

Edge5000i User Manual



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READ ME

Version	Editor	Release Date	Remark
V1.0	Jessi Zhou & Huaxin Wang	23 rd May 2022	
V1.1	Jessi Zhou	1 st June 2022	Interface Info and Release Note Updated
V1.2	Jessi Zhou	15 th June 2022	Pictures of Odge5000i Updated
V1.3	Zackie Yang	17 th Oct 2022	Support CBRS Support Cell split
V1.4	Zackie Yang	21 th Nov 2022	Support DHCP Support Mask Support Floor Noise check
V1.5	Jessi Zhou	9 th Feb 2023	Support Gateway Support Configuration in Web GUI of N41
V1.6	Zackie Yang	14 th Feb 2023	Support frame offset
V2.0	Zackie Yang	27 th June 2023	New OAM Support preferred output power configuration
V2.1	Zackie Yang	11 st July 2023	GPS update
V2.2	Zackie Yang	26 th Sep 2023	

For more information, please refer to the following video, which shows the installation method and physical connection of Odge5000i.

<https://youtu.be/Exkwogr1D4c>

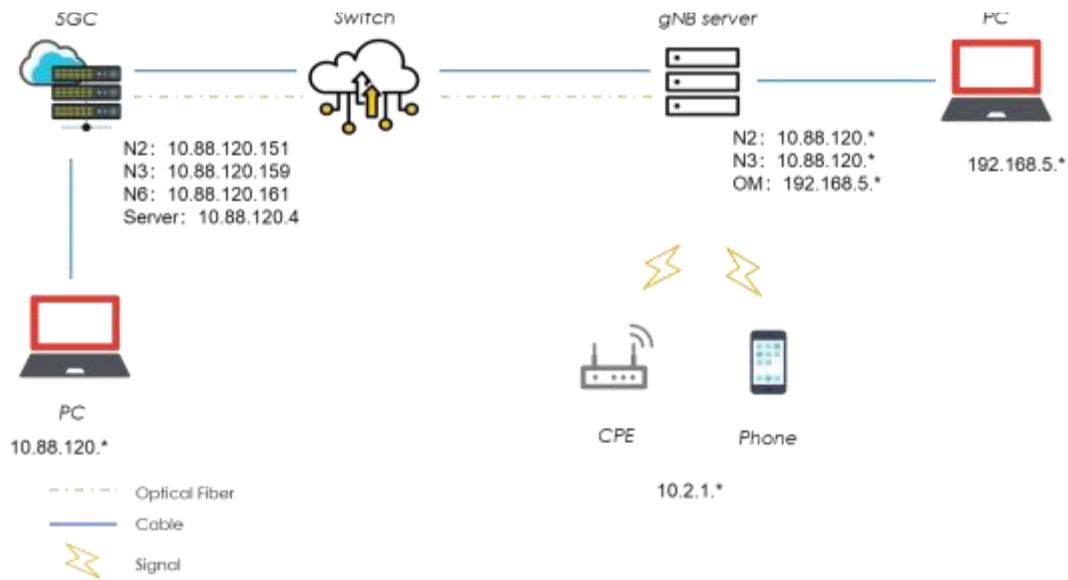
SOFTWARE MATRIX

Release Date	BBU Version	Accelerator Card Version	RRU Version	
0412_2022	5GNR_VPP_aa.tdd.fr1.2 .2.3_800312_r315_2022 1012_163023	r315_20220412_194 129	3550-3700 3500-3800	iDAS_DRRU_R518_V1.7.B 11S_70A_20220928_3625 TBD
0615_2022	5GNR_VPP_aa.tdd.fr1.2 .2.3_298_r315_2022061 5_143019;	FGBU20220509	3550-3700 3500-3800	iDAS_DRRU_R518_V0.1.B 11S_BB82_20220512_3625
1017_2022	5GNR_VPP_aa.tdd.fr1.2 .2.3_800312_r315_2022 1012_163023	FPGA 10141141	3550-3700 3500-3800	iDAS_DRRU_R518_V1.7.B 11S_70A_20220928_3625
			3800-4100	TBD
1115_2022	5GNR_VPP_aa.tdd.fr1.2 .2.3_800375_r315_2022 1109_113234_V2.2	FPGA 10141141	3550-3700 3500-3800 3800-4100	iDAS_DRRU_R518_V_M.2. 8.B11S_1FFC_20221104
1215_2022	5GNR_VPP_aa.tdd.fr1.2 .2.3_800375_r315_2022 1215_181338_V2.6	FPGA 10141141	3550-3700 3500-3800 3800-4100	iDAS_DRRU_R518_V_M.2. 21.B11S_BAD4_20221215
0213_2023	5GNR_VPP_aa.tdd.fr1.2 .2.3_800375_r315_2023 0203_103031_V2.8	FPGA 10141141	3550-3700 3500-3800 3800-4100	iDAS_DRRU_R518_V_M.2. 24.B11S_C8F3_20230209
0627_2023	5GNR_VPP_aa.tdd.fr1.2 .2.3.462_r611_m565_V3 .6SP01	FPGA 10141141	3550-3700 3500-3800 3800-4100	iDAS_DRRU_R518_M0.8.B 13S_8E03_20230601
0915_2023	5GNR_VPP_aa.tdd.fr1.2 .2.3.462_r817_m693_V3 .7SP05	FPGA 10141141	3550-3700 3500-3800 3800-4100	iDAS_DRRU_R518_M1.1.B 13S_ADED_20230824

1. Network Topology

Following is a network topology example for reference.

The IPs should be configured according to the on-site requirements. Please take 4.1 IP interconnection design for more details.



2. 5G Integrated gNodeB

The Odge5000i is a 4T4R outdoor integrated gNB, it comes with an all-in-one design.

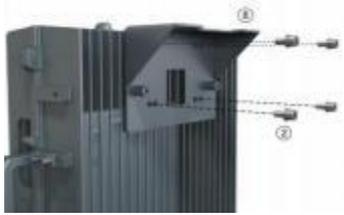
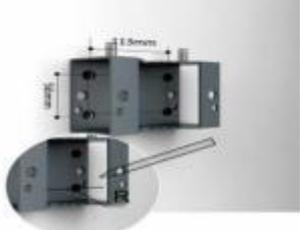


Odge5000i

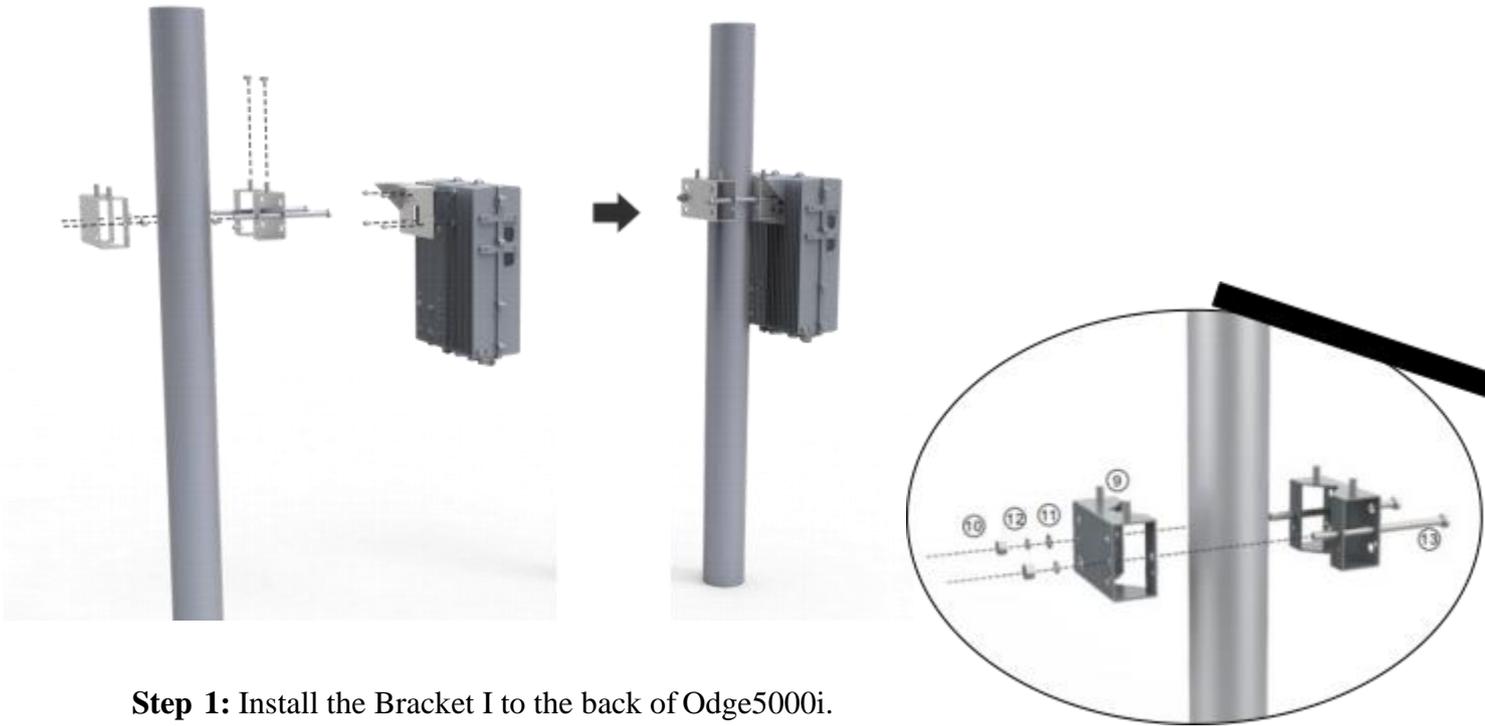
2.1 Installation Method

⊖ Back on the Wall



	<p>Step 1: Fasten the Bracket I to the back of Odge5000i</p>
	<p>Step 2: Mark the holes for mounting Bracket II</p>
	<p>Step 3: Drill the holes</p>
	<p>Step 4: Fixed the Bracket II to the wall</p>
	<p>Step 5: Hang the RU4370 on mounting bracket II and fasten it</p>
	<p>Step 6: Fasten Bracket I and Bracket II</p>

☺ **Pole Installation**



Step 1: Install the Bracket I to the back of Odge5000i.

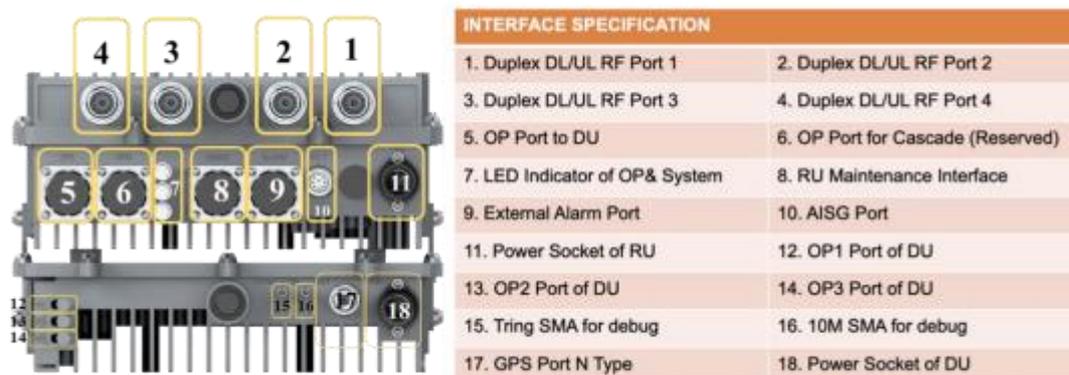
Step 2: Install the bracket II and Bracket III to the pole.

Step 3: Hang the Odge5000i on the mounting bracket and fasten with nuts M10.

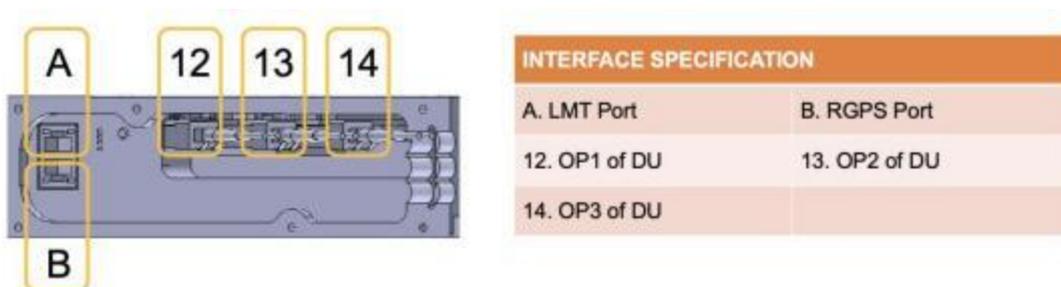
Step 4: Connect the ground cable and power cable.

Note: The diameter of Pole shall not be over 110mm or less than 55mm.

2.2 Odge5000i Physical Interfaces



External Interface of Odge5000i



Internal Interface of Odge5000i

No.	Name	Type	Remark
A	Maintenance Port (LMT)	Cat6 Ethernet (RJ45)	IP: 192.168.5.216
5	OP Port to DU	SFP+	
8	RU Maintenance Port	Cat6 Ethernet (RJ45)	IP: 10.7.3.200
11	Power Socket of RU	DC 48v	
12	OP1 of DU	SFP+	Reserved
13	OP2 of DU	SFP+	RU fronthaul port
14	OP3 of DU	SFP+	N2/N3 backhaul port to the 5GC
17	GPS sync	N type	
18	Power Socket of DU	DC 48v	

Common Interface of Odge5000i

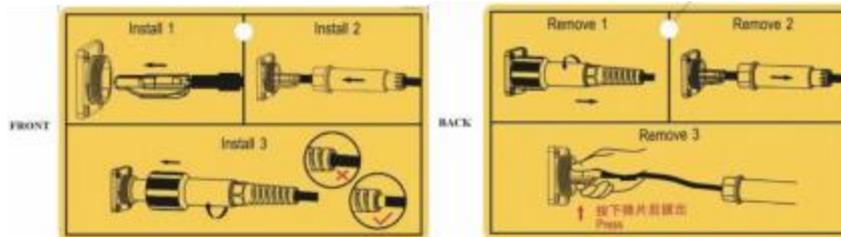
Cable Connection Guide:

1. Install the antenna of the RU (interface 1/2/3/4) according to the actual situation. (**Note:** Please do not operate the device without antenna or load)
2. Install the GPS antenna of the device and lightning protection, connect to the Interface 17 of the Odge5000i.
3. Find the patch cord shipped with the device, please note that the port with label A

should be connected to Interface 5 (OP Port to DU), and the other end has been connected to interface 13 (OP2 of DU) already.



4. Connect the Interface 5 (OP Port to DU) and RU Interface 13 (OP2 of DU) using the optical fiber jumper delivered with the device. The installation method of connecting one end of the RU is as shown in the figure below. After the other end is connected, waterproof treatment of plastic housing is required.



Fiber Jumper installation guide to RU (Interface 13)

5. Use the 2-outputs power cord delivered with the device to connect the power ports 11 and 18.
6. Connect Interface 14 (OP3 of DU) to 5GC.

Note:

- a. During the operation of the device, please keep the device installed correctly (wall or pole) to avoid the problem of limited cooling of the device.
- b. The N2 and N3 interfaces should be combined to a single physical port. It needs to configure two different IP addresses to distinguish the AMF and UPF.
- c. All IP addresses can be modified to match the local network requirements. For this part, please refer to *chap. 3.1 IP Interconnection Design*.

2.3 Web LMT Login

PC connects to the LMT port (Interface A) directly and configure PC's IP as 192.168.5.xx/24.

Open a browser and input the follow IP address: *http://192.168.5.216*

Account: *admin*

Password: *123456*



2.4 Web fiber Login

Connect Odge5000i Interface 14 (OP3 of DU) and PC to the same Optical Ethernet Switch. Configure PC's IP as the same segment with Odge5000i N2/N3 IP.

Open a browser and input the follow IP address: *http://Odge5000i N2/N3 IP*

Account: *admin*

Password: *123456*

2.5 SSH Login

PC connects to the LMT port (Interface A) directly and configure PC's IP as 192.168.5.xx/24.

Login via SSH with the IP 192.168.5.216.

- 1) Default IP Addresses of BBU
ssh root@192.168.5.216

- 2) Default account and password for BBU server
Account: *root*
Password: *root*

3. Odge5000i Parameters Configuration

Common BBU parameters like AMF, PLMN, NRARFCN, Layer numbers, Antennas numbers can be configured through the Web LMT interface. Gather the following information in advance.

Item	5GC
N2 (gNB<->AMF)	
N3 (gNB<->UPF)	
N6 (UPF<->DN)	
TAC	
PLMN	
NRARFCN	
BANDWIDTH	

3.1 IP Interconnection Design

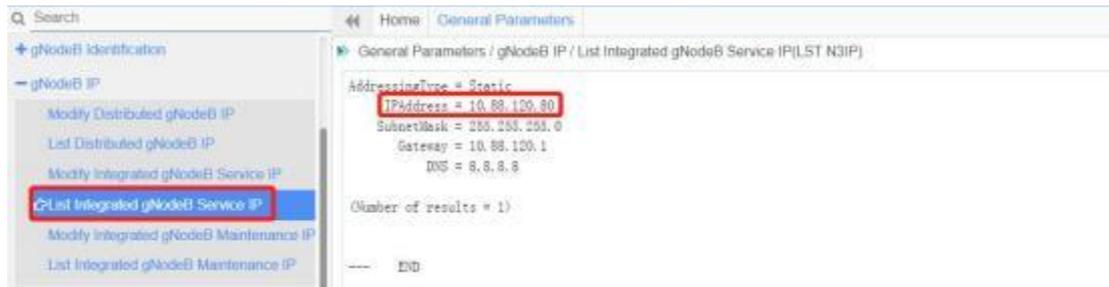
3.1.1 N2, N3 on same OPT Port

Path: General Parameters/gNodeB IP/Modify Integrated gNodeB Service IP

For example: if 5GC's N2(AMF) and N3(UPF) IP is 10.88.120.xx/24, set "AddressingType" to "Static", "IPAddress" to "10.88.120.xx", with the same segment of 5GC's AMF IP.

The screenshot shows the 'General Parameters / gNodeB IP / Modify Integrated gNodeB Service IP' configuration page. The 'AddressingType' is set to 'Static' and the 'IPAddress' is set to '10.88.120.80'. The 'SubnetMask' is set to '255.255.255.0' and the 'Gateway' is set to '10.88.120.1'. The 'DNS' field is empty. The 'Number of results' is 1. The 'Execute' button is highlighted in red.

Parameter name	Parameter value	Rem
AddressingType	Static	
IPAddress	10.88.120.80	
SubnetMask	255.255.255.0	
Gateway	10.88.120.1	
DNS		



3.1.2 Vlan

Assume that the vlan information to be configured is as follows (ps: this is an example, The specific configuration information should be configured according to the actual environment requirements)

IP INFO

5GC	N2 IP: 10.88.120.151/24	VLAN:20
	N3 IP: 10.88.130.159/24	VLAN:30
Switch	N2 GW: 10.88.120.1	VLAN:20
	N3 GW: 10.88.130.1	VLAN:30
gNodeB	N2 IP: 10.88.120.80/24	VLAN:20
	N3 IP: 10.88.130.80/24	VLAN:30

Step1 - Create 2 VLAN subnet card, VLAN 20 and VLAN 30

create sub-interfaces TenGigabitEthernet0 20

create sub-interfaces TenGigabitEthernet0 30

Notes: 20 and 30 are VLAN IDs, Please configure according to the actual IP plan.

Step2 - Set IP

set interface state TenGigabitEthernet0.20 up

set interface state TenGigabitEthernet0.30 up

set interface ip address TenGigabitEthernet0.20 10.88.120.80/24

set interface ip address TenGigabitEthernet0.30 10.88.130.80/24

Notes: 20 and 30 are VLAN IDs, 10.88.120.80/24 and 10.88.130.80/24 are the IP address, please configure according to the actual actual IP plan.

Step3 - Add Route

ip route add 10.88.120.151/24 via 10.88.120.1

ip route add 10.88.130.159/31 via 10.88.130.1

Notes: 10.88.120.151/24 and 10.88.130.159/24 are the 5GC IPs, 10.88.120.1 and 10.88.130.1 is the GW of gNB, please configure according to the actual IP plan.

Step4 - Set N2 interface:

nat44 add interface address TenGigabitEthernet0.20

nat44 add static mapping local 172.88.120.2 external TenGigabitEthernet0.20

set interface nat44 in host-vpp out TenGigabitEthernet0.20

Step5 - Set N3 interface

```
set interface ip upapp-bypass TenGigabitEthernet0.30
set interface ip6 upapp-bypass TenGigabitEthernet0.30
set interface n3 TenGigabitEthernet0.30
```

Notes:30 is the N3 VLAN ID, please configure according to the actual IP PLAN.

Step6 - Write all the above configurations to the *interface.txt* file

path: /opt/bbu/oam/cm

Notes:

 The configuration in the figure below is based on the above example, and the actual content should be configured according to the actual IP PLAN).

 **Line 2 & line 16 must be left empty when modifying.**

```
1 set int state TenGigabitEthernet0 up
2
3 create sub-interfaces TenGigabitEthernet0 20
4 create sub-interfaces TenGigabitEthernet0 30
5 set interface state TenGigabitEthernet0.20 up
6 set interface state TenGigabitEthernet0.30 up
7 set interface ip address TenGigabitEthernet0.20 10.88.120.80/24
8 set interface ip address TenGigabitEthernet0.30 10.88.130.80/24
9 ip route add 10.88.120.151/24 via 10.88.120.1
10 ip route add 10.88.130.159/24 via 10.88.130.1
11 create host-interface name vpp hw-addr 02:fe:99:f8:80:01
12 set interface state host-vpp up
13 set interface ip address host-vpp 172.88.120.1/24
14 set interface ip address host-vpp fdab::1/96
15 set ip neighbor host-vpp 172.88.120.2 02:fe:99:f8:80:02
16
17 set ip neighbor host-vpp fdab::2 02:fe:99:f8:80:02
18 nat44 add interface address TenGigabitEthernet0.20
19 nat44 add static mapping local 172.88.120.2 external TenGigabitEthernet0.20
20 set interface nat44 in host-vpp out TenGigabitEthernet0.20
21 set interface n3 TenGigabitEthernet0.30
22 set interface ip upapp-bypass TenGigabitEthernet0.30
23 set interface ip6 upapp-bypass TenGigabitEthernet0.30
24 set interface mtu 1500 TenGigabitEthernet0
```

Step7 - Check ifVLAN settings is correct.

```
# vppctl show int addr
```

```
^C
root@localdomain:~# vppctl show int addr
TenGigabitEthernet0 (up):
  L3 10.88.110.2/24
TenGigabitEthernet0.20 (up):
  L3 10.88.120.80/24
TenGigabitEthernet0.30 (up):
  L3 10.88.130.80/24
host-vpp (up):
  L3 172.88.120.1/24
  L3 fdab::1/96
local0 (dn):
```

10.88.120.80 and 10.88.130.80 are the VLAN IPs.

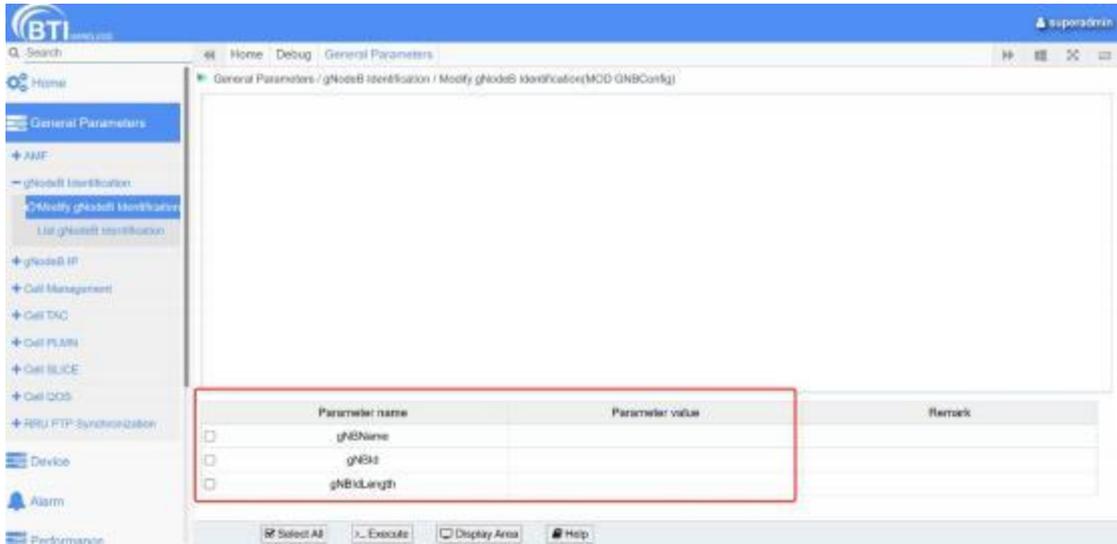
After the VLAN configuration of the Gnb side is completed, personnel on the switch side need to configure the corresponding interface vlan in order to finally connect to the core network.

3.2 gNB and Cell Naming Design

3.2.1 Configure gNB Name and gNB ID

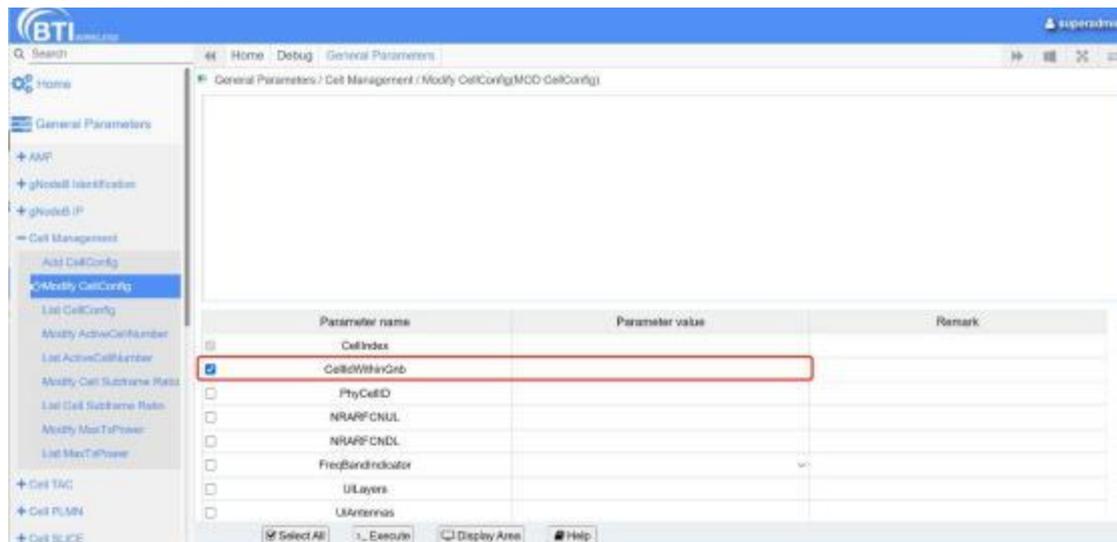
🕒 **gNB Name and gNB ID**

Path: General Parameters/gNodeB Identification/Modify gNodeB Identification



3.2.2 Configure Cell ID

Path: General Parameters/Cell Management/Modify CellConfig/cellIdWithinGnb



3.3 Cell Parameters Configuration

3.3.1 AMF IP

Path: Home/config/AMF

The screenshot displays the configuration page for AMF (Access and Mobility Management Function) in the Edgenectar system. The left sidebar shows a navigation menu with 'AMF' selected, and 'Modify AMF' highlighted. The main content area shows the configuration parameters for an AMF instance:

```

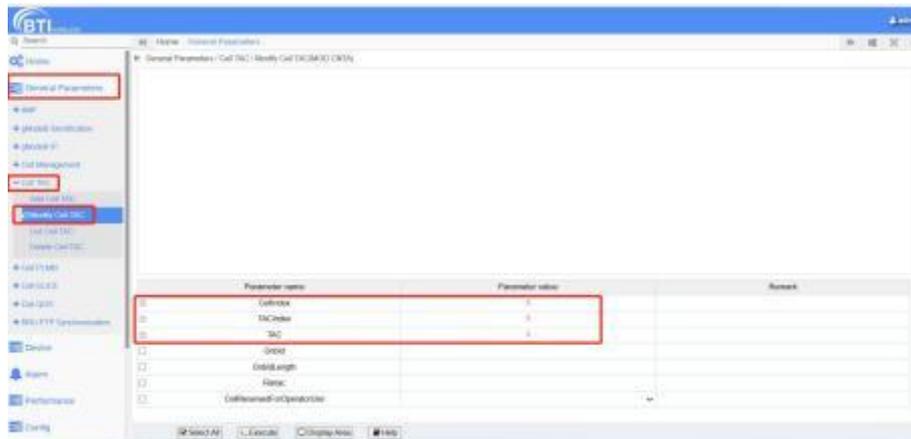
AMFIndex = 1
AmfIP1 = 10.88.2.150
LocalUpIPAddress = NULL
LocalUpIPv6Address = NULL
LocalPort = 60110
AmfPort = 38412
PLMNID = 46011f
AmfName = AMF
GnbId = NULL
GnbIdLength = NULL
AdminState = on
State = normal
SCTPInstId = 1
Default = on
    
```

Below the configuration, there is a table titled 'LST AMF;'. The table has columns for AMF parameters and their values. The 'AmfIP1' value '10.88.2.150' is highlighted with a red box.

LST AMF;		
<input type="checkbox"/>	AMFIndex	1
<input checked="" type="checkbox"/>	AmfIP1	10.88.2.150
<input type="checkbox"/>	LocalUpIPAddress	
<input type="checkbox"/>	LocalUpIPv6Address	
<input type="checkbox"/>	LocalPort	

3.3.2 TAC

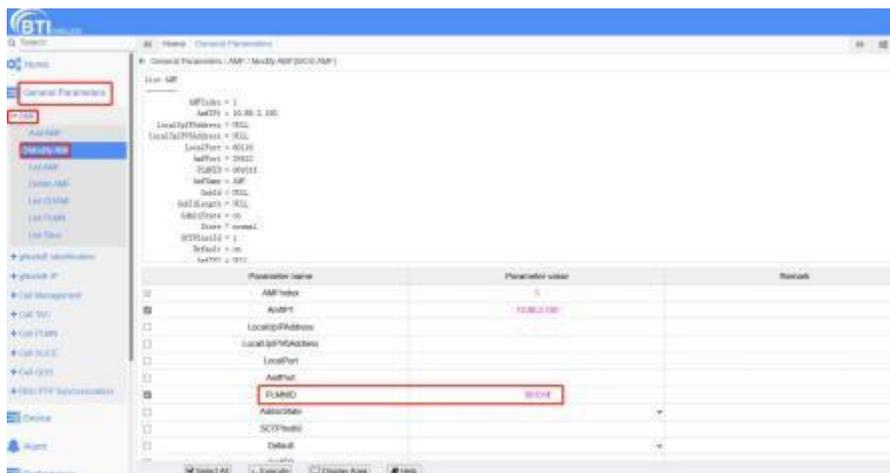
Path: Home/General Parameters/TA/TAC



3.3.3 PLMN

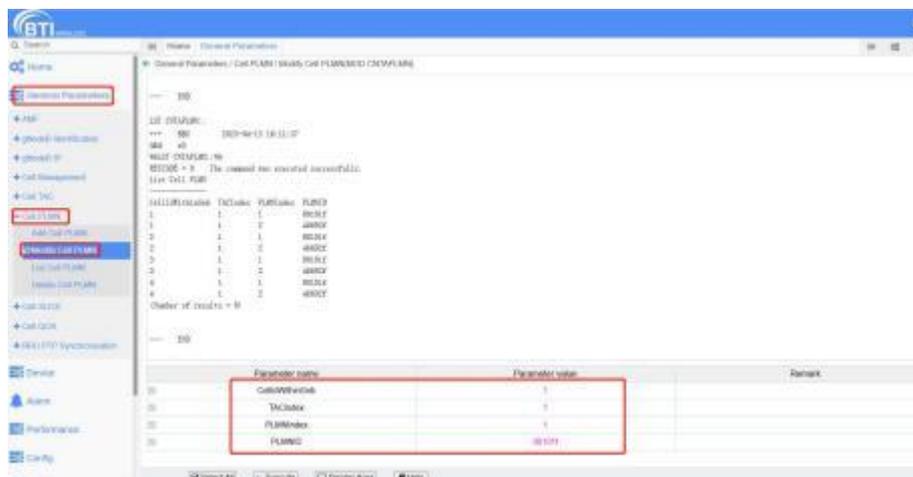
⊕ AMF Primary PLMNID

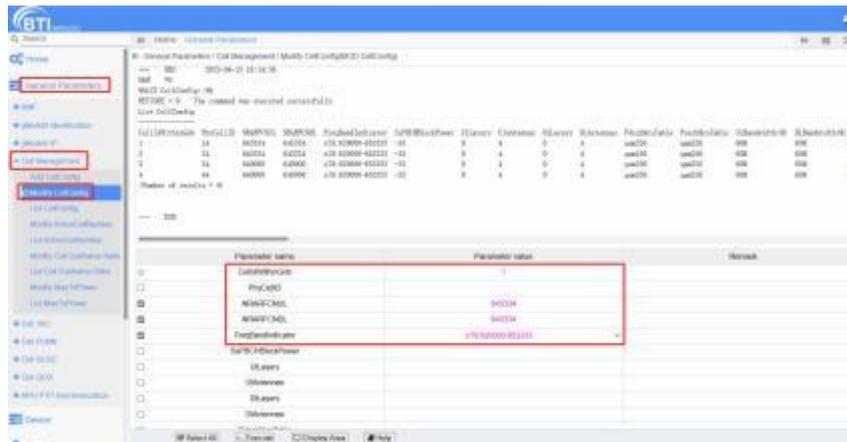
Path: General Parameters/AMF/Modify AMF



⊕ PLMNID

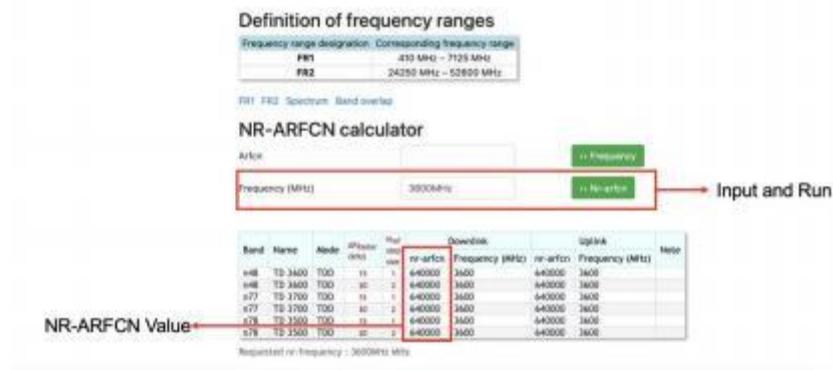
Path: General Parameters/Cell PLMN/Modify Cell PLMN





NR-ARFCN Value Calculation

Reference Website: https://www.sqimway.com/nr_band.php



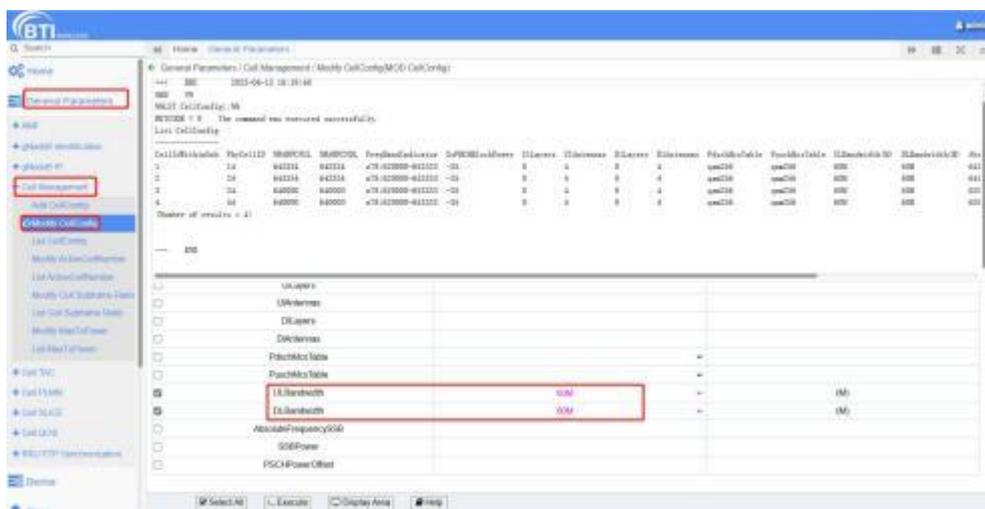
3.3.5 SSB

Path: General Parameters/Cell Management/List Cell Config

This version can automatically match the SSB based on the configured bandwidth.

3.3.6 Bandwidth

Path: General Parameters/Cell Management/Modify Cell Config



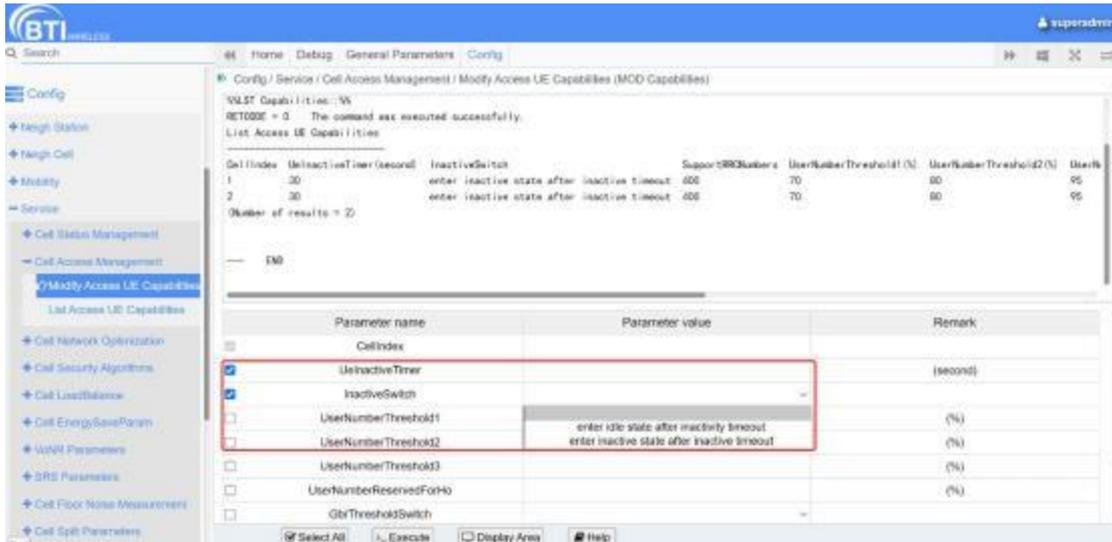
Note: This version can automatically match the RbNumber & c-srs & SRS-eable configuration based on the configured bandwidth.

3.3.7 SSB Power

SSB power will adapt automatically based on the different bandwidth in use.

3.3.8 Active Timer

Path: Config/Service/CellAccess Management/Modify Access UE Capabilities

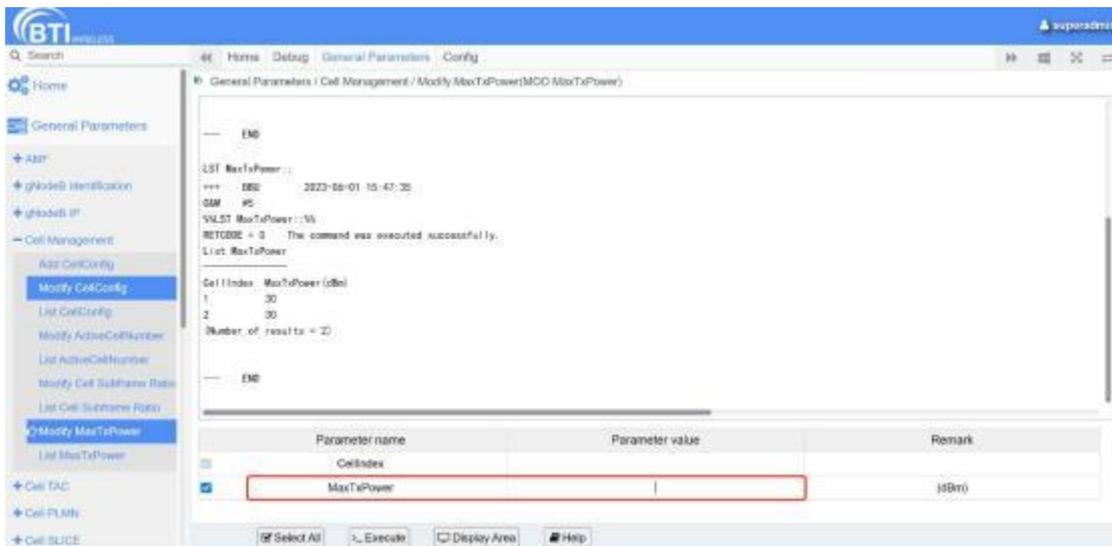


UeInactive Timer will be switched on by default.

UE will be idle status when no traffic passed for 30s to avoid fake connection.

3.3.9 Transmit Power

Path: Config/Service/CellAccess Management/Modify MaxTxPower



Range: 24~37, Unit: dbm

Note: It is recommended that the MaxTxPower should be at least 1w (30dbm).

3.3.10 TDD Configuration

Path: General Parameters/Cell Management/Modify Cell Subframe Ratio

☹ Scenario 1: 2.5ms single period 3U1D 10:2:2

BTI 4.0.0.2020

Home Debug General Parameters Config

General Parameters / Cell Management / Modify Cell Subframe Ratio(MOD PHYTddUULDL)

LST Sapbilities:
 +++ 888 2023-06-01 15:42:57
 --- 888
 VLSF Sapbilities: \N
 RETCODE = 0 The command was executed successfully.
 List Access UE Sapbilities

CellIndex	InactiveTimer(second)	InactiveSwitch	SupportBIONumbers	UserNumberThreshold1 (%)	UserNumberThreshold2 (%)	UserNumber
1	30	enter inactive state after inactive timeout.	400	70	80	95
2	30	enter inactive state after inactive timeout.	400	70	80	95

Number of results = 2

Parameter name	Parameter value	Remark
CellIndex	1	
ReferenceSubcarrierSpacing	kHz30	
DLTransmissionPeriodicity1	ms2p5	
NrofDownlinkSlots1	1	
NrofDownlinkSymbols1	10	
NrofUplinkSlots1	3	
NrofUplinkSymbols1	2	
IsPattern2Present	off	

Select All Execute Display Area Help

Search Home General Parameters

General Parameters / Cell Management / List Cell SubframeAssignment(LST PHYTddUULDL)

List Cell SubframeAssignment

```

-----
CellIndex = 1
ReferenceSubcarrierSpacing = kHz30
DLTransmissionPeriodicity1 = ms2p5
NrofDownlinkSlots1 = 1
NrofDownlinkSymbols1 = 10
NrofUplinkSlots1 = 3
NrofUplinkSymbols1 = 2
IsPattern2Present = off
DLTransmissionPeriodicity2 = ms2p5
NrofDownlinkSlots2 = 1
NrofDownlinkSymbols2 = 10
NrofUplinkSlots2 = 3
NrofUplinkSymbols2 = 2
    
```

LST PHYTddUULDL.indexid_CellConfig=1;

Select All Execute Help Copy Message Clear Output

CellIndex	
1	

☹ Scenario 2: 2.5ms single period 3D1U 10:2:2

General Parameters / Cell Management / Modify Cell Subframe Rate(D) PHYDDULDL

2023-04-07 16:36:28

WZJ PHYDDULDL, WZJ
 50000 = 0 The command was executed successfully.
 List Cell Subframe Rate

CellIndex	ReferenceSubcarrierSpacing	DULTransmissionPeriodicity	NrofDownlinkSlots	NrofDownlinkSymbols	NrofUplinkSlots	NrofUplinkSymbols	IsPattern2Present	DULTransmissionPeriodicity2	NrofDownlinkSlots2	NrofUplinkSlots2	NrofUplinkSymbols2
1	kHz30	ms2p5	3	10	1	2	off				
2	kHz30	ms2p5	1	30	3	2	off				
3	kHz30	ms2p5	1	30	3	2	off				
4	kHz30	ms2p5	1	30	3	2	off				

Order of rows(1-4)

Parameter name	Parameter value	Remark
CellIndex	1	
ReferenceSubcarrierSpacing	kHz30	
DULTransmissionPeriodicity1	ms2p5	
NrofDownlinkSlots1	3	
NrofDownlinkSymbols1	10	
NrofUplinkSlots1	1	
NrofUplinkSymbols1	2	
IsPattern2Present	off	
DULTransmissionPeriodicity2		
NrofDownlinkSlots2		

General Parameters / Cell Management / List Cell SubframeAssignment(LST PHYDDULDL)

List Cell SubframeAssignment

```

CellIndex = 1
ReferenceSubcarrierSpacing = kHz30
DULTransmissionPeriodicity1 = ms2p5
  NrofDownlinkSlots1 = 3
  NrofDownlinkSymbols1 = 10
  NrofUplinkSlots1 = 1
  NrofUplinkSymbols1 = 2
  IsPattern2Present = off
DULTransmissionPeriodicity2 = ms2p5
  NrofDownlinkSlots2 = 1
  NrofDownlinkSymbols2 = 10
  NrofUplinkSlots2 = 3
  NrofUplinkSymbols2 = 2
    
```

LST PHYDDULDL:indexid_CellConfig=1;

Select All Execute Help Copy Message Clear Output

CellIndex	1
CellIndex	1

Scenario 3: 2.5ms double periods 3D1U+2D2U 10:2:2

General Parameters / Cell Management / Modify Cell Subframe Rate(MOD PHYDDULDL)

2023-04-01 15:47:25

OM 95

Cell Index	Deactivation Time (second)	Inactivation Slot	SuperSRDUsers	UserNumber Threshold (U)	UserNumber Threshold (S)	User Number
1	30	enter inactive state after inactive timeout	400	70	80	85
2	30	enter inactive state after inactive timeout	400	70	80	85

(Number of results > 2)

END

LST MaxTxPower::

Parameter name	Parameter value	Remark
CellIndex	1	
ReferenceSubcarrierSpacing	kHz30	
DULTransmissionPeriodicity1	ms2p5	
NrofDownlinkSlots1	3	
NrofDownlinkSymbols1	10	
NrofUplinkSlots1	1	
NrofUplinkSymbols1	2	
IsPattern2Present	off	

<input checked="" type="checkbox"/>	NrofDownlinkSymbols1	10
<input checked="" type="checkbox"/>	NrofUplinkSlots1	1
<input checked="" type="checkbox"/>	NrofUplinkSymbols1	2
<input checked="" type="checkbox"/>	IsPattern2Present	off
<input checked="" type="checkbox"/>	DLULTransmissionPeriodicity2	ms2p5
<input checked="" type="checkbox"/>	NrofDownlinkSlots2	2
<input checked="" type="checkbox"/>	NrofDownlinkSymbols2	10
<input checked="" type="checkbox"/>	NrofUplinkSlots2	2
<input checked="" type="checkbox"/>	NrofUplinkSymbols2	2

Search Home General Parameters

General Parameters / Cell Management / List Cell SubframeAssignment(LST PHYTddULDL)

```

List Cell SubframeAssignment
-----
CellIndex = 1
ReferenceSubcarrierSpacing = kHz30
DLULTransmissionPeriodicity1 = ms2p5
NrofDownlinkSlots1 = 3
NrofDownlinkSymbols1 = 10
NrofUplinkSlots1 = 1
NrofUplinkSymbols1 = 2
IsPattern2Present = off
DLULTransmissionPeriodicity2 = ms2p5
NrofDownlinkSlots2 = 2
NrofDownlinkSymbols2 = 10
NrofUplinkSlots2 = 2
NrofUplinkSymbols2 = 2
    
```

LST PHYTddULDLindexd_CellConf=1:

Select All Help Copy Message Clear Output

<input checked="" type="checkbox"/>	CellIndex	1
-------------------------------------	-----------	---

Scenario 4: 5ms single period 7D2U 6:4:4

BT Home Config General Parameters Config

General Parameters / Cell Management / Modify Cell SubframeAssignment(LST PHYTddULDL)

DLULTransmissionPeriodicity1: 5ms

DLULTransmissionPeriodicity2: 5ms

Parameter name	Parameter value	Remark
CellIndex	1	
ReferenceSubcarrierSpacing	kHz30	
DLULTransmissionPeriodicity1	5ms	
NrofDownlinkSlots1	7	
NrofDownlinkSymbols1	6	
NrofUplinkSlots1	2	
NrofUplinkSymbols1	4	
IsPattern2Present	off	
DLULTransmissionPeriodicity2	ms2p5	
NrofDownlinkSlots2	2	
NrofDownlinkSymbols2	10	
NrofUplinkSlots2	2	
NrofUplinkSymbols2	2	

Search Home General Parameters

General Parameters / Cell Management / List Cell SubframeAssignment(LST PHYTddULDL)

```

List Cell SubframeAssignment
-----
CellIndex = 1
ReferenceSubcarrierSpacing = kHz30
DLULTransmissionPeriodicity1 = ms5
NrofDownlinkSlots1 = 7
NrofDownlinkSymbols1 = 6
NrofUplinkSlots1 = 2
NrofUplinkSymbols1 = 4
IsPattern2Present = off
DLULTransmissionPeriodicity2 = ms2p5
NrofDownlinkSlots2 = 2
NrofDownlinkSymbols2 = 10
NrofUplinkSlots2 = 2
NrofUplinkSymbols2 = 2
    
```

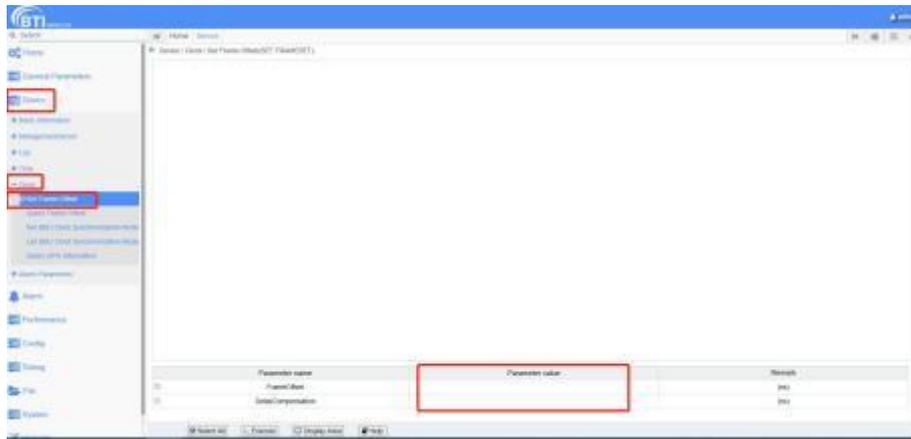
LST PHYTddULDLindexd_CellConf=1:

Select All Help Copy Message Clear Output

<input checked="" type="checkbox"/>	CellIndex	1
-------------------------------------	-----------	---

3.3.11 Frame Header Offset

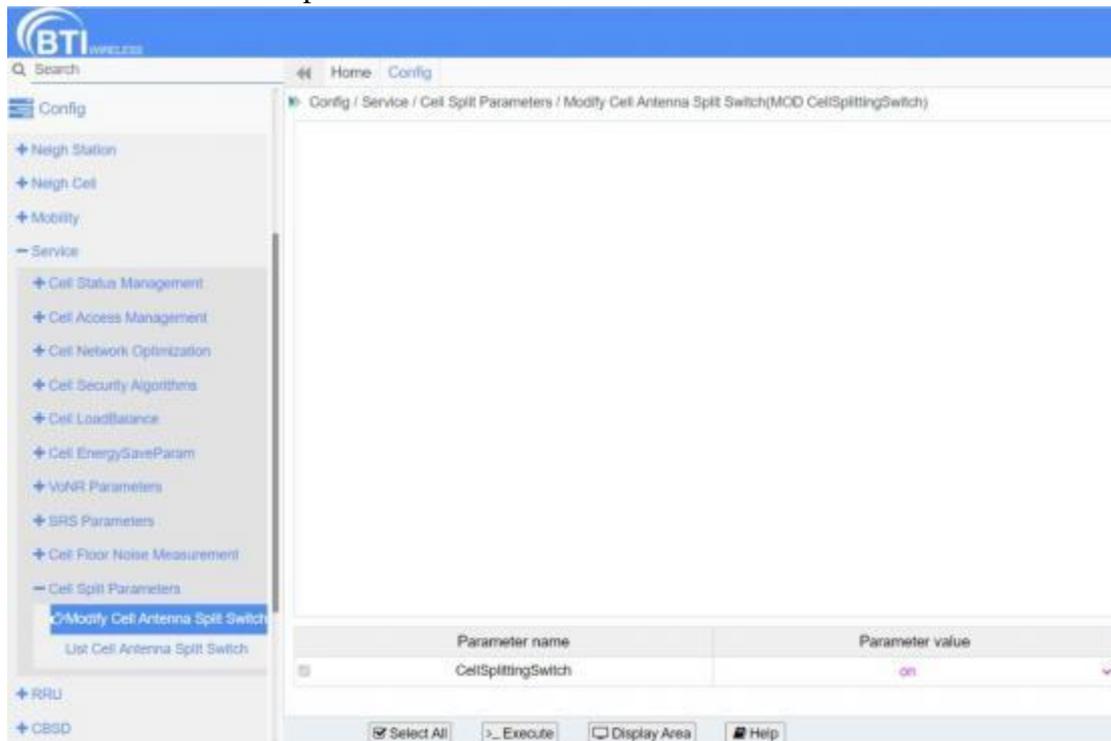
Path: Device/Clock/Set Frame Offset



3.3.12 Cell Split

Path: Config/Service/Cell Split Parameters/Modify CellAntenna Split Switch

Turn on the switch to split the cell.



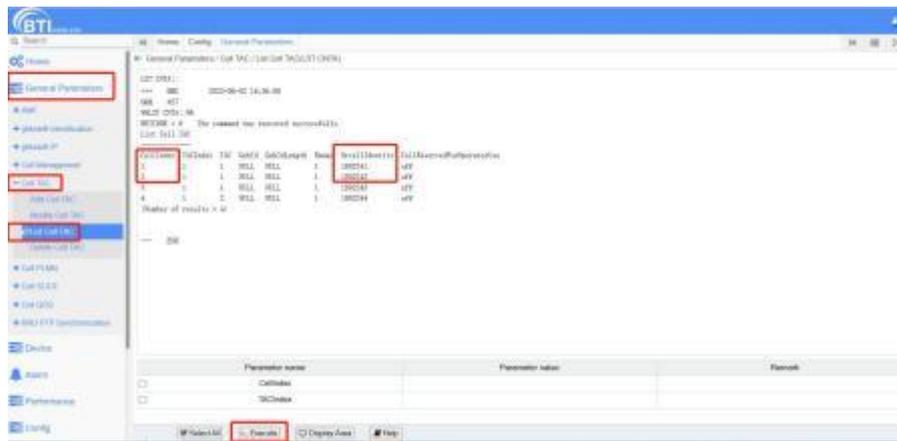
3.3.13 Handover Configuration

☹ Fill in the below table.

Item	Cell 1	Cell 2
gNB ID		
CID		
NRARFCN		
SSB		
Bandwidth		
TAC		
PLMN		
PCI		

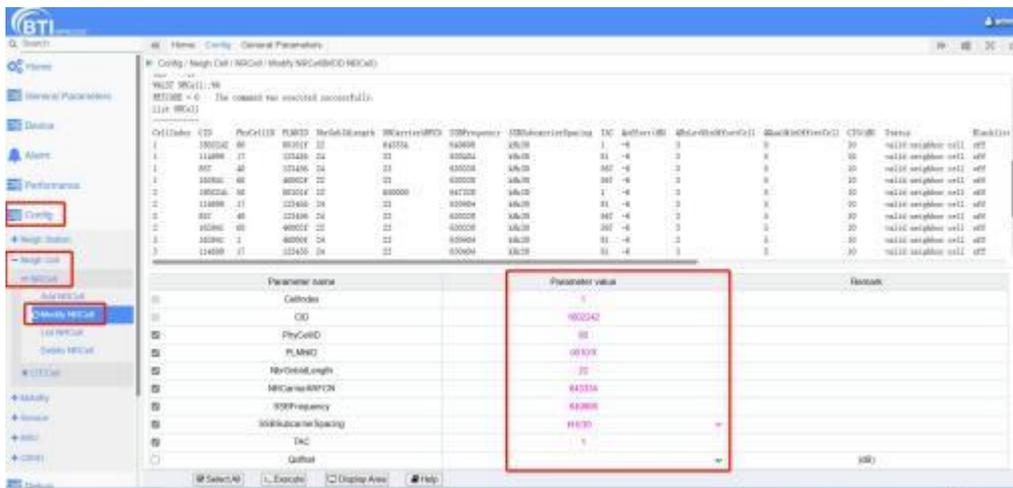
☹ Check CID

Path: *Config/Service/Overall/CN/TA/NrcellIdentity*



a) Add Neighbor cell

Path: *Config/Neigh Cell/NRCell/Modify NRCell*



b) Add Neighbor Station

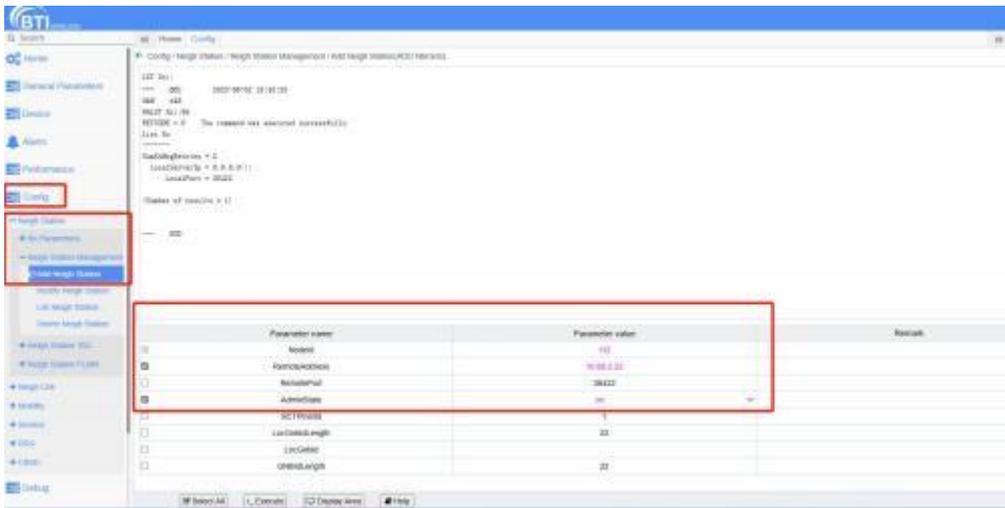
Step1 Configure Local Server IP

Path: *Config/Neigh Station/Xn Parameters/Modify Xn*



Step2: Add neighbor station

Path: Config/Neigh Station/Neigh Station Management/Add Neigh Station



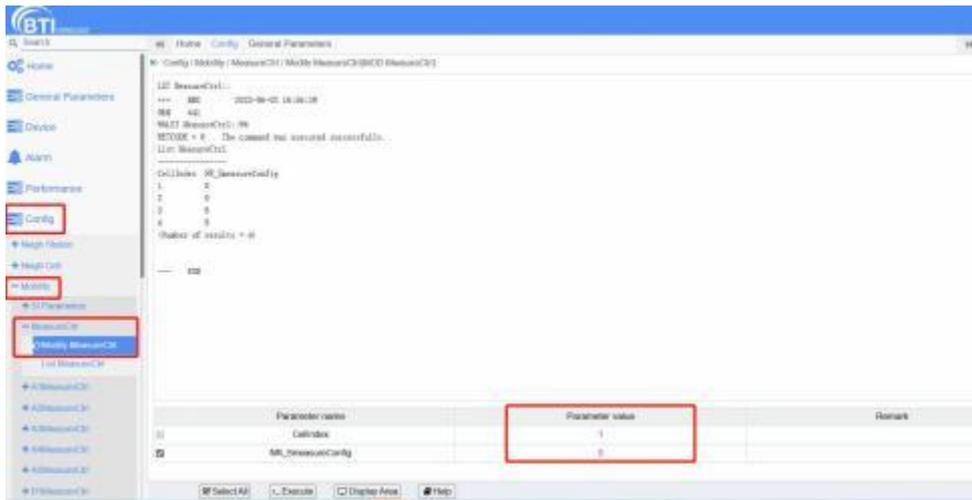
Hando

ver Configuration

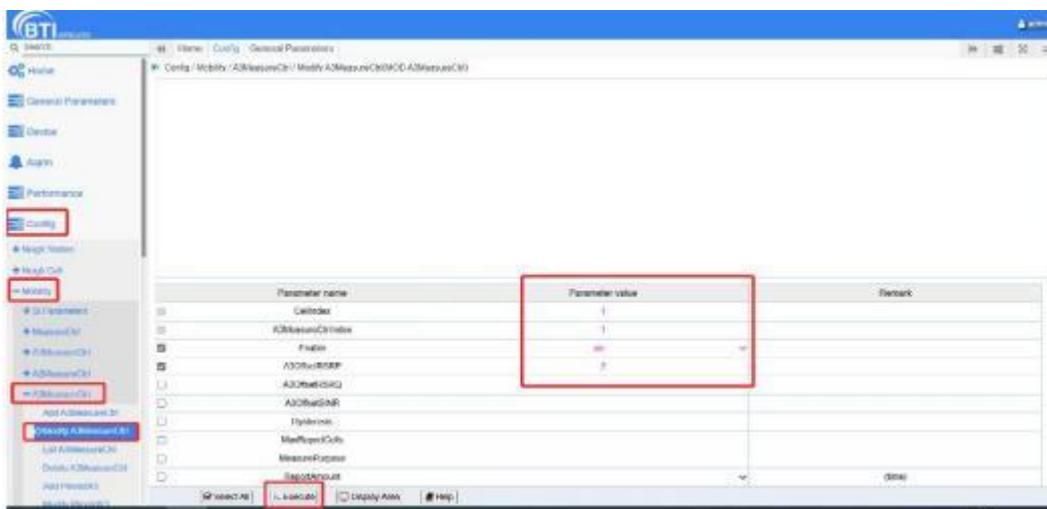
Path: Config/Modify/A3MeasureCtrl/Mobility A3MeasureCtrl

c) Intra-Frequency Handover

Step 1: Change NR_SmeasureConfig to 0.



Step 2: Change A3OffsetRSRP value to x(x=2 on the following screenshot)



When the RSRP difference of the two cells is bigger than x , handover will happen.

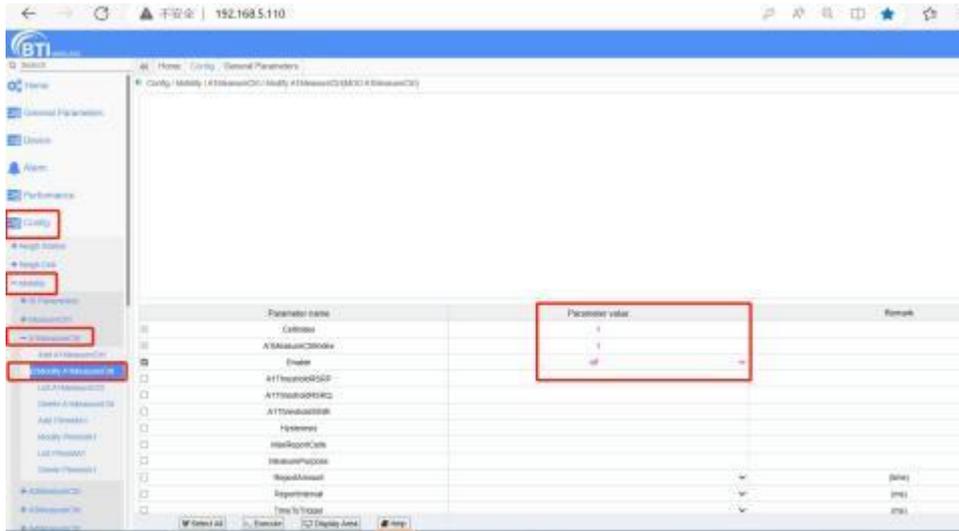
Note: this value can be adjusted.

d) Inter-Frequency Handover

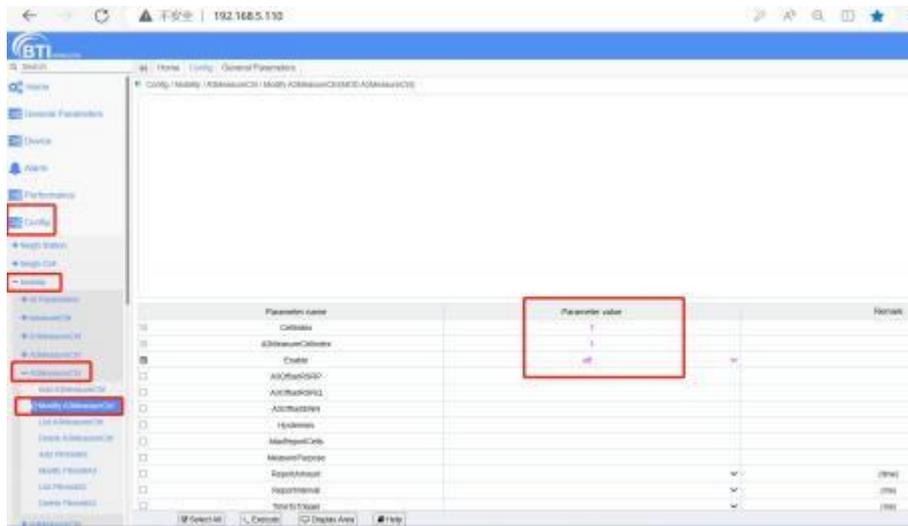
Step 1: Change NR_SmeasureConfig to 0.



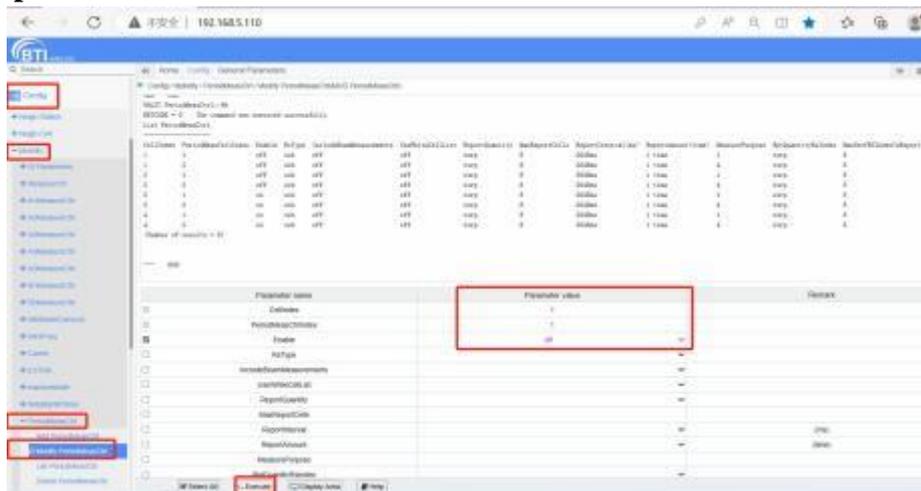
Step 2: Disable the A1MeasureCtrl



Step 3: Disable the A3MeasureCtrl



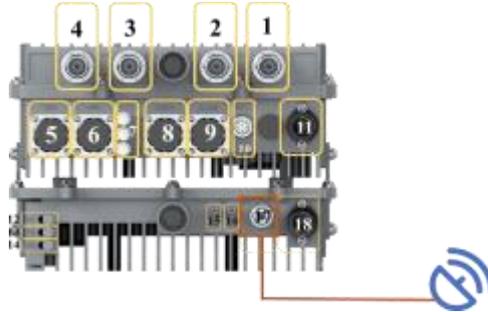
Step 4: Disable the PeriodMeasCtrl



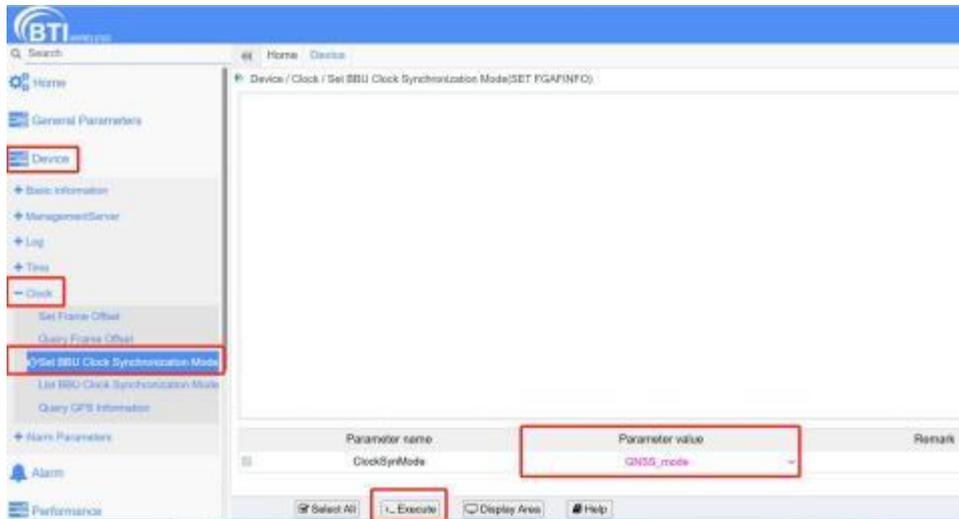
Step 5: Enable and configure the A2MeasureCtrl

3.4 Clock Sync

3.4.1 GPS Connection



Choose synchronization method



3.4.2 Check Synchronization status

Currently GPS synchronization status should be checked via ssh.

Step1. Login to the accelerator card

```
# ssh root@192.168.5.216 (Account: root; Password: root)
```

```
# ssh root@192.168.1.11 (password:sjnt1234)
```

Step2. Check GPS connection

If the printings show regval=00000033, which means GPS is locked.

```
# cd /data
```

```
# ./check_ad9545.sh
```

```
root@fgaf-zynqmp:~# cd /data
root@fgaf-zynqmp:/data# ./check_ad9545.sh
regval=00000033
root@fgaf-zynqmp:/data#
```

Step3. Check GPS performance

```
# ./gps_main 30 &
```

Last fifth list means how many stars are searched.

Last list 1 means GPS status is normal while 0 means GPS status is abnormal.

3.5 CBRS

Please skip this chapter if CBRS is not needed.

NOTE that When CBRS is enabled, please disable the CBRS function before modifying the configuration (Bandwidth) on BBU.

3.5.1 CBRS Preparation

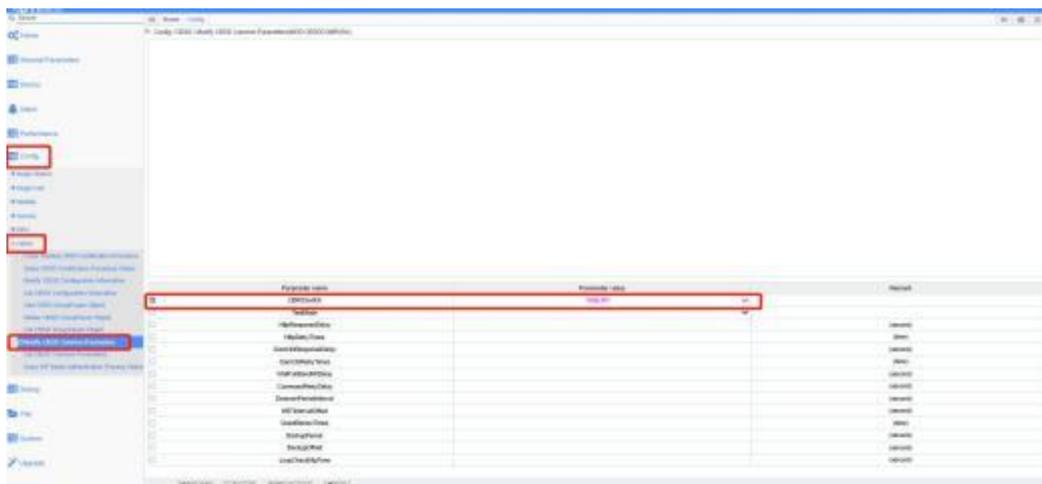
Please make sure the ping from BBU to Google SAS works.

If the ping fails, please check with *#route -n* to see if the route is added.

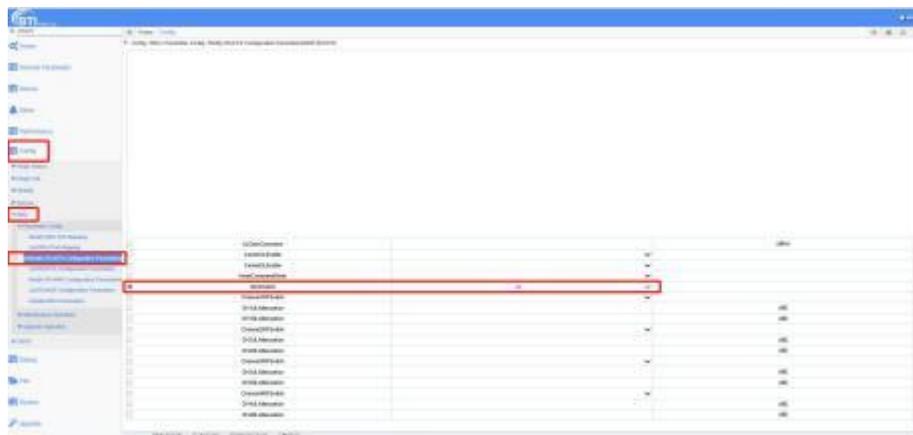
3.5.2 CBRS Switch

CBRS function will only be activated when the BBU CBRS switch is True and RRU CBRS Switch is Open.

Path: Config/CBSD/Modify CBSD Parameters



Path: Config/RRU/Parameter Config/Modify RU4370 Configuration Parameters



Note: The protocol state will operate normally after

- a. Complete the general and CBRS related parameters
- b. Complete the negotiation with the SAS server

3.5.3 CBRS Certificate Management

Path: File/Upload and download certificate

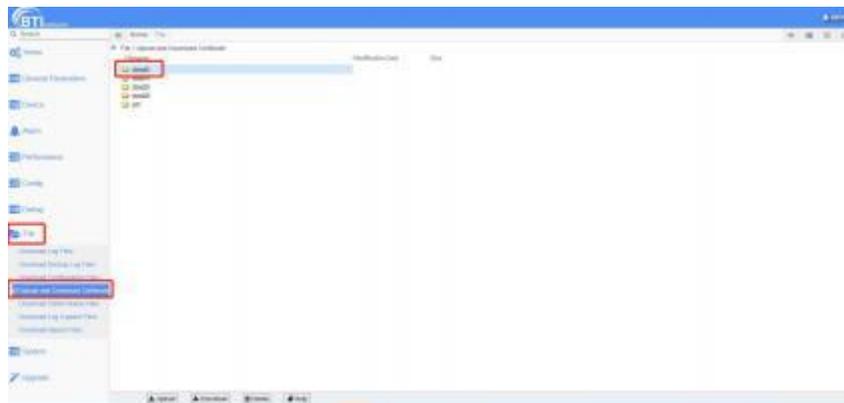
Note: The files should be provided by SAS. And before upload the 4files, take the first cell as an example, please make sure:

CA file is named as *cbSD0_cacert.pem*,

cert file is named as *cbSD0_clientcert.pem*,

key file is named as *cbSD0_clientkey.key*,

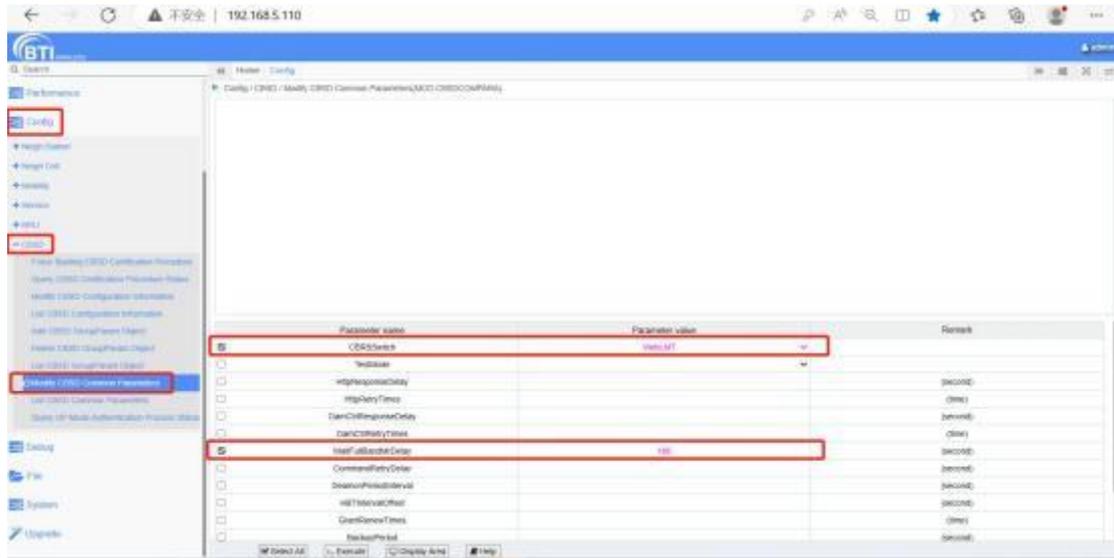
cpk key is named as *cbSD0_cpikey.key*,



CBSD	Cell
CBSD0	1
CBSD1	2
CBSD2	3
CBSD3	4

3.5.4 CBSD Common Configuration

Path: Home/Device/CBSD Management/CBSD Common



- ④ Set CBRS Switch to **WebLMT**
- ④ Set Wait Full Band Measurement Report Delay(second) to **180**

- ⊕ Set CBRS Enable to *on*
- ⊕ Configure Serial Number to the *same as RRU's*
- ⊕ **Choose the CBSD port number**
- ⊕ Input the SAS URL (google test sas: *https://test.sas.goog*)
- ⊕ Input the User ID *that registered on SAS*
- ⊕ Configure the FCC ID to **WBKRU-4370**
- ⊕ Set CBSD Category

CBDS Type	Maximum EIRP (dBm/10 MHz)	Maximum EIRP (dBm/MHz)	Antenna Height (Meter)
Category A	30 dBm or 1 watt	20 dBm	< 6 meters
Category B	47 dBm or 50 Watt	37 dBm	> 6 meters

- ⊕ Set PreferredFrequencyPoint
- ⊕ Set PreferredRfPower
- ⊕ Set CBSDInfo Enable as **True**
- ⊕ Configure CBSD Vendor as **BTI**
- ⊕ Set AirInterface Enable to *on*
- ⊕ Set Radio Technology to **NR**
- ⊕ Set CPI Enable to **On** when there is no pre-configuration on SAS portal was done. Otherwise set the button to **Of**.
- ⊕ Set CPI ID
- ⊕ Set CPI Name
- ⊕ Set Install Certification Time to the format as **xxxx-xx-xxTxx:xx:xxZ**
- ⊕ Set InstallationParam Enable to **True** when there is no pre-configuration on SAS portal was done. If installation related parameters are configured on both sides, the parameters will go with SAS portal even the switch is set as **True**.
- ⊕ Configure the installation parameters **according to the on-site info**.
- ⊕ Set CBSD Measurement Capability Report Type to **Disable**.

3.5.6 EIRP Calculation

RRU Port Outpower			BBU Register on SAS		
Bandwidth	RRU Outpower (dBm)	Port Outpower (dBm/10M)	Antenna Gain (dB)	Feeder Loss (dB)	EIRP(dBm/10M)
100M	37dBm	33	x	y	33+x-y
80M		34			34+x-y
60M		35			35+x-y
40M		37			37+x-y
20M		40			40+x-y
10M		43			43+x-y

EIRP= Port Outpower + Antenna Gain – Feeder Loss

Port Outpower - fixed, based on the Bandwidth

Antenna - configurable, based on the filed value

Feeder Loss - configurable, based on the filed value

eg: 40M Bandwidth, Antenna Gain 15dBi, Feeder Loss 3dB

Based on the format

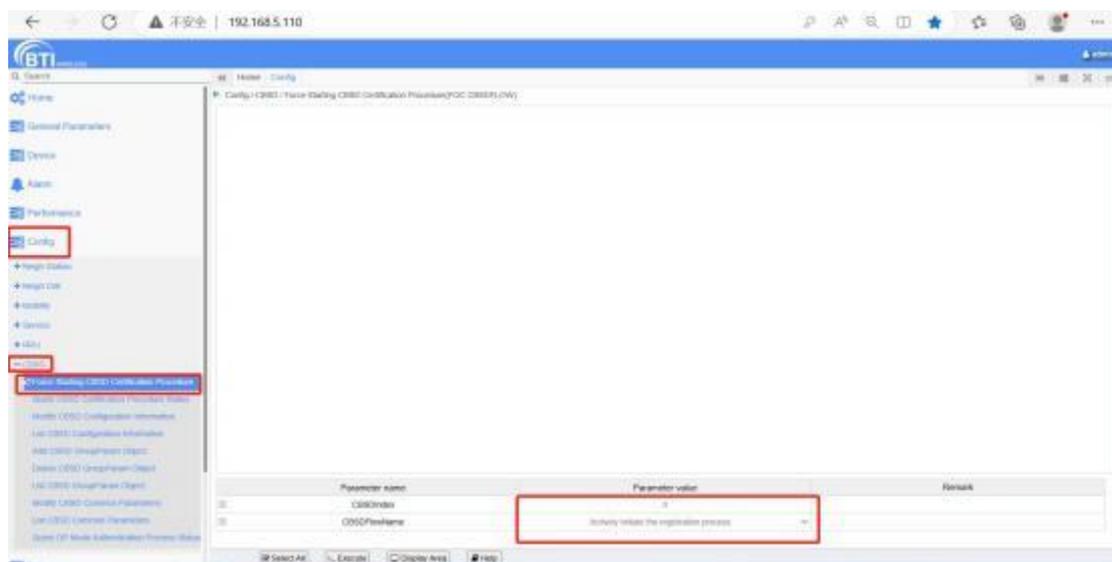
EIRP= Port Outpower + Antenna Gain – Feeder Loss

EIRP = 31(dBm/10M) +15(dBi) -3(dB) = 43 (dBm/10M)

Note - the maximum EIRP registered on official SAS of RU4370 is 47dBm/10M.

3.5.7 Trigger CBSD Registration Process

Path: Config/CBSD/Force Starting CBSD Certification Procedure



Step1. Choose the CBSD Index

Step2. Select registration of CBSD Certification Procedures Name

Step3. Execute

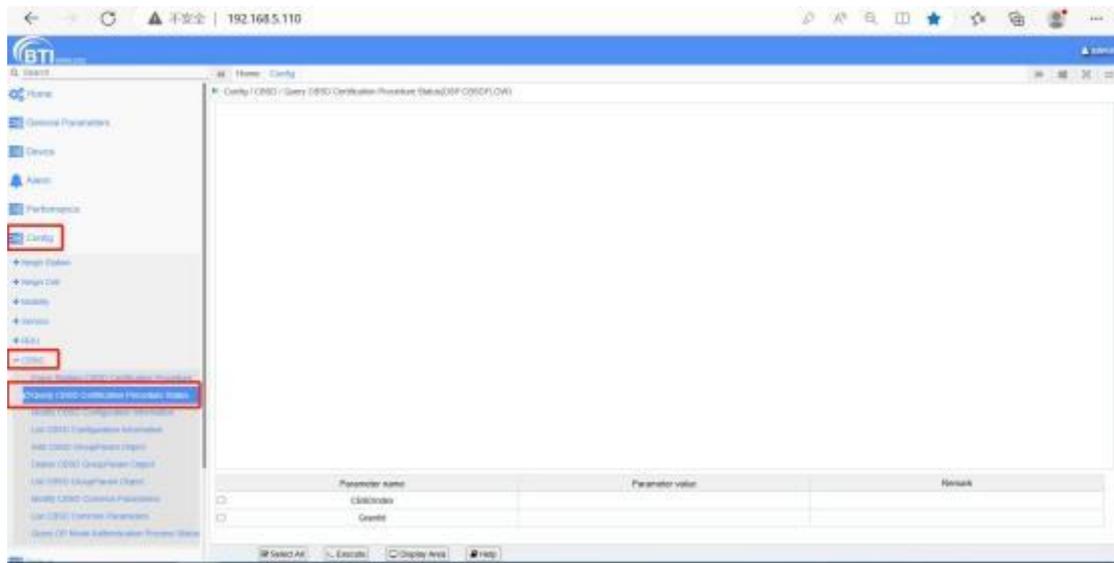
Note:

-  Before processing each test case, execute Force resetting the internal state
-  CBRS status can be viewed on the BBU cbrsProcess.log.

Path of CBRLog: /opt/bbu/oam/cbrs/
#tail -f/opt/bbu/oam/cbrs/cbrsProcess.log

3.5.8 Check CBSD Registration Status

Path: Home/Device/CBSD Management/Query CBSD Flow



Step1. Choose the CBSD Index

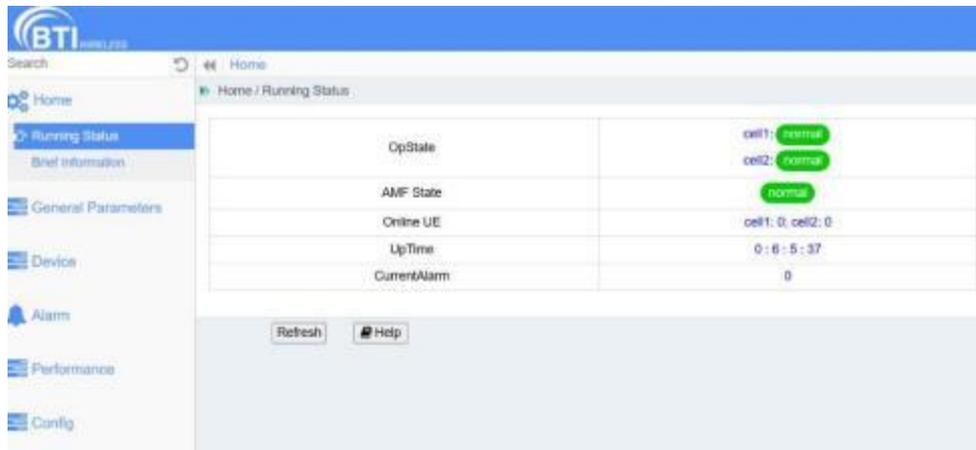
Step2. Check GrantDetails

State	Meaning
0	Idle
1	Granted
2	Authorized

3.6 System Information

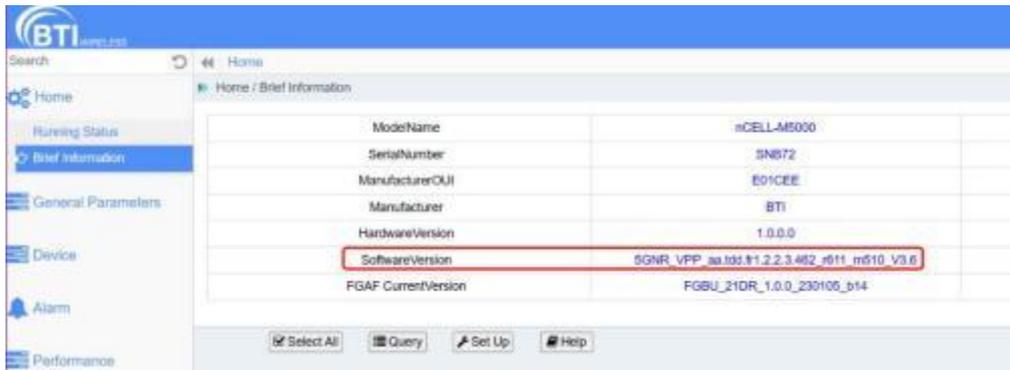
3.6.1 Operation Status and version

Path: Home / Running Status



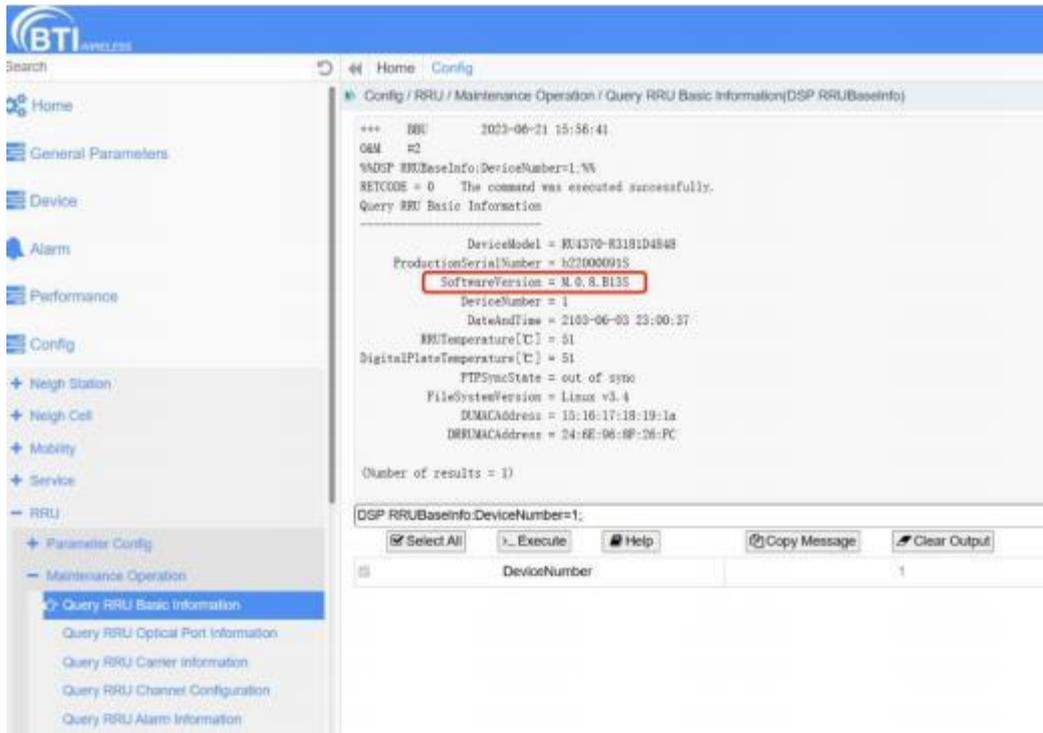
3.6.2 BBU Version

Path: Home/BriefInformation



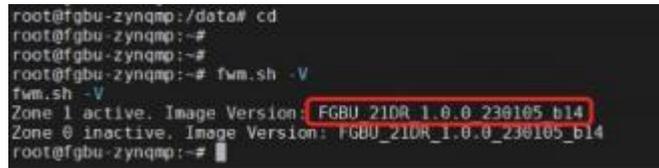
3.6.3 RRU Version

Path: Config/RRU/Maintenance Operation/Query RRU Basic Information



3.6.4 Accelerator Card Version

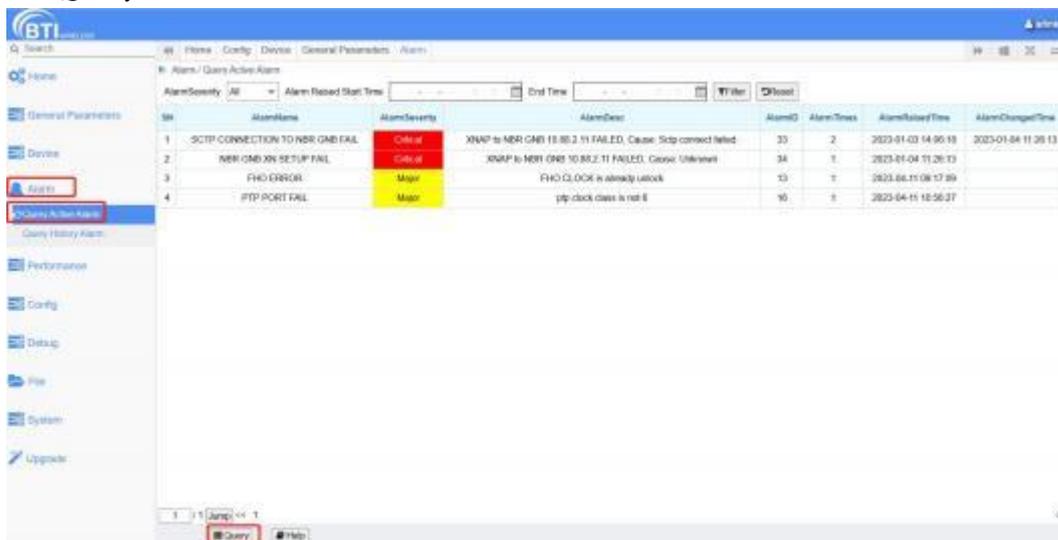
<ssh@192.168.2.24>



3.6.5 Alarm

Path: Alarm

Click *Query Active Alarm*, it will show the current alarms.



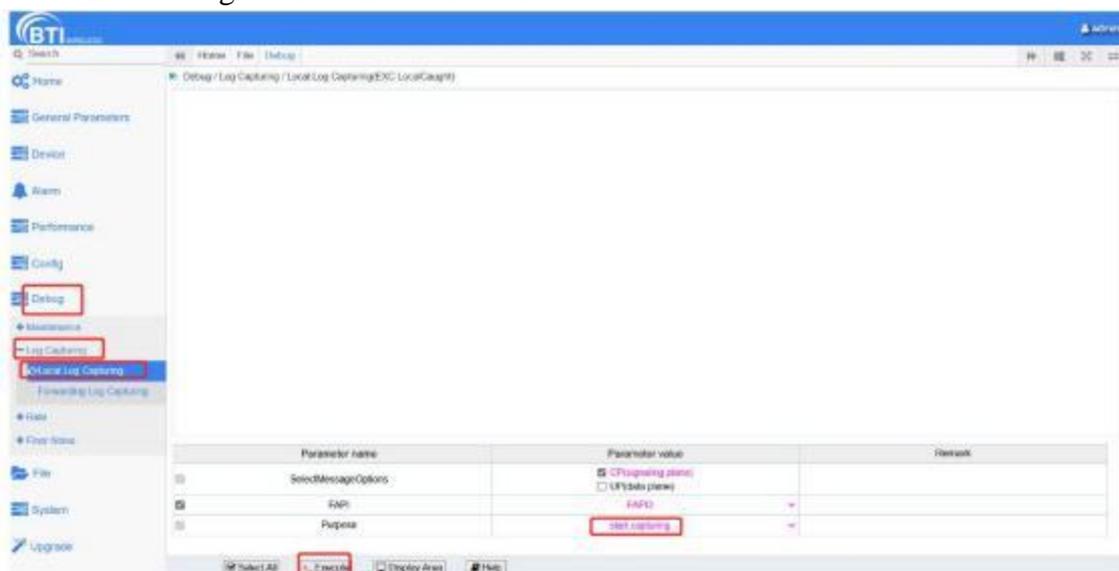
Click *Query History Alarm*, it will show the current alarms.

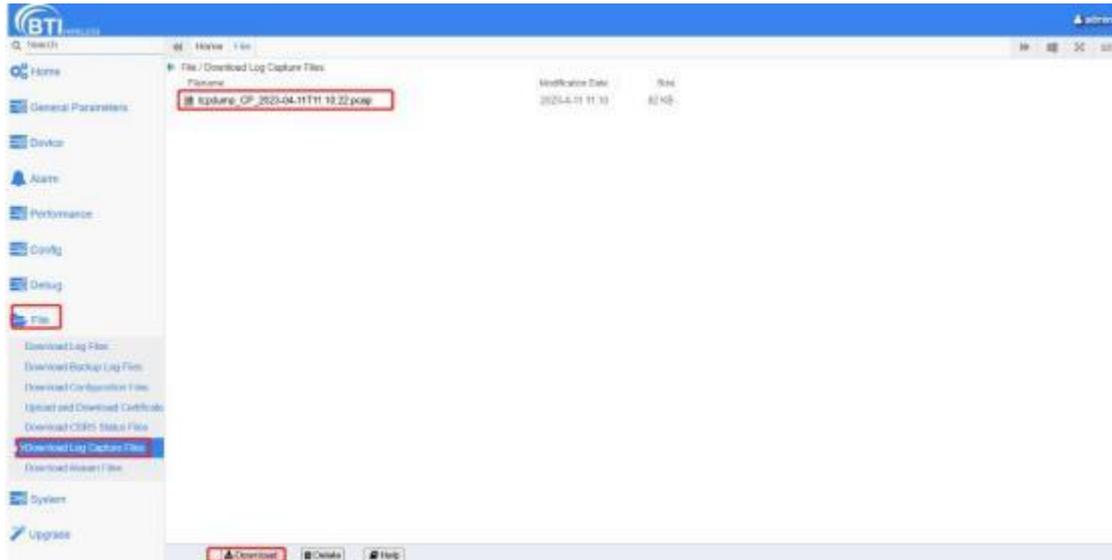
SN	AlarmName	AlarmSeverity	AlarmDesc	AlarmID	AlarmTime	AlarmRaisedTime	AlarmChangedTime	AlarmClearedTime
1	SCTP CONNECTION TO DU FAIL	Critical	SCTP to DU 100 0.2.12 is down	25	-	2023-04-11 08:17:18		2023-04-11 08:17:20
2	SCTP CONNECTION TO DU FAIL	Critical	SCTP to DU 102 0.2.11 is down	25	-	2023-04-11 08:17:17		2023-04-11 08:17:18
3	SCTP CONNECTION TO DU FAIL	Critical	SCTP to DU 102 0.2.12 is down	25	-	2023-04-11 08:17:17		2023-04-11 08:17:18
4	SCTP CONNECTION TO DU FAIL	Critical	SCTP to DU 102 0.2.13 is down	25	-	2023-04-11 08:17:17		2023-04-11 08:17:20
5	FHD ERROR	Major	FHD CLOCK is already unlocked	13	-	2023-04-10 15:14:25		2023-04-10 15:14:14
6	FHD ERROR	Major	FHD CLOCK is already unlocked	13	-	2023-04-10 15:16:54		2023-04-10 15:11:38
7	FHD ERROR	Major	FHD CLOCK is already unlocked	13	-	2023-04-10 16:31:57		2023-04-11 08:16:52
8	FHD ERROR	Major	9640_13M_CHECK	13	-	2023-04-11 10:44:05		2023-04-11 10:40:05
9	FTP PORT FAIL	Major	ftp clock class is not 0	30	-	2023-04-10 17:58:40		2023-04-10 15:02:32
10	FTP PORT FAIL	Major	ftp clock class is not 0	30	-	2023-04-10 18:02:37		2023-04-10 15:11:43
11	FTP PORT FAIL	Major	ftp clock class is not 0	30	-	2023-04-10 18:11:48		2023-04-10 15:14:23
12	FTP PORT FAIL	Major	ftp clock class is not 0	30	-	2023-04-10 18:14:26		2023-04-10 15:20:59
13	FTP PORT FAIL	Major	ftp clock class is not 0	30	-	2023-04-10 18:21:24		2023-04-10 15:24:56
14	FTP PORT FAIL	Major	ftp clock class is not 0	30	-	2023-04-10 18:25:01		2023-04-10 15:28:14
15	FTP PORT FAIL	Major	ftp clock class is not 0	30	-	2023-04-10 18:30:10		2023-04-10 15:40:30
16	FTP PORT FAIL	Major	ftp clock class is not 0	30	-	2023-04-10 18:40:41		2023-04-10 15:45:51
17	FTP PORT FAIL	Major	ftp clock class is not 0	30	-	2023-04-10 18:46:07		2023-04-10 15:50:12
18	FTP PORT FAIL	Major	ftp clock class is not 0	30	-	2023-04-10 18:56:18		2023-04-10 15:55:49
19	FTP PORT FAIL	Major	ftp clock class is not 0	30	-	2023-04-10 19:31:31		2023-04-10 15:55:22

3.6.6 Log Capture Process

Log Type	Description
Signaling log	Signaling log is control plane data. It is used to capture sctp, ngap, F1AP etc. The captured file size is quite small.
FAPi log	PHY and MAC interaction messages. It can be used to view MAC dispatching information. The captured file size may be quite large.
N3 log	Data plane, it is also called user plane. It captures FAPi messaging with additional details. The captured file size is the biggest.
Gatherlog	System configuration/status log

Local Caught - Download on GUI

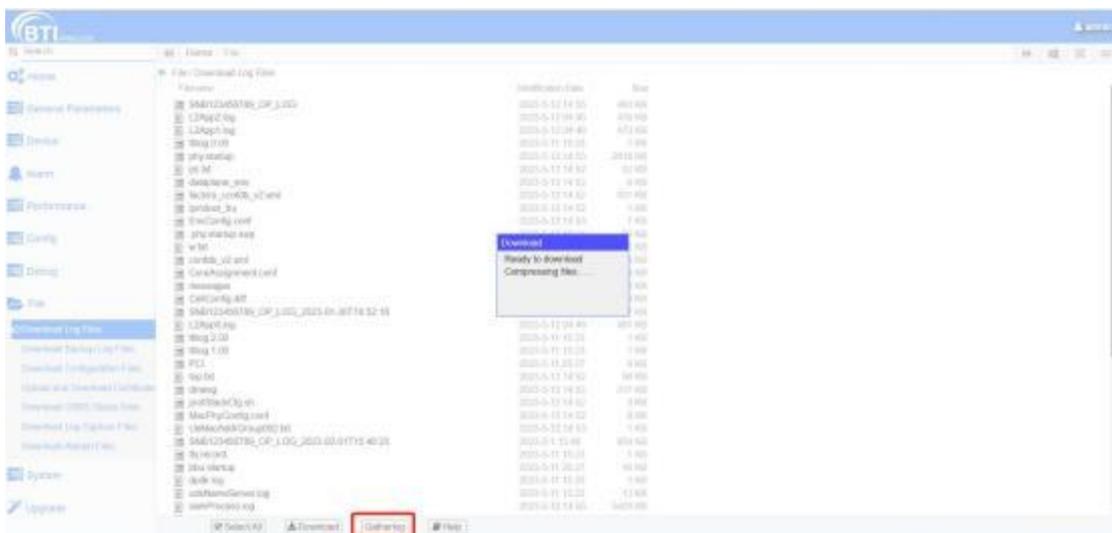




Forward Caught - Using tcpdump or wireshark



Gatherlog
path File/Download Log Files



Click gatherlog, the log will be compressed and downloaded automatically.

3.6.7 Fast saving configuration file

Confdb_v2_xml can be found in the gatherlog.

3.6.8 Fast uploading configuration file

Note: *The confdb_v2_xml can only be applied on the same BBU software version.*

- a). Run `#sp.sh -k` to stop the protocol stake.
- b). Upload the confdb_v2.xml to the path `/opt/bbu/oam/cm/`

```

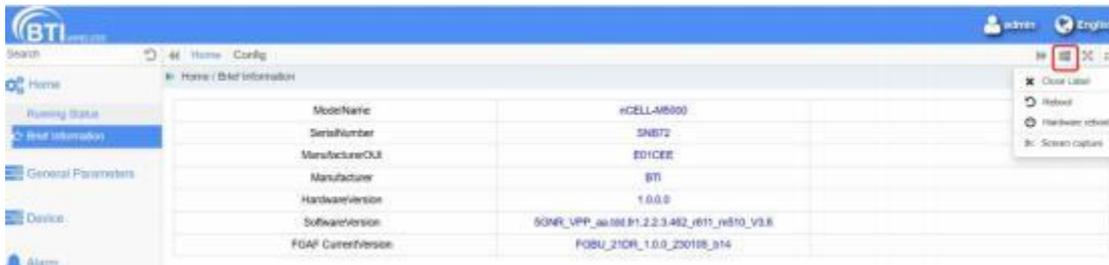
root@localdomain ~# cd /opt/bbu/oam/cm/
company.conf      CoreAssignment.conf  EnvConfig.conf      MacPhyConfig.conf   phyStart.sh
confdb_v2.xml     dataplane_env        logo.png            OTA.conf            protstackcfg.sh
confdb_v2.xml.back devinfo.cfg          MacAddrGroup.conf   pci_research_result.txt  wireshark_command.txt
root@localdomain ~# cd /opt/bbu/oam/cm/
    
```

- c). `chmod 777 confdb_v2.xml`
- d). Run `#restart.tcl`

3.6.9 Reboot the Device

Reboot = software restart

Hardware reboot = hardware & software restart



4. Common Commands

Check physical layer status:

`#tail -f/opt/bbu/oam/log/phy.startup`

```

root@localhost:~# tail -f /opt/bbu/oam/log/phy.startup
2021/12/07 CST 10:57:39.625054 DL Tx = 1003522
2021/12/07 CST 10:57:41.840321 DL Tx = 1013762
2021/12/07 CST 10:57:49.863989 DL Tx = 1024002
2021/12/07 CST 10:57:52.080179 DL Tx = 1034242
2021/12/07 CST 10:58:00.103995 DL Tx = 1044482
2021/12/07 CST 10:58:02.320187 DL Tx = 1054722
2021/12/07 CST 10:58:10.343766 DL Tx = 1064962
2021/12/07 CST 10:58:12.560158 DL Tx = 1075202
2021/12/07 CST 10:58:20.583912 DL Tx = 1085442
2021/12/07 CST 10:58:22.800310 DL Tx = 1095682
2021/12/07 CST 10:58:30.824266 DL Tx = 1105922
2021/12/07 CST 10:58:33.040087 DL Tx = 1116162
    
```

Check protocol stack status:

```
#tail -f /opt/bbu/oam/log/bbu.startup
```

```

7 MobaXterm 20.3 ?
(SSSH client, X-server and networking tools)

> SSH session to root@192.168.8.103
? SSH compression : ✓
? SSH-browser      : ✓
? X11-forwarding  : ✗ (disabled or not supported by server)
? DISPLAY         : 192.168.11.65:0.0

> For more info, ctrl+click on help or visit our website

Last login: Fri Sep 17 22:32:24 2021 from 192.168.8.111
[root@localhost ~]# tail -f /opt/bbu/oam/log/bbu.startup
2021/09/17 CST 22:07:31.238458 ipc_ready_check:246:mac_cell_id=0;
2021/09/17 CST 22:07:31.254243 ipc_ready_check:262:mac_cell_id=0;success;ret=8;
2021/09/17 CST 22:07:31.260661 MAC-PHY IPC initialization DONE!
2021/09/17 CST 22:07:31.307837 Wait for MAC-PHY synchronization.....
2021/09/17 CST 22:07:31.314788 Set MPI thread affinity for cell 0 with cpu[13] tid:21832
2021/09/17 CST 22:07:31.321382 processRlcThread: Set RLC thread affinity for cell 0 with cpu[12] tid:21834
2021/09/17 CST 22:07:31.364977 processRlcLogThread: Set RLC LOG thread affinity for cell 0 with cpu[12]
2021/09/17 CST 22:07:39.380656 sendPhyStartReq:498:fapiCellId=0;
2021/09/17 CST 22:08:03.936739 MAC-PHY synchronization DONE!
2021/09/17 CST 22:08:04.141293 Unknown: FRU header version 0XFF
    
```

Compare modified parameters:

```
/opt/bbu/bts/scripts/compare_FAPService.py
```

```

root@localhost:~# /opt/bbu/bts/scripts/compare_FAPService.py
Default file path: /opt/bbu/etc/confdb_v2.xml
New xml file path: /opt/bbu/oam/cn/confdb_v2.xml
Output file path: /opt/bbu/oam/log/cellConfig.diff
Comparing, please wait...
-----
code name | new xml value | default value
-----
CellConfig.1.NR.Capabilities.DeInactiveTimer | 30 | 30
CellConfig.1.NR.MSC.FiveQINumberOfEntries | 20 | 20
CellConfig.1.NR.RAN.CellEnable.RFEnable | true | true
CellConfig.1.NR.RAN.Mobility.ConnMode.IRAT.B1MeasureCtrl.1.PlmnId.1.PLMN | 46602f | 46602f
CellConfig.1.NR.RAN.Mobility.ConnMode.IRAT.B2MeasureCtrl.1.PlmnId.1.PLMN | 46602f | 46602f
CellConfig.1.NR.RAN.Mobility.ConnMode.NR.A1MeasureCtrl.1.Enable | 1 | 1
CellConfig.1.NR.RAN.Mobility.ConnMode.NR.A1MeasureCtrl.1.PlmnId.1.PLMN | 46602f | 46602f
CellConfig.1.NR.RAN.Mobility.ConnMode.NR.A1MeasureCtrl.2.PlmnId.1.PLMN | 46602f | 46602f
CellConfig.1.NR.RAN.Mobility.ConnMode.NR.A2MeasureCtrl.1.A2ThresholdSRP | 62 | 62
CellConfig.1.NR.RAN.Mobility.ConnMode.NR.A2MeasureCtrl.1.Enable | 1 | 1
CellConfig.1.NR.RAN.Mobility.ConnMode.NR.A2MeasureCtrl.1.PlmnId.1.PLMN | 46602f | 46602f
CellConfig.1.NR.RAN.Mobility.ConnMode.NR.A2MeasureCtrl.2.Enable | 1 | 1
    
```

View UEs connected to BBU:

```
odi -n duapp0 display-ue-info
```

```

root@localhost:~# odi -n duapp0 display-ue-info
odi: dest processor is: 192.0.2.1
odi: tx 31 bytes to port 47714 on 192.0.2.1
JE Crnti: 349 Profile State: Supervised
odi: rx 55 bytes (1 msg) from port 47714 on 192.0.2.1
odi: command time measured: 0.000761160 sec
odi: ok ( odi -n duapp0 display-ue-info )
root@localhost:~#
    
```

Stop Protocol stack and physical layer script:

```
sp.sh -k
```

```

[root@localhost ~]# sp.sh -k
sp.sh: SCRIPT_CUR_DIR=/opt/loads/SGNR_2.1.0.ax_227/rootfs/bts/scripts
Killing All processes
[root@localhost ~]#
    
```

Process background startup protocol stack and physical layer script

restart.tcl

Check MAC Layer Throughput

#Enable MAC layer DL:

odi -n duapp0 set-pdsch-fixed-rbs 273

odi -n duapp0 set-pdsch-padding-traffic 1

#Disable MAC layer DL:

odi -n duapp0 set-pdsch-padding-traffic 0

#Enable MAC layer UL:

odi -n duapp0 enable-auto-ul-sched 0

odi -n duapp0 set-presched 1 -1 100000 1

#Disable MAC layer UL:

odi -n duapp0 set-presched 0

#Watch throughput:

watch odi -n duapp0 show-mac-throughput-count 20

Inst	DL	UL	spout	[Mbps]	[MAC/RLC]	[Mbps]	[Slice0-3]	[Times]	Ratio	AvgMcs	AvgLayers	UdpTdu/AllTdu	UL	spout	[Mbps]	[MAC/RLC]	[Mbps]	[Slice0-3]	[Times]	AvgMcs	AvgLayers
20:	999	2526	0	0.0000	1380271	1385	0/0/0/1401	99	4864%	28.0000	4.0000	0/0	107	4740	0	0.0032	158364	0/0/0/501	25	1781	1.0000
19:	998	3672	0	0.0000	1380265	1546	0/0/0/1401	99	4937%	28.0000	4.0000	0/0	107	3618	0	0.0011	158190	0/0/0/500	25	1450	1.0000
18:	999	2526	0	0.0000	1380273	1638	0/0/0/1401	99	4958%	28.0000	4.0000	0/0	105	8470	0	0.0032	1580881	0/0/0/500	25	2040	1.0000
17:	999	2526	0	0.0000	1380273	1747	0/0/0/1401	99	4958%	28.0000	4.0000	0/0	106	3580	0	0.0018	1583364	0/0/0/501	25	8483	1.0000
16:	999	2526	0	0.0000	1380268	1385	0/0/0/1400	99	4244%	28.0000	4.0000	0/0	105	5895	0	0.0028	158064	0/0/0/500	25	1849	1.0000
15:	999	2526	0	0.0000	1380273	1273	0/0/0/1401	99	4958%	28.0000	4.0000	0/0	108	8149	0	0.0005	158364	0/0/0/501	25	1311	1.0000
14:	999	1765	0	0.0000	1380273	1365	0/0/0/1401	99	4958%	28.0000	4.0000	0/0	107	1421	0	0.0026	158088	0/0/0/500	25	2300	1.0000
13:	999	2526	0	0.0000	1380273	1273	0/0/0/1401	99	4958%	28.0000	4.0000	0/0	108	7694	0	0.0005	1580881	0/0/0/500	25	6933	1.0000
12:	999	2526	0	0.0000	1380269	1238	0/0/0/1400	99	4244%	28.0000	4.0000	0/0	105	4011	0	0.0031	158088	0/0/0/500	25	2283	1.0000
11:	999	2526	0	0.0000	1380269	1546	0/0/0/1400	99	4244%	28.0000	4.0000	0/0	107	7116	0	0.0019	158190	0/0/0/500	25	1483	1.0000
10:	999	2526	0	0.0000	1380273	1692	0/0/0/1401	99	4958%	28.0000	4.0000	0/0	106	3680	0	0.0021	158232	0/0/0/501	25	4068	1.0000
9:	999	1174	0	0.0000	1380273	1510	0/0/0/1401	99	4958%	28.0000	4.0000	0/0	106	8642	0	0.0010	158076	0/0/0/500	25	3663	1.0000
8:	999	2526	0	0.0000	1380273	1293	0/0/0/1401	99	4958%	28.0000	4.0000	0/0	109	3598	0	0.0032	158190	0/0/0/500	25	2067	1.0000
7:	999	2526	0	0.0000	1380273	819	0/0/0/1401	99	4958%	28.0000	4.0000	0/0	107	8922	0	0.0019	158232	0/0/0/500	25	2629	1.0000
6:	999	2526	0	0.0000	1380266	1510	0/0/0/1400	99	4244%	28.0000	4.0000	0/0	109	1752	0	0.0011	158190	0/0/0/500	25	3283	1.0000
5:	999	2526	0	0.0000	1380273	1273	0/0/0/1401	99	4958%	28.0000	4.0000	0/0	107	2189	0	0.0005	158364	0/0/0/501	25	4699	1.0000
4:	999	1170	0	0.0000	1380273	1510	0/0/0/1401	99	4958%	28.0000	4.0000	0/0	110	8997	0	0.0011	158190	0/0/0/500	25	2317	1.0000
3:	999	2526	0	0.0000	1380273	783	0/0/0/1401	99	4958%	28.0000	4.0000	0/0	108	3824	0	0.0018	158190	0/0/0/500	25	2884	1.0000
2:	999	2526	0	0.0000	1380269	1783	0/0/0/1400	99	4244%	28.0000	4.0000	0/0	106	3817	0	0.0018	158190	0/0/0/500	25	3117	1.0000
1:	999	2526	0	0.0000	1380268	1546	0/0/0/1400	99	4244%	28.0000	4.0000	0/0	108	9574	0	0.0011	158088	0/0/0/500	25	3883	1.0000

#vpp log capture

Enter vpp: *vppctl*

Start capture: *pcap tracefilename max 1000000 intfc any*

Stop capture: *pcap tracefilename of*

The captured log will be saved under /tmp, called *filename*

#TCP dump via SSH:

tcpdump -i any -s0 -w /tmp/filename.pcap

Appendix: Certification Compliance

CE Compliance:

This device complies with standard CE certification, Manufactured products comply with the requirements of harmonized European standards. More details please refer to the CE report.

FCC Compliance:

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.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to se harmful interference,, in which case the user will be required to correct the interference at his own expense.

WARNING: This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 80 inches (200 cm) between the radiator and your body. Changes or modification not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

