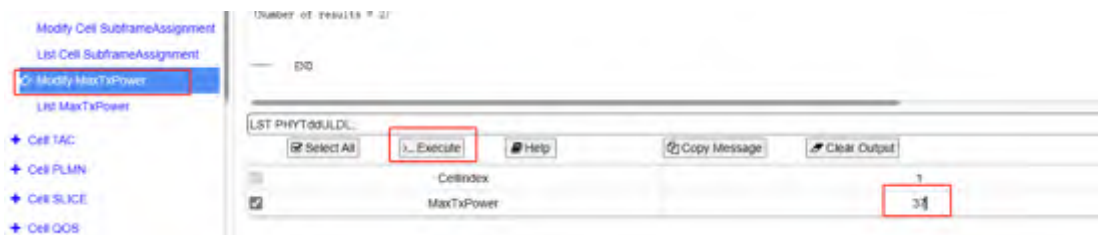
7、Modify the subframe ratio of Cell 1 to 2.5ms dual cycle 3D1U 10:2:2



8、Query cell subframe ratio



9、Modify the maximum transmit power of the cell to 37



10、Query the maximum transmit power of a cell



Instruction

- 1) Executing this command will synchronously update the maximum transmit power of the connected RRUs in the current cell.
- 2) The effective range of RU4460 is 33~46.

Configure Cell Slice

Describes how to configure the cell SLICE parameter. By default, the value of SNSSAI in the cell SLICE is 33554431. The value of this parameter should be consistent with the value of SNSSAI in the core network. Please configure it according to the actual situation.

Operation details

For example, modify the SNSSAI to 16843008 corresponding to Cell 1 which the TAC index is 1, the PLMN index is 1, and the Slice index is 1

The screenshot displays the 'Cell SLICE' configuration interface. On the left, the 'Cell SLICE' menu item is selected, and 'Modify Cell SLICE' is highlighted. The main panel shows the command 'LST CNTAPLMSlice;' and its output, which lists cell parameters including CellIndex, TACIndex, PLMNIndex, SliceIndex, and SNSSAI. Below the command area, there is a table for configuration with a red box highlighting the 'SNSSAI' field set to '16843008'.

CellIndex	TACIndex	PLMNIndex	SliceIndex	SNSSAI
1	1	1	1	33554431
1	1	2	1	33554431
2	1	1	1	33554431
2	1	2	1	33554431

(Number of results = 4)

END

LST CNTAPLMSlice;

Execute Help Copy Message Clear Output

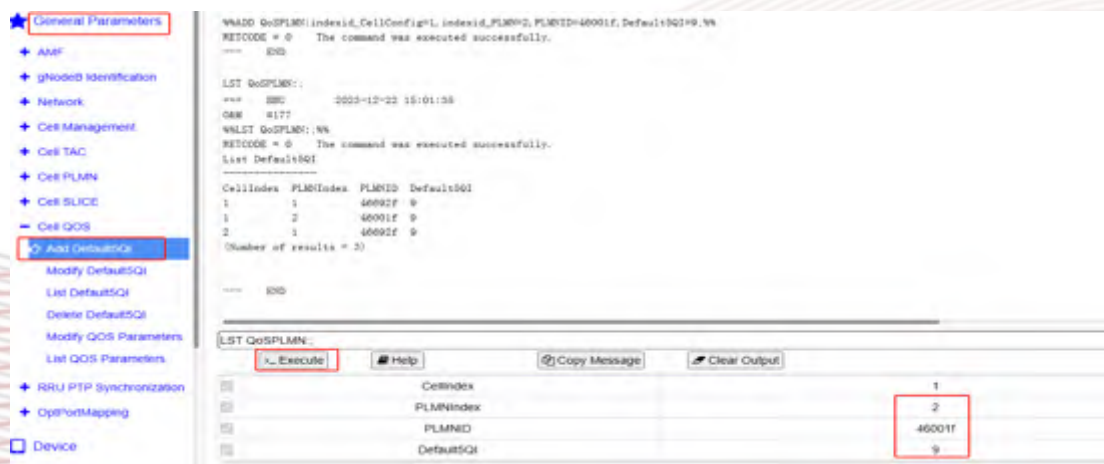
CellIndex	1
TACIndex	1
PLMNIndex	1
SliceIndex	1
SNSSAI	16843008

Configure Cell Qos

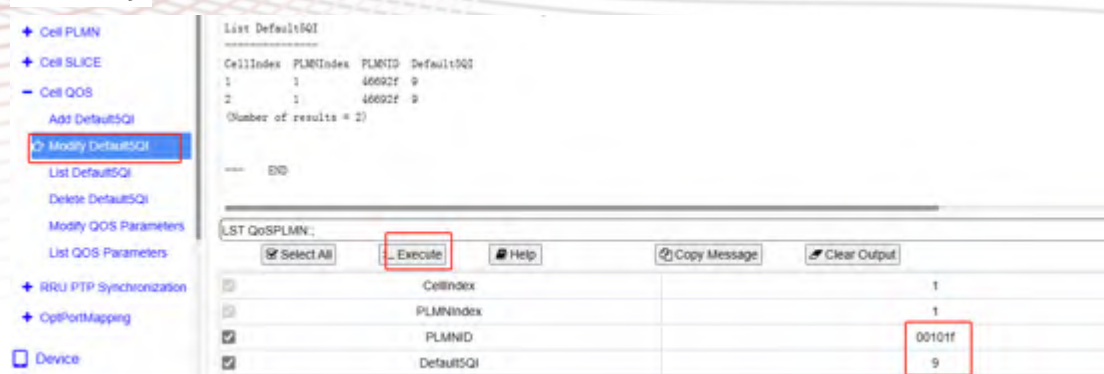
Describes how to configure cell QOS parameters through web interface and MML commands, including adding, modifying, querying, deleting the default 5QI, and modifying and querying QOS parameters;

Use Case:

1. Add PLMN index 2 in cell 1. The PLMNID is 46001f, and the default bearer is 9.



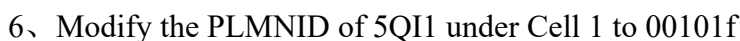
2、Modify Cell 1. The PLMNID under PLMN index number 1 is 00101f, and the default bearer is 9.

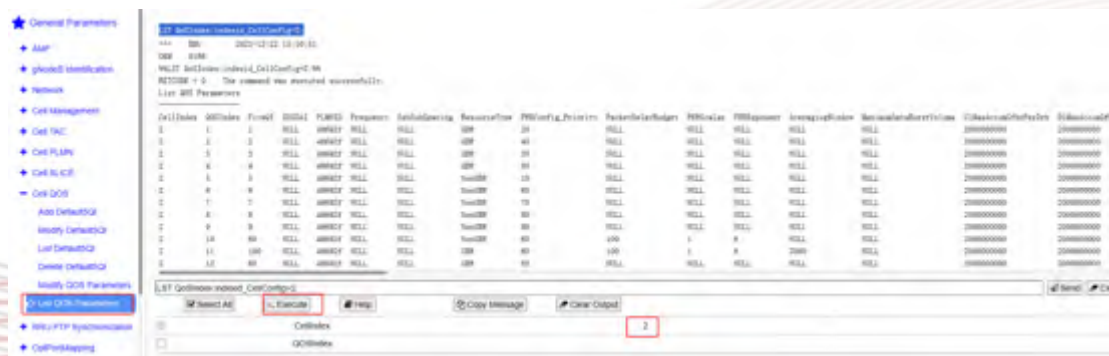


3、Delete the default bearer information ofPLMN Index 2 under Cell 1.



4、Modify Cell 1, QoS index 1, the corresponding SNSSAI of 5QI1 is 16843008.





6.2.1.6 Configure time, clock and PTP parameters

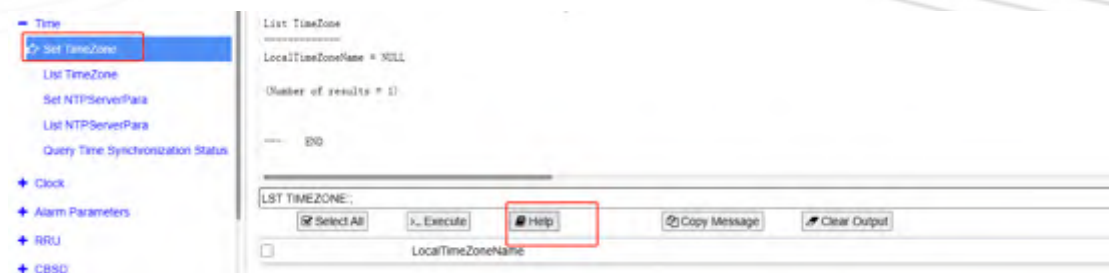
Configure Time

Describes how to set and query the local time zone information of a Base Station.

Operation details

Set and query the local time zone information of the Base Station in the node: Device ->Time.

Set the time zone of the Base Station: Click the "help" button on the right to get help before setting the time zone of the Base Station. View the time zone parameter description and fill format:



Parameter ID	Parameter Name	Parameter Description
		Parameter Description: This parameter indicates the time zone of the current gNodeB. The time zones that can be set include the following list and are case sensitive, the UTC Offset is in brackets.
		Africa/Abidjan (UTC+0)
		Africa/Accra (UTC+0)
		Africa/Addis_Ababa (UTC+3)
		Africa/Algiers (UTC+1)
		Africa/Asmara (UTC+3)
		Africa/Bamako (UTC+0)
		Africa/Bangui (UTC+1)
		Africa/Banjul (UTC+0)
		Africa/Bissau (UTC+0)
		Africa/Blantyre (UTC+2)
		Africa/Brazzaville (UTC+1)
		Africa/Bujumbura (UTC+2)
		Africa/Cairo (UTC+2)
		Africa/Casablanca (UTC+0)
		Africa/Ceuta (UTC+1)
		Africa/Conakry (UTC+0)
		Africa/Dakar (UTC+0)
		Africa/Dar_es_Salaam (UTC+3)
		Africa/Djibouti (UTC+3)
		Africa/Douala (UTC+1)
		Africa/El_Aaiun (UTC+0)
		Africa/Freetown (UTC+0)
		Africa/Gaborone (UTC+2)
		Africa/Harare (UTC+2)
		Africa/Johannesburg (UTC+2)
		Africa/Juba (UTC+3)
		Africa/Kampala (UTC+3)
		Africa/Khartoum (UTC+3)
		Africa/Kigali (UTC+2)
		Africa/Kinshasa (UTC+1)

Instruction

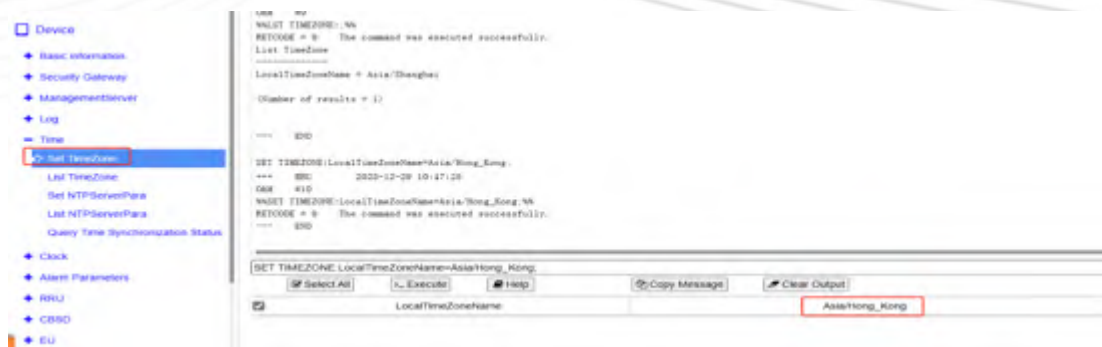
Set the time zone parameters of the base station, it's the time zone offset relative to UTC in parentheses and no need configure.

Use Case:

1、Query the local time zone information of the current Base Station:



2、Set the local time zone of the Base Station as Hong Kong time zone, as follows:



Configure Clock

It supports setting and querying BBU clock synchronization mode and querying GPS information;

Operation details

Proceed Setting and querying BBU clock synchronization mode and query GPS in the node: Device -> clock

Setting the BBU clock synchronization mode: supports 1588_mode, GNSS_mode, and free_run_mode. List the configuration descriptions of these modes as below:

Clock Synchronization Mode	Configuration Description
GNSS_mode	BBU Connects GPS antenna, set GNSS_mode
1588_mode	BBU Connects 1588 clock server, set 1588_mode
free_run_mode	No any clock source, set free-run_mode

Instruction

If the clock mode is configured as 1588_mode, connect to the 1588 clock server through the SFP1 port of the BBU.

Use Case:

1. Query the BBU clock synchronization mode:

Choose “list BBU Clock Synchronization Mode”, and click “Execute”



```
LST FGAFINFO;
+++ BBU 2023-12-29 13:50:47
O&M #17
%%LST FGAFINFO;%%
RETCODE = 0 The command was executed successfully.
List BBU Clock Synchronization Mode
-----
ClockSynMode = GNSS_mode
CurrentClockSynMode = GNSS_mode
ClockSyncStatus = lock

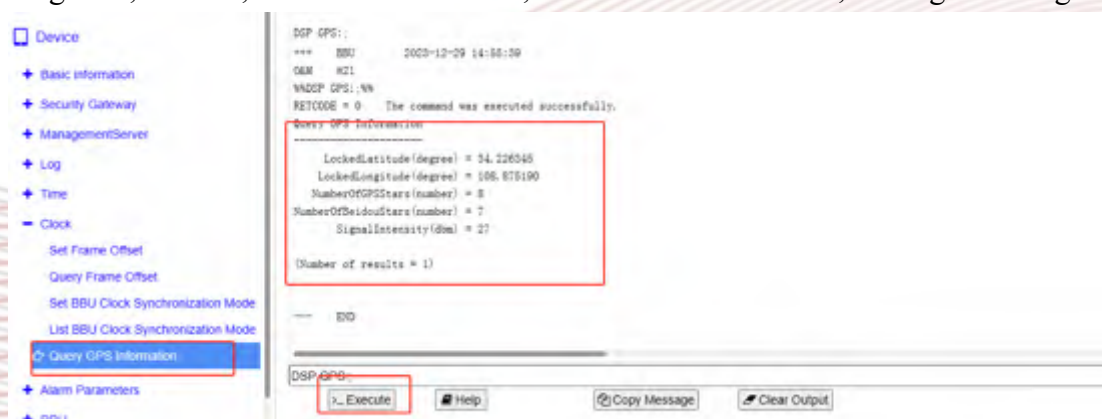
(Number of results = 1)

--- END
```

2、Set BBU clock mode as GNSS_mode;



When the BBU clock mode is GMSS_mode, you can also query the global positioning system: longitude, latitude, number of GPS stars, number of Beidou stars, and signal strength.



Configure RRU PTP Synchronization parameters

When the RRU model is RRU4460, set the PTP synchronization parameters as follows:

Clock class=6,

domain number=24,

UTC offset=37,

Announce interval=8Hz,

sync interval=16Hz,

delay request interval=16Hz,

ETH mode=Multicast.



Instruction

Above is the initial configuration of the Base Station. After all the parameters are configured,

restart the Base Station to make the cell parameter configurations effective.

6.2.1.7 Check Base Station Status

After all the parameters related to commissioning are configured, check the AMF status, clock lock status, current alarm, base station operation time, cell status, UE number, RRU information, RF switch and other information through the webLMT interface.

As shown in the figure below, check the LMT interface home page, status of all the four cells are normal.

The screenshot shows the BTI webLMT interface. The left sidebar contains navigation links: Home, General Parameters, Device, Alarm, Performance, Config, Maintenance, Debug, File, System, Upgrade, and Topology. The main content area displays the following tables:

RunInfo					
AntiRunStatus	CurrentClockSyncMode	ClockSyncStatus	ProcessStatus	currentAlarm	RunTime
normal	GNSS_mode	lock	normal	0	0:23:40:49

CellIndex	RunStatus	CellStatus	SubStatus	Online UE
1	normal	normal	normal	1
2	normal	normal	normal	1
3	normal	normal	normal	1
4	normal	normal	normal	1

RRUDeviceNumber	BBU CPId	CellIndex	RRUInfo	Master Optical Module	Slave Optical Module	RRUWorkFreqRange (MHz)
1	1	1	not in position	in position	in position	3550-3700
2	2	2	not in position	in position	in position	3550-3700
3	3	3	not in position	in position	in position	3550-3700
4	4	4	not in position	in position	in position	3550-3700

RRUDeviceNumber	Channel 1	Channel 2	Channel 3	Channel 4
1	on	on	on	on
2	on	on	on	on
3	on	on	on	on
4	on	on	on	on

RRUDeviceNumber	CHBaseBandPower	Channel 1	Channel 2	Channel 3	Channel 4
1	ULBasebandOutputPower(dBm)	-22	-21	-28	-27
	DLBasebandOutputPower(dBm)	-12	-13	-13	-13
2	ULBasebandOutputPower(dBm)	-23	-11	-22	-29
	DLBasebandOutputPower(dBm)	-11	-13	-13	-14
3	ULBasebandOutputPower(dBm)	-24	-21	-21	-22
	DLBasebandOutputPower(dBm)	-15	-19	-19	-19
4	ULBasebandOutputPower(dBm)	-13	-12	-18	-18
	DLBasebandOutputPower(dBm)	-13	-13	-14	-14

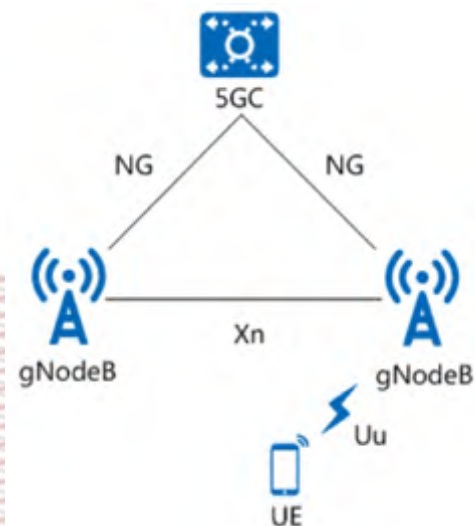
6.2.2 Base station function description and configuration reference

This chapter mainly provides the common functions introduction and parameter configurations of 5G RAN system.

6.2.2.1 Mobility Management

Function introduction

Connected mobility management is commonly referred to as handover. It ensures that UE can continue to receive network services during movement, gNodeB monitors the air interface status, judges and determine the changes to the serving cell.

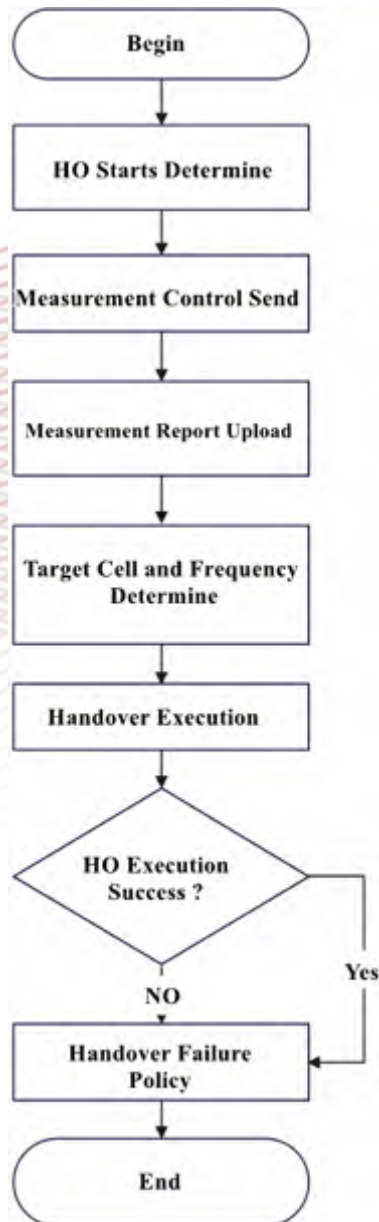


To ensure the mobile performance of UE in different scenarios, 5G networks support multiple types of handover functions. Please refer to the following table for details:

Handover Function	Function Description	Trigger Condition	Execution Condition
Intra Base Station Intra-Frequency HO	The terminal handover between cells of the same base station, and the SSB frequency points of the serving cell and the adjacent cell are the same	1. Configure the relationship between adjacent cells on the same frequency in the station; 2. Set NR measurement startup threshold and start NR measurement; 3. Turn on A3 enable switch;	A3 event received
Intra Base Station Inter-Frequency HO	The terminal handover between cells of the same base station, and the SSB frequencies of the serving cell and the adjacent cell are different	1. Configure the relationship between adjacent cells on the same frequency in the station; 2. Set NR measurement startup threshold and start NR measurement; 3. Add a different frequency measurement configuration 4. Turn on A2 and A5 enable switches 5. Receive A2 event	A5 event received
Inter Base Station Intra-Frequency XN HO	The terminal handover between cells of different base stations through the XN interface, and the SSB frequency points of the serving cell and the adjacent cell are the same, which is only applicable to mobile handovers within the AMF	1. Configure the relationship between adjacent cells on the same frequency between stations 2. The XN interface between the source and target gNB has been established 3. Set NR measurement startup threshold and start NR measurement; 4. Turn on A3 enable switch;	A3 event received

Inter Base Station Inter-Frequency XN HO	The terminal handover between cells of different base stations through the XN interface, and the SSB frequencies of the serving cell and the adjacent cell are different, which is only applicable to mobile handovers within the AMF	1. Configure the relationship between adjacent cells of different frequencies between stations 2. The XN interface between the source and target gNB has been established 3. Set NR measurement startup threshold and start NR measurement; 4. Add a different frequency measurement configuration 5. Turn on A2 and A5 enable switches 6 Receive A2 event	A5 event received
Inter Base Station Intra-Frequency NG HO	The terminal handover between cells of different BTSs through the NG interface, and the SSB frequency points of the serving cell and the adjacent cell are the same	1. Configure the relationship between adjacent cells on the same frequency between stations 2. Set NR measurement startup threshold and start NR measurement; 3. Set to disable the establishment of an XN connection to the cell 4. Turn on A3 enable switch;	A3 event received
Inter Base Station Inter-Frequency NG HO	The terminal handover between cells of different BTSs through the NG interface, and the SSB frequencies of the serving cell and the adjacent cell are different	1. Configure the relationship between adjacent cells of different frequencies between stations 2. The XN interface between the source and target gNB has been established 3. Set NR measurement startup threshold and start NR measurement; 4. Set to disable the establishment of an XN connection to the cell 5. Add a different frequency measurement configuration 6. Turn on A2 and A5 enable switches 7 Receive A2 event	A5 event received

The basic process of handover is shown in the following figure:



a. Handover Function Starts Determine:

Handover function startup decision refers to the process of deciding whether to start the handover function according to the startup conditions of each handover function, which mainly includes the following factors:

- Whether the switch of handover function has been turned on.
- Whether the signal quality of the service cell meets the conditions.

b. Measurement Control Distribution:

Measurement control distribution refers to the process in which gNodeB sends measurement configuration information to UE.

Any of the following scenarios will trigger gNodeB to send measurement configuration information:

- When the UE enters the connection state, gNodeB will send it to the UE through RRCReconfiguration Measurement configuration information.

- If the measurement configuration information is updated after the UE is in the connected state or the handover is completed, gNodeB will also Send updated measurement configuration information to UE through RRCReconfiguration.

Description of this chapter: The measurement control distribution of is triggered by this scenario, the measurement configuration information is configured by gNodeB and sent to UE.

c. Measurement report reporting

After receiving the measurement configuration information sent by gNodeB, the UE executes the measurement as instructed, filters the measured value according to the "filter coefficient", and then judges the event. When the event entry conditions are met, the UE will report the measurement report to gNodeB.

d. Target cell or target frequency point decision

This process mainly includes the following three aspects:

- Processing of measurement report
- Determination of handover strategy
- Generation of target cells or target frequency points

e. Handover execution

After the decision on the target cell or target frequency point list is completed, gNodeB will perform handover according to the selected handover strategy (including handover and redirection).

f. Failure policy

When the handover preparation fails:

If the cell with the best quality fails to be ready for handover, gNodeB is arranged in descending order according to the quality of the cells in the measurement report, instructing the UE to initiate handover attempts one by one to the next cell with the best quality. If handover preparation fails for all cells in the target cell list, wait for the next measurement report

Parameter Configuration Reference

1. Intra-Frequency/inter-Frequency handover in same station

Use Case:

The information of two cell handovers in same station is as follows:

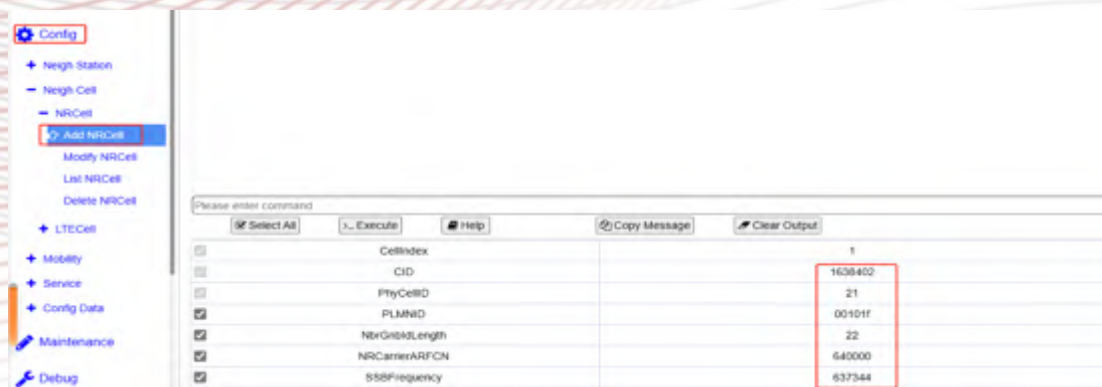
gNB IP: 192.168.5.116; gNB ID: 100		
Cell Config	Cell Index 1	Cell Index 2
PCI	11	21
CID	1638401	1638402
PLMN	00101f	00101f
Intra-Frequency config	ARFCN: 640000	ARFCN: 640000
	SSB Frequency: 637344	SSB Frequency: 637344
	Band Indicator: 78	Band Indicator: 78
Inter-Frequency Config	ARFCN: 643334	ARFCN: 640000
	SSB Frequency: 642624	SSB Frequency: 637344
	Band Indicator: 48	Band Indicator: 78

1) Neighbor Configuration

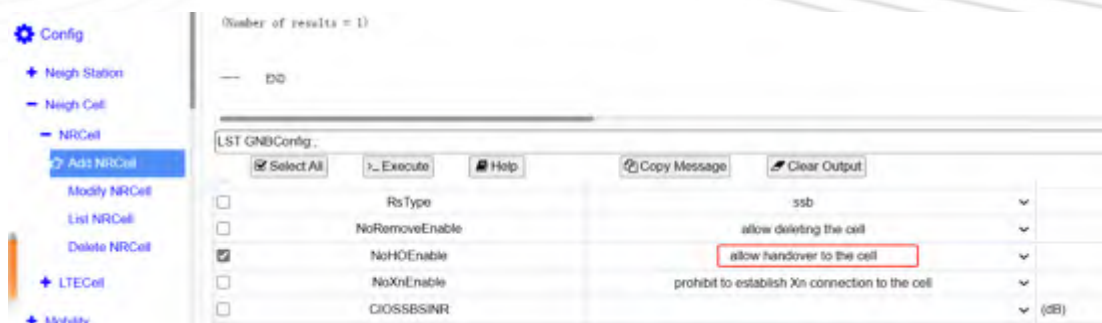
The adjacent cells in station are in the same base station, there is no need to add adjacent stations, only need add adjacent cells to each other.

Add adjacent cells in Node: Config->Neighbor Cell->Add NRCell, and fill in the adjacent cell parameter configuration in the operation column on the right, including: adjacent cell CID, PCI, PLMN, adjacent cell frequency points, etc., as shown in the following figure:

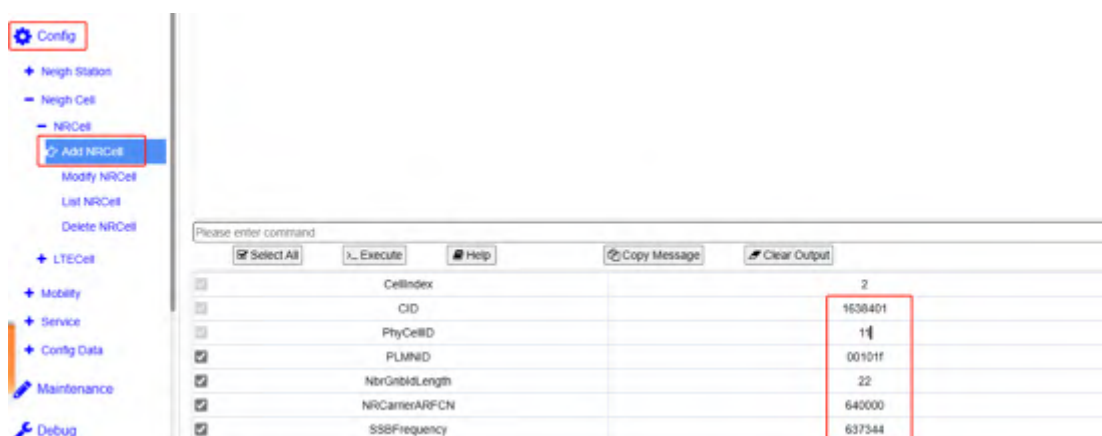
Add adjacent cell2 for Cell1:



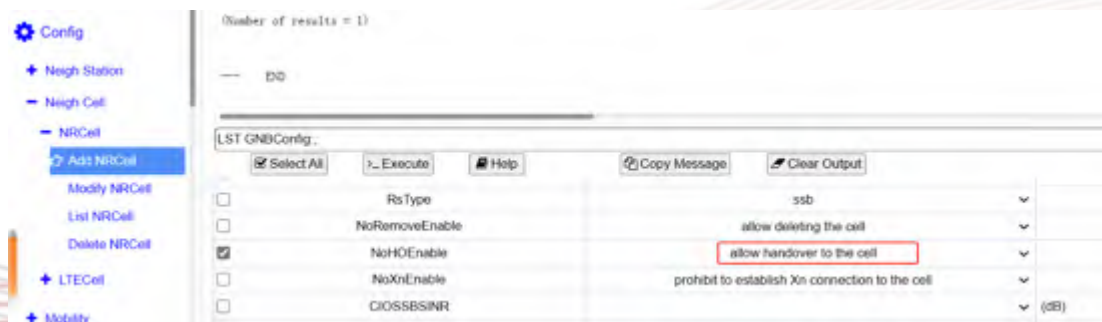
Set the “NoHOEnable” flag to allow handover to the cell



Add adjacent cell1 for Cell2:



Set the “NoHOEnable” flag to allow handover to the cell



Other parameters can use the system default parameters.

The above is an example of adding adjacent cells for intra-frequency. If it is a inter-frequency adjacent cell, need change the cell center frequency point and SSB frequency point to the corresponding configuration when adding adjacent cells. Other operations remain unchanged.

2) Mobility Management Config

➤ Modify NR measurement start threshold

Modify the NR measurement start threshold at the Node:

Config→Mobility→MeasureCtrl→Modify MeasureCtrl

The default threshold of NR measurement startup is 8, which means that when the level is less than $8-156=-148\text{dBm}$, NR measurement startup is enabled;

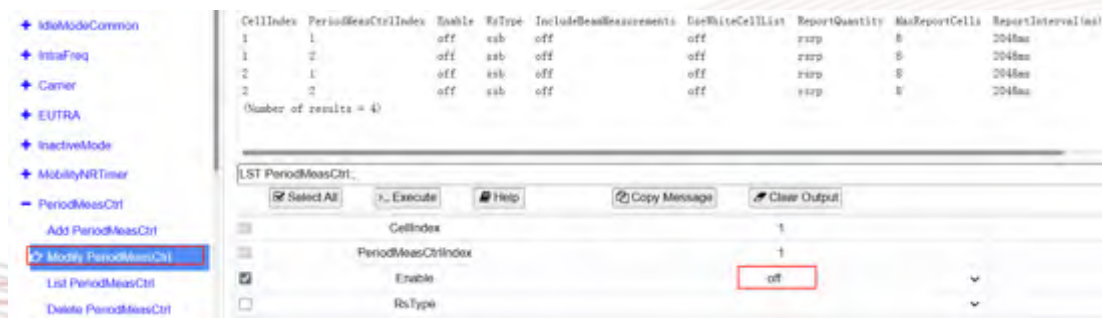
Set it to 0 which means close the threshold and make it start NR measurement all the time.



➤ Modify periodic measurement config

Modify the NR periodic measurement enable switch at node:

Config→Mobility→PeriodMeasCtrl→Modify PeriodMeasCtrl. Turning off the switch is to make it measure all the time instead of periodically.

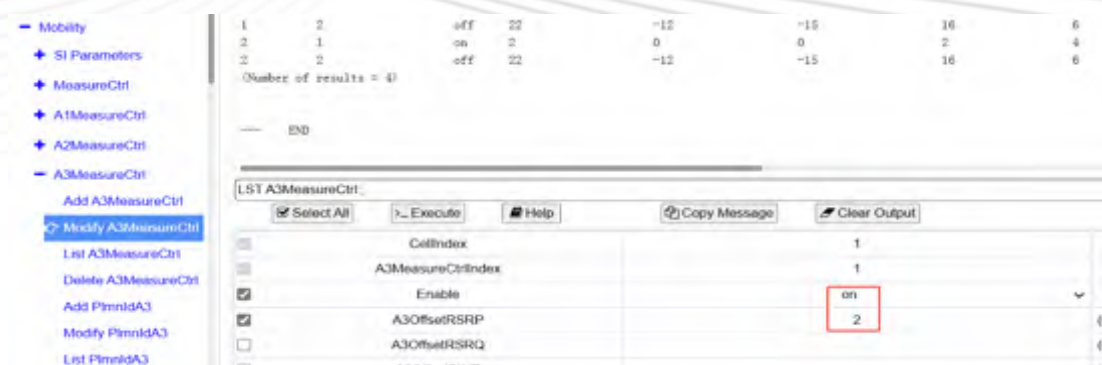


➤ Intra-frequency HO parameter config:

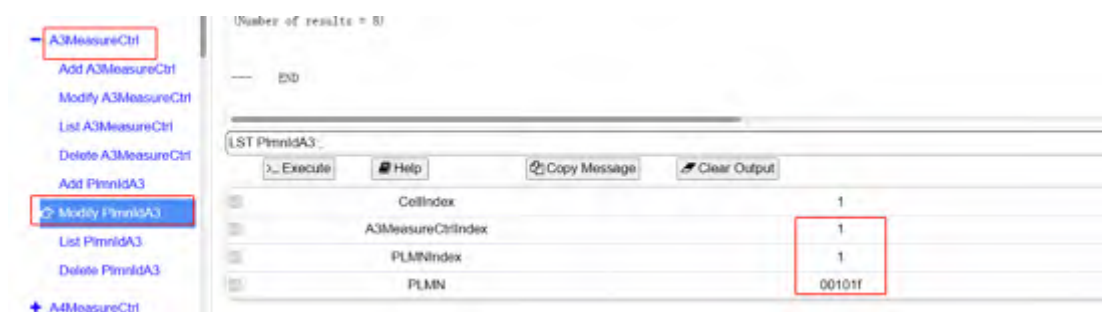
① Enable A3 Measurement

Modify A3 measurement configuration at node: Config→Mobility→A3MeasureCtrl.

Modify “A3offsetRSRP” to 2, which is the relative threshold value of triggering conditions of RSRP for A3 events. The actual value=field value * 0.5 dB. When this threshold is reached, handover will trigger, and the enable switch is set to “ON”.



Modify PLMN for A3 events

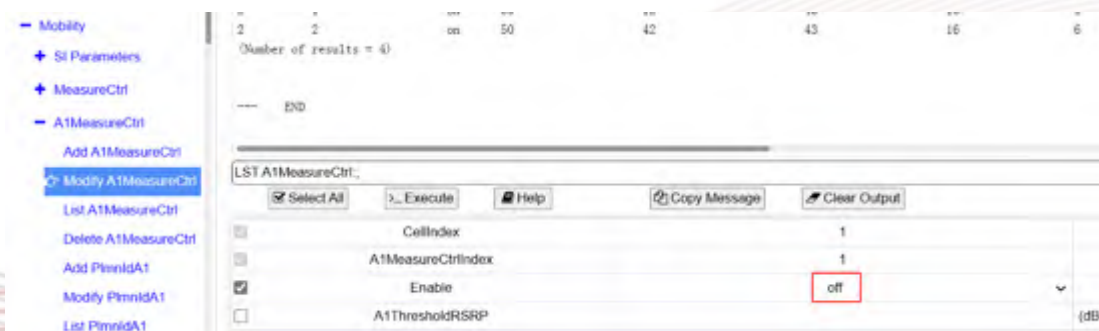


➤ Inter-frequency HO parameter Config:

① A1 Measurement Config

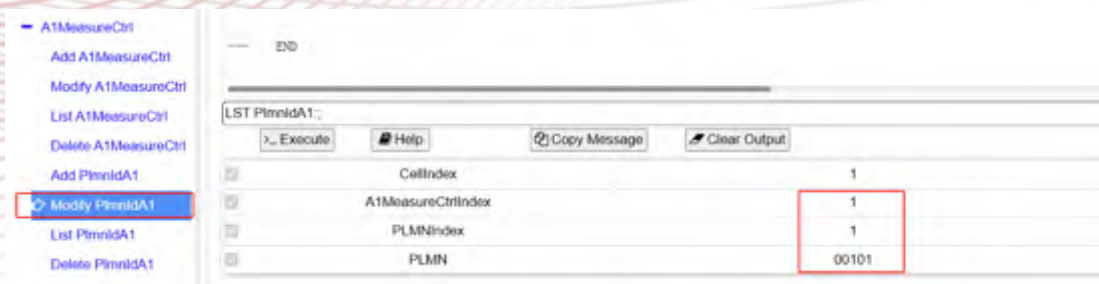
Configure A1 event measurement at node: Config→Mobility→A1MeasureCtrl.

When the enable switch is set to off, A1 event measurement is not enabled.



Or set the A1ThresholdRSRP event to an appropriate value, such as 90, that is, when the RSRP is better than $90-156=-66$ dbm, stop the inter-frequency measurement;

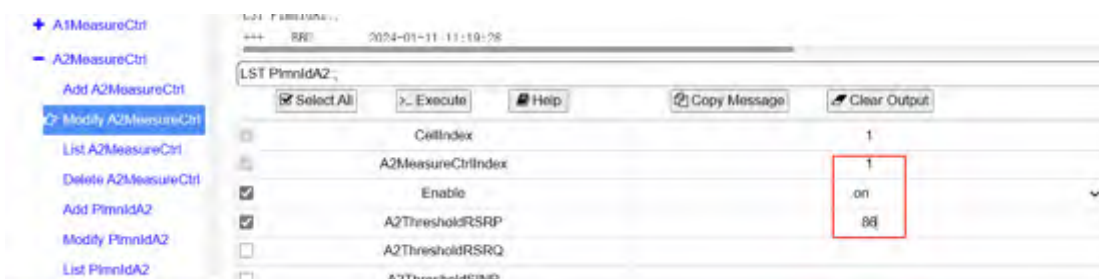
Modify A1 PLMN



② A2 Measurement Config

Configure A2 event measurement at node:Config→Mobility→A2MeasureCtrl.

Modify the A2ThresholdRSRP event to an appropriate value, such as 86, A2 is the threshold for starting measurement, which means that when the RSRP of the cell is worse than $86-156=-70$ dBm, start the measurement.



Configure PLMN for A2 events

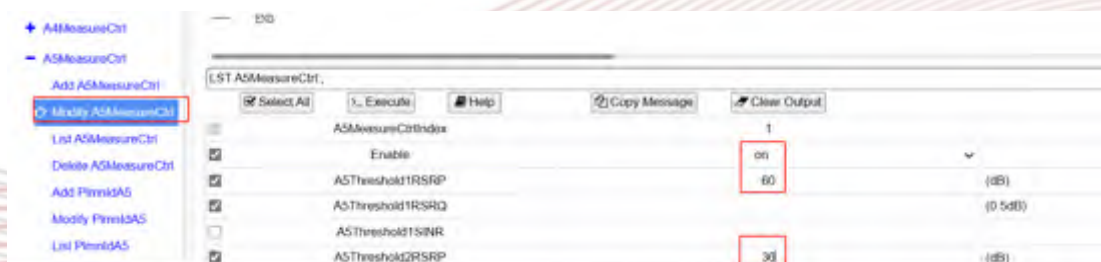


③ A5 Measurement Config

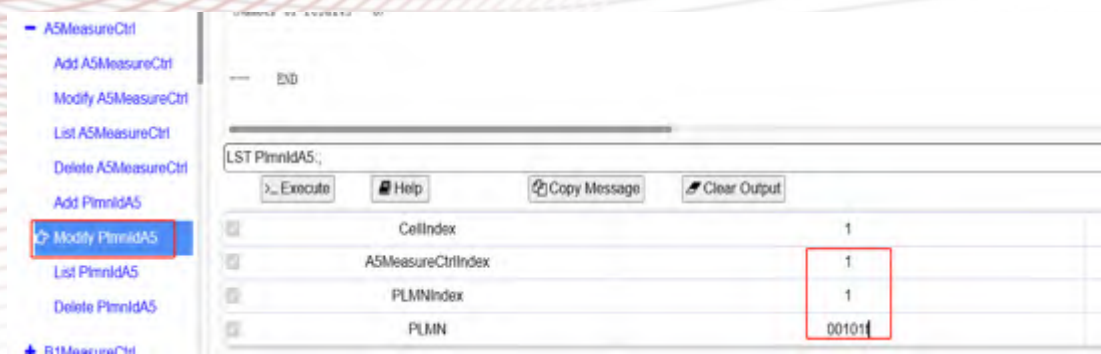
Configure A5 event measurement at node:Config→Mobility→A5MeasureCtrl.

Modify A5Threshold1RSRP as 60, and A5Threshold2RSRP as 36, it means that when the

RSRP of the source cell is worse than $60-156=-96$ dBm and the RSRP of the target cell is better than $36-156=-120$ dBm, it will trigger A5 event.

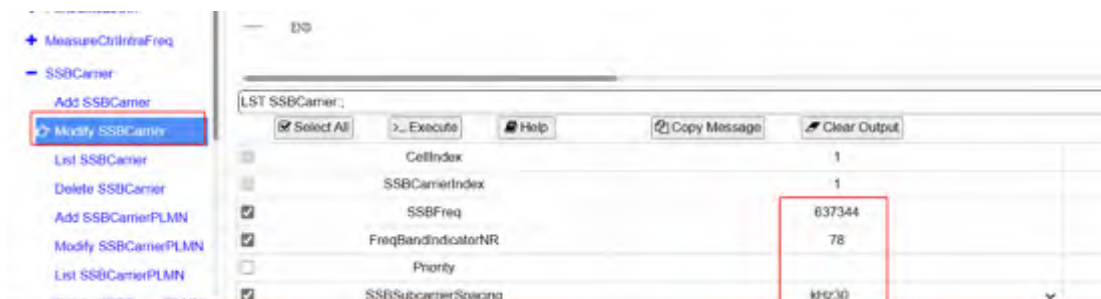


Modify PLMN of A5 event

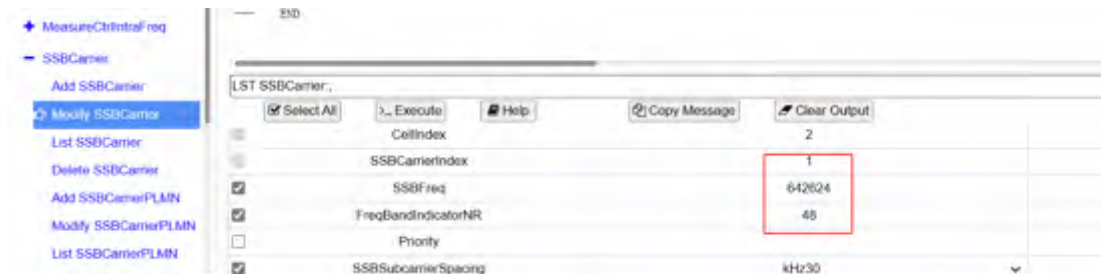


④ Modify the config of Inter-Frequency measurement

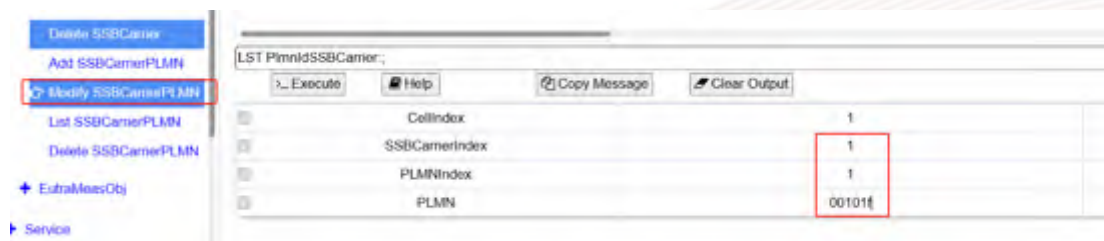
Modify the config of inter-frequency measurement at node: Config→Mobility→SSBCarrier.
Cell 1 adds the SSB frequency point of Cell 2.



Cell 2 adds the SSB frequency point of Cell 1.



Modify PLMN of inter-frequency point:



2. Intra-Frequency/Inter-Frequency Handover between different station

The information of two cell handovers between stations is as follows:

Parameter	Cell 1	Cell 2
Base Station ID	100	122
PCI	11	172
CGI	1638401	1998849
PLMN	00101f	00101f
Intra-Frequency Config	ARFCN: 640000 SSB Frequency: 637344 Band Indicator: 78	ARFCN: 640000 SSB Frequency: 637344 Band Indicator: 78
Inter-Frequency Config	ARFCN: 643334 SSB Frequency: 642624 Band Indicator: 48	ARFCN: 640000 SSB Frequency: 637344 Band Indicator: 78
Local server ip	10.88.2.116	10.88.2.122

Inter station handover includes XN handover and NG handover. If it's XN handover, both source and target gNB need configure XN parameter. NG handovers do not need configure. XN parameter configurations are as follows:

1) Configure XN local address

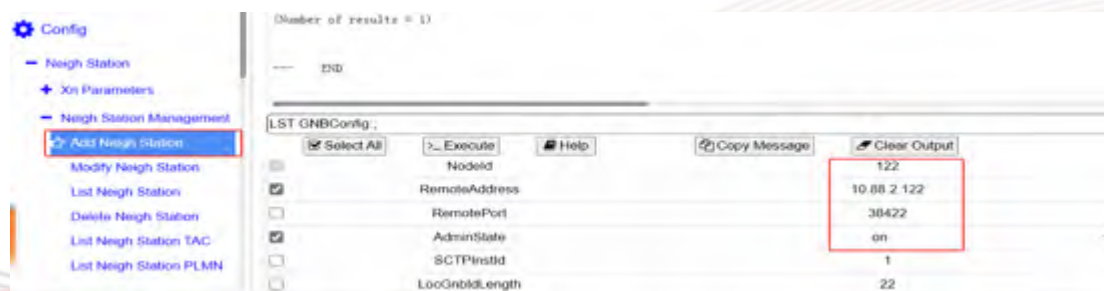
Modify XN parameter at node: Config->Neigh Station->Xn Parameters.

LocalServerIp refers to the control plane interface IP of the target base station, that is the N2 interface IP.



2) Add Neighbor Station

Add neighbor station configuration at node: Config->Neigh Station->Neigh Station Management, Fill in the following parameters. Other parameters are default. RemoteAddress is the IP address of the control plane interface of the adjacent station.



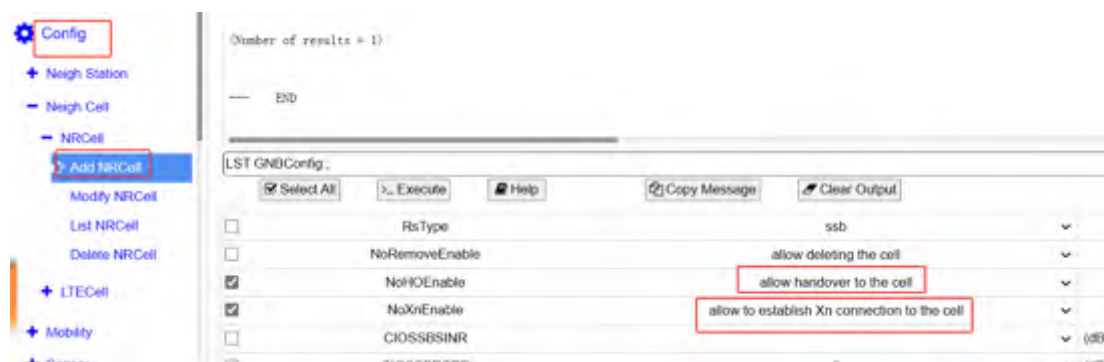
3) Add cell of adjacent station

Add corresponding parameters according to the cells of adjacent base station include: adjacent cell CID, PCI, PLMN, frequency, etc.



Set the “NoHoEnable” flag to allow handover to the cell,

If it is an XN handover, set the “NoXnEnableb” flag to “allow to establish XN connection to the cell”.



Instruction

Please click the "help" button on the right side of "Execute" to get help for detailed information of each parameter.

6.2.2.2 Cell QoS

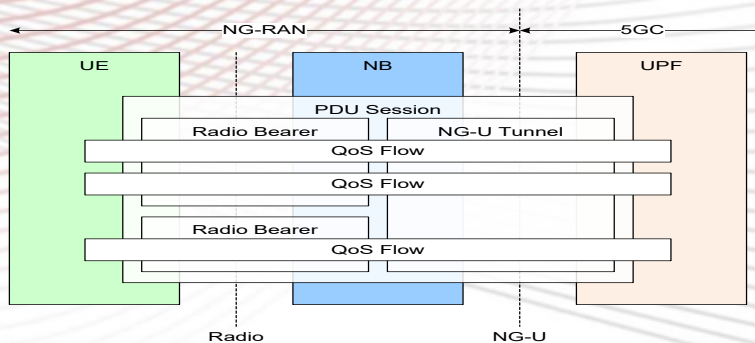
Function Introduction

QoS is a quality of service (QoS) model based on QoS flow in 5G networks, which supports GBR QoS Flow and Non GBR QoS Flow. In the NAS layer, QoS flow is the most fine-grained QoS differentiation in a PDU session. In the PDU session, the QoS flow is identified by the QFI,

and the value is 0~63, which is unique within a PDU session.

The QoS architecture of NG-RAN is shown in Figure 11.5.2-1:

- ✓ For each UE, 5GC establishes one or more PDU sessions;
- ✓ For a PDU session of each UE, NG-RAN can establish at least one DRB, and then can establish additional multiple DRBs (associated with the PDU session). Each DRB corresponds to one or more QoS streams;
- ✓ The NAS level packet filter of UE and 5GC maps UL and DL packets to different QoS streams respectively;
- ✓ DRBThe AS level mapping rule of UE and NG-RAN maps UL and DL QoS flows to different DRBs respectively;



NG-RAN and 5GC ensure QoS by mapping packets to appropriate QoS flows and DRBs, including two steps: IP flow to QoS flow mapping (completed by NAS layer) and QoS flow to DRB mapping (completed by AS layer).

Parameter Configuration Reference

The cell QOS parameter configuration includes two parts:

one is the default 5QI configuration;

the other is the QOS parameter configuration: Configure QOS parameters at General Parameters>Cell QOS;

1. Default 5QI configuration

Support adding, modifying, querying and deleting

Add a default 5QI: only one default 5QI can be added for a cell and a PLMN,

General Parameters

- AMF
- gNodeB Identification
- Network
- Cell Management
- Cell TAC
- Cell PLMN
- Cell SLICE
- Cell QOS
 - Add Default5QI**
 - Modify Default5QI
 - List Default5QI
 - Delete Default5QI
 - Modify QOS Parameters
 - List QOS Parameters
- RRU PTP Synchronization

LST QoSPLMN:
 +++ BBU 2024-01-11 10:38:03
 OAM #7
 NALST QoSPLMN: %
 RETCODE = 0 The command was executed successfully.
 List Default5QI

CellIndex	PLMNIndex	PLMNI	Default5QI
1	1	00101f	9
1	2	00101f	6
2	1	00101f	9

(Number of results = 3)

END

LST QoSPLMN:
 [Execute] [Help] [Copy Message] [Clear Output]

CellIndex	PLMNIndex	PLMNI	Default5QI
1	2	00101f	6

Modify Default 5QI

Cell QOS

- Add Default5QI
- Modify Default5QI**
- List Default5QI
- Delete Default5QI
- Modify QOS Parameters
- List QOS Parameters

LST CellConfig:
 [Select All] [Execute] [Help] [Copy Message] [Clear Output]

CellIndex	PLMNIndex	PLMNI	Default5QI
1	1	00101f	9

Delete Default 5QI:

Cell QOS

- Add Default5QI
- Modify Default5QI
- List Default5QI
- Delete Default5QI**
- Modify QOS Parameters
- List QOS Parameters

LST QoSPLMN:
 [Execute] [Help] [Copy Message] [Clear Output]

CellIndex	PLMNIndex
1	2

Query Default 5QI

Cell QOS

- Add Default5QI
- Modify Default5QI
- List Default5QI**
- Delete Default5QI
- Modify QOS Parameters
- List QOS Parameters

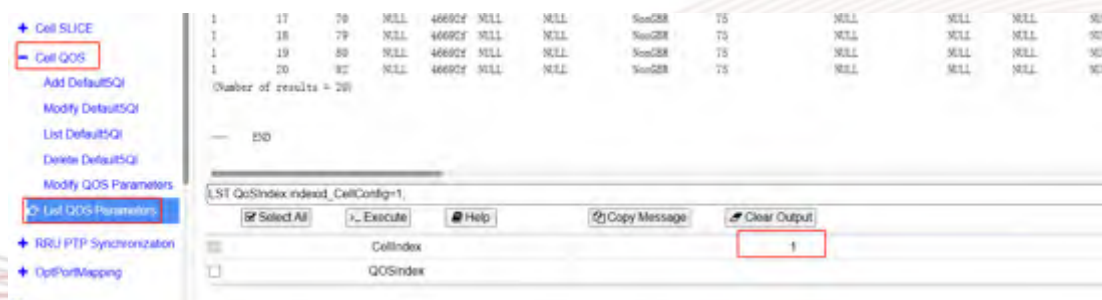
LST QoSPLMN:
 [Select All] [Execute] [Help] [Copy Message] [Clear Output]

CellIndex	PLMNIndex
1	2

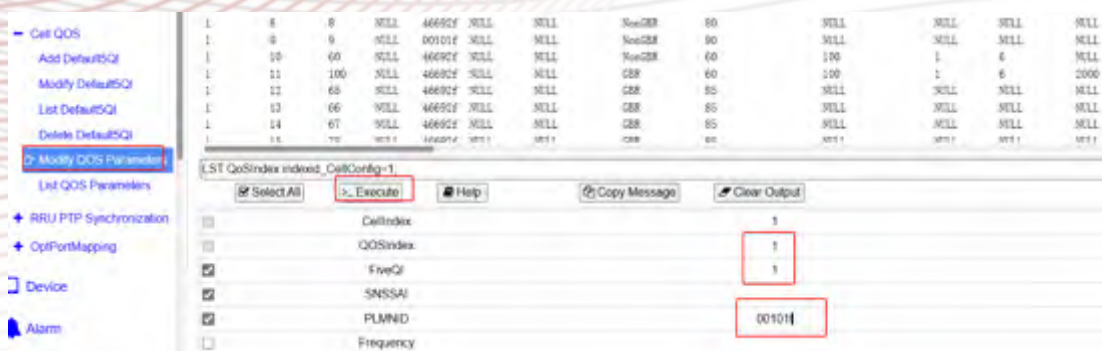
2. QOS Parameter Configuration

Support modifying and querying QOS parameters

Querying QOS parameters: Enter the cell ID and click “Execute”.



Select Modify QoS Parameters, and fill in the 5QI and QoS parameter values to be modified in the operation column on the right.



6.2.2.3 NMS Connection

Function introduction

NMS network management is a management system for base station equipment. Users can implement basic data configuration, monitoring and control, performance statistics, and other functions by logging into the network management.

Parameter Configuration Reference

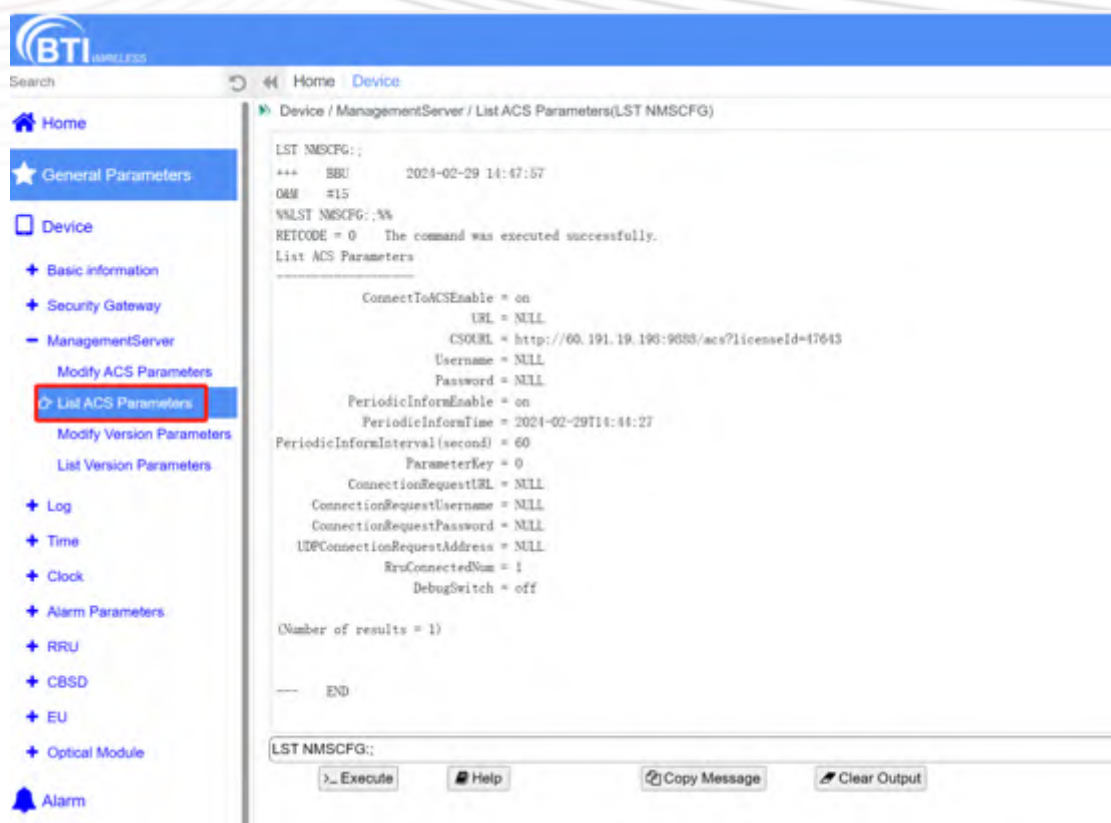
1、 Network Management Parameter Configuration in BBU:

Modify parameter at node: Device / ManagementServer / Modify ACS Parameters:

- 1) ConnectToAcsEnable: “on” indicates enable NMS connection
- 2) URL: fill in the correct URL address of local NMS server, make sure IP connectivity ok
- 3) CSOURL: fill in the correct URL address of cloud NMS server, make sure IP connectivity ok
- 4) PeriodicInformEnable: “on” indicates enable heartbeat notification
- 5) PeriodicInformTime: fill the start time of heartbeat notification
- 6) PeriodicInformInterval: Heartbeat notification cycle, default value is 60 seconds, fill in according to actual needs.



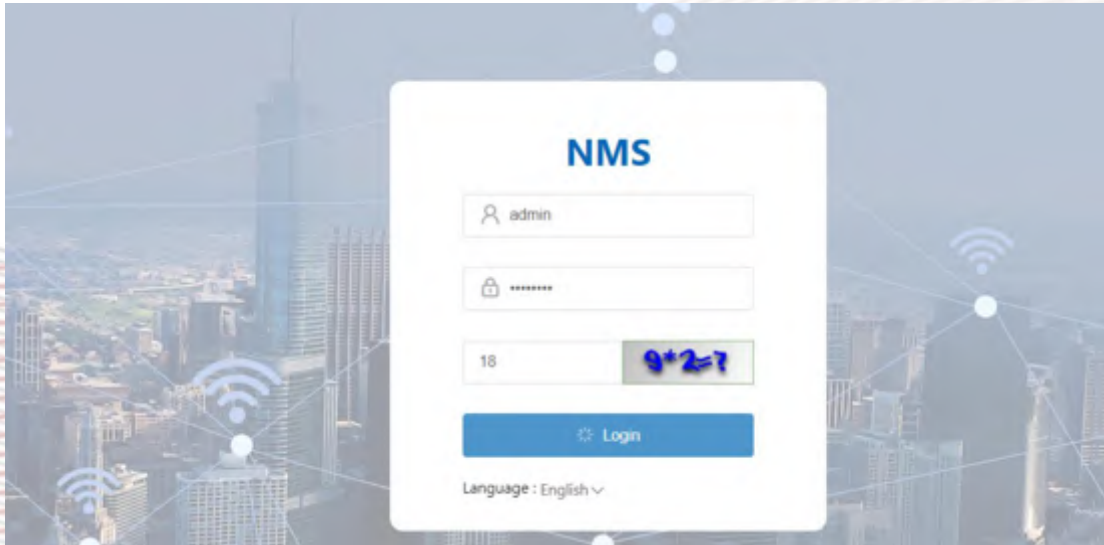
Query Parameters of NMS in BBU



2、Login WEB of NMS

1) Login NMS

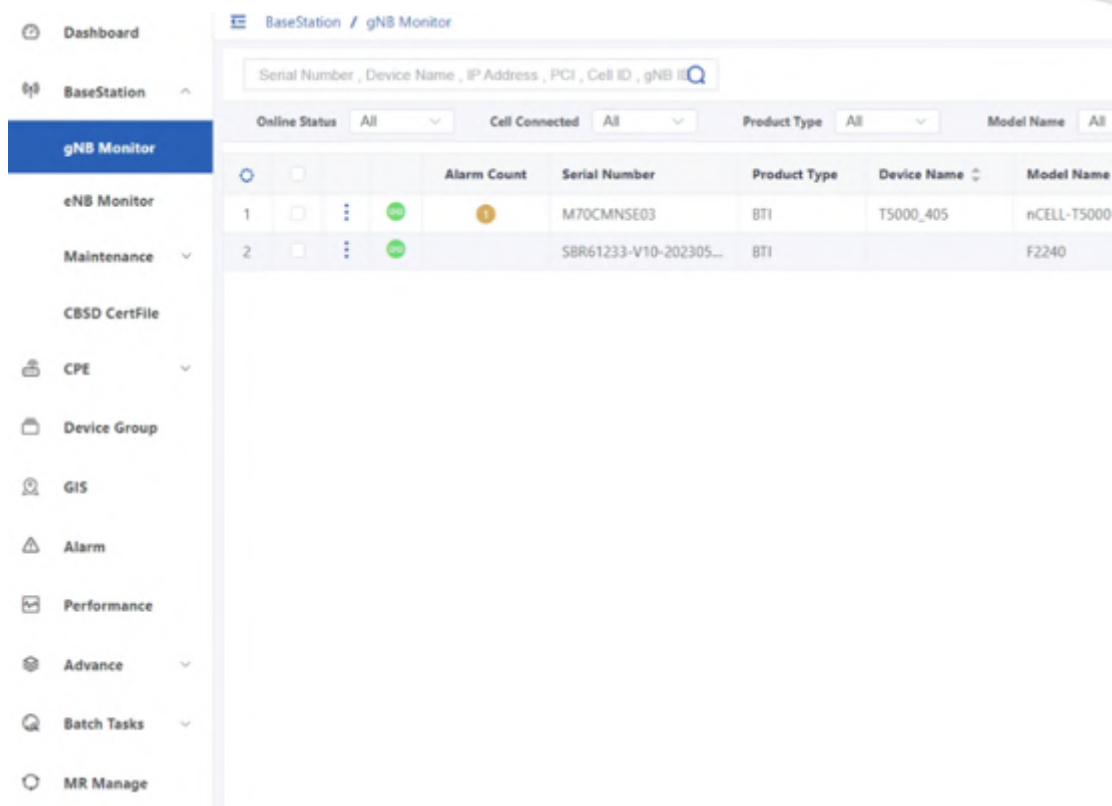
Enter the network management IP address using a web browser and enter the following network management login interface



Enter user username and password, click “Login” to login to the network management homepage.

1) View the status of base station equipment

Click on Device Management ->Base Station Monitor to filter base station devices according to different conditions. A green status light indicates that the base station device is currently connected to the network management normally, and a red status light indicates that the base station device is currently disconnected from the network management.

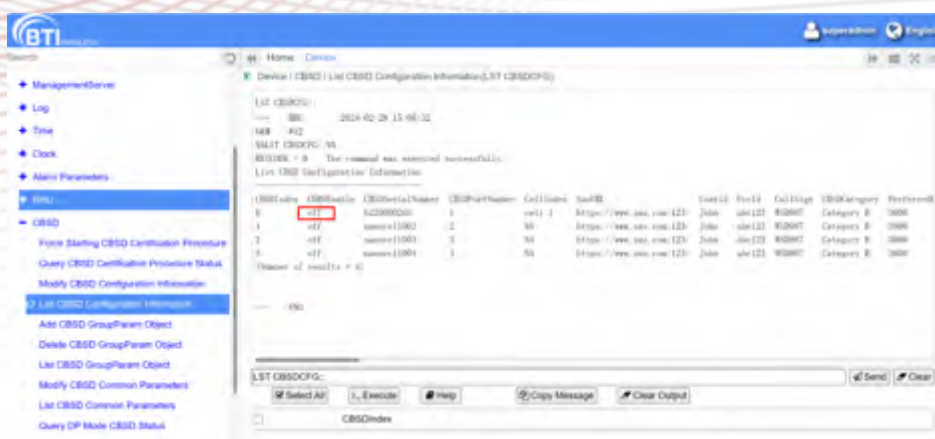


1) At same page, could view the basic information of the base station equipment, such as serial number, software version, IP address and the alarm count..etc.



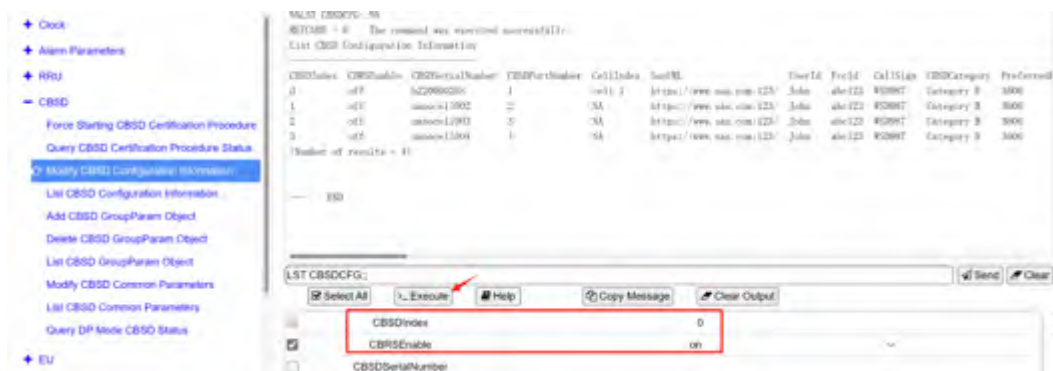
2) Turn on the corresponding CBRs switch

Query CBSD switch status, path: Config / CBSD / List CBSD Configuration Information



Turn on the corresponding CBSD switch. Path: Device/CBSD/Modify CBSD Configuration Information

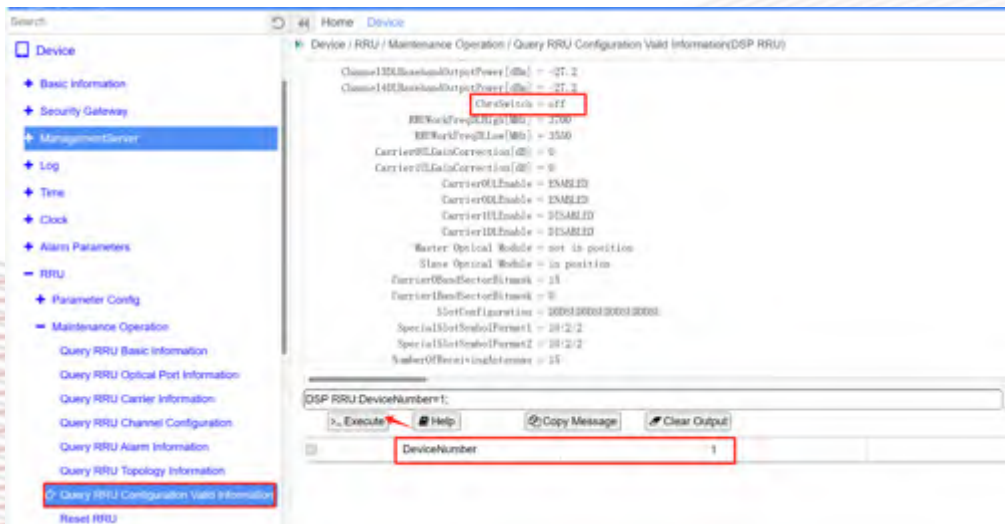
Enter cbsdindex, select CBRSEnable as on, and click “Execute” to take effect.



3) Turn on CBRs switch of RRU

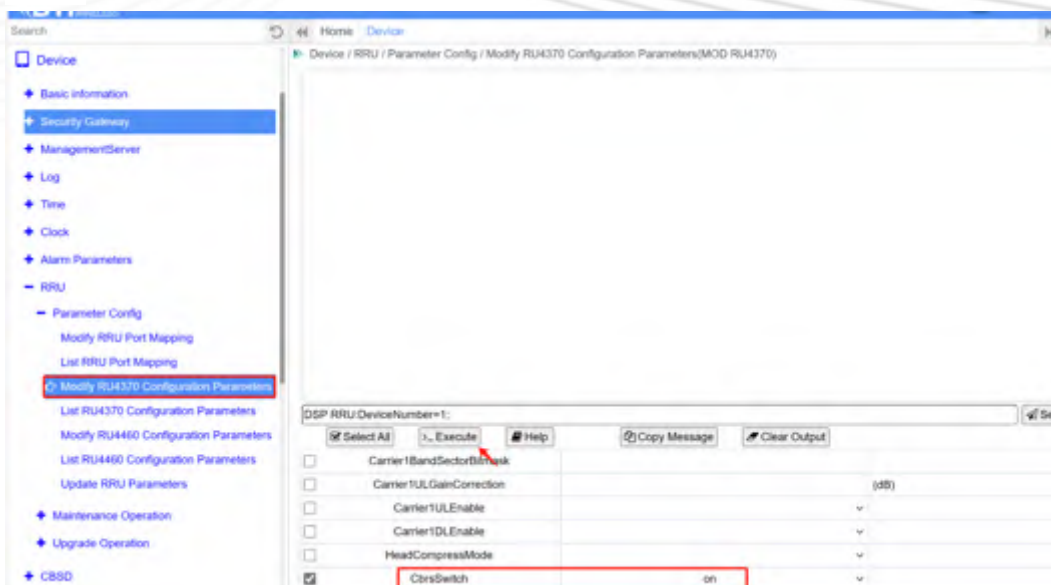
Query the CBRs switch status of the RRU. Path: Device/RRU/Maintenance Operation/Query RRU Configuration Valid Information

Enter the DeviceNumber to query, and click Execute to query.



Turn on the cbrs switch of the RRU. Path: Device/RRU/Parameter Config/Modify RU4370 Configuration Parameters.

Enter the corresponding DeviceNumber, select CBRSSwitch as on, and click Execute to take effect.



2、CBRS Certificate Management

Path: File / Upload and Download Certificate / CBSD Cert

Enter the corresponding CBSD path to upload the certificate. It is necessary to ensure the naming rules of the certificate. Take cbsd0 as an example,

CA file is named as *cbsd0_cacert.pem*,

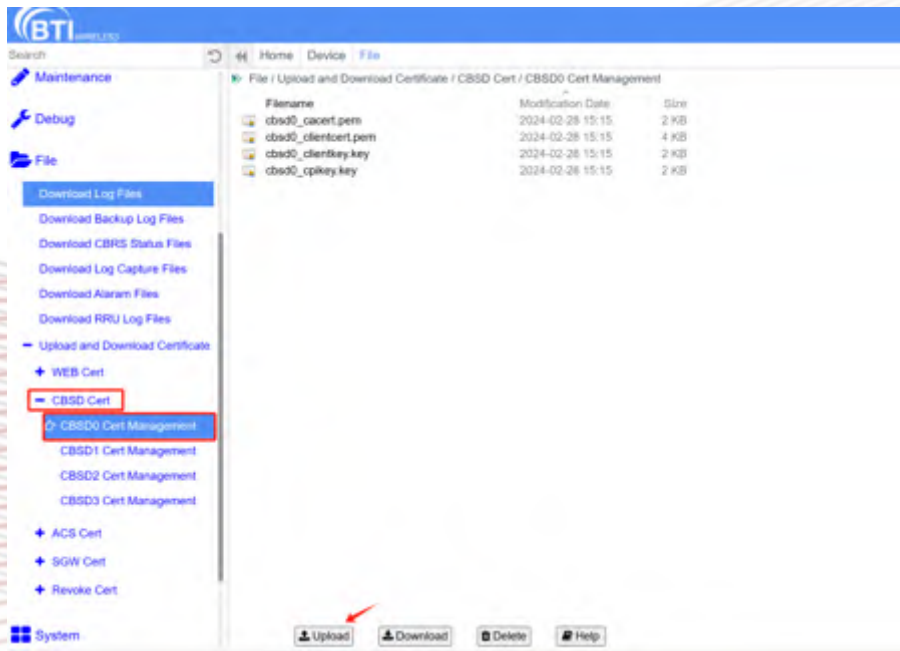
cert file is named as *cbsd0_clientcert.pem*,

key file is named as *cbsd0_clientkey.key*

cpi key file is named as *cbsd0_cpikey.key*



CBRS certificate.zip



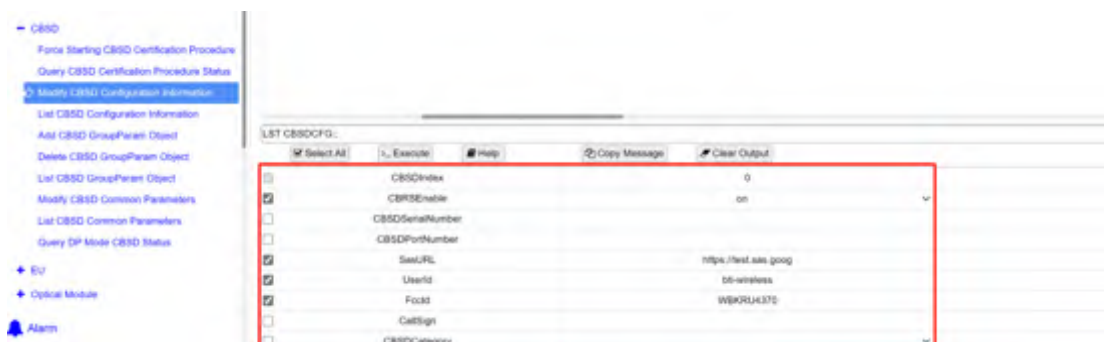
3、CBSD Parameter Configuration

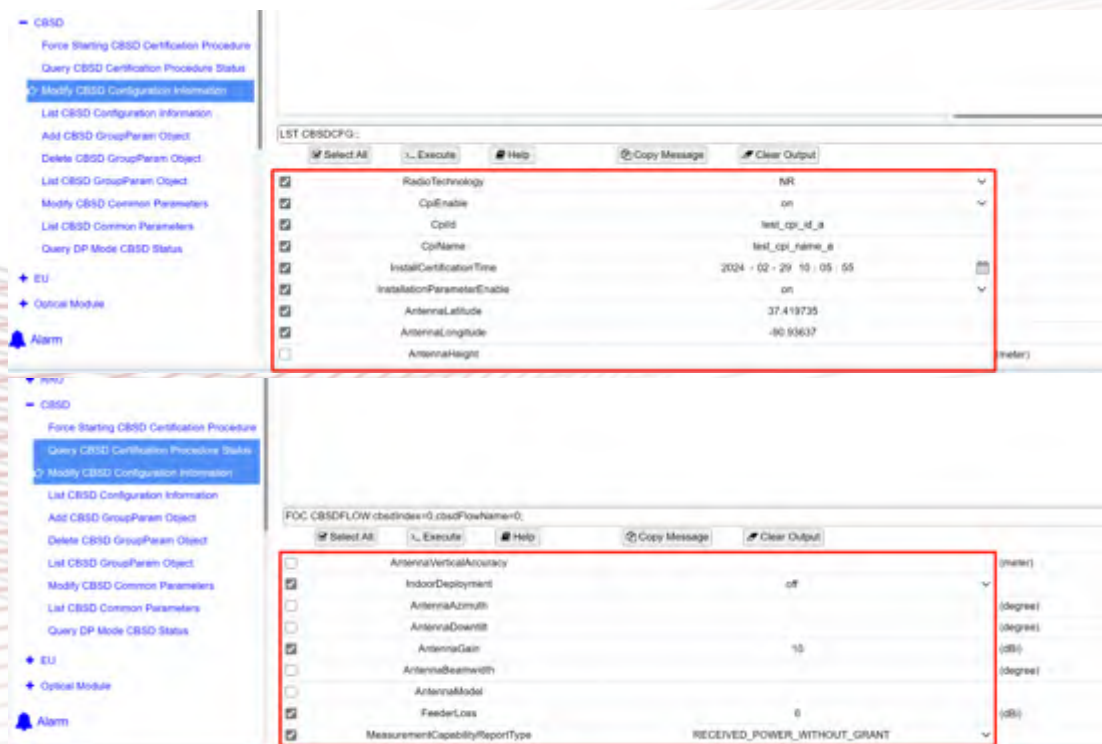
CBSD parameter configuration query path: Config/CBSD/List CBSD Configuration Information.

Enter the corresponding CBSD index number and query the corresponding cbsd parameter.



For parameter configuration of CBSD, refer to the following:





Explain the parameters that need to be confirmed and modified:

- Configure the CBSD device port number
- Configure SAS URL address(google test sas: <https://test.sas.goog>)
- Configure user ID as “bti-wireless”
- Configure FCC Certificate ID as “WBK-RU4370”
- Configure the preferred center frequency point: please modify according to the site planning; It is configured as the center frequency point you want to use. If this frequency point is included in the available frequency points replied by SAS, you can use this center frequency point to register. If it is not included, this parameter will not take effect, and the base station side will automatically assign the center frequency point
- Configure the priority transmit power: configure the transmit power that you want the RRU to use. This parameter represents the priority transmit power of the CBSD device.
- Information control switch of air interface is configured as on.
- Radio technology of air interface is configured as NR
- CPI switch is configured as on
- CPI ID ID: test_cpi_id_a
- CPI Name: test_cpi_name_a
- The installation certificate time shall be input according to the actual situation on site, such as: 2022-03-28T20:30:00Z
- CBSD installation information control switch is configured as ON
- CBSD Antenna latitude: modify according to the site planning
- CBSD Antenna longitude: modify according to the site planning
- CBSD Antenna height: modify according to the site planning, and the default value can not be confirmed

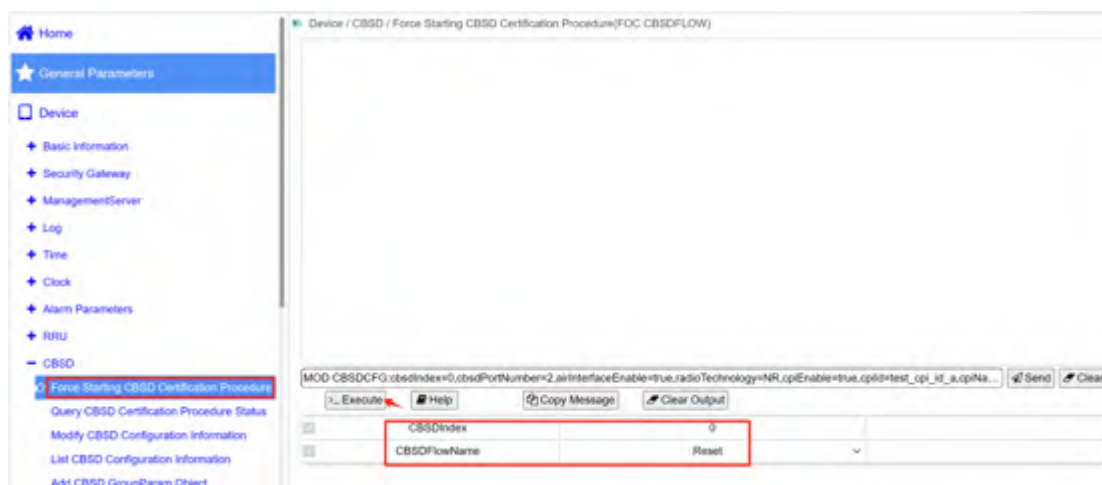
- CBSD Antenna height type: modify according to the site planning, and the default value cannot be confirmed
- CBSD Antenna horizontal accuracy: modify according to the site planning, and the default value cannot be confirmed
- CBSD Antenna vertical accuracy: modify according to the site planning, and the default value cannot be confirmed
- Whether the CBSD antenna is deployed indoors is modified to be closed
- CBSD antenna azimuth: modify according to the site planning, and the default value cannot be confirmed
- CBSD antenna downward inclination: please modify according to the site planning, and the default value cannot be confirmed
- CBSD antenna gain: 4 antenna is generally recommended to be configured as 10
- Maximum capacity of CBSD antenna EIRP: modify according to site planning
- CBSD antenna beam width: modify according to the site planning, and the default value cannot be confirmed
- CBSD Antenna model: modify according to the site planning, and the default value cannot be confirmed
- Feeder loss: 4 antennas are generally recommended to be configured as 6
- CBSD measurement capability reporting type is set to RECEIVED_POWER_WITHOUT_GRANT

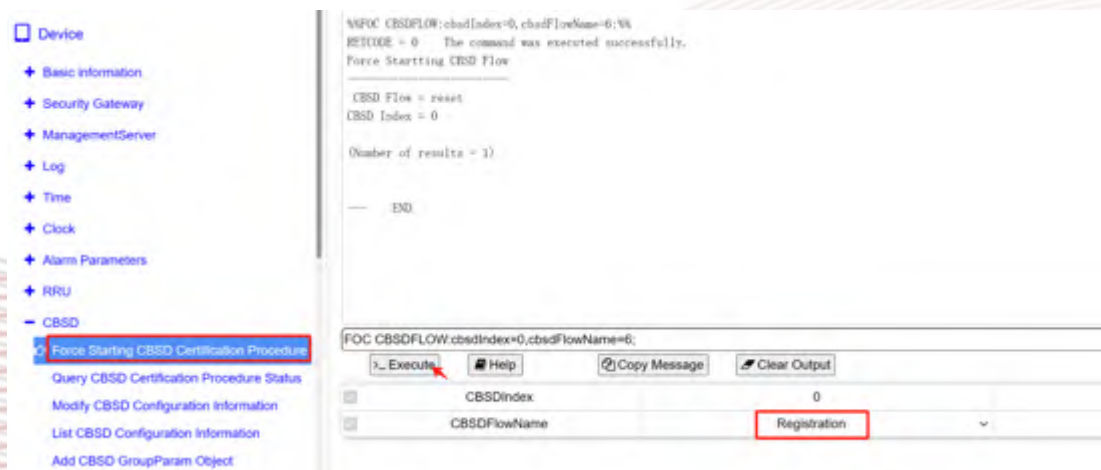
Configure installation parameters according to on-site environment:

4、CBSD Register Procedure

Manually turn on the cbsd switch to automatically initiate the registration process within 5 minutes. When cbsd is registered, modifying the installation parameters will automatically re initiate the registration process.

Initiate registration, de-registration and other processes can also be carried out manually. Path: Device/CBSD/Force Starting CBSD Certification Procedure

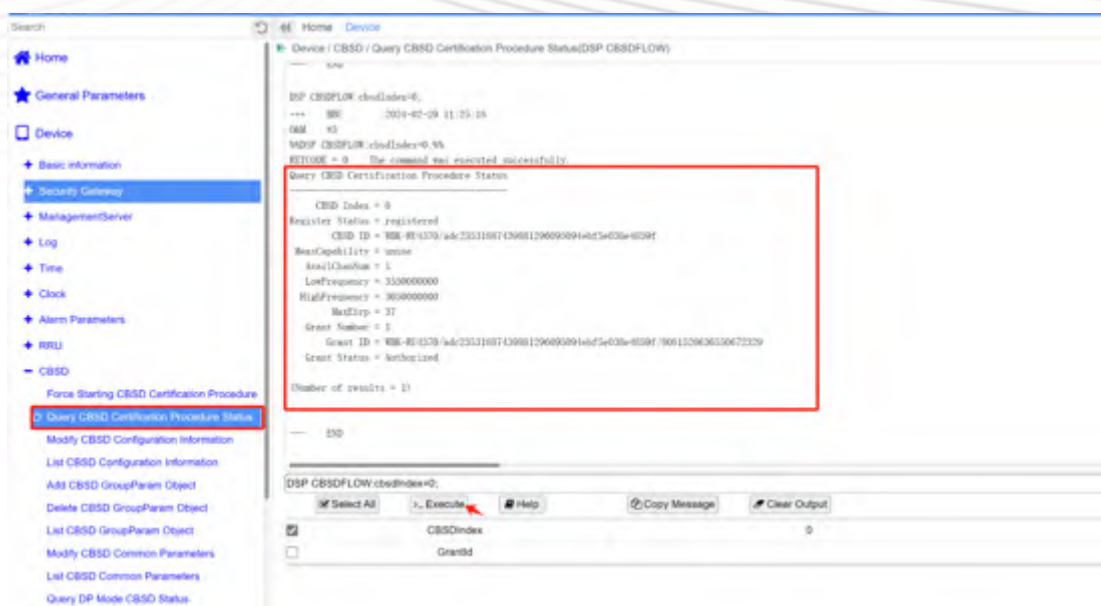




5、CBSD Certification status query

Path: Device / CBSD / Query CBSD Certification Procedure Status

Enter the index number of cbsd, click execute to query the certification status of cbsd, and then return the status information of current cbsd, including Register Status, CBSD ID, Frequency, EIPR, etc.



6.2.2.5 VONR Function

Function Introduction

VONR is the abbreviation of Voice over New Radio, which means voice communication based on new radio technology. It refers to the use of new radio technology in 5G wireless communication systems to support high-quality, low latency voice communication services. Traditionally, voice communication mainly depends on voice call services (such as GSM and UMTS) in 2G and 3G networks. However, with the development of 5G technology, VONR has become a new way. It combines voice communication with 5G network data communication to provide higher efficiency and better user experience.

Features of VONR include:

Low latency: VONR achieves lower call delay by reducing signaling transmission and processing time and optimizing network architecture. This is very important for applications such as real-time communication and interactive games.

Better coverage and capacity: The characteristics of 5G network enable VONR to achieve better coverage and higher network capacity, thus providing more stable and reliable voice communication services.

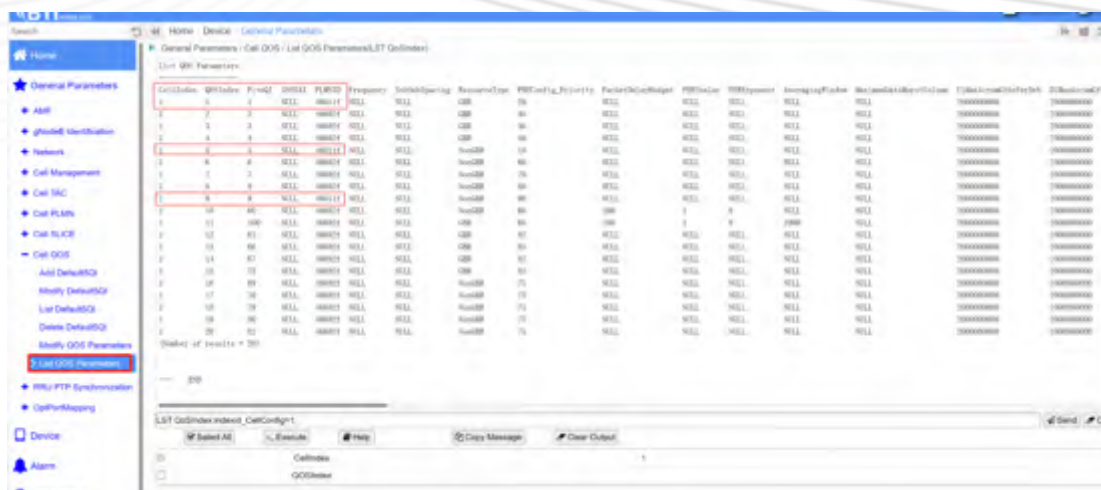
Integration of data and voice: VONR integrates voice communication and data communication together, so that users can enjoy high-speed data transmission and high-quality voice calls at the same time.

In a word, VONR is a high-quality and low delay voice communication service based on new radio technology in 5G network. It provides users with better communication experience by providing better voice quality, low latency, better coverage and other features

Parameter Configuration Reference

1、 BBU Parameter Configuration:

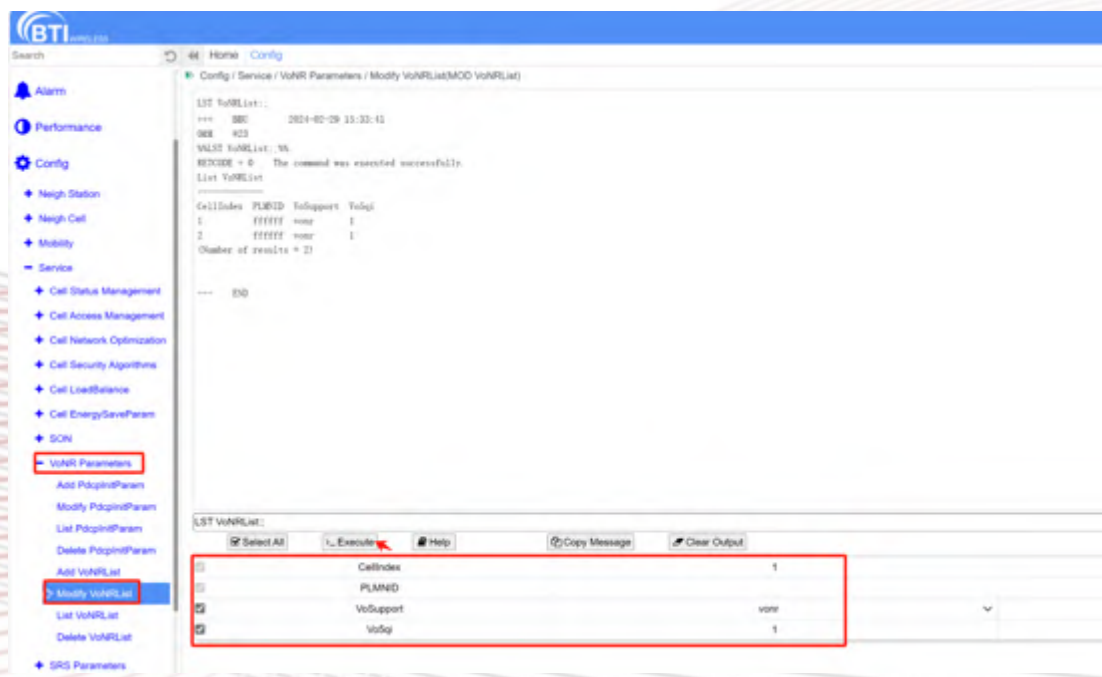
1) QOS Relevant configuration is correct (5QI1, 5QI5 and 5QI9)



2) Configure VONR Parameter:

Support vonr mode: select vonr

Dedicated bearer of vonr: select 1, which means the dedicated bearer of vonr is 5QI1



2、Conditions to make VONR call

Successful VONR voice calls usually require the following basic conditions:

5G network support: VONR is a voice call service built on the 5G network, so it is necessary to ensure that the mobile phone is connected to the 5G base station supporting VONR within the 5G network coverage, and the core network test is connected to the IMS network element equipment

VOLTE support: Voice over New Radio (VONR) is usually achieved through VoLTE (Voice over LTE) technology, so it is necessary to ensure that both devices and operators support the VoLTE function.

Device support: Mobile phones or other terminal devices need to support 5G networks and VoLTE functions, and the VoLTE function option should be enabled in network settings.

Network quality: A successful call also requires good network quality, including stable signal coverage, low latency, high bandwidth, etc., to ensure the clarity and stability of voice calls.

Called terminal equipment and network support: not only the calling equipment and network need to support VONR, but also the other equipment and network need to meet the same conditions to achieve VONR voice calls.

6.2.2.6 NR SON Function

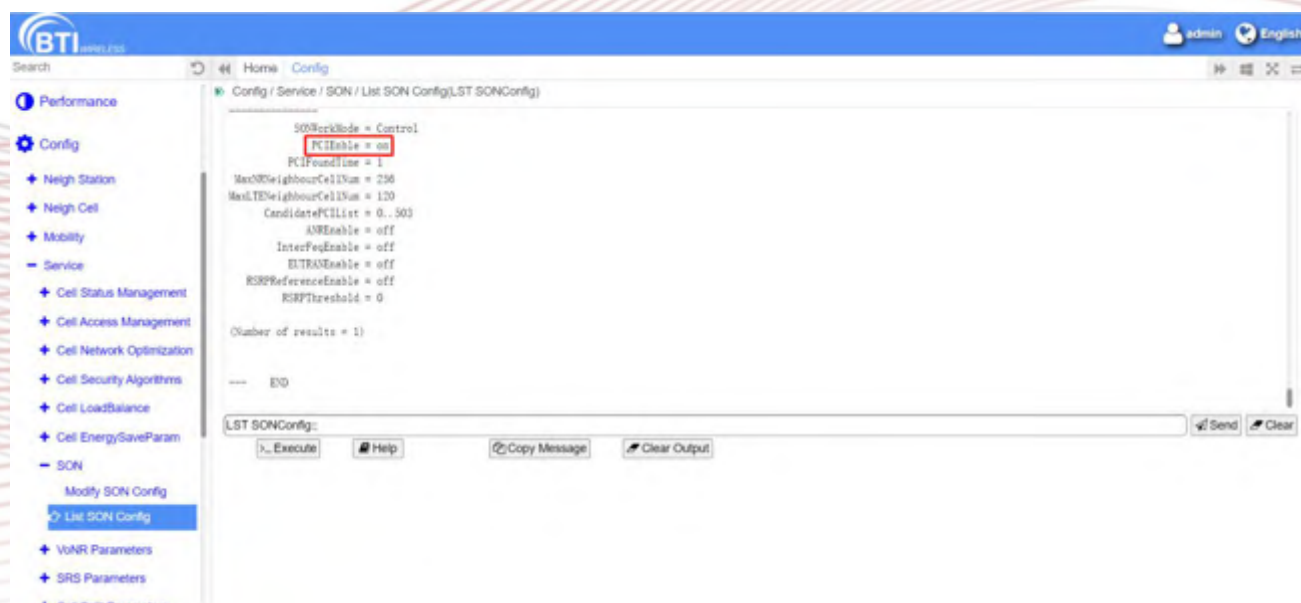
Function Introduction

Self organizing networks (SON): 5G SON standard is an important part of 5G network. It is a self configuring, self optimizing and self-healing network technology, aiming to improve the reliability and efficiency of 5G network. SON design is mainly to reduce operating costs by reducing the degree of human intervention in network design, construction and operation; Reduce capital expenditure by optimizing the use of available resources; Protect revenue by reducing the number of human errors. At present, the key technologies of SON include: PCI (Physical Cell Identity) automatic configuration, PCI self optimization, and ANR (Automatic Neighbour Relationship) automatic neighbor relationship function.

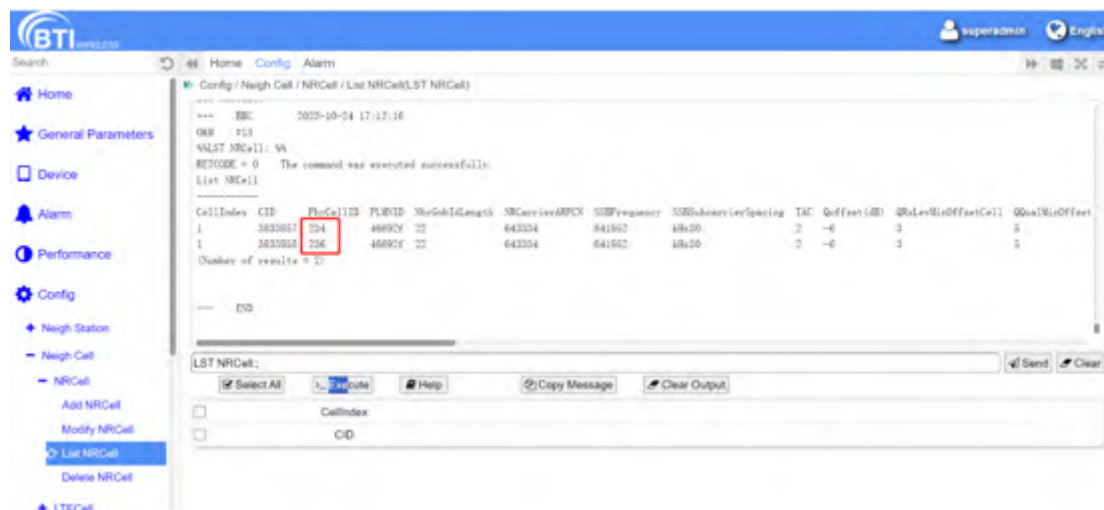
Parameter Configuration Reference

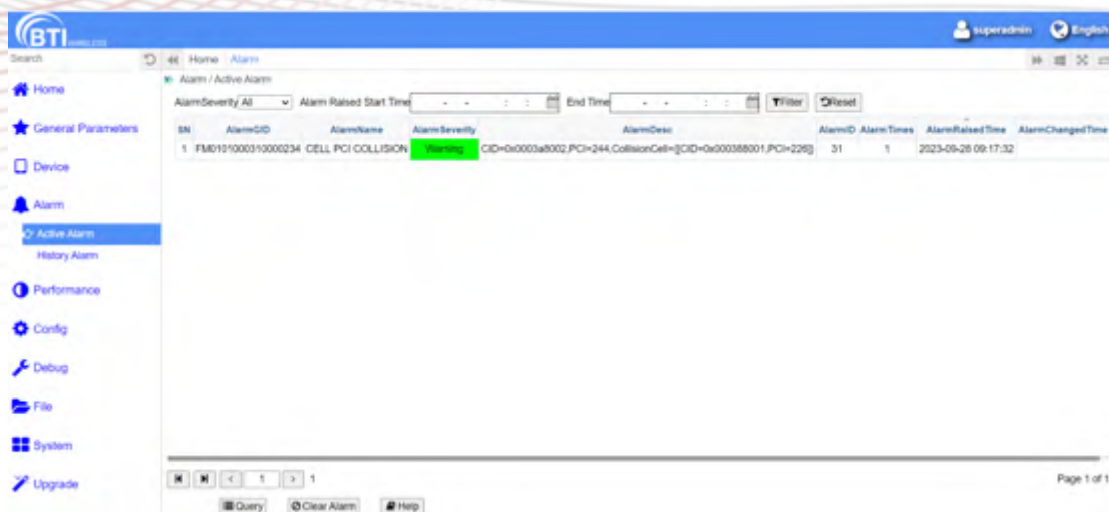
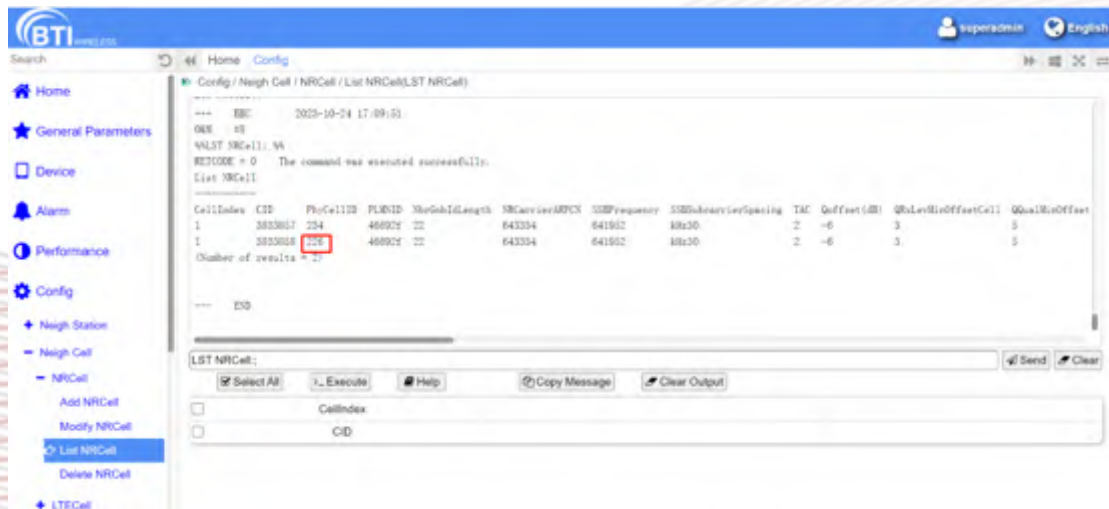
1、NR SON PCI Conflict detection

Turn on PCI detection switch.



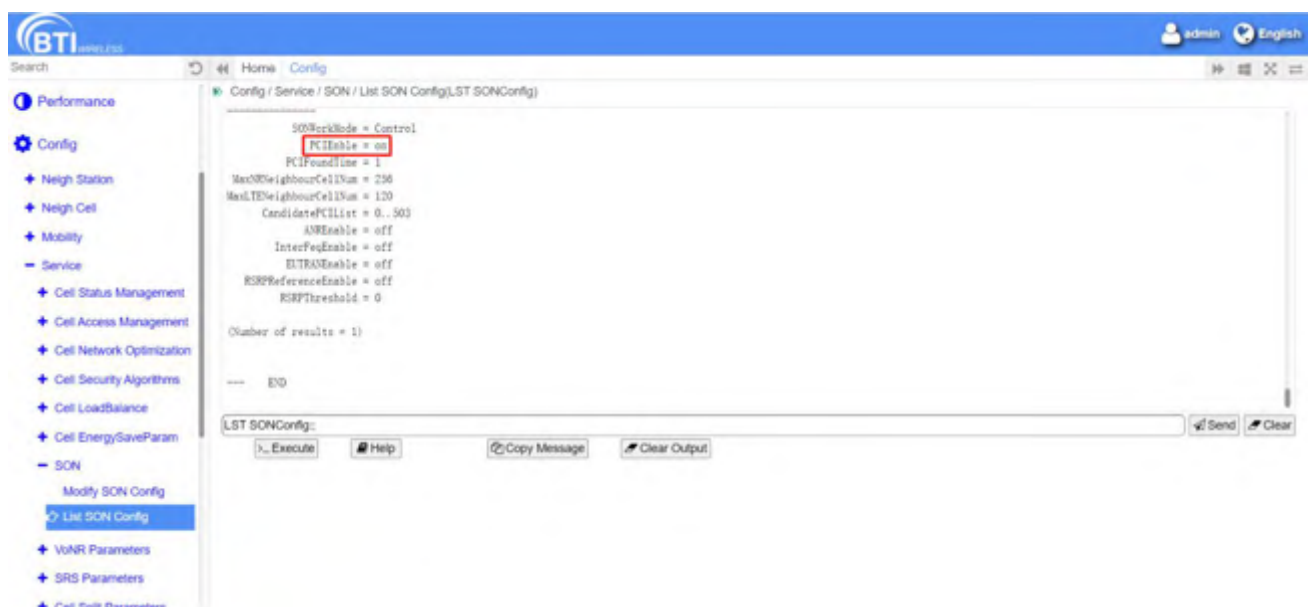
When ssb of the service cell is the same with the adjacent cell, or the arfcn of service cell is the same with ssb of the adjacent cell, and the service cell pci is the same as the adjacent cell pci, or the pci model 3 is the same, or the model 30 is the same, the pci conflict alarm will be generated. When this condition is not met, the alarm will be eliminated.



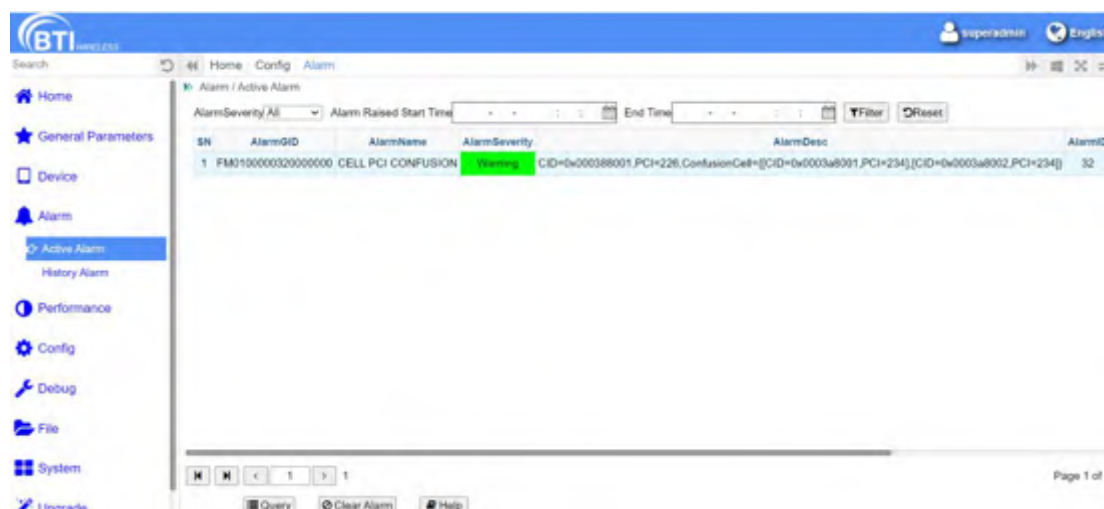
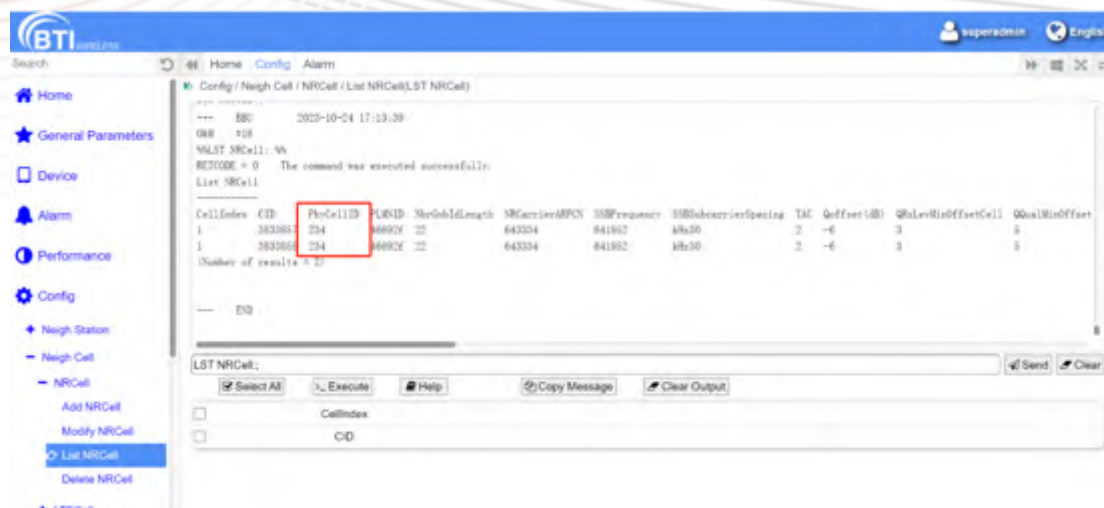
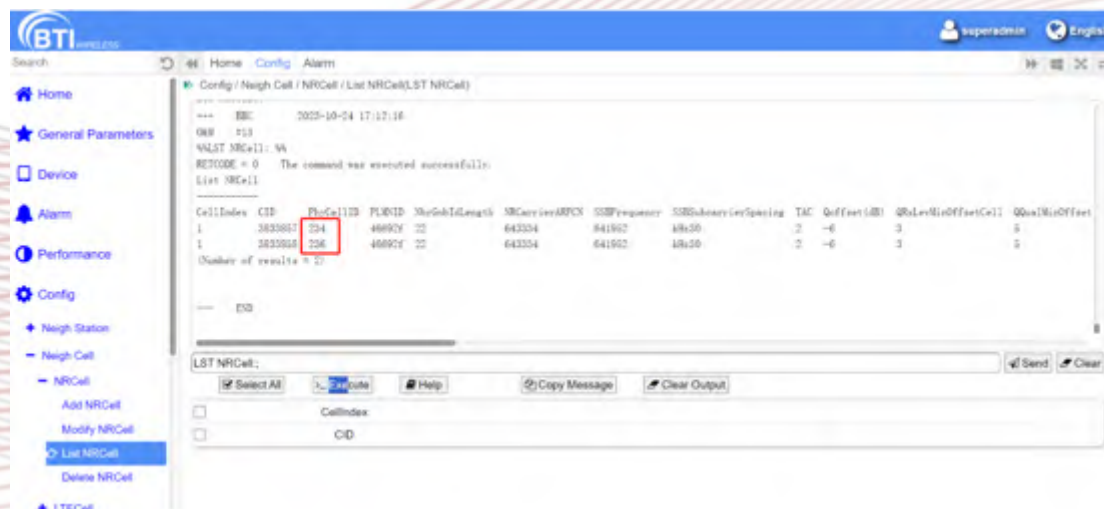


2、NR SON PCI Confusion detection

Turn on PCI detection switch.

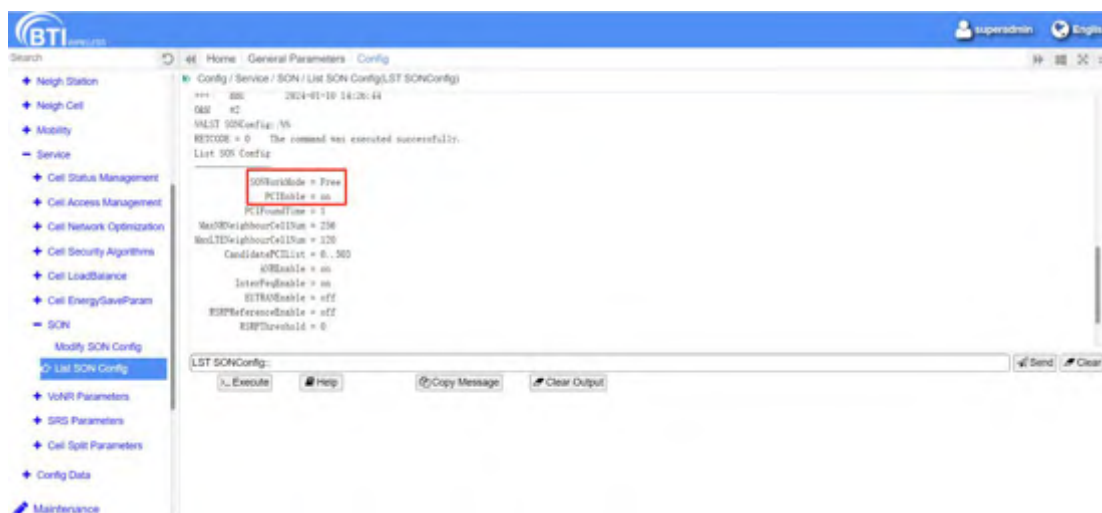
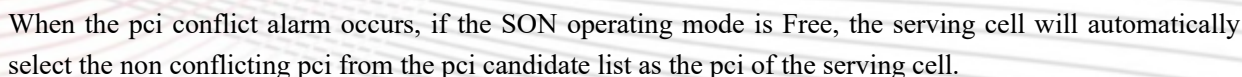


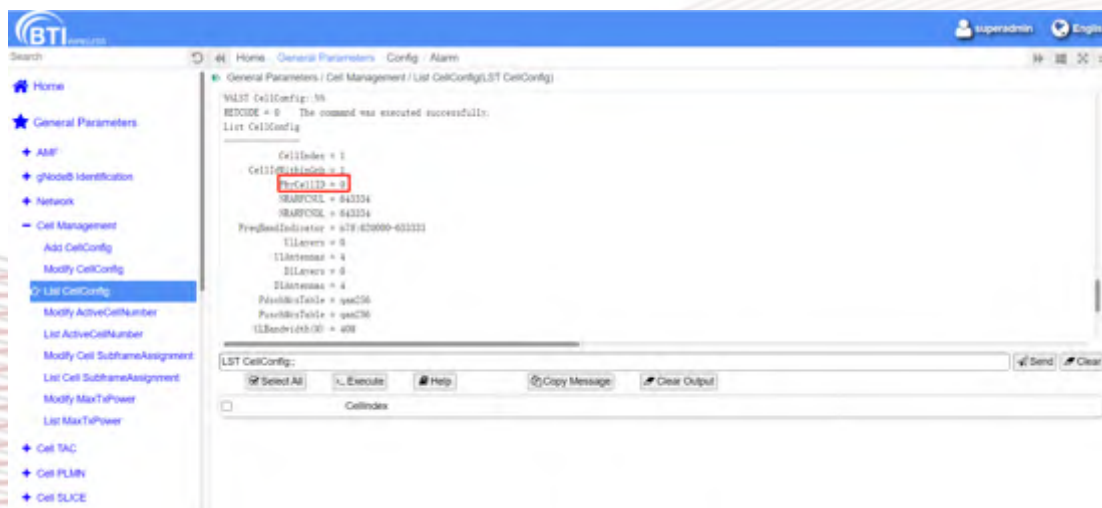
The service cell is configured with two adjacent cells. When the two adjacent cells have the same pci, the same ssb frequency point, and the same plmn, an alarm of pci confusion will be generated. If this condition is not met, the alarm will be eliminated.



3、NR SON PCI Self optimization

Set SON working mode as free, and turn on PCI detection switch.





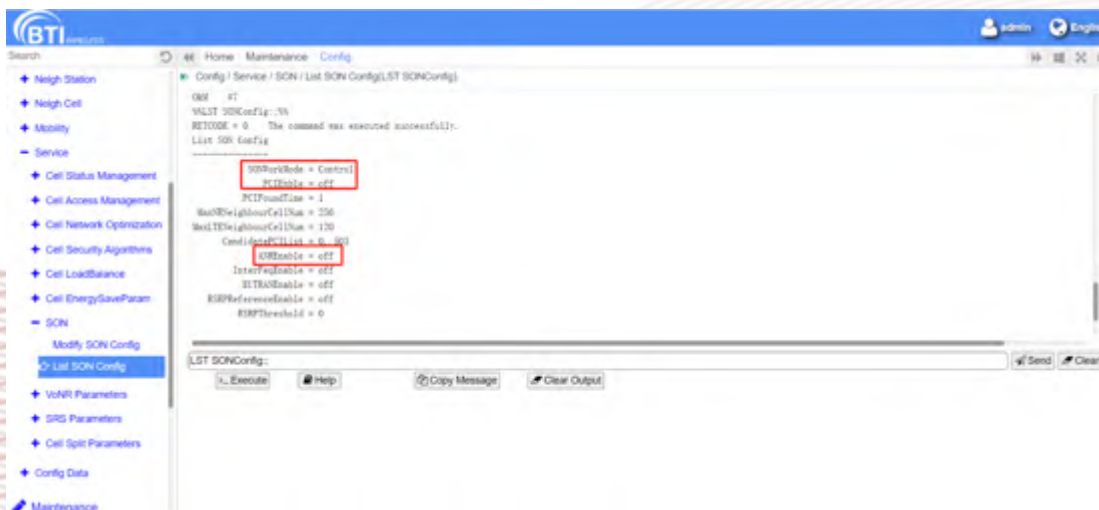
4、Automatic Neighborhood Relationship (ANR)

1.Default parameter of ANR.

- Both BTSs are not configured with adjacent stations and adjacent cell relationships. The automatic adjacent cell relationship switch is turned off.
- The UE measures the cell information of two BTSs, but does not automatically add the neighbor cell relationship.



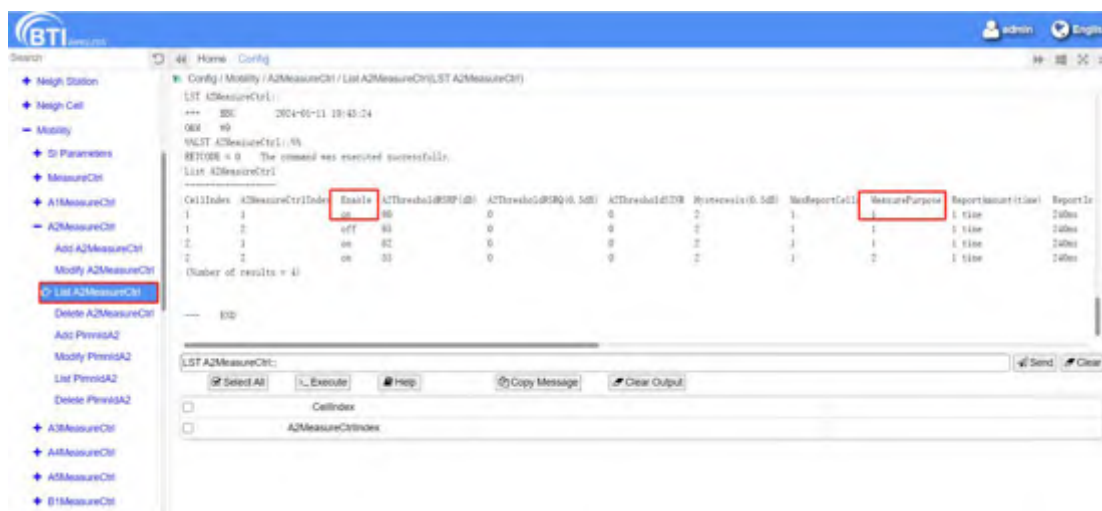
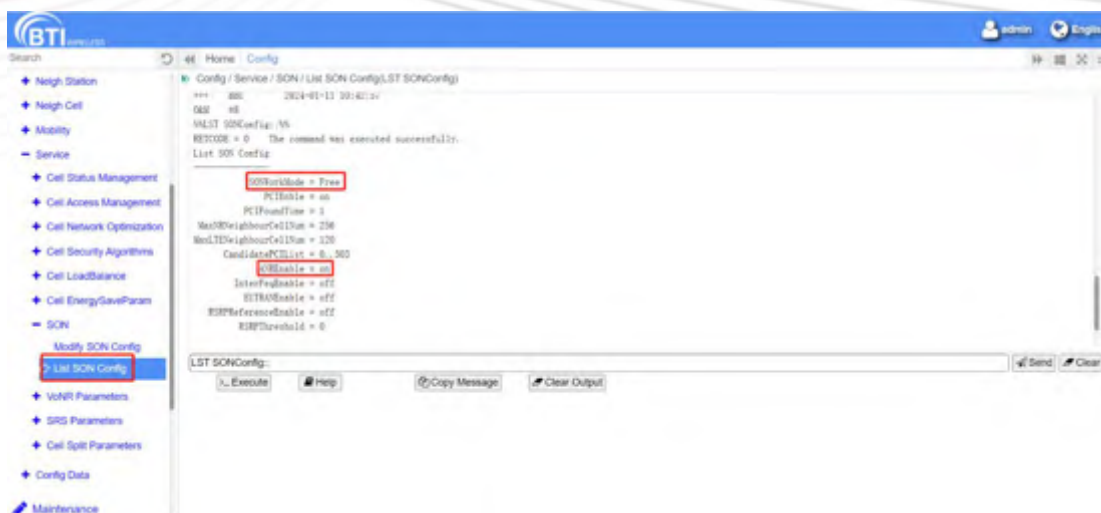


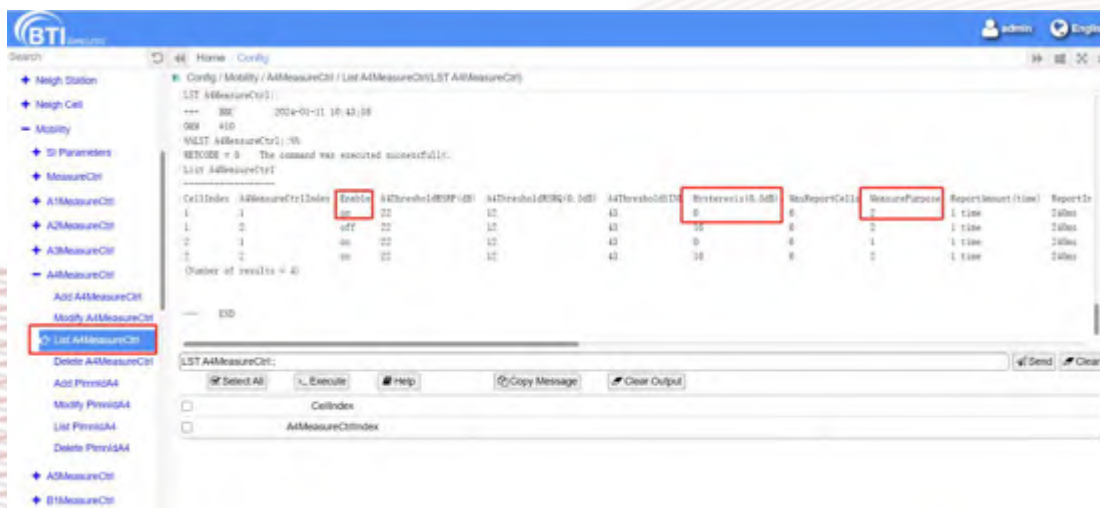


2.

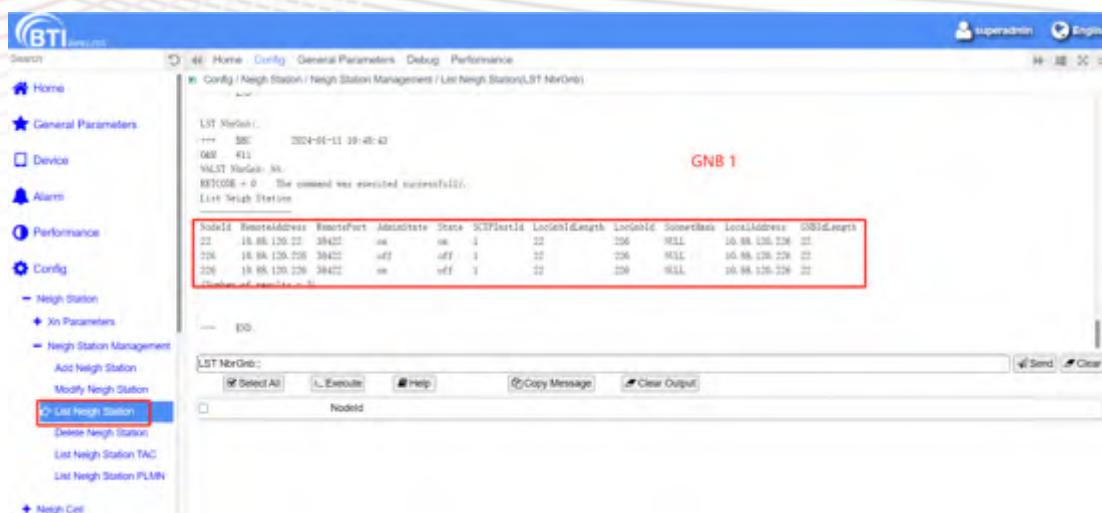
Turn on switch of automatic neighbor cell relationship between the two BTs, configure the SON working mode to free, and enable A2 and A4 event measurement. A2 measurement purpose is 1, A4 measurement purpose is 2, and A4 hysteresis value is changed to 0

(Note: Take the identification and addition of adjacent cells of inter-frequency as an example)



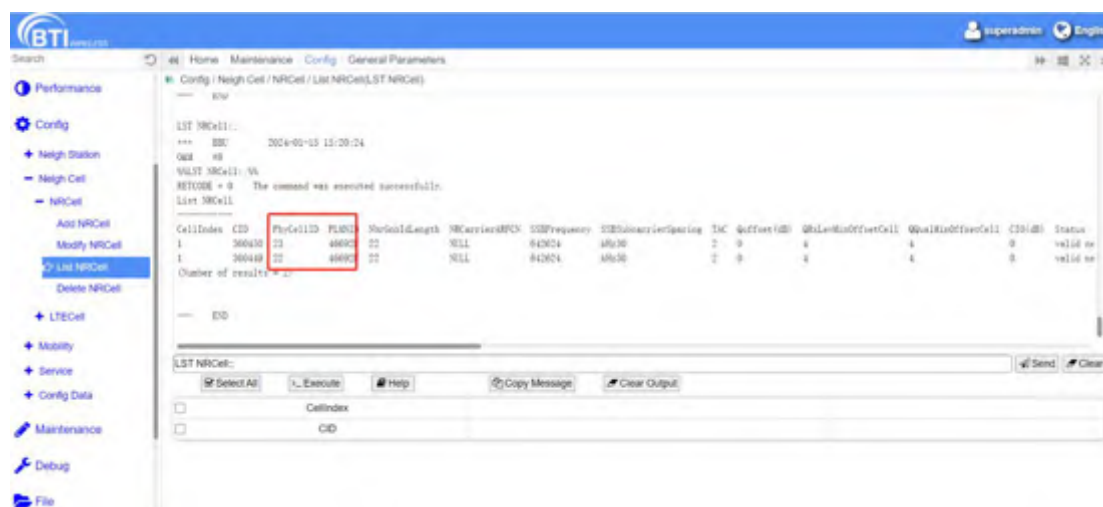


3. Make the UE measure the cell information of the two BTSs, and the BTS will automatically add neighbor stations and neighbor cell relationships



4.

Verify the ANR function, and confirm the neighbor cells are added automatically.

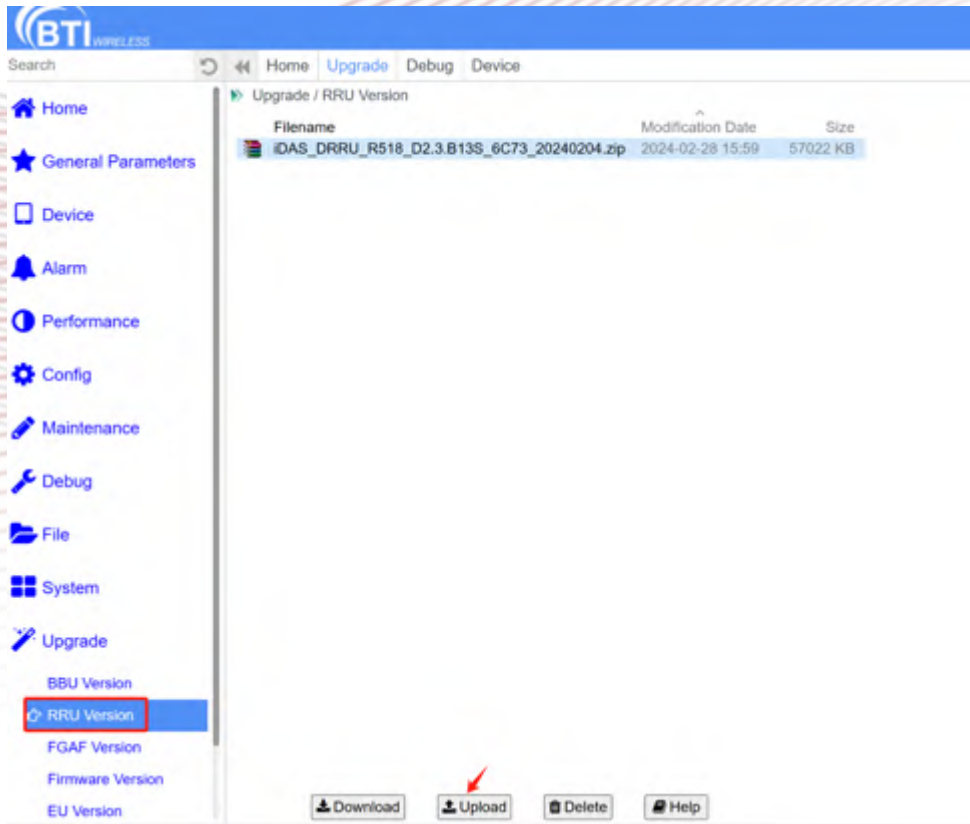


6.3 Upgrade Management

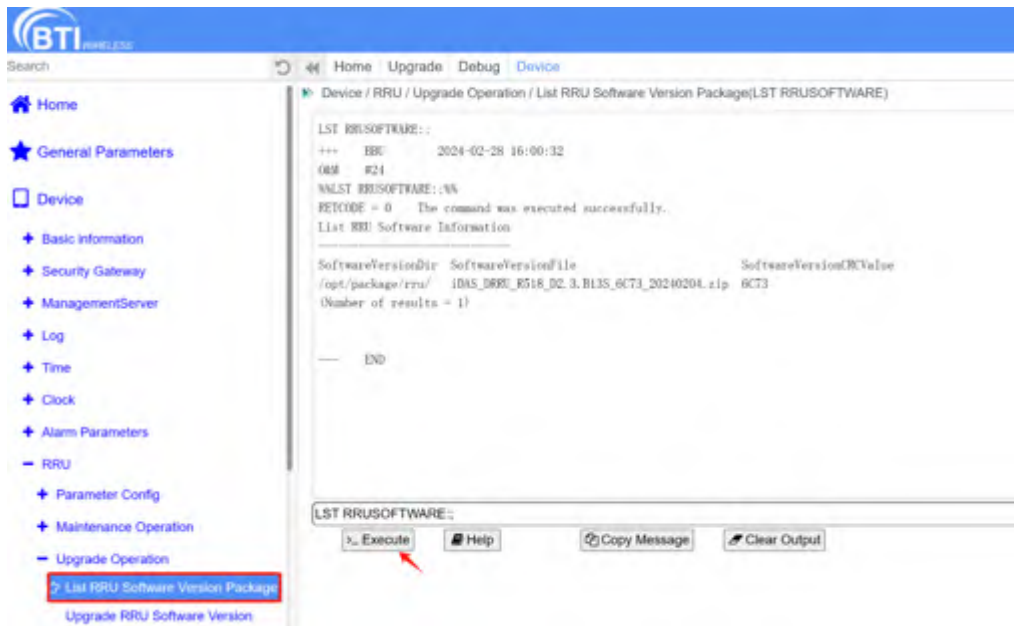
6.3.1 BBU Web upgrade RRU version

Version upgraded as follows:

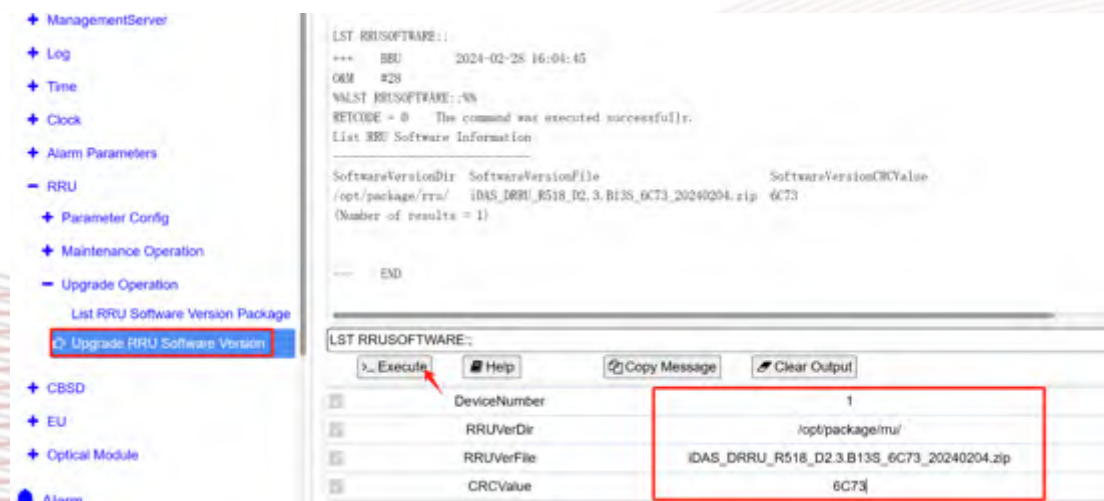
Uploads RRU version through web interface: Upgrade / RRU Version.



Query the currently uploaded version package.

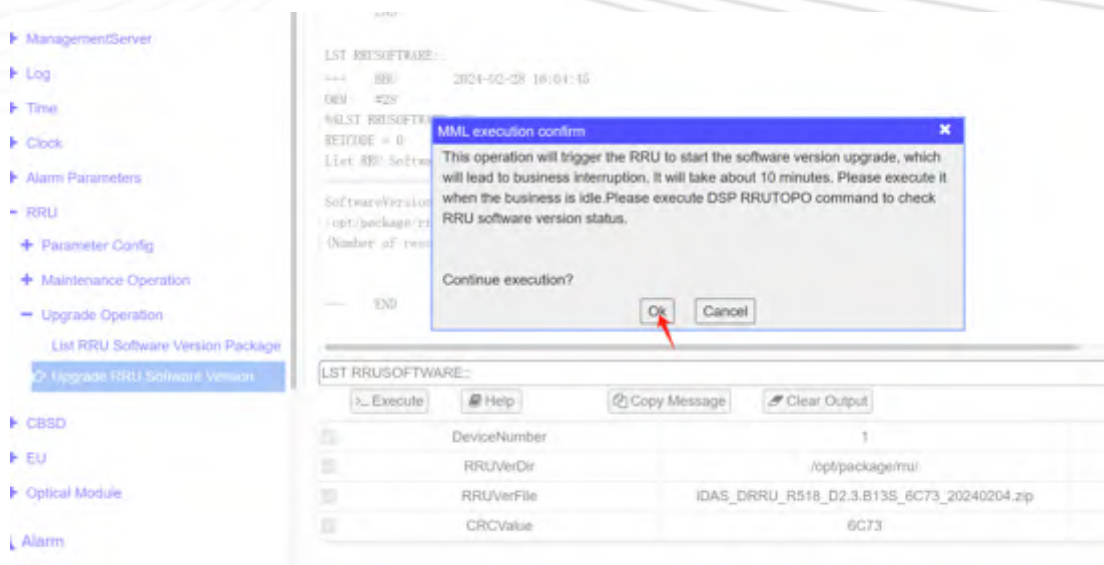


Upgrade the RRU version (write the queried information into the parameters required for the upgrade operation), and click Execute.



The page will prompt: “The operation will trigger the RRU to start the software version upgrade, which will lead to business interruption. It will take about 10 minutes. Please execute it when the business is idle. Please execute DSP RRUTOPO command to check the RRU software version status. Continue Execution ?”

Please click the ok button to continue.

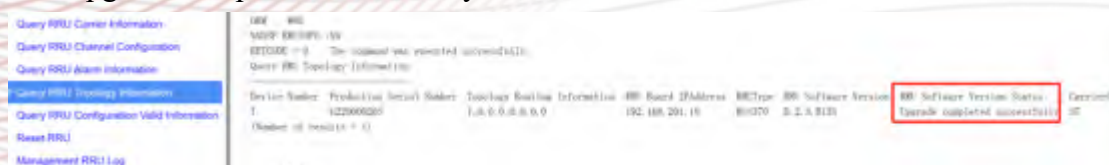


2、Upgrade progress query

Status 1: Upgrading via FTP



Status 2: Upgrade completed successfully



Status 3: Abnormal communication link



Status 4: The version works normally

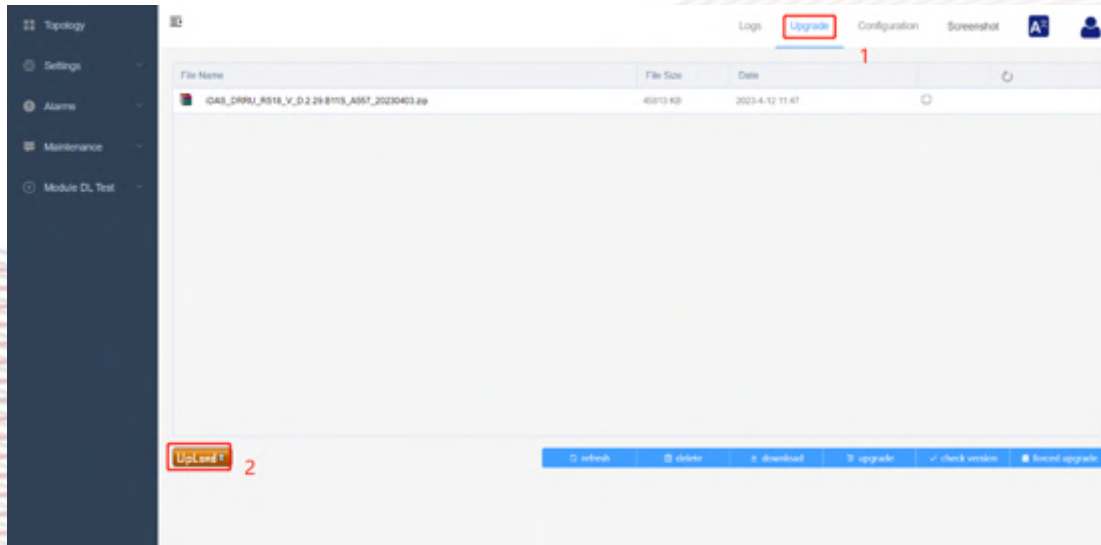


Instruction

Upgrading the RRU will cause business interruption, which takes about 10 minutes. Please execute when the business is idle.

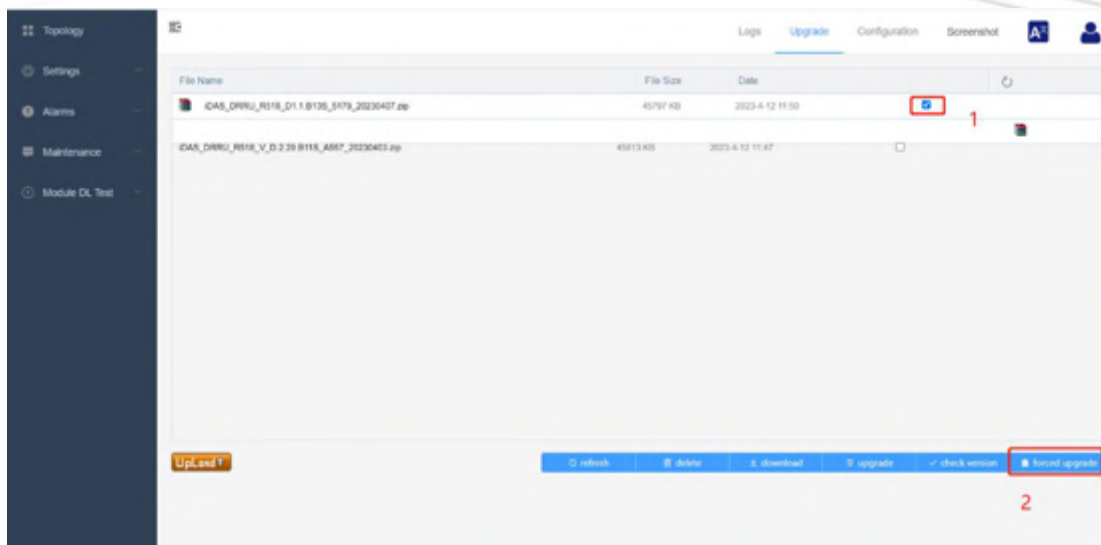
6.3.2 RRU web upgrade RRU version (Optional)

Click Upgrade to enter the upgrade interface, click Upload, open the path of the RRU version package saved on the computer, select the uploaded RRU version file, and click Open to upload.

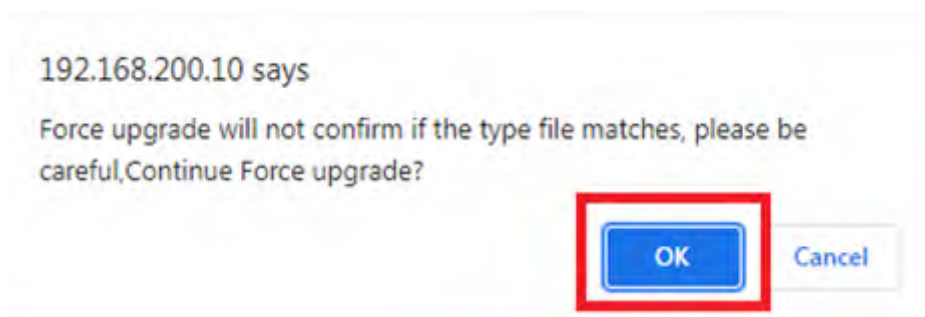


Note: The number of version packages in the interface should not exceed 4, which will take up a large amount of memory, leading to version package upload failure.

Choose the version package to be upgraded (iDAS_DRRU_R518_D1.1.B13S_5179_20230407), and click forced upgrade:



Click OK in the pop-up prompt box

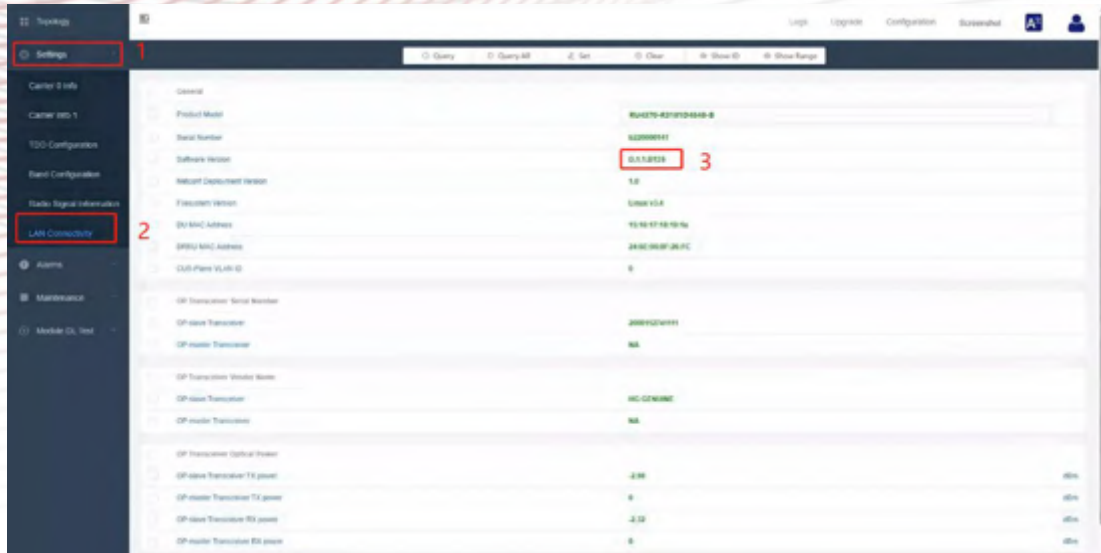


Input the upgrade code "iDas" in the pop-up box and click OK;

Click OK in the Confirm Upgrade pop-up to enter the upgrade status.

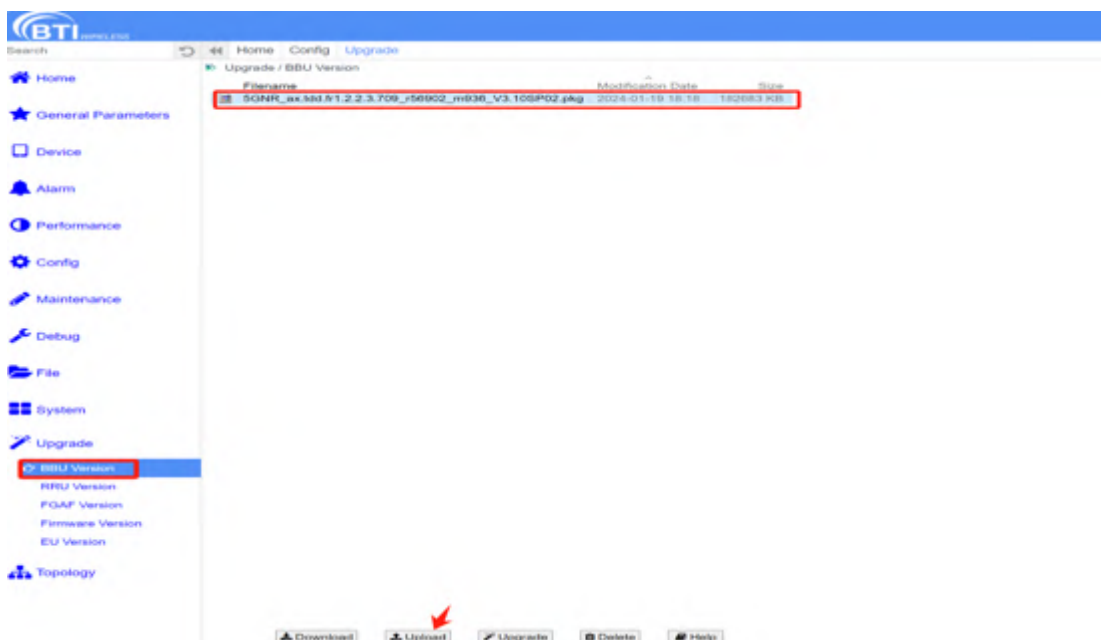
Note: After the upgrade is completed, the RRU will be restarted for about 5 to 10 minutes. Please be patient.

After the upgrade is completed, please clear the browser cache, open the WEB interface and login: click “Setting-LAN Connectivity” to check whether the software version matches.

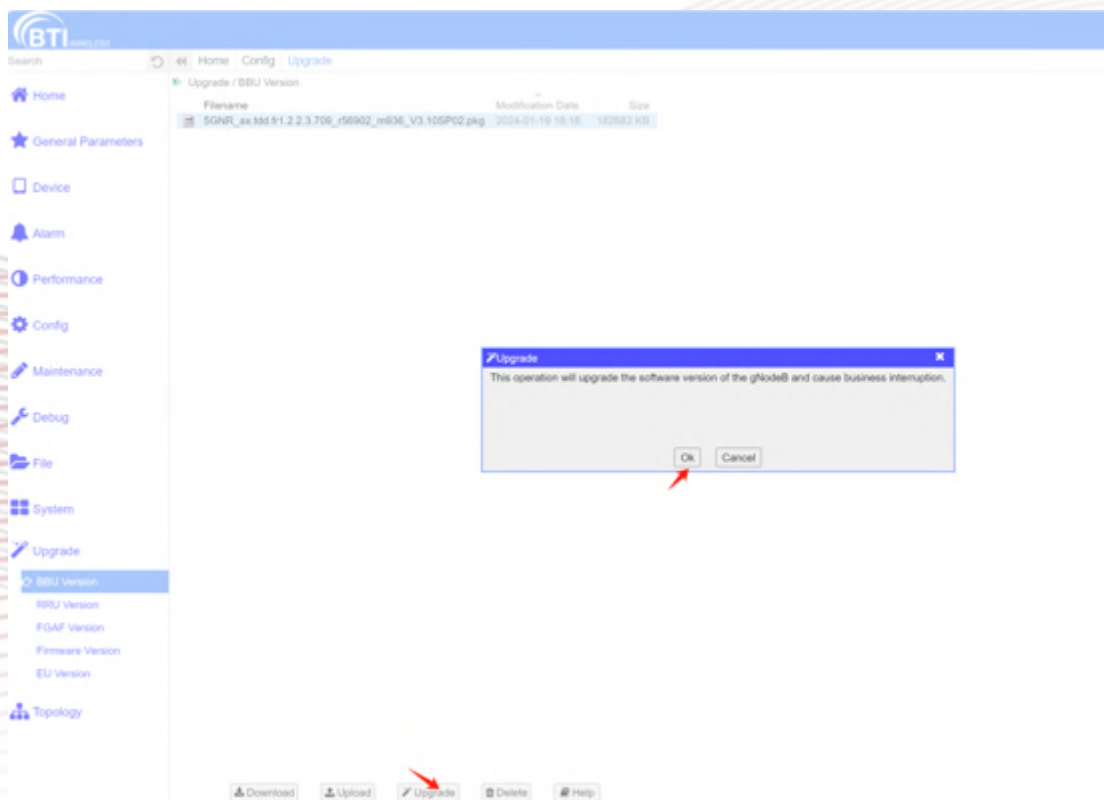


6.3.3 BBU web Upgrade protocol stack version

Upload Version Package.



Upgrade: select the version package and upgrade directly.



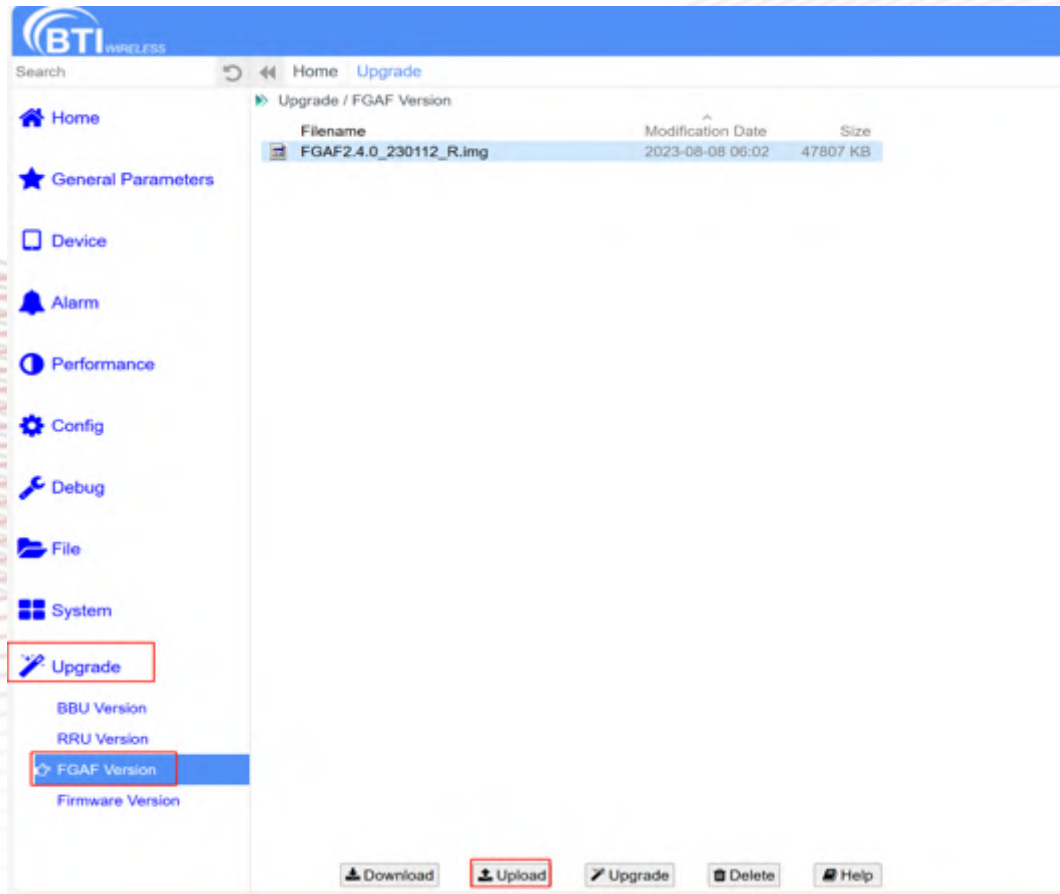
Instruction

1. Need upload the BBU software version to the NE board first
2. The BBU software upgrade is expected to take 10 minutes. Please ensure that the operation is performed in idle time.

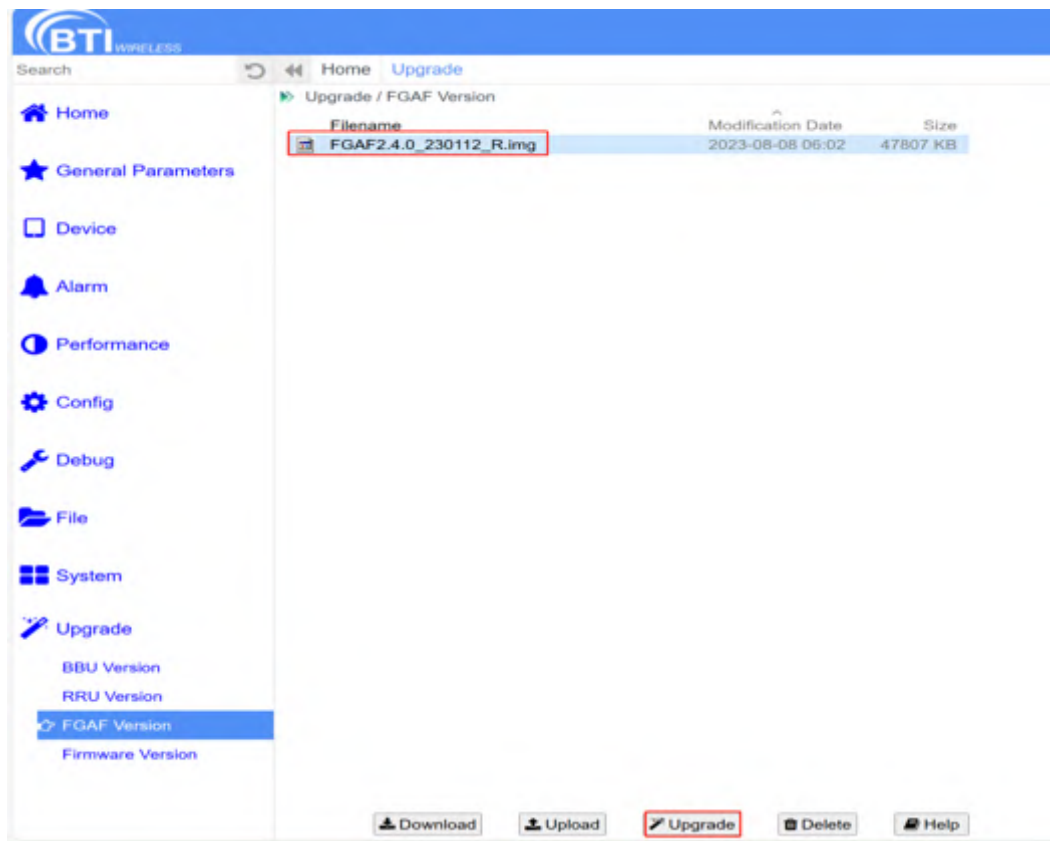
6.3.5 BBU web upgrade accelerator card

Upgrade instructions: Please confirm the version information of the accelerator card before upgrading. The accelerator card version is FGAF1.0.2_211103-R or later version. Please upgrade on the web interface of BBU and follow the instructions below; If not, please contact technical support for upgrading;

Upload version package



Upgrade: Select the version package and click the upgrade button to upgrade.

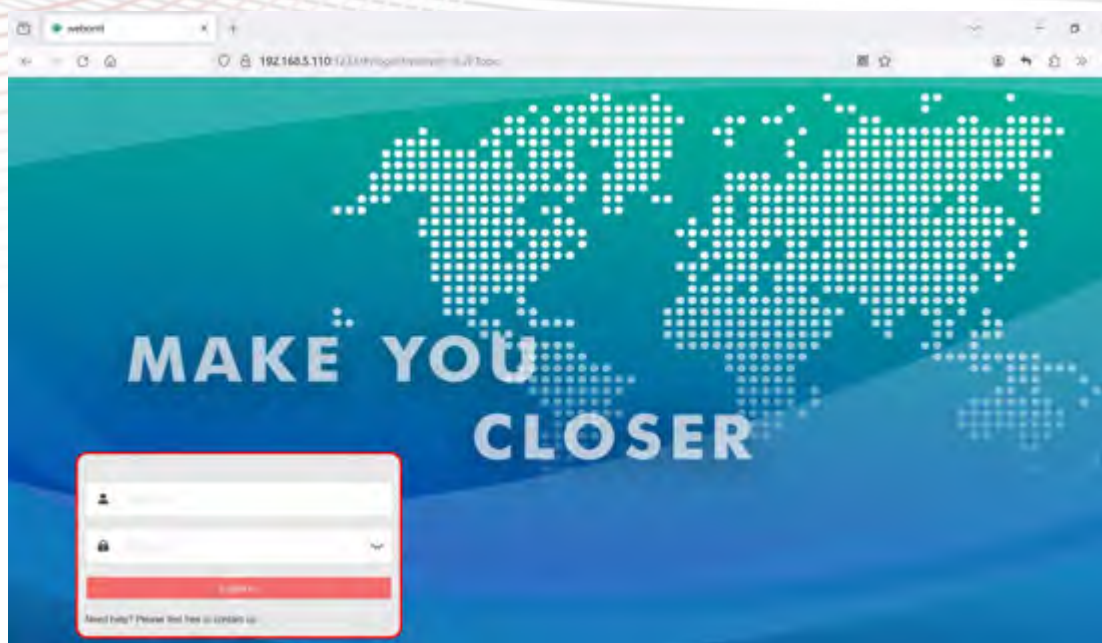


 Instruction

1. Need upload the BBU software version to the NE board first
2. The BBU software upgrade is expected to take 10 minutes. Please ensure that the operation is performed in idle time.

6.3.6 Login RRU Through BBU

To access RRU remotely through BBU, the RRU version needs to be supported first. The default port numbers are 1233, 1234, 1235, and 1236, corresponding to RRU numbers 1-4 respectively. Example of login method: If you want to access the RRU connected to 192.168.5.110 BBU optical port 1, you can directly enter 192.168.5.110:1233 in the browser.



Currently, custom modification of RRU mapping port numbers is also supported. The query and modification methods are as follows:



Instruction

The port mapping configuration for RRU ports 1-4 does not allow duplication.

6.4 Alarm Management

6.4.1 nCELL-T5000 Series Base Station Alarm Reference

6.4.1.1 Alarm Overview

Alarm refers to the fault information actively reported by equipment after certain faults or abnormalities occur; The alarm level is divided into Critical, Major, Minor, and Warning. Users need to determine how to handle the alarm based on the reported alarm level, its impact on the system, and alarm handling suggestions.

6.4.1.2 Alarm Reference

This chapter introduces the relevant explanations and handling suggestions for all alarms of nCELL-T5000 series base stations.

Communications Alarm						
Alarm ID	Alarm Type	Specific Problem	Perceived Severity	Trigger point	Impaction	Handle Suggestion
1	Communication Alarm	OMC DISCONNECT	Critical	Generated when the system cannot connect to the deployed NMS due to abnormal network communication.	Unable to operate and maintain this system remotely.	1. Please contact the customer's network maintenance personnel timely to confirm whether the system has been configured with correct network management parameters. You can use the LST NMSCFG command to query and confirm the configuration of network management parameters. 2. Please check the network connectivity between this system and NMS.
2	Communication Alarm	SCA CONNECTION FAIL	Critical	When the SCA connection fails, this alarm will be generated	Singaling gather function abnormal	1. Check if the SCA address configuration is correct. 2. Check if the network port of the device is working properly. 3. Check if it is connected to the SCA network. 4. Check if the interaction process with the SCA data channel is normal.
3	Communication Alarm	FHO ERROR	Major	When the function of the accelerator card is abnormal, this alarm will be generated	unction of the accelerator card is abnormal	1. Please check the condition of the accelerator card based on the alarm description information. 2. Please use the DSP DetailVersion command to check the version of accelerator card and see if it matches the current BBU version.
4	Communication Alarm	PING TO FHO FAIL	Critical	this alarm will be generated when ping the accelerator card fails	The base station and accelerator card cannot communicate properly.	Please contact the customer's network maintenance personnel to check the script configuration and the process of accelerator card.

5	Communication s Alarm	SCTP CONNE CTION TO AMF FAIL	Critical	When sctp fails to connect to the AMF core network, this alarm will be generated.	Cell is abnormal and terminal cannot access it.	1. Please use the command LST AMFConfigParam to query the current AMFIP. If the IP is incorrect, you can use the command MOD AMFConfigParam to modify AMFIP. 2. Check if the network port of the device is working properly. 3. Check if it is connected to the AMF network. 4. Check if AMF is working properly.
6	Communication s Alarm	SCTP CONNE CTION TO DU FAIL	Critical	SCTP connect DU fails	Cell is abnormal and terminal cannot access it.	Please check the IP plan and avoid using internal IP addresses in the system.
7	Communication s Alarm	SCTP CONNE CTION TO CU FAIL	Critical	SCTP connect CU fails	Cell is abnormal and terminal cannot access it.	Please check the IP plan and avoid using internal IP addresses in the system.
8	Communication s Alarm	SCTP CONNE CTION TO NBR GNB FAIL	Critical	SCTP connection of the Xn interface fails	Xn connection cannot be established	1. Check if the GNB address configuration of the neighboring station is correct. 2. Check if the network port of the device is working properly. 3. Check if it is connected to the neighboring station GNB. 4. Check if the neighboring GNB is working properly.
9	Communication s Alarm	SCTP CONNE CTION TO PART AMF FAIL	Major	N2 connection fails with CN	NG cannot be established	1. Please use the command LST AMFConfigParam to query the current AMFIP. If the IP is incorrect, you can use the command MOD AMFConfigParam to modify AMFIP. 2. Check if the network port of the device is working properly. 3. Check if it is connected to the AMF network. 4. Check if AMF is working properly.
10	Communication s Alarm	IPSEC ESTABLISHED FAILED	Critical	generated when ipsec sa creation fails or child SA creation fails.	Cell is abnormal and terminal cannot access it.	Please check the ipsec configuration, network connectivity, etc
11	Communication s Alarm	BBU AND RRU MAINTENANCE LINK ABNORMAL ALARM	Major	The BBU and RRU are connected by cable or optical fiber. This alarm is generated when the BBU	The service carried by the RRU is interrupted.	1. Check whether the RRU is powered down, not powered on or operates abnormally. 2. Check whether the optical fiber or cable between the BBU and the RRU is faulty. 3. Check whether the optical module of the BBU or RRU is faulty. 4. Check whether the hardware of the BBU or RRU board is faulty.

				detects that the RRU heartbeat is lost for more than 1 minute		
12	Communication Alarm	All AMFs ARE DISABLED	Major	Generated when the system detects that all core network management status is off.	all configured core network links are interrupted.	Check the configured core network link to ensure normal transmission.

Environmental Alarm

Alarm ID	Alarm Type	Specific Problem	Perceived Severity	Trigger point	Impaction	Handle Suggestion
1	Environmental Alarm	CHECK SEMATIC ERROR	Critical	Generated when the system detects that the configured IP is invalid or PCI is empty.	the cell will be abnormal	1. Please use the command LST AMFConfigParam to query and confirm whether the IP address is valid. You can use the command MOD AMFConfigParam to modify the invalid value. 2. Please use the command LST AMFPoolConfigParam to query and confirm whether the IP address and IPV6 address of the user face are valid. You can use the command MOD AMFPoolConfigParam to modify the invalid values. 3. Please use the command DSP IPAddress to query and confirm whether the IP address and default gateway are valid. You can use the command SET IPAddress to modify the invalid values. 4. Use the command LST CellConfig to query and confirm whether PCI is not empty. If it is empty, use the command MOD CellConfig to modify it. 5. Use the command LST NRCell or LST LTECell to query and confirm whether the adjacent cell PCI is not empty. If it is empty, use MOD NRCell or MOD LTECell to modify it.
2	Environmental Alarm	DISK USAGE OVER 75%	Major	Generated when it is detected that the disk space	it will cause the system to jam or even malfunction. Functions that will generate files, such as	Backup and delete files in the system, such as log files, backup log files, base station upgrade packages, base station upgrade package decompression files, RRU upgrade packages.

				utilization rate exceeds 75%.	PM, MR, upgrade and other functions are abnormal.	
3	Environmental Alarm	BBU BOARD TEMPERATURE TOO HIGH	Major	Generated when the equipment temperature is too high.	service will be interrupted, and webLMT and the network management cannot connect the equipment. In serious cases, the equipment may be damaged and cannot be repaired.	1. Use the fan to reduce the temperature of the equipment. 2. Turn off the equipment and wait for the temperature to decrease before re opening.
4	Environmental Alarm	CELL BARRED	Major	This alarm is generated when the cell is disabled.	Terminal cannot access	Use the command LST RunStatePara to check whether the cell block switch is off. If it is not off, use the command MOD RunStatePara to modify it.
5	Environmental Alarm	USER USAGE OVER 90	Minor	This alarm will be generated when the UE capacity reaches 90% of the total capacity.	Terminal is hard to access	1. When 90% of the access specification is reached, an alarm will be given, and when it is lower than 90% of the access specification, the alarm will be automatically cleared. 2. Add cells or base stations to improve the coverage capacity.
6	Environmental Alarm	PHY LOST TIMING	Critical	This alarm is generated when the system detects that phy timing is out of step.	When this alarm is generated, the physical layer functions abnormally. If the phy timing loses step and cannot be recovered within one minute, the BBU will restart.	1. After the system detects that phy timing out of step recovery, the alarm will be automatically cleared. 2. Please contact the customer's network operation and maintenance personnel to confirm the specific reason and try to restart.
7	Environmental Alarm	PHY HAPPEN TIMING BEAT	Major	This alarm is generated when the system detects that phy	the physical layer functions abnormally.	1. When the system detects that phy timing is no longer jumping, the alarm will be automatically cleared. 2. Please contact the customer's network operation and maintenance personnel to confirm the specific reason and try to restart.

				timing jumps.		
8	Environmental Alarm	PTP STATUS ALARM	Critical	This alarm will be generated when the system detects that the PTP clock is not synchronized.	Terminal can not access	1. Use the command LST FGAFINFO to check whether the clock is locked. If it is not locked and the current clock synchronization mode is GNSS_mode, check whether the GPS connection is normal. 2. Use the base station IP and the RRU mapping port queried by executing the command LST PortMapping to access the RRU interface and check whether the PTP status is abnormal.
9	Environmental Alarm	RRU STATUS ALARM	Critical	This alarm is generated when the system detects that the BBU has no heartbeat interaction with the RRU for a long time.	Terminal can not access	Please check the RRU connection and power on status.
10	Environmental Alarm	SAS STATUS ALARM	Critical	This alarm is generated when the system detects the SAS authorization exception.	Cell is abnormal, Terminal can not access	Please check the CBSD function switch. If it is enabled, please check the SAS authorization status.
11	Environmental Alarm	N3 ECHO ALARM	Critical	When the terminal accesses to do business, it starts link detection. This alarm will be	the cell is abnormal, and the terminal cannot do uplink and downlink services.	Please check whether the network connection between BBU and UPF is normal.

				generate d when the link is blocked.		
12	Enviro nment al Alarm	GNBID ABNOR MAL ALARM	Critical	This alarm is generate d when the first gNBId in the cell TAC list is inconsist ent with the gNBId in the BTS ID.	the corresponding cell cannot be activated and operated normally.	Use the command LST CNTA to view the BTS ID of the first data in the corresponding cell. If it is inconsistent with the BTS ID queried using the command LST GNBConfig, use the command MOD CNTA to modify it to be consistent, and then restart the BTS.
13	Enviro nment al Alarm	USER USAGE OVER 95	Major	Generate d when the number of access users exceeds 95% of the total capacity	It may cause system performance degradation, service interruption or other problems.	Try to temporarily increase the system capacity to meet the access needs of additional users.
14	Enviro nment al Alarm	USER USAGE OVER 98	Critical	Generate d when the number of access users exceeds 98% of the total capacity	It may cause system performance degradation, service interruption or other problems.	Try to temporarily increase the system capacity to meet the access needs of additional users.
15	Enviro nment al Alarm	RU ANTEN NAS ALARM	Critical	This alarm is generate d when the antenna is abnormal .	Terminal can not access	Please check whether the antenna is intact and connected normally.
16	Enviro nment al Alarm	SERVIC E PROTO COL ERROR	Critical	Generate d when the optical port mapping relations hip is configure d	The physical layer may lose packets and the service may not be available.	Please use the command LST OptPortMapping to check whether the optical port mapping relationship is not configured consistently, and contact the maintenance personnel to check the correctness of the physical layer configuration file.

				incorrectly or the corresponding physical layer is configured incorrectly.		
17	Environmental Alarm	EQUIPMENT OVER TEMPERATURE ALARM	Major	Generated when the RRU device temperature is higher than the set threshold value.	Prolonged over temperature operation may cause equipment performance degradation or damage.	1. Check whether the alarm threshold setting is reasonable. 2. Check the ambient temperature. 3. Check whether the position of the cooling teeth at the installation position of the RRU is reasonable.
18	Environmental Alarm	PTP ABNORMAL ALARM	Major	Generated when PTP clock information is not synchronized.	1. RRU local time will shift. 2. RF signals and services will be abnormal.	1. Check whether the optical fiber link is abnormal. 2. Check whether the BBU PTP configuration is correct. 3. Restart the RRU to recalibrate the PTP clock.

Equipment Alarm

Alarm ID	Alarm Type	Specific Problem	Perceived Severity	Trigger point	Impaction	Handle Suggestion
1	Equipment Alarm	UPGRADE FAIL	Critical	Generated when upgrading the BBU software version, RRU software version, accelerator card version or activating the backup BBU backup version through webLMT or the NMS fails.	Upgrade fails	1. The specific reason for the failure can be viewed in the "Alarm Description" to locate and solve the problem and clear the alarm. 2. The common alarm is described as "disk usage not enough". Please contact the customer's network operation and maintenance personnel to clean the base station software package decompression files, or log files, backup log files, base station upgrade packages, and RRU upgrade packages. 3. When this alarm is triggered due to power failure during the upgrade process, this alarm can be cleared by CLR ActAlarm command.

2	Equipment Alarm	CM CONFIGURATION FILE DAMAGE	Critical	Generated when the inheritance of the configuration file fails or the verification of the configuration file fails.	Configuration file is used abnormally, and the functions such as query and setting are unavailable.	Use the command RST DATA to reset the configuration file.
3	Equipment Alarm	OPTICAL PORT NOT IN PLACE	Critical	Generated when accelerator card or optical port is not in place.	accelerator card functions abnormally.	Please check the optical port.
4	Equipment Alarm	PARAMETER CONFIG OR DEVICE ENV	Minor	Generated when the firmware version is abnormal or the physical layer is incorrectly configured.	protocol stack function is abnormal.	Please contact the customer's network operation and maintenance personnel to check the firmware version and system parameter configuration.
5	Equipment Alarm	SYS DEVICE ENV ALARM	Major	Generated when the CPU core does not support multithreading, or the bios version is less than 3, or the network card speed does not reach 1000.	the data transmission delay is large, and some functions will be abnormal.	Please contact the customer's network operation and maintenance personnel to check the equipment environment.
6	Equipment Alarm	PTP PORT FAIL	Major	This alarm will be generated when the system detects that the PTP clock class is not 6.	PTP clock synchronization function is abnormal.	Please use the command SET 1588V2CFG to set the clock class to 6.
7	Equipment Alarm	NETWORK INTERFACE LINK FAIL	Major	Generated when the system detects that	PTP clock synchronization function is	Please contact the customer's network operation and maintenance personnel to confirm the specific reason.

				the configured PTP clock synchronization network link is abnormal.	abnormal.	
8	Equipment Alarm	HIGH MEMORY USAGE	Major	Generated when the system detects that the memory utilization rate exceeds 98%.	Functions of the BBU will be abnormal.	Please contact the customer's network operation and maintenance personnel to confirm the specific reason and try to restart.
9	Equipment Alarm	MTU GREATER THAN 1500	Major	Generated when the system detects that the MTU value of the network card is greater than 1500.	The transmission delay of the data packet passing through the network card is large, and the probability of bit error in the data packet is large, which may affect the normal operation of some functions.	Please modify the MTU value of the network card to ensure that it is not greater than 1500.
10	Equipment Alarm	CELL OUT OF SERVICE	Critical	This alarm is generated when the cell stops service.	Terminal can not access	Check whether there are high-level alarms. Restart the BTS after the alarms are resolved. For example, when the SCTP Connection to AMF FAIL alarm exists, the SCTP connection between the BTS and the AMF is abnormal, causing the BTS to be unavailable. After the SCTP Connection to AMF FAIL alarm is removed, the Cell Out of Service alarm will be cleared.
11	Equipment Alarm	AMF NG SETUP FAIL	Critical	Generated when the NG interface fails to be	the cell is abnormal and the terminal cannot	Use the commands LST AMFConfigParam and LST AMFPOOLConfigParam to query whether parameters such as PLMN and TAC are consistent

				established .	access.	with AMF. If they are inconsistent, use the commands MOD AMFConfigParam and MOD AMFPOOLConfigParam to modify them.
12	Equipment Alarm	F1 TO DU SETUP FAIL	Critical	generated when F1 interface fails to connect to DU.	the cell is abnormal and the terminal cannot access.	Please use the commands LST AMFConfigParam and LST AMFPOOLConfigParam to query whether the parameters such as PLMN and TAC are configured correctly. If they are incorrect, you can use the commands MOD AMFConfigParam and MOD AMFPOOLConfigParam to modify them.
13	Equipment Alarm	F1 TO CU SETUP FAIL	Critical	Generated when F1 interface fails to connect to CU.	the cell is abnormal and the terminal cannot access.	Please use the commands LST AMFConfigParam and LST AMFPOOLConfigParam to query whether the parameters such as PLMN and TAC are configured correctly. If they are incorrect, you can use the commands MOD AMFConfigParam and MOD AMFPOOLConfigParam to modify them.
14	Equipment Alarm	CELL PCI COLLISION	Warning	generated when the PCI module 3 or module 30 of the serving cell and the adjacent cell (including the adjacent station cell) are the same, and the downlink frequency point or SSB is the same.	it may cause call drop, affect handover performance, and make access difficult.	1. Modify the PCI and SSB of adjacent cells and adjacent stations to ensure that there is no conflict between cells. 2. Use the command LST CellConfig to check whether the PCI configured in the current cell is the same as the PCI module 3 or module 30 in the adjacent cell, and whether the downlink frequency point or SSB is the same. If they are the same, use the command MOD CellConfig to modify
15	Equipment Alarm	CELL PCI CONFUSION	Warning	generated when the PCI, SSB, and PLMN of the serving cell and the adjacent cell (including	it may cause call drop, affect handover performance, and make access difficult.	1. Modify the PCI, frequency point, and PLMN of adjacent cells and adjacent stations to ensure that there is no confusion between cells. 2. Use the commands LST CellConfig and LST CNTAPLMN to check whether the PCI, frequency point, PLMN and adjacent cell configurations

				the adjacent cell) are the same.		of the current cell are the same as those of the adjacent cell. If they are the same, use the commands MOD CellConfig and MOD CNTAPLMN to modify them.
16	Equipment Alarm	NBR GNB XN SETUP FAIL	Critical	generated when the Xn interface connection fails due to abnormal signaling flow.	Xn connection cannot be established .	The adjacent station may have a TimeToWait mechanism. Wait for a period of time before trying to connect again.
17	Equipment Alarm	NO SERVICE AMF FOR CELL	Major	generated when the AMF core network has no service.	the connection with the core network cannot be established , and the cell is unavailable.	Synchronously check whether the PLMN, TAC and other configurations of the BTS and the core network match.
18	Equipment Alarm	CHANNEL 1 OPEN LOAD ALARM	Major	This channel has no transmit power, and if the port is not connected to any antenna or load, an alarm will be generated.	Open load for a long time may cause damage to the RRU equipment.	Check whether an antenna or load is installed on the RRU device port.
19	Equipment Alarm	CHANNEL 2 OPEN LOAD ALARM	Major	This channel has no transmit power, and if the port is not connected to any antenna or load, an alarm will be generated.	Open load for a long time may cause damage to the RRU equipment.	Check whether an antenna or load is installed on the RRU device port.

20	Equipment Alarm	CHANNEL 3 OPEN LOAD ALARM	Major	This channel has no transmit power, and if the port is not connected to any antenna or load, an alarm will be generated.	Open load for a long time may cause damage to the RRU equipment.	Check whether an antenna or load is installed on the RRU device port.
21	Equipment Alarm	CHANNEL 4 OPEN LOAD ALARM	Major	This channel has no transmit power, and if the port is not connected to any antenna or load, an alarm will be generated.	Open load for a long time may cause damage to the RRU equipment.	Check whether an antenna or load is installed on the RRU device port.

Integrity Violation

Alarm ID	Alarm Type	Specific Problem	Perceived Severity	Trigger point	Impaction	Handle Suggestion
1	Integrity Violation	SYNTAX CHECK FAIL	Critical	This alarm is generated when the system detects that the BTS ID is greater than the maximum BTS ID.	Syntax error, the BTS ID is invalid	Use the command LST GNBCfg to query and confirm whether the relationship between the base station ID and the length of the base station ID is correct. If not, use the command MOD GNBCfg to modify.

Operational Violation Alarm

Alarm ID	Alarm Type	Specific Problem	Perceived Severity	Trigger point	Impaction	Handle Suggestion
1	Operational Violation	DU CONFIGURATION INVALID	Critical	generated when the system detects that the cell parameter configuration	TS function is abnormal, and the terminal cannot do business	Use the command LST PHYTddULDL to query and confirm whether the cell subframe matching is configured correctly. If it is not, use the command MOD

				is abnormal.	normally.	PHYTddULDL to modify it.
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Processing Error Alarm

Alarm ID	Alarm Type	Specific Problem	Perceived Severity	Trigger point	Impaction	Handle Suggestion
1	Processing Error Alarm	UPLOAD FAIL	Major	generated when uploading files to the NMS fails.	the user cannot obtain the log file of the BTS from the NMS	1. Use the command LST LogMgmt to query and confirm whether the BTS log parameters are correct. 2. Please check whether the network between the system and the ACS network management system can be connected normally.
2	Processing Error Alarm	ANTENNAS DISACCORD	Critical	generated when the system checks that the number of uplink antennas or downlink antennas in different cells is different when the system is started.	physical layer cannot be started.	Use the command LST CellConfig to query and confirm whether the ul antenna or dl antenna in different cells are consistent. If not, use the command MOD CellConfig to modify the ul antenna or dl antenna, and then restart the process to validate the configuration.
3	Processing Error Alarm	PROCESS OUT OF SERVICE	Critical	generated when it is detected that a process has stopped service.	functions involved in the process cannot be used, and the process monitor will try to restart the process to recover the abnormal process.	1. Please use the command LST MTNINFO to query and confirm whether the detection switch is turned off. If it is not turned off, you can use the command SET MTNINFO to modify it to turn off the process monitor. 2. Please contact the customer's network operation and maintenance personnel to confirm the specific reason and try to restart.
4	Processing Error Alarm	GENERATE INVALID PARAMETER	Critical	generated when the protocol stack fails to add or delete nodes.	adding or deleting nodes fails, and the nodes are involved in abnormal functions.	1. Please check the uniqueness of the new node and whether the values carried are correct according to the alarm description. 2. Please check whether the deleted node exists according to the alarm description.

5	Processing Error Alarm	HIGH CPU USAGE	Critical	generated when the system detects that the CPU utilization rate exceeds 95%.	system will show that it is stuck or even stuck.	1. Use the top command and other commands to check the processes with high CPU utilization and kill the non protocol stack processes. 2. Please contact the customer's network operation and maintenance personnel to confirm the specific reason and try to restart.
6	Processing Error Alarm	INCORRECT CORE ASSIGNMENT	Critical	generated when the system detects that the core allocation is incorrect.	Speed rate will be low, or even the BTS will start abnormally	Please contact the customer's network operation and maintenance personnel to check the distribution.
7	Processing Error Alarm	IP ROUTE FAIL	Critical	generated when the IP is wrong.	terminal cannot access or do business.	Please check according to plan and avoid using internal IP address of the system.
8	Processing Error Alarm	NO USER FOR 24 HOUR	Critical	generated when there is no UE access within 24 hours	This alarm has no impact on the system. In order to notify relevant personnel to check whether the equipment is faulty	Please check whether the network equipment, base station or other key components are faulty.
9	Processing Error Alarm	SUBFRAME NOT MATCH	Critical	generated when the system checks that the subframe matching parameter does not match the corresponding subframe matching type when starting.	BTS function is abnormal, and the terminal cannot do business normally.	Please check the sub frame matching parameters of all cells and modify them correctly.
10	Processing Error Alarm	SPLITCELL BANDWIDTH OVER LIMIT	Major	When the cell soft split switch is turned on, this alarm will be generated when the total bandwidth of the two split cells exceeds 100M.	cell splitting fails.	Modify the bandwidth of the split cell. The total bandwidth does not exceed 100M.
11	Processing Error Alarm	SPLITCELL TXPOWER OVER LIMIT	Major	When the cell soft split switch is turned on, this alarm will be generated when the total power of the two split cells exceeds 37	cell splitting fails.	Modify the power of the split cell. The total power does not exceed 37 dbm.

				dbm.		
12	Processing Error Alarm	CBSD EIRP OVER LIMIT	Major	When RRU transmits power, and the EIRP exceeds 47dbm/10M.	EIRP takes the default maximum of 47dbm/10M	Change antenna gain or road loss in split CBSD configuration, and adjust EIRP.
13	Processing Error Alarm	SPLITCELL BANDWIDTH FREQUENCY OVERLAP	Major	When the cell soft split switch is turned on, this alarm will be generated when the corresponding frequency points of the two cell bandwidths after splitting overlap.	cell splitting fails.	Modify the frequency points of the split cell. The frequency points cannot overlap.
14	Processing Error Alarm	PORTMAPPING AND SPLITSWITCH IS INCONSISTENT	Major	1. The cell optical port mapping relationship is configured to be 1 to many, but the device is restarted before the splitting switch is turned on. 2. In the splitting scenario, it is changed to no splitting, and the cell optical port mapping relationship is restored to 1-to-1. However, this device is restarted before the splitting switch is turned off.	Affects business under soft splitting or normal mode.	When modifying the optical port mapping relationship, check whether the soft split switch needs to be turned on or off.

Quality of Service Alarm

Alarm ID	Alarm Type	Specific Problem	Perceived Severity	Trigger point	Impaction	Handle Suggestion
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1	Quality of Service Alarm	CHANNEL1 UPLINK ALC OVERRANGE ALARM	Major	The uplink signal is greater than the allowable value of the RRU device, and the device's limit on the input signal has exceeded the limit value.	1. The uplink signal is too large, and the signal or service may be abnormal. 2. The uplink signal is too large, which may damage the low noise amplifier of the equipment.	1. Restart the RRU. 2. Scan the environment around the RRU for strong interference signals.
2	Quality of Service Alarm	CHANNEL2 UPLINK ALC OVERRANGE ALARM	Major	The uplink signal is greater than the allowable value of the RRU device, and the device's limit on the input signal has exceeded the limit value.	1. The uplink signal is too large, and the signal or service may be abnormal. 2. The uplink signal is too large, which may damage the low noise amplifier of the equipment.	1. Restart the RRU. 2. Scan the environment around the RRU for strong interference signals.
3	Quality of Service Alarm	CHANNEL3 UPLINK ALC OVERRANGE ALARM	Major	上 The uplink signal is greater than the allowable value of the RRU device, and the device's limit on the input signal has exceeded the limit value.	1. The uplink signal is too large, and the signal or service may be abnormal. 2. The uplink signal is too large, which may damage the low noise amplifier of the equipment.	1. Restart the RRU. 2. Scan the environment around the RRU for strong interference signals.
4	Quality of Service Alarm	CHANNEL4 UPLINK ALC OVERRANGE ALARM	Major	The uplink signal is greater than the allowable value of the RRU device, and the device's limit on the input signal has exceeded the limit value.	1. The uplink signal is too large, and the signal or service may be abnormal. 2. The uplink signal is too large, which may damage the low noise amplifier of the equipment.	1. Restart the RRU. 2. Scan the environment around the RRU for strong interference signals.
5	Quality of Service Alarm	CHANNEL1 STANDING WAVE RATIO ALARM	Major	When it is checked that the standing wave ratio of this channel is greater than	High SWR and poor signal quality may lead to service performance degradation.	1. Check whether the SWR threshold setting is reasonable. 2. Check whether the RRU antenna interface and feeder interface are tightened. Whether the feeder is normal.

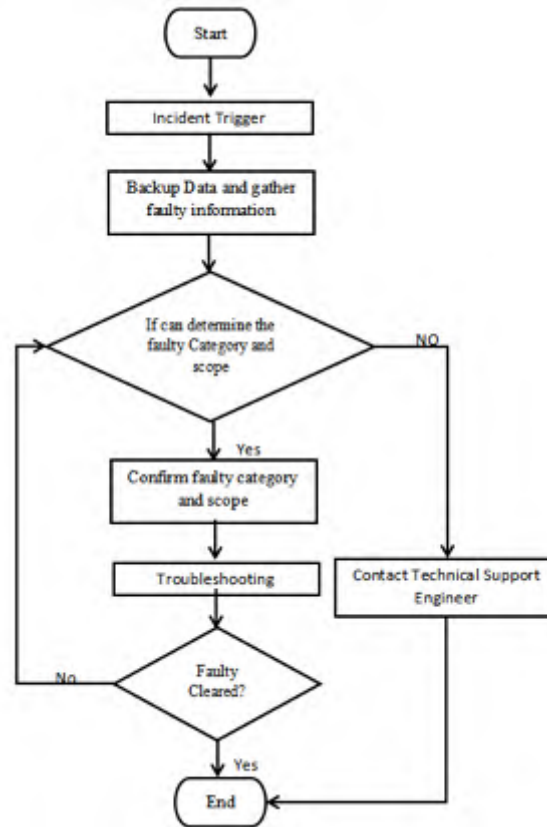
				the set threshold value, an alarm is generated.		
6	Quality of Service Alarm	CHANNEL2 STANDING WAVE RATIO ALARM	Major	When it is checked that the standing wave ratio of this channel is greater than the set threshold value, an alarm is generated.	High SWR and poor signal quality may lead to service performance degradation.	1. Check whether the SWR threshold setting is reasonable. 2. Check whether the RRU antenna interface and feeder interface are tightened. Whether the feeder is normal.
7	Quality of Service Alarm	CHANNEL3 STANDING WAVE RATIO ALARM	Major	When it is checked that the standing wave ratio of this channel is greater than the set threshold value, an alarm is generated.	High SWR and poor signal quality may lead to service performance degradation.	1. Check whether the SWR threshold setting is reasonable. 2. Check whether the RRU antenna interface and feeder interface are tightened. Whether the feeder is normal.
8	Quality of Service Alarm	CHANNEL4 STANDING WAVE RATIO ALARM	Major	When it is checked that the standing wave ratio of this channel is greater than the set threshold value, an alarm is generated.	High SWR and poor signal quality may lead to service performance degradation.	1. Check whether the SWR threshold setting is reasonable. 2. Check whether the RRU antenna interface and feeder interface are tightened. Whether the feeder is normal.
9	Quality of Service Alarm	CHANNEL1 DOWNLINK UNDER OUTPUT POWER ALARM	Major	If the downlink output power of this channel is lower than the set threshold value, an alarm will be generated.	Low power may cause service performance degradation and coverage area degradation.	1. Check whether the under power alarm threshold setting is reasonable. 2. Check whether the output power setting value is normal. 3. Contact the manufacturer to check whether the equipment gain calibration value is normal.
10	Quality of Service Alarm	CHANNEL2 DOWNLINK UNDER OUTPUT POWER ALARM	Major	If the downlink output power of this channel is lower than the set threshold value, an alarm will be generated.	Low power may cause service performance degradation and coverage area degradation.	1. Check whether the under power alarm threshold setting is reasonable. 2. Check whether the output power setting value is normal. 3. Contact the manufacturer to check whether the equipment gain calibration value is normal.

11	Quality of Service Alarm	CHANNEL3 DOWNLINK UNDER OUTPUTPOWER ALARM	Major	If the downlink output power of this channel is lower than the set threshold value, an alarm will be generated.	Low power may cause service performance degradation and coverage area degradation.	1. Check whether the under power alarm threshold setting is reasonable. 2. Check whether the output power setting value is normal. 3. Contact the manufacturer to check whether the equipment gain calibration value is normal.
12	Quality of Service Alarm	CHANNEL4 DOWNLINK UNDER OUTPUTPOWER ALARM	Major	If the downlink output power of this channel is lower than the set threshold value, an alarm will be generated.	Low power may cause service performance degradation and coverage area degradation.	1. Check whether the under power alarm threshold setting is reasonable. 2. Check whether the output power setting value is normal. 3. Contact the manufacturer to check whether the equipment gain calibration value is normal.
13	Quality of Service Alarm	CHANNEL1 DOWNLINK OVER OUTPUTPOWER ALARM	Major	If the downlink output power of this channel is higher than the set threshold value, an alarm will be generated.	Excessive power may cause overheating or abnormal restart of the equipment.	1. Check whether the setting of the over power alarm threshold is reasonable. 2. Contact the manufacturer to check whether the equipment gain calibration value is normal.
14	Quality of Service Alarm	CHANNEL2 DOWNLINK OVER OUTPUTPOWER ALARM	Major	If the downlink output power of this channel is higher than the set threshold value, an alarm will be generated.	Excessive power may cause overheating or abnormal restart of the equipment.	1. Check whether the setting of the over power alarm threshold is reasonable. 2. Contact the manufacturer to check whether the equipment gain calibration value is normal.
15	Quality of Service Alarm	CHANNEL3 DOWNLINK OVER OUTPUTPOWER ALARM	Major	If the downlink output power of this channel is higher than the set threshold value, an alarm will be generated.	Excessive power may cause overheating or abnormal restart of the equipment.	1. Check whether the setting of the over power alarm threshold is reasonable. 2. Contact the manufacturer to check whether the equipment gain calibration value is normal.
16	Quality of Service Alarm	CHANNEL4 DOWNLINK OVER OUTPUTPOWER ALARM	Major	If the downlink output power of this channel is higher than the set threshold value, an alarm will be generated.	Excessive power may cause overheating or abnormal restart of the equipment.	1. Check whether the setting of the over power alarm threshold is reasonable. 2. Contact the manufacturer to check whether the equipment gain calibration value is normal.

6.4.2 nCELL-T5000 Series Base Stations Troubleshooting Guide

6.4.2.1 Common troubleshooting process

The common troubleshooting process is shown in the figure below

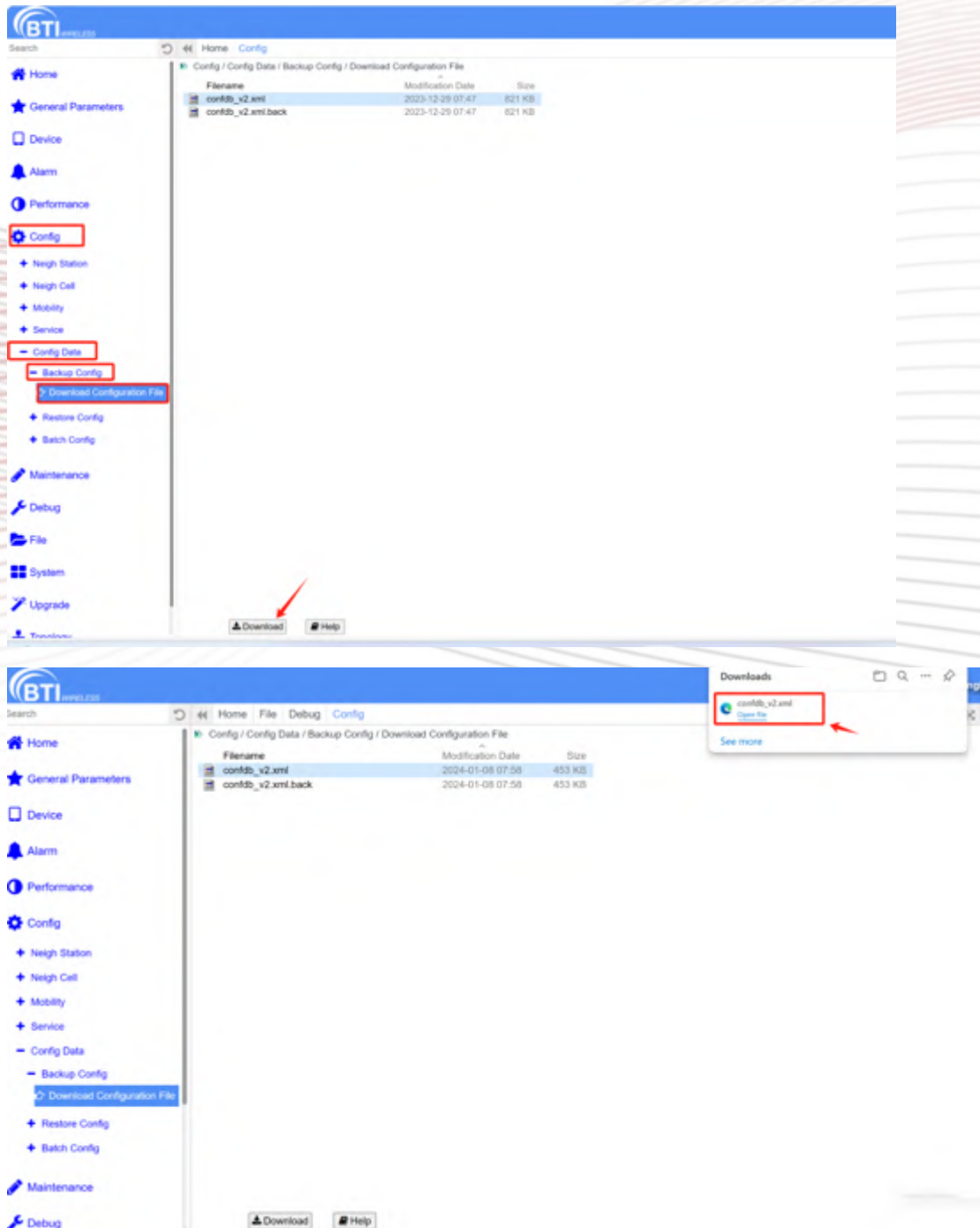


6.4.2.2 Common fault information collection

Items	Common fault information collection description
Config file	The configuration file is an XML file that carries the configuration data of the base station. Can be used to check if the configuration data currently running on the base station is correct
Gatherlog	Gatherlog is a collection of various log files, including CU/DU/alarm/config..etc
Alarm file	The alarm file includes active alarms and historical alarm information, which can be used to check if there are any current faults in the base station.
Signaling Trace	Standard signaling tracking is used to track signaling messages from interfaces such as CP and FAPI. Can be used to locate issues such as abnormal user access and dropped calls.
MR File	MR files can be used for network quality analysis, cross regional coverage analysis, network interference analysis, etc

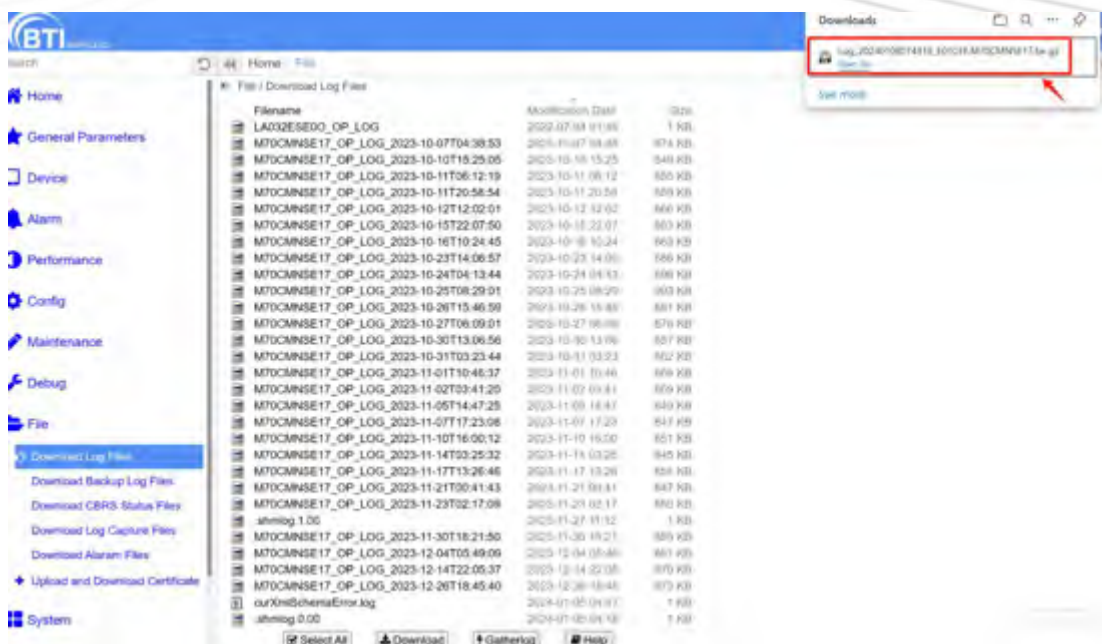
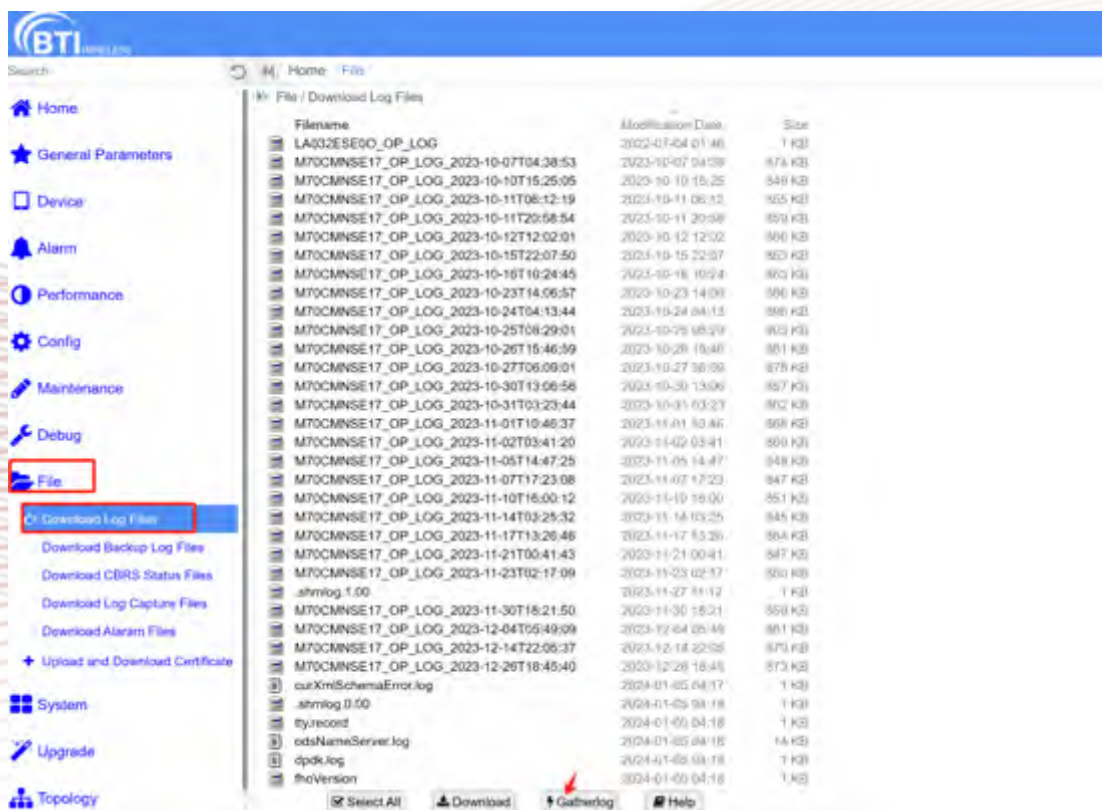
Collect Base Station Config File

In the web LMT interface“Config / Config Data / Backup Config / Download Configuration File” tab, Select the configuration file, click “Download” to download it locally.



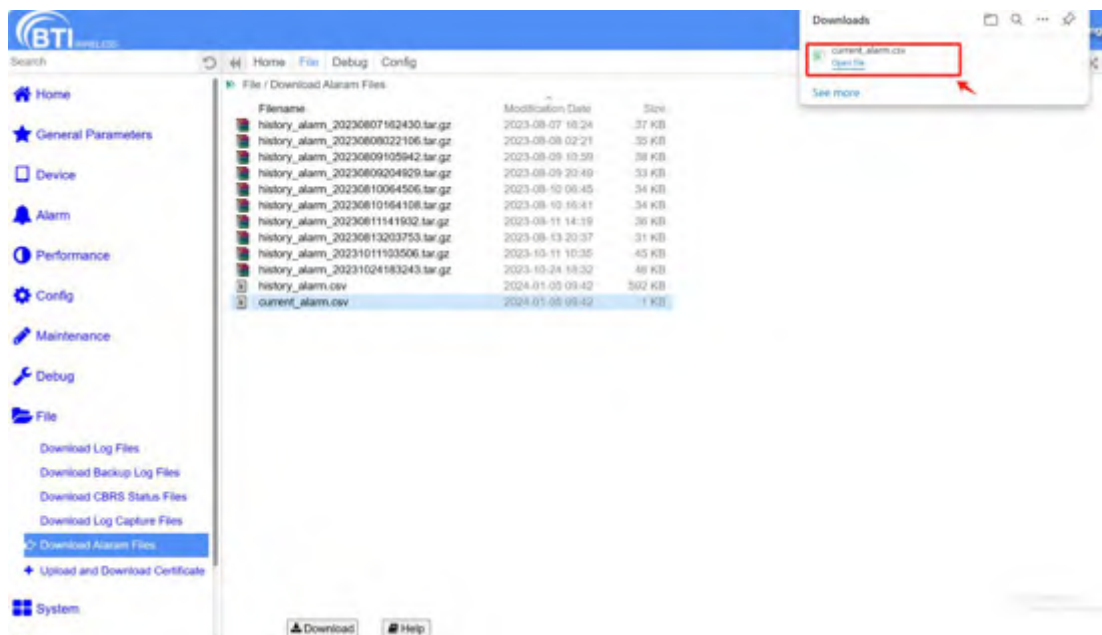
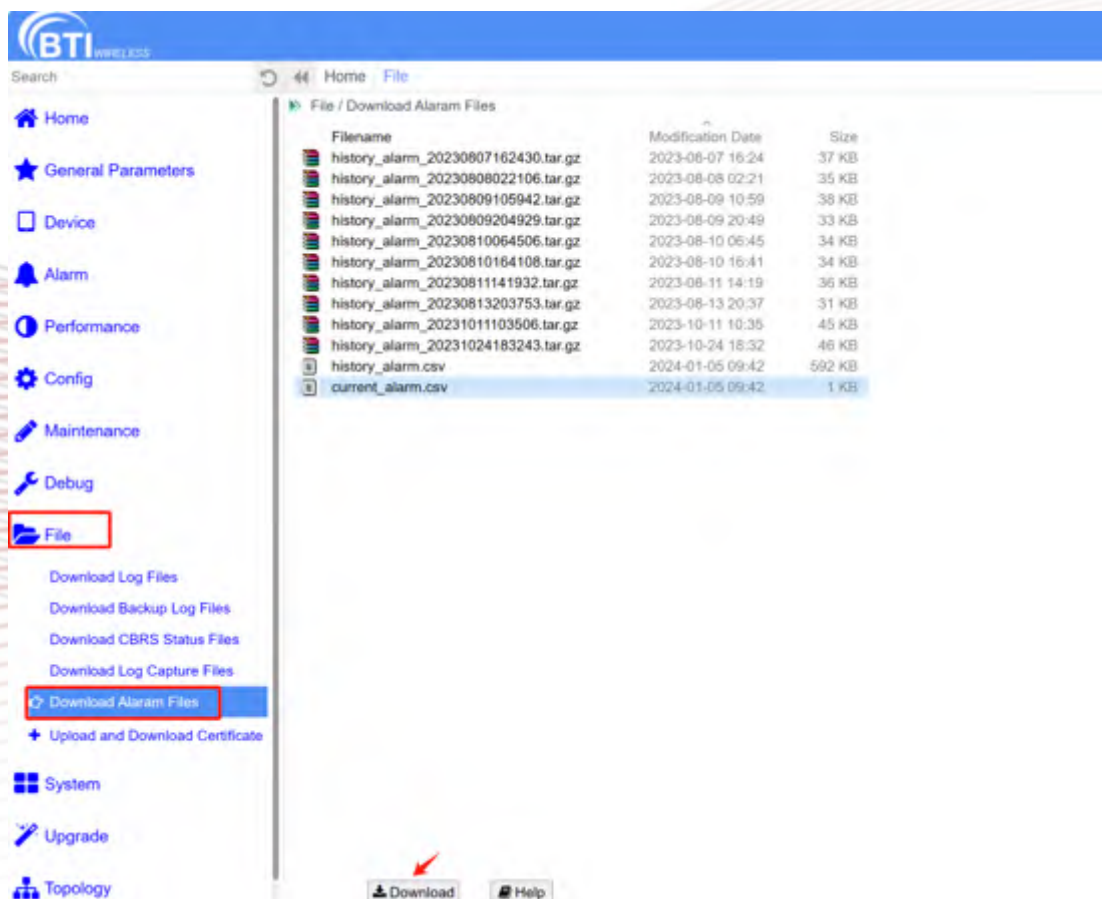
Collect Gatherlog

In the web LMT interface “File->Download Log Files” tab , click “Gatherlog” button, download the logs to the local location.



Collect Alarm File

In the web LMT interface “File / Download Alaram Files” tab, Select the alarm file to download, click the “Download” button to download it locally.



Collect Signaling Trace

Please Refer Chapter 6.1.1.7-Common Operation ->Trace Management

7.0 Term

Abbreviations	Definition
5QI (5G QoS Identifier)	5QI is a scalar used as a reference for specific QoS forwarding behaviors (such as packet loss rate, packet delay budget) to be provided to 5G QoS flows. It can be implemented in the access network by controlling the 5QI reference node specific parameters of QoS forwarding processing (such as scheduling weights, admission thresholds, queue management thresholds, link layer protocol configuration, etc.).
AMF (access and mobility management function)	The Access and Mobility Management Function (AMF) includes mobility management, connection management, legitimate interception, transparent proxy, access authentication, and authorization.
BBU (baseband unit)	Mobile access network devices for processing baseband signals
GPS (Global Positioning System)	The Global Positioning System (GPS) consists of three parts: the space part (satellite), the user part (receiver), and the control part (maintenance, etc.). The GPS receiver calculates its position based on the time difference of several satellites received.
MML (man-machine language)	The MML command allows network administrators to perform operations on abstract objects by issuing the MML command.
PCI (physical cell identifier)	Physical cell identification
PLMN (public land mobile network)	The Public Land Mobile Network (PLMN) is a network established and operated by regulatory authorities or recognized private telecommunications organizations (RPOA) to provide land mobile communication services to the public, providing communication possibilities for mobile users.
QoS (quality of service)	Overall business performance, which determines the satisfaction of users of a certain business with that business, characterizes the comprehensive indicators applicable to all businesses, including: -Business operability; -Business accessibility; -Business sustainability; -Business integrity; -Other performance of each business.
RRU (remote radio unit)	RRU (Remote Radio Unit) is an RF far-field unit that mainly completes the reception and transmission of baseband signals, as well as the modulation and demodulation, data processing, power amplification and other functions of RF signals. RRU is closer to the antenna compared to RFU, resulting in lower feeder losses.
TAC (tracking area code)	Tracking area code, the tracking area code which a cell belongs. A tracking area can cover one or more cells.
TDD (time division duplex)	Time Division Duplex (TDD) is an application of Time Division Multiplexing (TDM) technology used to separate transmitted and received signals and simulate full duplex communication on a half duplex communication link.
VLAN (virtual LAN)	Virtual Local Area Network (VLAN) is any broadcast domain divided at the data link layer (OSI model layer 2) of a computer network.

8.0 Contact Us

Method 1: www.btiwireless.com

Method 2: <https://btiwireless.zendesk.com/hc/en-us>