

Installation & Troubleshooting Document

(Compiled by: Nayyer Raza)

M4370 Hardware Installation:

Connect the following Hardware:

- 1- Fiber optic cable from the Firewall switch to OP3 of DU (BBU)
- 2- Fiber optic cable from OP2 of BBU to RU
- 3- GPS Antenna cable to connect to the GPS port on BBU
- 4- Power Cable from BBU to power outlet
- 5- Power Cable from the RU to power outlet
- 6- 4 Antennas from the Duplex RF Ports 1, 2, 3, 4 respectively.

M4370 Software & Configurations:

Perform the following steps:

Step 1:

Access the LMT using the IP Address: 192.168.5.216

Username: admin

Password: admin

Step 2:

Specify G-Node B name:

Example: SW-Dallas-Lab-GNB

The screenshot displays the BTI WIRELESS LMT web interface. The browser address bar shows the URL 192.168.5.216. The interface has a blue header with the BTI WIRELESS logo. A left sidebar contains a navigation menu with options: Home, General Parameters (selected), AMF, gNodeB Identification (with sub-options: Modify gNodeB Identification, List gNodeB Identification), Network, Cell Management, Cell TAC, Cell PLMN, Cell SLICE, and Cell QOS. The main content area shows the breadcrumb path: General Parameters / gNodeB Identification / List gNodeB Identification (LST GNBConfig). The command execution output is as follows:

```
LST GNBConfig;;
+++ BBU 2024-03-02 07:31:14
O&M #1
%%LST GNBConfig::%%
RETCODE = 0 The command was executed successfully.
List gNodeB Identification
-----
gNBName = New-SW-DallasLab
gNBId = 252
gNBIdLength = 22

(Number of results = 1)

--- END
```

At the bottom of the interface, there is a status bar with the text "LST GNBConfig;;" and three buttons: ">_ Execute", "Help", and "Copy Message". There is also a "Clear Output" button.

Step 3:

Assign Integrated G-Node B IP Address:

The screenshot shows the BTI WIRELESS web interface. The browser address bar displays '192.168.5.216'. The left sidebar contains a navigation menu with 'General Parameters' selected. Under 'General Parameters', the 'Network' section is expanded, and 'List Integrated gNodeB Service IP' is highlighted. The main content area shows the command execution results for 'LST N3IP;;'. The output includes the following information:

```
+++ BBU 2024-03-02 07:32:16
O&M #2
%%LST N3IP;;%%
RETCODE = 0 The command was executed successfully.
List Integrated gNodeB Service IP
-----
AddressingType = Static
IPAddress = 10.170.38.252
SubnetMask = 255.255.255.0
Gateway = 10.170.38.1
DNS = 8.8.8.8

(Number of results = 1)

--- END
```

At the bottom of the main content area, there is a text input field containing 'LST N3IP;;' and four buttons: '>_ Execute', 'Help', 'Copy Message', and 'Clear Output'.

Step 4:

Verify LMT (Maintenance IP Address for the M4370):

The screenshot shows the BTI WIRELESS web interface. The browser address bar displays '192.168.5.216'. The left sidebar contains a navigation menu with 'General Parameters' selected. Under 'General Parameters', the 'Network' section is expanded, and 'List Integrated gNodeB Maintenance IP' is highlighted. The main content area shows the command execution results for 'LST MTNIP;;'. The output includes the following information:

```
--- END

LST MTNIP;;
+++ BBU 2024-03-02 07:35:36
O&M #4
%%LST MTNIP;;%%
RETCODE = 0 The command was executed successfully.
List Integrated gNodeB Maintenance IP
-----
IPAddress = 192.168.5.216

(Number of results = 1)

--- END
```

At the bottom of the main content area, there is a text input field containing 'LST MTNIP;;' and four buttons: '>_ Execute', 'Help', 'Copy Message', and 'Clear Output'.

Step 5:

Add/Modify Cell Config Parameters (as per the client requirements):

The screenshot shows the BTI WIRELESS web interface. The browser address bar displays '192.168.5.216'. The left sidebar contains a menu with 'gNodeB Identification', 'Network', 'Cell Management', and 'Cell TAC'. Under 'Cell Management', 'Add CellConfig' is selected. The main content area shows the breadcrumb 'General Parameters / Cell Management / Add CellConfig(ADD CellConfig)' and a list of parameters for CellIndex = 1:

- CellIndex = 1
- CellIdWithinGnb = 1
- PhyCellID = 31
- NRARFCNUL = 638000
- NRARFCNDL = 638000
- FreqBandIndicator = n48:636667-646666
- ULayers = 0
- ULAntennas = 4
- DLayers = 0
- DIAntennas = 4
- PdschMcsTable = qam64
- PuschMcsTable = qam64
- ULBandwidth(M) = 40M
- DLBandwidth(M) = 40M
- AbsoluteFrequencySSB = 637344
- SSBPower = 6
- PSCHPowerOffset = db0

(Number of results = 1)

Step 6:

Add/Modify Cell Sub-Frame Assignments (as per the client requirements):

The screenshot shows the BTI WIRELESS web interface. The browser address bar displays '192.168.5.216'. The left sidebar contains a menu with 'gNodeB Identification', 'Network', 'Cell Management', and 'Cell TAC'. Under 'Cell Management', 'Modify Cell SubframeAssignment' is selected. The main content area shows the breadcrumb 'General Parameters / Cell Management / Modify Cell SubframeAssignment(MOD PHYTddULDL)' and a list of parameters for CellIndex = 1:

- 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

(Number of results = 1)

--- END

Step 7:

Adjust the Transmit Power Levels based on the requirements (between 24 dBm to 37 dBm):

The screenshot shows the BTI WIRELESS web interface. The browser address bar displays '192.168.5.216' with a 'Not secure' warning. The left sidebar contains a menu with categories: gNodeB Identification, Network, Cell Management, and Cell TAC. Under 'Cell Management', the 'Modify MaxTxPower' option is selected. The main content area shows the breadcrumb 'General Parameters / Cell Management / Modify MaxTxPower(MOD MaxTxPower)'. The terminal output displays the following text:

```
--- END
LST MaxTxPower;;
+++ BBU 2024-03-02 07:44:11
O&M #7
%%LST MaxTxPower::%%
RETCODE = 0 The command was executed successfully.
List MaxTxPower
-----
CellIndex = 1
MaxTxPower(dBm) = 37
(Number of results = 1)
--- END
```

Step 8:

Modify & Verify Cell TAC ID, and CID:

The screenshot shows the BTI WIRELESS web interface. The browser address bar displays '192.168.5.216' with a 'Not secure' warning. The left sidebar contains a menu with categories: Cell Management, Cell TAC, Cell PLMN, Cell SLICE, Cell QOS, RRU PTP Synchronization, Device, and Alarm. Under 'Cell TAC', the 'Add Cell TAC' option is selected. The main content area shows the breadcrumb 'General Parameters / Cell TAC / Add Cell TAC(ADD CNTA)'. The terminal output displays the following text:

```
O&M #8
%%LST CNTA::%%
RETCODE = 0 The command was executed successfully.
List Cell TAC
-----
CellIndex = 1
TACIndex = 1
TAC = 1
GnbId = NULL
GnbIdLength = NULL
Ranac = 1
NrcellIdentity = 4128769
CellReservedForOperatorUse = off
(Number of results = 1)
--- END
```


Step 9:

Add/Modify Cell PLMN ID as per the Client's Network needs after verifying MCC and MNC:

The screenshot shows the BTI WIRELESS web interface. The browser address bar displays '192.168.5.216' with a 'Not secure' warning. The left sidebar contains a menu with options: gNodeB Identification, Network, Cell Management, Cell TAC, Cell PLMN (selected), Cell SLICE, Cell QOS, and RRU PTP Synchronization. Under 'Cell PLMN', the sub-menu includes 'Add Cell PLMN', 'Modify Cell PLMN' (highlighted), 'List Cell PLMN', and 'Delete Cell PLMN'. The main content area shows the breadcrumb 'General Parameters / Cell PLMN / Modify Cell PLMN(MOD CNTAPLMN)'. The terminal output displays the command execution results:

```
--- END

LST CNTAPLMN;;
+++ BBU      2024-03-02 07:48:54
O&M  #9
%%LST CNTAPLMN:;%
RETCODE = 0   The command was executed successfully.
List Cell PLMN
-----
CellIndex  TACIndex  PLMNIndex  PLMNID
1          1         1          00101f
1          1         2          46692f
(Number of results = 2)

--- END
```

Step 10:

Add/Modify the Default 5QI Values:

The screenshot shows the BTI WIRELESS web interface. The browser address bar displays '192.168.5.216' with a 'Not secure' warning. The left sidebar contains a menu with options: Home, General Parameters (starred), AMF, gNodeB Identification, Network, Cell Management, Cell TAC, Cell PLMN, Cell SLICE, Cell QOS, and Add Default5QI. Under 'Cell QOS', the sub-menu includes 'Add Default5QI' and 'Modify Default5QI' (highlighted). The main content area shows the breadcrumb 'General Parameters / Cell QOS / Modify Default5QI(MOD QoSPLMN)'. The terminal output displays the command execution results:

```
--- END

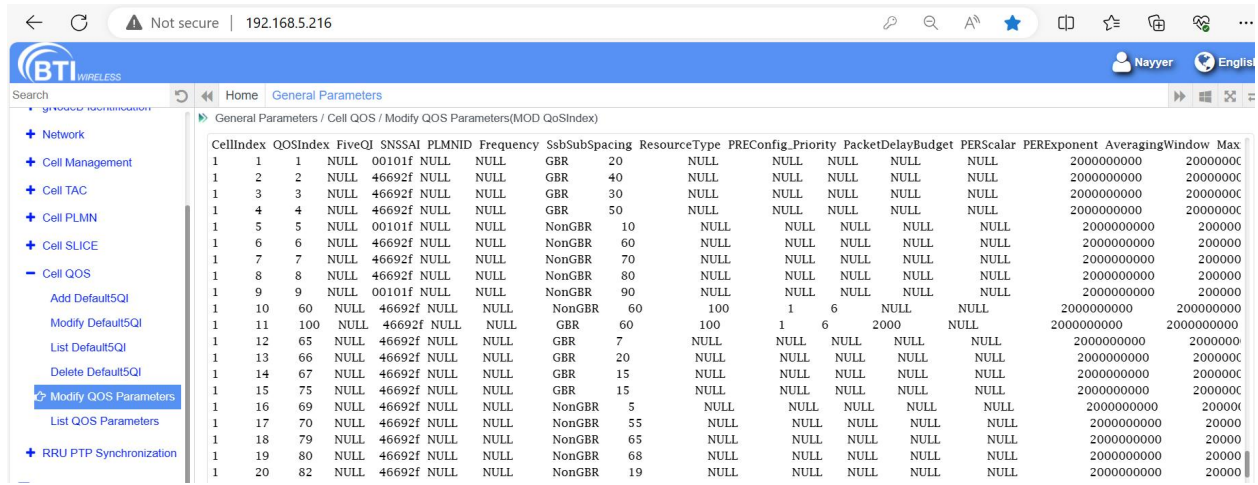
LST QoSPLMN;;
+++ BBU      2024-03-02 07:51:10
O&M  #10
%%LST QoSPLMN:;%
RETCODE = 0   The command was executed successfully.
List Default5QI
-----
CellIndex = 1
PLMNIndex = 1
  PLMNID = 00101f
Default5QI = 9

(Number of results = 1)

--- END
```

Step 11:

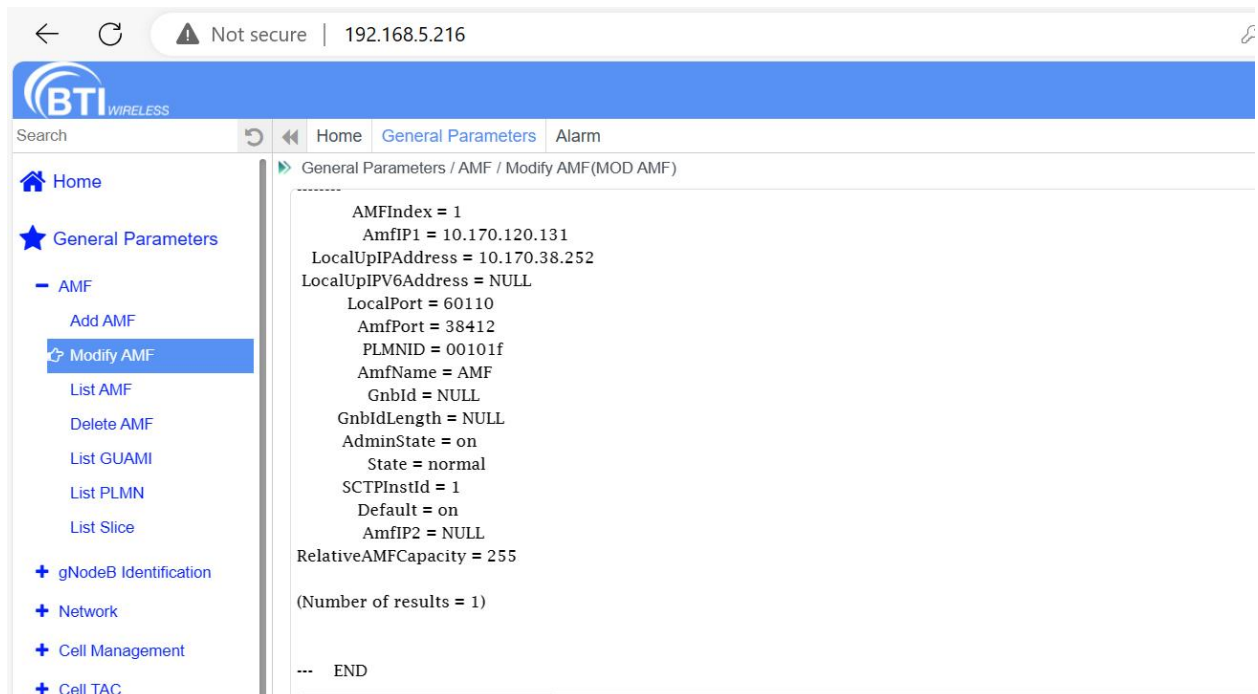
Modify the QOS Parameters for Cell Index 1:



CellIndex	QoSIndex	FiveQI	SNSSAI	PLMNID	Frequency	SsbSubSpacing	ResourceType	PREConfig_Priority	PacketDelayBudget	PERScalar	PERExponent	AveragingWindow	Max
1	1	1	NULL	00101f	NULL	NULL	GBR	20	NULL	NULL	NULL	2000000000	2000000C
1	2	2	NULL	46692f	NULL	NULL	GBR	40	NULL	NULL	NULL	2000000000	2000000C
1	3	3	NULL	46692f	NULL	NULL	GBR	30	NULL	NULL	NULL	2000000000	2000000C
1	4	4	NULL	46692f	NULL	NULL	GBR	50	NULL	NULL	NULL	2000000000	2000000C
1	5	5	NULL	00101f	NULL	NULL	NonGBR	10	NULL	NULL	NULL	2000000000	200000
1	6	6	NULL	46692f	NULL	NULL	NonGBR	60	NULL	NULL	NULL	2000000000	200000
1	7	7	NULL	46692f	NULL	NULL	NonGBR	70	NULL	NULL	NULL	2000000000	200000
1	8	8	NULL	46692f	NULL	NULL	NonGBR	80	NULL	NULL	NULL	2000000000	200000
1	9	9	NULL	00101f	NULL	NULL	NonGBR	90	NULL	NULL	NULL	2000000000	200000
1	10	60	NULL	46692f	NULL	NULL	NonGBR	60	100	1	6	2000000000	2000000000
1	11	100	NULL	46692f	NULL	NULL	GBR	60	100	1	6	2000000000	2000000000
1	12	65	NULL	46692f	NULL	NULL	GBR	7	NULL	NULL	NULL	2000000000	2000000C
1	13	66	NULL	46692f	NULL	NULL	GBR	20	NULL	NULL	NULL	2000000000	2000000C
1	14	67	NULL	46692f	NULL	NULL	GBR	15	NULL	NULL	NULL	2000000000	2000000C
1	15	75	NULL	46692f	NULL	NULL	GBR	15	NULL	NULL	NULL	2000000000	2000000C
1	16	69	NULL	46692f	NULL	NULL	NonGBR	5	NULL	NULL	NULL	2000000000	200000
1	17	70	NULL	46692f	NULL	NULL	NonGBR	55	NULL	NULL	NULL	2000000000	20000
1	18	79	NULL	46692f	NULL	NULL	NonGBR	65	NULL	NULL	NULL	2000000000	20000
1	19	80	NULL	46692f	NULL	NULL	NonGBR	68	NULL	NULL	NULL	2000000000	20000
1	20	82	NULL	46692f	NULL	NULL	NonGBR	19	NULL	NULL	NULL	2000000000	20000

Step 12:

Add/Modify 5GC Configurations (AMF IP) while making sure the GNB IP and PLMN ID are also corresponding to the respective values:



Parameter	Value
AMFIndex	= 1
AmfIP1	= 10.170.120.131
LocalUpIPAddress	= 10.170.38.252
LocalUpIPv6Address	= NULL
LocalPort	= 60110
AmfPort	= 38412
PLMNID	= 00101f
AmfName	= AMF
GnbId	= NULL
GnbIdLength	= NULL
AdminState	= on
State	= normal
SCTPInstId	= 1
Default	= on
AmfIP2	= NULL
RelativeAMFCapacity	= 255

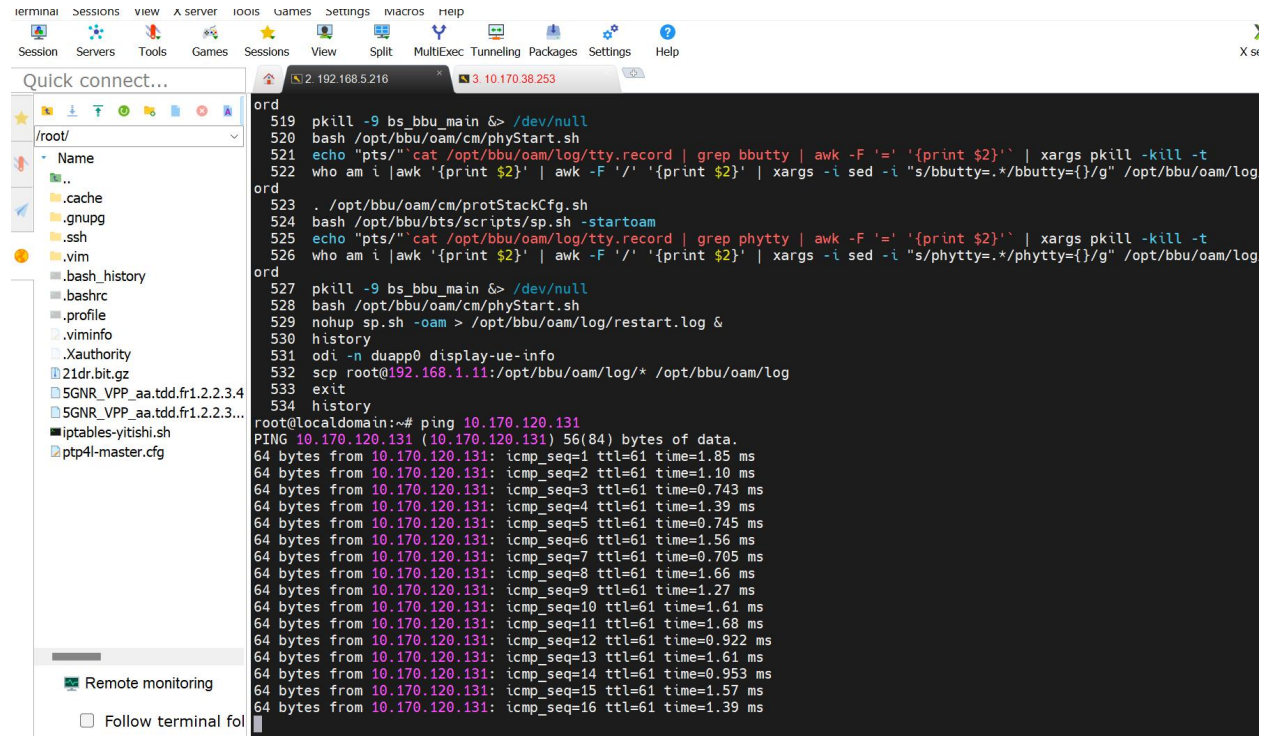
(Number of results = 1)

--- END

Connectivity:

Step1:

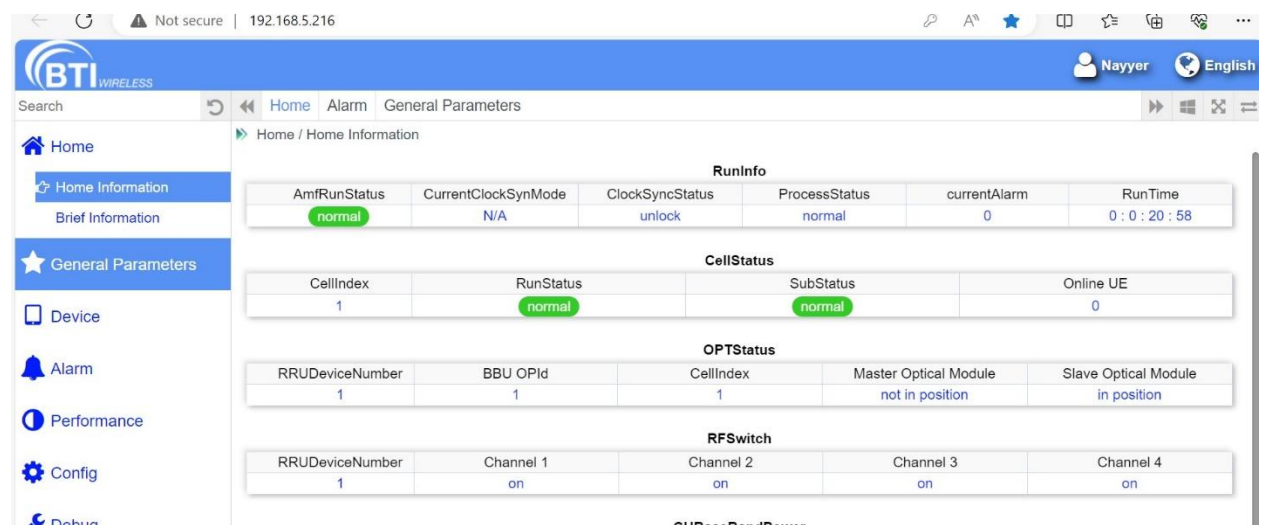
Verify Connectivity from the GNB to the AMF using MobaXTerm & SSh Tools:



The screenshot shows a MobaXTerm terminal window with a file explorer on the left. The terminal is connected to a remote host at 192.168.5.216. The user runs a series of commands to stop and restart services, then performs a ping test to 10.170.120.131. The ping output shows 16 successful packets with varying times.

```
ord
519 pkill -9 bs_bbu_main &> /dev/null
520 bash /opt/bbu/oam/cm/phyStart.sh
521 echo "pts/"`cat /opt/bbu/oam/log/tty.record | grep bbutty | awk -F '=' '{print $2}'` | xargs pkill -kill -t
522 who am i | awk '{print $2}' | awk -F '/' '{print $2}' | xargs -i sed -i "s/bbutty=.*/bbutty={}/g" /opt/bbu/oam/log
ord
523 . /opt/bbu/oam/cm/protStackCfg.sh
524 bash /opt/bbu/bts/scripts/sp.sh -startoam
525 echo "pts/"`cat /opt/bbu/oam/log/tty.record | grep phytty | awk -F '=' '{print $2}'` | xargs pkill -kill -t
526 who am i | awk '{print $2}' | awk -F '/' '{print $2}' | xargs -i sed -i "s/phytty=.*/phytty={}/g" /opt/bbu/oam/log
ord
527 pkill -9 bs_bbu_main &> /dev/null
528 bash /opt/bbu/oam/cm/phyStart.sh
529 nohup sp.sh -oam > /opt/bbu/oam/log/restart.log &
530 history
531 odi -n duapp0 display-ue-info
532 scp root@192.168.1.11:/opt/bbu/oam/log/* /opt/bbu/oam/log
533 exit
534 history
root@localdomain:~# ping 10.170.120.131
PING 10.170.120.131 (10.170.120.131) 56(84) bytes of data.
64 bytes from 10.170.120.131: icmp_seq=1 ttl=61 time=1.85 ms
64 bytes from 10.170.120.131: icmp_seq=2 ttl=61 time=1.10 ms
64 bytes from 10.170.120.131: icmp_seq=3 ttl=61 time=0.743 ms
64 bytes from 10.170.120.131: icmp_seq=4 ttl=61 time=1.39 ms
64 bytes from 10.170.120.131: icmp_seq=5 ttl=61 time=0.745 ms
64 bytes from 10.170.120.131: icmp_seq=6 ttl=61 time=1.56 ms
64 bytes from 10.170.120.131: icmp_seq=7 ttl=61 time=0.705 ms
64 bytes from 10.170.120.131: icmp_seq=8 ttl=61 time=1.66 ms
64 bytes from 10.170.120.131: icmp_seq=9 ttl=61 time=1.27 ms
64 bytes from 10.170.120.131: icmp_seq=10 ttl=61 time=1.61 ms
64 bytes from 10.170.120.131: icmp_seq=11 ttl=61 time=1.68 ms
64 bytes from 10.170.120.131: icmp_seq=12 ttl=61 time=0.922 ms
64 bytes from 10.170.120.131: icmp_seq=13 ttl=61 time=1.61 ms
64 bytes from 10.170.120.131: icmp_seq=14 ttl=61 time=0.953 ms
64 bytes from 10.170.120.131: icmp_seq=15 ttl=61 time=1.57 ms
64 bytes from 10.170.120.131: icmp_seq=16 ttl=61 time=1.39 ms
```

Also, verify AMF Connectivity through the Web GUI of GNodeB:



The screenshot shows the BTI WIRELESS Web GUI. The left sidebar contains navigation links: Home, Home Information, Brief Information, General Parameters, Device, Alarm, Performance, Config, and Reboot. The main content area displays 'Home / Home Information' with several status tables.

RunInfo					
AmfRunStatus	CurrentClockSynMode	ClockSyncStatus	ProcessStatus	currentAlarm	RunTime
normal	N/A	unlock	normal	0	0 : 0 : 20 : 58

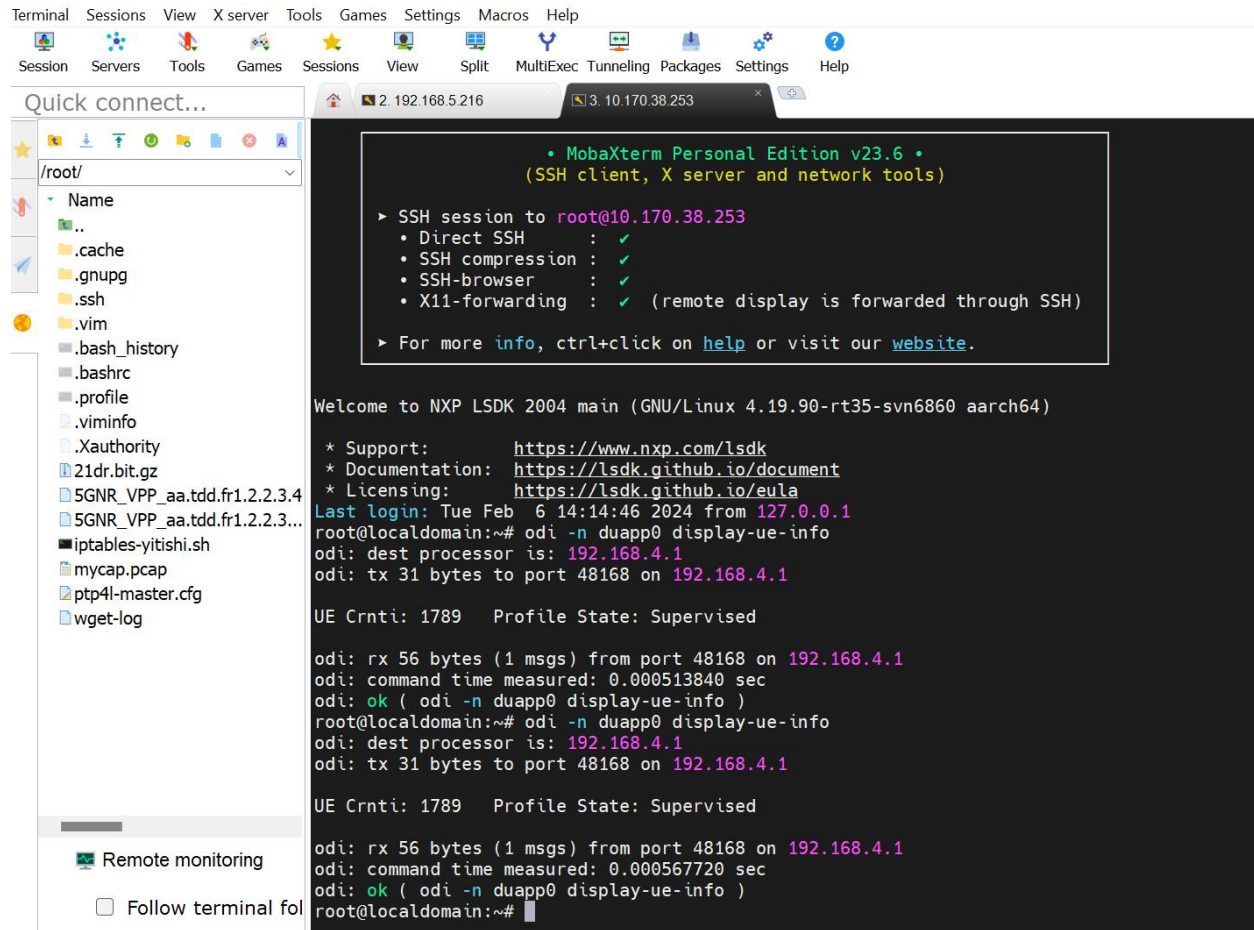
CellStatus			
CellIndex	RunStatus	SubStatus	Online UE
1	normal	normal	0

OPTStatus				
RRUDeviceNumber	BBU OPId	CellIndex	Master Optical Module	Slave Optical Module
1	1	1	not in position	in position

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

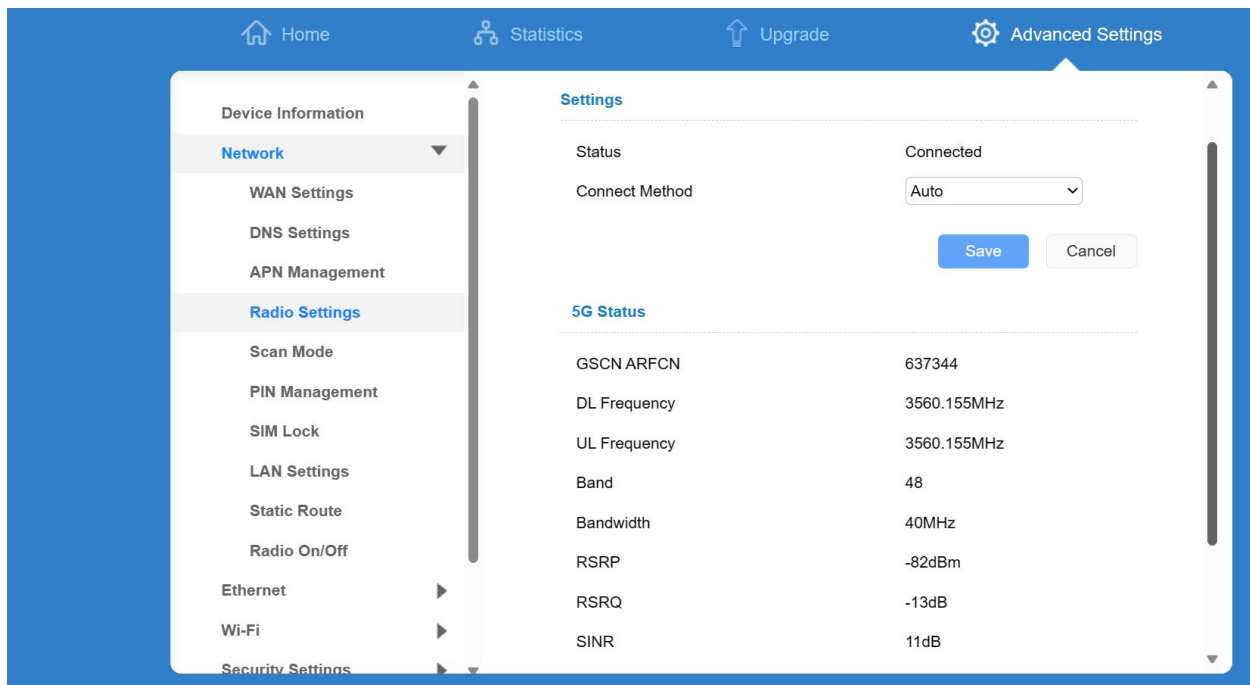
Step 2:

Verify if the CPE is connected with the G-Nodeb using the MobaXterm prompt of GNB:



Step 3:

Verify if CPE is connected through Web Portal:



Step 4:

Verify VPN Access in order to Access the Network without LMT.

Troubleshooting & Debugging:

Issue # 1:

Go through the history of Alarms & Verify Active Alarms:

← ↻ ⚠ Not secure | 192.168.5.216 🔍 🗑️ 🌟 📄 📌 🔄 🌐 ...

BTI WIRELESS Nayer English

Search Home General Parameters Alarm

Alarm / History Alarm

AlarmSeverity: All Alarm Raised Start Time: End Time: Filter Reset

SN	AlarmGID	AlarmName	AlarmSeverity	AlarmDesc	AlarmID	AlarmTimes	AlarmRaisedTime	AlarmChangedTime	AlarmClearedTime
1	FM0000000240000023	SCTP CONNECTION TO AMF FAIL	Critical	NGAP to AMF 192.168.10.100 is down Cause: Unknown	24	1	2022-01-22 16:59:05		2022-01-22 16:58:36
2	FM0000000240000023	SCTP CONNECTION TO AMF FAIL	Critical	NGAP to AMF 10.88.120.151 is down Cause: Unknown	24	1	2022-01-22 16:59:11		2022-01-22 17:01:48
3	FM0000000240000023	SCTP CONNECTION TO AMF FAIL	Critical	NGAP to AMF 192.168.10.100 is down Cause: Unknown	24	1	2022-01-22 16:59:22		2022-01-22 16:58:36
4	FM0000000240000023	SCTP CONNECTION TO AMF FAIL	Critical	NGAP to AMF 192.168.10.100 is down Cause: Unknown	24	1	2022-01-22 16:59:23		2023-11-17 09:33:32
5	FM0000000240000023	SCTP CONNECTION TO AMF FAIL	Critical	NGAP to AMF 192.168.10.100 is down Cause: Unknown	24	1	2022-01-22 17:02:09		2022-01-22 16:58:36
6	FM0000000240000023	SCTP CONNECTION TO AMF FAIL	Critical	NGAP to AMF 192.168.10.100 is down Cause: Unknown	24	1	2023-11-17 09:34:12		2023-11-18 05:12:09
7	FM0000000240000023	SCTP CONNECTION TO AMF FAIL	Critical	NGAP to AMF 10.170.120.131 is down Cause: Unknown	24	1	2023-11-18 05:12:10		2023-11-18 05:31:27
8	FM0000000250000001	SCTP CONNECTION TO DU FAIL	Critical	SCTP to DU 192.168.4.10 is down	25	1	2022-01-22 16:58:41		2022-01-22 16:58:45
9	FM0000000250000001	SCTP CONNECTION TO DU FAIL	Critical	SCTP to DU 192.168.4.10 is down	25	1	2022-01-22 16:58:51		2022-01-22 16:58:58
10	FM0000000250000001	SCTP CONNECTION TO DU FAIL	Critical	SCTP to DU 192.168.4.10 is down	25	1	2022-01-22 16:58:52		2022-01-22 16:58:58
11	FM0000000250000001	SCTP CONNECTION TO DU FAIL	Critical	SCTP to DU 192.168.4.10 is down	25	1	2022-01-22 16:58:53		2022-01-22 16:58:59
12	FM0000000250000001	SCTP CONNECTION TO DU FAIL	Critical	SCTP to DU 192.168.4.10 is down	25	1	2022-01-22 17:02:00		2022-01-22 17:02:06
13	FM0000000250000001	SCTP CONNECTION TO DU FAIL	Critical	SCTP to DU 192.168.4.10 is down	25	1	2022-01-22 17:06:48		2022-01-22 17:06:52
14	FM0000000250000001	SCTP CONNECTION TO DU FAIL	Critical	SCTP to DU 192.168.4.10 is down	25	1	2023-11-17 09:33:41		2023-11-17 09:33:47
15	FM0000000250000001	SCTP CONNECTION TO DU FAIL	Critical	SCTP to DU 192.168.4.10 is down	25	1	2023-11-18 05:31:36		2023-11-18 05:31:42
16	FM0000000250000001	SCTP CONNECTION TO DU FAIL	Critical	SCTP to DU 192.168.4.10 is down	25	1	2024-03-02 02:40:02		2024-03-02 02:40:06
17	FM0000000250000001	SCTP CONNECTION TO DU FAIL	Critical	SCTP to DU 192.168.4.10 is down	25	1	2024-03-02 04:50:10		2024-03-02 04:50:15
18	FM0000000250000001	SCTP CONNECTION TO DU FAIL	Critical	SCTP to DU 192.168.4.10 is down	25	1	2024-03-02 06:34:19		2024-03-02 06:34:25
19	FM0000000250000001	SCTP CONNECTION TO DU FAIL	Critical	SCTP to DU 192.168.4.10 is down	25	1	2024-03-02 07:00:11		2024-03-02 07:00:17

Home General Parameters Alarm

Home

General Parameters

Device

Alarm

Active Alarm

History Alarm

Performance

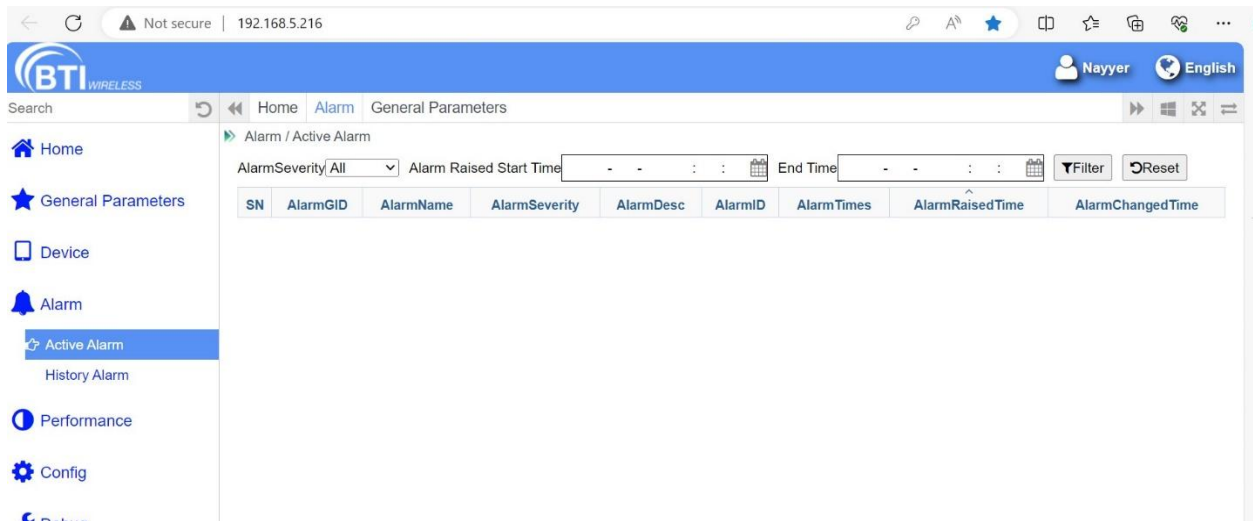
Config

Debug

File

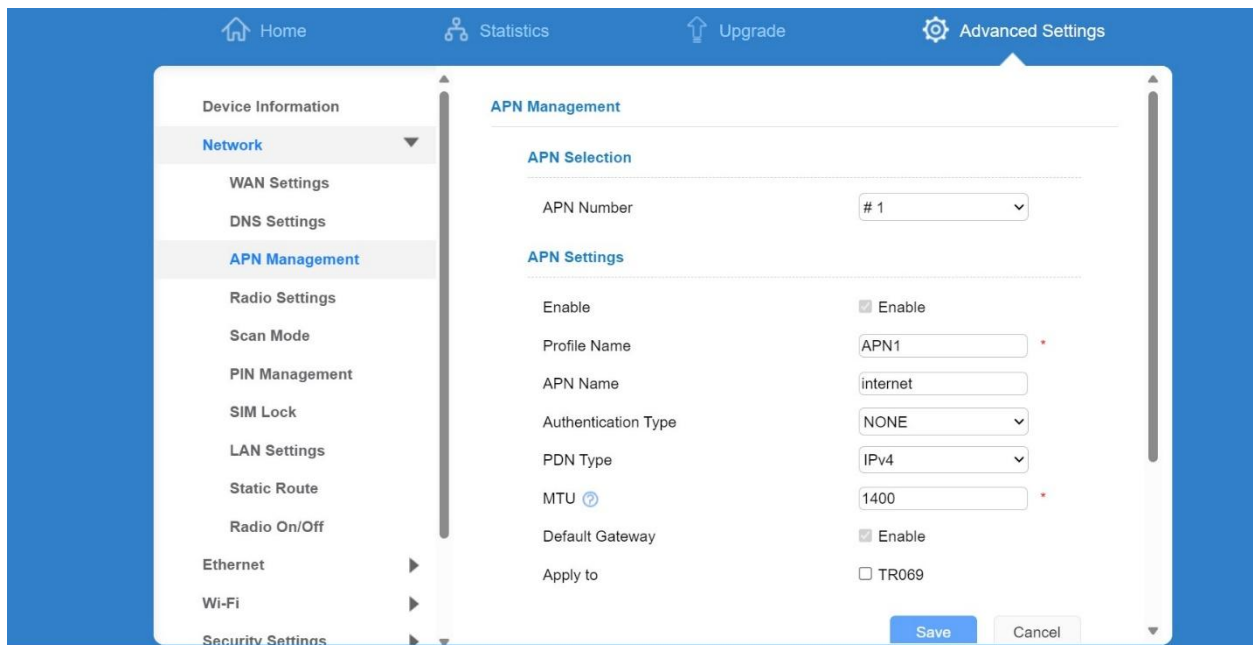
System

Upgrade



Issue # 2:

Verify and confirm the APN Settings including the APN Name (specific to customer; examples are: “internet”):



The APN was incorrect; changed from “xxxx” to “internet” after below Wireshark Log observation:

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help					
((udp.dstport>50000 && udp.dstport<51300 && icmp))[(nr_info.rach.numofpream > 0)]((mac-nr.rar.rapid > 0))					
#	Source	Destination	Protocol	Length	Info
240231	192.168.5.216	192.168.5.168	SJ_NrRrcDlDcch	60	RRC Release
240232	192.168.5.216	192.168.5.168	SJ_NGAP	81	UEContextReleaseComplete
240495	192.168.5.216	192.168.5.168	SJ_F1AP	90	UEContextReleaseCommand
242030	192.168.5.216	192.168.5.168	SJ_NGAP	139	InitialContextSetupRequest, Service accept
245271	192.168.5.216	192.168.5.168	SJ_NrRrcDlDcch	60	Security Mode Command
245272	192.168.5.216	192.168.5.168	SJ_F1AP	86	DLRRCTestMessageTransfer
245925	192.168.5.216	192.168.5.168	SJ_F1AP	62	UEContextReleaseComplete
260731	192.168.5.216	192.168.5.168	SJ_F1AP	80	ULRRCTestMessageTransfer
260731	192.168.5.216	192.168.5.168	SJ_NrRrcUlDcch	60	Security Mode Complete
262335	192.168.5.216	192.168.5.168	SJ_NrRrcDlDcch	60	DL Information Transfer, Service accept
262336	192.168.5.216	192.168.5.168	SJ_NGAP	62	InitialContextSetupResponse
262336	192.168.5.216	192.168.5.168	SJ_F1AP	100	DLRRCTestMessageTransfer
262946	192.168.5.216	192.168.5.168	SJ_F1AP	76	RRCTestDeliveryReport
280473	192.168.5.216	192.168.5.168	SJ_F1AP	162	ULRRCTestMessageTransfer
280474	192.168.5.216	192.168.5.168	SJ_NrRrcUlDcch	126	UL Information Transfer, UL NAS transport, PDU session establishment request
280475	192.168.5.216	192.168.5.168	SJ_NrRrcUlDcch	126	UL Information Transfer, UL NAS transport, PDU session establishment request
281180	192.168.5.216	192.168.5.168	SJ_NGAP	167	UplinkNASTransport, UL NAS transport, PDU session establishment request
281181	192.168.5.216	192.168.5.168	SJ_F1AP	76	RRCTestDeliveryReport
284393	192.168.5.216	192.168.5.168	SJ_NGAP	142	DownlinkNASTransport, DL NAS transport, PDU session establishment request (DNN not supporte...
284541	192.168.5.216	192.168.5.168	SJ_NrRrcDlDcch	120	DL Information Transfer, DL NAS transport, PDU session establishment request (DNN not suppo...
285043	192.168.5.216	192.168.5.168	SJ_F1AP	161	DLRRCTestMessageTransfer
300632	192.168.5.216	192.168.5.168	SJ_F1AP	76	RRCTestDeliveryReport
> Frame 17: 224 bytes on wire (1792 bits), 224 bytes captured (1792 bits) on interface \Device\NPF_{39965B36-7F0A-4B21-A86C-13DA77E80641}, id 0 > Ethernet II, Src: aa:ca:be:e6:d7:fa (aa:ca:be:e6:d7:fa), Dst: 50:91:e3:68:6d:04 (50:91:e3:68:6d:04) > Internet Protocol Version 4, Src: 192.168.5.216, Dst: 192.168.5.168 > User Datagram Protocol, Src Port: 38674, Dst Port: 50190 > CpCellApp > F1 Application Protocol					

The CPE was visible with the correct CRNTI from GNodeB after the APN was corrected:

```
Terminal Sessions View X server Tools Games Settings Macros Help
Session Servers Tools Games Sessions View Split MultiExec Tunneling Packages Settings Help

2. 192.168.5.216
rtt min/avg/max/mdev = 0.388/1.022/1.591/0.374 ms
root@localdomain:~# ping 10.170.120.131
PING 10.170.120.131 (10.170.120.131) 56(84) bytes of data.
64 bytes from 10.170.120.131: icmp_seq=1 ttl=62 time=1.10 ms
64 bytes from 10.170.120.131: icmp_seq=2 ttl=62 time=0.556 ms
64 bytes from 10.170.120.131: icmp_seq=3 ttl=62 time=0.917 ms
^C
--- 10.170.120.131 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2001ms
rtt min/avg/max/mdev = 0.556/0.859/1.105/0.229 ms
root@localdomain:~# odi -n duapp0 display-ue-info
odi: dest processor is: 192.168.4.1
odi: tx 31 bytes to port 45468 on 192.168.4.1

odi: rx 13 bytes (1 msgs) from port 45468 on 192.168.4.1
odi: command time measured: 0.000413680 sec
odi: ok ( odi -n duapp0 display-ue-info )
root@localdomain:~# ping 10.170.120.131
PING 10.170.120.131 (10.170.120.131) 56(84) bytes of data.
64 bytes from 10.170.120.131: icmp_seq=1 ttl=62 time=1.33 ms
64 bytes from 10.170.120.131: icmp_seq=2 ttl=62 time=0.363 ms
64 bytes from 10.170.120.131: icmp_seq=3 ttl=62 time=1.59 ms
64 bytes from 10.170.120.131: icmp_seq=4 ttl=62 time=0.798 ms
^C
--- 10.170.120.131 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 2999ms
rtt min/avg/max/mdev = 0.363/1.023/1.597/0.478 ms
root@localdomain:~# odi -n duapp0 display-ue-info
odi: dest processor is: 192.168.4.1
odi: tx 31 bytes to port 45468 on 192.168.4.1

UE Crnti: 541 Profile State: Supervised

odi: rx 55 bytes (1 msgs) from port 45468 on 192.168.4.1
odi: command time measured: 0.000610960 sec
odi: ok ( odi -n duapp0 display-ue-info )
root@localdomain:~#
```

Issue # 3:

If CPE keeps getting disconnected after being idle, verify CPE Inactivity Timer under UE Capabilities.

It can be modified from 30 seconds to 60 seconds:

Not secure | 192.168.5.216

BTI WIRELESS

Nayyer English

Home Config

Config / Service / Cell Access Management / Modify Access UE Capabilities(MOD Capabilities)

```

GbrThresholdSwitch = off
GbrULThreshold = 4000000000000
GbrDLThreshold = 4000000000000

(Number of results = 1)

--- END

MOD Capabilities:indexid_CellConfig=1,UeInactiveTimer=60;
+++ BBU 2024-02-08 09:57:03
O&M #2
%%MOD Capabilities:indexid_CellConfig=1,UeInactiveTimer=60;%%
RETCODE = 0 The command was executed successfully.
--- END

```

MOD Capabilities:indexid_CellConfig=1,UeInactiveTimer=60;

Select All Execute Help Copy Message Clear Output

CellIndex	1	
<input checked="" type="checkbox"/> UeInactiveTimer	60	(second)
<input type="checkbox"/> InactiveSwitch		
<input type="checkbox"/> UserNumberThreshold1		(%)
<input type="checkbox"/> UserNumberThreshold2		(%)
<input type="checkbox"/> UserNumberThreshold3		(%)

Issue # 4:

Incorrect PLMN was programmed. Updated PLMN from 315010 to 00101f after below 2 observations:

Home Alarm

Alarm / Active Alarm

AlarmSeverity: All Alarm Raised Start Time: - - : : End Time: - - : : Filter Reset

SN	AlarmGID	AlarmName	AlarmSeverity	AlarmDesc	AlarmID
1	FM0000000280000023	AMF NG SETUP FAIL	Critical	NGAP to AMF 10.170.120.131 is down Cause: CAUSE_MISC_UNKNOWN_PLMN	28
2	FM0000000290000001	F1 TO DU SETUP FAIL	Critical	F1AP to DU 192.168.4.10 is down	29
3	FM0400000300000001	F1 TO CU SETUP FAIL	Critical	F1AP to CU 1 is down	30

Search

Home Alarm General Parameters

Home

General Parameters

- AMF
- gNodeB Identification
- Network
- Cell Management
- Cell TAC
- Cell PLMN
 - Add Cell PLMN
 - Modify Cell PLMN
 - List Cell PLMN
 - Delete Cell PLMN
- Cell SLICE
- Cell QOS

General Parameters / Cell PLMN / List Cell PLMN(LST CNTAPLMN)

```
LST CNTAPLMN;
+++ BBU 2024-02-08 09:19:26
O&M #1
%%LST CNTAPLMN::%%
RETCODE = 0 The command was executed successfully.
List Cell PLMN
-----
CellIndex = 1
TACIndex = 1
PLMNIndex = 1
PLMNID = 315010

(Number of results = 1)

--- END
```

LST CNTAPLMN::

☒ Select All ☐ _ Execute ☐ Help

<input type="checkbox"/>	CellIndex	
<input type="checkbox"/>	TACIndex	

Issue # 5:

If AMF is Not accessible, verify the below:

Terminal Sessions View X server Tools Games Settings Macros Help

Session Servers Tools Games Sessions View Split MultiExec Tunneling Packages Settings Help

Quick connect...

/root/

- Name
- ..
- .cache
- .gnupg
- .ssh
- .vim
- .bash_history
- .bashrc
- .profile
- .viminfo
- .Xauthority
- 21dr.bit.gz
- SGNR_VPP_aa.tdd.fr1.2.2.3.4
- SGNR_VPP_aa.tdd.fr1.2.2.3...
- iptables-yitishi.sh
- ptp4l-master.cfg

Remote monitoring

☐ Follow terminal fol

```
669 bash /opt/bbu/bts/scripts/sp.sh -startoam
670 nohup sp.sh -oam > /opt/bbu/oam/log/restart.log &
671 scp root@192.168.1.11:/opt/bbu/oam/log/* /opt/bbu/oam/log
672 exit
673 history
674 odt -n duapp0 display-ue-info
675 exit
676 history
677 odt -n duapp0 display-ue-info
678 echo "pts/"`cat /opt/bbu/oam/log/tty.record | grep bbutty | awk -F '=' '{print $2}'` | xargs kill -kill -t
679 who am i | awk '{print $2}' | awk -F '/' '{print $2}' | xargs -i sed -i "s/bbutty=./bbutty={}/g" /opt/bbu/oam/log/tty.rec
ord
680 . /opt/bbu/oam/cm/protStackCfg.sh
681 bash /opt/bbu/bts/scripts/sp.sh -startoam
682 nohup sp.sh -oam > /opt/bbu/oam/log/restart.log &
683 scp root@192.168.1.11:/opt/bbu/oam/log/* /opt/bbu/oam/log
684 exit
685 history
root@localdomain:~# ping 10.170.38.253
PING 10.170.38.253 (10.170.38.253) 56(84) bytes of data.
64 bytes from 10.170.38.253: icmp_seq=2 ttl=62 time=1.74 ms
64 bytes from 10.170.38.253: icmp_seq=3 ttl=62 time=1.82 ms
64 bytes from 10.170.38.253: icmp_seq=4 ttl=62 time=1.87 ms
64 bytes from 10.170.38.253: icmp_seq=5 ttl=62 time=1.42 ms
^C
--- 10.170.38.253 ping statistics ---
5 packets transmitted, 4 received, 20% packet loss, time 4001ms
rtt min/avg/max/mdev = 1.429/1.718/1.875/0.176 ms
root@localdomain:~# ping 10.170.120.131
PING 10.170.120.131 (10.170.120.131) 56(84) bytes of data.
64 bytes from 10.170.120.131: icmp_seq=1 ttl=61 time=0.378 ms
64 bytes from 10.170.120.131: icmp_seq=2 ttl=61 time=1.58 ms
64 bytes from 10.170.120.131: icmp_seq=3 ttl=61 time=1.51 ms
^C
--- 10.170.120.131 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 1999ms
rtt min/avg/max/mdev = 0.378/1.159/1.581/0.552 ms
root@localdomain:~#
```

←↻⚠ Not secure | 10.170.120.141/#/index

AGrandEMS

HomeMonitorConfigurationPerformance

20

🔒🔍🔧🌐👤

Englishmanager

Home

Object	Status	Refresh Time	Version	Serial Number	IP Address
OMC_001	Normal	2024-03-08 11:52:53	2.2401.3	-	10.170.120.141
AMF_001	Normal	2024-03-08 11:52:53	2.2401.12	13750111	10.170.120.131
AUSF_001	Normal	2024-03-08 11:52:53	2.2401.11	13750111	10.170.120.132
UDM_001	Normal	2024-03-08 11:52:53	2.2402.14	13750111	10.170.120.133
SMF_001	Normal	2024-03-08 11:52:53	2.2401.13	13750111	10.170.120.134
PCF_001	Normal	2024-03-08 11:52:53	2.2401.13	13750111	10.170.120.135

Running Status

NormalAbnormal

Abnormal

Normal

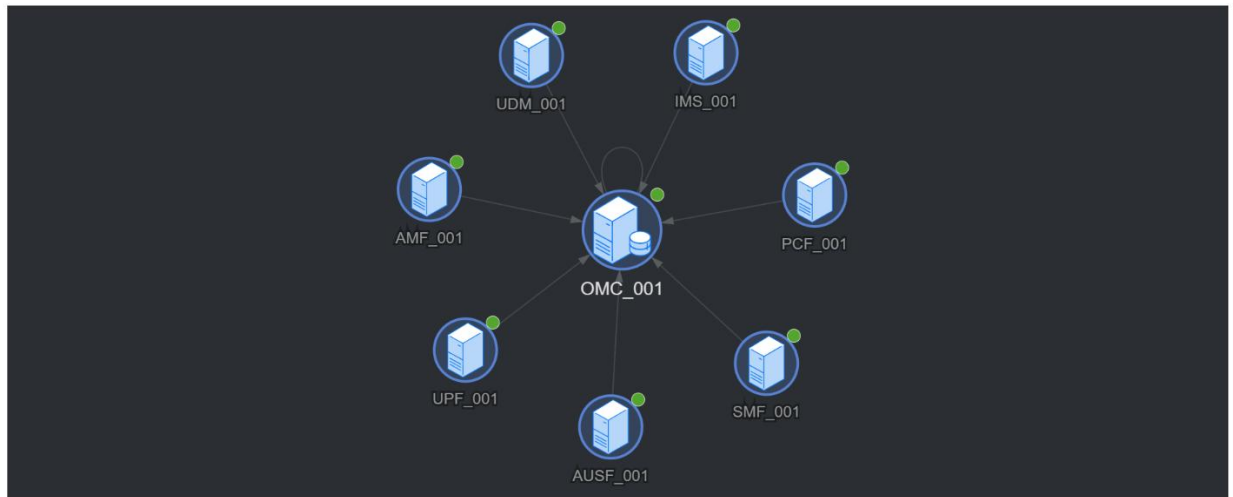
Brief Information

Object	OMC
Version	2.2401.3

Copyright ©2023 AGrandTech2024-03-08 19:48:44Doc

Graph Group Name: 5GC System Architecture2Refresh

```
graph TD
    OMC_001[OMC_001] --- N1((N1)) --- UE[UE]
    UE -.- N2((N2)) --- AMF_001[AMF_001]
    UE --- N3((N3)) --- (R)AN["(R)AN"]
    (R)AN -.- N6((N6)) --- DN[DN]
    (R)AN --- N4((N4)) --- UPF_001[UPF_001]
    UPF_001 --- N5((N5)) --- SMF_001[SMF_001]
    subgraph Core_Network [Core Network]
        AUSF_001[AUSF_001]
        AMF_001[AMF_001]
        PCF_001[PCF_001]
        UDM_001[UDM_001]
        IMS_001[IMS_001]
        UPF_001[UPF_001]
        SMF_001[SMF_001]
    end
```

Home
Active Alarms
Signaling Analysis
Signaling Capture
NE System Topology

Monitor / Trace / Signaling Capture

Batch Start
Batch Stop
Batch Download

<input type="checkbox"/>	NE Type	NE ID	NE Name	IP Address	Command	Operation
<input type="checkbox"/>	OMC	001	OMC_001	10.170.120.141	<input type="text" value="-n -s 0 -v -w"/>	Start Stop
<input type="checkbox"/>	AMF	001	AMF_001	10.170.120.131	<input type="text" value="-n -s 0 -v -w"/>	Start Stop
<input type="checkbox"/>	AUSF	001	AUSF_001	10.170.120.132	<input type="text" value="-n -s 0 -v -w"/>	Start Stop
<input type="checkbox"/>	UDM	001	UDM_001	10.170.120.133	<input type="text" value="-n -s 0 -v -w"/>	Start Stop
<input type="checkbox"/>	SMF	001	SMF_001	10.170.120.134	<input type="text" value="-n -s 0 -v -w"/>	Start Stop
<input type="checkbox"/>	PCF	001	PCF_001	10.170.120.135	<input type="text" value="-n -s 0 -v -w"/>	Start Stop
<input type="checkbox"/>	UPF	001	UPF_001	10.170.120.138	<input type="text" value="-n -s 0 -v -w"/>	Start Stop
<input type="checkbox"/>	IMS	001	IMS_001	10.170.120.140	<input type="text" value="-n -s 0 -v -w"/>	Start Stop

Issue # 6:

Using the Forward Log Capture sub heading under the Debug Menu, start Wireshark Log Capture to Troubleshoot Issue:

Debug

Maintenance

Log Capturing

Local Log Capturing

Forwarding Log Capturing

Rate

Floor Noise

File

System

Upgrade

AMFIndex PLMNIndex PLMNID

1 1 00101f

1 2 315010

1 3 99999f

1 4 999503

(Number of results = 4)

END

LST SupportPLMNList;

Execute

Help

Copy Message

Clear Output

SelectMessageOptions	<input checked="" type="checkbox"/> CP signaling plane <input type="checkbox"/> FAPI1 <input type="checkbox"/> FAPI3 <input type="checkbox"/> RLC <input type="checkbox"/> CELLTRACE
Cell	<input checked="" type="checkbox"/> Cell1 <input type="checkbox"/> Cell2 <input type="checkbox"/> Cell3 <input type="checkbox"/> Cell4
Purpose	start forwarding
TransmitIPv4Address	192.168.5.168

Several Wireshark Logs collected, with one of them being shared below:

#	Source	Destination	Protocol	Length	Info
727554	192.168.5.216	192.168.5.168	SJ_NrRrcDlDcch	60	DL Information Transfer, Service accept
727773	192.168.5.216	192.168.5.168	SJ_F1AP	97	DLRRCMesageTransfer
728462	192.168.5.216	192.168.5.168	SJ_F1AP	100	DLRRCMesageTransfer
729014	192.168.5.216	192.168.5.168	SJ_F1AP	76	RRCDeliveryReport
745294	192.168.5.216	192.168.5.168	SJ_F1AP	76	RRCDeliveryReport
750397	192.168.5.216	192.168.5.168	SJ_F1AP	1509	ULRRCMesageTransfer
750804	192.168.5.216	192.168.5.168	SJ_NrRrcUlDcch	1470	UE Capability Information
752819	192.168.5.216	192.168.5.168	SJ_NGAP	1501	UERadioCapabilityInfoIndication
752829	192.168.5.216	192.168.5.168	SJ_NGAP	64	InitialContextSetupResponse
753081	192.168.5.216	192.168.5.168	SJ_F1AP	166	ULRRCMesageTransfer
754556	192.168.5.216	192.168.5.168	SJ_NrRrcUlDcch	130	UL Information Transfer, UL NAS transport, PDU session establishment request
754557	192.168.5.216	192.168.5.168	SJ_NrRrcUlDcch	130	UL Information Transfer, UL NAS transport, PDU session establishment request
754557	192.168.5.216	192.168.5.168	SJ_NGAP	173	UplinkNASTransport, UL NAS transport, PDU session establishment request

0000 = Spare Half Octet: 0

▼ Payload container type

.... 0001 = Payload container type: N1 SM information (1)

▼ Payload container

Length: 5

▼ Plain NAS 5GS Message

Extended protocol discriminator: 5G session management messages (46)

PDU session identity: PDU session identity value 1 (1)

Procedure transaction identity: 1

Message type: PDU session establishment reject (0xc3)

▼ 5GSM cause - ESM cause

5GSM cause: Missing or unknown DNN in a slice (70)

▼ PDU session identity 2 - PDU session ID

Element ID: 0x12

PDU session identity: PDU session identity value 1 (1)

0010 00 4b f1 34 40 00 40 11 bc 9c c0 a8 05 d8 c0 a8 :K 4@ @-

0020 05 a8 8d 5f c3 fa 00 37 2a 0d 00 04 40 2b 00 00 :...7 *...@+...

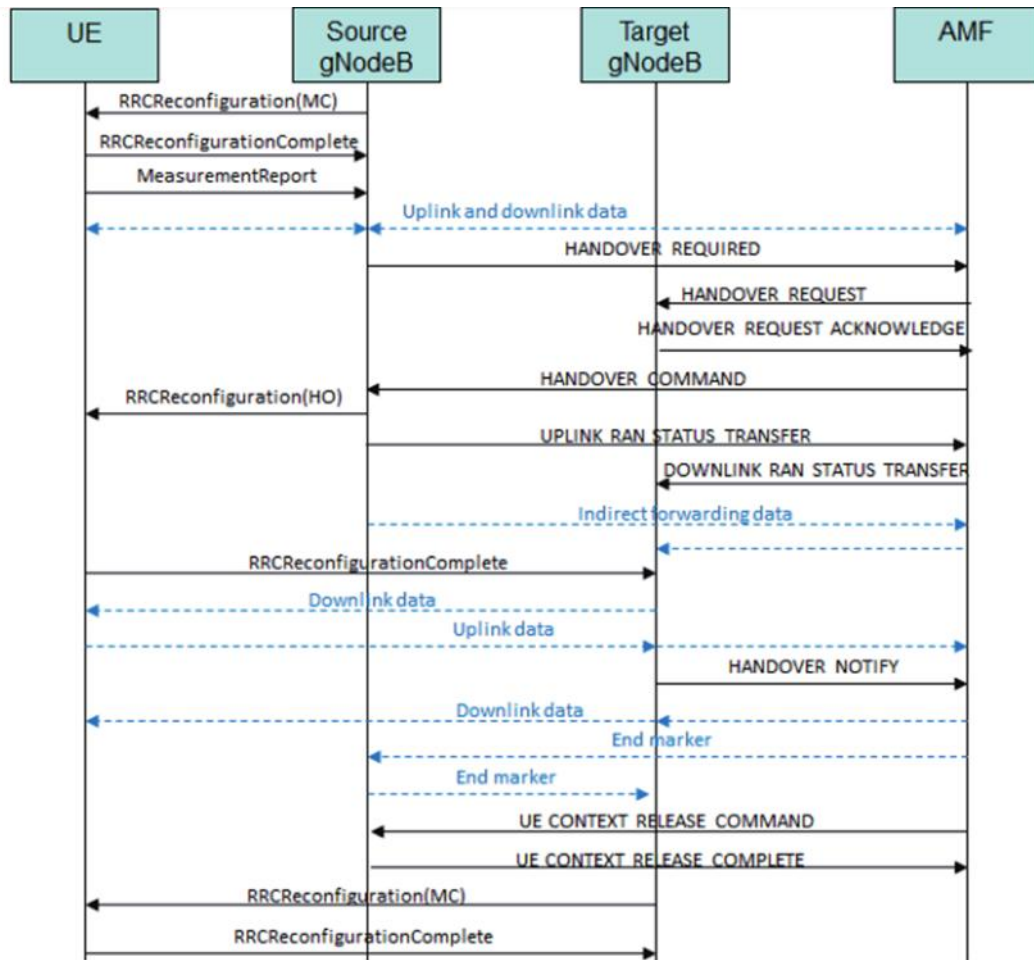
0030 03 00 0a 00 05 60 94 01 21 f8 00 55 00 02 00 09 :...1.U....

0040 00 26 00 15 14 7e 02 56 42 6e 38 04 7e 00 68 01 :8...~V 8n8~h-

0050 00 05 2e 01 01 c3 46 12 01 :...F...

“Ng Handovers”

Ng Intra-Frequency Handover (M4370):



- 1- Intra-Frequency Handover from PCI 71 (10.170.38.253) to PCI 31 (10.170.38.252):
- 2- Connect the laptop to the main Network using the Router and switch in order to monitor traffic & signaling for both of the GNB above using Wireshark
- 3- Verify the IP Address of laptop (connected to CPE) by using ipconfig below:

```
Command Prompt
Windows IP Configuration

Ethernet adapter Ethernet 2:

    Connection-specific DNS Suffix  . : 
    Link-local IPv6 Address . . . . . : fe80::2d90:4b52:6801:2172%6
    IPv4 Address. . . . . : 10.170.38.200
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 10.170.38.1
```

- 4- Start a continuous ping from the laptop connected to the CPE, to make sure the connected Mode stays on (needed for HO):

```
Command Prompt

C:\Users\Nayyer>ping 1.1.1.1 -t

Pinging 1.1.1.1 with 32 bytes of data:
Reply from 1.1.1.1: bytes=32 time=7ms TTL=56
Reply from 1.1.1.1: bytes=32 time=7ms TTL=56
Reply from 1.1.1.1: bytes=32 time=8ms TTL=56
Reply from 1.1.1.1: bytes=32 time=8ms TTL=56
Reply from 1.1.1.1: bytes=32 time=7ms TTL=56
Reply from 1.1.1.1: bytes=32 time=8ms TTL=56
Reply from 1.1.1.1: bytes=32 time=7ms TTL=56
Reply from 1.1.1.1: bytes=32 time=8ms TTL=56
Reply from 1.1.1.1: bytes=32 time=8ms TTL=56
Reply from 1.1.1.1: bytes=32 time=7ms TTL=56
```

- 5- Build the NR Cell Relation (from Source to Target GNB below):

← ↻ Not secure | 10.170.38.253

BTI WIRELESS

Search Home Config

Home

General Parameters

Device

Alarm

Performance

Config

Neigh Station

Neigh Cell

NRCell

Add NRCell

Modify NRCell

List NRCell

Delete NRCell

LTECell

Mobility

Service

Config / Neigh Cell / NRCell / List NRCell(LST NRCell)

```

CID = 4128769
PhyCellID = 31
PLMNID = 00101f
NbrGnblLength = 22
NRCarrierARFCN = 638000
SSBFrequency = 637344
SSBSubcarrierSpacing = kHz30
TAC = 1
Qoffset(dB) = -6
QRxLevMinOffsetCell = 3
QQualMinOffsetCell = 5
CIO(dB) = 0
Status = valid neighbor cell
Blacklisted = off
RsType = ssb
NoRemoveEnable = prohibit deleting the cell
NoHOEnable = allow handover to the cell
NoXnEnable = prohibit to establish Xn connection to the cell
CIOSSBSINR(dB) = 0x00000FFF
CIOSSBRSP(dB) = 0
CIOSSBRSPQ(dB) = 0x00000FFF
CIOCSISINR(dB) = 0x00000FFF
CIOCSIRSP(dB) = 0x00000FFF
CIOCSIRSPQ(dB) = 0x00000FFF

```

LST NRCell::

Select All Execute Help Copy Message Clear Output

CellIndex	CID
<input type="checkbox"/>	
<input type="checkbox"/>	

6- Verify the Cell Information on the Target GNB (PCI 31):

← ↻ Not secure | 10.170.38.252

BTI WIRELESS

Search Home General Parameters

General Parameters / Cell Management / List CellConfig(LST CellConfig)

List CellConfig

```

CellIndex = 1
CellIdWithinGnb = 1
PhyCellID = 31
NRARFCNUL = 638000
NRARFCNDL = 638000
FreqBandIndicator = n48:636667-646666
ULayers = 0
ULAntennas = 4
DLayers = 0
DLAntennas = 4
PdschMcsTable = qam64
PuschMcsTable = qam64
ULBandwidth(M) = 40M
DLBandwidth(M) = 40M
AbsoluteFrequencySSB = 637344
SSBPower = 6
PSCHPowerOffset = db0

```

(Number of results = 1)

LST CellConfig::

Select All Execute Help Copy Message Clear Output

CellIndex
<input type="checkbox"/>

7- Confirm that A5 is turned off on the Target GNB:

← ↻ Not secure | 10.170.38.252

BTI WIRELESS

Search

Home General Parameters Config

Performance

Config

- + Neigh Station
- + Neigh Cell
- Mobility
 - + SI Parameters
 - + MeasureCtrl
 - + A1MeasureCtrl
 - + A2MeasureCtrl
 - + A3MeasureCtrl
 - + A4MeasureCtrl
 - A5MeasureCtrl
 - Add A5MeasureCtrl
 - Modify A5MeasureCtrl
 - List A5MeasureCtrl
 - Delete A5MeasureCtrl
 - Add PimnIdA5
 - Modify PimnIdA5

Config / Mobility / A5MeasureCtrl / List A5MeasureCtrl(LST A5MeasureCtrl)

(Number of results = 1)

--- END

LST A5MeasureCtrl;;
 +++ BBU 2024-03-07 01:21:58
 O&M #4
 %%LST A5MeasureCtrl:%%
 RETCODE = 0 The command was executed successfully.
 List A5MeasureCtrl

CellIndex	A5MeasureCtrlIndex	Enable	A5Threshold1RSRP(dB)	A5Threshold1RSRQ(0.5dB)	A5Threshold1SINR	A5Threshold2RSRP(dB)	A5Threshold2RSRQ(0.5dB)	A5Threshold2SINR	A5Threshold2Time	A5Threshold2Time
1	1	off	22	12	43	22	12	43	16	6
1	2	off	22	12	43	22	12	43	16	6

(Number of results = 2)

--- END

LST A5MeasureCtrl;

☒ Select All

☐ CellIndex

☐ A5MeasureCtrlIndex

8- Adjust the A2 Thresh-hold on Source (based on the CPE RSRP value seen for the GNB)

← ↻ Not secure | 10.170.38.253

BTI WIRELESS

Search

Home Config

Device

Alarm

Performance

Config

- + Neigh Station
- + Neigh Cell
- Mobility
 - + SI Parameters
 - + MeasureCtrl
 - + A1MeasureCtrl
 - A2MeasureCtrl
 - Add A2MeasureCtrl
 - Modify A2MeasureCtrl
 - List A2MeasureCtrl
 - Delete A2MeasureCtrl
 - Add PimnIdA2

Config / Mobility / A2MeasureCtrl / List A2MeasureCtrl(LST A2MeasureCtrl)

CIOCSIRSRP(dB) = 0x00000FFF
 CIOCSIRSRQ(dB) = 0x00000FFF

(Number of results = 1)

--- END

LST A2MeasureCtrl;;
 +++ BBU 2024-02-10 14:02:56
 O&M #11
 %%LST A2MeasureCtrl:%%
 RETCODE = 0 The command was executed successfully.
 List A2MeasureCtrl

CellIndex	A2MeasureCtrlIndex	Enable	A2ThresholdRSRP(dB)	A2ThresholdRSRQ(0.5dB)	A2ThresholdSINR	Hysteresis(0.5dB)	MaxReportCells	MeasurePurpose	ReportAmount(time)	ReportTime
1	1	on	90	0	2	1	1	1 time	240ms	320ms
1	2	off	35	0	2	1	2	1 time	240ms	320ms

(Number of results = 2)

--- END

LST A2MeasureCtrl;

☒ Select All

☐ CellIndex

☐ A2MeasureCtrlIndex

The A2 Thresh-hold should be as such that:

“Event A2 (Serving becomes worse than threshold)”

9- Verify A2 PLMN:

← ↻ ⚠ Not secure | 10.170.38.253

BTI WIRELESS

Search Home Config

Config / Mobility / A2MeasureCtrl / List PimnidA2(LST PimnidA2)

- + Neigh Station
- + Neigh Cell
- Mobility
 - + SI Parameters
 - + MeasureCtrl
 - + A1MeasureCtrl
 - A2MeasureCtrl
 - Add A2MeasureCtrl
 - Modify A2MeasureCtrl
 - List A2MeasureCtrl
 - Delete A2MeasureCtrl
 - Add PimnidA2
 - Modify PimnidA2
 - List PimnidA2
 - Delete PimnidA2

CellIndex	A2MeasureCtrlIndex	Enable	A2ThresholdRSRP(dB)	A2ThresholdRSRQ(0.5dB)	A2ThresholdSINR	Hysteresis(0.5dB)	MaxReportCells	MeasurePurpose	ReportAm
1	1	on	90	0	2	1	1	1 time	240ms
1	2	off	35	0	2	1	2	1 time	240ms

(Number of results = 2)

--- END

LST PimnidA2::
 +++ BBU 2024-02-10 14:04:40
 O&M #12
 %%LST PimnidA2::%%
 RETCODE = 0 The command was executed successfully.
 List PimnidA2

CellIndex	A2MeasureCtrlIndex	PLMNIndex	PLMN
1	1	1	00101f
1	2	1	46692f

 (Number of results = 2)

--- END

10- A3 Thresh-hold on Source:

← ↻ ⚠ Not secure | 10.170.38.253

BTI WIRELESS

Search Home Config General Parameters

Config / Mobility / A3MeasureCtrl / List A3MeasureCtrl(LST A3MeasureCtrl)

- Performance
- Config
 - + Neigh Station
 - + Neigh Cell
 - Mobility
 - + SI Parameters
 - + MeasureCtrl
 - + A1MeasureCtrl
 - + A2MeasureCtrl
 - A3MeasureCtrl
 - Add A3MeasureCtrl
 - Modify A3MeasureCtrl
 - List A3MeasureCtrl
 - Delete A3MeasureCtrl
 - Add PimnidA3

CellIndex = 1
 MaxTxPower(dBm) = 30
 (Number of results = 1)

--- END

LST A3MeasureCtrl::
 +++ BBU 2024-02-10 14:08:51
 O&M #14
 %%LST A3MeasureCtrl::%%
 RETCODE = 0 The command was executed successfully.
 List A3MeasureCtrl

CellIndex	A3MeasureCtrlIndex	Enable	A3OffsetRSRP(0.5dB)	A3OffsetRSRQ(0.5dB)	A3OffsetSINR(0.5dB)	Hysteresis(0.5dB)	MaxReportCells	MeasurePurpose	ReportAmount(time)	ReportInte
1	1	on	2	0	2	4	1	1 time	240ms	320ms
1	2	off	22	-12	-15	16	6	2	1 time	240ms

 (Number of results = 2)

--- END

11- Wireshark Log Captures on Source GNB (and Target GNB):

← ↻ ⚠ Not secure | 10.170.38.253

BTI WIRELESS

Search Home Config General Parameters Debug

Debug / Log Capturing / Forwarding Log Capturing(EXC Transmit/Caught)

CellIndex = 1
MaxTxPower(dBm) = 30
(Number of results = 1)
--- END

LST A3MeasureCtrl;
+++ BBU 2024-02-10 14:08:51
O&M #14
%%LST A3MeasureCtrl:%%
RETCODE = 0 The command was executed successfully.
List A3MeasureCtrl

CellIndex	A3MeasureCtrlIndex	Enable	A3OffsetRSRP(0.5dB)	A3OffsetRSRQ(0.5dB)	A3OffsetSINR(0.5dB)	Hysteresis(0.5dB)	MaxReportCells	MeasurePurpose	Report
1	1	on	2	0	2	4	1	1 time	240ms
1	2	off	22	-12	-15	16	6	2	1 time

(Number of results = 2)
--- END

LST A3MeasureCtrl;

☒ SelectMessageOptions
☒ Cell
☒ Purpose
☒ TransmitIPv4Address

☒ CP signaling plane
☐ FAPI1
☐ FAPI3
☐ RLC
☐ CELLTRACE
☒ Cell1
☐ Cell2
☐ Cell3
☐ Cell4

Purpose: start forwarding

TransmitIPv4Address: 10.170.38.200

12- Start PDU Session on the Source GNB of PCI 71 (10.170.38.253):

Capturing from Ethernet 2

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Filter: ((udp.dsport>50000 && udp.dsport<51300 && !icmp)) || ((nr_info.rach.numofpream > 0) || ((mac-nr.rar.rapid > 0)) && ((ip.addr == 10.170.38.252) || (ip.addr == 10.170.38.253)))

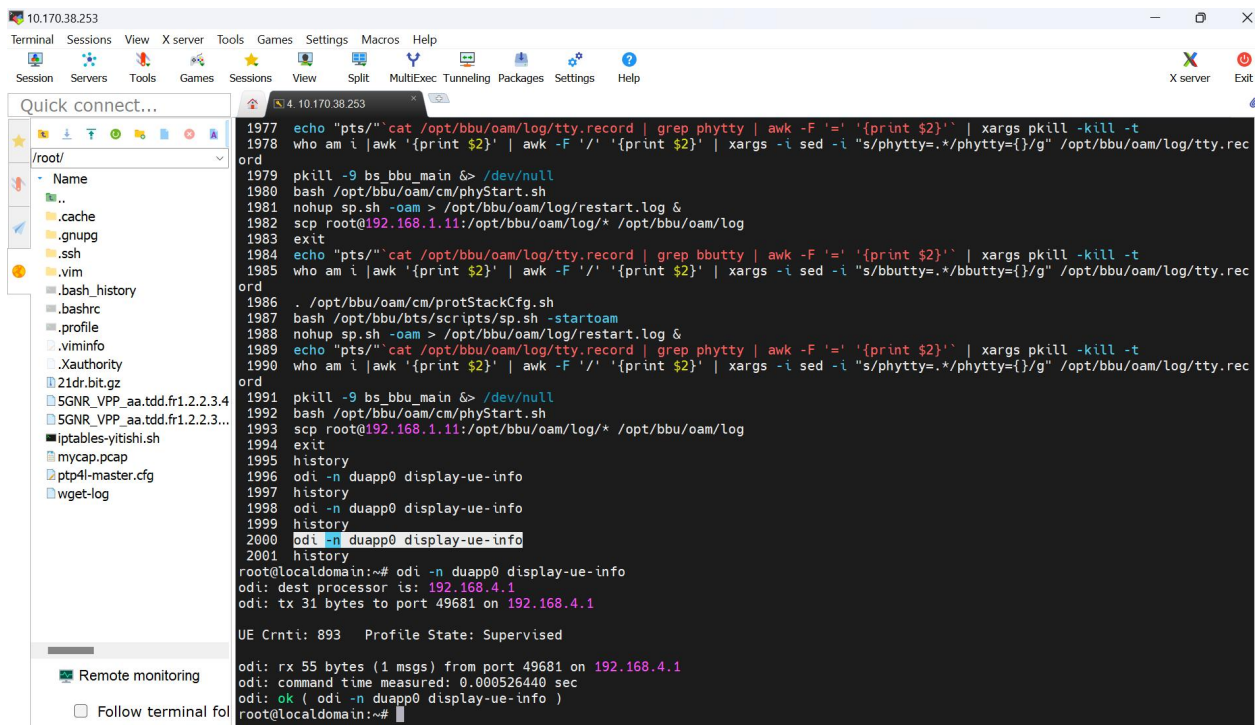
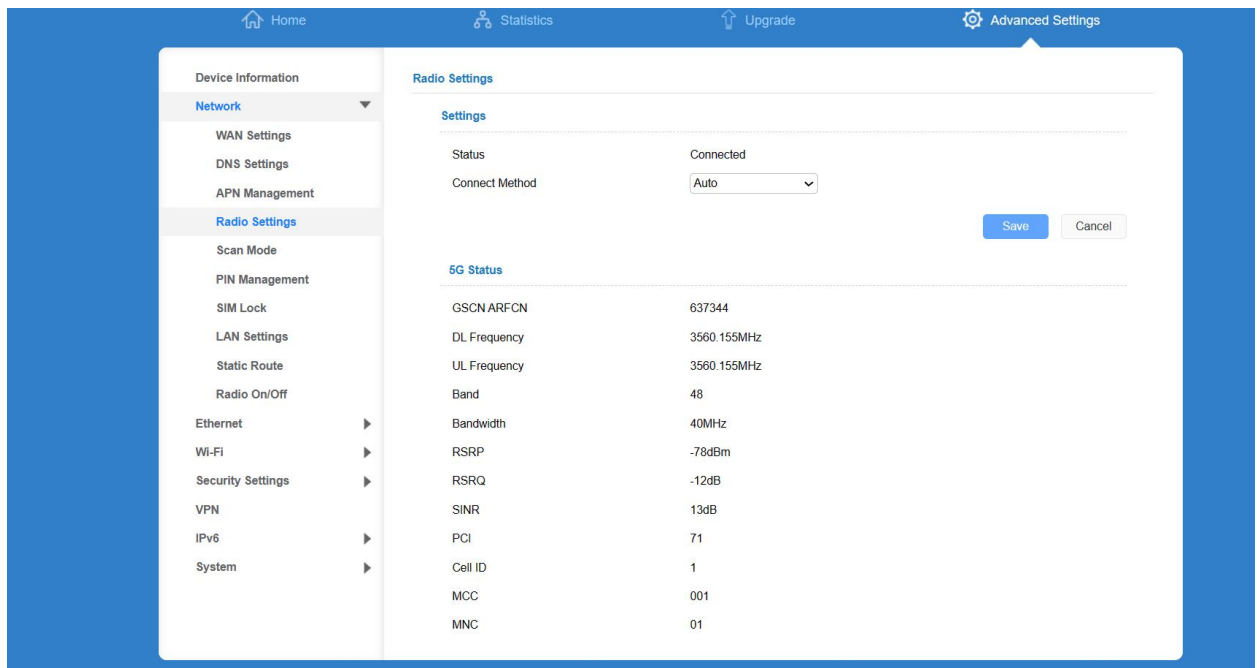
No.	Time	Source	Destination	Protocol	Length	Info
416	50.704354	10.170.38.253	10.170.38.200	SJ_NrRrcUIdcch	130	UL Information Transfer, UL NAS transport, PDU session establishment request
417	50.714393	10.170.38.253	10.170.38.200	SJ_NGAP	268	PDU Session Resource Setup Request, DL NAS transport, PDU session establishment a
419	50.718201	10.170.38.253	10.170.38.200	SJ_F1AP	166	UEContextSetupRequest
420	50.725746	10.170.38.253	10.170.38.200	SJ_F1AP	375	UEContextSetupResponse
421	50.730903	10.170.38.253	10.170.38.200	SJ_NrRrcDlDcch	495	RRC Reconfiguration, DL NAS transport, PDU session establishment accept
422	50.732189	10.170.38.253	10.170.38.200	SJ_F1AP	539	DLRRCMesageTransfer
423	50.758668	10.170.38.253	10.170.38.200	SJ_F1AP	80	ULRRCMesageTransfer
424	50.758669	10.170.38.253	10.170.38.200	SJ_NrRrcUIdcch	60	RRC Reconfiguration Complete
425	50.760559	10.170.38.253	10.170.38.200	SJ_F1AP	72	UEContextModificationRequest
426	50.761232	10.170.38.253	10.170.38.200	SJ_F1AP	76	RRCDeliveryReport
427	50.761233	10.170.38.253	10.170.38.200	SJ_F1AP	62	UEContextModificationResponse
428	50.762478	10.170.38.253	10.170.38.200	SJ_NGAP	84	PDU Session Resource SetupResponse
464	51.103710	10.170.38.253	10.170.38.200	SJ_F1AP	86	ULRRCMesageTransfer
465	51.103711	10.170.38.253	10.170.38.200	SJ_NrRrcUIdcch	60	Measurement Report
467	51.105443	10.170.38.253	10.170.38.200	SJ_F1AP	81	UEContextModificationRequest
468	51.108990	10.170.38.253	10.170.38.200	SJ_F1AP	77	UEContextModificationResponse
469	51.108991	10.170.38.253	10.170.38.200	SJ_F1AP	152	DLRRCMesageTransfer
470	51.108992	10.170.38.253	10.170.38.200	SJ_NrRrcDlDcch	111	RRC Reconfiguration
471	51.133141	10.170.38.253	10.170.38.200	SJ_F1AP	80	ULRRCMesageTransfer
472	51.133641	10.170.38.253	10.170.38.200	SJ_F1AP	76	RRCDeliveryReport
473	51.133642	10.170.38.253	10.170.38.200	SJ_NrRrcUIdcch	60	RRC Reconfiguration Complete
474	51.463814	10.170.38.253	10.170.38.200	SJ_NrRrcUIdcch	60	Measurement Report
475	51.463815	10.170.38.253	10.170.38.200	SJ_F1AP	86	ULRRCMesageTransfer

> Frame 100: 152 bytes on wire (1216 bits), 152 bytes captured (1216 bits) on interface \Device\NPF_{39965B36-7F0A-4B21-A86C-13DA77E80641}, id 0

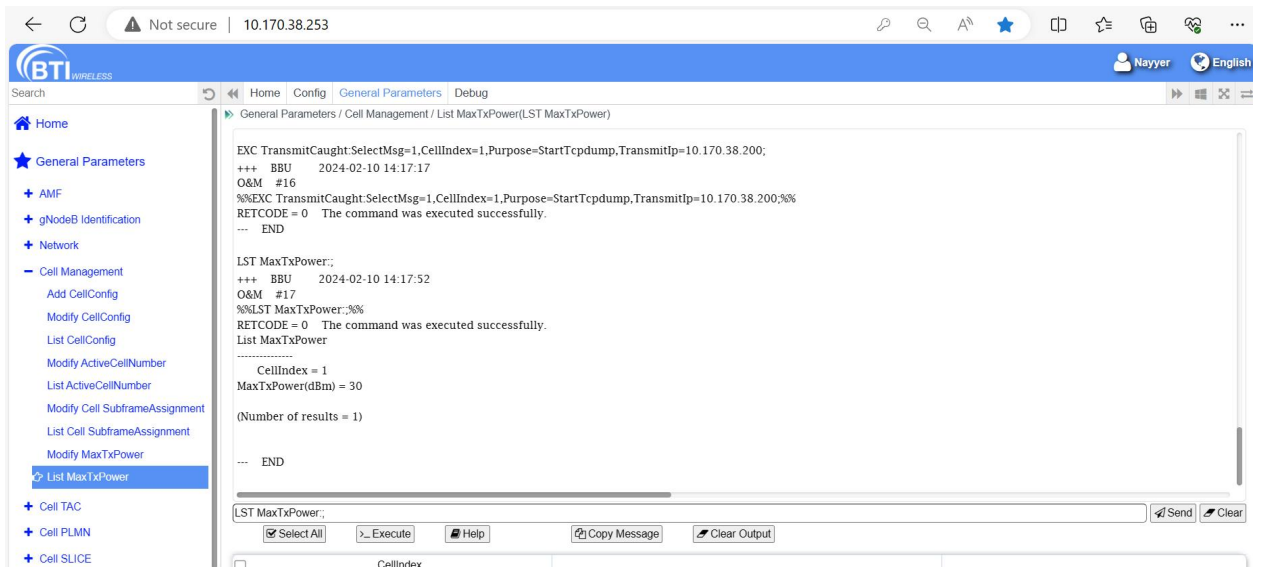
> Ethernet II, Src: SunwaveC_20:0f:28 (68:1d:64:20:0f:28), Dst: 50:91:e3:68:6d:04 (50:91:e3:68:6d:04)

> Internet Protocol Version 4, Src: 10.170.38.253, Dst: 10.170.38.200

13- Verify the CPE (with correct CRNTI) is on the Source GNB:

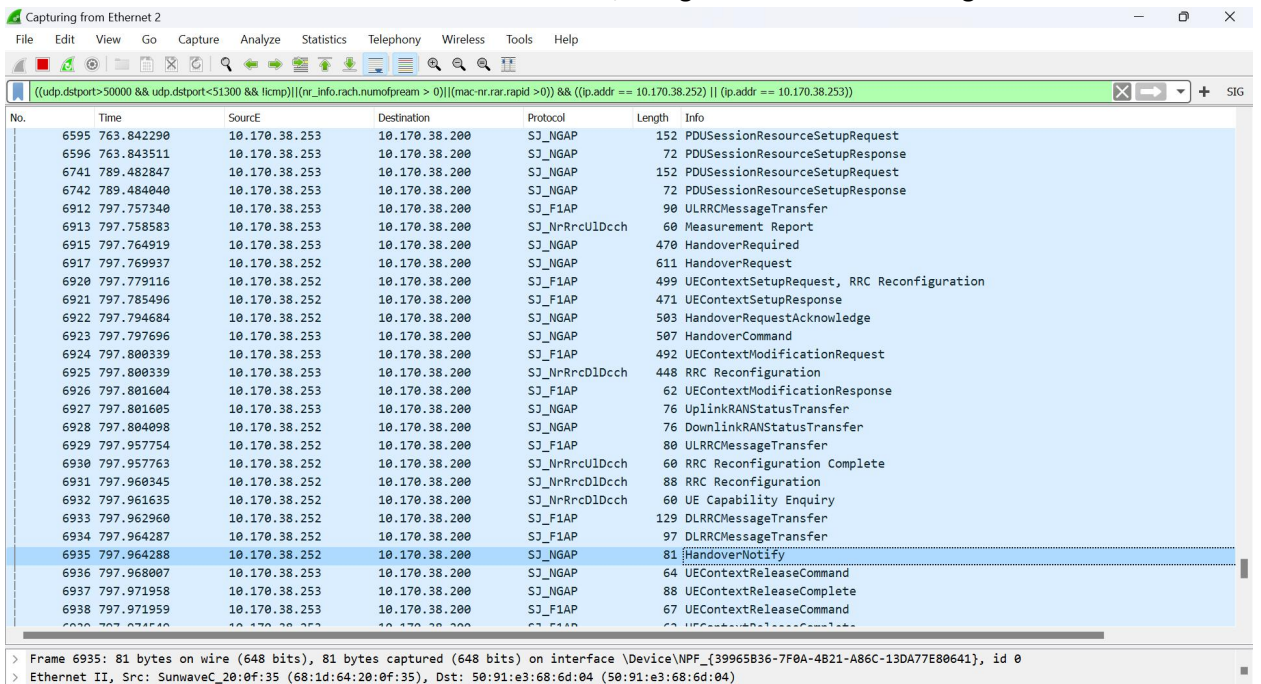


14- Starting value of TxPwr Level on the Source GNB:



15- Increase the TxPwr Level on the Target GNB, and very carefully decrease the TxPwr Level on the Source GNB until the conditions for A2 and A3 Thresholds are met.

16- Below is the screenshot of the Successful Handover, along with the Wireshark Log Attached:



17- Measurement Report:

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Filter: `((udp.dstport>50000 && udp.dstport<51300 && !icmp))|((nr_info.rach.numofpream > 0))|((mac-nr.rar.rapid > 0)) && ((ip.addr == 10.170.38.252) || (ip.addr == 10.170.38.253))`

No.	Time	Source	Destination	Protocol	Length	Info
6741	789.482847	10.170.38.253	10.170.38.200	SJ_NGAP	152	PDUSessionResourceSetupRequest
6742	789.484040	10.170.38.253	10.170.38.200	SJ_NGAP	72	PDUSessionResourceSetupResponse
6912	797.757340	10.170.38.253	10.170.38.200	SJ_F1AP	90	ULRRCCMessageTransfer
6913	797.758583	10.170.38.253	10.170.38.200	SJ_NrRrcUIdcch	60	Measurement Report
6915	797.764919	10.170.38.253	10.170.38.200	SJ_NGAP	470	HandoverRequired
6917	797.769937	10.170.38.252	10.170.38.200	SJ_NGAP	611	HandoverRequest
6920	797.779116	10.170.38.252	10.170.38.200	SJ_F1AP	499	UEContextSetupRequest, RRC Reconfiguration

```

measurementReport
  measResults
    measId: 2
    measResultServingMOList: 1 item
      Item 0
        MeasResultServMO
          servCellId: 0
          measResultServingCell
            physCellId: 71
            measResult
              cellResults
                resultsSSB-Cell
                  rsrp: -109dBm <= SS-RSRP < -108dBm (48)
                  rsrq: -25.5dB <= SS-RSRQ < -25.0dB (36)
    measResultNeighCells: measResultListNR (0)
      measResultListNR: 1 item
        Item 0
          MeasResultNR
            physCellId: 31
            measResult
              cellResults
                resultsSSB-Cell
                  rsrp: -78dBm <= SS-RSRP < -77dBm (79)

```

18- Handover Required:

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Filter: `((udp.dstport>50000 && udp.dstport<51300 && !icmp))|((nr_info.rach.numofpream > 0))|((mac-nr.rar.rapid > 0)) && ((ip.addr == 10.170.38.252) || (ip.addr == 10.170.38.253))`

No.	Time	Source	Destination	Protocol	Length	Info
6742	789.484040	10.170.38.253	10.170.38.200	SJ_NGAP	72	PDUSessionResourceSetupResponse
6912	797.757340	10.170.38.253	10.170.38.200	SJ_F1AP	90	ULRRCCMessageTransfer
6913	797.758583	10.170.38.253	10.170.38.200	SJ_NrRrcUIdcch	60	Measurement Report
6915	797.764919	10.170.38.253	10.170.38.200	SJ_NGAP	470	HandoverRequired
6917	797.769937	10.170.38.252	10.170.38.200	SJ_NGAP	611	HandoverRequest
6920	797.779116	10.170.38.252	10.170.38.200	SJ_F1AP	499	UEContextSetupRequest, RRC Reconfiguration
6921	797.785496	10.170.38.252	10.170.38.200	SJ_F1AP	471	UEContextSetupResponse
6922	797.794684	10.170.38.252	10.170.38.200	SJ_NGAP	503	HandoverRequestAcknowledge
6923	797.797696	10.170.38.253	10.170.38.200	SJ_NGAP	507	HandoverCommand
6924	797.800339	10.170.38.253	10.170.38.200	SJ_F1AP	492	UEContextModificationRequest
6925	797.800339	10.170.38.253	10.170.38.200	SJ_NrRrcUIdcch	448	RRC Reconfiguration

```

nR-CGI
  plmnIdentity: 00f110
    Mobile Country Code (MCC): Unknown (1)
    Mobile Network Code (MNC): Unknown (01)
    nRCellIdentity: 0x00003f0001
  indexToRFSP: 1
  uEHistoryInformation: 1 item
    Item 0
      LastVisitedCellItem
        lastVisitedCellInformation: nGRANCell (0)
          nGRANCell
            globalCellId: nR-CGI (0)
            nR-CGI
              plmnIdentity: 00f110
                Mobile Country Code (MCC): Unknown (1)
                Mobile Network Code (MNC): Unknown (01)
                nRCellIdentity: 0x00003f4001
            cellType
              cellSize: medium (2)

```

19- Handover Request:

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Filter: `((udp.dstport>50000 && udp.dstport<51300 && !icmp))((nr_info.rach.numofpream > 0))((mac-nr.rar.rapid > 0)) && ((ip.addr == 10.170.38.252) || (ip.addr == 10.170.38.253))`

No.	Time	Source	Destination	Protocol	Length	Info
6742	789.484040	10.170.38.253	10.170.38.200	SJ_NGAP	72	PDU Session Resource Setup Response
6912	797.757340	10.170.38.253	10.170.38.200	SJ_F1AP	90	ULRRCMessagerTransfer
6913	797.758583	10.170.38.253	10.170.38.200	SJ_NrRrcUIdcch	60	Measurement Report
6915	797.764919	10.170.38.253	10.170.38.200	SJ_NGAP	470	Handover Required
6917	797.769937	10.170.38.252	10.170.38.200	SJ_NGAP	611	Handover Request
6920	797.779116	10.170.38.252	10.170.38.200	SJ_F1AP	499	UE Context Setup Request, RRC Reconfiguration
6921	797.785496	10.170.38.252	10.170.38.200	SJ_F1AP	471	UE Context Setup Response
6922	797.794684	10.170.38.252	10.170.38.200	SJ_NGAP	503	Handover Request Acknowledge
6923	797.797696	10.170.38.253	10.170.38.200	SJ_NGAP	507	Handover Command
6924	797.800339	10.170.38.253	10.170.38.200	SJ_F1AP	492	UE Context Modification Request
6925	797.800339	10.170.38.253	10.170.38.200	SJ_NrRrcDlDcch	448	RRC Reconfiguration

- PLMN Identity: 00f110
 - Mobile Country Code (MCC): Unknown (1)
 - Mobile Network Code (MNC): Unknown (01)
 - aMFRegionID: 01 [bit length 8, 0000 0001 decimal value 1]
 - aMFSetID: 0040 [bit length 10, 6 LSB pad bits, 0000 0000 01.. decimal value 1]
 - aMFPPointer: 04 [bit length 6, 2 LSB pad bits, 0000 01.. decimal value 1]
 - Item 10: id-MobilityRestrictionList
 - ProtocolIE-Field
 - id: id-MobilityRestrictionList (36)
 - criticality: ignore (1)
 - value
 - MobilityRestrictionList
 - servingPLMN: 00f110
 - Mobile Country Code (MCC): Unknown (1)
 - Mobile Network Code (MNC): Unknown (01)
 - rATRestrictions: 1 item
 - Item 0
 - RATRestrictions-Item

20- Handover Request Acknowledgement:

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Filter: `((udp.dstport>50000 && udp.dstport<51300 && !icmp))((nr_info.rach.numofpream > 0))((mac-nr.rar.rapid > 0)) && ((ip.addr == 10.170.38.252) || (ip.addr == 10.170.38.253))`

No.	Time	Source	Destination	Protocol	Length	Info
6742	789.484040	10.170.38.253	10.170.38.200	SJ_NGAP	72	PDU Session Resource Setup Response
6912	797.757340	10.170.38.253	10.170.38.200	SJ_F1AP	90	ULRRCMessagerTransfer
6913	797.758583	10.170.38.253	10.170.38.200	SJ_NrRrcUIdcch	60	Measurement Report
6915	797.764919	10.170.38.253	10.170.38.200	SJ_NGAP	470	Handover Required
6917	797.769937	10.170.38.252	10.170.38.200	SJ_NGAP	611	Handover Request
6920	797.779116	10.170.38.252	10.170.38.200	SJ_F1AP	499	UE Context Setup Request, RRC Reconfiguration
6921	797.785496	10.170.38.252	10.170.38.200	SJ_F1AP	471	UE Context Setup Response
6922	797.794684	10.170.38.252	10.170.38.200	SJ_NGAP	503	Handover Request Acknowledge
6923	797.797696	10.170.38.253	10.170.38.200	SJ_NGAP	507	Handover Command
6924	797.800339	10.170.38.253	10.170.38.200	SJ_F1AP	492	UE Context Modification Request
6925	797.800339	10.170.38.253	10.170.38.200	SJ_NrRrcDlDcch	448	RRC Reconfiguration

- value
 - RAN-UE-NGAP-ID: 25
 - Item 2: id-PDUSessionResourceAdmittedList
 - ProtocolIE-Field
 - id: id-PDUSessionResourceAdmittedList (53)
 - criticality: ignore (1)
 - value
 - PDUSessionResourceAdmittedList: 1 item
 - Item 0
 - PDU Session Resource Admitted Item
 - pduSessionID: 1
 - handoverRequestAcknowledgeTransfer: 2007c00aaa26fc0000001f140004
 - HandoverRequestAcknowledgeTransfer
 - dL-NGU-UP-TNLInformation: gTPTunnel (0)
 - gTPTunnel
 - transportLayerAddress: 0aaa26fc [bit length 32, 0000 1010 1010 1010 0010 0110 1111 1100 decimal value 178923260]
 - TransportLayerAddress (IPv4): 10.170.38.252
 - gTP-TEID: 0000001f

21- Handover Command:

| No. | Time | Source | Destination | Protocol | Length | Info |
|------|------------|---------------|---------------|----------------|--------|--|
| 6917 | 797.769937 | 10.170.38.252 | 10.170.38.200 | SJ_NGAP | 611 | HandoverRequest |
| 6920 | 797.779116 | 10.170.38.252 | 10.170.38.200 | SJ_F1AP | 499 | UEContextSetupRequest, RRC Reconfiguration |
| 6921 | 797.785496 | 10.170.38.252 | 10.170.38.200 | SJ_F1AP | 471 | UEContextSetupResponse |
| 6922 | 797.794684 | 10.170.38.252 | 10.170.38.200 | SJ_NGAP | 503 | HandoverRequestAcknowledge |
| 6923 | 797.797696 | 10.170.38.253 | 10.170.38.200 | SJ_NGAP | 507 | HandoverCommand |
| 6924 | 797.800339 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 492 | UEContextModificationRequest |
| 6925 | 797.800339 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcDlDcch | 448 | RRC Reconfiguration |
| 6926 | 797.801604 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 62 | UEContextModificationResponse |
| 6927 | 797.801605 | 10.170.38.253 | 10.170.38.200 | SJ_NGAP | 76 | UplinkRANStatusTransfer |
| 6928 | 797.804098 | 10.170.38.252 | 10.170.38.200 | SJ_NGAP | 76 | DownlinkRANStatusTransfer |
| 6929 | 797.957754 | 10.170.38.252 | 10.170.38.200 | SJ_F1AP | 80 | ULRRCTestMessageTransfer |

Cell: 0

- NG Application Protocol
 - NGAP-PDU: successfulOutcome (1)
 - successfulOutcome
 - procedureCode: id-HandoverPreparation (12)
 - criticality: reject (0)
 - value
 - HandoverCommand
 - protocolIEs: 5 items
 - Item 0: id-AMF-UE-NGAP-ID
 - ProtocolIE-Field
 - id: id-AMF-UE-NGAP-ID (10)
 - criticality: reject (0)
 - value
 - AMF-UE-NGAP-ID: 3256
 - Item 1: id-RAN-UE-NGAP-ID
 - ProtocolIE-Field
 - id: id-RAN-UE-NGAP-ID (85)
 - criticality: reject (0)

22- Handover Notify:

| No. | Time | Source | Destination | Protocol | Length | Info |
|------|------------|---------------|---------------|----------------|--------|-------------------------------|
| 6926 | 797.801604 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 62 | UEContextModificationResponse |
| 6927 | 797.801605 | 10.170.38.253 | 10.170.38.200 | SJ_NGAP | 76 | UplinkRANStatusTransfer |
| 6928 | 797.804098 | 10.170.38.252 | 10.170.38.200 | SJ_NGAP | 76 | DownlinkRANStatusTransfer |
| 6929 | 797.957754 | 10.170.38.252 | 10.170.38.200 | SJ_F1AP | 80 | ULRRCTestMessageTransfer |
| 6930 | 797.957763 | 10.170.38.252 | 10.170.38.200 | SJ_NrRrcUlDcch | 60 | RRC Reconfiguration Complete |
| 6931 | 797.960345 | 10.170.38.252 | 10.170.38.200 | SJ_NrRrcDlDcch | 88 | RRC Reconfiguration |
| 6932 | 797.961635 | 10.170.38.252 | 10.170.38.200 | SJ_NrRrcDlDcch | 60 | UE Capability Enquiry |
| 6933 | 797.962960 | 10.170.38.252 | 10.170.38.200 | SJ_F1AP | 129 | DLRRCTestMessageTransfer |
| 6934 | 797.964287 | 10.170.38.252 | 10.170.38.200 | SJ_F1AP | 97 | DLRRCTestMessageTransfer |
| 6935 | 797.964288 | 10.170.38.252 | 10.170.38.200 | SJ_NGAP | 81 | HandoverNotify |
| 6936 | 797.968007 | 10.170.38.253 | 10.170.38.200 | SJ_NGAP | 64 | UEContextReleaseCommand |

Cell: 0

- NG Application Protocol
 - NGAP-PDU: initiatingMessage (0)
 - initiatingMessage
 - procedureCode: id-HandoverNotification (11)
 - criticality: ignore (1)
 - value
 - HandoverNotify
 - protocolIEs: 3 items
 - Item 0: id-AMF-UE-NGAP-ID
 - ProtocolIE-Field
 - id: id-AMF-UE-NGAP-ID (10)
 - criticality: reject (0)
 - value
 - AMF-UE-NGAP-ID: 3257
 - Item 1: id-RAN-UE-NGAP-ID
 - ProtocolIE-Field
 - id: id-RAN-UE-NGAP-ID (85)
 - criticality: reject (0)

Ng Inter-Frequency Handover (M4370):

- 1- Inter-Frequency Handover from PCI 71 (10.170.38.253) to PCI 31 (10.170.38.252):

- 2- Connect the laptop to the main Network using the Router and switch in order to monitor traffic & signaling for both of the GNB above using Wireshark
- 3- Verify the IP Address of laptop (connected to CPE) by using ipconfig below:

```
Command Prompt
Windows IP Configuration

Ethernet adapter Ethernet 2:

    Connection-specific DNS Suffix  . : 
    Link-local IPv6 Address . . . . . : fe80::2d90:4b52:6801:2172%6
    IPv4 Address. . . . . : 10.170.38.200
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 10.170.38.1
```

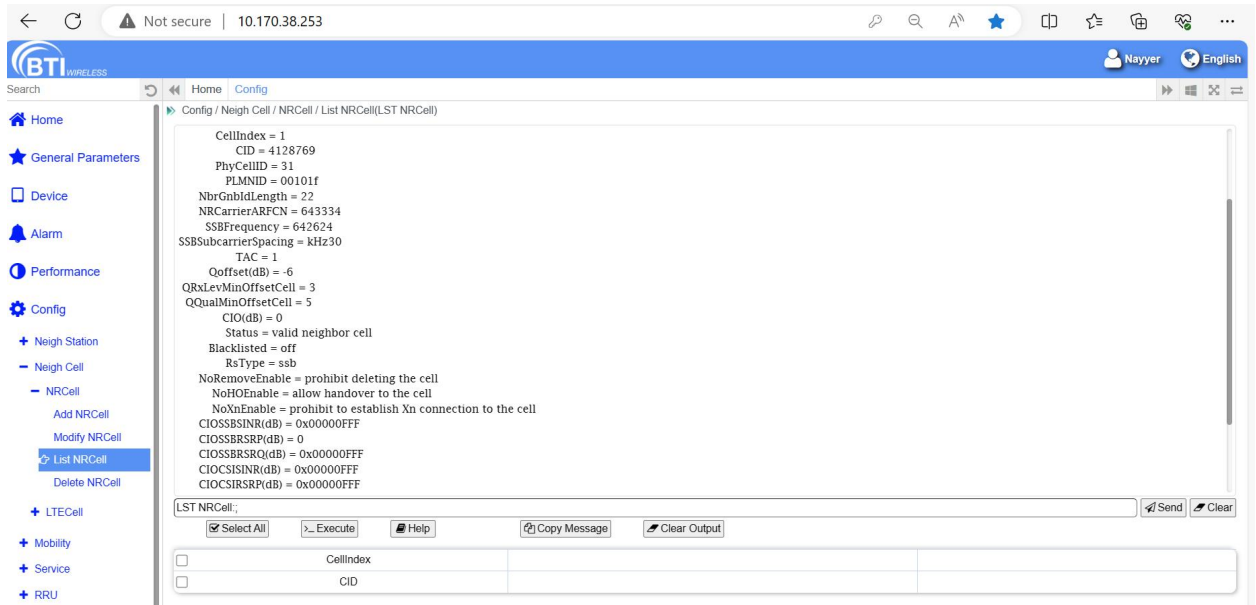
- 4- Start a continuous ping from the laptop connected to the CPE, to make sure the connected Mode stays on (needed for HO):

```
Command Prompt

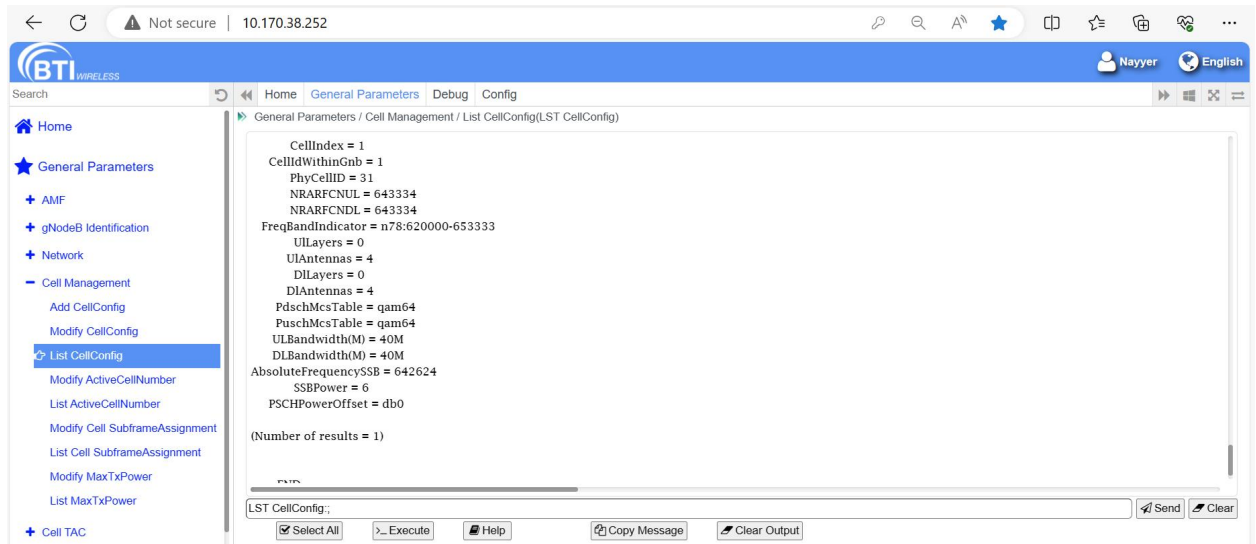
C:\Users\Nayyer>ping 1.1.1.1 -t

Pinging 1.1.1.1 with 32 bytes of data:
Reply from 1.1.1.1: bytes=32 time=7ms TTL=56
Reply from 1.1.1.1: bytes=32 time=7ms TTL=56
Reply from 1.1.1.1: bytes=32 time=8ms TTL=56
Reply from 1.1.1.1: bytes=32 time=8ms TTL=56
Reply from 1.1.1.1: bytes=32 time=7ms TTL=56
Reply from 1.1.1.1: bytes=32 time=8ms TTL=56
Reply from 1.1.1.1: bytes=32 time=7ms TTL=56
Reply from 1.1.1.1: bytes=32 time=8ms TTL=56
Reply from 1.1.1.1: bytes=32 time=8ms TTL=56
Reply from 1.1.1.1: bytes=32 time=7ms TTL=56
```

- 5- While making sure the "Frequency for Target Cell is updated with the correct ARFCN, Absolute SSB, and NR Band, Build the NR Cell Relation (from Source to Target GNB below):



6- Verify the Cell Information on the Target GNB (PCI 31):



7- Confirm that A5 is turned ON from the Target GNB:

Most important parameter to configure in an Inter-Frequency Handover is the A5 Thresh-hold value, in addition to the A2

For a successful Inter-Frequency HO to happen and A5 Event:

Serving Cell should become worse than threshold1

Neighbor Target Cell should become better than threshold2

A5 has 2 Thresholds that need to be configured as seen in below screenshot:

A5 Thd.1: defined signal threshold for serving cell. (96 dB which is -60 dBm)

A5 Thd.2: defined signal threshold for neighbor cell. (56 dB which is -100 dBm)

BTI WIRELESS

Home / Config

Config / Mobility / A5MeasureCtrl / List A5MeasureCtrl(LST A5MeasureCtrl)

CIOCSIRSRP(dB) = 0x00000FFF
CIOCSIRSRQ(dB) = 0x00000FFF

(Number of results = 1)

--- END

LST A5MeasureCtrl;
+++ BBU 2024-02-11 14:39:30
O&M #5
%%LST A5MeasureCtrl;%%
RETCODE = 0 The command was executed successfully.
List A5MeasureCtrl

| CellIndex | A5MeasureCtrlIndex | Enable | A5Threshold1RSRP(dB) | A5Threshold1RSRQ(0.5dB) | A5Threshold1SINR | A5Threshold2RSRP(dB) | A5Threshold2RSRQ(0.5dB) | A5Threshold2SINR | Hysteresis | | | | | |
|-----------|--------------------|--------|----------------------|-------------------------|------------------|----------------------|-------------------------|------------------|------------|---|---|--------|-------|-------|
| 1 | 1 | on | 96 | 12 | 43 | 56 | 12 | 43 | 16 | 6 | 1 | 1 time | 240ms | 128ms |
| 1 | 2 | off | 22 | 12 | 43 | 22 | 12 | 43 | 16 | 6 | 3 | 1 time | 240ms | 128ms |

(Number of results = 2)

--- END

LST A5MeasureCtrl;

Select All Execute Help Copy Message Clear Output

CellIndex
A5MeasureCtrlIndex

8- Verify A2 is Turned ON from Source GNB (Verify Threshold values):

BTI WIRELESS

Home / Config

Config / Mobility / A2MeasureCtrl / List A2MeasureCtrl(LST A2MeasureCtrl)

CellIndex A2MeasureCtrlIndex Enable A2Threshold1RSRP(dB) A2Threshold1RSRQ(0.5dB) A2Threshold1SINR A2Threshold2RSRP(dB) A2Threshold2RSRQ(0.5dB) A2Threshold2SINR Hysteresis

| | | | | | | | | | | | | | | |
|---|---|-----|----|----|----|----|----|----|----|---|---|--------|-------|-------|
| 1 | 1 | on | 96 | 12 | 43 | 56 | 12 | 43 | 16 | 6 | 1 | 1 time | 240ms | 128ms |
| 1 | 2 | off | 22 | 12 | 43 | 22 | 12 | 43 | 16 | 6 | 3 | 1 time | 240ms | 128ms |

(Number of results = 2)

--- END

LST A2MeasureCtrl;
+++ BBU 2024-02-11 14:41:28
O&M #6
%%LST A2MeasureCtrl;%%
RETCODE = 0 The command was executed successfully.
List A2MeasureCtrl

| CellIndex | A2MeasureCtrlIndex | Enable | A2Threshold1RSRP(dB) | A2Threshold1RSRQ(0.5dB) | A2Threshold1SINR | A2Threshold2RSRP(dB) | A2Threshold2RSRQ(0.5dB) | A2Threshold2SINR | Hysteresis(0.5dB) | MaxReportCells | MeasurePurpose | ReportAmount(time) | ReportInt |
|-----------|--------------------|--------|----------------------|-------------------------|------------------|----------------------|-------------------------|------------------|-------------------|----------------|----------------|--------------------|---------------|
| 1 | 1 | on | 90 | 0 | 0 | 2 | 1 | 1 | 1 time | 240ms | 320ms | ssb off | rsrp Event de |
| 1 | 2 | off | 35 | 0 | 0 | 2 | 1 | 2 | 1 time | 240ms | 320ms | ssb off | rsrp Event de |

(Number of results = 2)

--- END

LST A2MeasureCtrl;

Select All Execute Help Copy Message Clear Output

CellIndex
A2MeasureCtrlIndex

9- Confirm that A1 and A3 are both Turned OFF:

← ↻ 🔒 Not secure | 10.170.38.253

BTI WIRELESS

Search Home Config

Alarm

Performance

Config

- + Neigh Station
- + Neigh Cell
- Mobility
 - + SI Parameters
 - + MeasureCtrl
 - A1MeasureCtrl
 - Add A1MeasureCtrl
 - Modify A1MeasureCtrl
 - List A1MeasureCtrl
 - Delete A1MeasureCtrl
 - Add PimnidA1
 - Modify PimnidA1
 - List PimnidA1
 - Delete PimnidA1

Config / Mobility / A1MeasureCtrl / List A1MeasureCtrl(LST A1MeasureCtrl)

```
CellIndex A2MeasureCtrlIndex Enable A2ThresholdRSRP(dB) A2ThresholdRSRQ(0.5dB) A2ThresholdSINR Hysteresis(0.5dB) MaxReportCells MeasurePurpose ReportAmount(time) ReportInterval
1 1 on 90 0 0 2 1 1 1 time 240ms 320ms ssb off rsrp Event de
1 2 off 35 0 0 2 1 2 1 time 240ms 320ms ssb off rsrp
(Number of results = 2)

--- END

LST A1MeasureCtrl;
+++ BBU 2024-02-11 14:43:20
O&M #7
%%LST A1MeasureCtrl;%%
RETCODE = 0 The command was executed successfully.
List A1MeasureCtrl
-----
CellIndex A1MeasureCtrlIndex Enable A1ThresholdRSRP(dB) A1ThresholdRSRQ(0.5dB) A1ThresholdSINR(dB) Hysteresis(0.5dB) MaxReportCells MeasurePurpose ReportAmount(time) ReportInterval
1 1 off 60 12 43 16 6 1 1 time 240ms 512ms ssb on NULL r
1 2 off 50 42 43 16 6 2 1 time 240ms 128ms ssb on NULL r
(Number of results = 2)

--- END
```

LST A1MeasureCtrl;

Select All Execute Help Copy Message Clear Output

← ↻ 🔒 Not secure | 10.170.38.253

BTI WIRELESS

Search Home Config

Alarm

Performance

Config

- + Neigh Station
- + Neigh Cell
- Mobility
 - + SI Parameters
 - + MeasureCtrl
 - + A1MeasureCtrl
 - + A2MeasureCtrl
 - A3MeasureCtrl
 - Add A3MeasureCtrl
 - Modify A3MeasureCtrl
 - List A3MeasureCtrl
 - Delete A3MeasureCtrl
 - Add PimnidA3
 - Modify PimnidA3
 - List PimnidA3
 - Delete PimnidA3

Config / Mobility / A3MeasureCtrl / List A3MeasureCtrl(LST A3MeasureCtrl)

```
CellIndex A1MeasureCtrlIndex Enable A1ThresholdRSRP(dB) A1ThresholdRSRQ(0.5dB) A1ThresholdSINR(dB) Hysteresis(0.5dB) MaxReportCells MeasurePurpose ReportAmount(time) ReportInterval
1 1 off 60 12 43 16 6 1 1 time 240ms 512ms ssb on NULL r
1 2 off 50 42 43 16 6 2 1 time 240ms 128ms ssb on NULL r
(Number of results = 2)

--- END

LST A3MeasureCtrl;
+++ BBU 2024-02-11 14:43:59
O&M #8
%%LST A3MeasureCtrl;%%
RETCODE = 0 The command was executed successfully.
List A3MeasureCtrl
-----
CellIndex A3MeasureCtrlIndex Enable A3OffsetRSRP(0.5dB) A3OffsetRSRQ(0.5dB) A3OffsetSINR(0.5dB) Hysteresis(0.5dB) MaxReportCells MeasurePurpose ReportAmount(time) ReportInterval
1 1 off 2 0 0 2 4 1 1 time 240ms 320ms off ssb on rsrp
1 2 off 22 -12 -15 16 6 2 1 time 240ms 128ms off ssb on rsrp
(Number of results = 2)

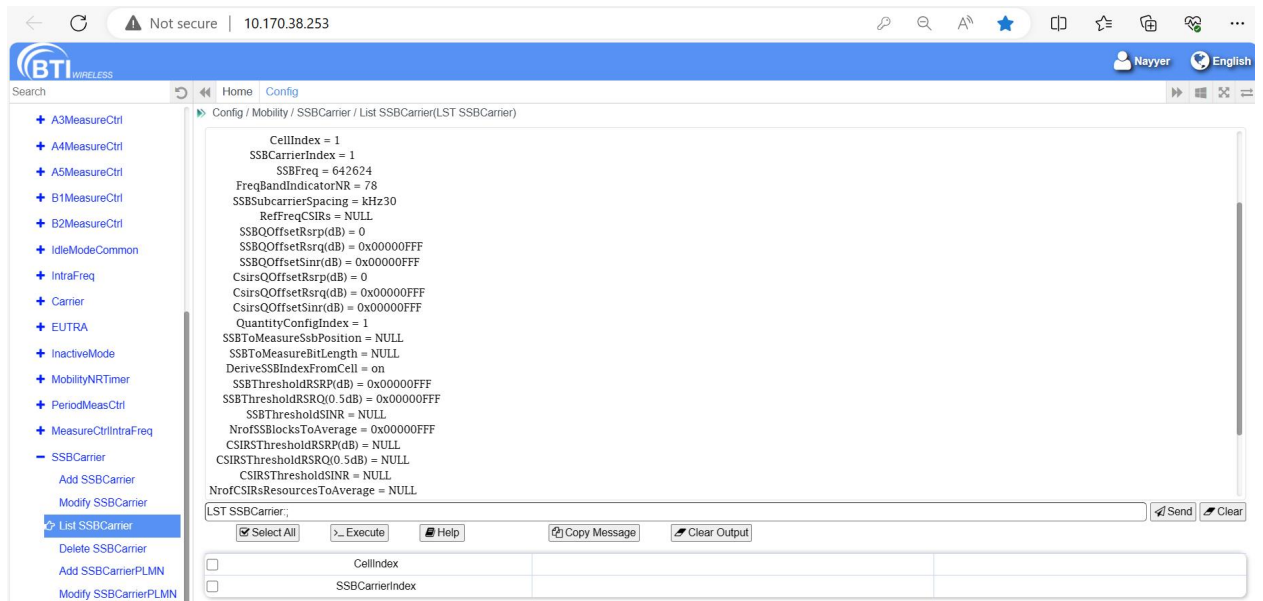
--- END
```

LST A3MeasureCtrl;

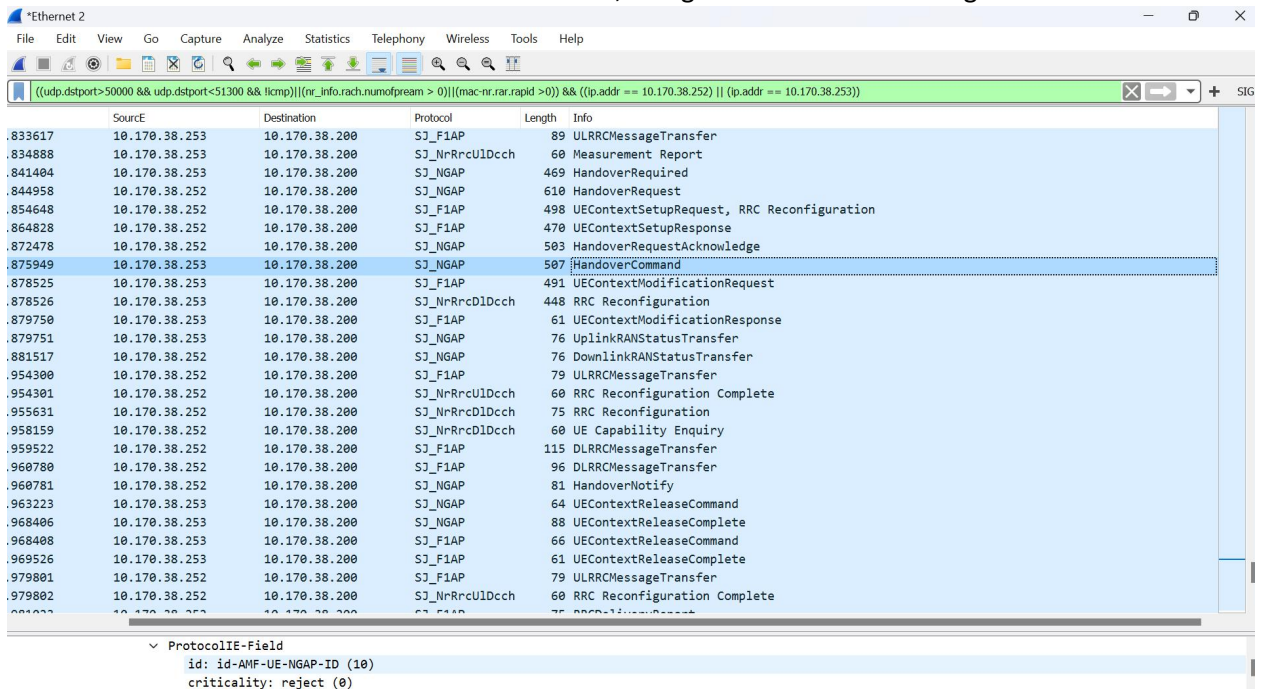
Select All Execute Help Copy Message Clear Output

| | | | |
|--------------------------|--------------------|--|--|
| <input type="checkbox"/> | CellIndex | | |
| <input type="checkbox"/> | A3MeasureCtrlIndex | | |

10- SSB Carrier List with correct values:



11- Below is the screenshot of the Successful Handover, along with the Wireshark Log Attached:



12- Measurement Report (Measure ID 1):

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

((udp.dstport>50000 && udp.dstport<51300 && !icmp))((nr_info.rach.numofpream > 0))((mac-nr.rar.rapid > 0)) && ((ip.addr == 10.170.38.252) || (ip.addr == 10.170.38.253))

| | Source | Destination | Protocol | Length | Info |
|--------|---------------|---------------|----------------|--------|-------------------------------|
| 624327 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 85 | ULRRCTestTransfer |
| 625579 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcULDcch | 60 | Measurement Report |
| 626876 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 80 | UEContextModificationRequest |
| 628087 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 76 | UEContextModificationResponse |
| 629268 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 150 | DLRRCTestTransfer |
| 629269 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcDlDcch | 110 | RRC Reconfiguration |
| 644451 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcULDcch | 60 | RRC Reconfiguration Complete |
| 644452 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 79 | ULRRCTestTransfer |
| 645811 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 75 | RRCDeliveryReport |

Length: 16
Checksum: 0x617b [unverified]
[Checksum Status: Unverified]
[Stream index: 21]
[Timestamps]
[Time since first frame: 242.190854000 seconds]
[Time since previous frame: 0.360522000 seconds]
CpCellApp
Cell: 0
NR Radio Resource Control (RRC) protocol
UL-DCCH-Message
message: c1 (0)
c1: measurementReport (0)
measurementReport
criticalExtensions: measurementReport (0)
measurementReport
measResults
measId: 1
measResultServingMOList: 1 item
Item 0
MeasResultServMO

13- Measurement Report (Measure ID 2) – Just before HO Required message:

*Ethernet 2

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

((udp.dstport>50000 && udp.dstport<51300 && !icmp))((nr_info.rach.numofpream > 0))((mac-nr.rar.rapid > 0)) && ((ip.addr == 10.170.38.252) || (ip.addr == 10.170.38.253))

| | Source | Destination | Protocol | Length | Info |
|--------|---------------|---------------|----------------|--------|------------------------------|
| 629268 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 150 | DLRRCTestTransfer |
| 629269 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcDlDcch | 110 | RRC Reconfiguration |
| 644451 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcULDcch | 60 | RRC Reconfiguration Complete |
| 644452 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 79 | ULRRCTestTransfer |
| 645811 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 75 | RRCDeliveryReport |
| 833617 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 89 | ULRRCTestTransfer |
| 834888 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcULDcch | 60 | Measurement Report |
| 841404 | 10.170.38.253 | 10.170.38.200 | SJ_MGAP | 469 | HandoverRequired |
| 841405 | 10.170.38.253 | 10.170.38.200 | SJ_MGAP | 510 | HandoverRequest |

NR Radio Resource Control (RRC) protocol
UL-DCCH-Message
message: c1 (0)
c1: measurementReport (0)
measurementReport
criticalExtensions: measurementReport (0)
measurementReport
measResults
measId: 2
measResultServingMOList: 1 item
Item 0
MeasResultServMO
measResultNeighCells: measResultListNR (0)
measResultListNR: 1 item
Item 0
MeasResultNR
physCellId: 31
measResult
cellResults
resultsSSB-Cell
rsrp: -89dBm <= SS-RSRP < -88dBm (68)

14- RRC ReConfig Message - Measurement ID 1 linked with A2 Threshold:

Successful_Inter-Frequency-HO.pcapng

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Filter: `((udp.dstport>50000 && udp.dstport<51300 && !icmp))[(nr_info.rach.numofpream > 0)][(mac-nr.rar.rapid > 0)] && ((ip.addr == 10.170.38.252) || (ip.addr == 10.170.38.253))`

| | SourceE | Destination | Protocol | Length | Info |
|--------|---------------|---------------|----------------|--------|-------------------------------|
| 625579 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcUIdcch | 60 | Measurement Report |
| 626876 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 80 | UEContextModificationRequest |
| 628087 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 76 | UEContextModificationResponse |
| 629268 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 150 | DLRRCMesageTransfer |
| 629269 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcUIdcch | 110 | RRC Reconfiguration |
| 644451 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcUIdcch | 60 | RRC Reconfiguration Complete |
| 644452 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 79 | ULRRCMesageTransfer |
| 645811 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 75 | RRCDeliveryReport |
| 833617 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 89 | ULRRCMesageTransfer |

```

    MeasObjectToAddMod
      measObjectId: 1
      measObject: measObjectNR (0)
        measObjectNR
          ssbFrequency: 637344
          ssbSubcarrierSpacing: kHz30 (1)
          smtc1
            periodicityAndOffset: sf20 (2)
              sf20: 0
              duration: sf1 (0)
          smtc2
            periodicity: sf10 (1)
            refFreqCSI-RS: 636728
          referenceSignalConfig
            ssb-ConfigMobility
              1... .. deriveSSB-IndexFromCell: True
            nrofSS-BlocksToAverage: 2
            quantityConfigIndex: 1
            offsetMO
  
```

Successful_Inter-Frequency-HO.pcapng

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Filter: `((udp.dstport>50000 && udp.dstport<51300 && !icmp))[(nr_info.rach.numofpream > 0)][(mac-nr.rar.rapid > 0)] && ((ip.addr == 10.170.38.252) || (ip.addr == 10.170.38.253))`

| | SourceE | Destination | Protocol | Length | Info |
|--------|---------------|---------------|----------------|--------|-------------------------------|
| 625579 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcUIdcch | 60 | Measurement Report |
| 626876 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 80 | UEContextModificationRequest |
| 628087 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 76 | UEContextModificationResponse |
| 629268 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 150 | DLRRCMesageTransfer |
| 629269 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcUIdcch | 110 | RRC Reconfiguration |
| 644451 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcUIdcch | 60 | RRC Reconfiguration Complete |
| 644452 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 79 | ULRRCMesageTransfer |
| 645811 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 75 | RRCDeliveryReport |
| 833617 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 89 | ULRRCMesageTransfer |

```

    Item 0
      ReportConfigToAddMod
        reportConfigId: 1
        reportConfig: reportConfigNR (0)
          reportConfigNR
            reportType: eventTriggered (1)
              eventTriggered
                eventId: eventA2 (1)
                  eventA2
                    a2-Threshold: rsrp (0)
                      rsrp: -67dBm <= SS-RSRP < -66dBm (90)
                      .... .. reportOnLeave: False
                      hysteresis: 1dB (2)
                      timeToTrigger: ms320 (8)
                    rsType: ssb (0)
                    reportInterval: ms240 (1)
                    reportAmount: r1 (0)
                  reportQuantityCell
                    1... .. rsrp: True
                    .0.. .. rsrq: False
                    0 .. .. rsrq: False
  
```

15- RRC Reconfig Message - Measurement ID 2 linked with A5 Threshold:

Successful_Inter-Frequency-HO.pcapng

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Filter: `((udp.dstport>50000 && udp.dstport<51300 && !icmp))((nr_info.rach.numofpream > 0))((mac-nr.rar.rapid > 0)) && ((ip.addr == 10.170.38.252) || (ip.addr == 10.170.38.253))`

| No. | Source | Destination | Protocol | Length | Info |
|--------|---------------|---------------|----------------|--------|-------------------------------|
| 625579 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcUIdcch | 60 | Measurement Report |
| 626876 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 80 | UEContextModificationRequest |
| 628087 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 76 | UEContextModificationResponse |
| 629268 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 150 | DLRRMessageTransfer |
| 629269 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcUIdcch | 110 | RRC Reconfiguration |
| 644451 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcUIdcch | 60 | RRC Reconfiguration Complete |
| 644452 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 79 | ULRRMessageTransfer |
| 645811 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 75 | RRCDeliveryReport |
| 833617 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 89 | ULRRMessageTransfer |

MeasObjectToAddMod

- measObjectId: 2
- measObject: measObjectNR (0)
 - measObjectNR
 - ssbFrequency: 642624
 - ssbSubcarrierSpacing: kHz30 (1)
 - smtc1
 - periodicityAndOffset: sf20 (2)
 - sf20: 0
 - duration: sf1 (0)
 - referenceSignalConfig
 - ssb-ConfigMobility
 - ... 1... deriveSSB-IndexFromCell: True
 - nrofSS-BlocksToAverage: 2
 - quantityConfigIndex: 1
 - offsetMO
 - cellsToAddModList: 1 item
 - Item 0
 - CellsToAddMod
 - physCellId: 31
 - cellIndividualOffset

Successful_Inter-Frequency-HO.pcapng

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Filter: `((udp.dstport>50000 && udp.dstport<51300 && !icmp))((nr_info.rach.numofpream > 0))((mac-nr.rar.rapid > 0)) && ((ip.addr == 10.170.38.252) || (ip.addr == 10.170.38.253))`

| No. | Source | Destination | Protocol | Length | Info |
|--------|----------------------------|---------------|----------------|--------|-------------------------------|
| 625579 | Time (format as specified) | 10.170.38.200 | SJ_NrRrcUIdcch | 60 | Measurement Report |
| 626876 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 80 | UEContextModificationRequest |
| 628087 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 76 | UEContextModificationResponse |
| 629268 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 150 | DLRRMessageTransfer |
| 629269 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcUIdcch | 110 | RRC Reconfiguration |
| 644451 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcUIdcch | 60 | RRC Reconfiguration Complete |
| 644452 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 79 | ULRRMessageTransfer |
| 645811 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 75 | RRCDeliveryReport |
| 833617 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 89 | ULRRMessageTransfer |

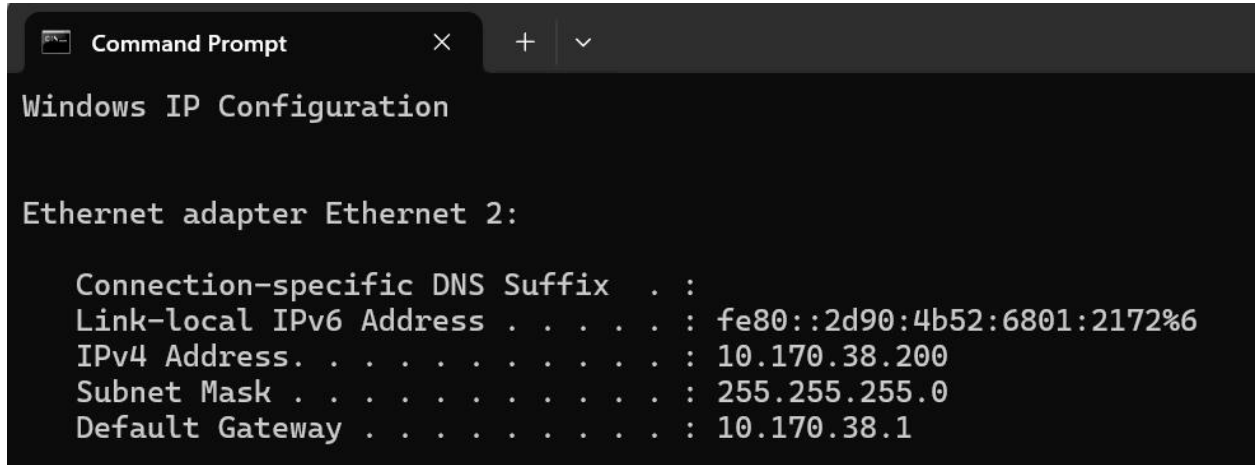
Item 1

- ReportConfigToAddMod
 - reportConfigId: 2
 - reportConfig: reportConfigNR (0)
 - reportConfigNR
 - reportType: eventTriggered (1)
 - eventTriggered
 - eventId: eventA5 (4)
 - eventA5
 - a5-Threshold1: rsrp (0)
 - rsrp: -61dBm <= SS-RSRP < -60dBm (96)
 - a5-Threshold2: rsrp (0)
 - rsrp: -101dBm <= SS-RSRP < -100dBm (56)
 - ..0. reportOnLeave: False
 - hysteresis: 8dB (16)
 - timeToTrigger: ms128 (5)
 - 0... useWhiteCellList: False
 - rsType: ssb (0)
 - reportInterval: ms240 (1)
 - reportAmount: r1 (0)
 - reportQuantityCell

"The Xn Handovers"

Xn Handover (Inter-Frequency):

- 1- Most important message in an Xn Handover is the "Path Switch" request message, that refers to the communication between the 2 GNodeBs directly during the Handover!
- 2- Xn Handover from PCI 71 (10.170.38.253) to PCI 31 (10.170.38.252):
- 3- Connect the laptop to the main Network using the Router and switch in order to monitor traffic & signaling for both of the GNB above using Wireshark
- 4- Verify the IP Address of laptop (connected to CPE) by using ipconfig below:



```
Command Prompt
Windows IP Configuration

Ethernet adapter Ethernet 2:

    Connection-specific DNS Suffix  . : 
    Link-local IPv6 Address . . . . . : fe80::2d90:4b52:6801:2172%6
    IPv4 Address. . . . . : 10.170.38.200
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 10.170.38.1
```

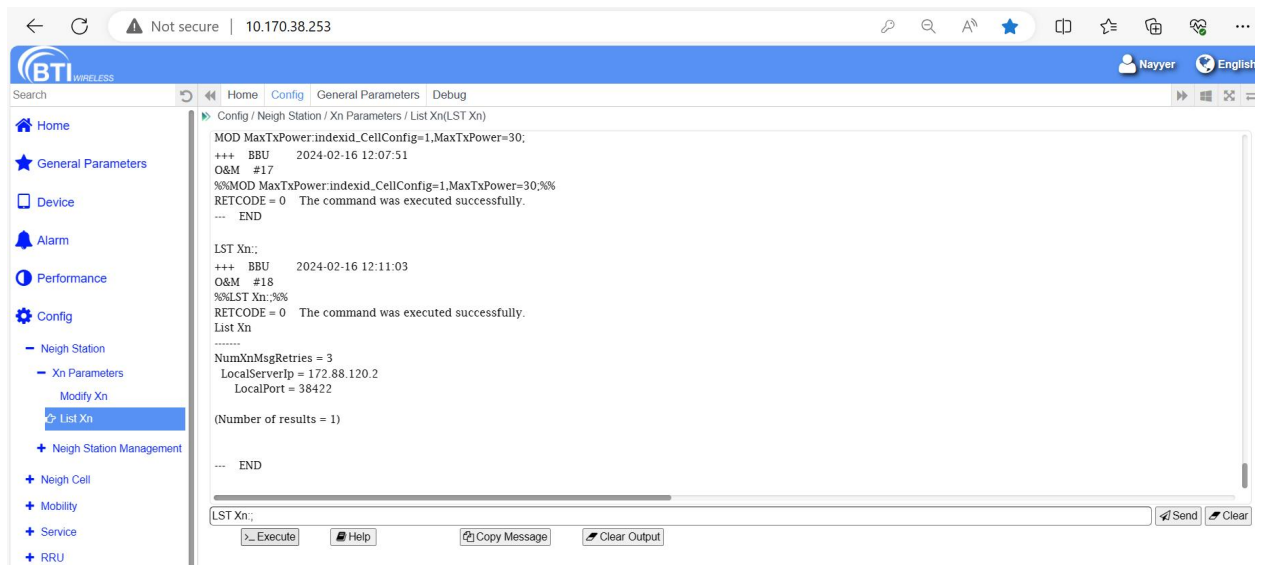
- 5- Start a continuous ping from the laptop connected to the CPE, to make sure the connected Mode stays on (needed for HO):

```
Command Prompt

C:\Users\Nayyer>ping 1.1.1.1 -t

Pinging 1.1.1.1 with 32 bytes of data:
Reply from 1.1.1.1: bytes=32 time=7ms TTL=56
Reply from 1.1.1.1: bytes=32 time=7ms TTL=56
Reply from 1.1.1.1: bytes=32 time=8ms TTL=56
Reply from 1.1.1.1: bytes=32 time=8ms TTL=56
Reply from 1.1.1.1: bytes=32 time=7ms TTL=56
Reply from 1.1.1.1: bytes=32 time=8ms TTL=56
Reply from 1.1.1.1: bytes=32 time=7ms TTL=56
Reply from 1.1.1.1: bytes=32 time=8ms TTL=56
Reply from 1.1.1.1: bytes=32 time=8ms TTL=56
Reply from 1.1.1.1: bytes=32 time=7ms TTL=56
```

6- Verify the Local IP Address is properly configured in the Xn Parameters:



```

LST Xn;;
+++   BBU      2024-03-08 15:18:01
O&M   #2
%%LST Xn:;%%
RETCODE = 0    The command was executed successfully.
List Xn
-----
NumXnMsgRetries = 3
  LocalServerIp = 172.88.120.2
  LocalPort = 38422

(Number of results = 1)

---   END

```

- 7- Configure the Xn Parameters listed under the Neighbor Station tab (while making sure the Admin State is ON):

The screenshot shows the BTI Wireless configuration interface in a web browser. The browser address bar shows '10.170.38.253'. The interface has a blue header with the BTI logo and a navigation menu on the left. The main content area displays the output of the 'List Neigh Station' command, which is identical to the text shown in the first image. The command was executed successfully, showing parameters for a neighbor station with NodeId 10, RemoteAddress 10.170.38.252, and LocalPort 38422. The interface also includes a search bar, a status bar at the bottom, and various utility buttons like 'Select All', 'Execute', 'Help', 'Copy Message', and 'Clear Output'.

8- Successful Inter-Frequency Xn Handover:

*Ethernet 2

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Filter: ((udp.dstport>50000 && udp.dstport<51300 && !icmp))(((nr_info.rach.numofpream > 0))((mac-nr.rar.rapid > 0))) && ((ip.addr == 10.170.38.252) || (ip.addr == 10.170.38.253))

| No. | Time | Source | Destination | Protocol | Length | Info |
|------|-----------|---------------|---------------|----------------|--------|--|
| 1350 | 59.410200 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcUIdcch | 60 | RRC Reconfiguration Complete |
| 1355 | 59.638475 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 90 | ULRRCTestTransfer |
| 1356 | 59.638476 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcUIdcch | 60 | Measurement Report |
| 1358 | 59.643727 | 10.170.38.253 | 10.170.38.200 | SJ_XnAP | 568 | HandoverRequest |
| 1360 | 59.749666 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 86 | ULRRCTestTransfer |
| 1361 | 59.749668 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcUIdcch | 60 | Measurement Report |
| 1365 | 59.990735 | 10.170.38.252 | 10.170.38.200 | SJ_XnAP | 568 | HandoverRequest |
| 1369 | 59.999813 | 10.170.38.252 | 10.170.38.200 | SJ_F1AP | 498 | UEContextSetupRequest, RRC Reconfiguration |
| 1370 | 60.007342 | 10.170.38.252 | 10.170.38.200 | SJ_F1AP | 471 | UEContextSetupResponse |
| 1371 | 60.015239 | 10.170.38.252 | 10.170.38.200 | SJ_XnAP | 511 | HandoverRequestAcknowledge |
| 1372 | 60.015784 | 10.170.38.253 | 10.170.38.200 | SJ_XnAP | 511 | HandoverRequestAcknowledge |
| 1373 | 60.018393 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcUIdcch | 448 | RRC Reconfiguration |
| 1374 | 60.019690 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 492 | UEContextModificationRequest |
| 1375 | 60.021008 | 10.170.38.253 | 10.170.38.200 | SJ_XnAP | 76 | SNStatusTransfer |
| 1376 | 60.021009 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 62 | UEContextModificationResponse |
| 1377 | 60.021595 | 10.170.38.252 | 10.170.38.200 | SJ_XnAP | 76 | SNStatusTransfer |
| 1380 | 60.098536 | 10.170.38.252 | 10.170.38.200 | SJ_F1AP | 80 | ULRRCTestTransfer |
| 1381 | 60.098537 | 10.170.38.252 | 10.170.38.200 | SJ_NrRrcUIdcch | 60 | RRC Reconfiguration Complete |
| 1382 | 60.101090 | 10.170.38.252 | 10.170.38.200 | SJ_NrRrcUIdcch | 75 | RRC Reconfiguration |
| 1383 | 60.103674 | 10.170.38.252 | 10.170.38.200 | SJ_F1AP | 116 | DLRRCTestTransfer |
| 1384 | 60.103674 | 10.170.38.252 | 10.170.38.200 | SJ_NrRrcUIdcch | 60 | UE Capability Enquiry |
| 1385 | 60.104977 | 10.170.38.252 | 10.170.38.200 | SJ_F1AP | 97 | DLRRCTestTransfer |
| 1386 | 60.104977 | 10.170.38.252 | 10.170.38.200 | SJ_NGAP | 114 | PathSwitchRequest |
| 1388 | 60.107688 | 10.170.38.252 | 10.170.38.200 | SJ_NGAP | 141 | PathSwitchRequestAcknowledge |
| 1389 | 60.109056 | 10.170.38.252 | 10.170.38.200 | SJ_XnAP | 61 | UEContextRelease |

> Frame 905: 105 bytes on wire (840 bits), 105 bytes captured (840 bits) on interface \Device\NPF_{39965836-7F0A-4B21-A86C-13DA77E80641}, id 0
 > Ethernet II, Src: SunwaveC_20:0f:35 (68:1d:64:20:0f:35), Dst: 50:91:e3:68:6d:04 (50:91:e3:68:6d:04)
 > Internet Protocol Version 4, Src: 10.170.38.252, Dst: 10.170.38.200
 > User Datagram Protocol, Src Port: 59374, Dst Port: 58190

9- Measurement Report 1:

Successful_XN-Handover.pcapng

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Filter: ((udp.dstport>50000 && udp.dstport<51300 && !icmp))(((nr_info.rach.numofpream > 0))((mac-nr.rar.rapid > 0))) && ((ip.addr == 10.170.38.252) || (ip.addr == 10.170.38.253))

| No. | Time | Source | Destination | Protocol | Length | Info |
|------|-----------|---------------|---------------|----------------|--------|---------------------------------|
| 1335 | 59.043935 | 10.170.38.253 | 10.170.38.200 | SJ_NGAP | 84 | PDUSessionResourceSetupResponse |
| 1340 | 59.388998 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 86 | ULRRCTestTransfer |
| 1341 | 59.388999 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcUIdcch | 60 | Measurement Report |
| 1343 | 59.391578 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 81 | UEContextModificationRequest |
| 1344 | 59.392877 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 77 | UEContextModificationResponse |
| 1346 | 59.394206 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcUIdcch | 110 | RRC Reconfiguration |
| 1347 | 59.395651 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 151 | DLRRCTestTransfer |
| 1348 | 59.408692 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 80 | ULRRCTestTransfer |
| 1349 | 59.410199 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 76 | RRCDeliveryReport |
| 1350 | 59.410200 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcUIdcch | 60 | RRC Reconfiguration Complete |
| 1355 | 59.638475 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 90 | ULRRCTestTransfer |
| 1356 | 59.638476 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcUIdcch | 60 | Measurement Report |
| 1358 | 59.643727 | 10.170.38.253 | 10.170.38.200 | SJ_XnAP | 568 | HandoverRequest |

```

  measurementReport
    criticalExtensions: measurementReport (0)
    measurementReport
      measResults
        measId: 1
        measResultServingMOList: 1 item
          Item 0
            MeasResultServMO
              servCellId: 0
              measResultServingCell
                physCellId: 71
                measResult
                  cellResults
                    resultsSSB-Cell
                      rsrp: -81dBm <= SS-RSRP < -80dBm (76)
                      rsrq: -10.5dB <= SS-RSRQ < -10.8dB (66)

```

10- Measurement Report 2 (right before Handover Request):

Successful_XN-Handover.pcapng

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Filter: ((udp.dstport>50000 && udp.dstport<51300 && !icmp))((nr_info.rach.numofpream > 0))((mac-nr.rar.rapid > 0)) && ((ip.addr == 10.170.38.252) || (ip.addr == 10.170.38.253))

| No. | Time | Source | Destination | Protocol | Length | Info |
|------|-----------|---------------|---------------|----------------|--------|-------------------------------|
| 1341 | 59.388999 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcU1Dcch | 60 | Measurement Report |
| 1343 | 59.391578 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 81 | UEContextModificationRequest |
| 1344 | 59.392877 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 77 | UEContextModificationResponse |
| 1346 | 59.394206 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcD1Dcch | 110 | RRC Reconfiguration |
| 1347 | 59.395651 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 151 | DLRRCMesageTransfer |
| 1348 | 59.408692 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 80 | ULRRCMesageTransfer |
| 1349 | 59.419100 | 10.170.38.253 | 10.170.38.200 | CT_E1AP | 76 | RRPDataTransferRequest |

Item 0

- ReportConfigToAddMod
 - reportConfigId: 1
 - reportConfig: reportConfigNR (0)
 - reportConfigNR
 - reportType: eventTriggered (1)
 - eventTriggered
 - eventId: eventA2 (1)
 - eventA2
 - a2-Threshold: rsrp (0)
 - rsrp: -67dBm <= SS-RSRP < -66dBm (90)
 -0. reportOnLeave: False
 - hysteresis: 1dB (2)
 - timeToTrigger: ms320 (8)
 - rsType: ssb (0)
 - reportInterval: ms240 (1)
 - reportAmount: r1 (0)
 - reportQuantityCell
 - 1... ..rsrp: True
 - ..0.rsrq: False
 - ..0.sinnr: False
 - maxReportCells: 1
 -0. includeBeamMeasurements: False

13- RRC-Reconfig Message Measure Object ID 2:

Successful_XN-Handover.pcapng

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Filter: ((udp.dstport>50000 && udp.dstport<51300 && !icmp))((nr_info.rach.numofpream > 0))((mac-nr.rar.rapid > 0)) && ((ip.addr == 10.170.38.252) || (ip.addr == 10.170.38.253))

| No. | Time | Source | Destination | Protocol | Length | Info |
|------|-----------|---------------|---------------|----------------|--------|-------------------------------|
| 1341 | 59.388999 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcU1Dcch | 60 | Measurement Report |
| 1343 | 59.391578 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 81 | UEContextModificationRequest |
| 1344 | 59.392877 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 77 | UEContextModificationResponse |
| 1346 | 59.394206 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcD1Dcch | 110 | RRC Reconfiguration |
| 1347 | 59.395651 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 151 | DLRRCMesageTransfer |

Item 1

- MeasObjectToAddMod
 - measObjectId: 2
 - measObject: measObjectNR (0)
 - measObjectNR
 - ssbFrequency: 642624
 - ssbSubcarrierSpacing: kHz30 (1)
 - smtc1
 - periodicityAndOffset: sf20 (2)
 - sf20: 0
 - duration: sf1 (0)
 - referenceSignalConfig
 - ssb-ConfigMobility
 - 1... deriveSSB-IndexFromCell: True
 - nrofSS-BlocksToAverage: 2
 - quantityConfigIndex: 1
 - offsetMO
 - cellsToAddModList: 1 item
 - Item 0
 - CellsToAddMod
 - physCellId: 31
 - cellIndividualOffset
 - freqBandIndicatorNR-v1530: 78
 - measCycleCell-v1530: sf160 (0)

14- Event A5 (related to Measure Object ID 2) in RRC-Reconfig Message:

Successful_XN-Handover.pcapng

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Filter: `((udp.dstport>50000 && udp.dstport<51300 && !icmp))((nr_info.rach.numofpream > 0))((mac-nr.rar.rapid > 0)) && ((ip.addr == 10.170.38.252) || (ip.addr == 10.170.38.253))`

| No. | Time | Source | Destination | Protocol | Length | Info |
|------|-----------|---------------|---------------|----------------|--------|-------------------------------|
| 1344 | 59.392877 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 77 | UEContextModificationResponse |
| 1346 | 59.394206 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcDlDcch | 110 | RRC Reconfiguration |
| 1347 | 59.395651 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 151 | DLRRMessageTransfer |

Item 1

- ReportConfigToAddMod
 - reportConfigId: 2
 - reportConfig: reportConfigNR (0)
 - reportConfigNR
 - reportType: eventTriggered (1)
 - eventTriggered
 - eventId: eventA5 (4)
 - eventA5
 - a5-Threshold1: rsrp (0)
 - rsrp: -61dBm <= SS-RSRP < -60dBm (96)
 - a5-Threshold2: rsrp (0)
 - rsrp: -101dBm <= SS-RSRP < -100dBm (56)
 - ..0. reportOnLeave: False
 - hysteresis: 8dB (16)
 - timeToTrigger: ms128 (5)
 - 0... useWhiteCellList: False
 - rsType: ssb (0)
 - reportInterval: ms240 (1)
 - reportAmount: r1 (0)
 - reportQuantityCell
 - 1.. rsrp: True
 -0. rsrq: False
 -0 sinr: False
 - maxReportCells: 6
 - ...1 includeBeamMeasurements: True

15- Handover Request:

Successful_XN-Handover.pcapng

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Filter: `((udp.dstport>50000 && udp.dstport<51300 && !icmp))((nr_info.rach.numofpream > 0))((mac-nr.rar.rapid > 0)) && ((ip.addr == 10.170.38.252) || (ip.addr == 10.170.38.253))`

| No. | Time | Source | Destination | Protocol | Length | Info |
|------|-----------|---------------|---------------|----------------|--------|------------------------------|
| 1349 | 59.410199 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 76 | RRCDeliveryReport |
| 1350 | 59.410200 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcUldcch | 60 | RRC Reconfiguration Complete |
| 1355 | 59.638475 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 90 | ULRRMessageTransfer |
| 1356 | 59.638476 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcUldcch | 60 | Measurement Report |
| 1358 | 59.643727 | 10.170.38.253 | 10.170.38.200 | SJ_XnAP | 568 | HandoverRequest |
| 1360 | 59.749666 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 86 | ULRRMessageTransfer |

Cell: 0

- NG-RAN Xn Application Protocol (XnAP)
 - XnAP-PDU: initiatingMessage (0)
 - initiatingMessage
 - procedureCode: id-handoverPreparation (0)
 - criticality: reject (0)
 - value
 - HandoverRequest
 - protocolIEs: 7 items
 - Item 0: id-sourceNG-RANnodeUEXnAPID
 - ProtocolIE-Field
 - id: id-sourceNG-RANnodeUEXnAPID (73)
 - criticality: reject (0)
 - value
 - NG-RANnodeUEXnAPID: 20
 - Item 1: id-Cause
 - ProtocolIE-Field
 - id: id-Cause (7)
 - criticality: reject (0)
 - value
 - Cause: radioNetwork (0)
 - radioNetwork: handover-desirable-for-radio-reasons (1)
 - Item 2: id-targetCellGlobalID

16- Handover Request Acknowledgement (from Target):

Successful_XN-Handover.pcapng

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Filter: `((udp.dstport>50000 && udp.dstport<51300 && !icmp))((nr_info.rach.numofpream > 0))((mac-nr.rar.rapid > 0)) && ((ip.addr == 10.170.38.252) || (ip.addr == 10.170.38.253))`

| No. | Time | Source | Destination | Protocol | Length | Info |
|------|-----------|---------------|---------------|----------------|--------|----------------------------|
| 1370 | 60.007342 | 10.170.38.252 | 10.170.38.200 | SJ_F1AP | 471 | UEContextSetupResponse |
| 1371 | 60.015239 | 10.170.38.252 | 10.170.38.200 | SJ_XnAP | 511 | HandoverRequestAcknowledge |
| 1372 | 60.015784 | 10.170.38.253 | 10.170.38.200 | SJ_XnAP | 511 | HandoverRequestAcknowledge |
| 1373 | 60.018393 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcD1Dcch | 448 | RRC Reconfiguration |

```

    dataForwardingInfoFromTarget
    qosFlowsAcceptedForDataForwarding-List: 1 item
    Item 0
    QoSFlowsAcceptedToBeForwarded-Item
    qosFlowIdentifier: 1
    dataForwardingResponseDRBItemList: 1 item
    Item 0
    DataForwardingResponseDRBItem
    drb-ID: 1
    dlForwardingUPNTNL: gtpTunnel (0)
    gtpTunnel
    tnl-address: 0aaa26fc [bit length 32, 0000 1010 1010 1010 0010 0110 1111 1100 decimal value 178923260]
    TransportLayerAddress (IPv4): 10.170.38.252
    gtp-teid: 0000002f
    ulForwardingUPNTNL: gtpTunnel (0)
    gtpTunnel
    tnl-address: 0aaa26fc [bit length 32, 0000 1010 1010 1010 0010 0110 1111 1100 decimal value 178923260]
    TransportLayerAddress (IPv4): 10.170.38.252
    gtp-teid: 00000030
  Item 3: id-Target2SourceNG-RANnodeTranspContainer
  ProtocolIE-Field
  id: id-Target2SourceNG-RANnodeTranspContainer (77)
  criticality: ignore (1)
  value

```

17- Path Switch Request:

Successful_XN-Handover.pcapng

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Filter: `((udp.dstport>50000 && udp.dstport<51300 && !icmp))((nr_info.rach.numofpream > 0))((mac-nr.rar.rapid > 0)) && ((ip.addr == 10.170.38.252) || (ip.addr == 10.170.38.253))`

| No. | Time | Source | Destination | Protocol | Length | Info |
|------|-----------|---------------|---------------|----------------|--------|------------------------------|
| 1382 | 60.101090 | 10.170.38.252 | 10.170.38.200 | SJ_NrRrcD1Dcch | 75 | RRC Reconfiguration |
| 1383 | 60.103674 | 10.170.38.252 | 10.170.38.200 | SJ_F1AP | 116 | DLRRCCMessageTransfer |
| 1384 | 60.103674 | 10.170.38.252 | 10.170.38.200 | SJ_NrRrcD1Dcch | 60 | UE Capability Enquiry |
| 1385 | 60.104977 | 10.170.38.252 | 10.170.38.200 | SJ_F1AP | 97 | DLRRCCMessageTransfer |
| 1386 | 60.104977 | 10.170.38.252 | 10.170.38.200 | SJ_NGAP | 114 | PathSwitchRequest |
| 1388 | 60.107688 | 10.170.38.252 | 10.170.38.200 | SJ_NGAP | 141 | PathSwitchRequestAcknowledge |
| 1389 | 60.109956 | 10.170.38.252 | 10.170.38.200 | SJ_XnAP | 61 | UEContextRelease |

```

    .0. . . . . = 128-EIA2: Not supported
    ..0. . . . . = 128-EIA3: Not supported
    ...0 0000 0000 0000 = Reserved: 0x0000
  Item 4: id-PDUSessionResourceToBeSwitchedDLList
  ProtocolIE-Field
  id: id-PDUSessionResourceToBeSwitchedDLList (76)
  criticality: reject (0)
  value
  PDUSessionResourceToBeSwitchedDLList: 1 item
  Item 0
  PDUSessionResourceToBeSwitchedDLItem
  pDUSessionID: 1
  pathSwitchRequestTransfer: 001f0aaa26fc0000002d0002
  PathSwitchRequestTransfer
  dL-NGU-UP-TNLInformation: gtpTunnel (0)
  gtpTunnel
  transportLayerAddress: 0aaa26fc [bit length 32, 0000 1010 1010 1010 0010 0110 1111 1100 decimal value 178923260]
  TransportLayerAddress (IPv4): 10.170.38.252
  gTP-TEID: 0000002d
  qosFlowAcceptedList: 1 item
  Item 0
  QoSFlowAcceptedItem
  qosFlowIdentifier: 1

```

18- Path Switch Request Acknowledge:

Successful_XN-Handover.pcapng

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Filter: ((udp.dstport>50000 && udp.dstport<51300 && !icmp))((nr_info.rach.numofpream > 0))((mac-nr.rar.rapid > 0)) && ((ip.addr == 10.170.38.252) || (ip.addr == 10.170.38.253))

| No. | Time | Source | Destination | Protocol | Length | Info |
|------|-----------|---------------|---------------|----------------|--------|------------------------------|
| 1384 | 60.103674 | 10.170.38.252 | 10.170.38.200 | SJ_NrRrcDlDcch | 60 | UE Capability Enquiry |
| 1385 | 60.104977 | 10.170.38.252 | 10.170.38.200 | SJ_FIAP | 97 | DLRRMessageTransfer |
| 1386 | 60.104977 | 10.170.38.252 | 10.170.38.200 | SJ_NGAP | 114 | PathSwitchRequest |
| 1388 | 60.107688 | 10.170.38.252 | 10.170.38.200 | SJ_NGAP | 141 | PathSwitchRequestAcknowledge |
| 1389 | 60.109056 | 10.170.38.252 | 10.170.38.200 | SJ_XnAP | 61 | UEContextRelease |
| 1390 | 60.110377 | 10.170.38.253 | 10.170.38.200 | SJ_XnAP | 61 | UEContextRelease |
| 1397 | 60.112971 | 10.170.38.253 | 10.170.38.200 | SJ_FIAP | 67 | UEContextReleaseCommand |

```

PDU Session Resource Switched Item
  pduSessionID: 1
  pathSwitchRequestAcknowledgeTransfer: 601f0aaa8289010000d00900
  PathSwitchRequestAcknowledgeTransfer
    uL-NGU-UP-TNLIInformation: gTPTunnel (0)
      gTPTunnel
        transportLayerAddress: 0aaa8289 [bit length 32, 0000 1010 1010 1010 1000 0010 1000 1001 decimal value 178946697]
        transportLayerAddress (IPv4): 10.170.130.137
        gTP-TEID: 010000d0
      securityIndication
        integrityProtectionIndication: not-needed (2)
        confidentialityProtectionIndication: not-needed (2)
  Item 5: id-AllowedNSSAI
    ProtocolIE-Field
      id: id-AllowedNSSAI (0)
      criticality: reject (0)
      value
        AllowedNSSAI: 1 item
          Item 0
            AllowedNSSAI-Item
              s-NSSAI
                sST: 01
                sD: 000001

```

Xn Handover (Intra-Frequency):

- 1- Most important message in an Intra-Frequency Xn Handover is the “Path Switch” request message, that refers to the communication between the 2 GNodeBs directly during the Handover!
- 2- Xn Handover from PCI 71 (10.170.38.253) to PCI 31 (10.170.38.252):
- 3- Connect the laptop to the main Network using the Router and switch in order to monitor traffic & signaling for both of the GNB above using Wireshark
- 4- Verify the IP Address of laptop (connected to CPE) by using ipconfig below:

```

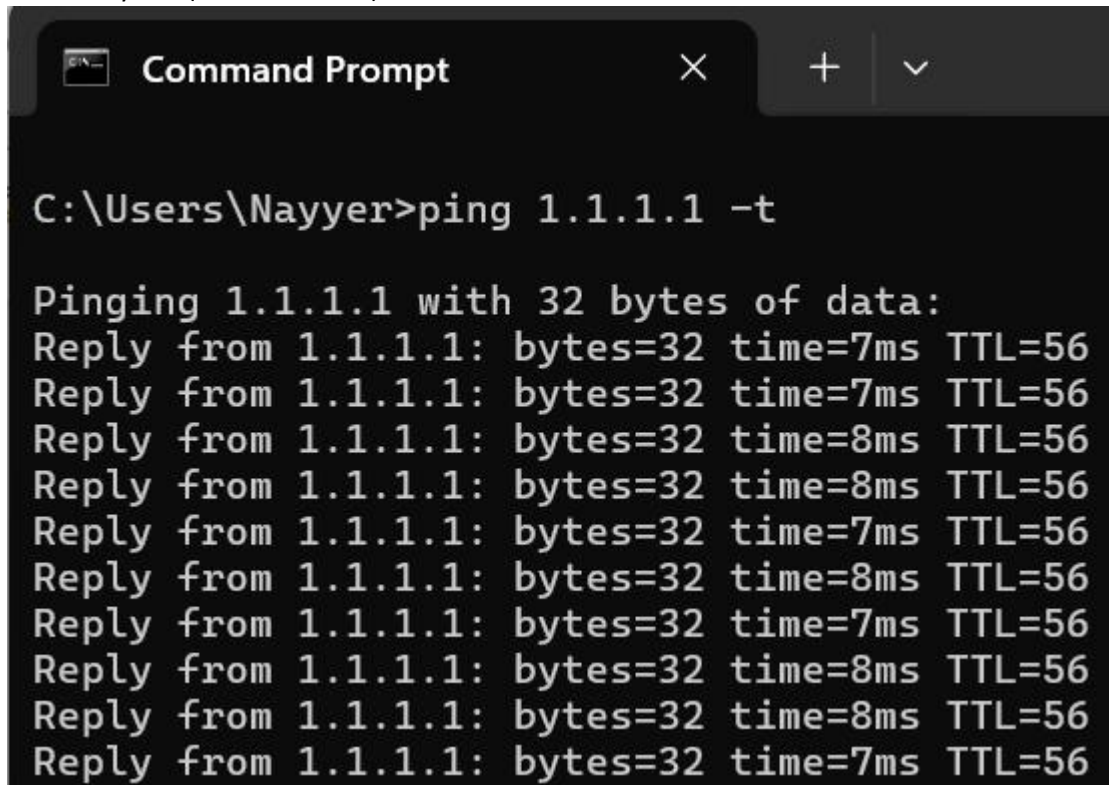
Command Prompt
Windows IP Configuration

Ethernet adapter Ethernet 2:

Connection-specific DNS Suffix . . : 
Link-local IPv6 Address . . . . . : fe80::2d90:4b52:6801:2172%6
IPv4 Address. . . . . : 10.170.38.200
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 10.170.38.1

```


- 5- Start a continuous ping from the laptop connected to the CPE, to make sure the connected Mode stays on (needed for HO):

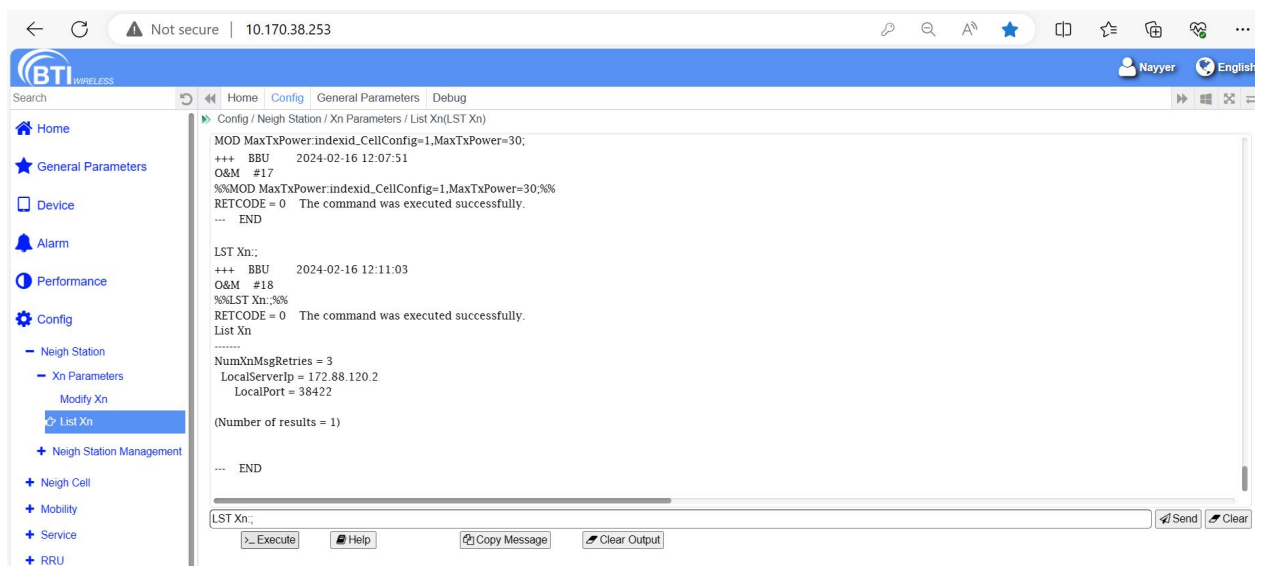


```
Command Prompt

C:\Users\Nayyer>ping 1.1.1.1 -t

Pinging 1.1.1.1 with 32 bytes of data:
Reply from 1.1.1.1: bytes=32 time=7ms TTL=56
Reply from 1.1.1.1: bytes=32 time=7ms TTL=56
Reply from 1.1.1.1: bytes=32 time=8ms TTL=56
Reply from 1.1.1.1: bytes=32 time=8ms TTL=56
Reply from 1.1.1.1: bytes=32 time=7ms TTL=56
Reply from 1.1.1.1: bytes=32 time=8ms TTL=56
Reply from 1.1.1.1: bytes=32 time=7ms TTL=56
Reply from 1.1.1.1: bytes=32 time=8ms TTL=56
Reply from 1.1.1.1: bytes=32 time=8ms TTL=56
Reply from 1.1.1.1: bytes=32 time=7ms TTL=56
```

- 6- Verify the Local IP Address is properly configured in the Xn Parameters:




```

LST Xn;;
+++   BBU      2024-03-08 15:18:01
O&M   #2
%%LST Xn:;%%
RETCODE = 0    The command was executed successfully.
List Xn
-----
NumXnMsgRetries = 3
  LocalServerIp = 172.88.120.2
  LocalPort = 38422

(Number of results = 1)

---   END

```

- 7- Configure the Xn Parameters listed under the Neighbor Station tab (while making sure the Admin State is ON):

The screenshot shows the BTI Wireless configuration interface in a web browser. The address bar shows '10.170.38.253'. The interface has a blue header with the BTI logo and a navigation menu on the left. The main content area displays the output of the 'List Neigh Station' command, which is identical to the text in the first image. The command was executed successfully, showing parameters for a neighbor station with NodeId 10, RemoteAddress 10.170.38.252, and LocalPort 38422. The interface also includes a search bar, a status bar at the bottom, and a 'Send' button.

8- While making sure the Frequency (same) for Target Cell is updated with the correct ARFCN, Absolute SSB, and NR Band, Build the NR Cell Relation, from Source to Target.

9- Successful Intra-Frequency Xn Handover:

Capturing from Ethernet 2

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Filter: ((udp.dstport>50000 && udp.dstport<51300 && !icmp))((nr_info.rach.numofpream > 0))((mac-nr.rar.rapid > 0)) && ((ip.addr == 10.170.38.252) || (ip.addr == 10.170.38.253))

| No. | Time | Source | Destination | Protocol | Length | Info |
|-----|-----------|---------------|---------------|----------------|--------|--|
| 533 | 70.289123 | 10.170.38.252 | 10.170.38.200 | SJ_XnAP | 555 | HandoverRequest |
| 536 | 70.298552 | 10.170.38.252 | 10.170.38.200 | SJ_F1AP | 485 | UEContextSetupRequest, RRC Reconfiguration |
| 537 | 70.306168 | 10.170.38.252 | 10.170.38.200 | SJ_F1AP | 471 | UEContextSetupResponse |
| 538 | 70.313930 | 10.170.38.252 | 10.170.38.200 | SJ_XnAP | 505 | HandoverRequestAcknowledge |
| 539 | 70.315201 | 10.170.38.253 | 10.170.38.200 | SJ_XnAP | 505 | HandoverRequestAcknowledge |
| 540 | 70.316174 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcDlDcch | 441 | RRC Reconfiguration |
| 541 | 70.318152 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 485 | UEContextModificationRequest |
| 542 | 70.318780 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 62 | UEContextModificationResponse |
| 543 | 70.318781 | 10.170.38.253 | 10.170.38.200 | SJ_XnAP | 76 | SNStatusTransfer |
| 544 | 70.320436 | 10.170.38.252 | 10.170.38.200 | SJ_XnAP | 76 | SNStatusTransfer |
| 547 | 70.428021 | 10.170.38.252 | 10.170.38.200 | SJ_F1AP | 80 | ULRRcMessageTransfer |
| 548 | 70.429268 | 10.170.38.252 | 10.170.38.200 | SJ_NrRrcDlDcch | 60 | RRC Reconfiguration Complete |
| 549 | 70.430536 | 10.170.38.252 | 10.170.38.200 | SJ_NrRrcDlDcch | 97 | RRC Reconfiguration |
| 550 | 70.431897 | 10.170.38.252 | 10.170.38.200 | SJ_F1AP | 138 | DLRRcMessageTransfer |
| 551 | 70.434409 | 10.170.38.252 | 10.170.38.200 | SJ_NGAP | 114 | PathSwitchRequest |
| 552 | 70.435711 | 10.170.38.252 | 10.170.38.200 | SJ_F1AP | 97 | DLRRcMessageTransfer |
| 553 | 70.435712 | 10.170.38.252 | 10.170.38.200 | SJ_NrRrcDlDcch | 60 | UE Capability Enquiry |
| 554 | 70.438420 | 10.170.38.252 | 10.170.38.200 | SJ_NGAP | 141 | PathSwitchRequestAcknowledge |
| 555 | 70.439727 | 10.170.38.252 | 10.170.38.200 | SJ_XnAP | 61 | UEContextRelease |
| 556 | 70.440326 | 10.170.38.253 | 10.170.38.200 | SJ_XnAP | 61 | UEContextRelease |

▼ PDUSessionResourceToBeSwitchedDLItem

pDUSessionID: 1

▼ pathSwitchRequestTransfer: 001f0aaa26fc000000170002

▼ PathSwitchRequestTransfer

▼ dL-NGU-UP-TNLInformation: gTPTunnel (0)

▼ gTPTunnel

▼ transportLayerAddress: 0aaa26fc [bit length 32, 0000 1010 1010 1010 0010 0110 1111 1100 decimal value 178923260]

TransportLayerAddress (IPv4): 10.170.38.252

gTP-TEID: 00000017

▼ qosFlowAcceptedList: 1 item

10- Measurement Report:

Successful_Intra-Freq_Xn.pcapng

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Filter: ((udp.dstport>50000 && udp.dstport<51300 && !icmp))((nr_info.rach.numofpream > 0))((mac-nr.rar.rapid > 0)) && ((ip.addr == 10.170.38.252) || (ip.addr == 10.170.38.253))

| No. | Time | Source | Destination | Protocol | Length | Info |
|-----|-----------|---------------|---------------|----------------|--------|---------------------------------|
| 247 | 23.962750 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 62 | UEContextModificationResponse |
| 248 | 23.965264 | 10.170.38.253 | 10.170.38.200 | SJ_NGAP | 84 | PDUSessionResourceSetupResponse |
| 249 | 24.309493 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 86 | ULRRcMessageTransfer |
| 250 | 24.310644 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcUldcch | 60 | Measurement Report |
| 253 | 24.509599 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 86 | ULRRcMessageTransfer |
| 254 | 24.510779 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcUldcch | 60 | Measurement Report |
| 519 | 69.049286 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 90 | ULRRcMessageTransfer |

▼ CpCellApp

Cell: 0

▼ NR Radio Resource Control (RRC) protocol

▼ UL-DCCH-Message

▼ message: c1 (0)

▼ c1: measurementReport (0)

▼ measurementReport

▼ criticalExtensions: measurementReport (0)

▼ measurementReport

▼ measResults

measId: 1

▼ measResultServingMOList: 1 item

▼ Item 0

▼ MeasResultServMO

servCellId: 0

▼ measResultServingCell

physCellId: 71

▼ measResult

▼ cellResults

▼ resultsSSB-Cell

rsrp: -81dBm <= SS-RSRP < -80dBm (76)

rsrq: -11.0dB <= SS-RSRQ < -10.5dB (65)

11- Measure Object ID with ssbFrequency 637344 (for Intra-Freq):

Successful_Intra-Freq_Xn.pcapng

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Filter: `((udp.dstport>50000 && udp.dstport<51300 && !icmp))((nr_info.rach.numofpream > 0))((mac-nr.rar.rapid > 0)) && ((ip.addr == 10.170.38.252) || (ip.addr == 10.170.38.253))`

| No. | Time | Source | Destination | Protocol | Length | Info |
|-----|-----------|---------------|---------------|----------------|--------|---|
| 240 | 23.932238 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 375 | UEContextSetupResponse |
| 241 | 23.937286 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcDlDcch | 504 | RRC Reconfiguration, DL NAS transport, PDU session establishment accept |
| 242 | 23.938573 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 548 | DLRRCTransfer |
| 243 | 23.960101 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 80 | ULRRCTransfer |
| 244 | 23.960101 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcUlDcch | 60 | RRC Reconfiguration Complete |
| 245 | 23.961410 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 72 | UEContextModificationRequest |
| 246 | 23.962740 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 76 | RRCDeliveryReport |
| 247 | 23.962750 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 62 | UEContextModificationResponse |
| 248 | 23.965264 | 10.170.38.253 | 10.170.38.200 | SJ_NGAP | 84 | PDU Session Resource Setup Response |

t-Reordering: ms120 (15)
cipheringDisabled: true (0)

- measConfig
 - measObjectToAddModList: 1 item
 - Item 0
 - MeasObjectToAddMod
 - measObjectId: 1
 - measObject: measObjectNR (0)
 - measObjectNR
 - ssbFrequency: 637344
 - ssbSubcarrierSpacing: kHz30 (1)
 - smtc1
 - periodicityAndOffset: sf20 (2)
 - sf20: 0
 - duration: sf1 (0)
 - smtc2
 - pci-List: 1 item
 - Item 0
 - PhysCellId: 31

12- Event A1 triggered Message:

Successful_Intra-Freq_Xn.pcapng

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Filter: `((udp.dstport>50000 && udp.dstport<51300 && !icmp))((nr_info.rach.numofpream > 0))((mac-nr.rar.rapid > 0)) && ((ip.addr == 10.170.38.252) || (ip.addr == 10.170.38.253))`

| No. | Time | Source | Destination | Protocol | Length | Info |
|-----|-----------|---------------|---------------|----------------|--------|---|
| 240 | 23.932238 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 375 | UEContextSetupResponse |
| 241 | 23.937286 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcDlDcch | 504 | RRC Reconfiguration, DL NAS transport, PDU session establishment accept |
| 242 | 23.938573 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 548 | DLRRCTransfer |
| 243 | 23.960101 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 80 | ULRRCTransfer |
| 244 | 23.960101 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcUlDcch | 60 | RRC Reconfiguration Complete |
| 245 | 23.961410 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 72 | UEContextModificationRequest |

- reportConfigToAddModList: 3 items
 - Item 0
 - ReportConfigToAddMod
 - reportConfigId: 1
 - reportConfig: reportConfigNR (0)
 - reportConfigNR
 - reportType: eventTriggered (1)
 - eventTriggered
 - eventId: eventA1 (0)
 - eventA1
 - a1-Threshold: rsrp (0)
 - rsrp: -97dBm <= S5-RSRP < -96dBm (60)
 - ..0. reportOnLeave: False
 - hysteresis: 8dB (16)
 - timeToTrigger: ms512 (10)
 - rsType: ssb (0)
 - reportInterval: ms240 (1)
 - reportAmount: r1 (0)
 - reportQuantityCell
 - 1... rsrp: True

13- Event A2 triggered Message:

Successful_Intra-Freq_Xn.pcapng

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Filter: `((udp.dstport>50000 && udp.dstport<51300 && !icmp))((nr_info.rach.numofpream > 0))((mac-nr.rar.rapid > 0)) && ((ip.addr == 10.170.38.252) || (ip.addr == 10.170.38.253))`

| No. | Time | Source | Destination | Protocol | Length | Info |
|-----|-----------|---------------|---------------|----------------|--------|---|
| 240 | 23.932238 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 375 | UEContextSetupResponse |
| 241 | 23.937286 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcDlDcch | 504 | RRC Reconfiguration, DL NAS transport, PDU session establishment accept |
| 242 | 23.938573 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 548 | DLRRCCMessageTransfer |
| 243 | 23.960101 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 80 | ULRRCCMessageTransfer |
| 244 | 23.960101 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcUlDcch | 60 | RRC Reconfiguration Complete |
| 245 | 23.961410 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 72 | UEContextModificationRequest |

```

reportConfigId: 2
  reportConfig: reportConfigNR (0)
    reportConfigNR
      reportType: eventTriggered (1)
        eventTriggered
          eventId: eventA2 (1)
            eventA2
              a2-Threshold: rsrp (0)
                rsrp: -67dBm <= S5-RSRP < -66dBm (90)
                ... .0... reportOnLeave: False
                hysteresis: 1dB (2)
                timeToTrigger: ms320 (8)
              rsType: ssb (0)
              reportInterval: ms240 (1)
              reportAmount: r1 (0)
            reportQuantityCell
              ... .1 rsrp: True

```

14- Event A3 triggered Message:

Successful_Intra-Freq_Xn.pcapng

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Filter: `((udp.dstport>50000 && udp.dstport<51300 && !icmp))((nr_info.rach.numofpream > 0))((mac-nr.rar.rapid > 0)) && ((ip.addr == 10.170.38.252) || (ip.addr == 10.170.38.253))`

| No. | Time | Source | Destination | Protocol | Length | Info |
|-----|-----------|---------------|---------------|----------------|--------|---|
| 240 | 23.932238 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 375 | UEContextSetupResponse |
| 241 | 23.937286 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcDlDcch | 504 | RRC Reconfiguration, DL NAS transport, PDU session establishment accept |
| 242 | 23.938573 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 548 | DLRRCCMessageTransfer |
| 243 | 23.960101 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 80 | ULRRCCMessageTransfer |
| 244 | 23.960101 | 10.170.38.253 | 10.170.38.200 | SJ_NrRrcUlDcch | 60 | RRC Reconfiguration Complete |
| 245 | 23.961410 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 72 | UEContextModificationRequest |

```

ReportConfigToAddMod
  reportConfigId: 3
  reportConfig: reportConfigNR (0)
    reportConfigNR
      reportType: eventTriggered (1)
        eventTriggered
          eventId: eventA3 (2)
            eventA3
              a3-Offset: rsrp (0)
                rsrp: 2dBm
                ... .0... reportOnLeave: False
                hysteresis: 1dB (2)
                timeToTrigger: ms320 (8)
                .0. .... useWhiteCellList: False
              rsType: ssb (0)
              reportInterval: ms240 (1)
              reportAmount: r1 (0)
            reportQuantityCell
              ..1. .... rsrp: True

```

15- Handover Request:

Successful_Intra-Freq_Xn.pcapng

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Filter: `((udp.dstport>50000 && udp.dstport<51300 && !icmp))((nr_info.rach.numofpream > 0))((mac-nr.rar.rapid > 0)) && ((ip.addr == 10.170.38.252) || (ip.addr == 10.170.38.253))`

| No. | Time | Source | Destination | Protocol | Length | Info |
|-----|-----------|---------------|---------------|---------------|--------|--|
| 254 | 24.510779 | 10.170.38.253 | 10.170.38.200 | SJ_NrRcUIdcch | 60 | Measurement Report |
| 519 | 69.049286 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 90 | ULRRcMessageTransfer |
| 520 | 69.050118 | 10.170.38.253 | 10.170.38.200 | SJ_NrRcUIdcch | 60 | Measurement Report |
| 522 | 69.054337 | 10.170.38.253 | 10.170.38.200 | SJ_XnAP | 555 | HandoverRequest |
| 533 | 70.289123 | 10.170.38.252 | 10.170.38.200 | SJ_XnAP | 555 | HandoverRequest |
| 536 | 70.298552 | 10.170.38.252 | 10.170.38.200 | SJ_F1AP | 485 | UEContextSetupRequest, RRC Reconfiguration |
| 537 | 70.306168 | 10.170.38.252 | 10.170.38.200 | SJ_F1AP | 471 | UEContextSetupResponse |
| 538 | 70.313930 | 10.170.38.252 | 10.170.38.200 | SJ_XnAP | 505 | HandoverRequestAcknowledge |

value

- HandoverRequest
 - protocolIEs: 7 items
 - Item 0: id-sourceNG-RANnodeUEXnAPIID
 - ProtocolIE-Field
 - id: id-sourceNG-RANnodeUEXnAPIID (73)
 - criticality: reject (0)
 - value
 - NG-RANnodeUEXnAPIID: 15
 - Item 1: id-Cause
 - ProtocolIE-Field
 - id: id-Cause (7)
 - criticality: reject (0)
 - value
 - Cause: radioNetwork (0)
 - radioNetwork: handover-desirable-for-radio-reasons (1)
 - Item 2: id-targetCellGlobalID
 - ProtocolIE-Field
 - id: id-targetCellGlobalID (78)
 - criticality: reject (0)

16- Handover Request Acknowledgement (from Target):

Successful_Intra-Freq_Xn.pcapng

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Filter: `((udp.dstport>50000 && udp.dstport<51300 && !icmp))((nr_info.rach.numofpream > 0))((mac-nr.rar.rapid > 0)) && ((ip.addr == 10.170.38.252) || (ip.addr == 10.170.38.253))`

| No. | Time | Source | Destination | Protocol | Length | Info |
|-----|-----------|---------------|---------------|---------------|--------|--|
| 522 | 69.054337 | 10.170.38.253 | 10.170.38.200 | SJ_XnAP | 555 | HandoverRequest |
| 533 | 70.289123 | 10.170.38.252 | 10.170.38.200 | SJ_XnAP | 555 | HandoverRequest |
| 536 | 70.298552 | 10.170.38.252 | 10.170.38.200 | SJ_F1AP | 485 | UEContextSetupRequest, RRC Reconfiguration |
| 537 | 70.306168 | 10.170.38.252 | 10.170.38.200 | SJ_F1AP | 471 | UEContextSetupResponse |
| 538 | 70.313930 | 10.170.38.252 | 10.170.38.200 | SJ_XnAP | 505 | HandoverRequestAcknowledge |
| 539 | 70.315201 | 10.170.38.253 | 10.170.38.200 | SJ_XnAP | 505 | HandoverRequestAcknowledge |
| 540 | 70.316174 | 10.170.38.253 | 10.170.38.200 | SJ_NrRcDlDcch | 441 | RRC Reconfiguration |
| 541 | 70.318152 | 10.170.38.253 | 10.170.38.200 | SJ_F1AP | 485 | UEContextModificationRequest |

Cell: 0

- NG-RAN Xn Application Protocol (XnAP)
 - XnAP-PDU: successfulOutcome (1)
 - successfulOutcome
 - procedureCode: id-handoverPreparation (0)
 - criticality: reject (0)
 - value
 - HandoverRequestAcknowledge
 - protocolIEs: 4 items
 - Item 0: id-sourceNG-RANnodeUEXnAPIID
 - ProtocolIE-Field
 - id: id-sourceNG-RANnodeUEXnAPIID (73)
 - criticality: ignore (1)
 - value
 - NG-RANnodeUEXnAPIID: 15
 - Item 1: id-targetNG-RANnodeUEXnAPIID
 - ProtocolIE-Field
 - id: id-targetNG-RANnodeUEXnAPIID (79)
 - criticality: ignore (1)
 - value
 - NG-RANnodeUEXnAPIID: 9

17- Path Switch Request:

Successful_Intra-Freq_Xn.pcapng

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Filter: `((udp.dstport>50000 && udp.dstport<51300 && !icmp))((nr_info.rach.numofpream > 0))((mac-nr.rar.rapid > 0)) && ((ip.addr == 10.170.38.252) || (ip.addr == 10.170.38.253))`

| No. | Time | Source | Destination | Protocol | Length | Info |
|-----|-----------|---------------|---------------|----------------|--------|------------------------------|
| 548 | 70.429268 | 10.170.38.252 | 10.170.38.200 | SJ_NrRrcUIdcch | 60 | RRC Reconfiguration Complete |
| 549 | 70.430536 | 10.170.38.252 | 10.170.38.200 | SJ_NrRrcDlDcch | 97 | RRC Reconfiguration |
| 550 | 70.431897 | 10.170.38.252 | 10.170.38.200 | SJ_F1AP | 138 | DLRRCMesssageTransfer |
| 551 | 70.434409 | 10.170.38.252 | 10.170.38.200 | SJ_NGAP | 114 | PathSwitchRequest |
| 552 | 70.435711 | 10.170.38.252 | 10.170.38.200 | SJ_F1AP | 97 | DLRRCMesssageTransfer |
| 553 | 70.435712 | 10.170.38.252 | 10.170.38.200 | SJ_NrRrcDlDcch | 60 | UE Capability Enquiry |
| 554 | 70.438420 | 10.170.38.252 | 10.170.38.200 | SJ_NGAP | 141 | PathSwitchRequestAcknowledge |
| 555 | 70.439727 | 10.170.38.252 | 10.170.38.200 | SJ_XnAP | 61 | UEContextRelease |

...0 0000 0000 0000 = Reserved: 0x0000

- Item 4: id-PDUSessionResourceToBeSwitchedDLList
 - ProtocolIE-Field
 - id: id-PDUSessionResourceToBeSwitchedDLList (76)
 - criticality: reject (0)
 - value
 - PDUSessionResourceToBeSwitchedDLList: 1 item
 - Item 0
 - PDUSessionResourceToBeSwitchedDLItem
 - pDUSessionID: 1
 - pathSwitchRequestTransfer: 001f0aaa26fc000000170002
 - PathSwitchRequestTransfer
 - dL-NGU-UP-TNLInformation: gTPTunnel (0)
 - gTPTunnel
 - transportLayerAddress: 0aaa26fc [bit length 32, 0000 1010 1010 1010 0010 0110 1111 1100 decimal value 178923260]
 - TransportLayerAddress (IPv4): 10.170.38.252
 - gTP-TEID: 00000017
 - qosFlowAcceptedList: 1 item
 - Item 0
 - QosFlowAcceptedItem
 - qosFlowIdentifier: 1

18- Path Switch Request Acknowledge:

Successful_Intra-Freq_Xn.pcapng

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Filter: `((udp.dstport>50000 && udp.dstport<51300 && !icmp))((nr_info.rach.numofpream > 0))((mac-nr.rar.rapid > 0)) && ((ip.addr == 10.170.38.252) || (ip.addr == 10.170.38.253))`

| No. | Time | Source | Destination | Protocol | Length | Info |
|-----|-----------|---------------|---------------|----------------|--------|------------------------------|
| 548 | 70.429268 | 10.170.38.252 | 10.170.38.200 | SJ_NrRrcUIdcch | 60 | RRC Reconfiguration Complete |
| 549 | 70.430536 | 10.170.38.252 | 10.170.38.200 | SJ_NrRrcDlDcch | 97 | RRC Reconfiguration |
| 550 | 70.431897 | 10.170.38.252 | 10.170.38.200 | SJ_F1AP | 138 | DLRRCMesssageTransfer |
| 551 | 70.434409 | 10.170.38.252 | 10.170.38.200 | SJ_NGAP | 114 | PathSwitchRequest |
| 552 | 70.435711 | 10.170.38.252 | 10.170.38.200 | SJ_F1AP | 97 | DLRRCMesssageTransfer |
| 553 | 70.435712 | 10.170.38.252 | 10.170.38.200 | SJ_NrRrcDlDcch | 60 | UE Capability Enquiry |
| 554 | 70.438420 | 10.170.38.252 | 10.170.38.200 | SJ_NGAP | 141 | PathSwitchRequestAcknowledge |
| 555 | 70.439727 | 10.170.38.252 | 10.170.38.200 | SJ_XnAP | 61 | UEContextRelease |

- Item 4: id-PDUSessionResourceSwitchedList
 - ProtocolIE-Field
 - id: id-PDUSessionResourceSwitchedList (77)
 - criticality: ignore (1)
 - value
 - PDUSessionResourceSwitchedList: 1 item
 - Item 0
 - PDUSessionResourceSwitchedItem
 - pDUSessionID: 1
 - pathSwitchRequestAcknowledgeTransfer: 601f0aaa8289010000d80900
 - PathSwitchRequestAcknowledgeTransfer
 - uL-NGU-UP-TNLInformation: gTPTunnel (0)
 - gTPTunnel
 - transportLayerAddress: 0aaa8289 [bit length 32, 0000 1010 1010 1010 1000 0010 1000 1001 decimal value 178946697]
 - TransportLayerAddress (IPv4): 10.170.130.137
 - gTP-TEID: 010000d8
 - securityIndication
 - integrityProtectionIndication: not-needed (2)
 - confidentialityProtectionIndication: not-needed (2)
 - Item 5: id-AllowedNSSAI
 - ProtocolIE-Field