

5G NR Femto cell User Manual



XDUP DQ 5G NR Femto cell User Manual 1



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XDUP DO HQ WHEQ DWR Q DOHR Q JTHQ WDOHR S VUJ KWHE357##### z z z kskp dyZrp #



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With the gradual development of 5G wireless network construction, the importance of indoor coverage in 5G applications is becoming increasingly high; Compared with 4G networks, 5G adopts a higher frequency band, with weak diffraction and penetration capabilities, and is prone to interference over long distances. Therefore, 5G indoor small base stations will be the protagonist of 5G construction.

FCC Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- ## 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 20 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.

1.1 Network Topology

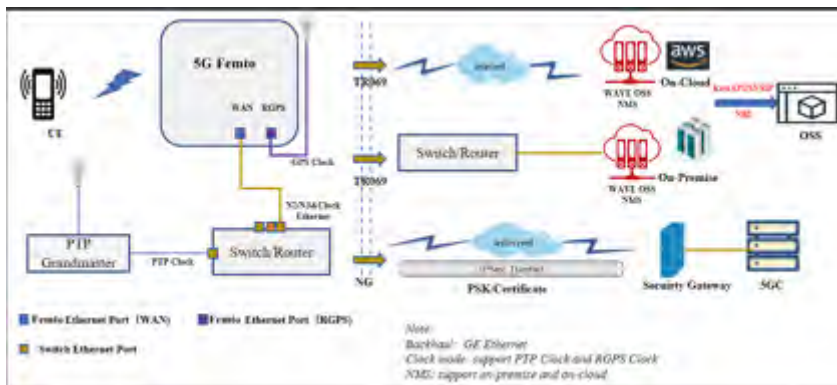


Figure 1. 5G Femtocell Network Diagram

XDUP DQ 8Q WHEQ DWIR Q DOIF R Q IIGHQ WIDOF R S UIM XWE357##### # # # ##### z z z kdp dyZp #

1.2. Hardware

1.2.1 Physical Indicators

Type	Index
Dimensions (Length*Width*Height) (mm)	200 * 200 *64
Weight (kg)	< 1.5 kg

1.2.2 Environmental performance

Type	Index
Ambient temperature	- 10 ~ +40°C
Environment humidity	5% ~ 95%
Waterproof and dustproof grade	IP30
Pressure range	70 ~ 106kPa

1.2.3 Power indicator

Voltage requirements	Describe	Remark
12V DC	12V DC Adapter	
POE (37V~57V)	POE network power supply	Support POE++ 802.3bt

1.3 Product Appearance



Figure 2. 1 diagram of appearance



Figure 3. Schematic diagram of the interface

Name	Detailed description	Interface Type	Quantity	Remark
Backhaul interface	Electric port, 1 Gbps	RJ45	1	Support POE++, Support PTP G8275.1
DC power supply	12V power interface	DC JACK	1	
GPS input	RGPS antenna input	RJ45	1	
Reset button	Reset		1	Factory reset

Figure 4. Interface description

Silk Screen	Function	LED Color	State	Description
	Power Indicator	blue	Off	No power or power supply abnormal
			Bright	Device power normal
	System Indicator	Blue/Red	Blue Bright	System running normal
			Red Bright	System Abnormal
	sync indicator	Blue/Red	Blue Bright	Synchronization succeeded
			Red Bright	Asynchronous mode or unsuccessful synchronization
	5G service indicator	Blue/Red	Blue Bright	Cell Up
			Red Bright	Cell Down
			Red Flashing	Backhaul Link Down

Figure 5. Description of indicator lights

1.4 Equipment installation

1.4.1 Installation preparation

Before installation, please ensure that the wiring work has been completed at the place where the device is installed.

1.4.2 Installation site selection

The installation location of the equipment must have enough space to facilitate equipment heat dissipation, installation, commissioning, and maintenance. The



installation location should be selected as follows:

- The installation location of the equipment should be well ventilated.
- The temperature and humidity of the equipment installation location cannot exceed the temperature and humidity range of the equipment.
- The installation location of the equipment should take measures such as dust proof and waterproof.
- The location of the equipment should be conducive to signal coverage.
- The location of the equipment should be far away from the interference source of high-power equipment.

5G Femto supports desktop, ceiling, and wall-mounted installation methods. To ensure that the equipment can work safely, reliably, and stably, the installation location of the equipment should make the equipment in a good operating environment.

After Femto is powered on, the indicator light will prompt the current status of the base station. And Determine whether the base station has been activated normally according to the display of the indicator light.

1.4.3 Installation method

Equipment and accessories:

Device:1 pc

Power Adapter:1 pc

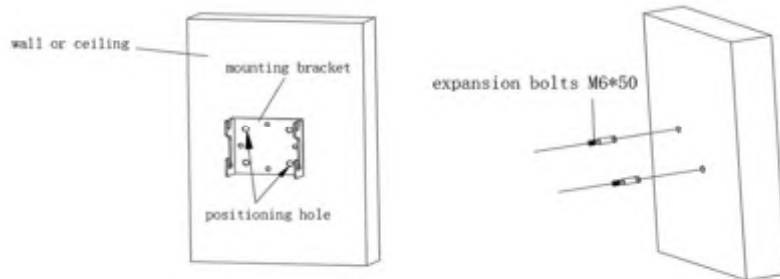
Bracket: 3 pcs (1 for Device, 1 for wall or ceiling,1 for desktop)

screw: 8 pcs

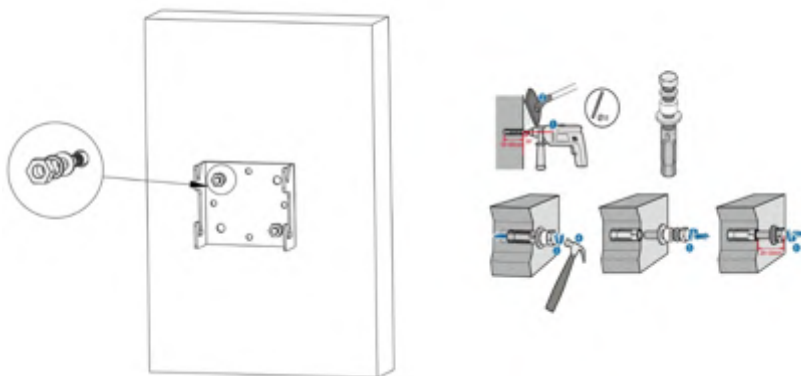
KDUP DQ HQ WHEQ DWIR Q DOIFR Q JIG HQ WIDOF R S\UJ KWIE357##### # # # ##### z z z kskp dyZrp #

- Wall & Ceiling

Drill hole in the wall or ceiling as per the size expansion bolt size

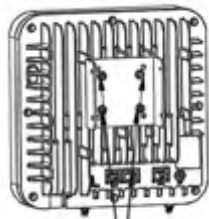


Install expansion bolt to bracket 2 and fix it in wall or ceiling

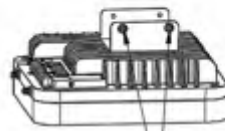


Fix bracket 1 to Femto body with 4 screws

XDUP DQ HQ WHEQ DWIR Q DOIR R Q IIS HQ WIDOR R S\UJ KWIE357##### # # # ##### z z z kskp dYXp #

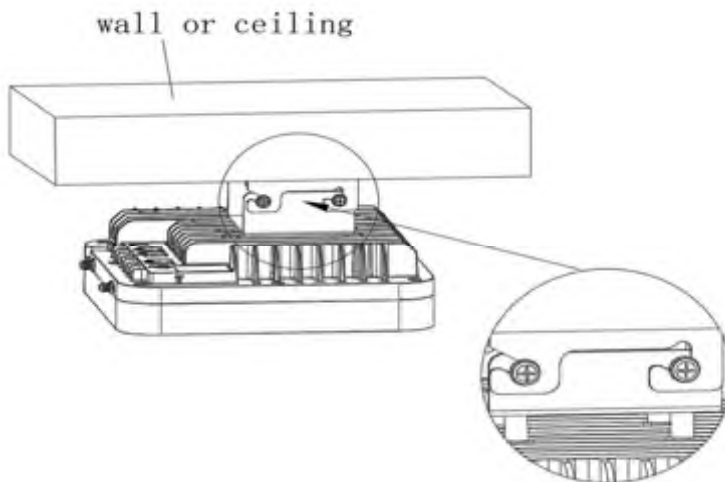


M4*10combination screw=4



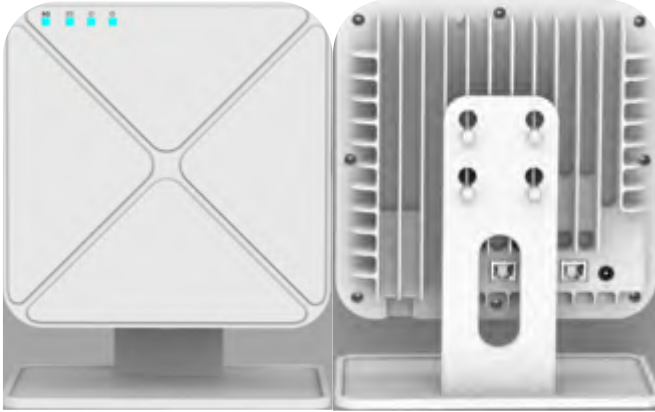
M4*10combination screw=4

Install bracket 1 carrying Femto onto the card slot of bracket 2, then fix the slot with 4 screws as below



● Desktop

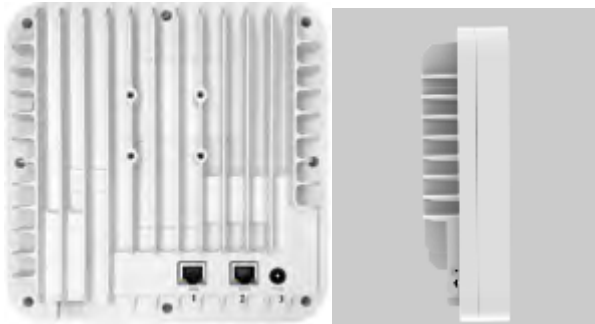
XDUP DQ HQ WHEQ DWIR Q DOIR R Q JIHQ WIDOR R S\UIJ KWIE357##### # # # ##### z z z kskp dYrp #



2 Connection method

2.1 Interface Connection Description

There are 2 network interfaces, WAN indicates backhaul GE Ethernet port for fm1-mac9 and RGPS indicates GPS clock synchronization interface.



Interface Specifications			
1	WAN: Backhaul Port(GE) fm1-mac 9	2	RGPS: GPS clock(RJ45)

KDUP DQ 8Q W8HQ DW8R Q DO8P R Q JIG HQ WID8P R S\UJ XW8357##### # # # ##### z z z 8k8p 8jZ8p #

3	+12V: Power (DC)	4	Reset: Factory reset
---	---------------------	---	-------------------------

Figure 6. Interface Description

2.2 WEB Login Method

After the Femto is powered on, Femto supposed to be on air auto by zero touching provisioning, in case need access and make changes at local, open browser like edge or chrome, put the URL address in browser and load, the URL format should be: <https://192.168.5.100>, there is a static IP(192.168.5.100) preset in the wan port for local access.

Default web Login user/password: admin/\$mallCel!@5421

Default SSH user/Password: root/Smallcell@5

Default Show hidden content password: Smallcell@5421

The latest version will remind clients to reset password when logging in for the first time.



KDUP DQ WQ WHEQ DWIR Q DOIR R Q JIGHQ WIDOR R S\UJ KWIE357##### # # # ##### z z z kkgp dyXp #

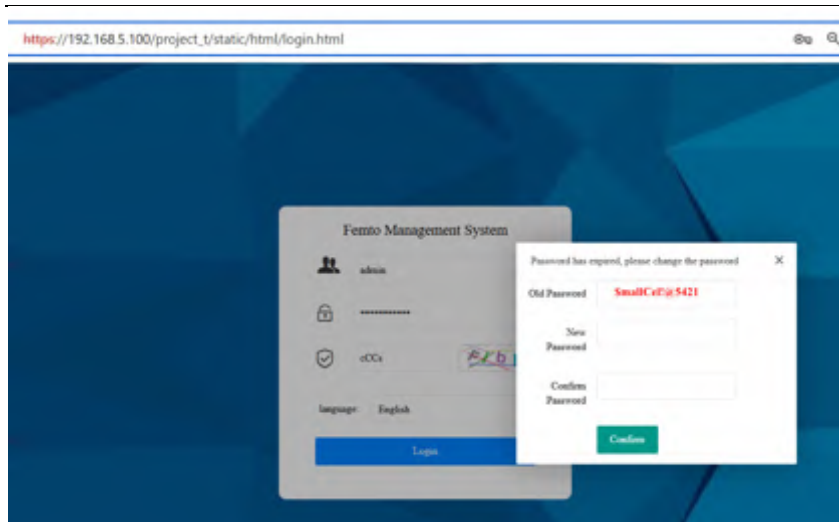


Figure 7. WEB login page

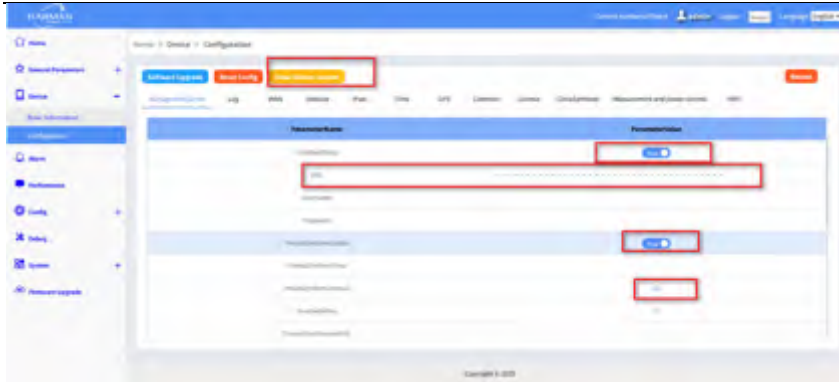
2.3 NMS Connectivity

Path Device-Configuration-Management Server

URL should be provided by NMS server side. Turn on the switch

“PeriodicInformEnable” to make Femto send interactive request to NMS, Parameter “PeriodicInformInterval” is the interval time of request, it is 60 seconds by default and can be modified as per requirement.

KDUP DQ HQ WHEQ DWIR Q DOIFR Q JIGHQ WIDOF R S\UJ KWIE357##### # # # ##### z z z kkgp dyZrp #



3 Quick-Start

Modify the general parameter configuration of the Femto such as parameter WAN IP, AMF IP, PLMN, PCI,TAC,Arfcn and SSB, number of layers, Mcstable,subframe,clock,vonr,...etc. Make sure the AMF link is normal, and operation status is running.

3.1 Modify WAN IP

Path Device-Configuration-WAN

WAN port supports N2/N3 separation and also supports N2/N3 integration.

The following is an example configuring N2&N3 integration on physical port fam1-mac9.

#####



5G Femto User Manual

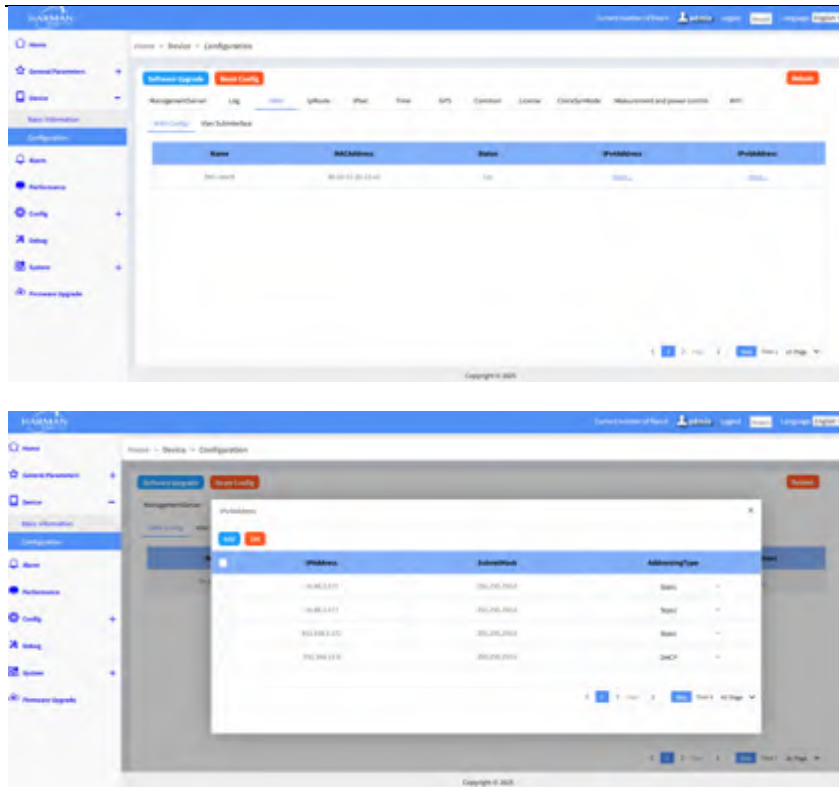


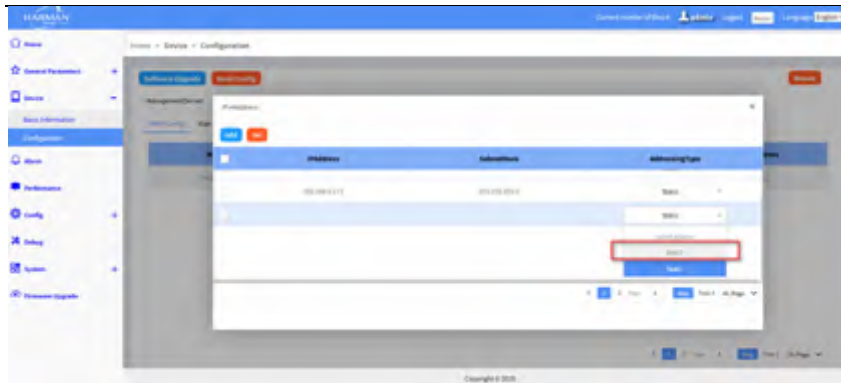
Figure 8. WAN IP

DHCP Configuration

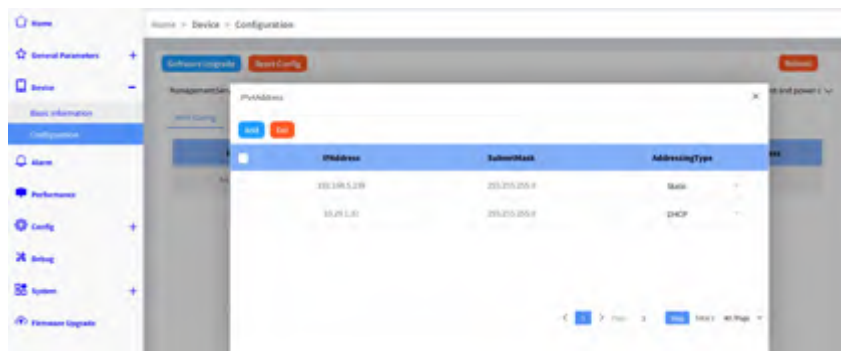
Take fm1-mac9 as an example

Modify the “Addressing Type” to DHCP

XDUP DQ 8Q W8IQ D8IQ Q DO8P R Q 1IG HQ WID8P R S U1U X W8E357##### # # # ##### z z z 3k8p dY8p #



Obtain IP via DHCP



After DHCP flow succeeds, IP Address and Subnet Mask are automatically filled with the address obtained from the DHCP server.

#####

When the VLAN function is required, configure the VLAN ID and VLAN IP according to the following configuration method.

WAN config:

[illegible]

Vlan SubInterface Config:



```

KDUPDQ#QWUQDWRQDO#FRQIIGHQWIDOF#R$\\UJ KW#5357#####
# # # ##### z z z kdp dyfrp#

```

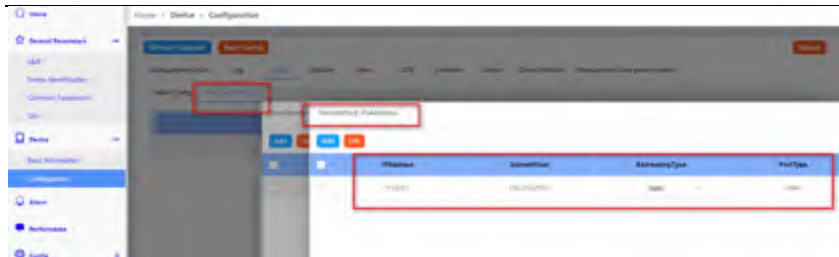


Figure11. VLAN IP modify

3.2 Modify IpRoute

Path Device-Configuration-IPRoute

When the WAN IP is not the same segment with the AMF IP, The local route must be added to make sure the route between the gNB and the 5GC is reachable.



Figure 12. Configure route

Note: The destination network segment should be a subnet which contains NMS IPs or 5GC IPs, the network prefix length is the number of mask digits, the gateway address is the next hop of Femto interface, the port name is the service port name, and the route table ID is filled according to the actual situation, only configure default route need set the table ID as 254, otherwise configure table ID as the value between 1~253. (Valid table id range is 1 ~ 254).

XDUP DQ HQ WHEQ DWHE Q DOWP R Q JIHQ WIDOWP R S\UJ KWHE357##### # # # ##### z z z kdkp dyZrp #

3.3 Modify AMF IP and Femto N3 IP

- AMF IP

Path General Parameters-Common Parameters

Configure the IP based on 5GC



Figure 13. AMF IP

- Femto N3 IP

Path General Parameters-AMF

“LocalUpIPAddress” indicates the User plane IP(N3) of Femto,not UPF IP, the actual IP should be configured according to transmission and network planning. If N2 IP and N3 IP of Femto are the same, or IPsec is enabled, here should be kept empty as below.

KDUP DQ HQ WHEQ DWIR Q DOIR R Q JIG HQ WIDOR R S\UJ KWIE357##### # # # ##### z z z kkg dyZp #

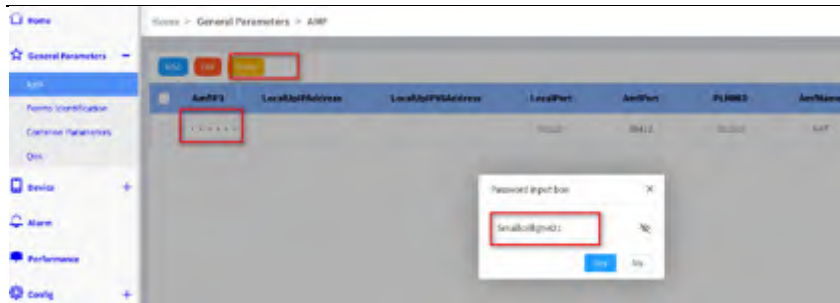


Figure 14. N3 IP of Femto

3.4 Modify PLMN

PLMN in Femto should be configured consistently with the PLMN configuration in 5GC. After login in the web LMT, there are four places which need to be modified, as shown in the following figure.

3.4.1 PLMN In AMF

Path General Parameters-Common Parameters

Modify the “PrimaryPLMNID” as example 00101f.



Figure 15. PLMN IN AMF

3.4.2 PLMN In TA

Path General Parameters-Common Parameters-TA-PLMNList

Figure 16. PLMN IN TA

The screenshot shows the 'General Parameters' tab in the Oracle Cloud Infrastructure console. The 'Instance ID' field is highlighted with a red box, and the 'Add Instance' button is also highlighted with a red box.

Figure 17. PLMNID List in TA

3.4.3 PLMN of Default 5QI

Path General Parameters-Qos- PLMNIndex

Modify the PLMNID.

[illegible]

```

KDUPDQ #Q WHUQ DWER Q DO#FR Q IIG HQ WID#FR S\ULJ KW#5357#####
# # # # ##### z z z kdp dYrp#

```

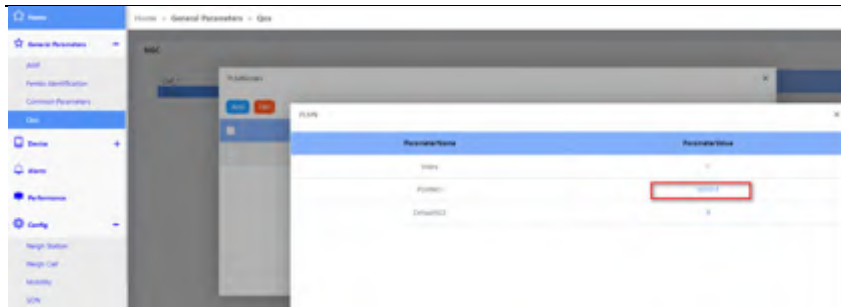
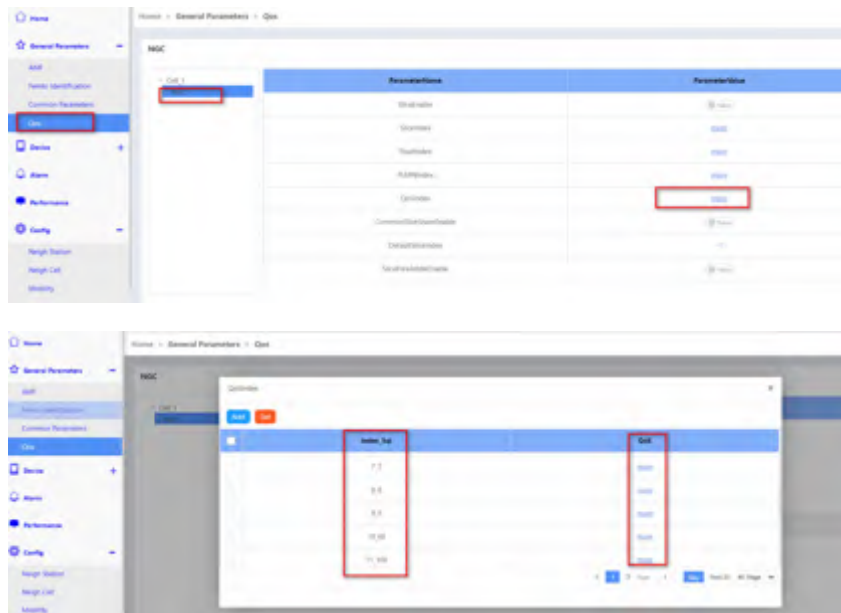


Figure 18. Default 5QI PLMN

3.4.4 PLMN of QosIndex

Path General Parameters-Qos- QosIndex

Generally no need configure the PLMN ID in QosIndex, in case it's configured as wrong PLMN, need modify it or delete it as empty.



KDUP DQ WREQ DWIR Q DOIR Q JIHQ WIDOR S\UJ KWIE357##### # # # ##### z z z kkg dyZp #

3.5 Modify Frequency Parameters

The distribution of downlink NRARFCN and uplink NRARFCN corresponds to the downlink and uplink center frequency points, and the absolute value of SSB frequency and frequency band indication, 4 parameters need to be modified.

SSB Value Calculation:

Reference Website - https://www.sqimway.com/nr_refA.php

Fill in the channel synchronization and run.

Arfcn GSCN is equal to AbsoluteFrequencySSB.

Normally the first Coreset(0) check that shows ok will be selected. Take the following as an example. (2496-2690M)

AbsoluteFrequencySSB = 510510

NRARFCNDL/NRARFCNUL = 518598.

Channel synchronization

Frequency band

n41

SCS ssbSCH

30 kHz

SCS Common

30 kHz

Bandwidth

100 MHz

NR Arfcn scan

518598

Control ResourceSet Zero

10 (48 RBs, offset 12)

Run

Full range for band TDD n41			
	Min	Max	Step
Frequency [MHz]	2496	2690	
NR-ARFCN	499200	537996	6
GSCN	6252	6714	3
Restricted range for a bandwidth of 100 MHz			
	Min	Max	
Frequency [MHz]	2546.01	2640	
NR-ARFCN	509202	528000	
NR-ARFCN selected	Frequency [MHz]	Point A Arfcn	Point A [MHz]
518598	2592.99	508770	2543.85
GSCN scan			
	Min	Max	
GSCN	6360	6594	

XDUP DQ HQ WHEQ DWIR Q DOIR R Q IIG HQ WIDOR R S\UIJ XWIE357##### # # # ##### z z z kdkp dYErp #

GSCN synchronization						SS/PBCH & SSB			NR-ARFCN		NRAR DL BWP	
GSCN	Frequency (MHz)	Δ MHz GSCN NR-ARFCN	Arfcn GSCN	N	M [1,3,5]	CRB ₁	k_{SSB} (KSC)	Offset to Point A (PRB)	CRB ₂	k_1	CRB _{start}	Correset(D) check
6369	2547.75	-45.24	509550	2123	7	10	20	0	137	6	-12	Invalid
6372	2548.95	-44.04	509790	2124	8	14	4	8	137	6	-8	Invalid
6375	2550.15	-42.84	510030	2125	9	17	12	14	137	6	-5	Invalid
6378	2551.35	-41.64	510270	2126	8	20	20	20	137	6	-2	Invalid
6381	2552.55	-40.44	510510	2127	8	24	4	28	137	6	2	ok
6384	2553.75	-39.24	510750	2128	8	27	12	34	137	6	5	ok
6387	2554.95	-38.04	510990	2129	8	30	20	40	137	6	8	ok
6390	2556.15	-36.84	511230	2130	8	34	4	48	137	6	12	ok
6393	2557.35	-35.64	511470	2131	8	37	12	54	137	6	15	ok
6396	2558.55	-34.44	511710	2132	8	40	20	60	137	6	18	ok
6399	2559.75	-33.24	511950	2133	8	44	4	68	137	6	22	ok
6402	2560.95	-32.04	512190	2134	8	47	12	74	137	6	25	ok
6405	2562.15	-30.84	512430	2135	8	50	20	80	137	6	28	ok
6408	2563.35	-29.64	512670	2136	8	54	4	88	137	6	32	ok
6411	2564.55	-28.44	512910	2137	8	57	12	94	137	6	35	ok
6414	2565.75	-27.24	513150	2138	8	60	20	100	137	6	38	ok
6417	2566.95	-26.04	513390	2139	3	64	4	108	137	6	42	ok
6420	2568.15	-24.84	513630	2140	8	67	12	114	137	6	45	ok
6423	2569.35	-23.64	513870	2141	3	70	20	120	137	6	48	ok
6426	2570.55	-22.44	514110	2142	8	74	4	128	137	6	52	ok
6429	2571.75	-21.24	514350	2143	3	77	12	134	137	6	55	ok

Figure 21. Calculate SSB

NRARFCN and AbsoluteFrequencySSB Modify

Path General Parameters - Common Parameters



Figure 22. Center frequency ARFCN and SSB ARFCN

Bandwidth Modify

KDUP DQ HQ WBSQ DWBS Q DOBFR Q JIG HQ WIDOBFR S\UJ KWBS357##### # # # ##### z z z kskp dYzP #

Path Config - Service – Overall – CellConfig

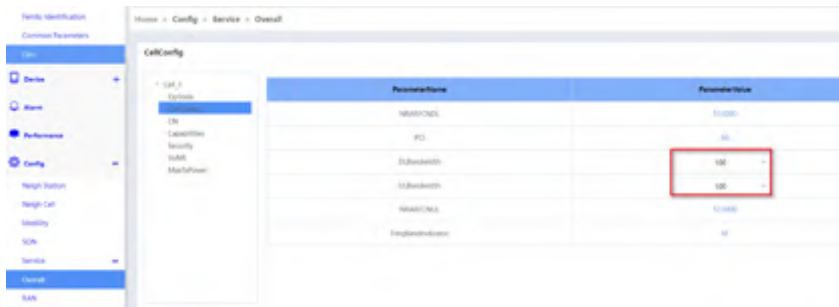


Figure 23. Bandwidth and frequency band indicator

Note: When bandwidth is 100MHz, SRS Auto config should be enabled, and it should be disabled for another bandwidth.

Path Config - Service – RAN – MAC

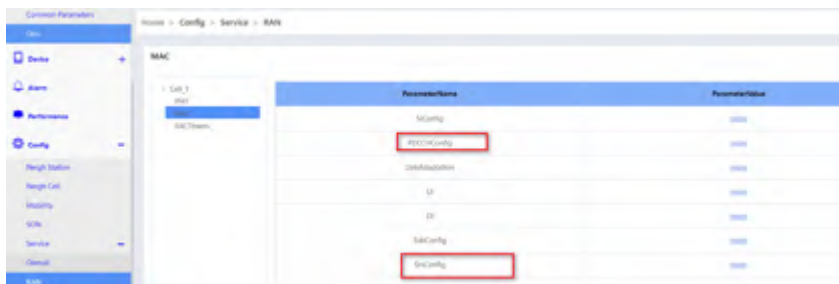


Figure 24. Srsconfig



KDUP DQ WHEQ DWIR Q DOIR R Q IIRHQ WIDOR R S\UIJ KWIE357##### # # # ##### z z z kkgp dYzP #

Figure 25. Srs Enable

RB number

Path

Config-Service-Overall-MAC-PDCCHConfig-ControlResourceSetToAddModList

Bandwidth/Mhz	100	80	60	40	20
RB number	273	217	162	106	51

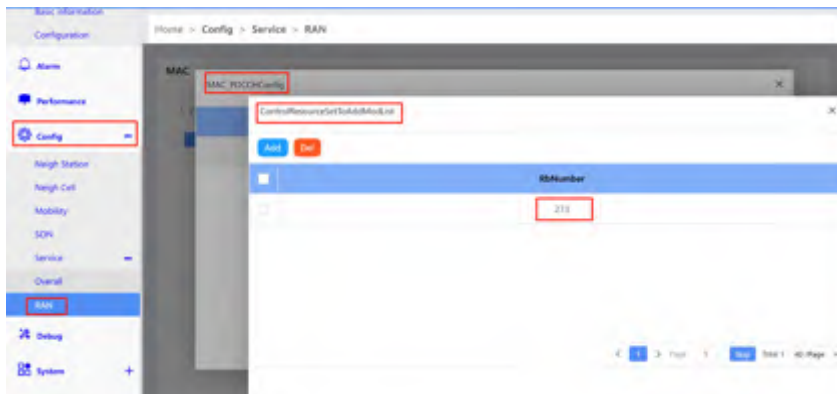


Figure 26. RB Number Configuration

3.6 Modify SubFrame Format

5G Femto supports the following three TDD Subframe formats.

- 2.5ms double period DDDSUDDSUU
- 2.5ms single period DSUUU
- 5ms single period DDDDDDDSUU

Default Subframe config:

XDUP DQ WQ WQ WQ WQ WQ Q DQ WQ R Q TQ WQ WQ WQ R S\UW KW E357##### # # # ##### z z z kkg qYp #

Path Config - Service - RAN - TddULDLConfigurationCommon



Figure 27. View Default frame format

Modify subframe config as 2.5ms single period DSUUU frame format

“DLTransmissionPeriodicity1”: 5 (5 indicates 2.5ms, 6 indicates 5ms)

“NrofDownlinkSlot1”: 1 (numbers of Downlink Slot)

“NrofDownlinkSymbols1”: 10 (numbers of Downlink Symbols)

“NrofUplinkSlot1”: 3 (numbers of Uplink Slot)

“NrofUplinkSymbols1”: 2 (numbers of Uplink Symbols)

“IsPattern2Present”: False (False: disable, True: enable)

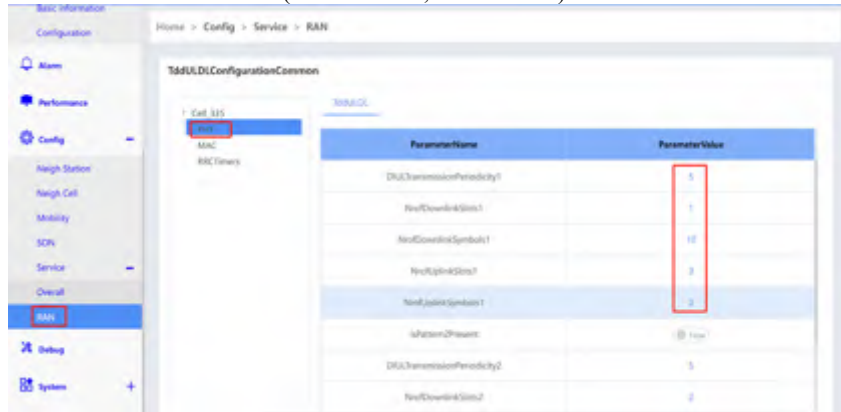


Figure 28. DSUUU frame format configuration

Note: For subframe config DSUUU, need change the parameter of the periodic BSR timer from

KDUP DQ HQ WHEQ DWIR Q DOIR R Q IIR HQ WIDOR R S UIR KWIE357##### # # # ##### z z z kkgp dyZrp #

“sf20” to “sf5” (RAN-MAC- ul - Periodic BSR Timer), other subframe config keep it as “sf20”.

Only DSUUU need change BSR timer to “sf5”, other subframe config keeps BSR timer as “sf20”.

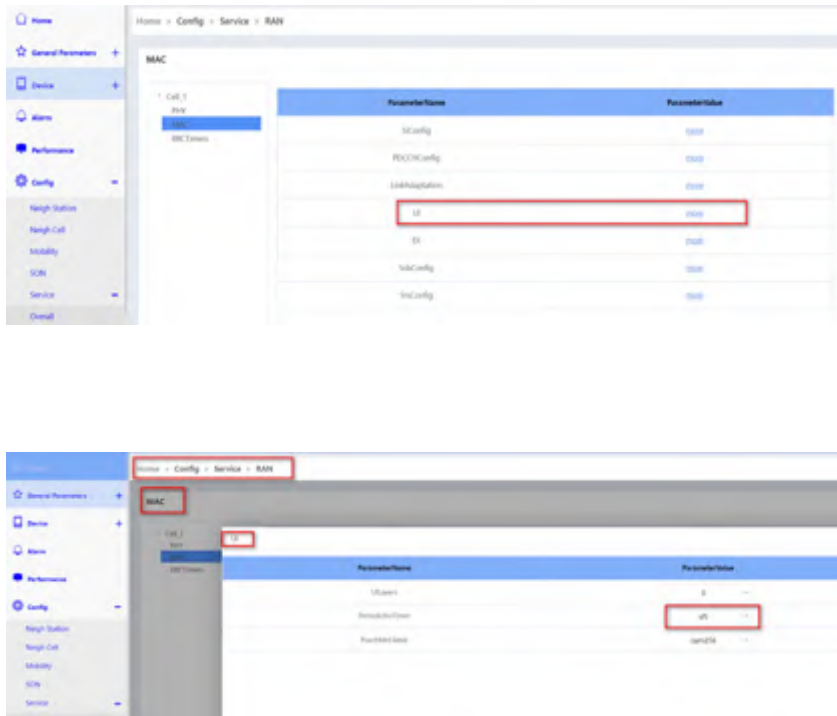


Figure 29. Modifying the BSR timer

Modify subframe config as 5ms single period DDDDDDSUU:

“DLULTransmissionPeriodicity1”: 6 (5 indicates 2.5ms, 6 indicates 5ms)

“NrofDownlinkSlot1”: 7 (numbers of Downlink Slot)

“NrofDownlinkSymbols1”: 6 (numbers of Downlink Symbols)

“NrofUplinkSlot1”: 2 (numbers of Uplink Slot)

“NrofUplinkSymbols1”: 4 (numbers of Uplink Symbols)

“IsPattern2Present”: False (False: disable, Ture: enable)

XDUP DQ HQ WHEQ DWHE Q DOHEP Q JIHQ WIDHEP R S\UJ KWHE357H##### # # # ##### z z z kkgp dYErp #

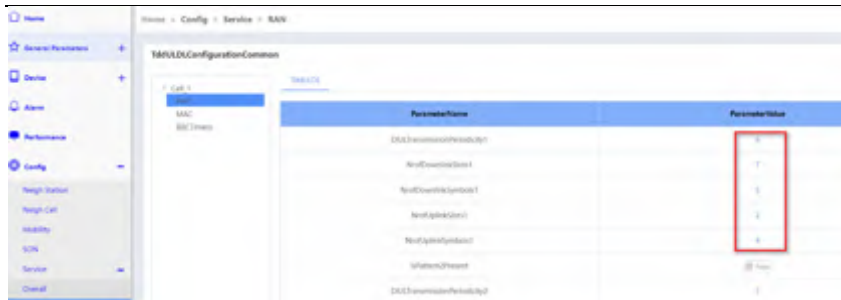


Figure 30. DDDDDDSUU frame format configuration

Modify subframe config as 2.5ms double period DDDSUDDSUU:

“DLULTransmissionPeriodicity1”: 5 (5 indicates 2.5ms, 6 indicates 5ms)

“NrofDownlinkSlot1”: 3 (numbers of Downlink Slot)

“NrofDownlinkSymbols1”: 10 (numbers of Downlink Symbols)

“NrofUplinkSlot1”: 1 (numbers of Uplink Slot)

“NrofUplinkSymbols1”: 2 (numbers of Uplink Symbols)

“IsPattern2Present”: Ture (False: disable, Ture: enable)

“DLULTransmissionPeriodicity2”: 5 (5 indicates 2.5ms, 6 indicates 5ms)

“NrofDownlinkSlot1”: 2 (numbers of Downlink Slot)

“NrofDownlinkSymbols1”: 10 (numbers of Downlink Symbols)

“NrofUplinkSlot1”: 2 (numbers of Uplink Slot)

“NrofUplinkSymbols1”: 2 (numbers of Uplink Symbols)

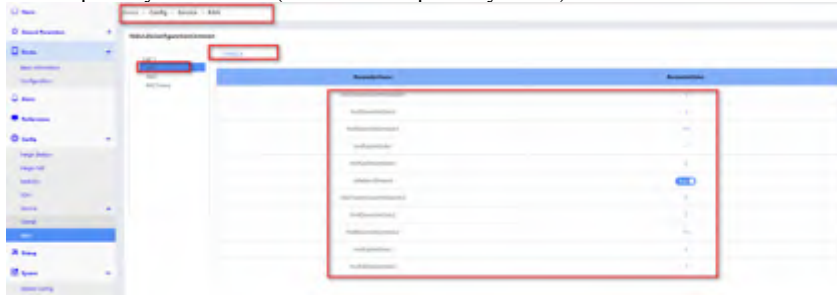


Figure 31. DDDSUDDSUU frame format configuration

3.7 Clock Sync Mode

Femto cell supports clock sync mode: GNSS_mode, 1588 mode and freerun.

Note:

- Need to reboot (not restart) to take effect after changing the sync mode.

KDUP DQ WHEQ DWIR Q DOIR Q JIHQ WIDIR S\UJ KWIE357##### # # # ##### z z z kkg dyZp #

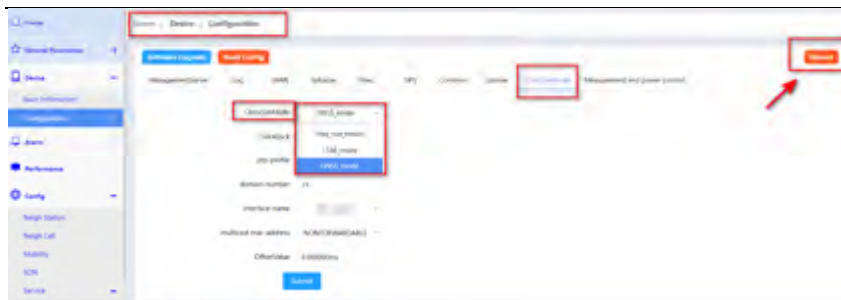


Figure 31. Clock Sync Mode

● 1588 Mode

ManagementServer	Log	WAN	IpRoute	IPsec	GPS	Common	License	ClockSyncMode	Measurement and power control
ClockSyncMode 1588_mode									
ClockLock LOCKED									
ptp-profile G_8275_1									
domain-number 24									
interface-name fm1-mac10									
multicast-mac-address NONFORWARDABLE									
OffsetValue 0.000000ms									
Submit									

● GPS Mode

ClockSyncMode	GNSS_mode
ClockLock	LOCKED
ptp-profile	G_8275_1
domain-number	24
interface-name	fm1-mac10
multicast-mac-address	NONFORWARDABLE
OffsetValue	0.000000ms
Submit	

KDUP DQ HQ WHEQ DWIR Q DOIFR Q JIHQ WIDOF R S UJ K WIE357##### # # # ##### z z z kkp dqZrp #

● Freerun Mode

ClockSynMode	free_run_mode
ClockLock	FREERUN
ptp-profile	G_8275_1
domain-number	24
interface-name	fes1-mac10
multicast-mac-address	NONFORWARDABLE
OffsetValue	0.000000ms
<button>Submit</button>	

3.8 IPSec Configuration

3.8.1 PSK Authentication Method

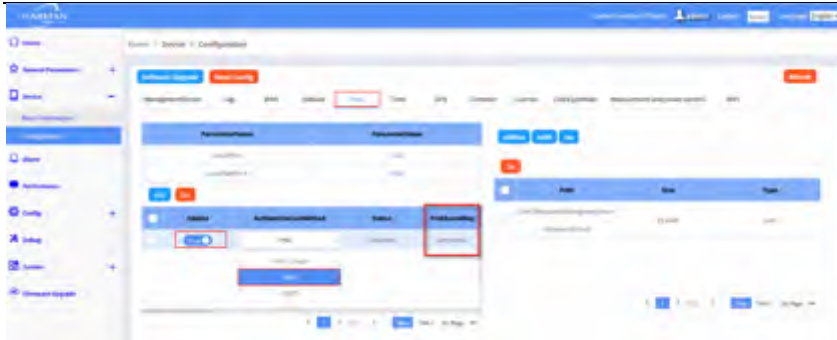
Path Device-Configuration-IPsec

Step1. Turn on the Enable switch and select PSK for Authentication Method

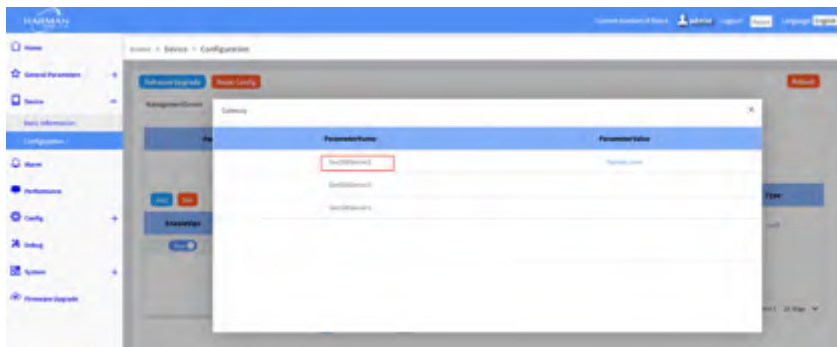


Step2. Configure the PreSharedKey

XDUP DQ W9HQ DWIR Q DOIFR Q JIHQ WIDOF R S\UJ KW6357##### # # # ##### z z z kdp dyZrp #



Step3. Configure the Security gateway IP or FQDN



Step4. Configure EncryptionAlgorithm, IntegrityAlgorithm, DH groupTransforms and turn on the EnableVips switch to request gateway to allocate virtual ipv4



KDUP DQ WHEQ DWIR Q DOIR R Q IIRHQ WIDOR R S UIR KWIE357##### # # # ##### z z z kdkp dYzP #



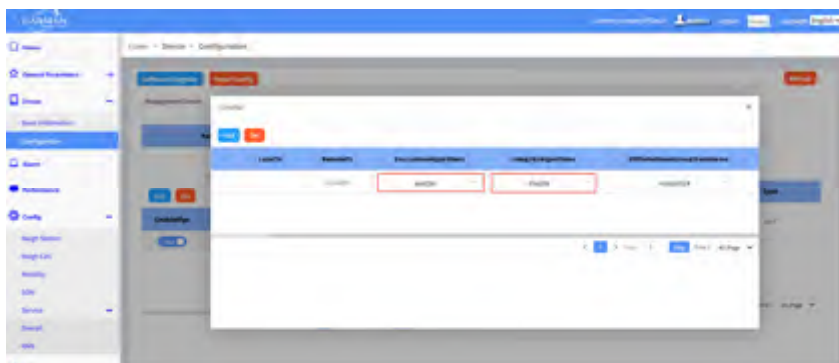
Step5. Configure the Local ID and Remote ID

Local ID keep as blank, remoteID configure as “%any”.



Step6. Configure Child SA

Vips need be enabled to request virtual ip from security gateway.



Local TS: local traffic selection, indicates the subnet to be encrypted for Femto.

KDUP DQ HQ WIDQ DWIR Q DOIR R Q IDHQ WIDQ R S UJ KW6357H##### # # # ##### z z z kdkp dqZrp #

For example: 192.168.8.0/24

Remote TS: remote traffic selection, indicates the subnet to be encrypted for 5GC or NMS, it supports configure 0.0.0.0/0, but need security gateway side to configure a fixed IP block in case there is route conflict for OAM SA and 5GC SA.

For example: 10.120.5.0/28

Configure the EncryptionAlgorithm, IntegrityAlgorithm, DH groupTransforms as well.

3.8.2 CERT Authentication Method

Path: **Device-Configuration-IPsec**

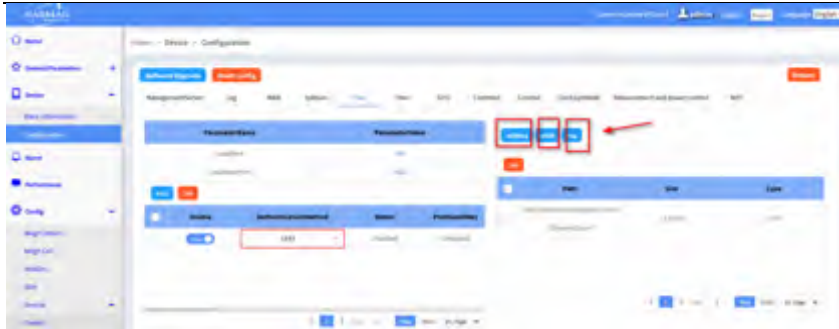
Step1. Turn on the Enable switch, and select CERT for Authentication Method.



Step2. Import CA certificate, import certificate file, Import private Key file

Before V3 version, need select “x509ca” to import ca certificate, select “x509” to import client certificate, select “rsa” to import private key.

XDUP DQ HQ WHEQ DWIR Q DOIFR Q JIHQ WIDOF R S\UJ KWIE357##### # # # ##### z z z kkgp dyZrp #



After V3 version, if the certificate is already preset in factory stage and can update by CMS server.

If the certificate is not preset, it requires to read the certificate from TPM module, need write new certificates to TPM module manually. Upload the certificates to any path of Femto server and enter the path where certificates are located, Refer below commands for certificate writing to TPM.

tpm2_rw w 0x1500008 ca.crt ##CA certificate

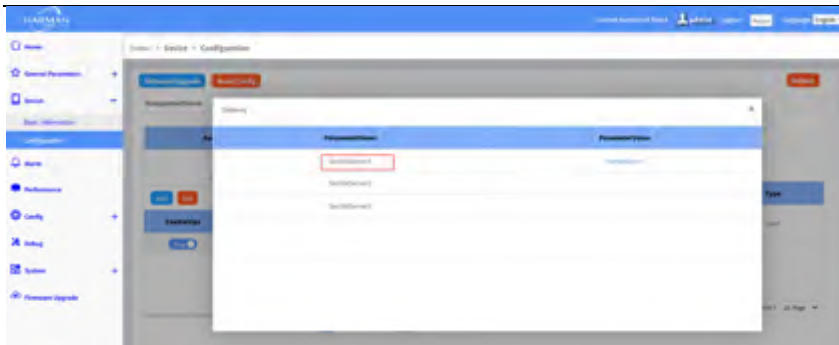
tpm2_rw w 0x1500009 client.crt ##Femto Client Certificate

tpm2_rw w 0x150000A client-key.pem ##Private key

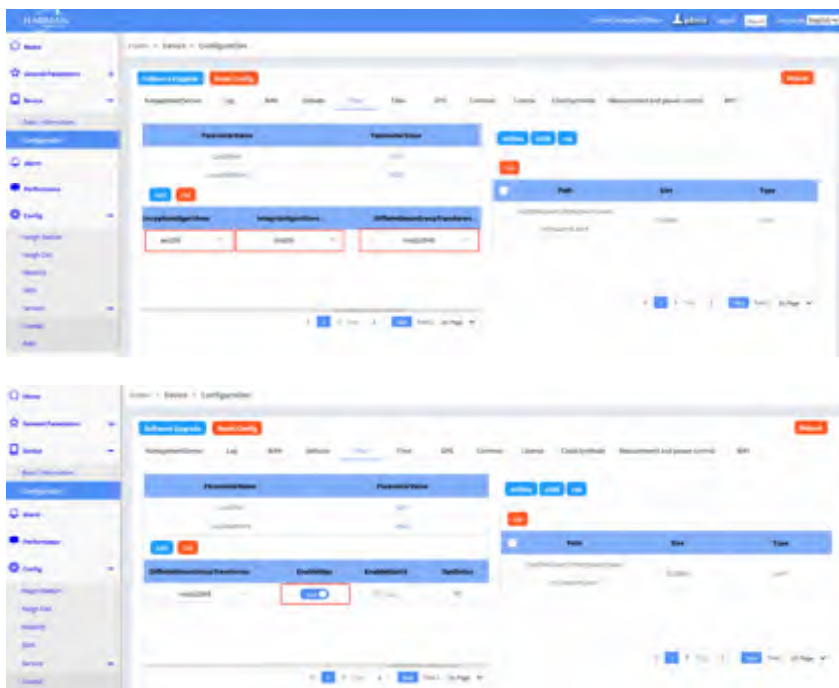
Restart Femto to take affect.

Step3. Configure the security gateway IP or FQDN

XDUP DQ WQ WHEQ DWIR Q DOIR R Q JIS HQ WIDOR R S\UJ KWIE357##### # # # ##### z z z kskp dyZrp #



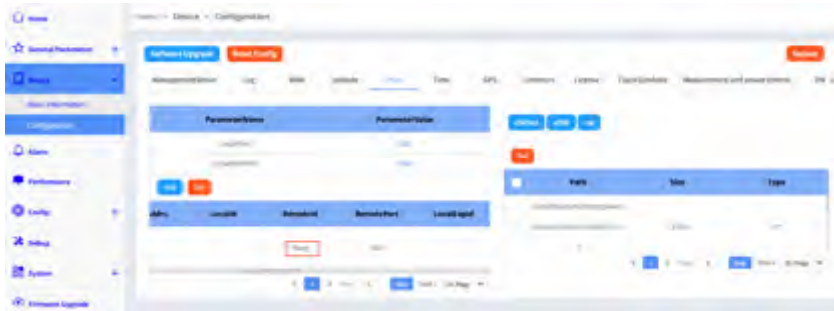
Step4. Configure EncryptionAlgorithm, IntegrityAlgorithm, DH groupTransforms and turn on the EnableVips switch to request gateway to allocate virtual ipv4



Step5. Configure the Local ID and Remote ID

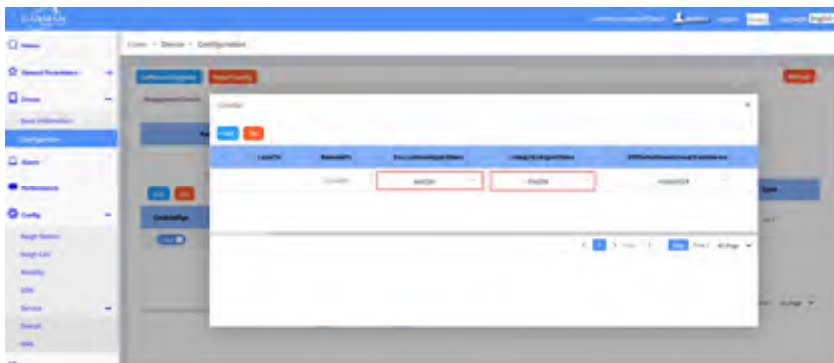
KDUP DQ WREQ DWIR Q DOIR R Q IIRHQ WIDIR R S UIR KWIR357##### # # # ##### z z z kkgp dyZrp #

Local ID should keep as blank, RemoteID configure as “%any”.



Step6. Configure Child SA

Vips need be enabled to request virtual ip from security gateway.



Local TS: local traffic selection, indicates the subnet to be encrypted for Femto.

For example: 192.168.8.0/24

Remote TS: remote traffic selection, indicates the subnet to be encrypted for 5GC or NMS, it supports configure 0.0.0.0/0, but need security gateway side to configure a fixed IP block in case there is route conflict for OAM SA and 5GC SA.

For example: 10.120.5.0/28

Configure the EncryptionAlgorithm, IntegrityAlgorithm, DH groupTransforms as well.

3.8.3 CERT Authentication Method- 2nd IPsec Tunnel

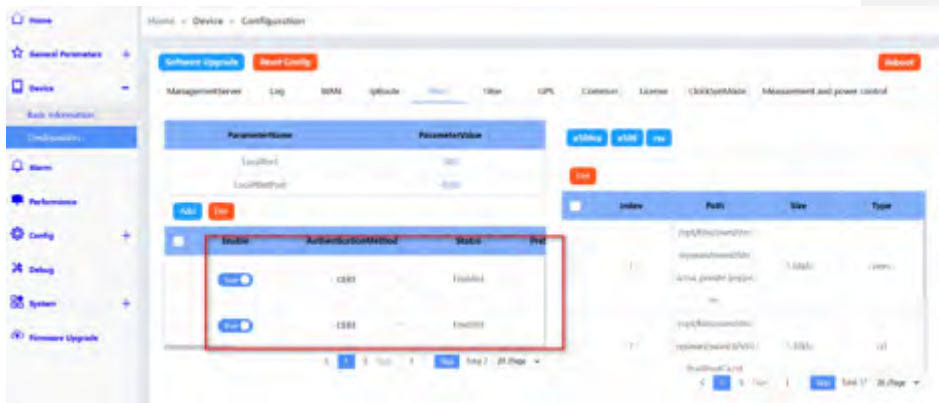
KDUP DQ WHEQ DWIR Q DOIR R Q JIGHQ WIDOR R S UIR KWIE357##### # # # ##### z z z kskp dyZrp #

Create the 2nd IPsec tunnel as per chapter “3.8.2 Cert Authentication Method”, and repeat the operation as per steps 1~6.

Adjust the Security Gateway Server IP, Remote ID and the encrypted IP block in security gateway side as per actual network plan. In case there is route conflict.

Path: **Device-Configuration-IPsec**

Step1. Create two IPsec items as below, one for O&M and one for NG link, Turn on the Enable switch, and select CERT for “AuthenticationMethod”,



Step2. Import CA certificate, Femto certificate and Key.

Before V3 version, need select “x509ca” to import ca certificate, select “x509” to import Femto certificate, select “rsa” to import private key.

XDUP DQ HQ WHEQ DWIR Q DOIR R Q JIG HQ WIDOR R S UJ K WHE357##### # # # ##### z z z kkgp dyZrp #



After V3 version, if the certificate is already preset in factory stage and can update by CMS server.

If the certificate is not preset, it requires to read the certificate from TPM module, need write new certificates to TPM module manually. Upload the certificates to any path of Femto server and enter the path where certificates are located, Refer below commands for certificate writing to TPM.

tpm2_rw w 0x1500008 ca.crt ##CA certificate

tpm2_rw w 0x1500009 client.crt ##Femto Client Certificate

tpm2_rw w 0x150000A client-key.pem ##Private key

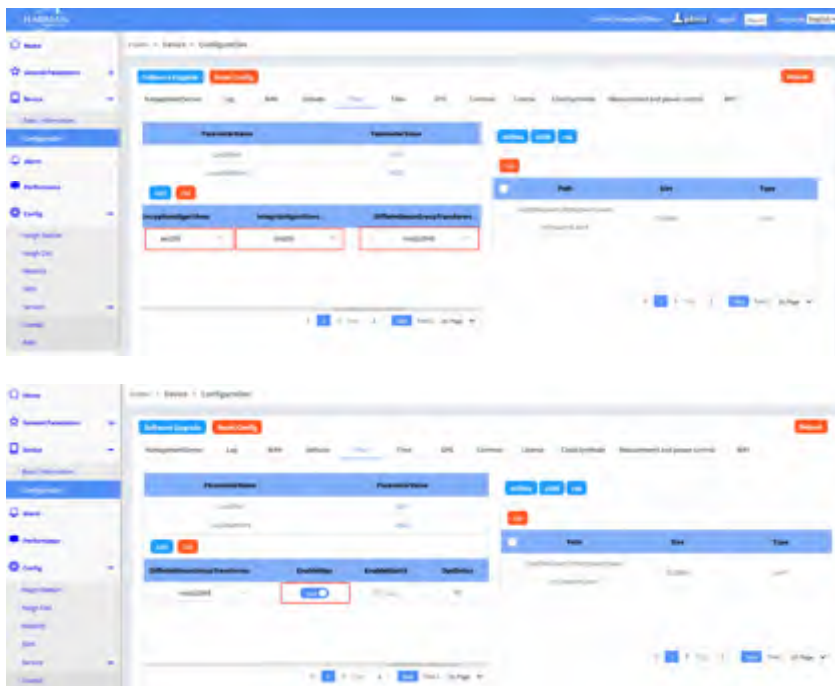
Restart Femto to take affect.

Step3. Configure the security gateway IP,configure different FQDN or security gateway IP as per OM and NG.

KDUP DQ HQ WHEQ DWIR Q DOIR R Q JIHQ WIDOR R S\UJ KWIE357##### # # # ##### z z z kskp dyZrp #

ParameterName	ParameterValue
SecGWServer1	
SecGWServer2	
URL	
LocalId	
RemoteId	

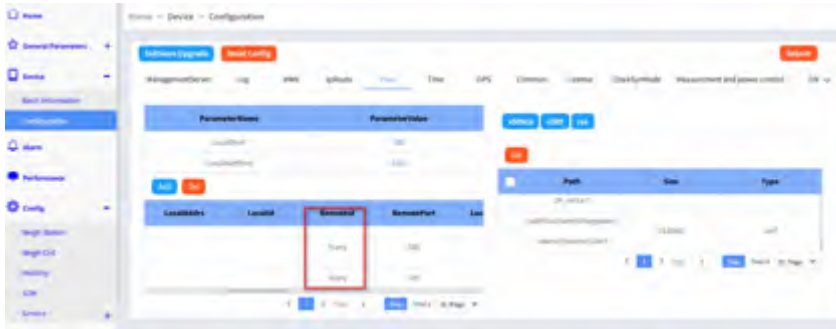
Step4. Configure EncryptionAlgorithm, IntegrityAlgorithm, DH groupTransforms and turn on the EnableVips switch to request gateway to allocate virtual ipv4



KDUP DQ W9HQ DWIR Q DOIR R Q IJHQ WIDIR S UJX KW6357##### # # # ##### z z z kdp dyZp #

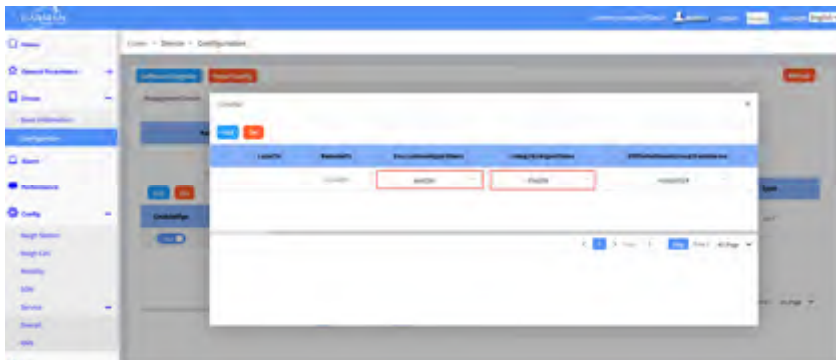
Step5. Configure the Local ID and Remote ID

Local ID keep as blank and RemoteID configure as “%any”.



Step6. Configure Child SA

Vips need be enabled to request virtual ip from security gateway.



Local TS: local traffic selection, indicates the subnet to be encrypted for Femto.

For example: 192.168.8.0/24

Remote TS: remote traffic selection, indicates the subnet to be encrypted for 5GC or NMS, it supports configure 0.0.0.0/0, but need security gateway side to configure a fixed IP block in case there is route conflict for OAM SA and 5GC SA.

For example: 10.120.5.0/28

Configure the EncryptionAlgorithm, IntegrityAlgorithm, DH groupTransforms as well.

KDUP DQ 8Q W8JQ DW8R Q DO8P R Q J8J8Q W8DO8P R S U8J K W8E357##### # # # ##### z z z 8k8p d8Z8p #

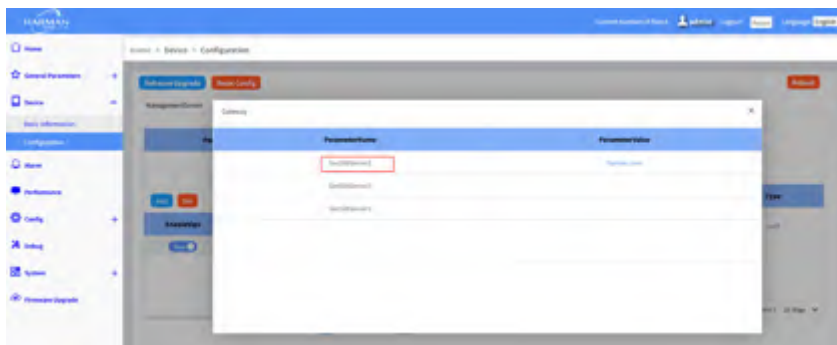
3.8.4 EAP-AKA

Path: Device-Configuration-IPsec

Step1. Turn on the Enable switch, and select EAP-AKA for AuthenticationMethod



Step2. Configure the security gateway IP



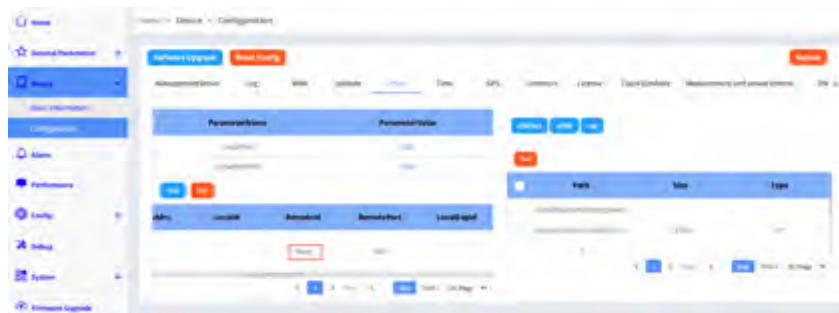
Step3. Configure EncryptionAlgorithm, IntegrityAlgorithm, DH groupTransforms and turn on the EnableVips switch to request gateway to allocate virtual ipv4

XDUP DQ WHEQ DWIR Q DOIR Q JIHQ WIDOR S UJ KWE357##### # # # ##### z z z kkp dyZp #



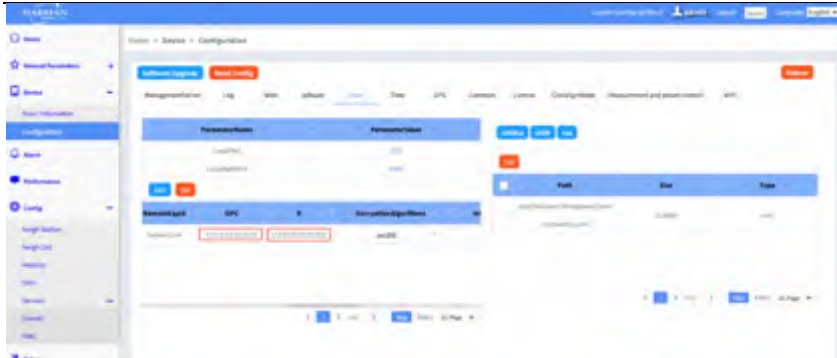
Step4. Configure the Local ID and Remote ID

Local ID keep as blank and RemoteID configure as “%any”.



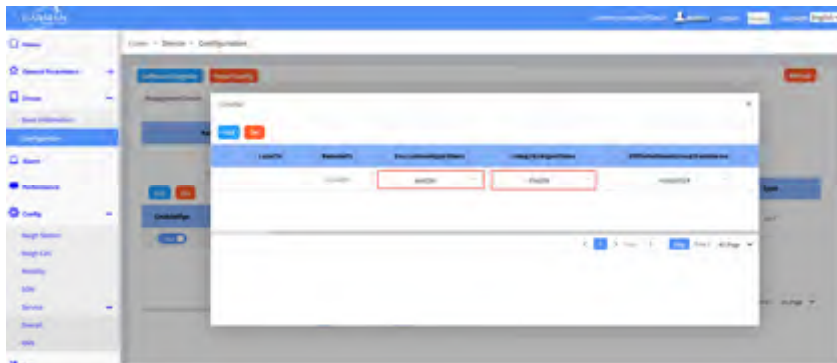
Step5. Configure EAP authentication - OPC, K value

XDUP DQ HQ WHEQ DWIR Q DOIR Q JIHQ WIDIR R S\UIJ KWIE357##### # # # ##### z z z kkg dyZp #



Step6. Configure Child SA

Vips need be enabled to request virtual ip from security gateway.



Local TS: local traffic selection, indicates the subnet to be encrypted for Femto.

For example: 192.168.8.0/24

Remote TS: remote traffic selection, indicates the subnet to be encrypted for 5GC or NMS, it supports configure 0.0.0.0/0, but need security gateway side to configure a fixed IP block in case there is route conflict for OAM SA and 5GC SA.

For example: 10.120.5.0/28

Configure the EncryptionAlgorithm, IntegrityAlgorithm, DH groupTransforms as well.

3.9 Neighbor Station and Neighbor Cell Configuration

KDUP DQ HQ WIDQ DQW Q DQW R Q JIG HQ WIDQ R S UJ K W E 3 5 7 H I J K L M N O P Q R S T U V W X Y Z [\] ^ _ ` a b c d e f g h i j k l m n o p q r s t u v w x y z { | } ~

If ANR is enabled under SON, then manually adding Neighbor station and neighbor cell will not be needed and can be ignored.

3.9.1 Neighbor Station

Path: **Config-Neigh Stations**

Step1.: Configure Local Server IP, keep default.

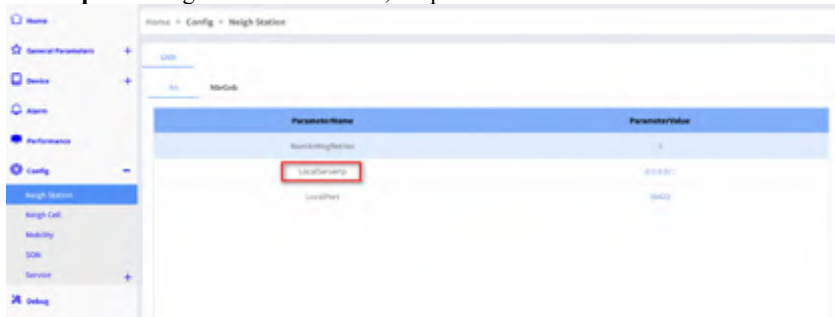


Figure 32. Local Server IP

Step2.: Configure Neighbor Station's parameters

Need fill the "RemoteAddress", "RemotePort", "NodeId", "LocalAddress", and enable "AdminState".

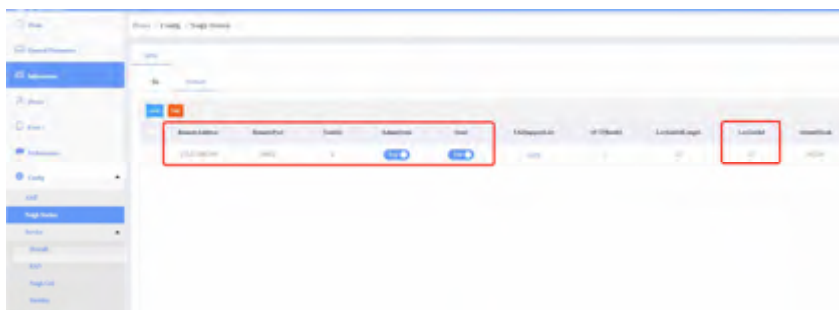


Figure 33. Neigh Station

Note:

It is required to configure neighbor station for XN handover between stations. After configuring, the base station will try to establish an XN connection.

If it's successful, it will give priority to XN Handover.

#####



3.9.2 Neighbor cell

Configure the neighbor cell parameters, support batch import and single add.

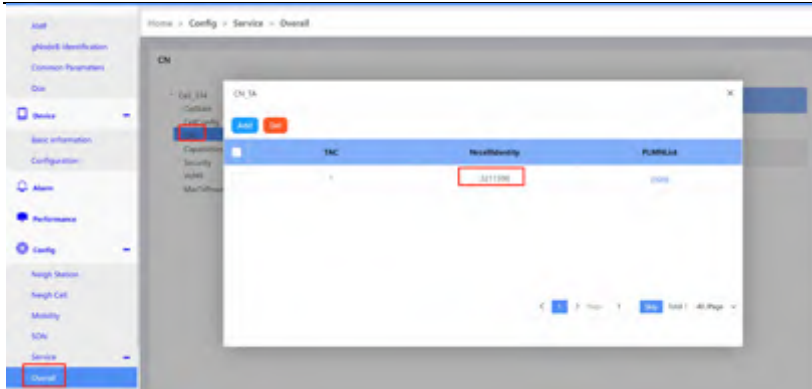
(PLMNID, CID, subFrequency, PhyCellID, TAC)



Figure 34. Neigh Cell

CID can be queried as below

KDUP DQ WHEQ DWIR Q DOBR Q JIHQ WIDOR S UJ KWIE357H##### # # # ##### z z z kkg dyZp #



3.10 SON Features

3.10.1 Intra-Frequency neighbor cells

Step1. Set SON Work Mode to “Free” and turn on “ANREnable” Switch

Path: **Config-SON**



Step2. Turn on A2 and A4 event measurement, A2 measurement purpose is 1, A4 measurement purpose is 2, A4 hysteresis value is configured to be small (can be configured to 0)

Path: **Config- Mobility-A2MeasureCtrl**

XDUP DQ HQ WHEQ DWIR Q DOIF R Q JIHQ WIDOF R S\UJ KWIE357##### # # # ##### z z z kskp dyZrp #



3.10.2 Inter-Frequency neighbor cells

Step1. Set SON Work Mode to Free and turn on ANRInterFreEnable Switch

Path: **Config-SON**



Step2. Configuring inter-frequency measurement parameters

KDUP DQ WHEQ DWIR Q DOIRP Q IIGHQ WIDOP R S\UJ KW6357##### # # # ##### z z z kkgp dYzP #

Path: Config- Mobility-SSBCarrier



Step3. Turn on A2 and A4 event measurement, A2 measurement purpose is 1, A4 measurement purpose is 1, and the hysteresis value is configured to be small (configurable to 0)

Path: Config- Mobility-A2MeasureCtrl



KDUP DQ HQ WHEQ DWIR Q DOIRP R Q IIRHQ WIDOR R S\UIJ KWIE357##### # # # ##### z z z kkp dyZrp #

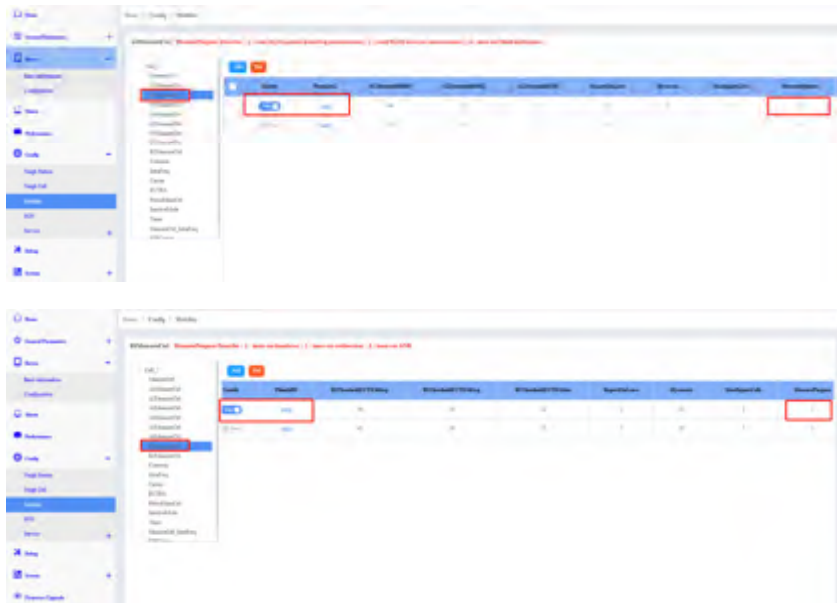
3.10.3 Eutra neighbor cells

Step1. Set SON Work Mode to Free and turn on ANREUTRANEnable Switch



Step2. Turn on A2 and B1 event measurement, A2 measurement purpose 2, B1 measurement purpose 3

Path: **Config- Mobility-A2MeasureCtrl**



KDUP DQ WHEQ DWIR Q DOIR R Q IJHQ WIDOR S UJ KWIE357##### # # # ##### z z z kkg dyZp #

Path: **Config- Mobility-EutraMeasObj**

3.10.5 PCI Optimization

```

KDUPDQ #QWUQDWIR QDO#FR Q IGHQWIDOFR S\ULJ KW#5357#####
# # # # ##### z z z kdp dyfrp #

```

Optimization Enable switch.

Home > Config > SDR

SDR Config Param

ParameterName	ParameterValue
SDRConfigMode	Distributed
SDRConfigMode	Free
PCISdrEnable	On
PCISdrConfigLoadTime	30
PCISdrConfigLoadTime	On
CandidateMTNList	00770
CandidateMTNList	00000
MTNList	On
MTNList	On
MTNList	On

3.11 Handover

Path: **Config-Mobility**

3.11.1 Intra-Frequency Handover

Step1. Enable NR measurement

[illegible]

Step2. Change *A3OffsetRSRP* value to 2.



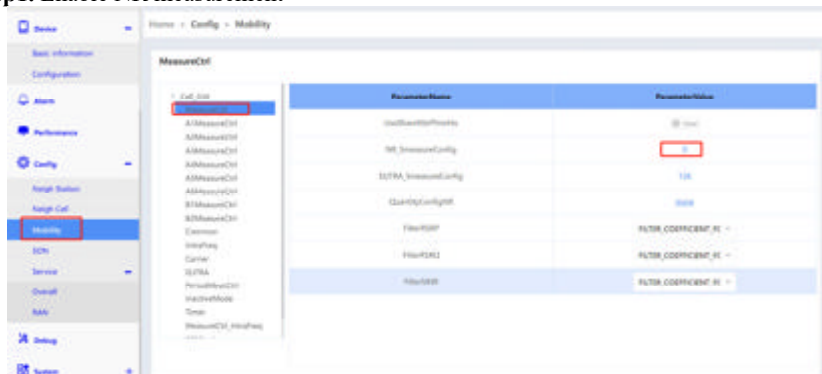
Figure 36. A3offsetRSRP

When the RSRP difference of the two cells is bigger than $2 \times 0.5\text{dbm}$, handover will happen.

Note: this value can be adjusted.

3.11.2 Inter-Frequency Handover

Step1. Enable NR measurement



Step 2 Change NR_SmeasureConfig to 0, which indicates NR measurement started all the time.

KDUP DQ HQHQ DWR Q DQPR Q JI HQ WIDOR S UJ KW E357H##### # # # ##### z z z kdp dyZp #

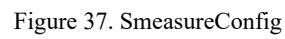


Figure 38

Figure 39

```

KDUPDQ #Q WHUQ DWER Q DO#FR Q IIG HQ WID#FR S\ULJ KW#5357#####
# # # # ##### z z z kdp dYrp#

```



Figure 40

Step 6 Enable the A2MeasureCtrl



Figure 41

Step 7 Configure A2



Figure 42

ThresholdRSRP: 62-156=-94

When RSRP smaller than -94, it will trigger the measurement report.

Note: A2ThresholdRSRP can be adjusted according to the situation.

XDUP DQ HQHQ DWR Q DOBR Q JI HQ WDO R S UJ KW E357##### # # # ##### z z z kkg dyZp #

Step 8 Set the trigger quantity to RSRP



Figure 43

Step 9 Enable A5MeasureCtrl and Configure A5 Threshold1RSRP &Threshold2RSRP.



Figure 44

Threshold1RSRP: $62-156=-94$

Threshold2RSRP: $56-156=-100$

When the RSRP of service cell is smaller than -94 and the RSRP of target cell is bigger than -100, then handover will happen.

Note: Threshold1RSRP & Threshold2RSRP can be adjusted according to the real use. The values suggested here will be easier to make the inter free handover happen and thus test this feature.

Step 10 Make sure the trigger quantity is RSRP

KDUP DQ HQ WHEQ DWIR Q DOIRP Q JIHQ WIDIR R S UIJ KWIE357H##### # # # ##### z z z kkgp dyZrp #



Figure 45

Step 11 Configure the SSB Freq of Neighbor Cell

Home>Config>Mobility>SSBCarrier



Figure 46

Step 12 Repeat the above confirmation on the handover target cell.

3.11.3 Handover between different systems

Step1. Manually configure a 4G neighboring cell, including PLMN ID, CID, EARFCN, PCI, and TAC.

XDUP DQ HQ WHEQ DWIR Q DOIRP Q IIGHQ WIDORP S\UIJ KWIE357##### # # # ##### z z z kkgp dYXp #



Step2. Configure the EUTRA.



Step3. Turn on A2 measurement switch and configure the A2Threshold.

A2 Measurement RSRP threshold is configured as 60. That is, if the RSRP of the serving cell measured by the UE is less than -96, the inter-frequency measurement is turned on and the measurement purpose is configured as 2. Note that the larger the A2 event RSRP threshold configuration value, the easier it is to trigger.



XDUP DQ W9JQ DWIR Q DOIR R Q JIG HQ WIDOR R S\UJ KWIE357H##### # # # ##### z z z kkp dyZrp #

Step4. Turn on B1 measurement switch and configure B1Threshold.

B1 Measurement RSRP threshold is configured to 35, the neighboring cell is higher than -105, then the inter-system switching is enabled, and the measurement purpose is configured to 1. Note that the smaller the B1 event RSRP threshold configuration value, the easier it is to trigger.

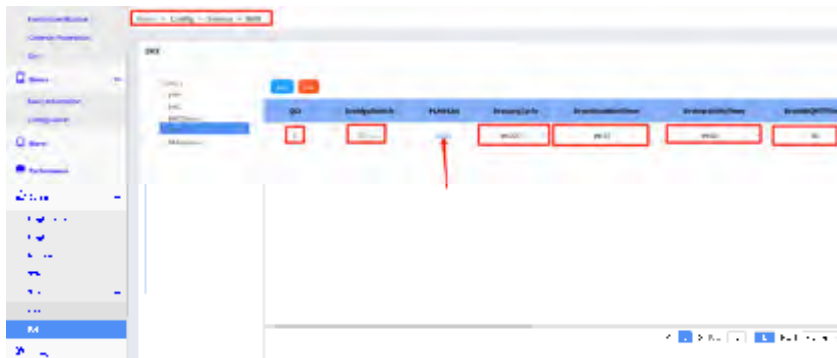
3.12 DRX/cDRX Configuration

3.12.1 ANR Enabled Scenario

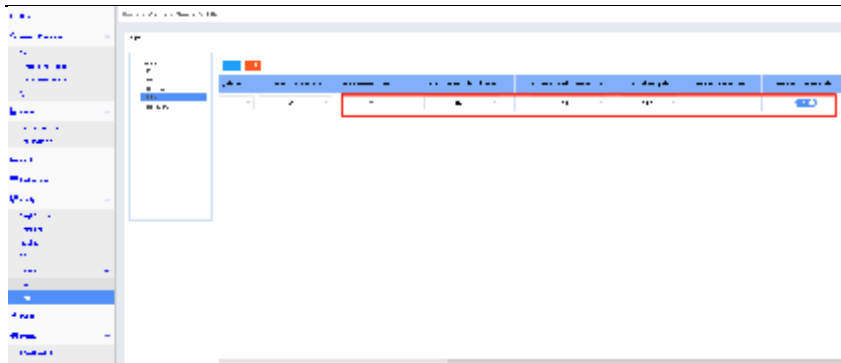
For ANR scenario, no need to turn on “DrxAlgoSwitch” switch, configure the following parameters according to actual network plan.

Enter directory: home/Config/Service/RAN

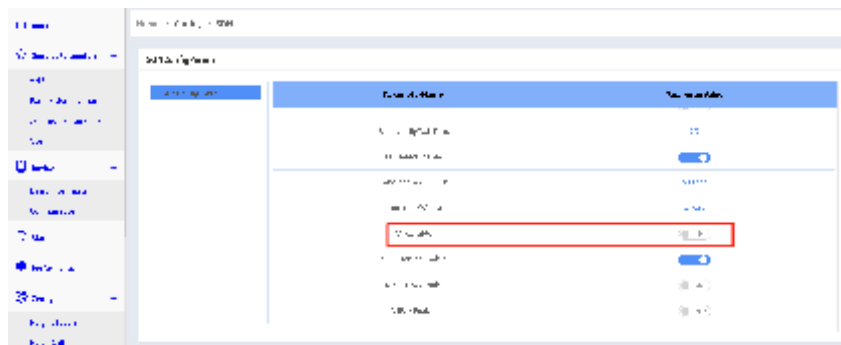
Modify the QCI for default bearer, keep the “DrxAlgoSwitch” disabled, modify the PLMN ID as per actual core plan, align the parameters as per below screenshot.



#####



3.12.1 ANR Disabled Scenario

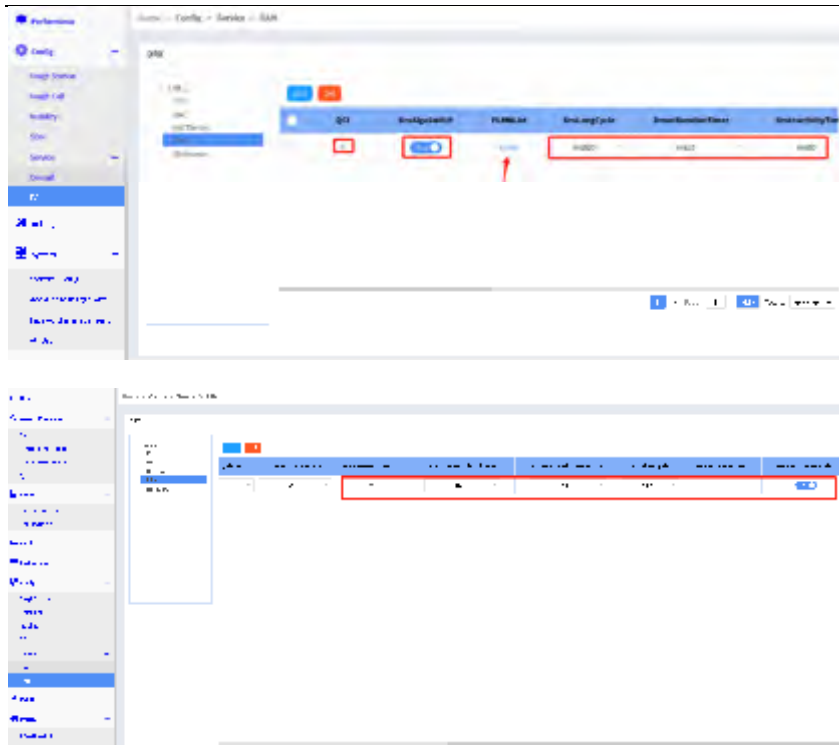


For ANR disabled scenario, need to turn on “DrxAlgoSwitch” switch, configure the following parameters according to actual network plan.

Enter directory: home/Config/Service/RAN

Modify the QCI for default bearer, Enable the “DrxAlgoSwitich”, modify the PLMN ID as per actual core plan, align the parameters as per below screenshot.

KDUP DQ HQ WHEQ DWIR Q DOHPR Q JIHQ WIDOP R S\UIJ KWIE357##### # # # ##### z z z kdkp dyZrp #



3.13 Slice Configuration

SNSSAI: Composed of SST+SD, displayed as decimal.

For example, 33554431 means SST is 0x01, SD is 0xFFFFF.

3.13.1 RB Resource Reservation Exclusive Mode

Step1. Slice Configuration

Home>General Parameters>Common Parameters>TA>PLMNList>SliceList

XDUP DQ HQ HQHQ DWR Q DOBR Q JIHQ WIDOR S\UJ KWIE357##### # # # ##### z z z kdkp dYzP #



Configuration slice 2 is 27721729, which is SST:01, SD:A70001

Home > General Parameters > QoS

NGC

QoS

ParameterName	ParameterValue
Index	9
FlareQI	9
SMISAI	8884100
PLSMVD	999999
Frequency	
SdrSubSpacing	

KDUFDQ #QWUQDWIR QDOFR Q IGHQWIDFR S\ULJ KW#5357##### # # # ##### z z z kdp dYfrp #

Home

General Parameters

QoS

Device

Alarms

Performance

Config

Home > General Parameters > QoS

QoS

ParameterName	ParameterValue
Index	22
FlowQI	1
QoS	27721725
PLMNID	999999
Frequency	
SubSubSpacing	

QoS

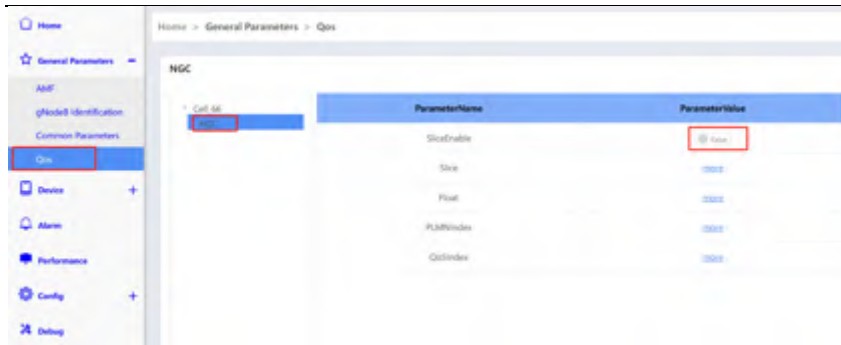
ParameterName	ParameterValue
ResourceType	NonGBR
PREConfig_Priority	90
RLCMode	AM
AMSNSize	18
UMSNSize	12
TreorderingUl	120

QoS

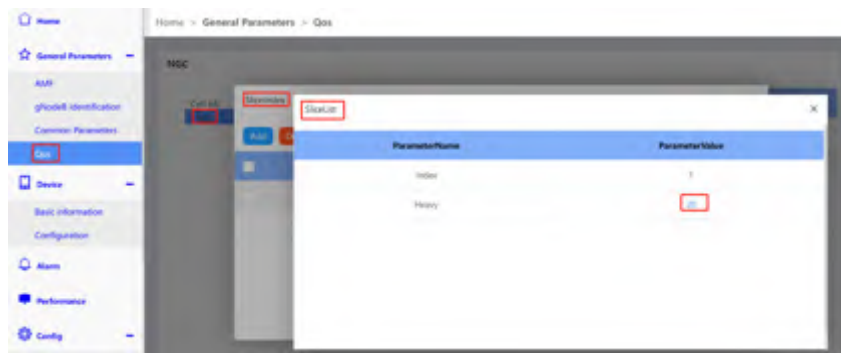
ParameterName	ParameterValue
RLCMode	AM
AMSNSize	18
UMSNSize	12
TreorderingUl	120
TreorderingDl	300
PdcpSnSizeUl	18
PdcpSnSizeDl	18

Step4. Turn on the DU slicing switch

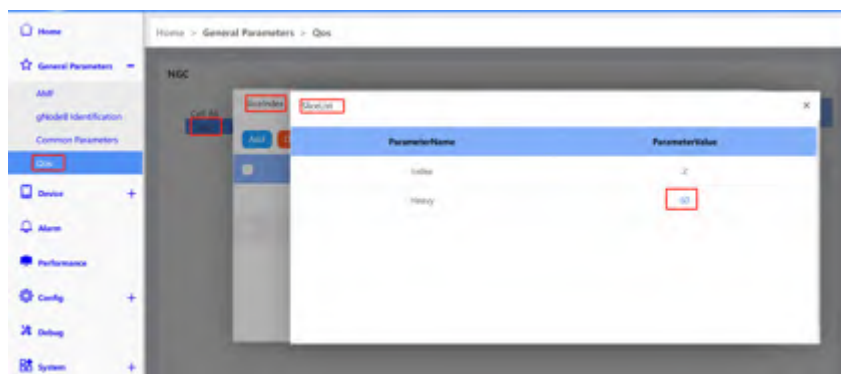
XDUP DQ HQ WHEQ DWHE Q DOHPR Q JIG HQ WIDOP R S UJX KWHE357##### # # # ##### z z z Xkdp dYXp #



Step5. Configure slice 1 weight

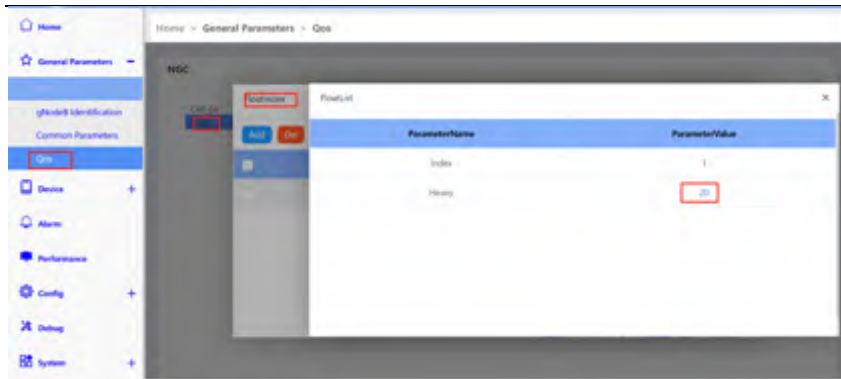


Step6. Configure slice 2 weight

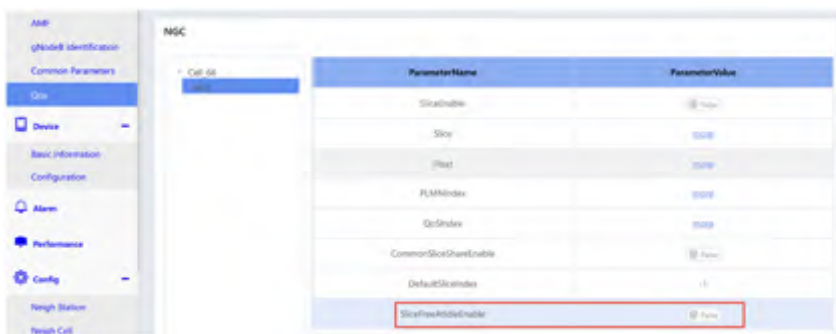


Step7. Configure Slice Float weight

XDUP DQ HQ WHEQ DWIR Q DOIFR Q JIGHQ WIDOF R S\UJ KWIE357##### # # # ##### z z z kkg dyZp #

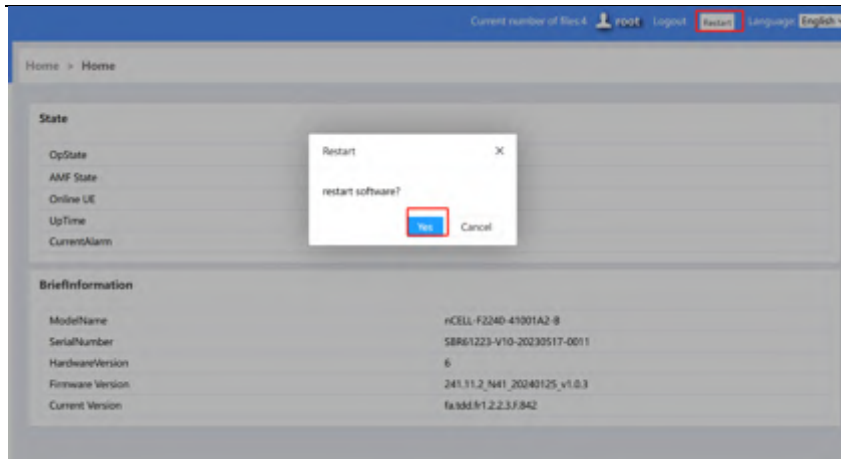


Step8. Enable the SliceFreeAtIdle switch



Step9. Soft restart protocol stack to take affect

XDUP DQ HQ WHEQ DWHE Q DOHEP R Q JIHHQ WIDOP R S\UJ KWHE357##### # # # ##### z z z kdkp dYXp #



Notes:

- Currently, only SliceList 1 can be configured as an exclusive resource, and SliceList 1 heavy + SliceList 2 heavy + FloatList 1 heavy = 100
- The SNSSAI value of QoS only needs to be modified in 5QI 9

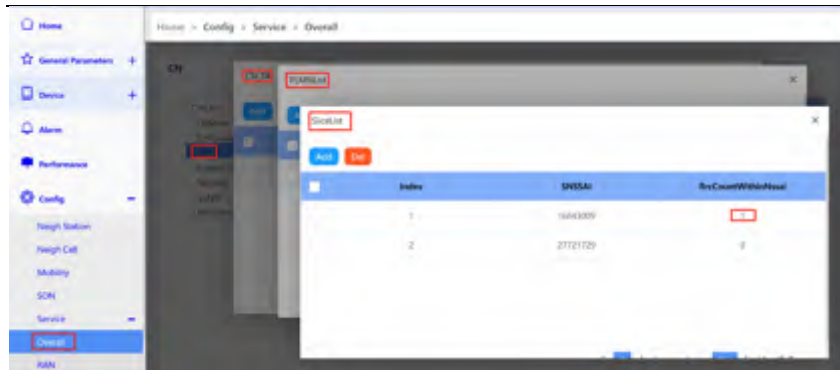
3.13.2 Slice-based user admission control

Step1. Turn on the RRC slice control switch



Step2. Configure the maximum number of access users for slice 1 to 1

XDUP DQ HQ WHEQ DWIR Q DOBFR Q JIDHQ WIDOF R S\UJ KWIE357##### # # # ##### z z z kdkp dyZrp #



KDUP DQ HQ WHEQ DWIR Q DOBFR Q IIS HQ WIDOF R S\UJ KWIE357##### # # # ##### z z z kkgp dyZrp #

3.14 Cell Management Parameter

Path: **Config-Service-Overall**

Parameter explanation:

AdminState: Disable/Enable Cell

CellBarred: Allow/Not Allow UE Access



Figure 48

3.15 VoNR(Voice over NR)

Path: **Config-Service-Overall**

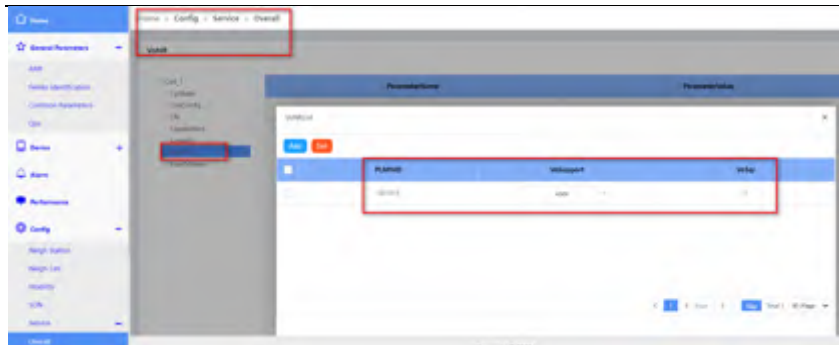
VoSupport: vonr

Vonr: Voice over NR by ims.

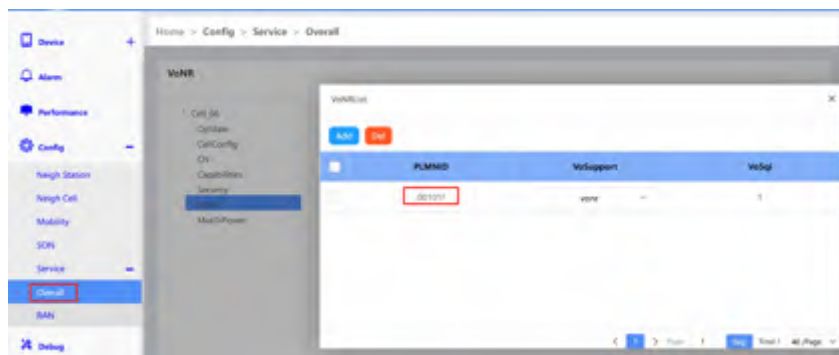
Vo5qi: Dedicated bearer of VoNR, The 5QI value of the voice service needs to be consistent with the 5G core network, generally it is 1 by default.

The PLMN ID is ffffff by default, it's not mandatory to modify and can work with default value, in case need modify, configure the same PLMN ID with TA.

XDUP DQ HQ WHEQ DWIR Q DOIR R Q JIHQ WIDIR R S\UJ KWIE357##### # # # ##### z z z kkgp dYrp #



Configure PLMNID in Overall-VoNR-VoNRList



3.16 PM/MR Configuration

PM/MR measurement task can be started from NMS side, and the switch, url, username, password will be downloaded to Femto.

Or configure manually as per below steps.

Step1. PM Configuration

Turn on the enable switch, configure the URL, and configure periodic upload interval, the periodical upload interval unit is second here, the periodic upload start time will

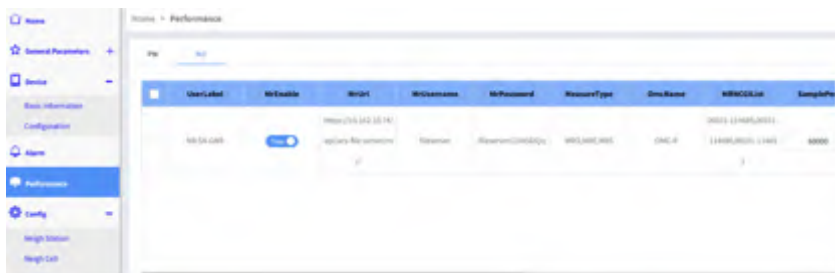
KDUP DQ WHEQ DWIR Q DOIR R Q JIHQ WIDIR R S UJX WHE357##### # # # ##### z z z kkgp dyZrp #

update as per the Femto system clock lock time.



Step2. MR Configuration

Turn on the MR enable switch and fill in the URL, username, password as below:



Measure Type and OmcName are the default values, MRNCGIList can be changed to “all” or configure the correct CGI; UploadPeriod unit is minute here ,

KDUP DQ HQ WBEQ DWBE Q DOBFR Q JIGHQ WIDOF R S UJX KWBE357##### # # # ##### z z z kdkp dqZrp #

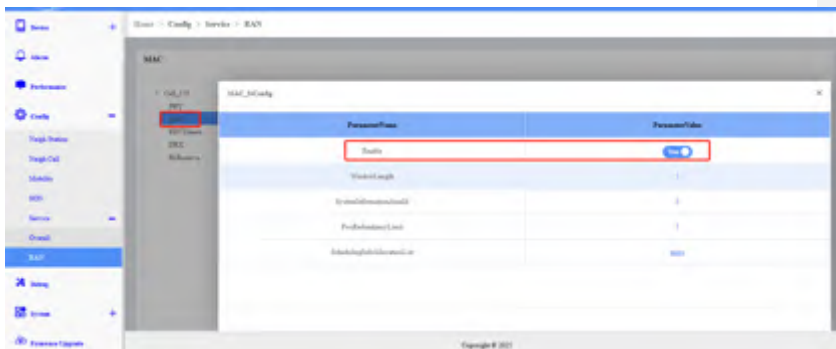
SampleBeginTime will update as per the Femto system clock lock time.



3.17 Cell Reselection

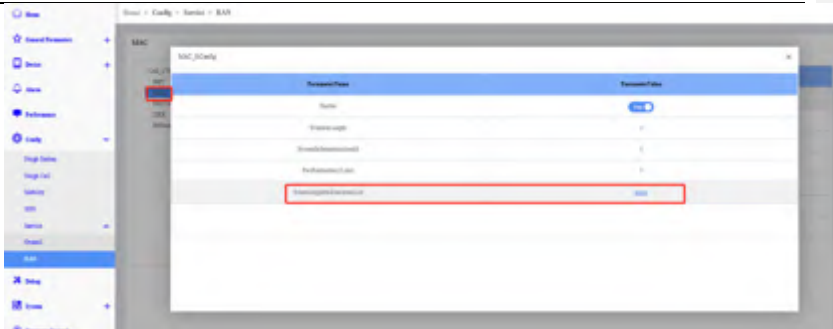
3.17.1 Intra-Frequency Reselection

The Enable switch needs to be turned on, and the cell will start sending other SIB messages except for SIB1



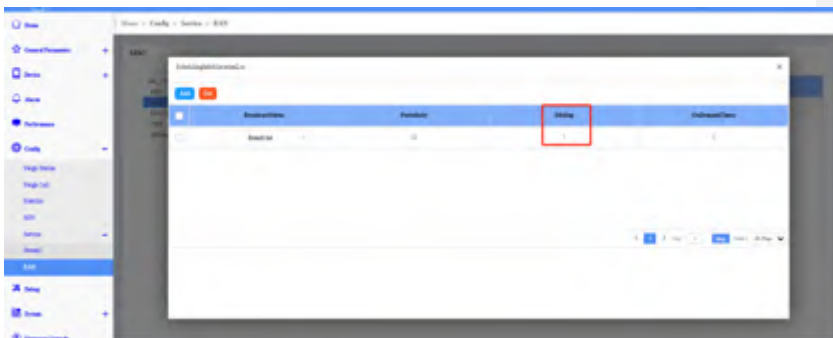
What specific SIB messages should be issued and configured in the “SchedulingInfoAllocationList”.

KDUP DQ 8Q W8HQ DW8R Q DO8FR Q J8HQ W8DO8R S\UJ KW8357##### # # # ##### z z z 8k8p 8Y8p #



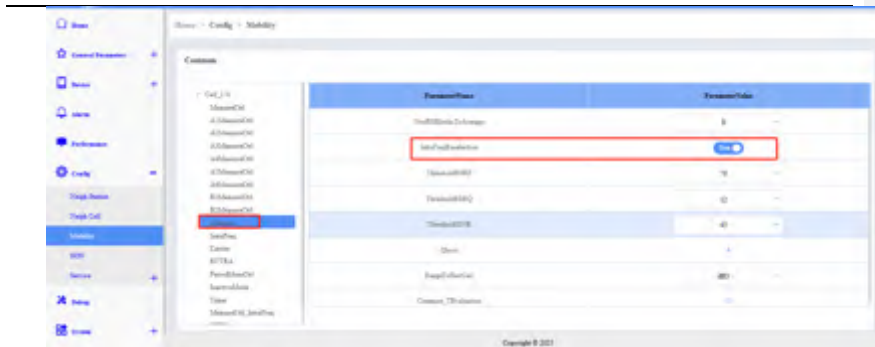
Check the parameter “SibMap”, 7 is converted to binary as 111, corresponding to sib2, sib3, sib4 from right to left.

Similarly, if sib2, sib4, and sib5 are issued, the SibMap value should be set as 13 (1101).



Turn on the switch for intra-frequency reselection.

KDUP DQ WREJ DWIR Q DOIF R Q IIS HQ WIDOF R S\UIJ KWIE357##### # # # ##### z z z kkgp dYErp #

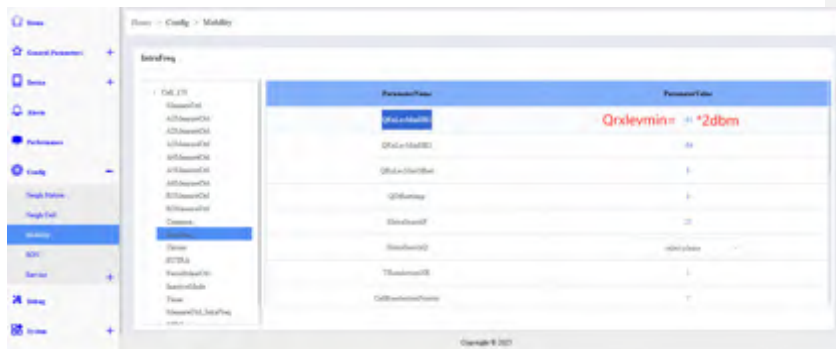


Generally, use RSRP as the criterion for reselection, so the same frequency measurement starting condition is: $Srxlev \leq SIntraSearchP$

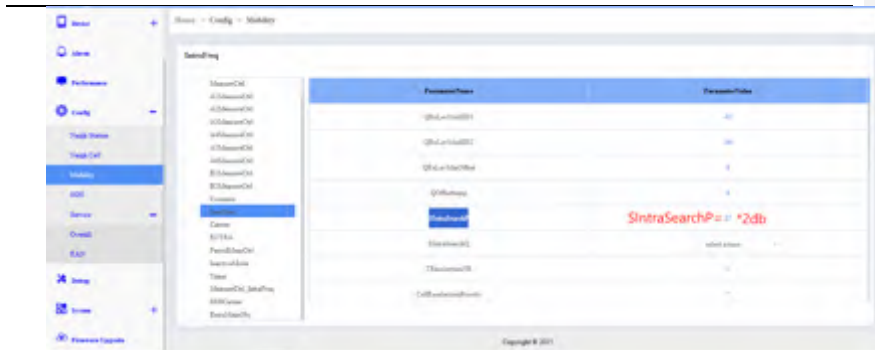
approach $Qrxlevmeas - (Qrxlevmin + Qrxlevminoffset) - Pcompensation - Qoffsettemp \leq SIntraSearchP$.

In general, the default value for $Pcompensation$ is 0, and $Qrxlevminoffset$ and $Qoffsettemp$ are only set as offsets when reselection is performed in different PLMNs,

When $Qrxlevmeas$ (current cell RSRP value) $\leq Qrxlevmin + SIntraSearchP$, start the measurement:



XDUP DQ HQHQ DWR Q DOFR Q JIHQ WIDOR S UJ KW6357##### # # # ##### z z z kkp dyZp #



Under the above configuration, when the RSRP value of the serving cell is less than or equal to threshold= $(-65 * 2) + (25 * 2)$, that is, when the RSRP value is less than or equal to -80, the same frequency measurement is enabled.

When the measured same frequency cell meets the R criterion ($R_n > R_s$), perform same frequency reselection:

$$R_s = Q_{meas,s} + Q_{hyst} - Q_{offset,temp}$$

$$R_n = Q_{meas,n} - Q_{offset} - Q_{offset,temp}$$

When $Q_{meas,n} - Q_{meas,s} > Q_{hyst} + Q_{offset}$, perform same frequency reselection.

Qoffset: The Qoffset value is 0 by default.



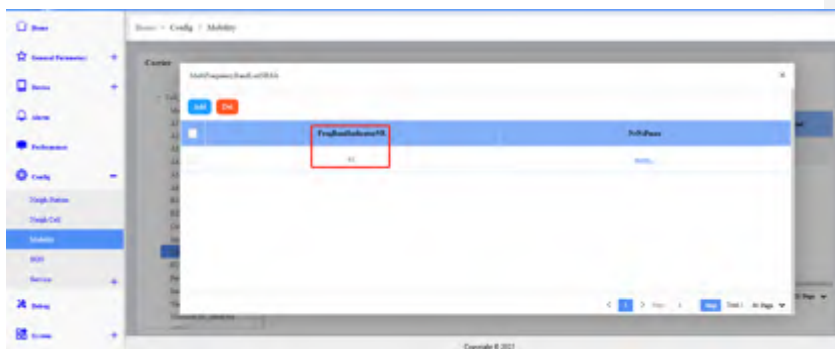
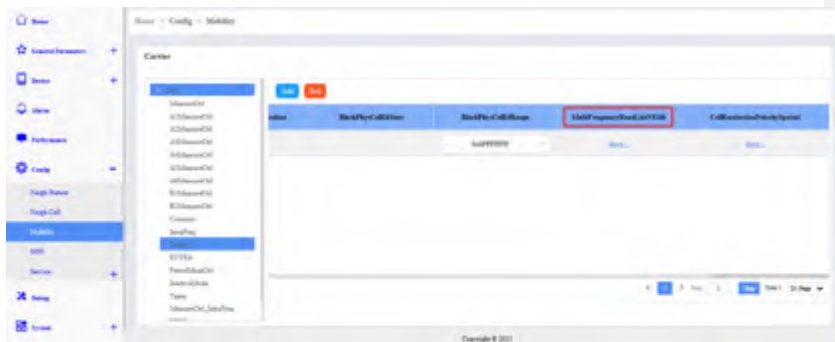
Under the above configuration, if the RSRP of the neighboring cell and the RSRP of the serving cell are greater than 4db and last for 1 second, reselection will be performed.

KDUP DQ HQ WHEQ DWIR Q DOIRP R QJHQ WIDIRP S UJX KWIE357##### # # # ##### z z z kskp dyZrp #



3.17.2 Inter-Frequency Reselection

First, it is necessary to confirm that the frequency band indication of the added inter frequency carrier is correct



XDUP DQ HQHQ DWR Q DQPR Q JIHQ WIDPR S UJX KW6357##### # # # ##### z z z kkg dyZp #

[illegible]

The screenshot shows the Oracle SQL Developer interface. The 'Query' window on the left contains the following SQL query:

```
SELECT * FROM QRTZ_JOB_DETAILS WHERE CLASS_NAME = 'org.springframework.scheduling.quartz.JobDetailImpl';
```

The 'Results' window on the right displays the query results in a table with two columns: 'JOB_NAME' and 'JOB_DATA'. The results are as follows:

JOB_NAME	JOB_DATA
org.springframework.scheduling.quartz.JobDetailImpl	{}

```

KDUPDQ #Q WHUQ DWIR Q DO#FR Q IGHQ WID#FR S\ULJ KW#5357#####
# # # # ##### z z z kdp dYfrp #

```

[illegible]

Under the above configuration, when the RSRP value of the serving cell is less than or equal to $\text{threshold} = (-65 * 2) + (25 * 2)$, that is, when the RSRP value is less than or equal to -80, start the inter frequency measurement.

Under the same priority, the R criterion also applies, that is, when $Q_{meas, n} > Q_{hyst} + Q_{offset}$, perform inter frequency reselection.

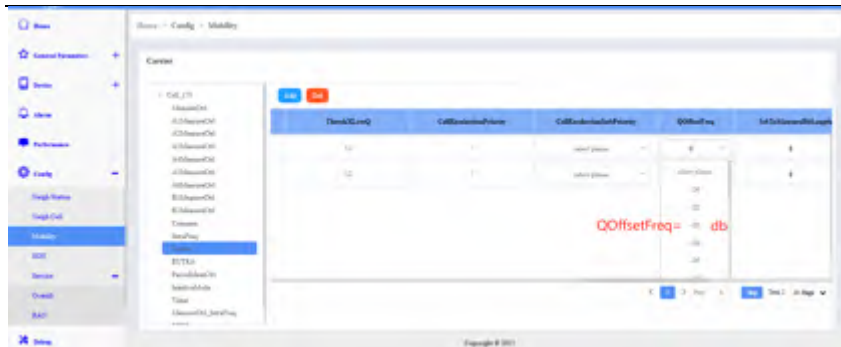
The screenshot shows the AWS IAM console interface. On the left, the 'Groups' list is visible, with 'Qhyst' highlighted. The main content area displays the 'Permissions' for the 'Qhyst' group. The table lists the following permissions:

Permission	Policy Name	Policy Type
AmazonS3ReadOnlyAccess	AmazonS3ReadOnlyAccess	Managed
AmazonEC2ReadOnlyAccess	AmazonEC2ReadOnlyAccess	Managed

A red annotation 'Qhyst = db' is written next to the 'AmazonS3ReadOnlyAccess' row.

At this point, Q_{offset} consists of two parts, $Q_{offset} = Q_{offsets,n} + Q_{offsetfrequency}$.

Qoffsets, n value is 0 by default.



when (neighboring cell rsrp - serving cell rsrp) is greater than 4db for 1 second, and inter frequency reselection is performed.

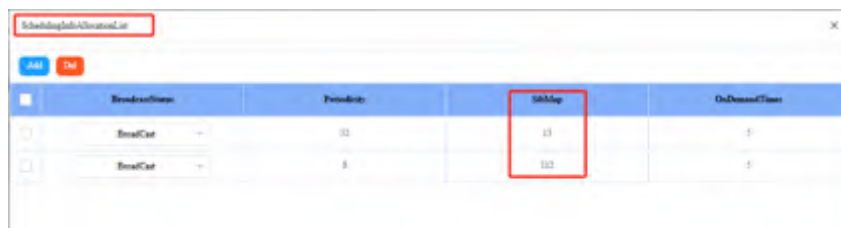
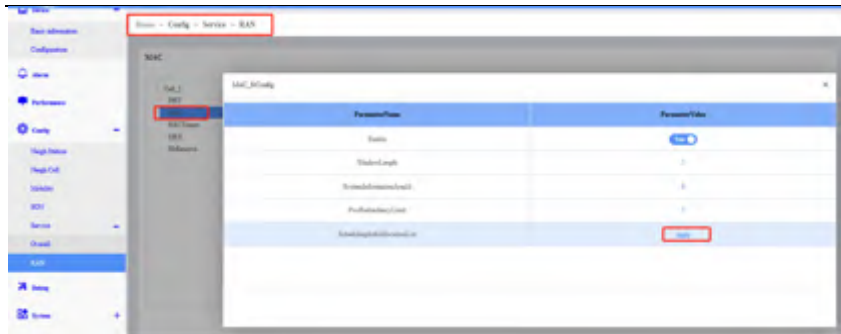


3.17.3 IRAT Reselection

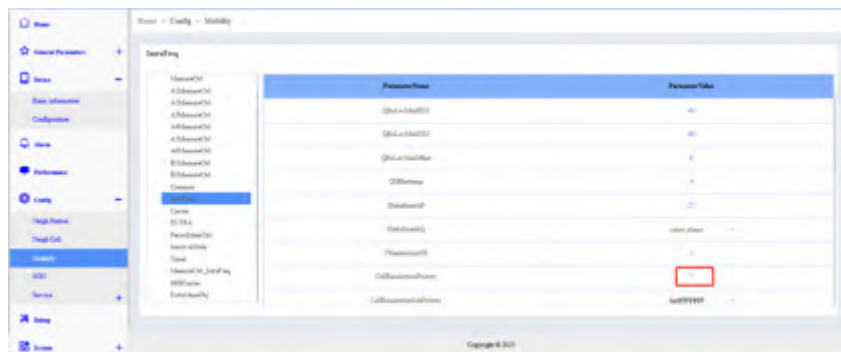
Confirm the configuration in “sibmap” and allow it to issue sib5, as shown in the following figure: 13 corresponds to binary 1101, including sib5

批注 [DY1]: As per TMO, LTE and 5G NSA HO is blind HO

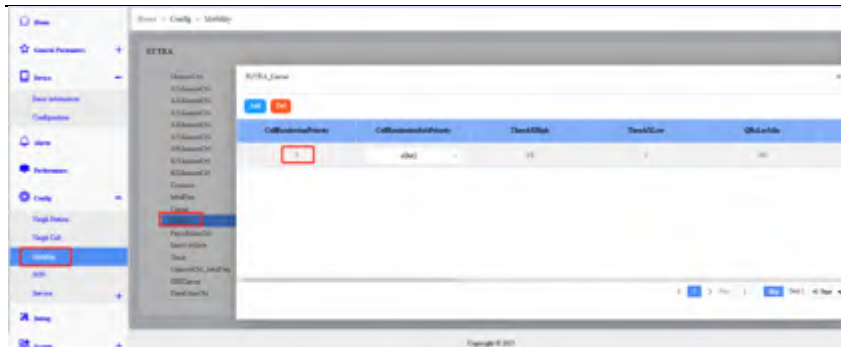
KDUP DQ HQHQ DWR Q DOFR Q JIHQ WIDOF R S UJ KW6357##### # # # ##### z z z kdp dYxp #



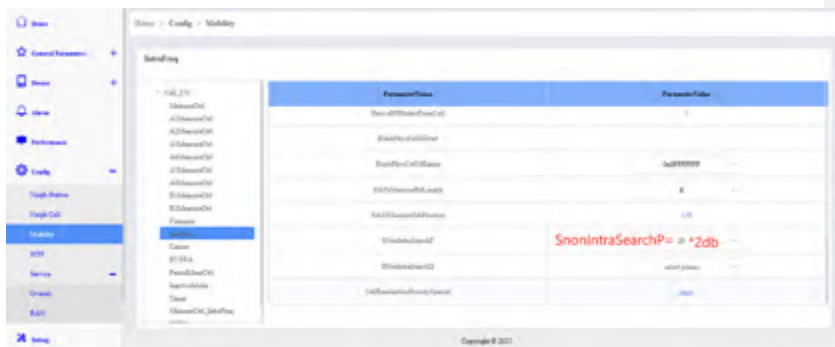
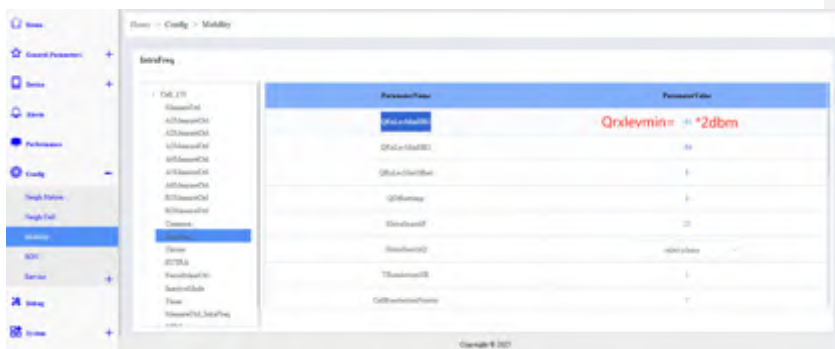
Confirm the priority of the current 5G cell and the target 4G cell. Generally, it is configured that the priority of the 5G cell is higher than that of the 4G cell.



KDUP DQ HQ WHEQ DWIR Q DOIR R Q IDHQ WIDOR R S UIM XWIE357##### # # # ##### z z z kkgp dyZrp #



The condition for starting measurement of different systems is $Srxlev \leq S_{nonInTraSearchP}$, similar to different frequencies. After bring in formula: $Qrxlevmeas$ (current cell RSRP value) $\leq Qrxlevmin + S_{nonInTraSearchP}$.



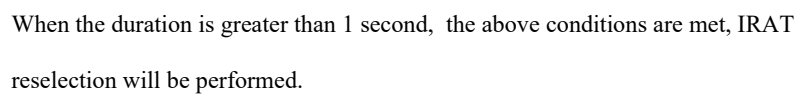
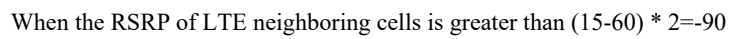
XDUP DQ HQ WIDQ DWR Q DOBFR Q IDHQ WIDQFR S UJX KW6357##### # # # ##### z z z kdp dyZp #

Under the above configuration, when the RSRP value of the serving cell is less than or equal to $\text{threshold} = (-65 * 2) + (25 * 2)$, that is, when the RSRP value is less than or equal to -80, start the measurement of different systems.

For the reproduction of high priority to low priority cells, it is necessary to ensure that the serving cell is below the threshold and the target cell is above the threshold, then perform reselection.

[illegible]

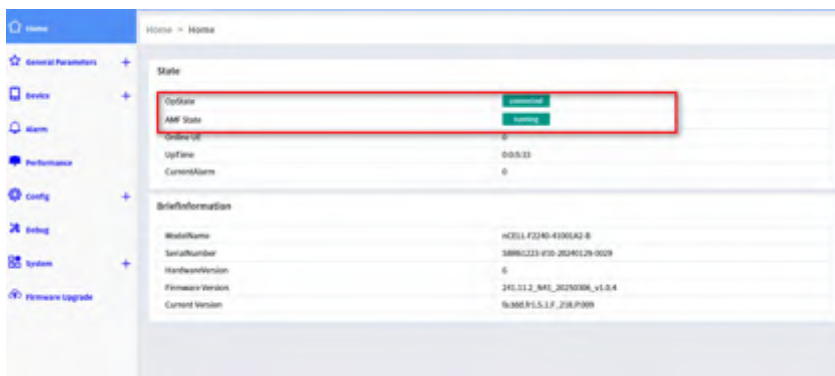
When the rsrp of serving cell is lower than $(8-60) * 2 = -104$



4 Device information

4.1 Operating status

After logging in to the Femto cell GUI, click the home page to view the cell running status and the software version information.



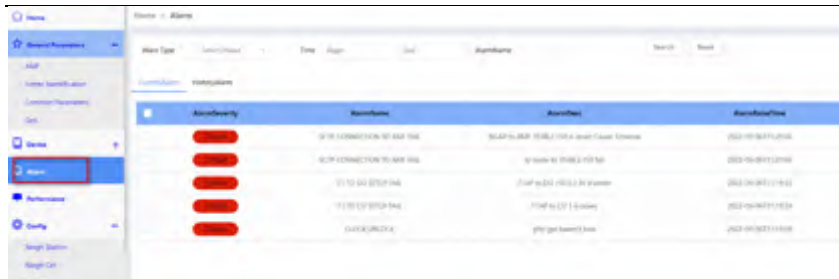
4.2 Alarm

Click the "Fault" > "Current Alarm" menu, and the current active alarm of the Femto cell is displayed on the operation interface.

Click the "Alarm" > "Historical Alarm" menu, and the operation interface displays the historical alarm information of the Femto cell.

Click the "Fault" menu, select "Alarm Type", fill in the start time and end time of "Time Query", click the "Query" button, select historical alarms according to conditions.

XDUP DQ HQ WHEQ DWIR Q DOIR R Q JI HQ WIDIR R S UJ KWIE357##### # # # ##### z z z kskp dyZrp #



4.3 Debug

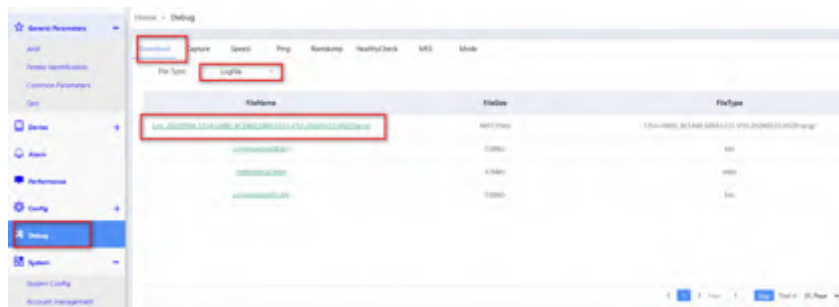
4.3.1 Log download

Path: **Debug**

Click the menu "Debug", as shown in the figure below and choose file type:

File types: log files, configuration files and performance files;

LogFile indicates the gather log which contains alarm/du/cu/oam/phy..etc.,logs.



After clicking the file, it will download to the local PC.

4.3.2 Log capture

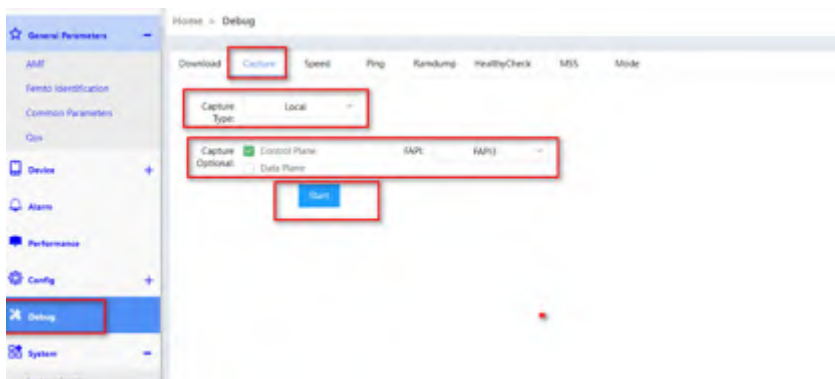
Packet capture type: local packet capture and forwarding packet capture;

KDUP DQ HQ WIDQ R Q DOH R Q JIDHQ WIDQ R S UJL KW6357##### # # # ##### z z z kdkp dYzP #

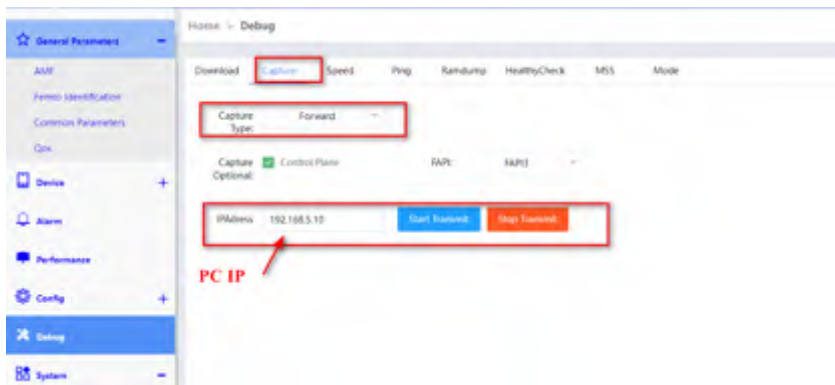
Local:

a) Choose the log type, “Control plane, data plane, fapi” can be selected, Click the button "Start" to automatically start packet capture locally;

b) Click this “Stop” button, the system will automatically download the log to view the data package download status.



Forward:



XDUP DQ W3HQ DW3R Q DO3P R Q T3HQ W3D3P R S\U3 K W357# # # # z z z 3k3p d3Zp #

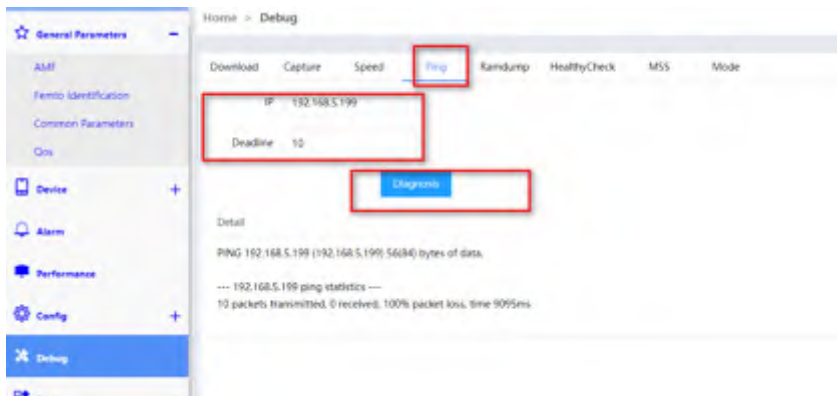
Forward capture: Change the capturing type to "forward", Fill the IP address as the local computer which connects to LAN or wan port, and use wireshark tool to start the capture, click “start Transmit” to forward the data to Wireshark.

Packet capture options: control plane, FAPI, data plane.

- **Control plane:** Also called signaling plane, it can capture network access signaling such as sctp / ngap / F1AP , log File is small;
- **FAPI:** BBU internal phy and mac Interactive messages, can view information such as MAC scheduling, log The file is relatively large;
- **Data plane:** also called user plane, in the fapi Based on the original data packet, log File is the largest.

4.3.3 Diagnosis

Network diagnosis can be performed through Home>Debug>ping

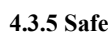


4.3.4 Healthy check

Enter Home>Debug>Healthy Check.

Healthy check is enabled by default, it's used to restore the system when system detects issue.

KDUP DQ HQ HQHQ DWR Q DOBFR Q JIGHQ WIDOF R S\UJ KWIE357##### # # # ##### z z z kkgp dYzP #



Enter Home>Debug>Safe

It supports to disable/Enable interface for web/ssh/ftp.



Click the sub menu "Restart" to restart the Femto cell protocol stack process.



Enter /Home/Device/Configuration/CertMS

Fill the URL for Certificate management server, it is used to interact with CMS ,

KDU P D Q # Q W H U Q D W I R Q D O M F R Q I I G H Q W I D O F R S \ U L J K W # 5 3 5 7 ##### # # # ##### z z z k d p d y f r p #

update new certificate during ZTP, or renew the new certificate when certificate is approaching expiration.



In case need update certificate manually, need upload the certificate to any path of the Femto and ssh to Femto OS, enter the path which certificates is located, then run below commands to write the certificates to TPM. Restart Femto to take affect.

tpm2_rw w 0x1500008 ca.crt ##CA certificate

tpm2_rw w 0x1500009 client.crt ##Femto Client Certificate

tpm2_rw w 0x150000A client-key.pem ###Private key

4.6 WIFI

Enter Home/Device/Configuration/WIFI

WifiScan Switch is disabled by default, when ZTP based on GPS is failed, it will enable the wifiscan to collect APs around Femto and reports to NMS and google location server to achieve coordinate, then implement for ZTP flow.

KDUP DQ HQ WHEQ DWIR Q DOIF R Q JI HQ WIDOF R S\UJ KWIE357##### # # # ##### z z z kskp dyZrp #



4.7 Battery

Enter Home/Device/Configuration/Battery

BatteryVoltage value indicates the percentage of current available power of Femto MCU.



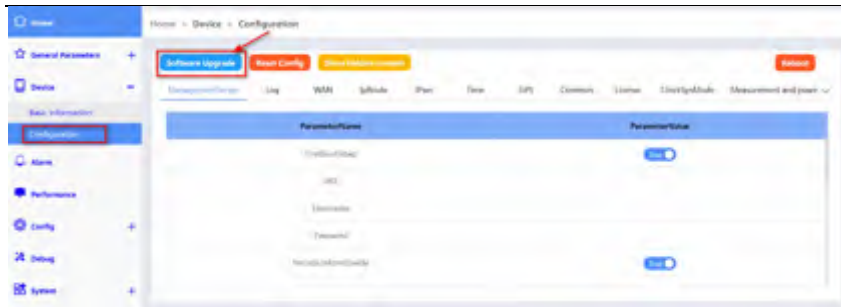
5 Upgrade

5.1 Software upgrade

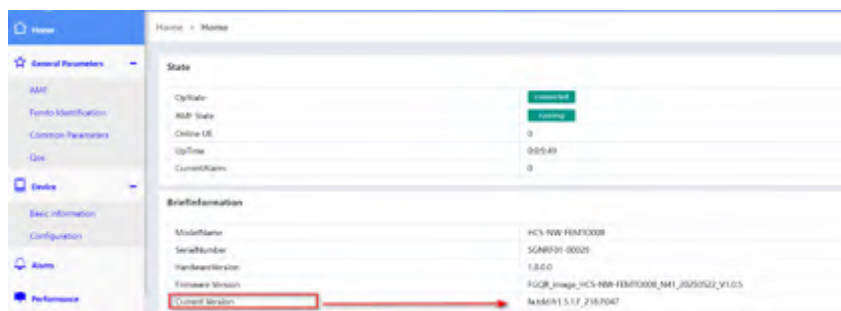
Upgrade via Web GUI

Path: Home-Device-Configuration

Navigate to sub menu "Device", click the "Software Upgrade" button, and select the corresponding upgrade package to upgrade.



Software version query , click information to view information, check whether the current version of the system is an upgraded version.

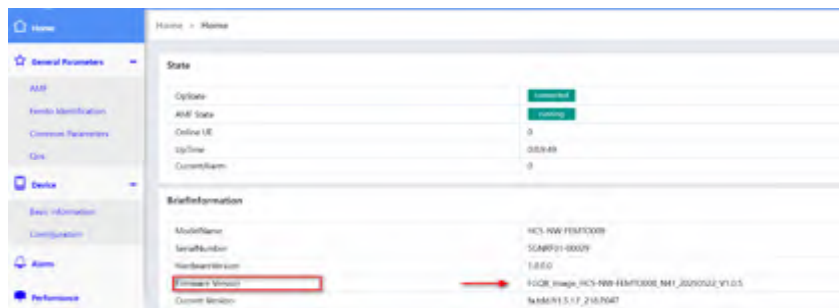
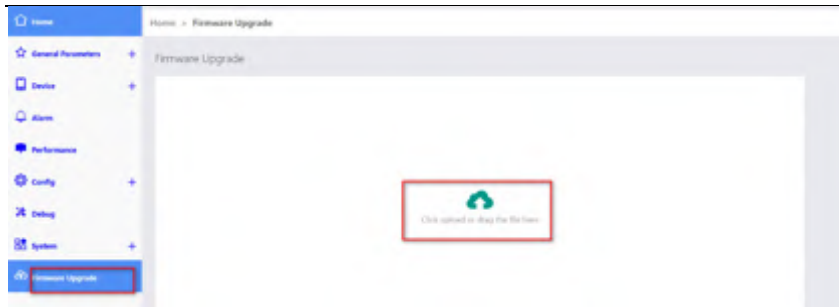


5.2 Firmware version upgrade

Path: Firmware Upgrade

Navigate to sub menu "Firmware Upgrade", click "Upload", and select the corresponding upgrade package to upgrade.

KDUP DQ HQHQ DWR Q DOBR Q JIHQ WIDOR S\UJ KWIE357##### # # # ##### z z z kkg dyZp #



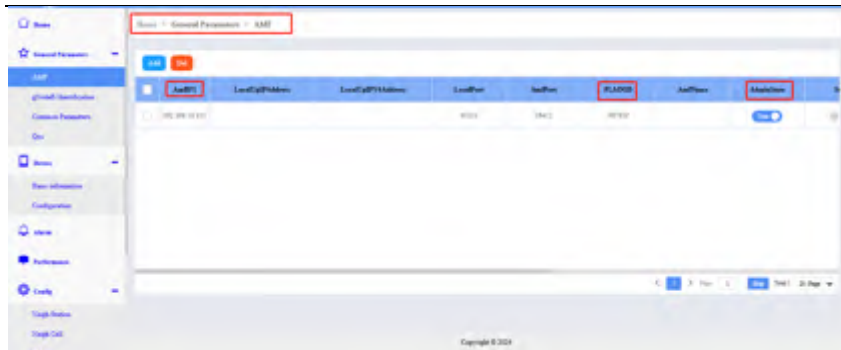
6 Common Troubleshooting

6.1 AMF state off-line

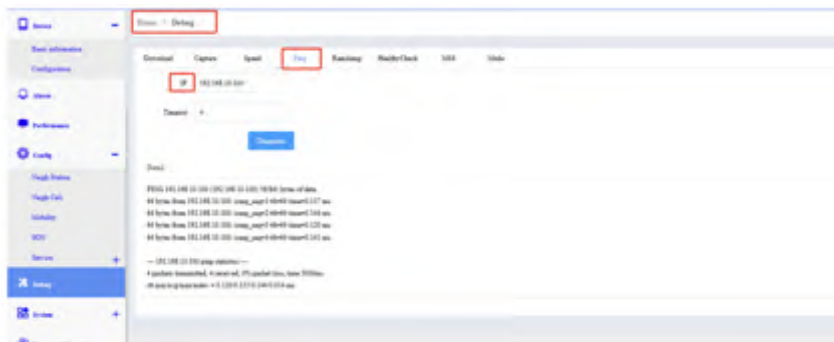
Check AMF related parameters

- AMF IP Configuration
- PLMNID Configuration
- Admin State status Switch

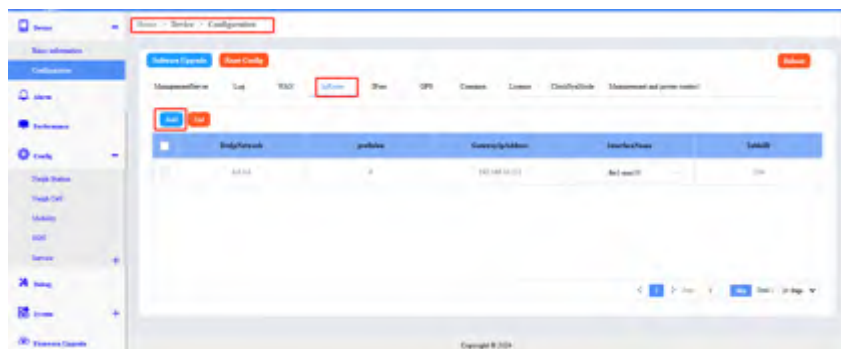
XDUP DQ HQ WHEQ DWIR Q DOIFR Q JIG HQ WIDOF R S\UJ K WIE357##### # # # ##### z z z kkg dyZrp #



- WAN IP Configuration
- PING AMF IP



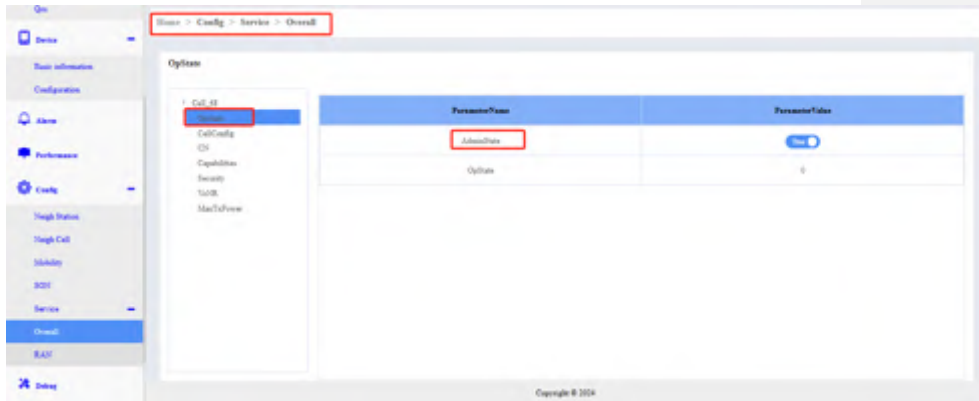
If the ping to AMF fails, check whether the wan port IP and the 5GC IP are in the same LAN. If not, please configure the IP route based on the network transmission.



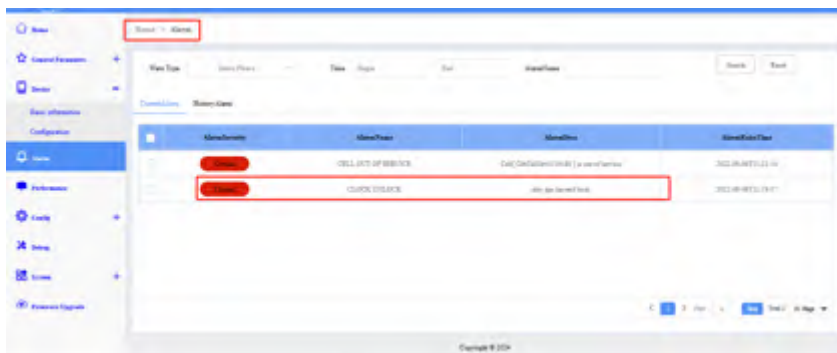
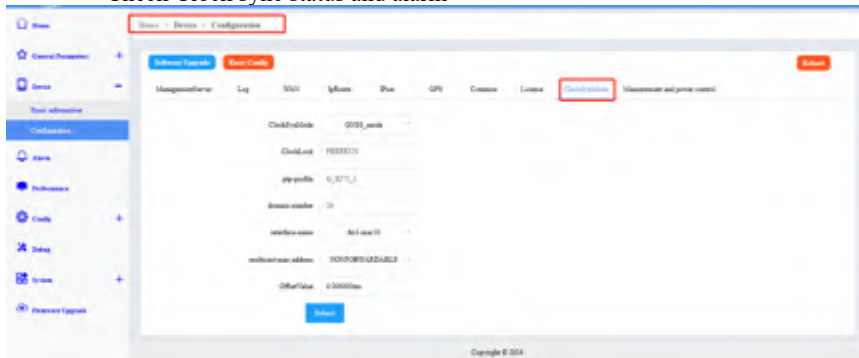
KDUP DQ HQ WHEQ DWIR Q DOIR R Q IIG HQ WIDOR R S UUI XWE357##### # # # ##### z z z kdp dqZrp #

6.2 OpState shows forbid

- Check if AdminState is set to True



- Check Clock sync status and alarm



KDUP DQ WHEQ DWIR Q DOFR Q IJHQ WIDFR S UJX KW6357##### # # # ##### z z z kdp dyZp #

6.3 Registration failure

● RRC Setup failure

a. No RRC setup request

-UE does not send RACH request: make sure UE supports 5G and configured band, can search the radio network of Femto, need capture UE logs for analysis

-High interference and Floor noise: Can query floor noise or collect fapi3 logs for analysis

b. RRC setup Reject

msg	Length	Info
FIAP	269	F1SetupRequest, MIB, SIB1
FIAP	238	F1SetupResponse, SIB2, SIB3, SIB4, SIB5
FIAP	255	GNB00ConfigurationUpdate, MIB, SIB1
FIAP	68	GNB00ConfigurationUpdateAcknowledge
FIAP	75	GNB00ConfigurationUpdate
FIAP	68	GNB00ConfigurationUpdateAcknowledge
FIAP	569	RRC Setup Request
NRNRDLCOCH	68	RRC Reject
FIAP	82	UEContextReleaseCommand
FIAP	64	UEContextReleaseComplete
FIAP	569	RRC Setup Request
NRNRDLCOCH	68	RRC Reject
FIAP	82	UEContextReleaseCommand
FIAP	64	UEContextReleaseComplete

-RNTI carried by "RRC setup request" has been allocated by the base station to other terminals

-Exceeding CAC access threshold

-Femto builds RRC setup failure

I need to collect control plane capture and gather logs for analysis.

c. RRC setup Complete timeout

-UE does not receive RRC setup, UE does not send RRC setup complete

Need collect UE logs for analysis

-Femto not receive RRC setup complete

Need collect fapi3 log for analysis.

● AMF selection failure

-Femto release after receiving RRC setup complete

XDUP DQ HQ WHEQ DWIR Q DOIR Q JIG HQ WIDIR R S\UIJ KWIE357##### # # # ##### z z z kdp dYErp #

QW-CU-UE-F1AP-ID	RRR	Info
		RRC Setup
10		DLRRCMesssageTransfer
10		SACK , DLRRCMesssageTransfer
10		SACK , ULRRCMesssageTransfer
10		ULRRCMesssageTransfer
		RRC Setup Complete, Registration request
		RRC Release
10		UEContextReleaseCommand
10		SACK , UEContextReleaseCommand
10		SACK , UEContextReleaseComplete
10		UEContextReleaseComplete
		RRC Setup Request
		RRC Setup Request
		RRC Setup Request
		RRC Setup
11		DLRRCMesssageTransfer
11		SACK , DLRRCMesssageTransfer
11		SACK , ULRRCMesssageTransfer
11		ULRRCMesssageTransfer
		RRC Setup Complete, Registration request
		RRC Release
11		UEContextReleaseCommand
11		SACK , UEContextReleaseCommand
11		SACK , UEContextReleaseComplete

I need to collect control plane capture and gather logs for analysis.

● Registration request rejected by 5G core network

F1AP	222	10624 RRC Setup Request
NrRrcUICch	60	10625 RRC Setup Request
NrRrcUICch	169	10626 RRC Setup
F1AP	261	10627 DLRRCMesssageTransfer
F1AP	161	10628 ULRRCMesssageTransfer
NrRrcUICch	175	10629 RRC Setup Complete, Registration request, Registration request
NGAP	168	10630 InitialUEMessage, Registration request, Registration request
NrRrcUICch	60	10633 RRC Release
F1AP	92	10634 UEContextReleaseCommand
F1AP	62	10635 UEContextReleaseComplete
F1AP	76	10636 RRCDeliveryReport

Need confirm UE is added in core network or Core internal problem.

● NAS Authentication Failure or Security Mode Failure

F1AP		ULRRCMesssageTransfer
NrRrcUICch		RRC Setup Complete, Registration request
NGAP	793	InitialUEMessage, Registration request
NGAP	793	DownlinkNASTransport, Authentication request
NrRrcUICch		DL Information Transfer, Authentication request
F1AP		DLRRCMesssageTransfer
F1AP		RRCDeliveryReport
F1AP		ULRRCMesssageTransfer
NrRrcUICch		DL Information Transfer, Authentication failure (MAC failure)
NrRrcUICch		DL Information Transfer, Authentication failure (MAC failure)
NGAP	793	UplinkNASTransport, Authentication failure (MAC failure)
NGAP	793	DownlinkNASTransport, Authentication reject
NrRrcUICch		DL Information Transfer, Authentication reject
F1AP		DLRRCMesssageTransfer
NGAP		UEContextReleaseCommand
NrRrcUICch		RRC Release
NGAP	793	UEContextReleaseComplete
F1AP		UEContextReleaseCommand
F1AP		UEContextReleaseComplete

KDUP DQ 8Q 8HQ DWR Q DOBFR Q JIDHQ WDOFR S\UJX KW6357##### # # # ##### z z z kdp dyZp #

Need confirm the Key/OPC/OP information is consistent between terminal and core network.

● AS Security Mode Failure

	Info
	UE Information Transfer, Authentication response
	UplinkNASTransport, Authentication response
	DownlinkNASTransport, Security mode command
	DL Information Transfer, Security mode command
12	DLRRCMessagesTransfer
12	ULRRCMessagesTransfer
12	RRCDeliveryReport
	UE Information Transfer, Security mode complete, Registration request
	UplinkNASTransport, Security mode complete, Registration request
	InitialContextSetupRequest, Registration accept
	Security Mode Command
12	DLRRCMessagesTransfer
12	ULRRCMessagesTransfer
12	RRCDeliveryReport
	Security Mode Complete
	UE Capability Enquiry
12	DLRRCMessagesTransfer
	DL Information Transfer, Registration accept
12	DLRRCMessagesTransfer
12	RRCDeliveryReport
12	ULRRCMessagesTransfer
12	ULRRCMessagesTransfer
	UE Capability Information

-Femto sends Security Mode Command to UE failure

-Femto wait Security mode complete time out.

I need to collect control plane capture and gather logs for analysis.

● UE capability report failure

	Security Mode Command
12	DLRRCMessagesTransfer
12	ULRRCMessagesTransfer
12	RRCDeliveryReport
	Security Mode Complete
	UE Capability Enquiry
12	DLRRCMessagesTransfer
	DL Information Transfer, Registration accept
12	DLRRCMessagesTransfer
12	RRCDeliveryReport
12	ULRRCMessagesTransfer
12	ULRRCMessagesTransfer
	UE Capability Information
	UERadioCapabilityInfoIndication
	InitialContextSetupResponse
	UL Information Transfer, Registration complete
	DL Information Transfer, Registration complete

a. Femto send UeCapabilityEnquiry failure

b. Femto wait UE CAPABILITY Information timeout

Need collect Control plane capture and gather log for analysis.

#####

a. UE does not initiate PDU session establish request

Need to check terminal setting and control plane capture for analysis.

Need check terminal APN setting and Control plane capture for analysis.

Need to collect control plane capture and gather logs for analysis.

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```
RRCTextSetupResponse  
RRConfigReq "01 WVS Transport", PDU session establishment attempt  
01 RRMessageTransfer  
01 RRMessageTransfer  
RRUplinkReport  
RRReconfigurationComplete  
ULContextModificationRequest  
ULContextModificationResponse  
PUSessionResourceSetupResponse
```

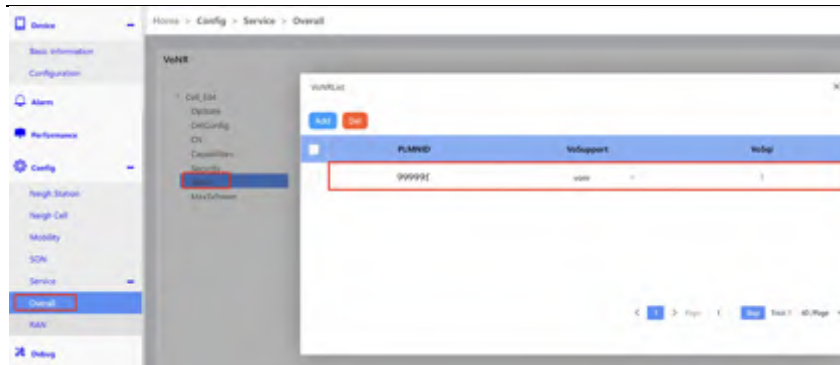
- UE initiate rrc reestablishment.

```

5 UplinkNAS transport, UL NAS transport, PDU session establishment request
5 PDUsessionResourceSetupRequest, UL NAS transport, PDU session establishment accept
5 PDUsessionResourceSetupResponse
5 TransportResourceReleaseCommand, UL NAS transport, PDU session release command (0-back failure)
  D BRCMessageTransfer
  D Information Transfer, UL NAS transport, PDU session establishment request
  D Information Transfer, UL NAS transport, PDU session establishment request
5 UplinkNAS transport, UL NAS transport, PDU session establishment request
5 PDUsessionResourceSetupRequest, UL NAS transport, PDU session establishment accept
5 PDUsessionResourceSetupResponse

```

- Check PLMNID Configuration
- Check the VoNR Support Configuration
- Check the Vo5QI, which is determined by 5GC (normally it is 1)



6.5 Handover Failure

● No neighbor cell measurement report

- Ensure both source and target cells can register and operate normally
- Clock not locked: Make sure the clock is locked for both local and neighbor station
- System frame is inconsistent: Check the subframe and frame offset is consistent
- Signal strength does not reach the measurement event threshold
- UE is not under shared radio coverage with neighbor cell

Need check configurations for both source and target gNB.

● No Handover Request

- Neighbor cell configuration incorrect: make sure the PLMN, PCI, SSB, TAC, CI are correct.

Need check neighbor cell configurations

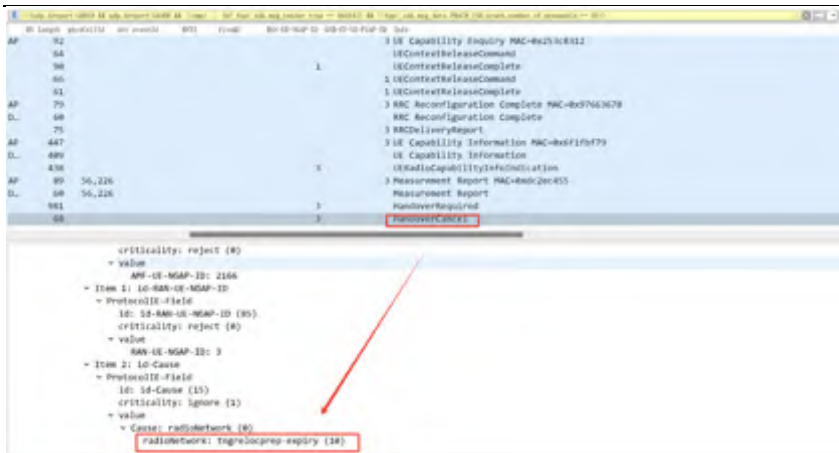
● Handover Preparation Failure

- Neighbor cell configuration incorrect: make sure the PLMN, TAC is correct.
- The bearer in target cell establishes fails

Need collect Control plane capture and gather log for analysis.

● Wait HandoverRequestACK timeout

KDUP DQ HQ WHEQ DWIR Q DOBFR Q JIHQ WIDOF R S\UJ KWIE357##### # # # ##### z z z kskp dyZrp #



-Incorrect gNBID length Configuration
Need control plane capture and gather log for analysis.

6.5 IPsec Setup Failure

● RemoteID error

Download the gather log and check the strongswan log, or ssh to the Femto server and enter path /opt/bbu/oam/cm to view the strongswan log with command:

```
tail -f strongwan
```

It shows “peer config, constraint checking failed”

```
KDUP DQ 00 WHEQ DWIR Q DOBFR Q IIS HQ WIDOF R S\UJ KWHE357##### # # # ##### z z z kskp dYzP #
```



- **System time is not updated or system time is not in the valid date of certificate**

tail -f strongwan

It shows “certificate invalid”

- **Encryption algorithm, integrity algorithm, DH group negotiate failed between Femto and security gateway for IPsec**

KDUFDQ #QWUQDWIR QDOFR Q IGHQWIDOFRS\ULJ KW#5357##### z z z kdp dylrp#

It shows “no proposal chosen notify error”

Enter directory: Home/Device/Configuration

Check the IPsec negotiation parameter for

- Encryption algorithm, integrity algorithm, DH group negotiate failed between Femto and security gateway for Child SA

Download the gather log and check the strongswan log, or ssh to the Femto server and

```

KDUPDQ #QWUQDWIR QDO#FR Q IGHQWIDOFR S\ULJ KW#5357#####
# # # # ##### z z z kdp dYfrp #

```



It shows “Failed to establish child sa”

[illegible]

Only sending, no response.

[illegible]

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