# R&S®SMW-K118
# Verizon 5GTF Signals
# User Manual

1178445302
Version 11

ROHDE&SCHWARZ
Make ideas real

This document describes the following software options:

- R&S®SMW-K118 Verizon 5GTF Signals (1414.3465.xx)

This manual describes firmware version FW 5.30.047.xx and later of the R&S®SMW200A.


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1178.4453.02 | Version 11 | R&S®SMW-K118

The following abbreviations are used throughout this manual: R&S®SMW200A is abbreviated as R&S SMW

# Contents

# 1 Welcome to the verizon 5GTF option

The R&S SMW-K118 is a firmware application that adds functionality to generate signals based on the Verizon 5G open trial specifications http://5gtf.org/.

### The R&S SMW-K118 key features

The following Verizon 5G open trial specifications are implemented:

- TS V5G.211, version V1.7
- TS V5G.212, version V1.5
- TS V5G.213, version V1.4

The following features are supported:

- Four downlink predefined configurations
- Four uplink predefined configurations
- Downlink signal is manually configurable
- Intuitive user interface with graphical display of time plan
- Support of PSS, SSS, ESS
- Support of DL and UL reference signals derived from cell ID
- Support of CSI-RS and BRS
- Support of xPBCH, xPDSCH, xPDCCH
- Support of modulation QPSK, 16QAM, 64QAM, 256QAM for xPDSCH
- Support of xPUSCH, xPUCCH
- Support of modulation QPSK, 16QAM, 64QAM, 256QAM for xPUSCH
- Support of DCI formats A1, B1, A2, B2
- Automatic xPDSCH scheduling from DCI
- Support of downlink MIMO and transmit diversity
- Simulation of single-layer and dual-layer beamforming scenarios ((transmission modes 1 to 3)
- Generation of signals with the length of one frame

This user manual contains a description of the functionality that the application provides, including remote control operation.

All functions not discussed in this manual are the same as in the base unit and are described in the R&S SMW user manual. The latest version is available at:

www.rohde-schwarz.com/manual/SMW200A

### Installation

You can find detailed installation instructions in the delivery of the option or in the R&S SMW service manual.

## 1.1 Accessing the verizon 5GTF dialog

**To open the dialog with Verizon 5GTF settings**

► In the block diagram of the R&S SMW, select "Baseband > V5GTF".

A dialog box opens and displays the provided general settings.

The signal is not generated immediately. To start signal generation with the default settings, select "State > On".

## 1.2 What's new

This manual describes firmware version FW 5.30.047.xx and later of the R&S®SMW200A.

Compared to the previous version, it provides the new features listed below:

- Time-based triggering, see "Time Based Trigger" on page 82 and "Trigger Time" on page 82.
- Editorial changes

## 1.3 Documentation overview

This section provides an overview of the R&S SMW user documentation. Unless specified otherwise, you find the documents at:

www.rohde-schwarz.com/manual/smw200a

### 1.3.1 Getting started manual

Introduces the R&S SMW and describes how to set up and start working with the product. Includes basic operations, typical measurement examples, and general information, e.g. safety instructions, etc. A printed version is delivered with the instrument.

### 1.3.2 User manuals and help

Separate manuals for the base unit and the software options are provided for download:

- Base unit manual
  Contains the description of all instrument modes and functions. It also provides an introduction to remote control, a complete description of the remote control commands with programming examples, and information on maintenance, instrument interfaces and error messages. Includes the contents of the getting started manual.

- Software option manual
  Contains the description of the specific functions of an option. Basic information on operating the R&S SMW is not included.

The contents of the user manuals are available as help in the R&S SMW. The help offers quick, context-sensitive access to the complete information for the base unit and the software options.

All user manuals are also available for download or for immediate display on the Internet.

### 1.3.3 Tutorials

The R&S SMW provides interactive examples and demonstrations on operating the instrument in form of tutorials. A set of tutorials is available directly on the instrument.

### 1.3.4 Service manual

Describes the performance test for checking compliance with rated specifications, firmware update, troubleshooting, adjustments, installing options and maintenance.

The service manual is available for registered users on the global Rohde & Schwarz information system (GLORIS):

https://gloris.rohde-schwarz.com

### 1.3.5 Instrument security procedures

Deals with security issues when working with the R&S SMW in secure areas. It is available for download on the internet.

### 1.3.6 Printed safety instructions

Provides safety information in many languages. The printed document is delivered with the product.

### 1.3.7 Data sheets and brochures

The data sheet contains the technical specifications of the R&S SMW. It also lists the options and their order numbers and optional accessories.

The brochure provides an overview of the instrument and deals with the specific characteristics.

See www.rohde-schwarz.com/brochure-datasheet/smw200a

### 1.3.8 Release notes and open source acknowledgment (OSA)

The release notes list new features, improvements and known issues of the current firmware version, and describe the firmware installation.

The software makes use of several valuable open source software packages. An open-source acknowledgment document provides verbatim license texts of the used open source software.

See www.rohde-schwarz.com/firmware/smw200a

### 1.3.9 Application notes, application cards, white papers, etc.

These documents deal with special applications or background information on particular topics.

See www.rohde-schwarz.com/application/smw200a and www.rohde-schwarz.com/manual/smw200a

### 1.3.10 Videos

Find various videos on Rohde & Schwarz products and test and measurement topics on YouTube: https://www.youtube.com/@RohdeundSchwarz

On the menu bar, search for your product to find related videos.


*Figure 1-1: Product search on YouTube*

## 1.4 Scope

Tasks (in manual or remote operation) that are also performed in the base unit in the same way are not described here.

In particular, it includes:

- Managing settings and data lists, like saving and loading settings, creating and accessing data lists, or accessing files in a particular directory.
- Information on regular trigger, marker and clock signals and filter settings, if appropriate.
- General instrument configuration, such as checking the system configuration, configuring networks and remote operation
- Using the common status registers

For a description of such tasks, see the R&S SMW user manual.

## 1.5 Notes on screenshots

When describing the functions of the product, we use sample screenshots. These screenshots are meant to illustrate as many as possible of the provided functions and possible interdependencies between parameters. The shown values may not represent realistic usage scenarios.

The screenshots usually show a fully equipped product, that is: with all options installed. Thus, some functions shown in the screenshots may not be available in your particular product configuration.

# 2 About Verizon 5GTF option

The Verizon 5GTF option enables you to generate signals based on the Verizon 5G open trial specifications http://5gtf.org/.



## 2.1 Required options

The basic equipment layout for generating Verizon 5GTF signals includes the:

- Base unit
- Standard or wideband Baseband Generator (R&S SMW-B10/-B9)
- Baseband main module (R&S SMW-B13) or wideband baseband main module (R&S SMW-B13XT)
- Frequency option (e.g. R&S SMW-B1003)
- Digital standard Verizon 5GTF (R&S SMW-K118)

You can generate signals via play-back of waveform files at the signal generator. To create the waveform file using R&S WinIQSIM2, you do not need a specific option.

To play back the waveform file at the signal generator, you have two options:

- Install the R&S WinIQSIM2 option of the digital standard, e.g. R&S SMW-K255 for playing LTE waveforms
- If supported, install the real-time option of the digital standard, e.g. R&S SMW-K55 for playing LTE waveforms

For more information, see data sheet.

## 2.2 Introduction to the Verizon 5GTF technology

This section provides an overview of the Verizon 5GTF downlink and uplink radio resources, physical channels and physical signals.



### 2.2.1 Frame structure

Verizon 5GTF signal is based on orthogonal frequency division multiplexing (OFDM) with a cyclic prefix (CP) in the downlink and uplink. Half duplex operation is supported

using time division duplex (TDD). A supported single component carrier bandwidth is 100 MHz with a subcarrier bandwidth of 75 kHz.

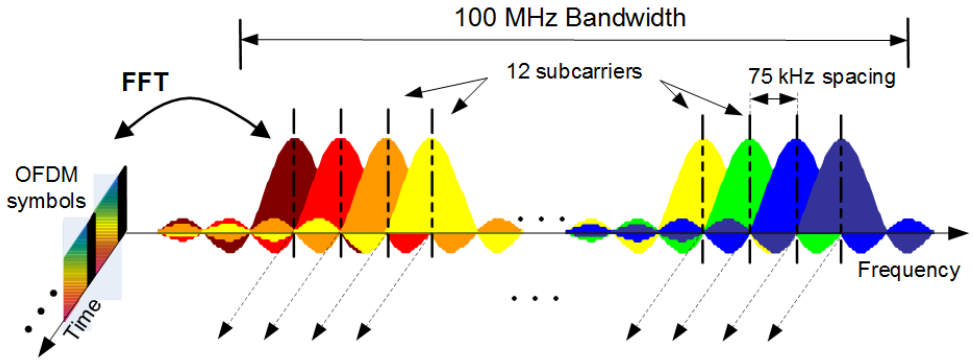



*Figure 2-1: Verizon 5GTF signal*

The additional units radio frame, subframe and slot (containing the OFDM symbols) are defined, see figures below. Each OFDM symbol contains a guard time called cyclic prefix (CP). A slot contains seven OFDM symbols with normal CP.

The basic time unit in Verizon 5GTF is the sample interval $T_s$ = 1 / (75000 x 2048) seconds.

The radio frame consists of 50 subframes and has a length of 10 ms. Each subframe has a length of 0.2 ms.

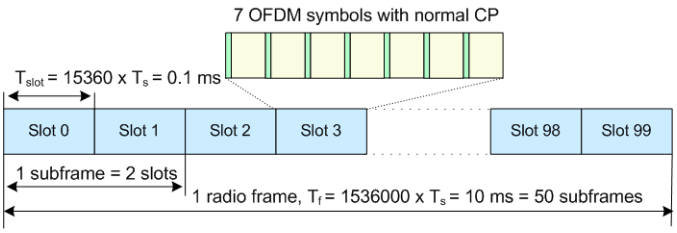



*Figure 2-2: Frame Structure*

Link direction (downlink or uplink) for data transmission can be dynamically switched on a subframe basis. One OFDM symbol serves as a guard period which must be allocated at the switching period from a downlink transmission to an uplink transmission.

The transmitted signal in each slot is described by one or several resource grids of 1200 subcarriers and 7 OFDM symbols.

The smallest time-frequency unit for downlink or uplink transmission is denoted a resource element. A resource element corresponds to one OFDM symbol.

For the mapping of physical channels to resources, the resource elements are grouped into resource blocks (RB). Each RB consists of 12 consecutive subcarriers (900 kHz) and 7 consecutive OFDM symbols (0.1 ms).

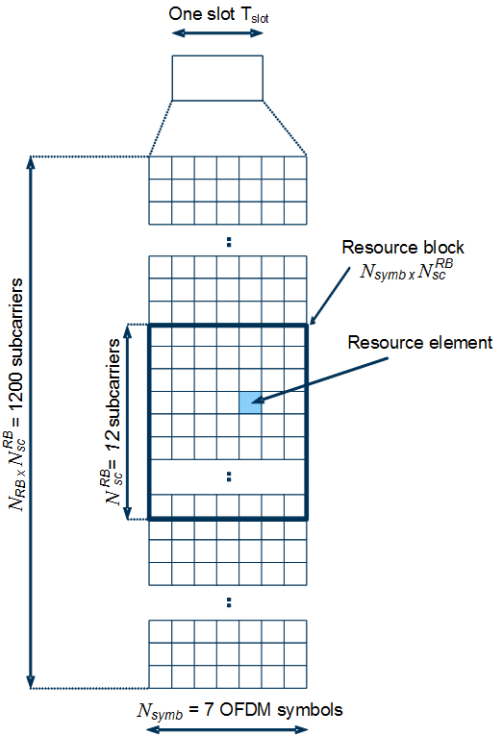



*Figure 2-3: Resource grid*

A subframe can be configured as one of following combinations of DL control/data and UL control/data:

- Subframe including DL control channel and DL data channel
- Subframe including DL control channel, DL data and UL control channel
- Subframe including DL control channel and UL data channel
- Subframe including DL control channel, UL data and UL control channel

### 2.2.2 Physical channel overview

A downlink physical channel corresponds to a set of resource elements carrying information originating from higher layers. Physical channels can be either broadcast channels or shared channels. Broadcast channels carry messages that are not directed at a particular UE; they are point-to-multipoint channels. Shared channels are shared by several UEs. At a given time, a shared channel is assigned to one UE only, but the assignment can change within a few timeslots. An overview of the physical channels of the generated downlink signal is given in the following table.

*Table 2-1: Physical DL channel*

| Physical DL channel | Purpose / modulation scheme / antenna ports (AP) |
|---|---|
| 5G physical broadcast channel (xPBCH) | Provides physical layer information of the cell to be read during cell search, e.g. number of transmit antennas, reference signal transmit power<br>QPSK; AP {0,…,7} |
| 5G physical downlink control channel (xPDCCH) | Carries UE-specific downlink control information (DCI), i.e. scheduling information or UL power control commands<br>QPSK; AP {107,109} - transmitted on symbol #0 or #0/#1 |
| 5G physical downlink shared channel (xPDSCH) | Carries user data<br>QPSK, 16QAM, 64QAM, 256QAM; AP {8,...,15} |

An uplink physical channel corresponds to a set of resource elements carrying information originating from higher layers. An overview of the physical channels of the generated uplink signal is given in the following table.

*Table 2-2: Physical UL channel*

| Physical UL channel | Purpose / type / modulation scheme / antenna ports (AP) |
|---|---|
| 5G physical uplink control channel (xPUCCH) | Carries uplink control information (UCI)<br>QPSK; AP {200, 201} - transmitted in the last symbol of a subframe. |
| 5G physical uplink shared channel (xPUSCH) | Carries user data<br>QPSK, 16QAM, 64QAM, 256QAM; AP {40, 41} |

### 2.2.3 Physical signal overview

A downlink physical signal corresponds to a set of resource elements used by the physical layer but does not carry information originating from higher layers. Two types of downlink physical signals are available: reference signals and synchronization signals.

| Physical DL signal | Purpose / transmission modes / antenna ports (AP) |
|---|---|
| Downlink UE-specific demodulation reference signals (DMRS) associated with xPDSCH (DMRS) | For demodulation of xPDSCH associated with AP 8-15 |
| Downlink UE-specific demodulation reference signals (DMRS) associated with xPDCCH | For demodulation of xPDCCH, AP 107, 109 |
| Channel state information reference signal (CSI-RS) | For channel quality feedback calculation, 8 or 16 AP configurable: 16-23 / 16-31 |
| Beam reference signal (BRS) | For demodulation of signals with beamforming; AP 0-7 |

| Physical DL signal | Purpose / transmission modes / antenna ports (AP) |
|---|---|
| DL phase noise compensation reference signal (PCRS) | Associated with xPDSCH, AP 60 and/or 61 |
| Primary synchronization signal (PSS)<br>Secondary synchronization signal (SSS)<br>Extended synchronization signal (ESS) | Acquisition of cell timing and cell identity during cell search, transmitted in symbol 0 to 13 in subframes 0 and 25 on AP 300-313 |

An uplink physical signal is used by the physical layer but does not carry information originating from higher layers. The following reference signals are defined in uplink:

| Physical UL signal | Purpose / transmission modes / antenna ports (AP) |
|---|---|
| Uplink demodulation reference signal (DMRS), associated with transmission of xPUSCH | For demodulation of xPUSCH, AP 40-41 |
| Uplink demodulation reference signal (DMRS), associated with transmission of xPUCCH | For demodulation of xPUCCH, AP 100, 200-201 |
| Sounding reference signal (SRS), not associated with transmission of xPUSCH or xPUCCH | Reference for 5GNB to monitor uplink channel quality, AP 40-41 |
| UL phase noise reference signal (PCRS), associated with transmission of xPUSCH | Associated with xPUSCH, AP 40, 41 |

### 2.2.4 Physical layer procedures

The following physical layer procedures are especially important:

- **Synchronization**
  During cell search, UE acquires time and frequency synchronization with a cell and detects the physical layer cell ID. Synchronization signals are transmitted in the downlink to facilitate cell search.
  Further, the UE monitors the downlink radio link quality of the primary cell for indicating out-of-sync/in-sync status to higher layers.
- **Beamforming**
  UE acquires beams from beam reference signals (BRS). Up to 8 antenna ports are supported by BRS. A UE tracks downlink transmitting beams through the periodic BRS measurements. The BRS transmission period is indicated via xPBCH.
  UE reports measured beam state information (BSI) on xPUCCH or xPUSCH to 5GNB.
  Beam switch is signaled via MAC-CE or DCI.
- **UE procedure for receiving the physical downlink shared channel**
  The UE monitors the xPDCCH of the serving cell with DCI format A1, A2, B1, or B2. After the detection of an xPDCCH intended for the UE, the UE decodes the corresponding xPDSCH in the same subframe with the single transport block. The decoding of xPDSCH scrambled by the C-RNTI is according to the following table.

*Table 2-3: xPDCCH and xPDSCH configured by C-RNTI*

| Transmission mode | DCI format | Transmission scheme of xPDSCH |
|---|---|---|
| Mode 1 | B1 | Single-antenna port |
| Mode 2 | B1 | Transmit diversity, 2 layer transmission |
| Mode 3 | B1 | Transmit diversity, 2 layer transmission |
| | B2 | Spatial multiplexing, up to 2 layer transmission |

- **UE procedure for transmitting the physical uplink shared channel**
  The UE monitors the xPDCCH of the serving cell with DCI format A1 or A2. After the detection of an xPDCCH intended for the UE, the UE adjusts the corresponding xPUSCH scrambled by the C-RNTI is according to the following table.

*Table 2-4: xPDCCH and xPUSCH configured by C-RNTI*

| Transmission mode | DCI format | Transmission scheme of xPUSCH |
|---|---|---|
| Mode 1 | A1 | Single-antenna port |
| Mode 2 | A1 | Single-antenna port, if DCI indicates 1 layer transmission<br>Transmit diversity, if DCI indicates 2 layer transmission |
| | A2 | Spatial multiplexing, up to 2 layer transmission |

## 2.3 Overview of the predefined configuration

The following configurations are supported:

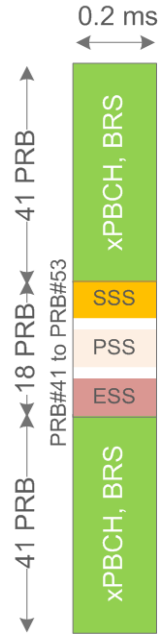
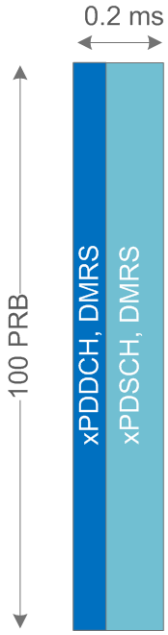
- Four downlink configurations
- Four uplink configurations

The following characteristics apply to all configurations:

- Duration = 50 subframes = 1 frame
- Cell ID = 0
- Number of layers = 1
- FIR filter, see Chapter 2.3.1, "Filtering", on page 19

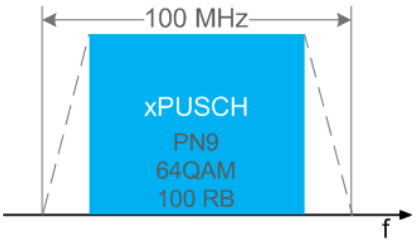
### Downlink configurations (Downlink_Config_x)

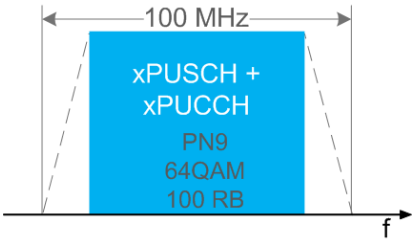
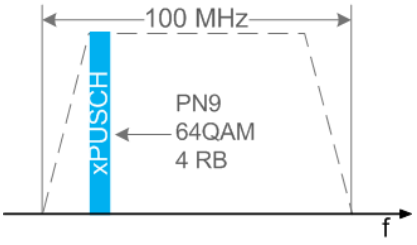
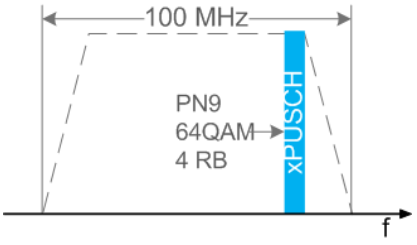
The configurations follow the same structure and use different xPDSCH modulation schemes.

| Subframe#0 and subframe#25 | All other subframes |
|---|---|
|  |  |
| Channel-coded xPBCH, incl.:<br>• BRS with configuration '01' (5 ms periodicity)<br>• Synchronization signals (PSS, SSS and ESS) | • xPDCCH, incl. DMRS<br>Symbol#0<br>Data source = PN9, scrambled<br>• xPDSCH, incl. DMRS<br>Symbol#1 to symbol#13<br>Data source = PN9, scrambled<br>Modulation = QPSK, 16QAM, 64QAM, 256QAM |

### Four uplink configurations (Uplink_Config_x)

Uplink configurations are filled with scrambled PN9 data and are 64QAM modulated.

| Uplink configuration | Channel | Number of RBs | Allocated OFDM symbols |
|---|---|---|---|
| "Uplink_Config_1"<br>  | xPUSCH,<br>incl. DMRS | 100 | #2 to #13 |

| | | | |
|---|---|---|---|
| "Uplink_Config_2"<br>  | xPUSCH,<br>incl. DMRS | 100 | #2 to #12 |
| | xPUCCH,<br>incl. DMRS | 6<br>(RB#47 to RB#52) | #13 |
| "Uplink_Config_3"<br>  | xPUSCH,<br>incl. DMRS | 4<br>@ lower edge | #2 to #13 |
| "Uplink_Config_4"<br>  | xPUSCH,<br>incl. DMRS | 4<br>@ upper edge | #2 to #13 |

### 2.3.1 Filtering

All provided configurations are automatically filtered by an FIR filter, consisting of 137 filter coefficients and assuming 1200 subcarriers and FFT size of 2048.

The FIR filter is generated by the following script:

```
filterSets.fftSize = 2048;
filterSets.nOccSubcarrier = 1200;
filterSets.transRegionRatio = 0.07;
filterSets.rp = 0.0001;
filterSets.rs = 60;

% steepness of filter
transRegion = filterSets.transRegionRatio * filterSets.fftSize/2; %in %,
controls steepness of filter slopes, relative to nyquist frequency

%cutoff frequencies
f = [filterSets.nOccSubcarrier/2 filterSets.nOccSubcarrier/2+transRegion];
```

```
%ripples in dB
dev = [(10^(filterSets.rp/20)-1)/(10^(filterSets.rp/20)+1)
10^(-filterSets.rs/20)];

%estimate filter order
[n,fo,ao,w] = firpmord(f,[1 0],dev,filterSets.fftSize);

%make filter symmetric
n = n + mod(n,2)

%generate filter coefficients
b = firpm(n,fo,ao,w);

% fvtool(b); %displays filter response

%% write filter out into .dat filter coefficient file
coeffsOut = zeros(2*length(b),1);
coeffsOut(1:2:end) = real(b);
coeffsOut(2:2:end) = imag(b);

dlmwrite(['\smw_user_filter_' num2str(n)
'coeffs_' num2str(filterSets.nOccSubcarrier)
'scs_' num2str(filterSets.fftSize) 'fft.dat'],coeffsOut);
```

# 3 Configuration and settings

Access:

► Select "Baseband" > "V5GTF".

The remote commands required to define these settings are described in Chapter 4, "Remote-control commands", on page 90.

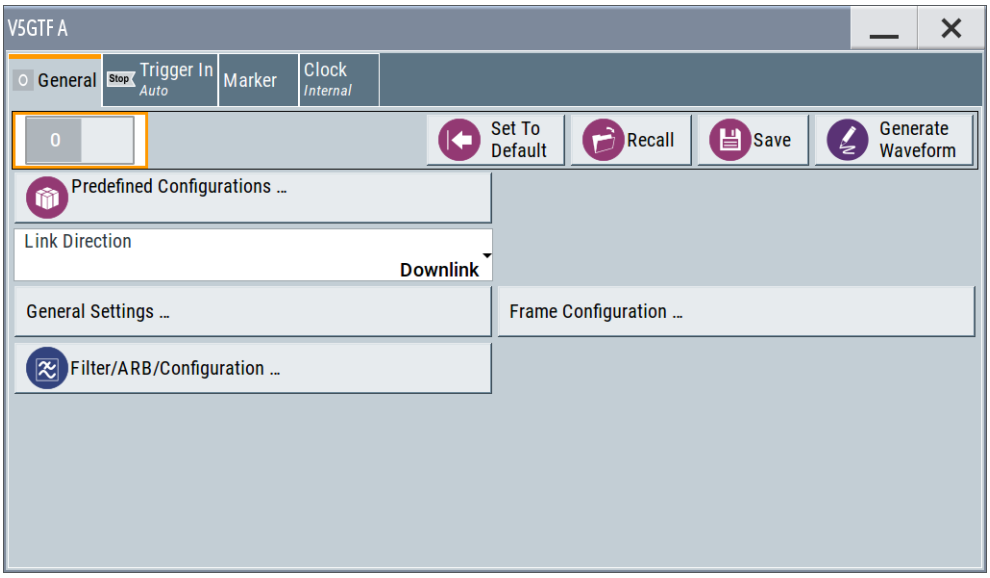
**Settings:**



## 3.1 General settings

Access:

► Select "Baseband" > "V5GTF" > "General".



This dialog comprises the standard general settings.

**Settings:**



**State**
Activates the standard and deactivates all the other digital standards and digital modulation modes in the same path.

Remote command:
`[:SOURce<hw>]:BB:V5G:STATe` on page 104

**Set to Default**
Calls the default settings. The values of the main parameters are listed in the following table.

Remote command:
`[:SOURce<hw>]:BB:V5G:PRESet` on page 104

**Save/Recall**
Accesses the "Save/Recall" dialog that is the standard instrument function for storing and recalling the complete dialog-related settings in a file. The provided navigation possibilities in the dialog are self-explanatory.

The filename and the directory, in which the settings are stored, are user-definable; the file extension is predefined.

See also chapter "File and Data Management" in the R&S SMW user manual.

Remote command:
`[:SOURce<hw>]:BB:V5G:SETTing:CATalog` on page 105
`[:SOURce<hw>]:BB:V5G:SETTing:DEL` on page 105
`[:SOURce<hw>]:BB:V5G:SETTing:LOAD` on page 105
`[:SOURce<hw>]:BB:V5G:SETTing:STORe` on page 105

**Generate Waveform File**
With enabled signal generation, triggers the instrument to save the current settings of an arbitrary waveform signal in a waveform file with predefined extension `*.wv`. You can define the filename and the directory, in that you want to save the file.

Using the ARB modulation source, you can play back waveform files and/or process the file to generate multi-carrier or multi-segment signals.

Remote command:
`[:SOURce<hw>]:BB:V5G:WAVeform:CREate` on page 106

**Predefined Configurations**
Accesses a standard "File Select" dialog to selects and load a predefined configuration from a file.

For details, see Chapter 2.3, "Overview of the predefined configuration", on page 17.

Remote command:
[:SOURce<hw>]:BB:V5G:SETTing:PCONfiguration on page 106
[:SOURce<hw>]:BB:V5G:SETTing:PCONfiguration:CATalog on page 106

**Link Direction**
Selects the transmission direction.

"Downlink"
The transmission direction selected is 5GNB to user equipment. The signal corresponds to that of a 5GNB.

"Uplink"
The transmission direction selected is user equipment to 5GNB. The signal corresponds to that of a user equipment. Uplink direction is available only for the predefined uplink configurations.

Remote command:
[:SOURce<hw>]:BB:V5G:LINK on page 106

**General Settings**
Accesses the "General Settings" dialog for configuring general downlink or uplink settings of the V5GTF system.

The available settings depend on the selected link direction. For description, refer to Chapter 3.2, "General DL settings", on page 23 and Chapter 3.6, "General UL settings", on page 56.

**Frame Configuration**
Accesses the "Frame Configuration" dialog for configuring the allocation of the resource blocks to the different users, and the configuration of the users.

The available settings depend on the selected link direction. For description, refer to Chapter 3.3, "DL frame configuration", on page 29 and Chapter 3.7, "UL frame configuration", on page 57.

**Filter/ARB/Configuration**
Accesses the dialog for the arbitrary waveform component, see Chapter 3.9, "Filter/ARB settings", on page 79.

## 3.2 General DL settings

Access:

1. Select "General" > "Link Direction" > "Downlink".

2. Select "General" > "General Settings".

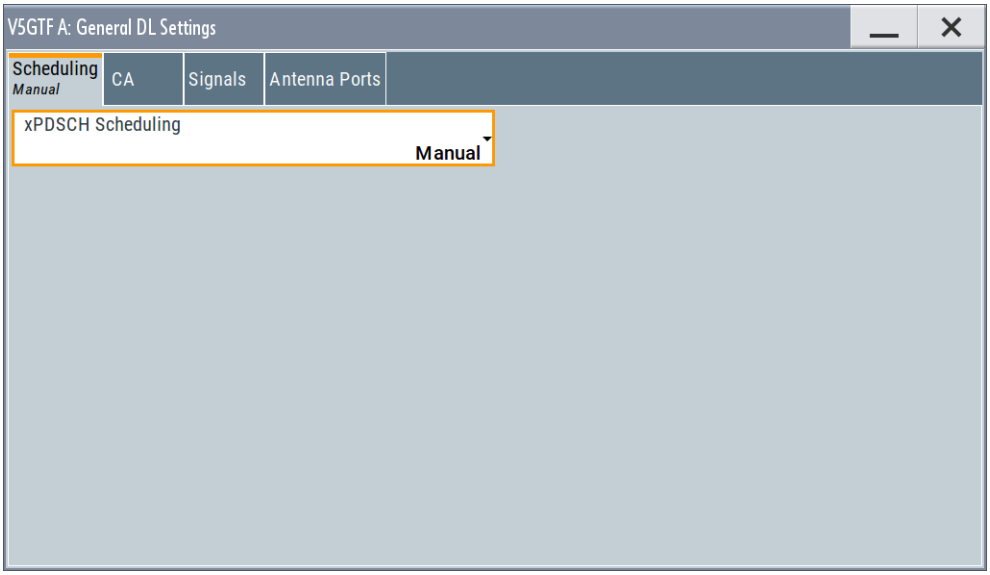
   The "General DL Settings" dialog allows you to configure the V5GTF system for transmission direction downlink that is the signal of one 5GNR carrier or one cell. The "General DL Settings" dialog consists of several tabs.



### 3.2.1 Scheduling

Access:

► Select "General DL Settings" > "Scheduling".




This dialog comprises xPDSCH scheduling setting.

**Settings:**

**xPDSCH Scheduling**
Selects manual or automatic xPDSCH scheduling mode.

- **Manual**: scheduling is configured via Chapter 3.3.5, "DL resource allocation table", on page 35 and "DCI Table" on page 41
- **Auto/DCI**: the best setting for xPDSCH and DCI is selected automatically

Remote command:
`[:SOURce<hw>]:BB:V5G:DL:CONF:MODE` on page 107

### 3.2.2 Carrier aggregation configuration

Access:

1. Select "General > General Settings".
2. Select "General DL Settings > CA".


*Figure 3-1: Carrier aggregation dialog*

The dialog provides the configuration of supported serving cells.

#### 3.2.2.1 Carrier aggregation settings

The following settings are provided:



**Activate Carrier Aggregation**
Not supported in the current version.

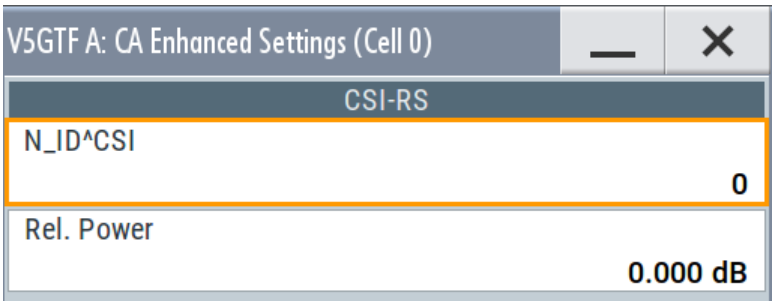
Remote command:
`[:SOURce<hw>]:BB:V5G:DL:CA:STATe` on page 108

**Serving Cell Table**
The table provides the settings of serving cells that can be used for the carrier aggregation. The current software supports one serving cell.

**Physical Cell ID ← Serving Cell Table**
Specifies the physical cell ID of the corresponding serving cell.

Remote command:
`[:SOURce<hw>]:BB:V5G:DL:CA:CELL<ch0>:ID` on page 108

**Enhanced Settings ← Serving Cell Table**
Opens the "CA Enhanced Settings" dialog per serving cell.




**N_ID^CSI ← Enhanced Settings ← Serving Cell Table**
Sets the scrambling identity $N_{ID}^{CSI}$ used to generate the CSI-RS signal.

Remote command:
`[:SOURce<hw>]:BB:V5G:DL:CA:CELL<ch0>:NIDCsi` on page 109

**Rel. Power ← Enhanced Settings ← Serving Cell Table**
Boosts the CSI-RS power compared to the cell-specific reference signals.

Remote command:
`[:SOURce<hw>]:BB:V5G:DL:CSIS[:CELL<ch0>]:POW` on page 110

**State ← Serving Cell Table**
Activates/deactivates the component carrier/physical cell - not configurable in the current version.

Remote command:
`[:SOURce<hw>]:BB:V5G:DL:CA:CELL<ch0>:STATe` on page 109

### 3.2.3 Signals settings

Access:

► Select "General DL Settings" > "Signals".

The "Signals" dialog comprises the settings of the following DL signals.

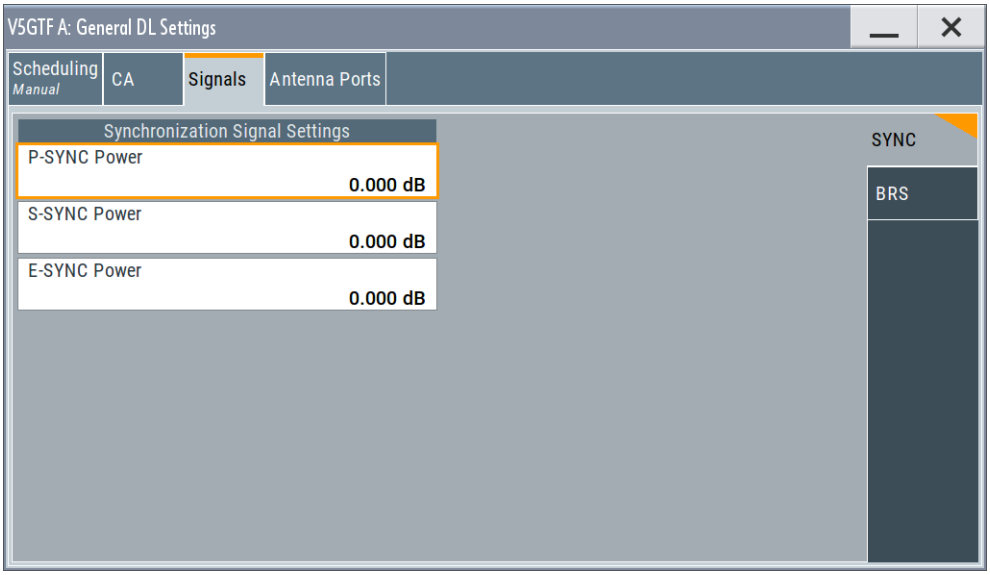
**Settings:**

#### 3.2.3.1 SYNC settings

Access:

1. Select "General DL Settings" > "Signals".
2. Select "SYNC".

   The tab provides synchronization settings.




**Settings:**

**P-SYNC / S-SYNC / E-SYNC Power**
Sets the power of the PSS / SSS / ESS allocations.

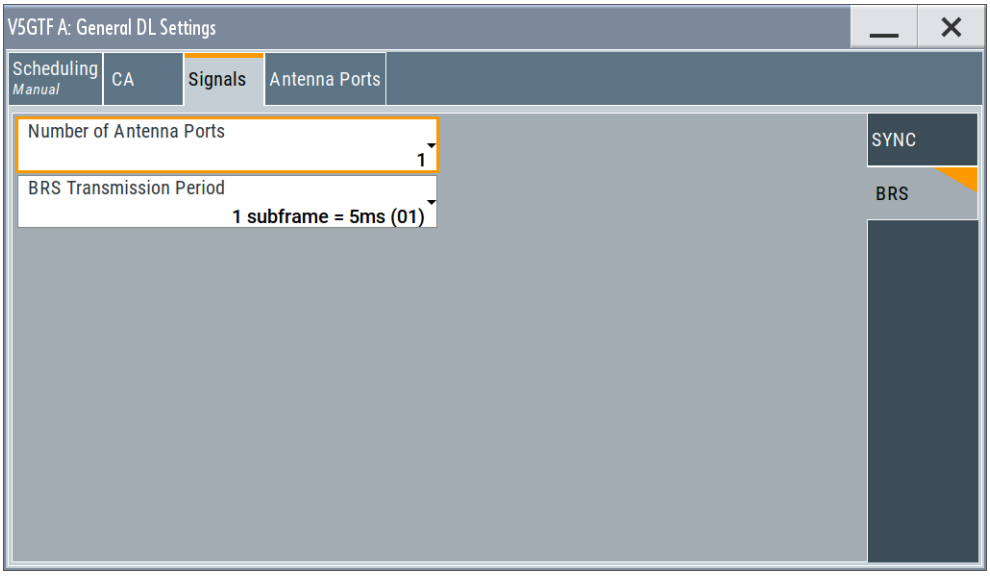
Remote command:
`[:SOURce<hw>]:BB:V5G:DL:SYNC:PPOWer` on page 111
`[:SOURce<hw>]:BB:V5G:DL:SYNC:SPOWer` on page 111
`[:SOURce<hw>]:BB:V5G:DL:SYNC:EPOWer` on page 111

#### 3.2.3.2 BRS settings

Access:

1. Select "General DL Settings" > "Signals".
2. Select "BRS".

   The tab provides beam reference signals (BRS) settings.




**Settings:**



**Number of Antenna Ports**
Specifies the number of antennas ports (one, two, four or eight) the beam reference signals (BRS) are transmitted on.

Remote command:
`[:SOURce<hw>]:BB:V5G:DL:SIGNals:BRS:NAP` on page 110

**BRS Transmission Period**
Specifies the beam reference signal transmission period signaled via xPBCH.

- **00**: single-slot (< 5 ms), maximum 7 downlink transmitting beams per antenna port
- **01**: single-subframe (= 5 ms), maximum 14 downlink transmitting beams per antenna port
- **10**: two-subframe (= 10 ms), maximum 28 downlink transmitting beams per antenna port
- **11**: four-subframe (= 20 ms), maximum 56 downlink transmitting beams per antenna port

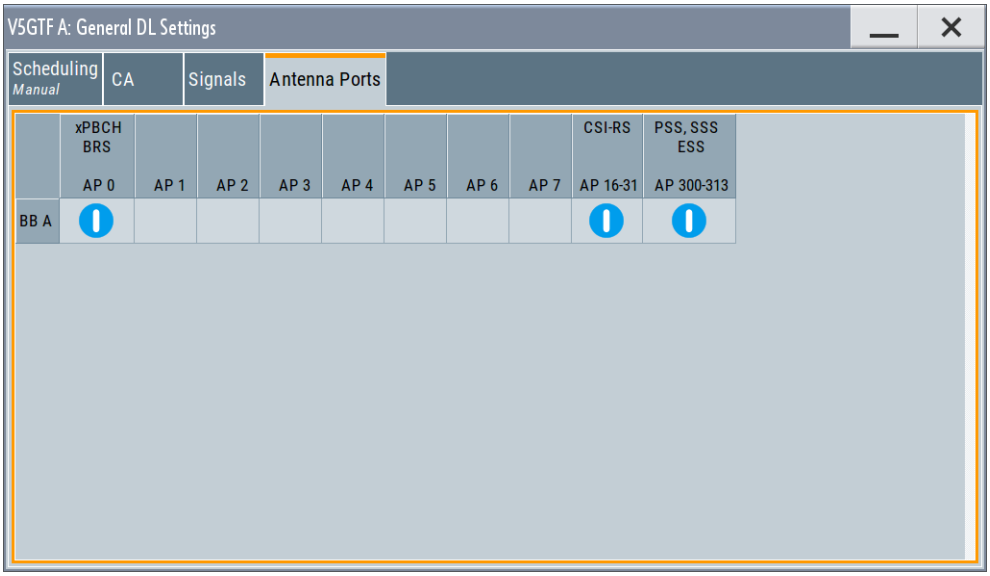
The BRS transmission period is the necessary time to sweep the whole downlink beams transmitted via BRS.

Remote command:
`[:SOURce<hw>]:BB:V5G:DL:SIGNals:BRS:BTRPeriod` on page 110

### 3.2.4 Antenna ports settings

Access:

► Select "General DL Settings" > "Antenna Ports".




The settings define the mapping of the logical antenna ports to the available physical TX antennas (basebands).

**Cell-Specific Antenna Port Mapping**
Comprises the mapping of the logical antenna ports to the available physical TX antennas (basebands).

Refer to "Cell-Specific Antenna Port Mapping" on page 55 for description of the provided settings.

## 3.3 DL frame configuration

Access:

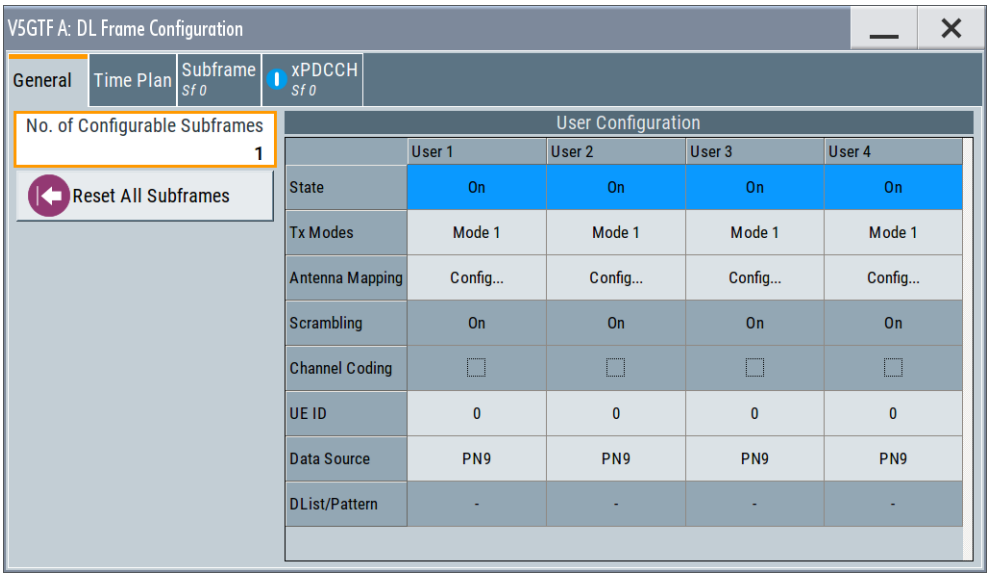
1. Select "General" > "Link Direction" > "Downlink".
2. Select "General" > "Frame Configuration".

   The "DL Frame Configuration" dialog allows you to configure the subframes and the OFDM resource allocations. The dialog consists of several tabs.

### 3.3.1 General frame configuration

Access:

► Select "DL Frame Configuration" > "General".




Use the provided settings to configure up to four scheduled UEs. To distribute them over the whole frame, set the data source of a certain allocation to "User x". This approach ensures that a common data source is used for allocations of one user equipment also in case that these allocations are non-adjacent.

**Settings:**



**No of Configurable Subframes**
Sets the number of configurable subframes.

All downlink subframes are filled periodically with the configured subframes except for the synchronization subframes. The last are set globally in the "General DL Settings" dialog. The xPBCH can only be configured in subframe 0 and 25.

Remote command:
`[:SOURce<hw>]:BB:V5G:DL:CONSubframes` on page 112

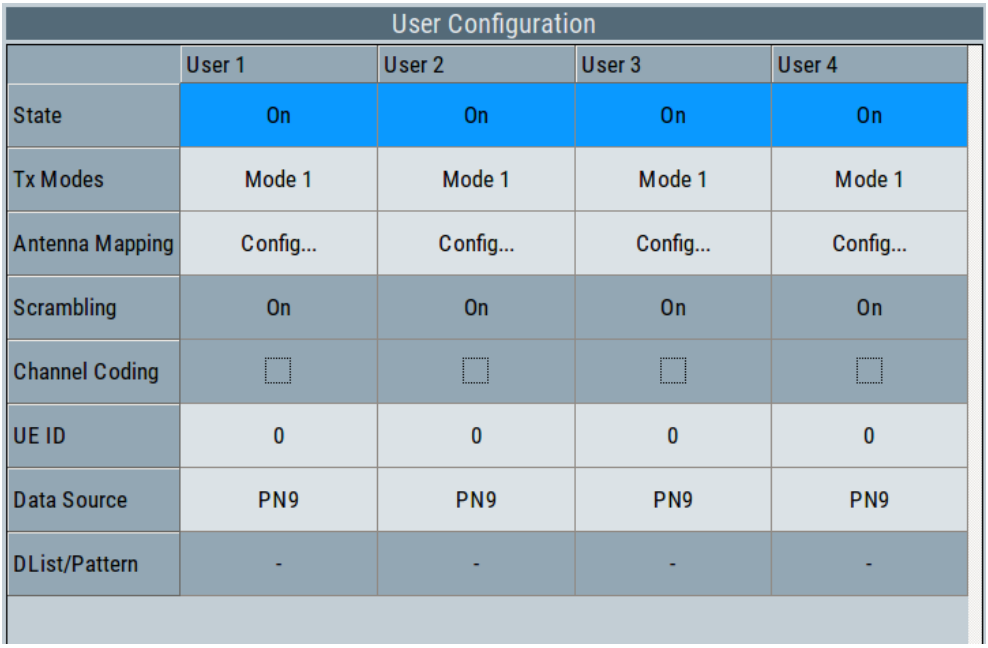
**Reset All Subframes**
Resets settings of all subframes including cyclic prefix and number of used allocations to the default values.

Remote command:
[:SOURce<hw>]:BB:V5G:DL:RSTFrame on page 112

### 3.3.2 User configuration

Access:

► Select "DL Frame Configuration" > "General" > "User Configuration".




Use the provided settings to configure up to four scheduled UEs. To distribute them over the whole frame, set the data source of a certain allocation to "User x". This approach ensures that a common data source is used for allocations of one user equipment also in case that these allocations are non-adjacent.

In one subframe, all allocations belonging to the same "User" use identical settings. Changing, for example, the modulation of one of the allocations of "User 1", changes the modulation in all other allocations of this user in the current subframe.

**Settings:**

**State**
Enables/disables a user.

Remote command:
[:SOURce<hw>]:BB:V5G:DL:USER<ch>:STATe on page 116

**TX Modes**
Specifies the transmission mode of the user. See also Table 2-3.

Remote command:
[:SOURce<hw>]:BB:V5G:DL:USER<ch>:TXM on page 116
[:SOURce<hw>]:BB:V5G:DL:USER<ch>:CELL<st0>:TXM on page 114

**Antenna Mapping Configuration**
Use "To access the user-specific antenna port mapping settings" on page 54 dialog to define the user-specific mapping of the logical antenna ports to the available physical TX antennas.

**Scrambling State**
Specifies whether the scrambling is enabled for all allocations belonging to the selected user - not configurable in the current version.

The parameter "Scrambling State" determines the "Enhanced Settings > Scrambling State" of all allocations for which you select the Data Source, DList/Pattern = "User x".

Remote command:
[:SOURce<hw>]:BB:V5G:DL:USER<ch>:SCRambling:STATe on page 115

**Channel Coding State**
Specifies channel coding for all allocations belonging to the selected user - not configurable in the current version.

Remote command:
[:SOURce<hw>]:BB:V5G:DL:USER<ch>:CCODing:STATe on page 114

**UE ID**
Sets the user equipment ID.

Remote command:
[:SOURce<hw>]:BB:V5G:DL:USER<ch>:UEID

**Data Source, DList/Pattern**
Selects the data source for the selected user.

The following standard data sources are available:
- "All 0, All 1"
  An internally generated sequence containing 0 data or 1 data.
- "PNxx"
  An internally generated pseudo-random noise sequence.
- "Pattern"
  An internally generated sequence according to a bit pattern.
  Use the "Pattern" box to define the bit pattern.
- "Data List/Select DList"
  A binary data from a data list, internally or externally generated.

Select "Select DList" to access the standard "Select List" dialog.
- Select the "Select Data List > navigate to the list file *.dm_iqd > Select" to select an existing data list.
- Use the "New" and "Edit" functions to create internally new data list or to edit an existing one.
- Use the standard "File Manager" function to transfer external data lists to the instrument.

See also:
- Section "Modulation Data" in the R&S SMW user manual.
- Section "File and Data Management" in the R&S SMW user manual.
- Section "Data List Editor" in the R&S SMW user manual

Remote command:
`[:SOURce<hw>]:BB:V5G:DL:USER<ch>:DATA` on page 114
`[:SOURce<hw>]:BB:V5G:DL:USER<ch>:DSELect` on page 115
`[:SOURce<hw>]:BB:V5G:DL:USER<ch>:PATTern` on page 115

### 3.3.3 Time plan

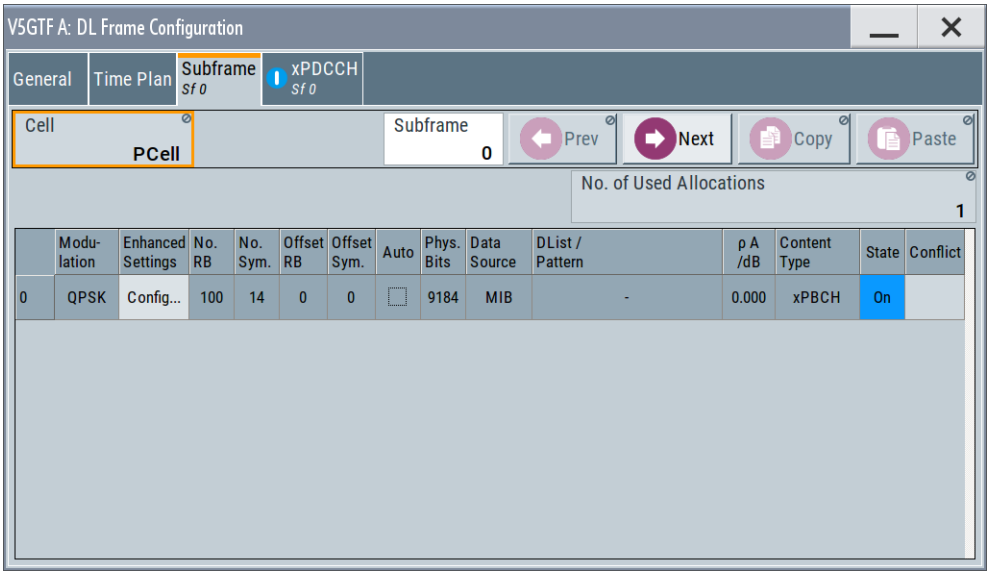
The description of time plan is covered in Chapter 3.8.1, "Time plan in DL", on page 76.

### 3.3.4 Subframe configuration control

Access:

1. Select "DL Frame Configuration" > "Subframe".
2. To access the common subframe configuration control, select one of the following:
   - "Frame Configuration > Subframe"
   - "Frame Configuration > xPDCCH"

   Provided are subframe control settings.




**Settings:**



**Cell**
In the current version, only primary cell is supported.

Remote command:
n.a

**Subframe Selection**
Sets the subframe to be configured in the frame configuration table.

Remote command:
n.a.

**Next/Prev**
Navigates through the subframes.

Remote command:
n.a.

**Copy/Paste**
Copies/pastes the settings of the selected subframe. Synchronization subframes settings are not considered.

Remote command:
n.a.

**No. of Used Allocations**
Specifies the number of scheduled allocations in the selected subframe.

The allocation of xPBCH in subframe 0 is fixed. From the subframe 1, several allocations are configurable.

The parameter is only configurable for manual scheduling, see Chapter 3.2.1, "Scheduling", on page 24.

Remote command:
`[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALCount` on page 117

### 3.3.5 DL resource allocation table

Access:

► Select "DL Frame Configuration" > "Subframe".

| | Modulation | Enhanced Settings | No. RB | No. Sym. | Offset RB | Offset Sym. | Auto | Phys. Bits | Data Source | DList / Pattern | ρ A /dB | Content Type | State | Conflict |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | QPSK | Config... | 96 | 2 | 0 | 0 | ☐ | 1440 | xPDCCH | - | 0.000 | xPDCCH | On | |
| 1 | QPSK | Config... | 100 | 2 | 0 | 12 | ☑ | - | - | - | 0.000 | CSI-RS | On | |
| 2 | 64QAM | Config... | 96 | 10 | 0 | 2 | ☑ | 62208 | User1 | - | 0.000 | xPDSCH | On | |
| 3 | 16QAM | Config... | 4 | 8 | 4 | 2 | ☐ | 0 | User2 | - | 0.000 | xPDSCH | On | ⚠ |

The resource allocation table comprises the settings necessary to configure the individual allocation parameters for a subframe.

**Settings:**



**Allocation number**
Displays the consecutive number of the allocation.

Remote command:
n.a.

**Modulation**
Specifies the modulation scheme for the allocation.

For the data source for an allocation = "User", changing this parameter sets also the modulation of all allocations, belonging to the same user in the subframe.

Remote command:
[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:MODulation
on page 119

**Enhanced Settings**
Open up the "Enhanced Settings" dialog. The description is covered in Chapter 3.4, "Enhanced DL settings", on page 48.

**No. RB (Resource Blocks)**
Defines bandwidth of selected allocation in terms of multiples of four resource blocks.

Remote command:
[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:RBCount on page 122

**No. Sym.**
Specifies the size of the selected allocation in OFDM symbols (configurable for xPDCCH and xPDSCH).

For content types xPDSCH, this value is only configurable, if auto mode is off. Automatic setting sets the parameter in a way that the allocation always fills the complete subframe with consideration of the symbol offset.

Remote command:
[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:SYMCount
on page 124

**Offset RB**
Queries the start resource block of the selected allocation. For content type xPDSCH, this value is configurable if auto mode is off.

Automatic setting depends on other settings, like the "Content type".

Remote command:
[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:RBOFfset
on page 123

**Offset Sym.**
Queries the start OFDM symbol of the selected allocation. For content type xPDSCH, this value is configurable if auto mode is off.

Remote command:
[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:SYMoffset
on page 124

**Auto**
Sets whether automatic offset calculation is used or not.

If the "Auto" mode is activated, the number of symbols, resource block offset and the start symbol offset are set automatically and cannot be changed.

By setting new allocations or changing the number of RBs of an existing allocation, the auto mode tries to distribute the allocations in an optimal manner. It adjusts the parameters "Offset RB" for the available resource blocks with activated auto mode.

If it is not possible to distribute the changed configuration to the available resources blocks, a conflict is displayed.

"Auto Offset Calculation" mode is only available for xPDSCH. For xPBCH, xPDCCH and CSI-RS, this parameter is always off.

Remote command:
`[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:AOC` on page 118

**Phys. Bits**
Displays the size of the selected allocation in bits.

"Auto" indicates automatically calculated value depending on other settings, like the "Content type".

Remote command:
`[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:PHYSbits?` on page 121

**Data Source, DList / Pattern**
Queries the data source for the selected allocation.

- **MIB** indicates that the xPBCH transmits master information blocks.
- **xPDCCH** indicates control channel allocation
- **User 1 to User 4**: assigns a particular user to the allocation of content type xPDSCH. The user data sources and "DList / Pattern" parameters are configurable in User configuration.

Remote command:
`[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:DATA` on page 118

**Rho A**
Sets the power $P_{xPDSCH}$ (ρ A) for the selected allocation.

The power of xPBCH, xPDCCH and CSI-RS allocation is read-only. The value $P_{CSI-RS}$ is specified in the carrier aggregation configuration dialog in General DL settings.

Remote command:
`[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:POWer` on page 121

**Content Type**
Indicates the type of the selected allocation.

Remote command:
`[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:CONType` on page 118

**State**
Sets the allocation to active or inactive state.

The parameter is only configurable for manual scheduling, see Chapter 3.2.1, "Scheduling", on page 24.

Remote command:
`[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:STATe` on page 123

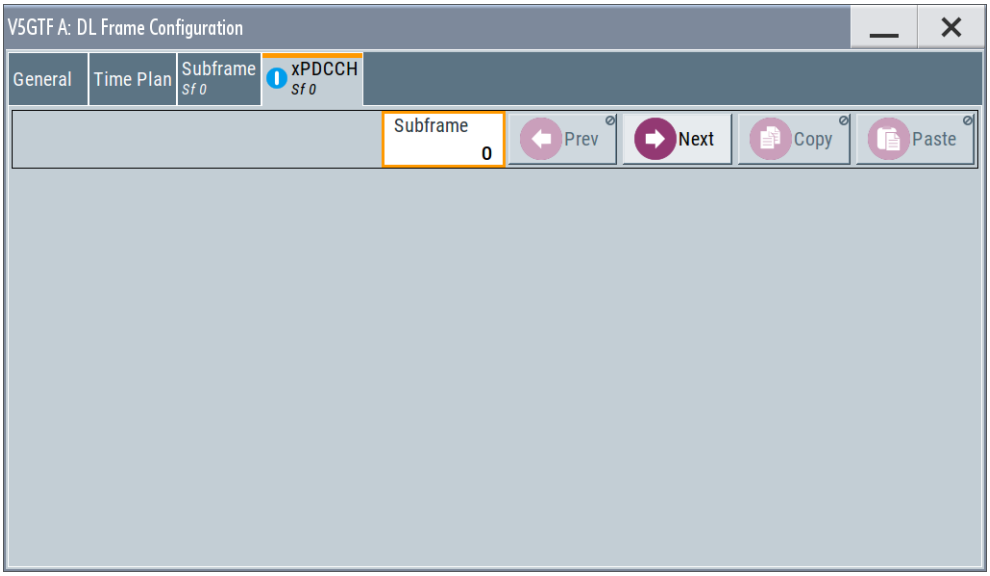
**Conflict**
Indicates a conflict between allocations. Avoid the overlapping of configured signals or channels.

Remote command:
`[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:CONFlict`
on page 118

### 3.3.6 xPDCCH settings

Access:

► Select "DL Frame Configuration" > "xPDCCH".




This dialog comprises the xPDCCH settings and information to be signaled via the control channel.

For subframe configuration control, refer to Chapter 3.3.4, "Subframe configuration control", on page 33.

**Settings:**

**Power**
Sets the power of the xPDCCH ($P_{xPDCCH}$).

The value set with this parameter is also displayed in the allocation table for the corresponding allocation.

Remote command:
`[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:POWer` on page 126

**Dummy CCE xREGs**
Sets the behavior of the dummy xREGs, i.e. determines whether dummy data or DTX is transmitted.

Remote command:
`[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:DCRegs:TRSource` on page 126

**Dummy CCE Data Source**
Selects the data source for xPDCCH.

The following standard data sources are available:
- "All 0, All 1"
  An internally generated sequence containing 0 data or 1 data.
- "PNxx"
  An internally generated pseudo-random noise sequence.
- "Pattern"
  An internally generated sequence according to a bit pattern.
  Use the "Pattern" box to define the bit pattern.
- "Data List/Select DList"
  A binary data from a data list, internally or externally generated.
  Select "Select DList" to access the standard "Select List" dialog.
  – Select the "Select Data List > navigate to the list file *.dm_iqd > Select" to select an existing data list.
  – Use the "New" and "Edit" functions to create internally new data list or to edit an existing one.
  – Use the standard "File Manager" function to transfer external data lists to the instrument.

See also:
- Section "Modulation Data" in the R&S SMW user manual.
- Section "File and Data Management" in the R&S SMW user manual.
- Section "Data List Editor" in the R&S SMW user manual

Remote command:
[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:DCRegs:DATA
on page 125
[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:DCRegs:DSELect
on page 125
[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:DCRegs:PATTern
on page 125

**Standard configuration functions**
Standard configuration functions:

"Append" Adds a row at the end of the table.

Remote command:
[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:APPend

"Insert" Insert a new row before the current one.

Remote command:
[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:SITem on page 127
[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:INSert on page 127

"Delete" Deletes the selected row.

Remote command:
[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:DELete on page 126

"Down/Up" Moves the selected row down or up.

Remote command:
[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:DOWN on page 127
[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:UP on page 127

**Reset**
Resets the table.

Remote command:
[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:RESet
on page 127

**Resolve Conflicts**
The "Resolve Conf." is a built-in algorithm that reassigns automatically the CCE values. Previously configured CCE values are not maintained. If the conflict cannot be resolved automatically, the values are left unchanged.

Remote command:
[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:SOLVe?
on page 128
To query the current conflicts:
[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:
CONFlict? on page 130

**DCI Table**
Comprises the settings of xPDCCH items, i.e. the number of rows in the DCI table.

**User ← DCI Table**
Selects the user that the DCI is dedicated to. The available DCI formats depend on this parameter and its transmission mode.

"User x" Selects one of the four users configured in the User configuration dialog.
The DCIs of an inactive user ("Configure User" > State > "Off") are not configurable and not considered by the calculation of "No. Dummy CCEs".

"None" Allows free definition of all settings

Remote command:
[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:
USER on page 141

**UE_ID/n_RNTI ← DCI Table**
Displays the UE_ID or the n_RNTI for the selected xPDCCH.

Remote command:
[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:
UEID on page 141

**Cell Index ← DCI Table**
Sets the component carrier on that the corresponding DCI is transmitted. The "Cell Index" of the PCell (primary cell) is always set to 0.

Remote command:
[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:
CELL on page 129

**DCI Format ← DCI Table**
Sets the DCI format for the selected xPDCCH.

The downlink control information (DCI) is a message used to control the physical layer resource allocation in both the UL and DL direction. It carries scheduling information and uplink power control commands.

The DCI is mapped on the xPDCCH. And depending on the DCI message size and usage are categorized into different formats.

*Table 3-1: Overview DCI formats*

| DCI format | Purpose |
|---|---|
| DCI Format A1 | xPUSCH scheduling |
| DCI Format B1 | xPDSCH scheduling |
| DCI Format A2/ B2 | A2 for spatial multiplexing, up to 2 layer transmission of xPUSCH |
| | B2 for up to 2 layer transmission of xPDSCH |

The fields of each DCI format are configurable parameters that can be adjusted in the corresponding dialog box.

Not all DCI formats are always enabled for selection. For dependencies, see Chapter 2.2.4, "Physical layer procedures", on page 16.

Remote command:
`[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIFmt` on page 139

**Content Config ← DCI Table**
Opens the DCI format configuration dialog to configure the DCI fields of the selected DCI format.

Remote command:
n.a.

**xPDCCH Format ← DCI Table**
Sets the xPDCCH format.

The xPDCCH format determines how many consecutive enhanced control channel elements (CCEs) are used for the transmission of the xPDCCH. Each CCE consists of multiple resource element groups (REGs).

*Table 3-2: Supported xPDCCH formats*

| xPDCCH format | Number of CCEs | Number of REGs per CCE | Number of xPDCCH bits |
|---|---|---|---|
| 0 | 2 | 2 | 192 |
| 1 | 4 | 4 | 384 |
| 2 | 8 | 8 | 768 |
| 3 | 16 | 16 | 1536 |

Remote command:
`[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:PFMT` on page 140

**Number CCEs ← DCI Table**
Defines the number of control channel elements used for the transmission of the xPDCCH.

The value depends on the selected xPDCCH Format.

Remote command:
[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:NCCes? on page 140

**xPDCCH Symbol ← DCI Table**
Sets the symbol for xPDCCH scheduling. The number of available symbols (one or two for xPDCCH) is set via "No. Sym." on page 36.

Remote command:
[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:SYMBol on page 141

**CCE Index ← DCI Table**
Sets the CCE start index.

The available CCEs depend on the selected xPDCCH Format.

Remote command:
[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:CINDex on page 129

**No. Dummy CCEs ← DCI Table**
Defines the number of dummy CCEs that are appended to the corresponding xPDCCH.

Remote command:
[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:NDCCes? on page 140

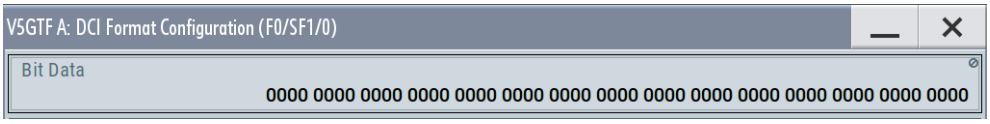
**Conflict ← DCI Table**
Indicates a conflict between two DCI formats.

Remote command:
[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:CONFlict? on page 130

## 3.3.7 DCI format configuration

Access:

1. Select "General > Link Direction > Downlink"
2. Select "General > Frame Configuration"
3. Select "DL Frame Configuration > xPDCCH"
4. In the DCI table, select "Content > Config..."



The dialog shows the enhanced settings of DCI format. The most of parameters depend on the selected DCI format. See also Chapter 2.2.4, "Physical layer procedures", on page 16.



**Bit Data**
Displays the resulting bit data as selected with the DCI format parameters.

Remote command:
`[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:BITData?` on page 130

**DCI Format A1**
The DCI format A1 is used for scheduling uplink transmission on xPUSCH and transmits the information listed in the following table.

| DCI Format A1 | |
|---|---|
| Last xPUSCH Symbol: 12 | Transmission Timing Offset I: 0 |
| Resource Block Assignment: 0 | HARQ Process Number: 0 |
| Modulation and Coding Scheme: 0 | New Data Indicator: ☐ |
| CSI/BSI/BRI Request: None | |
| UCI on xPUSCH w/o xUL-SCH data: ☐ | Beam Switch Indication: ☐ |
| SRS Request: No SRS Request | |
| RE Mapping Index for DMRS/PCRS: 0 | N_SCID: 0 |
| Precoding Matrix Indicator: 0 | TPC Command for xPUCCH: 0 |
| UL Dual PCRS: 0 | |

The fields defined in the DCI format are mapped to the information bits according to the specification and the resulting Bit Data is displayed.

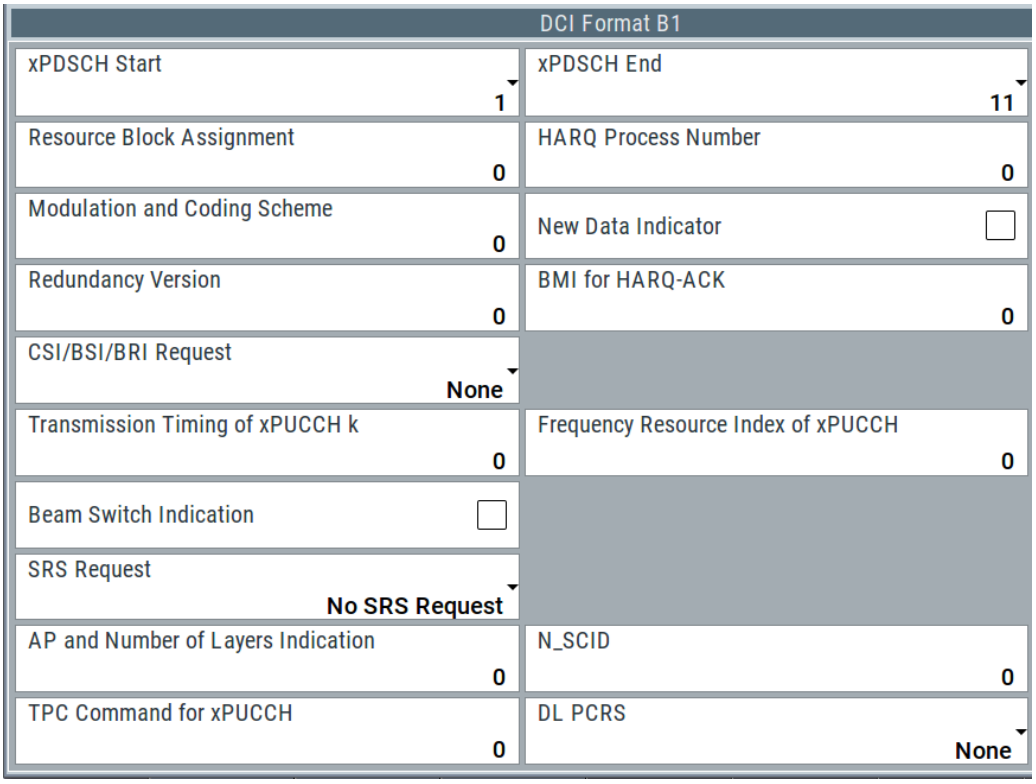
*Table 3-3: Configuration for DCI format A1*

| Control Information Field | SCPI command | Dependencies |
|---|---|---|
| "Last xPUSCH Symbol" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:XPRange on page 139 | |
| "Transmission Timing Offset I" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:TRTiming on page 137 | |
| "Resource Block Assignment" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:RBA on page 134 | |
| "HARQ Process Number" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:HPN on page 133 | For "Resource Block Assignment" < 325 |
| "Modulation and Coding Scheme" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:MCSR on page 133 | For "Resource Block Assignment" < 325 |
| "New Data Indicator" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:NDI on page 134 | For "Resource Block Assignment" < 325 |
| "CSI/BSI/BRI Request" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:CBBRequest on page 131 | |
| "Transmission Timing of CSI-RS/BRRS" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:CTRTiming on page 132 | For "CSI/BSI/BRI Request" = "CSI-RS" |
| "CSI-RS/BRRS Symbol" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:CBSYmbol on page 132 | For "CSI/BSI/BRI Request" = "CSI-RS" |
| "CSI-RS/BRRS Process" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:CBPRocess on page 132 | For "CSI/BSI/BRI Request" = "CSI-RS" |
| "UCI on xPUSCH w/o xUL-SCH Data" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:UCIind on page 137 | |
| "Beam Switch Indication" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:BSI on page 131 | |
| "SRS Request" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:SRSRequest on page 135 | |
| "SRS Symbol" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:SRSSymbol on page 136 | For "SRS Request" ≠ "No SRS Request" |
| "RE Mapping Index for DMRS/PCRS" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:REMap on page 135 | |
| "N_SCID" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:NSCid on page 134 | |

| Control Information Field | SCPI command | Dependencies |
|---|---|---|
| "Precoding Matrix Indicator" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:PMI on page 134 | |
| "TPC Command for xPUCCH" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:TPC on page 136 | |
| "UL Dual PCRS" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:ULPCrs on page 137 | |

### DCI Format B1

The DCI format B1 carries information for scheduling transmission of one codeword on xPDSCH. The different fields of this format are summarized in the following table.




The fields defined in the DCI format are mapped to the information bits according to the specification and the resulting Bit Data is displayed.

***Table 3-4: Configuration for DCI format B1***

| Control Information Field | SCPI command | Dependencies |
|---|---|---|
| "xPDSCH Start" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:XPSTart on page 139 | |
| "xPDSCH End" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:XPENd on page 138 | |

| Control Information Field | SCPI command | Dependencies |
|---|---|---|
| "Resource Block Assignment" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:RBA on page 134 | |
| "HARQ Process Number" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:HPN on page 133 | For "Resource Block Assignment" < 325 |
| "Modulation and Coding Scheme" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:MCSR on page 133 | For "Resource Block Assignment" < 325 |
| "New Data Indicator" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:NDI on page 134 | For "Resource Block Assignment" < 325 |
| "Redundancy Version" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:RV on page 135 | |
| "BMI for HARQ-ACK" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:BMI on page 131 | |
| "CSI/BSI/BRI Request" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:CBBRequest on page 131 | |
| "Transmission Timing of CSI-RS/BRRS" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:CTRTiming on page 132 | For "CSI/BSI/BRI Request" = "CSI-RS" |
| "CSI-RS/BRRS Symbol" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:CBSYmbol on page 132 | For "CSI/BSI/BRI Request" = "CSI-RS" |
| "CSI-RS/BRRS Process" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:CBPRocess on page 132 | For "CSI/BSI/BRI Request" = "CSI-RS" |
| "Transmission Timing of xPUCCH" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:UTRTiming on page 138 | |
| "Frequency Resource Index of xPUCCH" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:UFRI on page 137 | |
| "Beam Switch Indication" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:BSI on page 131 | |
| "SRS Request" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:SRSRequest on page 135 | |
| "SRS Symbol" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:SRSSymbol on page 136 | For "SRS Request" ≠ "No SRS Request" |
| "AP and Number of Layers Indication" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:APNLayer on page 130 | |

| Control Information Field | SCPI command | Dependencies |
|---|---|---|
| "N_SCID" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:NSCid on page 134 | |
| "TPC Command for xPUCCH" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:TPC on page 136 | |
| "DL PCRS" | [:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:DLPCrs on page 133 | |

**DCI Format A2/ B2**

The DCI formats are used in the following cases:

- DCI format A2: for xPUSCH scheduling in spatial multiplexing configuration, up to 2 layer transmission
- DCI format B2: for xPDSCH scheduling in spatial multiplexing configuration, up to 2 layer transmission

Because MIMO operation requires two codewords, the modulation and coding scheme, new data indicator and the redundancy version are signaled separately for each of the codewords. The spatial multiplexing also requires a transmission of precoding information.

The fields defined in the DCI format are mapped to the information bits according to the specification and the resulting Bit Data is displayed.

The DCI format A2 transmits the information listed in the table Table 3-3.

The DCI format B2 transmits the information listed in the table Table 3-4.

## 3.4 Enhanced DL settings

Access:

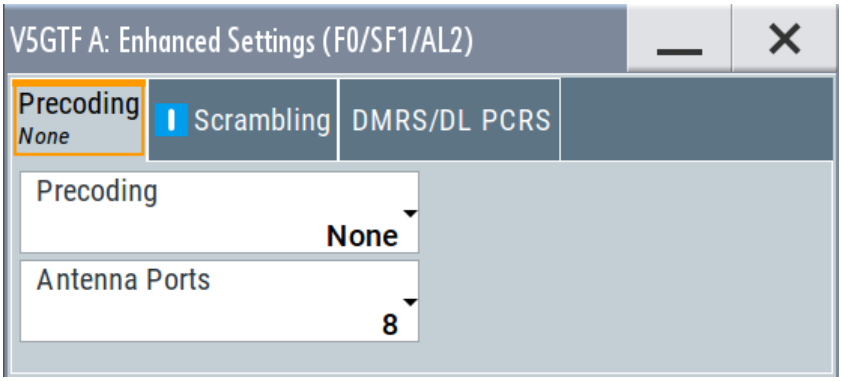
1. Select "General" > "Link Direction" > "Downlink".
2. Select "General" > "Frame Configuration".
3. Select "DL Frame Configuration" > "Subframe".
4. Select "Enhanced Settings" > "Config ...".

   The dialog specifies the precoding, scrambling, and antenna port mapping of the selected allocation.

### 3.4.1 Precoding settings

Access:

1. Select "Content Type" > "xPBCH"/"xPDCCH"/"xPDSCH".
2. Select "Enhanced Settings" > "Config".
3. Select "Precoding".




Provide setting of the following:



**Precoding Scheme**
Selects the precoding scheme for xPBCH, xPDCCH, and xPDSCH. See also Table 2-3.

- **"None"**: without precoding for single-antenna port transmission schemes
- **"Tx Diversity"**: for 2 layer transmission scheme
- **"Spatial Multiplexing"**: for up to 2 layer transmission scheme (only xPDSCH)

Remote command:
`[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:PRECoding:SCHeme`
on page 122

**Number of Layers**
Indicates the number of layers for precoding scheme ≠ "None".

Remote command:
`[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:PRECoding:LCOunt`
on page 122

**Precoding Antenna Ports**
Specifies the antenna ports used by the allocation, see "Precoding Scheme" on page 49.

Antenna ports depend on the selected precoding scheme:

- **"None"**: for single-antenna port transmission schemes

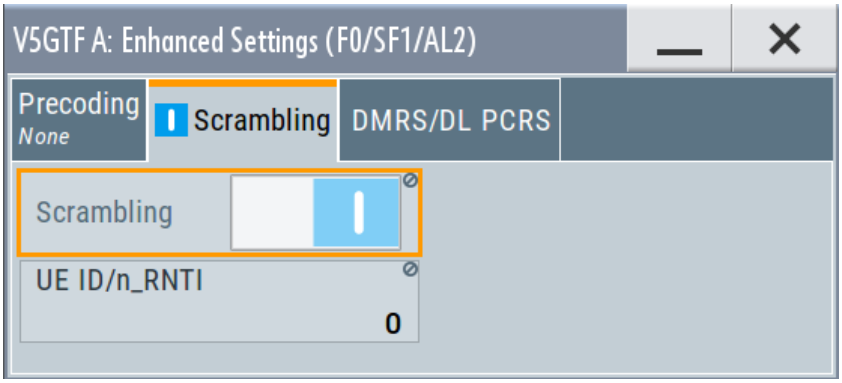
  - xPBCH: AP 0
  - xPDCCH: AP 107
  - xPDSCH: one AP from the range 8 to 15 (only for transmission mode 1)
- **"Tx Diversity"**: for 2 layer transmission scheme
  - xPBCH: AP 0/1
  - xPDCCH: AP 107/109
  - xPDSCH: an AP pair according to the specification (only for transmission modes 2 and 3)
- **"Spatial Multiplexing"**: for up to 2 layer transmission scheme
  - xPDSCH: one or two APs according to the specification (only for transmission mode 3)

Remote command:
`[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:PRECoding:AP`
on page 122

### 3.4.2 Scrambling settings

Access:

1. Select "Content Type" > "xPDSCH".
2. Select "Enhanced Settings" > "Config".
3. Select "Scrambling".




Settings:



**State Scrambling**
Enables/disables the bit-level scrambling.

If a "User x" is selected as Data Source, DList / Pattern in the allocation table for the corresponding allocation, the "State Scrambling" is read only. Its value is displayed as specified in the User configuration dialog for the corresponding user.

Remote command:
[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:SCRambling:STATe
on page 123

**UE ID/n_RNTI**
Queries the UE ID and $n_{RNTI}$.

The $n_{RNTI}$ is the radio network temporary identifier of the user to which the xPDSCH transmission is intended.

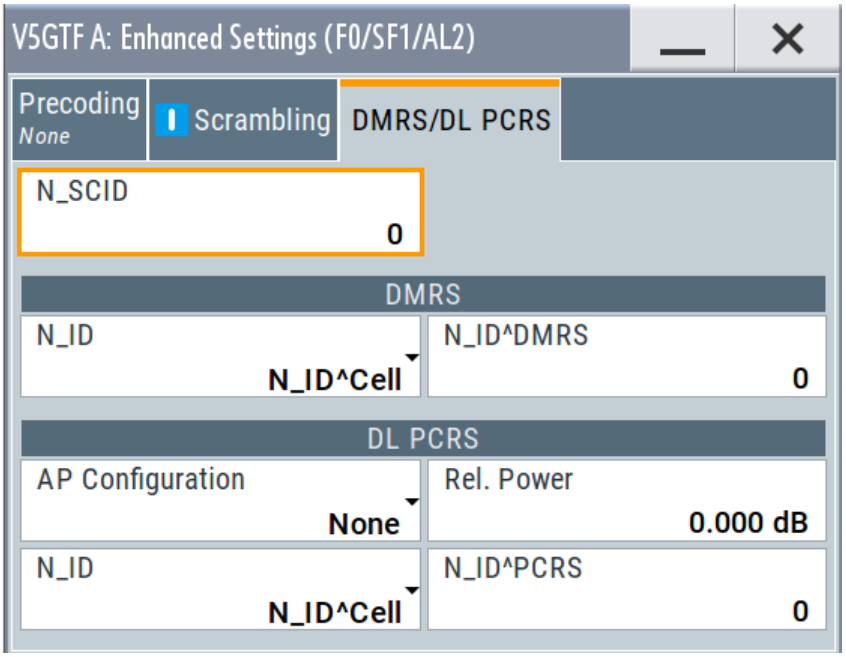
The values of both parameters are the same as specified in the User configuration dialog for the corresponding user.

Remote command:
[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:SCRambling:UEID
on page 123

### 3.4.3 Reference signal settings

Access:

1. Select "Content Type" > "xPDSCH".
2. Select "Enhanced Settings" > "Config".
3. Select "DMRS"/"DL PCRS".




Settings:

**N_SCID**
Sets the scrambling identity $n_{SCID}$ of UE-specific reference signals associated with xPDSCH. This value is used for initialization of the sequence used for generation of the UE-specific reference signals.

Remote command:
`[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:XPDSch:NSCid` on page 119

**N_ID**
Specifies the source of reference signal ID $n_{ID}$ for DMRS and PCRS associated with xPDSCH.

- For $N_{ID}^{Cell}$, the $n_{ID}$ value is configured via "Physical Cell ID" on page 26
- For $n_{ID}^{DMRS}$ and $n_{ID}^{PCRS}$, the corresponding $n_{ID}$ value is configured via "N_ID^DMRS / N_ID^PCRS" on page 52.

Remote command:
`[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:XPDSch:DMRS:NID` on page 119
`[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:XPDSch:PCRS:NID` on page 119

**N_ID^DMRS / N_ID^PCRS**
Specifies the demodulation reference signal ID $n_{ID}^{DMRS}$ and phase noise compensation reference signal ID $n_{ID}^{PCRS}$ associated with xPDSCH.

Remote command:
`[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:XPDSch:DMRS:NIDDmrs` on page 120
`[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:XPDSch:PCRS:NIDPcrs` on page 120

**AP Configuration**
Sets the antenna port mapping for demodulation reference signal associated with xPDSCH, see Chapter 3.5, "DL antenna port mapping settings", on page 53.

| | |
|---|---|
| "None (00)" | If no PCRS is transmitted, xPDSCH is mapped to the PCRS REs. |
| "AP 60 (01)" | If PCRS is transmitted in antenna port 60, xPDSCH is not mapped to the PCRS REs for antenna port 60. |
| "AP 61 (10)" | If PCRS is transmitted in antenna port 61, xPDSCH is not mapped to the PCRS REs for antenna port 61. |
| "AP 60/61 (11)" | If PCRS is transmitted in antenna port 60 and 61, xPDSCH is not mapped to the PCRS REs for both antenna port 60 and 61. |

Remote command:
[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:XPDSch:PCRS:APConf on page 120

**Rel. Power**
Sets the power $P_{DL\ PCRS}$ relative to xPDSCH for the allocation type xPDSCH.

Remote command:
[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:XPDSch:PCRS:RPOWer on page 121

### 3.4.4 Antenna port mapping for CSI-RS

The CSI-RS resource allocation in a subframe comprises one symbol which is either the last or the second last symbol, or the last two consecutive symbols. The transmission of CSI-RS is dynamically indicated in the xPDCCH.

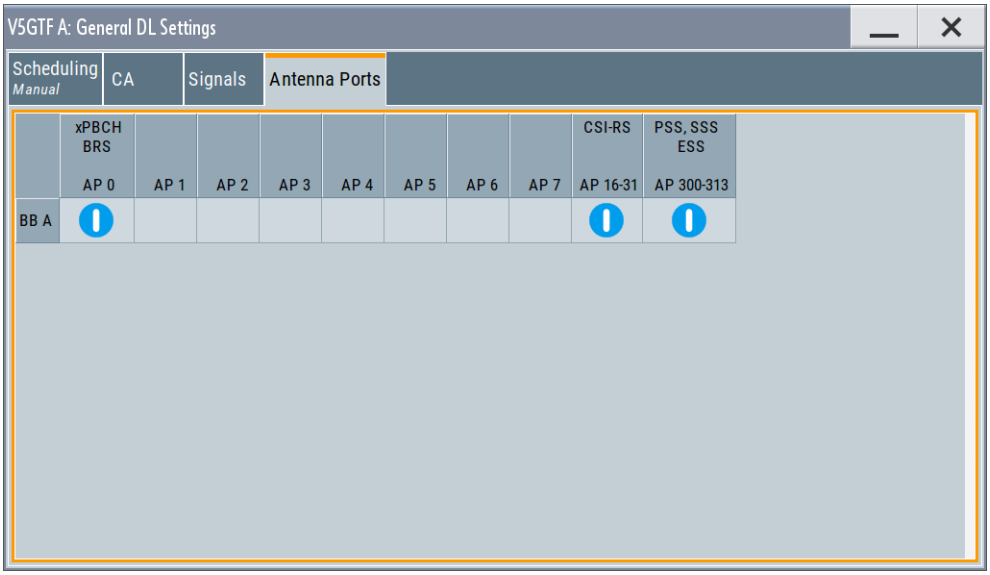
The description of setting is covered in "To access the CSI-RS- specific antenna port mapping in a subframe" on page 54.

## 3.5 DL antenna port mapping settings

The standard defines the different antenna ports for transmission in different transmission modes (TM, also "Tx Mode").

**To access the cell-specific antenna port mapping settings**

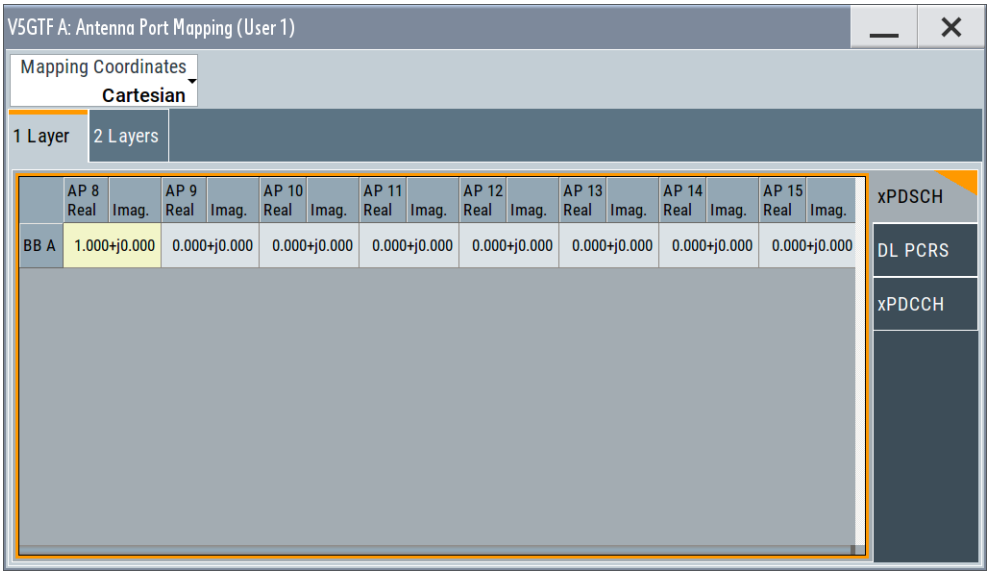
1. Select "General" > "Link Direction" > "Downlink".
2. Select "General" > "General Settings".
3. Select "General DL Settings" > "Antenna Ports".



This dialog maps the logical antenna ports to the physical TX antennas (basebands).

**To access the user-specific antenna port mapping settings**

1. Select "General" > "Link Direction" > "Downlink".
2. Select "General" > "Frame Configuration".
3. Select "General" > "User Configuration" > "Antenna Mapping" > "Config".

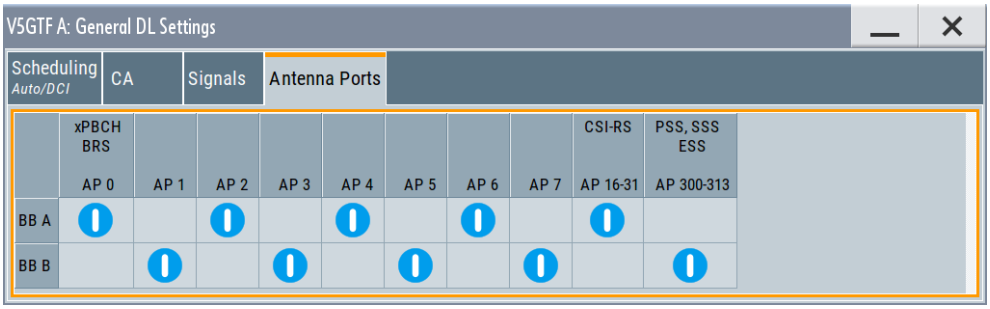



The yellow matrix elements in the mapping table indicate the enabled antenna ports mapped to physical TX antenna (baseband).
The configuration of up to two layers is supported, according to the selected tab at the top.
The configuration of xPDSCH, DL PCRS and xPDSCH is supported, according to the selected tab to the right.

**To access the CSI-RS- specific antenna port mapping in a subframe**

1. Select "General" > "Link Direction" > "Downlink".
2. Select "General" > "Frame Configuration".
3. Select "DL Frame Configuration" > "Subframe" > "Subframe#1" > "No. of Used Allocations" ≠ "1".
4. Select in allocation table "Content Type" > "CSI-RS".

5. Select in allocation table "Enhanced Settings" > "Config...".




This dialog maps and enables / disables the pairs of logical antenna ports to the physical TX antennas (basebands).

### Mapping table

The mapping table is a matrix with number of rows equal to the number of physical TX antennas and number of columns equal of the number of antenna ports (AP). The available antenna ports depend on the current configuration.

| Channel/Signal | Antenna ports |
|---|---|
| xPDSCH | AP8 to AP15 |
| xPDSCH-DMRS | AP8 to AP15 |
| DL PCRS | AP60, AP61 |
| xPDCCH | AP107, AP109 |
| xPDCCH-DMRS | AP107, AP109 |
| xPBCH | AP0 to AP7 |
| BRS | AP0 to AP7 |
| CSI-RS (8 or 16 APs) | AP16 to AP23, or AP16 to AP31 |
| PSS, SSS, ESS | AP300 to AP313 |

**Settings:**



**Cell-Specific Antenna Port Mapping**
Defines the mapping of the logical antenna ports (AP) to the available physical TX antennas (basebands), see Chapter 3.5, "DL antenna port mapping settings", on page 53.

The default setting in the mapping table is selected to fit the current configuration but it can be changed.

Remote command:
[:SOURce<hw>]:BB:V5G:DL:APM:CS:AP<dir0>:ROW<st0> on page 111
[:SOURce<hw>]:BB:V5G:DL:APM:CS:CSIap:ROW<st0> on page 111
[:SOURce<hw>]:BB:V5G:DL:APM:CS:XSSap:ROW<st0> on page 112

**User-Specific Antenna Port Mapping**
Comprises the settings for defining the mapping of the logical APs to the available physical TX antennas.

**Mapping Coordinates ← User-Specific Antenna Port Mapping**
Switches between the "Cartesian (Real/Imag)" and "Cylindrical (Magn./Phase)" coordinates representation. To disable an antenna port, set its vector size to 0.

Remote command:
[:SOURce<hw>]:BB:V5G:DL:USER<ch>:APM:MAPCoordinates on page 113

**Mapping Table ← User-Specific Antenna Port Mapping**
Defines the mapping of the antenna ports (AP) to the physical antennas, see also Chapter 3.5, "DL antenna port mapping settings", on page 53.

Remote command:
[:SOURce<hw>]:BB:V5G:DL:USER<ch>:APM[:LAYer<user>]:AP<dir0>:ROW<st0>:REAL on page 113
[:SOURce<hw>]:BB:V5G:DL:USER<ch>:APM[:LAYer<user>]:AP<dir0>:ROW<st0>:IMAGinary on page 113

**CSI-RS-Specific Antenna Port Mapping in a Subframe**
Enables / disables antenna ports for the CSI-RS transmission in the subframe.

CSI-RS is transmitted on antenna ports AP 16 to AP 23 or AP 16 to AP 31 respectively. The antenna ports associated with CSI reference signals are paired into CSI-RS groups (CRGs). A CRG comprises two consecutive antenna ports starting from antenna port AP16.

Remote command:
[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:APM:CSIRs:AP<gr0>:ROW<user>:STATe on page 117

## 3.6 General UL settings

The "General UL Settings" dialog allows you to configure the V5GTF system for transmission direction uplink.

1. To access this dialog, select "General > Link Direction > Uplink"
2. Select "General > General Settings"

   The "General UL Settings" dialog consists of carrier aggregation (CA) tab.

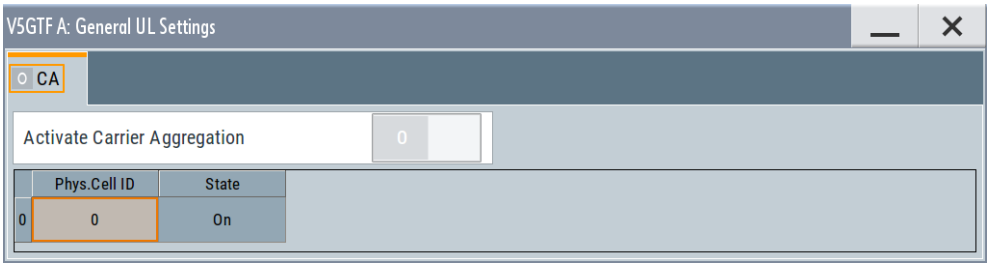



*Figure 3-2: Carrier aggregation dialog*

The dialog provides the configuration of supported serving cells.

**Activate Carrier Aggregation**
Not supported in the current version.

Remote command:
`[:SOURce<hw>]:BB:V5G:UL:CA:STATe?` on page 142

**Serving Cell Table**
The table provides the settings of serving cells that can be used for the carrier aggregation. The current software supports one serving cell.

**Physical Cell ID ← Serving Cell Table**
Specifies the physical cell ID of the corresponding serving cell.

Remote command:
`[:SOURce<hw>]:BB:V5G:UL:CA:CELL<ch0>:ID` on page 142

**State ← Serving Cell Table**
Activates/deactivates the component carrier/physical cell - not configurable in the current version.

Remote command:
`[:SOURce<hw>]:BB:V5G:UL:CA:CELL<ch0>:STATe?` on page 142

## 3.7 UL frame configuration

Access:

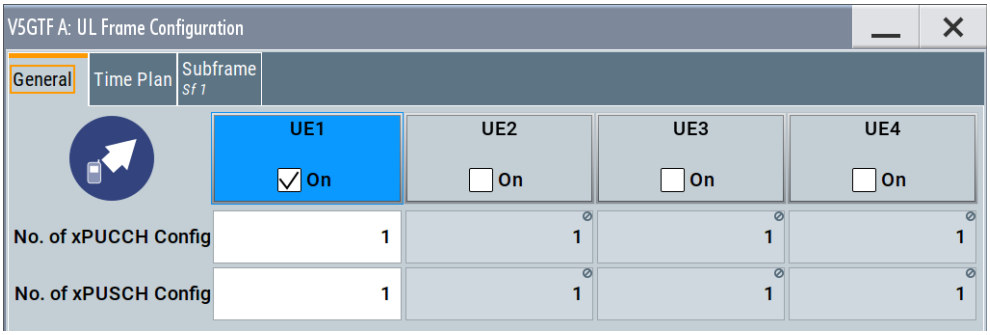
1. Select "General > Link Direction > Uplink"
2. Select "General > Frame Configuration".

   The "UL Frame Configuration" dialog allows you to configure the subframes and the OFDM resource allocations in uplink. The dialog consists of several tabs.

### 3.7.1 General frame configuration

Access:

1. Select "General > Link Direction > Uplink"
2. Select "General > Frame Configuration".
3. Select "UL Frame Configuration > General".




This dialog provides access to the user equipment settings and settings concerning the UL scheduling, like configuring the subframes and adjusting the xPUCCH/ xPUSCH scheduling.

**Settings:**



**UEx**
Accesses the User equipment configuration dialog for configuring the UE settings.

The check box activates or deactivates the selected UE.

**Note:** Disabling the UE deactivates its allocations: the reference signal, xPUSCH/ xPUCCH allocations are not transmitted.

Remote command:
`[:SOURce<hw>]:BB:V5G:UL:UE<st>:STATe` on page 143

**Number of xPUCCH/xPUSCH Configurations**
Sets the number of configurable subframes. It determines the scheduling cycle per UE in up to four frames.

All uplink subframes are filled periodically with the configured subframes. You can configure each UE in the User equipment configuration dialog.

The number of configurable subframes can be defined individually per xPUCCH and per xPUSCH. It enables the configuration of xPUCCH and xPUSCH with different repetition patterns independently.

**Example: Independent cycles for xPUSCH and xPUCCH of the same UE**

The xPUCCH of the UE has to be transmitted once a frame and the xPUSCH - once every eight subframes.

- In the "UL Frame Configuration > Number of Configurable Uplink Subframes" dialog, set "UE1 > xPUCCH" = 1
- In the "UL Frame Configuration > Number of Configurable Uplink Subframes" dialog, set "UE1 > xPUSCH" = 8
- Configure the xPUCCH and xPUSCH allocations of UE1 as required.

Remote command:

`[:SOURce<hw>]:BB:V5G:UL:UE<st>:CONSubframes:XPUCch` on page 143

`[:SOURce<hw>]:BB:V5G:UL:UE<st>:CONSubframes:XPUSch` on page 143

### 3.7.2 Time plan

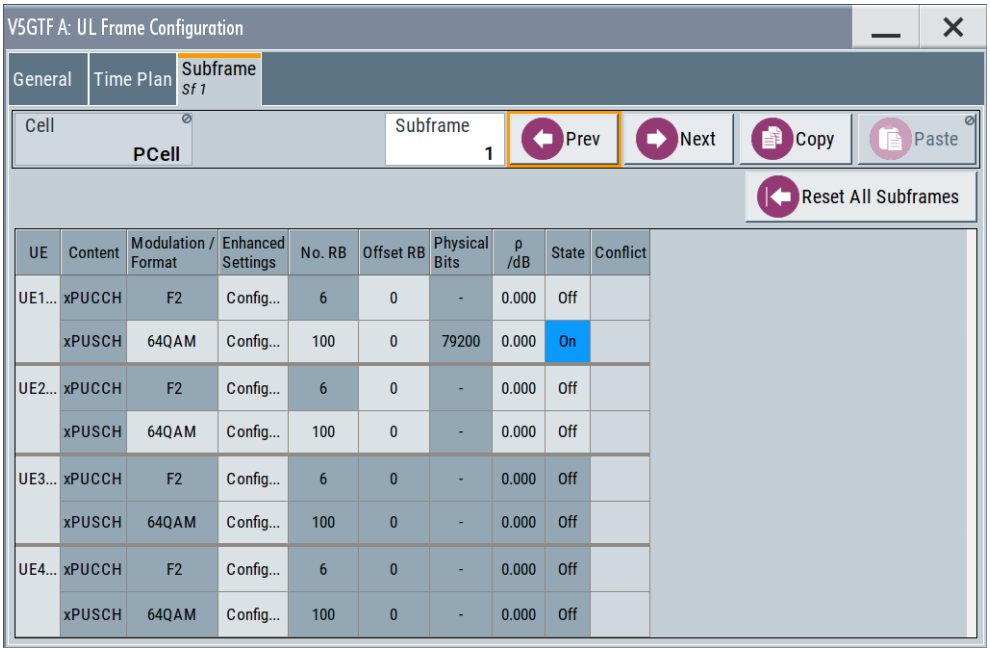
The description of time plan is covered in Chapter 3.8.2, "Time plan in UL", on page 77.

### 3.7.3 Subframe configuration

Access:

1. Select "General > Link Direction > Uplink".
2. Select "General > Frame Configuration".

3. Select "UL Frame Configuration > Subframe".

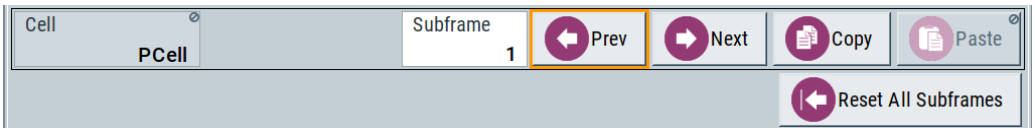



Provided are the settings for selecting and configuring the subframes. In the allocation table section, the individual allocation parameters for a subframe are set.



### 3.7.3.1 Subframe configuration control

This section explains the subframe configuration tools of frame configuration table.






**Cell**
In the current version, only primary cell is supported.

Remote command:
n.a

**Subframe**
Sets the subframe to be configured/displayed in the frame configuration table.

All uplink subframes are filled periodically with the configured subframes.

Subframes behind the configurable range of the corresponding UE or channel ("Number of xPUCCH/xPUSCH Configurations" on page 58) are displayed as read-only.

Remote command:
n.a.

**Next/Prev**
Navigates through the subframes.

Remote command:
n.a.

**Copy/Paste**
Copies/pastes the settings of the selected subframe.

Remote command:
n.a.

**Reset All Subframes**
Resets settings of all subframes to the default values.

Remote command:
`[:SOURce<hw>]:BB:V5G:UL:RSTFrame` on page 143

### 3.7.3.2 UL allocation table

In the resource allocation table, the individual allocation parameters for a subframe are set.

| UE | Content | Modulation / Format | Enhanced Settings | No. RB | Offset RB | Physical Bits | ρ /dB | State | Conflict |
|---|---|---|---|---|---|---|---|---|---|
| UE1... | xPUCCH | F2 | Config... | 6 | 0 | 96 | 0.000 | On | |
| | xPUSCH | 64QAM | Config... | 100 | 0 | 72000 | 0.000 | On | |
| UE2... | xPUCCH | F2 | Config... | 6 | 0 | 96 | 0.000 | On | ⚠ |
| | xPUSCH | 64QAM | Config... | 100 | 0 | 72000 | 0.000 | On | ⚠ |

**Settings:**

**UE**
Accesses the settings of the UE the selected allocation belongs to, see Chapter 3.7.5, "User equipment configuration", on page 70.

Remote command:
n.a.

**Content**
Displays the content type of an allocation.

Use the setting in dialog User equipment configuration to configure the xPUSCH data source.

Remote command:
`[:SOURce<hw>]:BB:V5G:UL[:SUBF<st0>]:ALLoc<ch0>:CONType` on page 148

**Modulation/Format**
For xPUSCH allocation, this parameter sets the modulation scheme (QPSK, 16QAM, 64QAM, or 256QAM) for the allocation.

For xPUCCH allocation, this parameter queries the xPUCCH format.

See also Table 2-4.

Remote command:
`[:SOURce<hw>]:BB:V5G:UL[:SUBF<st0>]:ALLoc<ch0>[:XPUSch]:MODulation` on page 149
`[:SOURce<hw>]:BB:V5G:UL[:SUBF<st0>]:ALLoc<ch0>[:XPUCch]:FORMat?` on page 149

**Enhanced Settings**
Accesses a dialog with further channel configuration settings. See Chapter 3.7.4, "Enhanced channel settings", on page 64.

Remote command:
n.a.

**No. RB**
Specifies the size of the selected allocation in resource blocks.

This parameter is read-only for xPUCCH transmission.

Remote command:
`[:SOURce<hw>]:BB:V5G:UL:SUBF<st0>:ALLoc<ch0>:XPUSch:RBCount` on page 149
`[:SOURce<hw>]:BB:V5G:UL[:SUBF<st0>]:ALLoc<ch0>:XPUCch:RBCount?` on page 149

**Offset RB**
Sets the resource block offset within the subframe of the selected allocation.

Remote command:
[:SOURce<hw>]:BB:V5G:UL[:SUBF<st0>]:ALLoc<ch0>:XPUCch:RBOFfset
on page 150
[:SOURce<hw>]:BB:V5G:UL[:SUBF<st0>]:ALLoc<ch0>:XPUSch:RBOFfset
on page 150

**Physical Bits/ Total Number of Physical Bits**
Displays the size of the selected allocation in bits. The value is set automatically according to the current allocation's settings. The xPUSCH bits are coded according to the Channel coding settings.

Remote command:
[:SOURce<hw>]:BB:V5G:UL[:SUBF<st0>]:ALLoc<ch0>:XPUCch:PHYSbits?
on page 150
[:SOURce<hw>]:BB:V5G:UL[:SUBF<st0>]:ALLoc<ch0>:XPUSch:PHYSbits?
on page 150

**Rho (Power)**
Sets the power ρ for the selected allocation, i.e. xPUSCH or xPUCCH power level.

The xPUSCH power level ($P_{xPUSCH}$) and the xPUCCH power level ($P_{xPUCCH}$) can vary per subframe.

For further power-related parameters, refer to:
- UE Power ($P_{UE}$) for global adjustment of the transmit power of the UE
- Rel. Power ($P_{UL\ PCRS}$) for boosting the reference signal

Remote command:
[:SOURce<hw>]:BB:V5G:UL[:SUBF<st0>]:ALLoc<ch0>:XPUCch:POWer
on page 151
[:SOURce<hw>]:BB:V5G:UL[:SUBF<st0>]:ALLoc<ch0>:XPUSch:POWer
on page 151

**State**
Sets the allocation to active or inactive state.

"On" Enables the allocation of the select UE.

"Off" Disables the allocation.
The xPUSCH/xPUCCH and the corresponding reference signals are deactivated.
Other allocations of the same UE are not affected.

Remote command:
[:SOURce<hw>]:BB:V5G:UL:SUBF<st0>:ALLoc<ch0>:XPUCch:STATe
on page 151
[:SOURce<hw>]:BB:V5G:UL:SUBF<st0>:ALLoc<ch0>:XPUSch:STATe
on page 151

**Conflict**
Indicates a conflict between UEs and in case an allocation exceeds the available number of resource blocks.

Remote command:
[:SOURce<hw>]:BB:V5G:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:XPUSch:CONFlict? on page 151
[:SOURce<hw>]:BB:V5G:UL[:SUBF<st0>]:ALLoc<ch0>:CONFlict? on page 151
[:SOURce<hw>]:BB:V5G:UL[:SUBF<st0>]:ALLoc<ch0>:XPUCch:CONFlict? on page 151

## 3.7.4 Enhanced channel settings

The configuration dialog displays the following uplink channels settings.

**Settings:**

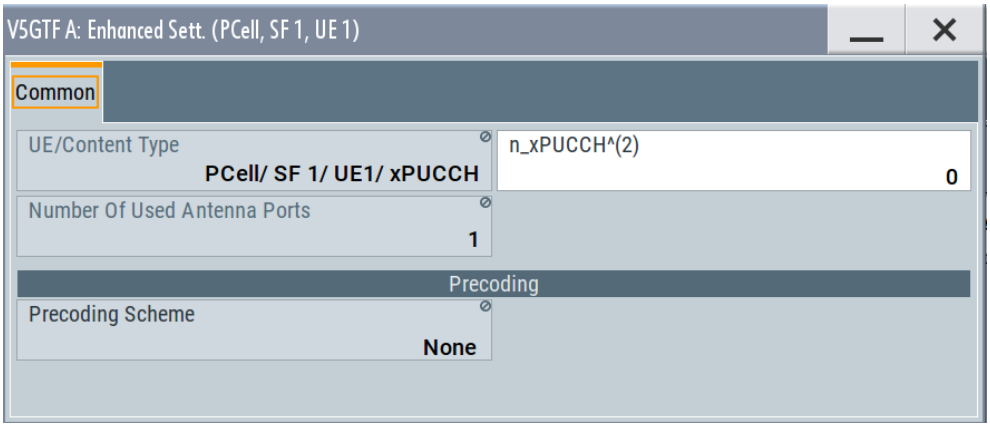


### 3.7.4.1 Enhanced xPUCCH settings

Access:

1. Select "General > Link Direction > Uplink".
2. Select "General > Frame Configuration".
3. Select "UL Frame Configuration > Subframe > Content > xPUCCH".
4. Select "Enhanced Settings > Configure".

   This dialog displays xPUCCH settings.




Provided are the following settings:

**Settings:**



**UE/Content Type**
Displays the cell, subframe, UE, and channel, for which the enhanced settings are displayed.

Remote command:
n.a.

**n_xPUCCH(2)**
Sets the frequency resource index of xPUCCH ($n_{xPUCCH}^{(2)}$). The value is indicated by UL DCI format.

Remote command:
`[:SOURce<hw>]:BB:V5G:UL[:SUBF<st0>]:ALLoc<ch0>:XPUCch:NXPucch`
on page 153

**Number of Used Antenna Ports**
Displays the number of antenna ports used for transmissions of the current xPUCCH format. To see the total number of antenna ports for xPUCCH transmission, refer to "Number of Antenna Ports for xPUCCH" on page 72

Remote command:
`[:SOURce<hw>]:BB:V5G:UL[:SUBF<st0>]:ALLoc<ch0>:XPUCch:NAPused?`
on page 152

**Precoding Scheme**
Selects the precoding scheme for xPUCCH.

- **"None"**: without precoding for single-antenna port transmission schemes
- **"Spatial Multiplexing"**: for up to 2 layer transmission scheme for Number of Antenna Ports for xPUCCH > 1

Remote command:
`[:SOURce<hw>]:BB:V5G:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:XPUCch:PRECoding:SCHeme?`
on page 152

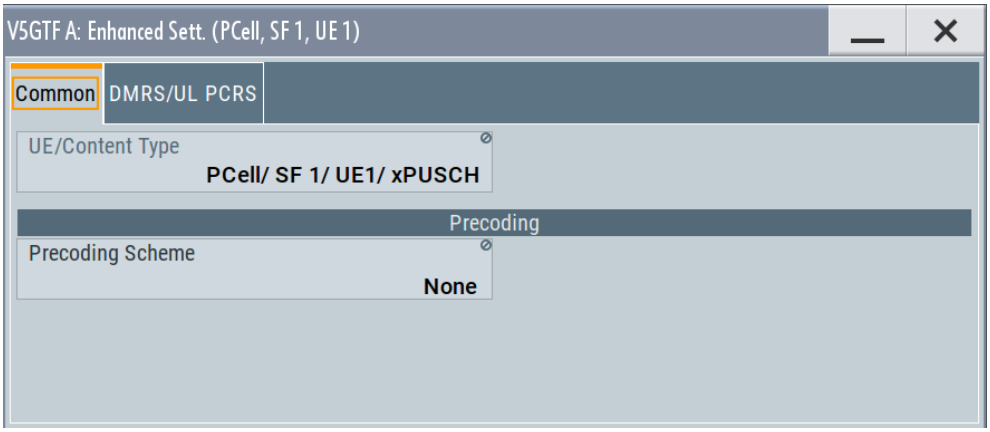
### 3.7.4.2 Common xPUSCH settings

This dialog allows you to define and configure xPUSCH parameters.

Access:

1. Select "General > Link Direction > Uplink".
2. Select "Frame Configuration > Subframe > Content > xPUSCH".
3. Select "UL Frame Configuration > Subframe > Content > xPUSCH".

4. Select "Enhanced Settings > Configure".
5. Select "Common".




The common settings comprise the following precoding and frequency hopping settings:

**UE/Content Type**
Displays the cell, subframe, UE, and channel, for which the enhanced settings are displayed.

Remote command:
n.a.

**Precoding Scheme**
Selects the precoding scheme for xPUSCH.

- **"None"**: without precoding for single-antenna port transmission schemes
- **"Spatial Multiplexing"**: for up to 2 layer transmission scheme for Number of Antenna Ports for xPUCCH > 1

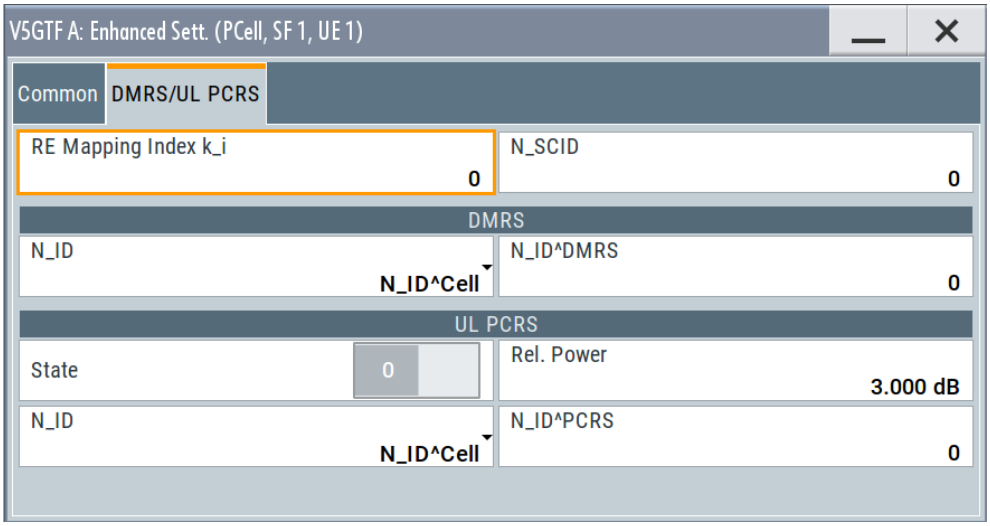
Remote command:
`[:SOURce<hw>]:BB:V5G:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:XPUSch:PRECoding:SCHeme?` on page 156

### 3.7.4.3 Reference signal settings

This dialog allows you to define and configure DMRS and PCRS parameters.

Access:

1. Select "General > Link Direction > Uplink".
2. Select "Frame Configuration > Subframe > Content > xPUSCH".
3. Select "Enhanced Settings > Configure".
4. Select "DMRS/UL PCRS".




**Settings:**



**RE Mapping Index k_i**
Sets the UL DCI format field resource element mapping index $k_i$ for DMRS/PCRS in uplink. Refer to the specification TS V5G.212, table 5.3.3.1.1-1 Number of layers and associated RE mapping index...

Remote command:
`[:SOURce<hw>]:BB:V5G:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:XPUSch:RMINdex` on page 156

**N_SCID**
Sets the scrambling identity $n_{SCID}$ of UE-specific reference signals associated with xPUSCH. The value is indicated by UL DCI format.

Remote command:
`[:SOURce<hw>]:BB:V5G:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:XPUSch:NSCid` on page 154

**N_ID**
Specifies the source of reference signal ID $n_{ID}$ for DMRS and PCRS associated with xPUSCH.

- For $N_{ID}^{Cell}$, the $n_{ID}$ value is configured via "Serving Cell Table" on page 57
- For $n_{ID}^{DMRS}$ and $n_{ID}^{PCRS}$, the corresponding $n_{ID}$ value is configured via "N_ID^DMRS / N_ID^PCRS" on page 68.

Remote command:
[:SOURce<hw>]:BB:V5G:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:XPUSch:DMRS:NID on page 153
[:SOURce<hw>]:BB:V5G:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:XPUSch:PCRS:NID on page 154

**N_ID^DMRS / N_ID^PCRS**
Specifies the demodulation reference signal ID $n_{ID}^{DMRS}$ and phase noise compensation reference signal ID $n_{ID}^{PCRS}$ associated with xPUSCH.

Remote command:
[:SOURce<hw>]:BB:V5G:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:XPUSch:DMRS:NIDDmrs on page 154
[:SOURce<hw>]:BB:V5G:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:XPUSch:PCRS:NIDPcrs on page 155

**State (UL PCRS)**
Enables or disables phase noise compensation reference signal ID $n_{ID}^{PCRS}$ associated with xPUSCH.

Remote command:
[:SOURce<hw>]:BB:V5G:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:XPUSch:PCRS:STATe on page 156

**Rel. Power**
Sets the power $P_{UL\ PCRS}$ relative to xPUSCH for the allocation type xPUSCH.

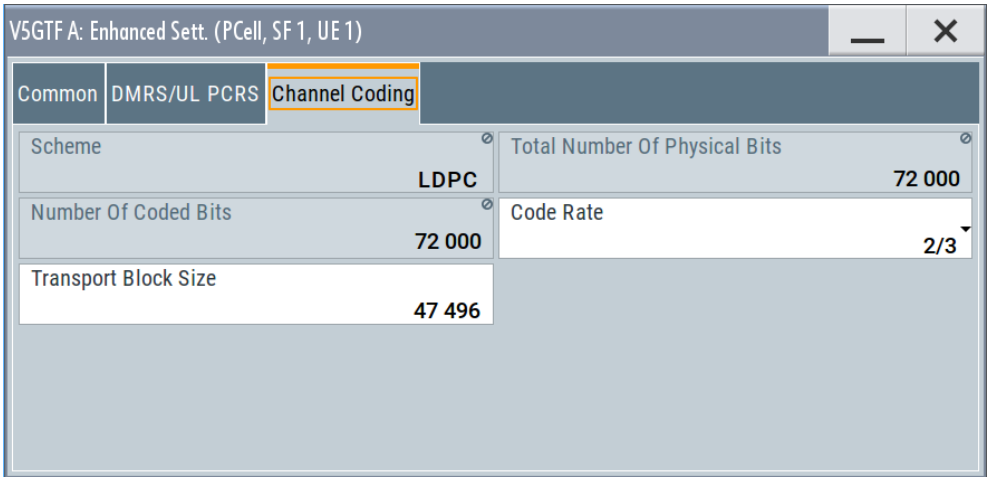
Remote command:
[:SOURce<hw>]:BB:V5G:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:XPUSch:PCRS:RPOWer on page 155

### 3.7.4.4 Channel coding settings

This dialog displays and configures coding and transport block size.

Access:

1. Select "General > Link Direction > Uplink".
2. Enable "Channel Coding and Multiplexing" in "User Equipment Configuration" dialog:
   a) Select "Frame Configuration > Subframe > UEx".
   b) Select "User Equipment Configuration > xPUSCH".
   c) Select "Channel Coding and Multiplexing > State > On".
3. Close "User Equipment Configuration" dialog.
4. Select "Frame Configuration > Subframe > Content > xPUSCH".
5. Select "Enhanced Settings > Configure".
6. Select "Channel Coding".




**Settings:**



**Scheme**
Sets the coding scheme to be used for user data transmission in uplink. This version supports only LDPC coding scheme.

Remote command:
n.a.

**Total Number of Physical Bits/ Number of Coded Bits**
The value corresponds to the number of physical bits of xPUSCH, see "Physical Bits/ Total Number of Physical Bits" on page 63.

Remote command:
n.a.

**Code Rate**
Sets the coding rate for LDPC or turbo coded blocks.

Remote command:
`[:SOURce<hw>]:BB:V5G:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:XPUSch:CCODing:CRATe` on page 157

**Transport Block Size**
Sets the size of the transport block per antenna port for user data transmission.

Remote command:
`[:SOURce<hw>]:BB:V5G:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:XPUSch:CCODing:TBSize` on page 157

### 3.7.5 User equipment configuration

Access:

1. Select "General > Link Direction > Uplink"
2. Select "General > Frame Configuration"
3. Select "UL Frame Configuration > General > UEx".

   You can configure up to four scheduled UEs and freely distribute them over the time.

The dialog consists of the following sections:

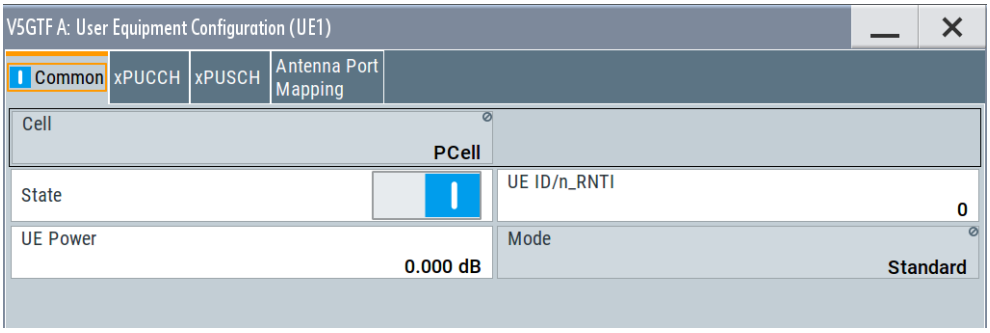


#### 3.7.5.1 Common settings

Access:

1. Select "General > Link Direction > Uplink"
2. Select "General > Frame Configuration"
3. Select "UL Frame Configuration > General > UEx".
4. Select "Common".

   The dialog enables/ disables the UE and configures its main settings.




**Settings:**

**Cell**
In the current version, only primary cell is supported.

Remote command:
n.a

**State**
Activates or deactivates the user equipment.

Disabling the UE deactivates its allocations: the reference signal and xPUSCH, xPUCCH allocations are not transmitted.

Remote command:
`[:SOURce<hw>]:BB:V5G:UL:UE<st>:STATe` on page 143

**UE ID/n_RNTI**
Sets the radio network temporary identifier (RNTI) of the UE.

Remote command:
`[:SOURce<hw>]:BB:V5G:UL:UE<st>:ID` on page 145

**UE Power**
Sets the power level of the selected UE ($P_{UE}$).

The $P_{UE}$ determines the power levels of the reference signals (DRMS and UL PCRS) and of the allocations, xPUSCH ($P_{xPUSCH}$) and xPUCCH ($P_{xPUCCH}$). Use the $P_{UE}$ for global adjustment of the transmit power of the UEs.

To vary the xPUSCH and xPUCCH power per subframe, refer to "Rho (Power)" on page 63.

Remote command:
`[:SOURce<hw>]:BB:V5G:UL:UE<st>:POWer` on page 145

**Mode**
Indicates whether the user equipment is in standard or in PRACH mode.

In the current version, only standard mode is supported.

Remote command:
`[:SOURce<hw>]:BB:V5G:UL:UE<st>:MODE?` on page 145

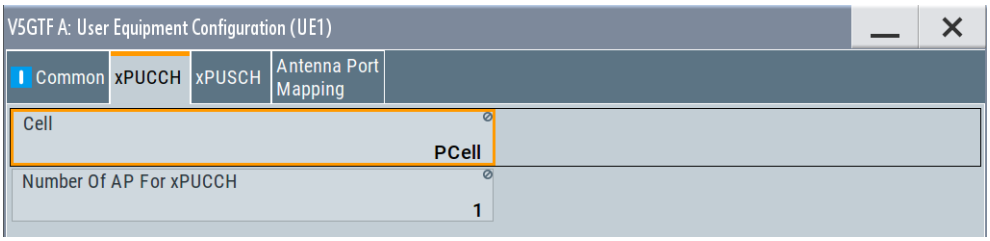
### 3.7.5.2 5G physical uplink control channel (xPUCCH)

The generation of LTE signals with UL-MIMO is an LTE-Advanced feature that requires the option R&S SMW-K85. xPUCCH is available in the primary cell (PCell) only.

Access:

1. Select "General > Link Direction > Uplink"
2. Select "General > Frame Configuration"
3. Select "UL Frame Configuration > General > UEx".
4. Select "xPUCCH".

The dialog displays the number of antenna ports used by xPUCCH.




Use the Enhanced channel settings dialog to adjust the additional xPUCCH settings.

**Settings:**

**Cell**
In the current version, only primary cell is supported.

Remote command:
n.a

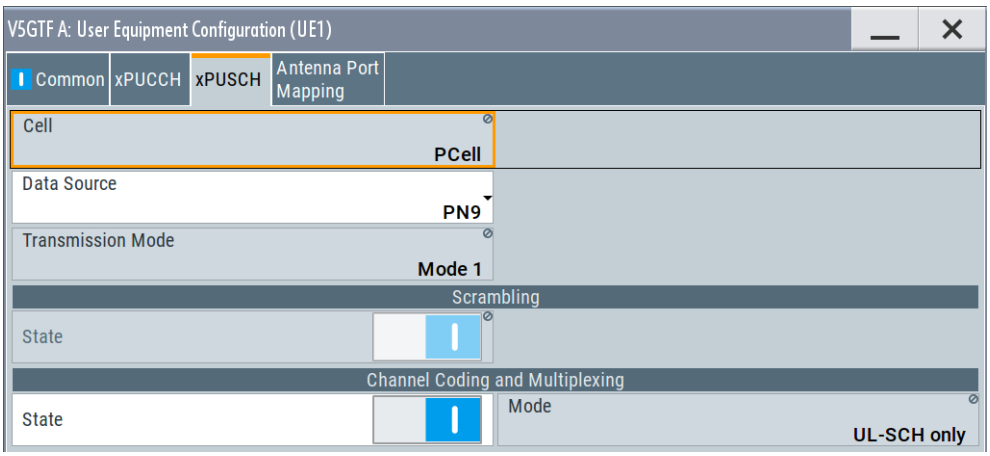
**Number of Antenna Ports for xPUCCH**
Specifies the number of antenna ports used for every xPUCCH transmission.

Remote command:
`[:SOURce<hw>]:BB:V5G:UL:UE<st>:XPUCch:NAPort?` on page 145

### 3.7.5.3 5G physical uplink shared channel (xPUSCH)

Access:

1. Select "General > Link Direction > Uplink"
2. Select "General > Frame Configuration"
3. Select "UL Frame Configuration > General > UEx".
4. Select "xPUSCH"



In this dialog, the data source for the xPUSCH can be selected and the channel coding can be configured. Use the Enhanced channel settings dialog to adjust the additional settings.

**Settings:**



**Cell**
In the current version, only primary cell is supported.

Remote command:
n.a

**Data Source**
Selects the data source for the xPUSCH allocation.

The following standard data sources are available:

- "All 0, All 1"
  An internally generated sequence containing 0 data or 1 data.
- "PNxx"
  An internally generated pseudo-random noise sequence.
- "Pattern"
  An internally generated sequence according to a bit pattern.
  Use the "Pattern" box to define the bit pattern.
- "Data List/Select DList"
  A binary data from a data list, internally or externally generated.
  Select "Select DList" to access the standard "Select List" dialog.
  - Select the "Select Data List > navigate to the list file *.dm_iqd > Select" to select an existing data list.
  - Use the "New" and "Edit" functions to create internally new data list or to edit an existing one.
  - Use the standard "File Manager" function to transfer external data lists to the instrument.

See also:

- Section "Modulation Data" in the R&S SMW user manual.
- Section "File and Data Management" in the R&S SMW user manual.
- Section "Data List Editor" in the R&S SMW user manual

Remote command:
`[:SOURce<hw>]:BB:V5G:UL:UE<st>[:CELL<ccidx>]:XPUSch:DATA`
on page 146
`[:SOURce<hw>]:BB:V5G:UL:UE<st>[:CELL<ccidx>]:XPUSch:PATTern`
on page 147
`[:SOURce<hw>]:BB:V5G:UL:UE<st>[:CELL<ccidx>]:XPUSch:DSELect`
on page 147

**Transmission Mode**
Specifies the xPUSCH transmission mode. The current version only supports "Mode 1" without spatial multiplexing.

Remote command:
`[:SOURce<hw>]:BB:V5G:UL:UE<st>[:CELL<ccidx>]:XPUSch:TXMode?`
on page 148

**State Scrambling (xPUSCH)**
Enables/disables scrambling for all xPUSCH allocations of the corresponding UE.

Remote command:
`[:SOURce<hw>]:BB:V5G:UL:UE<st>[:CELL<ccidx>]:XPUSch:SCRambling:STATe?`
on page 147

**State Channel Coding and Multiplexing (xPUSCH)**
Enables/disables channel coding and multiplexing of data and control information for all xPUSCH allocations of the corresponding UE.

If this parameter is disabled, the content retrieved from the Data Source is forwarded to the scrambler without any coding processing.

Remote command:
`[:SOURce<hw>]:BB:V5G:UL:UE<st>[:CELL<ccidx>]:XPUSch:CCODing:STATe`
on page 146

**Mode Channel Coding**
Defines the information transmitted on the xPUSCH.

| | |
|---|---|
| "UCI+UL-SCH" | Control information and data are multiplexed into the xPUSCH. |
| "UL-SCH" | Only data is transmitted on xPUSCH. |
| "UCI only" | Only uplink control information is transmitted on xPUSCH. |

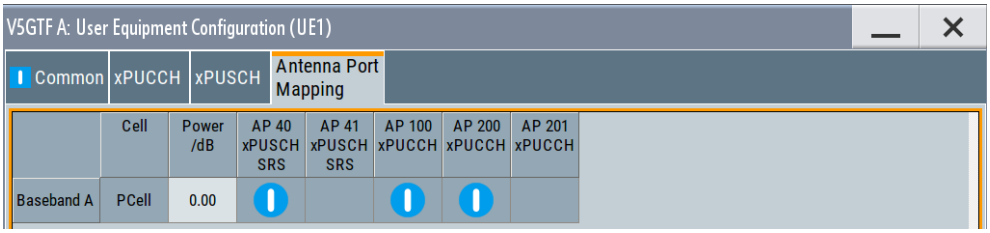
Remote command:
`[:SOURce<hw>]:BB:V5G:UL:UE<st>[:CELL<ccidx>]:XPUSch:CCODing:MODE?`
on page 146

### 3.7.5.4 Antenna port mapping

Access:

1. Select "General > Link Direction > Uplink"
2. Select "General > Frame Configuration"
3. Select "UL Frame Configuration > General > UEx".

4. Select "Antenna Port Mapping"




The "Antenna Port Mapping" settings define which baseband generates which antenna port.

**Settings:**



**Cell**
In the current version, only primary cell is supported.

Remote command:
n.a

**Power**
Applies a power offset to the selected cell.

Remote command:
`[:SOURce<hw>]:BB:V5G:UL:UE<st>:CELL<dir0>:ROW<ch0>:POFFset`
on page 144

**Antenna port mapping table**
The mapping table is a matrix with the following dimension:

- number of rows equal to the number of physical Tx antennas (Basebands)
- number of columns equal to the number of antenna ports (AP).

The available antenna ports depend on Number of Antenna Ports for xPUCCH.

The following table gives an overview of the available antenna port numbers as a function of the enabled "Number of Antenna Ports" per channel/signal.

***Table 3-5: Available antenna port numbers***

| **Number of antenna ports** | **1** | **2** |
|---|---|---|
| **Physical channel/signal** | | |
| xPUSCH | 40 | 40<br>41 |
| xPUCCH | 100 | 200<br>201 |
| SRS | 40 | 40<br>41 |

Per activated baseband, you can activate exactly one xPUSCH and one xPUCCH antenna port.

Remote command:
[:SOURce<hw>]:BB:V5G:UL:UE<st>:APMap:AP40Map:ROW<bbid>?
on page 144
[:SOURce<hw>]:BB:V5G:UL:UE<st>:APMap:AP41Map:ROW<bbid>?
on page 144
[:SOURce<hw>]:BB:V5G:UL:UE<st>:APMap:AP100Map:ROW<bbid>?
on page 144
[:SOURce<hw>]:BB:V5G:UL:UE<st>:APMap:AP200Map:ROW<bbid>?
on page 144
[:SOURce<hw>]:BB:V5G:UL:UE<st>:APMap:AP201Map:ROW<bbid>?
on page 144

## 3.8 Time plan

You can observe the current allocations of the resource block on the time plan. There are dedicated uplink and downlink time plans.

The time plan shows active channels and signals, the allocations of the active UEs and indicates the cell it applies for if a carrier aggregation is used. The time plan shows the allocation per used channel bandwidth and maximal 50 subframes. You can also scroll over all available subframes and open the time plan in a separate window.

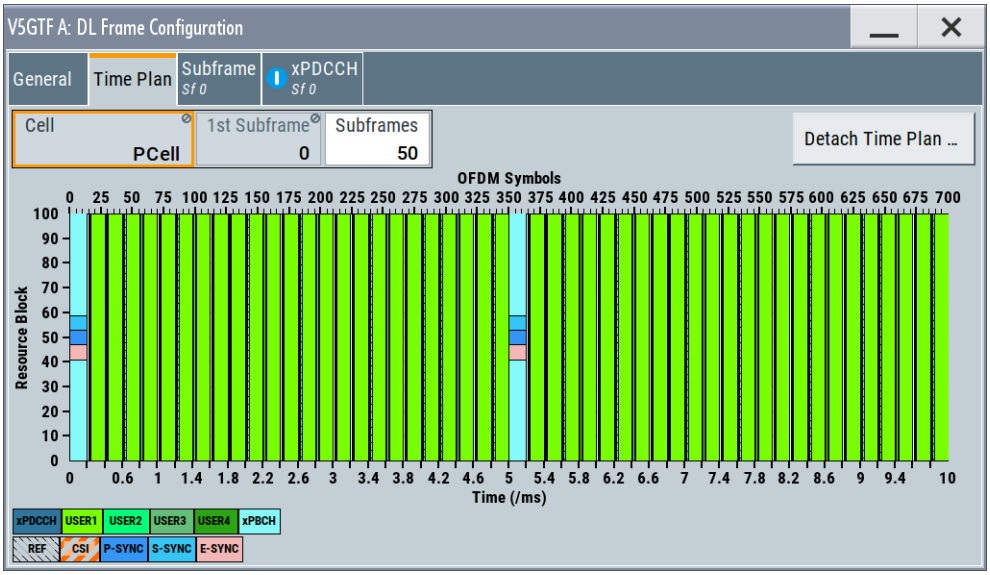


### 3.8.1 Time plan in DL

Access:

1. Select "General > Frame Configuration".
2. Select "DL Frame Configuration > Time Plan".

   The x-axis shows allocation in the time domain. The y-axis shows the resource blocks as smallest allocation granularity in the frequency domain. One allocation to a UE can span 1 to up to "No. of Resource Blocks" in the frequency domain.




**Settings**



**Cell**
In the current version, only primary cell is supported.

Remote command:
n.a

**First Subframe**
Selects the first subframe to be displayed.

Remote command:
n.a

**Subframes**
Selects the number of subframes to be displayed.

Remote command:
n.a

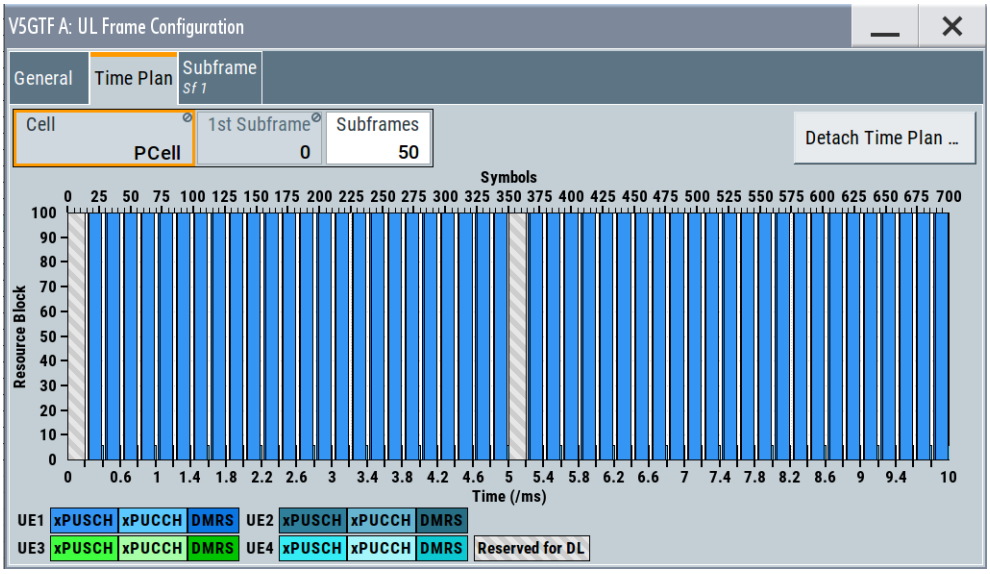
**Detach Time Plan**
Enlarges the time plan display in a separate window.

## 3.8.2 Time plan in UL

Access:

1. Select "General" > "Link Direction" > "Uplink".

2. Select "Frame Configuration" > "Time Plan".




This dialog shows the uplink time plan.

The x-axis shows allocation in the time domain. The y-axis shows the resource blocks as smallest allocation granularity in the frequency domain. One allocation of a UE can span 1 to up to "No. of Resource Blocks" in the frequency domain.

**Cell**
In the current version, only primary cell is supported.

Remote command:
n.a

**First Subframe**
Selects the first subframe to be displayed.

Remote command:
n.a

**Subframes**
Selects the number of subframes to be displayed.

Remote command:
n.a

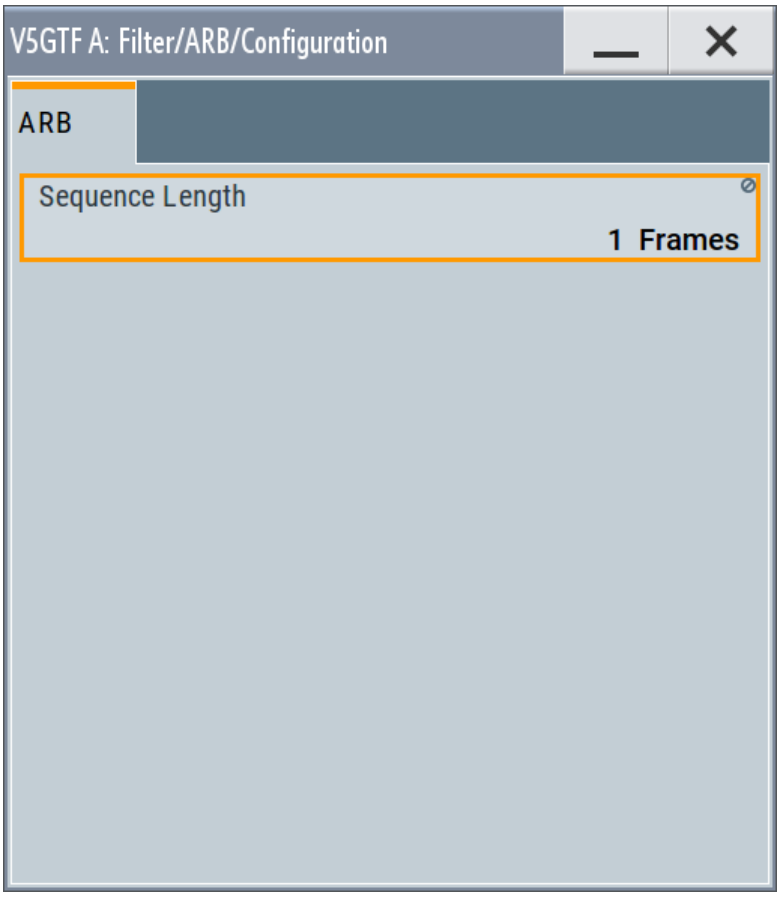
**Detach Time Plan**
Enlarges the time plan display in a separate window.

Remote command:
n.a

## 3.9 Filter/ARB settings

Access:

► Select "General" > "Filter/ARB/Configuration ...".




The dialog comprises the settings require for configuring the arbitrary waveform.

**Settings:**



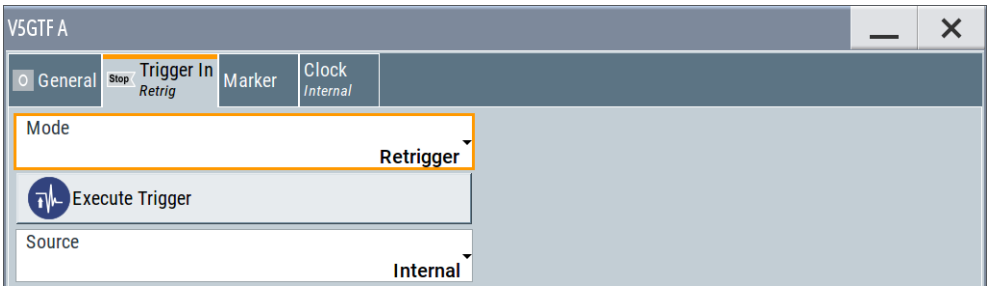
**ARB Sequence Length**
Queries the sequence length of the signal in number of frames. One frame corresponds to 10 ms. The signal is calculated in advance and output in the arbitrary waveform generator. The R&S SMW supports the sequence length of 1 frame.

Remote command:
`[:SOURce<hw>]:BB:V5G:SLENgth` on page 107

## 3.10 Trigger settings

Access:

► Select "Baseband" > "V5GTF" > "Trigger In".




This tab provides settings to select and configure the trigger, like trigger source, trigger mode and trigger delays, and to arm or trigger an internal trigger manually. The header of the tab displays the status of the trigger signal and trigger mode. As in the tabs "Marker" and "Clock", this tab provides also access to the settings of the related connectors.

**Routing and activating a trigger signal**

1. Define the effect of a trigger event and the trigger signal source.
   a) Select "Trigger In" > "Mode".
   b) Select "Trigger In" > "Source".
2. For external trigger signals, define the connector for signal input. See Chapter 3.13, "Local and global connectors settings", on page 88.
   You can map trigger signals to one or more USER x or T/M connectors.

   Local and global connectors settings allow you to configure the signal mapping, the polarity, the trigger threshold and the input impedance of the input connectors.
3. Activate baseband signal generation. In the block diagram, set "Baseband" > "On".

   The R&S SMW starts baseband signal generation after the configured trigger event.

**About baseband trigger signals**

This section focuses on the available settings.

For information on how these settings affect the signal, refer to section "Basics on ..." in the R&S SMW user manual.

**Settings:**

**Trigger settings common to all basebands**
To enable simultaneous signal generation in all basebands, the R&S SMW couples the trigger settings in the available basebands in any instrument's configuration involving signal routing with signal addition. For example, in MIMO configuration, routing and summing of basebands or of streams.

The icon indicates that common trigger settings are applied.

You can access and configure the common trigger source and trigger mode settings in any of the basebands. An arm or a restart trigger event applies to all basebands, too. You can still apply different delay to each of the triggers individually.

**Mode**
Selects trigger mode, i.e. determines the effect of a trigger event on the signal generation.

For more information, refer to chapter "Basics" in the R&S SMW user manual.

- "Auto"
  The signal is generated continuously.
- "Retrigger"
  The signal is generated continuously. A trigger event (internal or external) causes a restart.
- "Armed Auto"
  The signal is generated only when a trigger event occurs. Then the signal is generated continuously.
  An "Arm" stops the signal generation. A subsequent trigger event (internal or external) causes a restart.
- "Armed Retrigger"
  The signal is generated only when a trigger event occurs. Then the signal is generated continuously. Every subsequent trigger event causes a restart.
  An "Arm" stops signal generation. A subsequent trigger event (internal or external) causes a restart.
- "Single"
  The signal is generated only when a trigger event occurs. Then the signal is generated once to the length specified at "Signal Duration".
  Every subsequent trigger event (internal or external) causes a restart.

Remote command:
`[:SOURce<hw>]:BB:V5G[:TRIGger]:SEQuence` on page 158

**Signal Duration Unit**
Defines the unit for describing the length of the signal sequence to be output in the "Single" trigger mode.

Remote command:
[:SOURce<hw>]:BB:V5G:TRIGger:SLUNit on page 159

**Signal Duration**
Requires trigger "Mode" > "Single".

Enters the length of the trigger signal sequence.

Use this parameter, for example, for the following applications:
- To output the trigger signal partly.
- To output a predefined sequence of the trigger signal.

Remote command:
[:SOURce<hw>]:BB:V5G:TRIGger:SLENgth on page 159

**Running/Stopped**
With enabled modulation, displays the status of signal generation for all trigger modes.

- "Running"
  The signal is generated; a trigger was (internally or externally) initiated in triggered mode.
- "Stopped"
  The signal is not generated and the instrument waits for a trigger event.

Remote command:
[:SOURce<hw>]:BB:V5G:TRIGger:RMODe? on page 159

**Time Based Trigger**
Requires trigger "Mode" > "Armed Auto"/"Single".

Activates time-based triggering with a fixed time reference.

The R&S SMW triggers signal generation when its operating system time ("Current Time") matches a specified time trigger ("Trigger Time"). As trigger source, you can use an internal trigger or an external global trigger.

How to: Chapter "Time-based triggering" in the R&S SMW user manual.

Remote command:
[:SOURce<hw>]:BB:V5G:TRIGger:TIME[:STATe] on page 164

**Trigger Time**
Requires trigger "Mode" > "Armed Auto"/"Single".

Sets date and time for a time-based trigger signal.

Set a trigger time that is later than the "Current Time". The current time is the operating system time of the R&S SMW. If you set an earlier trigger time than the current time, time-based triggering is not possible.

How to: Chapter "Time-based triggering" in the R&S SMW user manual.

"Date" Sets the date of the time-based trigger in format YYYY-MM-DD.

Remote command:
[:SOURce<hw>]:BB:V5G:TRIGger:TIME:DATE on page 163

"Time" Sets the time of the time-based trigger in format hh:mm:ss.

Remote command:
[:SOURce<hw>]:BB:V5G:TRIGger:TIME:TIME on page 163

**Arm**
Stops the signal generation until subsequent trigger event occurs.

Remote command:
[:SOURce<hw>]:BB:V5G:TRIGger:ARM:EXECute on page 160

**Execute Trigger**
For internal trigger source, executes trigger manually.

Remote command:
[:SOURce<hw>]:BB:V5G:TRIGger:EXECute on page 160

**Source**
Selects the trigger source.

The following sources of the trigger signal are available:

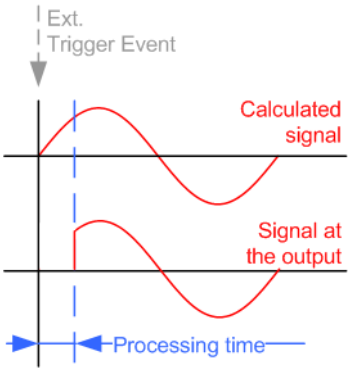
- "Internal"
  The trigger event is executed manually by the "Execute Trigger".
- "Internal (Baseband A/B)"
  The trigger event is provided by the trigger signal from the other basebands.
  If common trigger settings are applied, this trigger source is disabled.
- "External Global Trigger"
  The trigger event is the active edge of an external trigger signal provided and configured at the USER x connectors.
- "External Local Trigger"
  The trigger event is the active edge of an external trigger signal provided and configured at the local T/M/C connector.
  With coupled trigger settings, the signal has to be provided at the T/M/C1/2/3 connectors.
- "External Local Clock"
  The trigger event is the active edge of an external local clock signal provided and configured at the local T/M/C connector.
  With coupled trigger settings, the signal has to be provided at the T/M/C1 connector.

How to: "Routing and activating a trigger signal" on page 80

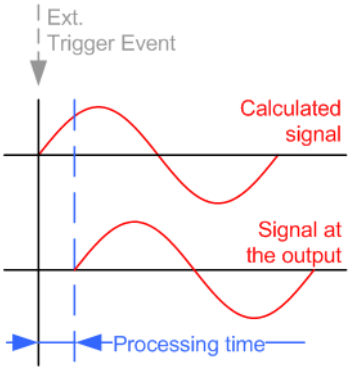
Remote command:
[:SOURce<hw>]:BB:V5G:TRIGger:SOURce on page 158

**Sync. Output to External Trigger/Sync. Output to Trigger**
Enables signal output synchronous to the trigger event.

- "On"
  Corresponds to the default state of this parameter.
  The signal calculation starts simultaneously with the trigger event. Because of the processing time of the instrument, the first samples are cut off and no signal is output. After elapsing of the internal processing time, the output signal is synchronous to the trigger event.




- "Off"
  The signal output begins after elapsing of the processing time. Signal output starts with sample 0. The complete signal is output.
  This mode is recommended for triggering of short signal sequences. Short sequences are sequences with signal duration comparable with the processing time of the instrument.




Remote command:
`[:SOURce<hw>]:BB:V5G:TRIGger:EXTernal:SYNChronize:OUTPut`
on page 160

**External Inhibit/Trigger Inhibit**
Applies for external trigger signal or trigger signal from the other path.

Sets the duration with that any following trigger event is suppressed. In "Retrigger" mode, for example, a new trigger event does not cause a restart of the signal generation until the specified inhibit duration does not expire.

For more information, see chapter "Basics" in the R&S SMW user manual.

Remote command:
`[:SOURce<hw>]:BB:V5G:TRIGger[:EXTernal]:INHibit` on page 163
`[:SOURce<hw>]:BB:V5G:TRIGger:OBASeband:INHibit` on page 162

**(External) Delay Unit**
Determine whatever the trigger delay is expressed in samples or directly defined as a time period (seconds).

To specify the delay, use the parameter (Specified) External Delay/(Specified) Trigger Delay.

The parameter Actual Trigger Delay/Actual External Delay displays the delay converted in time.

Remote command:
[:SOURce<hw>]:BB:V5G:TRIGger:DELay:UNIT on page 160

**(Specified) External Delay/(Specified) Trigger Delay**
The name of the parameter and the units the delay is expressed in, changes depending on the parameter (External) Delay Unit.

Delays the trigger event of the signal from:
- The external trigger source
- The other path
- The other basebands (internal trigger), if common trigger settings are used.

Use this setting to:
- Synchronize the instrument with the device under test (DUT) or other external devices
- Postpone the signal generation start in the basebands compared to each other

For more information, see chapter "Basics on ..." in the R&S SMW user manual.

The parameter displays the delay converted in time.

Remote command:
[:SOURce<hw>]:BB:V5G:TRIGger[:EXTernal]:DELay on page 162
[:SOURce<hw>]:BB:V5G:TRIGger:EXTernal:TDELay on page 162
[:SOURce<hw>]:BB:V5G:TRIGger:EXTernal:TDELay on page 162
[:SOURce<hw>]:BB:V5G:TRIGger:OBASeband:TDELay on page 161

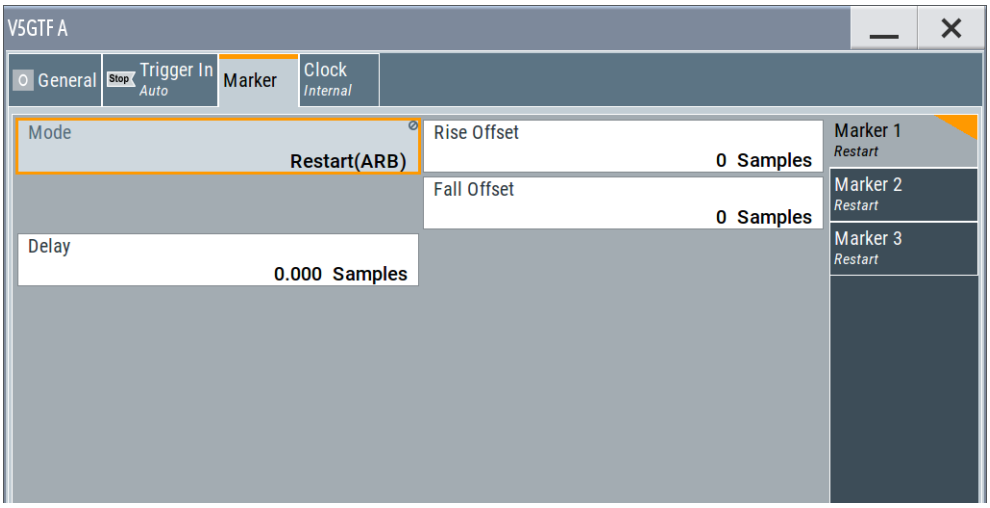
**Actual Trigger Delay/Actual External Delay**
Indicates the resulting trigger delay in "Time" unit.

Remote command:
[:SOURce<hw>]:BB:V5G:TRIGger:EXTernal:RDELay? on page 162
[:SOURce<hw>]:BB:V5G:TRIGger:OBASeband:RDELay? on page 161

## 3.11 Marker settings

Access:

► Select "Baseband" > "V5GTF" > "Marker".




This tab provides settings to select and configure the marker output signal including marker mode and marker delay.

**Routing and activating a marker signal**

1. To define the signal shape of an individual marker signal "x", select "Marker" > "Marker x" > "Mode".
2. Optionally, define the connector for signal output. See Chapter 3.13, "Local and global connectors settings", on page 88.
   You can map marker signals to one or more USER x or T/M connectors.
3. Activate baseband signal generation. In the block diagram, set "Baseband" > "On".

   The R&S SMW adds the marker signal to the baseband signal. Also, R&S SMW outputs this signal at the configured USER x connector.

**About marker output signals**

This section focuses on the available settings.

For information on how these settings affect the signal, refer to section "Basics on ..." in the R&S SMW user manual.

**Settings:**

**Mode**
Marker configuration for up to 3 markers. The settings are used to select the marker mode defining the shape and periodicity of the markers. The contents of the dialog change with the selected marker mode.

How to: "Routing and activating a marker signal" on page 86

"Restart (ARB)"
A marker signal is generated at the start of each ARB sequence.

Remote command:
`[:SOURce<hw>]:BB:V5G:TRIGger:OUTPut<ch>:MODE` on page 164

**Rise Offset/Fall Offset**
Shifts the rising or falling ramp of the marker by the selected number of samples. Positive values shift the rising ramp to later positions; negative values shift it to earlier positions.

Remote command:
`[:SOURce<hw>]:BB:V5G:TRIGger:OUTPut<ch>:FOFFset` on page 165
`[:SOURce<hw>]:BB:V5G:TRIGger:OUTPut<ch>:ROFFset` on page 165

**Delay**
Delays the marker signal at the marker output relative to the signal generation start.

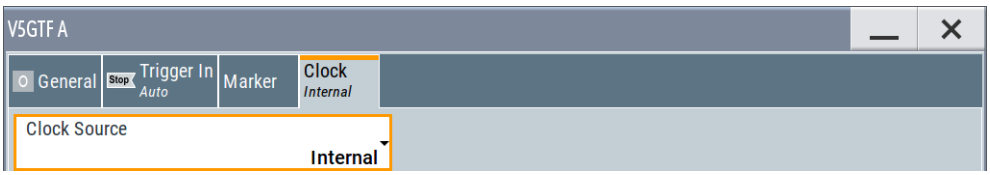
Variation of the parameter "Marker x" > "Delay" causes signal recalculation.

Remote command:
`[:SOURce<hw>]:BB:V5G:TRIGger:OUTPut<ch>:DELay` on page 165

## 3.12 Clock settings

Access:

► Select "Baseband" > "V5GTF" > "Clock".




This tab provides settings to select and configure the clock signal, like the clock source and clock mode.

**Defining the clock**

1. Select "Clock" > "Source" to define the source of clock signal.
2. For external clock signals, define the connector for signal input. See Chapter 3.13, "Local and global connectors settings", on page 88.
   You can map clock signals to one or more USER x or T/M connectors.

Local and global connectors settings allow you to configure the signal mapping, the polarity, the trigger threshold and the input impedance of the input connectors.

3. Activate baseband signal generation. In the block diagram, set "Baseband" > "On".

   The R&S SMW starts baseband signal generation with a symbol rate that equals the clock rate.

**About clock signals**

This section focuses on the available settings.

For information on how these settings affect the signal, refer to section "Basics on ..." in the R&S SMW user manual.

**Settings:**



**Clock Source**
Selects the clock source.

- "Internal"
  The instrument uses its internal clock reference.
- "External Local Clock"
  Option: R&S SMW-B10
  The instrument expects an external clock reference at the local T/M/C connector.

How to: "Defining the clock" on page 87

Remote command:
`[:SOURce<hw>]:BB:V5G:CLOCk:SOURce` on page 165

**Clock Mode**
Sets the type of externally supplied clock.

Remote command:
`[:SOURce<hw>]:BB:V5G:CLOCk:MODE` on page 166

**Measured External Clock**
Provided for permanent monitoring of the enabled and externally supplied clock signal.

Remote command:
`CLOCk:INPut:FREQuency?`

## 3.13 Local and global connectors settings

Accesses a dialog to configure local connectors or global connectors.

The button is available in the following dialogs or tabs:

- "Trigger / Marker / Clock" dialog that is accessible via the "TMC" block in the block diagram.

- "Trigger In", "Marker" and "Clock" tabs that are accessible via the "Baseband" block in the block diagram.


See also chapter "Local and global connectors settings" in the user manual.

# 4 Remote-control commands

The following commands are required to perform signal generation with the option R&S SMW-K118 in a remote environment. We assume that the R&S SMW has already been set up for remote operation in a network as described in the R&S SMW documentation. A knowledge about the remote control operation and the SCPI command syntax is assumed.

**Conventions used in SCPI command descriptions**

For a description of the conventions used in the remote command descriptions, see section "Remote Control Commands" in the R&S SMW user manual.

### Common Suffixes

The following common suffixes are used in the remote commands:

| Suffix | Value range | Description |
|---|---|---|
| `ENTity<ch>` | 1 to 4 | Entity in a multiple entity configuration with separate baseband sources<br>`ENTity3\|4` require option R&S SMW-K76 |
| `SOURce<hw>` | [1] to 4 | Available baseband signals<br>Only `SOURce1` possible, if the keyword `ENTity` is used |
| `OUTPut<ch>` | 1 to 3 | Available markers |

**Using SCPI command aliases for advanced mode with multiple entities**

You can address multiple entities configurations by using the SCPI commands starting with the keyword `SOURce` or the alias commands starting with the keyword `ENTity`.

Note that the meaning of the keyword `SOURce<hw>` changes in the second case.

For details, see section "SCPI Command Aliases for Advanced Mode with Multiple Entities" in the R&S SMW user manual.

## 4.1 Programming examples

The following sections provide programming examples for the Verizon 5G technical forum options.

The purpose of the examples is to present **all** commands for a given task. In real applications, one would rather reduce the examples to an appropriate subset of commands.

The programming examples have been tested with a software tool which provides an environment for the development and execution of remote tests. To keep the example as simple as possible, only the "clean" SCPI syntax elements are reported. Non-executable command lines (e.g. comments) start with two // characters.

At the beginning of the most remote control program, an instrument reset is recommended to set the instrument to a definite state. The commands `*RST` and `SYSTem:PRESet` are equivalent for this purpose. `*CLS` also resets the status registers and clears the output buffer.



### 4.1.1 Performing general tasks

The V5GTF options are programmed as follows:

- The application is controlled by SCPI commands with the following syntax: `...:BB:V5G:....`
- After a `*RST`, the V5GTF signal is switched off.
  To activate the V5GTF signal, use `SOURce1:BB:V5G:STATe ON`.
  Query the cell state using `SOURce1:BB:V5G:STATe?`. The result `1` indicates that the V5GTF signal is available.

#### 4.1.1.1 Initialization

```
// ***************************************************************************
// Initial system-reset
// ***************************************************************************
*RST; *OPC?
*CLS; *OPC?
syst:err?

// ***************************************************************
// Save and recall settings
// ***************************************************************
SOURce1:BB:V5G:SETTing:STORe "/var/user/v5g_dl_1"
```

```
*RST
SOURce1:BB:V5G:SETTing:CATalog?
SOURce1:BB:V5G:SETTing:LOAD "/var/user/v5g_ul_1"
SOURce1:BB:V5G:SETTing:DEL "v5g_dl_2"
```

### 4.1.2 General settings

```
// *****************************************************************
// Set to default, load predefined configuration.
// *****************************************************************
SOURce1:BB:V5G:PRESet
SOURce1:BB:V5G:SETTing:PCONfiguration:CATalog?
// Downlink_Config_1,Downlink_Config_2,Downlink_Config_3,Downlink_Config_4,
// Uplink_Config_1,Uplink_Config_2,Uplink_Config_3,Uplink_Config_4
SOURce1:BB:V5G:SETTing:PCONfiguration "Downlink_Config_1"

// *****************************************************************
// Set frequency and level, switch on the signal,
// query the signal length, create  a waveform file.
// *****************************************************************
SOURce1:FREQuency:CW 2800000000
SOURce1:POWer:POWer -50
SOURce1:BB:V5G:STATe ON
SOURce1:BB:V5G:SLENgth?
SOURce1:BB:V5G:WAVeform:CREate "/var/user/wv_v5g_dl_1"
```

### 4.1.3 Downlink settings

```
// *****************************************************************
// Set downlink signal to simulate 5GNB. Set manual scheduling.
// *****************************************************************
SOURce1:BB:V5G:LINK DOWN
SOURce1:BB:V5G:DL:CONF:MODE MAN
```

This section covers the following further settings:



#### 4.1.3.1 Carrier aggregation settings

```
// *****************************************************************
// Select downlink direction, query the states of carrier
```

```
// aggregation and serving cells.
// *****************************************************************
SOURce1:BB:V5G:LINK DOWN
SOURce1:BB:V5G:DL:CA:STATe?
// Response:  0
SOURce1:BB:V5G:DL:CA:CELL0:STATe?
// Response:  1

// *****************************************************************
// Set cell ID and enhanced settings: CSI ID and power
// level of reference signal. Query carrier aggregation
// status, time delay, frequency offset, and power offset.
// *****************************************************************
SOURce1:BB:V5G:DL:CA:CELL0:ID 204
SOURce1:BB:V5G:DL:CA:CELL0:NIDCsi 204
SOURce1:BB:V5G:DL:CSIS:CELL0:POW 0.5
SOURce1:BB:V5G:DL:CA:STATe?
// Response: 0
SOURce1:BB:V5G:DL:CA:CELL0:TDELay?
// Response: 0
SOURce1:BB:V5G:DL:CA:CELL0:DFReq?
// Response: 0
SOURce1:BB:V5G:DL:CA:CELL0:POFFset?
// Response: 0
```

#### 4.1.3.2 Signals settings

```
// *****************************************************************
// Set power of all synchronization channels.
// *****************************************************************
SOURce1:BB:V5G:DL:SYNC:PPOWer 10
SOURce1:BB:V5G:DL:SYNC:SPOWer 10
SOURce1:BB:V5G:DL:SYNC:EPOWer 10

// *****************************************************************
// Set the number of antenna ports for the BRS
// transmission and its periodicity.
// *****************************************************************
SOURce1:BB:V5G:DL:BRS:NAP AP2
SOURce1:BB:V5G:DL:BRS:BTRPeriod P01
```

#### 4.1.3.3 Antenna port configuration

```
// *****************************************************************
// Map the logical antenna ports to the physical antennas
// for xPBCH, BRS, CSI-RS and synchronization signals.
// *****************************************************************
SOURce1:BB:V5G:DL:USER1:APM:CS:AP0:ROW0 1
```

```
SOURce1:BB:V5G:DL:USER1:APM:CS:CSIap:ROW0 1
SOURce1:BB:V5G:DL:USER1:APM:CS:XSSap:ROW0 1
```

#### 4.1.3.4 Frame configuration

```
// ***************************************************************
// Reset frame configuration to default, set
// number of configurable subframes.
// ***************************************************************
SOURce1:BB:V5G:DL:RSTFrame
SOURce1:BB:V5G:DL:CONSubframes 24
```

#### 4.1.3.5 User configuration

```
// ***************************************************************
// Enable user one. Configure antenna ports using Cartesian
// mapping: set real and imaginary values for xPDSCH,
// DL PCRS and xPDDCH. Query the scrambling state, coding state
// and transmission mode of the user. Set UE ID and specify user
// data manually.
// ***************************************************************
SOURce1:BB:V5G:DL:USER1:STATe 1
SOURce1:BB:V5G:DL:USER2:STATe 0
SOURce1:BB:V5G:DL:USER3:STATe 0
SOURce1:BB:V5G:DL:USER4:STATe 0
SOURce1:BB:V5G:DL:USER1:APM:MAPCoordinates CART
SOURce1:BB:V5G:DL:USER1:APM:LAYer1:AP8:ROW0:REAL 1
SOURce1:BB:V5G:DL:USER1:APM:LAYer1:AP8:ROW0:IMAGinary 0
SOURce1:BB:V5G:DL:USER1:APM:LAYer1:AP60:ROW0:REAL 1
SOURce1:BB:V5G:DL:USER1:APM:LAYer1:AP60:ROW0:IMAGinary 0
SOURce1:BB:V5G:DL:USER1:APM:LAYer1:AP107:ROW0:REAL 1
SOURce1:BB:V5G:DL:USER1:APM:LAYer1:AP107:ROW0:IMAGinary 0
SOURce1:BB:V5G:DL:USER1:SCRambling:STATe?
SOURce1:BB:V5G:DL:USER1:CCODing:STATe?
SOURce1:BB:V5G:DL:USER1:CELL0:TXM?
SOURce1:BB:V5G:DL:USER1:UEID 1
SOURce1:BB:V5G:DL:USER1:DATA PATT
SOURce1:BB:V5G:DL:USER1:PATTern #H0E5A,13
```

#### 4.1.3.6 Subframe configuration

```
// ***************************************************************
// Enable xPBCH in subframe 0. Query allocation conflicts.
// ***************************************************************
SOURce1:BB:V5G:DL:SUBF0:ALLoc0:STATe 1
SOURce1:BB:V5G:DL:SUBF0:ALLoc0:CONFlict?

// ***************************************************************
```

```
// Specify four allocations in subframe 1. Enable xPDCCH channel.
// Query allocation conflicts.
// *********************************************************************
SOURce1:BB:V5G:DL:SUBF1:ALCount 4
SOURce1:BB:V5G:DL:SUBF1:ALLoc0:STATe 1
SOURce1:BB:V5G:DL:SUBF1:ALLoc0:CONFlict?

// *********************************************************************
// For the second allocation use CSI-RS, enable channel.
// Use antenna ports 16/17 and 24/25. Query allocation conflicts
// *********************************************************************
SOURce1:BB:V5G:DL:SUBF1:ALLoc1:CONType CSI
SOURce1:BB:V5G:DL:SUBF1:ALLoc1:STATe 1
SOURce1:BB:V5G:DL:SUBF1:ALLoc1:APM:CSIRs:AP16:ROW1:STATe 1
SOURce1:BB:V5G:DL:SUBF1:ALLoc1:APM:CSIRs:AP24:ROW1:STATe 1
SOURce1:BB:V5G:DL:SUBF1:ALLoc1:CONFlict?

// *********************************************************************
// For the third allocation use xPDSCH,  set power, enable
// channel. Assign user 1, set used modulation, resource block,
// enable automatic offset calculation.
// Query the size in symbols, offset in RB, offset in symbols,
// physical bits, and allocation conflicts.
// *********************************************************************
SOURce1:BB:V5G:DL:SUBF1:ALLoc2:CONType XPDS
SOURce1:BB:V5G:DL:SUBF1:ALLoc2:POWer 0
SOURce1:BB:V5G:DL:SUBF1:ALLoc2:STATe 1
SOURce1:BB:V5G:DL:SUBF1:ALLoc2:DATA USER1
SOURce1:BB:V5G:DL:SUBF1:ALLoc2:MODulation QAM64
SOURce1:BB:V5G:DL:SUBF1:ALLoc2:RBCount 8
SOURce1:BB:V5G:DL:SUBF1:ALLoc2:AOC 1
SOURce1:BB:V5G:DL:SUBF1:ALLoc2:SYMCount?
SOURce1:BB:V5G:DL:SUBF1:ALLoc2:RBOFfset?
SOURce1:BB:V5G:DL:SUBF1:ALLoc2:SYMoffset?
SOURce1:BB:V5G:DL:SUBF1:ALLoc2:PHYSbits?
SOURce1:BB:V5G:DL:SUBF1:ALLoc2:CONFlict?

// *********************************************************************
// Finally allocate user 2. Use N_SCID 1, antenna port 61.
// Set PCRS relative power. Query the size in symbols,
// offset in RB, offset in symbols, physical bits,
// precoding scheme, precoding layers, and allocation
// conflicts.
// *********************************************************************
SOURce1:BB:V5G:DL:SUBF1:ALLoc3:CONType XPDS
SOURce1:BB:V5G:DL:SUBF1:ALLoc3:POWer 0
SOURce1:BB:V5G:DL:SUBF1:ALLoc3:STATe 1
SOURce1:BB:V5G:DL:SUBF1:ALLoc3:DATA USER2
SOURce1:BB:V5G:DL:SUBF1:ALLoc3:MODulation QAM64
SOURce1:BB:V5G:DL:SUBF1:ALLoc3:RBCount 4
```

```
SOURce1:BB:V5G:DL:SUBF1:ALLoc3:AOC 1
SOURce1:BB:V5G:DL:SUBF1:ALLoc3:SYMCount?
SOURce1:BB:V5G:DL:SUBF1:ALLoc3:RBOFfset?
SOURce1:BB:V5G:DL:SUBF1:ALLoc3:SYMoffset?
SOURce1:BB:V5G:DL:SUBF1:ALLoc3:PHYSbits?
SOURce1:BB:V5G:DL:SUBF1:ALLoc3:PRECoding:SCHeme?
SOURce1:BB:V5G:DL:SUBF1:ALLoc3:PRECoding:LCOunt?
SOURce1:BB:V5G:DL:SUBF1:ALLoc3:PRECoding:AP?
SOURce1:BB:V5G:DL:SUBF1:ALLoc3:CONFlict?

// ****************************************************************
// Configure enhanced settings for user 2 and 3: set scrambling
// cell ID N_SCID, N_ID sources and N_IDs for DMRS and PCRS,
// set antenna port for PCRS, and PCRS relative power.
// Query precoding scheme, the scrambling state and ID.
// ****************************************************************
SOURce1:BB:V5G:DL:SUBF1:ALLoc2:XPDSch:NSCid 0
SOURce1:BB:V5G:DL:SUBF1:ALLoc2:XPDSch:DMRS:NID DMRS
SOURce1:BB:V5G:DL:SUBF1:ALLoc2:XPDSch:DMRS:NIDDmrs 0
SOURce1:BB:V5G:DL:SUBF1:ALLoc2:XPDSch:PCRS:NID PCRS
SOURce1:BB:V5G:DL:SUBF1:ALLoc2:XPDSch:PCRS:NIDPcrs 0
SOURce1:BB:V5G:DL:SUBF1:ALLoc2:XPDSch:PCRS:APConf A01
SOURce1:BB:V5G:DL:SUBF1:ALLoc2:XPDSch:PCRS:RPOWer 0
SOURce1:BB:V5G:DL:SUBF1:ALLoc2:PRECoding:SCHeme?
SOURce1:BB:V5G:DL:SUBF1:ALLoc2:SCRambling:STATe?
SOURce1:BB:V5G:DL:SUBF1:ALLoc2:SCRambling:UEID?

SOURce1:BB:V5G:DL:SUBF1:ALLoc3:XPDSch:NSCid 1
SOURce1:BB:V5G:DL:SUBF1:ALLoc3:XPDSch:PCRS:APConf A10
SOURce1:BB:V5G:DL:SUBF1:ALLoc3:XPDSch:PCRS:RPOWer 0
SOURce1:BB:V5G:DL:SUBF1:ALLoc3:PRECoding:SCHeme?
SOURce1:BB:V5G:DL:SUBF1:ALLoc3:SCRambling:STATe?
SOURce1:BB:V5G:DL:SUBF1:ALLoc3:SCRambling:UEID?
```

#### 4.1.3.7 xPDCCH configuration

```
// ****************************************************************
// Configure xPDCCH: set power, xREGs. Set used pattern manually.
// ****************************************************************
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:POWer 5
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:DCRegs:TRSource DATA
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:DCRegs:DATA PATT
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:DCRegs:PATTern #H0E5A,13

// ****************************************************************
// Reset the DCI table. Configure DCI table in subframe 1, row 0:
// set user. Query n_RNTI and cell index. Set DCI and xPDCCH format.
// Query the number of CCEs. Set xPDCCH symbol and CCE start index.
// Query the number of dummy CCEs.
```

```
// ****************************************************************
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:RES
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:USER USER1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:UEID?
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:CELL?
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIFmt FA1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:PFMT 0
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:NCCes?
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:SYMBol 1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:CINDex 0
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:NDCCes?

// ****************************************************************
// Configure the content of DCI format A1: last xPUSCH symbol,
// transmission timing offset I, resource block assignment,
// HARQ process number, MCS, new data indicator, CSI/BSI/BRI
// request including transmission timing,
// symbol and process of CSI-RS/BRRS.
// Enable UCI on xPUSCH and beam switch indication.
// Specify SRS request and SRS mapping. Set RE mapping
// index for DMRS/PCRS, N_SCID, precoding matrix indicator,
// TPC command for xPUCCH, and UL dual PCRS.
// ****************************************************************
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:XPRange S12
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:TRTiming 0
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:RBA 0
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:HPN 0
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:MCSR 10
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:NDI ON
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:CBBRequest CSIRs
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:CTRTiming 0
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:CBSYmbol S12
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:CBPRocess P0
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:UCIind ON
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:BSI ON
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:SRSRequest C0
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:SRSSymbol S13
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:REMap 0
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:NSCid 0
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:PMI 0
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:TPC 1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:ULPCrs 0

// ****************************************************************
// Configure the content of DCI format B1: set DCI format,
// xPDSCH start and end, resource block assignment,
// HARQ process number, MCS, new data indicator, redundancy
// version, BMI for HARQ-ACK, CSI/BSI/BRI request including
// transmission timing, symbol and process of CSI-RS/BRRS.
// Enable beam switch indication.
```

```
// Specify SRS request and SRS mapping.
// Set AP and number of layers indication, N_SCID,
// TPC command for xPUCCH, and UL dual PCRS.
// ****************************************************************
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIFmt FB1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:XPSTart S2
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:XPENd S13
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:RBA 0
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:HPN 0
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:MCSR 10
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:NDI ON
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:RV  0
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:BMI 0
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:CBBRequest CSIRs
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:CTRTiming 0
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:CBSYmbol S12
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:CBPRocess P0
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:UTRTiming 0
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:UFRI 0
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:BSI ON
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:SRSRequest C0
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:SRSSymbol S13
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:APNLayer 1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:NSCid 0
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:TPC 1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:DLPCrs AP6061

// ****************************************************************
// Query bit data.
// ****************************************************************
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:DCIConf:BITData?

// ****************************************************************
// Append a row in the DCI table, check conflicts. Move the second
// row up. Insert a row into the second position.
// ****************************************************************
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:APPend
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:ITEM0:CONFlict?
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:SIT 1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:UP
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:SIT 0
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:INS

// ****************************************************************
// Append the row three from the DCI table.
// ****************************************************************
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:SIT 2
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDCh:EXTC:DEL
```

### 4.1.4 Uplink settings

```
// ***************************************************************
// Set downlink signal to simulate UE.
// ***************************************************************
SOURce1:BB:V5G:LINK UP
```

This section covers the following further settings:



#### 4.1.4.1 Carrier aggregation settings

```
// ***************************************************************
// Select uplink direction, query the states of carrier
// aggregation and serving cells.
// ***************************************************************
SOURce1:BB:V5G:LINK UP
SOURce1:BB:V5G:UL:CA:STATe?
// Response:  0
SOURce1:BB:V5G:UL:CA:CELL0:STATe?
// Response:  1
```

#### 4.1.4.2 UL allocation settings

```
// ***************************************************************
// Enable UE1 and UE2. Set the number of configurable subframes.
// ***************************************************************
SOURce1:BB:V5G:UL:UE1:STATe 1
SOURce1:BB:V5G:UL:UE2:STATe 1
SOURce1:BB:V5G:UL:UE1:CONSubframes:XPUCch 1
SOURce1:BB:V5G:UL:UE1:CONSubframes:XPUSch 8
SOURce1:BB:V5G:UL:UE2:CONSubframes:XPUCch 2
SOURce1:BB:V5G:UL:UE2:CONSubframes:XPUSch 10

// ***************************************************************
// Reset all subframes.
// ***************************************************************
SOURce1:BB:V5G:UL:RSTFrame

// ***************************************************************
// Specify UE1 allocations for xPUCCH and xPUSCH: query content
// type, query the modulation format of xPUCCH.
// Set the modulation of xPUSCH. Specify number of RB, RB offset,
// physical bits, power. Enable allocations. Query conflicts.
// ***************************************************************
SOURce1:BB:V5G:UL:SUBF1:ALLoc0:CONType?
SOURce1:BB:V5G:UL:SUBF1:ALLoc0:XPUCch:FORMat?
```

```
SOURce1:BB:V5G:UL:SUBF1:ALLoc0:XPUCch:RBCount?
SOURce1:BB:V5G:UL:SUBF1:ALLoc0:XPUCch:RBOFfset 8
SOURce1:BB:V5G:UL:SUBF1:ALLoc0:XPUCch:PHYSbits?
SOURce1:BB:V5G:UL:SUBF1:ALLoc0:XPUCch:POWer -65
SOURce1:BB:V5G:UL:SUBF1:ALLoc0:XPUCch:STATe ON
SOURce1:BB:V5G:UL:SUBF1:ALLoc0:XPUCch:CONFlict?

SOURce1:BB:V5G:UL:SUBF1:ALLoc0:XPUSch:MODulation QAM256
SOURce1:BB:V5G:UL:SUBF1:ALLoc0:XPUSch:RBCount 40
SOURce1:BB:V5G:UL:SUBF1:ALLoc0:XPUSch:RBOFfset 8
SOURce1:BB:V5G:UL:SUBF1:ALLoc0:XPUSch:PHYSbits?
SOURce1:BB:V5G:UL:SUBF1:ALLoc0:XPUSch:POWer -65
SOURce1:BB:V5G:UL:SUBF1:ALLoc0:XPUSch:STATe ON
SOURce1:BB:V5G:UL:SUBF1:ALLoc0:XPUSch:CONFlict?

// ****************************************************************
// Configure enhanced xPUCCH settings: resource index n_xPUCCH (2),
// query number of antenna ports used by xPUCCH and precoding scheme.
// ****************************************************************
SOURce1:BB:V5G:UL:SUBF1:ALLoc0:XPUCch:NXPucch 1
SOURce1:BB:V5G:UL:SUBF1:ALLoc0:XPUCch:NAPused?
SOURce1:BB:V5G:UL:SUBF1:ALLoc0:XPUCch:PRECoding:SCHeme?

// ****************************************************************
// Configure enhanced xPUSCH settings: set RE mapping
// index for DMRS/PCRS, set scrambling
// cell ID N_SCID, N_ID sources and N_IDs for DMRS and
// alternatively for PCRS, set PCRS relative power.
// Query precoding scheme. Switch on UL PCRS.
// ****************************************************************
SOURce1:BB:V5G:UL:SUBF1:ALLoc0:XPUSch:RMINdex 2
SOURce1:BB:V5G:UL:SUBF1:ALLoc0:XPUSch:NSCid 0
SOURce1:BB:V5G:UL:SUBF1:ALLoc0:XPUSch:DMRS:NID DMRS
SOURce1:BB:V5G:UL:SUBF1:ALLoc0:XPUSch:DMRS:NIDDmrs 0
SOURce1:BB:V5G:UL:SUBF1:ALLoc0:XPUSch:PCRS:NID PCRS
SOURce1:BB:V5G:UL:SUBF1:ALLoc0:XPUSch:PCRS:NIDPcrs 0
SOURce1:BB:V5G:UL:SUBF1:ALLoc0:XPUSch:PCRS:RPOWer 0
SOURce1:BB:V5G:UL:SUBF1:ALLoc0:XPUSch:PRECoding:SCHeme?
SOURce1:BB:V5G:UL:SUBF1:ALLoc0:XPUSch:PCRS:STATe ON
```

#### 4.1.4.3 User configuration

```
// ****************************************************************
// Configure user1: enable the user, set user ID and UE power.
// Query UE mode and number of antenna ports for xPUCCH.
// ****************************************************************
SOURce1:BB:V5G:UL:UE1:STATe 1
SOURce1:BB:V5G:UL:UE1:ID 0
SOURce1:BB:V5G:UL:UE1:POWer 0
```

```
SOURce1:BB:V5G:UL:UE1:MODE?
SOURce1:BB:V5G:UL:UE1:XPUCch:NAPort?

// ****************************************************************
// Configure user1: for xPUSCH, set data source pattern,
// alternatively use pattern file.
// Query transmission mode, scrambling status, enable channel
// coding, query multiplexing mode.
// ****************************************************************
SOURce1:BB:V5G:UL:UE1:CELL0:XPUSch:DATA PATT
SOURce1:BB:V5G:UL:UE1:CELL0:XPUSch:PATTern #HFFF,3

//SOURce1:BB:V5G:UL:UE1:CELL0:XPUSch:DATA DLISt
//SOURce1:BB:V5G:UL:UE1:CELL0:XPUSch:DSELect 'pattern1.xml'

SOURce1:BB:V5G:UL:UE1:CELL0:XPUSch:TXMode?
SOURce1:BB:V5G:UL:UE1:CELL0:XPUSch:SCRambling:STATe?
SOURce1:BB:V5G:UL:UE1:CELL0:XPUSch:CCODing:STATe ON
SOURce1:BB:V5G:UL:UE1:CELL0:XPUSch:CCODing:MODE?

// ****************************************************************
// Configure user1: set power offset of the primary cell.
// Query all used antenna ports in the primary cell.
// ****************************************************************
SOURce1:BB:V5G:UL:UE1:CELL0:ROW0:POFFset 0
SOURce1:BB:V5G:UL:UE1:APMap:AP40Map:ROW0?
SOURce1:BB:V5G:UL:UE1:APMap:AP41Map:ROW0?
SOURce1:BB:V5G:UL:UE1:APMap:AP100Map:ROW0?
SOURce1:BB:V5G:UL:UE1:APMap:AP200Map:ROW0?
SOURce1:BB:V5G:UL:UE1:APMap:AP201Map:ROW0?

// ****************************************************************
// Configure user1: set coding rate and transport block size.
// ****************************************************************
SOURce1:BB:V5G:UL:CELL0:SUBF1:ALLoc0:XPUSch:CCODing:CRATe R34
SOURce1:BB:V5G:UL:CELL0:SUBF1:ALLoc0:XPUSch:CCODing:TBSize 1560
```

### 4.1.5 Trigger settings

```
// ****************************************************************
// Configure trigger in automatic mode.
// ****************************************************************
SOURce1:BB:V5G:TRIGger:SEQuence AUTo

// ****************************************************************
// Alternatively configure trigger in retrigger mode, source
// internal. Start signal generation via executing the trigger.
// ****************************************************************
SOURce1:BB:V5G:TRIGger:SEQuence RETR
```

```
SOURce1:BB:V5G:TRIGger:SOURce INTernal
SOURce1:BB:V5G:TRIGger:EXEcute

 ****************************************************************
// Alternatively configure trigger in retrigger mode, use
// the internal trigger signal from the other path.
// Set inhibit duration, specify delay in samples
// ****************************************************************
SOURce1:BB:V5G:TRIGger:SEQuence RETR
SOURce1:BB:V5G:TRIGger:SOURce INTB
SOURce1:BB:V5G:TRIGger:OBASeband:INHibit 10
SOURce1:BB:V5G:TRIGger:DELay:UNIT SAMP
SOURce1:BB:V5G:TRIGger:OBASeband:DELay 25

// ****************************************************************
// Alternatively set and query delay in seconds.
// ****************************************************************
SOURce1:BB:V5G:TRIGger:DELay:UNIT TIME
SOURce1:BB:V5G:TRIGger:OBASeband:TDELay 0.00001
SOURce1:BB:V5G:TRIGger:OBASeband:RDELay?

 ****************************************************************
// Alternatively configure trigger in armed retrigger mode, use
// external global trigger. Enable synchronization output.
// Set inhibit duration, specify delay in samples.
// ****************************************************************
SOURce1:BB:V5G:TRIGger:SEQuence ARETrigger
SOURce1:BB:V5G:TRIGger:SOURce EGT1
SOURce1:BB:V5G:TRIGger:EXTernal:SYNChronize:OUTPut 1
SOURce1:BB:V5G:TRIGger:EXTernal:INHibit 10
SOURce1:BB:V5G:TRIGger:DELay:UNIT SAMP
SOURce1:BB:V5G:TRIGger:EXTernal:DELay 25

// ****************************************************************
// Alternatively set and query delay in seconds.
// ****************************************************************
SOURce1:BB:V5G:TRIGger:DELay:UNIT TIME
SOURce1:BB:V5G:TRIGger:EXTernal:TDELay 0.00001
SOURce1:BB:V5G:TRIGger:EXTernal:RDELay?

// ****************************************************************
// Configure trigger in single mode. Set the output of
// the current waveform to the first sample after
// the next trigger event. Execute the trigger.
// ****************************************************************
SOURce1:BB:V5G:TRIGger:SEQuence SINGle
SOURce1:BB:V5G:TRIGger:SLUNit SAMP
SOURce1:BB:V5G:TRIGger:SLENgth 1
SOURce1:BB:V5G:TRIGger:EXEcute
```

```
/ ********************************************************************
// Alternatively configure internal trigger in armed retrigger
// mode. Start signal generation via executing the trigger.
// Stop signal generation via arming the trigger.
// Execute the trigger again to restarts signal generation.
// ********************************************************************
SOURce1:BB:V5G:TRIGger:SEQuence ARETrigger
SOURce1:BB:V5G:TRIGger:SOURce INTernal
SOURce1:BB:V5G:TRIGger:EXEcute
SOURce1:BB:V5G:TRIGger:ARM:EXECute
SOURce1:BB:V5G:TRIGger:EXEcute

// ********************************************************************
// Query trigger signal generation status.
// ********************************************************************
SOURce1:BB:V5G:TRIGger:RMODe?
```

### 4.1.6 Marker settings

#### Example: Marker configuration

```
// ********************************************************************
// Query marker mode, set rising and falling offsets.
// ********************************************************************
SOURce:BB:V5G:TRIGger:OUTPut2:MODE?
// RESTart
SOURce:BB:V5G:TRIGger:OUTPut2:FOFFset 10
SOURce:BB:V5G:TRIGger:OUTPut2:ROFFset 20

// ********************************************************************
// Set delay.
// ********************************************************************
SOURce:BB:V5G:TRIGger:OUTPut3:DELay 16
```

### 4.1.7 Clock settings

**Example: Clock configuration**

```
// ********************************************************************
// Select internal clock.
// ********************************************************************
SOURce1:BB:V5G:CLOCk:SOURce INTernal

// ********************************************************************
// Alternatively select external clock. Set its mode and query
// input frequency.
// ********************************************************************
SOURce:BB:V5G:CLOCk:SOURce ELCL
SOURce:BB:V5G:CLOCk:MODE SAMP
CLOCk:INPUt:FREQuency?
```

## 4.2 General tasks

The commands in the following sections control the generator status and manage the predefined configurations of the signal.



---

**[:SOURce<hw>]:BB:V5G:STATe** <V5GState>

Activates the standard.

**Parameters:**

<V5GState> 1 | ON | 0 | OFF
*RST: 0

**Example:** See Chapter 4.1.2, "General settings", on page 92.

**Manual operation:** See "State" on page 22

---

**[:SOURce<hw>]:BB:V5G:PRESet**

Sets the parameters of the digital standard to their default values (`*RST` values specified for the commands).

Not affected is the state set with the command SOURce<hw>:BB:V5G:STATe.

**Example:** See Chapter 4.1.2, "General settings", on page 92.

**Usage:** Event

**Manual operation:** See "Set to Default" on page 22

---

**[:SOURce<hw>]:BB:V5G:SETTing:CATalog**

Queries the files with settings in the default directory. Listed are files with the file extension *.v5g.

**Example:** See Chapter 4.1.1, "Performing general tasks", on page 91.

**Manual operation:** See "Save/Recall" on page 22

---

**[:SOURce<hw>]:BB:V5G:SETTing:DEL** <Filename>

Deletes the selected file from the default or the specified directory. Deleted are files with extension *.v5g.

**Setting parameters:**

<Filename> string

Filename or complete file path; file extension can be omitted

**Example:** See Chapter 4.1.1, "Performing general tasks", on page 91.

**Usage:** Setting only

**Manual operation:** See "Save/Recall" on page 22

---

**[:SOURce<hw>]:BB:V5G:SETTing:LOAD** <Filename>

Loads the selected file from the default or the specified directory. Loaded are files with extension *.v5g.

**Parameters:**

<Filename> "<filename>"

Filename or complete file path; file extension can be omitted

**Example:** See Chapter 4.1.1, "Performing general tasks", on page 91.

**Manual operation:** See "Save/Recall" on page 22

---

**[:SOURce<hw>]:BB:V5G:SETTing:STORe** <Filename>

Saves the current settings into the selected file; the file extension (*.v5g) is assigned automatically.

**Parameters:**

<Filename> string

Filename or complete file path

**Example:** See Chapter 4.1.1, "Performing general tasks", on page 91.

**Manual operation:** See "Save/Recall" on page 22

---

**[:SOURce<hw>]:BB:V5G:WAVeform:CREate** <WvFileCreate>

Stores the current settings as an ARB signal in a waveform file (`*.wv`).

**Setting parameters:**

<WvFileCreate> string

Filename or complete file path; file extension is assigned automatically

**Example:** See Chapter 4.1.2, "General settings", on page 92.

**Usage:** Setting only

**Manual operation:** See "Generate Waveform File" on page 22

---

**[:SOURce<hw>]:BB:V5G:SETTing:PCONfiguration:CATalog**

Queries the available configuration files in the default directory. Only predefined files are listed.

**Example:** See Chapter 4.1.2, "General settings", on page 92.

**Manual operation:** See "Predefined Configurations" on page 23

---

**[:SOURce<hw>]:BB:V5G:SETTing:PCONfiguration** <TestScenario>

Selects a predefined configuration.

**Parameters:**

<TestScenario> string

Filename as returned by the query `[:SOURce<hw>]:BB:V5G:SETTing:PCONfiguration:CATalog`.
File extension is omitted.

**Example:** See Chapter 4.1.2, "General settings", on page 92.

**Manual operation:** See "Predefined Configurations" on page 23

## 4.3 Network configuration

The commands in this section configure parameters of the simulated radio network.

---

**[:SOURce<hw>]:BB:V5G:LINK** <Link>

Defines the transmission direction.

**Parameters:**

<Link> UP | DOWN

UP corresponds to a UE signal (uplink)
DOWN corresponds to a 5GNB signal (downlink)

*RST: DOWN

**Example:** See Chapter 4.1.3, "Downlink settings", on page 92

**Manual operation:** See "Link Direction" on page 23

---

**[:SOURce<hw>]:BB:V5G:SLENgth** <SLength>

Specifies the sequence length of the signal in number of frames. The signal is calculated in advance and output in the arbitrary waveform generator.

**Parameters:**

<SLength> integer

Range: 1 to dynamic
*RST: 1

**Example:** See Chapter 4.1.2, "General settings", on page 92.

**Manual operation:** See "ARB Sequence Length" on page 79

## 4.4 Downlink configuration

The commands in the following sections define downlink characteristics.



### 4.4.1 Scheduling configuration

---

**[:SOURce<hw>]:BB:V5G:DL:CONF:MODE** <Scheduling>

Selects manual or automatic xPDSCH scheduling mode.

**Parameters:**

<Scheduling> MANual | AUTO

*RST: MANual

**Example:** See Chapter 4.1.3, "Downlink settings", on page 92

**Manual operation:** See "xPDSCH Scheduling" on page 24

### 4.4.2 Carrier aggregation configuration



**[:SOURce<hw>]:BB:V5G:DL:CA:STATe** <CaGlobalState>

Enables/disables the generation of several component carriers.

**Parameters:**

<CaGlobalState> 1 | ON | 0 | OFF

*RST: OFF

**Example:** See Chapter 4.1.3.1, "Carrier aggregation settings", on page 92.

**Manual operation:** See "Activate Carrier Aggregation" on page 25

**[:SOURce<hw>]:BB:V5G:DL:CA:CELL<ch0>:DFReq** <DeltaFreq>

Sets the frequency offset between the central frequency of the corresponding cell and the frequency of the primary cell.

**Parameters:**

<DeltaFreq> float

Range: -40 to 40
Increment: 0.1
*RST: 0
Default unit: MHz

**Example:** See Chapter 4.1.3.1, "Carrier aggregation settings", on page 92.

**[:SOURce<hw>]:BB:V5G:DL:CA:CELL<ch0>:ID** <PhysicalCellId>

Specifies the physical cell ID of the corresponding cell.

**Parameters:**

<PhysicalCellId> integer

Range: 0 to 503
*RST: 0

**Example:** See Chapter 4.1.3.1, "Carrier aggregation settings", on page 92.

**Manual operation:** See "Physical Cell ID" on page 26

**[:SOURce<hw>]:BB:V5G:DL:CA:CELL<ch0>:NIDCsi** <CaNIDCSI>

Sets the scrambling identity $N_{ID}^{CSI}$ used to generate the CSI-RS signal.

**Parameters:**

<CaNIDCSI> integer

Range: 0 to 503
*RST: 0

**Example:** See Chapter 4.1.3.1, "Carrier aggregation settings", on page 92.

**Manual operation:** See "N_ID^CSI" on page 26

**[:SOURce<hw>]:BB:V5G:DL:CA:CELL<ch0>:POFFset** <PowerOffset>

Specifies the power offset of the serving cell relative to the power level of the primary cell.

**Parameters:**

<PowerOffset> float

Range: -80 to 10
Increment: 0.01
*RST: 0
Default unit: dB

**Example:** See Chapter 4.1.3.1, "Carrier aggregation settings", on page 92.

**[:SOURce<hw>]:BB:V5G:DL:CA:CELL<ch0>:STATe** <CellState>

Queries the status of the corresponding serving cell.

**Parameters:**

<CellState> 1 | ON | 0 | OFF

*RST: OFF

**Example:** See Chapter 4.1.3.1, "Carrier aggregation settings", on page 92.

**Manual operation:** See "State" on page 26

**[:SOURce<hw>]:BB:V5G:DL:CA:CELL<ch0>:TDELay** <TimeDelay>

Specifies the time delay of the secondary cell relative to the primary cell.

**Parameters:**

<TimeDelay> integer

Range: 0 to 700000
*RST: 0

**Example:** See Chapter 4.1.3.1, "Carrier aggregation settings", on page 92.

**[:SOURce<hw>]:BB:V5G:DL:CSIS[:CELL<ch0>]:POW** <CsiRsPow>

Boosts the CSI-RS power compared to the cell-specific reference signals.

**Parameters:**

<CsiRsPow> float

Range: -8 to 15
Increment: 0.001
*RST: 0

**Example:** See Chapter 4.1.3.1, "Carrier aggregation settings", on page 92.

**Manual operation:** See "Rel. Power" on page 26

### 4.4.3 Beam reference signals and synchronization



**[:SOURce<hw>]:BB:V5G:DL:SIGNals:BRS:BTRPeriod** <TransPeriod>

Specifies the beam reference signal transmission period signaled via xPBCH.

**Parameters:**

<TransPeriod> P00 | P01 | P10 | P11

**P00**: single-slot (< 5 ms), maximum 7 downlink transmitting beams per antenna port
**P01**: single-subframe (= 5 ms), maximum 14 downlink transmitting beams per antenna port
**P10**: two-subframe (= 10 ms), maximum 28 downlink transmitting beams per antenna port
**P11**: four-subframe (= 20 ms), maximum 56 downlink transmitting beams per antenna port

*RST: P00

**Example:** See Chapter 4.1.3.2, "Signals settings", on page 93.

**Manual operation:** See "BRS Transmission Period" on page 28

**[:SOURce<hw>]:BB:V5G:DL:SIGNals:BRS:NAP** <BrsNumAp>

Specifies the number of antenna ports (one, two, four or eight) the BRSs are transmitted on.

**Parameters:**

<BrsNumAp> AP1 | AP2 | AP4 | AP8

*RST: AP1

**Example:** See Chapter 4.1.3.2, "Signals settings", on page 93.

**Manual operation:** See "Number of Antenna Ports" on page 28

---

**[:SOURce<hw>]:BB:V5G:DL:SYNC:EPOWer** <EPower>
**[:SOURce<hw>]:BB:V5G:DL:SYNC:PPOWer** <PPower>
**[:SOURce<hw>]:BB:V5G:DL:SYNC:SPOWer** <SPower>

Set the power level of synchronization signal, particularly PSS, SSS and ESS.

**Parameters:**
<SPower> float

Range: -80 to 10
Increment: 0.001
*RST: 0

**Example:** See Chapter 4.1.3.2, "Signals settings", on page 93

**Manual operation:** See "P-SYNC / S-SYNC / E-SYNC Power" on page 27

### 4.4.4 Antenna mapping commands



---

**[:SOURce<hw>]:BB:V5G:DL:APM:CS:AP<dir0>:ROW<st0>** <AntPortMapDat>

Defines the mapping of the logical antenna ports (AP0 to AP7) to the available physical TX antennas (basebands) for xPBCH and BRS signals. Row (ROW0 to ROW7) defines the baseband and at the same time also the cell.

**Parameters:**
<AntPortMapDat> 0 | 1 | OFF | ON

*RST: 1

**Example:** See Chapter 4.1.3.3, "Antenna port configuration", on page 93.

**Manual operation:** See "Cell-Specific Antenna Port Mapping" on page 55

---

**[:SOURce<hw>]:BB:V5G:DL:APM:CS:CSIap:ROW<st0>** <CsiAntPorts>

Defines the mapping of the logical antenna ports for CSI-RS signal (AP 16 to 31) to the available physical TX antennas (basebands). Row (ROW0 to ROW7) defines the baseband and at the same time also the cell.

**Parameters:**
<CsiAntPorts> 1 | ON | 0 | OFF

*RST: 1

**Example:** See Chapter 4.1.3.3, "Antenna port configuration", on page 93.

**Manual operation:** See "Cell-Specific Antenna Port Mapping" on page 55

---

**[:SOURce<hw>]:BB:V5G:DL:APM:CS:XSSap:ROW<st0>** <XSSAntPorts>

Defines the mapping of the logical antenna ports for synchronization signal (AP 300 to 313) to the available physical TX antennas (basebands). Row (ROW0 to ROW7) defines the baseband and at the same time also the cell.

**Parameters:**
<XSSAntPorts> 1 | ON | 0 | OFF
*RST: 1

**Example:** See Chapter 4.1.3.3, "Antenna port configuration", on page 93.

**Manual operation:** See "Cell-Specific Antenna Port Mapping" on page 55

## 4.4.5 DL frame: general configuration



---

**[:SOURce<hw>]:BB:V5G:DL:CONSubframes** <ConSubFrames>

Sets the number of configurable subframes.

**Parameters:**
<ConSubFrames> integer
Range: 1 to 40
*RST: 10

**Example:** See Chapter 4.1.3.4, "Frame configuration", on page 94.

**Manual operation:** See "No of Configurable Subframes" on page 30

---

**[:SOURce<hw>]:BB:V5G:DL:RSTFrame**

Resets all subframe settings of the selected link direction to the default values.

**Example:** See Chapter 4.1.3.4, "Frame configuration", on page 94

**Manual operation:** See "Reset All Subframes" on page 30

---

**[:SOURce<hw>]:BB:V5G:DL:USER<ch>:APM:MAPCoordinates** <MapCoord>

Switches between the Cartesian (real/imaginary) and cylindrical (magnitude/phase) coordinates representation.

**Parameters:**

<MapCoord> CARTesian | CYLindrical

*RST: CARTesian

**Example:** See Chapter 4.1.3.5, "User configuration", on page 94.

**Manual operation:** See "Mapping Coordinates" on page 56

---

**[:SOURce<hw>]:BB:V5G:DL:USER<ch>:APM[:LAYer<user>]:AP<dir0>:ROW<st0>:IMAGinary** <AntPortMapData>

Defines the mapping of the antenna ports to the physical antennas:

- Per user (1 to 4),
- Per layer (1 to 2),
- Per antenna port (8 to 15 and 60, 61, 107, 109), and
- Per row selecting baseband (0 to 7).

The command specifies imaginary / phase part.

**Parameters:**

<AntPortMapData> float

The `REAL` (magnitude) and `IMAGinary` (phase) values are interdependent. Their value ranges change depending on each other and so that the resulting complex value is as follows:
|`REAL`+j*`IMAGinary`| ≤ 1
Otherwise, the values are normalized to magnitude = 1.

Range: -1 to 360
Increment: 0.001
*RST: 0

**Example:** See Chapter 4.1.3.5, "User configuration", on page 94.

**Manual operation:** See "Mapping Table" on page 56

---

**[:SOURce<hw>]:BB:V5G:DL:USER<ch>:APM[:LAYer<user>]:AP<dir0>:ROW<st0>:REAL** <AntPortMapData>

Defines the mapping of the antenna ports to the physical antennas:

- Per user (1 to 4),
- Per layer (1 to 2),

- Per antenna port (8 to 15 and 60, 61, 107, 109), and
- Per row selecting baseband (0 to 7).

The command specifies real / magnitude part.

**Parameters:**

<AntPortMapData> float

The `REAL` (magnitude) and `IMAGinary` (phase) values are interdependent. Their value ranges change depending on each other and so that the resulting complex value is as follows:
|`REAL`+j*`IMAGinary`| ≤ 1
Otherwise, the values are normalized to magnitude = 1.

Range: -1 to 360
Increment: 0.001
*RST: dynamic

**Example:** See Chapter 4.1.3.5, "User configuration", on page 94.

**Manual operation:** See "Mapping Table" on page 56

---

**[:SOURce<hw>]:BB:V5G:DL:USER<ch>:CCODing:STATe** <State>

Queries the channel coding for all allocations belonging to the selected user.

**Parameters:**

<State> 1 | ON | 0 | OFF

*RST: OFF

**Example:** See Chapter 4.1.3.5, "User configuration", on page 94.

**Manual operation:** See "Channel Coding State" on page 32

---

**[:SOURce<hw>]:BB:V5G:DL:USER<ch>:CELL<st0>:TXM** <TxMode>

Queries the transmission mode of the user per cell.

**Parameters:**

<TxMode> M1 | M2 | M3

*RST: M1

**Example:** See Chapter 4.1.3.5, "User configuration", on page 94.

**Manual operation:** See "TX Modes" on page 32

---

**[:SOURce<hw>]:BB:V5G:DL:USER<ch>:DATA** <Data>

Selects the data source for the selected user configuration.

**Parameters:**

<Data> PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATTern | DLISt | ZERO | ONE

**PNxx**
Pseudo-random bit sequences (PRBS) of a length of xx bits. The length in bit can be 9, 11, 15, 16, 20, 21, or 23.

**PATTern**
User-defined pattern. The pattern can be specified via:
`[:SOURce<hw>]:BB:V5G:DL:USER<ch>:PATTern`
on page 115

**DLISt**
Internal data list is used. The data list can be specified via:
`[:SOURce<hw>]:BB:V5G:DL:USER<ch>:DSELect`
on page 115

**ZERO / ONE**
All 0 or all 1 pattern

*RST: PN9

**Example:** See Chapter 4.1.3.5, "User configuration", on page 94.

**Manual operation:** See "Data Source, DList/Pattern" on page 32

---

**[:SOURce<hw>]:BB:V5G:DL:USER<ch>:DSELect** <DSelect>

Selects an existing data list file from the default directory or from the specific directory.

**Parameters:**
<DSelect> string
File name inclusive file extension or complete file path

**Example:**
```
SOURce1:BB:V5G:DL:USER1:DATA DLIS
SOURce1:BB:V5G:DL:USER1:DSEL v5Gtf
```

**Manual operation:** See "Data Source, DList/Pattern" on page 32

---

**[:SOURce<hw>]:BB:V5G:DL:USER<ch>:PATTern** <Pattern>

Sets a bit pattern as data source. The command is relevant for:

`[:SOURce<hw>]:BB:V5G:DL:USER<ch>:DATAPATTern`.

**Parameters:**
<Pattern> 64 bit

*RST: #H0,1

**Example:** See Chapter 4.1.3.5, "User configuration", on page 94.

**Manual operation:** See "Data Source, DList/Pattern" on page 32

---

**[:SOURce<hw>]:BB:V5G:DL:USER<ch>:SCRambling:STATe** <State>

Queries scrambling status for all allocations belonging to the selected user.

**Parameters:**
<State> 1 | ON | 0 | OFF
*RST: ON

**Example:** See Chapter 4.1.3.5, "User configuration", on page 94.

**Manual operation:** See "Scrambling State" on page 32

---

**[:SOURce<hw>]:BB:V5G:DL:USER<ch>:STATe** <UserState>

Enables/disables a user.

**Parameters:**
<UserState> 1 | ON | 0 | OFF
*RST: 1

**Example:** See Chapter 4.1.3.5, "User configuration", on page 94.

**Manual operation:** See "State" on page 32

---

**[:SOURce<hw>]:BB:V5G:DL:USER<ch>:TXM** <TxMode>

Queries the transmission mode of the corresponding user as defined in specification.

**Parameters:**
<TxMode> M1 | M2 | M3
*RST: M1

**Example:** See Chapter 4.1.3.5, "User configuration", on page 94.

**Manual operation:** See "TX Modes" on page 32

---

**[:SOURce<hw>]:BB:V5G:DL:USER<ch>:UEID** <Ueid>

Sets the user equipment ID.

**Parameters:**
<Ueid> integer
Range: 0 to 65535
*RST: 0

**Example:** See Chapter 4.1.3.5, "User configuration", on page 94.

**Manual operation:** See "UE ID" on page 32

## 4.4.6 DL frame: subframe configuration

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALCount** <AllocCount>

Sets the number of scheduled allocations in the selected subframe.

**Parameters:**

<AllocCount> integer

Range: 0 to dynamic
*RST: 0

**Example:** See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

**Manual operation:** See "No. of Used Allocations" on page 34

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:APM:CSIRs:AP<gr0>:ROW<user>:STATe** <State>

Specifies, which antenna ports are used for CSI-RS.

**Parameters:**

<State> 1 | ON | 0 | OFF

*RST: OFF

**Example:** See Chapter 4.1.3.6, "Subframe configuration", on page 94.

**Manual operation:** See "CSI-RS-Specific Antenna Port Mapping in a Subframe" on page 56

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:AOC** <Aoc>

Sets whether automatic offset calculation is used or not.

**Parameters:**

<Aoc> 1 | ON | 0 | OFF
*RST: 1

**Example:** See Chapter 4.1.3.6, "Subframe configuration", on page 94.

**Manual operation:** See "Auto" on page 36

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:CONFlict** <Conflict>

Indicates a conflict between two allocations.

**Parameters:**

<Conflict> 1 | ON | 0 | OFF
*RST: OFF

**Example:** See Chapter 4.1.3.6, "Subframe configuration", on page 94.

**Manual operation:** See "Conflict" on page 38

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:CONType** <ConType>

Specifies the connection type for the selected allocation. xPBCH can be configured in subframe 0 or 25 only. All other content types can be configured in the remaining subframes only.

**Parameters:**

<ConType> XPDSch | XPBCh | XPDCch | CSI
*RST: XPDSch

**Example:** See Chapter 4.1.3.6, "Subframe configuration", on page 94.

**Manual operation:** See "Content Type" on page 37

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:DATA** <Data>

Sets the data source for the selected allocation.

**Parameters:**

<Data> MIB | XPDCch

**USERx**
Assign a user to the xPDSCH allocation. Specify the data source of the user via:
`[:SOURce<hw>]:BB:V5G:DL:USER<ch>:DATA`

**MIB**
(Result parameter)
Indicates that the xPBCH transmits master information blocks.

**XPDCch**
(Result parameter)
Indicates the connection type xPDCCH.
*RST: dynamic

**Example:** See Chapter 4.1.3.6, "Subframe configuration", on page 94.

**Manual operation:** See "Data Source, DList / Pattern" on page 37

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:MODulation** <Modulation>

Sets the modulation scheme for the allocation. Always use QPSK for xPBCH, xPDCCH and CSI-RS allocations.

**Parameters:**
<Modulation> QPSK | QAM16 | QAM64 | QAM256
*RST: QPSK

**Example:** See Chapter 4.1.3.6, "Subframe configuration", on page 94.

**Manual operation:** See "Modulation" on page 35

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:XPDSch:NSCid** <ScrambIdentity>

Specifies the scrambling identity $n_{SCID}$ of UE-specific reference signals associated with the selected xPDSCH allocation.

**Parameters:**
<ScrambIdentity> integer
Range: 0 to 1
*RST: 0

**Example:** See Chapter 4.1.3.6, "Subframe configuration", on page 94.

**Manual operation:** See "N_SCID" on page 52

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:XPDSch:DMRS:NID** <NIDSource>
**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:XPDSch:PCRS:NID** <NIDSource>

Specifies the source of reference signal ID $n_{ID}$ for DMRS and PCRS.

**Parameters:**
<NIDSource> CELL | DMRS | PCRS
The $n_{ID}$ = N_ID $^{Cell}$, $n_{ID}^{DMRS}$, or $n_{ID}^{PCRS}$
*RST: CELL

**Example:** See Chapter 4.1.3.6, "Subframe configuration", on page 94.

**Manual operation:** See "N_ID" on page 52

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:XPDSch:DMRS:NIDDmrs** <NIDDmrs>

Sets the demodulation reference signal ID $n_{ID}^{DMRS}$ associated with the selected xPDSCH allocation.

**Parameters:**

<NIDDmrs> integer

Range: 0 to 503
*RST: 0

**Example:** See Chapter 4.1.3.6, "Subframe configuration", on page 94.

**Manual operation:** See "N_ID^DMRS / N_ID^PCRS" on page 52

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:XPDSch:PCRS:NIDPcrs** <NIDPcrs>

Sets the phase noise compensation reference signal ID $n_{ID}^{PCRS}$ associated with the selected xPDSCH allocation.

**Parameters:**

<NIDPcrs> integer

Range: 0 to 503
*RST: 0

**Example:** See Chapter 4.1.3.6, "Subframe configuration", on page 94.

**Manual operation:** See "N_ID^DMRS / N_ID^PCRS" on page 52

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:XPDSch:PCRS:APConf** <APConfiguration>

Specifies the antenna ports used by downlink phase compensation reference signal (PCRS).

**Parameters:**

<APConfiguration> A00 | A01 | A10 | A11

**A00**
DL PCRS not present

**A01**
Antenna port 60 used

**A10**
Antenna port 61 used

**A11**
Antenna ports 60 and 61 used

*RST: A00

**Example:** See Chapter 4.1.3.6, "Subframe configuration", on page 94.

**Manual operation:** See "AP Configuration" on page 52

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:PHYSbits?**

Queries the size of the selected allocation in bits and considering the subcarriers that are used for other signals or channels with higher priority.

For a user 1...4, the total number of physical bits is the sum of the "Physical Bits" of all single allocations that belong to the same user in the subframe.

**Return values:**

<PhysicalBits> integer

Range: 0 to 105600
*RST: 0

**Example:** See Chapter 4.1.3.6, "Subframe configuration", on page 94.

**Usage:** Query only

**Manual operation:** See "Phys. Bits" on page 37

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:POWer** <Power>

Sets the power $P_{xPDSCH}$ for the selected allocation. The power levels of xPBCH, CSI-RS, and xPDCCH allocations are read-only.

**Parameters:**

<Power> float

Range: -80 to 10
Increment: 0.001
*RST: 0

**Example:** See Chapter 4.1.3.6, "Subframe configuration", on page 94.

**Manual operation:** See "Rho A" on page 37

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:XPDSch:PCRS:RPOWer** <RelativePower>

Sets the power $P_{DL\ PCRS}$ relative to xPDSCH for the allocation type xPDSCH.

**Parameters:**

<RelativePower> float

Range: -80 to 10
Increment: 0.001
*RST: 6

**Example:** See Chapter 4.1.3.6, "Subframe configuration", on page 94.

**Manual operation:** See "Rel. Power" on page 53

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:PRECoding:AP**
<AntennaPorts>

Specifies the antenna port or the pair of antenna ports used by the particular allocation in particular subframe.

**Parameters:**

<AntennaPorts> AP8_9 | AP10_11 | AP8_12 | AP9_13 | AP10_14 | AP11_15 | AP107_109 | AP0 | AP1 | AP2 | AP3 | AP4 | AP5 | AP6 | AP7 | AP8 | AP9 | AP10 | AP11 | AP12 | AP13 | AP14 | AP15 | AP107 | AP109 | AP0_1 | AP2_3 | AP4_5 | AP6_7 | AP12_13 | AP14_15

**Example:** See Chapter 4.1.3.6, "Subframe configuration", on page 94.

**Manual operation:** See "Precoding Antenna Ports" on page 49

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:PRECoding:LCOunt**
<LayerCount>

Indicates the number of layers used for Tx diversity or spatial multiplexing.

**Parameters:**

<LayerCount> integer

Range: 1 to 2
*RST: 1

**Example:** See Chapter 4.1.3.6, "Subframe configuration", on page 94.

**Manual operation:** See "Number of Layers" on page 49

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:PRECoding:SCHeme**
<Scheme>

Selects the precoding scheme for xPBCH, xPDCCH, and xPDSCH allocations.

**Parameters:**

<Scheme> NONE | SMUX | TXD

None, spatial multiplexing, TX diversity

*RST: NONE

**Example:** See Chapter 4.1.3.6, "Subframe configuration", on page 94.

**Manual operation:** See "Precoding Scheme" on page 49

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:RBCount**
<ResBlockCount>

Queries the size of the selected allocation in resource blocks (per slot). For xPDSCH, the parameter is configurable.

**Parameters:**
<ResBlockCount> integer
Range: 1 to 110
*RST: 1

**Example:** See Chapter 4.1.3.6, "Subframe configuration", on page 94.

**Manual operation:** See "No. RB (Resource Blocks)" on page 36

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:RBOFfset**
<ResBlockOffset>

Specifies the start resource block of the selected allocation.

**Parameters:**
<ResBlockOffset> integer
Range: 0 to dynamic
*RST: dynamic

**Example:** See Chapter 4.1.3.6, "Subframe configuration", on page 94.

**Manual operation:** See "Offset RB" on page 36

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:SCRambling:STATe**
<State>

Queries whether the scrambling is active for the selected allocation.

**Parameters:**
<State> 1 | ON | 0 | OFF
*RST: ON

**Example:** See Chapter 4.1.3.6, "Subframe configuration", on page 94.

**Manual operation:** See "State Scrambling" on page 50

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:SCRambling:UEID** <Ueid>

Queries the UE ID.

**Parameters:**
<Ueid> integer
Range: 0 to 65535
*RST: 0

**Example:** See Chapter 4.1.3.6, "Subframe configuration", on page 94.

**Manual operation:** See "UE ID/n_RNTI" on page 51

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:STATe** <State>

Sets the allocation state to active or inactive.

**Parameters:**
<State> 1 | ON | 0 | OFF
*RST: ON

**Example:** See Chapter 4.1.3.6, "Subframe configuration", on page 94Chapter 4.1.3.6, "Subframe configuration", on page 94.

**Manual operation:** See "State" on page 37

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:SYMCount** <SymCount>

Specifies the size of the selected allocation in OFDM symbols.

**Parameters:**
<SymCount> integer
Range: 1 to 14
*RST: 14 (xPBCH); 1 (xPDCCH); 13 (xPDSCH); 2 (CSI-RS)

**Example:** See Chapter 4.1.3.6, "Subframe configuration", on page 94.

**Manual operation:** See "No. Sym." on page 36

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ALLoc<ch0>:SYMoffset** <SymOffset>

Specifies the start OFDM symbol of the selected allocation.

**Parameters:**
<SymOffset> integer
Range: 0 to 13
*RST: 2

**Example:** See Chapter 4.1.3.6, "Subframe configuration", on page 94.

**Manual operation:** See "Offset Sym." on page 36

## 4.4.7 DL frame: xPDCCH configuration

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:DCRegs:DATA** <Data>

Selects the data source for xPDCCH.

**Parameters:**

<Data> PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATTern | DLISt | ZERO | ONE

**PNxx**
Pseudo-random bit sequences (PRBS) of a length of xx bits. The length in bit can be 9, 11, 15, 16, 20, 21, or 23.

**PATTern**
User-defined pattern. The pattern can be specified via: `[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:DCRegs:PATTern` on page 125

**DLISt**
Internal data list is used. The data list can be specified via: `[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:DCRegs:DSELect` on page 125

**ZERO | ONE**
Internal 0 or 1 data is used.

*RST: PN9

**Example:** See Chapter 4.1.3.7, "xPDCCH configuration", on page 96.

**Manual operation:** See "Dummy CCE Data Source" on page 39

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:DCRegs:DSELect** <Filename>

Specifies data list file. The setting is relevant for

`[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:DCRegs:DATA`DLISt

**Parameters:**

<Filename> string

**Manual operation:** See "Dummy CCE Data Source" on page 39

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:DCRegs:PATTern** <Pattern>

Sets the bit pattern. The setting is relevant for

`[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:DCRegs:DATA`PATTern

**Parameters:**
<Pattern> 64 bit
*RST: #H0,1

**Manual operation:** See "Dummy CCE Data Source" on page 39

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:DCRegs:TRSource** <TranSource>

Sets the behavior of the dummy xREGs, i.e. determines whether dummy data or DTX is transmitted.

Data is specified via `[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:DCRegs:DATA`.

**Parameters:**
<TranSource> DATA | DTX
*RST: DATA

**Example:** See Chapter 4.1.3.7, "xPDCCH configuration", on page 96.

**Manual operation:** See "Dummy CCE xREGs" on page 39

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:POWer** <Power>

Sets the power of the xPDCCH ($P_{xPDCCH}$).

The value set with this parameter is also displayed in the allocation table for the corresponding allocation.

**Parameters:**
<Power> float
Range: -80 to 10
Increment: 0.001
*RST: 0

**Example:** See Chapter 4.1.3.7, "xPDCCH configuration", on page 96.

**Manual operation:** See "Power" on page 39

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:APPend**

Adds a new row at the end of the DCI table.

**Example:** `SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:APPend`

**Manual operation:** See "Standard configuration functions" on page 40

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:DELete**

Deletes the selected row.

**Example:** SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:SIT 2
selects the third row in the DCI table
SOURce1:BB:V5G:SUBF1:ENCC:XPDC:EXTC:DEL
deletes the third row

**Usage:** Event

**Manual operation:** See "Standard configuration functions" on page 40

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:DOWN**
**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:UP**

Moves the selected row down or up.

**Example:** SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:SIT 2
Selects the third row in the DCI table.
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:UP
Shifts the third row up one row.

**Manual operation:** See "Standard configuration functions" on page 40

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:INSert**

Insert a new row before the currently selected item.

**Example:** SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:SIT 2
selects the third row in the DCI table
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:INS
inserts a new row before the third one

**Manual operation:** See "Standard configuration functions" on page 40

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:RESet**

Resets the table.

**Example:** SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:RES
resets the table

**Manual operation:** See "Reset" on page 40

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:SITem**
<SelectedItem>

Selects an xPDCCH item, i.e. a row in the DCI table.

**Parameters:**
<SelectedItem> integer
Range: 0 to 39
*RST: 0

**Example:** SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:SIT 2
selects the third row in the DCI table

**Manual operation:** See "Standard configuration functions" on page 40

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:SOLVe?**

Triggers a built-in algorithm that reassigns automatically the CCE values. Previously configured CCE values are not maintained.

If the conflict cannot be resolved automatically, the values are left unchanged.

**Example:** `SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:SOLVe`

**Usage:** Query only

**Manual operation:** See "Resolve Conflicts" on page 40

### 4.4.8 DL frame: xPDCCH configuration: DCI table

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:CELL** <CellIdx>

Determines the component carrier the corresponding DCI is transmitted on.

**Parameters:**

<CellIdx> integer

Range: 0 to 7
*RST: 0

**Example:** See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

**Manual operation:** See "Cell Index" on page 41

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:CINDex** <CceIndex>

Sets the CCE start index.

**Parameters:**

<CceIndex> integer

Range: 0 to 1E5
*RST: 0

**Example:** SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:CINDex 10
See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

**Manual operation:** See "CCE Index" on page 43

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:CONFlict?**

Indicates a conflict between two DCI formats.

**Return values:**
<Conflict> 1 | ON | 0 | OFF
*RST: OFF

**Example:** SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM0:CONFlict?
Queries whether there is a conflict
See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

**Usage:** Query only

**Manual operation:** See "Resolve Conflicts" on page 40
See "Conflict" on page 43

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:APNLayer** <DciApNumLay>

Sets the DCI format field antenna ports and number of layers indication.

**Parameters:**
<DciApNumLay> integer
Range: 0 to 9
*RST: 0

**Example:** SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIF FB1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIConf:APNLayer 1
See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:BITData?**

Queries the resulting bit data as selected with the DCI format parameters.

**Return values:**
<BitData> string

**Example:** SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIConf:BITData?
See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

**Usage:** Query only

**Manual operation:** See "Bit Data" on page 44

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:BMI** <DciBMI>

Sets the DCI format field bit mapping index for HARQ-ACK multiplexing (BMI).

**Parameters:**

<DciBMI> integer

Range: 0 to 7
*RST: 0

**Example:**
```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIF FB1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIConf:BMI 5
```
See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:BSI** <DciBSI>

Sets the DCI format field beam switch indication.

**Parameters:**

<DciBSI> 1 | ON | 0 | OFF

*RST: 0

**Example:**
```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIF FA1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIConf:BSI ON
```
See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:CBBRequest** <DciCBBReq>

Sets the DCI format field CSI/BSI/BRI request.

**Parameters:**

<DciCBBReq> NONE | CSIRs

None of CSI/BSI/BRI requested or CSI reporting requested

*RST: NONE

**Example:**
```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIF FA1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIConf:CBBRequest CSIRs
```
Enables CSI reporting.
See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:CBPRocess** <DciCBPIorBSI>

Sets the DCI format field process indicator or number of BSI reports.

**Parameters:**

<DciCBPIorBSI> P0 | P1 | P2 | P3

Process #0 to process #3

*RST: P0

**Example:**

```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:
DCIF FA1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:
DCIConf:CBPRocess P0
```

See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:CBSYmbol** <DciCBSymbInd>

Sets the DCI format field OFDM symbol index for CSI-RS / BRRS.

**Parameters:**

<DciCBSymbInd> S12 | S13 | S1213

13th symbol, 14th symbol, 13th and 14th symbol

*RST: S12

**Example:**

```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:
DCIF FA1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:
DCIConf:CBSYmbol S12
```

CSI-RS / BRRS transmission uses 13th OFDM symbol.

See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:CTRTiming** <DciCBrsTrTim>

Sets the DCI format field transmission timing of CSI-RS/BRRS.

**Parameters:**

<DciCBrsTrTim> integer

Range: 0 to 3

*RST: 0

**Example:**

```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:
DCIF FA1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:
DCIConf:CTRTiming 0
```

See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:DLPCrs** <DciDlPCRS>

Sets the DCI format field DL PCRS to specify antenna ports used by PCRS signal.

**Parameters:**

<DciDlPCRS> NONE | AP60 | AP61 | AP6061

No PCRS, PCRS on AP 60, 61, or APs 60-61

**Example:**

```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIF FB1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIConf:DLPCrs AP6061
```

Antenna ports 60 and 61 used

See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:HPN** <HarqProcessNumb>

Sets the DCI format field HARQ process number.

**Parameters:**

<HarqProcessNumb> integer

Range: 0 to 15
*RST: 0

**Example:**

```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIF FA1
```

Sets the DCI format

```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIC:HPN 5
```

Sets the HARQ process number

See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:MCSR** <Mcsr>

Sets the DCI format field modulation and coding scheme.

**Parameters:**

<Mcsr> integer

Range: 0 to 15
*RST: 0

**Example:**

```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIF FA1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIC:MCSR 5
```

See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:NDI** <NewDataIndicat>

Sets the DCI format field new data indicator.

**Parameters:**

<NewDataIndicat> 1 | ON | 0 | OFF

*RST: OFF

**Example:**

```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIF FA1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIC:NDI ON
```

See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:NSCid** <DciNSCID>

Sets the DCI format field SCID indicating which $n_{SCID}$ is applied for the DMRS/PCRS.

**Parameters:**

<DciNSCID> integer

Range: 0 to 1

*RST: 0

**Example:**

```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIF FA1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIConf:NSCid 0
```

See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:PMI** <DciPMI>

Sets the DCI format field precoding matrix indicator.

**Parameters:**

<DciPMI> integer

Range: 0 to 7

*RST: 0

**Example:**

```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIF FA1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIConf:PMI 0
```

See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:RBA** <ResBlockAssign>

Sets the DCI format field resource block assignment.

**Parameters:**

<ResBlockAssign> integer

Range: 0 to 325
*RST: 0

**Example:**
```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIF FA1
```
Sets the DCI format
```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIC:RBA 100
```
Sets Resource Block Assignment
See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:REMap** <DciReMap>

Sets the DCI format field resource element mapping index for DMRS/PCRS.

**Parameters:**

<DciReMap> integer

Range: 0 to 5
*RST: 0

**Example:**
```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIF FA1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIConf:REMap 2
```
See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:RV** <RedundVersion>

Sets the DCI format field redundancy version.

**Parameters:**

<RedundVersion> integer

Range: 0 to 3
*RST: 0

**Example:**
```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIF FB1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIC:RV 2
```
See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:SRSRequest** <SrsRequest>

Sets the DCI format field SRS request.

**Parameters:**

<SrsRequest> NONE | C0 | C1 | C2

No SRS request, configuration #0 to configuration #2

*RST: NONE

**Example:**

```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:
DCIF FA1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:
DCIConf:SRSRequest C0
```

SRS request set to configuration 0

See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:SRSSymbol** <DciSrsSym>

Sets the DCI format field SRS symbol relevant only for enabled SRS request.

**Parameters:**

<DciSrsSym> S12 | S13

13th symbol, 14th symbol

*RST: S12

**Example:**

```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:
DCIF FA1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:
DCIConf:SRSRequest C0
```

SRS request set to configuration 0

```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:
DCIConf:SRSSymbol S13
```

14th SRS symbol used

See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:TPC** <DciTPC>

Sets the DCI format field TPC command for xPUSCH.

**Parameters:**

<DciTPC> integer

Range: 0 to 3

*RST: 0

**Example:**

```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:
DCIF FA1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:
DCIC:TPC 2
```

See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:TRTiming** <DciTrTim>

Sets the DCI format field transmission timing offset of xPUSCH.

**Parameters:**

<DciTrTim> integer

Range: 0 to 7
*RST: 0

**Example:**
```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIF FA1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIConf:TRTiming 5
```
See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:UCIind** <DciUCIInd>

Sets the DCI format field UCI on xPUSCH w/o xUL-SCH data indicator.

**Parameters:**

<DciUCIInd> 1 | ON | 0 | OFF

*RST: 0

**Example:**
```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIF FA1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIConf:UCIind ON
```
See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:UFRI** <UCIFrRes>

Sets the DCI format field frequency resource index of xPUCCH for UCI report.

**Parameters:**

<UCIFrRes> integer

Range: 0 to 15
*RST: 0

**Example:**
```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIF FB1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIConf:UFRI 5
```
See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:ULPCrs** <DciULPCRS>

Sets the DCI format field UL dual PCRS for single-layer transmission.

**Parameters:**

<DciULPCRS> integer

**0**: scheduled xPUSCH uses a PCRS AP (corresponding to a DM-RS AP)
**1**: scheduled xPUSCH uses two PCRS APs

Range: 0 to 1
*RST: 0

**Example:**

```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:
DCIF FA1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:
DCIConf:ULPCrs 0
```

See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:UTRTiming** <DciUCITrTim>

Sets the DCI format field transmission timing of xPUCCH for UCI report.

**Parameters:**

<DciUCITrTim> integer

Range: 0 to 7
*RST: 0

**Example:**

```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:
DCIF FB1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:
DCIConf:UTRTiming 5
```

See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:XPENd** <DciXPDSCHEnd>

Sets the DCI format field xPDSCH end.

**Parameters:**

<DciXPDSCHEnd> S11 | S13

12th, 14th symbol

*RST: S11

**Example:**

```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:
DCIF FB1
```

Sets the DCI format

```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:
DCIConf:XPENd S11
```

Sets the xPDSCH end field to 12th symbol

See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:XPRange** <DciXPUSCHRange>

Sets the DCI format field xPUSCH range to specify the last xPUSCH symbol. The starting OFDM symbol for the xPUSCH is always the third symbol.

**Parameters:**

<DciXPUSCHRange> S13 | S12 | S14

13th, 12th, 14th symbol

*RST: S12

**Example:**

```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIF FA1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIConf:XPRange S12
```

The stopping of xPUSCH is the 12th symbol.

See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIConf:XPSTart** <DciXPDSCHStart>

Sets the DCI format field xPDSCH start.

**Parameters:**

<DciXPDSCHStart> S1 | S2

**S1**: second symbol
**S2**: third symbol

*RST: S1

**Example:**

```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIF FB1
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIConf:XPSTart S2
```

Sets the xPDSCH start field to third symbol.

See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:DCIFmt** <DciFormat>

Sets the DCI format for the selected xPDCCH.

**Parameters:**

<DciFormat> FA1 | FA2 | FB1 | FB2

*RST: FA1

**Example:**

```
SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:DCIFmt FA1
```

Selects DCI format A1

See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

**Manual operation:** See "DCI Format" on page 41

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:NCCes?**

Queries the number of control channel elements used for the transmission of the xPDCCH.

**Return values:**

<CceCount> integer

Range: 0 to 1E5
*RST: 1

**Example:** `SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:PFMT 0`
Selects xPDCCH with two CCEs.
`SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:NCCes?`
See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

**Usage:** Query only

**Manual operation:** See "Number CCEs" on page 42

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:NDCCes?**

Queries the number of dummy CCEs that are appended to the xPDCCH.

**Return values:**

<DummyCceCount> integer

Range: 0 to 1E5
*RST: 25

**Example:** `SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:NDCCes?`
See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

**Usage:** Query only

**Manual operation:** See "No. Dummy CCEs" on page 43

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:PFMT** <Format>

Sets the xPDCCH format for the selected xPDCCH.

**Parameters:**

<Format> integer

Range: 0 to 3
*RST: 0

**Example:** SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:PFMT 0
Selects xPDCCH with two CCEs.
See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

**Manual operation:** See "xPDCCH Format" on page 42

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:SYMBol** <Symbol>

Sets the xPDCCH symbol.

**Parameters:**
<Symbol> integer
Range: 0 to 1
*RST: 0

**Example:** See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

**Manual operation:** See "xPDCCH Symbol" on page 43

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:UEID** <Ueid>

Sets the n_RNTI for the selected xPDCCH.

**Parameters:**
<Ueid> integer
Range: 0 to 100000
*RST: 0

**Example:** SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:UEID 100
See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

**Manual operation:** See "UE_ID/n_RNTI" on page 41

---

**[:SOURce<hw>]:BB:V5G:DL[:SUBF<st0>]:ENCC:XPDCch:EXTC:ITEM<ch0>:USER** <User>

Selects the user the DCI is dedicated to.

The available DCI formats depend on the value of this parameter.

**Parameters:**
<User> USER1 | USER2 | USER3 | USER4 | NONE
*RST: USER1

**Return values:**
<User> USER1 | USER2 | USER3 | USER4 | NONE
Range: USER1 to NONE
*RST: USER1

**Example:** `SOURce1:BB:V5G:DL:SUBF1:ENCC:XPDC:EXTC:ITEM1:USER USER2`
The DCI is dedicated to user 2
See Chapter 4.1.3.7, "xPDCCH configuration", on page 96

**Manual operation:** See "User" on page 41

## 4.5 Uplink configuration

The commands in the following sections define uplink characteristics.



### 4.5.1 Carrier aggregation configuration

**[:SOURce<hw>]:BB:V5G:UL:CA:CELL<ch0>:ID** <ULCaPhyCellId>

Specifies the physical cell ID of the corresponding cell.

**Parameters:**
<ULCaPhyCellId> integer
Range: 0 to 503
*RST: 0

**Example:** See Chapter 4.1.4.1, "Carrier aggregation settings", on page 99.

**Manual operation:** See "Physical Cell ID" on page 57

**[:SOURce<hw>]:BB:V5G:UL:CA:CELL<ch0>:STATe?**

Queries the status of the corresponding serving cell.

**Return values:**
<ULCaCellState> 1 | ON | 0 | OFF
*RST: 0

**Example:** See Chapter 4.1.4.1, "Carrier aggregation settings", on page 99.

**Usage:** Query only

**Manual operation:** See "State" on page 57

**[:SOURce<hw>]:BB:V5G:UL:CA:STATe?**

Enables/disables the generation of several component carriers.

**Return values:**
<ULCaGlobState> 1 | ON | 0 | OFF
*RST: 0

**Example:** See Chapter 4.1.4.1, "Carrier aggregation settings", on page 99.

**Usage:** Query only

**Manual operation:** See "Activate Carrier Aggregation" on page 57

## 4.5.2 UL frame: general configuration



---

**[:SOURce<hw>]:BB:V5G:UL:UE<st>:STATe** <State>

Selects the user equipment state.

**Parameters:**
<State> 1 | ON | 0 | OFF
*RST: 1 (UE1); 0 (UE2 to UE4)

**Example:** See Chapter 4.1.4.2, "UL allocation settings", on page 99.

**Manual operation:** See "UEx" on page 58
See "State" on page 71

---

**[:SOURce<hw>]:BB:V5G:UL:UE<st>:CONSubframes:XPUCch** <ConfSubf>
**[:SOURce<hw>]:BB:V5G:UL:UE<st>:CONSubframes:XPUSch** <ConfSubframes>

Sets the number of configurable subframes.

**Parameters:**
<ConfSubframes> integer
Range: 1 to 40
*RST: 1

**Example:** See Chapter 4.1.4.2, "UL allocation settings", on page 99.

**Manual operation:** See "Number of xPUCCH/xPUSCH Configurations" on page 58

---

**[:SOURce<hw>]:BB:V5G:UL:RSTFrame**

Resets all subframe settings of the selected link direction to the default values.

**Example:** See Chapter 4.1.4.2, "UL allocation settings", on page 99.

**Manual operation:** See "Reset All Subframes" on page 61

### 4.5.3 UL frame: user equipment configuration



---

**[:SOURce<hw>]:BB:V5G:UL:UE<st>:APMap:AP40Map:ROW<bbid>?**
**[:SOURce<hw>]:BB:V5G:UL:UE<st>:APMap:AP41Map:ROW<bbid>?**
**[:SOURce<hw>]:BB:V5G:UL:UE<st>:APMap:AP100Map:ROW<bbid>?**
**[:SOURce<hw>]:BB:V5G:UL:UE<st>:APMap:AP200Map:ROW<bbid>?**
**[:SOURce<hw>]:BB:V5G:UL:UE<st>:APMap:AP201Map:ROW<bbid>?**

Sets which antenna port is generated by which baseband.

**Suffix:**
<bbid> 0..7
Baseband

**Return values:**
<AntPortMapping> 1 | ON | 0 | OFF
*RST: 0

**Example:** See Chapter 4.1.4.3, "User configuration", on page 100.

**Usage:** Query only

**Manual operation:** See "Antenna port mapping table" on page 75

---

**[:SOURce<hw>]:BB:V5G:UL:UE<st>:CELL<dir0>:ROW<ch0>:POFFset**
<UeCcPowerOffs>

**Parameters:**
<UeCcPowerOffs> float
Range: -80 to 10
Increment: 0.01
*RST: 0

**Manual operation:** See "Power" on page 75

**[:SOURce<hw>]:BB:V5G:UL:UE<st>:ID** <Id>

Sets the radio network temporary identifier (RNTI) of the UE.

**Parameters:**

<Id> integer

Range: 0 to 65535
*RST: 0

**Example:** See Chapter 4.1.4.3, "User configuration", on page 100.

**Manual operation:** See "UE ID/n_RNTI" on page 71

**[:SOURce<hw>]:BB:V5G:UL:UE<st>:MODE?**

Indicates whether the user equipment is in standard or in PRACH mode.

**Return values:**

<Mode> STD | PRACh

*RST: STD

**Example:** See Chapter 4.1.4.3, "User configuration", on page 100.

**Usage:** Query only

**Manual operation:** See "Mode" on page 71

**[:SOURce<hw>]:BB:V5G:UL:UE<st>:POWer** <Power>

Sets the power level of the selected UE.

**Parameters:**

<Power> float

Range: -80 to 10
Increment: 0.001
*RST: 0
Default unit: dBm

**Example:** See Chapter 4.1.4.3, "User configuration", on page 100.

**Manual operation:** See "UE Power" on page 71

**[:SOURce<hw>]:BB:V5G:UL:UE<st>:XPUCch:NAPort?**

Specifies the number of antenna ports used for every xPUCCH transmission.

**Return values:**

<NumAPs> AP1 | AP2

*RST: AP1

**Example:** See Chapter 4.1.4.3, "User configuration", on page 100.

**Usage:** Query only

**Manual operation:** See "Number of Antenna Ports for xPUCCH" on page 72

---

**[:SOURce<hw>]:BB:V5G:UL:UE<st>[:CELL<ccidx>]:XPUSch:CCODing:MODE?**

Defines the information transmitted on the xPUSCH.

**Return values:**

<Mode> COMBined | ULSChonly | UCIonly

**COMBined**
Control information and data are multiplexed into the xPUSCH.

**ULSChonly**
Only data is transmitted on xPUSCH.

**UCIonly**
Only uplink control information is transmitted on xPUSCH.

*RST: ULSChonly

**Example:** See Chapter 4.1.4.3, "User configuration", on page 100.

**Usage:** Query only

**Manual operation:** See "Mode Channel Coding" on page 74

---

**[:SOURce<hw>]:BB:V5G:UL:UE<st>[:CELL<ccidx>]:XPUSch:CCODing:STATe** <State>

Enables/disables channel coding and multiplexing of data and control information for all xPUSCH allocations of the corresponding UE.

**Parameters:**

<State> 1 | ON | 0 | OFF

*RST: OFF

**Example:** See Chapter 4.1.4.3, "User configuration", on page 100.

**Manual operation:** See "State Channel Coding and Multiplexing (xPUSCH)" on page 74

---

**[:SOURce<hw>]:BB:V5G:UL:UE<st>[:CELL<ccidx>]:XPUSch:DATA** <Data>

Selects the xPUSCH data source of the selected UE. For the selected UE, this data source is used for the xPUSCH channel in every subframe where this channel is configured.

**Parameters:**

<Data> PN9 | PN11 | PN15 | PN16 | PN20 | PN21 | PN23 | PATTern | DLISt | ZERO | ONE

**ZERO / ONE**
All 0 or all 1 pattern

**PATTern**
User-defined pattern. The pattern can be specified via:
`[:SOURce<hw>]:BB:V5G:UL:UE<st>[:CELL<ccidx>]:XPUSch:PATTern` on page 147

**PNxx**
Pseudo-random bit sequences (PRBS) of a length of xx bits. The length in bit can be 9, 11, 15, 16, 20, 21, or 23.

**DLISt**
Internal data list is used. The data list can be specified via:
`[:SOURce<hw>]:BB:V5G:UL:UE<st>[:CELL<ccidx>]:XPUSch:DSELect` on page 147

*RST: PN9

**Example:** See Chapter 4.1.4.3, "User configuration", on page 100.

**Manual operation:** See "Data Source" on page 73

---

**[:SOURce<hw>]:BB:V5G:UL:UE<st>[:CELL<ccidx>]:XPUSch:DSELect** <Filename>

Specifies data list file. The setting is relevant for

`[:SOURce<hw>]:BB:V5G:UL:UE<st>[:CELL<ccidx>]:XPUSch:DATADLISt`

**Parameters:**
<Filename> string

**Example:** See Chapter 4.1.4.3, "User configuration", on page 100.

**Manual operation:** See "Data Source" on page 73

---

**[:SOURce<hw>]:BB:V5G:UL:UE<st>[:CELL<ccidx>]:XPUSch:PATTern** <Pattern>

Sets the bit pattern for the voice data. The setting is relevant for

`[:SOURce<hw>]:BB:V5G:UL:UE<st>[:CELL<ccidx>]:XPUSch:DATAPATTern`

**Parameters:**
<Pattern> 64 bit

*RST: #H0,1

**Example:** See Chapter 4.1.4.3, "User configuration", on page 100.

**Manual operation:** See "Data Source" on page 73

---

**[:SOURce<hw>]:BB:V5G:UL:UE<st>[:CELL<ccidx>]:XPUSch:SCRambling:STATe?**

Enables/disables scrambling for all xPUSCH allocations of the corresponding UE.

**Return values:**
<State> 1 | ON | 0 | OFF
*RST: OFF

**Example:** See Chapter 4.1.4.3, "User configuration", on page 100.

**Usage:** Query only

**Manual operation:** See "State Scrambling (xPUSCH)" on page 74

---

**[:SOURce<hw>]:BB:V5G:UL:UE<st>[:CELL<ccidx>]:XPUSch:TXMode?**

Specifies the xPUSCH transmission mode.

**Return values:**
<TxMode> M1 | M2
**M1**
Spatial multiplexing not possible
**M2**
Spatial multiplexing possible
*RST: M1

**Example:** See Chapter 4.1.4.3, "User configuration", on page 100.

**Usage:** Query only

**Manual operation:** See "Transmission Mode" on page 74

### 4.5.4 UL frame: subframe configuration



---

**[:SOURce<hw>]:BB:V5G:UL[:SUBF<st0>]:ALLoc<ch0>:CONType** <ContentType>

Specifies the content type for the selected allocation.

**Parameters:**
<ContentType> XPUCch | XPUSch
*RST: XPUSch

**Example:** See Chapter 4.1.4.2, "UL allocation settings", on page 99

**Manual operation:** See "Content" on page 62

---

**[:SOURce<hw>]:BB:V5G:UL[:SUBF<st0>]:ALLoc<ch0>[:XPUCch]:FORMat?**

Queries the xPUCCH format.

**Return values:**
<Format> F1 | F1A | F1B | F2 | F2A | F2B | F3
*RST: F1

**Example:** See Chapter 4.1.4.2, "UL allocation settings", on page 99.

**Usage:** Query only

**Manual operation:** See "Modulation/Format" on page 62

---

**[:SOURce<hw>]:BB:V5G:UL[:SUBF<st0>]:ALLoc<ch0>[:XPUSch]:MODulation**
**<Modulation>**

Selects the modulation scheme for the specified allocation.

**Parameters:**
<Modulation> QPSK | QAM16 | QAM64 | PSK8 | QAM256
*RST: QPSK

**Example:** See Chapter 4.1.4.2, "UL allocation settings", on page 99.

**Manual operation:** See "Modulation/Format" on page 62

---

**[:SOURce<hw>]:BB:V5G:UL:SUBF<st0>:ALLoc<ch0>:XPUSch:RBCount**
**<XPuschRbCntSet1>**

Sets the size of the selected xPUSCH allocation in resource blocks per slot.

**Parameters:**
<XPuschRbCntSet1> float
Range: 4 to 100
Increment: 4
*RST: 12

**Example:** See Chapter 4.1.4.2, "UL allocation settings", on page 99.

**Manual operation:** See "No. RB" on page 62

---

**[:SOURce<hw>]:BB:V5G:UL[:SUBF<st0>]:ALLoc<ch0>:XPUCch:RBCount?**

Queries the size of the selected xPUCCH allocation in resource blocks per slot.

**Return values:**
<PuccRbCntSet1> integer
Range: 6 to 6
Increment: 4
*RST: 6

**Example:** See Chapter 4.1.4.2, "UL allocation settings", on page 99.

**Usage:** Query only

**Manual operation:** See "No. RB" on page 62

---

**[:SOURce<hw>]:BB:V5G:UL[:SUBF<st0>]:ALLoc<ch0>:XPUCch:RBOFfset**
<ContentType>

Sets the xPUCCH resource block offset within the subframe of the selected allocation.

**Parameters:**
<ContentType> float
Range: 0 to 90
Increment: 6
*RST: 0
Default unit: slot

**Example:** See Chapter 4.1.4.2, "UL allocation settings", on page 99.

**Manual operation:** See "Offset RB" on page 62

---

**[:SOURce<hw>]:BB:V5G:UL[:SUBF<st0>]:ALLoc<ch0>:XPUSch:RBOFfset**
<ContentType>

Sets thexPUSCH resource block offset within the subframe of the selected allocation.

**Parameters:**
<ContentType> float
Range: 0 to 49
Increment: 4
*RST: 0
Default unit: slot

**Example:** See Chapter 4.1.4.2, "UL allocation settings", on page 99.

**Manual operation:** See "Offset RB" on page 62

---

**[:SOURce<hw>]:BB:V5G:UL[:SUBF<st0>]:ALLoc<ch0>:XPUCch:PHYSbits?**
**[:SOURce<hw>]:BB:V5G:UL[:SUBF<st0>]:ALLoc<ch0>:XPUSch:PHYSbits?**

Queries the number of physical bits for the selected allocation.

**Return values:**
<XPuscPhysBits> integer
Range: 0 to 105600
*RST: 0

**Example:** See Chapter 4.1.4.2, "UL allocation settings", on page 99.

**Usage:** Query only

**Manual operation:** See "Physical Bits/ Total Number of Physical Bits" on page 63

---

**[:SOURce<hw>]:BB:V5G:UL[:SUBF<st0>]:ALLoc<ch0>:XPUCch:POWer**
<PuccPower>
**[:SOURce<hw>]:BB:V5G:UL[:SUBF<st0>]:ALLoc<ch0>:XPUSch:POWer**
<PuscPower>

Sets the power for the selected allocation.

**Parameters:**

<PuscPower> float

Range: -80 to 10
Increment: 0.001
*RST: 0
Default unit: dBm

**Example:** See Chapter 4.1.4.2, "UL allocation settings", on page 99.

**Manual operation:** See "Rho (Power)" on page 63

---

**[:SOURce<hw>]:BB:V5G:UL:SUBF<st0>:ALLoc<ch0>:XPUCch:STATe**
<PuccState>
**[:SOURce<hw>]:BB:V5G:UL:SUBF<st0>:ALLoc<ch0>:XPUSch:STATe**
<PuscState>

Sets the allocation state to active or inactive for the corresponding, including xPUSCH/ xPUCCH and the corresponding reference signals.

**Note:** Disabling an allocation does not affect other allocations of the UE.

**Parameters:**

<PuscState> 1 | ON | 0 | OFF

*RST: dynamic

**Example:** See Chapter 4.1.4.2, "UL allocation settings", on page 99.

**Manual operation:** See "State " on page 63

---

**[:SOURce<hw>]:BB:V5G:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:XPUSch:CONFlict?**
**[:SOURce<hw>]:BB:V5G:UL[:SUBF<st0>]:ALLoc<ch0>:CONFlict?**
**[:SOURce<hw>]:BB:V5G:UL[:SUBF<st0>]:ALLoc<ch0>:XPUCch:CONFlict?**

Indicates a conflict with other allocations.

**Return values:**

<XPuccConflict> 1 | ON | 0 | OFF

*RST: 0

**Example:** See Chapter 4.1.4.2, "UL allocation settings", on page 99

**Usage:** Query only

**Manual operation:** See "Conflict" on page 63

### 4.5.5 UL frame: enhanced channel configuration



---

**[:SOURce<hw>]:BB:V5G:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:XPUCch:PRECoding:SCHeme?**

Selects the precoding scheme for xPUCCH transmission.

**Return values:**

<PrecodingScheme> NONE | SMUX
None, spatial multiplexing
*RST: NONE

**Example:** See Chapter 4.1.4.2, "UL allocation settings", on page 99.

**Usage:** Query only

**Manual operation:** See "Precoding Scheme" on page 65

---

**[:SOURce<hw>]:BB:V5G:UL[:SUBF<st0>]:ALLoc<ch0>:XPUCch:NAPused?**

Queries the number of antenna ports used for transmissions of the specified xPUCCH allocation.

**Return values:**
<NumAntennaPorts> integer
Range: 1 to 2
*RST: 1

**Example:** See Chapter 4.1.4.2, "UL allocation settings", on page 99.

**Usage:** Query only

**Manual operation:** See "Number of Used Antenna Ports" on page 65

---

**[:SOURce<hw>]:BB:V5G:UL[:SUBF<st0>]:ALLoc<ch0>:XPUCch:NXPucch** <NXPucch>

Sets the resource index $n_{xPUCCH}^{(2)}$.

**Suffix:**
<ap> 0..1
Antenna port of the specified allocation for spatial multiplexing

**Parameters:**
<NXPucch> integer
Range: 0 to 15
*RST: 0

**Example:** See Chapter 4.1.4.2, "UL allocation settings", on page 99.

**Manual operation:** See "n_xPUCCH(2)" on page 65

---

**[:SOURce<hw>]:BB:V5G:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:XPUSch:DMRS:NID** <DmrsNid>

Specifies the source of reference signal ID $n_{ID}$ for DMRS.

**Suffix:**
<st0> 0..39
Subframe number

<ch0> 0..3
Allocation number

**Parameters:**
<DmrsNid> CELL | DMRS
The $n_{ID}$ = N_ID $^{Cell}$ or $n_{ID}^{DMRS}$
*RST: CELL

**Example:** See Chapter 4.1.4.2, "UL allocation settings", on page 99.

**Manual operation:** See "N_ID" on page 67

**[:SOURce<hw>]:BB:V5G:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:XPUSch:DMRS:NIDDmrs** <DmrsNidDmrs>

Sets the demodulation reference signal ID $n_{ID}^{DMRS}$ associated with the selected xPUSCH allocation.

**Suffix:**
<st0> 0..39
Subframe number

<ch0> 0..3
Allocation number

**Parameters:**
<DmrsNidDmrs> integer
Range: 0 to 503
*RST: 0

**Example:** See Chapter 4.1.4.2, "UL allocation settings", on page 99.

**Manual operation:** See "N_ID^DMRS / N_ID^PCRS" on page 68

**[:SOURce<hw>]:BB:V5G:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:XPUSch:NSCid** <NSCID>

Specifies the scrambling identity $n_{SCID}$ of UE-specific reference signals associated with the selected xPUSCH allocation.

**Suffix:**
<st0> 0..39
Subframe number

<ch0> 0..3
Allocation number

**Parameters:**
<NSCID> integer
Range: 0 to 1
*RST: 0

**Example:** See Chapter 4.1.4.2, "UL allocation settings", on page 99.

**Manual operation:** See "N_SCID" on page 67

**[:SOURce<hw>]:BB:V5G:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:XPUSch:PCRS:NID** <PcrsNid>

Specifies the source of reference signal ID $n_{ID}$ for PCRS.

**Suffix:**
<st0> 0..39
Subframe number

<ch0> 0..3
Allocation number

**Parameters:**
<PcrsNid> PCRS | CELL
The $n_{ID}^{PCRS}$ or $n_{ID}$ = N_ID $^{Cell}$
*RST: CELL

**Example:** See Chapter 4.1.4.2, "UL allocation settings", on page 99.

**Manual operation:** See "N_ID" on page 67

---

**[:SOURce<hw>]:BB:V5G:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:XPUSch:PCRS:NIDPcrs** <PcrsNidPcrs>

Sets the phase noise compensation reference signal ID $n_{ID}^{PCRS}$ associated with the selected xPUSCH allocation.

**Suffix:**
<st0> 0..39
Subframe number

<ch0> 0..3
Allocation number

**Parameters:**
<PcrsNidPcrs> integer
Range: 0 to 503
*RST: 0

**Example:** See Chapter 4.1.4.2, "UL allocation settings", on page 99.

**Manual operation:** See "N_ID^DMRS / N_ID^PCRS" on page 68

---

**[:SOURce<hw>]:BB:V5G:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:XPUSch:PCRS:RPOWer** <PcrsRelPow>

Sets the power $P_{DL\ PCRS}$ relative to xPUSCH for the allocation type xPUSCH.

**Suffix:**
<st0> 0..39
Subframe number

<ch0> 0..3
Allocation number

**Parameters:**
<PcrsRelPow> float
Range: -80.000 to 10.000
Increment: 0.001
*RST: 3.000

**Example:** See Chapter 4.1.4.2, "UL allocation settings", on page 99.

**Manual operation:** See "Rel. Power" on page 68

---

**[:SOURce<hw>]:BB:V5G:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:XPUSch:PCRS:STATe** <PcrsState>

Enables or disables phase noise compensation reference signal ID $n_{ID}^{PCRS}$ associated with xPUSCH.

**Suffix:**
<st0> 0..39
Subframe number

<ch0> 0..3
Allocation number

**Parameters:**
<PcrsState> 1 | ON | 0 | OFF
*RST: 0

**Example:** See Chapter 4.1.4.2, "UL allocation settings", on page 99.

**Manual operation:** See "State (UL PCRS)" on page 68

---

**[:SOURce<hw>]:BB:V5G:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:XPUSch:PRECoding:SCHeme?**

Selects the precoding scheme for xPUSCH transmission.

**Return values:**
<PrecodingScheme> NONE | SMUX
None, spatial multiplexing
*RST: NONE

**Example:** See Chapter 4.1.4.2, "UL allocation settings", on page 99.

**Usage:** Query only

**Manual operation:** See "Precoding Scheme" on page 66

---

**[:SOURce<hw>]:BB:V5G:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:XPUSch:RMINdex** <ReMappingIndex>

Sets the DCI format field resource element mapping index for DMRS/PCRS in uplink.

**Suffix:**
<st0> 0..39
Subframe number

<ch0> 0..3
Allocation number

**Parameters:**

<ReMappingIndex> integer

Range: 0 to 3
*RST: 0

**Example:** See Chapter 4.1.4.2, "UL allocation settings", on page 99.

**Manual operation:** See "RE Mapping Index k_i" on page 67

---

**[:SOURce<hw>]:BB:V5G:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:XPUSch:CCODing:CRATe** <CodeRate>

Sets the coding rate for user data transmission.

**Parameters:**

<CodeRate> R56 | R34 | R23 | R12

Coding rate 5/6, 3/4, 2/3, 1/2
*RST: R12

**Example:** See Chapter 4.1.4.3, "User configuration", on page 100.

**Manual operation:** See "Code Rate" on page 69

---

**[:SOURce<hw>]:BB:V5G:UL[:CELL<ccidx>][:SUBF<st0>]:ALLoc<ch0>:XPUSch:CCODing:TBSize** <TranspBlockSize>

Sets the size of the transport block per antenna port.

**Parameters:**

<TranspBlockSize> integer

Range: 1 to 253440
*RST: 2500

**Example:** See Chapter 4.1.4.3, "User configuration", on page 100.

**Manual operation:** See "Transport Block Size" on page 69

## 4.6 Trigger commands

**[:SOURce<hw>]:BB:V5G[:TRIGger]:SEQuence** <TrigMode>

Selects the trigger mode:

- `AUTO` = auto
- `RETRigger` = retrigger
- `AAUTo` = armed auto
- `ARETrigger` = armed retrigger
- `SINGle` = single

**Parameters:**

<TrigMode> AUTO | RETRigger | AAUTo | ARETrigger | SINGle

*RST: AUTO

**Example:** See Chapter 4.1.5, "Trigger settings", on page 101

**Manual operation:** See "Mode" on page 81

**[:SOURce<hw>]:BB:V5G:TRIGger:SOURce** <TrigSour>

Selects the trigger signal source and determines the way the triggering is executed. Provided are:

- Internal triggering by a command (`INTernal`)
- External trigger signal via one of the local or global connectors
  - `EGT1|EGT2`: External global trigger
  - `EGC1|EGC2`: External global clock
  - `ELTRigger`: External local trigger
  - `ELCLock`: External local clock
- Internal triggering by a signal from the other basebands (`INTA|INTB`)
- `OBASeband|BEXTernal|EXTernal`: Setting only
  Provided only for backward compatibility with other Rohde & Schwarz signal generators.
  The R&S SMW accepts these values and maps them automatically as follows:
  `EXTernal = EGT1, BEXTernal = EGT2, OBASeband = INTA or INTB`
  (depending on the current baseband)

**Parameters:**

<TrigSour> INTB|INTernal|OBASeband|EGT1|EGT2|EGC1|EGC2|ELTRigger|INTA|ELCLock|BEXTernal|EXTernal

*RST: INTernal

**Example:** See Chapter 4.1.5, "Trigger settings", on page 101.

**Manual operation:** See "Source" on page 83

---

**[:SOURce<hw>]:BB:V5G:TRIGger:RMODe?**

Queries the signal generation status.

**Return values:**

<TrigRunMode> STOP | RUN

*RST: 0

**Example:** See Chapter 4.1.5, "Trigger settings", on page 101.

**Usage:** Query only

**Manual operation:** See "Running/Stopped" on page 82

---

**[:SOURce<hw>]:BB:V5G:TRIGger:SLENgth** <TrigSeqLen>

Defines the length of the signal sequence that is output in the `SINGle` trigger mode.

**Parameters:**

<TrigSeqLen> integer

Range: 1 to 4294967295

*RST: 1

**Example:** See Chapter 4.1.5, "Trigger settings", on page 101.

**Manual operation:** See "Signal Duration" on page 82

---

**[:SOURce<hw>]:BB:V5G:TRIGger:SLUNit** <SeqLenUnit>

Defines the unit for the entry of the signal sequence length, generated after the trigger event.

**Parameters:**

<SeqLenUnit> SEQuence | FRAMe | SUBFrame | SLOT | SAMPle

**SEQuence**
Single sequence.

**FRAMe**
Single frame

**SUBFrame**
Single subframe.

**SLOT**
Single slot

**SAMPle**
Selected number of samples.
*RST: SEQuence

**Example:** See Chapter 4.1.5, "Trigger settings", on page 101.

**Manual operation:** See "Signal Duration Unit" on page 82

---

**[:SOURce<hw>]:BB:V5G:TRIGger:EXECute**

Executes a trigger.

**Example:** See Chapter 4.1.5, "Trigger settings", on page 101.

**Usage:** Event

**Manual operation:** See "Execute Trigger" on page 83

---

**[:SOURce<hw>]:BB:V5G:TRIGger:ARM:EXECute**

Stops signal generation; a subsequent trigger event restarts signal generation.

**Example:**
```
SOURce1:BB:V5G:TRIGger:SOURce INT
SOURce1:BB:V5G:TRIGger:SEQuence ARETrigger
SOURce1:BB:V5G:TRIGger:EXEcute
// executes a trigger, signal generation starts
SOURce1:BB:V5G:TRIGger:ARM:EXECute
// signal generation stops
SOURce1:BB:V5G:TRIGger:EXEcute
// executes a trigger, signal generation starts again
```

**Example:** See Chapter 4.1.5, "Trigger settings", on page 101.

**Usage:** Event

**Manual operation:** See "Arm" on page 83

---

**[:SOURce<hw>]:BB:V5G:TRIGger:EXTernal:SYNChronize:OUTPut** <TrigSyncOut>

Enables output of the signal synchronous to the external trigger event.

**Parameters:**
<TrigSyncOut> 1 | ON | 0 | OFF
*RST: 1

**Example:** See Chapter 4.1.5, "Trigger settings", on page 101.

**Manual operation:** See "Sync. Output to External Trigger/Sync. Output to Trigger" on page 83

---

**[:SOURce<hw>]:BB:V5G:TRIGger:DELay:UNIT** <TrigDelUnit>

Sets the units that the trigger delay is expressed in.

**Parameters:**
<TrigDelUnit> SAMPle | TIME
*RST: SAMPle

**Example:** See Chapter 4.1.5, "Trigger settings", on page 101.

**Manual operation:** See "(External) Delay Unit" on page 84

---

**[:SOURce<hw>]:BB:V5G:TRIGger:OBASeband:DELay** <OthDelay>

Sets the trigger delay for triggering by the trigger signal from the other path.

**Parameters:**
<OthDelay> float
Range: 0 to 65535
Increment: 0.01
*RST: 0

**Example:** See Chapter 4.1.5, "Trigger settings", on page 101.

---

**[:SOURce<hw>]:BB:V5G:TRIGger:OBASeband:RDELay?**

Queries the time a trigger event form the other path is delayed.

**Return values:**
<OthTimeResDel> float
Range: 0 to 688
Increment: 250E-12
*RST: 0

**Example:** See Chapter 4.1.5, "Trigger settings", on page 101.

**Usage:** Query only

**Manual operation:** See "Actual Trigger Delay/Actual External Delay" on page 85

---

**[:SOURce<hw>]:BB:V5G:TRIGger:OBASeband:TDELay** <OthTimeDelay>

Specifies the trigger delay for triggering by the signal from the other path.

**Parameters:**
<OthTimeDelay> float
Range: 0 to 688
Increment: 250E-12
*RST: 0

**Example:** See Chapter 4.1.5, "Trigger settings", on page 101.

**Manual operation:** See "(Specified) External Delay/(Specified) Trigger Delay" on page 85

**[:SOURce<hw>]:BB:V5G:TRIGger:OBASeband:INHibit** <OthInhibit>

For triggering via the other path, specifies the duration by which a restart is inhibited.

**Parameters:**

<OthInhibit> integer

Range: 0 to 67108863
*RST: 0

**Example:** See Chapter 4.1.5, "Trigger settings", on page 101.

**Manual operation:** See "External Inhibit/Trigger Inhibit" on page 84

**[:SOURce<hw>]:BB:V5G:TRIGger[:EXTernal]:DELay** <TrigExtDelay>

Sets the trigger delay.

**Parameters:**

<TrigExtDelay> float

Range: 0 to 68719476735
Increment: 0.01
*RST: 0

**Example:** See Chapter 4.1.5, "Trigger settings", on page 101.

**Manual operation:** See "(Specified) External Delay/(Specified) Trigger Delay" on page 85

**[:SOURce<hw>]:BB:V5G:TRIGger:EXTernal:TDELay** <TrigExtTimeDel>

Specifies the trigger delay for external triggering. The value affects all external trigger signals.

**Parameters:**

<TrigExtTimeDel> float

Range: 0 to 688
Increment: 250E-12
*RST: 0

**Example:** See Chapter 4.1.5, "Trigger settings", on page 101.

**Manual operation:** See "(Specified) External Delay/(Specified) Trigger Delay" on page 85

**[:SOURce<hw>]:BB:V5G:TRIGger:EXTernal:RDELay?**

Queries the time (in seconds) an external trigger event is delayed for.

**Return values:**

<TrigExtTimeResD> float

Range: 0 to 688
Increment: 250E-12
*RST: 0

**Example:** See Chapter 4.1.5, "Trigger settings", on page 101.

**Usage:** Query only

**Manual operation:** See "Actual Trigger Delay/Actual External Delay" on page 85

---

**[:SOURce<hw>]:BB:V5G:TRIGger[:EXTernal]:INHibit** <TrigExtInhibit>

Specifies the duration by which a restart is inhibited.

**Parameters:**

<TrigExtInhibit> integer

Range: 0 to 67108863
*RST: 0

**Example:** See Chapter 4.1.5, "Trigger settings", on page 101.

**Manual operation:** See "External Inhibit/Trigger Inhibit" on page 84

---

**[:SOURce<hw>]:BB:V5G:TRIGger:TIME:DATE** <Year>, <Month>, <Day>

Sets the date for a time-based trigger signal. For trigger modes single or armed auto, you can activate triggering at this date via the following command:

`SOURce<hw>:BB:<DigStd>:TRIGger:TIME:STATe`

`<DigStd>` is the mnemonic for the digital standard, for example, `ARB`. Time-based triggering behaves analogously for all digital standards that support this feature.

**Parameters:**

<Year> integer

Range: 1980 to 9999

<Month> integer

Range: 1 to 12

<Day> integer

Range: 1 to 31

**Example:** See example "Configure a time-based trigger signal" in the subchapter "Trigger Commands" of the chapter "SOURce:BB:ARB subsystem" in the R&S SMW user manual.

**Manual operation:** See "Trigger Time" on page 82

---

**[:SOURce<hw>]:BB:V5G:TRIGger:TIME:TIME** <Hour>, <Minute>, <Second>

Sets the time for a time-based trigger signal. For trigger modes single or armed auto, you can activate triggering at this time via the following command:

`SOURce<hw>:BB:<DigStd>:TRIGger:TIME:STATe`

`<DigStd>` is the mnemonic for the digital standard, for example, `ARB`. Time-based triggering behaves analogously for all digital standards that support this feature.

**Parameters:**

<Hour> integer
Range: 0 to 23

<Minute> integer
Range: 0 to 59

<Second> integer
Range: 0 to 59

**Example:** See example "Configure a time-based trigger signal" in the subchapter "Trigger Commands" of the chapter "SOURce:BB:ARB subsystem" in the R&S SMW user manual.

**Manual operation:** See "Trigger Time" on page 82

---

**[:SOURce<hw>]:BB:V5G:TRIGger:TIME[:STATe]** <State>

Activates time-based triggering with a fixed time reference. If activated, the R&S SMW triggers signal generation when its operating system time matches a specified time.

Specify the trigger date and trigger time with the following commands:

`SOURce<hw>:BB:<DigStd>:TRIGger:TIME:DATE`

`SOURce<hw>:BB:<DigStd>:TRIGger:TIME:TIME`

`<DigStd>` is the mnemonic for the digital standard, for example, `ARB`. Time-based triggering behaves analogously for all digital standards that support this feature.

**Parameters:**

<State> 1 | ON | 0 | OFF
*RST: 0

**Example:** See example "Configure a time-based trigger signal" in the subchapter "Trigger Commands" of the chapter "SOURce:BB:ARB subsystem" in the R&S SMW user manual.

**Manual operation:** See "Time Based Trigger" on page 82

## 4.7 Marker commands



---

**[:SOURce<hw>]:BB:V5G:TRIGger:OUTPut<ch>:MODE** <MarkMode>

Defines the signal for the selected marker output.

**Parameters:**
<MarkMode> RESTart

**Example:** See Chapter 4.1.6, "Marker settings", on page 103.

**Manual operation:** See "Mode" on page 87

---

**[:SOURce<hw>]:BB:V5G:TRIGger:OUTPut<ch>:ROFFset** <MarkRiseOffs>
**[:SOURce<hw>]:BB:V5G:TRIGger:OUTPut<ch>:FOFFset** <MarkFallOffs>

Shifts the rising or falling ramp of the marker by the selected number of samples.

**Parameters:**
<MarkFallOffs> integer

Range: -640000 to 640000
*RST: 0

**Example:** See Chapter 4.1.6, "Marker settings", on page 103.

**Manual operation:** See "Rise Offset/Fall Offset" on page 87

---

**[:SOURce<hw>]:BB:V5G:TRIGger:OUTPut<ch>:DELay** <MarkDelay>

Defines the delay between the signal on the marker outputs and the start of the signals.

**Parameters:**
<MarkDelay> float

Range: 0 to 16777215
Increment: 0.001
*RST: 0

**Example:** See Chapter 4.1.6, "Marker settings", on page 103.

**Manual operation:** See "Delay" on page 87

## 4.8 Clock commands



---

**[:SOURce<hw>]:BB:V5G:CLOCk:SOURce** <ClocSource>

Selects the clock source:

- `INTernal`: Internal clock reference
- `ELCLock`: External local clock
- `EXTernal = ELCLock`: Setting only
  Provided for backward compatibility with other Rohde & Schwarz signal generators

**Parameters:**

<ClocSource> INTernal | ELCLock | EXTernal

*RST: INTernal

**Example:** See Chapter 4.1.7, "Clock settings", on page 104.

**Manual operation:** See "Clock Source" on page 88

---

**[:SOURce<hw>]:BB:V5G:CLOCk:MODE** <ClocMode>

Sets the type of externally supplied clock.

**Parameters:**

<ClocMode> SAMPle

*RST: SAMPle

**Example:** See Chapter 4.1.7, "Clock settings", on page 104.

**Manual operation:** See "Clock Mode" on page 88

# Glossary: Terms and abbreviations

## Symbols

**5GNB:** 5G Node B

### B

**BRS:** Beam reference signal

### C

**CSI-RS:** Channel state information reference signal

### D

**DCI:** Downlink control information

**DMRS:** Demodulation reference signal

### E

**ESS:** Extended synchronization signal

### P

**PCRS:** Phase noise compensation reference signal

**PSS:** Primary synchronization signal

### S

**SRS:** Sounding reference signal

**SSS:** Secondary synchronization signal

### U

**UCI:** Uplink control information

### V

**Verizon 5GTF:** Verizon 5G Technical Forum
http://5gtf.org/

### X

**xBCH:** 5G broadcast channel

**xDL-SCH:** 5G downlink shared channel

**xPBCH:** 5G physical broadcast channel

**xPDCCH:** 5G physical downlink control channel

**xPDSCH:** 5G physical downlink shared channel

**xPRACH:** 5G physical random access channel

**xPUCCH:** 5G physical uplink control channel

**xPUSCH:** 5G physical uplink shared channel

**xUL-SCH:** 5G uplink shared channel

# List of commands

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