

# R&S® PULSE-K32/-K39

## Pulse Sequencer Digital, Standard Version and Expert Upgrade User Manual



1179387302  
Version 06

**ROHDE & SCHWARZ**  
Make ideas real



This document describes the following software options:

- R&S®PULSE-K32 standard version (1414.7077.22)
- R&S®PULSE-K39 expert upgrade (1414.7125.22)

This manual describes software version V2.7 and later of the R&S®Pulse Sequencer Digital.

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1179.3873.02 | Version 06 | R&S®PULSE-K32/-K39

Throughout this manual, products from Rohde & Schwarz are indicated without the ® symbol, e.g. R&S®PULSE-K32 is abbreviated as R&S PULSE-K32.

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# 1 Welcome to the R&S Pulse Sequencer Digital

The R&S Pulse Sequencer Digital is an application that generates complex pulse signals by using predefined, configurable test scenarios with different complexity. You can simulate the signals of different emitter and receiver configurations, including antennas and scan types.

The R&S Pulse Sequencer Digital software is a standalone, PC-based application that creates simulated signals that you can export to a customized plugin. You can use R&S Pulse Sequencer Digital for example to perform radar receiver tests and for research and development.

## Licenses

A license is not required for the demo version of the application.

To obtain a license provider (R&S PULSE-LPA) and license activation codes for R&S PULSE-K32 or R&S PULSE-K39, contact Rohde & Schwarz support.

For details, see:

- Description of the key features: [Chapter 1.1, "Key features"](#), on page 11.
- Licenses: [Chapter 2.3, "Licensing"](#), on page 19.

## Installation

For details on installation and activating licenses, see:

- Installation instructions included in the delivery of the option.
- Instructions described in [Chapter 2.2, "Installing the software"](#), on page 17.

## 1.1 Key features

### R&S PULSE-K32 standard features:

- Pulse definition
- Modulation on pulse with all major formats like chirps, Barker codes, polyphase codes, PSKs, AM, FM
- Single pulse, pulse train generation with repetition count per pulse
- Powerful sequencing tool with loops, nested loops, and fillers
- Inter-pulse modulation of amplitude, phase, frequency, etc. values from pulse to pulse
- Calculation of signal under consideration of one-way free space propagation according to emitter and receiver location on the 2D map
- Import of PDW files
- A "Platform" element that represents a real-world vehicle that can contain multiple emitters.

- The realization is similar to the DF receiver model.
- Platforms are mapped to a certain inertia profile (car, ship or plane).
- Platforms have a tactical icon in dynamic scenarios.
- Three-dimensional placement of emitters on the platform via 3-axis concept (X, Y and Z).
- A 2D and 3D preview of the emitter placement.
- Emitter definition by signal, antenna diagram, antenna scan, attitude information, EIRP, and carrier frequency
- Antenna diagram definition and antenna scan definition
- Antenna diagrams like pencil beams, cosecant beams, Gaussian diagrams, user-defined antenna diagrams, phased array antenna diagrams
- Antenna scan types like helical scans, circular scans, conical scans
- Receiver definition by antenna diagram, antenna scan, and attitude information

**R&S PULSE-K39 expert features:**

- Allows merging of multiple PDW lists in the "PDW list (Collection)" scenario type or multiple emitters in the "Emitters (Collection)" scenario into a single output file. The feature uses a priority scheme for dropping or just merges the pulses even if they overlap in time
- Enhances the localized and direction finding scenario types by movement profiles for emitters and receivers
- Predefined line and arc movements for simple movement traces
- Waypoint generation from user-defined "Traces" in the GUI
- Waypoint import interface for complex movement traces
- WGS84 waypoint interface and import of NMEA waypoints
- Import of Google Earth and Google Maps .kml files
- East-North-Up (ENU) 2D vector trajectory interface (line, arc) for automatic waypoint generation
- Motion interface for dynamics input (velocity vector or velocity magnitude) in ENU and WGS84
- Predefined waypoint files for land vehicles, ships, aircraft and spacecraft
- User-definable and predefined vehicle description files for land vehicles, ships, aircraft and spacecraft
- Smoothing of waypoints using vehicle description files
- Use georeferenced maps as visual backgrounds for 2D and 3D map views.
- Import the following map formats:
  - GeoTIF
- Create trajectories using the "Trace" function. This function uses a series of user-selected points on the map (i.e. a user-defined trace) to generate waypoints, automatically.
- Dedicated direction finding scenario and receiver element with multiple antennas and individual positioning

- Direction finding receiver definition with up to 20 antennas with individual positioning and pointing

## 1.2 Accessing the R&S Pulse Sequencer Digital

### To open the application

- ▶ On your PC, select "Start > R&S Pulse Sequencer Digital > R&S Pulse Sequencer Digital".

The software opens and per default displays the last opened workspace.

## 1.3 What's new

This manual describes software version V2.7 and later of the R&S®Pulse Sequencer Digital.

Compared to the previous version, it provides the following new features:

- Functions to improve the user experience
  - Enhanced toolbar, see [Chapter 2.5, "Understanding the displayed information"](#), on page 24.
  - Added import function to the repository menu, see [Chapter 4.2, "Repository manager settings"](#), on page 64.
  - Filtering of search results according to entered search string in various dialogs, for example see [Chapter 4.3, "Repository view"](#), on page 67.
  - Defining the settings according to the workflow when creating a scenario, see [Chapter 5.2, "Scenario settings"](#), on page 74.
- Editorial changes.

## 1.4 Documentation overview

This section provides an overview of the R&S Pulse Sequencer Digital user documentation. Unless specified otherwise, you find the documents on the R&S Pulse Sequencer Digital product page at:

<https://www.rohde-schwarz.com/manual/pulse-sequencer/>

### 1.4.1 User manuals and help

Introduces the R&S Pulse Sequencer Digital and describes how to start working with the product. Includes basic operations, typical examples, general information, and the

description of all software modes and functions. It also provides complete description of the remote control commands with programming examples.

The contents of the user manuals are available as help in the R&S Pulse Sequencer Digital. The help offers quick, context-sensitive access to the complete information.

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

### 1.4.2 Data sheets

The data sheet contains the technical specifications of the R&S Pulse Sequencer Digital. It also lists the options and their order numbers as well as optional accessories.

See <https://www.rohde-schwarz.com/brochure-datasheet/pulse-sequencer/>.

### 1.4.3 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 open source acknowledgment document provides verbatim license texts of the used open source software.

See <https://www.rohde-schwarz.com/software/pulse-sequencer/>.

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

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

See <https://www.rohde-schwarz.com/application/pulse-sequencer/>.

## 1.5 Scope

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

## 1.6 Notes on screenshots

When describing the functions of the product, we use sample screenshots. These screenshots are meant to illustrate as much 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 Getting started

This section describes the basic steps to be taken when starting up the R&S Pulse Sequencer Digital for the first time.

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### 2.1 Required options and licences

The R&S Pulse Sequencer Digital software is a standalone, PC-based application that creates digital simulation data for the verification of software algorithms, digital training and digital validation of [ELINT](#) systems.

The R&S Pulse Sequencer Digital is available in three operation modes:

- **Demo**  
A demo version that enables you to try out some of the main features of the application including access to the visualizations. However, you cannot export simulation data.  
This option does not require a license.
- **Standard (R&S PULSE-K32)**  
A standalone application offering basic simulation features. Provides a range of standard features and functionality, including exporting of simulated signal data  
Requires a license.
- **Expert (R&S PULSE-K39)**  
An optional extension to R&S PULSE-K32 that provides expert functionality.  
Requires a license.

Any of the licensed modes require a license dongle. The license provider R&S PULSE-LD is available as a separate product and *must be ordered in addition to the software licenses*.

For information about licenses, see [Chapter 2.3, "Licensing"](#), on page 19.



## 2.2 Installing the software

Software updates and the release notes describing the improvements and modifications are available for download at the product page <https://www.rohde-schwarz.com/software/pulse-sequencer/>.

The following software components must be installed to run the R&S Pulse Sequencer Digital successfully:

- R&S License Server
- VISA (Virtual Instrument Software Architecture)

The R&S License Server is installed automatically during installation of the R&S Pulse Sequencer Digital. VISA can be installed directly during installation of the R&S Pulse Sequencer Digital, or manually, independently of the R&S Pulse Sequencer Digital installation. We recommend that you use the R&S VISA driver. The R&S VISA driver is supplied with the R&S Pulse Sequencer Digital installation file, and can be installed together with the R&S Pulse Sequencer Digital software.

### Software and hardware requirements

Minimum requirements:

- **Software**
  - Microsoft®Windows 10, 64-Bit operating system (x64-based or x86-based processor)
- **Hardware**

*Table 2-1: Hardware requirements*

	Minimum requirements	Recommended hardware
AMD or Intel CPU	Dual Core, 2 GHz	Intel 8 Core i7 10700, AMD Ryzen series
RAM	≥ 2 GB	64 GB
Video	NVIDIA Quadro 128 MB or ATI Radeon	NVIDIA Quadro 128 MB or ATI Radeon
Video resolution	≥ 1280 x 1024 pixels	≥ 1920 x 1200 pixels
Network	LAN 1 GB/s	LAN 1 GB/s

### To install the software

Download the R&S Pulse Sequencer Digital software from the Rohde & Schwarz website.

The R&S Pulse Sequencer Digital software consists of the file

PS-DIGITAL-Install <major>.<minor>.<build>.<release>-x64.msi.

#### 1. Start the

PS-DIGITAL-Install <major>.<minor>.<build>.<release>-x64.msi file.

The filename follows the naming conventions:

- <major>.<minor> is the software version
- <build> is the build number.  
This is the day elapsed since 1 January 2000
- <release> indicates the release on the build date.  
This is 1/10 of the number of seconds elapsed since midnight.
- x64 indicates that this is a 64-bit installation file.  
You can run the software version with the extension x64 only on a 64-bit operating system, see "[Software and hardware requirements](#)" on page 17.

2. Depending on your user rights, select one of the following:

- a) Installation for all users (default)
  - Requires administrator rights
  - Is a per-machine installation
  - Project data and program data are common to all users
  - Users keep their individual settings
- b) Installation for current user only
  - Does not require administrator rights
  - Is a per-user installation
  - Installation in %HomePath%

3. Choose the setup type.

4. Follow the installation instructions.

The installer performs the following actions:

- If enabled, installs the R&S VISA software on the PC
- Installs the R&S License Server
- Installs the R&S Pulse Sequencer Digital software including an uninstall tool
- Creates a shortcut on the desktop
- Creates the folder structure listed in [Table 2-2](#).

**Table 2-2: Default file location (software installation for all users)**

File type	File location
Program data	%PROGRAMFILES(X86)%\Rohde-Schwarz\ Pulse Sequencer Digital (Path)
Project data (Repository data-base) SDK files	%PUBLIC%\Public\Documents\Rohde-Schwarz\ Pulse Sequencer Digital (DataPath)
Report files, startup log file, calculated data, volatile data	%HOMEPATH% (HomePath or ReportPath)
User settings (Workspace, etc.)	%HOMEPATH%\AppData\Roaming\Rohde-Schwarz\ Pulse Sequencer Digital

## 2.3 Licensing

A license is not required for the demo version of the R&S Pulse Sequencer Digital.

Running the R&S Pulse Sequencer Digital in standard mode requires a valid core license R&S PULSE-K32, and, depending on the desired features, additional licenses for options, like R&S PULSE-K39 for expert mode are required.

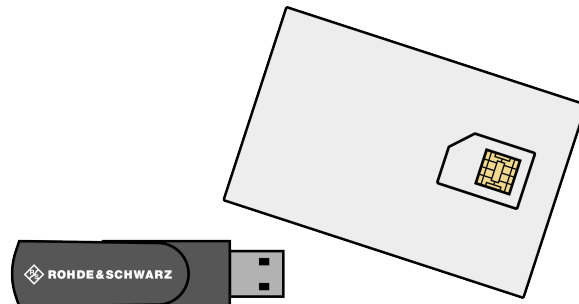
### R&S PULSE-LD

The R&S Pulse Sequencer Digital software requires a smart card containing the software license to be connected to the PC when you are using the software. The R&S PULSE-LD license provider contains the purchased software license and consists of a smart card and a USB dongle. The R&S PULSE-LD is available as a separate product and must be ordered in addition to the software.

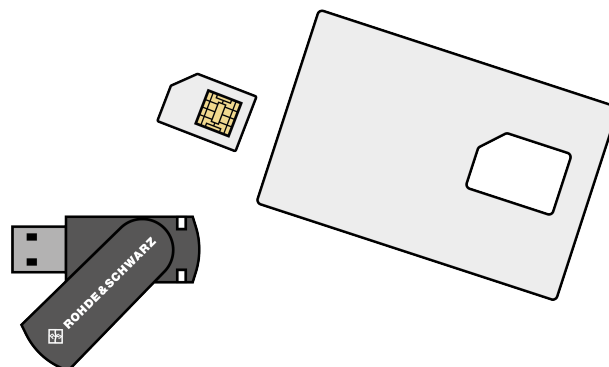
To obtain the license provider R&S PULSE-LD and license activation codes for R&S PULSE-K32 or R&S PULSE-K39, contact Rohde & Schwarz support.

### Using the license provider R&S PULSE-LD

1. The R&S PULSE-LD license provider consists of a smart card in full format and a USB smart card reader (dongle).

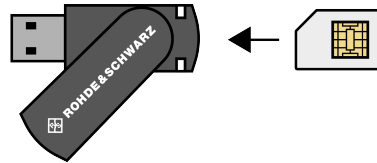


2. Break out the smart card in SIM format.

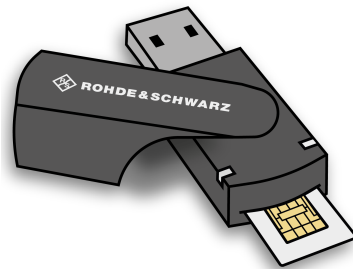


3. Twist out the upper part of the smart card reader.

4. Insert the smart card with the chip facing upwards and the angled corner facing the USB dongle, whose "Rohde & Schwarz" label is also facing upwards.



Insert the smart card as far as possible.



5. Twist the smart card reader back into its original state.



The license provider is ready for use on any USB interface.

6. Connect the license provider to the PC the R&S Pulse Sequencer Digital is running on.

The R&S License Server, that is installed automatically with the R&S Pulse Sequencer Digital installation, detects the license provider and the software licenses.

The software is ready to use.

### Activating licenses

When you order a license and a license provider at once, the purchased licenses are already registered, activated and are delivered on the license provider.

If you purchase a license, for example R&S PULSE-K39, at a latter time, you receive a license key, registered for your license provider and need to activate the license.

1. Connect the license provider to the PC the R&S Pulse Sequencer Digital is running on.
2. Open the "R&S License Server".
3. Select "Activate".
4. In the License Key field, enter the registered license key you have received.
5. Follow the instructions.

6. Restart the "R&S License Server".
7. Start the R&S Pulse Sequencer Digital.

### Missing licenses

If the R&S Pulse Sequencer Digital complains about missing licenses, run the R&S License Server Manager browser application.

1. On the R&S Pulse Sequencer Digital PC, select "Windows" > "Start" > "R&S License Server" > "R&S License Server Manager".
2. Check if the required R&S PULSE-LD license is visible in the "Licenses > Licence providers" tab.
3. Check if the required R&S PULSE-K32 or R&S PULSE-K39 licenses are visible in the "Licenses > Licences" tab.

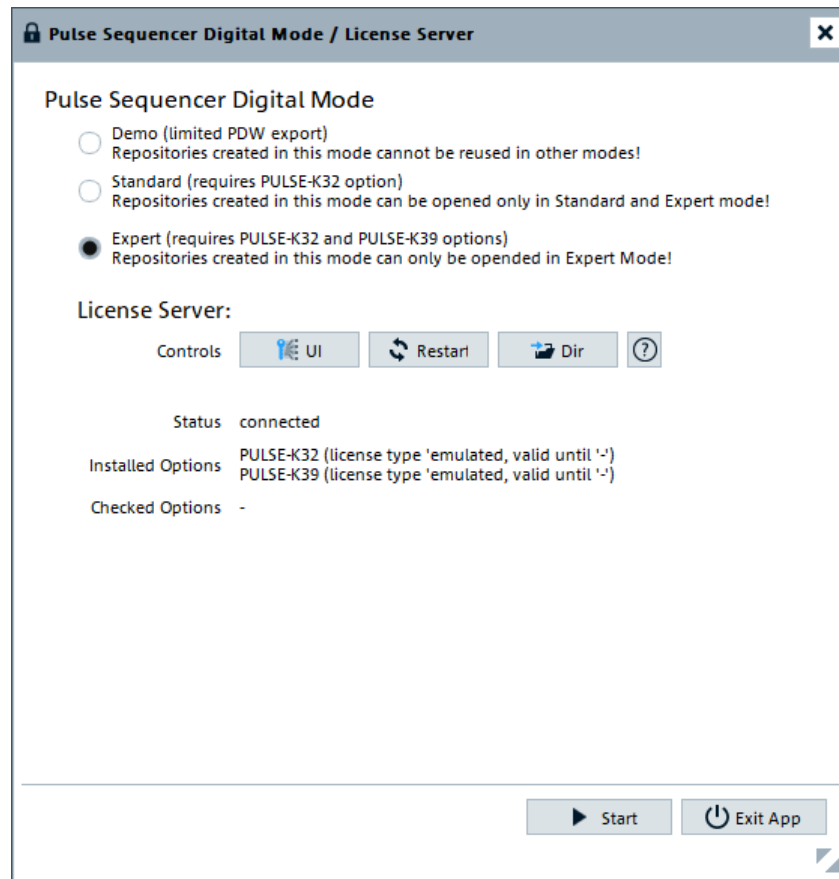
For more information, on the R&S License Server:

- In the "R&S License Server Manager" web interface, click the "Help" icon.
- Open Windows start menu and select "Open License Server Manual" to access the R&S License Server user manual in PDF format.

## 2.4 Starting the R&S Pulse Sequencer Digital for the first time

1. Check that you have a valid license registered on your PC.  
**Note:** If you do not have a license provider and license registered yet, you can run the software in demonstration mode. Continue with this procedure and select "Demo Mode" from the list of options.
2. On your PC:
  - a) Select "Start > R&S Pulse Sequencer Digital > R&S Pulse Sequencer Digital"  
or
  - b) Double click the shortcut icon on the desktop.The "Pulse Sequencer Digital Mode / License Server" dialog opens.

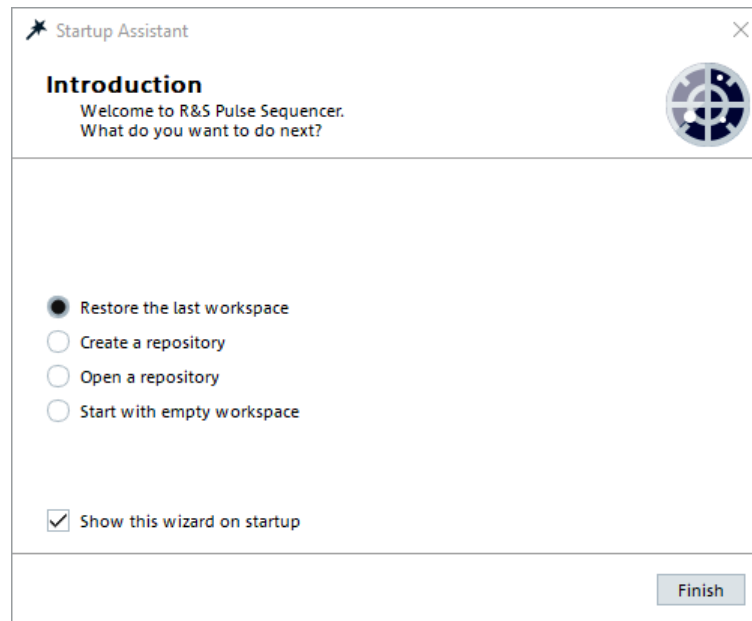
## Starting the R&amp;S Pulse Sequencer Digital for the first time



**Note:** Dialog options correspond to registered licenses. You cannot select an option in the dialog unless the required license is registered. "Installed Options" displays the available licenses.

3. In the "Pulse Sequencer Digital Mode / License Server" dialog, select the required mode from the available options.
  - a) For example, select "Pulse Sequencer Digital Mode = Demo".  
This option is always available, with or without license.  
Select this option if you want to experiment with the R&S Pulse Sequencer Digital functionality without producing PDWs.
  - b) If the respective license or combination there of are available and registered, select one of the following options:
    - "Pulse Sequencer Digital Mode = Standard (requires R&S PULSE-K32)"  
Select this mode if you want to create PDWs from scenarios that do not require advanced functions such as DF and maps.
    - "Pulse Sequencer Digital Mode = Expert (requires R&S PULSE-K32 and R&S PULSE-K39)"  
Select this mode if you require advanced functions such as DF, interleaving, movements and maps.
4. Select "Start".  
The "Startup Assistant" opens.

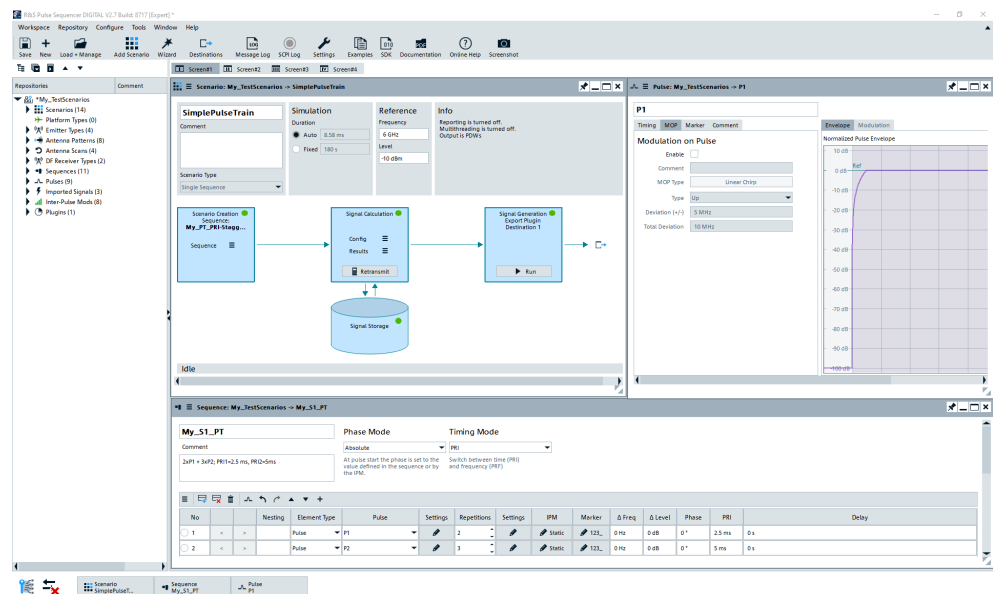
## Starting the R&amp;S Pulse Sequencer Digital for the first time



5. Select "Create a repository" > "Finish".
6. Follow the instructions. Use the default settings when starting R&S Pulse Sequencer Digital for the first time.

A new repository ("New\_<Year>-<Month>-<Day>T<Time>") is created that contains a simple scenario ("SimplePulseTrain").

Your workspace resembles the one shown in the following figure.



See also:

- [Figure 2-1](#) (in [Chapter 2.5, "Understanding the displayed information"](#), on page 24)
- [Chapter 2.6, "Software concept in brief"](#), on page 29

- Chapter 2.8, "Trying out the software", on page 34

## 2.5 Understanding the displayed information

The following figure shows an example test scenario during software operation. The different information areas are labeled. They are explained in more detail in the following sections.

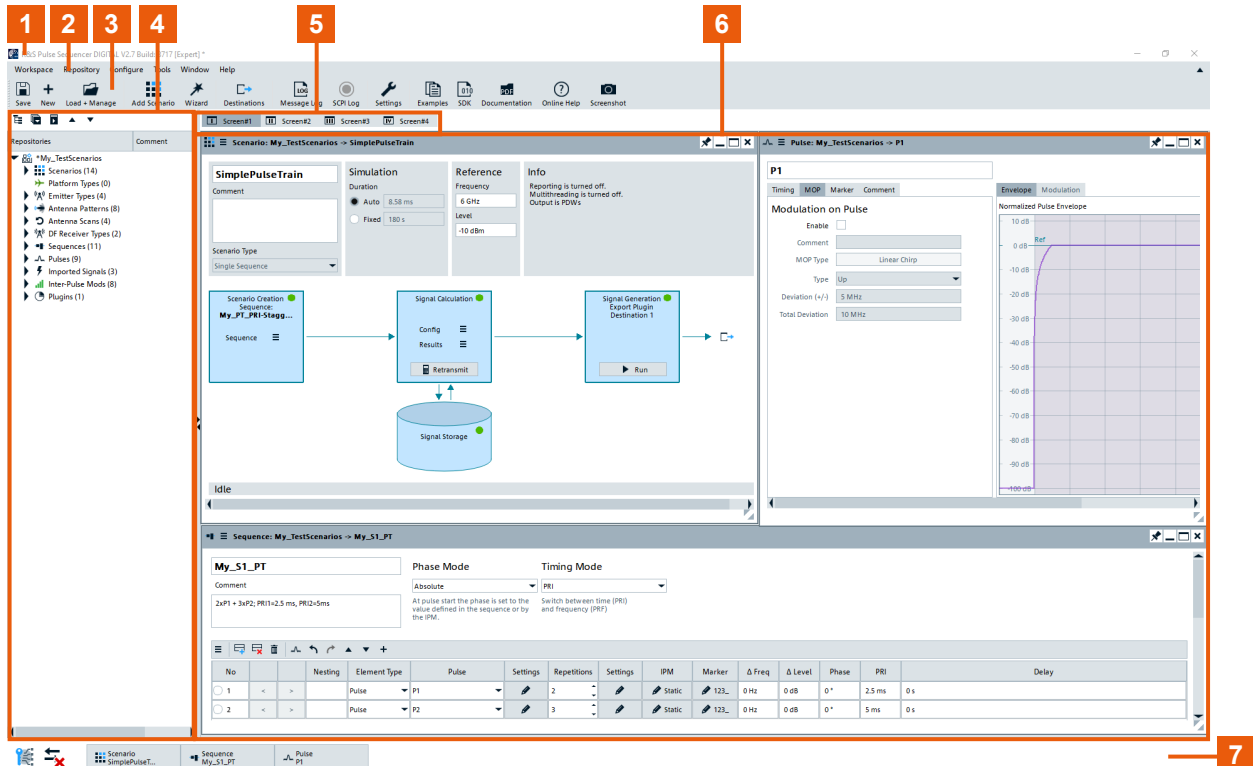


Figure 2-1: R&S Pulse Sequencer Digital default workspace: understanding the displayed information

- 1 = Title bar
- 2 = Menu bar with standard functions, e.g. save/open file etc.
- 3 = Toolbar
- 4 = Project tree (repository tree)
- 5 = Screens for individual scenarios
- 6 = Work area
- 4+6 = Workspace
- 7 = Taskbar with indication of enabled remote control incl. details like IP address (if enabled), information on the required highest security level (if enabled) and access to active dialogs

The user interface of the R&S Pulse Sequencer Digital offers an intuitive operating concept. Operation is similar to any operating system. All menus and dialogs use known elements, e.g., selection lists, checkboxes, and entry fields.



## Menu bar

Table 2-3: Content of the menu bar

Workspace	Repository	Configure		Tools		Window	Help
<ul style="list-style-type: none"> <li>• Clear</li> <li>• Open</li> <li>• Save</li> <li>• Save As</li> <li>• Exit</li> </ul>	<ul style="list-style-type: none"> <li>• New</li> <li>• Load or Manage</li> <li>• Save</li> <li>• Import</li> <li>• Export</li> <li>• Edit</li> </ul>	<ul style="list-style-type: none"> <li>• Destinations</li> <li>• Remote Control</li> <li>• Colors</li> <li>• Settings</li> </ul>		<ul style="list-style-type: none"> <li>• Script</li> <li>• Console</li> <li>• Wizard</li> </ul>		<ul style="list-style-type: none"> <li>• Message Log</li> <li>• SCPI Log</li> <li>• MinSize All Windows</li> <li>• Cascade</li> <li>• Close All</li> <li>• Screen 1 .. 4</li> </ul>	<ul style="list-style-type: none"> <li>• Online Help</li> <li>• Documentation</li> <li>• Examples</li> <li>• SDK</li> <li>• Tutorials</li> <li>• Debug Information</li> <li>• About</li> </ul>

## Toolbars

The R&S Pulse Sequencer Digital offers two toolbars.

Standard functions can be performed via the icons in the main toolbar at the top of the screen. Click the arrow on the right-hand side of the menu bar to expand and collapse the toolbar.



Figure 2-2: Standard functions in the main toolbar

- 1 = Save as: stores current workspace configuration
- 2 = Repository: Creates a repository/Opens "Manage Repository" dialog for loading, discarding or exporting repositories
- 3 = Project tree: Creates a scenario/Starts a wizard to create an emitter or pulse train in current repository
- 4 = Opens the "Destinations" dialog
- 5 = Logs: Opens the "Message Log" window/"SCPI Log" window
- 6 = Opens the "Program Settings" dialog
- 7 = Help: Opens the "Example Files" folder/Opens the "SDK" folder/Opens the help documentation folder containing help documents/Displays context-sensitive help topic for currently selected element
- 8 = Hardcopy: Copies current dialog to the clipboard

Functions relating to the "Project Tree" can be performed via the icons in the toolbar below the main toolbar.



Figure 2-3: Functions in the Project Tree toolbar

- 1 = Switches between tree view and table mode, see [Chapter 4.3, "Repository view"](#), on page 67
- 2 = Expand/collapse all nodes in the "Project Tree"
- 3 = Moves the elements within a node up/down in the "Project Tree"

## Virtual screens

Using the R&S Pulse Sequencer Digital you can handle several scenarios with even comprehensive settings at the same time. You can arrange the dialogs across multiple screens logically, so that you can easily switch between them. You can, for example, assign the subset of antenna dialogs to one screen and the pulse and modulation dialogs to another.

## Repository tree

The repository tree shows the content of all currently loaded repositories. Repository elements are indicated with the assigned icons, their names, and the first comment line.

You can also switch the tree view to table mode, see [Chapter 4.3, "Repository view"](#), on page 67.

Repositories	Comment
<ul style="list-style-type: none"> <li>√  *My_TestScenarios</li> <li>&gt;  Scenarios</li> <li>&gt;  Platform Types</li> <li>&gt;  Emitter Types</li> <li>&gt;  Antenna Patterns</li> <li>√  Antenna Scans <ul style="list-style-type: none"> <li><input type="checkbox"/> My_RasterScan raster scan</li> <li><input checked="" type="checkbox"/> My_Circular std circular scan</li> <li><input type="checkbox"/> Test Antenna Scan</li> <li><input type="checkbox"/> test scan</li> </ul> </li> <li>&gt;  DF Receiver Types</li> <li>&gt;  Sequences</li> <li>&gt;  Pulses</li> <li>&gt;  Imported Signals</li> <li>&gt;  Inter-Pulse Mods</li> <li>&gt;  Plugins</li> </ul>	

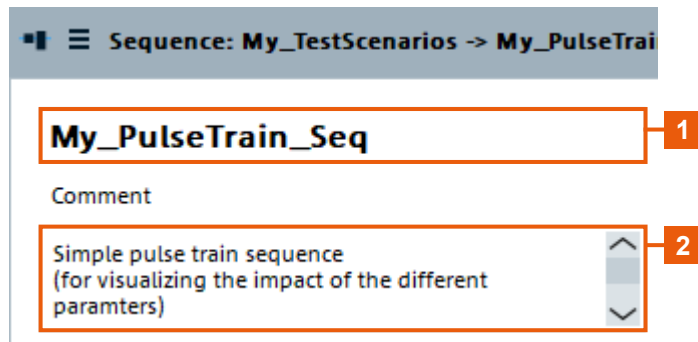
1 = Name, see ["Name and comment"](#) on page 26

2 = First comment line

## Name and comment

Each repository element is identified with its unique name and optional description entered in the comment field. The description can contain several lines; new line is added by pressing [Shift+Enter].

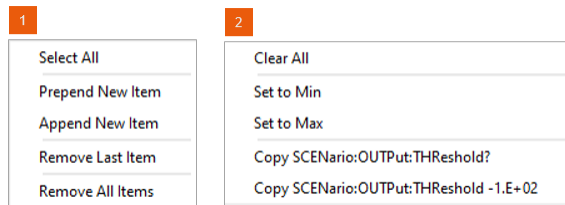
See also ["Dialog names"](#) on page 27.



- 1 = A unique name to indicate the element in the repository  
 2 = Description; the first line is displayed in the repository tree

### Context-sensitive menus

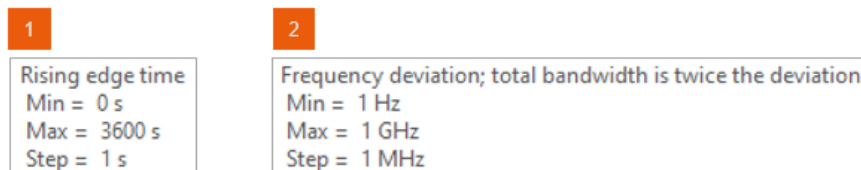
All user interface controls provide a context-sensitive menu. Context-sensitive menus are accessed with a right mouse click the control.



- 1 = Context menu of an icon  
 2 = Context menu of a parameter

### Tooltips

Tooltips indicate the possible value range of a parameter or list overview information on current settings.

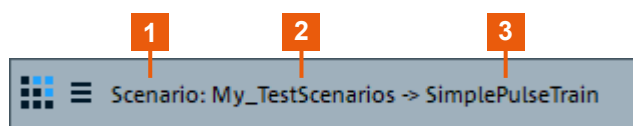


- 1 = Tooltip of a setting parameter, indicating the allowed value range  
 2 = Tooltip with detailed information on a setting

### Dialog names

The name of a dialog indicates its content or the functionality this dialog covers. The used naming convention helps you to recognize which database element you are configuring, to which scenario it belongs and what its current name is.

"<Repository Element>: <Scenario Name> -> <Function Name>"



- 1 = Repository element
- 2 = Scenario name
- 3 = Function name

### Undocking dialogs

If your workspace contains several simultaneously opened dialogs, you can undock dialogs and distribute them also outside the workspace, for example place them on a second monitor.

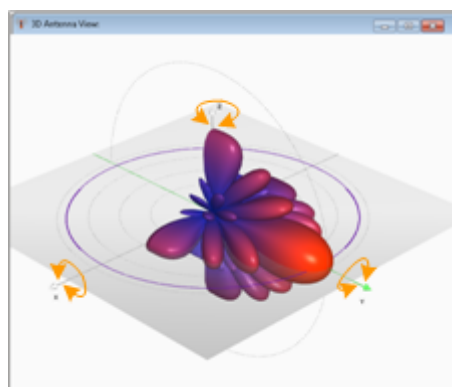


- 1 = Undocks the dialog

### Interactive 3D displays

Several dialogs display the configured settings as 2D or as interactive 3D models or full 3D antenna radiation patterns.

Turning the mouse wheel zooms in and out on these dialogs. Moving the mouse while holding the left mouse key rotates the 3D view around its origin.



### Interactive 2D map

Drag&drop elements into the 2D map or pan and zoom to change the displayed map area.

### Keyboard shortcuts

Keyboard shortcuts are available for the most common functions in the software.

## 2.6 Software concept in brief

The following is brief introduction to the software concept and the way it handles files and settings.

### Repository

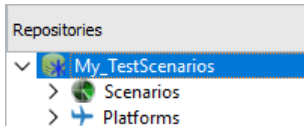
The R&S Pulse Sequencer Digital organizes the data in repositories.

A repository is a **file-based database** located on the local hard drive or on a network storage drive.

Repositories are entirely managed by the R&S Pulse Sequencer Digital. They can be password protected against unauthorized access. Repositories can be exported as archives and shared among multiple users if they are located on a network drive. Several users can have read permission to load and use the same repository simultaneously. However, only one user can have a write permission at a time.

When you create a repository in one operational mode, it is not always compatible with the other modes. For a description see ["Create"](#) on page 65.

For more information, see [Chapter 4, "Organizing the project data in repositories"](#), on page 61.



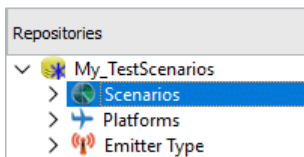
### Scenario

The scenario is the **top-level description** of the signals to be generated.

The type of the scenario determines which kind of signal is calculated and how this signal is processed. A more complex scenario combines several signals. Scenarios can also contain information about the time variation of the signals.

Starting a scenario creates the simulated data and exports them to user-written plugins.

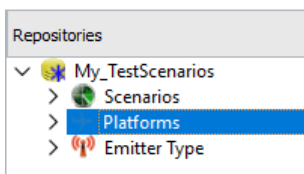
For more information, see [Chapter 5, "Selecting a suitable scenario and creating scenarios"](#), on page 73.



### Platform

A platform is a **group of up to 8 emitters** assigned to a single vehicle. A platform can be static or moving. A platform is characterized by its icon, list of emitters, position and trajectory. The emitters on a platform can be individually configured.

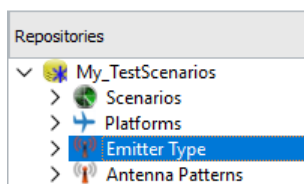
For more information, see [Chapter 12, "Creating platforms"](#), on page 247.



### Emitter

Emitters emulate **radar systems**. The emitter combines a sequence, an antenna scan, and an antenna pattern to one logical unit.

An emitter can work in more than one operating mode and switch between them. The *operating mode* is a description of the radar purpose, such as scanning, searching or tracking. For example, an airport surveillance radar can switch between different scan types to observe its airspace.



Each mode can have individual antenna and signal configuration. Multiple beams are possible within a mode.

For more information, see [Chapter 16, "Creating complex 2D scenarios with receiver and TX items"](#), on page 289.

## Antenna

The antenna characterizes the **radiation pattern of the emitter**. Typical radar antennas like the phase array antennas can adapt their radiation pattern dynamically, depending on the operating mode the radar is working in. For example, an antenna can use a cosecant beam in scan mode and pencil beam in track mode.

Antennas can have various scan types. The scan type describes the movement of the antenna. For example, circular, sector and custom.

For more information, see [Chapter 9, "Defining antenna patterns and antenna scans"](#), on page 170.

## Receiver

Receivers are used to model **direction finding systems**. They comprise of up to 20 individual antennas with individual patterns and positioning relative to a direction finding system.

Option:R&S PULSE-K39 required for direction finding.

For more information, see [Chapter 13, "Emulating receivers"](#), on page 259.

## Sequence

A sequence describes how pulses are arranged to form a waveform. The most simple sequence comprises one pulse that is repeated with a constant PRI (pulse repetition interval). Typical sequences however are rather complex; they can contain pulse definitions, waveforms, and sequencing elements such as repetitions and loops.

The sequence is a **logical description**. It cannot directly be represented as an I/Q waveform.

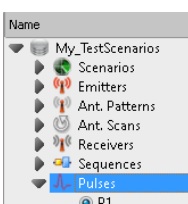
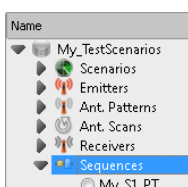
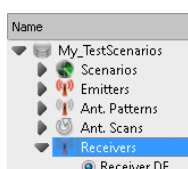
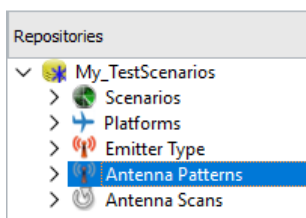
For more information, see [Chapter 7, "Building pulse sequences"](#), on page 119.

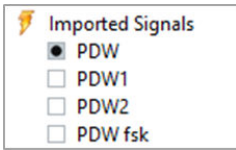
## Pulse

In the R&S Pulse Sequencer Digital, pulses are the **fundamental building block** of any signal. Pulses are described mathematically with their amplitude (envelope), the applied modulation on pulse (MOP) and the enabled marker signals. One single pulse description is however not sufficient to calculate (and process) a signal; pulses have to be organized in a sequence, and assigned to an emitter.

For more information, see [Chapter 6, "Creating a pulse library"](#), on page 93.

## Imported signals

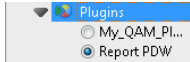




In addition to creating pulse signals you can also load PDW files and use them in sequences.

For more information, see [Chapter 18, "Working with PDWs"](#), on page 355.

### Plugins



A plugin is an **extension** to the standard functions of the R&S Pulse Sequencer Digital.

For even more flexibility, plugins can contain variables.

To export the simulated signal from the R&S Pulse Sequencer Digital, you can write "export" plugins that are customized to your interfaces. The export plugin enables you to extract the digital simulation data from the application in a defined format and export it to different formats or directly stream the data.

For more information, see ["How to import and assign user defined plugins"](#) on page 377.

## 2.7 Means of users interaction

This chapter provides an overview on how to work with the R&S Pulse Sequencer Digital and describes the manual operation of the software and also the alternative ways of operation.

There are two ways to operate the R&S Pulse Sequencer Digital:

- Manual operation:  
Run the software on your PC and use the mouse and/or keyboard.
- Remote control:  
Create programs to automate settings, tests and measurements. The software is controlled by a program, running on the same or on another computer.  
This way of operation is described [Chapter 23, "Automation of R&S Pulse Sequencer Digital"](#), on page 408.

### Basic operation concept

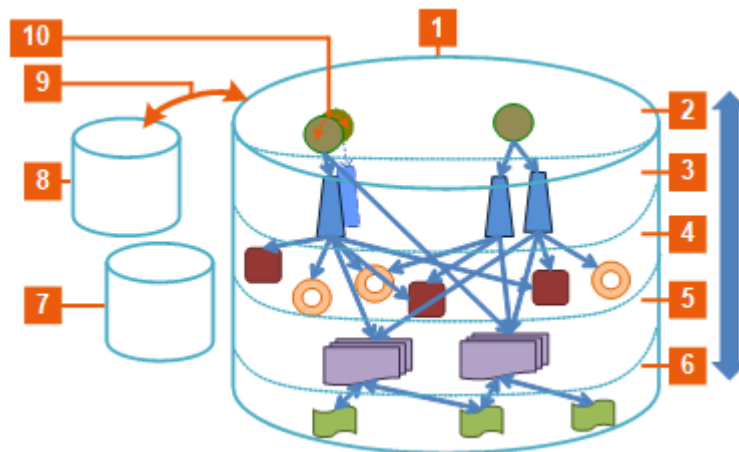
This section lists settings and functions that are common to the dialogs and are performed in the same manner throughout the software. You can use them alternatively or complementary.

As described in [Chapter 2.6, "Software concept in brief"](#), on page 29, the R&S Pulse Sequencer Digital software is based on a relational database that organizes database elements within repositories. Database elements are indicated by their names; within one repository, element names must be unique (see ["Name and comment"](#) on page 26).

## Creating elements

Once created, database elements can be used by other elements within the same repository. Elements can be created in both the bottom-up and the top-down direction, or in a combination of these two methods:

- *Bottom-up*: you can create your pulse and waveform library first, then build sequences, create scenarios, and use the created sequences or assign them to emitters.
- *Top-down*: create your scenario, create emitter, define the antenna pattern/scan, define the used sequence, and define the pulses and waveforms.



- 1, 7, 8 = Repository, one or more within the database  
 2 = Scenario level; scenarios describe one or more emitters and one or more sequences  
 3 = Emitter level; emitters are described among others with antenna patterns and antenna scans  
 4 = Antenna patterns and antenna scans  
 5 = Sequence level; sequences are built of one or more pulses or waveforms  
 6 = Pulse and waveform level  
 9, 10 = Creating elements at any level with clone and copy

For information on the naming conventions and description of the database elements, see [Chapter 2.6, "Software concept in brief"](#), on page 29.

## Handling database elements

While creating database elements, consider also the following possibilities:

- **Change**  
Files describing elements are stored once but can be used several times. When one file is changed, its parent elements are also updated.
- **Clone**  
Elements can be cloned to create a deep copy of the database element.
- **Delete**  
Elements can be deleted if they are not referenced by other elements.
- **Copy**  
If two repositories are opened in the project tree, a drag and drop operation creates a copy of the selected element and all referenced elements.












### Standard function in the context menus




Each dialog with settings belonging to a "higher-level" element provides standard functions to:

- Assign existing elements
- Create elements
- Edit the existing assigned element.

You can access these functions from the context-sensitive menus of the icons listed in [Table 2-4](#).

**Table 2-4: Overview of the used icons and their functions**

Icon	Name	Function/Description
	<Function> Menu (the name changes depending on the situation)	Smart menu with several options, depending on the current element and situation: <ul style="list-style-type: none"> <li>• New (Item)</li> <li>• Append item</li> <li>• Prepend item</li> <li>• Insert Item</li> <li>• Insert Item Before/After</li> <li>• Delete Item</li> <li>• Clear (Selection)</li> <li>• Edit</li> <li>• Select (from a list)</li> <li>• Rename</li> <li>• Import/Export</li> </ul>
	More	Select Edit New
	Pulse, Waveform	Creates repository element
	Antenna Pattern, Antenna Scan, Sequence	Accesses a dialog with detailed settings
	Emitter, receiver	
	3D, 2D diagram	
	Append item, Remove item, Delete	Appends or removes item, deletes all items
	Left/Right , Up/Down	Reorders items
	Copy and append	Copies the selected line of the table and appends it at the end of the table

Icon	Name	Function/Description
	Select	Selects a table row or an item for editing
	Enable/Disable	Activates or deactivates settings
	Hardcopy, Print	Copies current screen or dialog to the clipboard; Prints current diagram
	Name depends on contents	Opens a settings dialog. For example, "Visualization settings" or "Program settings".

### Standard functions for elements handling

The following standard direct interaction functions are supported:

- Double-click  
Opens the selected element for editing
- Clone  
Creates a copy of the selected element
- Drag and Drop  
A drag and drop operation:
  - Creates a copy of the selected element, together with all referenced elements
  - Assigns an element to a 2D view
  - Imports a repository
  - Imports waveform files into the repository
- Mouse wheel  
Turning the mouse wheel zooms in and out.

### Description of alternative methods

This manual describes the manual interaction with the software via the menus. Many elements that can be accessed from menus can also be accessed by clicking an icon or using the context menu. Alternative procedures are only described if they deviate from the standard operating procedures.

Throughout the manual, the term "select" refers to any of the described methods.

## 2.8 Trying out the software

This chapter introduces the most important functions and often used settings of the R&S Pulse Sequencer Digital step by step. The complete description of all functions and their usage is provided in the corresponding main chapters of this user manual.

### Prerequisite

The software is running and started up as described in [Chapter 2.4, "Starting the R&S Pulse Sequencer Digital for the first time"](#), on page 21.

The software is manually operated. Try out the following:

- [Completing the scenario that was automatically created upon start up](#)..... 35
- [Generating a simulated signal](#)..... 36
- [Verifying the generated signal in the signal preview](#)..... 37
- [Launching the built-in wizard](#)..... 38
- [Using the wizard to create a complex scenario](#)..... 39
- [Saving and recalling settings](#)..... 44
- [Advanced features and examples](#)..... 45

## 2.8.1 Completing the scenario that was automatically created upon start up

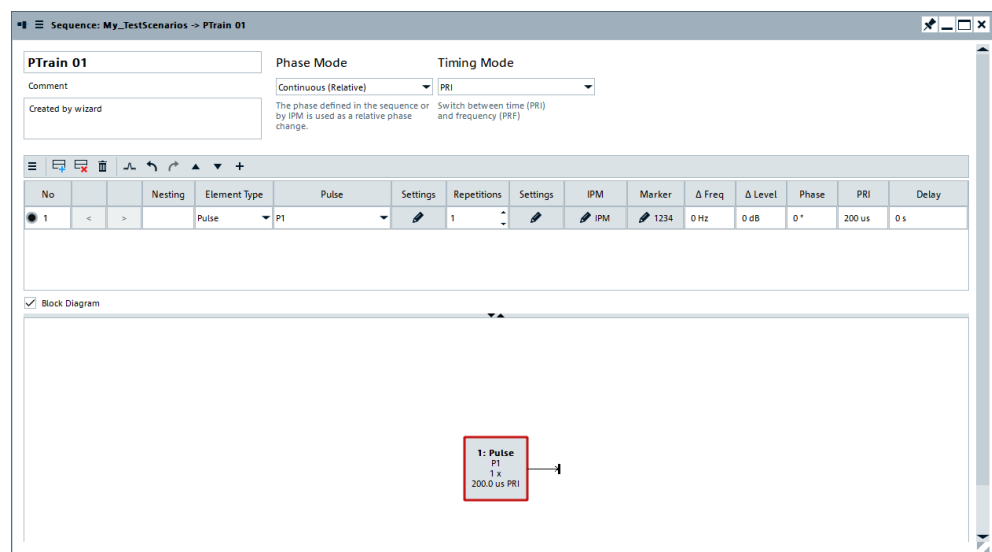
We assume that you have started the software as described in [Chapter 2.4, "Starting the R&S Pulse Sequencer Digital for the first time"](#), on page 21. Your workspace resembles the one shown on [Figure 2-1](#) (see section [Chapter 2.5, "Understanding the displayed information"](#), on page 24).

Your repository contains:

- "P1": an unmodulated pulse with pulse width of 100 us and rise and fall times set to zero
- "PTrain 01": a sequence containing one single pulse, "P1". This pulse is processed once ("Rep. Count = 1") and has a pulse repetition interval "PRI = 200 us".

**To create a sequence with 10 pulses, each having a PRI of 1 ms**

1. In the repository tree, select "Scenario > Sequences > PTrain 01".
2. In the "Sequence Description" table, select:
  - a) "Rep. Count = 10"
  - b) "PRI = 1 ms"



For information on the provided settings, see:

- [Chapter 7.2, "Sequence settings"](#), on page 120
- [Chapter 6.2.2, "Pulse timing settings"](#), on page 94

### To assign the sequence to the scenario

When created by the "Wizard", the sequence is automatically assigned to the scenario. If not, proceed as follows:

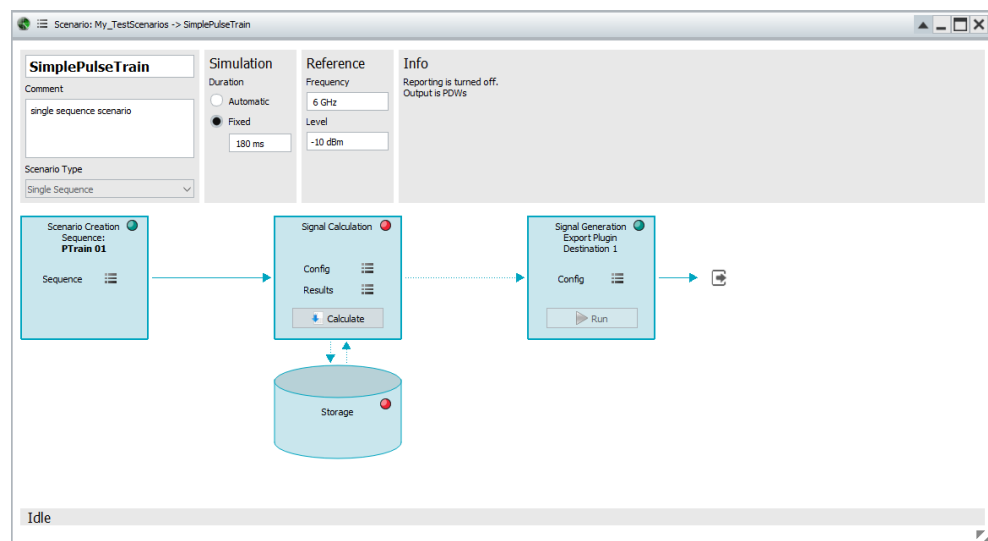
1. In the repository tree, select "Scenario > PTrain 01".  
The "Scenario" dialog opens and displays a block diagram of the signal flow.
2. In the block diagram, select "Sequence" and select the icon to open the context menu.
3. Select "Select > PTrain 01".  
The status indicator in the "Sequence" block is green.  
The status indicator in the "Signal Calculation" block is still red.

## 2.8.2 Generating a simulated signal

The initial situation is the configuration described in ["To start the signal calculation"](#) on page 37.

### To set the output target for the created signal

1. In the repository tree, select "Scenario > SimplePulseTrain".  
The "Scenario" dialog opens and displays a block diagram of the signal flow.
2. In the block diagram, select "Signal Generation" and select the icon to open the context menu.
3. Select "Config > Target > Destination".  
A list of the available Destinations appears.  
A check mark indicates the currently selected destination.
4. Select a destination from the list.  
The block name changes to indicate the selected destination.
5. The block diagram shows the updated settings.



The "Info" area shows a status indication and displays information and warnings about the scenario. For example, if the destination does not support elements used in the scenario, the information displays here. The created signal is output as PDWs to the export plugin.

You can now change some of the calculation and output settings.

6. Select "Signal Calculation > Config > Config".
7. In the "Signal Calculation Settings" dialog, select "Output".

If all preconditions for signal generation are fulfilled, the "Calculate" button is active and you can start signal calculation.

### To start the signal calculation

- ▶ In the "Scenario" dialog, select "Calculate".

The R&S Pulse Sequencer Digital calculates the simulated signal according to the selected settings and shows the current progress.

A green indicator in the "Signal Calculation" block confirms that the calculation is completed. The line between the "Signal Calculation" and the "Signal Generation" blocks confirms that the calculated signal can be transmitted to the selected target.

For information on the provided settings, see:

- [Chapter 5.2, "Scenario settings"](#), on page 74

### 2.8.3 Verifying the generated signal in the signal preview

It is often useful to check the generated signal visually, before you transfer it to the Destinations. The R&S Pulse Sequencer Digital provides a built-in function, the "Signal Preview", to represent the generated signal in a graphical form.

The initial situation is the configuration described in "[To start the signal calculation](#)" on page 37.

### To open the "Signal Preview" and visualize the generated signal

- ▶ In the "Scenario" dialog, select "Signal Calculation > Results > View" and select the name of the calculated waveform.

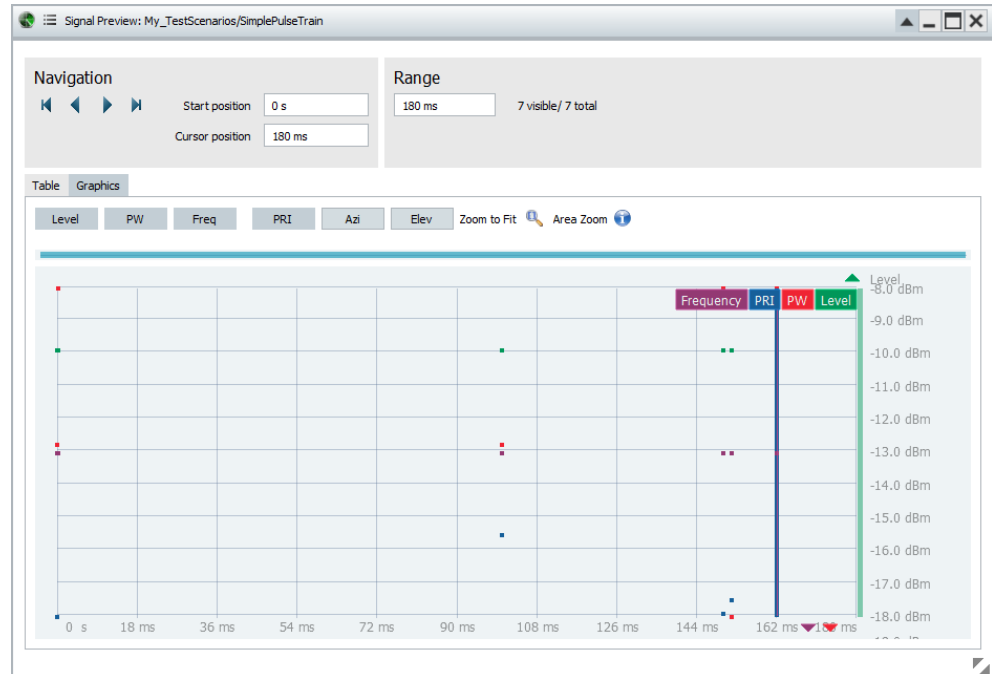


Figure 2-4: Signal Preview

## 2.8.4 Launching the built-in wizard

To help you get familiar with the software, the R&S Pulse Sequencer Digital provides a built-in startup assistant, the "Wizard".

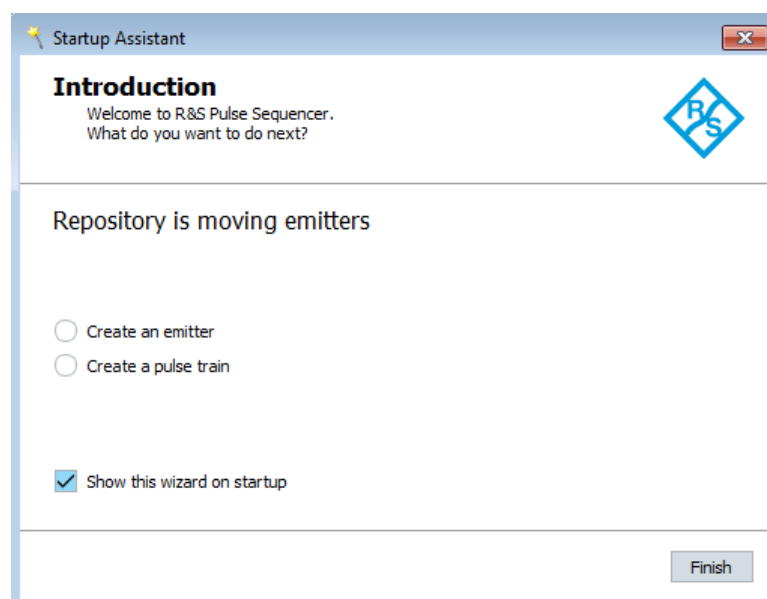
You can access this "Wizard":

- **On an application start:**  
That is, each time you start the software
- **On demand:**  
That is, any time during operation when you need a fast configuration of few settings.

### To start the built-in wizard

- ▶ In the tool bar, select "Tools > Wizard".

The "Startup Assistant" opens.



## 2.8.5 Using the wizard to create a complex scenario

The main application field of the R&S Pulse Sequencer Digital is the generation of pulsed signals. This example uses the "Wizard" to introduce the way you can create and define antenna patterns, antenna scans, emitters, etc. and interact with the software.

### To create a new single emitter scenario

1. Start the "Wizard", see [Chapter 2.8.4, "Launching the built-in wizard"](#), on page 38.
2. In the assistant dialog, select "Create Emitter".  
Confirm with "Next".

Startup Assistant

**Create radar emitter**  
Define the radar parameters.

Name: ComNav 01

Scenario:  Create complete single-emitter scenario

**Frequency and Level**

Frequency:  Static, 3 GHz

EIRP: 100 dBm

**Waveform Characteristics**

Pulse Width: 1 us

PRI:  Static, 2 ms

MOP: Barker

Bandwidth: 100 kHz

**Antenna Pattern and Scan**

Scan Time: 2 s

Pattern Type: Gaussian

Beamwidth Azimuth: 2 °

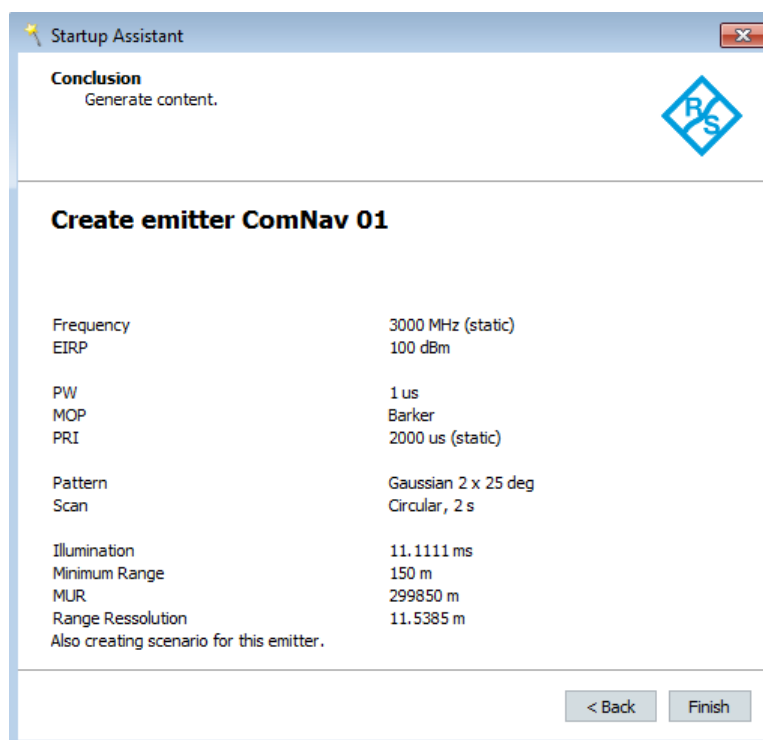
Beamwidth Elevation: 25 °

Illumination: 11.111 ms

< Back   Next >   Finish

- Use the default settings and select "Waveform Characteristics > MOP > Barker". Select "Next".





4. Confirm with "Finish".

The screenshot shows a software window titled "Emitter: My\_TestScenarios -> ComNav 01". The main configuration area includes:

- ComNav 01** (Title)
- Comment:** ComNav  
Illumination 11.111 ms
- EIRP:** 100 dBm
- Frequency:** 3 GHz

**Emitter Modes**

- Scan** (Selected mode)
- Ant. Pattern:** ComNav 01 (with 3D and 2D icons)
- Type:** Gaussian Model
- Frequency:** N/A
- Scan:** ComNav 01 (with 3D icon)
- Type:** Circular Scan

**Scan Beam Definitions**

- 1** (Selected definition)
- Sequence:** ComNav 01
- Offsets:**
  - Frequency:** 0 Hz
  - Elevation:** 0 °
  - Azimuth:** 0 °

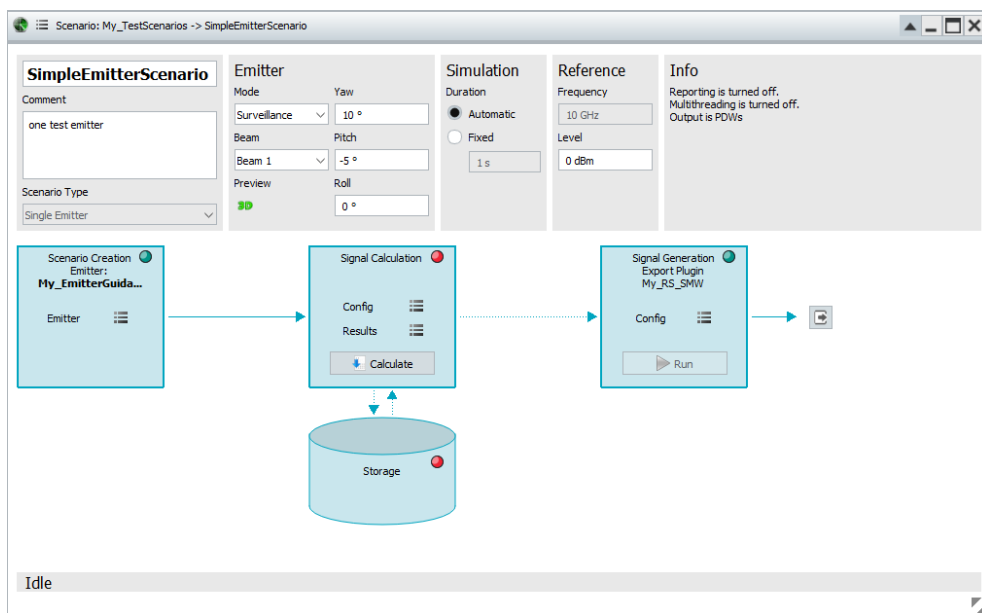
The software creates the scenario automatically with all required elements, e.g. one new emitter ("ComNav 01"), one new sequence ("ComNav 01"), new pulse ("ComNav 01"), etc.

For information on the provided settings, see:

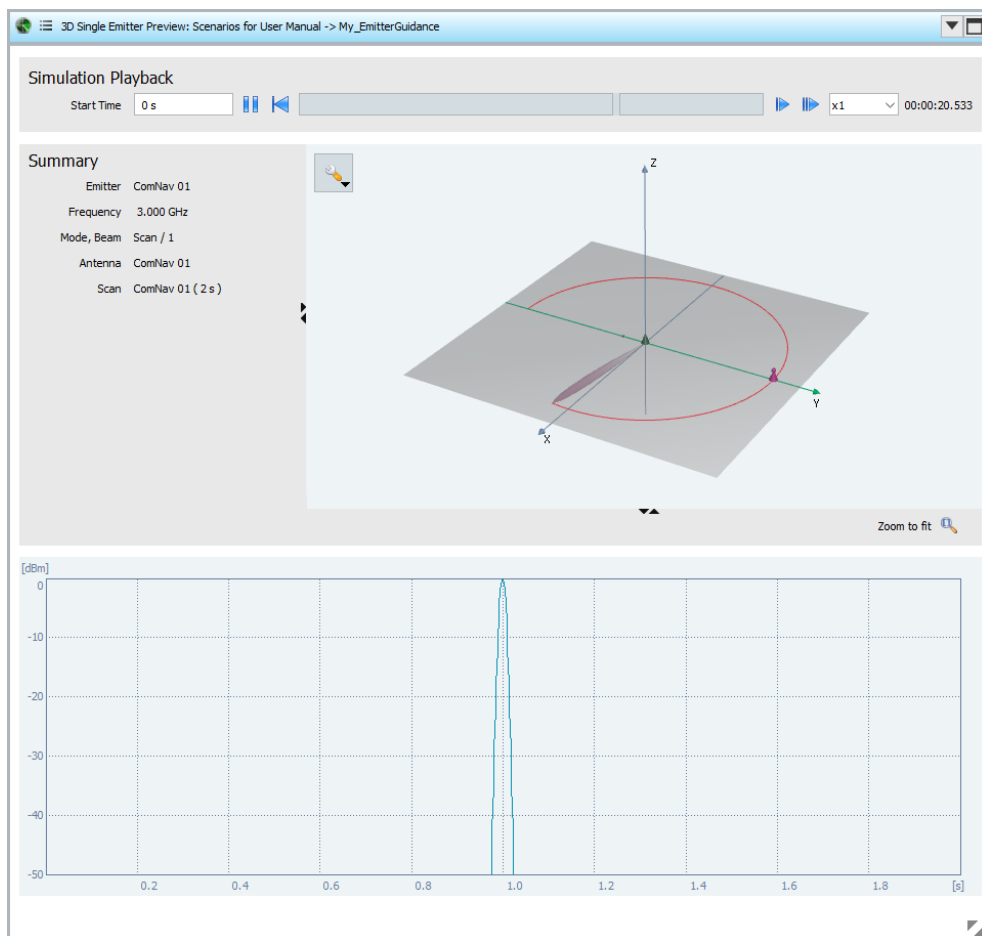
- [Chapter 10.1, "Emitter settings"](#), on page 220
- [Chapter 9.2, "Antenna pattern settings"](#), on page 174
- [Chapter 9.3, "Antenna scans settings"](#), on page 193
- [Chapter 6.2.3, "Modulation on pulse \(MOP\) settings"](#), on page 96

#### To visualize the signal received by a static receiver

1. Open the automatically created emitter-based scenario ("ComNav 01").



2. In the "Emitter" section on the block diagram, select the "3D" icon.



The "3D Single Emitter" dialog displays a live plot of the normalized signal power level at the receiver and an interactive 3D view of the emitter antenna pattern and scan.

3. Use the mouse wheel to zoom in and out.
4. To rotate the 3D view around its origin, left mouse click. Keep the key pressed and move the mouse.

For information, see [Chapter 16, "Creating complex 2D scenarios with receiver and TX items"](#), on page 289

### 2.8.6 Saving and recalling settings


Repositories are automatically saved when you exist the application. We recommend that you set a meaningful repository name before closing the application.

#### To rename the repository

Your workspace shows one automatically created repository, "New\_yyyy\_mm\_tttt".

1. In the repository tree, select "Repository > New\_yyyy\_mm\_tttt".
2. Change the name. Optionally, enter a comment.  
For example, enter "General > Name > K32 and K39 Tests" or a "Comment > Repository with test files".  
To enter a new line in the comment field, press [Shift+Enter].
3. Close the dialog.

#### To save the repository

A yellow data base icon  in the repository tree indicates that there are unsaved changes.

- ▶ In the menu bar, select "File > Save Repository > \_Repository name\_".

The repository is stored in the data path set during the program installation.

#### To exit the software

- ▶ Close the application software.

If the current repository contains unsaved changes, you are prompt to store or ignore them.

**Note:** Unsaved changes are lost.

For more information, see:

- [Chapter 2.9.1, "Customizing your workspace"](#), on page 45
- [Chapter 4.4, "How to manage the project data"](#), on page 69

## 2.8.7 Advanced features and examples

With these first steps, you have gained an impression of the provided functionality.

You find a comprehensive description of the full range of capabilities in the following sections:

- [Chapter 6.3, "How to create a new pulse and adjust its settings"](#), on page 116
- [Chapter 7.3, "How to create sequences and use the control elements"](#), on page 131
- [Chapter 5.3, "How to select and create a test scenario"](#), on page 90
- [Chapter 21.2, "How to create test reports"](#), on page 392
- [Chapter 9.4, "How to create a library with antenna patterns and scans"](#), on page 206
- [Chapter 10.4, "How to create and configure emitters"](#), on page 233
- [Chapter 16.1, "How to create scenarios with receiver and TX items"](#), on page 290
- [Chapter 8.2, "How to create IPM profiles and vary pulse parameters"](#), on page 160
- [Chapter 20.2, "How to configure and visualize markers"](#), on page 382
- ["How to import and assign user defined plugins"](#) on page 377

## 2.9 Customizing the software

You can change default application settings to adapt the user interface to your needs.

- [Customizing your workspace](#)..... 45
- [Changing colors and default configuration](#).....46

### 2.9.1 Customizing your workspace

A workspace comprises the repository tree on the left side with one or more loaded repositories, and the working area with one or more screens. You can create several workspaces with different repositories assigned to them. You can save and load a user-defined workspace and switch between the different workspaces.

#### To save a workspace

We assume that you have opened or created a repository and opened one or more dialogs in one of the screens.

1. In the menu bar, select "File > Save Workspace/Save Workspace As" or use the save icon in the toolbar.
2. In the explorer, enter a filename, e.g. `MyWorkspace.pswk` and confirm with "Ok".

Per default, the `*.pswk` file is stored in the application data directory.

**To load a workspace**

1. In the menu bar, select "File > Open Workspace".

Existing default and user-defined workspaces are listed.

2. Select a workspace.

The workspace opens. All dialogs and repositories associated with the workspace are displayed.

**To close a workspace**

You can close a workspace if you do not need it no longer or you need to switch to a different one.

- ▶ In the menu bar, select "File > Clear Workspace".

The workspace is closed.

Closing the workspace unloads all repositories and closes all dialogs.

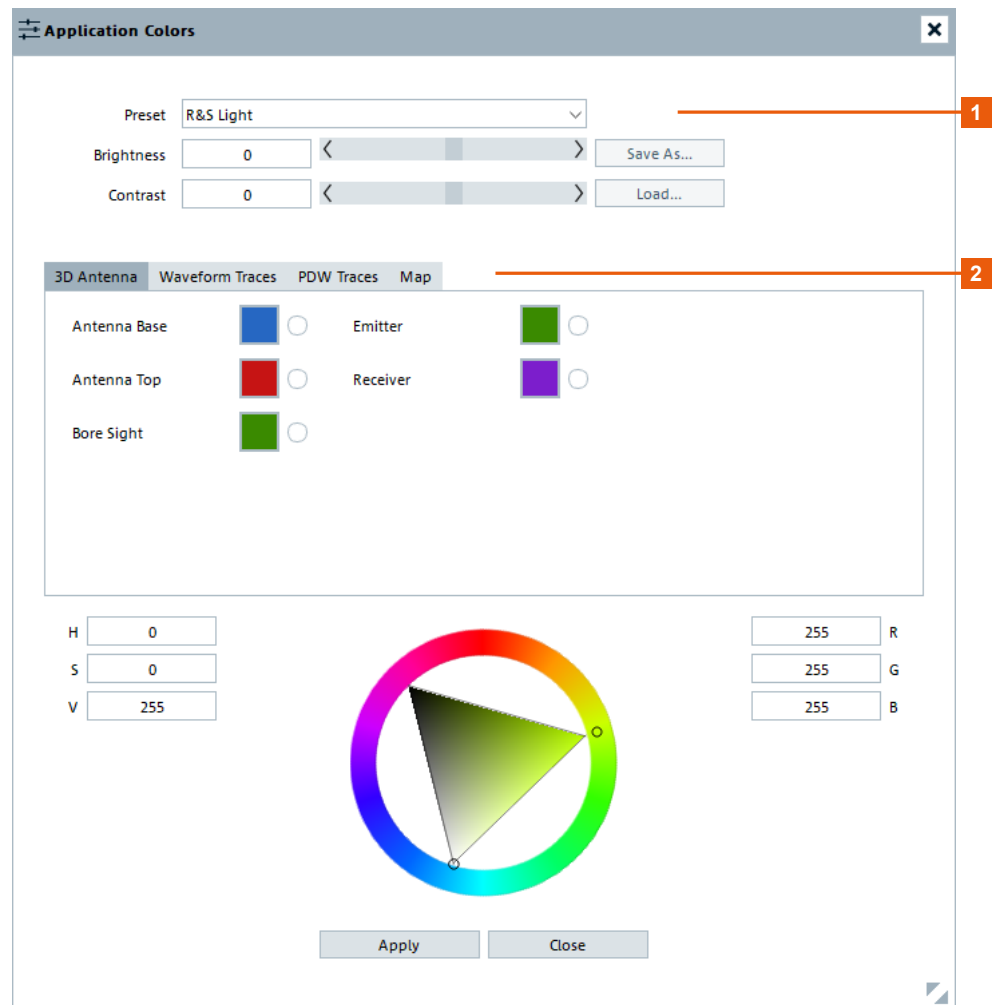
You can open a workspace again, see ["To load a workspace"](#) on page 46.

## 2.9.2 Changing colors and default configuration

You can change the default application settings, for example, change the display colors or change default settings of the R&S Pulse Sequencer Digital.

**To customize the display colors**

1. In the menu bar, select "Configure > Colors".



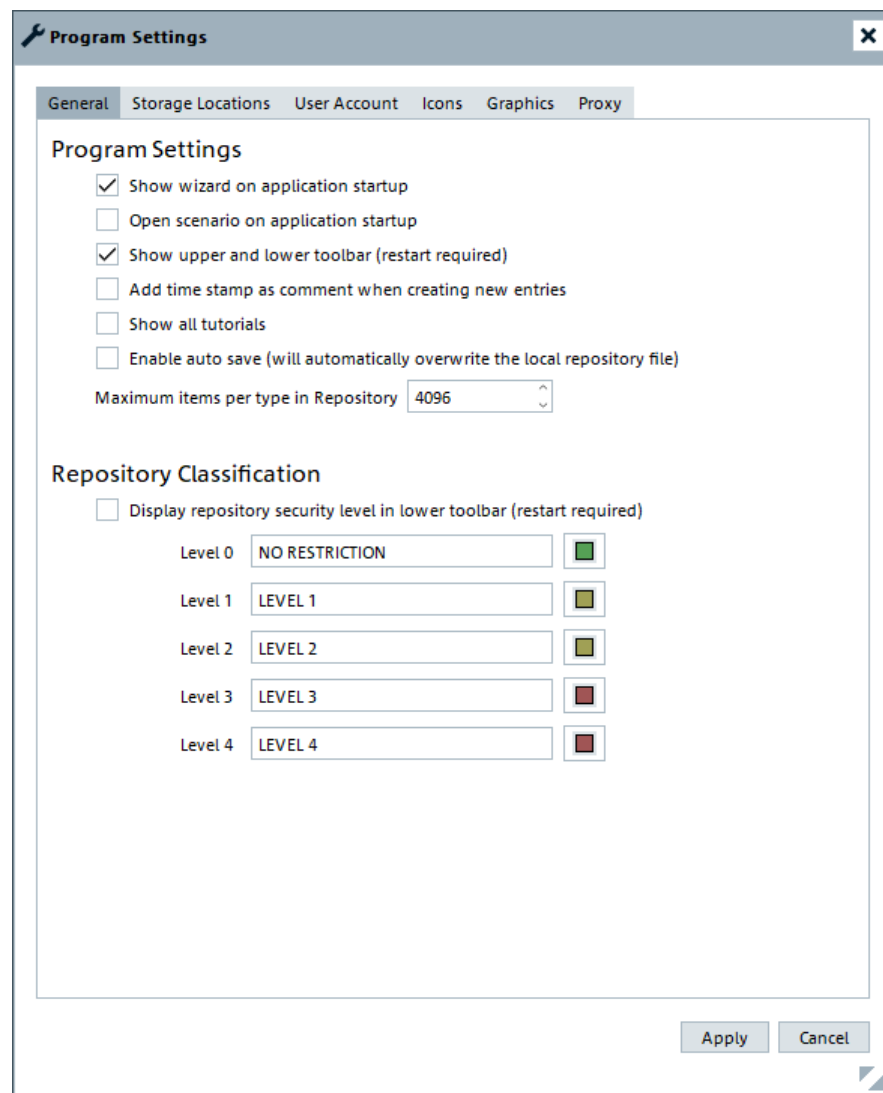
1 = Color scheme

2 = Assigns colors to the different display elements

2. Select a predefined color scheme and, if necessary, adjust the display colors individually.
3. Adjust the display colors of the individual elements, e.g. select "Traces > Magnitude" and change the default color.
4. Select "Save As" to store your custom color profile in a file, e.g. `MyColors.col`.

#### To change the general program settings

1. In the menu bar, select "Configure > Settings".



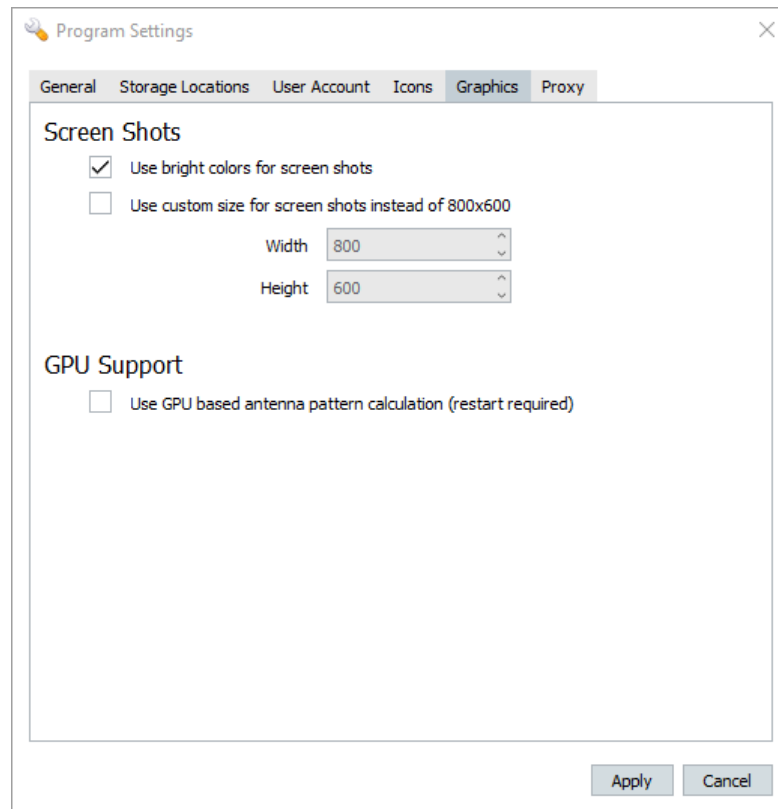
2. Change the settings, select the colors indicating the different security levels. For information on the security levels, see "[General Repository Settings](#)" on page 61.
3. Confirm with "Apply".

### To set the size and color scheme of the hardcopies

For documentation purposes, you can create a hardcopy or screenshot of the current screen or dialog. Hardcopies can be sent to the printer or stored to the clipboard.

1. To adjust the hardcopy size, in the menu bar, select "Configure > Settings > Graphics".





2. Select "Use bright colors for screenshots > On" e.g. for ink-saving printing.  
Brighter colors are used for all graphical screens instead of the ones set in the current color scheme.
3. Select "Use custom size for screenshots instead of 800x600 > On" and set the "Width" and "Height" in number of pixels.
4. Confirm with "Apply".

The settings provided on the other tabs in the "Program Settings" dialog are explained in:

- [Chapter 22, "Performing administration tasks"](#), on page 395

## 2.10 Getting information and help

If any questions or problems concerning the R&S Pulse Sequencer Digital arise, an extensive online help system is provided in the software and can be consulted at any time.

The integrated help system provides the description of all functions. The help system is context-sensitive and provides information specifically for the current operation or setting to be performed. In addition, general topics provide an overview on complete tasks or function groups and background information.

### Calling up Help

- ▶ To display the "Help" dialog for the currently focused screen element, e.g. a setting in an opened dialog, select the "Help" icon on the toolbar or press F1.

The "Help" dialog is displayed. A topic containing information about the focused element is displayed. If no context-specific help topic is available, a more general topic or the "Contents" tab is displayed.

The "Help" toolbar provides buttons with standard navigation functions. The "Help" window contains several tabs:

- "View" - shows the selected help topic
- "Contents" - contains a table of help contents
- "Index" - contains index entries to search for help topics  
The index is sorted alphabetically. You can browse the list, or search for entries in the list
- "Bookmarks" - contains custom bookmarks
- "Search" - provides text search

### To close the Help window

- ▶ Select the "Close" icon in the upper right corner of the help window.

## 3 Preparing for use

### Overview

The R&S Pulse Sequencer Digital runs as a standalone, PC-based application that creates simulated PDW datastreams that you can export to a customized plugin.

The software hands the simulated data to a so-called "destination", which wraps a user-written plugin that receives the data.

You can add as many destinations as you need. To enable you to export a PDW datastream, you need to assign an export plugin to a destination.

R&S Pulse Sequencer Digital plugins are user-configurable, enabling you to define the export content and format.

See:

- [Chapter 3.1, "Creating and using export plugins"](#), on page 51
- [Chapter 3.2, "PDW export plugin interface specification"](#), on page 53
- [Chapter 3.3, "Destinations settings"](#), on page 57
- [Chapter C, "Plug-in programming API"](#), on page 649.

### 3.1 Creating and using export plugins

To use export plugins in R&S Pulse Sequencer Digital, you need to load a plugin of this type and map it to a destination.

The following chapters explain how to perform these steps.

For a detailed description of the programming API for the plugin, see [Chapter C.2, "Export plugin"](#), on page 654.

#### Creating an export plugin

R&S Pulse Sequencer Digital is delivered with the necessary resources to enable you to create plugins to export the simulated signals.

We recommend using an application such as Visual Studio to open the resource files and create the plugin. However, you can use an alternative compiler if you prefer. The plugin exports an extern "C" interface which ensures the compatibility of the DLL.

Access:

1. Perform one of the following:
  - In the menu bar, select "Help > SDK > Export\_PDW > src"
  - On the main toolbar, select the icon "Open SDK folder > Export\_PDW > src".

This folder contains example resource files that you can modify as required.

2. Open the solution file, `PulseSequencer_Plugin.sln`.
3. Change the build configuration to "Release".

4. Rebuild the solution.

The export plugin is in the "Export\_PDW > bin" folder and ready for loading into R&S Pulse Sequencer Digital.

### Debugging the export plugin

#### To debug the DLL

1. Load the plugin project in Visual Studio or your preferred compiler.
2. Set the configuration to "Debug".
3. Set the target path to the location of the R&S Pulse Sequencer Digital executable file.
4. Start the debugger.  
`PS-DIGITAL.exe` starts.
5. Ensure that the PDB debug file is in the same folder as the DLL so that the debugging symbols load correctly and you can set the breakpoints.  
Normally the file location selected automatically by the debug build is correct.
6. When the DLL is loaded into R&S Pulse Sequencer Digital, you can start debugging the plugin code in Visual Studio.

### Loading an export plugin

To load an export plugin in to R&S Pulse Sequencer Digital, follow the same steps as for other plugin types.

For details, see ["To import a plugin"](#) on page 377.

Navigate to the "SDK > Export\_PDW > bin" folder to select the export plugin.

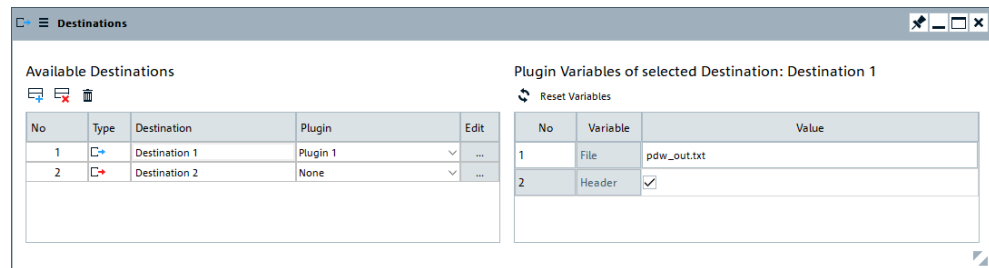
### Mapping plugins to destinations

When an export plugin is loaded as described in [Loading an export plugin](#), you can map it to a destination in R&S Pulse Sequencer Digital.

Access:

1. Perform one of the following:
  - In the menu bar, select "Configure" > "Destinations"
  - In the block diagram of a scenario, select "Signal Generation" > "Config" > "Destinations".

The "Destinations" dialog opens.



- To add a new destination, in "Available Destinations" select "Add a new destination".

A new entry displays at the end of the list, assigned with the next free number.

- To edit the destination name, double-click in the "Destination" field.
- Select an available plugin from the "Plugin" drop-down list.
- To edit the name or comment parameters, or to change the selected DLL, select "Edit".

The "Plugin" dialog opens.

- Edit the plugin variables on the right as required.

The plugin is mapped to the specified destination and ready for use in a scenario.

For a description of how to assign signals to destinations, see [Chapter 17.2, "Assign signals to destination"](#), on page 351.

## 3.2 PDW export plugin interface specification

The export plugin that R&S Pulse Sequencer Digital uses for the simulated signals is user-configurable. You can adapt the plugin for streaming or transferring the data as you require, including the content of the data.

The format of the PDW data at the export plugin interface function is a Rohde & Schwarz proprietary format as described in this chapter. In the plugin, the user is free to extract any needed information and adapt the data formats or representation of the values to map it to any needed format.

Depending on the scenario you are using and your export needs, some of the following parameters might not be necessary.

Parameters that are not set represent an invalid value. Parameters that do not have an invalid representation are guaranteed to be valid.

The serialized data uses little endian byte order.

### Data type

The invalid value depends on the data type:

- **uint8/16/32**

The invalid case is defined as all 1's in bit representation, which means 0xFF, 0xFFFF, ... in hex.

For unsigned integers, it is the definition of the maximum value that is possible, therefore the valid data range is limited by 1.

For example, for uint8 the data range is [0, 254] in decimal representation, as 255 is used to indicate the invalid case.

- **int16**

The invalid case is defined as 0x8000, which represents the minimum value -32768. Therefore the valid data range for int16 is [-32767, 32767].

- **float32**

The invalid case is defined as 0x7F7FFFFFFF, which represents the maximum available float number regarding IEEE-754.

**Table 3-1: PDW export plugin interface parameters**

Data type	Parameter	Byte size	Range	Invalid	Unit	Description
uint8	<b>version</b>	1	[0x00, 0xFF]	-	-	PDW format version. Initial version = 0x00.
uint16	<b>tx_platform_id</b>	2	[1, 65534]	0xFFFF	-	User configured platform ID
uint16	<b>tx_id</b>	2	[1, 65534]	0xFFFF	-	User configured emitter ID (per emitter mode)
uint8	<b>tx_platform_emit_id</b>	1	[1, 254]	0xFF	-	Emitter index inside platform (if platform emitter)
uint8	<b>tx_list_id</b>	1	[1, 254]	0xFF	-	List index in multi-emitter scenario: <ul style="list-style-type: none"> <li>• Emitter index for single emitter in list</li> <li>• Platform (parent) index if emitter is platform emitter</li> </ul>
uint8	<b>rx_id</b>	1	[1, 254]	0xFF	-	Database ID of the receiver (list index in repository tree view)
uint8	<b>rx_antenna_id</b>	1	[1, 254]	0xFF	-	Antenna ID of receiver
uint64	<b>toa</b>	8	[0, 18.446.744.073, ...] (s)	-	ps	TOA
uint64	<b>freq</b>	8	[0, 1.884*10 <sup>19</sup> ] (Hz)	-	Hz	Absolute frequency
uint64	<b>pulse_width</b>	8	[0, 18.446.744, ...] (s)	-	ps	Pulse width
int32	<b>level</b>	4	[-200, 200] (dBm)	-	0.01 dBm	Absolute level
uint8	<b>modulation</b>	1	[0x00, 0xFF]	-	-	Modulation flag See <a href="#">Modulation flags</a>

Data type	Parameter	Byte size	Range	Invalid	Unit	Description
uint32	<b>bandwidth</b>	4	[0, 42.94] (GHz)	0xFFFF	10 Hz	Bandwidth
uint64	<b>rise_time</b>	8	[0, 18.446.744, ...] (s)	-	ps	Pulse rise time
uint64	<b>fall_time</b>	8	0, 18.446.744, ...] (s)	-	ps	Pulse fall time
uint8	<b>marker_mask</b>	1	[0x00, 0x0F]	-	-	Marker bits (4321)
uint16	<b>azimuth</b>	2	[0, 360] (deg)	0xFFFF	0.1 deg	Tx azimuth
int16	<b>elevation</b>	2	[-90, 90] (deg)	20x8000	0.1 deg	Tx elevation
float32	<b>distance</b>	4	[-1e9, +1e9] (m)	0x7FFFFFFF	m	Tx distance to Rx origin
uint16	<b>rx_antenna_azimuth</b>	2	[0, 360] (deg)	0xFFFF	0.1 deg	Rx antenna azimuth
int16	<b>rx_antenna_elevation</b>	2	[-90, 90] (deg)	0x8000	0.1 deg	Rx antenna elevation
float32	<b>longitude</b>	4	[-180, 180] (deg)	0x7FFFFFFF	deg	Tx longitude coordinate in deg (7-8 positions after decimal point)
float32	<b>latitude</b>	4	[-90, 90] (deg)	0x7FFFFFFF	deg	Tx latitude coordinate in deg (7-8 positions after decimal point)
float32	<b>altitude</b>	4	[-1e9, +1e9] (m)	0x7FFFFFFF	m	Tx altitude coordinate
float32	<b>east</b>	4	[-1e9, +1e9] (m)	0x7FFFFFFF	m	Tx east coordinate (ENU). Reference coordinate is Rx position.
float32	<b>north</b>	4	[-1e9, +1e9] (m)	0x7FFFFFFF	m	Tx north coordinate (ENU). Reference coordinate is Rx position.
float32	<b>up</b>	4	[-1e9, +1e9] (m)	0x7FFFFFFF	m	Tx up coordinate (ENU).
uint16	<b>yaw</b>	2	[0, 360] (deg)	0xFFFF	0.1 deg	Tx yaw
int16	<b>pitch</b>	2	[-90, 90] (deg)	0x8000	0.1 deg	Tx pitch
uint16	<b>roll</b>	2	[0, 360] (deg)	0xFFFF	0.1 deg	Tx roll
	<b>reserved_field</b>	2				Reserved field for future additions
uint32	<b>speed</b>	4	[0, 5999] (m/s)	0xFFFFFFFF	0.01 m/s	Absolute speed of Tx movement
	<b>not yet implemented</b>	36				Parameters not yet implemented

Data type	Parameter	Byte size	Range	Invalid	Unit	Description
	reserved_field	113				Reserved field for future additions
Total byte size		256				

### Modulation flags

Table 3-2 shows the 8-bit encoding of the pulse modulation type.

**Table 3-2: Modulation flags**

modulation	hex code	bin code
unmodulated	00	00000000
fm	01	00000001
fm-step	02	00000010
2-fsk	03	00000011
4-fsk	04	00000100
8-fsk	05	00000101
16-fsk	06	00000110
32-fsk	07	00000111
64-fsk	08	00001000
msk	09	00001001
chirp-generic	10	00010000
chirp-linear-up	11	00010001
chirp-linear-down	12	00010010
chirp-linear-triangular	13	00010011
chirp-linear-piecewise	14	00010100
chirp-sine	15	00010101
barker-2	20	00100000
barker-3	21	00100001
barker-4a	22	00100010
barker-4b	23	00100011
barker-5	24	00100100
barker-7	25	00100101
barker-11	26	00100110
barker-13	27	00100111
polyphase-frank	30	00110000
polyphase-p1	31	00110001



modulation	hex code	bin code
polyphase-p2	32	00110010
polyphase-p3	33	00110011
polyphase-p4	34	00110100
bpsk	35	00110101
qpsk	36	00110110
8psk	37	00110111
phase-generic	3F	00111111
am-standard	40	01000000
am-lsb	41	01000001
am-usb	42	01000010
am-lsb-usb	43	01000011
am-step	44	01000100
ask	45	01000101
16-qam	50	01010000
32-qam	51	01010001
64-qam	52	01010010
128-qam	53	01010011
256-qam	54	01010100
noise 60	60	01100000
unknown	FE	11111110
EOF	FF	11111111

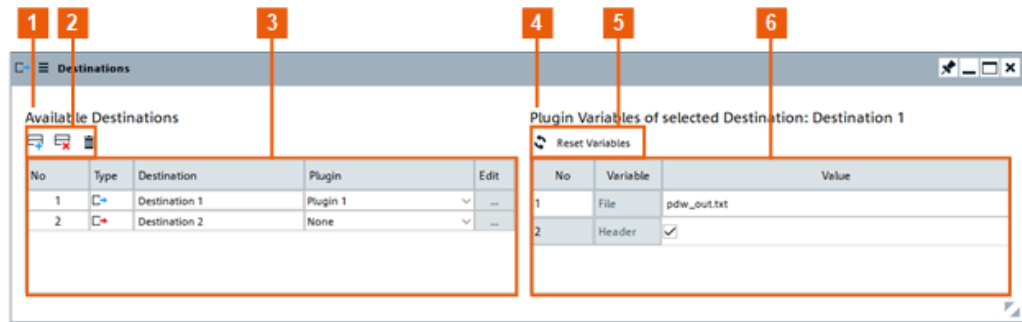
See also:

- [Chapter C.2, "Export plugin"](#), on page 654

### 3.3 Destinations settings

Access:

- ▶ Perform one of the following:
  - In the menu bar, select "Configure" > "Destinations"
  - In the block diagram of a scenario, select "Signal Generation" > "Config" > "Destinations".



**Figure 3-1: Destinations: understanding the displayed information**

- 1 = Displays all available destinations
- 2 = Adds/removes destinations
- 3 = Information and parameters for available destinations
- 4 = Plugin variables for currently selected destination
- 5 = Resets all variables for selected plugin
- 6 = Information and parameters of variables for selected plugin

## Settings

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L Type.....	59
L Destination.....	59
L Plugin.....	59
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L Reset variables.....	59
L No.....	59
L Variable.....	59
L Value.....	60

### Available destinations

Displays all available destinations in a repository. Destinations displayed here are available in all scenarios.

#### Add, delete, delete all ← Available destinations

Standard functions for items handling.

You cannot delete a destination that is assigned in a scenario. First remove the assignment, then delete the destination from the list.

Remote command:

[DESTination:ADD](#) on page 472

[DESTination:DELeTe](#) on page 472

[DESTination:CLEAr](#) on page 472

#### No ← Available destinations

Displays the destination number assigned automatically when added.

If you delete a destination from the list, the numbers below it are automatically re-assigned.

Remote command:

[DESTination:SElect](#) on page 426

#### **Type ← Available destinations**

Plugin type icon assigned automatically for export plugins.

#### **Destination ← Available destinations**

User-configurable name of the destination. To edit the name, select the field.

Remote command:

[DESTination:NAME](#) on page 427

#### **Plugin ← Available destinations**

Selects a plugin from the drop-down list.

The list contains all export plugins available in "Project tree > Plugins".

Remote command:

[DESTination:PLUGin:NAME](#) on page 472

#### **Edit ← Available destinations**

Opens the "Plugin" dialog where you can edit the name and comment fields or load a new DLL file.

For detailed information on importing plugins, see "[How to import and assign user defined plugins](#)" on page 377.

#### **Plugin variables**

Displays the variables for the current destination.

Remote command:

[DESTination:PLUGin:VARiable:CATalog](#) on page 503

[DESTination:PLUGin:VARiable:SElect](#) on page 503

#### **Reset variables ← Plugin variables**

Resets the variable parameters to the default, removing customizations. The reset applies to all parameter values, including values not currently selected in the list.

Remote command:

[DESTination:PLUGin:VARiable:RESet](#) on page 504

#### **No ← Plugin variables**

Displays the automatically assigned plugin variable number.

Remote command:

[DESTination:PLUGin:VARiable:SElect:ID](#) on page 504

#### **Variable ← Plugin variables**

Displays the variable type.

This parameter is for information only.

**Value ← Plugin variables**

Displays the value of the variable. To edit the values, double-click in the field.

Remote command:

[DESTination:PLUGin:VARiable:VALue](#) on page 504

## 4 Organizing the project data in repositories

This section explains the basic repository concept and informs you briefly how the software database is built.

An introduction to the concept of elements handling is provided in ["Creating elements"](#) on page 32.

### 4.1 Repository settings

Access:

- ▶ In the project tree, double-click the repository name.

The repository tree shows the content of the currently loaded repositories.

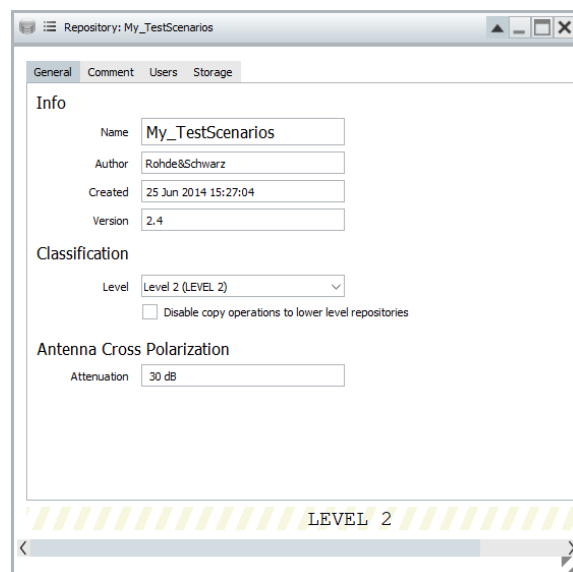
Settings:

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<a href="#">Comment</a> .....	62
<a href="#">Users</a> .....	63
<a href="#">Storage</a> .....	63

#### General Repository Settings

Provides general information related to repository management.

The "General" tab.



**Info ← General Repository Settings**

Provides information like the name of the author and the date of creation.

"Name" When a new repository is created, it is named automatically but you can rename it afterwards.

The automatically assigned names follow the syntax:

New\_<yyyy-mm-dd><T><hhmmss>, where <yyyy-mm-dd> and T<hhmmss> indicate the current date and time respectively.

"Author" Indicates the author.

"Created" Automatically assigned date and time indication.

"Version" Repository version.

Remote command:

[REPOSITORY:CATALOG?](#) on page 426

[REPOSITORY:CREATE](#) on page 426

[REPOSITORY:SELECT](#) on page 427

[REPOSITORY:REMOVE](#) on page 428

[REPOSITORY:AUTHOR](#) on page 528

[REPOSITORY:DATE](#) on page 528

[REPOSITORY:VERSION](#) on page 529

**Classification ← General Repository Settings**

Classification information is assigned to each repository to set the security level.

"Level" "Level 0" is the lowest level that means no restrictions and "Level 4" is the highest one. Elements belonging to a repository with higher level cannot be copied to a repository with lower one.

If more than one repository is loaded, the workspace displays the highest required classification level, see [Chapter 2.5, "Understanding the displayed information"](#), on page 24.

See also ["To change the general program settings"](#) on page 47.

"Disable copy operations to lower level repositories" If enabled, you cannot copy repository elements for repositories with higher classification level to repositories with lower one.

Remote command:

[REPOSITORY:SECURITY](#) on page 529

**Antenna Cross Polarization > Attenuation ← General Repository Settings**

Sets the attenuation level used to calculate the cross-polarized antenna patterns, see ["Polarization"](#) on page 178.

Remote command:

[REPOSITORY:XPOL:ATTENUATION](#) on page 529

**Comment**

Enter a short description of the repository.

Remote command:

[REPOSITORY:COMMENT](#) on page 428

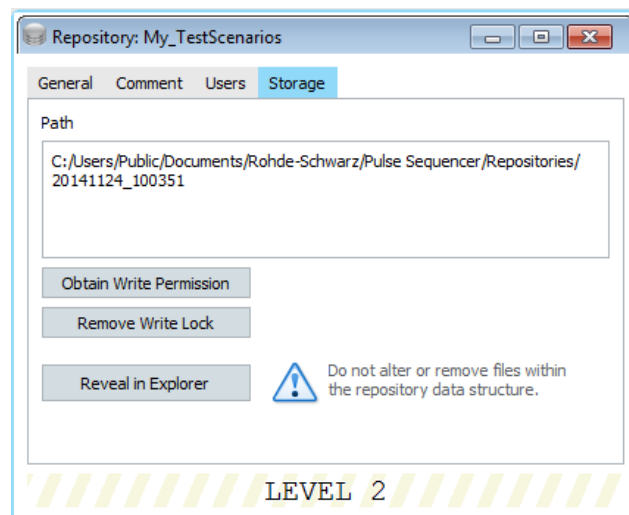
## Users

Provides settings related to user management.

For detailed information, see [Chapter 22.2, "User administration"](#), on page 396.

## Storage

This tab provides settings necessary to configure the default storage folder for the repositories.



"Path" Displays the location (network or local folder) the repository is stored in.

Remote command:

[REpository:PATH?](#) on page 528

"Obtain Write Permission"


Repositories allow the simultaneous access from several users. If a user with write permission has opened a repository, this write permission is exclusive. Another user will be granted with the write permission only after the first user had closed the repository or removed it from its workspace.

You can request an exclusive write permission only on a repository that is not opened by another user with write permission.

See also:

- ["Discovered Repositories on the Mass Storage"](#) on page 65
- ["To obtain write permission on a repository"](#) on page 72

"Remove Write Lock"

The R&S Pulse Sequencer Digital locks any improperly or unexpectedly closed repository and indicates this situation with a red lock symbol  in the *"Repository Tree"*. A locked repository can be unlocked only from the same PC and by the same user with write permission that had opened the repository before.

See ["To remove write lock that results from a previously crashed session"](#) on page 621.

"Reveal in Explorer"

You can open the repository file structure in the Windows Explorer.

**Note:** Do not change the repository content by changing the file structure in the Windows Explorer.

To move or share repositories with other users, always use the "Export/Import Repository Archive" function.

See:

- "To create and export a repository archive" on page 71
- "To import a repository archive via the menu bar" on page 71

Remote command:

REPOSITORY:FILENAME? on page 528

REPOSITORY:SAVE on page 529

## 4.2 Repository manager settings

Access:

- ▶ In the menu bar, select "File > Load and Manage Repository".

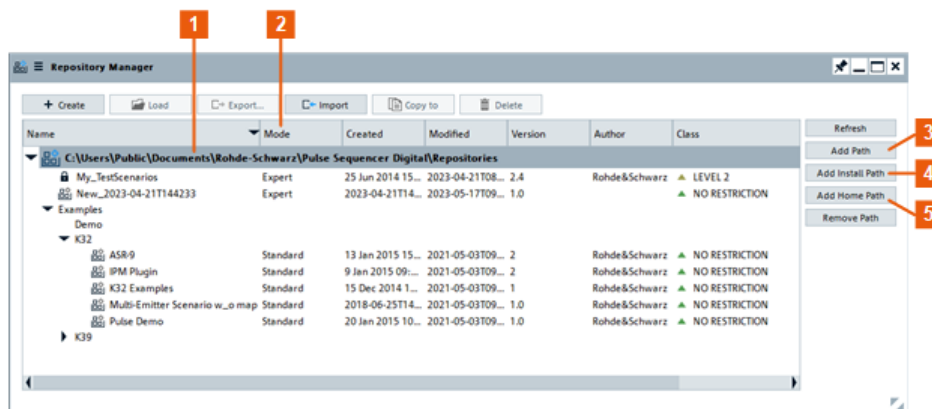


Figure 4-1: Repository Manager: understanding the displayed information

- 1 = Default repository path (DataPath), see also Table 2-2
- 2 = Mode/license type of repository, see "Create" on page 65
- 3 = Add custom path for repository discovery for saving and possibly sharing repositories, alternative to the DataPath and the HomePath
- 4 = Add the home path set during installation
- 5 = Add user's home path

The "Repository Manager" comprises the setting for managing the repository files and archives on the mass storage.

**Settings:**

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Load..... 65



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Import.....	66
Copy to.....	66
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Refresh.....	66
Add Path.....	66
Add Install Path, Add Home Path.....	66
Remove Path.....	67

### Discovered Repositories on the Mass Storage

Lists all found directories and the repository files that they contain.

You can change the column width and order.

A lock symbol on the database icon in the "Repository Manager" indicates one of the following situations:

- Repository is opened by another user with explicit write access.
- Insufficient user rights for the particular repository.
- Insufficient user rights on the file system (directory) the repository is stored in.

Try to:

- Wait until the repository has been closed and try to obtain exclusive write permission, see ["To obtain write permission on a repository"](#) on page 72.
- Change your current user or use a user with different role, see ["To change the default user used to access repositories"](#) on page 399.
- Log in as user with sufficient (write) access rights on the file system.

Remote command:

`REPManager:CATalog?` on page 530

### Create

Adds a repository in the selected directory.

The "Mode" ("Demo" / "Standard" / "Expert") indicates in which operation mode you created the repository (see [Chapter 2.1, "Required options and licences"](#), on page 16).

The following rules apply to repositories:

- Repositories created in the R&S PULSE-K32 can be opened with R&S PULSE-K39  
The repository is irreversibly updated to R&S PULSE-K39 complexity.
- Repositories created in R&S PULSE-K39 cannot be opened with R&S PULSE-K32.
- Repositories created in the demo version cannot be opened with R&S PULSE-K32 or R&S PULSE-K39.
- Repositories created in the original R&S Pulse Sequencer (RF) application can be imported into R&S Pulse Sequencer Digital.

See also [Chapter 22.3, "Defining storage locations"](#), on page 401.

### Load

Loads and displays the selected repository in the workspace.

See ["To load a repository"](#) on page 70.

Remote command:

`REPManager:LOAD` on page 530

**Export**

Exports the selected repository to an archive file.

See ["To create and export a repository archive"](#) on page 71.

Remote command:

[REPManager:EXPort](#) on page 531

**Import**

Imports a repository from a directory.

Remote command:

[REPManager:IMPort](#) on page 531

**Copy to**

Copies the selected repository to a new location.

The R&S Pulse Sequencer Digital automatically copies all relevant files and database elements.

**Delete**

Deletes the entire repository from the permanent mass storage, if:

- The current user has write permission, see [Table 22-1](#).
- The repository is not opened by another user with write permission.

Remote command:

[REPManager:DELeTe](#) on page 531

**Refresh**

Refreshes the list of found repository files.

**Add Path**

Opens the "Select Folder" dialog that is similar to the Windows Explorer.

Navigate to the required directory and load it. Found repository files are displayed in the list.

See also ["To set the storage location for repositories"](#) on page 402.

Remote command:

[REPManager:PATH:ADD](#) on page 532

[REPManager:CATalog?](#) on page 530

**Add Install Path, Add Home Path**

Adds and loads the directory automatically. Found repository files are displayed in the ["Discovered Repositories on the Mass Storage"](#) on page 65.

Where:

- "Add Install Path" opens the `DataPath` directory.  
Per default, this directory is the same displayed in "Repository Manager" (see [Figure 4-1](#)).
- "Add Home Path" opens the `HomePath` directory.

For information on the default file paths, see [Table 2-2](#).

See also [Chapter 22.3, "Defining storage locations"](#), on page 401.

Remote command:

[REPManager:PATH:ADD](#) on page 532

[REPManager:CATalog?](#) on page 530

### Remove Path

Removes the selected path. The repository files within this directory are also removed from the list.

Remote command:

[REPManager:PATH:DELeTe](#) on page 532

## 4.3 Repository view

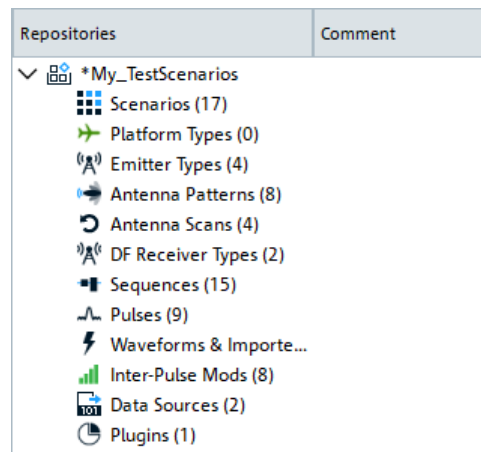
By default, the repository view is set to the tree view. In the tree view, every item of the repository element, e.g. "Scenarios", is displayed.

See "[Repository tree](#)" on page 26.

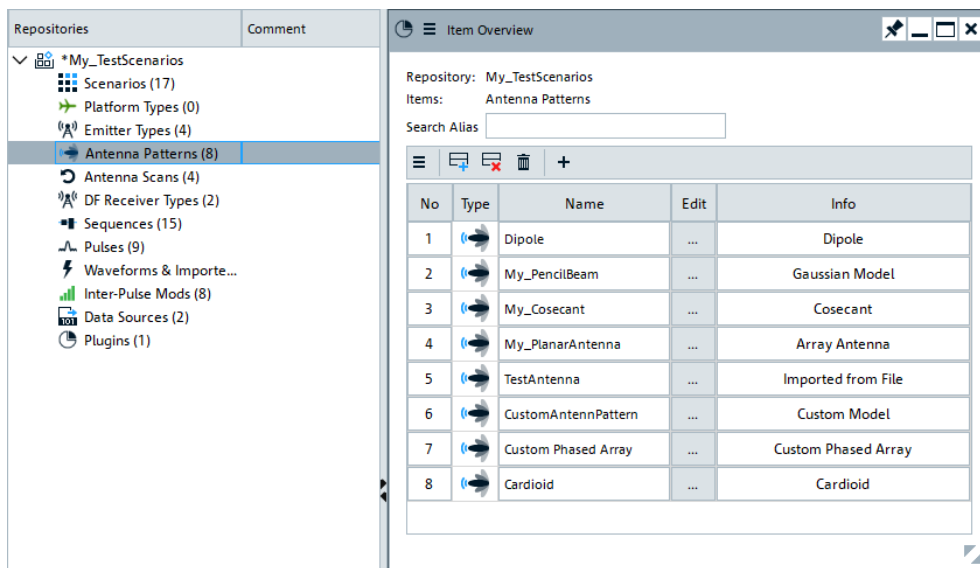
You can switch the tree view to a list view, which displays the number of items in the repository element in brackets. If you select a repository element in the list view, the "Item Overview" dialog opens and displays all items of the selected repository element.

Access:

1. In the project tree toolbar, click .



2. Click the repository element to open the item overview.



**Settings:**

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Items..... 68

Search Alias..... 68

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Item overview table..... 68

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    L Type..... 69

    L Name..... 69

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    L Info..... 69

**Repository**

Displays the name of the repository.

**Items**

Displays the name of the selected repository element related to the items.

**Search Alias**

Filters the list according to the string entered in the dialog.

**Edit, Append, Remove, Remove all, Copy and append**

Standard functions for items handling, see "Standard function in the context menus" on page 33.

**Item overview table**

The table shows the following information:

**No ← Item overview table**

Displays the number of the item.

**Type ← Item overview table**

Displays the type of the item, e.g. "Antenna Patterns".

**Name ← Item overview table**

Displays the name of the item.

**Edit ← Item overview table**

Opens the dialog to edit the selected item.

**Info ← Item overview table**

Displays important parameters of the item.

## 4.4 How to manage the project data

See:

- ["To create a repository"](#) on page 69
- ["To rename the repository"](#) on page 44
- ["To save the repository"](#) on page 44
- ["To delete a repository"](#) on page 70
- ["To remove a repository from the workspace"](#) on page 70
- ["To load a repository"](#) on page 70
- ["To create and export a repository archive"](#) on page 71
- ["To import a repository archive per drag&drop"](#) on page 71
- ["To share a repository with other users"](#) on page 72
- ["To protect a repository from accidental changes"](#) on page 398
- ["To remove the password protection on a repository"](#) on page 399
- ["To change the default user used to access repositories"](#) on page 399

### To create a repository

1. In the menu bar, select "File > New Repository".

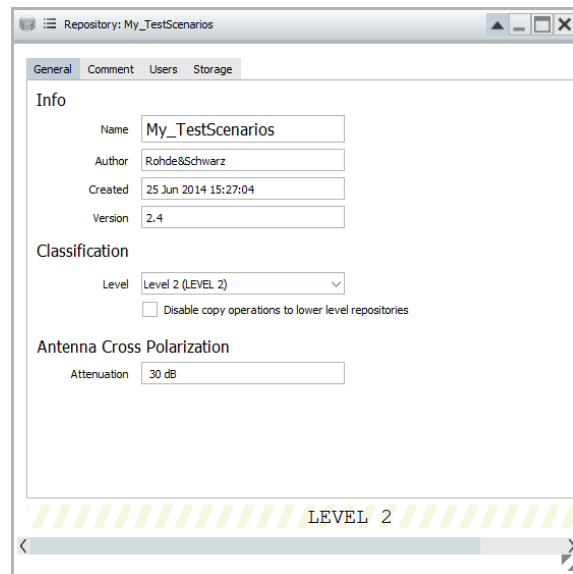
A new empty repository is created and added to the project tree.

Repositories are named automatically. The repository names follow the syntax:

New\_<yyyy-mm-dd><T><hhmmss>, where <yyyy-mm-dd> and T<hhmmss> indicate the current date and time respectively.

2. In the project tree, double-click the repository name.

The "Repository" dialog opens.



3. Change the settings. For example, change the automatically assigned "Name" and "Comment".
4. Set the "Classification > Level >" (see ["Classification"](#) on page 62).
5. Close the dialog.

#### To delete a repository

You can delete repositories that you no longer need, if this repository is not opened by another user with write permission.

1. Use a user with write access rights, e.g. "Admin" or "Creator" (see [Table 22-1](#)).
2. In the menu bar, select "File > Load and Manage Repository".
3. From the listed files, select a repository file, e.g. "My\_TestScenarios".
4. Select "Delete".

#### To remove a repository from the workspace

- ▶ In the project tree, select the repository e.g. "My\_TestScenarios". In the context menu, select "Unload from Workspace".

The repository is removed from the workspace but not deleted. You can open it again, see ["To load a repository"](#) on page 70.

#### To load a repository

1. In the menu bar, select "File > Load and Manage Repository".
2. If necessary, for example by loading and exchanging repositories with another user, change the directory in that the software searches for repository files.
3. From the listed files, select a repository file, e.g. "K32 Examples".

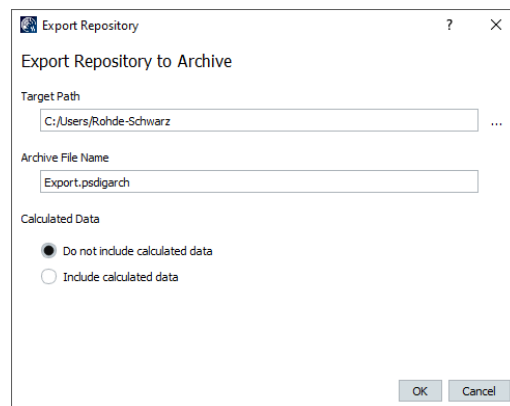
4. Confirm with "Load".

The repository is opened and displayed in the project tree.

### To create and export a repository archive

We assume that you have created a repository and configured at least one scenario.

1. Perform one of the following:
  - a) In the repository tree, select the repository.  
In the context menu, select "Export".
  - b) In the menu bar, select "File > Export Repository".  
From the listed files, select a not used repository file.



2. In the "Export" dialog, select "Target Path" to change the directory in which the repository archive file is stored.
3. Per default, the software saves repository archives as `Export.psdigarch` file. Select "Archive File Name" to change the filename.
4. Define whether the archive file includes the calculated data or not. Including calculated data increases the size of the archive.
5. Select "Ok".

The repository archive is stored in a file with the selected filename.  
The file extension `*.psdigarch` is assigned automatically.

### To import a repository archive per drag&drop

1. In your file explorer, navigate to the network directory with the repository archive.
2. Select a repository file, drag&drop it in the R&S Pulse Sequencer Digital.

The repository is opened and displayed in the project tree.

### To import a repository archive via the menu bar

1. In the menu bar, select "File > Import Repository".
2. Navigate to the network directory. Select a `*.psdigarch` file.

The "Load and Manage Repository" dialog opens.

3. Select a repository file and confirm with "Load".

The repository is opened and displayed in the project tree.

#### **To share a repository with other users**

To move or share repositories, use the "Export/Import Repository Archive" function. Do not access the repositories from your Windows Explorer.

1. See ["To create and export a repository archive"](#) on page 71.
2. See ["To import a repository archive via the menu bar"](#) on page 71.

#### **To obtain write permission on a repository**

Repositories can be opened with executive write permission by one user at a time.

If you have sufficient user rights, you can request an exclusive write permission on a repository that is not opened by another user with write permission.

1. In the project tree, double-click the repository name.
2. In the "Repository" dialog, select "Storage".
3. Select "Obtain Write Permission".



## 5 Selecting a suitable scenario and creating scenarios

This section explains the provided scenario types and helps you select the scenario most fitting to your current task.

### 5.1 Overview of the available scenarios and their complexity

The R&S Pulse Sequencer Digital supports six scenarios with different complexity. Select the scenario most fitting your test case:

- **Single sequence**

The single sequence scenario is used to create sequences from individual pulses. Pulse parameters include the pulse envelope, modulation on pulse (MOP), carrier frequency, and level. The sequence editor defines the order in which the pulses are generated and also adds control elements such as loops and fillers. Inter-pulse modulation profiles can be applied to vary pulse parameters.
- **Sequences (collection)**

The sequences (collection) scenario is used to create multiple sequences which can be selected in arbitrary order. Pulse parameters include the pulse envelope, modulation on pulse (MOP), carrier frequency, and level. The sequence editor defines the order in which the pulses are generated and also adds control elements such as loops and fillers. Inter-pulse modulation profiles can be applied to vary pulse parameters.
- **Single emitter**

The emitter scenario combines a pulse train with an antenna pattern and a particular antenna scan type. An emitter comprises several modes. Each mode is defined by an antenna pattern and an antenna scan, and multiple beams that contain the pulse train.
- **Emitters (collection)**

The emitter collection scenario provides a choice of multiple emitters that can be selected manually. An emitter comprises several modes. Each mode is defined by an antenna pattern and an antenna scan, and multiple beams that contain the pulse train. Multiple emitters can be interleaved into multiple output files using groups and a priority-based dropping algorithm. If pulses are overlapping, the pulses with the lower priority are dropped.
- **Localized emitters**

The localized emitters scenario combines multiple emitters and one receiver on a 2D map. An emitter comprises several modes. Each mode is defined by an antenna pattern and an antenna scan, and multiple beams that contain the pulse train. The receiver is defined by a single antenna pattern and scan. Multiple emitters can be interleaved into multiple output files using groups and a priority-based dropping algorithm.

If pulses are overlapping, the pulses with the lower priority are dropped.

- **Direction finding**

Option:R&S PULSE-K39

The direction finding scenario simulates multiple emitters and a single receiver with up to 10 antennas on a 2D map.

The individual signals for each receive antenna are simulated to enable the receiver to locate the position of a signal source.

Multiple emitters can be interleaved into multiple output files using groups and a priority-based dropping algorithm.

If pulses are overlapping, the pulses with the lower priority are dropped.

- **PDW list (collection)**

The PDW list collection finding scenario provides a choice of multiple PDW lists that can be selected manually. This scenario generates a Rohde & Schwarz proprietary PDW-based signal from a list of imported PDWs in custom format.

Imported PDW lists are read from a waveform object.

Multiple emitters can be interleaved into multiple output files using groups and a priority-based dropping algorithm.

Option:R&S PULSE-K39 required for interleaving.

If PDWs are overlapping, the PDWs with the lower priority are dropped.

See [Chapter 18, "Working with PDWs"](#), on page 355.

## 5.2 Scenario settings

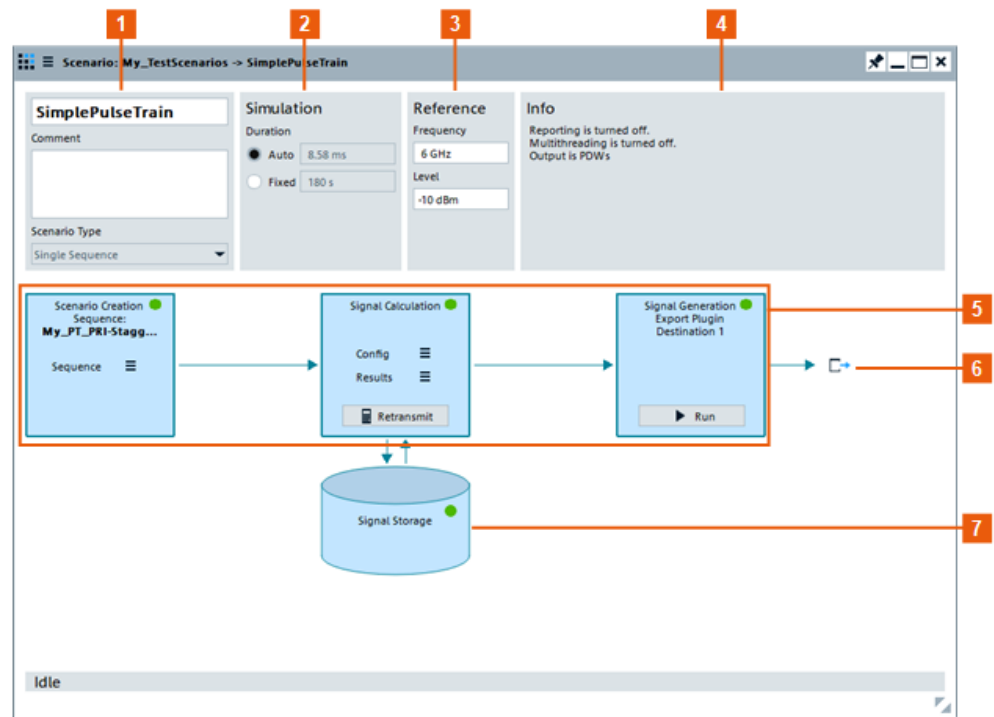
Access:

- ▶ Select "Repository Tree > Scenario".

The "Scenario" dialog provides the settings, necessary to configure the signal processing.

Settings include: settings to select the signal source, to create the waveform, to select the destination, and to transfer the waveform. The dialog also provides basic simulation control functions that are required for signal preview and are specific to each scenario type.

The dialog also shows an interactive block diagram of the main processing blocks, together with their current settings and state.



**Figure 5-1: Scenario dialog: Understanding the displayed information**

- 1 = Scenario overview
  - 2 = Simulation duration settings (see "Duration" on page 349)
  - 3 = Selected frequency information
  - 4 = Info: report generation, scenario setup, warnings about missing/incompatible assignments or configurations when red LEDs display
  - 5 = Block diagram of the processing chain (see "Scenario creation" on page 79, "Signal Calculation" on page 80, Chapter 5.2.1, "Common scenario settings", on page 75)
  - 6 = Selects and indicates the destination for the generated signal (see Chapter 3.3, "Destinations settings", on page 57)
  - 7 = Represents the storage that the simulation data is stored in
- Green LED = Indicates suitable source and destination  
 Yellow LED = Indicates sequence or export errors  
 Red LED = Indicates that there is no source, an incompatible sequence component or no destination selected  
 Dotted line = Interrupted signal flow, meaning there is no calculated waveform or no destination selected

The provided settings depend on the selected scenario type and on the target for signal generation (destination plugin).

## 5.2.1 Common scenario settings

The following settings are common to all scenario types:

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L Mode.....	77
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L Sequence/Sequences.....	80
Signal Calculation.....	80
L Config.....	80
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Interleaving.....	82
L Config.....	82
L Assign.....	83
L Results.....	83
L Interleave.....	83
L Retransmit.....	83
Signal Generation.....	84
L Run/Stop.....	84

### Scenario Name

Enter a unique name to identify your current scenario in the repository.

Remote command:

`SCENario:CREate` on page 426  
`SCENario:CATalog?` on page 426  
`SCENario:NAME` on page 427  
`SCENario:SElect` on page 427  
`SCENario:REMove` on page 428

### Comment

Enter a short description of the scenario. The first line is displayed in the repository tree.

Remote command:

`SCENario:COMMent` on page 428

### Scenario Type

Displays the scenario type.

Remote command:

`SCENario:TYPE` on page 544

**Simulation**

Contains settings relating to the scenario duration and interleaving in appropriate scenarios.

**Interleaving ← Simulation**

Option: R&S PULSE-K39.

Enables interleaving in scenarios that support it.

For a description of interleaving, see:

- ["About the interleaving"](#) on page 238
- ["Interleaving"](#) on page 82.

Remote command:

[SCENario:LOCALized:INTERleaving](#) on page 545

[SCENario:DF:INTERleaving](#) on page 545

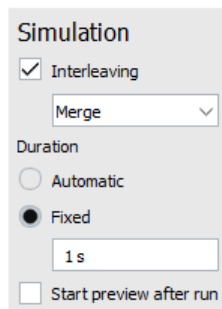
[SCENario:CEMit:INTERleaving](#) on page 545

[SCENario:CPDW:INTERleaving](#) on page 545

**Mode ← Interleaving ← Simulation**

Enabled if "Interleaving > On".

Defines the interleaving mode.



Select "Drop" or "Merge" mode.

In "Drop" mode, interleaves the PDWs using a priority-based algorithm that drops overlapping pulses. Set the priority in the [Config](#) dialog.

In "Merge" mode, merges all PDWs without dropping.

When using "Merge" mode, the "Priority" column in [Config](#) is hidden.

For a description, see ["About the interleaving"](#) on page 238 and ["Interleaving"](#) on page 82.

Remote command:

[SCENario:LOCALized:INTERleaving:MODE](#) on page 545

[SCENario:DF:INTERleaving:MODE](#) on page 545

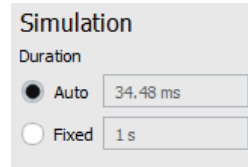
[SCENario:CEMit:INTERleaving:MODE](#) on page 545

**Duration ← Simulation**

Sets the simulation duration and works like the "Duration" settings in the "Signal Calculation > Config > Config > Duration" dialog. If you change the settings here, they update automatically in the "Signal Calculation > Config > Config > Duration" dialog.

The generated signal can:

- Last a specified duration.  
Short sequences are repeated, longer once are truncated.
- Have an automatically determined content and duration, that best fits the current scenario and configuration. After the signal calculation, the duration is displayed.



Short sequences result in waveform files with small size.

Short sequences are repeated, longer sequences are truncated.

See also "[Duration](#)" on page 349.

Remote command:

[SCENario:OUTPut:DURation:MODE](#) on page 562

[SCENario:OUTPut:DURation:TIME](#) on page 562

[SCENario:OUTPut:DURation:AUTO?](#) on page 562

### Start preview after run ← Simulation

Available if a destination is selected: "Signal Calculation > Config > Destinations".

Opens the "2D Movement Preview" automatically after you select "Signal Generation > Run".

### Reference

Contains settings relating to the selected frequency.

### Frequency ← Reference

Sets the carrier frequency of the instrument on which the generated waveform is modulated on.

Emitters use their current operating frequency, see "[EIRP](#)" on page 221.

Remote command:

[SCENario:OUTPut:FREQuency](#) on page 563

### Level ← Reference

Sets the reference level.

This value is used by the calculation of the pulse envelope. The reference level corresponds to the "Ref." line, displayed on the "Pulse Envelope Graph" as a relative ratio. For example, "Ref. = 1" corresponds to 100% \* "Level".

For unattenuated pulses, the "Level" sets the pulse top power.

### Example: Pulse top power of an unattenuated pulse

If:

- "Level = -30 dBm"
- "Pulse > Level > Attenuation > Top Power = 0 dB"

Then the pulse top power would be -30 dB (at the RF output).

**Example: Pulse top power of an attenuated pulse**

If:

- "Level = -30 dBm"
- "Pulse > Level > Attenuation Top Power = 10 dB"

Then the pulse top power would be -40 dB (at the RF output).

If:


- "Level = -30 dBm"
- "Pulse > Level > Attenuation > Top Power = 0 dB"
- $\Delta$  Level = 10 dB

Then the pulse top power would be -20 dB (at the RF output).

Remote command:

`SCENario:OUTPut:LEVel` on page 563**Info**

Displays status information on the current scenario setup:

- Report generation status, type and file location  
To enable report generation, select "Signal Calculation > Config > Config > Reporting > Reporting > Enable"  
See also "[Reporting](#)" on page 351 and [Chapter 21, "Creating reports and documenting measurement results"](#), on page 386.
- Warnings about incomplete or incompatible settings.  
For troubleshooting, open the settings dialog directly by clicking .

**Scenario creation**

Groups and accesses settings related to the signal source.

**Emitter/Emitters ← Scenario creation**

Access settings related to emitters.

- |            |  |
|------------|--|
| "Emitter"  | Available in single emitter scenarios.<br>Opens a context menu that enables you to edit, add or clear an emitter. You can also select an available emitter for the scenario from the menu.                           |
| "Emitters" | Available in multiple emitter scenarios.<br>Opens the "Emitters (Collection)" dialog where you can change the settings for multiple emitters.<br>For more details, see <a href="#">single or multiple emitters</a> . |

**Map ← Scenario creation**

Opens the 2D map in map-based scenarios.

See [Chapter 16.2, "2D map settings"](#), on page 298.**PDW lists ← Scenario creation**

Opens the "PDW Lists (Collection)" dialog where you can edit, add and remove lists for the scenario.

See [Chapter 18, "Working with PDWs"](#), on page 355

**Sequence/Sequences ← Scenario creation**

Access settings related to the pulse sequence.

- "Sequence" Opens a context menu that enables you to edit, add or clear a sequence. You can also select an available sequence for the scenario from the menu.  
Available in "SimplePulseTrain" and "PDW" scenarios.
- "Sequences" Opens the "Sequences (Collection)" dialog where you can change the settings for multiple sequences.  
Available in "PT Collection" scenarios.  
For more details, see [single or multiple pulse sequences, a waveform sequence](#).

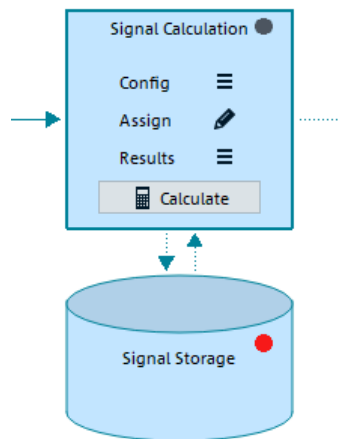
**Signal Calculation**

Groups and accesses settings related to the signal generation and the calculated output signal.

**Config ← Signal Calculation**

In general, the software calculates a waveform most suitable for the target currently selected in the "Signal Generation" block.

If you prefer to change these settings, however, select "Config".

**"Output Format"**

Accesses a dialog where you can change the settings influencing the waveform generation, see [Chapter 17.1, "Signal calculation settings"](#), on page 348.

**"Open Report Folder"**

Opens the report folder in Windows Explorer, see [Chapter 21, "Creating reports and documenting measurement results"](#), on page 386.

**"Target"**

Allows you to select your target "Destination" from a list.

**"Clear Target"**

Removes the selected target and sets the selection to "None".

**"Destinations"**

Accesses the "Destinations" dialog, see [Chapter 3.3, "Destinations settings"](#), on page 57.



Remote command:

[SCENario:START](#) on page 546

[SCENario:STOP](#) on page 546

[SYSTem:PROGress?](#) on page 594

[SCENario:STATe?](#) on page 546

### **Assign ← Signal Calculation**

In a "Scenario Type = Localized Emitters/Emitters (Collection)/Direction Finding/PDW List (Collection)", accesses the dialog for mapping of signals to Destinations.

Assigns signals to an existing plugin in the scenario.

See [Chapter 17.2, "Assign signals to destination"](#), on page 351.

See [Chapter 3.3, "Destinations settings"](#), on page 57.

### **Results ← Signal Calculation**

To observe the calculation results, select "Results".

Depending on your user rights, you have read-only or full access to the repository.

Users granted with full access rights are allowed to perform all the following functions:

"View"

Selects a generated file and visualizes it.

See [Chapter 15, "Visualizing and analyzing signals"](#), on page 284.

Remote command:

[SCENario:VOLatile:SEL](#) on page 565

[SCENario:VOLatile:VIEW](#) on page 565

"Clear calculated results"

Removes the calculated results from the scenario but not from the storage. Change the required settings and calculate again.

Remote command:

[SCENario:CACHe:VOLatile:CLEar](#) on page 547

"View signal statistics"

Opens the "Signal Statistics" dialog where you get information about the signal parameters, e.g. frequency, level and bandwidth. The results are displayed in a table.

### **Calculate ← Signal Calculation**

Select to start the signal calculation.

Starts signal calculation, if the prerequisites are fulfilled.

The software informs you about the estimated file size. A "Busy" indication in the status bar and detailed progress information indicates that the calculation is in progress.

"Stop"                    Aborts the current calculation process.

Remote command:

[SCENario:CALCulate](#) on page 546

[SCENario:STOP](#) on page 546

### **Retransmit ← Signal Calculation**

After calculating, you can retransmit the calculated data to all destinations.

### Interleaving

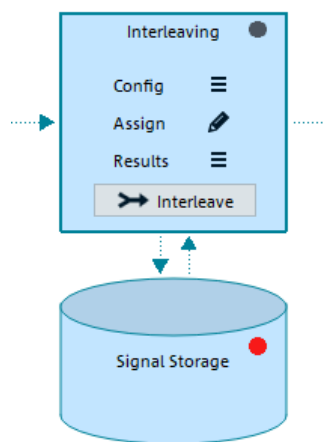
Option: R&S PULSE-K39

Displayed in "PDW Lists (Collection)", "Emitters (Collection)", "Localized Emitters" and "Direction Finding" scenarios, if "Simulation > Interleaving > On". See ["Simulation"](#) on page 77.

Groups and accesses settings related to the interleaving process and the analysis of interleaved and dropped PDWs.

Enables you to combine the emitters or PDW lists into multiple output files using groups, "Merge" mode, and a priority-based dropping algorithm, "Drop" mode.

The interleaving is a separate optional post-processing step in the signal calculation. If this step is required, it can be triggered separately (see ["Simulation"](#) on page 77).



See also:

- ["Emitters \(Collection\) scenario settings"](#) on page 86
- ["Localized emitters scenario settings"](#) on page 88
- ["Direction finding scenario settings"](#) on page 88
- ["PDW list scenario settings"](#) on page 89

### Config ← Interleaving

Allows you to configure the interleaving settings.

See:

- [Chapter 11.1, "Emitters \(Collection\) and localized emitters interleaving settings"](#), on page 239
- [Chapter 18.6, "PDW list \(Collection\) interleaving settings"](#), on page 370

### "Interleaving Groups"

Accesses a dialog where you can change the settings influencing the waveform generation, see [Chapter 17.1, "Signal calculation settings"](#), on page 348.

### "Destinations"

Accesses the "Destinations" dialog, see [Chapter 3.3, "Destinations settings"](#), on page 57.

**Assign ← Interleaving**

In a "Scenario Type = Localized Emitters/Emitters (Collection)/Direction Finding/PDW List (Collection)", accesses the dialog for mapping of signals to Destinations.

Assigns signals to an existing plugin in the scenario.

See [Chapter 17.2, "Assign signals to destination"](#), on page 351.

See [Chapter 3.3, "Destinations settings"](#), on page 57.

**Results ← Interleaving**

To observe the statistical information on the interleaved and dropped PDWs or pulses, select "Results".

Depending on your user rights, you have read-only or full access to the repository.

Users granted with full access rights are allowed to perform all the following functions:

"View" > "Analyze"

Opens the "Analyze Interleaving" dialog.

See [Chapter 18.9, "Analyze interleaving"](#), on page 375.

"View" > "Interleaved/Dropped PDWs"

Opens the "Dropped PDWs" dialog presents a visualization of the results.

See [Chapter 18.8, "Signal preview with interleaved and dropping statistics"](#), on page 374.

"Clear calculated results"

Removes the calculation results and enables you to edit the scenario settings and recalculate.

Remote command:

[SCENario:CACHE:VOLatile:CLEar](#) on page 547

"View signal statistics"

Opens the "Signal Statistics" dialog where you get information about the signal parameters, e.g. frequency, level and bandwidth. The results are displayed in a table.

**Interleave ← Interleaving**

Option:R&S PULSE-K39

Select to start interleaving.

Available in "PDW List (Collection)" and "Emitter (Collection)" scenarios, if "Interleaving > On" is used.

Triggers the calculation of a single output file that comprises the individual PDWs or pulses, where overlapping PDWs or pulses are dropped, based on a defined priority.

The "Interleaving progress" dialog visualizes the number of PDWs or pulses that are included in the output file and the percentage of other that are dropped.

See ["Interleaving"](#) on page 82.

Remote command:

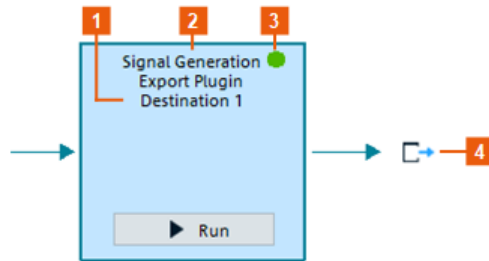
[SCENario:INTerleave](#) on page 546

**Retransmit ← Interleaving**

After calculating, you can retransmit the calculated data to all destinations.

### Signal Generation

Select "Signal Generation" > "Config > Destinations..." to transfer the simulated data to an export plugin.



1 = Destination, as selected with "Config > Destination"

2 = Current setup name, as selected in the dialog "menu bar > Configure > Destinations", see [Chapter 3.3, "Destinations settings"](#), on page 57

3 = Status indication

4 = Simulation export destination as selected in [Chapter 3.3, "Destinations settings"](#), on page 57

### Run/Stop ← Signal Generation

Provides the following functions:

"Run"                      Calls the run method of the export plugin.  
Use this function to perform a task like streaming all PDWs.

"Stop"                      Calls the stop method of the export plugin if needed.

Remote command:

`SCENario:START` on page 546

`SCENario:STOP` on page 546

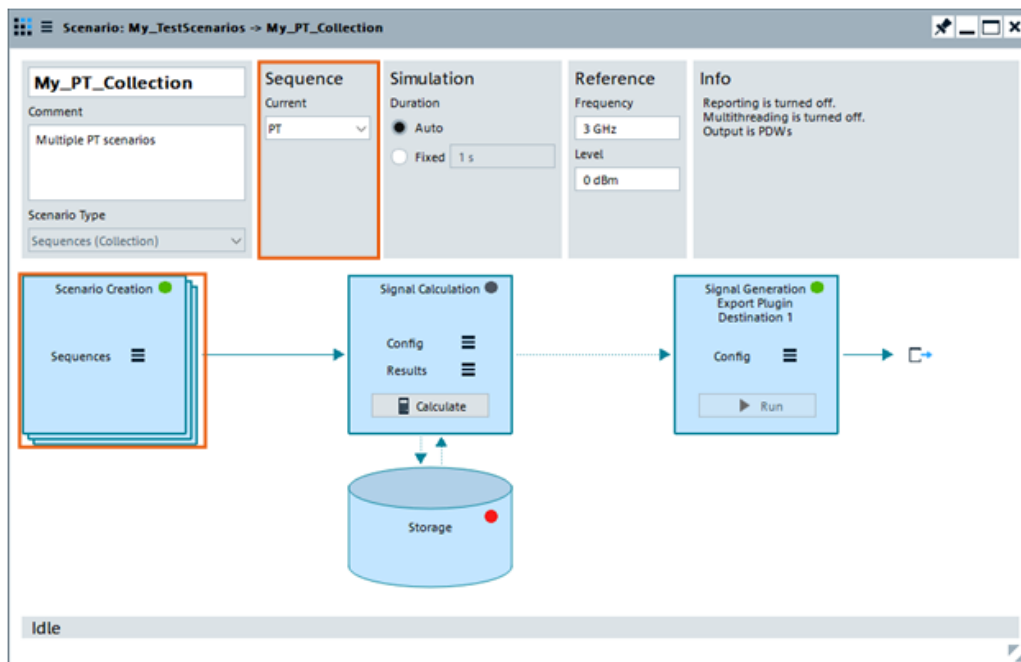
`SYSTEM:PROGress?` on page 594

`SCENario:STATe?` on page 546

## 5.2.2 Scenario-specific settings

<a href="#">Sequence (Collection) Scenario Settings</a> .....	85
<a href="#">Single emitter scenario settings</a> .....	86
<a href="#">Emitters (Collection) scenario settings</a> .....	86
<a href="#">Localized emitters scenario settings</a> .....	88
<a href="#">Direction finding scenario settings</a> .....	88
<a href="#">PDW list scenario settings</a> .....	89

## Sequence (Collection) Scenario Settings



A scenario with multiple sequences requires a list of sequences. You can switch between these sequences using "Scenario Creation" menu and select the one to be transmitted.

The "Sequence" field indicates the alias name of the sequence currently selected.

See:

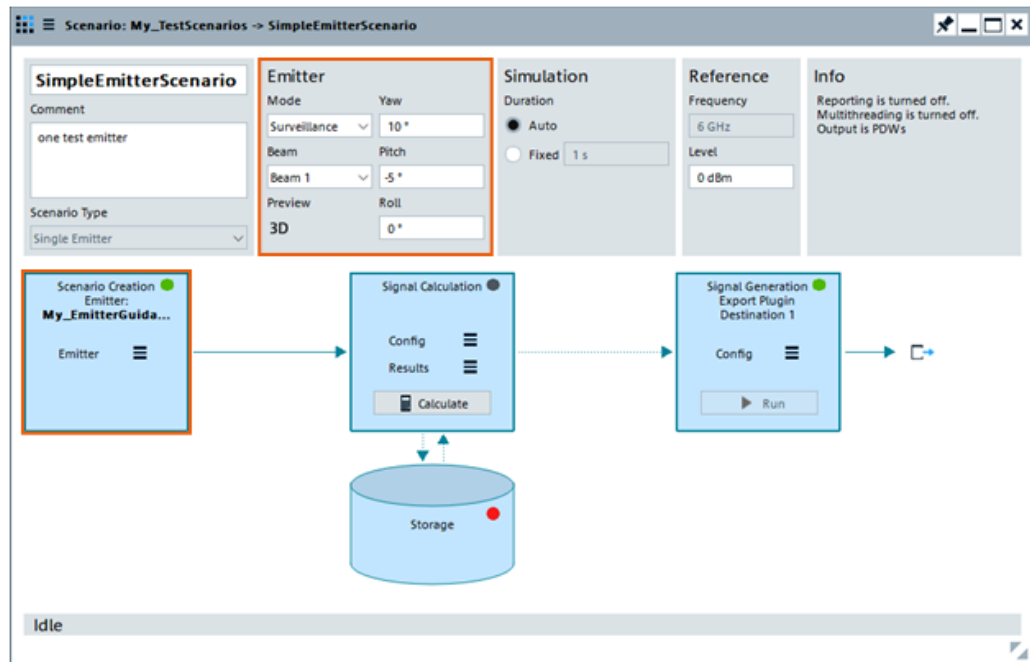
- [Chapter 7.2.5, "Lists with multiple sequences"](#), on page 129
- [Chapter 5.2.1, "Common scenario settings"](#), on page 75

Remote command:

`SCENario:CSEquence` on page 556

`SCENario:CSEquence:CURRent` on page 548

### Single emitter scenario settings



Use the context menu in the "Scenario Creation" block to select and configure the emitter.

You can switch between the emitter modes, define the current beam, set the attitude, and visualize the signal received by a static receiver on a 3D preview.

In this scenario, the "Frequency" is a read-only parameter that displays the [Frequency](#) value of the current emitter (as selected in the "Emitter" dialog).

See:

- ["Emitter attitude"](#) on page 218
- [Chapter 10.4, "How to create and configure emitters"](#), on page 233
- [Chapter 10.1, "Emitter settings"](#), on page 220
- [Chapter 5.2.1, "Common scenario settings"](#), on page 75

Remote command:

[SCENario:EMITter](#) on page 549

[SCENario:EMITter:MODE](#) on page 550

[SCENario:EMITter:MODE:BEAM](#) on page 550

[SCENario:EMITter:CLEar](#) on page 433

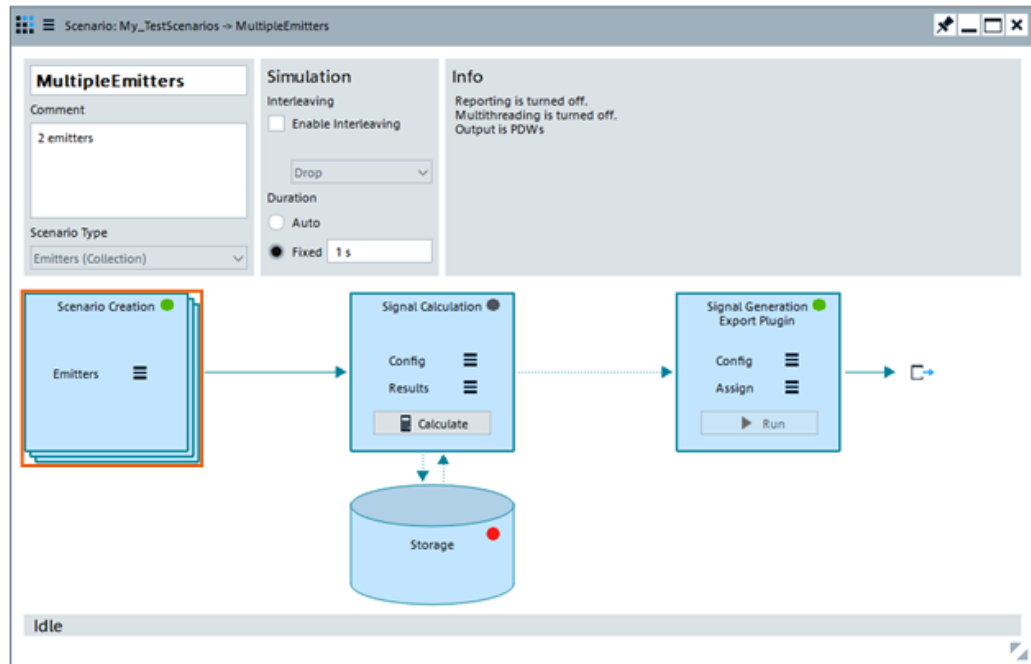
[SCENario:EMITter:DIRection:PItCh](#) on page 549

[SCENario:EMITter:DIRection:YAW](#) on page 548

[SCENario:EMITter:DIRection:ROLL](#) on page 549

### Emitters (Collection) scenario settings

You can use "Emitter (Collection)" scenario to test the receiver's ability to detect the signal from different static emitters. In this dedicated scenario, you can configure several emitters and switch between them sequentially. You can also configure the receiver and change its position in the scanning beam of the emitters.



In addition to processing the emitters sequentially, if the selected destination supports **interleaving**, you can also combine them into multiple output files using groups and a priority-based dropping algorithm. During the interleaving process, overlapping pulses with lower priority are dropped. You can configure the priority of the individual emitters. If "Simulation > Interleaving > On", the block diagram shows the dedicated [Interleaving](#) block.

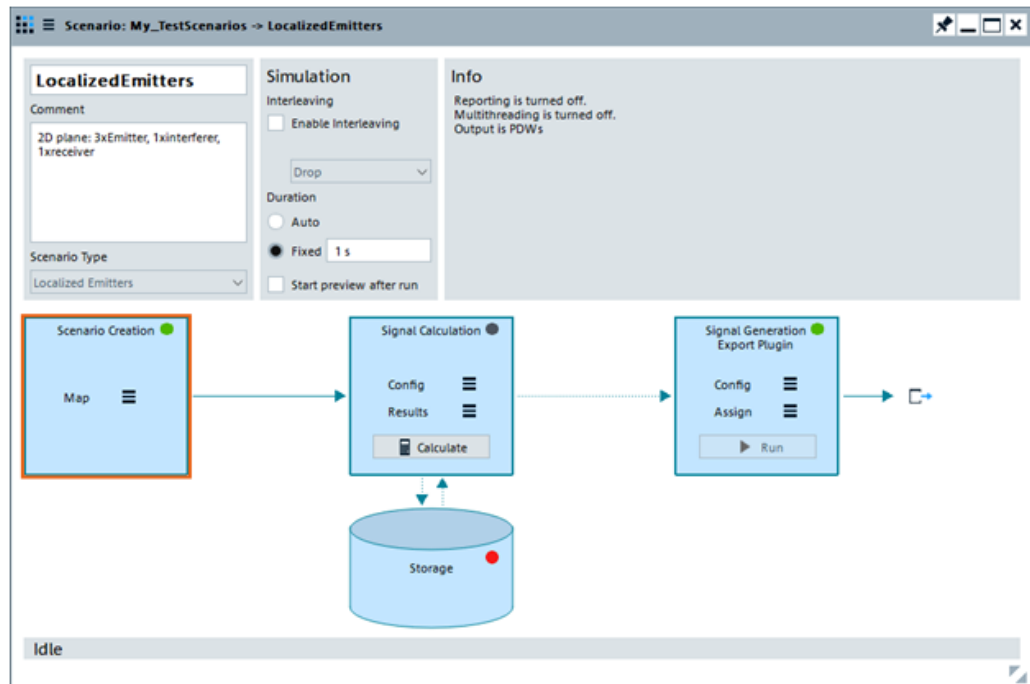
See:

- [Chapter 11, "Combining the signals of multiple emitters"](#), on page 238
- ["Interleaving"](#) on page 82
- ["To configure complex scenarios with several emitters"](#) on page 235
- [Chapter 10.3, "Emitters \(Collection\) settings"](#), on page 225

Remote command:

[SCENario:CEMit:INTerleaving](#) on page 545

### Localized emitters scenario settings



You can use the "Localized Emitter" scenario to test the receiver's ability to detect the sum signal from different static emitters. In this dedicated scenario, you configure the signal of one or more emitters that would be received by a receiver with defined characteristics. You can also configure the receiver and change its position in the scanning beam of the emitters.

Select "Scenario Creation > Map" to display the 2D view of the receiver and currently configured emitters, together with their main characteristics.

In this preview, you see the current position and attitude of the emitters.

This feature is only available after a destination has been set via "Signal Generation > Config".

In addition to processing the emitters sequentially, if the selected destination supports interleaving, you can also combine them into multiple output files using groups and a priority-based dropping algorithm. During the interleaving process, overlapping pulses with lower priority are dropped. You can configure the priority of the individual emitters.

If "Simulation > Interleaving > On", the block diagram shows the dedicated [Interleaving](#) block.

See:

- [Chapter 16.1, "How to create scenarios with receiver and TX items"](#), on page 290
- [Chapter 17.2, "Assign signals to destination"](#), on page 351
- [Chapter 5.2.1, "Common scenario settings"](#), on page 75

Remote command:

[SCENario:LOCalized:INTerleaving](#) on page 545

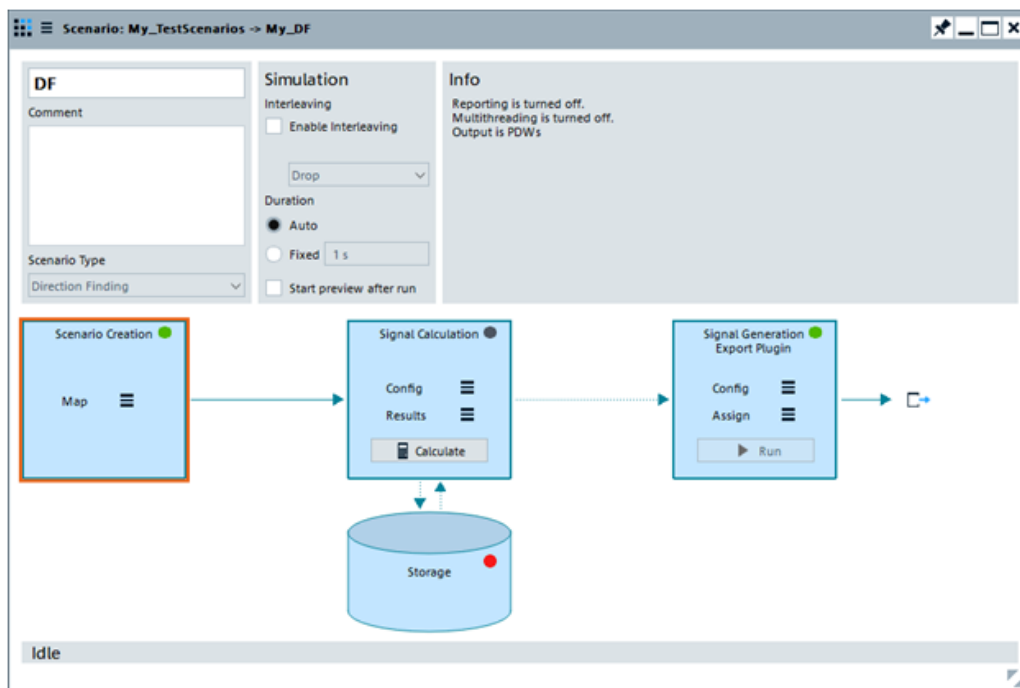
### Direction finding scenario settings

Option:R&S PULSE-K39



The "Direction Finding" scenario simulates multiple emitters and a single receiver with up to 20 antennas on a 2D map. This scenario is suitable to test direction finding systems and to detect interfering signals or transmissions in unauthorized bands.

The generated files are the individual signals of each receive antenna.



Select "Scenario Creation > Map" to display the 2D view of the receiver and the configured emitters, together with their main characteristics.

In addition to processing the emitters sequentially, if the selected emitters supports interleaving, you can also combine them into multiple output files using groups and a priority-based dropping algorithm. During the interleaving process, overlapping pulses with lower priority are dropped. You can configure the priority of the individual emitters. If "Simulation > Interleaving > On", the block diagram shows the dedicated [Interleaving](#) block.

See:

- [Chapter 13.2, "Receiver settings"](#), on page 264
- [Chapter 16.1, "How to create scenarios with receiver and TX items"](#), on page 290
- [Chapter 17.2, "Assign signals to destination"](#), on page 351

Remote command:

`SCENario:DF:INTERleaving` on page 545

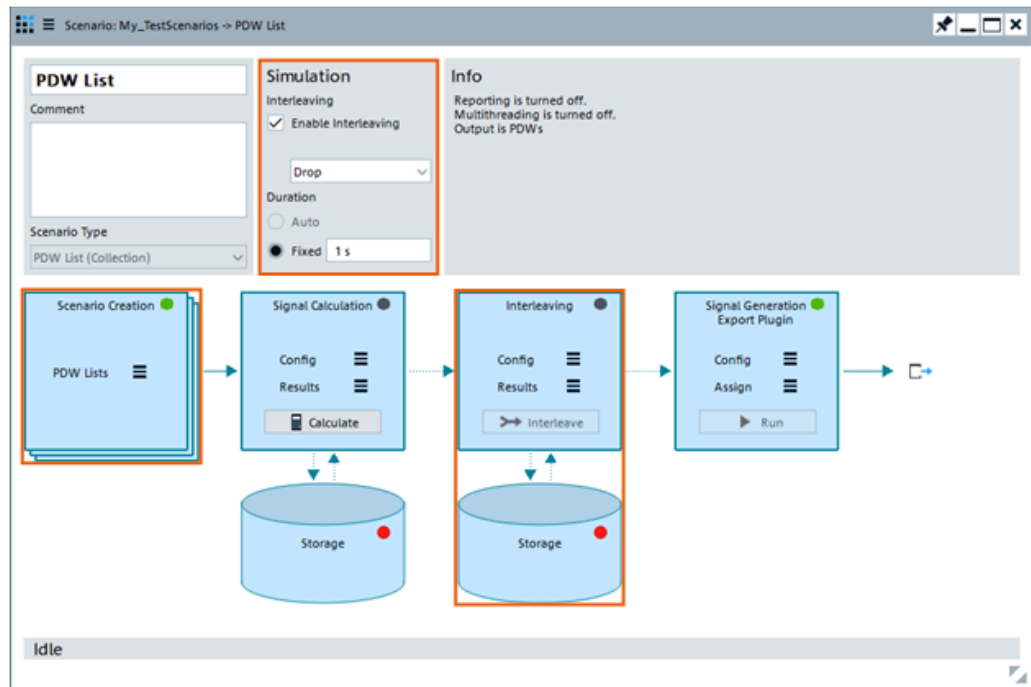
### PDW list scenario settings

Option:R&S PULSE-K39

The "PDW List (Collection)" scenario is dedicated for importing custom PDW lists from legacy test cases and importing them into the application.

Moreover, you can use the "PDW List (Collection)" scenario to configure several PDW lists and switch between them sequentially. You can also combine them into multiple output files using groups and a priority-based dropping algorithm. During the interleaving process, overlapping PDWs with lower priority are dropped, where you define the priority of the individual PDW lists.

If "Simulation > Interleaving > On", the block diagram shows the dedicated [Interleaving](#) block.



See:

- [Chapter 18, "Working with PDWs"](#), on page 355

Remote command:

[SCENario:CPDW:CURRent](#) on page 548

[SCENario:CPDW:INTerleaving](#) on page 545


### 5.3 How to select and create a test scenario

The overview in [Table 5-1](#) helps you decide which scenario type is suitable for a certain test case.

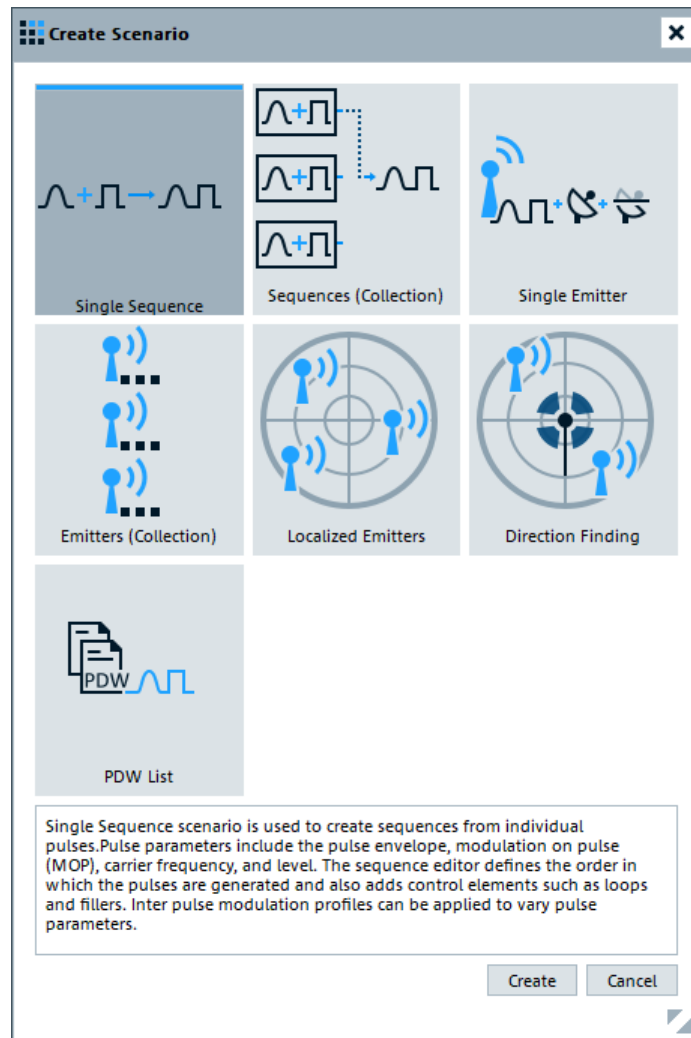
**Table 5-1: Typical test cases with their suitable scenario types**

Test case	Scenario type
Low-level receiver tests Receiver tests with IPM profiles and modulation on pulse	Single sequence Sequences (collection)
Receiver stress tests, where the receiver antenna is an omnidirectional antenna. The emitted signal follows the amplitude changes of antenna patterns and scans Simulation of the signal at the receiver antenna output The receiver power is normalized to maximum	Single emitter Emitters (collection)
Advanced receiver tests, like reception of multiple signals at the same time. The received signals can be the signals of emitters also in the presence of the background noise of many other emitters Emitters and receiver can be moving objects The emitter and the receiver antenna patterns and antenna scans are considered Receiver power is calculated according to free space loss between emitter and receiver	Localized emitters
Receiver tests for direction finding applications Option:R&S PULSE-K39	Direction finding
Import of custom PDW list Merging of multiple PDW lists into a single output file using a priority scheme for dropping	PDW list
Merging of multiple emitters into multiple output files using groups and a priority-based dropping algorithm.	Emitters (collection) Localized emitters Direction finding

**To create a single pulse train scenario**

1. To access the scenario settings dialog, perform one of the following:
  - a) Select "Repository Tree > Scenario > New".
  - b) In the "Toolbar", select the scenario icon .

A scenario wizard opens that helps you to select a predefined scenario configuration.



2. Select "Scenario Type > Single Sequence".

Confirm with "Create"

Created is a new scenario with default name `Scenario <n>`, where `n` is a number starting at one.

The provided settings depend on the selected scenario type.

See [Chapter 5.2, "Scenario settings"](#), on page 74 for description.

3. Add information to describe and identify the scenario, like a name or a comment.

Use the standard functions in the context menus to select or create sequences, select the destination, etc.

See [Table 2-4](#).

Perform further configurations, see:

- [Chapter 7.3, "How to create sequences and use the control elements"](#), on page 131

## 6 Creating a pulse library

This section provides background information on pulse generation and pulse characteristics, explains the provided settings and how to use them to create a pulse library.

- [Basics on pulse signals and pulse generation](#)..... 93
- [Pulse settings](#).....93
- [How to create a new pulse and adjust its settings](#)..... 116

### 6.1 Basics on pulse signals and pulse generation

Some background knowledge on basic terms and principles used in pulse generation is provided here for a better understanding of the required configuration settings.

The pulse parameters to be configured are based primarily on the IEEE 181 Standard 181–2003. For detailed descriptions refer to the standard documentation ("IEEE Standard on Transitions, Pulses, and Related Waveforms", from the IEEE Instrumentation and Measurement (I&M) Society, 7 July 2003).

### 6.2 Pulse settings

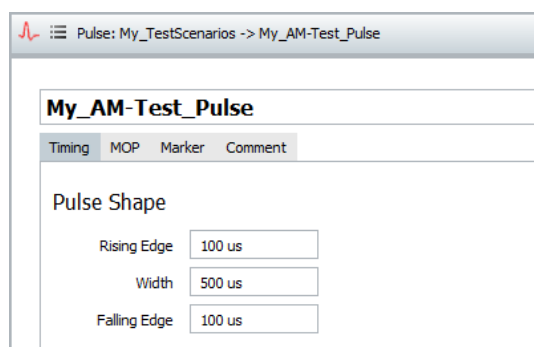
Access:

- ▶ Select "Repository Tree > Pulse > New".

Pulses are characterized by the following settings:

- [Pulse name and comment](#)..... 93
- [Pulse timing settings](#)..... 94
- [Modulation on pulse \(MOP\) settings](#).....96
- [Envelope and modulation graphs](#)..... 112

#### 6.2.1 Pulse name and comment



The screenshot shows a software interface for configuring a pulse. At the top, there is a breadcrumb trail: "Pulse: My\_TestScenarios -> My\_AM-Test\_Pulse". Below this, the title "My\_AM-Test\_Pulse" is displayed in a text box. Underneath, there are four tabs: "Timing", "MOP", "Marker", and "Comment". The "Timing" tab is selected. The main content area is titled "Pulse Shape" and contains three input fields: "Rising Edge" with a value of "100 us", "Width" with a value of "500 us", and "Falling Edge" with a value of "100 us".

**Settings:**

[Pulse Name](#).....94  
[Comment](#).....94

**Pulse Name**

Displays the name of the current pulse.

Remote command:

- [PULSe:CREate](#) on page 426
- [PULSe:NAME](#) on page 427
- [PULSe:CATalog?](#) on page 426
- [PULSe:SElect](#) on page 426
- [PULSe:REMove](#) on page 428

**Comment**

General pulse information.

Remote command:

- [PULSe:COMMeNt](#) on page 428

**6.2.2 Pulse timing settings**

Access:

- ▶ Select "Pulse > Timing".

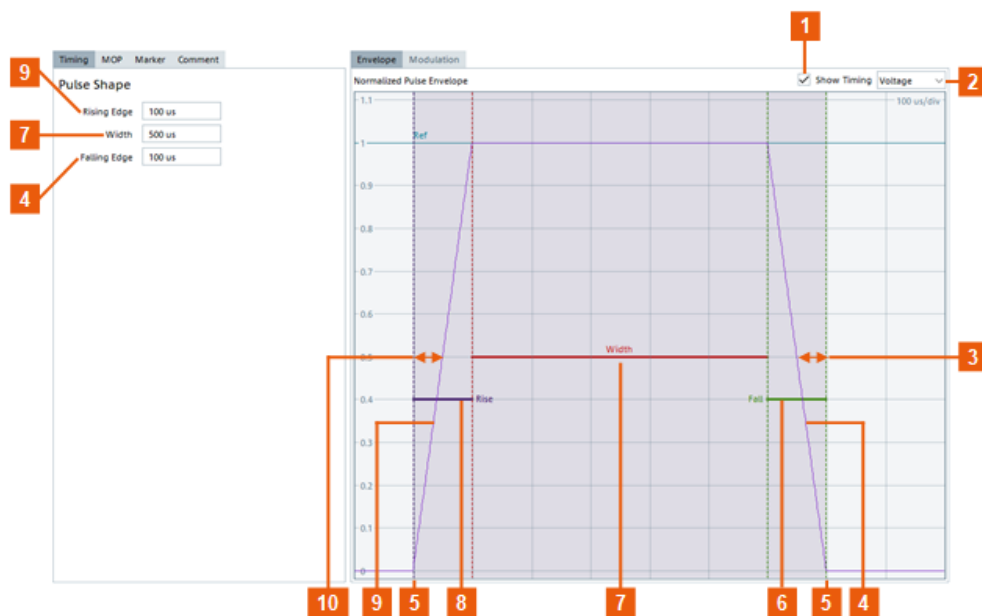


Figure 6-1: Pulse timing: understanding the displayed information

- 1 = "Show Timing > On" indicates the pulse timing parameters on the envelope graph
- 2 = "Pulse Envelope Units > Voltage"
- 3 = Time period between end of pulse and the end of falling edge = 62.5 us, i.e. the time it takes the voltage to fall from 50% to 0% of the top level
- 4, 6 = "Falling Edge = 100 us", i.e. the time it takes the voltage to fall from 90% to 10% of the top level
- 5 = Beginning of the rising and falling edge
- 7 = "Width = 500 us", i.e. the duration the voltage is above 50% of the top level
- 8, 9 = "Rising Edge = 100 us", i.e. the time it takes the voltage to rise from 10% to 90% of the top level
- 10 = "Time period between beginning of the rising edge and pulse start = 62.5 us". I.e. the time it takes the voltage to rise from 0% to 50% of the top level

### Settings:

Use the following parameters to define the pulse in the time domain:

Pulse Shape Settings.....	95
Time period between beginning of rising edge and pulse start / Time period between end of pulse and end of falling edge.....	95

### Pulse Shape Settings

These parameters define the pulse shape:

- Rising/Falling edge
- Width
- Rising/Falling slope

The current pulse shape is displayed on the [Envelope graph](#). To visualize the timing parameters on the graph, select "Envelope > Show Timing > On".

The total pulse duration and the pulse off time are calculated automatically from the selected pulse width, rise and fall time, and the [PRI](#) (see [PRI/PRF](#)).

#### "Rising/Falling Edge"

Transition time of the rising/falling edge.

Remote command:

[PULSe:TIME:RISE](#) on page 520

[PULSe:TIME:FALL](#) on page 520

#### "Width"

Pulse duration.

Remote command:

[PULSe:TIME:WIDTH](#) on page 520

### Time period between beginning of rising edge and pulse start / Time period between end of pulse and end of falling edge

Display information on the time periods during which the RF power is attenuated or suppressed but per default there is modulation or data content present.

**Note:** Avoiding data truncation.

Per default, modulation is already present during the rising and falling phases.

## 6.2.3 Modulation on pulse (MOP) settings

Access:

1. Select "Pulse > MOP".
2. Select "Enable Modulation on Pulse (MOP)".

The screenshot shows the 'My\_TestPulse' configuration window with the 'MOP' tab selected. Under 'Modulation on Pulse', the 'Enable' checkbox is checked and labeled '1'. The 'Comment' field is empty and labeled '2'. The 'MOP Type' dropdown is set to 'AM' and labeled '3'. A sub-section, outlined in orange and labeled '4', contains three fields: 'Type' set to 'LSB + USB', 'Frequency' set to '100 kHz', and 'Mod. Depth' set to '80%'.

*Figure 6-2: MOP settings: understanding the displayed information*

- 1 = Enables pulse signal modulation
- 2 = "Comment"
- 3 = "MOP Type" selects the modulation scheme
- 4 = Modulation parameters, depending on the selected "MOP Type"

Further available settings depend on the selected modulation.

- [AM and ASK modulation](#)
- [FM and FSK modulation](#)
- [Chirp modulation](#)
- [Phase modulation](#)
- [Vector modulation](#)
- [Noise](#)

### 6.2.3.1 Common MOP parameters

#### Enable

Enables/disables that the pulse signal is modulated. If the MOP is disabled, the software generates an envelope signal based on the pulse level and timing parameters.

Remote command:

`PULSE:MOP:ENABLE` on page 516



**Comment**

Optional description.

Remote command:

[PULSe:MOP:COMMeNt](#) on page 428

**MOP Type**

Selects a modulation scheme.

Further available settings depend on the selected modulation.

Remote command:

[PULSe:MOP:TYPE](#) on page 517

**6.2.3.2 AM and ASK modulation**

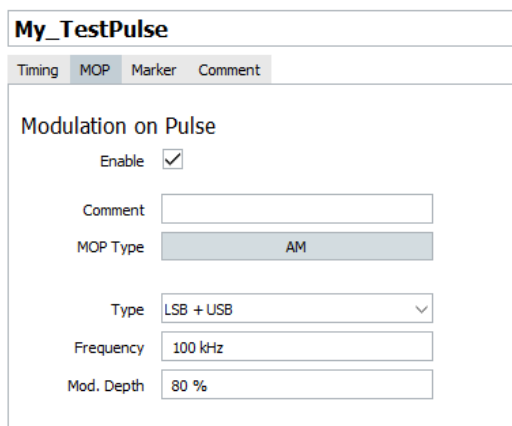
The amplitude modulation (AM) and amplitude shift key modulation (ASK) are modulation schemes that vary the amplitude of the signal.

**Settings:**

[AM](#).....97  
[AM Step](#)..... 98  
[ASK](#)..... 98

**AM**

Enables an AM with a single tone.



"Type" Modulation method, like a double-sideband ("Standard"), a low sideband ("LSB"), an upper sideband ("USB"), or a double sideband with suppressed carrier ("LSB+USB") amplitude modulation.

"Frequency" Modulation frequency.

"Mod. Depth" Depth of the modulation signal in percent, i.e. the peak change in the RF amplitude from its unmodulated value to the amplitude of the unmodulated carrier.

Remote command:

[PULSe:MOP:AM:TYPE](#) on page 510

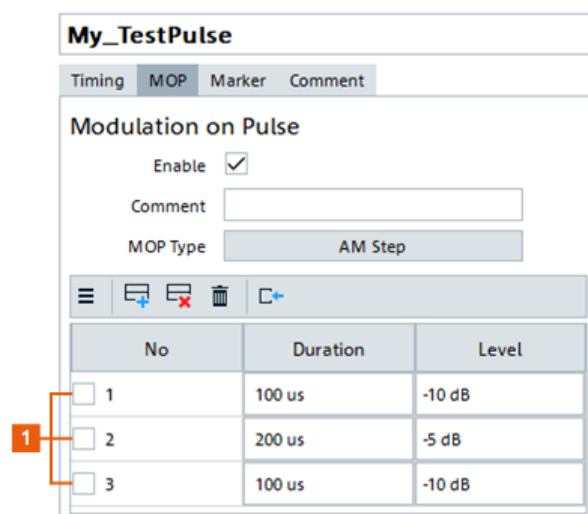
[PULSe:MOP:AM:FREQuency](#) on page 510

[PULSe:MOP:AM:MDEPth](#) on page 510

### AM Step

Defines a modulation as a sequence of discrete states (table rows), each described with its "Duration" and "Level".

Use the standard "Append", "Remove Last", or "Delete All" functions to add or remove a row. The provided settings are self-explanatory.



**Figure 6-3: MOP Type > AM Step: understanding the displayed information (Pulse Width = 500 us, Restrict MOP to = Pulse Width)**

1 = Three discrete states with different attenuation values and a total duration of 400 us

If the total time of the defined states is shorter than the duration of the pulse area on which the MOP is applied, an attenuation of 0 dB is assumed for the remaining time.

Remote command:

[PULSe:MOP:AMSTep:ADD](#) on page 429

[PULSe:MOP:AMSTep:COUNT?](#) on page 430

[PULSe:MOP:AMSTep:SELEct](#) on page 430

[PULSe:MOP:AMSTep:INSert](#) on page 431

[PULSe:MOP:AMSTep:LEVEl](#) on page 511

[PULSe:MOP:AMSTep:DURation](#) on page 511

[PULSe:MOP:AMSTep:CLEar](#) on page 433

[PULSe:MOP:AMSTep:DELEte](#) on page 432

### ASK

Enables an ASK where the amplitude of the RF carrier is attenuated for a symbol value of zero and remains at full level for symbol values of one. The level of attenuation is specified as depth in percent.

**My\_TestPulse**

Timing MOP Marker Comment

**Modulation on Pulse**

Enable

Comment

MOP Type **ASK**

Mod. Depth

Symbol Rate

Inverted

"Mod. Depth"

Depth of the modulation signal in percent.

$$m = (Amplitude_{max} - Amplitude_{min}) / (Amplitude_{max} + Amplitude_{min})$$

"Symbol Rate" Symbol rate of the modulating signal.

"Inverted" Inverts the amplitude-shift keying (ASK) modulation.  
Meaning the RF carrier is attenuated for a symbol value of one.

Remote command:

[PULSe:MOP:ASK:MDEPth](#) on page 512

[PULSe:MOP:ASK:INVert](#) on page 511

[PULSe:MOP:ASK:SRATe](#) on page 512

### 6.2.3.3 FM and FSK modulation

The frequency modulation (FM) and frequency shift keying (FSK) modulation are modulation schemes that vary the frequency of the signal.

#### Settings:

<a href="#">FM</a> .....	99
<a href="#">FM Step</a> .....	100
<a href="#">FSK, 4FSK, 8FSK, 16FSK, 32FSK, 64FSK</a> .....	101
<a href="#">MSK</a> .....	101

#### FM

Enables an FM with a single tone.

**My\_TestPulse**

Timing MOP Marker Comment

**Modulation on Pulse**

Enable

Comment

MOP Type **FM**

Frequency

Deviation

"Frequency" Modulation frequency

"Deviation" FM frequency deviation

Remote command:

[PULSe:MOP:FM:FREQuency](#) on page 517

[PULSe:MOP:FM:DEVIation](#) on page 517

### FM Step

The FM step modulation is a common pulse compression technique. It defines a modulation as a sequence of discrete states (table rows), each described with its "Duration" and "Frequency".

Use the standard "Append", "Remove Last", or "Delete All" functions to add or remove a row. The provided settings are self-explanatory.

### Example: Sequence composed of four pulses with "MOP = FM Step"

- Configure an FM step with  $f_{\text{start}} = -50$  MHz,  $f_{\text{end}} = 50$  MHz, Step = 25 MHz, #Steps = 5.

**My\_TestPulse**

Timing MOP Marker Comment

**Modulation on Pulse**

Enable

Comment

MOP Type **FM Step**

No	Duration	Frequency
<input type="checkbox"/> 1	25 us	-50 MHz
<input type="checkbox"/> 2	25 us	-25 MHz
<input type="checkbox"/> 3	25 us	0 Hz

- Build a sequence and use the "Signal Preview" dialog to visualize the signal.

Remote command:

[PULSe:MOP:FMSTep:ADD](#) on page 429

[PULSe:MOP:FMSTep:COUNT?](#) on page 430

[PULSe:MOP:FMSTep:SElect](#) on page 430  
[PULSe:MOP:FMSTep:INSert](#) on page 432  
[PULSe:MOP:FMSTep:FREQuency](#) on page 511  
[PULSe:MOP:FMSTep:DURation](#) on page 511  
[PULSe:MOP:FMSTep:CLEar](#) on page 433  
[PULSe:MOP:FMSTep:DELeTe](#) on page 432

### FSK, 4FSK, 8FSK, 16FSK, 32FSK, 64FSK

Enables an FSK. High symbols set the frequency to "+Deviation" and low symbols to "-Deviation".

**My\_TestPulse**

Timing
MOP
Marker
Comment

#### Modulation on Pulse

Enable

Comment

MOP Type FSK

Type 2-FSK ▼

Symbol Rate 100 kHz

Deviation 10 kHz

Inverted

"Type" Selects the FSK modulation type.

"Symbol Rate" Symbol rate of the modulating signal.

"Deviation" FSK frequency deviation

"Inverted" Inverts the FSK modulation.

Remote command:

[PULSe:MOP:FSK:TYPE](#) on page 515

[PULSe:MOP:FSK:DEVIation](#) on page 517

[PULSe:MOP:FSK:SRATE](#) on page 518

[PULSe:MOP:FSK:INVert](#) on page 511

[PULSe:MOP:4FSK:DEVIation](#) on page 517

[PULSe:MOP:4FSK:SRATE](#) on page 518

[PULSe:MOP:8FSK:DEVIation](#) on page 517

[PULSe:MOP:8FSK:SRATE](#) on page 517

### MSK

Enables an MSK.

**My\_TestPulse**

Timing MOP Marker Comment

**Modulation on Pulse**

Enable

Comment

MOP Type **MSK**

Symbol Rate

Inverted

"Symbol Rate" Symbol rate of the modulating signal.

"Inverted" Inverts the MSK modulation.

Remote command:

[PULSe:MOP:MSK:SRATe](#) on page 512

[PULSe:MOP:MSK:INVert](#) on page 511

### 6.2.3.4 Chirp modulation

A chirp is a signal in which the frequency varies over the time. The chirp sweeps the RF signal across a set frequency range.

The chirp modulation scheme is used for pulse compression.

**Settings:**

<a href="#">Linear Chirp</a> .....	102
<a href="#">Piecewise Linear Chirp</a> .....	103
<a href="#">Custom Chirp</a> .....	104
<a href="#">Polynomial Chirp</a> .....	106

#### Linear Chirp

The linear chirp varies the frequency linearly over time.

**My\_TestPulse**

Timing MOP Marker Comment

**Modulation on Pulse**

Enable

Comment

MOP Type **Linear Chirp**

Type

Deviation (+/-)

Total Deviation **20 MHz**

- "Type" Defines the frequency variation:
- Linearly increasing ("Up")
  - Linearly decreasing ("Down")
  - Following a full sine wave ("Sine")
  - Ascending and then descending ("Triangular")
- "Deviation" Chirp deviation.  
The "Total Deviation" value updates automatically if you change the "Deviation".

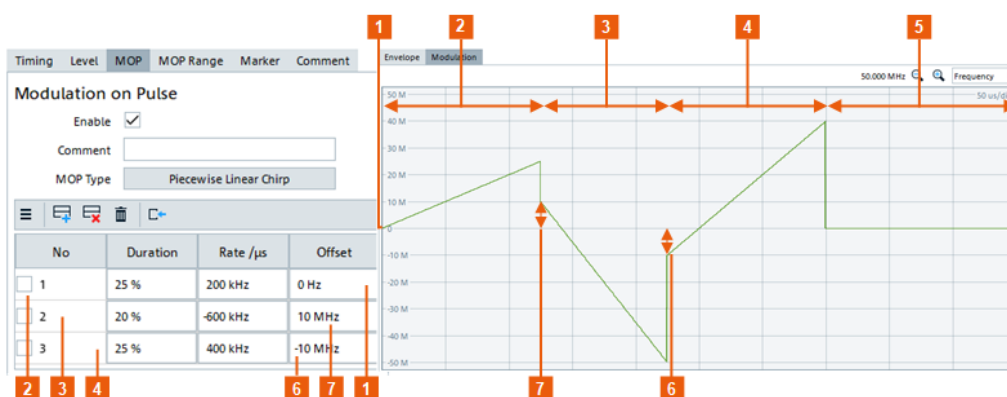
Remote command:

[PULSe:MOP:CHIRp:TYPE](#) on page 514

[PULSe:MOP:CHIRp:DEVIation](#) on page 514

### Piecewise Linear Chirp

Define the chirp as a sequence of chirp intervals with user-definable length and frequency deviation.



**Figure 6-4: Piecewise Linear Chirp: understanding the displayed information**

- 1 = Offset = 0 Hz; the start chirp frequency is 0 Hz  
 2, 3, 4 = Three chirp intervals with total duration of 70% of the whole time of which the MOP is applied\*)  
 5 = In the remaining 30% of the chirp time, the frequency is kept constant  
 6 = Negative offset; the start chirp frequency in the third interval is -10 MHz  
 7 = Positive offset; the start chirp frequency in the second interval is 10 MHz  
 \* = Theoretical example, in practice you rather vary the frequency during the whole time

- "Duration" Set the length of each chirp interval as a percentage of the whole duration to which the MOP is applied.  
 For example, if a pulse width of 100 us and rising/falling edge of 0 us is used and the MOP is applied without restrictions, the whole duration is 100 us.  
 If the sum of all intervals is less than 100%, constant frequency is used in the remaining part.  
 If the sum of the defined intervals exceeds 100%, the parts outside the 100% are ignored.

Remote command:

[PULSe:MOP:PIECewise:DURation](#) on page 515

"Rate/μs" Set the chirp rate in Hz/μs.

**Example:**

If the MOP is applied on 100 us and a chirp with "Rate = 400 KHz/us" is applied for 25 us ([Duration = 25%]), then the frequency deviation during this interval is 10 MHz.

Remote command:

[PULSe:MOP:PIECewise:RATE](#) on page 515

"Offset" Offsets the start frequency of the chirp in the selected interval. Meaning within the interval, the chirp is shifted with the defined value.

Remote command:

[PULSe:MOP:PIECewise:OFFSet](#) on page 515

Remote command:

[PULSe:MOP:PIECewise:ADD](#) on page 429

[PULSe:MOP:PIECewise:COUNT?](#) on page 430

[PULSe:MOP:PIECewise:INSert](#) on page 432

[PULSe:MOP:PIECewise:CLEar](#) on page 433

[PULSe:MOP:PIECewise:DELeTe](#) on page 432

[PULSe:MOP:PIECewise:SELeCt](#) on page 430

[PULSe:MOP:PIECewise:DURation](#) on page 515

[PULSe:MOP:PIECewise:RATE](#) on page 515

[PULSe:MOP:PIECewise:OFFSet](#) on page 515

**Custom Chirp**

The custom chirp modulation is defined as a sequence of discrete "Frequency" stages. The duration of each stage depends on the pulse duration to which the MOP is applied and the number of defined frequency stages.



**My\_TestPulse**

Timing MOP Marker Comment

**Modulation on Pulse**

Enable

Comment

MOP Type **Custom Chirp**

☰

No	Frequency
<input type="checkbox"/> 1	10 MHz
<input type="checkbox"/> 2	5 MHz
<input type="checkbox"/> 3	-10 MHz

"New/Select, Append, Insert, Delete, Clear" Icons that access standard functions, like add or delete row (see also [Table 2-4](#)).

Use the functions in the context-sensitive menu to append new item or reorder the existing item.

"Import data from file"

Standard file management function to load a custom chirp from and as an ASCII file with \*.txt or \*.csv file extension.

When a file is loaded, the "Data Import" dialog assists you to select the used delimiter and separator to interpret the file content.

Import to custom chirp MOP

File

Column Delimiter  First Row

Decimal Marker  Last Row

1000 Separator  First Column

Last Column

Preview

1	10000000
2	5000000
3	-10000000

The provided settings are self-explanatory.

Remote command:

[PULSe:MOP:CCHirp:ADD](#) on page 429

[PULSe:MOP:CCHirp:INSert](#) on page 432

[PULSe:MOP:CCHirp:COUNT?](#) on page 430

[PULSe:MOP:CCHirp:SELEct](#) on page 430

[PULSe:MOP:CCHirp:FREQuency](#) on page 516

[PULSe:MOP:CCHirp:DELEte](#) on page 432

[PULSe:MOP:CCHirp:CLEar](#) on page 433

### Polynomial Chirp

Define the chirp as a polynomial with one or more "Term"/"Coefficient" value pairs.

The instantaneous frequency versus time  $f(t)$  is calculated according to the equation:

$f(t) = \sum (a_n * t^n)$ , where:

- $n = 1 .. 32$  is the term
- $a_n = -10^{22}$  to  $10^{22}$  are the coefficients.

**My\_TestPulse**

Timing MOP Marker Comment

**Modulation on Pulse**

Enable

Comment

MOP Type Polynomial Chirp

No	Term	Coefficient
<input type="checkbox"/> 1	0	3 M
<input type="checkbox"/> 2	2	250000 G

**Figure 6-5: Polynomial Chirp: understanding the displayed information**

1 = Coefficient  $a_0 = 3e6 = 3$  MHz

2 = Coefficient  $a_2 = 2.5e14$

3 = First term  $n = 0$

4 = Second term  $n = 2$  (the coefficient  $a_1$  is not used)

The polynomial chirp defined with the settings on [Figure 6-5](#) is:

$$f(t) = a_0 + a_2 * t^2 = 3e6 + 2.5e14 * t^2.$$

Remote command:

[PULSe:MOP:PCHirp:ADD](#) on page 429

[PULSe:MOP:PCHirp:COUNT?](#) on page 430

[PULSe:MOP:PCHirp:SELEct](#) on page 430

[PULSe:MOP:PCHirp:INSert](#) on page 432

[PULSe:MOP:PCHirp:TERM](#) on page 518

[PULSe:MOP:PCHirp:COEFFicient](#) on page 518

[PULSe:MOP:PCHirp:CLEar](#) on page 433

[PULSe:MOP:PCHirp:DELeTe](#) on page 432

### 6.2.3.5 Phase modulation

Provided are the following phase modulation technics:

<a href="#">Barker</a> .....	107
<a href="#">Poly Phase</a> .....	108
<a href="#">Custom Phase</a> .....	109
<a href="#">BPSK</a> .....	109
<a href="#">QPSK</a> .....	110
<a href="#">8PSK</a> .....	111

#### Barker

Phase modulation with Barker codes results in signals with low autocorrelation properties.

The screenshot shows a configuration window titled "My\_TestPulse" with tabs for "Timing", "MOP", "Marker", and "Comment". The "MOP" tab is selected, and the "Modulation on Pulse" section is visible. The settings are as follows:

- Enable:
- Comment:
- MOP Type: Barker
- Code: R13
- Blank signal during transition
- Transition: 20 %

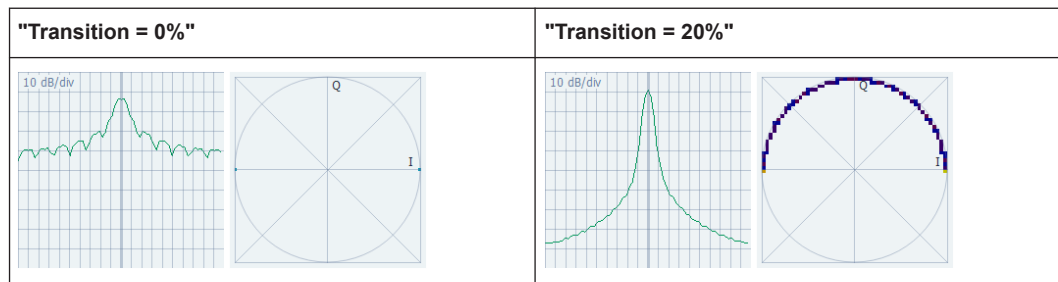
Barker codes are used for pulse compression and are defined by:

"Code" A Barker code is a finite sequence of N values of +1 and -1; R13, for example, is the '+1+1+1+1+1-1-1+1+1-1+1+1' sequence.

"Blank signal during transition"

If "Transition > 0%", blanks out the signal during the transition time.

"Transition" Sets the transition duration for constant envelope operation. A "Transition = 0%" is the border case, where the change for +1 to -1 or conversely is performed immediately. The transition skips (switches back and forth on a direct line) between the constellation points. With a "Transition > 0%", the two constellation points are still exactly opposite, but the transition follows a circular arc. The values on the transition curve are uniformly distributed. Observe the effect of a "Transition > 0%" on the modulation envelope, the displayed spectrum, and on the I/Q constellation diagram. The greater the value, the slower the transition, the longer the transition time.



Remote command:

[PULSe:MOP:BARKEr:CODE](#) on page 512

[PULSe:MOP:BARKEr:TTIME](#) on page 512

[PULSe:MOP:BARKEr:BLANK](#) on page 513

### Poly Phase

A polyphase code modulation is suitable for pulse compression and is used in low probability of intercept (LPI) radars.

**My\_TestPulse**

Timing MOP Marker Comment

**Modulation on Pulse**

Enable

Comment

MOP Type **Poly Phase**

Type **Frank** ▼

Length M

"Type" Selection of polyphase compression codes: the default Frank code, and four modified versions of the Frank code, the P1, P2, P3 and P4 codes.

"Length M" Sets the code order, i.e. the number of elements.

Remote command:

[PULSe:MOP:POLY:TYPE](#) on page 519

[PULSe:MOP:POLY:LENGTh](#) on page 519

### Custom Phase

Defines a sequence of phase values. The phase changes are distributed evenly.

Use the standard "Append", "Remove Last", or "Delete All" functions to add or remove a row. The provided settings are self-explanatory.

**My\_TestPulse**

Timing MOP Marker Comment

**Modulation on Pulse**

Enable

Comment

MOP Type Custom Phase

☰ + - ☒ ☑

No	Value
<input type="checkbox"/> 4	0 deg
<input type="checkbox"/> 5	-135 deg
<input type="checkbox"/> 6	135 deg

Remote command:

[PULSe:MOP:PLISt:ADD](#) on page 429

[PULSe:MOP:PLISt:COUNt?](#) on page 430

[PULSe:MOP:PLISt:SELEct](#) on page 430

[PULSe:MOP:PLISt:INSert](#) on page 432

[PULSe:MOP:PLISt:VALue](#) on page 518

[PULSe:MOP:PLISt:CLEar](#) on page 433

[PULSe:MOP:PLISt:DELEte](#) on page 432

### BPSK

A binary phase shift keying (BPSK) modulation applies a phase shift with a selected offset ("Phase") at each constellation point.

**My\_TestPulse**

Timing MOP Marker Comment

**Modulation on Pulse**

Enable

Comment

MOP Type

Type

Symbol Rate  Auto fit bits into pulse width

Phase

Transition

"Type" Selects the BPSK modulation method, like a standard BPSK modulation or a BPSK modulation with a constant envelope (**C-BPSK**).

"Symbol Rate" Symbol rate of the modulating signal, user defined or automatically estimated.

"Phase" Phase shift between the constellation point.

"Transition"

These parameters are important, when a BPSK modulation with a constant envelope is used.

A "Transition = 0%" is a border case, where the change between two constellation points is performed immediately. The transition skips (switches back and forth on a direct line) between the constellation points.

The greater the value, the slower the transition. With a "Transition > 0%", the two constellation points are still exactly opposite, but the transition follows a circular arc.

Remote command:

[PULSe:MOP:BPSK:TYPE](#) on page 514

[PULSe:MOP:BPSK:SRATE](#) on page 513

[PULSe:MOP:BPSK:SRATE:AUTO](#) on page 513

[PULSe:MOP:BPSK:PHASE](#) on page 513

[PULSe:MOP:BPSK:TTYPE](#) on page 514

[PULSe:MOP:BPSK:TTIME](#) on page 514

### QPSK

A quadrature phase shift keying (**QPSK**) modulation applies a phase shift at each constellation point.

**My\_TestPulse**

Timing MOP Marker Comment

**Modulation on Pulse**

Enable

Comment

MOP Type **QPSK**

Type Standard ▾

Symbol Rate 100 kHz

"Type"

Selects the QPSK modulation method.

- "Standard"  
A regular QPSK modulation.
- "OQPSK, DQPSK"  
An offset QPSK ("OQPSK"), or a differential QPSK "DQPSK" modulation.
- "SOQPSK-A, SOQPSK-B, SOQPSK-TG"  
Three variants of the shaped-offset QPSK ("SOQPSK") modulation.  
For the aeronautical telemetry "SOQPSK-TG" modulation, you can enable differential encoding according to the telemetry standard IRIG 106-04.

Remote command:

[PULSe:MOP:QPSK:TYPE](#) on page 519

[PULSe:MOP:QPSK:SOQPSk:IRIG](#) on page 519

"Symbol Rate"

Symbol rate of the modulating signal.

Remote command:

[PULSe:MOP:QPSK:SRATe](#) on page 519

**8PSK**

An 8 phased shift keying modulation applies a phase shift at each constellation point.

"Symbol Rate"

Symbol rate of the modulating signal.

Remote command:

[PULSe:MOP:8PSK:SRATe](#) on page 517

**6.2.3.6 Vector modulation**

Provided are the following QAM modulations:

[16QAM](#), [32QAM](#), [64QAM](#), [128QAM](#), [256QAM](#)..... 111

**16QAM, 32QAM, 64QAM, 128QAM, 256QAM**

A quadrature amplitude modulation QAM applies an amplitude shift at each constellation point.

**My\_TestPulse**

Timing MOP Marker Comment

**Modulation on Pulse**

Enable

Comment

MOP Type **QAM**

Type 16 QAM

Symbol Rate 1 MHz

"Type" Selects the QAM type.

"Symbol Rate" Symbol rate of the modulating signal.

Remote command:

[PULSe:MOP:QAM:TYPE](#) on page 516

[PULSe:MOP:QAM:SRATE](#) on page 518

### 6.2.3.7 Noise

Generates an **AWGN** noise signal with selected "Bandwidth".

The noise is superimposed during all pulse phases.

MOP Type **Noise**

Bandwidth 1 MHz

Remote command:

[PULSe:MOP:NOISE:BWIDTh](#) on page 518

## 6.2.4 Envelope and modulation graphs

Envelope graph.....	112
Modulation graph.....	113
L Time domain display.....	114
L FFT preview settings.....	115
L I/Q constellation diagram.....	115
L Spectrum.....	115

### Envelope graph

Displays the current pulse shape depending on the following:

- The [Pulse Shape Settings](#) settings

For example, see the envelope graph on [Figure 6-1](#).



"Show Timing" Set "Show Timing > On" to visualize the pulse width, rise and fall time on the graph.

This visualization is useful if you are not familiar with the definition of the pulse parameters.

"Normalized Pulse Envelope > Pulse envelope unit"

Changes the used units.

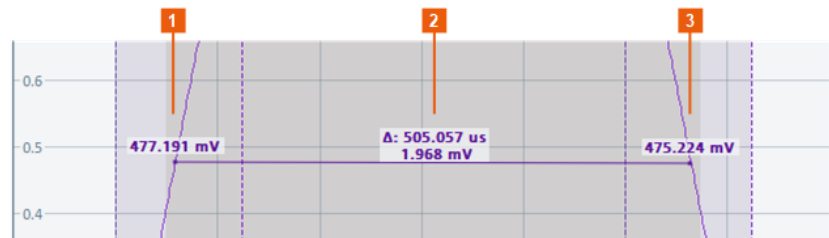
The options "Voltage", "Watt" and three logarithmic scales with different resolution ("10 dB/Div", "5 dB/Div" and "1 dB/Div") are available. To display the effect of large overshoots or ripples for example, use the "5 dB/Div" or "1 dB/Div" scale.

"Temporary delta information"

Drag the mouse cursor on the graph.

The delta information is displayed temporarily above the line.

### Example: Measuring the pulse width with the help of delta marker



1 = Start y value [units depending on the selected "Pulse Envelope Units"]

2 = Delta information: upper value is the  $\Delta x$  [s], lower value is the  $\Delta y$  [units depending on the selected "Pulse Envelope Units"]

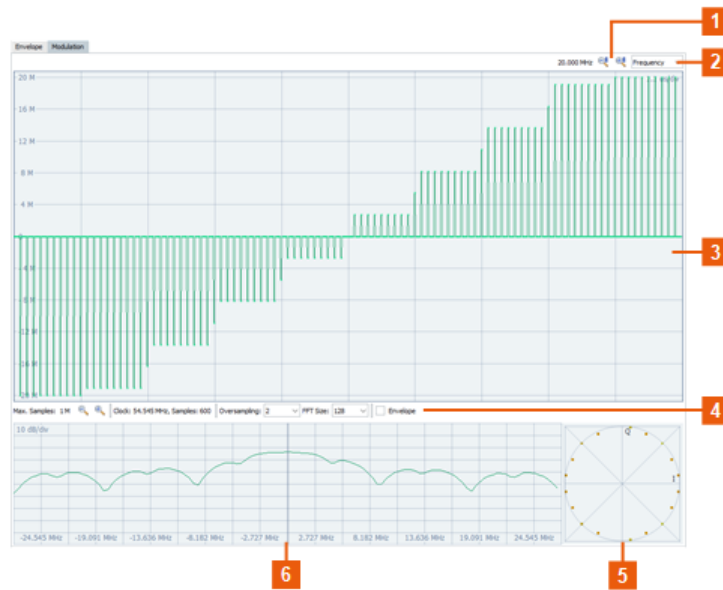
3 = End y value [units depending on the selected "Pulse Envelope Units"]

Remote command:

[PULSe:PREView:MODE](#) on page 520

### Modulation graph

The MOP is visualized on three diagrams: the time domain view, the spectrum, and the I/Q constellation diagrams.



**Figure 6-6: Modulation graph: Understanding the displayed information (MOP Type > Polyphase code, Type = P2, Length M = 10)**

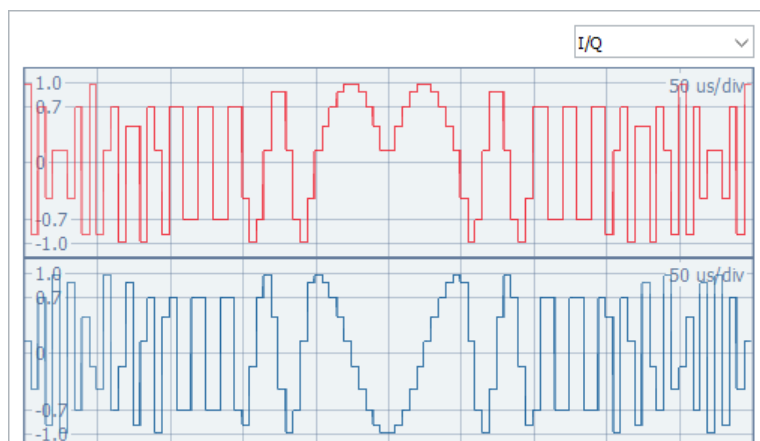
- 1 = Zoom in/out on the x axis; y axis zoom is supported for the frequency display
- 2 = Indicated is the "Frequency" variation
- 3 = Time domain view
- 4 = FFT preview settings
- 5 = I/Q constellation diagram
- 6 = Spectrum

### Time domain display ← Modulation graph

Use the "Modulation" parameter to change the displayed modulation characteristics.

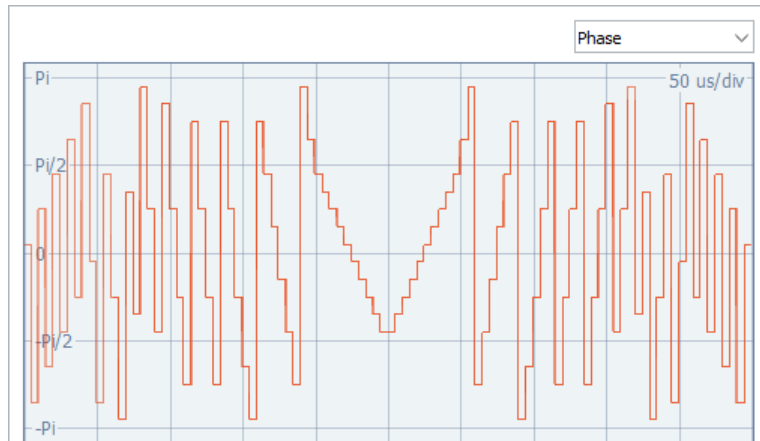
Available are:

"I/Q diagram" Displays the I and Q signal versus time. Both signals use a linear scale in the range between -1.0 and +1.0.



**"Phase diagram"**

Displays the phase angle of the signal versus time. The diagram shows the phase changes in the range  $-\pi$  and  $+\pi$ .



A phase change is equivalent to a rotation at a constant radius in the constellation diagram.

**"Frequency diagram"**

Displays the instantaneous signal frequency versus time.

Remote command:

[PULSe:PREView:MOP](#) on page 521

**FFT preview settings ← Modulation graph**

Displays information about the FFT preview and allows to set parameters:

**"Max. Samples"**

Displays the maximum value of samples possible.

**"Zoom in/Zoom out"**

Changes the resolution on the x and y axis.

**"Clock, Samples"**

Displays clock frequency and number of samples.

**"Oversampling"**

Sets the oversampling factor in the modulation preview.

**"FFT Size"**

Sets the FFT size in the modulation preview.

**"Envelope"**

Activates the envelope in the modulation preview.

**I/Q constellation diagram ← Modulation graph**

Displays the probability at which I/Q points occur.

The color scale is logarithmic; the most probable points are indicated with bright yellow color.

**Spectrum ← Modulation graph**

Displays the [FFT](#) spectrum. The FFT uses a logarithmic scale between 0 dB and -100 dB.

## 6.3 How to create a new pulse and adjust its settings

Pulses are the fundamental building elements of any sequence and therefore have to be created before you can create a sequence.

See:

- ["To create a pulse"](#) on page 116
- ["To define the timing parameters of a pulse"](#) on page 116
- ["To define and apply modulation on the pulses \(MOP\)"](#) on page 117
- ["To visualize the pulse characteristics"](#) on page 118

### To create a pulse

1. Perform one of the following:

- a) Select "Repository Tree > Pulse > New".
- b) In the "Sequence" dialog, select the pulse icon.

A new pulse with default settings is created and added to the repository tree.

New pulses are named `Pulse <n>` where n is a number starting at one.

You can add information to describe and identify the pulse, like a name or a comment.

2. Change the pulse name, e.g. "P1".

A pulse is described by its timing and level parameters, applied modulation on pulse (MOP) and enabled marker signals.

For background information on the pulse parameters, see [Chapter 6.1, "Basics on pulse signals and pulse generation"](#), on page 93.

For description of the required settings, see:

- [Chapter 6.2.2, "Pulse timing settings"](#), on page 94
- [Chapter 6.2.4, "Envelope and modulation graphs"](#), on page 112

### To define the timing parameters of a pulse

1. In the repository tree, select "Pulse > PulseName e.g. P1 > Timing".
2. Set the timing-related parameters, such as:
  - Delay
  - Rise/fall
3. To configure the pulse repetition interval (PRI), use the parameter [PRI/PRF](#).

- Use the "Envelope" graph to visualize the current envelope profile.



**Figure 6-7: Pulse timing: understanding the displayed information**

- = "Show Timing > On" indicates the pulse timing parameters on the envelope graph
- = "Pulse Envelope Units > Voltage"
- = "Time period between end of pulse and the end of falling edge = 62.5 us". I.e. the time it takes the voltage to fall from 50% to 0% of the top level
- , 6 = "Falling Edge = 100 us", i.e. the time it takes the voltage to fall from 90% to 10% of the top level
- = Beginning of the rising and falling edge
- = "Width = 500 us", i.e. the duration the voltage is above 50% of the top level
- , 9 = "Rising Edge = 100 us" i.e. the time it takes the voltage to rise from 10% to 90% of the top level
- = "Time period between beginning of the rising edge and pulse start = 62.5 us". I.e. the time it takes the voltage to rise from 0% to 50% of the top level



Per default, the pulses within a pulse sequence that is built by repeating the same pulse, have constant on time and PRI.

You can define **IPM** profiles to vary the pulse parameters on a pulse-to-pulse basis. See [Chapter 8.2, "How to create IPM profiles and vary pulse parameters"](#), on page 160.

### To define and apply modulation on the pulses (MOP)

The "MOP" settings define the intra-pulse modulation, i.e. the modulation applied on the pulse rise, on, and off time. The R&S Pulse Sequencer Digital provides a wide range of commonly used modulation schemes, such as AM, FM, or Chirp. You can also add your custom pulse content, [Chapter 19, "Defining complex modulation schemes and IPM profiles"](#), on page 377.

To access the "MOP" settings:

- In the repository tree, select "Pulse > PulseName > MOP".

The available modulation settings depend on the selected "MOP Type".

See [Chapter 6.2.3, "Modulation on pulse \(MOP\) settings"](#), on page 96.

2. Select for example "MOP > MOP Type > Chirp > Linear Chirp".
3. Select "MOP > Enable > On".
4. Select "Timing > Rising Edge = Falling Edge = 25%".

Use the "Signal Preview" dialog to observe the effect of the enabled modulation, see [Chapter 15, "Visualizing and analyzing signals"](#), on page 284.

#### **To visualize the pulse characteristics**

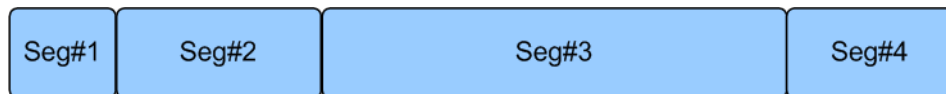
1. Use the "Envelope Graph" to display the envelope shape.  
See [Figure 6-1](#).
2. Set "Show Timing > On" to visualize the pulse width, rise and fall time on the graph.

## 7 Building pulse sequences

This section explains the sequencing principles and signal processing, like creating loops.

### 7.1 About the sequencing principles

Sequences are described in table form where the rows are processed sequentially and appended to the final simulated signal, see [Figure 7-1](#).



*Figure 7-1: Default segments processing: One segment after the other*

Each row is repeated once or as defined with the repetition count parameter (see ["Repetition"](#) on page 124).

See also:

- ["To define and enable pulse repetition"](#) on page 132
- [Chapter 7.2.2, "Pulse repetition settings"](#), on page 125

Complex sequences can also include the following:

- **Loop**  
A loop spans one or more rows (pulses) and processes these rows in the same order several times. Nested loops are complex loops that span rows and loops. The loop duration is defined by the loop repetition number. The loop repetition number is a fixed value or a randomly selected value within a value range, defined with its minimum, maximum and step values.

See also:

- ["To define and apply a loop"](#) on page 133
- [Chapter 7.2.3, "Loop settings"](#), on page 127

- **Filler**  
Fillers are unmodulated signals used to fill in certain period in a sequence.

Signals can be of type:

- Blank

There are two ways to set the duration of a filler: by defining the time duration to be filled in (total duration) or by defining of a certain moment of time (time synchronization).

The filler duration can be a fixed value or defined as an equation. If the filler is configured within a loop, the equation uses the loop variables.

See also:

- [Chapter 7.2.4, "Fillers settings"](#), on page 128

## 7.2 Sequence settings

Access:

- In the repository tree, select "Sequence > New".

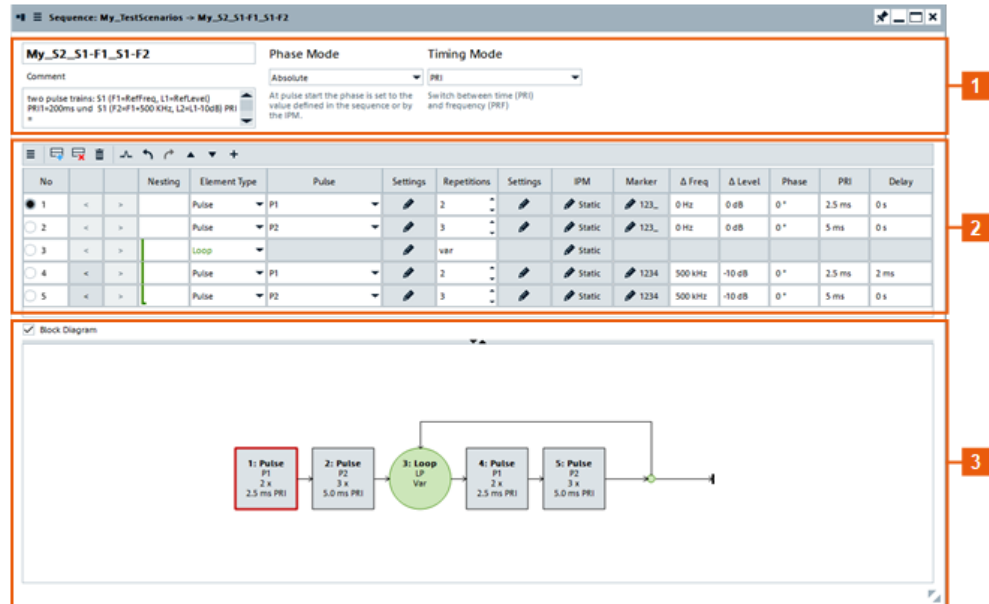


Figure 7-2: Sequence Settings

- 1 = Sequence name, comment, type, and phase and timing mode
- 2 = Sequence description table, where each row represents one item
- 3 = Interactive graphical representation of the current sequence, displayed if "Block Diagram > On"

For step-by-step descriptions, see [Chapter 7.3, "How to create sequences and use the control elements"](#), on page 131.

### Settings:

- [Sequence description settings](#)..... 120
- [Pulse repetition settings](#)..... 125
- [Loop settings](#)..... 127
- [Fillers settings](#)..... 128
- [Lists with multiple sequences](#)..... 129

### 7.2.1 Sequence description settings

- [Sequence Name, Comment, Type, Sequence Description Table, Block Diagram](#)..... 121
- [Phase Mode](#)..... 121
- [Timing Mode](#)..... 123
- [New, Insert, Append, Remove, Clear Items, Undo/Redo](#)..... 123
- [Select, No](#)..... 123
- [Nesting](#)..... 123



Element Type.....	124
Pulse.....	124
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IPM.....	124
Marker.....	124
$\Delta$ Freq.....	124
$\Delta$ Level.....	124
Phase.....	125
PRI/PRF.....	125
Delay.....	125

### Sequence Name, Comment, Type, Sequence Description Table, Block Diagram

A sequence is defined with its unique name, an optional description and with information on the sequence content, waveforms, or pulses.

A sequence is defined in table form where each row represents one item.

If enabled, an interactive block diagram displays the current sequence configuration.

- Left-click to select the item (see "[Select, No.](#)" on page 123).
- Right-click to access the context menu (see "[New, Insert, Append, Remove, Clear Items, Undo/Redo](#)" on page 123).
- Double click an item works like the "Settings (...)" icon in the "Sequence Description Table" and accesses the settings of the item directly.

Remote command:

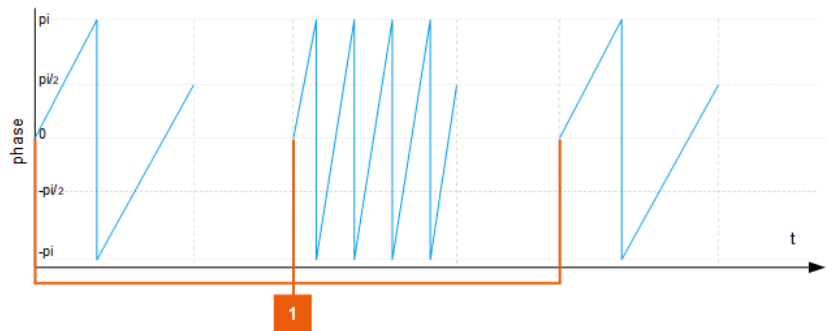
- [SEquence:CREate](#) on page 426
- [SEquence:CATalog?](#) on page 426
- [SEquence:SElect](#) on page 427
- [SEquence:NAME](#) on page 427
- [SEquence:COMment](#) on page 428
- [SEquence:TYPE](#) on page 585
- [SEquence:REMove](#) on page 428

### Phase Mode

Defines how the phase is set at each pulse start.

**"Absolute"**

The pulse start phase is set to a value defined in the sequence description table (**Phase**) or by the IPM.

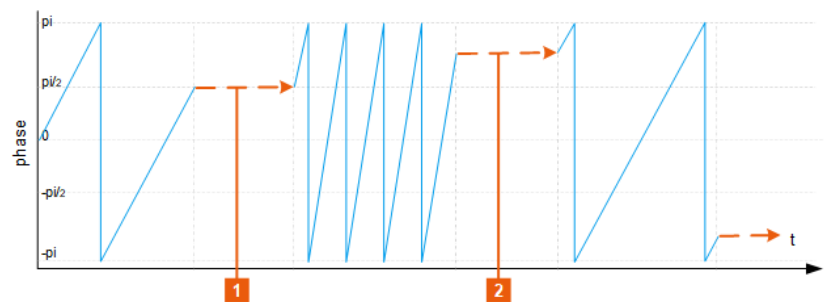


**Figure 7-3: "Phase Mode = Absolute" and "Sequence Description (table) > Phase = 0 deg" (IPM not defined)**

1 = Start phase of all pulses is 0 deg

**"Continuous (Relative)"**

The phase defined in the sequence description table (**Phase**) or by IPM is used as a relative phase change. The phase of the last valid sample of a pulse is held; the specified phase value is applied as a phase offset on it.



**Figure 7-4: "Phase Mode = Continuous (Relative)" and "Sequence Description (table) > Phase = 0 deg" (IPM not defined)**

1, 2 = With "Phase = 0 deg", the phase offset is also 0 deg. The phase of last sample of a pulse is also the start phase of the next one

"Memory" If there are frequency steps, the phase is set to a state as if the frequency has never changed.

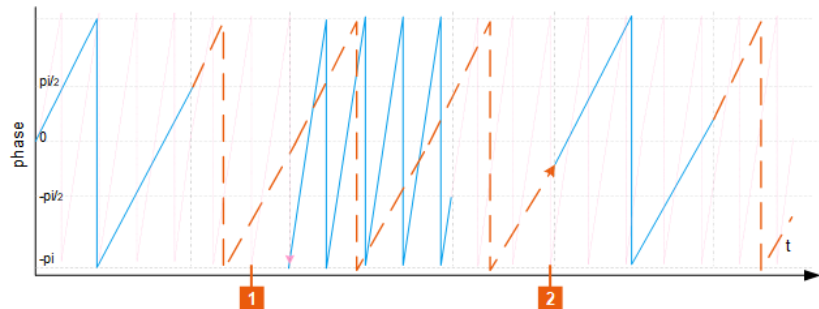


Figure 7-5: "Phase Mode = Memory" and "Sequence Description (table) > Phase = 0 deg" (IPM not defined)

1, 2 = Alternating switching between the outputs of frequency synthesizers (two signals in the example). At the beginning of each pulse, the phase is set to a state the frequency would have had if it had been continuously running

Remote command:

[SEquence: PHASe:MODE](#) on page 586

### Timing Mode

Switches between time (PRI) and frequency (PRF), see [PRI/PRF](#).

Remote command:

[SEquence: TIME:MODE](#) on page 586

### New, Insert, Append, Remove, Clear Items, Undo/Redo

Standard functions for items handling, see "[Standard function in the context menus](#)" on page 33.

Select a row, for example, to delete it or to insert a row before it.

Remote command:

[SEquence: ITEM:ADD](#) on page 429

[SEquence: ITEM:CLEAr](#) on page 433

[SEquence: ITEM:DELeTe](#) on page 432

### Select, No.

Select an item to perform any row-based actions.

Items are indicated by consecutive number; also used for indication in remote control.

Remote command:

[SEquence: ITEM:SELeCt](#) on page 431

[SEquence: ITEM:COUNt?](#) on page 430

### Nesting

Indents table rows to include them in a loop or build parallel branches.

Remote command:

[SEquence: ITEM:INDent](#) on page 587

**Element Type**

Defines the type of content of the current item. Available are:

- |          |   |
|----------|---|
| "Pulse"  | To select a pulse, use the <a href="#">Pulse</a> .  |
| "Filler" | Creates dummy data, like a blank segment.<br>See <a href="#">Chapter 7.2.4, "Fillers settings"</a> , on page 128. |
| "Loop"   | Creates a loop<br>See <a href="#">Chapter 7.2.3, "Loop settings"</a> , on page 127.                               |

Remote command:

[SEquence: ITEM: TYPE](#) on page 592

**Pulse**

Lists all available pulses.

- To access the settings of an existing pulse, select "... (Settings)".
- To create a new pulse, select the icon.  
See also [Chapter 6, "Creating a pulse library"](#), on page 93.

Remote command:

[SEquence: ITEM: PULSe](#) on page 590

**Repetition**

Sets the number of times the item is repeated. For more complex repetition patterns, select "... (more)".

See [Chapter 7.2.2, "Pulse repetition settings"](#), on page 125.

Remote command:

[SEquence: ITEM: REP: COUNT: FIXEd](#) on page 590

[SEquence: ITEM: LOOP: COUNT: FIXEd](#) on page 588

**Settings**

Accesses the "Rep: Line Item" dialog with further repetition settings.

**IPM**

Enables and defines an inter-pulse modulation.

See [Chapter 8, "Defining and enabling inter-pulse modulation effects"](#), on page 139.

**Marker**

Defines the active markers per pulse phase, see [Chapter 20, "Defining and enabling marker signals"](#), on page 380.

**Δ Freq.**

Enables a frequency offset relative to the reference frequency.

Frequency-dependent parameter values are defined relative to this value.

See also ["To define and apply a loop"](#) on page 133.

Remote command:

[SEquence: ITEM: FREQUENCY: OFFSet](#) on page 587

**Δ Level**

Defines a level offset per row.

A negative level offset simulates a pulse attenuation. For example, a "Level = -3 dB" means that the pulses of the current row are processed with power level that is the half of the power.

Level-dependent parameter values are defined relative to this value.

See also ["To define and apply a loop"](#) on page 133.

Remote command:

[SEquence:ITEM:LEVel:OFFSet](#) on page 588

### Phase

Sets a phase offset at the beginning of the row. Phase-dependent parameter values are defined relative to this value.

For example, a "Phase = 30 deg" shifts the phase in the first pulse of the current row; enabled modulation would further change the phase. The phase offset is not compensated at the row end.

See also ["Phase Mode"](#) on page 121.

Remote command:

[SEquence:ITEM:PHASe:OFFSet](#) on page 589

### PRI/PRF

The column name changes depending on the selected [Timing Mode](#).

Sets the pulse repetition interval (PRI), i.e. the pulse period or the pulse repetition frequency (PRF).

Use the "PRI" parameter to define pulses with constant total pulse cycle duration and enabled timing variations like jitter for example.

Remote command:

[SEquence:ITEM:PRI](#) on page 590

[SEquence:ITEM:PRF](#) on page 590

### Delay

Enables a start delay.

A delay within an overlay shifts the start time of the overlay elements relative to each other. Time-dependent parameter values are defined relative to this value.

See also ["To define and apply a loop"](#) on page 133.

Remote command:

[SEquence:ITEM:PDELay](#) on page 589

## 7.2.2 Pulse repetition settings

Per default, a table row in the sequence description table, i.e. a pulse or a waveform, is processed once. To repeat an item several times, enable a repetition.

Rep: Line Item 1

Repetitions

Fixed Value  
 Randomly Selected

Minimum   
Maximum   
Step

Auto Set by Duration

Duration

Repetition Variables

Prefix

Index 1..N <prefix>\_i  
Rep. Count N <prefix>\_n  
Start Time <prefix>\_t

For a step-by-step instruction, see ["To define and enable pulse repetition"](#) on page 132.

### Repetition Number

Defines how many times a sequence item, for example a pulse or loop, is repeated.

The repetition number can be:

- A fixed value
- A randomly selected value within a value range, defined with its minimum, maximum and step values ("Randomly Selected")
- Defined to fit in a selected duration ("Auto Set by Duration"), where the repetition number can be rounded up or down

Remote command:

[SEquence:ITEM:REP:TYPE](#) on page 591

[SEquence:ITEM:REP:COUNT:MINimum](#) on page 591

[SEquence:ITEM:REP:COUNT:MAXimum](#) on page 591

[SEquence:ITEM:REP:COUNT:STEP](#) on page 591

[SEquence:ITEM:REP:COUNT:DURation](#) on page 590

[SEquence:ITEM:REP:COUNT:ROUNding](#) on page 591

### Repetition Variables

You can define repetition variables that are used by the pulse calculation within one row.

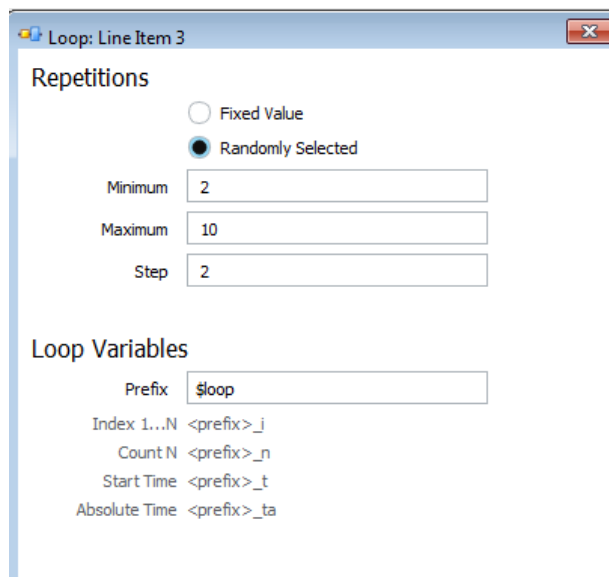
"Prefix" Indicates the repetition the variable belongs to. If empty, no variables are used.  
The variable prefix is a case-sensitive entry.

Remote command:

[SEquence:ITEM:REP:VARiable](#) on page 592

### 7.2.3 Loop settings

Per default, table rows in the sequence description table are processed sequentially. To process a subset of pulses or waveforms several times, create a loop.



For a step-by-step instruction, see ["To define and apply a loop"](#) on page 133.

#### Loop Repetition

The loop repetition number is a fixed value or a randomly selected value within a value range, defined with its minimum, maximum and step values.

Remote command:

[SEQUENCE:ITEM:LOOP:TYPE](#) on page 589

[SEQUENCE:ITEM:LOOP:COUNt:MINimum](#) on page 588

[SEQUENCE:ITEM:LOOP:COUNt:MAXimum](#) on page 588

[SEQUENCE:ITEM:LOOP:COUNt:STEP](#) on page 588

#### Loop Variables

You can define loop variables that are used by the pulse calculation within the loop. When you use a variable, always indicate the prefix and the extension.

- |                     |  |
|---------------------|--|
| "Prefix"            | Indicates the loop to that the variable belongs. If empty, no loop variables are used.<br>The variable prefix is a case-sensitive entry. |
| "Loop Index 1 .. N" | "<prefix>_j" indicates the current repetition number and is a value in the range 1 .. N, where N is the repetition number.               |
| "Loop Count N"      | "<prefix>_n" indicates the repetition number, fixed or randomly selected as defined with <a href="#">Loop Repetition</a> .               |
| "Start Time"        | "<prefix>_t" indicates the start time of each subsequent loop  |

"Absolute Time"

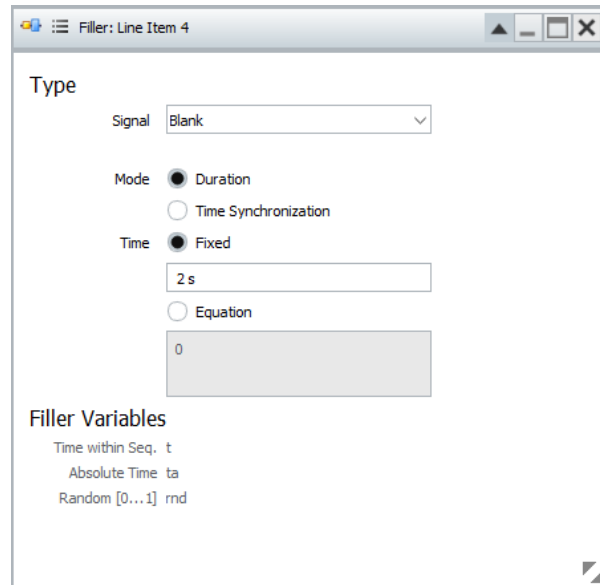
"<prefix>\_ta" indicates the absolute time

Remote command:

[SEquence:ITEM:LOOP:VARiable](#) on page 589

## 7.2.4 Fillers settings

You can enable and add fillers.



### Signal

Selects the type of signal to be generated for filling in the dummy segment.

"Blank" A blank segment with the selected duration is appended to the sequence.

Remote command:

[SEquence:ITEM:FILLer:SIGNAL](#) on page 586

### Mode

Filling segments are commonly used for synchronization purposes. This parameter defines the way the filler duration is determined:

"Duration" Enables a dummy signal for a given period of time.

"Time Synchronization"

In this mode, signal data is generated up to the defined point in time. If the selected time has already elapsed, an error is generated and the calculation is stopped.

Use this mode if a signal has to start at a defined point in time and the length of the previous signals vary or is not known.

Remote command:

[SEquence:ITEM:FILLer:MODE](#) on page 586



**Time**

Defines the timing of the filler.

"Fixed" Uses a fixed time

"Equation" Defines the time point as an equation.

Remote command:

[SEQUENCE:ITEM:FILLER:TIME](#) on page 586

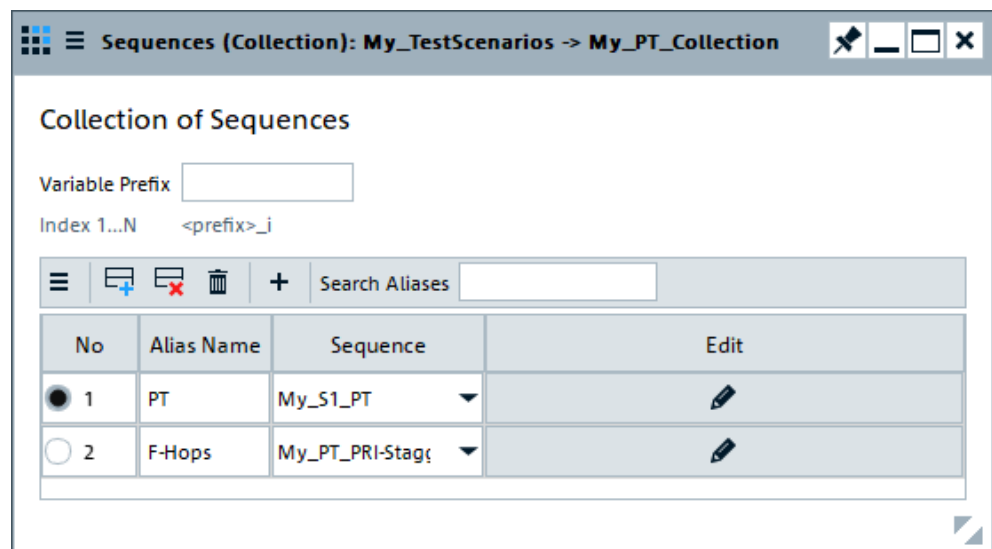
[SEQUENCE:ITEM:FILLER:TIME:FIXED](#) on page 587

[SEQUENCE:ITEM:FILLER:TIME:EQUATION](#) on page 587

**7.2.5 Lists with multiple sequences**

Access:

1. In a "Sequences (Collection)" scenario, select "Sequences > Edit".



Switching between multiple sequences is possible in the pulse train sequential scenario.

2. Select "Edit > ..." to access the properties of the individual sequence. See [Chapter 7.2, "Sequence settings"](#), on page 120.

<a href="#">Variables</a> .....	129
<a href="#">List of sequences</a> .....	130
L <a href="#">Alias Name</a> .....	130
L <a href="#">Sequence</a> .....	130
L <a href="#">Edit</a> .....	130

**Variables**

You can define collection variables and use them, e.g., in the formula editors, in the reports, etc.

"Prefix"	Indicates the sequence to that the variable belongs. If empty, no variables are used. The variable prefix is a case-sensitive entry.
"Index 1 .. N"	"<prefix>_I" indicates the current number and is a value in the range 1 to N. Enter the <prefix> only; the extension _I is appended automatically.
"Count N"	"<prefix>_n" is the number of variables. Enter the <prefix> only; the extension _I is appended automatically.

Remote command:

[SCENario:CSEquence:VARiable](#) on page 557

### List of sequences

Displays a list of sequences.

To add a sequence, select the "Data Source" icon and select "Insert After".

To reorder sequences (items in the list), use the "Up/Down" functions.

Use the standard "Append", "Remove Last", "Delete All" or "Copy and append" functions to add or remove a sequence. The provided settings are self-explanatory.

Remote command:

[SCENario:CSEquence:ADD](#) on page 429

[SCENario:CSEquence:SElect](#) on page 430

[SCENario:CSEquence:CURREnt](#) on page 548

[SCENario:CSEquence:CLEar](#) on page 433

[SCENario:CSEquence:DELeTe](#) on page 432

### Alias Name ← List of sequences

Enters a name.

Remote command:

[SCENario:CSEquence:ALiAs](#) on page 548

### Sequence ← List of sequences

Select a sequence from the list of available sequences.

Remote command:

[SCENario:CSEquence](#) on page 556

### Edit ← List of sequences

Opens the "Sequence" dialog for the selected sequence, see [Chapter 7.2, "Sequence settings"](#), on page 120.

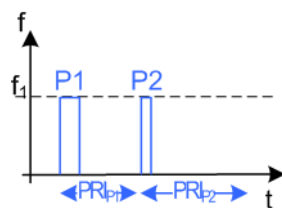
## 7.3 How to create sequences and use the control elements

See:

- ["To create a simple sequence"](#) on page 131
- ["To define and enable pulse repetition"](#) on page 132
- ["To define and apply a loop"](#) on page 133
- ["To create a scenario with several pulse train sequences"](#) on page 135

### To create a simple sequence

This example explains how to create a simple sequence with two pulses, P1 and P2.



We assume that the required pulses have been created, see [Chapter 6.3, "How to create a new pulse and adjust its settings"](#), on page 116.

1. In the repository tree, select "Sequence > New".
2. In the "Sequence" dialog, enter a "Name" and a "Comment", e.g. `My_S1_PT`.
3. For each sequence item, perform the following steps:
  - a) Select the "Append New Item" icon.
  - b) In the "Sequence Description" table, select "Type > Pulse". Select an existing pulse, e.g. "Pulse > P1".
  - c) If the list is empty, select the pulse icon to create a pulse first.
  - d) See [Chapter 6.3, "How to create a new pulse and adjust its settings"](#), on page 116
  - e) Set the  $\text{PRI}_{P1}$ , e.g. "PRI = 2.5 ms".

## 4. Enable "Show Block Diagram".

No	Nesting	Element Type	Pulse/Waveform	Settings	Repetitions	Settings	IPM	Marker	Δ Freq	Δ Level	Phase	PRI	Delay
1		Pulse	P1		2		Static	123_	0 Hz	0 dB	0°	2.5 ms	0 s
2		Pulse	P2		3		Static	123_	0 Hz	0 dB	0°	5 ms	0 s

Block Diagram

```

graph LR
    A["1: Pulse P1  
2 x  
2.5 ms PRI"] --> B["2: Pulse P2  
3 x  
5.0 ms PRI"]
  
```

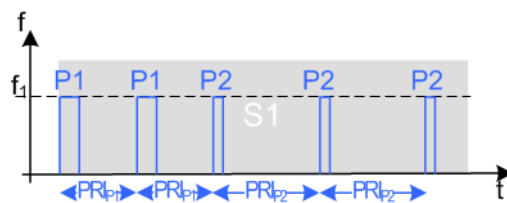
- 1 = Pulse with different PRIs, i.e items with different duration  
 2 = Sequence with two items

The items are processed once and one after the other (see also [Figure 7-1](#)). You can change the default processing, see:

- ["To define and enable pulse repetition"](#) on page 132
- ["To define and apply a loop"](#) on page 133

**To define and enable pulse repetition**

This example explains how to repeat pulses several times, for example to configure a pulse sequence as illustrated on [Figure 7-6](#).



**Figure 7-6: Example of pulse sequence composed of 2xP1 and 3xP2, where the pulses use different PRIs**

$$\text{PRI}_{P1} = 2.5 \text{ ms}$$

$$\text{PRI}_{P2} = 5 \text{ ms}$$

We assume that a sequence with two items has been created, see ["To create a simple sequence"](#) on page 131.

1. Open this sequence.
2. In the "Sequence Description" table, for the first pulse, select "Rep. Count = 2"
3. For the second item, set "Rep. Count = 3".

No	Nesting	Element Type	Pulse/Waveform	Settings	Repetitions	Settings	IPM	Marker	Δ Freq	Δ Level	Phase	PRI	Delay
1		Pulse	P1		2		Static	123_	0 Hz	0 dB	0°	2.5 ms	0 s
2		Pulse	P2		3		Static	123_	0 Hz	0 dB	0°	5 ms	0 s

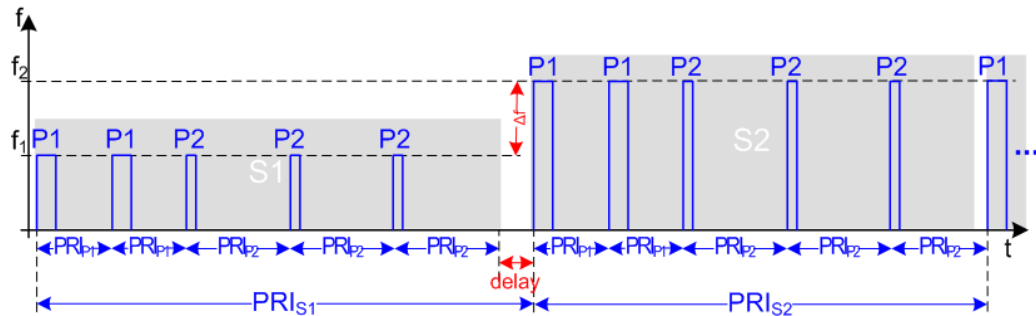
The pulse sequence S1 consists of 5 pulses and has a  $PRI_{S1} = 20$  ms.



Use the "Signal Preview" display to visualize the result, see [Chapter 15.1, "Signal preview settings"](#), on page 284.

**To define and apply a loop**

This example explains how to create a loop with pulses and to repeat it several times, for example to configure a pulse sequence as illustrated on [Figure 7-7](#).



**Figure 7-7: Example of pulse sequence composed of two subsequences, S1 and S2**

S1, S2 = Both sequences follow the same pulse pattern (2xP1 and 3xP2)  
 $PRI_{S1} = PRI_{S2} + \text{"Delay"}$   
 $f_2 = f_1 + \text{"ΔFreq"}$

We assume that a sequence with four items has been created, as shown on the following figure.

Sequence: My\_TestScenarios -> My\_S2\_S1-F1\_S1-F2

Phase Mode: Absolute | Timing Mode: PRI

Comment: two pulse trains: S1 (F1=RefFreq, L1=RefLevel) PRI1=200ms und S1 (F2=F1+500 KHz, L2=L1-10dB) PRI1

No	Nesting	Element Type	Pulse	Settings	Repetitions	Settings	IPM	Marker	Δ Freq	Δ Level	Phase	PRI	Delay
1		Pulse	P1		2		Static	123_	0 Hz	0 dB	0°	2.5 ms	0 s
2		Pulse	P2		3		Static	123_	0 Hz	0 dB	0°	5 ms	0 s
3		Pulse	P1		2		Static	1234	500 kHz	-10 dB	0°	2.5 ms	2 ms
4		Pulse	P2		3		Static	1234	500 kHz	-10 dB	0°	5 ms	0 s

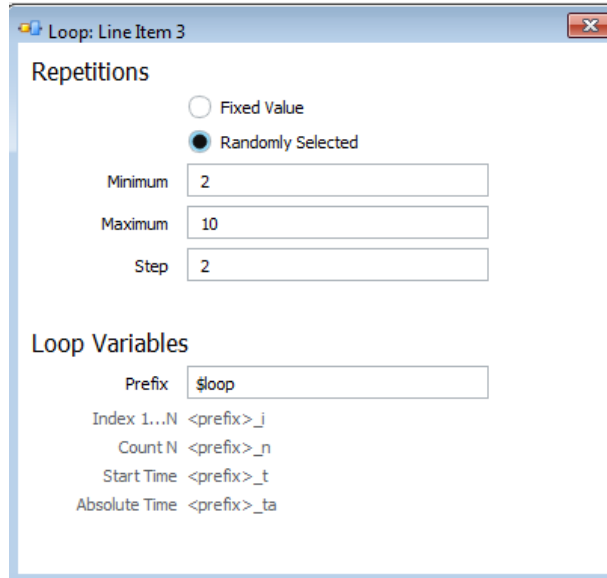
Block Diagram:

```

    graph LR
      P1["1: Pulse P1  
2 x  
2.5 ms PRI"] --> P2["2: Pulse P2  
3 x  
5.0 ms PRI"]
      P2 --> P3["3: Pulse P1  
2 x  
2.5 ms PRI"]
      P3 --> P4["4: Pulse P2  
3 x  
5.0 ms PRI"]
  
```

1. In the "Sequence Description" table:

- a) Select the third item. Select "Insert Item Before Selection"
- b) Select "Element Type > Loop"
- c) Select the "... (more)" icon and enable a random loop repetition.



The loop is repeated 2, 4, 6, 8 or 10 times.

- d) To include the last two items (Line items 3 and 5) in the loop, select the "Increase indentation level >" icon.

No	Nesting	Element Type	Pulse	Settings	Repetitions	Settings	IPM	Marker	Δ Freq	Δ Level	Phase	PRI	Delay
1		Pulse	P1		2		Static	123_	0 Hz	0 dB	0°	2.5 ms	0 s
2		Pulse	P2		3		Static	123_	0 Hz	0 dB	0°	5 ms	0 s
3		Loop			var		Static						
4		Pulse	P1		2		Static	1234	500 kHz	-10 dB	0°	2.5 ms	2 ms
5		Pulse	P2		3		Static	1234	500 kHz	-10 dB	0°	5 ms	0 s

The sequence graph in the "Sequence Description" confirms that the two items are included in the loop. The loop is repeated a random number of times.

2. To enable a different PRI for the looped items, select the first pulse in the loop and set "Delay = 2 ms".

$$PRI_{S1} = PRI_{S2} + 2 \text{ ms} = 22 \text{ ms.}$$

3. For the pulses in the loop, set the " $\Delta$  Freq = 500 KHz" and " $\Delta$  Level = -10 dB".
4. Assign the sequence My\_S2\_S1-F1\_S1-F2 to a pulse train scenario.  
Start the calculation. Select "Results > View".

The "Signal Preview" dialog displays the results.

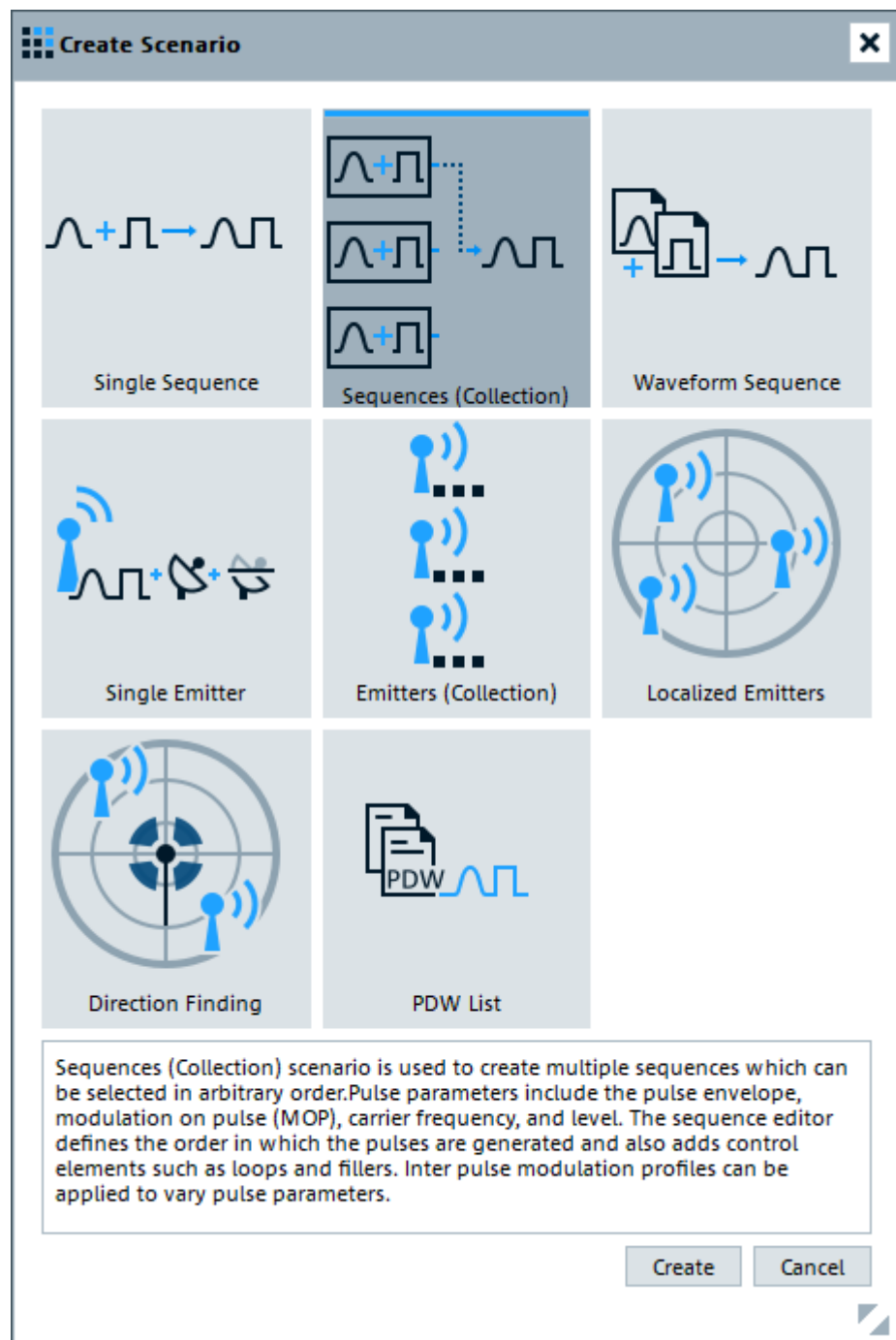
Select "Graphics > PRI" to observe the PRI for the pulses in the sequence. Select different parameters to visualize them on the graph.

### To create a scenario with several pulse train sequences

If your test situation requires you to test the receiver's ability to detect different pulse sequences, you can use "Sequences (Collection)" scenario. In this dedicated scenario, you can configure several pulse train sequences and switch between them sequentially.

The following example creates a complex scenario with two pulse train sequences to explain the principle.

1. Select "Repository Tree > Scenario > New".
2. In the "Scenario Wizard", select "Scenario Type > Sequences (Collection)".



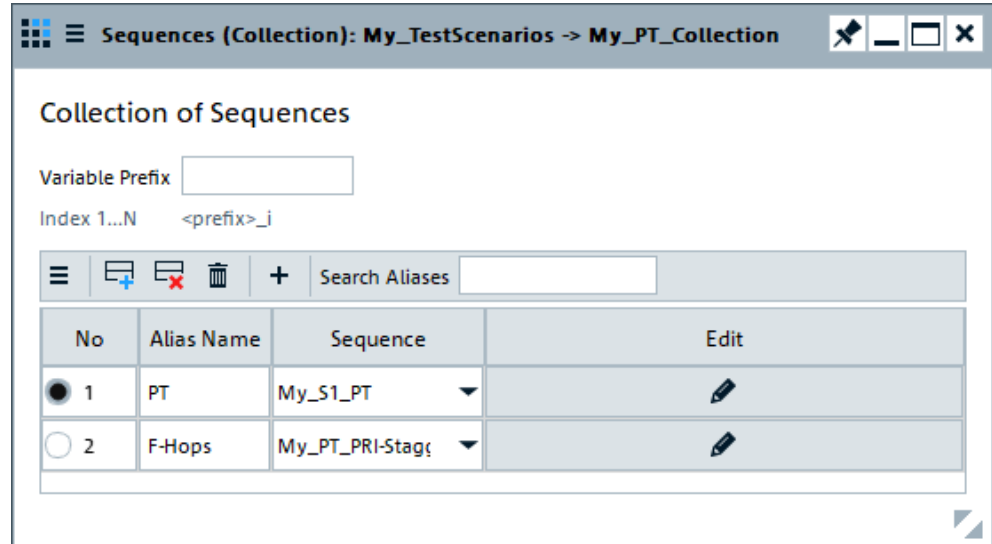
3. Confirm with "Create".
4. Enter a scenario name and a description.
5. In the block diagram, select "Sequences > Edit".  
The "Sequences (Collection)" dialog opens.
6. Use the standard "New" function to insert the first sequence in the list.  
You can select from the list of available sequences or create a new one.



How to create sequences and use the control elements

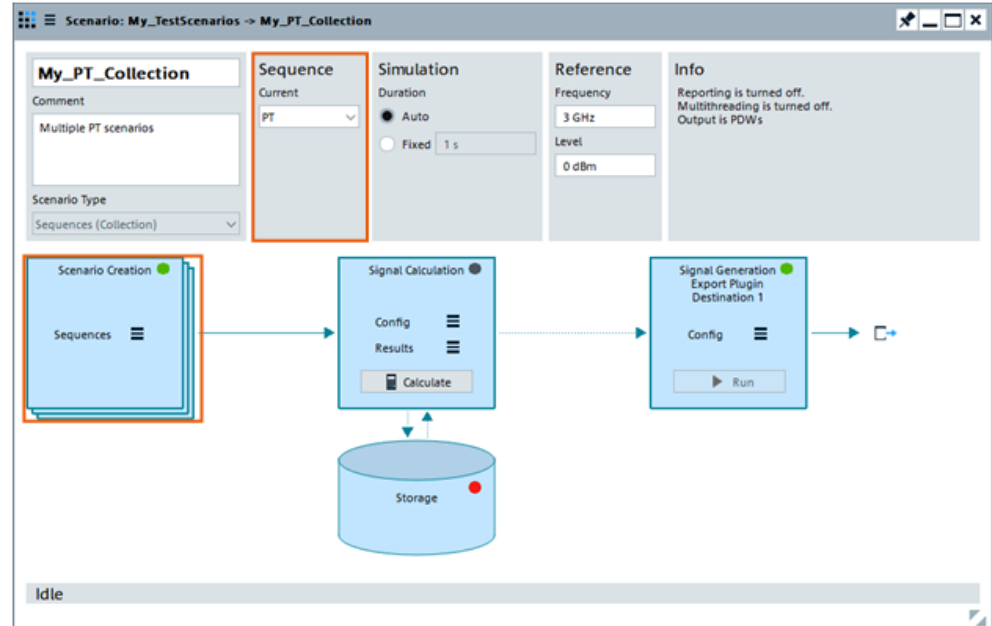
See also ["To create a simple sequence"](#) on page 131.

- In the list of sequences, select a "Sequence". Use the standard "New", "Append/Remove" and "Up/Down" functions to add items to the list or reorder them.



For description of the provided settings, see [Chapter 7.2.5, "Lists with multiple sequences"](#), on page 129.

- In the "Scenario" dialog, select the name of the sequence, e.g. "PT".



For description of the provided scenario settings, see [Chapter 5.2, "Scenario settings"](#), on page 74.

**To create a pulse train sequence and scenario automatically with the "Startup Assistant"**

Alternatively to the methods described in this section, you can use the "Startup Assistant" to create a pulse train automatically.

1. In the menu bar, select "Help > Wizard".
2. Select "Create a pulse train".  
Confirm with "Next".
3. Follow the instructions, use the default settings and select "Finish".

For description of the provided settings, see:

- [Chapter 5.2, "Scenario settings"](#), on page 74
- [Chapter 6.2, "Pulse settings"](#), on page 93
- [Chapter 8.1, "IPM profiles settings"](#), on page 142
- [Chapter 20.1, "Marker settings"](#), on page 380

## 8 Defining and enabling inter-pulse modulation effects

Per default, pulses calculated from the settings of one table row in the sequence description table are identical. To simulate a change of parameters from one pulse to another, like PRI stagger for example, you can define inter-pulse modulation (IPM) effects and assign them to the sequence elements.

Throughout this description, the IPM effects are commonly named parameter variations.

### Pulse repetition patterns

The pulse repetition patterns are commonly used to:

- Avoid range ambiguities caused by echoes of far away objects, which fall into the detection period of the next pulse
- Protect the radar signal against jamming
- Deal with clutter (ground, sea, weather)
- Make the radar more difficult to be identified by frequency hopping

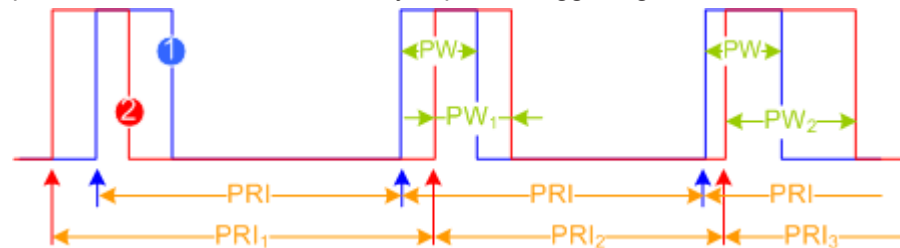
### IPM effects

In the following, two common IPM techniques, the jittered PRI and staggered PRI, are used to explain the principle:

#### • Jittered PRI

In general, a jitter is understood as the short-term variations of a significant pulse parameter, deviating from their ideal positions in time in either random or ordered way (see [Figure 8-1](#)).

You can, for example, use the random variation of the rising and falling pulse edge positions to simulate a technically imperfect trigger signal.



**Figure 8-1: Example of Jitter effects**

1 = Ideal pulse with constant pulse repetition interval (PRI) and pulse width (PW)

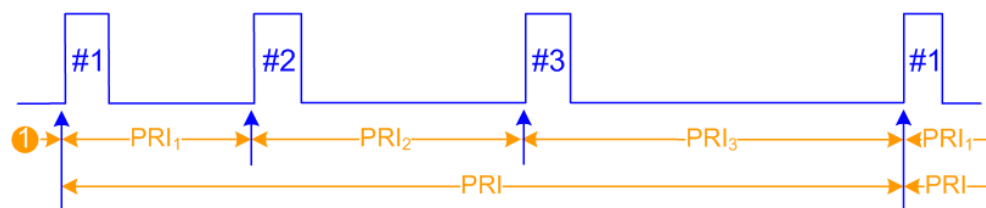
2 = Pulse affected by Jitters: Jitter PRI (PRI<sub>1</sub> ≠ PRI<sub>2</sub>) and varying pulse width (PW<sub>1</sub> ≠ PW<sub>2</sub>)

As illustrated on [Figure 8-1](#), the time between two subsequent pulses varies randomly, on a pulse-to-pulse basis, as does the pulse width.

#### • Staggered PRI

Staggered pulse trains are commonly used against range ambiguities and blind speeds, see also "[Pulse repetition patterns](#)" on page 139.

Staggered PRI is a transmission method based on pulse trains with constant pulse width (PW) and varying PRI. The principle of staggered PRI is illustrated on [Figure 8-2](#)



**Figure 8-2: Example of an IPM effect: Staggered PRI**

- 1 = Stagger start delay
- #1,#2,#3 = Pulse train group composed of three pulses
- PRI = Group PRI: Pulse repetition interval of the pulse train group
- PRI<sub>1</sub>,PRI<sub>2</sub>,PRI<sub>3</sub> = Pulses transmitted with different PRI

As illustrated in [Figure 8-2](#), within a pulse train group each successive pulse uses a different PRI; the pulse train group is slewing.

- **Frequency Hopping**  
Frequency hopping and frequency agility is a further anti-jamming method. If frequency hopping is used, the radar signal switches rapidly and periodically between different carrier frequencies.

There are no predefined parameter variations in the software but IPM profiles can be assigned to the parameter listed in [Table 8-1](#).

**Table 8-1: Parameters to which IPM profiles can be assigned**

Parameter group	Pulse parameter
Level	Offset [dB] <a href="#">Δ Level</a>
MOP	AM Modulation Depth [%] AM Frequency [Hz] FM Deviation [Hz] FM Frequency [Hz] Symbol Rate [Hz] FSK Deviation [Hz] Chirp Deviation [Hz]
Timing	Rise Time [s] <a href="#">Pulse &gt; Time &gt; Rising Edge</a> Pulse Width [s] <a href="#">Pulse &gt; Time &gt; Width</a> Fall Time [s] <a href="#">Pulse &gt; Time &gt; Falling Edge</a> Delay [s]

Parameter group	Pulse parameter
	PRI [s]/PRF [Hz]
Phase	Offset [°]
Δ Freq.	Offset [Hz]

### Source profiles

Parameter variations are described as the combination of a source (profile or variable) and the target element (pulse, sequence or waveform), to that the variation is assigned. If you assign more than one variation to an element, these variations are superimposed (see [Chapter 8.1.4, "Inter-pulse modulation \(IPM\) settings"](#), on page 156).

Source profiles are jitter and IPM profiles. You can use the same profiles for more than one variation; the R&S Pulse Sequencer Digital calculates the profile values independent from each other.

Each jitter and IPM effect affects one of the parameters listed in [Table 8-1](#) and can use the following profiles:

- [Steps](#)
- [Waveform](#)
- [Random List](#)
- [Random Steps](#)
- [List](#)
- [Interpolated Shape](#)
- [Random](#)
- [Equation](#)
- [Plug-in](#)
- [Binomial](#)

## 8.1 IPM profiles settings

Access:

- ▶ Select "Repository Tree > IPM > New".

Settings:

- [Common IPM settings](#)..... 142
- [IPM profiles settings](#)..... 144
- [Edit list settings](#)..... 155
- [Inter-pulse modulation \(IPM\) settings](#)..... 156

### 8.1.1 Common IPM settings

- [IPM Profile Name](#)..... 142
- [IPM Profile Comment](#)..... 143
- [Unit of Affected Parameter](#)..... 143
- [Profile](#)..... 143
- [2D](#)..... 143

#### IPM Profile Name

Enters the name of the profile.

Remote command:

[IPM:CREate](#) on page 426

[IPM:NAME](#) on page 427

[IPM:CATalog?](#) on page 425

[IPM:SElect](#) on page 426

[IPM:REMove](#) on page 428

### IPM Profile Comment

Adds a description.

Remote command:

[IPM:COMMeNT](#) on page 428

### Unit of Affected Parameter

Sets the units of the [IPM](#) parameters.

Available are: "Time [s]", "Frequency [Hz]", "Level [dB]", "Phase [deg]", "Percent [%]".

Remote command:

[IPM:UNIT](#) on page 478

### Profile

Sets the shape of the profile:

- [Steps](#)
- [Waveform](#)
- [Random List](#)
- [List](#)
- [Interpolated Shape](#)
- [Random](#)
- [Equation](#)

Further available parameters depend on the selected shape.

Remote command:

[IPM:TYPE](#) on page 478

### 2D

Opens a preview diagram of the selected profile.

Two views are available:

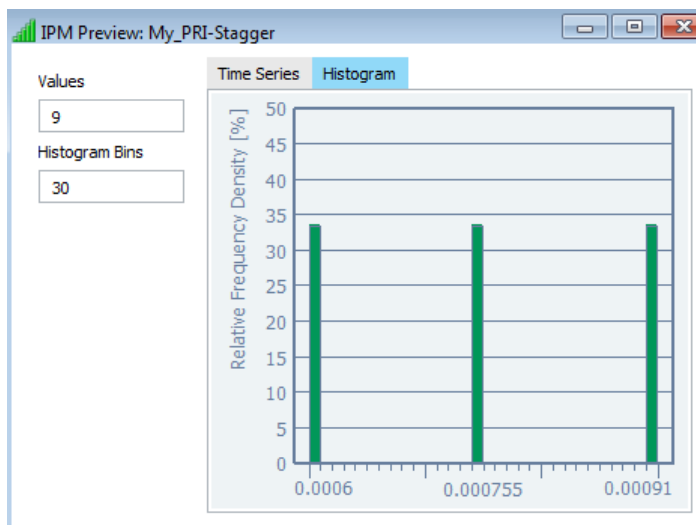
- "Time Series"  
A visualization of the profile variation over time
- "Histogram"  
A statistical representation of the relative frequency density, calculated for the selected number of "Histogram Bins".  
The histogram plots the number of times data points appear in a particular bin.

The displayed characteristics on both views are defined by:

"Values"                Sets the number of values to be displayed.

"Duration"             Sets the displayed duration.

## "Histogram Bins"



Sets the number of histogram bins, i.e. the histogram sets used to group the obtained data. Bins of equal size are used. The bin size is calculated from the value range used on the y-axis in the time series display and the number of bins.

Remote command:

[DIALog: IPMPlot:VIEW](#) on page 489

[DIALog: IPMPlot:SAMPLEs](#) on page 489

## 8.1.2 IPM profiles settings

The following IPM shapes can be defined:

<a href="#">Steps</a> .....	144
<a href="#">List</a> .....	145
<a href="#">Waveform</a> .....	147
<a href="#">Interpolated Shape</a> .....	148
<a href="#">Equation</a> .....	149
<a href="#">Random List</a> .....	150
<a href="#">Random Steps</a> .....	151
<a href="#">Random</a> .....	152
<a href="#">Plug-in</a> .....	153
<a href="#">Binomial</a> .....	154

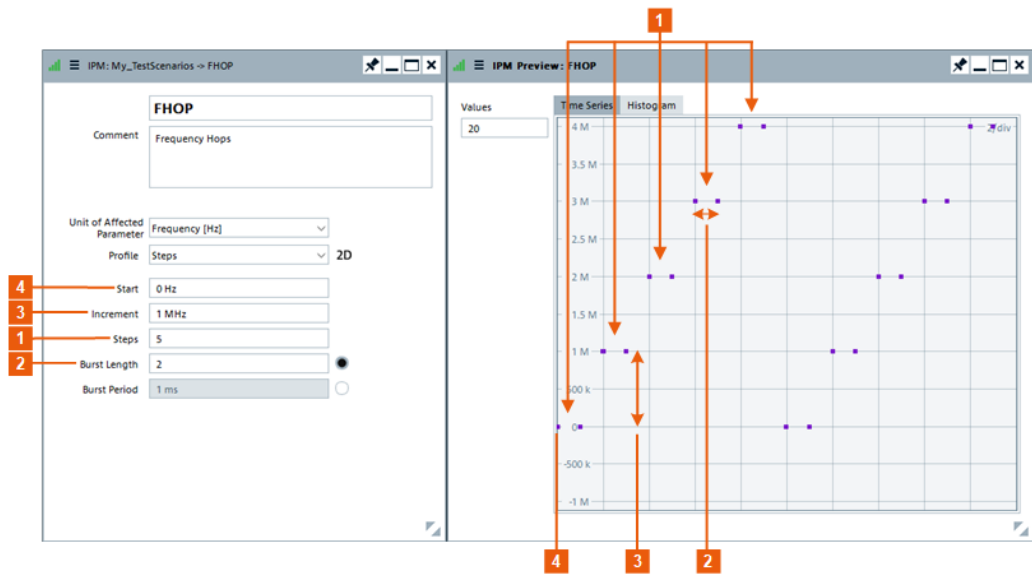
### Steps

This IPM profile follows a staircase shape and creates a sequence of identical values before it moves on the next one.

The profile shape is defined as a function of "Number of Steps", "Start" and "Increment" values; the stop value is calculated automatically.

The parameters "Burst Length" and "Burst Period" are exclusive. They define how often or how long an increment is repeated, i.e. how many identical values are created.





**Figure 8-3: IPM with shape "Profile = Steps"**

- 1 = "Number of Steps" = 5
- 2 = "Burst Length" = 2
- 3 = "Increment" = 1 MHz
- 4 = "Start" = 0 Hz

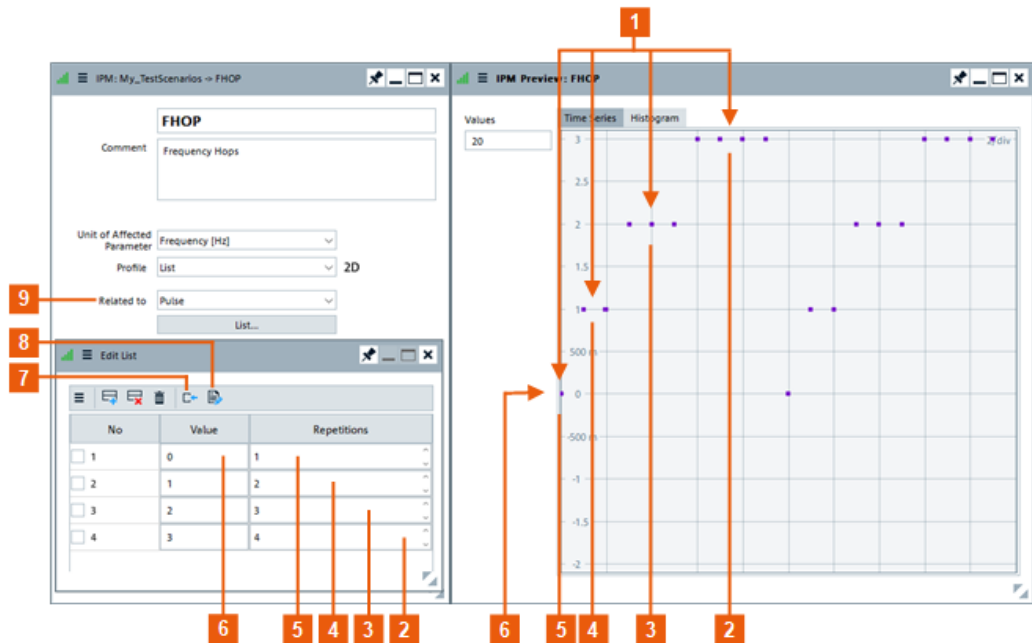
Remote command:

- [IPM:STEP:STEPS](#) on page 486
- [IPM:STEP:START](#) on page 485
- [IPM:STEP:INCRement](#) on page 485
- [IPM:STEP:BASE](#) on page 484
- [IPM:STEP:BURSt](#) on page 485
- [IPM:STEP:PERiod](#) on page 485

### List

The IPM shape is a sequence of discrete values defined in a list.

The list items are processed sequentially and cyclically. When the list end is reached, the list is processed from the beginning. Each list item is repeated once or several times, or for the defined time duration.



**Figure 8-4: IPM with shape "Profile = List"**

- 1 = "List Count" = 4
- 2, 3, 4, 5 = The increments are repeated different number of times: "Repetitions#1 = 1", "Repetitions#2 = 2", "Repetitions#3 = 3", etc.
- 6 = "List Start" = 0
- 7 = "Import Data from File" icon
- 8 = "Populate list" icon
- 9 = "Related to = Pulse"

List profiles are defined in the standard list editor in table form, see ["Edit List"](#) on page 155.

Use one of the following options to create an IPM list profile:

- To create a list manually, use the standard icons and functions in the context menu (see ["Standard function in the context menus"](#) on page 33). Enter the list values manually.
- To import a list in ASCII format, select the "Import Data from File" icon.
- To create a list automatically and fill it in with values, select the "Populate list" icon. Enter the "Start" and "Increment" values and the number of list elements ("Count") and select "Populate".

"Firing Order" If "Related to = Pulses", defines the sequencing of the PRIs in time. Without the firing order, PRIs defined in lists are processed in their sequential order, where a list element is repeated the number of times defined as "Repetition" (see [Figure 8-4](#)). By using firing order, PRIs defined once can be reused several times and processed in a different order than their sequence order in the list. The "Repetition" field is ignored and the actual number of times a PRI is repeated each time is defined in the firing order definition field.

Supported are the following expressions:

- M – N
- MxL

Where:

- M and N are list elements numbers
- L is number of repetitions.

#### Example:

With "Firing Order > On", the expression  $1x1,2x2,3x3,4x4$  results in the sequence 1,2,2,3,3,3,4,4,4,4, that is the same as the example on [Figure 8-4](#).

You can observe the "Time Series" on the 2D view.

Remote command:

[IPM:LIST:FIRing:ENABle](#) on page 480

[IPM:LIST:FIRing:SEQuence](#) on page 480

Remote command:

[IPM:LIST:ITEM:ADD](#) on page 429

[IPM:LIST:ITEM:COUNT?](#) on page 430

[IPM:LIST:ITEM:SELEct](#) on page 431

[IPM:LIST:ITEM:VALue](#) on page 479

[IPM:LIST:BASE](#) on page 479

[IPM:LIST:ITEM:REPetition](#) on page 479

[IPM:LIST:ITEM:TIME](#) on page 479

[IPM:LIST:ITEM:DELEte](#) on page 432

#### Waveform

Sets an IPM shape that follows a ramp, sine, or triangular waveform function. The waveform amplitude is defined by the "Peak-to-Peak" value. A constant "Offset" can be applied to the entire waveform. The waveform period is set as "Period Time" or as number of pulses ("Pulse Count") it lasts.

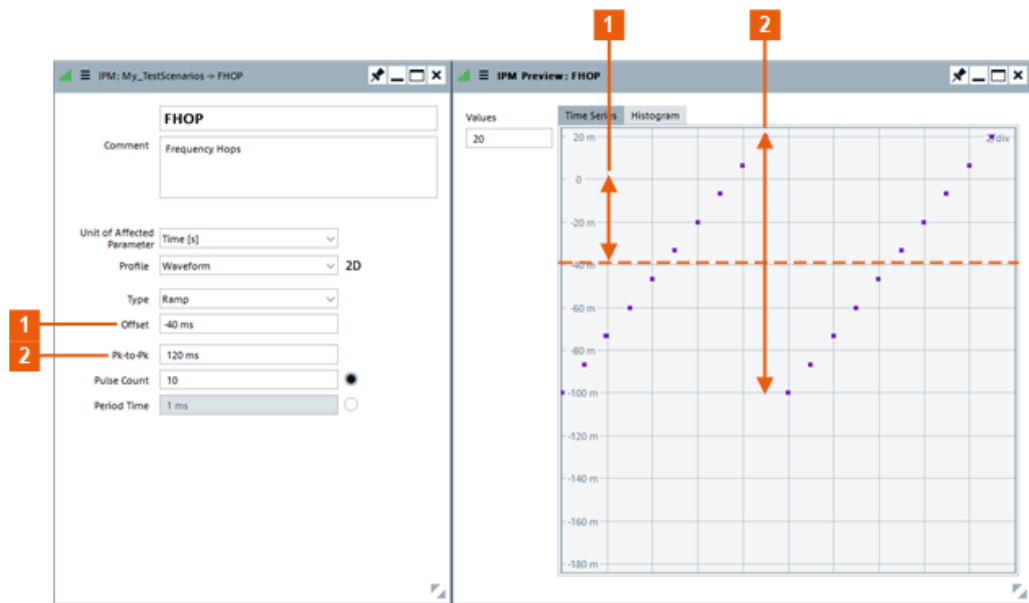


Figure 8-5: IPM with shape "Profile = Waveform" (Type = Ramp)

1 = "Offset" = -40 ms

2 = "Peak-to-Peak" = 120 ms

"Linear Ramp" The linear ramp is a profile with a sawtooth shape. The generated values monotonically increase from ("Offset"- $\frac{\text{Pk-to-Pk}}{2}$ ) to ("Offset"+ $\frac{\text{Pk-to-Pk}}{2}$ ).

"Sine" The sine profile creates values that follow one period of a sine wave. Enable a "Phase Offset" to change the start phase of the sine wave.

"Triangular" The triangular profile changes a parameter from a minimum to a maximum value and back to the minimum value, following a triangular shape.

Remote command:

[IPM:WAVEform:BASE](#) on page 487

[IPM:WAVEform:TYPE](#) on page 487

[IPM:WAVEform:PKPK](#) on page 488

[IPM:WAVEform:OFFSet](#) on page 487

[IPM:WAVEform:PHASe](#) on page 487

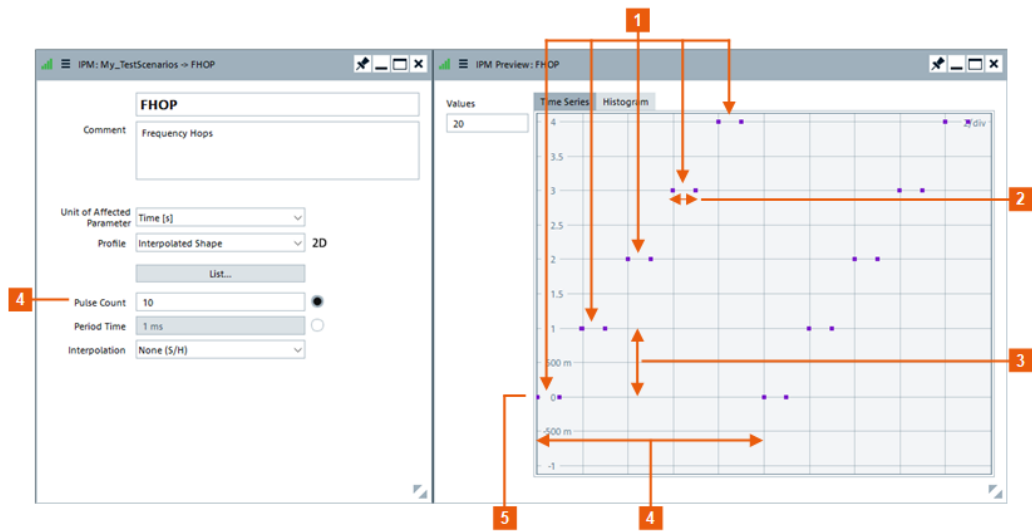
[IPM:WAVEform:COUNt](#) on page 487

[IPM:WAVEform:PERiod](#) on page 488

### Interpolated Shape

The IPM shape is a sequence of values defined in a list. The list items are mapped to several repetitions ("Pulse Count") or equally distributed over a selected period of time ("Period Time").

The transition between the increments can also be linearly interpolated.



**Figure 8-6: IPM with shape "Profile = Interpolated Shape" ("Interpolation = None (S/H)")**

1 = "List Count" = 5

2 = Each increment is repeated two times = "Pulse Count"/"List Count"

3 = "List Increment" = 1

4 = "Pulse Count" = 10

5 = "List Start" = 0

"Period Time" Sets the period of time over that the list items are equally distributed.

"Pulse Count" Sets the number of pulses for that the data from the list is used.

Remote command:

[IPM:SHAPE:BASE](#) on page 484

[IPM:SHAPE:PERIOD](#) on page 484

[IPM:SHAPE:COUNT](#) on page 484

[IPM:SHAPE:INTERPOL](#) on page 484

### Equation

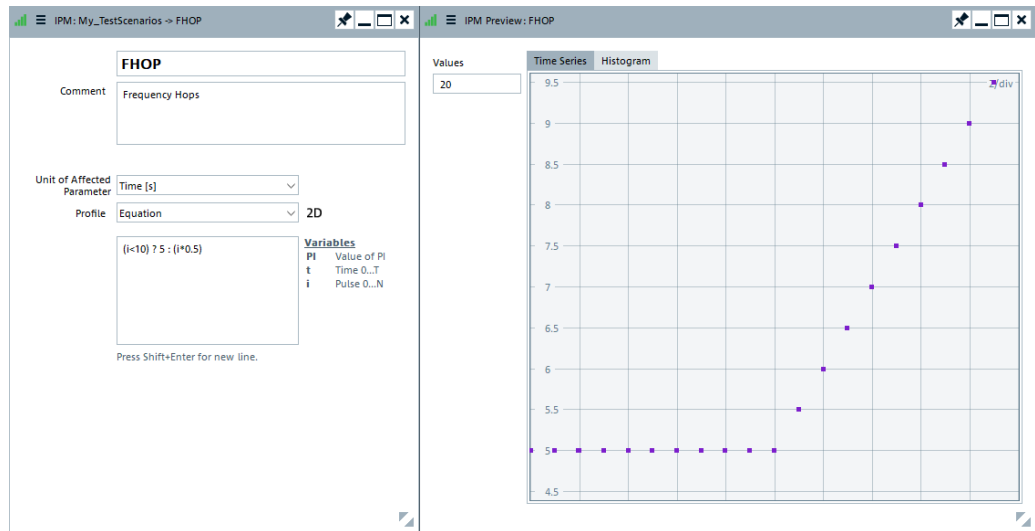
Defines the IPM shape as a function of:

$t = 0 \dots T$  is the absolute time.

$i = 0 \dots N-1$  is a pulse counter, where  $N$  is the maximum number of pulses.

**Example:**

$$(i < 10) ? 5 : (i * 0.5)$$



See [Chapter B, "Formula syntax"](#), on page 646.

Remote command:

[IPM:EQuation](#) on page 478

**Random List**

The IPM shape is a sequence of discrete values that are randomly selected from a list with user defined values.

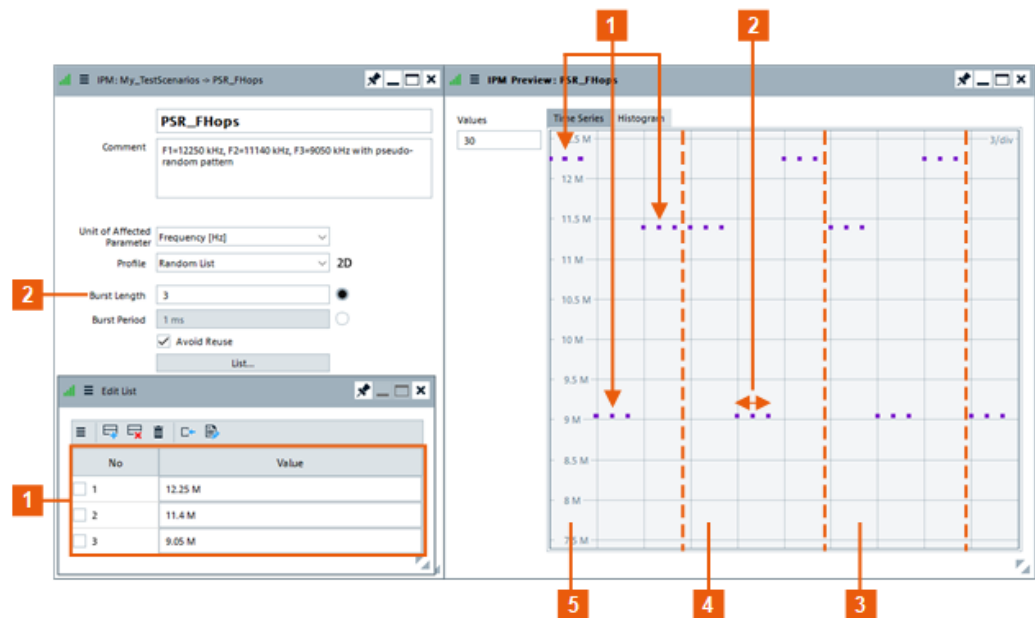


Figure 8-7: IPM with shape "Profile = Random List"

- 1 = "List Items" = 3  
 2 = "Burst Length" = 3  
 3, 4, 5 = Subsequent patterns with values that are selected on a pseudo-random manner from the defined 3 list items

"Burst Length/  
Burst Period" The parameters "Burst Length" and "Burst Period" are exclusive. They define how often or how long an increment is repeated, i.e. how many identical values are created.

"Avoid Reuse" Ensures that each value is used only once per burst.

"List" Accesses the standard list editor to define a list in table form, see ["Edit List"](#) on page 155

- To create a list manually, use the standard icons and functions in the context menu (see ["Standard function in the context menus"](#) on page 33). Enter the list values manually.
- To import a list in ASCII format, select "Import Data from file" icon, navigate to a suitable file, select it and import it.
- To create a list automatically and fill it in with values, select the "Populate List" icon. Enter the "Start" and "Increment" values and the number of list elements ("Count") and select "Populate".

Remote command:

[IPM:RLIST:BASE](#) on page 483

[IPM:RLIST:BURSt](#) on page 483

[IPM:RLIST:PERIoD](#) on page 483

[IPM:RLIST:REUSe](#) on page 483

### Random Steps

The IPM shape is a sequence of discrete values and step size that are randomly selected from a user defined value ranges.

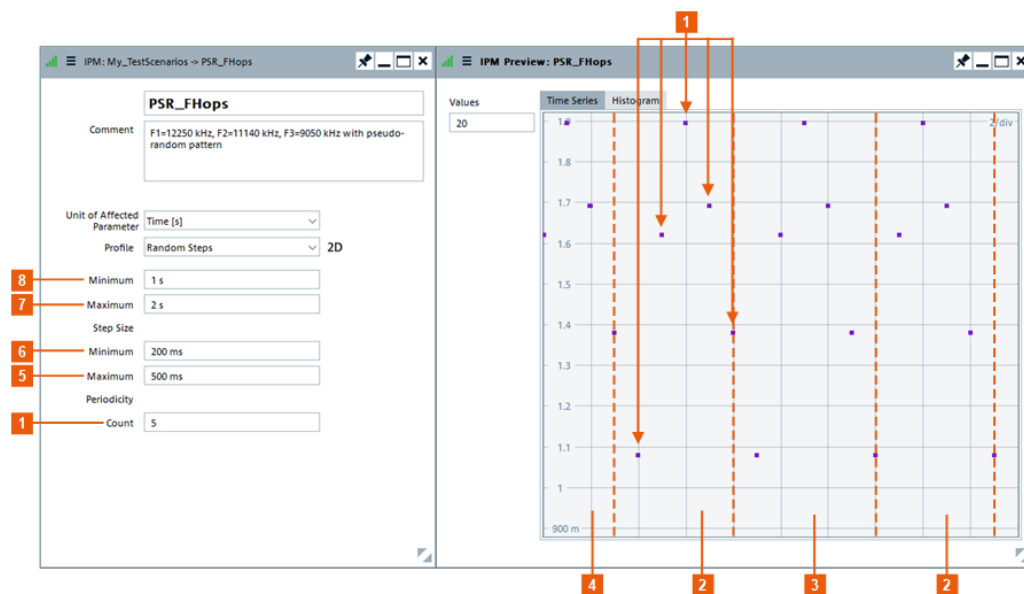


Figure 8-8: IPM with shape "Profile = Random Steps"

- 1 = "Periodicity > Count = 5", i.e. selected are five random values
- 2 to 4 = Subsequent patterns
- 5, 6 = User defined step size
- 7, 8 = User defined value range

#### "Periodicity > Count"

Sets the pattern length, i.e. the number of values that are selected on a pseudo-random manner.

Remote command:

[IPM:RSTep:MINimum](#) on page 486

[IPM:RSTep:MAXimum](#) on page 486

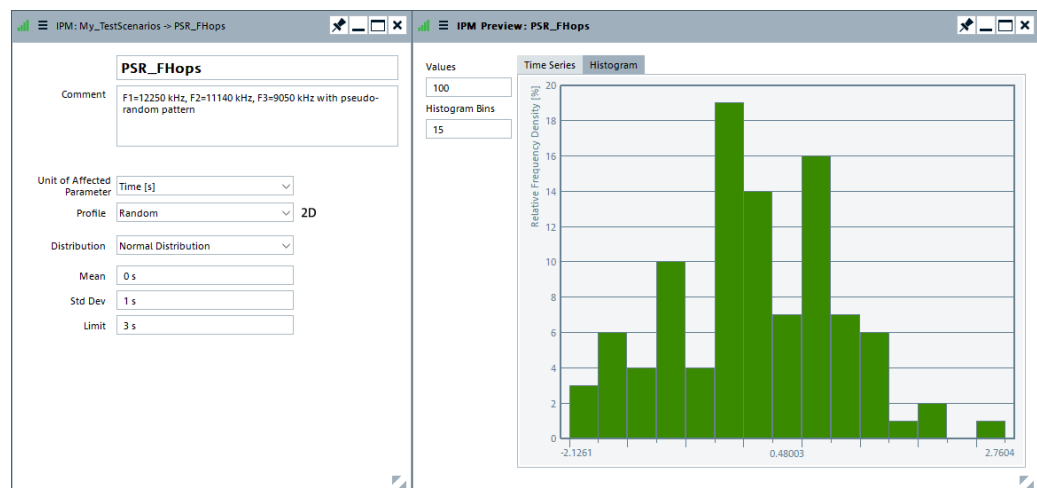
[IPM:RSTep:STEP:MINimum](#) on page 486

[IPM:RSTep:STEP:MAXimum](#) on page 486

[IPM:RSTep:PERiod](#) on page 486

#### Random

Random jitter is unlimited in its value range and is caused by thermal noise and similar effects. The IPM shape is a sequence of random values according to the select "Distribution" function.



**Figure 8-9: IPM with shape "Profile = Random" and "Distribution = Normal Distribution"**

#### "Uniform Distribution"

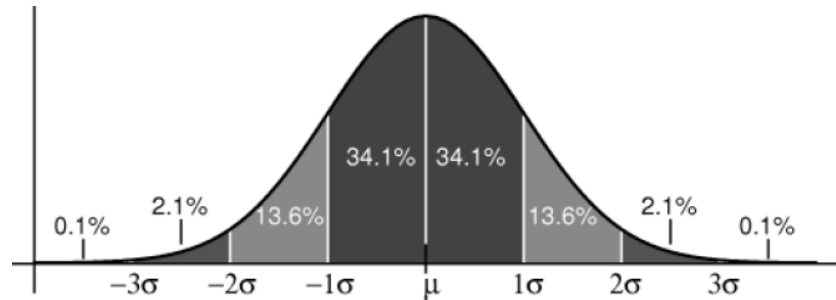
With this distribution, values occur with the same probability in the range between the minimum and maximum level. The granularity is the value set with the parameter "Step".



**"Normal Distribution"**

The gauss probability density function or normal distribution is characterized by the static parameters "Mean" ( $\mu$ ), "Standard Deviation" ( $\sigma$ ) and "Limit".

The [Figure 8-10](#) illustrates the probability at which values would occur related to the standard deviation if no limit was set.



**Figure 8-10: Normal distribution**

**"U Distribution"** The U distribution is characterized by a function with lower limit and upper limit that are calculated from selected "Center" and "Range" values.

**Remote command:**

[IPM:RANDOM:DISTRIBUTION](#) on page 481

[IPM:RANDOM:UNIFORM:MINIMUM](#) on page 482

[IPM:RANDOM:UNIFORM:MAXIMUM](#) on page 482

[IPM:RANDOM:UNIFORM:STEP](#) on page 482

[IPM:RANDOM:NORMAL:MEAN](#) on page 481

[IPM:RANDOM:NORMAL:STD](#) on page 481

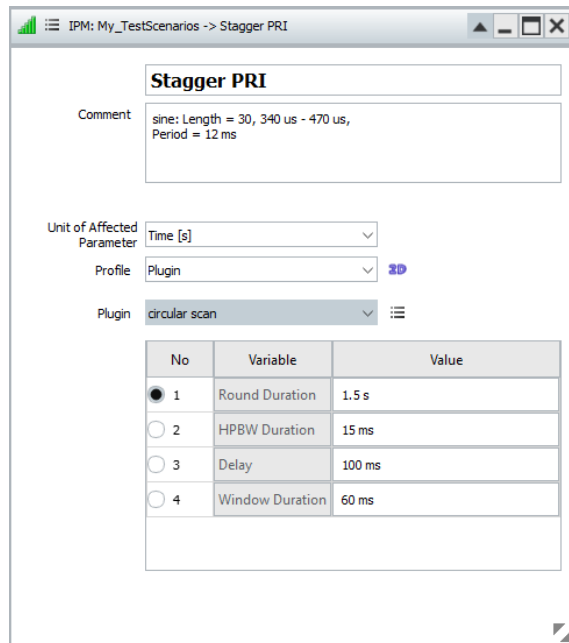
[IPM:RANDOM:NORMAL:LIMIT](#) on page 481

[IPM:RANDOM:U:CENTER](#) on page 482

[IPM:RANDOM:U:RANGE](#) on page 482

**Plug-in**

Custom IPM profiles are used in the same way as the internal IPM profiles.



"Plugin Name" Selects and loads a user-defined IPM profile from a file.  
The IPM profile must exist in the "Plug-in" library of the repository.

"Plugin Variables"

Sets the values of the variables defined and used in the plug-in.

Use the standard context menu functions to:

- Reset the plug-in variables
- Access the load "Plug-in" settings, see [Chapter 19, "Defining complex modulation schemes and IPM profiles"](#), on page 377

Remote command:

[IPM:PLUGin:NAME](#) on page 427

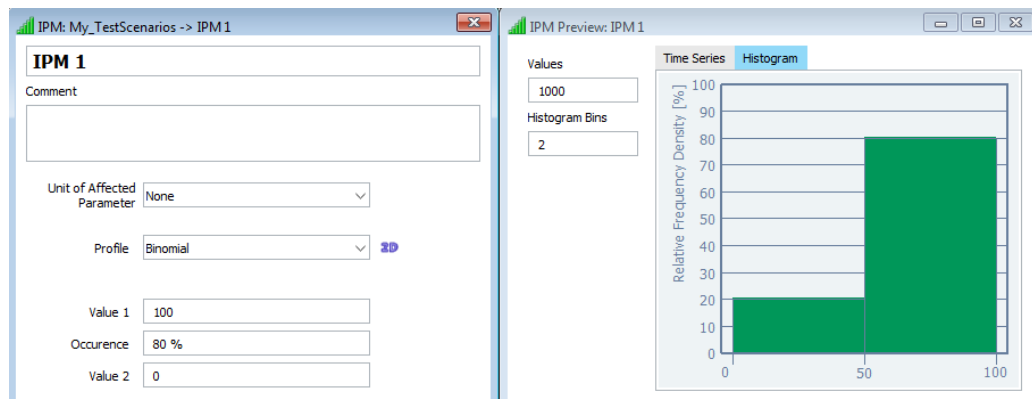
[IPM:PLUGin:VARiable:CATalog?](#) on page 503

[IPM:PLUGin:VARiable:SElect](#) on page 503

[IPM:PLUGin:VARiable:VALue](#) on page 504

## Binomial

This IPM profile follows a binomial distribution function.



The profile can be used to omit pulses randomly.

"Value 1, Value 2"

Values of the binomial distribution function.

"Occurrence"

Probability of occurrence of value 1 in per cent.

The probability of occurrence of value 2 is calculated as:  $100\% -$

"Occurrence"

Remote command:

[IPM:BINomial:VAL1](#) on page 488

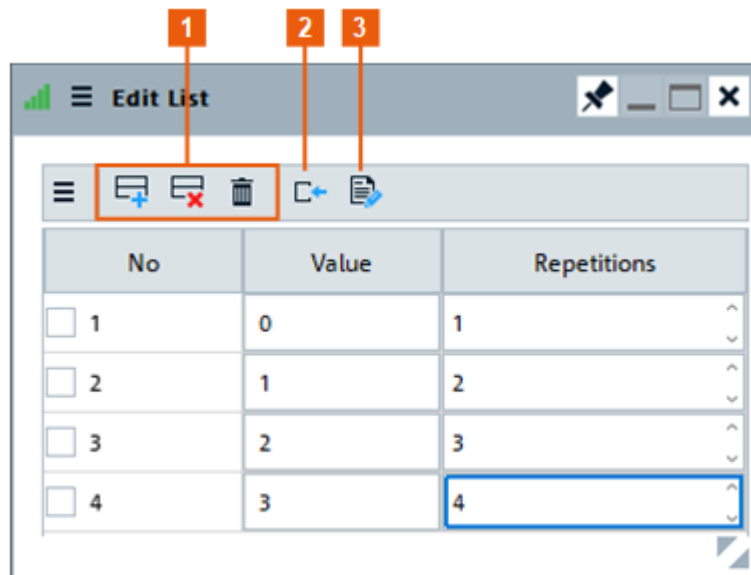
[IPM:BINomial:VAL2](#) on page 488

[IPM:BINomial:PVAL1](#) on page 489

### 8.1.3 Edit list settings

#### Edit List

List editor with standard functions.



1 = Standard functions for item handling

2 = "Import Data from File" icon

3 = "Populate list" icon

"New/Select"

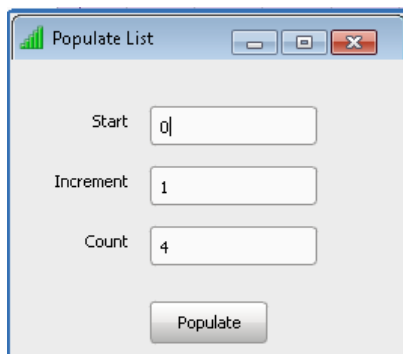
Accesses standard functions for item handling like "Select/Remove All" or "Insert After".

See [Table 2-4](#).

"Import Data from File"

Opens the Windows Explorer to navigate and select an ASCII file with list data.

"Populate List" Accesses the "Populate List" dialog.



To fill in a list with values automatically, set:

- "Start": start value
- "Increment": step with that the values are incremented
- "Count": number of list items.

"Item" Selects an item.

"No" Automatically assigned number to each list item.

"Value" Enters the value of the list item.

"Repetitions" Defines how many times a particular list item is repeated.

Remote command:

[IPM:LIST:LOAD](#) on page 480

[IPM:LIST:SAVE](#) on page 480

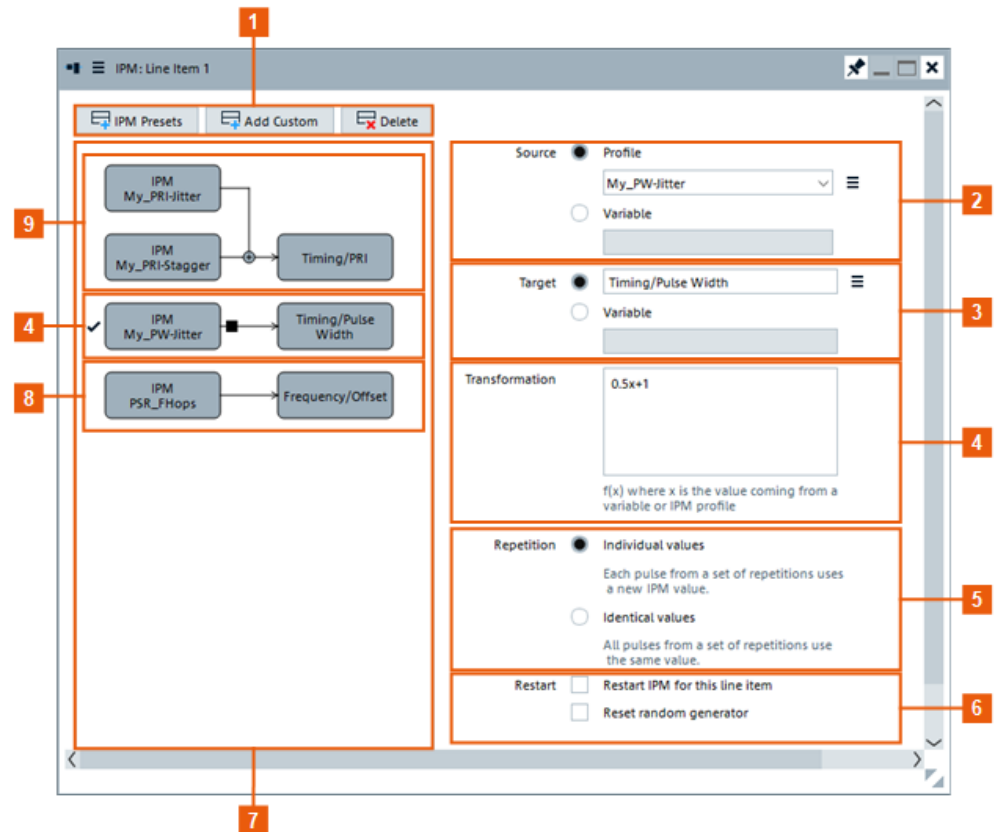
[IPM:LIST:CLEAR](#) on page 433

### 8.1.4 Inter-pulse modulation (IPM) settings

Access:

- ▶ In the "Sequence" dialog, select a pulse item.

Select "IPM > Static".



**Figure 8-11: IPM: Understanding the displayed information**

- 1 = Standard add/delete functions to create IPM of the selected type or remove the selected IPM from the repository
- 2 = Variation profile
- 3 = Defines the pulse parameter or the variable on that the IPM is applied
- 4 = Enables and defines a transformation
- 5 = Sets the way repeating pulses are processed
- 6 = Configures the random generator
- 7 = Graphical representation of the configured variations and the parameters on that they are applied
- 8 = Second variation is assigned to a different element ("Target > Frequency > Offset")
- 9 = Two variations are assigned the same element ("Target > Timing > PRI"); these variations are added

### Settings:

<a href="#">Add Custom/Delete</a> .....	158
<a href="#">IPM graph</a> .....	158
<a href="#">Source</a> .....	158
<a href="#">Target</a> .....	158
<a href="#">Transformation f(x)</a> .....	159
<a href="#">Repetition</a> .....	159
<a href="#">Restart</a> .....	159

### ☰ Add Custom/Delete

Standard functions to create **IPM** of the selected type, to disable the selected IPM, or to remove an automatically created one from the repository.

Provided are the following predefined IPM profiles:

- PRI Stagger
- PRI Dwell Switch
- PRI discrete Jitter
- PRI Triangular PFM
- Frequency Agile

Remote command:

[SEquence:ITEM:IPM:ADD](#) on page 429

[SEquence:ITEM:IPM:COUNT?](#) on page 430

[SEquence:ITEM:IPM:SElect](#) on page 431

[SEquence:ITEM:IPM:DElete](#) on page 432

### IPM graph

Graphical representation of the configured variations and the elements they are applied on.

The elements are interactive. Right-click to open the context menu.

### Source

Parameter variations are defined as profiles or variables.

"Profile" Lists the available Jitter and **IPM** profiles in the repository. To create a profile or to edit an existing one, select the "New/Select" icon.

"Variable" The variation follows the variable values. The variable must exist and must be defined. Variable names are case-sensitive.

Variables apply to the following elements:

- **One sequence item** (row in the [sequence description table](#))
- If defined for a **loop**, to all items (pulses, waveforms or nested loops) within the loop.
- In **nested loops**, variables of the parent loop are inherited.

See "[To use variables to describe parameter variations](#)" on page 167.

Remote command:

[SEquence:ITEM:IPM:SOURce:TYPE](#) on page 476

[SEquence:ITEM:IPM:SOURce](#) on page 476

[SEquence:ITEM:IPM:SOURce:VARiable](#) on page 476

### Target

Profiles can be assigned to an existing pulse parameter or to a variable.

- To select a parameter, use the "New/Select" icon
- To select a variable, enter the variable name (prefix and extension, e.g. "Level\_Offset\_j"). This variable is available within the current sequence item (row in the sequence description table).

Variable names are case-sensitive.

Parameter variations can be applied on the pulse parameters listed in [Table 8-1](#).

Remote command:

[SEquence:ITEM:IPM:TARGet:TYPE](#) on page 477

[SEquence:ITEM:IPM:TARGet:PARAmeter](#) on page 477

[SEquence:ITEM:IPM:TARGet:VARiable](#) on page 477

### Transformation f(x)

Transformations are an alternative way to describe the output value of the IPM as a mathematical function of the raw value from the IPM profile.

#### Example:

$0.5 * x + 1$

The example uses the equation  $f(x) = a * x + b$ , where the multiplier  $a = 0.5$  and the offset  $b = 1$ .

See:

- ["To use variables to describe parameter variations"](#) on page 167
- [Chapter B, "Formula syntax"](#), on page 646

Remote command:

[SEquence:ITEM:IPM:EQUation](#) on page 477

### Repetition

Defines the way the variations are applied on repeating pulses:

"Individual value"

A new value is calculated per pulse.

"Identical value"

The same values are used for all repetition of a particular item in the [Sequence > Sequence Description Table](#).

New values are selected each time the same IPM profile is applied to a different item.

Use the "Restart" options to reset an IPM profile.

Remote command:

[SEquence:ITEM:IPM:MODE](#) on page 477

### Restart

If the IPM profile uses a random generator, you can:

- Restart the IPM per sequence line item, i.e.:
  - Resets incremented values
  - Starts processing of list from the first item
  - Restarts plug-ins
- Reset the start seed of random generator.

Remote command:

[SEquence:ITEM:IPM:REStart](#) on page 478

[SEquence:ITEM:IPM:RANDom:RESet](#) on page 478

## 8.2 How to create IPM profiles and vary pulse parameters

See:

- ["To create an IPM with the "Startup Assistant""](#) on page 160
- ["To access the IPM profile dialog"](#) on page 160
- ["To create a simple staggered PRI IPM profile"](#) on page 160
- ["To assign the staggered PRI profile to the PRI parameter of a pulse"](#) on page 162
- ["To visualize the impact of the IPM profiles"](#) on page 164
- ["To create and assign a PRI Jitter"](#) on page 165
- ["To vary pulse parameters simultaneously"](#) on page 166
- ["To create and apply a frequency agile \(frequency hopping\) pattern"](#) on page 164
- ["To use variables to describe parameter variations"](#) on page 167

### To create an IPM with the "Startup Assistant"

1. In the menu bar, select "Help > Wizard".
2. Select "Create a new inter-pulse modulation > On".
3. Select "Next".
4. Select the "Unit" and the "Profile" type.  
See [Unit of Affected Parameter](#) and [Profile](#).

### To access the IPM profile dialog

Perform one of the following:

1. Select "Repository Tree > IPM > New".
2. Open the "Repository Tree > Sequence > Sequence Description > IPM > IPM/Static > IPM" dialog and:
  - a) On the right of "Source Profile" parameter, open the context menu
  - b) Select "New IPM".

A new empty IPM profile is created and added to the project tree.

New profiles are named IPM <n> where n is a number starting at one.

You can add information to describe and identify the profile, like a name or a comment.

### To create a simple staggered PRI IPM profile

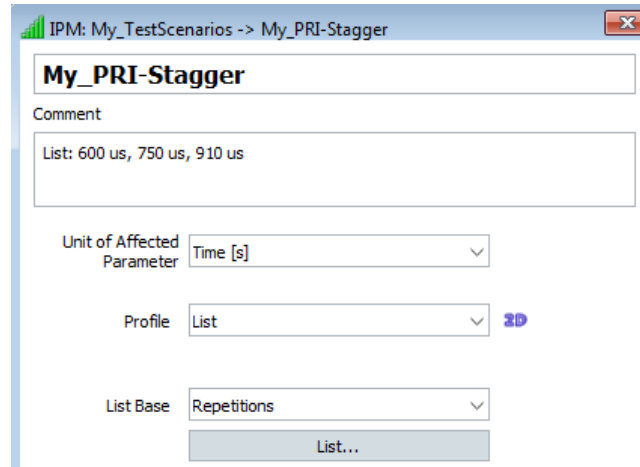
In this example, we create an IPM profile that contains three time values, defined in a list form. We assign this IPM profile to the PRI parameter of a pulse, see ["To assign the staggered PRI profile to the PRI parameter of a pulse"](#) on page 162.

Generated is a pulse train containing three pulses, as, for example, the pulse train on [Figure 8-2](#).

1. Open an IPM profile dialog.  
See ["To access the IPM profile dialog"](#) on page 160.



2. Select "Unit >Time [s]" and "Profile > List"



See also [Chapter 8.1.2, "IPM profiles settings"](#), on page 144.

3. Select "List...".  
Create a list with three items.

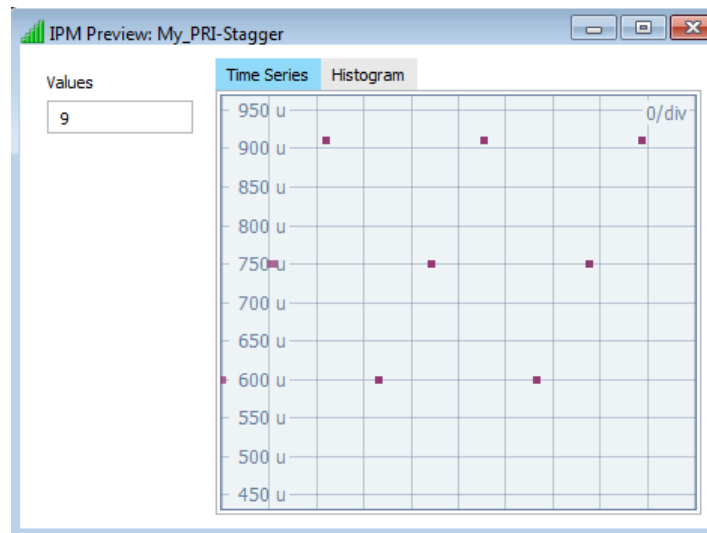
No	Value	Repetitions
<input type="checkbox"/> 1	600 u	1
<input type="checkbox"/> 2	750 u	1
<input type="checkbox"/> 3	910 u	1

**Figure 8-12: Example of a simple staggered PRI IPM profile**

1 =  $PRI_1 = 600 \text{ us}$   
 2 =  $PRI_2 = 750 \text{ us}$   
 3 =  $PRI_3 = 910 \text{ us}$

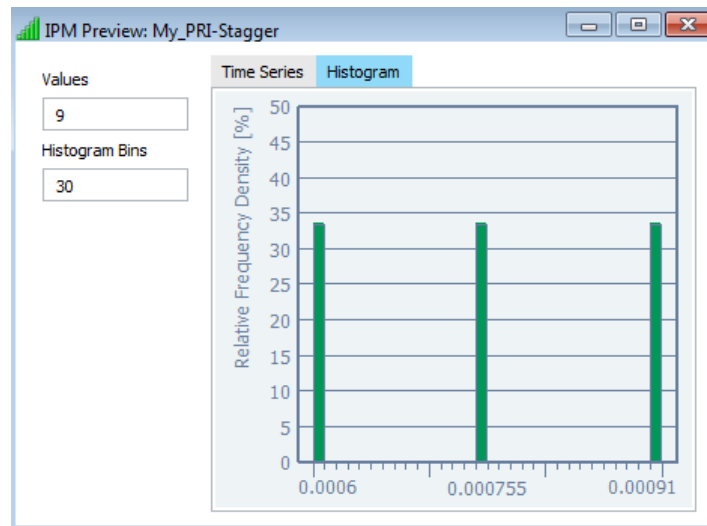
The value of each item is set to the required PRI; items are processed once.

4. In the "IPM" dialog, select "2D > Time Series" to visualize the configured IPM profile in the time domain.



Created is a simple profile with three values only.

5. Select "Histogram" to retrieve statistical information on the IPM profile.

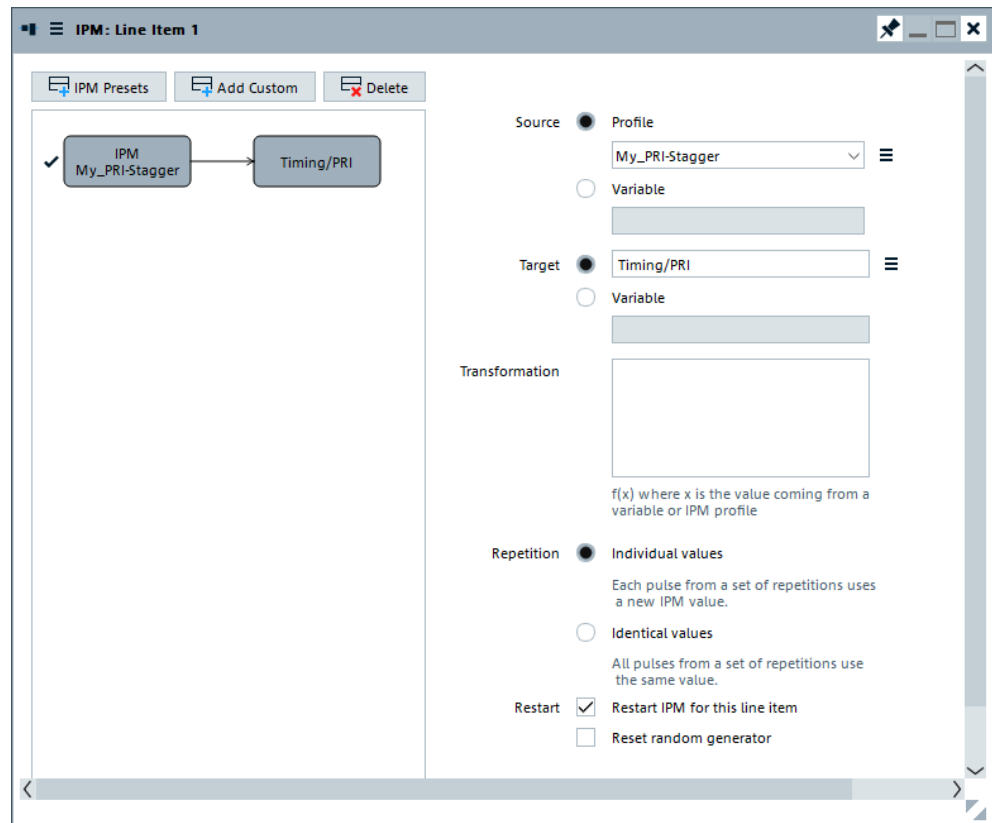


In practice, a staggered PRI profile follows more complex structure and comprises of a larger number of pulses, see for example [Figure 8-4](#).

#### To assign the staggered PRI profile to the PRI parameter of a pulse

1. Open the pulse sequence to which the created profile is applied, e.g. "My\_PT\_PRI-Stagger".  
See also ["To create a simple sequence"](#) on page 131.
2. In the "Sequence" dialog, select a pulse item.  
Select "IPM > Static".  
Per default, there are no predefined parameter variations in the "IPM" dialog.
3. To assign the created IPM profile:

- a) Select "Add Custom".  
New empty profile "IPM None" is created.
- b) Select "Source > Profile > My\_PRI\_Stagger".
- c) On the right of "Target" parameter, open the context menu.  
Select "Timing > PRI".



For description of the provided settings, see [Chapter 8.1.4, "Inter-pulse modulation \(IPM\) settings"](#), on page 156.

4. In the "Sequence" dialog:
  - a) Set "Repetition Count = 12"
  - b) Set "Delay = 230 us" to enable a stagger start delay, see [Figure 8-2](#)

No	Value	Repetitions
<input type="checkbox"/> 1	600 u	1
<input type="checkbox"/> 2	750 u	1
<input type="checkbox"/> 3	910 u	1

The "Sequence" dialog confirms, that a parameter variation varying the PRI is applied ("IPM = IPM" and "PRI = var").

### To visualize the impact of the IPM profiles

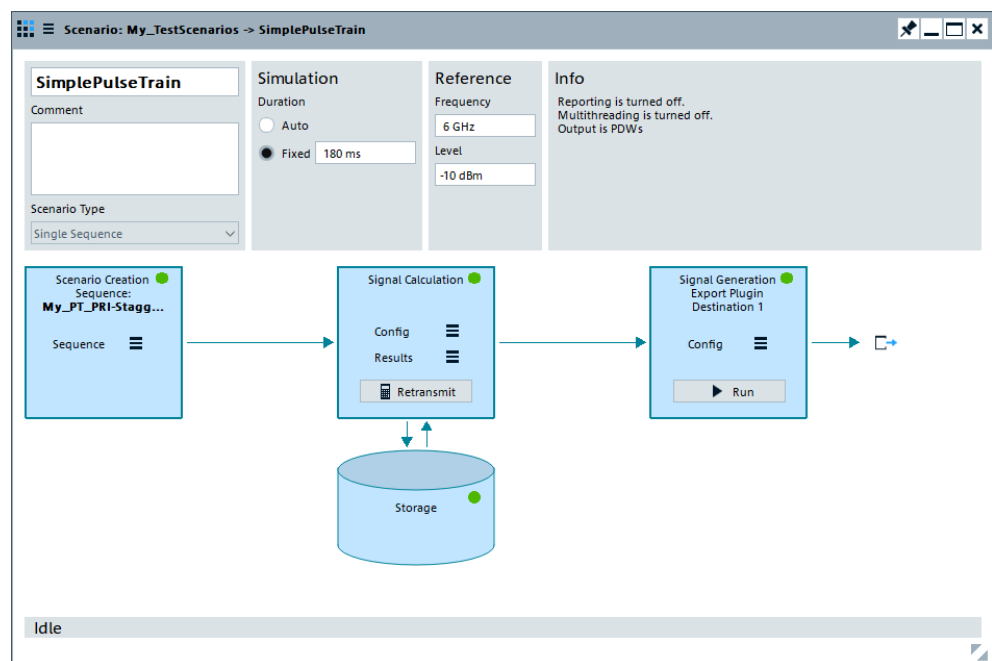
We assume, that a PRI stagger has been configured and applied to a pulse train, as described in ["To assign the staggered PRI profile to the PRI parameter of a pulse"](#) on page 162.

We also assume, that a "Pulse Train" or a "Pulse Train (Collection)" scenario is configured, a destination is selected, and the sequence is assigned to this scenario (see [Chapter 5.3, "How to select and create a test scenario"](#), on page 90).

To visualize the resulting sequence:

1. In the "Scenario" dialog, select "Signal Calculation > Calculate".

The software calculates the signal. Green LEDs indicate that the processing is completed.



2. Select the sequence in "Signal Calculation > Results > View".

The "Signal Preview" confirms the configured pulse sequence with enabled PRI stagger.

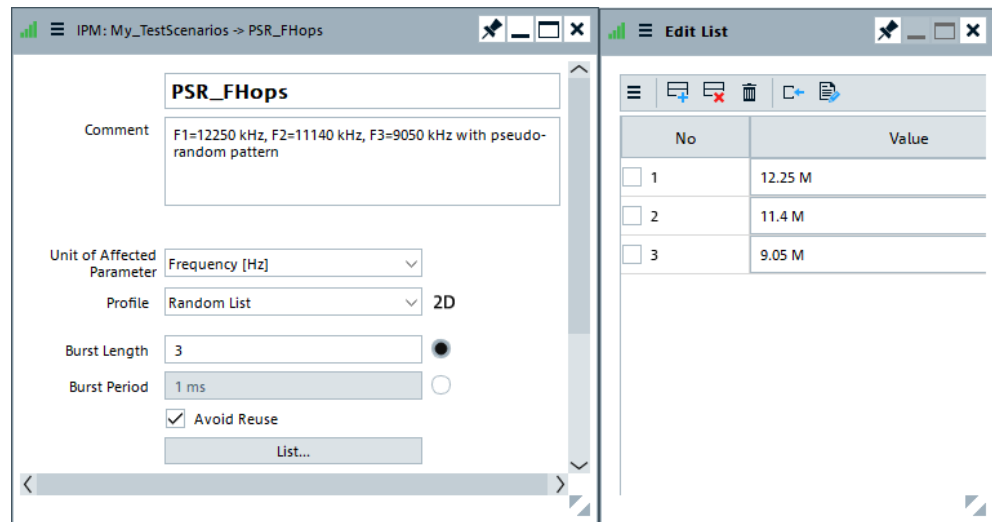
For detailed description of the provided settings, see [Chapter 15, "Visualizing and analyzing signals"](#), on page 284 .

### To create and apply a frequency agile (frequency hopping) pattern

1. In the "Sequence" dialog, select "IPM" to open the "IPM" dialog.
2. Select "Frequency Agile".

A new IPM profile is created, automatically named and assigned to the "Frequency/Offset" parameter.

3. Configure the parameters, for example, as shown on the following figure.



4. Use the 2D view to display the configured pattern.  
See also [Figure 8-7](#).
5. Observe the "Sequence" dialog.  
The sequence configuration settings confirm the configuration.

No	Nesting	Element Type	Pulse/Waveform	Settings	Repetitions	Settings	IPM	Marker	Δ Freq	Δ Level	Phase	PRI	Delay
1	< >	Pulse	P1		30		IPM	123_	var	0 dB	0°	1 ms	0 s

6. Use the "Signal Preview" dialog to visualize the generated signal.  
See also:
  - ["To visualize the impact of the IPM profiles"](#) on page 164

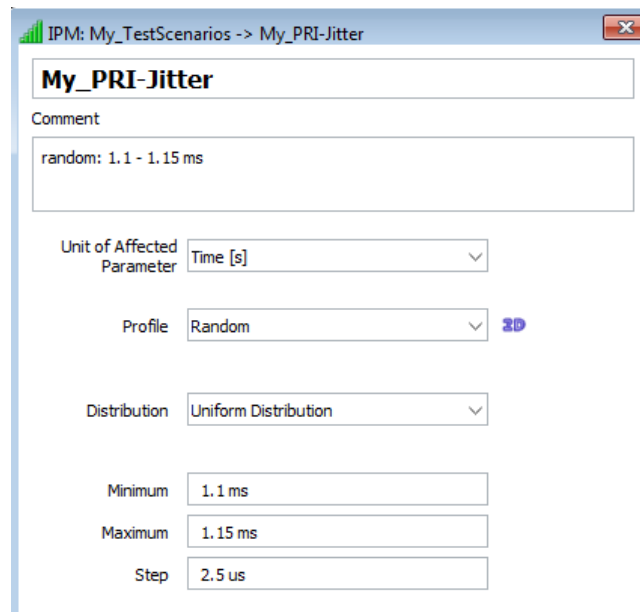
The signal will hop the three frequencies according to a pseudo-random pattern. Each hop frequency is used three times.

### To create and assign a PRI Jitter

There is a dedicated function for creating PRI Jitters, the "PRI Discrete Jitter" in the "IPM" dialog (see also ["To create and apply a frequency agile \(frequency hopping\) pattern"](#) on page 164).

In this example, however, we create manually a randomly varying IPM profile with 20 different values. Within 20 ms, the PRI varies in the range 1.1 ms to 1.15 ms.

1. Create an IPM Profile that uses "Profile > Random" and, for example, a "Distribution > Uniform Distribution".  
See also ["To access the IPM profile dialog"](#) on page 160.



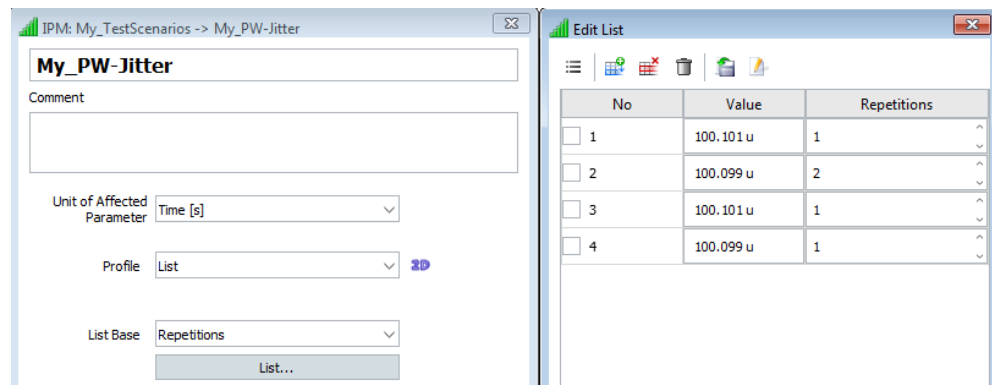
2. Select "2D" to visualize the function.
3. Open the required sequence. Assign the IPM profile to a pulse train.  
See ["To create and apply a frequency agile \(frequency hopping\) pattern"](#) on page 164.

### To vary pulse parameters simultaneously

We assume, that a PRI jitter has been configured and applied to a pulse train, as described in ["To create and assign a PRI Jitter"](#) on page 165.

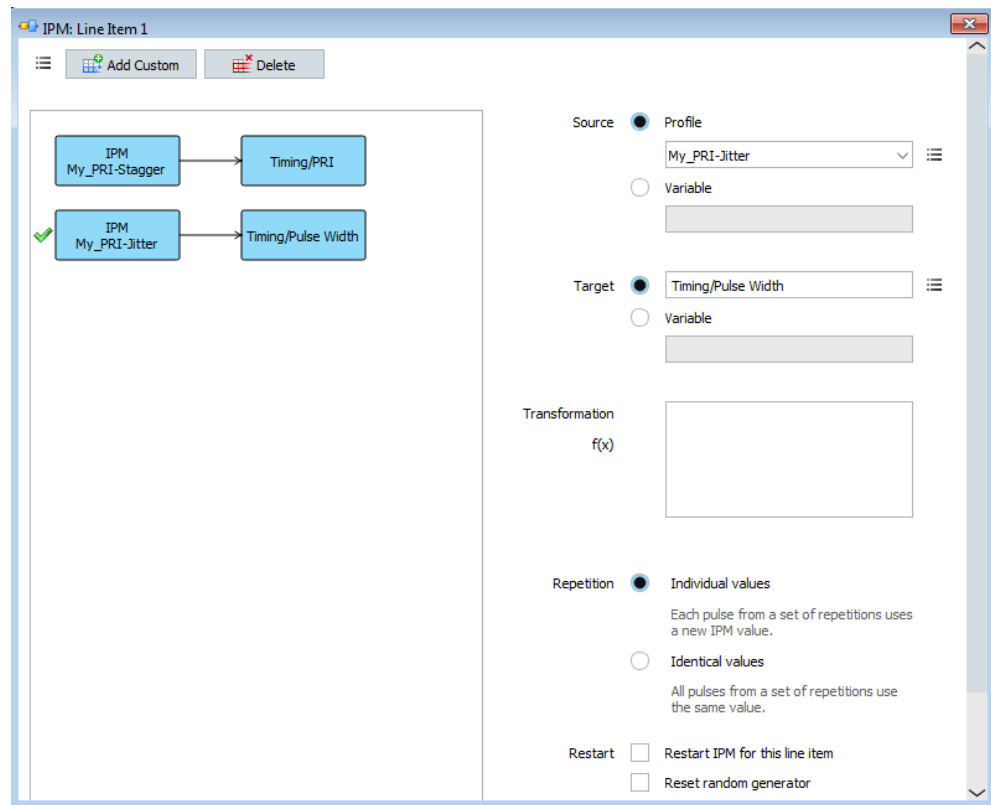
To apply a second variation, for example a PW jitter, perform the following:

1. Create an IPM Profile, for example as shown on the following figure.



Configured is a pulse width (PW) pattern with five values.

2. Open the required sequence.  
Assign the IPM profile to the same pulse train as the PRI Jitter.



**Tip:** You can vary one pulse parameter with more than one profile, see [Figure 8-11](#).

Configured is a pulse train, consisting of 20 pulses, each with different PRI value. The PW pattern is applied on five consequent pulses and is repeated four times. In this example, the PRI varies in the range 1.1 ms to 1.15 ms; the PW between 100.101 us and 100.099 us.

**To use variables to describe parameter variations**

In this example, we create a sequence of two pulses P1 and P2 that are included in a loop. We use an IPM step profile that creates ten values within the range -10 dB to 0 dB.

We assign this IPM profile to the loop and use it to create and vary a variable. This variable in turn is the source for the variations of the two pulses, included in the loop.

1. Create two unmodulated pulses with pulse width of 10 us.
2. Create a sequence with the following settings:

Sequence Description

No	Nesting	Element Type	Pulse/Waveform	Settings	Repetitions	IPM	Marker	Δ Freq	Δ Level	Phase	PRI	Delay
1	< >	Loop		...	10	IPM						
2	< >	Pulse	Pulse 1	...	1	IPM	1 2 3 4 ...	0 Hz	var	0 °	20 us	0 s
3	< >	Pulse	Pulse 1	...	1	IPM	1 2 3 4 ...	0 Hz	var	0 °	30 us	0 s

3. Create a step profile with the following settings:

IPM: My\_TestScenarios -> IPM 1

**IPM 1**

Comment

Unit of Affected Parameter: None

Profile: Steps

Start: 0

Increment: -1

Steps: 10

Burst Length: 1

Burst Period: 1 ms

4. Assign the IPM profile to the loop item.
  - a) Select "Target > Variable".
  - b) Set the variable name.

IPM: Line Item 1

Add Custom Delete

IPM IPM 1 → LevelSteps

Source: Profile (IPM 1)

Target: Variable (LevelSteps)

Transformation: f(x)

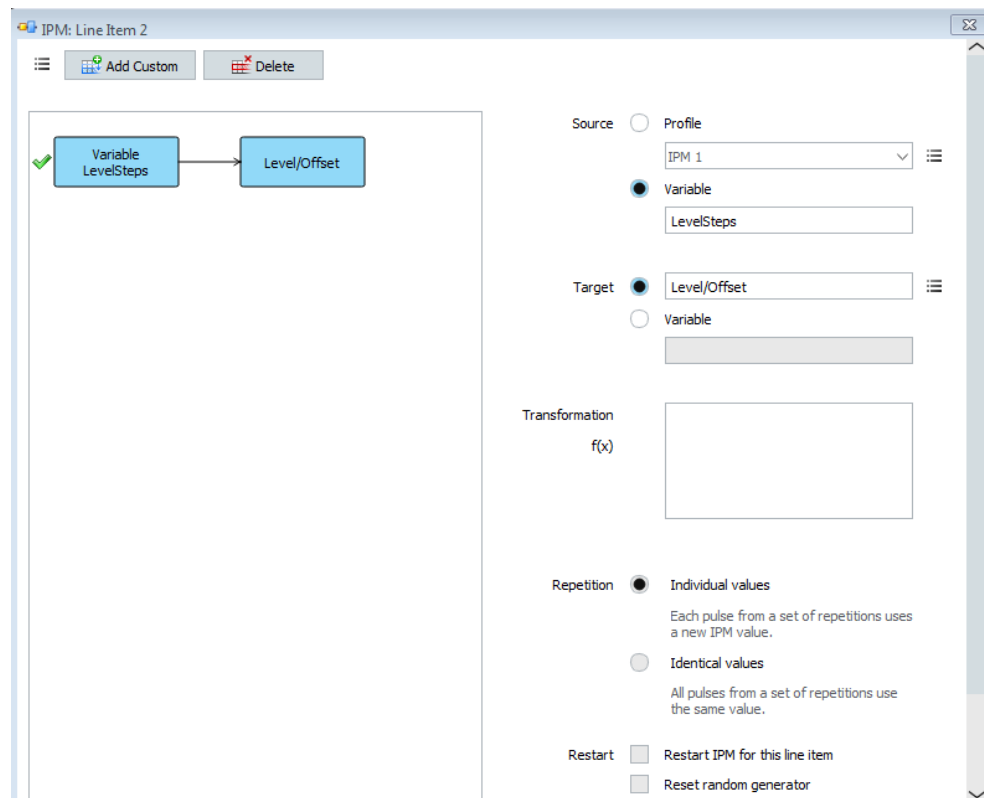
Repetition: Individual values (Each pulse from a set of repetitions uses a new IPM value.)

Restart: Restart IPM for this line item, Reset random generator

5. For both pulses:
  - a) Assign the created variable as a source of the IPM variations.



b) Set the "Target > Level > Offset".



6. Only for "Pulse 2", type into "Transformation f(x)"  $x - 10$ .

7. Assign the sequence to a scenario.

Calculate the waveform.

Open the "Signal Preview" dialog.

The display confirms that the level of "Pulse 1" decreases from 0 dB with step of 1 dB.

The level of "Pulse 2" follows the same pattern but the level is 10 dB lower than the "Pulse 1" level.

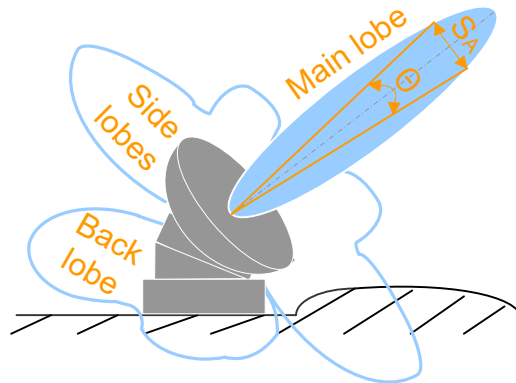
## 9 Defining antenna patterns and antenna scans

This section informs you about the antenna pattern types and antenna scan types provided by R&S Pulse Sequencer Digital. It also helps you select and configure a subset of antenna characteristics as a basis for the emitter configuration and its different operating modes.

### 9.1 Overview of the main antenna parameters

Transmitting antennas are elements that radiate energy. Energy emitted in a particular direction is referred to as a *beam* or *lobe*. The direction in which the most energy is radiated is the *main beam* or *main lobe* (see [Figure 9-1](#)). Energy radiated energy in other directions (i.e. not in the main lobe) forms the side lobes and the back lobe.

The beamwidth is a key parameter. Beamwidth is usually defined as an angle. The angle is measured at the transmitting antenna (centered on the beam-axis) as shown in [Figure 9-1](#). The value (e.g. 5°) indicates the angle at which the power of the beam is 50% (3 dB) lower than the peak power on the beam-axis. This angle is referred to as the half-power beamwidth (HPBW).



**Figure 9-1: Main characteristics of an antenna**

Main lobe/beam	= The region around the direction with maximum radiation
Side lobes	= Energy radiated in undesired direction
$S_A$	= Angular resolution
$\Theta$ (theta)	= Antenna beamwidth or the -3 dB angle, defined by the half-power (HPBW)

#### Antenna pattern

Antennas of different type and with different purpose use wider or more directed beams, for example pencil beams have a typical HPBW of about 2 deg.

The R&S Pulse Sequencer Digital provides a wide range of commonly used antenna patterns, such as parabolic, cosecant squared, or planar phased array antennas. Moreover you can:

- Adjust the antenna pattern settings to simulate, for example, a directive antenna that concentrates the radiated energy in a particular direction
- Simulate a back lobe pattern
- Create a custom antenna pattern based on the required antenna characteristics (see ["To create a custom antenna pattern based on the required antenna characteristics"](#) on page 211)
- Import your custom antenna pattern (see ["To import a user-defined antenna pattern from file in one of the predefined file formats"](#) on page 212 and ["To import an antenna pattern file in custom file format"](#) on page 215)
- Design your phased array antenna
- Visualize the antenna pattern on a 2D and a 3D preview, see [Figure 9-12](#).

### Antenna scan

Antenna scans describe the movement of the antenna beam in three-dimensional space. A conical scan, for example, is a movement where the beam points in the direction of the target and is rotated in a circle. The half-power points of the beam draw a circle.

The R&S Pulse Sequencer Digital provides a wide range of commonly used antenna scans, such as a raster scan, helical scan, or conical scan. You can also:

- Adjust the antenna scan settings
- Visualize the configured antenna scan on a 3D preview
- Design your antenna scan
- Observe the signal received by a receiver for a particular antenna pattern and antenna scan configuration

See:

- ["Received signal amplitude"](#) on page 259
- ["To visualize the signal received by a static receiver"](#) on page 234

### Antenna polarization and polarization loss

The polarization of an antenna describes the orientation of the electric wave radiated by the antenna. Polarization can be constant, or it can rotate with each wave cycle.

The [Table 9-1](#) gives an overview and a short description of the supported polarization types.

**Table 9-1: Polarization types**

Polarization	Type	Short description
Vertical (V)	Linear polarization	The electrical field is vertical to the propagation direction (y-axis).
Horizontal (H)		The electrical field is horizontal to the propagation direction (y-axis).

Polarization	Type	Short description
Circuit right (CR)	Circular polarization	The electrical field rotates clockwise (CW) relative to the propagation direction.
Circuit left (CL)		The electrical field rotates counterclockwise (CCW) relative to the propagation direction.
Slant right (SR)	Linear polarization	The electrical field is rotated at 45° from the vertical case.
Slant left (SL)		The electrical field is rotated at -45° from the vertical case

The theoretical maximum received power is achieved if the transmit and the receive antenna are co-polarized and aligned. That is, if the antennas at the emitter and the receiver both use the same polarization and point to each other. If the antennas use different polarizations, the received power decreases. The polarization loss is given by the ratio of the received power to the maximum power. Theoretically, if the transmit and the receive antennas are cross-polarized, the polarization loss is infinite. In practice, however, this value is not reached. In this implementation, the polarization loss value used if the antennas are cross-polarized is a user-definable value.

Table 9-2 lists the polarization loss for any combination of transmit and receive antenna polarizations.

**Table 9-2: Polarization loss values depending on the different antenna combinations**

Polarization of the transmit antenna	Polarization of the receive antenna	Polarization loss [dB]
Vertical (V)	Vertical (V) (co-polarized antennas)	0
	Horizontal (H) (cross-polarized antennas)	-∞  (As set with the parameter <a href="#">Maximum Attenuation for Antenna Cross Polarization</a> )
	Slant right (SR) or Slant left (SL)	- 3
	Circuit right (CR) or Circuit left (CL)	- 3
Horizontal (H)	Horizontal (H) (co-polarized antennas)	0
	Slant right (SR) or Slant left (SL)	- 3
	Circuit right (CR) or Circuit left (CL)	- 3
Circuit right (CR)	Circuit right (CR) (co-polarized antennas)	0

Polarization of the transmit antenna	Polarization of the receive antenna	Polarization loss [dB]
	Circuit left (CL) (cross-polarized antennas)	$-\infty$ (As set with the parameter <a href="#">Maximum Attenuation for Antenna Cross Polarization</a> )
Circuit right (CR) or Circuit left (CL)	Slant right (SR) or Slant left (SL)	- 3

See:

- ["Polarization"](#) on page 176
- ["Polarization"](#) on page 178
- ["To observe the effect of polarization"](#) on page 215

## 9.2 Antenna pattern settings

Access:

- ▶ Select "Repository Tree > Antenna Pattern > New".

### Settings

Antenna patterns are characterized by the following common and specific settings:

Antenna Pattern Name.....	175
Comment.....	175
Type.....	175
Z-Rotation, X-Rotation.....	176
Frequency, Bandwidth.....	176

Polarization.....	176
Simulate Back Lobe, Attenuation, Type.....	177
Resolution.....	178
2D and 3D diagrams.....	178
L 2D.....	178
L 3D.....	178
L Minimum Level.....	178
L Polarization.....	178
L Pattern.....	179
L Electronic Steering > Z-/X-Rotation.....	179
Dipole Antenna Settings.....	179
Parabolic Antenna Settings.....	179
Gaussian Antenna Settings.....	180
Sin(x)/x Antenna Settings.....	180
Pyramidal Horn Antenna Settings.....	181
Cosecant Squared Antenna Settings.....	181
Planar Phased Array Antenna Settings.....	182
Custom Antenna Settings.....	184
Custom Phased Array Settings.....	185
Cardioid Antenna Settings.....	190
Imported antenna settings.....	190
L Import Filter.....	190
L Load/Purge.....	191
L Number of patterns and points.....	191
L Import wizard.....	191

### Antenna Pattern Name

Enter the name of the antenna pattern.

Remote command:

[ANTenna:NAME](#) on page 427

[ANTenna:CATalog?](#) on page 425

[ANTenna:CREate](#) on page 426

[ANTenna:SElect](#) on page 426

[ANTenna:REMove](#) on page 428

### Comment

Enter a short description.

Remote command:

[ANTenna:COMMeNt](#) on page 427

### Type

Selects the antenna pattern. Use the "2D" and "3D" diagrams to visualize the polar antenna gain patterns.

Further provided antenna pattern settings depend on the selected antenna model, see:

- [Dipole Antenna Settings](#)
- [Parabolic Antenna Settings](#)
- [Gaussian Antenna Settings](#)
- [Sin\(x\)/x Antenna Settings](#)
- [Pyramidal Horn Antenna Settings](#)

- [Cosecant Squared Antenna Settings](#)
- [Planar Phased Array Antenna Settings](#)
- [Imported antenna settings](#)
- [Custom Antenna Settings](#)
- [Custom Phased Array Settings](#)
- [Cardioid Antenna Settings](#)

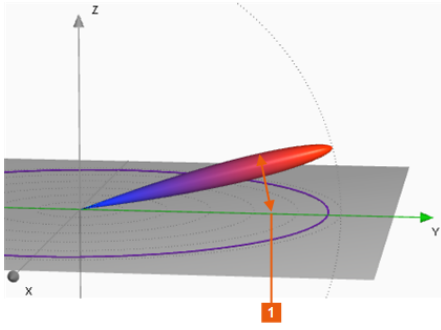
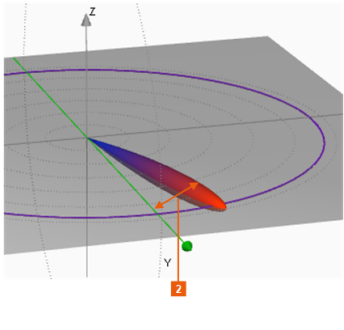
Remote command:

`ANTenna:MODEl:TYPE` on page 440

### Z-Rotation, X-Rotation

Rotates the antenna pattern around the selected axis.

**Table 9-3: Effect of antenna pattern rotation**

"X-Rotation = 15°"	"Z-Rotation = 15°"
	
<p>1) rotation around the x-axis Positive values rotate the antenna boresight towards the positive z-axis.</p>	<p>2) rotation around the z-axis Positive values rotate the antenna boresight counterclockwise towards the x-axis.</p>

This parameter is useful for example:

- To simulate a radar boresight displacement
- To align a user-defined antenna pattern to the boresight;  
(see ["To import a user-defined antenna pattern from file in one of the predefined file formats"](#) on page 212).

Remote command:

`ANTenna:MODEl:ROTation:X` on page 449

`ANTenna:MODEl:ROTation:Z` on page 449

### Frequency, Bandwidth

Sets the frequency and bandwidth the antenna pattern is calculated for.

See also:

- [Frequency](#)
- [Emitter Modes](#)

Remote command:

`ANTenna:MODEl:FREQuency` on page 447

`ANTenna:MODEl:BANDwidth` on page 447

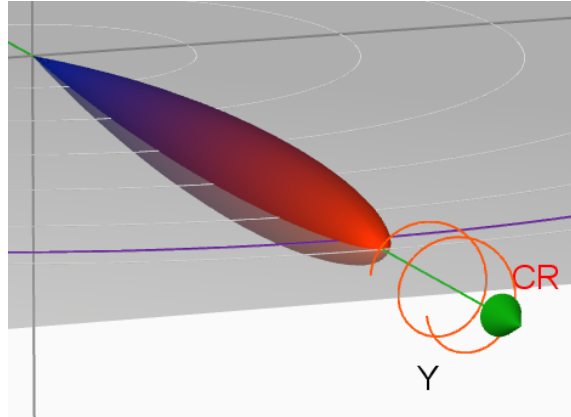
### Polarization

Sets the antenna polarization.



The polarization of an antenna describes the orientation of the electric wave radiated by the antenna. Polarization can be constant, or it can rotate with each wave cycle.

The selected polarization is indicated on the 3D diagram.



**Figure 9-2: Indication of the selected polarization on the 3D diagram**

See also "[Antenna polarization and polarization loss](#)" on page 171.

- "Vertical (V)"      Linear polarization.  
The electrical field is vertical to the propagation direction (y-axis).
- "Horizontal (H)"      Linear polarization.  
The electrical field is horizontal to the propagation direction (y-axis).
- "Circuit Right (CR)"      Circular polarization.  
The electrical field rotates clockwise (CW) relative to the propagation direction.
- "Circuit Left (CL)"      Circular polarization.  
The electrical field rotates counterclockwise (CCW) relative to the propagation direction.
- "Slant Right (SR)"      Linear polarization.  
The electrical field is rotated at 45° from the vertical case.
- "Slant Left (SL)"      Linear polarization.  
The electrical field is rotated at -45° from the vertical case.

Remote command:

[ANTenna:MODEl:POLarization](#) on page 440

### **Simulate Back Lobe, Attenuation, Type**

Enables the simulation of a back lobe and sets its power level and shape.

The parameter "Type" defines the shape of the back lobe pattern:

- "Mirror": the back lobe pattern is the mirrored antenna pattern, attenuated with the selected value, see [Figure 9-13](#).

- "Omnidirectional": the back lobe pattern is a hemisphere, attenuated with the selected value.

Remote command:

[ANTenna:MODEl:BACKlobe:ENABle](#) on page 444

[ANTenna:MODEl:BACKlobe:TYPE](#) on page 444

[ANTenna:MODEl:BACKlobe:ATTenuation](#) on page 444

### Resolution

This parameter is only available when you use R&S Pulse Sequencer Digital in CPU mode. Either select CPU mode on initial start-up, or change to CPU mode by selecting "Configure > Settings... > Graphics > GPU Support" and deselecting GPU support. Changing modes requires you to restart the application.

Sets a custom resolution for the antenna pattern simulation.

Use this parameter to reduce interpolation errors when simulating antennas with very narrow HPBWs and side lobes.

Remote command:

[ANTenna:MODEl:SINC:RESolution](#) on page 448

### 2D and 3D diagrams

You can visualize the antenna characteristics as 2D and 3D interactive diagrams.

#### 2D ← 2D and 3D diagrams

This diagram is a plot of the radiated energy, measured at different angles and at a constant distance from the antenna. The 2D diagram indicates the calculated [HPBW](#) and the 3 dB line ("Show 3dB Line > On").

The 2D diagram display the antenna pattern as a XY (azimuth cut) or YZ (elevation cut) graph with polar or with Cartesian coordinates.

- The polar diagram shows the radiation in all possible directions, i.e. the main, side and back lobes, see [Figure 9-12](#).
- The Cartesian diagram is useful to determine the main lobe to back lobe and main lobe to side lobes ratio of highly directive antennas.

Remote command:

[PLOT:POLar:TYPE](#) on page 449

[PLOT:POLar:CUT](#) on page 450

[PLOT:POLar:LOG:MIN](#) on page 450

#### 3D ← 2D and 3D diagrams

This diagram displays the radiated energy as a 3D spatial radiation model.

#### Minimum Level ← 2D and 3D diagrams

Defines the minimum displayed side lobes level.

#### Polarization ← 2D and 3D diagrams

Shows the co-polarized and the cross-polarized antenna pattern.

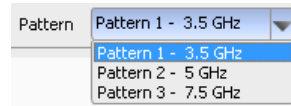
The co-polarized and cross-polarized antennas are selected automatically for the current antenna, see [Table 9-2](#). The cross-polarization is calculated at a polarization loss, as selected with the parameter [Maximum Attenuation for Antenna Cross Polarization](#).

See ["To observe the effect of polarization"](#) on page 215.

This function cannot be used for user-defined antenna patterns imported as a file.

### Pattern ← 2D and 3D diagrams

A file describing custom antenna pattern can contain more than one antenna patterns. If a custom antenna pattern is loaded, this parameter selects the antenna pattern number that is displayed.



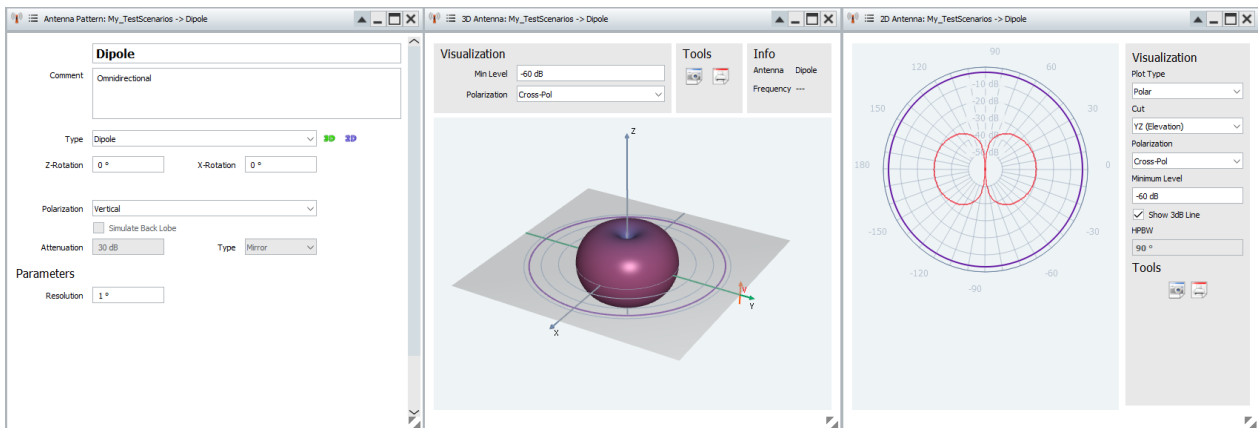
The parameter also indicates the frequency for that the antenna pattern is designed.

### Electronic Steering > Z-/X-Rotation ← 2D and 3D diagrams

For "Antenna Model > Custom Phased Array", turns the antenna diagram around the selected axis.

### Dipole Antenna Settings

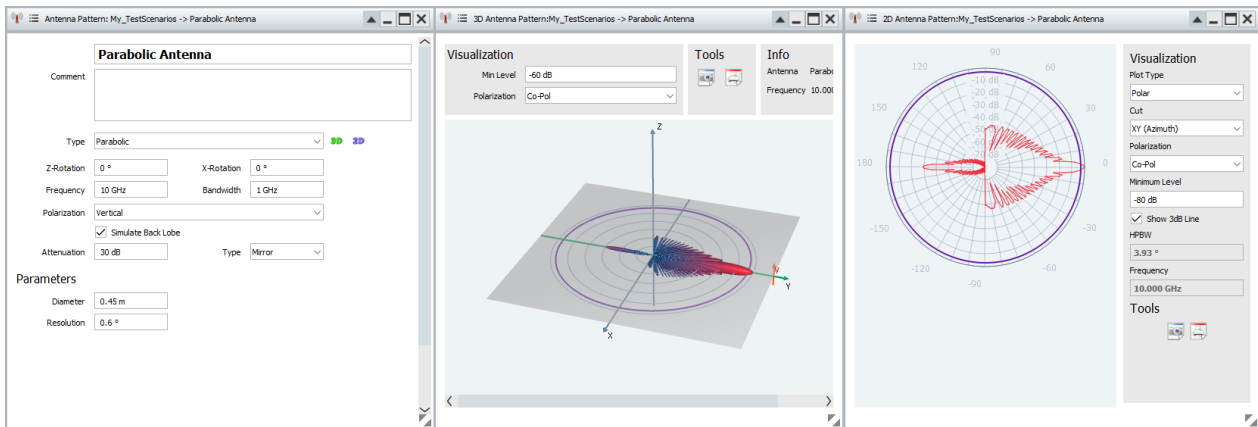
A dipole antenna is a simple antenna with a radiation pattern, shaped like a toroid (doughnut) symmetrical about the axis of the dipole.



### Parabolic Antenna Settings

A parabolic antenna has a curved surface with the cross-sectional shape of a parabola with a user defined "Diameter".

Typically, a parabolic antenna radiates the power in a narrow main lobe along the antenna y-axis.



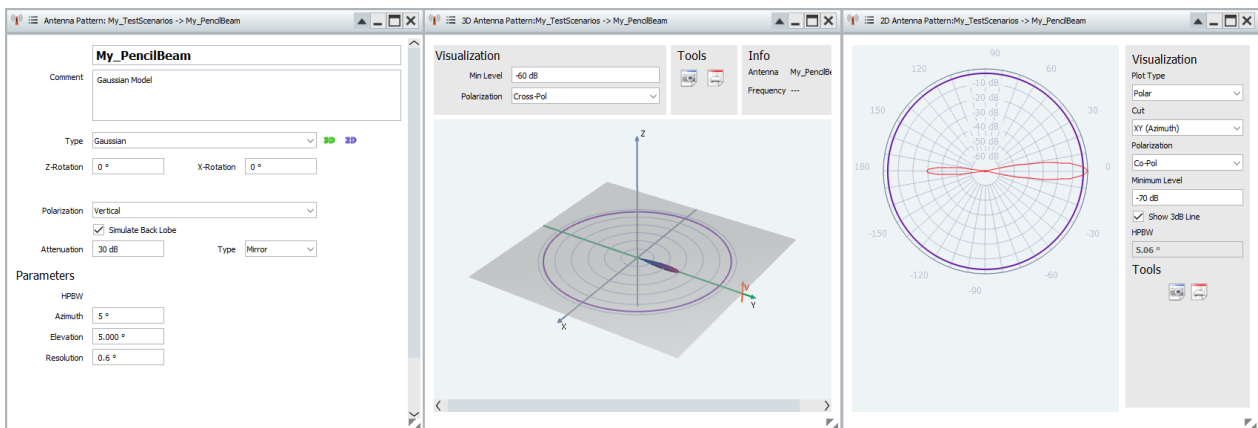
Remote command:

[ANTenna:MODEL:PARabolic:DIAMeter](#) on page 449

### Gaussian Antenna Settings

An antenna with radiation pattern that follows the Gaussian distribution.

The main parameter is the **HPBW** that specifies the angular width within which the antenna is most sensitive. The HPBW can be defined for azimuth and elevation separately.



Remote command:

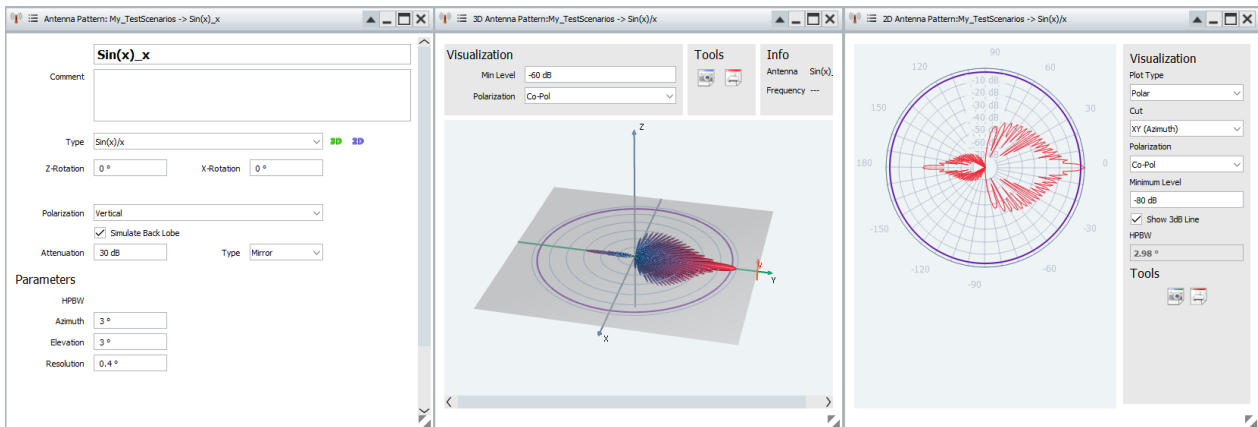
[ANTenna:MODEL:GAUSSian:HPBW:AZIMuth](#) on page 448

[ANTenna:MODEL:GAUSSian:HPBW:ELEVation](#) on page 448

### Sin(x)/x Antenna Settings

An antenna with radiation pattern that follows the Sin(x)/x distribution.

The antenna is characterized by the **HPBW**. The HPBW can be defined for azimuth and elevation separately.



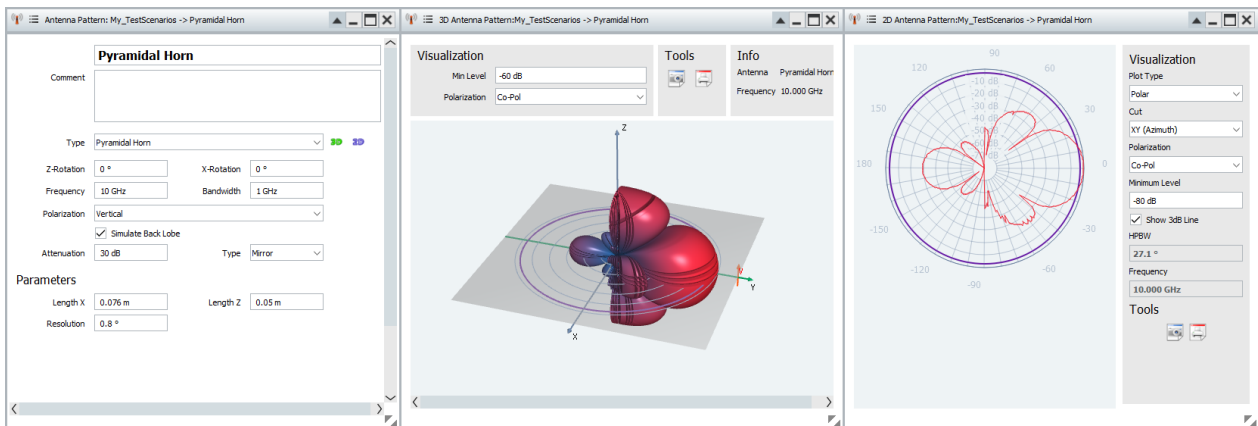
Remote command:

[ANTenna:MODEL:SINC:HPBW:AZIMuth](#) on page 448

[ANTenna:MODEL:SINC:HPBW:ELEVation](#) on page 448

### Pyramidal Horn Antenna Settings

A pyramidal horn antenna has a horn shape in the form of a four-sided pyramid and a rectangular cross section. The lengths of the rectangular sides "Length X, Length Z" are configurable.



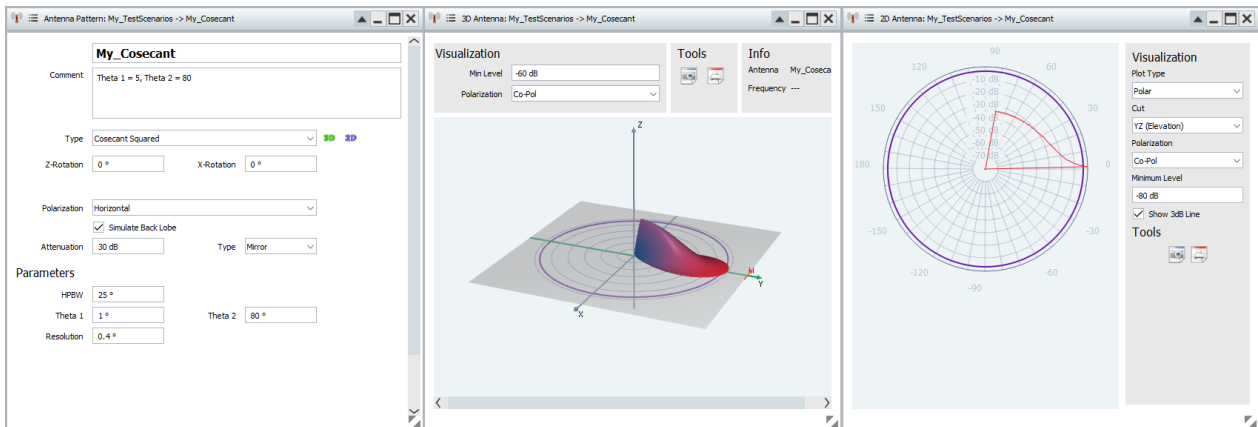
Remote command:

[ANTenna:MODEL:HORN:LX](#) on page 448

[ANTenna:MODEL:HORN:LZ](#) on page 448

### Cosecant Squared Antenna Settings

Cosecant squared antennas are designed for air-surveillance radar sets.



Remote command:

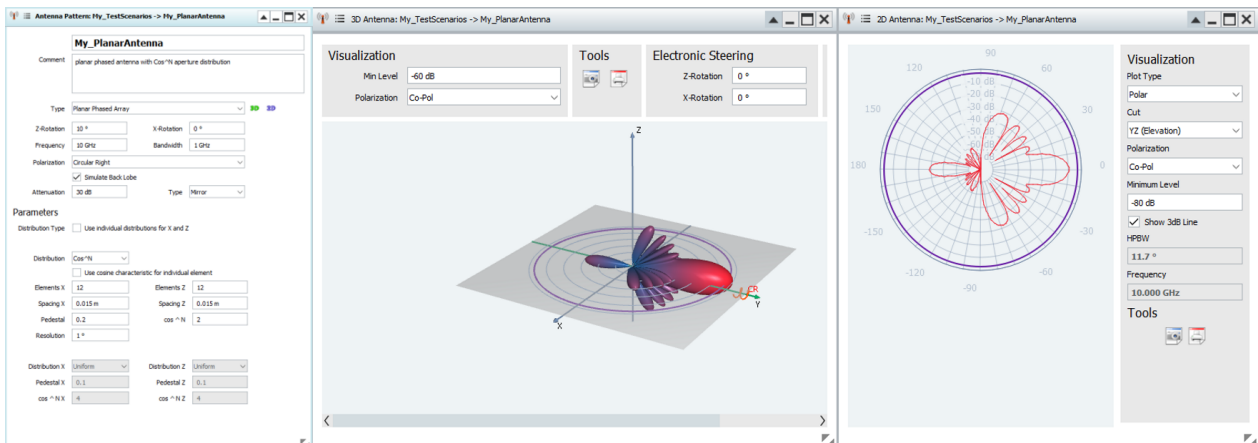
[ANTenna:MODEL:COsecant:HPBW](#) on page 447

[ANTenna:MODEL:COsecant:T1](#) on page 444

[ANTenna:MODEL:COsecant:T2](#) on page 444

### Planar Phased Array Antenna Settings

A planar phased array antenna consists of several antenna elements.



The characteristics of the individual antenna elements influence the transition between the main/side lobes and the back lobes of the phased array antenna, see [Table 9-4](#).

See also "[To create an antenna pattern](#)" on page 207.

"Distribution Type"

Enables using the individual distribution function for X and Z direction.

Remote command:

[ANTenna:MODEL:ARRay:DISTRibution:TYPE](#) on page 441

"Distribution" Determines the antenna pattern as a function of the variables  $x$  and  $z$ , the pedestal level  $P$  and the coefficient  $N$ :

Where:

- $P = 0$  to  $1$   
As set with the parameter "Pedestal".
- $N = 2$  to  $10$   
As set with the parameter " $\cos^N$ ".
- $x = -1$  to  $+1$   
 $z = -1$  to  $+1$

To simplify the description, only the  $f(x)$  functions are listed. The  $f(z)$  values are calculated in the same manner.

The distribution functions are calculated as follows:

- "Uniform"  
 $f(x) = 1$
- "Parabolic"  
 $f(x) = 1 - (1 - P) * x^2$
- "Cosine"  
 $f(x) = P + (1 - P) * \cos(0.5 * x * \pi)$
- " $\cos^2$ "  
 $f(x) = P + (1 - P) * 0.5 * (1 + \cos(x * \pi))$
- " $\cos^N$ "  
If  $N > 2$ ,  $f(x) = P + (1 - P) * (\cos(0.5 * x * \pi))^N$   
For  $N = 2$ ,  $f(x) = 1$
- "Triangular"  
If  $N > 2$ ,  $f(x) = P + (1 - P) * (1 - \text{abs}(x))$   
(the *abs* function returns the absolute value of the variable)  
For  $N = 2$ ,  $f(x) = 1$
- "Hamming"  
 $f(x) = P + (1 - P) * (0.54 - 0.46 * \cos((1.0 + x) * \pi))$
- "Hann"  
 $f(x) = P + (1 - P) * (0.5 - 0.5 * \cos((1.0 + x) * \pi))$

Remote command:

[ANTenna:MODEl:ARRay:DIStribution](#) on page 441

"Use cosine characteristic for individual antenna element"

Per default, the individual antenna elements use omnidirectional characteristic. If the parameter "Use cosine characteristic for individual antenna element" is enabled, the cosine characteristic is used.

Remote command:

[ANTenna:MODEl:ARRay:ELEMeNt:COStine](#) on page 442

"Elements, Spacing"

Number of radiating elements in X/Z direction and spacing between the elements.

Remote command:

[ANTenna:MODEl:ARRay:NX](#) on page 442

[ANTenna:MODEl:ARRay:NZ](#) on page 442

[ANTenna:MODEl:ARRay:XDIStance](#) on page 444

[ANTenna:MODEl:ARRay:ZDIStance](#) on page 444

"Pedestal"	Sets the pedestal level P. Remote command: <a href="#">ANTenna:MODEl:ARRay:PEDestal</a> on page 443
"cos^N"	Sets the value of the coefficient N in the $\cos^N$ distribution. Remote command: <a href="#">ANTenna:MODEl:ARRay:COsN</a> on page 440
"Distribution X"/"Distribution Z"	Requires "Distribution Type" enabled. Sets the individual distribution function for X and Z direction. Remote command: <a href="#">ANTenna:MODEl:ARRay:DIStRiBution:X</a> on page 442 <a href="#">ANTenna:MODEl:ARRay:DIStRiBution:Z</a> on page 442
"Pedestal X"/"Pedestal Z"	Requires "Distribution Type" enabled. Sets the individual pedestal level for X and Z direction. Remote command: <a href="#">ANTenna:MODEl:ARRay:PEDestal:X</a> on page 443 <a href="#">ANTenna:MODEl:ARRay:PEDestal:Z</a> on page 443
"cos^N X"/"cos^N Z"	Requires "Distribution Type" enabled. Sets the individual value of the coefficient N in the $\cos^N$ distribution for X and Z direction. Remote command: <a href="#">ANTenna:MODEl:ARRay:COsN:X</a> on page 440 <a href="#">ANTenna:MODEl:ARRay:COsN:Z</a> on page 440
Remote command:	<a href="#">ANTenna:MODEl:ARRay:DIStRiBution</a> on page 441 <a href="#">ANTenna:MODEl:ARRay:ELEMeNt:COsine</a> on page 442 <a href="#">ANTenna:MODEl:ARRay:NX</a> on page 442 <a href="#">ANTenna:MODEl:ARRay:NZ</a> on page 442 <a href="#">ANTenna:MODEl:ARRay:XDIStance</a> on page 444 <a href="#">ANTenna:MODEl:ARRay:ZDIStance</a> on page 444 <a href="#">ANTenna:MODEl:ARRay:PEDestal</a> on page 443 <a href="#">ANTenna:MODEl:ARRay:COsN</a> on page 440

### Custom Antenna Settings

You can define an antenna pattern based on the required antenna characteristics.

See [Figure 9-15](#).

"HPBW XY, HPBW YZ"

**HPBW** specifies the angular width within which the antenna is most sensitive.

"Side lobe level"

Attenuation applied on the first pair of side lobes compared to the power level of main lobe



"Rolloff factor" Step size, used to calculate the attenuation of the subsequent side lobes.

"Side lobe scale"

Scale factor, used to calculate the HPBW of the side lobes, i.e. how much smaller or wider the side lobes are compared to the main lobe.

Remote command:

[ANTenna:MODEl:CUSTom:HPBW:XY](#) on page 446

[ANTenna:MODEl:CUSTom:HPBW:YZ](#) on page 446

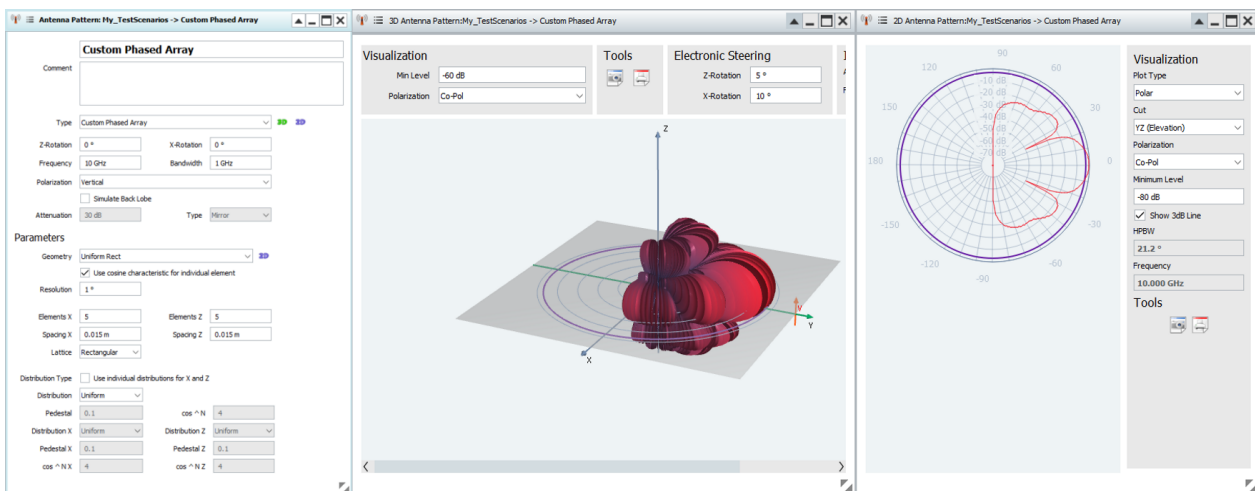
[ANTenna:MODEl:CUSTom:SLStart](#) on page 446

[ANTenna:MODEl:CUSTom:SLRolloff](#) on page 446

[ANTenna:MODEl:CUSTom:SLScale](#) on page 447

### Custom Phased Array Settings

You can define a phased array antenna with user-definable geometry, number of elements and spacing between them.



"Geometry"

An antenna array is a set of two or more antennas, called antenna elements.

The geometry describes how the single antenna elements of the array are arranged:

- "Uniform Linear" - in a row
- "Uniform Rectangular" - in a rectangular grid
- "Circular Planar" - in a circle
- "Uniform Hex" - as a hexagon

Remote command:

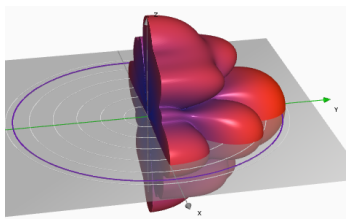
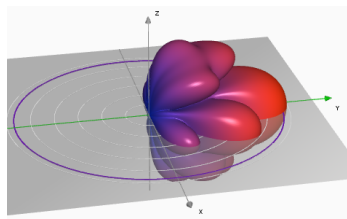
[ANTenna:MODEl:CARRay:GEOMetry](#) on page 445

**"Use cosine characteristic for individual antenna element"**

Per default, the individual antenna elements use omnidirectional characteristic. If the parameter is enabled, the cosine characteristic is used.

The characteristics of the individual antenna elements influence the transition between the main/side lobes and the back lobes of the phased array antenna, see [Table 9-4](#).

**Table 9-4: Effect of the parameter "Use cosine characteristic for individual antenna element"**

Off (default)	On
	

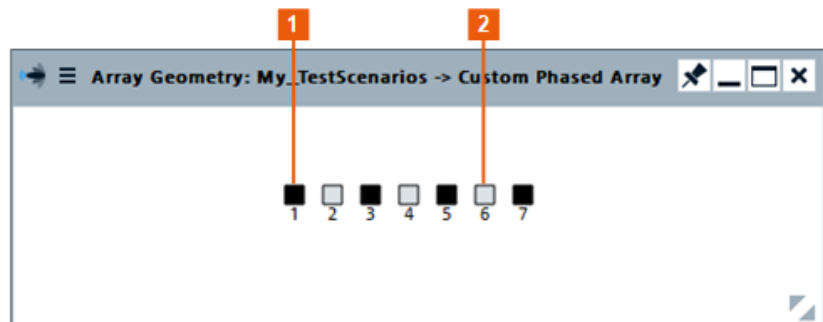
Remote command:

[ANTenna:MODEl:CARRay:ELEMent:COStine](#) on page 442

**"2D"**

Illustrates the array geometry.

Click an antenna element to activate or deactivate it.



**Figure 9-3: Example: Linear array antenna with seven elements**

1 = Active element

2 = Deactivated element

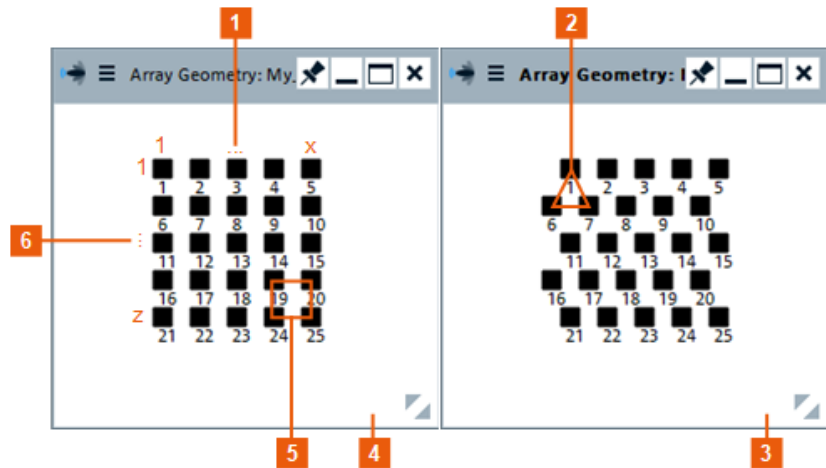
Remote command:

[ANTenna:MODEl:CARRay:ELEMent](#) on page 445

### "Uniform rectangular antenna array"

A rectangular array is a planar antenna array with X number of columns and Z number of rows. The antenna elements can be placed on rectangularly or triangularly lattice.

Per default, the number of elements in the rows and in the columns is the same and the elements are uniformly distributed. You can change the spacing and use unequal number of elements.



**Figure 9-4: Example: Rectangle array antenna with different grids**

1, 6 = Number of antenna elements

2, 3 = Triangular lattice

4, 5 = Rectangular lattice

Remote command:

[ANTenna:MODEl:CARRay:RECTangular:NX](#) on page 442

[ANTenna:MODEl:CARRay:RECTangular:NZ](#) on page 442

[ANTenna:MODEl:CARRay:RECTangular:XDistance](#)  
on page 444

[ANTenna:MODEl:CARRay:RECTangular:ZDistance](#)  
on page 444

[ANTenna:MODEl:CARRay:RECTangular:LATTice](#) on page 445

### "Uniform Linear"

A linear array is a planar array where the antenna elements are placed in a row, see [Figure 9-3](#).

You can change the number of antenna elements and the distance between them. The elements are uniformly distributed.

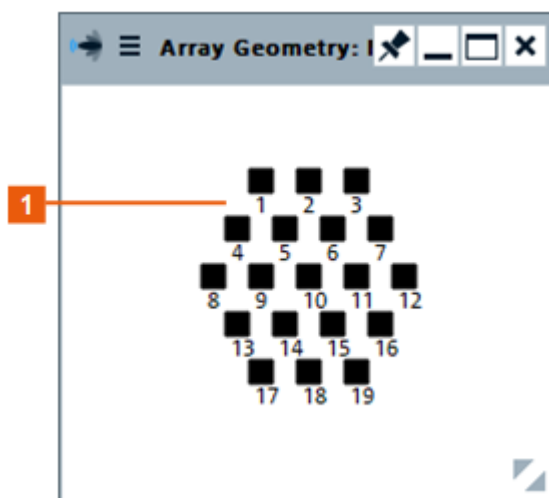
Remote command:

[ANTenna:MODEl:CARRay:LINEar:N](#) on page 442

[ANTenna:MODEl:CARRay:LINEar:Distance](#) on page 443

**"Uniform hexagonal antenna array"**

An array with a hexagonal shape, where each of the six sides has the selected number of antenna elements.



**Figure 9-5: Example: Hexagonal array antenna with three elements per side**

1 = Elements per side

Remote command:

[ANTenna:MODeL:CARRay:HEXagonal:N](#) on page 442

[ANTenna:MODeL:CARRay:HEXagonal:DIStance](#) on page 443

**"Planar Circular"**

An array with a shape similar to a circle, selectable radius size, and lattice.

Remote command:

[ANTenna:MODeL:CARRay:CIRCular:RADius](#) on page 445

[ANTenna:MODeL:CARRay:CIRCular:DIStance](#) on page 443

[ANTenna:MODeL:CARRay:CIRCular:LATTice](#) on page 445

**"Distribution Type"**

Enables using the individual distribution function for X and Z direction.

Remote command:

[ANTenna:MODeL:CARRay:DIStribution:TYPE](#) on page 441

"Distribution"	<p>Determines the antenna pattern as a function of the variables <math>x</math> and <math>z</math>, the pedestal level <math>P</math> and the coefficient <math>N</math>:</p> <p>Where:</p> <ul style="list-style-type: none"> <li>• <math>P = 0</math> to <math>1</math> As set with the parameter "Pedestal".</li> <li>• <math>N = 2</math> to <math>10</math> As set with the parameter "<math>\cos^N</math>".</li> <li>• <math>x = -1</math> to <math>+1</math> <math>z = -1</math> to <math>+1</math></li> </ul> <p>To simplify the description, only the <math>f(x)</math> functions are listed. The <math>f(z)</math> values are calculated in the same manner.</p> <p>The distribution functions are calculated as follows:</p> <ul style="list-style-type: none"> <li>• "Uniform" <math>f(x) = 1</math></li> <li>• "Parabolic" <math>f(x) = 1 - (1 - P) * x^2</math></li> <li>• "Cosine" <math>f(x) = P + (1 - P) * \cos(0.5 * x * \pi)</math></li> <li>• "<math>\cos^2</math>" <math>f(x) = P + (1 - P) * 0.5 * (1 + \cos(x * \pi))</math></li> <li>• "<math>\cos^N</math>" If <math>N &gt; 2</math>, <math>f(x) = P + (1 - P) * (\cos(0.5 * x * \pi))^N</math> For <math>N = 2</math>, <math>f(x) = 1</math></li> <li>• "Triangular" If <math>N &gt; 2</math>, <math>f(x) = P + (1 - P) * (1 - \text{abs}(x))</math> (the <i>abs</i> function returns the absolute value of the variable) For <math>N = 2</math>, <math>f(x) = 1</math></li> <li>• "Hamming" <math>f(x) = P + (1 - P) * (0.54 - 0.46 * \cos((1.0 + x) * \pi))</math></li> <li>• "Hann" <math>f(x) = P + (1 - P) * (0.5 - 0.5 * \cos((1.0 + x) * \pi))</math></li> </ul> <p>Remote command: <a href="#">ANTenna:MODEl:CARRay:DIStribution</a> on page 441</p>
"Pedestal"	<p>Sets the pedestal level <math>P</math>.</p> <p>Remote command: <a href="#">ANTenna:MODEl:CARRay:PEDestal</a> on page 443</p>
" $\cos^N$ "	<p>Sets the value of the coefficient <math>N</math> in the <math>\cos^N</math> distribution.</p> <p>Remote command: <a href="#">ANTenna:MODEl:CARRay:COsN</a> on page 440</p>
"Distribution X"/"Distribution Z"	<p>Requires "Distribution Type" enabled. Sets the individual distribution function for X and Z direction.</p> <p>Remote command: <a href="#">ANTenna:MODEl:CARRay:DIStribution:X</a> on page 442 <a href="#">ANTenna:MODEl:CARRay:DIStribution:Z</a> on page 442</p>

**"Pedestal X"/"Pedestal Z"**

Requires "Distribution Type" enabled.

Sets the individual pedestal level for X and Z direction.

Remote command:

[ANTenna:MODEl:CARRay:PEDestal:X](#) on page 443

[ANTenna:MODEl:CARRay:PEDestal:Z](#) on page 443

**"cos^N X"/"cos^N Z"**

Requires "Distribution Type" enabled.

Sets the individual value of the coefficient N in the  $\cos^N$  distribution for X and Z direction.

Remote command:

[ANTenna:MODEl:CARRay:COsN:X](#) on page 441

[ANTenna:MODEl:CARRay:COsN:Z](#) on page 441

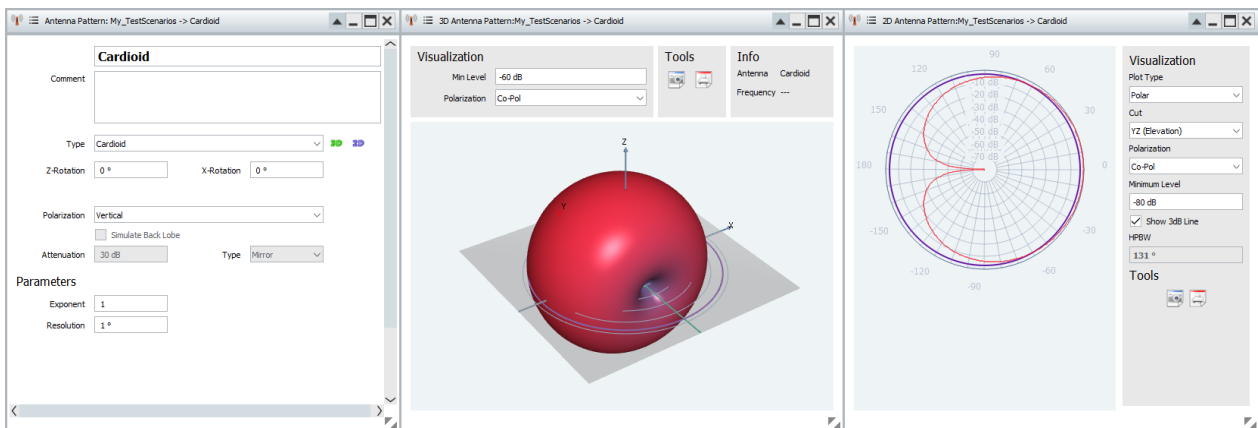
**Cardioid Antenna Settings**

A cardioid antenna is an antenna with a heart-like radiation pattern.

The cardioid equation expressed in polar coordinates is calculated as follows:

$r(\varphi) = [1 + \cos(\varphi)]^{exp}$ , where:

- $\varphi$  is the rotation angle
- $exp$  is the exponent.

**"Exponent"**

Use values greater than 1 to narrow the antenna beam.

Remote command:

[ANTenna:MODEl:CARDoId:EXPonent](#) on page 449

**Imported antenna settings**

You can define and load your custom antenna patterns.

See:

- ["To import a user-defined antenna pattern from file in one of the predefined file formats"](#) on page 212.

**Import Filter ← Imported antenna settings**

Selects the import filter used to parse the antenna pattern file.

- "Internal" Parses antenna patterns in the following file formats:
- FEKO Far Field (\*.ffe) files
  - \*.ant\_pat files in the Rohde & Schwarz proprietary format
  - Antenna Magus \*.tsv files
  - ANSYS HFSS \*.ffd files
  - Antenna patterns in \*.csv file format.  
The [Import wizard](#) assists you to import \*.csv files.
- "Plugin Name" Any selection other than "Internal" selects a user-defined antenna pattern import filter (plug-in). The import filter must exist in the "Plug-in" library.  
See [Chapter C.5, "Custom antenna pattern import functions"](#), on page 661.  
Antenna patterns in custom file format are files with extension \*.txt.

#### Load/Purge ← Imported antenna settings

Standard functions for file management.

Remote command:

[ANTenna:MODEl:USER:LOAD](#) on page 449

[ANTenna:MODEl:USER:CLEar](#) on page 433

#### Number of patterns and points ← Imported antenna settings

Indicates the number of patterns and points as retrieved from the load file.

#### Import wizard ← Imported antenna settings

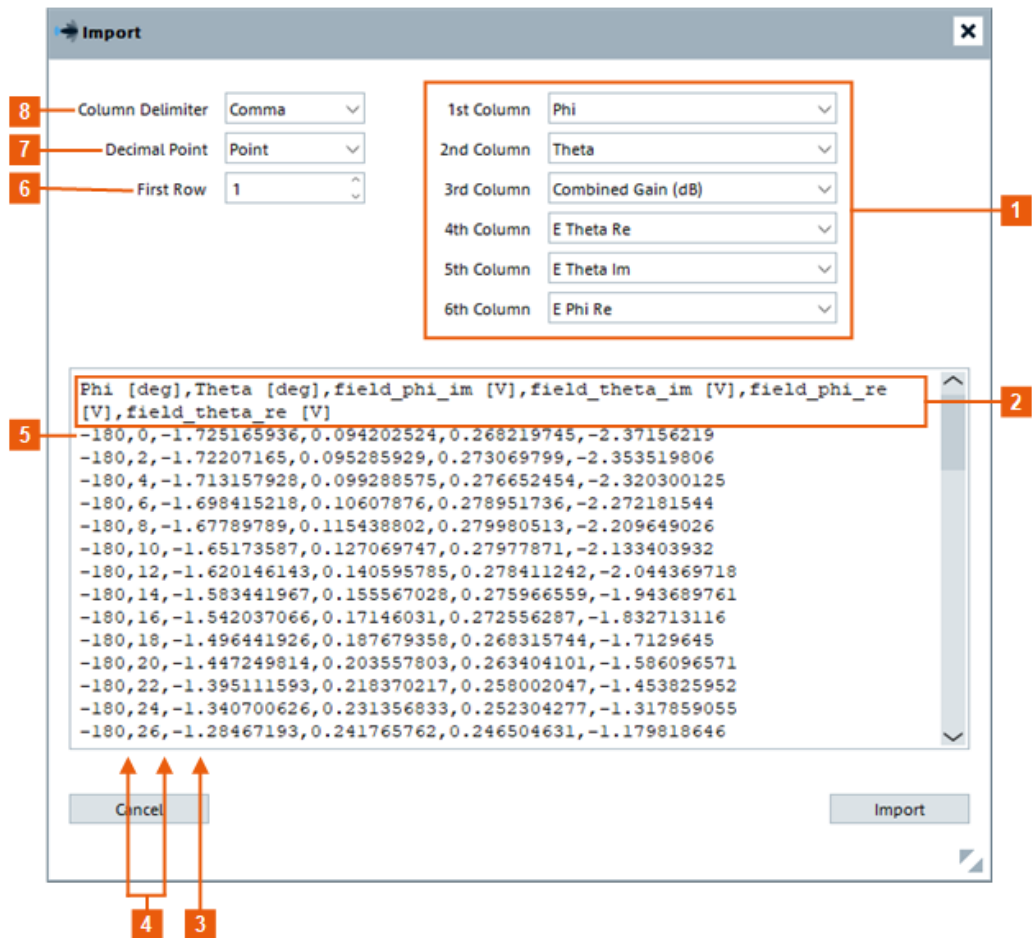
When a \*.csv file is loaded, the "Import Wizard" opens and tries to determine:

- The used column separator
- The decimal delimiter
- The number of the first line with meaningful data, where the numbering start with 1 and empty lines are counted
- The data content of each column.

You can change the values afterwards.

For example, the file on [Figure 9-6](#) contains a line that explains the parameters in each column.

If your file does not contain this information or if the automatically selected column separators do not match the information in the file, change the values. Always check if the parameters in the "Import Wizard" dialog match the particular file format and content.



**Figure 9-6: Import Wizard: understanding the displayed information**

- 1, 2 = Parameter per column and column header information
- 3, 7 = Decimal separator: point or comma
- 4, 8 = Column separator: comma, semicolon, withe space
- 5, 6 = First row



## 9.3 Antenna scans settings

Access:

- ▶ Select "Repository Tree > Antenna Scan > New".

### Settings:

Antenna Scan Name.....	194
Comment.....	194
Scan Type.....	194
3D Scan View.....	194
Electronic Scan.....	195
3D Scan View.....	195
L Simulation Period.....	195
L Visualization.....	195
Info.....	195
Circular Scan.....	195
Sector Scan.....	197
Raster Scan.....	198
Conical Scan.....	198
Helical Scan.....	199
Spiral Scan.....	200
Lobe Switching Scan.....	201

Sine Scan.....	202
Custom Scan.....	203
Lissajous.....	205

### Antenna Scan Name

Enter the name of the antenna scan.

Remote command:

`SCAN:NAME` on page 427

`SCAN:CATalog?` on page 426

`SCAN:SElect` on page 427

`SCAN:CREate` on page 426

`SCAN:REMove` on page 428

### Comment

Enter a short description.

Remote command:

`SCAN:COMment` on page 428

### Scan Type

Defines the scan type.

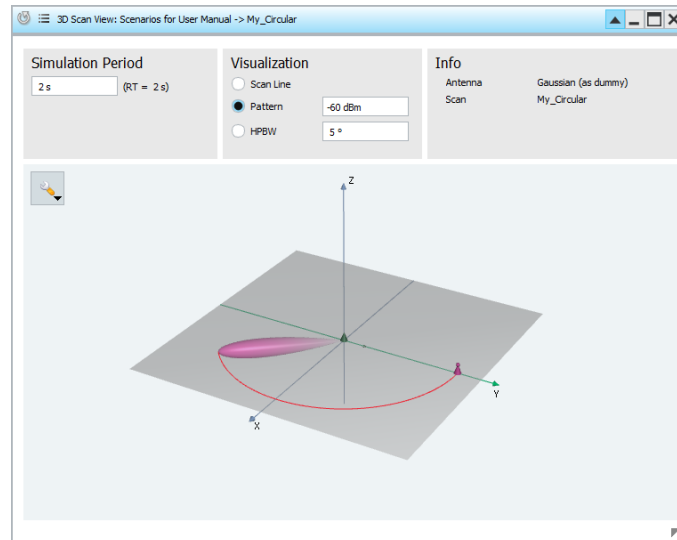
Use the "3D Scan View" diagram to visualize the selected scan.

Remote command:

`SCAN:TYPE` on page 458

### 3D Scan View

To access the "3D Scan View" open any "Antenna Scan" or "Emitter Type" and click the "Display 3D antenna scan" button.



This window contains control and information elements at the top of the window. In the top left corner of the pattern visualization area there is a "Transparency settings" icon that enables you to change the way the scan is displayed. This icon is also available in the "3D Single Emitter Preview" window.

**Electronic Scan**

Defines how the scan works.

If this setting is activated and an emitter uses this scan together with a phased array antenna, electronic steering is applied.

In a normal scan, the antenna is mounted on a mechanical motor that performs the scan. In electronic scan mode, the antenna is fixed and the scan is performed electronically. The antenna does not move. The pattern is aimed towards the desired location by applying phase offsets to the individual antenna elements.

Remote command:

[SCAN:STEEring](#) on page 464

**3D Scan View**

Visualizes the antenna scan in a 3D preview.

See the example on [Figure 9-14](#).

**Simulation Period ← 3D Scan View**

Sets the time it takes the animation to complete a scan.

The "Real Time" is also displayed.

**Visualization ← 3D Scan View**

Defines the way the scan is represented:

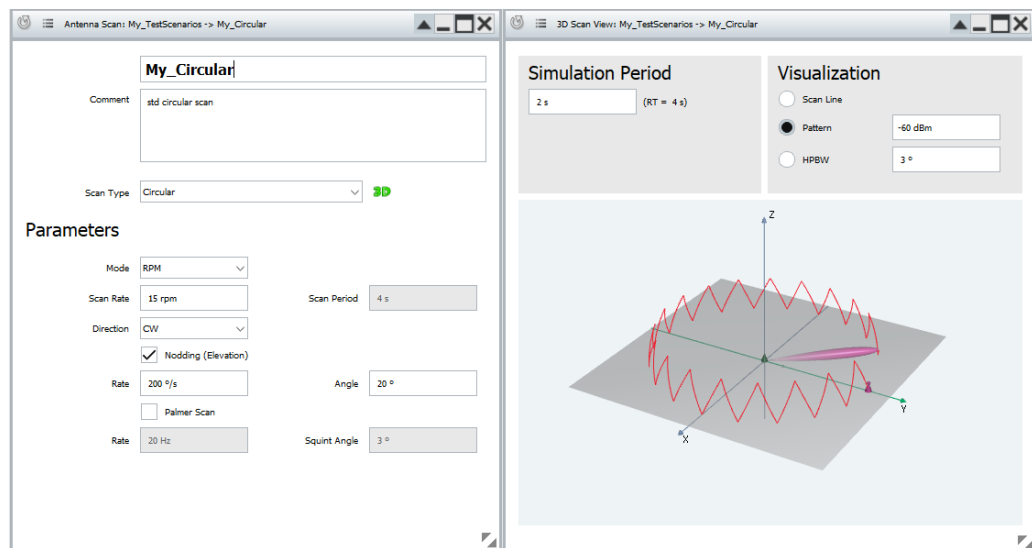
- "Scan Line = On": the scan is represented by a line; the antenna pattern is disregarded.
- "Pattern Visualization > Pattern": the visualization uses a Gaussian pattern. If you have opened this dialog from the "Emitter" dialog or the 2D map, the visualization corresponds to the current selected antenna pattern.
- "Pattern Visualization > HPBW": the antenna is represented by its [HPBW](#).
- "Minimum Displayed Level": the minimum displayed side lobes level.

**Info**

Summary information.

**Circular Scan**

A circular antenna turns in a circle and scans 360°.



**Figure 9-7: Circular scan with enabled nodding**

- "Mode" Sets if the scan turning speed is set as a scans rate or as a period. The value "Scan Rate" and "Scan Period" are interdependent and updated automatically whenever one of the two is changed.
- "Scan Rate" Sets speed the antenna is turning with.
- "Scan Period" Sets the time it takes for the antenna to turn once.
- "Direction" Sets the direction, clockwise ("CW") or counterclockwise ("CCW"), the antenna is turning in.
- "Nodding (Elevation)" If enabled, superimposes a horizontal nodding on the circular scan. The height of the nods and their rise time are defined with the parameters "Angle" and "Rate", see [Figure 9-7](#).
- "Palmer Scan" If enabled, superimposes a conical scan on the circular scan, see [Figure 9-8](#).
- "Rate" Enabled if "Palmer Scan > On". Defines how fast the palmer scan is turning.
- "Squint Angle" Enabled if "Palmer Scan > On". Sets the radius of the scanned circle.

Remote command:

[SCAN:CIRCular:MODE](#) on page 453

[SCAN:CIRCular:RPM](#) on page 454

[SCAN:CIRCular:PERiod](#) on page 453

[SCAN:CIRCular:ROTation](#) on page 453

[SCAN:CIRCular:NODDing](#) on page 459

[SCAN:CIRCular:NRATe](#) on page 459

[SCAN:CIRCular:NELevation](#) on page 459

[SCAN:CIRCular:PALMer](#) on page 459

[SCAN:CIRCular:PRATe](#) on page 460

[SCAN:CIRCular:PSQuint](#) on page 460

## Sector Scan

A sector antenna scans only a sector with defined "Sector Width".

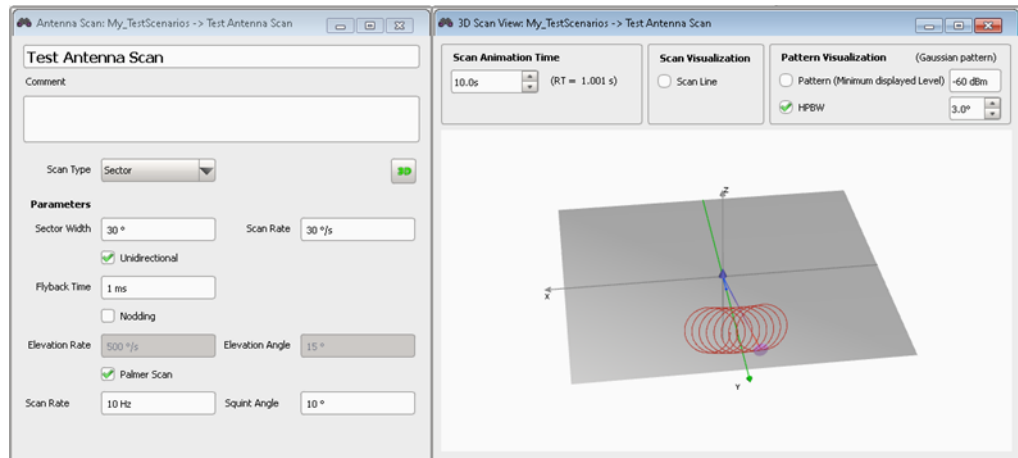


Figure 9-8: Sector scan with enabled Palmer scan

### "Sector Width, deg"

Sets the width of the scanned sector.

### "Scan Rate, deg/s"

Defines how fast the antenna is turning.

"Unidirectional" The antenna uses a unidirectional scan mode, i.e. the antenna turns in one direction only and "jumps" back within the selected "Flyback Time".

"Nodding" If enabled, superimposes a horizontal nodding on the circular scan. The height of the nods and their rise time are defined with the parameters "Elevation Angle" and "Elevation Rate", see [Figure 9-7](#).

"Palmer Scan" If enabled, superimposes a conical scan on the circular scan, see [Figure 9-8](#).

"Rate" Enabled if "Palmer Scan > On".  
Defines how fast the palmer scan is turning.

"Squint Angle" Enabled if "Palmer Scan > On".  
Sets the radius of the scanned circle.

Remote command:

[SCAN:SECTor:WIDTh](#) on page 457

[SCAN:SECTor:RATE](#) on page 454

[SCAN:SECTor:UNIDirection](#) on page 457

[SCAN:SECTor:FLYBack](#) on page 456

[SCAN:SECTor:NODDing](#) on page 459

[SCAN:SECTor:NELevation](#) on page 459

[SCAN:SECTor:NRATe](#) on page 459

[SCAN:SECTor:PALMer](#) on page 459

[SCAN:SECTor:PRATe](#) on page 460

[SCAN:SECTor:PSQuint](#) on page 460

**Raster Scan**

The raster antenna scans a sector with defined "Sector Width" but performs several scans with different elevations.

See [Figure 9-14](#).

"Raster Width, deg"

Sets the width of the scanned sector.

Scanned is an angle of  $\pm$ "Raster Width"/2 degrees, starting from the Y axis.

"Scan Rate, deg/s"

Defines how fast the antenna is turning.

"Bar Count, Bar Width"

Sets the number of bars and the distance between two consecutive scanned bars (sectors).

"Retrace Time" Defines how fast the antenna returns to its initial orientation after completing the last bar.

"Direction" Switches between a horizontal and a vertical scanning direction.

"Rewind" Continuous scan in that upon reaching the end of the last bar, the antenna scans backwards.

"Unidirectional" The antenna uses a unidirectional scan mode. The scan is not a continuous but the antenna turns in one direction only (counterclockwise, CCW) and "jumps" to the next bar within the selected "Flyback Time".

"Palmer Scan" If enabled, superimposes a conical scan on the circular scan, see [Figure 9-8](#).

"Rate" Enabled if "Palmer Scan > On".  
Defines how fast the palmer scan is turning.

"Squint Angle"

Enabled if "Palmer Scan > On".  
Sets the radius of the scanned circle.

Remote command:

[SCAN:RASTer:WIDTh](#) on page 457

[SCAN:RASTer:RATE](#) on page 454

[SCAN:RASTer:BARWidth](#) on page 456

[SCAN:RASTer:BARs](#) on page 455

[SCAN:RASTer:RETRace](#) on page 457

[SCAN:RASTer:DIRection](#) on page 457

[SCAN:RASTer:REWind](#) on page 456

[SCAN:RASTer:UNIDirection](#) on page 457

[SCAN:RASTer:FLYBack](#) on page 456

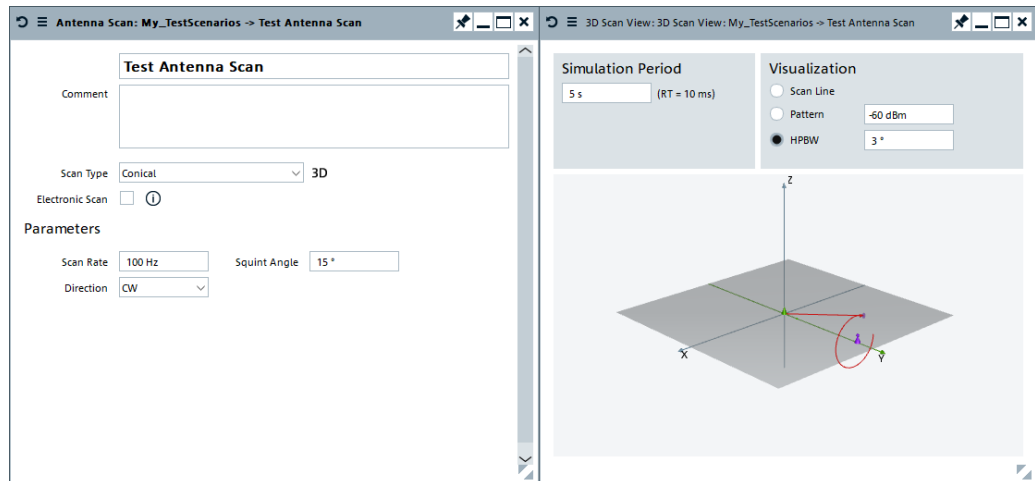
[SCAN:RASTer:PALMer](#) on page 459

[SCAN:RASTer:PRATe](#) on page 460

[SCAN:RASTer:PSQuint](#) on page 460

**Conical Scan**

A conical antenna scans a conus with defined "Squint Angle" (radius); the radar beam is rotated around the y-axis (i.e. boresight).



"Scan Rate, Hz"

Defines how fast the antenna is turning.

"Squint Angle, deg"

Sets the radius of the scanned circle.

"Direction"

Sets the direction, clockwise ("CW") or counterclockwise ("CCW"), the antenna is turning in.

Remote command:

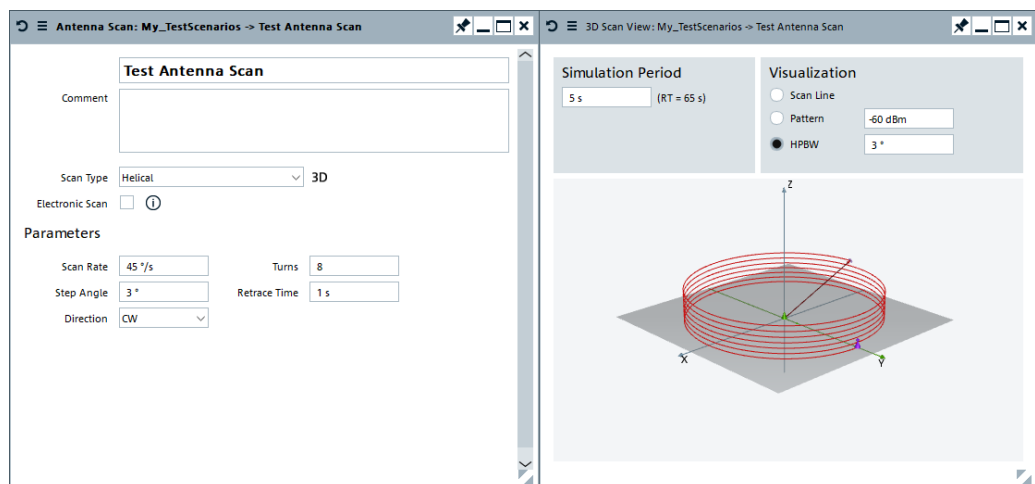
[SCAN:CONical:RATE](#) on page 454

[SCAN:CONical:ROTation](#) on page 453

[SCAN:CONical:SQUint](#) on page 455

### Helical Scan

A helical antenna scan turns in a circle (scans 360°) and performs several scans with different elevations.



"Scan Rate, deg/s"

Defines how fast the antenna is turning.

"Step Angle, deg"

Sets the step width with that the antenna azimuth changes.

- "Turns" Sets the number of 360° turns the antenna performs.
- "Retrace Time" Defines how fast the antenna returns to its initial orientation after completing the last turn.
- "Direction" Sets the direction, clockwise ("CW") or counterclockwise ("CCW"), the antenna is turning in.

Remote command:

[SCAN:HELical:RPM](#) on page 454

[SCAN:HELical:ELEVation:STEP](#) on page 454

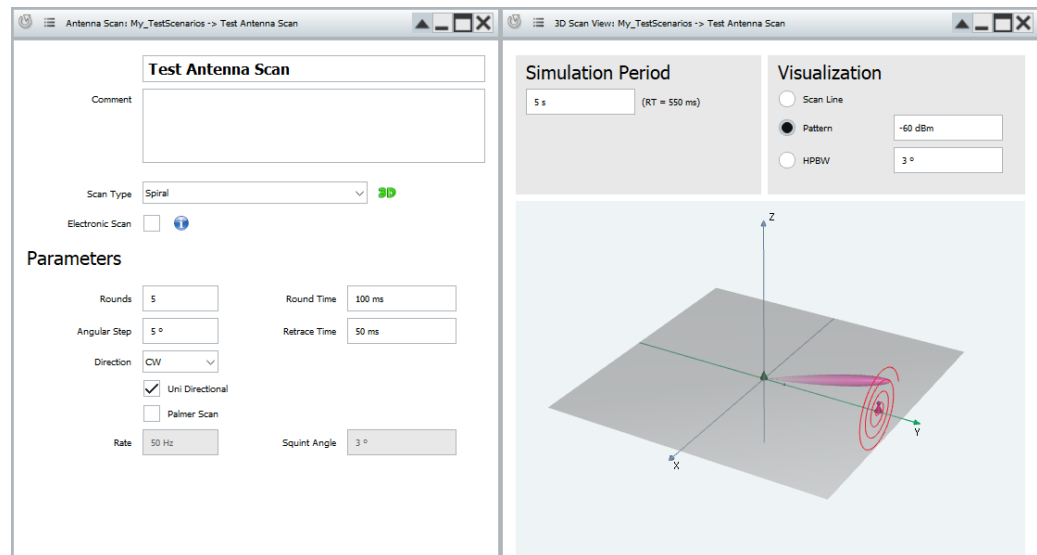
[SCAN:HELical:TURNs](#) on page 454

[SCAN:HELical:RETRace](#) on page 457

[SCAN:HELical:ROtation](#) on page 453

### Spiral Scan

A spiral antenna scan turns in a circle (scans 360°) and performs several scans with different radii.



- "Rounds" Sets the number of rounds the antenna performs.
- "Angular Step" Sets the distance in degrees with that the scan radius is increased.
- "Round Time" Defines how fast the antenna is turning.
- "Retrace Time" Define how fast the antenna returns to its initial orientation after completing the last turn.
- "Direction" Sets the direction, clockwise ("CW") or counterclockwise ("CCW"), the antenna is turning in.



**"Uni Directional"**

Sets the scan behavior when the scan reaches the last round:

- "Uni Directional = On" - the scan is not continuous. It turns for the specified number of rounds and then takes the retrace time to return to the origin of the spiral scan.
- "Uni Directional = Off" - the scan is continuous; it turns forth and backwards. When the specified number of rounds is reached, the scan direction turns backwards back to the origin of the spiral scan.

**"Palmer Scan"** If enabled, superimposes a conical scan on the circular scan, see [Figure 9-8](#).

**"Rate", "Squint Angle"** Enabled if "Palmer Scan > On". Defines how fast the palmer scan is turning.

**"Squint Angle"** Enabled if "Palmer Scan > On". Sets the radius of the scanned circle.

Remote command:

[SCAN:SPIRAl:ROUNds](#) on page 458

[SCAN:SPIRAl:STEP](#) on page 458

[SCAN:SPIRAl:RTIME](#) on page 458

[SCAN:SPIRAl:RETRace](#) on page 457

[SCAN:SPIRAl:ROtation](#) on page 453

[SCAN:SPIRAl:UNIDirection](#) on page 457

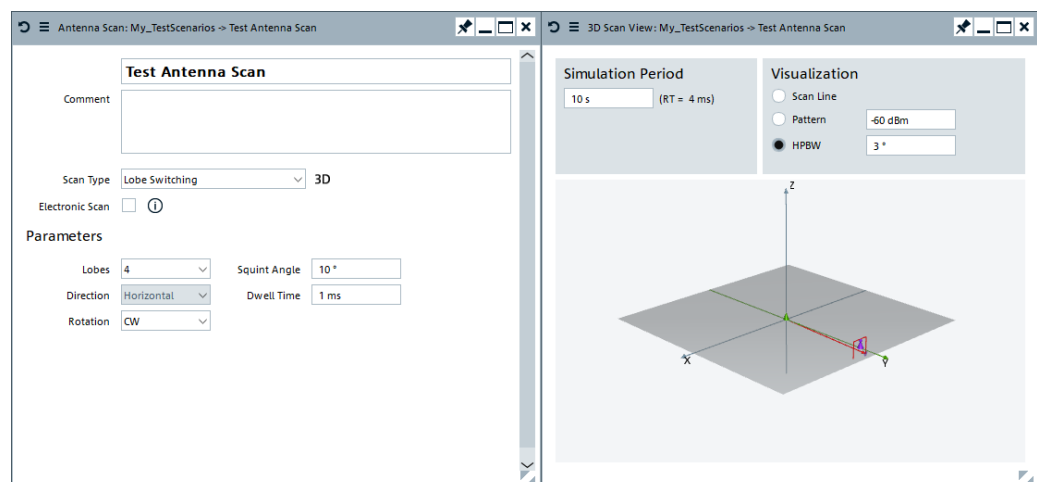
[SCAN:SPIRAl:PALMer](#) on page 459

[SCAN:SPIRAl:PRATe](#) on page 460

[SCAN:SPIRAl:PSQuint](#) on page 460

**Lobe Switching Scan**

A lobe switching antenna uses two or four slightly separated antenna elements.



**"Lobes"** Set the number of lobes.

**"Direction"** Sets the switching direction, i.e. horizontal or vertical.

- "Squint Angle" Sets the angle that the beam axis is offset from the tracking axis (i.e. the y-axis) of the antenna.
- "Dwell Time" Sets the antenna motion, i.e. how fast the switches between the lobes.
- "Direction" Sets the direction, clockwise ("CW") or counterclockwise ("CCW"), the antenna is turning in.

Remote command:

[SCAN:LSW:LOBes](#) on page 455

[SCAN:LSW:DIRection](#) on page 455

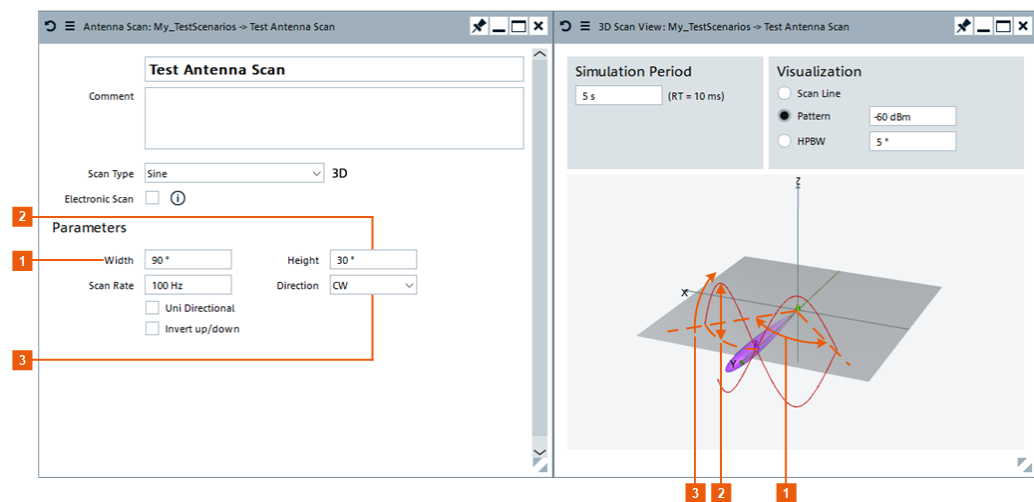
[SCAN:LSW:SQUint](#) on page 455

[SCAN:LSW:DWELL](#) on page 455

[SCAN:LSW:ROTation](#) on page 453

### Sine Scan

A sine antenna scan draws a sine wave.



**Figure 9-9: Sine scan: understanding the displayed information**

1 = Width is the sector width, i.e. the angle on the XY plane between the origin and the end of the scan

2 = Height is the sine amplitude

3 = Seen from the receiver, the scan turns clockwise ("Direction = CW") and draws the upper sine wave first ("Invert up/down scan = Off")

"Width, deg"

Sets the width of the scanned sector. i.e. the angle on the XY plane between the origin and the end of the scan.

"Height, deg"

Sets the amplitude of the sine wave.

"Scan Rate, deg/s"

Defines how fast the antenna is turning.

"Direction"

Sets the antenna turning direction, clockwise ("CW") or counterclockwise ("CCW").

**"Uni Directional"**

Sets the scan behavior when the scan reaches the last point:

- "Uni Directional = On": the scan is not continuous. It draws 1 sine wave and then jumps back to the origin of the scan.
- "Uni Directional = Off": the scan is continuous; it draws two symmetrical sine waves. When the scan reaches the sine end position, it returns back to the origin drawing a sine wave that is the mirrored version of the sine scan.

**"Invert up/down scan"**

Sets the sine scan order and defines whether the upper or the down (mirrored) sine scan is used first.

Remote command:

[SCAN:SIN:WIDTH](#) on page 463

[SCAN:SIN:HEIGHT](#) on page 463

[SCAN:SIN:RATE](#) on page 454

[SCAN:SIN:ROTation](#) on page 453

[SCAN:SIN:UNIDirection](#) on page 457

[SCAN:SIN:INVersion](#) on page 464

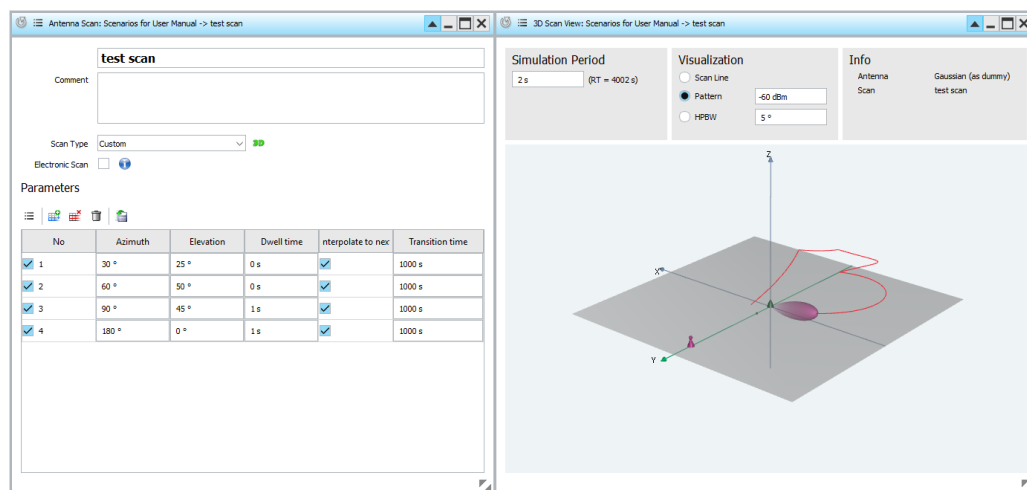
**Custom Scan**

Describes the antenna scan as a sequence of discrete scan positions.

Each position is defined by an elevation angle and an azimuth angle.

The trajectory between two subsequent positions is interpolated.

[Figure 9-10](#) shows a simple custom scan defined using 4 beam positions.



**Figure 9-10: Custom scan defined by four positions**

**"New, Select, Append, Remove, Clear Items"**

Standard functions for item handling, see [Table 2-4](#).

**"Import data from file"**

Opens a dialog that enables you to import a custom scan definition from a CSV file (see [Figure 9-10](#)).

The dialog previews the data in the file and enables you to ignore the headers (if present) and map the columns in the file to the columns in the "Parameters" table.

Create Custom Scan from .csv

Column Delimiter: Comma

Decimal Point: Point

First Row: 2

1st Column: Azimuth

2nd Column: Elevation

3rd Column: Dwell Time

4th Column: Interpolate to Next

5th Column: Transition Time

```
Azimuth,Elev,Dwell,Interp,Trans
120,30,1,1,1
105,40,1,1,1
75,40,1,1,1
60,30,1,1,1
75,20,1,1,1
105,20,1,1,1
```

Cancel Import

**Figure 9-11: Importing custom scan parameters**

### Positions table

Each row of the table contains parameters that define a position and the behavior of the custom scan. The scan moves sequentially down the table. The scan direction depends on the "Azimuth" (value and sign) and "Elevation" (value and sign) parameters. The scan behavior depends on the other parameters.

Each row consists of the following parameters:

- "Azimuth" (angle offset from the y-axis)
- "Elevation" (angle offset from horizontal)
- "Dwell time" defines how long the beam remains at a particular position.
- "Interpolate to next" defines whether the beam jumps or moves smoothly from the current position to the next position.
  - Selected = smooth movement
  - Deselected = jump
- "Transition time" defines the time over which the beam movement is interpolated.

**Note:** When the scan repeats, the beam position jumps from the last position to the first position.

If a jump is the correct behavior, do not select "Interpolate to next" for the last position (e.g. like the flyback at the end of a helical scan).

If the correct behavior is a smooth transition (e.g. the custom scan defines a closed shape), select "Interpolate to next" for the last position so that the scan repeats without a jump.

### Remote command:

[SCAN:CUSTom:ENTRy:ADD](#) on page 429

[SCAN:CUSTom:ENTRy:INSert](#) on page 431

[SCAN:CUSTom:ENTRy:COUNT?](#) on page 430

[SCAN:CUSTom:ENTRy:SELEct](#) on page 431

[SCAN:CUSTom:ENTRy:DELEte](#) on page 432

[SCAN:CUSTom:ENTRy:CLEar](#) on page 433

[SCAN:CUSTom:IMPorT:FILE](#) on page 460

[SCAN:CUSTom:IMPorT:EXEC](#) on page 460

[SCAN:CUSTom:ENTRy:AZIMuth](#) on page 460

[SCAN:CUSTom:ENTRy:ELEVation](#) on page 461

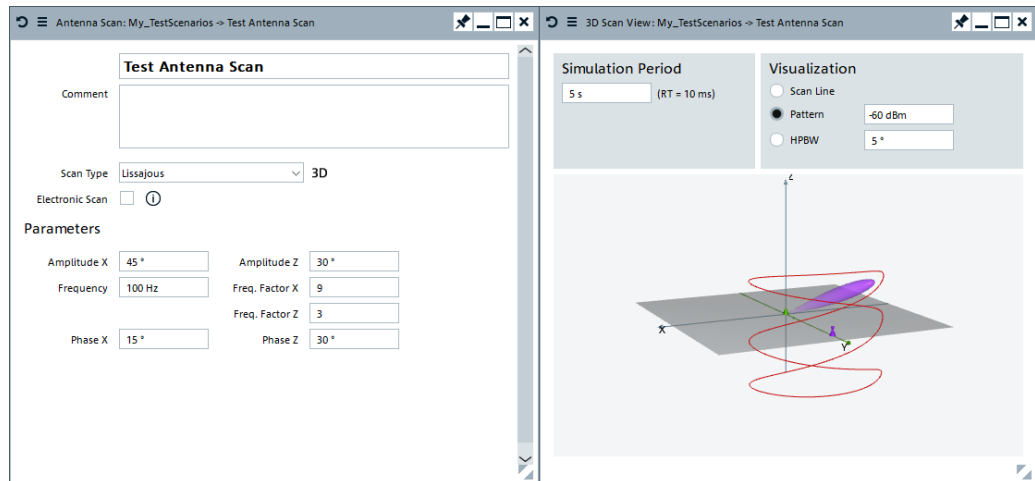
[SCAN:CUSTom:ENTRy:DWELL](#) on page 461

[SCAN:CUSTom:ENTRy:JUMPType](#) on page 461

[SCAN:CUSTom:ENTRy:TRANStime](#) on page 462

### Lissajous

The antenna scan follows a Lissajous curve.



Lissajous curves are mathematically described as follows:

- $x(t) = A \cdot \cos(\omega_x \cdot t - \sigma_x)$
- $z(t) = B \cdot \cos(\omega_z \cdot t - \sigma_z)$

"Amplitude X, Amplitude Z"

Magnitudes A and B of two harmonic vibrations.

"Frequency" Base frequency

"Freq X : Freq Z"

The two angular frequencies  $\omega_x$  and  $\omega_z$  are defined by their ratios and calculated as follows:

$$\omega_x = \text{"Freq X"} \cdot \text{"Frequency"}$$

$$\omega_z = \text{"Freq Z"} \cdot \text{"Frequency"}$$

The ratio "Freq X : Freq Z" determines the number of lobes in the curve.

"Phase X, Phase Z"

Phases  $\sigma_x$  and  $\sigma_z$  of the two harmonic vibrations.

Remote command:

[SCAN:LISSajous:AMPX](#) on page 462

[SCAN:LISSajous:AMPZ](#) on page 462

[SCAN:LISSajous:FREQ](#) on page 462

[SCAN:LISSajous:XFACTOR](#) on page 463

[SCAN:LISSajous:ZFACTOR](#) on page 463

[SCAN:LISSajous:PHIX](#) on page 463

[SCAN:LISSajous:PHIZ](#) on page 463

## 9.4 How to create a library with antenna patterns and scans

See:

- ["To create an antenna pattern"](#) on page 207

How to create a library with antenna patterns and scans

- "To create an antenna scan" on page 210
- "To create a custom antenna pattern based on the required antenna characteristics" on page 211
- "To import a user-defined antenna pattern from file in one of the predefined file formats" on page 212
- "To import an antenna pattern file in custom file format" on page 215
- "To observe the effect of polarization" on page 215

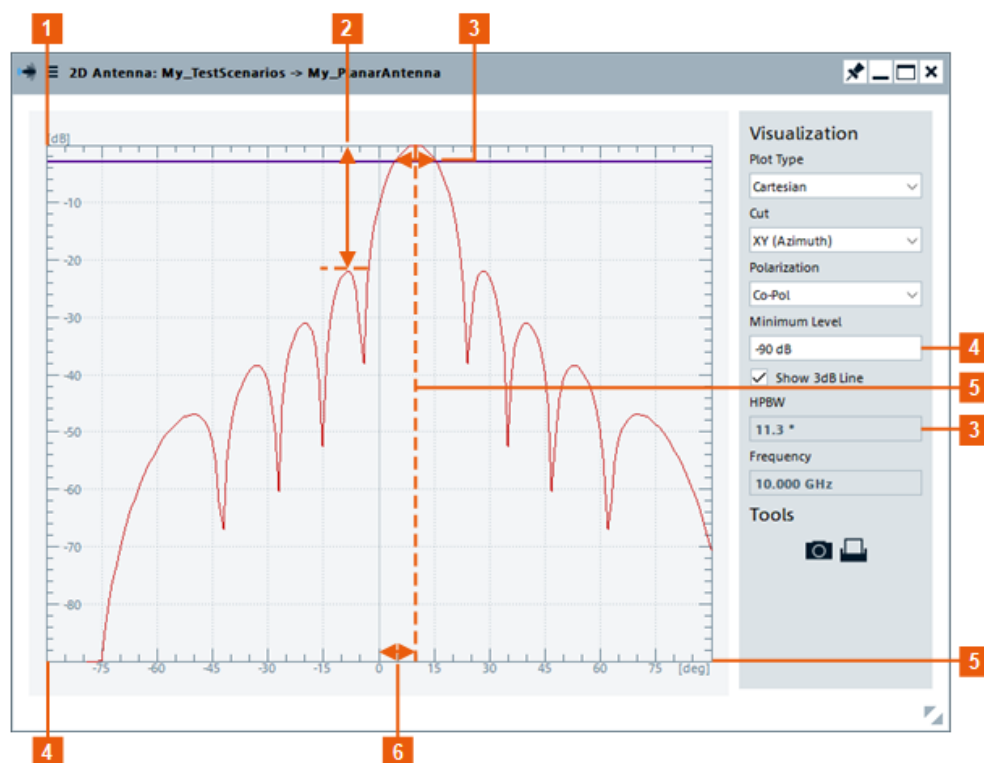
### To create an antenna pattern

1. Select "Repository Tree > Antenna Pattern > New" .
2. Select "Antenna Model", e.g. "Planar Phased Array".

The screenshot shows the configuration window for a 'My\_PlanarAntenna'. The title bar reads 'Antenna Pattern: My\_TestScenarios -> My\_PlanarAntenna'. The main title is 'My\_PlanarAntenna'. Below the title is a 'Comment' field containing 'planar phased antenna with parabolic aperture distribution'. The 'Type' is set to 'Planar Phased Array'. There are '3D' and '2D' view toggles. The 'Z-Rotation' and 'X-Rotation' are both set to '0 °'. The 'Frequency' is '10 GHz' and the 'Bandwidth' is '1 GHz'. The 'Polarization' is set to 'Vertical'. There is an unchecked checkbox for 'Simulate Back Lobe'. The 'Attenuation' is '40 dB' and the 'Type' is 'Omni'. Under the 'Parameters' section, the 'Distribution' is 'Parabolic', with an unchecked checkbox for 'Use cosine characteristic for individual element'. The 'Elements X' and 'Elements Z' are both '12'. The 'Spacing X' and 'Spacing Z' are both '0.015 m'. The 'Pedestal X' is '0.1' and 'cos ^ N' is '4'.

3. Adjust further settings, like "Rotation", "Frequency" or "Aperture Distribution".
4. Select "2D" to display the antenna pattern in a graph in polar or with Cartesian coordinates.

How to create a library with antenna patterns and scans



**Figure 9-12: 2D antenna pattern: understanding the displayed information**

- 1, 5 = Antenna pattern diagram, as a function of angle (deg) and antenna gain (dB)
- 2 = Side lobe level
- 3 = HPBW, i.e. the beamwidth at half power (3 dB)
- 4 = Antenna gain minimum (-90 dB)
- 5 = Beam axis
- 6 = "Z-Rotation = 10°"

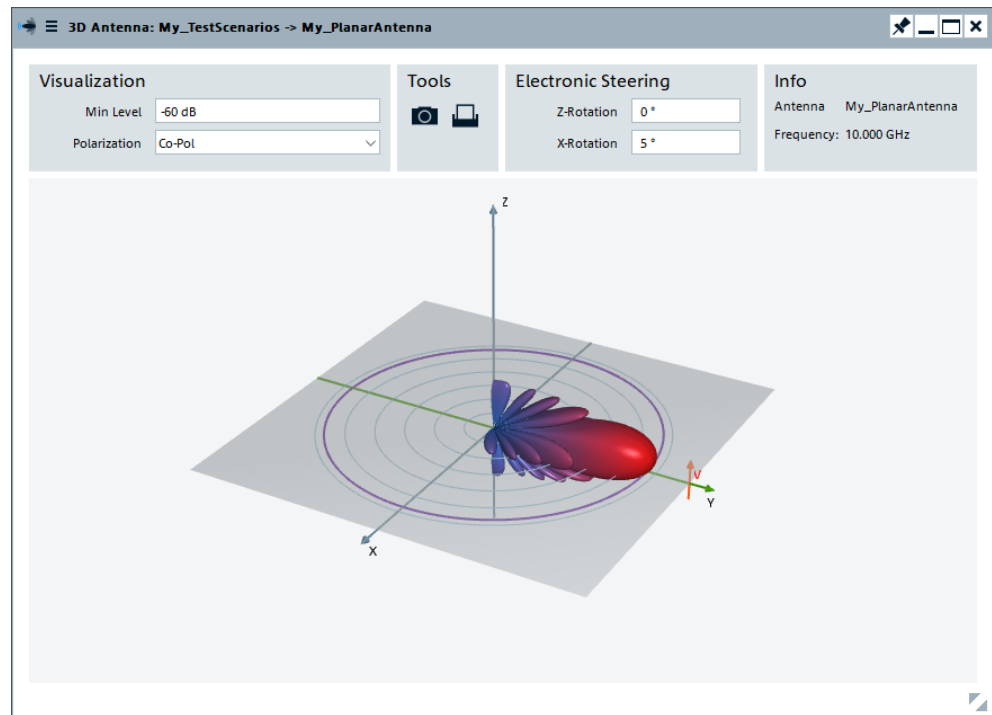
5. Change the number of used elements ,e.g. "Elements X = 20". Compare the 2D diagram.

More antenna elements result in a smaller beamwidth and side lobes with lower level.

6. Select "Antenna Pattern > 3D" to display the 3D antenna pattern.



How to create a library with antenna patterns and scans



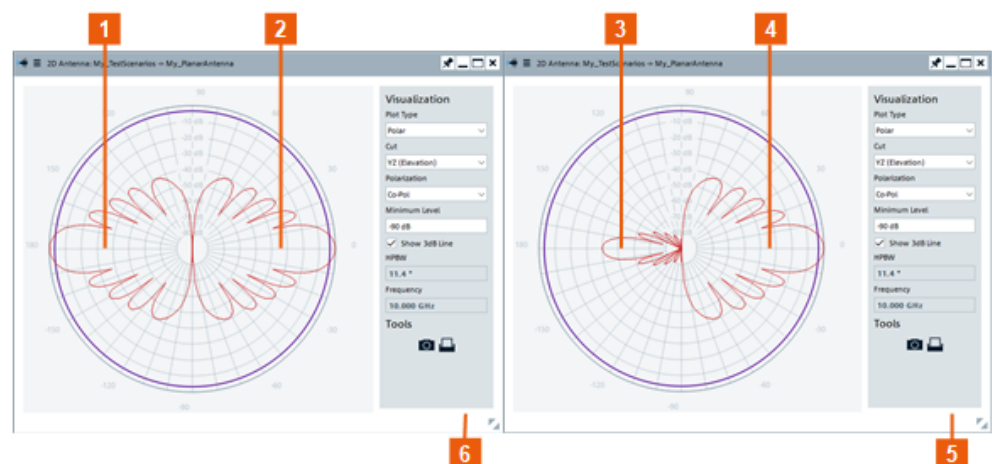
The 3D view is interactive. Use the mouse cursor to turn it around any of the axes and the mouse wheel to zoom in the view.

7. Select "Antenna Pattern > Simulate Back Lobe > On" and "Attenuation = 0 dB".
8. In the 2D view, select "Polar" coordinates.

The display confirms the antenna pattern with a back lobe, where the back lobe is simulated as the mirrored pattern of the main lobe ("Type > Mirror").

See [Figure 9-13](#).

9. Select "Antenna Pattern > Back Lobe Attenuation = 40 dB".



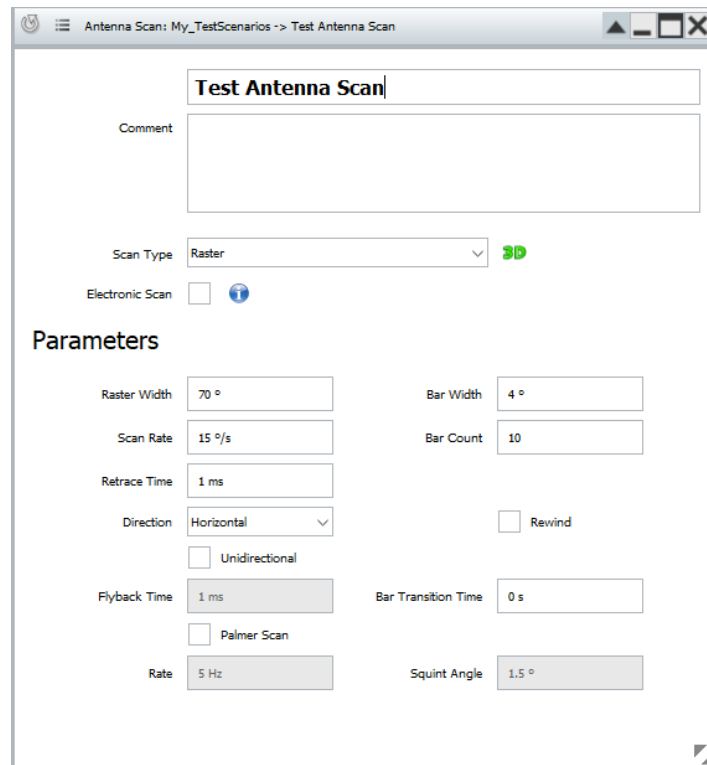
**Figure 9-13: Simulate back lobe: understanding the displayed information**

- 1 = Unattenuated back lobe, i.e. the mirrored pattern of the main lobe
- 2, 4 = Main lobe
- 3 = Attenuated back lobe
- 5 = "Attenuation = 40 dB"
- 6 = "Attenuation = 0 dB"

For description of the provided settings, see [Chapter 9.2, "Antenna pattern settings"](#), on page 174.

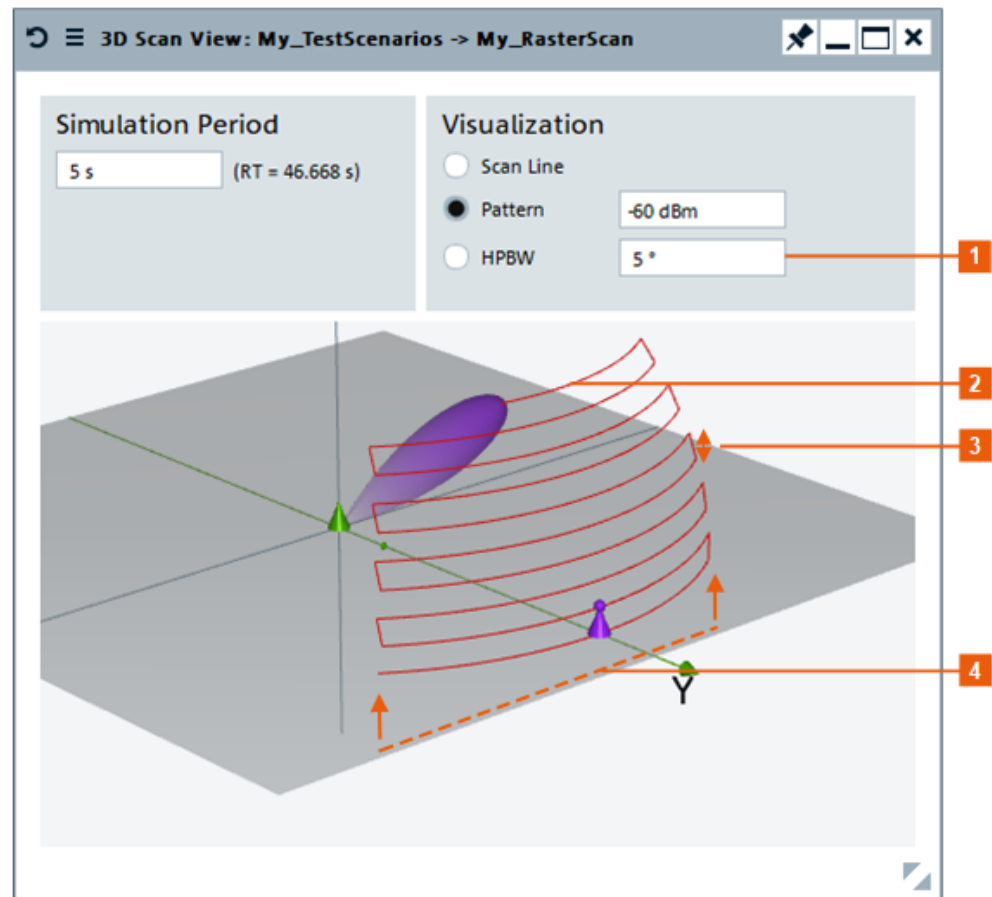
### To create an antenna scan

1. Select "Repository Tree > Antenna Scans > New".
2. Select "Scan Type", e.g. "Raster Scan".



3. Adjust further settings, like "Raster Width" and "Bar Width".
4. Select "3D" to display the 3D antenna pattern.
5. Use the mouse cursor to turn it around any of the axes and the mouse wheel to zoom in the view.

The antenna scan confirms the settings.



**Figure 9-14: Horizontal raster scan: understanding the displayed information**

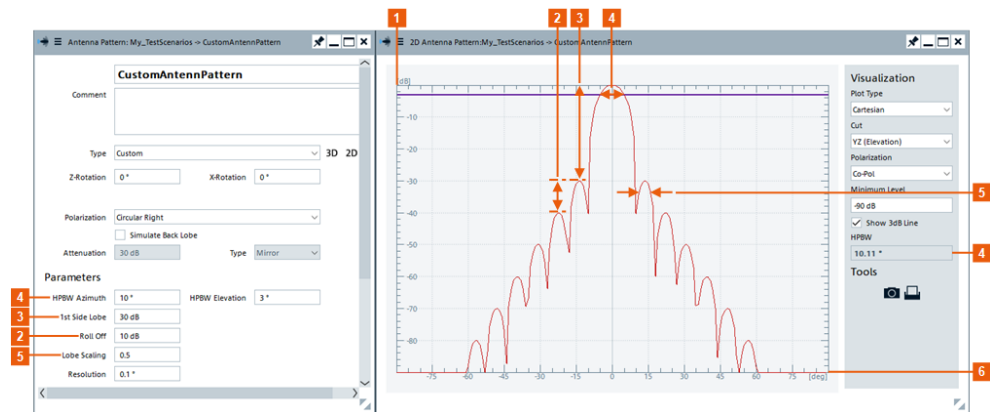
- 1 = Antenna pattern visualized as "HPBW = 5°"
- 2 = Tenth scan as defined with "Bar Count"
- 3 = "Bar Width = 4°"
- 4 = "Raster Width"

For description of the provided settings, see [Chapter 9.3, "Antenna scans settings"](#), on page 193.

#### **To create a custom antenna pattern based on the required antenna characteristics**

1. Create an "Antenna Pattern".  
See ["To create an antenna pattern"](#) on page 207.
2. Select "Antenna Model > Custom".
3. Adjust the settings, e.g. set the "HPBW XY = 10°", "HPBW YZ = 3°", etc.
4. Observe the antenna pattern on the 2D and 3D views.

How to create a library with antenna patterns and scans



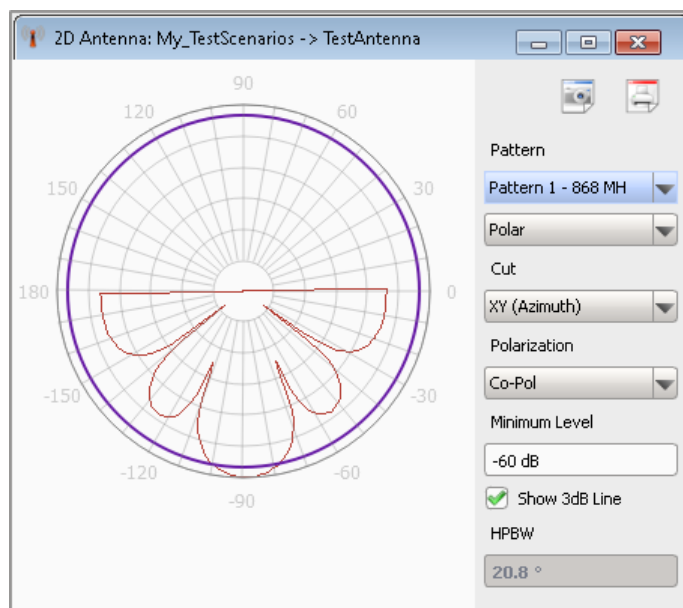
**Figure 9-15: Custom antenna pattern: understanding the displayed information**

- 1, 6 = Antenna pattern diagram, as a function of angle (deg) and antenna gain (dB)
- 2 = Roll-off factor or step size, used to calculate the attenuation of the subsequent side lobes
- 3 = Side lobe level, i.e. the attenuation of the first pair of side lobes
- 4 = "HPBW XY = 10°", i.e. the main beamwidth at half power (3 dB)
- 5 = Scale factor to calculate the HPBW of the side lobes, i.e. how much smaller or wider the side lobes are, compared to the main lobe

### To import a user-defined antenna pattern from file in one of the predefined file formats

You can import custom antenna pattern files of different file types.

1. Create an "Antenna Pattern".
2. Select "Antenna Model > Import from File".
3. Select "Import Filter > internal".
4. Select "Load". Navigate to the folder with your custom antenna patterns. Load a \*.ffe, a \*.tsv, a \*.ffd, a \*.csv, or a \*.ant\_pat file.
5. Open the 2D view to visualize the antenna pattern.



**Figure 9-16: 2D view: Example of a user-defined antenna pattern**

In this example, the antenna pattern is directed to  $-90^{\circ}$ .

6. Select "Antenna Pattern > Z-Rotation =  $90^{\circ}$ ".

Antenna Pattern: My\_TestScenarios -> TestAntenna

**TestAntenna**

Comment: Data import from C:/\_PS\_files/pattern.ant\_pat

Type: Import from File 3D 2D

Z-Rotation: -90 ° X-Rotation: 0 °

Frequency: 10 GHz Bandwidth: 1 GHz

Simulate Back Lobe

Attenuation: 30 dB Type: Mirror

**Parameters**

Import Filter: Internal

Load...

Purge

1 Pattern(s)

180 Elevation Points

359 Azimuth Points

- On the 2D and 3D views, observe the effect of this parameter.

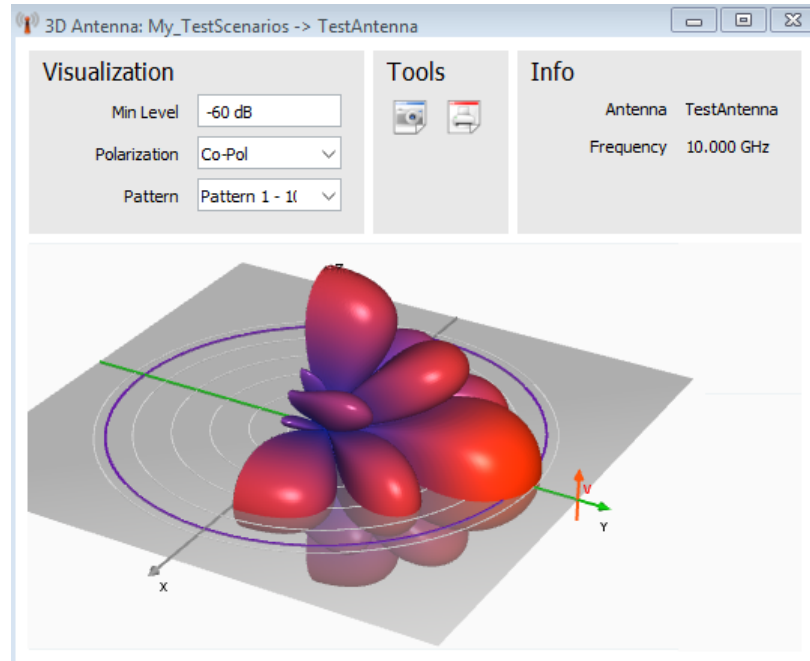


Figure 9-17: 3D view: Example of a user-defined antenna pattern

The antenna pattern is directed on the y-axis.

#### To import an antenna pattern file in custom file format

Importing antenna patterns in custom file format require that you create a suitable import filter first. That is, that you define and import the file format as a plug-in.

- Import the plug-in in the repository, for example `My_AntPatternFileFormat`. See ["To import a plugin"](#) on page 377.
- Create an antenna pattern. Select "Model > Import from File".
- Select "Import Filter > `My_AntPatternFileFormat`".
- Select "Load". Navigate to the folder with your custom antenna pattern (\*.txt file). Select it.
- Open the 2D and 3D view to visualize the antenna pattern.

If the file contains more than one antenna patterns, select the pattern to be displayed.

#### To observe the effect of polarization

- Create an antenna with a Gaussian beam pattern and a vertical polarization.
- Open the 3D display. Observe the pattern for "Polarization > Co-Pol" and "Minimum Level = -90 dB".
- Select "Polarization > Cross-Pol".

The automatically selected cross-polarized antenna is an antenna with *horizontal (H)* polarization.

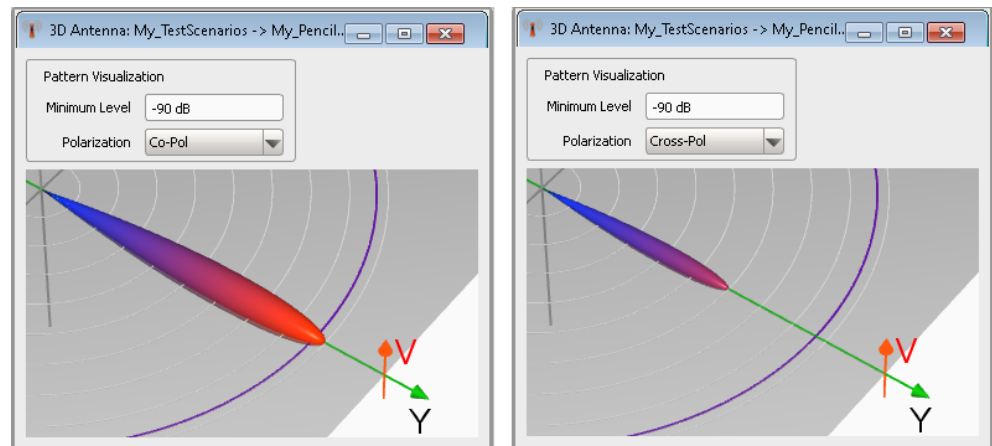


Figure 9-18: Effect of cross-polarization

The left figure shows the Gaussian antenna pattern. The right figure shows the resulting antenna pattern. This pattern has the same shape but the maximum power that is 30 dB lower than the co-polarized case. That is, the applied *polarization loss is -30 dB*.

4. Create a 2D scenario with one emitter and a receiver.
5. Assign the Gaussian beam pattern to the emitter and the receiver.  
To simplify the explanation, this example does not use an antenna scan.  
**Note:** If the receiver uses an isotropic omnidirectional antenna, the antenna polarization is unused.
6. Align the receiver and the emitter: for the emitter, set "Altitude > Point to Receiver > On" and "Roll = 0°".
7. Open the "3D View with Receiver". Observe the maximum normalized power level at the receiver.

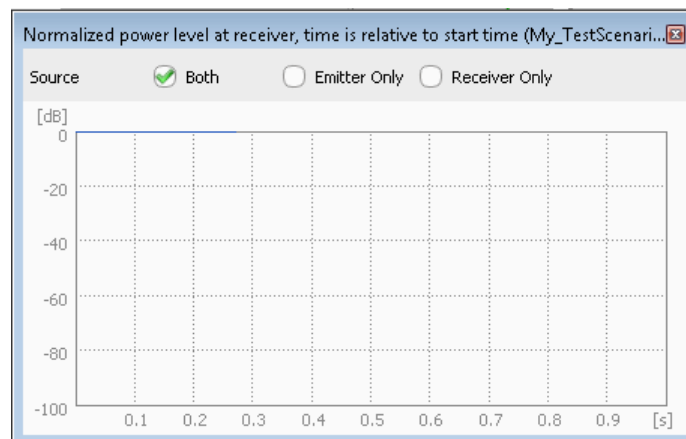
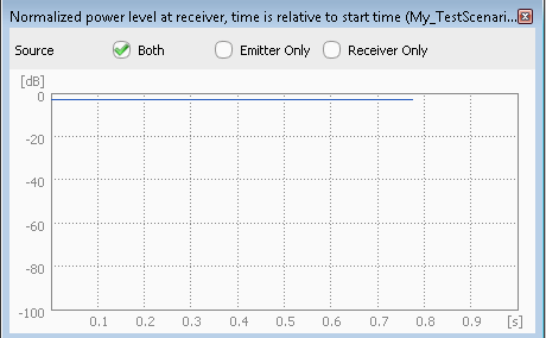
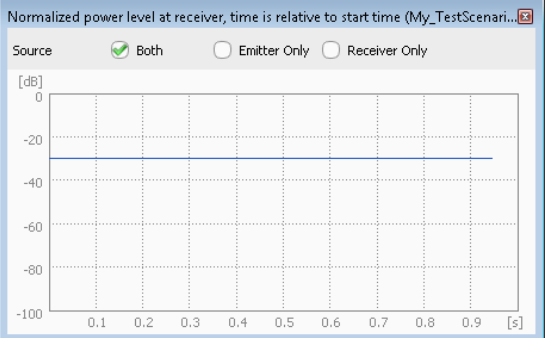


Figure 9-19: Normalized power level at the receiver, if the antennas are co-polarized (Roll = 0°)



The maximum power level is 0 dB.

8. Change the antenna roll angle. Compare the maximum normalized power level at the receiver.

Normalized power level at the receiver for "Roll = 45°"	Normalized power level at the receiver for "Roll = 90°"
	
<p>The maximum power level is 3 dB less than the co-polarized case.</p>	<p>The antennas are cross-polarized. The maximum power level is 30 dB less than the co-polarized case.</p>

See also:

- [Table 9-2](#)
- [Chapter 16.1, "How to create scenarios with receiver and TX items"](#), on page 290

## 10 Emulating emitters

In the context of this software, a simple emitter describes a pulse sequence whereas a complex emitter emulates a radar system. The emitters are characterized by parameters like operating mode, beam, waveform, antenna pattern, and antenna scan.

The available emitter settings depend on the complexity of the simulated system:

- Simple emitters are described only by a sequence of pulses. Antenna beam patterns and antenna scans are not required
- Complex emitters are described by the combination of an operating mode, antenna pattern, antenna scan and a sequence.

### Operational mode

As in the real-world where radar systems can run in different operational modes, in the R&S Pulse Sequencer Digital an emitter can also work in more than one operational mode and switch between them. The operational mode is a description of the radar purpose, such as scanning, searching or tracking. For example, an airport surveillance radar can switch between different scan types to observe its airspace.

Each mode can have individual antenna and signal configuration. Multiple beams are possible within a mode. Moreover, the R&S Pulse Sequencer Digital can emulate emitters that change their mode over time.

Related settings:

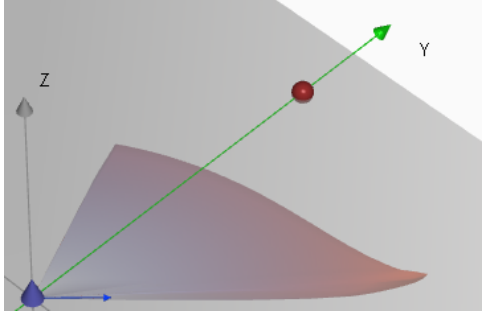
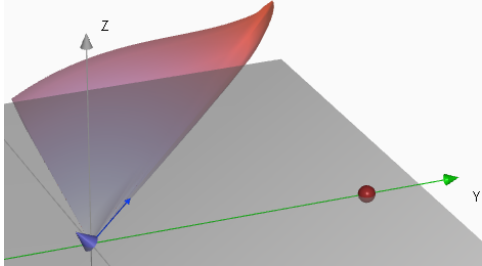
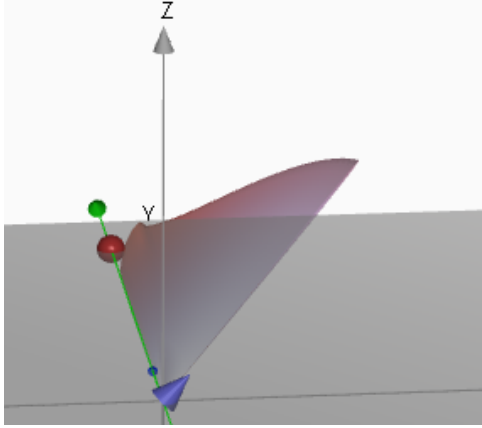
- ["Emitter Modes"](#) on page 221
- ["Behaviour"](#) on page 312
- [Chapter 10.3.3, "Mode editor settings"](#), on page 230

### Emitter attitude

The attitude is a description of the emitter orientation. Emitters can be rotated in three dimensions: yaw, pitch and roll.

The examples in [Table 10-1](#) show an emitter with a cosecant antenna pattern in a single emitter scenario. In direction finding scenarios and scenarios with multiple emitters, the effect is the same.

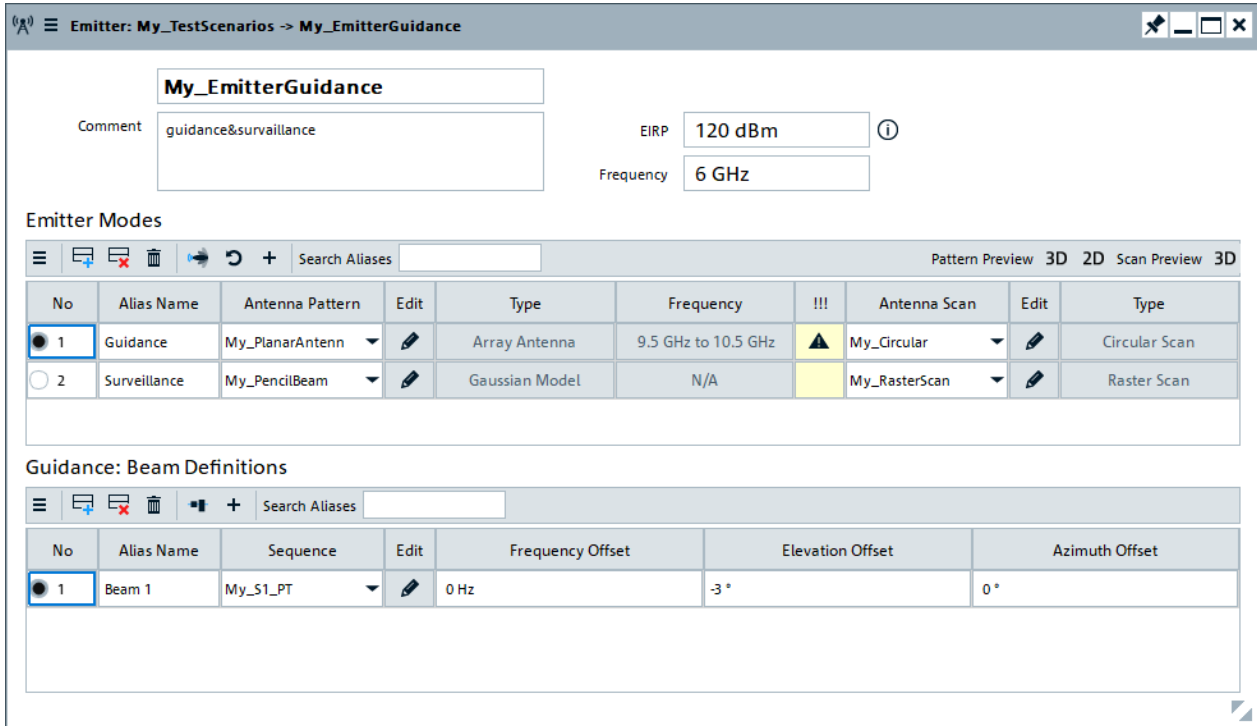
Table 10-1: Impact of the yaw, pitch and roll angles on the emitter attitude

Attitude	Rotation around axis	Rotation
Yaw	Z-axis	<p>In the x/y plane, to the left/right</p>  <p>Yaw = 45° ("Pitch = Roll = 0°")</p>
Pitch	X-axis	<p>In the y/z plane, up/down</p>  <p>Pitch = 45° ("Yaw = Roll = 0°")</p>
Roll	Y-axis	<p>In the x/z plane</p>  <p>Roll = 45° ("Yaw = Pitch = 0°")</p>

## 10.1 Emitter settings

Access:

- ▶ Select "Repository Tree > Emitter > New".



An emitter is described as a combination of an operating mode, an antenna pattern, an antenna scan, and a sequence. Complex emitters support several beams per operating mode. Enter the settings either in the table or in the dialog fields.

### Settings:

- [Emitter Name](#)..... 220
- [Comment](#)..... 221
- [EIRP](#)..... 221
- [Frequency](#)..... 221
- [Emitter Modes](#)..... 221
- [ID](#)..... 222
- [Emitter Beams Definition](#)..... 222

### Emitter Name

Enter the emitter's name.

Remote command:

- [EMITter:NAME](#) on page 427
- [EMITter:CREate](#) on page 426
- [EMITter:SElect](#) on page 426

[EMITter:CATalog?](#) on page 425

[EMITter:REMove](#) on page 428

### Comment

Enter a short description.

Remote command:

[EMITter:COMMeNt](#) on page 427

### EIRP

Sets the equivalent isotopically radiated power (EIRP) of the emitter.

This parameter is used, if the emitter is configured in a "Scenario Type > Localized Emitter".

### Example:

For emitter with:

- Transmit power = 1 MW, i.e. 60 dBW
- Antenna gain = 20 dBi

Set "EIRP = 80 dBW".

Remote command:

[EMITter:EIRP](#) on page 469

### Frequency

Sets the emitter's operating frequency.

If the selected antenna is calculated for a particular frequency, set the emitter's "Frequency" to a value within the suggested frequency range, see "[Emitter Modes](#)" on page 221.

Remote command:

[EMITter:FREQuency](#) on page 469

### Emitter Modes

Defines one or more modes that the emitter works in (see "[Operational mode](#)" on page 218).

Use the standard functions in the context menu or in the table to create or rename modes.

Copy a selected line in the table and append it on the existing table via "+".

Search for a defined emitter mode via "Search Alias".

Each emitter mode is defined by the combination of an antenna pattern, antenna scan and at least one beam with assigned pulse sequence.

R&S Pulse Sequencer Digital can emulate radar systems that change their mode over time, see "[Behaviour](#)" on page 312.

Use the 3D view to visualize the selected antenna scan and pattern, see:

- "[2D and 3D diagrams](#)" on page 178
- "[3D Scan View](#)" on page 195

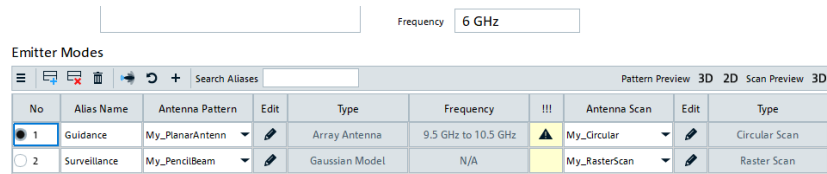
**"Antenna Pattern"**

Selects an existing antenna pattern or accesses a dialog for creating an antenna pattern.

See ["To create an antenna pattern"](#) on page 207.

The antenna pattern and type are displayed.

A warning symbol indicates that the current antennas design frequency does not match the emitter's [Frequency](#).



Set the emitter's [Frequency](#) to a value within the suggested frequency range.

**"Antenna Scan"**

Selects an existing antenna scan or accesses a dialog for creating an antenna scan.

See ["To create an antenna scan"](#) on page 210

Remote command:

[EMITter:MODE:NAME](#) on page 427

[EMITter:MODE:ADD](#) on page 429

[EMITter:MODE:COUNT?](#) on page 429

[EMITter:MODE:SElect](#) on page 430

[EMITter:MODE:CLEar](#) on page 433

[EMITter:MODE:DELeTe](#) on page 432

[EMITter:MODE:ANTenna](#) on page 469

[EMITter:MODE:ANTenna:CLEar](#) on page 433

[EMITter:MODE:SCAN](#) on page 470

[EMITter:MODE:SCAN:CLEar](#) on page 433

**ID**

Sets the identifier for the selected emitter mode.

Remote command:

[EMITter:MODE:ID](#) on page 471

**Emitter Beams Definition**

In each operating mode, the emitter uses one or more beams (e.g. with different pulse sequences), while using the same antenna and scan type. Emitters use multiple beams for exact position detection, especially when the distance to the objects and beamwidth increase.

Use the standard functions in the table to create or rename beams.

Search for a defined beam via "Search Alias".

Assign a pulse sequence to each beam.

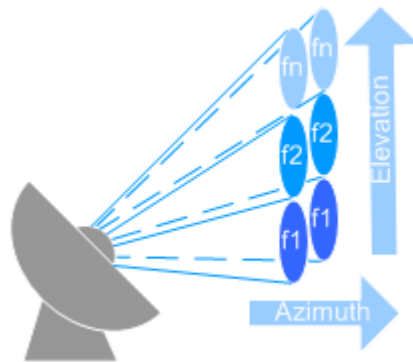


Figure 10-1: Stacked beams (simplified representation)

"Sequence" Selects an existing sequence or accesses a dialog for creating a sequence.  
See [Chapter 7.3, "How to create sequences and use the control elements"](#), on page 131

"Frequency Offset" Offsets the beam frequency by the selected value, see [Figure 10-1](#).

"Beam Position Offset" Offsets the beam in terms of an "Elevation" and an "Azimuth", see [Figure 10-1](#).

To *offset the complete emitter's antenna*, use one of the "Elevation" parameters, depending on your current scenario:

- "Single Emitter" scenario: [Elevation](#)  
(See ["To configure an emitter in a scenario with static receiver"](#) on page 234)
- "Localized Emitters" scenario: [Elevation](#)

Remote command:

[EMITter:MODE:BEAM:ADD](#) on page 429

[EMITter:MODE:BEAM:COUNT?](#) on page 429

[EMITter:MODE:BEAM:NAME](#) on page 427

[EMITter:MODE:BEAM:SELEct](#) on page 430

[EMITter:MODE:BEAM:STATE](#) on page 470

[EMITter:MODE:BEAM:SEQuence](#) on page 470

[EMITter:MODE:BEAM:OFFSet:AZIMuth](#) on page 469

[EMITter:MODE:BEAM:OFFSet:ELEVation](#) on page 470

[EMITter:MODE:BEAM:OFFSet:FREQuency](#) on page 470

[EMITter:MODE:BEAM:CLEar](#) on page 433

[EMITter:MODE:BEAM:DELEte](#) on page 432

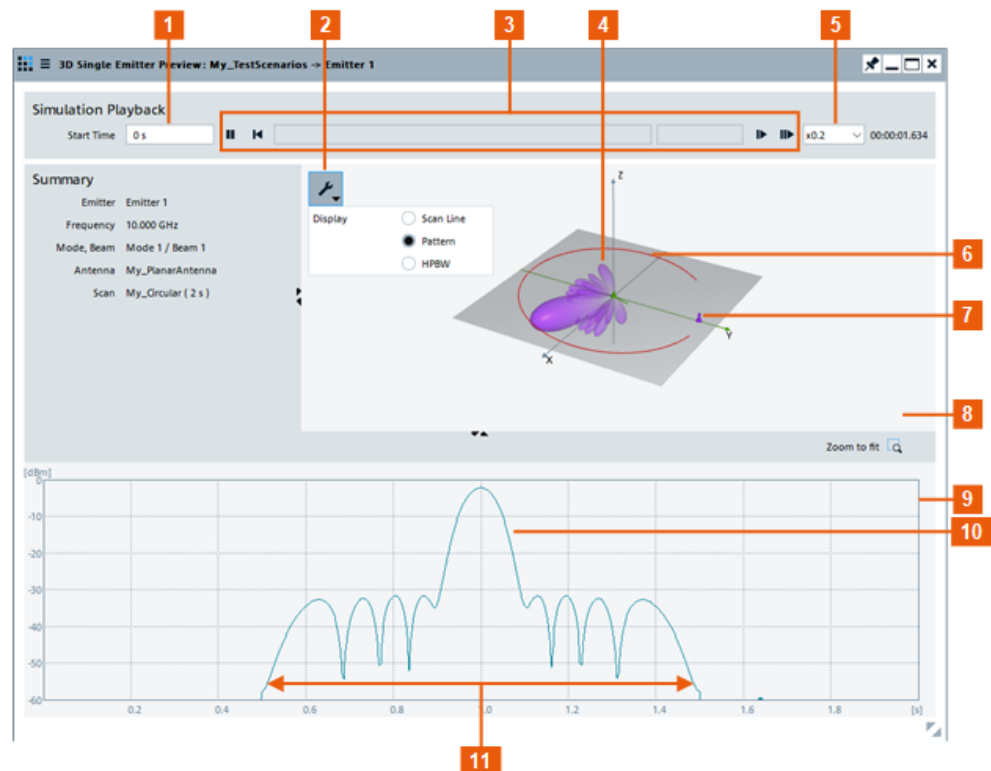
## 10.2 3D single emitter preview settings

Access:

1. Open a "Single Emitter" or an "Emitter (Collection)" scenario.
2. In the block diagram, select "3D".

The dialog displays:

- A 3D view of the emitter antenna with its pattern and scan
- A live plot of the normalized signal power level at the receiver



**Figure 10-2: 3D Emitter Preview: Understanding the displayed information**

- 1 = Preview time span (selected is one antenna turn)
- 2 = "Display settings" icon; defines how the scan is visualized
- 3 = Time bar; use the slider to set the "Start Time"
- 4 = Antenna pattern diagram of the emitter; antenna pattern without back lobes
- 5 = Play speed and time counter
- 6 = Circular antenna scan
- 7 = Receiver with an isotropic antenna pattern, no antenna scan and at a fixed location
- 8 = Interactive 3D view
- 9 = Live plot of the normalized signal power level at the receiver
- 10 = Antenna pattern without back lobes
- 11 = Antenna pattern (main and side lobes), compare with the pattern on [Figure 9-12](#)



**Available settings:**

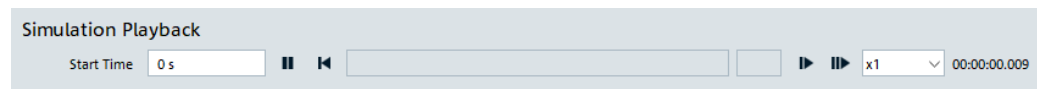
Simulation Playback.....	225
Display settings.....	225

**Simulation Playback**

Controls the timing of the simulation.

For example, with these settings you can analyze when/where/how often the beams overlap while simulating:

- A static scanning RX and a static scanning TX with different scan cycles.
- A moving RX and static TX
- A moving TX with different modes and a static RX



**Figure 10-3: Simulation Playback**

In addition to setting the overall duration, you can also observe a particular time-segment of the simulation by starting and stopping at particular times.

**Note:** The duration of a simulation depends on the scenario. An emitter with a long trajectory and low speed causes a long duration. A short trajectory and/or high speed cause a short duration.

The duration provides the maximum value for the "Stop Time" and "Preview Interval" settings.

"Start Time" Set to *0 s* or *minimum*, to play the simulation from the beginning. Typically, set this value to begin the simulation at a particular point along the trajectory.

Buttons Control the simulation using the following buttons:

- Pause/Play - use this toggle to pause the simulation and resume playing.
- Restart - use this button to restart the simulation at the configured "Start Time".
- Play slower/Play faster - decrease/increase the "Speed-up factor"

**Display settings**

Defines the way that the scan is represented:

"Scan Line" The scan is visualized by a line; the antenna pattern is disregarded.

"Pattern" The visualization corresponds to the current selected antenna pattern.

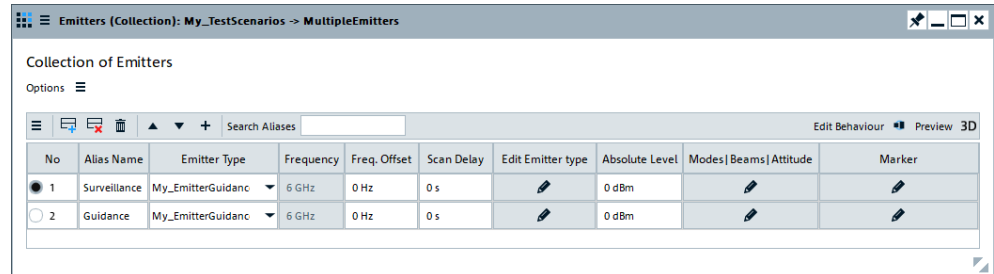
## 10.3 Emitters (Collection) settings

Access:

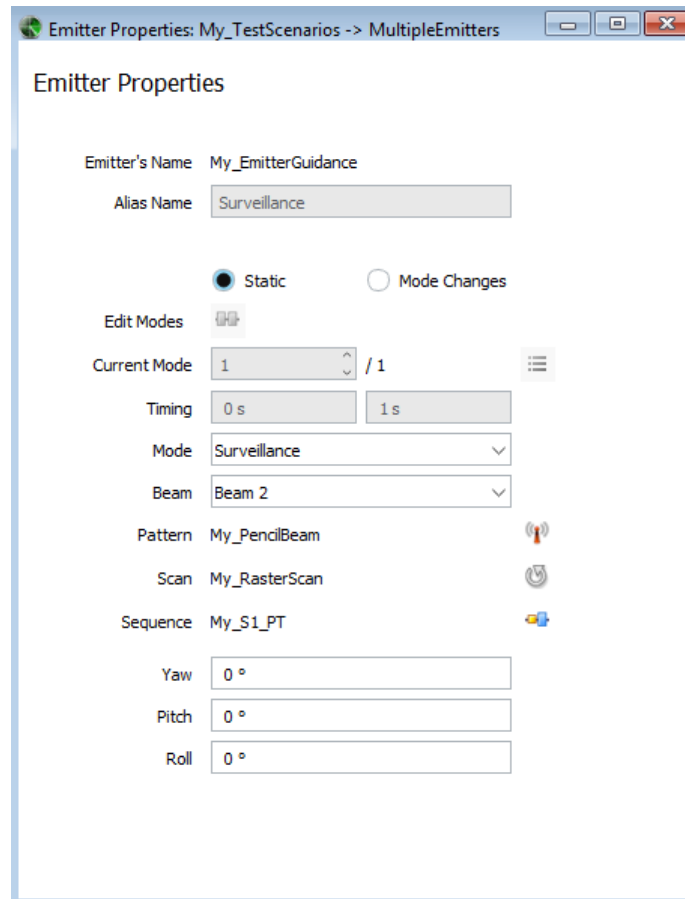
1. Open an "Emitters (Collection)" scenario.

- In the block diagram, select "Emitters > Edit".

The "Emitters (Collection)" scenario comprises several emitters. They display in list form.



- To observe and configure the properties of the individual emitters, select "Edit Emitter type". To configure attitude and behavior, select "Modes|Beams|Attitude".



The display resembles the emitters properties as they are configured in the "Emitter" dialogs, see [Chapter 10.1, "Emitter settings"](#), on page 220.

- [Collection of emitters](#).....227
- [Emitter properties](#).....229
- [Mode editor settings](#).....230

### 10.3.1 Collection of emitters

#### Settings:

Search Aliases.....	227
Options.....	227
Insert, Append, Prepend, Remove, Clear All, Move Up/Down, Copy and append.....	227
Preview 3D.....	227
Edit Modes.....	227
List of emitters.....	228
L No.....	228
L Alias Name.....	228
L Emitter Type.....	228
L Frequency.....	228
L Frequency offset.....	228
L Scan delay.....	228
L Edit Emitter Type.....	228
L Absolute Level.....	229
L Modes Beams Attitude.....	229
Markers.....	229

#### Search Aliases

Allows a fast search of the configured emitters; useful in scenarios with many emitters.

Filters and displays emitters in table rows according to the entered search string.

#### Options

Joint configuration of these values for all emitters at once.

- "Reset Freq. Offset"
- "Reset Scan Delay"
- "Reset Abs. Level"

#### Insert, Append, Prepend, Remove, Clear All, Move Up/Down, Copy and append

Standard functions, available as context menu and as icons.

See also "[To configure complex scenarios with several emitters](#)" on page 235.

Remote command:

[SCENario:CEMit:ADD](#) on page 429

[SCENario:CEMit:SELeCt](#) on page 430

[SCENario:CEMit:DELeTe](#) on page 432

[SCENario:CEMit:CLEar](#) on page 433

#### Preview 3D

Opens the "3D Scan Pair View" for the selected "Emitter".

See [Chapter 16.3, "3D scan pair view settings"](#), on page 302.

#### Edit Modes

Accesses the "Mode Editor" dialog.

This dialog allows graphical configuration for defining the duration that an emitter is working in the different modes.

Works like the [Mode Changes](#) settings but rather than defining the start and end time of a mode, you drag the start and end time on the time scale.

See:

- ["Behaviour"](#) on page 312
- [Chapter 10.3.3, "Mode editor settings"](#), on page 230

#### **List of emitters**

Displays an overview of the configured emitters in table form.

#### **No ← List of emitters**

Subsequent number.

Selects the emitter for that the "Preview 3D" and "Edit Modes" apply.

Remote command:

[SCENario:CEMit:SElect](#) on page 430

#### **Alias Name ← List of emitters**

Enters an alias name.

Remote command:

[SCENario:CEMit:ALias](#) on page 548

#### **Emitter Type ← List of emitters**

Selects an emitter.

Remote command:

[SCENario:CEMit:EMITter](#) on page 549

#### **Frequency ← List of emitters**

Indicates the [Frequency](#) value of the selected emitter.

#### **Frequency offset ← List of emitters**

Sets a frequency offset for the selected emitter.

Use this feature to configure the same emitter transmitting on different frequency.

Remote command:

[SCENario:CEMit:FQOffset](#) on page 555

#### **Scan delay ← List of emitters**

Adds a time delay for the selected emitter and thus shifts the scans in time compared to each other.

Use this feature to simulate more realistic situation in that the emitters do not all point to the receiver at the beginning of the simulation.

Remote command:

[SCENario:CEMit:SCNDelay](#) on page 555

#### **Edit Emitter Type ← List of emitters**

Accesses the [Emitter settings](#) dialog.

**Absolute Level** ← **List of emitters**

Sets the absolute level of the selected emitter.

Remote command:

[SCENario:CEMit:LVABs](#) on page 556

**Modes|Beams|Attitude** ← **List of emitters**

Accesses the [Emitter properties](#) dialog that shows an overview information of the properties of the selected emitter.

For emitters that can work in several modes, the dialog allows configuration of the mode changes. Some other settings are read-only.

**Markers**

Accesses the "Emitter Marker Config" dialog.

See "[Emitter Marker](#)" on page 315.

**10.3.2 Emitter properties**

Each emitter is described with the following parameters:

<a href="#">Emitter's Name, Alias Name</a> .....	229
<a href="#">Edit Modes</a> .....	229
<a href="#">Static, Mode Changes</a> .....	229
<a href="#">Antenna Pattern, Scan, Sequence</a> .....	230
<a href="#">Pitch, Yaw, Roll</a> .....	230

**Emitter's Name, Alias Name**

Indicates the emitter name and its alias name, as selected in the [Collection of emitters table](#).

**Edit Modes**

Accesses the "Mode Editor".

The mode editor allows graphical configuration for defining the duration that an emitter is working in the different modes.

Works like the [Mode Changes](#) settings but rather than defining the start and end time of a mode, you drag the start and end time on the time scale.

See:

- "[Behaviour](#)" on page 312
- [Chapter 10.3.3, "Mode editor settings"](#), on page 230

**Static, Mode Changes**

Enables emulation of emitters that change their mode over time.

See "[Behaviour](#)" on page 312.

"Mode"               Selects the mode that the emitter is working in.

"Beam"               Sets the number of the currently used beam.

Remote command:

`SCENario:CEMit:EMITter:MODE` on page 550

`SCENario:CEMit:EMITter:MODE:BEAM` on page 550

### Antenna Pattern, Scan, Sequence

Displays the current selected antenna pattern, antenna scan, and sequence.

To change any of them, select the corresponding icon.

### Pitch, Yaw, Roll

Offsets the antenna in terms of a "Pitch", a "Yaw" and a "Roll", see "Emitter attitude" on page 218.

Remote command:

`SCENario:CEMit:DIRection:PItCh` on page 549

`SCENario:CEMit:DIRection:YAW` on page 548

`SCENario:CEMit:DIRection:ROLL` on page 549

`SCENario:CEMit:EMITter:MODE:TRACkrec` on page 551

## 10.3.3 Mode editor settings

Access:

1. Open an "Emitter (Collection)" scenario.
2. In the block diagram, select "Emitters > Edit".
3. Select "Edit Modes".

You access the "Mode Editor" dialog for configuration of the mode changes of *all emitters* available in the scenario.

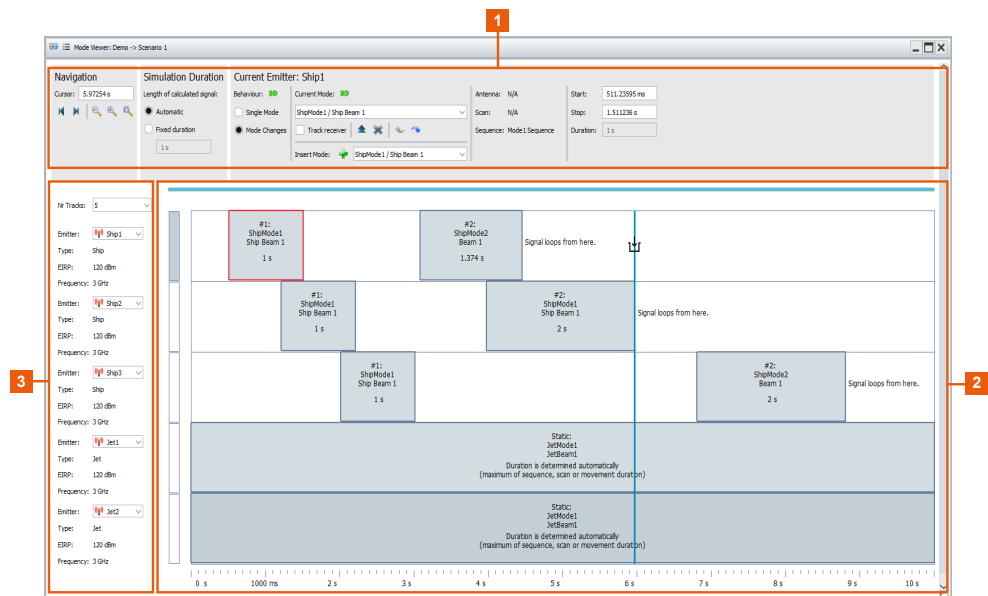


Figure 10-4: Mode Editor in Scenario Type = Localized Emitters

- 1 = Emitter and visualization settings
- 2 = Visualization area
- 3 = Configuration of the visualization area: select the number of displayed tracks ("Nr Tracks") and which emitter is displayed in the respective track

The "Mode Editor" is a graphical editor for joint configuration and defining the duration emitters are working in the different modes.

Works like the [Mode Changes](#) settings for each of the emitters. Rather than defining the start and end time of a mode, you drag the start and end time on the time scale.

### Settings:

<a href="#">Navigation</a> .....	231
<a href="#">Simulation Duration</a> .....	231
<a href="#">Current Emitter</a> .....	231
L <a href="#">Behavior</a> .....	231
L <a href="#">Current Mode</a> .....	231
L <a href="#">Track receiver</a> .....	231
L <a href="#">Editing Emitter Sequences</a> .....	232
L <a href="#">Insert Mode</a> .....	232
L <a href="#">Antenna/Scan/Sequence</a> .....	232
L <a href="#">Start/Stop</a> .....	232
L <a href="#">Duration</a> .....	232
<a href="#">Graph</a> .....	232

### Navigation

Standard functions: Move start/end into view and zooming.

"Cursor" indicates and sets the current cursor position.

### Simulation Duration

Resembles the settings in ["Duration"](#) on page 349. Included here for your convenience.

### Current Emitter

You can configure mode changes only for emitters with several modes, see ["Emitter Modes"](#) on page 221.

#### Behavior ← Current Emitter

Select the mode for the emitter.

"Single Mode"   Constant behavior over time.

"Mode Changes"

Change of behavior over time.

#### Current Mode ← Current Emitter

Sets the mode of the selected emitter.

#### Track receiver ← Current Emitter

If activated, modes track and follow the receiver with their antenna scan.

**Editing Emitter Sequences ← Current Emitter**

Edit emitter sequences directly in the visualization area.

 Extract selected mode

Removes the selected mode and its respective timeslot. Subsequent modes are shifted to close the timeslot of the removed mode.

 Lift selected mode

Removes the selected mode. Timeslot of the removed mode is left as gap in the sequence.

 Undo/Redo

Standard functions to reverse or repeat operation.

**Insert Mode ← Current Emitter**

 Inserts an emitter with the selected mode/beam at the cursor position.

**Antenna/Scan/Sequence ← Current Emitter**

Displays the mode and beam configuration of the selected emitter.

**Start/Stop ← Current Emitter**

Sets the beginning and the end time of the selected mode.

To define the beginning and end time, use one of the following:

- Enter the time value in the corresponding field
- Drag the beginning and end borders of the bar representing the selected mode on the graph

**Duration ← Current Emitter**

Indicates the duration of the selected mode. The value is calculated automatically from the selected "Start" and "Stop" values.

Remote command:

[SCENario:DF:MCHG:STATe](#) on page 557

[SCENario:DF:MCHG:SELEct](#) on page 431

[SCENario:DF:MCHG:ADD](#) on page 429

[SCENario:DF:MCHG:CLEar](#) on page 433

[SCENario:DF:MCHG:DELeTe](#) on page 432

[SCENario:DF:MCHG:COUNT?](#) on page 430

[SCENario:DF:MCHG:STARt](#) on page 557

[SCENario:DF:MCHG:STOP](#) on page 557

**Graph**

Comprises one or more bars, one per emitter available in the scenario.

To configure a particular emitter, select it. A blue bar next to the name indicates the currently selected one.

To edit a mode, select it. Currently selected modes are highlighted in red. You can set the start and end time of a mode by dragging it on the time axis or by setting the "Start" and "Stop" time.



## 10.4 How to create and configure emitters

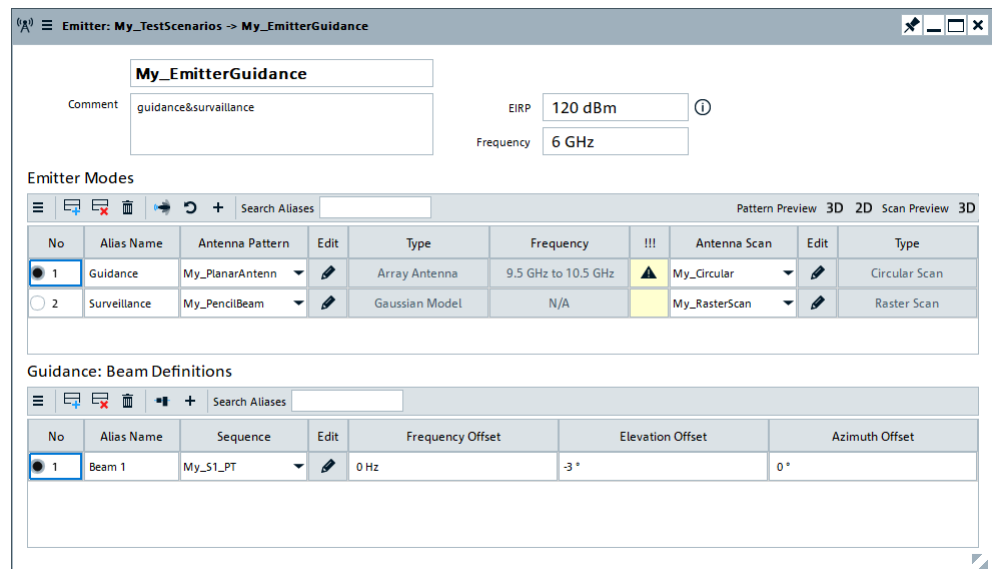
See:

- ["To create and configure a new emitter"](#) on page 233
- ["To configure an emitter in a scenario with static receiver"](#) on page 234
- ["To visualize the signal received by a static receiver"](#) on page 234
- ["To configure complex scenarios with several emitters"](#) on page 235

### To create and configure a new emitter

You can clone or copy an existing emitter or create an emitter:

1. Select "Repository Tree > Emitter > New".
2. Enter a name and a comment.
3. Select "Mode 1".  
To rename the emitter, double-click the alias name. Enter a name for the emitter mode, e.g. "Guidance".
4. Select "Ant. Pattern" and select an antenna pattern from the antenna library.
5. Select "Antenna Scan" and select an antenna scan from the scan library.
6. To configure the "Beam":
  - a) Select the beam via "No".
  - b) Select "Sequence" and select a sequence from the library.
7. If necessary, add a second beam.



For description of the provided settings, see [Chapter 10.1, "Emitter settings"](#), on page 220.

### To configure an emitter in a scenario with static receiver

1. Open a "Single Emitter" scenario.

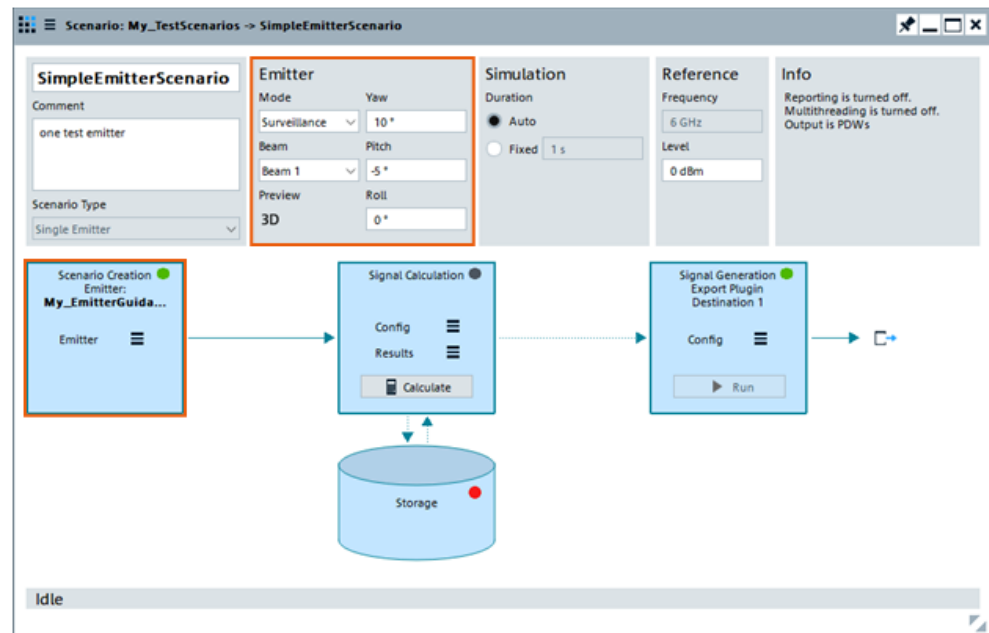


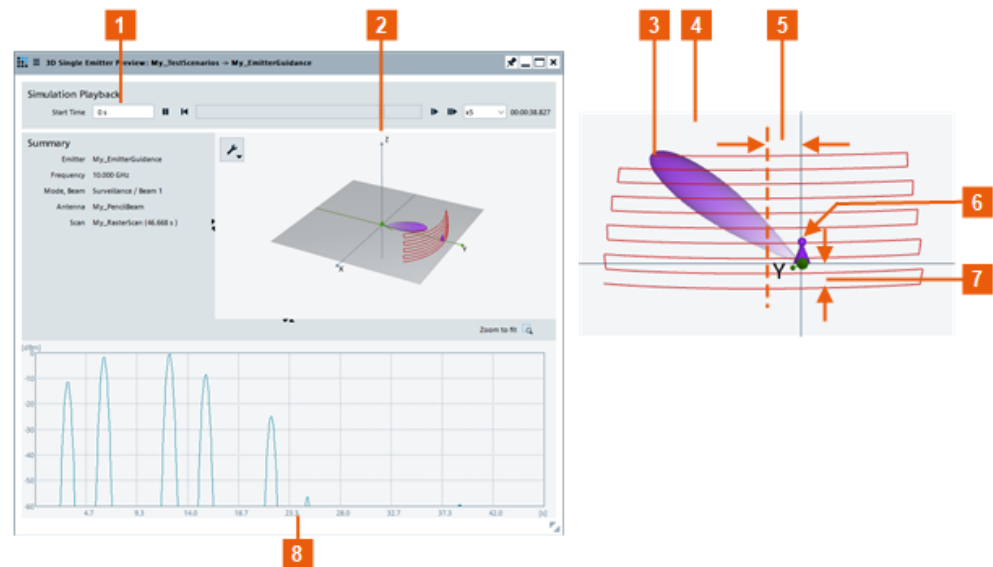
Figure 10-5: Single emitter scenario settings

2. In the block diagram, select "Scenario Creation > Emitter".  
In the context menu, select an emitter from the list of available emitters.
3. Configure the emitter settings, for example, select the current "Emitter Mode" and "Emitter Beam".

For a description of the possible settings, see [Chapter 10.3, "Emitters \(Collection\) settings"](#), on page 225.

### To visualize the signal received by a static receiver

1. Open a scenario with single emitter, e.g. "SimpleEmitterScenario".
2. In the block diagram, select "Emitter" settings > "Preview 3D".  
The dialog displays the signal as "seen" by a static receiver. By default, the receiver is located in such a way that the emitter scan is oriented with 0 deg "Pitch" and "Yaw" at it.
3. To "move" the receiver on the x-axis and on the z-axis, use "Emitter" settings > "Pitch" and "Yaw" (see [Figure 10-5](#)). The position on the y-axis (the distance to the emitter) is a fixed value.



**Figure 10-6: Signal at the receiver (XZ view): understanding the displayed information**

- 1 = Selection of preview time span (selected is one antenna turn). See ["Simulation Playback"](#) on page 225.
- 2, 4 = 4 is the XZ representation of the 2 3D view; 2 uses "Scan Line" = "Pattern"; 4 uses "Scan Line" = "On"
- 3 = Current position of the scanning beam
- 5 = "Yaw = 10 deg" turns the antenna horizontally, i.e. the receiver is not at the central scan axis but rotated in clockwise (CW) direction on the x-axis
- 6 = Receiver's position, determined by the selected "Yaw" and "Pitch"; the position on the y-axis (the distance to the emitter) is fixed
- 7 = "Pitch = -5 deg" turns the antenna vertically, i.e. "moves" the receiver on the z-axis
- 8 = Amplitude changes in the received signal over time

- 4. Use the mouse to change the orientation of the interactive 3D diagram and to zoom on it.

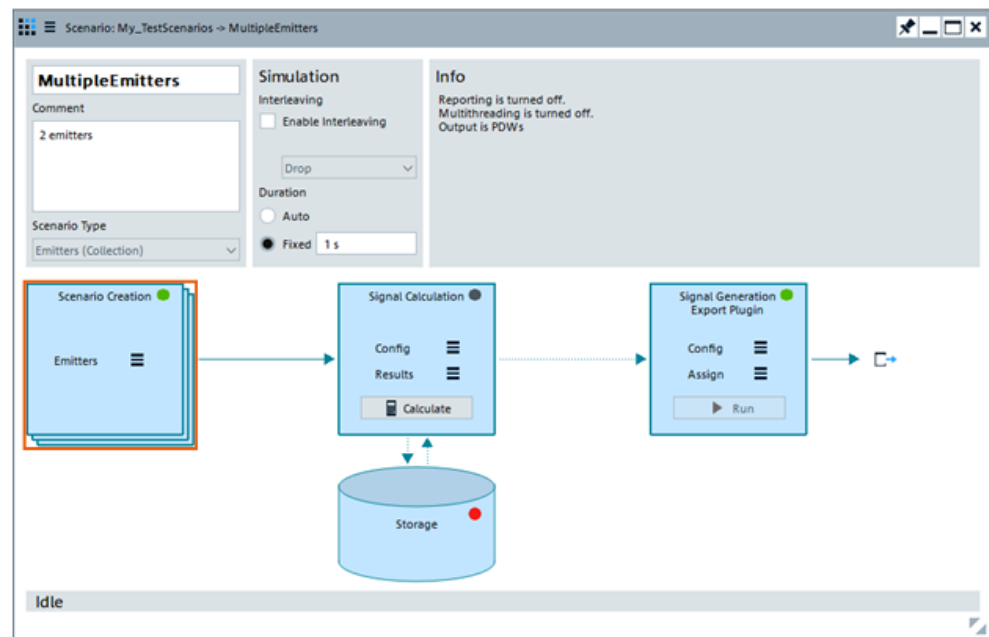
For a description of the provided settings, see [Chapter 10.2, "3D single emitter preview settings"](#), on page 224.

### To configure complex scenarios with several emitters

If your test situation requires testing the receiver's ability to detect the signal from different static emitters, you can use the "Emitter (Collection)" scenario. In this dedicated scenario, you can configure several emitters and switch between them sequentially. You can also configure the receiver and change its position in the scanning beam of the emitters.

The following example creates a complex scenario with several emitters and a receiver to explain the principle.

- 1. Open an "Emitter (Collection)" scenario.



- In the block diagram, select "Scenario Creation > Emitters".  
The "Emitters (Collection)" dialog opens.
- Use the standard "Append" function to insert the first emitter in the list.  
You can select from the list of available emitters or create an emitter.
- Configure the emitter settings, for example, enter an alias name.

The screenshot shows the 'Emitters (Collection)' dialog window. It contains a table with the following data:

No	Alias Name	Emitter Type	Frequency	Freq. Offset	Scan Delay	Edit Emitter type	Absolute Level	Modes Beams Attitude	Marker
1	Surveillance	My_EmitterGuidanc	6 GHz	0 Hz	0 s		0 dBm		
2	Guidance	My_EmitterGuidanc	6 GHz	0 Hz	0 s		0 dBm		

- In the "Emitters (Collection)" dialog, select the emitter that is transmitting, e.g. "Surveillance" in the "No" column.
- From the controls above the table, select the "Preview 3D" view to visualize the signal received by a static receiver.  
See [Figure 10-6](#).

For a description of the provided settings, see:

- [Chapter 10.3, "Emitters \(Collection\) settings"](#), on page 225
- [Chapter 10.2, "3D single emitter preview settings"](#), on page 224

**To create a single emitter scenario automatically with the "Startup Assistant"**

Alternatively to the methods described in this section, you can use the "Startup Assistant" to create a single emitter scenario.

1. In the menu bar, select "Help > Wizard".
2. Select "Create an emitter".  
Confirm with "Next".
3. Follow the instructions, use the default settings and select "Finish".  
For detailed step-by-step description, see [Chapter 2.8.5, "Using the wizard to create a complex scenario"](#), on page 39.

For information on the provided settings, see:

- [Chapter 10.1, "Emitter settings"](#), on page 220
- [Chapter 9.2, "Antenna pattern settings"](#), on page 174
- [Chapter 9.3, "Antenna scans settings"](#), on page 193
- [Chapter 6.2.3, "Modulation on pulse \(MOP\) settings"](#), on page 96

# 11 Combining the signals of multiple emitters

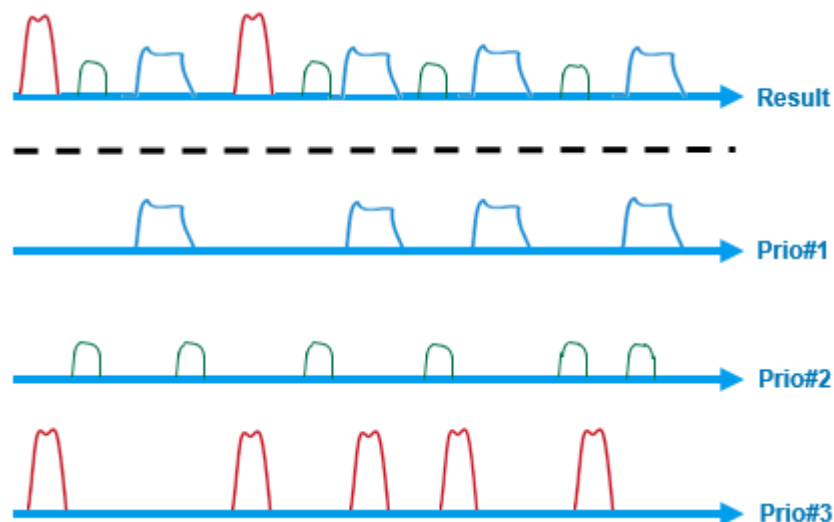
In a real-world scenario, radar receivers have to detect and process several simultaneous signals from different emitters. Such scenarios are referred to as multi-emitter scenarios. In multi-emitter scenarios, the signal at the radar receiver is a combination of the signals of several emitters.

## About the interleaving

Option: R&S PULSE-K39

In addition to processing the emitters sequentially, you can also combine them into a single output file.

During the interleaving process in "Drop" mode, overlapping pulses within the same interleaving group and with lower priority are dropped. The priority of the individual emitters is configurable as is the definition of several groups and the assignment of the emitters to them. In "Merge" mode, priorities are not set and overlapping pulses are interleaved without dropping.



**Figure 11-1: Principle of the priority-based interleaving algorithm (applied per interleaving group)**

Prio#1 = Pulses with the highest priority (i.e. the priority value is 0 or smaller than the value for the other emitters)

Prio#3 = Pulses with the lowest priority (i.e. the highest priority value within the emitters)

Interleaving signals and combining them into single output signal is a function provided in the following scenario types:

- Emitters (collection)
- Localized emitters
- Direction finding
- PDW list (collection)

This section described the settings in the first three scenario types. For description of the settings in the last one, see [Chapter 18.6, "PDW list \(Collection\) interleaving settings"](#), on page 370.

- [Emitters \(Collection\) and localized emitters interleaving settings](#)..... 239
- [Emitters interleaving progress statistics](#).....243
- [Signal preview with interleaved and dropping statistics](#).....244
- [Analyze interleaved signals](#).....245

## 11.1 Emitters (Collection) and localized emitters interleaving settings

Option:R&S PULSE-K39

Access:

1. In a "Scenario Type = Emitters (Collection)/Localized Emitters/Direction Finding", select "Emitter > Interleaving > On".
2. Select "Interleaving > Config".

Dialog displays the available emitters as configured in the dialogs:

- [Emitters \(Collection\)](#)
- "Localized Emitters" > [Properties of TX items \(emitters and platforms\)](#)
- "Direction Finding" > [Properties of TX items \(emitters and platforms\)](#).

The interleaving related settings, like "Time Offset" and "Priority", are also displayed.

Alias Name	Emitter Type	Frequency	Freq. Offset	Scan Delay	Marker	Enable	Time Offset	Prio (0=Highest)	Level Offset	Interleaving Group
Surveillance	My_EmitterGuidanc	6 GHz	0 Hz	0 s		<input checked="" type="checkbox"/>	0 s	0	0 dB	Default
Guidance	My_EmitterGuidanc	6 GHz	0 Hz	0 s		<input checked="" type="checkbox"/>	0 s	1	0 dB	Default

Settings:

- [Threshold](#)..... 240
- [Search Aliases](#)..... 240
- [Interleaving Options](#)..... 240
- [Edit](#)..... 240
- [Alias Name](#)..... 240
- [Emitter type](#)..... 240
- [Frequency](#)..... 240
- [Freq. Offset](#)..... 241
- [Scan delay](#)..... 241
- [Marker](#)..... 241
- [Enable](#)..... 241

Time Offset.....	241
Priority.....	241
Level Offset.....	242
Interleaving Group.....	242
Edit Interleaving Groups.....	242
L Select, Insert, Append/Prepend, Remove, Clear.....	242
L No.....	243
L Alias Name.....	243

### Threshold

Enters a level threshold to limit the dynamic range of the signal. Pulses at levels below this threshold are omitted.

Resembles the value set with the parameter "Scenario > Signal Generation > Config > Waveform Generation > Output > Threshold".

Remote command:

[SCENario:CEMit:THReshold](#) on page 563

[SCENario:DF:THReshold](#) on page 564

[SCENario:LOCalized:THReshold](#) on page 564

[SCENario:OUTPut:THReshold](#) on page 564

### Search Aliases

Allows fast search of the configured emitters; useful in scenarios with many emitters.

Filters and displays emitters in table rows according to the entered search string.

### Interleaving Options

Joint configuration of all emitters at once.

- "Enable All"/"Disable All"
- "Reset Time offset"/"Reset Level offset"
- "Reset Prio"

### Edit

Opens the "Interleaving Groups" dialog.

See "[Edit Interleaving Groups](#)" on page 242.

### Alias Name

Displays the alias name.

Remote command:

[SCENario:CEMit:ALIAS](#) on page 548

### Emitter type

Displays the emitter name as selected with [Emitter Type](#).

Remote command:

[SCENario:CEMit:EMITter](#) on page 549

### Frequency

Indicates the [Frequency](#) value of the selected emitter, as selected in the [Emitter](#) dialog.



Remote command:

[SCENario:CEMit:FREQuency?](#) on page 555

### **Freq. Offset**

Displays the frequency offset of the emitter as selected with [Frequency offset](#).

Remote command:

[SCENario:CEMit:FQOFFset](#) on page 555

### **Scan delay**

Displays the scan delay for the emitter as selected with [Scan delay](#).

Remote command:

[SCENario:CEMit:SCNDElay](#) on page 555

### **Marker**

Opens the "Emitter Marker Config" dialog.

See [Emitter Marker](#).

### **Enable**

Selects the emitter for interleaving.

If disabled, the signal of the emitter is not included in the interleaved output signal.

Remote command:

[SCENario:CEMit:ENABle](#) on page 559

[SCENario:DF:ENABle](#) on page 559

[SCENario:LOCalized:ENABle](#) on page 559

### **Time Offset**

Available if "Enable" = On.

Shifts the signals relative to each other to prevent high drop out rates due to pulse overlap.

Use this function, for example, to decrease the number of dropped pulses.

Remote command:

[SCENario:CEMit:LDELay](#) on page 560

[SCENario:DF:LDELay](#) on page 560

[SCENario:LOCalized:LDELay](#) on page 560

### **Priority**

Available if "Enable" = On.

Sets the priority of the selected emitter. Higher value means lower priority. If pulses are overlapping, the pulses from the emitter with lower priority are discarded.

See [Figure 11-1](#).

Remote command:

[SCENario:CEMit:PRIority](#) on page 560

[SCENario:DF:PRIority](#) on page 560

[SCENario:LOCalized:PRIority](#) on page 560

**Level Offset**

Available if "Enable" = On.

Adds a relative level offset between the signals.

Remote command:

[SCENario:CEMit:LEVel](#) on page 560

[SCENario:DF:LEVel](#) on page 560

[SCENario:LOCalized:LEVel](#) on page 560

**Interleaving Group**

Assigns the emitter to one of the available interleaving groups, defined in the [Edit Interleaving Groups](#) dialog.

Remote command:

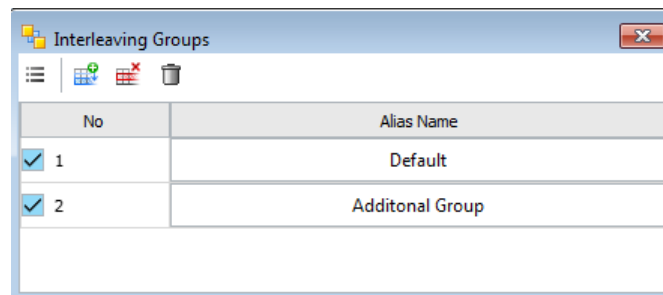
[SCENario:CEMit:GROup](#) on page 561

[SCENario:DF:GROup](#) on page 561

[SCENario:LOCalized:GROup](#) on page 561

**Edit Interleaving Groups**

Select the icon to access the "Interleaving Groups" dialog.



Interleaving groups allow you to combine the emitter signals into different output signals.

Use the standard functions (icons) to add a new group, rearrange the groups, delete the existing one or all groups.

**Select, Insert, Append/Prepend, Remove, Clear ← Edit Interleaving Groups**

Standard functions for items handling, see ["Standard function in the context menus"](#) on page 33.

Select a row, for example, to delete it or to insert a row before it.

Remote command:

[SCENario:CEMit:GROup:CATalog?](#) on page 561

[SCENario:CEMit:GROup:SElect](#) on page 430

[SCENario:CEMit:GROup:ADD](#) on page 429

[SCENario:CEMit:GROup:DElete](#) on page 432

[SCENario:CEMit:GROup:CLEar](#) on page 433

[SCENario:DF:GROup:CATalog?](#) on page 561

[SCENario:DF:GROup:SElect](#) on page 430

[SCENario:DF:GROup:ADD](#) on page 429

[SCENario:DF:GROup:DElete](#) on page 432

[SCENario:DF:GROup:CLEar](#) on page 433

[SCENario:LOCalized:GROup:CATalog?](#) on page 561

[SCENario:LOCalized:GROup:SElect](#) on page 430

[SCENario:LOCalized:GROup:ADD](#) on page 429

[SCENario:LOCalized:GROup:DElete](#) on page 432

[SCENario:LOCalized:GROup:CLEar](#) on page 433

#### **No. ← Edit Interleaving Groups**

Select a row to perform any row-based actions.

Interleaving groups are indicated by consecutive number; also used for indication in remote control.

Remote command:

[SCENario:CEMit:GROup:COUnT?](#) on page 429

[SCENario:CEMit:GROup:SElect](#) on page 430

[SCENario:DF:GROup:COUnT?](#) on page 429

[SCENario:DF:GROup:SElect](#) on page 430

[SCENario:LOCalized:GROup:COUnT?](#) on page 429

[SCENario:LOCalized:GROup:SElect](#) on page 430

#### **Alias Name ← Edit Interleaving Groups**

Enter an alias name for the interleaving group.

Remote command:

[SCENario:CEMit:GROup:ALIAS](#) on page 561

[SCENario:DF:GROup:ALIAS](#) on page 561

[SCENario:LOCalized:GROup:ALIAS](#) on page 561

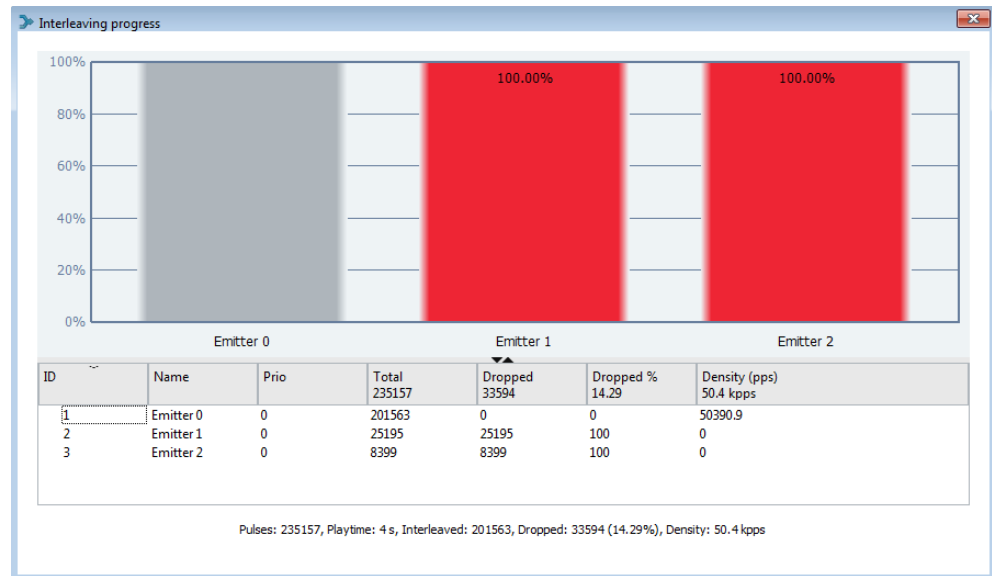
## 11.2 Emitters interleaving progress statistics

Option:R&S PULSE-K39

Access:

1. In a "Scenario Type = Emitters (Collection)", select "Emitter > Interleaving > On".
2. Select "Signal Control > Prepare".
3. Select "Signal Control > Interleave".

The "Interleaving Progress" display opens automatically during the signal calculation, if pulses lists are merged. It indicates the percentage of pulses being processed and dropped for each of the emitters.



## 11.3 Signal preview with interleaved and dropping statistics

Option: R&S PULSE-K39

Access:

1. In a "Scenario Type = Emitters (Collection)", select "Emitter > Interleaving > On".
2. Select "Signal Control > Prepare".
3. Select "Signal Control > Interleave".
4. Select "Interleaving > Results > Interleaved PDW/Dropped PDWs".

ID	TOA	Level	PW	Freq	Phase	Mode	MOP	Param	Marker
1	Emitter 0	0.000 000 000 0...	0.00 dB	1 us	0 Hz	0.00	RT	UNMOD	0010
2	Emitter 0	0.000 010 000 0...	0.00 dB	1 us	0 Hz	0.00	RT	UNMOD	0010
3	Emitter 0	0.000 020 000 0...	0.00 dB	1 us	0 Hz	0.00	RT	UNMOD	0010
4	Emitter 0	0.000 030 000 0...	0.00 dB	1 us	0 Hz	0.00	RT	UNMOD	0010
5	Emitter 0	0.000 040 000 0...	0.00 dB	1 us	0 Hz	0.00	RT	UNMOD	0010
6	Emitter 0	0.000 050 000 0...	0.00 dB	1 us	0 Hz	0.00	RT	UNMOD	0010
7	Emitter 0	0.000 060 000 0...	0.00 dB	1 us	0 Hz	0.00	RT	UNMOD	0010
8	Emitter 0	0.000 070 000 0...	0.00 dB	1 us	0 Hz	0.00	RT	UNMOD	0010
9	Emitter 0	0.000 080 000 0...	0.00 dB	1 us	0 Hz	0.00	RT	UNMOD	0010
10	Emitter 0	0.000 090 000 0...	0.00 dB	1 us	0 Hz	0.00	RT	UNMOD	0010
11	Emitter 0	0.000 100 000 0...	0.00 dB	1 us	0 Hz	0.00	RT	UNMOD	0010

The dialog is similar to the "Signal Preview" dialog.

This section describes the settings dedicated to the "Interleaved/Dropped" dialogs. For description of all other settings, see [Chapter 15.1, "Signal preview settings"](#), on page 284.

#### Settings:

<a href="#">Display &gt; Filter</a> .....	245
<a href="#">Table</a> .....	245
<a href="#">Graphics</a> .....	245
<a href="#">Graphics &gt; Highlight</a> .....	245
<a href="#">Histogram</a> .....	245
<a href="#">Statistic</a> .....	245

#### Display > Filter

If interleaving is used, the calculated output signal contains pulses originating for multiple PDW lists or emitters. By default, all pulses are displayed. Use the "Filter" parameter to narrow down the displayed information to the pulses of one of the emitters/PDW lists.

The filter does not change the zoom level or the scaling on both axis.

#### Table

Provides summary information on the number of processes pulses and the content of the output file.

#### Graphics

Visualize the variation of the parameters over time.

For details, see "[Graphics](#)" on page 287.

#### Graphics > Highlight

Highlights pulses belonging to the selected emitter/PDW list.

#### Histogram

Resembles the information displayed during the signal processing, see [Chapter 18.7, "PDW interleaving progress statistics"](#), on page 373.

Use the filtering option to narrow down to the displayed information according to one of the predefined criteria.

#### Statistic

The drop out statistic is the table form representation of the same information as the [Histogram](#).

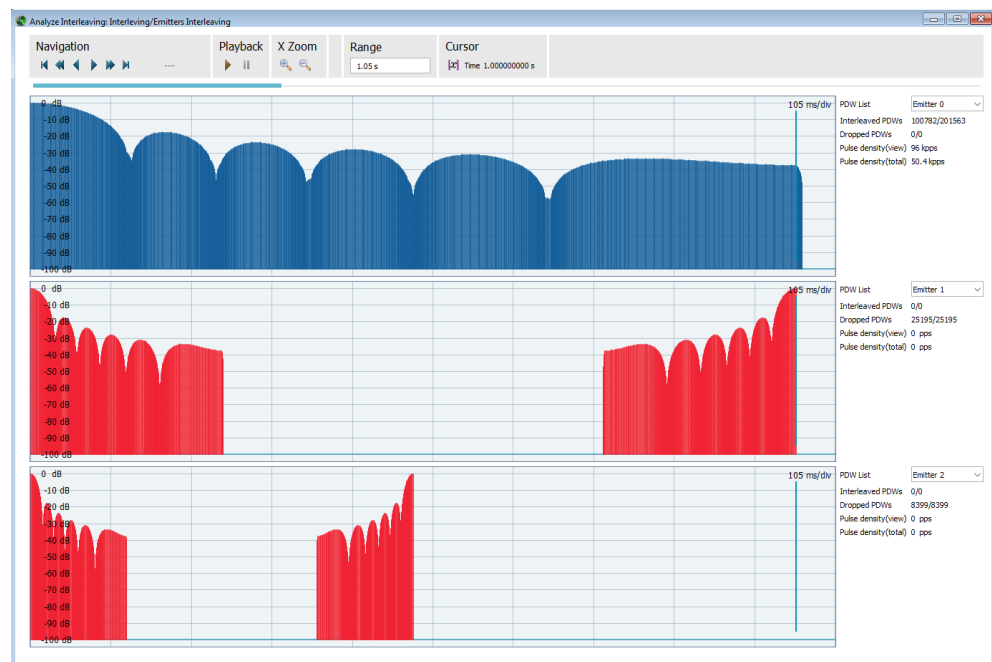
## 11.4 Analyze interleaved signals

Option:R&S PULSE-K39

Access:

1. In a "Scenario Type = Emitters (Collection)", select "Emitter > Interleaving > On".
2. Select "Simulation > Interleaving".
3. Select "Signal Calculation > Calculate".
4. Select "Interleaving > Results > View > Analyze".

The "Interleaving progress" dialog indicates the pulses that are and are not included in the resulting output file. Pulses displayed in **red** are **dropped out**.



The provided settings are a subset of the settings available in the "Signal Preview" displays and they have the same effect.

5. To increase the number of interleaved pulses, add a *delay to one of the emitters*. For example, zoom in the beginning of the signal until you can observe the individual pulses and estimated the required delay. Set, for example, "Interleaving > Config > Emitter#1 > Time Offset = 5 us". Create the output signal in the same manner. The signal is not recalculated; only the new interleaving settings applied. Observe the resulting output signal.

Depending on the settings, the output file includes more or even all pulses originating from all emitters.

## 12 Creating platforms

This section describes the use of platforms in the R&S Pulse Sequencer Digital. It covers their characteristics and explains the provided settings and views.

### 12.1 About platforms

A platform is a group of up to 8 emitters assigned to a single vehicle.

A platform is characterized by its icon, list of emitters, position and trajectory.

The emitters on a platform can be individually configured.

One or more platforms can be included in a scenario. Within a scenario, each platform can be individually enabled or disabled.

### 12.2 Platform settings

This section describes how platforms can be created and configured.

Access:

- ▶ To create a platform, do one of the following:
  - a) In the repository tree, select "Platform Types" > context menu > "New".
  - b) Select an existing platform > context menu > "Clone".

A new platform is added to the repository. The "Platform" dialog opens.



R&S Pulse Sequencer Digital generates new platform names automatically. You can edit the platform name.

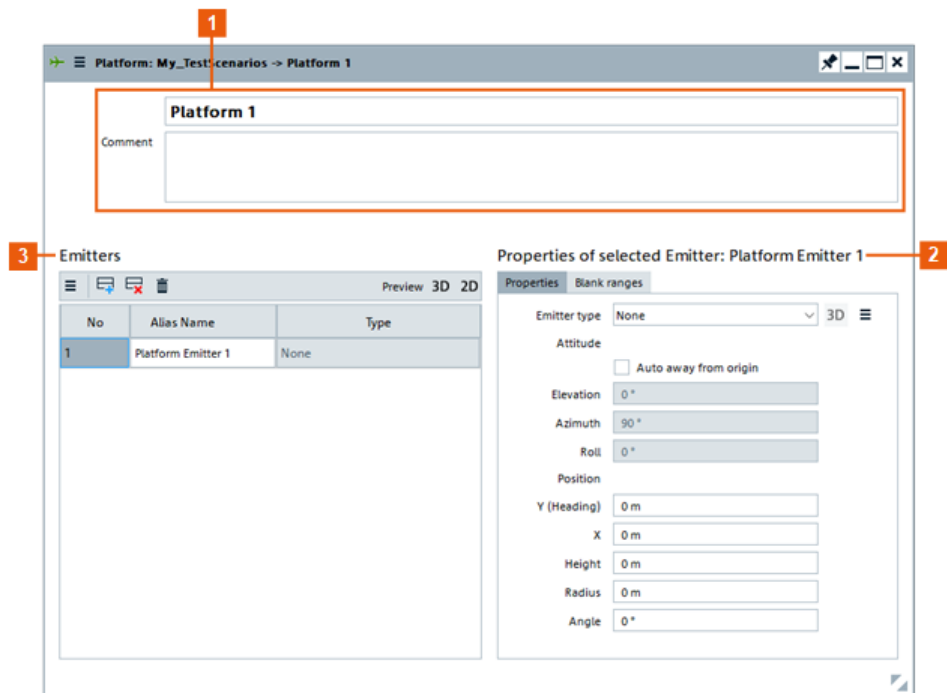


Figure 12-1: New platform in the Platform dialog

- 1 = Platform information
- 2 = Properties of selected emitter
- 3 = Emitter list

## Settings

- [Platform information](#)..... 248
- [Emitter list](#)..... 249
- [Properties of selected emitter](#)..... 252
- [Blank ranges of selected emitter](#)..... 255

### 12.2.1 Platform information

#### Name

The name of the new platform is created automatically.

The format of the new name depends on how it was created.

- **New platform**  
The automatically generated name consists of the word *Platform* and a number - e.g. Platform 1. The number is incremented for every new platform.
- **Cloned platform**  
The name of a cloned platform consists of the name of the parent and a numerical index. For example:
  - Platform 1
  - Platform 1.1 = first clone of *Platform 1*
  - Platform 1.2 = second clone of *Platform 1*



- Platform 1.2.1 = first clone of Platform 1.2

To change the name, select the text and edit it.

**Note:** R&S Pulse Sequencer Digital does not support duplicate names. If you enter a duplicate name, a popup error message appears.

Remote command:

- [PLATform:NAME](#) on page 427
- [PLATform:CREate](#) on page 426
- [PLATform:SElect](#) on page 426
- [PLATform:CATalog?](#) on page 425
- [PLATform:REMove](#) on page 428

**Comment**

Use this optional field to provide additional information about the platform.

Remote command:

- [PLATform:COMment](#) on page 427

**ID**

Platform identifier.

Remote command:

- [PLATform:ID](#) on page 578

**12.2.2 Emitter list**

Enables you to add, remove and edit the emitters of the platform.

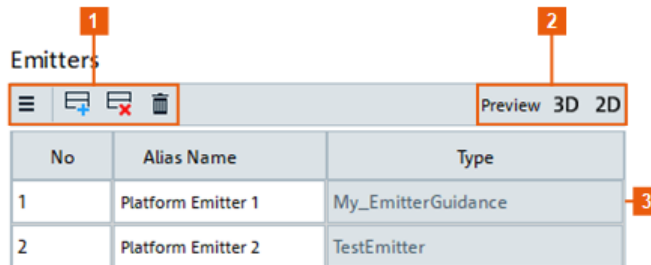


Figure 12-2: Emitter list example

- 1 = Icons for standard functions
- 2 = Icons for 2D or 3D previews of the platform
- 3 = List of emitters: by number ("No") and "Alias Name"

- [Icons for standard functions](#).....250
- [List of emitters](#).....250
- [Icon for 2D preview](#).....250
- [Icon for 3D preview](#).....251
  - [L Selected Emitter](#).....252
    - [L Mode](#).....252
    - [L Beam](#).....252
  - [L Opacity](#).....252

**Icons for standard functions**

Enable you to access properties, add or delete an emitter (see also [Table 2-4](#)).

**List of emitters**

A platform must have at least one emitter, so one unconfigured emitter is added to a new platform.

You can configure up to 8 emitters on a platform.

Select an emitter to view/edit its properties in [Properties of selected emitter](#).

Remote command:

[PLATform:EMITter:SElect](#) on page 426

[PLATform:EMITter:ALIAS](#) on page 579

**Icon for 2D preview**

Icon that accesses the 2D preview of the platform.

[Figure 12-3](#) shows an example with two emitters.

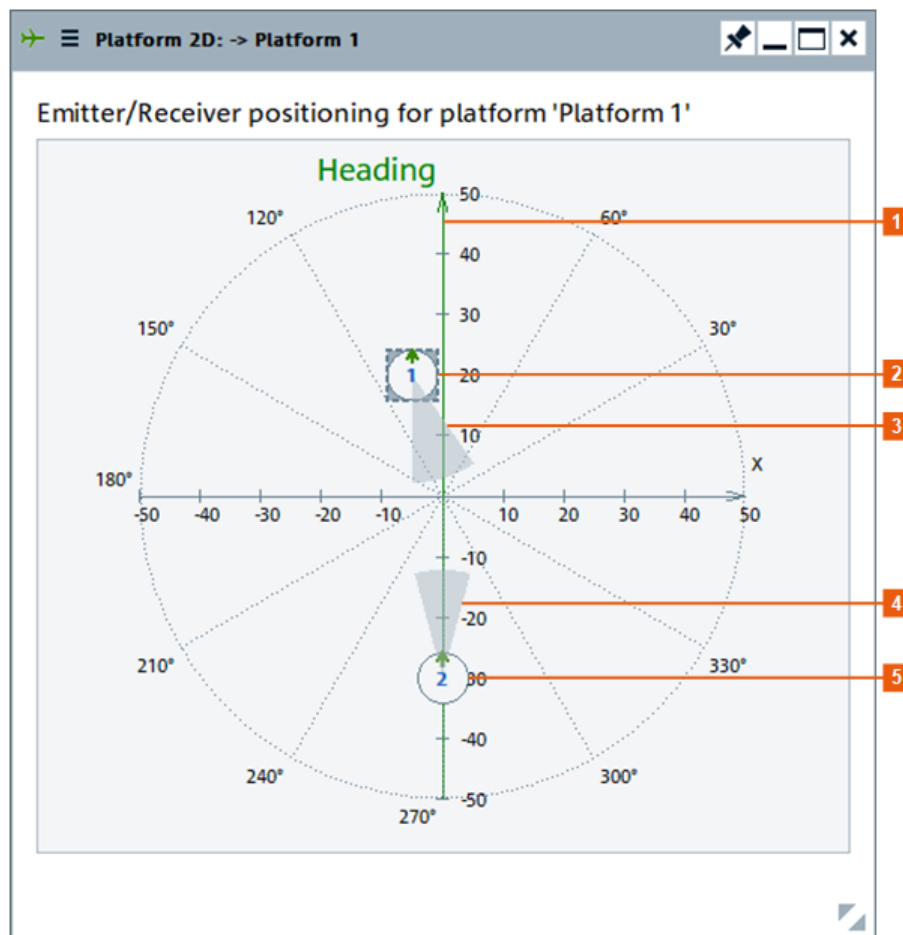


Figure 12-3: Platform 2D view example

- 1 = Heading of platform
- 2 = Emitter-1
- 3 = Blank range of emitter-1
- 4 = Blank range of emitter-2
- 5 = Emitter-2

This example shows you:

- A platform that represents two radars aboard a ship.
- "Heading" indicates the platform's direction of travel.
- Emitter-1 is mounted off-axis and has a blanking range towards the rear of the platform.
- Emitter-2 is mounted on-axis and has a blanking range towards the front of the platform.
- The icon for emitter-1 has a frame. This frame indicates that this emitter is selected in the emitter list.

### Icon for 3D preview

Icons that access the 2D or 3D preview of the platform.

Figure 12-4 shows an example with the same two emitters as Figure 12-3.

The "2D" view shows the precise horizontal placement of the emitters. The "3D" view shows the placement of the emitters, both horizontally and vertically, relative to the platform's origin.

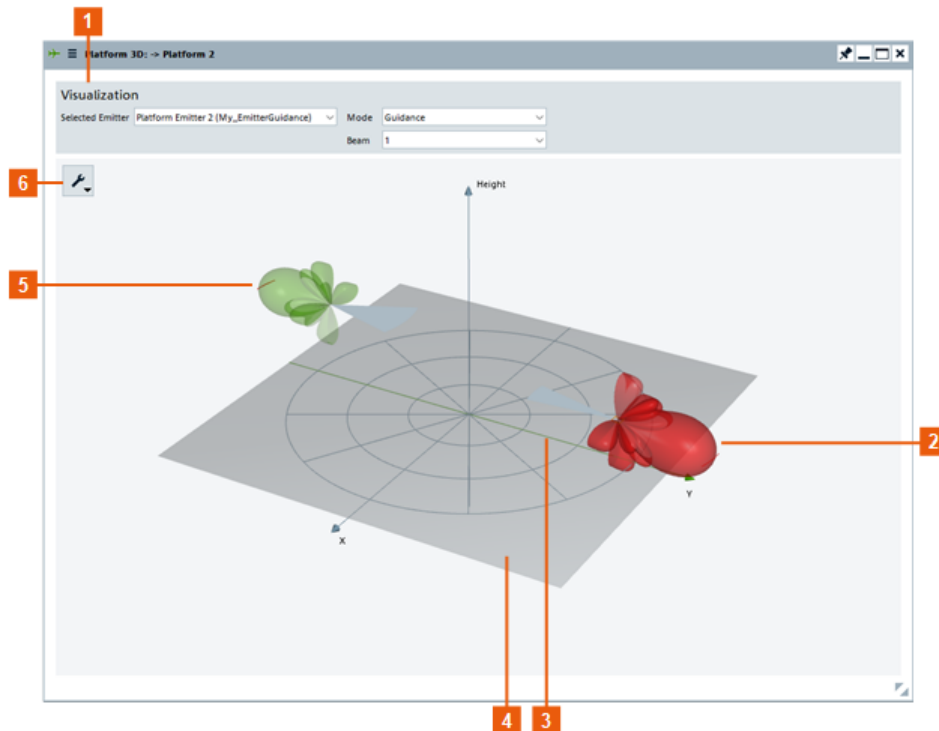


Figure 12-4: Platform 3D view example

- 1 = Visualization settings
- 2 = Antenna pattern and blank range of emitter 1
- 3 = Heading of platform

- 4 = Ground plain
- 5 = Antenna pattern and blank range of emitter 2
- 6 = Tools

Settings and tools:

**Selected Emitter** ← **Icon for 3D preview**

Sets the emitter for which the "Mode" and "Beam" settings apply.

The drop-down list contains all emitters of the selected platform.

The selected emitter is colored red in the 3D preview.

**Mode** ← **Selected Emitter** ← **Icon for 3D preview**

Defines which mode of the selected emitter is visualized in the 3D preview.

The drop-down list contains all modes of the selected emitter.

**Beam** ← **Selected Emitter** ← **Icon for 3D preview**

Defines which beam of the selected emitter is visualized in the 3D preview.

The drop-down list contains all beams of the selected emitter.

**Opacity** ← **Icon for 3D preview**

Use this function to make the antenna patterns more or less transparent.

### 12.2.3 Properties of selected emitter

This tab contains the parameters of the emitter selected in the "Emitter" list of the "Platform" dialog.

Properties of selected Emitter: Platform Emitter 2

Properties	Blank ranges
Emitter	Phased array 1 <span style="color: green;">3D</span> <span>☰</span>
Elevation	0 °
Azimuth	270 °
Roll	0 °
Attitude	<input type="checkbox"/> Auto away from origin
Y (Heading)	-30 m
X	0 m
Height	30 m
Radius	30 m
Angle	270 °

Figure 12-5: Example of emitter properties configuration

**Settings**

<a href="#">Emitter</a> .....	253
<a href="#">Elevation</a> .....	253
<a href="#">Azimuth</a> .....	253
<a href="#">Roll</a> .....	253
<a href="#">Attitude</a> .....	254
<a href="#">Y (Heading)</a> .....	254
<a href="#">X</a> .....	254
<a href="#">Height</a> .....	254
<a href="#">Radius</a> .....	255
<a href="#">Angle</a> .....	255

**Emitter**

Selects the emitter assigned to the item selected in the "Emitter" list of the "Platform" dialog.

Remote command:

[PLATform:EMITter](#) on page 579

**Elevation**

Sets the elevation of the emitter item's pointing direction, relative to the platform's azimuth plane.

Values can be:

- Positive - pointing above the azimuth plane (e.g. air traffic control radar)
- Negative - pointing below the azimuth plane (e.g. aircraft landing radar)

This setting "[Attitude](#)" on page 254 overrides the "Elevation" parameter.

Remote command:

[PLATform:EMITter:ELEVation](#) on page 581

**Azimuth**

Sets the azimuth of the emitter item's pointing direction, relative to the platform's heading.

For static emitters, this parameter sets the azimuth of the beam.

For circular emitters, this parameter sets the beam direction at the start of the scan.

For sector scans, this parameter sets center of the scanned sector.

The setting "[Attitude](#)" on page 254 overrides the "Azimuth" parameter.

Remote command:

[PLATform:EMITter:AZIMuth](#) on page 579

**Roll**

Sets the roll of the emitter item's pointing direction, relative to the platform's up direction.

Remote command:

[PLATform:EMITter:ROLL](#) on page 582

### Attitude

Selecting the "Auto away from origin" checkbox, sets the "Azimuth" and "Elevation" automatically.

- "Elevation" - automatically set to 0°
- "Azimuth" - automatically configured so that the beam axis is radial to the platform origin.

Remote command:

[PLATform:EMITter:DIRection:AWAY](#) on page 581

### Y (Heading)

The position of an emitter on a platform is defined by three parameters:

- "Y (Heading)"
- "X" (see ["X"](#) on page 254)
- "Height" (see ["Height"](#) on page 254)

The "Y (Heading)" parameter defines the position of the emitter (in the direction of movement) relative to the platform's origin.

**Note:** The XY position can also be defined via the "Radius" from the origin and the "Angle" relative to the X-axis.

Remote command:

[PLATform:EMITter:Y](#) on page 583

### X

The position of an emitter on a platform is defined by three parameters:

- "Y (Heading)" (see ["Y \(Heading\)"](#) on page 254)
- "X"
- "Height" (see ["Height"](#) on page 254)

The "X" parameter defines the position of the emitter (at right-angles to the direction of movement) relative to the platform's origin.

**Note:** The XY position can also be defined via the "Radius" from the origin and the "Angle" relative to the X-axis.

Remote command:

[PLATform:EMITter:X](#) on page 582

### Height

The position of an emitter on a platform is defined by three parameters:

- "Y (Heading)" (see ["Y \(Heading\)"](#) on page 254)
- "X" (see ["X"](#) on page 254)
- "Height"

The "Height" parameter defines the position of the emitter relative to the XY plane.

**Note:** You can use the "Height" parameter with the XY positioning method or the *angle and radius* method.

Remote command:

[PLATform:EMITter:HEIGHt](#) on page 582

**Radius**

The position of an emitter on a platform is defined by three parameters:

- "Angle" (see "Angle" on page 255)
- "Radius"
- "Height" (see "Height" on page 254)

The "Radius" parameter defines the position of the emitter on the XY plane, relative to the platform's origin.

**Note:** The XY position can also be defined via the "X" and "Y (Heading)" parameters.

Remote command:

[PLATform:EMITter:RADius](#) on page 582

**Angle**

The position of an emitter on a platform is defined by three parameters:

- "Angle"
- "Radius" (see "Radius" on page 255)
- "Height" (see "Height" on page 254)

The "Angle" parameter defines the position of the emitter on the XY plane, relative to the platform's X-axis.

**Note:** The XY position can also be defined via the "X" and "Y (Heading)" parameters.

Remote command:

[PLATform:EMITter:ANGLe](#) on page 579

**12.2.4 Blank ranges of selected emitter**

This tab displays the sectors in which the selected emitter mutes its signal output.

1

Properties of selected Emitter: Platform Emitter 2

Properties Blank ranges

No	Start	Stop
1	160 °	215 °
2	260 °	275 °

2

3

**Figure 12-6: Example of blank ranges configuration**

1 = Icons that access standard functions

2 = Blank range stop angle

3 = Blank range start angle

On real platforms, blank ranges represent:

- Sectors in which the radar does not transmit.  
For example, to avoid saturating other antennas with the high-power signal from the emitter or to avoid wave-scatter from metal structures such as masts.
- Sectors in which the propagation of the transmitted radar signal is blocked.

For example, due to obstructions such as masts and superstructure.

### Settings

No.....	256
Start.....	256
Stop.....	256
Set of ranges.....	256

### No

Number of the individual blank range entry.

Remote command:

`PLATform:EMITter:BLANkranges:SElect` on page 430

### Start

Set the angle for the beginning of the selected blank range.

Remote command:

`PLATform:EMITter:BLANkranges:STARt` on page 580

### Stop

Set the angle for the end of the selected blank range.

Remote command:

`PLATform:EMITter:BLANkranges:STOP` on page 581

### Set of ranges

You can enter a set of blank ranges for the selected emitter, using a single SCPI command.

The following SCPI example, adds a set of three blank ranges to emitter number 3.

The comma-separated value list (90,120,160,200,350,10) contains three pairs of start/stop values.

- start=90, stop=120
- start=160, stop=200
- start=350, stop=10

This approach is more efficient than using several blank range start/stop commands.

Remote command:

`PLATform:EMITter:BLANkranges` on page 580

## 12.3 Working with platforms

The platforms you create appear in the repository, as shown in [Figure 12-7](#).



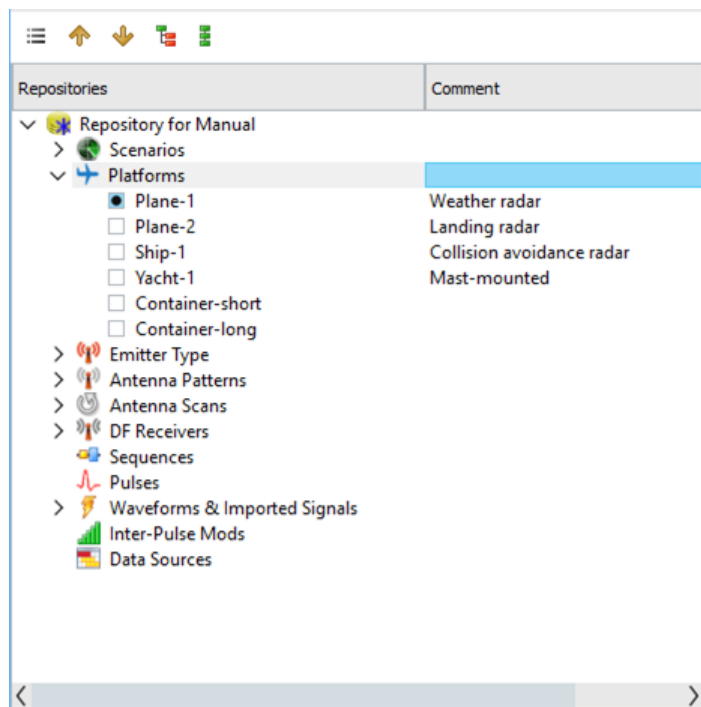


Figure 12-7: Examples of platforms in a repository

### To create a platform

1. To create a platform, do one of the following:
  - a) In the repository tree, select "Platform Types > New".
  - b) Select an existing platform > context menu > "Clone".

A new platform is added to the repository. The "Platform" dialog opens.
2. Configure the platform as described in [Chapter 12.2, "Platform settings"](#), on page 247.

### To edit a platform

1. In the repository tree, select a platform.
 

The "Platform" dialog opens.
2. Configure the platform as described in [Chapter 12.2, "Platform settings"](#), on page 247.

### To delete a platform

1. In the repository tree, select a platform.
2. In the context menu, select "Delete".
 

A dialog opens to confirm the action.
3. Click "Yes" to delete the platform.
 

The selected platform is removed from the repository.

**To add a platform to a scenario**

1. In the repository tree, select a scenario.
2. In the scenario dialog, click "Scenario Creation > Map".
3. To add a platform to a scenario, do one of the following:
  - a) Drag&drop the platform onto the 2D map.
  - b) Drag&drop the platform into the "TX Items" list.
  - c) In the 2D map: In the context menu, select "Add Platform".

**To edit a platform in a scenario**

1. To open the platform dialog to edit the platform, do one of the following:
  - a) Double-click the platform in the "TX Items" list.
  - b) Double-click the platform in the 2D map.The "TX Items Properties" dialog opens.
2. Edit the platform parameters.

**To remove a platform from a scenario**

1. In the repository tree, select a scenario.
2. In the scenario dialog, click "Scenario Creation > Map".
3. To remove a platform from a scenario, do one of the following:
  - a) In the "TX Items" list: Select the platform > context menu > "Remove".
  - b) In the 2D map: Select the platform > context menu > "Remove".The selected entry is removed from the scenario.

## 13 Emulating receivers

The available receiver settings depend on the complexity of the simulated system:

- Receivers in the "Single Emitter" and "Emitters (Collection)" scenario types. These receivers have *an omnidirectional antenna with no antenna scan*. These scenarios only simulate the effect of emitter antennas and scans. Attenuation due to distance and free space propagation is not considered.
- Receivers in a 2D multi-emitters receiver scenario have *one receive antenna*. They are described by an antenna beam pattern, an antenna scan, and an attitude information. The distance between the emitters and the receiver is configurable. This receiver complexity is used in the "Localized Emitters" scenario.
- Direction finding (DF) receivers can have *up to 20 antenna elements*. Each antenna element is described by the combination of an antenna pattern, antenna position and attitude. The receiver itself is also described with its position and attitude information. This receiver complexity is used in the "Direction Finding" scenario. Option:R&S PULSE-K39 required for direction finding.

**Table 13-1: Overview of the receiver types and provided settings**

Scenario type	"Single Emitter" "Emitters (Collection)"	"Localized Emitters"	"Direction Finding"
Separate repository elements	-	-	Yes
Related settings	-	<a href="#">Chapter 13.1, "Receiver properties in localized emitters scenario"</a> , on page 261	<a href="#">Chapter 13.2, "Receiver settings"</a> , on page 264
Scenario	Emitter-receiver	2D multi-emitter-receiver	2D multi-antenna receiver
2D map (gaming area)	-	Yes	
Emitter-receiver distance	Fixed	Configurable (Emitters placed on the 2D map)	
Receiver attitude	-	Configurable (Pitch, yaw, roll, and height)	
Number of antenna (elements)	1	1	≤ 20
Antenna pattern	Isotropic	Configurable	
Antenna scan	None (steady)	Configurable	-
Antenna attitude	-	-	Configurable (Pitch, yaw, and roll per antenna element)

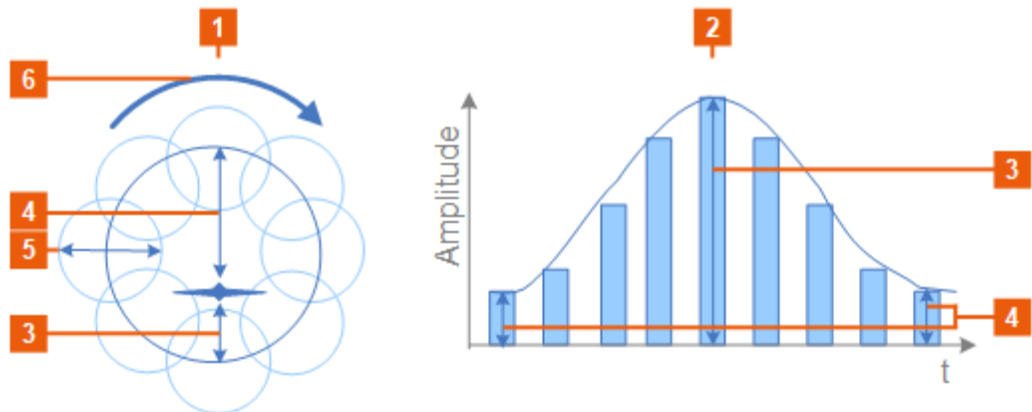
### Received signal amplitude

One of the typical receiver characteristics is the minimum detectable signal (MDS). The MDS is a measure of the receiver sensitivity and describes the minimum received sig-

nal amplitude  $S_{\min}$  that the receiver is able to detect. A typical receiver achieves an  $S_{\min}$  within the range of -80 dBm and -110 dBm.

In any type of emitter-receiver scenarios, the R&S Pulse Sequencer Digital calculates the received signal and displays the time variation of the received normalized power.

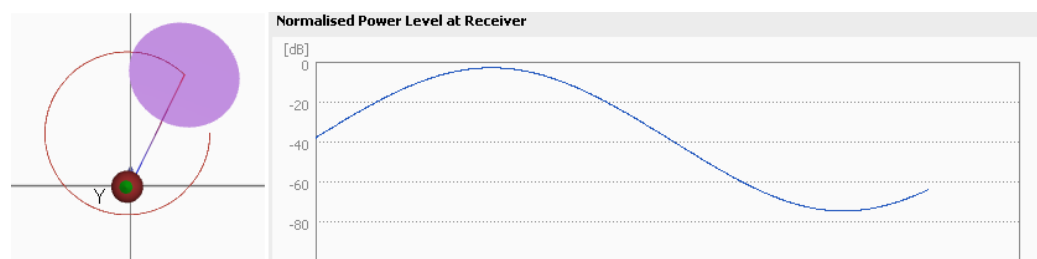
The principle is illustrated on [Figure 13-1](#).



**Figure 13-1: Simplified representation of a conical scan and the received signal**

- 1 = Conical scan (boresight perspective)
- 2 = Amplitude variation of the received signal
- 3, 4 = Target-to-beam distance determines the amplitude of the received signal
- 5 = Antenna beam represented as its HPBW
- 6 = Direction of the rotating scan

The signal received by a static receiver is a sinusoidal waveform. The amplitude of the wave is proportional to the distance between the target and the beam axis. [Figure 13-2](#) shows how this simple case of an emitter-receiver scenario is visualized in the software.



**Figure 13-2: Normalized power level at receiver (simple emitter-receiver scenario)**

For example, see ["To visualize the signal received by a static receiver"](#) on page 234.

For step-by-step instructions, see:

- ["How to create a direction finding scenario"](#) on page 291

For description of the provided settings, see:

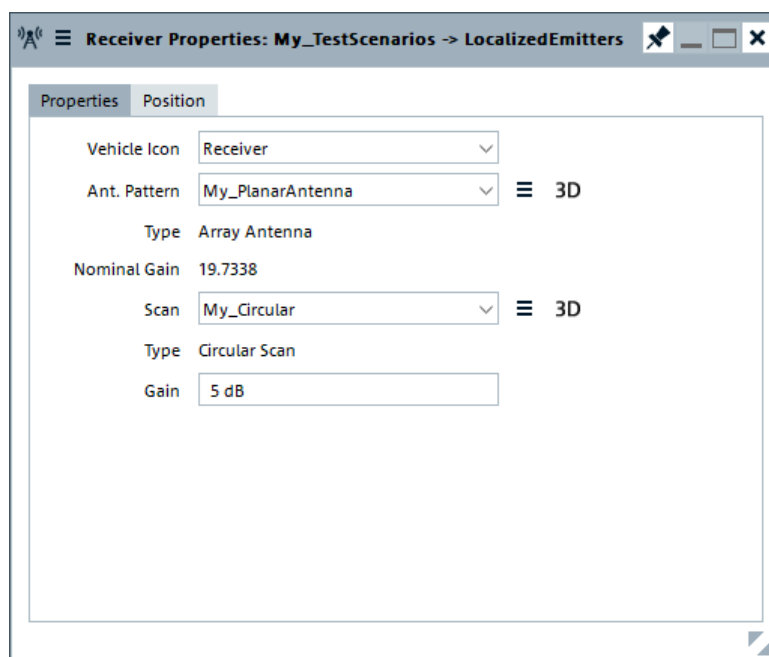
- [Chapter 13.1, "Receiver properties in localized emitters scenario"](#), on page 261
- [Chapter 13.2, "Receiver settings"](#), on page 264

- [Chapter 13.3, "DF system configuration settings"](#), on page 268

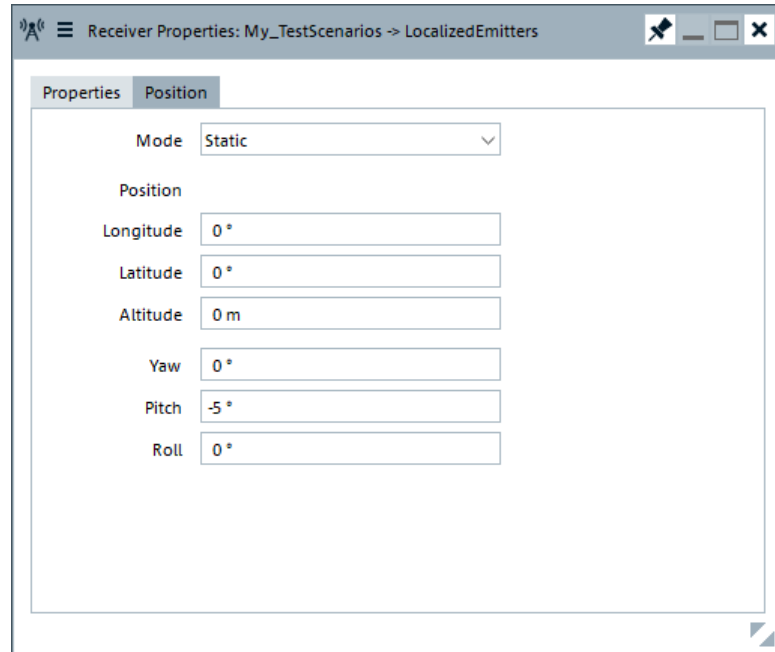
## 13.1 Receiver properties in localized emitters scenario

Access:


1. In the 2D map of a "Localized Emitters" scenario, select "Receiver Properties > Properties".



2. Select "Receiver Properties > Position".



### Settings:

<a href="#">Vehicle Icon</a> .....	262
<a href="#">Antenna Pattern/Scan, Type, , 3D</a> .....	262
<a href="#">Nominal Gain</a> .....	262
<a href="#">Gain</a> .....	262
<a href="#">Position &gt; Latitude, Longitude, Altitude, Yaw, Pitch, Roll</a> .....	263

### Vehicle Icon

Selects the icon for the receiver on the 2D map.

The icons are merely indication; the function and the properties of the receiver do not depend on the icon.

Remote command:

[SCENario:LOCalized:RECeiver:MOVement:VEHicle](#) on page 574

### Antenna Pattern/Scan, Type, , 3D

Selects an antenna pattern and antenna scan.

3D opens a plot that visualizes the antenna pattern and scan.

Remote command:

[SCENario:LOCalized:RECeiver:ANTenna](#) on page 553

[SCENario:LOCalized:RECeiver:SCAN](#) on page 553

### Nominal Gain

Displays the nominal gain of the antenna pattern.

### Gain

Sets the antenna [Gain](#).

Remote command:

[SCENario:LOCalized:RECeiver:GAIN](#) on page 554

#### **Position > Latitude, Longitude, Altitude, Yaw, Pitch, Roll**

The receiver's position is defined as latitude/longitude coordinates and attitude parameters. The available settings depend on the selected "Mode".

The position receiver settings in "Localized Emitters" and "Direction Finding" scenarios are identical.

For description, see [Chapter 13.4, "Receiver position settings in localized emitters and direction finding scenarios"](#), on page 270.

Remote command:

[SCENario:DF:RECeiver:LATitude](#) on page 552

[SCENario:DF:RECeiver:LONGitude](#) on page 552

[SCENario:DF:RECeiver:HEIGHt](#) on page 553

[SCENario:LOCalized:RECeiver:LATitude](#) on page 552

[SCENario:LOCalized:RECeiver:LONGitude](#) on page 552

[SCENario:LOCalized:RECeiver:HEIGHt](#) on page 553

## 13.2 Receiver settings

Access:

- ▶ Select "Repository Tree > DF Receiver Types > New".

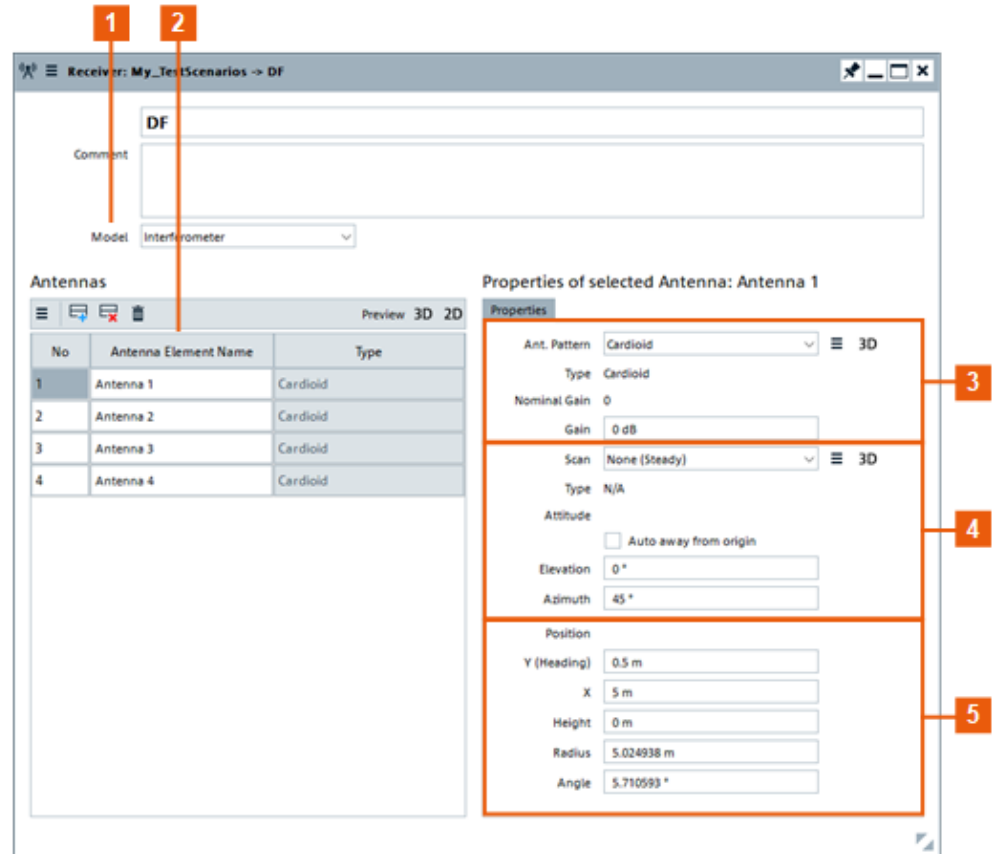


Figure 13-3: Receiver: understanding the displayed information

- 1 = Receiver model
- 2 = Up to 20 individual antenna elements
- 3 = Antenna pattern and gain per antenna element
- 4 = Altitude and orientation per antenna element
- 5 = Location and position information per antenna element

Direction finding (DF) receivers can have up to 20 antenna elements, each described with an antenna pattern and position.

See also "[How to create a direction finding scenario](#)" on page 291.

### Settings:

<a href="#">Receiver Name</a> .....	265
<a href="#">Comment</a> .....	265
<a href="#">Model</a> .....	265
<a href="#">Antenna Configuration</a> .....	266



Properties of selected Antenna: Antenna x.....	267
L Properties.....	267
L Position.....	268

### Receiver Name

Enter the receiver's name.

Remote command:

`REceiver:NAME` on page 427

`REceiver:CREate` on page 426

`REceiver:SElect` on page 426

`REceiver:CATalog?` on page 425

`REceiver:REMove` on page 428

### Comment

Enter a short description.

Remote command:

`REceiver:COMMeNt` on page 427

### Model

Defines the model of the DF receiver.

"Interferometer"

Interferometer direction finding receivers work phase coherent and evaluate the **phase difference** between the single antenna ports. They are usually **small**, with a diameter in the range of a wavelength. In this mode, the R&S Pulse Sequencer Digital calculates the relative phase difference between the incoming signal and the antenna positions. The differences in the time of arrival (TOA) of the incoming signals are assumed to be equal for all antenna to prevent small rounding errors in sample granularity.

"TDOA" (Time difference of arrival)

TDOA direction finders use the **absolute time of arrival** of a signal to determine the direction. They do not evaluate phase information, because they are usually **big-sized**. In TDOA receiver, the antenna ports are placed far from one another so that the time delay is large enough and suitable for analysis.

Examples of TDOA receivers are the antennas mounted at the two wings of an airplane or at the outer borders of a ground station. Because of the distance between the antennas, there is a difference in the time the incoming signal arrives at the antennas. In this mode, the R&S Pulse Sequencer Digital calculates the absolute TOA of the incoming signal for each antenna. The phase difference between the single antenna ports is calculated from their absolute distance to the emitter.

"Combined (Interferometer/TDOA)"

The combined model calculates the relative phases between the antenna ports and calculates the individual TOAs for each antenna port.

Remote command:

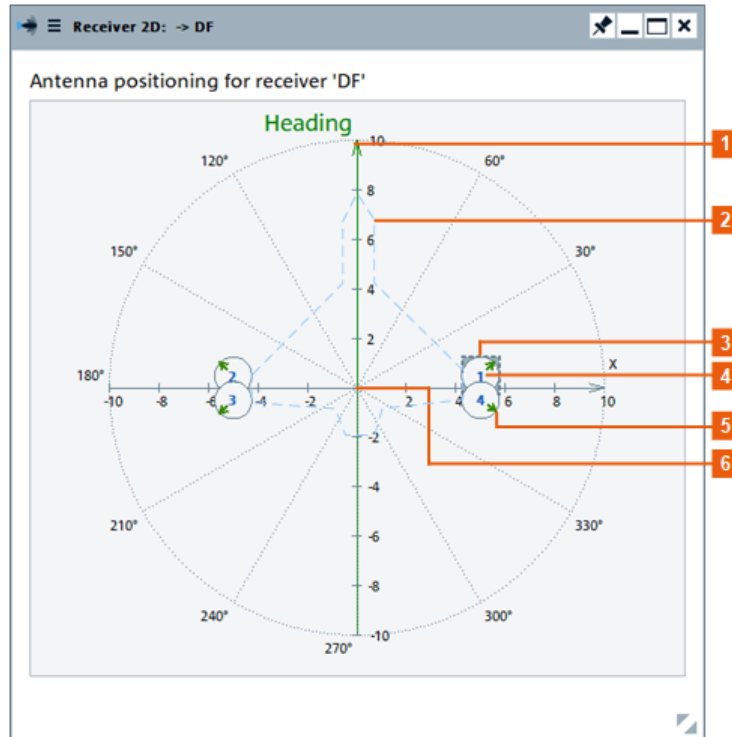
[RECeiver:MODe1](#) on page 523

### Antenna Configuration

DF receiver can have up to 10 antenna elements.

#### "Positioning Preview 2D"

Displays the distribution of the antenna elements in a 2-dimensional chart (XY plane).



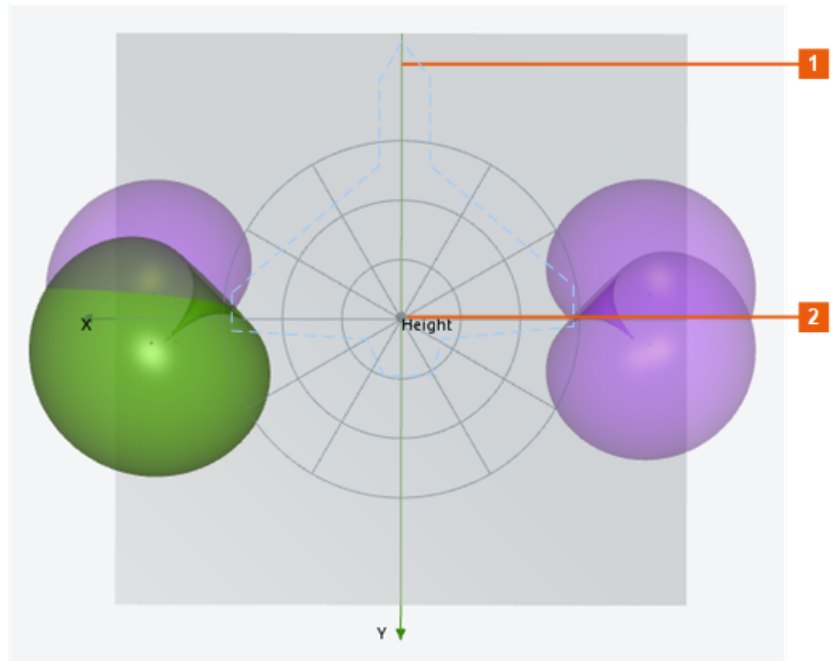
**Figure 13-4: Antenna Positioning: understanding the displayed information**

- 1 = Heading (y axis); indicated with a colored line
- 2 = Airplane graphic is not displayed in the software (shown here for better understanding)
- 3 = Selected antenna element
- 4 = Antenna element consequent number, as listed in the "List of antenna elements" table
- 5 = Antenna element orientation
- 6 = Receiver origin

See also ["How to create a direction finding scenario"](#) on page 291.

**"Positioning Preview 3D"**

Displays the distribution of the antenna elements in a 3-dimensional chart (XY plane).



1 = Heading (y axis); indicated with a colored line

2 = Receiver origin

**"List of antenna elements"**

Use the standard functions in the context menu and the icons to add, reorder, or remove antenna elements.

New elements are named automatically but you can change the alias name.

**Remote command:**

[REceiver:ANTenna:ADD](#) on page 429

[REceiver:ANTenna:SElect](#) on page 430

[REceiver:ANTenna:ALias](#) on page 523

[REceiver:ANTenna:DElete](#) on page 432

[REceiver:ANTenna:CLEar](#) on page 433

**Properties of selected Antenna: Antenna x**

Describes the selected antenna element.

Open the "2D/3D Positioning Preview" view to display the configuration, see [Figure 13-4](#).

**Properties ← Properties of selected Antenna: Antenna x**

Comprises the antenna and receiver orientation-related settings:

**"Antenna Pattern, Antenna Scan, Type"**

Selects an existing antenna pattern or accesses a dialog for creating a new one.

The antenna pattern, scan and type are displayed.

See also ["To create an antenna pattern"](#) on page 207.

Remote command:

[RECeiver:ANTenna:PATtern](#) on page 524

[RECeiver:ANTenna:SCAN](#) on page 525

**"Nominal Gain"** Displays the nominal gain of the antenna pattern.

**"Gain"** Sets the antenna [Gain](#).

Remote command:

[RECeiver:ANTenna:GAIN](#) on page 525

**"Pointing Direction"**

Turns the antenna beam axis in the elevation and the azimuth.

"Auto away form origin" sets the azimuth automatically, so that the beam axis is radial to the receiver origin.

Remote command:

[RECeiver:ANTenna:DIRection:AWAY](#) on page 525

[RECeiver:ANTenna:DIRection:AZIMuth](#) on page 525

[RECeiver:ANTenna:DIRection:ELEVation](#) on page 526

**Position ← Properties of selected Antenna: Antenna x**

Antenna elements are spaced relative to the receiver origin.

Their 3D positions are defined as:

- "X" and "Y (heading)" values relative to the receiver origin.
- "Angle" (azimuth plane) and "Radius" (distance to the receiver origin on the XY plane), where "Angle = 0°" is on the X-axis.
- "Height" offset on the Z-axis relative to the receiver origin.

**Example:**

"X = 0 m" and "Y = -0.14 m" corresponds to "Radius = 0.14 m" and "Angle = 270 °".

Remote command:

[RECeiver:ANTenna:POSition:X](#) on page 524

[RECeiver:ANTenna:POSition:Y](#) on page 524

[RECeiver:ANTenna:POSition:RADius](#) on page 524

[RECeiver:ANTenna:POSition:ANGLE](#) on page 524

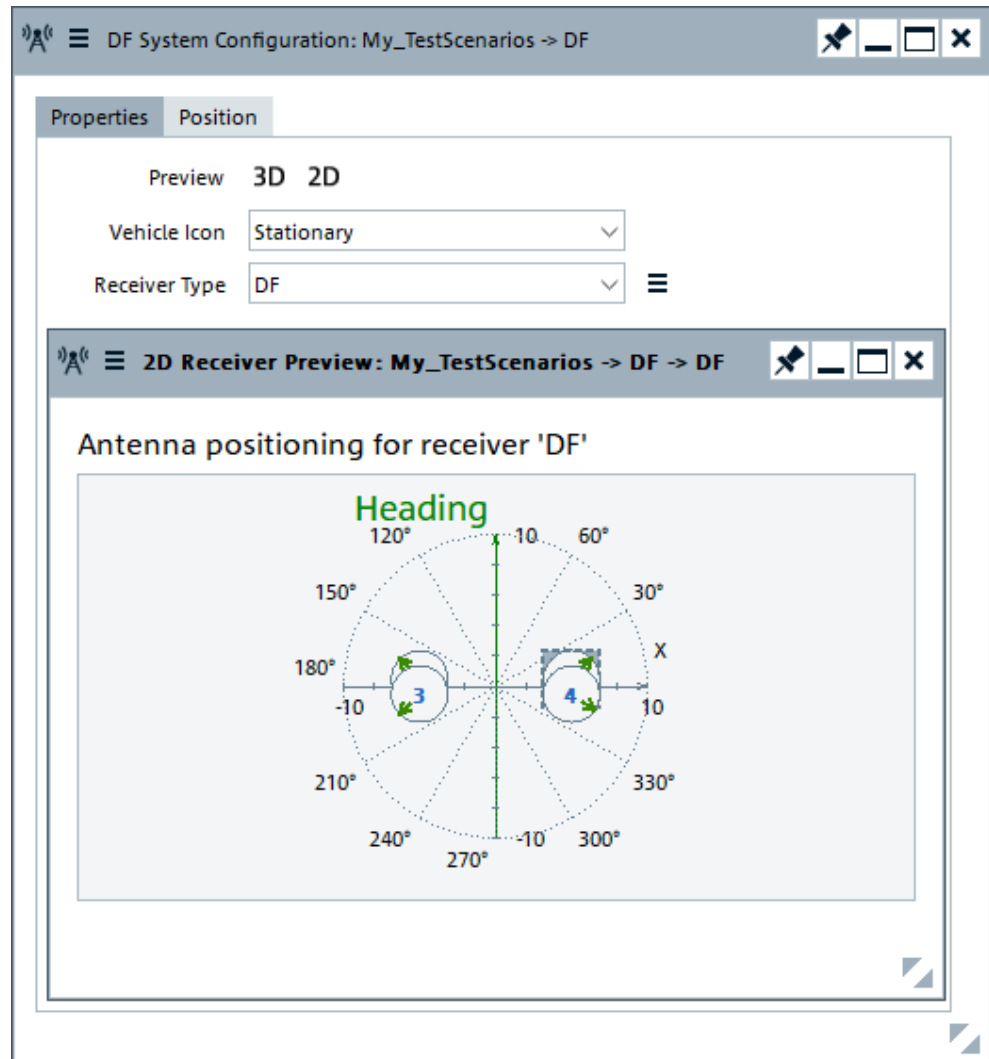
[RECeiver:ANTenna:POSition:HEIGht](#) on page 524

## 13.3 DF system configuration settings

Option:R&S PULSE-K39

Access:

1. Open a "Direction Finding" scenario.
2. In the block diagram, select "Map > 2D".
3. On the 2D map, select "Receiver > Properties".
4. Select "2D/3D" to display the "Antenna Positioning".



See also ["How to create a direction finding scenario"](#) on page 291.

#### Settings:

Properties.....	270
L Vehicle Icon.....	270
L Receiver.....	270
Position > Latitude, Longitude, Height.....	270
Antenna Positioning.....	270

**Properties**

Each receiver is described with the following parameters:

**Vehicle Icon ← Properties**

Selects the icon for the receiver on the 2D map.

The icons are merely indication; the function and the properties of the receiver do not depend on the icon.

Remote command:

[SCENario:DF:REceiver:MOVement:VEHicle](#) on page 574

**Receiver ← Properties**

Selects an existing receiver or accesses a dialog for creating a new one.

Remote command:

[SCENario:DF:REceiver](#) on page 556

**Position > Latitude, Longitude, Height**

The receiver's position is defined as latitude/longitude coordinates and attitude parameters. The available settings depend on the selected "Mode".


The position receiver settings in "Localized Emitters" and "Direction Finding" scenarios are identical.

For description, see [Chapter 13.4, "Receiver position settings in localized emitters and direction finding scenarios"](#), on page 270.

**Antenna Positioning**

Displays the distribution of the antenna elements on a 2D map (XY plane).

The graph resembles the one in the "Receiver" dialog, see [Figure 13-4](#).

Use the split window icon  to detach the diagram and open it in a separate window.

## 13.4 Receiver position settings in localized emitters and direction finding scenarios

Option:R&S PULSE-K39 required for direction finding.

As with the emitters, you can also define receivers that move along a trajectory with a defined shape. The receiver configuration is similar to the configuration of the moving emitters.

For introduction to the topic and details on the waypoint files, see:

- [Chapter 16.5, "Moving emitters and platforms"](#), on page 323
- [Chapter A.3, "Movement files"](#), on page 637.

Access:

1. In the 2D map of a "Localized Emitters" or "Direction Finding" scenario, select "Receiver Properties > Properties".

## Receiver position settings in localized emitters and direction finding scenarios

## 2. Select "Position".

The available settings depend on the selected "Mode".

The screenshot shows the 'Position' settings panel with the following fields and values:

- Mode:** Moving (dropdown)
- Trajectory:** Line (dropdown)
- Start Position:**
  - Latitude: 0 °
  - Longitude: 0 °
  - Height: 4000 m
- Attitude:**
  - Yaw: 0 °
  - Pitch: 0 °
  - Roll: 0 °
- Speed:** 180 m/s
- Acceleration:** 0 m/s<sup>2</sup>
- End Position:**
  - East: -1360.383 m
  - North: 5403.743 m
  - Height: 4000 m
- Mode:** Cyclic (dropdown)

For example of possible further configurations, see [Chapter 16.5, "Moving emitters and platforms"](#), on page 323.

**Settings:**

Mode.....	272
Trajectory.....	272
Start Position > Latitude, Longitude, Height.....	273
Attitude > Pitch, Yaw, Roll.....	273
Line trajectory definition.....	273
L Speed.....	273
L Acceleration.....	273
L End Position.....	273
L Mode.....	273
Arc trajectory definition.....	274
L Speed.....	274
L Angle.....	274
L Center Position.....	274
L Mode.....	274
Waypoints trajectory definition.....	275
L Waypoint File.....	276
L  Load, Delete.....	276

## Receiver position settings in localized emitters and direction finding scenarios

L	Read Out Mode.....	276
L	Reference Frame.....	276
L	Smoothing > State.....	277
L	Vehicle File.....	277
L	☰ Load, Delete.....	277
L	Attitude Behavior.....	277
L	Yaw/Heading, Pitch/Elevation, (Start) Roll/Bank.....	278
L	Calculate.....	278
L	☰ Clear.....	278
Trace	trajectory definition.....	278
L	Start Position > Latitude, Longitude.....	279
L	Trace Points.....	279
L	Speed.....	279
L	East, North, Height.....	279
L	Mode.....	279

**Mode**

Sets if the receiver is static or moving.

Option: R&S PULSE-K39 is required for moving receivers.

"Static"	The receiver is static; its coordinates are fixed during the whole scenario. See <a href="#">Start Position &gt; Latitude, Longitude, Height</a> and <a href="#">Attitude &gt; Pitch, Yaw, Roll</a> .
"Moving"	The receiver is moving from defined start position and follows the selected trajectory. See <a href="#">Trajectory</a> .

Remote command:

[SCENario:LOCalized:LOCation:REC:PMODE](#) on page 569

**Trajectory**

Defines the trajectory shape.

"Line"	The receiver is moving on a straight line, starting from its current position ( <a href="#">Start Position &gt; Latitude, Longitude, Height</a> ) and ending at the selected "End Position".
"Arc"	The receiver moves on a part of a circle, where the center of the circle is defined with the "Center Position".
"Waypoint"	Receiver with varying coordinates, defined in waypoints files. You find a subset of example files in installation package but you can also create and load your own files.
"Trace"	The receiver follows a user-defined route. You can define the route in the map view using the "Trace" function. R&S Pulse Sequencer Digital generates waypoints from the trace, automatically.

Remote command:

[SCENario:LOCalized:RECeiver:MOVement:TYPE](#) on page 569

[SCENario:DF:RECeiver:MOVement:TYPE](#) on page 569



## Receiver position settings in localized emitters and direction finding scenarios

**Start Position > Latitude, Longitude, Height**

Sets the receiver's position.

Remote command:

[SCENario:DF:RECEiver:LATitude](#) on page 552

[SCENario:DF:RECEiver:LONGitude](#) on page 552

[SCENario:LOCALized:RECEiver:HEIGHT](#) on page 553

**Attitude > Pitch, Yaw, Roll**

For static receivers, defines the orientation of the antenna as "Pitch", "Yaw", "Roll".

See [Table 10-1](#).

Remote command:

[SCENario:LOCALized:RECEiver:DIRection:YAW](#) on page 548

[SCENario:LOCALized:RECEiver:DIRection:PITCh](#) on page 549

[SCENario:LOCALized:RECEiver:DIRection:ROLL](#) on page 549

[SCENario:DF:RECEiver:DIRection:YAW](#) on page 548

[SCENario:DF:RECEiver:DIRection:PITCh](#) on page 549

[SCENario:DF:RECEiver:DIRection:ROLL](#) on page 549

**Line trajectory definition**

A line is defined with:

**Speed ← Line trajectory definition**

Sets the speed of the moving receiver.

Remote command:

[SCENario:LOCALized:RECEiver:MOVement:SPEed](#) on page 572

[SCENario:DF:RECEiver:MOVement:SPEed](#) on page 572

**Acceleration ← Line trajectory definition**

Sets the acceleration of the moving receiver.

Remote command:

[SCENario:LOCALized:RECEiver:MOVement:ACCeleration](#) on page 572

[SCENario:DF:RECEiver:MOVement:ACCeleration](#) on page 572

**End Position ← Line trajectory definition**

Sets the "East/North" coordinates and the "Height" of the receiver at the end of the movement.

Remote command:

[SCENario:LOCALized:RECEiver:MOVement:EAST](#) on page 572

[SCENario:LOCALized:RECEiver:MOVement:NORTH](#) on page 573

[SCENario:LOCALized:RECEiver:MOVement:HEIGHT](#) on page 573

[SCENario:DF:RECEiver:MOVement:EAST](#) on page 572

[SCENario:DF:RECEiver:MOVement:NORTH](#) on page 572

[SCENario:DF:RECEiver:MOVement:HEIGHT](#) on page 573

**Mode ← Line trajectory definition**

Defines the behavior of the moving object when the end of the trajectory is reached.

## Receiver position settings in localized emitters and direction finding scenarios

"Cyclic"	<p>The trajectory file is repeated cyclically. Once the "End Position" is reached, file movement starts again from the beginning.</p> <p>Using this mode is recommended in the following cases:</p> <ul style="list-style-type: none"> <li>• A circle trajectory</li> <li>• A trajectory in which the start and the end positions are close to each other.</li> </ul>
"Round Trip"	The emitter moves back and forth on the defined trajectory.
"One Way"	<p>The movement is executed once.</p> <p>When the "End Position" is reached, this position is assumed to be a static one.</p>

Remote command:

[SCENario:DF:RECeiver:MOVement:RMODe](#) on page 576

[SCENario:LOCalized:RECeiver:MOVement:RMODe](#) on page 576

### Arc trajectory definition

An arc is defined with:

#### Speed ← Arc trajectory definition

Sets the speed of the moving receiver.

Remote command:

[SCENario:LOCalized:RECeiver:MOVement:SPEEd](#) on page 572

[SCENario:DF:RECeiver:MOVement:SPEEd](#) on page 572

#### Angle ← Arc trajectory definition

Sets the arc angle and thus defines the arc length.

Remote command:

[SCENario:LOCalized:RECeiver:MOVement:ANGLe](#) on page 572

[SCENario:DF:RECeiver:MOVement:ANGLe](#) on page 572

#### Center Position ← Arc trajectory definition

Sets the "East/North" coordinates of the center of the circle on that the receiver is moving.

Remote command:

[SCENario:LOCalized:RECeiver:MOVement:EAST](#) on page 572

[SCENario:LOCalized:RECeiver:MOVement:NORTH](#) on page 573

[SCENario:DF:RECeiver:MOVement:EAST](#) on page 572

[SCENario:DF:RECeiver:MOVement:NORTH](#) on page 572

#### Mode ← Arc trajectory definition

Defines the behavior of the moving object when the end of the trajectory is reached.

"Cyclic"	<p>The trajectory file is repeated cyclically. Once the "End Position" is reached, file movement starts again from the beginning.</p> <p>Using this mode is recommended in the following cases:</p> <ul style="list-style-type: none"> <li>• A circle trajectory</li> <li>• A trajectory in which the start and the end positions are close to each other.</li> </ul>
----------	---

## Receiver position settings in localized emitters and direction finding scenarios

- "Round Trip" The emitter moves back and forth on the defined trajectory.
- "One Way" The movement is executed once.  
When the "End Position" is reached, this position is assumed to be a static one.

Remote command:

[SCENario:DF:RECEiver:MOVement:RMODe](#) on page 576

[SCENario:LOCalized:RECEiver:MOVement:RMODe](#) on page 576

### Waypoints trajectory definition

A waypoint file is description of a movement with possibly attitude coordinates that can have different forms, like, for example, a sequence of positions or vector arc movement. A waypoint file must have the extension \*.txt, \*.kml or \*.xtd. For description, see [Chapter A.3, "Movement files"](#), on page 637.

You find a subset of example files in installation package but you can also create and load custom-specific files. Moreover, waypoint smoothing can be activated if vehicle description files are used.

The screenshot shows the 'Position' configuration window. It is divided into several sections:

- Properties:** Mode is set to 'Moving' and Trajectory is set to 'Waypoints'.
- Trajectory:** Waypoint File is 'Munich\_Car\_Motion.xtd', Read Out Mode is 'Cyclic', and Reference Frame is 'WGS-84'.
- Smoothing:** State is checked, and Vehicle File is 'LandVehicle.xvd'.
- Attitude:** Mode is 'Align To Motion', Yaw is 0°, Pitch is 0°, and Roll is 2°.
- Buttons:** A 'Calculate' button is located below the attitude settings.
- Movement Data:** A summary section showing:
  - Start Position: 48.1455 °, 11.5768 °, 500.038 m
  - End Position: 48.1455 °, 11.5768 °, 500.038 m
  - Duration: 109.8 s
  - Read Out Mode: Cyclic (forced)
  - Smoothing: On
  - Attitude: Align To Motion

## Receiver position settings in localized emitters and direction finding scenarios

If waypoint files are used, the receiver position and trajectory are retrieved from the file content; the traditional position coordinates parameters are disabled.

**Waypoint File ← Waypoints trajectory definition**

Indicates the name of the currently used waypoint file.

**☰ Load, Delete ← Waypoints trajectory definition**

Opens the Windows explorer so that you can navigate to and load waypoint file.

Discards the selected waypoint file.

Remote command:

[SCENario:DF:RECEiver:MOVement:WAYPoint](#) on page 573

[SCENario:DF:RECEiver:MOVement:WAYPoint:CLEar](#) on page 573

[SCENario:LOCalized:RECEiver:MOVement:WAYPoint](#) on page 573

[SCENario:LOCalized:RECEiver:MOVement:WAYPoint:CLEar](#) on page 574

**Read Out Mode ← Waypoints trajectory definition**

Defines the way that the waypoint file is processed.

- "Cyclic"            The waypoint file is processed cyclically. Once the last waypoint is reached, file processing starts again from the beginning.
- Using this mode is recommended if the waypoint file describes one of the following:
- A circle trajectory
  - A trajectory in which the start and the end positions are close to each other.
- "Round Trip"        By reaching the end of the file, the file is processed backwards.
- "One Way"            The file is processed once.
- By reaching the end of the file, the last described position is assumed to be a static one.

Remote command:

[SCENario:DF:RECEiver:MOVement:RMODe](#) on page 576

[SCENario:LOCalized:RECEiver:MOVement:RMODe](#) on page 576

**Reference Frame ← Waypoints trajectory definition**

Select the reference frame used to define the emitters coordinates.

The transformation between the reference frames is performed automatically.

The following applies:

- $X_{WGS84} = (1 - 0.008 \cdot 10^{-6}) \cdot X_{PZ90} - 0.2041 \cdot 10^{-7} \cdot Y_{PZ90} + 0.1716 \cdot 10^{-7} \cdot Z_{PZ90} - 0.013$
- $Y_{WGS84} = (1 - 0.008 \cdot 10^{-6}) \cdot Y_{PZ90} - 0.2041 \cdot 10^{-7} \cdot X_{PZ90} + 0.1115 \cdot 10^{-7} \cdot Z_{PZ90} + 0.106$
- $Z_{WGS84} = (1 - 0.008 \cdot 10^{-6}) \cdot Z_{PZ90} - 0.1716 \cdot 10^{-7} \cdot X_{PZ90} - 0.1115 \cdot 10^{-7} \cdot Y_{PZ90} + 0.022$

Both reference frames are ECEF frames with a set of associated parameters.

- "WGS-84"            The world geodetic system WGS-84 is the reference frame used by GPS.
- "PZ 90.11 (GLONASS)"    Parametry Zemli PZ (parameters of the Earth) is a reference frame, used, for example, by GLONASS.

## Receiver position settings in localized emitters and direction finding scenarios

Remote command:

[SCENario:DF:RECeiver:MOVement:RFrAme](#) on page 576

[SCENario:LOCalized:RECeiver:MOVement:RFrAme](#) on page 576

### Smoothing > State ← Waypoints trajectory definition

The discrete positions (waypoints) defined in the waypoints file can cause abrupt changes in the movement direction.

The R&S Pulse Sequencer Digital provides an internal interpolating algorithm that smooths the movement or the trajectory. This algorithm evaluates the dedicated vehicle description (\*.xvd) file, retrieves the velocity vector and the <proximity> value, and inserts waypoints to smooth the trajectory. The resulting movement is more realistic.

To use the algorithm, enable "Smoothing", select "Vehicle File > Load" to load a \*.xvd file and select "Calculate". See [Chapter A.4, "Vehicle description files \(Used for smoothening\)"](#), on page 644.

Remote command:

[SCENario:DF:RECeiver:MOVement:SMOothening](#) on page 576

[SCENario:LOCalized:RECeiver:MOVement:SMOothening](#) on page 576

### Vehicle File ← Waypoints trajectory definition

Indicates the name of the currently used vehicle description (\*.xvd) file.

### Load, Delete ← Waypoints trajectory definition

Opens the Windows explorer so that you can navigate to and load vehicle description file.

Discards the selected vehicle description file.

Remote command:

[SCENario:DF:RECeiver:MOVement:VFILe](#) on page 575

[SCENario:DF:RECeiver:MOVement:VFILe:CLEAr](#) on page 575

[SCENario:LOCalized:RECeiver:MOVement:VFILe](#) on page 575

[SCENario:LOCalized:RECeiver:MOVement:VFILe:CLEAr](#) on page 575

### Attitude Behavior ← Waypoints trajectory definition

Defines how the attitude information is defined.

"From Waypoint File"

The attitude parameters are extracted from the selected waypoint file. Further settings are not required.

This setting forces the attitude parameters to motion direction even if the waypoint has attitude information, like, for example, in a \*.xtd file with <property waypointformat="position\_attitude">. For specific emitters like ships or land vehicles, it is realistic to set the yaw and pitch to vehicle's motion direction. This is because the usual body axes angles of a land vehicle are in the direction of the velocity vector.

For other emitters, however, like landing plane, this parameter is not useful. As an example, the nose of the plane is in an upward direction at the time when the plane is moving downwards.

## Receiver position settings in localized emitters and direction finding scenarios

"Align to Motion"

Enables a constant rate of change of the roll.

"Constant"

Emitter's attitude is set as the combination of the "Yaw/Heading", "Pitch/Elevation", "Roll/Bank" values.

The resulting attitude is a constant value.

Remote command:

[SCENario:DF:RECeiver:MOVement:ATTitude](#) on page 574

[SCENario:LOCalized:RECeiver:MOVement:ATTitude](#) on page 574

### **Yaw/Heading, Pitch/Elevation, (Start) Roll/Bank ← Waypoints trajectory definition**

Sets the angles of rotation in the corresponding direction, i.e. the rotation around the respective yaw, pitch and roll axes. "Yaw/Heading, Pitch/Elevation, Roll/Bank" are defined relative to the local horizon.

Remote command:

[SCENario:DF:RECeiver:MOVement:YAW](#) on page 575

[SCENario:DF:RECeiver:MOVement:PITCh](#) on page 575

[SCENario:DF:RECeiver:MOVement:ROLL](#) on page 575

[SCENario:LOCalized:RECeiver:MOVement:YAW](#) on page 575

[SCENario:LOCalized:RECeiver:MOVement:PITCh](#) on page 575

[SCENario:LOCalized:RECeiver:MOVement:ROLL](#) on page 575

### **Calculate ← Waypoints trajectory definition**

Loads the selected waypoint and vehicle description file.

The "Movement Data" display indicates a summary of the major parameters:

- Start/End position
- Duration of the movement
- Read-out mode as defined in the file
- Smoothing state
- Attitude behavior

The status LED indicates the following states:

- **Red:** the waypoint file is not selected, the file is not imported and the movement not calculated or the file is erroneous.
- **Green:** Movement is calculated.

Remote command:

[SCENario:DF:RECeiver:MOVement:IMPort](#) on page 576

[SCENario:LOCalized:RECeiver:MOVement:IMPort](#) on page 577

### **Clear ← Waypoints trajectory definition**

Discards the waypoint and vehicle description file.

Remote command:

[SCENario:DF:RECeiver:MOVement:CLEar](#) on page 577

[SCENario:LOCalized:RECeiver:MOVement:CLEar](#) on page 577

### **Trace trajectory definition**

The "Trace" trajectory definition is similar to the "Waypoint" trajectory definition.

The differences are:

## Receiver position settings in localized emitters and direction finding scenarios

- The "Waypoint" trajectory is defined by a file. The waypoint file contains all needed coordinates so no additional settings are required.
- The "Trace" trajectory is defined by a set of user-defined "Trace Points". No coordinate information is available, so additional settings are required. As with a "Line" or "Arc" trajectory, the start position must be specified. Also, the position of each trace point must be individually configured.

A trace is defined with:

**Start Position > Latitude, Longitude ← Trace trajectory definition**

Sets the receiver's starting position.

Remote command:

[SCENario:DF:RECEiver:LATitude](#) on page 552

[SCENario:DF:RECEiver:LONGitude](#) on page 552

**Trace Points ← Trace trajectory definition**

Selects a specific trace point.

Remote command:

[SCENario:LOCALized:RECEiver:MOVement:PSTep:SElect](#) on page 571

[SCENario:DF:RECEiver:MOVement:PSTep:SElect](#) on page 571

**Speed ← Trace trajectory definition**

Sets the speed of the moving receiver at the selected trace point.

Remote command:

[SCENario:LOCALized:RECEiver:MOVement:SPEed](#) on page 572

[SCENario:DF:RECEiver:MOVement:SPEed](#) on page 572

**East, North, Height ← Trace trajectory definition**

Sets the "East/North" coordinates and the "Height" of the receiver at the selected trace point.

Remote command:

[SCENario:LOCALized:RECEiver:MOVement:EAST](#) on page 572

[SCENario:LOCALized:RECEiver:MOVement:NORTH](#) on page 573

[SCENario:LOCALized:RECEiver:MOVement:HEIGHT](#) on page 573

[SCENario:DF:RECEiver:MOVement:EAST](#) on page 572

[SCENario:DF:RECEiver:MOVement:NORTH](#) on page 572

[SCENario:DF:RECEiver:MOVement:HEIGHT](#) on page 573

**Mode ← Trace trajectory definition**

Defines the behavior of the moving object when the end of the trajectory is reached.

- |              |  |
|--------------|--|
| "Cyclic"     | The trajectory file is repeated cyclically. Once the "End Position" is reached, file movement starts again from the beginning.<br><br>Using this mode is recommended in the following cases: <ul style="list-style-type: none"> <li>• A circle trajectory</li> <li>• A trajectory in which the start and the end positions are close to each other.</li> </ul> |
| "Round Trip" | The emitter moves back and forth on the defined trajectory.  |

## Receiver position settings in localized emitters and direction finding scenarios

"One Way"      The movement is executed once.  
When the "End Position" is reached, this position is assumed to be a static one.

Remote command:

[SCENario:DF:RECeiver:MOVement:RMODe](#) on page 576

[SCENario:LOCalized:RECeiver:MOVement:RMODe](#) on page 576



## 14 Working with imported signals

In addition to creating pulse sequences in R&S Pulse Sequencer Digital, you can also create sequences composed of imported signals.

If the data format is in one of the supported import formats listed below, you can import the pulses into the pulse library.

### Supported file types

- Custom text-based PDW lists in ASCII or coma-separated file format (\*.txt or \*.csv), see [Chapter 18.2, "PDW import mechanism"](#), on page 361. You can use the imported signals to retrieve information on the reference signal level and to change it.
- AMMOS IF (\*.aif), AMMOS PDW (\*.pdw or \*.ppdw) and AMREC recording (\*.dat) files  
Rohde & Schwarz proprietary data formats used with Rohde & Schwarz monitoring equipment. These files typically contain multiple data streams.  
The R&S Pulse Sequencer Digital extracts IF (I/Q) or PDW data from these files.

### Related settings

#### Import Wizard

The data import wizard converts custom I/Q data into a Rohde & Schwarz waveform file.

The dialog and the provided settings differ depending on the selected file format but the differences are self-explanatory.

#### AMMOS IF and AMMOS PDW Import

AMMOS IF, AMREC recording files and AMMOS PDW are Rohde & Schwarz proprietary data formats used with Rohde & Schwarz monitoring equipment. These files typically contain multiple data streams.

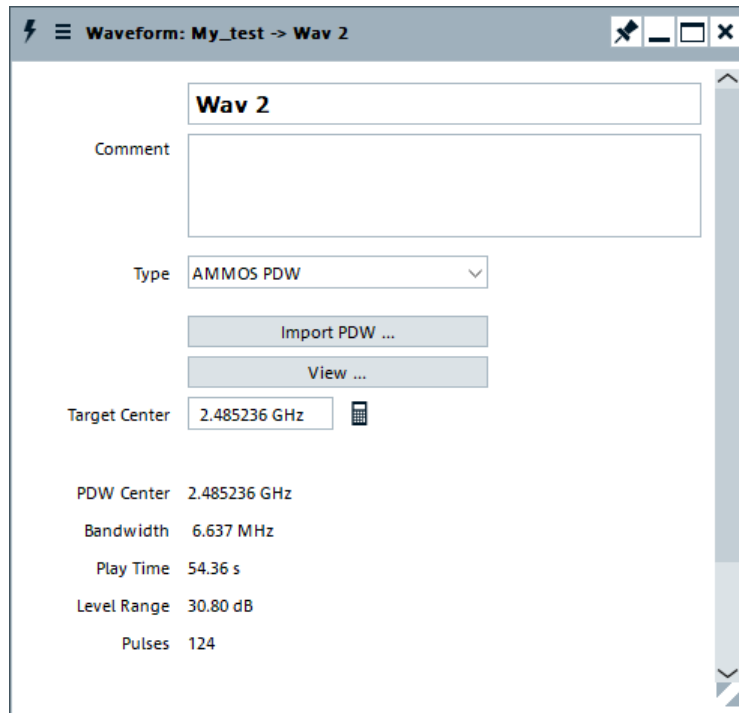
The R&S Pulse Sequencer Digital extracts IF (I/Q) or PDW data from these files.

The import process and wizard are described in:

- ["Import Wizard"](#) on page 281
- [Chapter 18.4, "PDW data import wizard settings"](#), on page 365.

The following is a description of the dedicated settings.

Access: "Imported Signals > Type = AMMOS PDW".



"Import PDW"    Accesses a file import wizard, see ["Import Wizard"](#) on page 281.

"View"

Access dialogs which visualize the waveform and displays more useful information on it.

"Target Center"

Sets the center frequency of the generator.

When a PDW list file is imported, the value is set to the automatically calculated center frequency of the PDW file. The value resembles the value indicated as "PDW Center".

The frequency offsets of the pulses are recalculated. The bandwidth increases.

"Calculate"

The "Calculate" icon resets the "Target Center" field to the value displayed as "PDW Center".

"PDW Center, Bandwidth, Play Time, Level Range, Pulses"

If the PDW list file is imported in the repository, the dialog displays information on the waveform:

- "PDW Center": *Calculated center frequency*  
The indicated value is the center frequency that the software uses during the import process. The pulses are calculated relatively to this value.  
The "PDW Center" is calculated as the middle frequency between the min and the max frequency values included in the PDW file. Chirp frequency deviations are considered.
- "Bandwidth": Calculated bandwidth
- "Play Time": Duration
- "Level Range": Calculated level range
- "Pulses": Number of pulses in the waveform.

## Input File ← AMMOS IF and AMMOS PDW Import

Figure 14-1: Import Wizard for Type = AMMOS PDW

## "R&amp;S PDW File"

Selects the source file.

## "ACH Filter"

Sets the analysis channel filter that defines which of the four analysis channels within the bandwidth is used.

If ACH filter is not used ("ACH Filter = Off"), the import mechanism discards all pulses that overlap with the current one. This behavior cannot be changed. To ensure processing of one pulse per time, apply an ACH filter.

## "MOP Filter"

Filters out pulses based on the used modulation.

## "CW Support"

Enables import and replay of CW signals.

## Level Attenuation ← AMMOS IF and AMMOS PDW Import

Graphical representation of the retrieved information, together with statistical information on the processed data.

Displayed is the time variation of the following parameters:

- Level Attenuation
- PRI
- PW
- Frequency

See also [Chapter 15.1, "Signal preview settings"](#), on page 284.

# 15 Visualizing and analyzing signals

Signals generated with the software or imported into the repository can be visualized with the built-in "Signal Preview" function. The R&S Pulse Sequencer Digital reads a generated signal, evaluates it and displays the I and Q data, the spectrum, and the constellation diagram of a signal section or of the entire signal. The "Signal Preview" is only available if **a signal was calculated (created) successfully**.

Moreover, with R&S Pulse Sequencer Digital you can visualize the content of signals in Rohde & Schwarz format created by external software. Double-clicking the signal name in your file explorer automatically opens the "Signal Preview" dialog. Furthermore, you can select the R&S Pulse Sequencer Digital as the default program for opening such files.

- [Signal preview settings](#)..... 284

## 15.1 Signal preview settings

R&S PULSE-K39.

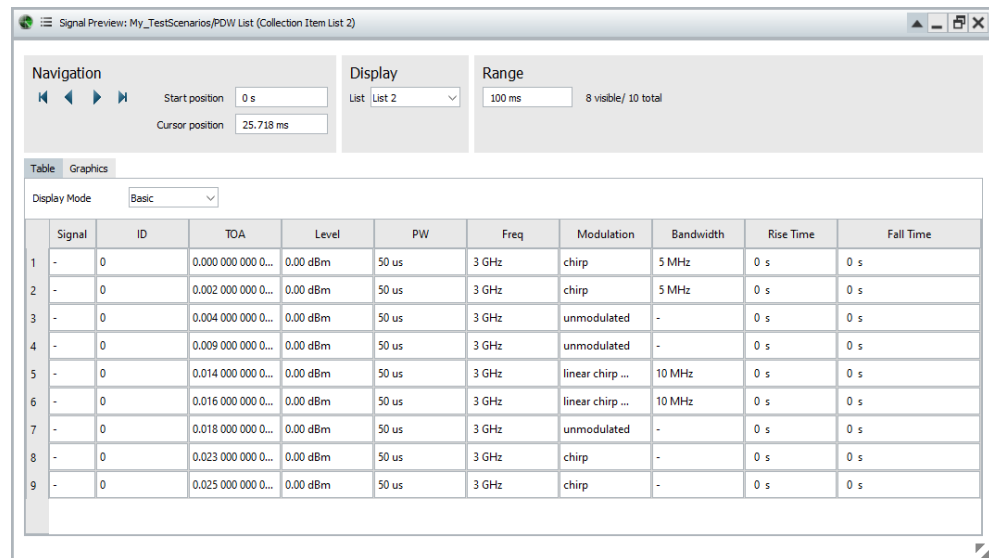
Per default, the R&S Pulse Sequencer Digital evaluates the settings and creates simulated signals out of them.

However, if extending sequencing functionality is used, the output is in Rohde & Schwarz proprietary file format.

Files generated in this way cannot be evaluated as I and Q data, as this evaluation is done with the waveforms. Instead, a dedicated "Signal Preview" dialog displays the main pulse characteristics in a table form.

Access:

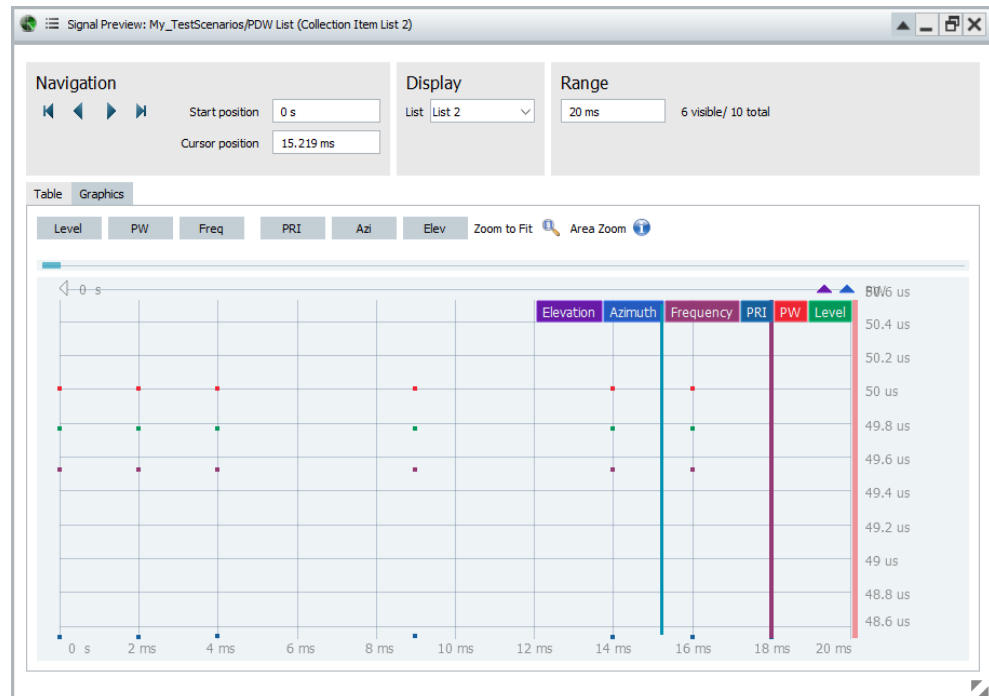
1. In the "Scenario" dialog, depending on the scenario type, select "Signal Generation > Config > [Target] >Destinations".
2. Select "Signal Calculation > Calculate".
3. Select "Signal Calculation > Results > View" and select the required file.
4. In the "Signal Preview" dialog, select "Table".



5. Select, for example, "Graphics > Frequency".

6. Select "Zoom to Fit".

The "Level", "PW", "Frequency", "PRI", "Azi" and "Elev" graphs visualize the variation of the corresponding parameter over time.



7. You can observe the variation of one or several PDW parameters simultaneously. Select a parameter to include it on the display.

The display is color-coded.

8. Click the parameter name to change the units on the y-axis.

The color bar on the right of the display indicates the current PDW parameter.

### Settings:

Navigation.....	286
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Display.....	286
Range.....	286
Table.....	286
Graphics.....	287
L Available parameters.....	287
L Zoom to Fit.....	288
L Zoom Area.....	288

### Navigation

Steps forward or backward to the first or last page.

### Start Position

Sets the start time of the current page.

### Cursor Position

Sets the position of the cursor, expressed in seconds.

### Display

Selects a list to display if more than one list is used in the calculation.

### Range

Selects the time range of the current page.

Selecting a lower value reduces the number of pulses visible. The "visible/total" display next to the field updates accordingly.

You can also change this value by holding the cursor over the graph and using the mouse scroll wheel.

### Table

Lists the file content in table form.

Select "Display Mode" > "Basic" / "Advanced" to show/hide some pulse parameters in the table. Parameters requiring "Advanced" mode are indicated below.

Each row represents one pulse. The sequence in this example consists of 9999 pulses, each described with:

"Signal"	Displays the emitter ID (emitter source of the pulse). The emitter ID is available in collection and map-based scenarios. This information is useful for interleaved signals where the output file contains the pulses of multiple emitters. In DF scenarios, displays emitter ID (source of the pulse) and Rx antenna ID (the antenna that received the pulse). The last entry in this column, "EOF", indicates the file duration.
"ID"	Assigned ID number for the emitter.

"TOA"	Time of arrival The value reflects the selected <a href="#">PRI/PRF</a> , incl. <a href="#">Delay</a> .
"Level"	Pulse level, as configured with the parameter <a href="#">Level</a> , incl. IPM variations.
"PW"	Pulse width, as configured with the parameter <a href="#">Width</a> , incl. IPM variations.
"Freq."	Frequency as set with the parameter <a href="#">Δ Freq.</a> , incl. <a href="#">IPM</a> variations. In this example, a frequency hopping IPM profile varies the frequency in the range 0 Hz to 5 MHz.
"Modulation"	Indicates the modulation type.
"Bandwidth"	Indicates the pulse bandwidth, as configured in " <a href="#">Pulse Shape Settings</a> " on page 95.
"Rise Time"	Indicates the pulse rise time, as configured in " <a href="#">Pulse Shape Settings</a> " on page 95.
"Fall Time"	Indicates the pulse fall time, as configured in " <a href="#">Pulse Shape Settings</a> " on page 95.
"Marker [4321]"	Available in "Display Mode > Advanced". Indicates if the corresponding marker is active.
"Azimuth"	Available in "Display Mode > Advanced". Indicates the azimuth of the pulse.
"Elevation"	Available in "Display Mode > Advanced". Indicates the elevation of the pulse.
"Rx Ant. Azimuth"	Indicates the azimuth of the Rx antenna.
"Rx Ant. Elevation"	Available in "Display Mode > Advanced". Indicates the elevation of the Rx antenna.

### Graphics

Visualize the variation of the corresponding parameter over time.

#### Available parameters ← Graphics

The difference in TOA between two consecutive pulses is used to calculate the pulse repetition interval (PRI).

You can observe the variation of one or more PDW parameters simultaneously. The display is color-coded.

The color bar on the right of the display indicates the current PDW parameter. Click the PDW parameter name on the right corner of the graph to change the units on the y-axis.



**Figure 15-1: Signal Preview: understanding the displayed information**

- 1 = PDW parameters displayed on the graph
- 2 = Current PDW parameter, indicated by the label on the y-axis and the color bar. To change it, click the colored label of the PDW parameter of interest
- 3 = Zoom/shift slider scales and repositions the PDW parameters on the display
- 4 = Auto-scale arrows indicated that the PDW parameter is zoomed in, that is not all values are visible. Click the arrow to zoom out and display all values

The value ranges for both axis are selected automatically. To change the zoom:

- On the x-axis, select the **Zoom to Fit** or turn the mouse wheel.
- On the y-axis, click the labels and move the "Zoom/shift slider".  
To zoom out, click the auto-scale arrow (see [Figure 15-1](#)).

#### **Zoom to Fit ← Graphics**

Scales the graphs automatically to fit into the current time range.

Turn the mouse wheel to zoom in/out in the display.

#### **Zoom Area ← Graphics**

Provides information on defining a zoom area.

Hold the cursor over the blue icon to see the Tooltip.

On the graph, hold [CTRL] and the left mouse button, and drag the mouse to define the zoom area.



## 16 Creating complex 2D scenarios with receiver and TX items

The dedicated scenario types for complex 2D emitter-receiver scenarios are:

- "Localized Emitters"
- "Direction Finding" (Option:R&S PULSE-K39)

Complex 2D emitter-receiver scenarios can include the following elements:

- **"Receiver"**  
Simple or complex, depending on the scenario.  
There is exactly one receiver per gaming area (2D map).  
The receiver is described by one or more antenna elements, static position and attitude information.
- **"Emitters"**  
Simple or complex, depending on their definition.  
Emitters are described by the combination of an operating mode, antenna pattern, antenna scan and a sequence, static position and attitude information.
- **"Background emitters"**  
Background emitters are a source of a noise-like pulsed background signal, broadcasted with equal power in all directions. They are added to the scenario as sequences of pulses.
- **"Platforms"**  
A platform is a group of up to 8 emitters associated with a single icon.  
Platforms are differentiated from other emitters by a configurable colored background.  
Each emitter on the platform can be individually configured and controlled.

Complex 2D emitter-receiver scenarios support the following georeferenced map formats:

- GeoTIF

For step-by-step instructions, see:

- [Chapter 16.1, "How to create scenarios with receiver and TX items"](#), on page 290

For a description of the related settings, see:

- [Chapter 16.2, "2D map settings"](#), on page 298
- [Chapter 16.3, "3D scan pair view settings"](#), on page 302
- [Chapter 16.4.1, "Available TX items"](#), on page 308
- [Chapter 16.5, "Moving emitters and platforms"](#), on page 323
- [Chapter 16.7, "Background emitters properties"](#), on page 335

## 16.1 How to create scenarios with receiver and TX items

Depending on the test situation, select one of the following scenario types:

- If your test situation requires testing the receiver's ability to detect the sum signal from different static emitters, you can use a **"Localized Emitter"** scenario. In this dedicated scenario, you configure the signal of one or more emitters that are received by a receiver with defined characteristics. You can also configure the receiver and change its position in the scanning beam of the emitters.
- If your test situation requires testing a multichannel receiver and its ability to detect the origin of a signal, you can use a **"Direction Finding"** scenario. Option: R&S PULSE-K39 required for direction finding. In this dedicated scenario, you configure the signal of one or more emitters that is received by a receiver with up to 10 antenna elements. The receiver evaluates the receiver signal and estimates the origin of the emitter, based on received power level and time delays.

See:

- ["General workflow for creating complex 2D scenarios"](#) on page 290
- ["How to create a direction finding scenario"](#) on page 291
- ["How to create the scenario and configure the receiver"](#) on page 292
- ["How to configure moving emitters and receiver"](#) on page 294
- [Chapter 16.8, "Platforms with multiple emitters"](#), on page 337
- [Chapter 16.10, "Using georeferenced maps"](#), on page 342

### General workflow for creating complex 2D scenarios

To explain the principle, the provided example creates a complex "Direction Finding" scenario. One emitter is placed on the 2D map at a given distance to a multichannel receiver. The receiver and the emitter characteristics are configured.



To create "Localized Emitter" scenarios, follow the same workflow.

For example, drag and drop further elements, such as emitters, platforms and background signals to the 2D map and configure their settings.

Follow the following general steps:

1. Open a suitable scenario.
2. In the block diagram, select "Map".  
The "2D" dialog displays a 2D view of the receiver and currently configured emitters, together with their main characteristics.
3. Add a georeferenced background map to the "2D" dialog, if required.
4. Drag and drop items from the repository onto the 2D map (or relevant list).
  - Emitters (drop on map or "TX Items" list)
  - Platforms (drop on map or "TX Items" list)
5. Use the mouse to reposition (drag and drop) items on the map.

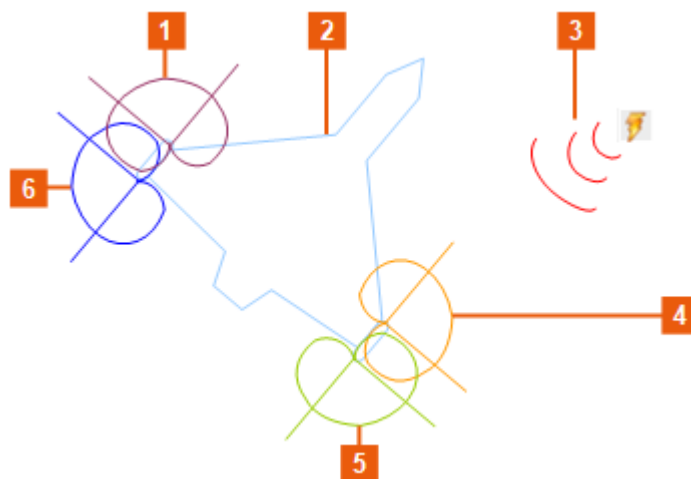
6. Use the context menu of any of the elements on the 2D map to:
  - a) Access and configure the "Properties".  
For example, define the elements position more precisely. Or change the attitude (orientation) of the antenna.
  - b) Display the 3D antenna patterns and scans.  
For example, select "Normalized power level at Receiver > Source > Emitter Only > On" to display only the signal at the receiver.  
The calculation assumes a receiver with an omnidirectional antenna pattern.
  - c) To add/remove an emitter or platform.
  - d) To select an icon.
  - e) To configure a trajectory (movement path).
7. Use the mouse wheel to change the scale of the 2D diagram, i.e. to change the distance between the receiver and the emitters.

For a description of the provided settings, see:

- [Chapter 16.2, "2D map settings"](#), on page 298
- [Chapter 16.3, "3D scan pair view settings"](#), on page 302
- [Chapter 16.4.1, "Available TX items"](#), on page 308
- [Chapter 16.7, "Background emitters properties"](#), on page 335

### How to create a direction finding scenario

This example shows you how to create and configure a scenario for testing of a four channel receiver. A four channel receiver can be located for example on the wings of an airplane, see [Figure 16-1](#).



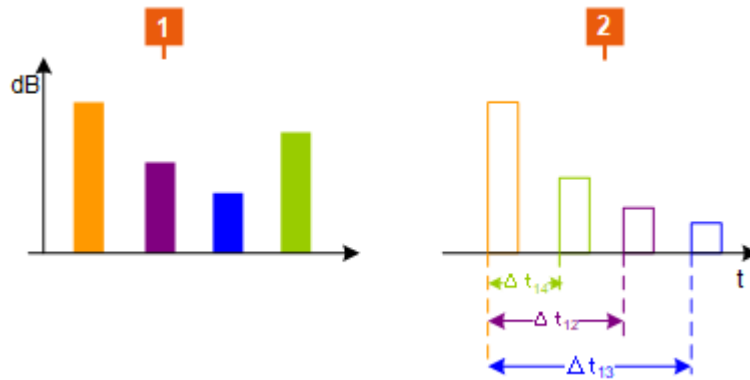
**Figure 16-1: Direction finding: four channel receiver**

- 1, 4, 5, 6 = Four sectors (i.e. the four antennas of a multichannel receiver)  
 2 = Airplane with a direction finding receiver  
 3 = Emitter

Each of the four antennas receives signal with different power level. In this example, the antenna at the first sector (at the front on the right side) receives the strongest signal. The signals are also received with different time delays. The signal at the third sec-

tor, for example, has the longest time delay. Multichannel direction finding receivers measure the received power levels and time delays and estimates the origin of the emitter.

The illustrations on [Figure 16-2](#) show the principle of amplitude and time delay based direction finding.

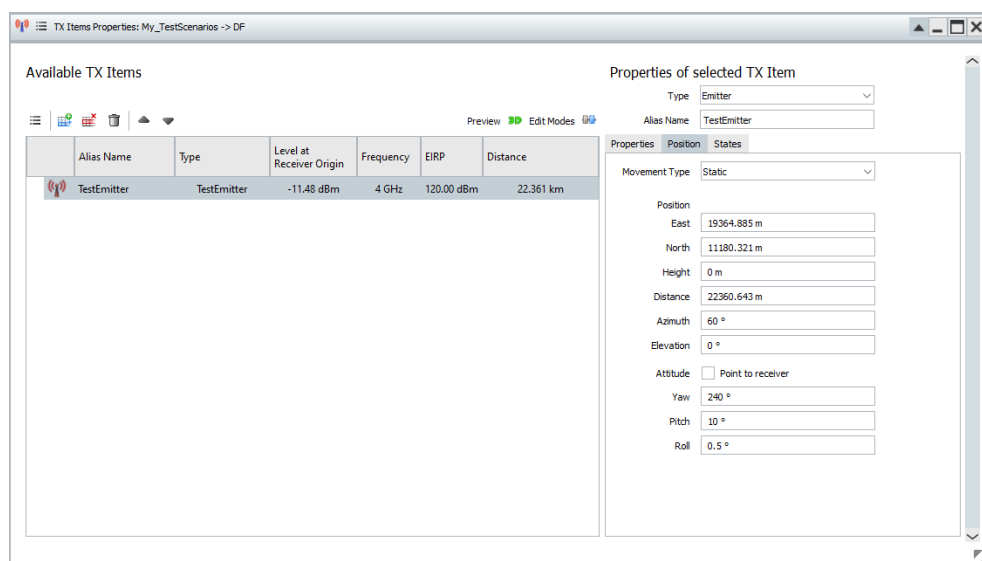


**Figure 16-2: Principle of the amplitude and time delay based direction finding**

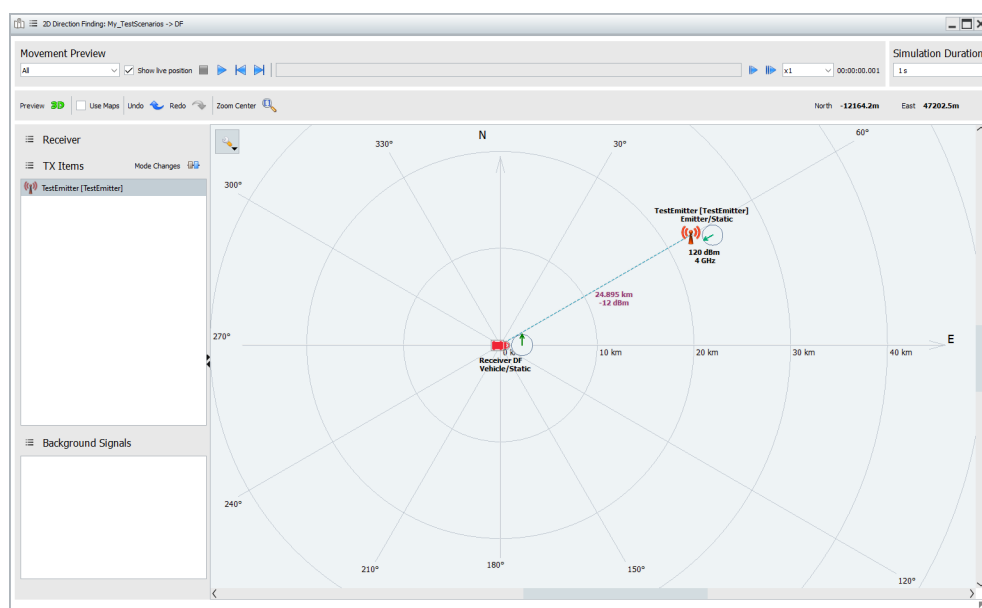
1 = Power levels received by each of the four antennas at the receiver  
 2 = Relative time delays between the received

### How to create the scenario and configure the receiver

1. Create a direction finding scenario.
2. Create a receiver.  
 For example of suitable receiver settings, see [Chapter 13.2, "Receiver settings"](#), on page 264 and:
  - [Figure 13-3](#)
  - [Figure 13-4](#).
3. In the scenario dialog, select "Map > 2D".
4. Create an emitter.  
 For example, use a raster scan and an antenna with a narrow (pencil) antenna beam.  
 Enable a "Pitch = 10°" because the receiver is 10000 higher than the emitter.

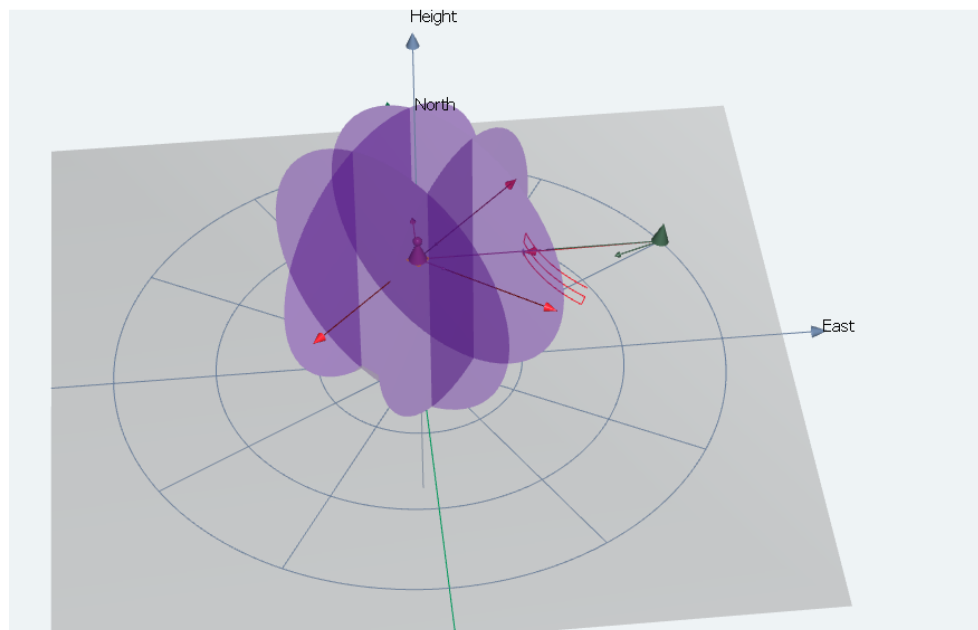


5. Drag and drop the emitter onto the 2D map.



6. Select "Receiver > context menu > Properties".  
Set "Height = 10000 m".
7. Select "Available Tx Items > Preview 3D".  
Observe the display. Zoom in; turn on the 3D display for a better overview.

Change the antenna selected with the parameter "Receiver Antenna".



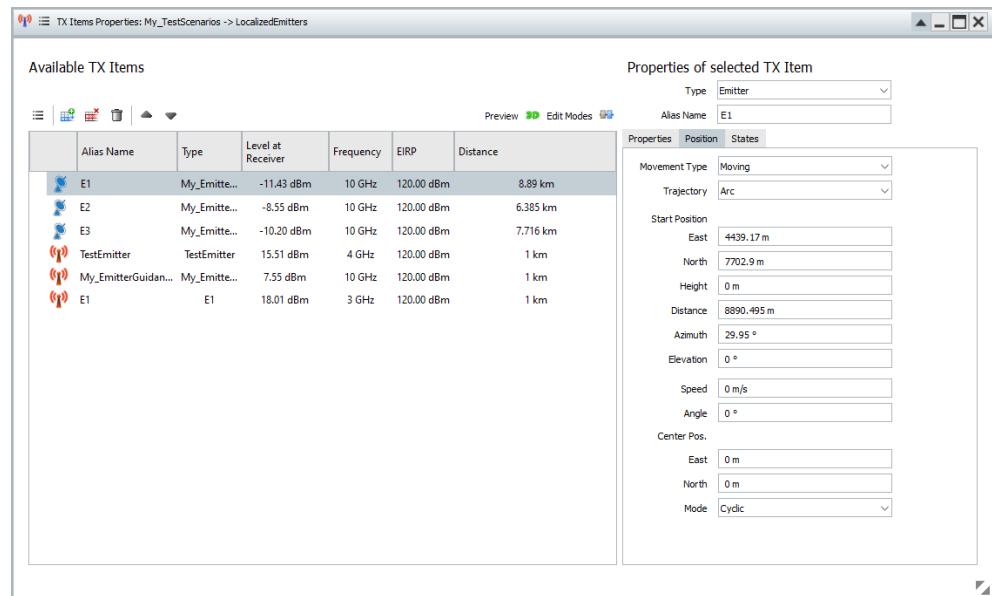
The 3D view displays the four antennas of the multichannel receiver. The receiver and the emitter are at different heights.

The power level of the received signal changes depending on the current "Receiver Antenna".

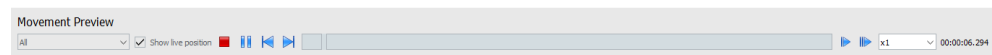
In this example, the signal from the antenna placed on the right side at the front of the airplane ("Antenna = front right") receives the strongest signal (see [Figure 16-2](#)).

#### How to configure moving emitters and receiver

1. On the 2D map, select "Properties > TX Items".
2. In the list of "Available TX Items", select an emitter.
3. Select "Properties of the Selected emitters > Position".
4. Select "Mode > Moving".



- Configure the "Trajectory" and further settings.  
See [Chapter 16.9, "Creating trajectories on a 2D map"](#), on page 341.
- To observe the movement, on the 2D map, select "Movement Preview > Play".

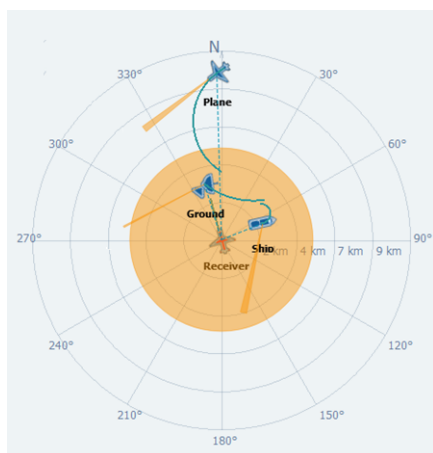


**Figure 16-3: 2D map > Movement Preview**

If "Show live position" is activated, an overview dialog opens and displays a live preview of important position parameters per Tx item. You can close the "2D Live Preview" at any time. The movement is not interrupted.

ID	Alias Name	Distance	Level at Rx Origin	Azimuth	Elevation	North	East	Height
3	Ground	5,138 km	-2 dBm	342.8°	0.0°	3.33 km	-1.02 km	0.00 km
2	Plane	10,387 km	-13 dBm	358.3°	0.0°	10.64 km	-0.37 km	4000.00 km
1	Ship	4,784 km	4 dBm	72.9°	0.0°	1.03 km	2.44 km	-0.00 km

The "Movement Preview" dialog displays the duration of the moving scenario. With "Scenario > Signal Calculation > Config > Config > Signal Calculation Settings > Duration > Simulation Duration = Auto", the duration is calculated automatically so that the movement of all objects is completed.

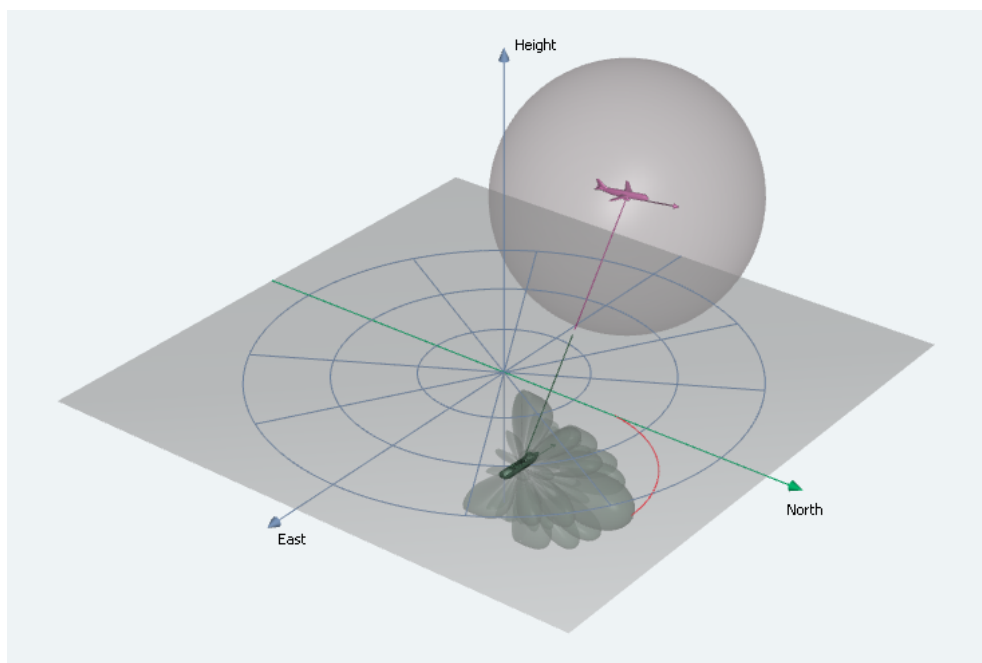


**Figure 16-4: 2D map showing antenna types**

Beam = Indicates directional antenna of any kind. The sector direction corresponds to the actual scan direction.

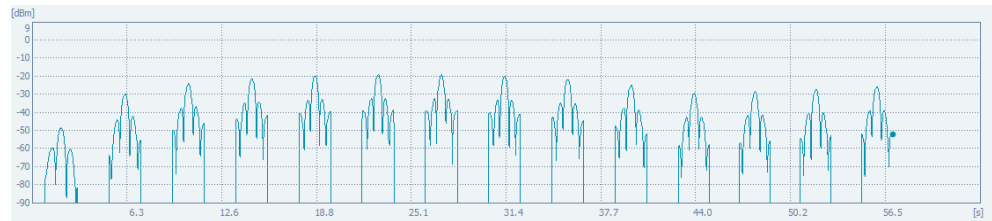
Circle = Represents an omni-directional (isotropic) antenna.

7. To observe the signal variation at the receiver, select an "Emitter > context menu > 3D View with Receiver".



The power level at the receiver varies due to the receiver's antenna pattern and scan. The free space attenuation over the dynamically changing distance between the emitter and the receiver also affects the level.

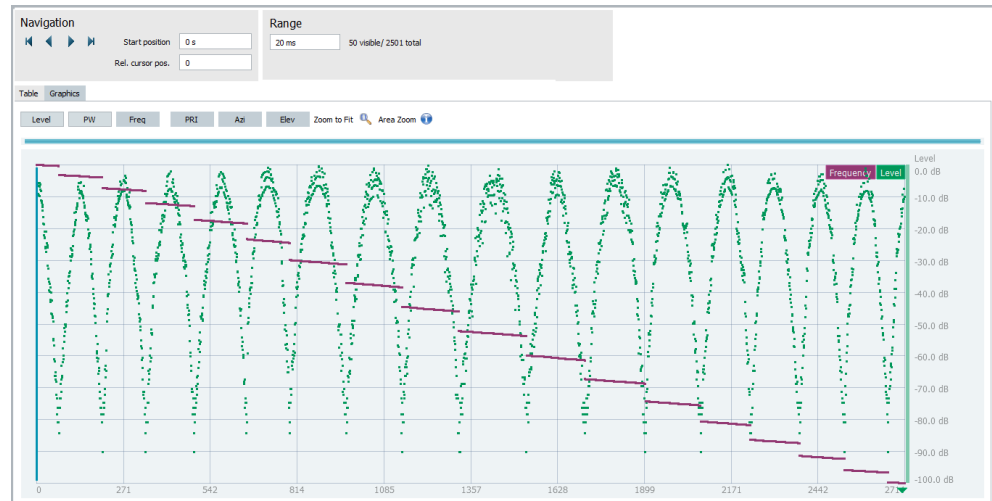




When interpreting the results, consider the type of receive antenna and the emitter's trajectory and altitude. A low received power level does not always correspond to long distance between emitter and receiver. A receive antenna with high directivity and gain only provides a high signal power if the emitter is in the main beam. If the emitter overflies the receiver, you can expect large sudden changes in the signal level. If the receive antenna is omni-directional, you can expect a smooth rise and fall in level as the emitter passes by.

8. Calculate the signal. Observe the generated signals:
  - a) In the scenario dialog, select "Signal Calculation > Config > Config > Signal Calculations Settings > Output" and modify as required.
  - b) Select "Signal Generation > Assign" and select the destination.
  - c) Select "Signal Calculation > Calculate".
  - d) Select, for example, "Signal Generation > Results > View > Ground".
  - e) In the "Signal Preview" dialog, select "Frequency".

In this example, the receiver and the emitter (Ground) are moving objects, where the receiver approaches the emitter and later departs from it.



The "Frequency" and "Level" displays confirm the expected frequency variation caused by the Doppler effect. The Doppler is a positive value during the approaching phase and negative one during the time the receiver is flying away from the emitter.

## 16.2 2D map settings

Access:

- ▶ Perform one of the following:
  - In a "Scenario Type = Localized Emitters", select "Map".
  - In a "Scenario Type = Direction Finding", select "Map".

The name of the dialog changes depending on the scenario but the settings and the workflow are similar.

The 2D diagram displays the configuration on a map with North/East coordinates.

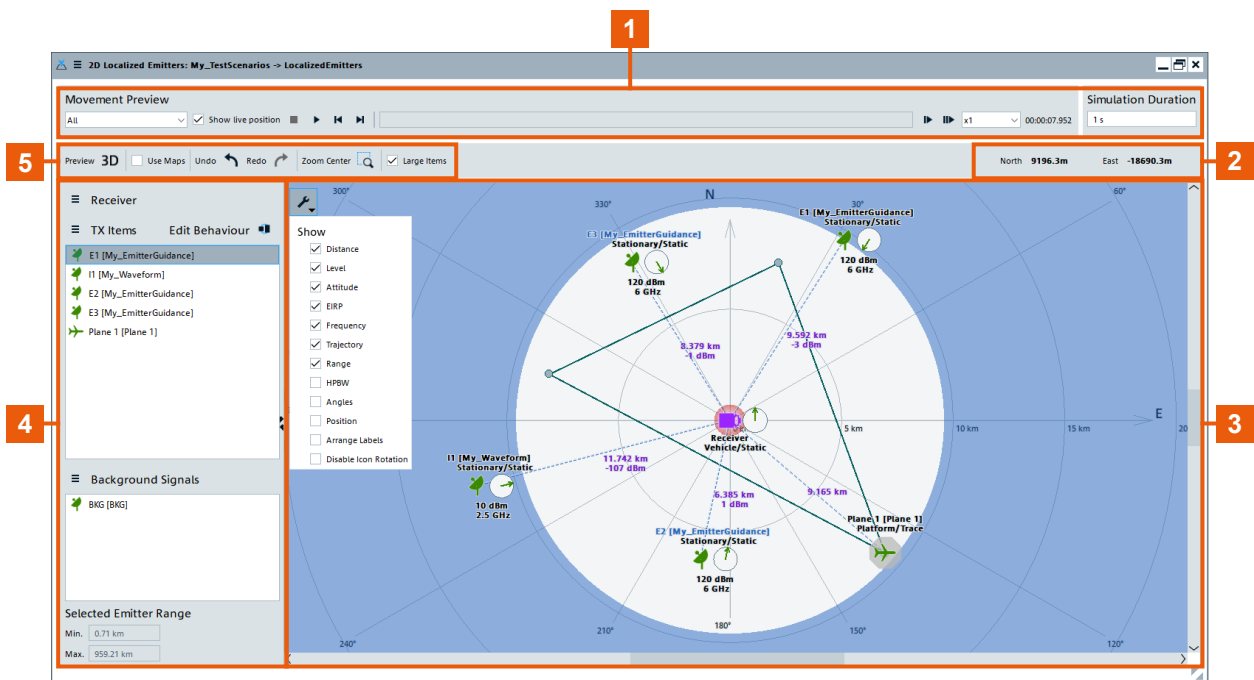


Figure 16-5: 2D view: understanding the displayed information

- 1 = Simulation tools and information
- 2 = Cursor coordinates
- 3 = Visualization area
- 4 = Receiver/TX Items
- 5 = Display controls

See also [Chapter 16.5, "Moving emitters and platforms"](#), on page 323.

### Settings:

<a href="#">Movement Preview</a> .....	299
<a href="#">Position Step</a> .....	299
<a href="#">Simulation Duration</a> .....	299
<a href="#">2D Live Preview Stats</a> .....	299
<a href="#">Undo/Redo</a> .....	299
<a href="#">Pan, Zoom</a> .....	299
<a href="#">Large Items</a> .....	300

Visualization settings > Distance, Level, Attitude, EIRP, Frequency, Trajectory, Range, HPBW, Angles, Position, Arrange Labels.....	300
Platform, Emitter, Properties.....	302
Background Signals.....	302
Platform/Emitter position on the 2D map and distance to the receiver.....	302

### Movement Preview

Use the drop-down menu to select the trajectory of a specific platform. Selecting "All" displays the trajectories of all platforms.

"Show live position"

Activates the dialog "2D Live Preview Stats" on page 299.

"Start/Stop, Pause, Move to Start/End"

Standard play functions.

"Time Line"

Indicates the current time of the simulation.

"Play slower/faster"

Switches to the next/previous value of the time scale coefficient.

"Time Scale Coefficient"

Applies a coefficient to speed up or slow down the display.

### Position Step

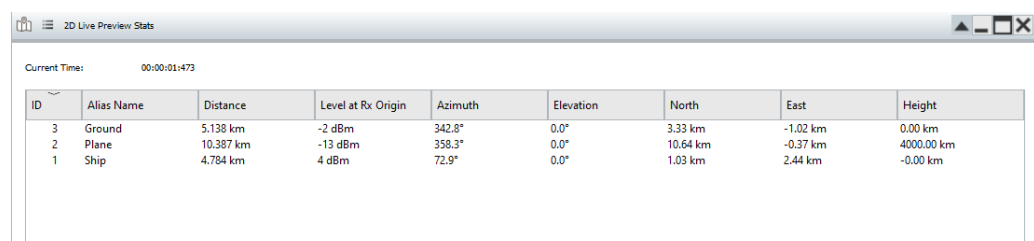
Available if an emitter with "Position > Mode = Steps" is present. You can select a specific step for the emitter on the 2D map.

### Simulation Duration

Available if a fixed simulation time is defined for the selected scenario, see "Duration" on page 349.

### 2D Live Preview Stats

If "Show live position" is activated and a preview is started ("Play"), displays a live track of the positions of the TX items.



ID	Alias Name	Distance	Level at Rx Origin	Azimuth	Elevation	North	East	Height
3	Ground	5.138 km	-2 dBm	342.8°	0.0°	3.33 km	-1.02 km	0.00 km
2	Plane	10.387 km	-13 dBm	358.3°	0.0°	10.64 km	-0.37 km	4000.00 km
1	Ship	4.784 km	4 dBm	72.9°	0.0°	1.03 km	2.44 km	-0.00 km

Closing the dialog does not interrupt the movement preview.

Remote command:

`PREView:POSition?` on page 577

### Undo/Redo

Reverses the drag&drop operation on the 2D map.

### Pan, Zoom

- Pan: Use the mouse to move the displayed map area.

- Zoom in/out: Turn the mouse wheel to zoom in or out.
- Zoom center: Press the zoom icon.

**Large Items**

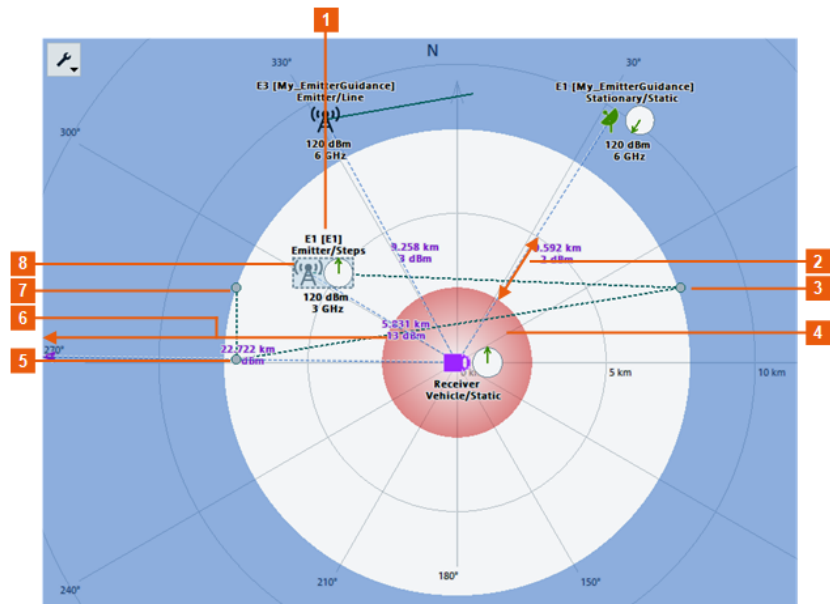
Activates the larger size for items displayed in the visualization area.

**Visualization settings > Distance, Level, Attitude, EIRP, Frequency, Trajectory, Range, HPBW, Angles, Position, Arrange Labels**

To change the displayed information, enable or disable the corresponding parameter.

"Range"

If enabled, indicates the dynamic range for the simulation, numerically and as a color-coded indication.



**Figure 16-6: 2D map > Visualization > Range: Understanding the displayed information**

- 1 = Selected emitter (Emitter 1, movement = position steps)
- 2 = Unused area, where the radius (outer border) is the minimum distance between the receiver and the selected emitter; in this example, this is the position of step 1
- 3, 5, 7, = Four position steps, emitter currently displayed at position step 3
- 8
- 4 = Minimum distance from the receiver that can be simulated for the selected emitter
- 6 = Dynamic range of the signal generator (outer border outside of the displayed area)

- Red background  
Range where the maximum simulated output power is exceeded.
- Blue background  
Range where you can place an emitter or emitters and the simulation generates the signal in its dynamic range.
  - Outer border = lowest output power that can be generated for the selected emitter and position mode.
  - Inner border = minimum distance between the receiver and the selected emitter.

"Position > Mode = Static", the position of the emitter  
 "Position > Mode = Steps/Moving", among all steps/trajectory point, the position of the closest to receiver one

If an emitter moves beyond the outer-border of the blue area, the signal becomes too weak to be generated.

If emitters are too close to the receiver and enters the red area, the simulated output power can be insufficient to generate such high power. In such cases, the power levels clipped to the value

specified in the signal calculation settings (see ["Clipping Level"](#) on page 349).

- White background  
Unused area on the map, showing the cross-section between the red and blue area.

"Angels"	If enabled, displays the azimuth and elevation angles in a label near the emitter.
"Position"	If enabled, displays the positions in terms of north/east coordinates and height.
"Arrange Labels"	If enabled, moves the labels to avoid any overlapping.

### Platform, Emitter, Properties

Double-click the "Platform/Emitter" name to access the "Emitter Properties" dialog, see [Chapter 16.4.1, "Available TX items"](#), on page 308.

### Background Signals

Displays the sequences or the background emitters that compose the background signal.

To add a background emitter, drag and drop a sequence containing the emitter in the block.

Remote command:

See [SCENario:LOCalized:SEquence](#) on page 554.

See [SCENario:DF:SEquence](#) on page 554.

### Platform/Emitter position on the 2D map and distance to the receiver

The 2D map indicates the current distance, calculated from the current platform/emitter position on the 2D map.

To change the current position of the emitter, use one of the following possibilities:

- Drag the platform/emitter to the new position on the 2D map.
- Open its context menu, select "Properties > Position" and change the coordinates, the "Attitude" and the "Distance".

If several position steps are defined, the changes apply to the current step ("Current Step"), see [Discrete position steps](#).

## 16.3 3D scan pair view settings

Access:

1. Perform one of the following:
  - In a scenario type "Localized Emitters", select "Map" > "3D"
  - In a scenario type "DF" (Direction Finding), select "Map" > "3D"
2. In the 2D map, perform one of the following:
  - In one of the lists, select an emitter or platform > "Properties" > "3D"

- In the map, right-click an emitter or platform > context menu > "3D View with Receiver".

The "3D Scan Pair View" appears.

If you loaded a georeferenced map in the 2D view, it also appears in the 3D view.

The available settings depend on the scenario:

- A simple scenario containing an emitter and a receiver (each with only one antenna) offers fewer settings.
- A complex scenario containing moving platforms (each with multiple emitters) and a scanning DF receiver (with multiple antennas) offers more settings.

However, if you understand how your emitters are configured, the differences are self-explanatory.

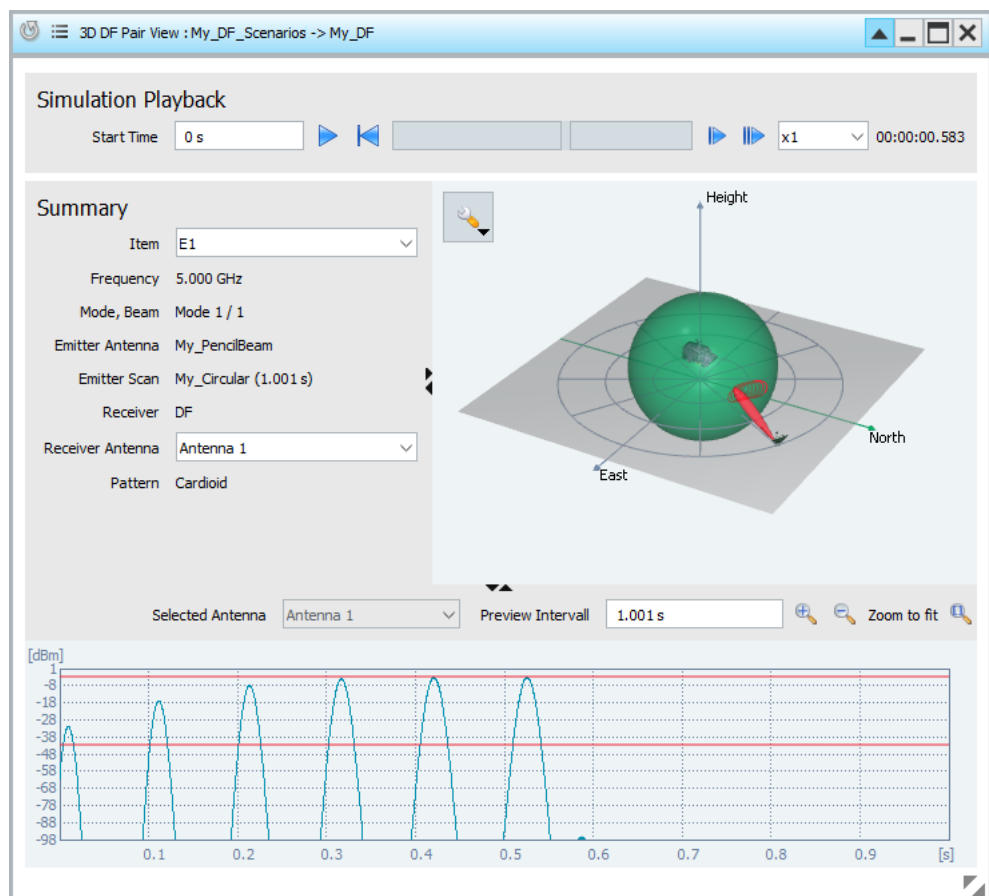


Figure 16-7: Example: 3D Scan Pair View display, Scenario Type = DF

This dialog displays:

- A live plot of the normalized signal power level at the receiver.
- A 3D view of the receiver and emitter antennas with their patterns and scans.
- In "Direction Finding" scenario, the plot and the 3D view correspond to the selected receiver antenna element.

**Settings:**

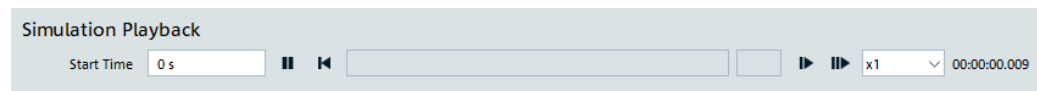
Simulation Playback.....	304
Summary (live plot and 3D view configuration).....	305
Settings.....	305
Preview graphic settings.....	307

**Simulation Playback**

Controls the timing of the simulation.

For example, with these settings you can analyze when/where/how often the beams overlap while simulating:

- A static scanning RX and a static scanning TX with different scan cycles.
- A moving RX and static TX
- A moving TX with different modes and a static RX



**Figure 16-8: Simulation Playback**

In addition to setting the overall duration, you can also observe a particular time-segment of the simulation by starting and stopping at particular times.

**Note:** The duration of a simulation depends on the scenario. An emitter with a long trajectory and low speed causes a long duration. A short trajectory and/or high speed cause a short duration.

The duration provides the maximum value for the "Stop Time" and "Preview Interval" settings.

"Start Time" Set to 0 s or *minimum*, to play the simulation from the beginning. Typically, set this value to begin the simulation at a particular point along the trajectory.

Buttons Control the simulation using the following buttons:

- Pause/Play - use this toggle to pause the simulation and resume playing.
- Restart - use this button to restart the simulation at the configured "Start Time".
- Play slower/Play faster - decrease/increase the "Speed-up factor"



**Summary (live plot and 3D view configuration)**

Summary

Item Ship-LCS1

Subitem Platform Emitter 3

Show All

Frequency 5.000 GHz

Mode, Beam Mode 1 / 1

Emitter Antenna My\_PencilBeam

Emitter Scan My\_Circular (2 s)

Receiver Receiver DF

Receiver Antenna Antenna 4 - custom

Pattern CustomAntennPattern

**Figure 16-9: Summary**

The "Summary" provides the following information fields and drop-down lists:

"Item"	Lists all emitters and platforms of the selected scenario. Select the item you want to use for the simulation. If you select a platform, see "Subitem" for a list of the emitters on the platform.
"Subitem"	Lists all emitters on the selected platform. Select the emitter you want to use for the simulation.
"Frequency"	Shows the frequency used by the selected emitter.
"Mode, Beam"	Shows the active mode and beam combination (continuously updated) during the simulation. This information is useful when: <ul style="list-style-type: none"> <li>• The selected emitter has more than 1 mode.</li> <li>• The active mode has more than one beam.</li> </ul>
"Emitter Antenna"	Shows the "Antenna Pattern" used by the selected emitter.
"Emitter Scan"	Shows the name of the "Antenna Scan" used by the selected emitter.
"Receiver"	Shows the name of the selected emitter.
"Receiver Antenna"	Lists all antennas configured for the selected receiver. Select the antenna you want to use for the simulation.
"Pattern"	Shows the "Antenna Pattern" used by the selected "Receiver Antenna".

**Settings**

Access: click the visualization settings icon to open the settings dialog.

Display	<input type="radio"/> Scan Line
	<input checked="" type="radio"/> Pattern
	<input type="radio"/> HPBW
Rx Opacity	<input type="range"/>
Tx Opacity	<input type="range"/>
Show LOS	<input type="checkbox"/>
Show Skybox	<input type="checkbox"/>
Show Map	<input type="checkbox"/>
Map Opacity	<input type="range"/>
Zoom Center	<input type="radio"/> North
	<input checked="" type="radio"/> Track Emitter
	<input type="radio"/> Mouse Click

Defines the way the scan is represented:

"Scan Line" The RX and TX beams are represented by lines.

"Pattern" The RX and TX beams are represented by antenna patterns.

"HPBW" The RX and TX beams are represented by colored eclipses. The size of an eclipse indicates the half-power beam-width [HPBW](#).

"Show Line of Sight" Displays the line of sight (LOS) between the emitter and the receiver.

"North" When zoomed/zooming, the view is focused on the center of the "North" line. Typically used with maps. Helps you maintain an awareness of the map's orientation.

"Track Emitter" When zoomed/zooming, the view is focused on the emitter. Typically used with moving emitters. The view stays focused on the emitter as it moves.

"Mouse Click" When zoomed/zooming, the view is focused on a user-defined marker. Use the left mouse button to put a marker on the map. Enables you to decide the focus of the view when zoomed/zooming.

### Preview graphic settings

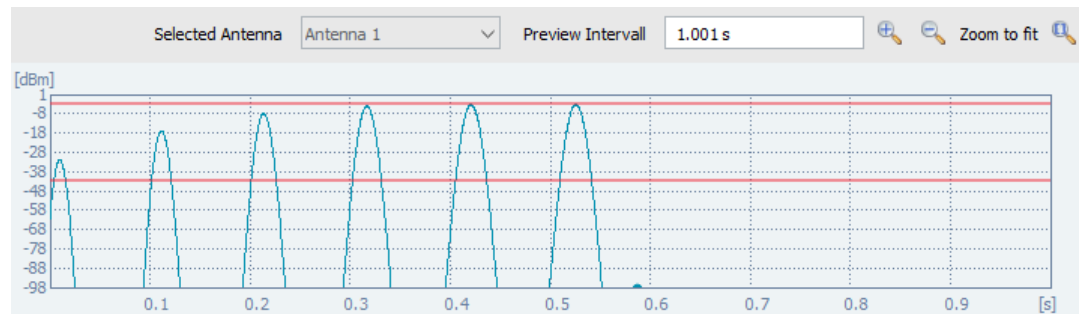


Figure 16-10: Settings for the preview graphic

Define which signal is visualized in the graphic.

See also ["How to create the scenario and configure the receiver"](#) on page 292.

#### "Selected Antenna"

In "Direction Finding" scenario and if "Receiver Antenna > Show that All Antennas" is selected, switches between the receiver antenna elements.

#### "Preview Interval"

Sets the time interval shown on the preview at the bottom of the view. The horizontal axis of the preview corresponds to the configured "Preview Interval".

Typically, set to a multiple of the TX scan cycle time, to show several sweeps in one preview. For example, for an emitter with a 2 second cycle, an interval of 10 seconds shows 5 sweeps.

**Note:** "Preview Interval" is the time represented by the horizontal axis of the preview. It is not the time taken to fill the preview.

"Preview Duration" is the time taken to fill the preview, which is calculated from your settings, automatically.

#### "Zoom in", "Zoom out" and "Zoom to fit"

These icons refer to the preview graphic settings time axis:

## 16.4 Properties of TX items (emitters and platforms)

The "TX Items" dialog provides access to the properties of all the emitters and platforms in the current scenario.

Access:

1. Open a suitable scenario.

Use any scenario that offers "Map" in the "Scenario Creation" block.

- "Localized Emitters"
- "Direction Finding"

2. In the block diagram, select "Map".

The "2D" dialog displays a 2D view of the receiver and currently configured emitters, platforms, together with their main characteristics.

3. In the "2D" dialog, use one of the following to access the "TX Items Properties" dialog:
  - "Properties" list > "TX Items" link
  - Map
    - Double-click a platform/emitter icon
    - Right-click a platform/emitter icon > context menu > "Properties"
  - "TX Items" list
    - Double-click an entry
    - Right-click an entry > context menu > "Properties"

The "TX Items Properties" dialog opens.

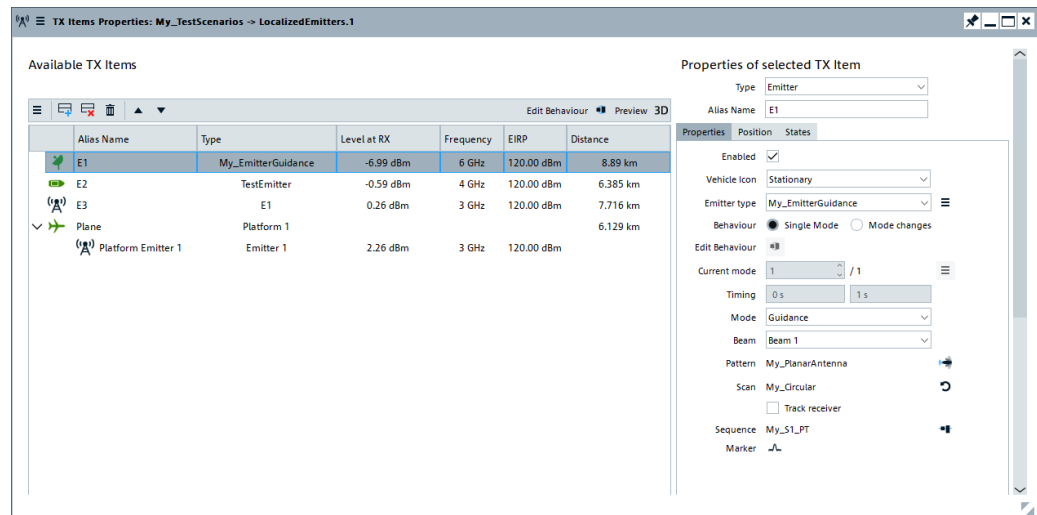


Figure 16-11: TX Items Properties dialog example

As Figure 16-11 shows, this dialog contains 2 parts:

- "Available TX Items" (left)  
Select the item you want to configure.
- "Properties of selected TX Item" (right)  
This part contains 3 tabs. Use the appropriate tab to configure the "Properties", "Position" or "States" of the selected item.

### 16.4.1 Available TX items

Access:

- ▶ In the "2D" dialog, use one of the following to access the "TX Items Properties" dialog:
  - "Properties" list > "TX Items"

- Map
  - Double-click a platform/emitter icon
  - Right-click a platform/emitter icon > context menu > "Properties"
- "TX Items" list
  - Double-click an entry
  - Right-click an entry > context menu > "Properties"

<a href="#">Append, Delete, Clear, Move Up/Down</a> .....	309
<a href="#">Preview 3D</a> .....	309
<a href="#">Edit Behaviour</a> .....	309
<a href="#">List of available emitters</a> .....	309

### Append, Delete, Clear, Move Up/Down

Use the standard functions of these buttons to add, reorder, or remove items.

### Preview 3D

Opens the "3D Preview" for the selected "Emitter".

See [Chapter 16.3, "3D scan pair view settings"](#), on page 302.

### Edit Behaviour

Accesses the "Mode Editor" dialog.

This is a graphical editor for jointly configuring and defining the duration emitters are working in the different modes.

It works like the [Mode Changes](#) settings for each of the emitters but rather than defining the start and end time of a mode, you drag the start and end time on the time scale.

In the dialog, you can configure the mode changes of all emitters available in the scenario.

For a description, see [Chapter 10.3.3, "Mode editor settings"](#), on page 230.

### List of available emitters

Overview information of the available emitters in table form.

"Alias Name"	Displays an alias name.
"Type"	Displays the type of TX item.
"Level at RX"	<p>Indicates the maximum level at the receiver origin. The calculation considers the receiver EIRP and the free space attenuation. Individual antenna attenuation due to positioning and polarization is omitted.</p> <p>Remote command: <a href="#">SCENario:LOCalized:LEVel</a> on page 560 <a href="#">SCENario:DF:LEVel</a> on page 560</p>
"Frequency"	<p>As set with the parameter <a href="#">Frequency</a>.</p> <p>Remote command: <a href="#">SCENario:LOCalized:FREQuency?</a> on page 555 <a href="#">SCENario:DF:FREQuency?</a> on page 555</p>

"EIRP"	As set with the parameter <a href="#">EIRP</a> or with the parameter "EIRP".
"Distance"	The distance from the TX item to the receiver. As set with the <a href="#">East, North, Height/Distance, Azimuth, Elevation</a> parameters.

Remote command:

[SCENario:LOCalized:ADD](#) on page 429

[SCENario:LOCalized:SElect](#) on page 430

[SCENario:LOCalized:CURRent](#) on page 548

[SCENario:LOCalized:DElete](#) on page 432

[SCENario:LOCalized:CLEar](#) on page 433

[SCENario:DF:ADD](#) on page 429

[SCENario:DF:SElect](#) on page 430

[SCENario:DF:CURRent](#) on page 548

[SCENario:DF:DElete](#) on page 432

[SCENario:DF:CLEar](#) on page 433

## 16.4.2 Properties of the selected TX item

Access:

- In the "2D" dialog, use one of the following to access the "TX Items Properties" dialog:
  - "Properties" list > "TX Items"
  - Map
    - Double-click a platform/emitter icon
    - Right-click a platform/emitter icon > context menu > "Properties"
  - "TX Items" list
    - Double-click an entry
    - Right-click an entry > context menu > "Properties"
- In the list of "Available TX Items", select a platform/emitter.  
For details on the "Properties of Selected TX Item" area, see the following sub-chapters.

In "Properties of selected TX Item", not all TX items support all tabs.

See [Table 16-1](#).

Table 16-1: TX items and tabs

"TX Item"	"Properties" tab	"Position" tab	"States" tab	Remarks
Platform	•	•	○	States depend on emitters. See <a href="#">Chapter 16.4.2.3, "States"</a> , on page 321.
Platform emitter	•	○	•	Position depends on platform. See <a href="#">Chapter 16.4, "Properties of TX items (emitters and platforms)"</a> , on page 307.
Emitter	•	•	•	Independent emitter. See <a href="#">Chapter 16.4, "Properties of TX items (emitters and platforms)"</a> , on page 307.

The selected "TX Item" is described with the following parameters:


- [Properties \(Type, alias name and configuration\)](#)..... 311
- [Position settings \(Static position and discrete position steps\)](#)..... 315
- [States](#)..... 321

#### 16.4.2.1 Properties (Type, alias name and configuration)

The content of the "Properties" tab depends on which TX item you select. Not all the configuration options display for all TX items.

Access:

1. In the list of "Available TX Items", select a platform/emitter.
2. Select "Properties of selected TX Item" > "Properties" tab.

Type.....	312
Alias Name.....	312
Emitter Name.....	312
Enabled.....	312
Platform type.....	312
Vehicle Icon.....	312
Behaviour.....	312
L Single Mode.....	313
L Mode Changes.....	313
L Edit Behaviour.....	313
L Current Mode.....	313
L  Append, Remove Current, Remove All.....	314
L Timing.....	314
EIRP.....	314
Frequency.....	314
Mode.....	314
Beam.....	315

Antenna Pattern, Scan, Sequence.....	315
Track Receiver.....	315
Emitter Marker.....	315

**Type**

Defines whether an emitter is configured.

Remote command:

[SCENario:LOCalized:TYPE](#) on page 553

[SCENario:DF:TYPE](#) on page 553

**Alias Name**

Enters an alias name.

Remote command:

[SCENario:LOCalized:ALIAS](#) on page 548

[SCENario:DF:ALIAS](#) on page 548

**Emitter Name**

Selects a platform/emitter.

Remote command:

[SCENario:LOCalized:EMITter](#) on page 549

[SCENario:DF:EMITter](#) on page 549

**Enabled**

Enables selected item for calculation.

Remote command:

[SCENario:DF:EMITter:ENABLE](#) on page 550

[SCENario:LOCalized:EMITter:ENABLE](#) on page 550

**Platform type**

Defines or edits the platform assigned to the selected "TX Item".

Remote command:

[SCENario:LOCalized:EMITter](#) on page 549

[SCENario:DF:EMITter](#) on page 549

**Vehicle Icon**

Assign different icons to the emitters on the 2D map.

The icons are merely for display; the function and the properties of the emitters do not depend on the icon.

Remote command:

[SCENario:LOCalized:MOVement:VEHicle](#) on page 574

[SCENario:DF:MOVement:VEHicle](#) on page 574

**Behaviour**

Enables emulation of emitters that change their mode over time.

For more information on emitter modes, see "[Operational mode](#)" on page 218.



To visualize the effect of the mode switching, select "2D map > Emitter (with several modes) > context menu > 3D View with Receiver".

You can define and configure the duration of the modes in one of the following ways:

- With the settings:
  - ["Append, Remove Current, Remove All"](#) on page 314
  - ["Current Mode"](#) on page 313
  - ["Timing"](#) on page 314
- With the graphical editor "Edit Modes", see [Chapter 10.3.3, "Mode editor settings"](#), on page 230.

### Single Mode ← Behaviour

The emitter works in one constant mode, as selected with the "Mode" and "Beam" parameters during the whole scenario.

This setting applies even for emitters for which you defined different modes, possibly each with several beams, in the [Emitter](#) dialog.

Remote command:

```
SCENario:CEMit:MCHG:STATe 0
SCENario:LOCalized:MCHG:STATe 0
SCENario:DF:MCHG:STATe 0
```

### Mode Changes ← Behaviour

If selected, you can define different emitter modes and their timing.

Each mode lasts a defined duration. Once it elapses, the subsequent mode is used.

Use the "Mode changes" function to simulate more realistic scenarios where emitters do not use one fixed mode but change their beam and antenna settings over time.

Remote command:

```
SCENario:CEMit:MCHG:STATe on page 557
SCENario:LOCalized:MCHG:STATe on page 557
SCENario:DF:MCHG:STATe on page 557
```

### Edit Behaviour ← Behaviour

Accesses the "Mode Editor" dialog.

This is a graphical configuration for defining the duration the *selected emitter* is working in the different modes.

Works like the [Mode Changes](#) settings but rather than defining the start and end time of a mode, you drag the start and end time on the time scale.

### Current Mode ← Behaviour

Selects the entry (mode) for which the displayed and configured settings apply.

The second number indicates the number of enabled modes.

Remote command:

```
SCENario:CEMit:MCHG:SElect on page 431
SCENario:LOCalized:MCHG:SElect on page 431
SCENario:DF:MCHG:SElect on page 431
SCENario:CEMit:MCHG:COUNT? on page 430
```

[SCENario:LOCalized:MCHG:COUNT?](#) on page 430

[SCENario:DF:MCHG:COUNT?](#) on page 430

### ▣ **Append, Remove Current, Remove All** ← **Behaviour**

Standard functions for entry handling.

Remote command:

[SCENario:CEMit:MCHG:ADD](#) on page 429

[SCENario:LOCalized:MCHG:ADD](#) on page 429

[SCENario:DF:MCHG:ADD](#) on page 429

[SCENario:CEMit:MCHG:DELeTe](#) on page 432

[SCENario:LOCalized:MCHG:DELeTe](#) on page 432

[SCENario:DF:MCHG:DELeTe](#) on page 432

[SCENario:CEMit:MCHG:CLEar](#) on page 433

[SCENario:LOCalized:MCHG:CLEar](#) on page 558

[SCENario:DF:MCHG:CLEar](#) on page 433

### **Timing** ← **Behaviour**

Sets the duration of the mode, defined as start and end time.

Where:

- The start value of one entry must be smaller than or equal to the end value.
- The start value of a subsequent entry has to be greater than the end value of the previous one.

**Tip:** Configure the modes backwards: configure the last mode first, set its end time first.

Remote command:

[SCENario:CEMit:MCHG:START](#) on page 557

[SCENario:CEMit:MCHG:STOP](#) on page 557

[SCENario:LOCalized:MCHG:START](#) on page 558

[SCENario:LOCalized:MCHG:STOP](#) on page 558

[SCENario:DF:MCHG:START](#) on page 557

[SCENario:DF:MCHG:STOP](#) on page 557

### **EIRP**

Sets the EIRP.

Remote command:

[EMITter:EIRP](#) on page 469

### **Frequency**

Sets the frequency of the TX item.

Remote command:

[EMITter:FREQuency](#) on page 469

### **Mode**

Selects the mode the emitter is working in.

Remote command:

[SCENario:LOCalized:EMITter:MODE](#) on page 550

[SCENario:DF:EMITter:MODE](#) on page 550

**Beam**

Sets the number of currently used beams.

Remote command:

[SCENario:LOCalized:EMITter:MODE:BEAM](#) on page 550

[SCENario:DF:EMITter:MODE:BEAM](#) on page 550

**Antenna Pattern, Scan, Sequence**

Displays the currently selected antenna pattern, antenna scan and sequence.

To change any of them, select the corresponding icon.

**Track Receiver**

If enabled, the scan follows the receiver automatically.

Remote command:

[SCENario:LOCalized:EMITter:MODE:TRACkrec](#) on page 551

[SCENario:DF:EMITter:MODE:TRACkrec](#) on page 551

**Emitter Marker**

Available in map-based and emitter collection scenarios.

Enables the configuration of up to 4 gate markers in the "Emitter Marker Config" dialog.

The gate marker has the same width as the pulse.

Select the required mode:

- "Unchanged"  
Leaves the marker unchanged, as defined in the pulses and sequences settings of this emitter.
- "Force Marker"  
Forces the selected marker type for every pulse from this emitter.

For details of other types of marker, see [Chapter 20, "Defining and enabling marker signals"](#), on page 380.

Remote command:

[SCENario:DF:MARKer:FORCe](#) on page 500

[SCENario:DF:MARKer:GATE](#) on page 500

[SCENario:LOCalized:MARKer:FORCe](#) on page 500

[SCENario:LOCalized:MARKer:GATE](#) on page 500

**16.4.2.2 Position settings (Static position and discrete position steps)**

Access:

1. On the 2D map, select "Properties > TX Items".
2. In the list of "Available TX Items", select an emitter.
3. Select "Properties of the Selected Emitters > Position"

The emitters on the 2D map are static or moving elements with configurable coordinates.

Properties	Position	States
Mode	Steps	
Current step	1	/ 2
Position		
East	-4240.92 m	
North	-5466.08 m	
Height	0 m	
Distance	6918.34 m	
Azimuth	217.81 °	
Elevation	0 °	
Attitude		
	<input checked="" type="checkbox"/>	Point to receiver
Yaw	37.81 °	
Pitch	0 °	
Roll	0 °	

The platform/emitter position can be defined as:

- East/North/Height coordinates relative to the origin
- Azimuth/Distance/Elevation angular positions relative to the origin
- Longitude/Latitude/Altitude absolute coordinates (requires [georeferenced map](#))

The definitions are interdependent.

Mode.....	316
Longitude, Latitude, Altitude.....	317
East, North, Height/Distance, Azimuth, Elevation.....	317
Attitude.....	318
Discrete position steps.....	319
L Current Entry/Number of Entry.....	319
L  Append, Remove Current, Remove All.....	320
L Auto fill.....	320
L  Import list X,Y,Z / Dist., Azim., Elev. [Y, P, R].....	320
Fill Position Steps.....	320
L Position Steps > 2D Line.....	320
L Position Steps > 2D Circle.....	321
L Attitude > Pointing, Yaw, Pitch, Roll.....	321
L Append.....	321
L Ok.....	321
L Cancel.....	321

### Mode

Sets if the emitter is static or moving.

Option:R&S PULSE-K39 required for moving emitters.

- "Static" The emitter is static; its coordinates are fixed during the whole scenario.  
See [East, North, Height/Distance, Azimuth, Elevation](#).
- "Steps" You can define several static positions for each emitter.  
See ["Discrete position steps"](#) on page 319.
- "Moving" Emitters are moving objects, defined with their start position and trajectory.  
See ["Fill Position Steps"](#) on page 320.  
See [Chapter 16.9, "Creating trajectories on a 2D map"](#), on page 341.

Remote command:

[SCENario:DF:LOCation:PMODE](#) on page 569

[SCENario:LOCalized:LOCation:PMODE](#) on page 569

### Longitude, Latitude, Altitude

Sets the position of the selected emitter using absolute coordinates (requires [georeferenced map](#)).

Remote command:

[SCENario:DF:LOCation:LONGitude](#) on page 570

[SCENario:DF:LOCation:LATitude](#) on page 570

[SCENario:DF:LOCation:ALTitude](#) on page 569

[SCENario:LOCalized:LOCation:LONGitude](#) on page 570

[SCENario:LOCalized:LOCation:LATitude](#) on page 570

[SCENario:LOCalized:LOCation:ALTitude](#) on page 570

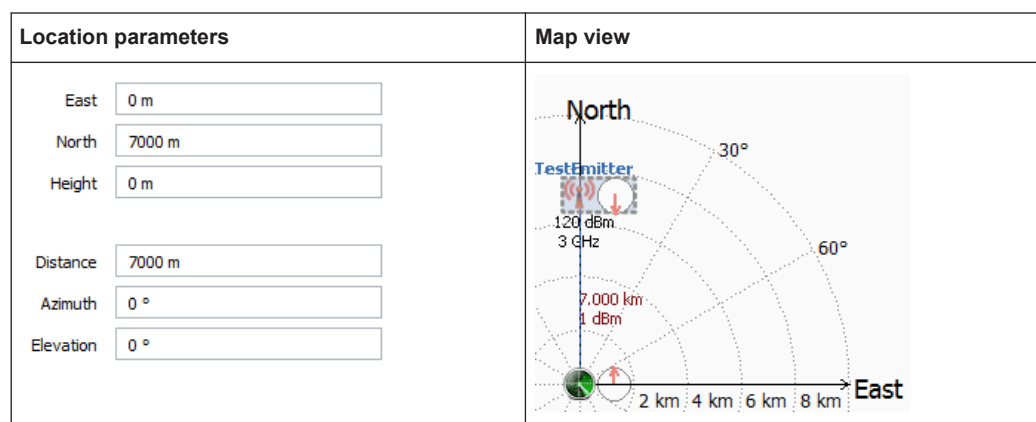
### East, North, Height/Distance, Azimuth, Elevation

To change the location of an element:

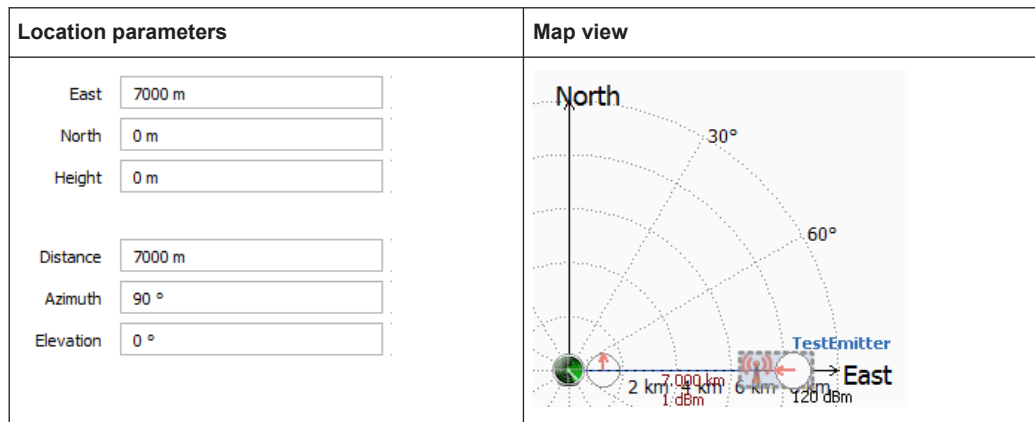
- Drag this element on the 2D map.
- Use the "Position" parameters to define the location more precisely.

### Example:

- An emitter with the East/North coordinates "East = 0 m", "North = 7000 m" is placed on the North, i.e. the "Azimuth Angle = 0°".



- If the "Azimuth Angle = 90°", the emitter is placed on the east axis, i.e. "North = 0 m" and "East = 7000 m".



Remote command:

[SCENario:LOCALized:LOCation:EAST](#) on page 551

[SCENario:LOCALized:LOCation:NORTH](#) on page 551

[SCENario:LOCALized:LOCation:HEIGHT](#) on page 553

[SCENario:LOCALized:DISTance](#) on page 551

[SCENario:LOCALized:LOCation:AZIMuth](#) on page 551

[SCENario:LOCALized:LOCation:ELEVation](#) on page 552

[SCENario:DF:LOCation:EAST](#) on page 551

[SCENario:DF:LOCation:NORTH](#) on page 551

[SCENario:DF:LOCation:HEIGHT](#) on page 553

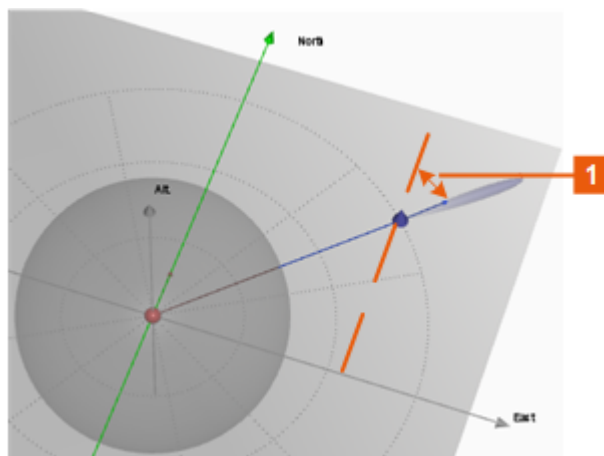
[SCENario:DF:DISTance](#) on page 551

[SCENario:DF:LOCation:AZIMuth](#) on page 551

[SCENario:DF:LOCation:ELEVation](#) on page 552

### Attitude

Defines the orientation of the antennas as "Pitch", "Yaw", and "Roll".



**Figure 16-12: Yaw: understanding the displayed information**

1 = Yaw is the angle between the antenna's boresight and north

If "Point to Receiver" is enabled, the antenna is automatically turned in the direction of the receiver.

See also "Emitter attitude" on page 218.

Remote command:

[SCENario:LOCalized:DIRection:TRACk](#) on page 550

[SCENario:LOCalized:DIRection:PItCh](#) on page 549

[SCENario:LOCalized:DIRection:YAW](#) on page 548

[SCENario:LOCalized:DIRection:ROLL](#) on page 549

[SCENario:DF:DIRection:TRACk](#) on page 550

[SCENario:DF:DIRection:PItCh](#) on page 549

[SCENario:DF:DIRection:YAW](#) on page 548

[SCENario:DF:DIRection:ROLL](#) on page 549

### Discrete position steps

In "Scenario Type > Localization/Direction Finding", you can define a sequence of **discrete static positions** (steps) to simulate position change of the emitter. With "**Mode > Steps**", the emitter is not moving but it changes its position in terms of **coordinates, height and attitude**.

The time duration the emitter remains at a particular position is defined depending on the selected "Scenario > Signal Calculation > Config > Config > Signal Calculation Settings" > "Duration", see [Table 16-2](#).

**Table 16-2: Time duration per position**

"Duration"	"Antenna Scan"	"Mode Change"	Time duration (or waveform content) <i>per position</i>
"Auto"	Steady (no scan)	Static	One sequence
	Any scan type	Static	One antenna scan
	Any, incl. no scan	Static/Mode Change	All defined modes
"Fixed"	Any, incl. no scan	Static/Mode Change	Time specified with the parameter "Duration > Fixed" divided by the number of steps Longer sequences or scans are truncated; shorter repeated Longer modes are truncated; shorter are not repeated

**Note:** To prevent that transitions (or jumps) over large distances lead to pulses overtaking one another, distance-related signal propagation delays are not considered.

### Current Entry/Number of Entry ← Discrete position steps

Selects the position step for that the displayed position coordinates apply. This is also the position indicated on the 2D map.

The second number indicates the number of available static positions.

Remote command:

[SCENario:DF:LOCation:PSTep:SElect](#) on page 431

[SCENario:DF:LOCation:PSTep:COUNT?](#) on page 430

[SCENario:LOCalized:LOCation:PSTep:SElect](#) on page 431

[SCENario:LOCalized:LOCation:PSTep:COUNT?](#) on page 430

### Append, Remove Current, Remove All ← Discrete position steps

Standard functions for entry handling.

Remote command:

[SCENario:DF:LOCation:PSTep:ADD](#) on page 429

[SCENario:DF:LOCation:PSTep:SElect](#) on page 431

[SCENario:DF:LOCation:PSTep:DElete](#) on page 432

[SCENario:LOCalized:LOCation:PSTep:ADD](#) on page 429

[SCENario:LOCalized:LOCation:PSTep:SElect](#) on page 431

[SCENario:LOCalized:LOCation:PSTep:DElete](#) on page 432

### Auto fill ← Discrete position steps

Opens the "Fill Position Steps" dialog.

See ["Fill Position Steps"](#) on page 320.

### Import list X,Y,Z / Dist., Azim., Elev. [Y, P, R] ← Discrete position steps

To define the static positions one by one, you can also import the positions from list files. Lists are simple text files with extension \*.txt. You can create the lists with any text editor, for example, Notepad.

The list contains the coordinates of each position and (optionally) the yaw, pitch, roll [Y, P, R] values. Position coordinates can be specified in one of the following formats:

- X, Y, Z: East, North, Height
- Dist., Azim., Elev.: Distance, Pitch, Roll

The coordinates of two subsequent positions are separated by line break.

### Fill Position Steps

"Fill Position Steps" is a wizard, where you can define steps automatically, based on start and end position and the number of static positions. Static positions can be placed on a straight line or on a circle.

### Position Steps > 2D Line ← Fill Position Steps

When distributed on a straight line, the static positions are defined with:

- "Start East/North" coordinates
- "Stop East/North" coordinates



- "Steps" defines the number of static positions between the start and the stop position; positions are spaced equidistant.

**Position Steps > 2D Circle ← Fill Position Steps**

When distributed on circle, the static positions are defined with:

- "Distance" sets the circle radius, where the circle center is at the receiver.
- "Start Angle" sets the angle of the start position, where "Start Angle = 0°" corresponds to North.
- "Increment" defines the step size with that the angle is incremented.
- "Steps" defines the number of static positions between the start and the end position; positions are spaced equidistant, where the step size is defined with "Increment".

**Attitude > Pointing, Yaw, Pitch, Roll ← Fill Position Steps**

Defines the orientation of the antennas:

- "Pointing = Static", the orientation is given as "Pitch", "Yaw", and "Roll".
- "Pointing = to Receiver/ to Front": the antenna attitude is adapted automatically at the specified direction and depending on the current static position.  
This setting is usefully if the static positions are distributed on a circle.

**Append ← Fill Position Steps**

Adds the automatically created positions at the end of the current positions' list.

**Ok ← Fill Position Steps**

Confirms the settings and applies them.

**Cancel ← Fill Position Steps**

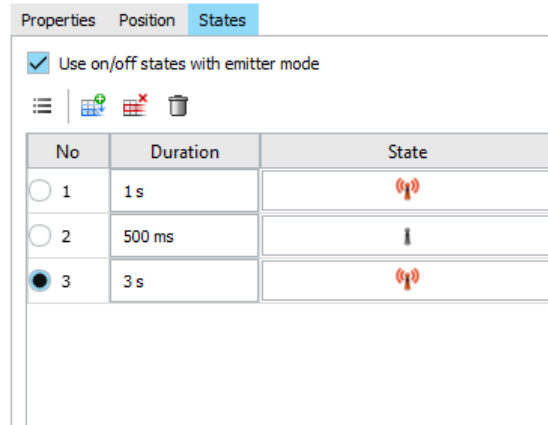
Aborts the changes. Configurations in the "Fill Position Steps" dialog are lost.

### 16.4.2.3 States

Access:

1. On the 2D map, select "Emitter Properties".
2. In the list of "Available TX Items", select an emitter.
3. Select "Properties of Selected TX Item > Properties > Configuration > Static".

## 4. Select "States".



Emitters with constant operation mode can be configured to interrupt their signal transmission. You can define the duration of the intervals during that the emitters transmit signal and during which they are muted.

**Settings:**

<a href="#">Use on/off states with emitter mode</a> .....	322
<a href="#">Append, Remove Current, Remove All</a> .....	322
<a href="#">No</a> .....	323
<a href="#">Duration</a> .....	323
<a href="#">State</a> .....	323
<a href="#">Execute States in Loop</a> .....	323

**Use on/off states with emitter mode**

Enables that an emitter can use on and off states.

Remote command:

[SCENario:DF:EMITter:STATe:ENABle](#) on page 558

[SCENario:LOCalized:EMITter:STATe:ENABle](#) on page 558

**Append, Remove Current, Remove All**

Standard functions for entry handling.

Remote command:

[SCENario:DF:EMITter:STATe:ADD](#) on page 429

[SCENario:DF:EMITter:STATe:INSert](#) on page 431

[SCENario:DF:EMITter:STATe:COUNT?](#) on page 430

[SCENario:DF:EMITter:STATe:DELeTe](#) on page 432

[SCENario:DF:EMITter:STATe:CLEar](#) on page 433

[SCENario:LOCalized:EMITter:STATe:ADD](#) on page 429

[SCENario:LOCalized:EMITter:STATe:INSert](#) on page 431

[SCENario:LOCalized:EMITter:STATe:COUNT?](#) on page 430

[SCENario:LOCalized:EMITter:STATe:DELeTe](#) on page 432

[SCENario:LOCalized:EMITter:STATe:CLEar](#) on page 433

**No**

Subsequent number indicating the state.

Remote command:

[SCENario:DF:EMITter:STATe:SElect](#) on page 431

[SCENario:LOCalized:EMITter:STATe:SElect](#) on page 431

**Duration**

Sets the duration during that the emitter remains in the current state.

Remote command:

[SCENario:DF:EMITter:STATe:DURation](#) on page 558

[SCENario:LOCalized:EMITter:STATe:DURation](#) on page 558

**State**

Select the icon to toggle the state.

Remote command:

[SCENario:DF:EMITter:STATe:VALue](#) on page 558

[SCENario:LOCalized:EMITter:STATe:VALue](#) on page 558

**Execute States in Loop**

Repeats the states definition cyclically.

Remote command:

[SCENario:DF:EMITter:STATe:LOOP](#) on page 559

[SCENario:LOCalized:EMITter:STATe:LOOP](#) on page 559

## 16.5 Moving emitters and platforms

Option:R&S PULSE-K39

In addition to the static emitters, and the possibility to define emitters that change their position at discrete steps, you can also define emitters that move along a trajectory with a defined shape. Emitters can move along simple trajectories, such as a straight line, a circle or a part of a circle (arc). Emitters can follow complex trajectories defined by a sequence of map coordinates.

A sequence of map coordinates can be defined in two ways.

- **"Trace points"**

You can use the "Trace" function to set a sequence of coordinates (known as "Trace points") manually:

- **In the map**

Select an emitter > right-click > context menu > "Trajectory" > "Trace"

Left-click to set trace points. Right-click to apply the trace.

- **In the position settings of an emitter**

Select an emitter > right-click > "Properties" > "Position" tab

Select and set/edit the position of each "Trace point" in turn.

- **"Waypoints"**

You can load a waypoint file which configures a sequence of coordinates, automatically. Waypoint files are simple text files with predefined file format and extension. For a description, see [Chapter A.3, "Movement files"](#), on page 637.

To improve the visualization, you can assign different icons to the emitters on the 2D map. The icons are merely used for visualization purposes; the function and the properties of the emitters do not depend on the icon.

If at least one moving emitter is configured and its trajectory is defined, you can visualize it on the 2D map. The 2D map also displays the movement of the emitter along the trajectory. In the 3D combined views of the receiver and emitter, you observe the effect of all events, influencing the received signal strength. These are: antenna pattern and scan at the emitter and receiver, distance between the emitter and receiver, emitter movement and antenna attitude.



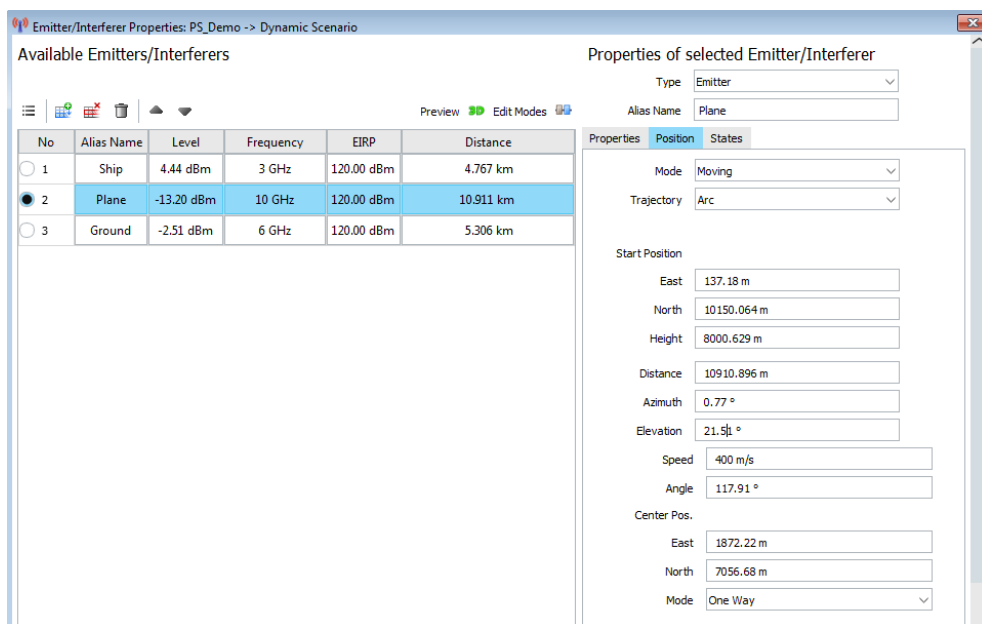
Positions are configured relative to the receiver's origin using the "East", "North" and "Height" settings.

If a georeferenced map is loaded (see [Chapter 16.10, "Using georeferenced maps"](#), on page 342), absolute positions can also be defined using the "Longitude", "Latitude" and "Altitude" settings.

Similar to the emitters, the receiver can also be a moving object. The receiver configuration is similar to the configuration of the moving emitters. For settings description, see [Chapter 13, "Emulating receivers"](#), on page 259.

Access:

1. On the 2D map, select "Emitter Properties".
2. In the list of "Available TX Items", select an emitter.
3. Select "Properties of the Selected TX Item > Position".
4. Select "Mode > Moving".



5. Configure the "Trajectory" and further settings.

For step-by-step description, see ["How to configure moving emitters and receiver"](#) on page 294.

For information trajectories, see [Chapter 16.9, "Creating trajectories on a 2D map"](#), on page 341.

**Settings:**

- Trajectory..... 326
- Line trajectory definition..... 326
  - Speed..... 326
  - Acceleration..... 326
  - End Position..... 327
  - Mode..... 327
- Arc trajectory definition..... 327
  - Speed..... 327
  - Angle..... 327
  - Center Position..... 328
  - Mode..... 328
- Trace trajectory definition..... 328
  - Trace points..... 328
  - Longitude..... 329
  - Latitude..... 329
  - Altitude..... 329
  - East from RX..... 329
  - North from RX..... 329
  - Height..... 329
  - Distance to RX..... 329
  - Azimuth from RX..... 329
  - Elevation from RX..... 330
  - Speed..... 330

L Mode.....	330
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L Vehicle File.....	333
L  Load, Delete.....	333
L Attitude.....	333
L Yaw, Pitch, Roll.....	333
L Calculate.....	334
L  Clear.....	334

### Trajectory

Defines the trajectory shape.

"Line"	The emitter is moving on a straight line, starting from the current position of the emitter ( <a href="#">East</a> , <a href="#">North</a> , <a href="#">Height/Distance</a> , <a href="#">Azimuth</a> , <a href="#">Elevation</a> ) and ending at the selected "End Position".
"Arc"	The emitter moves on a part of a circle, where the center of the circle is defined with the "Center Position".
"Waypoint"	Emitter with varying coordinates, defined in waypoints files. You find a subset of example files in installation package but you can also create and load your own files.
"Trace"	Emitter with varying coordinates, defined as a set of "Trace points".

Remote command:

[SCENario:LOCALized:MOVement:TYPE](#) on page 569

[SCENario:DF:MOVement:TYPE](#) on page 569

### Line trajectory definition

A line is defined with:

#### Speed ← Line trajectory definition

Sets the speed of the moving emitter.

Remote command:

[SCENario:LOCALized:MOVement:SPEEd](#) on page 572

[SCENario:DF:MOVement:SPEEd](#) on page 572

#### Acceleration ← Line trajectory definition

Sets the acceleration of the moving emitter.

Remote command:

[SCENario:LOCALized:MOVement:ACCEleration](#) on page 572

[SCENario:DF:MOVement:ACCEleration](#) on page 572

**End Position ← Line trajectory definition**

Sets the "East/North" coordinates and the "Height" of the emitter at the end of the movement.

If "Maps" are enabled, the end point can also be defined using "Latitude", "Longitude" and "Altitude".

Remote command:

[SCENario:LOCalized:MOVement:EAST](#) on page 572

[SCENario:LOCalized:MOVement:NORTH](#) on page 573

[SCENario:LOCalized:MOVement:HEIGHt](#) on page 573

[SCENario:DF:MOVement:EAST](#) on page 572

[SCENario:DF:MOVement:NORTH](#) on page 572

[SCENario:DF:MOVement:HEIGHt](#) on page 573

[SCENario:LOCalized:MOVement:ALTituDe](#) on page 570

[SCENario:LOCalized:MOVement:LATituDe](#) on page 571

[SCENario:LOCalized:MOVement:LONGituDe](#) on page 571

[SCENario:DF:MOVement:ALTituDe](#) on page 570

[SCENario:DF:MOVement:LATituDe](#) on page 570

[SCENario:DF:MOVement:LONGituDe](#) on page 570

**Mode ← Line trajectory definition**

Defines the behavior of the moving object when the end of the trajectory is reached.

"Cyclic"	The trajectory is repeated cyclically. Once the "End Position" is reached, file movement starts again from the beginning.  Using this mode is recommended in the following cases: <ul style="list-style-type: none"> <li>• A circle trajectory</li> <li>• A trajectory in which the start and the end positions are close to each other.</li> </ul>
"Round Trip"	The emitter moves back and forth on the defined trajectory.
"One Way"	The movement is executed once. When the "End Position" is reached, this position is assumed to be a static one.

Remote command:

[SCENario:DF:MOVement:RMODe](#) on page 576

[SCENario:LOCalized:MOVement:RMODe](#) on page 576

**Arc trajectory definition**

An arc is defined with:

**Speed ← Arc trajectory definition**

Sets the speed of the moving emitter.

Remote command:

[SCENario:LOCalized:MOVement:SPeEd](#) on page 572

[SCENario:DF:MOVement:SPeEd](#) on page 572

**Angle ← Arc trajectory definition**

Sets the arc angle and thus defines the arc length.

Remote command:

[SCENario:LOCalized:MOVement:ANGLe](#) on page 572

[SCENario:DF:MOVement:ANGLe](#) on page 572

### Center Position ← Arc trajectory definition

Sets the "East/North" coordinates of the center of the circle on that the emitter is moving.

If "Maps" are enabled, the center point can also be defined using "Latitude" and "Longitude".

Remote command:

[SCENario:LOCalized:MOVement:EAST](#) on page 572

[SCENario:LOCalized:MOVement:NORTH](#) on page 573

[SCENario:LOCalized:MOVement:CLATitude](#) on page 571

[SCENario:LOCalized:MOVement:CLONgitude](#) on page 571

[SCENario:DF:MOVement:EAST](#) on page 572

[SCENario:DF:MOVement:NORTH](#) on page 572

[SCENario:DF:MOVement:CLATitude](#) on page 571

[SCENario:DF:MOVement:CLONgitude](#) on page 571

### Mode ← Arc trajectory definition

Defines the behavior of the moving object when the end of the movement is reached.

"Cyclic"	The trajectory is repeated cyclically. Once the "End Position" is reached, file movement starts again from the beginning.  Using this mode is recommended in the following cases: <ul style="list-style-type: none"> <li>• A circle trajectory</li> <li>• A trajectory in which the start and the end positions are close to each other.</li> </ul>
"Round Trip"	The emitter moves back and forth on the defined trajectory.
"One Way"	The movement is executed once. When the "End Position" is reached, this position is assumed to be a static one.

Remote command:

[SCENario:DF:MOVement:RMODe](#) on page 576

[SCENario:LOCalized:MOVement:RMODe](#) on page 576

### Trace trajectory definition

You can use the "Trace" function to set a sequence of coordinates (known as "Trace points"), manually.

A trace is defined with:

### Trace points ← Trace trajectory definition

Selects the trace point that is configured by the following fields.

Remote command:

[SCENario:LOCalized:LOCation:PSStep:SElect](#) on page 431

[SCENario:DF:LOCation:PSStep:SElect](#) on page 431



**Longitude ← Trace trajectory definition**

Sets the longitude of the selected trace point.

Remote command:

[SCENario:LOCALized:LOCation:LONGitude](#) on page 570

[SCENario:DF:LOCation:LONGitude](#) on page 570

**Latitude ← Trace trajectory definition**

Sets the latitude of the selected trace point.

Remote command:

[SCENario:LOCALized:LOCation:LATitude](#) on page 570

[SCENario:DF:LOCation:LATitude](#) on page 570

**Altitude ← Trace trajectory definition**

Sets the altitude above sea-level of the selected trace point.

Remote command:

[SCENario:LOCALized:LOCation:ALTitude](#) on page 570

[SCENario:DF:LOCation:ALTitude](#) on page 569

**East from RX ← Trace trajectory definition**

Sets the number of meters East, from the receiver to the selected trace point.

Remote command:

[SCENario:LOCALized:LOCation:EAST](#) on page 551

[SCENario:DF:LOCation:EAST](#) on page 551

**North from RX ← Trace trajectory definition**

Sets the number of meters North, from the receiver to the selected trace point.

Remote command:

[SCENario:LOCALized:LOCation:NORTH](#) on page 551

[SCENario:DF:LOCation:NORTH](#) on page 551

**Height ← Trace trajectory definition**

Sets the number of meters vertically, from the plane of the receiver to the selected trace point.

Remote command:

[SCENario:LOCALized:LOCation:HEIGHT](#) on page 553

[SCENario:DF:LOCation:HEIGHT](#) on page 553

**Distance to RX ← Trace trajectory definition**

Number of meters along the line-of-sight from the receiver to the selected trace point.

Remote command:

[SCENario:LOCALized:DISTance](#) on page 551

[SCENario:DF:DISTance](#) on page 551

**Azimuth from RX ← Trace trajectory definition**

Horizontal angle from the receiver to the selected trace point.

Remote command:

[SCENario:LOCalized:LOCation:AZIMuth](#) on page 551

[SCENario:DF:LOCation:AZIMuth](#) on page 551

### **Elevation from RX ← Trace trajectory definition**

Vertical angle from the receiver to the selected trace point.

Remote command:

[SCENario:LOCalized:LOCation:ELEVation](#) on page 552

[SCENario:DF:LOCation:ELEVation](#) on page 552

### **Speed ← Trace trajectory definition**

Sets the speed of the moving emitter.

Remote command:

[SCENario:LOCalized:MOVement:SPEed](#) on page 572  
[SCENario:LOCalized:MOVement:SPEed](#) 100

[SCENario:DF:MOVement:SPEed](#) on page 572

### **Mode ← Trace trajectory definition**

Defines the behavior of the moving object when the end of the movement is reached.

"Cyclic"	The trajectory is repeated cyclically. Once the "End Position" is reached, file movement starts again from the beginning.  Using this mode is recommended in the following cases: <ul style="list-style-type: none"> <li>• A circle trajectory</li> <li>• A trajectory in which the start and the end positions are close to each other.</li> </ul>
"Round Trip"	The emitter moves back and forth on the defined trajectory.
"One Way"	The movement is executed once. When the "End Position" is reached, this position is assumed to be a static one.

Remote command:

[SCENario:LOCalized:MOVement:RMODe](#) on page 576

[SCENario:DF:MOVement:RMODe](#) on page 576

### **Smoothing for traces**

The discrete positions (trace points) defined by a "Trace" can cause abrupt changes in the movement direction. This function is identical to the smoothing function used with a waypoints file except that the waypoints are derived from the trace rather than a file (see "[Smoothing for way points > State](#)" on page 332).

### **Waypoints trajectory definition**

A waypoint file is description of a movement with possibly attitude coordinates that can have different forms, like, for example, a sequence of positions or vector arc movement. A waypoint file must have the extension \*.txt, \*.kml or \*.xtd. For description, see [Chapter A.3, "Movement files"](#), on page 637.

You find a subset of example files in installation package but you can also create and load custom-specific files. Moreover, waypoint smoothing can be activated if vehicle description files are used.

Properties **Position**

Mode: Moving

Trajectory: Waypoints

**Trajectory**

Waypoint File: Munich\_Car\_Motion.txt

Read Out Mode: Cyclic

Reference Frame: WGS-84

**Smoothing**

State:

Vehicle File: LandVehicle.xvd

**Attitude**

Mode: Align To Motion

Yaw: 0 °

Pitch: 0 °

Roll: 2 °

Calculate

**Movement Data**

Start Position: 48.1455 °, 11.5768 °, 500.038 m

End Position: 48.1455 °, 11.5768 °, 500.038 m

Duration: 109.8 s

Read Out Mode: Cyclic (forced)

Smoothing: On

Attitude: Align To Motion

If waypoint files are used, the emitter position and trajectory are retrieved from the file content; the traditional position coordinates parameters are disabled.

#### **Waypoint File** ← **Waypoints trajectory definition**

Indicates the name of the currently used waypoint file.

#### **Load, Delete** ← **Waypoints trajectory definition**

Opens the Windows explorer so that you can navigate to and load waypoint file.

Discards the selected waypoint file.

Remote command:

[SCENario:DF:MOVement:WAYPoint](#) on page 573

[SCENario:LOCalized:MOVement:WAYPoint](#) on page 573

#### **Read Out Mode** ← **Waypoints trajectory definition**

Indicates the way the waypoint file is processed.

"Cyclic"	The waypoint file is processed cyclically. Once the last waypoint is reached, file processing starts again from the beginning. Using this mode is recommended if the waypoint file describes one of the following: <ul style="list-style-type: none"> <li>• A circle trajectory</li> <li>• A trajectory in which the start and the end positions are close to each other.</li> </ul>
"Round Trip"	When the end of the file is reached, the file is processed backwards.
"One Way"	The file is processed once. When the end of the file is reached, the last described position is assumed to be a static one.

Remote command:

[SCENario:DF:MOVement:RMODE](#) on page 576

[SCENario:LOCalized:MOVement:RMODE](#) on page 576

### Reference Frame ← Waypoints trajectory definition

Select the reference frame used to define the emitters coordinates.

The transformation between the reference frames is performed automatically.

The following applies:

- $X_{WGS84} = (1 - 0.008 \cdot 10^{-6}) \cdot X_{PZ90} - 0.2041 \cdot 10^{-7} \cdot Y_{PZ90} + 0.1716 \cdot 10^{-7} \cdot Z_{PZ90} - 0.013$
- $Y_{WGS84} = (1 - 0.008 \cdot 10^{-6}) \cdot Y_{PZ90} - 0.2041 \cdot 10^{-7} \cdot X_{PZ90} + 0.1115 \cdot 10^{-7} \cdot Z_{PZ90} + 0.106$
- $Z_{WGS84} = (1 - 0.008 \cdot 10^{-6}) \cdot Z_{PZ90} - 0.1716 \cdot 10^{-7} \cdot X_{PZ90} - 0.1115 \cdot 10^{-7} \cdot Y_{PZ90} + 0.022$

Both reference frames are ECEF frames with a set of associated parameters.

"WGS-84" The World Geodetic System WGS-84 is the reference frame used by GPS.

"PZ 90.11 (GLONASS)"

Parametry Zemli PZ (parameters of the Earth) is a reference frame, used, for example, by GLONASS.

Remote command:

[SCENario:DF:MOVement:RFRame](#) on page 576

[SCENario:LOCalized:MOVement:RFRame](#) on page 576

### Smoothing for way points > State ← Waypoints trajectory definition

The discrete positions (waypoints) defined in the waypoints file can cause abrupt changes in the movement direction.

The R&S Pulse Sequencer Digital provides an internal interpolating algorithm that smooths the movement or the trajectory. This algorithm evaluates the dedicated vehicle description (\*.xvd) file, retrieves the velocity vector and the <proximity> value, and inserts waypoints to smooth the trajectory. The resulting movement is more realistic.

To use the algorithm, enable "Smoothing", select "Vehicle File > Load" to load a \*.xvd file and select "Calculate". See [Chapter A.4, "Vehicle description files \(Used for smoothing\)"](#), on page 644.

Remote command:

[SCENario:DF:MOVement:SMOothening](#) on page 576

[SCENario:LOCalized:MOVement:SMOothening](#) on page 576

### **Vehicle File ← Waypoints trajectory definition**

Indicates the name of the currently used vehicle description (\*.xvd) file.

#### **☰ Load, Delete ← Waypoints trajectory definition**

Opens the Windows explorer so that you can navigate to and load vehicle description file.

Discards the selected vehicle description file.

Remote command:

[SCENario:DF:MOVement:VFILE](#) on page 575

[SCENario:DF:MOVement:VFILE:CLEar](#) on page 575

[SCENario:LOCalized:MOVement:VFILE](#) on page 575

[SCENario:LOCalized:MOVement:VFILE:CLEar](#) on page 575

### **Attitude ← Waypoints trajectory definition**

Defines how the attitude information is defined.

"From Waypoint File"

The attitude parameters are extracted from the selected waypoint file. Further settings are not required.

This forces the attitude parameters towards motion direction even if the waypoint has attitude information, like, for example, in a \*.xtd file with `<property waypointformat="position_attitude">`. For specific emitters like ships or land vehicles, it is realistic to set the yaw and pitch to vehicle's motion direction. This is because the usual body axes angles of a land vehicle are in the direction of the velocity vector.

For other emitters, however, like landing plane, this parameter is not useful. As an example, the nose of the plane is in an upward direction at the time when the plane is moving downwards.

"Align to Motion"

Enables a constant rate of change of the roll.

"Constant"

Emitter's attitude is set as the combination of the "Yaw/Heading", "Pitch/Elevation", "Roll/Bank" values.

The resulting attitude is a constant value.

Remote command:

[SCENario:DF:MOVement:ATTitude](#) on page 574

[SCENario:LOCalized:MOVement:ATTitude](#) on page 574

### **Yaw, Pitch, Roll ← Waypoints trajectory definition**

Sets the angles of rotation in the corresponding direction, i.e. the rotation around the respective yaw, pitch and roll axes. "Yaw, Pitch, Roll" are defined relative to the local horizon.

Remote command:

[SCENario:DF:MOVement:YAW](#) on page 575

[SCENario:DF:MOVement:PITCh](#) on page 575

[SCENario:DF:MOVement:ROLL](#) on page 575

[SCENario:LOCalized:MOVement:YAW](#) on page 575

[SCENario:LOCalized:MOVement:PITCh](#) on page 575

[SCENario:LOCalized:MOVement:ROLL](#) on page 575

### **Calculate** ← Waypoints trajectory definition

Loads the selected waypoint and vehicle description file.

The "Movement Data" display indicates a summary of the major parameters:

- Start/End Position
- Duration of the movement
- Read Out Mode as defined in the file
- Smoothing state
- Attitude behavior

The status LED indicates the following states:

- **Red:** the waypoint file is not selected, the file is not imported and the movement not calculated or the file is erroneous.
- **Green:** Movement is calculated

Remote command:

[SCENario:DF:MOVement:IMPort](#) on page 576

[SCENario:LOCalized:MOVement:IMPort](#) on page 577

### **Clear** ← Waypoints trajectory definition

Discards the waypoint and vehicle description file.

Remote command:

[SCENario:DF:MOVement:CLEar](#) on page 577

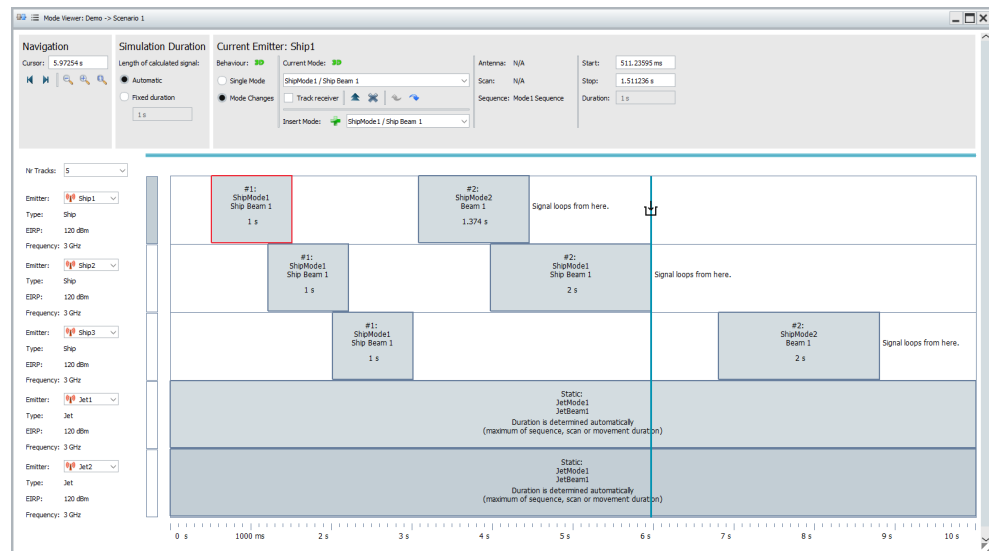
[SCENario:LOCalized:MOVement:CLEar](#) on page 577

## 16.6 Mode editor

Access:

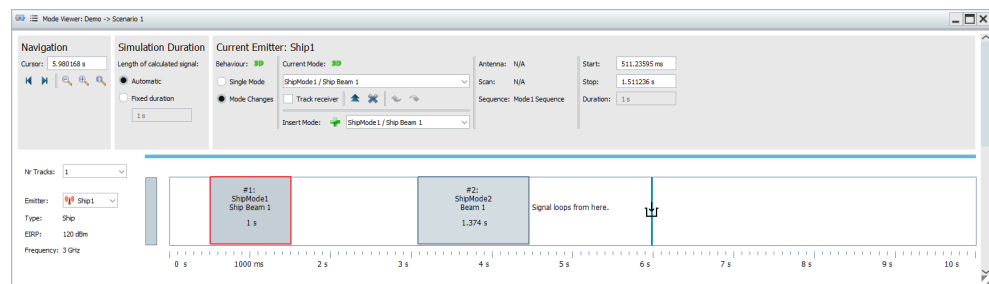
1. Perform one of the following:
  - In a "Scenario Type = Localized Emitters", select "Emitters > 2D".
  - In a "Scenario Type = Direction Finding", select "Map > 2D".
2. In the 2D map, select "Properties > Available TX Items".
3. Select "Edit Modes".

You access the dialog for configuration of the mode changes of *all emitters* available in the scenario.



- In the "Properties" of the selected emitter, select "Edit Modes".

You access the "Mode Editor" dialog for the *current emitter*.



The "Mode Editor" is a graphical editor for joint configuration and defining the duration emitters are working in the different modes.

Operation is similar to [Mode Changes](#) settings for each of the emitters. However, rather than defining the start and end time of a mode, you drag the start and end time on the time scale.

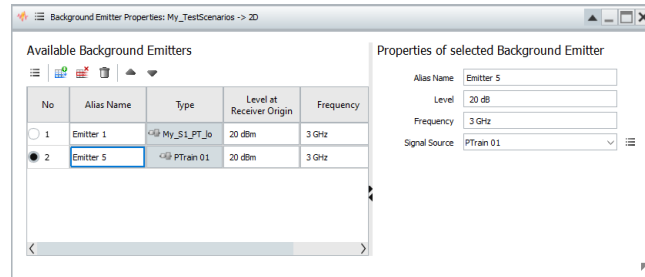
The provided settings and configuration possibilities are identical with the configuration of an individual emitter. For description, see [Chapter 10.3.3, "Mode editor settings"](#), on page 230.

## 16.7 Background emitters properties

Access:

- Perform one of the following:
  - In a "Scenario Type = Localized Emitters", select "Emitters > 2D".
  - In a "Scenario Type = Direction Finding", select "Map > 2D".

2. In the 2D map, double-click the signal in the "Background Signals" block.



### Settings:

<a href="#">Available Background Emitters</a> .....	336
<a href="#">Properties of selected Background Emitter</a> .....	336
L <a href="#">Alias Name</a> .....	336
L <a href="#">Level</a> .....	337
L <a href="#">Frequency</a> .....	337
L <a href="#">Signal Source</a> .....	337

### Available Background Emitters

Displays a list of the sequences used to create the individual background signals.

Use the standard functions in the context menu to add, reorder, or remove items.

Background emitters are identified by their "Alias Name", "Type", "Level" and used "Frequency".

Background emitters do not have antennas, specific positions on the 2D map or direction.

See also "[General workflow for creating complex 2D scenarios](#)" on page 290.

Remote command:

[SCENario:LOCalized:ALIAS](#) on page 548

[SCENario:DF:ALIAS](#) on page 548

[SCENario:LOCalized:WAVEform:LEVel](#) on page 554

[SCENario:DF:WAVEform:LEVel](#) on page 554

[SCENario:LOCalized:WAVEform:FREQuency](#) on page 555

[SCENario:DF:WAVEform:FREQuency](#) on page 555

### Properties of selected Background Emitter

Displays and sets the properties for the selected background emitter.

Changing the properties here updates the values for the corresponding emitter in the "Available Background Emitters" list.

### Alias Name ← Properties of selected Background Emitter

Sets the name of the selected emitter.

Remote command:

[SCENario:LOCalized:ALIAS](#) on page 548

[SCENario:DF:ALIAS](#) on page 548



**Level ← Properties of selected Background Emitter**

Sets the level at the receiver for the selected emitter.

The value is the maximum level at the receiver origin. The calculation considers only emitter EIRP and free space attenuation and omits individual antenna attenuation due to position and polarization.

Remote command:

[SCENario:LOCalized:WAVeform:LEVel](#) on page 554

[SCENario:DF:WAVeform:LEVel](#) on page 554

**Frequency ← Properties of selected Background Emitter**

Sets the frequency of the selected emitter.

Remote command:

[SCENario:LOCalized:WAVeform:FREQuency](#) on page 555

[SCENario:DF:WAVeform:FREQuency](#) on page 555

**Signal Source ← Properties of selected Background Emitter**

Sets the signal source of the selected emitter.

To change the source, select one from the drop-down list.

To edit the current source or add a new one, select the icon and then select the required item from the menu.

Remote command:

[SCENario:LOCalized:WAVeform](#) on page 554

[SCENario:DF:WAVeform](#) on page 554

## 16.8 Platforms with multiple emitters

Access:

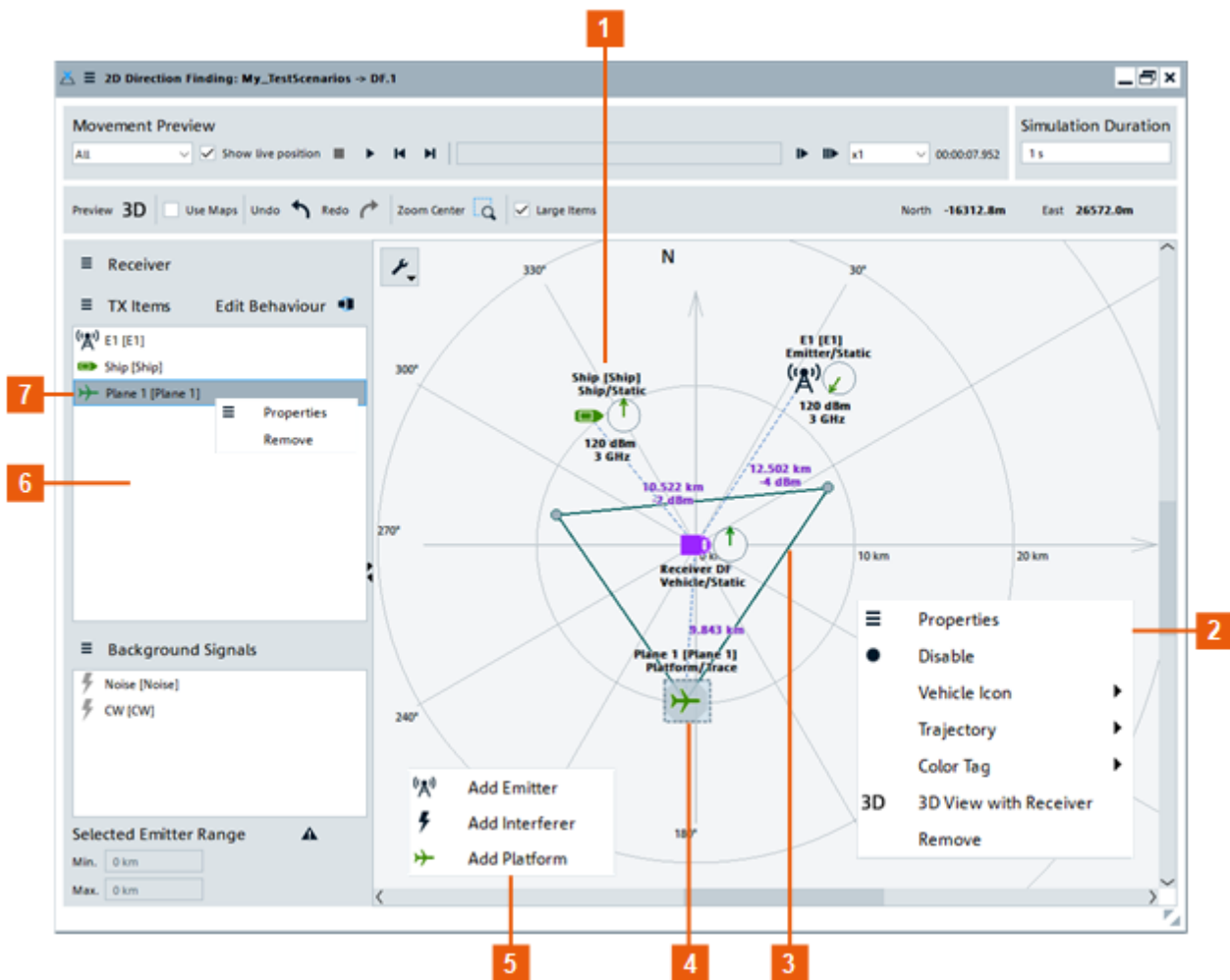
1. Open a suitable scenario.

Use any scenario that offers "Map" in the "Scenario Creation" block.

- "Localized Emitters"
- "Direction Finding"

2. In the block diagram, select "Map".

The "2D" dialog displays a two-dimensional view of the receiver and currently configured emitters and platforms.



**Figure 16-13: Platform-related functions of the 2D dialog**

- 1 = Static platform
- 2 = [Platform context menu](#)
- 3 = Trajectory of moving platform
- 4 = Moving platform
- 5 = [Map area context menu](#) (right-click)
- 6 = "TX Items" list
- 7 = [TX Items context Menu](#) (right-click)

Figure 16-13 shows the platform-related elements of the "2D" dialog.

### Adding and configuring platforms

Use the following procedure to add and configure platforms in a scenario:

1. Access the "2D" dialog (as described previously).
2. Add platforms to the list.

Use one of the following methods:

- Drag&drop a platform from the repository.

- Right-click in the map area and select "New Platform" in the context menu (see [Chapter 16.8.2, "Map area context menu"](#), on page 340).

A platform icon appears in the "Platforms" list and on the map.

### 3. Configure the platform.

Use one of the following methods:

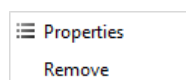
- Right-click a platform icon on the map.  
A context menu appears. Select "Properties".  
See [Chapter 16.8.3, "Platform context menu"](#), on page 340.
- Right-click an entry in the "Platforms" list.  
A context menu appears. Select "Properties".  
See [Chapter 16.8.1, "TX items context menu"](#), on page 339.
- Double-click a platform icon or "Platforms" list entry.  
Opens the "TX Items Properties" dialog.  
See [Figure 16-11](#).
- Click the "TX Items" icon in the list of "Properties" links.  
Opens the "TX Items Properties" dialog.  
See [Figure 16-11](#).

#### Settings:

- [TX items context menu](#)..... 339
- [Map area context menu](#)..... 340
- [Platform context menu](#)..... 340

## 16.8.1 TX items context menu

To access this context menu, right-click an entry in the list.



The following functions are available on the context menu:

- [Properties](#)..... 339
- [Remove](#)..... 339

#### Properties

Opens the "TX Items Properties" dialog.

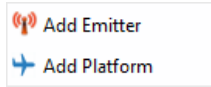
See [Figure 16-11](#).

#### Remove

Removes the selected platform from the list.

## 16.8.2 Map area context menu

To access this context menu, right-click anywhere in the map area that is not occupied by an object (e.g. an emitter).



The following functions are available on the context menu:

<a href="#">Add Emitter</a> .....	340
<a href="#">Add Platform</a> .....	340

### Add Emitter

Adds an emitter icon to the map at the cursor position.

Adds a corresponding entry to the "Emitters" list.

**Note:** Double-click the entry or the icon to configure it in the [TX Items Properties dialog](#).

### Add Platform

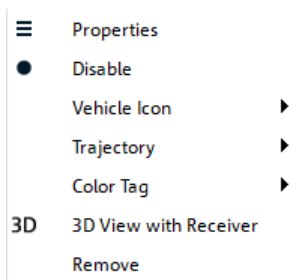
Adds a platform icon to the map at the cursor position.

Adds a corresponding entry to the "Platforms" list.

**Note:** Double-click the entry or the icon to configure it in the [TX Items Properties dialog](#).

## 16.8.3 Platform context menu

To access this context menu, right-click a platform icon in the map area.



The following functions are available on the context menu:

<a href="#">Properties</a> .....	341
<a href="#">Enable/Disable</a> .....	341
<a href="#">Vehicle Icon</a> .....	341
<a href="#">Trajectory</a> .....	341
<a href="#">Color Tag</a> .....	341
<a href="#">3D View with Receiver</a> .....	341
<a href="#">Remove</a> .....	341

**Properties**

Opens the "TX Items Properties" dialog.

See [Chapter 16.4, "Properties of TX items \(emitters and platforms\)"](#), on page 307.

**Enable/Disable**

Toggles the platform's emitters on/off within the scenario.

Determines whether the platform is considered in a calculation or not.

**Vehicle Icon**

Selects the icon for the platform on the 2D map.

The icons are merely indication; the function and the properties of the platform do not depend on the icon.

You can import and use custom icons, see [Chapter 16.11, "Importing user icons"](#), on page 345.

**Trajectory**

Defines the path followed by a moving platform.

R&S Pulse Sequencer Digital supports several trajectory types, including: line, arc, trace and waypoint.

See [Chapter 16.5, "Moving emitters and platforms"](#), on page 323.

See [Chapter 16.9, "Creating trajectories on a 2D map"](#), on page 341.

**Color Tag**

A platform icon can have a colored background.

Set the color to: "None", "Green", "Blue", or "Red".

**3D View with Receiver**

Opens a "3D" view containing the selected platform and the receiver/DF.

See [Chapter 16.3, "3D scan pair view settings"](#), on page 302.

**Remove**

Removes the selected platform from the list.

## 16.9 Creating trajectories on a 2D map

Option:R&S PULSE-K39

Access:

1. In a "2D Map", right-click to open the context menu.
2. In the context menu, select "Trajectory" to open a list of trajectory types.
3. Select a trajectory type from the list.
4. Use the mouse-keys to create the trajectory on the map.

**Settings**

Line.....	342
Arc.....	342
Trace.....	342
Waypoints.....	342

**Line**

A line appears between the current position of the emitter and the mouse-pointer.

Move the mouse-pointer to adjust the position and direction of the line. Left-click to fix the end point of the line trajectory.

**Arc**

A circle is drawn that centers on the mouse-pointer and passes through the emitter position. Left-click to fix the center of the circle. Move the mouse-pointer to define the length of the arc. Left-click to fix the end point of the arc trajectory.

**Trace**

A line appears between the current position of the emitter and the mouse-pointer.

Move the mouse-pointer to adjust the position and direction of the line. Left-click to set a trace point. Set the required number of trace points. Right-click to apply the trace (this action does not set an additional trace point).

**Waypoints**

This option only defines the type of trajectory. You must also define the waypoints file.

Select the emitter > right-click > "Properties" > "Position" tab > "Waypoint file"

## 16.10 Using georeferenced maps

The expert option R&S PULSE-K39 enables you to use georeferenced maps with R&S Pulse Sequencer Digital.

The key benefits of this option are that you can:

- Visualize a real-world geographical scenario.
- Accurately position emitters to emulate real-world radar installations:
  - Drag and drop the icons on the map.
  - Use the actual coordinates (lat/lon) of the emitters.
- Create realistic movement paths:
  - Ships moving in shipping lanes.
  - Planes using air corridors and flight levels.
  - Vehicles driving on roads.
- Easy handling:
  - Load and unload maps via toolbar.
  - Reposition map using left mouse-key.
  - Zoom in/out using mouse scroll-button.

**Access:**

1. Open a suitable scenario.

Use any scenario that offers "Map" in the "Scenario Creation" block.

- "Localized Emitters"
- "Direction Finding"

2. In the block diagram, select "Map".

The "2D" dialog displays a 2D view of the receiver and currently configured emitters, together with their main characteristics.

3. In the "2D" dialog, select the "Use Maps" checkbox.

Use Maps

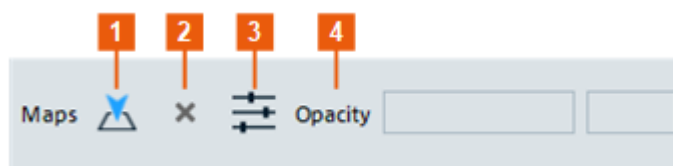
**Note:** If you enable this function, the scenario uses the R&S PULSE-K39 option and it **cannot be removed** from the signal generation of the scenario.

For this reason, a popup message appears asking you to confirm.

Select "No" if you do not want the scenario to depend on the extended option.

Select "Yes" to proceed.

The "Map Options" toolbar appears.



**Figure 16-14: Map Options toolbar**

- 1 = "Open Map" file browser  
 2 = Unload map  
 3 = "Application Colors" dialog  
 4 = Set opacity of loaded map

**Settings:**

Use Maps.....	343
Application Colors.....	343
Open Map.....	344
Unload map.....	345
Opacity.....	345

**Use Maps**

Option: R&S PULSE-K39

Enables the scenario to use georeferenced maps.

Once enabled, it cannot be disabled (see the note in ["Access:"](#) on page 343).

**Application Colors**

Customizes the colors used in R&S Pulse Sequencer Digital.

Alternative access: select "Configure" > "Colors". See also [Changing Colors](#)).

Use the "Map" tab to customize the map-specific colors.

**Open Map**

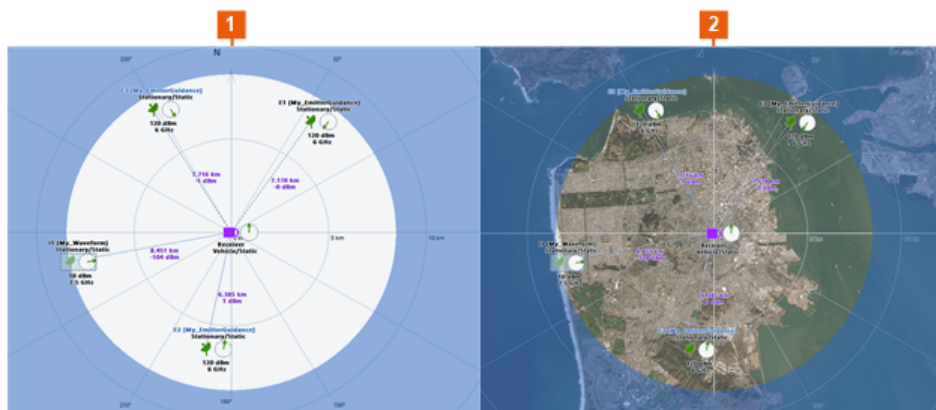
Use this dialog to select a georeferenced map file.

The file browser only displays acceptable file formats.

Supported formats:

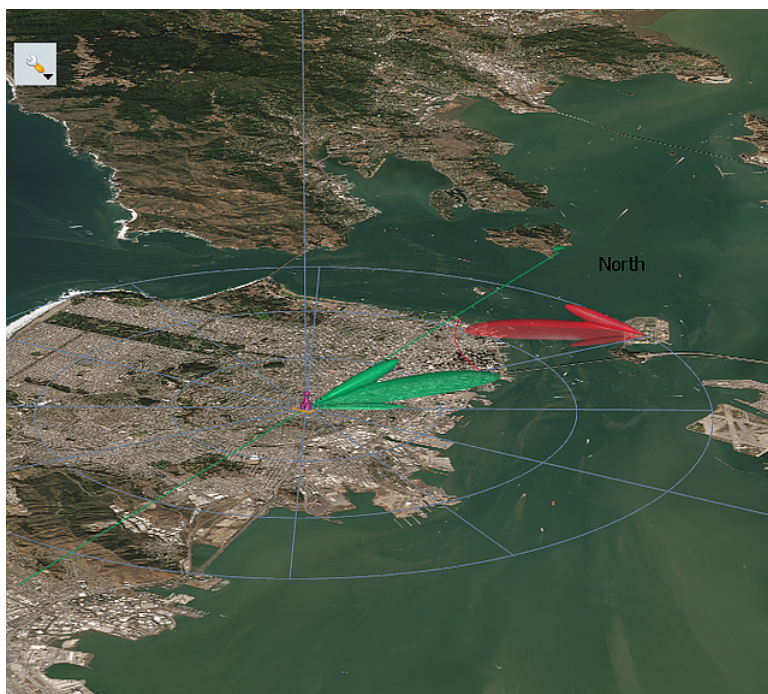
- .tif
- .tiff

If the format of the selected file is supported, the map appears in the "2D" diagram and "3D Live Visualization".



**Figure 16-15: 2D diagram before and after loading a map**

- 1 = Scenario with a plain background
- 2 = Scenario with a georeferenced map



**Figure 16-16: 3D Live Visualization with map background**



If the selected file does not contain the required georeferencing metadata, R&S Pulse Sequencer Digital outputs error messages in the "Message Log".

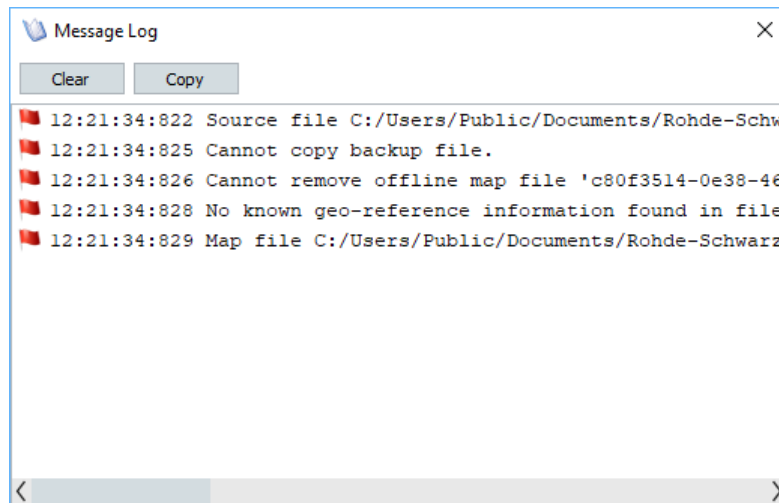


Figure 16-17: Typical errors caused by missing metadata

### Unload map

Use this function to unload the current map.

The "2D" diagram is not affected by this action - e.g. the current map centering and zoom level stay the same.

**Note:** The map is unloaded immediately.

The application does not ask you to confirm the action.

There are no negative consequences if you accidentally unload a map. Use the "Open Map" dialog to load the map again.

### Opacity

Use this function to make the map or the scenario more or less prominent.

Move the slider left/right to make the background color more/less visible through the map.

For example:

- To focus on the map, set the slider fully to the right.
- To focus on the scenario, set the slider fully to the left.
- To show the scenario in relation to the environment, set the slider in the middle.

## 16.11 Importing user icons

You can import custom icons to expand the list of available icons for displaying RX and TX items in a scenario.

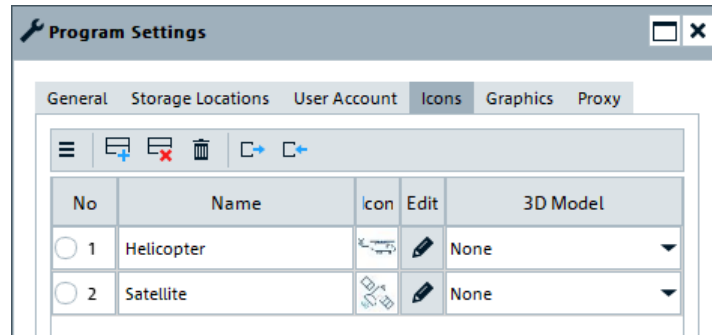
1. In the menu bar, select "Configure > Settings > Icons".

An empty list is shown.

## 2. Add icons to your list.

Use one of the following methods:

- Add single icons to the list by using the standard functions, see [Table 2-4](#).
- Import an icon archive that was created by the pulse sequencer software.



## 3. With the icons in the list you can do the following:

- Rename the icon.
- Edit the icon.
- Select a 3D model for it.
- Export the icons to create an archive.

## 4. Finish with "Apply".

You can now select the user icons from the list of "Vehicle Icons" in a scenario, see [Chapter 16.8.3, "Platform context menu"](#), on page 340.

**Settings:**

<a href="#">Export/import icons as archive</a> .....	346
<a href="#">Name</a> .....	346
<a href="#">Icon</a> .....	346
<a href="#">Edit</a> .....	346
<a href="#">3D Model</a> .....	346

**Export/import icons as archive**

Export the icons to create an archive or import an icon archive that was created by the pulse sequencer software.

**Name**

Enter the name of the icon.

**Icon**

Displays the imported user icon.

**Edit**

Change the displayed user icon.

**3D Model**

Select a 3D model for the icon from a list of predefined models. The selected 3D model is used to display the TX/RX item in the interactive 3D display.

"None": a cone is shown for the TX/RX item in the interactive 3D display.

# 17 Configuring the simulation

In order to generate and export the simulated signals from R&S Pulse Sequencer Digital, you need to configure the settings in the "Scenario" dialog.

The following chapters explain the necessary steps.

## 17.1 Signal calculation settings

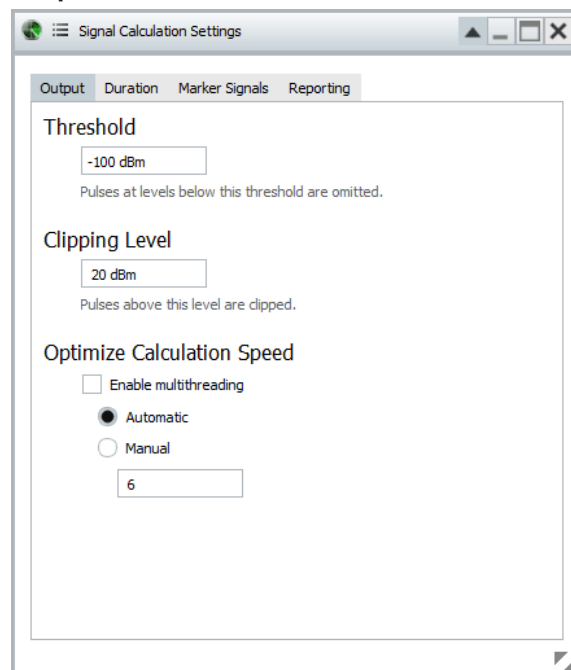
Access:

- ▶ In the "Scenario" dialog, select "Signal Calculation > Config".

Settings:

Output.....	348
L Threshold.....	349
L Clipping Level.....	349
L Optimize calculation speed.....	349
Duration.....	349
Marker Signals.....	350
Reporting.....	351

**Output**



**Threshold ← Output**

Enters a level threshold to limit the dynamic range of the signal. Pulses at levels below this threshold are omitted.

The maximum "Threshold" is 0 dBm.

Remote command:

[SCENario:OUTPut:THReshold](#) on page 564

**Clipping Level ← Output**

Enters a maximum level to limit the dynamic range of the signal. Pulses at levels above this threshold are reduced (*clipped*) to the configured level.

Remote command:

[SCENario:OUTPut:CLIPping](#) on page 562

**Optimize calculation speed ← Output**

Enable this parameter to apply multithreading and decrease the calculation time.

Select one of the options:

- "Automatic"  
The system automatically applies the optimum number of threads for the scenario.
- "Manual"  
Define the number of threads to be used.

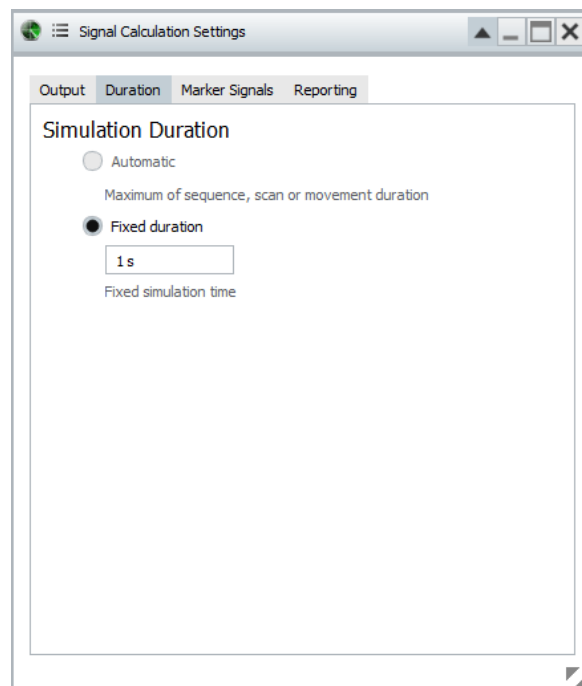
See also [Chapter 22.4, "Speeding up calculation"](#), on page 404.

Remote command:

[SCENario:OUTPut:MULTithread](#) on page 564

[SCENario:OUTPut:MTMode](#) on page 564

[SCENario:OUTPut:MTThreads](#) on page 564

**Duration**

Provides duration-related settings:

"Duration"

Defines the simulation content.

The generated signal can:

- Last a specified duration.  
Short sequences are repeated, longer ones are truncated.
- Have an automatically determined maximum content and duration that best fits the current scenario and configuration.  
Short sequences are repeated, longer ones are truncated.

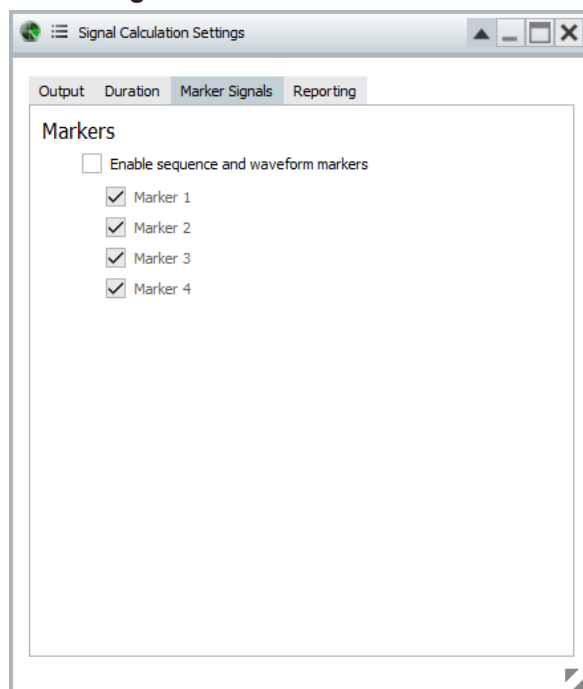
See also [Table 16-2](#).

Remote command:

[SCENario:OUTPut:DURation:MODE](#) on page 562

[SCENario:OUTPut:DURation:TIME](#) on page 562

### Marker Signals



Enables configured markers to be considered in the generated file.

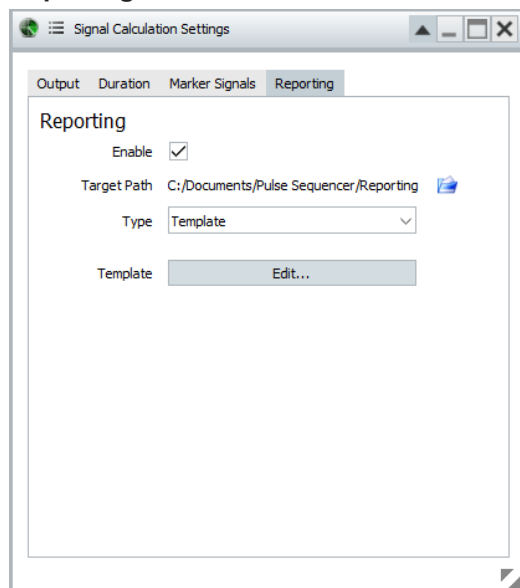
See "[Global Marker Signals](#)" on page 381.

Remote command:

[SCENario:OUTPut:MARKer:ENABle](#) on page 499

[SCENario:OUTPut:MARKer:FLAGs](#) on page 499

## Reporting



Enables and configures report file generation.

**Note:** Settings change depending on which "Type" option is selected.

See [Chapter 21, "Creating reports and documenting measurement results"](#), on page 386.

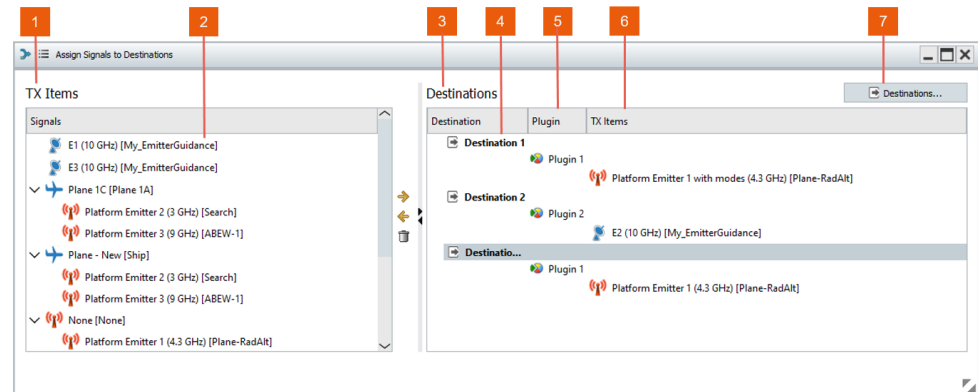
## 17.2 Assign signals to destination

In "Localized Emitters" and "Direction Finding" scenarios, you have to select the signal of an emitter or receiver that you want to export to the connected plugin.

In the "Scenario" dialog, perform the following:

1. For scenario type "Localized Emitters", select "Signal Generation Export Plugin > Assign" to open the "Assign Signals to Destinations" dialog.  
For scenario type "Direction Finding", select "Signal Generation Export Plugin > Assign" to open the "Assign Receiver Signals to Destinations" dialog.
2. For all scenario types, select "Signal Generation Export Plugin > Config" to open the "Destinations" dialog.

The name and the contents of the dialog change depending on the scenario but the settings and the workflow are similar.



**Figure 17-1: Assign Signals to Destinations: understanding the displayed information (Scenario > Signal Generation Export Plugin > Assign)**

- 1 = Available "TX Items" or "Interleaving Groups" if enabled (Option:R&S PULSE-K39 required for interleaving)
- 2 = Unassigned emitters
- 3 = List of destinations (entries depend on "Scenario > Signal Generation > Config", see ["Available for Assignment"](#) on page 354)
- 4 = Destination name
- 5 = Available plugins assigned to destination
- 6 = Signal of emitter assigned to plugin/details of interleaving groups if enabled (see ["Interleaving Groups"](#) on page 353 and ["Groups Contents"](#) on page 354)
- 7 = Opens "Destinations" dialog (see [Chapter 3.3, "Destinations settings"](#), on page 57)

For step-by-step instructions, see:

- [Chapter 16.1, "How to create scenarios with receiver and TX items"](#), on page 290

### Settings:

TX Items.....	352
L Emitters.....	352
L Receiver Signals.....	353
L Interleaving Groups.....	353
Add, Remove, Clear.....	353
Destinations.....	354
L Available for Assignment.....	354
L Plugin.....	354
L Groups/Emitters.....	354
L Groups Contents.....	354

### TX Items

Common representation of the available signals.

**Tip:** You can assign several signals to the same plugin.

### Emitters ← TX Items

Lists the alias names of all configured emitters that are still not assigned to a destination.

Select an emitter and drag and drop it on one of the plugins.



Remote command:

[ASSignment:EMITters:LIST?](#) on page 465

[ASSignment:EMITters:SElect](#) on page 431

### Receiver Signals ← TX Items

Lists all receiver signals that are still not assigned to a destination.

There is one receiver signal per receiver antenna element and emitter combination.

The name of the receiver signal follows the syntax:

"<Antenna Element Alias> - <Emitter Name Alias>", as selected with the parameters:

- ["Antenna Configuration"](#) on page 266
- ["Alias Name"](#) on page 312

Remote command:

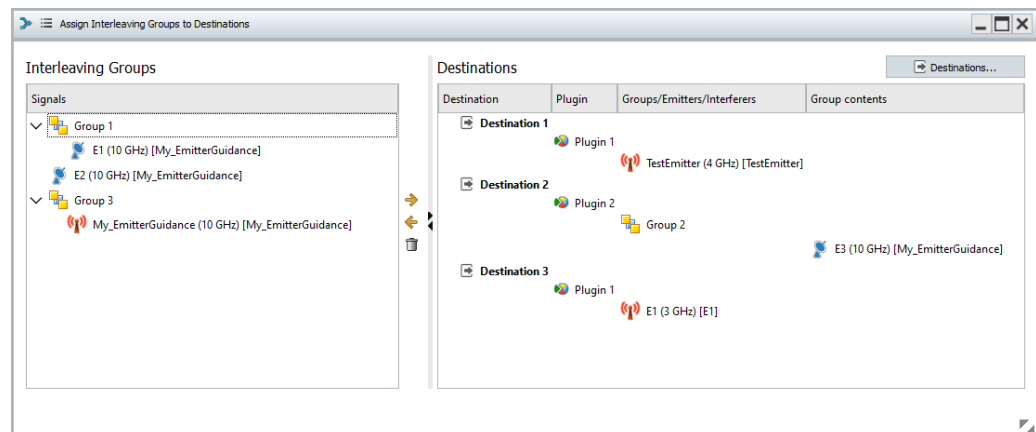
[ASSignment:ANTennas:LIST?](#) on page 466

[ASSignment:ANTennas:SElect](#) on page 431

### Interleaving Groups ← TX Items

Option:R&S PULSE-K39

In scenarios that have interleaving enabled, the "Interleaving Groups" list shows all interleaving groups defined for the selected scenario.



**Figure 17-2: Assign Interleaving Groups to Destinations**

Click the group name to expand the group content. All emitters assigned to the particular group are shown.

Interleaving groups are assigned jointly. Select the group name and drag and drop it on one of the plugins.

See also ["Groups/Emitters"](#) on page 354.

Remote command:

[ASSignment:GROup:LIST?](#) on page 467

[ASSignment:GROup:SElect](#) on page 467

### Add, Remove, Clear

Use these buttons to add a selected emitter to or remove it from the selected plugin.

Alternatively, use the drag and drop method.

Remote command:

[ASSignment:DESTination:PATH:EMITter:ADD](#) on page 429

[ASSignment:DESTination:PATH:EMITter:SElect](#) on page 431

[ASSignment:DESTination:PATH:EMITter:DElete](#) on page 432

[ASSignment:DESTination:PATH:EMITter:CLEar](#) on page 433

[ASSignment:DESTination:PATH:ANTenna:ADD](#) on page 429

[ASSignment:DESTination:PATH:ANTenna:SElect](#) on page 431

[ASSignment:DESTination:PATH:ANTenna:DElete](#) on page 432

[ASSignment:DESTination:PATH:ANTenna:CLEar](#) on page 433

### Destinations

Lists the destinations with their names, available plugins and assigned emitters or interleaving groups with their group content.

#### Available for Assignment ← Destinations

The number of listed destinations depends on "Scenario > Signal Generation Export Plugin > Config":

- "Scenario > Signal Generation Export Plugin" > **"Assign"**  
Only the plugin destinations that are available in the current setup in the "Destinations" dialog are listed here.  
See [Chapter 3.3, "Destinations settings"](#), on page 57.
- "Scenario > Signal Generation Export Plugin" > **"Config"**

Lists all destinations that are available in the repository.

Remote command:

[ASSignment:DESTination:LIST?](#) on page 466

[ASSignment:DESTination:SElect](#) on page 431

[ASSignment:DESTination:PATH:LIST?](#) on page 466

[ASSignment:DESTination:PATH:SElect](#) on page 431

[ASSignment:DESTination:PATH:EMITter:LIST?](#) on page 467

[ASSignment:DESTination:PATH:ANTenna:LIST?](#) on page 467

#### Plugin ← Destinations

Indicates the available plugins for each destination.

#### Groups/Emitters ← Destinations

Indicates the alias names of the assigned signal sources. If interleaving is enabled, displays the group names of the assigned signals (see [Figure 17-2](#)).

#### Groups Contents ← Destinations

In scenarios with enabled interleaving, indicates the emitters or PDW lists that are assigned to the particular plugin (see [Figure 17-2](#)).

## 18 Working with PDWs

The pulse description word (PDW) is a commonly used file format that describes radar signals. The PDWs contain the radar signal parameters for each pulse together with a timestamp that defines the pulse start time. Sometimes the PDWs can originate from earlier simulations or live recordings. In other cases, you would like to generate the radar test signal directly in PDW format.

In R&S Pulse Sequencer Digital, you have the following different possibilities to use PDWs:

- **Import custom PDW lists ("Imported Signals")**

Instead of configuring pulses, MOPs, sequences and IPM effects, you can import your custom PDW lists.

Based on files with mapping rules, the R&S Pulse Sequencer Digital PDW import interface transforms the custom-specific PDW list into the Rohde & Schwarz proprietary PDW format.

You can use imported signals in PDW lists in scenario sequences.

Custom PDWs can be imported in any scenario type, but the created output file differs depending on the scenario type:

- The "PDW List (Collection)" scenario is dedicated for importing custom PDWs.
- In scenario other than the "PDW List (Collection)", the created output file is a waveform.

Waveforms describing long simulation time are usually large.

- **Merging the signals of several emitters** (several PDW lists)

Per default, you use the "PDW List (Collection)" scenario to configure several PDW lists and switch between them sequentially.

However, you can also combine them into a single output file. During the interleaving process, overlapping PDWs with lower priority are dropped, where you define the priority of the individual PDW lists (see [Figure 18-2](#)).

The solution above introduce the possibilities to generate or regenerate test signals with the R&S Pulse Sequencer Digital.

For step-by-step instructions, see:

- [Chapter 18.1, "How to import PDW lists and create output files"](#), on page 356.

For description of the related settings, see:

- [Chapter 18.5, "PDW list \(Collection\) settings"](#), on page 368.
- [Chapter 18.7, "PDW interleaving progress statistics"](#), on page 373.
- [Chapter 18.8, "Signal preview with interleaved and dropping statistics"](#), on page 374.

## 18.1 How to import PDW lists and create output files

### To import PDW list data

The import of custom PDW list files requires a template that describes how to extract the information from the PDW list file.

The instruction shows you how to operate the software and import the PDW list files. We assume that the template file is created, as described in the document "R&S Pulse Sequencer Digital PDW Import Interface Specification".

1. Select "Repository Tree > Imported Signals > New".
2. Select "Type > PDW Data".
3. Select "Import".
4. In the "PDW Data Import" dialog, load the PDW list file and the PDW template.
  - a) Select the "Select PDW File" icon.  
PDW list files are custom text-based PDW lists in ASCII or coma-separated file format (\*.txt or \*.csv).
  - b) Select the "Import template file" icon.  
Template files are ASCII files with predefined file format and file extension \*.pdwt.
5. Select "Process PDW File".

The PDW list file is parsed. The "Import Status" dialog displays parsing process information.

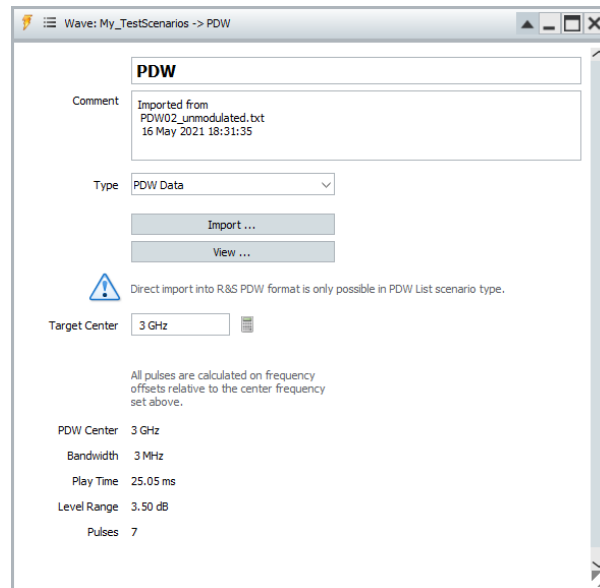
6. Select "Imported Data" to observe detailed information on the imported file.  
The imported data is temporarily stored in memory.

The screenshot shows the "PDW Data Import" dialog box. The left pane displays the PDW list file content, which includes a table of parameters and a series of comments. The right pane displays the template file content, which is a Pulse Sequencer Import Template. Below the panes, there is a "Process PDW File" button and a "Normalize TGA" checkbox. At the bottom, there is an "Import Status" section with a table of imported data.

TGA [ms]	Width [us]	Center [GHz]	Offset [kHz]	Phase [°]	Level [dB]	MOP	Marker
0.000000	50.000	3.000000000	0.000	0.00	0.00	CW	0000
2.000000	160.000	3.000000000	0.000	0.00	0.00	FSK, Chip Rate 100 kHz, Chips 16, States 2, Step 3 kHz	0000
4.000000	160.000	3.000000000	0.000	0.00	0.00	FSK, Chip Rate 100 kHz, Chips 16, States 4, Step 1 kHz	0000
6.000000	80.000	3.000000000	0.000	0.00	0.00	FSK, Chip Rate 100 kHz, Chips 8, States 8, Step 250 kHz	0000
8.000000	40.000	3.000000000	0.000	0.00	0.00	FSK, Chip Rate 100 kHz, Chips 4, States 16, Step 500 kHz	0000
10.000000	160.000	3.000000000	0.000	0.00	0.00	FSK, Chip Rate 100 kHz, Chips 16, States 16, Step 100 kHz	0000
12.000000	50.000	3.000000000	0.000	0.00	0.00	CW	0000

7. Select "Import into Repository" to store the data permanently in the repository.  
The imported PDW information can be used as part of a sequence.

8. Observe the overview information in the "Wave" dialog.



9. Select "View" to display more details on the waveform.

TOA [ms]	Width [us]	Center [GHz]	Offset [kHz]	Phase [°]	Level [dB]	MOP	Marker
0.000000	10.000	3.000000000	1500.000	0.00	0.00	CW	0000
1.000000	20.000	3.000000000	1500.000	45.00	-1.00	CW	0000
3.000000	30.000	3.000000000	-1500.000	90.50	-1.50	CW	0000
5.000000	10.000	3.000000000	-1500.000	-90.50	-2.00	CW	0000
15.000000	20.000	3.001500000	0.000	180.00	-2.50	CW	0000
20.000000	30.000	2.998500000	0.000	0.00	-3.00	CW	0000
25.000000	50.000	3.000000000	0.000	0.00	-3.50	CW	0000

The dialog shows the waveform bandwidth, the level range and the waveform content as a sequence of pulses with their main characteristics.

The displayed information resembles the information in the "PDW Data Import > Imported Data" dialog.

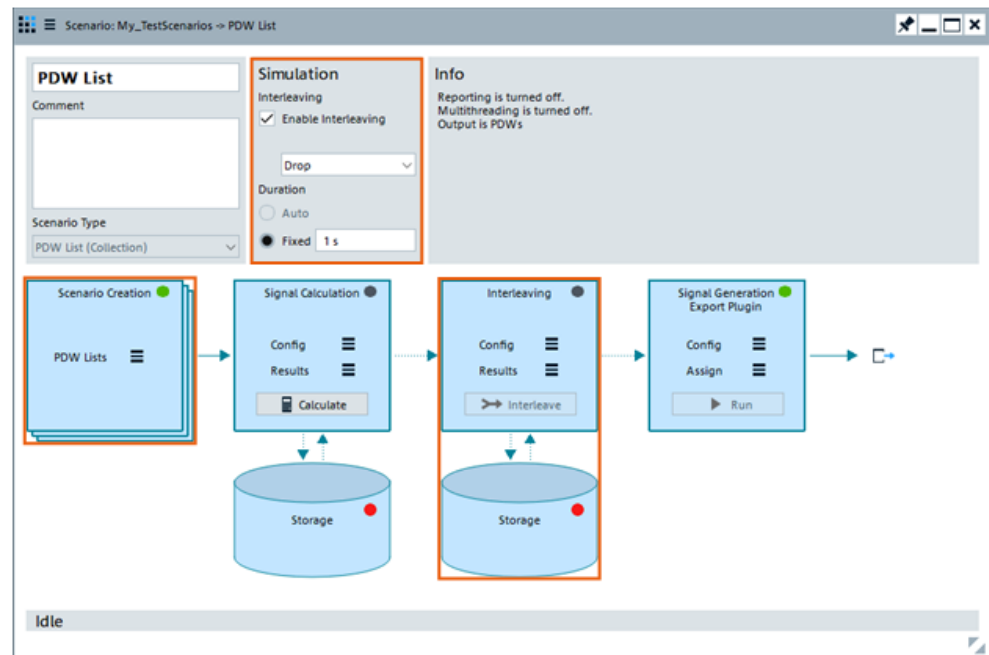
10. Assign the waveform to a sequence.  
 11. Assign the sequence to a scenario.  
 a) Calculate the signal.  
 b) In the "Scenario" dialog, select "Signal Calculation > Results > View".

The "Signal Preview" dialog displays the calculated unmodulated pulses, each with the specified timing settings.

For more information, see [Chapter 15, "Visualizing and analyzing signals"](#), on page 284.

## Create PDW list scenario

1. Select "Scenarios > New" > "Scenario Type = PDW List (Collection)".



2. Select "Scenario Creation > PWD Lists" to open the "PDW List (Collection)" dialog.
3. Select "Append" to add PDWs.
4. Enter an alias name.  
Select "PDW List" and select an existing waveform element containing an imported PDW.
5. Option: R&S PULSE-K39.  
To merge the PDW lists into a single output file, in the block diagram select "Simulation > Interleaving > On".  
The "Interleaving" block appears on the block diagram.
6. Select "Interleaving > Config".

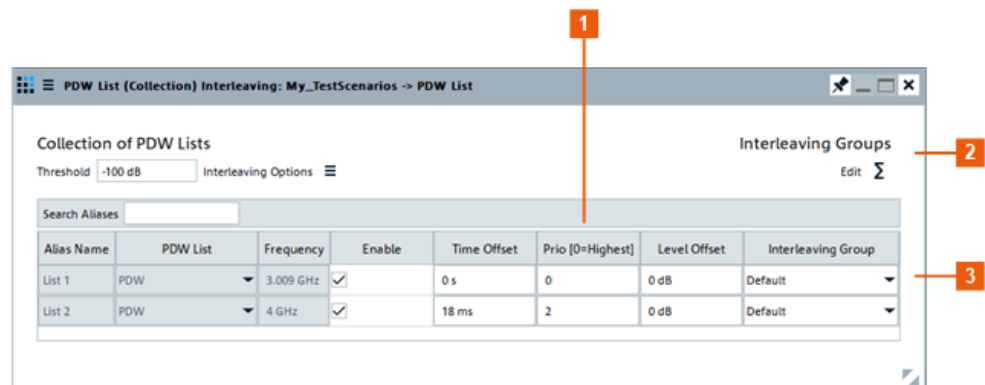
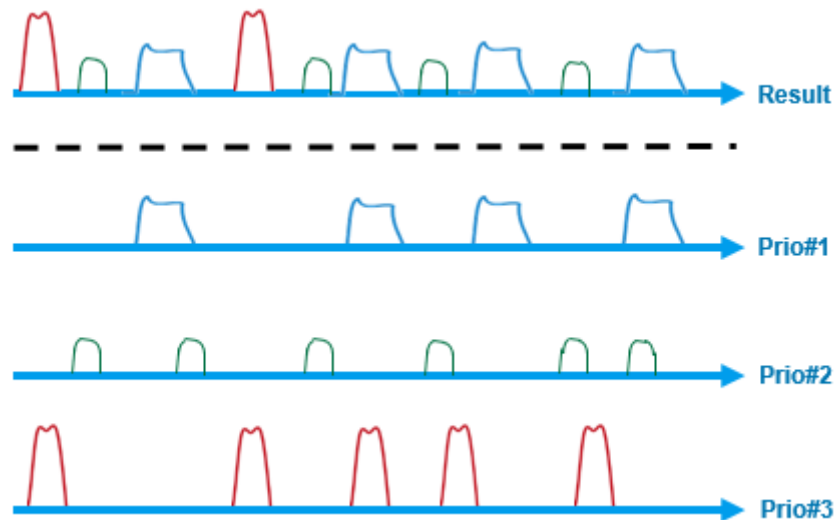


Figure 18-1: PDW List (Collection) Interleaving: understanding the displayed information

- 1 = Priority of the selected PDW lists
- 2 = Enables you to change settings for interleaving groups
- 3 = Enables you to select an interleaving group

7. For each PDW, define a "Priority".

Multiple lists can be interleaved into a single output file using a priority-based dropping algorithm.



**Figure 18-2: Principle of the priority-based interleaving algorithm**

Prio#1 = PDW list with the highest priority (i.e. the priority value is 0 or smaller than the value for the other PDW lists)

Prio#3 = PDW list with the lowest priority (i.e. the highest priority value within the PDW lists)

8. Select a destination that supports the following **mandatory** options:

- Select a destination with a valid export plugin
- Multiple emitters
- Extended sequencing R&S PULSE-K39.

9. Select "Signal Calculation > Calculate".

The signal is calculated and the "Signal Calculation" status indication is green.

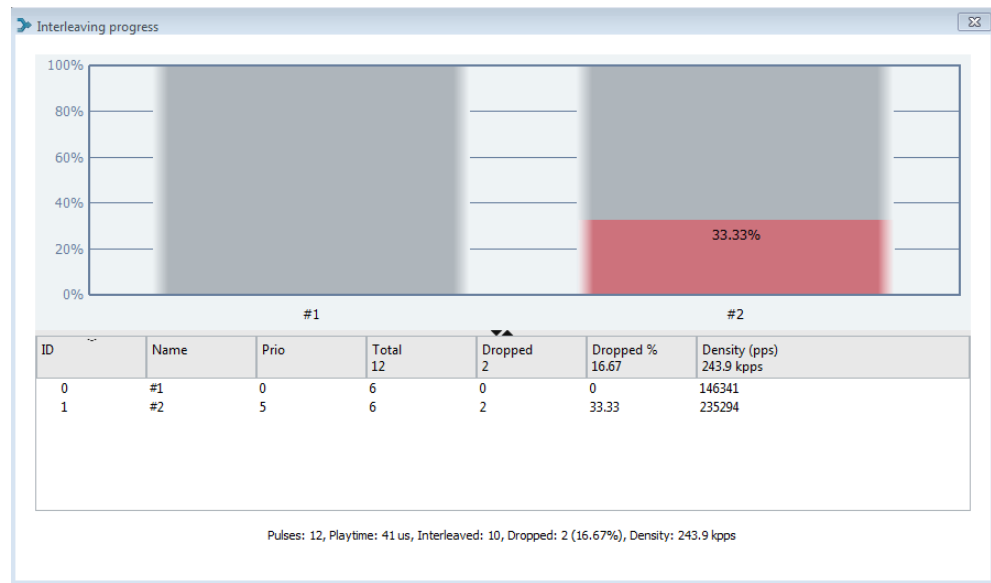
The signal calculation and interleaving steps are separated from each other. The interleaving can be applied optionally, as post-processing on the previously calculated data. As long as the "Signal Calculation" settings are not changed, signal recalculation is not required.

10. Option:R&S PULSE-K39.

Select "Interleaving > Interleave"

During the interleaving, the "Interleaving progress" display indicates the percentage of pulses being processed and dropped in each of the PDW lists.

How to import PDW lists and create output files

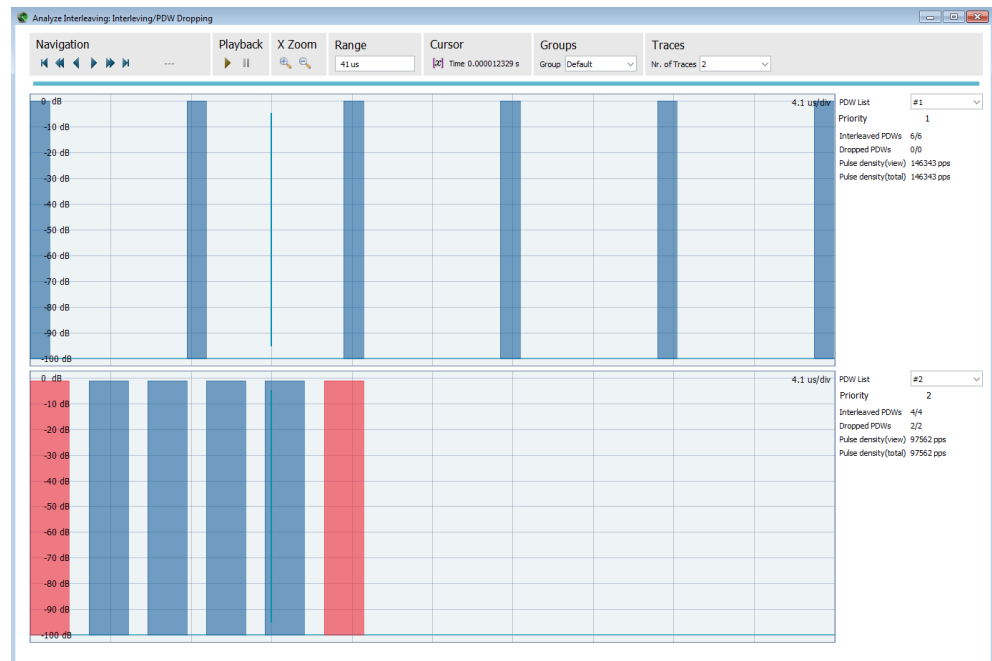


11. To observe more information on the created output files, in the "Scenario" dialog:
  - a) Select "Interleaving > Results > View > Interleaved PDW/Dropped PDWs". Both views display summary information on the interleaved or dropped PDWs and a drop out statistic. The information is represented in a table and in a graphical form ("Table"/"Statistic" and "Graphics"/"Histogram").

Signal	ID	TOA	Level	PW	Freq	Modulation	Bandwidth	Rise Time	Fall Time	
1	List 1	1	0.000 000 000 ...	0.00 dBm	30 us	3.009 GHz	unmodulated	-	0 s	0 s
2	List 1	1	0.003 000 000 ...	-3.00 dBm	30 us	3.009 GHz	unmodulated	-	0 s	0 s
3	List 1	1	0.006 000 000 ...	0.00 dBm	60 us	3.011 GHz	unmodulated	-	0 s	0 s
4	List 1	1	0.009 000 000 ...	0.00 dBm	60 us	3.008 GHz	unmodulated	-	0 s	0 s
5	List 1	1	0.012 000 000 ...	-6.00 dBm	15 us	3.009 GHz	unmodulated	-	0 s	0 s
6	List 1	1	0.015 001 500 ...	-6.00 dBm	15 us	3.009 GHz	unmodulated	-	0 s	0 s
7	List 1	1	0.018 000 000 ...	0.00 dBm	30 us	3.009 GHz	unmodulated	-	0 s	0 s
8	List 1	2	0.021 000 000 ...	-3.00 dBm	30 us	4 GHz	unmodulated	-	0 s	0 s
9	List 1	2	0.024 000 000 ...	0.00 dBm	60 us	4.002 GHz	unmodulated	-	0 s	0 s
10	List 1	2	0.027 000 000 ...	0.00 dBm	60 us	3.998 GHz	unmodulated	-	0 s	0 s
11	List 1	2	0.030 000 000 ...	-6.00 dBm	15 us	4 GHz	unmodulated	-	0 s	0 s
12	List 1	2	0.033 001 500 ...	-6.00 dBm	15 us	4 GHz	unmodulated	-	0 s	0 s
13	List 1	2	0.036 000 000 ...	0.00 dBm	30 us	4 GHz	unmodulated	-	0 s	0 s
14	EOF	0								

- b) Select "Interleaving > Results > View > Analyze". The "Analyze Dropped PDWs" dialog indicates the PDWs that are and are not included in the resulting output file. PDWs displayed in **red** are **dropped out**.



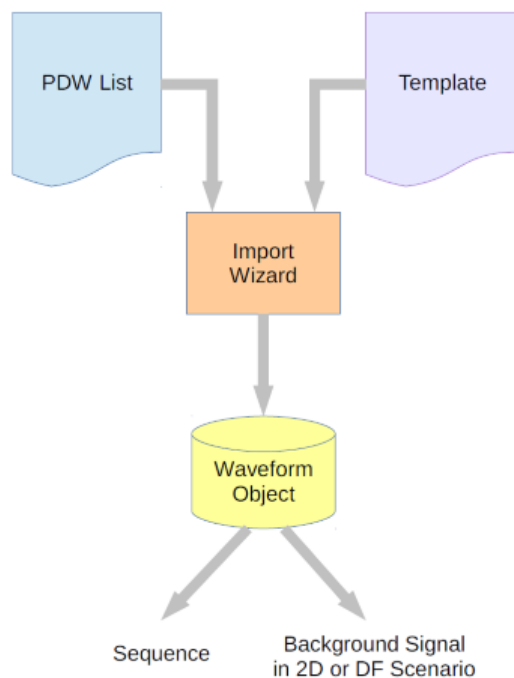


12. To increase the number of interleaved PDWs, add a delay to one of the PDW lists. Set, for example, "Interleaving > Config > PDW\_1 > Time Offset = 11 us". Create the output signal in the same manner. Observe the resulting output signal.
- Depending on the PDW list, multiple or all PDWs from all PDW lists are included in the output file.

## 18.2 PDW import mechanism

R&S Pulse Sequencer Digital uses a template-based import mechanism for the PDW import. Import templates are human readable text files that describe how information is extracted from the PDW list file. The PDW list file is also a human readable text file using one single row per PDW. The columns contain the various parameters related to the PDW.

The diagram on [Figure 18-3](#) shows the principal concept.



**Figure 18-3: Import mechanism principle**

The "PDW Data Import" wizard is a dialog that loads both files and shows their content. This dialog is also used to control the import process and accept the imported data.

The import process starts by parsing the text-based template file. Once parsing the template is complete, R&S Pulse Sequencer Digital loads and analyzes the PDW list file. All imported data is temporarily stored in memory until you choose to store the data permanently in the repository.

Storing the data lets R&S Pulse Sequencer Digital copy the extracted PDW data to a waveform object within the R&S Pulse Sequencer Digital repository. The internal storage format is a proprietary binary stream. If future extensions to the data stream are required, R&S Pulse Sequencer Digital automatically converts existing streams to the newer format.

After the import process has completed the original template and PDW files are no longer required.

For description of the related settings, see:

- [Chapter 18.4, "PDW data import wizard settings"](#), on page 365.

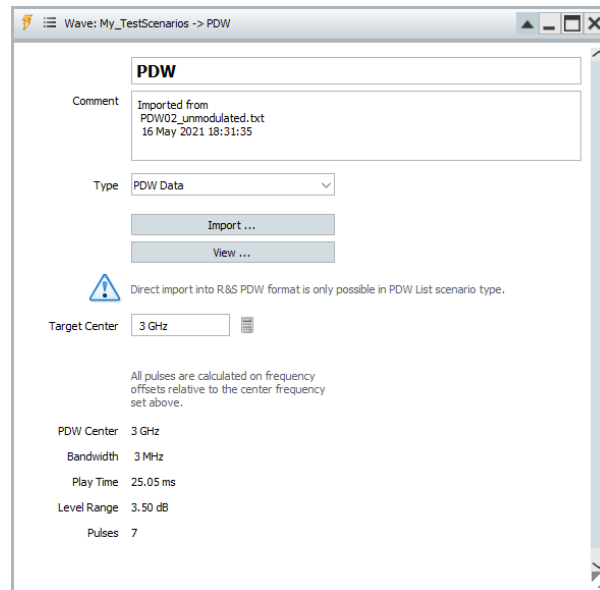
For step-by-step instruction, see:

- ["To import PDW list data"](#) on page 356.

## 18.3 PDW data settings

Access:

1. Select "Repository Tree > Imported Signals > New".
2. Select "Type = PDW Data".



This section describes the available settings. For step-by-step instructions, see "[To import PDW list data](#)" on page 356.

### Settings:

<a href="#">Import</a> .....	363
<a href="#">View &gt; PDW Data View</a> .....	363
<a href="#">Target Center</a> .....	364
<a href="#">Calculate</a> .....	364
<a href="#">PDW Center, Bandwidth, Play Time, Level Range, Pulses</a> .....	364

### Import

Accesses a file import wizard, see [Chapter 18.4, "PDW data import wizard settings"](#), on page 365.

### View > PDW Data View

If the PDW list file is imported in the repository, it opens the "PDW Data View".

Navigation Start Line Entries per Page  
 0 50 Viewing: 0-7/7 Bandwidth 3 MHz Level Range 3.50 dB

TOA [ms]	Width [us]	Center [GHz]	Offset [kHz]	Phase [°]	Level [dB]	MOP	Marker
0.000000	10.000	3.000000000	1500.000	0.00	0.00	CW	0000
1.000000	20.000	3.000000000	1500.000	45.00	-1.00	CW	0000
3.000000	30.000	3.000000000	-1500.000	90.50	-1.50	CW	0000
5.000000	10.000	3.000000000	-1500.000	-90.50	-2.00	CW	0000
15.000000	20.000	3.001500000	0.000	180.00	-2.50	CW	0000
20.000000	30.000	2.998500000	0.000	0.00	-3.00	CW	0000
25.000000	50.000	3.000000000	0.000	0.00	-3.50	CW	0000

The dialog shows the waveform bandwidth, the level range and the waveform content as a sequence of pulses with their main characteristics.

The displayed information resembles the information in the "PDW Data Import > Imported Data" dialog.

"Start Line" Sets the first line to be displayed.

Remote command:

[IMPort:VIEW:TIME:START](#) on page 495

"Entries per Page"

Sets the number of lines displayed per page.

Remote command:

[IMPort:VIEW:COUNT](#) on page 495

"Start, End, Forwards, Backwards"

Scrolls through the entries in the selected way.

Remote command:

[IMPort:VIEW:MOVE:START](#) on page 495

[IMPort:VIEW:MOVE:FORWARD](#) on page 495

[IMPort:VIEW:MOVE:BACKWARDS](#) on page 495

[IMPort:VIEW:MOVE:END](#) on page 495

### Target Center

Sets the center frequency for the output waveform.

When a PDW list file is imported, the value is set to the automatically calculated center frequency of the PDW file. The value resembles the value indicated as "PDW Center".

The frequency offsets of the pulses are recalculated. The bandwidth increases.

### Calculate

The "Calculate" icon resets the "Target Center" field to the value displayed as "PDW Center".

### PDW Center, Bandwidth, Play Time, Level Range, Pulses

If the PDW list file is imported in the repository, the dialog displays information on the waveform:

- "PDW Center": *Calculated center frequency*

The indicated value is the center frequency the software uses during the import process. The pulses are calculated relatively to this value.

The "PDW Center" is calculated as the middle frequency between the min and the max frequency values included in the PDW file.

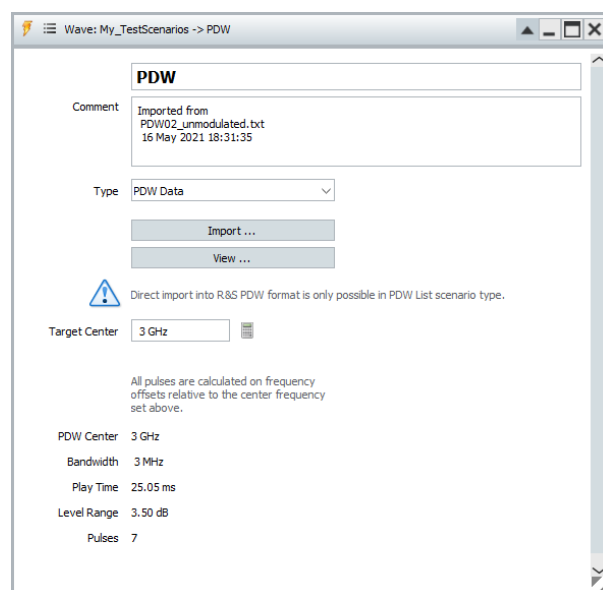
Chirp frequency deviations are considered.

- "Bandwidth": Calculated bandwidth
- "Play Time": Duration
- "Level Range": Calculated level range
- "Pulses": Number of pulses in the waveform.

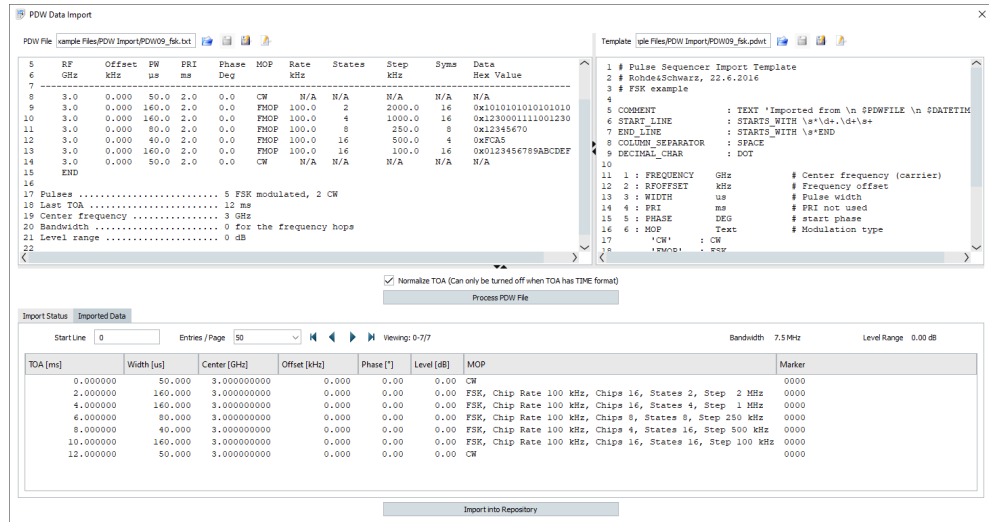
## 18.4 PDW data import wizard settings

Access:

1. Select "Repository Tree > Waveform > New".
2. Select "Type = PDW Data".



3. Select "Import".



If the required template file is provided, the "PDW Data Import" wizard converts custom PDW list files into a Rohde & Schwarz waveform file.

This section describes the available settings. For step-by-step instructions, see "To import PDW list data" on page 356.

**Settings:**

- PDW File..... 366
- Select PDW data file, Create new PDW data file, Save/Save as..... 366
- Template..... 367
- Select import template file, Create new import template, Save/Save as..... 367
- PDW and template files content editor..... 367
- Normalize TOA..... 367
- Process PDW File..... 367
- Import Status..... 367
- Imported Data..... 367
- Import into Repository..... 368

**PDW File**

File path and filename of the custom text-based PDW list file.

PDW list files are files in ASCII or coma-separated file format (\* .txt or \* .csv).

Remote command:

IMPort : PDW : FILE : PDW on page 491

**Select PDW data file, Create new PDW data file, Save/Save as**

Icons with standard file handling functions.

**Note:** The "Save/Save as" function stores changes in the PDW file or template itself. To parse the data, import it and store it into the repository, select "Process PDW File" and "Import into repository".

Remote command:

[IMPORt:PDW:FILE:PDW:LOAD](#) on page 492

[IMPORt:PDW:FILE:PDW:SAVE](#) on page 492

### Template

File path and filename of the import template file.

Template files are ASCII files with predefined file format and file extension \*.pdwt.

For more information, see document "R&S Pulse Sequencer Digital PDW Import Interface Specification".

Remote command:

[IMPORt:PDW:FILE:TEMPlate](#) on page 491

**Select import template file, Create new import template, Save/Save as**  
Icons with standard file handling functions.

Remote command:

[IMPORt:PDW:FILE:TEMPlate:LOAD](#) on page 492

[IMPORt:PDW:FILE:TEMPlate:SAVE](#) on page 492

### PDW and template files content editor

Displays the content of the loaded file in the editor.

If necessary, edit the files and store the changes.

### Normalize TOA

If selected, it normalizes the time of arrival (TOA) of the first entry to zero. The following timestamps are considered relative to the first timestamp.

Remote command:

[IMPORt:PDW:NORM](#) on page 492

### Process PDW File

Starts parsing the PDW file.

Observe the parsing process information in the "Import Status" dialog.

The imported data is temporarily stored in memory.

Remote command:

[IMPORt:PDW:EXECute](#) on page 492

### Import Status

Indicates the parsing and import status.

Remote command:

[IMPORt:PDW:STATus?](#) on page 492

### Imported Data

Shows summary information retrieved from the imported waveform, such as the waveform bandwidth, the level range and the waveform content as a sequence of pulses with their main characteristics.

Remote command:

[IMPort:PDW:DATA:SEL](#) on page 493

[IMPort:PDW:DATA:MOP?](#) on page 493

[IMPort:PDW:DATA:WIDTH?](#) on page 494

etc.

### Import into Repository

Stores the data permanently in the repository.

As any other waveform element, the imported PDW information can be used as part of a sequence.

Remote command:

[IMPort:PDW:STORe](#) on page 494

## 18.5 PDW list (Collection) settings

Access:

- ▶ In a "Scenario Type = PDW List", select "PWD Lists > Edit".

Dialog displays overview information of the available PDW lists in table form.

No	Alias Name	PDW List	Absolute Level	Frequency
1	List 1	PDW	0 dBm	3.009 GHz
2	List 2	PDW	0 dBm	4 GHz

### Settings:

<a href="#">Options</a> .....	368
<a href="#">Append, Delete, Clear, Move Up/Down, Copy and append</a> .....	369
<a href="#">Search Aliases</a> .....	369
<a href="#">No</a> .....	369
<a href="#">Alias Name</a> .....	369
<a href="#">PDW List</a> .....	369
<a href="#">Absolute Level</a> .....	369
<a href="#">Frequency</a> .....	369

### Options

Joint configuration of all PDW lists at once.

- "Reset Frequency"



- "Reset Abs. Level"

**Append, Delete, Clear, Move Up/Down, Copy and append**

Use the standard functions in the context menu to add, reorder, or remove items.

Remote command:

[SCENario:CPDW:ADD](#) on page 429

[SCENario:CPDW:DELeTe](#) on page 432

[SCENario:CPDW:CLEar](#) on page 433

**Search Aliases**

Allows fast search of the PDW list; useful in scenarios with many PDW lists.

Filters and displays PDW lists in table rows according to the entered search string.

**No**

Subsequent number.

Remote command:

[SCENario:CPDW:SELeCt](#) on page 431

**Alias Name**

Enters an alias name.

Remote command:

[SCENario:CPDW:ALIAS](#) on page 559

**PDW List**

Selects the waveform element, used to import the PDW list.

Remote command:

[SCENario:CPDW:NAME](#) on page 559

**Absolute Level**

Sets the absolute level for the selected PDW list.

Thus, you can combine PDW lists with different levels into one output signal.

Remote command:

[SCENario:CPDW:LVABs](#) on page 556

**Frequency**

Sets the frequency for the selected PDW list.

Thus, you can combine PDW lists with different frequencies into one output signal.

Remote command:

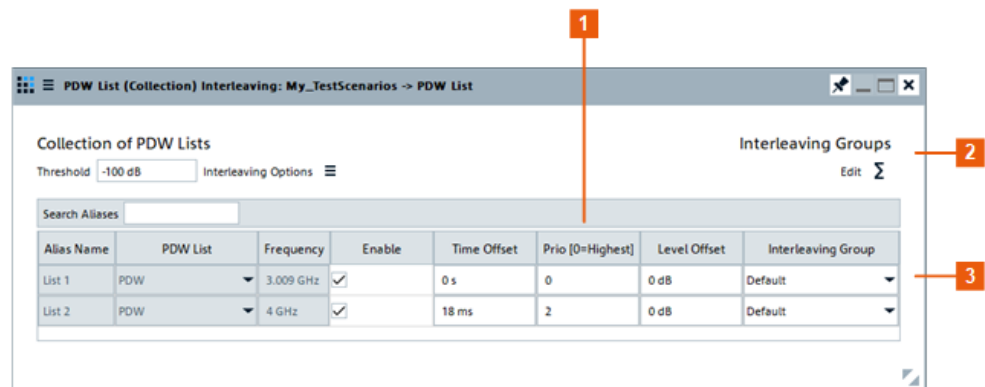
[SCENario:CPDW:FREQ](#) on page 555

## 18.6 PDW list (Collection) interleaving settings

Access:

1. In a "Scenario Type = PDW List", select "PWD Lists > Interleaving > On".
2. Select "Interleaving > Config".

Dialog displays the available PDW lists as configured in the [PDW List \(Collection\)](#) dialog, together with interleaving related settings, like "Time Offset" and "Priority".



**Figure 18-4: PDW List (Collection) Interleaving: understanding the displayed information**

- 1 = Priority of the selected PDW lists; applies only if PDW lists are merged, see [Figure 18-2](#).
- 2 = Opens the "Interleaving Groups" dialog, where you can define groups within that the interleaving is applied
- 3 = Each PDW list is assigned to an interleaving group

### Settings:

Threshold.....	370
Search Aliases.....	371
Interleaving Options.....	371
Alias Name.....	371
PDW List.....	371
Frequency.....	371
Enable.....	371
Time Offset.....	371
Priority [ 0 = Highest].....	371
Level Offset.....	372
Group.....	372
Edit Interleaving Groups.....	372
L Select, Insert, Append/Prepend, Remove, Clear.....	372
L No.....	372
L Alias Name.....	373

### Threshold

Enters a level threshold to limit the dynamic range of the signal. Pulses at levels below this threshold are omitted.

Resembles the value set with the parameter "Scenario > Signal Calculation > Config > Config > Signal Calculation Settings > Output > Threshold".

Remote command:

[SCENario:CPDW:THReshold](#) on page 563

### Search Aliases

Allows fast search of the PDW list; useful in scenarios with many PDW lists.

Filters and displays PDW lists in table rows according to the entered search string.

### Interleaving Options

Joint configuration of all PDW lists at once.

- "Enable All"/"Disable All"
- "Reset Time offset"/"Reset Level offset"
- "Reset Prio"

### Alias Name

Displays the alias name, as set with the parameter "Scenario > PDW Lists > Edit" > [Alias Name](#).

Remote command:

[SCENario:CPDW:ALias](#) on page 559

### PDW List

Displays the waveform element, used to import the PDW list.

Remote command:

[SCENario:CPDW:NAME](#) on page 559

### Frequency

Indicates the frequency of the particular PDW list, as set with the parameter "Scenario > PDW Lists > Edit" > [Frequency](#).

### Enable

Includes the PDW list in the output file.

Remote command:

[SCENario:CPDW:ENABLE](#) on page 559

### Time Offset

Shifts the processing of the PDW list in time.

Use this function, for example, to decrease the number of dropped PDWs.

Remote command:

[SCENario:CPDW:LDELay](#) on page 560

### Priority [ 0 = Highest]

Sets the priority of the selected PDW list. Higher value means lower priority. If PDWs are overlapping, the PDWs from the PDW list with lower priority are discarded.

See [Figure 18-2](#).

Remote command:

[SCENario:CPDW:PRIority](#) on page 560

### Level Offset

Adds a level offset.

The value is set relative to the value set with the parameter "Scenario > PDW Lists > Edit" > [Absolute Level](#).

Remote command:

[SCENario:CPDW:LEVel](#) on page 560

### Group

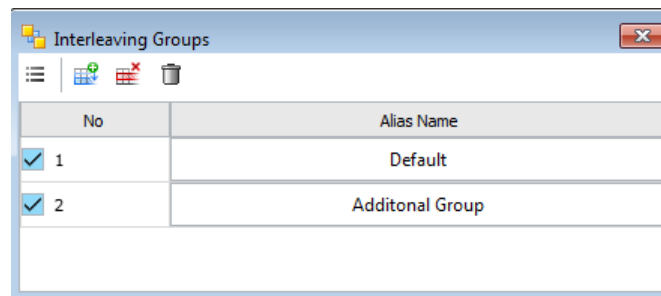
Assigns the emitter to one of the available interleaving groups, defined in the [Edit Interleaving Groups](#) dialog.

Remote command:

[SCENario:CPDW:GROup](#) on page 561

### Edit Interleaving Groups

Select the icon to access the "Edit Interleaving Groups" dialog.



Interleaving groups allow you to combine the emitter signals into different output signals.

Use the standard functions (icons) to add a new group, rearrange the groups, delete the existing one or all groups.

### Select, Insert, Append/Prepend, Remove, Clear ← Edit Interleaving Groups

Standard functions for items handling, see ["Standard function in the context menus"](#) on page 33.

Select a row, for example, to delete it or to insert a row before it.

Remote command:

[SCENario:CPDW:GROup:CATalog?](#) on page 561

[SCENario:CPDW:GROup:SElect](#) on page 430

[SCENario:CPDW:GROup:ADD](#) on page 429

[SCENario:CPDW:GROup:DElete](#) on page 432

[SCENario:CPDW:GROup:CLEar](#) on page 433

### No. ← Edit Interleaving Groups

Select a row to perform any row-based actions.

Interleaving groups are indicated by consecutive number; also used for indication in remote control.

Remote command:

[SCENario:CPDW:GROup:COUNt?](#) on page 429

[SCENario:CPDW:GROup:SElect](#) on page 430

### Alias Name ← Edit Interleaving Groups

Enter an alias name for the interleaving group.

Remote command:

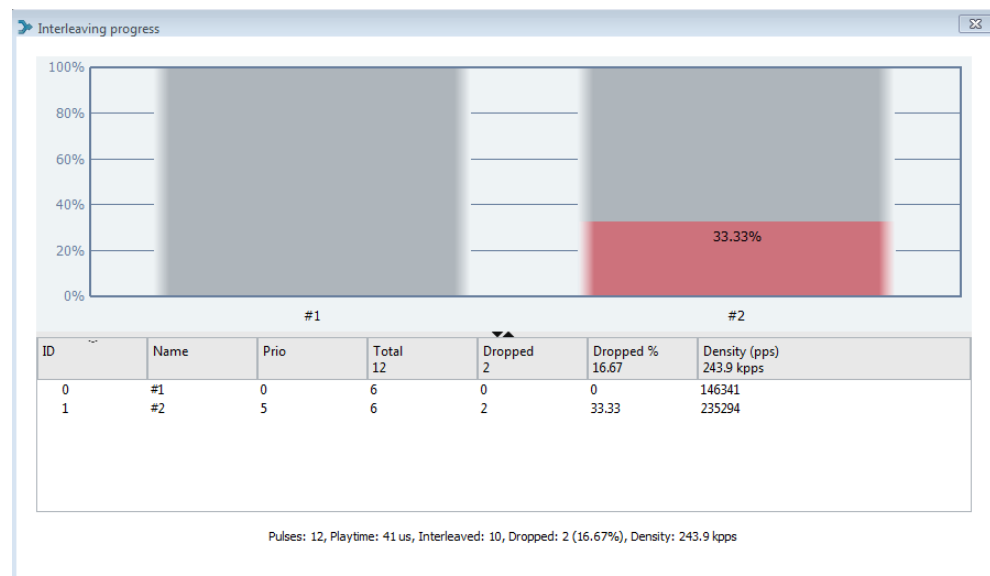
[SCENario:CPDW:GROup:ALias](#) on page 561

## 18.7 PDW interleaving progress statistics

Access:

1. In a "Scenario Type = PDW List", select "Interleaving > On".
2. Select "Signal Control > Prepare".
3. Select "Signal Control > Interleave".

The "Interleaving Progress" display opens automatically during the signal calculation, if PDW lists are merged. It indicates the percentage of pulses being processed and dropped in each of the PDW lists.



## 18.8 Signal preview with interleaved and dropping statistics

Access:

1. In a "Scenario Type = PDW List", select "Interleaving > On".
2. Select "Signal Control > Prepare".
3. Select "Signal Control > Interleave".
4. Select "Interleave > Results > Interleaved PDW/Dropped PDWs".

Signal	ID	TOA	Level	PW	Freq	Modulation	Bandwidth	Rise Time	Fall Time
List 1	1	0.000 000 000 ...	0.00 dBm	30 us	3.009 GHz	unmodulated	-	0 s	0 s
List 1	1	0.003 000 000 ...	-3.00 dBm	30 us	3.009 GHz	unmodulated	-	0 s	0 s
List 1	1	0.006 000 000 ...	0.00 dBm	60 us	3.011 GHz	unmodulated	-	0 s	0 s
List 1	1	0.009 000 000 ...	0.00 dBm	60 us	3.008 GHz	unmodulated	-	0 s	0 s
List 1	1	0.012 000 000 ...	-6.00 dBm	15 us	3.009 GHz	unmodulated	-	0 s	0 s
List 1	1	0.015 001 500 ...	-6.00 dBm	15 us	3.009 GHz	unmodulated	-	0 s	0 s
List 1	1	0.018 000 000 ...	0.00 dBm	30 us	3.009 GHz	unmodulated	-	0 s	0 s
List 1	2	0.021 000 000 ...	-3.00 dBm	30 us	4 GHz	unmodulated	-	0 s	0 s
List 1	2	0.024 000 000 ...	0.00 dBm	60 us	4.002 GHz	unmodulated	-	0 s	0 s
List 1	2	0.027 000 000 ...	0.00 dBm	60 us	3.998 GHz	unmodulated	-	0 s	0 s
List 1	2	0.030 000 000 ...	-6.00 dBm	15 us	4 GHz	unmodulated	-	0 s	0 s
List 1	2	0.033 001 500 ...	-6.00 dBm	15 us	4 GHz	unmodulated	-	0 s	0 s
List 1	2	0.036 000 000 ...	0.00 dBm	30 us	4 GHz	unmodulated	-	0 s	0 s
EOF	0								

The dialog is similar to the "Signal Preview" dialog.

This section describes the settings dedicated to the "Interleaved/Dropped PDWs" dialogs. For description of all other settings, see [Chapter 15.1, "Signal preview settings"](#), on page 284.

### Settings:

<a href="#">Display &gt; Filter</a> .....	375
<a href="#">Display &gt; Groups</a> .....	375
<a href="#">Table</a> .....	375
<a href="#">Graphics</a> .....	375
<a href="#">Graphics &gt; Highlight</a> .....	375
<a href="#">Histogram</a> .....	375
<a href="#">Statistics</a> .....	375

**Display > Filter**

If interleaving is used, the calculated output signal contains pulses originating for multiple PDW lists or emitters. By default, all PDWs are displayed. Use the "Filter" parameter to narrow down the displayed information to the PDWs of one of the PDW lists.

The filter does not change the zoom level or the scaling on both axis.

**Display > Groups**

If interleaving groups are used, selects the group for which pulses are displayed.

**Table**

Provides summary information on the number of processes PDWs and the content of the output file.

**Graphics**

Visualize the variation of the parameters over time.

For details, see [Chapter 15.1, "Signal preview settings"](#), on page 284.

**Graphics > Highlight**

Highlights pulses belonging to the selected PDW list.

**Histogram**

Resembles the information displayed during the signal processing, see [Chapter 18.7, "PDW interleaving progress statistics"](#), on page 373.

Use the filtering option to narrow down to the displayed information according to one of the predefined criteria.

**Statistics**

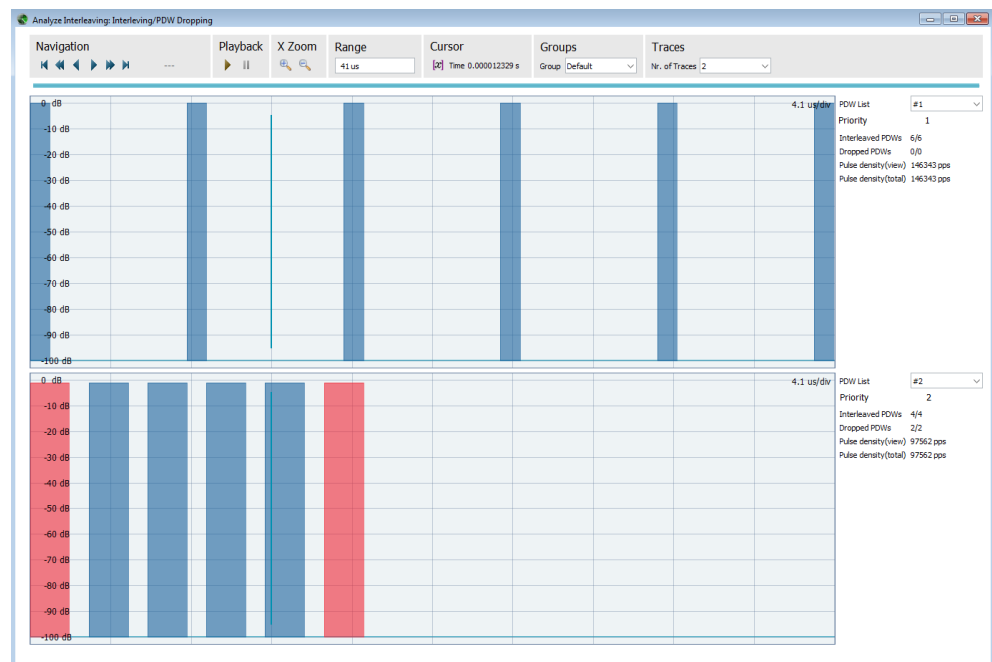
The drop out statistic is the table form representation of the same information as the [Histogram](#).

## 18.9 Analyze interleaving

Access:

1. In a "Scenario Type = PDW List", select "Interleaving > On".
2. Select "Signal Control > Prepare".
3. Select "Signal Control > Interleave".
4. Select "Interleaving > Results > View > Analyze".

The "Analyze Interleaving" dialog indicates the PDWs that are and are not included in the resulting output file. PDWs displayed in **red color are dropped out**.



The provided settings are a subset of the settings available in the "Waveform View/ Signal Preview" displays and they have the same effect.

For description, see [Chapter 15.1, "Signal preview settings"](#), on page 284.

The following settings are dedicated to this dialog.

### Display > Groups

If interleaving groups are used, selects the group whose pulses are displayed.

### Traces

Sets the number of traces to be displayed.

If the selected interleaving group comprises many PDW lists, this function can be used to narrow down the number of simultaneously displayed traces and hence increase the zoom level on the y-axis.

### Information per trace

The following information is displayed:

- Trace name
- Priority
- Interleaved PDWs
- Dropped PDWs
- Pulse density (view)
- Pulse density (total)



# 19 Defining complex modulation schemes and IPM profiles

R&S Pulse Sequencer Digital enables you to define custom antenna patterns and IPM profiles using an external plugin.

Plugins are Microsoft Windows DDL modules that contain the maths that is required for the envelope shaping and the modulation on pulse.

Some example plugins are provided with the software as binary and source code. These examples can serve as a starting point for your own applications. Once imported, the software handles the plugins automatically.

Each plugin:

- Has to provide a range of functions to identify itself
- Can register a set of configuration parameters that can be used as variables inside the plugin.

You can load plugins to:

- Define a custom inter-pulse modulation profile (IPM)
- Create a report file during the signal calculation process
- Define the file format of the custom antenna pattern files.

## How to import and assign user defined plugins

See:

- [Chapter C, "Plug-in programming API"](#), on page 649 for a description of the plugin programming API and instructions on how to load the plugin examples.
- ["To import a plugin"](#) on page 377
- ["To assign the user defined IPM profile"](#) on page 378

See also:

- ["To import an antenna pattern file in custom file format"](#) on page 215
- [Chapter 21, "Creating reports and documenting measurement results"](#), on page 386

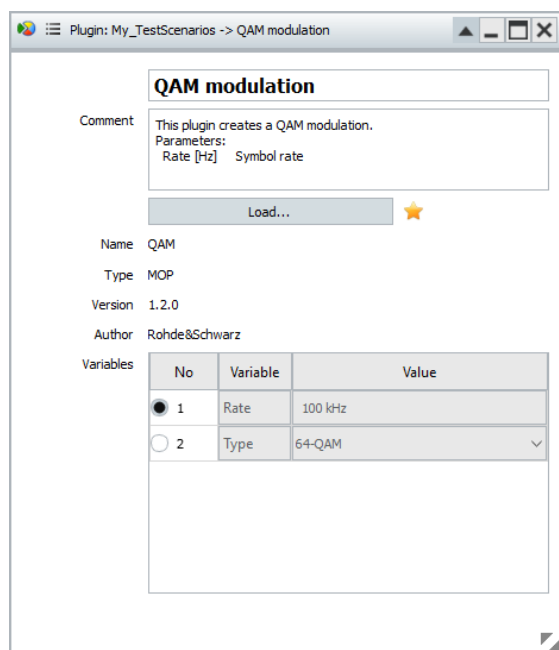
## To import a plugin

1. In the repository tree, select "Plugins > New".
2. In the "Plugin" dialog, enter a name and description.
3. Select "Load", navigate to the \*.dll file, and select it.

Only files containing modulation data are listed and can be loaded.

The software loads the \*.dll file, retrieves information from it and displays it in the "Plugin" dialog.

The "Variables" table lists the plugin variables. You can edit them when you load the plugin into a repository element.



You can use the plugins to create:

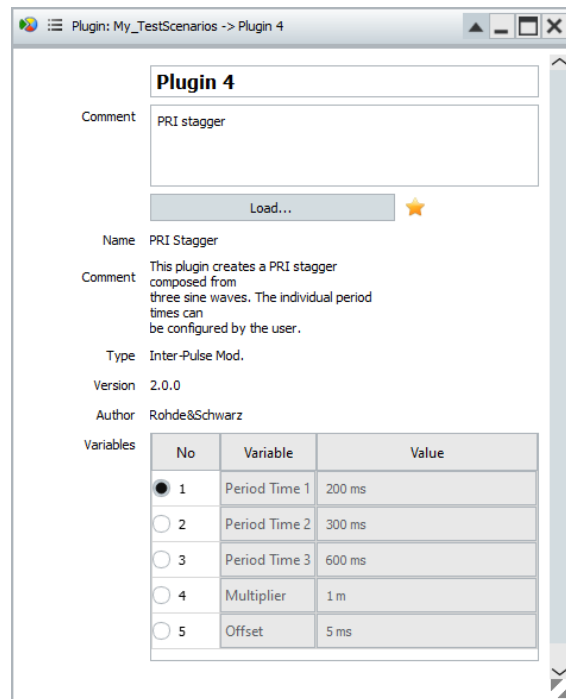
- Create custom IPM profile, see ["To assign the user defined IPM profile"](#) on page 378
- Import custom antenna pattern file formats, see ["To import an antenna pattern file in custom file format"](#) on page 215.

Remote Commands:

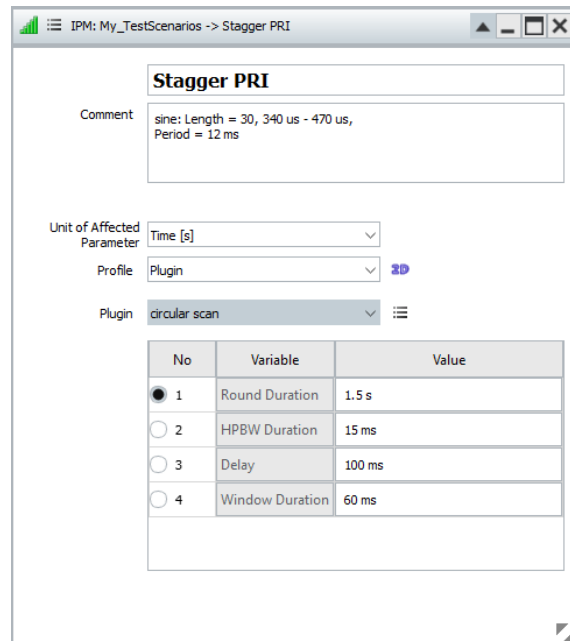
- `PLUGIn:CREate` on page 426
- `PLUGIn:CATalog?` on page 425
- `PLUGIn:NAME` on page 427
- `PLUGIn:COMMeNt` on page 428
- `PLUGIn:LOAD` on page 502
- `PLUGIn:SELEct` on page 426
- `PLUGIn:REMOve` on page 428
- `PLUGIn:MODule:NAME?` on page 427
- `PLUGIn:MODule:TYPE?` on page 502
- `PLUGIn:MODule:VERSion?` on page 502
- `PLUGIn:MODule:AUTHor?` on page 502
- `PLUGIn:MODule:COMMeNt?` on page 502
- `PLUGIn:MODule:DATA?` on page 503

### To assign the user defined IPM profile

1. Import a suitable plugin.



2. In the repository tree, select "Inter-Pulse Mods > IPM-Name".
3. Select "Profile > Plugin".
4. Select "Plugin" and select a loaded user-defined IPM profile, e.g. `Stagger PRI`.



5. Select "2D" to visualize the IPM profile.
6. If required, change the values of the used variables and observe the effect on the "2D" diagram.

## 20 Defining and enabling marker signals

Markers signals or markers are binary signals that are additionally generated and added to the generated signal.

For details, see the user manual of the corresponding base unit.

### 20.1 Marker settings

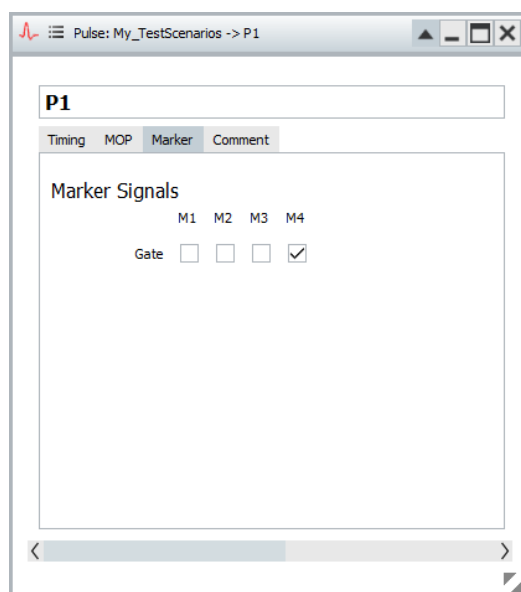
In the R&S Pulse Sequencer Digital, you define markers on four levels: on a pulse basis, for emitters, in the sequence or define global conditions like the start of a scenario.

Access:

1. Select "Repository Tree > Pulse > Marker".  
See ["Pulse Markers"](#) on page 380.
2. Select "Repository Tree > Sequence > Sequence Description > Marker".  
See ["Sequence Markers"](#) on page 381.
3. Select "Map > TX Items > Properties > TX Items Properties".  
See ["Emitter Marker"](#) on page 315
4. Select "Repository Tree > Scenario > Signal Calculation > Config > Marker Signals > Enable sequence and waveform markers".  
See ["Global Marker Signals"](#) on page 381.

#### Pulse Markers

You can assign up to 4 gate markers to the pulse.



Marker information is directly added to the resulting waveform and the marker signal output is therefore synchronous with the waveform playback.

See also ["Emitter Marker"](#) on page 315

Remote command:

`PULSe:MARKer:GATE` on page 498

### Sequence Markers

Marker	M1	M2	M3	M4
First	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Last	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
All	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Condition	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Variable: LP\_i  
 =  
 Value: 5

"First, Last, All" If pulse markers are defined, you can also define markers on multiple repeating pulses and mark the first, last or all pulses.

"Condition, Variable, Value"

A marker signal is generated if a defined condition is fulfilled. Conditions are defined as logical expressions, where the variable value ("Variable") is compared to a fixed value ("Value"). The variable must exist.

#### Example:

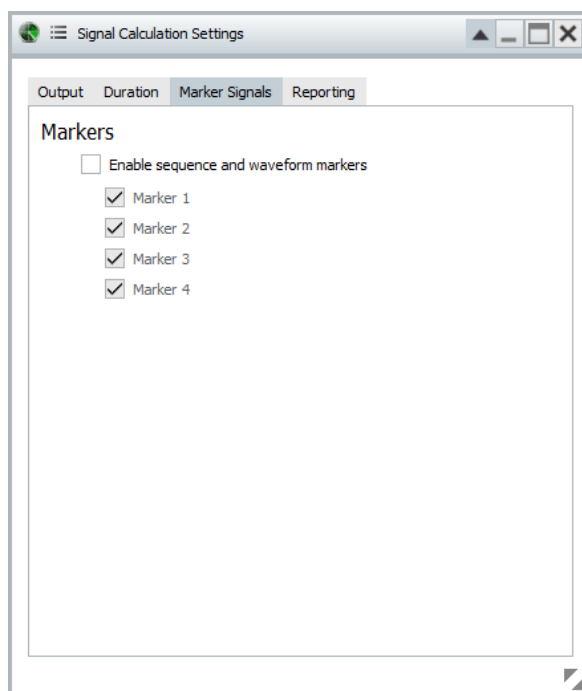
If a sequence item is included into a loop, you can create marker signals that mark for example one specific loop run number.

See:

- [Chapter 7.2.3, "Loop settings"](#), on page 127
- ["To enable sequence markers"](#) on page 383

### Global Marker Signals

If the selected sequence in a scenario contains markers, you can define that these markers be considered in the output from the signal calculation.



Remote command:

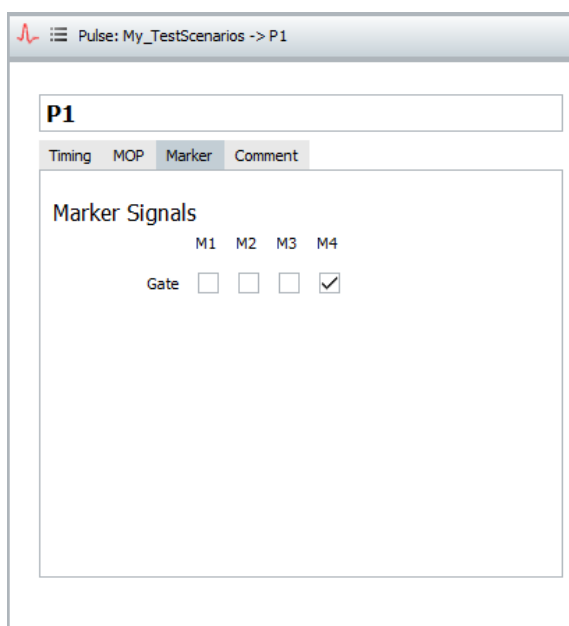
[SCENario:OUTPut:MARKer:ENABle](#) on page 499

[SCENario:OUTPut:MARKer:FLAGs](#) on page 499

## 20.2 How to configure and visualize markers

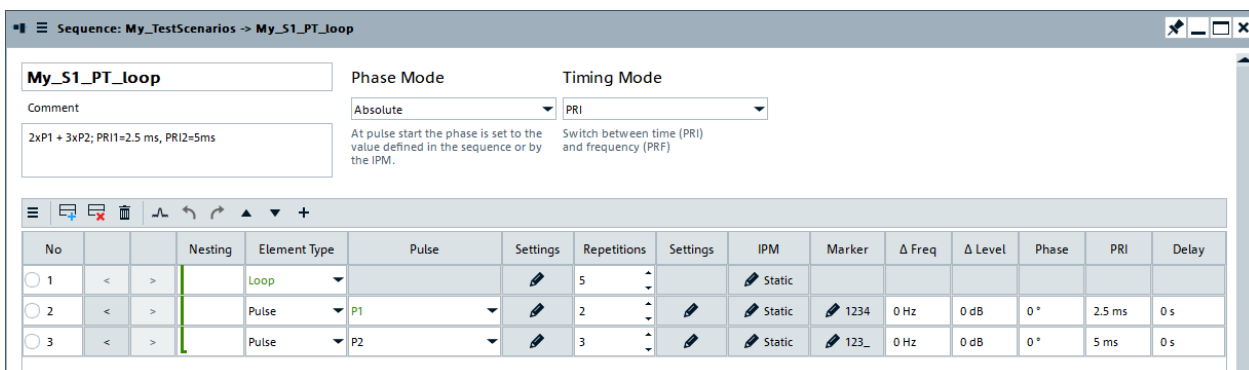
### To enable pulse markers

1. Select "Repository Tree > Pulse > Marker".
2. Enable up to four "Gate" markers for the pulse.



**To enable sequence markers**

1. Select "Repository Tree > Sequence".



*Figure 20-1: Example of a sequence composed of two pulses included into a loop*

2. Select "Loop > ..." and enter "Loop Variables > Prefix = LP".

Loop: Line Item 1

**Repetitions**

Fixed Value  
 Randomly Selected

Minimum: 1  
Maximum: 10  
Step: 1

**Loop Variables**

Prefix: LP

Index 1...N <prefix>\_j  
Count N <prefix>\_n  
Start Time <prefix>\_t  
Absolute Time <prefix>\_ta

3. Select "Sequence Description table > Item#2 > Marker".
4. Select "M1 > All", "M2 > First", "M3 > Last".

Markers: Line Item 1

**Marker**

	M1	M2	M3	M4
First	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Last	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
All	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Condition	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Variable: LP\_j  
=   
Value: 5

The Marker 2 is generated only for the first pulse out of all repetitions.

5. Select "M4 > Condition", "Variable = LP\_j" and "Value = 5".

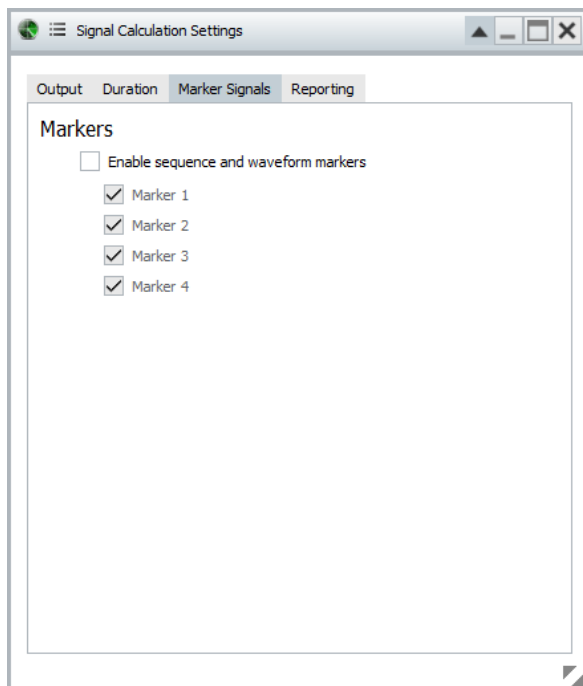
If the condition  $LP_j = 5$  is fulfilled, a marker is generated. That is, marker 4 is generated during the fifth loop run.

#### To enable marker signals in the output signal

1. Select "Repository Tree > Scenario > Signal Calculation > Config > Config > Signal Calculation Settings".



2. Select "Marker Signals > Enable sequence and waveform markers".



## 21 Creating reports and documenting measurement results

In R&S Pulse Sequencer Digital, you can document your measurement results and software configuration in the following ways:

- Create and export a repository archive, so that you can repeat measurements under the same conditions
- Create automatically scaled hardcopy of current screens or dialogs
- Create and store reports in text files, in HTML format or in Excel files with several spreadsheets.

This section focuses on the built-in report generation function. For information on the other functions, see:

- ["To create and export a repository archive"](#) on page 71
- ["To set the size and color scheme of the hardcopies"](#) on page 48

### Report generation

The R&S Pulse Sequencer Digital provides a built-in report generation function so that all parameters used during the signal generation are automatically saved to a printable file. You can configure the target directory in which the generated reports are stored.

Report files can be formatted based on:

- **Template**

The reporting uses a predefined but editable template. Generated is an ASCII text file or an HTML page, where data is formatted in columns, including header description. The reporting files in ASCII format use the predefined file extension \*.pwd

- ASCII text file

This is a template-based report.

```
User: R&S
Rep Path: C:\_PS_files\reports

Date: 28.10.2015 10:07:25
ISO Date: 2015-10-28T10:07:25

Repository: My_TestScenarios
Comment:
Version: 2.3
Author: Rohde&Schwarz
Created: 25 Jun 2014 15:27:04
Path: C:\Users\Public\Documents\Rohde-Schwarz\Pulse Sequencer\Repositories\20141124_100351

Scenario: SimplePulseTrain
Comment:
```

TOA ns	RF GHZ	PW US	PA dBm	MF	MOP	Bw kHz	Rep
0	3.0	120.000	-30.0	0	NONE	0	1
2500000	3.0	120.000	-30.0	0	NONE	0	2
5000000	3.0	220.000	-30.0	0	NONE	0	1
10000000	3.0	220.000	-30.0	0	NONE	0	2
15000000	3.0	220.000	-30.0	0	NONE	0	3
22000000	3.0	120.000	-40.0	0	NONE	0	1
24500000	3.0	120.000	-40.0	0	NONE	0	2

**Figure 21-1: Example of an ASCII report file ("Type > Template")**

- HTML page

### PDW Report Generated with PS Example

User	R&S
Repository Path	C:\PS_files\reports
Date	28.10.2015 08:15:18
ISO Date	2015-10-28T08:15:18
Repository	My_TestScenarios
Comment	
Version	2.3
Author	Rohde&Schwarz
Created	25 Jun 2014 15:27:04
Path	C:\Users\Public\Documents\Rohde-Schwarz\Pulse Sequencer\Repositories\20141124_100351

#### SimplePulseTrain

TOA	RF	PW	PA	MF	MOP	BW	Rep
ns	GHz	us	dBm			kHz	
0	3.0	120.000	-30.0	0	NONE	0	1
2500000	3.0	120.000	-30.0	0	NONE	0	2
5000000	3.0	220.000	-30.0	0	NONE	0	1
10000000	3.0	220.000	-30.0	0	NONE	0	2
15000000	3.0	220.000	-30.0	0	NONE	0	3
22000000	3.0	120.000	-40.0	0	NONE	0	1
24500000	3.0	120.000	-40.0	0	NONE	0	2

Figure 21-2: Example of an HTML report file ("Type > Template")

- **User-defined plugin**  
This reporting creates reports according to custom templates, e.g. DFS. You can, for example, create a Microsoft Excel plugin that retrieves the pulse parameters and enters them in a spreadsheet.

For a detailed description of the file formats, the template and the plugin, see:

- [Chapter C, "Plug-in programming API"](#), on page 649
- [Chapter 19, "Defining complex modulation schemes and IPM profiles"](#), on page 377.

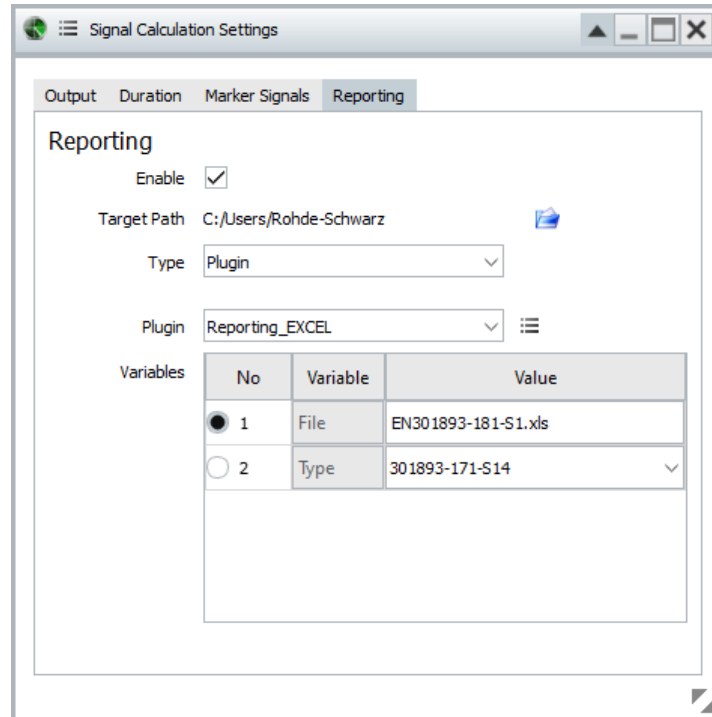
See also [Chapter 21.2, "How to create test reports"](#), on page 392.

## 21.1 Reporting settings

Access:

1. In the "Scenario" dialog, select "Signal Calculation > Config > Config".

2. Select "Reporting".



#### Available settings:

Reporting Enable.....	388
Target Path, Set Path.....	388
Type.....	389
Edit Template.....	389
Specific settings for Type > AMMOS PDW.....	390
L Format.....	390
L Frame Length.....	391
L Start Time, User Set Value.....	391
L Azimuth.....	391
Plugin and plugin variables.....	391

#### Reporting Enable

Enables generation of reports.

Remote command:

[SCENario:PDW:ENABle](#) on page 504

#### Target Path, Set Path

Indicates the current storage location.

Per default, report logs are stored in the user directory of the current user, that is the %HOMEPATH% directory.

To change the storage location, select the "Set the target path" icon.

See also ["To set the storage location for the generated report files"](#) on page 392.

Remote command:

[SCENario:PDW:PATH](#) on page 504

### Type

Sets the template used by the reporting function.

- |             |   |
|-------------|---|
| "Default"   | Loads the predefined template.<br>The report is a plain text file. The format is simple, column-based and cannot be modified. Further settings are not required.  |
| "Template"  | Enables the predefined template for editing (see <a href="#">"Edit Template"</a> on page 389).  |
| "Plugin"    | Generates report in custom format by using a plugin.<br>Custom templates are used in the same way as the predefined template (see <a href="#">"Plugin and plugin variables"</a> on page 391).<br>For details on the plugin API, see <a href="#">Chapter C, "Plug-in programming API"</a> , on page 649. |
| "AMMOS PDW" | Writes PDW reports in the Rohde & Schwarz proprietary PDW format.<br>This format is used by Rohde & Schwarz monitoring products.  |

Remote command:

[SCENario:PDW:TYPE](#) on page 505

### Edit Template

Opens the predefined template in edit mode.

```

1
2 # Pulse Sequencer PDW Report
3 #
4 Date:      <ISODATE>
5 Repository: <REPOSITORY>
6 Scenario:  <SCENARIO>
7
8          TOA |    ABS FREQ |    PW |    RISE |    FALL |    PRI |
9          ns |    GHz |    us |    us |    us |    us |
10 -----
11 .HDR
12          <TOA>|          <RF>|    <PW> |    <RT> |    <FT> |    <PRI>|
13 # END OF REPORT
14 .FMT TOA:12.0f:-9
15 .FMT RF:9.6f:9
16 .FMT PW:9.3f:-6
17 .FMT PA:6.1f:0
18 .FMT RT:9.3f:-6
19 .FMT FT:9.3f:-6
20 .FMT PRI:9.3f:-6
21 .FMT BW:6.0f:3
22 .FMT PHS:6.1f:0
23 .FMT BEAR_AZI:6.1f:0
24 .FMT BEAR_ELE:6.1f:0
25 .FMT RX_AZI:6.1f:0
26 .FMT RX_ELE:6.1f:0
27 .FMT TX_NORTH:9.3f:0
28 .FMT TX_EAST:9.3f:0
29 .FMT TX_UP:9.3f:0
30 .FMT TX_PITCH:6.1f:0
31 .FMT TX_YAW:6.1f:0
32 .FMT TX_ROLL:6.1f:0
33 .FMT RX_NORTH:9.3f:0
34 .FMT RX_EAST:9.3f:0
35 .FMT RX_UP:9.3f:0
36 .FMT RX_PITCH:6.1f:0
37 .FMT RX_YAW:6.1f:0
38 .FMT RX_ROLL:6.1f:0
39

```

Figure 21-3: Example: Template that creates text reports in ASCII format

**Note:** The software uses the last modified template version. Previous versions cannot be recalled.

Before you modify the template, store the template content as a text file.

Remote command:

[SCENario:PDW:TEMPlate](#) on page 506

### Specific settings for Type > AMMOS PDW

The following settings are dedicated to "Type > AMMOS PDW":

#### Format ← Specific settings for Type > AMMOS PDW

Selects format of the AMMOS file.

"PDW" Standard AMMOS PDWs, including header information.

"PPDW" Shortened AMMOS PDWs, without header information.

Remote command:

[SCENario:PDW:AMMos:PPDW](#) on page 505

### **Frame Length** ← **Specific settings for Type > AMMOS PDW**

Sets the frame length.

A frame can contain several PDWs but it can also be empty.

Remote command:

[SCENario:PDW:AMMos:FRAMe](#) on page 505

### **Start Time, User Set Value** ← **Specific settings for Type > AMMOS PDW**

Defines how the report start time is set.

- "User Defined Value > Off"  
The reporting start time is time at that the scenario calculation starts.
- "User Defined Value > On"  
The reporting starts at user-defined moment. This setting is useful, for example, if particular event or moment of time is to be captured.

Remote command:

[SCENario:PDW:AMMos:UTIME:ENABle](#) on page 506

[SCENario:PDW:AMMos:UTIME:ISO](#) on page 506

### **Azimuth** ← **Specific settings for Type > AMMOS PDW**

Defines whether the angle of the RX antenna or the bearing (i.e. the azimuth direction of the emitter) is reported.

The former is suitable if spinning dish antennas are used. Use the bearing for direction finding.

Remote command:

[SCENario:PDW:AMMos:AZIMuth](#) on page 506

### **Plugin and plugin variables**

Selects and loads a reporting template form a \*.dll file. This template must exist in the "plugin" library.

Report plugins can register a set of variables that can be used to control the plugin's algorithms.

See:

- [Chapter C, "Plug-in programming API"](#), on page 649
- ["To import a plugin"](#) on page 377.

Remote command:

[SCENario:PDW:PLUGIn:NAME](#) on page 505

[SCENario:PDW:PLUGIn:VARiable:CATalog?](#) on page 503

[SCENario:PDW:PLUGIn:VARiable:SElect](#) on page 503

[SCENario:PDW:PLUGIn:VARiable:VALue](#) on page 504

## 21.2 How to create test reports

This section shows how to:

- ["To enable report file generation"](#) on page 392
- ["To set the storage location for the generated report files"](#) on page 392
- ["To change the report type"](#) on page 393

### To enable report file generation

The "Scenario" dialog provides information on the report logging status. The related information is displayed to the right of the "Comment" field.

Sequences (Collection)

Plugin-based report is written to C:\\_My\_Report\_Files.  
Data output is in MSW or waveform format.

To enable or disable the report file generation, proceed as following:

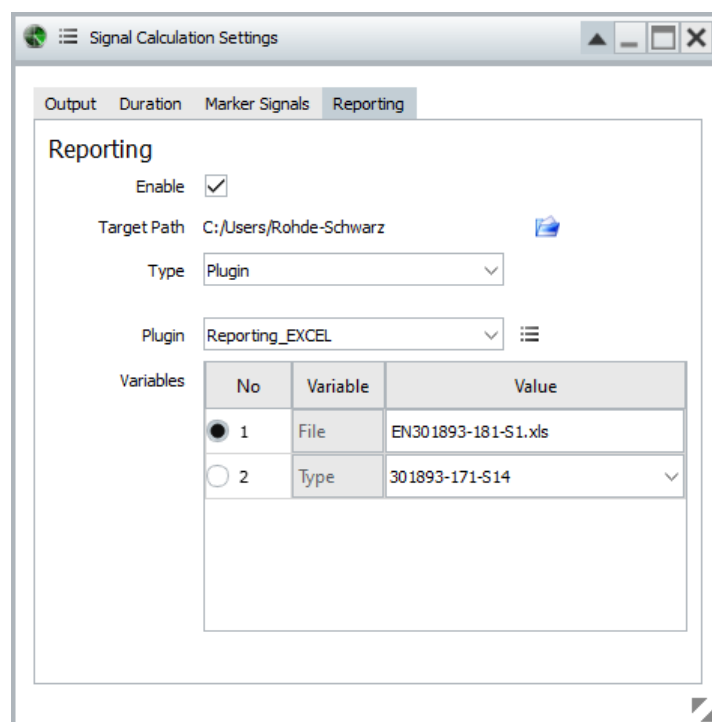
1. In the "Scenario" dialog, select "Waveform Generation > Config".
2. In the "Signal Calculation Settings" dialog, select "Reporting > Reporting Enable > On".

### To set the storage location for the generated report files

Per default, report files are stored in the user home directory of the current user, that is the %HOMEPATH% directory.

1. Open the "Scenario" dialog to retrieve information on the current storage location.  
Information is displayed to the right of the "Comment" field.
2. Select "Signal Calculation > Config > Config".
3. In the "Signal Calculation Settings" dialog, select "Reporting".  
The parameter "Target Path" indicates the current storage location.





4. To change this location, select the "Set target path" icon, navigate to the directory, and confirm with "Select Folder".

#### To change the report type

You can also store the test reports in text form or as HTML pages (e.g. if Microsoft Excel is not installed on your PC).

To change the type of the generated reports, proceed as following:

1. In the "Scenario" dialog, select "Signal Calculation > Config > Config > Report".
2. Select "Type > Template".
3. Select "Edit" to display the current template.

```

Edit PDW Report Template

1 # Pulse Sequencer PDW Report
2 #
3 Date:          <ISODATE>
4 Repository:   <REPOSITORY>
5 Scenario:     <SCENARIO>
6
7             TOA |           RF |           PW |           PA | MF | MOP |           BW |
8             ns |           GHz |           us |           dBm | | |           kHz |
9 -----
10 .HDR
11 <TOA> | <RF> | <PW> | <PA> | <MF> | <MOP> | <BW> |
12 # END OF REPORT
13 .OPT <TOA:12.0f:-9>
14 .OPT <RF:9.6f:9>
15 .OPT <PW:9.3f:-6>
16 .OPT <PA:6.1f:0>
17 .OPT <BW:6.0f:3>
18
Reset OK Cancel

```

You can also change the used templates or create and load your plugin.

See:

- [Chapter C, "Plug-in programming API"](#), on page 649
- [Chapter 19, "Defining complex modulation schemes and IPM profiles"](#), on page 377.

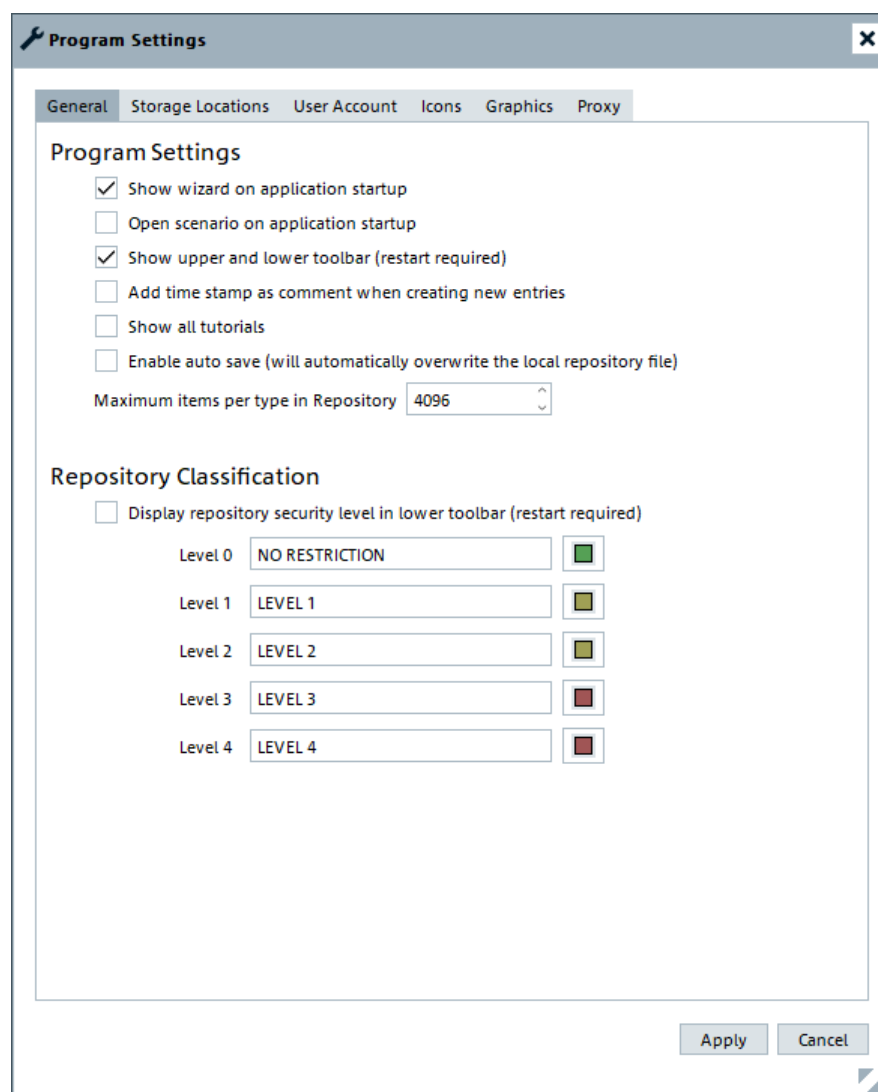
## 22 Performing administration tasks

This section informs you about file handling, user management and settings you can use to speed up calculation.

### 22.1 Setting general program settings

Access:

- ▶ In the menu bar, select "Configure > Settings".



Program Settings.....	396
Repository Classification.....	396
Apply, Cancel.....	396

### Program Settings

Enable each of the optional configurations according to your needs.

Define the value for maximum items per type in the repository. The limit for items per type is 4096.

Remote command:

`PROGram:STARtup:WIZard:ENABle` on page 435

`PROGram:STARtup:LOAD:ENABle` on page 435

`PROGram:TOOLbar:ENABle` on page 436

`PROGram:COMMeNt:ENABle` on page 434

`PROGram:TUTORials:SHOW:ENABle` on page 436

### Repository Classification

Define whether the classification level is displayed in the repository and sets the used colors, see "[To change the general program settings](#)" on page 47.

See also [Chapter 2.9, "Customizing the software"](#), on page 45.

Remote command:

`PROGram:CLASs:ENABle` on page 434

### Apply, Cancel

Accept or reject the changed settings.

Remote command:

`PROGram:SETTings:ACCEpt` on page 435

`PROGram:SETTings:REJect` on page 435

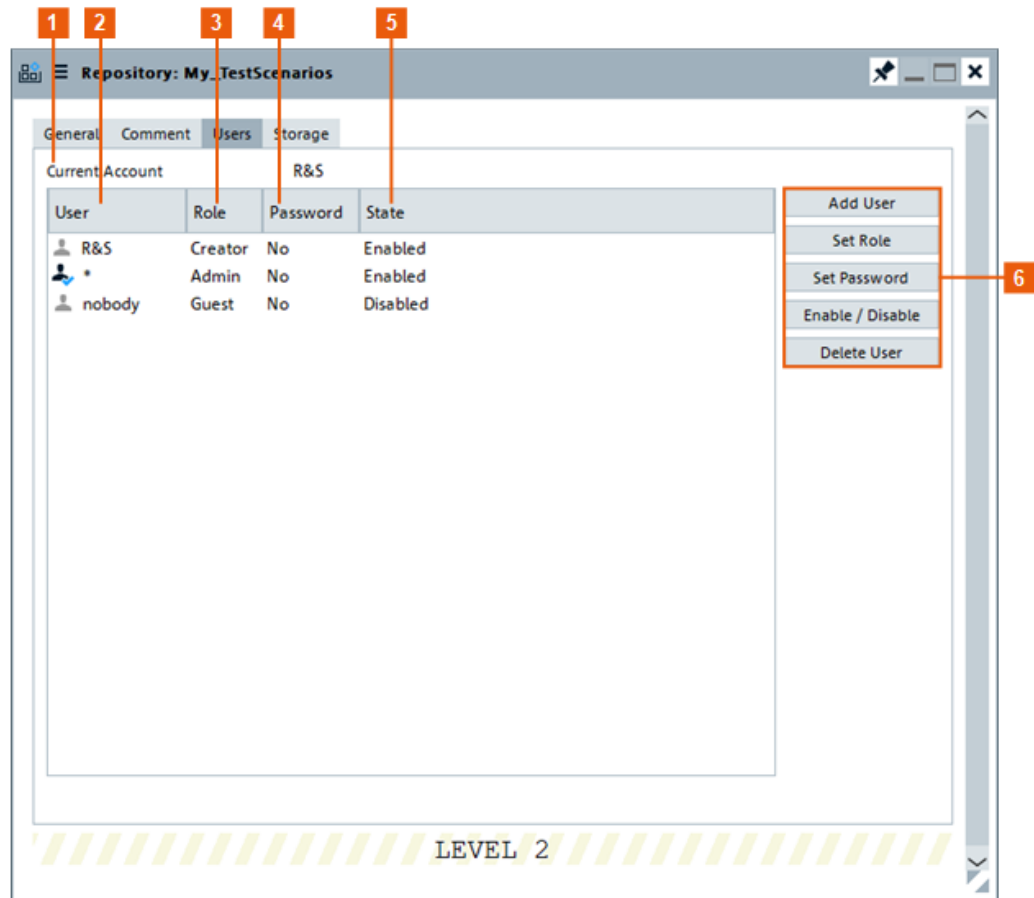
## 22.2 User administration

The R&S Pulse Sequencer Digital uses its own **user rights management** that is independent from the user administration of the operating system but follows the same principles: the current user cannot delete its own account; users with lower access rights cannot delete accounts with higher rights.

### User roles

Repositories support simultaneous access from several users. Per default, all users are granted with the same (administrator) rights. The user rights can be restricted by assigning of a different user role, other than the creator role. At least one user with administrator rights must always exist.

To protect a repository from accidental changes, the repository data can be password protected. Passwords are then required to access a repository and any loss of the password would render the repository inaccessible.



**Figure 22-1: Repository > Users: understanding the displayed information**

- 1 = Indicates the user name of the logged in user
- 2 = Login name or custom user name
- 3 = Assigned user role; the creator role is assigned automatically and cannot be changed (see also [Table 22-1](#))
- 4 = Identifies if the repository is password protected or not
- 5 = Current user state
- 6 = Standard functions for user management

**Table 22-1: Overview of the available user roles and their access rights**

User role	Read access	Write access	Create a scenario from the existing elements	Delete elements	Copy repository elements
Creator	x	x	x	x	x
Admin	x	x	x	x	x
User	x	-	x	-	x
Guest	x	-	-	-	x

Per default, the R&S Pulse Sequencer Digital uses your Windows login name to access the repositories but you can also use a custom name, see ["User Account"](#) on page 401.

See also [Chapter 22.2.1, "How to set and change user passwords"](#), on page 398.

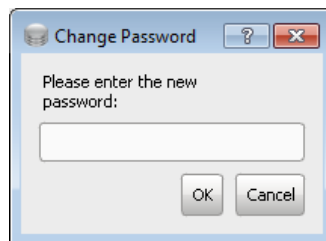
## 22.2.1 How to set and change user passwords

See:

- ["To protect a repository from accidental changes"](#) on page 398
- ["To remove the password protection on a repository"](#) on page 399
- ["To change the default user used to access repositories"](#) on page 399

### To protect a repository from accidental changes

1. In the project tree, double-click the repository name.
2. In the "Repository" dialog, select "Users".
3. To protect the repository with a password:
  - a) Select "Users > <current Account>" and select "Set Password".  
The "Change Password" dialog opens.



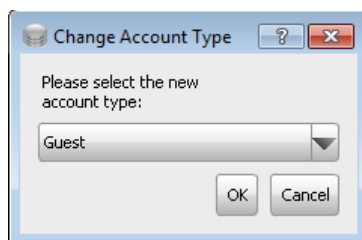
- b) Enter a password and confirm with "Ok".

On a new startup or when this repository is loaded, the R&S Pulse Sequencer Digital requires the correct password to load the repository.



4. To allow read-only access:

- a) Select "Users > \*" and select "Set Role".  
The "Change Account Type" dialog opens.



- b) Select a new role with read-only access, e.g. "Guest" and confirm with "Ok".

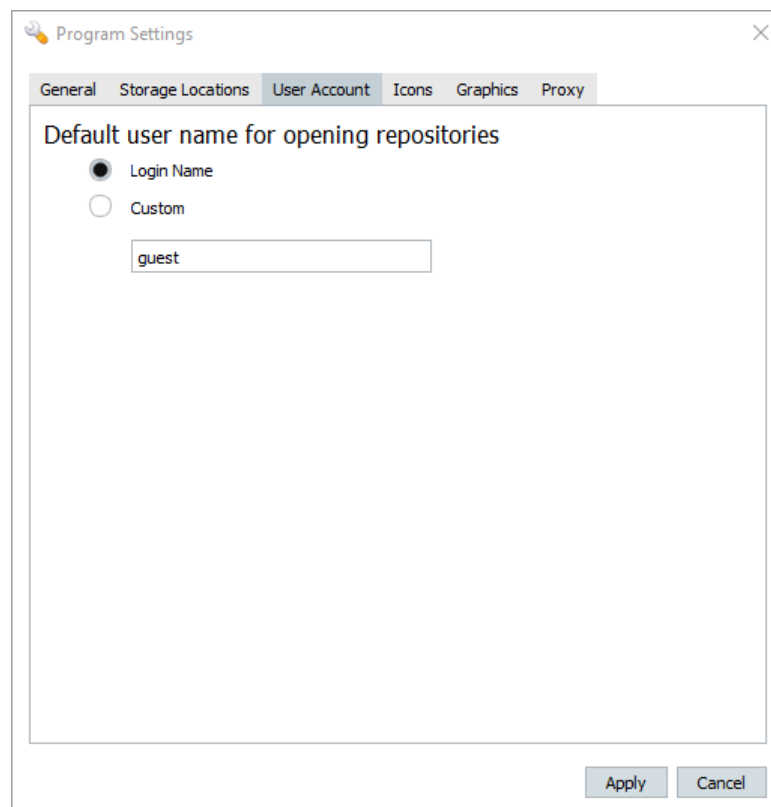
#### To remove the password protection on a repository

1. In the project tree, double-click the repository name.
2. In the "Repository" dialog, select "Users".
3. Select "Users > <Current Account>" and select "Set Password".
4. In the "Change Password" dialog, leave the password field blank.
5. Confirm with "Ok".

The "Users" dialog confirms that the repository is not protected with a password.

#### To change the default user used to access repositories

1. In the toolbar, select "Configure > Settings > User Account".



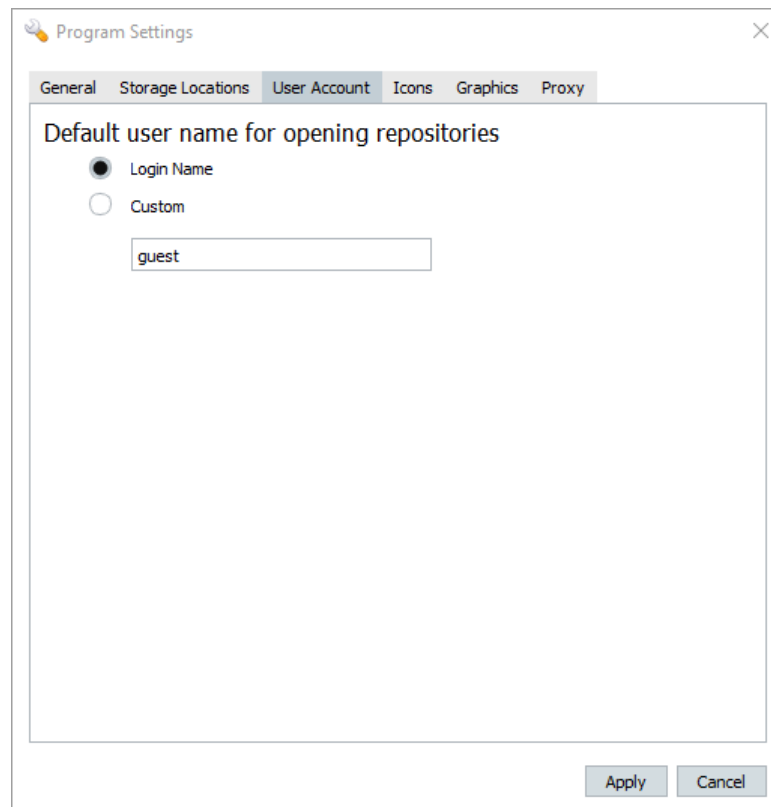
2. Select "Custom > On" and enter an existing user name.

## 22.2.2 Related settings

Access:

1. To open the "Repository" user management dialog:
  - a) In the project tree, double-click a repository name.  
In the "Repository" dialog, select "Users".

For example, see [Figure 22-1](#)
2. To change the default account used to open repositories, perform the following:
  - a) In the menu bar, select "Configure > Settings".
  - b) Select "User Account".



<a href="#">Users</a> .....	400
<a href="#">User Account</a> .....	401

### Users

Indicates the user name of the currently used account and an overview of all defined users together with their roles.

For more information, see [Chapter 22.2, "User administration"](#), on page 396.



Remote command:

[REpository:ACcess?](#) on page 527

### User Account

Set the user name for opening the repositories. Per default, your Windows login name is used, but you can also define and use a custom user name.

For more information, see [Chapter 22.2, "User administration"](#), on page 396.

## 22.3 Defining storage locations

During software installation, the R&S Pulse Sequencer Digital creates a predefined folder structure, concerning program and project data, report files, startup log file etc. The default folders depend on how the software is installed, for all users or for a particular one, but you can change some of them, if necessary.

[Table 22-2](#) resumes the information provided in [Installing the software](#) and extends it with information on whether and how file paths can be modified.

**Table 22-2: Overview of file types, default storage locations and where to change the file paths**

File type	Default location*	Modification	Information indicated in
Program data	%PROGRAMFILES(X86)%\ Rohde-Schwarz\ Pulse Sequencer Digital (Path)	not possible	
Project data (repository data- base) SDK files	%PUBLIC%\Public\Documents\ Rohde-Schwarz\ Pulse Sequencer Digital (DataPath)	"Repository Manager > Add Path/Add Home Path" See <a href="#">"To set the storage location for repositories"</a> on page 402.	<ul style="list-style-type: none"> <li>"Program Settings &gt; Storage Location &gt; Repository Databases"</li> <li>For a particular repository: "Repository &gt; Storage" See <a href="#">"To find out current stor- age location for reports, pro- gram and project data"</a> on page 402.</li> </ul>
Report files	%HOMEPATH% (HomePath or ReportPath)	<ul style="list-style-type: none"> <li>"Program Settings &gt; Storage Location &gt; Reports Path"</li> <li>"Scenario &gt; Signal Calculation &gt; Config &gt; Reports &gt; Target Path" See <a href="#">"To set the storage loca- tion for the generated report files"</a> on page 392.</li> </ul>	"Scenario > Status Inforamtion"
Startup log file	%HOMEPATH%	not possible	-
User settings (workspace, etc.)	%HOMEPATH%\AppData\ Roaming\Rohde-Schwarz\ Pulse Sequencer Digital	not possible	-

\*) Software installation for all users.

### 22.3.1 How to set and change storage locations

See:

- ["To find out current storage location for reports, program and project data"](#) on page 402
- ["To set the storage location for repositories"](#) on page 402
- See also [Chapter A, "Supported file types and file formats"](#), on page 624.

#### To find out current storage location for reports, program and project data

Use one of the following:

1. Select "Menu bar > Help > Debug Information".  
Observe the information in the R&S Pulse Sequencer Digital section.  
Storage locations are indicated for *reports, program and project data*.
2. Select "Menu bar > Configure > Settings > Storage Locations".  
Observe the indication for "Repository Databases > Install Path" and "Reports".  
Storage locations are indicated for *reports and project data*.
3. Double-click a repository name and select "Repository > Storage".  
The storage location of the *particular repository* is indicated.
4. Open a "Scenario" and observe the displayed "Status information".  
The *reports* storage location is indicated.

#### To set the storage location for repositories

Per default, repositories are saved in the `DataPath` directory (see [Table 22-2](#)). Alternatively, you can define a specific path and, for example, save repositories in a network folder. The latter allows for repository sharing among different users or access from different computers.

1. Select "Menu bar > Configure > Settings > Storage Locations".
2. Select "Repository Databases > Creation > On".
3. Select "Menu bar > File > Load and Manage Repository".
4. In the "Repository Manager", select "Add Home Path".
5. In the "Repository Manager", select "Add Path".
6. Navigate to the required directory. Select it.  
Found repository files are displayed in the list.
7. To create a repository in the user-defined repository path or in the home directory, select corresponding path and select "Create."

### 22.3.2 Storage locations settings

Access:

1. In the menu bar, select "Configure > Settings".
2. In the "Program Settings" dialog, select "Storage Location".

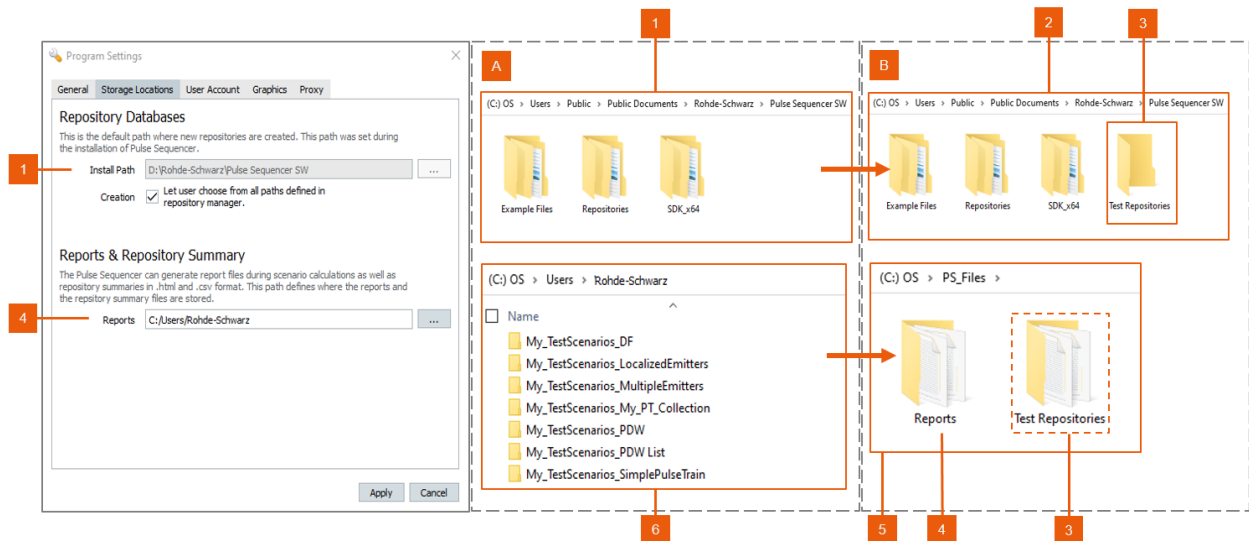


Figure 22-2: Storage Location: Understanding the displayed information

- A = Default storage location
- B = User-defined storage location or subdirectories
- 1 = Default "Install Path" / "DataPath" - cannot be changed; subdirectories are permitted (see "To set the storage location for repositories" on page 402)
- 2 = "DataPath"
- 3 = User-defined repository storage location, as subdirectory of the default "DataPath" or "HomePath" directory, or in a freely defined location (e.g. in the UserDirectory)
- 4 = Reports, default and user-defined location
- 5 = UserDirectory, user-defined storage location
- 6 = "%HomePath%"

For step-by-step descriptions, see Chapter 22.3.1, "How to set and change storage locations", on page 402.

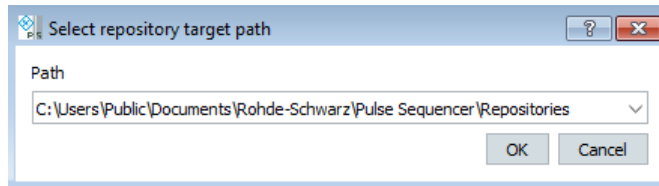
**Settings:**

Repository Databases.....403  
 Reports.....404

**Repository Databases**

Indicates information concerning the repository storage place.

- "Install Path" Storage location for repository files.  
Resembles the information displayed in the "Repository Manager" (see [Figure 4-1](#)).  
Remote command:  
[PROGram:PATH:INSTAll?](#) on page 435
- "Creation" Enable this parameter, so that each time a new repository is created ("File > New Repository"), you are prompted to select its storage location.



All repository paths display that are available in the [Repository Manager](#).

See also ["To set the storage location for repositories"](#) on page 402.

Remote command:

[PROGram:STORAgeloc:ENABle](#) on page 436

### Reports

Defines the directory that holds generated reports.

Works like "Signal Calculation > Config > Config > Reporting > Target Path".

Remote command:

[PROGram:PATH:REPort](#) on page 435

## 22.4 Speeding up calculation

In R&S Pulse Sequencer Digital, you have the different possibilities to speed up the calculation process. Use them exclusively or simultaneously.

### Overview

To improve performance, especially if movements are simulated and large waveforms are calculated, we recommend that you:

- Optimize calculation speed by enabling multiple threads.
- Enable GPU-based antenna pattern calculation

### Step-by-step instructions

See [Chapter 22.4.1, "How to optimize performance"](#), on page 405.

### Settings

See [Chapter 22.4.2, "Related settings"](#), on page 405.

## 22.4.1 How to optimize performance

### To speed up calculation by enabling multiple threads

1. In the "Scenario" dialog, select "Signal Calculation > Config > Config > Output".
2. Select "Optimize calculation speed > Enable multithreading > On".

### To accelerate the antenna pattern calculation and display

The calculation of antenna patterns can be a time consuming operation. To accelerate this operation and the 2D and 3D display of the antenna patterns, proceed as follows:

1. In the menu bar, select "Configure > Settings > Graphics".
2. Select "GPU Support > Use GPU based antenna pattern calculation > On".

#### GPU Support

Use GPU based antenna pattern calculation (restart required)

3. Confirm with "Apply".
4. Restart the software.

The GPU (graphics processing unit) takes over the calculation. The calculation is accelerated around 800 times.

## 22.4.2 Related settings

<a href="#">Optimize calculation speed</a> .....	405
<a href="#">GPU Support</a> .....	405

### Optimize calculation speed

Enable this parameter to apply multithreading and decrease the calculation time.

Select one of the options:

- "Automatic"  
The system automatically applies the optimum number of threads for the scenario.
- "Manual"  
Define the number of threads to be used.

See also [Chapter 22.4, "Speeding up calculation"](#), on page 404.

Remote command:

[SCENario:OUTPut:MULTithread](#) on page 564

[SCENario:OUTPut:MTMode](#) on page 564

[SCENario:OUTPut:MTTHreads](#) on page 564

### GPU Support

Access: "Configure > Settings > Graphics".

If enabled, accelerates the antenna pattern calculation and display.

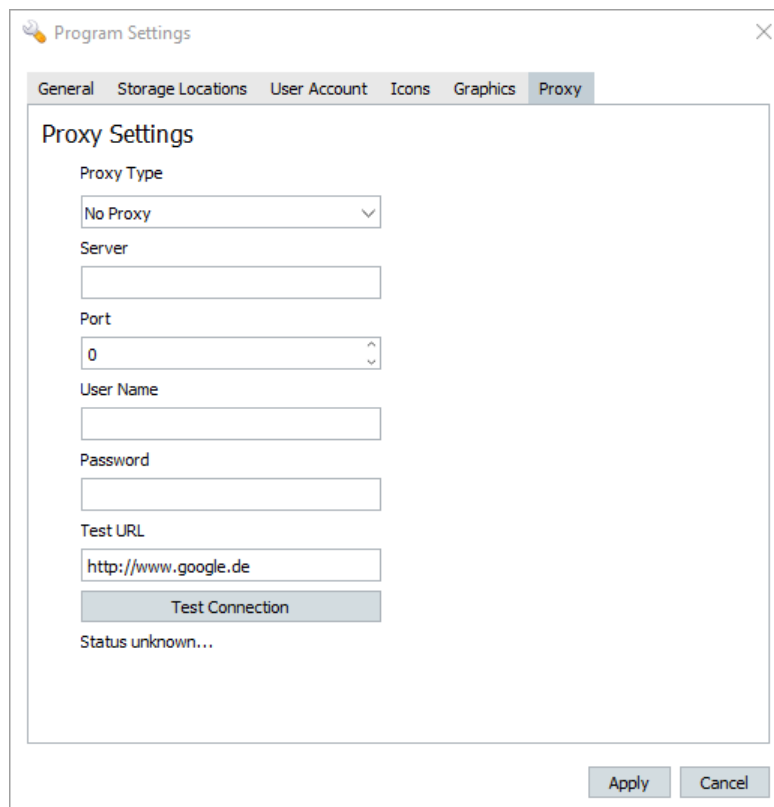
See also [Chapter 22.4, "Speeding up calculation"](#), on page 404.

Remote command:

[PROGram:GPU:ENABLE](#) on page 434

## 22.5 Configuring a proxy server

Access: in the menu bar, select "Configure > Settings > Proxy".



The screenshot shows the "Program Settings" dialog box with the "Proxy" tab selected. The "Proxy Settings" section contains the following fields and controls:

- Proxy Type:** A dropdown menu currently set to "No Proxy".
- Server:** An empty text input field.
- Port:** A spinner control currently set to "0".
- User Name:** An empty text input field.
- Password:** An empty text input field.
- Test URL:** A text input field containing "http://www.google.de".
- Test Connection:** A button to test the connection.
- Status unknown...:** A label indicating the connection test status.

At the bottom right of the dialog box are "Apply" and "Cancel" buttons.

A proxy server is useful when a PC running the R&S Pulse Sequencer Digital in a local network needs secure access to the internet, for example, to download georeferenced maps.

### To configure a proxy server

1. Set "Proxy Type" = "HTTP Proxy".
2. Enter the IP and port of the proxy server.
3. Enter the user name and password to access the proxy server.
4. Enter a test URL of your choice.
5. Select "Test Connection" to attempt connection to the specified test URL.  
The dialog displays the status of the connection test.
6. Select "Apply".

7. To reject the changes and close the dialog, select "Cancel".  
The settings remain saved in the dialog fields if you do not clear them.

Select "Proxy Type = No Proxy" to deactivate the proxy settings.

## 22.6 Updating the software

You find the last released software version and the release notes on the R&S Pulse Sequencer Digital product page at:

<https://www.rohde-schwarz.com/software/pulse-sequencer/>.

### To update the software version

1. Download the software and the release notes.
2. Follow the installation instructions provided in the release notes.

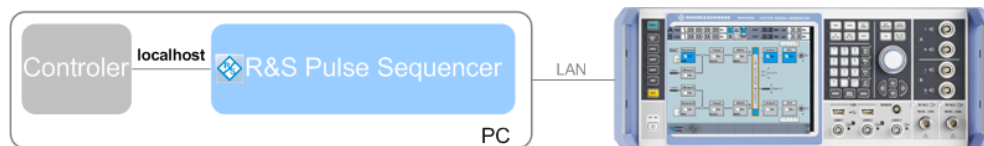
## 23 Automation of R&S Pulse Sequencer Digital

In addition to working with the R&S Pulse Sequencer Digital software interactively, it is also possible to operate and control it from a remote PC. Remote control operation allows you to automate the configuration process and is useful when a higher configuration speed is required.

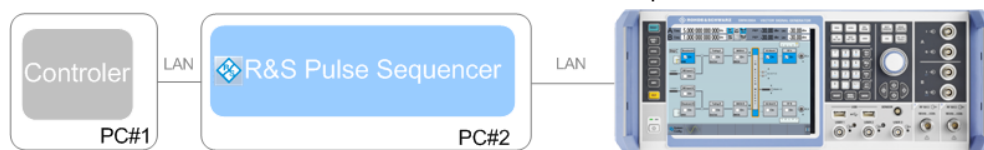
Remote control is an operation by which the software is operated remotely from a so called controller. A controller can be any PC on which some required software is installed and configured. R&S Pulse Sequencer Digital can be but not necessarily is installed on the same PC. In case R&S Pulse Sequencer Digital is not physically located on the controller's PC, a LAN connection between both PCs is required.

The following figures depict the following three possible cases:

- The controller is a script in the R&S Pulse Sequencer Digital itself and controls the software and possibly also other instruments.
- The controller and R&S Pulse Sequencer Digital are on the same PC.



- The controller and the software are installed on two separate PCs.



In remote control operation, the software itself is operated by remote control commands. For description of specific SCPI commands, refer to [Chapter 24, "Remote control commands"](#), on page 416.



A knowledge about the remote control operation and the SCPI command syntax is assumed.

### Supported interfaces and protocols

R&S Pulse Sequencer Digital support remote control over the LAN interface and with the socket protocol. The socket controller is sufficient; a VISA (Virtual Instrument Software Architecture) library is not required.

Socket communication requires the specification of the port (commonly referred to as port number); the registered default port is 5025 but it can be changed if necessary.

### Socket communication

Socket communication is a simple network communication and is also referred to as "Raw Ethernet communication". It is available by default on all operating systems.

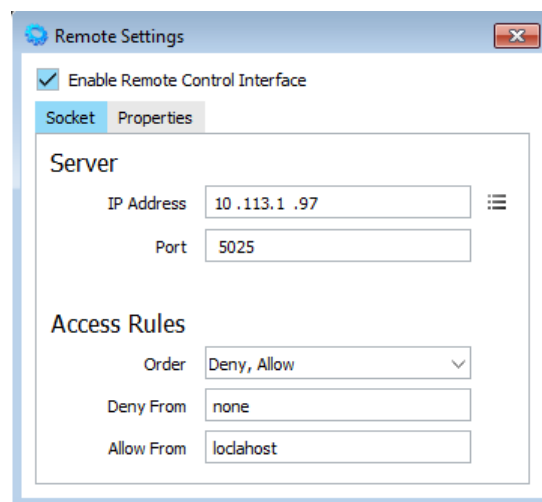


The simplest way to establish socket communication is to use the built-in telnet program. The telnet program is part of every operating system and supports a communication with the software on a command-by-command basis. For more convenience and to enable automation by programs, user-defined sockets can be programmed.

## 23.1 Remote settings

Access:

- ▶ In the menu bar, select "Configure > Remote Control".



### Settings:

Enable Remote Control Interface.....	409
Socket.....	409
L Server.....	409
L Access Rules.....	410
Properties.....	410

### Enable Remote Control Interface

Activates the remote control interface.

If enabled, the "IP Address" of the server and the used port are indicated in the taskbar.

### Socket

Configures the remote control interface.

#### Server ← Socket

Configures the TCP/IP server to be used for remote control:

"IP Address"     Enter the IP address of the TCP/IP server or select it from the list of automatically retrieved values.

"Port" Sets the port number for the remote control interface.

#### Access Rules ← Socket

Defines the access rules:

"Order" Sets the order of the deny/allow rules.

"Deny from/Allow from"

Deny or allow remote access.

Allowed values:

- none
- all
- localhost i.e. 127.0.0.1
- If DNS supported, the hostname of a particular computer
- IPv4 address
- Address area, e.g. 192.168.10

#### Properties

Set the serial number of the software. The serial number is a unique 6-digit number, returned as a result of the \*IDN? query.

See ["To identify the R&S Pulse Sequencer Digital by its serial number"](#) on page 413.

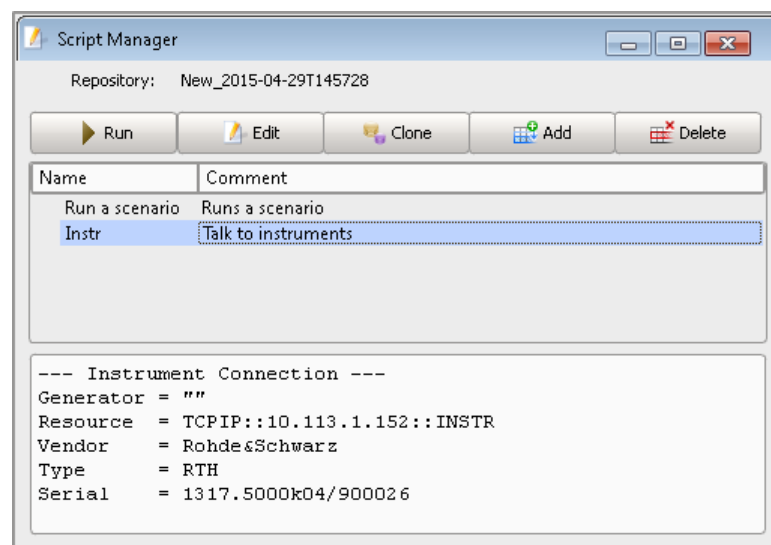
## 23.2 Script manager settings

The R&S Pulse Sequencer Digital provides also a built-in java script editor. With this function, you can write scripts that control the software.

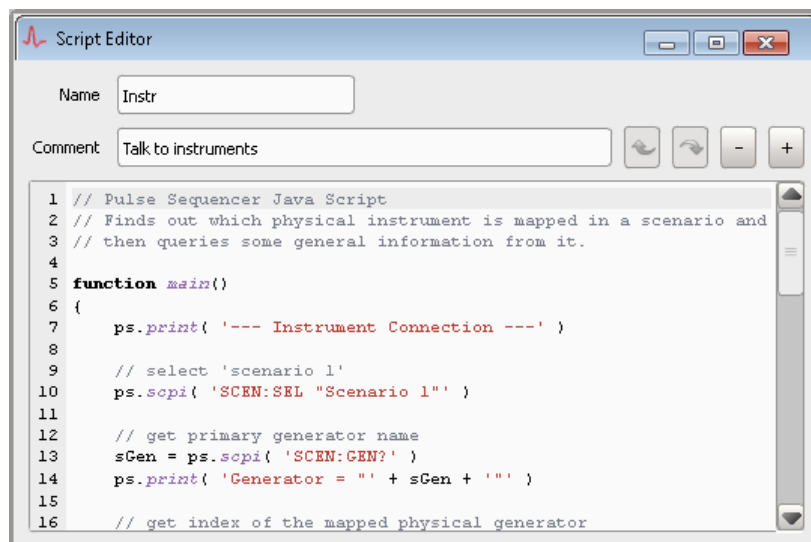
#### To access the script manager

1. In the menu bar, select "Tools > Script".

The "Script Manager" lists the available scripts with their name and comment.



2. To execute a script, select "Run".  
The script output from the `ps.print` function is displayed in the "Script Manager".
3. To create a script, select "Add" or use the "Clone" function.
4. To edit a script, double-click a script in the script list or select a script and select "Edit".



You can write or copy your java script file here.

For description of the script syntax and script examples, see:

- [Chapter D, "Scripting API"](#), on page 665
- [Chapter D.3, "Script examples"](#), on page 670

<a href="#">Script Manager</a> .....	411
<a href="#">Script Editor</a> .....	411

### Script Manager

The dialog indicates the current repository and lists the available scripts with their name and comment.

If a script is executed, the script output, i.e. the output from the `ps.print` function, is displayed in the lower part of the dialog.

- |                      |   |
|----------------------|---|
| "Run"                | Executes the selected script.                                 |
| "Edit"               | Opens the selected script for editing in the "Script Editor". |
| "Clone, Add, Delete" | Performs the corresponding action.                            |

### Script Editor

The script editor is a dialog, where you can change the name of a script, add a comment and create or edit the script code.

The icons provide common "Undo/Redo" and "Zoom In/Out" functions.

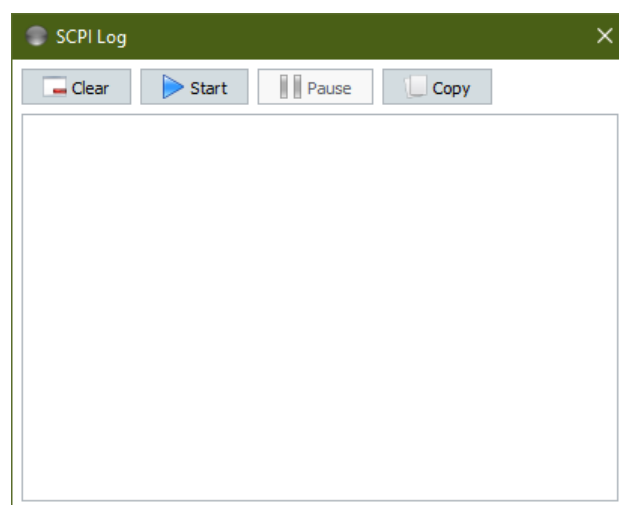
## 23.3 SCPI log settings

The "SCPI Log" dialog provides a sequential register of the SCPI commands associated with actions performed on the user interface. Copy the list of recorded SCPI commands to the clipboard and create scripts to automate the usage of the R&S Pulse Sequencer Digital.


### To start logging SCPI commands

1. Select the "SCPI Log" dialog icon  on the taskbar.

The "SCPI Log" dialog opens.



2. Select the "Start" button.

The "SCPI Log" dialog button on the taskbar changes to .

The "Start" button is grayed out and the "Pause" button becomes available.

3. To skip logging, select "Pause".
4. To resume logging, select "Start".

See also [Chapter 23.5, "How to log SCPI commands"](#), on page 414.

<a href="#">Copy</a> .....	412
<a href="#">Clear</a> .....	412
<a href="#">Context menu</a> .....	412

#### Copy

Copies the copy the content of the "SCPI Log" dialog to the clipboard.

#### Clear

Deletes the content of the "SCPI Log" dialog.

#### Context menu

In the "SCPI Log" dialog, open the context menu (right click) to access a context menu with basic text editing capabilities.

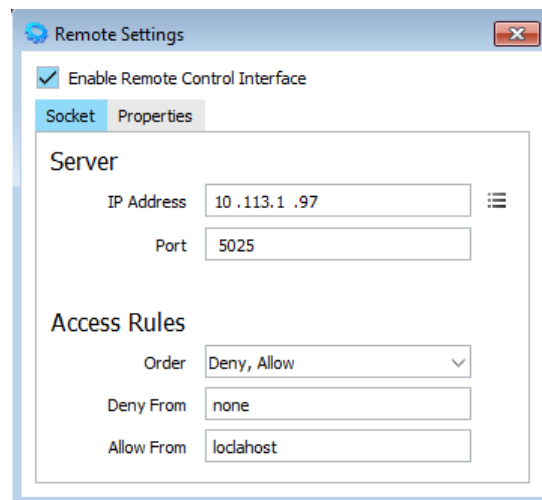
## 23.4 How to configure and enable remote control of R&S Pulse Sequencer Digital

See:

- ["To access the required settings"](#) on page 413
- ["To use the console to test SCPI commands"](#) on page 414
- ["To find the SCPI command corresponding to a parameter on the user interface"](#) on page 414

### To access the required settings

1. In the menu bar, select "Configure > Remote Control".
2. Select "Enable Remote Control Interface".
3. Do not change the default socket port.

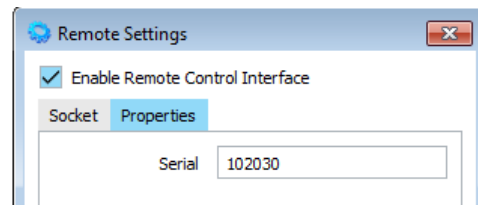


### To identify the R&S Pulse Sequencer Digital by its serial number

If you remotely control several R&S Pulse Sequencer Digital from the same controller, it is useful to use serial numbers to distinguish between the different installations.

To set the serial number of the software:

1. In the menu bar, select "Configure > Remote Control".
2. Open the "Properties" tab.
3. In the "Serial" field, enter a unique 6-digit number.



To query the serial number, use the command `*IDN?`.

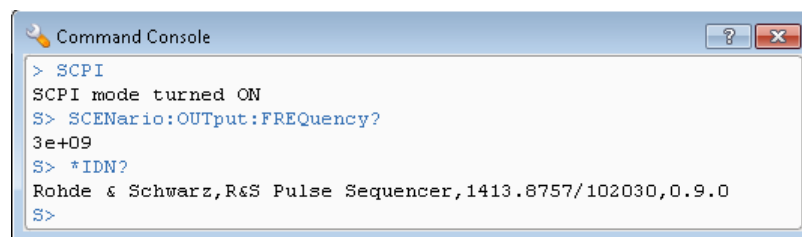
See also ["To use the console to test SCPI commands"](#) on page 414.

### To use the console to test SCPI commands

R&S Pulse Sequencer Digital provides a built-in console window that allows you to test SCPI commands or commands sequences.

1. To access this window, in the menu bar, select "Tools > Console"
2. In the "Command Console" window, type `SCPI` to start the remote control mode.
3. Enter any SCPI command.

See ["To use the console to test SCPI commands"](#) on page 414.



### To find the SCPI command corresponding to a parameter on the user interface

Perform one of the following:

1. Right mouse click to open the context menu of the parameter.
2. Press F1 to open the "Help" window. You find a link to the description of the SCPI command right after the parameter description.

For a concise description of the available SCPI commands, see [Chapter 24, "Remote control commands"](#), on page 416.

## 23.5 How to log SCPI commands

To start logging, see [To start logging SCPI commands](#).

1. Create the emitter.

For details on creating scenarios and setting emitter properties, see:

- [Chapter 16, "Creating complex 2D scenarios with receiver and TX items"](#), on page 289
- [Chapter 16.7, "Background emitters properties"](#), on page 335

The "SCPI Log" dialog displays:

```
SCENario:CEMit:ADD
SCENario:CEMit:SElect 4
SCENario:LOCalized:TYPE BACKGROUND
A new emitter is added.
```

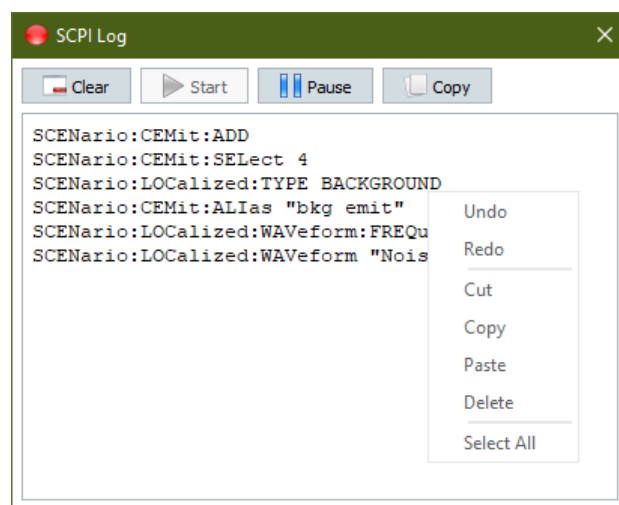
2. Rename the emitter.

A new line appears in the "SCPI Log" dialog:

```
SCENario:CEMit:ALIAS "bkg emit"
```

3. To edit the logged SCPI command list, open the context menu (right-click). The provided functions are self-explanatory.

The figure below shows the final result.



The context menu only edits the item or items selected in the SCPI log list. It does not change the GUI.

## 24 Remote control commands

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

• <a href="#">Conventions used in SCPI command descriptions</a> .....	416
• <a href="#">Programming examples</a> .....	417
• <a href="#">Common commands</a> .....	417
• <a href="#">Commands with similar syntax</a> .....	418
• <a href="#">Program settings</a> .....	434
• <a href="#">Antenna pattern commands</a> .....	437
• <a href="#">Antenna scan commands</a> .....	451
• <a href="#">Signal mapping commands</a> .....	465
• <a href="#">Emitter commands</a> .....	468
• <a href="#">Destination commands</a> .....	471
• <a href="#">Inter-pulse modulation commands</a> .....	473
• <a href="#">Import interface commands</a> .....	490
• <a href="#">License server commands</a> .....	495
• <a href="#">Marker commands</a> .....	496
• <a href="#">Plugin and reporting commands</a> .....	501
• <a href="#">Pulse commands</a> .....	507
• <a href="#">Receiver commands</a> .....	522
• <a href="#">Repository commands</a> .....	526
• <a href="#">Scenario commands</a> .....	533
• <a href="#">Moving emitters and receivers commands</a> .....	565
• <a href="#">Platform command</a> .....	578
• <a href="#">Sequence commands</a> .....	584
• <a href="#">Status commands</a> .....	592
• <a href="#">System, message log and program commands</a> .....	593
• <a href="#">Signal preview commands</a> .....	595
• <a href="#">List of remote commands</a> .....	596

### 24.1 Conventions used in SCPI command descriptions

The following conventions are used in the remote command descriptions:

- **Command usage**  
If not specified otherwise, commands can be used both for setting and for querying parameters.  
If a command can be used for setting or querying only, or if it initiates an event, the usage is stated explicitly.
- **Parameter usage**  
If not specified otherwise, a parameter can be used to set a value and it is the result of a query.  
Parameters required only for setting are indicated as **Setting parameters**.



Parameters required only to refine a query are indicated as **Query parameters**. Parameters that are only returned as the result of a query are indicated as **Return values**.

- **Conformity**

Commands that are taken from the SCPI standard are indicated as **SCPI confirmed**. All commands used by the R&S Pulse Sequencer Digital follow the SCPI syntax rules.

- **Asynchronous commands**

A command which does not automatically finish executing before the next command starts executing (overlapping command) is indicated as an **Asynchronous command**.

- **Reset values (\*RST)**

Default parameter values that are used directly after resetting the instrument (\*RST command) are indicated as \*RST values, if available.

- **Factory preset values**

Default parameter values that are reset only by factory preset.

- **Default unit**

The default unit is used for numeric values if no other unit is provided with the parameter.

- **Manual operation**

If the result of a remote command can also be achieved in manual operation, a link to the description is inserted.

## 24.2 Programming examples

The following sections provide simple programming examples for the R&S Pulse Sequencer Digital. 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 the built-in console which provides an environment for the development and execution of remote tests. To keep the examples as simple as possible, only the "clean" SCPI-like syntax elements are reported. The // character combination ("double-slash") indicates a non-executable command line (e.g. a comment).

## 24.3 Common commands

Common commands are described in the IEEE 488.2 (IEC 625-2) standard. These commands have the same effect and are employed in the same way on different devices. The headers of these commands consist of "\*" followed by three letters. Many common commands are related to the Status Reporting System.

Available common commands:

*IDN?	418
*OPT?	418
*RST	418

**\*IDN?**

## Identification

Returns the instrument identification.

**Return values:**

<ID> "Rohde&Schwarz,<device type>,<part number>/<serial number>,<firmware version>"

**Usage:** Query only

**\*OPT?**

## Option identification query

Queries the options included in the instrument. For a list of all available options and their description, refer to the specifications document.

**Return values:**

<Options> The query returns a list of options. The options are returned at fixed positions in a comma-separated string. A zero is returned for options that are not installed.

**Usage:** Query only

**\*RST**

## Reset

Sets the software to a defined default status. The default settings are indicated in the description of commands.

Unsaved settings are lost.

**Usage:** Setting only

## 24.4 Commands with similar syntax

This section describes commands, that follow similar syntax and are common to the command groups listed in the following sections.

- <COMMAND> : **ADD**
- <COMMAND> : **CATa**log
- <COMMAND> : **CL**Ea
- <COMMAND> : **COM**ment
- <COMMAND> : **COUN**t

- <COMMAND>:CREate
- <COMMAND>:DELeTe
- <COMMAND>:INSert
- <COMMAND>:NAME
- <COMMAND>:REMove
- <COMMAND>:SElect

### Commands for handling of repository elements

Repository elements are referenced by their *unique name*. The name can contain empty spaces. In each of the command groups, there is a . . . :SElect command. Use this command to select one repository element to which the subsequent commands apply.

A typical remote control sequence would look like in the [Example "Handling repository elements"](#) on page 419.

#### Example: Handling repository elements

The following is a simple example that explains the principle of repository elements handling by using the common commands.

```
// activate the remote control mode
SCPI
// create new empty repository
REpository:CREate "Repository for tests"
REpository:CATalog?
// "Repository for tests"
REpository:SAVE

// create two new scenarios
SCENario:CREate "New 1"
SCENario:CREate "New 2"
SCENario:SElect "New 1"
SCENario:COMment "simple test scenario"
// rename the scenario
SCENario:NAME "New"
// remove it from the repository
SCENario:CATalog?
// "New", "New 2"
SCENario:REMove "New 2"
SCENario:CATalog?
// "New"

// create new pulse
// PULSe:CREate "New"
PULSe:CATalog?
// "New"
// although the pulse and the scenario use the same name,
// they are different and unique elements for the repository
```

### Commands for handling of list and table items

Several repository elements are described in table form or as lists. For example, the sequence description table, the FM and AM Step modulations, IPM profiles in list form, or lists of multiple emitters.

Lists and tables are composed of items, where items are referenced by their *number*. Use the `...:SElect` command to select one item to which the subsequent commands apply.

A typical remote control sequence would look like in the [Example "Handling items"](#) on page 420.

#### Example: Handling items

The following is a simple example that explains the principle of items handling by using the common commands.

```
// activate the remote control mode
SCPI
// creates a pulse-based sequence with 2 items (i.e. segments)
SEquence:CREate "Seq1"
SEquence:SElect "Seq1"
SEquence:TYPE PULSe
SEquence:ITEM:ADD
SEquence:ITEM:COUNT?
// 1
SEquence:ITEM:SElect 1; SEquence:ITEM:TYPE PULSe
SEquence:ITEM:PULSe "P1"
SEquence:ITEM:ADD
SEquence:ITEM:COUNT?
// 2
SEquence:ITEM:DElete 2
SEquence:ITEM:COUNT?
// 1
SEquence:ITEM:CLEar
SEquence:ITEM:COUNT?
// 0
```

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SCENario:CEMit:GROUp:CLEAr.....	433
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PULSe:MOP:AMSTeP:CLEAr.....	433
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PULSe:MOP:PCHirp:CLEAr.....	433
PULSe:MOP:PLISt:CLEAr.....	433
PULSe:MOP:CCHirp:CLEAr.....	433
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SCENario:LOCalized:EMITter:STATe:CLEAr.....	433
SCENario:CPDW:CLEAr.....	433
SCENario:DF:CLEAr.....	433
SEQuence:ITEM:CLEAr.....	433

---

**ANTenna:CATalog?**

**EMITter:CATalog?**

**RECeiver:CATalog?**

**IPM:CATalog?**

**PLATform:CATalog?**

**PLUGin:CATalog?**

**PULSe:CATalog?**  
**SCAN:CATalog?**  
**SCENario:CATalog?**  
**SEQuence:CATalog?**  
**WAVeform:CATalog?**  
**REPository:CATalog?**

Queries the available repository elements in the database.

**Return values:**

<Catalog> string

**Example:** See [Example"Working with repositories"](#) on page 526

**Usage:** Query only

**Manual operation:** See ["Info"](#) on page 62

**ANTenna:CREate <Create>**  
**EMITter:CREate <Create>**  
**RECeiver:CREate <Create>**  
**IPM:CREate <Create>**  
**PLATform:CREate <Create>**  
**PLUGin:CREate <Create>**  
**PULSe:CREate <Create>**  
**SCAN:CREate <Create>**  
**SCENario:CREate <Create>**  
**SEQuence:CREate <Create>**  
**WAVeform:CREate <Create>**  
**REPository:CREate <Create>**

Creates a repository element with the selected name.

**Setting parameters:**

<Create> string

Must be unique for the particular type of repository elements.  
May contain empty spaces.

**Example:** See [Example"Working with repositories"](#) on page 526

**Usage:** Setting only

**Manual operation:** See ["Info"](#) on page 62

**ANTenna:SELEct <Select>**  
**EMITter:SELEct <Select>**  
**PLATform:EMITter:SELEct <Select>**  
**PLATform:SELEct <Select>**  
**RECeiver:SELEct <Select>**  
**DESTination:SELEct <Select>**  
**IPM:SELEct <Select>**  
**PLUGin:SELEct <Select>**  
**PULSe:SELEct <Select>**

**SCAN:SElect** <Select>  
**SCENario:SElect** <Select>  
**SEquence:SElect** <Select>  
**WAVeform:SElect** <Select>  
**REPository:SElect** <Select>

Selects the repository element to which the subsequent commands apply.

**Parameters:**

<Select>                      string  
                                   Element name, as defined with the ...:CREate or ...:NAME  
                                   command.  
                                   To query the existing elements, use the ...:CATalog? com-  
                                   mand.  
                                   For example, REPository:CATalog?.

**Example:**                    See [Example"Working with repositories"](#) on page 526.

**Manual operation:**    See ["Info"](#) on page 62

**ANTenna:NAME** <Name>  
**EMITter:MODE:NAME** <Name>  
**EMITter:NAME** <Name>  
**EMITter:MODE:BEAM:NAME** <Name>  
**PLATform:NAME** <Name>  
**RECeiver:NAME** <Name>  
**DESTination:NAME** <Name>  
**IPM:NAME** <Name>  
**IPM:PLUGin:NAME** <Name>  
**PLUGin:MODule:NAME?**  
**PLUGin:NAME** <Name>  
**PULSe:NAME** <Name>  
**SCAN:NAME** <Name>  
**SCENario:NAME** <Name>  
**SEquence:NAME** <Name>  
**WAVeform:NAME** <Name>

Renames the selected repository element.

**Parameters:**

<Name>                        string  
                                   Must be unique for the particular type of repository elements.  
                                   May contain empty spaces.

**Example:**                    See [Example"Handling repository elements"](#) on page 419

**ANTenna:COMMeNt** <Comment>  
**EMITter:COMMeNt** <Comment>  
**INSTrument:COMMeNt** <Comment>  
**PLATform:COMMeNt** <Comment>  
**RECeiver:COMMeNt** <Comment>

**IPM:COMMeNt** <Comment>  
**PLATform:COMMeNt** <Comment>  
**PLUGin:COMMeNt** <Comment>  
**PULSe:COMMeNt** <Comment>  
**PULSe:MOP:COMMeNt** <Comment>  
**SCAN:COMMeNt** <Comment>  
**SCENario:COMMeNt** <Comment>  
**SEQuence:COMMeNt** <Comment>  
**WAVeform:COMMeNt** <Comment>  
**REPository:COMMeNt** <Comment>

Adds a description to the selected repository element.

**Parameters:**

<Comment>                    string

**Example:**                    See [Example"Working with repositories"](#) on page 526

**Manual operation:**    See ["Comment"](#) on page 62

**ANTenna:REMOve** <Remove>  
**EMITter:REMOve** <Remove>  
**PLATform:REMOve** <Remove>  
**RECeiver:REMOve** <Remove>  
**IPM:REMOve** <Remove>  
**PLUGin:REMOve** <Remove>  
**PULSe:REMOve** <Remove>  
**SCAN:REMOve** <Remove>  
**SCENario:REMOve** <Remove>  
**SEQuence:REMOve** <Remove>  
**WAVeform:REMOve** <Remove>  
**REPository:REMOve** <File>[,<Username>,<Passwd>]

Removes the selected element from the workspace.

The element must not reference any child elements. Remove the referenced elements first.

**Setting parameters:**

<File>                    string  
    Element name, as defined with the . . . :CREate or . . . :NAME command.

<Username>                string  
    Required if the repository is password protected

<Passwd>                 string  
    Required if the repository is password protected

**Example:**                    See [Example"Working with repositories"](#) on page 526

**Usage:**                      Setting only

**Manual operation:**    See ["Info"](#) on page 62

---

SCENario:CPDW:GROup:ADD  
 SCENario:CEMit:GROup:ADD  
 SCENario:DF:GROup:ADD  
 SCENario:LOCalized:GROup:ADD  
 ASSignment:DESTination:PATH:EMITter:ADD  
 ASSignment:DESTination:PATH:ANTenna:ADD  
 EMITter:MODE:ADD  
 EMITter:MODE:BEAM:ADD  
 PLATform:EMITter:ADD  
 PLATform:EMITter:BLANKranges:ADD  
 RECeiver:ANTenna:ADD  
 PULSe:MOP:AMSTep:ADD  
 PULSe:MOP:FMSTep:ADD  
 PULSe:MOP:PCHirp:ADD  
 PULSe:MOP:PIECewise:ADD  
 PULSe:MOP:CCHirp:ADD  
 PULSe:MOP:PLISt:ADD  
 SCENario:LOCalized:ADD  
 SCENario:DF:ADD  
 SCENario:CSEquence:ADD  
 SCENario:CEMit:ADD  
 SCENario:CEMit:MCHG:ADD  
 SCENario:DF:MCHG:ADD  
 SCENario:DF:EMITter:STATe:ADD  
 SCENario:LOCalized:MCHG:ADD  
 SCENario:LOCalized:EMITter:STATe:ADD  
 SCENario:DF:LOCation:PSTep:ADD  
 SCENario:LOCalized:LOCation:PSTep:ADD  
 SCAN:CUSTom:ENTRy:ADD  
 SCENario:CPDW:ADD  
 IPM:LIST:ITEM:ADD  
 SEQUENCE:ITEM:IPM:ADD  
 SEQUENCE:ITEM:ADD

Appends new item.

**Example:** See [Example "Handling items"](#) on page 420

**Usage:** Event

**Manual operation:** See ["New, Insert, Append, Remove, Clear Items, Undo/Redo"](#) on page 123

---

PLATform:EMITter:BLANKranges:COUNT?  
 SCENario:CPDW:GROup:COUNT?  
 SCENario:CEMit:GROup:COUNT?  
 SCENario:DF:GROup:COUNT?  
 SCENario:LOCalized:GROup:COUNT?  
 INSTRument:COUNT?  
 EMITter:MODE:BEAM:COUNT?  
 EMITter:MODE:COUNT?

**PULSe:MOP:AMSTep:COUNT?**  
**PULSe:MOP:FMSTep:COUNT?**  
**PULSe:MOP:PCHirp:COUNT?**  
**PULSe:MOP:PLISt:COUNT?**  
**PULSe:MOP:CCHirp:COUNT?**  
**PULSe:MOP:PIECewise:COUNT?**  
**IPM:LIST:ITEM:COUNT?**  
**SCENario:CEMit:MCHG:COUNT?**  
**SCENario:DF:MCHG:COUNT?**  
**SCENario:LOCalized:MCHG:COUNT?**  
**SCENario:LOCalized:EMITter:STATe:COUNT?**  
**SCENario:DF:EMITter:STATe:COUNT?**  
**SCENario:DF:LOCation:PSTep:COUNT?**  
**SCENario:LOCalized:LOCation:PSTep:COUNT?**  
**SCAN:CUSTom:ENTRy:COUNT?**  
**SETup:COUNT?**  
**SEQuence:ITEM:IPM:COUNT?**  
**SEQuence:ITEM:COUNT?**

Queries the number of existing items.

**Return values:**

<Count>                    integer  
                               \*RST:            0

**Example:**                    See [Example "Handling items"](#) on page 420

**Usage:**                      Query only

**Manual operation:**    See "[Select, No.](#)" on page 123

---

**PLATform:EMITter:BLANkranges:SElect <Select>**  
**PLATform:EMITter:SElect <Select>**  
**PLATform:SElect <Select>**  
**SCENario:CPDW:GROup:SElect <Select>**  
**SCENario:CEMit:GROup:SElect <Select>**  
**SCENario:DF:GROup:SElect <Select>**  
**SCENario:LOCalized:GROup:SElect <Select>**  
**SCENario:LOCalized:SElect <Select>**  
**SCENario:DF:SElect <Select>**  
**SCENario:CSEQuence:SElect <Select>**  
**SCENario:CEMit:SElect <Select>**  
**EMITter:MODE:BEAM:SElect <Select>**  
**EMITter:MODE:SElect <Select>**  
**RECeiver:ANTenna:SElect <Select>**  
**PULSe:MOP:AMSTep:SElect <Select>**  
**PULSe:MOP:FMSTep:SElect <Select>**  
**PULSe:MOP:PCHirp:SElect <Select>**  
**PULSe:MOP:PLISt:SElect <Select>**  
**PULSe:MOP:CCHirp:SElect <Select>**  
**PULSe:MOP:PIECewise:SElect <Select>**

**SCAN:CUSTom:ENTRy:SElect** <Select>  
**IPM:LIST:ITEM:SElect** <Select>  
**SCENario:CEMit:MCHG:SElect** <Select>  
**SCENario:DF:MCHG:SElect** <Select>  
**SCENario:DF:LOCation:PSTep:SElect** <Select>  
**SCENario:DF:EMITter:STATe:SElect** <Select>  
**SCENario:LOCalized:LOCation:PSTep:SElect** <Select>  
**SCENario:LOCalized:EMITter:STATe:SElect** <Select>  
**SCENario:LOCalized:MCHG:SElect** <Select>  
**SCENario:CPDW:SElect** <Select>  
**SETup:SElect** <Select>  
**SEquence:ITEM:IPM:SElect** <Select>  
**SEquence:ITEM:SElect** <Select>

Selects the item to which the subsequent commands apply.

**Parameters:**

<Select> float  
 Item number within the range 1 to . . . :COUNT.  
 For example, [SEquence:ITEM:COUNT?](#).  
 Range: 1 to 4096

**Example:** See [Example "Handling items"](#) on page 420

**Manual operation:** See ["Select, No."](#) on page 123

**INSTrument:SElect** <Select>  
**ASSignment:ANTennas:SElect** <Select>  
**ASSignment:EMITters:SElect** <Select>  
**ASSignment:DESTination:SElect** <Select>  
**ASSignment:DESTination:PATH:SElect** <Select>  
**ASSignment:DESTination:PATH:EMITter:SElect** <Select>  
**ASSignment:DESTination:PATH:ANTenna:SElect** <Select>

Selects the element to which the subsequent commands apply.

**Parameters:**

<Select> string  
 Available element as queried with the corresponding . . . :LIST  
 command.  
 For example, [ASSignment:DESTination:PATH:ANTenna:  
LIST?](#) on page 467

**Example:** See [Chapter 17.2, "Assign signals to destination"](#), on page 351.

**Manual operation:** See ["Add, Remove, Clear"](#) on page 353

**SCAN:CUSTom:ENTRy:INSert** <Insert>  
**SCENario:DF:EMITter:STATe:INSert** <Insert>  
**SCENario:LOCalized:EMITter:STATe:INSert** <Insert>  
**PULSe:MOP:AMSTep:INSert** <Insert>

**PULSe:MOP:FMSTep:INSert** <Insert>  
**PULSe:MOP:PCHirp:INSert** <Insert>  
**PULSe:MOP:CCHirp:INSert** <Insert>  
**PULSe:MOP:PIECewise:INSert** <Insert>  
**PULSe:MOP:PLISt:INSert** <Insert>

Inserts a new item before the selected one.

**Setting parameters:**

<Insert> float  
 \*RST: 0

**Usage:** Setting only

**Manual operation:** See "[Custom Phase](#)" on page 109

---

**PLATform:EMITter:BLANkranges:DELeTe** <Delete>  
**PLATform:EMITter:DELeTe** <Delete>  
**SCENario:CPDW:GROUp:DELeTe** <Delete>  
**SCENario:CEMit:GROUp:DELeTe** <Delete>  
**SCENario:DF:GROUp:DELeTe** <Delete>  
**SCENario:LOCalized:GROUp:DELeTe** <Delete>  
**ASSignment:DESTination:PATH:EMITter:DELeTe**  
**ASSignment:DESTination:PATH:ANTenna:DELeTe**  
**SCAN:CUSTom:ENTRy:DELeTe** <Delete>  
**EMITter:MODE:BEAM:DELeTe** <Delete>  
**EMITter:MODE:DELeTe** <Delete>  
**RECeiver:ANTenna:DELeTe**  
**IPM:LIST:ITEM:DELeTe** <Delete>  
**PULSe:MOP:AMSTep:DELeTe** <Delete>  
**PULSe:MOP:FMSTep:DELeTe** <Delete>  
**PULSe:MOP:PCHirp:DELeTe** <Delete>  
**PULSe:MOP:CCHirp:DELeTe** <Delete>  
**PULSe:MOP:PLISt:DELeTe** <Delete>  
**PULSe:MOP:PIECewise:DELeTe** <Delete>  
**SCENario:LOCalized:DELeTe** <Delete>  
**SCENario:CEMit:MCHG:DELeTe** <Delete>  
**SCENario:DF:MCHG:DELeTe** <Delete>  
**SCENario:LOCalized:MCHG:DELeTe** <Delete>  
**SCENario:LOCalized:EMITter:STATe:DELeTe** <Delete>  
**SCENario:DF:EMITter:STATe:DELeTe** <Delete>  
**SCENario:DF:DELeTe** <Delete>  
**SCENario:CSEquence:DELeTe** <Delete>  
**SCENario:CEMit:DELeTe** <Delete>  
**SCENario:DF:LOCation:PSTep:DELeTe** <Delete>  
**SCENario:LOCalized:LOCation:PSTep:DELeTe** <Delete>  
**SCENario:CPDW:DELeTe** <Delete>  
**SEquence:ITEM:IPM:DELeTe** <Delete>  
**SEquence:ITEM:DELeTe** <Delete>

Deletes the particular item.



**Setting parameters:**

<Delete> float  
 \*RST: 0

**Example:** See [Example"Handling items"](#) on page 420

**Usage:** Setting only

**Manual operation:** See ["New, Insert, Append, Remove, Clear Items, Undo/Redo"](#) on page 123

---

PLATform:EMITter:BLANkranges:CLEar  
 PLATform:EMITter:CLEar  
 SCENario:CPDW:GROup:CLEar  
 SCENario:CEMit:GROup:CLEar  
 SCENario:DF:GROup:CLEar  
 SCENario:LOCalized:GROup:CLEar  
 ANTenna:MODEl:USER:CLEar  
 SCAN:CUSTom:ENTRy:CLEar  
 EMITter:MODE:ANTenna:CLEar  
 EMITter:MODE:BEAM:CLEar  
 EMITter:MODE:CLEar  
 EMITter:MODE:SCAN:CLEar  
 RECeiver:ANTenna:CLEar  
 IPM:LIST:CLEar  
 PULSe:MOP:AMSTep:CLEar  
 PULSe:MOP:FMSTep:CLEar  
 PULSe:MOP:PCHirp:CLEar  
 PULSe:MOP:PLISt:CLEar  
 PULSe:MOP:CCHirp:CLEar  
 PULSe:MOP:PIECewise:CLEar  
 ASSignment:DESTination:PATH:EMITter:CLEar  
 ASSignment:DESTination:PATH:ANTenna:CLEar  
 SCENario:EMITter:CLEar  
 SCENario:CSEQUence:CLEar  
 SCENario:CEMit:CLEar  
 SCENario:CEMit:MCHG:CLEar  
 SCENario:LOCalized:CLEar  
 SCENario:DF:MCHG:CLEar  
 SCENario:DF:EMITter:STATe:CLEar  
 SCENario:LOCalized:EMITter:STATe:CLEar  
 SCENario:CPDW:CLEar  
 SCENario:DF:CLEar  
 SEQUence:ITEM:CLEar

Deletes all items from the list or the table.

**Example:** See [Example"Handling items"](#) on page 420

**Usage:** Event

**Manual operation:** See ["New, Insert, Append, Remove, Clear Items, Undo/Redo"](#) on page 123

## 24.5 Program settings

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<a href="#">PROGram:COMMeNt:ENABLE</a> .....	434
<a href="#">PROGram:GPU:ENABLE</a> .....	434
<a href="#">PROGram:PATH:INSTall?</a> .....	435
<a href="#">PROGram:MODE</a> .....	435
<a href="#">PROGram:PATH:REPort</a> .....	435
<a href="#">PROGram:SETTings:ACcept</a> .....	435
<a href="#">PROGram:SETTings:REJect</a> .....	435
<a href="#">PROGram:STARtup:LOAD:ENABLE</a> .....	435
<a href="#">PROGram:STARtup:WIZard:ENABLE</a> .....	435
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<a href="#">PROGram:TOOLbar:ENABLE</a> .....	436
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---

### **PROGram:CLASs:ENABLE** <Enable>

Enables whether the workspace classification level appears in the lower window (restart required).

**Parameters:**

<Enable>            ON | OFF | 1 | 0

**Manual operation:** See ["Repository Classification"](#) on page 396

---

### **PROGram:COMMeNt:ENABLE** <Enable>

Add timestamp as comment when creating entries.

**Parameters:**

<Enable>            ON | OFF | 1 | 0

**Manual operation:** See ["Program Settings"](#) on page 396

---

### **PROGram:GPU:ENABLE** <Enable>

Enables the GPU (Graphics Processing Unit) to be used for antenna pattern calculations.

Using the GPU accelerates the calculation.

Requires a restart.

**Parameters:**

<Enable>            ON | OFF | 1 | 0

**Manual operation:** See ["GPU Support"](#) on page 405

---

**PROGram:PATH:INSTall?**

Queries the storage location for repository files.

**Return values:**

<Install>                    string

**Usage:**                    Query only

**Manual operation:**    See "[Repository Databases](#)" on page 403

---

**PROGram:MODE <Mode>**

Selects the operation mode on start-up.

**Parameters:**

<Mode>                    DEMO | STANdard | EXPert

---

**PROGram:PATH:REPort <Report>**

Sets the directory that holds generated reports.

**Parameters:**

<Report>                    string

**Manual operation:**    See "[Reports](#)" on page 404

---

**PROGram:SETTings:ACcept****PROGram:SETTings:REJect**

Reject changes to program settings.

**Usage:**                    Event

**Manual operation:**    See "[Apply, Cancel](#)" on page 396

---

**PROGram:STARtup:LOAD:ENABLE <Enable>**

Sets if a scenario is opened each time the software is started up.

**Parameters:**

<Enable>                    ON | OFF | 1 | 0

**Manual operation:**    See "[Program Settings](#)" on page 396

---

**PROGram:STARtup:WIZard:ENABLE <Enable>**

Enable this command, if you wish the wizard to open when the software starts.

**Parameters:**

<Enable>                    ON | OFF | 1 | 0

**Manual operation:**    See "[Program Settings](#)" on page 396

---

---

**PROGram:STORageloc:ENABLE** <Enable>

If enabled, you can select the directory in that new repository is saved.

**Parameters:**

<Enable>            ON | OFF | 1 | 0

**Manual operation:**    See "[Repository Databases](#)" on page 403

---

**PROGram:TOOLbar:ENABLE** <Enable>**Parameters:**

<Enable>            ON | OFF | 1 | 0

**Manual operation:**    See "[Program Settings](#)" on page 396

---

**PROGram:TUTorials:SHOW:ENABLE** <Enable>

This setting re-enables all tutorials.

Tutorials are shown upon opening certain dialogs for the first time (e.g. 2D Map). When the tutorial has been viewed, it is then disabled.

**Parameters:**

<Enable>            ON | OFF | 1 | 0

**Example:**            PROG:TUT:SHOW:ENAB ON

**Manual operation:**    See "[Program Settings](#)" on page 396

## 24.6 Antenna pattern commands

### Example: Configuring antenna patterns

```
SCPI
ANTenna:CREate "My_PlanarAntenna"
ANTenna:COMMeNt "planar phased antenna with parabolic aperture distribution"
ANTenna:MODEl:TYPE ARRay
ANTenna:MODEl:FREQuency 1e+10
ANTenna:MODEl:BANDwidth 1e+9
ANTenna:MODEl:POLarization HORizontal
ANTenna:MODEl:ARRay:DISTRibution PARabolic
ANTenna:MODEl:ARRay:Nx 12
ANTenna:MODEl:ARRay:Nz 12
ANTenna:MODEl:ARRay:XDIStance 0.6
ANTenna:MODEl:ARRay:ZDIStance 0.3
ANTenna:MODEl:ARRay:ELEMent:COsine 0
ANTenna:MODEl:ARRay:PEDestal 0.1

ANTenna:CREate "Test"
ANTenna:MODEl:TYPE HORN
ANTenna:MODEl:ROtation:Z 0
ANTenna:MODEl:ROtation:X 0
ANTenna:MODEl:FREQuency 1e+10
ANTenna:MODEl:POLarization HORizontal
ANTenna:MODEl:HORN:LX 0.076
ANTenna:MODEl:HORN:LZ 0.05
ANTenna:MODEl:HORN:RESolution 5.E-01

ANTenna:CREate "My_PencilBeam"
ANTenna:MODEl:TYPE SINC
ANTenna:MODEl:ROtation:Z 0
ANTenna:MODEl:ROtation:X 0
ANTenna:MODEl:POLarization HORizontal
ANTenna:MODEl:SINC:HPBW 3

ANTenna:CREate "Test CSC"
ANTenna:MODEl:TYPE COSecant
ANTenna:MODEl:POLarization HORizontal
ANTenna:MODEl:COSecant:HPBW 2
ANTenna:MODEl:COSecant:T1 5
ANTenna:MODEl:COSecant:T2 70

ANTenna:CREate "User"
ANTenna:MODEl:TYPE USER
ANTenna:MODEl:USER:LOAD "C:/_PS_files/antenna.ant_pat"
ANTenna:MODEl:ROtation:Z -90
ANTenna:MODEl:ROtation:X 0
ANTenna:MODEl:POLarization HORizontal
```

ANTenna:MODEl:USER:CLEAr

ANTenna:CREate "Custom"  
 ANTenna:MODEl:TYPE CUSTom  
 ANTenna:MODEl:POLarization HORIZontal  
 ANTenna:MODEl:CUSTom:HPBW:XY 10  
 ANTenna:MODEl:CUSTom:HPBW:YZ 3  
 ANTenna:MODEl:CUSTom:SLStart 30  
 ANTenna:MODEl:CUSTom:SLRolloff 10  
 ANTenna:MODEl:CUSTom:SLScale 0.5  
 ANTenna:MODEl:BACKlobe:ENABLE 1  
 ANTenna:MODEl:BACKlobe:TYPE MIRRor  
 ANTenna:MODEl:BACKlobe:ATTenuation 40

ANTenna:NAME "Custom Phased Array"  
 ANTenna:MODEl:TYPE CARRAY  
 ANTenna:MODEl:POLarization VERTical  
 ANTenna:MODEl:CARRay:GEOMetry RECTANGULAR  
 ANTenna:MODEl:CARRay:RECTangular:NX 25  
 ANTenna:MODEl:CARRay:RECTangular:NZ 25  
 ANTenna:MODEl:CARRay:RECTangular:XDISTance 0.015  
 ANTenna:MODEl:CARRay:RECTangular:ZDISTance 0.015  
 ANTenna:MODEl:CARRay:ELEMent:COSSine 1  
 ANTenna:MODEl:CARRay:RECTangular:LATTice RECTANGULAR  
 ANTenna:MODEl:CARRay:DISTRibution COSN  
 ANTenna:MODEl:CARRay:COSSN 4

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ANTenna:MODEl:CARRay:COSSN:Z.....	441
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ANTenna:MODEl:CARRay:DISTRibution:X.....	442
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## Antenna pattern commands

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ANTenna:MODeL:CARRay:PEDestal:X.....	443
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ANTenna:MODeL:CARRay:ELEMent.....	445
ANTenna:MODeL:CUSTom:HPBW:XY.....	446
ANTenna:MODeL:CUSTom:HPBW:YZ.....	446
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ANTenna:MODeL:CUSTom:SLRolloff.....	446
ANTenna:MODeL:CUSTom:SLSCale.....	447
ANTenna:MODeL:BANDwidth.....	447
ANTenna:MODeL:FREQuency.....	447
ANTenna:MODeL:COSeCant:HPBW.....	447
ANTenna:MODeL:GAUSSian:HPBW:AZIMuth.....	448
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ANTenna:MODeL:DIPole:RESolution.....	448
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---

### ANTenna:MODEl:TYPE <Type>

Sets the antenna pattern.

#### Parameters:

<Type>                   DIPole | PARabolic | GAUSSian | SINC | HORN | COSecant |  
ARRay | USER | CUSTom | CARRay | CARDoId | PLUGin

**Example:**               See [Example"Configuring antenna patterns"](#) on page 437.

**Manual operation:**   See ["Type"](#) on page 175

---

### ANTenna:MODEl:POLarization <Polarization>

Sets the antenna polarization.

#### Parameters:

<Polarization>       VERTical | HORizontal | CRIGHt | CLEFt | SRIGHt | SLEFt

**Example:**               [Example"Configuring antenna patterns"](#) on page 437

**Manual operation:**   See ["Polarization"](#) on page 176

---

### ANTenna:MODEl:CARRay:COsN <Cosn>

### ANTenna:MODEl:ARRay:COsN <Cosn>

Sets the value of the coefficient N in the  $\cos^N$  distribution.

#### Parameters:

<Cosn>                   float  
Range:                2 to 10

**Example:**               [Example"Configuring antenna patterns"](#) on page 437

**Manual operation:**   See ["Planar Phased Array Antenna Settings"](#) on page 182

---

### ANTenna:MODEl:ARRay:COsN:Z <Z>

### ANTenna:MODEl:ARRay:COsN:X <X>

Requires ANTenna:MODEl:ARRay:DISTRibution:TYPE 1.

Sets the individual value of the coefficient N in the  $\cos^N$  distribution for X and Z direction.

#### Parameters:

<X>                       float  
Range:                2 to 10



**Manual operation:** See ["Planar Phased Array Antenna Settings"](#) on page 182

---

**ANTenna:MODEl:CARRay:COsN:Z** <Z>

**ANTenna:MODEl:CARRay:COsN:X** <X>

Requires ANTenna:MODEl:CARRay:DISTRibution:TYPE 1.

Sets the individual value of the coefficient N in the  $\cos^N$  distribution for X and Z direction.

**Parameters:**

<X> float  
Range: 2 to 10

**Manual operation:** See ["Custom Phased Array Settings"](#) on page 185

---

**ANTenna:MODEl:CARRay:DISTRibution:TYPE** <Type>

**ANTenna:MODEl:ARRay:DISTRibution:TYPE** <Type>

Enables using the individual distribution function for X and Z direction.

**Parameters:**

<Type> ON | OFF | 1 | 0

**Manual operation:** See ["Planar Phased Array Antenna Settings"](#) on page 182

---

**ANTenna:MODEl:ARRay:DISTRibution** <Distribution>

Sets the aperture distribution of the Planar Phased Array antenna.

**Parameters:**

<Distribution> UNIFORM | PARabolic | COSine | CSquared | COSN |  
TRIangular | HAMMING | HANN

**Example:** [Example"Configuring antenna patterns"](#) on page 437

**Manual operation:** See ["Planar Phased Array Antenna Settings"](#) on page 182

---

**ANTenna:MODEl:CARRay:DISTRibution** <Distribution>

Sets the aperture distribution of the Custom Phased Array antenna.

**Parameters:**

<Distribution> UNIFORM | PARabolic | COSine | CSquared | COSN |  
TRIangular | HAMMING | HANN

**Example:** See [Example"Configuring antenna patterns"](#) on page 437

**Manual operation:** See ["Custom Phased Array Settings"](#) on page 185

---

**ANTenna:MODEl:ARRay:DISTRibution:Z** <Z>

**ANTenna:MODEl:ARRay:DISTRibution:X** <X>

Requires **ANTenna:MODEl:ARRay:DISTRibution:TYPE** 1.

Sets the individual aperture distribution function for X and Z direction.

**Parameters:**

<X> UNIFORM | PARabolic | COSine | CSquared | COSN |  
TRIangular | HAMMING | HANN

**Manual operation:** See ["Planar Phased Array Antenna Settings"](#) on page 182

---

**ANTenna:MODEl:CARRay:DISTRibution:Z** <Z>

**ANTenna:MODEl:CARRay:DISTRibution:X** <X>

Requires **ANTenna:MODEl:ARRay:DISTRibution:TYPE** 1.

Sets the individual aperture distribution function for X and Z direction.

**Parameters:**

<X> UNIFORM | PARabolic | COSine | CSquared | COSN |  
TRIangular | HAMMING | HANN

**Manual operation:** See ["Custom Phased Array Settings"](#) on page 185

---

**ANTenna:MODEl:ARRay:ELEMent:COSine** <Cosine>

**ANTenna:MODEl:CARRay:ELEMent:COSine** <Cosine>

Sets the characteristic of individual antenna elements.

**Parameters:**

<Cosine> ON | OFF | 1 | 0  
**0|OFF**  
Omnidirectional characteristic  
**1|ON**  
Cosine characteristic

**Example:** See [Example"Configuring antenna patterns"](#) on page 437

**Manual operation:** See ["Custom Phased Array Settings"](#) on page 185

---

**ANTenna:MODEl:CARRay:LINear:N** <N>

**ANTenna:MODEl:CARRay:HEXagonal:N** <N>

**ANTenna:MODEl:CARRay:RECTangular:Nx** <Nx>

**ANTenna:MODEl:CARRay:RECTangular:Nz** <Nz>

**ANTenna:MODEl:ARRay:Nx** <Nx>

**ANTenna:MODEl:ARRay:Nz** <Nz>

Sets the number of elements of the antenna array.

**Parameters:**

<Nz> float  
 Range: 2 to 1000 (planar phased array; linear phase array), 100 (rectangular phase array), 50 (hexagonal phase array)

**Example:** [Example"Configuring antenna patterns"](#) on page 437

**Manual operation:** See ["Planar Phased Array Antenna Settings"](#) on page 182

**ANTenna:MODEl:CARRay:PEDestal** <Pedestal>

**ANTenna:MODEl:ARRay:PEDestal** <Pedestal>

Sets the pedestal level of the antenna array.

**Parameters:**

<Pedestal> float  
 Range: 0 to 1

**Example:** [Example"Configuring antenna patterns"](#) on page 437

**Manual operation:** See ["Planar Phased Array Antenna Settings"](#) on page 182

**ANTenna:MODEl:ARRay:PEDestal:Z** <Z>

**ANTenna:MODEl:ARRay:PEDestal:X** <X>

Requires **ANTenna:MODEl:ARRay:DISTriBution:TYPE** 1.

Sets the individual pedestal level of the antenna array in X or Z direction.

**Parameters:**

<X> float  
 Range: 0 to 1

**Manual operation:** See ["Planar Phased Array Antenna Settings"](#) on page 182

**ANTenna:MODEl:CARRay:PEDestal:Z** <Z>

**ANTenna:MODEl:CARRay:PEDestal:X** <X>

Requires **ANTenna:MODEl:ARRay:DISTriBution:TYPE** 1.

Sets the individual pedestal level of the antenna array in X or Z direction.

**Parameters:**

<X> float  
 Range: 0 to 1

**Manual operation:** See ["Custom Phased Array Settings"](#) on page 185

**ANTenna:MODEl:CARRay:CIRCular:DISTanCe** <Distance>

**ANTenna:MODEl:CARRay:HEXagonal:DISTanCe** <Distance>

**ANTenna:MODEl:CARRay:LINear:DISTanCe** <Distance>

**ANTenna:MODEl:CARRay:RECTangular:XDISTance** <Xdistance>

**ANTenna:MODEl:CARRay:RECTangular:ZDISTance** <Zdistance>

**ANTenna:MODEl:ARRay:XDISTance** <Xdistance>

**ANTenna:MODEl:ARRay:ZDISTance** <Zdistance>

Sets the spacing between the elements of the array antenna.

**Parameters:**

<Zdistance> float

Range: 0.0001 to 1

**Example:** [Example"Configuring antenna patterns"](#) on page 437

**Manual operation:** See ["Planar Phased Array Antenna Settings"](#) on page 182

**ANTenna:MODEl:BACKlobe:ENABLE** <Enable>

Enables the simulation of a back lobe.

**Parameters:**

<Enable> ON | OFF | 1 | 0

**Example:** [Example"Configuring antenna patterns"](#) on page 437

**Manual operation:** See ["Simulate Back Lobe, Attenuation, Type"](#) on page 177

**ANTenna:MODEl:BACKlobe:TYPE** <Type>

Sets the shape of the back lobe pattern.

**Parameters:**

<Type> MIRROR | OMNIdirect

**Example:** [Example"Configuring antenna patterns"](#) on page 437

**Manual operation:** See ["Simulate Back Lobe, Attenuation, Type"](#) on page 177

**ANTenna:MODEl:BACKlobe:ATTenuation** <Attenuation>

Sets the attenuation of the back lobe.

**Parameters:**

<Attenuation> float

Range: 0 to 100

**Example:** [Example"Configuring antenna patterns"](#) on page 437

**Manual operation:** See ["Simulate Back Lobe, Attenuation, Type"](#) on page 177

**ANTenna:MODEl:COSecant:T1** <T1>

**ANTenna:MODEl:COSecant:T2** <T2>

Sets the Theta parameters.

**Parameters:**

<T2> float  
 Range: 1 to 90

**Example:** [Example"Configuring antenna patterns"](#) on page 437

**Manual operation:** See "[Cosecant Squared Antenna Settings](#)" on page 181

**ANTenna:MODEl:CARRay:CIRCular:LATTice** <Lattice>

**ANTenna:MODEl:CARRay:RECTangular:LATTice** <Lattice>

Sets the lattice.

**Parameters:**

<Lattice> RECTangular | TRIangular

**Example:** [Example"Configuring antenna patterns"](#) on page 437

**Manual operation:** See "[Custom Phased Array Settings](#)" on page 185

**ANTenna:MODEl:CARRay:CIRCular:RADIus** <Radius>

Set the radius of the circular phased array antenna.

**Parameters:**

<Radius> float  
 Range: 1 to 50

**Manual operation:** See "[Custom Phased Array Settings](#)" on page 185

**ANTenna:MODEl:CARRay:GEOMetry** <Geometry>

Sets the geometry of the custom phased array antenna.

**Parameters:**

<Geometry> RECTangular | LINear | HEXagonal | CIRCular

**Example:** [Example"Configuring antenna patterns"](#) on page 437

**Manual operation:** See "[Custom Phased Array Settings](#)" on page 185

**ANTenna:MODEl:CARRay:ELEMent** <Element>

Set the state of one or more antenna elements.

Antenna elements are indicated by their subsequent number, as it is displayed in the "Antenna Geometry" dialog ([Figure 9-3](#)).

**Parameters:**

<Element> numeric list  
 A comma-separated list of numbers or of range of numbers enclosed in brackets. In the case of a range, the end points are inclusive.  
 The listed numbers indicate the *active* antenna elements; if a number is omitted, the antenna element is disabled.

**Example:**

```
ANTenna:MODEl:CARRay:GEOMetry LINEAR
ANTenna:MODEl:CARRay:LINear:N 7
ANTenna:MODEl:CARRay:ELEMent? (1,3:7)
// element 1 and 3 through 7 are active
ANTenna:MODEl:CARRay:ELEMent (1,3,5,7)
// antenna elements 1, 3, 5 and 7 are active
// antenna elements 2, 4 and 6 are deactivated
```

**Manual operation:** See ["Custom Phased Array Settings"](#) on page 185

**ANTenna:MODEl:CUSTom:HPBW:XY <Xy>**

**ANTenna:MODEl:CUSTom:HPBW:YZ <Yz>**

Sets the required HPBW of the custom antenna.

**Parameters:**

<Yz> float  
 Range: 0.1 to 45

**Example:** [Example"Configuring antenna patterns"](#) on page 437

**Manual operation:** See ["Custom Antenna Settings"](#) on page 184

**ANTenna:MODEl:CUSTom:SLStart <Slstart>**

Sets the power level of the first pairs of side lobes.

**Parameters:**

<Slstart> float  
 Range: 1 to 90

**Example:** [Example"Configuring antenna patterns"](#) on page 437

**Manual operation:** See ["Custom Antenna Settings"](#) on page 184

**ANTenna:MODEl:CUSTom:SLRolloff <Slrolloff>**

Sets the factor used to calculate the HPBW of the side lobes.

**Parameters:**

<Slrolloff> float  
 Range: 1 to 45

**Example:** [Example"Configuring antenna patterns"](#) on page 437

**Manual operation:** See ["Custom Antenna Settings"](#) on page 184

---

**ANTenna:MODEl:CUSTom:SLSCale** <SlScale>

Sets the step size to calculate the power level of the side lobes.

**Parameters:**

<SlScale> float  
Range: 0.01 to 10

**Example:** [Example"Configuring antenna patterns"](#) on page 437

**Manual operation:** See ["Custom Antenna Settings"](#) on page 184

---

**ANTenna:MODEl:BANDwidth** <Bandwidth>

Sets the antenna bandwidth.

**Parameters:**

<Bandwidth> float  
Range: 1e+06 to 1e+11

**Example:** [Example"Configuring antenna patterns"](#) on page 437

**Manual operation:** See ["Frequency, Bandwidth"](#) on page 176

---

**ANTenna:MODEl:FREQUency** <Frequency>

Sets the frequency.

**Parameters:**

<Frequency> float  
Range: 1e+06 to 1e+11  
Default unit: Hz

**Example:** See [Example"Configuring antenna patterns"](#) on page 437

**Manual operation:** See ["Frequency, Bandwidth"](#) on page 176

---

**ANTenna:MODEl:COSeCant:HPBW** <Hpbw>

Sets the Half-Power Beam Width Coscant Squared antenna.

**Parameters:**

<Hpbw> float  
Range: 0.01 to 30

**Example:** See [Example"Configuring antenna patterns"](#) on page 437.

**Manual operation:** See ["Coscant Squared Antenna Settings"](#) on page 181

---

**ANTenna:MODEl:GAUSSian:HPBW:AZIMuth** <Azimuth>  
**ANTenna:MODEl:GAUSSian:HPBW:ELEVation** <Elevation>  
**ANTenna:MODEl:SINC:HPBW:AZIMuth** <Azimuth>  
**ANTenna:MODEl:SINC:HPBW:ELEVation** <Elevation>

Sets the Half-Power Beam Width in azimuth and elevation direction for the Gaussian and Sin(x)/x antennas.

**Parameters:**

<Elevation>                      float  
    Range:      0.1 to 45  
    Default unit: degree

**Example:**                      See [Example"Configuring antenna patterns"](#) on page 437.

**Manual operation:**      See ["Sin\(x\)/x Antenna Settings"](#) on page 180

---

**ANTenna:MODEl:ARRay:RESolution** <Resolution>  
**ANTenna:MODEl:CARRay:RESolution** <Resolution>  
**ANTenna:MODEl:CARDoid:RESolution** <Resolution>  
**ANTenna:MODEl:COSecant:RESolution** <Resolution>  
**ANTenna:MODEl:CUSTom:RESolution** <Resolution>  
**ANTenna:MODEl:DIPole:RESolution** <Resolution>  
**ANTenna:MODEl:GAUSSian:RESolution** <Resolution>  
**ANTenna:MODEl:HORN:RESolution** <Resolution>  
**ANTenna:MODEl:PARAbolic:RESolution** <Resolution>  
**ANTenna:MODEl:SINC:RESolution** <Resolution>

Sets a custom resolution for the antenna pattern simulation.

**Parameters:**

<Resolution>                      float  
    Range:      0.1 to 1

**Example:**                      See [Example"Configuring antenna patterns"](#) on page 437.

**Manual operation:**      See ["Resolution"](#) on page 178

---

**ANTenna:MODEl:HORN:LX** <Lx>  
**ANTenna:MODEl:HORN:LZ** <Lz>

Sets the length of the rectangular sides of the Pyramidal Horn antenna.

**Parameters:**

<Lz>                                      float  
    Range:      0.01 to 100  
    Default unit: m

**Example:**                      [Example"Configuring antenna patterns"](#) on page 437

**Manual operation:**      See ["Pyramidal Horn Antenna Settings"](#) on page 181



---

**ANTenna:MODEl:PARAbolic:DIAMeter** <Diameter>

Sets the diameter of the parabolic dish antenna.

**Parameters:**

<Diameter> float  
Range: 0.05 to 100  
Default unit: m

**Example:** [Example"Configuring antenna patterns"](#) on page 437

**Manual operation:** See ["Parabolic Antenna Settings"](#) on page 179

---

**ANTenna:MODEl:ROTation:X** <X>**ANTenna:MODEl:ROTation:Z** <Z>

Sets the X and Z antenna rotation.

**Parameters:**

<Z> float  
Range: -180 to 180  
Default unit: degree

**Example:** [Example"Configuring antenna patterns"](#) on page 437

**Manual operation:** See ["Z-Rotation, X-Rotation"](#) on page 176

---

**ANTenna:MODEl:CARDoid:EXPOnent** <Exponent>

Use values greater than 1 to narrow the antenna beam.

**Parameters:**

<Exponent> float  
Range: 1 to 20

**Manual operation:** See ["Cardioid Antenna Settings"](#) on page 190

---

**ANTenna:MODEl:USER:LOAD** <Load>

Loads a custom antenna pattern file.

**Setting parameters:**

<Load> string

**Example:** [Example"Configuring antenna patterns"](#) on page 437

**Usage:** Setting only

**Manual operation:** See ["Load/Purge"](#) on page 191

---

**PLOT:POLar:TYPE** <Type>

Sets the coordinates of the 2D antenna pattern diagram.

**Setting parameters:**

<Type> POLar | CARTesian

**Example:**

```
PLOT:POLar:TYPE CARTesian
```

```
PLOT:POLar:CUT XY
```

```
PLOT:POLar:LOG:MIN -90
```

**Usage:**

Setting only

**Manual operation:** See "2D" on page 178

---

**PLOT:POLar:CUT <Cut>**

Sets the diagram cut.

**Setting parameters:**

<Cut> XY | YZ

**Example:**

See [PLOT:POLar:TYPE](#) on page 449

**Usage:**

Setting only

**Manual operation:** See "2D" on page 178

---

**PLOT:POLar:LOG:MIN <Min>**

Sets the minimum value displayed on the y axis.

**Setting parameters:**

<Min> float

**Example:**

See [PLOT:POLar:TYPE](#) on page 449

**Usage:**

Setting only

**Manual operation:** See "2D" on page 178

## 24.7 Antenna scan commands

### Example: Defining antenna scans

```

SCPI
SCAN:CREate "My_RasterScan"
SCAN:TYPE RASter
SCAN:RASter:WIDTh 70
SCAN:RASter:BARWidth 3
SCAN:RASter:RATE 15
SCAN:RASter:BARs 10
SCAN:RASter:DIRection HORizontal
SCAN:RASter:RETRace 0.001
SCAN:RASter:UNIDirection 1
SCAN:RASter:FLYBack 0.001
SCAN:RASter:PALMer 1
SCAN:RASter:PRATe 5
SCAN:RASter:PSQuint 1.5

SCAN:CREate "Test Antenna Scan"
SCAN:TYPE HELical
SCAN:HELical:RPM 45
SCAN:HELical:TURNs 8
SCAN:HELical:ELEVation:STEP 3
SCAN:HELical:RETRace 1
SCAN:HELical:ROTation CW

// circular scan
SCAN:CIRCular:MODE RPM
SCAN:CIRCular:RPM 6.E+01
SCAN:CIRCular:PERiod?
// 1.E+00

```

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SCAN:HELical:ROTation.....	453
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SCAN:SIN:ROTation.....	453
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SCAN:CIRCular:MODE.....	453
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SCAN:CIRCular:RPM.....	454
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## Antenna scan commands

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SCAN:SPIRal:RTIME.....	458
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SCAN:TYPE.....	458
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SCAN:SECTor:NODDing.....	459
SCAN:CIRCular:NELevation.....	459
SCAN:SECTor:NELevation.....	459
SCAN:CIRCular:NRATe.....	459
SCAN:SECTor:NRATe.....	459
SCAN:CIRCular:PALMer.....	459
SCAN:RASTer:PALMer.....	459
SCAN:SPIRal:PALMer.....	459
SCAN:SECTor:PALMer.....	459
SCAN:CIRCular:PRATe.....	460
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SCAN:SPIRal:PRATe.....	460
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SCAN:SIN:WIDTH.....	463
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---

**SCAN:CIRCular:ROTation** <Rotation>

**SCAN:CONical:ROTation** <Rotation>

**SCAN:HELical:ROTation** <Rotation>

**SCAN:LSW:ROTation** <Rotation>

**SCAN:SIN:ROTation** <Rotation>

**SCAN:SPIRal:ROTation** <Rotation>

Sets the rotation direction of the antenna.

**Parameters:**

<Rotation> CW | CCW

**Example:** See [Example "Defining antenna scans"](#) on page 451

**Manual operation:** See ["Spiral Scan"](#) on page 200

---

**SCAN:CIRCular:MODE** <Mode>

Sets if the scan turning speed is set as a scans rate or as a period.

**Parameters:**

<Mode> RPM | SEC

**RPM**

Scan rate, set with the command [SCAN:CIRCular:RPM](#).

**SEC**

Scan period, set with the command [SCAN:CIRCular:PERiod](#).

**Example:** See [Chapter 24.7, "Antenna scan commands"](#), on page 451.

**Manual operation:** See ["Circular Scan"](#) on page 195

---

**SCAN:CIRCular:PERiod** <Period>

Sets the time it takes for the antenna to turn once.

**Parameters:**

<Period> float

Range: 0.006 to 6000

**Example:** See [Chapter 24.7, "Antenna scan commands"](#), on page 451.

**Manual operation:** See ["Circular Scan"](#) on page 195

---

**SCAN:CIRCular:RPM** <Rpm>

**SCAN:HELical:RPM** <Rpm>

Sets the rotation speed of the antenna.

**Parameters:**

<Rpm> float  
Range: 0.01 to 1000  
Default unit: degree/s

**Example:** [Example"Defining antenna scans"](#) on page 451

**Manual operation:** See ["Helical Scan"](#) on page 199

---

**SCAN:CONical:RATE** <Rate>

**SCAN:SECTor:RATE** <Rate>

**SCAN:SIN:RATE** <Rate>

**SCAN:RASTer:RATE** <Rate>

Sets the turning speed.

**Parameters:**

<Rate> float  
Range: 0.01 to 100000  
Default unit: degree/s

**Example:** [Example"Defining antenna scans"](#) on page 451

**Manual operation:** See ["Raster Scan"](#) on page 198

---

**SCAN:HELical:ELEVation:STEP** <Step>

Sets the step width with that the antenna changes its elevation.

**Parameters:**

<Step> float  
Range: 0.01 to 11.25  
Default unit: degree

**Example:** See [Example"Defining antenna scans"](#) on page 451

**Manual operation:** See ["Helical Scan"](#) on page 199

---

**SCAN:HELical:TURNs** <Turns>

Sets the number of turns.

**Parameters:**

<Turns> float  
Range: 1 to 30

**Example:** [Example"Defining antenna scans"](#) on page 451

**Manual operation:** See ["Helical Scan"](#) on page 199

---

**SCAN:LSW:DIRection** <Direction>

Sets the horizontal or vertical switching direction.

**Parameters:**

<Direction>            H | V

**Example:**            [Example"Defining antenna scans"](#) on page 451

**Manual operation:** See "[Lobe Switching Scan](#)" on page 201

---

**SCAN:LSW:DWELI** <Dwell>

Sets the speed with that the antenna switches between the lobes.

**Parameters:**

<Dwell>                float  
Range:                1e-06 to 1

**Example:**            See [Example"Defining antenna scans"](#) on page 451

**Manual operation:** See "[Lobe Switching Scan](#)" on page 201

---

**SCAN:LSW:LOBes** <Lobes>

Set the number of lobes.

**Parameters:**

<Lobes>                2 | 4

**Example:**            [Example"Defining antenna scans"](#) on page 451

**Manual operation:** See "[Lobe Switching Scan](#)" on page 201

---

**SCAN:CONical:SQUint** <Squint>**SCAN:LSW:SQUint** <Squint>

Sets the offset angle of the antenna beam, that means for the conical antenna the parameter sets the radius of the scanned circle.

**Parameters:**

<Squint>                float  
Range:                0.05 to 15  
Default unit: degree

**Example:**            [Example"Defining antenna scans"](#) on page 451

**Manual operation:** See "[Lobe Switching Scan](#)" on page 201

---

**SCAN:RASTer:BARs** <Bars>

Sets the number of scanned bars (sectors).

**Parameters:**

<Bars> float  
Range: 1 to 30

**Example:** [Example"Defining antenna scans"](#) on page 451

**Manual operation:** See ["Raster Scan"](#) on page 198

**SCAN:RASTer:BARTranstime** <Bartranstime>

Transition time between two bars in bidirectional scan mode.

**Parameters:**

<Bartranstime> float  
Range: 0 to 1  
Increment: 1 ms  
Default unit: seconds

**SCAN:RASTer:BARWidth** <Barwidth>

Sets the distance between two consecutive scanned bars (sectors).

**Parameters:**

<Barwidth> float  
Range: 0.1 to 9  
Default unit: m

**Example:** [Example"Defining antenna scans"](#) on page 451

**Manual operation:** See ["Raster Scan"](#) on page 198

**SCAN:RASTer:REWInd** <Rewind>

If enabled, the antenna scans forwards and backwards.

**Parameters:**

<Rewind> ON | OFF | 1 | 0

**Example:** See [Example"Defining antenna scans"](#) on page 451.

**Manual operation:** See ["Raster Scan"](#) on page 198

**SCAN:RASTer:FLYBack** <Flyback>**SCAN:SECTor:FLYBack** <Flyback>

Sets the Flyback time for the antenna working in unidirectional mode.

**Parameters:**

<Flyback> float  
Range: 0 to 1  
Default unit: s

**Example:** [Example"Defining antenna scans"](#) on page 451



**Manual operation:** See ["Sector Scan"](#) on page 197

---

**SCAN:HELical:RETRace** <Retrace>

**SCAN:RASTer:RETRace** <Retrace>

**SCAN:SPIRAl:RETRace** <Retrace>

Sets the speed for the antenna to return to the initial orientation.

**Parameters:**

<Retrace> float  
Range: 0 to 1

**Example:** [Example"Defining antenna scans"](#) on page 451

**Manual operation:** See ["Spiral Scan"](#) on page 200

---

**SCAN:SPIRAl:UNIDirection** <Unidirection>

**SCAN:RASTer:UNIDirection** <Unidirection>

**SCAN:SIN:UNIDirection** <Unidirection>

**SCAN:SECTor:UNIDirection** <Unidirection>

Enables a unidirectional scan mode.

**Parameters:**

<Unidirection> ON | OFF | 1 | 0

**Example:** See [Example"Defining antenna scans"](#) on page 451

**Manual operation:** See ["Sector Scan"](#) on page 197

---

**SCAN:RASTer:WIDTh** <Width>

**SCAN:SECTor:WIDTh** <Width>

Sets the width of the sector to be scanned.

**Parameters:**

<Width> float  
Range: 0.1 to 360  
Default unit: degree

**Example:** [Example"Defining antenna scans"](#) on page 451

**Manual operation:** See ["Sector Scan"](#) on page 197

---

**SCAN:RASTer:DIRection** <Direction>

Sets the scanning direction.

**Parameters:**

<Direction> HORizontal | VERTical

**Manual operation:** See ["Raster Scan"](#) on page 198

see [Example"Defining antenna scans"](#) on page 451

---

**SCAN:SPIRAl:ROUNDs** <Rounds>

Sets the number of rounds the antenna performs.

**Parameters:**

<Rounds> float  
Range: 0.1 to 15

**Example:** [Example"Defining antenna scans"](#) on page 451

**Manual operation:** See "[Spiral Scan](#)" on page 200

---

**SCAN:SPIRAl:RTIME** <Rtime>

Sets the turning speed of the antenna.

**Parameters:**

<Rtime> float  
Range: 0.01 to 100  
Default unit: degree/s

**Example:** [Example"Defining antenna scans"](#) on page 451

**Manual operation:** See "[Spiral Scan](#)" on page 200

---

**SCAN:SPIRAl:STEP** <Step>

Determines the step size to increase the scan radius.

**Parameters:**

<Step> float  
Range: 1 to 11.25  
Default unit: degree

**Example:** [Example"Defining antenna scans"](#) on page 451

**Manual operation:** See "[Spiral Scan](#)" on page 200

---

**SCAN:TYPE** <Type>

Sets the scan type.

**Parameters:**

<Type> CIRCular | SECTor | RASTer | CONical | HELical | SPIRAl |  
LSW | SIN | CUSTom | LISSajous

**Example:** [Example"Defining antenna scans"](#) on page 451

**Manual operation:** See "[Scan Type](#)" on page 194

---

**SCAN:CIRCular:NODDing** <Nodding>

**SCAN:SECTor:NODDing** <Nodding>

Enables superimposing a horizontal nodding on the scan.

**Parameters:**

<Nodding> ON | OFF | 1 | 0

**Example:**

```
SCAN:SECTor:NODDing 1
SCAN:SECTor:NRATe 500
SCAN:SECTor:NELevation 15
```

**Manual operation:** See "[Sector Scan](#)" on page 197

---

**SCAN:CIRCular:NELevation** <Nelevation>

**SCAN:SECTor:NELevation** <Nelevation>

Sets the elevation angle.

**Parameters:**

<Nelevation> float  
Range: 0.01 to 90

**Example:** See [SCAN:SECTor:NODDing](#) on page 459

**Manual operation:** See "[Sector Scan](#)" on page 197

---

**SCAN:CIRCular:NRATe** <Nrate>

**SCAN:SECTor:NRATe** <Nrate>

Sets the elevation rate.

**Parameters:**

<Nrate> float  
Range: 0.01 to 2000

**Example:** See [SCAN:SECTor:NODDing](#) on page 459

**Manual operation:** See "[Sector Scan](#)" on page 197

---

**SCAN:CIRCular:PALMer** <Palmer>

**SCAN:RASTer:PALMer** <Palmer>

**SCAN:SPIRAl:PALMer** <Palmer>

**SCAN:SECTor:PALMer** <Palmer>

Enables superimposing a conical scan on the current scan.

**Parameters:**

<Palmer> ON | OFF | 1 | 0

**Manual operation:** See "[Sector Scan](#)" on page 197

see [Example"Defining antenna scans"](#) on page 451

---

**SCAN:CIRCular:PRATe** <Prate>  
**SCAN:RASTer:PRATe** <Prate>  
**SCAN:SPIRAl:PRATe** <Prate>  
**SCAN:SECTor:PRATe** <Prate>

Sets the scan rate.

**Parameters:**

<Prate> float  
Range: 0.1 to 1000

**Manual operation:** See "[Sector Scan](#)" on page 197

see [Example "Defining antenna scans"](#) on page 451

---

**SCAN:CIRCular:PSQuint** <Psquint>  
**SCAN:RASTer:PSQuint** <Psquint>  
**SCAN:SPIRAl:PSQuint** <Psquint>  
**SCAN:SECTor:PSQuint** <Psquint>

Sets the squint angle.

**Parameters:**

<Psquint> float  
Range: 0.05 to 45

**Manual operation:** See "[Sector Scan](#)" on page 197

see [Example "Defining antenna scans"](#) on page 451

---

**SCAN:CUSTom:IMPort:FILE** <File>

Sets the file to import.

**Parameters:**

<File> string

**Example:** SCAN:CUSTom:IMPort:FILE "D:/PS/scan1.csv"

**Manual operation:** See "[Custom Scan](#)" on page 203

---

**SCAN:CUSTom:IMPort:EXEC**

Starts importings the file.

**Usage:** Event

**Manual operation:** See "[Custom Scan](#)" on page 203

---

**SCAN:CUSTom:ENTRy:AZIMuth** <Azimuth>

Sets the azimuth of the scan position.

**Parameters:**

<Azimuth> float  
Range: -180 to 180

**Example:**

```
SCAN:TYPE CUSTOM
SCAN:CUSTom:ENTRy:ADD
SCAN:CUSTom:ENTRy:COUNT?
// 4
SCAN:CUSTom:ENTRy:SElect 1
SCAN:CUSTom:ENTRy:AZimuth 90
SCAN:CUSTom:ENTRy:ELeVation 25
SCAN:CUSTom:ENTRy:DWELL 10
SCAN:CUSTom:ENTRy:JUMPType JUMP
SCAN:CUSTom:ENTRy:SElect 2
SCAN:CUSTom:ENTRy:AZimuth -120
SCAN:CUSTom:ENTRy:ELeVation 5
SCAN:CUSTom:ENTRy:DWELL 25
SCAN:CUSTom:ENTRy:JUMPType MOVE
SCAN:CUSTom:ENTRy:TRANStime 40
...
```

**Manual operation:** See ["Custom Scan"](#) on page 203

**SCAN:CUSTom:ENTRy:ELeVation** <Elevation>

Sets the elevation of the scan position.

**Parameters:**

<Elevation> float  
Range: -90 to 90

**Example:** See [SCAN:CUSTom:ENTRy:AZIMuth](#) on page 460

**Manual operation:** See ["Custom Scan"](#) on page 203

**SCAN:CUSTom:ENTRy:DWELL** <Dwell>

Sets how long the scan stays in a position.

**Parameters:**

<Dwell> float  
Range: 0 to 3600

**Example:** See [SCAN:CUSTom:ENTRy:AZIMuth](#) on page 460

**Manual operation:** See ["Custom Scan"](#) on page 203

**SCAN:CUSTom:ENTRy:JUMPType** <Jumptype>

Defines how to move to the next position, either with a jump or with a transition.

For transitions, you need to define a transition time.

**Parameters:**

<Jumptype> ON | OFF | 1 | 0  
**ON | 1**  
 Jump enabled.  
**OFF | 0**  
 Transition enabled.

**Example:** See [SCAN:CUSTom:ENTRy:AZIMuth](#) on page 460

**Manual operation:** See "[Custom Scan](#)" on page 203

**SCAN:CUSTom:ENTRy:TRANstime** <Transtime>

Sets the time for the transition between two positions.

**Parameters:**

<Transtime> float  
 Range: 0 to 3600

**Example:** See [SCAN:CUSTom:ENTRy:AZIMuth](#) on page 460

**Manual operation:** See "[Custom Scan](#)" on page 203

**SCAN:LISSajous:AMPX** <Ampx>

**SCAN:LISSajous:AMPZ** <Ampz>

Sets the magnitudes of two harmonic vibrations.

**Parameters:**

<Ampz> float  
 Range: 0.01 to 45

**Example:**

```
SCAN:LISSajous:AMPX 45
SCAN:LISSajous:AMPZ 30
SCAN:LISSajous:FREQ 10
SCAN:LISSajous:XFACTOR 9
SCAN:LISSajous:ZFACTOR 3
SCAN:LISSajous:PHIX 15
SCAN:LISSajous:PHIZ 30
```

**Manual operation:** See "[Lissajous](#)" on page 205

**SCAN:LISSajous:FREQ** <Freq>

Sets the base frequency.

**Parameters:**

<Freq> float  
 Range: 0.01 to 1000

**Example:** See [SCAN:LISSajous:AMPZ](#) on page 462

**Manual operation:** See ["Lissajous"](#) on page 205

**SCAN:LISSajous:PHIX** <Phix>

**SCAN:LISSajous:PHIZ** <Phiz>

Sets the phases of the two harmonic vibrations.

**Parameters:**

<Phiz> float  
Range: 0 to 360

**Example:** See [SCAN:LISSajous:AMPZ](#) on page 462

**Manual operation:** See ["Lissajous"](#) on page 205

**SCAN:LISSajous:XFACTOR** <Xfactor>

**SCAN:LISSajous:ZFACTOR** <Zfactor>

Sets the ratio between the two angular frequencies.

**Parameters:**

<Zfactor> float  
Range: 1 to 10

**Example:** See [SCAN:LISSajous:AMPZ](#) on page 462

**Manual operation:** See ["Lissajous"](#) on page 205

**SCAN:SIN:WIDTH** <Width>

Sets the angle on the XY plane between the origin and the end of the scan.

**Parameters:**

<Width> float  
Range: 1 to 180

**Example:**

```
SCAN:TYPE SIN
SCAN:SIN:WIDTH 90
SCAN:SIN:HEIGHT 30
SCAN:SIN:RATE 100
SCAN:SIN:ROTation CW
SCAN:SIN:UNIDirection 0
SCAN:SIN:INVersion 0
```

**Manual operation:** See ["Sine Scan"](#) on page 202

**SCAN:SIN:HEIGHT** <Height>

Sets the amplitude of the sine wave.

**Parameters:**

<Height> float  
Range: 1 to 90

**Example:** See [SCAN:SIN:WIDTH](#) on page 463

**Manual operation:** See "[Sine Scan](#)" on page 202

---

**SCAN:SIN:INVersion** <Inversion>

Sets whether the upper or the down (mirrored) sine wave is used first.

**Parameters:**

<Inversion> ON | OFF | 1 | 0  
**OFF**  
Upper sine first  
**ON**  
Down sine first

**Example:** See [SCAN:SIN:WIDTH](#) on page 463

**Manual operation:** See "[Sine Scan](#)" on page 202

---

**SCAN:STEering** <Steering>

Defines whether electronic steering is used.

Electronic steering is only available for scan types that use phased array antennas.

**Parameters:**

<Steering> ON | OFF | 1 | 0

**Example:** SCAN:STEering ON

**Manual operation:** See "[Electronic Scan](#)" on page 195



## 24.8 Signal mapping commands

### Example: Performing signal to destination mapping in 2D scenario

```
ASSignment:DESTination:LIST?
// "Destination 1"
ASSignment:Destination:SElect "Destination 1"

ASSignment:Destination:PATH:LIST?
// "Plugin 1"
ASSignment:Destination:PATH:SElect "Plugin 1"

ASSignment:EMITters:SElect "Bkg. Emitter 1"
ASSignment:Destination:PATH:EMITter:ADD
ASSignment:Destination:PATH:EMITter:LIST?
// "Bkg. Emitter 1"
ASSignment:EMITters:LIST?
// "I1"
```

### Example: Receiver signals to destination mapping in direction finding scenario

```
ASSignment:DESTination:LIST
// "Destination 1"
ASSignment:DESTination:SElect "Destination 1"
ASSignment:DESTination:PATH:LIST?
// "Plugin 1"
ASSignment:DESTination:PATH:SElect "Plugin 1"
ASSignment:ANTennas:SElect "Antenna 4 - TestEmitter"
ASSignment:DESTination:PATH:ANTenna:ADD
ASSignment:DESTination:PATH:ANTenna:LIST?
// "Antenna 4 - TestEmitter"
ASSignment:DESTination:PATH:ANTenna:SElect "Antenna 4 - TestEmitter"
ASSignment:DESTination:PATH:ANTenna:DElete
ASSignment:DESTination:PATH:ANTenna:LIST?
// ""
```

ASSignment:EMITters:LIST?.....	465
ASSignment:ANTennas:LIST?.....	466
ASSignment:DESTination:LIST?.....	466
ASSignment:DESTination:PATH:LIST?.....	466
ASSignment:DESTination:PATH:ANTenna:LIST?.....	467
ASSignment:DESTination:PATH:EMITter:LIST?.....	467
ASSignment:GROup:LIST?.....	467
ASSignment:GROup:SElect.....	467

---

### ASSignment:EMITters:LIST?

Queries the alias names of the unassigned emitters.

**Return values:**

<List> "<Emitter/Inter#1>","<Emitter/Inter#2>","...

**Example:**

See [Example"Performing signal to destination mapping in 2D scenario"](#) on page 465

**Usage:**

Query only

**Manual operation:**

See ["Emitters"](#) on page 352

**ASSignment:ANTennas:LIST?**

Queries the alias names of the unassigned receiver signals.

**Return values:**

<List> "<ReceiverSignal#1>","<ReceiverSignal#2>","...

**Example:**

See [Example"Receiver signals to destination mapping in direction finding scenario"](#) on page 465.

**Usage:**

Query only

**Manual operation:**

See ["Receiver Signals"](#) on page 353

**ASSignment:DESTination:LIST?**

Queries a list of the available destinations.

**Return values:**

<List> "<GenName#1>","<GenName2>","...

**Example:**

See [Example"Performing signal to destination mapping in 2D scenario"](#) on page 465

**Usage:**

Query only

**Manual operation:**

See ["Available for Assignment"](#) on page 354

**ASSignment:DESTination:PATH:LIST?**

Queries the available paths.

**Return values:**

<List> "<Path#1>","<Path#2>","...

List of available paths.

**Example:**

See [Example"Performing signal to destination mapping in 2D scenario"](#) on page 465

**Usage:**

Query only

**Manual operation:**

See ["Available for Assignment"](#) on page 354

---

**ASSignment:DESTination:PATH:ANTenna:LIST?**

Queries the list of assigned receiver signals to the selected plugin.

**Return values:**

<List> "<ReceiverSignal#1>",<ReceiverSignal#2>",...

**Example:** See [Example "Receiver signals to destination mapping in direction finding scenario"](#) on page 465.

**Usage:** Query only

**Manual operation:** See ["Available for Assignment"](#) on page 354

---

**ASSignment:DESTination:PATH:EMITter:LIST?**

Queries the list of assigned emitters to the selected path.

**Return values:**

<List> "<Emitter/Inter#1>",<Emitter/Inter#2>",...

**Example:** See [Example "Performing signal to destination mapping in 2D scenario"](#) on page 465.

**Usage:** Query only

**Manual operation:** See ["Available for Assignment"](#) on page 354

---

**ASSignment:GROup:LIST?**

If interleaving groups are defined, queries the alias names of the unassigned interleaving groups.

**Return values:**

<List> string

**Example:** See [ASSignment:GROup:SElect](#) on page 467.

**Usage:** Query only

**Manual operation:** See ["Interleaving Groups"](#) on page 353

---

**ASSignment:GROup:SElect <Select>**

Assigns the selected group to the plugin and path selected with the commands [ASSignment:DESTination:SElect](#) on page 431 and [ASSignment:DESTination:PATH:SElect](#) on page 431.

**Parameters:**

<Select> string

**Example:**

```

ASSignment:DESTintation:LIST?
// "Destination 1"
ASSignment:DESTintation:SElect "Destination 1"
ASSignment:DESTintation:PATH:LIST?
// "RF A"
ASSignment:DESTintation:PATH:SElect "Plugin 1"
ASSignment:GRoup:LIST?
// "Default","Group 2"
ASSignment:GRoup:SElect "Default"

```

**Manual operation:** See ["Interleaving Groups"](#) on page 353

## 24.9 Emitter commands

### Example: Creating emitters

```

EMITter:CREate "My_EmitterGuidance"
EMITter:COMMENT "guidance&surveillance"
EMITter:EIRP 120
EMITter:FREQuency 3e+09
EMITter:MODE:ADD
EMITter:MODE:SElect 1
EMITter:MODE:NAME "Guidance"
ANTenna:CATalog?
// "Isotropic","My_PencilBeam","Test CSC","My_PlanarAntenna","Test","Custom"
EMITter:MODE:ANTenna "My_PencilBeam"
SCAN:CATalog?
// "Test Antenna Scan","My_RasterScan"
EMITter:MODE:SCAN "My_RasterScan"
EMITter:MODE:BEAM:ADD
EMITter:MODE:BEAM:SElect 1
EMITter:MODE:BEAM:STATE 1
SEQuence:CATalog?
// "Test Sequence","My_S2_S1-F1_S1-F2","PT"
EMITter:MODE:BEAM:SEQuence "My_S2_S1-F1_S1-F2"
EMITter:MODE:BEAM:OFFSet:FREQuency 0
EMITter:MODE:BEAM:OFFSet:ELEVation 0
EMITter:MODE:BEAM:OFFSet:AZIMuth 0

```

<a href="#">EMITter:EIRP</a> .....	469
<a href="#">EMITter:FREQuency</a> .....	469
<a href="#">EMITter:MODE:ANTenna</a> .....	469
<a href="#">EMITter:MODE:BEAM:OFFSet:AZIMuth</a> .....	469
<a href="#">EMITter:MODE:BEAM:OFFSet:ELEVation</a> .....	470
<a href="#">EMITter:MODE:BEAM:OFFSet:FREQuency</a> .....	470
<a href="#">EMITter:MODE:BEAM:SEQuence</a> .....	470

<a href="#">EMITter:MODE:BEAM:STATe.....</a>	470
<a href="#">EMITter:MODE:SCAN.....</a>	470
<a href="#">EMITter:MODE:ID.....</a>	471

---

#### **EMITter:EIRP** <Eirp>

Sets the EIRP of the emitter.

##### **Parameters:**

<Eirp> float  
 Range: -100 to 200  
 Default unit: dBW

**Example:** See [Example"Creating emitters"](#) on page 468

**Manual operation:** See ["EIRP"](#) on page 221

---

#### **EMITter:FREQUency** <Frequency>

Sets the operating frequency.

##### **Parameters:**

<Frequency> float  
 Range: 1000 to 1e+11  
 Default unit: Hz

**Example:** [Example"Creating emitters"](#) on page 468

**Manual operation:** See ["Frequency"](#) on page 221

---

#### **EMITter:MODE:ANTenna** <Antenna>

Assigns an existing antenna pattern, see [ANTenna : CATAlog?](#).

##### **Parameters:**

<Antenna> string

**Example:** [Example"Creating emitters"](#) on page 468

**Manual operation:** See ["Emitter Modes"](#) on page 221

---

#### **EMITter:MODE:BEAM:OFFSet:AZIMuth** <Azimuth>

Sets the Azimuth value for the beam offset.

##### **Parameters:**

<Azimuth> float  
 Range: 0 to 360

**Example:** [Example"Creating emitters"](#) on page 468

**Manual operation:** See ["Emitter Beams Definition"](#) on page 222

---

**EMITter:MODE:BEAM:OFFSet:ELEVation** <Elevation>

Offsets the position of the beam in both the azimuth or elevation.

**Parameters:**

<Elevation> float  
Range: -90 to 90

**Example:** [Example"Creating emitters"](#) on page 468

**Manual operation:** See ["Emitter Beams Definition"](#) on page 222

---

**EMITter:MODE:BEAM:OFFSet:FREQuency** <Frequency>

Offsets the frequency of the beam.

**Parameters:**

<Frequency> float  
Range: -1e+09 to 1e+09

**Example:** [Example"Creating emitters"](#) on page 468

**Manual operation:** See ["Emitter Beams Definition"](#) on page 222

---

**EMITter:MODE:BEAM:SEQuence** <Sequence>

Assigns a pulse sequence, see [SEQUence:CREate](#).

**Parameters:**

<Sequence> string

**Example:** [Example"Creating emitters"](#) on page 468

**Manual operation:** See ["Emitter Beams Definition"](#) on page 222

---

**EMITter:MODE:BEAM:STATe** <State>

Activates a beam.

**Parameters:**

<State> ON | OFF | 1 | 0

**Example:** [Example"Creating emitters"](#) on page 468

**Manual operation:** See ["Emitter Beams Definition"](#) on page 222

---

**EMITter:MODE:SCAN** <Scan>

Assigns an antenna scan, see [SCAN:CREate](#).

**Parameters:**

<Scan> string

**Example:** [Example"Creating emitters"](#) on page 468

**Manual operation:** See ["Emitter Modes"](#) on page 221

---

**EMITter:MODE:ID** <Id>

**Parameters:**

<Id> float  
Range: 1 to 65536

**Manual operation:** See ["ID"](#) on page 222

## 24.10 Destination commands

### Example: Creating destinations

```
SCPI
SCENario:STOP
DESTination:COUNT?
// 4
DESTination:ADD "Destination 5"
DESTination:NAME "Destination 5"
DESTination:SElect 5
DESTination:PLUGin:NAME "Plugin 2"
PLUGin:COMMENT "PDW export_plugin"
PLUGin:LOAD "C:/Users/R&S/Pulse Sequencer SW/SDK_x64/Export_Excel/bin/Export-PDW.dll"
DESTination:PLUGin:VARiable:SElect:ID 1
DESTination:PLUGin:VARiable:VALue "pdw_out.csv"
DESTination:PLUGin:VARiable:SElect:ID 2
DESTination:PLUGin:VARiable:SElect "Header"
DESTination:PLUGin:VARiable:VALue "1"
DESTination:COUNT?
// 5
DESTination:SElect 3
DESTination:DElete 3
```

<a href="#">DESTination:COUNT?</a> .....	471
<a href="#">DESTination:ADD</a> .....	472
<a href="#">DESTination:PLUGin:NAME</a> .....	472
<a href="#">DESTination:CLEar</a> .....	472
<a href="#">DESTination:DElete</a> .....	472

---

### DESTination:COUNT?

Queries the number of available destinations.

**Return values:**

<Count> integer

**Example:** See [Example"Creating destinations"](#) on page 471

**Usage:** Query only

---

**DESTination:ADD** <Add>

Adds a destination to the list.

**Setting parameters:**

<Add> string

**Example:** See [Example"Creating destinations"](#) on page 471

**Usage:** Setting only

**Manual operation:** See ["Add, delete, delete all"](#) on page 58

---

**DESTination:PLUGin:NAME** <Name>

Sets the name of the export plug-in.

**Parameters:**

<Name> string

**Example:** See [Example"Creating destinations"](#) on page 471

**Manual operation:** See ["Plugin"](#) on page 59

---

**DESTination:CLEar**

Deletes all destinations from the current list.

**Example:** See [Example"Creating destinations"](#) on page 471

**Usage:** Event

**Manual operation:** See ["Add, delete, delete all"](#) on page 58

---

**DESTination:DELeTe** <Delete>

Deletes the selected destination from the list.

**Setting parameters:**

<Delete> float

**Example:** See [Example"Creating destinations"](#) on page 471

**Usage:** Setting only

**Manual operation:** See ["Add, delete, delete all"](#) on page 58



## 24.11 Inter-pulse modulation commands

### Example: Using list and waveform type IPM profiles

```

SCPI
IPM:CREate "My_PRI-Stagger"
IPM:COMment "List: 600 us, 750 us, 910 us"
IPM:UNIT SEConds
IPM:TYPE LIST
IPM:LIST:ITEM:ADD
IPM:LIST:ITEM:SElect 1
IPM:LIST:ITEM:BASE PULSe
IPM:LIST:ITEM:VALue 0.0006
IPM:LIST:ITEM:REPetitions 1
IPM:LIST:ITEM:COUNT 1
IPM:LIST:ITEM:ADD
IPM:LIST:ITEM:SElect 2
IPM:LIST:ITEM:VALue 0.00075
IPM:LIST:ITEM:COUNT 2
...
IPM:LIST:SAVE "C:\_PS_files\IPM_PRI_Stagger.txt"
IPM:LIST:CLEar
// load an existing ASCII file
IPM:LIST:LOAD "C:\_PS_files\IPM_PRList.txt"

IPM:CREate "Stagger PRI"
IPM:UNIT SEConds
IPM:TYPE WAVeform
IPM:WAVeform:TYPE SINE
IPM:WAVeform:OFFSet 0.0004
IPM:WAVeform:PHASe 0
IPM:WAVeform:PKPK 0.00014
IPM:WAVeform:BASE PULSe
IPM:WAVeform:COUNT 30

```

### Example: Assigning an IPM profile to a sequence

```

SCPI
SEquence:SElect "Test Sequence"
SEquence:ITEM:SElect 1
SEquence:ITEM:IPM:ADD
SEquence:ITEM:IPM:SOURce:TYPE PROFile
SEquence:ITEM:IPM:SOURce "My_PRI-Stagger"
SEquence:ITEM:IPM:TARGet:TYPE PARAmeter
SEquence:ITEM:IPM:TARGet:PARAmeter PRI
SEquence:ITEM:IPM:EQUation "0.5*x+1"
SEquence:ITEM:IPM:MODE INDividual
SEquence:ITEM:IPM:REStArt 0
SEquence:ITEM:IPM:RANDom:RESet 0

```

**Example: Using the step IPM profile**

```
SCPI
IPM:CREate "FHOP"
IPM:COMment "Frequency Hops"
IPM:UNIT HERTz
IPM:TYPE STEPs
IPM:STEP:START 0
IPM:STEP:INCRement 1e+06
IPM:STEP:STEPs 5
IPM:STEP:BASE LENGth
IPM:STEP:BURSt 2
```

**Example: Using PRI profiles of random type**

```
SCPI
IPM:CREate "My_PRI-Jitter"
IPM:UNIT SEConds
IPM:TYPE RANDom
IPM:RANDom:DISTRibution UNIFORM
IPM:RANDom:UNIFORM:MINimum 0.0011
IPM:RANDom:UNIFORM:MAXimum 0.00115
IPM:RANDom:UNIFORM:STEP 2.5e-06
DIALog:IPMPlot:VIEW TIMeseries
DIALog:IPMPlot:SAMPles 30

IPM:CREate "Test"
IPM:UNIT SEConds
IPM:TYPE RSTep
IPM:RSTep:MINimum 0.0005
IPM:RSTep:MAXimum 0.005
IPM:RSTep:STEP:MINimum 0.0001
IPM:RSTep:STEP:MAXimum 0.0005
IPM:RSTep:PERiod 10

IPM:CREate "Test2"
IPM:UNIT HERTz
IPM:TYPE RLISt
// create a List (see the "My_PRI-Stagger" example)
IPM:RLISt:BASE LENGth
IPM:RLISt:BURSt 3
IPM:RLISt:REUSE 0
```

**Example: Using the interpolated shape IPM profile**

```

SCPI
IPM:CREate "Custom IPM"
IPM:UNIT DB
IPM:TYPE SHAPE
// create a List (see the "My_PRI-Stagger" example)
IPM:SHAPE:BASE PULSE
IPM:SHAPE:COUNT 10
// IPM:SHAPE:BASE TIME
// IPM:SHAPE:PERIOD 0.5
IPM:SHAPE:INTERPOL NONE

```

SEQUENCE:ITEM:IPM:SOURCE:TYPE.....	476
SEQUENCE:ITEM:IPM:SOURCE.....	476
SEQUENCE:ITEM:IPM:SOURCE:VARIABLE.....	476
SEQUENCE:ITEM:IPM:TARGET:TYPE.....	477
SEQUENCE:ITEM:IPM:TARGET:PARAMETER.....	477
SEQUENCE:ITEM:IPM:TARGET:VARIABLE.....	477
SEQUENCE:ITEM:IPM:EQUATION.....	477
SEQUENCE:ITEM:IPM:MODE.....	477
SEQUENCE:ITEM:IPM:RESTART.....	478
SEQUENCE:ITEM:IPM:RANDOM:RESET.....	478
IPM:TYPE.....	478
IPM:UNIT.....	478
IPM:EQUATION.....	478
IPM:LIST:BASE.....	479
IPM:LIST:ITEM:VALUE.....	479
IPM:LIST:ITEM:REPETITION.....	479
IPM:LIST:ITEM:TIME.....	479
IPM:LIST:FIRING:ENABLE.....	480
IPM:LIST:FIRING:SEQUENCE.....	480
IPM:LIST:LOAD.....	480
IPM:LIST:SAVE.....	480
IPM:RANDOM:ISTRIBUTION.....	481
IPM:RANDOM:NORMAL:LIMIT.....	481
IPM:RANDOM:NORMAL:MEAN.....	481
IPM:RANDOM:NORMAL:STD.....	481
IPM:RANDOM:U:CENTER.....	482
IPM:RANDOM:U:RANGE.....	482
IPM:RANDOM:UNIFORM:MINIMUM.....	482
IPM:RANDOM:UNIFORM:MAXIMUM.....	482
IPM:RANDOM:UNIFORM:STEP.....	482
IPM:RLIST:BASE.....	483
IPM:RLIST:BURST.....	483
IPM:RLIST:PERIOD.....	483
IPM:RLIST:REUSE.....	483
IPM:SHAPE:BASE.....	484
IPM:SHAPE:COUNT.....	484
IPM:SHAPE:INTERPOL.....	484
IPM:SHAPE:PERIOD.....	484

IPM:STEP:BASE.....	484
IPM:STEP:BURSt.....	485
IPM:STEP:PERiod.....	485
IPM:STEP:INCRement.....	485
IPM:STEP:STARt.....	485
IPM:STEP:STEPs.....	486
IPM:RSTep:MINimum.....	486
IPM:RSTep:MAXimum.....	486
IPM:RSTep:STEP:MINimum.....	486
IPM:RSTep:STEP:MAXimum.....	486
IPM:RSTep:PERiod.....	486
IPM:WAVeform:TYPE.....	487
IPM:WAVeform:BASE.....	487
IPM:WAVeform:COUNT.....	487
IPM:WAVeform:OFFSet.....	487
IPM:WAVeform:PHASe.....	487
IPM:WAVeform:PERiod.....	488
IPM:WAVeform:PKPK.....	488
IPM:BINomial:VAL1.....	488
IPM:BINomial:VAL2.....	488
IPM:BINomial:PVAL1.....	489
DIALog:IPMPlot:VIEW.....	489
DIALog:IPMPlot:SAMPles.....	489

---

**Sequence:ITEM:IPM:SOURce:TYPE** <Type>

Sets whether the variation is defined as a profile or as a variable.

**Parameters:**

<Type>                    PROFile | VARiable

**Example:**                See [Example"Assigning an IPM profile to a sequence"](#)  
on page 473

**Manual operation:**    See ["Source"](#) on page 158

---

**Sequence:ITEM:IPM:SOURce** <Source>

Selects the profile source.

Use the command `IPM:CATalog?` to query the existing profiles.

**Parameters:**

<Source>                    string

**Example:**                See [Assigning an IPM profile to a sequence](#)

**Manual operation:**    See ["Source"](#) on page 158

---

**Sequence:ITEM:IPM:SOURce:VARiable** <Variable>

Sets the variable that defines the variation.

**Parameters:**

<Variable> string

**Manual operation:** See ["Source"](#) on page 158

---

**SEQUENCE:ITEM:IPM:TARGET:TYPE** <Type>

Sets whether the profile is assigned to a parameter or to a variable.

**Parameters:**

<Type> PARAMeter | VARIable

**Example:** See [Assigning an IPM profile to a sequence](#)

**Manual operation:** See ["Target"](#) on page 158

---

**SEQUENCE:ITEM:IPM:TARGET:PARAMETER** <Parameter>

Sets the pulse parameter to that the IPM variation is assigned.

**Parameters:**

<Parameter> LEVel | RLEVel | SRATe | FREQuency | PRI | WIDTh | FALL | AMFREquency | FMDEviation | DELay | FSKDEviation | PRF | FMFREquency | CDEViation | PHASe | RISE | AMDepth

**Example:** See [Assigning an IPM profile to a sequence](#)

**Manual operation:** See ["Target"](#) on page 158

---

**SEQUENCE:ITEM:IPM:TARGET:VARIABLE** <Variable>

Sets the variable to that the variation is assigned.

**Parameters:**

<Variable> string

**Manual operation:** See ["Target"](#) on page 158

---

**SEQUENCE:ITEM:IPM:EQUATION** <Equation>

Defines output value of the IPM mathematically.

**Parameters:**

<Equation> string

**Example:** See [Assigning an IPM profile to a sequence](#)

**Manual operation:** See ["Transformation f\(x\)"](#) on page 159

---

**SEQUENCE:ITEM:IPM:MODE** <Mode>

Defines the way the variations are applied on repeating pulses.

**Parameters:**

<Mode>                    INDividual | SAME

**Example:**

See [Assigning an IPM profile to a sequence](#)

**Manual operation:**

See "[Repetition](#)" on page 159

---

**SEQUENCE:ITEM:IPM:REStart** <Restart>

Restarts the IPM for this sequence line item.

**Parameters:**

<Restart>                ON | OFF | 1 | 0

**Example:**

See [Assigning an IPM profile to a sequence](#)

**Manual operation:**

See "[Restart](#)" on page 159

---

**SEQUENCE:ITEM:IPM:RANDom:RESet** <Reset>

Resets the start seed of random generator.

**Parameters:**

<Reset>                 ON | OFF | 1 | 0

**Example:**

See [Assigning an IPM profile to a sequence](#)

**Manual operation:**

See "[Restart](#)" on page 159

---

**IPM:TYPE** <Type>

Sets the shape of the profile.

**Parameters:**

<Type>                    STEPs | WAVeform | RLISt | LISt | SHAPe | RANDom |  
EQUation | PLUGIn | RSTep | BINomial

**Example:**

See [Using list and waveform type IPM profiles](#)

**Manual operation:**

See "[Profile](#)" on page 143

---

**IPM:UNIT** <Unit>

Sets the units of the profile.

**Parameters:**

<Unit>                    NONE | SEConds | HERTz | DB | DEGRees | PERCent

**Example:**

See [Using list and waveform type IPM profiles](#)

**Manual operation:**

See "[Unit of Affected Parameter](#)" on page 143

---

**IPM:EQUation** <Equation>

Defines the IPM shape as a function.

**Parameters:**

<Equation> string

**Example:** IPM:EQUation "(i<10) ? 5 : (i\*0.5)"

**Manual operation:** See ["Equation"](#) on page 149

---

**IPM:LIST:BASE <Base>**

Sets the IPM profile base and defines how the steps repetition is defined.

**Parameters:**

<Base> PULSe | TIME

**PULSe**

Steps are repeated several times, as set with the command [IPM:LIST:ITEM:REPetition](#).

**TIME**

Steps are repeated for the defined time duration, as set with the command [IPM:LIST:ITEM:TIME](#).

**Example:** See [Using list and waveform type IPM profiles](#)

**Manual operation:** See ["List"](#) on page 145

---

**IPM:LIST:ITEM:VALue <Value>**

Sets the value of the selected list item.

**Parameters:**

<Value> float

Range: -1e+11 to 1e+11

**Example:** See [Example"Using list and waveform type IPM profiles"](#) on page 473

**Manual operation:** See ["List"](#) on page 145

---

**IPM:LIST:ITEM:REPetition <Repetition>**

Sets the number of times a list item is repeated.

**Parameters:**

<Repetition> float

Range: 1 to 1e+09

**Example:** See [Using list and waveform type IPM profiles](#)

**Manual operation:** See ["List"](#) on page 145

---

**IPM:LIST:ITEM:TIME <Time>**

Sets how long a list item is repeated.

**Parameters:**

<Time> float  
Range: 0 to 1e+09

**Example:**

```
IPM:TYPE LIST
IPM:LIST:ITEM:SElect 3
IPM:LIST:ITEM:BASE TIME
IPM:LIST:ITEM:VALue 0.0006
IPM:LIST:ITEM:TIME 0.1
```

**Manual operation:** See ["List"](#) on page 145

**IPM:LIST:FIRing:ENABLE** <Enable>

Enables using firing order for list-based IPM profiles.

**Parameters:**

<Enable> ON | OFF | 1 | 0

**Example:** See [IPM:LIST:FIRing:SEquence](#) on page 480.

**Manual operation:** See ["List"](#) on page 145

**IPM:LIST:FIRing:SEquence** <Sequence>

Sets the firing order sequence.

**Parameters:**

<Sequence> string

**Example:**

```
IPM:LIST:FIRing:ENABle 1
IPM:LIST:FIRing:SEquence "1x1,2x2,3x3,4x4"
```

**Manual operation:** See ["List"](#) on page 145

**IPM:LIST:LOAD** <Load>

Loads an IPM profile form an ASCII file.

**Parameters:**

<Load> string  
File path, file name, and file extension

**Example:** See [Using list and waveform type IPM profiles](#)

**Manual operation:** See ["Edit List"](#) on page 155

**IPM:LIST:SAVE** <Save>

Stores the IPM profile as a file.



**Parameters:**

<Save> string  
File path incl. file name and extension.

**Example:** See [Using list and waveform type IPM profiles](#)

**Manual operation:** See ["Edit List"](#) on page 155

**IPM:RANDom:DISTRibution** <Distribution>

Sets the distribution function.

**Parameters:**

<Distribution> UNIFORM | NORMAL | U

**Example:** See [Example"Using PRI profiles of random type"](#) on page 474

**Manual operation:** See ["Random"](#) on page 152

**IPM:RANDom:NORMal:LIMit** <Limit>

Sets the limit parameter of the normal distribution function.

**Parameters:**

<Limit> float  
Range: -1e+09 to 1e+09

**Example:** See [IPM:RANDom:NORMal:MEAN](#) on page 481

**Manual operation:** See ["Random"](#) on page 152

**IPM:RANDom:NORMal:MEAN** <Mean>

Sets the mean parameter of the normal distribution function.

**Parameters:**

<Mean> float  
Range: -1e+09 to 1e+09

**Example:**

```
IPM:RANDom:DISTRibution NORMal
IPM:RANDom:NORMal:MEAN 0
IPM:RANDom:NORMal:STD 1
IPM:RANDom:NORMal:LIMit 3
```

**Manual operation:** See ["Random"](#) on page 152

**IPM:RANDom:NORMal:STD** <Std>

Sets the standard deviation parameter of the normal distribution function.

**Parameters:**

<Std> float  
Range: 1e-09 to 1e+06

**Example:** See [IPM:RANDom:NORMa1:MEAN](#) on page 481

**Manual operation:** See ["Random"](#) on page 152

#### **IPM:RANDom:U:CENTer** <Center>

Sets the center parameter of the U distribution.

**Parameters:**

<Center> float  
Range: -1e+09 to 1e+09

**Manual operation:** See ["Random"](#) on page 152

#### **IPM:RANDom:U:RANGe** <Range>

Sets the range parameter of the U distribution.

**Parameters:**

<Range> float  
Range: 1e-09 to 1e+09

**Manual operation:** See ["Random"](#) on page 152

#### **IPM:RANDom:UNIForm:MINimum** <Minimum>

#### **IPM:RANDom:UNIForm:MAXimum** <Maximum>

Sets the range of the uniform distribution function.

**Parameters:**

<Maximum> float  
Range: -1e+09 to 1e+09

**Example:** See [Example"Using PRI profiles of random type"](#) on page 474

**Manual operation:** See ["Random"](#) on page 152

#### **IPM:RANDom:UNIForm:STEP** <Step>

Sets the granularity of the uniform distribution function.

**Parameters:**

<Step> float  
Range: 1e-09 to 1e+09

**Example:** See [Example"Using PRI profiles of random type"](#) on page 474

**Manual operation:** See ["Random"](#) on page 152

---

**IPM:RLIST:BASE** <Base>

Sets the IPM profile base and defines how the increments repetition is defined.

**Parameters:**

<Base>                   LENGTH | TIME

**LENGTH**

Increments are repeated several times, as set with the command `IPM:RLIST:BURSt`.

**TIME**

Increments are repeated for the defined time duration, as set with the command `IPM:RLIST:PERiod`.

**Example:**                See [Example"Using PRI profiles of random type"](#) on page 474.

**Manual operation:**    See ["Random List"](#) on page 150

---

**IPM:RLIST:BURSt** <Burst>

Defines how many times an increment is repeated.

**Parameters:**

<Burst>                   float  
Range:            1 to 8192

**Example:**                See [Example"Using PRI profiles of random type"](#) on page 474.

**Manual operation:**    See ["Random List"](#) on page 150

---

**IPM:RLIST:PERiod** <Period>

Sets how long an increment is repeated.

**Parameters:**

<Period>                   float  
Range:            1e-09 to 1e+09

**Example:**

```
IPM:RLIST:BASE TIME
IPM:RLIST:PERiod 0.01
```

**Manual operation:**    See ["Random List"](#) on page 150

---

**IPM:RLIST:REUSe** <Reuse>

If disabled, each value is used only once.

**Parameters:**

<Reuse>                   ON | OFF | 1 | 0

**Example:**

```
IPM:RLIST:REUSe 0
```

**Manual operation:**    See ["Random List"](#) on page 150

---

---

**IPM:SHAPE:BASE** <Base>

Defines the way the list items are processed.

**Parameters:**

<Base> PULSe | TIME

**Example:** See [Using the interpolated shape IPM profile](#)

**Manual operation:** See ["Interpolated Shape"](#) on page 148

---

**IPM:SHAPE:COUNT** <Count>

Sets the number of pulses for that the data from the list is used.

**Parameters:**

<Count> integer  
Range: 1 to 1e+09

**Example:** See [Using the interpolated shape IPM profile](#)

**Manual operation:** See ["Interpolated Shape"](#) on page 148

---

**IPM:SHAPE:INTERPOL** <Interpol>

Enables a linear transition between the increments.

**Parameters:**

<Interpol> LINear | NONE

**Example:** See [Using the interpolated shape IPM profile](#)

**Manual operation:** See ["Interpolated Shape"](#) on page 148

---

**IPM:SHAPE:PERIOD** <Period>

Sets the period of time over that the list items are equally distributed.

**Parameters:**

<Period> float  
Range: 1e-09 to 1e+09

**Example:** See [Using the interpolated shape IPM profile](#)

**Manual operation:** See ["Interpolated Shape"](#) on page 148

---

**IPM:STEP:BASE** <Base>

Sets the IPM profile base and defines how the increments repetition is defined.

**Parameters:**

<Base> LENGth | TIME

**LENGTH**

Steps are repeated several times, as set with the command `IPM:STEP:BURSt`.

**TIME**

Steps are repeated for the defined time duration, as set with the command `IPM:STEP:PERiod`.

**Example:** See [Example"Using the step IPM profile"](#) on page 474

**Manual operation:** See ["Steps"](#) on page 144

**IPM:STEP:BURSt <Burst>**

Sets the number of times an increment is repeated.

**Parameters:**

<Burst> float  
Range: 1 to 1000

**Example:** See [Example"Using the step IPM profile"](#) on page 474

**Manual operation:** See ["Steps"](#) on page 144

**IPM:STEP:PERiod <Period>**

Sets how long an increment is repeated.

**Parameters:**

<Period> float  
Range: 1e-09 to 1e+09

**Example:**  
`IPM:STEP:BASE TIME`  
`IPM:STEP:PERiod 0.01`

**Manual operation:** See ["Steps"](#) on page 144

**IPM:STEP:INCRement <Increment>**

Sets the step size.

**Parameters:**

<Increment> float  
Range: -1e+09 to 1e+09

**Example:** See [Example"Using the step IPM profile"](#) on page 474

**Manual operation:** See ["Steps"](#) on page 144

**IPM:STEP:STARt <Start>**

Sets the start value.

**Parameters:**

<Start> float  
Range: -1e+09 to 1e+09

**Example:** See [Example"Using the step IPM profile"](#) on page 474

**Manual operation:** See ["Steps"](#) on page 144

---

**IPM:STEP:STEPs** <Steps>

Sets the number of steps.

**Parameters:**

<Steps> float  
Range: 1 to 10000

**Example:** See [Example"Using the step IPM profile"](#) on page 474

**Manual operation:** See ["Steps"](#) on page 144

---

**IPM:RSTep:MINimum** <Minimum>**IPM:RSTep:MAXimum** <Maximum>

Sets the value range.

**Parameters:**

<Maximum> float  
Range: 0 to 1e+11

**Example:** See [Example"Using PRI profiles of random type"](#) on page 474

**Manual operation:** See ["Random Steps"](#) on page 151

---

**IPM:RSTep:STEP:MINimum** <Minimum>**IPM:RSTep:STEP:MAXimum** <Maximum>

Sets the step size range.

**Parameters:**

<Maximum> float  
Range: 0.1 to 0.5

**Example:** See [Example"Using PRI profiles of random type"](#) on page 474

**Manual operation:** See ["Random Steps"](#) on page 151

---

**IPM:RSTep:PERiod** <Period>

Sets the pattern length.

**Parameters:**

<Period> float  
Range: 0 to 4096

**Example:** See [Example "Using PRI profiles of random type"](#) on page 474

**Manual operation:** See ["Random Steps"](#) on page 151

#### IPM:WAVeform:TYPE <Type>

Sets the profile shape.

**Parameters:**

<Type> RAMP | SINE | TRIangular

**Example:** See [Using list and waveform type IPM profiles](#)

**Manual operation:** See ["Waveform"](#) on page 147

#### IPM:WAVeform:BASE <Base>

Defines how the waveform period is defined, as a time duration or as a number of pulses.

**Parameters:**

<Base> PULSe | TIME

**Example:** See [Using list and waveform type IPM profiles](#)

**Manual operation:** See ["Waveform"](#) on page 147

#### IPM:WAVeform:COUNT <Count>

Sets the waveform period as number of pulses.

**Parameters:**

<Count> integer

Range: 1 to 1e+09

**Example:** See [Using list and waveform type IPM profiles](#)

**Manual operation:** See ["Waveform"](#) on page 147

#### IPM:WAVeform:OFFSet <Offset>

Shifts the profile by the selected offset.

**Parameters:**

<Offset> float

Range: -1e+09 to 1e+09

**Example:** See [Using list and waveform type IPM profiles](#)

**Manual operation:** See ["Waveform"](#) on page 147

#### IPM:WAVeform:PHASe <Phase>

Enables a phase offset to change the start phase of the sine wave.

**Parameters:**

<Phase> float  
 Range: -1e+09 to 1e+09  
 Default unit: sec

**Example:** See [Using list and waveform type IPM profiles](#)

**Manual operation:** See ["Waveform"](#) on page 147

**IPM:WAVeform:PERiod <Period>**

Sets the waveform period.

**Parameters:**

<Period> float  
 Range: 1e-09 to 1e+09  
 Default unit: sec

**Example:** See [Using list and waveform type IPM profiles](#)

**Manual operation:** See ["Waveform"](#) on page 147

**IPM:WAVeform:PKPK <Pkp>**

Sets the value range of the linear ramp profile or the period of the sine profile.

**Parameters:**

<Pkp> float  
 Range: 1e-09 to 1e+09  
 Default unit: sec

**Example:** See [Using list and waveform type IPM profiles](#)

**Manual operation:** See ["Waveform"](#) on page 147

**IPM:BINomial:VAL1 <Val1>****IPM:BINomial:VAL2 <Val2>**

Sets the values of the binomial distribution function.

**Parameters:**

<Val2> float  
 Range: -1e+09 to 1e+09

**Example:**

```
IPM:TYPE BINOMIAL
IPM:BINomial:VAL1 100
IPM:BINomial:PVAL1 80
IPM:BINomial:VAL2 0
```

**Manual operation:** See ["Binomial"](#) on page 154



---

**IPM:BINomial:PVAL1** <Pval1>

Sets the probability of occurrence of value 1 in the binomial distribution function.

**Parameters:**

<Pval1> float  
Range: 0 to 100  
Default unit: PCT

**Example:** See [IPM:BINomial:VAL2](#) on page 488

**Manual operation:** See ["Binomial"](#) on page 154

---

**DIALog:IPMPlot:VIEW** <View>

Defines what kind of information is represented in the IPM profile diagram.

**Setting parameters:**

<View> TIMeseries | HISTogram

**TIMeseries**

Visualization of the profile variation over time

**HISTogram**

Statistical representation of the relative frequency density

**Example:** See [Example"Using PRI profiles of random type"](#) on page 474.

**Usage:** Setting only

**Manual operation:** See ["2D"](#) on page 143

---

**DIALog:IPMPlot:SAMPles** <Samples>

Sets the number of values to be displayed in the preview diagram of the IPM profile.

**Setting parameters:**

<Samples> float

**Example:** See [Example"Using PRI profiles of random type"](#) on page 474.

**Usage:** Setting only

**Manual operation:** See ["2D"](#) on page 143

## 24.12 Import interface commands

### Example: PDW import (unmodulated pulses)

```

IMPort:PDW:FILE:PDW:LOAD "C:/_PS_files/PDW import/PDW01_unmodulated.txt"
IMPort:PDW:FILE:PDW?
// C:/_PS_files/PDW import/PDW01_unmodulated.txt
IMPort:PDW:FILE:TEMPlate:LOAD "C:/_PS_files/PDW import/PDW01_unmodulated.pdwt"
IMPort:PDW:FILE:TEMPlate?
// C:/_PS_files/PDW import/PDW01_unmodulated.pdwt

```

```

IMPort:PDW:NORM 1
IMPort:PDW:EXECute
IMPort:PDW:STATus?
// 1
IMPort:PDW:DATA:SEL 1
IMPort:PDW:DATA:TOA?
// 0
IMPort:PDW:DATA:WIDTH?
// 3e-05
IMPort:PDW:DATA:FREQuency?
// 3e+09
IMPort:PDW:DATA:OFFSet?
// 0
IMPort:PDW:DATA:PHASe?
// 0
IMPort:PDW:DATA:LEVel?
// 0
IMPort:PDW:DATA:MOP?
// CW

```

IMPort:PDW:FILE:PDW.....	491
IMPort:PDW:FILE:TEMPlate.....	491
IMPort:PDW:FILE:PDW:LOAD.....	492
IMPort:PDW:FILE:TEMPlate:LOAD.....	492
IMPort:PDW:FILE:PDW:SAVE.....	492
IMPort:PDW:FILE:TEMPlate:SAVE.....	492
IMPort:PDW:NORM.....	492
IMPort:PDW:EXECute.....	492
IMPort:PDW:STATus?.....	492
IMPort:PDW:DATA:SEL.....	493
IMPort:PDW:DATA:MOP?.....	493
IMPort:PDW:DATA:AM:DEPTH?.....	493
IMPort:PDW:DATA:AM:MODFREQ?.....	493
IMPort:PDW:DATA:ASK:CHIPcount?.....	493
IMPort:PDW:DATA:ASK:RATE?.....	493
IMPort:PDW:DATA:ASK:STATes?.....	493
IMPort:PDW:DATA:ASK:STEP?.....	493
IMPort:PDW:DATA:CPH:CHIPcount?.....	493
IMPort:PDW:DATA:CPH:VALues.....	493

IMPort:PDW:DATA:FM:DEVIation?	493
IMPort:PDW:DATA:FM:MODFreq?	493
IMPort:PDW:DATA:FREQuency?	493
IMPort:PDW:DATA:FSK:CHIPcount?	493
IMPort:PDW:DATA:FSK:RATE?	494
IMPort:PDW:DATA:FSK:STATes?	494
IMPort:PDW:DATA:FSK:STEP?	494
IMPort:PDW:DATA:LEVel?	494
IMPort:PDW:DATA:OFFSet?	494
IMPort:PDW:DATA:PHASe?	494
IMPort:PDW:DATA:PLFM:VALues	494
IMPort:PDW:DATA:PSK:CHIPcount?	494
IMPort:PDW:DATA:PSK:RATE?	494
IMPort:PDW:DATA:PSK:STATes?	494
IMPort:PDW:DATA:PSK:STEP?	494
IMPort:PDW:DATA:LFM:RATE?	494
IMPort:PDW:DATA:NLFM:CUBic?	494
IMPort:PDW:DATA:NLFM:LINear?	494
IMPort:PDW:DATA:NLFM:QUADratic?	494
IMPort:PDW:DATA:TOA?	494
IMPort:PDW:DATA:WIDTh?	494
IMPort:PDW:DATA:ASK:PATtern?	494
IMPort:PDW:DATA:FSK:PATtern?	494
IMPort:PDW:DATA:PSK:PATtern?	494
IMPort:PDW:STORe	494
IMPort:VIEW:COUNT	495
IMPort:VIEW:TIME:STARt	495
IMPort:VIEW:COUNT	495
IMPort:VIEW:MOVE:BACKwards	495
IMPort:VIEW:MOVE:FORWard	495
IMPort:VIEW:MOVE:STARt	495
IMPort:VIEW:MOVE:END	495

---

#### IMPort:PDW:FILE:PDW <Pdw>

Sets or queries the name of the used PDW list file.

##### Parameters:

<Pdw> absolute file path and filename, incl. file extension

**Example:** See [Example"PDW import \(unmodulated pulses\)"](#) on page 490.

**Manual operation:** See ["PDW File"](#) on page 366

---

#### IMPort:PDW:FILE:TEMPlate <Template>

Sets or queries the name of the used import template file.

##### Parameters:

<Template> absolute file path and filename, incl. file extension

**Example:** See [Example"PDW import \(unmodulated pulses\)"](#) on page 490.

**Manual operation:** See ["Template"](#) on page 367

---

**IMPort:PDW:FILE:PDW:LOAD**

**IMPort:PDW:FILE:TEMPlate:LOAD**

Loads the selected file.

**Example:** See [Example"PDW import \(unmodulated pulses\)"](#) on page 490.

**Usage:** Event

**Manual operation:** See ["Select import template file, Create new import template, Save/Save as"](#) on page 367

---

**IMPort:PDW:FILE:PDW:SAVE**

**IMPort:PDW:FILE:TEMPlate:SAVE**

Stores the selected file.

**Example:** See [Example"PDW import \(unmodulated pulses\)"](#) on page 490.

**Usage:** Event

**Manual operation:** See ["Select import template file, Create new import template, Save/Save as"](#) on page 367

---

**IMPort:PDW:NORM** <Norm>

Normalizes the TOA (time of arrival) of the first pulse to 0. Subsequent TOAs are relative.

**Parameters:**

<Norm> ON | OFF | 1 | 0

**Example:** See [Example"PDW import \(unmodulated pulses\)"](#) on page 490.

**Manual operation:** See ["Normalize TOA"](#) on page 367

---

**IMPort:PDW:EXECute**

Starts parsing the PDW list file.

**Example:** See [Example"PDW import \(unmodulated pulses\)"](#) on page 490.

**Usage:** Event

**Manual operation:** See ["Process PDW File"](#) on page 367

---

**IMPort:PDW:STATus?**

Queries the parsing status.

**Return values:**

<Status> ON | OFF | 1 | 0  
 1  
 Import completed

**Example:** See [Example"PDW import \(unmodulated pulses\)"](#) on page 490.

**Usage:** Query only

**Manual operation:** See ["Import Status"](#) on page 367

**IMPort:PDW:DATA:SEL <Sel>**

Selects the pulse for that the further queries apply.

**Parameters:**

<Sel> float  
 Range: 1 to max

**Example:** See [Example"PDW import \(unmodulated pulses\)"](#) on page 490.

**Manual operation:** See ["Imported Data"](#) on page 367

**IMPort:PDW:DATA:MOP?**

Queries the used modulation on pulse (MOP).

Use the corresponding command to query further pulse and modulation parameter for the respective MOP.

**Return values:**

<Mop> CW | AM | FM | ASK | FSK | PSK | LFM | NLFM | TFM | BKR2a |  
 BKR2b | BKR3 | BKR4a | BKR4b | BKR5 | BKR7 | BKR11 |  
 BKR13 | CPH | PLFM

**Example:** See [Example"PDW import \(unmodulated pulses\)"](#) on page 490.

**Usage:** Query only

**Manual operation:** See ["Imported Data"](#) on page 367

**IMPort:PDW:DATA:AM:DEPT**?  
**IMPort:PDW:DATA:AM:MODFreq**?  
**IMPort:PDW:DATA:ASK:CHIPcount**?  
**IMPort:PDW:DATA:ASK:RATE**?  
**IMPort:PDW:DATA:ASK:STATes**?  
**IMPort:PDW:DATA:ASK:STEP**?  
**IMPort:PDW:DATA:CPH:CHIPcount**?  
**IMPort:PDW:DATA:CPH:VALues** <Values>  
**IMPort:PDW:DATA:FM:DEVIation**?  
**IMPort:PDW:DATA:FM:MODFreq**?  
**IMPort:PDW:DATA:FREQuency**?  
**IMPort:PDW:DATA:FSK:CHIPcount**?

**IMPOrt:PDW:DATA:FSK:RATE?**  
**IMPOrt:PDW:DATA:FSK:STATes?**  
**IMPOrt:PDW:DATA:FSK:STEP?**  
**IMPOrt:PDW:DATA:LEVel?**  
**IMPOrt:PDW:DATA:OFFSet?**  
**IMPOrt:PDW:DATA:PHASe?**  
**IMPOrt:PDW:DATA:PLFM:VALues** <Values>  
**IMPOrt:PDW:DATA:PSK:CHIPcount?**  
**IMPOrt:PDW:DATA:PSK:RATE?**  
**IMPOrt:PDW:DATA:PSK:STATes?**  
**IMPOrt:PDW:DATA:PSK:STEP?**  
**IMPOrt:PDW:DATA:LFM:RATE?**  
**IMPOrt:PDW:DATA:NLFM:CUBic?**  
**IMPOrt:PDW:DATA:NLFM:LINear?**  
**IMPOrt:PDW:DATA:NLFM:QUADratic?**  
**IMPOrt:PDW:DATA:TOA?**  
**IMPOrt:PDW:DATA:WIDTh?**

Queries the pulse parameter.

**Return values:**

<Width> float

**Example:** See [Example"PDW import \(unmodulated pulses\)"](#) on page 490.

**Usage:** Query only

**Manual operation:** See ["Imported Data"](#) on page 367

**IMPOrt:PDW:DATA:ASK:PATtern?**  
**IMPOrt:PDW:DATA:FSK:PATtern?**  
**IMPOrt:PDW:DATA:PSK:PATtern?**

Queries the pulse parameter.

**Return values:**

<Pattern> string

**Example:** See [Example"PDW import \(unmodulated pulses\)"](#) on page 490.

**Usage:** Query only

**IMPOrt:PDW:STORe**

Stores the imported PDW list file as waveform element in the repository.

**Example:** See [Example"PDW import \(unmodulated pulses\)"](#) on page 490.

**Usage:** Event

**Manual operation:** See ["Import into Repository"](#) on page 368

---

**IMPort:VIEW:COUNT** <Count>

Sets the entries per page to be displayed.

**Parameters:**

<Count> 50 | 100 | 500 | 1000 | 5000 | 10000 | 50000 | 100000

**Manual operation:** See "[View > PDW Data View](#)" on page 363

---

**IMPort:VIEW:TIME:START** <Start>

Sets the start line displayed on the page.

**Parameters:**

<Start> float

**Manual operation:** See "[View > PDW Data View](#)" on page 363

---

**IMPort:VIEW:COUNT** <Count>

Sets the entries per page to be displayed.

**Parameters:**

<Count> 50 | 100 | 500 | 1000 | 5000 | 10000 | 50000 | 100000

**Manual operation:** See "[View > PDW Data View](#)" on page 363

---

**IMPort:VIEW:MOVE:BACKwards**

**IMPort:VIEW:MOVE:FORward**

**IMPort:VIEW:MOVE:START**

**IMPort:VIEW:MOVE:END**

Goes to the first/next/previous/last page.

**Usage:** Event

**Manual operation:** See "[View > PDW Data View](#)" on page 363

---

## 24.13 License server commands

---

**LSERver:APPLY**

Applies the changes.

**Usage:** Event

---

**LSERver:HOST** <Host>

Sets the license server host.

**Parameters:**

&lt;Host&gt; string

**LSERver:OPTions?**

Queries the available options.

**Return values:**

&lt;Options&gt; string

**Usage:** Query only**LSERver:PORT <Port>**

Sets the license server port.

**Parameters:**

&lt;Port&gt; float

**LSERver:READy?**

Queries the status of the license server.

**Return values:**

&lt;Ready&gt; ON | OFF | 1 | 0

**Usage:** Query only**LSERver:STATUs?**

Queries the status of the license server.

**Return values:**

&lt;Status&gt; string

**Usage:** Query only

## 24.14 Marker commands

Marker commands enable or up to four markers in any combination at once.

Markers signals are binary signals. Each marker signal is represented by a single bit within a marker byte. The [Table 24-1](#) explains the assignment.

*Table 24-1: Setting parameter as function of the marker states*

Marker	Marker byte	Value of the settings parameter in the remote commands
M1	0000 0001	0x01
M2	0000 0010	0x02



Marker	Marker byte	Value of the settings parameter in the remote commands
M3	0000 0100	0x04
M4	0000 1000	0x08

In the following examples, we assume that a pulse-base sequence "Test Sequence" and the required Pulses have been created.

See also:

- [Example "Handling items"](#) on page 420
- [Example "Creating an unmodulated pulse"](#) on page 507

### Example: Defining pulse and sequence markers and enabling the global markers

```

SCPI
PULSe:SElect "P1"

// enable Marker 1 als gate marker
PULSe:MARKer:GATE 1

SEquence:SElect "Test Sequence"
SEquence:ITEM:SElect 1
SEquence:ITEM:MARKer:FIRSt 2
SEquence:ITEM:MARKer:LAST 4
SEquence:ITEM:MARKer:ALL 1

// enable Marker 1 to mark the fifth loop run, i.e.
// enable the condition $loop_i = 5 for Marker 1
// the used loop variable $loop must exist
SEquence:ITEM:MARKer:CONDition 1
SEquence:ITEM:MARKer:CONDition:VARiable "$loop_i"
SEquence:ITEM:MARKer:CONDition:TYPE EQUAL
SEquence:ITEM:MARKer:CONDition:VALue "5"

SCENario:OUTPut:MARKer:ENABle 1
SCENario:OUTPut:MARKer:FLAGs 14

```

### Example: Defining emitter markers

```

SCPI
ScENario:CEMit:Select 1
SCENario:CEMit:MARKer:FORCe 1
SCENario:CEMit:MARKer:GATE 1

```

<a href="#">PULSe:MARKer:GATE</a> .....	498
<a href="#">SEquence:ITEM:MARKer:CONDition</a> .....	498
<a href="#">SEquence:ITEM:MARKer:FIRSt</a> .....	498
<a href="#">SEquence:ITEM:MARKer:LAST</a> .....	498
<a href="#">SEquence:ITEM:MARKer:ALL</a> .....	498
<a href="#">SEquence:ITEM:MARKer:CONDition:TYPE</a> .....	498

SEquence:ITEM:MARKer:CONDition:VARiable.....	499
SEquence:ITEM:MARKer:CONDition:VALue.....	499
SCENario:OUTPut:MARKer:ENABLE.....	499
SCENario:OUTPut:MARKer:FLAGs.....	499
SCENario:CEMit:MARKer:FORCe.....	500
SCENario:DF:MARKer:FORCe.....	500
SCENario:LOCalized:MARKer:FORCe.....	500
SCENario:CEMit:MARKer:GATE.....	500
SCENario:DF:MARKer:GATE.....	500
SCENario:LOCalized:MARKer:GATE.....	500

---

### **PULSe:MARKer:GATE** <Gate>

Enables up to four gate markers.

#### **Parameters:**

<Gate> float  
 see [Table 24-1](#).  
 Range: 0 to 65535

**Example:** See [Example "Defining pulse and sequence markers and enabling the global markers"](#) on page 497

**Manual operation:** See ["Pulse Markers"](#) on page 380

---

### **SEquence:ITEM:MARKer:CONDition** <Condition>

**SEquence:ITEM:MARKer:FIRSt** <First>

**SEquence:ITEM:MARKer:LAST** <Last>

**SEquence:ITEM:MARKer:ALL** <All>

Enables up to four markers of the corresponding type.

#### **Parameters:**

<All> float  
 See [Table 24-1](#).  
 Range: 0 to 65535

**Example:** See [Example "Defining pulse and sequence markers and enabling the global markers"](#) on page 497.

---

### **SEquence:ITEM:MARKer:CONDition:TYPE** <Type>

Sets the sign in the logical condition.

#### **Parameters:**

<Type> SMALLer | GREater | EQUal | NOTequal

**Example:** See [Example "Defining pulse and sequence markers and enabling the global markers"](#) on page 497

---

**SEquence:ITEM:MARKer:CONDition:VARiable** <Variable>

Defines the value that is compared with the fixed values set with the command [SEquence:ITEM:MARKer:CONDition:VALue](#) on page 499.

**Parameters:**

<Variable>                      string

**Example:**                      See [Example"Defining pulse and sequence markers and enabling the global markers"](#) on page 497

---

**SEquence:ITEM:MARKer:CONDition:VALue** <Value>

Sets the numerical value used with the comparison.

**Parameters:**

<Value>                          string

**Example:**                      See [Example"Defining pulse and sequence markers and enabling the global markers"](#) on page 497

---

**SCENario:OUTPut:MARKer:ENABle** <Enable>

Enables that markers are considered by the generation of the output waveform file.

**Parameters:**

<Enable>                        ON | OFF | 1 | 0

**Example:**                      See [Example"Defining pulse and sequence markers and enabling the global markers"](#) on page 497

**Manual operation:**    See ["Marker Signals"](#) on page 350

---

**SCENario:OUTPut:MARKer:FLAGs** <Flags>

Enables up to four markers.

**Parameters:**

<Flags>                          int  
                                       Binary value, where:  
                                       M1 = 1  
                                       M1 = 2  
                                       M1 = 4  
                                       M1 = 8  
                                       Range:        0 to 15  
                                       \*RST:        15

**Example:**                      See [Example"Defining pulse and sequence markers and enabling the global markers"](#) on page 497

**Manual operation:**    See ["Marker Signals"](#) on page 350

---

**SCENario:CEMit:MARKer:FORCe** <Force>

**SCENario:DF:MARKer:FORCe** <Force>

**SCENario:LOCalized:MARKer:FORCe** <Force>

Determines how the marker is handled.

**Parameters:**

<Force> ON | OFF | 1 | 0

**ON | 1**

Forces the selected marker type for every pulse of the selected emitter

**OFF | 0**

Leaves the marker unchanged, as defined in the pulses and sequences of this emitter.

**Example:** See [Example"Defining emitter markers"](#) on page 497.

**Manual operation:** See ["Emitter Marker"](#) on page 315

---

**SCENario:CEMit:MARKer:GATE** <Gate>

**SCENario:DF:MARKer:GATE** <Gate>

**SCENario:LOCalized:MARKer:GATE** <Gate>

Enables marker for gate.

**Parameters:**

<Gate> float

Binary value, where:

M1 = 1

M1 = 2

M1 = 4

M1 = 8

Range: 0 to 15

**Example:** See [Example"Defining emitter markers"](#) on page 497.

**Manual operation:** See ["Emitter Marker"](#) on page 315

## 24.15 Plugin and reporting commands

### Example: Loading plugins in the repository

```

PLUGin:CREate "Plugin 5"
PLUGin:SElect "Plugin 5"
PLUGin:LOAD "C:\_PS_files\APatImport.dll"
PLUGin:MODule:AUTHor?
// Rohde&Schwarz
PLUGin:MODule:NAME?
// Multiple Patterns
PLUGin:MODule:TYPE?
// Pattern Import
PLUGin:MODule:VERSion?
// 1.0.0
PLUGin:MODule:COMMeNt?
// This plugin creates custom antenna patterns.
PLUGin:MODule:DATA?
// 0

```

### Example: Using a plugin as an IPM profile

```

SCPI
IPM:CREate "Custom IPM"
IPM:UNIT PERCent
IPM:TYPE PLUGin
PLUGin:CATalog?
// "My_QAM_Plugin","CustomIPM"
IPM:PLUGin:NAME "CustomIPM"
IPM:PLUGin:VARiable:CATalog?
// "$step","$pw"
IPM:PLUGin:VARiable:SElect "$pw"
IPM:PLUGin:VARiable:VALue 0.00001

```

### Example: Generating reports

```

SCPI
SCENario:PDW:ENABle 1
SCENario:PDW:PATH "C:\_My_Report_Files"
SCENario:PDW:TYPE PLUGin
PLUGin:CATalog?
// "My_QAM_Plugin","CustomIPM","Report PDW","Reporting DFS"
SCENario:PDW:PLUGin:NAME "Report PDW"
SCENario:PDW:PLUGin:VARiable:CATalog?
// "File","Header"
SCENario:PDW:PLUGin:VARiable:SElect "File"
SCENario:PDW:PLUGin:VARiable:VALue?
// "pdw_out.txt"

```

PLUGin:LOAD.....	502
PLUGin:MODule:AUTHor?.....	502
PLUGin:MODule:COMMeNt?.....	502
PLUGin:MODule:VERsion?.....	502
PLUGin:MODule:TYPE?.....	502
PLUGin:MODule:DATA?.....	503
DESTination:PLUGin:VARiable:CATalog.....	503
SCENario:PDW:PLUGin:VARiable:CATalog?.....	503
IPM:PLUGin:VARiable:CATalog?.....	503
DESTination:PLUGin:VARiable:SElect.....	503
SCENario:PDW:PLUGin:VARiable:SElect.....	503
IPM:PLUGin:VARiable:SElect.....	503
DESTination:PLUGin:VARiable:VALue.....	504
SCENario:PDW:PLUGin:VARiable:VALue.....	504
IPM:PLUGin:VARiable:VALue.....	504
DESTination:PLUGin:VARiable:SElect:ID.....	504
SCENario:PDW:PLUGin:VARiable:SElect:ID.....	504
DESTination:PLUGin:VARiable:RESet.....	504
SCENario:PDW:PLUGin:VARiable:RESet.....	504
SCENario:PDW:ENABle.....	504
SCENario:PDW:PATH.....	504
SCENario:PDW:TYPE.....	505
SCENario:PDW:PLUGin:NAME.....	505
SCENario:PDW:AMMos:PPDW.....	505
SCENario:PDW:AMMos:FRAMe.....	505
SCENario:PDW:AMMos:UTIMe:ENABle.....	506
SCENario:PDW:AMMos:UTIMe:ISO.....	506
SCENario:PDW:AMMos:AZIMuth.....	506
SCENario:PDW:TEMPLate.....	506

---

**PLUGin:LOAD** <Load>

Loads the selected DLL file, see also [Chapter C, "Plug-in programming API"](#), on page 649.

**Setting parameters:**

<Load>                      string  
    File path incl. file name and extension

**Example:**                      See [Example "Loading plugins in the repository"](#) on page 501

**Usage:**                          Setting only

---

**PLUGin:MODule:AUTHor?**  
**PLUGin:MODule:COMMeNt?**  
**PLUGin:MODule:VERsion?**  
**PLUGin:MODule:TYPE?**

Queries information on the loaded file.

The query returns information as specified in the description of the corresponding function in [Chapter C, "Plug-in programming API"](#), on page 649.

The following are the possible values for the type query.

**Return values:**

<Type> REPort | IPM  
**IPM**  
 Plugin for IPM  
**REPort**  
 Plugin for reports created during the waveform generation

**Example:** See [Example "Loading plugins in the repository"](#) on page 501

**Usage:** Query only

**PLUGin:MODule:DATA?**

Queries whether the plugin requires data from a data source.

**Return values:**

<Data> 0 | 1  
**0**  
 Data source is not required  
**1**  
 Data source is required  
 \*RST: 0

**Example:** See [Example "Loading plugins in the repository"](#) on page 501

**Usage:** Query only

**DESTination:PLUGin:VARiable:CATalog** <Catalog>

**SCENario:PDW:PLUGin:VARiable:CATalog?**

**IPM:PLUGin:VARiable:CATalog?**

Queries the variables used in the plugin.

**Return values:**

<Catalog> string

**Example:** See [Example "Using a plugin as an IPM profile"](#) on page 501

**Usage:** Query only

**Manual operation:** See ["Plug-in"](#) on page 153

**DESTination:PLUGin:VARiable:SElect** <Select>

**SCENario:PDW:PLUGin:VARiable:SElect** <Select>

**IPM:PLUGin:VARiable:SElect** <Select>

Selects a plugin variable.

**Parameters:**

<Select> string

**Example:** See [Example"Using a plugin as an IPM profile"](#) on page 501

**Manual operation:** See ["Plug-in"](#) on page 153

---

**DESTination:PLUGIn:VARiable:VALue** <Value>

**SCENario:PDW:PLUGIn:VARiable:VALue** <Value>

**IPM:PLUGIn:VARiable:VALue** <Value>

Sets the values of the selected variable.

**Parameters:**

<Value> string

**Example:** See [Example"Using a plugin as an IPM profile"](#) on page 501

**Manual operation:** See ["Plug-in"](#) on page 153

---

**DESTination:PLUGIn:VARiable:SElect:ID** <Id>

**SCENario:PDW:PLUGIn:VARiable:SElect:ID** <Id>

Selects a plugin variable ID.

**Parameters:**

<Id> float

\*RST: 0

---

**DESTination:PLUGIn:VARiable:RESet**

**SCENario:PDW:PLUGIn:VARiable:RESet**

Resets the variable values to the defaults.

**Usage:** Event

---

**SCENario:PDW:ENABLE** <Enable>

Enables generation of Pulse Descriptor Word (PDW) reports.

**Parameters:**

<Enable> ON | OFF | 1 | 0

**Example:** See [Example"Generating reports"](#) on page 501

**Manual operation:** See ["Reporting Enable"](#) on page 388

---

**SCENario:PDW:PATH** <Path>

Sets the target directory in that the generated report files are stored.

**Parameters:**

<Path> string



**Example:** See [Example "Generating reports"](#) on page 501

**Manual operation:** See ["Target Path, Set Path"](#) on page 388

#### SCENario:PDW:TYPE <Type>

Sets the template used by the reporting function.

**Parameters:**

<Type>                    DEFault | TEMPlate | PLUGin | AMMos

**Manual operation:** See ["Type"](#) on page 389

#### SCENario:PDW:PLUGin:NAME <Name>

Selects and loads a reporting template. This template must exist in the "Plugin" library.

To query a list of available plugins, use the command [PLUGin:CATalog?](#).

**Parameters:**

<Name>                    string

**Example:** See [Example "Generating reports"](#) on page 501

**Manual operation:** See ["Plugin and plugin variables"](#) on page 391

#### SCENario:PDW:AMMos:PPDW <Ppdw>

If enabled, the format of the AMMOS file is set to PPDW. Otherwise PDW is assumed.

**Parameters:**

<Ppdw>                    ON | OFF | 1 | 0

**Example:**

```
SCENario:PDW:TYPE AMMos
SCENario:PDW:AMMos:PPDW 1
SCENario:PDW:AMMos:FRAME 200
SCENario:PDW:AMMos:UTIME:ENABLE 1
SCENario:PDW:AMMos:UTIME:ISO
SCENario:PDW:AMMos:UTIME:ISO "2017-05-24T23:46:00"
SCENario:PDW:AMMos:AZIMuth RX
```

**Manual operation:** See ["Format"](#) on page 390

#### SCENario:PDW:AMMos:FRAME <Frame>

Sets the frame length.

**Parameters:**

<Frame>                    float  
Range:                    50 to 500

**Example:** See [SCENario:PDW:AMMos:PPDW](#) on page 505.

**Manual operation:** See ["Frame Length"](#) on page 391

---

**SCENario:PDW:AMMos:UTIME:ENABLE** <Enable>

Defines how the report start time is set.

**Parameters:**

<Enable> ON | OFF | 1 | 0

**0**

The reporting start time is time at that the scenario calculation starts.

**1**

The reporting starts at user-defined moment, set with the command [SCENario:PDW:AMMos:UTIME:ISO](#).

**Example:** See [SCENario:PDW:AMMos:PPDW](#) on page 505.

**Manual operation:** See "[Start Time, User Set Value](#)" on page 391

---

**SCENario:PDW:AMMos:UTIME:ISO** <Iso>

Sets the reporting start time, if [SCENario:PDW:AMMos:UTIME:ENABLE](#)1.

**Parameters:**

<Iso> "<YYYY>-<Month>-<DD>T<HH:MM:SS>"

**Example:** See [SCENario:PDW:AMMos:PPDW](#) on page 505.

**Manual operation:** See "[Start Time, User Set Value](#)" on page 391

---

**SCENario:PDW:AMMos:AZIMuth** <Azimuth>

For [SCENario:PDW:TYPEAMMos](#), defines whether the angle of the Rx antenna or the bearing is reported.

**Parameters:**

<Azimuth> RX | BEARing

**Manual operation:** See "[Azimuth](#)" on page 391

---

**SCENario:PDW:TEMPLate** <Template>

Edits the selected template.

**Parameters:**

<Template> string

**Example:**

```

SCPI
SCENario:PDW:TEMplate?
# Pulse Sequencer PDW Report
#
Date:          <ISODATE>
Repository:   <REPOSITORY>
Scenario:     <SCENARIO>

          TOA |          RF |          PW |          PA | MF | MOP |          BW |
          ns |          GHz |          us |          dBm |  |    |          kHz |
-----
.HDR
<TOA> | <RF> | <PW> | <PA> | <MF> | <MOP> | <BW> |
# END OF REPORT
.OPT <TOA:12.0f:-9>
.OPT <RF:9.6f:9>
.OPT <PW:9.3f:-6>
.OPT <PA:6.1f:0>
.OPT <BW:6.0f:3>

```

**Manual operation:** See ["Edit Template"](#) on page 389

## 24.16 Pulse commands

The following are examples on how to create and configure pulses in remote environment.

### Example: Creating an unmodulated pulse

```

SCPI
PULSe:CREate "P_1"
PULSe:CATalog?
// "P_1"
PULSe:SElect "P_1"
PULSe:COMment "PW=100us"
PULSe:TIME:REFerence FULL
PULSe:TIME:WIDTh 100 us
PULSe:TIME:RISE 10 us
PULSe:TIME:FALL 10 us
PULSe:TYPE:RISE LINear
PULSe:TYPE:FALL LINear
PULSe:MOP:ENABle 0
PULSe:MOP:EXCLude:ENABle 0
// remane the pulse
PULSe:NAME "P1"

```

**Example: Creating a linear chirp pulse**

```

SCPI
PULSe:CREate "LinearChirp"
PULSe:CUSTom 0
PULSe:TIME:RISE 1e-05
PULSe:TIME:WIDTH 0.0001
PULSe:TIME:FALL 1e-05

PULSe:MOP:ENABLE 1
PULSe:MOP:TYPE CHIRP
PULSe:MOP:CHIRp:TYPE UP
PULSe:MOP:CHIRp:DEVIation 5e+06

// PULSe:MOP:TYPE PWISechirp
// PULSe:MOP:PIECewise:ADD
// PULSe:MOP:PIECewise:SElect 1
// PULSe:MOP:PIECewise:DURation 25
// PULSe:MOP:PIECewise:FREQuency 200
// PULSe:MOP:PIECewise:OFFSet 0
// PULSe:MOP:PIECewise:ADD
// PULSe:MOP:PIECewise:SElect 2
// PULSe:MOP:PIECewise:DURation 25
// PULSe:MOP:PIECewise:FREQuency -400
// PULSe:MOP:PIECewise:OFFSet 10E6

```

**Example: Creating an FM step pulse**

```

SCPI
PULSe:CREate "FM_Step"
PULSe:TIME:RISE 0
PULSe:TIME:WIDTH 0.000125
PULSe:TIME:FALL 0

PULSe:MOP:ENABLE 1
PULSe:MOP:COMment "fstart = -50 MHz, fend = 50 MHz, Df = 25 MHz (N = 5)"
PULSe:MOP:TYPE FMSTep
PULSe:MOP:FMSTep:ADD
PULSe:MOP:FMSTep:SElect 1
PULSe:MOP:FMSTep:DURation 2.49999993684469e-05
PULSe:MOP:FMSTep:FREQuency -50000000
PULSe:MOP:FMSTep:ADD
PULSe:MOP:FMSTep:SElect 2
PULSe:MOP:FMSTep:DURation 2.49999993684469e-05
PULSe:MOP:FMSTep:FREQuency -25000000
...

```

**Example: Creating a BPSK pulse**

```

SCPI
PULSe:CREate "Test"
PULSe:MOP:ENABle 1
PULSe:MOP:TYPE BPSK
PULSe:MOP:BPSK:TYPE NORMAl
PULSe:MOP:BPSK:SRATe:AUTO 0
PULSe:MOP:BPSK:SRATe 1e+06
PULSe:MOP:BPSK:PHASe 180
PULSe:MOP:BPSK:TTYPe COSine
PULSe:MOP:BPSK:TTIME 5

```

PULSe:MOP:AM:FREQuency.....	510
PULSe:MOP:AM:MDEPth.....	510
PULSe:MOP:AM:TYPE.....	510
PULSe:MOP:AMSTep:DURation.....	511
PULSe:MOP:FMSTep:DURation.....	511
PULSe:MOP:AMSTep:LEVel.....	511
PULSe:MOP:FMSTep:FREQuency.....	511
PULSe:MOP:MSK:INVert.....	511
PULSe:MOP:FSK:INVert.....	511
PULSe:MOP:ASK:INVert.....	511
PULSe:MOP:ASK:MDEPth.....	512
PULSe:MOP:MSK:SRATe.....	512
PULSe:MOP:ASK:SRATe.....	512
PULSe:MOP:BARKer:CODE.....	512
PULSe:MOP:BARKer:TTIME.....	512
PULSe:MOP:BARKer:BLANK.....	513
PULSe:MOP:BPSK:PHASe.....	513
PULSe:MOP:BPSK:SRATe.....	513
PULSe:MOP:BPSK:SRATe:AUTO.....	513
PULSe:MOP:BPSK:TTIME.....	514
PULSe:MOP:BPSK:TTYPe.....	514
PULSe:MOP:BPSK:TYPE.....	514
PULSe:MOP:CHIRp:TYPE.....	514
PULSe:MOP:CHIRp:DEVIation.....	514
PULSe:MOP:FSK:TYPE.....	515
PULSe:MOP:PIECewise:DURation.....	515
PULSe:MOP:PIECewise:RATE.....	515
PULSe:MOP:PIECewise:OFFSet.....	515
PULSe:MOP:CCHirp:FREQuency.....	516
PULSe:MOP:QAM:TYPE.....	516
PULSe:MOP:ENABle.....	516
PULSe:MOP:TYPE.....	517
PULSe:MOP:FM:DEVIation.....	517
PULSe:MOP:FM:FREQuency.....	517
PULSe:MOP:8FSK:DEVIation.....	517
PULSe:MOP:4FSK:DEVIation.....	517
PULSe:MOP:FSK:DEVIation.....	517
PULSe:MOP:8PSK:SRATe.....	517

PULSe:MOP:8FSK:SRATe.....	517
PULSe:MOP:4FSK:SRATe.....	518
PULSe:MOP:QAM:SRATe.....	518
PULSe:MOP:FSK:SRATe.....	518
PULSe:MOP:NOISe:BWIDth.....	518
PULSe:MOP:PCHirp:COEFFicient.....	518
PULSe:MOP:PCHirp:TERM.....	518
PULSe:MOP:PLISt:VALue.....	518
PULSe:MOP:POLY:LENGth.....	519
PULSe:MOP:POLY:TYPE.....	519
PULSe:MOP:QPSK:SRATe.....	519
PULSe:MOP:QPSK:TYPE.....	519
PULSe:MOP:QPSK:SOQPsk:IRIG.....	519
PULSe:TIME:FALL.....	520
PULSe:TIME:RISE.....	520
PULSe:TIME:WIDTh.....	520
PULSe:SETTings.....	520
PULSe:PREView:MODE.....	520
PULSe:PREView:MOP.....	521

---

#### **PULSe:MOP:AM:FREQuency** <Frequency>

Sets modulation frequency.

##### **Parameters:**

<Frequency>            float  
                               Range:     0.001 to 1e+09

**Example:**            See [PULSe:MOP:AM:TYPE](#) on page 510

**Manual operation:** See "[AM](#)" on page 97

---

#### **PULSe:MOP:AM:MDEPth** <Mdepth>

Sets the modulation depth.

##### **Parameters:**

<Mdepth>                float  
                               Range:     0 to 100  
                               Default unit: percent

**Example:**            See [PULSe:MOP:AM:TYPE](#) on page 510

**Manual operation:** See "[AM](#)" on page 97

---

#### **PULSe:MOP:AM:TYPE** <Type>

Selects the modulation type.

##### **Parameters:**

<Type>                    STD | LSB | USB | SB

**Example:**

```
PULSe:MOP:TYPE AM
PULSe:MOP:AM:TYPE STD
PULSe:MOP:AM:FREQuency 50000
PULSe:MOP:AM:MDEPth 50
```

**Manual operation:** See ["AM"](#) on page 97

**PULSe:MOP:AMSTep:DURation** <Duration>  
**PULSe:MOP:FMSTep:DURation** <Duration>

Sets the step time.

**Parameters:**

<Duration> float  
 Range: 0 to 3600  
 Default unit: s

**Example:** See [Example"Creating an FM step pulse"](#) on page 508

**Manual operation:** See ["FM Step"](#) on page 100

**PULSe:MOP:AMSTep:LEVel** <Level>

Sets the step level.

**Parameters:**

<Level> float  
 Range: -100 to 0

**Example:** See [Example"Creating an FM step pulse"](#) on page 508

**Manual operation:** See ["AM Step"](#) on page 98

**PULSe:MOP:FMSTep:FREQuency** <Frequency>

Sets the step frequency.

**Parameters:**

<Frequency> float  
 Range: -1e+09 to 1e+09

**Example:** See [Example"Creating an FM step pulse"](#) on page 508.

**Manual operation:** See ["FM Step"](#) on page 100

**PULSe:MOP:MSK:INVert** <Invert>

**PULSe:MOP:FSK:INVert** <Invert>

**PULSe:MOP:ASK:INVert** <Invert>

Inverts the modulation.

**Parameters:**

<Invert> ON | OFF | 1 | 0

**Example:**

```
PULSe:MOP:TYPE ASK
PULSe:MOP:ASK:MDEPth 100
PULSe:MOP:ASK:INVert 1
PULSe:MOP:ASK:SRATe 1e+06
```

**Manual operation:** See ["ASK"](#) on page 98

**PULSe:MOP:ASK:MDEPth** <Mdepth>

Sets the modulation depth.

**Parameters:**

<Mdepth> float  
 Range: 0 to 100  
 Default unit: percent

**Example:** See [PULSe:MOP:ASK:INVert](#) on page 511

**Manual operation:** See ["ASK"](#) on page 98

**PULSe:MOP:MSK:SRATe** <Srate>

**PULSe:MOP:ASK:SRATe** <Srate>

Sets the symbol rate.

**Parameters:**

<Srate> float  
 Range: 1 to 1e+09

**Example:** See [PULSe:MOP:ASK:INVert](#) on page 511

**Manual operation:** See ["ASK"](#) on page 98

**PULSe:MOP:BARKer:CODE** <Code>

Selects the code sequence.

**Parameters:**

<Code> R2A | R2B | R3 | R4A | R4B | R5 | R7 | R11 | R13

**Example:**

```
PULSe:MOP:TYPE BARKer
PULSe:MOP:BARKer:CODE R13
PULSe:MOP:BARKer:TTIME 10
PULSe:MOP:BARKer:BLANK 1
```

**Manual operation:** See ["Barker"](#) on page 107

**PULSe:MOP:BARKer:TTIME** <Ttime>

Sets the transition time.



**Parameters:**

<Time> float  
 Range: 0 to 50  
 Default unit: percent

**Example:** See [PULSe:MOP:BARKer:CODE](#) on page 512

**Manual operation:** See ["Barker"](#) on page 107

---

**PULSe:MOP:BARKer:BLANK** <Blank>

Blanks out the signal during the transition time.

**Parameters:**

<Blank> ON | OFF | 1 | 0

**Example:** See [PULSe:MOP:BARKer:CODE](#) on page 512

**Manual operation:** See ["Barker"](#) on page 107

---

**PULSe:MOP:BPSK:PHASe** <Phase>

Sets the phase.

**Parameters:**

<Phase> float  
 Range: 0 to 180  
 Default unit: degree

**Example:** See [Example"Creating a BPSK pulse"](#) on page 509

**Manual operation:** See ["BPSK"](#) on page 109

---

**PULSe:MOP:BPSK:SRATe** <Srate>

Sets the symbol rate.

**Parameters:**

<Srate> float  
 Range: 1 to 1e+09

**Example:** See [Example"Creating a BPSK pulse"](#) on page 509

**Manual operation:** See ["BPSK"](#) on page 109

---

**PULSe:MOP:BPSK:SRATe:AUTO** <Auto>

Enables automatic adjusting of the bits in the pulse width.

**Parameters:**

<Auto> ON | OFF | 1 | 0

**Example:** See [Example"Creating a BPSK pulse"](#) on page 509

**Manual operation:** See ["BPSK"](#) on page 109

#### **PULSe:MOP:BPSK:TTIME** <Ttime>

Sets the transition time.

##### **Parameters:**

<Ttime> float  
 Range: 0 to 50  
 Default unit: percent

**Example:** See [Example"Creating a BPSK pulse"](#) on page 509

**Manual operation:** See ["BPSK"](#) on page 109

#### **PULSe:MOP:BPSK:TTYPE** <Ttype>

Selects the transition type.

##### **Parameters:**

<Ttype> LINear | COSine

**Example:** See [Example"Creating a BPSK pulse"](#) on page 509

**Manual operation:** See ["BPSK"](#) on page 109

#### **PULSe:MOP:BPSK:TYPE** <Type>

Sets the modulation type.

##### **Parameters:**

<Type> STANdard | CONStant

**Example:** See [Example"Creating a BPSK pulse"](#) on page 509

**Manual operation:** See ["BPSK"](#) on page 109

#### **PULSe:MOP:CHIRp:TYPE** <Type>

Selects the modulation type.

##### **Parameters:**

<Type> UP | DOWN | SINE | TRIangular | PIECewise

**Example:** See [Example"Creating a linear chirp pulse"](#) on page 508

**Manual operation:** See ["Linear Chirp"](#) on page 102

#### **PULSe:MOP:CHIRp:DEVIation** <Deviation>

Sets the modulation deviation.

**Parameters:**

<Deviation> float  
Range: 1 to 1e+09

**Example:** See [Example"Creating a linear chirp pulse"](#) on page 508

**Manual operation:** See ["Linear Chirp"](#) on page 102

**PULSe:MOP:FSK:TYPE <Type>**

Selects the FSK modulation type.

**Parameters:**

<Type> FS2 | FS4 | FS8 | FS16 | FS32 | FS64

**Example:**

```
PULSe:MOP:TYPE FSK
PULSe:MOP:FSK:TYPE FS8
```

**Manual operation:** See ["FSK, 4FSK, 8FSK, 16FSK, 32FSK, 64FSK"](#) on page 101

**PULSe:MOP:PIECewise:DURation <Duration>**

Set the length of the chirp interval as a percentage of the duration the MOP is applied on.

**Parameters:**

<Duration> float  
Range: 0 to 100

**Example:** See [Example"Creating a linear chirp pulse"](#) on page 508

**Manual operation:** See ["Piecewise Linear Chirp"](#) on page 103

**PULSe:MOP:PIECewise:RATE <Rate>**

Set the chirp rate.

**Parameters:**

<Rate> float  
Range: -1e+15 to 1e+15  
Default unit: Hz/s

**Example:** See [Example"Creating a linear chirp pulse"](#) on page 508

**Manual operation:** See ["Piecewise Linear Chirp"](#) on page 103

**PULSe:MOP:PIECewise:OFFSet <Offset>**

Offsets the start frequency of the chirp.

**Parameters:**

<Offset> float  
Range: -1e+09 to 1e+09

**Example:** See [Example"Creating a linear chirp pulse"](#) on page 508

**Manual operation:** See ["Piecewise Linear Chirp"](#) on page 103

### **PULSe:MOP:CCHirp:FREQuency** <Frequency>

Set the frequency of the custom chirp.

#### **Parameters:**

<Frequency> float  
Range: -1e+09 to 1e+09

#### **Example:**

```
// custom chirp with 4 frequencies
PULSe:MOP:TYPE CCHIPRP
PULSe:MOP:CCHirp:ADD
PULSe:MOP:CCHirp:COUNT 4
PULSe:MOP:CCHirp:SEL 1
PULSe:MOP:CCHirp:FREQuency 1e+07
PULSe:MOP:CCHirp:SEL 2
PULSe:MOP:CCHirp:FREQuency 5e+06
PULSe:MOP:CCHirp:SEL 3
PULSe:MOP:CCHirp:FREQuency -1e+07
PULSe:MOP:CCHirp:SEL 4
PULSe:MOP:CCHirp:FREQuency 0
```

**Manual operation:** See ["Custom Chirp"](#) on page 104

### **PULSe:MOP:QAM:TYPE** <Type>

Selects the QAM type.

#### **Parameters:**

<Type> Q16 | Q32 | Q64 | Q128 | Q256

#### **Example:**

```
PULSe:MOP:TYPE QAM
PULSe:MOP:QAM:TYPE Q256
```

**Manual operation:** See ["16QAM, 32QAM, 64QAM, 128QAM, 256QAM"](#) on page 111

### **PULSe:MOP:ENABle** <Enable>

Defines whether a MOP is applied.

#### **Parameters:**

<Enable> ON | OFF | 1 | 0

**Example:** See [Example"Creating a linear chirp pulse"](#) on page 508

**Manual operation:** See ["Enable"](#) on page 96

---

**PULSe:MOP:TYPE** <Type>

Select the modulation scheme.

**Parameters:**

<Type> AM | ASK | AMSTep | FM | FSK | FMSTep | CHIRp | PCHirp |  
BARKer | POLYphase | PLISt | BPSK | QPSK | NOISe |  
PWISechirp | CCHirpp | PSK8 | QAM | MSK

**Example:** See [Example "Creating a linear chirp pulse"](#) on page 508.

**Manual operation:** See ["MOP Type"](#) on page 97

**Manual operation:** See [Chapter 6.2.3, "Modulation on pulse \(MOP\) settings"](#), on page 96.

---

**PULSe:MOP:FM:DEVIation** <Deviation>

Sets the modulation deviation.

**Parameters:**

<Deviation> float  
Range: 0.1 to 1e+09  
Default unit: Hz

**Manual operation:** See ["FM"](#) on page 99

---

**PULSe:MOP:FM:FREQUency** <Frequency>

Sets the modulation frequency.

**Parameters:**

<Frequency> float  
Range: 0.002 to 1e+09

**Manual operation:** See ["FM"](#) on page 99

---

**PULSe:MOP:8FSK:DEVIation** <Deviation>**PULSe:MOP:4FSK:DEVIation** <Deviation>**PULSe:MOP:FSK:DEVIation** <Deviation>

Sets the modulation deviation.

**Parameters:**

<Deviation> float  
Range: 0.001 to 1e+09  
Default unit: Hz

**Manual operation:** See ["FSK, 4FSK, 8FSK, 16FSK, 32FSK, 64FSK"](#) on page 101

---

**PULSe:MOP:8PSK:SRATe** <Srate>**PULSe:MOP:8FSK:SRATe** <Srate>

**PULSe:MOP:4FSK:SRATe** <Srate>

**PULSe:MOP:QAM:SRATe** <Srate>

**PULSe:MOP:FSK:SRATe** <Srate>

Sets the symbol rate of the modulated signal.

**Parameters:**

<Srate> float

Range: 1 to 1e+09

**Manual operation:** See "[FSK, 4FSK, 8FSK, 16FSK, 32FSK, 64FSK](#)" on page 101

**PULSe:MOP:NOISe:BWIDth** <Bwidth>

Sets the bandwidth.

**Parameters:**

<Bwidth> float

Range: 1 to 1e+09

Default unit: Hz

**Manual operation:** see [Chapter 6.2.3.7, "Noise"](#), on page 112

**PULSe:MOP:PCHirp:COEFficient** <Coefficient>

Sets the coefficient of the chirp polynomial.

**Parameters:**

<Coefficient> float

Range: -1e+32 to 1e+32

**Manual operation:** See "[Polynomial Chirp](#)" on page 106

**PULSe:MOP:PCHirp:TERM** <Term>

Sets the term of the chirp polynomial.

**Parameters:**

<Term> float

Range: 0 to 32

**Manual operation:** See "[Polynomial Chirp](#)" on page 106

**PULSe:MOP:PLISt:VALue** <Value>

Sets the phase.

**Parameters:**

<Value> float

Range: -180 to 180

Default unit: degree

**Manual operation:** See ["Custom Phase"](#) on page 109

**PULSe:MOP:POLY:LENGTH** <Length>

Sets the polyphase length (code order).

**Parameters:**

<Length> integer  
Range: 1 to 100

**Manual operation:** See ["Poly Phase"](#) on page 108

**PULSe:MOP:POLY:TYPE** <Type>

Selects the modulation type.

**Parameters:**

<Type> FRANK | P1 | P2 | P3 | P4

**Manual operation:** See ["Poly Phase"](#) on page 108

**PULSe:MOP:QPSK:SRATe** <Srate>

Sets the symbol rate.

**Parameters:**

<Srate> float  
Range: 1 to 1e+09

**Manual operation:** See ["QPSK"](#) on page 110

**PULSe:MOP:QPSK:TYPE** <Type>

Selects the modulation type.

**Parameters:**

<Type> NORMal | OQPSk | DQPSk | ASOQpsk | BSOQpsk | TGSoqpsk

**Manual operation:** See ["QPSK"](#) on page 110

**PULSe:MOP:QPSK:SOQPsk:IRIG** <Irig>

Enables differential encoding according to the telemetry standard IRIG 106-04.

**Parameters:**

<Irig> ON | OFF | 1 | 0

**Example:**

```
PULSe:MOP:QPSK:TYPE TGSoQPSK
PULSe:MOP:QPSK:SRATe 1e+06
PULSe:MOP:QPSK:SOQPsk:IRIG 1
```

**Manual operation:** See ["QPSK"](#) on page 110

---

**PULSe:TIME:FALL** <Fall>

**PULSe:TIME:RISE** <Rise>

Sets the transition time of the rising and falling edges.

**Parameters:**

<Rise> float  
Range: 0 to 3600

**Example:** See [Example"Creating a linear chirp pulse"](#) on page 508

**Manual operation:** See ["Pulse Shape Settings"](#) on page 95

---

**PULSe:TIME:WIDTH** <Width>

Sets the time during that the pulse is on top power.

**Parameters:**

<Width> float  
Range: 0 to 3600  
Default unit: s

**Example:** See [Example"Creating a linear chirp pulse"](#) on page 508

**Manual operation:** See ["Pulse Shape Settings"](#) on page 95

---

**PULSe:SETTings** <Settings>

Switches between the displayed settings.

**Setting parameters:**

<Settings> TIMing | MOP | MKR | GENeral

**Example:**

```
PULSe:SETTings MOP
PULSe:PREView:MODE MOP
PULSe:PREView:MOP IQ
```

**Usage:** Setting only

---

**PULSe:PREView:MODE** <Mode>

Switches between the envelope and modulation graphs.

**Setting parameters:**

<Mode> ENvelope | MOP

**Example:** See [PULSe:SETTings](#) on page 520

**Usage:** Setting only

**Manual operation:** See ["Envelope graph"](#) on page 112



---

**PULSe:PREView:MOP** <Mop>

Sets the displayed modulation characteristics.

**Setting parameters:**

<Mop>                    IQ | PHASe | FREQuency

**Example:**                See [PULSe:SETTings](#) on page 520

**Usage:**                    Setting only

**Manual operation:**    See "[Time domain display](#)" on page 114

## 24.17 Receiver commands

### Example: Creating receivers

```

REceiver:CREate "Receiver DF"
REceiver:CATalog?
// "Receiver1", "Receiver DF"
REceiver:SElect?
// Receiver DF
REceiver:NAME?
// Receiver DF
REceiver:MODEL?
// INTERfero

REceiver:ANTenna:ADD
REceiver:ANTenna:SElect 1
REceiver:ANTenna:ALias "Antenna 1"
REceiver:ANTenna:POSition:X 0.14
REceiver:ANTenna:POSition:Y 0
REceiver:ANTenna:POSition:RADIUS 0.14
REceiver:ANTenna:POSition:ANGLE 0
REceiver:ANTenna:POSition:HEIGHT 0
ANTenna:CATalog?
// "Isotropic", "My_PencilBeam", "My_Cosecant", "My_PlanarAntenna", "CustomAntennPattern"
REceiver:ANTenna:PATtern "My_PlanarAntenna"
REceiver:ANTenna:SCAN "NONE"
REceiver:ANTenna:GAIN 2
REceiver:ANTenna:DIRection:AWAY 1
REceiver:ANTenna:DIRection:ELEVation 0
REceiver:ANTenna:DIRection:AZIMuth?
// 0

REceiver:ANTenna:ADD
REceiver:ANTenna:SElect 2

REceiver:ANTenna:ALias "Antenna 2"
REceiver:ANTenna:POSition:X 0
REceiver:ANTenna:POSition:Y 0.14
REceiver:ANTenna:POSition:RADIUS 0.14
REceiver:ANTenna:POSition:ANGLE 90
REceiver:ANTenna:POSition:HEIGHT 0
REceiver:ANTenna:PATtern "My_PlanarAntenna"
REceiver:ANTenna:SCAN "NONE"
REceiver:ANTenna:GAIN 0
REceiver:ANTenna:DIRection:AWAY 1
REceiver:ANTenna:DIRection:ELEVation 0
REceiver:ANTenna:DIRection:AZIMuth?
// 90

```

See also [Example "Moving emitters and receivers"](#) on page 565.

<a href="#">REceiver:ANTenna:ALias</a> .....	523
<a href="#">REceiver:MODEl</a> .....	523
<a href="#">REceiver:ANTenna:POSition:X</a> .....	524
<a href="#">REceiver:ANTenna:POSition:Y</a> .....	524
<a href="#">REceiver:ANTenna:POSition:RADius</a> .....	524
<a href="#">REceiver:ANTenna:POSition:ANGLE</a> .....	524
<a href="#">REceiver:ANTenna:POSition:HEIGht</a> .....	524
<a href="#">REceiver:ANTenna:PATtern</a> .....	524
<a href="#">REceiver:ANTenna:SCAN</a> .....	525
<a href="#">REceiver:ANTenna:GAIN</a> .....	525
<a href="#">REceiver:ANTenna:DIRection:AWAY</a> .....	525
<a href="#">REceiver:ANTenna:DIRection:AZIMuth</a> .....	525
<a href="#">REceiver:ANTenna:DIRection:ELEVation</a> .....	526

---

### **REceiver:ANTenna:ALias** <Alias>

Sets an alias name for the selected antenna element.

#### **Parameters:**

<Alias>                      string

**Example:**                      See [Example "Creating receivers"](#) on page 522.

**Manual operation:**      See ["Antenna Configuration"](#) on page 266

---

### **REceiver:MODEl** <Model>

Sets the receiver model.

#### **Parameters:**

<Model>                      INTerfero | TDOA | COMBined

For details, see ["Model"](#) on page 265.

#### **INTerfero**

Interferometer

Calculates the relative phase difference between the single antenna ports.

#### **TDOA**

Time difference of arrival

Calculates the absolute time of arrival (TOA) of the incoming signal for each antenna.

#### **COMBined**

Calculates the relative phases between the antenna ports and calculates the the individual TOAs for each antenna port.

**Example:**                      See [Example "Creating receivers"](#) on page 522.

**Manual operation:**      See ["Model"](#) on page 265

---

**REceiver:ANTenna:POSition:X** <X>**REceiver:ANTenna:POSition:Y** <Y>

Sets the antenna element position as X and Y values, relative to the receiver origin.

**Parameters:**

<Y> float  
Range: -1e+06 to 1e+06

**Example:** See [Example"Creating receivers"](#) on page 522.

**Manual operation:** See ["Position"](#) on page 268

---

**REceiver:ANTenna:POSition:RADius** <Radius>

Sets the distance from the antenna element to the receiver origin.

**Parameters:**

<Radius> float  
Range: 0 to 1e+06

**Example:** See [Example"Creating receivers"](#) on page 522.

**Manual operation:** See ["Position"](#) on page 268

---

**REceiver:ANTenna:POSition:ANGLE** <Angle>

Sets the antenna element position as an angle offset from the X-axis.

**Parameters:**

<Angle> float  
Range: 0 to 360

**Example:** See [Example"Creating receivers"](#) on page 522.

**Manual operation:** See ["Position"](#) on page 268

---

**REceiver:ANTenna:POSition:HEIGHT** <Height>

Sets the antenna element height, relative to the receiver origin.

**Parameters:**

<Height> float  
Range: -1e+06 to 1e+06

**Example:** See [Example"Creating receivers"](#) on page 522.

**Manual operation:** See ["Position"](#) on page 268

---

**REceiver:ANTenna:PATTern** <Pattern>

Assigns an existing antenna pattern, see [ANTenna:CATalog?](#).

**Parameters:**

<Pattern> string

**Example:** See [Example"Creating receivers"](#) on page 522.

**Manual operation:** See ["Properties"](#) on page 267

---

**RECeiver:ANTenna:SCAN <Scan>**

Sets the antenna scan.

**Parameters:**

<Scan> string

**Example:** See [Example"Creating receivers"](#) on page 522.

**Manual operation:** See ["Properties"](#) on page 267

---

**RECeiver:ANTenna:GAIN <Gain>**

Sets the gain of the individual antenna element.

**Parameters:**

<Gain> float

Range: -120 to 120

**Example:** See [Example"Creating receivers"](#) on page 522.

**Manual operation:** See ["Properties"](#) on page 267

---

**RECeiver:ANTenna:DIRection:AWAY <Away>**

Sets the azimuth automatically, so that the beam axis is radial to the receiver origin.

**Parameters:**

<Away> ON | OFF | 1 | 0

**Example:** See [Example"Creating receivers"](#) on page 522.

**Manual operation:** See ["Properties"](#) on page 267

---

**RECeiver:ANTenna:DIRection:AZIMuth <Azimuth>**

Turns the antenna beam axis.

**Parameters:**

<Azimuth> float

Range: 0 to 360

**Example:** See [Example"Creating receivers"](#) on page 522.

**Manual operation:** See ["Properties"](#) on page 267

**REceiver:ANTenna:DIRection:ELEVation <Elevation>**

Turns the antenna beam axis.

**Parameters:**

<Elevation>            float  
                               Range:     -90 to 90

**Example:**                See [Example "Creating receivers"](#) on page 522.

**Manual operation:**    See ["Properties"](#) on page 267

## 24.18 Repository commands



Do not change the default folder structure and the repository file names.

Changing file paths and file names may lead to data loss and irreparable faults in the data sources.

**Example: Working with repositories**

```

SCPI
// create new empty repository
REpository:CREate "Repository for tests"
REpository:CATalog?
// line brakes added to improve the readability
//"Repository for tests",
//"C:\Users\Public\Documents\Rohde-Schwarz\Pulse Sequencer\Repositories",
//"K32 and K39 Tests",
//"C:\Users\Public\Documents\Rohde-Schwarz\Pulse Sequencer\Repositories",
//"Rep", "C:\Users\Public\Documents\Rohde-Schwarz\Pulse Sequencer\Repositories"
REpository:SAVE
REpository:SElect "Repository for tests"
REpository:AUTHor "My Company Name"
REpository:DATE?
REpository:SECurity LEV1
REpository:VERSion "1.1"
REpository:COMplexity EMITter
REpository:XPOL:ATTenuation 30
REpository:SAVE
REpository:PATH?
// C:\Users\Public\Documents\Rohde-Schwarz\PulseSequencer\Repositories\20140722_113521
REpository:FILEname?
// C:\Users\Public\Documents\Rohde-Schwarz\PulseSequencer\Repositories
   \20140722_113521\Config.ps_rep
REpository:ACCess?
// RW, Login=no, Pass=no, Uname=testuser
REpository:REMove "Rep"

```

```

REPManager:PATH:LIST?
// "C:\Users\Public\Documents\Rohde-Schwarz\PulseSequencer\Repositories"
REPManager:PATH:ADD "C:\_ps_files"
REPManager:PATH:LIST?
// "C:\Users\Public\Documents\Rohde-Schwarz\PulseSequencer\Repositories","C:\_ps_files"
REPManager:CATalog?
// "Repository for tests",
   "C:\Users\Public\Documents\Rohde-Schwarz\PulseSequencer\Repositories",
// "K32 and K39 Tests",
   "C:\Users\Public\Documents\Rohde-Schwarz\PulseSequencer\Repositories",
// "My_Tests","C:\_ps_files"
REPManager:LOAD "K32 and K39 Tests"
REPManager:EXPort "K32 and K39 Tests","c:\_ps_files\my.psarch"
REPManager:DELeTe "My_Tests"
REPManager:CATalog?
// "Repository for tests",
   "C:\Users\Public\Documents\Rohde-Schwarz\PulseSequencer\Repositories",
// "K32 and K39 Tests",
   "C:\Users\Public\Documents\Rohde-Schwarz\PulseSequencer\Repositories"

```

REPository:ACCess?	527
REPository:AUTHor	528
REPository:DATE	528
REPository:FILEname?	528
REPository:PATH?	528
REPository:SAVE	529
REPository:SECurity	529
REPository:VERSion	529
REPository:XPOL:ATTenuation	529
REPository:UUID?	529
REPManager:CATalog?	530
REPManager:LOAD	530
REPManager:DELeTe	531
REPManager:EXPort	531
REPManager:IMPort	531
REPManager:PATH:ADD	532
REPManager:PATH:DELeTe	532
REPManager:PATH:LIST?	532

---

### REPository:ACCess?

Queries information on the access rights of the current user.

#### Return values:

<Access>                    <permission>,<login>,<pass>,<Uname>

**<permission>**  
                              Permission of the current user, for example RW (read-write)

**<login>,<pass>**  
                              Login/Pass=No: Password not required  
                              Login/Pass=Yes: Password required

**<Uname>**

User name of the current user

**Example:** See [Example"Working with repositories"](#) on page 526**Usage:** Query only**Manual operation:** See ["Users"](#) on page 400**REPository:AUTHor <Author>**

Enters information on the author.

**Parameters:**

&lt;Author&gt; string

**Example:** See [Example"Working with repositories"](#) on page 526**Manual operation:** See ["Info"](#) on page 62**REPository:DATE <Date>**

Queries the creation data.

**Parameters:**

&lt;Date&gt; string

**Example:** See [Example"Working with repositories"](#) on page 526**Manual operation:** See ["Info"](#) on page 62**REPository:FILENAME?**

Queries the file name of the repository archive.

**Return values:**

&lt;Filename&gt; string

File path, incl. file name, and extension

**Example:** See [Example"Working with repositories"](#) on page 526**Usage:** Query only**Manual operation:** See ["Storage"](#) on page 63**REPository:PATH?**

Queries the directory in that the repository archive is stored.

**Return values:**

&lt;Path&gt; string

**Example:** See [Example"Working with repositories"](#) on page 526**Usage:** Query only



**Manual operation:** See ["Storage"](#) on page 63

---

### REPository:SAVE

Stores the repository archive.

To query the storage location, use the command `REPository:PATH?`.

**Example:** See [Example"Working with repositories"](#) on page 526

**Usage:** Event

**Manual operation:** See ["Storage"](#) on page 63

---

### REPository:SECurity <Security>

Sets the security level.

**Parameters:**

<Security> LEV0 | LEV1 | LEV2 | LEV3 | LEV4

**Example:** See [Example"Working with repositories"](#) on page 526

**Manual operation:** See ["Classification"](#) on page 62

---

### REPository:VERSion <Version>

Sets the repository version.

**Parameters:**

<Version> string

**Example:** See [Example"Working with repositories"](#) on page 526

**Manual operation:** See ["Info"](#) on page 62

---

### REPository:XPOL:ATTenuation <Attenuation>

Sets the attenuation used to calculate the cross-polarized antenna patterns.

**Parameters:**

<Attenuation> float  
\*RST: 0

**Example:** See [Example"Working with repositories"](#) on page 526

**Manual operation:** See ["Antenna Cross Polarization > Attenuation"](#) on page 62

---

### REPository:UUID?

Queries the repository's Universally Unique Identifier (UUID).

**Return values:**

<Uuid> string

**Example:** REPOSITORY:UUID?  
// 89d00568-e9d7-4470-8b8d-2179336da541

**Usage:** Query only

### REPMANAGER:CATALOG?

Queries available repository elements in the database.

**Return values:**

<Catalog> "<RepositoryName>","<path>"  
<RepositoryName> is the name of the repository as defined with the command [REPOSITORY:CREATE](#)  
<Path> is the complete file path

**Example:** See [Example"Working with repositories"](#) on page 526

**Usage:** Query only

**Manual operation:** See ["Discovered Repositories on the Mass Storage"](#) on page 65

### REPMANAGER:LOAD <RepName>[,<Path>[,<Username>,<Passwd>]]

Loads the selected repository to the workspace.

If more than one repository with the same name exist, loaded is the first repository with a name match.

To query the available repository elements in the database, use the command [REPOSITORY:CATALOG?](#).

**Setting parameters:**

<RepName> string  
Repository name, as configured in the workspace.

<Path> string  
Complete file path, as queried with the command [REPMANAGER:PATH:LIST?](#).  
The <Path> must be specified, if <Username> and <Passwd> are used.

<Username> string  
Required if the repository is password protected

<Passwd> string  
Required if the repository is password protected

**Example:** See [Example"Working with repositories"](#) on page 526

**Usage:** Setting only

**Manual operation:** See ["Load"](#) on page 65

---

**REPManager:DELeTe** <RepName>[,<Path>[,<Username>,<Passwd>]]

Deletes the entire repository from the permanent mass storage.

**Setting parameters:**

<RepName>	string	Repository name, as configured in the workspace. If more than one repository with the same name exists, the <Path> must be specified.
<Path>	string	Complete file path, as queried with the command <a href="#">REPManager:PATH:LIST?</a> . The <Path> must be specified, if the <RepName> is not unique and if <Username> and <Passwd> are used.
<Username>	string	Required if the repository is password protected
<Passwd>	string	Required if the repository is password protected

**Example:** See [Example"Working with repositories"](#) on page 526

**Usage:** Setting only

**Manual operation:** See ["Delete"](#) on page 66

---

**REPManager:EXPort** <RepName>[,<Path>],<PSArchiveFile>

Exports the selected repository file to an archive file.

**Setting parameters:**

<RepName>	string	Repository name, as configured in the workspace.
<Path>	string	Complete file path, as queried with the command <a href="#">REPManager:PATH:LIST?</a> .
<PSArchiveFile>	Complete file path, incl. file name, and extension (*.psarch).	

**Example:** See [Example"Working with repositories"](#) on page 526.

**Usage:** Setting only

**Manual operation:** See ["Export"](#) on page 66

---

**REPManager:IMPort** <Import>

Imports a repository from a directory.

**Setting parameters:**

<Import>	string	
----------	--------	--

**Usage:** Setting only

**Manual operation:** See ["Import"](#) on page 66

---

#### **REPManger:PATH:ADD <Add>**

Add the selected directory.

**Setting parameters:**

<Add> string  
Complete file path

**Example:** See [Example"Working with repositories"](#) on page 526

**Usage:** Setting only

**Manual operation:** See ["Add Path"](#) on page 66

---

#### **REPManger:PATH:DELeTe <Delete>**

Removes the selected file path.

**Setting parameters:**

<Delete> string  
File path

**Example:** See [Example"Working with repositories"](#) on page 526

**Usage:** Setting only

**Manual operation:** See ["Remove Path"](#) on page 67

---

#### **REPManger:PATH:LIST?**

Queries the directory in that the repository files are stored.

**Return values:**

<List> string  
Complete file path

**Example:** See [Example"Working with repositories"](#) on page 526

**Usage:** Query only

## 24.19 Scenario commands

### Example: Creating simple pulse train scenario

```
SCPI
SCENario:CREate "SimplePulseTrain"
SCENario:TYPE SEquence
SCENario:ID?
// 4
SCENario:OUTPut:FREquency 6e+09
SCENario:OUTPut:LEVel -10
SCENario:OUTPut:RESet:ENABle 1
SCENario:OUTPut:RUNMode CONTinuous
SEquence:CATalog?
// "My_S1_PT","My_S2_S1-F1_S1-F2","My_PT_PRI-Stagger","My_PT_F-Hops",
// "My_WV_Seq","My_TestSequence"
SCENario:SEquence "My_S1_PT"
PLUGin:CREate
PLUGin:LOAD "C:/Export-PDW.dll"
DESTination:ADD "Destination 1"
DESTination:PLUGin:NAME "Plugin 1"
SCENario:DESTination "Destination 1"
SCENario:OUTPut:DURation:MODE AUTO
// SCENario:OUTPut:DURation:TIME 0.10
SCENario:OUTPut:THReshold -100
SCENario:OUTPut:RECall:ENABle 1
SCENario:CALCulate
SCENario:STATe?
// RUN
SYSTEM:PROGress?
// 74
SYSTEM:PROGress?
// 100
SCENario:CACHe:VOLatile:VALid?
// 1
SCENario:CACHe:VOLatile:RELease
// SCENario:CACHe:VOLatile:CLEar
SCENario:START
```

**Example: Creating sequence collection scenario**

```
SCPI
SCENario:CREate "My_PT_Collection"
SCENario:TYPE CSEquence
SCENario:CSEquence:ADD
SCENario:CSEquence:SElect 1
SCENario:CSEquence:ALias "PT"
SCENario:CSEquence "My_S2_S1-F1_S1-F2"
SCENario:CSEquence:ADD
SCENario:CSEquence:SElect 2
SCENario:CSEquence:ALias "F-Hops"
SCENario:CSEquence "My_PT_F-Hops"
SCENario:CSEquence:CURRent 1
...
SCENario:CALCulate
```

**Example: Creating a simple emitter scenario**

```
SCPI
SCENario:CREate "SimpleEmitterScenario"
SCENario:TYPE EMITter
EMITter:CATalog?
// "My_EmitterGuidance","TestEmitter"
SCENario:EMITter "My_EmitterGuidance"
SCENario:EMITter:MODE 2
SCENario:EMITter:MODE:BEAM 1
SCENario:EMITter:DIRection:YAW -10
SCENario:EMITter:DIRection:PItCh -5
...
SCENario:DEStination "My Destination"
SCENario:CALCulate
```

**Example: Creating a scenario with multiple emitters and background emitters**

```

SCPI
SCENario:CREate "LocalizedEmitters"
SCENario:TYPE Localized
EMITter:CATalog?
// "My_EmitterGuidance","TestEmitter"
ANTenna:CATalog?
// "Isotropic","My_PencilBeam","My_Cosecant","My_PlanarAntenna","Testantenna"
SCAN:CATalog?
// "My_RasterScan","My_Circular","Test Antenna Scan"

SCENario:LocalizeD:RECeiver:ANTenna "My_Cosecant"
SCENario:LocalizeD:RECeiver:SCAN "My_Circular"
SCENario:LocalizeD:RECeiver:GAIN 5
SCENario:LocalizeD:RECeiver:HEIGHT 1
SCENario:LocalizeD:RECeiver:DIRection:YAW 0
SCENario:LocalizeD:RECeiver:DIRection:PITCh -5

SCENario:LocalizeD:ADD
SCENario:LocalizeD:SElect?

SCENario:LocalizeD:ADD
SCENario:LocalizeD:SElect 6
SCENario:LocalizeD:TYPE EMITter
SCENario:LocalizeD:ALias "E4"
SCENario:LocalizeD:EMITter "My_EmitterGuidance"
SCENario:LocalizeD:EMITter:MODE 1
SCENario:LocalizeD:EMITter:MODE:BEAM 2
SCENario:LocalizeD:DIRection:TRACk 1
SCENario:LocalizeD:DIRection:PITCh 0
SCENario:LocalizeD:DIRection:YAW -87.8901
SCENario:LocalizeD:LOCation:EAST 253.448
SCENario:LocalizeD:LOCation:NORTH -6879.31
SCENario:LocalizeD:DISTance?
// 6883.98

SCENario:LocalizeD:ADD
SCENario:LocalizeD:SElect 7
SCENario:LocalizeD:TYPE Emitter
SCENario:LocalizeD:ALias "PT"
SEQuence:CATalog?
// "My_S2_S1-F1_S1-F2","My_PT_PRI-Stagger","My_PT_F-Hops",
// "My_TestSequence","My_PulseTrain_Seq"
SCENario:LocalizeD:SEQuence "My_PulseTrain_Seq"

...
SCENario:CALCulate

```

**Example: Direction finding scenario**

```
SCENario:NAME "DF"
SCENario:DF:RECeiver:MOVement:VEHicle STATIONARY
SCENario:DF:RECeiver "Receiver DF"
SCENario:DF:LOCation:REC:PMODE STATIC
SCENario:DF:RECeiver:LATitude -3.781666183E+01
SCENario:DF:RECeiver:LONGitude 1.4496665955E+02
SCENario:DF:RECeiver:HEIGHt 1.E+02
SCENario:DF:RECeiver:DIRection:YAW 0.E+00
SCENario:DF:RECeiver:DIRection:PITCh 0.E+00
SCENario:DF:RECeiver:DIRection:ROLL 0.E+00

SCENario:DF:TYPE EMITTER
SCENario:DF:ALias "TestEmitter"
SCENario:DF:EMITter "TestEmitter"
SCENario:DF:MOVement:VEHicle
SCENario:DF:MCHG:STATe 0
SCENario:DF:EMITter:MODE 1
SCENario:DF:EMITter:MODE:BEAM 1
SCENario:DF:EMITter:MODE:TRACkrec 1
SCENario:DF:LOCation:PMODE MOVING
SCENario:DF:LOCation:EAST 3.998600097656E+03
SCENario:DF:LOCation:NORTH 6.902350097656E+03
SCENario:DF:LOCation:HEIGHt 0.E+00
SCENario:DF:DISTance 7.977545898438E+03
SCENario:DF:LOCation:AZIMuth 3.008413852012E+01
SCENario:DF:LOCation:ELEVation 0.E+00
SCENario:DF:MOVement:SPEed 1.E-01
SCENario:DF:MOVement:ACCeleration 0.E+00
SCENario:DF:MOVement:EAST 0.E+00
SCENario:DF:MOVement:NORTH 0.E+00
SCENario:DF:MOVement:HEIGHt 0.E+00
SCENario:DF:MOVement:RMODE ONEWAY
...
```



**Example: Enabling mode changing**

The following is a simple example on how to enable 3 modes for the emitter with alias E4 in the example [Example "Creating a scenario with multiple emitters and background emitters"](#) on page 535.

```

SCENario:LOCalized:SElect 6
SCENario:LOCalized:ALias?
// "E4"
SCENario:LOCalized:TYPE?
// EMITter
SCENario:LOCalized:EMITter?
// "My_EmitterGuidance"
// enable mode change and add 3 entries
SCENario:LOCalized:MCHG:STATe 1
SCENario:LOCalized:MCHG:ADD
SCENario:LOCalized:MCHG:ADD
SCENario:LOCalized:MCHG:COUNT?
// 3
// start configuration of the last (entry#3)
SCENario:LOCalized:MCHG:SElect 3
// configure the stop time first
SCENario:LOCalized:MCHG:STOP 10
SCENario:LOCalized:MCHG:START 5
SCENario:LOCalized:EMITter:MODE 2
SCENario:LOCalized:EMITter:MODE:BEAM 2
// configure entry#2
SCENario:LOCalized:MCHG:SElect 2
// set stop time of entry#2 = start time of entry#3
SCENario:LOCalized:MCHG:STOP 5
SCENario:LOCalized:MCHG:START 3
SCENario:LOCalized:EMITter:MODE 2
SCENario:LOCalized:EMITter:MODE:BEAM 1
// configure entry#1
SCENario:LOCalized:MCHG:SElect 1
// set stop time of entry#1 = start time of entry#2
SCENario:LOCalized:MCHG:STOP 3
SCENario:LOCalized:MCHG:START 0
SCENario:LOCalized:EMITter:MODE 1
SCENario:LOCalized:EMITter:MODE:BEAM 1

// SCENario:LOCalized:MCHG:CLEar

```

**Example: Configuring position steps**

The following is a simple example on how to enable 3 positions for the emitter with alias E4.

```

SCENario:LOCalized:SElect 6
SCENario:LOCalized:ALias?
// "E4"
SCENario:LOCalized:TYPE?
// EMITter
SCENario:LOCalized:EMITter?
// "My_EmitterGuidance"
// enable position steps and add 2 entries
SCENario:LOCalized:PSTep:STATe 1
SCENario:LOCalized:PSTep:ADD
SCENario:LOCalized:PSTep:ADD
SCENario:LOCalized:PSTep:COUNT?
// 2
// position step#1 is already defiend

SCENario:LOCalized:PSTep:SElect 2
SCENario:LOCalized:DIRection:YAW -150
SCENario:LOCalized:LOCation:EAST 4.439169921875E+03
SCENario:LOCalized:LOCation:NORTh 7.702899902344E+03

SCENario:LOCalized:PSTep:SElect 3
SCENario:LOCalized:DIRection:TRACk 1
SCENario:LOCalized:LOCation:EAST 2.323706054688E+03
SCENario:LOCalized:LOCation:NORTh 4.177126464844E+03

```

**Example: Configuring different modes**

The following is a simple example on how to enable emitter with different modes.

```

SCENario:LOCalized:EMITter "TestEmitter"
SCENario:LOCalized:EMITter:STATe:ENABLe 1
SCENario:LOCalized:EMITter:STATe:ADD
SCENario:LOCalized:EMITter:STATe:SElect 1
SCENario:LOCalized:EMITter:STATe:DURation 1
SCENario:LOCalized:EMITter:STATe:VALue 1
SCENario:LOCalized:EMITter:STATe:ADD
SCENario:LOCalized:EMITter:STATe:COUNT?
// 2

SCENario:LOCalized:EMITter:STATe:SElect 2
SCENario:LOCalized:EMITter:STATe:DURation 2
SCENario:LOCalized:EMITter:STATe:VALue 0

SCENario:LOCalized:EMITter:STATe:LOOP 1

```

**Example: Creating and configuring PDW list scenario**

The following is a simple example on how to create a PDW list scenario.

```
// create scenario
SCENario:TYPE PDW
SCENario:CREate
SCENario:NAME "PDW List"
```

See [Example"PDW import \(unmodulated pulses\)"](#) on page 490.

```
// repeat the same steps for all your PDW lists

// configure the PDW list scenario
SCENario:CPDW:ADD
SCENario:CPDW:SElect 1
SCENario:CPDW:ALias "PDW Custom"
SCENario:CPDW:NAME "PDW"
SCENario:CPDW:LVABs 0
SCENario:CPDW:FREQ 3e+9

SCENario:CPDW:ADD
SCENario:CPDW:SElect 2
SCENario:CPDW:ALias "My PDW"
SCENario:CPDW:NAME "PDW_2"
SCENario:CPDW:LVABs -3
SCENario:CPDW:FREQ 3e+9

SCENario:CPDW:INTERleaving 0

// calculate the multiplexed signal of the two PDW lists
SCENario:CPDW:INTERleaving 1
SCENario:OUTPut:THReshold -1.E+02
// set the priority of each PSW list
// the higher the number the higher the priority
SCENario:CPDW:SElect 1
SCENario:CPDW:ENABle 1
SCENario:CPDW:DELay 0
SCENario:CPDW:PRIority 10
SCENario:CPDW:LEVel 0
SCENario:CPDW:LDELay 10
SCENario:CPDW:GROup:CATalog?
// "Default","Group 2"
SCENario:CPDW:GROup "Default"

SCENario:CPDW:SElect 2
SCENario:CPDW:ENABle 1
SCENario:CPDW:DELay 0.01
SCENario:CPDW:PRIority 5
SCENario:CPDW:LEVel -5
SCENario:CPDW:LDELay 0
SCENario:CPDW:GROup "Default"
```

```
// convert and calculate the multiplexed signal
SCENario:CPDW:CURRent 1
SCENario:START
SCENario:INTerleave
SCENario:CAChE:REPository:ENABle:INTerleave

// remove the second file from the PDW list
SCENario:CPDW:SElect 2
SCENario:CPDW:DElete
// remove all entries in the PDW list scenario
// SCENario:CPDW:CLEar
```

### Example: Creating and configuring PDW list scenario

The following is a simple example on how to configure interleaving groups. It uses as an example a PDW list scenario, for example as configured in [Example "Creating and configuring PDW list scenario"](#) on page 539.

```
// create scenario
SCENario:TYPE PDW
SCENario:CREate
SCENario:NAME "PDW List"

SCENario:INTerleaving:GROup:COUNT?
// 1
SCENario:CPDW:GROup:SElect 1
SCENario:CPDW:GROup:ALias?
// "Default"
SCENario:CPDW:GROup:ADD
SCENario:CPDW:GROup:COUNT?
// 2
SCENario:CPDW:GROup:SElect 2
SCENario:CPDW:GROup:ALias "Group 2"
SCENario:CPDW:GROup:CATalog?
// "Default","Group 2"

SCENario:CPDW:INTerleaving 1
SCENario:CPDW:INTerleaving:MODE MERGE
SCENario:CPDW:SElect 1
SCENario:CPDW:ENABle 1
SCENario:CPDW:GROup "Default"
SCENario:CPDW:SElect 2
SCENario:CPDW:ENABle 1
SCENario:CPDW:GROup "Default"
SCENario:CPDW:SElect 3
SCENario:CPDW:ENABle 1
SCENario:CPDW:GROup "Group 2"

// the first and the second PDW lists are interleaved;
// the third one belongs to a different interleaving group
```

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---

### SCENario:TYPE <Type>

Sets the scenario type.

#### Parameters:

<Type>                   SEQUence | CSEQUence | EMITter | CEMitter | LOCalized | DF | PDW

**Example:**               See [Example"Creating simple pulse train scenario"](#) on page 533



**Manual operation:** See ["Scenario Type"](#) on page 76

---

### SCENario:ID?

Queries the database identifier of the selected scenario.

**Return values:**

<Id> float  
\*RST: 0

**Example:** See [Example"Creating simple pulse train scenario"](#) on page 533

**Usage:** Query only

---

### SCENario:LOCalized:INTERleaving <Interleaving>

### SCENario:DF:INTERleaving <Interleaving>

### SCENario:CEMit:INTERleaving <Interleaving>

### SCENario:CPDW:INTERleaving <Interleaving>

If enabled, multiple PDW lists are interleaved into a single output file using a priority-based dropping algorithm.

Set the priority with the command [SCENario:CPDW:PRIority](#).

**Parameters:**

<Interleaving> ON | OFF | 1 | 0

**Example:** See [Example"Creating and configuring PDW list scenario"](#) on page 539.

**Manual operation:** See ["Interleaving"](#) on page 77

---

### SCENario:LOCalized:INTERleaving:MODE <Mode>

### SCENario:DF:INTERleaving:MODE <Mode>

### SCENario:CEMit:INTERleaving:MODE <Mode>

Select the mode for interleaving.

**Parameters:**

<Mode> DROP | MERGe

**DROP**

Interleaving uses a priority-based dropping algorithm.

**MERGE**

Emitters or PDW lists are merged into multiple output files using groups.

**Example:** See [Example"Creating and configuring PDW list scenario"](#) on page 540.

**Manual operation:** See ["Mode"](#) on page 77

---

**SCENario:CALCulate**

Starts the signal calculation.

**Example:** See [Example "Creating simple pulse train scenario"](#) on page 533.

**Usage:** Event

**Manual operation:** See ["Calculate"](#) on page 81

---

**SCENario:START**

Starts the signal generation.

**Example:** See [Example "Creating simple pulse train scenario"](#) on page 533.

**Usage:** Event

**Manual operation:** See ["Config"](#) on page 80

---

**SCENario:STOP**

Stops the signal calculation.

**Example:** See [Example "Creating simple pulse train scenario"](#) on page 533.

**Usage:** Event

**Manual operation:** See ["Config"](#) on page 80

---

**SCENario:INTerleave**

If `SCENario:CEMit:INTerleaving`|`SCENario:CPDW:INTerleaving`|`SCENario:LOCalized:INTerleaving`|`SCENario:DF:INTerleaving` 1, triggers the calculation of a single output file.

The output file comprises the individual PDWs or pulses, where overlapping PDWs or pulses within an interleaving group are dropped, based on a defined priority.

**Example:** See [Example "Creating and configuring PDW list scenario"](#) on page 539.

**Usage:** Event

**Manual operation:** See ["Interleave"](#) on page 83

---

**SCENario:STATE?**

Queries the current scenario status.

**Return values:**  
<State> IDLE | RUN

---

**Example:** See [Example"Creating simple pulse train scenario"](#) on page 533

**Usage:** Query only

**Manual operation:** See ["Config"](#) on page 80

**SCENario:ILCache:VOLatile:VALid?****SCENario:CACHe:VOLatile:VALid?**

Queries whether the volatile/repository memory contains a valid signal file.

**Return values:**

<Valid> ON | OFF | 1 | 0

**Example:** See [Example"Creating simple pulse train scenario"](#) on page 533

**Usage:** Query only

**SCENario:ILCache:VOLatile:CLEar****SCENario:CACHe:VOLatile:CLEar**

Deletes the files from the volatile/repository memory.

**Example:** See [Example"Creating simple pulse train scenario"](#) on page 533

**Usage:** Event

**Manual operation:** See ["Results"](#) on page 81

**SCENario:DESTination <Destination>**

Sets the destination for the signal.

**Parameters:**

<Destination> string

Use the command [DESTination:PLUGin:VARiable:CATalog](#) on page 503 to query a list of available export plugins.

**SCENario:SEQuence <Sequence>**

Assigns a pulse sequence, see [SEQuence:CATalog?](#) on page 426.

**Parameters:**

<Sequence> string

**Example:** See [Example"Creating simple pulse train scenario"](#) on page 533

**SCENario:SEQuence:CLEar**

**Usage:** Event

---

**SCENario:DF:ALias** <Alias>  
**SCENario:CEMit:ALias** <Alias>  
**SCENario:CSEquence:ALias** <Alias>  
**SCENario:LOCalized:ALias** <Alias>

Enters an alias name.

**Parameters:**

<Alias>                      string

**Example:**                      See [Example"Creating a scenario with multiple emitters and background emitters"](#) on page 535

**Manual operation:**    See ["Alias Name"](#) on page 312

---

**SCENario:CPDW:CURRENT** <Current>  
**SCENario:DF:CURRENT** <Current>  
**SCENario:LOCalized:CURRENT** <Current>  
**SCENario:CSEquence:CURRENT** <Current>

Sets the sequence/emitter that is used by the scenario.

**Parameters:**

<Current>                      float

Number of the sequence/emitter in the list with multiple sequences

\*RST:                      1

**Example:**                      See [Example"Creating sequence collection scenario"](#) on page 534

**Manual operation:**    See ["Sequence \(Collection\) Scenario Settings"](#) on page 85

---

**SCENario:DF:DIRection:YAW** <Yaw>  
**SCENario:EMITter:DIRection:YAW** <Yaw>  
**SCENario:CEMit:DIRection:YAW** <Yaw>  
**SCENario:LOCalized:DIRection:YAW** <Yaw>  
**SCENario:DF:RECeiver:DIRection:YAW** <Yaw>  
**SCENario:LOCalized:RECeiver:DIRection:YAW** <Yaw>

Sets the yaw.

**Parameters:**

<Yaw>                              float

Range:                      0 to 360

**Example:**                      See [Example"Creating a scenario with multiple emitters and background emitters"](#) on page 535

**Manual operation:**    See ["Attitude > Pitch, Yaw, Roll"](#) on page 273

---

**SCENario:DF:DIRection:PITCh** <Pitch>  
**SCENario:DF:RECeiver:DIRection:PITCh** <Pitch>  
**SCENario:EMITter:DIRection:PITCh** <Pitch>  
**SCENario:CEMit:DIRection:PITCh** <Pitch>  
**SCENario:LOCalized:RECeiver:DIRection:PITCh** <Pitch>  
**SCENario:LOCalized:DIRection:PITCh** <Pitch>

Sets the pitch.

**Parameters:**

<Pitch>                      float  
                                     Range:     -90 to 90  
                                     Default unit: grad

**Example:**                      See [Example"Creating a scenario with multiple emitters and background emitters"](#) on page 535

**Manual operation:**    See ["Attitude"](#) on page 318

---

**SCENario:DF:DIRection:ROLL** <Roll>  
**SCENario:DF:RECeiver:DIRection:ROLL** <Roll>  
**SCENario:EMITter:DIRection:ROLL** <Roll>  
**SCENario:CEMit:DIRection:ROLL** <Roll>  
**SCENario:LOCalized:RECeiver:DIRection:ROLL** <Roll>  
**SCENario:LOCalized:DIRection:ROLL** <Roll>

Sets the roll.

**Parameters:**

<Roll>                         float  
                                     Range:     0 to 360

**Manual operation:**    See ["Attitude"](#) on page 318

---

**SCENario:DF:EMITter** <Emitter>  
**SCENario:EMITter** <Emitter>  
**SCENario:CEMit:EMITter** <Emitter>  
**SCENario:LOCalized:EMITter** <Emitter>

Assigns an existing emitter or an existing waveform, see [WAVEform:CATalog?](#) and [EMITter:CATalog?](#).

**Parameters:**

<Emitter>                      string

**Example:**                      See [Example"Creating a scenario with multiple emitters and background emitters"](#) on page 535

**Manual operation:**    See ["Emitter Name"](#) on page 312

---

**SCENario:DF:EMITter:ENABLE** <Enable>  
**SCENario:LOCalized:EMITter:ENABLE** <Enable>  
**SCENario:CEMit:EMITter:ENABLE** <Enable>

In a map-based scenario, enable selected item for calculation.

**Parameters:**

<Enable>                    ON | OFF | 1 | 0

---

**SCENario:DF:EMITter:MODE** <Mode>  
**SCENario:EMITter:MODE** <Mode>  
**SCENario:CEMit:EMITter:MODE** <Mode>  
**SCENario:LOCalized:EMITter:MODE** <Mode>

Set the emitter mode.

**Parameters:**

<Mode>                    float  
                               Range:        1 to 32

**Example:**                See [Example"Creating a scenario with multiple emitters and background emitters"](#) on page 535

**Manual operation:**    See ["Mode"](#) on page 314

---

**SCENario:DF:EMITter:MODE:BEAM** <Beam>  
**SCENario:EMITter:MODE:BEAM** <Beam>  
**SCENario:CEMit:EMITter:MODE:BEAM** <Beam>  
**SCENario:LOCalized:EMITter:MODE:BEAM** <Beam>

Sets the used beam of the current mode.

**Parameters:**

<Beam>                    float  
                               Range:        1 to 32

**Example:**                See [Example"Creating a scenario with multiple emitters and background emitters"](#) on page 535

**Manual operation:**    See ["Beam"](#) on page 315

---

**SCENario:DF:DIRection:TRACK** <Track>  
**SCENario:LOCalized:DIRection:TRACK** <Track>

Turns the antenna in the direction of the receiver.

**Parameters:**

<Track>                    ON | OFF | 1 | 0

**Example:**                See [Example"Creating a scenario with multiple emitters and background emitters"](#) on page 535

**Manual operation:**    See ["Attitude"](#) on page 318

---

**SCENario:DF:EMITter:MODE:TRACkrec** <Trackrec>  
**SCENario:CEMit:EMITter:MODE:TRACkrec** <Trackrec>  
**SCENario:LOCalized:EMITter:MODE:TRACkrec** <Trackrec>

If enabled, the scan follows the receiver automatically.

**Parameters:**

<Trackrec>            ON | OFF | 1 | 0

**Manual operation:**    See "[Track Receiver](#)" on page 315

---

**SCENario:DF:DISTance** <Distance>  
**SCENario:LOCalized:DISTance** <Distance>

Sets the distance to the receiver.

**Parameters:**

<Distance>            float  
                               Range:     0 to 1e+09  
                               Default unit: m

**Example:**            See [Example"Creating a scenario with multiple emitters and background emitters"](#) on page 535

**Manual operation:**    See "[East, North, Height/Distance, Azimuth, Elevation](#)" on page 317

---

**SCENario:DF:LOCation:EAST** <East>  
**SCENario:DF:LOCation:NORTH** <North>  
**SCENario:LOCalized:LOCation:EAST** <East>  
**SCENario:LOCalized:LOCation:NORTH** <North>

Sets the emitter coordinates.

**Parameters:**

<North>                float  
                               Range:     -1e+09 to 1e+09  
                               Default unit: m

**Example:**            See [Example"Creating a scenario with multiple emitters and background emitters"](#) on page 535

**Manual operation:**    See "[East, North, Height/Distance, Azimuth, Elevation](#)" on page 317

---

**SCENario:DF:LOCation:AZIMuth** <Azimuth>  
**SCENario:LOCalized:LOCation:AZIMuth** <Azimuth>

Sets the azimuth.

**Parameters:**

<Azimuth>             float  
                               Range:     0 to 360

**Example:**

```

SCENario:LOCalized:LOCation:NORTH 7000
SCENario:LOCalized:LOCation:EAST 0
SCENario:LOCalized:LOCation:ALTitude 0

SCENario:LOCalized:DISTance?
// 7000
SCENario:LOCalized:LOCation:AZIMuth?
// 0
SCENario:LOCalized:LOCation:ELEVation?
// 0

SCENario:LOCalized:LOCation:AZIMuth 90
SCENario:LOCalized:LOCation:NORTH?
// 4.28626e-13
SCENario:LOCalized:LOCation:EAST?
// 7000

SCENario:LOCalized:LOCation:ALTitude 10
SCENario:LOCalized:LOCation:ELEVation?
// 0.0818511
SCENario:LOCalized:DISTance?
// 7000.01

```

**Manual operation:** See ["East, North, Height/Distance, Azimuth, Elevation"](#) on page 317

**SCENario:DF:LOCation:ELEVation** <Elevation>

**SCENario:LOCalized:LOCation:ELEVation** <Elevation>

Sets the elevation.

**Parameters:**

<Elevation> float  
Range: -90 to 90

**Example:** See [SCENario:LOCalized:LOCation:AZIMuth](#) on page 551

**Manual operation:** See ["East, North, Height/Distance, Azimuth, Elevation"](#) on page 317

**SCENario:DF:RECeiver:LATitude** <Latitude>

**SCENario:DF:RECeiver:LONGitude** <Longitude>

**SCENario:LOCalized:RECeiver:LATitude** <Latitude>

**SCENario:LOCalized:RECeiver:LONGitude** <Longitude>

Sets the latitude/longitude coordinates of the static receiver.

**Parameters:**

<Longitude> float  
Range: -180 to 180



**Example:** See [Example"Direction finding scenario"](#) on page 536.

**Manual operation:** See ["Position > Latitude, Longitude, Altitude, Yaw, Pitch, Roll"](#) on page 263

**SCENario:DF:RECeiver:HEIGht** <Height>  
**SCENario:DF:LOCation:HEIGht** <Height>  
**SCENario:LOCalized:RECeiver:HEIGht** <Height>  
**SCENario:LOCalized:LOCation:HEIGht** <Height>

Sets the height of the antenna.

**Parameters:**

<Height> float  
 Range: -1e+09 to 1e+09

**Example:** See [Example"Creating a scenario with multiple emitters and background emitters"](#) on page 535

**Manual operation:** See ["East, North, Height/Distance, Azimuth, Elevation"](#) on page 317

**SCENario:DF:WAVeform:ANTenna** <Antenna>  
**SCENario:LOCalized:RECeiver:ANTenna** <Antenna>  
**SCENario:LOCalized:WAVeform:ANTenna** <Antenna>

Assigns an existing antenna pattern, see [ANTenna:CATalog?](#) on page 425.

**Parameters:**

<Antenna> string

**Example:** See [Example"Creating a scenario with multiple emitters and background emitters"](#) on page 535

**SCENario:DF:WAVeform:SCAN** <Scan>  
**SCENario:LOCalized:RECeiver:SCAN** <Scan>  
**SCENario:LOCalized:WAVeform:SCAN** <Scan>

Assigns an existing antenna scan, see [SCAN:CATalog?](#) on page 426.

**Parameters:**

<Scan> string

**Example:** See [Example"Creating a scenario with multiple emitters and background emitters"](#) on page 535

**SCENario:DF:TYPE** <Type>  
**SCENario:LOCalized:TYPE** <Type>

Defines whether an emitter is configured.

**Parameters:**

<Type> EMITter

**Example:** See [Example"Creating a scenario with multiple emitters and background emitters"](#) on page 535

**Manual operation:** See ["Type"](#) on page 312

#### **SCENario:LOCalized:RECeiver:GAIN** <Gain>

Sets the antenna [Gain](#).

##### **Parameters:**

<Gain> float  
Range: -120 to 120

**Example:** See [Example"Creating a scenario with multiple emitters and background emitters"](#) on page 535

**Manual operation:** See ["Gain"](#) on page 262

#### **SCENario:DF:SEQuence** <Sequence>

#### **SCENario:LOCalized:SEQuence** <Sequence>

Assigns a sequence to the background signal.

##### **Parameters:**

<Sequence> string

**Example:** See [Example"Creating a scenario with multiple emitters and background emitters"](#) on page 535

**Manual operation:** See ["Background Signals"](#) on page 302

#### **SCENario:DF:WAVeform** <Waveform>

#### **SCENario:LOCalized:WAVeform** <Waveform>

Assigns an existing emitter, see [WAVeform:CATalog?](#) and [EMITter:CATalog?](#).

##### **Parameters:**

<Waveform> string

**Example:** See [Example"Creating a scenario with multiple emitters and background emitters"](#) on page 535

**Manual operation:** See ["Signal Source"](#) on page 337

#### **SCENario:DF:WAVeform:LEVel** <Level>

#### **SCENario:DF:WAVeform:EIRP** <Eirp>

#### **SCENario:LOCalized:WAVeform:LEVel** <Level>

#### **SCENario:LOCalized:WAVeform:EIRP** <Eirp>

Sets the [EIRP](#) of the interferer.

**Parameters:**

<Eirp> float  
Range: -200 to 200

**Example:**

See [Example"Creating a scenario with multiple emitters and background emitters"](#) on page 535

**SCENario:DF:WAVEform:FREQuency** <Frequency>

**SCENario:LOCalized:WAVEform:FREQuency** <Frequency>

Sets the frequency of the emitter.

**Parameters:**

<Frequency> float  
Range: 1000 to 1e+11

**Example:**

See [Example"Creating a scenario with multiple emitters and background emitters"](#) on page 535.

**Manual operation:** See ["Available Background Emitters"](#) on page 336

**SCENario:DF:FREQuency?**

**SCENario:LOCalized:FREQuency?**

**SCENario:CEMit:FREQuency?**

**SCENario:CPDW:FREQ** <Freq>

Sets the frequency for the selected emitter.

**Parameters:**

<Freq> float  
Range: -1000 to 1e+11

**Example:**

See [Example"Creating and configuring PDW list scenario"](#) on page 539.

**Manual operation:** See ["Frequency"](#) on page 369

**SCENario:CEMit:FQOffset** <Fqoffset>

Sets the frequency offset for the selected emitter.

**Parameters:**

<Fqoffset> float  
Range: -2e+09 to 2e+09

**Manual operation:** See ["Frequency offset"](#) on page 228

**SCENario:CEMit:SCNDelay** <Scndelay>

Sets the scan delay for the selected emitter.

**Parameters:**

<Scndelay> float  
Range: -3600 to 3600

**Example:** SCENario:CEMit:SCNDeLay 100

**Manual operation:** See ["Scan delay"](#) on page 228

**SCENario:CEMit:LVABs** <Lvabs>

**SCENario:CPDW:LVABs** <Lvabs>

Sets the absolute level for the selected PDW list.

**Parameters:**

<Lvabs> float  
Range: -130 to 30

**Example:** See [Example "Creating and configuring PDW list scenario"](#) on page 539.

**Manual operation:** See ["Absolute Level"](#) on page 369

**SCENario:DF:SYNChronize:ENABle** <Enable>

**SCENario:LOCalized:SYNChronize:ENABle** <Enable>

Enables synchronized setup.

**Parameters:**

<Enable> ON | OFF | 1 | 0

**SCENario:DF:RECeiver** <Receiver>

Selects an existing receiver, see [RECeiver:CATalog?](#) on page 425.

**Parameters:**

<Receiver> string

**Example:**  
RECeiver:CATalog?  
// "Receiver DF", "DF"  
SCENario:DF:RECeiver "Receiver DF"

**Manual operation:** See ["Receiver"](#) on page 270

**SCENario:CSEQuence** <Csequence>

Select an existing sequence, see [SEQuence:CATalog?](#) on page 426.

**Parameters:**

<Csequence> string

**Example:** See [Example "Creating sequence collection scenario"](#) on page 534

**Manual operation:** See ["Sequence \(Collection\) Scenario Settings"](#) on page 85

---

**SCENario:CSEquence:VARiable** <Variable>

Sets the collection variable.

**Parameters:**

<Variable>                    string

**Example:**                    SCENario:CSEquence:VARiable?

**Manual operation:**    See "[Variables](#)" on page 129

---

**SCENario:DF:MAPS:ENABLE** <Enable>**SCENario:LOCalized:MAPS:ENABLE** <Enable>

Enable maps for the selected scenario. This operation cannot be undone.

**Parameters:**

<Enable>                    ON | OFF | 1 | 0

---

**SCENario:DF:MAPS:LOAD** <Load>**SCENario:LOCalized:MAPS:LOAD** <Load>

This command loads a georeferenced map for the selected scenario.

Supported formats:

- .tif
- .tiff

**Setting parameters:**

<Load>

**Usage:**                    Setting only

---

**SCENario:DF:MCHG:STATe** <State>**SCENario:CEMit:MCHG:STATe** <State>**SCENario:LOCalized:MCHG:STATe** <State>

Enables mode changes.

**Parameters:**

<State>                    ON | OFF | 1 | 0

**Example:**                    See [Example "Enabling mode changing"](#) on page 537.

**Manual operation:**    See "[Single Mode](#)" on page 313

---

**SCENario:DF:MCHG:START** <Start>**SCENario:DF:MCHG:STOP** <Stop>**SCENario:CEMit:MCHG:START** <Start>**SCENario:CEMit:MCHG:STOP** <Stop>

**SCENario:LOCalized:MCHG:STARt** <Start>

**SCENario:LOCalized:MCHG:STOP** <Stop>

Sets the start and end time per mode entry.

**Parameters:**

<Stop> float  
\*RST: 0

**Example:** See [Example"Enabling mode changing"](#) on page 537.

**Manual operation:** See ["Timing"](#) on page 314

**SCENario:CEMit:MCHG:CLEar**

**SCENario:DF:MCHG:CLEar**

**SCENario:LOCalized:MCHG:CLEar**

Removes all defined modes.

**Example:** See [Example"Enabling mode changing"](#) on page 537.

**Usage:** Event

**Manual operation:** See ["Append, Remove Current, Remove All"](#) on page 314

**SCENario:DF:EMITter:STATe:ENABLE** <Enable>

**SCENario:LOCalized:EMITter:STATe:ENABLE** <Enable>

Enables that an emitter can use on and off states.

**Parameters:**

<Enable> ON | OFF | 1 | 0

**Example:** See [Example"Configuring different modes"](#) on page 538.

**Manual operation:** See ["Use on/off states with emitter mode"](#) on page 322

**SCENario:DF:EMITter:STATe:DURation** <Duration>

**SCENario:LOCalized:EMITter:STATe:DURation** <Duration>

Sets the duration during that the emitter remains in the current state.

**Parameters:**

<Duration> float  
Range: -1e+06 to 1e+06

**Example:** See [Example"Configuring different modes"](#) on page 538.

**Manual operation:** See ["Duration"](#) on page 323

**SCENario:DF:EMITter:STATe:VALue** <Value>

**SCENario:LOCalized:EMITter:STATe:VALue** <Value>

Sets the emitter state during the selected period.

**Parameters:**

<Value> ON | OFF | 1 | 0

**Example:**

See [Example"Configuring different modes"](#) on page 538.

**Manual operation:**

See ["State"](#) on page 323

**SCENario:DF:EMITter:STATe:LOOP** <Loop>

**SCENario:LOCalized:EMITter:STATe:LOOP** <Loop>

Repeats the states definition cyclically.

**Parameters:**

<Loop> ON | OFF | 1 | 0

**Example:**

See [Example"Configuring different modes"](#) on page 538.

**Manual operation:**

See ["Execute States in Loop"](#) on page 323

**SCENario:CPDW:NAME** <Name>

Selects the waveform element, used to import the PDW list.

Query the list of waveform elements with the command [WAVeform:CATalog?](#).

**Parameters:**

<Name> string

**Example:**

See [Example"Creating and configuring PDW list scenario"](#) on page 539.

**Manual operation:**

See ["PDW List"](#) on page 369

**SCENario:CPDW:ALIAS** <Alias>

Enters an alias name.

**Parameters:**

<Alias> string

**Example:**

See [Example"Creating and configuring PDW list scenario"](#) on page 539.

**Manual operation:**

See ["Alias Name"](#) on page 369

**SCENario:DF:ENABLE** <Enable>

**SCENario:LOCalized:ENABLE** <Enable>

**SCENario:CEMit:ENABLE** <Enable>

**SCENario:CPDW:ENABLE** <Enable>

If enabled, the PDW list is included in the output file.

**Parameters:**

<Enable> ON | OFF | 1 | 0

**Example:** See [Example"Creating and configuring PDW list scenario"](#) on page 539.

**Manual operation:** See ["Enable"](#) on page 371

**SCENario:DF:PRiority** <Priority>  
**SCENario:LOCalized:PRiority** <Priority>  
**SCENario:CEMit:PRiority** <Priority>  
**SCENario:CPDW:PRiority** <Priority>

Sets the priority of the selected PDW list , where the higher the value the higher the priority.

**Parameters:**

<Priority> float  
 Range: 1 to 100

**Example:** See [Example"Creating and configuring PDW list scenario"](#) on page 539.

**Manual operation:** See ["Priority \[ 0 = Highest\]"](#) on page 371

**SCENario:DF:LDELay** <Ldelay>  
**SCENario:LOCalized:LDELay** <Ldelay>  
**SCENario:CEMit:LDELay** <Ldelay>  
**SCENario:CPDW:LDELay** <Ldelay>

If interleaving is enabled, shifts the processing of the selected PDW list in time.

**Parameters:**

<Ldelay> float  
 Range: -1e+09 to 1e+09

**Example:** See [Example"Creating and configuring PDW list scenario"](#) on page 539.

**Manual operation:** See ["Time Offset"](#) on page 371

**SCENario:DF:LEVel** <Level>  
**SCENario:LOCalized:LEVel** <Level>  
**SCENario:CEMit:LEVel** <Level>  
**SCENario:CPDW:LEVel** <Level>

Adds a level offset.

**Parameters:**

<Level> float  
 Range: -200 to 0

**Example:** See [Example"Creating and configuring PDW list scenario"](#) on page 539.

**Manual operation:** See ["Level Offset"](#) on page 372



---

**SCENario:DF:GROup** <Group>  
**SCENario:LOCalized:GROup** <Group>  
**SCENario:CEMit:GROup** <Group>  
**SCENario:CPDW:GROup** <Group>

Assigns the emitter to one of the available interleaving groups.

**Parameters:**

<Group>                      string  
 Query a list of the alias names of the existing interleaving groups with the command [SCENario:CPDW:GROup:CATalog?](#).

**Example:**                      See [Example"Creating and configuring PDW list scenario"](#) on page 539.

**Manual operation:**    See ["Group"](#) on page 372

---

**SCENario:CEMit:GROup:CATalog?**  
**SCENario:DF:GROup:CATalog?**  
**SCENario:LOCalized:GROup:CATalog?**  
**SCENario:CPDW:GROup:CATalog?**

Queries the alias names of the configured interleaving groups.

**Return values:**

<Catalog>                      string  
 A list of coma-separated alias names.

**Example:**                      See [Example"Creating and configuring PDW list scenario"](#) on page 540.

**Usage:**                              Query only

**Manual operation:**    See ["Select, Insert, Append/Prepend, Remove, Clear"](#) on page 372

---

**SCENario:CEMit:GROup:ALias** <Alias>  
**SCENario:DF:GROup:ALias** <Alias>  
**SCENario:LOCalized:GROup:ALias** <Alias>  
**SCENario:CPDW:GROup:ALias** <Alias>

Sets an alias name for the selected interleaving group.

See also [ASSignment:GROup:SElect](#) on page 467.

**Parameters:**

<Alias>                              string

**Example:**                      See [Example"Creating and configuring PDW list scenario"](#) on page 540.

**Manual operation:**    See ["Alias Name"](#) on page 373

---

**SCENario:OUTPut:CLIPping** <Clipping>

Sets a maximum level to limit the dynamic range of the signal. Pulses at levels above this threshold are reduced (clipped) to the configured level.

**Manual operation:** See ["Clipping Level"](#) on page 349

---

**SCENario:OUTPut:DURation:MODE** <Mode>

Sets how the waveform duration is defined.

**Parameters:**

<Mode> AUTO | MANual

**AUTO**

Sets the simulation time to maximum of sequence, scan or movement duration.

**MANual**

Sets the simulation time to a fixed value.

**Example:** See [Example"Creating simple pulse train scenario"](#) on page 533

**Manual operation:** See ["Duration"](#) on page 77

---

**SCENario:OUTPut:DURation:TIME** <Time>

Sets the duration of the generated waveform.

**Parameters:**

<Time> float  
Range: 1e-06 to 1.8432e+06

**Example:** See [Example"Creating simple pulse train scenario"](#) on page 533.

**Manual operation:** See ["Duration"](#) on page 77

---

**SCENario:OUTPut:DURation:AUTO?**

Requires SCENario:OUTPut:DURation:MODE AUTO.

Queries the value of the automatically determined signal duration.

**Return values:**

<Auto> float  
Range: 1e-06 to 1.8432e+06

**Usage:** Query only

**Manual operation:** See ["Duration"](#) on page 77

---

---

**SCENario:OUTPut:FREQuency** <Frequency>

Sets the carrier RF frequency of the generated signal.

**Parameters:**

<Frequency> float  
Range: 1000 to 1e+11

**Example:** See [Example"Creating simple pulse train scenario"](#) on page 533

**Manual operation:** See ["Frequency"](#) on page 78

---

**SCENario:OUTPut:LEVel** <Level>

Sets the reference level used by the calculation of the pulse envelope.

**Parameters:**

<Level> float  
Range: -130 to 30

**Example:** See [Example"Creating simple pulse train scenario"](#) on page 533

**Manual operation:** See ["Level"](#) on page 78

---

**SCENario:OUTPut:SUPResS:ENABle** <Enable>

Enable to prevent waveform recalculation if the RF frequency is changed.

**Parameters:**

<Enable> ON | OFF | 1 | 0

**Example:** SCENario:OUTPut:SUPResS:ENABle 1

---

**SCENario:OUTPut:RESet:ENABle** <Enable>

Restarts the connected instrument on scenario start.

**Parameters:**

<Enable> ON | OFF | 1 | 0

**Example:** See [Example"Creating simple pulse train scenario"](#) on page 533

---

**SCENario:OUTPut:RUNMode** <Runmode>

Defines the way the generated signal is processed.

**Parameters:**

<Runmode> CONTInuous | SINGLE

**Example:** See [Example"Creating simple pulse train scenario"](#) on page 533

---

**SCENario:CEMit:THReshold** <Threshold>

**SCENario:CPDW:THReshold** <Threshold>

**SCENario:LOCalized:THReshold** <Threshold>

**SCENario:DF:THReshold** <Threshold>

**SCENario:OUTPut:THReshold** <Threshold>

Sets a threshold. Pulses at levels below this threshold are omitted.

**Parameters:**

<Threshold> float  
Range: -100 to 0

**Example:** See [Example"Creating simple pulse train scenario"](#) on page 533

**Manual operation:** See ["Threshold"](#) on page 240

**SCENario:OUTPut:MULTithread** <Multithread>

Enable to optimize the calculation speed.

**Parameters:**

<Multithread> ON | OFF | 1 | 0

**Example:** SCENario:OUTPut:MULTithread ON

**Manual operation:** See ["Optimize calculation speed"](#) on page 349

**SCENario:OUTPut:MTMode** <Mtmode>

If multithreading is enabled with [SCENario:OUTPut:MULTithread](#) on page 564, sets the mode to use for multithreading.

**Parameters:**

<Mtmode> AUTO | MANual

**Example:** SCENario:OUTPut:MTMode?  
// SCENario:OUTPut:MTMode AUTO

**Manual operation:** See ["Optimize calculation speed"](#) on page 349

**SCENario:OUTPut:MTTHreads** <Mtthreads>

In manual mode, sets the required number of threads for the signal calculation.

**Parameters:**

<Mtthreads> float  
Range: 0 to 1000

**Example:** SCENario:OUTPut:MTMode  
MANUAL SCENario:OUTPut:MTTHreads?  
// SCENario:OUTPut:MTTHreads 16

**Manual operation:** See ["Optimize calculation speed"](#) on page 349

**SCENario:VOLatile:SEL <Sel>**

If several files are created, select the one to be visualized.

**Parameters:**

<Sel> float  
Subsequent number, indicating the files in the volatile memory.

**Manual operation:** See ["Results"](#) on page 81

**SCENario:VOLatile:VIEW**

If a waveform exists in the volatile memory, opens the "Waveform Viewer" and displays this waveform.

**Usage:** Event

**Manual operation:** See ["Results"](#) on page 81

## 24.20 Moving emitters and receivers commands

**Example: Moving emitters and receivers**

The following is a simple example on how to enable a moving emitter. The same configuration steps apply for the receivers in the localized emitters and direction finding scenarios.

```
SCENario:NAME "Dynamic Scenario"
SCENario:LOCALized:TYPE EMITTER
SCENario:LOCALized:ALIAS "Plane"
SCENario:LOCALized:MOVement:VEHICLE AIRPLANE
SCENario:LOCALized:LOCation:PMODE MOVING
SCENario:LOCALized:MOVement:TYPE WAYPOINT
SCENario:LOCALized:MOVement:WAYPoint "C:/Users/Public/Documents/Rohde-Schwarz/
Pulse Sequencer/Example Files/Movements/Waypoints/Munich_Flight.xtd"
SCENario:LOCALized:MOVement:RFRame WGS
SCENario:LOCALized:MOVement:RMODE ONEWAY

SCENario:LOCALized:MOVement:VFILE "Big_Aircraft.xvd"
SCENario:LOCALized:MOVement:SMOothing 1

SCENario:LOCALized:MOVement:ATTitude MOTION
SCENario:LOCALized:MOVement:YAW?
// 0
SCENario:LOCALized:MOVement:PITCH?
// 0
SCENario:LOCALized:MOVement:ROLL 1.E-01
SCENario:LOCALized:MOVement:IMPort
```

## Moving emitters and receivers commands

```

SCENario:LOCalized:ADD
SCENario:LOCalized:TYPE EMITTER
SCENario:LOCalized:ALIAS "Ship"
SCENario:LOCalized:MOVement:VEHicle SHIP
SCENario:LOCalized:LOCation:PMODE MOVING

```

```

SCENario:LOCalized:MOVement:TYPE ARC
// start position
SCENario:LOCalized:LOCation:EAST 2.386050048828E+03
SCENario:LOCalized:LOCation:NORTH 1.016520019531E+03
SCENario:LOCalized:LOCation:HEIGHT 0.E+00
SCENario:LOCalized:DISTance 4.767236816406E+03
SCENario:LOCalized:LOCation:AZIMuth 6.692472065778E+01
SCENario:LOCalized:LOCation:ELEVation 0.E+00
// center position
SCENario:LOCalized:MOVement:SPEEd 4.E+01
SCENario:LOCalized:MOVement:ANGLE 1.6988E+02
SCENario:LOCalized:MOVement:EAST 2.3103E+03
SCENario:LOCalized:MOVement:NORTH 1.59021E+03
SCENario:LOCalized:MOVement:RMODE ROUNDTRIP

```

```

SCENario:LOCalized:RECeiver:MOVement:VEHicle AIRPLANE
SCENario:LOCalized:LOCation:REC:PMODE MOVING
SCENario:LOCalized:RECeiver:MOVement:TYPE LINE
// start position
SCENario:LOCalized:RECeiver:LATitude 0.E+00
SCENario:LOCalized:RECeiver:LONGitude 0.E+00
SCENario:LOCalized:RECeiver:HEIGHT 4.E+03

```

```

SCENario:LOCalized:RECeiver:MOVement:SPEEd 1.8E+02
SCENario:LOCalized:RECeiver:MOVement:ACCEleration 0.E+00
// end position
SCENario:LOCalized:RECeiver:MOVement:EAST -1.360382727273E+03
SCENario:LOCalized:RECeiver:MOVement:NORTH 5.4037425E+03
SCENario:LOCalized:RECeiver:MOVement:HEIGHT 4.E+03
SCENario:LOCalized:RECeiver:MOVement:RMODE CYCLic

```

SCENario:DF:LOCation:PMODE.....	569
SCENario:LOCalized:LOCation:PMODE.....	569
SCENario:DF:LOCation:REC:PMODE.....	569
SCENario:LOCalized:LOCation:REC:PMODE.....	569
SCENario:DF:MOVement:TYPE.....	569
SCENario:DF:RECeiver:MOVement:TYPE.....	569
SCENario:LOCalized:RECeiver:MOVement:TYPE.....	569
SCENario:LOCalized:MOVement:TYPE.....	569
SCENario:DF:LOCation:ALTitude.....	569
SCENario:LOCalized:LOCation:ALTitude.....	570
SCENario:DF:LOCation:LATitude.....	570
SCENario:DF:LOCation:LONGitude.....	570
SCENario:LOCalized:LOCation:LATitude.....	570
SCENario:LOCalized:LOCation:LONGitude.....	570

## Moving emitters and receivers commands

SCENario:DF:MOVement:ALTitude.....	570
SCENario:LOCalized:MOVement:ALTitude.....	570
SCENario:DF:MOVement:LATitude.....	570
SCENario:DF:MOVement:LONGitude.....	570
SCENario:LOCalized:MOVement:LATitude.....	571
SCENario:LOCalized:MOVement:LONGitude.....	571
SCENario:DF:MOVement:CLATitude.....	571
SCENario:DF:MOVement:CLONGitude.....	571
SCENario:LOCalized:MOVement:CLATitude.....	571
SCENario:LOCalized:MOVement:CLONGitude.....	571
SCENario:DF:RECeiver:MOVement:PSTep:SElect.....	571
SCENario:LOCalized:RECeiver:MOVement:PSTep:SElect.....	571
SCENario:DF:MOVement:SPEed.....	572
SCENario:DF:RECeiver:MOVement:SPEed.....	572
SCENario:LOCalized:RECeiver:MOVement:SPEed.....	572
SCENario:LOCalized:MOVement:SPEed.....	572
SCENario:DF:MOVement:ACCeleration.....	572
SCENario:DF:RECeiver:MOVement:ACCeleration.....	572
SCENario:LOCalized:RECeiver:MOVement:ACCeleration.....	572
SCENario:LOCalized:MOVement:ACCeleration.....	572
SCENario:DF:MOVement:ANGLE.....	572
SCENario:DF:RECeiver:MOVement:ANGLE.....	572
SCENario:LOCalized:RECeiver:MOVement:ANGLE.....	572
SCENario:LOCalized:MOVement:ANGLE.....	572
SCENario:DF:MOVement:EAST.....	572
SCENario:DF:RECeiver:MOVement:EAST.....	572
SCENario:LOCalized:RECeiver:MOVement:EAST.....	572
SCENario:LOCalized:MOVement:EAST.....	572
SCENario:DF:MOVement:NORTH.....	572
SCENario:DF:RECeiver:MOVement:NORTH.....	572
SCENario:LOCalized:RECeiver:MOVement:NORTH.....	573
SCENario:LOCalized:MOVement:NORTH.....	573
SCENario:DF:MOVement:HEIGHT.....	573
SCENario:DF:RECeiver:MOVement:HEIGHT.....	573
SCENario:LOCalized:RECeiver:MOVement:HEIGHT.....	573
SCENario:LOCalized:MOVement:HEIGHT.....	573
SCENario:DF:MOVement:WAYPoint.....	573
SCENario:DF:RECeiver:MOVement:WAYPoint.....	573
SCENario:LOCalized:RECeiver:MOVement:WAYPoint.....	573
SCENario:LOCalized:MOVement:WAYPoint.....	573
SCENario:DF:RECeiver:MOVement:WAYPoint:CLEar.....	573
SCENario:DF:LOCation:WAYPoint:CLEar.....	573
SCENario:LOCalized:LOCation:WAYPoint:CLEar.....	574
SCENario:LOCalized:RECeiver:MOVement:WAYPoint:CLEar.....	574
SCENario:DF:MOVement:ATTitude.....	574
SCENario:DF:RECeiver:MOVement:ATTitude.....	574
SCENario:LOCalized:RECeiver:MOVement:ATTitude.....	574
SCENario:LOCalized:MOVement:ATTitude.....	574
SCENario:DF:RECeiver:MOVement:VEHicle.....	574
SCENario:LOCalized:RECeiver:MOVement:VEHicle.....	574

## Moving emitters and receivers commands

SCENario:DF:MOVement:VEHicle.....	574
SCENario:LOCalized:MOVement:VEHicle.....	574
SCENario:DF:MOVement:VFILe.....	575
SCENario:DF:RECeiver:MOVement:VFILe.....	575
SCENario:LOCalized:RECeiver:MOVement:VFILe.....	575
SCENario:LOCalized:MOVement:VFILe.....	575
SCENario:DF:MOVement:VFILe:CLEar.....	575
SCENario:DF:RECeiver:MOVement:VFILe:CLEar.....	575
SCENario:LOCalized:RECeiver:MOVement:VFILe:CLEar.....	575
SCENario:LOCalized:MOVement:VFILe:CLEar.....	575
SCENario:DF:MOVement:YAW.....	575
SCENario:DF:RECeiver:MOVement:YAW.....	575
SCENario:LOCalized:RECeiver:MOVement:YAW.....	575
SCENario:LOCalized:MOVement:YAW.....	575
SCENario:DF:MOVement:PITCh.....	575
SCENario:DF:RECeiver:MOVement:PITCh.....	575
SCENario:LOCalized:RECeiver:MOVement:PITCh.....	575
SCENario:LOCalized:MOVement:PITCh.....	575
SCENario:DF:MOVement:ROLL.....	575
SCENario:DF:RECeiver:MOVement:ROLL.....	575
SCENario:LOCalized:RECeiver:MOVement:ROLL.....	575
SCENario:LOCalized:MOVement:ROLL.....	575
SCENario:DF:MOVement:RFRame.....	576
SCENario:DF:RECeiver:MOVement:RFRame.....	576
SCENario:LOCalized:RECeiver:MOVement:RFRame.....	576
SCENario:LOCalized:MOVement:RFRame.....	576
SCENario:DF:MOVement:RMODe.....	576
SCENario:DF:RECeiver:MOVement:RMODe.....	576
SCENario:LOCalized:RECeiver:MOVement:RMODe.....	576
SCENario:LOCalized:MOVement:RMODe.....	576
SCENario:DF:MOVement:SMOothening.....	576
SCENario:DF:RECeiver:MOVement:SMOothening.....	576
SCENario:LOCalized:RECeiver:MOVement:SMOothening.....	576
SCENario:LOCalized:MOVement:SMOothening.....	576
SCENario:DF:MOVement:IMPort.....	576
SCENario:DF:RECeiver:MOVement:IMPort.....	576
SCENario:LOCalized:RECeiver:MOVement:IMPort.....	577
SCENario:LOCalized:MOVement:IMPort.....	577
SCENario:DF:MOVement:CLEar.....	577
SCENario:DF:RECeiver:MOVement:CLEar.....	577
SCENario:LOCalized:RECeiver:MOVement:CLEar.....	577
SCENario:LOCalized:MOVement:CLEar.....	577
SCENario:DF:SUBitem:CURRent.....	577
SCENario:LOCalized:SUBitem:CURRent.....	577
SCENario:DF:SUBitem:SElect.....	577
SCENario:LOCalized:SUBitem:SElect.....	577
PREView:POSition?.....	577



---

**SCENario:DF:LOCation:PMODE** <Pmode>

**SCENario:LOCalized:LOCation:PMODE** <Pmode>

Sets if the emitter is static or moving.

**Parameters:**

<Pmode>                    STATIC | STEPs | MOVing

**Example:**                See [Example "Moving emitters and receivers"](#) on page 565.

**Manual operation:**    See ["Mode"](#) on page 316

---

**SCENario:DF:LOCation:REC:PMODE** <Pmode>

**SCENario:LOCalized:LOCation:REC:PMODE** <Pmode>

Sets if the receiver is static or moving.

**Parameters:**

<Pmode>                    STATIC | MOVing

**Example:**                See [Example "Moving emitters and receivers"](#) on page 565.

**Manual operation:**    See ["Mode"](#) on page 272

---

**SCENario:DF:MOVement:TYPE** <Type>

**SCENario:DF:RECeiver:MOVement:TYPE** <Type>

**SCENario:LOCalized:RECeiver:MOVement:TYPE** <Type>

**SCENario:LOCalized:MOVement:TYPE** <Type>

Defines the trajectory shape.

**Parameters:**

<Type>                      LINE | ARC | WAYPoint | TRACe

**Example:**                See [Example "Moving emitters and receivers"](#) on page 565.

**Manual operation:**    See ["Trajectory"](#) on page 326

---

**SCENario:DF:LOCation:ALTitude** <Altitude>

Use for defining the altitude of a fixed emitter (no movement) on a georeferenced map.

**Parameters:**

<Altitude>                 float  
 Range:                    -1e+09 to 1e+09

**Example:**                SCEN:DF:LOC:ALT 42  
 SCEN:DF:LOC:LAT 48.1351  
 SCEN:DF:LOC:LONG 11.5820

**Manual operation:**    See ["Longitude, Latitude, Altitude"](#) on page 317

---

**SCENario:LOCalized:LOCation:ALTitude** <Altitude>

Sets the altitude of the antenna.

**Parameters:**

<Altitude> float  
Range: -1e+09 to 1e+09

**Example:** see [Example"Creating a scenario with multiple emitters and background emitters"](#) on page 535

**Manual operation:** See "[Longitude, Latitude, Altitude](#)" on page 317

---

**SCENario:DF:LOCation:LATitude** <Latitude>**SCENario:DF:LOCation:LONGitude** <Longitude>**SCENario:LOCalized:LOCation:LATitude** <Latitude>**SCENario:LOCalized:LOCation:LONGitude** <Longitude>

Use for defining the position of a fixed emitter (no movement) on a georeferenced map.

Positive values represent °East.

Negative values represent °West.

**Parameters:**

<Longitude> float  
Range: -180 to 180

**Example:**  
SCEN:LOC:LOC:ALT 42  
SCEN:LOC:LOC:LAT 48.1351  
SCEN:LOC:LOC:LONG 11.5820

**Manual operation:** See "[Longitude, Latitude, Altitude](#)" on page 317

---

**SCENario:DF:MOVement:ALTitude** <Altitude>**SCENario:LOCalized:MOVement:ALTitude** <Altitude>

Use for defining the altitude of a moving emitter (line trajectory) on a georeferenced map. Use to define the altitude of the end-points of the line.

**Parameters:**

<Altitude> float  
Range: -1e+09 to 1e+09

**Example:**  
SCEN:LOC:MOV:ALT 42  
SCEN:LOC:MOV:LAT 48.1351  
SCEN:LOC:MOV:LONG 11.5820

**Manual operation:** See "[End Position](#)" on page 327

---

**SCENario:DF:MOVement:LATitude** <Latitude>**SCENario:DF:MOVement:LONGitude** <Longitude>

**SCENario:LOCalized:MOVement:LATitude** <Latitude>

**SCENario:LOCalized:MOVement:LONGitude** <Longitude>

Use for defining the movement of an emitter (line trajectory) on a georeferenced map.  
Use to define the end-points of the line.

Positive values represent °East.

Negative values represent °West.

**Parameters:**

<Longitude> float  
Range: -180 to 180

**Example:**

```
SCEN:LOC:MOV:ALT 42
SCEN:LOC:MOV:LAT 48.1351
SCEN:LOC:MOV:LONG 11.5820
```

**Manual operation:** See ["End Position"](#) on page 327

**SCENario:DF:MOVement:CLATitude** <Clatitude>

**SCENario:DF:MOVement:CLONGitude** <Clongitude>

**SCENario:LOCalized:MOVement:CLATitude** <Clatitude>

**SCENario:LOCalized:MOVement:CLONGitude** <Clongitude>

Use for defining the movement of an emitter (arc trajectory) on a georeferenced map.  
Use to define the center-point of the arc.

Positive values represent °East.

Negative values represent °West.

**Parameters:**

<Clongitude> float  
Range: -180 to 180

**Example:**

```
SCEN:LOC:MOV:CLAT 48.1351
SCEN:LOC:MOV:CLONG 11.5820
```

**Manual operation:** See ["Center Position"](#) on page 328

**SCENario:DF:RECeiver:MOVement:PSTep:SELEct** <Select>

**SCENario:LOCalized:RECeiver:MOVement:PSTep:SELEct** <Select>

Selects the specified point on a trace trajectory.

**Parameters:**

<Select> float  
\*RST: 1

**Example:**

```
SCEN:LOC:REC:MOV:PST:SEL 7
```

**Manual operation:** See ["Trace Points"](#) on page 279

---

**SCENario:DF:MOVement:SPEed** <Speed>  
**SCENario:DF:RECeiver:MOVement:SPEed** <Speed>  
**SCENario:LOCalized:RECeiver:MOVement:SPEed** <Speed>  
**SCENario:LOCalized:MOVement:SPEed** <Speed>

Sets the speed of the moving emitter.

**Parameters:**

<Speed>                      float  
                                     Range:        0 to 5999

**Example:**                      See [Example"Moving emitters and receivers"](#) on page 565.

**Manual operation:**    See "[Speed](#)" on page 326

---

**SCENario:DF:MOVement:ACceleration** <Acceleration>  
**SCENario:DF:RECeiver:MOVement:ACceleration** <Acceleration>  
**SCENario:LOCalized:RECeiver:MOVement:ACceleration** <Acceleration>  
**SCENario:LOCalized:MOVement:ACceleration** <Acceleration>

Sets the acceleration of the moving emitter.

**Parameters:**

<Acceleration>                float  
                                     Range:        -100 to 100

**Example:**                      See [Example"Moving emitters and receivers"](#) on page 565.

**Manual operation:**    See "[Acceleration](#)" on page 326

---

**SCENario:DF:MOVement:ANGLE** <Angle>  
**SCENario:DF:RECeiver:MOVement:ANGLE** <Angle>  
**SCENario:LOCalized:RECeiver:MOVement:ANGLE** <Angle>  
**SCENario:LOCalized:MOVement:ANGLE** <Angle>

Sets the arc angle and thus defines the arc length.

**Parameters:**

<Angle>                         float  
                                     Range:        -360 to 360

**Example:**                      See [Example"Moving emitters and receivers"](#) on page 565.

**Manual operation:**    See "[Angle](#)" on page 327

---

**SCENario:DF:MOVement:EAST** <East>  
**SCENario:DF:RECeiver:MOVement:EAST** <East>  
**SCENario:LOCalized:RECeiver:MOVement:EAST** <East>  
**SCENario:LOCalized:MOVement:EAST** <East>  
**SCENario:DF:MOVement:NORTH** <North>  
**SCENario:DF:RECeiver:MOVement:NORTH** <North>

**SCENario:LOCalized:RECeiver:MOVement:NORTH** <North>

**SCENario:LOCalized:MOVement:NORTH** <North>

Sets the East/North coordinates of the emitter at the end of the movement.

**Parameters:**

<North> float  
Range: -1e+09 to 1e+09

**Example:** See [Example"Moving emitters and receivers"](#) on page 565.

**Manual operation:** See ["End Position"](#) on page 327

**SCENario:DF:MOVement:HEIGHt** <Height>

**SCENario:DF:RECeiver:MOVement:HEIGHt** <Height>

**SCENario:LOCalized:RECeiver:MOVement:HEIGHt** <Height>

**SCENario:LOCalized:MOVement:HEIGHt** <Height>

Sets the height of the emitter at the end of the movement.

**Parameters:**

<Height> float  
Range: -1e+09 to 1e+09

**Example:** See [Example"Moving emitters and receivers"](#) on page 565.

**Manual operation:** See ["End Position"](#) on page 327

**SCENario:DF:MOVement:WAYPoint** <Waypoint>

**SCENario:DF:RECeiver:MOVement:WAYPoint** <Waypoint>

**SCENario:LOCalized:RECeiver:MOVement:WAYPoint** <Waypoint>

**SCENario:LOCalized:MOVement:WAYPoint** <Waypoint>

Loads the selected waypoint file.

To import and apply the files, send the command `SCENario:LOCalized:MOVement:IMPort`.

**Parameters:**

<Waypoint> string  
Filename or complete file path, incl. file extension.  
Waypoint files must have the extension \*.txt, \*.kml or \*.xtd.  
Example files are provided with the software.  
For description, see [Chapter A.3, "Movement files"](#), on page 637.

**Example:** See [Example"Moving emitters and receivers"](#) on page 565.

**Manual operation:** See ["Load, Delete"](#) on page 331

**SCENario:DF:RECeiver:MOVement:WAYPoint:CLEar**

**SCENario:DF:LOCation:WAYPoint:CLEar**

**SCENario:LOCalized:LOCation:WAYPoint:CLEar**

**SCENario:LOCalized:RECeiver:MOVement:WAYPoint:CLEar**

Discards the selected file.

**Example:** See [Example"Moving emitters and receivers"](#) on page 565.

**Usage:** Event

**Manual operation:** See "[Load, Delete](#)" on page 276

**SCENario:DF:MOVement:ATTitude <Attitude>**

**SCENario:DF:RECeiver:MOVement:ATTitude <Attitude>**

**SCENario:LOCalized:RECeiver:MOVement:ATTitude <Attitude>**

**SCENario:LOCalized:MOVement:ATTitude <Attitude>**

Defines how the attitude information is defined.

**Parameters:**

<Attitude> WAYPoint | MOTion | CONSTant

**WAYPoint**

The attitude parameters are extracted from the selected way-point file.

**MOTion**

Enables a constant rate of change of the roll.

See [SCENario:LOCalized:MOVement:ROLL](#) on page 575

**Constant**

The attitude is constant values.

**Example:** See [Example"Moving emitters and receivers"](#) on page 565.

**Manual operation:** See "[Attitude](#)" on page 333

**SCENario:DF:RECeiver:MOVement:VEHicle <Vehicle>**

**SCENario:LOCalized:RECeiver:MOVement:VEHicle <Vehicle>**

Assigns the selected icon.

**Parameters:**

<Vehicle> LVEHicle | SHIP | AIRPlane | STATIONary | RECeiver

**Example:** See [Example"Moving emitters and receivers"](#) on page 565.

**Manual operation:** See "[Vehicle Icon](#)" on page 262

**SCENario:DF:MOVement:VEHicle <Vehicle>**

**SCENario:LOCalized:MOVement:VEHicle <Vehicle>**

Assigns the selected icon.

**Parameters:**

<Vehicle> LVEHicle | SHIP | AIRPlane | STATIONary | DEFault | CAR

**Example:** See [Example"Moving emitters and receivers"](#) on page 565.

**Manual operation:** See "[Vehicle Icon](#)" on page 312

---

**SCENario:DF:MOVement:VFILE** <Vfile>  
**SCENario:DF:RECeiver:MOVement:VFILE** <Vfile>  
**SCENario:LOCalized:RECeiver:MOVement:VFILE** <Vfile>  
**SCENario:LOCalized:MOVement:VFILE** <Vfile>

Loads the selected vehicle description file (\* .xvd).

To import and apply the files, send the command **SCENario:LOCalized:MOVement:IMPort**.

**Parameters:**

<Vfile> string  
 Filename or complete file path, incl. file extension.  
 Example files are provided with the software.  
 For description, see [Chapter A.4, "Vehicle description files \(Used for smoothening\)"](#), on page 644.

**Example:** See [Example "Moving emitters and receivers"](#) on page 565.

**Manual operation:** See "[Load, Delete](#)" on page 333

---

**SCENario:DF:MOVement:VFILE:CLEar**  
**SCENario:DF:RECeiver:MOVement:VFILE:CLEar**  
**SCENario:LOCalized:RECeiver:MOVement:VFILE:CLEar**  
**SCENario:LOCalized:MOVement:VFILE:CLEar**

Discards the selected vehicle description file.

**Example:** See [Example "Moving emitters and receivers"](#) on page 565.

**Usage:** Event

**Manual operation:** See "[Load, Delete](#)" on page 333

---

**SCENario:DF:MOVement:YAW** <Yaw>  
**SCENario:DF:RECeiver:MOVement:YAW** <Yaw>  
**SCENario:LOCalized:RECeiver:MOVement:YAW** <Yaw>  
**SCENario:LOCalized:MOVement:YAW** <Yaw>  
**SCENario:DF:MOVement:PITCh** <Pitch>  
**SCENario:DF:RECeiver:MOVement:PITCh** <Pitch>  
**SCENario:LOCalized:RECeiver:MOVement:PITCh** <Pitch>  
**SCENario:LOCalized:MOVement:PITCh** <Pitch>  
**SCENario:DF:MOVement:ROLL** <Roll>  
**SCENario:DF:RECeiver:MOVement:ROLL** <Roll>  
**SCENario:LOCalized:RECeiver:MOVement:ROLL** <Roll>  
**SCENario:LOCalized:MOVement:ROLL** <Roll>

Sets the angles of rotation in the corresponding direction.

**Parameters:**

<Roll> float  
Range: -180 to 180

**Example:** See [Example"Moving emitters and receivers"](#) on page 565.

**Manual operation:** See ["Yaw, Pitch, Roll"](#) on page 333

**SCENario:DF:MOVement:RFRame** <Rframe>  
**SCENario:DF:RECeiver:MOVement:RFRame** <Rframe>  
**SCENario:LOCalized:RECeiver:MOVement:RFRame** <Rframe>  
**SCENario:LOCalized:MOVement:RFRame** <Rframe>

Select the reference frame used to define the emitters coordinates.

**Parameters:**

<Rframe> WGS | PZ

**Example:** See [Example"Moving emitters and receivers"](#) on page 565.

**Manual operation:** See ["Reference Frame"](#) on page 332

**SCENario:DF:MOVement:RMODE** <Rmode>  
**SCENario:DF:RECeiver:MOVement:RMODE** <Rmode>  
**SCENario:LOCalized:RECeiver:MOVement:RMODE** <Rmode>  
**SCENario:LOCalized:MOVement:RMODE** <Rmode>

Defines the behavior of the moving object when the end of the trajectory is reached.

**Parameters:**

<Rmode> CYCLic | ROUNdtrip | ONEWay

**Example:** See [Example"Moving emitters and receivers"](#) on page 565.

**Manual operation:** See ["Mode"](#) on page 327

**SCENario:DF:MOVement:SMOothening** <Smoothing>  
**SCENario:DF:RECeiver:MOVement:SMOothening** <Smoothing>  
**SCENario:LOCalized:RECeiver:MOVement:SMOothening** <Smoothing>  
**SCENario:LOCalized:MOVement:SMOothening** <Smoothing>

If a vehicle description file is loaded, activates smoothing.

See [SCENario:LOCalized:MOVement:VFILE](#) on page 575.

**Parameters:**

<Smoothing> ON | OFF | 1 | 0

**Example:** See [Example"Moving emitters and receivers"](#) on page 565.

**Manual operation:** See ["Smoothing for way points > State"](#) on page 332

**SCENario:DF:MOVement:IMPort**  
**SCENario:DF:RECeiver:MOVement:IMPort**



**SCENario:LOCalized:RECeiver:MOVement:IMPort****SCENario:LOCalized:MOVement:IMPort**

Imports the selected waypoint and vehicle description files into the repository and **applies** them.

**Example:** See [Example "Moving emitters and receivers"](#) on page 565.

**Usage:** Event

**Manual operation:** See ["Calculate"](#) on page 334

**SCENario:DF:MOVement:CLEar****SCENario:DF:RECeiver:MOVement:CLEar****SCENario:LOCalized:RECeiver:MOVement:CLEar****SCENario:LOCalized:MOVement:CLEar**

Discards the waypoint and vehicle description file.

**Example:** See [Example "Moving emitters and receivers"](#) on page 565.

**Usage:** Event

**Manual operation:** See ["Clear"](#) on page 334

**SCENario:DF:SUBitem:CURRent <Current>****SCENario:LOCalized:SUBitem:CURRent <Current>****Parameters:**

<Current> float  
Range: 1 to 4096

**SCENario:DF:SUBitem:SElect <Select>****SCENario:LOCalized:SUBitem:SElect <Select>****Parameters:**

<Select> float  
Range: 1 to 4096

**PREView:POSition?**

If movement is enabled, queries the current positions of the Tx items.

**Return values:**

<Position> string  
Semicolon-separated string with the format:  
TIME=<time\_from\_simulation\_start>;  
ID=<Tx item ID>;NAME=<Tx item alias  
name>;DIST=<distance>km;LEVATT=<Level at Rx  
origin>dBm;  
AZI=<Azimuth>deg;ELEV=<Elevation>deg;N=<North>km;E=<East>k

**Example:**

```
PREView:POStion?
// line breaks added for better readability
// TIME=00:00:24.012;
// ID=1;NAME=Ship;DIST=6.128km;LEVATT=2dBm;AZI=122.2deg;ELEV=0.0deg;N=1.7
// ID=2;NAME=Plane;DIST=560.512km;LEVATT=13dBm;AZI=144.5deg;ELEV=0.0deg;N=
// ID=3;NAME=Ground;DIST=4.090km;LEVATT=-0dBm;AZI=177.5deg;ELEV=0.0deg;N=
```

**Usage:**

Query only

**Manual operation:** See ["2D Live Preview Stats"](#) on page 299

## 24.21 Platform command

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PLATform:EMITter:ROLL.....	582
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---

**PLATform:NAME** <Name>

Queries the name of the platform.

**Parameters:**

&lt;Name&gt;                    string

**Manual operation:** See ["Name"](#) on page 248

---

**PLATform:ID** <Id>

Platform identifier.

**Parameters:**

&lt;Id&gt;                        float

Range:            1 to 65536

**Manual operation:** See ["ID"](#) on page 249

---

**PLATform:EMITter** <Emitter>

The string must be unique within the repository.

Letters, numbers, spaces and some special characters can be used.

Examples of special characters:

- Supported: !\$%()=?-+\_.
- Not supported: §&/:äöü

**Parameters:**

<Emitter>                    string

**Manual operation:**    See "[Emitter](#)" on page 253

---

**PLATform:EMITter:ID** <Id>

Queries the ID number of the emitter.

**Parameters:**

<Id>                            float  
                                  \*RST:            1

---

**PLATform:EMITter:ALias** <Alias>

Sets an alias name for the selected platform emitter element.

**Parameters:**

<Alias>                        string

**Manual operation:**    See "[List of emitters](#)" on page 250

---

**PLATform:EMITter:ANGLE** <Angle>

You can set the position of the selected emitter relative to the platform's origin, using this command combined with `PLATform:EMITter:RADIus`.

- `PLATform:EMITter:ANGLE` sets the angle of the emitter element on the azimuth plane, relative to the platform's heading.
- `PLATform:EMITter:RADIus` sets the distance of the emitter element on the azimuth plane, relative to the platform's origin.

**Parameters:**

<Angle>                        float  
                                  Range:        0 to 360  
                                  Increment: 0.01

**Manual operation:**    See "[Angle](#)" on page 255

---

**PLATform:EMITter:AZIMuth** <Azimuth>

Angle of the emitter element's pointing direction relative to the platform's heading.

**Parameters:**

<Azimuth> float  
 Range: 0 to 360  
 Increment: 0.01

**Manual operation:** See "[Azimuth](#)" on page 253

**PLATform:EMITter:BLANkranges** <Blankranges>

Creates a set of blank ranges for the currently selected platform emitter.

This approach is more efficient than using several blank range start/stop commands.

The ranges are defined as a set of comma-separated values.

**Parameters:**

<Blankranges>

**Manual operation:** See "[Set of ranges](#)" on page 256

**PLATform:EMITter:BLANkranges:SElect** <Select>

Selects a particular blank range for the currently selected platform emitter.

Use with the following commands to configure a blank range:

- [PLATform:EMITter:BLANkranges:STARt](#) on page 580
- [PLATform:EMITter:BLANkranges:STOP](#) on page 581

To configure several blank ranges with a single command, you can use [PLATform:EMITter:BLANkranges](#) on page 580 . This approach is more efficient than using several blank range start/stop commands.

**Parameters:**

<Select> float  
 \*RST: 1

**Manual operation:** See "[No](#)" on page 256

**PLATform:EMITter:BLANkranges:STARt** <Start>

Sets the start angle for the selected blank range.

The reference value (i.e. 0°) is the configured "Azimuth" value for the selected emitter.

Use together with [PLATform:EMITter:BLANkranges:SElect](#) on page 430.

To configure several blank ranges with a single command, you can use [PLATform:EMITter:BLANkranges](#) on page 580 . This approach is more efficient than using several blank range start/stop commands.

**Parameters:**

<Start> float  
 Range: 0 to 360

**Example:**            `PLATform:EMITter:BLANkranges:  
SElect 1 ; PLATform:EMITter:BLANkranges:START  
160`

**Manual operation:** See "[Start](#)" on page 256

### **PLATform:EMITter:BLANkranges:STOP <Stop>**

Sets the stop angle for the selected "Blank Range".

The reference value (i.e. 0°) is the configured "Azimuth" value for the selected emitter.

Use together with [PLATform:EMITter:BLANkranges:SElect](#) on page 430.

To configure several blank ranges with a single command, you can use [PLATform:EMITter:BLANkranges](#) on page 580 . This approach is more efficient than using several blank range start/stop commands.

#### **Parameters:**

<Stop>                    float  
Range:                    0 to 360

**Example:**            `PLATform:EMITter:BLANkranges:  
SElect 1 ; PLATform:EMITter:BLANkranges:STOP  
200`

**Manual operation:** See "[Stop](#)" on page 256

### **PLATform:EMITter:DIRection:AWAY <Away>**

This command automatically configures the transmission direction of the selected emitter.

No effect if emitter is at origin.

Affects emitters whose position (relative to the origin) has been defined by one of the following methods:

- Set X and Y values
- Set Angle and Radius values

The transmission direction is configured so that it is directly away from the origin.

#### **Parameters:**

<Away>                    ON | OFF | 1 | 0

**Manual operation:** See "[Attitude](#)" on page 254

### **PLATform:EMITter:ELEVation <Elevation>**

Elevation of the emitter item's pointing direction, relative to the azimuth plane.

#### **Parameters:**

<Elevation>                float  
Range:                    -90 to 90

**Manual operation:** See ["Elevation"](#) on page 253

---

#### **PLATform:EMITter:HEIGHt** <Height>

Height of the selected emitter element relative to the platform's origin.

Can be used, for example, to differentiate between:

- Radars mounted on different parts of a ship or aircraft.
- Various radars situated across a land-based radar installation.

#### **Parameters:**

<Height>                      float  
    Range:        -500 to 500

**Manual operation:** See ["Height"](#) on page 254

---

#### **PLATform:EMITter:RADIus** <Radius>

You can set the position of the selected emitter relative to the platform's origin, using this command combined with `PLATform:EMITter:ANGLE`.

- `PLATform:EMITter:ANGLE` sets the angle of the emitter element on the azimuth plane, relative to the platform's heading.
- `PLATform:EMITter:RADIus` sets the distance of the emitter element on the azimuth plane, relative to the platform's origin.

#### **Parameters:**

<Radius>                      float  
    Range:        0 to 2000

**Manual operation:** See ["Radius"](#) on page 255

---

#### **PLATform:EMITter:ROLL** <Roll>

Roll of the emitter item's pointing direction relative to the platform's up direction.

Can be used, for example, to simulate the emissions from a mast-mounted radar on a marine platform affected by wind.

#### **Parameters:**

<Roll>                              float  
    Range:        -180 to 180

**Manual operation:** See ["Roll"](#) on page 253

---

#### **PLATform:EMITter:X** <X>

Set the position of the selected emitter relative to the platform's origin, using this command combined with `PLATform:EMITter:Y`.

X and Y represent the two principle axis of the platform.

- The Y-axis represents the axis along the center-line of the platform.  
This axis:
  - Corresponds to its heading.
  - Passes through the origin.
- The X-axis:
  - Is at right-angles to the Y-axis.
  - Passes through the origin.
- `PLATform:EMITter:Y` sets the distance of the emitter element from the origin, along the Y-axis.  
Positive values are towards the heading.
- `PLATform:EMITter:X` sets the distance of the emitter element from the origin, along the X-axis.

**Parameters:**

`<X>` float  
Range: -2000 to 2000

**Manual operation:** See "[X](#)" on page 254

**PLATform:EMITter:Y <Y>**

Set the position of the selected emitter relative to the platform's origin, using this command combined with `PLATform:EMITter:X`.

X and Y represent the two principle axis of the platform.

- The Y-axis represents the axis along the center-line of the platform.  
This axis:
  - Corresponds to its heading.
  - Passes through the origin.
- The X-axis:
  - Is at right-angles to the Y-axis.
  - Passes through the origin.
- `PLATform:EMITter:Y` sets the distance of the emitter element from the origin, along the Y-axis.  
Positive values are towards the heading.  
Step = 0.01 m
- `PLATform:EMITter:X` sets the distance of the emitter element from the origin, along the X-axis.  
Step = 0.01 m

**Parameters:**

`<Y>` float  
Range: -2000 to 2000

**Manual operation:** See "[Y \(Heading\)](#)" on page 254

## 24.22 Sequence commands

In the following examples, we assume that a pulse-base sequence "Test Sequence" and the required Pulses have been created.

See also:

- [Example "Handling items"](#) on page 420
- [Example "Creating an unmodulated pulse"](#) on page 507

### Example: Creating a filler segment

```
SCPI
SEquence:CREate "Test Sequence"
SEquence:ITEM:ADD
SEquence:ITEM COUNT?
// 2
SEquence:ITEM:SElect 2
SEquence:ITEM:TYPE FILLer
SEquence:ITEM:FILLer:SIGNAL BLANK
SEquence:ITEM:FILLer:MODE DURation
SEquence:ITEM:FILLer:TIME FIXed
SEquence:ITEM:FILLer:TIME:FIXed 5e-3
```

### Example: Creating a simple sequence with two pulses repeated different number of times

```
SCPI
SEquence:SElect "Test Sequence"
SEquence:TYPE?
SEquence:PHASe:MODE ABSolute
SEquence:TIME:MODE PRI

SEquence:ITEM:ADD
SEquence:ITEM:SElect 1; SEQeunce:ITEM:TYPE PULSe
SEQunece:ITEM:PULSe "P1"
SEquence:ITEM:PRI 2.5E-03
// SEquence:TIME:MODE PRF
// SEquence:ITEM:PRF?
// 4.E+02
SEquence:ITEM:PDElay 2E-03
SEquence:ITEM:REP:TYPE FIXed
SEquence:ITEM:REP:COUNt:FIXed 2

SEquence:ITEM:ADD
SEquence:ITEM:SElect 2; SEQeunce:ITEM:TYPE LOOP
SEquence:ITEM:LOOP:TYPE VARIable
SEquence:ITEM:LOOP:COUNt:MINimum 2
SEquence:ITEM:LOOP:COUNt:MAXimum 10
SEquence:ITEM:LOOP:COUNt:STEP 2
```



```

SEquence:ITEM:ADD
SEquence:ITEM:SElect 3; SEquence:ITEM:TYPE PULSe
SEquence:ITEM:PULSe "P1"
SEquence:ITEM:PRI 5 ms
SEquence:ITEM:FREquency:OFFSet 1000000
SEquence:ITEM:LEVel:OFFSet -10
SEquence:ITEM:REP:TYPE DURation
SEquence:ITEM:REP:COUNT:DURation 0.001
SEquence:ITEM:REP:COUNT:ROUNding UP
SEquence:ITEM:INDent 1

```

SEquence:TYPE.....	585
SEquence:PHASe:MODE.....	586
SEquence:TIME:MODE.....	586
SEquence:ITEM:FILLer:MODE.....	586
SEquence:ITEM:FILLer:SIGNal.....	586
SEquence:ITEM:FILLer:TIME.....	586
SEquence:ITEM:FILLer:TIME:EQUation.....	587
SEquence:ITEM:FILLer:TIME:FIXed.....	587
SEquence:ITEM:FREquency:OFFSet.....	587
SEquence:ITEM:INDent.....	587
SEquence:ITEM:LEVel:OFFSet.....	588
SEquence:ITEM:LOOP:COUNT:FIXed.....	588
SEquence:ITEM:LOOP:COUNT:MINimum.....	588
SEquence:ITEM:LOOP:COUNT:MAXimum.....	588
SEquence:ITEM:LOOP:COUNT:STEP.....	588
SEquence:ITEM:LOOP:TYPE.....	589
SEquence:ITEM:LOOP:VARiable.....	589
SEquence:ITEM:PDELay.....	589
SEquence:ITEM:PHASe:OFFSet.....	589
SEquence:ITEM:PRF.....	590
SEquence:ITEM:PRI.....	590
SEquence:ITEM:PULSe.....	590
SEquence:ITEM:REP:COUNT:DURation.....	590
SEquence:ITEM:REP:COUNT:FIXed.....	590
SEquence:ITEM:REP:COUNT:MINimum.....	591
SEquence:ITEM:REP:COUNT:MAXimum.....	591
SEquence:ITEM:REP:COUNT:ROUNding.....	591
SEquence:ITEM:REP:COUNT:STEP.....	591
SEquence:ITEM:REP:TYPE.....	591
SEquence:ITEM:REP:VARiable.....	592
SEquence:ITEM:TYPE.....	592

---

### SEquence:TYPE <Type>

Sets the sequence type.

#### Parameters:

<Type>                      PULSe

**Example:**                      See [Example "Handling items"](#) on page 420

**Manual operation:** See ["Sequence Name, Comment, Type, Sequence Description Table, Block Diagram"](#) on page 121

---

#### **SEQUence:PHASe:MODE** <Mode>

Defines how the phase is set at each pulse start.

**Parameters:**

<Mode> ABSolute | CONTInuous | MEMory

**Example:** See [Example"Creating a filler segment"](#) on page 584

**Manual operation:** See ["Phase Mode"](#) on page 121

---

#### **SEQUence:TIME:MODE** <Mode>

Switches between time-based (PRI) and frequency-based (PRF) pulse repetition definition.

**Parameters:**

<Mode> PRI | PRF

**Example:** See [Example"Creating a simple sequence with two pulses repeated different number of times"](#) on page 584

**Manual operation:** See ["Timing Mode"](#) on page 123

---

#### **SEQUence:ITEM:FILLer:MODE** <Mode>

Sets how the filler duration is determined.

**Parameters:**

<Mode> DURation | TSYNc

**Example:** See [Example"Creating a filler segment"](#) on page 584

**Manual operation:** See ["Mode"](#) on page 128

---

#### **SEQUence:ITEM:FILLer:SIGNal** <Signal>

Sets the signal type.

**Parameters:**

<Signal> BLANK

**Example:** See [Example"Creating a filler segment"](#) on page 584

**Manual operation:** See ["Signal"](#) on page 128

---

#### **SEQUence:ITEM:FILLer:TIME** <Time>

Defines the way the duration is defined.

**Parameters:**

<Time>                   FIXed | EQUation

**Example:**                See [Example"Creating a filler segment"](#) on page 584

**Manual operation:**    See ["Time"](#) on page 129

---

**SEquence:ITEM:FILLer:TIME:EQUation** <Equation>

Sets the filler duration as an equation.

**Parameters:**

<Equation>               string

**Example:**                SEquence:ITEM:FILLer:TIME:EQUation?

**Manual operation:**    See ["Time"](#) on page 129

---

**SEquence:ITEM:FILLer:TIME:FIXed** <Fixed>

Sets the duration of the filler.

**Parameters:**

<Fixed>                   float

Range:        0 to 1e+09

Default unit: sec

**Example:**                See [Example"Creating a filler segment"](#) on page 584

**Manual operation:**    See ["Time"](#) on page 129

---

**SEquence:ITEM:FREQuency:OFFSet** <Offset>

Enables a frequency offset.

**Parameters:**

<Offset>                  float

Range:        -1e+09 to 1e+09

Default unit: Hz

**Example:**                See [Example"Creating a simple sequence with two pulses repeated different number of times"](#) on page 584

**Manual operation:**    See ["Δ Freq."](#) on page 124

---

**SEquence:ITEM:INDent** <Indent>

Indents the selected item rows to include it, for example, in a loop.

**Parameters:**

<Indent>                  float

Range:        0 to 5

**Example:** See [Example"Creating a simple sequence with two pulses repeated different number of times"](#) on page 584

**Manual operation:** See ["Nesting"](#) on page 123

#### **SEquence:ITEM:LEVel:OFFSet** <Offset>

Sets a level offset.

**Parameters:**

<Offset> float  
 Range: -100 to 0  
 Default unit: dB

**Example:** See [Example"Creating a simple sequence with two pulses repeated different number of times"](#) on page 584

**Manual operation:** See ["Δ Level"](#) on page 124

#### **SEquence:ITEM:LOOP:COUNT:FIXed** <Fixed>

Sets the repetition number as a numeric value.

**Parameters:**

<Fixed> float  
 Range: 1 to 65535

**Example:** See [Example"Creating a simple sequence with two pulses repeated different number of times"](#) on page 584

**Manual operation:** See ["Repetition"](#) on page 124

#### **SEquence:ITEM:LOOP:COUNT:MINimum** <Minimum>

#### **SEquence:ITEM:LOOP:COUNT:MAXimum** <Maximum>

Sets the value range of the loop count.

**Parameters:**

<Maximum> float  
 Range: 1 to 65535

**Example:** See [Example"Creating a simple sequence with two pulses repeated different number of times"](#) on page 584

**Manual operation:** See ["Loop Repetition"](#) on page 127

#### **SEquence:ITEM:LOOP:COUNT:STEP** <Step>

Sets the loop count granularity.

**Parameters:**

<Step> float  
 Range: 1 to 65535

**Example:** See [Example"Creating a simple sequence with two pulses repeated different number of times"](#) on page 584

**Manual operation:** See ["Loop Repetition"](#) on page 127

#### **SEquence:ITEM:LOOP:TYPE** <Type>

Sets how the loop repetition is defined.

**Parameters:**

<Type>                      FIXed | VARiable

**Example:** See [Example"Creating a simple sequence with two pulses repeated different number of times"](#) on page 584

**Manual operation:** See ["Loop Repetition"](#) on page 127

#### **SEquence:ITEM:LOOP:VARiable** <Variable>

Sets a loop variable.

**Parameters:**

<Variable>                      string

**Example:** See [Example"Creating a simple sequence with two pulses repeated different number of times"](#) on page 584

**Manual operation:** See ["Loop Variables"](#) on page 127

#### **SEquence:ITEM:PDELay** <Pdelay>

Enables a start delay.

**Parameters:**

<Pdelay>                      float  
    Range:      0 to 1e+09  
    Default unit: sec

**Example:** See [Example"Creating a simple sequence with two pulses repeated different number of times"](#) on page 584

**Manual operation:** See ["Delay"](#) on page 125

#### **SEquence:ITEM:PHASe:OFFSet** <Offset>

Sets a phase offset.

**Parameters:**

<Offset>                      float  
    Range:      -180 to 180

**Example:**                      SEquence:ITEM:PHASe:OFFSet 30

**Manual operation:** See ["Phase"](#) on page 125

---

**SEquence:ITEM:PRF** <Prf>**SEquence:ITEM:PRI** <Pri>

Sets the pulse repetition interval (PRI) or the pulse repetition frequency (PRF).

**Parameters:**

<Pri> float  
Range: 0 to 1e+09

**Example:** See [Example"Creating a simple sequence with two pulses repeated different number of times"](#) on page 584

**Manual operation:** See ["PRI/PRF"](#) on page 125

---

**SEquence:ITEM:PULSe** <Pulse>

Assigns a pulse to the selected item.

Use the command [PULSe:CATalog?](#) to query the available pulses.

**Parameters:**

<Pulse> string  
Pulse name

**Example:** See [Example"Creating a simple sequence with two pulses repeated different number of times"](#) on page 584

**Manual operation:** See ["Pulse"](#) on page 124

---

**SEquence:ITEM:REP:COUNT:DURation** <Duration>

Sets a time duration.

**Parameters:**

<Duration> float  
Range: 0 to 1e+09  
Default unit: sec

**Example:** See [Example"Creating a simple sequence with two pulses repeated different number of times"](#) on page 584

**Manual operation:** See ["Repetition Number"](#) on page 126

---

**SEquence:ITEM:REP:COUNT:FIXed** <Fixed>

Sets the repetition number as a numeric value.

**Parameters:**

<Fixed> float  
Range: 1 to 65535

**Example:** See [Example"Creating a simple sequence with two pulses repeated different number of times"](#) on page 584

**Manual operation:** See ["Repetition"](#) on page 124

---

**SEquence:ITEM:REP:COUNT:MINimum** <Minimum>  
**SEquence:ITEM:REP:COUNT:MAXimum** <Maximum>

Sets the value range of the repetition count.

**Parameters:**

<Maximum> float

Range: 1 to 65535

**Example:** See [Example"Creating a simple sequence with two pulses repeated different number of times"](#) on page 584

**Manual operation:** See ["Repetition Number"](#) on page 126

---

**SEquence:ITEM:REP:COUNT:ROUNDing** <Rounding>

Sets how the repetition number is rounded.

**Parameters:**

<Rounding> DN | UP

**Example:** See [Example"Creating a simple sequence with two pulses repeated different number of times"](#) on page 584

**Manual operation:** See ["Repetition Number"](#) on page 126

---

**SEquence:ITEM:REP:COUNT:STEP** <Step>

Sets the repetition count granularity.

**Parameters:**

<Step> float

Range: 1 to 65535

**Example:** See [Example"Creating a simple sequence with two pulses repeated different number of times"](#) on page 584

**Manual operation:** See ["Repetition Number"](#) on page 126

---

**SEquence:ITEM:REP:TYPE** <Type>

Sets how the repetition number is defined.

**Parameters:**

<Type> FIXed | VARiable | DURation

**Example:** See [Example"Creating a simple sequence with two pulses repeated different number of times"](#) on page 584

**Manual operation:** See ["Repetition Number"](#) on page 126

---

**SEquence:ITEM:REP:VARiable** <Variable>

Sets a repetition variable.

**Parameters:**

<Variable>                      string

**Manual operation:**    See ["Repetition Variables"](#) on page 126

---

**SEquence:ITEM:TYPE** <Type>

Sets the content type of the selected item.

**Parameters:**

<Type>                              PULSe | FILLer | LOOP

**Example:**                      See [Example "Creating a filler segment"](#) on page 584

**Manual operation:**    See ["Element Type"](#) on page 124

---

## 24.23 Status commands

This system contains the commands for the status reporting system.

**Value ranges**

- **Return parameters**

Queries return the current value of the respective register, which permits a check of the device status.

Range: A decimal value in the range 0 to 32767 ( $=2^{15}-1$ )

- **Setting parameters**

The configuration commands set the respective register thus determining which status changes of the R&S Pulse Sequencer Digital cause the status registers to be changed.

Range: A decimal value in the range 0 to 32767 ( $=2^{15}-1$ )

---

**STATus:OPERation:CONDition?**

Queries the content of the CONDition part of the STATus:OPERation register. This part contains information on the action currently being performed in the instrument. The content is not deleted after being read out because it indicates the current status.

**Return values:**

<Condition>                      float

**Example:**

:STATus:OPERation:CONDition?

Queries the Status:Operation:Condition register.

**Usage:**

Query only

---



## 24.24 System, message log and program commands

The `SYSTEM`, `MSGLog` and `PROG` subsystems contain a series of commands for general functions which do not directly affect signal generation.

---

### `SYSTEM:ERRor?`

Queries the error/event queue for the oldest item and removes it from the queue. The response consists of an error number and a short description of the error.

Positive error numbers are instrument-dependent. Negative error numbers are reserved by the SCPI standard.

#### Return values:

`<Error>` string  
 Error/event\_number,  
 "Error/event\_description";Device-dependent  
 info]"  
 If the queue is empty, the response is 0, "No error"

**Example:** See `SYSTEM:ERRor:ALL?` on page 593

**Usage:** Query only

---

### `SYSTEM:ERRor:ALL?`

Queries the error/event queue for all unread items and removes them from the queue. The response is a comma-separated list of error number and a short description of the error in FIFO order.

Positive error numbers are instrument-dependent. Negative error numbers are reserved by the SCPI standard.

#### Return values:

`<All>` string  
 List of: Error/event\_number,  
 "Error/event\_description";Device-dependent  
 info]"  
 If the queue is empty, the response is 0, "No error"

**Example:** `SYSTEM:ERRor:ALL?`  
 Queries all entries in the error queue  
 Response: 0, 'no error'  
 No errors have occurred since the error queue was last read out

**Usage:** Query only

---

### `SYSTEM:ERRor:COUNT?`

Queries the number of entries in the error queue. If the error queue is empty, '0' is returned.

**Return values:**

<Count> string

**Example:**

```
SYSTem:ERRor:COUNT?
```

Queries the number of entries in the error queue

```
Response: 1
```

One error has occurred since the error queue was last read out

**Usage:**

Query only

---

**SYSTem:PROGress?**

Queries the signal generation progress status.

**Return values:**

<Progress> float

**Example:**

See [Example "Creating simple pulse train scenario"](#) on page 533

**Usage:**

Query only

**Manual operation:**

See ["Config"](#) on page 80

---

**MSGLog:ERRor?**

Queries the last error listed in the "Message Log" dialog.

**Return values:**

<Error> string

**Example:**

```
MSGLog:POPup 1
```

```
MSGLog:ERRor?
```

```
// 09:38:41:837 Cannot open input file.
```

**Usage:**

Query only

**Manual operation:** See [Chapter 25, "Troubleshooting"](#), on page 618.

---

**MSGLog:POPup <Popup>**

Opens/closes the "Message Log" dialog.

**Parameters:**

<Popup> ON | OFF | 1 | 0

**Manual operation:** See [Chapter 25, "Troubleshooting"](#), on page 618.

---

**PROGram:HIDE****PROGram:SHOW**

Minimizes/maximizes the R&S Pulse Sequencer Digital workspace.

**Usage:**

Event

## 24.25 Signal preview commands

<code>SCENario:VOLatile:VIEW:XMODE</code> .....	595
<code>SCENario:VOLatile:VIEW:YMODE</code> .....	595
<code>SCENario:VOLatile:VIEW:ZOOM:POINT</code> .....	595
<code>SCENario:VOLatile:VIEW:ZOOM:RANGE</code> .....	595

---

### `SCENario:VOLatile:VIEW:XMODE` <Xmode>

Sets the units (time or samples) used on the x axis.

#### Setting parameters:

<Xmode>            SAMPLEs | TIME

**Usage:**            Setting only

---

### `SCENario:VOLatile:VIEW:YMODE` <Ymode>

Sets the view mode.

#### Setting parameters:

<Ymode>            IQ | MAGDb | MAGW | MAGV | PHASe | FREQuency | PAV

**Usage:**            Setting only

---

### `SCENario:VOLatile:VIEW:ZOOM:POINT` <Point>

Sets center point of the displayed area.

#### Setting parameters:

<Point>            float  
 Always related to time  
 Default unit: s

#### Example:

```
SCENario:VOLatile:VIEW:ZOOM:POINT 300 us
SCENario:VOLatile:VIEW:ZOOM:RANGE 100u
// 100 us around the 300 us point, i.e.
// displayed is the time span of 200 us to 400 us

SCENario:VOLatile:VIEW:ZOOM:POINT 0.5 ms
SCENario:VOLatile:VIEW:ZOOM:RANGE 2 m
// displayed is the time span of 0 s to 2 ms
```

**Usage:**            Setting only

---

### `SCENario:VOLatile:VIEW:ZOOM:RANGE` <Range>

Sets the displayed waveform part as a range around the selected center point, set with the command `SCENario:VOLatile:VIEW:ZOOM:POINT`.

**Setting parameters:**

<Range> float  
Expressed as a time span (units can be omitted) or as number of samples

**Example:** See [SCENario:VOLatile:VIEW:ZOOM:POINT](#)

**Usage:** Setting only

## 24.26 List of remote commands

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## 25 Troubleshooting

The R&S Pulse Sequencer Digital monitors the functions performed and automatically detects errors and irregularities. The software logs status and error messages, warnings, SCPI commands sent to the software, or additional information in a log file. Some of the messages are also entered in the error/event queue of the status reporting system.

### 25.1 Querying error messages

The following information sources help you determine the cause for an error or an unexpected program behavior:

- **Message log**

The "Message Log" dialog lists information about all messages in a history list. If the software detects an error, the "Message Log" dialog pops up automatically and displays the error message.

- **Debug information**

Additionally to the log information, the software provides a dialog with debug information. It lists information like the version of the used VISA library, the list of all loaded modules, or the report and data paths.

- The **psstartup.log** file

If the software stops functioning properly, a log file is created automatically and stored in the %HOMEPATH% directory when the software is started again, see [Table 2-2](#).

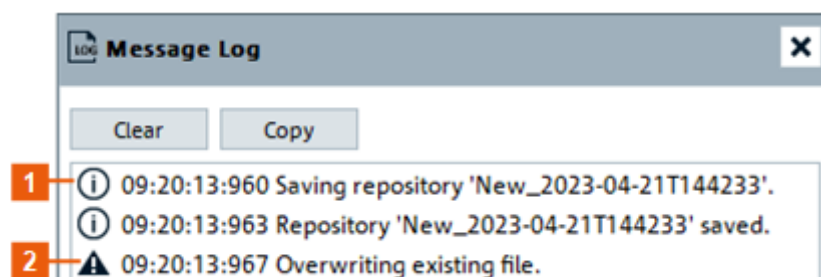
See:

- ["To access the "Message Log" dialog"](#) on page 618
- ["To open the "Message Log" dialog in debug mode"](#) on page 619
- ["To access the "Debug Information" dialog"](#) on page 620
- ["To remove write lock that results from a previously crashed session"](#) on page 621

#### To access the "Message Log" dialog

► Perform one of the following:

- a) In the toolbar, select the "Log" icon.
- b) In the menu bar, select "Window > Message Log".



1 = Info message  
2 = Warning

The displayed information is read-only but you can mark and copy it.

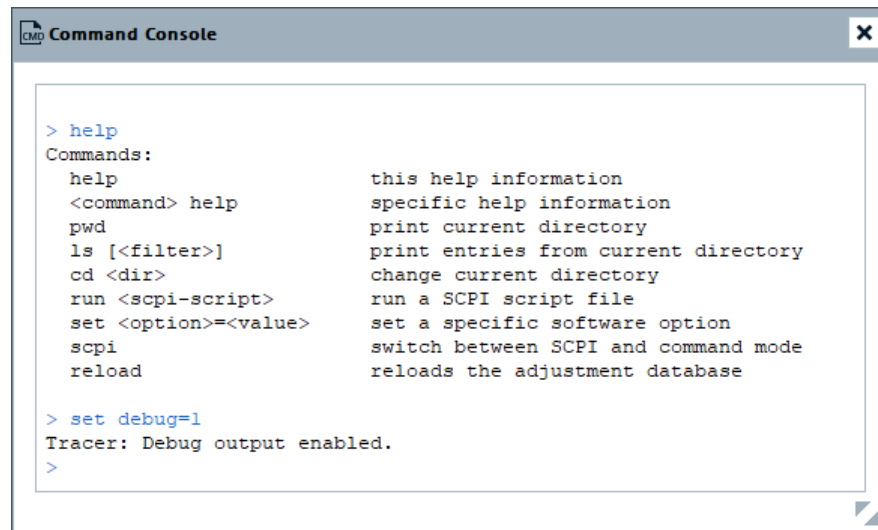
Remote command:

[MSGLog:POPup](#) on page 594

[MSGLog:ERRor?](#) on page 594

#### To open the "Message Log" dialog in debug mode

1. In the toolbar, select the "Console Window" icon.
2. In the "Command Console" window, type *help*.  
The dialog lists all available commands.
3. Enter *set debug = 1* to enable the debug messages to be output in the "Message Log" view.

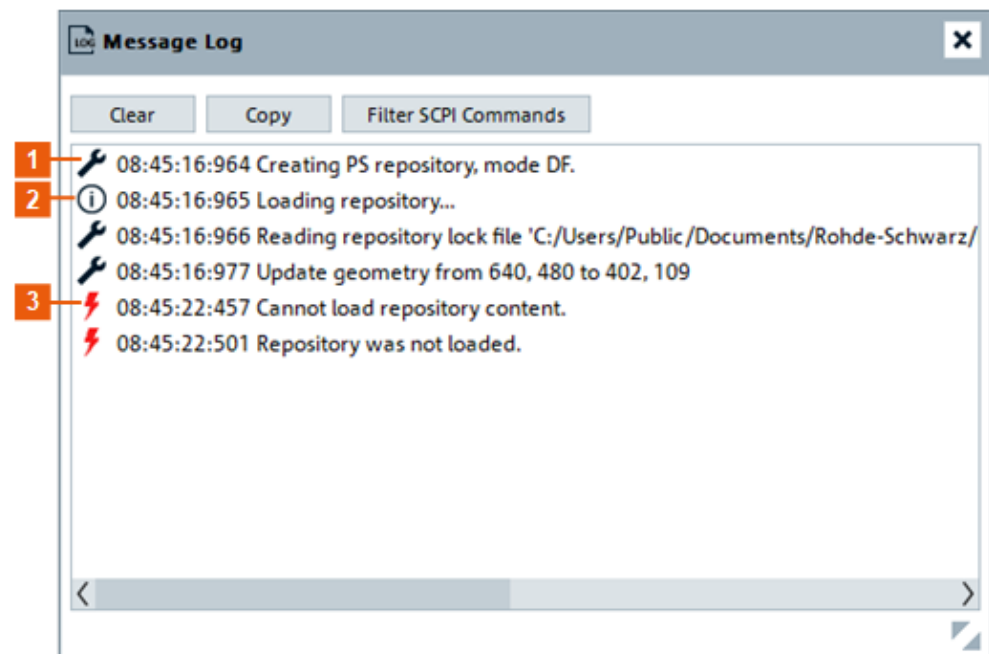


```

CMD Command Console
> help
Commands:
  help           this help information
  <command> help specific help information
  pwd            print current directory
  ls [<filter>]  print entries from current directory
  cd <dir>       change current directory
  run <scpi-script> run a SCPI script file
  set <option>=<value> set a specific software option
  scpi           switch between SCPI and command mode
  reload         reloads the adjustment database

> set debug=1
Tracer: Debug output enabled.
>

```



Clear Copy Filter SCPI Commands

```

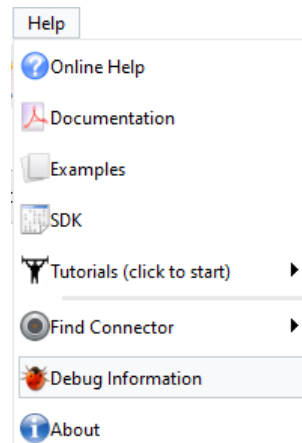
1 08:45:16:964 Creating PS repository, mode DF.
2 08:45:16:965 Loading repository...
  08:45:16:966 Reading repository lock file 'C:/Users/Public/Documents/Rohde-Schwarz/
  08:45:16:977 Update geometry from 640, 480 to 402, 109
3 08:45:22:457 Cannot load repository content.
  08:45:22:501 Repository was not loaded.

```

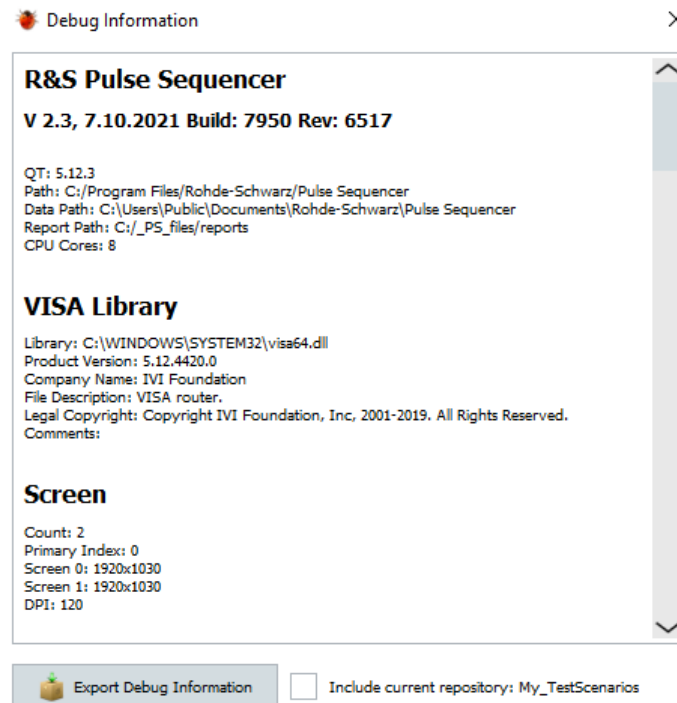
- 1 = Debug message
- 2 = Info message
- 3 = Error message

### To access the "Debug Information" dialog


- ▶ In the menu bar, select "Help > Debug Information".



A dialog opens and displays information that helps the debugging.



### To remove write lock that results from a previously crashed session

A red lock symbol  on the database icon in the "Repository Tree" indicates that a session was terminated improperly. A locked repository can be unlocked only from the same PC and by the same user with write permission that had opened the repository before.

1. In the project tree, double-click the repository name.
2. In the "Repository" dialog, select "Storage > Remove Write Lock".

The repository is unlocked; you can change or store repository settings. See also [Chapter 4.1, "Repository settings"](#), on page 61.

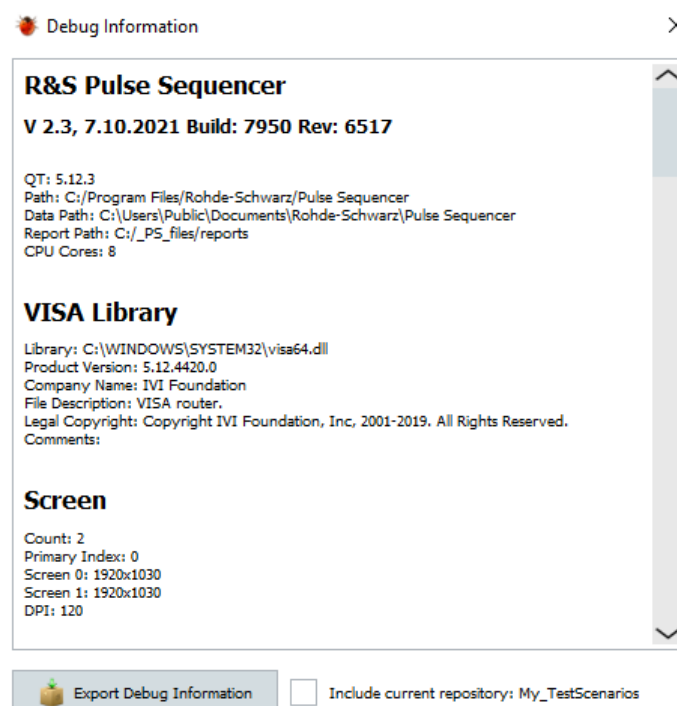
## 25.2 Collecting information for technical support

If you encounter problems that you cannot solve yourself, contact your Rohde & Schwarz support center as listed at <http://www.customersupport.rohde-schwarz.com>. Our support center staff is optimally trained to assist you in solving problems.

The support center finds solutions more quickly and efficiently if you provide them with information on the software and an error description.

### To collect error information in a debug file

1. Select "Help > Debug Information".



2. You can include or not the selected repository in the debug information file.
  - a) Select "Include current repository" and in the "Export Debug Information" dialog confirm the export with "Yes".
  - b) If your repository contains sensitive data, deselect "Include current repository".
3. Select "Export Debug Information".
4. Navigate to the directory you want to save the file in.  
The filename is assigned automatically.

The debug information and further required data is collected automatically.  
The debug file `DebugInfo.psd` is created and saved in the selected directory.

The file contains:

- \*.ini files, collected from the  
%HOMEPATH%\AppData\Roaming\Rohde-Schwarz\  
Pulse Sequencer Digital directory.
- Text as it is displayed in the "Debug Information" dialog (debug\_info.txt).
- If enabled, the repository (\*.psarch).

Name	Size	Packed	Type	Modified
..			File folder	
colors.ini	1.319	1.319	Configuration setti...	17.09.2021 09:44
config.ini	2.745	2.745	Configuration setti...	17.09.2021 10:12
crash.ini	20	20	Configuration setti...	17.09.2021 09:54
debug_info.txt	7.571	7.571	Text Document	17.09.2021 10:34
help.psarch	107.520	107.520	PSARCH File	17.09.2021 10:34
mapping.ini	4.973	4.973	Configuration setti...	28.07.2021 08:54
settings_2.ini	44.204	44.204	Configuration setti...	17.09.2021 09:44

Attach the DebugInfo.psdarch file to an email in which you describe the problem. Send the email to the customer support address for your region as listed on the Internet (<http://www.customersupport.rohde-schwarz.com>).

## 25.3 Contacting customer support

### Technical support – where and when you need it

For quick, expert help with any Rohde & Schwarz product, contact our customer support center. A team of highly qualified engineers provides support and works with you to find a solution to your query on any aspect of the operation, programming or applications of Rohde & Schwarz products.

### Contact information

Contact our customer support center at [www.rohde-schwarz.com/support](http://www.rohde-schwarz.com/support), or follow this QR code:



Figure 25-1: QR code to the Rohde & Schwarz support page

# Annex

## A Supported file types and file formats

This section summarizes the file types supported by the application and provides information about the default file locations.

### List of supported file types and file extensions

**Table A-1: Supported file types**

Extension	Description
*.ant_pat *.ffe *.tsv *.ffd *.csv	Antenna pattern
*.dll	Plug-in, for example with user modulation, IPM profile
*.ini	Initialization file Contains information on default location for temporary files
psstartup.log	Log file created automatically if the software stops functioning properly
*.riq	Rohde & Schwarz proprietary I/Q data file format used by the R&S®PR100 portable receiver.
*.wav	Rohde & Schwarz proprietary audio-like file format that contains I/Q samples instead of the usual FM stereo signal. Although the file extension suggests that this file is a standard auto file, stereo players do not recognize it.
*.iq.tar	Rohde & Schwarz proprietary I/Q data file format used by some signal and spectrum analyzers, e.g. R&S®FSW. The *.iq.tar file contains I/Q data in binary format together with meta information that describes the nature and the source of data, e.g. the sample rate.
*.mat	MATLAB file that contains complex 1xN or Mx1 vectors.
*.txt	Standard ASCII files with comma-separated values. The *.txt files can be used to: <ul style="list-style-type: none"> <li>Describe settings that are based on lists, like for example the custom pulse envelope shapes, the list for IPM profiles, or data lists.</li> <li>Describe custom I/Q data, with I and Q vectors in one file or in separated *_i.txt and *_q.txt files; If file pairs are stored in the same directory, they are recognized automatically by the "Import Wizard"</li> </ul>



Extension	Description
*.bin	Files with custom I/Q data in binary format
*.aif *.dat *.pdw and *.ppdw	AMMOS IF files AMREC recording files AMMOS PDW Rohde & Schwarz proprietary data formats used with Rohde & Schwarz monitoring equipment. These files typically contain multiple data streams. The R&S Pulse Sequencer Digital extracts IF (I/Q) or PDW data from these files.

## A.1 File format of the reporting template

The template uses an ASCII text. Text that is not a token, a format (.FMT), or an option (.OPT) description is directly transferred to the final report.

### Example: Example of a template that generates report in ASCII format

```
# R&S Pulse Sequencer, PDW Report
#
Date: <DATE>
Repository: <REPOSITORY>
Scenario: <SCENARIO>

TOA      RF      PW      PA      MOP
          GHz    us      dBm

-----
.HDR
<TOA> ; <RF> ; <PW> ; <PA> ; <MOP>
# END OF REPORT
.FMT TOA:12.0f:-9
.FMT RF:9.6f:9
.FMT PW:7.3f:-6
.FMT PA:4.0f:0
```

← Text

← <Token>

← .HDR  
<Col#1> ; <Col#2> ; ...

← .FMT Token:Format:Exponent

Figure A-1: PDW template explanation

### General template text and available tokens

The general template text is copied to the final report. All tokens are replaced with values or text provided by the software.

See [Table A-2](#) for an overview of the available tokens.

Table A-2: List of available tokens

Token name	Description
<USER>	Current user name
<TPATH>	Target file path of the directory in that the generated report file is stored
<ISODATE>	Date & time in ISO format

Token name	Description
<DATE>	Date & time in local format
<REPOSITORY>	Repository name
<RCOMM>	Repository comment
<VERSION>	Repository version
<AUTHOR>	Repository author
<RCDATE>	Repository creation data
<RPATH>	Root path of repository
<SCENARIO>	Scenario name
<SCOMM>	Scenario comment

### Adding and formatting data with the .HDR keyword

Each report contains one or more data lines. The position of these data lines in the report is indicated with the keyword `.HDR`. Usually, the reported data is formatted in table form, where the column names are defined with the information right after the `.HDR` line.

Each report template must have a `.HDR` line and subsequent second line defining the individual columns information and following the syntax:

```
.HDR
<Col#1>;<Col#2>;...
```

See [Table A-3](#) for an overview of the available tokens.

**Table A-3: List of available .HDR tokens**

Token name	Description
<b>Values related to the generated pulse data</b>	
<TOA>	Time of arrival
<PRI>	PRI of current pulse (0% - 0%)
<PRF>	PRF of current pulse (1/PRI or 0)
<PW>	Pulse width (0% - 0%)
<RT>	Rise time
<FT>	Fall time
<RF>	Center frequency of pulse (absolute)
<BW>	RF bandwidth (FMOP) incl. BB filter
<PA>	Pulse amplitude (at pulse start)
<MF>	MOP flag, where 1 indicates that MOP is active
<MOP>	MOP type, AMOP, PMOD, FMOP
<DF>	Frequency offset from carrier

Token name	Description
<RFC>	Center frequency of emitter / sequence
<DP>	Phase offset (deg)
<PHS>	Absolute start phase at the beginning of pulse (deg)
<RX_AZI>	Azimuth angle of receive antenna at the beginning of pulse (deg)
<RX_ELE>	Elevation angle of receive antenna at the beginning of pulse (deg)
<BEAR_AZI>	Emitter bearing (e.g. simulate direction finder AoA output in PDW)
<BEAR_ELE>	Emitter elevation (e.g. simulate direction finder output in PDW)
<TX_NORTH>	Emitter distance in north direction from origin
<TX_EAST>	Emitter distance in east direction from origin
<TX_UP>	Emitter height above origin
<TX_PITCH>	Emitter attitude pitch angle
<TX_YAW>	Emitter attitude yaw angle
<TX_ROLL>	Emitter attitude roll angle
<RX_NORTH>	Receiver distance in north direction from origin
<RX_EAST>	Receiver in east direction from origin
<RX_UP>	Receiver height above origin
<RX_PITCH>	Receiver attitude pitch angle
<RX_YAW>	Receiver attitude yaw angle
<RX_ROLL>	Receiver attitude roll angle
<b>Global variables from IPM profiles or loops, etc.</b>	
<VarName>	Variable from the internal variable pool
<b>Automatically generated count values related to the sequencing</b>	
<@ITEM>	Sequence line item, 1 to N
<@REP>	Repetition, 1 to M
<@COLL>	Collection line item, 1 to L

### Defining format with the .FMT keyword

Each format line must begin with .FMT and follow the syntax:

```
.FMT Token:Format:Exponent
```

The .FMT keyword formats the numeric data output, see [Table A-4](#).

**Table A-4: Format keyword syntax description**

Parameter	Description
Token	Name of the token
Format	The format of the numeric data is compared to a regular expression: [0-9]*.[0-9]*[+diufFeExX] To prevent e.g. application crash, data that does not match this expression is ignored.
Exponent	Sets an exponent to convert the numeric value; e.g. -9 converts the reported data into nano.

See [Figure A-1](#).

### Defining options with the .OPT keyword

This keyword defines one or multiple options, that further control the output of the PDW report generator. Each option line must begin with `.OPT` and follow the syntax:

```
.OPT TAG=<CURLY>,EXT=<html>
```

**Table A-5: Option keyword syntax description**

Parameter	Description
TAG	TAG=CURLY ANGLE Sets the brackets type
EXT	Sets the extension of the reporting file

### Defining conditions with the .COND keyword

This keyword defines conditions, so that PDWs are generated only, if the condition is fulfilled. The condition line must begin with `.COND` keyword, can contain one or multiple comma-separated conditions and follow the syntax:

```
.COND <token name> <condition> <value>,[<token name> <condition>  
<value>],
```

Where the following <condition> are supported:

- Equal to: `==` or `=`
- Different that: `!=` or `<>`
- Greater/smaller than: `>` and `<`
- Greater/smaller or equal: `>=` and `<=`

#### Example:

The condition `.COND PA > -100.0` reports only the PDWs with pulse amplitude > -100 dBm.

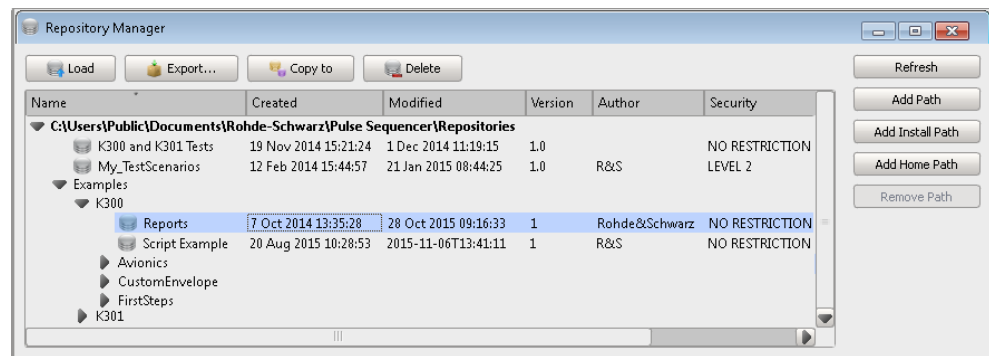
### Template examples

Template examples are provided in the repositories supplied with the software.

You can load the example repository or copy&paste the templates content in your own repository, try out them, and further develop them.

Access:

1. Select "File > Load and Manager Repositories".
2. In the "Repository Manager", double click the "Examples > K300 > Reports".



Created is a new repository with several scenarios using different kind of reporting templates.

3. Open a scenario.  
In the "Scenario" dialog, select "Waveform Generation > Config > Reporting > Template > Edit".

#### Example: Example of a template that generates report in HTML format

The following is the content of the template that creates a report in HTML format. The report is the same as in the ASCII file example shown on [Figure 21-3](#), but the output is HTML formatted.

```
# Pulse Sequencer Report Template
# The following section defines the HTML report. All values
# in curly brackets are replaced by the actual values.
.OPT TAG=CURLY,EXT=html

<HTML> <HEAD> <TITLE>PDW Report</TITLE> <HEAD>
<BODY> <H2>PDW Report Generated with PS Example</H2>
  <P><TABLE style="width:100%;text-align:left;background-color:gold;">
    <colgroup> <col style="width:30%"> <col style="width:70%"> </colgroup>
    <TR style="background-color:blue;color:white;" >
      <TD>User</TD> <TD>{USER}</TD> </TR>
    <TR> <TD>Repository Path</TD> <TD>{TPATH}</TD> </TR>
    <TR> <TD>Date</TD> <TD>{DATE}</TD> </TR>
    <TR> <TD>ISO Date</TD> <TD>{ISODATE}</TD> </TR>
  </TABLE></P>
  <P><TABLE style="width:100%;text-align:left;background-color:gold;">
    <colgroup> <col style="width:30%"> <col style="width:70%"> </colgroup>
    <TR style="background-color:blue;color:white;" >
      <TD>Repository</TD> <TD>{REPOSITORY}</TD> </TR>
```

```

<TR> <TD>Comment</TD> <TD>{RCOMM}</TD> </TR>
<TR> <TD>Version</TD> <TD>{VERSION}</TD> </TR>
<TR> <TD>Author</TD> <TD>{AUTHOR}</TD> </TR>
<TR> <TD>Created</TD> <TD>{RCDATE}</TD> </TR>
<TR> <TD>Path</TD> <TD>{RPATH}</TD> </TR>
</TABLE></P>
<H3>{SCENARIO}</H3>
<P>{SCOMM}</P>

<P><TABLE style="width:100%;text-align:left;background-color:lightgrey;">
<TR style="background-color:blue;color:white;" >
<TD>TOA</TD> <TD>RF</TD> <TD>PW</TD> <TD>PA</TD> <TD>MF</TD> <TD>MOP</TD>
<TD>BW</TD> <TD>Rep</TD> </TR>
<TR style="background-color:blue;color:white;" >
<TD>ns</TD> <TD>GHz</TD> <TD>us</TD> <TD>dBm</TD> <TD> </TD> <TD> </TD>
<TD>kHz</TD> <TD> </TD> </TR>
.HDR
<TR> <TD>{TOA}</TD> <TD>{RF}</TD> <TD>{PW}</TD> <TD>{PA}</TD> <TD>{MF}</TD>
<TD>{MOP}</TD> <TD>{BW}</TD> <TD>{@REP}</TD> </TR>
</TABLE>
</BODY>
# The following .FMT lines define the data format
#
.FMT TOA:12.0f:-9
.FMT RF:9.1f:9
.FMT PW:9.3f:-6
.FMT PA:6.1f:0
.FMT BW:6.0f:3
.FMT @REP:3i:0

```

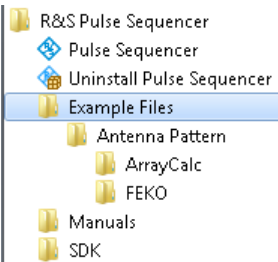
## A.2 Antenna pattern file formats

R&S Pulse Sequencer Digital supports:

- ["FEKO far field file format \\*.ffe"](#) on page 631
- ["Antenna Magus file format \\*.tsv"](#) on page 631
- ["ANSYS HFSS file format \\*.ffd"](#) on page 631
- ["Antenna patterns in \\*.csv file format"](#) on page 632
- ["Rohde&Schwarz proprietary antenna pattern \\*.ant\\_pat file format"](#) on page 633

### Examples of antenna pattern files

A subset of antenna pattern examples is included in the software.



Access:

- ▶ On your PC, open "Start > All Programs > R&S Pulse Sequencer Digital > Example Files > Antenna Pattern".

You can load and import the patterns, try out them, and further develop them.

See "[To import a user-defined antenna pattern from file in one of the predefined file formats](#)" on page 212.

### FEKO far field file format \*.ffe

FEKO is an electromagnetic simulation software tool distributed by the EM Software & Systems-S.A. (Pty) Ltd.

The R&S Pulse Sequencer Digital supports the \*.ffe files with version V1, V2, and V3.

For information on the file format, see the official product page <http://www.feko.info/>.

### Antenna Magus file format \*.tsv

Antenna Magus is an antenna design software tool.

The \*.tsv files are text files that describe the antenna pattern in a tabular structure. These files contain a header section and data part with tab-separated values.

For information, see <http://www.antennamagus.com/>.

### Example: Antenna Magus \*.tsv file (extract)

```
# Far-field exported from Antenna Magus 5.3.0.1686
# On Friday, March 06, 2015 at 1:18:13 PM
# Frequency: 3.0E+9 Hz
# Power: 0.171146799151093 W
# Theta Samples: 181
# Phi Samples: 361
#Theta Phi Re(E_Theta) Im(E_Theta) Re(E_Phi) Im(E_Phi)
0.000000000000E+000 0.000000000000E+000 4.303687774512E-016 0.000000000000E+000 -7.148424634567E+000 -1.436268526906E+000
1.000000000000E+000 0.000000000000E+000 4.425352450194E-016 0.000000000000E+000 -7.363209895869E+000 -1.542584165100E+000
...
```

### ANSYS HFSS file format \*.ffd

ANSYS HFSS software is the industry standard for simulating 3-D full-wave electromagnetic fields.

The R&S Pulse Sequencer Digital supports the \*.ffd multi-frequency far field pattern files but imports only the first frequency.

For information, see <http://www.ansys.com/>.

**Example: ANSYS HFSS \*.ffd file (extract)**

The values in the columns are the complex values of the electromagnetic field in theta and phi direction.

```
0 180 19
0 360 37
Frequencies 1
Frequency 8.680000000000000e+008
-3.029304169961667e+000 -3.592562203897908e+000 6.108290737961166e-001 1.376043194687679e+000
-2.877212877279787e+000 -3.299035718428788e+000 1.127582356352358e+000 1.978979886470077e+000
```

**Antenna patterns in \*.csv file format**

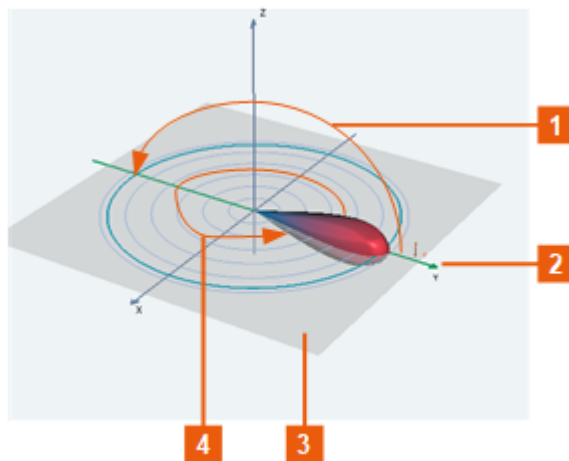
Several of the popular antenna design software tools export antenna patterns also as \*.csv files.

The \*.csv files are text files that describe the antenna pattern in a tabular structure. These files contain a header section and data part with up to six columns. The values can be separated by commas, semicolons, or with spaces.

When a file is selected, the "Import Wizard" tries to determine the used column separator, decimal delimiter and to data content of the columns. You can change the values afterwards.

Following parameters describe an antenna (see [Figure A-2](#)):

- Theta  
Elevation angle with value range 0° to 180°, where Theta = 0° means negative Z-axis direction
- Phi  
Azimuth angle with value range 0° to 360°, where Phi = 0° means positive Y-axis direction
- Use constant resolution step for both antenna parameters.



**Figure A-2: Coordinate system**



- 1 = Elevation angle with value range 0° to 180°
- 2 = Phi = 0°
- 3 = Theta = 0°
- 4 = Azimuth angle with value range 0° to 360°

### Example: Antenna Magus file in \*.csv format (extract)

```

FRQ=3.0E+9
PIN=0.171146799151093
THETA_SYM_0=0
THETA_SYM_90=0
PHI_SYM_0=0
PHI_SYM_90=0
INTERP_DBI=0
Theta(,deg) Phi(,deg) E_Theta(Re,) E_Theta(Im,) E_Phi(Re,) E_Phi(Im,)

# Far-field exported from Antenna Magus 5.3.0.1686
# On Friday, March 06, 2015 at 1:17:55 PM
# Theta Samples: 181
# Phi Samples: 361
0.000000000000E+000,0.000000000000E+000,4.303687774512E-016,0.000000000000E+000,-7.148424634567E+000,-1.436268526906E+000
1.000000000000E+000,0.000000000000E+000,4.425352450194E-016,0.000000000000E+000,-7.363209895869E+000,-1.542584165100E+000
...

```

### Example: ANSYS HFSS files in \*.csv format (extract)

The following are two examples of the ANSYS HFSS file in \*.csv file format. The first file describes the electromagnetic fields, whereas the second one the gain in dBi.

```

Phi[deg],Theta[deg],re(rEPhi)[mV],im(rEPhi)[mV]
0,0,610.829,1376.04
10,0,1127.58,1978.98
...

Phi[deg],Theta[deg],dB(GainTotal)
0,0,-2.79687
10,0,-2.79687
...

```

### Rohde&Schwarz proprietary antenna pattern \*.ant\_pat file format

The [Table A-6](#) describes the used tags and parameters.

**Table A-6: Format of \*.ant\_pat file**

Element	Description
<antenna_pattern>	Root element of the antenna pattern file
<az_res>	Resolution of the columns in the <data> section Value in degrees integer divider of 360

Element	Description
<elev_res>	Resolution of the rows in the <data> section Value in degrees integer divider of 180
<data>	The file has to contain up to: <ul style="list-style-type: none"> <li>• [1 + 360/&lt;az_res&gt;] columns</li> <li>• [1 + 180/&lt;elev_res&gt;] rows</li> </ul> If the column resolution exceeds the resolution specified with the <az_res> element, an interpolation is applied.  You can also define a subset of values, for example to define a beam antenna pattern. Missing values are internally set to zero, see <a href="#">Example "Beam antenna pattern"</a> on page 634.

The following are two examples of the file format: the description of a beam-like antenna pattern and the description of an antenna pattern with back lobes and medium resolution.

#### Example: Beam antenna pattern

This example shows that partially defined antenna patterns are also allowed.

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<antenna_pattern>
  <az_res> 5.00000000e+00 </az_res>
  <elev_res> 5.00000000e+00 </elev_res>
  <data>
    -30,-20,-10,0, 10, 20, 30
    -30,100,100,100,100,100,100,100,100,
    -20,100,100,100,100,100,100,100,
    -10,100,100,10, 100,10, 100,100,
    0,100,100,100,0, 100,100,100,
    10,100,100,10, 100,10,1 00,100,
    20,100,100,100,100,100,100,100,
    30,100,100,100,100,100,100,100,
  </data>
</antenna_pattern>
```

In this example, defined are only the subset of values that describe the beam pattern; all other values are assumed to be zero, see [Figure A-3](#).

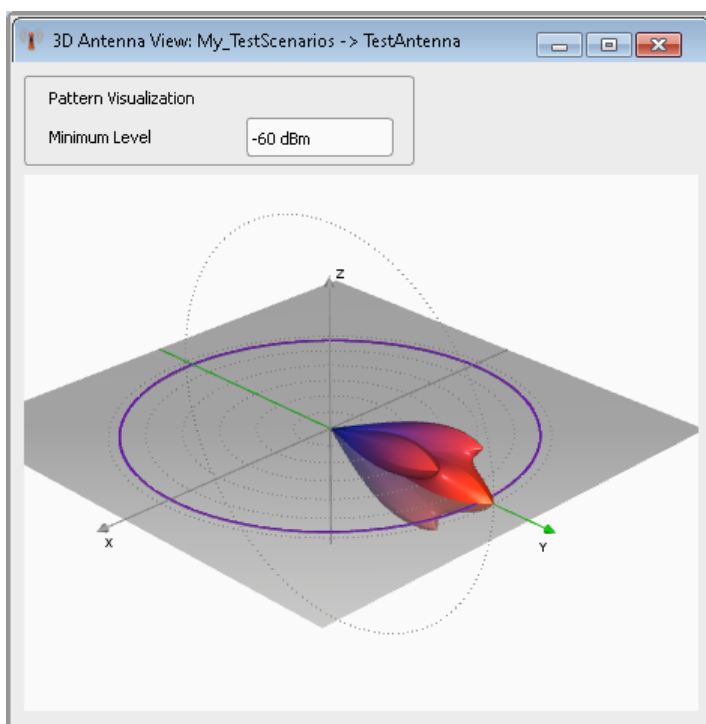


Figure A-3: 3D view of the imported partially defined antenna pattern

**Example: Antenna pattern with back lobes**

```

<?xml version="1.0" encoding="ISO-8859-1"?>
<antenna_pattern>
<az_res> 5.00000000e+00 </az_res>
<elev_res> 5.00000000e+00 </elev_res>
<data>
-180,-160,-140,-120,-100,-80,-60,-40,-20,0,20, 40, 60, 80, 100,120,140,160,180
-90,100,100,100,100,100,100,100,100,100,100,30,100,100,100,100,100,100,100,100
-80,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100
-70,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100
-60,100,100,100,100,100,100,100,100,100,100,20, 100,100,100,100,100,100,100,100
-50,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100
-40,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100
-30,100,100,100,100,100,100,100,100,100,100,10, 100,100,100,100,100,100,100,100
-20,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100
-10,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100
0, 30, 100,100,20 ,100,100,10, 100,100,0, 100,100,10, 100,100,20, 100,100,30
10,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100
20,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100
30,100,100,100,100,100,100,100,100,100,100,10, 100,100,100,100,100,100,100,100
40,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100
50,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100
60,100,100,100,100,100,100,100,100,100,100,20, 100,100,100,100,100,100,100,100
70,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100
80,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100,100
90,100,100,100,100,100,100,100,100,100,100,30, 100,100,100,100,100,100,100,100
</data>
</antenna_pattern>

```

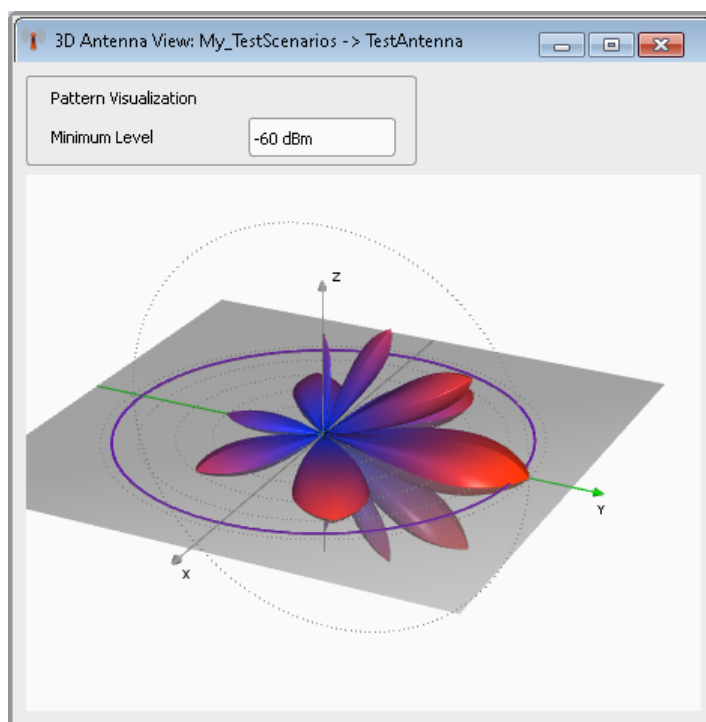


Figure A-4: 3D view of the imported antenna pattern with back lobes

## A.3 Movement files

### A.3.1 Waypoint file format

A waypoint file is a simple text file (\*.txt) that describes a trajectory as a sequence of positions called waypoints. The file contains a resolution [ms] that give the time between two consecutive waypoints and a list of waypoint coordinates, one row per waypoint.

Each waypoint is specified with its longitude [° (decimal format)], latitude [° (decimal format)], altitude [m].

**Example:**

The resolution command at the beginning of the file specifies the time (in ms) between two consecutive waypoints. In this example, it is 50 ms. The value is different than 10 ms; the waypoint file is resampled.

```
RESOLUTION: 50
144.966666334601,-37.8166633061788,100.00000009313
144.966662392613,-37.8166632247233,100.00000039116
144.966658453002,-37.8166630889914,100.00000008475
144.966654516955,-37.8166628990241,100.000000149943
144.966650585658,-37.8166626548785,100.000000235625
144.966646660296,-37.8166623566284,100.000000339001
...
etc.
```

### A.3.2 Vector trajectory file format

In the vector trajectory file format, motion is defined in an East North plane which is tangent to earth at the specified reference point. The curvature of the Earth is not considered in the interpretation of the  $U_p$  (U) coordinate elements when moving east or north.

The vector trajectory file format is suitable for description of movements where the curvature of the earth is negligible. This file format is not intended for long-distance simulations where the curvature of the earth is significant.

This file format uses a script containing the commands defined in the following table:

Command	Description
REFERENCE: lon, Lat, alt	Specifies the Cartesian Reference of the ENU coordinates system. Given as a geodetic WGS84 point (longitude, Latitude, Altitude).
START: E ,N, U, Velocity	Start location is the initial "current location" in the ENU Cartesian coordinate of center REFERENCE. East, North and UP (ENU) coordinates are then provided (m). The last argument is the start velocity in (m/s).
ARC: E, N, Angle	Specifies a 2-Dimensional ARC (East, North) with the first two arguments representing the center of the ARC (m) in the Cartesian basis. The last argument specifies the angle in degrees (°) of the Arc Starting the "current location". Angle sign is significant because it indicates positive direction (counterclockwise) or negative direction (clockwise). The end edge of the arc represents the new "current location". Velocity does not change when using an ARC command.
LINE: ΔE, ΔN, Acceleration	Specifies a 2-dimensional line from the current location or first edge (Current loc E, Current loc N) to the next location or second edge (Current loc E + ΔE, Current loc N + ΔN) (m). The argument Acceleration specifies a constant acceleration/deceleration, where Acceleration = 0 indicates constant velocity. Unit for acceleration is (m/s <sup>2</sup> ). The second edge is used as the current location for the next command. The speed at this second edge is also used as the start speed for the next command.

Command	Description
LINE3D: $\Delta E$ , $\Delta N$ , $\Delta U$ , Acceleration	<p>Describes a 3-dimensional straight line in ENU coordinates, where the first edge is described as (E, N, U) and the second edge as (E + <math>\Delta E</math>, N + <math>\Delta N</math>, U + <math>\Delta U</math>) (m).</p> <p>The argument <code>Acceleration</code> specifies a constant acceleration/deceleration, where <code>Acceleration = 0</code> indicates constant velocity. Unit for acceleration is (m/s<sup>2</sup>).</p> <pre>***** MOVEMENT FILE ***** RESOLUTION: 10 REFERENCE: 0,0,0 START: 0, 0, 10000, 20 LINE3D: 0, 0, -10000, 0</pre>
STAY: Time	Stay at the current location for <code>Time</code> period (ms).

### Example: Example of a waypoint file

This example explains a waypoint file, describing a moving emitter on a rectangular trajectory of 940m by 1440m with rounded corners defined in [Table A-7](#) and [Figure A-5](#).

The initial reference is first defined followed by acceleration to final speed of 100 km/h in 250 m. The emitter then maintains the speed for 400 m. The speed then decreases to 25 km/h in 250 m. The UE then turn 90 degrees with turning radius of 20 m at 25 km/h. The speed increases to 100 km/h in 250 m.

The sequence is repeated to complete the rectangle.

**Table A-7: Trajectory parameters**

Parameter	Distance (m)	Speed (km/h)
$l_{11}$ , $l_{15}$ , $l_{21}$ , $l_{25}$	20	25
$l_{12}$ , $l_{14}$ , $l_{22}$ , $l_{24}$	250	25 to 100 and 100 to 25
$l_{13}$	400	100
$l_{23}$	900	100

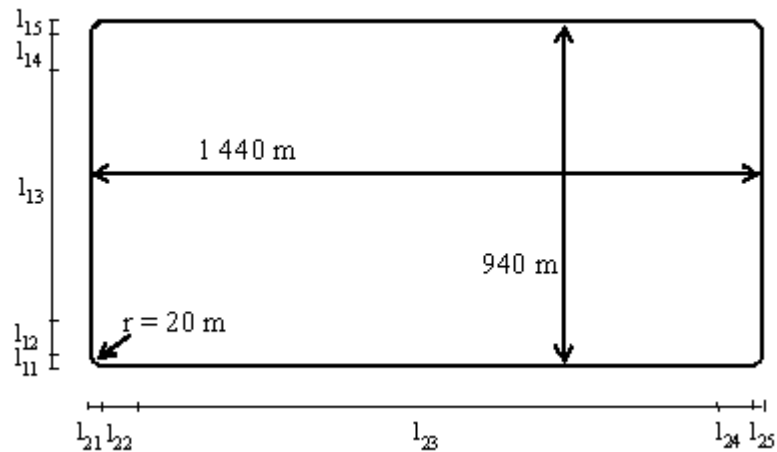


Figure A-5: Trajectory

The following is the content of the waypoint file.



The start tag `MOVEMENT FILE` is a mandatory element for each movement description. If this tag is omitted, the software interprets the coordinates described in the waypoint file as static one.

### A.3.3 Trajectory description files

The trajectory description files use the file extension `*.xtd`. See [Example "Trajectory description files in <positiononly> waypoint format"](#) on page 642 for a simple example of the file format.

The [Table A-8](#) describes the used tags and parameters.



Table A-8: Format of \*.xtd file

Container	Tag name	Parameter	Description
<general>	<property>	<waypointformat>	<p>Defines the format of the waypoint data.</p> <p>The possible values are:</p> <ul style="list-style-type: none"> <li>• "positiononly" Only waypoint data</li> <li>• "position_attitude" Waypoint and attitude data</li> <li>• "position_velocitymagnitude" Waypoints and velocity magnitude information per point</li> <li>• "position_velocitymagnitude_attitude" Waypoints, velocity magnitude and attitude data</li> <li>• "position_velocityvector" Waypoints and velocity vector per location</li> <li>• "position_velocityvector_attitude" Waypoints, velocity vector and attitude per point</li> </ul> <p>Smoothing is only possible with <code>&lt;property waypointformat="positiononly"&gt;</code> and waypoints and *.kml.</p> <p>The description of the waypoints has to follow the selected format.</p> <p>For example, <code>&lt;waypointvector data="0.05,144.966662392613,-37.8166632247233,100.00000039116"/&gt;</code> with <code>&lt;property waypointformat="positiononly"/&gt;</code> and <code>&lt;datavectorhastimestamp="yes"&gt;</code>.</p>
		<datavectorhastimestamp>	<p>Determines the way the time stamp (elapsed time starting simulation time) is defined.</p> <ul style="list-style-type: none"> <li>• With <code>&lt;datavectorhastimestamp="yes"&gt;</code> The time stamp of a waypoint is retrieved from the <code>&lt;waypointvector data&gt;</code>, as the first data vector parameter.</li> <li>• With <code>&lt;datavectorhastimestamp="no"&gt;</code> the time stamp is internally calculated based on the following rule: <ul style="list-style-type: none"> <li>– The time stamp of first waypoint is <math>T_1 = 0</math></li> <li>– The time stamp of the waypoint<sub>N</sub> is <math>T_N = (N-1) \cdot \text{timeresolution}</math></li> </ul> </li> </ul>
		<coordsystem>	<p>Defines the coordinate system used by the definition of the <code>&lt;waypointvector data&gt;</code>.</p> <p>Possible values: "enu", "cart ecef", "geod wgs84" or "geod pz90"</p>
		<timeresolution>	<p>If <code>&lt;datavectorhastimestamp="no"&gt;</code>, applies implicitly time stamps to waypoints. Otherwise, the time stamp is retrieved automatically, see <code>&lt;datavectorhastimestamp&gt;</code>.</p>
		<enurefpoint>	<p>Coordinates of the reference waypoint in ENU format</p>
		<endbehaviour>	<p>Determines the behavior of the moving object at the end of the trajectory.</p> <p>Possible values: "jump", "return", "stop"</p>
		<attitudeunit>	<p>Defines the unit ("rad" or "deg") the attitude is expressed in</p>
		<noofwaypoints>	<p>Number of the used waypoints vectors.</p> <p>Use the parameter to minimize the size of the waypoint without actually deleting the waypoints</p>

Container	Tag name	Parameter	Description
		<attitudecontinuous>	If <attitudecontinuous="no">, the attitude angles to be read are bounded by $2\pi$ . The <attitudecontinuous="yes"> means that they are not bounded.
<waypoints>			Description of the trajectory as a list of waypoint vectors.
	<waypointvector>	<data>	<p>Coordinates of the waypoint in the format selected by &lt;coordsystem&gt;</p> <ul style="list-style-type: none"> <li>[time,]longitude,latitude,altitude (geod wgs84)</li> <li>[time,]X,Y,Z (cart ecef)</li> <li>[time,]EAST,NORTH,UPPER (enu)</li> </ul> <p>Depending on the &lt;datavectorhastimestamp&gt;, 3 or 4 values are evaluated with &lt;property waypointformat="positiononly"/&gt;</p> <p>Depending on the &lt;property waypointformat&gt;, more information can be provided. The following is a list of the information appended to the coordinates of the waypoint mentioned above.</p> <ul style="list-style-type: none"> <li>&lt;property waypointformat="positiononly"&gt; No additional information</li> <li>&lt;property waypointformat="position_attitude"&gt; <b>yaw/heading,pitch/elevation,roll/bank</b>, e.g. [time,]longitude,latitude,altitude,yaw,pitch,roll The vehicle attitude (yaw, pitch and roll) parameters are configured relative to the local horizon</li> <li>&lt;property waypointformat="position_velocitymagnitude"&gt; <b>vel</b>, e.g. [time,]X,Y,Z,vel</li> <li>&lt;property waypointformat="position_velocitymagnitude_attitude"&gt; <b>vel,yaw/heading,pitch/elevation,roll/bank</b>, e.g. [time,]EAST,NORTH,UPPER,vel,yaw,pitch,roll</li> <li>&lt;property waypointformat="position_velocityvector"&gt; Velocity vector <b>Vx,Vy,Vz</b>, e.g. [time,]X,Y,Z,Vx,Vy,Vz</li> <li>&lt;property waypointformat="position_velocityvector_attitude"&gt; <b>yaw/heading,pitch/elevation,roll/bank,Vx,Vy,Vz</b>, e.g. [time,]longitude,latitude,altitude,yaw,pitch,roll, Vx,Vy,Vz.</li> </ul> <p><b>Note:</b> If the waypoints are in geod wgs84, velocity vector is assumed in Cartesian ECEF coordinate system.</p>

### Example: Trajectory description files in <positiononly> waypoint format

The following are two examples in <property waypointformat="positiononly"> format. The examples emphasize on the different formats and explain the used time stamp principle.

- The <waypointvector data> parameters in the following example are vectors with size of 3, because of the tag <property datavectorhastimestamp="no">. Even if a fourth value has been defined, it would have been ignored.  
The time stamp is defined with the tag <property timeresolution="0.05">:  
 $T_1 = 0$ ,  $T_2 = (2-1)*0.05 = 0.05$ , and so on,  $T_{12} = (12-1)*0.05 = 0.55$

```
<trajectory>
  <general>
    <property waypointformat="positiononly"/>
    <property datavectorhastimestamp="no"/>
```

```

    <property coordsystem="enu"/>
    <property timeresolution="0.05"/>
    <property enurefpoint="54.0,10.0,12"/>
    <property endbehaviour="return"/>
    <property noofwaypoints="12"/>
</general>
<waypoints>
    <waypointvector data="0,0,0"/>
    <waypointvector data="0,1,0"/>
    <waypointvector data="0,2,0"/>
    <waypointvector data="0,3,0"/>
    <waypointvector data="0,4,0"/>
    <waypointvector data="0,5,0"/>
    <waypointvector data="0,6,0"/>
    <waypointvector data="0,7,0"/>
    <waypointvector data="0,8,0"/>
    <waypointvector data="0,9,0"/>
    <waypointvector data="0,10,0"/>
    <waypointvector data="0,11,0"/>
</waypoints>
</trajectory>

```

- In the following example, the tag `<property datavectorhastimestamp="yes">` and all four values in the `<waypointvector data>` parameters are evaluated. The time stamp is retrieved automatically; the time stamp of a waypoint is the first value in the corresponding `<waypointvector data>` parameter:  
 $T_1 = 0$ ,  $T_2 = 0.05$ , and so on,  $T_{12} = 0.55$ .

```

<trajectory>
  <general>
    <property waypointformat="positiononly"/>
    <property datavectorhastimestamp="yes"/>
    <property coordsystem="geod wgs84" />
    <property endbehaviour="return"/>
    <property duration="2.0"/>
  </general>
  <waypoints>
    <waypointvector data="0,144.966666334601,-37.8166633061788,100.00000009313"/>
    <waypointvector data="0.05,144.966662392613,-37.8166632247233,100.00000039116"/>
    <waypointvector data="0.10,144.966658453002,-37.8166630889914,100.0000008475"/>
    <waypointvector data="0.15,144.966654516955,-37.8166628990241,100.00000149943"/>
    <waypointvector data="0.20,144.966650585658,-37.8166626548785,100.00000235625"/>
    <waypointvector data="0.25,144.966646660296,-37.8166623566284,100.00000339001"/>
    <waypointvector data="0.30,144.966642742053,-37.8166620043635,100.000004461936"/>
    <waypointvector data="0.35,144.966638832109,-37.81666159819,100.00000603497"/>
    <waypointvector data="0.40,144.966634931642,-37.8166611382304,100.00000762753"/>
    <waypointvector data="0.45,144.96663104183,-37.8166606246233,100.00000941567"/>
    <waypointvector data="0.50,144.966627163843,-37.8166600575235,100.00001138076"/>
    <waypointvector data="0.55,144.96662329885,-37.8166594371019,100.00001354143"/>
  </waypoints>
</trajectory>

```

```
</waypoints>
</trajectory>
```

## A.4 Vehicle description files (Used for smoothing)

The vehicle description files use the file extension \*.xvd. The following is a simple example of the file format.

```
<vehicle>
  <info name="Car"/>
  <limits>
    <property maxspeed="100.0"/>
    <property maxg="0.6"/>
    <property maxg_lateral="0.6"/>
    <property maxjerk="15"/>
    <property maxjerk_lateral="15"/>
    <property maxyawrate="0"/>
    <property maxyawacceleration="0"/>
    <property maxyawjerk="0"/>
    <property maxpitchangle="0"/>
    <property maxpitchrate="0"/>
    <property maxpitchacceleration="0"/>
    <property maxpitchjerk="0"/>
    <property maxrollangle="0"/>
    <property maxrollrate="0"/>
    <property maxrollacceleration="0"/>
    <property maxrolljerk="0"/>
    <property proximity="0"/>
  </limits>
</vehicle>
```

The [Table A-9](#) describes the used tags and parameters.

**Table A-9: Format of \*.xvd file**

Container	Tag name	Parameter	Description
<info>	<name>		Vehicle name
	<limits>		
<property>	<maxspeed>		Maximal Speed (m/s)
	<maxg>		Maximum tangential acceleration in g unit
	<maxg_lateral>		Maximum radial acceleration (due to centrifugal force) in g unit
	<maxjerk>		Maximum tangential Jerk in m/s <sup>2</sup>
	<maxjerk_lateral>		Maximum radial Jerk in m/s <sup>2</sup>
	<maxyawrate>		Maximum rate of change of the yaw/heading (rad/s)

## Vehicle description files (Used for smoothing)

Container	Tag name	Parameter	Description
		<maxyawacceleration>	Maximum second rate of change (acceleration) of the yaw/heading (rad/s <sup>2</sup> )
		<maxyawjerk>	Maximum third rate of change (jerk) of the yaw/heading (rad/s <sup>3</sup> )
		<maxpitchangle>	Maximum pitch/elevation angle (rad)
		<maxpitchrate>	Maximum rate of change of the pitch/elevation (rad/s)
		<maxpitchacceleration>	Maximum second rate of change (acceleration) of the pitch/elevation (rad/s <sup>2</sup> )
		<maxpitchjerk>	Maximum third rate of change (jerk) of the pitch/elevation (rad/s <sup>3</sup> )
		<maxrollangle>	Maximum roll/bank angle (rad)
		<maxrollrate>	Maximum rate of change of the roll/bank (rad/s)
		<maxrollacceleration>	Maximum second rate of change (acceleration) of the roll/bank (rad/s <sup>2</sup> )
		<maxrolljerk>	Maximum third rate of change (jerk) of the roll/bank (rad/s <sup>3</sup> )
		<proximity>	Specifies the maximum allowed deviation from the original waypoints (m)

## B Formula syntax

You can use mathematical expression to define custom modulation types or envelope shapes.

The R&S Pulse Sequencer Digital uses the fast math parser library muParser, that is an extensible high performance math expression parser library written in C++.

This section list some of the default features supported by the parser. For detailed information, see the muParser product home page <http://beltoforion.de/article.php?a=muparser&p=features>.

### Basic syntax elements

**Table B-1: Mathematical operations**

Element	Description
+	Addition
-	Subtraction
*	Multiplication
/	Division
^	By the power of

**Table B-2: Built-in functions (Extract)**

Element	Description
sin	sine function
cos	cosine function
exp	raised to the power of x
etc.	

**Table B-3: Other operators**


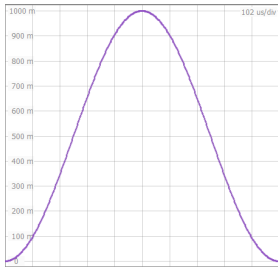
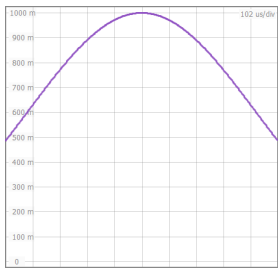
Element	Description	Syntax
?:	if then else operator	<if_condition>?<then_expression>:<else_expression>

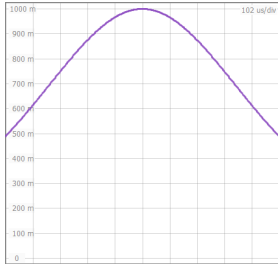
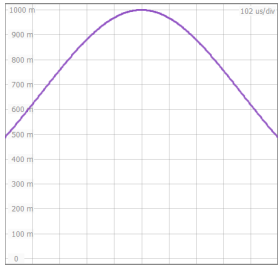
**Table B-4: Constant and variables**

Element	Description	
Constants:	PI	$\pi$
	$T_r$	Pulse rise time
	$T_w$	Pulse width time
	$T_f$	Pulse fall time

Element	Description	
	T $T = T_r + T_w + T_f$	Total pulse time
Variables:	ip<n>	Inter-pulse modulation value <n>
	t t = 0 .. T	Time

### Equations and parameters used to define custom pulse envelopes

Envelope name	Equation	Envelope shape
"Rectangular Pulse"	1	
"Triangular Pulse"	$(t < T/2) ? t/(T/2) : 1 - (t - T/2)/(T/2)$	
"Raised Cosine Pulse"	$0.5 * ( 1 - \cos( 2 * \text{PI} * t/T ) )$	
"Gaussian Pulse"	$\exp( -4 * \ln(2) * ( (t - T_r - T_w/2) / T_w )^2 )$	

Envelope name	Equation	Envelope shape
"Lorentzian Pulse"	$1 / ( ( 1 + 4 * ( \text{sqrt}(2)-1 ) * ( t-\text{Tr}-\text{Tw}/2 ) / \text{Tw} )^2 ) )^2$	
"Sech Pulse"	$1 / ( \cosh( ( 2 * ( t-\text{Tr}-\text{Tw}/2 ) * \ln( 1+\text{sqrt}(2) ) ) / \text{Tw} ) )^2$	

Where Amplitude value range is 0 V to 1 V.



## C Plug-in programming API

The functionality of the R&S Pulse Sequencer Digital can be extended by plug-ins. A plug-in is a Microsoft Windows DLL. This DLL can be loaded into a repository and then remains there.

You can load plug-ins to:

- Define a custom inter-pulse modulation profile (IPM)
- Create a report file
- Define the file format of the custom antenna pattern files.

### Access:

A subset of example plug-ins is included in the software.

- ▶ On your PC, open "Start > All Programs > R&S Pulse Sequencer Digital > SDK".

You can load the plug-ins in your own repository, try out them, and further develop them.

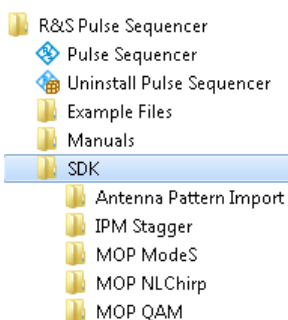
See "[To import a plugin](#)" on page 377.

The following is a list of all functions that the plug-in has to provide:

• <a href="#">Common functions</a> .....	649
• <a href="#">Export plugin</a> .....	654
• <a href="#">IPM functions</a> .....	657
• <a href="#">Reporting functions</a> .....	659
• <a href="#">Custom antenna pattern import functions</a> .....	661
• <a href="#">List of Plugin Functions</a> .....	664

### C.1 Common functions

<a href="#">getType</a> .....	650
<a href="#">getVersion</a> .....	650
<a href="#">getComment</a> .....	650
<a href="#">getAuthor</a> .....	651
<a href="#">getName</a> .....	651
<a href="#">getError</a> .....	651
<a href="#">int getNextMsg</a> .....	652
<a href="#">int initPlugin</a> .....	652
<a href="#">shutdownPlugin</a> .....	652
<a href="#">int getPrivateMemSize</a> .....	652
<a href="#">int getVariable</a> .....	653
<a href="#">int setVariable</a> .....	653
<a href="#">int setVariableEx</a> .....	653



---

**getType** ( char szModType[1024])

**(mandatory)**

Queries the plug-in type.

The type defines the purpose of the plug-in. It is the most important parameter returned to the main application.

Do not change the type of the plug-in after it is used within a repository. The type also defines which functions have to be provided by the plug-in (API). It also affects in which R&S Pulse Sequencer Digital dialogs the plug-in becomes visible.

**Parameters:**

szModType                      string

**(return parameter)**

A keyword that denominates the plug-in type.

**"modulation" | "mop"**

MOP plug-in

**"ipm"**

IPM plug-in

**"report"**

Reports plug-in for reports created during the waveform generation

**"export"**

Customer written plugin which receives PDW data from the R&S Pulse Sequencer Digital.

---

**getVersion** ( char szModVer[1024] )

**(mandatory)**

Queries the version string of the plug-in.

The version string is not further evaluated in the software. It only serves as an additional piece of information. The returned version string is visible on the plug-in dialog panel.

**Parameters:**

szModVer                      "<Major>.<Minor>.<Revision>"

**(return parameter)**

<Major>, <Minor>, and <Revision> are numerical values.

---

**getComment** ( char szModComment[4096] )

**(mandatory)**

Queries the comment string of the plug-in.

The comment string is not further evaluated in the software. It only serves as an additional piece of information. The returned comment string is visible on the plug-in dialog panel.

**Parameters:**

szModComment      string

**(return parameter)**

Line breaks are permissible. To generate new line, insert ' \n ' into the string.

---

**getAuthor** ( char szModAuthor[1024] )**(mandatory)**

Queries the author string of the plug-in.

The author string is not further evaluated in the software. It only serves as an additional piece of information. The returned author string is visible on the plug-in dialog panel.

**Parameters:**

szModAuthor      string

**(return parameter)**

Empty string is allowed

---

**getName** ( char szModName[1024] )**(mandatory)**

Queries the plug-in name.

The name string is not further evaluated in the software. It only serves as an additional piece of information. However, be careful changing names once the plug-in is in use. The returned name string is visible on the plug-in dialog panel.

**Return values:**

szModName      string

**(return parameter)****getError** ( char szModError[1024] )**(mandatory)**

Queries the plug-ins for errors.

This function is called if a plug-in function returns an error. In addition, the function is called repeatedly to poll the plug-in for errors that are not related to a specific function call. This function must return an empty string if there are no pending error messages. Returning an error stops the R&S Pulse Sequencer Digital calculations.

Error messages should only be returned once.

**Parameters:**

szModError      string

**(return parameter)**

Error message as zero-terminated ASCII string.

---

**int getNextMsg** ( char szInfoMsg[4096] )

**(mandatory)**

Sends messages to the application. The messages are passed to the "Message Log" of the application, merely for user information.

**Parameters:**

szInfoMsg            "<Prefix>:<Text>"

**(return parameter)**

The message can contain a prefix that denominates the type of information sent.

D = Debug

I = Information

W = Warning

E = Error

If no prefix is present, the information type (I) is assumed.

**Return values:**

boolean              The function is called repeatedly until it returns false (0).

---

**int initPlugin** ( void )

**(mandatory)**

This function initializes the plug-in. It is called once after the plug-in is loaded into memory and can set internal variables.

**Return values:**

boolean

**true (1)**

The initialization completed successfully

**false (0)**

Error during the initialization. The plug-in is unloaded from memory

---

**shutdownPlugin** ( void )

**(optional)**

This function is called before the plug-in gets unloaded from memory. This function can be used to release allocated resources. A plug-in is unloaded from memory if it gets removed from the repository or the main application closes.

---

**int getPrivateMemSize** ( void )

**(optional)**

This function sets the required amount of user data.

Avoid storing parameter settings as global variables because global variables are shared among multiple instances of the plugin. Register a user data block in the application and pass the pointer `pcPrivateMem` as argument instead.

**Return values:**

PrivateMemSize      Required size of user memory in bytes

---

**int** `getVariable` ( int `iIndex`, char `szConfig`[4096] )

**(mandatory)**

Plug-ins can register variables in the R&S Pulse Sequencer Digital user interface. These variables are initialized with a default value but you can change the value later. The modified variable value is stored as part of the repository. This mechanism allows the reuse of a plug-in in different configurations.

This function is called repeatedly by the main application and reads information about the variables to be registered. On each function call, the zero-based variable index value `iIndex` increases by one. The index uniquely references a variable.

**Parameters:**

<code>iIndex</code>	<b>(input parameter)</b> Zero-based variable index
<code>szConfig</code>	<b>(return parameter)</b> The string of variables to be registered is composed as follows: <b>DBL,&lt;name&gt;,&lt;unit&gt;,&lt;default&gt;,&lt;min&gt;,&lt;max&gt;,&lt;dec. digits&gt;</b> Real Number <b>INT,&lt;name&gt;,&lt;unit&gt;,&lt;default&gt;,&lt;min&gt;,&lt;max&gt;</b> Integer <b>BOOL,&lt;name&gt;,&lt;default&gt;</b> Boolean <b>STR,&lt;name&gt;,&lt;default&gt;[,&lt;validator-regexp&gt;]</b> String <b>SEL,&lt;name&gt;,&lt;opt&gt; &lt;opt&gt; ...,&lt;default index&gt;</b> Selection Value range of <code>&lt;default index&gt;</code> : 0 to (number of <code>&lt;opt&gt;</code> -1)

**Return values:**

boolean	<b>true</b> A variable is registered under this index number
	<b>false</b> No variable was registered; the function is not called anymore

**Example:**

```
SEL, Type, 16-QAM | 32-QAM | 64-QAM | 256-QAM, 2
```

This field is named "Type" and lists the options:  
16-QAM, 32-QAM, 64-QAM, and 128-QAM  
The default value is 64-QAM

---

**int** `setVariable` ( int `iIndex`, const char `szValue`[4096] )

**int** `setVariableEx` ( void \*`pcPrivateMem`, int `iIndex`, const char `szValue`[4096] )

**(mandatory)** - for R&S Pulse Sequencer Digital export plug-in.

**(optional)**

Sets the value of a variable. The variable is referenced by the same zero-based index `iIndex` used in `getVariable()`. The variable value is transferred as string. This string must be interpreted according to the variable data type.

**Parameters:**

<code>pcPrivateMem</code>	<b>(input parameter)</b> User data memory pointer, see <code>int getPrivateMemSize</code> .
<code>iIndex</code>	<b>(input parameter)</b> The zero-based index value references the variable
<code>szValue</code>	Zero-terminated ASCII string <b>(input parameter)</b> Variable value as formatted ASCII string. Use functions such as <code>atof()</code> or <code>atoi()</code> for conversion.

## C.2 Export plugin

<code>int initExport</code> .....	654
<code>bool requiresSCPIRequest</code> .....	654
<code>bool SCPIReply</code> .....	655
<code>bool start</code> .....	655
<code>bool ready</code> .....	656
<code>bool exportPDW</code> .....	656
<code>bool run</code> .....	656
<code>bool is running</code> .....	656
<code>bool stop</code> .....	657

---

**int initExport** ( void )

**(mandatory)**

This function is used to initialize the plugin after it is loaded. The function is called with each PDW calculation.

**Return values:**

boolean	<b>true (1)</b> The initialization completed successfully
	<b>false (0)</b> Error during the initialization or the parameter is not used. The plug-in is unloaded from memory

---

**bool requiresSCPIRequest** (char szRequest[1024], int \*ID )

**(optional)**

Returns requested SCPI string.

Use this function for accessing the whole simulation database if information is required that is not part of the PDW export format. Parameters could include emitter names, antenna types, IPM settings and so on.

**Parameters:**

szRequest	<b>(output parameter)</b> Plug-in SCPI string. Max 1023 characters. The function is called to retrieve SCPI queries from the plugin
ID	<b>(output parameter)</b> Each query needs an ID. This ID can be used in the <a href="#">SCPIReply</a> function to identify the answer.
boolean	<b>true (1)</b> Indicates to the R&S Pulse Sequencer Digital that the plug-in will query additional information <b>false (0)</b> Indicates that no more information is needed

---

**bool SCPIReply** (const char \*szReply, int ID, bool bOK)

**(optional)**

Returns SCPI query result.

**Parameters:**

szReply	<b>(input parameter)</b> SCPI string. Max 1023 characters. The function is called by the R&S Pulse Sequencer Digital to answer SCPI queries from the plug-in.
ID	<b>(input parameter)</b> Each query has an ID. This ID can be used inside this function to identify the answer.
boolean	<b>true (1)</b> Indicates to the R&S Pulse Sequencer Digital that the SCPI reply was received

---

**bool start**

**(mandatory)**

Signals that the calculation starts.

The R&S Pulse Sequencer Digital calls this function at the start of the calculation before the first PDWs are exported in the [exportPDW](#) function.

Use this function for performing tasks before the simulation data transfer, such as opening a file or a socket.

**Parameters:**

boolean	true (1) Successful
---------	------------------------

---

**bool ready****(mandatory)**

Signals that the calculation is ready.

The R&S Pulse Sequencer Digital calls this function after the calculation has finished and the last PDW has been exported in the `exportPDW` function.

Use this function for performing tasks after the simulation data was transferred, such as closing a file, cleaning up temporary files or closing a socket.

**Parameters:**

boolean	true (1)
	Successful

---

**bool exportPDW (const char \*szPDW)****(mandatory)**

Exports PDW parameters.

This function receives the PDW data in a predefined data format.

Use this function to extract all required information for your use case, adapt the data to your data formats, write it to a file, stream it to a socket or transfer it as required.

**Parameters:**

szPDW	<b>(input parameter)</b> PDW simulation data in a defined format, typecast the data pointer accordingly.
boolean	true (1)
	Successful

---

**bool run****(mandatory)**

Signals run.

Corresponds to selecting "Run" in the R&S Pulse Sequencer Digital application or using the corresponding SCPI command.

Use this function to perform tasks after the simulation data has been received, such as streaming it to a socket or performing postprocessing.

**Parameters:**

boolean	true (1)
	Successful

---

**bool is running****(mandatory)**



Signals run state.

**Parameters:**

boolean	true (1)	Indicates to the R&S Pulse Sequencer Digital that the plug-in is currently busy.
---------	----------	--

**bool stop**

**(mandatory)**

Signals stop.

Use this function to perform tasks the same as if you select "Stop" in the R&S Pulse Sequencer Digital application or using the corresponding SCPI command, for example aborting file writes, streaming or postprocessing tasks.

**Parameters:**

boolean	true (1)	Successful
---------	----------	------------

## C.3 IPM functions

<a href="#">setRndFnPtr</a> .....	657
<a href="#">restart</a> .....	658
<a href="#">restartEx</a> .....	658
<a href="#">int calculateNextIpmValue</a> .....	658
<a href="#">int calculateNextIpmValueEx</a> .....	658

**setRndFnPtr** ( void \*pRndFn, void \*pThis )

**(optional)**

Sets a pointer to a random function `pRndFn` and the associated `pThis` pointer. Both pointers are needed for calling the built-in random number function.

Plug-ins must use the random generator provided by the application. This generator produces a random sequence with a defined start seed. If necessary, the application can reproduce a particular calculation with the same values. This mechanism is required because the main application performs an initial dry run to determine parameters such as sequence duration and clock rate. This random generator ensures that the same values are used during dry run and the final calculation.

The prototype of the callback function is defined as follows:

```
typedef int (*RndFnCallback)( void*, int );
```

The random generator is called using the provided pointers:

```
int iRnd = pRndFn( pThis, iMaxVal );
```

The random generator returns a 32-bit random unsigned integer value in the range 0 to 65535.

---

**restart ( )**

**restartEx** ( void \*pcPrivateMem)

**(optional)**

Restarts the IPM pattern generation.

This function is called if the IPM pattern generation is requested to restart. The sequence "IPM Configuration" dialog contains the option "Restart IPM for this line item". Setting this option calls this function at the beginning of the line item calculation.

This option is useful if IPM patterns follow a certain rule or have memory, e.g. lists where items shall not be reused.

**Parameters:**

pcPrivateMem           **(input parameter)**  
User data memory pointer, see [int getPrivateMemSize](#)

---

**int calculateNextIpmValue** ( double dTime, uint64 iCount, double \*pdValue )

**int calculateNextIpmValueEx** ( void \*pcPrivateMem, double dTime, uint64 iCount, double \*pdValue )

**(mandatory)**

Requests the next IPM value from the IPM plug-in.

IPM values can either be calculated based on a timestamp or an index. The time is the start time of the current sequence line item, e.g. the pulse start time. The index is an integer number that increases by one each time an IPM value is requested from the plug-in.

**Parameters:**

pcPrivateMem           **(input parameter)**  
User data memory pointer, see [int getPrivateMemSize](#)

dTime                   **(input parameter)**  
Timestamp of the next IPM value

iCount                  **(input parameter)**  
64-bit unsigned integer value  
Zero-based index of the next IPM value

pdValue                 **(return parameter)**  
Calculated IPM value.

**Return values:**

boolean                 **true (1)**  
Calculation successful

## C.4 Reporting functions

For information on the report generation function, see:

- [Chapter 21, "Creating reports and documenting measurement results"](#), on page 386

The following is a list of plug-in functions for creating reports:

<a href="#">setParam</a> .....	659
<a href="#">reportBegin</a> .....	660
<a href="#">reportEnd</a> .....	660
<a href="#">reportEntryComplete</a> .....	661

---

**setParam** ( const char \*szType, const char szValue[1024] )

**(mandatory)**

Sets various report parameters.

This function is repeatedly called. It sets different parameters on each call.

Because pulses can have different parameters, some pulse parameters have to be set before the calculation of the particular pulse starts. User variables that are defined and used within a sequence are set with their names (<user\_var>) and values.

**Parameters:**

szType	Zero-terminated ASCII string
	<b>(input parameter)</b>
	Sets the type of data that is transmitted.
	<b>"REPOSITORY"</b>
	String
	Repository name
	<b>„SCENARIO“</b>
	String
	Scenario name
	<b>„ISODATE“</b>
	String
	Date & time in ISO format
	<b>„VERSION“</b>
	String
	Repository version
	<b>„AUTHOR“</b>
	String
	Repository author
	<b>„TPATH“</b>
	String
	Target file path of the directory in that the generated report file is stored

	<b>„TOA“</b> Float Time of arrival (timestamp of pulse)
	<b>„PW“</b> Float Pulse width (0% - 0%)
	<b>„PRI“</b> Float PRI of current pulse (0% - 0%)
	<b>„BW“</b> Float RF bandwidth (FMOP) incl. BB filter
	<b>„RFC“</b> Float Center frequency of emitter / sequence
	<b>„@ITEM“</b> Integer Sequence line item, 1 to N
	<b>„@COLL“</b> Integer Collection line item, 1 to L
	<b>„@CNT“</b> Integer Repetition count
	<b>„@REP“</b> Integer Current repetition, 1...M
	<b>„&lt;user_var&gt;“</b> Variable type, depending on the variable User variable name
szValue	Zero-terminated ASCII string <b>(input parameter)</b>

---

**reportBegin ( )**
**(mandatory)**

A new report begins.

This function is called once at the beginning of a calculation run. In case of collection scenarios, this function is called once before the first collection item gets processed.

The function can be used to open the report file and to set the header information.

---

**reportEnd ( )**
**(mandatory)**

A report ends.

This function is called once when all calculations are completed. In case of collection scenarios, this function is called once when the last collection item is calculated.

---

#### **reportEntryComplete ( )**

**(mandatory)**

A pulse entry is generated.

This function is called after each pulse. It creates the report entry for each pulse.

## C.5 Custom antenna pattern import functions

The following is a list of functions for importing antenna patterns in custom file format.

<a href="#">bool importPattern</a> .....	661
<a href="#">getConversionInfo</a> .....	661
<a href="#">int getPatternCount</a> .....	662
<a href="#">bool getFrequency</a> .....	662
<a href="#">bool getThetaRange</a> .....	662
<a href="#">bool getPhiRange</a> .....	663
<a href="#">bool getPatValue</a> .....	663
<a href="#">cleanUp</a> .....	663

---

#### **bool importPattern ( const char \*szFile )**

**(mandatory)**

Run the pattern import procedure.

This function imports the antenna pattern into the internal pattern memory. Since this import is done in the foreground thread, it should not take too much time.

#### **Return values:**

boolean	<b>true</b>
	Success

---

#### **getConversionInfo ( char szInfo[4096] )**

**(optional)**

Get the result from the antenna pattern import.

This function is called after the [importPattern\(\)](#) call. It returns general information and error messages from the import procedure.

#### **Parameters:**

szInfo	"<Prefix>:<Text>"
	<b>(return parameter)</b>

The text can contain multiple lines. Each line can start with a prefix that denominates the information type.

D = Debug

I = Information

W = Warning

E = Error

### **int getPatternCount ( )**

**(mandatory)**

Read the number of imported patterns.

This function is the first one that gets called by the main application after a successful import.

### **bool getFrequency ( int iPatIndex, double \*pdFMin, double \*pdFMax )**

**(mandatory)**

Get the frequency for a specific pattern.

This function is called once for each imported pattern. It returns the *frequency range* assigned to an antenna pattern.

**Parameters:**

iPatIndex                      Zero-based antenna index

**Return values:**

boolean                        **true**  
                                       Success

### **bool getThetaRange ( int iPatIndex, double \*pdTMin, double \*pdTMax, int \*piValueCnt )**

**(mandatory)**

Get the theta range of a specific pattern.

This function is called once for each imported pattern. It returns the *theta range* assigned to an antenna pattern.

**Parameters:**

iPatIndex                      Zero-based antenna index

pdTMin                         Minimum theta angle

pdTMax                         Maximum theta angle

piValueCnt                    Number of theta values

**Return values:**

boolean                        **true**  
                                       Success

---

**bool getPhiRange** ( int iPatIndex, double \*pdPMin, double \*pdPMax, int \*piValueCnt )

**(mandatory)**

Get the phi range of a specific pattern.

This function is called once for each imported pattern. It returns the *phi range* assigned to an antenna pattern.

**Parameters:**

iPatIndex	Zero-based antenna index
pdPMin	Minimum phi angle
pdPMax	Maximum phi angle
piValueCnt	Number of phi values

**Return values:**

boolean	<b>true</b> Success
---------	------------------------

---

**bool getPatValue** ( int iPatIndex, int iPhiIndex, int iThetaIndex, float \*pfEHorizontal, float \*pfEVertical, float \*pfPhaseVertical )

**(mandatory)**

Get one data point from a pattern.

This function is called once for each imported pattern and once for each data point. It returns the *pattern data* to the main application.

**Parameters:**

iPatIndex	Zero-based antenna index
iPhiIndex	Zero-based phi index
iThetaIndex	Zero-based theta index
pfEHorizontal	Voltage-based gain, horizontal
pfEVertical	Voltage-based gain, vertical
pfPhaseVertical	Vertical phase with respect to horizontal phase

**Return values:**

boolean	<b>true</b> Success
---------	------------------------

---

**cleanUp** ( void )

Clean up all data.

This function is called after all data has been read from the plug-in. All memory can now be freed.

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## D Scripting API

The detailed description of the script syntax is out of scope of this user manual. Refer to the script standard, that can be found under the following link:

<http://www.ecma-international.org/publications/standards/Ecma-262.htm>

Alternatively, any tutorial or documentation on JavaScript could be used.

In addition to the script standard, the R&S Pulse Sequencer Digital introduces 2 proprietary objects: the global object `ps` and the newable object `QVisa`.

The objects `QDir`, `QFile`, `QMessageBox`, `QFileDialog` are Qt classes, where R&S Pulse Sequencer Digital supports only a subset of the methods.

In this section, you find a list of the supported methods per class and the description of the proprietary methods and objects.

The standard Qt classes and methods are not described here. For information, refer to the Qt documentation:

<http://doc.qt.io/qt-5/index.html>

### D.1 Global script extensions

The global object `ps` extends the script functionality. It provides the following methods within the script context:

QString	<code>scpi</code>	( const QString &sOut )
bool	<code>sync</code>	( int iTimeout )
void	<code>traceError</code>	( const QString &sMsg )
void	<code>traceDebug</code>	( const QString &sMsg )
void	<code>traceInfo</code>	( const QString &sMsg )
void	<code>print</code>	( const QString &sMsg )
void	<code>sleep</code>	( unsigned int iMs )
void	<code>setGlobalVar</code>	( const QString &sToken, const QString &sValue )
QString	<code>getGlobalVar</code>	( const QString &sToken )
QString	<code>getScriptPath</code>	( )

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<a href="#">ps.getGlobalVar</a> .....	667
<a href="#">ps.getScriptPath</a> .....	667

---

### **ps.scpi** ( const QString &sOut )

Remote control of the application itself.

This method can be used as command or query. In the latter case, the returned data is a string value.

**Example:**

```
ps.scpi( '*RST' )
var sIdent = ps.scpi( '*IDN?' )
```

---

### **ps.sync** ( int iTimeout )

Suspends script execution until the R&S Pulse Sequencer Digital has finished a calculation task.

This is done by polling the operation condition register of the SCPI parser and wait for the command `STATus:OPERation:CONDition?` to return zero.

The method returns true if the register value becomes zero within the timeout period `iTimeout`. If there is a timeout, the method returns false.

**Example:**

```
var iTimoMs = 5000
ps.sync( iTimoMs )
```

---

### **ps.traceError** ( const QString &sMsg )

### **ps.traceDebug** ( const QString &sMsg )

### **ps.traceInfo** ( const QString &sMsg )

Traces log messages and prints messages to the "Message Log" dialog.

Three methods exist to output text messages to the application message log. By default, the message log shows only information and error messages.

Perform one of the following to enable debug output:

- Start the application with the command-line argument `--debug`
- In the command console window, enter `Set Debug = 1`.  
See also ["To open the "Message Log" dialog in debug mode"](#) on page 619.

**Example:**

```
ps.info( 'This is an info text.' )
ps.debug( 'This is a debug message.' )
ps.error( 'This is an error message.' )
```

---

### **ps.print** ( const QString &sMsg )

Printing any text or string to the "Script Manager" dialog.

Convert non-string variables into strings before using them with this method.

**Example:**

```
ps.print( 'My Text' )
var dVal = 1e-3
ps.print( 'Value = ' + dVal.toString() )
```

---

### **ps.sleep** ( unsigned int iMs )

Sets a waiting period specified in milliseconds and suspends script execution for at least this amount of time.

**Example:**

```
var iTimeMs = 500
ps.sleep( iTimeMs )
```

---

### **ps.setGlobalVar** ( const QString &sToken, const QString &sValue )

### **ps.getGlobalVar** ( const QString &sToken )

Exchanging Data Between Scripts.

The `ps` script extension provides two methods that access a global variable pool. These variables are of the data type string and remain valid for as long as the application runs. The variables are not saved when the application terminates. Each variable is identified by a name token.

The method `setGlobalVar` registers a new variable or updates an existing variable. The method `getGlobalVar` reads data from a variable. If the variable does not exist, an empty string is returned.

**Example:**

```
ps.setGlobalVar( 'Var1', 'This is some text.' )
ps.setGlobalVar( 'Var2', dValue.toString() )

dValue = parseFloat( ps.getGlobalVar( 'Var2' ) )
```

---

### **ps.getScriptPath** ( )

Returns the absolute file path of the directory where the script file is stored.

## D.2 Newable script extensions

The term newable describes objects that can be created dynamically using the `new` operator. A script can create multiple instances of these objects. The script engine automatically destroys all dynamically created objects at the end of the script.

### D.2.1 QDir

For description of the `QDir` class, see <http://doc.qt.io/qt-5/qdir.html>.

The following `QDir` methods are available within script context:

```

QString      absoluteFilePath  ( const QString & fileName ) const
QString      absolutePath     ( ) const
bool         cd                ( const QString & dirName )
bool         cdUp              ( )
QString      dirName           ( ) const
bool         exists            ( ) const
QString      filePath          ( const QString & fileName ) const
bool         isReadable        ( ) const
bool         isRoot            ( ) const
bool         mkdir             ( const QString & dirName ) const
bool         mkpath            ( const QString & dirPath ) const
QString      path              ( ) const
bool         remove            ( const QString & fileName )
bool         rmdir             ( const QString & dirName ) const
void         setPath           ( const QString & path )
QStringList  entryList         ( quint32 filters,
                               quint32 sort ) const

// static
QString      currentPath       ( )
QString      homePath          ( )
QString      rootPath          ( )
QString      tempPath          ( )

```

## D.2.2 QFile

For description of the `QFile` class, see <http://doc.qt.io/qt-5/qfile.html>.

The two methods `writeString` and `readLine` are Rohde & Schwarz proprietary methods. They work on the `QTextStream` method.

The following `QFile` methods are available within script context:

```

bool         exists            ( ) const
bool         open              ( quint32 mode )
bool         remove            ( )
void         setFileName       ( const QString & name )
bool         copy              ( const QString & newName )
qint64       size              ( ) const
void         close             ( )
quint32      error             ( ) const

// reimplemented on QTextStream
bool         seek              ( qint64 pos )
void         flush             ( )
bool         atEnd             ( ) const

// custom methods (not part of QFile, work on QTextStream)

```

```
bool                writeString ( const QString &sStr )
QString            readLine    ( int iMaxLen )
```

---

### **file.writeString** ( const QString &sStr )

Writes the string to the selected file. Strings are appended as separate lines.

---

### **file.readLine** ( int iMaxLen )

Reads the next line of text from the file.

#### **Setting parameters:**

iMaxLen                    Maximum number of characters to be read.

## **D.2.3 QFileDialog**

For description of the `QFileDialogFile` class, see <http://doc.qt.io/qt-5/qfiledialog.html>.

The following `QFileDialogFile` methods are available within script context:

```
void                setAcceptMode      ( quint32 mode )
void                setDefaultSuffix  ( const QString & suffix )
void                setDirectory      ( const QString & directory )
void                setFileMode       ( quint32 mode )
void                setNameFilter     ( const QString & filter )
void                setOption         ( quint32 option, bool on )
void                setViewMode       ( quint32 mode )
QStringList        selectedFiles      ( ) const
int                exec                ( )

// static public method
QString            getOpenFileName    ( const QString & caption,
                                       const QString & dir,
                                       const QString & filter,
                                       quint32 options )

QString            getExistingDirectory( const QString & caption,
                                       const QString & dir,
                                       quint32 options )

QString            getSaveFileName    ( const QString & caption,
                                       const QString & dir,
                                       const QString & filter,
                                       quint32 options )
```

## D.2.4 QMessageBox

For description of the `QMessageBox` class, see <http://doc.qt.io/qt-5/qmessagebox.html>.

The following `QMessageBox` methods are available within script context:

```

void          setDetailedText    ( const QString & text )
void          setIcon            ( quint32 Icon )
void          setInformativeText ( const QString & text )
void          setStandardButtons ( quint32 buttons )
void          setText            ( const QString & text )
void          setTextFormat      ( quint32 format )
void          setWindowTitle     ( const QString & title )

// static methods
int           critical           ( const QString & title,
                                const QString & text,
                                quint32 buttons = QMessageBox::Ok,
                                quint32 defaultButton = QMessageBox::NoButton )

quint32       information        ( const QString & title,
                                const QString & text,
                                quint32 buttons = QMessageBox::Ok,
                                quint32 defaultButton = QMessageBox::NoButton )

int           question           ( const QString & title,
                                const QString & text,
                                quint32 buttons = QMessageBox::StandardButtons
                                ( QMessageBox::Yes | QMessageBox::No ),
                                quint32 defaultButton = QMessageBox::NoButton )

int           warning            ( const QString & title,
                                const QString & text,
                                quint32 buttons = QMessageBox::Ok,
                                quint32 defaultButton = QMessageBox::NoButton )

```

## D.3 Script examples

A subset of script examples is provided in the repositories supplied with the software.

Access:

1. Select "File > Load and Manager Repositories".
2. In the "Repository Manager", double click on the "Examples > K32 > Script Example".

### 3. Select "Script > Manage".

The script examples are loaded in the "Script Manager".  
You can try out script examples and further develop them.

The following is the content of one of the scripts.

#### IPM Diagnostics

```
// This script reads 100 IPM values and writes
// them to a text file. the data can be used for an analysis
// of the IPM data.

// get the temporary path
dir = new QDir();
temppath = dir.tempPath();
fd = new QFileDialog();

// select file
filename = fd.getSaveFileName( 'Save File As', temppath, '', 0 );
if( filename.length > 0 ) {

    // create new IPM profile
    ps.scpi( 'IPM:CRE "ipm_test" );
    ps.scpi( 'IPM:SEL "ipm_test" );

    // switch to normal distribution
    ps.scpi( 'IPM:TYPE RAND' );
    ps.scpi( 'IPM:RAND:DIST NORM' );

    // configure distribution
    ps.scpi( 'IPM:RAND:NORM:MEAN 0' );
    ps.scpi( 'IPM:RAND:NORM:STD 1' );
    ps.scpi( 'IPM:RAND:NORM:LIM 100' );

    // start internal diagnostic system
    ps.scpi( 'IPM:DIAG:INIT' );

    file = new QFile();
    file.setFileName( filename );
    file.open( 0x0002 );

    ps.print( 'Writing file...' );

    for( var i=1; i<100; i++ ) {
        value = ps.scpi( 'IPM:DIAG:READ?' );
        file.writeString( value + '\n' );
    }

    file.close();
    ps.print( 'Done' );
}
```

```
// remove IPM profile
ps.scpi( 'IPM:REM "ipm_test"' );
}
```

## D.4 List of Script Objects and Methods

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## E Common coding algorithms

In the notation used below  $a_n$  denotes the  $n^{\text{th}}$  input symbol and  $b_n$  denotes the correspondingly coded output symbol. Individual bits in the symbols from the LSB (least significant bit) to the MSB (most significant bit) are denoted by  $a_{0n}$ ,  $a_{1n}$ , etc. The same applies to the output symbols.

Common coding types are listed in [Table E-1](#).

**Table E-1: Common coding algorithms**

Coding	Coding algorithm	Applicable for K bit/symbol
"None"	$b_n = a_n$	$k = 1...8$
"Differential"	$b_n = (a_n + b_{-1}) \text{ modulo } 2^k$	$k = 1...7$
"Differential + Gray"	Gray coding with differential coding	$k = 1...7$

The following example illustrates how one of common coding schemes in combination with a modulation method influence the signal.

### Example: Differential coding for QPSK modulation with K = 2 bit/symbol

Decimal display; the value range for modulation symbols is  $a_n = \{0, 1, 2, 3\}$

According to [Table E-1](#) and for  $k = 2$ , the recursive coding is defined as  $b_n = (a_n + b_{-1}) \text{ modulo } 4$

Depending on the state of a preceding modulation symbol  $b_{-1}$ , the coded modulation symbol  $b_n$  is obtained for example from modulation symbol  $a_n = 2$  as follows:

$b_{-1}$	0	1	2	3
$b_n$	2	3	0	1

With differential coding, the assignment of modulation symbols  $a_n$  (binary indication: MSB, LSB) to the phase differences shown in the following table is generated:

**Table E-2: Phase difference for QPSK**

Modulation symbol $a_n$	00	01	10	11
Phase difference	$0^\circ$	$90^\circ$	$180^\circ$	$270^\circ$

# Glossary: Terms and abbreviations

## A

**AM:** Amplitude modulation

**Antenna:** The antenna characterizes the radiation pattern of the [Emitter](#)

**ARB:** Arbitrary Waveform Generator

An I/Q modulation source forming a part of the supported signal generators. The ARB allows the playback and output of any externally calculated modulation signal in the form of waveform file. It also allows the generation of multi-carrier or multi-segment signals from waveform files.

**ASK:** Amplitude-shift keying modulation

**ASR:** Airport Surveillance Radar

**AWGN:** Additive white gaussian noise

## B

**Barker:** Special sequences (codes) that assures phase modulated signals with low autocorrelation properties.

**Boresight:** Antenna boresight is the direction to which an antenna shows the maximum gain.

**BPSK:** Binary phase shift keying modulation

**BW:** Bandwidth

## C

**C-BPSK:** [BPSK](#) modulation with a constant envelope

**Chirp:** Signal in which the frequency varies over the time.

**CW:** Continuous wave signal, that is an unmodulated signal.

## D

**DQPSK:** Differential [QPSK](#)

**DUT:** Device under test

## E

**EIRP:** Equivalent isotopically radiated power

**ELINT:** Electronic intelligence, meaning information that comes from signals that typically do not contain speech or text.

**Emitter:** In the context of this software, emitters emulate radar systems.

**EW:** Electronic warfare

## F

**FFT:** Fast Fourier transform

**FM:** Frequency modulation

**FSK:** Frequency-shift keying modulation

## G

**Gain:** Antenna gain is a measure of the antenna's ability to concentrate electromagnetic energy in a narrow beam.

**GUI:** Graphical User Interface

## H

**HPBW:** Half-Power Beam Width

## I

**Inter-Pulse Modulation:** [IPM](#)

**Intra-Pulse Modulation:** [MOP](#)

**IPM:** Inter-Pulse Modulation

## M

**MOP:** Modulation on Pulse

**MSW:** Multi-segment waveform

## O

**OQPSK:** Offset [QPSK](#)

## P

**PAPR:** Peak to average power ratio

**PDW:** Pulse Descriptor Word  
Format of the reported data.

**Plugin:** A loadable Microsoft Windows DDL module that describes custom modulation schemes or envelope shapes.

**Poly Phase:** [polyphase](#)

**polyphase:** Code used by pulse modulation and suitable for pulse compression.

**PRF:** Pulse repetition frequency

**PRI:** Pulse repetition interval  
Defines the overall time of a pulse cycle.

**PRT:** Pulse repetition time

**Pulse sequence:** [Pulse train](#)

**Pulse train:** A sequence of repetitive pulses

**Pulse-to-Pulse Modulation:** [IPM](#)

**PW:** Pulse width

## Q

**QPSK:** Quadrature phase shift keying modulation

## R

**RADAR:** Radio Detecting and Ranging

**RCS:** Radar cross section, RCS, or  $\sigma$   
The RCS is a measure of the energy that an object intercepts and scatters back towards the radar.

**Repository:** In the context of this software, a repository is a file-based database located on the local hard drive or on a network storage drive.

## S

**Scenario:** In the context of this software, a scenario is the top-level description of the signals to be generated.

**Sequence:** In the context of this software, a sequence describes how pulses are arranged to form a waveform.

**Stagger PRI:** Pulse train composed of two or more pulse subtrains that use the same PRI.

**V**

**VSG:** Vector Signal Generator

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