R&S®QuickStep Test Executive Software

Getting Started

1530429202

Getting Started

Version 07

ROHDE&SCHWARZ

This manual applies to the following options:

- R&S QuickStep Test Executive Software (1528.9010.02)
- R&S QuickStep Test Sequencer Software (1528.9049.02)
- Development option for R&S QuickStep Test Executive Software (1528.9026.02)
- R&S QuickStep OTA Basic Application, ATSCAL (1528.9078.02)
- R&S QuickStep license dongle and key card (1528.9003.02)

The firmware of the instrument uses several valuable open source software packages. For information, see the "Open Source Acknowledgment" document, which is available for download from the customer web section on GLORIS, the global Rohde & Schwarz information system: https://extranet.rohde-schwarz.com.
Rohde & Schwarz would like to thank the open source community for their valuable contribution to embedded computing.

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1530.4292.02 | Version 07 | R&S®QuickStep

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

Contents

1 Welcome

Welcome to the R&S QuickStep Test Executive software! QuickStep provides a high-speed test sequencer in combination with a powerful graphical user interface for the parameterization and control of test execution. Test procedures are designed in a graphical editor as flow charts based on the provided or additionally developed test functions.

QuickStep lets you set up and run test plans – sequences of individual tests together with scheduling and execution information –, to build test procedures and to evaluate the test results. During test execution, QuickStep controls the test equipment.

QuickStep includes example test projects for typical test conditions and hardware setups. It offers facilities to adapt given test plans and their execution schedules and to develop new ones. Customer extensions can easily be integrated, e.g. for exploiting or developing special test algorithms.

If you only use the QuickStep OTA basic application (installed with QuickStep, QS-ATSCAL license required), most test executive features are hidden at the GUI but used in the background. For details, see the QuickStep ATSCAL OTA Testing user manual.

1.1 Key Features

General features:

- High performance:
  QuickStep causes a minimum processing overhead. The test execution speed is comparable to native C++/C# code. Parallel execution of code is supported.
- User-friendly handling:
  Configurations are done via graphical user interface (GUI) and intuitive handling (for example drag & drop). Standard tests need only a minimum configuration effort.
- High flexibility and wide application range:
  - Examples and reference test cases are available and ready to run.
    The test packages are optimized regarding time consumption.

  - QuickStep is not confined to a certain set of test instruments since standard communication interfaces are used for controlling the test equipment. 3rd-party instruments are easily integrated.
  - Customer-defined test setups and test conditions are supported.
  - QuickStep is appropriate for production tests (particularly due to high performance) as well as for test development purposes.
- Support for developing test functionality and easy integration of customer code

Test plan configuration:

- Static and dynamic parameter references
- Convenient set and sweep functions
- Search and filter functions
- Limit handling
- Control phases (for example for instrument initialization) around sequences of test steps
- Dynamic control statements (loops, if conditions, jumps)

Test results and execution protocol:

- Diagram for result plots
- Histogram view for statistical analysis
- Configurable result charts and live view results
- Configurable reports
- Test execution protocol viewer

System configuration management:

- Graphical representation of the test setup
- Intuitive building of system configurations with elements from a library
- Parameter and path mapping for multiple test setups

Development of new tests:

- Intuitive building of test procedures via flow charts of blocks from a library
- Control structures (conditions, "If", "Or") and dependencies
- GUI supported generation of source code templates for new test functions
- Powerful API to support standard functionality
- Microsoft Visual Studio® based test function development with C++ or C#

- Debugging support: Breakpoints allow to pause a test run on well-defined steps and block functions; single step execution mode is provided
- Re-use and extension of R&S Forum and MATLAB scripts
- Support of user-defined dialogs implemented with Windows Forms or WPF
- Standalone usage of block DLLs

1.2 Software Components, Product Licensing

The software has the following components:

- **Test Executive Software**
  Includes the complete functionality to define tests based on the provided block functions, to run tests and analyze the results.
  Type: R&S QS-APP, included option keys: R&S QS-EXE, R&S QS-EDI, R&S QS-SEQ
- **Test Sequencer Software**
  Executes QuickStep tests. This component is used in combination with a QuickStep application which provides the calling GUI.
  Type: R&S QS-SEQ, option key: R&S QS-SEQ
- **Development Option**
  Enables the creation of new block functions. The Block Development Tool provides the complete interface to integrate user code into QuickStep via MS Visual Studio projects.
  Type: R&S QS-DEV, option key: R&S QS-DEV
  Additionally required type: R&S QS-APP
- **OTA Basic Application**
  Provides the OTA ATSCAL view for easy and integrated control of OTA (over the air) RF radiation testing, particularly for calibration and antenna measurements in combination with an ATS1000. No configuration of a testplan or test procedure is needed. Test results (total radiated power, gain, radiation pattern) are also displayed in the view including polar and 3D chart.
  Type: R&S QS-ATSCAL, option key: R&S QS-ATSCAL
  Additionally required type: R&S QS-SEQ or R&S QS-APP
- **ATSDRV Positioner Driver Package**
  Provides the functionality to control an ATS-CCP1 antenna positioner with turntable and one antenna boom.
  Type: R&S QS-ATSDRV, free of charge

The licensing is realized with a **License Dongle** to be connected with a USB port at the PC where QuickStep is used. The license dongle consists of a smart card and a USB smart card reader. The definition and execution of tests with the Test Executive Software is limited to 25 steps if the license dongle is not available or the license is not valid. The development or OTA functionality is only available with valid license.

1.3 Documentation

PDF documentation

The pdf documents are included on the product's USB stick. Most documents are also accessible after QuickStep installation via the Windows "Start" button and the folder "R&S QuickStep > Documentation" or via the QuickStep Help menu. Additionally, the Getting Started is provided as printed document.

The pdf documentation consists of the following documents:

- **Getting Started**
  Provides basic information about the product and how to install it.
- **User Manual**
  Provides detailed information about the features of the application and how to install, configure and use the application. The manual includes descriptions of the applied mechanisms, step-by-step procedures showing how to carry out typical tasks, a reference chapter where the GUI elements and their usage are described, and application examples.
- **OTA Testing User Manual**
  User manual that is specialized for the OTA ATSCAL component of QuickStep.
- **Release Notes**
  Contains the most current information on the application, for example latest changes, news, restrictions.
- **Training Manuals**
  Provide detailed descriptions how to use QuickStep based on instructive examples. The descriptions include step-by-step procedures and many hints on practical usage.
  – User Training: Covers all topics related to the usage of QuickStep – except for the development of new blocks.

  – Developer Training: Covers the tasks for developing functional blocks. Code examples illustrating how user-defined block functions are developed. The example code can be copied and inserted in programming files in MS Visual Studio; therefore two versions of the training manual exist: one for programming in C++, one for programming in C#.

- **Quick Reference**
  Lists the typically required API functions on a poster.
- **ActiveReports User Guide**
  Describes how to use the ReportDesigner which is accessible via the Test Procedure Editor's toolbar. The ReportDesigner allows to create and edit report definitions and styles for the QuickStep reporting functionality.

Help, CHM documentation

- The context-sensitive help system is embedded in QuickStep. Press the "Help" button or the F1 key to access the help from the graphical user interface.
- The QuickStep API description is a help system describing the classes and files for block development. It is accessible via the Windows "Start" button and the folder "R&S QuickStep > Help and Manuals" or via the QuickStep Help menu.
- Developer documentation (CHM files) of the provided R&S base blocks for reuse of the block functions for the development of 3rd party blocks.

2 Required Hardware, Software and Firmware

Required hardware and operating system

- Standard PC
- Windows 7 as 64 bit version, including service pack 1 and universal C runtime update (KB2999226) or Windows 8.1, Windows 10

Required software

The QuickStep installer includes all required software. That is the QuickStep software itself and environment software such as Microsoft C++ Redistributable Packages, .NET Framework including Developer Pack, and the R&S License Server Manager including the R&S License Server.

Additional and Optional software

If you want to use VISA instruments for your tests or even develop your own QuickStep blocks, then install the related additional software.

Table 2-1: Additional and optional software

Software	Usage
R&S VISA 5.5.5 or higher	VISA communication with test instruments (except for GPIB)
VISA for GPIB instruments provided by the manufacturer	Alternative VISA communication with test instruments for GPIB connections
NI Driver for GPIB-USB-HS adapter	NI USB-GPIB adapter
R&S NRP Toolkit	NRP power meter measurements; includes NRPZ VXI plug&play drivers
SignalCraft Scout Driver	SignalCraft Scout USB to serial / GPIO adapter
Microsoft Visual Studio (Community) for C++/C# (supported versions: 2012, 2013, 2015, 2017; for C++ also 2010)	Integrated development environment for block development

Software	Usage
R&S Forum (supported versions: 3.2.0, 3.3.0)	Editor and runtime environment to create and execute Python scripts, for example for remote control of instruments
Mathworks MATLAB (supported versions: 2016b, 2017a)	Editor and runtime environment to create and execute MATLAB scripts

R&S-VISA and NI-VISA can be installed in parallel. The VISA variant can be selected per connection type (GPIB, Socket, HiSLIP, USB), for example in the RsVisaConfigure tool. R&S VISA does not support GPIB connections.

The optional software is not provided with QuickStep but can be downloaded from the manufacturer's website or is provided together with the test instruments.

For obtaining Visual Studio Community, search for "Visual Studio Community" on https://www.microsoft.com/en-us/download and follow the first link.

Special test instruments may require additional software on the host PC, for example device drivers.

Required firmware on the test instruments

The provided example test applications require certain firmware versions and options of the involved measurement equipment. So, verify that the firmware versions and options on the measurement equipment comply with the requirements given in the release notes.

Refer to the manuals of the measurement equipment on how to check and respectively update the firmware if necessary.

3 Installation and Start

The QuickStep software is provided on the product's USB stick.

3.1 Putting the Smart Card into Operation

The QuickStep software is licensed with a smart card-based licensing system. The smart card in SIM format can be used together with the card reader provided with the QuickStep delivery. Alternatively, the full format smart card can be inserted into a reader connected to, or built into, a PC.

A smart card and a USB smart card reader (USB stick) is provided with the delivery.

Proceed as follows:

1. Break out your smart card.

Figure 3-1: Smart card and USB smart card reader

2. Insert the smart card with the chip facing upwards and the angled corner facing to the USB stick into the USB stick. The USB stick's LED or "Rohde & Schwarz" label is also facing upwards.

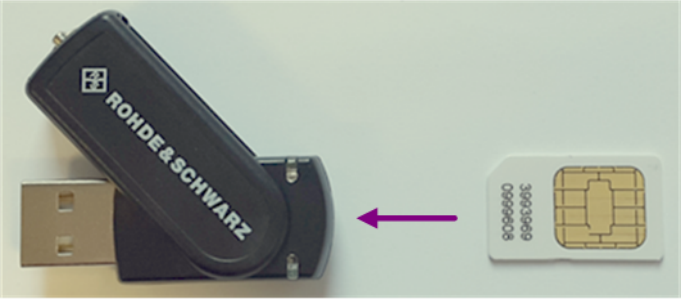

Figure 3-2: Inserting the smart card

3. Push the smart card completely inside the USB smart card reader.

The QuickStep software can now be used together with the USB smart card reader.

3.2 Installing QuickStep

The QuickStep software is provided as `RSQuickStep_[BuildNo].exe` file.

Proceed as follows to install QuickStep on the PC:

1. Copy the `RSQuickStep_[BuildNo].exe` file into a local directory on your PC.
2. Double-click `RSQuickStep_[BuildNo].exe`.
   The installation wizard opens. The dialog includes the license terms and conditions.

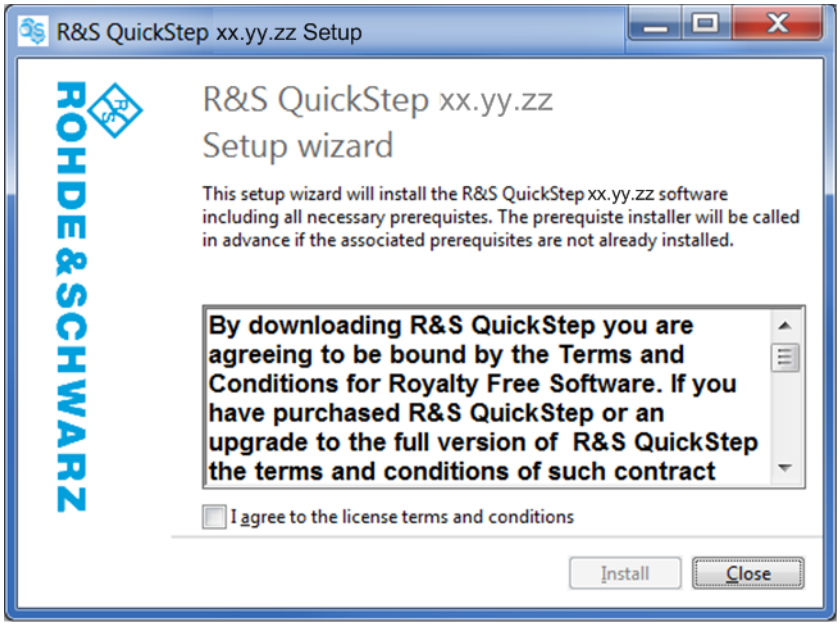

Figure 3-3: Installation wizard

3. Read the license terms and conditions carefully and tick the checkbox at "I agree to the license terms and conditions" if you agree. Then click "Install" to start the installation.
   The installation progress is displayed. The installation comprises QuickStep itself, environmental software and QuickStep applications.
   The "Installation Successfully Completed" report indicates the end of a successfull installation process. Additionally, optional software packages not installed yet are listed (to be installed later if required for your intended usage of QuickStep).
   The installation of the environmental software might require a restart. Click "Restart" in this case to finish the installation.
4. Click "Launch" or "Close".

QuickStep is stored under `C:\Program Files\Rohde-Schwarz\QuickStep\`. The example and user files can be found under `C:\Users\Public\Documents\Rohde-Schwarz\QuickStep`. Depending on the Windows installation this path might vary. Use the links in the "R&S QuickStep" folder in the Windows start menu to determine the exact location.

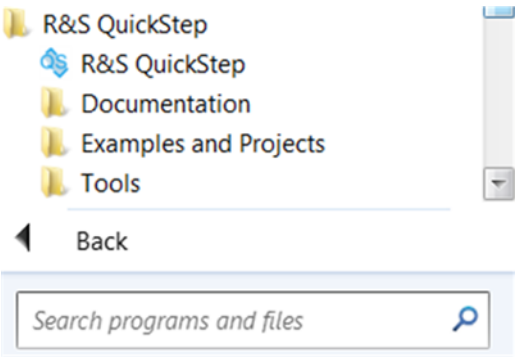

Figure 3-4: QuickStep in the Windows start menu

Separate icons are created on the desktop to directly start QuickStep, the QuickStep Block Development Tool and the QuickStep OTA application.

If Forum 3.2.0 is installed on the PC, QuickStep copies a Python file into the Forum installation directory to enable the QuickStep-Forum integration. This might cause a Windows “User Account-Control” warning depending on the setup of the PC. Administrator rights are required to copy this file.

QuickStep is ready to be started at the PC.

Installation via command line with log file creation

In case of an error during usual installation, try the installation via command line with log file creation:

1. Open a command shell.
2. Navigate to the directory containing the QuickStep `*.exe` installation file.
3. Enter *RSQuickStep_<Version>.exe -log quickstep_installation.log*.
4. If the installation still ends with an error, send the created `quickstep_installation.log` via e-mail to R&S Customer Support to get further help. Use the contact information listed at http://www.customersupport.rohde-schwarz.com.

3.3 Installing Optional Software, Configurations

For installing optional software and configuring the connections to your test instruments, see the QuickStep User Manual.

3.4 Starting QuickStep

Prerequisites:

- QuickStep has been installed on the PC.
- A smart card reader with inserted smart card for QuickStep (providing the required licenses) has been connected with the PC. Connecting the smart card can also be done after start of QuickStep.
- The test instruments and the PC have been connected according to the desired test setup.

Proceed as follows:

1. Start all involved test instruments and devices.
2. Ensure that all test instruments are reachable from the PC.
3. At the PC, start QuickStep with a double-click from the Windows start menu or from the desktop icon.

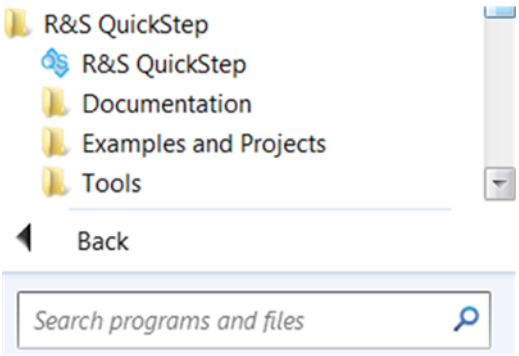

Figure 3-5: QuickStep in the Windows start menu

QuickStep starts up and provides a start dialog.

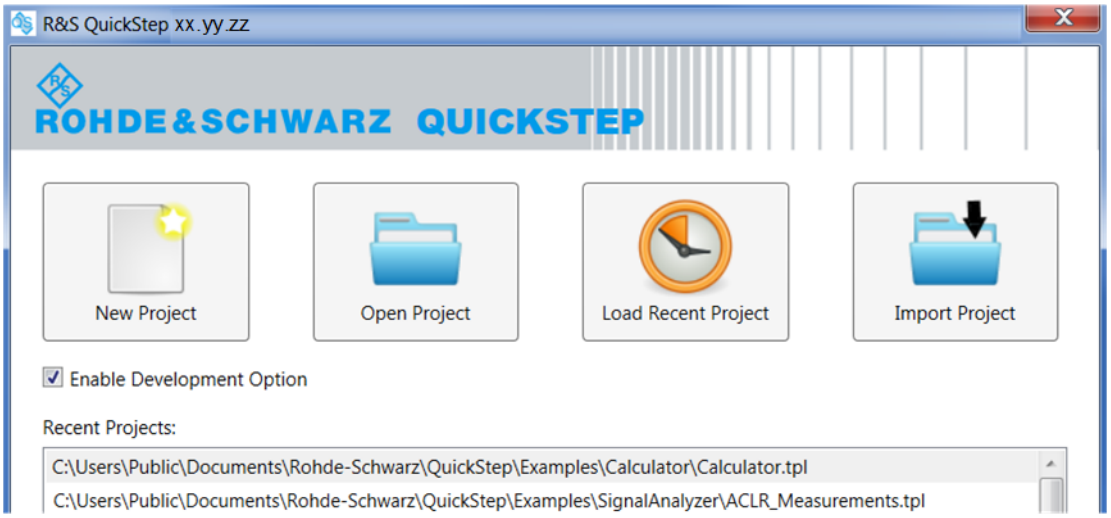

Figure 3-6: Start dialog

If you start the QuickStep OTA ATSCAL application, this start dialog is not shown. Login as user *Operator*. No password is required and the following steps are not relevant.

4. If you do not want QuickStep to occupy an existing QS-DEV license, deactivate the "Enable Development Option". Then, the Test Procedure Editor and the Test Procedure Debugger will not be available.

5. Select one of the project options (for example, "Open Project") or double-click a project from the list of "Recent Projects".
   This selection does not cut the access to other projects. Afterwards, you can change the project or define a new one via the QuickStep "File" menu.

   A license check is performed. Its result is reported in the "Log Viewer".

Recommended next step for beginners

If you are not yet familiar with QuickStep and look for a tutorial, proceed with the training manuals. They are accessible via the Windows "Start" button and the folder "R&S QuickStep > Documentation" or via the Help menu in QuickStep. The training manuals provide step-by-step procedures based on instructive examples.

4 Introduction to QuickStep

This chapter provides a brief overview over QuickStep for a first orientation. The given information is not comprehensive and not represented with full complexity.

4.1 Typical Test Setup

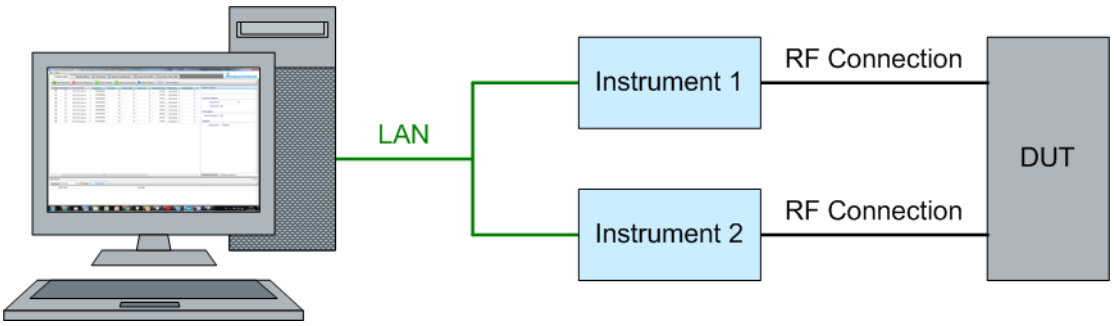

Figure 4-1: Schematic test setup (DUT: Device under Test)

Characteristics:

- QuickStep runs on a PC and controls the test instruments.
- QuickStep basically commands a sequence of test steps where the values of one or several test parameters are varied. The results for each test step are collected and presented within QuickStep.
- Typically, SCPI commands sent over LAN (or GPIB) control the test instruments. Any other remote control interface might be adapted.
- The test instruments can be of any type. Examples are generators, analyzers, power supplies, power sensors, switching devices. The number of used test instruments is not limited.
- One or more test instruments provide test signals as input for the DUT. Vice versa, one or several test instruments gather signals or data from the DUT.

  Examples:

  – A generator instrument provides an RF signal to the DUT. QuickStep defines the properties of the RF signal to be transmitted.

  – An analyzer instrument receives RF signals from the DUT and measures their properties. QuickStep gets the results from the analyzer.

  – A power supply with variable voltage powers the DUT.

4.2 Graphical User Interface

All operational tasks for configuring and executing tests are carried out on the PC. When starting QuickStep, the "QuickStep" window – the graphical user interface (GUI) – opens.

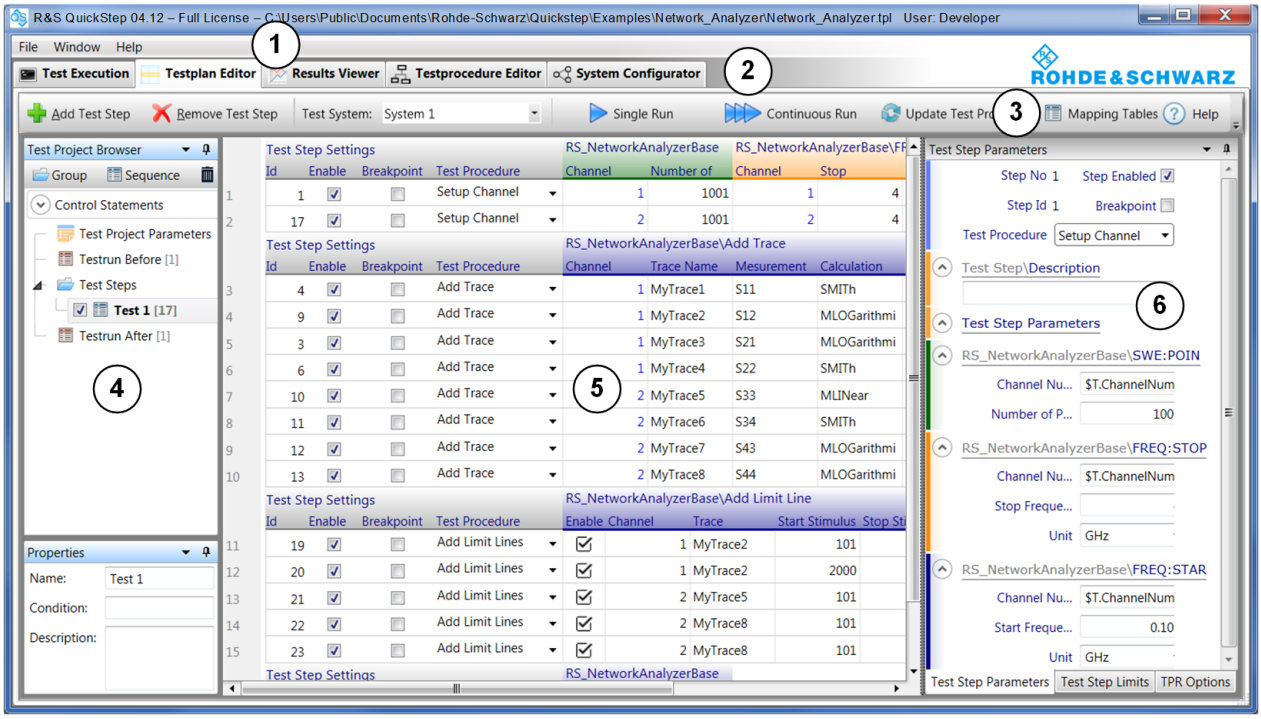

Figure 4-2: GUI overview

1 = Menu bar
2 = Tabs
3 = Toolbar
4 = Navigation / browser / library
5 = Main pane
6 = Secondary pane

The GUI is structured with a menu bar, tabs, a toolbar and several panes. The content to be displayed is distributed in several tabs. The selected tab defines which type of information is displayed in the different panes. See the descriptions below for information on the content for single tabs. The entries in the toolbar also depend on the selected tab.

4.2.1 Test Execution

This view becomes relevant when the current test is executed. You can start the test run and control the test execution.

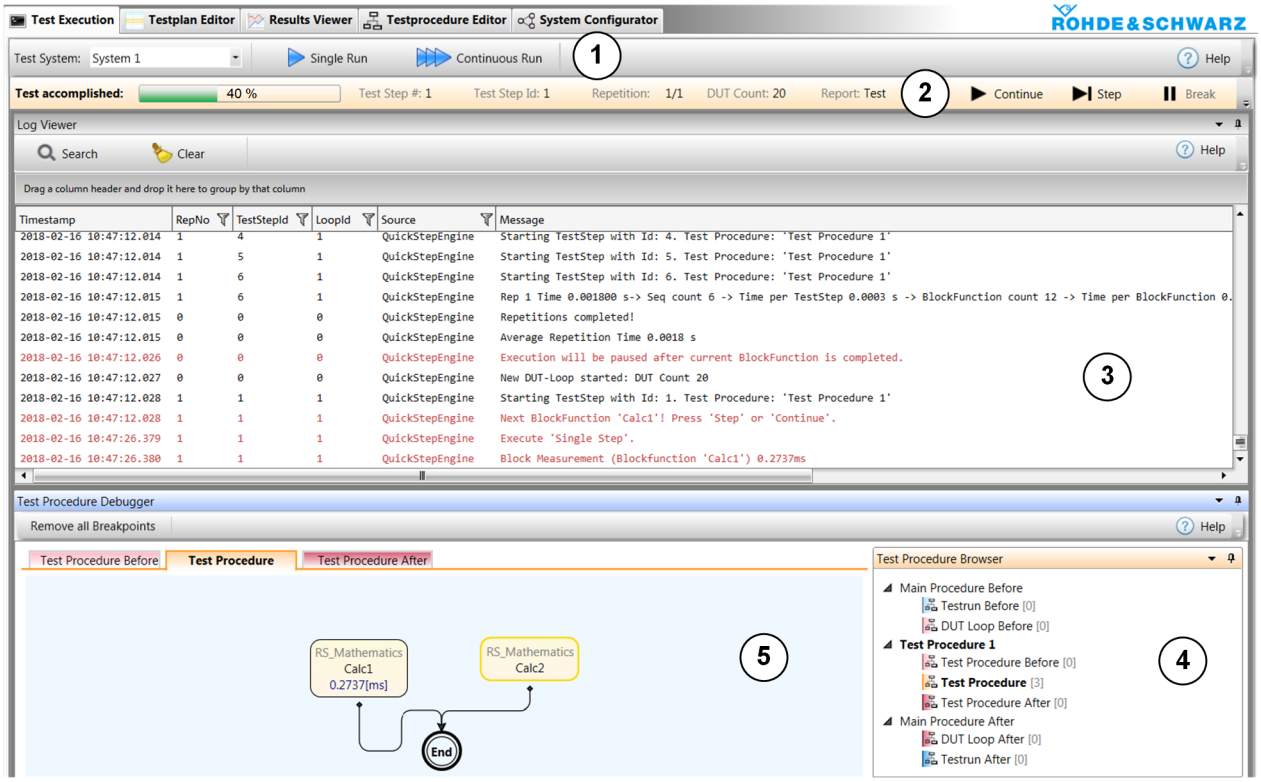

Figure 4-3: Test Execution

1 = Start the test execution
2 = See and control the execution progress
3 = View the logged messages
4 = Select the block function flow chart of interest
5 = Inspect the current block function

Progress bar

The progress bar shows how far the test has been executed. You can control test execution, for example resume test execution after a halt due to a breakpoint in the test plan.

Log Viewer

The Log Viewer protocols the events occurred during operation of QuickStep, particularly after starting the test execution. The messages are color-coded.

Test Procedure Debugger

The "Test Procedure Debugger" allows to check the values of parameters during test run. It includes the Test Procedure Browser from the Test Procedure Editor for selecting the block function diagram that contains the block function of interest.

The debugger works together with the progress bar during test run. You can proceed in the test execution step by step with the "Step" button. If you have defined breakpoints for test steps (to be done in the Testplan Editor) and have clicked the "Continue" button, the test execution is halted at each breakpoint until you click "Continue" again.

4.2.2 Test Plan Editor

The "Test Plan Editor" is the initial view of QuickStep. The user prepares a list of test steps and starts the test execution from the toolbar.

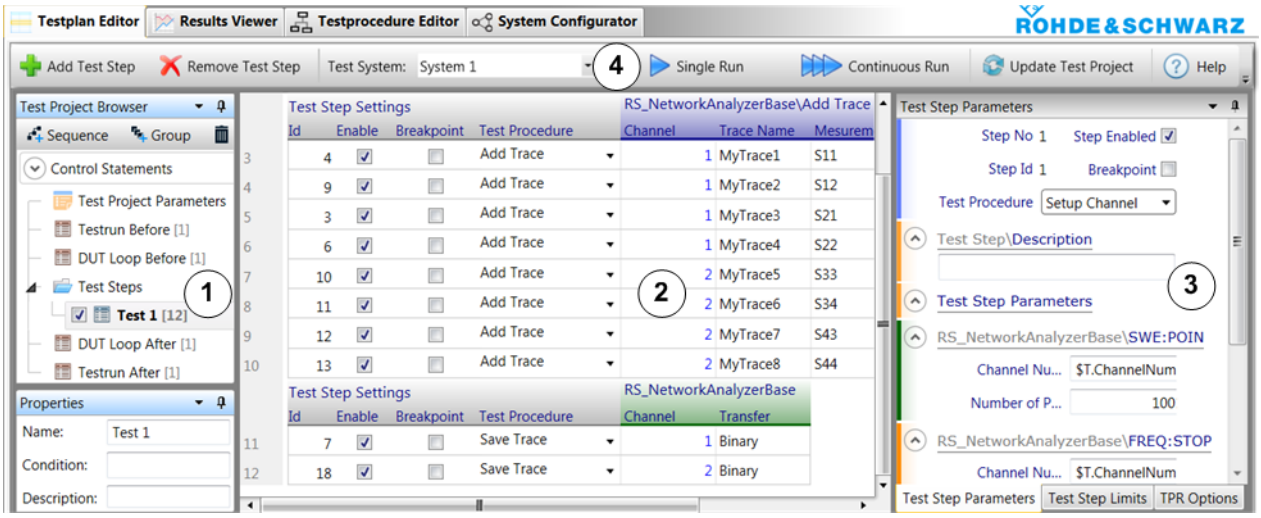

Figure 4-4: Testplan Editor

1 = Select a sequence of test steps (or define groups and sequences)
2 = Inspect and edit the sequence of test steps
3 = Edit parameter values
4 = Start the test plan

Central test step table

In the table, each test step is represented in one row, the columns display the related parameters. Parameter values can directly be edited in the table after a double-click.

Each test step is connected to a test procedure by the entry in the "Test Procedure" column. The parameter set of each test step is dynamically adapted according to the selected test procedure. If test procedure parameters are modified in the test procedure editor, the modifications get effective in the test plan editor after clicking "Update Test Project".

Powerful sweep and set functions allow quick generation of parameter sweeps for efficient parameter setting of multiple test steps. Multi-parameter sweeps might be defined within one single test step. Prioritization might be used to keep control on the order of the parameter sweeps within nested loops.

Panes on the right-hand side

In the "Test Step Parameters" tab, the parameters of a test step are displayed in vertical order for a better overview and providing a more convenient way to edit parameters without scrolling. The "TPR Options" tab contains parameters for the whole test, for example repetitions. The "Test Step Limits" tab shows the configured limits for measurement results.

Regarding test development, various settings for logging and debugging are offered. Breakpoints for debugging and single-step execution can be enabled for specific test steps.

Test Project Browser on the left-hand side

Multiple test step parameter tables are organized in a tree structure for keeping an overview of large tests. Control structures can be applied to sequences of test steps, their parameters are configured in the right pane. "Test Project Parameters" contains static and dynamic global parameters to be configured in the middle pane.

4.2.3 Results Viewer

The results of a test run are displayed in the "Results Viewer".

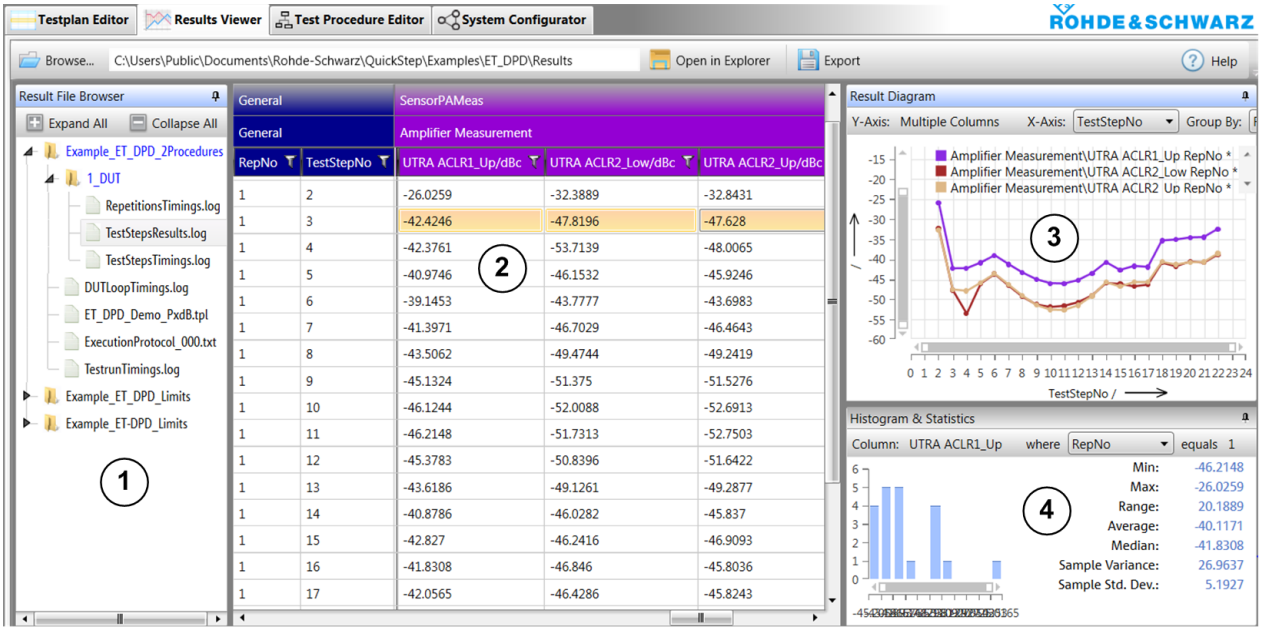

Figure 4-5: Results Viewer

1 = Select a result file
2 = Inspect the result table and select one or more result columns
3 = Inspect the diagram representation of the results for the selected column(s)
4 = Inspect the distribution of result values and check the statistical evaluation

Results File Browser on the left-hand side

The "Result File Browser" helps to keep an overview of large sets of result data. Each test run generates a new time-stamped folder with a complete set of result files with measurement and timing results as comma-separated value (CSV) files. For each DUT, a separate subfolder is created. If results of the type trace are generated, these are also collected in a DUT-specific subfolder. Additionally, a copy of the test plan and the execution log is stored as a reference.

When selecting a result file in the Result File Browser, its content is shown as table in the central area. `TestStepsResults.log` is the main result file containing the results for each test step. `ExecutionProtocol ... .txt` contains all logged messages with timestamp and origin.

Central Results Table

The central "Results Table" shows the results in a table. In case `TestStepsResults.log` has been selected, each test step is presented in one row and each result parameter in one column. If one or several result parameters

in the results table are selected, the results over the test steps (or other configurable running variables) are represented in the diagram on the right-hand side.

Each column of the table offers powerful sort and filter functions. An export filter makes it possible to export a subset of the table as CSV or XLS file. In case the table shows the content of the execution protocol, it is possible to export and reuse SCPI sequences within other test environments (for example).

Analysis panes on the right-hand side

The "Diagram" pane plots the data of a single or multiple columns that are selected within the result table. Scatter plots are possible, since any result parameter can be selected for the x-axis of the plot. Results can be assigned to color-coded groups by selecting an additional grouping parameter. Delta markers are available for measurements.

If results of the trace type are selected, an adopted diagram pane is available. Traces files can also be loaded directly into the central results table and displayed with the standard results viewer. Zoom in and out is supported by mouse click, mouse wheel and diagram bars.

The "Histogram & Statistics" pane provides a histogram pane and statistical analysis of the result data that is selected within the result table.

4.2.4 Test Procedure Editor

A test procedure basically defines what functionality is executed when the test steps connected to the test procedure are carried out. It is set up as flowchart with a graphical editor, based on a library of provided functions or user-developed functions.

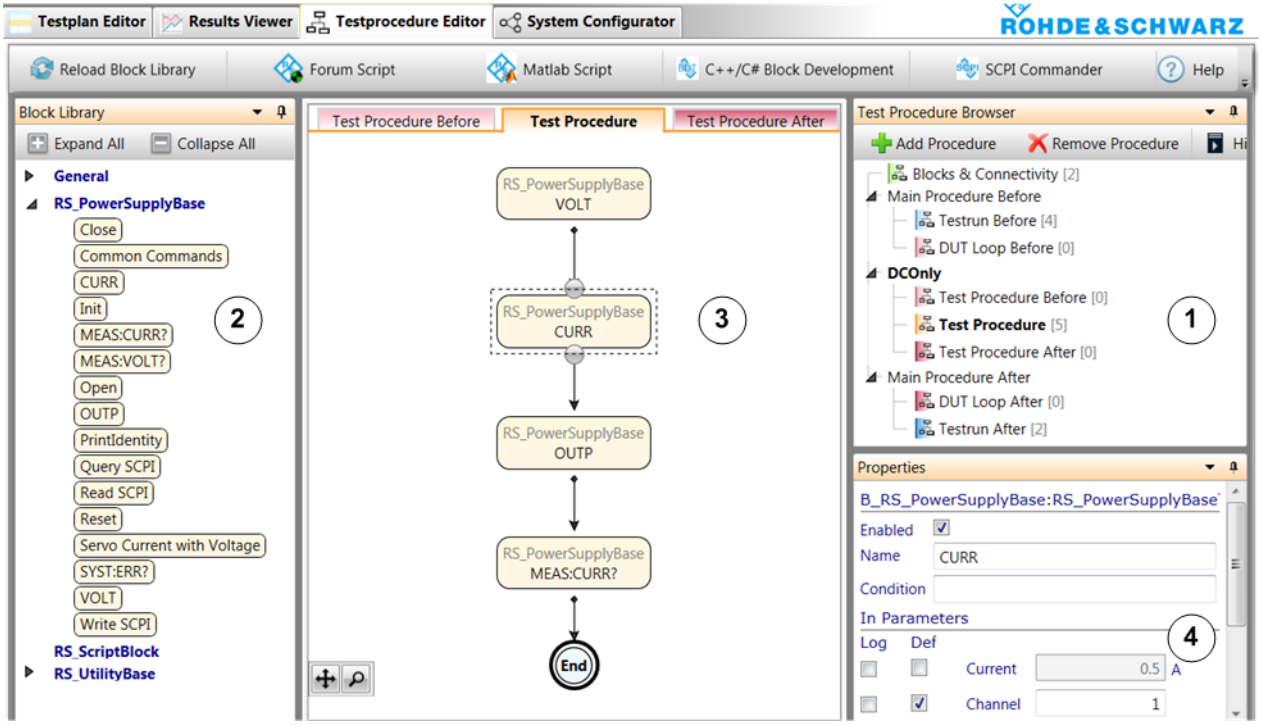

Figure 4-6: Test Procedure Editor

1 = Select an execution phase
2 = Drag a new block function into the main pane
3 = Select block functions, add block function dependencies, select a block function
4 = Edit the parameters of the selected block function

Control elements such as "If", "Or", “Fork” and “Join” are available to handle execution branches and loops. Conditions achieve a conditional execution of test functions. All test function parameters can be made available for test parameterization within the test plan editor. Existing test procedures can be modified or extended without source code development.

The toolbar provides access to tools for developing blocks, handling SCPI commands for connected test instruments, designing reports and integrating scripts.

4.2.5 System Configurator

The "System Configurator" reflects the test setup and can be used for setting the device- and connection-specific parameters as occurring with the test setup.

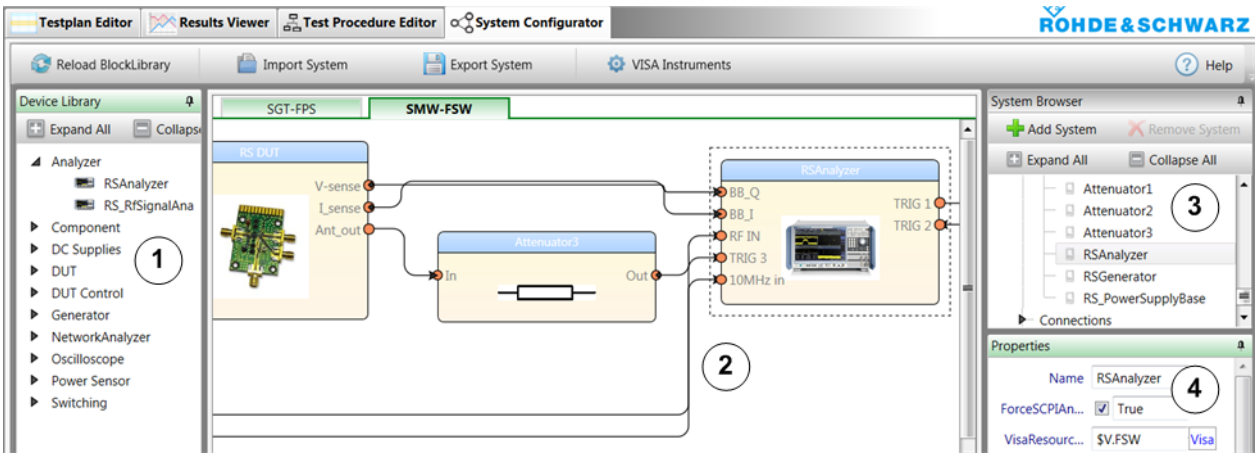

Figure 4-7: System Configurator

1 = Drag a symbol into the main area
2 = Connect the symbols
3 = Select an element
4 = Edit the properties (parameters) of the selected element

The main pane displays the used devices (test instruments, components, even attenuators) and connections. You drag devices from the "Device Library" on the left pane into the main pane. Then you draw connections between the devices. On the right side in the "Properties" pane, you can see and edit the properties of the currently activated device.

The system configurator facilitates the handling of several use cases:

- Assistance for building up a VISA connection to a test instrument.
- Automatic calculation of the RF path loss during test execution. Attenuations/ losses for individual components of the system are defined, then one or more connections and system components are assigned to an RF path.
- Easy switching between several test benches. Therefore, the system configuration contains the configuration for each of them.
- Management of system-dependent parameters like connection IDs.

4.2.6 OTA ATSCAL

The "OTA ATSCAL" view provides a comprehensive GUI for measuring the radio transmission characteristics of RF components like antennas including the calibration.

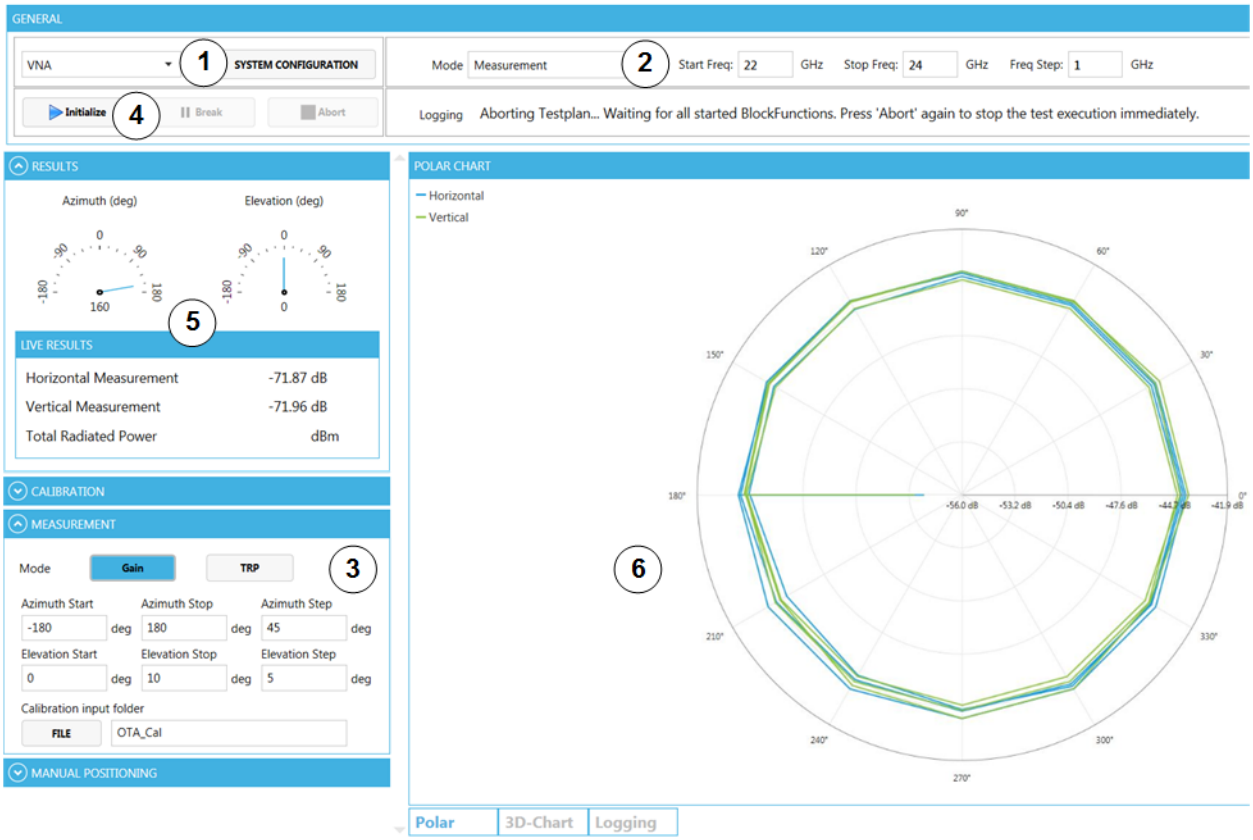

Figure 4-8: OTA view

1 = Select the used test instruments and configure the test system
2 = Set the frequency range and frequency increment, select the operating mode, for example "Measurement"
3 = Set the measurement angles and the measured quantity
4 = Initiate, continue or stop the measurement
5 = See the current angles and the live results
6 = Inspect the measurement results in a chart

4.3 Block Function Development

The Block Development Tool is provided for defining new test blocks, test functions and the associated function parameters. Based on these definitions, Microsoft Visual Studio C++ or C# projects with source code templates are automatically generated. The templates just have to be extended with user code in order to create user-specific test functions. The newly developed test functions are available in the test procedure editor after compilation.

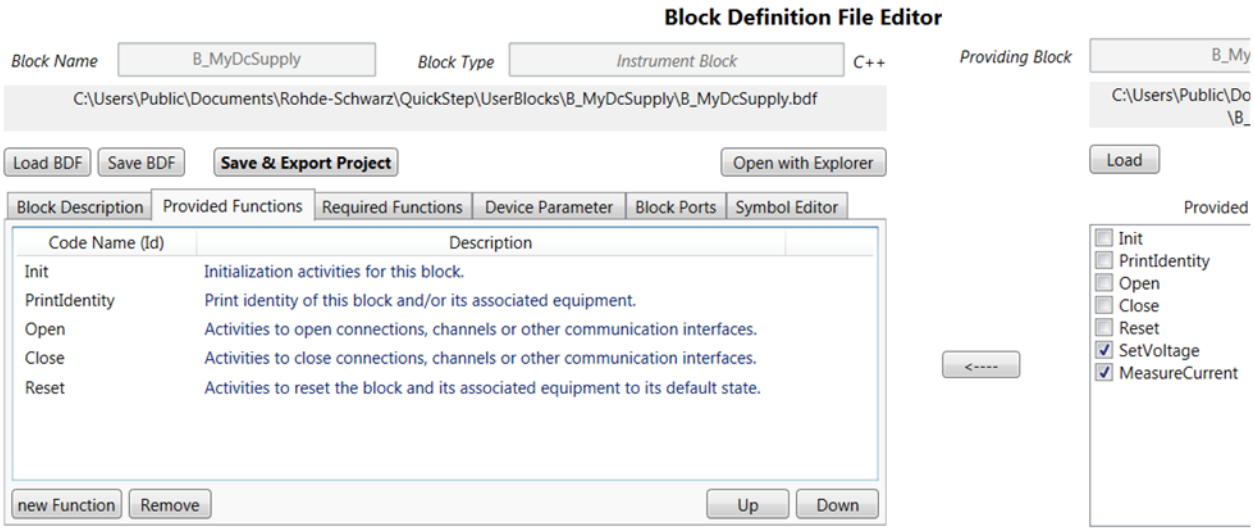

Figure 4-9: Main section of the Block Development Tool

The QuickStep API (application programmer interface) offers a set of functions for data exchange with other functions and logging of results. Even users with limited software development experience can implement new test functions with just a few lines of code. Development experts can exploit all capabilities of Visual Studio for development of complex test functions.