Keysight 5G NR Test Application Framework

Testing Layer 1 and Layer 2

User Guide

KEYSIGHT TECHNOLOGIES

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TABLE OF CONTENTS

1 INTRODUCTION

This user guide describes how to use the Keysight 5G NR Test Application Framework.

2 WHAT'S NEW

The main updates in this version of this help are:

2.1 New features in 5G NR Test Application v11.58

- SCPI Switch
  - SCPI Switch – new topic.
- IMS support
  - IMS Registration
  - IMS Tabs: UE Info Tab, Registered User Info Tab, Security Tab, Status Tab and Message Summary Tab.
- NR PHY tabs
  - HARQ Tab – added DL Redundancy Versions and UL Redundancy Versions parameters.
- LTE RRC/NAS tabs
  - RRC Tab – added DRB Inactivity Timer parameter.
  - EPS Bearer Config Tab – added External IP Data Interface parameter.
  - Meas Config Tab – new tab.
- Scheduling
  - Quick Config Tab – new tab.
  - Link Adaptation Tab – renamed from Common Config tab.

2.2 New features in 5G NR Test Application v11.57

- Integrated Tx Measurements
  - XApps RF Tx Measurements
- Blind Handover
  - Handover Menu – updated.
  - Blind Handover – new tutorial.
- NR Autonomous Scheduler
  - Autonomous Scheduler – new tutorial.
  - NR > Scheduling > Slot Config Tab – added downlink and uplink Time Domain Allocation Policy parameters.
- Test Frequency Presets
  - Config Tab – added Test Channel and UE Enquiry Incl parameters.

2.3 Other updates to the help

- 5G NR Test Application Configuration Options – new topic.
- Switching Operating Mode – removed NSA IP operating mode.
- PUSCH Tab – add MCS Table and MCS Table Transform Precoder.
- Slot Config Tab – added VRB to PRB Mapping.

3 RELATED DOCUMENTS

The following documents may be useful when reading this document. See the Customer Support topic for information about access to the latest software releases and documentation.

- 5G Test System Setup Help
- 5G NR Test Application Release Notes
- IMS-SIP Network Emulator Help

This document refers to the following 3GPP specifications:

3GPP LTE specifications

- 36.101, 36.133
- 36.211, 36.212, 36.213,
- 36.321, 36.322, 36.331
- 36.508, 36.521-1

3GPP 5G NR specifications

Note: All 5G NR specifications referred to in this document are to version 15.5.0 of the specifications.

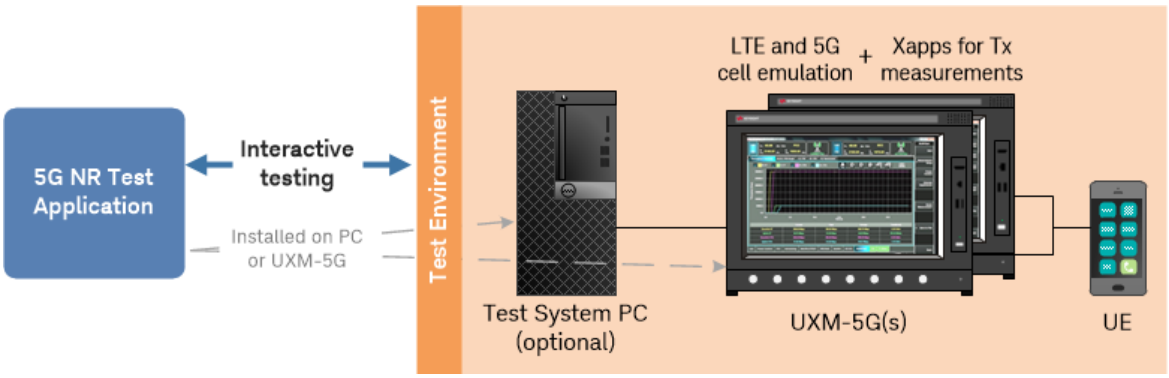
- 38.101-1, 38.101-2, 38.104
- 38.211, 38.212, 38.213, 38.214
- 38.304, 38.321, 38.331
- 38.521-1, 38.521-2, 38.521-3, 38.521-4

4 GET STARTED

4.1 About 5G NR Test Application Framework

Also see: 5G NR Test Application Configuration Options, About The Workspace and Using 5G NR Test Application Framework

5G NR Test Application Framework provides interactive real-time testing during early stages of chipset and device development, through to systems integration and verification. The main hardware in the test environment is shown below.



5G NR Test Application can be installed on the Test System PC or on the UXM-5G unit, so a separate Test System PC is optional in the test environment.

The UXM-5G Is the transceiver that emulates the 5G network. It is installed with the Windows operating system, and Keysight X-Series Measurement Application (XApps), which provides Tx measurements.

4.1.1 Features

5G NR Test Application Framework provides the following main features:

- Interactive testing. The Test Application Framework is not script-based, so you can run tests even when the device under test has failed, and re-run the same scenario without starting a new session.
- Pre-defined configurations for typical networks.
- Easy access to 5G network parameters and *LTE network parameters* at lower layers.
- Test automation using SCPI.
- Integrated measurement tools focused on performance.
- Integrated Keysight X-Series Measurement Application (X-Apps) for measuring RF and Physical layer.

4.1.2 Operating modes

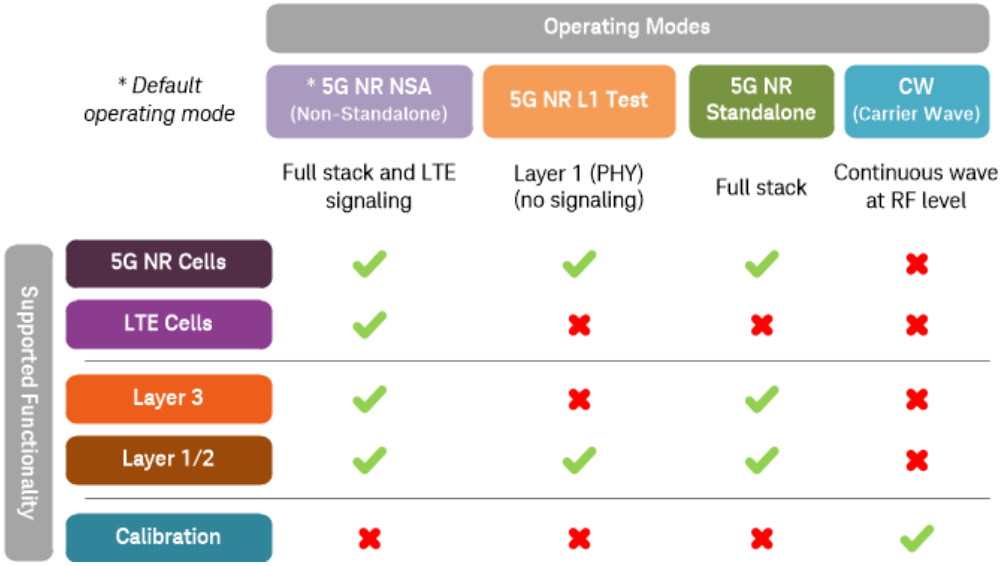
Note: *By default, this help displays topics for 5G NR NSA operating mode. To switch the help to another mode, click*  *in the Help navigation bar and choose the required operating mode. For more information, see Filtering the help.*

5G NR Test Application Framework supports the following network emulation operating modes:

- Non-Standalone Mode (NSA)
- Layer 1 Test Mode
- Standalone Mode
- Carrier Wave Mode

By default, 5G NR Tests Application Framework opens in NSA mode. To switch mode, see Switching Operating Mode.

The functionality supported by each operating mode is summarised below:



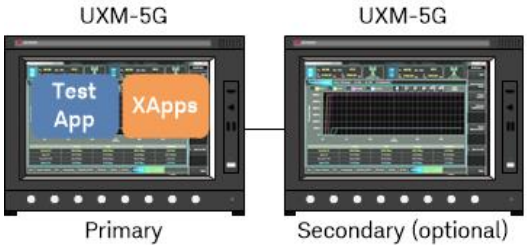
4.2 5G NR Test Application Configuration Options

In a 5G NR Test Application test system, you can install the 5G NR Test Application on a separate Test System PC or on the UXM-5G unit.

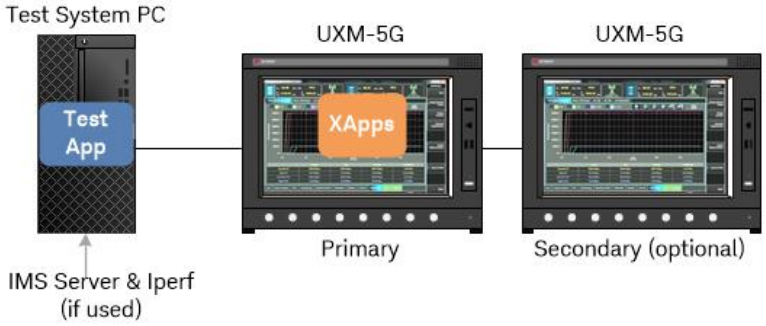
A single UXM-5G unit supports up to eight 5G NR component carriers and three LTE/LTE-A cells, so you may wish to add a secondary UXM-5G unit to support additional cells.

For details of the hardware units in a 5G NR Test Application test system, see the *5G Test System Setup Help* (listed in Related Documents).

4.2.1 5G NR Test Application on UXM-5G



4.2.2 5G NR Test Application on separate Test System PC



4.2.3 Features supported by configuration options

The following table lists the features the features supported in the two 5G NR Test Application configuration options:

Feature	5G NR Test Application on separate Test System PC	5G NR Test Application on UXM-5G
Tx measurements	✗	✔
Rx measurements (BLER/Tput Tab, CSI Tab)	✔	✔
IMS	✔ (requires IMS Server)	✗
Data Throughput	✔ (requires Iperf)	✔ (limited throughput)

4.3 About The Workspace

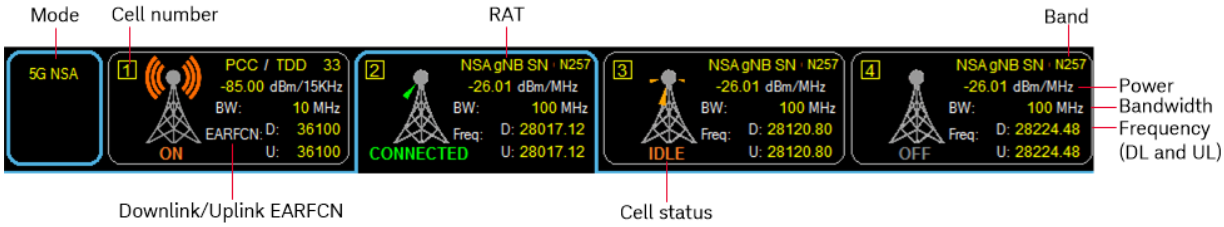
Also see: Main Menu, Tabs Displayed For NR Cells and Tabs Displayed For LTE Cells

The 5G NR Test Application workspace is launched when you start the application and is displayed in a window on the Test System PC or on the UXM-5G screen depending on your setup. The screen and its tabs differ depending on the Operating Mode of the 5G NR Test Application.

See the Help system for a workspace tour video.

4.3.1 Cell details – NSA, L1 and LTE-Anchor over IP modes

The cell details tabs select the cell whose configuration to change. It also displays information about the cell and whether it is active or inactive. The cells displayed depend on the operating mode of the application. The cells shown can be 5G NR cells and/or LTE cells.



where:

- Mode – is the operating mode in which the application is running.
- Cell number – is the number assigned to the cells by the application as shown on the System > Config tab, and is different to physical cell ID.
- RAT – displays the radio access technology of the cell (5GNR or LTE).
- Band – displays the selected band for the cell.
- Power – the transmit power level of the cell.
- Bandwidth – the downlink bandwidth as defined on the Cell > Config tab.
- Frequency – the uplink and downlink frequencies used by the 5G NR cell.
- EARFCN – the uplink and downlink EARFCN values used by the LTE cell.
- Cell status – shows the status of the RRC Connection between the UE and the cell, as one of the following:
  - OFF – the cell is OFF. It is not possible for a UE to connect to this cell.

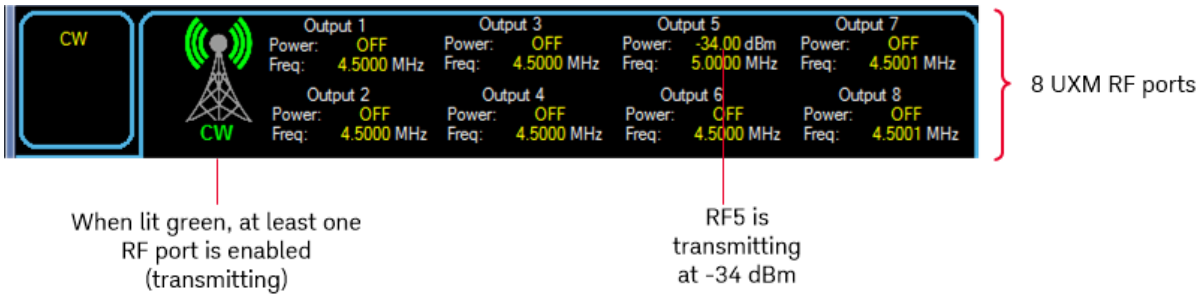
- ON – the cell is ON. A UE could connect to this cell, but it has not yet done so.
- CONNECTED – the UE is in RRC Connected state.
- AGGREGATED – this cell is currently aggregated as a carrier. The UE has been sent an RRC Connection Reconfiguration adding this SCell to the configuration.

To query the cell connection status, you can use the following SCPI command:

BSE:STATus:NR5G:<cell>, which returns one of the following values: *<OFF | ON | CONNected | IDLE | AGGRegated | ACTivated>*.

4.3.2 Cell details – CW mode

The cell details show the ports on the UXM-5G unit and indicates whether each port is transmitting (in which case the carrier wave power is shown) or not transmitting (OFF).



To start transmitting:

1. On the Cell > Config Tab, select the RF port to enable.
2. Configure the CW Power and CW frequency.
3. Select the Enable check box.

4.3.3 Tabs

The tabs provide all the fields required for system and cell configuration.

Note: Before using tabs, select (click) the cell you wish to configure in the cell details bar. The tabs will apply to this cell.

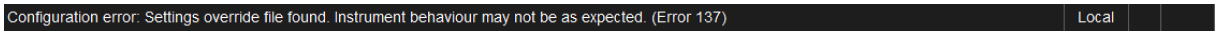
Each main tab has sub-tabs. The main tabs are at the bottom of the workarea, and the sub-tabs for each main tab appear at the top of the workarea under the cell details bar. For information about the fields displayed on each tab, see Tabs Displayed For NR Cells and Tabs Displayed For LTE Cells.

4.3.4 Main menu

The main menu enables you to perform instrument-level actions. For more information, see Main menu.

4.3.5 Status bar

The status bar displays any important error messages, or if configured, SCPI commands for the last executed action.



4.4 Using 5G NR Test Application Framework

The steps to set up and run 5G NR Test Application Framework are:

4.4.1 Step 1: Configure the hardware

Configure the test system hardware and install the 5G NR Test Application Framework application as described in the 5G Test System Setup Help. You can install the application on either of the following:

- The UXM-5G unit (using an attached monitor, not shown in the diagram above).
- An external Test System PC connected to the UXM-5G unit (as shown above).

4.4.2 Step 2: Choose the operating mode

1. Open 5G NR Test Application Framework on the UXM-5G or Test System PC.
2. Select the operating mode. This will determine the basic functionality of the 5G NR Test Application.

4.4.3 Step 3: Run tests

Follow testing procedures for the chosen operating mode:

- Non-Standalone Mode
- Layer 1 Test Mode
- Standalone Mode
- Carrier Wave Mode

Switch on the cell(s) and perform any test-specific steps (for example: initiate data transfer or initiate a call). Make any changes required to the default configuration, using the tabs for NR cells and tabs for LTE cells.

4.4.4 Step 4: Analyse results

Analyse the results in real time, or end the test and analyse the log files.

5 TUTORIALS

The following topics explain how to perform tasks using the 5G NR Test Application:

- Bandwidth Parts
- Beam Management
- Blind Handover
- Control Resource Sets (CORESET)
- DRX
- EN-DC And Split Radio Bearers
- IMS Registration
- Scheduling
  - Frame Structure
  - Scheduling
  - SSB Scheduling
  - Autonomous Scheduler
- NR cells
  - Cell Locations Within Bandwidth
  - Switching Cells On And Off
- Operating Modes
  - Switching Operating Mode
  - Non-Standalone Mode
  - Layer 1 Test Mode
  - Standalone Mode
  - Carrier Wave Mode
- Path Loss Correction
- PDU Editor
- PUCCH
- RRC Reconfiguration

5.1 Antenna Configuration (MIMO, SISO)

Configuring the downlink/uplink antenna ports used for testing requires you to update multiple fields on different tabs and also information elements in the RRC Connection Reconfiguration message.

5G NR Tabs > Cell > Config Tab

- DL Physical Antenna Ports
- UL Physical Antenna Ports

5G NR Tabs > Scheduling > Slot Config Tab

- Antenna Ports (controlled by the value of the DCI Type)

LTE Tabs > Cell > NR Cell Reconfig > Select Message

- 1CC DL SISO UL SISO (FR2)

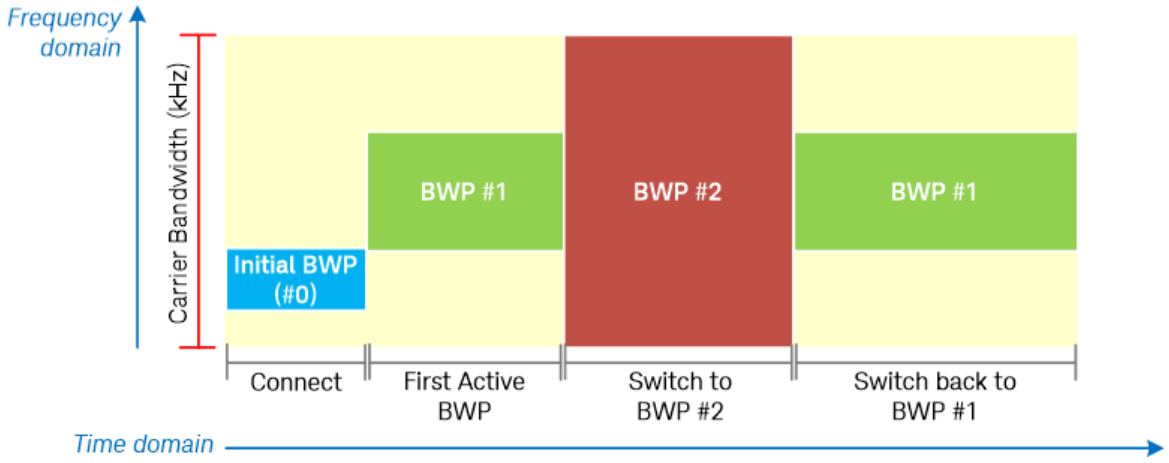
- 1CC DL MIMO UL SISO (FR2)
- 1CC DL MIMO UL MIMO (FR2)
- 2CC DL SISO UL SISO (FR2)
- 2CC DL MIMO UL MIMO (FR2)
- 4CC DL SISO UL SISO (FR2)
- 4CC DL MIMO UL MIMO (FR2)

5.2 Bandwidth Parts

Specification reference: section 4.4.5 in 3GPP TS 38.211 and section 12 in 3GPP TS 38.213.

The very wide bandwidth supported in NR can be costly in terms of the power consumption of the UE, and not all devices are able to receive the full carrier bandwidth. NR defines bandwidth parts (BWPs), which support devices not able to receive full carrier bandwidth. A device can use a narrow bandwidth for monitoring control channels and for receiving small-to-medium-sized data transmissions, and it can use the full bandwidth for receiving large amounts of data.

The initial bandwidth part is always BWP 0, and used during UE connection. in addition, you can define up to four bandwidth parts for downlink, and up to four bandwidth parts for uplink. Only one bandwidth part can be active at one time.

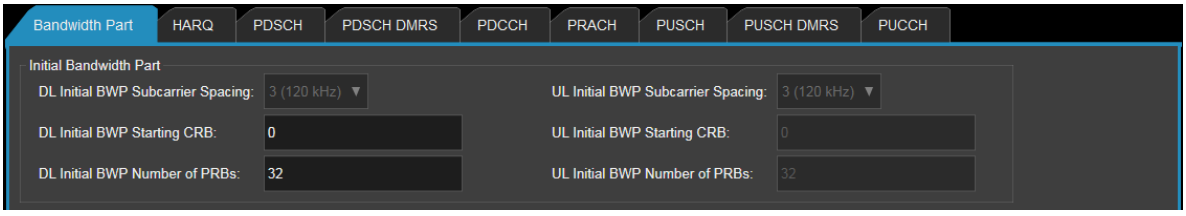


A bandwidth part is characterized by a numerology (subcarrier spacing and cyclic prefix) and a set of consecutive physical resource blocks (PRB) in the numerology of the bandwidth part, starting at a certain common resource block (CRB).

5.2.1 To configure bandwidth parts

1. In 5G Test Application Framework, select an NR cell.
2. Select the PHY tab, then the Bandwidth Part sub-tab.
3. Under Initial Bandwidth Part, configure for downlink (DL) and uplink (UL) respectively the starting carrier resource block and the number of consecutive physical resource blocks in the initial bandwidth part (BWP 0).

   Note: You cannot change the subcarrier spacing, which is taken from the basic cell configuration (Cell > Config > SCS Common) and used for scheduling.

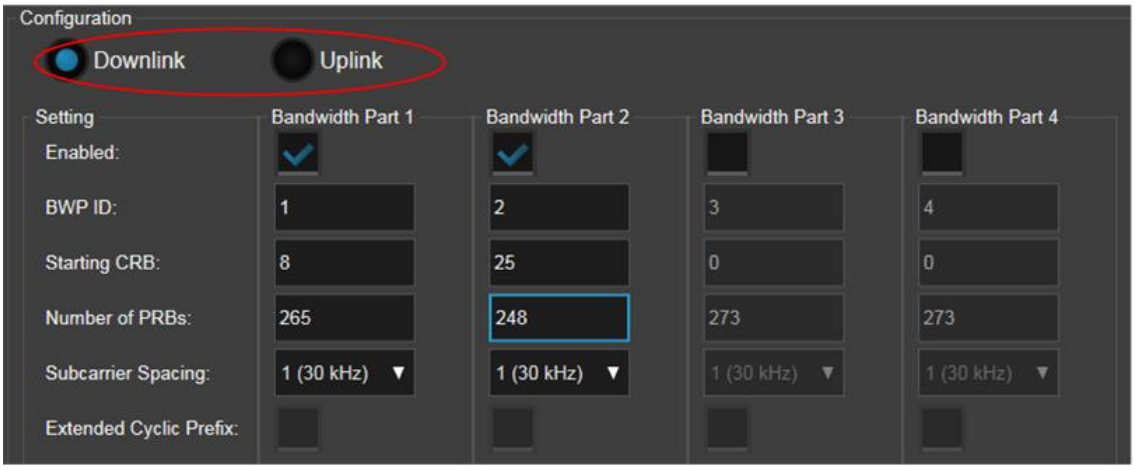


4. Under Carrier Bandwidth Parts:

a. Specify the First Active Bandwidth Part for downlink and uplink respectively. You can choose BWP 0 or any of the bandwidth parts BWP 1 to 4 defined in (b), provided they are Enabled.

Note: The first active bandwidth part is the Bandwidth Part Index shown on the Slot Configuration for downlink or uplink. Also see To make a bandwidth part active.

b. Under Configuration, select Downlink to configure up to four DL BWPs and Uplink to configure up to four UL BWPs.



For field descriptions, see Carrier Bandwidth Parts.

Notes:

- *You must enable a bandwidth part to configure it, but being enabled does not make the bandwidth part active. For details, see To make a bandwidth part active.*
- *You can specify a separate subcarrier spacing for bandwidth parts that does not match the Cell > Config > SCS Common value. However, the Slot map on the Scheduling Map Tab will only be correct for the cell's SCS Common subcarrier spacing.*

5. For a downlink bandwidth part, select each of the sub-tabs for PDSCH, PDSCH DMRS and PDCCH. For an uplink bandwidth part, select each of the sub-tabs for PUSCH, PUSCH DMRS and PUCCH.

a. From the Bandwidth Part drop-down list, select the bandwidth part that you are configuring.

b. Provide configuration details in the fields on the tab.

5.2.2 To make a bandwidth part active

After initial connection, the UE uses the First Active Bandwidth Part identified in step 4a above.

To make another bandwidth part active:

1. In 5G Test Application Framework, select the NR cell to which the UE is connected.

2. Select the PHY tab, then the Bandwidth Part sub-tab, and check that the required bandwidth part is enabled for Downlink or Uplink under Carrier Bandwidth Parts.

3. Select the Scheduling tab, then the Slot Config sub-tab:

a. In the Direction field, select Downlink or Uplink.

b. When the UE is connected, the Bandwidth Part Index field is enabled for editing. Select the bandwidth part that you wish to make active. If the bandwidth part is not listed, check that you enabled for downlink or uplink in step 2 above.

4. Click Apply Changes.

5.3 Beam Management

Beam management is a set of lower layer procedures to acquire and maintain a set of beams used for DL and UL transmission/reception. Beam management includes the following:

- Beam sweeping – an operation where beams are transmitted and/or received during a predetermined interval, in order to cover a spatial area.
- Beam search and acquisition – where the UE selects its own Tx/Rx beam(s).
- Beam measurement – where the UE measures characteristics of received beamformed signals.
- Beam reporting – where the UE reports information about the beam measurements to the cell.
- Beam refinement – an operation where
- Beam switching – an operation initiated by RRC Connection Reconfiguration or MAC CE Initiated.

QCL definition - Antenna ports are quasi co-located (QCL'ed) if a UE can assume that the large-scale properties (Doppler spread/shift, Timing offset, average delay, delay spread, average gain) of a signal received from each antenna ports are the wholly or partially identical.

5.3.1 Beam measurement

5.3.1.1 CSI-IM

CSI IM (Channel State Information Interference Management) resources are used to measure the interference of signals from neighbour cells. Typically, CSI IM resources are assigned to resource elements where the cell is not transmitting and therefore the received signal will be an indication of interference from other sources.

CSI-IM resources utilise four resource elements (in two different patterns) and can be scheduled periodically, aperiodically or semi-persistently. CSI-IM is configured on the Beam Management > CSI IM Tab.

5.3.2 Beam switching

The Beam Switch tab provides three mechanisms to perform a beam switch.

- RRC Connection Reconfiguration beam switch – Configuring a new TCI State ID
- MAC CE initiated beam switch – Configure the PDCCH Config options
- PDSCH scheduling beam switch – Updating the TCI ID on the Scheduling > Slot Config tab and configuring the PDSCH config below.

5.4 Blind Handover

Blind Handover is a mechanism to change basic parameters of the cell while in CONNECTED state. This is the preferred mechanism by RF users to sweep over different channels.

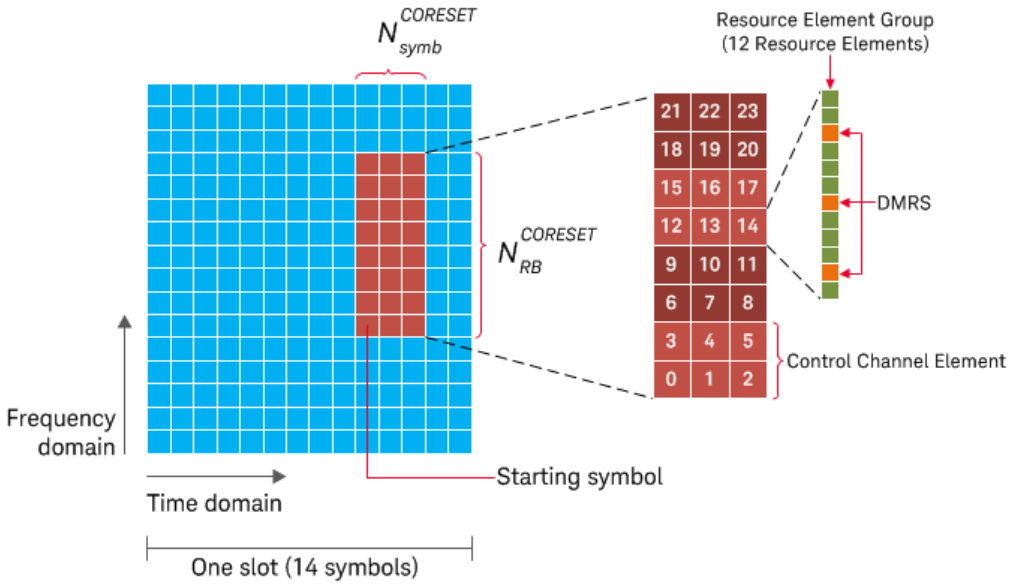
Performing a PCC Blind Handover sends an RRCConnectionReconfiguration message to tell the UE to move its PCC to a new cell. This cell does not exist until the command has been sent to the UE

You can change the following values:

- For an LTE cell – Band, EARFCN, Cell ID.
- For an NR cell – Band, ARFCN, Cell ID.

5.5 Control Resource Sets (CORESET)

A Control Resource Set (CORESET) defines search spaces in resource blocks (defined by parameters in the MIB) that contain control information. The CORESETs can vary in size, can be located at any point in the resource block and can be contiguous or non-contiguous.



A CORESET is made up of multiple control channel elements, which themselves are made up of resource element groups (i.e, multiples of 12 REs) in frequency domain and '1 or 2 or 3' OFDM symbols in time domain.

For more information see section 7.3.2.2 in 3GPP TS 38.211.

5.5.1 To configure the CORESET

1. Select the 5G NR cell tab.
2. Select the PHY tab, then the PDCCH sub-tab.
3. Select the search space to configure:
   - Common Search Space – the region in which the network transmits the PDCCH that the UE decodes using predetermined algorithms.
   - UE-Specific Search Space – the region defined by RRC messages that the UE uses to decode the PDCCH.
4. Configure the parameters for the Common and UE-Specific search spaces.
5. Click Apply to confirm the changes.

5.6 DRX

Tabs for configuring DRX: MAC/RLC/PDCP > DRX (for NR) and Conn. DRX (for LTE)

This tutorial describes Connected mode Discontinuous Reception (C-DRX) and how to configure C-DRX for LTE and NR cells.

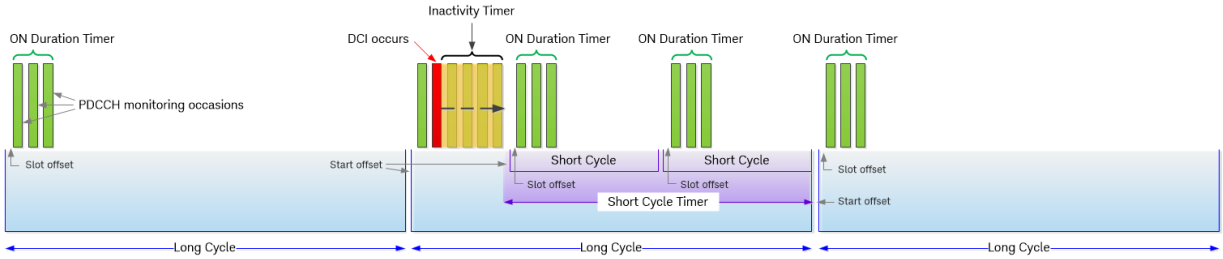
5.6.1 About DRX

Data transmission between the UE and the base station uses radio frames with10 ms duration, where each radio frame consists of 10 x 1ms subframes. The Physical Downlink Control Channel (PDCCH) at the beginning of each subframe indicates in Downlink Control Information (DCI) whether there is data for the UE to receive. The UE must monitor the PDCCHs in each subframe to find out whether they carry data to receive. Because devices do not receive data in every subframe, this monitoring leads to high battery consumption.

The main purpose of DRX is to lower battery consumption in the UE when there is no uplink or downlink data. When there is no traffic, the UE enters into sleep mode (with the receiver circuitry switched off) for a period of time configured by the network. This allows for a significant reduction in power. When there is traffic, the UE wakes up for data reception and transmission. The network delivers DRX configuration information to the UE through an RRC reconfiguration message during handover, or a System Information Block Type 2 (SIB2) during initial attach.

5.6.2 Configuring DRX

To configure DRX parameters for an LTE or NR cell, select the MAC/RLC/PDCP tab, then the DRX sub-tab (for NR) or Conn DRX tab (for LTE). The following diagram shows how the main DRX parameters control when the UE monitors PDCCH:



There are two types of DRX cycle: a long cycle and (optionally) a short cycle.

5.6.2.1 Long DRX cycle

When DRX is enabled, the long cycle starts. The UE monitors PDCCH only during the period defined by the On Duration Timer (the ON period), and sleeps for the remaining time of the cycle (the OFF period).

During the ON period:

- If no PDCCH is received, the long cycle repeats.
- If a PDCCH is received, the UE remains awake for the duration of the Inactivity Timer. This timer allows for the majority of situations, when if the UE is scheduled and active with receiving or transmitting data, it is highly likely that it will be scheduled again in the near future. One reason could be that it was not possible to transmit all the data in the transmission buffer in using one scheduling occasion and hence additional occasions are needed. Waiting until the next On Duration Timer would result in additional delays.

  When the Inactivity Timer expires:

  - If no short cycle is enabled, the UE sleeps for the remaining time of the long cycle. Then the long cycle repeats.
  - If a short cycle is enabled, the short cycle repeats for the duration of the Short Cycle Timer, as described below. If there is no DCI (no PDCCH) when the Short Cycle Timer expires, the long cycle repeats.

5.6.2.2 Short DRX cycle

The short DRX cycle is optional, because the long DRX cycle (combined with the UE remaining awake for a period after being scheduled) is sufficient for most scenarios.

A short cycle is useful for services such as voice-over-IP, which are characterized by periods of regular transmission, followed by periods of no or very little activity. If a short cycle is enabled:

- The UE follows the long DRX cycle until it receives a DCI (PDCCH).
- When the Inactivity Timer expires, the UE follows the short DRX cycle, which repeats for the period defined by the Short Cycle Timer. This timer is a multiple of short cycles that fits within the OFF period of a long DRX cycle.

Example use of short DRX cycle: Handling voice-over-IP could be done by setting the short cycle to 20 ms, as the voice codec typically delivers a voice-over-IP packet per 20 ms. The long cycle would then be used to handle longer periods of silence between talk spurts.

5.6.2.3 Offsets

The following offsets apply to long and short DRX cycles:

The Slot Offset is the delay in submilliseconds (1/32 ms units) before starting the On Duration Timer.

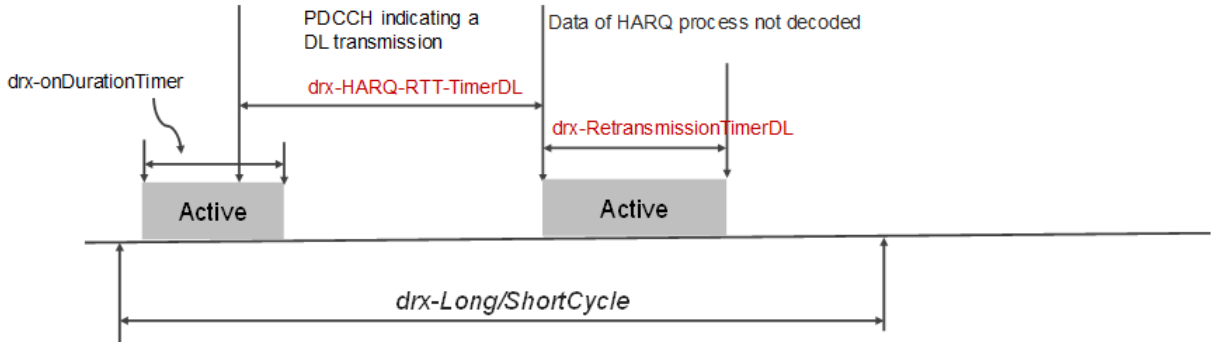
The Start Offset defines the subframe where the long cycle and short cycle starts.

5.6.3 HARQ retransmissions

If the UE is scheduled a transmission in the downlink it could not decode, a typical situation is that the base station (gNB or eNB) retransmits the data at a later time, often as soon as possible.

The DRX configuration includes a HARQ retransmission timer for downlink and uplink. The timer starts after an erroneously received transport block, and wakes up the UE receiver when it is likely for the base station to schedule a retransmission.

The HARQ timers are:



5.6.4 Terminating the ON period

In addition to the RRC configuration of the DRX parameters, the base station can send a MAC Control Element (CE) command to terminate an On Duration Timer (ON period) and instruct the UE to follow the long DRX cycle. This can be used to reduce the device power consumption when the base station knows that there is no additional data awaiting transmission in the downlink and hence there is no need for the UE to be active.

5.7 EN-DC And Split Radio Bearers

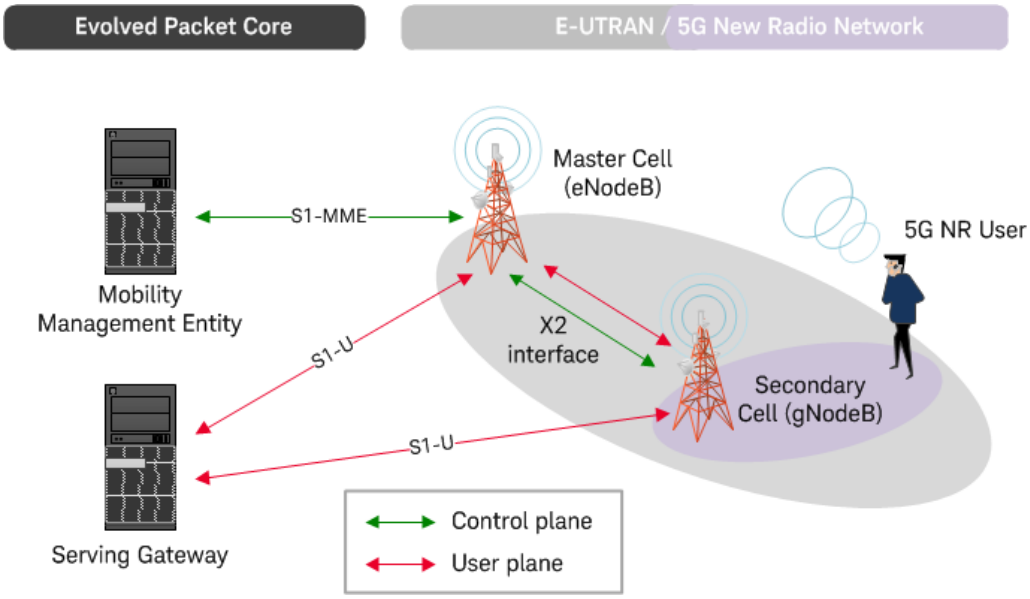
This tutorial describes how dual connectivity works between E-UTRAN and New Radio cells, and also describes how to configure split radio bearers in Test Application Framework

5.7.1 About E-UTRAN New Radio Dual Connectivity

E-UTRAN New Radio Dual Connectivity (EN-DC) provides a mechanism for EN-DC enabled devices to send and receive data to and from connected E-UTRAN and/or 5G NR cells. This enables network operators to leverage existing E-UTRAN infrastructure whilst adding 5G NR cells to increase capacity and performance.

The E-UTRAN cells (eNodeBs) are grouped into master cell groups (MCGs) and the 5G NR cells (gNodeBs) are grouped into secondary cell groups (SCGs). Master cells (eNodeBs) communicate with secondary cells (gNodeBs) over the X2 interface for user and control plane data. The eNodeBs and gNodeBs communicate with the evolved packet core (EPC) using the S1 interface, with all mobility management data from the EPC transmitted to the gNodeBs via the eNodeBs.

For more information about dual connectivity, see section 4 in 3GPP TS 37.340.



5.7.2 Signaling Radio Bearers

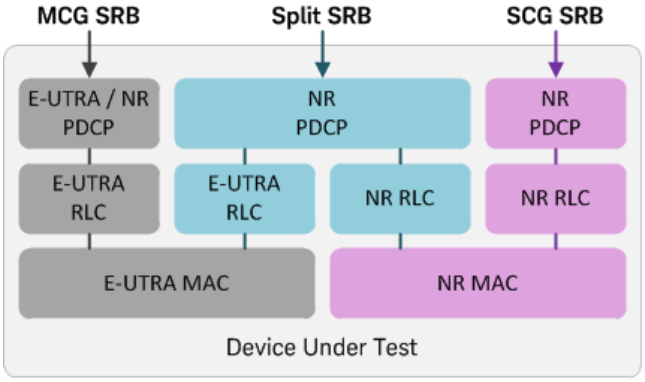
A Signaling Radio Bearer (SRB) is responsible for carrying downlink control channel (DCCH) signaling data during the initial connection establishment (configuring the initial radio access bearers RABs) and for all subsequent signaling requests (handovers, reconfiguration and release requests).

5.7.2.1 Control Plane

Initially, SRB1 uses the E-UTRAN PDCP, then after the NR connection establishment, the master cell group (MCG) SRBs (SRB1 and SRB2) can use either the NR PDCP and/or the E-UTRAN PDCP.

EN-DC-capable devices can have DRBs and SRBs configured for use with the NR PDCP before EN-DC is configured.

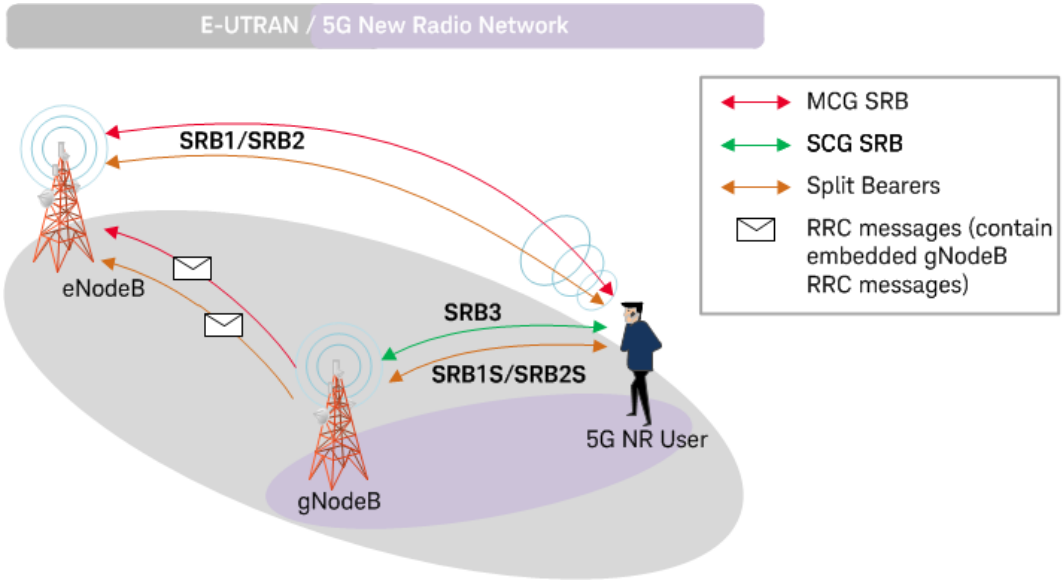
5.7.2.2 User Plane



From the device under test's perspective, there are three types of signaling radio bearer:

- The master cell group (MCG) is a group of serving cells (eNodeBs) associated with the master (E-UTRAN) node, which provides a direct SRB (SRB1, SRB2) between the master node and the device under test. The SRB also delivers RRC messages which include RRC configurations for the secondary node.
- The split SRB is a signaling radio bearer (SRB1+SRB1S, SRB2+SRB2S) that is split between the master node and the secondary node. This enables the master node to send RRC messages for the master and/or secondary node. The master node also delivers RRC messages which include RRC configurations for the secondary node.
- The secondary cell group (SCG) is a group of serving cells (gNodeBs) associated with the secondary (5G NR) node, which provides a direct SRB (SRB3) between the secondary node and the device under test and is used to deliver RRC messages.

The following diagram displays the different signaling radio bearers used.



5.7.3 To configure split radio bearers

1. Identify the radio bearer to split between E-UTRAN and New Radio. The radio bearer identifier (drb_identity) is defined in the RRC Connection Reconfiguration message for both the E-UTRAN and New Radio cells.
   - The drb_identity for LTE is specified under radioResourceConfigDedicated.
   - The drb_identity for NR is specified under nCE > nr_Config > nr_SecondaryCellGroupConfig.
2. Select a 5G NR tab, then display the MAC/RLC/PDCP > DRB tab.
3. Specify the radio bearer ID of the bearer to split.

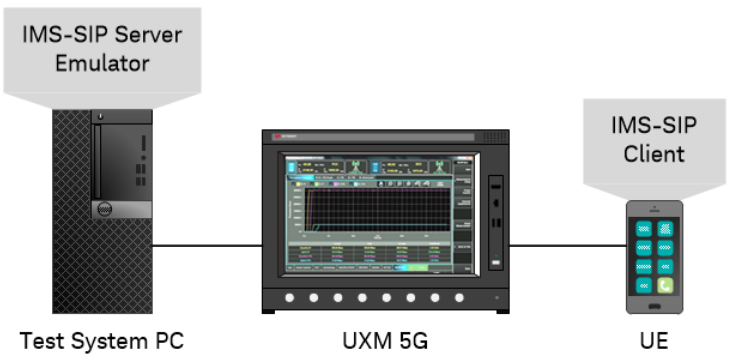
   Note: The radio bearer identifier must match the value defined in the RRC Connection Reconfiguration message for the LTE and 5G NR cell.
4. Specify the split ratio percentages for E-UTRAN and New Radio.

   Note: The split ratios for E-UTRAN and New Radio must add up to 100.
5. Click Apply.

5.8 IMS Registration

This tutorial describes how to perform an IMS registration using the Test Application and the Keysight IMS-SIP Server Emulator. Emulating IMS registration requires a separate PC which runs the IMS Server.

For more information about the IMS Emulator, see the IMS-SIP Network Emulator Help.



The steps to perform an IMS Registration using Test Application and the Keysight IMS-SIP Server Emulator:

- Configure IP addresses on the network interface
- Launch and configure Test Application

- Perform an IMS registration

5.8.1 Configure IP addresses on the network interface

Note: The exact details in this section depend on the network-interface used for testing. The examples in this section are for the Anite TCP/IP adapter and the 10Gbps adapter on the instrument.

To configure IP addresses on the network interface:

1. On the Test System PC, display the configured network connections via: Control Panel > Network and Internet > Network Connections.
2. Modify the network-interface (NIC) parameters by right-clicking on the network connection for the appropriate NIC (Anite TCP/IP or 10Gbps Adapter) as below:

   Anite TCP/IP Adapter

   a. Right click on the network connection for the adapter with the device name Anite TCP/IP Adapter (typically configured with a name of Local Area Connection), then select Properties.

   b. Configure IPv4 and IPv6 addresses as follows:

      For IPv4:

      i. Click Internet Protocol Version 4 (TCP/IPv4) and click Properties.
      ii. Select Use the following IP address.
      iii. Under IP address, specify 192.168.10.1.
      iv. Under Subnet mask, specify 255.255.255.0.
      v. Click OK.

      For IPv6:

      i. Click Internet Protocol Version 6 (TCP/IPv4) and click Properties.
      ii. Select Use the following IP address.
      iii. Under IP address, specify FD00:2000::1.
      iv. Under Subnet prefix length, specify 48.
      v. Click OK.

   10Gbps Adapter

   a. Right click on the network connection for the adapter with the device name Intel(R) Ethernet Server Adapter X520-2#2 (typically configured with a name of Local Area Connection 4), then select Properties.

   b. Configure IPv4 and IPv6 addresses as follows:

      For IPv4:

      i. Click Internet Protocol Version 4 (TCP/IPv4) and click Properties.
      ii. Select Use the following IP address.
      iii. Under IP address, specify 192.168.2.1.
      iv. Under Subnet mask, specify 255.255.255.0.
      v. Click OK.

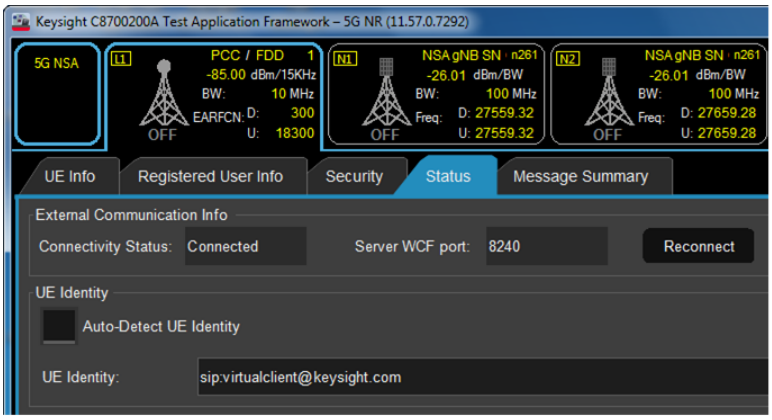
      For IPv6:

      i. Click Internet Protocol Version 6 (TCP/IPv4) and click Properties.
      ii. Select Use the following IP address.
      iii. Under IP address, specify FD00:3000::1.
      iv. Under Subnet prefix length, specify 48.
      v. Click OK.

5.8.2 Launch and configure Test Application

To launch and configure the Test Application:

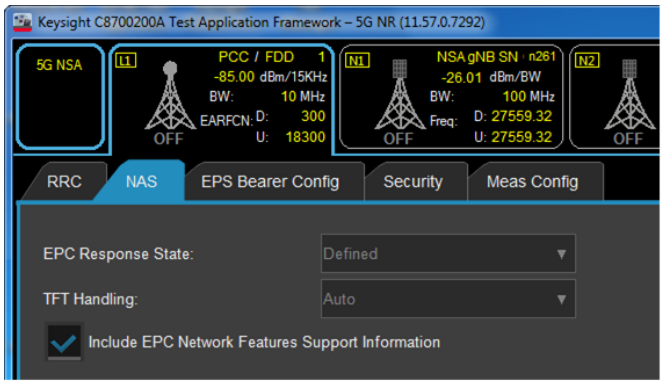
1. Launch the Test Application, which automatically launches the IMS Server application.
2. Verify that the Test Application is connected to the IMS Server as follows:
   a. On the LTE cell, display the IMS tab and the Status sub-tab.
   b. Under External Communication Info, ensure that the Connectivity Status is Connected (as shown below):



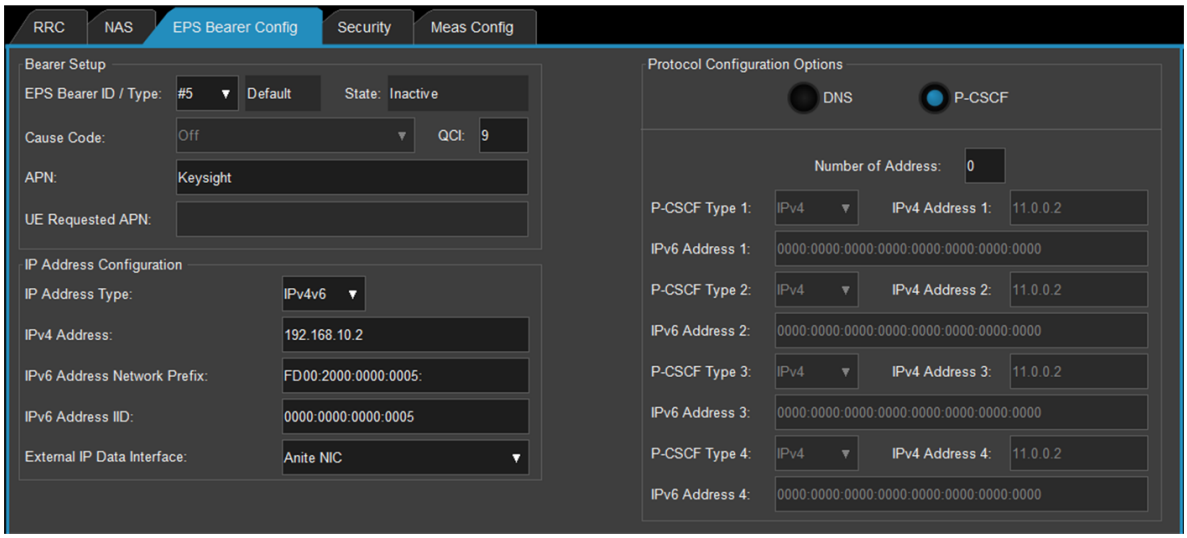
3. Under UE Identity, select or re-configure the Auto-Detect UE Identity parameter.

   Note: For most use cases, the Auto-Detect UE Identity should be enabled, except for unregistered-calling cases (such as eCall) or if auto-detect has issues. If disabled, user must manually enter the correct UE identity.

4. Configure general Test Application parameters for the UE under test (power levels, band, etc..).
5. Display the RRC/NAS tab, then the NAS sub-tab.
6. Select the Include EPC Network Features Support Information parameter.



7. Select the RRC/NAS > EPS Bearer Config sub-tab.



8. Configure the EPS bearers according to the following tables (depending on the NIC used):

   Note: *The table-content assumes the UE requests 2 default-bearers, with the second being an IMS bearer.*

   Anite TCP/IP Adapter

EPS Bearer ID	APN	IPv4 Address	IPv6 Prefix	IPv6 IID	External IP Data Interface	P-CSCF Addresses
5	Keysight	192.168.10.2	FD00:2000:0000:0005:	0000:0000:0000:0005	Anite NIC	N/A
6	ims	192.168.10.3	FD00:2000:0000:0006:	0000:0000:0000:0006	Anite NIC	192.168.10.1, FD00:2000:0000:0000:0000:0000:0000:00

   10Gbps NIC

EPS Bearer ID	APN	IPv4 Address	IPv6 Prefix	IPv6 IID	External IP Data Interface	P-CSCF Addresses
5	Keysight	192.168.2.2	FD00:3000:0000:0005:	0000:0000:0000:0005	10Gbps NIC	N/A
6	ims	192.168.2.3	FD00:3000:0000:0006:	0000:0000:0000:0006	10Gbps NIC	192.168.10.1, FD00:3000:0000:0000:0000:0000:0000:000

   Note: *The 'ims' APN is UE-specific and should be aligned to what the UE wants.*

5.8.3 Perform an IMS registration

Note: *The steps required to provoke IMS registration from the UE are UE-specific, so this section covers the high-level steps.*

To perform an IMS registration:

1. In Test Application, switch on the LTE cell.
2. Power on (or power cycle) the UE and wait for the LTE attach.
3. If the UE is not configured to automatically request an IMS bearer and to send registration, you must manually trigger the UE to perform these actions (for example using AT commands).

   Note: *If this is the first time registering using this ISIM/Identity:*

- *Upon registration, a profile for the user is created in the IMS Server (with a default configuration of 'no-security' in IMS).*
- *The UE should be IMS de-registered and re-registered in this case, to sync IMS security correctly into the new profile.*

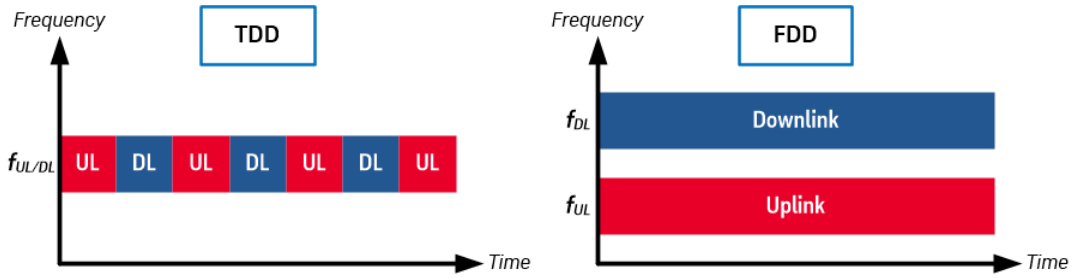
4. If IMS registration is successful (and the UE IMS identity in Test Application is correctly aligned), the Test App displays the following IMS-related information:
   - Registered User Info tab – displays a list of UE IMS registrations.
   - Message Summary tab – displays the registration messaging.
   - UE Info tab – displays various IMS identity and capability information for the registered device.

5.9 Scheduling

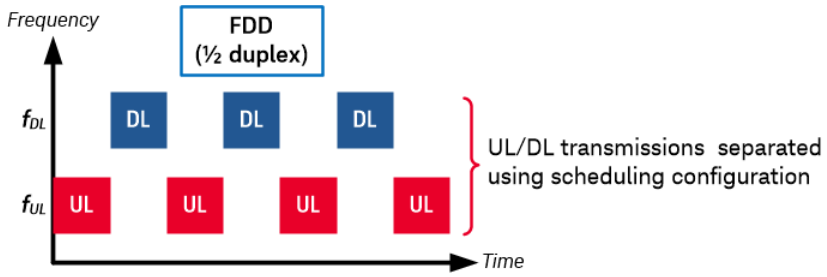
5.9.1 Frame Structure

See also: Scheduling

The structure of 5G NR frames differ depending on the duplex mode supported by the NR cell, defined in the cell configuration (Cell > Config > Duplex_Mode).

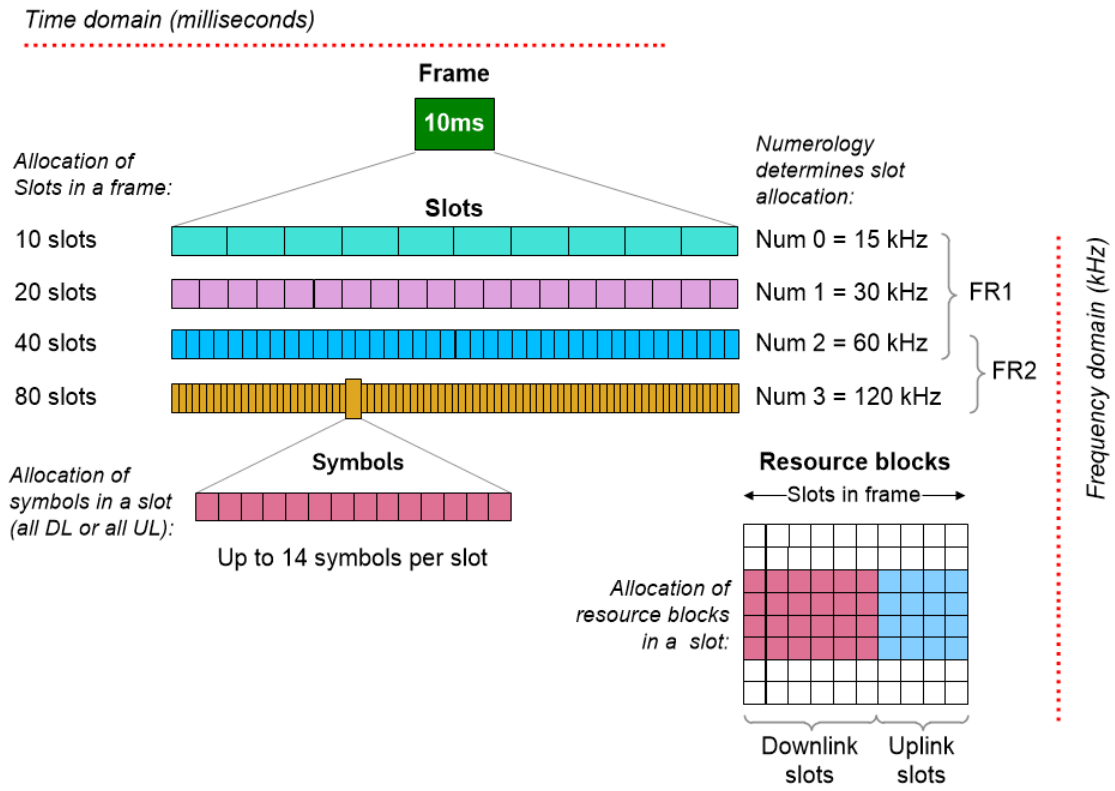


If the device under test only supports half-duplex FDD, that is it cannot simultaneously transmit and receive, then you can ensure that the uplink and downlink resource allocations do not overlap using the scheduling configuration.



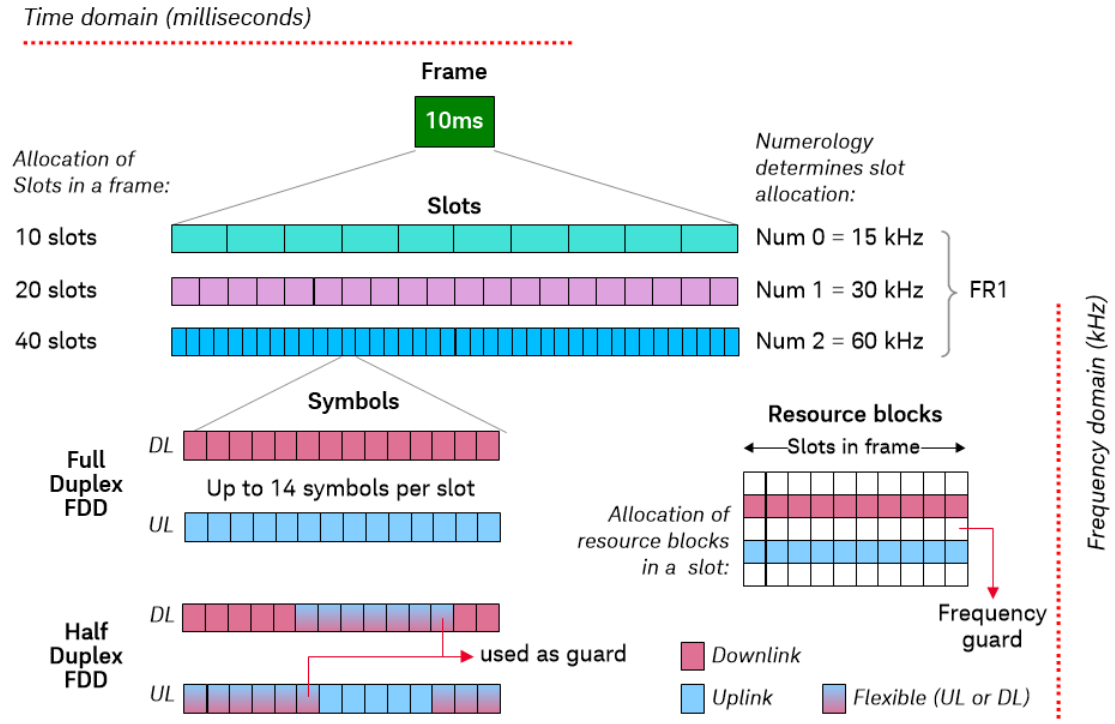
5.9.1.1 TDD frame structure

A Time Division Duplex (TDD) transmission scheme transmits and receives data using a single frequency but with uplink and downlink data differentiated by time. In TDD schemes a frame is defined as 10ms and consists of a number of slots depending on the numerology.



5.9.1.2 FDD frame structure

A Frequency Division Duplex (TDD) transmission scheme transmits and receives data using separate frequencies for uplink and downlink data. In FDD schemes a frame is defined as 10ms and consists of a number of slots depending on the numerology with simultaneous (full duplex mode) uplink and downlink transmissions.



5.9.1.3 Frames and slots

A frame has a duration of 10 milliseconds and consists of 10 subframes. The number of slots in each frame and hence their time interval depends on the Numerology, which corresponds to subcarrier spacing in the frequency domain:

- Numerology 0 (FR1) – subcarrier spacing 15 kHz = 10 slots per frame

- Numerology 1 (FR1) – subcarrier spacing 30 kHz = 20 slots per frame
- Numerology 2 (FR1 and FR2) – subcarrier spacing 60 kHz = 40 slots per frame
- Numerology 3 (FR2) – subcarrier spacing 120 kHz = 80 slots per frame

Each slot can be configured with a different configuration of uplink and downlink (or flexible) symbols. Slot formats are defined in Table 11.1.1-1 in 3GPP TS 38.213. For TDD, symbols in a slot can be used for either uplink or downlink. For FDD, symbols can be used for uplink, downlink or flexible (which can be used for either uplink or downlink.

Note: In the current Protocol R&D Toolset release, all symbols in a TDD slot can be used for either uplink or downlink. In future releases, a mix of uplink and downlink will be allowed.

5.9.1.4 Symbols

Each slot contains 14 Orthogonal Frequency Division Modulation (OFDM) symbols. NR enables transmission to start at any OFDM symbol, and to last only as many symbols as needed for the communication. This type of mini-slot transmission can facilitate very low latency for critical data, as well as minimize interference to other links, according to the "lean design" principle in NR that aims at minimizing transmissions, leading to higher network energy efficiency and lower interference.

Note: When using an extended cyclic prefix, the number of symbols is a slot is 12. For more information, refer to section 4.3.2 in 3GPP TS 38.211.

5.9.1.5 Resource blocks

A resource block (RB) consists of 12 consecutive subcarriers in the frequency domain. In the Scheduling dialog, you can configure the number of resource blocks for uplink and downlink, and hence the number of supported sub-carriers.

5.9.2 Scheduling

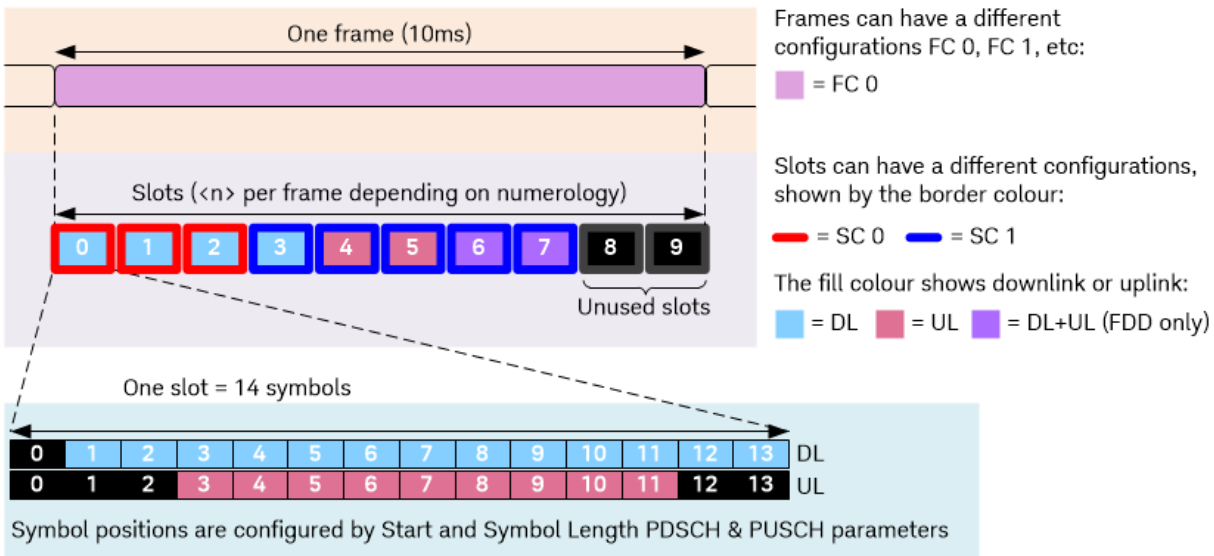
Also see: Frame Structure and SSB Scheduling

The 5G NR Test Application provides a mechanism to configure a repeating pattern of different frame configurations, each of which has a different slot map that contains different slot configurations. Each slot configuration contains different parameters for configuring uplink and downlink scheduling.

5.9.2.1 The scheduling map

The scheduling map for an NR cell is shown on the cell's Scheduling > Scheduling Map tab.

Currently, all symbols in a slot can be used for either uplink or downlink. In future releases, a mixture of uplink and downlink will be allowed to configure the different allowed slot formats defined in Table 4.3.2-3 in 3GPP TS 38.211.



Note: A slot configuration can differ from frame to frame, so SC 0 under FC 0 could differ from SC 0 under FC 1.

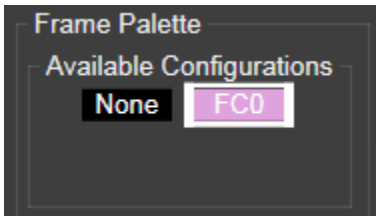
5.9.2.2 Numerology

On the NR cell's Cell > Config tab, the numerology/subcarrier spacing determines the number of slots per 10 ms frame, which in turn determines the duration of each slot. The available numerology values depend on the cell's frequency range, as shown below:

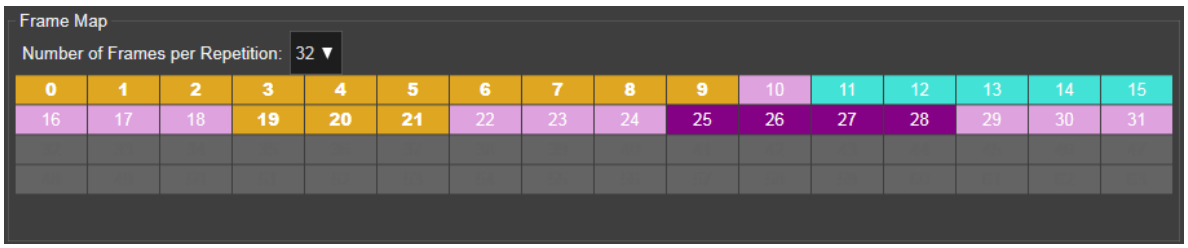
Duplex Mode	Frequency Range	Numerology (μ) & Subcarrier Spacing	Slots Per Frame	Duration of each slot
TDD and FDD	FR1	0 (15 kHz)	10	1 ms
	FR1	1 (30 kHz)	20	0.5 ms
	FR1	2 (60 kHz)	40	0.25 ms
TDD only	FR2 and Custom	2 (60 kHz)	40	0.25 ms
	FR2 and Custom	3 (120 kHz)	80	0.125 ms

5.9.2.3 To configure scheduling

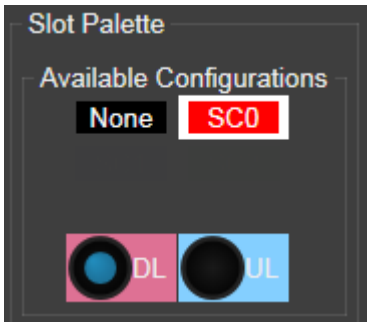
1. Select the required NR cell in the cell details area of the workspace.
2. On the Cell > Config tab, specify the Frequency Range and Subcarrier Spacing.
3. Display the Scheduling > Scheduling Map tab.
4. Note the shortcut bar. If you have more than one slot configuration, you can use the Copy to all SCs button to copy the fixed MCS Index and Starting resource block number and number of resource blocks for the selected slot configuration in the uplink or downlink to all slot configurations.
5. Specify the Number of Frames Per Repetition, which determines the number of frames in the frame map.
6. In the Frame Palette, under Available Configurations, click FC0.



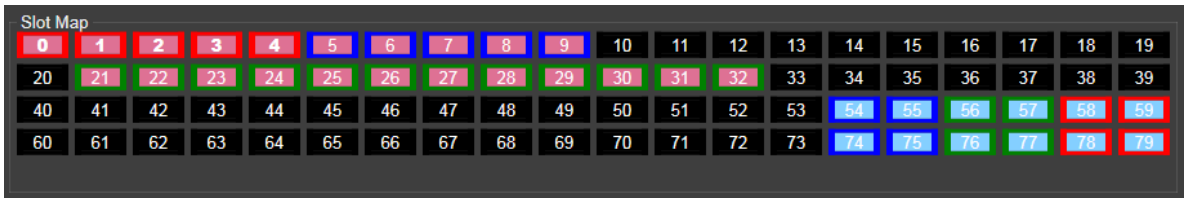
7. On the Frame Map, click on the frame numbers for which to schedule resources in the repeating frame map pattern.



8. In the Slot Palette, under Available Configurations, click SC0.

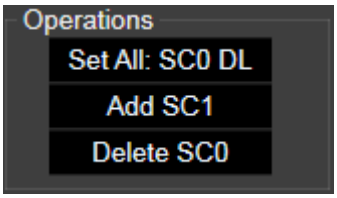


9. Click DL, then on the Slot Map, click on the slots for which to schedule downlink resources.
10. Click UL, then on the Slot Map, click on the slots for which to schedule uplink resources.



The colour of the slots indicates whether the slot is configured for uplink (blue) or downlink (pink) resources, and the colour of the borders indicates the slot configuration used for that slot.

11. Optionally, define additional slot configurations as part of frame configuration 0 as follows:
    a. On the Scheduling Map sub-tab, under Slot Palette > Operations, click Add SC1.
    b. Under Slot Palette > Available Configurations, select SC1.

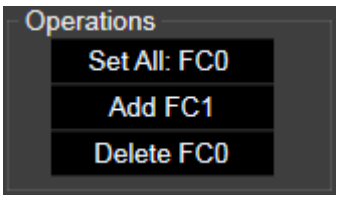


    c. Click DL, then on the Frame Map, click on the slots for which to schedule downlink resources.
    d. Click UL, then on the Frame Map, click on the slots for which to schedule uplink resources.

    You can specify up to five unique slot configurations (SC0, SC1, SC2, SC3, and SC4) for each frame configuration.

    Note: Slot configurations are unique to the selected frame configuration i.e. SC0 under FC0 is different to SC0 under FC1.

12. Optionally, define additional frame configurations as follows:
    a. On the Scheduling Map sub-tab, under Frame Palette > Operations, click Add FC1.



    b. Under Frame Palette > Available Configurations, select FC1.
    c. Repeat steps 5-9 (above).

    You can specify up to five frame configurations (FC0, FC1, FC2, FC3, and FC4), each with up to five unique slot configurations.

13. Once you have defined the frames and slots in which to schedule uplink and downlink resources, configure the uplink and downlink settings, on the Slot Config tab, for each slot configuration in each frame configuration as follows:

a. Select the Slot Config tab.

b. Under Frame Configuration, select the frame configuration to configure.

c. Under Slot Configuration, select the slot configuration to configure.

d. Under Direction, select:

- Downlink – to configure the downlink settings under DL Settings.
- Uplink – to configure the uplink settings under UL Settings.

14. Once complete, update all of the scheduling information to the cell by clicking Apply from the main menu.

5.9.3 SSB Scheduling

The Synchronization Signal Block (SSB) is used during initial access procedures, when a device finds a cell to camp on, receive system information and request a connection through random access.

5.9.3.1 Synchronization Signal Block

A Primary Synchronization Signal (PSS) and Secondary Synchronization Signal (SSS), is periodically transmitted on the downlink from each NR cell. The device uses these to find, synchronize with, and identify the network. The Physical Broadcast Channel (PBCH) is transmitted with the PSS/SSS and contains a minimum amount of system information essential for initial access to the cell, and an indication of where the remaining broadcast system information is transmitted.

Together, the PSS, SSS and PBCH are referred to as the SS-Block or SSB.

5.9.3.2 Configuring the SSB

5G NR Test Application provides the following main parameters for the SSB:

1. Subcarrier Spacing – specified on the NR cell's Cell > SSB/Broadcast tab.

The SSB is transmitted on a set of time/frequency resource elements within the basic OFDM grid. The SSB bandwidth is the number of subcarriers used for the SSB (240) multiplied by the subcarrier spacing.

A single numerology/subcarrier spacing is defined for the SSB within the frequency range of the NR cell. The following table lists frequency ranges and corresponding SSB numerologies:

Numerology (μ)	Subcarrier spacing (kHz)	Frequency Range
0	15	FR1
1	30	FR1
3	120	FR2 and Custom
4	240	FR2 and Custom

Note:

- A subcarrier spacing of 60 kHz cannot be used for SSB transmission regardless of frequency range.
- A subcarrier spacing of 240 kHz can be used for SSB transmission although it is currently not supported for other downlink transmissions. 240 kHz enables a very short time duration for each SS block. This is relevant in the case of beam-sweeping over many beams with a corresponding large number of time multiplexed SS blocks.

2. Periodicity – specified on the NR cell's Cell > SSB/Broadcast tab.

The SSB is transmitted periodically with a period from 5 ms to 160 ms. A longer SSB period means that a device must stay on each frequency for a longer time in order to conclude that there is no PSS/SSS on the frequency. This is compensated by the “synchronization raster”, which means that within each frequency band, there is a more limited set of possible locations of SS block compared with LTE. Instead of searching for an SSB at each position of the carrier raster (as in LTE), a device only needs to search for an SSB on the sparser synchronization raster.

Typically, a device doing initial cell search can assume that the SSB block is repeated at least once every 20 ms. However:

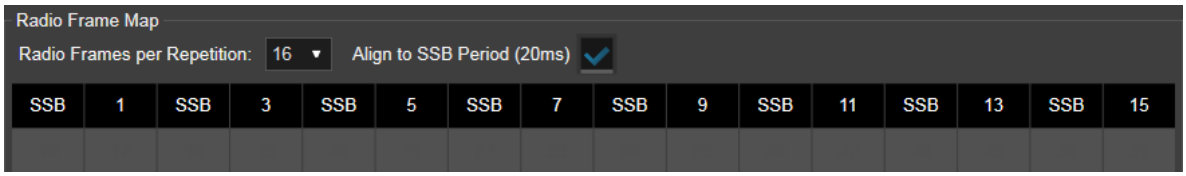
- A shorter SSB periodicity may be used to enable faster cell search for devices in connected mode.
- A longer SSB periodicity may be used to further enhance network energy performance.

You can shown the SSB periodicity on the Scheduling map:

a. From the NR cell's Scheduling tab, select the Scheduling Map sub-tab.

b. Select the option Align to SSB Period.

The frame map shows the frames in which SSB are transmitted. The following example shows SSB transmitted in every alternate frame, given an SSB periodicity of 20 ms.



3. SSB Positions – specified on the NR cell's Beam Mgmt > SSB tab.

It is possible to transmit SSB in different beams in a time-multiplexed fashion. The set of SSBs within a beam-sweep is referred to as an SS burst set. On the NR cell's Beam Mgmt > SSB tab you can specify the position of each SSB within a burst set.

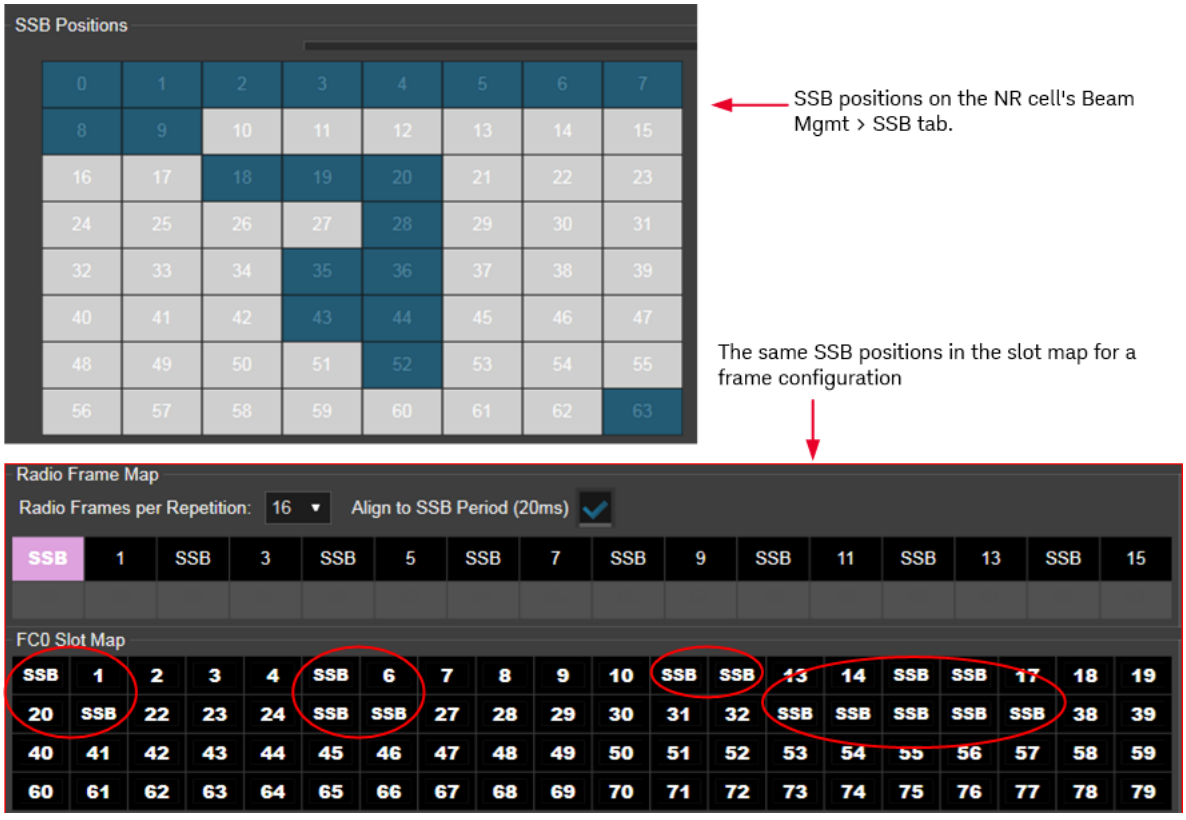
You can shown the SSB positions on the Scheduling map:

a. From the NR cell's Scheduling tab, select the Scheduling Map sub-tab.

b. Select the option Align to SSB Period.

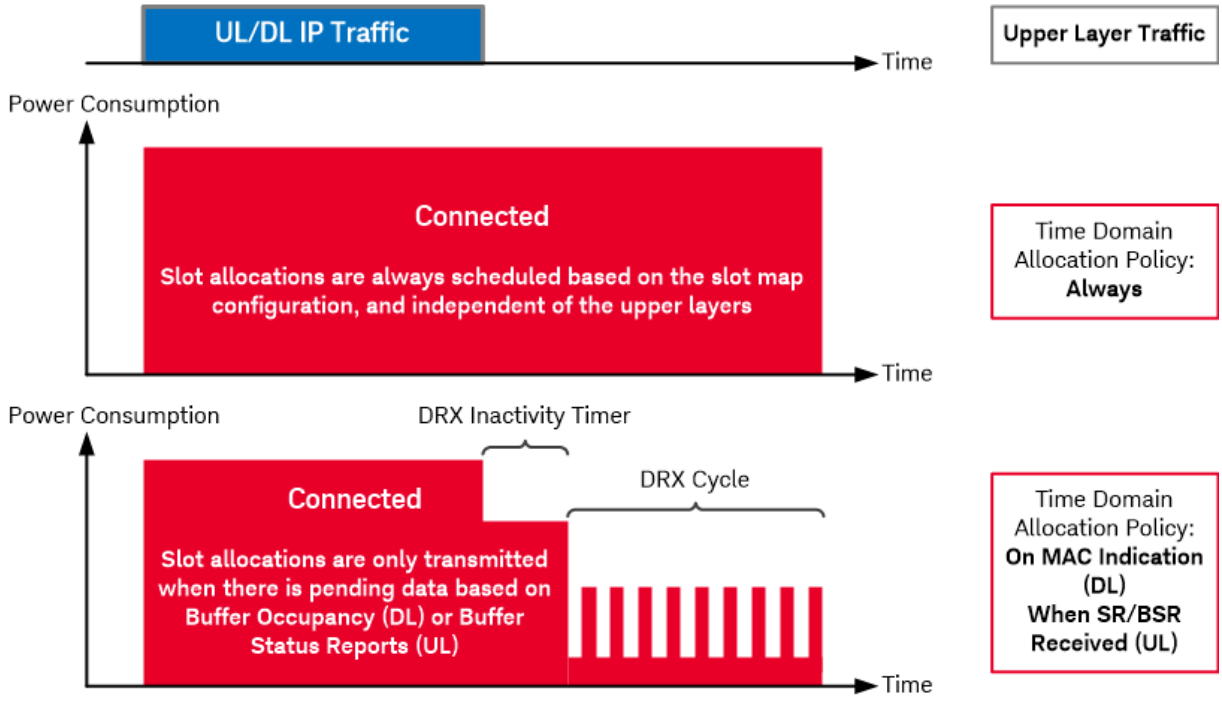
c. Select a frame that is transmitting SSB (that is, click on a frame that contains the text SSB).

The slot map shows the slots in which SSB are transmitted. The following example shows an SSB position map and its corresponding display in the slot map.



5.9.4 Autonomous Scheduler

Autonomous scheduling is used in battery drain tests to emulate real world scenarios that attempt to minimise power consumption. It does this by reducing the number of PDSCH/PUSCH slot allocations scheduled when there is no upper layer data, which is identified from the buffer occupancy (downlink) or buffer status reports (uplink) reported by the UE.



5.9.4.1 To configure autonomous scheduling

1. Configure scheduling to use when data is being sent using the Scheduling > Scheduling Map tab.
2. Enable the Time Domain Allocation Policy for downlink and/or uplink data:
   a. Display the Scheduling > Slot Config Tab.

      For Downlink:

      i. Under Direction, select Downlink.
      ii. Under Time Domain Allocation Policy, select On MAC Indication.

      For Uplink:

      i. Under Direction, select Uplink.
      ii. Under Time Domain Allocation Policy, select When SR/BSR Received.
3. Configure the DRX options on the MAC/RLC/PDCP > DRX Tab.

5.10 NR Cells

5.10.1 Cell Frequencies And Locations

This tutorial explains the frequency-related parameters in 5G NR Test Application and how they affect cell positioning on the NR Cell Locations map.

5.10.1.1 Frequency-related parameters

The following parameters are configured on the Cell > Config Tab for an NR cell.

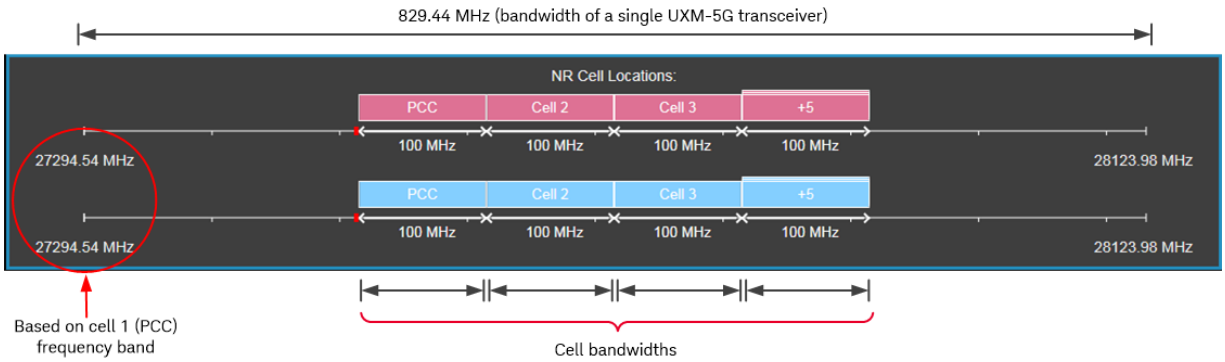
- Frequency Range – automatically updates the DL ARFCN and DL Point A values.
- DL ARFCN – the uplink ARFCN value is identical to the downlink value when using TDD.
- DL Point A – the uplink Point A value is identical to the downlink value when using TDD.

- Band – updates the other frequency parameters so that they are relevant to the selected band.
- Subcarrier Spacing – range 15 kHz to 240 kHz, but limited by the frequency range.

Note: These parameters are also set in the RRC Connection Reconfiguration message sent by the LTE cell. When the message is sent, the values defined in the user interface override the values defined in the information elements in the message.

5.10.1.2 Cell locations map

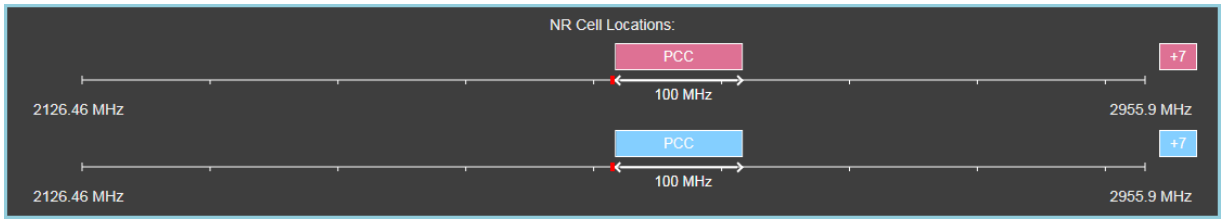
The System > Config Tab shows an NR Cell Locations map, which positions the available NR cells within the total available bandwidth of a single UXM-5G transceiver (829.44 MHz). An example is shown below:



In this example, cells 1 to 3 are spaced within the available bandwidth, and cells 4 to 8 are transmitting on the same frequency, which means that their transmissions may overlap. Downlink transmissions are shown in pink and uplink in blue. In the example, all cells are TDD, so the downlink bandwidth range is the same as the uplink bandwidth range.

The map always shows a total available bandwidth of 829.44 MHz. This is the bandwidth of a single UXM-5G transceiver. The MHz range (in the example, 27294.54 to 28123.98) is based on the band for NR cell 1 (PCC), which in the example is frequency range FR2, band n261.

The UXM-5G unit supports eight transceivers: four for uplink/downlink, and four for downlink. If the cell spacing puts some cells outside the bandwidth range for the PCC cell, more than one transceiver will be used for transmission. The map does not show the positioning for cells are outside the transceiver bandwidth for cell 1, as shown in the following example:



5.10.1.3 To change cell locations

There are two ways to configure cell locations:

- Manual mode – by manually changing the frequency-related parameters for each cell.
- Optimization mode – by allowing 5G NR Test Application to space cells automatically.

Note: There is a third configuration mode called Explicit. This mode is for Keysight use only.

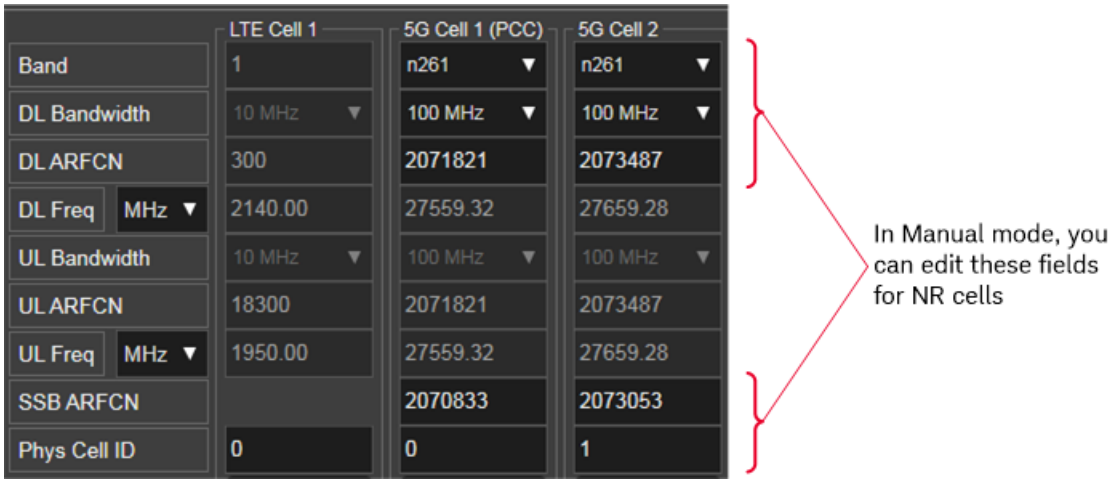
5.10.1.3.1 Manual configuration mode

To configure the cell locations map manually:

1. Choose the System tab, then the Config sub-tab.

2. In the first field, Config Mode, select Manual.

   This option allows you to edit the Band, Bandwidth, ARFCN and SSB ARFCN fields for each NR cell in the columns above the cell location map:

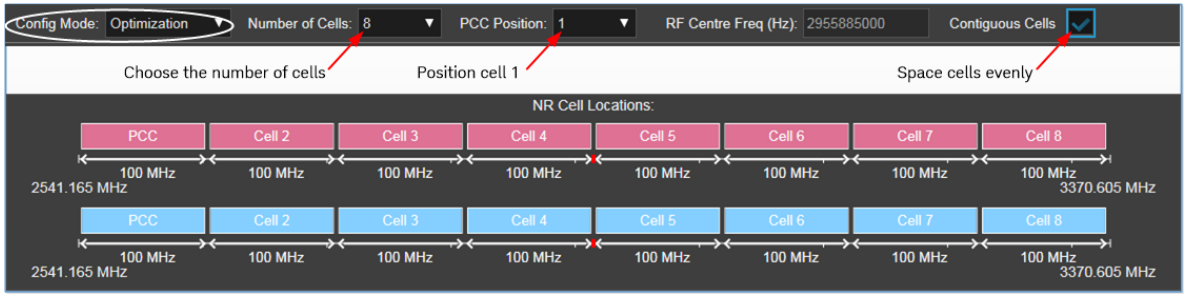


3. Edit the frequency-related fields for each cell in the columns above the location map, or change the same fields in the cell's Config tab.

   The location map updates dynamically with changed band and frequency values.

5.10.1.3.2 Optimization configuration mode

To optimize cell spacing, that is, to space cells evenly within the transceiver bandwidth:



1. Choose the System tab, then the Config sub-tab.
2. In the first field, Config Mode, select Optimization.
3. Choose optimization options:
   a. The required Number of Cells. If the number is less than eight, the remaining cells are disabled.
   b. Set the PCC Position (cell 1 position) anywhere in the cell group, from 1 to <n> where <n> is the required number of cells. This updates the ARFCN and frequency values for all required cells.
   c. Ignore the RF Centre Freq value. This is the internal UXM-5G centre frequency and cannot be changed.
   d. Click Contiguous Cells to apply even spacing across the required number of cells, based on PCC cell values.

   The band, bandwidth and ARFCN values for the other cells are disabled for the other cells, and the location map updates to show the contiguous spacing.

5.10.2 NR Cell Measurement

This tutorial describes how to configure and start NR cell intra/inter frequency measurement tests in 5G NR Test Application.

5.10.2.1 Steps to use measurement reporting

1. In the cell details area at the top of the workspace, select the NR cell whose measurements you wish to configure.
2. Select the RRC/NAS tab.
3. Configure the measurement report parameters as would be required in the meas config information element. Please refer attached screenshots as an example for the same.
4. Press apply button in the TA GUI. This will configure the default RrcConfiguration message to now have the meas-config information element in the NR container of the reconfiguration message.
5. Now please start the test procedure as normal by switching on the LTE/NR cells and attaching the UE.
6. Once the default ASN is sent out at this point – this will carry the NR container with measurement report configuration message and UE will then be expected to send the measurement report.
7. If the UE does indeed send the measurement reports – we shall me able to see it in the LTE Cell-> UE Info->UE Measurement Reports tab.

5.10.3 Switching Cells On And Off

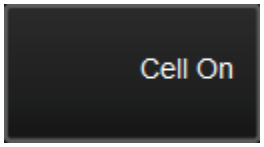
You can activate or deactivate a cell in the following ways:

5.10.3.1 Using Cell On/Off on the System > Config tab

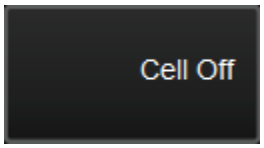
1. Display the System > Config tab:
2. In the column for the required cell, click the **Cell On** button to activate the cell.
3. When a cell is active, the button displays **Cell Off**. Click to deactivate the cell.

5.10.3.2 Using Cell ON/Off in the menu

1. Select the tab for the LTE or NR cell to be activated.
2. In the main menu, click **Cell On** to activate the selected cell:



3. If the currently selected cell tab is active, the button displays **Cell Off**. Click to deactivate the cell:



5.10.3.3 Using the NR S-Cell Aggregation panel

See *Connecting a device to a 5G NR cell*.

5.10.3.4 Using SCPI commands

To activate a cell:

SCPI: BSE:CONFig:<cell>:ACTive[:STATe] ON

To deactivate a cell:

SCPI: BSE:CONFig:<cell>:ACTive[:STATe] OFF

5.11 Operating Modes

5.11.1 Switching Operating Mode

See the Help system for a video.

Note: By default, this help displays topics for Non-Standalone operating mode (5G NR NSA). To switch the help content between operating modes, see the instructions for filtering the help.

5.11.1.1 To switch operating mode

1. From the main menu, click **Utility**, then **TA Mode Switch**, which displays the TA Mode Switch dialog.
2. Select the operating mode to use:
   - 5G NR NSA
   - 5G NR L1 Test
   - 5G NR Standalone
   - CW
3. Click **Switch TA Mode**.

SCPI: SYSTem:APPLication:NAME <NRNS | NSA | NRCW | NRSA | NREL1>

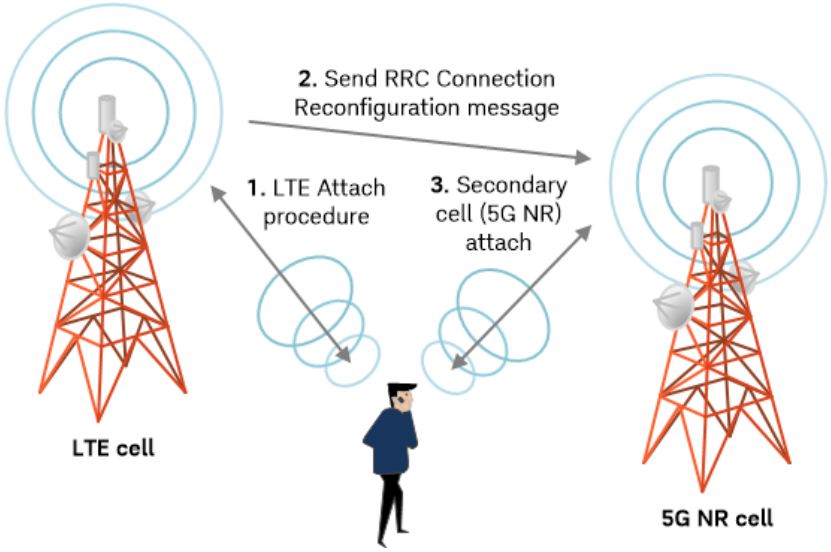
where:

- NRNS is NR Non Signaling (L1 Test)
- NSA is NR NSA
- NRCW is NR CW
- NRSA is NR Standalone
- NREL1 is NR Enhanced L1 (not currently supported)

5.11.2 Non-Standalone Mode

5G NR Test Application supports non-standalone mode option 3a, as defined in section 13.3.2 of 3GPP TS 38.912.

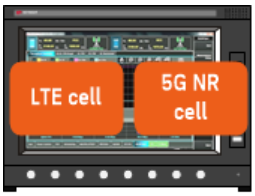
Early 5G networks and devices are Non-Standalone (NSA), that is, the 5G network is supported by existing 4G infrastructure. The device under test first connects to the existing LTE network (step 1 below), then connects to the 5G NR cell as a secondary cell (steps 2 and 3 below).



NSA mode uses the full protocol stack defined using ASN.1. It uses LTE signaling procedures and configures the NR containers which get sent to the device. You can change cells and channels dynamically.

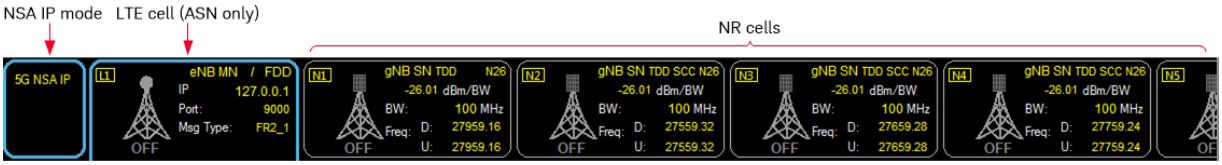
5.11.2.1 NSA mode in 5G NR Test Application

NSA is the default operating mode in 5G NR Test Application. The 5G NR and LTE cells are simulated on a single UXM-5G unit or on two UXM-5G units:



UXM-5G

When you switch to NSA IP mode, the cells displayed by 5G NR Application include an LTE cell and eight NR cells. Scroll the cell display to the right to show all NR cells:



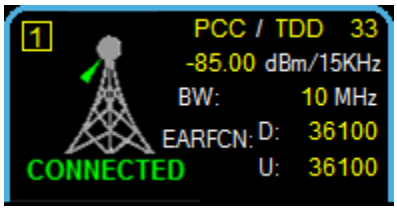
In NSA IP mode, the 5G NR Test Application shows the LTE cell, but the tabs displayed for the LTE cell do not include LTE cell configuration (no MAC/RLS/, PHY etc.). Instead, the Cell > Config Tab shows the LTE RRC Configuration Request ASN.

The tabs displayed for NR cells are listed in Tabs Displayed For NR Cells.

5.11.2.2 Connecting a device to a 5G NR cell

See the Help system for a video.

1. Set the operating mode to 5G NSA.
2. Select the LTE tab and configure the LTE parameters on the LTE tabs.
3. Activate the LTE cell, and wait for the UE to attach to the LTE cell. This is indicated by displaying a **Connected** status on the LTE cell tab.



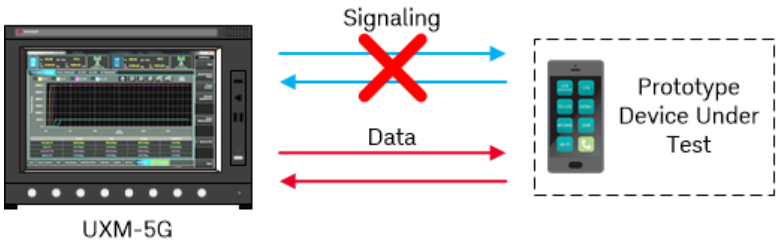
4. From the menu, select **S-Cell Aggregation**, which displays the NR S-Cell Aggregation panel.
5. Select the check boxes next to the secondary cells to aggregate, then click **Apply**.

5.11.2.3 To clear aggregated cells

From the menu, select **S-Cell Aggregation**, and in the NR S-Cell Aggregation dialog clear the check boxes for cells to be removed.

5.11.3 Layer 1 Test Mode

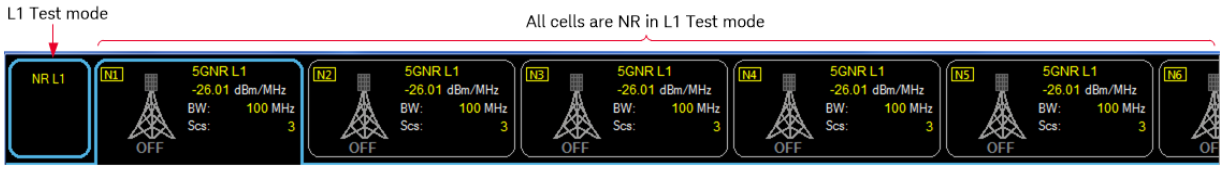
Layer 1 Test Mode is intended for early device development phases where the device is not able to perform an attach using non-standalone mode but can send and receive physical layer signals to and from the device under test:



NR L1 mode is a non-signaling mode, with no layer 3 involved to send procedures. This enables you to work solely on the layer 1 and 2 layers to analyse how the device responds to different configurations using up to eight 5G NR cells using carrier aggregation. You can broadcast a channel and check the signals to verify whether you are able to synchronize with the signals and decode all the values.

5.11.3.1 L1 Test mode in 5G NR Test Application

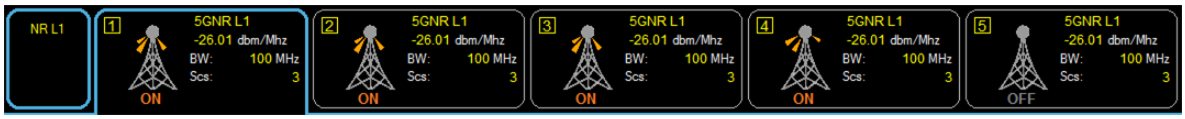
When you switch to NR L1 mode, the cells displayed by 5G NR Application are all NR (there is no LTE cell):



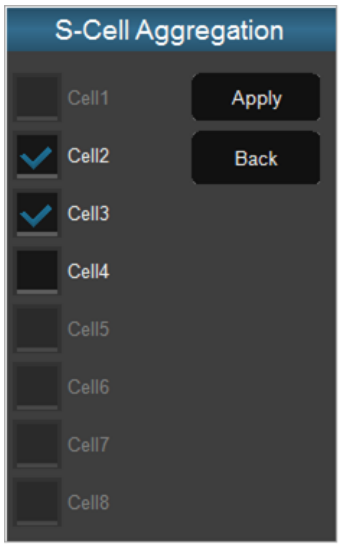
The tabs displayed are as listed in Tabs Displayed For NR Cells. There are no ASN parameters involved, because everything is driven through the 5G NR Test Application parameters. When you switch a cell on, the 5G NR Test Application parameters directly activate the cell proxy and UE proxy. You can change parameters dynamically.

5.11.3.2 To configure carrier aggregation

1. Activate the Primary cell.
2. Activate the secondary cells you want to aggregate.



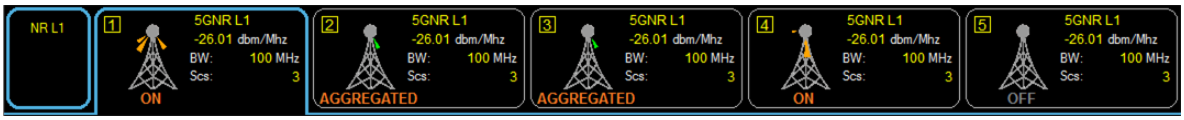
3. Select the Primary cell tab.
4. From the menu, select S-Cell Aggregation, which displays the following dialog.



5. Select the checkboxes next to the secondary cells to aggregate, then click Apply.

   Note: You will see an error if you are not currently on the primary cell tab when you click apply.

   The secondary cells aggregated with the primary cell are then displayed as Aggregated.



5.11.3.3 To clear a previously configured aggregation group

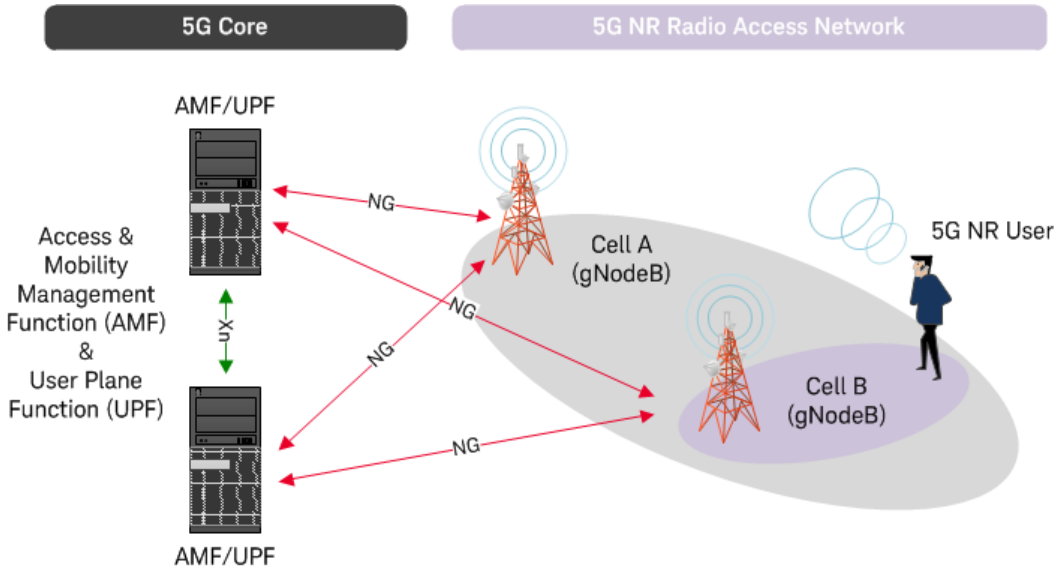
You cannot modify a group of aggregated cells. To make changes, you must remove all aggregated cells and create a new aggregated cell group.

1. Select the Primary cell tab.
2. From the menu, select S-Cell Aggregation.
3. Clear all checkboxes and click Apply.

   Note: You cannot remove individual secondary cells from the group, you must remove all secondary cells.

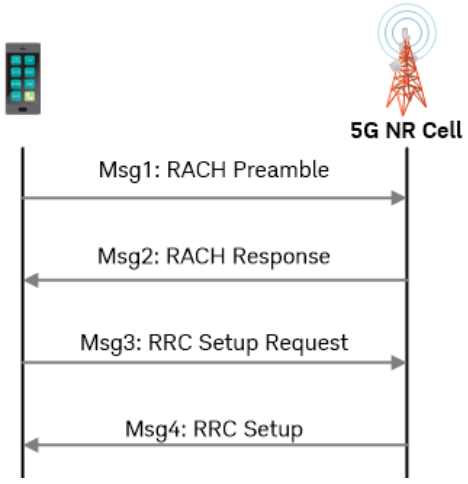
5.11.4 Standalone Mode

Standalone mode uses a new architecture which includes an enhanced 5G Core and 5G Radio Access Network. Unlike non-standalone mode, standalone mode does not have any underlying dependency on existing LTE infrastructure.



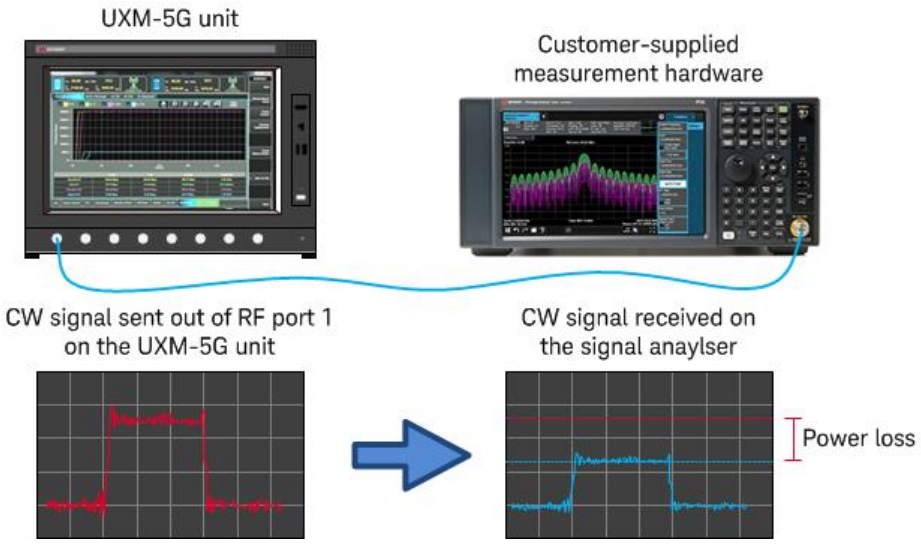
5.11.4.1 To configure a 5G NR cell in standalone mode

1. Switch the primary cell on.
2. Switch the UE on.
3. The following messages are exchanged between the UE, gNodeB and 5G core network:



5.11.5 Carrier Wave Mode

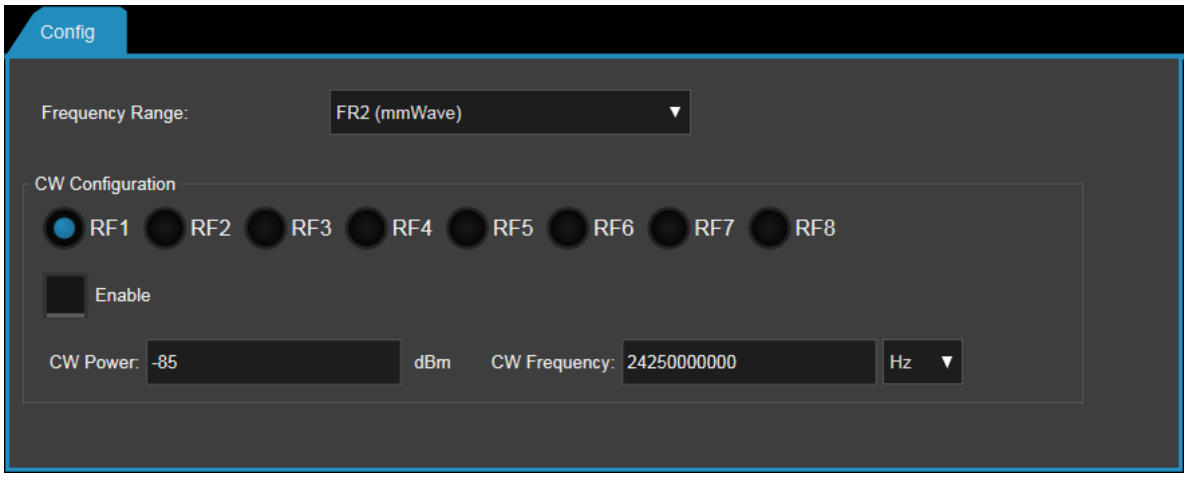
Due to the early stages of the 5G markets, current UXM-5G and Common Interface Unit hardware are not calibrated when delivered. The 5G NR Test Application Framework provides a mode of operation (CW mode) that performs a simple calibration.



CW is RF level mode that sends a continuous wave. The calibration procedure allows you to transmit frequencies at a defined power level and measure the received power level at the chosen frequency using measurement hardware. The measured power levels can be used to adjust the power levels configured in the 5G NR Test Application Framework to compensate for any differences.

5.11.5.1 To perform a basic calibration

1. Set the operating mode to CW.
2. Select the 5G NR tab, then select the Cell > Config Tab.



3. Specify the Frequency Range in which you are testing.
4. Select the RF port on which to send the carrier wave signal.
5. Click Enable, then specify the carrier wave Power and Frequency.
6. From the main menu, click Apply to start the carrier wave signal.
7. Measure the received signal on the measurement hardware.
8. Adjust the power levels in the 5G NR Test Application to compensate for any losses.

5.12 Optimizing EIP

The Optimize Expected Input Power (EIP) feature adjusts the EIP value when in the CONNECTED state. It automatically calculates the theoretical EIP value which optimizes the received power signal based on continuous power measurements of the PUSCH, PUCCH and SRS signals.

The feature uses the following algorithm:

- Every one second, it sends a request to the Layer 1 service to update the statistics for each cell which is CONNECTED.
- It measures the max received reports (dBFs) over all channels on the appropriate cell or cells.
- It calculates the optimal value of EIP: EIPnew = EIP – TargetPower (dBFs) + PowerMeasured (dBFs)

If a cell is switched on or off, all measurement reports for that cell are reset.

5.12.1 When to optimize EIP

It is suggested that you optimize EIP:

- After the NR cell is aggregated (after ATTACH).
- Before taking a measurement.
- After changing the UE Power Control.
- If results observed are not expected (i.e. BLER > 0%, poor EVM, or power measurement incorrect).

5.12.2 Steps to optimize EIP

1. Connect the test device to an NR cell.
2. Select the connected cell in the Cell details area of the 5G NR Test Application workspace.
3. Select the Cell tab, then the UE Power Meas sub-tab.
4. In the UE Power Meas sub-tab:
   a. Click **Reset** and wait for 1-2 seconds for the measurements to get updated.
   b. Click **Optimise EIP for Current Cell** so that the new EIP value is calculated.
5. Click **Apply** so that the new EIP value is applied.
6. (Optionally) Run steps 4 to 5 a total of two to three times to achieve higher accuracy.
7. To confirm the EIP was optimized properly, the MAX (PUSCH (dBFs), PUCCH (dBFs)) value should be very similar to the **Target Power (dBFs)**, which by default is set to -24 dBm.

5.13 Path loss Correction using HCCU

Always use HCCU for path loss correction; do not use Cell > Config tab > Cable Loss, which has been deprecated.

This tutorial describes how to use the Path Loss option on the Utility menu to compensate path loss. The Path Loss option automatically opens the Keysight NES Hardware Configuration Utility at its Path Losses dialog.

5.13.1 NES Hardware Configuration Utility

Keysight's NES Hardware Configuration Utility (HCCU) is a local web service that configures the test system hardware for use with Keysight Network Emulation Solutions, including 5G NR Test Application.

In addition to configuring test system hardware, HCCU compensates internal and external path losses across all NES applications running with the UXM 5G (this includes 5G NR Test Application), as follows:

- HCCU enables a system-level path loss automatic correction. Once the correction tables are entered, it will apply to all applications that are running.

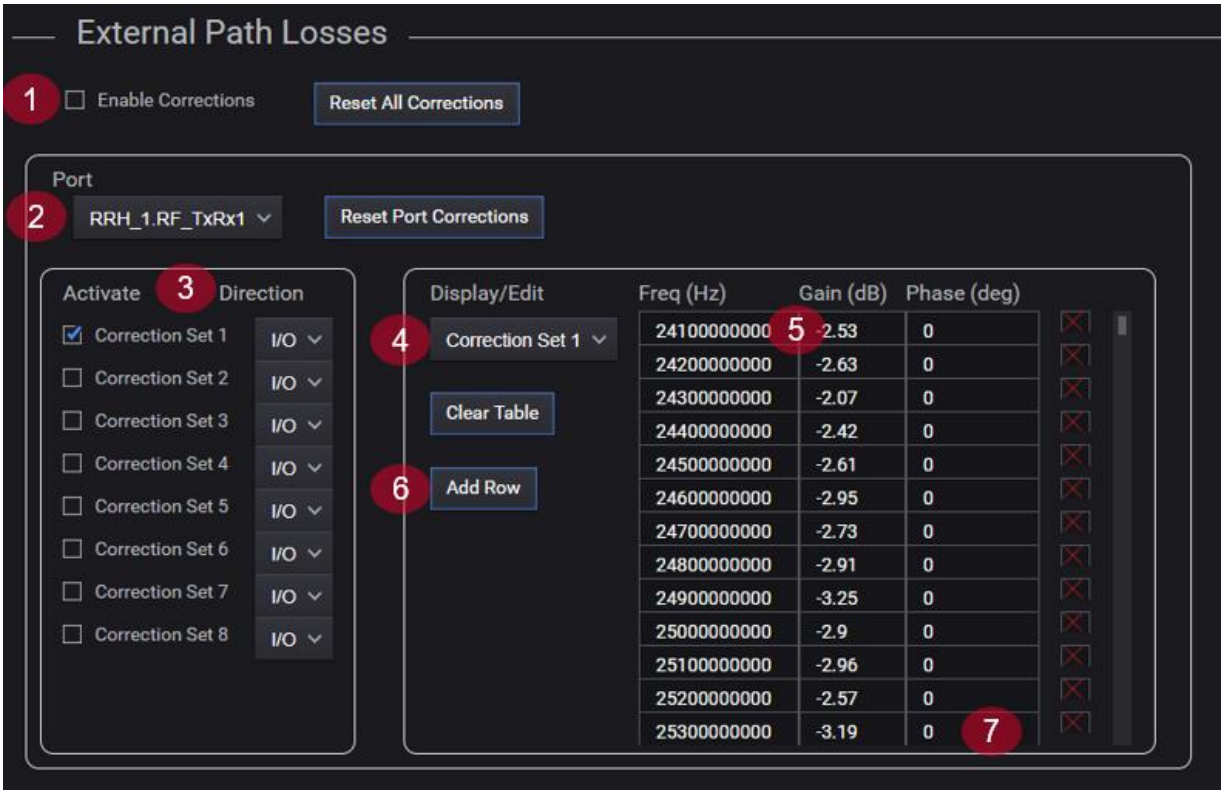
- You can define full system path losses, including multi-frequency and multi-connector.
- The compensation is done at Instrument Services level and therefore, there is no need to add compensations anywhere else in the system (that is, no corrections are needed in Xapps or 5G NR Test Application).

  Note: You should not add any correction in Xapps or other application. If you do, the correction will be added to the HCCU correction and compensated twice.

A power loss correction in HCCU is persistent with a UXM 5G full power cycle and, once configured, and is applied independently of 5G NR Test Application (or any other NES software).

5.13.2 To apply system level path loss correction

You can open HCCU independently, or from the 5G NR Test Application by selecting Path Loss from the Utility menu.



1. Enable/disable all corrections [1].
2. Select the port [2].
3. Activate/deactivate/set direction of Correction sets [3].
4. Select a Correction Set to display/edit [4].
5. Add path loss data [5].
6. Add a row using the Add Row button [6], or by pressing the tab on the last cell [7].

5.14 PDU Editor

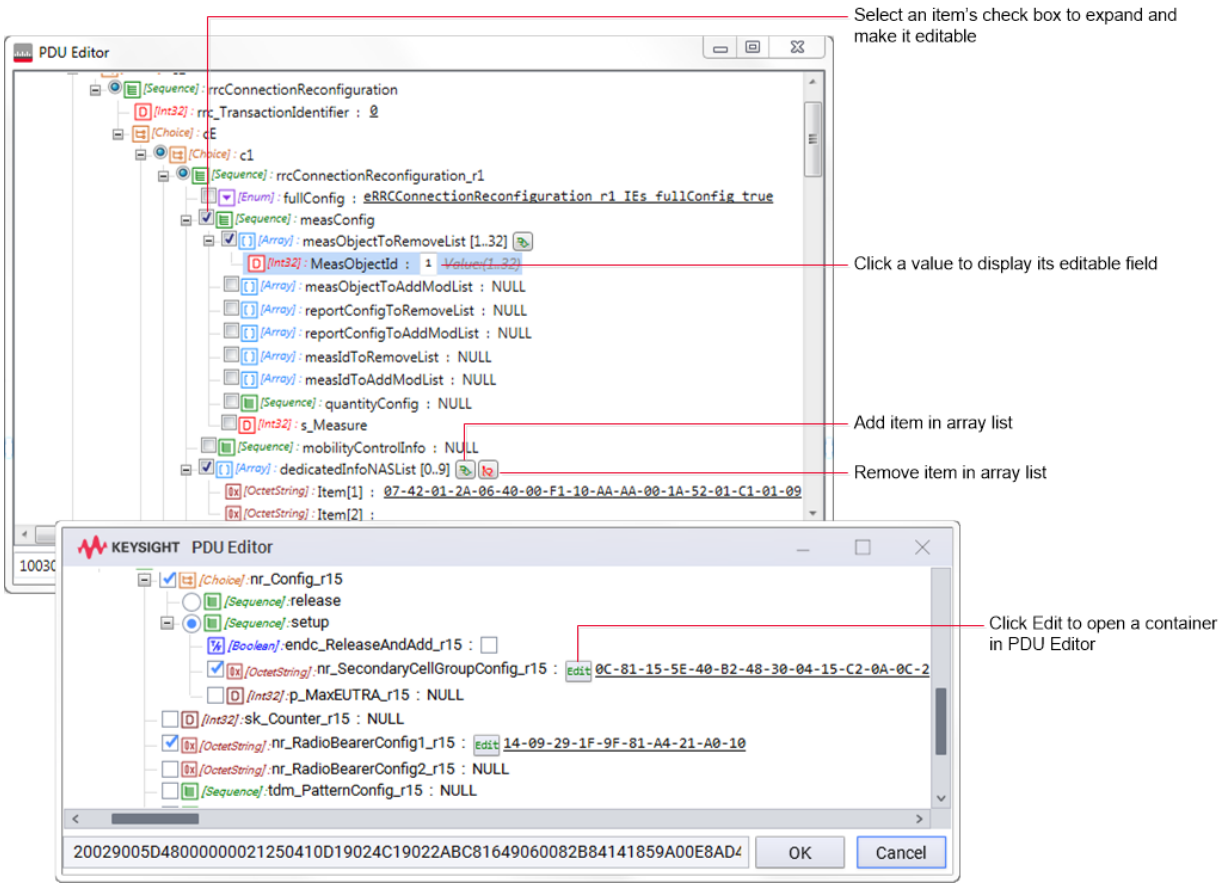
5G NR Test Application Framework has an integrated PDU Editor for editing RRC Connection Reconfiguration messages.

See the Help system for a video.

5.14.1 To use PDU Editor

The PDU Editor is available for an LTE cell's RRC Reconfiguration message. To open the editor, select a message selected on the Cell > NR Cell Reconfig Tab, and click Edit.

Example PDU Editor display:



An editable value is underlined. Click the underlined value to open its input field and make the required change. The valid range of values is shown on the right of the field and in its tooltip. If you type an invalid value, the editor shows it in red text.

5.14.2 PDU Editor controls

+− – expand and collapse branches in the tree structure.

☑☐ – select and de-select optional parameters.

– add and remove and item from an array.

Edit – opens a secondary window for editing the content of a container.

5.14.3 PDU Editor tools

The PDU Editor tools are on the right of the editor window:

– opens a search input box. Type part or all of a parameter name and click the arrows to search up and down for matching parameters.

> *Note: A search does not find parameters in collapsed branches. You should expand branches before searching.*

– removes unused (de-selected) optional parameters from the display.

– includes unused (de-selected) optional parameters in the display.

– saves the PDU.

– refreshes the display.

5.15 PUCCH

The Physical Uplink Control CHannel (PUCCH) carries uplink control information (UCI) including:

- ACKs/NACKs
- Scheduling requests
- Channel state information

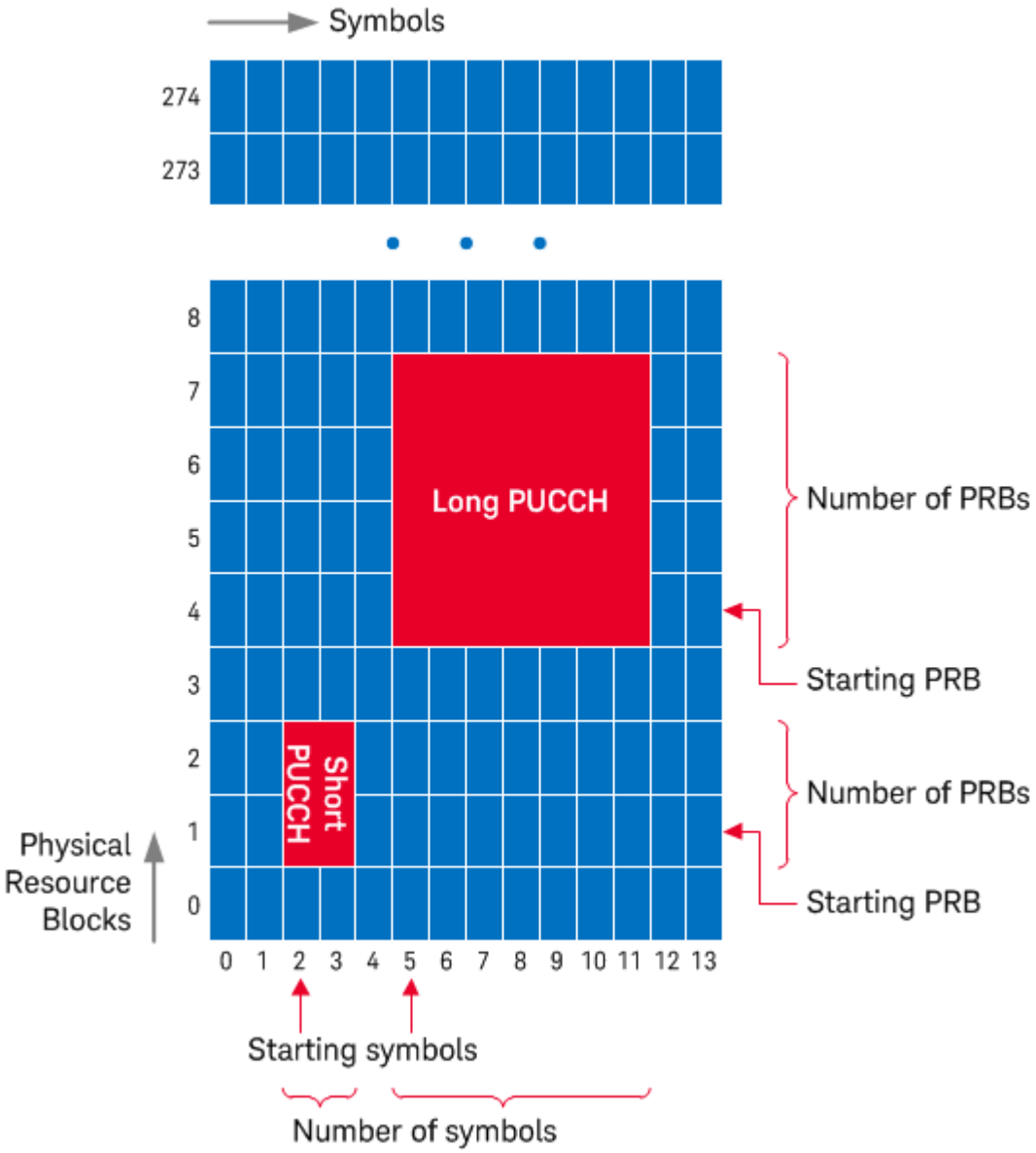
Unlike the LTE PUCCH, the 5G NR PUCCH uses configurable time and frequency allocations, which enables support for a wide range of devices. For more information about the PUCCH, refer to section 6.3.2 in 3GPP TS 38.211.

5.15.1 PUCCH Formats

5G NR provides five different PUCCH formats as described in the following table.

PUCCH Format	Number of symbols	Starting symbol index	Number of bits	Number of PRBs	Starting PRB	Initial cyclic shift	Description
0	1-2	0-13	≤2	n/a	0-274	PUCCH-F0-F1-initial-cyclic-shift	Short PUCCH.
1	4-14	0-13	≤2	n/a	0-274	PUCCH-F0-F1-initial-cyclic-shift	Long PUCCH.
2	1-2	0-13	>2	1-16	0-274	n/a	Short PUCCH.
3	4-14	0-13	>2	1-16	0-274	n/a	Long PUCCH. ***Note:*** *Not currently supported.*
4	4-14	0-13	>2	n/a	0-274	n/a	Long PUCCH. ***Note:*** *Not currently supported.*

The options in the table above define which resources the PUCCH uses.



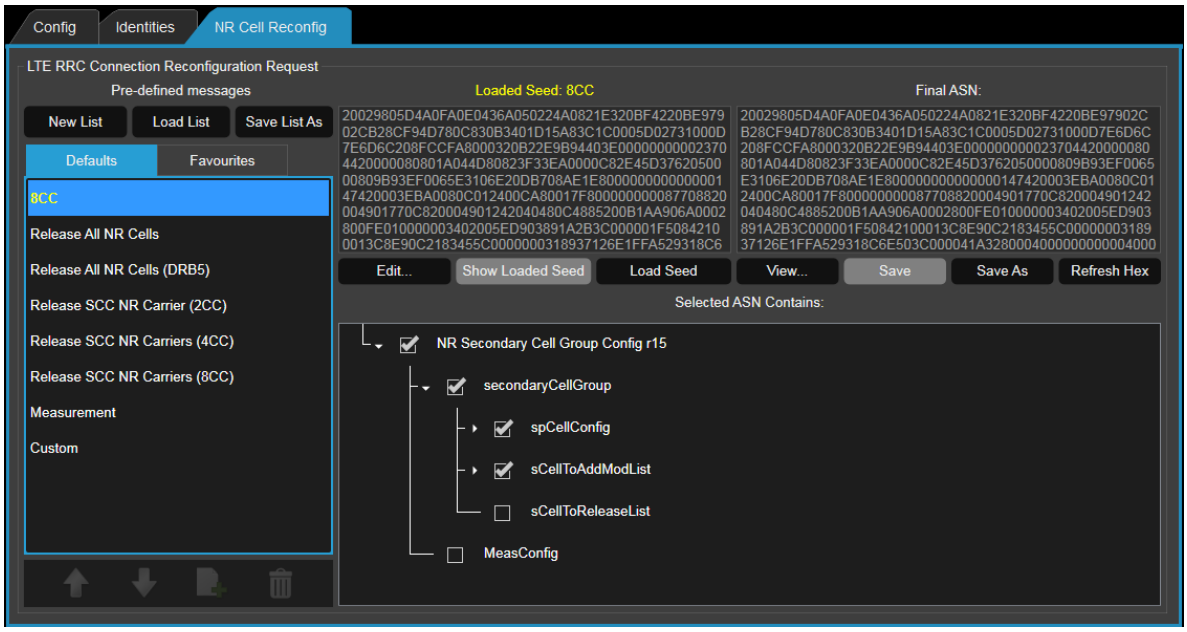
5.15.2 To configure PUCCH

1. Select an 5G NR cell tab.
2. Select the PHY tab, then the PUCCH sub-tab.
3. Click Enable PUCCH to enable the physical uplink control channel.
4. Select the required PUCCH Format.
5. Configure the options related to the selected format.

5.16 RRC Reconfiguration

In non-standalone mode, you can use the LTE cell's NR Cell Reconfig tabConfig tab to send an RRC Reconfiguration message.

1. Set the operating mode to NSA.
2. (Optional) Load an example NSA SCPI file to use as a starting point for configuring the parameters.
3. Select the LTE tab.
4. Under the Cell > NR Cell Reconfig tabCell > Config tab, select the required RRC Connection Reconfiguration message.

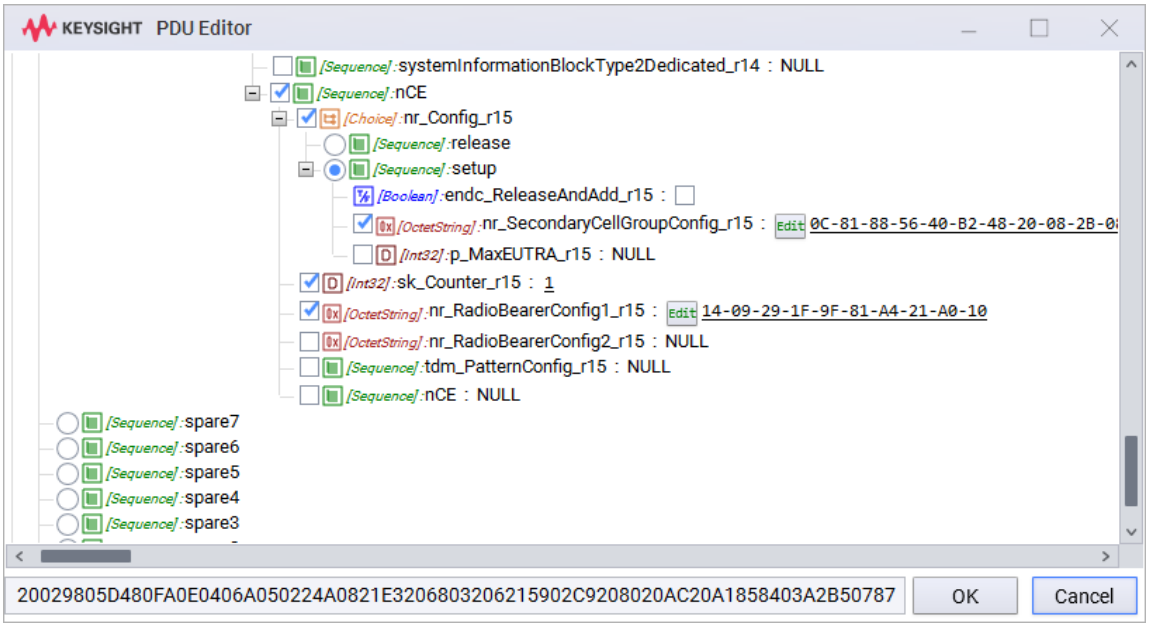


The RRC Connection Reconfiguration messages includes the nr_Config_r15 container which includes the nr_SecondaryCellGroupConfig_r15 and nr_RadioBearerConfig_r15 containers. The UE uses these containers to configure a secondary cell group bearer and establish radio connections between the UE and the secondary (5G NR) node.

Alternatively you can use a SCPI command instead of a seed.

5. (Optionally) Create a custom message by clicking Edit and modifying the message as follows:

   a. Click Edit to modify the message contents using the Keysight PDU Editor.



   b. Modify the information elements.

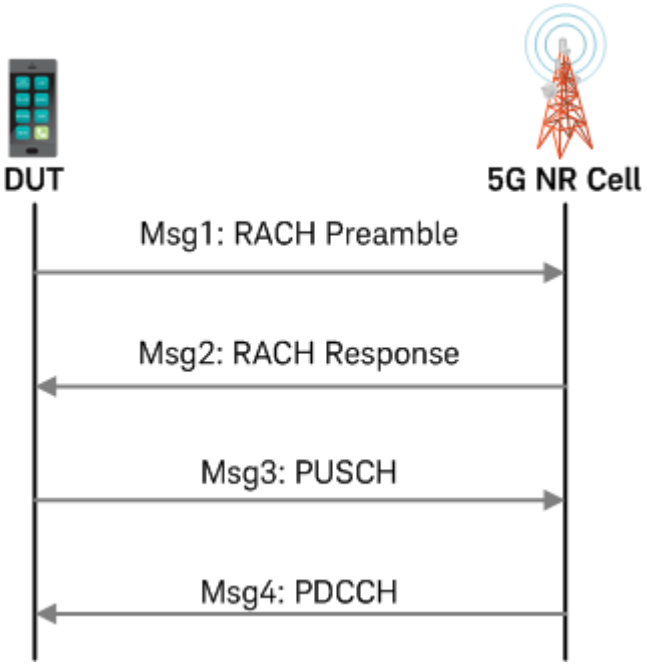
   c. (Optionally) Edit the nr_SecondaryCellGroupConfig_r15 message by clicking Edit next to the information element.

      This opens a second PDU Editor window for editing the nr_SecondaryCellGroupConfig_r15 message.

   d. Click OK when complete to save the changes and close the PDU Editor.

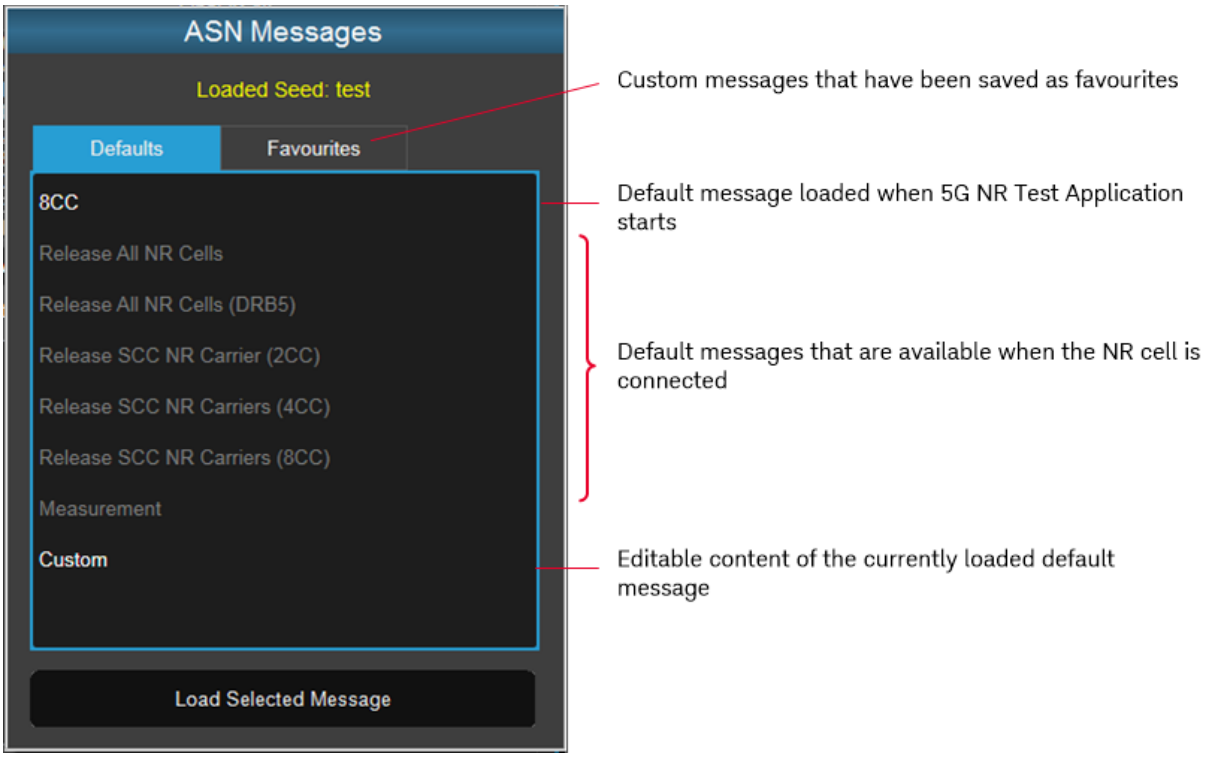
6. Click Send Selected Message.

   This triggers 5G NR Test Application to send the RRC Connection Reconfiguration message to the device under test, which then sends a RACH preamble (Message 1) to the 5G NR cell. The 5G NR cell and device under test exchange Message 2, 3 and 4 as shown in the sequence below.



The device under test is now connected to both the LTE and 5G NR cell (Dual Connectivity), with the control plane is on the LTE cell and the user plane is on the 5G NR cell.

5.16.1 To load saved ASN messages



6 MENUS

6.1 Main menu

5G NR Test Application Framework provides a soft-keys menu on the right of the workspace. There are three types of menu button:

- Menu options with a right arrow – display a sub-menu.
- Menu options with a left arrow – display a dialog.
- Menu options without an arrow – perform an immediate action.

6.1.1 Main Menu options

Main Menu	Options
Cell On	Switches selected cell on and off
Connect	• SCC Aggregation *(not used in this release)* • MAC Padding *(only displayed for an LTE cell)*
ASN Message	ASN Messages panel
NR S-Cell Aggregation	NR S-Cell Aggregation panel
Handover *(only displayed for an NR cell)*	Blind Handover: • Blind Handover dialog Beam Switch: • RRC Connection Reconfiguration • MAC CE initiated
Function Test	IMS: • Opens the IMS tab: UE Info, Registered User Info, Security, Status, Message Summary • De-Register UE • Re-Register UE • Send 3GPP SMS
Link to X-Apps	Connects to X-Apps, and if successful: • Launches Tx Measurements in TX Meas tab • Displays the Tx Meas menu
Utility	• Export/Import SCPI • Preset • Re-sync X-Apps • Preferences • Path Loss • Log Session Control • TA Mode Switch

		• Search • Start RTT • Start Licence Manager
	Apply	When CONNECTED, updates the network with GUI changes.
	Tx Measurements	Tx Meas menu: *(These options are only displayed if X-Apps is connected. They are described in the X-Apps help system.)* • Channel Power • Occupied BW • ACP • Spectrum Emission Mask • Transmit On/Off Power • Modulation Analysis • IQ Waveform • Monitor Spectrum
	Rx Measurements	• BLER/Throughput: ▪ Opens the BLER/Tput tab: Throughput Summary, DL/UL OTA Graph, UL OTA, DL OTA ▪ Menu: ▪ Start ▪ Measurement Setup ▪ Power Control ▪ Graph Data ▪ Reset Measurement • CSI Statistics ▪ Opens the CSI tab: CQI/RI Tab ▪ Menu: ▪ Measurement Setup ▪ Reset Measurement

Main Menu		Options
Cell On		Switches selected cell on and off
	Handover	Blind Handover: • Blind Handover dialog Beam Switch: • RRC Connection Reconfiguration • MAC CE initiated
	ASN Message	ASN Messages panel
	NR S-Cell Aggregation	NR S-Cell Aggregation panel

Tx Measurements	Tx Meas menu: *(These options are only displayed if X-Apps is connected. They are described in the X-Apps help system.)* • Channel Power • Occupied BW • ACP • Spectrum Emission Mask • Transmit On/Off Power • Modulation Analysis • IQ Waveform • Monitor Spectrum
Rx Measurements	• BLER/Throughput: ▪ Opens the BLER/Tput tab: Throughput Summary, DL/UL OTA Graph, UL OTA, DL OTA ▪ Menu: ▪ Start ▪ Measurement Setup ▪ Power Control ▪ Graph Data ▪ Reset Measurement • CSI Statistics ▪ Opens the CSI tab: CQI/RI Tab ▪ Menu: ▪ Measurement Setup ▪ Reset Measurement
Link to X-Apps	Connects to X-Apps, and if successful: • Launches Tx Measurements in TX Meas tab • Displays the Tx Meas menu: *(These options are only displayed if X-Apps is connected. They are described in the X-Apps help system.)* ▪ X-Apps help system.) ▪ Channel Power ▪ Occupied BW ▪ ACP ▪ Spectrum Emission Mask ▪ Transmit On/Off Power ▪ Modulation Analysis ▪ IQ Waveform ▪ Monitor Spectrum
Utility	• Export/Import SCPI • Preset • Re-sync X-Apps

	• Preferences • Path Loss • Log Session Control • TA Mode Switch • Search • Start RTT • Start Licence Manager
Apply Changes	When CONNECTED, updates the network with GUI changes.

Main Menu		Options
Cell On		Switches selected cell on and off
	Handover	Blind Handover: • Blind Handover dialog Beam Switch: • RRC Connection Reconfiguration • MAC CE initiated
	Rx Measurements	• BLER/Throughput: ▪ Opens the BLER/Tput tab: Throughput Summary, DL/UL OTA Graph, UL OTA, DL OTA ▪ Menu: ▪ Start ▪ Measurement Setup ▪ Power Control ▪ Graph Data ▪ Reset Measurement • CSI Statistics ▪ Opens the CSI tab: CQI/RI Tab ▪ Menu: ▪ Measurement Setup ▪ Reset Measurement
	Link to X-Apps	Connects to X-Apps, and if successful: • Launches Tx Measurements in TX Meas tab • Displays the Tx Meas menu: *(These options are only displayed if X-Apps is connected. They are described in the X-Apps help system.)* ▪ Channel Power ▪ Occupied BW ▪ ACP ▪ Spectrum Emission Mask ▪ Transmit On/Off Power ▪ Modulation Analysis

	▪ IQ Waveform ▪ Monitor Spectrum
Utility	• Export/Import SCPI • Preset • Re-sync X-Apps • Preferences • Path Loss • Log Session Control • TA Mode Switch • Search • Start RTT • Start Licence Manager
Apply Changes	When CONNECTED, updates the network with GUI changes.

Main Menu	Options
Utility	• Export/Import SCPI • Preset • Re-sync X-Apps • Preferences • Path Loss • Log Session Control • TA Mode Switch • Search • Start RTT • Start Licence Manager

6.1.2 Using the Apply button

The Apply button only has a function when you are connected to the network.

When you first connect, the network is updated with the configuration in Test Application Framework. You can make changes to fields in the GUI while connected, but these changes are not updated to the network. To update changes to the network, click **Apply Changes**.

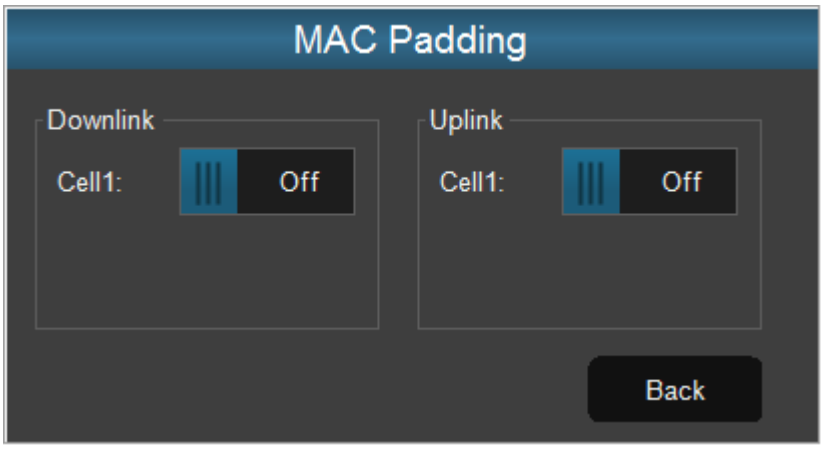
6.2 Connect Menu

Navigation: Main Menu > Connect

6.2.1 SCC Aggregation panel

Not used in this release.

6.2.2 MAC Padding

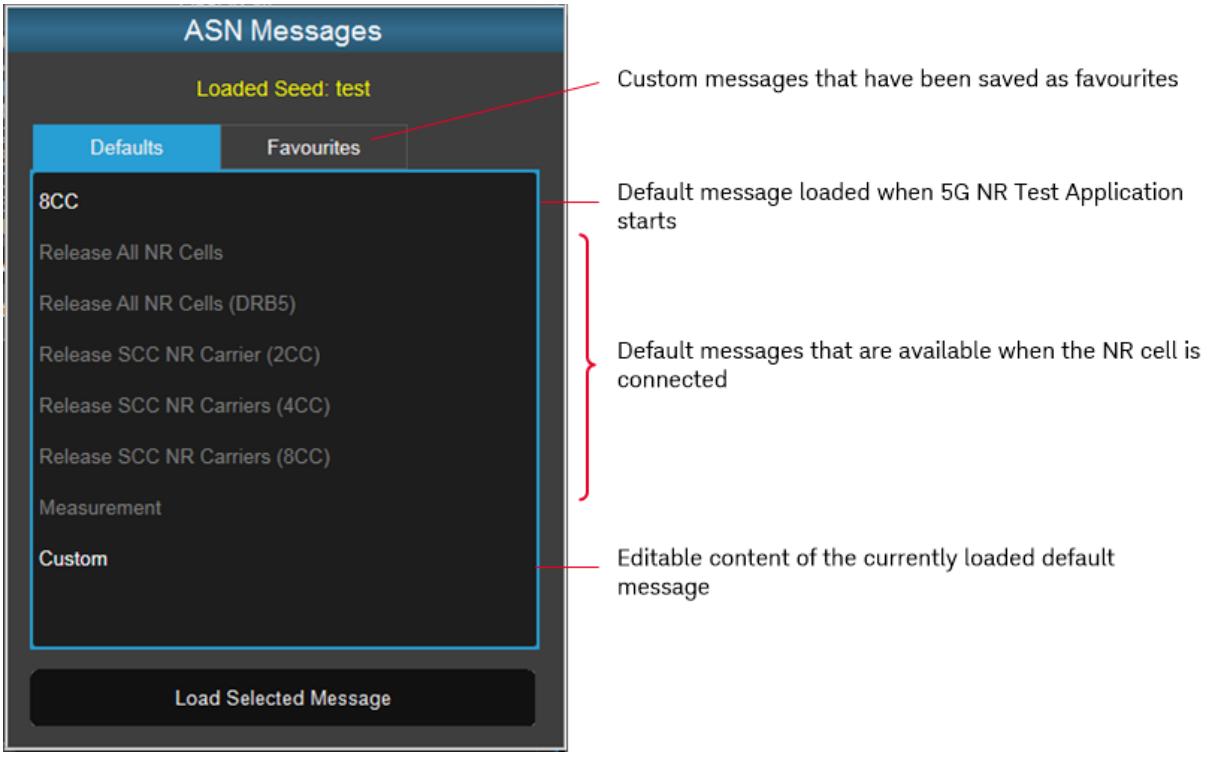


Click the On/Off switches to enable or disable MAC data padding for the LTE cell in the downlink and/or uplink.

SCPI: BSE:CONFig:LTE:CELL1:MAC:DL:PADDing[:STATe]

6.3 ASN Messages Panel

The ASN Messages panel is available from the main menu. It shows the Pre-defined messages list on the Cell > NR Cell Reconfig tab, but is available from other tabs so that when you load a pre-defined message you can see the changes being applied in the current tab.



There are two pre-defined message lists: a defaults list and a favourites list. Click the links for more information about these tabs.

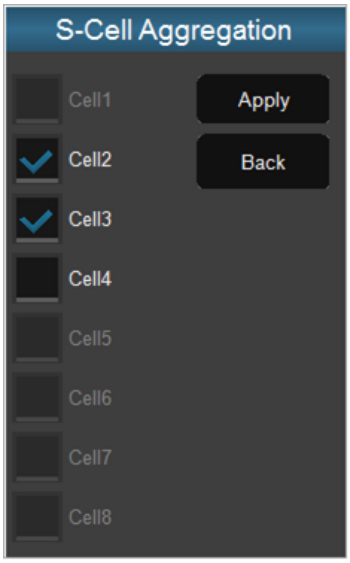
To use the panel, select a pre-defined RRC Connection Reconfiguration Request and click Load Selected Message. This updates fields in all tabs with the message configuration.

Note: The ASN Messages panel does not allow you to edit messages. To edit a message, select the Cell > NR Cell Reconfig tab.

6.4 NR S-Cell Aggregation Panel

Also see: Connecting a device to a 5G NR cell

Use the S-Cell Aggregation panel to aggregate and release secondary NR cells.



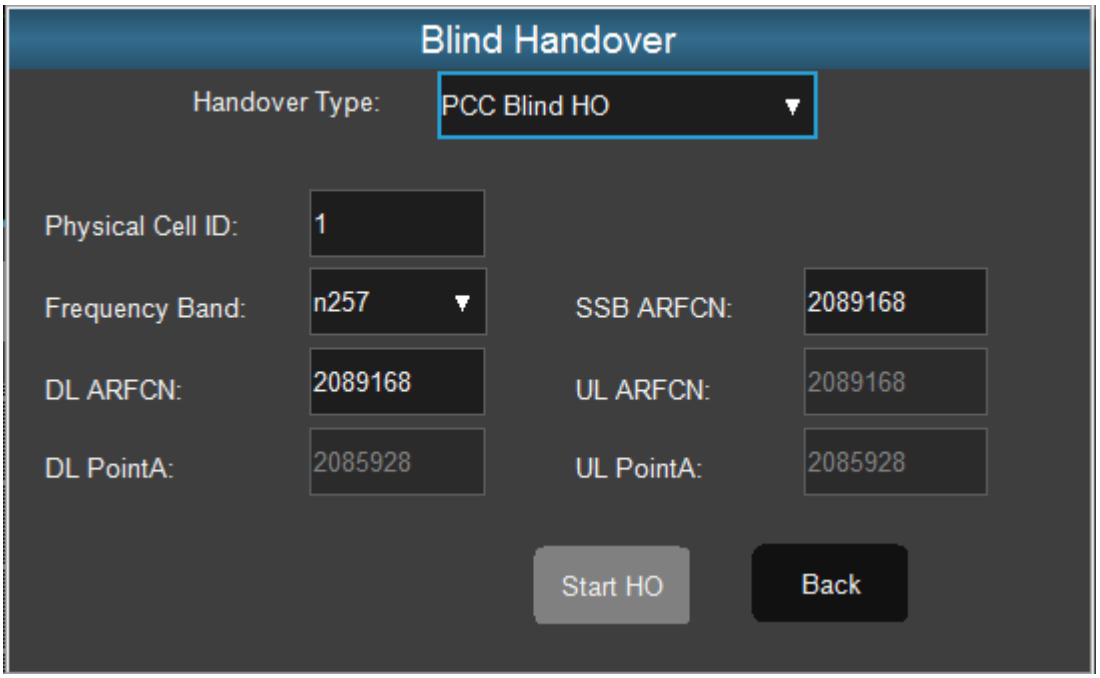
Select the check boxes next to the secondary cells to aggregate, then click **Apply**.

Note: *You will see an error if you are not currently on the primary cell tab when you click apply.*

6.5 Handover menu

Navigation: Main Menu > Handover

6.5.1 Blind Handover



These options are described in the Blind Handover tutorial.

6.5.2 Beam Switch

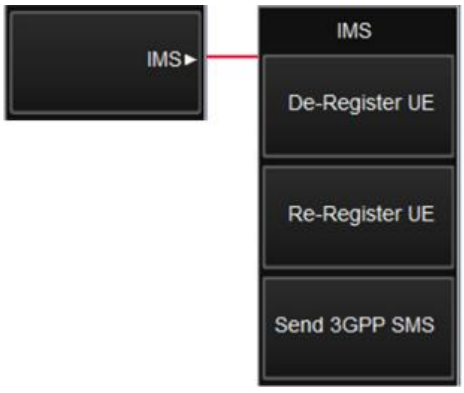
The beam switch options allow you to initiate a beam switch using an RRC Connection Reconfiguration message or a MAC Control Element (CE).

6.6 IMS menu

Navigation: Main Menu > Function Test > IMS

The IMS menu provides IMS simulation commands that register and de-register a UE and initiate an SMS message.

To open the IMS menu, from the main menu select **Function Test > IMS**.



The IMS menu opens the IMS tabs on the GUI:

- IMS > UE Info tab
- Registered User Info Tab
- Security Tab
- Status Tab
- Message Summary Tab

The menu commands are:

- De-Register UE – request an IMS de-registration of the UE.

  SCPI: SYSTem:IMS:SERVer:UE:DERegister

- Re-Register UE – attempt to trigger/solicit an IMS re-registration from the UE.

  SCPI: SYSTem:IMS:SERVer:UE:RERegister

- Send 3Gpp SMS – send a 3GPP SMS message to the UE over IMS.

  SCPI: SYSTem:IMS:SERVer:SMS:SEND

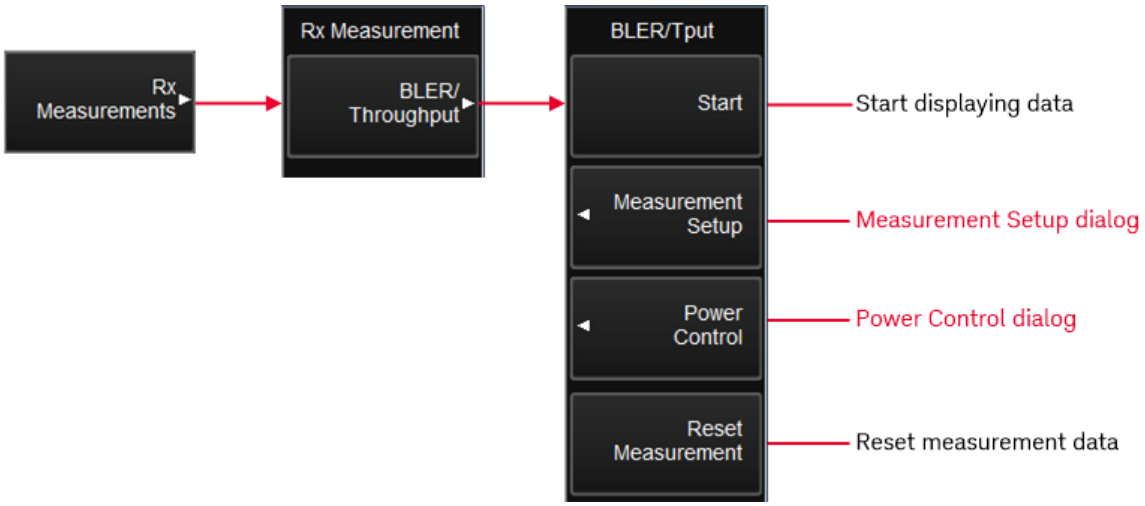
6.7 Rx Measurements

For transmitter (TX) measurements, use the X-Apps utility on the Tx Meas Tab.

6.7.1 Rx Measurements

This menu applies to all cells, not just the selected cell.

Use the RX Measurements option on the Main Menu to configure the display of information received on the UXM-5G unit's receive ports and displayed on the BLER/Tput Tab (Throughput Summary, DL/UL OTA Graph, UL OTA and DL OTA).



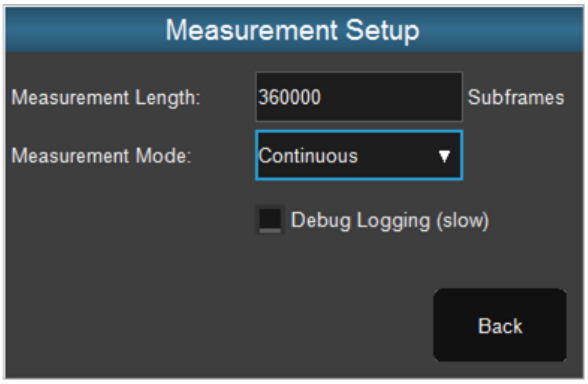
6.7.1.1 Start/Stop

Click **Start** and **Stop** to start and stop displaying BLER/Throughput data for all cells. The menu name changes to **Stop** when measurements are running, and back to **Start** when measurements are stopped.

SCPI: BSE:NR5G:MEASure:BTHRoughput[:STATe] <ON |OFF>

6.7.1.2 Measurement Setup dialog

The measurement setup dialog configures Sample-Time-Offset (STO) measurements to display in the BLER/Throughput graphs.



Measurement Length

For an LTE cell, this field is read-only.

If the Measurement Mode (below) is **Single**, set the measurement length in subframes, in the range 200 to 360000.

SCPI: BSE:NR5G:MEASure:BTHRoughput:LENGth[:ALL] <200 ... 360000>

Measurement Mode

Set the STO measurement mode for all cells, which defines whether measurements are gathered as a **Continuous** or **Single** set of data.

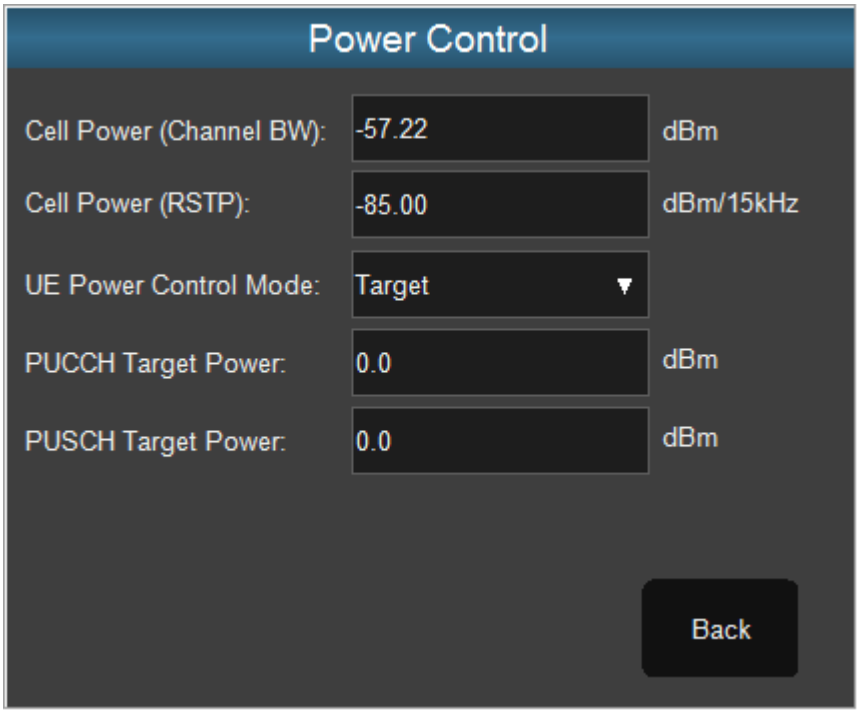
SCPI: BSE:NR5G:MEASure:BTHRoughput:CONTinuous[:ALL] <0 | 1>

where 1 is Continuous mode and 0 is Single mode.

Debug Logging (slow)

Select this check box to create a debug log.

6.7.1.3 Power Control dialog



6.7.1.4 Reset Measurement

Click **Reset Measurement** to clear the currently displayed data for all cells.

SCPI: BSE:NR5G:MEASure:BTHRoughput:CLEar

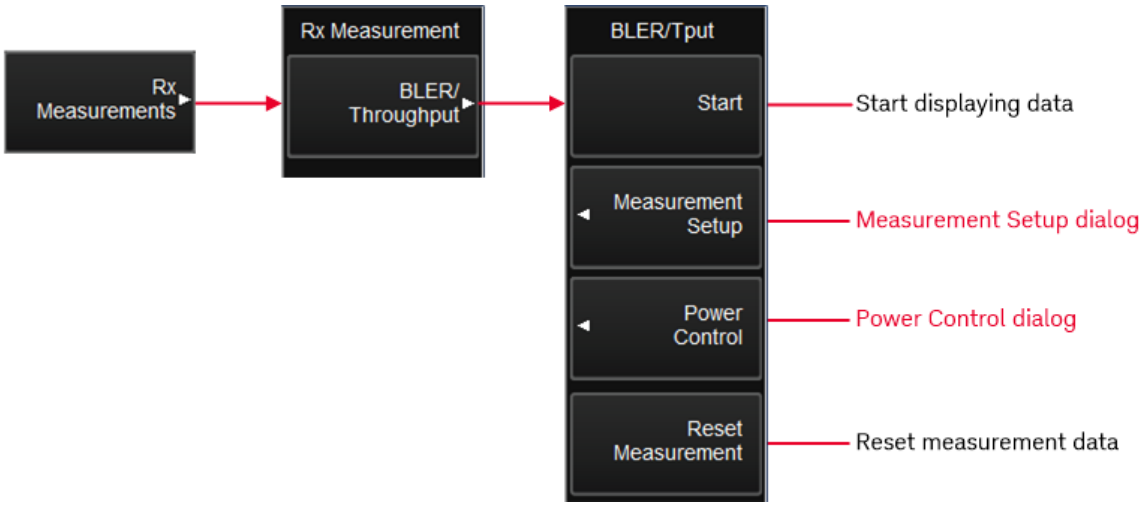
6.8 Rx Measurements

For transmitter (TX) measurements, use the X-Apps utility on the Tx Meas Tab.

6.8.1 Rx Measurements

This menu applies to all cells, not just the selected cell.

Use the RX Measurements option on the Main Menu to configure the display of information received on the UXM-5G unit's receive ports and displayed on the BLER/Tput Tab (Throughput Summary, DL/UL OTA Graph, UL OTA and DL OTA).



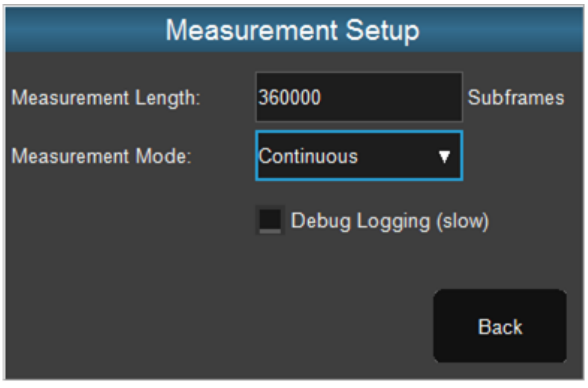
6.8.1.1 Start/Stop

Click **Start** and **Stop** to start and stop displaying BLER/Throughput data for all cells. The menu name changes to **Stop** when measurements are running, and back to **Start** when measurements are stopped.

SCPI: BSE:NR5G:MEASure:BTHRoughput[:STATe] <ON |OFF>

6.8.1.2 Measurement Setup dialog

The measurement setup dialog configures Sample-Time-Offset (STO) measurements to display in the BLER/Throughput graphs.



Measurement Length

For an LTE cell, this field is read-only.

If the Measurement Mode (below) is **Single**, set the measurement length in subframes, in the range 200 to 360000.

SCPI: BSE:NR5G:MEASure:BTHRoughput:LENGth[:ALL] <200 ... 360000>

Measurement Mode

Set the STO measurement mode for all cells, which defines whether measurements are gathered as a **Continuous** or **Single** set of data.

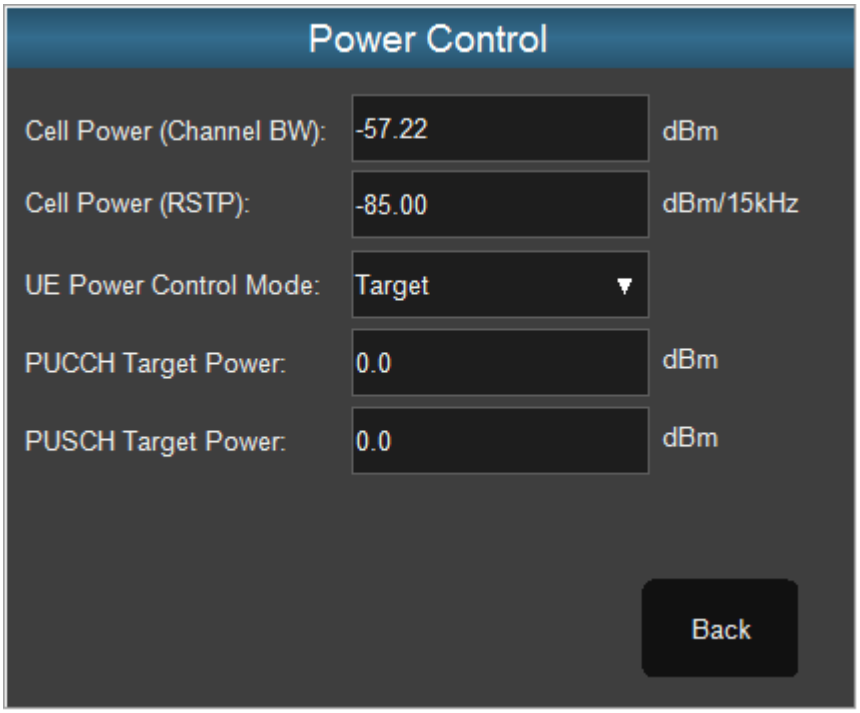
SCPI: BSE:NR5G:MEASure:BTHRoughput:CONTinuous[:ALL] <0 | 1>

where 1 is Continuous mode and 0 is Single mode.

Debug Logging (slow)

Select this check box to create a debug log.

6.8.1.3 Power Control dialog



6.8.1.4 Reset Measurement

Click **Reset Measurement** to clear the currently displayed data for all cells.

SCPI: BSE:NR5G:MEASure:BTHRoughput:CLEar

6.9 Utility Menu

Navigation: Main Menu > Utility

6.9.1 Export/Import SCPI

See Importing and Exporting SCPI Files.

6.9.2 Preset

6.9.2.1 Full Preset

This option resets all UXM-5G configurations to the configuration held in memory.

6.9.2.2 Factory Preset

This option resets all UXM-5G configurations to factory settings.

*SCPI: *RST*

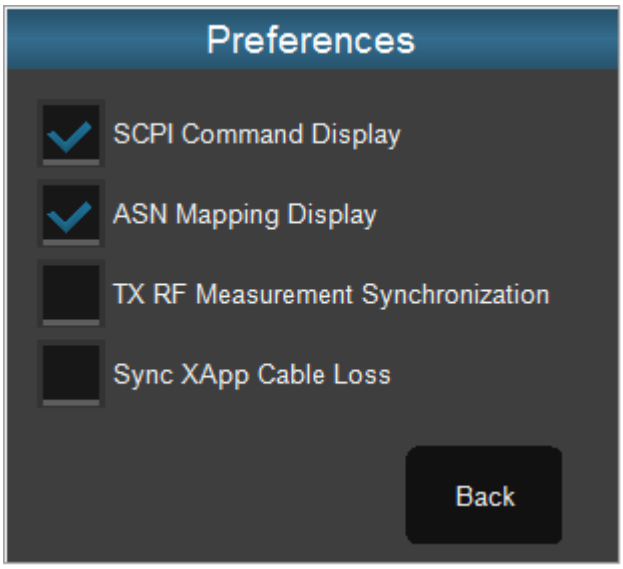
6.9.3 Re-synchronize X-Apps

This option re-synchronizes with the X-Apps tool.

SCPI: BSE:FUNCtion:LTE:TXMeas:SYNC[:IMMediate]

6.9.4 Preferences

This option selects 5G NR Test Application preferences:



The options are:

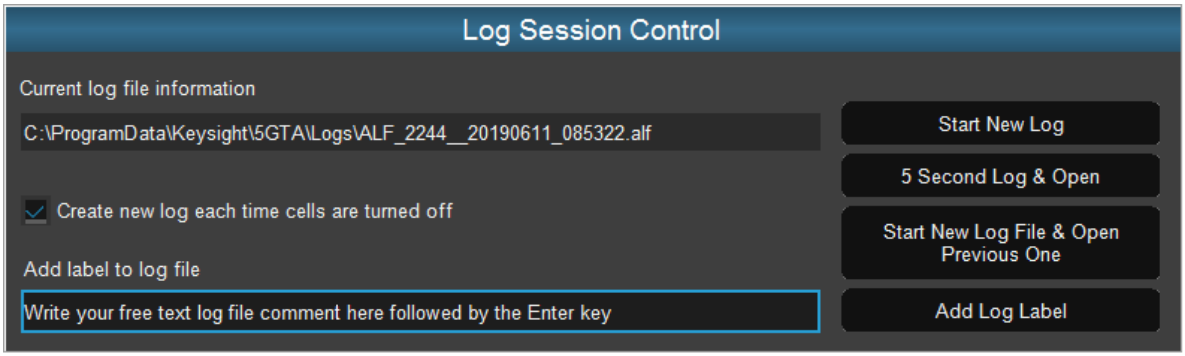
- SCPI command display – displays the SCPI command (if available) for the current field on the left of the status bar at the bottom of the screen.
- ASN Mapping display – displays the ASN command (if available) for the current field on the right of the status bar at the bottom of the screen.
- TX RF Measurement Synchronization – continuously synchronizes with X-Apps Tx measurements.
- Sync XApp Cable Loss – continuously synchronizes with the X-Apps Tx measurements.

6.9.5 Path Loss

This option opens the NES Hardware Configuration Utility (HCCU) Path Loss Correction dialog.

6.9.6 Log Session Control

This options opens the following dialog for logging session control information:



1. Click Start New Log to create a new alf log file.

   The Current Log file information field is updated with the new filename, which has an updated date and timestamp as part of the filename.

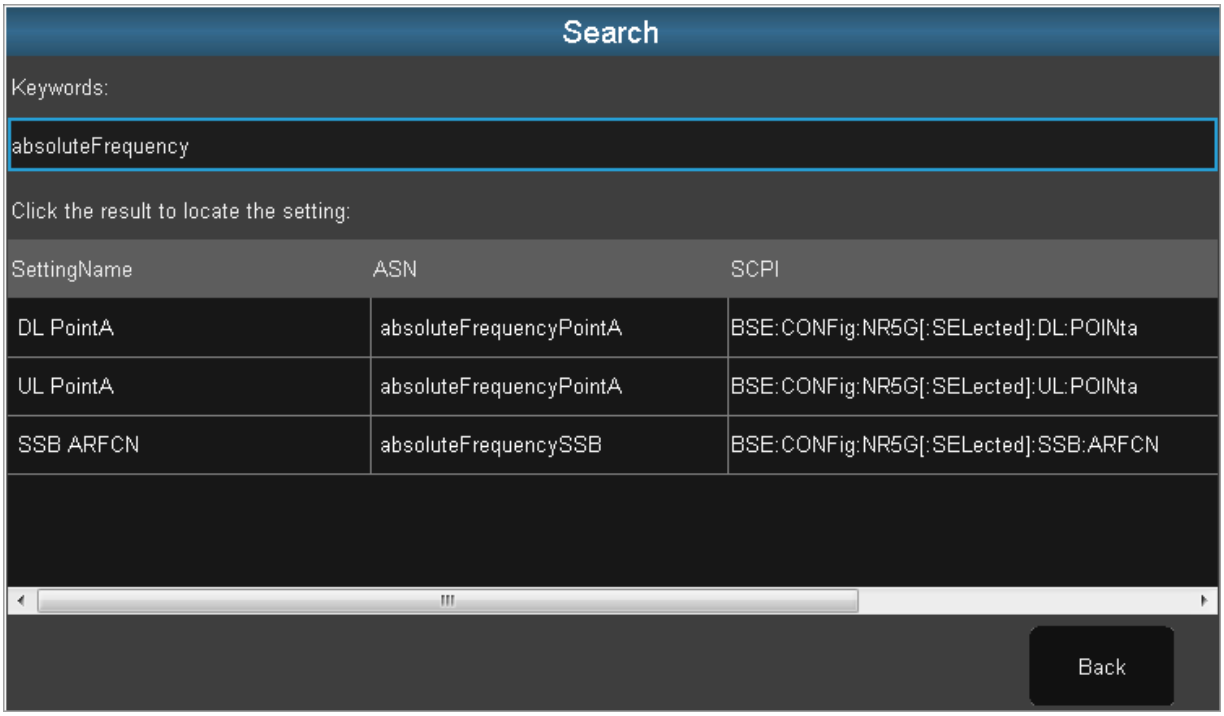
2. Optionally, add a custom label to the log file, then click Add Log Label.

6.9.7 TA Mode Switch

This option switches the 5G NR Test Application operating mode.

6.9.8 Search

This option searches for a parameter, ASN or SCPI command. The search dialog (shown below) provides a search string that filters on parameter names (in the Test Application Framework user interface), ASN information element names or SCPI commands.



1. In the Keywords input box, type the search string you want to find.

   The list of results filters the parameters/IEs/SCPI as you type.

2. Click on one of the results to display the tab in the Test Application Framework user interface and indicate where the parameter is located on the tab.

6.9.9 Start RTT

This option starts the real time trace. The trace presents a scrolling display of events and parameters associated with a running test, and is a useful tool for monitoring the execution of tests that you are running manually.

6.9.10 Start Licence Manager

This options opens the Keysight License Manager application.

7 NR TABS

7.1 Tabs Displayed For NR Cells

The following tabs and sub-tabs are displayed for an NR cell in 5G NR NSA operating mode:

Tabs	Sub-tabs
System	Config, Impairments, App Info, Message Summary, Error Log, RUI Log, Logging, RF Connectors
Cell	Config, Identities, SSB/Broadcast, UE Power Control, Advanced
Beam Management	Beam Switch, Resource Config, Resources, TCI State, NZP CSI RSI, CSI IM, SSB, Quick Config
PHY	Bandwidth Part, HARQ, PDSCH, PDSCH DMRS, PDCCH, PRACH, PUSCH, PUSCH DMRS, PUCCH
Scheduling	Quick Config, Scheduling Map, Slot Config, TDD UL-DL Config Common, PUSCH TDRA, PDSCH TDRA, Link Adaptation
MAC/RLC/PDCP	RACH, Schedule, DRB, DRX, PDCCH Order
RRC/NAS	CSI Reporting, Meas Objects, Report Config, Meas Config, Quantity Config
Data Generation	General
BLER/Tput	Throughput Summary, DL/UL OTA Graph, UL OTA, DL OTA
CSI	CQI/RI
Tx Meas	XApps RF Tx Measurements
IMS	UE Info, Registered User Info, Security, Status, Message Summary

The following tabs and sub-tabs are displayed for an NR cell in 5G NR L1 Test operating mode:

Tabs	Sub-tabs
System	Config, Platform Configuration, App Info, Error Log, RUI Log, Logging
Cell	Config, Identities, SSB/Broadcast, Advanced
Beam Management	SSB, Quick Config
PHY	Bandwidth Part, HARQ, PDSCH, PDSCH DMRS, PDCCH, PRACH, PUSCH, PUSCH DMRS, PUCCH
Scheduling	Quick Config, Scheduling Map, Slot Config, TDD UL-DL Config Common, PUSCH TDRA, PDSCH TDRA, Link Adaptation
MAC/RLC/PDCP	RACH
Data Generation	General
CSI	CQI/RI
BLER/Tput	Throughput Summary, DL/UL OTA Graph, UL OTA, DL OTA

The following tabs and sub-tabs are displayed for an NR cell in 5G NR Standalone operating mode:

Tabs	Sub-tabs
System	Config, App Info, Message Summary, Error Log, RUI Log, Logging

NR Procedures	General
Cell	Config, Identities, SSB/Broadcast, UE Power Control, Advanced
Beam Management	Beam Switch, Resource Config, Resources, TCI State, NZP CSI RSI, CSI IM, SSB, Quick Config
PHY	Bandwidth Part, HARQ, PDSCH, PDSCH DMRS, PDCCH, PRACH, PUSCH, PUSCH DMRS, PUCCH
Scheduling	Quick Config, Scheduling Map, Slot Config, TDD UL-DL Config Common, PUSCH TDRA, PDSCH TDRA, Link Adaptation
MAC/RLC/PDCP	RACH, DRB, DRX, PDCCH Order
RRC/NAS	PDU Session Control, Security, CSI Reporting, Meas Objects, Report Config, Meas Config, Quantity Config
Data Generation	General
BLER/Tput	Throughput Summary, DL/UL OTA Graph, UL OTA, DL OTA
CSI	CQI/RI
Tx Meas	XApps RF Tx Measurements

The following tabs and sub-tabs are displayed in CW operating mode:

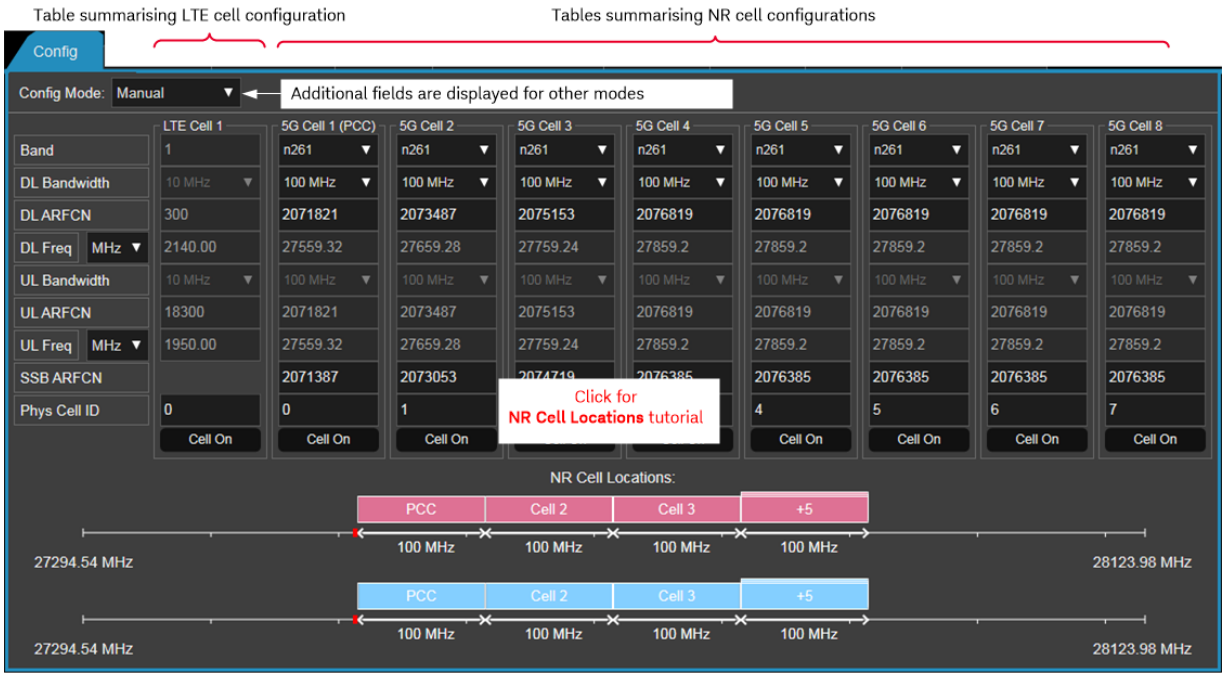
Tabs	Sub-tabs
System	App Info, Error Log, RUI Log
Cell	Config

7.2 System Tab

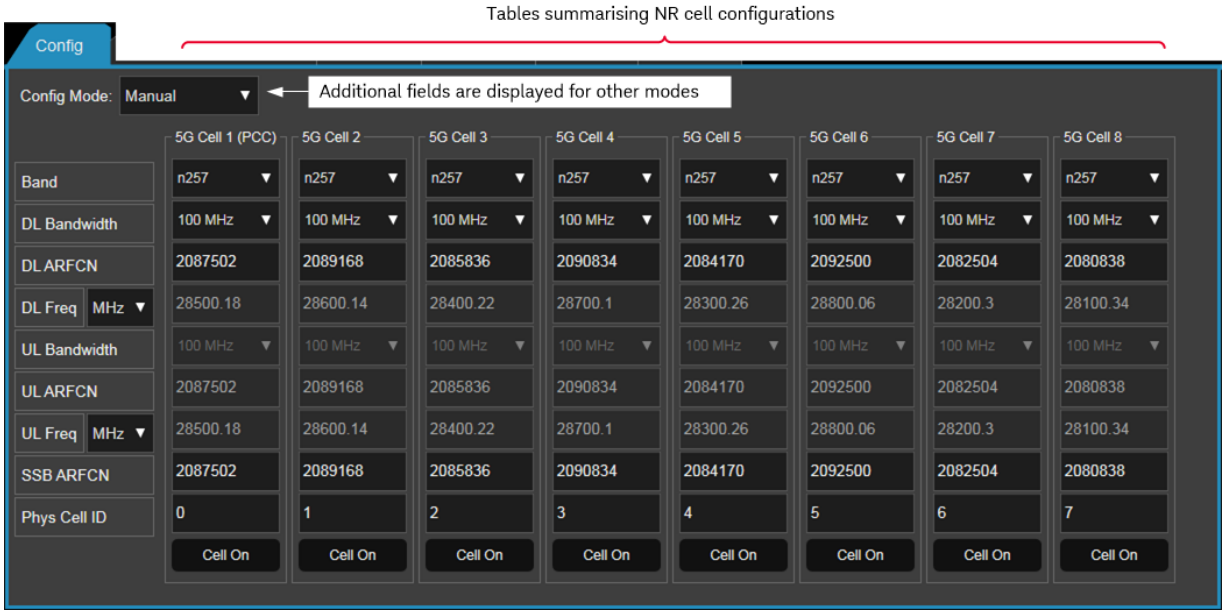
7.2.1 System > Config Tab

The Config tab summarises the configuration of available cells, and (for 5G NR cells only) allows you to change some parameters. To start a cell, click the **Cell On** button under the list of parameters for the cell.

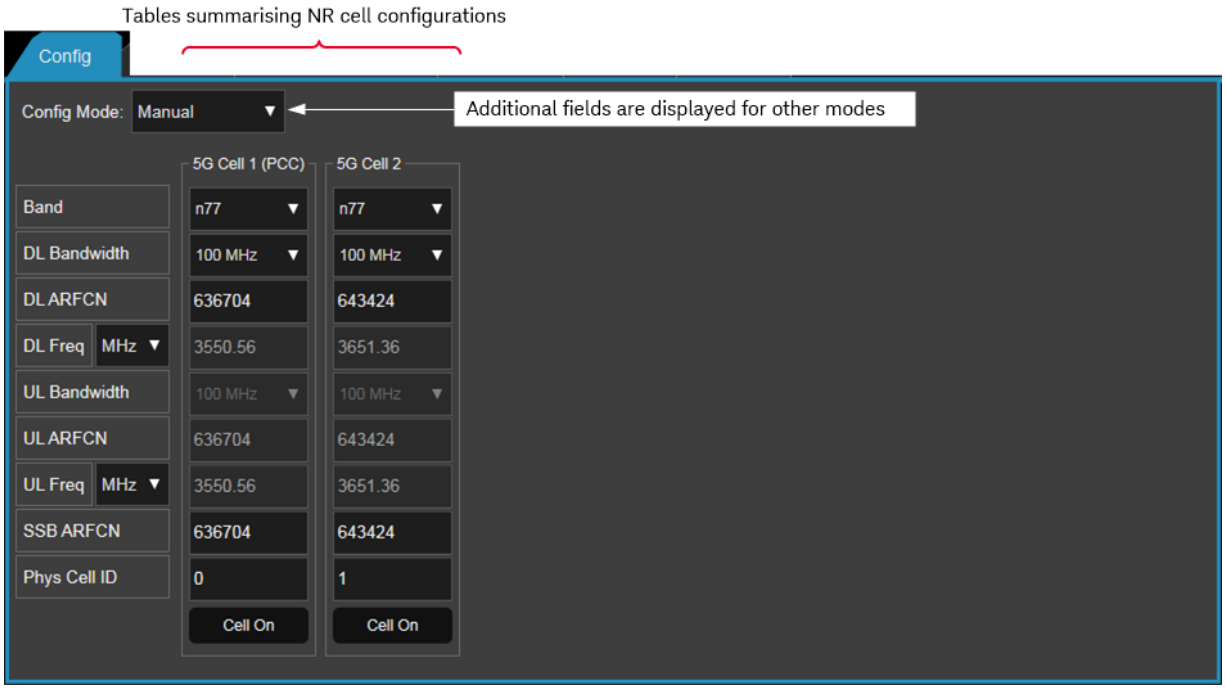
Screen for NSA mode:



Screen for NR L1 mode:



Screen for Standalone mode



Config Mode

Specifies the mode to use to configure the spacing of NR cells. Choose between:

- Manual – to manually supply the frequency-related parameters that determine the cell location manually (Band, Bandwidth, ARFCN and SSB ARFCN).
- Optimization – to allow 5G NR Test Application to space cells automatically. The following additional fields are displayed for you to choose optimization options:
  - Number of Cells. Select the required number of cells. The remaining cells are disabled.
  - PCC Position. Select the position of NR cell 1 (PCC), from 1 to <n> where <n> is the required number of cells. This updates the ARFCN and frequency values for all required cells.
  - RF Centre Freq. This is the internal UXM-5G centre frequency and cannot be changed.

- Contiguous Cells. Select this ncheck box to apply even spacing across the required number of cells, based on PCC cell values. The band, bandwidth and ARFCN values for the other cells are disabled for the other cells, and the location map updates to show the contiguous spacing.

- Explicit – *Keysight use only*.

Band

This field is duplicated on the Cell > Config tab (Band). It is read-only for LTE.

Specify the band used by the cell. The available bands depend on the Duplex Mode (TDD or FDD) and Frequency Range, as shown below:

Duplex mode	Frequency range	Supported NR operating bands
FDD	FR1 (sub-6GHz)	n1, n2, n3, n5, n7, n8, n12, n20, n25, n28, n65, n66, n70, n71, n74
TDD	FR1 (sub-6GHz)	n34, n38, n39, n40, n41, n50, n51, n77, n78, n79
TDD	FR2 (mmWave)	n257, n258, n260, n261
TDD	Intermediate frequencies	Custom

The band determines the DL and UL frequency ranges. For FR1 operating bands, see section 5.2 in 3GPP TS 38.101-1. For FR2 operating bands, see section 5.2 in 3GPP TS 38.101-2.

SCPI: BSE:CONFig:NR5G:<cell>:BAND <N1 | N2 | N3 | N5 | N7 | N8 | N20 | N28 | N38 | N41 | N50 | N51 | N66 | N70 | N71 | N74 | N75 | N76 | N77 | N78 | N79 | N258 | N257 | N260 | N261>

DL Bandwidth

This field is duplicated on the Cell > Config tab (DL Bandwidth).

Specify the downlink bandwidth to use for this cell. The available bandwidths depend on the Frequency Range, as shown below:

Frequency range	Supported bandwidths (MHz)
FR1 (sub-6GHz)	5, 10, 15, 20, 40, 50, 60, 80, 90, 100
FR2 (mmWave)	50, 100, 200
Custom (intermediate frequencies)	50, 100, 200

SCPI: BSE:CONFig:NR5G:<cell>:DL:BW <BW5 | BW10 | BW15 | BW20 | BW40 | BW50 | BW60 | BW80 | BW100 | BW200>

DL ARFCN

This field is duplicated on the Cell > Config tab (DL ARFCN).

Specify the downlink absolute radio frequency channel number (ARFCN), which is a unique identifier used to calculate the exact frequency of the radio channel. The displayed value, and the limits of allowed values, depend on the Frequency Range and Band defined above.

SCPI: BSE:CONFig:NR5G:<cell>:DL:ARFCN <0 ... 400000000>

DL Freq

This field is duplicated on the Cell > Config tab (DL Frequency).

This parameter depends on the Frequency Range, as shown below:

Frequency range	DL Frequency field
FR1 or FR2	Specifies the downlink frequency (in Hz) to use for FR1 or FR2 testing.

Custom	Specifies the downlink frequency (in Hz) to use for intermediate frequency testing.

SCPI: BSE:CONFig:NR5G:<cell>:DL:FREQuency <300000000 ... 40000000000>

UL Bandwidth

This field is duplicated on the Cell > Config tab (UL Bandwidth).

For an FDD cell, specify the uplink bandwidth to use for the cell. For TDD, this field is read-only because its value must be the same as the DL Bandwidth. The available bandwidths depend on the Frequency Range, as shown below:

Frequency range	Supported bandwidths (MHz)
FR1 (sub-6GHz)	5, 10, 15, 20, 40, 50, 60, 80, 90, 100
FR2 (mmWave)	50, 100, 200
Custom (intermediate frequencies)	50, 100, 200

SCPI: BSE:CONFig:NR5G:<cell>:UL:BW <BW5 | BW10 | BW15 | BW20 | BW40 | BW50 | BW60 | BW80 | BW100 | BW200>

UL ARFCN

This field is duplicated on the Cell > Config tab (UL ARFCN).

For an FDD cell, specify the uplink absolute radio frequency channel number (ARFCN), which is a unique identifier used to calculate the exact frequency of the radio channel. For TDD, this field is read-only because its value must be the same as the DL ARFCN. The allowed values depend on the Frequency Range and Band.

SCPI: BSE:CONFig:NR5G:<cell>:UL:ARFCN <0 ... 2279165>

UL Freq

This field is duplicated on the Cell > Config tab (UL Frequency).

For an FDD cell, specify the uplink frequency to use for the cell. For TDD, this field is read-only because its value must be the same as the DL Frequency. This parameter depends on the Frequency Range, as shown below:

Frequency range	DL Frequency field
FR1 or FR2	Specifies the uplink frequency (in Hz) to use for FR1 or FR2 testing.
Custom	Specifies the uplink frequency (in Hz) to use for intermediate frequency testing.

SCPI: BSE:CONFig:NR5G:<cell>:UL:FREQuency <300000000 ... 40000000000>

SSB ARFCN

This field is duplicated on the Cell > Config tab (SSB_ARFCN) and Cell > SSB General tab (SSB ARFCN).

Specify the SSB ARFCN (0 to 3279165) to use for this cell. For more information, see section 5.4.2.1 in 3GPP TS 38.104.

SCPI: BSE:CONFig:NR5G:<cell>:SSB:ARFCN <0 ... 3279165>

Physical Cell ID

This field is duplicated on the Cell > Identities tab (Physical Cell ID) for an NR cell. For an LTE cell, the physical cell ID is always 0.

The physical cell ID (0 to 1007), which is typically used as the default for scrambling sequence initialization if no explicit parameter is provided.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:CELL:ID <1 ... 1007>

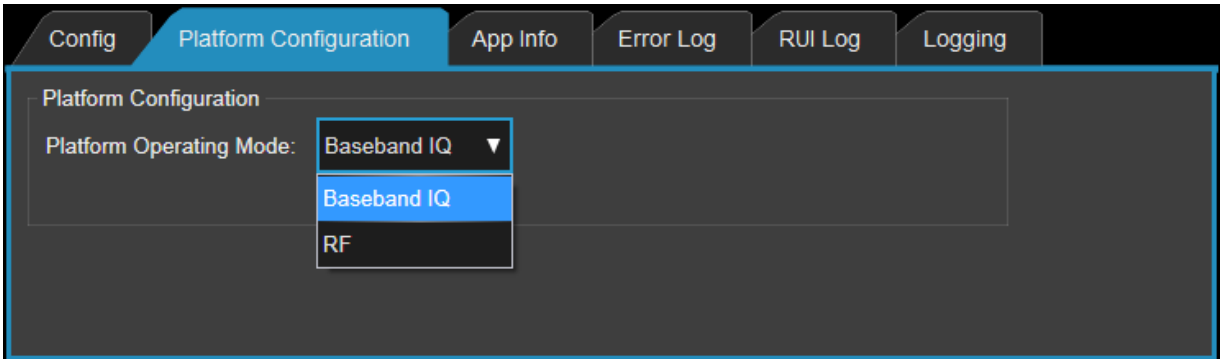
Cell On/Off

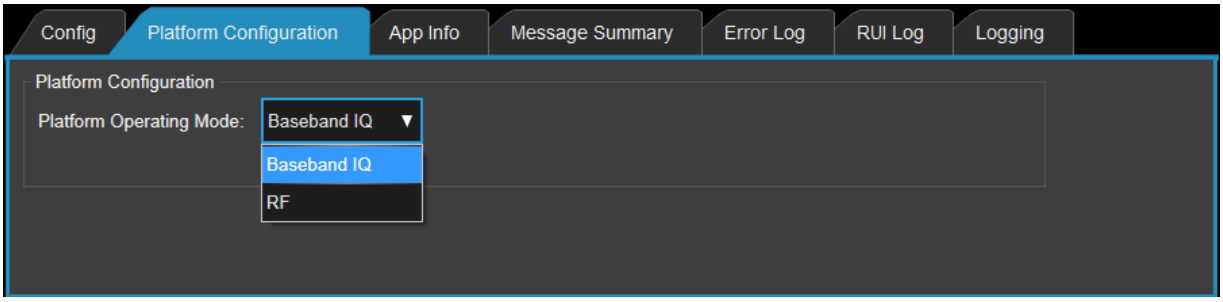
Click to switch the cell on or off.

NR Cell locations

See Cell locations map.

7.2.2 System > Platform Configuration tab





Platform Operating Mode

For information about baseband IQ (BBIQ) and RF connections, see the 5G Test System Setup Help.

Choose the platform operating mode as:

- Baseband IQ – BBIQ connections, which send baseband IQ signals from the test system to prototype devices that do not currently support radio frequencies.
- RF – RF connections between the transceivers and device under test.

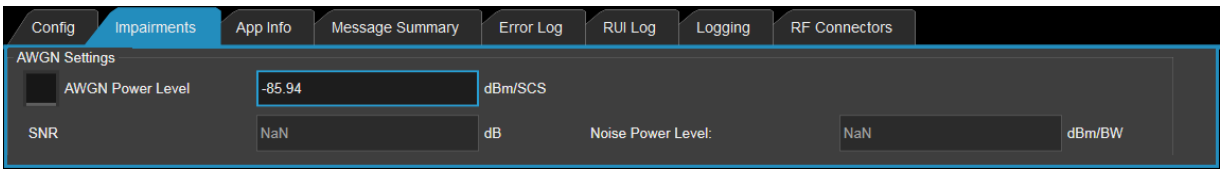
The mode change is confirmed with the message:

Operating mode change complete

SCPI: BSE:CONFig:NR5G:<cell>:INTerface <BBIQ | RF>

7.2.3 Impairments Tab

The Impairments tab configures how to impair the NR RF signal by adding white gaussian noise (AWGN).



AWGN Power Level dBm/SCS

Select this check box to enable AWGN impairment, then supply a power level in the range -194.94 to -73 dBm per subcarrier spacing.

SCPI: BSE:CONFig:NR5G:<cell>:IMPairments:AWGN:STATe <ON | 1 | OFF | 0>

SCPI: BSE:CONFig:NR5G:<cell>:IMPairments:AWGN:POWer <-194.94 ... -73>

SNR

Specify the signal to noise ratio.

SCPI: BSE:CONFig:NR5G:<cell>:IMPairments:AWGN:SNR <-400 ... 200>

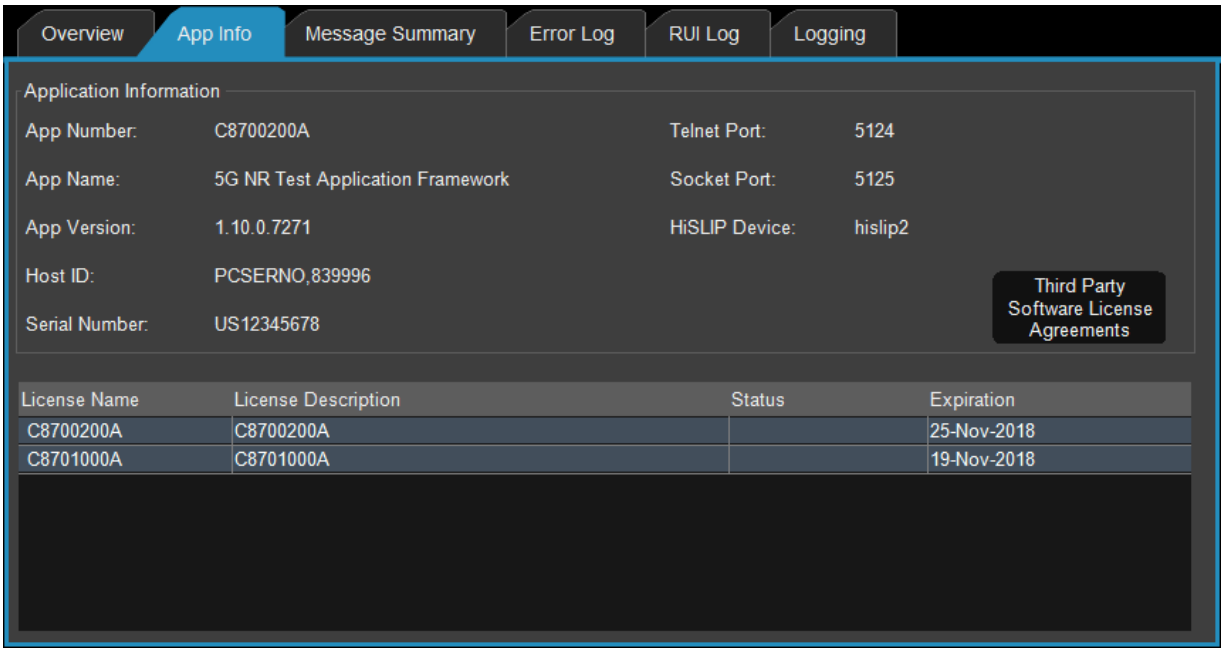
Noise Power Level

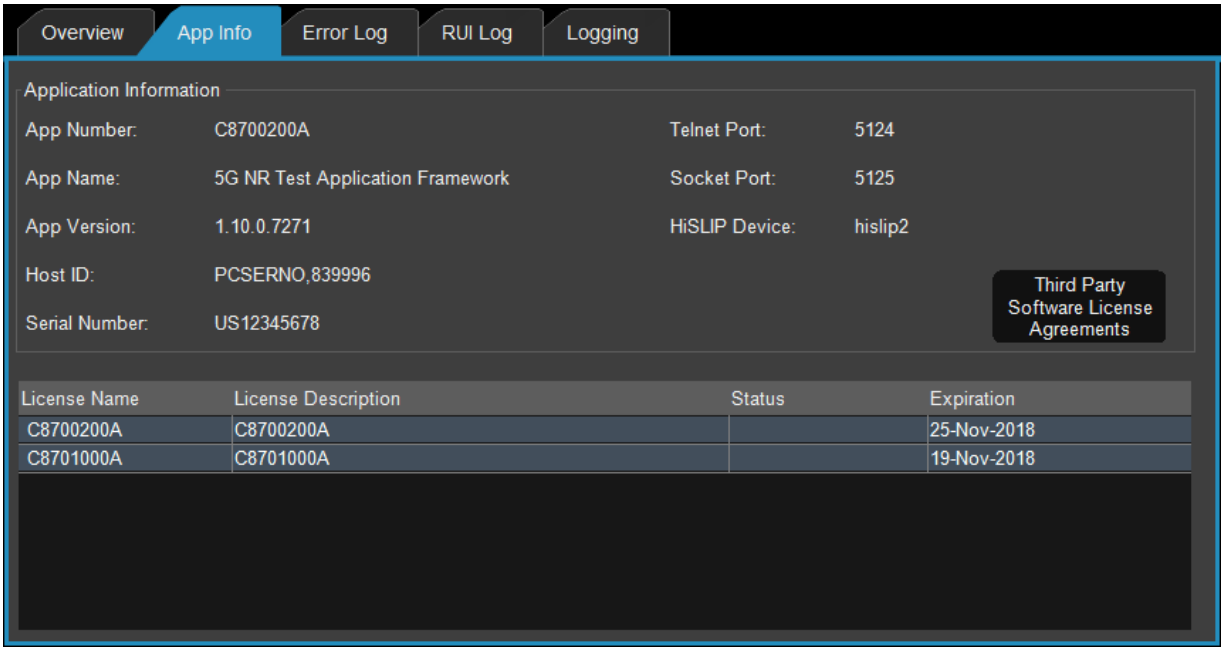
Specify the noise amplitude.

SCPI: BSE:CONFig:NR5G:<cell>:IMPairments:AWGN:NAMPlitude <-400 ... 200>

7.2.4 System > App Info Tab

The App Info tab displays information about the UXM-5G unit and the software installed on it.





App Number

Displays the part number for the 5G NR Test Application running on the Test System PC or UXM-5G unit.

App Name

Displays the name of the application running on the Test System PC or UXM-5G unit.

App Version

Displays the software version number of the application running on the Test System PC or UXM-5G unit.

Host ID

Displays the host ID of the PC that Keysight License Manager requires when you load licenses.

Serial Number

Displays the serial number of the unit required by Customer Support when discussing repairs/calibrations.

Telnet Port

Displays the port number used to connect Telnet services to the unit.

Socket Port

Displays the port number used for socket connections to the unit.

HiSLIP Device

Displays the HiSLIP server used to communicate with the UXM-5G unit.

License Name

Lists the licences installed on the unit.

License Description

Displays a brief description for each licence.

Status

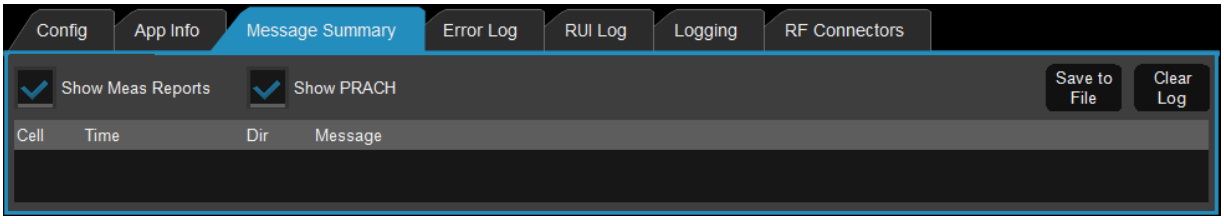
Displays the status of each licence.

Expiration

Displays the expiration date for each licence. For licences without an expiry date, this field displays **Permanent** next to the licence.

7.2.5 System > Message Summary Tab

The Message Summary tab displays a record of the messages between the test system and the device under test.



Show Meas Reports

Select to display measurement reports in the message summary.

Show PRACH

Select to display PRACH messages in the message summary.

Save To File

Click to save the messages to an xml file.

SCPI: BSE:FUNCtion:MESSage:SAVE

Clear Log

Click to remove all logged messages.

SCPI: BSE:FUNCtion:MESSage:CLEar

Cell

Displays the cell to/from which the message was sent/received.

Time

Displays the time that the messages was sent/received.

Dir

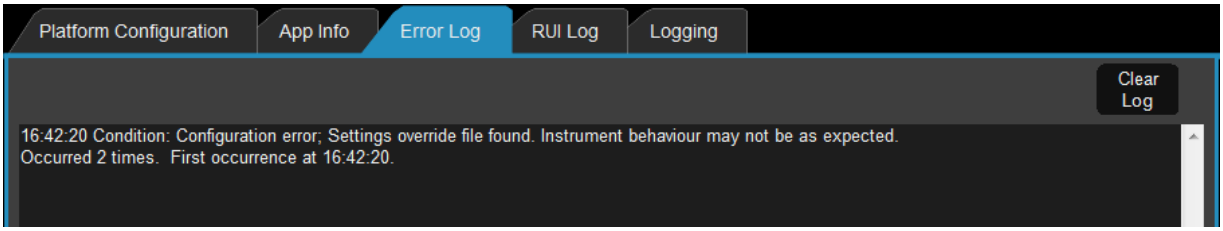
Displays the direction of the message.

Message

Displays the type of message sent/received.

7.2.6 System > Error Log Tab

The Error Log tab displays the error message log which logs errors. All errors and events that are generated are displayed in the error message log. When the log is full, a new message is sent to the log and the oldest message is removed from the log. The log is cleared when the test set powers up.

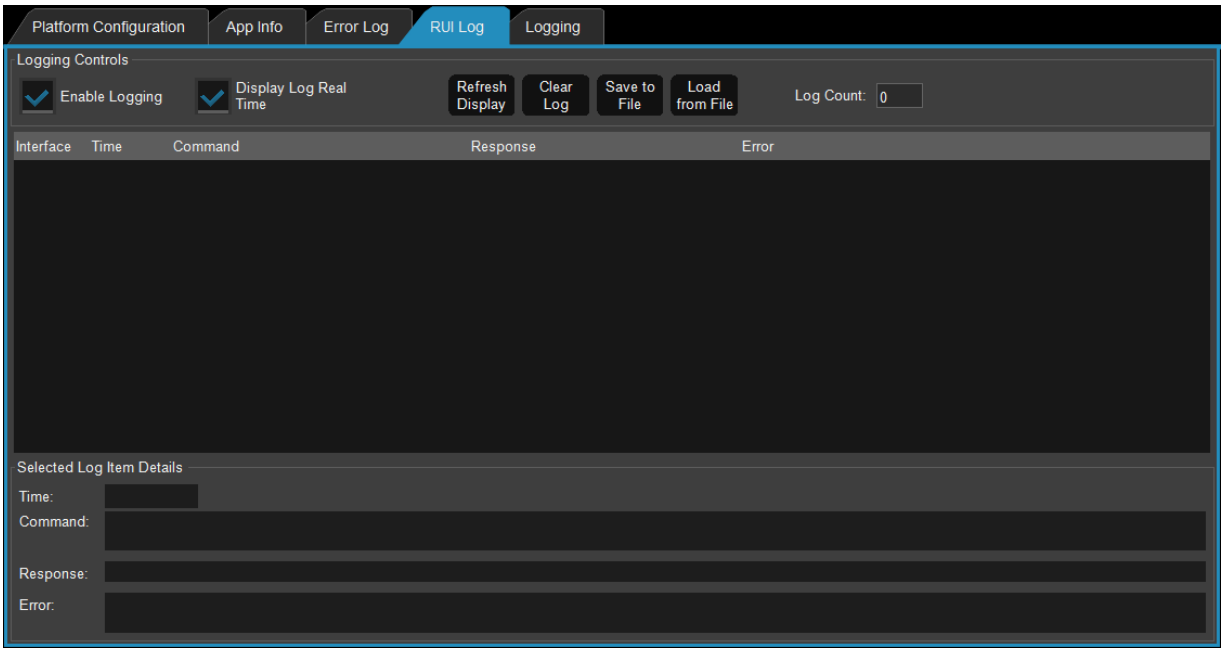


Clear Log

Click to remove all logged messages from the current log.

7.2.7 System > RUI Log Tab

The RUI Log tab displays the remote user interface (RUI) log.



Enable Logging

Select to enable the remote user interface (RUI) log.

SCPI: SYSTem:LOG:UI:REMote[:STATe]

Display Log Real Time

Select to display all logged messages for the next message received, and display each message logged to the message queue immediately. Clear to not update the log display.

Note: Changing the state of this control does not have an immediate effect on the log display.

SCPI: SYSTem:LOG:UI:REMote:DISPlay:RTIMe

Refresh Display

Click to refresh the log.

SCPI: SYSTem:LOG:UI:REMote:DISPlay:REFResh

Clear Log

Click to clear the log.

SCPI: SYSTem:LOG:UI:REMote:CLEar

Save To File

Click to save the RUI log to a file.

SCPI: SYSTem:LOG:UI:REMote:SAVE

Load From File

Click to load a RUI log from a file.

SCPI: SYSTem:LOG:UI:REMote:LOAD

Log Count

Displays the current number of log entries.

SCPI: SYSTem:LOG:UI:REMote:COUNt

Interface

Displays the interface on which the remote user interface command was received.

Time

Displays the time in the following format: HH:MM:SS.nn

Command

Displays the command string from the message.

Response

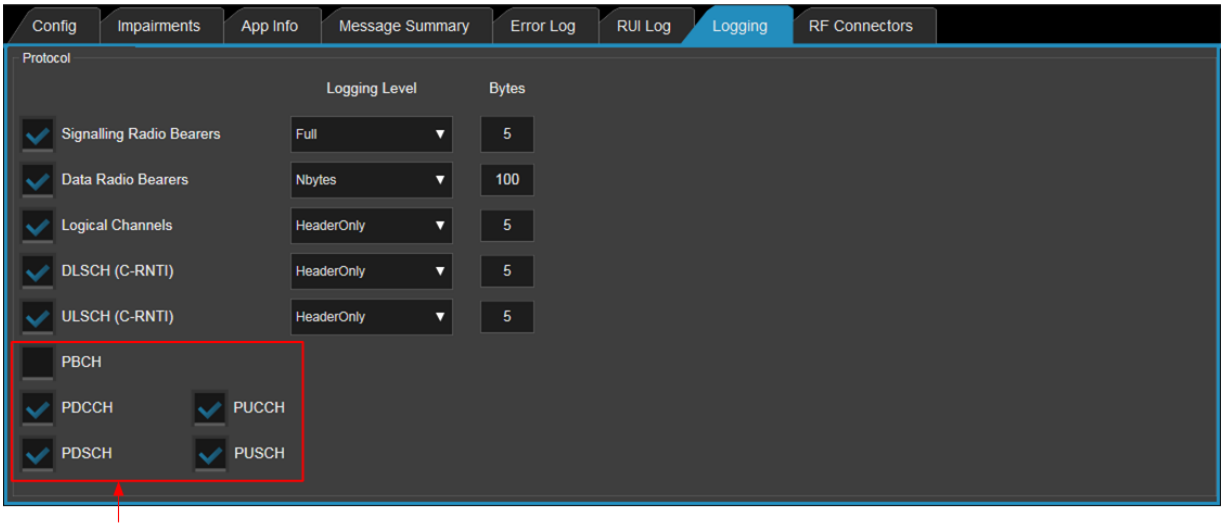
Displays the response string from the message. This can be an empty string if the message does not contain a response, like a command.

Error

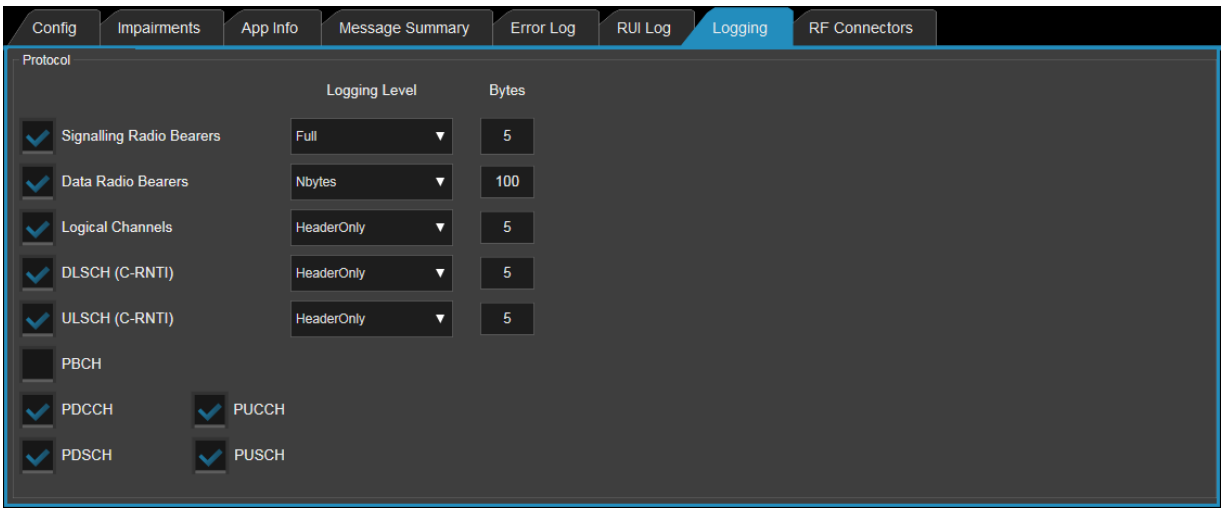
Displays the error string from the message. This can be an empty string if the message does not contain an error. Initially sized to display two lines of text.

7.2.8 System > Logging Tab

The Logging tab controls the level of protocol logging to the ALF log file. The logging applies to the NR or LTE cell selected in the cell details area of the workspace.



Note: *These options are absent on the Logging tab for an LTE cell; the downlink channels are included in the DLSCH option and the uplink channels included in the ULSCH option.*



Signaling Radio Bearers

Select this check box to include signaling radio bearers in the logged data for this cell.

SCPI: BSE:CONFig:<celltype>:<cell>:LOG:SRBearer:STATe <0 | 1>

Additional information for signaling radio bearers:

- Logging Level

  Select the amount of data to log: **Full** (header plus payload), **Header Only**, or **Nbytes** (header plus first <n> bytes of message payload).

  SCPI: BSE:CONFig:<celltype>:<cell>:LOG:SRBearer:LEVel <HEADER | FULL | NBYTE>

- Bytes

  For a logging level of **N bytes**, specify the number of bytes to log (0 to 1000).

  SCPI: BSE:CONFig:<celltype>:<cell>:LOG:SRBearer:NBytes <0 ... 1000>

Data Radio Bearers

Select this check box to include data radio bearers in the logged data for this cell.

SCPI: BSE:CONFig:<celltype>:<cell>:LOG:DRBearer:STATe <0 | 1>

Additional information for data radio bearers:

- Logging Level

  Select the amount of data to log: **Full** (header plus payload), **Header Only**, or **Nbytes** (header plus first <n> bytes of message payload).

  SCPI: BSE:CONFig:<celltype>:<cell>:LOG:DRBearer:LEVel <HEADER | FULL | NBYTE>

- Bytes

  For a logging level of **N bytes**, specify the number of bytes to log (0 to 1000).

  SCPI: BSE:CONFig:<celltype>:<cell>:LOG:DRBearer:NBytes <0 ... 1000>

Logical Channels

Select this check box to include logical channels in the logged data for this cell.

SCPI: BSE:CONFig:<celltype>:<cell>:LOG:LOGChan:STATe <0 | 1>

Additional information for data radio bearers:

- Logging Level

  Select the amount of data to log: **Full** (header plus payload), **Header Only**, or **Nbytes** (header plus first <n> bytes of message payload).

  SCPI: BSE:CONFig:<celltype>:<cell>:LOG:LOGChan:LEVel <HEADER | FULL | NBYTE>

- Bytes

  For a logging level of **N bytes**, specify the number of bytes to log (0 to 1000).

  SCPI: BSE:CONFig:<celltype>:<cell>:LOG:LOGChan:NBytes <0 ... 1000>

DLSCH (C-RNTI)

Select this check box to log data transported on the Downlink Shared Channel for C-RNTI (connected mode only).

SCPI: BSE:CONFig:<celltype>:<cell>:LOG:DLSCh:STATe <0 | 1>

Additional information for data radio bearers:

- Logging Level

Select the amount of data to log: **Full** (header plus payload), **Header Only**, or **Nbytes** (header plus first <n> bytes of message payload).

SCPI: BSE:CONFig:<celltype>:<cell>:LOG:DLSCh:LEVel <HEADER | FULL | NBYTE>

- Bytes

  For a logging level of **N bytes**, specify the number of bytes to log (0 to 1000).

  SCPI: BSE:CONFig:<celltype>:<cell>:LOG:DLSCh:NBytes <0 ... 1000>

ULSCH (C-RNTI)

Select this check box to log uplink data transported on the Uplink Shared Channel for C-RNTI (connected mode only).

SCPI: BSE:CONFig:<celltype>:<cell>:LOG:ULSCh:STATe <0 | 1>

Additional information for data radio bearers:

- Logging Level

  Select the amount of data to log: **Full** (header plus payload), **Header Only**, or **Nbytes** (header plus first <n> bytes of message payload).

  SCPI: BSE:CONFig:<celltype>:<cell>:LOG:ULSCh:LEVel <HEADER | FULL | NBYTE>

- Bytes

  For a logging level of **N bytes**, specify the number of bytes to log (0 to 1000).

  SCPI: BSE:CONFig:<celltype>:<cell>:LOG:ULSCh:NBytes <0 ... 1000>

PBCH

This option is absent for LTE cells and included in the DLSCH option.

Select this check box for full logging of data transported on the Primary Broadcast Channel.

SCPI: BSE:CONFig:<celltype>:<cell>:LOG:PBCH:STATe <0 | 1>

PDCCH

This option is absent for LTE cells and included in the DLSCH option.

Select this check box for full logging of data transported on the Physical Downlink Control Channel.

SCPI: BSE:CONFig:<celltype>:<cell>:LOG:PDCCh:STATe <0 | 1>

PDSCH

This option is absent for LTE cells and included in the DLSCH option.

Select this check box for full logging of data transported on the Physical Downlink Control Channel.

SCPI: BSE:CONFig:<celltype>:<cell>:LOG:PDSCh:STATe <0 | 1>

PUCCH

This option is absent for LTE cells and included in the ULSCH option.

Select this check box for full logging of data transported on the Physical Uplink Control Channel.

SCPI: BSE:CONFig:<celltype>:<cell>:LOG:PUCCh:STATe <0 | 1>

PUSCH

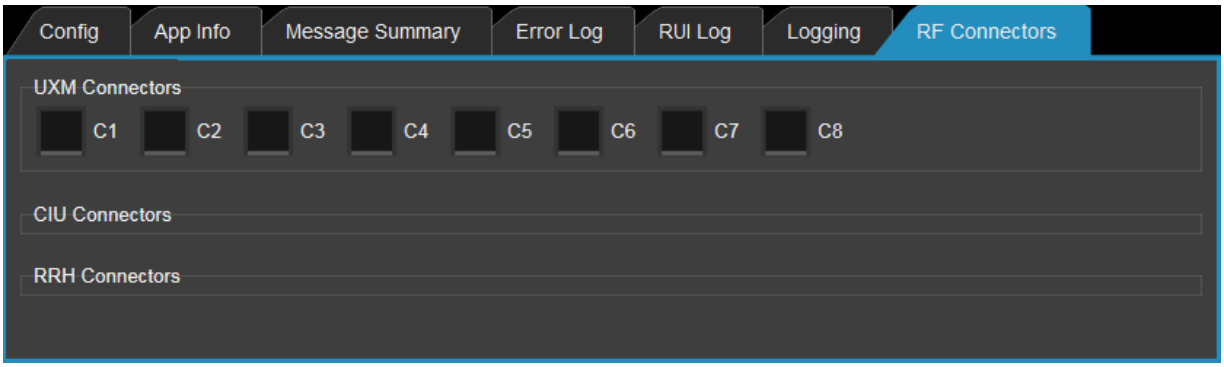
This option is absent for LTE cells and included in the ULSCH option.

Select this check box for full logging of data transported on the Physical Uplink Shared Channel.

SCPI: BSE:CONFig:<celltype>:<cell>:LOG:PUSCh:STATe <0 | 1>

7.2.9 System > RF Connectors tab

The RF Connectors tab allows you to add and remove the connectors used by test cases. For example, you could remove the downlink signal between an RRH and the antenna located within a chamber.



UXM/CIU/RRH Connectors

When 5G NR Test Application Framework starts, it checks how many connectors are present in the test system, and displays up to three types of connector IDs:

- C1 to C8 – identifies a UXM connector.
- IF1_1A to IF1_2B – identifies a CIU (Common Interface Unit) connector.
- MMW1 to MMW8 – identifies an RRH (Remote Radio Head) connector.

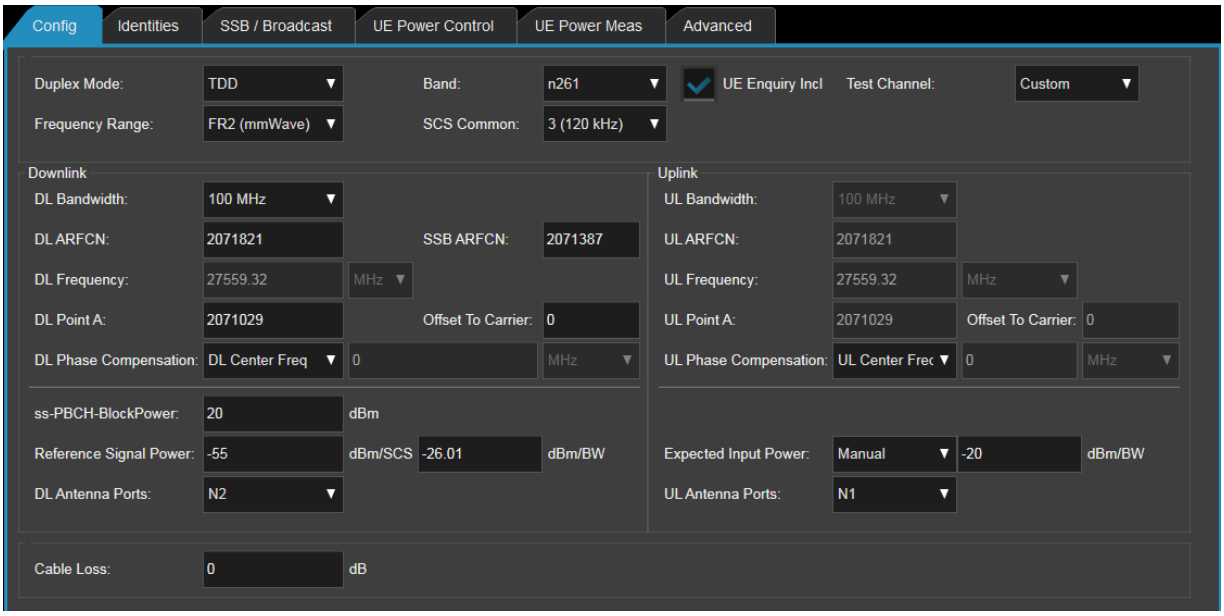
Select check boxes for the connectors that are to be enabled for use by test cases.

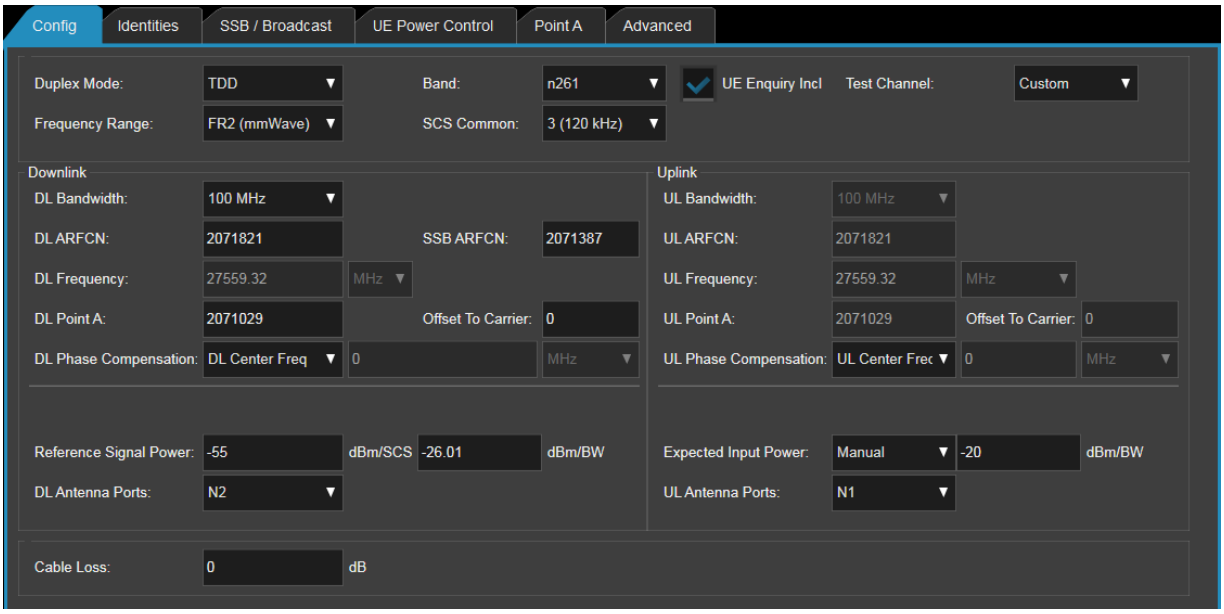
SCPI: BSE:CONFig:NR5G:CTRL:RF:SIGNals <List<UxmConnectorId,ON | OFF>>

7.3 Cell Tab

7.3.1 Cell > Config Tab

The Config tab configures the power and frequencies supported by this cell.





Duplex Mode

Select whether this cell uses TDD or FDD.

SCPI: BSE:CONFig:NR5G:<cell>:DUPLex:MODE <TDD | FDD>

Frequency Range

Select the frequency range supported by this cell. Unless you select Custom, the DL ARFCN and DL Frequency values are adjusted automatically for the selected frequency range.

- FR1 (sub-6GHz)
- FR2 (mmWave) – *available for TDD only*.
- Custom – *available for TDD only* – allows you to supply your own value in the DL Frequency field. Use this option for intermediate frequencies.

SCPI: BSE:CONFig:NR5G:<cell>:FREQuency:RANGe <FR1 | FR2 | CUSTom>

Band

Specify the band used by the cell. The available bands depend on the Duplex Mode (TDD or FDD) and Frequency Range, as shown below:

Duplex mode	Frequency range	Supported NR operating bands
FDD	FR1 (sub-6GHz)	n1, n2, n3, n5, n7, n8, n12, n20, n25, n28, n65, n66, n70, n71, n74
TDD	FR1 (sub-6GHz)	n34, n38, n39, n40, n41, n50, n51, n77, n78, n79
TDD	FR2 (mmWave)	n257, n258, n260, n261
TDD	Intermediate frequencies	Custom

The band determines the DL and UL frequency ranges. For FR1 operating bands, see section 5.2 in 3GPP TS 38.101-1. For FR2 operating bands, see section 5.2 in 3GPP TS 38.101-2.

SCPI: BSE:CONFig:NR5G:<cell>:BAND <N1 | N2 | N3 | N5 | N7 | N8 | N20 | N28 | N38 | N41 | N50 | N51 | N66 | N70 | N71 | N74 | N75 | N76 | N77 | N78 | N79 | N258 | N257 | N260 | N261>

SCS Common

This field is duplicated on the SSB Braodcast tab (Subcarrier Spacing Common).

Select the numerology (μ), which in turn defines the subcarrier spacing. The table below shows the available frequency ranges for a TDD and FDD cell, which determines the available numerologies. The numerology

determines the number of slots per frame (shown on the Schedule map) and the supported DL Bandwidths and UL Bandwidths.

Duplex Mode	Frequency Range	Numerology (μ) & Subcarrier Spacing	Slots Per Frame	TDD Supported Bandwidths	FDD Supported Bandwidths
TDD and FDD	FR1	0 (15 kHz)	10	10, 15, 20, 40, 50	5, 10, 15, 20
	FR1	1 (30 kHz)	20	10, 15, 20, 40, 50, 60, 80, 90, 100	10, 15, 20
	FR1	2 (60 kHz)	40	10, 15, 20, 40, 50, 60, 80, 90, 100	10, 15, 20
TDD only	FR2 and Custom	2 (60 kHz)	40	50, 100, 200	n/a
	FR2 and Custom	3 (120 kHz)	80	50, 100, 200	n/a

For more information, see Table 4.2-1 in 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:SUBCarrier:SPACing:COMMon <MU0 | MU1 | MU2 | MU3>

UE Enquiry Incl

Select this check box to retrieve UE Capability information.

SCPI: BSE:CONFig:NR5G:<cell>:RRC:UEEnquiry:INCLUdeBand <ON | 1 | OFF | 0>

Test Channel

Select how the Test Application configures the ARFCN, Point A, Offset To Carrier and the KSSB values for the cell.

Choose between **Low**, **Mid**, **High** to use the values defined in the tables in section 4.3.1 of 3GPP TS 38.508-1, or select **Custom** to specify your own values.

SCPI: BSE:CONFig:NR5G:<cell>:TESTChanLoc <LOW | MID | HIGH | CUSTOM>

7.3.1.1 Downlink

DL Bandwidth

Specify the downlink bandwidth to use for this cell. The available bandwidths depend on the Frequency Range, as shown below:

Frequency range	Supported bandwidths (MHz)
FR1 (sub-6GHz)	5, 10, 15, 20, 40, 50, 60, 80, 90, 100
FR2 (mmWave)	50, 100, 200
Custom (intermediate frequencies)	50, 100, 200

SCPI: BSE:CONFig:NR5G:<cell>:DL:BW <BW5 | BW10 | BW15 | BW20 | BW40 | BW50 | BW60 | BW80 | BW100 | BW200>

DL ARFCN

Specify the downlink absolute radio frequency channel number (ARFCN), which is a unique identifier used to calculate the exact frequency of the radio channel. The displayed value, and the limits of allowed values, depend on the Frequency Range and Band defined above.

SCPI: BSE:CONFig:NR5G:<cell>:DL:ARFCN <0 ... 400000000>

SSB ARFCN

This field is duplicated in the SSB ARFCN field on the Cell > SSB General tab and System > Config Tab.

Specify the SSB ARFCN (0 to 3279165) to use for this cell. For more information, see section 5.4.2.1 in 3GPP TS 38.104.

SCPI: BSE:CONFig:NR5G:<cell>:SSB:ARFCN <0 ... 3279165>

DL Frequency

This parameter depends on the Frequency Range, as shown below:

Frequency range	DL Frequency field
FR1 or FR2	Specifies the downlink frequency (in Hz) to use for FR1 or FR2 testing.
Custom	Specifies the downlink frequency (in Hz) to use for intermediate frequency testing.

SCPI: BSE:CONFig:NR5G:<cell>:DL:FREQuency <300000000 ... 40000000000>

DL Point A

This field is duplicated in the DL_ARFCN-PointA field on the Point A tab.

Specify the downlink ARFCN of reference point A, which defines the lowest subcarrier of common resource block 0, and is used as a common reference point for other resource block grids. For more information, see section 4.4.4.2 in 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:DL:POINta <0 ... 3279165>

Offset To Carrier

Specify the number of downlink physical resource blocks (PRB), from Point A to the lowest usable subcarrier in the carrier bandwidth.

SCPI: BSE:CONFig:NR5G:<cell>:DL:OTCarrier <0 ... 2199>

DL Phase Compensation

Select the downlink phase compensation:

- Off – disables downlink phase compensation.
- DL Center Freq – auto-configures the compensation value.
- Custom – provides a custom compensation value. The adjacent fields are enabled, allowing you to supply a value for DL phase compensation, and to select the units as Hz, KHz, MHz or GHz.

SCPI: BSE:CONFig:NR5G:<cell>:DL:PHASe:COMPensation:STATe <OFF | DLCF | CUSTom>

SCPI: BSE:CONFig:NR5G:<cell>:DL:PHASe:COMPensation <0 ... 18446744073709551615> – required for CUSTom option.

7.3.1.2 Uplink

UL Bandwidth

For an FDD cell, specify the uplink bandwidth to use for the cell. For TDD, this field is read-only because its value must be the same as the DL Bandwidth. The available bandwidths depend on the Frequency Range, as shown below:

Frequency range	Supported bandwidths (MHz)
FR1 (sub-6GHz)	5, 10, 15, 20, 40, 50, 60, 80, 90, 100
FR2 (mmWave)	50, 100, 200
Custom (intermediate frequencies)	50, 100, 200

SCPI: BSE:CONFig:NR5G:<cell>:UL:BW <BW5 | BW10 | BW15 | BW20 | BW40 | BW50 | BW60 | BW80 | BW100 | BW200>

UL ARFCN

For an FDD cell, specify the uplink absolute radio frequency channel number (ARFCN), which is a unique identifier used to calculate the exact frequency of the radio channel. For TDD, this field is read-only because its value must be the same as the DL ARFCN. The allowed values depend on the Frequency Range and Band.

SCPI: BSE:CONFig:NR5G:<cell>:UL:ARFCN <0 ... 2279165>

UL Frequency

For an FDD cell, specify the uplink frequency to use for the cell. For TDD, this field is read-only because its value must be the same as the DL Frequency. This parameter depends on the Frequency Range, as shown below:

Frequency range	DL Frequency field
FR1 or FR2	Specifies the uplink frequency (in Hz) to use for FR1 or FR2 testing.
Custom	Specifies the uplink frequency (in Hz) to use for intermediate frequency testing.

SCPI: BSE:CONFig:NR5G:<cell>:UL:FREQuency <300000000 ... 40000000000>

UL Point A

Specify the uplink ARFCN of reference point A, which defines the lowest subcarrier of common resource block 0, and is used as a common reference point for other resource block grids.

Note: *This field is duplicated in the UL_ARFCN-PointA field on the PointA tab.*

SCPI: BSE:CONFig:NR5G:<cell>:UL:POINta <0 ... 3279165>

UL OffsetToCarrier

For uplink, specify the number of physical resource blocks (PRB), from Point A to the lowest usable subcarrier in the carrier bandwidth.

SCPI: BSE:CONFig:NR5G:<cell>:UL:OTCarrier <0 ... 2199>

UL Phase Compensation

Select the uplink phase compensation:

- Off – disables uplink phase compensation.
- DL Center Freq – auto-configures the compensation value.
- Custom – provides a custom compensation value. The adjacent fields are enabled, allowing you to supply a value for DL phase compensation, and to select the units as Hz, KHz, MHz or GHz.

SCPI: BSE:CONFig:NR5G:<cell>:UL:PHASe:COMPensation:STATe <OFF | DLCF | CUSTom>

SCPI: BSE:CONFig:NR5G:<cell>:UL:PHASe:COMPensation <0 ... 18446744073709551615> – required for CUSTom option.

ss-PBCH-BlockPower (dBm)

Specify the transmission power (-60 to 50 dBm) used to transmit the SSB. This is defined in SIB 1, and the DUT uses this value to estimate the transmission power of the random access preamble as described in section 7.4 in 3GPP TS 38.213.

SCPI: BSE:CONFig:NR5G:<cell>:SSB:POWer:ADVertised <-60 ... 50>

Reference Signal Power

Specifies the downlink power, measured in two ways:

- dBm/SCS – energy per resource element (-200.0 to +10.0 dBm).
- dbm/BW – energy per resource element per bandwidth (-168 to 42 dBm). This field is updated with changes to SCS Common and DL Bandwidth values.

Note: If you change the dBm value in one field, the equivalent value updates in the other field.

SCPI: BSE:CONFIG:NR5G:<cell>[:DL]:POWer:EPRE <-200 ... 10> – dBm/SCS value

SCPI: BSE:CONFIG:NR5G:<cell>[:DL]:POWer:DBmBw <-168 ... 42> – dBm/BW value

DL Antenna Ports

Select the actual number of physical RF signals generated by the cell, which should match the number of physical antenna ports that the UE uses to receive RF signals from this cell.

SCPI: BSE:CONFig:NR5G:<cell>:DL:PANTenna:PORTs <N1 | N2 | N4 | N8>

Expected UL Power

Specifies the expected uplink power to be used by the test device. This is related to the power at which the cell transmits to the device. The value can range between -110.0 and +30.0 dBm, and can be specified to one decimal place (0.1 dBm steps).

SCPI: RFANalyzer:NR5G:<cell>:MANual:POWer <-110 ... 0>

UL Antenna Ports

Select the actual number of physical RF signals received by this cell, which should match the number of physical antenna ports that the UE transmits to this cell.

SCPI: BSE:CONFig:NR5G:<cell>:UL:PANTenna:PORTs <N1 | N2 | N4>

Cable Loss

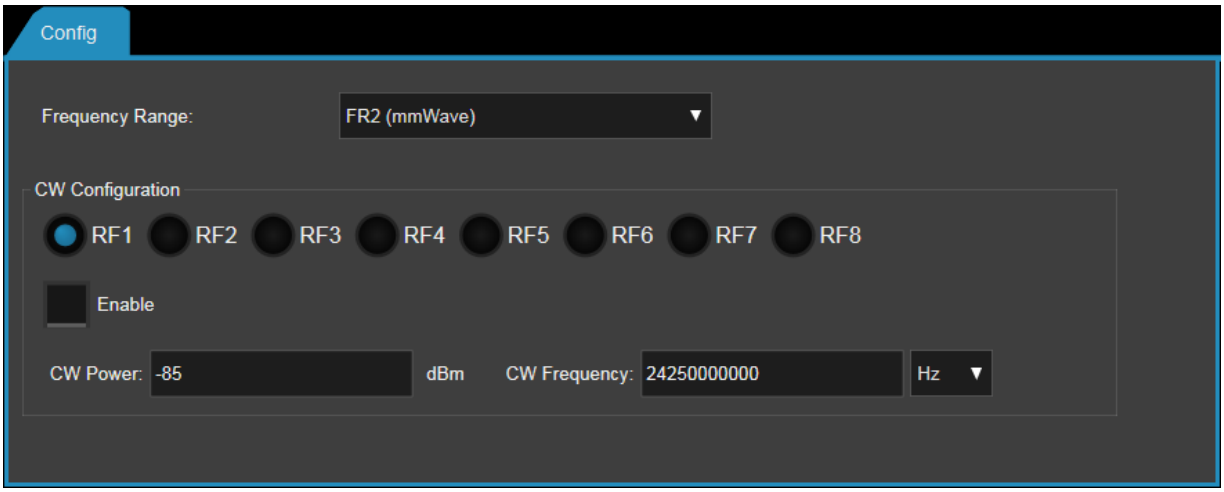
This field has been deprecated and replaced with the Path Loss option on the Utility menu.

For more information, see the Path Loss Correction tutorial.

SCPI: BSE:CONFig:NR5G:<cell>:CABLe:LOSS <-100 ... 100>

7.3.2 Cell > Config Tab

The Config tab can be used to perform a basic calibration of the test system hardware by transmitting frequencies at a defined power level and measuring the received power level and frequency. The results can be used to adjust the power levels configured in the Test Application.



Frequency Range

Select the frequency range of the frequency signal to generate:

- FR1 (sub-6GHz) – limits the CW frequency to 450MHz to 6 GHz.
- FR2 (mmWave) – limits the CW frequency to values from 24.25 GHz to 41.1 GHz.
- Custom – limits the CW frequency to values from 6.1 GHz to 12 GHz.

7.3.2.1 CW Configuration

RF 1/2/3/4/5/6/7/8

Select the RF port on which to transmit the carrier wave defined below.

Enable

Select to enable sending the carrier wave.

CW Power

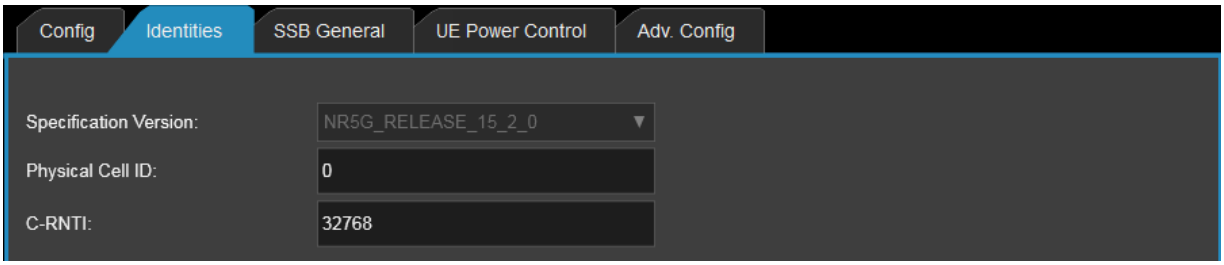
Specify the power of the carrier wave (-100 to -7 dBm) transmitted on the RF port defined above.

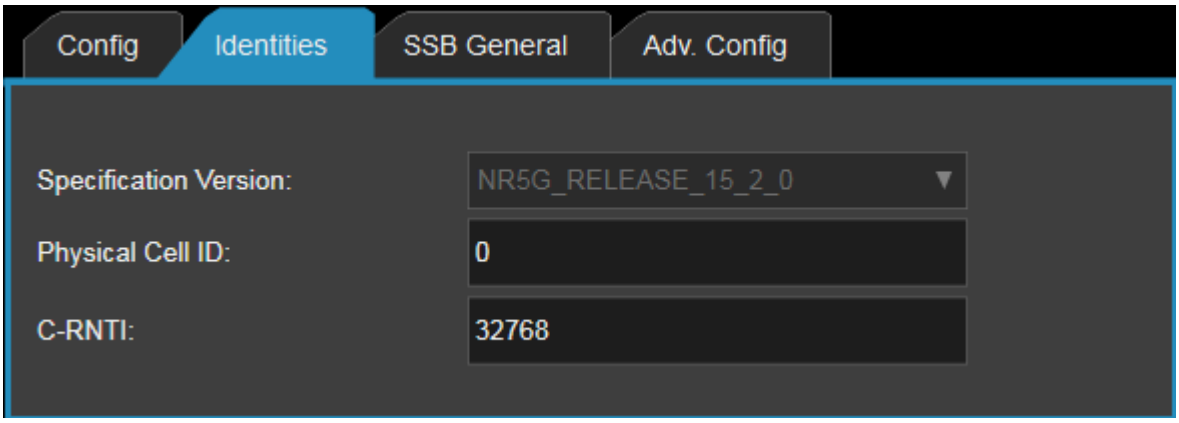
CW Frequency

Specify the frequency of the carrier wave transmitted on the RF port defined above. The range of allowed value depends on the Frequency Range defined above.

7.3.3 Identities Tab

The Identities tab configures options that uniquely identify this cell.





Specification Version

Displays the version of the specification to use.

Currently only 5G NR (3GPP TS 38.211 v15.2.0) is supported.

SCPI: BSE:CONFig:NR5G:<cell>:SPEC:VERSion?

Physical Cell ID

The physical cell ID (0 to 1007), which is typically used as the default for scrambling sequence initialization if no explicit parameter is provided.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:CELL:ID <1 ... 1007>

C-RNTI

Specify a unique UE identification number (1 to 65519) within the group of carrier aggregated cells.

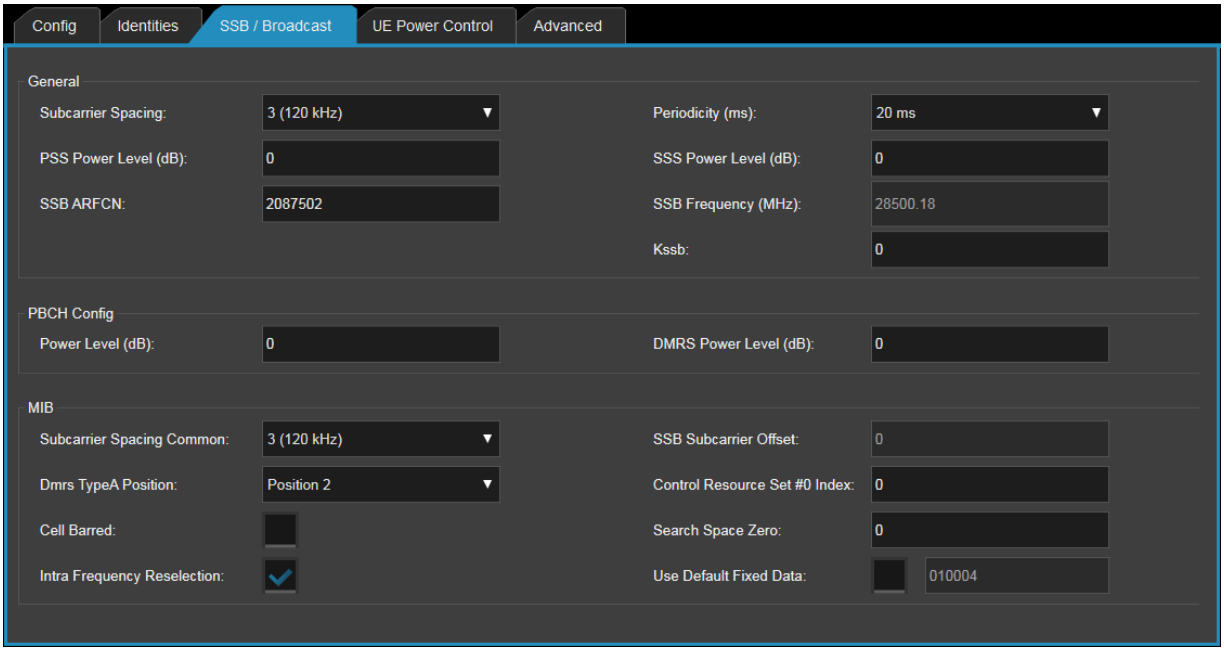
Note: Values used for RA-RNTI (1-10) cannot be used and values in the range 65524-65535 are currently reserved.

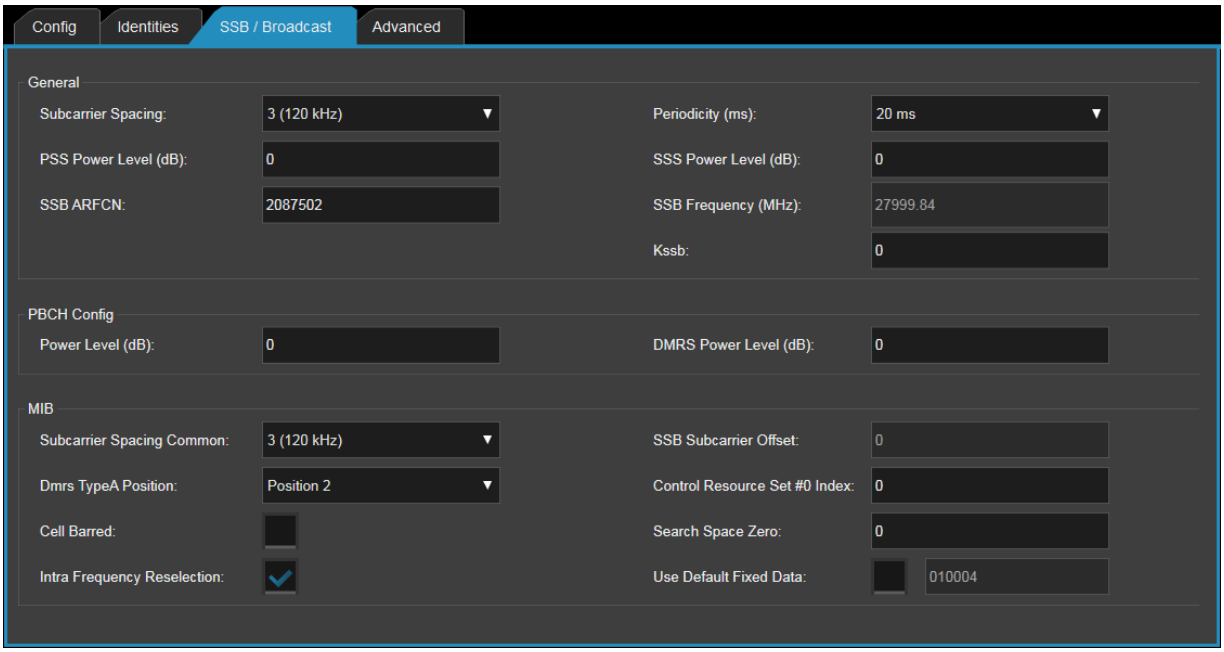
SCPI: BSE:CONFig:NR5G:<cell>:CRNTi <1 ... 65519>

7.3.4 SSB / Broadcast Tab

Also see: SSB Scheduling tutorial.

The SSB / Broadcast tab configures options for the Secondary Synchronization Block (SSB).





7.3.4.1 General

Subcarrier Spacing

Also see: Subcarrier Spacing in the SSB Scheduling tutorial.

Select the subcarrier spacing for SSB. The available values depends on the cell's Frequency Range on the Cell > Config tab:

Numerology (μ)	Subcarrier spacing (kHz)	Frequency Range
0	15	FR1
1	30	FR1
3	120	FR2 and Custom
4	240	FR2 and Custom

SCPI: BSE:CONFig:NR5G:<cell>:SSB:SUBCarrier:SPACing <MU0 | MU1 | MU3 | MU4>

PSS Power Level (dB)

Specify the Primary Synchronisation Signal (PSS) in dBs (-200.0 to 10.0), which defines the baseline downlink signal power relative to RSTP.

Note: *Each individual beam has a further power offset applied on the Beam Management sub-tabs.*

SCPI: BSE:CONFig:NR5G:<cell>:SSB:PSS:GAIN <-200 ... 10>

SSB ARFCN

This field is identical to SSB_ARFCN on the Cell > Config tab and System > Config Tab.

Specify the SSB ARFCN (0 to 3279165) to use for this cell. For more information, see section 5.4.2.1 in 3GPP TS 38.104.

SCPI: BSE:CONFig:NR5G:<cell>:SSB:ARFCN <0 ... 3279165>

Periodicity (ms)

Also see: Periodicity in the SSB Scheduling tutorial.

Specify the SSB half-frame period (in ms), as defined by the SIB1 information element ssb-periodicityServingCell. The SSB periodicity is used for rate matching purposes. Choose between: 5ms, 10ms, 20ms, 40ms, 80ms or 160ms. For more information, see section 6.2.2 in 3GPP TS 38.331.

Note: If the field is absent, the UE applies the value ms5.

SCPI: BSE:CONFig:NR5G:<cell>:SSB:PERiodicity <MS5 | MS10 | MS15 | MS20 | MS40 | MS80 | MS160>

SSS Power Level (dB)

Specify the baseline downlink signal power relative to RSTP in dB.

SCPI: BSE:CONFig:NR5G:<cell>:SSB:SSS:GAIN <-200 ... 10>

SSB Frequency (MHz)

Displays the SSB frequency.

SCPI: BSE:CONFig:NR5G:<cell>:SSB:FREQuency?

Kssb

This field is displayed read-only in the SSB_Subcarrier_Offset field below.

Specify the subcarrier offset from subcarrier 0 in the common resource block to subcarrier 0 of the SS/PBCH block. The offset can be in the range 0 to 23 for FR1, or 0 to 11 for FR2.

For more information, see the description of the 'k' parameter in section 7.4.3.1 in 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:SSB:KSSB <0 ... 23>

7.3.4.2 PBCH Config

Power Level (dB)

Specify the baseline downlink signal power (-200.0 to 10.0 dB) relative to RSTP.

Note: Each individual beam has a further power offset applied from the relevant entry in the Beam Configuration table.

SCPI: BSE:CONFig:NR5G:<cell>:SSB:PBCH:DATA:GAIN <-200 ... 10>

DMRS Power Level (dB)

Specify the baseline PBCH DMRS power (-200.0 to 20.0 dB) relative to RSTP.

SCPI: BSE:CONFig:NR5G:<cell>:SSB:PBCH:DMRS:GAIN <-200 ... 10>

7.3.4.3 MIB

Use Default Fixed Data

The Master Information Block (MIB) contains System Frame Number information which varies with every transmission and static data containing other essential information. The total length of the data is 16 bits, of which 8 bits comprise a reduced Frame Number. This Data Unit must be configured with 16 bits of data, of which bits 2-9 are replaced with the reduced Frame Number prior to transmission and the remaining 8 bits must contain the remaining static contents of the MIB.

Select this option to use a default value for the 8 bits of static content that forms part of the Master Information Block (MIB). This option disables the remaining field in this MIB section of the screen.

Clear this option to define the parameters for the 8 bits of static content. In this case, the adjacent field shows the hexadecimal representation of the MIB for the chosen parameter values.

SCPI: BSE:CONFig:NR5G:<cell>:SSB:MIB:OVERride[:STATe] <ON | OFF>

SCPI: BSE:CONFig:NR5G:<cell>:SSB:MIB:OVERride:PAYLoad <hex>

Subcarrier Spacing Common

This field is duplicated on the Cell > Config tab (SCS Common).

Select the numerology (μ), which in turn defines the subcarrier spacing. The table below shows the available frequency ranges for a TDD and FDD cell, which determines the available numerologies. The numerology determines the number of slots per frame (shown on the Schedule map) and the supported DL Bandwidths and UL Bandwidths.

Duplex Mode	Frequency Range	Numerology (μ) & Subcarrier Spacing	Slots Per Frame	TDD Supported Bandwidths	FDD Supported Bandwidths
TDD and FDD	FR1	0 (15 kHz)	10	10, 15, 20, 40, 50	5, 10, 15, 20
	FR1	1 (30 kHz)	20	10, 15, 20, 40, 50, 60, 80, 90, 100	10, 15, 20
	FR1	2 (60 kHz)	40	10, 15, 20, 40, 50, 60, 80, 90, 100	10, 15, 20
TDD only	FR2 and Custom	2 (60 kHz)	40	50, 100, 200	n/a
	FR2 and Custom	3 (120 kHz)	80	50, 100, 200	n/a

For more information, see Table 4.2-1 in 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:SUBCarrier:SPACing:COMMon <MU0 | MU1 | MU2 | MU3>

DMRS Type A Position

This field replicates DMRS Type A Position on the PHY > PDSCH DMRS tab, and any change updates both fields.

Specify the position of the first downlink DMRS: Position 2 or Position 3. The position corresponds to the layer 1 parameter DL-DMRS-typeA-pos. For more information, see section 7.4.1.1.2 in 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:DL:DMRS:TAPosition <POS2 | POS3>

Cell Barred

Select to define the status of the cell as 'Barred'. When barred, the UE can not select this cell as and must follow the steps outlined in section 5.3.1 in 3GPP TS 38.304.

SCPI: BSE:CONFig:NR5G:<cell>:RRC:ACCess:BARRing <ON | OFF>

SSB Subcarrier Offset

This field is a read-only display of the Kssb value above.

Control Resource Set #0 Index

Specify the index number (0 to 15) for parameters of the common CORESET#0. The values are interpreted in a similar way to the corresponding bits in MIB pdcch-ConfigSIB1. For more information see section 10 in 3GPP TS 38.213.

SCPI: BSE:CONFig:NR5G:<cell>:SSB:COReset0 <0 ... 15>

Search Space Zero

Specify the index number (0 to 15) for parameters of the common SearchSpace#0. The values are interpreted in a similar way to corresponding bits in MIB pdcch-ConfigSIB1. For more information see section 10 in 3GPP TS 38.213.

SCPI: BSE:CONFig:NR5G:<cell>:SSB:SSID0 <0 ... 15>

PDCCH Config SIB1

Specify an integer (0 to 255) which determines a bandwidth for PDCCH/SIB, a common ControlResourceSet (CORESET) a common search space and necessary PDCCH parameters.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PDCCh:CONFig:SIB1 <0 ... 255>

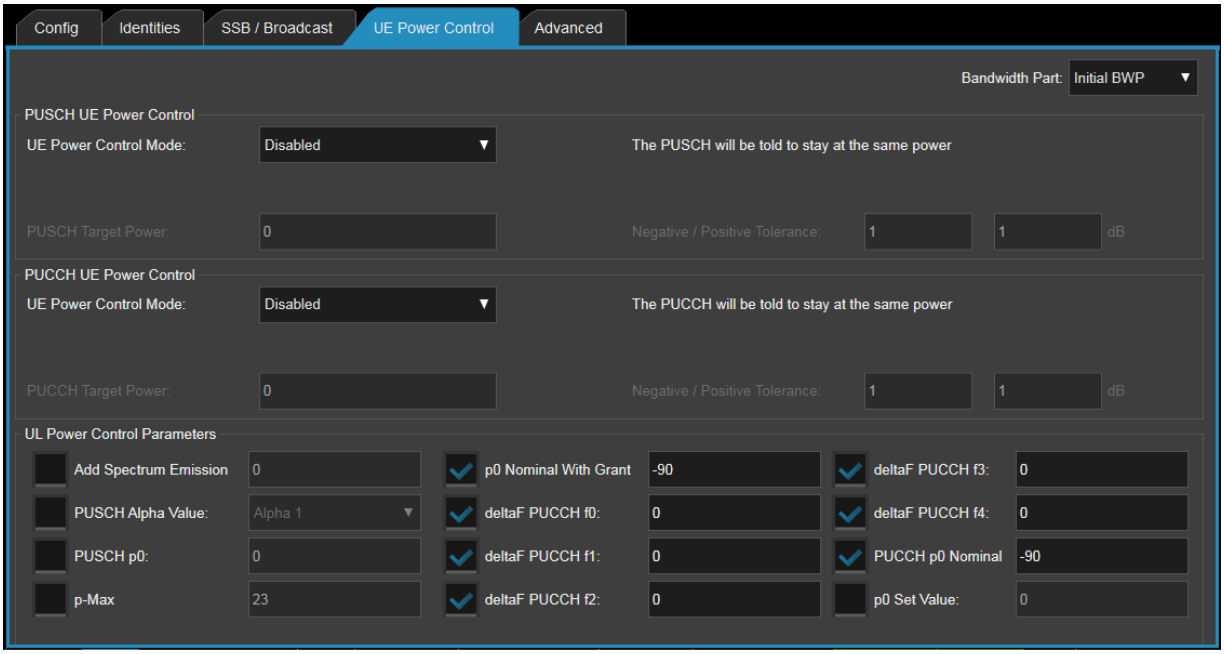
Intra Frequency Reselection

Select to allow the UE to select another cell on the same frequency of re-selection criteria are fulfilled. For more information, see section 5.3.1 in 3GPP TS 38.304.

SCPI: BSE:CONFig:NR5G:<cell>:RRC:INTRa:RESelection:ALLowed <ON | OFF>

7.3.5 UE Power Control Tab

The UE Power Control tab configures the uplink power control.



Bandwidth part

Select the bandwidth part to be configured. The drop-down list contains the initial bandwidth part and each uplink carrier bandwidth part that is Enabled on the NR cell's PHY > Bandwidth Part Tab.

7.3.5.1 PUSCH / PUCCH UE Power Control

UE Power Control Mode

The UE power control mode specifies how 5G NR Test Application generates Transmission Power Control (TPC) commands for PUSCH and PUCCH. The TPC commands are sent in DCI messages.

Select one of the following:

- Target – sends TPC commands to the UE to adjust its output power to a target dBm, within a specified tolerance.

  Target mode requires the following values:

  a. Target Power

     Specify the target UE transmitter output power (-90 to 40 dBm).

     SCPI: BSE:CONFig:NR5G:<cell>:UL[:PUSCh]:CLPControl:TARGet[:POWer] <-90 ... 40>

SCPI: *BSE:CONFig:NR5G:<cell>:UL:PUCCh:CLPControl:TARGet[:POWer] <-90 ... 40>*

b. Negative / Positive Tolerance

Specify the relative power (0 to 10 dB) below the target power (for negative tolerance) and above the target power (for positive tolerance). These values specify the range around the PUSCH/PUCCH target power, which the BSE application stops adjusting the UE PUSCH/PUCCH once it reaches that range. The range is defined as [target power – tolerance low, target power + tolerance high].

SCPI: *BSE:CONFig:NR5G:<cell>:UL[:PUSCh]:CLPControl:TARGet:TOLerance:NEGative <0 ... 10>*

SCPI: *BSE:CONFig:NR5G:<cell>:UL[:PUSCh]:CLPControl:TARGet:TOLerance:POSitive <0 ... 10>*

SCPI: *BSE:CONFig:NR5G:<cell>:UL:PUCCh:CLPControl:TARGet:TOLerance:NEGative <0 ... 10>*

SCPI: *BSE:CONFig:NR5G:<cell>:UL:PUCCh:CLPControl:TARGet:TOLerance:POSitive <0 ... 10>*

- Manual – the UE power is not adjusted unless you explicitly send a manual adjustment of power to either the PUSCH or PUCCH. To make a manual adjustment, supply the following:

  a. TPC value

  The TPC command to be sent to the UE. Choose between:

  - Down -1 dB, Up +1 dB or Up +3 dB – these commands trigger a single step increase or decrease of the power by -1, +1 or +3 dB).
  - Maintenance – (0 dB) directs the UE to maintain its power level at the current value.

  SCPI: *BSE:CONFig:NR5G:<cell>:UL[:PUSCH]:CLPControl:MANual:TPCValue <NM1 | N0 | N1 | N3>*

  SCPI: *BSE:CONFig:NR5G:<cell>:UL:PUCCh:CLPControl:MANual:TPCValue <NM1 | N0 | N1 | N3>*

  b. Send TPC Command

  In manual mode, 5G NR Test Application will not send a TPC command until you click this button.

- All Up Bits – the UE is continuously sent DCI messages, with TPC bits instructing the UE to increase the power level of the PUSCH or PUCCH by 1 dB. This also results in the PUSCH or PUCCH being transmitted continuously. This option is often used to drive the UE to its maximum power level for the purpose of conducting RF testing.
- All Down Bits – the UE is continuously sent DCI messages, with TPC bits instructing the UE to decrease the power level of the PUSCH or PUCCH by 1 dB. This also results in the PUSCH or PUCCH being continuously transmitted (although at a very low power level). This option is often used to drive the UE to its minimum power level.

  Note: After using All Down Bits, the UE power could be very low. If you return to Auto, you might need to use UL or DL MAC Padding to provide enough allocations for the UE to return to the UE target power.

- Disabled – disables UE power control.
- Auto – moves the UE to the optimum power level relative to the receiver window (which will vary with expected input power).

SCPI: *BSE:CONFig:NR5G:<cell>:UL[:PUSCh]:CLPControl:MODE <TARGET | MANual | UP | DOWN | DISabled | AUTO>*

7.3.5.2 UL Power Control Parameters

Add Spectrum Emission

Select a value for the additional spectrum emission (0 to 7) which indicates the emission requirements for the UE, and determines whether the value is present in the RRC message that allocates the NR cell.

SCPI: *BSE:CONFig:NR5G:<cell>:RRC:ASEMission <ON | OFF>*

SCPI: *BSE:CONFig:NR5G:<cell>:RRC:ASEMission:VALue <0 ... 7>*

PUSCH Alpha Value

Specify the PUSCH alpha value used to calculate the UE transmitted power, as described in section 7.1.1 in 3GPP TS 38.213.

Choose between: Alpha 0, Alpha 1, Alpha 4, Alpha 5, Alpha 6, Alpha 7, Alpha 8 and Alpha 9.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUSCh:ALPHasets:ALPHa:STATe <ON | OFF>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUSCh:ALPHasets:ALPHa <Alpha0 | Alpha1 | Alpha2>

PUSCH p0

Specify the PUSCH p0 value used to calculate the UE transmitted power, as described in section 7.1.1 in 3GPP TS 38.213.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUSCh:ALPHasets:P0:STATe <ON | OFF>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUSCh:ALPHasets:P0 <-2147483648 ... 2147483647>

p-Max

Select this checkbox to include the p-Max information element in SIB1. If this checkbox is cleared, the p-Max information element is absent from SIB1, and the UE applies the maximum power according to its capability.

SCPI: BSE:CONFig:NR5G:<cell>:RRC:PMAX <ON | OFF>

If this checkbox is selected, specify the maximum output power (-30 to 33 dB) that the UE is allowed to transmit on this cell.

SCPI: BSE:CONFig:NR5G:<cell>:RRC:PMAX:VALue <-30 ... 33>

p0 Nominal With Grant

Specify the P0 value (in dBm) for PUSCH with grant (except msg3) for this cell. The value must be between -202 and 24, and be an even value (step size 2). The value is applied in the PUSCH-ConfigCommon IE as defined in section 6.3.2 of 3GPP TS 38.331.

This parameter corresponds to the layer 1 parameter 'p0-nominal-pusch-withgrant' described in section 7.1 of 3GPP TS 38.213.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUSCh:ENABle:PNGRant:STATe <ON | OFF>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUSCh:ENABle:PNGRant <-202 ... 24>

deltaF PUCCH f0

Specify the PUCCH F0 value used to calculate the PUCCH transmission power, as described in section 7.2.1 in 3GPP TS 38.213. The value is applied in the PUCCH-ConfigCommon IE as defined in section 6.3.2 of 3GPP TS 38.331.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUCCh:DELTaf:F0:STATe <ON | OFF>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUCCh:DELTaf:F0 <-16 ... 15>

deltaF PUCCH f1

Specify the PUCCH F1 value used to calculate the PUCCH transmission power, as described in section 7.2.1 in 3GPP TS 38.213. The value is applied in the PUCCH-ConfigCommon IE as defined in section 6.3.2 of 3GPP TS 38.331.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUCCh:DELTaf:F1:STATe <ON | OFF>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUCCh:DELTaf:F1 <-16 ... 15>

deltaF PUCCH f2

Specify the PUCCH F2 value used to calculate the PUCCH transmission power, as described in section 7.2.1 in 3GPP TS 38.213. The value is applied in the PUCCH-ConfigCommon IE as defined in section 6.3.2 of 3GPP TS 38.331.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUCCh:DELTaf:F2:STATe <ON | OFF>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUCCh:DELTaf:F2 <-16 ... 15>

deltaF PUCCH f3

Specify the PUCCH F3 value used to calculate the PUCCH transmission power, as described in section 7.2.1 in 3GPP TS 38.213. The value is applied in the PUCCH-ConfigCommon IE as defined in section 6.3.2 of 3GPP TS 38.331.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUCCh:DELTaf:F3:STATe <ON | OFF>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUCCh:DELTaf:F3 <-16 ... 15>

deltaF PUCCH f4

Specify the PUCCH F4 value used to calculate the PUCCH transmission power, as described in section 7.2.1 in 3GPP TS 38.213. The value is applied in the PUCCH-ConfigCommon IE as defined in section 6.3.2 of 3GPP TS 38.331.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUCCh:DELTaf:F4:STATe <ON | OFF>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUCCh:DELTaf:F4 <-16 ... 15>

PUCCH p0 Nominal

Specify the nominal P0 value (in dBm) for PUCCH for this cell. The value must be between -202 and 24, and be an even value (step size 2). The value is applied in the PUCCH-ConfigCommon IE as defined in section 6.3.2 of 3GPP TS 38.331.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUCCh:P0:NOMInal:STATe <ON | OFF>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUCCh:P0:NOMInal <-202 ... 24>

p0 Set Value

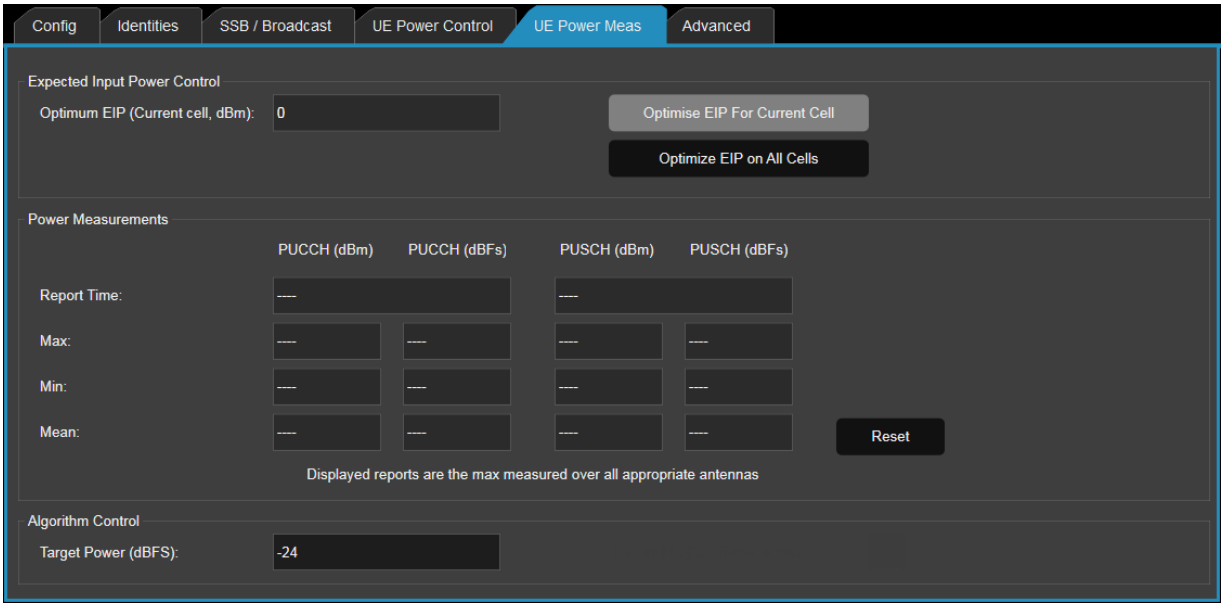
Specify the P0 set value (in dBm) for PUCCH for this cell. The value is applied in the PUCCH-ConfigCommon IE as defined in section 6.3.2 of 3GPP TS 38.331.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUCCh:P0SET:P0VALue:STATe <ON | OFF>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUCCh:P0SET:P0VALue <-16 ... 15>

7.3.6 UE Power Meas Tab

Also see: Optimizing EIP tutorial



7.3.6.1 Expected Input Power Control

Optimum EIP (Current cell, dBm)

Read-only field

The automatically calculated Expected Input Power Control (EIP) value, based upon the last valid measurement

SCPI: BSE:CONFig:NR5G:<cell>:ULPWr:EIP:AUPDate:VALue

Optimize EIP buttons

Applies the auto-calculated EIP value for this cell. For more information, see the *Optimizing EIP tutorial*.

SCPI: BSE:MEASure:NR5G:<cell>:ULPwr:EIP:OPTimise

Applies the auto-calculated EIP value for every cell.

SCPI: BSE:MEASure:NR5G:ULPwr:EIP:OPTimise:ALL

7.3.6.2 Power Measurements

Read-only fields

These fields display uplink PUCCH and PUSCH power measurements.

Report time

Displays the time the last measurement report was received for PUCCH and PUSCH.

SCPI: BSE:MEASure:NR5G:<cell>:ULPWr:PUCCh:TIME?

SCPI: BSE:MEASure:NR5G:<cell>:ULPWr:PUSCh:TIME?

Max

Displays the maximum dBms and dBFs received over the last measurement period for PUCCH and PUSCH.

SCPI: BSE:MEASure:NR5G:<cell>:ULPWr:PUCCh:MAX:Dbm?

SCPI: BSE:MEASure:NR5G:<cell>:ULPWr:PUCCh:MAX:DBFS?

SCPI: BSE:MEASure:NR5G:<cell>:ULPWr:PUSCh:MAX:Dbm?

SCPI: BSE:MEASure:NR5G:<cell>:ULPWr:PUSCh:MAX:DBFS?

Min

Displays the minimum dBms and dBFs received over the last measurement period for PUCCH and PUSCH.

SCPI: BSE:MEASure:NR5G:<cell>:ULPWr:PUCCh:MIN:Dbm?

SCPI: BSE:MEASure:NR5G:<cell>:ULPWr:PUCCh:MIN:DBFS?

SCPI: BSE:MEASure:NR5G:<cell>:ULPWr:PUSCh:MIN:Dbm?

SCPI: BSE:MEASure:NR5G:<cell>:ULPWr:PUSCh:MIN:DBFS?

Mean

Displays the mean dBms and dBFs received over the last measurement period for PUCCH and PUSCH.

SCPI: BSE:MEASure:NR5G:<cell>:ULPWr:PUCCh:MEAN:Dbm?

SCPI: BSE:MEASure:NR5G:<cell>:ULPWr:PUCCh:MEAN:DBFS?

SCPI: BSE:MEASure:NR5G:<cell>:ULPWr:PUSCh:MEAN:Dbm?

SCPI: BSE:MEASure:NR5G:<cell>:ULPWr:PUSCh:MEAN:DBFS?

Reset button

Reset

Resets all measured values to minimum values.

SCPI: BSE:MEASure:NR5G:<cell>:ULPWr:RESet

7.3.6.3 Algorithm Control

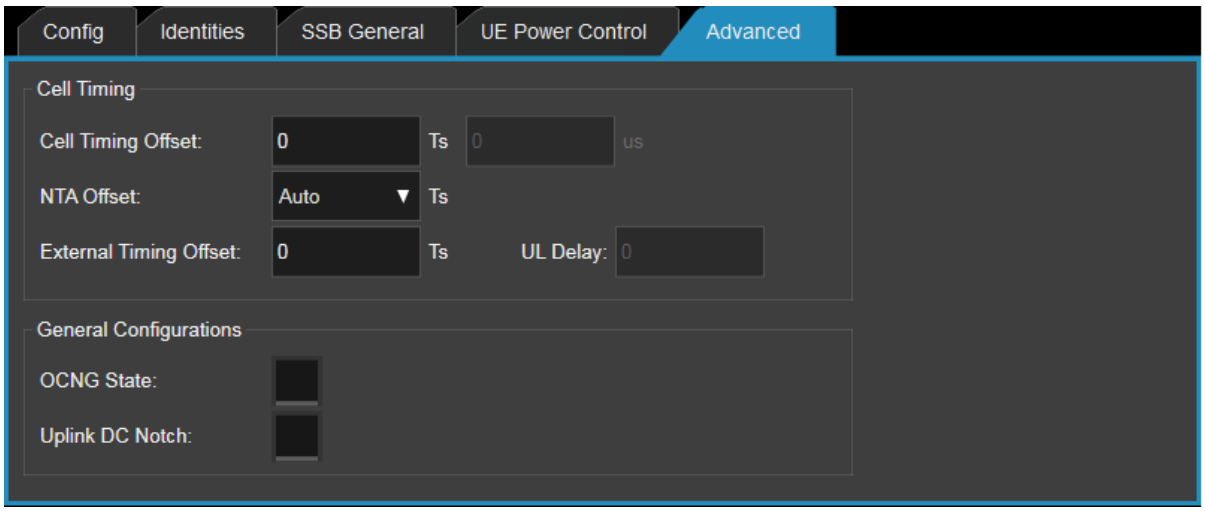
Target Power (dBFS)

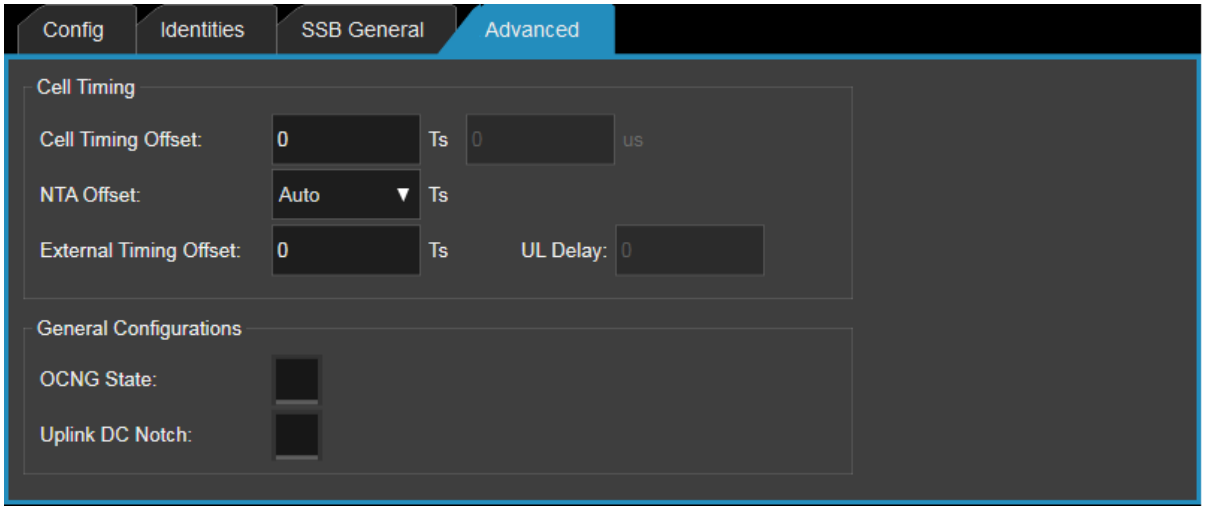
The automatic EIP calculations will adjust to this target power.

SCPI: BSE:MEASure:NR5G:<cell>:ULPWr:TARGet:POWer:DBFS <-100 ... 10>

7.3.7 Advanced Tab

The Advanced tab configures cell timing, and the OFDMA Channel Noise Generator (OCNG) which generates noise to simulate a fully-populated 5G NR channel.





7.3.7.1 Cell Timing

Cell Timing Offset

Specify the timing offset (-307200..307200 Ts).

SCPI: BSE:CONFig:NR5G:<cell>:TIMing:OFFSet <-307200 ... 307200>

NTA Offset

Select the NTA Offset (in Ts) from the following options:

- Auto – select to allow Test Application Framework to choose the appropriate offset.
- 0 – applies to FR1 (FDD) only.
- 25600 – applies to FR1 (TDD) only.
- 39936 – applies to FR1 (TDD) only.
- 13792 – applies to FR2 only.

For more information, see table 7.1.2-2 in 3GPP TS 38.133.

SCPI: BSE:CONFig:NR5G:<cell>:TIMing:DLUL:NTAOffset <AUTO | ZERO | N25600 | N39936 | N13792>

External Timing Offset

Specifies any external timing offset (-1024 to 1024 Ts) between the uplink and the downlink for this cell. This can be introduced by external equipment that shifts the relative times of downlink and uplink.

SCPI: BSE:CONFig:NR5G:<cell>:TIMing:DLUL:EXToffset <-1024 ... 1024>

UL Delay

Specifies the delay in the uplink receiver with respect to the downlink transceiver. Choose a value from -3072 to 3072 samples (-30.72MHz to +30.72MHz), where 3072 samples represents 100 microseconds.

SCPI: BSE:CONFig:NR5G:<cell>:TIMing:DLUL:DIFFerence <-3072 ... 3072>

7.3.7.2 General Configuration

OCNG State

Select this check box to enable OFDMA Channel Noise generation (OCNG). OCNG generates pseudo-random QPSK data, which simulates a fully-populated downlink channel (PDCCH and/or PDSCH) for the cell.

When operating in low power scenarios, enabling OCNG can also help the UE to synchronise with a cell.

Note: *Enabling OCNG for a cell may impact measurements and reports from the UE.*

SCPI: BSE:CONFig:NR5G:<cell>:PHY:OCNG:STATe <ON | 1 | OFF | 0>

Uplink DC Notch

If active, the DC carrier (index 0) is notched.

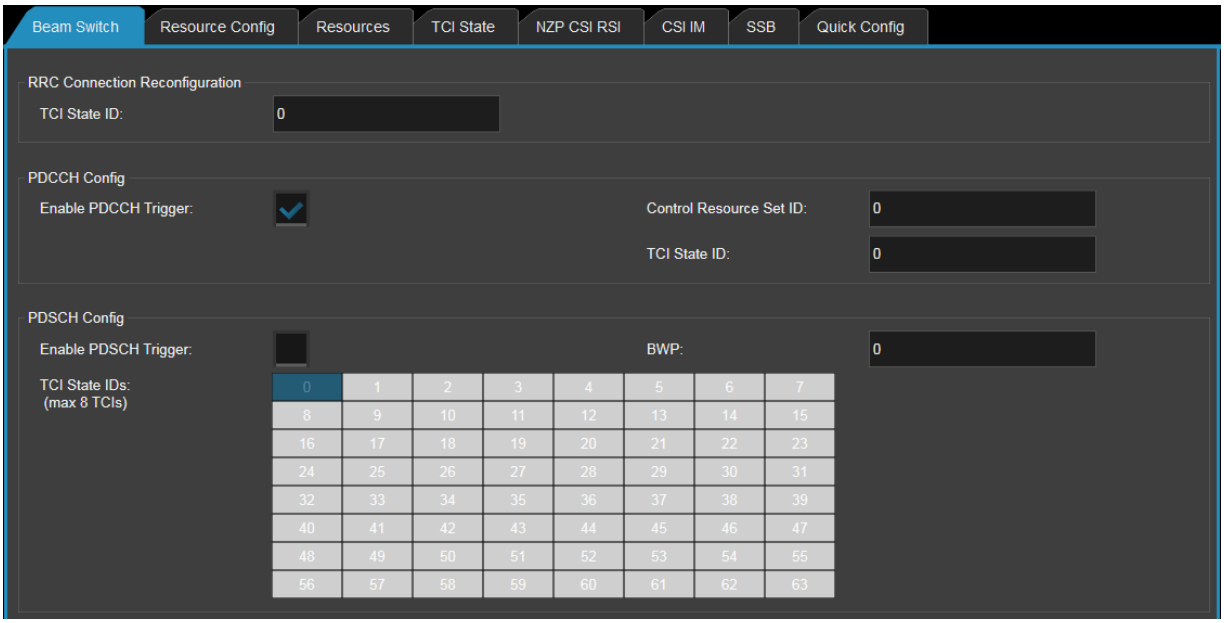
SCPI: BSE:CONFig:NR5G:<cell>:PHY:DC:NOTCh <ON | OFF>

7.4 Beam Management Tab

7.4.1 Beam Switch Tab

The Beam Switch tab provides configuration options for the following beam switch mechanisms:

- RRC Connection Reconfiguration – configuring a new TCI State ID.
- MAC-CE Initiated – configuring PDCCH Config options.
- PDSCH Config – updating the TCI ID on the Scheduling > Slot Config tab and configuring the PDCSCH Config options.



7.4.1.1 RRC Connection Reconfiguration

TCI State ID

Specify the TCI state ID (0 to 63) to use in an RRC Reconfiguration Beam Switch. The TCI State is defined on the TCI State Tab.

This parameter maps to the TCI-StateId parameter in the TCI-State information element in the RRC Connection Reconfiguation message.

SCPI: BSE:CONFig:NR5G:<cell>:BEAM:SWITch:RRCreconfig:TCI <0 ... 63>

7.4.1.2 PDCCH Config

Enable PDCCH Trigger

Select to include PDCCH beam switch when performing a MAC-CE initiated beam switch.

SCPI: BSE:CONFig:NR5G:<cell>:BEAM:SWITch:PDCChconfig:STATe <ON | 1 | OFF | 0>

Control Resource Set ID

The PDCCH coreset to include in a MAC-CE initiated beam switch.

SCPI: BSE:CONFig:NR5G:<cell>:BEAM:SWITch:PDCChconfig:CORese t <0 ... 11>

TCI State ID

The PDCCH TCI State ID to include in a MAC-CE initiated beam switch.

SCPI: BSE:CONFig:NR5G:<cell>:BEAM:SWITch:PDCChconfig:TCI <0 ... 63>

7.4.1.3 PDSCH Config

Enable PDSCH Trigger

States whether to include PDSCH beam switch when performing a PDCSH scheduling beam switch.

SCPI: BSE:CONFig:NR5G:<cell>:BEAM:SWITch:PDSChconfig:STATe <ON | 1 | OFF | 0>

BWP

Specify the PDSCH Bandwidth Part (0 to 3) to include in a PDSCH scheduling beam switch.

SCPI: BSE:CONFig:NR5G:<cell>:BEAM:SWITch:PDSChconfig:BWP <0 ... 3>

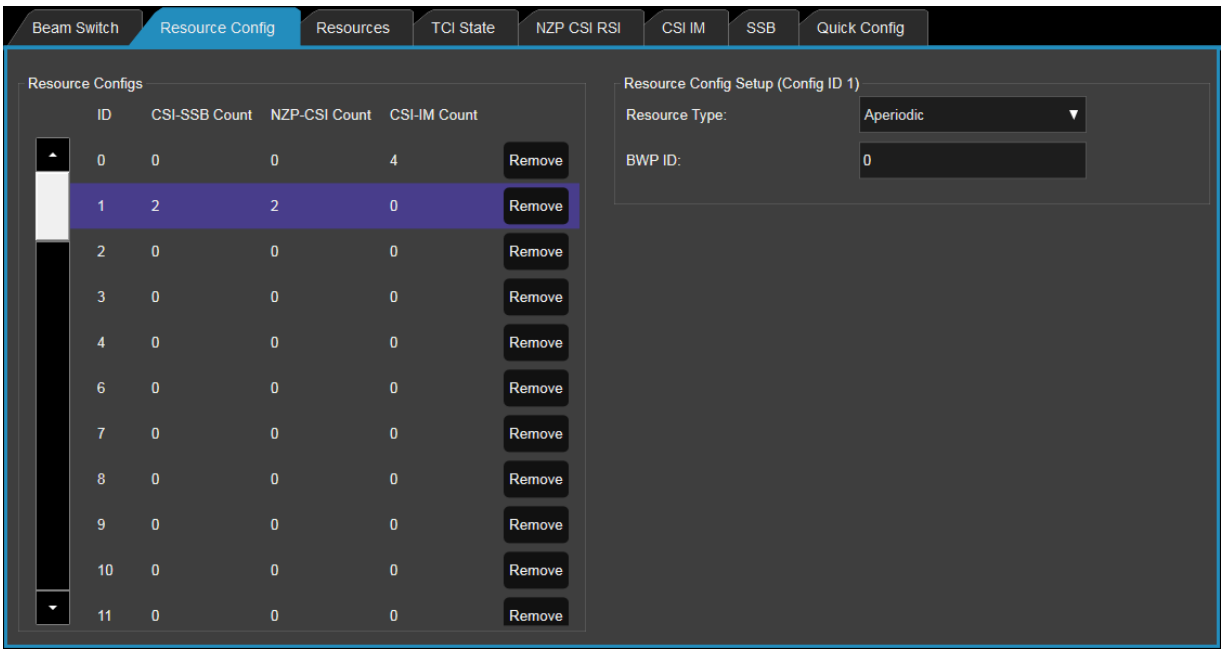
TCI State IDs

Select up to eight PDSCH TCI State IDs for use in a PDSCH scheduling beam switch.

SCPI: BSE:CONFig:NR5G:<cell>:BEAM:SWITch:PDSChconfig:TCI <"8000000000000000" ... "FFFFFFFFFFFFFFFF">

7.4.2 Resource Config Tab

The Resource Config tab defines resource configurations and enables a configuration on the Resources Tab.



7.4.2.1 Resource Configs

This table lists resource configurations.

ID

Displays the resource configuration index number. Click **Add** to add a new resource configuration (up to 64 resource configurations). By default, a new row is assigned the lowest available integer from 0 to 63, but you can edit the ID before clicking **Add**. To delete a row, click **Remove** on the row to be removed.

SCPI: BSE:CONFig:NR5G:<cell>:RESource:SELect <0 ... 63> – selects a resource configuration index.

Select (highlight) a resource configuration row to enable it on the Resources Tab.

SCPI: BSE:CONfig:NR5G:<cell>:RESource:<raDef>:STATe <ON | OFF> – enables or disables the definition of the selected resource configuration.

CSI-SSB Count

Displays the number of SSB resource lists included (selected) on the Resources Tab.

NZP-CSI Count

Displays the number of NZP resource lists included (selected) on the Resources Tab.

CSI-IM Count

Displays the number of CSI-IM resource lists included (selected) on the Resources Tab.

7.4.2.2 Resource Config Setup (Config ID <n>)

These parameters configure the resource configuration setup for the selected row in the Resource Configs table (above).

Resource Type

Select the time domain behaviour of the resource configuration:

- Semi-persistent – transmit the set of CSI-RS within a resource set only after CSI-RS transmission has been activated via a MAC control element (MAC CE) and continue until explicitly deactivated. Once activated, the set of CSI-RS within a resource set periodically according to the periodicity and offset defined on the NZP CSI RSI Tab and/or CSI IM Tab.
- Aperiodic – transmit the set of CSI-RS within a resource set only if triggered by signaling in the DCI as a result of a PDSCH trigger.
- Periodic – transmit the set of CSI-RS within a resource set periodically according to the periodicity and offset defined on the NZP CSI RSI Tab and/or CSI IM Tab.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:<raDef>:TYPE <SEMI | APERiodic | PERiodic>

BWP ID

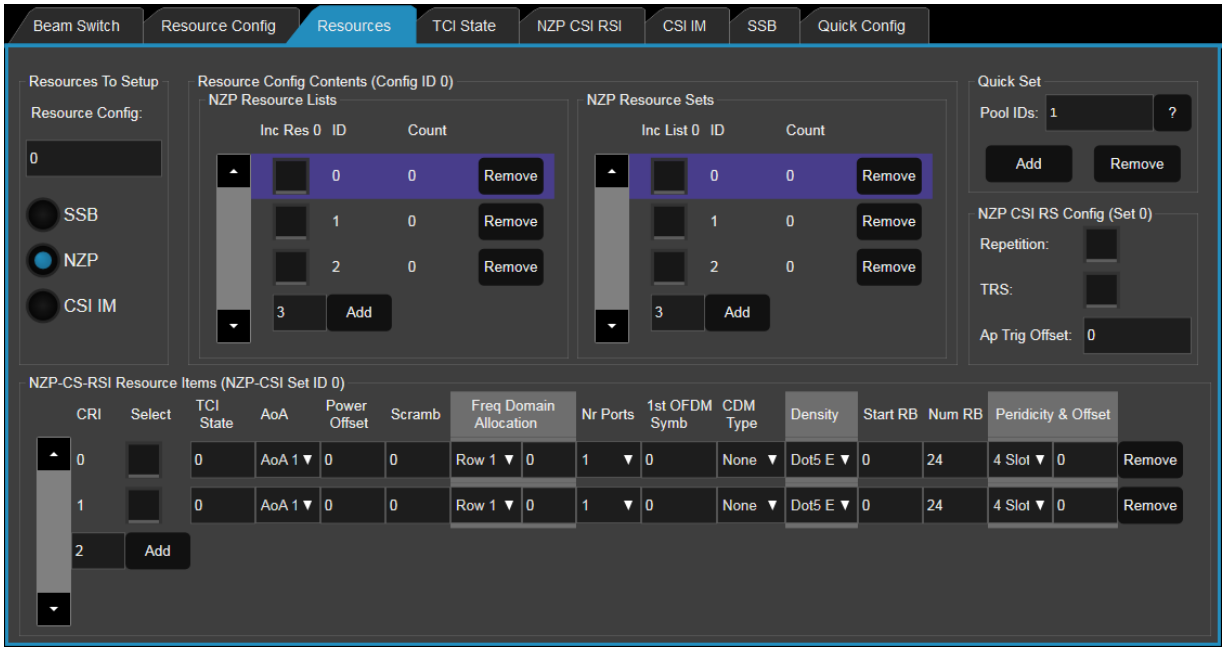
Specify the bandwidth part ID (0 to 3) to use for the selected resource configuration.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:<raDef>:BWP <0 ... 3>

7.4.3 Resources Tab

The Resources tab configures resources defined on the Resource Config tab. The Resource Config ID in the first field is the one highlighted on the Resource Config tab.

Note: Under the Resource Config ID field are radio buttons for SSB, NZP and CSI-IM, and the one selected affects the screen display. The screen shows fields specific to SSB, NZP or CSI-IM, so it may not appear as shown below. The screen below shows the display when NZP is selected.



7.4.3.1 Resources To Setup

Resource Config

Displays the resource configuration ID selected on the Resource Config Tab. You can override the selected by entering a resource configuration ID in the range 0 to 63. The remaining fields assign resource lists and resource sets to this resource configuration.

SSB / NZP / CSI IM

Choose one of SSB, NZP or CSI IM to assign SSB, NZP or CSI-IM resource lists and resource sets respectively to the selected resource configuration. The screen display updates with fields specific to the selected item.

Note: There is no SCPI command for this option; instead there are SSB, NZP or CSIM parameters in the SCPI commands for the remaining items on this screen.

7.4.3.2 Resource Config Contents (Config ID <n>)

The two tables under this heading show resource lists and resource sets belonging to the selected resource configuration, where <n> is the resource configuration ID.

7.4.3.2.1 SSB/NZP/CSI-IM Resource Lists

This table selects the resource lists to be included in this resource configuration, where "SSB", "NZP" or "CSI-IM" in the heading indicates the type of resource list.

Inc Res <n>

Select this check box for each resource list that you wish to include in this resource configuration, where <n> is the resource configuration ID.

Note: A resource configuration can contain a mix of SSB and NZP resource lists, but you cannot mix CSI-IM resource lists with SSB or NZP in the same resource configuration.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:<raDef>:<SSB | NZP | CSIM> <"00000000000000000" ... "FFFFFFFFFFFFFFFF"> – a bitmap specifying the included resource lists in this resource configuration.

ID

The resource list index number. Click **Add** to add a new resource list (up to 64). By default, a new row is assigned the lowest available integer from 0 to 63, but you can edit the ID before clicking **Add**. To delete a row, click **Remove** on the row to be removed.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:LIST:<SSB | NZP | CSIM>:SELect <0 ... 63> – selects a resource list index.

Select (highlight) a resource list to assign resource sets to it. The list is then enabled under Resource Sets.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:LIST:<SSB | NZP | CSIM>:<raList>:STATe <ON | 1 | OFF | 0> – enables or disables the definition of this resource list.

Count

Read-only field

Shows the number of resource sets assigned to this resource list in the Resource Sets table.

7.4.3.2.2 SSB/NZP/CSI-IM Resource Sets

This table selects the resource sets to be included in the resource list highlighted in the Resource Lists table, where "SSB", "NZP" or "CSI-IM" in the heading indicates the type of resource set.

Inc List <n>

Select this check box for each resource set that you wish to include in this resource list, where <n> is the resource list ID.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:LIST:<SSB | NZP | CSIM>:<raList>:SETs <"00000000000000000" ... "FFFFFFFFFFFFFFFF"> – a bitmap specifying the included resource sets in this resource list.

ID

The resource set index number. Click **Add** to add a new resource set (up to 64). By default, a new row is assigned the lowest available integer from 0 to 63, but you can edit the ID before clicking **Add**. To delete a row, click **Remove** on the row to be removed.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:SET:<SSB | NZP | CSIM>:SELect <0 ... 63> – selects a resource set index.

Select (highlight) a resource set to assign resource items to it. The set number is then enabled in the heading for Resource Items.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:SET:<SSB | NZP | CSIM>:<raSet>:STATe <ON | 1 | OFF | 0> – enables or disables the definition of this resource set.

Count

Read-only field

Shows the number of SSB, NZP or CSI-IM resource items assigned to this resource set in the Resource Items table.

7.4.3.3 Quick Set

Optional section

You can use the **Add** and **Remove** buttons in this section to quickly select items in the SSB, NZP or CSI-IM resource configuration tables below. Quick Set also adds items to the NZP and CSI-IM tables if rows for the items do not exist (this is not necessary for the SSB table, which has a fixed size of 64 rows).

Note: *Performing a Quick Set on this tab also updates the corresponding table on the SSB tab, NZP CSI RSI tab or CSI IM tab.*

Pool IDs

This field is identical to Pool IDs on the Quick Config tab.

Supply a range (a 'pool') of resource item IDs. These items will then be selected automatically in the table below. Permitted entries are:

- Comma-separated lists of individual resource item IDs, for example, 1,5,7,10
- Ranges of resource item IDs separated by a hyphen, for example, 5-10
- A repeated interval determined by the previous two resource item IDs followed by a comma, a space and three dots, for example:
  - 0,2, ... chooses all even-numbered items, and 2,4, ... chooses even-numbered items starting from 2.
  - 1,3, ... chooses all odd-numbered items, and 5,7, ... chooses odd-numbered items starting from 5.
  - 0,3, ... chooses a repeated interval of four items, 0-3, then 8-11, and so on.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:QUICkset:IDS "string" – where "string" is as described above but enclosed in quotes.

Click **Add** to select the item IDs in the Resource Items table, or click **Remove** to clear the selections in the table.

7.4.3.4 NZP CSI RS Config (Set <n>)

This section only appears when the SSB_NZP_CSI-IM option is **NZP**.

Repetition

The repetition associated with the NZP resource set.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:LIST:NZP:<raSet>:REPetition <ON | 1 | OFF | 0>

TRS

The Tracking Reference Signal associated with the NZP resource set.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:LIST:NZP:<raSet>:TRS <ON | 1 | OFF | 0>

Ap Trig Offset

The aperiodic trigger offset associated with the NZP resource set.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:LIST:NZP:<raSet>:AP:TRIG:OFFSet <0 ... 4>

7.4.3.5 Resource Items (Set ID <n>)

This section contains a resource items table for SSB, NZP-CS-RSI or CSI-IM, depending on the option selected under SSB_NZP_CSI-IM. The table shows the resource items defined for the selected resource set, where <n> is the resource set ID.

Selected

Each table has a **Selected** check box at the start of each row. Select this check box for each resource item that you wish to include in this resource set.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:SET:SSB:<raSet>:CONFigs <"000000" ... "FFFFFF"> – a bitmap specifying the SSB resource items include in this resource set.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:SET:NZP:<raSet>
<"00000000000000000000000000000000000000000000000000000000" ...
"FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF">– a bitmap specifying the NZP resource items include in this resource set.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:SET:CSIM:<raSet>:CONFigs <"0000000000" ... "FFFFFFFFFF"> – a bitmap specifying the CSI-IM resource items include in this resource set.

Remaining fields

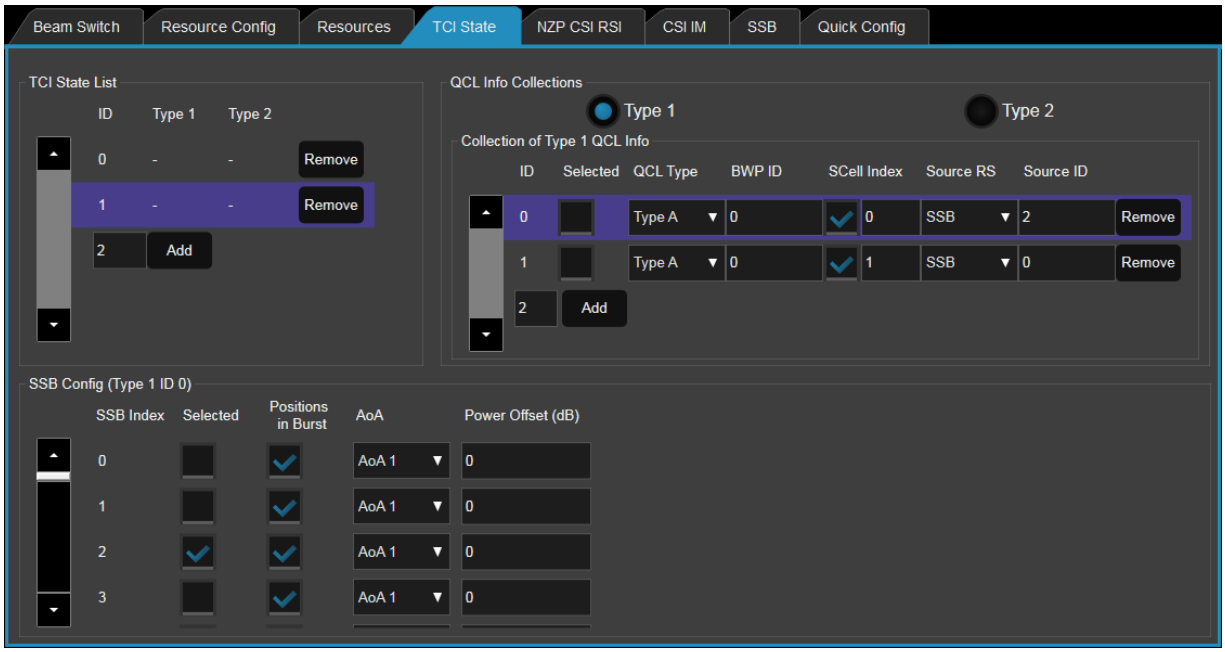
The remaining fields are identical to fields in the corresponding tables on the following tabs:

- SSB tab – for SSB resource items.
- NZP CSI RSI tab – for NZP resource items.
- CSI IM tab – for CSI-IM resource items.

7.4.4 TCI State Tab

Specification reference: 3GPP TS 38.214 section 5.1.5.

The TCI State tab defines the mapping between TCI state configurations and quasi co-location types (QCL).



7.4.4.1 TCI State List

ID

The TCI state list index number. Click **Add** to add a new TCI state list (up to 64). By default, a new row is assigned the lowest available integer from 0 to 63, but you can edit the ID before clicking **Add**. To delete a row, click **Remove**.

SCPI: BSE:CONFig:NR5G:<cell>:TCIState:CONFig:SELect <0 ... 63> – selects a TCI state list index.

Select (highlight) a TCI state to assign a Type 1 and/or Type 2 QCL information collection.

SCPI: BSE:CONFig:NR5G:<cell>:TCIState:CONFig:<raList>:STATe <ON | 1 | OFF | 0> – enables or disables the definition of this TCI state list item.

Type 1

Displays the ID of any Type 1 QCL Info Collection assigned to this TCI state list item.

Type 2

Displays the ID of any Type 2 QCL Info Collection assigned to this TCI state list item.

7.4.4.2 QCL Info Collections

Type 1 / Type 2

Select the type of QCL Info Collection table that you wish to define:

- Type 1 – for the first downlink reference signal.
- Type 2 – for the second downlink reference signal (if configured).

For more information, see 3GPP TS 38.214 section 5.1.5.

7.4.4.2.1 Collection of Type <n> QCL Info

This table defines QCL information items of type <n>, where <n> is 1 or 2 as selected in the previous field. You can select one Type 1 row and (provided a Type 1 row is assigned) one Type 2 row to the selected TCI state list item.

ID

The QCL information index number. Click **Add** to add a new QCL information item (up to 64). By default, a new row is assigned the lowest available integer from 0 to 63, but you can edit the ID before clicking **Add**. To delete a row, click **Remove** on the row to be removed.

SCPI: BSE:CONFig:NR5G:<cell>:TCIState:CONFig:<tciStateType>:SELect <0 ... 63> – selects a QCL information index.

Select (highlight) a QCL information row to display its associated SSB or NZP resource table in the lower half of the screen. The type of table depends on the row's Source RS option (**SSB** or **NZP**). Within the SSB or NZP table, the row that applies to the QCL information row is the one identified by the row's Source ID field.

SCPI: BSE:CONFig:NR5G:<cell>:TCIState:CONFig:<tciStateType>:<qclInfoId>:STATe <ON | 1 | OFF | 0> – enables or disables the definition of this QCL information item.

Selected

You can select this check box for one Type 1 row to assign it to the selected TCI state list item. Provided a Type 1 row is assigned, you can also select the check box for a Type 2 row to assign it to the selected TCI state list item.

SCPI: BSE:CONFig:NR5G:<cell>:TCIState:CONFig:<raList>:<tciStateType>:QCLinfo <0 ... 63>

QCL Type

The quasi co-location type, one of

- A – Doppler shift, Doppler spread, average delay, delay spread.
- B – Doppler shift, Doppler spread.
- C – Doppler shift, average delay.
- D – Spatial Rx parameter.

SCPI: BSE:CONFig:NR5G:<cell>:TCIState:CONFig:<tciStateType>:<qclInfoId>:QCLType <A | B | C | D>

BWP ID

The quasi co-location bandwidth part ID. To configure bandwidth parts, see the Bandwidth Parts tutorial.

SCPI: BSE:CONFig:NR5G:<cell>:TCIState:CONFig:<tciStateType>:<qclInfoId>:BWPid <0 ... 3>

SCell Index

Select the check box to enable the secondary cell index for this QCL information item, then supply an index number in the range 0 to 100.

SCPI: BSE:CONFig:NR5G:<cell>:TCIState:CONFig:<tciStateType>:<qclInfoId>:SCELl:STATe <ON | 1 | OFF | 0>

SCPI: BSE:CONFig:NR5G:<cell>:TCIState:CONFig:<tciStateType>:<qclInfoId>:SCELl <0 ... 100>

Source RS

The source reference signal for this QCL information item. Choose between:

- SSB – Updates the Config table (below)to apply to SSB configuration options.
- NZP – Updates the Config table (below) to apply to NZP configuration options.

SCPI: BSE:CONFig:NR5G:<cell>:TCIState:CONFig:<tciStateType>:<qclInfoId>:SOURce:RS <SSB | NZPCri>

Source ID

Specifies the row number in the Config table (below) that belongs to this QCL information item. The specified row number is automatically selected in the Config table. Alternatively, you use the Config table to update this field by manually selecting a row in the Config table.

- If the Source RS is SSB, the range is 0 - 63.
- If the Source RS is NZP, the range is 0 - 191.

SCPI: BSE:CONFig:NR5G:<cell>:TCIState:CONFig:<tciStateType>:<qclInfoId>:SOURce:ID <0 ... 63> – range if the Source RS is SSB.

SCPI: BSE:CONFig:NR5G:<cell>:TCIState:CONFig:<tciStateType>:<qclInfoId>:SOURce:ID <0 ... 191> – range if the Source RS is NZP.

7.4.4.3 SSB/NZP-CSI-RSI-Resource Config (Type 1 | 2 ID <n>)

This table is the SSB Config table if the Source RS option is SSB, or the NZP-CSI-RSI_Resource Config table if the Source RS option is NZP.

In the table heading, the Type (1 or 2) refers to the QCL info collection type, and <n> is the selected QCL information item.

Selected

The Selected check box in each table is ticked for the row identified in the QCL table's Source ID field (above). If you select a different check box, this will update the Source ID in the QCL table to display the new row number.

Remaining fields

The remaining fields in each table are described on the following tabs:

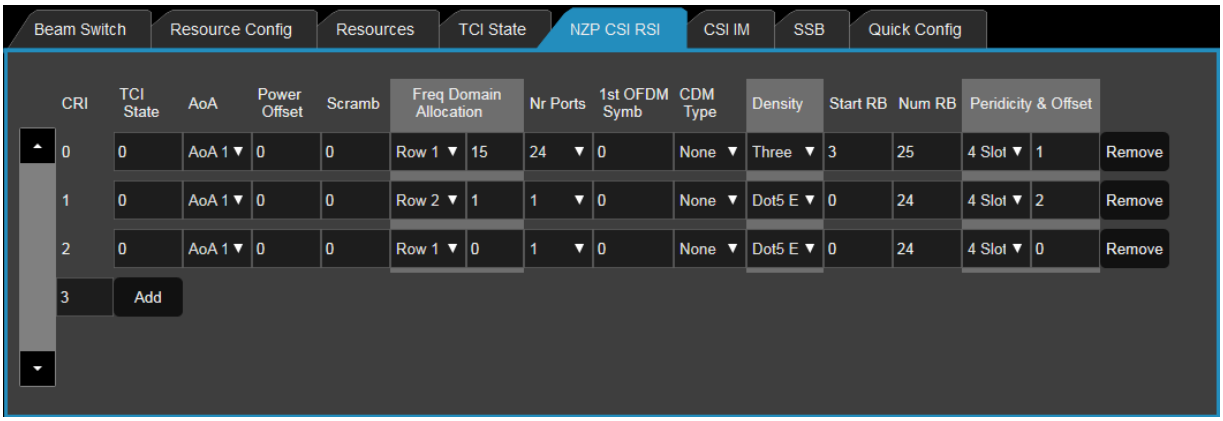
- SSB tab – for the SSB Config table.
- NZP CSI RSI tab – for the NZP-CSI-RSI_Resource Config table.

Note: *Any changes that you make to the tables will also appear on their corresponding SSB or NZP CSI RSI tabs.*

7.4.5 NZP CSI RSI Tab

Specification reference: 3GPP TS 38.214 section 5.2.2.3.1.

The NZP CSI RSI tab configures the non-zero power CSI RSI parameters.



CRI

Displays the CSI-RS resource configuration identity (0 to 191), as defined by the NZP-CSI-RS-ResourceId information element in section 6.3.2 of 3GPP TS 38.331.

Click Add to define a new NZP CSI RSI resource (up to 192 resource configurations). By default, a new row is assigned the lowest available integer from 0 to 191, but you can edit the ID before clicking Add. To delete a row, click Remove on the row to be removed.

SCPI: BSE:CONfig:NR5G:<cell>:CSI:RESource:CONFig:NZP:<cri>:STATe <ON | 1 | OFF | 0> – enables or disables the definition of this NZP resource item.

TCI State

Specify the TCI State ID (0 to 127) to associate with this NZP CSI RSI.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:CONFig:NZP:<cri>:TCIStateid <0 ... 127>

AoA

Select the angle of arrival beam to use.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:CONFig:NZP:<cri>:AOA <AOA1 | AOA2 | AOA3 | AOA4>

Power Offset

Specify the offset which is the assumed ratio of PDSCH EPRE to NZP CSI-RS EPRE when UE derives CSI feedback and takes values in the range of [-8, 15] dB with 1 dB step size.

Specify the Power Offset SSB parameter, which represents the offset (dBs) in signal power of the SSB transmitted in each beam.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:CONFig:NZP:<cri>:POWeroffset <-8 ... 15>

Scramb

Specify the scrambling ID (0 to 1023) of the CSI-RS.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:CONFig:NZP:<cri>:SCRambling <0 ... 1023>

Frequency Domain Allocation

There are two fields for frequency domain allocation:

1. A row number indicating the CSI-RS location within a slot, as defined in Table 7.4.1.5.3-1 of 3GPP TS 38.211
2. The frequency-domain location expressed as a bitmap, as described in section 7.4.1.5.3 of 3GPP TS 38.211.

The supported row numbers and bitmap values are:

- Row 1 – bitmap contains 4 bits, so the bitmap range is 0-15.
- Row 2 – bitmap contains 12 bits, so the bitmap range is 0-4095.
- Row 4 – bitmap contains 3 bits, so the bitmap range is 0-7.

- Other – bitmap contains 6 bits, so the bitmap range is 0-63. This option selects a row in Table 7.4.1.5.3-1 from the entries in the NR Ports, Density and CDM Type fields.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:CONFig:NZP:<cri>:FDA:TYPE <ROW1 | ROW2 | ROW4 | OTHer>

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:CONFig:NZP:<cri>:FDA <0 ... 0xFFF>

NR Ports

The number of ports transmitting CSI-RS (1, 2, 4, 8, 12, 16, 24 or 32). For more information, see section 7.4.1.5 in 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:CONFig:NZP:<cri>:RM:NPORts <P1 | P2 | P4 | P8 | P12 | P16 | P24 | P32>

1st OFDM Symb

Specify the first OFDM symbol (0 to 13) in the physical resource block used for CSI-RS. This is the time domain allocation within a physical resource block. For more information, see section 7.4.1.5.3 in 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:CONFig:NZP:<cri>:RM:FIRSt:OFDN:SYMBol <0 ... 13>

CDM Type

Select the CDM pattern, one of None (no CDM), CDM2, CDM 4 (FD2, TD2), or CDM 8 (FD2, TD4). For more information, see section 7.4.1.5 in 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:CONFig:NZP:<cri>:RM:CDM <NOCD | CDM2 | CDM4 | CDM8>

Density

Specify the frequency density of each CSI-RS port per physical resource block (PRB) as follows:

- Dot5 Even PRBs – Density 0.5, and even-numbered PRB allocation with respect to the common resource block grid. Allowed for NR Port values 1, 2, 16, 24 and 32.
- Dot5 Odd PRBs – Density 0.5, and odd-numbered PRB allocation with respect to the common resource block grid. Allowed for NR Port values 1, 2, 16, 24 and 32 ports.
- One – Density 1. Allowed for NR Port values 1, 2, 4, 8, 12, 16, 24 and 32.
- Three – Density 3. Allowed for NR Port value 1.
- Spare

For more information, see section 5.2.2.3.1 in 3GPP TS 38.214, and section 7.4.1.5.3 in 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:CONFig:NZP:<cri>:RM:DENSity <DT5E | DT5O | ONE | THREe | SPARe>

Start RB

Specify the resource block (0 to 274) where this CSI-RS resource starts in relation to common resource block 0 within a bandwidth part (BWP). For more information, see section 5.2.2.3.1 in 3GPP TS 38.214, and section 7.4.1.5.3 in 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:CONFig:NZP:<cri>:RM:RB:STARt <0 ... 274>

Num RB

Specify the number of resource blocks (24 to 274) across which this CSI-RS resource spans. The minimum size is 24, or the BWP size if the BWP is larger than 24. For more information, see section 5.2.2.3.1 in 3GPP TS 38.214, and section 7.4.1.5.3 in 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:CONFig:NZP:<cri>:RM:RB:COUNt <24 ... 276>

Periodicity & Offset

These two fields define the CSI-RS periodicity and slot offset for periodic and semi-persistent CSI-RS.

1. Periodicity – select when periodic or semi-persistent CSI-RS are sent (every <n> slots).

2. Offset – select the slot offset (0 to 639) where periodic or semi-persistent CSI-RS start.

Note: All the CSI-RS resources within one set are configured with the same periodicity, while the slot offset can be same or different for different CSI-RS resources.

For more information, see section 5.2.2.3.1 in 3GPP TS 38.214.

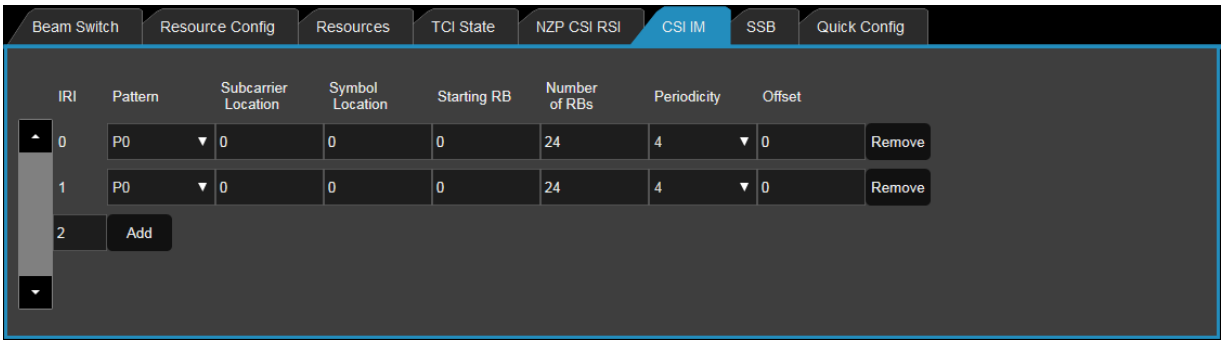
SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:CONFig:NZP:<cri>:PERiodicity <SLOTS4 | SLOTS5 | SLOTS8 | SLOTS10 | SLOTS16 | SLOTS20 | SLOTS32 | SLOTS40 | SLOTS64 | SLOTS80 | SLOTS160 | SLOTS320 | SLOTS640>

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:CONFig:NZP:<cri>:POFFset <0 ... 639>

7.4.6 CSI IM Tab

Specification reference: 3GPP TS 38.214 section 5.2.2.4.

The CSI IM tab configures CSI Interference Management resources.



IRI

Displays the CSI-IM resource configuration identity (0 to 31).

Click Add to define a new CSI-IM resource (up to 32 resource configurations). To delete a row, click Remove on the row to be removed.

Pattern

Select the pattern (P0 or P1) that determines the OFDM symbol location of the CSI-IM resource within a slot.

For information about the definition of each pattern, see section 5.2.2.4 in 3GPP TS 38.214.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:CONFig:CSIM:<iri>:PATTern <P0 |P1>

Subcarrier Location

Specify the subcarrier occupancy (0 to 10) of the CSI-IM resource within a slot for the selected pattern.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:CONFig:CSIM:<iri>:SUBCarrier:LOCation <0 ... 10>

Symbol Location

Specify the location (0 to 13) of the OFDM symbol of the CSI-IM resource within a slot for the selected pattern.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:CONFig:CSIM:<iri>:SYMBol:LOCation <0 ... 13>

Starting RB

Specify the resource block (0 to 274) where the CSI-IM starts.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:CONFig:CSIM:<iri>:RB:STARt <0 ... 274>

Number of RBs

Specify the number of physical resource blocks (24 to 276) across which this CSI-IM resource spans. The minimum size is 24.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:CONFig:CSIM:<iri>:RB:COUNt <24 ... 276>

Periodicity

Select when periodic or semi-persistent CSI-IM are sent (every <n> slots).

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:CONFig:CSIM:<iri>:PERiodicity <N4 | N5 | N8 | N10 | N16 | N20 | N32 | N40 | N64 | N80 | N160 | N320 | N640>

Offset

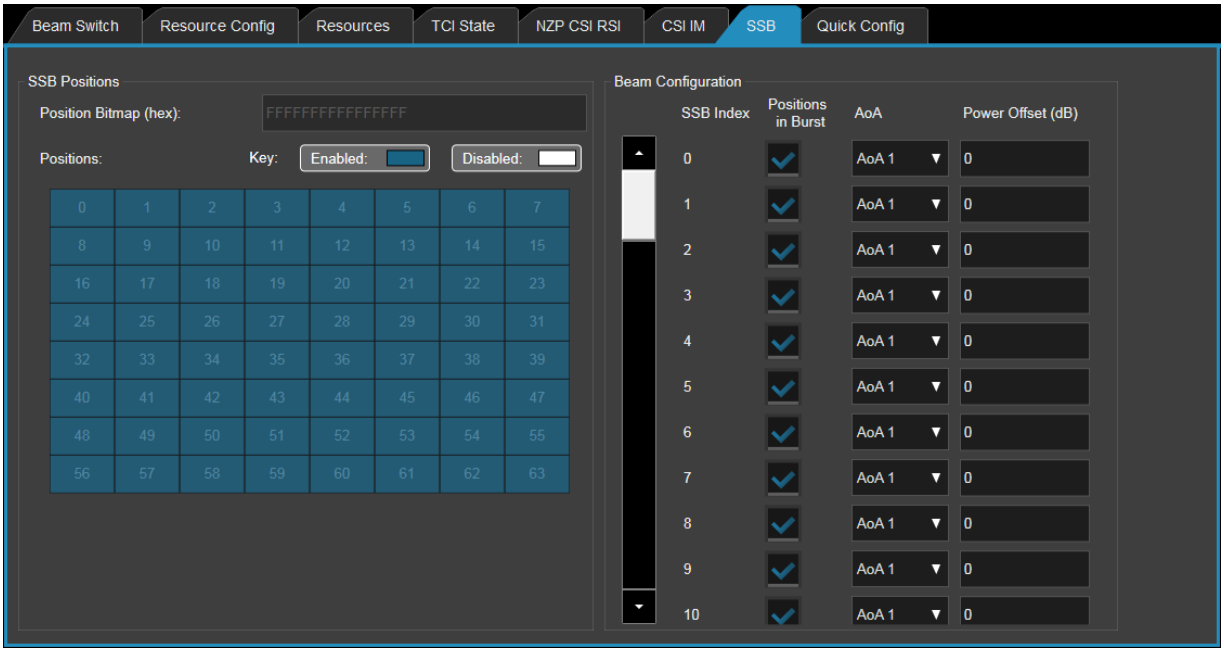
Specify the slot offset where periodic or semi-persistent CSI-IM start.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:CONFig:CSIM:<iri>:OFFSet <ON | OFF>

7.4.7 SSB Tab

Also see: SSB Scheduling tutorial.

The SSB (Synchronization Signal Block) tab configures the assignment of angle of arrival beams and power offsets to beam indices (SSB index).



7.4.7.1 SSB Positions

Also see: SSB Positions in SSB Scheduling tutorial.

Position Bitmap

Read-only field

Displays the hexadecimal value for the 64 bit string representing SSBs enabled and disabled under Positions.

SCPI: BSE:CONFig:NR5G:<cell>:SSB:BURSt:POSitions <0 ... 0xFFFFFFFFFFFFFFFF>

Positions

You can select or clear each of these 64 square toggles to enable and disable SSB positions. Each enabled SSB translates to 1. The resulting value is shown in the following fields:

- As a hexadecimal value in the SSB Position Bitmap.
- As selected/deselected check boxes in the Beam Configuration table under Positions In Burst.
- As selected/deselected check boxes in the SSB Resouce Items table (on the Resources tab) under Selected.

7.4.7.2 Beam Configuration

SSB Index

Read-only field

Displays the SSB index of the SSB position bitmap, which represents the beam reference number (0 to 63).

Positions in Burst

Modifying this field for an SSB automatically updates the Position Bitmap.

Select the SSBs to form a hexadecimal representation of the SSB Position Bitmap configured using the interactive 64 square toggles below. It is an alternate way of supplying the Position Bitmap (above).

SCPI: BSE:CONFig:NR5G:<cell>:SSB:BURSt:POSitions <0 ... 0xFFFFFFFFFFFFFFFF>

AoA

Select the angle of arrival beam to use.

SCPI: BSE:CONFig:NR5G:<cell>:SSB:<ssbIndex>:AOA <AOA1 | AOA2 | AOA3 | AOA4>

Power Offset

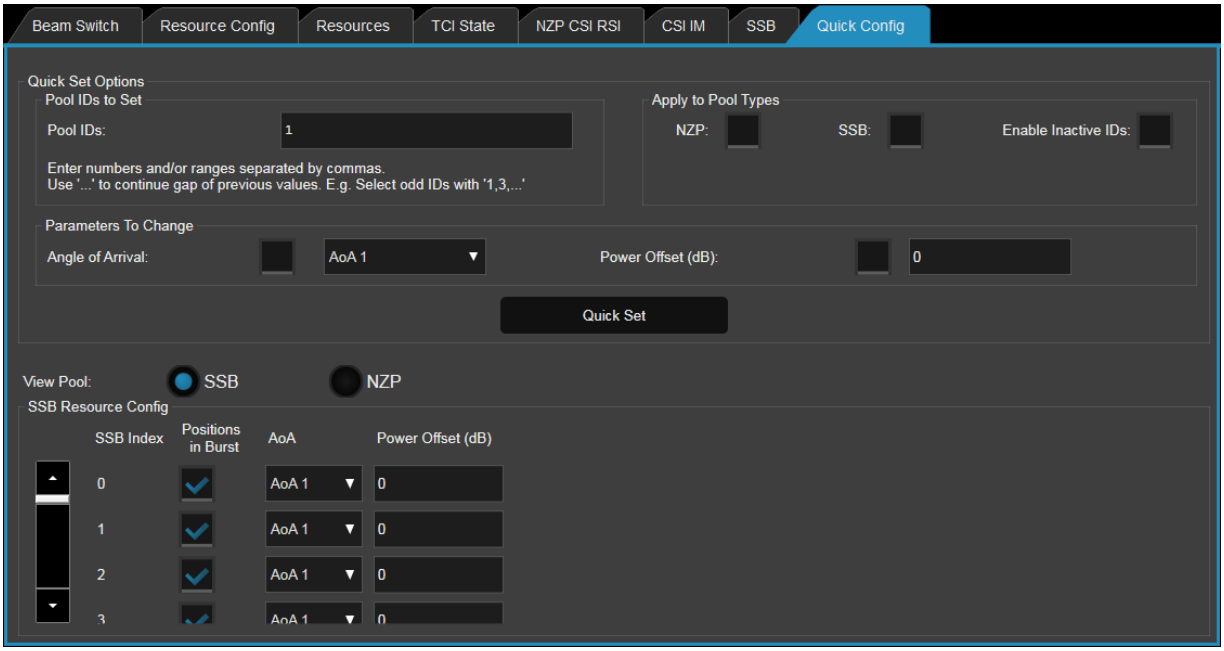
Specify the Power Offset SSB parameter, which represents the offset (dBs) in signal power of the SSB transmitted in each beam.

SCPI: BSE:CONFig:NR5G:<cell>:SSB:<ssbIndex>:POWeroffset <-200 ... 0>

7.4.8 Quick Config Tab

You can use the **Quick Set** button on this Quick Config tab to quickly change parameters for a pool of items in the SSB or NZP resource configuration table. Quick Set also adds items to the NZP table if rows for them do not exist (this is not necessary for the SSB table, which has a fixed size of 64 rows).

***Note:** Performing a Quick Set on this tab also updates the corresponding table on the SSB tab or NZP CSI RSI tab.*



7.4.8.1 Pool IDs to Set

This section chooses the resource SSB and/or NZP resource items whose configuration options are to be updated.

Pool IDs

This field is identical to Pool IDs on the Resources Tab.

Supply a range (a 'pool') of resource item IDs. These items will then be selected automatically in the table below. Permitted entries are:

- Comma-separated lists of individual resource item IDs, for example, 1,5,7,10
- Ranges of resource item IDs separated by a hyphen, for example, 5-10
- A repeated interval determined by the previous two resource item IDs followed by a comma, a space and three dots, for example:
  - 0,2, ... chooses all even-numbered items, and 2,4, ... chooses even-numbered items starting from 2.
  - 1,3, ... chooses all odd-numbered items, and 5,7, ... chooses odd-numbered items starting from 5.
  - 0,3, ... chooses a repeated interval of four items, 0-3, then 8-11, and so on.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:QUICkset:IDS "string" – where "string" is as described above but enclosed in quotes.

7.4.8.2 Apply to Pool Types

Select check boxes for the type of resource item types to which the pool IDs apply.

NZP

Select this check box to include NZP resource items when performing the Quick Set.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:QUICkset:INCLude:NZP <ON | OFF>

SSB

Select this check box to include SSB resource items when performing the Quick Set.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:QUICkset:INCLude:SSB <ON | OFF>

Enable Inactive IDs

Only applies to the NZP Resource Config table.

Select this check box to add rows for items that are currently not included in the table.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:QUICkset:INCLude:INACtive <ON | OFF>

7.4.8.3 Parameters To Change

7.4.8.3.1 Angle of Arrival

AoA check box

Select this check box to update the AoA field in items updated by the Quick Set.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:QUICkset:AOA:STATe <ON | OFF>

AoA 1/2/3/4

If the check box is selected, choose the angle of arrival beam to assign to all items updated by the Quick Set.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:QUICkset:AOA:VALue <AOA1 | AOA2 | AOA3 | AOA4>

Power Offset (dB)

Select the check box to update the Power Offset field in items updated by the Quick Set. Then, in the value field, specify the power offset value to apply to all items updated by the Quick Set. The permitted range is:

- -200 to 0 – for SSB items.
- -8 to 15 – for NZP items.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:QUICkset:POWeroffset:STATe <ON | OFF>

SCPI: BSE:CONFig:NR5G:<cell>:CSI:RESource:QUICkset:POWeroffset:VALue <-200 ... 15>

7.4.8.4 Quick Set

Quick Set – Click to apply the Quick Set options to all Pool ID items.

7.4.8.5 View Pool

You can display the resource configuration table for SSB or NZP items. Select SSB or NZP to choose which table to display.

SSB/NZP Resource Config table

For a description of the SSB or NZP resource configuration table, see:

- SSB tab – for SSB resource items.
- NZP CSI RSI tab – for NZP resource items.

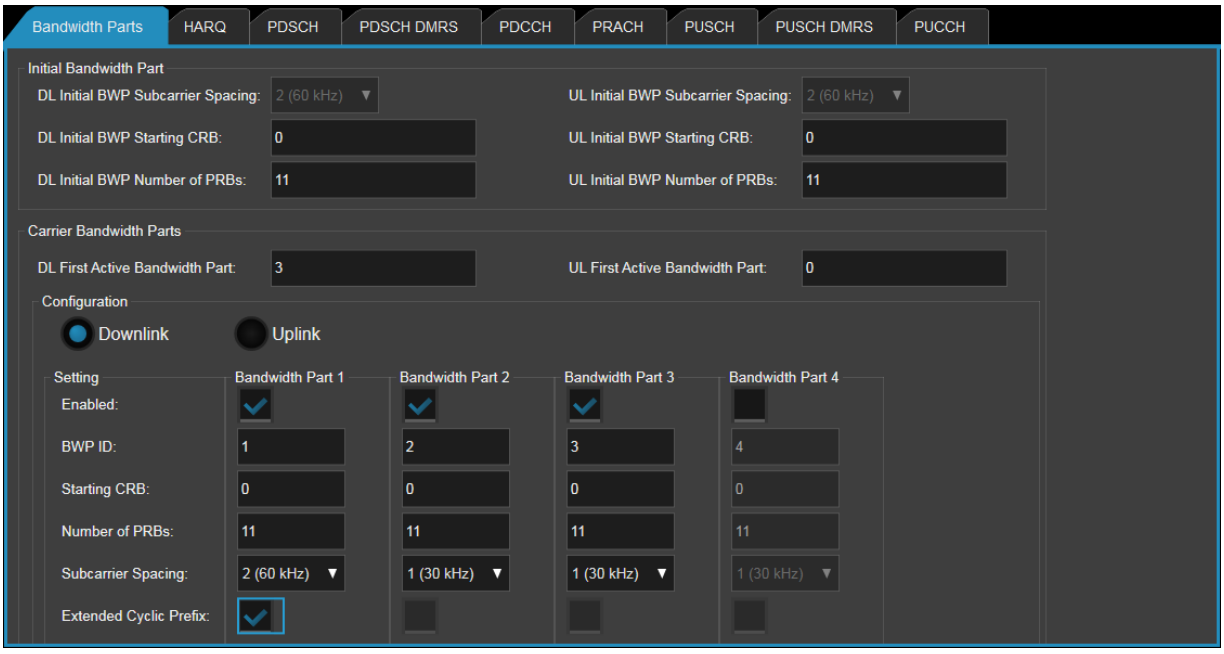
Note: Any changes that you make to the tables will also appear on their corresponding SSB tab or NZP CSI RSI tab.

7.5 PHY Tab

7.5.1 Bandwidth Part Tab

Also see: Bandwidth Parts tutorial

The PHY > Bandwidth Parts tab configures the initial bandwidth part for uplink and downlink, and up to four additional bandwidth parts for uplink and downlink.



7.5.1.1 Initial Bandwidth Part

DL Initial BWP Subcarrier Spacing / UL Initial BWP Subcarrier Spacing

Read-only field

Displays the common subcarrier spacing defined in Cell > Config > SCS Common, which determines the subcarrier spacing of the initial bandwidth part.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:DL:IBWP:SUBCarrier:SPACing <MU0 | MU1 | MU2 | MU3 | MU4>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:UL:IBWP:SUBCarrier:SPACing <MU0 | MU1 | MU2 | MU3>

DL Initial BWP Starting CRB / UL Initial BWP Starting CRB

For a cell configured for TDD, the UL value is the same as the DL value and is read-only.

Specify an integer, from 0 to 65, to define the starting common resource block (CRB) of the initial bandwidth part of the cell.

This parameter relates to the initial bandwidth part, defined by the CORESET for PDCCH Common Search Space Type0, which is derived from pdcch-ConfigSIB1 (RMSI-PDCCH-Config) in the MIB. For more information, see section 13 in as specified in 3GPP TS 38.213.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:DL:IBWP:CRB:STARt <0 ... 272>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:UL:IBWP:CRB:STARt <0 ... 255>

DL Initial BWP Number of PRBs / UL Initial BWP Number of PRBs

For a cell configured for TDD, the UL value is the same as the DL value and is read-only.

Specify an integer, from 1 to 6, to define the number of resource blocks in the initial bandwidth part of the cell.

This parameter relates to the initial bandwidth part, defined by the CORESET for PDCCH Common Search Space Type0, which is derived from pdcch-ConfigSIB1 (RMSI-PDCCH-Config) in the MIB. For more information, see section 13 in as specified in 3GPP TS 38.213.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:DL:IBWP:NUM:PRBS <20 ... 273>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:UL:IBWP:NUM:PRBS <20 ... 275>

7.5.1.2 Carrier Bandwidth Parts

DL First Active Bandwidth Part / UL First Active Bandwidth Part

These fields specify for downlink and uplink the bandwidth part ID which will be sent to the UE as the first active bandwidth part. The BWP ID can be in the range 0 to 4:

- 0 – the initial bandwidth part.
- 1, 2, 3 or 4 – a downlink or uplink carrier bandwidth part, which must be **Enabled** in the Configuration table below.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:DL:FIRSt:BWP <0 ... 4>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:UL:FIRSt:BWP <0 ... 4>

7.5.1.2.1 Configuration

These fields configure up to four downlink or uplink carrier bandwidth parts:

- Select **Downlink** to configure up to four downlink carrier bandwidth parts. Related tabs for configuring each downlink bandwidth part are PDSCH, PDSCH DMRS and PDCCH.
- Select **Uplink** to configure up to four uplink bandwidth parts. Related tabs for configuring each downlink bandwidth part are PUSCH, PUSCH DMRS and PUCCH.

The fields for each bandwidth part are the same, described below.

Enabled

Select or clear this check box to enable or disable the bandwidth part.

Note: Bandwidth parts must be enabled and disabled sequentially, that is, bandwidth part 1 must be enabled before bandwidth part 2 and bandwidth part 4 must be disabled before bandwidth part 3.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:DL:<cbwp>:STATe <ON | 1 | OFF | 0>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:UL:<cbwp>:STATe <ON | 1 | OFF | 0>

BWP ID

the bandwidth part ID (indicator). For more information, see section 6.3.2 in 3GPP TS 38.331.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:DL:<cbwp>:INDex <1 ... 4>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:UL:<cbwp>:INDex <1 ... 4>

Starting CRB

The start of the Bandwidth Part. Defined by the number of the Carrier Resource Block where the Bandwidth Part starts. For more information, see section 4.4.4.2 in 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:DL:<bwp>:CRB:STARt <0 ... 272>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:UL:<bwp>:CRB:STARt <0 ... 272>

Number of PRBs

The number of physical resource blocks (PRBs) within this bandwidth part. For more information, see section 4.4.4.3 in 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:DL<bwp>:NUM:PRBs <1 ... 273>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:UL<bwp>:NUM:PRBs <1 ... 273>

Subcarrier Spacing

The numerology (μ) used for this bandwidth part. For more information, see section 4.2 in 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:DL:<bwp>:SUBCarrier:SPACing <MU0 | MU1 | MU2 | MU3 | MU4>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:UL:<bwp>:SUBCarrier:SPACing <MU0 | MU1 | MU2 | MU3 | MU4>

Extended Cyclic Prefix

Indicates whether this bandwidth part uses extended cyclic prefix. The default is false (cleared) implying that the normal cyclic prefix is used.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:DL:<bwp>:CPSize <NORMal | EXTended>

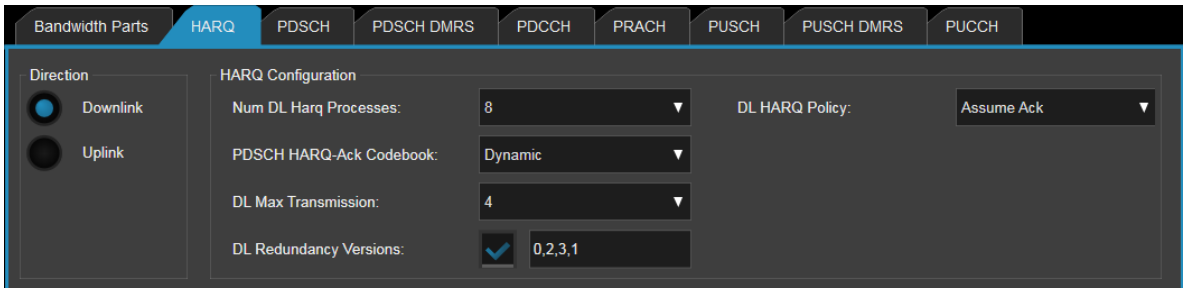
SCPI: BSE:CONFig:NR5G:<cell>:PHY:UL:<bwp>:CPSize <NORMal | EXTended>

7.5.2 HARQ Tab

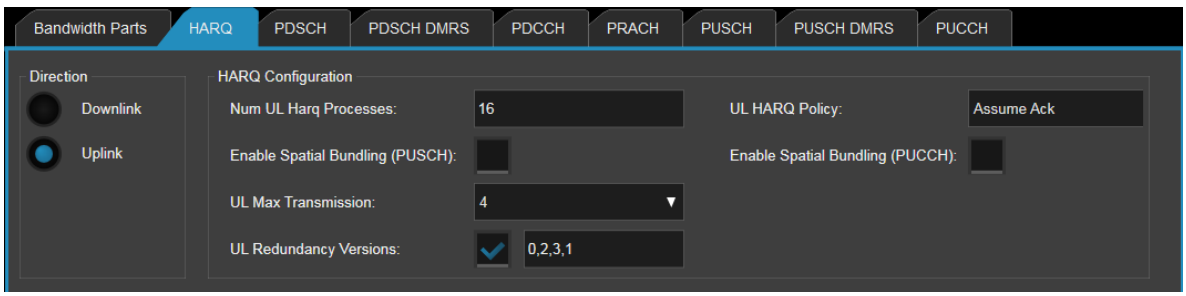
The HARQ tab configures the number of uplink and downlink HARQ processes, and the downlink HARQ policy.

7.5.2.1 Direction

- Select Downlink to configure up downlink HARQ processes:



- Select Uplink to configure uplink HARQ processes:



7.5.2.2 DL HARQ Configuration

Num DL HARQ Processes

Specify the number of downlink HARQ processes that are active. Choose between 1, 2, 4, 6, 8, 10, 12, 13, 14, 15 and 16.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:DL:HARQ:PROCesses <N1 | N2 | N4 | N6 | N8 | N10 | N12 | N13 | N14 | N16>

PDSCH HARQ-Ack Codebook

NR supports multiplexing of acknowledgments for multiple transport blocks received by a device into one multi-bit acknowledgment message. The multiple bits can be multiplexed using either a semi-static codebook or a dynamic codebook.

- Semi Static – acknowledgment information for all carriers, scheduled or not, is included in the report.
- Dynamic – only the acknowledgment information for the scheduled carriers is included in the report (addresses the drawback of a potentially large semi-static codebook size).

SCPI: BSE:CONFig:NR5G:<cell>:PHY:DL:HARQ:PDSCh:CODebook <SEMI | DYNAMIC>

DL Max Transmissions

Specify the maximum number of times a downlink HARQ process will transmit. Choose between 1, 2, 3, 4, 5, 6, 7, 8, 10, 12, 16, 20, 24 and 28.

Note: If DL_HARQ_Policy is Assume Ack, the value will always be will be 1.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:DL:HARQ:MAXTrans <N1 | N2 | N3 | N4 | N5 | N6 | N7 | N8 | N10 | N12 | N16 | N20 | N24 | N28>

DL Redundancy Versions

Select this check box to define a downlink redundancy version pattern, or clear the check box to use the default value of 0.

The redundancy version pattern is a comma-separated list with a maximum number of entries as the value of the DL Max Transmissions field defined above. The list defines values used to calculate the version of the retransmission to send.

For more information, see sections 5.1.2.1 and 6.1.2.3.1 in 3GPP TS 38.214.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:DL:HARQ:RV:SEQuence:STATe <ON | 1 | OFF | 0>

DL HARQ Policy

Specify the downlink HARQ process behaviour:

- Prioritise Retx – consider a cyclic redundancy check (CRC) but give priority to HARQ processes with pending retransmissions.
- Assume Ack – like sequential, but assumes the ACK was received even if the cyclic redundancy check failed.
- Prioritise NewTx – consider a cyclic redundancy check but give priority to free HARQ processes.
- Force Retx – like sequential, but force retransmissions even if the cyclic redundancy check is successful.
- Sequential – consider a cyclic redundancy check but select HARQ processes in sequence.

SCPI: BSE:CONFig:NR5G:<cell>:MAC:DL:HARQ:POLicy <PRTX | AACK | PNTX | FRTX | SEQ>

7.5.2.3 UL HARQ Configuration

Num UL HARQ Processes

Specify the number (8 to 16) of uplink HARQ processes that are active.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:UL:HARQ:PROCesses <1 ... 16>

UL Max Transmissions

Specify the maximum number of times an uplink HARQ process will transmit. Choose between 1, 2, 3, 4, 5, 6, 7, 8, 10, 12, 16, 20, 24 and 28.

Note: If UL HARQ Policy is Assume Ack, the value will always be 1.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:UL:HARQ:MAXTrans <N1 | N2 | N3 | N4 | N5 | N6 | N7 | N8 | N10 | N12 | N16 | N20 | N24 | N28>

UL Redundancy Versions

Select this check box to define a uplink redundancy version pattern, or clear the check box to use the default value of 0.

The redundancy version pattern is a comma-separated list with a maximum number of entries as the value of the UL Max Transmissions field defined above. The list defines values used to calculate the version of the retransmission to send.

For more information, see sections 5.1.2.1 and 6.1.2.3.1 in 3GPP TS 38.214.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:UL:HARQ:RV:SEQuence:STATe <ON | 1 | OFF | 0>

Enable Spatial Bundling (PUSCH)

Select to enable spatial bundling of HARQ ACKs on the PUSCH.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:DL:HARQ:PUSCh:SPATial:BUNDling <ON | 1 | OFF | 0>

UL HARQ Policy

Specify the uplink HARQ process behaviour:

- Prioritise Retx – consider a cyclic redundancy check (CRC) but give priority to HARQ processes with pending retransmissions.
- Assume Ack – like sequential, but assumes the ACK was received even if the cyclic redundancy check failed.
- Prioritise NewTx – consider a cyclic redundancy check but give priority to free HARQ processes.
- Force Retx – like sequential, but force retransmissions even if the cyclic redundancy check is successful.
- Sequential – consider a cyclic redundancy check but select HARQ processes in sequence.

SCPI: BSE:CONFig:NR5G:<cell>:MAC:UL:HARQ:POLicy <PRTX | AACK | PNTX | FRTX | SEQ>

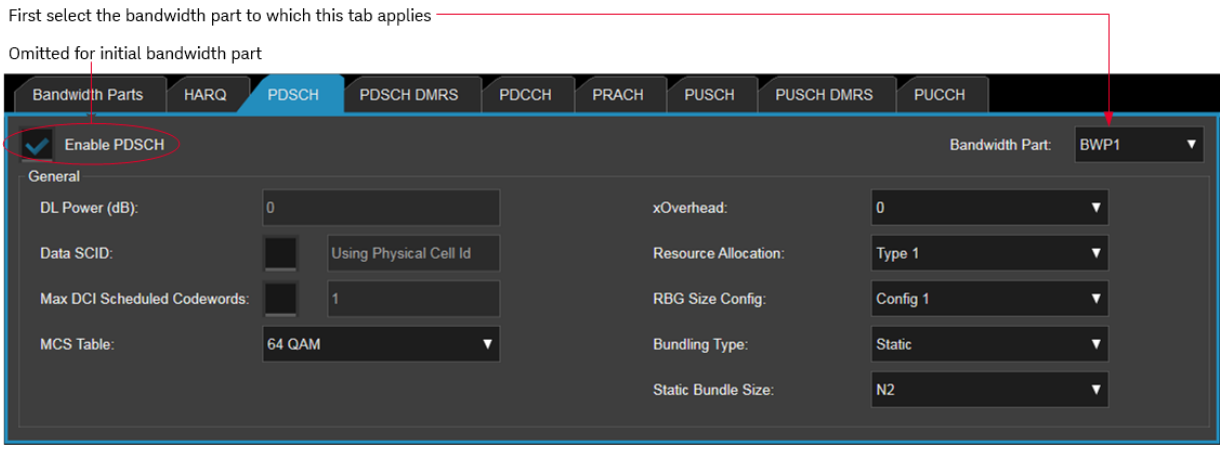
Enable Spatial Bundling (PUCCH)

Select to enable spatial bundling of HARQ ACKs on the PUCCH.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:DL:HARQ:PUCCh:SPATial:BUNDling <ON | 1 | OFF | 0>

7.5.3 PDSCH Tab

The PDSCH tab configures the Physical Downlink Shared Channel (PDSCH).



Bandwidth part

Select the bandwidth part to be configured. The drop-down list contains the initial bandwidth part and each downlink carrier bandwidth part that is **Enabled** on the NR cell's PHY > Bandwidth Part Tab.

Enable PDSCH

This field is omitted for the initial bandwidth part (PDSCH always enabled).

Select or clear this check box to enable or disable PDSCH for the selected bandwidth part.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PDSCh:STATe <ON | 1 | OFF | 0>

7.5.3.1 General

DL Power (dB)

Read-only field

Shows the baseline downlink signal power for the selected bandwidth, from -200.0 to 10.0 dB, relative to the Reference Signal Power defined on the Cell > Config tab.

Note: *Each individual beam has a further power offset applied on the Beam Management sub-tabs.*

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PDSCh:DATA:GAIN <-200 ... 10>

Data SCID

Select this option to specify a data scrambling identifier (SCID), from -1 to 1007, that initialises data scrambling for the PDSCH. This option corresponds to the 10-bit layer 1 parameter ScramblingID defined in section 5.2.2.3 in 3GPP TS 38.214.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PDSCH:SCID:STATe <ON | 1 | OFF | 0> – selects the option.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PDSCH:SCID <0 ... 1007> – specifies the value.

Max DCI Scheduled Codewords

Select this option to specify the maximum number of codewords (1 or 2) that a single DCI schedules. This changes the number of MCS/RV/NDI bits in the DCI message from 1 to 2.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PDSCH:MAXCodewords:STATe <ON | 1 | OFF | 0> – selects the option.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PDSCH:MAXCodewords <1 | 2> – specifies the value.

MCS Table

Determines the table to use to determine the modulation scheme and code rate. Select one of **64 QAM**, **256 QAM** or **64 QAM Low SE**.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PDSCh:MCS:TABle <Q64 | Q256 | Q64Lse>

xOverhead

Defines the value of the Xoh-PDSCH parameter (0, 6, 12 or 18), which accounts for the overhead from CSI-RS/CORESET when calculating the number of resource elements allocated for PDSCH within a physical resource block. For more information, see section 5.1.3.2 in 3GPP TS 38.214.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PDSCH:XOVerhead <XOH0 | XOH6 | XOH12 | XOH18>

Resource Allocation

Specify the time domain PDSCH resource allocation. For more information, see sections 5.1.2.2 and 6.1.2.2 in 3GPP TS 38.214. The options are:

- Fix the resource allocation to Type 0 or Type 1.
- Set the resource allocation dynamically (Dynamic).

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PDSCH:RATYpe <TYPE0 | TYPE1>

RBG Size Config

Specify the DMRS precoding resource block group (RBG) which provides information of precoding granularity of PDSCH.

- Config 1 – four PRBs mapped to a single VRBG index.
- Config 2 – all assigned PRBs in the frequency domain.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PDSCH:RBGSize <CONF1 | CONF2>

Bundling Type

Choose how the resource element group (REG) bundle size is to be determined:

- Static – use the Static Bundle Size (below).
- Dynamic – choose between Dynamic Bundle Size 1 and Dynamic Bundle Size 2

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PDSCh:BUNDling:TYPe <STATic | DYNamic>

Static Bundle Size

Only available when Bundling Type is Static.

Choose a bundle size of N2 (duration is one or two OFDM symbols), N4 or Wideband.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PDSCh:BUNDling:STATic:SIZE <N2 | N4 | WBANd>

Dynamic Bundle Size 1 / Dynamic Bundle Size 2

Only available when Bundling Type is Dynamic.

Choose the first dynamic bundle size as N2 (duration is one or two OFDM symbols), N4, Wideband, N2 Wideband or N4 Wideband.

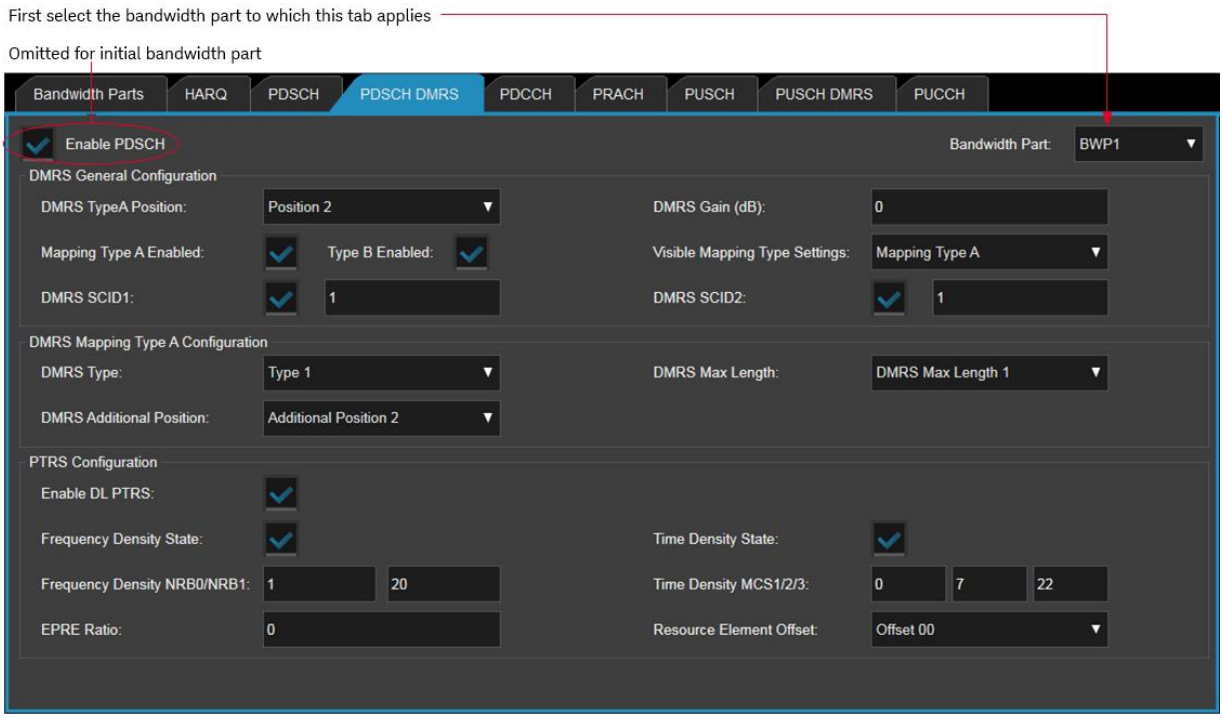
Choose the second dynamic bundle size as N2, N4 or Wideband.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PDSCh:BUNDling:DYNamic:SIZE1 <N2 | N4 | WBANd | WBN2 | WBN4>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PDSCh:BUNDling:DYNamic:SIZE2 <N2 | N4 | WBANd>

7.5.4 PDSCH DMRS Tab

The PDSCH DMRS tab configures the demodulation reference signal (DMRS) in the Physical Downlink Shared Channel (PDSCH).



Bandwidth part

Select the bandwidth part to be configured. The drop-down list contains the initial bandwidth part and each downlink carrier bandwidth part that is **Enabled** on the NR cell's PHY > Bandwidth Part Tab.

Enable PDSCH

This field is omitted for the initial bandwidth part (PDSCH always enabled).

Select or clear this check box to enable or disable PDSCH for the selected bandwidth part.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PDSCh:STATe <ON | 1 | OFF | 0>

7.5.4.1 DMRS General Configuration

The DMRS Configuration parameters configure the demodulation reference signal (DMRS).

DMRS Type A Position

This field replicates DMRS Type A Position on the Cell > SSB / Broadcast tab, and any change updates both fields.

Specify the position of the first downlink DMRS: **Position 2** or **Position 3**. The position corresponds to the layer 1 parameter DL-DMRS-typeA-pos. For more information, see section 7.4.1.1.2 in 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:DL:DMRS:TAPosition <POS2 | POS3>

DMRS Gain

Specify the baseline PDSCH DMRS power, from -200.0 to 10.0 dB, relative to reference signal transmit power (Reference Signal EPRE) defined on the Cell > Config tab.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:DL:DMRS:GAIN <-200 ... 10>

Mapping Type A Enabled

Select to enable DMRS mapping type A, where the first DMRS is located in symbol 2 or 3 of the slot, and the DMRS is mapped relative to the start of the slot boundary, regardless of where in the slot the actual data transmission starts. This mapping type is primarily intended for the case where the data occupies most of a slot.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:DL:MTA:STATe <ON | 1 | OFF | 0>

Type B Enabled

Select to enable DMRS mapping type B, where the first DMRS is located in the first symbol of the data allocation, that is, the DMRS location is not given relative to the slot boundary but rather relative to where the data are located. This mapping is originally motivated by transmissions over a small fraction of the slot to support very low latency and other transmissions that benefit from not waiting until a slot boundary starts but can be used regardless of the transmission duration.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:DL:MTB:STATe <ON | 1 | OFF | 0>

Visible Mapping Type Settings

Select Mapping Type A or Mapping Type B.

DMRS SCID1 / DMRS SCID2

For mapping type A:

- Select the check box to use SCIDs (scrambling IDs), then specify the scrambling ID (0 to 65,535) parameter used when initializing the random sequence for downlink DMRS scrambling. For more information, see section 5.1in 3GPP TS 38.214.
- Clear the check box for the UE to use the Physical Cell ID (physCellId) for scrambling.

SCPI commands specifying whether SCIDs are used:

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:DL:DMRS:SCID:ONE:STATe <ON | 1 | OFF | 0>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:DL:DMRS:SCID:TWO:STATe <ON | 1 | OFF | 0>

SCPI commands specifying the SCID:

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:DL:DMRS:SCID1 <0 ... 65535>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:DL:DMRS:SCID2 <0 ... 65535>

7.5.4.2 DMRS Mapping Type A Configuration

DMRS Type

Select the DMRS type to use for downlink: Type 1 or Type 2. The types determine the parameters used for the PDSCH DMRS. For more information, see section 7.4.1.1.1 in 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:DL:DMRS:TYPE <TYPE1 | TYPE2>

DMRS Max Length

Specify the maximum number of OFDM symbols for downlink front loaded DMRS.

- DMRS Max Length 1 – a single-symbol DMRS can be scheduled for the UE by DCI, and the UE can be configured with a number of additional DMRS for PDSCH by the DMRS Additional Position parameter (defined above), which can take the values 0, 1 2 or 3.
- DMRS Max Length 2 – both single-symbol DMRS and double symbol DMRS can be scheduled for the UE by DCI, and the UE can be configured with a number of additional DMRS for PDSCH by the DMRS Additional Position parameter (defined above), which can take the values 0 or 1.

For more information, see section 5.1.6.2 in 3GPP TS 38.214.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:DL:DMRS:MAXLength <MLEN1 | MLEN2>

DMRS Additional Position

Choose one of the Additional Positions 0 - 3 for an additional DMRS in the downlink, which indicates the total number and which OFDM symbols to use for DL DMRS mapping. For more information, see the *dmrs-AdditionalPosition* parameter in section 7.4.1.1.2 of 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:DL:DMRS:ADDPosition <APOS0 | APOS1 | APOS2 | APOS3>

7.5.4.3 PTRS Configuration

The PTRS Configuration parameters configure the phase-tracking reference signals (PTRS).

Enable DL PTRS

Select to indicate whether the device under test is configured with the higher layer parameter Downlink-PTRS-Config set to ON. The configuration for the downlink depends on whether this option is selected. For more information, see section 5.1.6.3 in 3GPP TS 38.214.

Note: As per 3GPP TS 38.331 (section 6.3.2), the downlink PTRS configuration is included in the field phaseTrackingRS of DMRS-DownlinkConfig.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:DL:PTRS:STATe <ON | OFF>

Frequency Density State

Select to enable the use of the higher layer frequencyDensity parameter that determines which parameters are used when configuring the PTRS. For more information, see section 5.1.6.3 in 3GPP TS 38.214.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:DL:PTRS:FDENsity:STATe <ON | 1 | OFF | 0>

Frequency Density NRB0/NRB1

In each field, for NRB0 and MRB1 respectively, specify a value (1 to 276) for the N_{RB0} parameter that is used to determine the frequency density of the downlink PTRS as a function of the scheduled bandwidth. For more information, see Table 5.1.6.3-2 in 3GPP TS 38.214.

Note: The value of N_{RB0} must be less than the value of N_{RB1}.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:DL:PTRS:FDENsity:NRB0 <1 ... 276>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:DL:PTRS:FDENsity:NRB1 <1 ... 276>

EPRE Ratio

Specify the energy per resource element (EPRE) ratio between PTRS and PDSCH for EPRE port 1.

Note: The value is always 0, which corresponds to codepoint 00 *in Table 4.1-2 in 3GPP TS 38.214.*

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:DL:PTRS:EPRE:PORT1 <0 ... 3>

Time Density State

Select to enable the use of the higher layer timeDensity parameter that determines which parameters are used when configuring the PTRS. The time density is calculated using the Time Density MCS values (configured below) and Table 5.1.6.3-1 in 3GPP TS 38.214.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:DL:PTRS:TDENsity:STATe <ON | 1 | OFF | 0>

Time Density MCS1/2/3

In each field, for MCS1, 2 and 3 respectively, specify a value (0 to 29) for the ptrs-MCS1/2/3 parameter that determines the time density of the downlink PTRS as a function of the scheduled MCS. For more information, see Table 5.1.6.3-1 in 3GPP TS 38.214.

Note: The values must be in an ascending sequence, that is, MCS2 must be greater than MCS1, and MCS3 must be greater than MCS2.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:DL:PTRS:TDENsity:MCS1 <0 ... 29>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:DL:PTRS:TDENsity:MCS2 <0 ... 29>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:DL:PTRS:TDENsity:MCS3 <0 ... 29>

Resource Element Offset

Select the subcarrier offset for the downlink PTRS that is used to specify the number of PTRS ports. The value corresponds to the layer 1 parameter DL-PTRS-RE-offset.

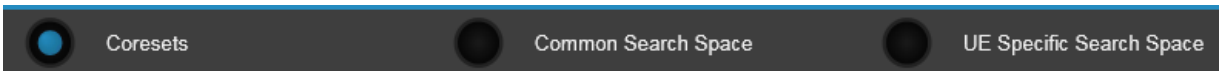
Choose between Offset 00, Offset 01, Offset 10 and Offset 11.

For more information, see section 5.1.6.3 in 3GPP TS 38.214.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:DL:PTRS:RELement:OFFSet <OFFS00 | OFFS01 | OFFS10 | OFFS11>

7.5.5 PDCCH Tab

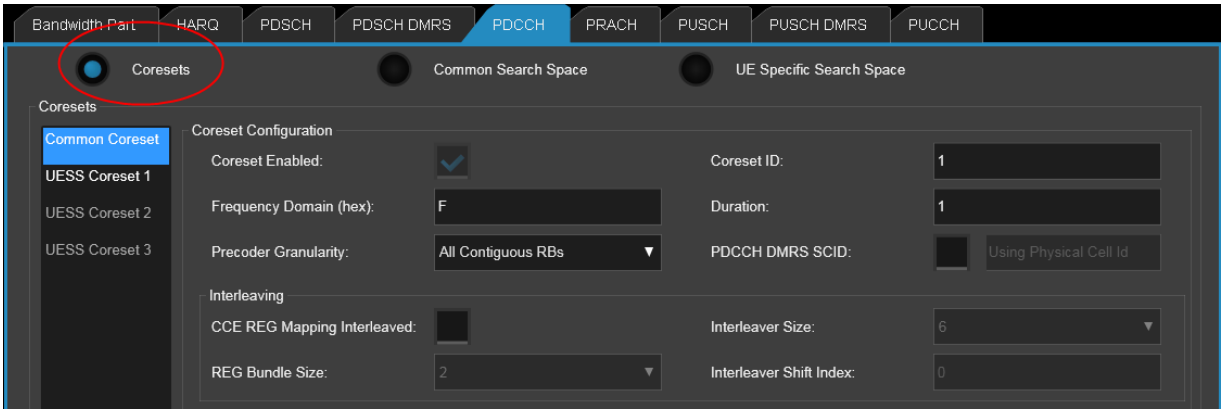
The PDCCH tab configures the Physical Downlink Control Channel (PDCCH) for one of the following:



The option you select determines the screen display:

- Coresets – displays Control Resource Sets (Coresets) options.
- Common Search Space – displays Common Search Space options.
- UE Specific Search Space – displays UE Specific Search Space options.

7.5.5.1 Coresets



The Coresets options update the configuration for the common and UE-specific coresets.

- Common Coreset – always enabled.
- UESS Coreset 1/2/3 – you can enable up to three UE-specific coresets.

Select which coreset to configure then specify values for the fields below. For more information about coresets, see the Control Resource Set (CORESET) tutorial or section 10.1 in 3GPP TS 38.213.

Coreset Enabled

Select whether to use the selected control resource set (coreset).

Note: The Common Coreset is always used and cannot be disabled.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<coresetid>:STATe <ON | 1 | OFF | 0>

Frequency Domain (hex)

Specify the hexadecimal characters (defined by the CORESET-freq-dom parameter) that determine which groups of 6 non-overlapping physical resource blocks (PRBs) are used by this CORESET.

When converted to binary, a '1' in the bitmap indicates to the network to allocate the corresponding group of 6 PRBs to a control resource set, and a '0' in the bitmap the indicates to the network to not allocate the corresponding 6 PRBs to the control resource set. For more information, see section 10.1 in 3GPP TS 38.213.

Note: Bit 0 corresponds to the first group of 6 PRBs i.e. 6 PRBs with lowest index in DL BWP.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<coresetid>:FDOMain <0 ... 0x3FFFFFFFFFFF>

Precoder Granularity

Select the precoder granularity in the frequency domain for the interleaved case:

- Same as Reg Bundle

- All Contiguous RBs

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<coresetid>:CCEReg:PGRanularity <SAME | CONTiguous>

Coreset ID

Specify an integer from 1 to 11 that uniquely identifies the control resource set, so that it can be referenced in the common and UE-specific search space configurations.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<coresetid>:ID <1 ... 11>

Duration

Specify the duration of this Control Resource Set in symbols. For more information, refer to the CORESET-time-duration description in section 10.1 of 3GPP TS 38.213.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<coresetid>:CDURation <1 ... 3>

PDCCH DMRS Scrambling ID

Select the checkbox to configure a value for the scrambling identifier. Clear the checkbox to use the value of the physical cell identifier.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<coresetid>:CCEReg:SCID:STATe <ON | 1 | OFF | 0>

If enabled, specify a value for the PDCCH DMRS scrambling initalization identifier, which corresponds to the layer 1 parameter PDCCH-DMRS-Scrambling-ID as defined in section 5.1 in 3GPP TS 38.214.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<coresetid>:CCEReg:SCID <0 ... 65535>

CCE Reg Mapping Interleaved

Indicates whether the Control Channel Element (CCE) to Resource Element Group (REG) mapping is interleaved for this Control Resource Set. For more information, refer to the CORESET-CCE-to-REG-mapping-type description in section 10.1 of 3GPP TS 38.213.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<coresetid>:CCEReg:MAPPing <ON | 1 | OFF | 0>

REG Bundle Size

(Only enabled if CCE REG Mapping Interleaved is selected)

Select the size of the Resource Element Group (REG) bundle (2, 3 or 6) of this Control Resource Set. For more information, refer to the CORESET-REG-bundle-size description in section 10.1 of 3GPP TS 38.213.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<coresetid>:CCEReg:BSIZe <N2 | N3 | N6>

Interleaver Size

(Only enabled if CCE REG Mapping Interleaved is selected)

Select the interleaver size (2, 3 or 6) of this Control Resource Set. For more information, refer to the CORESET-interleaver-size description in section 7.3.2.2 of 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<coresetid>:CCEReg:ISIZe <N2 | N3 | N6>

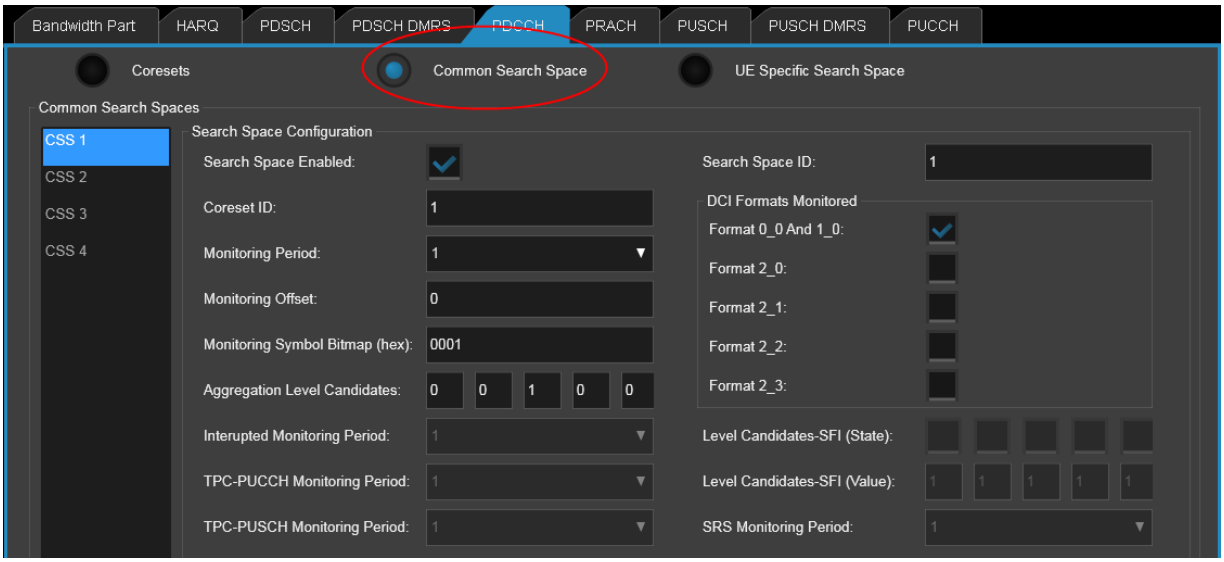
Interleaver Shift Index

(Only enabled if CCE REG Mapping Interleaved is selected)

Specify the interleaver shift index (0 to 274) for this Control Resource Set. For more information, refer to the CORESET-shift-index description in section 7.3.2.2 of 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<coresetid>:CCEReg:ISHIft <0 ... 274>

7.5.5.2 Common Search Space



The Common Search Space is the region in which the network transmits the PDCCH that the UE decodes using predetermined algorithms. Once it has decoded the PDCCH in the common search space, the UE can determine the location of the UE-specific search space. via subsequent RRC signaling.

The Common Search Space options update the configuration for up to four common search spaces: CSS1, CSS2, CSS3 or CSS4.

Select which common search space to configure then specify values for the fields below.

Search Space Enabled

Select whether or not to use the selected common search space.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:CSS:<searchspaceid>:STATe <ON | 1 | OFF | 0>

Search Space ID

Specify a unique identifier for the selected common search space.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:CSS:<searchspaceid>:IDENtity <1 ... 39>

Coreset ID

Specify the identifier of the coreset configuration to use with the selected common search space.

For more information, see controlResourceSetId of SearchSpace IE in section 6.3.2 in 3GPP TS 38.331.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:CSS:<searchspaceid>:CORESet <0 ... 11>

Monitoring Period

Specify the number of slots to use as the Monitoring Period for the Search Space Set. For more information, refer to the Monitoring-periodicity-PDCCH-slot description in section 10.1 of 3GPP TS 38.213.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:CSS:<searchspaceid>:MPERiod <MP1 | MP2 | MP4 | MP5 | MP8 | MP10 | MP20 | MP40 | MP80 | MP160 | MP320 | MP640 | MP1280 | MP2560>

Monitoring Offset

Specify the Monitoring Offset in slots for the Search Space Set.

For more information, refer to the Monitoring-offset-PDCCH-slot description in section 10.1 of 3GPP TS 38.213.

Note: *The value of the Monitoring Offset must be less than the Monitoring Period defined above.*

SCPI: BSE:CONFig:NR5G:<cell>:PHY:CSS:<searchspaceid>:MOFFset <0 ... 19>

Monitoring Symbol Bitmap

Specify the bitmap the Search Space Set that indicates the first symbol(s) of the control resource set within a slot for PDCCH monitoring. For more information, refer to the Monitoring-offset-PDCCH-slot description in section 10.1 of 3GPP TS 38.213.

Note: Bit 0 corresponds to symbol 1 of 14 in a slot.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:CSS:<searchspaceid>:MSYMbol <0x1 ... 0x3FFF>

Aggregation Level Candidates

Specify the array that gives the number of candidates (0 to 8) for each aggregation level {1, 2, 4, 8, 16}, for the Search Space Set.

For more information, refer to the layer 1 parameter Aggregation-level-1/2/4/8/16 in section 10.1 of 3GPP TS 38.213. For more information on the number of candidates, refer to the nrofCandidates parameter of the SearchSpace information element in section 6.3.2 of 3GPP TS 38.331.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:CSS:<searchspaceid>:CANDidates:AGGRlevel:ONE <0 ... 8>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:CSS:<searchspaceid>:CANDidates:AGGRlevel:TWO <0 ... 8>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:CSS:<searchspaceid>:CANDidates:AGGRlevel:FOUR <0 ... 8>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:CSS:<searchspaceid>:CANDidates:AGGRlevel:EIGHt <0 ... 8>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:CSS:<searchspaceid>:CANDidates:AGGRlevel:SIXTeen <0 ... 8>

DCI Formats Monitored

Select which DCI Formats are monitored using the selected common search space. This parameter corresponds to information in higher layer parameters RNTI-monitoring and USS-DCI-format. For more information, see section 10.1 in 3GPP TS 38.213, and the information in searchSpaceType member of SearchSpace IE in section 6.3.2 of 3GPP TS 38.331.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<searchspaceid>:DCI:F0010:STATe <ON | 1 | OFF | 0>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<searchspaceid>:DCI:F20:STATe <ON | 1 | OFF | 0>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<searchspaceid>:DCI:F21:STATe <ON | 1 | OFF | 0>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<searchspaceid>:DCI:F22:STATe <ON | 1 | OFF | 0>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<searchspaceid>:DCI:F23:STATe <ON | 1 | OFF | 0>

Interrupted Monitoring Period

(Only enabled if DCI Formats Monitored has Format 2_1 selected)

Select the monitoring period (in slots) for the Search Space Set when monitoring DCI Format 2_1. For more information, refer to the layer 1 parameter 'INT-monitoring-periodicity' in section 11.2 in 3GPP TS 38.213.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:CSS:<searchspaceid>:MPERiod:INTerupted <MP1 | MP2 | MP4 | MP5 | MP8 | MP10 | MP20 >

TPC-PUCCH Monitoring Period

(Only enabled if DCI Formats Monitored has Format 2_2 selected)

Select the monitoring period (in slots) for the Search Space Set when monitoring DCI Format 2_2 scrambled by PUCCH-TPC-RNTI. For more information, refer to the layer 1 parameter 'PUCCH-monitoring-periodicity' in section 11.3 in 3GPP TS 38.213.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:CSS:<searchspaceid>:MPERiod:PUCCh <MP1 | MP2 | MP4 | MP5 | MP8 | MP10 | MP20>

TPC-PUSCH Monitoring Period

(Only enabled if DCI Formats Monitored has Format 2_2 selected)

Select the monitoring period (in slots) for the Search Space Set when monitoring DCI Format 2_2 scrambled by PUSCH-TPC-RNTI. For more information, refer to the layer 1 parameter 'PUSCH-monitoring-periodicity' in section 11.3 in 3GPP TS 38.213.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:CSS:<searchspaceid>:MPERiod:PUSCh <MP1 | MP2 | MP4 | MP5 | MP8 | MP10 | MP20>

Level Candidates-SFI (State)

(Only enabled if DCI Formats Monitored has Format 2_0 selected)

Select which elements in the array of candidates to specify using the parameter below. From left to right, the checkboxes map to aggregation levels (1, 2, 4, 8 and 16).

SCPI: BSE:CONFig:NR5G:<cell>:PHY:CSS:<searchspaceid>:AGGRlevel:SFI:ONE:STATe <ON | 1 | OFF | 0>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:CSS:<searchspaceid>:AGGRlevel:SFI:TWO:STATe <ON | 1 | OFF | 0>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:CSS:<searchspaceid>:AGGRlevel:SFI:FOUR:STATe <ON | 1 | OFF | 0>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:CSS:<searchspaceid>:AGGRlevel:SFI:EIGHt:STATe <ON | 1 | OFF | 0>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:CSS:<searchspaceid>:AGGRlevel:SFI:SIXteen:STATe <ON | 1 | OFF | 0>

Level Candidates-SFI (Value)

(Only enabled if DCI Formats Monitored has Format 2_0 selected and the state (above) is enabled)

For each selected level candidate checkbox (above), specify the number of candidates for each aggregation level {1, 2, 4, 8, 16}, for the Search Space Set when used for Dci Format 2_0.

For more information, refer to the layer 1 parameter 'SFI-Num-PDCCH-cand' in section 11.1.1 in 3GPP TS 38.213, and nrofCandidates-SFI member of SearchSpace IE in section 6.3.2 of 3GPP TS 38.331.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:CSS:<searchspaceid>:AGGRlevel:SFI:ONE:VALUe <1 | 2>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:CSS:<searchspaceid>:AGGRlevel:SFI:TWO:VALUe <1 | 2>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:CSS:<searchspaceid>:AGGRlevel:SFI:FOUR:VALUe <1 | 2>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:CSS:<searchspaceid>:AGGRlevel:SFI:EIGHt:VALUe <1 | 2>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:CSS:<searchspaceid>:AGGRlevel:SFI:SIXteen:VALUe <1 | 2>

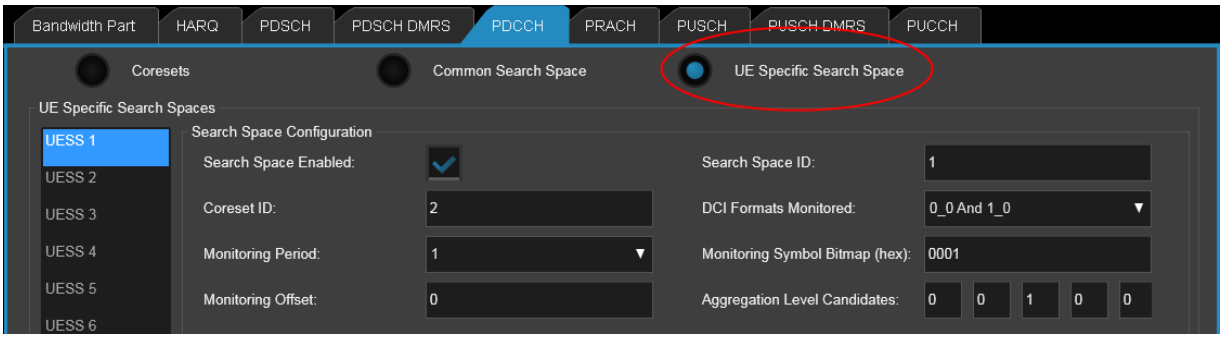
SRS Monitoring Period

(Only enabled if DCI Formats Monitored has Format 2_3 selected)

Specify the number of slots used as the monitoring periodicity of SRS PDCCH for DCI format 2-3. This parameter corresponds to the layer 1 parameter 'SRS-monitoring-periodicity' as described in sections 7.3.1 and 11.3 in 3GPP TS 38.212 and 3GPP TS 38.213 respectively.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:CSS:<searchspaceid>:MPERiod:SRS <MP1 | MP2 | MP4 | MP5 | MP8 | MP10 | MP20>

7.5.5.3 UE Specific Search Space



The UE-Specific Search Space is the region defined by RRC messages that the UE uses to decode the PDCCH.

The UE-Specific Search Space options updates the configuration for up to ten UE-specific search spaces: UESS1, UESS2, UESS3, UESS4, UESS5, UESS6, UESS7, UESS8, UESS9 or UESS10.

Select which UE-specific search space to configure then specify values for the fields below.

Search Space Enabled

Select whether or not to use the selected UE-specific search space.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:UESS:<searchspaceid>:STATe <ON | 1 | OFF | 0>

Coreset ID

Specify the identifier of the coreset configuration to use with the selected UE-specific search space.

For more information, refer to the controlResourceSetId of SearchSpace IE in section 6.3.2 in 3GPP TS 38.331.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:UESS:<searchspaceid>:CORes et <0 ... 11>

Monitoring Period

Specify the number of slots to use as the Monitoring Period for the Search Space Set. For more information, refer to the Monitoring-periodicity-PDCCH-slot description in section 10.1 of 3GPP TS 38.213.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:UESS:<searchspaceid>:MPERiod <MP1 | MP2 | MP4 | MP5 | MP8 | MP10 | MP20 | MP40 | MP80 | MP160 | MP320 | MP640 | MP1280 | MP2560>

Monitoring Offset

Specify the monitoring offset (in slots) to use for the selected UE-specific search space.

For more information, refer to the Monitoring-offset-PDCCH-slot description in section 10.1 of 3GPP TS 38.213.

Note: The value of the Monitoring Offset must be less than the Monitoring Period defined above.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:UESS:<searchspaceid>:MOFFset <0 ... 19>

Search Space ID

Specify a unique identifier for the selected UE-specific search space.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:UESS:<searchspaceid>:IDENtity <1 ... 39>

DCI Formats Monitored

Select which DCI Formats are monitored using this Search Space Set. This parameter corresponds to information in higher layer parameters RNTI-monitoring and USS-DCI-format. For more information, see section 10.1 in 3GPP TS 38.213, and the information in searchSpaceType member of SearchSpace IE in section 6.3.2 of 3GPP TS 38.331.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:UESS:<searchspaceid>:DCIFormats:MONitored <DCI0010 | DCI0011>

Monitoring Symbol Bitmap

Specify the bitmap the UE-specific search space that indicates the first symbol(s) of the control resource set within a slot for PDCCH monitoring. For more information, refer to the Monitoring-offset-PDCCH-slot description in section 10.1 of 3GPP TS 38.213.

Note: Bit 0 corresponds to symbol 1 of 14 in a slot.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:UESS:<searchspaceid>:MSYMbol <0x1 ... 0x3FFF>

Aggregation Level Candidates

Specify the array that gives the number of candidates (0 to 8) for each aggregation level {1, 2, 4, 8, 16}, for the UE-specific search space.

For more information, refer to the layer 1 parameter Aggregation-level-1/2/4/8/16 in section 10.1 of 3GPP TS 38.213. For more information on the number of candidates, refer to the nrofCandidates parameter of the SearchSpace information element in section 6.3.2 of 3GPP TS 38.331.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:UESS:<searchspaceid>:CANDidates:AGGRlevel:ONE <0 ... 8>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:UESS:<searchspaceid>:CANDidates:AGGRlevel:TWO <0 ... 8>

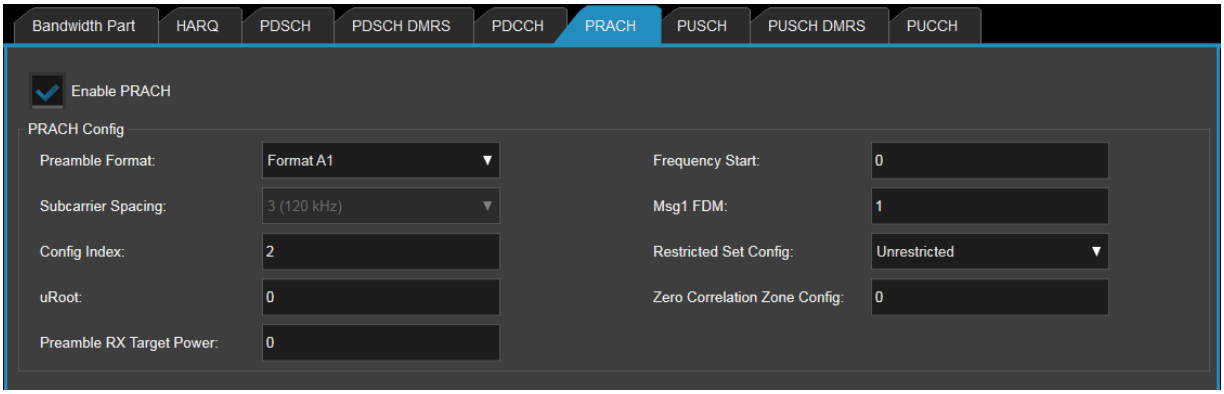
SCPI: BSE:CONFig:NR5G:<cell>:PHY:UESS:<searchspaceid>:CANDidates:AGGRlevel:FOUR <0 ... 8>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:UESS:<searchspaceid>:CANDidates:AGGRlevel:EIGHt <0 ... 8>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:UESS:<searchspaceid>:CANDidates:AGGRlevel:SIXTeen <0 ... 8>

7.5.6 PRACH Tab

The PRACH tab configures the Physical Random Access Channel (PRACH).



Enable PRACH

Read-only field

PRACH is always enabled for the primary cell and disabled for secondary cells.

Select to enable the reception of PRACH messages.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PRACH:STATE <ON | 1 | OFF | 0>

7.5.6.1 PRACH Config

Preamble Format

Select the preamble format of the PRACH as defined in Tables 6.3.3.1-1 and 6.3.3.1-2 in 3GPP TS 38.211. Selecting the preamble format also defines the symbols that may be used for PRACH in the subframe.

Note: This parameter can be obtained from PrachConfigIndex but there are values (231 to 260) that have two possible preamble formats. In such case, the PreambleFormat specify which will be used.

Note: This parameter is directly related to PrachConfigIndex through Tables 6.3.3.2-2 and 6.3.3.2-3

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PRACH:PREamble:FORMat <FORM0 | FORM1 | FORM2 | FORM3 | FORMA1 | FORMA2 | FORMA3 | FORMB1 | FORMB2 | FORMB3 | FORMB4 | FORMC0 | FORMC2>

Subcarrier Spacing

Displays the numerology (μ), which determines the subcarrier spacing. The numerology is defined on the Cell > Config tab. For more information, see section 4.2 in 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PRACH:SUBCarrier:SPACing <MU0 | MU1 | MU2 | MU3 | MU4>

Config Index

Specify the PRACH configuration index as defined in Table 6.3.3.2-2 in 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PRACH:CONFig:INDex <0 ... 255>

uRoot

Specify the root sequence index that the UE will use.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PRACH:UROot <0 ... 837>

Preamble RX Target Power

Specify the target power level at the network receiver side as defined in section 7.4 in see 3GPP TS 38.213.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PRACH:POWer:INITial <-202 ... 60>

Frequency Start

Specify the frequency offset of lowest PRACH transmission occasion in frequency domain with respect to PRB 0 of the initial active uplink bandwidth part.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PRACH:FREQuency:STARt <0 ... 274>

Msg1 FDM

Specify the number of PRACH transmission occasions FDMed in one time instance.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PRACH:MOFDm <1 ... 8>

Restricted Set Config

Select the configuration of an unrestricted set or one of two types of restricted sets. For more information, see section 6.3.3.1 in 3GPP TS 38.211.

- Unrestricted
- Restricted Set Type A
- Restricted Set Type B

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PRACH:RESTricted:SCONfig <UNRestricted | TYPEA | TYPEB>

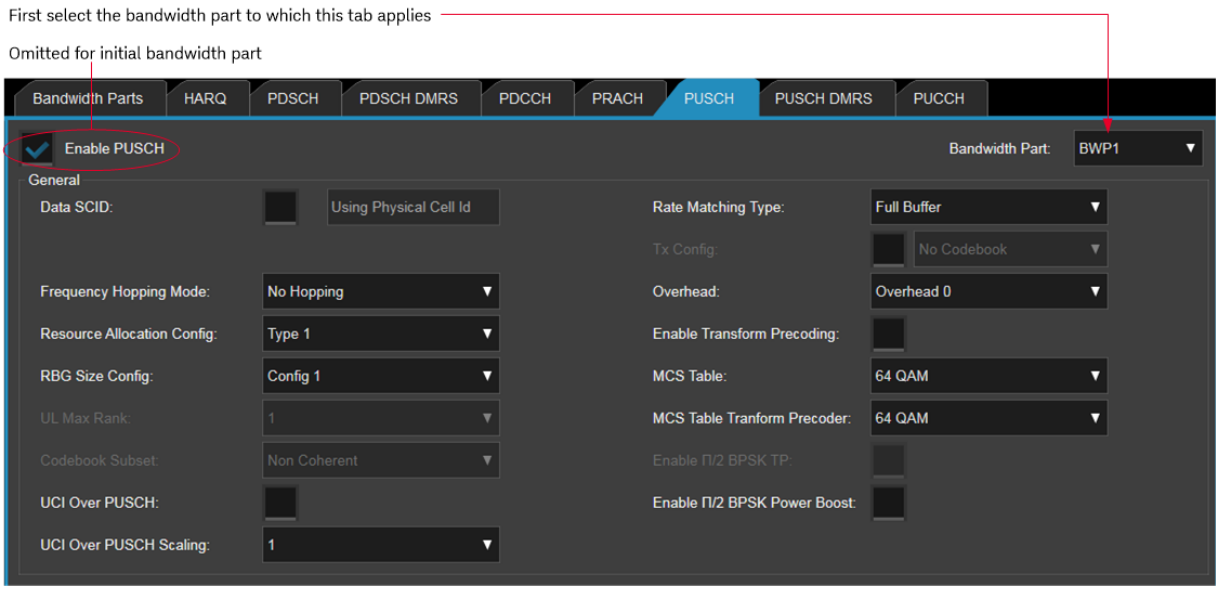
Zero Correlation Zone Config

Specify the N-CS configuration. For more information, see Table 6.3.3.1-3 in 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PRACH:ZCZone:INDex <0 ... 15>

7.5.7 PUSCH Tab

The PUSCH tab configures the Physical Uplink Shared Channel (PUSCH).



Bandwidth part

Select the bandwidth part to be configured. The drop-down list contains the initial bandwidth part and each uplink carrier bandwidth part that is **Enabled** on the NR cell's PHY > Bandwidth Part Tab.

Enable PUSCH

This field is omitted for the initial bandwidth part (PUSCH always enabled).

Select or clear this check box to enable or disable PUSCH for the selected bandwidth part.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PUSCh:STATe <ON | 1 | OFF | 0>

7.5.7.1 General

Data SCID

Select whether to specify the PUSCH scrambling identifier (SCID) or to use the physical cell identifier.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PUSCh:SCID:STATe <ON | 1 | OFF | 0>

Specify the unique identifier (0 to 1023) used for PUSCH scrambling identifier, defined by the Data-scrambling-Identity parameter in section 6.3.1.1 in 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PUSCh:SCID <0 ... 1023>

Frequency Hopping Mode

Select the hopping mode used by the UE for PUSCH transmissions. If this parameter is not configured, the UE is not expected to apply any hopping procedure. For more information, refer to the Frequency-hopping-PUSCH parameter in section 6.3 in 3GPP TS 38.214.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PUSCh:FHMode <NOHopping | HMODe1 | HMODe2>

Resource Allocation Config

Select the type of resource allocation applied in the frequency domain to PUSCH. This should be used if no information, with regards to allocation, is carried on the scheduling DCI.

For more information, refer to the Resource-allocation-config parameter in section 6.1.2.2 in 3GPP TS 38.214.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PUSCh:RAConfig <DYNamic | TYPE0 | TYPE1>

RBG Size Config

Select the configuration used for uplink resource allocation type 0. For more information, refer to the rbg-Size parameter in section 6.1.2.2.1 in 3GPP TS 38.214.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PUSCh:RBGSize <CONF1 | CONF2>

UL Max Rank

Select the subset of precoders (1 to 4) to be used addressed by TPMI. It is used in tables 7.3.1.1.2-2 to -5 in 3GPP TS 38.212.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PUSCh:ULMAxrank <RANK1 | RANK2 | RANK3 | RANK4>

Codebook Subset

Select the subset of precoders to be used addressed by TPMI. It is used in tables 7.3.1.1.2-2 to -5 in 3GPP TS 38.212.

- Fully Coherent – the UE can control the relative phase between any of the up to four ports that are to be used for transmission.
- Partially Coherent
- Non Coherent

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PUSCh:CSUBset <FULLy | PARTially | NONCoherent>

UCI Over PUSCH

Select to send Uplink Control Information over PUSCH. Also see UCI Over PUSCH Scaling.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PUSCh:UOPusch:STATe <ON | 1 | OFF | 0>

UCI Over PUSCH Scaling

Specify the scaling factor (0.5, 0.65, 0.8 or 1.0) to limit the number of resource elements assigned to UCI on PUSCH.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PUSCh:UOPusch:SCALing <FOP5 | POP65 | POP8 | F1P0

Rate Matching Type

Select the type of rate matching applied to PUSCH (Full Buffer or Limited Buffer).

For more information, see section 6.2.5 in 3GPP TS 38.212.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PUSCh:RMTYpe <FULL | LIMited>

Tx Config

Select whether the UE uses codebook-based or non-codebook-based uplink transmissions:

- Codebook – precoding is based on network measurements and selection of uplink precoder. The network decides on an uplink transmission rank, that is, the number of layers to be transmitted, and a corresponding precoder matrix to use for the transmission.
- No Codebook – precoding is based on device measurements and precoder indications to the network.

For more information, refer to the ulTxConfig parameter in section 6.1.1 in 3GPP TS 38.214.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PUSCh:TXConfig <CODebook | NOCodebook>

Overhead

Select the overhead which indicates the number of resource elements taken into account when counting the number of available resource elements for PUSCH transmission.

For more information, refer to the Xoh-PUSCH parameter in section 6.1.4.2 in 3GPP TS 38.214.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PUSCh:OVERhead <OH0 | OH6 | OH12 | OH18>

Enable Transform Precoding

Select to enable transform precoding for PUSCH transmissions. For more information, refer to the transform-precoding-scheduled parameter in section 6.1.3 in 3GPP TS 38.214.

There are three transforming precoding tables for PDSCH and PUSCH in 3GPP TS 38.214, listed below. The tables give the Modulation Order and the MCS index range (0 to 27 or 0 to 28), configured on the Schedule tab > MCS_Index and Slot Config tab > Fixed MCS Index.

- Table 5.1.3.1-1 – applies when Transform Precoding is disabled and 64 QAM is configured (Enable 256 QAM (precoding) is not selected). The MCS index is up to 28.
- Table 5.1.3.1-2 – applies when Transform Precoding is enabled and Enable 256 QAM (precoding) is configured. The MCS index is up to 27.
- Table 6.1.4.1-1 – applies when Transform Precoding is enabled and 64 QAM is configured (Enable 256 QAM (precoding) is not selected). The MCS index is up to 27. In the Modulation Order column, the entry "q" is defined by Enable π 2 BPSK TP (below). If selected, q = 1, otherwise q = 2.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PUSCh:TPENabled <ON | 1 | OFF | 0>

MCS Table

Specify the table to use to determine the modulation scheme and code rate. Select one of 64 QAM, 256 QAM or 64 QAM Low SE.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PUSCh:MCS:TABle <Q64 | Q256 | Q64Lse>

MCS Table Transform Precoder

Specify the MCS table that the UE will use for PUSCH with transform precoding.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PUSCh:TPRecoding:MCS:TABle <Q64 | Q256 | Q64Lse>

Enable π/2 BPSK TP

Enabled if Enable Transform Precoding is selected.

Select to enable BPSK Transform Precoding. Binary Phase Shift Keying (BPSK) is a two phase modulation scheme, where the 0s and 1s in a binary message are represented by two different phase states in the carrier signal: θ = 0° for binary 1 and θ = 180° for binary 0.

In 3GPP TS 38.214 Table 6.1.4.1-1, if BPSK Transform Precoding is selected, q = 1, otherwise q = 2.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PUSCh:PITP:STATe <ON | 1 | OFF | 0>

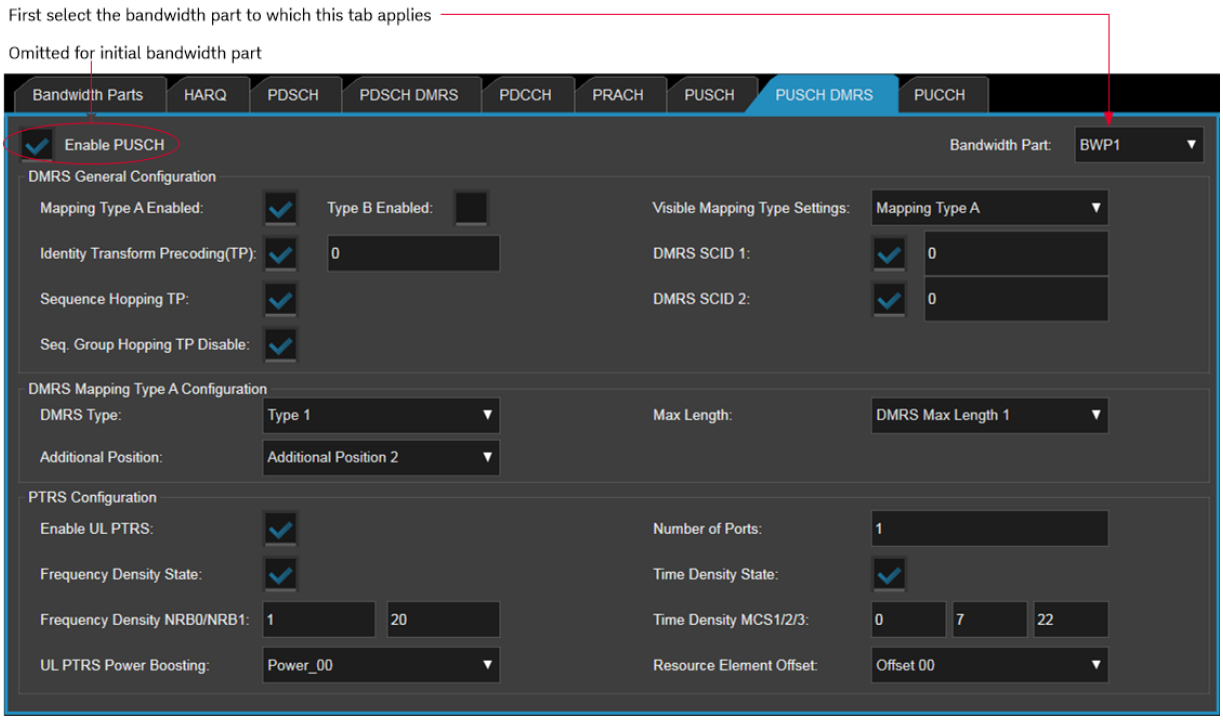
Enable π/2 BPSK Power Boost

Select to enable improved power amplifier efficiency, useful when coverage is limited.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PUSCh:OVERhead:PITBpsk:BOOSt <ON | 1 | OFF | 0>

7.5.8 PUSCH DMRS Tab

The PUSCH DMRS tab configures the demodulation reference signal (DMRS) in the Physical Uplink Shared Channel (PUSCH).



Bandwidth part

Select the bandwidth part to be configured. The drop-down list contains the initial bandwidth part and each uplink carrier bandwidth part that is **Enabled** on the NR cell's PHY > Bandwidth Part Tab.

Enable PUSCH

This field is omitted for the initial bandwidth part (PUSCH always enabled).

Select or clear this check box to enable or disable PUSCH for the selected bandwidth part.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:PUSCh:STATe <ON | 1 | OFF | 0>

7.5.8.1 DMRS General Configuration

The DMRS Configuration parameters configure the demodulation reference signal (DMRS).

Mapping Type A Enabled

Select to enable DMRS mapping type A, where the first DMRS is located in symbol 2 or 3 of the slot, and the DMRS is mapped relative to the start of the slot boundary, regardless of where in the slot the actual data transmission starts. This mapping type is primarily intended for the case where the data occupies most of a slot.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:UL:MTA:STATe <ON | 1 | OFF | 0>

Type B Enabled

Select to enable DMRS mapping type B, where the first DMRS is located in the first symbol of the data allocation, that is, the DMRS location is not given relative to the slot boundary but rather relative to where the data are located. This mapping is originally motivated by transmissions over a small fraction of the slot to support very low latency and other transmissions that benefit from not waiting until a slot boundary starts but can be used regardless of the transmission duration.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:UL:MTB:STATe <ON | 1 | OFF | 0>

Identity Transform Precoding

Specify how uplink Mapping Type A DMRS value is generated when transform precoding is used for uplink transmissions:

- Select the check box to supply a value in the range 0 to 1007.
- Clear the check box to use the Physical Cell ID (physCellId).

For more information, refer to the nPUSCH-Identity-Transform-precoding parameter in section 6.4.1.1.1.2 in 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:UL:DMRS:ITPRecoding:STATe <ON | OFF>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:UL:DMRS:ITPRecoding <0 .. 1007>

Sequence Hopping TP

Select to use sequence hopping transform precoding, where the base sequence used varies on a slot-by-slot basis, can be used to randomize the interference between different cells.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:UL:DMRS:SHTprecoding:STATe <ON | OFF>

Seq. Group Hopping TP Disable

Select disable group sequence hopping.

SCPI: BSE:CONFig:NR5G:PHY:<bwp>:UL:DMRS:SGprecoding:STATe <ON | OFF>

Visible Mapping Type Settings

Select Mapping Type A or Mapping Type B.

DMRS SCID 1 / DMRS SCID2

For mapping type A:

- Select the check box to use SCIDs (scrambling IDs), then specify the scrambling ID (0 to 65,535) parameter used when initializing the random sequence for downlink DMRS scrambling. For more information, see section 5.1in 3GPP TS 38.214.
- Clear the check box for the UE to use the Physical Cell ID (physCellId) for scrambling.

SCPI commands specifying whether SCIDs are used:

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:UL:DMRS:SCID:ONE:STATe <ON | 1 | OFF | 0>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:UL:DMRS:SCID:TWO:STATe <ON | 1 | OFF | 0>

SCPI commands specifying the SCID:

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:UL:DMRS:SCID1 <0 ... 65535>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:UL:DMRS:SCID2 <0 ... 65535>

7.5.8.2 DMRS Mapping Type A Configuration

DMRS Type

Select the DMRS type to use for uplink: Type 1 or Type 2. The types determine how the reference signals are mapped to resource elements.

For more information, refer to the UL-DMRS-config-type parameter in section 6.4.1.1.3 in 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:UL:DMRS:TYPE <TYPE1 | TYPE2>

Additional Position

Choose one of the Additional Positions 0 - 3 for an additional DMRS in the uplink, which indicates the total number and which OFDM symbols to use for UL DMRS mapping. For more information, see the *dmrs-AdditionalPosition* parameter in section 6.4.1.1.3 of 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:UL:DMRS:ADDPosition <APOS0 | APOS1 | APOS2 | APOS3>

Max Length

Specify the maximum number of OFDM symbols for uplink front loaded DMRS. The value is used to select the appropriate table for UL DMRS time mapping.

- DMRS Max Length 1
- DMRS Max Length 2

For more information, see the *maxLength* parameter in section 6.4.1.1.3 of 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:UL:DMRS:MAXLength <MLEN1 | MLEN2>

7.5.8.3 PTRS Configuration

The PTRS Configuration parameters configure the phase-tracking reference signals (PTRS).

Enable UL PTRS

Select to indicate whether the device under test is configured with the higher layer parameter Uplink-PTRS-present set to ON. The configuration for the uplink depends on whether this option is selected.

For more information, see section 6.2.3.1 in 3GPP TS 38.214.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:UL:PTRS:STATe <ON | OFF>

Frequency Density State

The array indicates the thresholds as per table 6.2.3-2 in 38.214 (v15.0.0) section 6.2.3. This parameters only apply to uplink transmission without transform precoding. Range for each threshold is (0..276).

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:UL:PTRS:FDENsity:STATe <ON | OFF>

Frequency Density NRB0/NRB1

There are two input fields for NRB0 and NRB1 respectively. S

In each field, specify a value (0 to 276) for the N_{RB0} parameter and N_{RB1} parameter that is used to determine the frequency density of the uplink PTRS as a function of the scheduled bandwidth. These parameters only applies to uplink transmissions without transform precoding. For more information, see section 6.2.3.2 in 3GPP TS 38.214.

Note: *The value of N_{RB1} must be greater than the value of N_{RB0}*

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:UL:PTRS:FDENsity:NRB0 <1 ... 276>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:UL:PTRS:FDENsity:NRB1 <1 ... 276>

UL PTRS Power Boosting

Select the power boosting value which indicates the power boosting factor per PTRS port. For more information, refer to the uplink *PTRS-Power* parameter in section 6.2.3.1 in 3GPP TS 38.214.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:UL:PTRS:PBOosting <P00 | P01 | P10 | P11>

Number Of Ports

Choose 1 or 2 as the maximum number of configured PTRS ports (1 or 2). This parameter applies to uplink transmission without transform precoding. For more information, refer to the *maxNrofPorts* parameter in section 6.2.3 in 3GPP TS 38.214.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:UL:PTRS:NUMBer:PORTs <1 | 2>

Time Density State

Select to enable the use of the higher layer timeDensity parameter that determines which parameters are used when configuring the PTRS. The time density is calculated using the Time Density MCS values (below) and Table 6.2.3.1-1 in 3GPP TS 38.214.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:UL:PTRS:TDENsity:STATe <ON | OFF>

Time Density MCS1/2/3

There are three input fields for MCS 1, 2 and 3 respectively.

In each field, specify a value (0 to 29) for the ptrs-MCS1, ptrs-MCS2 and ptrs-MCS3 parameters that determine the time density of the uplink PTRS as a function of the scheduled MCS. For more information, see Table 6.2.3.1-1 in 3GPP TS 38.214.

Note: The value of ptrs-MCS3 must be greater than ptrs-MCS2, which must be greater than ptrs-MCS1.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:UL:PTRS:TDENsity:MCS1 <0 ... 29>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:UL:PTRS:TDENsity:MCS2 <0 ... 29>

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:UL:PTRS:TDENsity:MCS3 <0 ... 29>

Resource Element Offset

Select the subcarrier offset for the uplink PTRS that is used to specify the number of PTRS ports. This parameter is used in the resource mapping of PTRS and applies to uplink transmission without transform precoding.

Choose between **Offset 00**, **01**, **10** and **11**. For more information, see Table 6.4.1.2.2.1-1 in 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:<bwp>:UL:PTRS:RELement:OFFSet <OFFS00 | OFFS01 | OFFS10 | OFFS11>

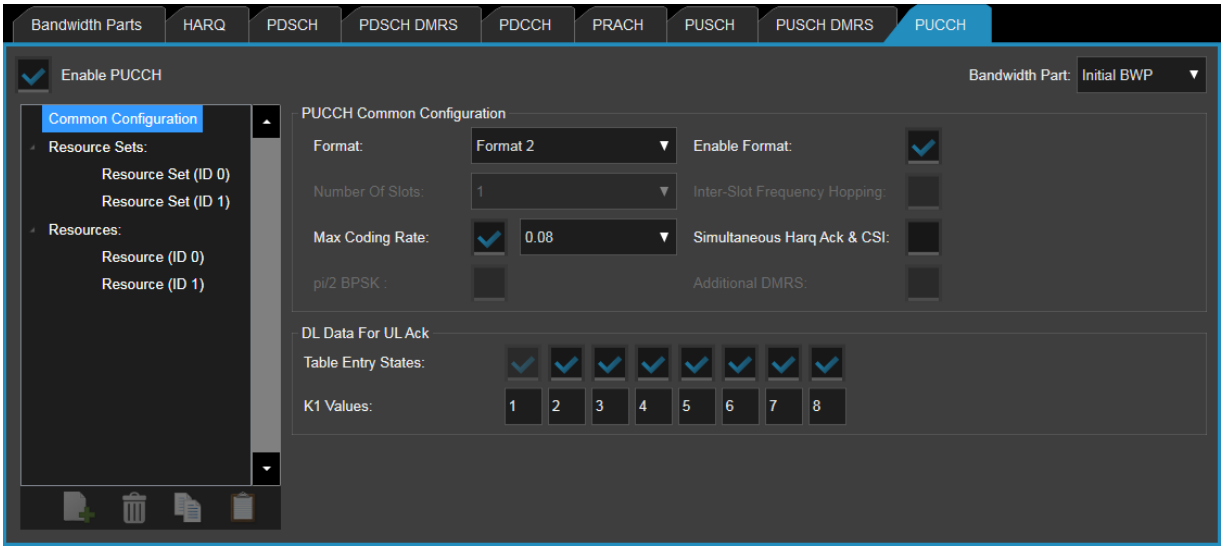
7.5.9 PUCCH Tab

Also see: PUCCH tutorial

The PUCCH tab configures the Physical Uplink Control Channel (PUCCH) for the common configuration and the up to four resource sets, each containing resource set configurations.

7.5.9.1 Common Configuration

From the left hand pane, select **Common Configuration** to configure the PUSCH Common Configuration for the cell.



Enable PUCCH

Select to enable Physical Uplink Control Channel (PUCCH).

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUCCh:STATe <ON | OFF>

DL Data For UL Ack (States)

Select to enable or disable the states (1 to 8) used for downlink data.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUCCh:<ulresourcesetid>:<pucchresourceid>:<dtua>:STATe <ON | OFF>

DL Data For UL Ack (Values)

Specify the value (0 to 15) for each state.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUCCh:<ulresourcesetid>:<pucchresourceid>:<dtua>:VALue <0 ... 15>

7.5.9.2 Resource Set Configuration

Selecting a resource set lets you configure a unique set of configuration for each resource.

To configure a resource set:

1. From the left hand pane, expand the Resource Set configuration.
2. Select the Resource to configure.
3. Modify the configuration items for the resource.

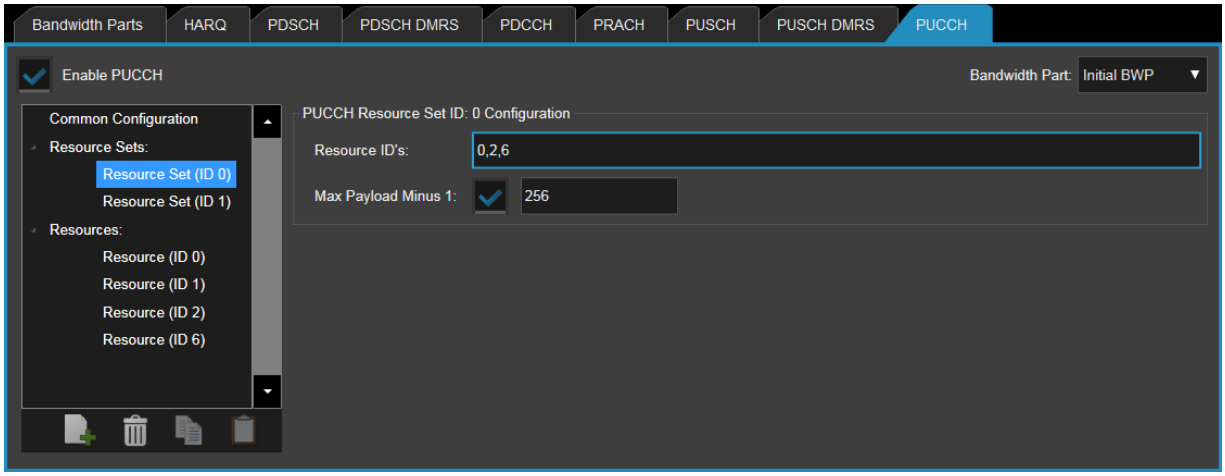
   Each resource has a unique ID in the group box heading (Resource ID 0 in the image below).
4. Repeat steps 1 - 3 for all resource configurations you want to configure.

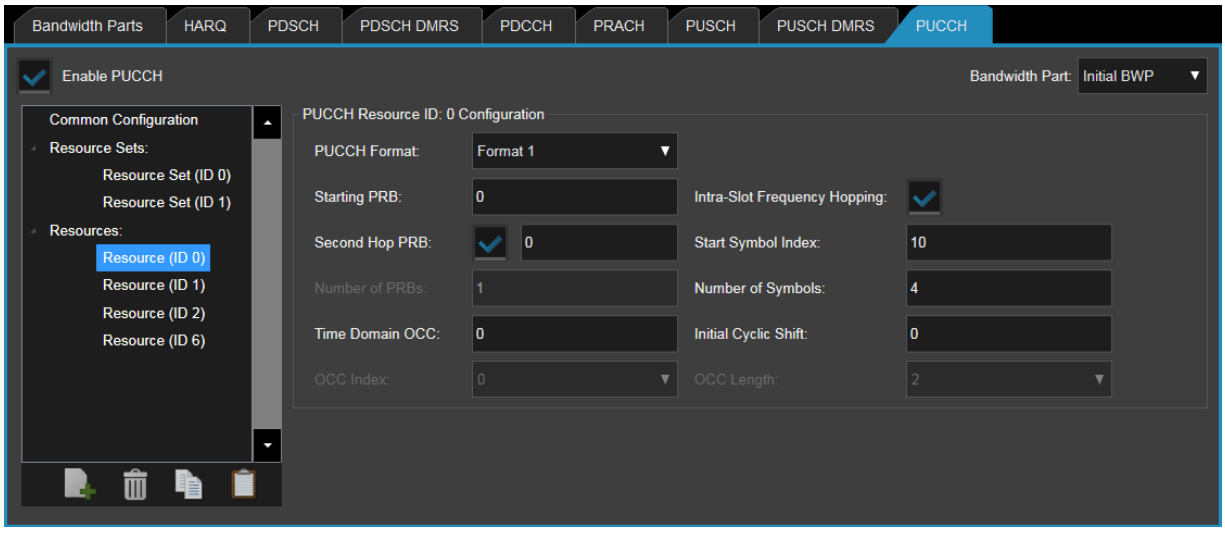
To apply a resource set configuration:

1. Select the Enable PUCCH checkbox.
2. Select the checkbox(es) for all resource sets to include.

   SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUCCh:<ulresourcesetid>:STATe <ON | OFF>
3. Select the checkbox(es) for all resource configurations to include.

   SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUCCh:<ulresourcesetid>:<pucchresourceid>:STATe <ON | OFF>
4. Click Apply.





Enable PUCCH

Select to enable Physical Uplink Control Channel (PUCCH).

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUCCh:STATe <ON | OFF>

PUCCH Format

Specify the PUCCH format for this PUCCH resource.

For more information, see section 6.3.2 in 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUCCh:<ulresourcesetid>:<pucchresourceid>:FORMat <FORM0 | FORM1 | FORM2>

Intra Slot Frequency Hopping

Select to enable group hopping and disable sequence hopping, and clear to disable group hopping and enable sequence hopping.

For more information, see sections 6.3.2.2.1 and 6.4.1.3 in 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUCCh:<ulresourcesetid>:<pucchresourceid>:FHOPping:STATe <ON | OFF>

Start Symbol Index

Specify the starting symbol index (0 to 13) which determines the starting physical resource block (PRB). For more information, see section 9.2.1 in 3GPP TS 38.213.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUCCh:<ulresourcesetid>:<pucchresourceid>:SYMBols:STARt <0 ... 13>

Initial Cyclic Shift

Only applies when using PUCCH Format 0 or 1.

Specify the index (0 to 11) of the cyclic shift for PUCCH formats 0 and 1. For more information, see section 9.2.1 in 3GPP TS 38.213.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUCCh:<ulresourcesetid>:<pucchresourceid>:ICYC:SHIFt <0 ... 11>

Number of PRBs

Only applies when using PUCCH Format 2.

Specify the number of physical resource blocks (-1 to 16).

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUCCh:<ulresourcesetid>:<pucchresourceid>:PRB:NUM <-1 ... 16>

Starting PRB

Specify the starting physical resource block (0 to 274). For more information, see section 9.2.1 in 3GPP TS 38.213.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUCCh:<ulresourcesetid>:<pucchresourceid>:PRB:STARting <0 ... 274>

Second Hop PRB

Specify the index (0 to 127) of the starting PRB for second hop in case of frequency hopping.

This value is applicable for intra-slot frequency hopping and corresponds to L1 parameter 'PUCCH-2nd-hop-PRB'. For more information, see section 9.2 in 3GPP TS 38.213.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUCCh:<ulresourcesetid>:<pucchresourceid>:FHOPping:SPRB <0 ... 127>

Number of Symbols

Displays the number of symbols (1 to 14).

Note: *This parameter applies to all PUCCH formats but the ranges vary from format to format.*

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUCCh:<ulresourcesetid>:<pucchresourceid>:SYMBols:NUM <1 ... 14>

Time Domain OCC

Only displayed when using PUCCH Format 1.

Specify the index (0 to 6) of the orthogonal cover code (OCC) to use with PUCCH format 1.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PUCCh:<ulresourcesetid>:<pucchresourceid>:OCC:TIME <0 ... 6>

OCC Index

(Not supported in this release)

OCC Length

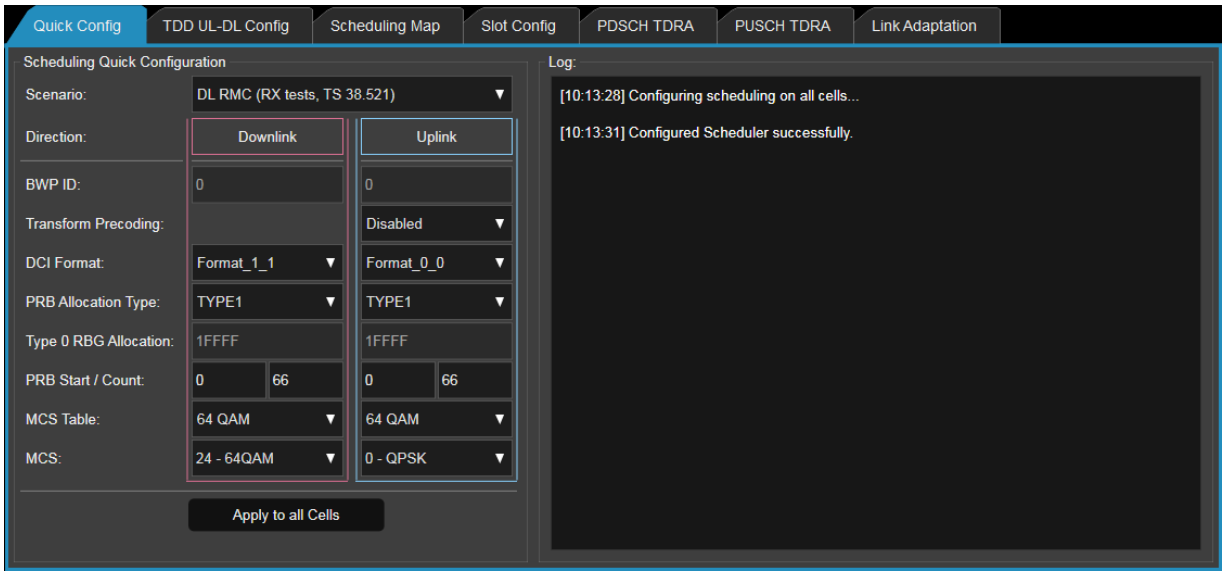
(Not supported in this release)

7.6 Scheduling Tab

7.6.1 Quick Config Tab

The Quick Config tab provides a mechanism to configure the scheduling for all cells according to scenarios defined in the 3GPP 38.521 series specifications.

*Note: You can only make changes to the fields on this tab when the cell is off, and the changes are not applied until you click **Apply to all Cells**.*



7.6.1.1 Scheduling Quick Configuration

Scenario

Select the scheduling scenario to use for testing. Choose between the configurations in the following conformance specifications:

- DL RMC (RX tests, TS 38.521) – as defined in 3GPP 38.521 series specifications.
- UL RMC (TX tests, TS 38.521) – as defined in 3GPP 38.521 series specifications.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:QCONFig:SCENario <DLRMc | ULRMc>

BWP ID

Displays the bandwidth part ID (configured on the PHY > Bandwidth Parts tab) used to configure the scheduling parameters.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:QCONFig:<direction>:BWP:INDEx <0 ... 5>

Transform Precoding

Select whether to use transform precoding in the uplink scheduling configuration. Choose between:

- Disabled – disable transform precoding.
- Enabled – enable transform precoding and disable Enable π/2 BPSK TP.
- Enabled (pi/2 BPSK) – enable transform precoding and Enable π/2 BPSK TP.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:QCONFig:UL:TRANsform:PRECoding <DISabled | ENABled | ENABPi2>

DCI Format

Select the DCI format to use for downlink (Format_1_0 or Format_1_1) and uplink (Format_0_0 or Format_0_1).

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:QCONFig:DL:DCI:FORMat <F1_0 | F1_1>

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:QCONFig:UL:DCI:FORMat <F0_0 | F0_1>

PRB Allocation Type

Select the physical resource block allocation type (TYPE0 or TYPE1) as defined on the Scheduling > Slot Config Tab.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:QCONFig:<direction>:PRB:ALLOcation:TYPE <TYPE0 | TYPE1>

Type 0 RBG Allocation

If the PRB Allocation Type is set to TYPE0, specify the hexadecimal representation of the type 0 physical resource block group allocation as defined on the Scheduling > Slot Config Tab.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:QCONFig:<direction>:RBG:ALLOcation <string>

PRB Start / Count

Specify the physical resource block start and count as defined on the Scheduling > Slot Config Tab.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:QCONFig:<direction>:STARt:PRB <0 ... 65>

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:QCONFig:<direction>:PREF:NUM:PRBs <1 ... 66>

MCS Table

Specify the downlink and uplink MCS Table values as defined on the PHY > PDSCH Tab and PHY > PUSCH Tab.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:QCONFig:<direction>:MCSTable <Q64 | Q256 | Q64Lse>

MCS

Specify the downlink and uplink MCS values as defined on the Scheduling > Slot Config Tab.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:QCONFig:<direction>:PREF:MCS <0 ... 28>

Apply to all cells button

Note: *This button is disabled when the cell is on.*

Click to apply the configuration defined by the scenario and parameters above to all cells.

SCPI: BSE:CONFig:NR5G:SCHeduling:QCONFig:APPLy:ALL

7.6.1.2 Log

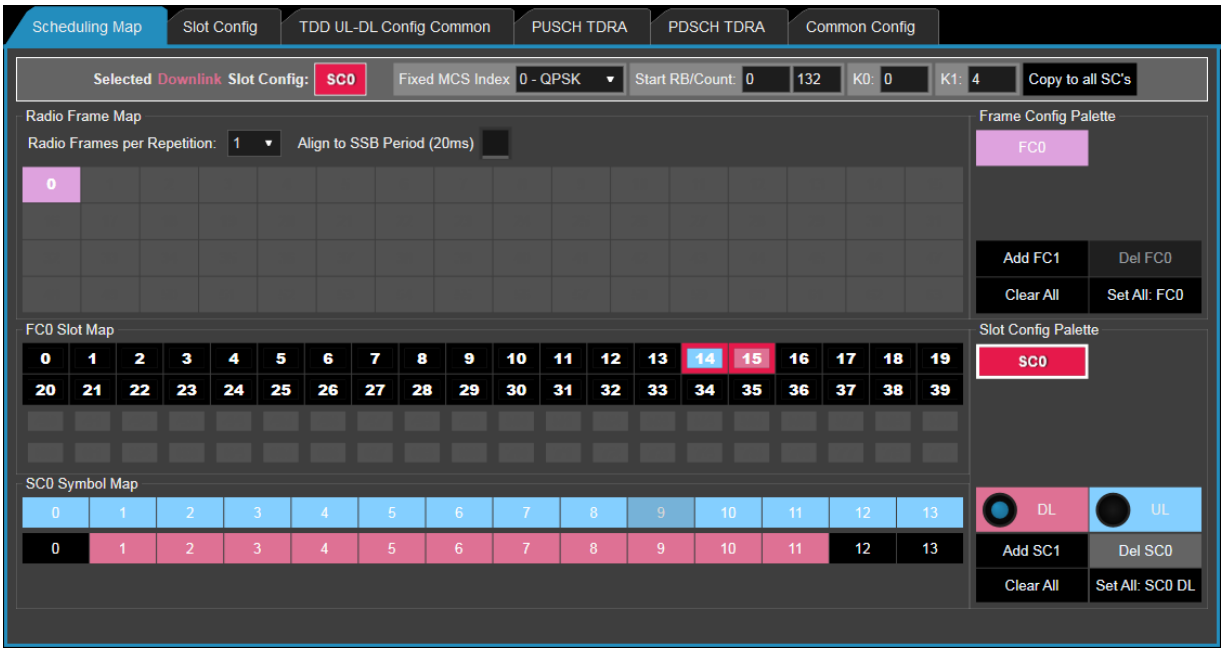
After you click Apply to all cells, this log pane displays whether Test Application successfully applied the configuration. If there were errors in the configuration, this pane lists the errors.

7.6.2 Scheduling Map Tab

Also see: Scheduling tutorial

The Scheduling Map tab configures the resource allocation for the selected cell.

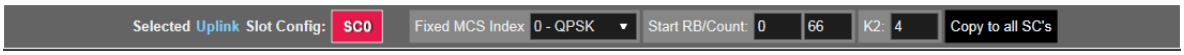
Note: *You can only modify the scheduling configuration for the primary cell.*



Shortcut Bar

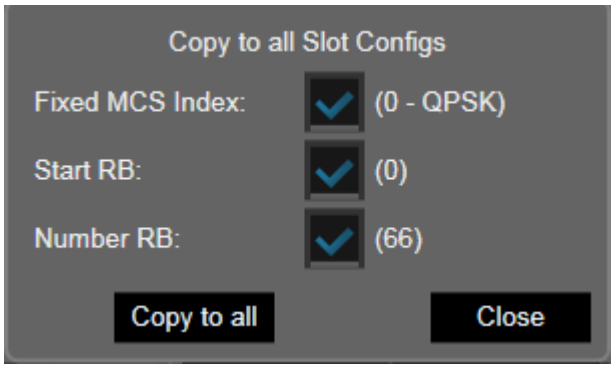
For a downlink slot:

For an uplink slot:



The shortcut bar allows you to apply the most common scheduling settings without switching between tabs, and provides the option to copy the same configuration to multiple cells simultaneously. The options are:

- Selected – displays Downlink or Uplink to reflect the DL or UL option selected in the Slot Config Palette. Use the palette to switch between downlink and uplink.
- Slot Config – displays the slot configuration (SC0, SC1 etc.) selected in the Slot Config Palette. use the palette to select a different slot configuration.
- For Downlink – the bar provides shortcuts the following fields for a downlink slot on the Slot Config tab:
  - Fixed MCS Index (*displayed when the Radio Allocation Policy is set to Fixed Resources)* or
  - Initial / Max MCS Index (*displayed when the Radio Allocation Policy is set to BLER Based Link Adaptation)*
  - Start RB / Count
  - K0 *(shortcut to the PDSCH TDRA table)*
  - K1 *(HARQ Feedback K1)*
- For Uplink – the bar provides shortcuts the following fields for a downlink slot on the Slot Config tab:
  - Fixed MCS Index
  - Start RB / Count
  - K2 *(shortcut to the PUSCH TDRA table)*
- Copy to all SC's – click to choose values that you wish to copy to all slot configurations. the following dialog opens; click check boxes for the values you wish to copy, then select Copy to all.



7.6.2.1 Frame Map

Align to SSB Period

Select to show which frames, slots and symbols will (or may) contain an SSB transmission.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:ALIGn:SSB:STATe <ON | OFF>

Apply On Connect

Select to apply the changes once connected to the cell.

SCPI: BSE:CONFig:NR5G:SCHeduling:SC:AUTo:APPLy <ON | OFF>

Number of Frames per Repetition

Select the number of frames to include in the repeating pattern that determines the frame map. Choose between 1, 2, 4, 8, 16, 32 and 64.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:FREPetition <N1 | N2 | N4 | N8 | N16 | N32 | N64>

Radio Frame Map

Select which frame configurations to use for each frame in the frame map by selecting an available frame configuration, then clicking on a frame in the frame map to which to apply the frame configuration.

Note: *The size of the frame map is limited to the Number of Frames per Repetition defined above.*

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:FMAP <0x0 ... 0xFFFFFFFFFFFFFFFF>

7.6.2.2 Frame Palette

Available configurations

Select how many frame configurations to use on the frame map.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:FC[:COUNt] <1 ... 5>

Operations

Perform actions on the frame map or number of available configurations as follows:

- Set All: FC0 – sets all frames in the frame map to the currently selected available configuration.
- Add FC2 – adds an additional frame configuration. You can specify up to five unique frame configurations.
- Delete FC1 – deletes the most recently added frame configuration.

7.6.2.3 Slot Map

Slot map

Select which slot configurations to use for each slot in the slot map, and determine whether each slot is scheduled for uplink or downlink. The length of the slot map is determined by the numerology, defined on the Cell > Config Tab, as defined in table 4.3.2-1 in 3GPP TS 38.211 (shown below).

Numerology (μ)	Subcarrier spacing (kHz)	Number of slots per frame
0	15	10
1	30	20
2	60	40
3	120	80
4	240	*Not currently supported.*
5	320	*Not currently supported.*

7.6.2.4 Slot Config Palette

Available configurations

Select how many slot configuration to use on the slot map, then select whether the slot is used for uplink or downlink transmissions.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:SCCount <1 ... 5>

Operations

Perform actions on the slot map or number of available configurations as follows:

- Set All: SC0 DL – sets all frames in the frame map to the currently selected available configuration and direction (uplink or downlink).
- Add SC2 – adds an additional slot configuration. You can specify up to five unique slot configurations.
- Delete SC1 – deletes the most recently added slot configuration.

7.6.2.5 Symbol Map

For the selected slot in the Slot Map, the Symbol Map shows:

- For an uplink slot, the start position and number of uplink symbols (coloured blue)
- For a downlink slot, the start position and number of downlink symbols (coloured pink).

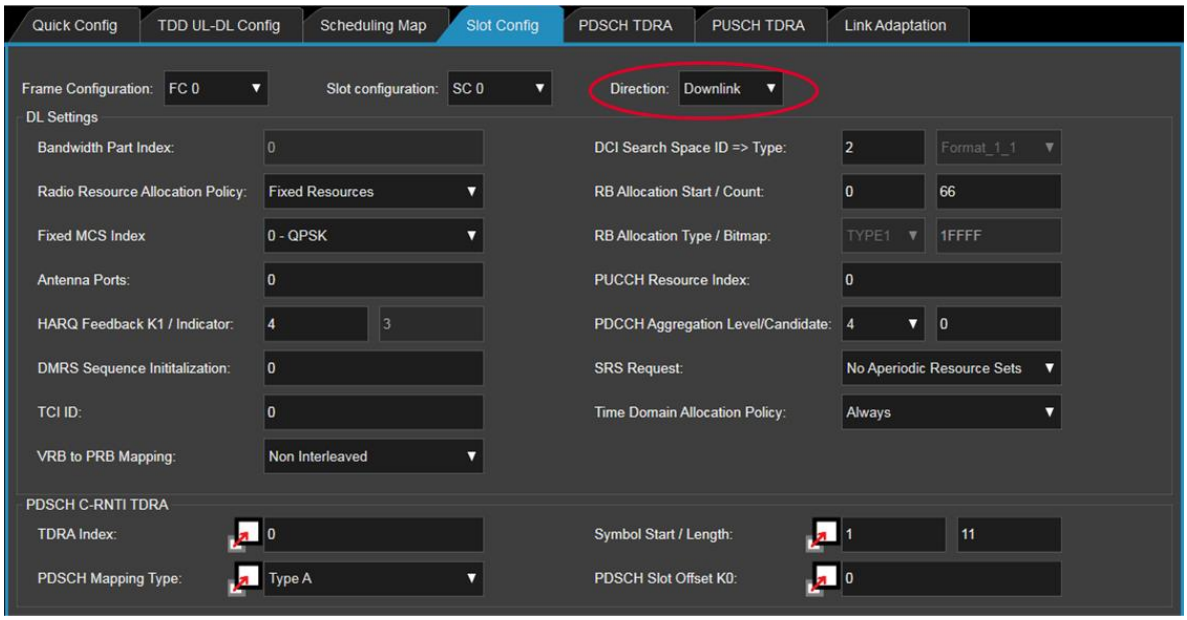
For FDD cells only, a slot can be used for both uplink and downlink.

The TDRA table for PUSCH (uplink) and PDSCH (downlink) configure the start position and number of symbols in a slot, and each slot configuration on the Scheduling > Slot tab includes the index number of one of these tables.

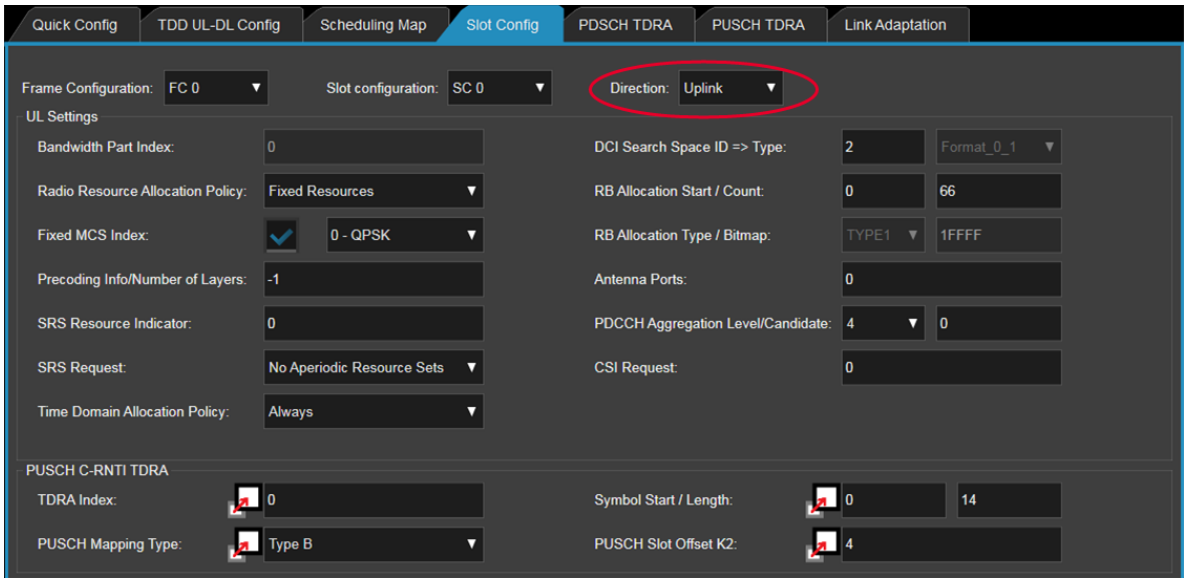
7.6.3 Slot Config Tab

The Slot Config tab defines each slot configuration (SC 0, SC 1, etc.) used in the Scheduling Map. There are different fields for downlink slots and uplink slots:

- Downlink Slot Config



- Uplink Slot Config



Frame Configuration

Select the frame configuration to edit. The drop-down list contains the frame configurations (FC 0, FC 1, etc.) added to the Frame Config Palette in the Scheduling Map. Select a frame configuration to make it the active configuration on this tab and on the Scheduling Map.

Slot configuration

Select the slot configuration, which belongs to the frame configuration selected above, to edit. The drop-down list contains the frame configurations (SC 0, SC 1, etc.) added to the Slot Config Palette in the Scheduling Map. Select a slot configuration to make it the active configuration on this tab and on the Scheduling Map.

Direction

Select whether to define the uplink or downlink configuration for the selected frame and slot configurations. The direction (Uplink or Downlink) will also be selected in the Slot Config Palette in the Scheduling Map.

7.6.3.1 DL Settings

Bandwidth Part Index

Read-only field.

Displays the DL First Active Bandwidth Part configured on the PHY > Bandwidth Part tab, which will be indicated to the UE in the associated DCI, and used for the PDSCH.

Note: 5G NR Test Application does not support changing the bandwidth part while the UE is connected. To change the bandwidth part, switch off the UE and select a different First Active Bandwidth Part on the PHY > Bandwidth Part tab. Then configure slots for the new bandwidth part and reconnect the UE.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:DL:BPINdex <-1 ... 3>

Radio Resource Allocation Policy

Select whether to configure the modulation and coding scheme (MCS) using a fixed MCS index or by means of BLER measurement:

- Fixed Resources – when using a fixed allocation, configure the Fixed MCS Index.
- BLER Based Link Adaptation – when using BLER-based allocation, configure the Initial/Max MCS Index.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:DL:RRESource:APOLicy <FIXed | BLER>

Fixed MCS Index

This field is only displayed when the Radio Allocation Policy is set to Fixed Resources.

Specify the MCS Index (0 to 28), which selects the modulation format and target code rate used for transport block size selection. Table 5.1.3.1-1 in 3GPP TS 38.214 shows the mapping of MCS index to modulation order.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:DL:IMCS:FIXed <ON | OFF>

Initial/Max MCS Index

These two fields are only displayed when the Radio Allocation Policy is set to BLER Based Link Adaptation.

When using BLER-based dynamic link adaptation to update the MCS based on uplink measurements, specify:

- The initial MCS Index (0 to 28) to use.
- The maximum allowed MCS index (0 to 28).

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:DL:IMCS <0 ... 28>

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:DL:MAXimum:IMCS <0 ... 28>

Antenna Ports

When the DCI Type is not Format_1_1, this field is disabled and set to -1.

Defines the Layer 1 parameter 'Antenna Ports' in section 7.3.1.2.2 in 3GPP TS 38.212, and indexes the tables 7.3.1.2.2-1/2/3/4 depending on the DL-DMRS-config-type and DL-DMRS-max-len parameters.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:DL:APORts <-1 ... 31>

HARQ Feedback K1 / Indicator

Specify for the DCI value:

- The actual number of slots (1 to 8) indicated by the DCI value.

  Note: For DCI Format 1_0, the PdschToHarqFbTimingIndicator to PdschToHarqFbSlotTimingK1 mapping is fixed. However, for DCI Format 1_1, it is a look-up in an RRC-configured table.

- *(Read-only field)* The timing indicator (0 to 7) included in DCI Format 1_0 or 1_1.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:DL:PDSCh:HARQ:FEEDback:TIMing:KONE <1 ... 8>

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:DL:PDSCh:HARQ:FEEDback:TIMing:INDicator <0 ... 7>

DMRS Sequence Initialization

Specify the scrambling code identifier to use for the downlink transmission.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:DL:SCID <0 ... 1>

TCI ID

Specify the TCI state (0 to 63) (identified by the TCI-StateId IE) that applies to the PDCCH control resource set identified by the Coreset ID.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:TCIid <0 ... 63>

VRB to PRB Mapping

Select whether the mapping from virtual to physical resource blocks is Interleaved or Non-Interleaved.

For more information about VRB to PRB mapping, see section 7.3.1.6 in 3GPP TS 38.211.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:DL:VRB:PRB:MAPPing <INT | NINT>

DCI Search Space ID => Type

Specify a search space ID (1 to 39) which implicitly identifies a search space type (common, UE specific) and DCI format (Format_1_0 or Format_1_1). This unique identifier for a search space is useful if you have configured multiple search spaces of the same type.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:DL:DCI:SEARch:SSID <1 ... 39>

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:DL:DCI:TYPE <F1_0 | F1_1>

RB Allocation Start / Count

Only used if the Radio Resource Allocation Policy is Fixed Resources..

Select the start (0 to 65) and length (0 to 66) of the resource block allocation as defined by the RBstart and LRBs described in sections 5.1.2 and 6.1.2 in 3GPP TS 38.213. The resource block allocation is defined within the active carrier bandwidth part.

Note: If the count is set to zero, the associated resource allocation is used only for the purposes of triggering CSI operations that result in UCI reports on PUCCH (DLResourceAllocation only) or no UCI report.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:DL:RBALlocation:FIXed:RBSTart <0 ... 272>

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:DL:RBALlocation:FIXed:RBNumber <1 ... 273>

Resource Allocation Type / Bitmap

Read-only field.

Specifies the resource block allocation type (TYPE0 or TYPE1). The bitmap value is used for TYPE0 only. For more information, see sections 5.1.2.2 and 6.1.2.2 in 3GPP TS 38.214.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:DL:RBALlocation:TYPE <Type0 | Type1>

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:DL:RBALlocation:TYPE:ZERO <0 ... 3FFFF>

PUCCH Resource Index

Specify the frequency resource index (0 to 7) to use for PUCCH for receiving HARQ feedback from the UE

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:DL:PUCCh:RINDex <0 ... 7>

PDCCH Aggregation Level / Candidate

Specification reference: section 10.1 in 3GPP TS 38.213.

In these two fields:

- Specify the number of control channel elements (CCE) aggregated for sending DCIs: 1, 2, 4, 8, or 16.
- Specify which PDCCH candidate will be used to transmit the DCI message, using the candidate index 0 to 7.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:DL:DCI:AUTO:AGGRegation:LEVel <N1 | N2 | N4 | N8 | N16>

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:DL:DCI:PCANdidate <0 ... 7>

SRS Request

When the DCI Type is not Format_1_1, this field is disabled and contains "DCI_1_1 only".

Select the Sounding Reference Signal (SRS) Request part of the DL DCI message that optionally requests aperiodic SRS messages to be sent from one of the configured groups of CSI-RS within a resource set. With an aperiodic SRS transmission, no periodicity is configured. Instead, the UE is triggered about each transmission by means of signaling in the DCI.

Choose between:

- No aperiodic SRS resource sets – no aperiodic resource sets triggered.
- Aperiodic SRS resource set(s) 1, 2 or 3 – resource trigger set to 1, 2 or 3.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:DL:SRS:REQuest <APER_OFF | APER_1 | APER_2 | APER_3>

Time Domain Allocation Policy

Select when to send MAC Padding as follows:

- Always – always sends MAC Padding.
- On MAC Indication – wait until there is data in MAC to be sent.

Sending MAC padding when there is data scheduled (and not always) reduces the power consumed by the UE. For more information, refer to the Autonomous Scheduler tutorial.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:DL:TDOMain:APOLicy <ALWays | ONMac>

TDRA Index / PDSCH Mapping Type / Symbol Start/Length / PDSCH Slot Offset K0


– indicates these fields are shortcuts.

These fields are shortcuts to the PDSCH TDRA table, allowing you to quickly select an Index and view/edit the combinations of K0, Symbol Start, Symbol Length and Type.

7.6.3.2 UL Settings

Bandwidth Part Index

Read-only field.

Displays the UL First Active Bandwidth Part configured on the PHY > Bandwidth Part tab, which will be indicated to the UE in the associated DCI, and used for the PUSCH.

Note: *5G NR Test Application does not support changing the bandwidth part while the UE is connected. To change the bandwidth part, switch off the UE and select a different First Active Bandwidth Part on the PHY > Bandwidth Part tab. Then configure slots for the new bandwidth part and reconnect the UE.*

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:UL:BPINdex <-1 ... 3>

Radio Resource Allocation Policy

This field always contains Fixed Resource, that is, the modulation and coding scheme (MCS) is configured using a fixed MCS index (specified below).

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:UL:RRESource:APOLicy <FIXed | BLER>

Fixed MCS Index

Specify the MCS Index (0 to 28), which selects the modulation format and target code rate used for transport block size selection. Table 5.1.3.1-1 in 3GPP TS 38.214 shows the mapping of MCS index to modulation order.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:UL:IMCS:FIXed <ON | OFF>

Precoding Info / Number of Layers

When the DCI Type is not Format_0_1, this field is disabled and contains "DCI_0_1 only", which in SCPI is a value of -1.

Specify the number of layers and precoding information (0 to 63) depending on the TxConfig, CodebookSubset and ULMaxRank. The range of allowed values depends on the table used in section 7.3.1.1.2 in 3GPP TS 38.212. The range varies depending which table (7.3.1.1.2-2/3/4/5) is used.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:UL:PRECodeinfo <-1 ... 63>

SRS Resource Indicator

When the DCI Type is not Format_0_1, this field is disabled and contains "DCI_0_1 only".

Specify the Sounding Reference Signal (SRS) resource indicator (0 to 63), which corresponds to the layer 1 parameter "SRS resource indicator" described in section 7.3.1.1.2 of 3GPP TS 38.212.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:UL:SRSRes <0 ... 63>

SRS Request

When the DCI Type is not Format_0_1, this field is disabled and contains "DCI_0_1 only".

Select the Sounding Reference Signal (SRS) Request part of the DL DCI message that optionally requests aperiodic SRS messages to be sent from one of the configured groups of CSI-RS within a resource set. With an aperiodic SRS transmission, no periodicity is configured. Instead, the UE is triggered about each transmission by means of signaling in the DCI.

Choose between:

- No aperiodic SRS resource sets – no aperiodic resource sets triggered.
- Aperiodic SRS resource set(s) 1, 2 or 3 – resource trigger set to 1, 2 or 3.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:UL:SRS:REQuest <APER_OFF | APER_1 | APER_2 | APER_3>

Time Domain Allocation Policy

Select when to send uplink MAC Padding as follows:

- Always – always sends MAC Padding.
- When SR/BSR Received – only give allocations when a Scheduling Request is sent by the UE.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:UL:TDOMain:APOLicy <ALWays | ONSRbsr>

DCI Search Space ID => Type

Specify a search space ID (1 to 39) which implicitly identifies a search space type (common, UE specific) and DCI format (Format_0_0 or Format_0_1). This unique identifier for a search space is useful if you have configured multiple search spaces of the same type.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:UL:DCI:SEARch:SSID <1 ... 39>

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:UL:DCI:TYPE <F0_0 | F0_1>

RB Allocation Start / Count

Select the start (0 to 65) and length (0 to 66) of the resource block allocation as defined by the RBstart and LRBs described in sections 5.1.2 and 6.1.2 in 3GPP TS 38.213. The resource block allocation is defined within the active carrier bandwidth part.

Note: If the count is set to zero, the associated resource allocation is used only for the purposes of triggering CSI operations that result in no UCI report.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:UL:RBALlocation:FIXed:RBSTart <0 ... 272>

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:UL:RBALlocation:FIXed:RBNumber <1 ... 273>

Reource Allocation Type / Bitmap

Read-only field.

Specifies the resource block allocation type (TYPE0 or TYPE1). The bitmap value is used for TYPE0 only. For more information, see sections 5.1.2.2 and 6.1.2.2 in 3GPP TS 38.214.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:UL:RBALlocation:TYPE <Type0 | Type1>

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:UL:RBALlocation:TYPE:ZERO <0 ... 3FFFF>

Antenna Ports

When the DCI Type is not Format_0_1, this field is disabled and contains "DCI_0_1 only".

Defines the number of Layer 1 parameter 'Antenna Ports' (0 to 31) in section 7.3.1.1.2 in 3GPP TS 38.212, and indexes the tables 7.3.1.1.2-6/.../23 depending on the TransformPrecoding, UL-DMRS-config-type, UL-DMRS-max-length and srs-usage paramteers.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:UL:APORts <-1 ... 31>

PDCCH Aggregation Level / Candidate

Specification reference: section 10.1 in 3GPP TS 38.213.

In these two fields:

- Specify the number of control channel elements (CCE) aggregated for sending DCIs: 1, 2, 4, 8, or 16.
- Specify which PDCCH candidate will be used to transmit the DCI message, using the candidate index 0 to 7.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:UL:DCI:AUTO:AGGRegation:LEVel <N1 | N2 | N4 | N8 | N16>

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:UL:DCI:PCANdidate <0 ... 7>

CSI Request

Specify a value (0 to 63) for the index of the RRC IE aperiodicTriggerStateList on CSI-MeasConfig. The value provides information on the CSI request and CSI-RS resources as follows:

- A value of 0 indicates that there is no CSI request.
- A value greater than 0 (1 - 63) with an associated report_trigger_size = 0 on the latest received configuration of CSI_Meas_Config_Content, indicates that there is no CSI request with independence of the value of CSI request.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:<fc>:<sc>:UL:CSI:REQuest <0 ... 63>

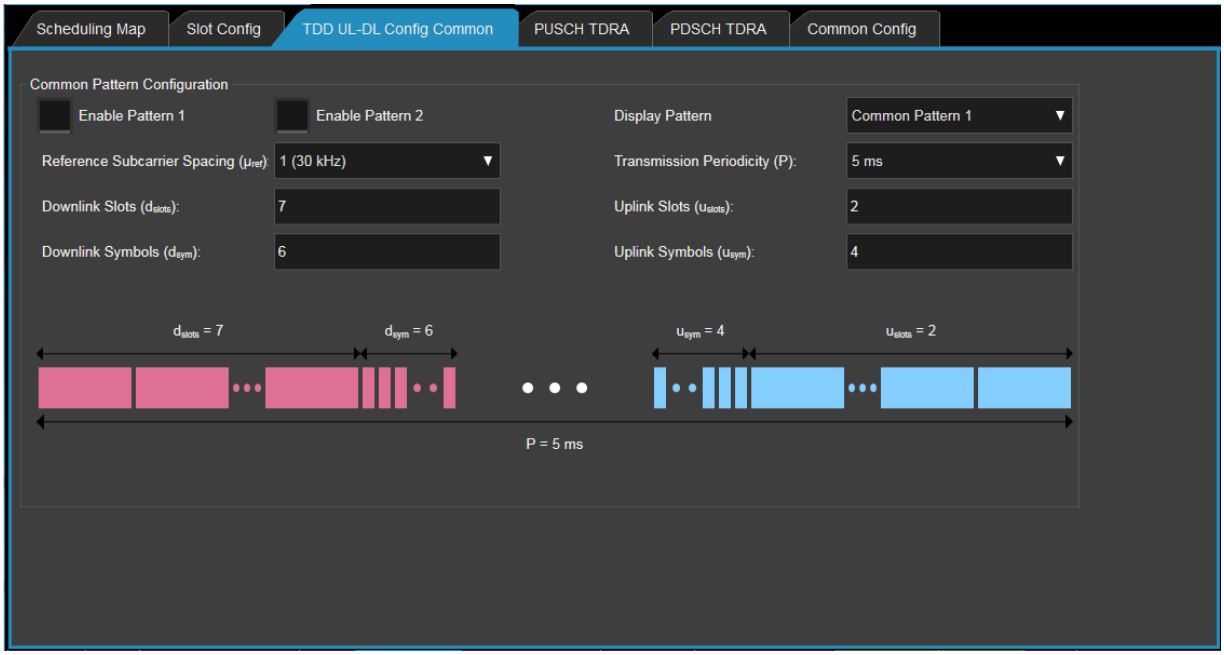
TDRA Index / PUSCH Mapping Type / Symbol Start/Length / PUSCH Slot Offset K2

 – indicates these fields are shortcuts.

These fields are shortcuts to the PUSCH TDRA table, allowing you to quickly select an Index and view/edit the combinations of K2, Symbol Start, Symbol Length and Type.

7.6.4 TDD UL-DL Config Common Tab

The TDD UL-DL Config Common Tab configures the TDD uplink-downlink pattern that determines when the cell transmits and receives data.



7.6.4.1 Pattern 1 Configuration

Enable

Select to enable configuration of the uplink/downlink TDD pattern.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:TDDPATtern:STATE <ON | OFF>

Reference Subcarrier Spacing (μ_{ref})

Select the reference subcarrier spacing that determines the time domain boundaries in the UL-DL pattern which must be common across all subcarrier-specific virtual carriers.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:TDDPATtern:SUBCarrier:SPACing <MU0 | MU1 | MU2 | MU3>

Downlink Slots (d_{slots})

Specify the number of consecutive full DL slots from the start of the UL-DL period.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:TDDPATtern:DLSLots <0 ... 160>

Downlink Symbols (d_{sym})

Specify the number of consecutive DL symbols in the beginning of the slot following the last full DL slot.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:TDDPATtern:DLSYmbols <0 ... 14>

Transmission Periodicity (P)

Select the periodicity (0.5, 0.625, 1, 1.25, 2, 2.5, 5 or 10 ms) of the uplink-downlink pattern.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:TDDPATtern:PERiod <MS0P5 | MS0P625 | MS1 | MS1P25 | MS2 | MS2P5 | MS5 | MS10>

Uplink Slots (u_{slots})

Specify the number of consecutive full UL slots from the end of the UL-DL period.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:TDDPATtern:ULSLots <0 ... 160>

Uplink Symbols (u_{sym})

Specify the number of consecutive UL symbols in the end of the slot preceding the first full UL slot.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:TDDPATtern:ULSYmbols <0 ... 14>

7.6.5 PUSCH TDRA Tab

Specification reference: 3GPP TS 38.214 section 6.1.2.1.

The Scheduling > Physical Uplink Shared Channel (PUSCH) Time Domain Resource Allocation (TDRA) tab defines the table for uplink scheduling grants. There is a shortcut to this table on the Slot Configuration tab and in the Shortcut bar at the top of the Scheduling Map.

Common Table / Dedicated Table

Select which table you wish to configure:

- Common table – used for the RACH procedure (no dedicated uplink channel).
- Dedicated table – used when the RACH is complete and the device is connected.
- BWP check box – *(dedicated table only)*. By default, selects the PHY > Bandwidth Parts UL First Active Bandwidth Part. You can configure a dedicated table for a different bandwidth part; the drop-down list contains the Enabled uplink bandwidth parts on the PHY > Bandwidth Parts tab.

  Note: 5G NR Test Application does not support changing bandwidth parts when the UE is connected, To change the active bandwidth part, switch off the UE, change the value of UL First Active Bandwidth Part, then reconnect the UE.

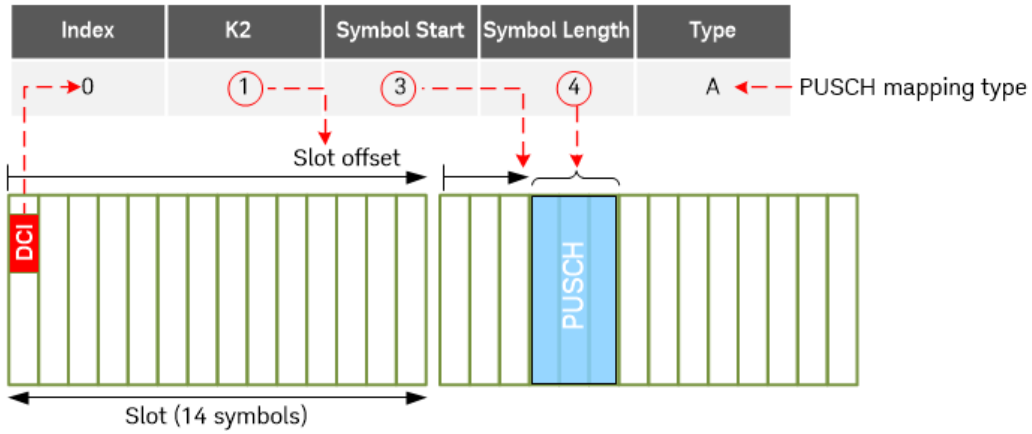
Number of Entries

Select a number of entries in the PUSCH TDRA table, in the range 0 to 16 entries.

SCPI: BSE:CONFig:NR5G:<cell>:PUSCH:TDRA:COMMon:TABLe:SIZE <0 ... 16> – for the common table.

SCPI: BSE:CONFig:NR5G:<cell>:PUSCH:TDRA:DEDicated:<bwp>:TABLe:SIZE <0 ... 16> – for the dedicated table.

PUSCH TDRA table



Index

Each table entry has an index number that can be selected for an uplink slot on the Slot Configuration tab and in the Shortcut bar at the top of the Scheduling Map.

K2

Specify the slot offset (a delay of 0 to 38 slots), from the slot in which DCI was obtained to the slot in which data is transmitted on the uplink channel. Typically, the uplink delay will be larger than the downlink delay because of the need to schedule uplink transmissions further into the future.

SCPI: BSE:CONFig:NR5G:<cell>:PUSCH:TDRA:COMMon:TABLe:<tdraIndex>:K2 <0 ... 38> – for the common table.

SCPI: BSE:CONFig:NR5G:<cell>:PUSCH:TDRA:DEDicated:<bwp>:TABLe:<tdraIndex>:K2 <0 ... 38> – for the dedicated table.

Symbol Start

This parameter is shown diagrammatically for uplink symbols (coloured blue) in the Symbol Map on the Scheduling Map tab. The symbols will start in the Symbol Start position for the PUSCH TDRA table entry selected in the K2 field of the Scheduling Map shortcut bar.

For the slot selected by K2, specify the first symbol (in the range 0 to 13) in which the data is transmitted. The combination of symbol start and symbol length must fit within one slot, that is, Symbol Start + Symbol Length <= 14.

SCPI: BSE:CONFig:NR5G:<cell>:PUSCH:TDRA:COMMon:TABLe:<tdraIndex>:SSTart <0 ... 13> – for the common table.

SCPI: BSE:CONFig:NR5G:<cell>:PUSCH:TDRA:DEDicated:<bwp>:TABLe:<tdraIndex>:SSTart <0 ... 13> – for the dedicated table.

Symbol Length

This parameter is reflected in the number of uplink symbols (coloured blue) in the Symbol Map on the Scheduling Map tab for the PUSCH TDRA table entry selected in the K2 field of the Scheduling Map shortcut bar.

Specify the duration of the transmission (the number of symbols 0 to 13). The combination of symbol start and symbol length must fit within one slot, that is, Symbol Start + Symbol Length <= 14.

SCPI: BSE:CONFig:NR5G:<cell>:PUSCH:TDRA:COMMon:TABLe:<tdraIndex>:SLENgth <0 ... 13> – for the common table.

SCPI: BSE:CONFig:NR5G:<cell>:PUSCH:TDRA:DEDicated:<bwp>:TABLe:<tdraIndex>:SLENgth <0 ... 13> – for the dedicated table.

Type

Applies to the SLIV (Start and Length Indicator Value) values in Table 6.1.2.1-1 in 3GPP TS 38.214.

Select the PUSCH mapping type, Type A or Type B. If Type A, the symbol length cannot be less than 4.

SCPI: BSE:CONFig:NR5G:<cell>:PUSCH:TDRA:COMMon:TABLe:<tdraIndex>:MTYPe <TYPE_A | TYPE_B> – for the common table.

SCPI: BSE:CONFig:NR5G:<cell>:PUSCH:TDRA:DEDicated:<bwp>:TABLe:<tdraIndex>:MTYPe <TYPE_A | TYPE_B> – for the dedicated table.

Index used

Read-only field.

Contains Yes for table entries that are selected in the TDRA Index field for uplink slot configurations defined on the Slot Config tab. For unused entries, this field contains No.

Preset

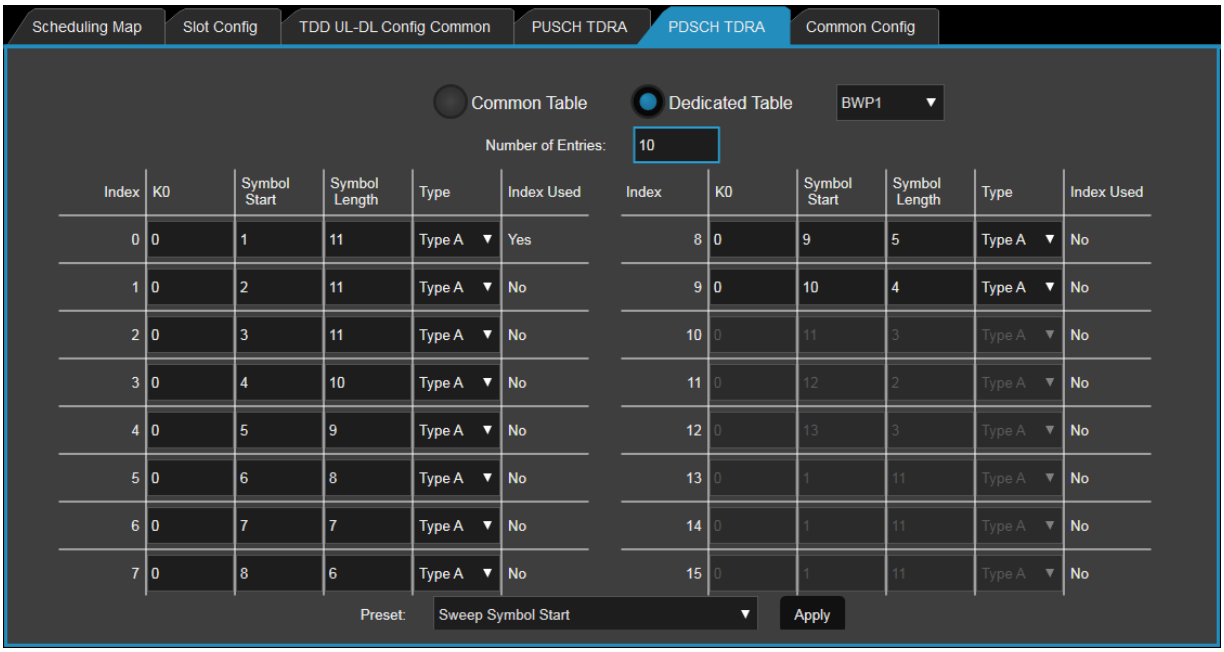
There are two presets for quickly populating the PUSCH TDRA table, allowing you to go through the various combinations of SLIV (Start and Length Indicator Value) in the TDRA Index on the Scheduling > Slot Config tab.

To use a preset, select Sweep Symbol Start or Sweep Symbol Start With Max Length, then click Apply,

7.6.6 PDSCH TDRA Tab

Specification reference: 3GPP TS 38.214 section 5.1.2.1.

The Scheduling > Physical Downlink Shared Channel (PDSCH) Time Domain Resource Allocation (TDRA) tab defines the table for downlink scheduling grants. There is a shortcut to this table on the Slot Configuration tab and in the Shortcut bar at the top of the Scheduling Map.



Common Table / Dedicated Table

Select which table you wish to configure:

- Common table – used for the RACH procedure (no dedicated uplink channel).
- Dedicated table – used when the RACH is complete and the device is connected.
- BWP check box – *(dedicated table only)*. By default, selects the PHY > Bandwidth Parts DL First Active Bandwidth Part. You can configure a dedicated table for a different bandwidth part; the drop-down list contains the Enabled downlink bandwidth parts on the PHY > Bandwidth Parts tab.

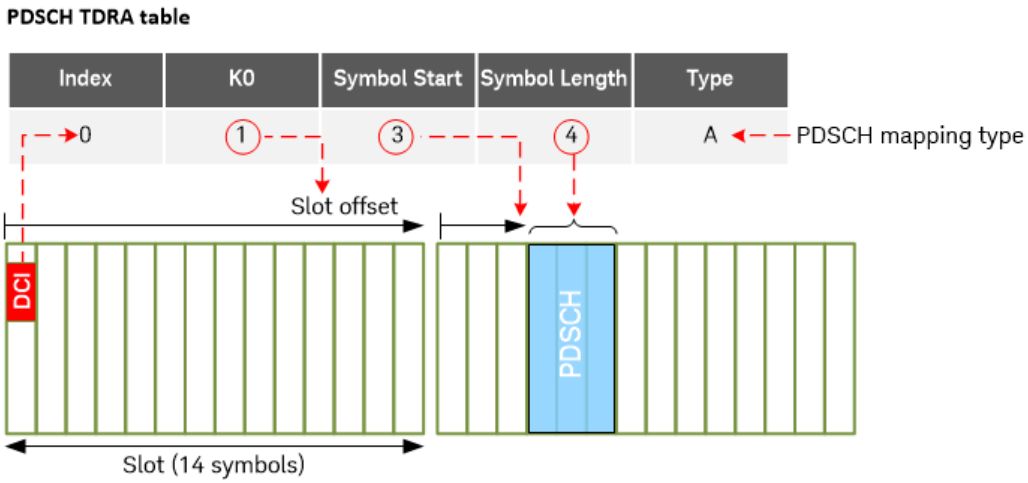
  Note: 5G NR Test Application does not support changing bandwidth parts when the UE is connected, To change the active bandwidth part, switch off the UE, change the value of DL First Active Bandwidth Part, then reconnect the UE.

Number of Entries

Select a number of entries in the PDSCH TDRA table, in the range 0 to 16 entries.

SCPI: BSE:CONFig:NR5G:<cell>:PDSCH:TDRA:COMMon:TABLe:SIZE <0 ... 16> – for the common table.

SCPI: BSE:CONFig:NR5G:<cell>:PDSCH:TDRA:DEDicated:<bwp>:TABLe:SIZE <0 ... 16> – for the dedicated table.



Index

Each table entry has an index number that can be selected for a downlink slot on the Slot Configuration tab and in the Shortcut bar at the top of the Scheduling Map.

K0

Specify the slot offset (a delay of 0 to 38 slots), from the slot in which DCI was obtained to the slot in which data is transmitted on the downlink channel.

SCPI: BSE:CONFig:NR5G:<cell>:PDSCH:TDRA:COMMon:TABLe:<tdraIndex>:K0 <0 ... 38> – for the common table.

SCPI: BSE:CONFig:NR5G:<cell>:PDSCH:TDRA:DEDicated:<bwp>:TABLe:<tdraIndex>:K0 <0 ... 38> – for the dedicated table.

Symbol Start

This parameter is shown diagrammatically for downlink symbols (coloured pink) in the Symbol Map on the Scheduling Map tab. The symbols will start in the Symbol Start position for the PDSCH TDRA table entry selected in the K0 field of the Scheduling Map shortcut bar.

For the slot selected by K0, specify the first symbol (in the range 0 to 13) in which the data is transmitted. The combination of symbol start and symbol length must fit within one slot, that is, Symbol Start + Symbol Length <= 14.

SCPI: BSE:CONFig:NR5G:<cell>:PDSCH:TDRA:COMMon:TABLe:<tdraIndex>:SSTart <0 ... 13> – for the common table.

SCPI: BSE:CONFig:NR5G:<cell>:PDSCH:TDRA:DEDicated:<bwp>:TABLe:<tdraIndex>:SSTart <0 ... 13> – for the dedicated table.

Symbol Length

This parameter is reflected in the number of downlink symbols (coloured pink) in the Symbol Map on the Scheduling Map tab for the PDSCH TDRA table entry selected in the K0 field of the Scheduling Map shortcut bar.

Specify the duration of the transmission (the number of symbols 0 to 13). The combination of symbol start and symbol length must fit within one slot, that is, Symbol Start + Symbol Length <= 14.

SCPI: BSE:CONFig:NR5G:<cell>:PDSCH:TDRA:COMMon:TABLe:<tdraIndex>:SLENgth <0 ... 13> – for the common table.

SCPI: BSE:CONFig:NR5G:<cell>:PDSCH:TDRA:DEDicated:<bwp>:TABLe:<tdraIndex>:SLENgth <0 ... 13> – for the dedicated table.

Type

Applies to the SLIV (Start and Length Indicator Value) values in Table 5.1.2.1-1 in 3GPP TS 38.214.

Select the PDSCH mapping type, **Type A** or **Type B**. If Type A, the symbol length cannot be less than 3.

SCPI: BSE:CONFig:NR5G:<cell>:PDSCH:TDRA:COMMon:TABLe:<tdraIndex>:MTYPe <TYPE_A | TYPE_B> – for the common table.

SCPI: BSE:CONFig:NR5G:<cell>:PDSCH:TDRA:DEDicated:<bwp>:TABLe:<tdraIndex>:MTYPe <TYPE_A | TYPE_B> – for the dedicated table.

Index used

Read-only field.

Contains **Yes** for table entries that are selected in the TDRA Index field for downlink slot configurations defined on the Slot Config tab. For unused entries, this field contains **No**.

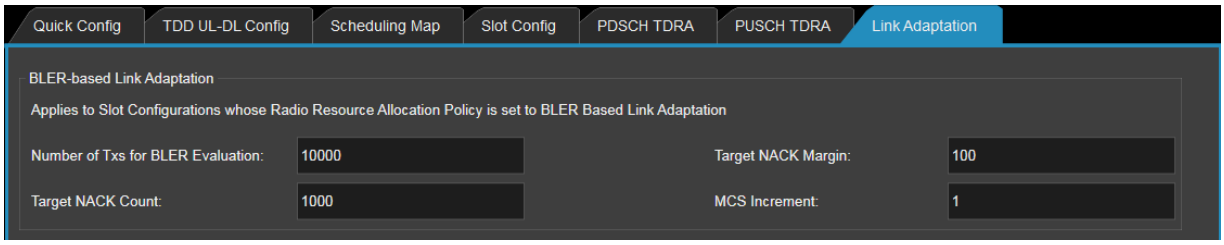
Presets

There are two presets for quickly populating the PDSCH TDRA table, allowing you to go through the various combinations of SLIV (Start and Length Indicator Value) in the TDRA Index on the Scheduling > Slot Config tab.

To use a preset, select **Sweep Symbol Start** or **Sweep Symbol Start With Max Length**, then click **Apply**,

7.6.7 Link Adaptation Tab

The Link Adaptation Tab applies to downlink slots when the Radio Allocation Policy is set to BLER Based Link Adaptation.



BLER Based Link Adaptation modifies the MCS value based on the reported number of NACKs received from the device under test.

Number of Txs for BLER Evaluation

Specify the number of transmissions (0 to 10000) to evaluate when determining the value of the BLER used to decide whether the MCS index should be increased.

SCPI: BSE:CONFig:NR5G:<cell>:MAC:LADaptation:NTX:BEValuation <1 ... 10000>

Target NACK Count

Specify the target number of NACKs (0 to 10000) received every Number of Transmissions for BLER Evaluation (above) that will trigger a change in the value of the MCS index. The target is also modified by the Target ACK margin field below to account for hysteresis.

Note: *The value must be less than the value of the Number of Transmissions for BLER Evaluation field (above).*

SCPI: BSE:CONFig:NR5G:<cell>:MAC:LADaptation:NTX:TARGet:NACK:COUNt <0 ... 10000>

Target NACK Margin

Specify the number of NACKs (0 to 10000) to use as a margin for the Target NACK Count (above) to account for hysteresis.

Note: The value must be less than the value of the Number of Transmissions for BLER Evaluation field (above).

SCPI: BSE:CONFig:NR5G:<cell>:MAC:LADaptation:NTX:TARGet:NACK:MARGin <0 ... 10000>

Size of MCS increment

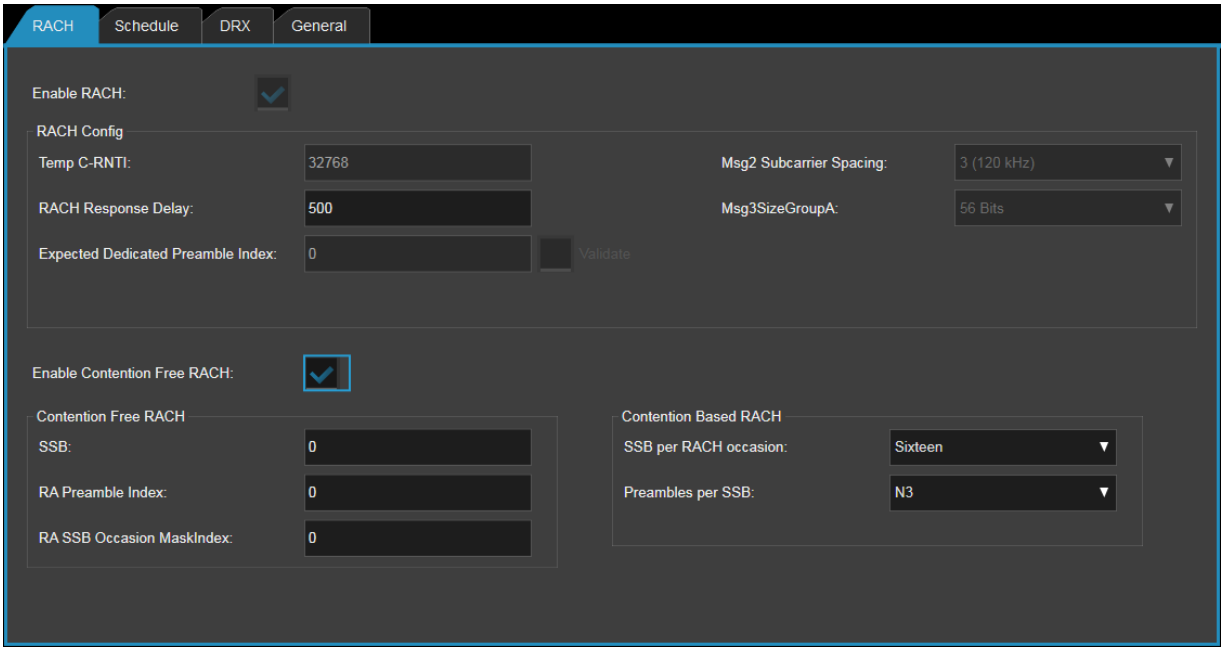
Specify the increase (1 to 28) in MCS value to apply when the number of NACKs received is above the target margin.

SCPI: BSE:CONFig:NR5G:<cell>:MAC:LADaptation:MCS:INCRement <1 ... 28>

7.7 MAC/RLC/PDCP Tab

7.7.1 RACH Tab

The RACH tab configures how the cell handles RACH indications from the UE and any subsequent Contention Resolution procedures.



Enable RACH

Select to enable the random access channel.

SCPI: BSE:CONFig:NR5G:<cell>:MAC:RACH:IGNore <ON | OFF>

7.7.1.1 RACH Config

Temp C-RNTI

Allocates a temporary identification number (1 to 65519) to the UE during the random access procedure. For more information, see section 7.1 in 3GPP TS 38.321.

Note: Changing this value also updates the C-RNTI parameters on the Cell > Identities tab.

SCPI: BSE:CONFig:NR5G:<cell>:CRNTi <1 ... 65519>

Rach Response Delay

Specifies the minimum delay (0 to 100,000) in microseconds from the end of the preamble reception to Random Access Response transmission. A queued preamble will stay in the queue for at least this time before it is transmitted.

SCPI: BSE:CONFig:NR5G:<cell>:MAC:RACH:RDELay <0 ... 100000>

Expected Dedicated Preamble Index

Specifies the value of the expected dedicated preamble index.

For more information, see RACH-ConfigDedicated in section 6.3.2 in 3GPP TS 38.331.

Msg2 Subcarrier Spacing

Note: *The available values depend on the subcarrier spacing defined on the Cell > Config tab.*

Specify the subcarrier spacing (numerology) used for Msg2 (NR PUSCH RA Response).

SCPI: BSE:CONFig:NR5G:<cell>:PHY:MAC:RACH:MSG2:SUBCarrier:SPACing <MU0 | MU1 | MU2 | MU3 | MU4>

Msg3 Size Group A

Specifies the threshold that the UE uses to choose preamble group A (0, 56, 144, 208, 256, 282, 480, 640, 800 or 1000 bits). There are two groups, A and B, and the chosen group indicates to the gNB what size of initial grants it should give to the UE. Group A indicates the UE has little data or not good radio conditions (small grants), and group B indicates that the UE has a larger amount of data and good radio conditions (bigger grants).

If a group B preamble is used by the UE, the gNB attempts to schedule a Msg3 (RRC Connection Request) of at least this size.

A value of zero indicates that this parameter is not configured.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:MAC:RACH:MSG3:GASize <SZ56 | SZ144 | SZ208 | SZ256 | SZ282 | SZ480 | SZ640 | SZ800 | SZ1000>

Enable Contention Free RACH

Select this check box to instruct the UE to send a contention free RACH (one in which the gNB informs the UE which preamble signature to use). Supply the RACH details in the Contention Free RACH fields (below).

SCPI: BSE:CONFig:NR5G:<cell>:MAC:RACH:CFRA:ENABle <ON | 1 | OFF | 0>

7.7.1.2 Contention Free RACH

SSB

Specify the SSB index, which identifies an SS-Block within an SS-Burst.

SCPI: BSE:CONFig:NR5G:<cell>:MAC:RACH:CFRA:SSB:INDex <0 ... 63>

RA Preamble Index

Specify the preamble index that the UE should use when performing contention free RACH upon selecting the candidate beams identified by this SSB

SCPI: BSE:CONFig:NR5G:<cell>:MAC:RACH:CFRA:SSB:PREamble:INDex <0 ... 63>

RA SSB Occasion MaskIndex

This index defines PRACH occasion(s) associated with an SSB in which the MAC entity may transmit a Random Access Preamble.

For more information, see section 5.17 in 3GPP TS 38.321.

SCPI: BSE:CONFig:NR5G:<cell>:MAC:RACH:CFRA:SSB:OCCasion:INDex <0 ...15>

7.7.1.3 Contention Based RACH

SSB per RACH occasion

Select the number of Synchronization Signal Blocks (SSB) per RACH occasion, where:

- OneEighth – corresponds to one SSB per 8 RACH occasions.
- OneFourth – corresponds to one SSB associated with 4 RACH occasions, and so on.

SCPI: BSE:CONFig:NR5G:<cell>:MAC:RACH:CBRA:SSB:NUMber <OneEighth | OneFourth | OneHalf | One | Two | Four | Eight | Sixteen>

Preambles Per SSB

Select the number of contention-based preambles per Synchronization Signal Blocks (SSB).

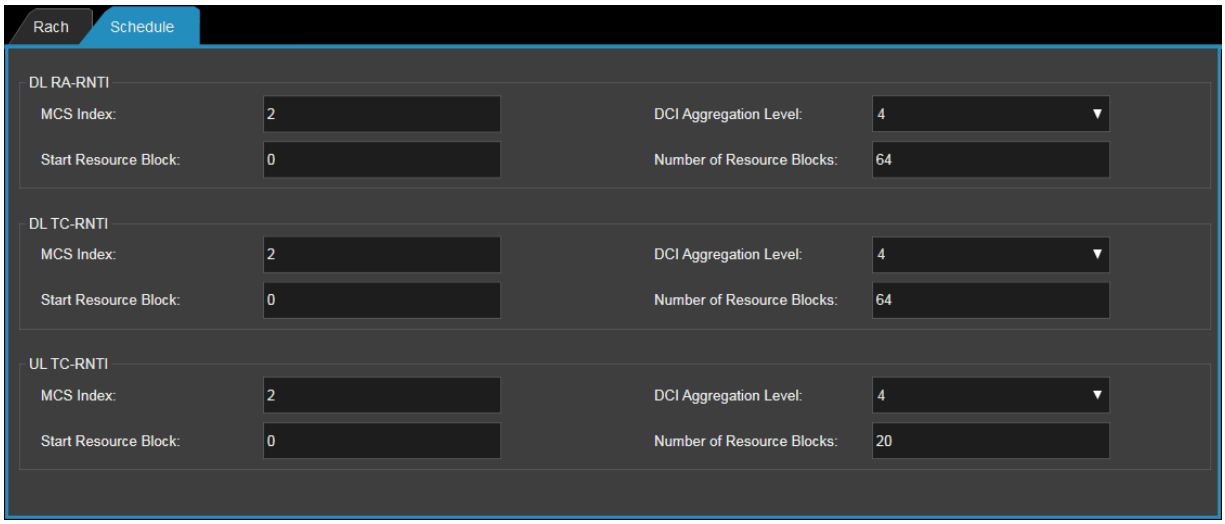
- N4 – corresponds to 4 contention-based preambles per SSB.
- N8 – corresponds to 8 contention-based preambles per SSB, and so on.

This value defines the range of preamble IDs reserved for contention-based RACH. The values chosen for contention-free RACH are outside that range.

SCPI: BSE:CONFig:NR5G:<cell>:MAC:RACH:CBRA:SSB:Preambles:NUMber <N1 | N2 | N3 | N4 | N5 | N6 | N7 | N8 | N9 | N10 | N11 | N12 | N13 | N14 | N15 | N16 | N20 | N24 | N28 | N32 | N36 | N40 | N44 | N48 | N52 | N56 | N60 | N64

7.7.2 Schedule Tab

The Schedule tab configures the radio network temporary identifiers (RNTI).



7.7.2.1 DL RA-RNTI / DL TC-RNTI / UL TC-RNTI

MCS Index

Select the MCS Index (0 to 28), which selects the modulation format and TBS Index used for a transport block. The TBS index is then used to look up the transport block size.

For more information about the MCS Index, see section 7.1.7.1 in 3GPP TS 38.213.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:RARNti:DL:IMCS <0 ... 28>

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:TCRNti:DL:IMCS <0 ... 28>

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:TCRNti:UL:IMCS <0 ... 28>

Start Resource Block

Specify the index of the starting resource block:

- 0 to 50 (DL RA-RNTI)
- 0 to 65 (DL TC-RNTI and UL TC-RNTI)

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:RARNti:DL:RBALlocation:RBSTart <0 ... 274>

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:TCRNti:DL:RBALlocation:RBSTart <0 ... 274>

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:TCRNti:UL:RBALlocation:RBSTart <0 ... 274>

DCI Aggregation Level

Specify the aggregation level: 1, 2, 4, 8 or 16.

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:RARNti:DL:AGGRegation:LEVel <N1 | N2 | N4 | N8 | N16>

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:TCRNti:DL:AGGRegation:LEVel <N1 | N2 | N4 | N8 | N16>

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:TCRNti:UL:AGGRegation:LEVel <N1 | N2 | N4 | N8 | N16>

Number of Resource Blocks

Specify the number of resource blocks: 1 to (66 - Start Resource Block).

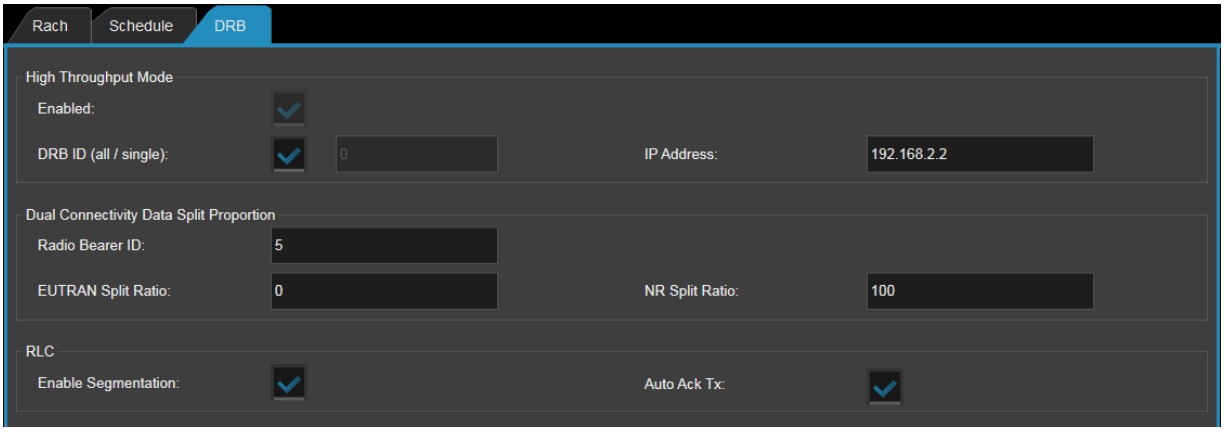
SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:RARNti:DL:RBALlocation:RBNumber <0 ... 275>

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:TCRNti:DL:RBALlocation:RBNumber <0 ... 275>

SCPI: BSE:CONFig:NR5G:<cell>:SCHeduling:TCRNti:UL:RBALlocation:RBNumber <0 ... 275>

7.7.3 DRB Tab

The DRB tab configures data radio bearer functionality including high data throughput mode, split bearers and segmentation at RLC layer.



7.7.3.1 High Throughput Mode

Enabled

Select to enable high throughput DRB mode in PDCP and RLC layers which causes reception of IP data directly into PDCP without using SDU (service data unit) SAPs (service access points).

Note: When enabled, the following features are not supported: Data forwarding on Handover and retransmission of unacknowledged RLC AM SDUs on PDCP Status Report and PDCP re-establishment.

DRB ID (all / single)

Select the checkbox to use high data throughput mode for all data radio bearers, or clear the checkbox and specify the specific data radio bearer for which to use high data throughput mode.

SCPI: BSE:CONFig:NR5G:<cell>:HTM:ADRBs <ON | OFF>

If the checkbox is cleared, specify a unique identifier for the data radio bearer (DRB), as defined by the DRB-Identity RRC IE defined in section 6.3.2 in 3GPP TS 38.331.

SCPI: BSE:CONFig:NR5G:<cell>:HTM:DRBid <0 ... 15>

IP Address

Specify the IP address to use in high data throughput mode.

SCPI: BSE:CONFig:NR5G:<cell>:HTM:IP <IP address>

7.7.3.2 Dual Connectivity Data Split Proportion

For more information, see EN-DC And Split Radio Bearers.

Radio Bearer ID

Specify the ID of the split radio bearer. The range is 1 - 32, but typically bearers 1 - 3 are for signaling. For data splitting, choose a bearer in the range 4 - 32.

SCPI: BSE:CONFig:NR5G:<cell>:DC:DATA:SPLIt:RATIo:BEARer:ID <0 ... 15>

EUTRAN Split Ratio

Specify the proportion of downlink data sent to the LTE part of the split radio bearer.

Note: *The sum of the EUTRAN and NR Split Ratio percentages must be 100%.*

SCPI: BSE:CONFig:NR5G:<cell>:DC:DATA:SPLIt:RATIo:EUTRAn <0 ... 100>

NR Split Ratio

Specify the proportion of downlink data sent to the NR part of the split radio bearer.

Note: *The sum of the EUTRAN and NR Split Ratio percentages must be 100%.*

SCPI: BSE:CONFig:NR5G:<cell>:DC:DATA:SPLIt:RATIo:NR <0 ... 100>

7.7.3.3 RLC

Enable Segmentation

Select to enable the segmentation of RLC data PDUs in AM (Acknowledge Mode) data transfer. Disable the option if the UE does not support segmented data.

SCPI: BSE:CONFig:NR5G:DRB:RLC:AM:ENable:SEGMentation <ON | OFF>

Auto Ack Tx

Select to send acknowledgements automatically to any message at the RLC layer.

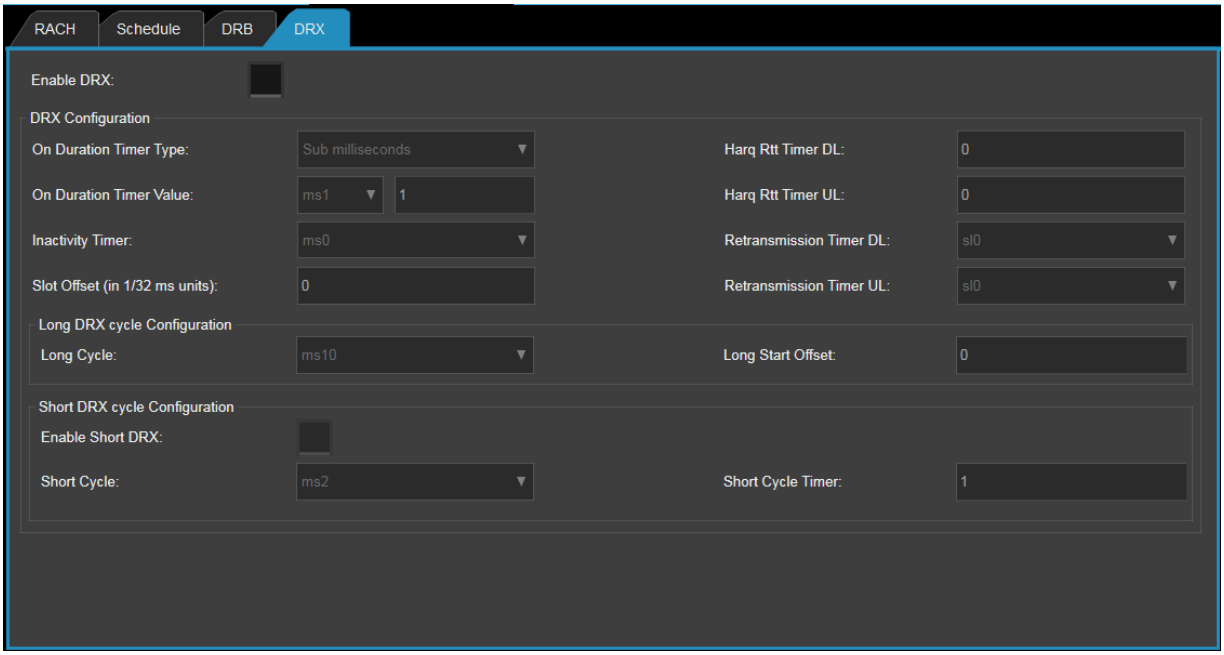
SCPI: BSE:CONFig:NR5G:DRB:RLC:AM:AUToack <ON | OFF>

7.7.4 DRX Tab

Also see: DRX tutorial

Specification reference: 3GPP TS 38.321 section 5.7.

The DRX tab configures Connected Mode Discontinuous Reception (C-DRX) for the NR cell selected in Cell details area of the workspace.



Enable DRX

Select the check box to enable Discontinuous Reception (DRX).

SCPI: BSE:CONFig:NR5G:<cell>:MAC:CDRX:ENABle <ON | 1 | OFF | 0>

7.7.4.1 DRX Configuration

On Duration Timer Type

Select the type of On Duration Timer Value as **milliseconds** or **sub milliseconds** (1/32 ms).

SCPI: BSE:CONFig:NR5G:<cell>:MAC:CDRX:ONDuration:TYPE <SUB | MILLI>

On Duration Timer Value

Specify the duration of the ON time within one DRX cycle. This value applies to both long and short cycles.

There are two Timer Value fields, but only one is enabled:

- First field (enabled for an On Duration Timer Type of milliseconds) – select the time in ms in the range 0 to 6, 8, 10, 20, 30, 40, 50, 60, 80, 100, 200, 300, 500, 750, 1280, 1920, 2560 (ignore the "spare" options).
- Second field (enabled for an On Duration Timer Type of sub milliseconds) – select the number of 1/32 ms units in the range 1 to 31.

SCPI: BSE:CONFig:NR5G:<cell>:MAC:CDRX:ONDuration:MILLiseconds <MS1 | MS2 | MS3 | MS4 | MS5 | MS6 | MS8 | MS10 | MS20 | MS30 | MS40 | MS50 | MS60 | MS80 | MS100 | MS200 | MS300 | MS400 | MS500 | MS600 | MS800 | MS1000 | MS1200 | MS1600 | SPARE8 | SPARE7 | SPARE6 | SPARE5 | SPARE4 | SPARE3 | SPARE2 | SPARE1>

SCPI: BSE:CONFig:NR5G:<cell>:MAC:CDRX:ONDuration:SUBMilli <1 ... 31>

Inactivity Timer

Specify how long the UE should remain ON after receiving a DCI (PDCCH) indicating a new UL or DL transmission for the UE. Select the time in ms in the range 0 to 6, 10, 20, 30, 40, 50, 60, 80, 100, 200, 300, 500, 750, 1280, 1920, 2560 (ignore the "spare" options).

SCPI: BSE:CONFig:NR5G:<cell>:MAC:CDRX:INACtivity <MS0 | MS1 | MS2 | MS3 | MS4 | MS5 | MS6 | MS8 | MS10 | MS20 | MS30 | MS40 | MS50 | MS60 | MS80 | MS100 | MS200 | MS300 | MS500 | MS750 | MS1280 | MS1920 | MS2560 | SPARE9 | SPARE8 | SPARE7 | SPARE6 | SPARE5 | SPARE4 | SPARE3 | SPARE2 | SPARE1>

Slot Offset (in 1/32 ms units)

Specify the delay (the number of 1/32 ms units) before starting the On Duration Timer Value. Choose a number in the range 0 to 31.

SCPI: BSE:CONFig:NR5G:<cell>:MAC:CDRX:SLOT:OFFSet <1 ... 31>

Harq Rtt Timer DL

Also see: HARQ retransmissions

Specify the number of symbols (0 to 56) from the erroneous transport block before a DL retransmission will be received.

SCPI: BSE:CONFig:NR5G:<cell>:MAC:CDRX:HARQ:RETX:DL:TIMer <0 ... 56>

Harq Rtt Timer UL

Also see: HARQ retransmissions

Specify the number of symbols (0 to 56) from the erroneous transport block before a grant for UL retransmission will be received.

SCPI: BSE:CONFig:NR5G:<cell>:MAC:CDRX:HARQ:RETX:UL:TIMer <0 ... 56>

Retransmission Timer DL / Retransmission Timer UL

The maximum duration in slot lengths of the bandwidth part in which the DL/UL retransmission will be received. Choose between sl0, sl1, sl2, sl4, sl6, sl8, sl16, sl24, sl33, sl40, sl64, sl80, sl96, sl112, sl128, sl160 and sl320 (ignore the "spare" options).

SCPI: BSE:CONFig:NR5G:<cell>:MAC:CDRX:RETX:DL:TIMer <SL0 | SL1 | SL2 | SL4 | SL6 | SL8 | SL16 | SL24 | SL33 | SL40 | SL64 | SL80 | SL96 | SL112 | SL128 | SL160 | SL320 | SPARE15 | SPARE14 | SPARE13 | SPARE12 | SPARE11 | SPARE10 | SPARE9 | SPARE8 | SPARE7 | SPARE6 | SPARE5 | SPARE4 | SPARE3 | SPARE2 | SPARE1>

SCPI: BSE:CONFig:NR5G:<cell>:MAC:CDRX:RETX:UL:TIMer <SL0 | SL1 | SL2 | SL4 | SL6 | SL8 | SL16 | SL24 | SL33 | SL40 | SL64 | SL80 | SL96 | SL112 | SL128 | SL160 | SL320 | SPARE15 | SPARE14 | SPARE13 | SPARE12 | SPARE11 | SPARE10 | SPARE9 | SPARE8 | SPARE7 | SPARE6 | SPARE5 | SPARE4 | SPARE3 | SPARE2 | SPARE1>

7.7.4.2 Long DRX Cycle Configuration

Long Cycle

Select the value of the long DRX cycle in milliseconds; one of ms10, ms20, ms32, ms40, ms60, ms64, ms70, ms80, ms128, ms160, ms256, ms320, ms512, ms640, ms1024, ms1280, ms2048, ms2560, ms5120 or ms10240.

SCPI: BSE:CONFig:NR5G:<cell>:MAC:CDRX:CYCLe <MS10 | MS20 | MS32 | MS40 | MS60 | MS64 | MS70 | MS80 | MS128 | MS160 MS256 | MS320 | MS512 | MS640 | MS1024 | MS1280 | MS2048 | MS2560 | MS5120 | MS10240>

Long Start Offset

Specify a start offset, which defines the subframe where the long cycle starts. The range is 0 up to the size of the long cycle.

SCPI: BSE:CONFig:NR5G:<cell>:MAC:CDRX:SOFFset <0..10239>

7.7.4.3 Short DRX Cycle Configuration

Also see: Short DRX cycle.

Enable Short DRX

Select the check box to enable a short DRX cycle.

SCPI: BSE:CONFig:NR5G:<cell>:MAC:CDRX:SDRX[:STATe] <ON | 1 | OFF | 0>

Short Cycle

Select the value of the short DRX cycle in milliseconds; one of ms10, ms20, ms32, ms40, ms60, ms64, ms70, ms80, ms128, ms160, ms256, ms320, ms512, ms640, ms1024, ms1280, ms2048, ms2560, ms5120 or ms10240.

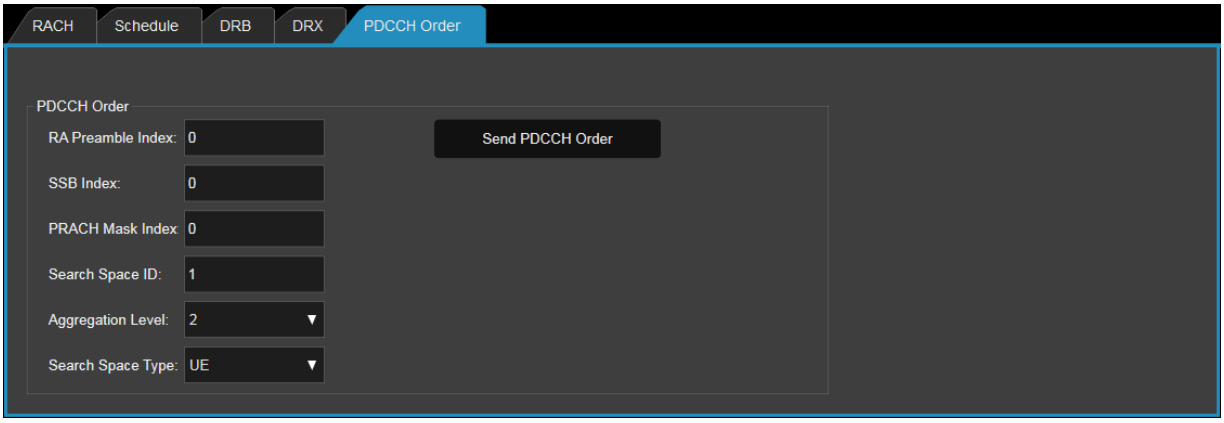
SCPI: BSE:CONFig:NR5G:<cell>:MAC:CDRX:SDRX:CYCLe <MS10 | MS20 | MS32 | MS40 | MS60 | MS64 | MS70 | MS80 | MS128 | MS160 MS256 | MS320 | MS512 | MS640 | MS1024 | MS1280 | MS2048 | MS2560 | MS5120 | MS10240>

Short Cycle Timer

Specify the length of time that the UE should follow the short cycle. The value is a multiple of 1 to 16 short cycles, where 1 = one short cycle, 2 = two short cycles, and so on. The timer must fit within the OFF period of a long DRX cycle.

SCPI: BSE:CONFig:NR5G:<cell>:MAC:CDRX:SDRX:TIMer <1..16>

7.7.5 PDCCH Order

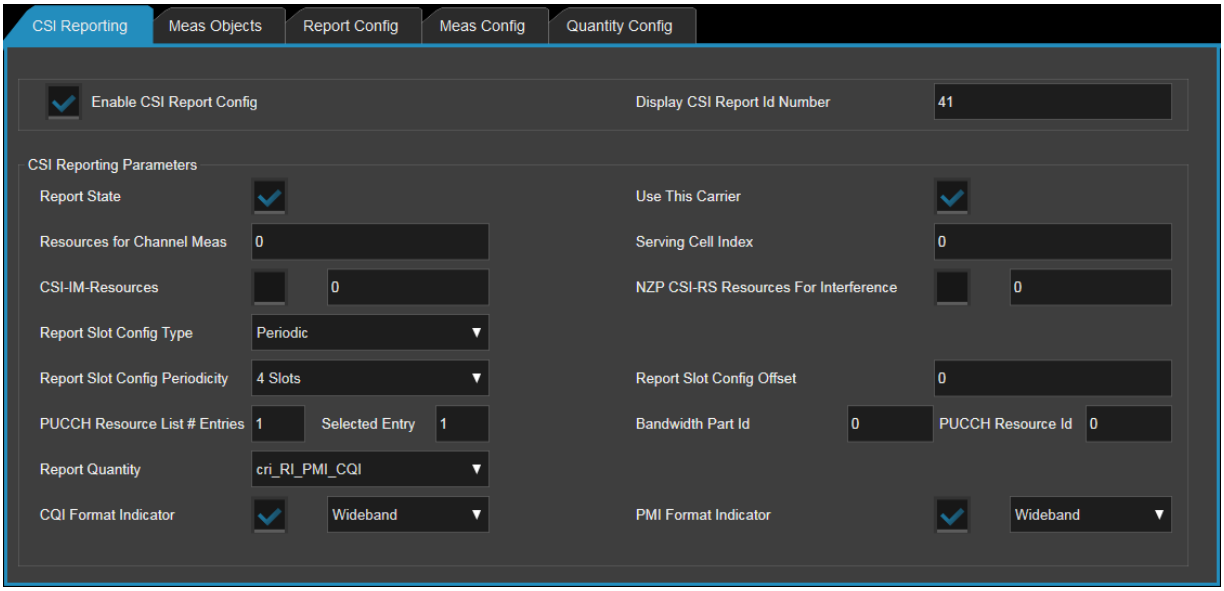


7.8 RRC/NAS

7.8.1 CSI Reporting Tab

Specification reference: 3GPP TS 38.331 page 201 (CSI-ReportConfig).

The CSI Reporting tab configures up to 64 periodic or semi-persistent Channel State Information (CSI) reports.



Enable CSI Report Config

Select the check box to enable CSI reporting (enables CSI-ReportConfig), or clear the check box to disable all CSI report (allows you to disable all reports without modifying the Report State of individual reports).

SCPI: BSE:CONFig:NR5G:<cell>:CSI:REPort:CONFig:STATe <ON | 1 | OFF | 0>

Display CSI Report Id Number

Supply the CSI report number, in the range 0 to 63.

7.8.1.1 CSI Reporting Parameters

These fields configure values for the selected CSI report (0 to 63)

Report State

Select the check box to enable the CSI report identified in the Display CSI Report Id Number field.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:REPort:CONFig:<csireport>:STATe <ON | 1 | OFF | 0>

Resources for Channel Meas

Supply the CSI reporting resource for channel measurement.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:REPort:CONFig:<csireport>:RESources:CHANnel:MEASurement <0 ... 111>

CSI-IM-Resources

Select the check box to enable CSI IM resources. In the input field, enter CSI reporting resources for CSI IM measurement, in the range 0 to 111.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:REPort:CONFig:<csireport>:RESources:CSI:IM:INTerference:STATe <ON | 1 | OFF | 0>

SCPI: BSE:CONFig:NR5G:<cell>:CSI:REPort:CONFig:<csireport>:RESources:CSI:IM:INTerference <0 ... 111>

Report Slot Config Type

Specification reference: 3GPP TS 38.214 Table 5.2.1.4-1 and section 5.2.1.5.

Select the CSI report configuration type as one of Periodic, Semi Persistent on PUCCH, Semi Persistent on PUSCH or Aperiodic.

- Periodic – the UE reports CSI according to the Report Slot Config Periodicity and Report Slot Config Offset below.
- Semi Persistent on PUCCH or Semi Persistent on PUSCH – the UE reports CSI on the physical uplink control channel or shared channel respectively, only after CSI transmission has been activated via a MAC control element, and continue until deactivated. Once activated, the UE reports CSI periodically according to the Report Slot Config Periodicity and Report Slot Config Offset below.
- Aperiodic – the UE reports CSI only if triggered by signaling in the DCI .

SCPI: BSE:CONFig:NR5G:<celTYpe <PERiodic | SPPUCCH | SPPUSCH | APERiodic>

Report Slot Config Periodicity

Applies to periodic reports only

For periodic CSI reports, specify the periodicity in slots: 4 Slots, 5 Slots, 8 Slots, 10 Slots, 16 Slots, 20 Slots, 40 Slots, 80 Slots, 160 Slots or 320 Slots.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:REPort:CONFig:<csireport>:RCONfig:PERiodic:RSConfig:PERiodicity <SLOTS4 | SLOTS5 | SLOTS8 | SLOTS10 | SLOTS16 | SLOTS20 | SLOTS40 | SLOTS80 | SLOTS160 | SLOTS320>

PUCCH Resource List # Entries / Selected Entry

Select a resource set (1 to 4) from the PHY > PUCCH resource list, and select which resource within the resource set's Resource ID field (1, 2, 3 or 4) that you wish to view and edit.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:REPort:CONFig:<csireport>:RCONfig:PERiodic:PUCCh:RLISt:NUMBer <1 ... 4>

Report Quantity

Specification reference: 3GPP TS 38.214 section 5.2.1.

Specify the CSI-related quantities to be reported by the UE:

- None
- cri_RI_PMI_CQI, cri_RI_i1, cri_RI_i1_CQI and cri_RI_CQI – combinations of carrier resource indicator (CRI) with rank indicator (RI), precoder-matrix indicator (PMI) and channel-quality indicator (CQI), and wideband instance (i1).
- cri_RSRP and ssb_index_RSRP – reference-signal received power (RSRP) indicating received signal strength.
- cri_RI_L1_PMI_CQI – CRI and RI with layer 1 reporting of PMI and CQI.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:REPort:CONFig:<csireport>:RCONfig:REPort:QUANtity <NONE | CRPC | CRI1 | CRIC | CRC | CRSRP | SIRSrp | CRLPC>

CQI Format Indicator

Select the check box to include this optional parameter. When included, choose between:

- Wideband – the full reporting bandwidth, which in NR can be very wide, up to 400 MHz. Some devices may not be able to receive such a wide bandwidth
- Subband – covers a fraction of the overall reporting bandwidth.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:REPort:CONFig:<csireport>:RCONfig:RFConfig:CQI:FINDicator:STATe ON | 1 | OFF | 0

SCPI: BSE:CONFig:NR5G:<cell>:CSI:REPort:CONFig:<csireport>:RCONfig:RFConfig:CQI:FINDicator:VALue <WIDeband | SUBBand>

Use This Carrier

Select this check box to send CSI reports to this cell.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:REPort:CONFig:<csireport>:CARRier:UTHis <ON | 1 | OFF | 0>

Serving Cell Index

Supply the serving cell index number for this cell, where 0 applies to the PCC cell.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:REPort:CONFig:<csireport>:CARRier:INDex <0 ... 31>

NZP CSI-RS Resources For Interference

Select the check box to include this optional parameter. When included, supply an entry number in the NZP CSI resource set list (value 1 corresponds to the first entry, value 2 to the second entry, and so on).

SCPI: BSE:CONFig:NR5G:<cell>:CSI:REPort:CONFig:<csireport>:RESources:NZP:CSIRs:INTerference:STATe <ON | 1 | OFF | 0>

SCPI: BSE:CONFig:NR5G:<cell>:CSI:REPort:CONFig:<csireport>:RESources:NZP:CSIRs:INTerference <0 ... 111>

Report Slot Config Offset

For periodic or semi-persistent CSI reports, select the slot offset (0 to 319) when the CSI reports start.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:REPort:CONFig:<csireport>:RCONfig:PERiodic:RSConfig:OFFSet <0 ... 319>

Bandwidth Part Id

The bandwidth part ID (0 to 4) to which this CSI report configuration applies.

SCPI: BSE:CONFig:NR5G:<cell>:CSI:REPort:CONFig:<csireport>:RCONfig:PERiodic:PUCCh:RLISt:<reslist>:BWPid <0 ... 4>

PUCCH Resource Id

The PUCCH resource (0 to 127) assigned for CSI reporting.

SCPI:
BSE:CONFig:NR5G:<cell>:CSI:REPort:CONFig:<csireport>:RCONfig:PERiodic:PUCCh:RLISt:<reslist>:PUCCh:ID <0 ... 127>

PMI Format Indicator

Select the check box to include this optional parameter. When included, choose between:

- Wideband – the full reporting bandwidth, which in NR can be very wide, up to 400 MHz. Some devices may not be able to receive such a wide bandwidth
- Subband – covers a fraction of the overall reporting bandwidth.

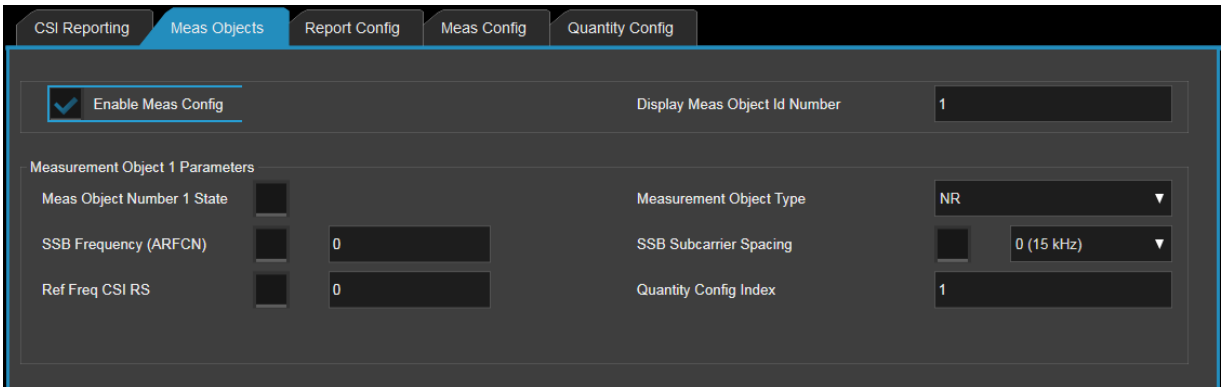
SCPI: BSE:CONFig:NR5G:<cell>:CSI:REPort:CONFig:<csireport>:RCONfig:RFConfig:PMI:FINDicator:STATe ON | 1 | OFF | 0

SCPI: BSE:CONFig:NR5G:<cell>:CSI:REPort:CONFig:<csireport>:RCONfig:RFConfig:PMI:FINDicator:VALue <WIDeband | SUBBand>

7.8.2 Meas Objects Tab

Specification reference: 3GPP TS 38.331 page 235–240 (MeasObjectId).

The Meas Objects tab configures the frequency/time location, and subcarrier spacing of reference signals to be measured by the UE.



Enable Meas Config

This field is repeated on the Meas Objects tab, Report Config tab, Meas Config tab and Quantity Config tab.

Select the check box to enable measurement configuration.

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:STATe <ON | 1 | OFF | 0>

Display Meas Object Id Number

Supply the measurement object ID number, in the range 1 to 64. The measurement object ID is linked with one or more reporting configurations on the Meas Config tab.

7.8.2.1 Measurement Object <n> Parameters

This section displays parameters for the selected measurement object, where <n> is its Id Number.

Measurement Object <n> State

Select the check box to enable the measurement object (identified in the Display Meas Object Id Number field).

From the drop-down list, select how to supply the measurement object parameters. Choose between:

- Manual – supply the measurement object values manually.
- Auto: NR Cell <n> – overwrite measurement object values with those from a selected cell, where <n> is the cell number.

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:<mobj>:AUTO:CONFigure <MANual | NRCELL1 | NRCELL2 | NRCELL3 | NRCELL4| NRCELL5 | NRCELL6 | NRCELL7 | NRCELL8>

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:<mobj>:STATe <ON | 1 | OFF | 0>

SSB Frequency (ARFCN)

Select or clear the check box to control whether the SSB frequency is specified in the measurement object.

The default value in the input field depends on the option chosen in the Measurement Object <n> State field:

- If **Manual** is selected – the field contains zero. Specify an SSB ARFCN (0 to 3279165) to use for this measurement object.
- If **Auto: NR Cell <n>** is selected – the field contains the DL SSB ARFCN value on the Config tab of the referenced cell (cell <n>).

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:<mobj>:SSBFrequency:STATe <ON | 1 | OFF | 0>

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:<mobj>:SSBFrequency <0 ... 3279165>

Ref Freq CSI RS

Select or clear the check box to control whether the Channel State Information-Reference Signal (CSI-RS) is specified in the measurement object.

In the input field, specify the value of ARFCN for CSI-RS (0 to 400000000). The default value is 2079451.

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:<mobj>:RFReq:CSIRs:STATe <ON | 1 | OFF | 0>

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:<mobj>:RFReq:CSIRs:ARFCn <0 ... 400000000>

Measurement Object Type

From the drop-down list, select the type of measurement object: **NR** or **EUTRA**.

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:<mobj>:TYPE <NR | EUTRa>

SSB Subcarrier Spacing

Select or clear the check box to control whether the subcarrier spacing is specified for the measurement object.

The default value in the drop-down list depends on the option chosen in the Measurement Object <n> State field:

- If **Manual** is selected – the field contains 0 (15 kHz), which may be invalid. Select a valid value for the cell (0 (15 kHz), 1 (30 kHz), 2 (60 kHz), 3 (120 kHz) or 4 (240 kHz), as indicated by the Subcarrier Spacing value in the SSB/Broadcast tab.
- If **Auto: NR Cell <n>** is selected – the field contains the Subcarrier Spacing value in the SSB/Broadcast tab of the referenced cell (cell <n>).

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:<mobj>:SSB:SCSPacing:STATe <ON | 1 | OFF | 0>

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:<mobj>:SSB:SCSPacing <SCS15 | SCS30 | SCS60 | SCS120 | SCS240>

Quantity Config Index

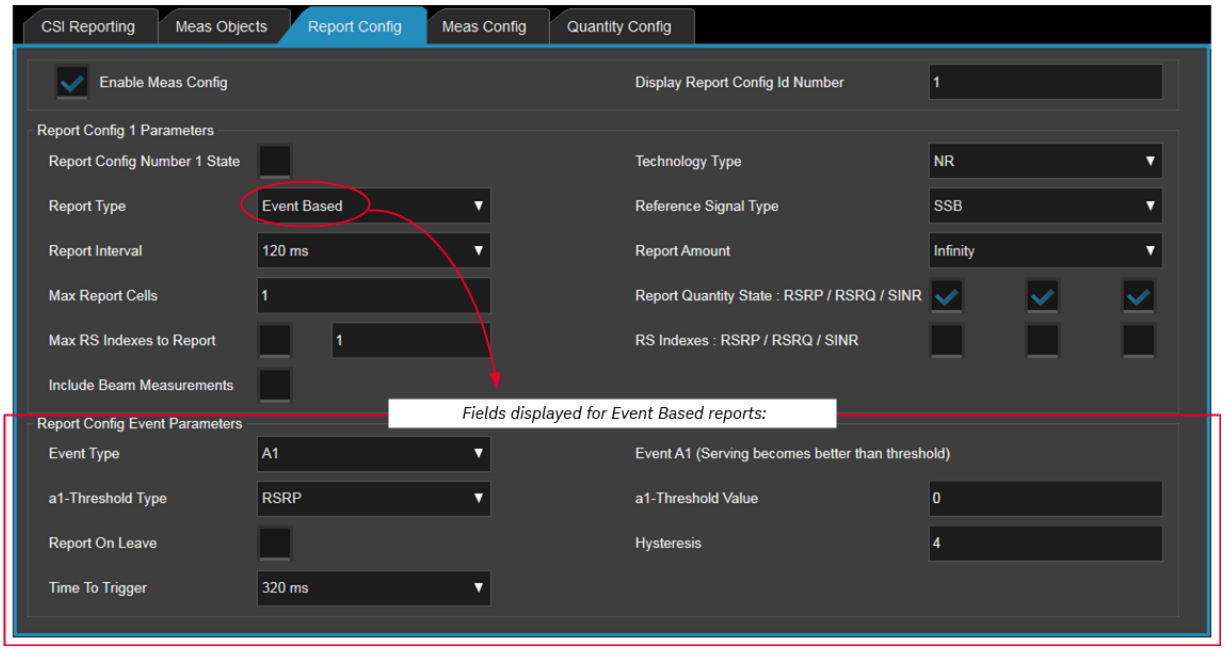
The value of Quantity Index for the Measurement Object v11.52.4

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:<mobj>:QUANtity:CINDex <1 ... 2>

7.8.3 Report Config Tab

Specification reference: 3GPP TS 38.331 section 5.5.5.

The Report Config tab configures list of reporting configurations. You can associate one or more reporting configurations with a measurement object on the Meas Config tab.



Enable Meas Config

This field is repeated on the Meas Objects tab, Report Config tab, Meas Config tab and Quantity Config tab.

Select the check box to enable measurement configuration.

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:STATe <ON | 1 | OFF | 0>

Display Report Config Id Number

Supply a report configuration ID number, in the range 1 to 64. The report configuration is mapped to a measurement object on the Meas Config tab.

7.8.3.1 Report Config <n> Parameters

This section displays parameters for the selected report configuration, where <n> is its Id Number.

Report Type

Choose the criterion that triggers the UE to send a measurement report. The report types are:

- Periodical – send reports using the periodicity specified in the fields below.
- Event Based – base reporting on the Report Config Event Parameters specified below.
- Report CGI (Cell Global identity) – send periodical reports that contain cell access related information.

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:<mrep>:TYPE <PER | EVENT | CGI>

Report Interval

Periodical reports only

Set the periodical reporting timer to one of 120 ms, 240 ms, 480 ms, 640 ms, 1024 ms, 2048 ms, 5120 ms, 10240 ms, 20480 ms, 40960 ms, 1 min, 6 min, 12 min or 30 min.

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:<mrep>:REPort:INTerval <MS120 | MS240 | MS480 | MS640 | MS1024 | MS2048 |MS5120 |MS10240 |MS20480 |MS40960 | M1 |M6 |M12 |M30>

Max Report Cells

Specify the maximum number of cells (1 to 8) that the UE should include in each measurement report.

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:<mrep>:MAX:RCELls <1 ... 8>

Max RS Indexes to Report

Select or clear the check box to control whether the UE reports reference signals.

In the input field, specify the maximum number of reference signals that the UE should report (1 to 32).

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:<mrep>:MAXRs:INDexes:TOReport:STATe <ON | 1 | OFF | 0>

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:<mrep>:MAXRs:INDexes:TOReport <1 ... 32>

Include Beam Measurements

Select or clear the check box to control whether the UE reports beam measurements.

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:<mrep>:INCLude:BEAM:MEASurements <ON | 1 | OFF | 0>

Technology Type

From the drop-down list, select the type of measurement the UE is to perform (NR or Inter-RAT). A measurement object can be linked to any reporting configuration of the same RAT.

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:<mrep>:TECHnology:TYPE <NR | INTER>

Reference Signal Type

From the drop-down list, select the type of reference signal the UE uses for beam and cell measurement results: Synchronization Signal Block (SSB) or Channel State Information-Reference Signal (CSI-RS).

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:<mrep>:RSTYpe <SSB | CSIRS>

Report Amount

From the drop-down list, select the number of measurement reports (R1 to R64) or select infinity for any number of reports.

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:<mrep>:REPort:AMOunt <R1 | R2 | R4 | R8 | R16 | R32 | R64 | Infinity>

Report Quantity State : RSRP / RSRQ / SINR

Select or clear each check box to control whether the UE reports Reference Signal Received Power (RSRP), Reference Signal Received Quality (RSRQ) or Signal to Interference and Noise Ratio (SINR).

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:<mrep>:PERiodical:REPort:RSRP:STATe <ON | 1 | OFF | 0>

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:<mrep>:PERiodical:REPort:RSRQ:STATe <ON | 1 | OFF | 0>

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:<mrep>:PERiodical:REPort:SINR:STATe <ON | 1 | OFF | 0>

RS Indexes : RSRP / RSRQ / SINR

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:<mrep>:REPort:QUANtity:RSINdexes:RSRP:STATe <ON | 1 | OFF | 0>

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:<mrep>:REPort:QUANtity:RSINdexes:RSRQ:STATe <ON | 1 | OFF | 0>

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:<mrep>:REPort:QUANtity:RSINdexes:SINR:STATe <ON | 1 | OFF | 0>

7.8.3.2 Report Config Event Parameters

Specification reference: 3GPP TS 38.331 section 5.5.4.

The screen includes these field when the Report Type is Event Based.

Event Type

a2 Threshold Type

Report On Leave

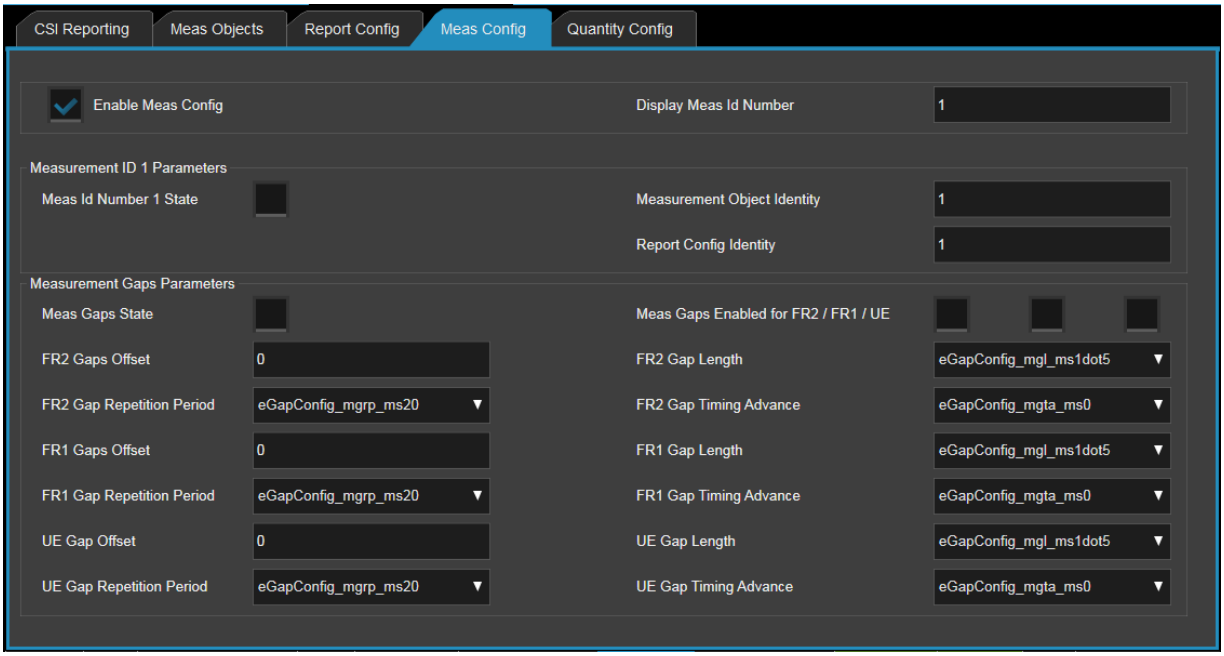
Time To Trigger

a2 Threshold Value

Hysteresis

7.8.4 Meas Config Tab

The Meas Config tab links measurement objects with report configurations, and defines gaps (periods that the UE may use to perform measurements).



Enable Meas Config

This field is repeated on the Meas Objects tab, Report Config tab, Meas Config tab and Quantity Config tab.

Select the check box to enable measurement configuration.

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:STATe <ON | 1 | OFF | 0>

Display Meas Id Number

Supply the measurement number, in the range 1 to 64.

7.8.4.1 Measurement ID <n> Parameters

This section displays parameters for the selected measurement, where <n> is its Id Number.

Measure Id <n> State

Select the check box to enable the measurement (identified in the Display Meas Id Number field).

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:<mid>:STATe <ON | 1 | OFF | 0>

Measurement Object Identity

Supply a measurement object ID number (1 to 64) configured on the Meas Objects tab, which you wish to associate with a reporting configuration.

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:<mid>:MEAS:OBJect:ID <1 ... 64>

Report Config Identity

Supply a report configuration ID number, in the range 1 to 64 to associate with the measurement object identified in the previous field. You can associate several reporting configurations with the same measurement object.

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:<mid>:REPort:CONFig:ID <1 ... 64>

7.8.4.2 Measurement Gaps Parameters

*These parameters are **not** restricted to the measurement identified in the Display Meas Id Number field.*

These parameters define periods that the UE may use to perform measurements.

Meas Gaps State

Select the check box to enable measurement gaps.

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:MGAPs:STATe <ON | 1 | OFF | 0>

Meas Gaps Enabled for FR2 / FR1 / UE

Select each check box to enable FR2 gaps, FR1 gaps and UE gaps respectively. Each option has its own set of parameters below.

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:MGAPs:GAP:FRTWo:STATe <ON | 1 | OFF | 0>

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:MGAPs:GAP:FRONe:STATe <ON | 1 | OFF | 0>

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:MGAPs:GAP:UE:STATe <ON | 1 | OFF | 0>

FR2 / FR1 / UE Gaps Offset

SCPI: BSE:CONFig:NR5G:<cell>:RRC:MCONfig:MGAPs:GAP:FRTWo:OFFSet <ON | 1 | OFF | 0>

BSE:CONFig:NR5G:<cell>:RRC:MCONfig:MGAPs:GAP:FRTWo:OFFSet 0 Integer 0..159

BSE:CONFig:NR5G:<cell>:RRC:MCONfig:MGAPs:GAP:FRTWo:MGLength MS1PT5 Enum MS1PT5|MS3| MS3PT5| MS4| MS5PT5

BSE:CONFig:NR5G:<cell>:RRC:MCONfig:MGAPs:GAP:FRTWo:MGRPeriod MS20 Enum MS20|MS40|MS80|MS160

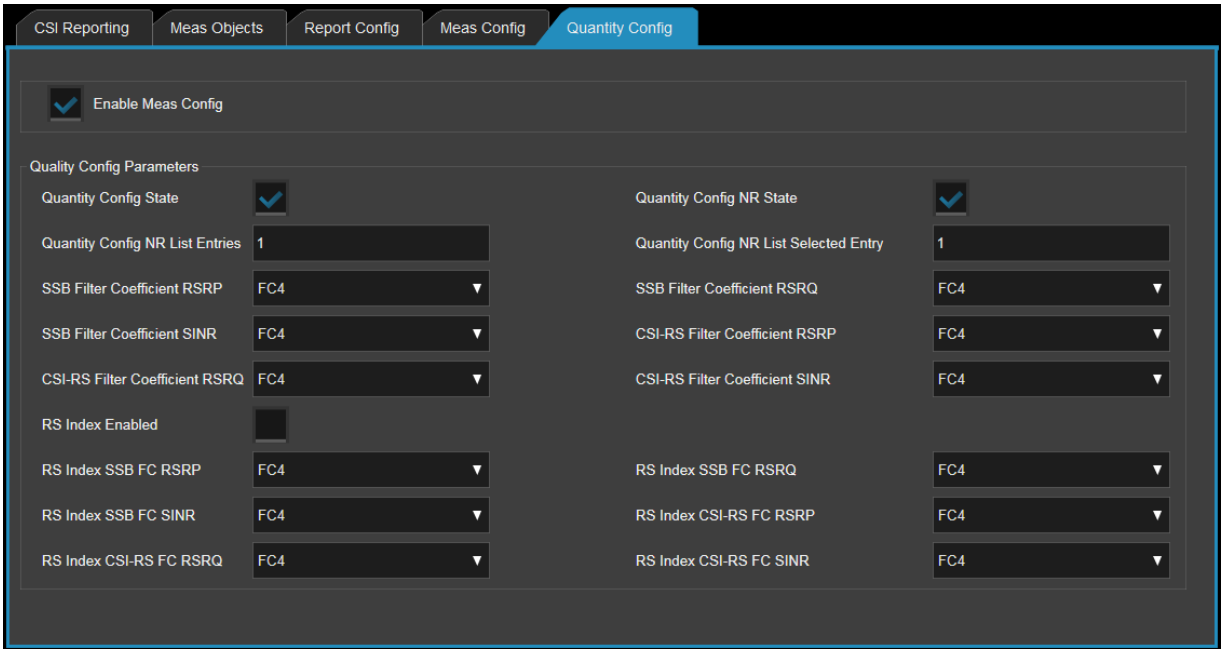
BSE:CONFig:NR5G:<cell>:RRC:MCONfig:MGAPs:GAP:FRTWo:MGTadvance MS0 Enum MS0 | MS0PT25|MS0PT5

FR2 / FR1 / UE Gap Length

FR2 / FR1 / UE Gap Repetition Period

FR2 / FR1 / UE Gap Timing Advance

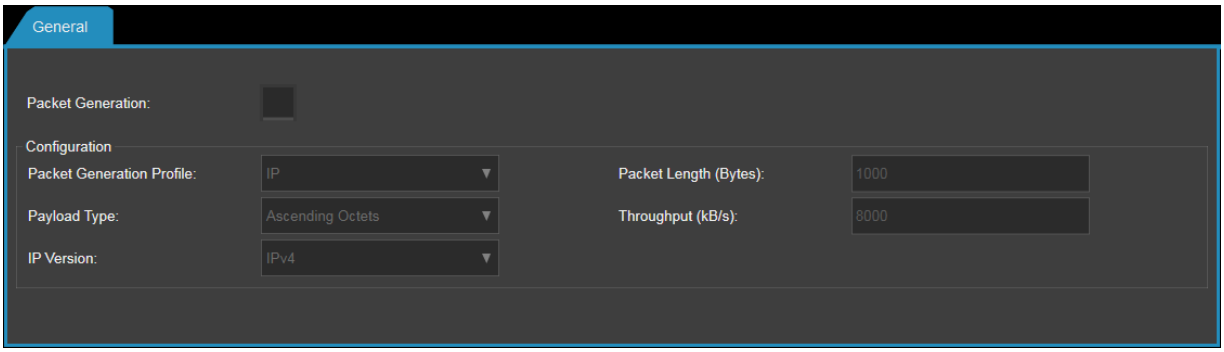
7.8.5 Quantity Config Tab



7.9 Data Generation Tab

7.9.1 General Tab

The General tab enables/disables and configures the generation of PDCP data sent to the device under test.



Packet Generation

Select to enable the generation of packets according to the options configured below.

Note: Packet generation does not start until you click Apply.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PDCP:PGEN:STATe <ON | OFF>

7.9.1.1 Configuration

Packet Generation Profile

Select how much header information to send in generated packets.

- None – no headers are included in generated packets.
- IP – an IP header is included in generated packets.
- IPUDP – IP and UDP headers are included in generated packets.

Payload Type

Select the type of data that is included in the PDCP data payload, following any headers:

- Zeroes – the packet contains only zeros.
- Ascending Octets – the payload is octets of increasing value ; 01, 02, ..., FF.
- Random – the payload is randomly generated.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PDCP:PGEN:PAYLoad <ZEROES | ASC_OCTETS | RANDOM>

IP Version

Set the IP header version of generated packets (IPv4 or IPv6).

Packet Length (bytes)

Specify the length of packets generated by the packet generator (in bytes), not including any headers.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PDCP:PGEN:LENGth <1 ... 8140>

Throughput (kB/s)

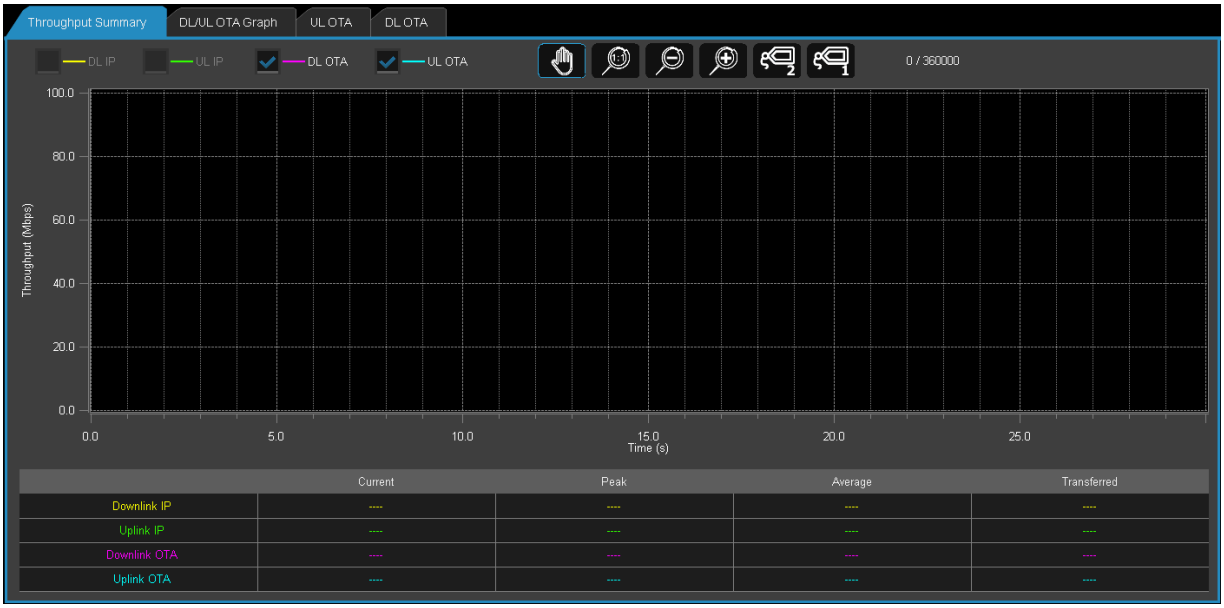
Specify the data throughput generated by the packet generator in Kb/s (not including any header overhead).

SCPI: BSE:CONFig:NR5G:<cell>:PHY:PDCP:PGEN:THRoughput <1 ... 4294967295>

7.10 BLER/Tput Tab

7.10.1 Throughput Summary Tab

The Throughput Summary tab displays a graph of uplink and downlink data throughput over time.



7.10.2 DL/UL OTA Graph Tab

The DL/UL OTA Graph tab displays graphs of the OTA throughput over time and the BLER (%) over time at the same time, and provides a table of statistics. for throughput and BLER.

The equivalent SCPI commands, which return values as defined below are:

SCPI: BSE:NR5G:MEASure:BTHRoughput:DL:BLER:<cell>?

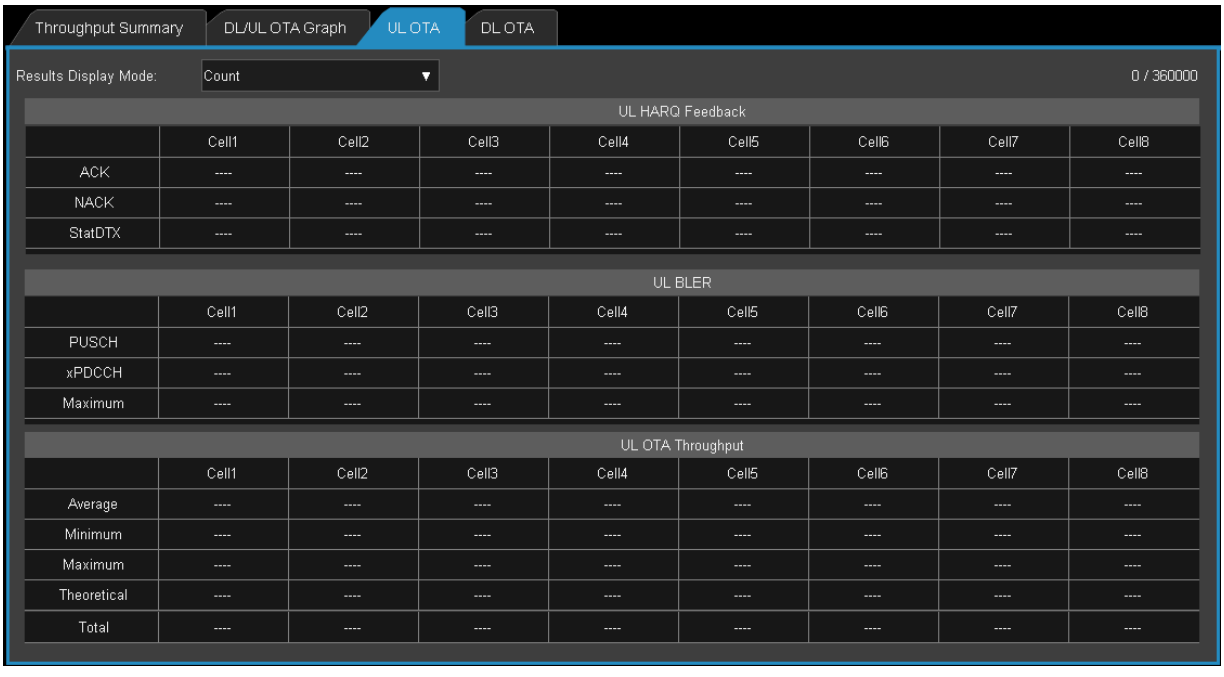
Format for returned array is: progress-count, ack-count, ack-ratio, nack-count, nack-ratio, statdtx-count, statdtx-ratio, pdschBlerCount, pdschBlerRatio

SCPI: BSE:NR5G:MEASure:BTHRoughput:UL:BLER:<cell>?

Format for returned array is: progress-count, ack-count, ack-ratio, nack-count, nack-ratio

7.10.3 UL OTA Tab

The UL OTA tab displays a table of uplink OTA measurements including HARQ feedback, BLER and Throughput.



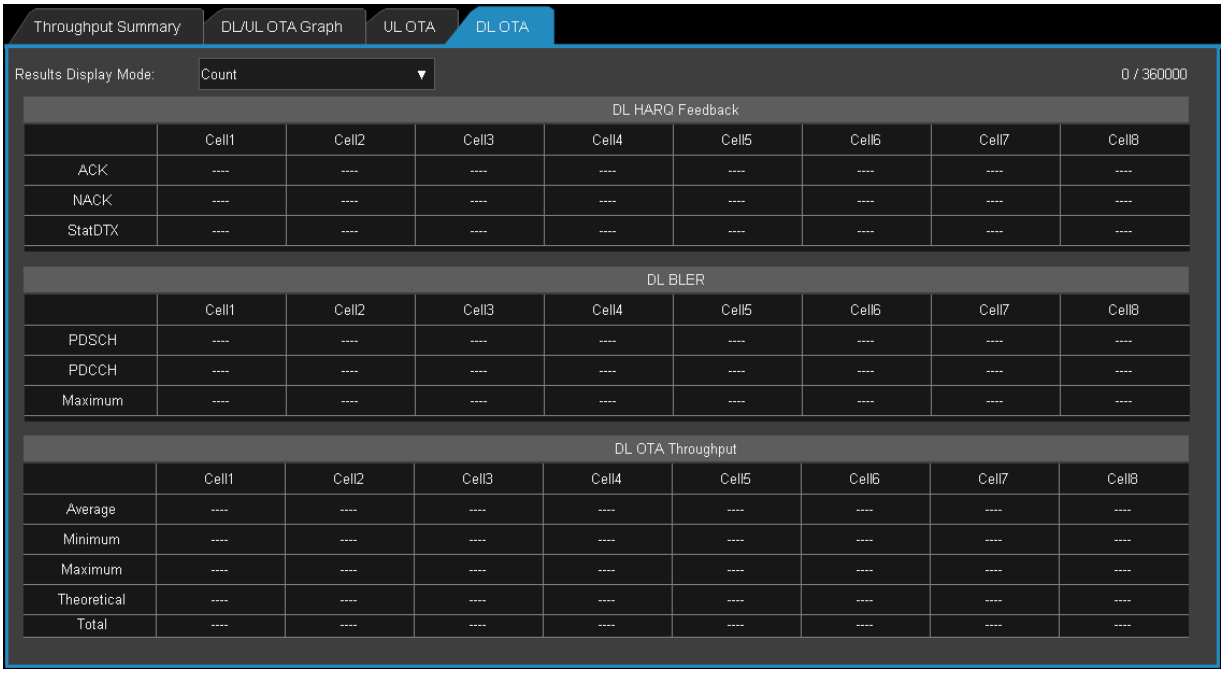
The equivalent SCPI commands, which return values as defined below are:

SCPI: BSE:NR5G:MEASure:BTHRoughput:UL:THRoughput:OTA:<cell>?

Format for returned array is: progress-count, current-tput, min-tput, max-tput, average-tput, theoretical-max tput

7.10.4 DL OTA Tab

The DL OTA tab displays a table of downlink OTA measurements including HARQ feedback, BLER and Throughput.



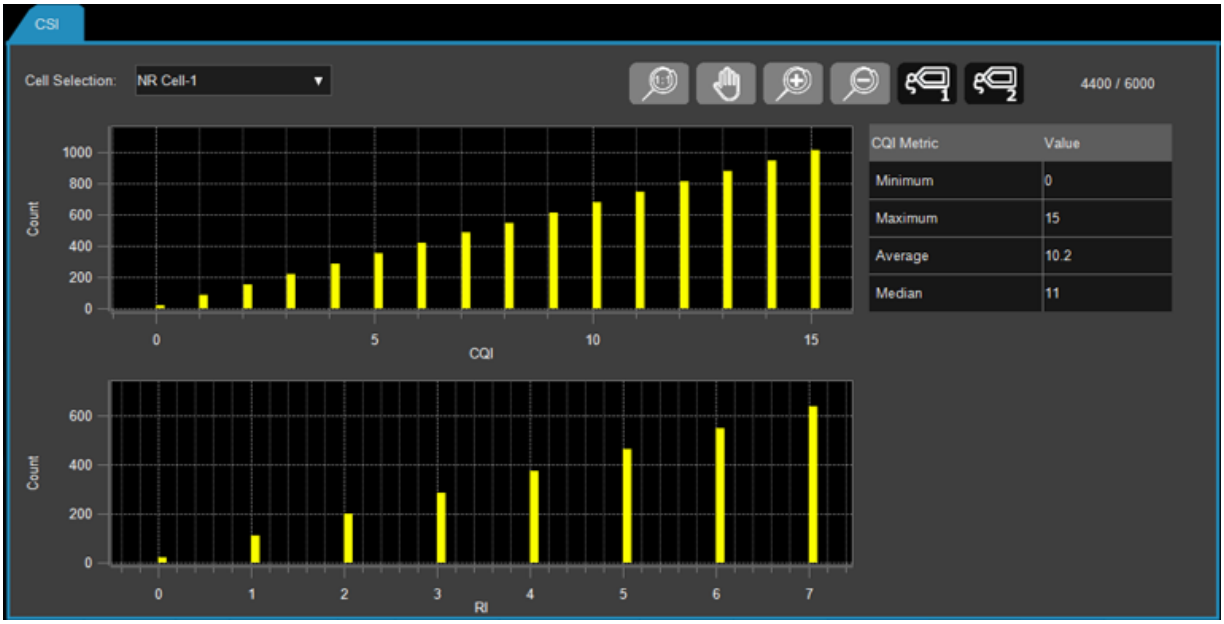
The equivalent SCPI commands, which return values as defined below are:

SCPI: BSE:NR5G:MEASure:BTHRoughput:DL:THRoughput:OTA:<cell>?

Format for returned array is: progress-count, current-tput, min-tput, max-tput, average-tput, theoretical-max tput

7.11 CSI

The CQI/RI tab shows channel-state information (CSI) reports received from the device, and includes channel-quality indicator (CQI) and rank indicator (RI).



Cell Selection

From the drop-down list, select the NR cell whose CSI reports you wish to display.

7.12 Tx Meas

7.12.1 XApps RF Tx Measurements

This feature is only available when running 5G NR Test Application on the UXM-5G.

Use the TX Meas tab to connect to the Keysight X-Series Measurement Application (XApps).

7.12.1.1 To display the Tx Measurements tab

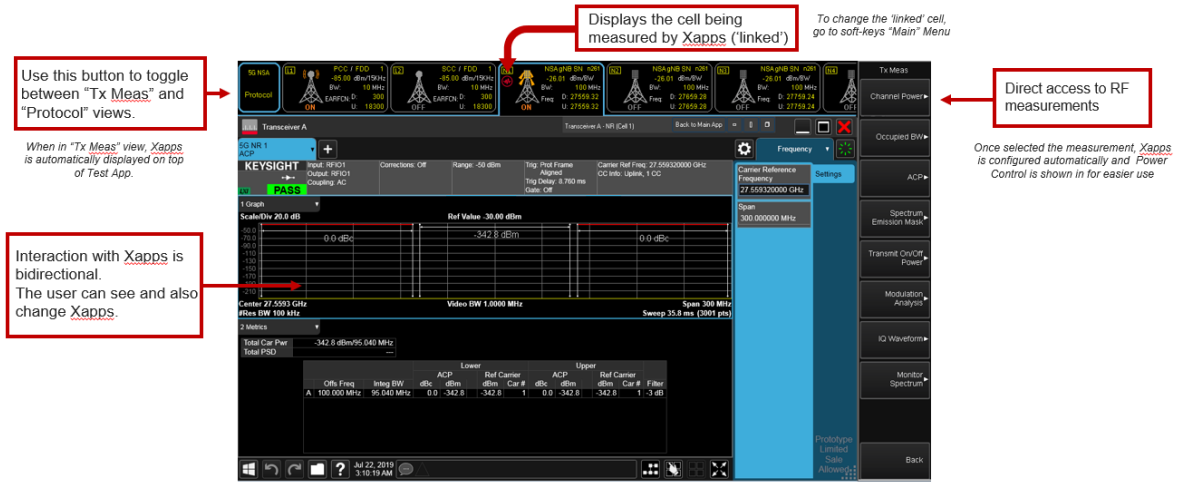
This tab is initially hidden. To display the tab:

1. From the Main Menu, select Link to X-Apps

   The Tx Measurement menu opens.

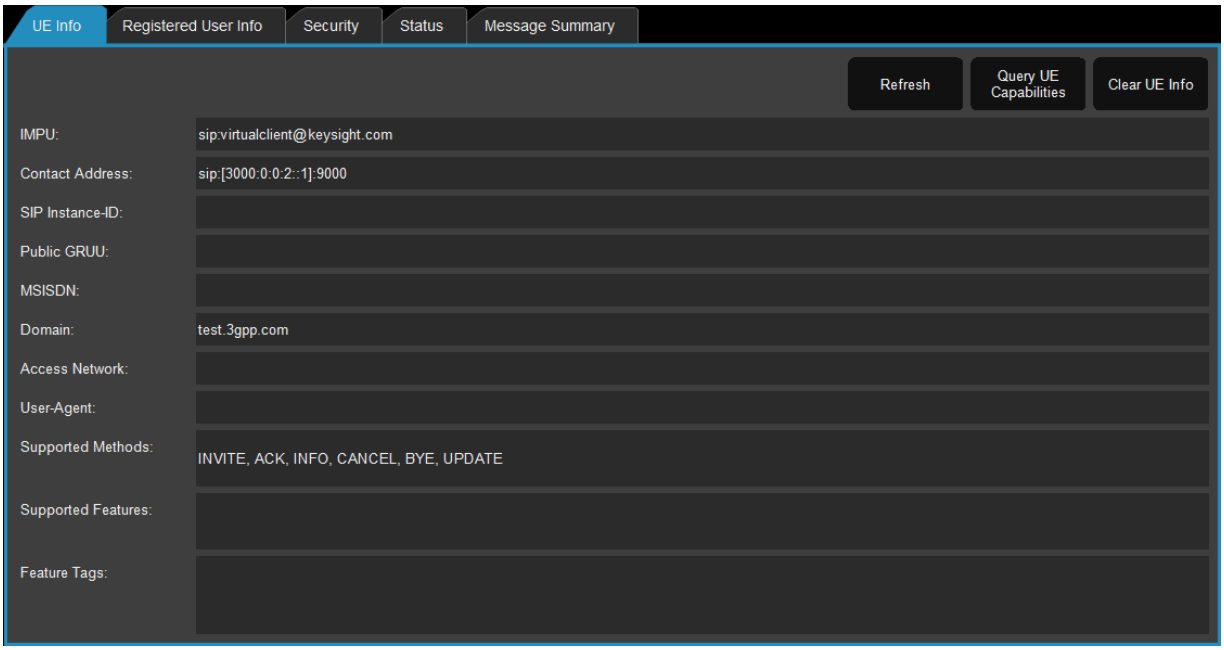
2. Click Tx Meas.

   The Tx Meas tab opens:



7.13 IMS

The UE Info Tab displays information extracted based on the Register provided when the UE performs an IMS Registration.



Refresh

Click Refresh for update the information from the IMS Server.

SCPI: SYSTem:IMS:SERVer:UE:INFormation:REFResh

Query UE Capability

Click to perform an IMS capability enquiry of the UE via a SIP INFO request.

SCPI: SYSTem:IMS:SERVer:UE:INFormation:CAPability:GET

Clear UE Info

Click Clear to clear the information displayed.

SCPI: SYSTem:IMS:SERVer:UE:INFormation:CLEar

IMPU

Displays the IMS Public User Identity (IMPU) from the reported UE-Info.

SCPI: SYSTem:IMS:SERVer:UE:INFormation:IMPU?

Contact Address

Displays the contact address from the reported IMS UE-Info.

SCPI: SYSTem:IMS:SERVer:UE:INFormation:CONTact[:ADDRess]?

SIP Instance-ID

Displays the '+sip.instanceid' value from the reported IMS UE-Info.

SCPI: SYSTem:IMS:SERVer:UE:INFormation:ID?

Public GRUU

Displays the 'Public GRUU' from the reported IMS UE-Info.

SCPI: SYSTem:IMS:SERVer:UE:INFormation:PUBLic:GRUU?

MSISDN

Displays the 'MSISDN number' value associated with the UE's IMS registration.

SCPI: SYSTem:IMS:SERVer:UE:INFormation:MSISdn?

Domain

Displays the domain from the reported IMS UE-Info.

SCPI: SYSTem:IMS:SERVer:UE:INFormation:DOMain?

Access Network

Displays the access network from the reported IMS UE-Info.

SCPI: SYSTem:IMS:SERVer:UE:INFormation:ANETwork?

User-Agent

Displays the User-Agent value from the reported IMS UE-Info (as reported by the UE in the 'User-Agent' SIP header).

SCPI: SYSTem:IMS:SERVer:UE:INFormation:UAGent?

Supported Methods

Displays the UE-supported SIP method-types from the reported IMS UE-Info (as indicated by the UE in the SIP headers).

SCPI: SYSTem:IMS:SERVer:UE:INFormation:SUPPorted:METHods?

Supported Features

Displays the supported features header from the reported IMS UE-Info (as indicated by the UE in the SIP headers).

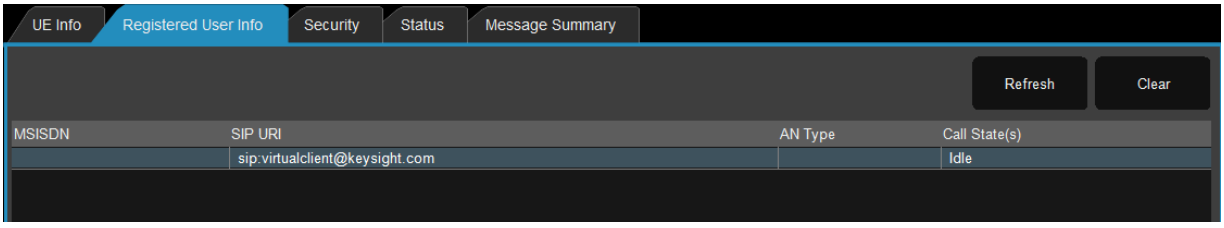
SCPI: SYSTem:IMS:SERVer:UE:INFormation:SUPPorted:FEATures?

Feature Tags

Displays the Feature Tags field value from the reported IMS UE-Info.

SCPI: SYSTem:IMS:SERVer:UE:INFormation:SUPPorted:FTAGs?

Shows a summary of the status of each user registered on the IMS Server.



Refresh

Click **Refresh** for update the information from the IMS Server.

SCPI: SYSTem:IMS:SERVer:RUSer:INFormation:REFResh

Clear

Click **Clear** to clear the information displayed.

SCPI: SYSTem:IMS:SERVer:RUSer:INFormation:CLEar

MSISDN

Displays the MSISDN of the registered user.

SIP URI

Displays the SIP user resource identifier (URI), which is a unique address that can be used (for example) to identify a specific VoIP system.

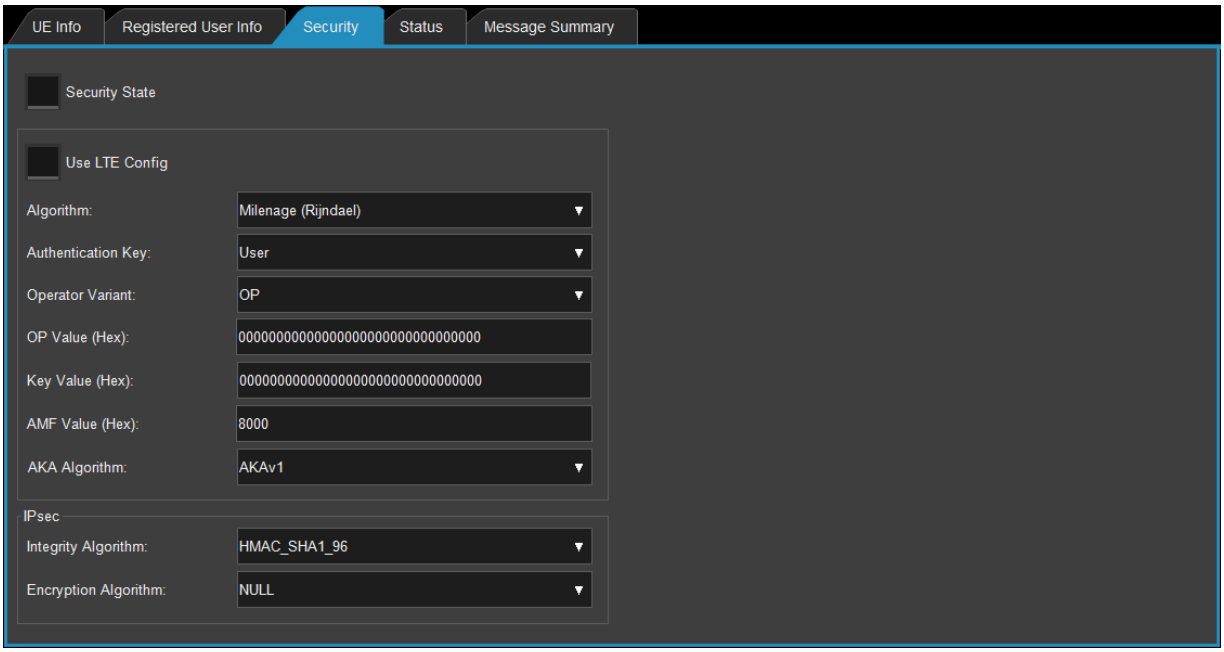
AN Type

Displays any reported access network type for the registered user.

Call State(s)

Displays the status of the currently active calls. Each user can have up to 3 simultaneous calls.

The Security tab configures parameters used in authentication, which are generally the same as the LTE options. This tab lets you define different security parameters from the LTE options defined on the RRC/NAS > Security tab.



Security State

Select to enable IMS security.

SCPI: SYSTem:IMS:SERVer:CONFig:SECurity[:STATe] <ON | OFF>

Use LTE Config

Select to automatically link IMS security-parameters to the LTE RAT values.

SCPI: SYSTem:IMS:SERVer:CONFig:SECurity:AUTHenticate:COUPling[:LTE][:STATe] <ON | OFF>

Algorithm

Specifies the IMS authentication algorithm:

- Dummy
- Milenage (Rijndael)

SCPI: SYSTem:IMS:SERVer:CONFig:SECurity:AUTHenticate:ALGorithm <DUMMy | MILenage>

Authentication Key

Specifies the type of IMS authentication private-key (K):

- Keysight SIM
- 3GPP SIM
- User

SCPI: SYSTem:IMS:SERVer:CONFig:SECurity:AUTHenticate:KEY[:TYPE] <KEYSight | TEST3GPP | USER>

Operator Variant

Specifies the type of IMS authentication OP-variant:

- OPc
- OP

SCPI: SYSTem:IMS:SERVer:CONFig:SECurity:AUTHenticate:OPVariant[:TYPE] <OPC | OP>

OP Value (Hex)

Specifies the value of the IMS authentication OP-variant.

SCPI: SYSTem:IMS:SERVer:CONFig:SECurity:AUTHenticate:OPVariant:VALue <00000000000000000000000000000000 ... FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF>

Key Value (Hex)

Specifies the IMS user-defined authentication private-key (K) value, which is used when the key-type is configured to 'user'.

SCPI: SYSTem:IMS:SERVer:CONFig:SECurity:AUTHenticate:KEY:USER <00000000000000000000000000000000 ... FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF>

AMF Value (Hex)

Specifies the value of the IMS authentication AMF (Authentication Management Field).

SCPI: SYSTem:IMS:SERVer:CONFig:SECurity:AUTHenticate:AMF <0000 ... FFFF>

AKA Algorithm

Specifies the IMS authentication AKA algorithm:

- AKAv1
- AKAv2

SCPI: SYSTem:IMS:SERVer:CONFig:SECurity:AUTHenticate:AKA[:ALGorithm] <AKAv1 | AKAv2>

7.13.1 IPSec

Integrity Algorithm

Specifies the IMS IPsec integrity algorithm:

- HMAC_MD5_96
- HMAC_SHA1_96

SCPI: SYSTem:IMS:SERVer:CONFig:SECurity:IPSec:INTegrity[:ALGorithm] <HMAC_MD5_96 | HMAC_SHA1_96>

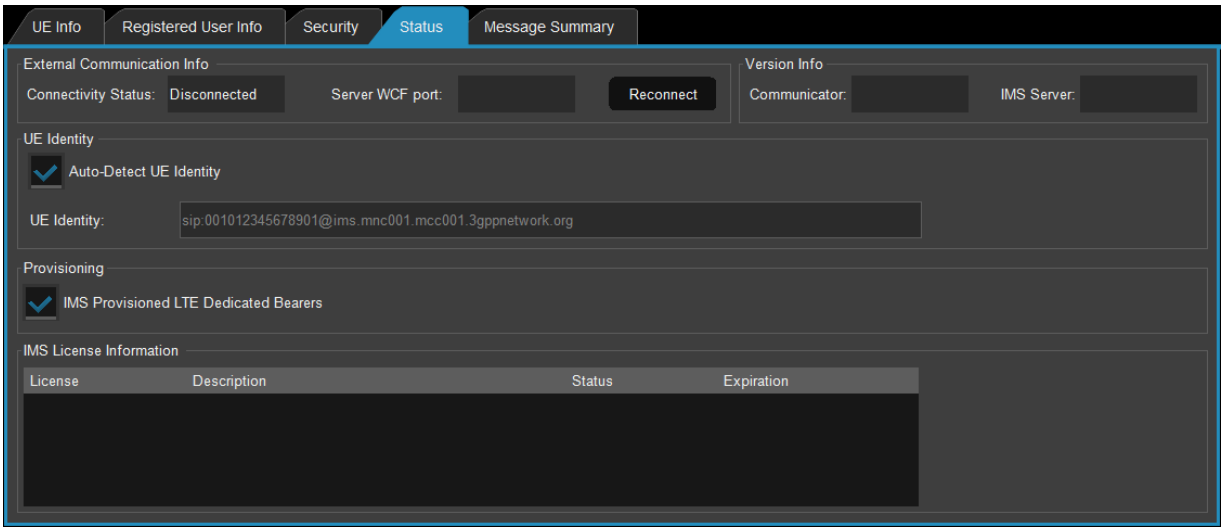
Encryption Algorithm

Specifies the IMS IPsec encryption algorithm:

- NULL
- DES3_CBC
- AES_CBC

SCPI: SYSTem:IMS:SERVer:CONFig:SECurity:IPSec:ENCRyption[:ALGorithm] <NULL | DES3_CBC | AES_CBC>

The Status tab displays whether the Test Application is connected to the IMS Server.



7.13.2 External Communication Info

Connectivity Status

Displays the current connection-status of the link from UXM TA to IMS Server: Unknown, Connecting, Connected, Disconnecting or Disconnected.

SCPI: SYSTem:IMS:SERVer:STATus:EXTernal:CONNection:STATus?

Server WCF Port

Displays the current/active destination (TCP) port Test Application uses to communicate with the IMS Server.

SCPI: SYSTem:IMS:SERVer:STATus:EXTernal:CONNection:PORT?

Reconnect

Click to trigger a connection/reconnection of Test Application to the Keysight IMS Server application.

SCPI: SYSTem:IMS:SERVer:CONFig:EXTernal:CONNection:REConnect

7.13.3 Version Info

Communicator

Displays the version-string associated with the API communication-module used for interfacing to the Keysight IMS Server.

SCPI: SYSTem:IMS:SERVer:STATus:VERSion:API?

IMS Server

Displays the version-string of the Keysight IMS Server application to which Test Application is currently connected.

SCPI: SYSTem:IMS:SERVer:STATus:VERSion:APPLication?

7.13.4 UE Identity

Auto-Detect UE Identity

Select to enable auto-detection of the UE's IMS (SIP) identity.

SCPI: SYSTem:IMS:SERVer:CONFig:UE:IDENtity:DETect[:AUTO] <ON | 1 | OFF | 0>

UE Identity

If Auto-Detect UE Identity is selected, specify the UE's IMS (SIP) identity. For example, "sip:001012345678901@ims.mnc001.mcc001.3gppnetwork.org".

SCPI: SYSTem:IMS:SERVer:CONFig:UE:IDENtity <string>

7.13.5 Provisioning

IMS Provisioned LTE Dedicated Bearers

Select to automatically influence LTE dedicated-bearer creation/modification/removal by IMS session-state changes associated with the UE.

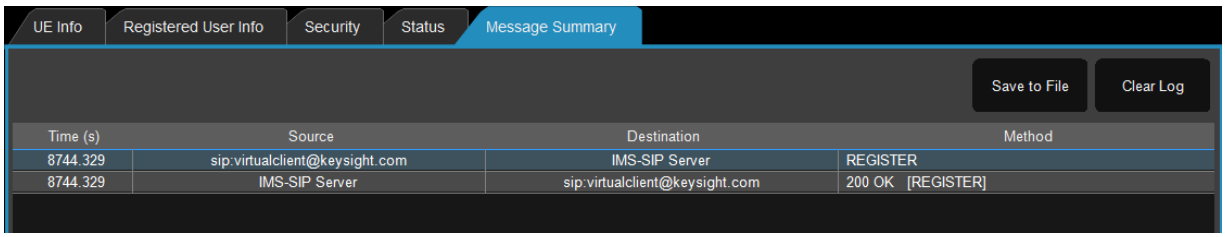
SCPI: SYSTem:IMS:SERVer:CONFig:EXTernal:LTE:DEDicated:ACReate[:STATe] <ON | 1 | OFF | 0>

7.13.6 IMS License Information

Displays IMS-related licensing information (License, Description, Status and Expiration) from the Keysight IMS Server application to which the Test Application is connected.

SCPI: SYSTem:IMS:SERVer:STATus:LICense:INFormation?

The Message Summary tab displays the IMS Messaging log reported from the IMS Server.



Save To File

Click to save the IMS message-summary log.

SCPI: SYSTem:IMS:SERVer:MESSage:LOG:SAVE <filename of message summary log>

Clear Log

Click to clear the IMS message-summary log.

SCPI: SYSTem:IMS:SERVer:MESSage:LOG:CLEar

Time

Displays the time that the IMS messages was sent/received.

Source

Displays the source of the IMS message.

Destination

Displays the destination of the IMS message.

Method

Displays the method for the IMS message.

8 LTE TABS

8.1 Tabs Displayed For LTE Cells

The following tabs and sub-tabs are displayed for an LTE cell in 5G NR NSA operating mode:

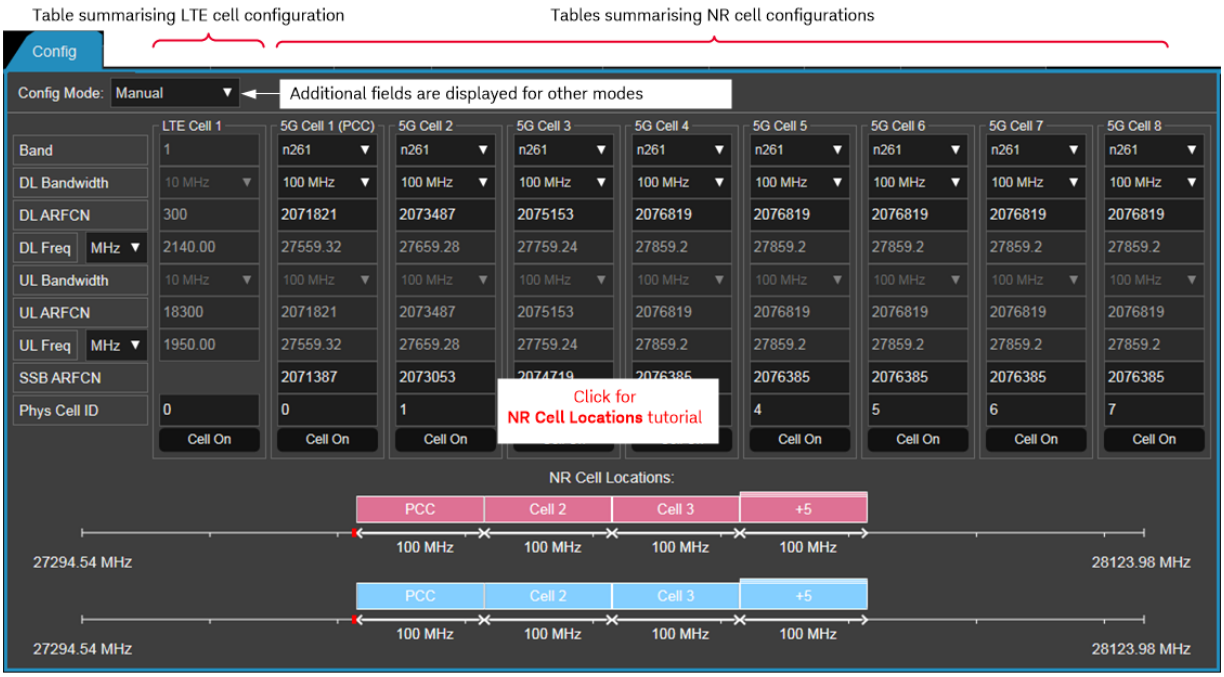
Tabs	Sub-tabs
System	Config, RF Config, Impairments, App Info, Message Summary, Error Log, RUI Log, Logging, RF Connectors
Cell	Config, Identities, NR Cell Reconfig
PHY	General, UE Power Control, Boosting
Scheduling	Subframes Config, DL RB Allocation, Quick Setup
MAC/RLC/PDCP	General, HARQ, DRB, Conn. DRX
RRC/NAS	RRC, NAS, EPS Bearer Config, Security
UE Info	UE Reported Info, UE Measurement Reports
BLER/tput	Throughput Summary, DL/UL OTA Graph, UL OTA, DL OTA
IMS	UE Info, Registered User Info, Security, Status, Message Summary

8.2 System Tab

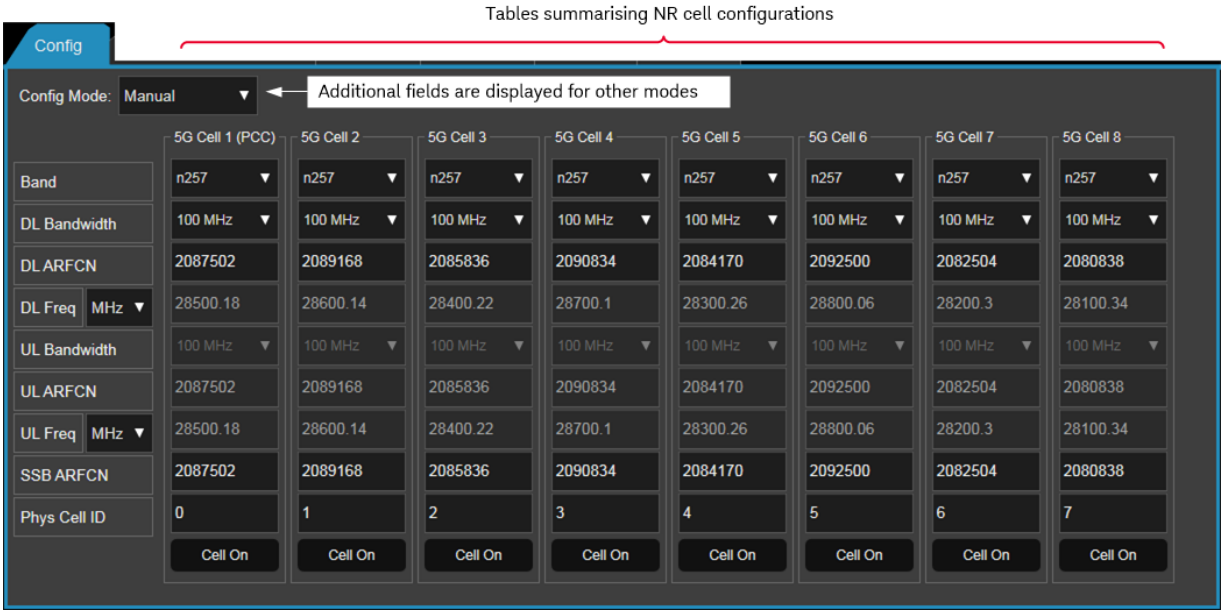
8.2.1 System > Config Tab

The Config tab summarises the configuration of available cells, and (for 5G NR cells only) allows you to change some parameters. To start a cell, click the **Cell On** button under the list of parameters for the cell.

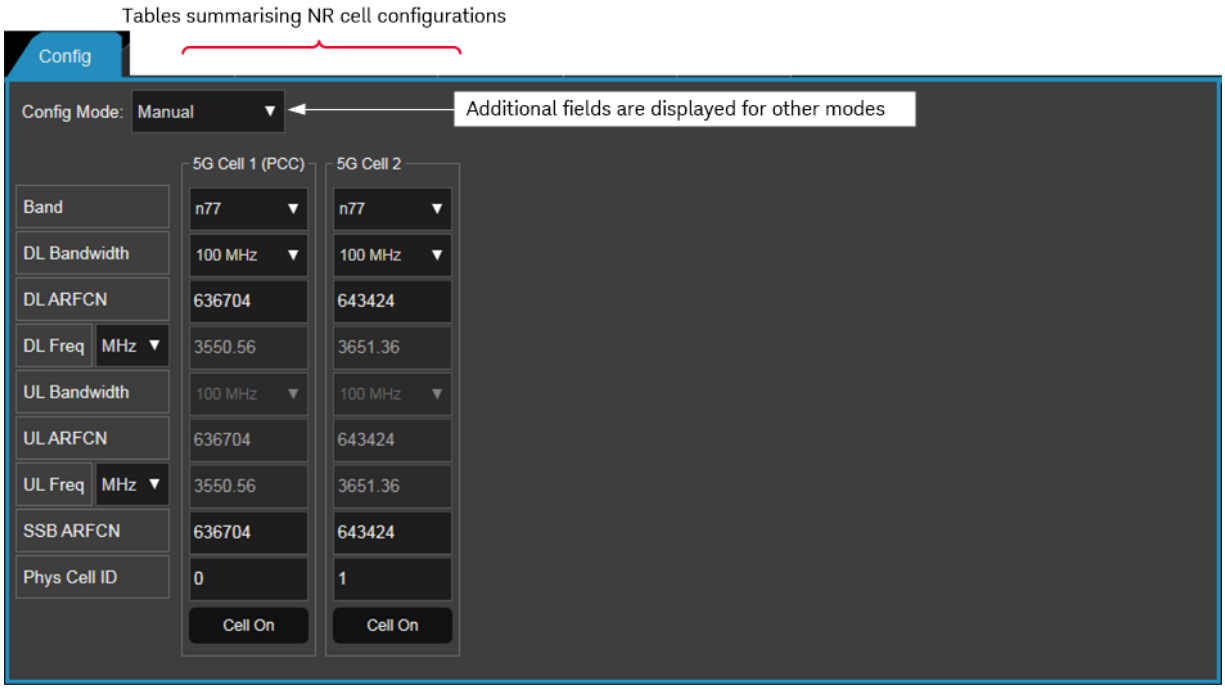
Screen for NSA mode:



Screen for NR L1 mode:



Screen for Standalone mode



Config Mode

Specifies the mode to use to configure the spacing of NR cells. Choose between:

- Manual – to manually supply the frequency-related parameters that determine the cell location manually (Band, Bandwidth, ARFCN and SSB ARFCN).
- Optimization – to allow 5G NR Test Application to space cells automatically. The following additional fields are displayed for you to choose optimization options:
  - Number of Cells. Select the required number of cells. The remaining cells are disabled.
  - PCC Position. Select the position of NR cell 1 (PCC), from 1 to <n> where <n> is the required number of cells. This updates the ARFCN and frequency values for all required cells.
  - RF Centre Freq. This is the internal UXM-5G centre frequency and cannot be changed.
  - Contiguous Cells. Select this ncheck box to apply even spacing across the required number of cells, based on PCC cell values. The band, bandwidth and ARFCN values for the other cells are disabled for the other cells, and the location map updates to show the contiguous spacing.
- Explicit – *Keysight use only*.

Band

This field is duplicated on the Cell > Config tab (Band). It is read-only for LTE.

Specify the band used by the cell. The available bands depend on the Duplex Mode (TDD or FDD) and Frequency Range, as shown below:

Duplex mode	Frequency range	Supported NR operating bands
FDD	FR1 (sub-6GHz)	n1, n2, n3, n5, n7, n8, n12, n20, n25, n28, n65, n66, n70, n71, n74
TDD	FR1 (sub-6GHz)	n34, n38, n39, n40, n41, n50, n51, n77, n78, n79
TDD	FR2 (mmWave)	n257, n258, n260, n261
TDD	Intermediate frequencies	Custom

The band determines the DL and UL frequency ranges. For FR1 operating bands, see section 5.2 in 3GPP TS 38.101-1. For FR2 operating bands, see section 5.2 in 3GPP TS 38.101-2.

SCPI: BSE:CONFig:NR5G:<cell>:BAND <N1 | N2 | N3 | N5 | N7 | N8 | N20 | N28 | N38 | N41 | N50 | N51 | N66 | N70 | N71 | N74 | N75 | N76 | N77 | N78 | N79 | N258 | N257 | N260 | N261>

DL Bandwidth

This field is duplicated on the Cell > Config tab (DL Bandwidth).

Specify the downlink bandwidth to use for this cell. The available bandwidths depend on the Frequency Range, as shown below:

Frequency range	Supported bandwidths (MHz)
FR1 (sub-6GHz)	5, 10, 15, 20, 40, 50, 60, 80, 90, 100
FR2 (mmWave)	50, 100, 200
Custom (intermediate frequencies)	50, 100, 200

SCPI: BSE:CONFig:NR5G:<cell>:DL:BW <BW5 | BW10 | BW15 | BW20 | BW40 | BW50 | BW60 | BW80 | BW100 | BW200>

DL ARFCN

This field is duplicated on the Cell > Config tab (DL ARFCN).

Specify the downlink absolute radio frequency channel number (ARFCN), which is a unique identifier used to calculate the exact frequency of the radio channel. The displayed value, and the limits of allowed values, depend on the Frequency Range and Band defined above.

SCPI: BSE:CONFig:NR5G:<cell>:DL:ARFCN <0 ... 400000000>

DL Freq

This field is duplicated on the Cell > Config tab (DL Frequency).

This parameter depends on the Frequency Range, as shown below:

Frequency range	DL Frequency field
FR1 or FR2	Specifies the downlink frequency (in Hz) to use for FR1 or FR2 testing.
Custom	Specifies the downlink frequency (in Hz) to use for intermediate frequency testing.

SCPI: BSE:CONFig:NR5G:<cell>:DL:FREQuency <300000000 ... 40000000000>

UL Bandwidth

This field is duplicated on the Cell > Config tab (UL Bandwidth).

For an FDD cell, specify the uplink bandwidth to use for the cell. For TDD, this field is read-only because its value must be the same as the DL Bandwidth. The available bandwidths depend on the Frequency Range, as shown below:

Frequency range	Supported bandwidths (MHz)
FR1 (sub-6GHz)	5, 10, 15, 20, 40, 50, 60, 80, 90, 100
FR2 (mmWave)	50, 100, 200
Custom (intermediate frequencies)	50, 100, 200

SCPI: BSE:CONFig:NR5G:<cell>:UL:BW <BW5 | BW10 | BW15 | BW20 | BW40 | BW50 | BW60 | BW80 | BW100 | BW200>

UL ARFCN

This field is duplicated on the Cell > Config tab (UL ARFCN).

For an FDD cell, specify the uplink absolute radio frequency channel number (ARFCN), which is a unique identifier used to calculate the exact frequency of the radio channel. For TDD, this field is read-only because its value must be the same as the DL ARFCN. The allowed values depend on the Frequency Range and Band.

SCPI: BSE:CONFig:NR5G:<cell>:UL:ARFCN <0 ... 2279165>

UL Freq

This field is duplicated on the Cell > Config tab (UL Frequency).

For an FDD cell, specify the uplink frequency to use for the cell. For TDD, this field is read-only because its value must be the same as the DL Frequency. This parameter depends on the Frequency Range, as shown below:

Frequency range	DL Frequency field
FR1 or FR2	Specifies the uplink frequency (in Hz) to use for FR1 or FR2 testing.
Custom	Specifies the uplink frequency (in Hz) to use for intermediate frequency testing.

SCPI: BSE:CONFig:NR5G:<cell>:UL:FREQuency <300000000 ... 40000000000>

SSB ARFCN

This field is duplicated on the Cell > Config tab (SSB_ARFCN) and Cell > SSB General tab (SSB ARFCN).

Specify the SSB ARFCN (0 to 3279165) to use for this cell. For more information, see section 5.4.2.1 in 3GPP TS 38.104.

SCPI: BSE:CONFig:NR5G:<cell>:SSB:ARFCN <0 ... 3279165>

Physical Cell ID

This field is duplicated on the Cell > Identities tab (Physical Cell ID) for an NR cell. For an LTE cell, the physical cell ID is always 0.

The physical cell ID (0 to 1007), which is typically used as the default for scrambling sequence initialization if no explicit parameter is provided.

SCPI: BSE:CONFig:NR5G:<cell>:PHY:CELL:ID <1 ... 1007>

Cell On/Off

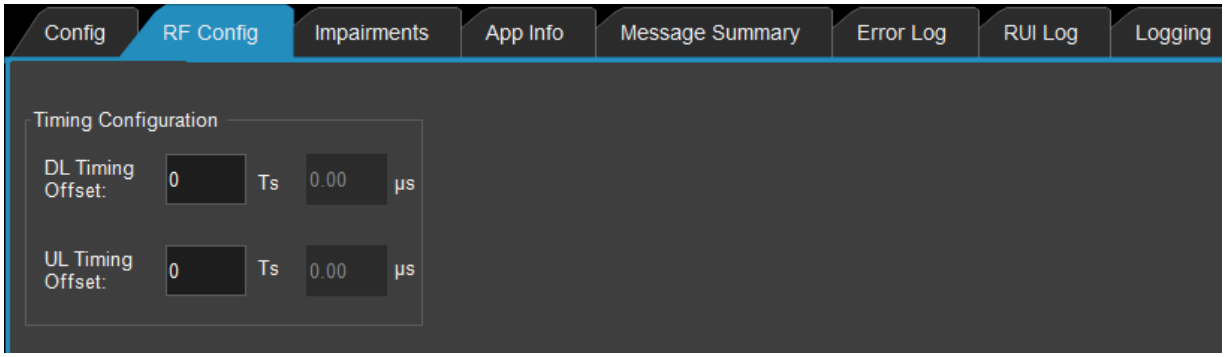
Click to switch the cell on or off.

NR Cell locations

See Cell locations map.

8.2.2 RF Config Tab

The RF Config tab configures the uplink/downlink timing offsets.



8.2.2.1 Timing Configuration

DL Timing Offset

To be supplied

SCPI: SYSTem:LTE:TIMing:OFFSet:<cell> <0 ... 314572799>

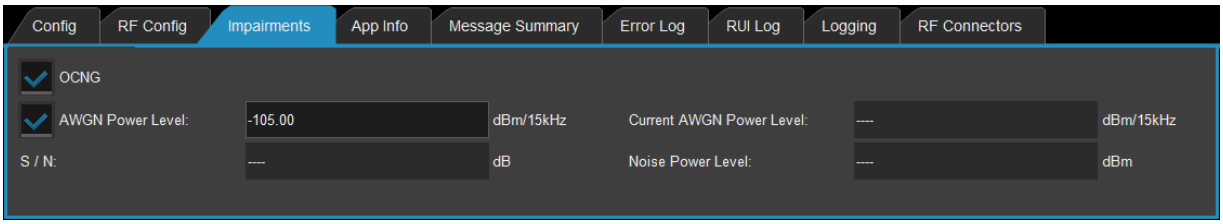
UL Timing Offset

To be supplied

SCPI: SYSTem:LTE:ULTIMing:OFFSet:<cell> <-30720 ... 30720>

8.2.3 Impairments Tab (LTE Cell)

The Impairments tab configures how to impair the LTE RF signal by adding white gaussian noise (AWGN).



OCNG

Select to enable OFDM Channel Noise Generation (OCNG), which models allocations to virtual UEs (which are not under test), and is mainly used when performing Radio Conformance Testing.

SCPI: BSE:CONFig:LTE:<cell>:IMPairments:OCNG <ON | 1 | OFF | 0>

AWGN Power Level

Select the added white gaussian noise (AWGN) mode. Select the AWGN Power Level checkbox to set the power level, then define the power level for the noise (dBm/15kHz) relative to a single resource element.

SCPI: BSE:CONFig:LTE:<cell>:IMPairments:AWGN <ON | 1 | OFF | 0>

SCPI: BSE:CONFig:LTE:<cell>:IMPairments:AWGN:POWer <-155 ... -30>

S / N

Specify the signal to noise ration (S/N) in dBm/15kHz of the AWGN Power Level relative to the cell power.

SCPI: BSE:CONFig:LTE:<cell>:IMPairments:AWGN:SNR <-400 ... 200>

Current AWGN Power Level

Displays the current AWGN power level ub dBm/15kHz.

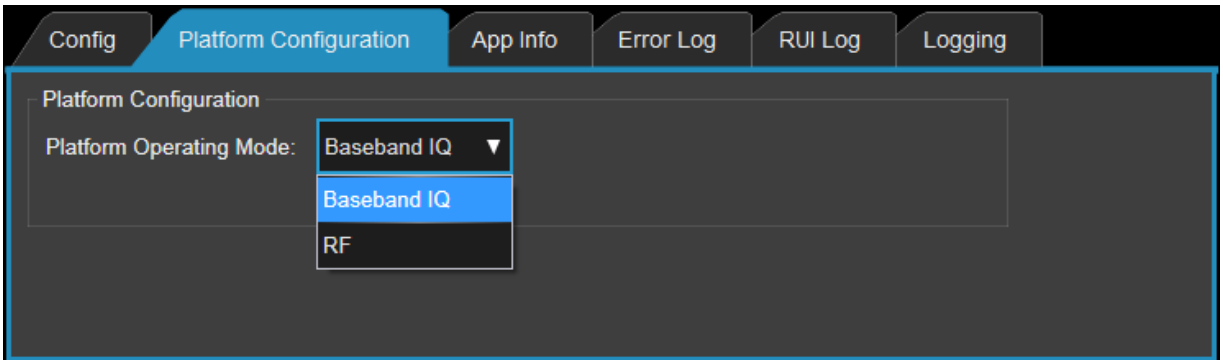
SCPI: BSE:CONFig:LTE:<cell>:IMPairments:AWGN:POWer:CURRent

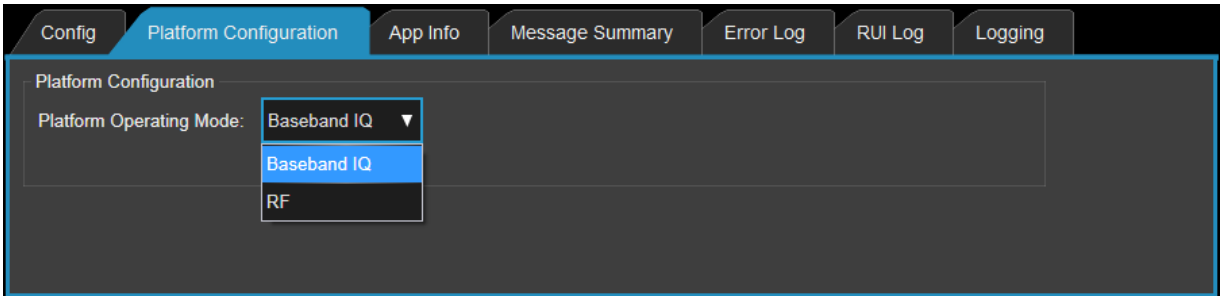
Noise Power Level

Specify the integrated power level of the AWGN in dBm.

SCPI: BSE:CONFig:LTE:<cell>:IMPairments:AWGN:NAMPlitude <-400 ... 200>

8.2.4 System > Platform Configuration tab





Platform Operating Mode

For information about baseband IQ (BBIQ) and RF connections, see the 5G Test System Setup Help.

Choose the platform operating mode as:

- Baseband IQ – BBIQ connections, which send baseband IQ signals from the test system to prototype devices that do not currently support radio frequencies.
- RF – RF connections between the transceivers and device under test.

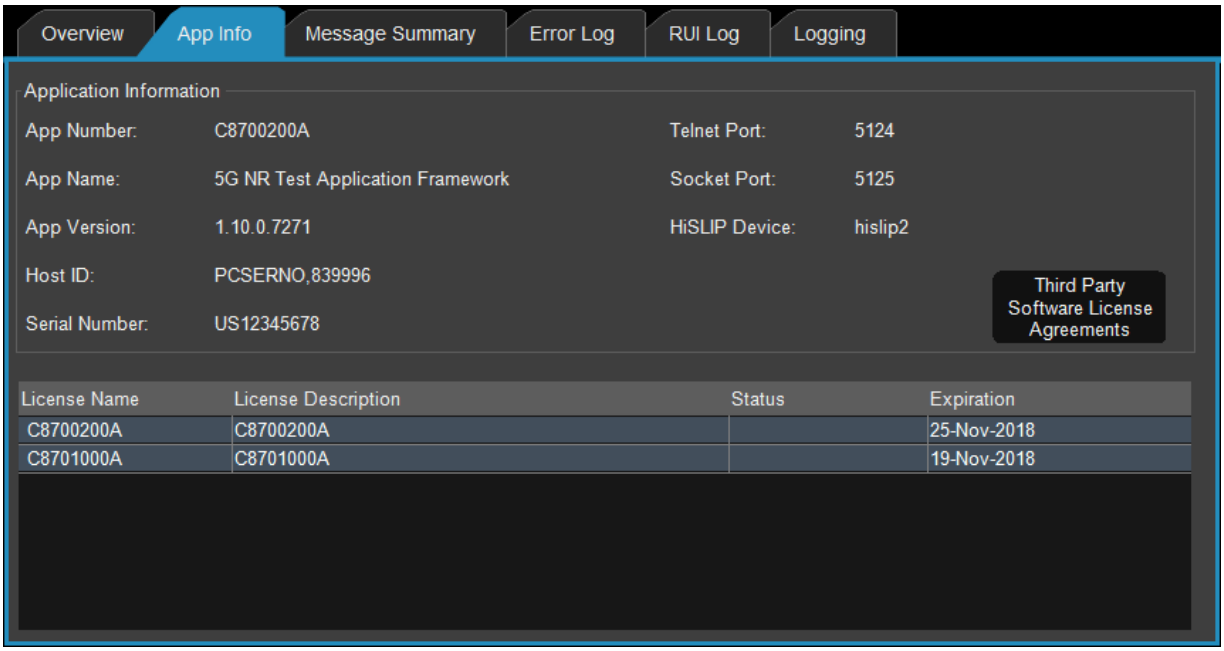
The mode change is confirmed with the message:

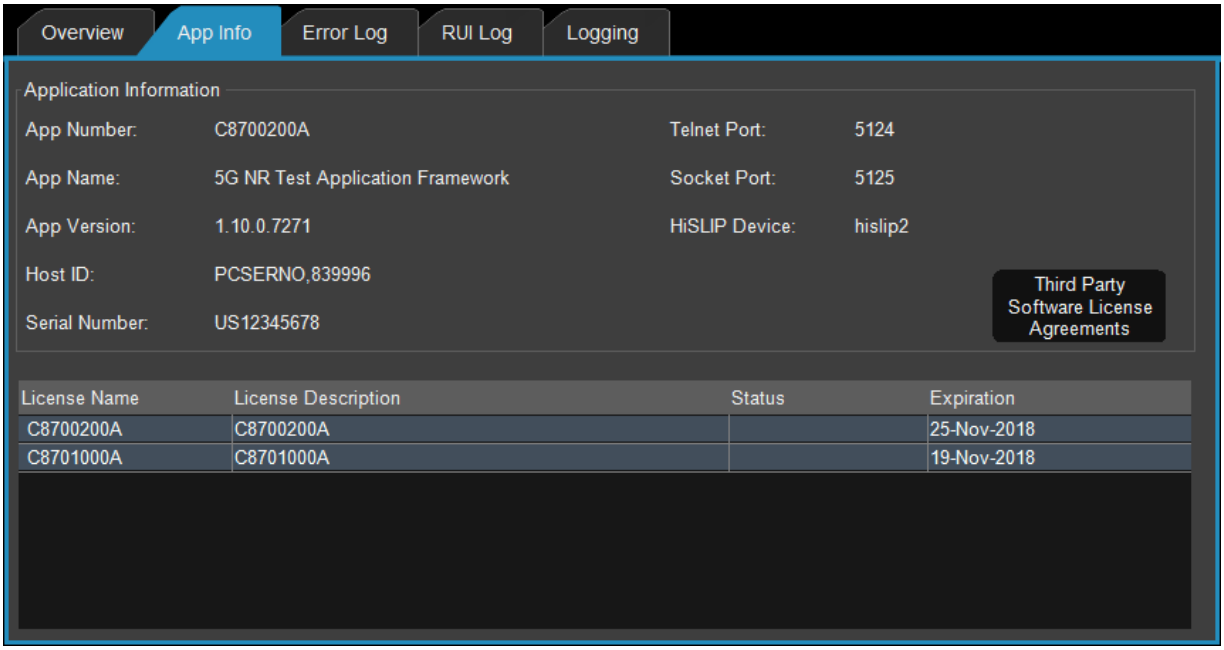
Operating mode change complete

SCPI: BSE:CONFig:NR5G:<cell>:INTerface <BBIQ | RF>

8.2.5 System > App Info Tab

The App Info tab displays information about the UXM-5G unit and the software installed on it.





App Number

Displays the part number for the 5G NR Test Application running on the Test System PC or UXM-5G unit.

App Name

Displays the name of the application running on the Test System PC or UXM-5G unit.

App Version

Displays the software version number of the application running on the Test System PC or UXM-5G unit.

Host ID

Displays the host ID of the PC that Keysight License Manager requires when you load licenses.

Serial Number

Displays the serial number of the unit required by Customer Support when discussing repairs/calibrations.

Telnet Port

Displays the port number used to connect Telnet services to the unit.

Socket Port

Displays the port number used for socket connections to the unit.

HiSLIP Device

Displays the HiSLIP server used to communicate with the UXM-5G unit.

License Name

Lists the licences installed on the unit.

License Description

Displays a brief description for each licence.

Status

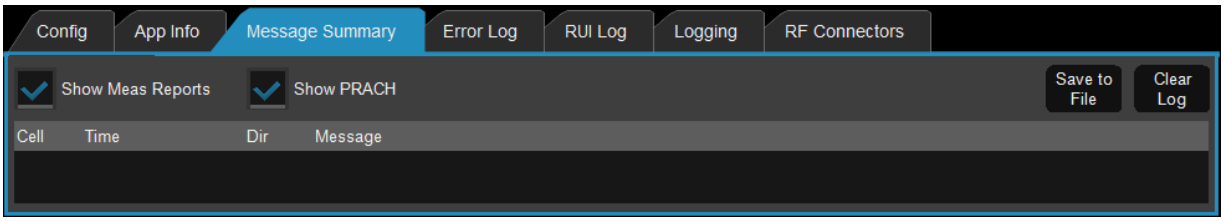
Displays the status of each licence.

Expiration

Displays the expiration date for each licence. For licences without an expiry date, this field displays **Permanent** next to the licence.

8.2.6 System > Message Summary Tab

The Message Summary tab displays a record of the messages between the test system and the device under test.



Show Meas Reports

Select to display measurement reports in the message summary.

Show PRACH

Select to display PRACH messages in the message summary.

Save To File

Click to save the messages to an xml file.

SCPI: BSE:FUNCtion:MESSage:SAVE

Clear Log

Click to remove all logged messages.

SCPI: BSE:FUNCtion:MESSage:CLEar

Cell

Displays the cell to/from which the message was sent/received.

Time

Displays the time that the messages was sent/received.

Dir

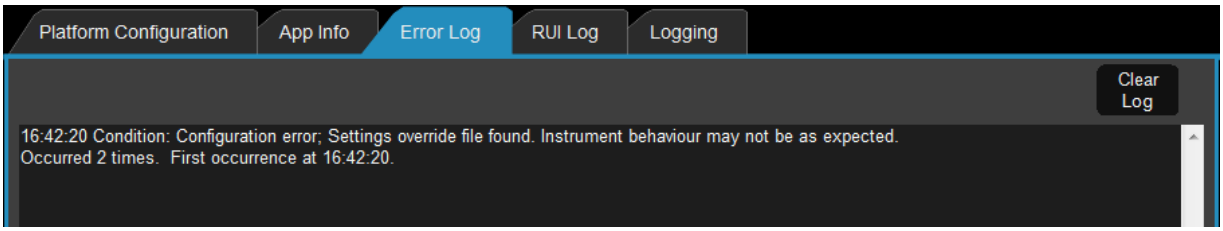
Displays the direction of the message.

Message

Displays the type of message sent/received.

8.2.7 System > Error Log Tab

The Error Log tab displays the error message log which logs errors. All errors and events that are generated are displayed in the error message log. When the log is full, a new message is sent to the log and the oldest message is removed from the log. The log is cleared when the test set powers up.

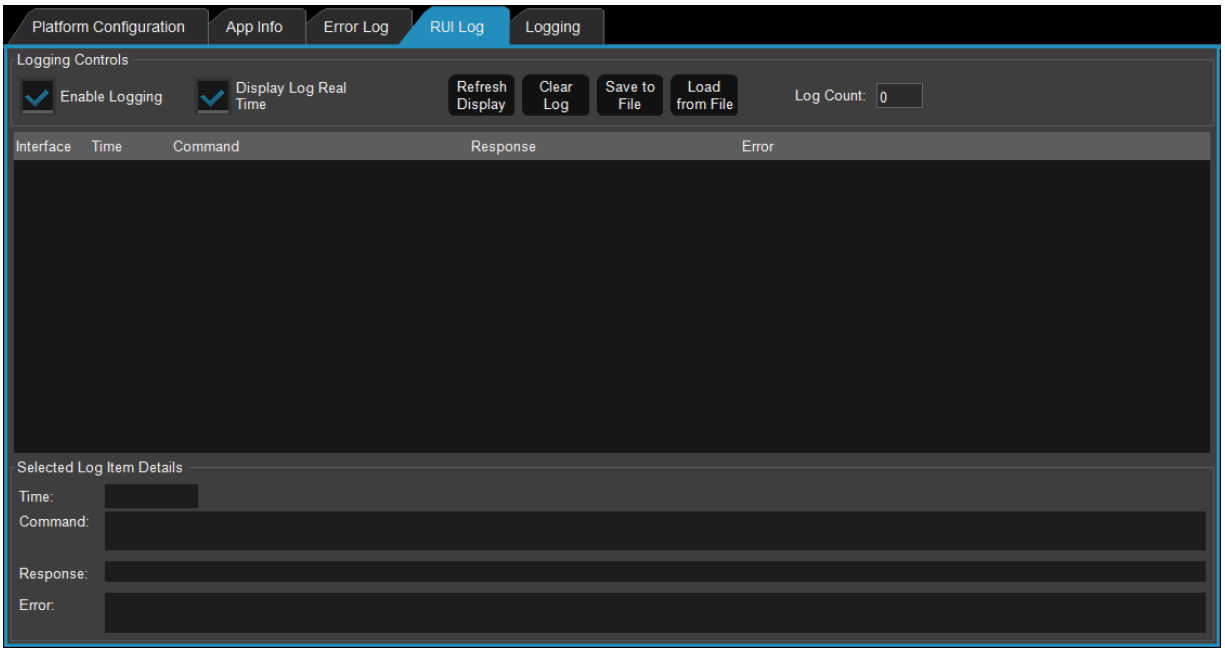


Clear Log

Click to remove all logged messages from the current log.

8.2.8 System > RUI Log Tab

The RUI Log tab displays the remote user interface (RUI) log.



Enable Logging

Select to enable the remote user interface (RUI) log.

SCPI: SYSTem:LOG:UI:REMote[:STATe]

Display Log Real Time

Select to display all logged messages for the next message received, and display each message logged to the message queue immediately. Clear to not update the log display.

Note: Changing the state of this control does not have an immediate effect on the log display.

SCPI: SYSTem:LOG:UI:REMote:DISPlay:RTIMe

Refresh Display

Click to refresh the log.

SCPI: SYSTem:LOG:UI:REMote:DISPlay:REFResh

Clear Log

Click to clear the log.

SCPI: SYSTem:LOG:UI:REMote:CLEar

Save To File

Click to save the RUI log to a file.

SCPI: SYSTem:LOG:UI:REMote:SAVE

Load From File

Click to load a RUI log from a file.

SCPI: SYSTem:LOG:UI:REMote:LOAD

Log Count

Displays the current number of log entries.

SCPI: SYSTem:LOG:UI:REMote:COUNt

Interface

Displays the interface on which the remote user interface command was received.

Time

Displays the time in the following format: HH:MM:SS.nn

Command

Displays the command string from the message.

Response

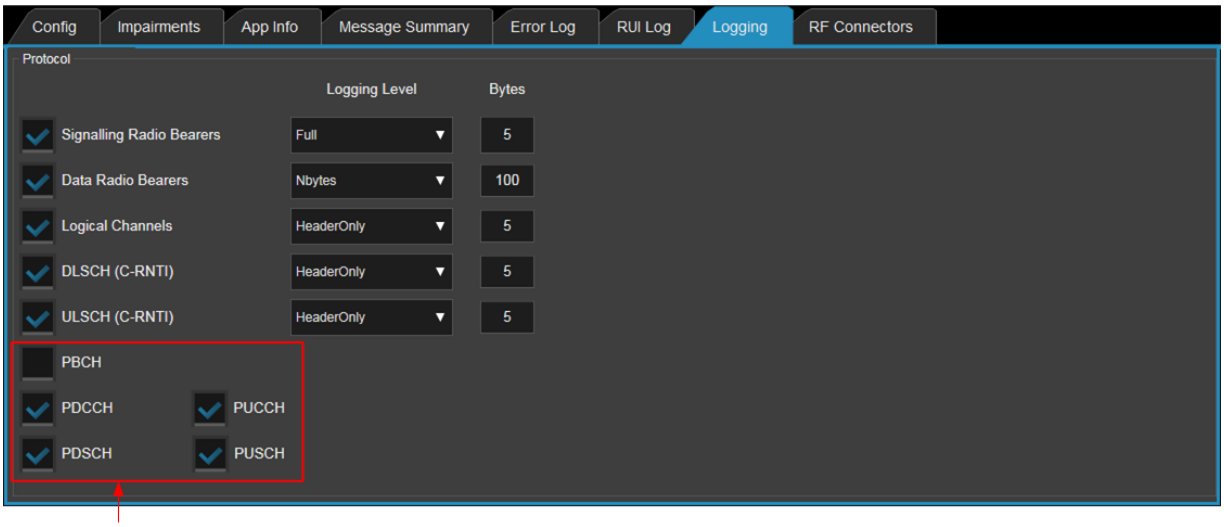
Displays the response string from the message. This can be an empty string if the message does not contain a response, like a command.

Error

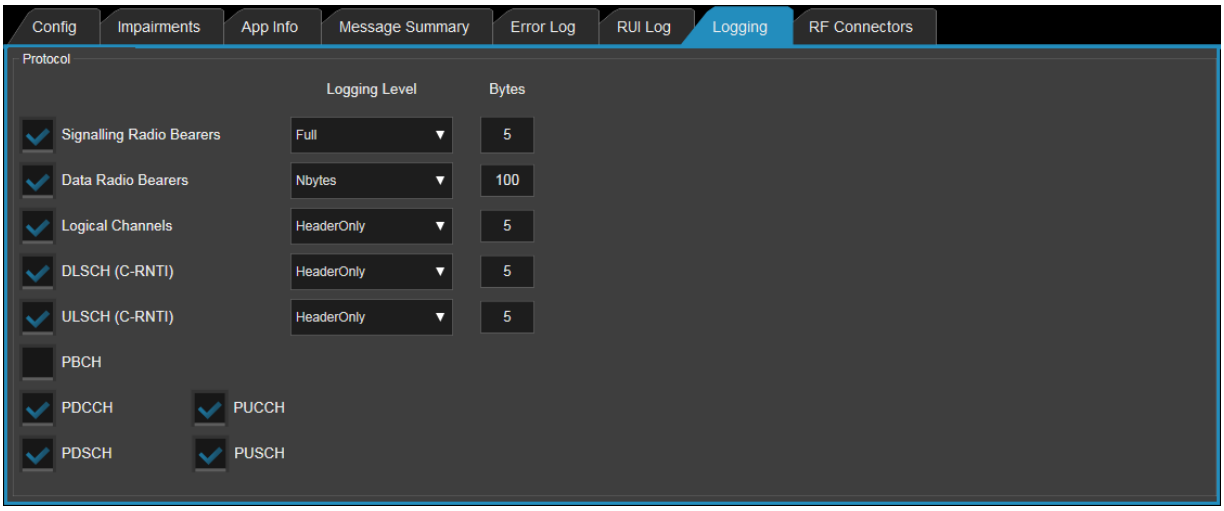
Displays the error string from the message. This can be an empty string if the message does not contain an error. Initially sized to display two lines of text.

8.2.9 System > Logging Tab

The Logging tab controls the level of protocol logging to the ALF log file. The logging applies to the NR or LTE cell selected in the cell details area of the workspace.



Note: *These options are absent on the Logging tab for an LTE cell; the downlink channels are included in the DLSCH option and the uplink channels included in the ULSCH option.*



Signaling Radio Bearers

Select this check box to include signaling radio bearers in the logged data for this cell.

SCPI: BSE:CONFig:<celltype>:<cell>:LOG:SRBearer:STATe <0 | 1>

Additional information for signaling radio bearers:

- Logging Level

  Select the amount of data to log: Full (header plus payload), Header Only, or Nbytes (header plus first <n> bytes of message payload).

  SCPI: BSE:CONFig:<celltype>:<cell>:LOG:SRBearer:LEVel <HEADER | FULL | NBYTE>

- Bytes

  For a logging level of N bytes, specify the number of bytes to log (0 to 1000).

  SCPI: BSE:CONFig:<celltype>:<cell>:LOG:SRBearer:NBytes <0 ... 1000>

Data Radio Bearers

Select this check box to include data radio bearers in the logged data for this cell.

SCPI: BSE:CONFig:<celltype>:<cell>:LOG:DRBearer:STATe <0 | 1>

Additional information for data radio bearers:

- Logging Level

Select the amount of data to log: Full (header plus payload), Header Only, or Nbytes (header plus first <n> bytes of message payload).

SCPI: BSE:CONFig:<celltype>:<cell>:LOG:DRBearer:LEVel <HEADER | FULL | NBYTE>

- Bytes

  For a logging level of N bytes, specify the number of bytes to log (0 to 1000).

  SCPI: BSE:CONFig:<celltype>:<cell>:LOG:DRBearer:NBytes <0 ... 1000>

Logical Channels

Select this check box to include logical channels in the logged data for this cell.

SCPI: BSE:CONFig:<celltype>:<cell>:LOG:LOGChan:STATe <0 | 1>

Additional information for data radio bearers:

- Logging Level

  Select the amount of data to log: Full (header plus payload), Header Only, or Nbytes (header plus first <n> bytes of message payload).

  SCPI: BSE:CONFig:<celltype>:<cell>:LOG:LOGChan:LEVel <HEADER | FULL | NBYTE>

- Bytes

  For a logging level of N bytes, specify the number of bytes to log (0 to 1000).

  SCPI: BSE:CONFig:<celltype>:<cell>:LOG:LOGChan:NBytes <0 ... 1000>

DLSCH (C-RNTI)

Select this check box to log data transported on the Downlink Shared Channel for C-RNTI (connected mode only).

SCPI: BSE:CONFig:<celltype>:<cell>:LOG:DLSCh:STATe <0 | 1>

Additional information for data radio bearers:

- Logging Level

  Select the amount of data to log: Full (header plus payload), Header Only, or Nbytes (header plus first <n> bytes of message payload).

  SCPI: BSE:CONFig:<celltype>:<cell>:LOG:DLSCh:LEVel <HEADER | FULL | NBYTE>

- Bytes

  For a logging level of N bytes, specify the number of bytes to log (0 to 1000).

  SCPI: BSE:CONFig:<celltype>:<cell>:LOG:DLSCh:NBytes <0 ... 1000>

ULSCH (C-RNTI)

Select this check box to log uplink data transported on the Uplink Shared Channel for C-RNTI (connected mode only).

SCPI: BSE:CONFig:<celltype>:<cell>:LOG:ULSCh:STATe <0 | 1>

Additional information for data radio bearers:

- Logging Level

  Select the amount of data to log: Full (header plus payload), Header Only, or Nbytes (header plus first <n> bytes of message payload).

  SCPI: BSE:CONFig:<celltype>:<cell>:LOG:ULSCh:LEVel <HEADER | FULL | NBYTE>

- Bytes

For a logging level of N bytes, specify the number of bytes to log (0 to 1000).

SCPI: BSE:CONFig:<celltype>:<cell>:LOG:ULSCh:NBytes <0 ... 1000>

PBCH

This option is absent for LTE cells and included in the DLSCH option.

Select this check box for full logging of data transported on the Primary Broadcast Channel.

SCPI: BSE:CONFig:<celltype>:<cell>:LOG:PBCH:STATe <0 | 1>

PDCCH

This option is absent for LTE cells and included in the DLSCH option.

Select this check box for full logging of data transported on the Physical Downlink Control Channel.

SCPI: BSE:CONFig:<celltype>:<cell>:LOG:PDCCh:STATe <0 | 1>

PDSCH

This option is absent for LTE cells and included in the DLSCH option.

Select this check box for full logging of data transported on the Physical Downlink Control Channel.

SCPI: BSE:CONFig:<celltype>:<cell>:LOG:PDSCh:STATe <0 | 1>

PUCCH

This option is absent for LTE cells and included in the ULSCH option.

Select this check box for full logging of data transported on the Physical Uplink Control Channel.

SCPI: BSE:CONFig:<celltype>:<cell>:LOG:PUCCh:STATe <0 | 1>

PUSCH

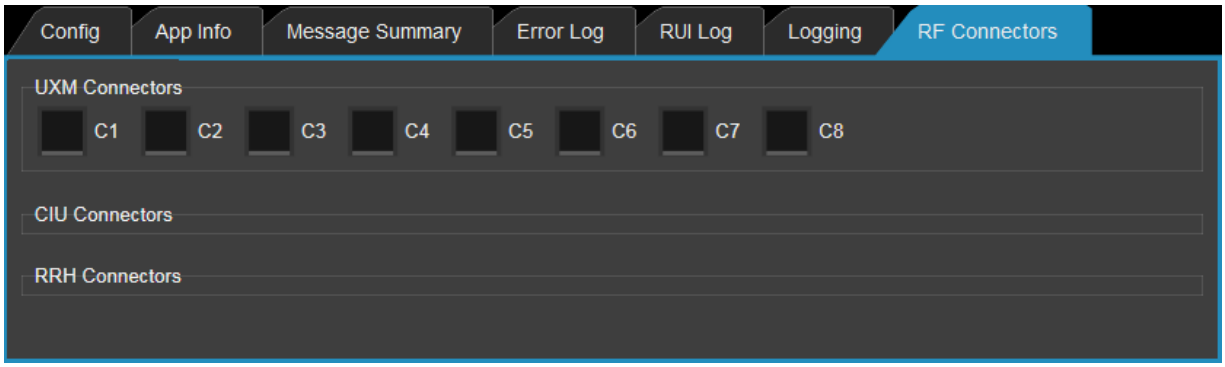
This option is absent for LTE cells and included in the ULSCH option.

Select this check box for full logging of data transported on the Physical Uplink Shared Channel.

SCPI: BSE:CONFig:<celltype>:<cell>:LOG:PUSCh:STATe <0 | 1>

8.2.10 System > RF Connectors tab

The RF Connectors tab allows you to add and remove the connectors used by test cases. For example, you could remove the downlink signal between an RRH and the antenna located within a chamber.



UXM/CIU/RRH Connectors

When 5G NR Test Application Framework starts, it checks how many connectors are present in the test system, and displays up to three types of connector IDs:

- C1 to C8 – identifies a UXM connector.

- IF1_1A to IF1_2B – identifies a CIU (Common Interface Unit) connector.
- MMW1 to MMW8 – identifies an RRH (Remote Radio Head) connector.

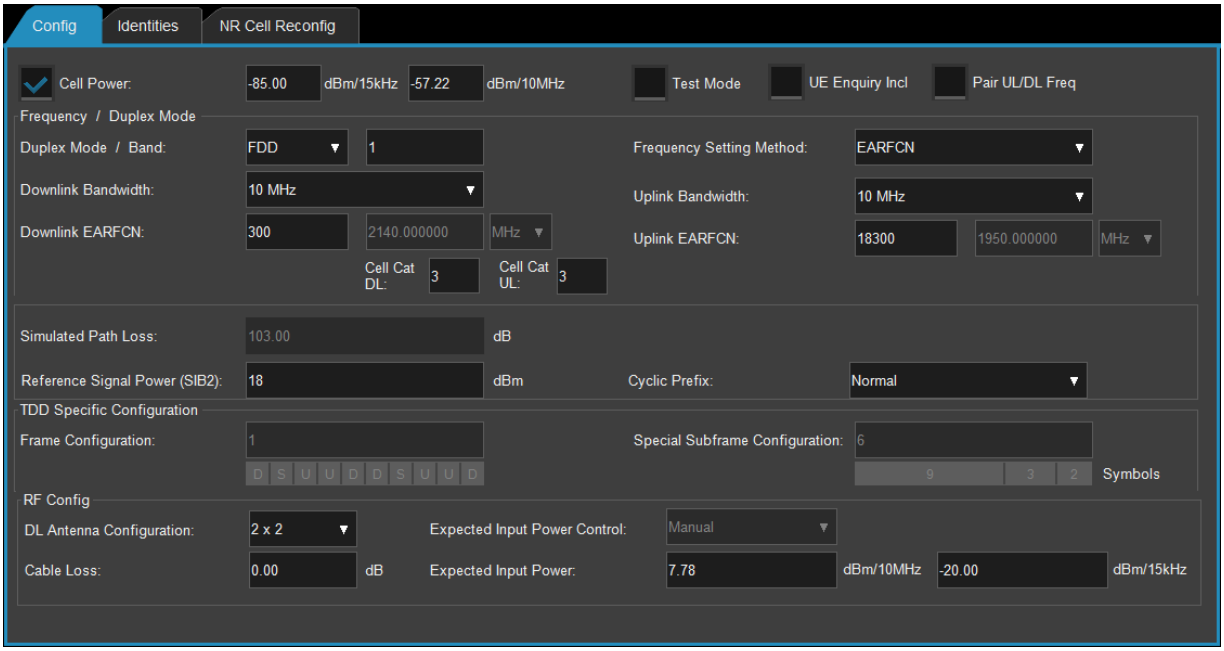
Select check boxes for the connectors that are to be enabled for use by test cases.

SCPI: BSE:CONFig:NR5G:CTRL:RF:SIGNals <List<UxmConnectorId,ON | OFF>>

8.3 Cell Tab

8.3.1 Cell > Config Tab

The Config tab for an LTE cell contains the basic cell configuration information.



Cell Power

Select this check box to use the cell power values configured below. Clear the checkbox to use a cell power of -200 dBm/15kHz.

If the checkbox is selected, specify the reference signal transmit power (RSTP) in dBm/15kHz and the power level of cell when all resource elements are transmitting at the same power levels as the reference signals (units of dBm / <downlink bandwidth> where the downlink bandwidth is defined below).

SCPI: BSE:CONFig:LTE:<cell>[:NBIot][:DL]:POWer:STATe <ON | 1 | OFF | 0>

SCPI: BSE:CONFig:LTE:<cell>:DL:POWer <-142.00 ... -14.78>

SCPI: BSE:CONFig:LTE:<cell>:DL:POWer:CHANnel <channel power>

Test Mode

3GPP TS 36.508 defines various test states which are recommended for some test cases defined in 36.521-1, 36.523-1 and 36.523-3. These test states generally isolate the radio bearers from the IP stack, and can optionally loop back data. Select this check box to run 5G NR Test Application in test mode.

SCPI: BSE:CONFig:NAS:UE:TEST:MODE <ON | 1 | OFF | 0>

UE Enquiry Incl

Select this check box to retrieve UE Capability information for display on the UE Band Comb Tab.

Pair UL/DL Freq

SCPI: BSE:CONFig:PAIR:ULDL <ON | 1 | OFF | 0>

8.3.1.1 Frequency / Duplex Mode

Duplex Mode / Band

Specify the frame structure (duplex mode) to use for this cell: TDD or FDD. Then specify the TDD or FDD band to use.

SCPI: BSE:CONFig:LTE:<cell>:DUPLex:MODE <TDD | FDD>

SCPI: BSE:CONFig:LTE:<cell>:BAND <1 ... 255>

Frequency Setting Method

Select the method to use to calculate the uplink and downlink frequency:

- EARFCN – uses uplink EARFCN and downlink EARFCN fields to calculate cell frequencies.
- Frequency – uses uplink frequency and downlink frequency fields to calculate cell frequencies.
- Customized Band – uses uplink/downlink EARFCN and Customized Band Configuration fields to calculate cell frequencies.

SCPI: BSE:CONFig:LTE:<cell>:FSMethod <EARFcn | FREQuency | CBANd>

Downlink/Uplink Bandwidth

Specify the downlink bandwidth to use: 1.4, 3, 5, 10, 15 or 20 MHz.

SCPI: BSE:CONFig:LTE:<cell>:DL:BW <BW1P4 | BW3 | BW5 | BW10 | BW15 | BW20>

SCPI: BSE:CONFig:LTE:<cell>:UL:BW <BW1P4 | BW3 | BW5 | BW10 | BW15 | BW20>

EARFCN / Downlink EARFCN / Uplink EARFCN

(Only displayed if the Frequency Setting Method is EARFCN or Customized Band)

Specify the uplink and downlink E-UTRA Absolute Radio Frequency Channel Number (EARFCN) of the cell. The range of allowed values depend on the configured band. For more information, see section 5.7.3 in 3GPP TS 36.101.

SCPI: BSE:CONFig:LTE:<cell>:DL:EARFcn <0 ... 261894>

SCPI: BSE:CONFig:LTE:<cell>:UL:EARFcn <0 ... 261894>

Downlink Frequency / Uplink Frequency

(Only displayed if Frequency Setting Method is Frequency)

Specify the cell downlink frequency in MHz. The range of allowed values depend on the EARFCN and band. For more information, see section 5.7.3 in 3GPP TS 36.101.

Note: *Changing the downlink frequency automatically changes UL EARFCN and Band.*

SCPI: BSE:CONFig:LTE:<cell>:DL:FREQuency <300 ... 3800 MHz>

8.3.1.2 Path loss

An eNB advertises the power level it is using to transmit the reference signals on a cell inside the System Information Block 2 message in the referenceSignalPower parameter. This enables a UE to calculate the path loss between the received signal power and the power level that the eNB actually used.

It would be unusual for a real eNB to frequently change the power level of the reference signals. Normally, it transmits a value for this parameter that the UE reads once and then assumes it will not changed for a period of time.

However, during the UE design process it is common to want to change the DL power level of the cell. For example: when performing receiver sensitivity testing. In this case, the power level can often be lowered below the minimum power level that can be advertised by the cell.

For this reason, and because it would not be possible to be sure what value the UE has currently read from the System Information, 3GPP TS 36.508 recommends setting the value of this parameter to 18 dBm – and not changing this when the DL power level of the cell is changed.

This setting can be used to simulate different path losses in the system.

When using this setting, please note that if the path loss is too low, the UE will transmit at a very low power level, and it may be impossible to demodulate the signal.

Simulated Path Loss

Displays the simulated path loss (in dB) calculated from the reference signal power (SIB2) defined below.

Reference Signal Power (SIB2)

Specify the reference signal power sent to the device using the referenceSignalPower parameter in the System Information Block 2 message.

SCPI: BSE:CONFig:LTE:<cell>:PHY:REFerence:SIGNal:POWer <-60 ... 50>

Cyclic Prefix

Select whether this cell uses an **Extended** or **Normal** cyclic prefix.

SCPI: BSE:CONFig:LTE:<cell>:PHY:CPSize <NORMal | EXTended>

8.3.1.3 TDD Specific Configuration

(This section is only enabled if the Duplex Mode is set to TDD)

Frame Configuration

Specify the TDD uplink-downlink configuration value (0 to 6), which defines the U, D and S subframes used in TDD mode. For more information, see section 4.2 in 3GPP TS 36.211.

Note: *This value can only be set at the time of initial activation of the Cell. It cannot be changed on subsequent re-activations of the Cell. To change the value of this property, first de-activate the cell, then specify a new value and activate the Cell.*

SCPI: BSE:CONFig:LTE:<cell>:PHY:TDD:ULDL:CONFig <0 ... 6>

Special Subframe Configuration

Specify the TDD special subframe configuration value (0 to 9), which defines various parameters of the S subframes used in TDD mode. For more information, see section 4.2 in 3GPP TS 36.211.

Note: *This value can only be set at the time of initial activation of the Cell. It cannot be changed on subsequent re-activations of the Cell. To change the value of this property, first de-activate the cell, then specify a new value and activate the Cell.*

SCPI: BSE:CONFig:LTE:<cell>:PHY:TDD:SSFRame:CONFig <0 ... 9>

8.3.1.4 RF Config

DL Antenna Configuration

Select the downlink antenna configuration: 1x1, 1x2 and 2x2.

SCPI: BSE:CONFig:LTE:<cell>:PHY:DL:ANTenna:CONFig <D1U1 | D1U2 | D1U4 | D2U1 | D2U2 | D2U4 | D4U1 | D4U2 | D4U4 | D8U2 | D8U4>

DL Cable Loss

Specify the downlink cable loss (dB) from -100.00 to 100.00.

SCPI: BSE:CONFig:LTE:<cell>:LTE:CABLe:LOSS <-100 ... 100>

Expected Input Power Control

*Always set to **Manual**.*

SCPI: RFANalyzer:LTE:<cell>:CONTrol:POWer:AUTO <ON | 1 | OFF | 0>

Expected Input Control

Controls whether the attenuation applied to the UL signal is automatically calculated or manually set by you. If the manual setting is selected, the Manual Input Power setting is used.

SCPI: RFANalyzer:LTE:<cell>:MANual:POWer <-60 ... 30>

8.3.1.5 Customized Band Configuration

(Only displayed if Frequency Setting Method is Customized Band)

Downlink/Uplink Start EARFCN/Frequency

Specify the starting EARFCN and starting Frequency for the custom band.

SCPI: BSE:CONFig:LTE:<cell>:DL:STARt:EARFcn:CBANd <0 ... 262143>

SCPI: BSE:CONFig:LTE:<cell>:DL:STARt:FREQuency:CBANd <300.000000 ... 3800.000000>

SCPI: BSE:CONFig:LTE:<cell>:UL:STARt:EARFcn:CBANd <0 ... 65535>

SCPI: BSE:CONFig:LTE:<cell>:UL:STARt:FREQuency:CBANd <300.000000 ... 3800.000000>

Frequency Step

Specify the size of the frequency step to use in the custom band.

SCPI: BSE:CONFig:LTE:<cell>:CBANd:FREQuency:STEP <100.000 ... 1000.000>

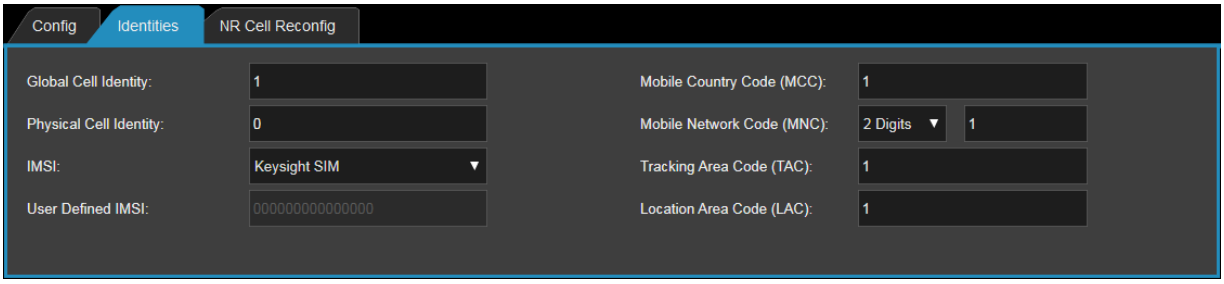
Number Of Steps

Specify the number of steps in the custom band.

SCPI: BSE:CONFig:LTE:<cell>:CBANd:STEP:COUNt <20 ... 2000>

8.3.2 Cell > Identities Tab (LTE)

The Identities tab configures identifiers for the cell, SIM and area codes.



Global Cell Identity

Specify an integer that unambiguously identifies a cell within a PLMN.

SCPI: BSE:CONFig:LTE:<cell>:IDENtity:GLOBal <0 ... 268435455>

Physical Cell Identity

Specify an integer that represents the identity of an EUTRAN cell.

SCPI: BSE:CONFig:LTE:<cell>:PHY:CELL:ID <0 ... 503>

IMSI

Select the type of SIM used in the device under test:

- Keysight SIM – the device uses a Keysight SIM card.
- 3GPP SIM – the device uses a 3GPP SIM card.

- User Defined – the device uses a user defined SIM card with an IMSI defined using the User Defined IMSI field.

SCPI: BSE:CONFig:LTE:<cell>:PAGing:IMSI <KEYSight | TEST3GPP | USER>

User Defined IMSI

(Enabled if the IMSI above is set to User Defined)

Specify the IMSI used in the device under test.

SCPI: BSE:CONFig:LTE:<cell>:PAGing:IMSI:USER <000000 ... 9999999999999999>

Mobile Country Code (MCC)

Specify a sequence of 3 digits (0 to 9) represented as long (Hex), where the last 3 nibbles represents 3 digits of the MCC (e.g MCC digits 123 is set as 0x00000123).

SCPI: BSE:CONFig:LTE:<cell>:IDENtity:MCCode<ncode> <0 ... 999>

Mobile Network Code (MNC)

Specify the number of binary coded decimals (BCD) digits that make up the Mobile Network Code (MNC): 2 or 3 digits. Then specify The MNC as a sequence of 2 or 3 digits (0 to 9) represented as long (Hex) where the last 2/3 nibbles represents digits of the MNC (e.g MNC digits 123 is set as 0x00000123 when using a 3 digit MNC length).

SCPI: BSE:CONFig:LTE:<cell>:IDENtity:MNCode<ncode>:LENGth <2 | 3>

SCPI: BSE:CONFig:LTE:<cell>:IDENtity:MNCode<ncode> <0 ... 999>

Tracking Area Code (TAC)

Specify an integer (0 to 65,535) that identifies a tracking area within the scope of a PLMN.

SCPI: BSE:CONFig:LTE:<cell>:IDENtity:TACode <0 ... 65535>

Location Area Code (LAC)

Specify an integer (0 to 65,535) that identifies the location area to which the cell belongs.

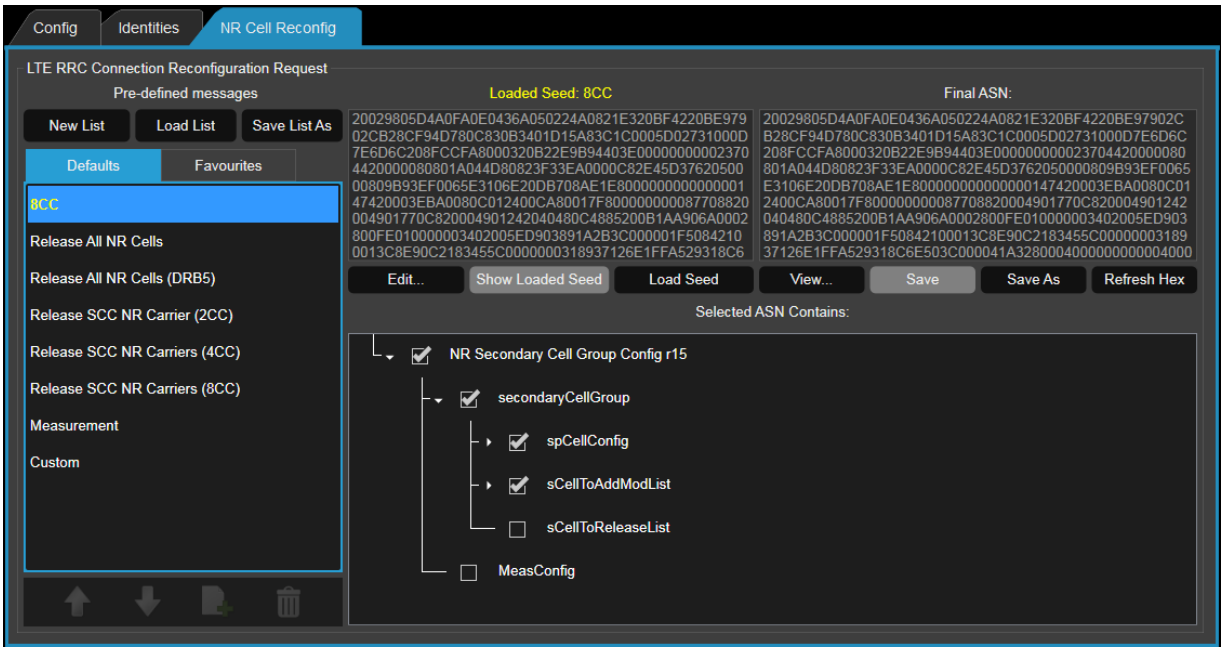
SCPI: BSE:CONFig:LTE:<cell>:IDENtity:LACode <0 ... 65535>

8.3.3 Cell > NR Cell Reconfig Tab

Also see: ASN Messages Panel

The NR Cell Reconfig tab for an LTE cell edits and loads RRC Connection Reconfiguration requests sent from the LTE cell to the UE. When you load a message seed, 5G NR Test Application reads from the ASN and updates fields in all tabs with the ASN configuration. This is called **ASN readback**.

Screen for NSA mode:



8.3.3.1 Pre-defined messages

There are tabs for two pre-defined message lists: a Defaults tab and a Favourites tab. When you select a message in either list, the screen shows:

- ASN message content – displayed in hexadecimal under the headings Loaded_seed (or Editing_seed) and Final ASN.
- ASN tree structure – displayed under the heading Selected ASN Contains. The tree shows which branches are selected by the message in the NR Secondary Cell Group Config r15 container.

The steps to load a message are described below. The currently loaded message is shown in yellow.

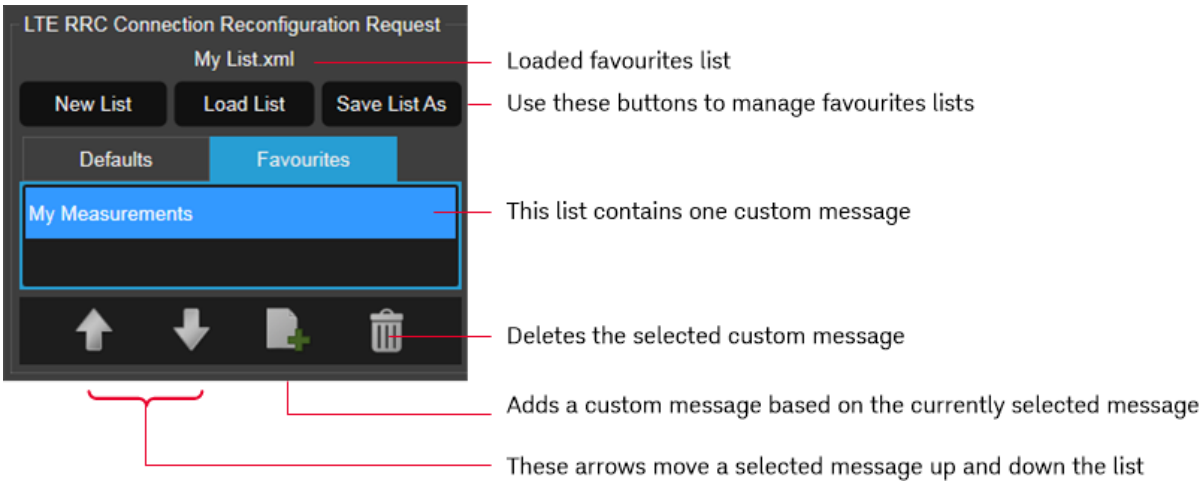
Defaults tab

The defaults tab shows the following Keysight-supplied pre-defined messages:

- 8CC message – this is the default message, which is loaded when 5G NR Test Application starts. Its configuration allows up to eight component carriers. You can use the NR S-Cell Aggregation Panel to manage carrier aggregation.
- Release and Measurement messages – these are for releasing cells and taking measurements, and are only available for loading when the NR cell is connected. When not connected, you can still select a message to edit it and save in a favourites list.
- Custom message – this is an editable version of the currently selected pre-defined message. It is selected automatically when you click Edit for a pre-defined message, or you can select it manually before clicking Edit. You can edit a custom message and save it as a favourite without affecting the original pre-defined message on which it is based.

Favourites tab

If you have multiple test systems, you can build up favourites lists with all the messages that you would like to run, and then share that list between test systems. You can have any number of lists, each containing any number of messages.



The Favourites tab shows messages that you have and saved in a favourites list. The name of the currently loaded list appears above the Favourites tab.

Use the following buttons to manage a list:

- New List – creates and loads an empty list in the default list location. The default location for a list is:

  C:\ProgramData\Keysight\5GTA\ASN Favourite Lists\<list_name.xml>

  The new list name appears above the Favourites tab. Future messages that you save will be added to this list.

- Load List – lists existing favourites lists in the last location selected for lists. Select a list and click:
  - Load List – to open it. The Favourites tab now lists messages in the selected list, and its list name appears above the Favourites tab.
  - Delete List – to delete it.

  To navigate to the parent folder for selecting a different list location, click in the first table row.

- Save List As – saves a copy of the current list under another name or in a new location. To navigate to the parent folder for selecting a different list location, click in the first table row. You can also click Create Folder to create a new sub-folder. In the File Name field, enter a name for your list, then click Save List.

To manage a message, select it in the favourites list, and use the following buttons:

-  and  – move the message up and down the list.
-  – saves a copy of the message under another name within the current list.
-  – deletes the message.

8.3.3.2 Loaded seed / Editing seed

This area of the screen shows the hexadecimal contents of the currently selected message. The heading text reads:

- Editing Seed: <message name> if the message is selected but not loaded, meaning that it is available to edit.
- Loaded Seed: <message name> if the message is loaded. The heading is shown in yellow to indicate that this is the currently loaded message.

  Note: After loading a seed, you can edit parameters on other tabs within the 5G NR Test Application. These changes are not updated to the Loaded Seed display (or to the Final ASN display until you click .

Edit

Opens the PDU Editor for editing message parameters.

Note: When you click Edit for a pre-defined message on the Defaults tab, the message is automatically displayed as a custom message, allowing you to edit it and save as a favourite.

Show loaded Seed

Click to refresh the display with the message whose configuration is currently loaded.

Load Seed

Click to load the selected pre-defined message. This triggers an ASN readback, which means that Test Application Framework reads from the ASN and populates the application with the ASN configuration.

SCPI: BSE:CONFig:LTE:RRC:REConfig:LOAD

8.3.3.3 Final ASN

This area of the screen shows the same contents as under Loaded seed / Editing seed. Its purpose is to allows you to save changes that you have made on tabs after loading a seed. To do this:

1. Load a seed.
2. Make changes to fields on tabs, as required.
3. Select Refresh Hex.
4. Click Save or Save As.

View

Click to display the Final ASN in Keysight PDU Manager. You cannot edit the content.

Save/Save As

Click to save changes to the message to a favourites list.

Refresh Hex

Click to update the Final ASN message with the configuration defined across all 5G NR Test Application Framework tabs. If you have made changes since loading the seed, you can save these changes by click Save or Save As.

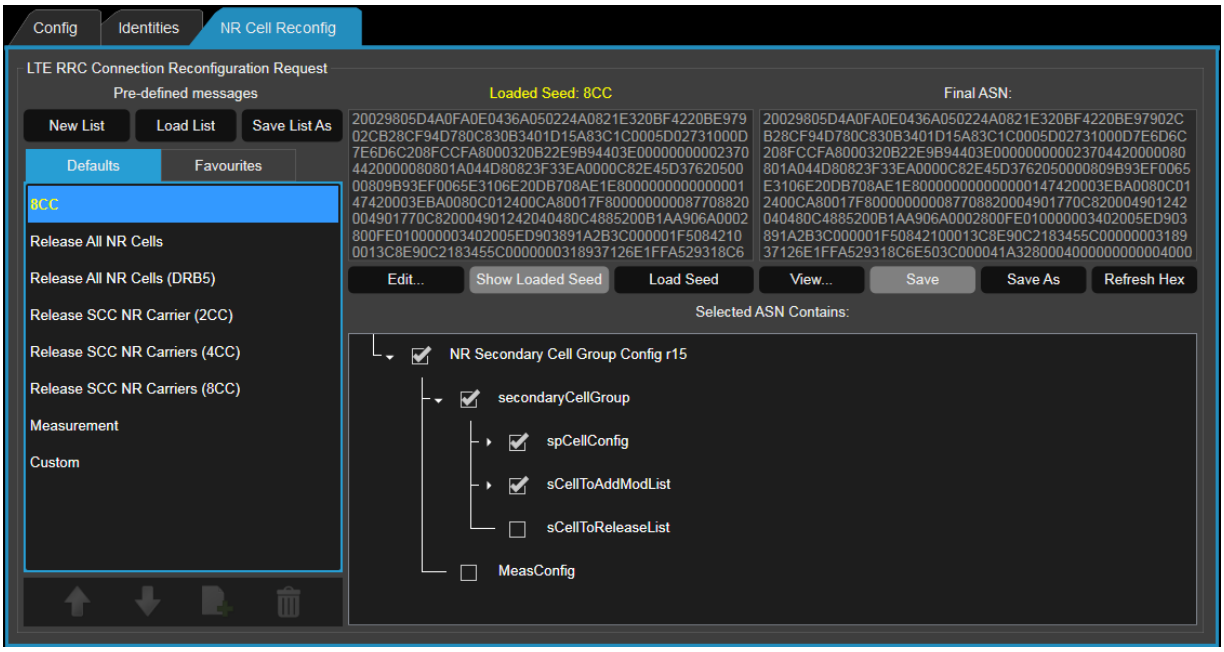
SCPI: BSE:CONFig:LTE:RRC:REConfig:MSG:REFresh

8.3.4 Cell > NR Cell Reconfig Tab

Also see: ASN Messages Panel

The NR Cell Reconfig tab for an LTE cell edits and loads RRC Connection Reconfiguration requests sent from the LTE cell to the UE. When you load a message seed, 5G NR Test Application reads from the ASN and updates fields in all tabs with the ASN configuration. This is called ASN readback.

Screen for NSA mode:



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The steps to load a message are described below. The currently loaded message is shown in yellow.

Defaults tab

The defaults tab shows the following Keysight-supplied pre-defined messages:

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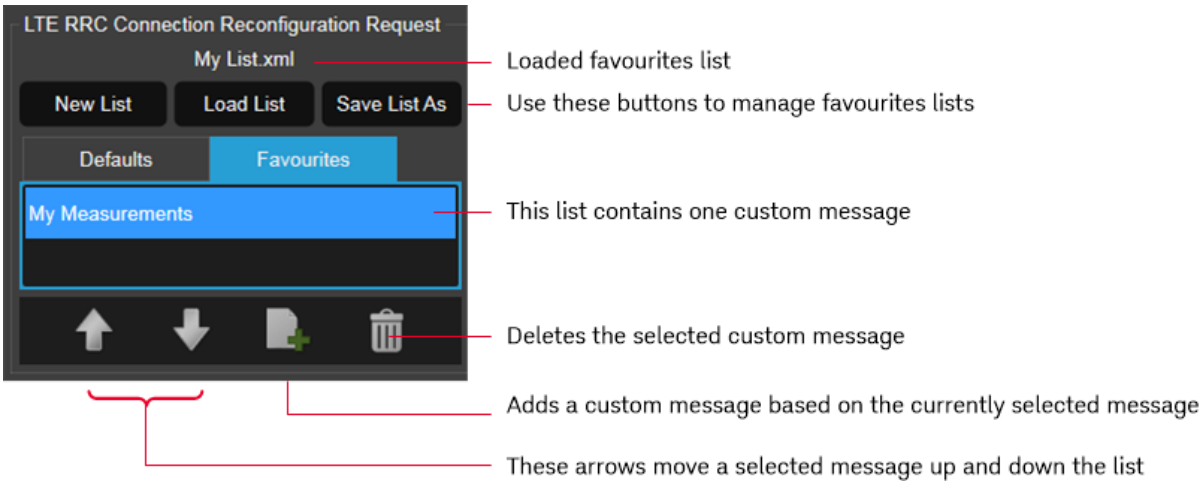
- Release and Measurement messages – these are for releasing cells and taking measurements, and are only available for loading when the NR cell is connected. When not connected, you can still select a message to edit it and save in a favourites list.
- Custom message – this is an editable version of the currently selected pre-defined message. It is selected automatically when you click Edit for a pre-defined message, or you can select it manually before clicking Edit. You can edit a custom message and save it as a favourite without affecting the original pre-defined message on which it is based.

Favourites tab

If you have multiple test systems, you can build up favourites lists with all the messages that you would like to run, and then share that list between test systems. You can have any number of lists, each containing any number of messages.



The Favourites tab shows messages that you have and saved in a favourites list. The name of the currently loaded list appears above the Favourites tab.

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- New List – creates and loads an empty list in the default list location. The default location for a list is:

  C:\ProgramData\Keysight\5GTA\ASN Favourite Lists\<list_name.xml>

  The new list name appears above the Favourites tab. Future messages that you save will be added to this list.

- Load List – lists existing favourites lists in the last location selected for lists. Select a list and click:
  - Load List – to open it. The Favourites tab now lists messages in the selected list, and its list name appears above the Favourites tab.
  - Delete List – to delete it.

  To navigate to the parent folder for selecting a different list location, click in the first table row.

- Save List As – saves a copy of the current list under another name or in a new location. To navigate to the parent folder for selecting a different list location, click in the first table row. You can also click Create Folder to create a new sub-folder. In the File Name field, enter a name for your list, then click Save List.

To manage a message, select it in the favourites list, and use the following buttons:

-  and  – move the message up and down the list.
-  – saves a copy of the message under another name within the current list.
-  – deletes the message.

8.3.4.2 Loaded seed / Editing seed

This area of the screen shows the hexadecimal contents of the currently selected message. The heading text reads:

- Editing Seed: <message name> if the message is selected but not loaded, meaning that it is available to edit.
- Loaded Seed: <message name> if the message is loaded. The heading is shown in yellow to indicate that this is the currently loaded message.

  Note: After loading a seed, you can edit parameters on other tabs within the 5G NR Test Application. These changes are not updated to the Loaded Seed display (or to the Final ASN display until you click .

Edit

Opens the PDU Editor for editing message parameters.

Note: When you click Edit for a pre-defined message on the Defaults tab, the message is automatically displayed as a custom message, allowing you to edit it and save as a favourite.

Show loaded Seed

Click to refresh the display with the message whose configuration is currently loaded.

Load Seed

Click to load the selected pre-defined message. This triggers an ASN readback, which means that Test Application Framework reads from the ASN and populates the application with the ASN configuration.

SCPI: BSE:CONFig:LTE:RRC:REConfig:LOAD

8.3.4.3 Final ASN

This area of the screen shows the same contents as under Loaded seed / Editing seed. Its purpose is to allows you to save changes that you have made on tabs after loading a seed. To do this:

1. Load a seed.
2. Make changes to fields on tabs, as required.
3. Select Refresh Hex.
4. Click Save or Save As.

View

Click to display the Final ASN in Keysight PDU Manager. You cannot edit the content.

Save/Save As

Click to save changes to the message to a favourites list.

Refresh Hex

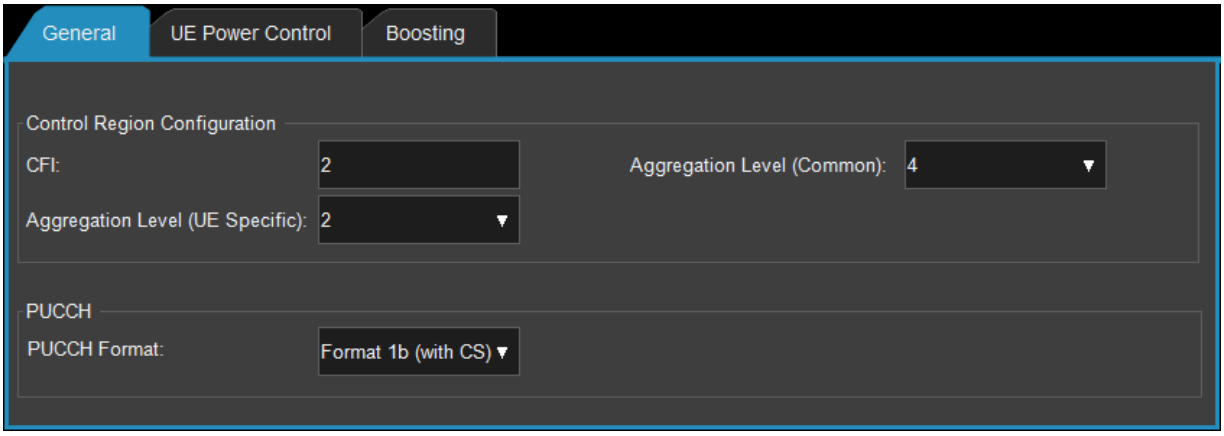
Click to update the Final ASN message with the configuration defined across all 5G NR Test Application Framework tabs. If you have made changes since loading the seed, you can save these changes by click Save or Save As.

SCPI: BSE:CONFig:LTE:RRC:REConfig:MSG:REFresh

8.4 PHY Tab

8.4.1 General Tab (LTE)

The General tab configures control region and PUCCH format.



8.4.1.1 Control Region Configuration

CFI

Specify the number of symbols (1 to 3) to use as the control format indicator (CFI) in the LTE network emulation. The selection is signaled on the PCFICH channel.

This allows layer 1 tests to set up test patterns and inject data into the PCFICH for layer 1 testing. If a MAC is configured on the cell, the SAP (service access points) will be disconnected and therefore any configuration will have no effect.

For more information, see section 5.3.4 in 3GPP TS 36.212.

SCPI: BSE:CONFig:LTE:<cell>:PHY:PCFich:CFI <1 | 2 | 3>

Aggregation Level (UE Specific)

Specify the transmission format (PDCCH aggregation level) of the UE-specific search space, as specified in section 9.1 in 3GPP TS 36.213. Choose between: 1, 2, 4 and 8.

SCPI: BSE:CONFig:LTE:<cell>:PHY:PDCCh:SSALevel:UESPecific <N1| N2 | N4 | N8>

Aggregation Level (Common)

Specify the transmission format (for example: PDCCH aggregation level) of the common search space, as specified in 3GPP TS 36.213. Choose between: 4 and 8.

SCPI: BSE:CONFig:LTE:<cell>:PHY:PDCCh:SSALevel:COMMon <N4 | N8>

8.4.1.2 PUCCH

PUCCH Format

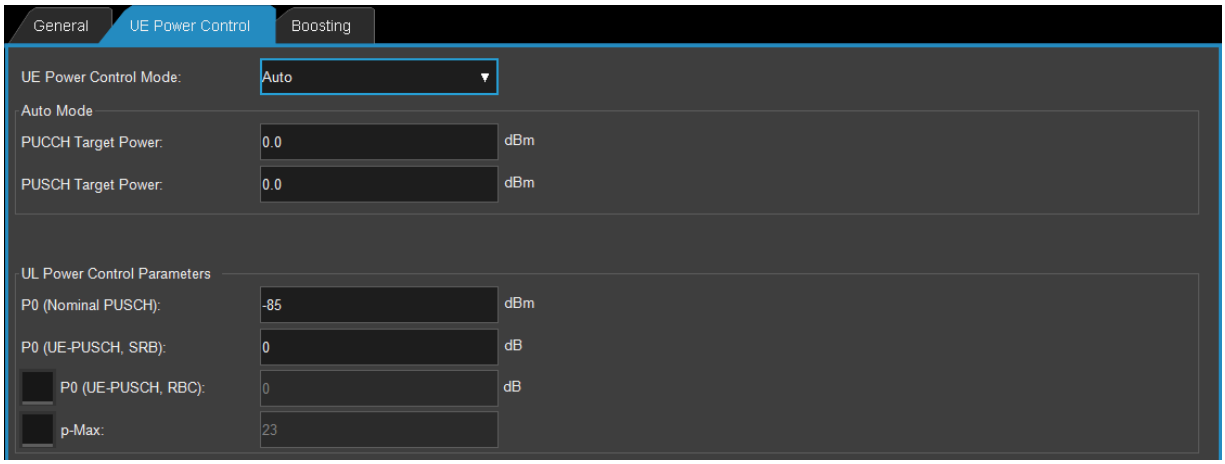
Select the PUCCH Format to use during carrier aggregation.

- Format 1b (with CS) – use format 1b for downlink HARQ Feedback.
- Format 3 – use this format for downlink HARQ Feedback as follows:
  - For FDD, when more than one Component Carrier is enabled.
  - For TDD, at all times.

SCPI: BSE:CONFig:LTE:<cell>:PHY:PUCCh:FORMat <T1BCS | T3>

8.4.2 UE Power Control Tab (LTE)

The UE Power Control tab configures how the UXM generates transmission power control (TPC) commands and defines uplink power control parameters.



UE Power Control Mode

Specify the mode which determines how the UXM LTE application generates transmission power control (TPC) commands for both PUSCH and PUCCH.

- Auto – the UE is told to increase or decrease its power level to reach the target power levels. This is a Closed Loop Power Control mode of operation. You can specify a different power level for the PUSCH and PUCCH. This does not result in continuous transmissions of DCI messages, specifically for the purpose of power control.
- Disabled – the UE power is not adjusted unless you explicitly send a manual adjustment of power to either the PUSCH or PUCCH.
- All Up Bits – the UE is continuously sent DCI 0 messages, which include TPC bits telling the UE to increase the power level of the PUSCH by 1 dB. This also results in the PUSCH being continuously transmitted. This is often used to drive the UE to its maximum power level for the purpose of conducting RF testing.
- All Down Bits – the UE is continuously sent DCI 0 messages, which include TPC bits telling the UE to decrease the power level of the PUSCH by 1 dB. This also results in the PUSCH being continuously transmitted (although at a very low power level). This is often used to drive the UE to its minimum power level.

SCPI: BSE:CONFig:LTE:<cell>:UL:CLPControl:MODE <AUTO | MANual | UP | DOWN>

8.4.2.1 Auto Mode

PUCCH Target Power

(Only enabled if UE Power Control Mode is set to Auto)

Specify the target PUCCH power, -50 to 30 dBm, to use when the UE Power Control Mode is Auto.

SCPI: BSE:CONFig:LTE:<cell>:UL:CLPControl:TARGet[:POWer] <-50.0 ... 30.0>

PUSCH Target Power

(Only enabled if UE Power Control Mode is set to Auto)

Specify the target PUSCH power, -50 to 30 dBm, to use when the UE Power Control Mode is Auto.

SCPI: BSE:CONFig:LTE:<cell>:UL:CLPControl:TARGet[:POWer] <-50.0 ... 30.0>

8.4.2.2 UL Power Control Parameters

P0 (Nominal PUSCH)

Specify the value of the p0-NominalPUSCH parameter (carried in SIB2) that determines the UE transmit power for a PUSCH transmission. For more information, see section 5.1.1 in 3GPP TS 36.213.

Note: *Only applicable for non-persistent scheduling.*

SCPI: BSE:CONFig:LTE:<cell>:RRC:PZN:PUSCh <-126 ... 24>

P0 (UE-PUSCH, SRB)

Specify the p0-UE-PUSCH parameter that is used to determine the UE transmit power for a PUSCH transmission. For more information, see section 5.1.1 in 3GPP TS 36.213.

Note: *Only applicable for non-persistent scheduling.*

SCPI: BSE:CONFig:LTE:<cell>:RRC:PZUE:PUSCh <-8 ... 7>

P0 (UE-PUSCH, RBC)

For 3GPP test cases such as 36.521-1 s6.3.5.1, it is necessary to have a different value of p0-UE-PUSCH in the RRC Connection Setup message and RRC Connection Reconfiguration.

To enable this, select the checkbox which adds the uplinkPowerControlDedicated Information Element to the RRC Connection Reconfiguration that contains the Attach Accept.

Then specify the value of the p0-UE-PUSCH parameter which is used to determine UE transmit power for a PUSCH transmission. For more information, see section 5.1.1 in 3GPP TS 36.213.

Note: *Only applicable for non-persistent scheduling.*

SCPI: BSE:CONFig:LTE:<cell>:RRC:UPCDedicated:RBC <ON | OFF>

SCPI: BSE:CONFig:LTE:<cell>:RRC:PZUE:PUSCh:RBC <-8 ... 7>

p-Max

Select this checkbox to include the p-Max information element in SIB1. If this checkbox is cleared, the p-Max information element is absent from SIB1, and the UE applies the maximum power according to its capability.

If this checkbox is selected, specify the maximum output power (-30 to 33 dB) that the UE is allowed to transmit on this cell.

SCPI: BSE:CONFig:LTE:<cell>:RRC:PMAX <ON | OFF>

SCPI: BSE:CONFig:LTE:<cell>:RRC:PMAX:VALue <-30 ... 33>

8.4.3 Boosting Tab (LTE)

The Boosting tab configures power boosting in LTE which is mainly performed on the cell-specific reference signals (RS). As the reference signals are embedded into the overall signal bandwidth at certain resource elements (RE), in order to have a constant power for all OFDM symbols to avoid power variations at the UE receiver, different powers are allocated to each downlink channel for the OFDM symbols where RS is present or absent.

PDSCH PA

Specify a value (-6, -4.77, -3, -1.77, 0, 1, 2 or 3 dB) for the UE-specific parameter which controls the ratio of PDSCH energy per resource element (EPRE) to cell-specific reference signal EPRE among PDSCH resource elements for each OFDM symbol where the reference signal is absent.

Note: *This is not applicable to PDSCH REs with zero EPRE.*

SCPI: BSE:CONFig:LTE:<cell>:DL:POWer:BOOSting:PDSCh:PA <NDB6 | NDB4P77 | NDB3 | NDB1P77 | DB0 | DB1 | DB2 | DB3>

PSS PA

Specify a value (-6, -4.77, -3, -1.77, 0, 1, 2 or 3 dB) for the UE-specific parameter which controls the ratio of PSS EPRE to cell-specific RS EPRE among PSS Res for each OFDM symbol where RS is absent.

Note: *This is a network internal parameter which is not sent to the UE over the air.*

This maps directly onto the Rho A value used in Phy.

There is no PSS p-b setting – as the PSS is always transmitted on symbols that do not contain cell-specific reference signals.

This definition of boosting made for the LTE channels can be extended for the NB-IoT channels noting that in the case of NB-IoT there only one boosting valid per DL antenna configuration disregarding the presence or not of narrowband reference signals.

SCPI: BSE:CONFig:LTE:<cell>:DL:POWer:BOOSting:PSS:PA <NDB6 | NDB4P77 | NDB3 | NDB1P77 | DB0 | DB1 | DB2 | DB3>

SSS PA

Specify a value (-6, -4.77, -3, -1.77, 0, 1, 2 or 3 dB) for the UE-specific parameter which controls the ratio of PSS EPRE to cell-specific RS EPRE among SSS Res for each OFDM symbol where RS is absent.

Note: This is a network internal parameter which is not sent to the UE over the air.

This maps directly onto the Rho A value used in Phy.

There is no SSS p-b setting – as the SSS is always transmitted on symbols that do not contain cell-specific reference signals.

This definition of boosting made for the LTE channels can be extended for the NB-IoT channels noting tha in the case of NB-IoT there only one boosting valid per DL antenna configuration disregarding the presence or not of narrowband reference signals.

SCPI: BSE:CONFig:LTE:<cell>:DL:POWer:BOOSting:SSS:PA <NDB6 | NDB4P77 | NDB3 | NDB1P77 | DB0 | DB1 | DB2 | DB3>

PDSCH PB

Specify the value (0 to 3) of the cell-specific parameter (PDSCH p-b) provided in SIB2 to control the ratio of PDSCH EPRE to cell-specific RS EPRE among PDSCH REs for each OFDM symbol where RS is present. This is not applicable for each OFDM symbol where RS is absent.

SCPI: BSE:CONFig:LTE:<cell>:DL:POWer:BOOSting:PDSCh:PB <0 ... 3>

Other Channel PA

Specify a value (-6, -4.77, -3, -1.77, 0, 1, 2 or 3 dB) for the UE-specific parameter for other channels (PBCH, PCFICH, PHICH and PDCCH) PA which controls the ratio of these channels' EPRE to cell-specific RS EPRE among these channels' Res for each OFDM symbol where RS is absent.

Note: This is a network internal parameter which is not sent to the UE over the air.

This definition of boosting made for the LTE channels can be extended for the NB-IoT channels noting tha in the case of NB-IoT there is only one boosting valid per DL antenna configuration disregarding the presence or not of narrowband reference signals.

SCPI: BSE:CONFig:LTE:<cell>:DL:POWer:BOOSting:OTHer:PA <NDB6 | NDB4P77 | NDB3 | NDB1P77 | DB0 | DB1 | DB2 | DB3>

Other Channel PB

Specify a value (0 to 3) for the UE-specific parameter for other channels (PBCH, PCFICH, PHICH and PDCCH) PB which controls the ratio of these channels' EPRE to cell-specific RS EPRE among these channels' Res for each OFDM symbol where RS is present.

Note: This is a network internal parameter which is not sent to the UE over the air.

This definition of boosting made for the LTE channels can be extended for the NB-IoT channels noting tha in the case of NB-IoT there is only one boosting valid per DL antenna configuration disregarding the presence or not of narrowband reference signals.

SCPI: BSE:CONFig:LTE:<cell>:DL:POWer:BOOSting:OTHer:PB <0 ... 3>

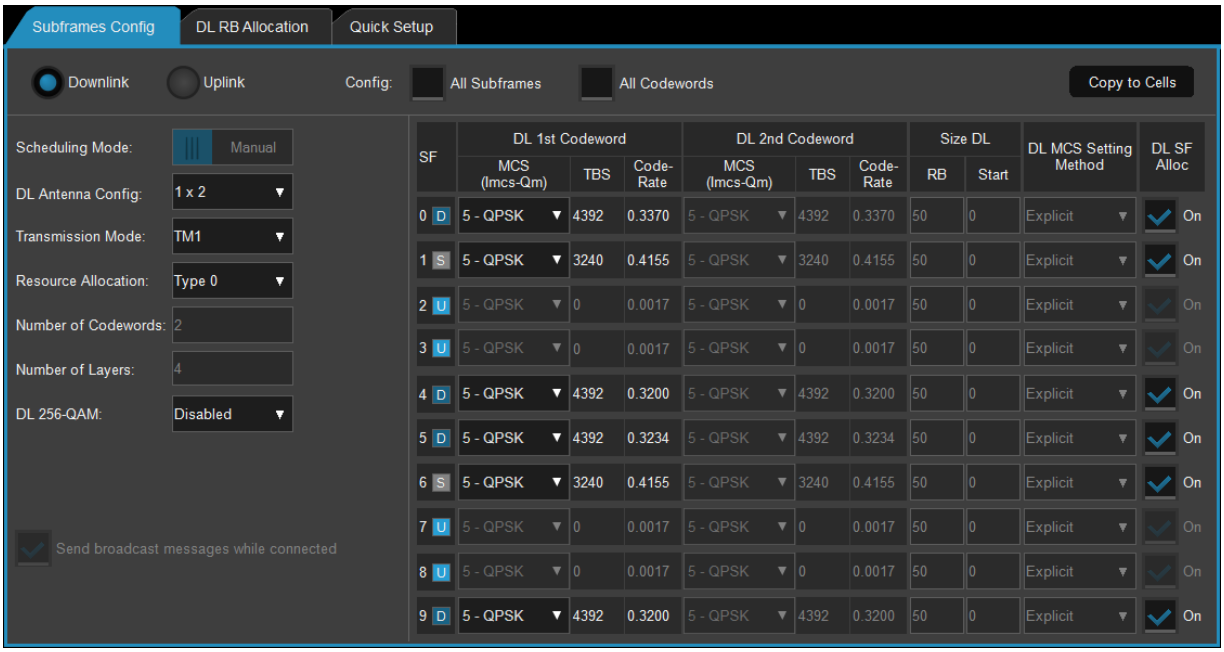
8.5 Scheduling Tab

8.5.1 Subframes Config Tab

The Subframes Config tab configures the subframes used for uplink and downlink resource allocation.

8.5.1.1 Downlink

Select the Downlink radio button to configure the downlink subframes.



All Subframes

Select to apply the configuration to all subframes.

All Codewords

Select to apply the configuration to all codewords.

Copy To Cells

(Not supported in this release)

Click to copy the subframe configuration to other cells in the application.

Subframes Table

Displays information about each subframe in the downlink resource allocation:

- SF – specify which subframes are used for uplink traffic (U) or downlink traffic (D). A value of 'S' is for special downlink traffic.
- MCS – specify the modulation and coding scheme to use for the subframe.

  Note: For Transmission Modes of TM3 or TM4, you can specify the MCS for the first and second codewords.

  SCPI: BSE:CONFig:LTE:<cell>:PHY:DL:IMCS:SLSymbol14:<subframe>[:ALL] <0 ... 28>

  SCPI: BSE:CONFig:LTE:<cell>:PHY:DL:IMCS:ALL <0 ... 28>

  SCPI: BSE:CONFig:LTE:<cell>:PHY:DL:IMCS:SLSymbol14:<subframe>:CW0 <0 ... 28>

  SCPI: BSE:CONFig:LTE:<cell>:PHY:DL:IMCS:SLSymbol14:<subframe>:CW1 <0 ... 28>
- TBS – displays the number of bits that can be transmitted on the subframe for the first and second codewords.
- Code-Rate – displays the coding rate for the subframe for the first and second codewords.
- RB – specify the size of the allocation provided to the UE by specifying the number of physical resource blocks (PRBs) in the downlink direction allocated in each subframe.
- Start – specify the offset (in number of PRBs) from the lower frequencies in the system bandwidth for the bandwidth allocation for the DL direction to be allocated in each subframe. Accordingly, for each cell, there are 10 values of DL RB Start (one for each subframe) maintained for each DL Bandwidth setting.
- DL MCS Setting Method – display the method used to set the downlink MCS setting.

  SCPI: BSE:CONFig:LTE:<cell>:PHY:DL:IMCS:MODE <EXPLicit | WCQI>

- DL SF Allocation – select which downlink subframes to use for transmitting PDSCH.

  SCPI: BSE:CONFig:LTE:<cell>:PHY:DL:SFRame:ALLocation:<subframe> <ON | OFF>

  SCPI: BSE:CONFig:LTE:<cell>:PHY:DL:SFRame:ALLocation[:ALL] <ON | OFF>

Scheduling Mode

(Currently only Manual is supported)

Select Manual to configure the uplink scheduling resources manually using the fields below. Select Automatic to have the 5G NR Test Application set the values itself.

SCPI: BSE:CONFig:LTE:<cell>:MAC:<direction>:SCHeduler:MODE <MANual | AUTO>

DL Antenna Config

Select the downlink antenna configuration between the transceiver and the device under test. Choose between: 1x1, 1x2, 2x2 and 2x1.

SCPI: BSE:CONFig:LTE:<cell>:PHY:DL:ANTenna:CONFig <D1U1 | D1U2 | D1U4 | D2U1 | D2U2 | D2U4 | D4U1 | D4U2 | D4U4 | D8U2 | D8U4>

Transmission Mode

Select the transmission mode for downlink transmissions on the DLSCH: TM2, TM3, TM4, TM6 or Implicit.

SCPI: BSE:CONFig:LTE:<cell>:RRC:TMODe <IMPLicit | TM1 | TM2 | TM3 | TM4 | TM6 | TM7Siso | TM7Mimo | TM8 | TM9>

Resource Allocation

Currently only Type 0 *is supported.*

SCPI: BSE:CONFig:LTE:<cell>:PHY:DL:RESource:ALLocation[:TYPE] <TYPE0 | TYPE2Local>

Number Of Codewords

Displays the number of codewords sent to the UE in s subframe when using a transmission mode that supports spatial multiplexing.

SCPI: BSE:CONFig:LTE:<cell>:PHY:DL:NUMCodewords <1 | 2>

Number Of Layers

Note: *Enabled when DL Antenna Configuration is set to 4x4 or 8x4 and when PMI/RI mode is Static.*

Displays the number of layers on which to map codewords.

SCPI: BSE:CONFig:LTE:<cell>:PHY:DL:NUMLayers <2 ... 4>

DL 256-QAM

In 3GPP Release 12, you can enable an option that means that 256 QAM can be used as a modulation format on the downlink. This is only to be used in conditions with a very high signal to noise ratio.

If you enable this option, the way in which the DL MCS Index field is interpreted changes and an alternative MCS mapping table is used.

Table 7.1.7.1-1A in 3GPP TS 36.213 shows this new mapping. The mapping enables higher values of TBS index to be selected. The higher values correspond to larger transport block sizes and are transmitted using 256 QAM modulation.

As well as transport block size, this setting also has an effect on the range of the DL MCS Index setting. The range of DL MCS indices allowed is reduced by one. Similarly, the CQI to MCS Mapping table is altered – as MCS index value 28 is no longer allowed.

You can enable this setting independently on each cell. If it is enabled before an SCell is aggregated, it is configured at the point of aggregation. If it is enabled before a UE attaches to a PCell, it is enabled inside the RRC Connection Setup message.

In non-signaling mode it is enabled/disabled immediately, without any messages being sent to the UE.

If enabled or disabled in the RRC Connected state, or if a cell has already been aggregated, an RRC Connection Reconfiguration message is sent containing the CQI-ReportConfig-v12x0 Information Element.

This option only affects UE specific allocations using C-RNTI. DL allocations using SPS-RNTI, SI-RNTI, P-RNTI and RA-RNTI are unaffected and continue to use table 7.1.7.1-1 without regard to the value of this setting.

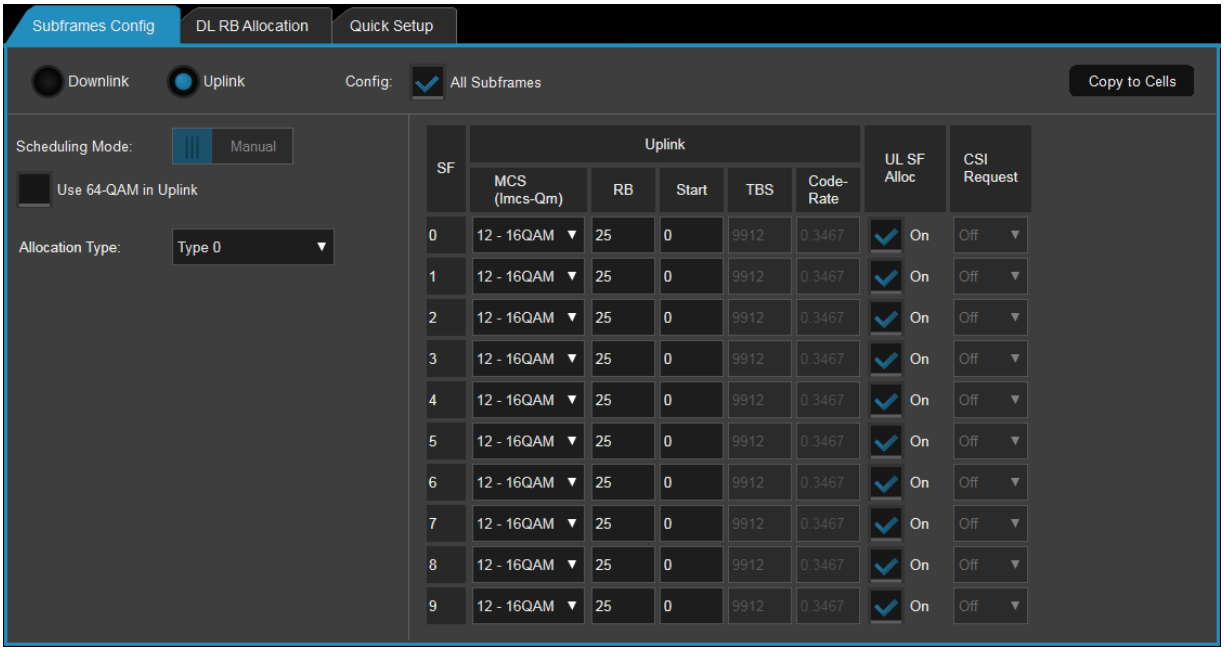
SCPI: BSE:CONFig:LTE:<cell>:PHY:DL:IMCS:ATABle <ALLSubframes | DISabled>

Send Broadcast Messages While Connected

(Always enabled in this release)

8.5.1.2 Uplink

Select the Uplink radio button to configure the uplink subframes.



All Subframes

Select to apply the configuration to all subframes.

Copy To Cells

(Not supported in this release)

Click to copy the subframe configuration to other cells in the application.

Subframes Table

Displays information about each subframe in the uplink resource allocation:

- SF – specify which subframes are used for uplink traffic (U) or downlink traffic (D). A value of 'S' is for special downlink traffic.
- MCS – specify the modulation and coding scheme to use for the subframe.

  SCPI: BSE:CONFig:LTE:<cell>:PHY:UL:IMCS:<subframe> <0 ... 100>

- RB – specify the size of the allocation provided to the UE by specifying the number of physical resource blocks (PRBs) in the uplink direction allocated in each subframe.

  Note: *If the Allocation Type is set to Type 1, you must specify the resource block allocation for 2 sets of resource blocks.*

  SCPI: BSE:CONFig:LTE:<cell>:PHY:UL:RB:ALLocation:<subframe>:<ulbandwidth> <0 ... 100>

- Start – specify the offset (in number of PRBs) from the lower frequencies in the system bandwidth for the bandwidth allocation for the UL direction to be allocated in each subframe. Accordingly, for each cell, there are 10 values of UL RB Start (one for each subframe) maintained for each UL Bandwidth setting.

  Note: If the Allocation Type is set to Type 1, you must specify the start of the resource block for 2 sets of resource blocks.

- TBS – displays the number of bits that can be transmitted on the subframe.
- Code-Rate – displays the coding rate for the subframe.
- UL SF Allocation – select which uplink subframes to use for transmitting PUSCH.

  SCPI: BSE:CONFig:LTE:<cell>:PHY:UL:SFRame:ALLocation[:ALL] <ON | OFF>

  SCPI: BSE:CONFig:LTE:<cell>:PHY:UL:SFRame:ALLocation:<subframe> <ON | OFF>

- CSI Request – displays whether a CSI Report is requested for each uplink subframe.

Scheduling Mode

(Currently only Manual is supported)

Select Manual to configure the uplink scheduling resources manually using the fields below. Select Automatic to have the 5G NR Test Application set the values itself.

SCPI: BSE:CONFig:LTE:<cell>:MAC:<direction>:SCHeduler:MODE <MANual | AUTO>

Use 64-QAM In Uplink

Select to configure the UXM-5G unit to try and use 64 QAM for UL MCS index values of 21 or higher. Clear this option to continue to use 16 QAM for MCS index values of 21 or higher.

The transport block size versus space on the physical channel means that this is only really practical up to an MCS value of 23 or so.

Note: Many UEs do not support 64 QAM on the uplink. You must first check the UE category to see if this is possible for your device (see 3GPP TS 36.306).

SCPI: BSE:CONFig:LTE:<cell>:PHY:UL:QAM64[:STATe] <ON | OFF>

Allocation Type

Select the resource allocation type:

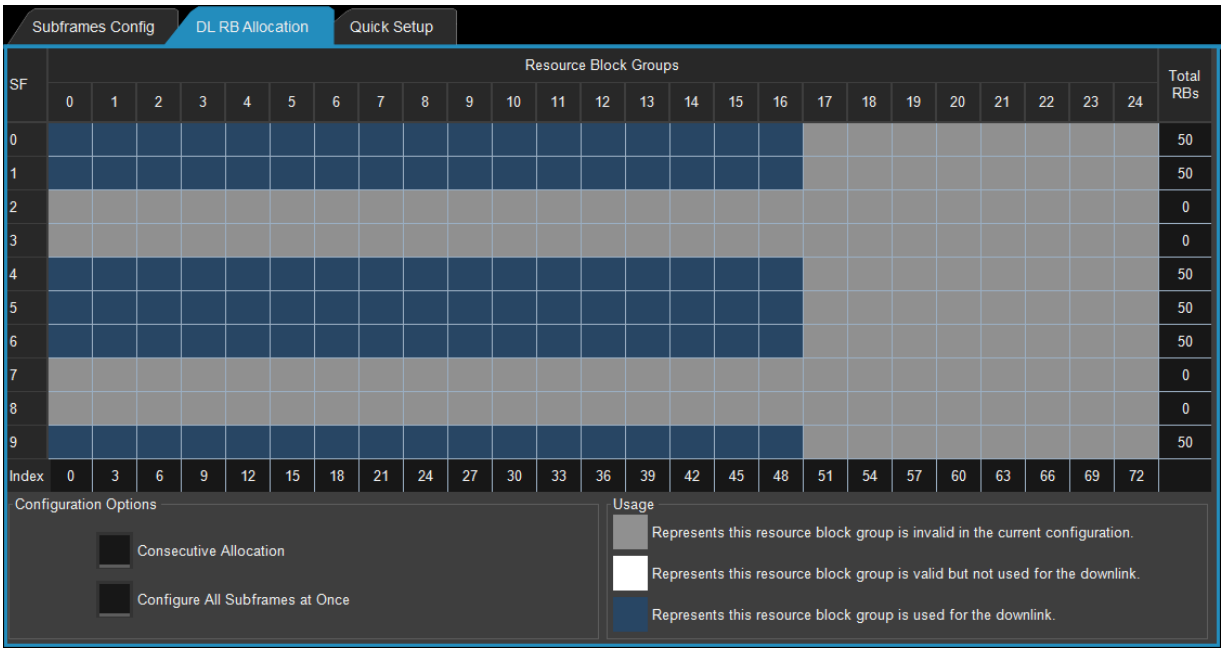
- Type 0 – the allocation will consist of a single contiguous set of RBs.
- Type 1 – the system will attempt to allocate two sets of resource blocks.

SCPI: BSE:CONFig:LTE:<cell>:PHY:UL:RESource:ALLocation[:TYPE] <TYPE0 | TYPE1>

8.5.2 DL RB Allocation Tab

The DL RB Allocation tab configures the allocation sent to the UE for each cell, which specifies the resource blocks used for downlink transmissions in each subframe.

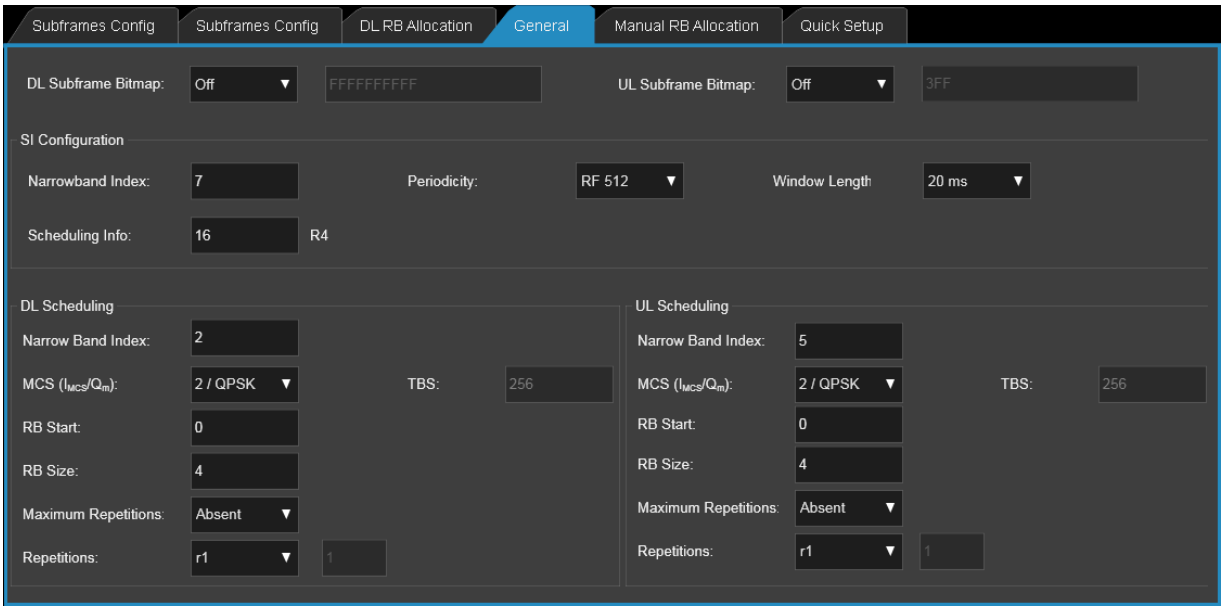
SCPI: BSE:CONFig:LTE:<cell>:PHY:DL:RB:ALLocation:TYPE0:<subframe> <1 ... 33554431>



To be supplied

8.5.3 General Tab

The General tab configures general uplink and downlink scheduling parameters.



To be supplied

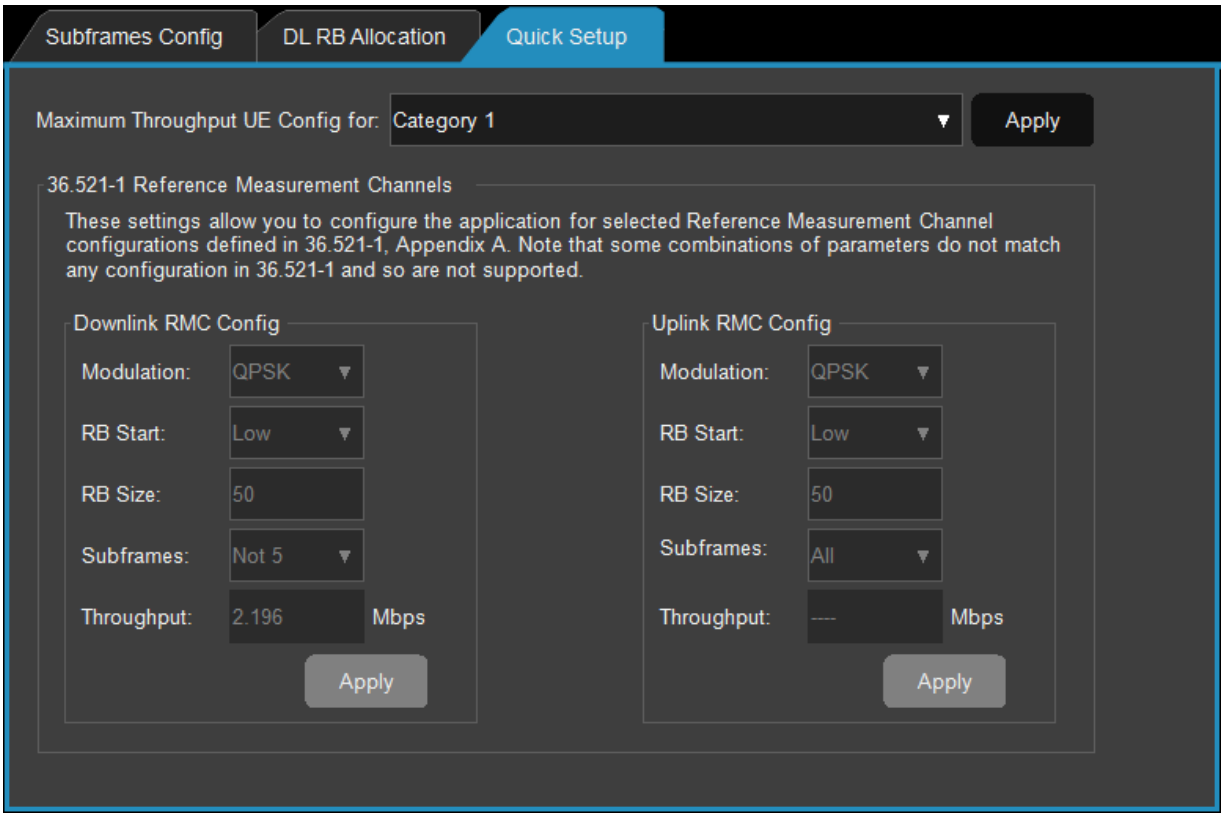
8.5.4 Manual RB Allocation Tab

The Manual RB Allocation tab lets you manually configure the uplink and downlink resource allocation.

To be supplied

8.5.5 Quick Setup Tab

The Quick Setup Tab enables you to specify the maximum throughput supported by your UE and automatically configure the reference measurement channels (RMCs).



Maximum Throughput UE Config for

Select the maximum throughput category supported by your device under test and click Apply to update the RMC settings below.

SCPI: BSE:CONFig:LTE:<cell>:PHY:ICONfig:MTHRoughput <category>

8.5.5.1 Reference Measurement Channels

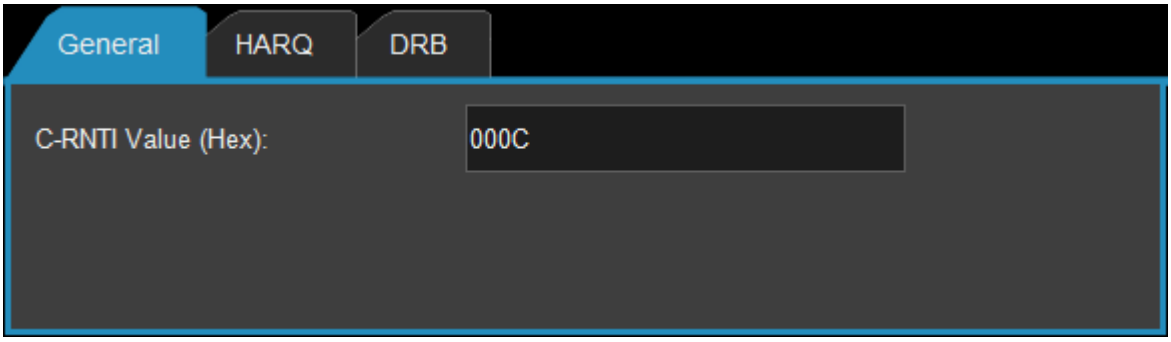
The Reference Measurement Channels (RMC) are predefined configuration to perform TX and RX 3GPP test cases. For TDD the 3GPP test specification requires TDD UL/DL configuration 1. Other TDD UL/DL Configurations do not support RMC configuration. Also, the RMC configuration is not supported if TTI Bundling is enabled.

The RMC configuration supported in the UXM is governed by the following tables in 3GPP TS 36.521-1. Note that “Full RB Allocation” refers to the condition where all RBs in the bandwidth are used and “Partial RB Allocation” is where a subset of the available RBs is used. The “Full RB Allocation” tables will also apply where the number of RBs to be allocated is the maximum value for any bandwidth, regardless of whether that is the currently used bandwidth or not.

8.6 MAC/RLC/PDCP Tab

8.6.1 General Tab (LTE)

The General tab configures the C-RNTI value.



C-RNTI Value (Hex)

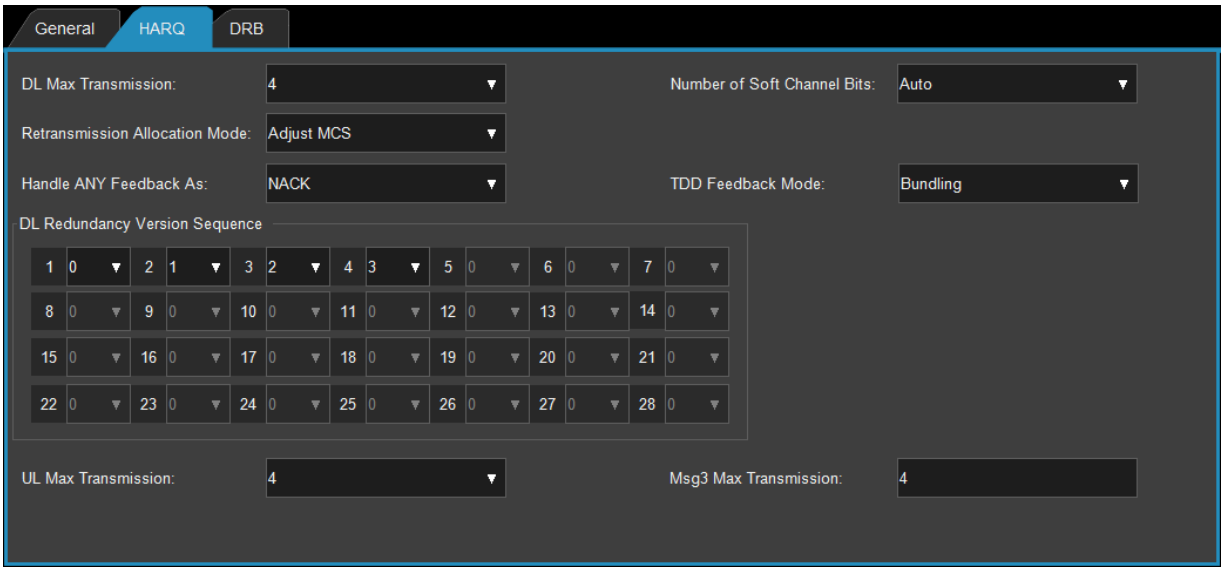
Specify the C-RNTI value (4 character HEX) which provides a unique UE identification at the cell level and is used to scramble the data sent/received from the device under test.

Note: The values corresponding to the RA-RANTI values cannot be used for C-RNTI. For FDD, 0x0001..0x000A are reserved for RA-RANTI values. For TDD, some values in the range 0x0001...0x003C can be reserved for RA-RNTI depending on which UL/DL configuration and PRACH configuration Indices used.

SCPI: BSE:CONFig:LTE:<cell>:CRNTi <hex>

8.6.2 HARQ Tab

The HARQ tab configures the uplink and downlink Hybrid Automatic Repeat Request (HARQ) transmissions.



DL Max Transmission

Specify the maximum number of times a HARQ process transmits downlink transport blocks without getting an acknowledgement. Successful transmission of a downlink transport block is met with the UE sending an ACK or NACK. Specifying a value of 1 for this parameter effectively disables DL HARQ operation, since it prevents DL retransmissions.

For more information about HARQ processes, see section 5.4.2.2 in 3GPP TS 36.321.

SCPI: BSE:CONFig:LTE:<cell>:MAC:DL:HARQ:MAXTx <N1 | N2 | N3 | N4 | N5 | N6 | N7 | N8 | N10 | N16 | N20 | N24 | N28>

Retransmission Allocation Mode

Select the algorithm used for PRB allocation during retransmissions:

- Adjust MCS – rely on the configured resource allocator to perform a new PRB allocation while keeping the TBS of previous transmission attempt (thus adjusting IMCS if required). This mode is suggested in scenarios where some PRBs cannot be used in certain subframes (see section 7.1 in 3GPP TS 36.213). A combination of an explicit, per-subframe, scheduler and 'Adjust MCS' is the only way transmission modes 7 and 8 can avoid central PRBs for both new transmissions and retransmissions. This is the recommended setting for most scenarios.
- Same MCS – PRB allocation for retransmissions is the same as in previous transmission attempt. No adjustments are made to IMCS either.

SCPI: BSE:CONFig:LTE:<cell>:MAC:DL:HARQ:RTAMode <AMCS | SMCS>

Number Of Soft Channel Bits

Specifies the UE Category (0 to 16, or Auto) required to calculate the number of soft channel bits to use.

The default setting is automatic, which automatically selects the UE Category reported in the UE Capability Information message sent by the UE during connection setup. If you select this option, the correct number of soft channel bits are automatically selected.

For UEs that do not send this message or for testing with a smaller number of bits than the UE Category supports, a value can be selected manually.

SCPI: BSE:CONFig:LTE:<cell>:MAC:DL:HARQ:SCBits <AUTO | CAT0 | CAT1 | CAT2 | CAT3 | CAT4 | CAT5 | CAT6 | CAT7 | CAT8 | CAT8 | CAT9 | CAT10 | CAT11 | CAT12 | CAT13 | CAT14 | CAT15 | CAT16>

Handle ANY Feedback As

Select whether to interpret a HARQ Feedback type of "ANY" as an ACK or NACK.

The "ANY" feedback type can be sent by the UE when PUCCH Format 1b is in use. It is used when there is insufficient resources available to signal complete HARQ feedback. As a result, the Base Station Emulator must

choose whether to interpret “ANY” as either an ACK or NACK for the purposes of counting BLER and for determining whether to retransmit a Transport Block.

SCPI: BSE:CONFig:LTE:<cell>:MAC:DL:HARQ:ANY <ACK | NACK>

TDD Feedback Mode

TDD HARQ Feedback Mode controls the type of feedback mode that will be used for HARQ when in TDD operation (frame type 2). Note that this setting does not apply to TDD operation in Band 46 (LAA, frame type 3).

Select the downlink HARQ Feedback Mode to use in TDD configurations:

- Bundling – one Ack/Nack bit represents the status of a codeword across multiple subframes. The UE will typically perform an AND operation on all the ACK/NACK messages to different DL subframes, and send a single ACK/NACK message back to eNB.
- Multiplexing – one Ack/Nack bit represents the status all codewords in a single subframe. On PUCCH the Ack/Nack bits are decoded according to TS 36.213 Tables 10.1.3-2, 3 and 4. The UE will send separate ACK/NACK messages.

For more information, see sections 7.3 and 10.1 in 3GPP TS 36.213.

SCPI: BSE:CONFig:LTE:<cell>:MAC:DL:HARQ:TDD:FMODe <BUNDling | MULTiplexing>

DL Redundancy Version Sequence

Specify the redundancy version (or RV) used during the rate matching process when a transport block is being encoded. If a transport block is retransmitted, a different redundancy version from the original transmission is generally used – this enables incremental redundancy to improve the chances of the transport block being decoded.

For the UL, the sequence of RV values used is fixed (to 0, 2, 3, 1) as specified in 3GPP TS 36.321. On the DL, however, the sequence can be modified. The default has been chosen to match sections 8.3.1 and 8.3.2 in 3GPP TS 36.521-1.

This parameter can be changed when the Cell is Active.

SCPI: BSE:CONFig:LTE:<cell>:MAC:DL:HARQ:RVSequence <0 ... 3>

UL Max Transmission

Specify the maximum number of times to expect the UE to attempt to transmit a transport block before it is discarded. Specifying a value of 1 for this parameter effectively disables UL HARQ operation, since it prevents UL retransmissions.

For more information about HARQ processes, see section 5.4.2.2 in 3GPP TS 36.321.

SCPI: BSE:CONFig:LTE:<cell>:MAC:UL:HARQ:MAXTx <N1 | N2 | N3 | N4 | N5 | N6 | N7 | N8 | N10 | N16 | N20 | N24 | N28>

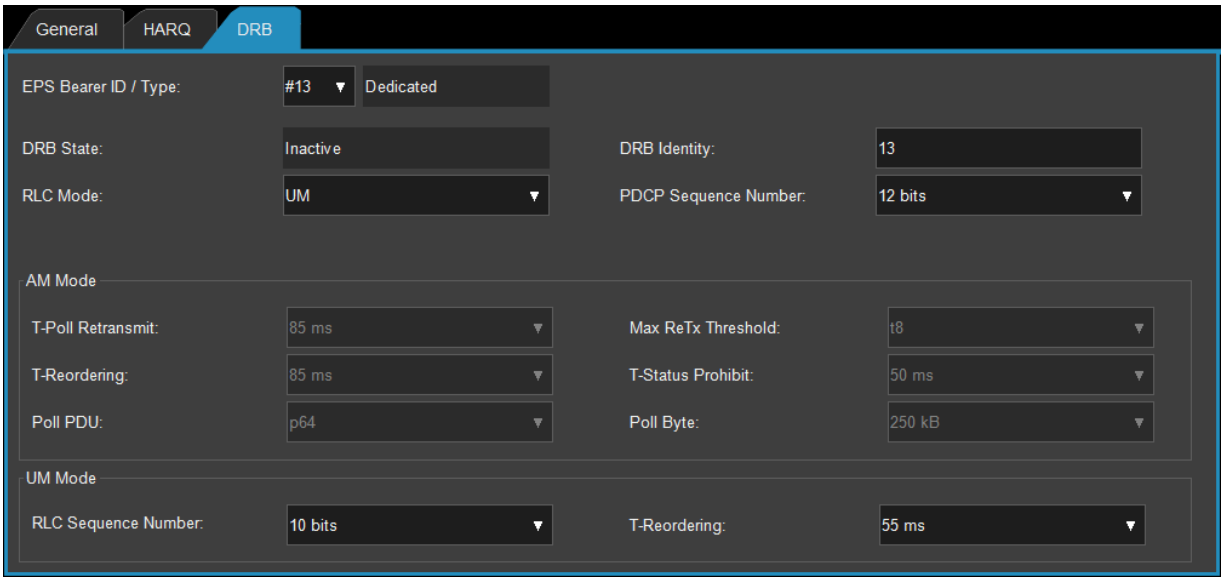
Msg3 Max Transmission

Select the number of times the LTE Application expects the UE to attempt to transmit for the Message 3 during the random access procedure before it is discarded.

SCPI: BSE:CONFig:LTE:<cell>:MAC:UL:HARQ:MSG3:MAXTx <1 ... 8>

8.6.3 DRB Tab

The DRB tab configures the data radio bearers (DRBs).



EPS Bearer ID / Type

Specify a unique identifier for the EPS bearer.

SCPI: BSE:CONFig:LTE:<cell>:DRB:<ebid>:IDENtity <1 ... 32>

DRB State

Displays whether or not the selected data radio bearer is active or inactive.

SCPI: BSE:CONFig:LTE:<cell>:DRB:<ebid>:STATe <ON | OFF>

RLC Mode

Select the RLC Mode of operation used on the DRB:

- AM (Acknowledged Mode) – selects an AM configuration for RLC and PDCP.
- UM (Unacknowledged Mode) – selects a bi-directional UM configuration at RLC and also makes the PDCP configuration UM.

SCPI: BSE:CONFig:LTE:<cell>:DRB:<ebid>:RLC:MODE <AM | UM>

DRB Identity

Specify an index number (1 to 32) associated with the DRB that is assigned to the UE during the RRC Connection Reconfiguration process.

SCPI: BSE:CONFig:LTE:<cell>:DRB:<ebid>:IDENtity <1 ... 32>

PDCP Sequence Number

Specify the length (in bits) of the PDCP sequence number: 12 bits or 7 bits.

Note: *DRBs that use RLC AM always use a PDCP sequence number length of 12 bits.*

SCPI: BSE:CONFig:LTE:<cell>:DRB:<ebid>:PDCP:SNLength <SEVen | TWELve>

8.6.3.1 AM Mode

The fields in this section are enabled if the RLC Mode is set to AM.

T-Poll Retransmit

Select how long (in milliseconds) a UE's RLC AM entity waits for an ACK or NACK of an RLC AM PDU that it transmits. When the Poll Retransmit Timer expires, it sends an RLC data PDU containing a polling bit. Setting the polling bit requests that the receiving RLC AM entity sends a STATUS PDU, containing ACK/NACK information.

SCPI: BSE:CONFig:LTE:<cell>:DRB:<ebid>:RLC:TPRetransmit <MS5 | MS10 | MS15 | MS20 | MS25 | MS30 | MS35 | MS40 | MS45 | MS50 | MS55 | MS60 | MS65 | MS70 | MS75 | MS80 | MS85 | MS90 | MS95 | MS100 | MS105 | MS110 | MS115 | MS120 | MS125 | MS130 | MS135 | MS140 | MS145 |MS150 | MS155 |MS160 | MS165 | MS170 | MS175 | MS180 | MS185 | MS190 | MS195 | MS200 | MS205 | MS210 | MS215 | MS220 | MS225 | MS230 | MS235 | MS240 | MS245 | MS250 | MS300 | MS350 | MS400 | MS450 | MS500 | MS1000 | MS2000 | MS3000 | MS4000 | MS6000 | MS10000 | MS15000 | MS25000 | MS40000 | MS60000 | MS90000 | MS120000 | MS180000>

T-Reordering

Specify how long (in milliseconds) the receiving RLC AM entity in the UE waits, when receiving RLC AM PDUs that are out of order, before triggering a STATUS report. Transmitting the STATUS report requests retransmission of any missing RLC PDUs.

For more information, see section 5.1.3.2 in 3GPP TS 36.322.

SCPI: BSE:CONFig:LTE:<cell>:DRB:<ebid>:RLC:AMRTimer <MS0 | MS5 | MS10 |MS15 | MS20 | MS25 | MS30 | MS35 | MS40 | MS45 | MS50 | MS55 | MS60 | MS65 | MS70 | MS75 | MS80 | MS85 | MS90 | MS95 | MS100 | MS110 | MS120 | MS130 | MS140 | MS150 | MS160 | MS170 | MS180 | MS190 | MS200>

Poll PDU

Select the number of PDUs transmitted by a UE's RLC AM entity before it sets the polling bit in the RLC data PDU that it transmits. Setting the polling bit requests that the receiving RLC AM entity send a STATUS PDU, containing ACK/NACK information.

SCPI: BSE:CONFig:LTE:<cell>:DRB:<ebid>:RLC:PPDu <P4 | P8 | P16 | P32 | P64 | P128 | P256 | PINFinity>

Max ReTx Threshold

Select how many times the RLC AM entity in the UE retransmits an RLC PDU.

SCPI: BSE:CONFig:LTE:<cell>:DRB:<ebid>:RLC:MRTHreshold <T1 | T2 | T3 | T4 | T6 | T8 | T16 | T32>

T-Status Prohibit

Select the frequency (in milliseconds) of STATUS reports transmitted by the receiving RLC AM entity in a UE. A value of 0 ms disables the timer. This timer is used by the transmitting side of an AM RLC entity to delay transmission of a Status Message. For more information see section 5.2.3 in 3GPP TS 36.322.

SCPI: BSE:CONFig:LTE:<cell>:DRB:<ebid>:RLC:TSPRohibit <MS5 | MS10 | MS15 | MS20 | MS25 | MS30 | MS35 | MS40 | MS45 | MS50 | MS55 | MS60 | MS65 | MS70 | MS75 | MS80 | MS85 | MS90 | MS95 | MS100 | MS105 | MS110 | MS115 | MS120 | MS125 | MS130 | MS135 | MS140 | MS145 |MS150 | MS155 |MS160 | MS165 | MS170 | MS175 | MS180 | MS185 | MS190 | MS195 | MS200 | MS205 | MS210 | MS215 | MS220 | MS225 | MS230 | MS235 | MS240 | MS245 | MS250 | MS300 | MS350 | MS400 | MS450 | MS500>

Poll Byte

Select how many kilobytes of data are transmitted by a UE's RLC AM entity before it sets the polling bit in the RLC data PDU that it transmits. Setting the polling bit requests that the receiving RLC AM entity send a STATUS PDU, containing ACK/NACK information.

SCPI: BSE:CONFig:LTE:<cell>:DRB:<ebid>:RLC:PBYTe <KB25 | KB50 | KB75 | KB100 | KB125 | KB250 | KB375 | KB500 | KB750 | KB1000 | KB1250 | KB1500 | KB2000 | KB3000>

8.6.3.2 UM Mode

The fields in this section are enabled if the RLC Mode is set to UM.

RLC Sequence Number

Select the RLC Sequence number length: 5 bits or 10 bits.

SCPI: BSE:CONFig:LTE:<cell>:DRB:<ebid>:RLC:SNLength <FIVE | TEN>

T-Reordering

Select how long (in milliseconds) the receiving RLC UM entity in the UE will wait, when receiving an RLC PDU that has its sequence number out of order before delivering the PDU to higher layers. Delaying for a short period

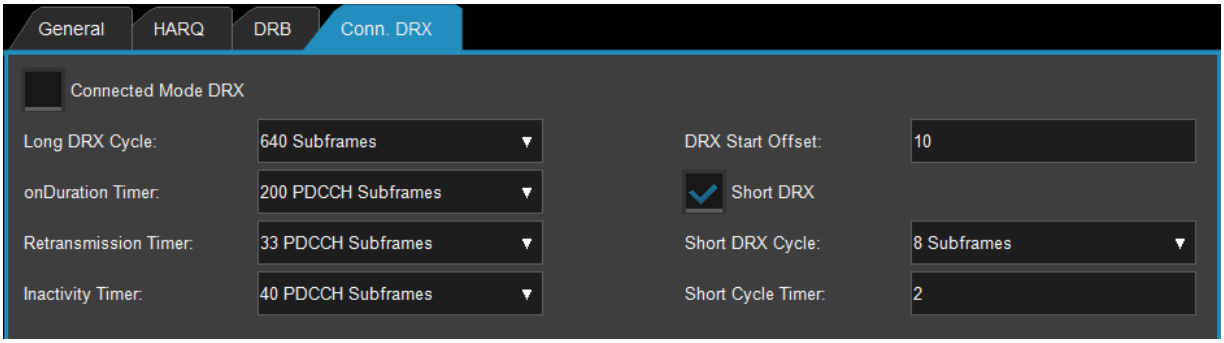
increases the chance that the RLC PDUs are delivered to the upper layers in the correct order but has an effect on latency.

SCPI: BSE:CONFig:LTE:<cell>:DRB:<ebid>:RLC:UMRTimer <MS0 | MS5 | MS10 |MS15 | MS20 | MS25 | MS30 | MS35 | MS40 | MS45 | MS50 | MS55 | MS60 | MS65 | MS70 | MS75 | MS80 | MS85 | MS90 | MS95 | MS100 | MS110 | MS120 | MS130 | MS140 | MS150 | MS160 | MS170 | MS180 | MS190 | MS200>

8.6.4 Conn DRX Tab (LTE)

Also see: DRX tutorial

The Conn DRX tab configures Connected Mode Discontinuous Reception (C-DRX) for the LTE cell selected in Cell details area of the workspace.



Connected Mode DRX

Select the check box to enable Discontinuous Reception (DRX).

SCPI: BSE:CONFig:LTE:<cell>:MAC:CDRX <ON | 1 | OFF | 0>

Long DRX Cycle

Select the value of the long DRX cycle in subframes; one of 10, 20, 32, 40, 64, 80, 128, 160, 256, 320, 512, 640, 1024, 1280, 2048 or 2560.

SCPI: BSE:CONFig:LTE:<cell>:MAC:CDRX:LDCYcle <SF10 | SF20 | SF32 | SF40 | SF64 | SF80 | SF128 | SF160 | SF256 | SF320 | SF512 | SF640 | SF1024 | SF1280 | SF2048 | SF2560>

OnDuration Timer

Select the number of PDCCH subframes for which the DRX cycle is in the 'On' state. This values applies to both the long and short DRX cycles, and should be less than the DRX Start Offset.

***Note:** If the UE is working as an NB-IoT device, this value is specified in PDCCH periods, as defined in 3GPP TS 36.321.*

SCPI: BSE:CONFig:LTE:<cell>:MAC:CDRX:ONDuration <PSF1 | PSF2 | PSF3 | PSF4 | PSF5 | PSF6 | PSF8 | PSF10 | PSF20 | PSF30 | PSF40 | PSF50 | PSF60 | PSF80 | PSF100 | PSF200>

Retransmission Timer

Select the number of PDCCH subframes to use as the retransmission timer.

***Note:** If the UE is working as an NB-IoT device, this value is specified in PDCCH periods, as defined in 3GPP TS 36.321.*

SCPI: BSE:CONFig:LTE:<cell>:MAC:CDRX:RETX:TIMer <PSF1 | PSF2 | PSF4 | PSF6 | PSF8 | PSF16 | PSF24 | PSF33>

Inactivity Timer

Select the number of PDCCH subframes to use as the inactivity timer.

SCPI: BSE:CONFig:LTE:<cell>:MAC:CDRX:INACtivity <PSF1 | PSF2 | PSF3 | PSF4 | PSF5 | PSF6 | PSF8 | PSF10 | PSF20 | PSF30 | PSF40 | PSF50 |PSF60 | PSF80 | PSF100 | PSF200 | PSF300 | PSF500 | PSF750 | PSF1280 | PSF1920 | PSF2560>

DRX Start Offset

Select the number of PDCCH subframes to use as the offset at the start of the DRX 'On' state.

SCPI: BSE:CONFig:LTE:<cell>:MAC:CDRX:SOFFset <0 ... 637>

Short DRX

Select this check box to enable the short DRX cycle.

SCPI: BSE:CONFig:LTE:<cell>:MAC:CDRX:SDRX <ON | 1 | OFF | 0>

Short DRX Cycle

Select the value of the short DRX cycle in subframes; one of 2, 5, 8, 10, 16, 20, 32, 40, 64, 80, 128, 160, 256, 320 or 640.

SCPI: BSE:CONFig:LTE:<cell>:MAC:CDRX:SDRX <SF2 | SF5 | SF8 | SF10 | SF16 | SF20 | SF32 | SF40 | SF64 | SF80 | SF128 | SF160 | SF256 | SF320 | SF640>

Short DRX Timer

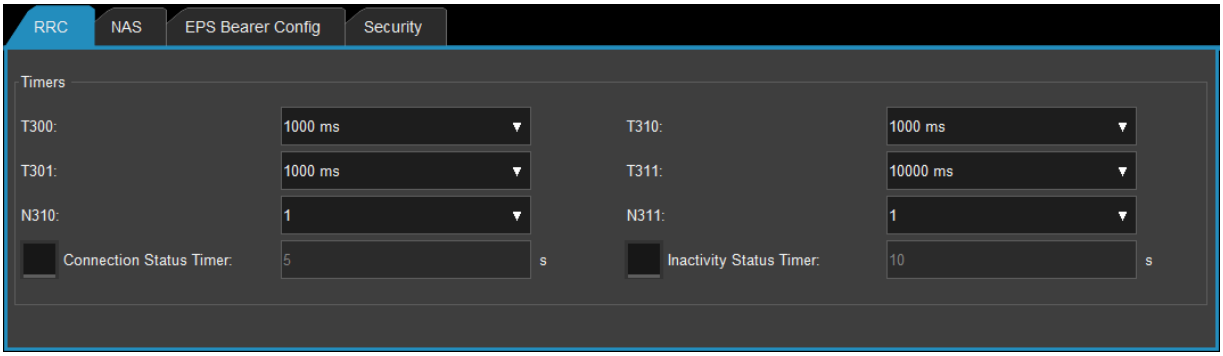
Specify the value as a multiple of the length of the Short DRX Cycle. For example, a value of 2 corresponds to 2 times the Short DRX Cycle.

SCPI: BSE:CONFig:LTE:<cell>:MAC:CDRX:SDRX:TIMer <1 ... 16>

8.7 RRC/NAS Tab

8.7.1 RRC Tab

The RRC tab configures the timers and constants used in the RRC layer.



8.7.1.1 Timers

T300

Select a value for the T300 timer which is part of the SIB2 message. For more information, see sections 5.3.3.6 and 7.3 in 3GPP TS 36.331.

SCPI: BSE:CONFig:LTE:<cell>:RRC:T300 <MS100 | MS200 | MS300 | MS400 | MS600 | MS1000 | MS1500 | MS2000>

T301

Select a value for the T301 timer which is part of the SIB2 message. For more information, see section 7.3 in 3GPP TS 36.331.

SCPI: BSE:CONFig:LTE:<cell>:RRC:T301 <MS100 | MS200 | MS300 | MS400 | MS600 | MS1000 | MS1500 | MS2000>

T310

Select a value for the T310 timer which is part of the SIB2 message. For more information, see section 7.3 in 3GPP TS 36.331.

SCPI: BSE:CONFig:LTE:<cell>:RRC:T310 <MS200 | MS500 | MS1000 | MS2000>

T311

Select a value for the T311 timer which is part of the SIB2 message. For more information, see section 7.3 in 3GPP TS 36.331.

SCPI: BSE:CONFig:LTE:<cell>:RRC:T311 <MS1000 | MS3000 | MS5000 | MS10000 | MS15000 | MS20000 | MS30000>

N310

Select a value for the N310 constant which defines the maximum number of consecutive out-of-sync indications received from lower layers.

SCPI: BSE:CONFig:LTE:<cell>:RRC:N310 <1 | 2 | 3 | 4 | 6 | 8 | 10 | 20>

N311

Select a value for the N311 constant which defines the maximum number of consecutive in-sync indications received from lower layers.

SCPI: BSE:CONFig:LTE:<cell>:RRC:N311 <1 | 2 | 3 | 4 | 5 | 6 | 8 | 10>

Connection Status Timer

Select to detect whether a UE, which is in the RRC Connected state, is still present in the cell (and thus represent the Connection Status correctly), then specify the number of seconds (2 to 60) that can pass without proof that a UE is present on the cell before the Connection Status is changed.

If this timer is enabled, when in CONN state (see Connection Status), once per second or so, a small transport block filled with MAC padding (from now on referred to as the “keep alive” transport block) is sent to the UE addressed by the C-RNTI. In a configuration with multiple carriers, this only takes place on the PCC. The instrument checks whether the UE receives this transport block. Receiving an ACK, or a NACK, is counted as a ‘good’ result. A StatDTX counts as a ‘bad’ result. If there are no ‘good’ results in the period defined below as the “Connection Timer” , the Connection Status is changed from CONNected to IDLE. If any receiver tests are running, they are stopped. If the UXM receives any other ACKs or NACKs in response to any other transmissions the Connection Timer is reset. If Connected Mode DRX is enabled, the Connection Timer is disabled. – as the customer would not want the UE to be brought out of a DRX state purely to send a keep alive. If this timer is disabled, no such “keep alive” transport blocks are sent.

SCPI: BSE:CONFig:LTE:<cell>:RRC:CTIMer:STATe <ON | OFF>

SCPI: BSE:CONFig:LTE:<cell>:RRC:CTIMer:TIME <2 ... 60>

Inactivity Status Timer

Select to monitor whether the UE is sending or receiving any data on a DRB, then specify the number of seconds (1 to 2000) the UE remains in the RRC Connected state while not transferring any data on a DRB before the LTE Application sends an RRC Connection Release to it. This RRC Connection Release is sent to the UE on an appropriate subframe when Connected Mode DRX or Measurement Gaps are enabled – to ensure that the UE is listening.

If no RLC activity is detected for the number of seconds specified by the Inactivity Timer setting, an RRC Connection Release is automatically sent to the UE. The behavior is turned off while receiver testing is in progress. This behavior mirrors the behavior in some networks where UEs are only allowed to remain in the RRC Connected state while they are actively using the services of that network. Sending the UE to the RRC Idle state frees up network resources and saves UE battery life.

SCPI: BSE:CONFig:ITIMer <ON | OFF>

SCPI: BSE:CONFig:ITIMer:TIME <1 ... 2000>

DRB Inactivity Timer

Select this check box to enable the inactivity timer to mirror the behavior in some networks where the UE is only allowed to remain in the RRC Connected state whilst the UE is actively using the network services. When the UE is not in the RRC Idle state, this frees up network resources and saves UE battery life.

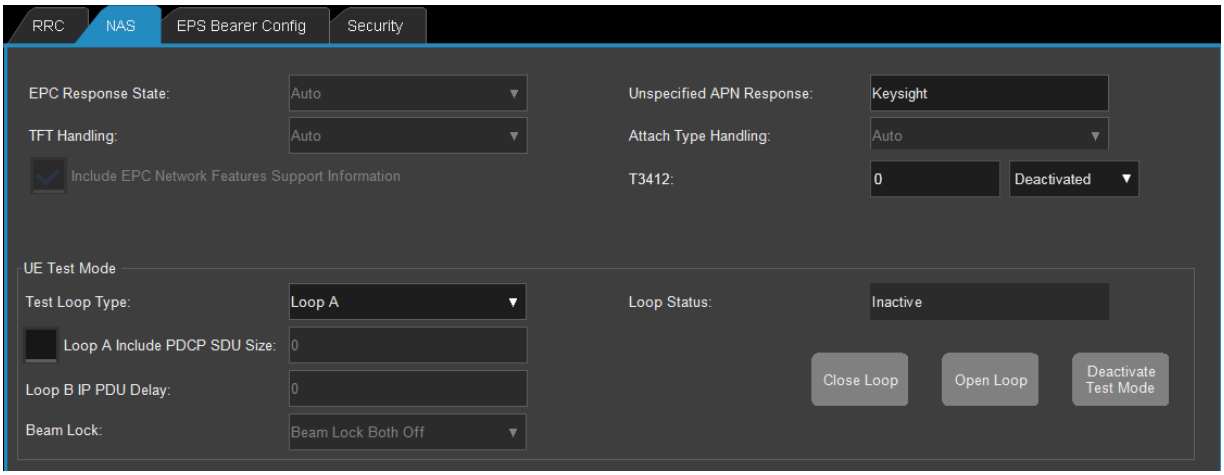
Specify the number of seconds (0 to 60) for which the network checks (at the PDCP level) for inactivity, before sending an RRC Release message to the UE.

SCPI: BSE:CONFig:LTE:PDCP:DRB:INACtivity[:STATe] <ON | 1 | OFF | 0>

SCPI: BSE:CONFig:LTE:PDCP:DRB:INACtivity:TIMEr <1 ... 60>

8.7.2 NAS Tab

The NAS tab configures the NAS layer options.



EPC Response State

*Currently, only **Auto** is supported.*

The EPC Response State enables the UXM to choose between automatically (Auto) responding to ESM messages and assigning the configuration (IP Address Type, APN, Number of DNS Servers, DNS Server Addresses, Number of P-CSCF Addresses, P-CSCF Addresses) that the UE is asking for or being able to explicitly define the response.

SCPI: BSE:CONFig:NAS:ARESPonse AUTO

TFT Handling

*Currently, only **Auto** is supported.*

Sets the Traffic Flow Template (TFT) handling type.

SCPI: BSE:CONFig:NAS:TFTHandling AUTO

Include EPC Network Features Support Information

Select to include the EPS Network Features Support Information Element in the Attach Accept message.

SCPI: BSE:CONFig:NAS:ENFSupport[:STATe] <ON | OFF>

Unspecified APN Response

Specify the Access Point Name used when the EPC Response State is set to Auto, and when the UE does not specify an APN.

SCPI: BSE:CONFig:NAS:UAPName <string>

Attach Type Handling

*Currently, only **Auto** is supported.*

Sets the attach type handling.

SCPI: BSE:CONFig:NAS:ATHandling AUTO

T3412

Specify the value of the periodic tracking area update timer, then specify if it is activated or deactivated.

SCPI: BSE:CONFig:NAS:T3412 <timer>

8.7.2.1 UE Test Mode

Test Loop Type

Select the type of UE Test Mode to use: Loop A or Loop B.

For more information about test loops, see section 6.1 in 3GPP TS 36.509.

SCPI: BSE:CONFig:NAS:TC:LOOP:TYPE <A | B>

Loop A Include PDCP SDU Size

(Only enabled if the Test Loop Type is set to Loop A)

Select to include the PDCP SDU Size Information Element, then specify the value used for the PDCP SDU Size. If included, the PDCP SDU scaling takes place as described in section 5.4.3 in 3GPP TS 36.509.

SCPI: BSE:CONFig:NAS:TC:LOOP:A:SDU:SIZE:INCLude <ON | OFF>

SCPI: BSE:CONFig:NAS:TC:LOOP:A:SDU:SIZE <0 ... 12160>

Loop B IP PDU Delay

(Only enabled if the Test Loop Type is set to Loop B)

Specify the delay, in seconds, to used to loopback an IP PDU.

SCPI: BSE:CONFig:NAS:TC:LOOP:B:PDU:DELay <0 ... 255>

Beam Lock

(Currently disabled)

Loop Status

Displays the current status of the loop: Active or Inactive.

Close Loop

Select to close the Test Loop.

SCPI: BSE:CONFig:NAS:TC:LOOP:OPEN

Open Loop

If the current Loop Status is closed, use this command to re-open it.

Note: This is also the only way to modify any of the settings related to the test loop. You need to re-open it and then close it again.

SCPI: BSE:CONFig:NAS:TC:LOOP:OPEN

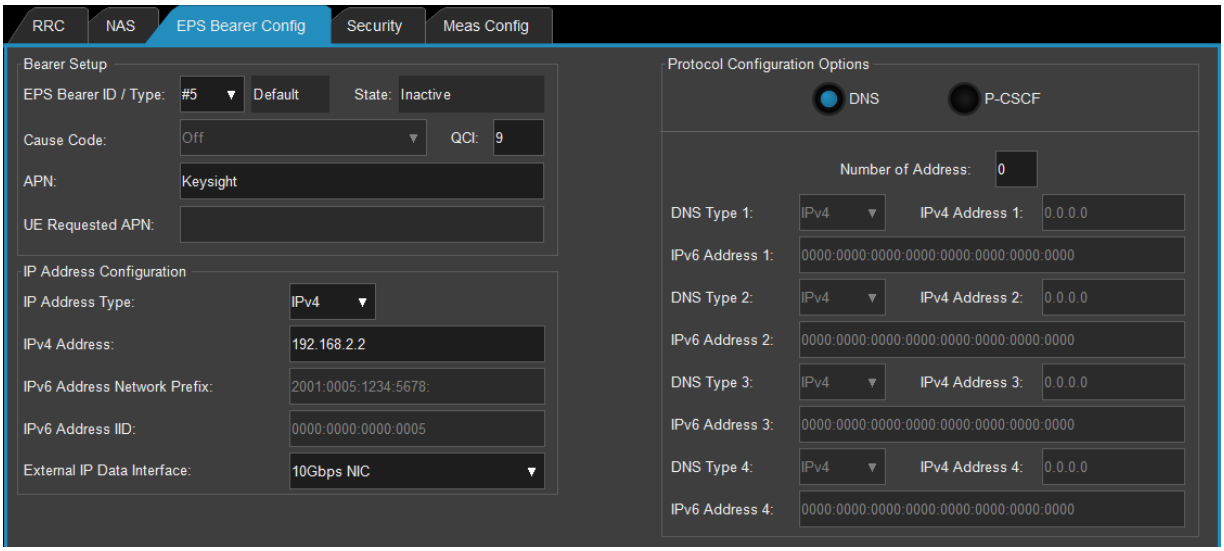
Deactivate Test Mode

Select to deactivate the test mode.

SCPI: BSE:CONFig:NAS:TC:MODE:DEACtivate

8.7.3 EPS Bearer Config Tab

The EPS Bearer Config tab configures the EPS bearers used by the LTE cell.



8.7.3.1 Bearer Setup

EPS Bearer ID / Type

Select the identifier for the EPS bearer. The type of EPS bearer is also displayed.

State

Displays the state of the EPS bearer.

SCPI: BSE:CONFig:NAS:<ebid>:STATe

Cause code

Not supported in this release.

QCI

Specify a value (1 to 9) for the Quality of Service Control Indicator (QCI) that represents the type of connection that is provided by the Default or Dedicated EPS Bearer.

SCPI: BSE:CONFig:NAS:<ebid>:QCI <1 ... 9>

APN

Displays the Access Point Name used when configuring a default bearer.

SCPI: BSE:CONFig:NAS:<ebid>:DEFault:APName <string>

UE Requested APN

Displays the APN that the UE is requesting a connection to in the PDN Connectivity Request.

SCPI: BSE:CONFig:NAS:<ebid>:DEFault:URAPname <string>

8.7.3.2 IP Address Configuration

IP Address Type

Select the IP address type: IPv4, IPv6, IPv4v6 or nonIP.

SCPI: BSE:CONFig:NAS:<ebid>:DEFault[:IP]:ADDRess[:TYPE] <IPV4 | IPV6 | IPV4V6>

IPv4 Address

Specify the IPv4 IP Address used when configuring a default bearer.

SCPI: BSE:CONFig:NAS:<ebid>:DEFault:IP:ADDRess:V4 <string>

IPv6 Address Network Prefix

Specify the UE prefix to be allocated for each UE PDN.

SCPI: BSE:CONFig:NAS:<ebid>:DEFault:IP:ADDRess:V6:PREFix <string>

IPv6 Address IID

Specify the IPv6 IP Address used when configuring a default bearer.

SCPI: BSE:CONFig:NAS:<ebid>:DEFault:IP:ADDRess:V6 <string>

External IP Data Interface

Specify the external IP data interface (NIC) that the EPS bearer uses: None, Anite NIC or 10Gbps NIC.

SCPI: BSE:CONFig:NAS:<ebid>:EXTernal:IP:INTerface <NONE | LTMode | HTMode>

8.7.3.3 Protocol Configuration Options

Select whether a DNS address or P-CSCF address is used when configuring a default bearer.

8.7.3.3.1 Number of Addresses

Specify the number of DNS or P-CSCF Server addresses included in the PCO.

SCPI: BSE:CONFig:NAS:<ebid>:DEFault:DNS[:NUMBer] <integer>

SCPI: BSE:CONFig:NAS:<ebid>:DEFault:PCSCf[:NUMBer] <integer>

8.7.3.3.2 DNS Type 1/2/3/4

For each address, specify whether an IPv4 or IPv6 DNS address is used when configuring a default bearer.

SCPI: BSE:CONFig:NAS:<ebid>:DEFault:<dns>:TYPE <IPV4 | IPV6 | IPV4V6>

8.7.3.3.3 P-CSCF Type 1/2/3/4

For each address, specify whether an IPv4 or IPv6 P-CSCF address is used when configuring a default bearer.

SCPI: BSE:CONFig:NAS:<ebid>:DEFault:<pcscf>:TYPE <IPV4 | IPV6 | IPV4V6>

8.7.3.3.4 IPv4 Address 1/2/3/4

For each address, specify the IPv4 DNS or P-CSCF server address used when configuring a default bearer.

SCPI: BSE:CONFig:NAS:<ebid>:DEFault:<dns>:ADDRess:V4 <string>

SCPI: BSE:CONFig:NAS:<ebid>:DEFault:<pcscf>:ADDRess:V4 <string>

8.7.3.3.5 IPv6 Address 1/2/3/4

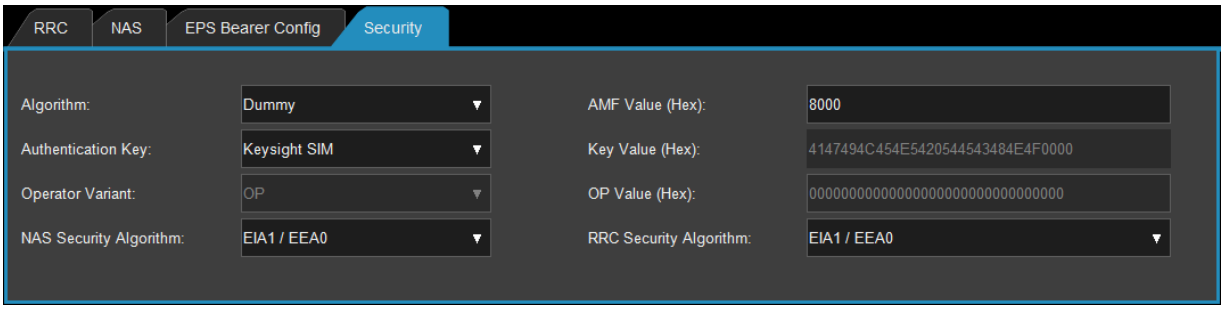
For each address, specify the IPv6 DNS or P-CSCF server address used when configuring a default bearer.

SCPI: BSE:CONFig:NAS:<ebid>:DEFault:<dns>:ADDRess:V6 <string>

SCPI: BSE:CONFig:NAS:<ebid>:DEFault:<pcscf>:ADDRess:V6 <string>

8.7.4 Security Tab

The Security tab configures the authentication parameters for the LTE cell.



Algorithm

Sets the authentication algorithm.

SCPI: BSE:CONFig:SECurity:AUTHenticate:ALGorithm <DUMMy | MILenage>

AMF Value (Hex)

Specify the Authentication Management Field (AMF). For more information, see 3GPP TS 33.102.

SCPI: BSE:CONFig:SECurity:AUTHenticate:AMF <0000 ... FFFF>

Authentication Key

Select the key which defines the 32-Hex string representing the 128-bit subscriber key (K).

SCPI: BSE:CONFig:SECurity:AUTHenticate:KEY <KEYSight | TEST3GPP | USER>

Key Value (Hex)

If the Authentication Key is not 'User', this field displays the authentication key (in Hex) defined above. If the Authentication Key is set to 'User', this field specifies the 32 character hexadecimal string that represents the 128-bit subscriber key.

SCPI: BSE:CONFig:SECurity:AUTHenticate:KEY:USER <hex>

Operator Variant

Specify whether the key option contains OP or OPc.

SCPI: BSE:CONFig:SECurity:AUTHenticate:OPVariant <OP | OPC>

OP Value (Hex)

Displays the value of the operator variant (in Hex) selected above.

SCPI: BSE:CONFig:SECurity:AUTHenticate:OPVariant:VALue <hex>

NAS Security Algorithm

Select the NAS integrity and ciphering algorithms.

SCPI: BSE:CONFig:SECurity:NAS:ICALgorithm <EIA0EEA0 | EIA1EEA0 | EIA2EEA0 | EIA1EEA1 | EIA2EEA2 | EIA1EEA2 | EIA2EEA1>

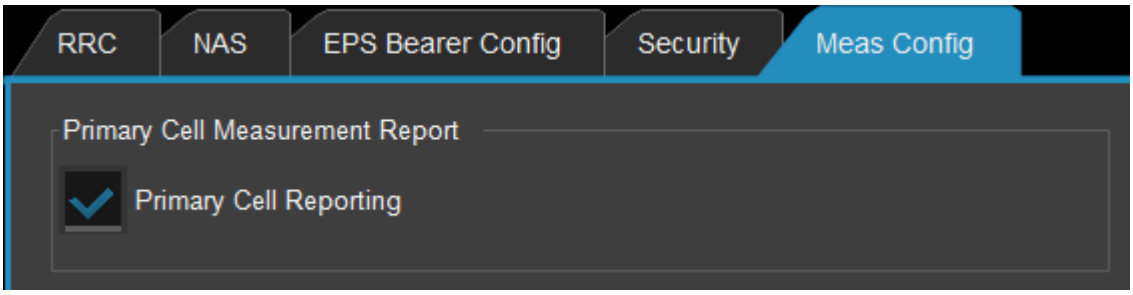
RRC Security Algorithm

Select the RRC integrity and ciphering algorithms.

SCPI: BSE:CONFig:LTE:<cell>:RRC:SECurity[:ICALgorithm] <EIA0EEA0 | EIA1EEA0 | EIA2EEA0 | EIA1EEA1 | EIA2EEA2 | EIA1EEA2 | EIA2EEA1>

8.7.5 Meas Config Tab

The Meas Config tab configures sending of RSRP/RSRQ reports from the UE.



Primary Cell Reporting

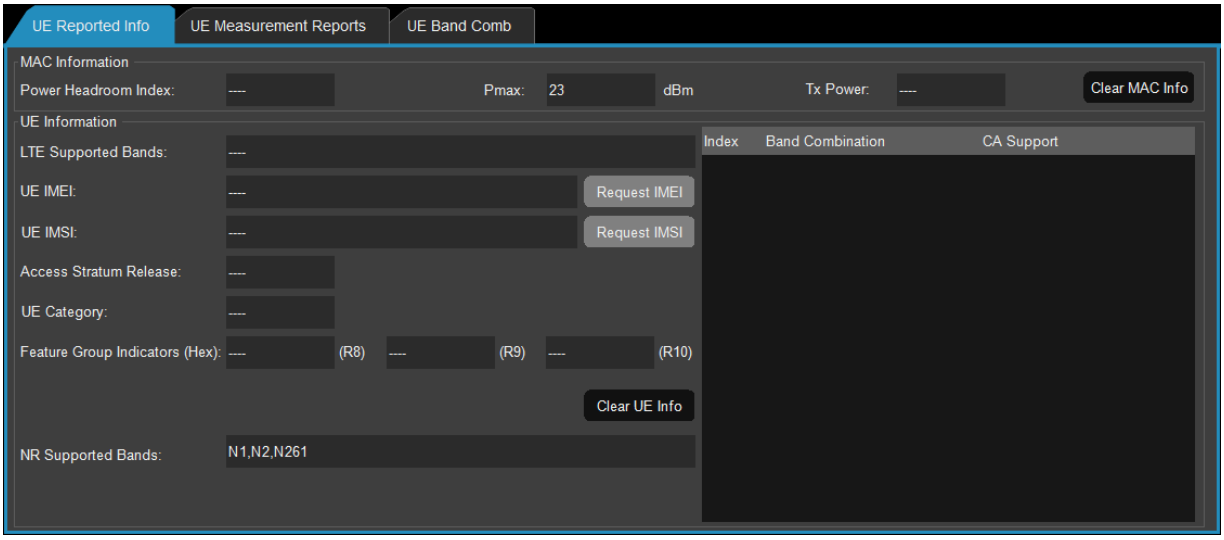
Select this check box to configure the UE to periodically transmit RSRP/RSRQ reports for the primary serving cell. When in the RRC Connected state, changes made to this field trigger an RRC Connection Reconfiguration message to the UE to enable or disable measurement reporting.

SCPI: BSE:CONFig:LTE:<cell>:MEASurement:REPort:PCELl[:STATe] <ON | 1 | OFF | 0>

8.8 UE Info Tab

8.8.1 UE Reported Info Tab

The UE Reported Info tab displays information received from the device under test.



8.8.1.1 MAC Information

Power Headroom Index

Displays the most recent power headroom report index reported by the device under test to the currently selected cell.

SCPI: BSE:INFO:<cell>:MAC:REPorted:PHRindex

Pmax

Displays the value configured in SIB1. If there is no value configured in SIB1, +23dBm is shown.

SCPI: BSE:INFO:<cell>:MAC:REPorted:PMAX

Tx Power

Displays the transmission power calculated from the power headroom index and Pmax values above. For more information, see section 6.1.3.6 in 3GPP TS 36.321 and section 9.1.8.4 in 3GPP TS 36.133.

SCPI: BSE:INFO:<cell>:MAC:REPorted:TXPower

Clear MAC Info

Click to clear the information in the MAC information group.

SCPI: BSE:INFO:<cell>:MAC:REPorted:CLEar

8.8.1.2 UE Information

During the attach process the UE sends a variety of information about itself to the network. Not all of the following results are available from all UEs, and depending on the signaling involved, some results are available and others are not.

LTE Supported Bands

Displays the frequency bands supported by the device under test.

SCPI: BSE:INFO:<cell>:UEReported:SBANds:EUTRan

UE IMEI

Displays the international mobile equipment identity (IMEI) number for the device under test. Click **Request IMEI** to get the IMEI from the device under test.

SCPI: BSE:INFO:<cell>:UEReported:IMEI

UE IMSI

Displays the international mobile subscriber identity (IMSI) number for the device under test. Click **Request IMSI** to get the IMSI from the device under test.

SCPI: BSE:INFO:<cell>:UEReported:IMSI

Access Stratum Release

Displays the accessStratumRelease reported in UE Eutra Capability information element. If the reported value from the UE is not understood by the UXM, UNKN is returned. NONE is returned when no value has been reported by the UE.

SCPI: BSE:INFO:<cell>:UEReported:ASRelease

UE Category

Displays the UE category (integer from 1 to 12), as reported in the UE Eutra Capability information element.

SCPI: BSE:INFO:<cell>:UEReported:CATegory

Feature Group Indicators (Hex)

Displays the Feature Group Indicators reported in UE Eutra Capability information element. Depending on the 3GPP release level that the UE supports, it may include REL8, REL9Add, or REL10 Feature Group Indicators. They are all 32 bit values. In addition, a “state” value is maintained for each of release8, release9 or release10 that indicates whether this release’s FGI has been reported.

SCPI: BSE:INFO:<cell>:UEReported:FGINdicators:RELease8

SCPI: BSE:INFO:<cell>:UEReported:FGINdicators:RELease9

SCPI: BSE:INFO:<cell>:UEReported:FGINdicators:RELease10

Clear UE Info

Click to clear the information in the UE information group.

SCPI: BSE:INFO:<cell>:UEReported:CLEar

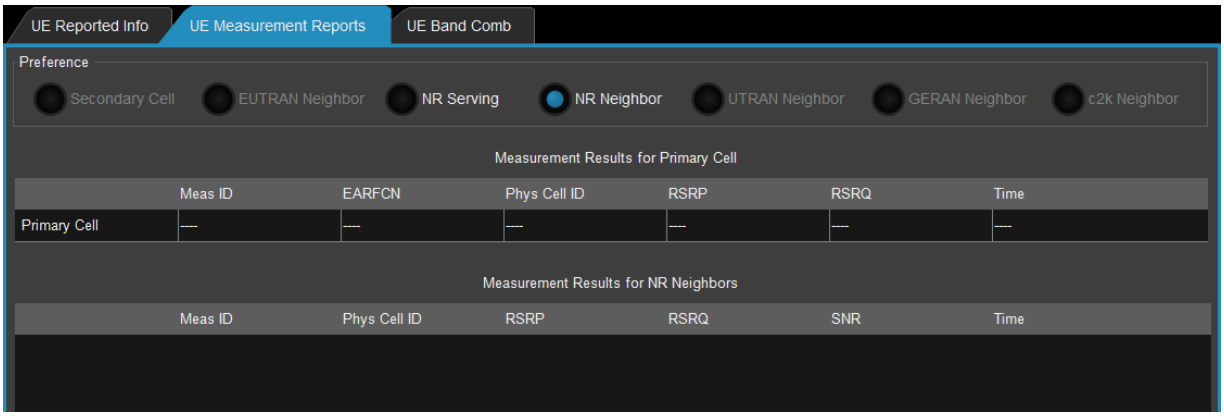
NR Supported Bands

Displays a comma-separated list of supported bands for NR.

SCPI: BSE:CONFig:NR5G:<cell>:UECapability:SUPPbands <string>

8.8.2 UE Measurement Reports (LTE)

The UE Measurement Reports tab



Preference

- Secondary Cell –
- EUTRAN Neighbor –
- NR Serving –
- NR Neighbor –
- UTRAN Neighbor –
- GERAN Neighbor –
- C2K Neighbor –

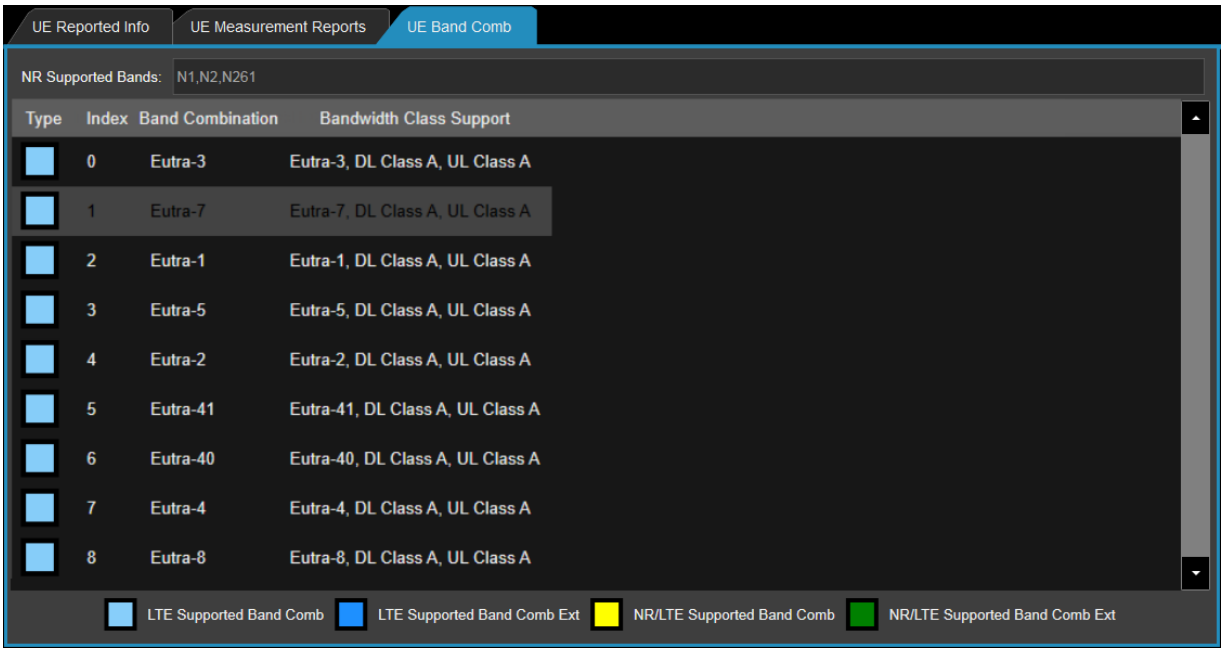
Measurement Results for Primary Cell/NR Neighbors

- Meas ID –
- EARFCN –
- Phys Cell ID –
- RSRP –
- RSRQ –
- SNR –
- Time –

8.8.3 UE Band Comb Tab

When the option for UE Enquiry Include is selected on the LTE cell's Config tab, the UE Band Combination tab shows decoded UE capabilities.

SCPI: BSE:CONFig:NR5G:<cell>:UECapability:MSG <string> – where <string> is an XML message with decoded UE capabilities



NR Supported Bands

Displays the comma-separated list of NR Supported Bands on the LTE cell's UE Reported Info tab.

Type

Uses the colour key at the bottom of the tab to differentiate between LTE and NR devices, supported band combinations and supported band combination ext.

Index

Identifies each band/bandwidth combination.

Band Combination

Shows supported band combinations.

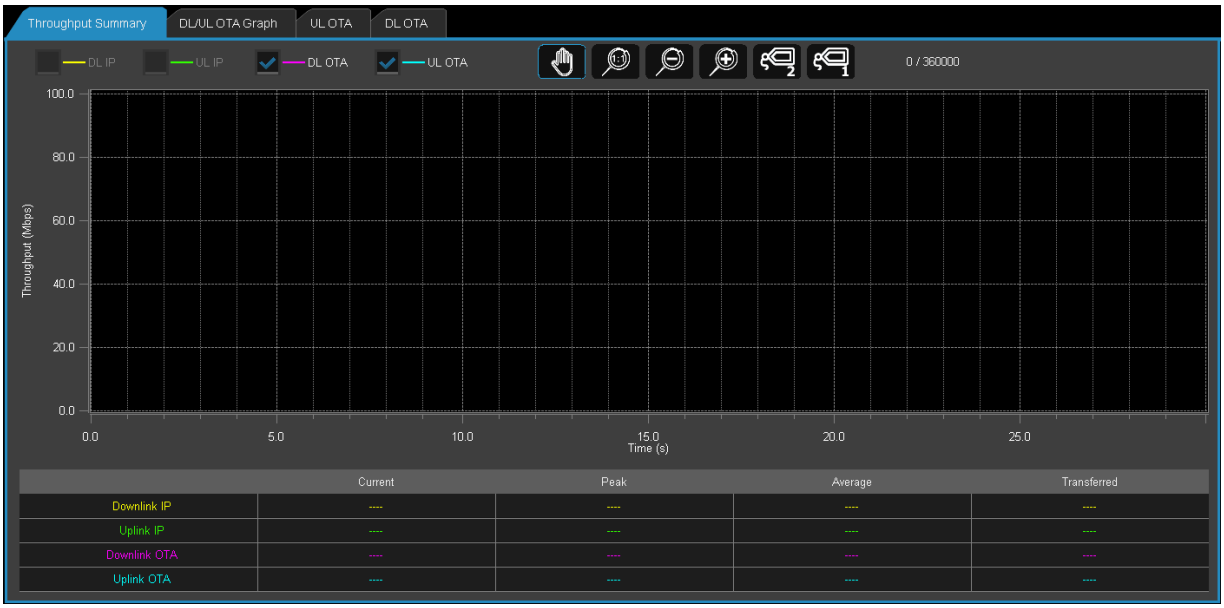
Bandwidth Class Support

Shows supported bandwidth classes.

8.9 BLER/Tput Tab

8.9.1 Throughput Summary Tab

The Throughput Summary tab displays a graph of uplink and downlink data throughput over time.



8.9.2 DL/UL OTA Graph Tab

The DL/UL OTA Graph tab displays graphs of the OTA throughput over time and the BLER (%) over time at the same time, and provides a table of statistics. for throughput and BLER.

The equivalent SCPI commands, which return values as defined below are:

SCPI: BSE:NR5G:MEASure:BTHRoughput:DL:BLER:<cell>?

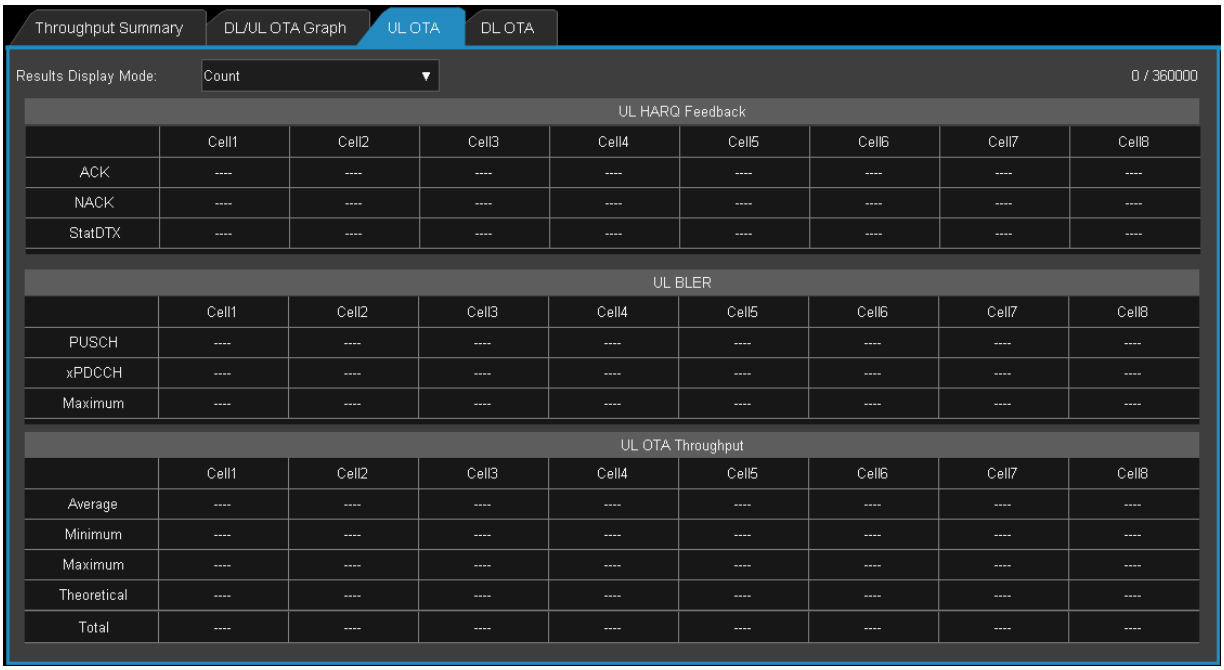
Format for returned array is: progress-count, ack-count, ack-ratio, nack-count, nack-ratio, statdtx-count, statdtx-ratio, pdschBlerCount, pdschBlerRatio

SCPI: BSE:NR5G:MEASure:BTHRoughput:UL:BLER:<cell>?

Format for returned array is: progress-count, ack-count, ack-ratio, nack-count, nack-ratio

8.9.3 UL OTA Tab

The UL OTA tab displays a table of uplink OTA measurements including HARQ feedback, BLER and Throughput.



The equivalent SCPI commands, which return values as defined below are:

SCPI: BSE:NR5G:MEASure:BTHRoughput:UL:THRoughput:OTA:<cell>?

Format for returned array is: progress-count, current-tput, min-tput, max-tput, average-tput, theoretical-max tput

8.9.4 DL OTA Tab

The DL OTA tab displays a table of downlink OTA measurements including HARQ feedback, BLER and Throughput.

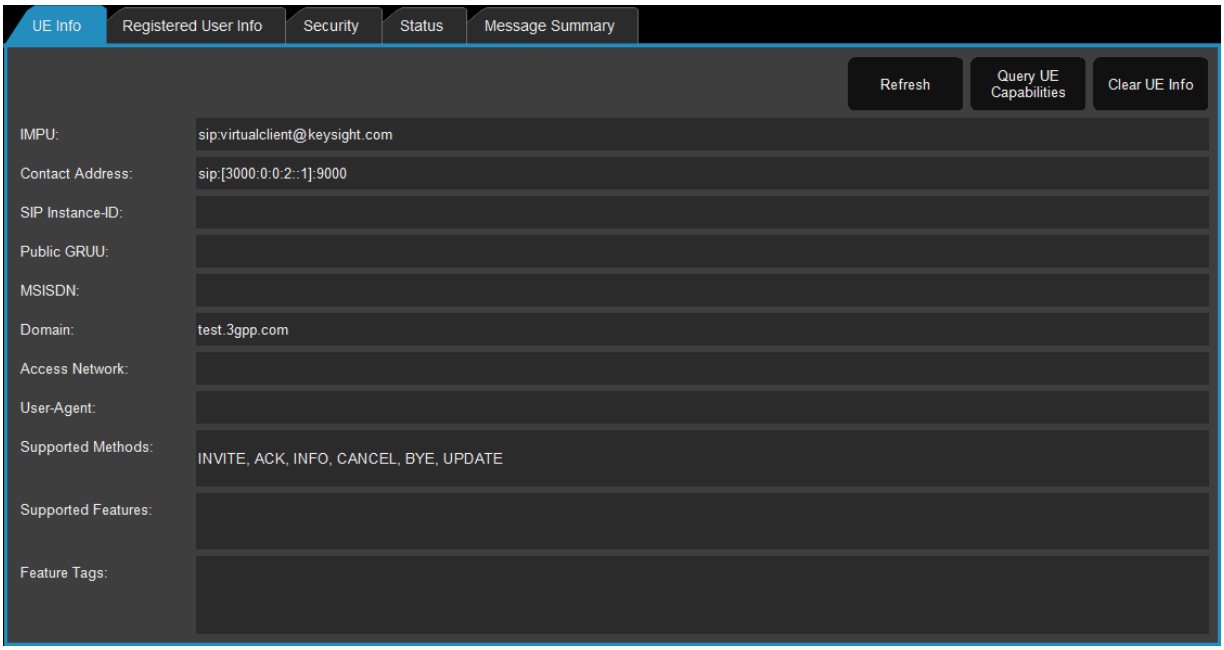
The equivalent SCPI commands, which return values as defined below are:

SCPI: BSE:NR5G:MEASure:BTHRoughput:DL:THRoughput:OTA:<cell>?

Format for returned array is: progress-count, current-tput, min-tput, max-tput, average-tput, theoretical-max tput

8.10 IMS

The UE Info Tab displays information extracted based on the Register provided when the UE performs an IMS Registration.



Refresh

Click Refresh for update the information from the IMS Server.

SCPI: SYSTem:IMS:SERVer:UE:INFormation:REFResh

Query UE Capability

Click to perform an IMS capability enquiry of the UE via a SIP INFO request.

SCPI: SYSTem:IMS:SERVer:UE:INFormation:CAPability:GET

Clear UE Info

Click Clear to clear the information displayed.

SCPI: SYSTem:IMS:SERVer:UE:INFormation:CLEar

IMPU

Displays the IMS Public User Identity (IMPU) from the reported UE-Info.

SCPI: SYSTem:IMS:SERVer:UE:INFormation:IMPU?

Contact Address

Displays the contact address from the reported IMS UE-Info.

SCPI: SYSTem:IMS:SERVer:UE:INFormation:CONTact[:ADDRess]?

SIP Instance-ID

Displays the '+sip.instanceid' value from the reported IMS UE-Info.

SCPI: SYSTem:IMS:SERVer:UE:INFormation:ID?

Public GRUU

Displays the 'Public GRUU' from the reported IMS UE-Info.

SCPI: SYSTem:IMS:SERVer:UE:INFormation:PUBLic:GRUU?

MSISDN

Displays the 'MSISDN number' value associated with the UE's IMS registration.

SCPI: SYSTem:IMS:SERVer:UE:INFormation:MSISdn?

Domain

Displays the domain from the reported IMS UE-Info.

SCPI: SYSTem:IMS:SERVer:UE:INFormation:DOMain?

Access Network

Displays the access network from the reported IMS UE-Info.

SCPI: SYSTem:IMS:SERVer:UE:INFormation:ANETwork?

User-Agent

Displays the User-Agent value from the reported IMS UE-Info (as reported by the UE in the 'User-Agent' SIP header).

SCPI: SYSTem:IMS:SERVer:UE:INFormation:UAGent?

Supported Methods

Displays the UE-supported SIP method-types from the reported IMS UE-Info (as indicated by the UE in the SIP headers).

SCPI: SYSTem:IMS:SERVer:UE:INFormation:SUPPorted:METHods?

Supported Features

Displays the supported features header from the reported IMS UE-Info (as indicated by the UE in the SIP headers).

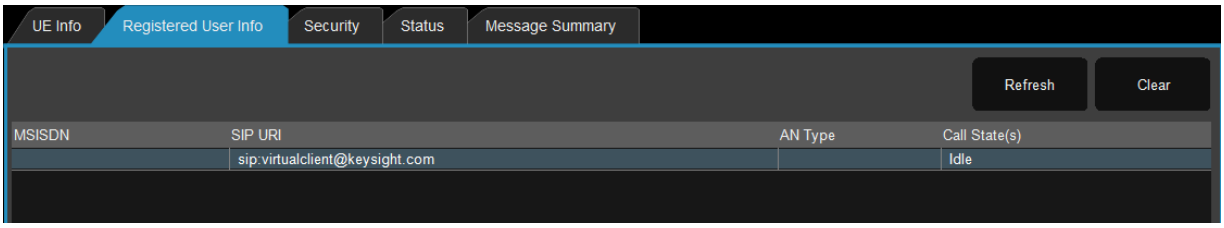
SCPI: SYSTem:IMS:SERVer:UE:INFormation:SUPPorted:FEATures?

Feature Tags

Displays the Feature Tags field value from the reported IMS UE-Info.

SCPI: SYSTem:IMS:SERVer:UE:INFormation:SUPPorted:FTAGs?

Shows a summary of the status of each user registered on the IMS Server.



Refresh

Click **Refresh** for update the information from the IMS Server.

SCPI: SYSTem:IMS:SERVer:RUSer:INFormation:REFResh

Clear

Click **Clear** to clear the information displayed.

SCPI: SYSTem:IMS:SERVer:RUSer:INFormation:CLEar

MSISDN

Displays the MSISDN of the registered user.

SIP URI

Displays the SIP user resource identifier (URI), which is a unique address that can be used (for example) to identify a specific VoIP system.

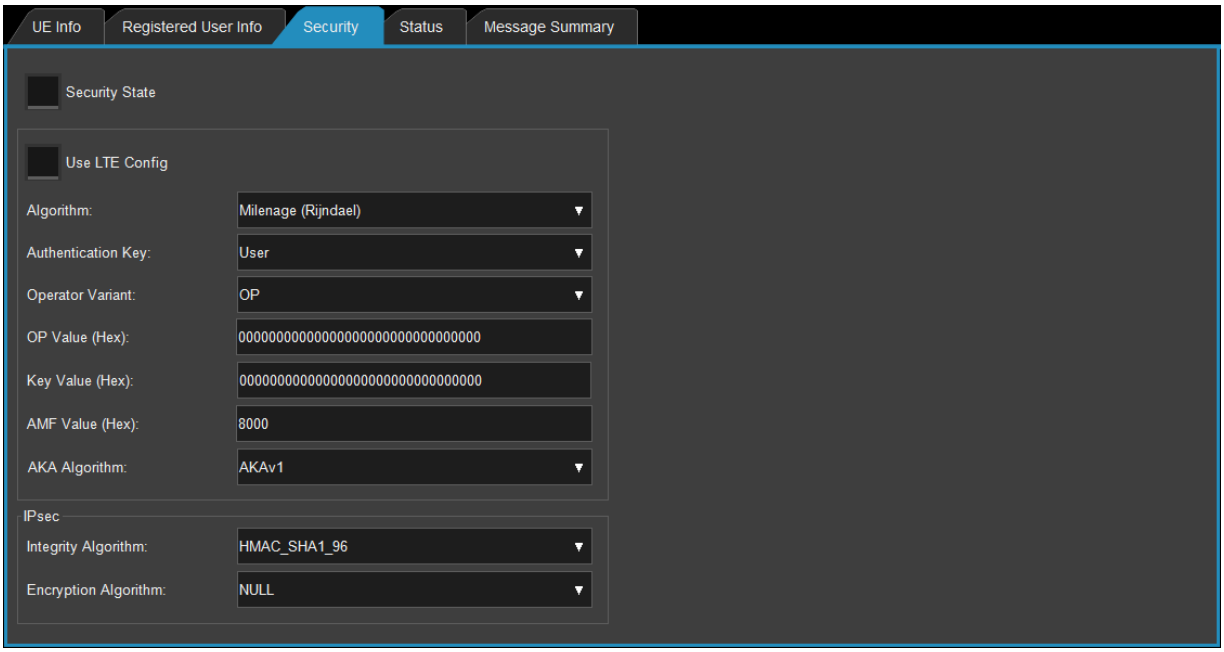
AN Type

Displays any reported access network type for the registered user.

Call State(s)

Displays the status of the currently active calls. Each user can have up to 3 simultaneous calls.

The Security tab configures parameters used in authentication, which are generally the same as the LTE options. This tab lets you define different security parameters from the LTE options defined on the RRC/NAS > Security tab.



Security State

Select to enable IMS security.

SCPI: SYSTem:IMS:SERVer:CONFig:SECurity[:STATe] <ON | OFF>

Use LTE Config

Select to automatically link IMS security-parameters to the LTE RAT values.

SCPI: SYSTem:IMS:SERVer:CONFig:SECurity:AUTHenticate:COUPling[:LTE][:STATe] <ON | OFF>

Algorithm

Specifies the IMS authentication algorithm:

- Dummy
- Milenage (Rijndael)

SCPI: SYSTem:IMS:SERVer:CONFig:SECurity:AUTHenticate:ALGorithm <DUMMy | MILenage>

Authentication Key

Specifies the type of IMS authentication private-key (K):

- Keysight SIM
- 3GPP SIM
- User

SCPI: SYSTem:IMS:SERVer:CONFig:SECurity:AUTHenticate:KEY[:TYPE] <KEYSight | TEST3GPP | USER>

Operator Variant

Specifies the type of IMS authentication OP-variant:

- OPc
- OP

SCPI: SYSTem:IMS:SERVer:CONFig:SECurity:AUTHenticate:OPVariant[:TYPE] <OPC | OP>

OP Value (Hex)

Specifies the value of the IMS authentication OP-variant.

SCPI: SYSTem:IMS:SERVer:CONFig:SECurity:AUTHenticate:OPVariant:VALue <00000000000000000000000000000000 ... FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF>

Key Value (Hex)

Specifies the IMS user-defined authentication private-key (K) value, which is used when the key-type is configured to 'user'.

SCPI: SYSTem:IMS:SERVer:CONFig:SECurity:AUTHenticate:KEY:USER <00000000000000000000000000000000 ... FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF>

AMF Value (Hex)

Specifies the value of the IMS authentication AMF (Authentication Management Field).

SCPI: SYSTem:IMS:SERVer:CONFig:SECurity:AUTHenticate:AMF <0000 ... FFFF>

AKA Algorithm

Specifies the IMS authentication AKA algorithm:

- AKAv1
- AKAv2

SCPI: SYSTem:IMS:SERVer:CONFig:SECurity:AUTHenticate:AKA[:ALGorithm] <AKAv1 | AKAv2>

8.10.1 IPSec

Integrity Algorithm

Specifies the IMS IPsec integrity algorithm:

- HMAC_MD5_96
- HMAC_SHA1_96

SCPI: SYSTem:IMS:SERVer:CONFig:SECurity:IPSec:INTegrity[:ALGorithm] <HMAC_MD5_96 | HMAC_SHA1_96>

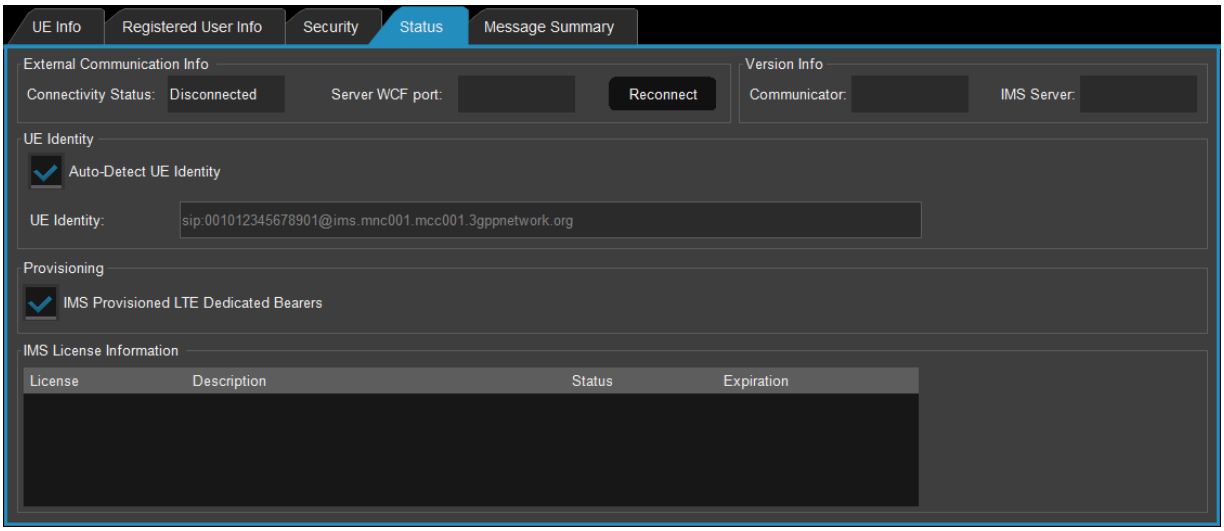
Encryption Algorithm

Specifies the IMS IPsec encryption algorithm:

- NULL
- DES3_CBC
- AES_CBC

SCPI: SYSTem:IMS:SERVer:CONFig:SECurity:IPSec:ENCRyption[:ALGorithm] <NULL | DES3_CBC | AES_CBC>

The Status tab displays whether the Test Application is connected to the IMS Server.



8.10.2 External Communication Info

Connectivity Status

Displays the current connection-status of the link from UXM TA to IMS Server: Unknown, Connecting, Connected, Disconnecting or Disconnected.

SCPI: SYSTem:IMS:SERVer:STATus:EXTernal:CONNection:STATus?

Server WCF Port

Displays the current/active destination (TCP) port Test Application uses to communicate with the IMS Server.

SCPI: SYSTem:IMS:SERVer:STATus:EXTernal:CONNection:PORT?

Reconnect

Click to trigger a connection/reconnection of Test Application to the Keysight IMS Server application.

SCPI: SYSTem:IMS:SERVer:CONFig:EXTernal:CONNection:REConnect

8.10.3 Version Info

Communicator

Displays the version-string associated with the API communication-module used for interfacing to the Keysight IMS Server.

SCPI: SYSTem:IMS:SERVer:STATus:VERSion:API?

IMS Server

Displays the version-string of the Keysight IMS Server application to which Test Application is currently connected.

SCPI: SYSTem:IMS:SERVer:STATus:VERSion:APPLication?

8.10.4 UE Identity

Auto-Detect UE Identity

Select to enable auto-detection of the UE's IMS (SIP) identity.

SCPI: SYSTem:IMS:SERVer:CONFig:UE:IDENtity:DETect[:AUTO] <ON | 1 | OFF | 0>

UE Identity

If Auto-Detect UE Identity is selected, specify the UE's IMS (SIP) identity. For example, "sip:001012345678901@ims.mnc001.mcc001.3gppnetwork.org".

SCPI: SYSTem:IMS:SERVer:CONFig:UE:IDENtity <string>

8.10.5 Provisioning

IMS Provisioned LTE Dedicated Bearers

Select to automatically influence LTE dedicated-bearer creation/modification/removal by IMS session-state changes associated with the UE.

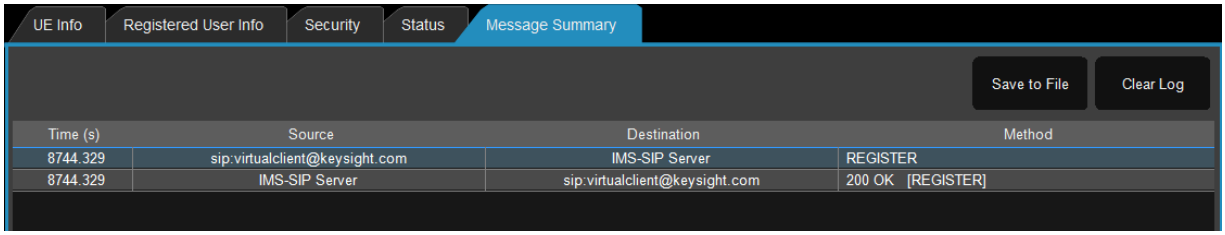
SCPI: SYSTem:IMS:SERVer:CONFig:EXTernal:LTE:DEDicated:ACReate[:STATe] <ON | 1 | OFF | 0>

8.10.6 IMS License Information

Displays IMS-related licensing information (License, Description, Status and Expiration) from the Keysight IMS Server application to which the Test Application is connected.

SCPI: SYSTem:IMS:SERVer:STATus:LICense:INFormation?

The Message Summary tab displays the IMS Messaging log reported from the IMS Server.



Save To File

Click to save the IMS message-summary log.

SCPI: SYSTem:IMS:SERVer:MESSage:LOG:SAVE <filename of message summary log>

Clear Log

Click to clear the IMS message-summary log.

SCPI: SYSTem:IMS:SERVer:MESSage:LOG:CLEar

Time

Displays the time that the IMS messages was sent/received.

Source

Displays the source of the IMS message.

Destination

Displays the destination of the IMS message.

Method

Displays the method for the IMS message.

9 SCPI COMMANDS

9.1 About SCPI Commands

In this help system, click the SCPI *button in the Help navigation bar for a complete list of SCPI commands with links to the topics that describe them.*

You can use SCPI (Standard Commands for Programmable Instruments) commands to perform functions remotely on the 5G NR Test Application or to automate testing in Test Automation Platform (TAP) scripts using functionality in the 5G NR Test Application.

9.1.1 To search for a SCPI commands in the user interface

Each field on each tab in the 5G NR Test Application user interface has a corresponding SCPI command. you can display the SCPI command for a field as follows:

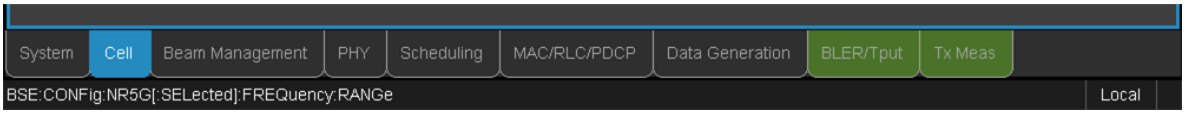
- Choose the option to display SCPI commands in the status bar. You can then copy the command and paste it into another application.
- Use the Search option on the Utility menu to search the user interface for field that is equivalent to a SCPI command.

Also see: SCPI Command Syntax

9.1.2 To display SCPI commands in the status bar

1. From the Main menu, select Utility.
2. Click Preferences to display the preferences options.
3. Select the SCPI Command Display checkbox and click Back.

   The Status bar will then display the SCPI commands for the selected field on the user interface.



9.1.3 To copy SCPI commands

To copy the SCPI command, right click on the SCPI command in the status bar and click Copy. The SCPI command text is stored to the clipboard and can be pasted into another application.

Note: The displayed SCPI command string does not include the allowed values. For details of allowed values for the SCPI command, refer to the description of the field in the Help.

9.2 SCPI Command Syntax

SCPI commands either set parameter values or query parameter values. Query commands end with a ? character, and commands require you to define the value for the parameter.

9.2.1 SCPI command examples

The following is SCPI command format for setting the duplex mode for a cell.

BSE:CONFig:<rat>:<cell>:DUPLex:MODE <TDD|FDD>

where <cell> is CELL1, CELL2, ... , CELL8, and is based on the cell identifier shown on top left of cell tab in the user interface (typically cell 1 is LTE, and all other cells are 5G NR), and <TDD | FDD> denotes the allowed values: TDD or FDD. An example SCPI command that sets the duplex mode for Cell 1 to TDD would be:

BSE:CONFig:NR5G:CELL1:DUPLex:MODE TDD

An example of a SCPI command query is:

BSE:CONFig:NR5G:<cell>:SSB:FREQuency?

Note: Some SCPI queries also include parameters.

9.2.2 SCPI syntax rules

9.2.2.1 Optional characters in command names

The names of most SCPI commands can be abbreviated; where a name is given with a mixture of upper-case and lower-case letters, the lower-case letters can be omitted to shorten the command. (CONFig becomes CONF, for example).

BSE:CONFig:CELL1:DUPLex:MODE TDD

BSE:CONF:CELL1:DUPL:MODE TDD

However, this mixture of upper and lower cases is used simply to show which characters are optional. Case is not actually significant in SCPI command parsing; CONF could also be sent as Conf or conf.

9.2.2.2 Alternative parameter values

Where a parameter has a limited set of possible values, the alternatives are stated in the form of a list separated by vertical bars. For example, A|B|C means that the parameter must be either A, B, or C.

9.2.2.3 Optional elements

Often the full format of a command includes elements that can be omitted in most circumstances (they are enclosed in [brackets] to show that they are optional). If an element is optional, that means it has a default value, and therefore doesn't need to be stated in the command unless the default value is unacceptable.

The node :INSTrument[0|1] can be given as INSTrument0 or INSTrument1. However, the numerical suffix is optional, meaning that 0 is the default value, and therefore INSTrument means the same thing as INSTrument0. Because the lower case letters can be omitted, INST also means the same thing as INSTrument0.

9.2.3 SCPI command variables

The following table lists the allowed values for variables used in SCPI commands.

Variable	Description	Permitted values
<alev>	Aggregation Level.	ALEVel1 | ALEV2 | ALEV4 | ALEV8 | ALEV16
<blertabs>	LTE BLER/Tput subtabs.	SUMMary | OTAGraph | ULOTa | DLOTa
<bwpid>	Bandwidth part.	DL0
<cell>	The cell to which the SCPI command relates.	CELL1 | CELL2 | ... | CELL8
<celltabs>	LTE Cell subtabs.	CONFig | IDENtities
<coresetid>	Control Resource Sets (CORESET) Identifier.	COReset1 | COReset2 | ... | COReset12
<cri>	CSI Resource Item	CRI0 | CRI1 | ... | CRI191
<direction>	Direction: Downlink or Uplink.	DL | UL
<dlbandwidth>	Downlink Bandwidth (MHz)	B1P4 | B3 | B5 | B10 | B15 | B20
<dns>	Domain Name Server.	DNS1 | DNS2 | DNS3 | DNS4

<dtua>	DL Data for UL Ack	DTUA1 | DTUA2 | DTUA3 | DTUA4 | DTUA5 | DTUA6 | DTUA7 | DTUA8
<ebid>	EPS Bearer Identifier.	EBID5 | EBID6 | EBID7 | EBID8 | EBID10 | EBID11 | EBID12 | EBID13
<fc>	Frame configuration.	FC0 | FC1 | FC2 | FC3 | FC4
<ipaddress>	IP Address.	IPv4 | IPv6
<iri>	CSI Resource Item	IRI0 | IRI1| IRI2 | ... | IRI32
<mrpdtabs>	LTE MAC/RLC/PDCP subtabs.	GENeral | HARQ | DRB
<ncode>	Network code	1 | 2 | 3 | 4 | 5 | 6
<pcscf>	Proxy-Call Session Control Function.	PCSCf1 | PCSCf2 | PCSCf3 | PCSCf4
<phytabs>	LTE PHY subtabs.	GENeral | UEPControl | BOOSting
<pucchresourceid>	PUCCH Resource Identifier.	PRESource0
<qclInfoId>	Quasi Co Location information identifier.	QCLinfo0 | QCLinfo1 | ... | QCLinfo63
<ra>	Resource allocation.	RALLoc1 | RALLoc2 | ... | RALLoc10
<radef>	Resource allocation definition	DEF0 | DEF1 | ... | DEF63
<ralist>	Resource allocation list	LIST0 | LIST1 | ... | LIST63
<raset>	Resource set	SET0 .. SET63
<rat>	Radio Access Technology.	NR5G | LTE
<rrcnastabs>	LTE RRC/NAS subtabs.	RRC | NAS | EPSBearer | SECurity
<sc>	Slot configuration.	SC0 | SC1 | SC2 | SC3 | SC4
<schedulingtabs>	LTE Scheduling subtabs.	SUBFRames | QSETup | RBALlocation
<screentabs>	LTE tabs on the user interface.	SYSTem | CELL | PHY | SCHeduling | MRPDcp | RNAS | UEINfo | BTHRoughput
<searchspaceid>	Search Space Identifier.	SSID0 | SSID1 | SSID2
<subframe>	Subframe number.	SFRame0 | SFRame1 | ... | SFRame9
<ssbindex>	SSB index	<INDex0 | INDex1 | ... | INDex63>
<systtabs>	LTE System subtabs.	OVERview | RFConfig | IMP | MESSage | ERRor | RUI
<tciStateType>	Transmission Configuration Indicator (TCI) state type.	TYPE1 | TYPE2
<tftfilter>	Traffic Flow Template Filter.	TFTFilter1 | TFTFilter2 | TFTFilter3 | TFTFilter4
<ueinfotabs>	LTE UE Info subtabs.	REPorted | CAPabilities
<ulbandwidth>	LTE uplink bandwidth	BW1P4 | BW3 | BW5 | BW10 | BW15 | BW20 | BW0P2
<ulresourcesetid>	Uplink Resource Set Identifier.	RSET0

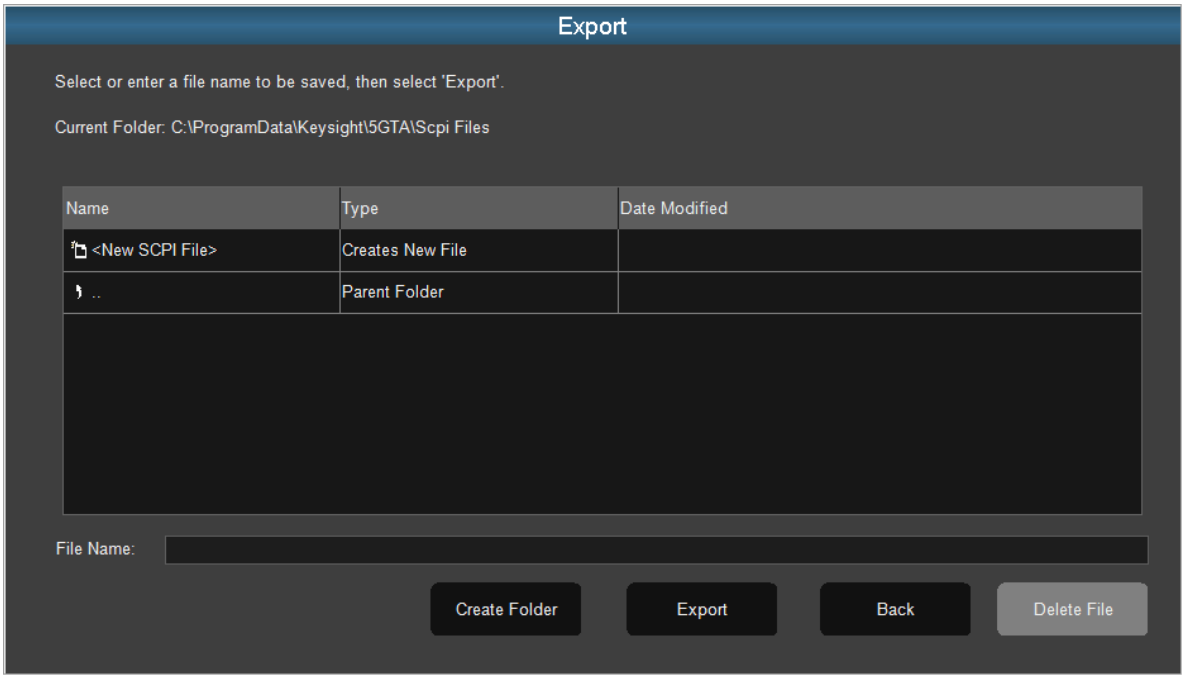
9.3 Importing and Exporting SCPI Files

SCPI files can be exported and imported from the Main Menu > Utility options. The default location for SCPI files is:

C:\ProgramData\Keysight\5GTA\Scpi Files

9.3.1 To export the 5G NR Test Application configuration as a SCPI file

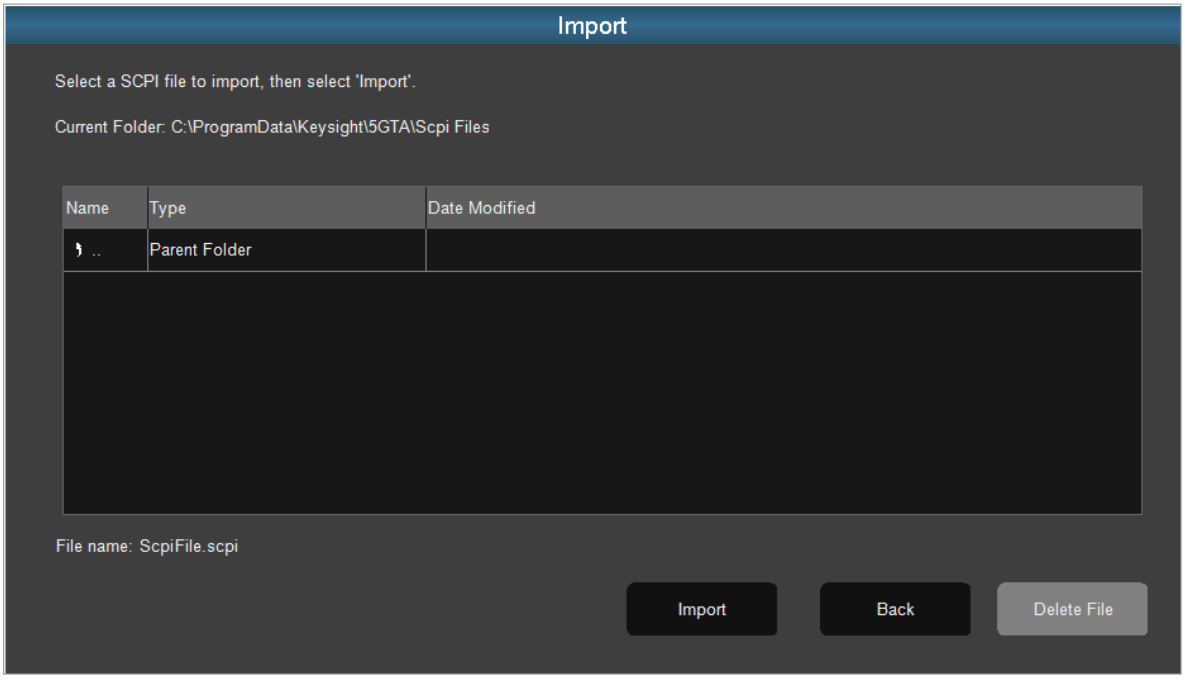
1. From the main menu, click Utility, then Export, which displays the export dialog.



2. Navigate to the directory to which to export the 5G NR Test Application settings.
3. Specify a File Name for the SCPI file, then click Export.

9.3.2 To import an exported 5G NR Test Application configuration

1. From the main menu, click Utility, then Import, which displays the import dialog.

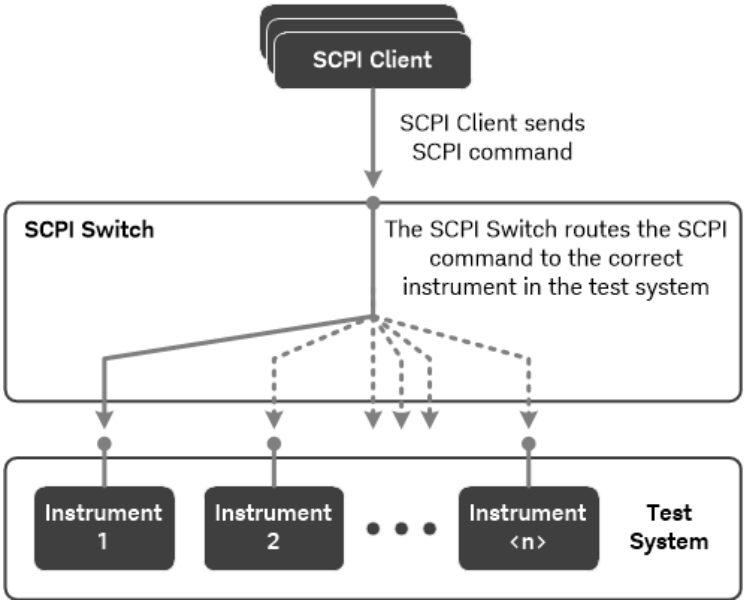


2. Navigate to the directory to which you previously saved a 5G NR Test Application SCPI file.
3. Select the SCPI file, then click Import.

9.4 SCPI Switch

The SCPI Switch is a server that enables multiple SCPI clients (each with their own SCPI session) to send SCPI commands to any unit in an NES test system through a single SCPI instrument interface. Once the SCPI Switch is configured, the client can send commands to any instrument and the SCPI Switch (transparently to the client) routes the SCPI commands to the correct instrument.

Note: The client does not need to be aware of the SCPI Switch and can send SCPI commands as if directly connected to the required instrument.



Keysight provide internal SCPI Switch Commands (provided at the end of this user guide) that enable automation clients to configure and control the switch. The commands can:

- Control the switch and associated instruments – instrument connection & status, instrument selection, connection reestablishment with instrument.
- Configure the switch – add, delete and configure an instrument managed by the switch.

Notes on SCPI commands:

- SCPI Switch Commands cannot be sent as a list of semi-colon-separated SCPI commands that include commands for other instruments.
- Changes made using SCPI Switch configuration commands (ISWI:CONF) are applied in the current session and future sessions (including between power cycles) but only for the current client.
- Commands with a new line separator, "\n", will be split and executed separately, and can only contain a single query that must be the last command.

9.4.1 Configuring the SCPI Switch

The base VISA address for the SCPI Switch server is:

TCPIP0::<host address>::13000::SOCKET

By default, the server is configured to support the NES setup instruments in the following table.

Note: The SCPI Switch only supports SOCKET connections.

Instrument name	Base VISA Address	Timeout (ms)

Test Application	TCPIP0::localhost::5125::SOCKET	120000
HCCU	TCPIP0::localhost::4882::SOCKET	120000
X-Apps	TCPIP0::localhost::5075::SOCKET	40000

10 TROUBLESHOOTING

10.1 Test fails/crashes when 5G NR Test Application is running on the UXM-5G unit

If the 5G NR Test Application crashes, before you restart the 5G NR Test Application, perform the following steps:

1. Reconfigure the Test System using the **Configure 5G NR Test App** as described in the 5G Test System Setup Help.
2. Check that the network connection has an IPv4 address of 201.20.2.1 configured.

11 SCPI SWITCH COMMANDS

Instrument: SCPISwitch

Specificaiton Version: 1.0.1Instrument Types

Type	Range
status	*Range:* ONLIne, OFFLine
instrumentStatus	*Range:* NOTC, CONN, UNRE, ERR, CONG, WAIT, ARM, TRIT

11.1 Switch

11.1.1 Subsystems properties

11.1.1.1 Switch - Interface Version

Returns the current interface version implemented by the instrument ISWItcher

11.1.1.1.1 Property Description

SCPI Command	ISWItcher:IDN?
Parameters	
Return Type	String
Units	
Default	
Range	

11.1.1.1.2 Notes

Returns the interface version of this instrument ISWItcher.
*IDN? Format.

11.1.1.1.3 Error Conditions

11.1.1.1.4 Example

```
ISWItcher:CONTrol:VERSion?<br>
> Keysight Technologies,ScpiISWItcher,0,1.0.0.0
```

11.1.1.1.5 Banded By

11.1.1.1.6 Dependencies

11.1.1.1.7 Version

First Version available: 1.0.0
Implementation status: Implemented

11.1.1.2 Switch - ISWItcher Error

Returns the error codes from the error message queue.

11.1.1.2.1 Property Description

SCPI Command	ISWItcher:ERRor?

Parameters	
Return Type	(Integer,String)
Units	
Default	
Range	

11.1.1.2.2 Notes

Returns a pair: error code, description.
Equivalent to SYST:ERR? returning and popping elements from the Error queue.

11.1.1.2.3 Error Conditions

11.1.1.2.4 Example

```
ISWItcher:ERR?<br>
> 12, "Unable to reestablish session with instrument TA"<br>
ISWItcher:ERR?<br>
> 0, "No error"
```

11.1.1.2.5 Banded By

11.1.1.2.6 Dependencies

11.1.1.2.7 Version

First Version available: 1.0.0
Implementation status: Implemented

11.1.1.3 Switch - ISWIcher Error Count

Returns the number of errors in the Switch's error queue.

11.1.1.3.1 Property Description

SCPI Command	ISWItcher:ERRor:COUNt?
Parameters	
Return Type	Integer
Units	
Default	
Range	

11.1.1.3.2 Notes

Returns the equivalent to SYST:ERR:COUN? standard SCPI query.

11.1.1.3.3 Error Conditions

11.1.1.3.4 Example

```
ISWItcher:ERRor:COUNt?<br>
> 0<br>
ISWItcher:ERR?<br>
> 0, "No error"
```

11.1.1.3.5 Banded By

11.1.1.3.6 Dependencies

11.1.1.3.7 Version

First Version available: 1.0.1
Implementation status: Implemented

11.1.1.4 Switch - ISWIcher Header Help

Returns the list of SCPI headers supported by the Switch.

11.1.1.4.1 Property Description

SCPI Command	ISWItcher:HELP:HEADers?
Parameters	
Return Type	String
Units	
Default	
Range	

11.1.1.4.2 Notes

Returns the equivalent to SYST:HELP:HEADers? standard SCPI query. The switch will also return some standard commands support such as *IDN?. All standard commands are always routed to the selected instrument.

11.1.1.4.3 Error Conditions

11.1.1.4.4 Example

```
ISWItcher:HELP:HEADers?<br>
> #3463<br>
:ISWItcher:CONFig<br>
:ISWItcher:CONFig:ADD/nquery/<br>
:ISWItcher:CONFig:DELete/nquery/<br>
:ISWItcher:CONFig:DUPlicate/nquery/<br>
:ISWItcher:CONFig:PRESet/nquery/<br>
:ISWItcher:CONFig:SPLit<br>
:ISWItcher:CONTrol?/qonly/<br>
:ISWItcher:CONTrol:RESTablish[:NAME]/nquery/<br>
:ISWItcher:CONTrol:SELect<br>
:ISWItcher:CONTrol:STATus:ALL?/qonly/<br>
:ISWItcher:CONTrol:STATus[:NAME]?/qonly/
```

11.1.1.4.5 Banded By

11.1.1.4.6 Dependencies

11.1.1.4.7 Version

First Version available: 1.0.1
Implementation status: Implemented

11.1.1.5 Switch - Available

Provides a list of instruments that are controlled by the ISWItcher.

11.1.1.5.1 Property Description

SCPI Command	ISWItcher:CONTrol?

Parameters	
Return Type	List<String>
Units	
Default	"TA","HCCU","XA1"
Range	

11.1.1.5.2 Notes

Returns a list of instruments that are controlled by this ISWItcher. By default: "XA1", "TA", "HCCU".
All instruments have been configured to their corresponding default VISA address in the local host.
Additional instruments can be added using the Add command or updated using the configure command.

Please refer to the Configure command.

11.1.1.5.3 Error Conditions

11.1.1.5.4 Example

```
ISWItcher:CONTrol?<br>
> "TA","HCCU","XA1"
```

11.1.1.5.5 Banded By

11.1.1.5.6 Dependencies

11.1.1.5.7 Version

First Version available: 1.0.0
Implementation status: Implemented

11.1.1.6 Switch - Select

Sets and instrument managed by the ISWItcher to forwarded commands to. From this point on, all commands/queries sent will be forwarded to the instrument defined.

11.1.1.6.1 Property Description

SCPI Command	ISWItcher:CONTrol:SELect
Parameters	
Return Type	String
Units	
Default	"TA"
Range	

11.1.1.6.2 Notes

Sets the instrument to control. All SCPI commands from this point on will be forwarded to the selected instrument.

Instrument configured by default: "TA"

No commands will be forward to the selected instrument/application in the event that it is not in CONNected state. If the application is Unreachable/NOTConnected, it will attempt to send commands to the instrument and if it cannot be reached, it will remain in an unreachable state.

If the instrument is in NOTConnected/NOTConnected state, the ISWItcher will try establish the connection prior to sending the command to the instrument.

ISWItcher instrument selection is per SCPI session basis. This command does not affect other ongoing or future SCPI sessions.

Executing a command on a disconnected instrument will add the following error in the ISWItcher error queue: -
200,"Execution error;Instrument 'TA' not connected."

11.1.1.6.3 Error Conditions

Application not found in repository

11.1.1.6.4 Example

```
ISWItcher:CONTrol:SELect "HCCU"<br>
ISWItcher:CONTrol:SELect?<br>
> "HCCU"<br>
:SETup:INSTrument:LIST?<br>
HCCU> "NE_1","0","TSPC","1"<br>
```

11.1.1.6.5 Banded By

11.1.1.6.6 Dependencies

11.1.1.6.7 Version

First Version available: 1.0.0
Implementation status: Implemented

11.1.1.7 Switch - Status Selected

Returns the status of the instrument currently selected.

11.1.1.7.1 Property Description

SCPI Command	ISWItcher:CONTrol:STATus?
Parameters	
Return Type	Enum(instrumentStatus) - Instrument type
Units	
Default	
Range	

11.1.1.7.2 Notes

11.1.1.7.3 Error Conditions

11.1.1.7.4 Example

```
ISWItcher:CONTrol:SELect?<br>
> "HCCU"<br>
ISWItcher:CONTrol:STATus?<br>
> CONN
```

11.1.1.7.5 Banded By

11.1.1.7.6 Dependencies

11.1.1.7.7 Version

First Version available: 1.0.0
Implementation status: Implemented

11.1.1.8 Switch - Status

Returns the status of an instrument by name.

11.1.1.8.1 Property Description

SCPI Command	ISWItcher:CONTrol:STATus?
Parameters	String
Return Type	Enum(instrumentStatus) - Instrument type
Units	
Default	
Range	

11.1.1.8.2 Notes

11.1.1.8.3 Error Conditions

Instrument not managed by the ISWItcher

11.1.1.8.4 Example

```
ISWItcher:CONTrol:STATus? "HCCU"<br>
> CONN
```

11.1.1.8.5 Banded By

11.1.1.8.6 Dependencies

11.1.1.8.7 Version

First Version available: 1.0.1
Implementation status: Implemented

11.1.1.9 Switch - Status Name

Returns the status of an instrument by name. Same the status query.

11.1.1.9.1 Property Description

SCPI Command	ISWItcher:CONTrol:STATus:NAME?
Parameters	String
Return Type	Enum(instrumentStatus) - Instrument type
Units	
Default	
Range	

11.1.1.9.2 Notes

11.1.1.9.3 Error Conditions

Instrument not managed by the ISWItcher

11.1.1.9.4 Example

```
ISWItcher:CONTrol:STATus:NAME? "HCCU"<br>
> CONN
```

11.1.1.9.5 Banded By

11.1.1.9.6 Dependencies

11.1.1.9.7 Version

First Version available: 1.0.0
Implementation status: Implemented

11.1.1.10 Switch - Status All

Returns the status of all the instruments managed by the ISWItcher.

11.1.1.10.1 Property Description

SCPI Command	ISWItcher:CONTrol:STATus:ALL?
Parameters	
Return Type	List<String,String>
Units	
Default	
Range	

11.1.1.10.2 Notes

11.1.1.10.3 Error Conditions

11.1.1.10.4 Example

```
ISWItcher:CONTrol:STATus:ALL?<br>
> "TA", "CONN", "XA1", "CONN", "HCCU", "CONN"
```

11.1.1.10.5 Banded By

11.1.1.10.6 Dependencies

11.1.1.10.7 Version

First Version available: 1.0.0
Implementation status: Implemented

11.1.1.11 Switch - Reestablish All

Reestablish the connections of all the instruments in the system if they were not connected. This command also reads the contents of the persistent storage and sets the instruments up. Command only.

11.1.1.11.1 Property Description

SCPI Command	ISWItcher:CONTrol:RESTablish
Parameters	
Return Type	None
Units	
Default	
Range	

11.1.1.11.2 Notes

When a client connects to the ISWItcher, all connections to the instruments managed are established (if instruments are operational). The ISWItcher will maintain the SCPI sessions to the instrument.

In the event that the connection to an instrument drops, the client will receive a timeout on the next command/query it sends and the status of the instrument will be set to NOTConnected. The client can choose to recover sending the "Reestablish" command. This command will try to recover all instruments. The reestablishment will try to establish a new session to the instrument that dropped. If the ISWItcher could connect to an Instrument, its status will be set to CONNected. If not: NOTConnected or UNREsponsive.

Please refer to "Get Status" and "Status All".

This command reads the persistent storage ISWItcher configuration to reestablish the connections with the instruments.

11.1.1.11.3 Error Conditions

11.1.1.11.4 Example

```
ISWItcher:CONTrol:RESTablish
```

11.1.1.11.5 Banded By

11.1.1.11.6 Dependencies

11.1.1.11.7 Version

First Version available: 1.0.0
Implementation status: Implemented

11.1.1.12 Switch - Reestablish

Reestablish the connections to the instrument in the event that an instrument dropped the connection. Command only.

11.1.1.12.1 Property Description

SCPI Command	ISWItcher:CONTrol:RESTablish
Parameters	String
Return Type	None
Units	
Default	
Range	

11.1.1.12.2 Notes

When a client connects to the ISWItcher, all connections to the instruments managed are established (if instruments are reachable and operational). The ISWItcher will maintain the SCPI sessions to the instrument.

In the event that the connection to an instrument drops, the client will receive a timeout on the next command/query it sends and the status of the instrument will be set to NOTConnected. The client can choose to recover sending the "Reestablish" command to an instrument or to all instruments (please refer to "Reestablish All"). The reestablishment will try to establish a new session to the instrument that dropped. If the ISWItcher could connect to an Instrument, its status will be set to CONNected.If not: NOTConnected or UNREsponsive.

Please refer to "Get Status" and "Status All".

11.1.1.12.3 Error Conditions

Instrument not managed by the ISWItcher

11.1.1.12.4 Example

```
ISWItcher:CONTrol:RESTablish "TA"
```

11.1.1.12.5 Banded By

11.1.1.12.6 Dependencies

11.1.1.12.7 Version

First Version available: 1.0.1
Implementation status: Implemented

11.1.1.13 Switch - Reestablish Name

Same as restablish command. Command only.

11.1.1.13.1 Property Description

SCPI Command	ISWItcher:CONTrol:RESTablish:NAME
Parameters	String
Return Type	None
Units	
Default	
Range	

11.1.1.13.2 Notes

Same as reestablish command. The only difference is the SCPI node is qualified.

11.1.1.13.3 Error Conditions

Instrument not managed by the ISWItcher

11.1.1.13.4 Example

```
ISWItcher:CONTrol:RESTablish:NAME "TA"
```

11.1.1.13.5 Banded By

11.1.1.13.6 Dependencies

11.1.1.13.7 Version

First Version available: 1.0.0
Implementation status: Implemented

11.1.1.14 Switch - Configure

Gets/sets the visa configuration and timeouts of the instrument managed by the ISWItcher.

When a configuration is changed for an instrument, it will attempts to reestablish connections with the instrument.

Changes are persistent between power cycles of the system.

System defaults:

"TA": "TCPIP0::localhost::5125::SOCKET", 120000

"XA1": "TCPIP0::localhost::5075::SOCKET", 40000

"HCCU": "TCPIP0::localhost::4882::SOCKET", 1200000

WARNING:

Configurations, addition and deletions are done in the context of the current client session. Changes are stored persistently but other connected clients with sessions open will not see the changes till the perform a Reestablish command.

11.1.1.14.1 Property Description

SCPI Command	ISWItcher:CONFig
Parameters	String
Return Type	(String,Integer)
Units	
Default	
Range	

11.1.1.14.2 Notes

Configures the VISA address and timeouts of the instrument.
The commands specifies an instrument by name and associates it with a VISA address and a read time out.

Visa - valid Visa instrument address. All supported.

Timeout - In milliseconds. Maximum timeout for the instrument to respond. Mainly used to specify timeout for queries sent to the remote instrument.
By default, the instruments managed by the systems will have the configuration as if the instruments was running in the local host and its nominal VISA port.

REMARKS:

1. Read command returns a list of strings while the write command the timeout is specified as an integer.

2. These changes will be available in the current and future SCPI session. Other active SCPI sessions are not affected.

11.1.1.14.3 Error Conditions

Instrument not managed by the ISWItcher. Parameter format error.

11.1.1.14.4 Example

```
ISWItcher:CONFig? "HCCU"<br>
> "TCPIP1::localhost::hislipHCCU::INSTR", "120000"<br>
<br>
ISWItcher:CONFig "HCCU", "TCPIP0::localhost::4882::SOCKET", 20000<br>
ISWItcher:CONFig? "HCCU"<br>
> "TCPIP0::localhost::4882::SOCKET", "20000"
```

11.1.1.14.5 Banded By

11.1.1.14.6 Dependencies

11.1.1.14.7 Version

First Version available: 1.0.0
Implementation status: Implemented

11.1.1.15 Switch - Add

Adds a new instrument to be managed by the system. Command only.

When a new instrument is added the ISWItcher will attempt to connect to the instrument.

WARNING:

Configurations, addition and deletions are done in the context of the current client session. Changes are stored persistently but other connected clients with sessions open will not see the changes till the perform a Reestablish command.

11.1.1.15.1 Property Description

SCPI Command	ISWItcher:CONFig:ADD

Parameters	
Return Type	(String,String,Integer)
Units	
Default	
Range	

11.1.1.15.2 Notes

Input arguments:

Visa - valid Visa instrument address. All supported.

Timeout - In milliseconds. Maximum timeout for the instrument to respond. Mainly used to specify timeout for queries sent to the remote instrument.The system will not connect to the instrument or attempt to connect to the instrument till the "select" command is invoked.
Timeout - maximum timeout for the instrument to respond. In seconds.

REMARKS:

1. Read command returns a list of strings while the write command the timeout is specified as an integer.

2. These changes will be available in the current and future SCPI session. Other active SCPI sessions are not affected.

11.1.1.15.3 Error Conditions

The command will have no effect over an existing instrument.

11.1.1.15.4 Example

```
ISWItcher:CONFig:ADD "HCCUAlias", "TCPIP0::localhost::4882::SOCKET", 20000
```

11.1.1.15.5 Banded By

11.1.1.15.6 Dependencies

11.1.1.15.7 Version

First Version available: 1.0.0
Implementation status: Implemented

11.1.1.16 Switch - Delete

Delete an instrument from the system.

WARNING:

Configurations, addition and deletions are done in the context of the current client session. Changes are stored persistently but other connected clients with sessions open will not see the changes till the perform a Reestablish command.

11.1.1.16.1 Property Description

SCPI Command	ISWItcher:CONFig:DELete
Parameters	String
Return Type	None
Units	
Default	
Range	

11.1.1.16.2 Notes

Deletes and instrument for the instrument repository. Changes are persistent.

REMARKS:

1. These changes will be available in the current and future SCPI session. Other active SCPI sessions are not affected.

11.1.1.16.3 Error Conditions

Instrument not found in managed repository. Instrument currently selected cannot be deleted.

11.1.1.16.4 Example

```
ISWItcher:CONFig:DELete "HCCUAlias"
```

11.1.1.16.5 Banded By

11.1.1.16.6 Dependencies

11.1.1.16.7 Version

First Version available: 1.0.0
Implementation status: Implemented

11.1.1.17 Switch - Preset

Clears all the configured instruments and restores the managed instrument repository to the factory defaults. Since configuration are presistent between reboots, this commands clears any user defined configurations using: Configure, Add, Delete and Split Commands.

Immediate execution command for instrument defaults.

11.1.1.17.1 Property Description

SCPI Command	ISWItcher:CONFig:PRESet
Parameters	
Return Type	None
Units	
Default	
Range	

11.1.1.17.2 Notes

Presets the list of available instruments managed by the switch and any switch configuration configurations. Please refer to INSTrument:CONTrol?

Default selected instrument: "TA".

11.1.1.17.3 Error Conditions

11.1.1.17.4 Example

```
ISWItcher:CONTrol:PRESet<br>
<br>
ISWItcher:CONTrol?<br>
> "TA", "HCCU", "XA1"<br>
ISWItcher:CONFig:SPLit?<br>
> ON<br>
ISWItcher:CONTrol:SELect?<br>
> "TA"
```

11.1.1.17.5 Banded By

11.1.1.17.6 Dependencies

11.1.1.17.7 Version

First Version available: 1.0.0
Implementation status: Implemented

11.1.1.18 Switch - Split

SCPI commands can be chained together using '\n'. Where '\n' is the end of command in the SCPI protocol. Instruments will take this chain and process each command individually as if they had arrived in sequence.

This is a switch property that determines how to process such incoming commands.

SCPI commands can be chained together with '\n' and they are sent to the instrument in one block. However, with the switch in between, '\n' commands chains could potentially be sent to any instrument controlled by the switch including the switch.

This split property, if *ON*, makes the switch command processor to take the input command and split it into individual commands separated by '\n'. Each command is then sent to its corresponding instrument (selected instrument or to the SCPI switch) for processing.

If the property is *OFF*, the entire chain will be sent to the currently selected instrument in one block. if *OFF*, all the commands contained in a '\n' separated chain have to be for the specific selected instrument. If not, they will fail. Users can't mix commands for different instruments, or the switch, if this property is set to false.

The default behavior of the switch is to split the commands, i.e. ON = 1

11.1.1.18.1 Property Description

SCPI Command	ISWItcher:CONFig:SPLit
Parameters	
Return Type	Boolean
Units	
Default	ON
Range	

11.1.1.18.2 Notes

This property by default is configured to *ON (1)* allowing client applications to chain commands '\n' separated for both the switch and the selected instrument.

We have seen client applications that breaking the SCPI standard by introducing '\n' inside a command. This causes some errors with client applications as they could be waiting for a response over a query that has been split in two.

REMARKS:

If any of the commands in a '\n' string is for the switch and this property is configured to false. The entire chain will be sent to the switch for processing.

11.1.1.18.3 Error Conditions

11.1.1.18.4 Example

```
ISWItcher:CONFig:SPLit ON<br>
<br>
> cmd1 \n cmd2 \n … \n cmdn<br>
Commands will be sent individually one after the other either to the selected
instrument of the SCPI switch<br>
<br>
ISWItcher:CONFig:SPLit OFF<br>
```

```
<br>
> cmd1 \n cmd2 \n … \n cmdn<br>
All the commands in the chain will be sent to the selected instrument or the
switch.<br>
The command chain will be sent to the switch for processing if any of the commands
that make up the chain are for the switch.
```

11.1.1.18.5 Banded By

11.1.1.18.6 Dependencies

11.1.1.18.7 Version

First Version available: 1.0.0
Implementation status: Implemented

11.1.1.19 Switch - Duplicate

Duplicates an instruments with a new name.

If the origin instrument exists, it will copy its configuration, create a new instrument with the specified name and will try to connect to it.
If the new alias already exists in the switch, no changes will be applied to the existing instrument.

Command only.

11.1.1.19.1 Property Description

SCPI Command	ISWItcher:CONFig:DUPlicate
Parameters	String String
Return Type	None
Units	
Default	
Range	

11.1.1.19.2 Notes

The command takes two string parameters: origin, destination. If the origin instrument exists and the destination instrument doesn't a duplicate instrument will be created.
This command makes the newly created instrument persistent. Other clients connected to the switch can pick up the duplicated instrument by executing the refresh command.

11.1.1.19.3 Error Conditions

Parameter error if origin instrument name is not managed by the switch.

11.1.1.19.4 Example

```
ISWItcher:CONT?<br>
> "TA", "HCCU", "XA1"<br>
ISWItcher:CONF:DUP "XA1", "XA2"<br>
ISWItcher:CONT?<br>
> "TA", "HCCU", "XA1", XA2
```

11.1.1.19.5 Banded By

11.1.1.19.6 Dependencies

11.1.1.19.7 Version

First Version available: 1.0.0
Implementation status: Implemented