

R&S® Pulse Sequencer (DFS)

DFS Signal Generation Software

User Manual



1177.5327.02 – 04

This document describes the following software options:

- R&S®SMW-K350
1413.9160.02
- R&S®SMBV-K350
1419.2767.02
- R&S®SMU-K350
1408.8830.02
- R&S®SMJ-K350
1409.3702.02
- R&S®SGT-K350
1419.8107.02

The software contained in this product makes use of several valuable open source software packages. For information, see the "Open Source Acknowledgement" document, which is available for download from the R&S Pulse Sequencer (DFS) product page at e.g. <http://www.rohde-schwarz.com/product/SMW200A.html> > "Downloads > Software".

Rohde & Schwarz would like to thank the open source community for their valuable contribution to embedded computing.

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Mühlendorfstr. 15, 81671 München, Germany

Phone: +49 89 41 29 - 0

Fax: +49 89 41 29 12 164

Email: info@rohde-schwarz.com

Internet: www.rohde-schwarz.com

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The following abbreviations are used throughout this manual: R&S®SMW200A is abbreviated as R&S SMW, R&S®SMU200A is abbreviated as R&S SMU, R&S®SMJ100A is abbreviated as R&S SMJ, R&S®SMBV100A is abbreviated as R&S SMBV, R&S®SGT100A is abbreviated as R&S SGT, R&S®Pulse Sequencer is abbreviated as R&S Pulse Sequencer.

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1 Preface

1.1 About this Manual

This User Manual provides all the information **specific to the R&S Pulse Sequencer (DFS)**.

The main focus in this manual is on the provided settings and the tasks required to generate a signal. The following topics are included:

- **Welcome to the R&S Pulse Sequencer (DFS)**
Introduction to and getting familiar with the option
- **Getting Started**
Information needed to install and start working with the software, as well as basic operation and typical signal generation examples
- **About the R&S Pulse Sequencer (DFS)**
Background information on basic terms and principles in the context of the signal generation
- **How to Generate a Signal with the R&S Pulse Sequencer (DFS)**
The basic procedure to perform signal generation tasks and step-by-step instructions for more complex tasks or alternative methods.
Detailed examples guide you through typical signal generation scenarios and allow you to try out the application immediately
- **Annex**
Reference material, such as extensive lists, tables, or overviews
- **Glossary**
Alphabetical list of often used terms and abbreviations
- **Index**

1.2 Documentation Overview

The user documentation for the R&S Pulse Sequencer (DFS) consists of the following parts:

- Online Help system included in the software
- User Manual
- Release Notes

Online Help

The R&S®Pulse Sequencer Online Help is embedded in the software. It offers quick, context-sensitive access to the complete information needed for operation and programming.

User Manual

The user manual describes the R&S Pulse Sequencer (DFS).

For basic information on operating the R&S Pulse Sequencer in general, as well as its functions together with examples on some specific tasks and a complete description of the remote control commands with programming examples, see the R&S Pulse Sequencer user manual.

User manuals are available for download from the R&S website, on the product page of the signal generator.

As an alternative to the individual PDF files, online documentation is provided without downloading. You find the online documentation at the product page of the signal generator, for example at <http://www.rohde-schwarz.com/product/SMW200A.html> > Downloads > Manuals.

Release Notes

The release notes describe the installation of the software, new and modified functions, eliminated problems, and last minute changes to the documentation. The corresponding software version is indicated on the title page of the release notes.

The most recent release notes are available for download from the R&S website, on the signal generator's product page. For example at <http://www.rohde-schwarz.com/product/SMW200A.html> > Downloads > Firmware.

1.3 Conventions Used in the Documentation

1.3.1 Typographical Conventions

The following text markers are used throughout this documentation:

Convention	Description
"Graphical user interface elements"	All names of graphical user interface elements on the screen, such as dialog boxes, menus, options, buttons, and softkeys are enclosed by quotation marks.
KEYS	Key names are written in capital letters.
File names, commands, program code	File names, commands, coding samples and screen output are distinguished by their font.
<i>Input</i>	Input to be entered by the user is displayed in italics.
Links	Links that you can click are displayed in blue font.
"References"	References to other parts of the documentation are enclosed by quotation marks.

1.3.2 Conventions for Procedure Descriptions

When describing how to operate the software, several alternative methods may be available to perform the same task. In this case, the procedure using the menu bar is described. 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.

The term "select" may refer to any of the described methods.

1.3.3 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 test situations.

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 Welcome to the R&S Pulse Sequencer (DFS)

Worldwide, the two frequency bands 5.25 GHz to 5.35 GHz and 5.47 GHz to 5.725 GHz are used by various radar systems and in addition, are allocated to unlicensed WLAN devices. A requirement arising from this frequency band reuse is a method called Dynamic Frequency Selection (DFS).

A system that requires DFS must be capable to avoid interfering with radar systems. This is achieved by various methods:

- Verify that the channel is free of any radar signals before using it.
- Continuous monitoring for radar signals once a channel is in use. The channel needs to be vacated if a radar signal is detected.
- Blacklisting channels where a radar signal was detected.
- Using channels equally (Uniform Loading).
- Transmit only the required amount of power (Transmit Power Control).

Most radar systems in these bands are used by the military and their actual signatures are confidential. The representative test patterns therefore contain random variations. The specifications require that WLAN devices not only detect a specific pattern but also respond to a wider variety of signals.

Different standards documents exist worldwide that define requirements and test patterns. An overview is provided in Appendix, "DFS Standards and References".

R&S Pulse Sequencer (DFS) key features

The R&S Pulse Sequencer (DFS) software is a stand-alone, PC-based application that generates Dynamic Frequency Selection (DFS) pulse patterns according to [FCC](#), [ETSI](#), and [TELEC](#) standards. This software is available for free download on the R&S website.

Waveforms can be played by the following instruments:

- R&S SMW
- R&S SMBV
- R&S SMU
- R&S SMJ
- R&S SGT

The processing of the generated waveforms requires software option R&S SMW/SMBV/SMU/SMJ/SGT-K350 installed on the instrument.

Key features:

- Supported Standards for Europe, the US, and Japan
- Generation of all required waveforms and automatic transfer to the signal generator
- Automatic report generation.
Reports contain all parameters used for the waveform calculation

- Two report formats: Excel spread sheets and ASCII text format

Scope of this user manual

The R&S Pulse Sequencer (DFS) is the DFS variant of the R&S®Pulse Sequencer software that is specially developed for DFS testing.

This user manual describes the functionality that the R&S Pulse Sequencer (DFS) software provides.

Functions that are the same as in the R&S®Pulse Sequencer software are not described here; they are described in its user manual.

Functions of the vector signal generators are also not described here; they are described in the user manual of the corresponding base unit. The latest version is available for download at the instrument's page, e.g. at [R&S SMW200A product homepage](#).

Installation

You can find detailed installation instructions in the delivery of the option or in [Chapter 3.2, "Installing the Software"](#), on page 11.

2.1 Accessing the R&S Pulse Sequencer (DFS)

To open the application

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

The software opens and displays the "Repository Manager" or the last used "Workspace".

3 Getting Started

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

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3.1 Required Options

The R&S Pulse Sequencer (DFS) software is a stand-alone, PC-based application that creates waveform files. This software is available for free download on the R&S website. Waveforms generated with the software can be played by a subset of instruments, that must fulfill the minimum requirements listed below.

The following vector signal generators support the [FCC 06-96](#) Type 6 simulated frequency hopping.

R&S SMW200A

R&S SMW200A base unit equipped with:

- Option Baseband Generator (R&S SMW-B10)
- Option Memory Extension for ARB (R&S SMW-K511)
- Option Frequency (R&S SMW-B106)
- Option Baseband main module, one I/Q path to RF (R&S SMW-B13)
- Option DFS (R&S SMW-K350)

R&S SMBV100A

R&S SMBV100A base unit equipped with:

- Option Baseband Generator (R&S SMBV-B51)
- Option Memory Extension for ARB (R&S SMBV-K511)
- Option Frequency (R&S SMBV-B1xx)
- Option DFS (R&S SMBV-K350)

R&S SGT100A

R&S SGT100A base unit equipped with:

- Option Frequency (R&S SGT-KB106)
- Option Baseband Generator (R&S SGT-K510)
- Option Memory Extension for ARB (R&S SGT-K51x)
- Option DFS (R&S SGT-K350)

R&S SMJ100A and R&S SMU200A

R&S SMJ100A or R&S SMU200A base unit equipped with:

- Option Baseband Generator (R&S SMJ/SMU-B9)
- Option Baseband main module (R&S SMJ/SMU-B13)
- Option Frequency (R&S SMJ/SMU-B106)
- Option DFS (R&S SMJ/SMU-K350)

3.2 Installing the Software

Software updates and the Release Notes describing the improvements and modifications are available for download at the [product page of the signal generator, e.g. R&S SMW](#).

Software and Hardware Requirements

The following minimum requirements have to be met:

- **Software**
 - Microsoft®Windows 7 Professional 32 Bit (SP1) operating system
 - R&S®VISA (Virtual Instrument Software Architecture) software library other VISA runtime library
The R&S®VISA is provided for download at the Rohde & Schwarz website <http://www.rohde-schwarz.com/rsvisa>.
 - Microsoft Excel (recommended)

• **Hardware**

Table 3-1: Hardware requirements

	Minimum requirements	Recommended hardware
AMD or Intel CPU	Dual Core, 2 GHz	2 x 3 GHz
RAM	≥ 2 GB	8 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
Rendering	OpenGL, shader model 3	OpenGL, shader model 3
Network	LAN 1 GB/s	LAN 1 GB/s

To install the software

Download the R&S Pulse Sequencer (DFS) software form the R&S website.

The R&S Pulse Sequencer (DFS) software consists of the file
PS-DFS-Install <major>.<minor>.<build>.<release>.msi.

1. Start the PS-DFS-Install <major>.<minor>.<build>.<release>.msi file.

The file name 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.

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 installation is completed. Per default, a shortcut icon is created on the desktop.

The software creates the folder structure listed in [Table 3-2](#).

Table 3-2: Default file location (software installation for all users)

File type	File location
Program data, SDK files	%PROGRAMFILES(X86)%\Rohde-Schwarz\ Pulse Sequencer DFS (Path)
Project data (Repositories)	%PUBLIC%\Public Documents\Rohde-Schwarz\ Pulse Sequencer DFS (DataPath)
Report files	%HOMEPATH% (HomePath or ReportPath)
User settings (Workspace, etc.)	%HOMEPATH%\AppData\Roaming\Rohde-Schwarz\ Pulse Sequencer DFS

3.3 Starting the R&S Pulse Sequencer (DFS) for the First Time

- ▶ On your PC,

- a) Select "Start > All Programs > R&S Pulse Sequencer (DFS) > R&S Pulse Sequencer (DFS)" or
- b) Double click on the shortcut icon on the desktop.

The R&S Pulse Sequencer (DFS) workspace opens and shows the loaded "Example Repositories".

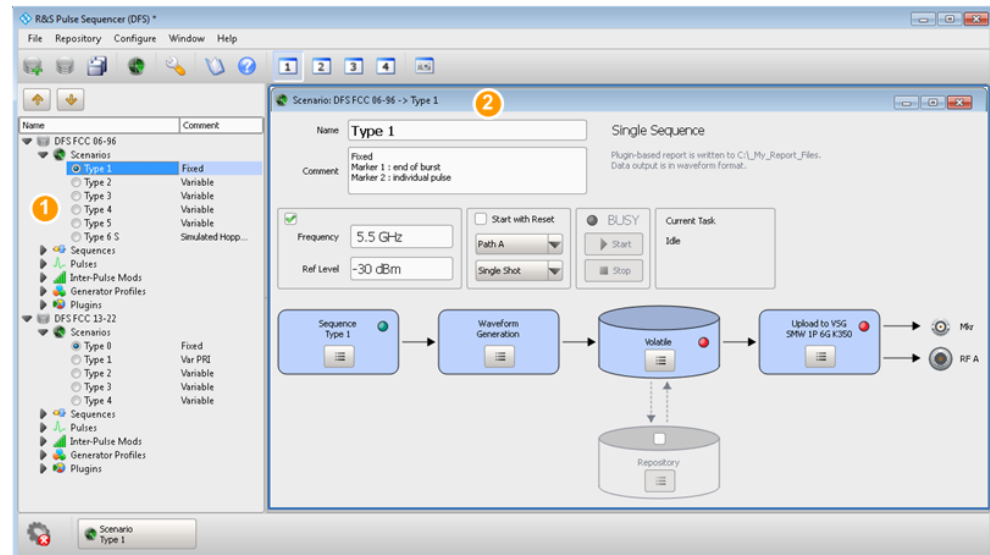


Figure 3-1: R&S Pulse Sequencer (DFS) workspace: Understanding the displayed information

- 1 = Project tree displaying the loaded DFS FCC test patterns
- 2 = Scenario dialog displaying a loaded test pattern (DFS FCC 06-96 Type 1)

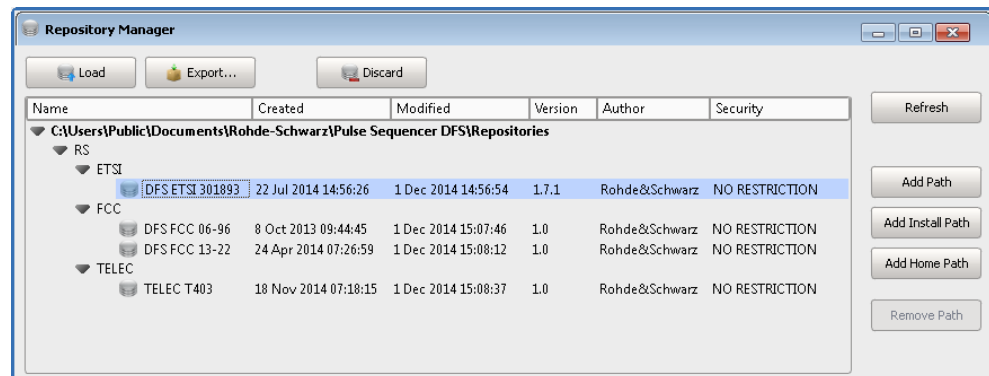
Follow the steps described in [Chapter 3.4, "Loading a DFS Project File"](#), on page 13.

See also [Chapter A, "Overview of the Test Requirements and Provided Test Patterns"](#), on page 37.

3.4 Loading a DFS Project File

We assume that you have started the R&S Pulse Sequencer (DFS), as described in [Chapter 3.3, "Starting the R&S Pulse Sequencer \(DFS\) for the First Time"](#), on page 12.

1. In the R&S Pulse Sequencer (DFS), select "File > Load and Manage Repositories".



- In the "Repository Manager", select the required Standard, e.g. "ETSI > ETSI 301893".

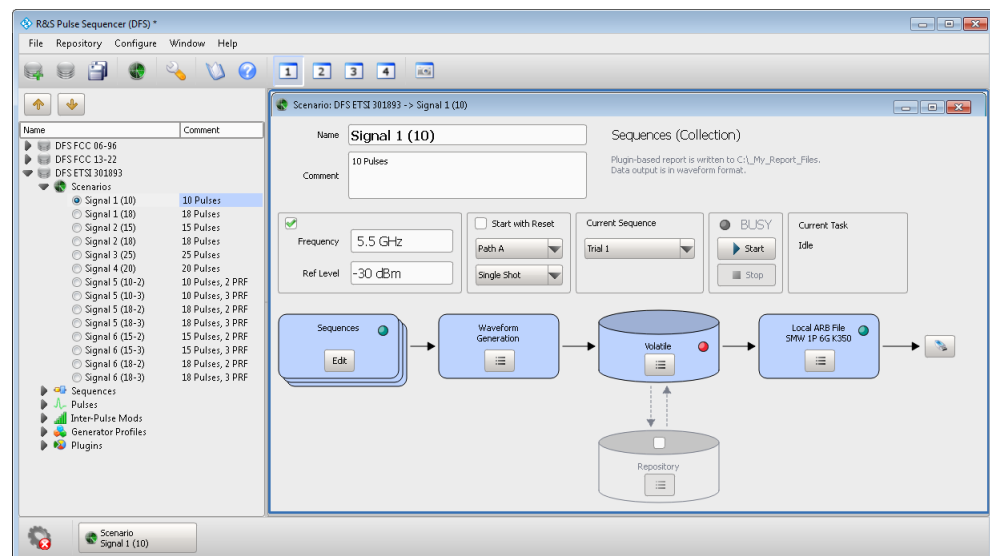
Repository files contain all signal definitions and report templates that are required by the standard.

See also [Chapter 4.1, "Normative Reference"](#), on page 19.

- Select "Load".

The project tree opens and lists the project content.

Your workspace should contain the selected predefined [ETSI](#) test patterns.



See:

- [Chapter 5, "Generating Test Files and Conducting the Trials"](#), on page 20
- [Chapter A, "Overview of the Test Requirements and Provided Test Patterns"](#), on page 37

3.5 Getting Information and Help

If any questions or problems concerning the R&S Pulse Sequencer (DFS) 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 as well as background information.



Functions that are the same as in the R&S®Pulse Sequencer are not described in this manual.

You find information on them in the online help system and in the R&S®Pulse Sequencer user manual.

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.

4 About the R&S Pulse Sequencer (DFS)

The R&S Pulse Sequencer (DFS) comes as a stand-alone PC-based software with pre-configured project files for various DFS standards.

Test setup

A typical setup includes a PC with installed software and a connected signal generator. An example of a simplified test setup is shown on [Figure 4-1](#).

You find the detailed requirements for the various standards in the related standard documents. See also [Chapter 4.1, "Normative Reference"](#), on page 19.

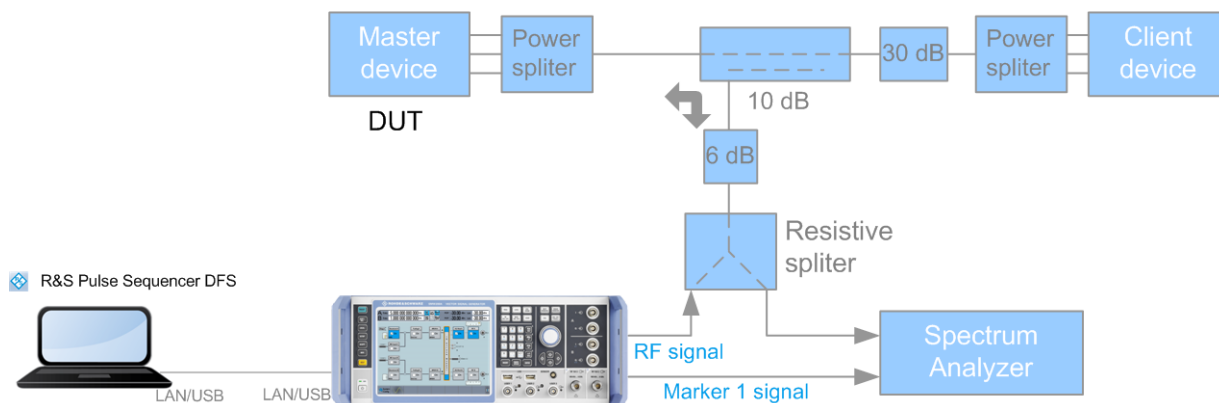


Figure 4-1: Simplified test setup for conducted DFS tests (Example with R&S SMW)

The setup uses a master device as DUT and a client device for the setup of the data link. The test signal is attenuated by an additional 30 dB in the RF path to the client device. This ensures that only the master device responds to the test signal.

The R&S Pulse Sequencer (DFS) calculates the test patterns and transfers them to the signal generator. The signal generator injects the DFS test signal into the communication between the master and the client device. The spectrum analyzer is operated in zero span mode on the channel center frequency. It monitors the traffic between the two devices and the injected radar pulses. Both, the signal generator and the spectrum analyzer can be remote controlled by a PC software for test automation.

Consider to trigger the spectrum analyzer sweep when a new radar test signal is injected. A suitable trigger source is one of the markers signals contained in the generated DFS test patterns.

If the signal levels are high enough an alternative method for the measurement of the RF test signals or the data traffic is the use of the R&S®NRP-Z81 Power Sensor. The [Figure 4-2](#) shows a measurement of the FCC Type 1 pulse train generated by a signal generator. Marker 1 is used as external trigger for the power sensor. This signal marks the end of the entire burst.

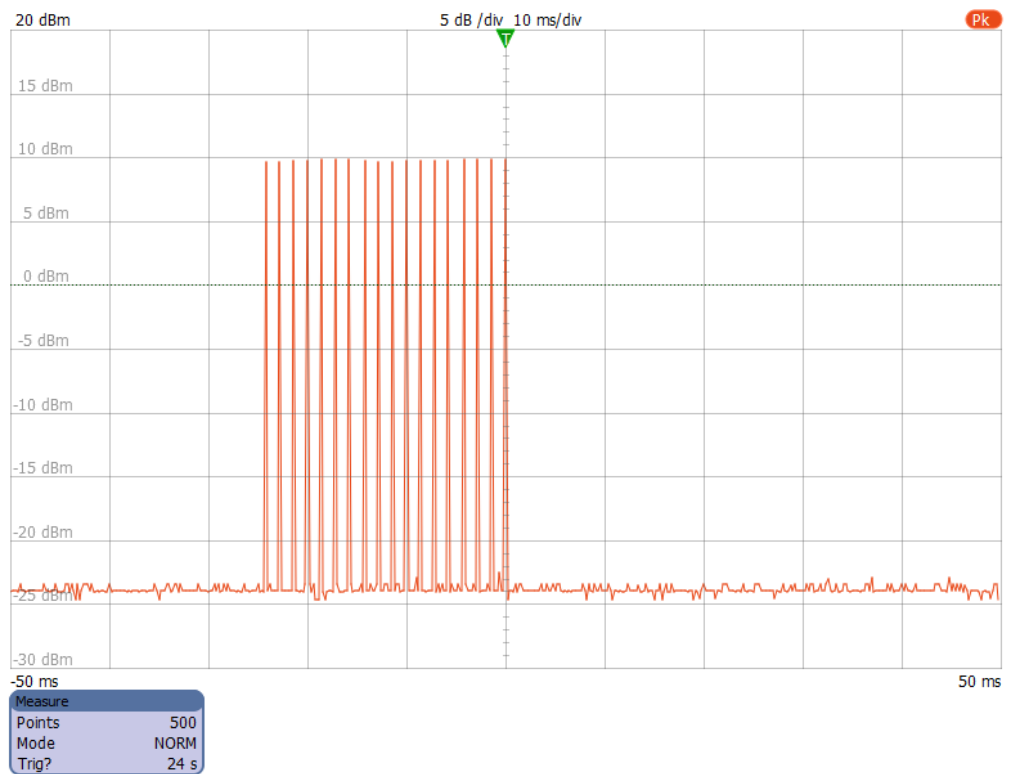


Figure 4-2: Power Sensor measurement result (FCC 06-96 Type 1 pulse train)

A signal created and processed in this way is suitable for performing test in accordance with the standards, listed in Appendix, "DFS Standards and References".

See also [Chapter 5, "Generating Test Files and Conducting the Trials"](#), on page 20.

Report generation

The R&S Pulse Sequencer (DFS) provides a built-in report generation function. During waveform generation, this report function documents all used parameters and stores them into a file. The storage location is configurable.

Report files can be stored as:

- **Microsoft Excel spread sheets** (default)

The provided templates can be modified. For detailed description of the file formats, the template and the plugin, see the R&S Pulse Sequencer user manual.

Status information on whether report logging is enabled or not is displayed in the "Scenario" dialog, see [Figure 5-1](#).

Embedded marker signals

The generated waveforms contain two predefined marker signals:

- **Marker 1**
A short marker that marks the end of the last pulse, i.e. the end of the waveform. The rising edge of this signal marks the measurements start point, e.g. in Channel Move Time measurements.
- **Marker 2**
Marks the individual pulses
This signal can be used to trigger a spectrum analyzer, e.g. for pulse train verification measurements in zero span mode.

An overview information on the marker signals is displayed in the "Comment" field of each test scenario, see [Figure 5-1](#).

Marker signals are output at the corresponding BNC connectors of the Rohde&Schwarz signal generator. In the R&S SMW for example, these signals are routed per default to the USER 1/2 and to the T/M 2/3 connectors. You can use these signals to synchronize or to trigger connected spectrum analyzers or power sensors. For examples, see [Figure 4-1](#) and [Figure 4-2](#).

4.1 Normative Reference

The DFS testing is subject of the standards listed in Appendix, "DFS Standards and References".

The software provides the required test patterns for the following standards:

- ETSI, see [Chapter A.1, "ETSI 301 893, ETSI 302 502"](#), on page 37
- FCC 06-96, see [Chapter A.2, "FCC 06-96"](#), on page 38
- FCC 13-22, see [Chapter A.3, "FCC 13-22"](#), on page 41
- TELEC-T403, see [Chapter A.4, "TELEC-T403"](#), on page 42

5 Generating Test Files and Conducting the Trials

DFS signals created with the R&S Pulse Sequencer (DFS) can be processed by:

- R&S SMW
- R&S SMBV
- R&S SMJ
- R&S SMU
- R&S SGT

The R&S Pulse Sequencer (DFS) creates DFS test signals according to the specification listed in [Chapter 4.1, "Normative Reference"](#), on page 19.

For detailed description of the requirements and the test signals, see [Chapter A, "Overview of the Test Requirements and Provided Test Patterns"](#), on page 37.

How to perform DFS tests with R&S Pulse Sequencer (DFS) and Rohde&Schwarz vector signal generator

The following outlines the main steps to be performed with the R&S Pulse Sequencer (DFS) and the signal generator.

For description on the exact test setup, refer to the corresponding standard documentation.

We assume that the vector signal generator is equipped with the options listed in [Chapter 3.1, "Required Options"](#), on page 10.

1. Install the R&S Pulse Sequencer (DFS) on a PC as described in [Chapter 3.2, "Installing the Software"](#), on page 11.
2. Connect the vector signal generator and the PC with the installed R&S Pulse Sequencer (DFS) software to a LAN.
See [Figure 4-1](#).
3. Route the marker 1 signal from the vector signal generator to the trigger input of the spectrum analyzer or the power sensor.
Marker signals are output at one of the BNC connectors of the vector signal generator. For more information, refer to the user manual of the corresponding instrument.
4. Ensure that Microsoft Excel is installed on the PC.
Otherwise use template-based reporting.
5. Start the R&S Pulse Sequencer (DFS) software and load the DFS repository of the standard to be tested.
See [Chapter 3.4, "Loading a DFS Project File"](#), on page 13.
6. In the R&S Pulse Sequencer (DFS), set up the connection between the software and the vector signal generator.
See [Chapter 5.1, "How to Connect the Signal Generator"](#), on page 21.

7. Create test reports.
See [Chapter 5.2, "How to Create Test Reports"](#), on page 25.
8. Conduct the trial.
See [Chapter 5.3, "How to Create the Waveforms and Conduct the Trial"](#), on page 27.

The R&S Pulse Sequencer (DFS) creates all required files and transfers them to the vector signal generator.

5.1 How to Connect the Signal Generator

The R&S Pulse Sequencer (DFS) distinguishes between generator profiles and physical instruments. The profiles describe minimum instrument capabilities regarding DFS signal generation. Profiles are assigned to physical instruments, that need to be equipped with the required options and fulfill the minimum requirements. Signal generation requires that the connected instrument and the selected profile match. This is indicated with green status indicators.

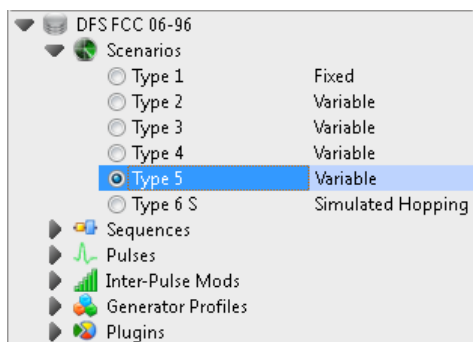
This section shows how to:

- ["To select a predefined generator profile"](#) on page 21
- ["To add a connected physical signal generator to the list of available instruments"](#) on page 22
- ["To assign the generator profile to the physical signal generator"](#) on page 23

To select a predefined generator profile

We assume that you have loaded a DFS repository as described in [Chapter 3.4, "Loading a DFS Project File"](#), on page 13.

1. In the project tree, select the required "Scenario".
In the context of this software, the term scenario describes all trials of a waveform. For example, to perform DFS tests according to FCC Type 5, select "DFS FCC 06-96 > Scenario > Type 5".



The "Scenario" dialog opens and displays information on the sequence, generated waveform, marker signals, etc.

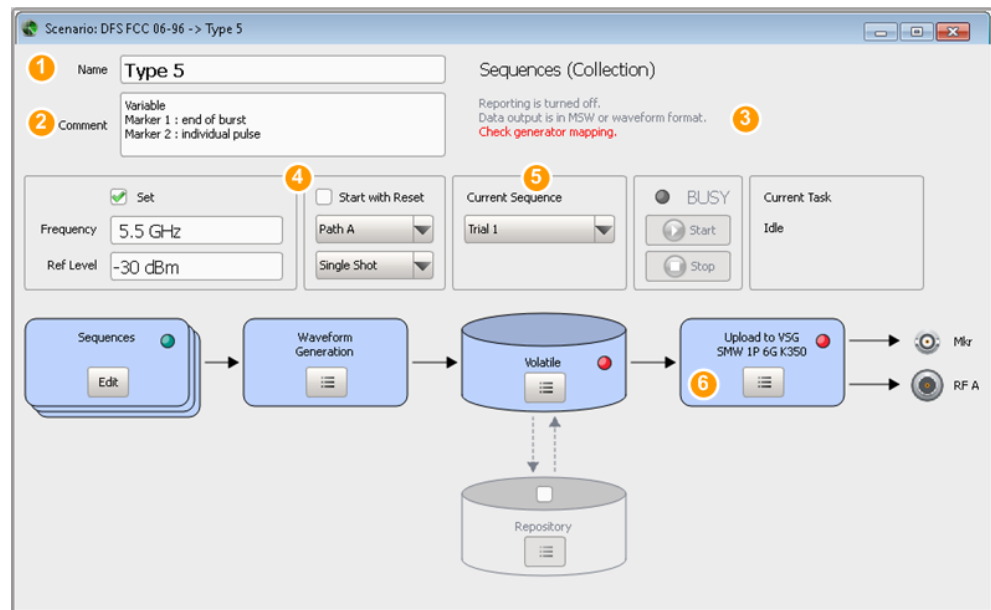


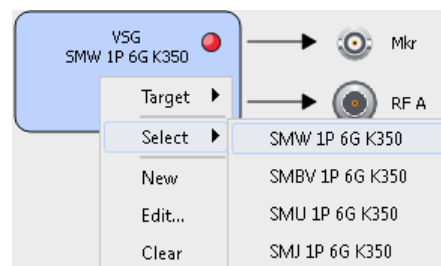
Figure 5-1: Scenario dialog: Understanding the displayed information

- 1 = Scenario name
- 2 = Additional information on generated markers and whether the same or variable trials are used
- 3 = Information on the storage location, the generated waveform (single or multi-segment), and display of status messages
- 4 = Settings related to the vector signal generator, like RF frequency, or output path.
- 5 = If the test requires several trials, the entire set of sequences are automatically generated; "Current Sequence" indicates the name of the currently selected trail
- 6 = Selected predefined generator profile, together with status indication

See also ["Embedded marker signals"](#) on page 19.

2. In the "VSG" block, open the context menu and select one of the predefined generator profiles.

For example, select "VSG > Select > SMW 1P 6G K350", that is a R&S SMW with one baseband, max RF of 6 GHz and R&S SMW-K350.

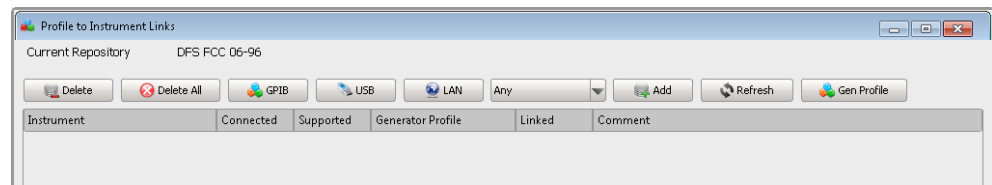


A generator profile is selected but the status indicator is red because no physical instrument is connected.

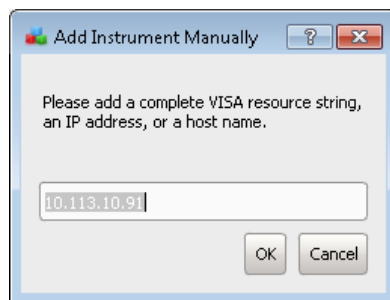
To add a connected physical signal generator to the list of available instruments

1. In the menu bar, select "Config > Profile to Instrument Links".

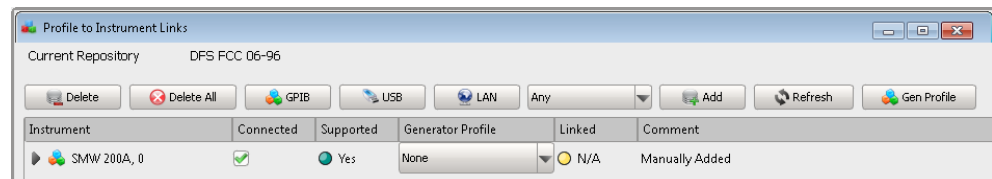
The "Generator Link" dialog opens.



2. If the "List of Instruments" is empty, perform one of the following:
 - a) Select "Any > R&S SMW" to limit the scan function and select "LAN" to start the scan for connected instruments via LAN.
 - b) Select "Add", and enter the IP address, the computer name, or the complete VISA resource string of the connected instrument, then select "Ok".



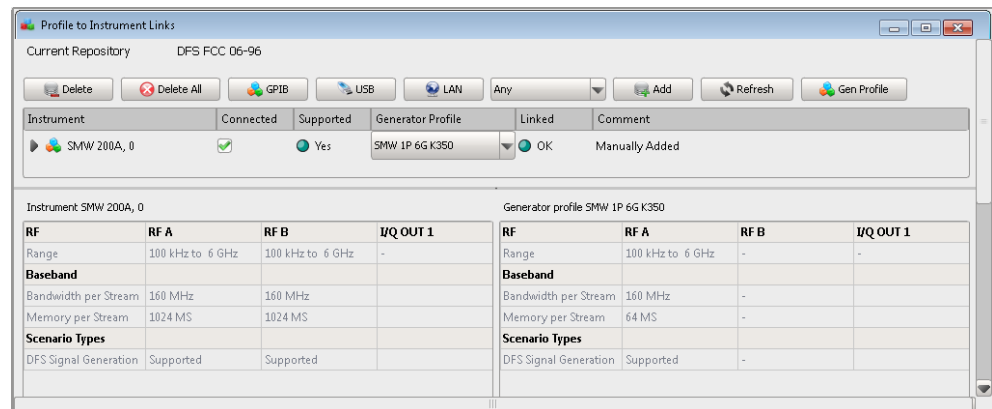
The new instrument is added to the list. A generator profile is not mapped.



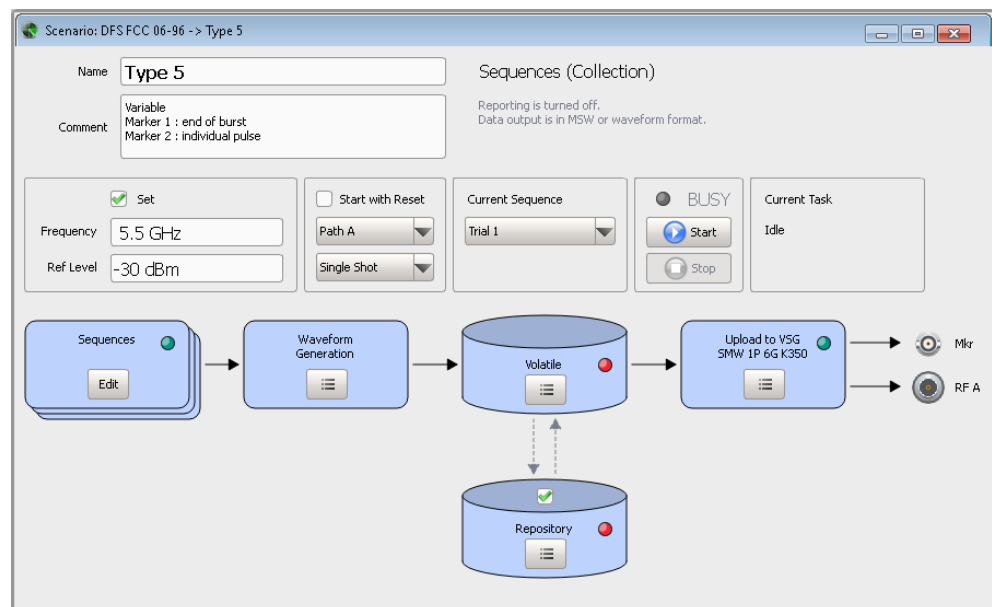
To assign the generator profile to the physical signal generator

1. In the "Profile to Instrument Links" dialog, select the physical instrument that is used to generate the DFS test signal.
2. Select "Profile" and select the generator profile name you have selected in the current scenario.
For example, select "Profile > SMW 1P 6G K350".

The software compares the profile minimum requirements against the configuration of the physical instrument.



3. Observe the status indication.
A green status indicator confirms the match and the successful mapping process. The selected instrument is equipped with the required options.
4. If the status indicator remains red:
 - a) Compare the instrument's capabilities with the requirements of the selected profile
 - b) Observe the tooltip of the "Error" indication.
Tooltips provide hints and additional information.
5. Close the dialog and observe the status indication in the "Scenario" dialog.



The status indicator in the "VSG" block is green; the "Start" button is active.

5.2 How to Create Test Reports

An introduction to the reporting function is provided in "Report generation" on page 17.

This section shows how to:

- "To enable report file generation" on page 25
- "To set the storage location for the generated report files" on page 25
- "To change the report type" on page 26

To enable report file generation

In R&S Pulse Sequencer (DFS), the reporting function is enabled per default.

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.

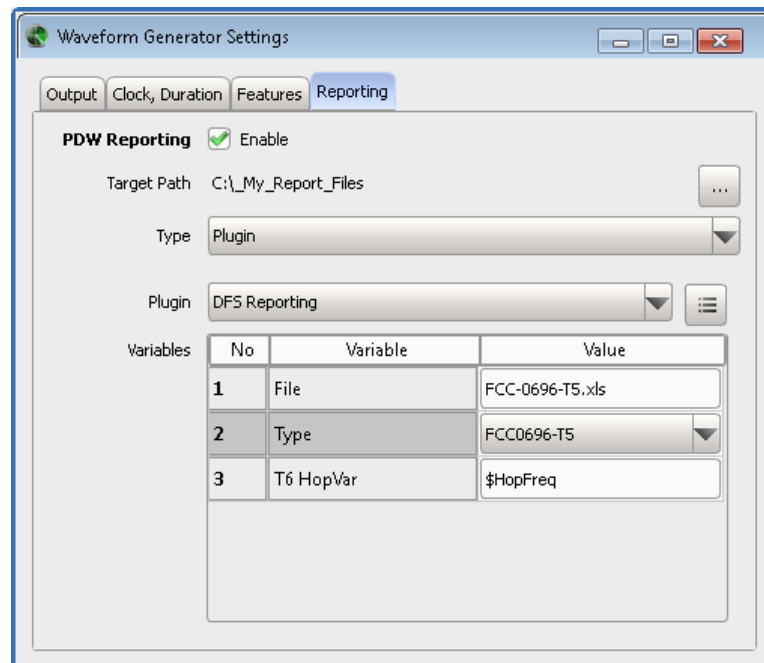
To enable or disable the report file generation, proceed as following:

1. In the "Scenario" dialog, select "Waveform Generation > Config".
2. In the "Waveform Generation 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 "Waveform Generation > Config > Reporting".
The parameter "Target Path" indicates the current storage location.



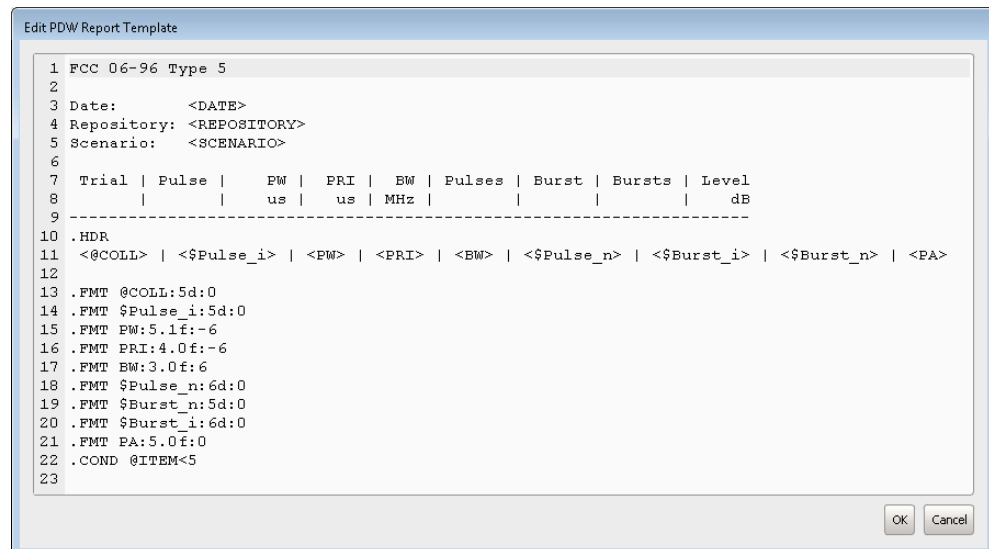
3. To change this location, select the "Set Path" icon, navigate to the directory, and confirm with ok.

To change the report type

You may prefer to store the test reports in text form or as HTML page, if for example 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 "Waveform Generation > Config > Report".
2. Select "Type > Template".
3. Select "Edit" to display the current template.



```

1 FCC 06-96 Type 5
2
3 Date:      <DATE>
4 Repository: <REPOSITORY>
5 Scenario:  <SCENARIO>
6
7 Trial | Pulse |   PW | PRI | BW | Pulses | Burst | Bursts | Level
8      |       |   us | us | MHz |        |      |       | dB
9 -----
10 .HDR
11 <@COLL> | <$Pulse_i> | <PW> | <PRI> | <BW> | <$Pulse_n> | <$Burst_i> | <$Burst_n> | <PA>
12
13 .FMT @COLL:5d:0
14 .FMT $Pulse_i:5d:0
15 .FMT PW:5.1f:-6
16 .FMT PRI:4.0f:-6
17 .FMT BW:3.0f:6
18 .FMT $Pulse_n:6d:0
19 .FMT $Burst_n:5d:0
20 .FMT $Burst_i:6d:0
21 .FMT PA:5.0f:0
22 .COND @ITEM<5
23

```

For detailed description of the file formats, the template and the plugin, see the R&S Pulse Sequencer user manual.

5.3 How to Create the Waveforms and Conduct the Trial

Once you have completed the configuration described in [Chapter 5.1, "How to Connect the Signal Generator"](#), on page 21, you can start waveform generation.

We assume that the reporting function uses the predefined report plugin.

This section shows how to:

- ["To generate the waveforms"](#) on page 27
- ["To view the created reports"](#) on page 29
- ["To store the generated waveforms in the repository"](#) on page 29
- ["To verify the configuration of the connected signal generator"](#) on page 30
- ["To play the generated signal"](#) on page 31
- ["To set the DUT's frequency and bandwidth for FCC 06-96 Type 6 tests with simulated hopping"](#) on page 32

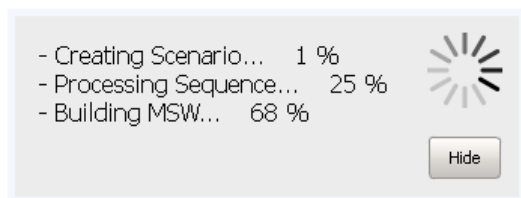
To generate the waveforms

We recommend that you create all waveforms before starting the manual tests. Waveform generation is only required once for all trials.

1. In the "Scenario" dialog, observe the displayed "Comment".
Some scenarios require more configurations, like for example the [FCC 06-96 Type 6 tests](#).
2. Perform the required configuration first.
See also ["To set the DUT's frequency and bandwidth for FCC 06-96 Type 6 tests with simulated hopping"](#) on page 32.

3. In the "Scenario" dialog, select "Start".

The waveform calculation starts. Depending on the PC performance, waveform calculation may take several minutes. Progress information, the size of the waveform and a Busy status indicator are displayed.



Note: Do not interrupt this process. Do not execute other actions while the generation is in progress.

With the waveform generation start, the software performs automatically the following:

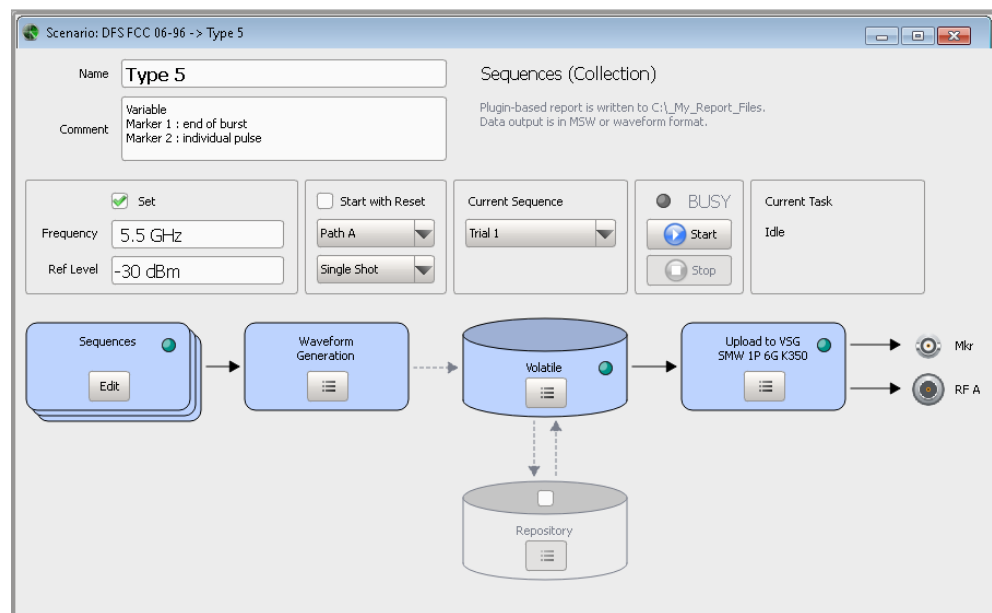
- Invokes Microsoft Excel and opens a spread sheet for reporting

TYPE 5 PARAMETER SHEET							Rohde & Schwarz Pulse Sequencer
Trial Number : 3							
Bursts in Trial: 11							
Burst	Number of Pulses	Pulse Width (µsec)	Chirp Width (MHz)	Pulse 1-to-2 Spacing (µsec)	Pulse 2-to-3 Spacing (µsec)	Start Location Within Interval (msec)	
1	11	51,5	8				
2	11	98,5	17	1275	1117		
3	11	58,8	10	1582			
4	11	55,1	13				
5	11	85,6	5	1179	1629		
6	11	59,4	7	1676			
7	11	90,9	15	1137			
8	11	60,1	5	1426			
9	11	85,4	13	1082	1366		
10	11	99,8	9				
11	11	88	5	1576			

Figure 5-2: Example of a spread sheet

- Creates the individual waveforms and transfers them to the vector signal generator
- Stores the populated reports and closes Microsoft Excel
- Configures RF frequency, sets the pulse top power level, and activates the RF output
- Loads the selected trial into the ARB and activates the ARB.

The green status indicator in the "Volatile" block indicates that the waveform generation has completed successfully.



If the default "Single Shot" play mode is used, the vector signal generator plays the waveform once.

To view the created reports

Once the waveform is created, you can view the created report files.

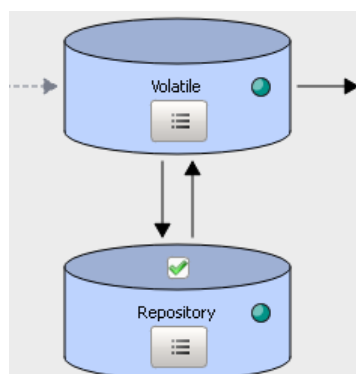
- ▶ In the "Scenario" dialog, select "Waveform Generation > Open Report Folder".

To store the generated waveforms in the repository

According to the DFS standards, each new waveform calculation uses new random values.

To continue testing later or to the repeat measurements with the *same* random parameters, generated waveforms can be stored in the repository.

1. In the "Scenario" dialog, select "Repository > On".
2. Select "Volatile > Release to Repository".



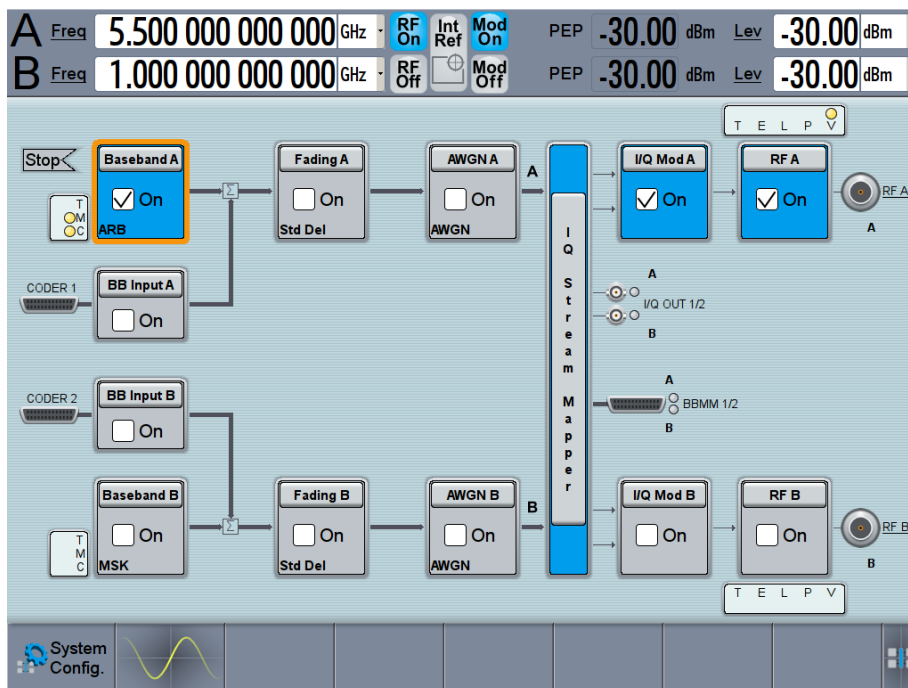
The green indicator in the "Repository" block confirms that the calculated waveforms are stored in the repository. The dotted line also indicates that waveform data is retrieved from the repository.

3. To load previously stored waveforms, select "Repository > Load from Repository".
4. To trigger a waveform calculation for the same "Scenario" but with *new* random values, perform the reverse operation:
 - a) select "Volatile > Clear"
 - b) select "Repository > Off"
 - c) select "Start".

To verify the configuration of the connected signal generator

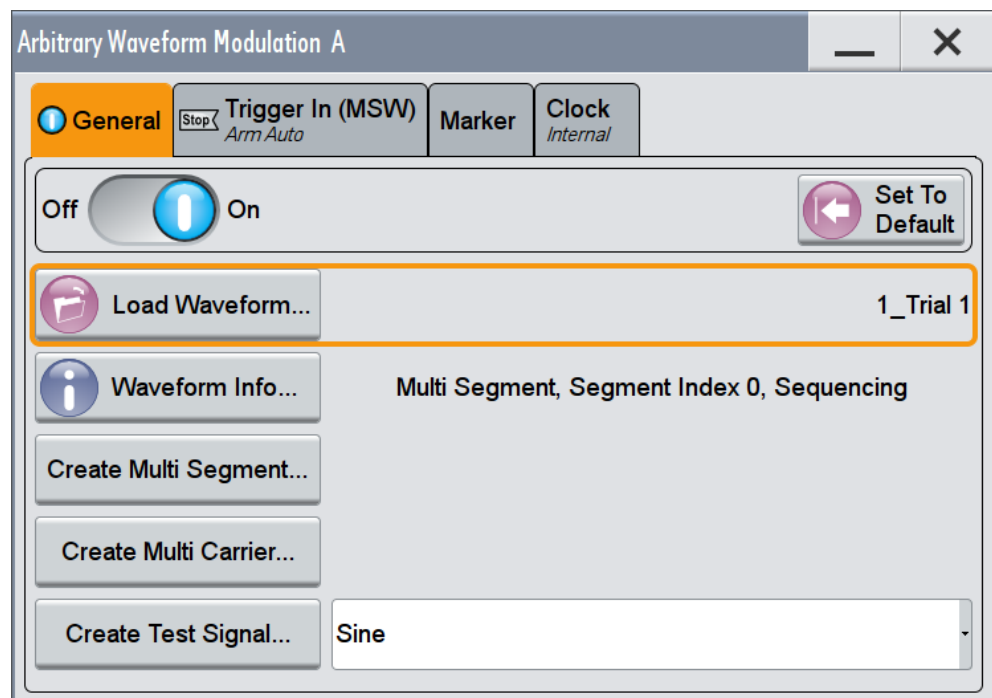
All required waveforms are stored in the user directory on the instrument's hard disk. The following example uses R&S SMW.

1. On the instrument's display, observe the block diagram.



The displayed "RF Frequency" and "PEP" values confirms the settings performed in the R&S Pulse Sequencer (DFS). "ARB" and "RF A" are activated.

2. Select "Baseband > ARB".



The waveform "1_Trial 1" is loaded.

To play the generated signal

The signal generator is configured in "Trigger Mode > Armed Auto". To play the waveform, execute the trigger manually:

- ▶ In the signal generator, select "Baseband > ARB > Trigger > Execute Trigger".

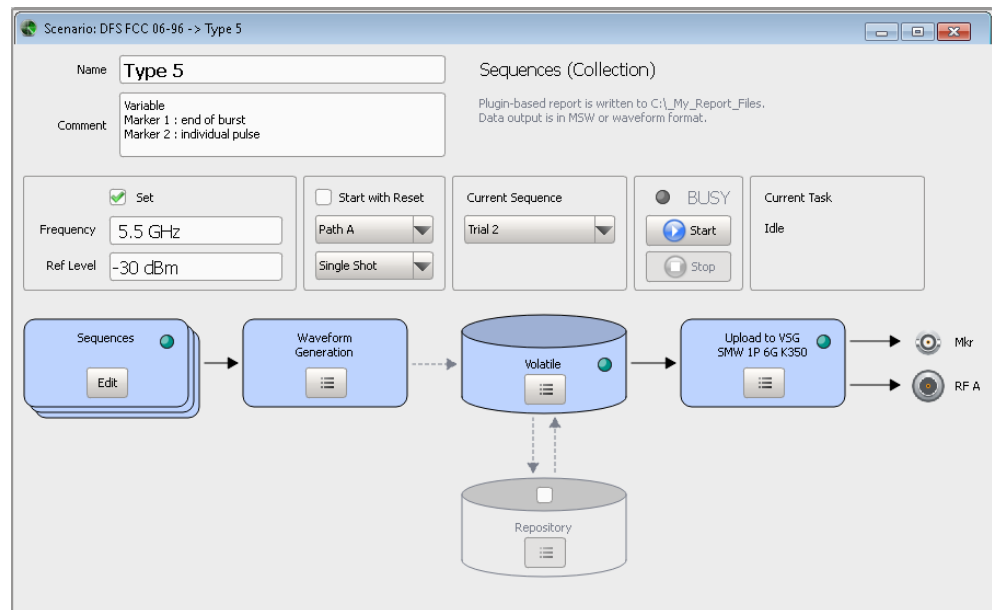
The instrument generates the selected waveform once. The required test signal is output at RF A connector.

The "Marker 1" and "Marker 2" signals, at the T/M 2 and T/M 3 connectors.

To load and process further trials from the same DFS type

All required waveform had been created and transferred to the instrument. With the following steps, you select the trial to be loaded in the ARB:

1. In the R&S Pulse Sequencer (DFS), open the "Scenario" dialog and select the next trial, e.g. select "Current Sequence > Trial 2"



2. Select "Start".

The waveform of Trial 2 is activated in the ARB.

If "Single Shot" play mode is used, signal generation starts automatically. The waveform is played once.

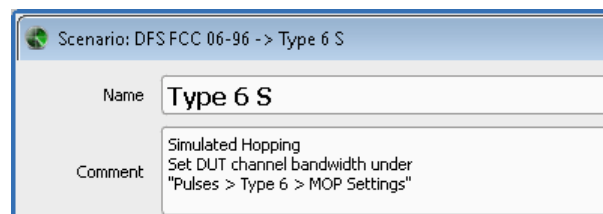
To set the DUT's frequency and bandwidth for FCC 06-96 Type 6 tests with simulated hopping

FCC 06-96 Type 6 tests use simulated hopping. A short introduction to the principle is provided in [Chapter A.2.3, "Radar Type 6"](#), on page 40.

To calculate the waveform, the R&S Pulse Sequencer (DFS) software uses the following parameters: the DUT's bandwidth, the center frequency, and the description of the frequency hopping.

To configure the required parameters, proceed as following:

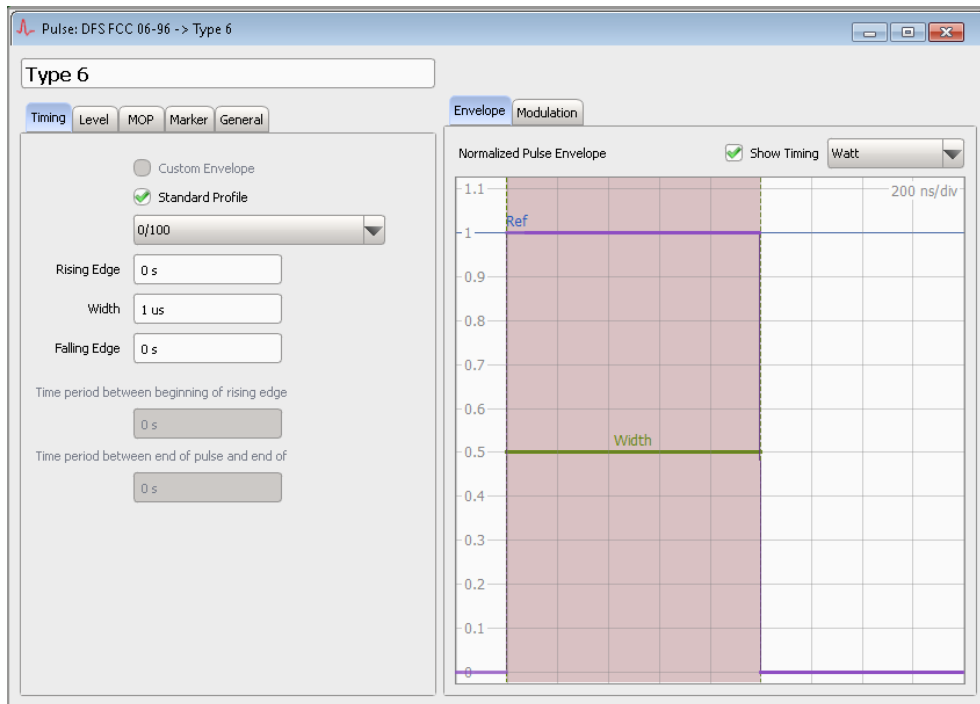
1. In the "Scenario" dialog, set the parameter "Frequency" to the operating frequency of the DUT.
2. Observe the displayed "Comment".



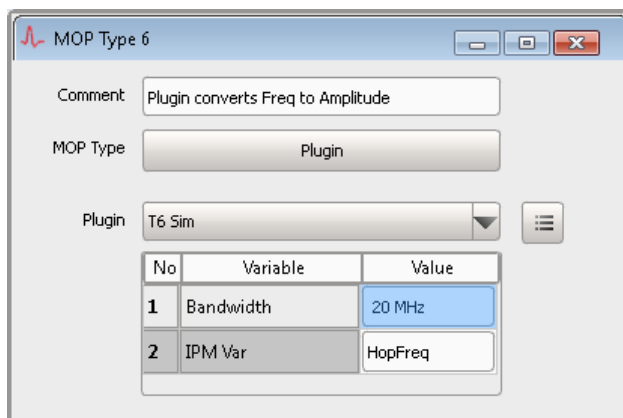
To perform [FCC 06-96](#) Type 6 tests with simulated hopping, adjust the DUT's bandwidth.

The default bandwidth is 20 MHz. To change this value:

- In the "Repository tree", select "DFS FCC 06-96 > Pulses > Pulse 6".



- In the "Pulse" dialog, select "MOP > Settings"



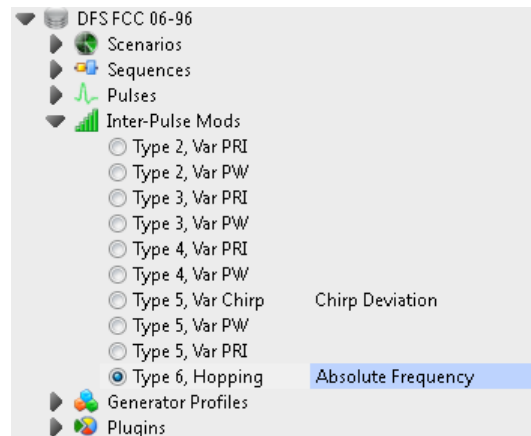
- Select "Bandwidth" and enter the DUT bandwidth according to the particular test requirements, e.g. 20 MHz.

Generated are only pulses whose frequency f_{nop} fall within this "Bandwidth". Frequencies that fall outside the "Bandwidth" are suppressed.

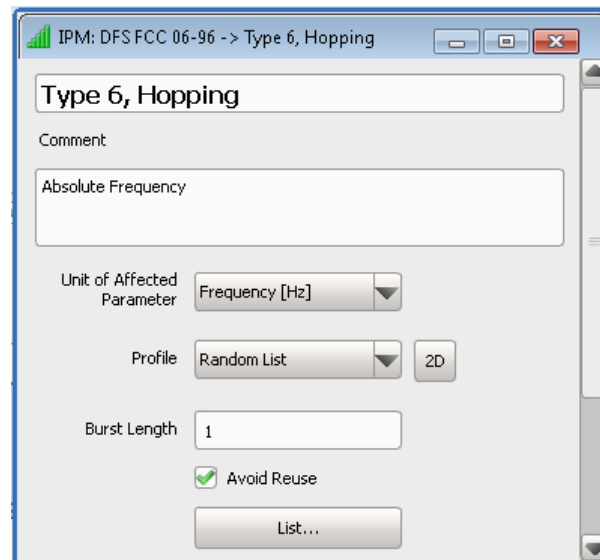
See also [Figure A-1](#).

Note: Do not change the value of the variable "IPM Var"! The value "HopFreq" is internally used for the calculation of the frequency hops.

- The frequency hopping is described with a predefined IPM profile. To see the IPM profile, select "Repository Tree > IPM" and select the IPM profile "Type 6, Hopping".



The "IPM" dialog opens and displays information on the configured IPM profile.



The "Type 6, Hopping" is implemented as a "Random List" profile. The frequency is selected on a random manner without frequency reuse.

7. To retrieve information on the used frequency range, select "List".

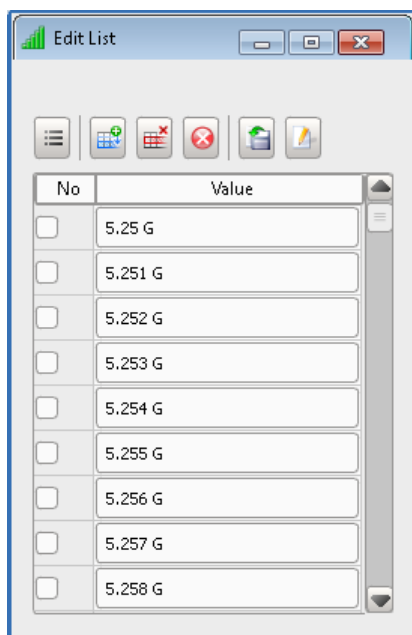


Figure 5-3: IPM profile for DFS FCC 06-96 type 6 tests with simulated hopping (Extract)

The list contains 475 frequencies in the frequency range between 5.25 GHz to 5.724 GHz. The extract on Figure 5-3 shows the first few values.

For more information on the provided settings, see the R&S Pulse Sequencer user manual.

8. Close the dialogs.
9. Conduct the trial, see "To generate the waveforms" on page 27.
10. Open the generated report file FCC-0696-T6Sim.xls.

The file contains one overview sheet and 30 individual sheets, one for each trial.

TYPE 6 PARAMETER SHEET				
Trial Number : 15				
Bursts in Trial: 100				
Burst	Carrier (GHz)	Hop (GHz)	DUT BW (MHz)	Within RX
1	5,5	5,459	20	
2	5,5	5,28	20	
3	5,5	5,606	20	
4	5,5	5,714	20	
5	5,5	5,576	20	
6	5,5	5,278	20	
7	5,5	5,483	20	
8	5,5	5,374	20	
9	5,5	5,499	20	*
10	5,5	5,567	20	
11	5,5	5,491	20	*

Figure 5-4: DFS FCC 06-96 type 6 Trial 15 spread sheet (Extract)

* = indicates frequencies that fall within the bandwidth of the DUT

Each spread sheet lists the randomly selected 100 frequencies and indicates the frequency hops that fall within the bandwidth of the DUT.

See also [Figure A-1](#).

Annex

A Overview of the Test Requirements and Provided Test Patterns

A.1 ETSI 301 893, ETSI 302 502

This section describes the generation of the DFS related radar test signals according to the ETSI specifications.

A.1.1 Waveform Requirements 301893 V1.7.1 (2012-06)

The waveform requirements are listed in [Table A-1](#).

Table A-1: Waveform Requirements 301893 V1.7.1 (Annex D, DFS)

Radar Test Signal	Pulse Width [us]	PRF [us]	Pulses per Burst	Requirements
1	0.5 .. 5	200 .. 1000	10, 18	Variable PRF and pulse width
2	0.5 .. 15	200 .. 1600	15, 18	
3	0.5 .. 15	2300 .. 4000	25	
4	20 .. 30	2000 .. 4000	20	
5	0.5 .. 2	300 .. 400	10, 18	
6	0.5 .. 2	400 .. 1200	15, 18	

The radar test signal 6 also requires a linear chirp modulation from -2.5 MHz to +2.5 MHz within the pulse. The test signals 5 and 6 use two or three different PRF values in a staggered configuration. An additional requirement exists that the difference between the PRF values is between 20 Hz and 50 Hz for the type 5 signal and between 80 Hz and 400 Hz for the type 6 signal.

For all test signals a total of 20 randomly generated test patterns are required.

A.1.2 Waveform Requirements 302502 V1.2.1 (2008-02)

The waveform requirements are listed in [Table A-2](#).

Table A-2: Waveform Requirements 302502 V1.2.1 (Annex D, DFS, Table D.3.1)

Radar Test Signal	Pulse Width [us]	PRF [us]	Pulses per Burst	Requirements
1	1	750	15	Variable PRF and pulse width
2	1, 2, 5	200, 300, 500, 800, 1000	10	
3	10, 15	200, 300, 500, 800, 1000	15	
4	1, 2, 5, 10, 15	1200, 1500, 1600	15	
5	1, 2, 5, 10, 15	2300, 3000, 3500, 4000	25	
6	20, 3	2000, 3000, 4000	20	

The radar test signal 6 requires a linear chirp modulation from -2.5 MHz to +2.5 MHz within the pulse. For the test signals 2 to 6, a total of 20 randomly generated test patterns are required.

This standard adds two more waveforms that simulate frequency hopping radar systems, see [Table A-3](#).

Table A-3: Waveform Requirements 302502 V1.2.1 (Annex D, DFS, Table D.3.2)

Radar Test Signal	Pulse Width [us]	PRF [us]	Pulses per Burst	Burst Length [ms]	MOP
1	1	3000	9	3	-
2	20	4500	9	2	Chirp

Both signals use bursts that contain 9 pulses with fixed pulse width and fixed PRF. The second signal also uses a linear FM chirp from -2.5 MHz to +2.5 MHz. In contrast to the other waveforms the spacing between the bursts is increased from trial to trial by a fixed step size, see [Table A-4](#).

Table A-4: Waveform Requirements 302502 V1.2.1 (burst spacing)

Radar Test Signal	Trials	Min Spacing [ms]	Max Spacing [ms]	Step Size [ms]
1	29	1.25	37.5	1.25
2	29	5	150	5

A.2 FCC 06-96

This section describes the generation of the DFS related radar test signals according to the [FCC 06-96](#) specification.

In the R&S Pulse Sequencer (DFS), there is a repository, that contains all relevant pulse definitions and creates waveforms of all the required trials. The provided test patterns are in line with the requirements listed in [Table A-5](#).

Table A-5: FCC 06-96: Overview of the related chapters

Chapter	Test Patterns/Trials	Description	Related section
Chapter 6.1	Radar Type 1 .. 4	Short Pulse Radar Waveforms	Chapter A.2.1, "Radar Type 1 to 4" , on page 39
Chapter 6.2	Radar Type 5	Long Pulse Radar Test Waveform	Chapter A.2.2, "Radar Type 5" , on page 39
Chapter 6.3	Radar Type 6	Frequency Hopping Radar Test Waveform	Chapter A.2.3, "Radar Type 6" , on page 40

You can use the built-in reporting function to generate and store report files. If enabled, the reporting plug-in populates Microsoft Excel spread sheets, formatted according to the requirements and populated with the parameters used during the waveform generation. You can use these spread sheets during testing or for filing test results.

A.2.1 Radar Type 1 to 4

The parameters for the waveforms of Type 1 to 4 are listed in [Table A-6](#).

Table A-6: Radar Types 1 to 4: Parameters overview

Radar Type	Pulse Width (0.1 us steps)	PRI [us] (1 us steps)	Number of Pulses	Requirements	Comment
1	1	1428	18	1 waveform	Fixed (static) PRI
2	1 .. 5	150 .. 230	23 .. 29	min 30 unique waveforms per type	Variable PRI, pulse width, and number of pulses
3	6 .. 10	200 .. 500	16 .. 18		
4	11 .. 20	200 .. 500	12 .. 16		

A.2.2 Radar Type 5

Radar type 5 is a waveform that uses FM chirped bursts and that randomly varies several pulse parameters. The overall duration of the waveform is 12 seconds. The time is divided equally, depending on the number of used bursts. Each burst starts at a random moment within its time interval. The number of pulses and the FM chirp deviation are selected randomly for per burst and applied to all pulses belonging to same burst.

The same applies for the PRI with the exception that bursts containing three pulses also vary the PRI within the burst. In this case, the intra-pulse spacing is different between pulse one and two as well as between pulse two and three.

The parameters for the waveform of Type 5 are listed in [Table A-7](#).

Table A-7: Radar Type 5: Parameters overview

Radar Type	Pulse Width (0.1 us steps)	PRI [us] (1 us steps)	Pulses per Burst	Bursts	Chirp Deviation [MHz]	Requirements	Comment
5	50 .. 100	1000 .. 2000	1 .. 3	8 .. 20	5 .. 20	30 unique waveforms	Variable PRI, pulse width, and number of pulses/ bursts

The R&S Pulse Sequencer (DFS) automatically creates the required waveforms of all 30 trials.

A.2.3 Radar Type 6

Radar type 6 is a waveform that consists of 9 consecutive pulses on one frequency. This burst is referred to as the pulses per hop.

A total of 100 frequencies are selected from a range 5.25 GHz to 5.724 GHz. The frequency changes every 3 ms and each burst of 9 pulses uses a unique frequency. It must be ensured that at least one of the random frequencies falls into the receiver bandwidth of the DUT.

The parameters for the waveform of Type 6 are listed in [Table A-8](#).

Table A-8: Radar Type 6: Parameters overview

Radar Type	Pulse Width [us]	PRI [us]	Waveform duration [ms]	Pulses per hop	Hop rate [Hz]
6	1	333	300	9	333

Simulated frequency hopping

The [FCC 06-96 Radar Type 6](#) waveform uses a static pattern but requires hops across a wide frequency range. A real frequency hopping is a demanding implementation, that would for example require a vector signal generator with large bandwidth or a fast hopping synthesizer. As an alternative, the standard proposes a method called simulated hopping. Because DUTs are devices that receive RF signals in a limited RF band, it is allowed to simulate only this subset of random frequency hops, that would fall within the DUT's bandwidth.

The principle of the simulated hopping is illustrated on [Figure A-1](#).

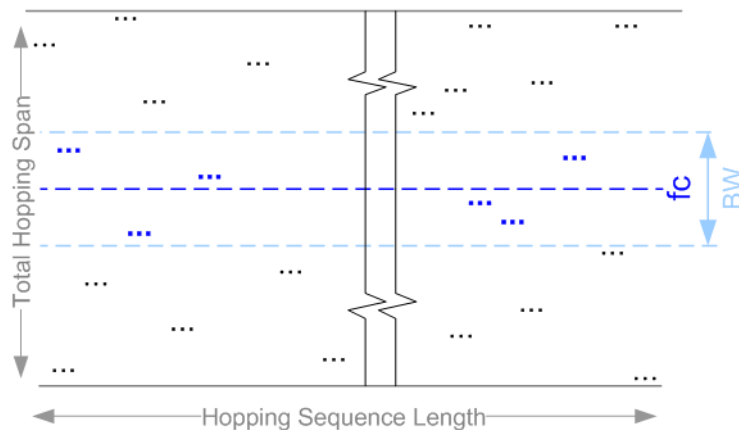


Figure A-1: Principle of simulated hopping (according to FCC 06-96)

f_c = center frequency

BW = DUT's bandwidth

black dots = hops that are outside the DUT's bandwidth

blue dots = hops that are within the DUT's bandwidth

If simulated hopping is used, generated are only pulses with frequency f_{hop} that fulfill the equation:

$$(f_c - BW/2) < f_{hop} < (f_c + BW/2)$$

For the example on [Figure A-1](#), generated are the six blue hops that are within the DUT's bandwidth.

In the R&S Pulse Sequencer (DFS), the DUT's receiver bandwidth and center frequency are configurable parameters. The frequency hopping is described with the pre-defined IPM profile "Type 6, Hopping".

During waveform generation, the software selects random frequencies, lists all frequencies in the reporting file and then selects and marks those frequencies that are within the selected DUT bandwidth.

See also ["To set the DUT's frequency and bandwidth for FCC 06-96 Type 6 tests with simulated hopping"](#) on page 32.

A.3 FCC 13–22

This section describes the generation of the DFS related radar test signals according to the FCC 13-22 specification.

Table A-9: FCC 13–22: Overview of the related chapters

Chapter	Test Patterns/Trials	Description	Related section
Chapter 6.1	Radar Type 0 .. 4	Short Pulse Radar Waveforms	Table A-10

The parameters for the waveforms of Type 0 .. 4 are listed in [Table A-10](#).

Table A-10: Radar Types 0 .. 4: Parameters overview

Radar Type	Pulse Width (0.1 us steps)	PRI [us] (1 us steps)	Number of Pulses	Requirements	Comment
0	1	1428	18	1 waveform	Fixed (static) PRI
1	1	518 .. 3066	18 .. 102 ^{*)}	Test A and Test B ^{**)}	Variable PRI, pulse width, and number of pulses
2	1 .. 5	150 .. 230	23 .. 29	min 30 unique waveforms per type;	
3	6 .. 10	200 .. 500	16 .. 18		
4	11 .. 20	200 .. 500	12 .. 16	If more than 30 waveforms are used, then each additional waveform must also be unique	

^{*)} Roundup $\{(1/360) \cdot [19 \cdot 10^6 / \text{PRI}[\text{us}]]\}$

^{**)}

- Test A: waveforms with 15 unique randomly selected PRI values
- Test B: waveforms with 15 unique randomly selected PRI values, excluding PRI values selected in Test A
- If more than 30 waveforms are used, then each additional waveform must be generated with Test B and must be unique and not repeated from the previous waveforms in Test A and Test B

A.4 TELEC-T403

The [TELEC](#) standard specifies DFS parameters for testing on two bands:

- The 5.3 GHz band, see [Chapter A.4.1, "Japan Radar Parameters for W53 Band"](#), on page 42
- The 5.6 GHz band, see [Chapter A.4.2, "Japan Radar Parameters for W56 Band"](#), on page 43

A.4.1 Japan Radar Parameters for W53 Band

The waveform requirements for the Types 1 and 2 are listed in [Table A-11](#).

Table A-11: Short Pulse Radar Types 1 and 2: Parameters overview

Radar Type	Pulse Width [us]	Pulse Repetition Frequency [Hz]	Number of Pulses	Requirements	Comment
1	1	700	18	1 waveform	Fixed (static) PRI
2	2.5	260	18	Non-modulated pulses	

A.4.2 Japan Radar Parameters for W56 Band

The requirements for DFS testing on the 5.6 GHz band are divided into:

- Short pulse radar types, see [Table A-12](#)
- Long pulse radar type, see [Table A-13](#)
- Frequency hopping radar type, see [Table A-14](#).

Table A-12: Short Pulse Radar Types 1 .. 6: Parameters overview

Radar Type	Pulse Width [us]	Pulse Repetition Frequency [Hz]	Number of Pulses	Requirements	Comment
1	0.5	720	18		Fixed (static) PRI
2	1	700	18		
3	2	250	18		
4	1 .. 5	4347 .. 6667	23 .. 29		Variable PRI, pulse width, and number of pulses
5	6 .. 10	2000 .. 5000	16 .. 18		
6	11 .. 20	2000 .. 5000	12 .. 16		

The Long Pulse Radar Type 1 requirements are identical with the requirements of [FCC 06-96 Radar Type 5](#).

Table A-13: Long Pulse Radar Type 1: Parameters overview

Radar Type	Pulse Width (0.1 us steps)	PRI [us] (1 us steps)	Pulses per Burst	Bursts	Chirp Deviation [MHz]	Requirements	Comment
1	50 .. 100	1000 .. 2000	1 .. 3	8 .. 20	5 .. 20	30 unique waveforms	Variable PRI, pulse width, and number of pulses/ bursts

The Hopping Radar Type 1 requirements are identical with the requirements of [FCC 06-96 Radar Type 6](#). Simulated frequency hopping is used.

Table A-14: Hopping Radar Type 1: Parameters overview

Radar Type	Pulse Width [us]	PRI [us]	Waveform duration [ms]	Pulses per hop	Hop rate [Hz]
1	1	333	300	9	333

B References

- R&S SMW200A Vector Signal Generator user manual, the latest version is available for download at [R&S SMW200A product homepage](#).
- R&S SMBV100A Vector Signal Generator operating manual, the latest version is available for download at [R&S SMBV100A product homepage](#).
- R&S SMU200A Vector Signal Generator operating manual, the latest version is available for download at [R&S SMU200A product homepage](#).
- R&S SMJ100A Vector Signal Generator operating manual, the latest version is available for download at [R&S SMJ100A product homepage](#).
- R&S SGT100A SGMA Vector RF Source operating manual, the latest version is available for download at [R&S SGT100A product homepage](#).

Glossary: Terms and Abbreviations

A

AS/NZS: Australia and New Zealand standards

D

DFS: Dynamic Frequency Selection

DUT: Device under test

F

FCC: U.S. Federal Communication Commission

G

GUI: Graphical User Interface

I

Inter-Pulse Modulation: [IPM](#)

Intra-Pulse Modulation: [MOP](#)

IPM: Inter-Pulse Modulation

M

MOP: Modulation on Pulse

MSW: Multi-segment waveforms

P

PDW: Pulse Descriptor Word
Format of the reported data

PEP: Peak Envelope Power

[DFS](#) testing requires to control the pulse power rather than an average signal power; for DFS testing, the PEP is equal to the average level.

Plugin: A loadable Microsoft Windows DDL module that describes custom modulation schemes or envelope shapes.

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

R

RSS: Industry Canada, Radio Standards Specifications

S

Stagger PRI: Pulse train composed of two or more pulse subtrains that use the same PRI

T

TELEC: Japan standard

Glossary: DFS Standards and References

A

AS/NZS 4268:2008: Australia and New Zealand standards
Radio equipment and systems – Short range devices – Limits and methods of measurement

E

ETSI: The European Telecommunications Standards Institute
<http://www.etsi.org>

ETSI EN 301 893 V1.7.1: (2012-06)
[en_301893v010701p.pdf](#)

ETSI EN 302 502 V1.2.1: (2008-02)
[en_302502v010201o.pdf](#)
Broadband Radio Access Networks (BRAN);
5.8 GHz fixed broadband data transmitting systems;
Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive

F

FCC: U.S. Federal Communication Commission
<http://www.fcc.gov>
FCC search page for approved devices: <https://fjallfoss.fcc.gov/oetcf/eas/reports/GenericSearch.cfm>

FCC 06-96: U.S. Federal Communication Commission Part 15, Subpart E
[FCC-06-96A1.pdf](#)
APPENDIX "COMPLIANCE MEASUREMENT PROCEDURES FOR UNLICENSED NATIONAL INFORMATION INFRASTRUCTURE DEVICES OPERATING THE 5250–5350 MHz AND 5470–5725 MHz BANDS INCORPORATING DYNAMIC FREQUENCY SELECTION".

FCC 13-22: U.S. Federal Communication Commission
[FCC-13-22A1.pdf](#)
APPENDIX B "Changes to Compliance Measurement Procedures For Unlicensed-National Information Infrastructure Devices Operating in The 5250–5350 MHz and 5470–5725 MHz Bands Incorporating Dynamic Frequency Selection".

N

NTIA: National Telecommunications And Information Administration
DFS information
<http://ntiacsd.ntia.doc.gov/dfs/>

R

RSS 210: Issue 7, June 2007

Industry Canada, Radio Standards Specifications

Low-power License-exempt Radiocommunication Devices (All Frequency Bands) Category I Equipment

This document refers under section A9.4 (b) to the DFS test procedures published by the U.S. Federal Communication Commission (FCC).

T

TELEC-T403: Japan standard

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