R&S[®]ZNrun Vector Network Analyzer Automation Suite User Manual







Make ideas real



This manual describes the R&S®ZNrun application software and related options:

- R&S[®]ZNRUN-K1, automated test software for VNAs (1326.7124.02)
- R&S[®]ZNRUN-K2, multi-client capability (1326.7130.02)
- R&S[®]ZNRUN-K5, DUT/VNA multiplicity (1334.4250.02)
- R&S[®]ZNRUN-K6, measurement tuning capability (1334.4237.02)
- R&S[®]ZNPC, license dongle (1325.6601.02)
- R&S[®]ZNPC-LS, license dongle PC software for floating license (1325.6601.03)

© 2021 Rohde & Schwarz GmbH & Co. KG Mühldorfstr. 15, 81671 München, Germany Phone: +49 89 41 29 - 0 Email: info@rohde-schwarz.com Internet: www.rohde-schwarz.com Subject to change – data without tolerance limits is not binding. R&S[®] is a registered trademark of Rohde & Schwarz GmbH & Co. KG. Trade names are trademarks of the owners.

1176.9906.02 | Version 07 | R&S®ZNrun

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

Contents

1	Introduction	5
2	Getting Started	7
3	Application Overview	.11
4	ZNrun Workbench	. 15
5	ZNrun Calibration Client	.61
6	ZNrun Measurement Client	69
	Glossary: Frequently used terms	.71

1 Introduction

R&S ZNrun is a PC-based software suite for the definition, configuration and execution of automated VNA tests. It controls the involved measurement devices (VNAs, switch matrices, calibration units) and supports many Rohde & Schwarz instruments. A plugin interface is provided to control additional measurement equipment and devices under test via VISA connections.

R&S ZNrun stands for modularity, extensibility, compatibility and optimized speed of measurement execution. Therefore it is ideal for use in high volume production of multiport devices requiring control during test, e.g. for testing the RF properties in various operating states.

Setting up R&S ZNrun for testing is as simple as describing the test setup (test equipment, DUTs) and defining the test sequence. Configurations are modular and reusable and therefore minimize your configuration time. Based on the configuration, R&S ZNrun calculates a connection plan, which is optimized for both quality and measurement speed. It also calculates an initialization sequence, calibration plan and a speed-optimized test plan. At execution time, R&S ZNrun verifies that the measurement can be performed with the connected measurement equipment.

R&S ZNrun comes with the following applications:

• ZNrun Server

The core of the software suite. Runs and manages Measurement Execution Units (MEUs). A plug-in interface enables user-defined extensions, such as custom devices and post processors. See Chapter 3, "Application Overview", on page 11.

ZNrun Workbench

The main graphical user interface (GUI) of R&S ZNrun. Allows you to develop, test and tune a MEU, before it is used in the production field. Deploys the MEU to a ZNrun Server and communicates with the server during MEU execution. Integrates or gives access to the other R&S ZNrun applications (ZNrun Calibration Client, ZNrun Measurement Client, ZNrun Visualization Client). See Chapter 4, "ZNrun Workbench", on page 15.

ZNrun Calibration Client

A GUI application for guiding a technician through all the steps of the calibration process. For laboratory use, it offers a more advanced interface, which allows definition of user-defined calibration tasks. See Chapter 5, "ZNrun Calibration Client", on page 61.

• ZNrun Measurement Client

An application for controlling the execution of a MEU on a ZNrun Server. Provides a graphical and a remote control interface (SCPI commands). A plug-in interface enables user-defined extensions, such as the creation of custom log files and reports. See Chapter 6, "ZNrun Measurement Client", on page 69.

ZNrun Visualization Client

The ZNrun Visualization Client allows you to visualize and document measurement results. It is available as a stand-alone application and integrated in the ZNrun Workbench. See Chapter 4.5.2, "Visualization Workspace", on page 55.

2 Getting Started

2.1 Installation

R&S ZNrun can be installed on a single PC running Windows 10 (32-bit or 64-bit). A full installation requires up to 600 Mbyte available disk space for the 32-bit, and up to 1.5 Gbyte for the 64-bit installation.

The installer must be run with administrative privileges and possibly finishes with a reboot. The following components are automatically installed, if not already present on the target PC:

- .NET Framework 4.7.2
- R&S VISA library (32-bit or 64-bit), the Rohde & Schwarz implementation of the VISA I/O API
- R&S License Server software

The following features are offered for installation:

∄ R&S ZNrun 2.2x Se	tup				-		×						
Custom Setup Select the way you want features to be installed.													
Click the icons in the tree below to change the way features will be installed.													
Image: Second	erver ion Client ation Client nch tes (Examples) VNA Control Python Plug-in Report Generator Plug-in Plug-ins		This feat hard driv	ure requ e.	ires 50M	1B on you	ır						
Location:	C: \Program Files (x86) \Roh	de-Sd	hwarz\ZNr	un\2.2x		B <u>r</u> owse							
Reget Disk Usage			<u>B</u> ack	<u>N</u> e	xt	Cano	el						

- "ZNrun Server", "Calibration Client", "Measurement Client", "Visualization Client", "Workbench": see Chapter 1, "Introduction", on page 5
- "Templates (Examples)": R&S ZNrun also provides a rich application programming interface for the creation of custom plug-ins and clients. To get you started with this API, examples are provided as a Visual Studio 2017 solution. The template examples are installed at

C:\ProgramData\Rohde-Schwarz\ZNrun\2.30x\Resources\Templates.

"Multiple VNA Control": currently not supported

- "Generic Python Plugin": enables Python scripting of ZNrun Server plug-ins.
- "Generic Report Generator Plugin": allows a plugin developer to create PDF reports from a plugin
- "Default Plug-ins": Currently only comprises a single plug-in for the ZNrun Measurement Client. Its source code is included in the "Templates (Examples)" installer feature.

Note that the provided plug-ins are not part of the regular software maintenance.

For development of custom device or post-processor plugins, you need Microsoft Visual Studio 2017 or higher.

2.2 Running Your First Measurement

Before running your first measurement (using a single VNA), make sure the ZNrun Server machine can access VNA via remote control, using communication interfaces such as LAN, USB, or GPIB. If peripheral devices (calibration units, switch matrices, ...) are also needed, connect them to the VNA.

To run your first measurement on real hardware, perform the following steps:

- Start the ZNrun Server: select "R&S ZNrun 2.30 > ZNrun Server" from the Windows Start menu.
- Run the ZNrun Workbench: select "R&S ZNrun 2.30" > "ZNrun Workbench" from the Windows start menu. The ZNrun Workbench allows you to create a ZNrun project.
- 3. Click the "Start" button in the main toolbar of the ZNrun Workbench to trigger the following actions:
 - a) The workbench sends the project to the server. If the project is valid, the server creates a "Measurement Execution Unit" (MEU) from it.
 - b) The server executes the first measurement cycle.

To run a measurement, a ZNrun Server with a valid license R&S ZNRUN-K1 is required. The license is contained in the Licensing and must be installed on the same machine where the ZNrun Server runs.

2.3 Licensing

Running the ZNrun Server requires a valid core license R&S ZNRUN-K1, and, depending on the desired features, additional licenses for options R&S ZNRUN-K2 etc.

Licenses are available as local and floating variants.

• Local licenses must be available on the ZNrun Server.

• **Floating** licenses can also reside on remote license servers that can be reached by the ZNrun Server's license server via LAN.

R&S ZNPC license dongle

R&S ZNRUN licenses "live" on dedicated R&S ZNPC IC chips that are delivered as a smart card and a USB dongle. You can either use the smart card with a smart card reader, or remove the license chip and insert it into the USB dongle.



Figure 2-1: R&S ZNPC license dongle

In any case, the license chip must be properly detected by the license server instance on the PC it is physically connected to. Make sure the RSSmartCardService driver is installed, when the smart card or dongle is connected to this PC for the first time.

R&S License Server

The R&S License Server is used for option management on a PC, device or server. It supports:

- parallel usage of local dongles by multiple applications ("shared access")
- license verification via LAN, using https connections to central license servers with floating licenses

If the ZNrun Server complains about missing licenses, run the R&S License Server Manager browser app from the Windows start menu of the ZNrun Server PC ("Start" > "R&S License Server" > "R&S License Server Manager"). Make sure the required R&S ZNPC licenses are visible in the "Licenses" tab.

R&S License Server 1.25.1 - mu74152	Arsint.net			() About	() Help
License providers **	C C A A	ootprint			**
ZNPC (100019)	III To Designation	To License type	To Count	T¢ Status	
License Server: mu741527.rsint.net (1.25.1)	ZNRUN-K1 - ZNRUN-K1 Automated Test SW VNA	permanent	1	0	
ZNPC (900015) Device ID: 1325.6601K02-900015-eq	ZNRUN-K2 - ZNRUN-K2 Multiclient capability for K1	permanent	1	9	
License Server: mu741527.rs <mark>int.n</mark> et (1.25.1)	ZNRUN-K3 - ZNRUN-K3 Graph Viewer ZNrun	permanent	1	0	
	Showing 3 of 3 licenses.				

If you want to use local licenses but no local licenses are visible, verify that the smart card or license dongle is properly inserted into the smart card reader or USB port of the ZNrun Server PC, respectively. If a license dongle is used, make sure that the IC chip is fully inserted into the dongle (see Figure 2-1).

If you want to use floating licenses, make sure to define one or more remote floating license servers in the license server manager of the ZNrun Server PC and check their connection state.

R&S License Server 1.25.1 - mu741527.rsint.	net						① ③ About Help
PLicenses Analytics PConfiguration							
Configuration **	C + II Refresh Add Remove					Lest d	pdate (UTC): 2021-01-27 14:04:43
Local license server	🖽 🏷 Hostname	To Server version	₹ IP address	To Port	To Readonly	To Description	Te Connection state
The store Barrara series	amu818.rsint.net	1.26.1	10.0.2.220	9443		Central License Server 01	0
 Floating license servers 	amu819.rsint.net	1.26.1	10.0.2.221	9443		Central License Server 02	Serve and a server and a server a ser
Product definitions	Showing 2 of 2 items.	nists-philip	din 10	i deres		i kan	



For more information, see the R&S License Server help, which can be opened from the "Help" icon in the top right corner of the R&S License Server Manager pages.

3 Application Overview

The R&S ZNrun software suite consists of a central server component (ZNrun Server) and a set of client applications (ZNrun Workbench, ZNrun Calibration Client, ZNrun Measurement Client, ZNrun Visualization Client). See Chapter 1, "Introduction", on page 5.



3.1 Client-Server Architecture

The **ZNrun Server** manages the communication with the measurement instruments and the DUT. Rohde & Schwarz instruments are controlled via VISA and/or proprietary USB protocols. Additional test equipment and DUTs can be controlled via VISA or the RFFE/GPIO ports of the R&S ZNA, R&S ZNB or R&S ZNBT. Any type of hardware or software interface can be integrated with R&S ZNrun via the plug-in interface.

The **ZNrun Workbench** allows you to create ZNrun project files, which, when deployed to the ZNrun Server, define one or more server-side Measurement Execution Units (MEUs).

Before starting the actual measurement, the involved vector network analyzers have to be calibrated for full system error correction and/or absolute power level correctness. For this purpose, the R&S ZNrun provides the **ZNrun Calibration Client**, a simple graphical user interface, suitable for guiding a technician through the required calibration steps. For laboratory use, it offers an advanced interface that allows to define custom calibration tasks.

The **ZNrun Measurement Client** allows you to connect to a Measurement Execution Unit that was previously uploaded to the ZNrun Server. It provides a graphical user interface for measurement execution. It shows a stop watch timer that is synchronized with the measurements, which makes it easy to measure the execution time of measurement cycles or single steps. The measurements steps can be performed without interruption – in a so called measurement cycle – or step by step. It is also possible to execute several measurement cycles in succession. Measurement results are written to the hard disk on-the-fly.



It can take some seconds until all parameters have been uploaded to the devices and all communication paths have been tested. However, this upload is done only once: all following measurements require a minimum amount of setup time.

3.2 ZNrun Server

The ZNrun Server can accommodate multiple Measurement Execution Units, but with option R&S ZNrun-K1 alone you can only run one at a time. For parallel execution of multiple Measurement Execution Units, you need option R&S ZNrun-K2.

In addition to VISA, the server can communicate over arbitrary communication interfaces via plug-ins. Plug-ins allow external hardware (such as DUTs and 3rd party measurement equipment) to be synchronized with measurements.



Figure 3-1: ZNrun Server with two Measurement Execution Units

3.3 DUT-Centric Approach

The DUT and its measurements represent the core of the R&S ZNrun data model ("DUT Measurement Plan").

Typically, DUTs are implemented as "system on a chip" and do not support coaxial connectors. Such a DUT comprises several logical ports that are connected to physical ports using a measurement adapter. The measurement devices can be connected toe the physical ports of the measurement adapter.



Figure 3-2: DUT model

The DUT Measurement Plan defines the parameters to be measured at or between certain logical ports. It also defines how the measurement is done, e.g. it describes the stimuli the VNA provides during the measurement.

At certain points in time during a measurement sequence, the ZNrun Server possibly needs to interact with the DUT to change its operating state. The DUT Measurement Plan defines those interactions using "DUT State Switches" or plug-ins.

3.4 ZNrun Project Files

A ZNrun project file is an XML file (with root element Project), containing one or more MeasurementExecutionUnit XML elements.

Each MeasurementExecutionUnit element describes an executable measurement task on the ZNrun Server. It comprises three main child elements:

- a MeasurementDevicesPlan element, describing the measurement equipment configuration
- a DutMeasurementPlan element, describing the DUT, the measurement adapter (test fixture), and the measurement parameters

- an optional ConnectionPlan element describing the physical connections between measurement devices and measurement adapter. Normally, the ConnectionPlan is calculated on the ZNrun server as part of the optimization process, but it can also be specified explicitly
- Q
- The structure of the XML files is defined in various XML schema files that can be found at <ZNrun InstallDir>\Server\Schemas.
- The ZNrun Workbench creates ZNrun projects that contain only a single MeasurementExecutionUnit. Its child elements (MeasurementDevicesPlan, DutMeasurementPlan, ConnectionPlan, ...) are distributed to separate files, which makes it easier to reuse them in other ZNrun projects.

4 ZNrun Workbench

The ZNrun Workbench application provides the main graphical user interface (GUI) of R&S ZNrun. It can be used to develop, test and tune a Measurement Execution Unit (MEU) before it is used in the production field. Furthermore, it gives convenient access to the other client applications (ZNrun Calibration Client, ZNrun Measurement Client, ZNrun Visualization Client).

The ZNrun Workbench supports the two core features of the R&S ZNrun application:

- **Multiplicity** (with option R&S ZNrun-K5)
 - DUT multiplicity

A key feature of the ZNrun Workbench is DUT multiplicity. The ZNrun Workbench natively supports the configuration of measurements on multiple DUTs.

- VNA multiplicity
 The ZNrun Workbench also supports the configuration and execution of a MEU with multiple vector network analyzers.
- **Tuning** (with option R&S ZNrun-K6)

Tuning is a special feature of the R&S ZNrun framework. It can be used to change and optimize the configuration of a MEU during the execution to maximize the use of the measurement. Furthermore, tuning comes with three tools to enhance the capabilities of the configuration of a MEU with the ZNrun Workbench: "Save Changes", "Create Snapshot", and "Recall Snapshot".

Additionally you can use the ZNrun Workbench to roll out a MEU to multiple test stations.

Workflow

The workflow with the ZNrun Workbench is separated into five phases:



Figure 4-1: ZNrun Workbench workflow

•	Application Overview	.15
•	Getting Started	.25
•	Configuration Phase	.26
•	Calibration Phase	.54
•	Execution and Visualization Phase	.54
•	Rollout Phase	.56

4.1 Application Overview

The ZNrun Workbench is the central graphical user interface to start and control the components of the R&S ZNrun. The same layout is used for all application phases.

Application Overview

				-	
ZNrun Workbench			_		\times
	ļ 🎝 į 🔤 1				
		View			
2	3		4		
_	_				
Message Log				~	դ
Type T Message					T
	5				
	6				

Figure 4-2: Overview of the ZNrun Workbench layout

- 1 = Main toolbar
- 2 = "DUT Center" panel
- 3 = Workspace
- 4 = "View" panel
- 5 = Log panel
- 6 = Status bar

4.1.1 Main Toolbar

The main toolbar contains the controls to configure and execute a Measurement Execution Unit (MEU). It allows you to start the calibration client, see Chapter 4.4, "Calibration Phase", on page 54, and the visualization client, see Chapter 4.5, "Execution and Visualization Phase", on page 54.

In the configuration phase, the main toolbar has four functional tool groups:

Table 4-1: Main toolbar actions in configuration phase

Group	lcon	Name	Action
Basic commands		New	Creates a MEU configuration with the ZNrun Workbench data structure.
		Open workbench file	Loads an existing MEU configuration from a ZNrun Workbench data structure.
		Open ZNrun project	Loads the data structure from an existing R&S ZNrun project.

Group	Icon	Name	Action				
		Save	Saves all changes to the working ZNrun Work- bench file system.				
		Save as	Saves the MEU configuration in the ZNrun Work- bench file system format.				
	\$_	Validate	Validates the MEU configuration				
Import tools	\checkmark	Import stimuli	Stimuli can be imported from XML files contain- ing valid DutMeasurementPlan serializations. For details, see Chapter 4.3.3, "Import Stimuli",				
			on page 52.				
Execution tools	→]	Go to execution	Switches to the execution phase (see Chap- ter 4.5, "Execution and Visualization Phase", on page 54 for details).				
	Ċ,̈́́	Repeat	Activates the continuous loop of the measure- ment cycle.				
		Start	Switches to the execution phase and starts the measurement cycle.				
Rollout tools	*	Go to rollout	Switches to the rollout phase (see Chapter 4.6, "Rollout Phase", on page 56 for details)				
Settings tools	++ ++	Activate tuning	Activates the tuning in the execution phase (see Chapter 4.5.1.1, "Tuning", on page 55 for details).				
	*	Settings	Launches the "Settings" dialog (Chapter 4.1.7, "Options", on page 23)				
	1 1 1	DUT-related calibration	Launches the calibration client (see Chapter 4.4, "Calibration Phase", on page 54)				
	16	Launch visualization client	Launches the visualization client (see Chap- ter 4.5.2, "Visualization Workspace", on page 55)				

In the execution phase, the main toolbar also has four functional groups:

Table 4-2: Main toolbar actions in execution phase

Group		Name	Action
Settings tools	ţt+	Activate tuning	Activates tuning (see Chapter 4.5.1.1, "Tuning", on page 55 for details).
			Once tuning is activated, it cannot be deactiva- ted unless you leave the execution phase.
	*	Settings	Launches the "Settings" dialog (Chapter 4.1.7, "Options", on page 23)
	16	Launch visualization client	Launches the visualization client (see Chap- ter 4.5.2, "Visualization Workspace", on page 55)
Execution tools	[→	Leave	Leaves the execution phase and returns to the configuration phase.
	Ċ,	Repeat	Activates or deactivates the continuous loop of the measurement cycle.
		Start	Starts the execution of the measurement cycle.
		Step	Performs one step in the measurement cycle.
	\bigcirc	Abort	Aborts the running execution of the measure- ment cycle.
		Log cycle execution	Logs the execution of one complete cycle to a log file on the system.
	⋇	Show connections (PDF)	Shows the connection plan of the current MEU in your PDF file viewer.
Tuning tools		Save	Saves the changed configuration to the ZNrun Workbench data structure.
	Ō	Create snapshot	Saves a temporary copy of the current configura- tion. If a changed configuration is saved, the snapshot is deleted.
	$\frac{e^{i_1+i_2}}{e_{i_1}e^{i_2}}$	Recall snapshot	Loads the configuration of the snapshot. If no snapshot exists, the original configuration is loaded.
Visualization tools	5	Add new visualization	Adds a new visualization workspace in the work- space area.

Group		Name	Action
	Ī	Remove	Drag and drop charts from the visualization workspace to the bin to remove charts.
	All 🗸	DUT selection	Choose a DUT index from the dropdown menu. If a new graph is created in the workspace, only the measurements related to the DUT index are displayed.

Table 4-3: Main toolbar actions in rollout phase

Group		Name	Action
Settings tools	*	Settings	Launches the "Settings" dialog (Chapter 4.1.7, "Options", on page 23)
Rollout tools		Leave rollout	Leaves the rollout phase and returns to the con- figuration phase.
	R	Generate projects	Generates MEUs from the master MEU and the test stations according to your rollout plan.
	0 0	Roll out	Rolls out generated MEUs to their dedicated test stations.
	\bigcirc	Abort	Aborts queued packages to be rolled out.
		Log rollout status	Logs the status of current rollout session to a log file on the file system.
		Overwrite	Activates or deactivates whether or not existing generated MEUs shall be overwritten during "Generate projects".

4.1.2 DUT Center

The "DUT Center" displays the measurement cycle with all its measurement paths. You can select between two different representations:

 "Structured Shape": Visualization of the measurement cycle in a tree-like structure. For every element (sequential context, parallel context, or step) a breakpoint for the execution phase of the whole measurement cycle can be set or deleted from the context menu. If a breakpoint is set, a red dot is displayed on the right of the specific element.



In the example above, a breakpoint is set for StimulusPortgroupMeasurement "SPM1_Spara".

• "Flattened Shape": Flat outline of all measurements currently available. All measurements used in the measurement cycle are grayed out. Every measurement can be released (i.e. excluded) from the measurement cycle with the right click context menu.



In the example above, measurement paths "MP_IN2_0_5" and "MP_IN2_VSWRA_0_6" are released.

Hovering over a measurement path displays additional information. In the configuration phase, the port group, stimulus and switch & state are shown. In the execution phase, a short notation for the measurement parameter, the destination port, and the source port are shown.

4.1.3 Workspace

The main window area is reserved for the configuration of the MEU or for the visualization of measurements. Each configuration group can be displayed in the workspace as a separate tab. In the top half of each tab, a list overview of all configurations is shown. In the bottom half, a more detailed configuration of each list element is displayed. See section Chapter 4.3.2, "Expert Mode", on page 30 for a detailed explanation of all configuration capabilities.

All tabs in the workspace are floatable and dockable.

Measurement Paths	Measurement Paths DUT Ports Port Map Stimuli Measurement Cycle X																
DUT Number of Parallel Measurements 2 × ∧ Use Power Waves default ×												=		•			
Name T	Source Port T	Destination P	ort 🔻 Po	ort Group 🔻	Meas. Parameter	T	Format	T	Stimulus	T	Limit Lines	•	AGC Configuration T	Switch &	State	T	
MP001	LP001	LP001	PG	3001	Sss		DB_MAG		Stimulus001								×
MP002	LP003	LP004	PG	3001	Sss		DB_MAG		Stimulus002								×
MP003	LP001	LP001	PG	3001	Sss		SMITH		Stimulus003								x
MP004	LP001	LP002	PG	3001	Sss		DB_MAG		Stimulus003								×
Details																	
Path Ports Stimulus	Limit Lines Switch & S	State															
Name			Meas. Parame	eter			Kind					Forma	t				
MP001			Sss				ADVANCED					DB_M/	AG				

Figure 4-3: Populated workspace

4.1.4 Configuration View

The "Configuration View" is the main tool for selecting configuration settings. It offers two different modes:

 In "Expert" mode, all configuration settings are listed. Selecting a configuration setting opens the corresponding tab in the workspace.

View	
•	
DUT	^
DUT Ports Port Map State Switches	
Measurement	~
Measurement Devices	~
Connection Plan	~
Local Data	~

See Chapter 4.3.2, "Expert Mode", on page 30 for details.

 The "Project Pilot" mode lets you quickly configure MEUs from scratch. A reduced quantity of configuration settings and the automation of most of the configurations simplifies the configuration phase.

View		
۰		÷
٠.	Project Pilot	41
O DUT Ge	ometry	^
Setup the Ports. Min	DUT Geometry by defining Logical Port d that existing DUT Geometry data will	s and Physical be replaced. Setup Ports
Group Log	ical Ports into Port Groups.	
		Add Port Groups
O Measur	ement	~
O Equipm	ent	~
Executio	on	~

The "Project Pilot" can also be used to modify an existing ZNrun Workbench project. See Chapter 4.3.1, "Project Pilot", on page 26 for details.

4.1.5 Log Views

By default, the log views are docked at the bottom of the ZNrun Workbench window.

The "Message Log" displays upcoming events during the execution of the ZNrun Workbench.

Message Log	~ 7
Type T Message	т
Leaving Execution	
Message Log Validation Log	

The "Validation Log" displays MEU validation results.

Validation Log	×
Type ▼ Message	Ŧ
Validation finished without errors	
Message Log Validation Log	

From its context menu, you can copy the selected message to the clipboard, or clear the related log.

4.1.6 Status Bar

Server	10.111.0.66	~	Last Author	STOLTE	Cycle #	0	Latest Duration	00:00.000

The status bar of the ZNrun Workbench window gives access to the following information/settings:

- Server connection Select an item from the list of detected ZNrun Servers
- Project (modification) history

The last author is displayed in the status bar. Click the corresponding status bar section to view the full project history.

Project History - test			×
User	Ŧ	Date	Ŧ
STOLTE		9/18/2020 11:33:52 AM	
Restrict number of items 10 V		Clear History	OK

The project (modification) history is tracked in the ProjectHistory.xml file, that is maintained by the ZNrun Workbench together with the Project.xml.

 Measurement execution status, including the number of measurement cycles and the duration of the last measurement cycle (execution phase only) Hovering over the measurement execution status calls up a popup that displays the detailed execution statistics:
 Execution Statistics

 Executed
 0

 Limit Exceeded
 0

 Passed
 0

 Aborted
 0

 Failed
 0

Authenticated users (optional)

To limit the projects that can be run on a particular ZNrun Server to those last modified by a particular group of users:

 enable user authentication in the "ZNrun Settings" client (Windows Start menu > "R&S ZNrun 2.30" > "ZNrun Settings" > ZNrun Server > "User Authentication Servce")



2. maintain a newline-separated list of authenticated users in C:\ProgramData\Rohde-Schwarz\ZNrun\<version>\ AuthenticatedUsers.txt

on the ZNrun Server.

4.1.7 Options

The "Options" dialog is accessible via the main toolbar.

 On the "Execution" tab, you can choose to add date and time to the created measurement cycle log file names. Furthermore, you can specify the export directory and define the logfile prefix.

Application Overview

Options		×
Execution Visualization		
Add Date/Time to Log Filename		
Export Directory	C:\Users\stolte\AppData\Local\Temp\	Browse
Logfile Prefix	MeasTimeLog	
		OK

• On the "Visualization" tab, you can set the default workspace layout. Furthermore, you can specify the export directory, and the height of the images exported from the visualization workspace.

Options		×
Execution Visualization		
Default Workspace Layout		
Export Directory	C:\Users\stolte\AppData\Local\Temp\	
Image Export Height	240	
		ОК

 On the "Rollout" tab, you can specify where your Device Park is located and how many rollouts shall be performed in parallel. See Chapter 4.6, "Rollout Phase", on page 56 for details. Furthermore, you can specify the report directory and define the report file prefix.

Options	×
Execution Visualization Rollout	
Device Park Directory	Browse
Number of Rollouts in Parallel 8 🗸 🔨	
Report Directory	Browse
Report File Prefix Rollout	
Add Date/Time to Filename	
	ОК

4.2 Getting Started

There are three ways to get started with the ZNrun Workbench:

- You can create a Measurement Execution Unit (MEU) configuration with the ZNrun Workbench data structure using the first button in the main toolbar
- You can open an already existing MEU configuration from a ZNrun Workbench file (*.znwbf).
- You can load the MEU configuration from a ZNrun project file of a previous R&S ZNrun version. The ZNrun Workbench automatically converts the ZNrun project to a ZNrun Workbench project.

DUT Center	Measurement Paths					×	View	
	DUT xxx Number o	f Parallel Measurements 1 😽	Use I	Power Waves Yes	~	= •		
Sequential001 SPM_PowerOnDummy_0_0 SPM_PowerOnDummy_0_0	Name T Source Port T	Destination T Port Group	🔻 Meas. Paran	Format T	Stimulus 🍸 Limit Lines	F Switch & Sta	Measurement	
MP_PowerOnDummy_0_0	MP_PowerOnDur OUT_Spara	OUT_Spara 1P_OUT_Sp	ara Sss	DB_MAG	PowerOn	×	meddurement	
SPM1_Spara	MP_IN2_0_1 IN2	OUT_Spara 2P_IN2_OU	T_Spa Sss	DB_MAG	Stimuli_Spara1	x	Measurement Devices	
MP_IN2_0_1	MP_IN2_VSWRA_ IN2	1N2 2P_IN2_OU	T_Spa Sss	SWR	Stimuli_VSWR1	×	Connection Plan	
V SPM1_VSWR	MP_IN2_VSWRX_ OUT_Spara	OUT_Spara 2P_IN2_OU	T_Spa Sss	SWR	Stimuli_VSWR1	×	Local Data	
MP_IN2_VSWRX_0_3	MP_IN2_NF_0_4 P01	P03 2P_IN2_OU	T_NF NF	DB_MAG	.Stimuli_NF1	×		
SPM1_NF	MP IN2 0 5 IN2	OUT Snara 2P IN2 OU	T Sna Sss	DR MAG	Stimuli Snara?	×		
MP_IN2_NF_0_4 SPM2_Spara SPM2_Spara	Details							
MP_IN2_0_5 ✓ SPM2_VSWR ✓ SPM2_VSWR MP_IN2_VSWRA_0_6	Path Ports Stimulus Limit Line	s Switch & State						
essage Log								~
pe ▼ Message								
Messane Log Validation Log								

Figure 4-4: Successfully loaded ZNrun Workbench file.

- Q
- If loading the MEU configuration from file was unsuccessful, an error message is displayed in the Message Log.
- If a ZNrun Server IP-address is specified in the ZNrun Workbench file, and the server is available, the workbench uses this server for execution of the MEU. Otherwise, a R&S ZNrun server has to be selected from the drop-down menu of the available server connections.

After creating or loading a MEU configuration, the following actions in the main tool bar are enabled:

- Save all changes to the working ZNrun Workbench file system.
- Save your MEU configuration in the ZNrun Workbench file system format.
- Validate the MEU configuration.

4.3 Configuration Phase

In the configuration phase, you use Configuration View to define or modify the MEU. From this phase, calibration of devices or execution of measurements can be started. Additionally it is possible to switch to Chapter 4.6, "Rollout Phase", on page 56.

To change between "Project Pilot" and "Expert" mode, go to the "View" widget and select the appropriate icon.

left icon = Expert Mode right icon = Project Pilot

4.3.1 Project Pilot

The "Project Pilot" allows you to configure MEUs from scratch quickly. The "Project Pilot" proceeds in four steps:



Figure 4-5: Workflow in the project pilot mode

4.3.1.1 DUT Geometry

Viev	1	
¢	B M	÷
< >	Project Pilot	••
0	OUT Geometry	^
Set Por	up the DUT Geometry by defining Logical Ports ts. Mind that existing DUT Geometry data will l	s and Physical be replaced.
		Setup Ports
Gro	up Logical Ports into Port Groups.	
		Add Port Groups
0	Neasurement	~
0 6	quipment	~
E	xecution	~

Figure 4-6: Project Pilot, step 1: DUT Geometry definition

The "DUT Geometry" definition is subdivided into three steps:

- 1. Set up the logical and physical ports.
- 2. Group logical ports into port groups.
- 3. Configure the DUT ports in detail.

If at least one physical port, one logical port and one port group are defined, the change indicator next to DUT geometry label turns from gray to blue.

1. Set up the logical and physical ports

Use the "Setup Ports" button to open the corresponding dialog.

DUT Geometry - Setup Ports				×	
Number of Single Logical Ports		10	~	^	
Number of Balanced Logical Ports		0	~	^	
Number of Physical Ports		10	10		
Create One Port Group For All Ports			1		
Create A Port Group For Each Port Pair					
	ОК	c	ance		

Figure 4-7: Setup Ports dialog

Specify the number of single-ended and balanced logical ports. These values determine the number of physical ports, because each single-ended logical port contributes one physical port and each balanced logical port contributes two physical ports.

At this step, you can also apply two simple port grouping mechanisms: group all ports in one group, and/or group each port pair. The next step offers a free configuration of port groups.

2. Group logical ports into port groups

Use the "Add Port Groups" button to open the corresponding dialog.

90	T Geometry - Add Port Groups				×
	Name	۲	Туре		
2	LP001		Single		
~	LP002		Single		
~	LP003		Single		
~	LP004		Single		
	LP005		Single		
	LP006		Single		
	LP007		Single		
	LPOOB		Single		
	LP009		Single		
	LP010		Single		
		DK.		Eastel	2007

Figure 4-8: Add Port Groups dialog

Select one or more logical ports from the list of available logical ports, then press "Apply" or "OK" to join them in a port group.

 Configure the DUT ports in detail. In the last step of the "DUT Geometry" configuration of the "Project Pilot", you can adjust the DUT ports as in expert mode, see "DUT Ports" on page 31.

4.3.1.2 Measurement



Figure 4-9: Project Pilot, step 2: Measurement definition

The definition of measurements proceeds in three steps:

- 1. Add measurement paths for the source port and a destination port.
- 2. Add complete n-port measurements for a port group.
- 3. Configure the measurements in detail.

If at least one measurement path is defined, the change indicator next to measurement label turns from gray to blue.

 Add measurement paths for the source port and a destination port. Use the "Add Paths – Ports" button to open the corresponding dialog. From here, you can create measurement paths with user-defined parameters such as "Source Port", "Destination Port", "Format", "Start Frequency", "Stop Frequency", and "Number of Points".

Measurement - Ad	ld Paths - Ports					×
Meas. Parameter	Sss Ssd Sds Sdd Stime	ulus Type Lin Freq				
Source Port	T Destination Port	▼ Format	▼ Start Frequency [Hz]	Stop Frequency [Hz]	T Number of Points	т
LP001	LP002	DB_MAG	10000	1000000	1000	ж
Click here to add n	ew item					

Figure 4-10: Add Paths – Ports dialog

If a stimulus with the same "Start Frequency", "Stop Frequency", and "Number of Points" exists, the ZNrun Workbench automatically assigns it to the measurement

path. Otherwise the ZNrun Workbench creates a linear frequency stimulus with these parameters and assigns it to the measurement path. By default, the "Add Paths – Ports" dialog selects "Sss" as the measurement parameter.

Add complete n-port measurements for a port group.
 Use the "Add Paths – Port Group" button to open the corresponding dialog. You can select a whole port group to create measurement paths for each port pair of the port group. Similar to step 1, the parameters are "Format", "Start Frequency", "Stop Frequency", and "Number of Points".

Measurement - Ac	dd Paths - Port Group				×
Meas. Parameter	Sss Ssd Sds Sdd Stimulus	Type Lin Freq			
Port Group	▼ Format	 Start Frequency [Hz] 	Stop Frequency [Hz]	▼ Number of Poi	nts T
PG001	AUTO	10000	1000000	1000	×
Click here to add r	new item				

Figure 4-11: Add Paths – Ports Group dialog

The same logic as in step 1 applies to the reuse or creation of stimulus objects. And also the "Add Paths – Ports Group" dialog selects "Sss" as the default measurement parameter.

 Configure the measurements in detail. In the last step of the measurement configuration of the "Project Pilot", you can adjust the measurement parameters as in the expert mode, see Chapter 4.3.2.2, "Measurement Configuration", on page 33.

4.3.1.3 Equipment

• 🛄			;
< >	Project Pilot		••
O DUT Geom	ietry		~
O Measurem	ent		~
C equipment			~
Scan the Net that existing	work for VNA Devices and select tl VNA Device data will be replaced.	nose to use. Mir	nd
Scan the Net that existing	work for VNA Devices and select tl VNA Device data will be replaced.	nose to use. Mir Setup VNA Dev	nd

Figure 4-12: Project Pilot, step 3: Equipment definition

The equipment definition is done in a single step.

Use the "Setup VNA Devices" button to open the corresponding dialog.

R&S [®] ZNrun		Z	Nrun W	orkbenc	h
		С	onfigurat	tion Phas	е
Equipment - Setup VNA Devices)	×
DUT Ports Total: 10, Used: 10, Selected VNA Ports: 0	Interface Type	Vxi11	~	Search	
Type Type Tort Count Ty Visa Resource					Ŧ

Figure 4-13: Setup VNA Devices dialog

Choose the interface type and search in the network for VNA devices. The list displays the available devices with their type, port count, and the visa resource. During the import of the device information, all existing data is overwritten. Hence, you have to confirm every replacement of an already existing VNA device.

4.3.1.4 Execution

+ 🔝		
< >	Project Pilot	4
O DUT Geor	netry	~
O Measurem	ent	~
C Equipment		~
Execution		^
After the Step Project is vali	is above are complete, you are r d and run the Measurements.	eady to check if your
		Validate
		Start

Figure 4-14: Project Pilot, step 4: Execution

Finally, you can send the MEU to the selected ZNrun Server for validation or execution of the MEU.

4.3.2 Expert Mode

In "Expert" mode, you can use the full capabilities of the ZNrun Workbench to configure every aspect of the MEU. To change a specific configuration setting, you can choose an item from the navigation view ("View") which is then displayed in the workspace.

Measurement Paths		×	View
DUT Number of Parallel Measurements 1	Use Power Waves default 🗠		• 🖬
		≡ +	DUT ~
Name T Source Port T Destination I T Port Grou	p ▼ Meas. Param ▼ Format ▼ Stimulus	T Limit Lines T Switch & Sta T	Measurement ~
MP001 LP001 LP001 PG001	Sss DB_MAG Stimulus0	01 🗙	
MP002 LP003 LP004 PG001	Sss DB_MAG Stimulus0	02 🗙	Measurement Devices ~
MP003 LP001 LP001 PG001	Sss SMITH Stimulus0	03 🗙	Connection Plan 🗸
			Local Data ~
Details			
Path Ports Stimulus Limit Lines Switch & State			

Figure 4-15: Expert mode: workspace and navigation view

4.3.2.1 DUT Configuration

The purpose of the "DUT" configuration group is to give access to all DUT-related configuration settings.

DUT	^
DUT Ports	
Port Map	
State Switches	

DUT Ports

The "DUT Ports" workspace gives access to the DUT port definition, which consists of in three steps:

- 1. Define the physical ports.
- 2. Define the logical ports.
- 3. Define the port groups.

DUT Ports																		×
Physical Po	rts				Logical Ports	Logical Ports					P	ort Groups						
			≡	+						=		+					≡	+
Name ^	т Туре	۲	Logical Port		Name 1	Туре	Ŧ	Physical Port	1 7	Physical Port 2	٣			Name		Logical Ports	Ŧ	
PP001	DC		LP001	×	LP001	Balanced		PP001		PP002		×	+	PG001		[LP001] [LP002]] [LP003]	×
PP002	RF		LP001	×	LP002	Single		PP003				×	+	PG002		[LP001] [LP003]] [LP004]	×
PP003	RF		LP002	×	LP003	DC		PP004				×						
PP004	RF		LP003	×														
Details																		
Physical Port	Logical Port P	ort Grou	qu															
Name		Der	scription		Delay		One	Nay Loss Los	s at DC			Loss	at Fre	1	F	req for Loss		
PP001					20			OFF										

Figure 4-16: DUT ports workspace

1. "Physical Ports"

The physical ports of the DUT can be added ("+") or removed ("x") in the "Physical Ports " list of the workspace. There you can declare the type of the physical ports to be either RF or DC.

In the "Details" view, you can add a textual description of the physical port and specify its delay. Furthermore you can toggle "One Way Loss" ON and define the related parameters "Loss at DC", "Loss at Frequency", and "Frequency for Loss".

Details						
Physical Port	Logical Port Port Group					
Name	Description	Delay	One Way Loss	Loss at DC	Loss at Freq	Freq for Loss
PP001			OFF			

Figure 4-17: Physical port details

2. "Logical Ports"

A logical port represents the basic element for further definitions of DUT properties and can be added or removed in the "Logical Ports" list of the workspace. There you can declare the type of the logical port to be either single-ended, balanced, or DC. Depending on its type, the logical port comprises one or two physical ports. In the "Details" view, you can provide correction properties for the logical port: its reference impedance (common and differential for balanced ports), and de-/ embedding information. See the user manual of your VNA for more information.

Details.													
Physical Port	ogwal Port Po	rt Group											
Name	Туре		Common Reference Imped	Commo ance Ref Imp	n Cor (real) [Ω] Ref	mmon Timp (imag) [Ω]	Differential Reference Impeda	Differen ance Ref Imp	tial ((real) [Ω] F	Differential Ref Imp (imag) [Ω]	Deembeddin	g Type	Embedding Type
- LP001	Balance	d	OFF				OFF				File		Circuit Model
Balanced Lo	ogical Port De	embedding i	File										
File Name													
MyDeembedd	ngFile s4p												
Balanced Lo	ogical Port En	nbedding Cire	ait Model										
Circuit Model	Resistance R1	Resistance R2	Resistance R3	Conductance G1	Conductance G2	Conductance G3	Capacitance C1	Capacitance C2	Capacitance C	3 Inductance L1	Inductance 1.2	Inducta	nce L3
STBL.	and the local	Schutz	-dejamo	Aller	-		and a	2013/013					

Figure 4-18: Logical port details

3. "Port Groups"

In general, a DUT consists of one or more groups of logical ports, which together provide a particular functionality. In the "Port Groups" list of the workspace, you can create and remove such port groups.

In the "Details" view, you can provide ground loop de-/embedding information for the selected port group.

Details							
Physical Port	Logical Port Po	rt Group					
Name - P6002			k	dentifier	Deembedding Type	Embedding Type	
			5	c1bca42-d7ae-4e2e-98a3-866801d390b2	Circuit Model	File	
Ground Los	op Deembede	ding Circuit Mo	del				
Circuit Model	Resistance R1	Conductance GI	Capacitance (Cl Inductance L1			
SL.	default	defeuit	default	niciault			
Ground Los	op Embedding	g File					
File Name							
MyEmbedding	File.s4p						

Figure 4-19: Details of one port group

Port Map

The "Port Map" workspace consists of a table that lists the port mappings defined during DUT Ports definition. The table columns are read-only, however you can delete a port mapping using the "x" icon to the right of the related table row.

Port Map				×
				=
Logical Port	T Mapping Type	▼ Physical Port 1	Physical Port 2	٣
LP001	Balanced	PP001	PP002	×
LP002	Single	PP003		×
LP003	DC	PP004		×
LP004	Single	PP004		×

Figure 4-20: Port Map workspace

State Switches

R&S ZNrun focuses on measuring complex DUTs. Besides multiple ports, such a DUT typically provides one or more "control interfaces" that are used to set or request the DUT's state. Depending on the capabilities and applications of the DUT, you have to choose a proper communication path and to define the different states.

State Switc	thes													×
Nam	10	^	Ť	Communicat	ion Channel		T Resour	ce		T V	aiting Time		+	
- State	Switch001			VISA						2	000			×
State			Ť	Command			T Overw	itten Logical I	Ports DUT Indices	T 0	verwritten Port Groups E	UT Indices	+	+
- State	eSwitchState00	1					[0]			Į.a	ŋ			
DUT Index	x of Overwrith	en Logi	al Ports			Ŧ	Overwritt	m Logical Por	ts.				τ.	
0							[LP001] [L	002]						*
DUT Index	x of Overwritte	en Port	Groups			т	Overwritt	n Port Group					Ŧ	+
All														
_														
State Over Switch	nwritten Setting	75			State				Index	DUT				
StateSwitch	H001				StateSwitchState	e001			0					
Logical Po	et Y	+	Name	Тур	•	Common Reference	Impedank	Common Ref Imp (rea	Commo () (Ω) Ref Imp	n (imag) (i	Deembedding Typ	e Embeddin	ng Typ	pe
LP001		×	- LP001	Sing	gle		DN	44	22		File	Circuit Ma	odel	
LP002		×	Single Logica	I Port Deen	bedding File									
			File Name											
			None											
			Single Logica	al Port Embe	dding Circuit	Model								
			Circuit Model	Resistance R1	Resistance R2	Conductan	ce Gi Co	ductance G2	Capacitance CI	Capacit	ance C2 Inductance L1	Inductance	12	
			CSL	default	stefanis	default	det	uill.	(default	eetboli	definali	delaudi		

Figure 4-21: State Switch workspace

4.3.2.2 Measurement Configuration

The "Measurement" configuration group allows you to set up the measurement.

Measurement	^
Measurement Paths	
Stimuli	
Limit Lines	
Measurement Cycle	
Plugins	
Calibration Sequences	
Automatic Gain Control	
Time Domain	

Configuration Phase

•	Measurement Paths	.34
•	Stimuli	. 35
•	Limit Lines	.37
•	Measurement Cycle	. 38
•	Plugins	. 43
•	Calibration Sequence	46
•	Automatic Gain Control	.46
•	Time Domain	.46

Measurement Paths

In the "Measurement Paths" workspace, you can define and configure the collection of all measurement paths. In the top section of the workspace, you can set the meta-parameters "DUT", "Number of Parallel Measurements", and "Use Power Waves". The number of parallel measurements refers to the DUT multiplicity, i.e. the number of DUTs to be measured.

Measurement Paths									×
DUT	Number of Parallel Meas	surements 1 × ^	Use Power Wa	aves default \vee				≡	+
Name T	Source Port T	Destination Port 7	Port Group T	Meas. Parameter 🛛 🔻	Format T	Stimulus	T Limit Lines T	Switch & State T	
MP001	LP001	LP001	PG001	Sss	DB_MAG	Stimulus001			×
MP002	LP003	LP004	PG001	Sss	DB_MAG	Stimulus002			×
MP003	LP001	LP001	PG001	Sss	SMITH	Stimulus003			×
MP004	LP001	LP002	PG001	Sss	DB_MAG	Stimulus003			×
Details									
Path Ports Stimulus	Limit Lines Switch & S	itate							
Name		Meas. Paramet	ter	Kind			Format		
MP001		Sss		ADVAN	CED		DB_MAG		

Figure 4-22: Measurement Paths workspace

The menu that can be opened from the hamburger icon above the configuration table, allows you to toggle the visibility of the configuration possibilities.

=
✓ Name
✓ Source Port
 Destination Port
🖌 Port Group
🖌 Meas. Parameter
Kind Kind
✓ Format
✓ Stimulus
✓ Limit Lines
AGC Configuration
AGC Stimulus Segment
✓ Switch & State
Time Domain Measurement
Time Gate
✓

Table 4-4: Configuration possibilities of a measurement path

Name	Options
"Name"	Set a custom name for the measurement path.
"Source Port"	Select the source port of the measurement from the list of available ports specified in the DUT ports configuration. The source port has to be in the specified port group.
"Destination Port"	Select the destination port of the measurement from the list of available ports speci- fied in the DUT ports configuration. The destination port has to be in the specified port group.
"Port Group"	Assign a port group to the measurement path. The port group is specified in the DUT ports configuration. The source port and the destination port have to be in the specified port group.
"Measurement Parameter"	Select the mixed mode S-parameter to be measured.
"Kind"	Select the measurement result to be calculated. "ADVANCED" "INSERTION_LOSS" "RETURN_LOSS" "VSWR" "ATTENUATION" "ISOLATION" "BALANCED_AMPLITUDE" "BALANCED_PHASE"
"Format"	Select how the result is formatted (a.k.a. "Trace Format") "DB_MAG" "LIN_MAG" "IMAG" "REAL" "PHASE" "UNWRAP_PHASE" "SMITH"
"Stimulus"	Select a stimulus from the list of available stimuli defined in the Stimuli configuration.
"Limit Lines"	Select a limit line from the list of available limit lines specified in the Limit Lines con- figuration.
"AGC Configura- tion"	Select an AGC configuration table from the list of available AGC configuration tables specified in the Automatic Gain Control configuration.
"AGC Stimulus Segment"	Select an AGC stimulus segment from the list of available AGC stimulus segments specified in the Automatic Gain Control configuration.
"Switch & State"	In the "Details" view, add the required State Switches by clicking the "+" icon and selecting the appropriate "Switch". Then specify the appropriate "State" and "Command".
"Time Domain"	Select one of the time domain measurements configured in the Time Domain work-space.
"Time Gate"	Select one of the time gates configured in the Time Domain workspace

Stimuli

In the "Stimuli" workspace, you can define and configure the stimuli you later want to use for different measurement and calibration purposes. New stimuli can be created in the list overview or can be imported with the "Import Stimuli" option, see Chapter 4.3.3, "Import Stimuli", on page 52 for details.

Configuration Phase

Stimuli											>
										=	+
Name				▼ Purpose			т	Туре			T
Stimulus001				USE_FOF	MEASUREMENT			Lin Freq			×
Stimulus002				USE_FOF	USER_CALIBRATION_TASK			Log Freq			×
Stimulus003				USE_FOF	MEASUREMENT			Segmented			×
Details											
Stimulus											
Name	Purpose	Туре	=	Start Frequency [Hz]	Stop Frequency [Hz]	Power [dBm]	Numb	er of Points	Bandwidth [Hz]	Freq. Sweep Mode	+
Stimulus003	USE_FOR_MEASUREMENT	Segmented	1	10000	100000	-50	200		default	Stepped	×

Figure 4-23: Stimuli workspace

The menu that can be opened from the hamburger icon above the configuration table, allows you to toggle the visibility of the configuration possibilities.

≡	
	Identifier
✓	Name
✓	Purpose
✓	Туре
✓	

A stimulus is defined by a VNA sweep type ("Type") and the corresponding sweep parameters.

Table 4-5: Supported stimulus parameters

Sweep type	Sweep parameters
"Lin Freq" (linear frequency)	 "Start Frequency" "Stop Frequency" "Power " (optional) "Number of Points" IF "Bandwidth" (optional) "Freq. Sweep Mode"
"Log Freq" (logarithmic frequency)	 "Start Frequency" "Stop Frequency" "Power " (optional) "Number of Points" IF "Bandwidth" (optional)
"Segmented" (segmented frequency)	Each segment represents the frequency range of a linear frequency sweep. You can define it with the same parameters (see first table row).
"Power" (dB-linear power)	 "Start Power" "Stop Power" "CW Frequency" "Number of Points" IF "Bandwidth" (optional)
Sweep type	Sweep parameters
--------------------------------	---
"CW Mode" (continuous wave)	 "CW Frequency" "Power " (optional) "Number of Points" IF "Bandwidth" (optional)
"Time"	 CW Frequency "Power " (optional) "Number of Points" IF "Bandwidth" (optional) "Stop Time"

Limit Lines

In the "Limit Lines" workspace, you can define the limits you want to apply to subsequent measurements.

- A single "Linear" limit line imposes straight-lined upper and/or lower limits on scalar results for a particular stimulus range.
- A "Formula"-defined limit line imposes an upper or lower limit on scalar results for a particular stimulus range.
- A "Circle" imposes a limit on complex (two-dimensional) results.

Limit Lines								×
							= •	
Name				т Туре			т	
LimitLine001				Linear				×
LimitLine002				Formula				×
LimitLine003				Circle				×
Details								
Limit Lines								
Name	Туре	Start Stimulus	Stop Stimulus	Start Lower Limit	Stop Lower Limit	Start Upper Limit	Stop Upper Limit	
LimitLine001	Linear	0	0	0	0	0	0	

Figure 4-24: Limit Lines workspace

The "Details" section allows you to configure the selected limit line in detail.

Table 4-6: Limit line parameters

Line type	Parameters
"Linear" (straight line)	 "Start Stimulus" "Stop Stimulus" "Start Lower Limit" "Stop Lower Limit" "Start Upper Limit" "Stop Upper Limit"
"Formula" (formula-defined)	 "Start Stimulus" "Stop Stimulus" "Formula". See the user manual of your VNA for supported formulas and their syntax. Limit "Type": upper or lower
Circle (circular)	 "Radius" "Center X" "Center Y"

Measurement Cycle

A measurement cycle represents a physical measurement on one or more DUTs. You can specify the order in a tree-like structure as shown in Figure 4-25. If no measurement cycle is defined, the R&S ZNrun server automatically creates a cycle.



Figure 4-25: Measurement cycle tree structure

The definition of the measurement cycle is done in three steps:

- 1. Define the structure of the measurement cycle.
- 2. Define the constituent Stimulus Portgroup Mesurements (SPMs).
- 3. Define the constituent custom device actions and post processor actions.
- 1. Define the structure of the measurement cycle.

As shown in the Figure 4-25, you can add multiple top-level sequential contexts to the measurement cycle.

Measurement Cycle	
Cycle	+
	Add Sequential Context

To every top-level sequential context, you can add multiple steps and parallel contexts.

Sequential001	x	+ Ad	+ d Ste	2p
Sequential001	x	+	+	
			Ad	ld Parallel Context

To each parallel context, you can add further sequential contexts. During the execution phase, the ZNrun Server runs these sequential contexts in parallel.

• Parallel001	x	+
		Add Sequential Context

To a sequential context inside a parallel context, you can add multiple steps.



For an example of a complete measurement cycle tree structure, see the following screenshot.

le	+		
Sequential001	x + +		
Step001	×		
Step002	×		
Parallel001	x +		
Sequential002	× + • Sequential003	x +	
	x Step005	x	
Step003			

Figure 4-26: Measurement Cycle workspace.

You can assign a custom name to each sequential context, parallel context, or step. For a sequential context, you can also specify a purpose in the "Sequential Measurement Context tab" tab of the "Details" area.

To disable or enable a sequential context, parallel context or step, click the corresponding tree node icon (blue circle).

Sequential contexts, parallel contexts, and steps can function as breakpoints in the execution of the measurement, i.e. to step or pause commands. Click to the left of the corresponding tree node icon to set or remove a breakpoint. A red circle indicates an active breakpoint.

A measurement step is a container for stimulus port groups measurements, custom device actions and postprocessors.

 Add and configure a "Stimulus Portgroup Measurement" (SPM) To add an SPM to a measurement step, select the step in the "Measurement Cycle" workspace and click the "+" icon in the header of the SPM table ("Details" area > "Stimulus Portgroup Measurement" tab).

Details										
Stimulus Port	group Me	asurement	Custom D	evice Action	Post Proc	cessor Action	Sequent	tial Measurement	Context	
Step Name	Name	Priority P	re Action	Priority Mai	in Action	Priority Post	Action	Channel Bits	Power Measurement Parameter	+
									Add Stimulus Portgroup Measurem	ent

To add a measurement path to the SPM, select the SPM in the SPM table and click the "+" icon in the header of the "Measurement Paths" table.

R&S [®] ZN	run						ZN	run Workbe	nch
							Con	figuration Ph	lase
Details									
Stimulus Por	tgroup Me	asurement	Custom Device A	ction Post Pro	cessor Action	Sequential Measu	rement Context		
Step Name	Name	Priority Pre A	Actio Priority M	1ain Actic Prio	rity Post Actic	Channel Bits	Power Measurer	nent Parameter	+
Step001	Step001	0	0	0		default	O	FF	x
Measure	ement Pa	ths							
Name So	ource Port	Destinatio	n Port Port Gro	oup Stimulus	AGC Config	uration AGC Stir	mulus Segment	Switch & State	+
								Add Measurment	Path

You can also drag a released (unused) measurement path from the flattened view of the "DUT Center" to the "Measurement Cycle" workspace. Drop it on an existing step or on the free space below the last step of a sequential context. The latter automatically adds a step containing this measurement path.

A yellow right-pointing triangle indicates possible drop targets.

and the second se	r ringins				~
Cycle		÷.			
Sequential001	x +	+			
• Step001	×				
• Step002	×				
Parallel001	x +				
Sequential002	ж +	Sequential003	×	+	
●■ Step003	×	Step005	×		
 MP003 	×	• Step006	×		
	Cycle Sep001 Sep002 Sep002 Sep002 Sequential001 Sequential002 Sequential002 Motion Motion Motion Sequential002 Sequential003 Se	Cycle Cycle Sequentia001 X + Sep00 X Sep002 X Sep002 X Sep003 X M Moos X Moos X X	Cycle	Cycle	Cycle

Figure 4-27: Drag & drop of a released measurement path

In the SPM table, you can configure the SPM properties "Name", "Priority Pre Action", "Priority Main Action", "Priority Post Action", "Channel Bits", and toggle the "Power Measurement Parameter" settings. If you switch the latter ON, the "Stimulus Portgroup Measurement" tab displays an additional "Power Measurement Parameter" table that allows for an in-depth configuration of receive power settings.

Details							
Stimulus Portgro	up Measurement	Custom Device Ac	tion Post Processor Action	Sequential Measurement Cont	ext		
Step Name	Name P	riority Pre Action	Priority Main Action	Priority Post Action	Channel Bits	Power Measurement Para	rameter 🔶 🔶
Step001	Step001 0		0	0	alejoub	ON	×
Power Mea	surement Paras	meter	-	-			
Power Mea	surement Para	neter	etector Time	Average Fa	actor	Is Noise Sea	uential Mode
Power Mea Gain Control AUTO	surement Parar	neter D	letector Time	Average Fa 200	ector	Is Noise Sequ	uential Mode
Power Mea Gain Control AUTO Cal Power Off	surement Paran Cal Max Numbe	neter D 11 r Re Cal Toleran	letector Time 0 Cal Convergence F Cal Re	Average Fa 200 ceiver Wave Q Cal Reference F	actor Power Cal Receiver Pow	Is Noise Sequence ON	uential Mode ON Cal Gain Contr

Note that a measurement step executes in a single VNA channel. Hence each measurement path in every SMP of a measurement step must have identical channel settings ("Port Group", "Stimulus", "AGC Configuration", "AGC Stimulus Segment", "Switch & State").

Datails								
Matina Terriyinan M	naturmini Custeri Drece Ac	tion Post Processor Action Sequer	tsi Maasuromo	nt Context				
Step Name	Name	Priority Pre Action	1	Priority Main Action	Priority Post Action	Channel Bits	Power Measurement Parameter	+
Step601	Step001	c		0	0	ciertopole :	1.00	
Measurement P	aths							
Name	Source Port	Destination Port	Port Group	Stimulus	AGC Cor	figuration AGC Stimulus Segmer	nt Switch & State	+
MPDOT	LP001	LPC01	PG001	.56mulusi	101			×
MP002	LP002	LPG04	PG001	Stimulas	101			
Power Measurer	ment Parameter							
Gain Control		Detector Tim			Average Facto	or.	Is Noise Sequential M	Mode
AUTO		ta			200		DN DN	
Cal Power Offset	Cal Max Number Readings	Cal Tolerance Cal Convergen	ce Factor C	al Receiver Wave Quantity	Cal Reference Power Value	Cal Receiver Power Level Cal Noise I	Receiver Bandwidth Cal Gain Control	st
0	20	£1 1		8	REFERENCE RECEIVER	-45 300000	LOW NOISE	

Figure 4-28: Stimulus Portgroup measurement detail configuration

 Define the custom device actions and post processor actions. To add a custom device action to a measurement step, select the step in the "Measurement Cycle" workspace, activate the "Custom Device Action" tab in the "Details" area, and click the "+" icon in the table header.

Measurement Cycle				×
Cycle	+			
Step001	x			Û
				>
Details				
Stimulus Portgroup Measurement	Custom Device Action	Post Processor Action	Sequential Measurement Context	
Name Custom Device F	riority Pre Action Prior	ity Main Action Price	ority Post Action Parameter	+
			Add Custom Device A	ction

For each custom device action you can specify a custom "Name" and the parameters "Custom Device", "Priority Pre Action", "Priority Main Action", "Priority Post Action", and "Parameter".

To add a "Custom Curve" to the custom device action, click the "+" icon in the "Custom Curve" table header.

Details						
Stimulus Portgroup Measurement	t					
Name Cu	ustom Device Priority	Pre Action Priority Main Ac	tion Priority Post Action	Parameter +		
- CustomDeviceAction001	0	0	0	x		
Custom Curve Display Name						
				Add Custom Curve		

Similarly, to add a custom post processor action to a measurement step, select the step in the "Measurement Cycle" workspace, activate the "Post Processor Action" tab in the "Details" area, and click the "+" icon in the table header.

Measurement Cycle				×
Cycle	+			
Step001	×			Û
				>
Details				
Stimulus Portgroup Measurement	Custom Device Action	Post Processor Action	Sequential Measurement Context	
Name Post P		+		
			Add Post Processor Ad	tion

Here a custom "Name", the "Post Processor" and a "Parameter" can be specified. To add a "Custom Curve" to the post processor action, click the "+" icon in the "Custom Curve" table header.

Details					
Stimul	us Portgroup Measureme	nt Custom Device Action	Post Processor Action	Sequential Measurement Context	
1	Name	Post Processor	Parameter		+
- 1	PostProcessorAction001				x
Custo	m Curve		Display Name		+
					Add Custom Curve

You can define custom devices, post processors and custom curves in the Plugins workspace.

Plugins

In the "Plugins" workspace you can configure custom devices, post processors and custom curves.

Use the "+" icons to add a plugin of the respective plug-in type.

Plugins				×
Custom Devices			=	+
Name	т Туре	▼ Class Name	▼ Parameter File Path	Ŧ
Post Processors			=	+
Name	т Туре	▼ Class Name	Parameter File Path	T
Custom Curves			≡	+
Identifier T Type	▼ Label X Axis ▼ Label Y Axis	▼ Sampling Type ▼ Scale X Axis	▼ Scale Y Axis ▼ Limit Definition	T

The menus that can be opened from the hamburger icons above the configuration tables, allow you to toggle the visibility of the plug-in type-specific columns.



left	=	custom devices
middle	=	post processors
right	=	custom curves

	Ī	able	4-7:	Settings	for p	olugins
--	---	------	------	----------	-------	---------

Plug-in type	Setting	Description		
"Custom Devices"	"Name"	A descriptive name of the custom device.		
	Туре	The implementation type: • ".NET Assembly" • "Python"		
	"Class Name"	The fully qualified name of the custom device class, including its namespace.		
	"Category"	Plug-in category (read-only): the fully qualified name of the ICustomDevice interface		

Configuration Phase

Plug-in type	Setting	Description				
	"Parameter File Path"	The path to the corresponding parameter file (read- only). The path is a local resource. It can be specified in the Extension Registrations workspace.				
"Post Processors"	Name	A descriptive name of the post processor.				
	Туре	The implementation type: • ".NET Assembly" • "Python"				
	"Class Name"	The full qualified name of the post processor class, including its namespace.				
	"Category"	Plug-in category (read-only): the fully qualified name of the IPostProcessor interface				
	"Parameter File Path"	The path to the corresponding parameter file (read- only).				
		The path is a local resource. It can be specified in the Extension Registrations workspace.				
"Custom Curves"	"Identifier"	The string identifier of the custom curve.				
	"Type"	The graph type: • "Cartesian" • "Polar" • "Smith" • "Smith Inverted"				
	"Label X Axis" / "Label Y Axis"	The label of the x-axis/y-axis.				
	"Sampling Type"	 "None" (initial state, must be changed) "Range": "Start" "Stop" "Number of Points" Points (list of points) 				

Configuration Phase

Plug-in type	Setting	Description					
	"Scale X Axis" / "Scale Y Axis"	The scale of the x-axis/y-axis. Only editable for "Cartesian" curves. • Linear • Logarithmic					
	"Limit Definition"	Switches limit definition for the respective custom curve ON or OFF. If set to ON, a "Limit Definition" table appears beneath the custom curve.					
		You can assign a "Name" and "Rank" to this limit. For cartesian curves ("Cartesian"), the limit consists of a set of straight limit lines, each of them defined via: Limit "Type" ("Upper Limit" or "Lower Limit") "Start Value X" "Stop Value X" "Start Value Y" "Stop Value Y"					
		For complex curves ("Polar", "Smith", "Smith Inver- ted"), the limit consists of a single circular value range, defined via: • Radius • Center X • Center Y					

Custom Curves					= +
Identifier T	Type 🔻 Label X Axi	s 🔻 Label Y Axis 🔻 Sampl	ling Type 🔻 Scale X Axis	▼ Scale Y Axis ▼	Limit Definition T
- CustomCurve001	Cartesian	None	LINEAR	LINEAR	ON X
Limit Definition					
Name			Rank		
— My Limit			default		
Туре	Start Value X	Stop Value X	Start Value Y	Stop Valu	e Y +
Upper Limit	100000000	300000000	0	0	x
Lower Limit	100000000	300000000	-10	-10	x

Figure 4-29: Limit definition: cartesian curve

Cu	stom Curves													=		+	
	Identifier T	Туре	T	Label X Axis	τı	Label Y Axis	T	Sampling Type	T	Scale X Axis	T	Scale Y Axis	T	Limit Definition	7	,	
-	CustomCurve001	Polar						None						ON		ж	¢
C	istom Curve Sa	mpling															
Poi	nts																+
Li	mit Definition																
Na	me		Rank			Radiu	IS			Center X			C	Center Y			
Му	Limit		default	t		1				0			C)			

Figure 4-30: Limit definition: complex curve

Calibration Sequence

In the "Calibration Sequence" workspace, you can specify different calibration sequences for custom device actions. For each calibration step, a custom device with a parameter has to be chosen.

G	Calibration Sequences # Messurement Reference 1 = Calibrat										
#	Measurement Reference			+							
1	- CalSeq1			×							
=	Custom Device Action	Custom Device	Parameter	+							
1	CustomDeviceAction001	CustomDevice001	4	x							
2	CustomDeviceAction002	CustomDevice002	2	×							
з	CustomDeviceAction003	CustomDevice003	42	x							
2	+ CalSeq2			×							

Figure 4-31: Calibration Sequence workspace

Automatic Gain Control

"Automatic Gain Control" (AGC) enables a receiver to sense and adapt its signal input to optimize dynamic range and avoid overload conditions from strong signals or dynamically changing signals across successive scans.

In the "Automatic Gain Control" workspace, you can define and configure AGC tables for the VNA types supporting AGC. Furthermore you can group this AGCs tables to AGC segment maps.

Automatic Gain Control														×		
AGC Configurations								Segment Ma	ps							
			≡		+							≡	+			
Identifier	ier T Port Count							Identifier				т				
- AgcTable001	2			×		1				AgcStimulusSegr	mentMap001				×	
VNA Type			1	r	+			GC Configuratio	n				+			
ZVA				x			1 AgcTable001									
ZVB					x			igcTable002					×			
+ AgcTable002 2					×			AgcStimulusSegr	mentMap002				×			
Details																
AGC Configuration																
Name	Designated VNA	#	DrivePort		Ree	ceh	ve	l Recei	ve Port 2							
AgcTable001	ZVA	1	AUTO	~	AU	то	,	✓ AUTC)	~						
		2	LOW_DISTORTION	~	LO	w_	DI	rion ~ low,	DISTORTION	~						

Figure 4-32: Automatic Gain Control workspace

Time Domain

Vector network analyzers are able to measure the complex S-parameters of a device under test (DUT) for different frequencies. By applying an inverse Fourier transform, these frequency domain results can be transformed to the time domain, and represented as the impulse response or step response of the DUT. In the time domain, some DUT characteristics can be analyzed easily, for instance faults in cables can be directly localized.

Moreover, special time domain filters, so-called gates, can be used to suppress unwanted signal components such as multireflections. By transforming the gated time domain representation back to the frequency domain, the unwanted signal components are also removed from the S-parameter representation. In the "Time Domain" workspace, you can configure the two parts of the time domain measurement.



Figure 4-33: Time Domain workspace

Table 4-8: Time	e domain	measurement	settings
-----------------	----------	-------------	----------

Category	Setting	Description			
Time domain measurement	"Name"	The name of the time domain measurement.			
	"Filter"	 "BANDPASS" impulse response "LOWPASS" impulse response "LOWPASS_STEP" response 			
	"DC Value Manual"	Sets the DC value manually, if "DC Value Continuous Extrapola- tion" is disabled.			
	"DC Value Continuous Extrapola- tion"	Enables or disables the continu- ous extrapolation of the DC value. If enabled ("YES"), "DC Value Manual" is disabled.			
	"Impulse Response"	Shape of the filter applied in the frequency domain: "RECT" (rectangular) "HANN" "HAMM" (Hamming) "BOHM" (Bohman) "DCH" (Dolph-Chebyshev)			
	"Side Lobe Level"	If the impulse response is set to "DCH", the side lobe level can be edited.			
	"Resolution Enhancement Factor"	A factor of 1 means that the origi- nal sweep range and the mea- sured sweep points are used for the time domain transformation. With higher resolution enhance- ment factors, the measurement data are extrapolated using a lin- ear prediction method. As a result, the time domain resolution can be improved.			
"Time Gate"	"Name"	The name of the time gate.			
	"Axis Pair"	CENTER_SPANSTART_STOP			

Category	Setting	Description
	"Center"/"Span"	The center/span of the time gate. Only editable if "Axis Pair" is set to "CENTER_SPAN".
	"Start"/"Stop"	Sets the start/stop value of the time gate. Only editable if "Axis Pair" is set to "START_STOP".
	"Show Range Line"	Displays or hides the range line.
	"Used Filter"	 "BANDPASS": only the time domain information inside the time gate is considered "NOTCH": only the time domain information inside the time gate is considered
	"Shape"	Shape of the filter applied in the time domain: • "RECT" (rectangular) • "HANN" • "HAMM" (Hamming) • "BOHM" (Bohman) • "DCH" (Dolph-Chebyshev)
	"Side Lobe Level"	If "Shape" is set to "DCH", the side lobe level can be edited.

4.3.2.3 Measurement Devices Configuration

The purpose of the measurement devices configuration group is the definition of all measurement-related configuration settings.

Measurement Devices									
Devices									
Device Connections									

Devices

The "Devices" workspace allows you to add and configure VNAs, switch matrices, calibration units, calibration kits, and power meters.

Configuration Phase

evices						
VNA Devices						= •
Name	т Туре	T Port Count	Y Purpose	T Communication Channel T Re	source T Waiting Time	Ŧ
VNA001	ZNB			VISA	2000	
Vatrices						= •
Name	т Туре		T Communication Channel	T Resource	Y Waiting Time	Ŧ
alibration Unit Devices						= •
lame	т Туре		T Communication Channel	T Resource	Y Waiting Time	т
Calibration Kit Devices						= •
ame			т Туре			Ŧ
ower Meter Devices						= •
ame			т Туре			Ŧ

Figure 4-34: Devices workspace

For calibration units, calibration kits and power meters, the configuration is straightforward.

For VNAs and switch matrices, you have to configure the RF ports (and DC ports for an R&S ZNB/ZNBT with option B81).

levices																					
VNA Devices																				=	
Name		Ŧ	Туре		7	Port Count		т	Purpose		т	Comm	unication (Char	nel Y	Resource	٣	Waiting Time		,	,
- VNA001			ZNB			4						VISA					(ENE)				*
Name	٣	Alias		٣	Descr	iption	۲	Device	Port Type	٣	Connect	or Type		۲	Gender		Ŧ	Is Node Port	Cable Length		7
P1								VNA_P	ORT		UNKNO	NN			male			No	default:		
P2								VNA_P	ORT		UNKNO	NN			male			No	default		
P3								VNA_P	ORT		UNKNO	NN			male			No	defouit		
P4								VNA P	ORT		UNKNO	NN			male			No	default		

Figure 4-35: VNA Devices configuration

Table 4-9: Measurement device port types

/NA Devices"	"Device Port Type"	Description				
	"GENERIC"	Default value if no specification of the port type is needed for a cer- tain measurement device cate- gory.				
"VNA Devices"	"VNA_PORT"	An RF port of a VNA, usually rep- resented by a coaxial connector. This port type provides a receiver and a signal generator at the same time.				
	VNA_DC_PORT	A DC port of a VNA. There is no possibility to generate a signal at this type of port.				

Configuration Phase

Device category	"Device Port Type"	Description				
"Matrices"	MATRIX_VNA_PORT	A matrix port that is typically con- nected to a VNA port.				
		In cascaded matrix configurations, a "MATRIX_VNA_PORT" is con- nected to a "MATRIX_TEST_PORT" of another matrix. Currently this is not supported.				
	MATRIX_TEST_PORT	A matrix port that is typically used as a test port, i.e. that is connec- ted to the measurement adapter of a DUT.				
		In cascaded matrix configurations, a "MATRIX_TEST_PORT" is con- nected to a "MATRIX_VNA_PORT" of another matrix. Currently this is not sup- ported.				

Device Connections

The "Device Connections" workspace allows you to define of the connections between VNAs and switch matrices.

Device Connections							×	
						≡	+	
VNA Y	VNA Port	٣	Matrix	٣	Matrix Port	۲		
VNA001	P1		Matrix001				×	

Figure 4-36: Device Connections workspace.

4.3.2.4 Connection Plan Configuration

According to the R&S ZNrun API, a ConnectionPlan relates

MeasurementDevices and DUTmeasurementPlans. It has an impact on the execution of the measurement cycle and the required physical (re-) connections. The "Connection Plan" workspace allows you to configure a ConnectionPlan data structure, possibly including DUT multiplicity and VNA multiplicity.

Connection Plan									×
Use Connection Plan Algorithm								_	
Device Name	Test Port Name	T Physical Port Name T Dut Index			Dut Index	T Display Name			
VNA001	P21		PP001		0				×

Figure 4-37: Connection Plan workspace

The ZNrun Workbench can calculate the connection plan automatically ("Use Connection Plan Algorithm"). However, if you provide a list of connections for a VNA device, they are respected by the connection plan algorithm. If more than one VNA is used, the connection plan algorithm has to be disabled and all connection have to be defined manually. Click the "+" icon above the "Connection Plan" table to add a new connection. Use the "Device Name" and "Test Port Name" to select a test port on the VNA or matrix. Use the "Physical Port Name" and "DUT Index" to select the connected DUT port. Finally specify a "Display Name" for the connection (optional).



The "DUT Index" refers to a physical DUT. The number of DUTs can be defined via the "DUT" setting in the Measurement Paths workspace.

4.3.2.5 Local Data Configuration

In this configuration group, you can specify the local data of the ZNrun project, i.e. the project data that probably have to be modified, when the project is deployed to another ZNrun Server instance.

Local Data	
Device Communication Properties	
DUT State Switch Communication Propertie	s
Extension Registrations	

- Device Communication Properties......51

Device Communication Properties

The "Device Communication Properties" workspace gathers the communication properties of all measurement devices. All communication properties are editable.

Device Communication Properties							×
							≡
Device Name	Communication Channel	٣	Resource	٣	Waiting Time	٣	
VNA001	VISA				2000		×
Matrix001	LOGICAL				2000		×
CalibrationUnit001	VNA_CONTROLLED_VIA_LAN				2000		x

Figure 4-38: Device Communication Properties workspace

If you remove a row from the "Device Communication Properties" table, the corresponding device is **not** removed from the measurement plan. Only its communication properties are reset.

DUT State Switch Communication Properties

This workspace gathers the communication properties of all state switches. All communication properties are editable.

DUT State Switch Communication Properties								
				≡				
Switch T	Туре т	Resource T	Waiting Time	T				
StateSwitch001	VISA]	0	×				

Figure 4-39: DUT State Switch Communication Properties workspace.

If you remove a row from the "DUT State Switch Communication Properties" table, the corresponding state switch is **not** removed from the measurement plan. Only its communication properties are reset.

Extension Registrations

The "Extension Registrations" workspace gathers information on registered plugins. It displays "Category" and "Class Name" of every custom device and post processor defined in the Plugins workspace. Here you can specify a local path to a parameter file ("Parameter File Path").

Extension Registrations			×
			≡
Category	▼ Class Name	T Parameter File Path	Ŧ

Figure 4-40: Extension Registrations workspace

Q

If you remove a row from the "Extension Registrations" table, the corresponding extension is **not** removed from the list of plug-ins. Only the parameter file path is deleted.

4.3.3 Import Stimuli

You can import stimuli from file. Select the "Import Stimuli" icon from the Chapter 4.1.1, "Main Toolbar", on page 16 and pick an *.xml file that contains a valid serialization of a DutMeasurementPlan. For example, you can use the

DutMeasurementPlan.xml that is created by the ZNrun Workbench when the workbench project is saved. The ZNrun Workbench automatically extracts all stimuli from the DUTmeasurementPlan and displays them in a list.

Configuration Phase

Name	т Туре	▼ Full Calibration	▼ Start	▼ Stop
PowerOn	Segmented		1000000	1000000
Stimuli_Spara1	Segmented		50000000	3000000
Stimuli_VSWR1	Segmented		100000000	1500000
Stimuli_NF1	Lin Freq		100000000	1100000
Stimuli_Spara2	Segmented		50000000	3000000
Stimuli_VSWR2	Segmented		100000000	1500000
Stimuli_NF2	Lin Freq		1100000000	1200000
Stimuli_Spara3	Segmented		50000000	3000000
Stimuli_VSWR3	Segmented		100000000	1500000
Stimuli_NF3	Lin Freq		120000000	1300000
Stimuli_Spara4	Segmented	D	50000000	3000000
Stimuli_VSWR4	Segmented		100000000	1500000
Stimuli_NF4	Lin Freq		130000000	1400000
Stimuli_Spara5	Segmented		50000000	3000000
Stimuli_VSWR5	Segmented		100000000	1500000
Stimuli_NF5	Lin Freq		150000000	1600000
Stimuli_Spara6	Segmented		50000000	3000000
Stimuli_VSWR6	Segmented		100000000	1500000
Stimuli_NF6	Lin Freq		160000000	1700000
Stimuli_Spara7	Segmented		50000000	3000000
Stimuli_VSWR7	Segmented		100000000	1500000
Stimuli NF7	Lin Freq		170000000	1800000

Figure 4-41: Import Stimuli dialog

Use the checkboxes to the left to select the stimuli to be imported.

There are three different "Import" modes:

- **Replace:** All new stimuli are imported. Duplicates are replaced with the imported stimuli.
- **Rename:** All new stimuli are imported. The ZNrun Workbench assigns all duplicates a new unique identifier.
- Skip: All new stimuli are imported. Duplicates are not imported.

The default stimuli import mode is "Rename".

4.4 Calibration Phase

After the Measurement Execution Unit (MEU) has been configured, you can proceed with the calibration using the "ZNrun Calibration Client".

To launch the ZNrun Calibration Client in "DUT Related Calibration"-mode, click the calibration icon in the Main Toolbar.



Figure 4-42: Calibration toolbar icon with calibration mode selector

To select another calibration mode ("Full Calibration", "User Defined Calibration", "DUT Related Calibration Without Connection Test"), use the drop-down menu beneath the calibration icon.

For a description of the ZNrun Calibration Client, see Chapter 5, "ZNrun Calibration Client", on page 61.

4.5 Execution and Visualization Phase

After the configuration and calibration of the Measurement Execution Unit (MEU), you can finally proceed with the execution and visualization of the measurement.

4.5.1 Execution View

The "Execution View " workspace gathers all information of the MEU execution. In this workspace, the measurement cycle is displayed in a tree like structure, similar to the Measurement Cycle configuration workspace.

Additional information such as the execution status, execution duration or calibration status of a sequential context, parallel context or step is displayed to the right of the corresponding tree node.

Execution View			×
Cycle 00:00.000			
Sequential001	00:00.000		
SPM_PowerOnDummy_0_0	00:00.000	8	
SPM1_Spara	00:00.000	0	
SPM1_VSWR	00:00.000	0	

Figure 4-43: Execution View workspace

In the same way as described for the measurement cycle configuration workspace, you can enable or disable the execution of nodes and set or delete breakpoints.

To start and manipulate the execution, you can use the execution tools in the main toolbar (see Table 4-2).



Figure 4-44: Toolbar icons for the execution phase

4.5.1.1 Tuning

Tuning is a special feature of the R&S ZNrun framework. It enables you to change and optimize the configuration of a MEU during the execution phase.

A parameter change affects all instances of the MEU. Furthermore, tuning comes with three tools to enhance the capabilities of the configuration of a MEU with the ZNrun Workbench:



Figure 4-45: Tuning tools

4.5.1.2 Connections

In the "Connections" workspace, the connection plan is displayed.

It contains the information of the Connection Plan Configuration, plus all automatically generated connections (indicated by a checkmark in "Generated" column).

Connections										×	
Device Name	٣	Test Port Name	٣	Physical Port Name	Ŧ	Dut Index	٣	Display Name	٣	Generated	٣
VNA001		P1		P09		0				\checkmark	
VNA001		P3		P01		0				\checkmark	
VNA001		P2		P02		0				\checkmark	
VNA001		P4		P03		0				\checkmark	
VNA001		P8		PP001		0				\checkmark	
VNA001		P7		PP002		0				\checkmark	
VNA001		P6		PP003		0				~	
VNA001		P5		PP004		0				~	
VNA001		P9		P09		1				~	
VNA001 VNA001 VNA001 VNA001 VNA001		P6 P5 P9		PP001 PP002 PP003 PP004 P09		0 0 0 1				* * * *	

Figure 4-46: Connections workspace

4.5.2 Visualization Workspace

The outcomes of the measurements can be displayed in the "Visualization" workspace. You can either create an empty chart and drag & drop a "Stimulus Portgroup Measurement" from the "DUT Center" onto it. Or you can display a "Stimulus Portgroup Measurement" directly, by dragging & dropping it from the "DUT Center" to the workspace. To delete a chart, drag and drop it to the bin in the Chapter 4.1.1, "Main Toolbar", on page 16 of the ZNrun Workbench.

To focus on the results of a particular DUT, select the corresponding DUT index from the dropdown menu. Then newly created charts only display the measurements related to this DUT.

All charts are updated during the execution of the measurement cycle. All charts can be edited using the visualization tools:



Table 4-10: Visualization tools (from left to right)

Group	Name	Action			
Basic tools	Add empty chart	Adds a new empty chart to the workspace.			
Visualization tools	Add marker	Adds a marker to the chart. The position of the marker in the chart can be changed by dragging. A legend entry is created.			
	Freeze trace	Adds the current trace of the chart permanently to the chart. Creates a legend entry.			
	Show legends	Shows or hides the legend of a chart.			
	Show limits	Shows the limit lines of the mea- surement path in the chart.			
Layout tools	Grid layout	Arranges the charts in a dynamic grid layout. The size of the charts is fixed.			
	Stack layout	Arranges the charts stacked over one another. The width of the chart is dynamically adjusted.			
	Maximize view	Adjusts the size of the chart to the size of the workspace.			
	Keep aspect ratio	Keeps the aspect ratio of all charts equal. A change of the aspect ratio of one chart affects all charts.			
	Couple chart sizes	Keeps the size of all charts equal. A change of the size of one chart affects all charts.			
Export tools	Export chart to file	Exports the selected chart as .PNG. The destination folder is chosen by a dialog.			
	Copy chart to clipboard	Copies the selected chart to the clipboard.			

4.6 Rollout Phase

You can use ZNrun Workbench to roll out a valid Measurement Execution Unit (MEU) to multiple test stations, controlled by one or multiple ZNrun Server(s). The MEU loaded in ZNrun Workbench serves as master MEU. The test stations must be described as your "Device Park".



A test station is a set of devices comprising, for example:

- one or more VNAs
- one or more DUT adapters
- matrix devices (optional)
- calibration devices (optional)

To control rollout, use the rollout tools in the main toolbar (see Table 4-3).

$ \Rightarrow$	R	Ф.	0		
----------------	---	----	---	--	--

4.6.1 Device Park

The "Device Park" describes your available test stations (VNAs, matrices). It is located in an arbitrary root directory on your file system.

Each test station in the device park is represented by a subdirectory. The name of the directory is used as name of the test station. Each test station subdirectory needs to contain a MeasurementDevicesPlan.xml and a MeasurementDevicesLocalData.xml file:

<Root>

```
|-- <TestStationName>
```

- |-- <MeasurementDevicesPlan>.xml
- |-- <MeasurementDevicesLocalData>.xml
- |-- <TestStationName>
 - |-- <MeasurementDevicesPlan>.xml
 - |-- <MeasurementDevicesLocalData>

Additional files in the subdirectory are ignored for rollout.



Set up the root directory of your device park in the "Rollout" tab of the options dialog (see Chapter 4.1.7, "Options", on page 23).

4.6.2 Rollout Plan View

Rollout Plan Rollout S	Status						×
Device Park		Sele	ect / Deselect All	Rollout Plan			
Test Station T	Devices	Nr Test Ports	▼ Use ▼	Test Station	▼ Server IP	▼ Generated ▼	
VNA24	[VNA,TCPIP::ZNrunZNBT3]	24		VNA2_Matrix24	127.0.0.1	1	¢.
VNA2_Matrix24	[VNA,TCPIP::ZNrunZNB1] [Matrix001,127.0.0.1]	24	~	VNA4	127.0.0.1	2	
VNA4	[VNA001,TCPIP::ZNrunZNBT1::hislip0]	4	~	VNA8	unknown	2	¢
VNA4_Matrix10	[VNA,TCPIP::ZNrunZNB1] [Matrix001,localhost]	10					
VNA8	[VNA,TCPIP::ZNrunZNBT1]	8	✓				
VNA8_Matrix16_16	[VNA,TCPIP::ZNrunZNBT1] [Matrix_1,localhost] [Matrix_2,localhost]	32					
ZNB4	[VNA,TCPIP::ZNrunZNB1]	4					
ZNBT24	[VNA001,TCPIP::ZNrunZNBT2]	24					
ZNBT24_ZNB4_VNA4	[VNA001,TCPIP::ZNrunZNBT1] [VNA002,TCPIP::ZNrunZNB1] [VNA003,TCPIP::ZNrunZNB2]	32					
Details							
VNA Devices Matrix D	Devices Calibration Unit Devices Cali	bration Kit Devices Power M	leter Devices				
Name	т Туре т	Port Count T	Purpose	T Communication	Chanı 🔻 Resource	▼ Waiting Time	7
+ VNA	UNKNOWN	2		VISA	TCPIP::ZNrunZNB1	0	

Device Park section

The upper left part of the "Rollout Plan" presents the device park in tabular form, each test station identified by its configured "Test Station" name.

Device Park			Sel	ect / D	eselect A
Test Station 7	Devices	Ŧ	Nr Test Ports	Ŧ	Use 🔻
VNA24	[VNA,TCPIP::ZNrunZNBT3]		24		ET.
VNA2_Matrix24	[VNA,TCPIP::ZNrunZNB1] [Matrix001,127.0.0.1]		24		
VNA4	[VNA001.TCPIP::ZNrunZNBT1::hislip0]		4		4
VNA4_Matrix10	[VNA,TCPIP::ZNrunZNB1] [Matrix001,Iocalhost]		10		U.
VNA8	[VNA,TCPIP::ZNranZNBT1]		8		~
VNA8_Matrix16_16	[VNA,TCPIP::ZNrunZNBT1] [Matrix_1,localhost] [Matrix_2,localhost]		32		
ZNB4	[VNA,TCPIP::ZNrunZNB1]		4		
ZNBT24	[VNA001,TCPIP::ZNrunZNBT2]		24		
ZNBT24_ZNB4_VNA4	[VNA001,TCPIP::ZNrunZNBT1] [VNA002,TCPIP::ZNrunZNB1] [VNA003,TCPIP::ZNrunZNB2]		32		

For each test station, the corresponding table row displays:

- the constituent "Devices" (resource strings)
- the overall "Nr. of Test Ports" available for DUT connections

Tick the "Use" checkbox for those test stations, to which you want to roll out the master MEU.



A test station that does not offer sufficient test ports for the master MEU is grayed out and cannot be used for rollout.

When you select a test station, the "Details" view provides more details:

Deta	ails														
VN/	A Devices	Matrix Devices	C	alibration Unit Devices	Cali	ibration Kit Devices	Power	Meter Devices							
	Name		T	Туре	T	Port Count	T	Purpose	۲	Con	mmunication Chanı 🔻	Resource	T	Waiting Time	T
+	VNA			UNKNOWN		2				VISA	5A	TCPIP::ZNrunZNB1		0	

Rollout Plan section

The test stations selected for "Use" in the Device Park section are transferred to the "Rollout Plan" section in upper right part of the "Rollout Plan" view.

T	Server IP	7	Generated T	
	127.0.0.1			ж
	127.0.0.1			x
	unknown		*	x
	T	Server IP 127.0.0.1 127.0.0.1 unknown	Server IP T 127.0.0.1 127.0.0.1 unknown 127.0.1	Server IP Cenerated T 127.0.0.1 2 127.0.0.1 2 unknown 2

For each test station, enter the IP address of the ZNrun Server to be used for rollout ("Server IP"). Then click the "Generate projects" button in the main tool bar (see Table 4-3).

A generated MEU comprises all components of the master MEU, except for any measurement devices and their local data, which are read from the used test station.

Manual changes to generated MEUs

At that point, you can apply manual changes to the generated MEUs. Manual changes can be necessary to adjust individual test stations (e. g. to set up de-/embedding) or the connection plan.

Edit the project files manually or in the ZNrun Workbench, or run a script to perform the necessary changes.

Repeated MEU generation

If you have modified your master MEU or the test stations in your device park, you have to regenerate the MEUs. Toggle the "Overwrite" button in the main tool bar to allow formerly generated MEUs to be overwritten (see Table 4-3).

Note that MEU regeneration also overwrites any manual changes applied to the formerly generated MEUs.

4.6.3 Rollout Status View

When your generated measurement execution units are ready for rollout, open the "Rollout Status" view.

Rollout Sta	tus						×
Select / Deselect All							
Roll Out	T Generated MEU	▼ Server IP	▼ State	٣	Message Lines 🔻	Primary Message	T
	ZNrun_Test_Config_VNA2_Matrix24	127.0.0.1					
	ZNrun_Test_Config_VNA4	127.0.0.1	×	\times	81	MeasurementDevices: At least one matrix state must be available. Perform calibration to fix it!	
~	ZNrun_Test_Config_VNA8	unknown	×		2	SocketException: Der angegebene Host ist unbekannt	
Details							
Messages							
Gen	erated MEU						
- ZNr	in_Test_Config_VNA4						
Type M	essage						
F W. M. Sti	arnings: assurementDevices: At least one matrix state mulusPortGroupMeasurement (SPM_PowerO mulusPortGroupMeasurement (SPM1_Spara)	must be available. Perform nDummy_0_0) requires a requires a new matrix stat	n calibration to fix it! new matrix state te				

For each "Generated MEU" that you want to roll out right now, tick the "Roll Out" checkbox in the respective column. Then click the "Roll out" button in the main tool bar (see Table 4-3).

The rollout process starts and for each selected "Generated MEU" the "State" column indicates the rollout progress. A connection plan generated by the respective ZNrun Server can be downloaded using the "Connections" icon

The ZNrun Workbench collects the messages received from the related ZNrun Servers. The "Rollout Status" view displays the number of "Message Lines" collected, and a "Primary Message". When you select a generated MEU, the "Details" view presents all messages.

You can repeat rollout for the same or a different selection of generated MEUs. The "Rollout Status" view reflects the status for all the rollouts performed during the current rollout session.

Rollout status log

You can log the rollout status of the current session to a file, according to your options (see Chapter 4.1.7, "Options", on page 23). Click the "Log rollout status" button in the main tool bar (see Table 4-3).

5 ZNrun Calibration Client

R&S ZNrun comes with a graphical calibration client that can be accessed via the Windows Start menu item "R&S ZNrun [version]" > "ZNrun Calibration Client".

The calibration client has a simple user interface suitable for guiding a technician through all the steps of the calibration process. For laboratory use, it offers a more advanced interface which allows definition of user-defined calibration tasks.

5.1 Calibration Modes

The ZNrun Calibration Client offers 4 different calibration modes:

DUT-related calibration

The required calibration tasks are derived from an existing

DUTMeasurementPlan, i.e. the calibration fits exactly to the measurement requirements of a particular DUT (stimuli, test ports, states of matrix and switches). Every measurement parameter in the DUTMeasurementPlan is calibrated exactly without interpolation, which is the preferred option if a fast and accurate calibration is desired.

Depending on the individual measurement steps, this option can lead to individual calibrations for every measurement step.

Generic calibration

Creates a multi-purpose calibration for a set of test ports, based on user-defined calibration stimuli settings. The intention is to use a common calibration for multiple DUTs and test ports without the need to recalibrate. Make sure to define a sufficient frequency range to prevent uncalibrated traces.

In contrast to DUT-related calibration, a generic calibration usually results in interpolated calibrations for a given DUTMeasurementPlan.

If switch matrices are involved, only a subset of the possible matrix routes is calibrated, compromising between calibration effort/time and application benefit.

• Full calibration

Similar to generic calibration, but with every possible switch matrix route being calibrated. This calibration mode enables full flexibility of test port usage.

User-defined calibration

Allows the creation of any calibration or recalibration. The three calibration modes described above can serve as starting points, but you can even define custom calibrations based on a single calibration standard (Open, Short, Match, Through ...).

Depending on how matrix devices are controlled, there are restrictions while combining test ports into groups simultaneously used by measurement or calibration.

Partial port group calibration (default) – matrix directly controlled by ZNrun Server

The test ports are divided into groups whose size is equal to the number of used matrix VNA ports, and for whom routes between the related matrix test ports and matrix VNA ports exist. All such port combinations are calibrated. Transmission measurements

between two ports are then restricted to the combinations covered in the partial port group calibration. This mechanism can be used with all supported VNAs.

Full port group calibration – matrix directly controlled by VNA

All possible groups of test ports, whose size is equal to the number of used matrix VNA ports and for whom routes between the related matrix test ports and matrix VNA ports exist, are fully calibrated. You can then measure transmission parameters between each pair of test ports without restriction. The downside is an increased calibration time, because the number of calibration procedures can be large. This mechanism can be used for VNAs whose firmware supports matrix control.

5.2 Deployment

The ZNrun Calibration Client offers two different modes of operation:

- Calibration step mode: execution of the actual calibration process in a step-bystep manner
- Calibration task mode: configuration of user-defined calibration tasks which can be executed in the calibration step mode afterwards

The operation mode of the calibration client can be controlled via command-line arguments.

By default the ZNrun Calibration Client connects to a ZNrun Server running on the same machine and conducts a generic calibration (see Chapter 5.1, "Calibration Modes", on page 61) in calibration step mode.

5.3 Command Line Interface

The ZNrun Calibration Client can be parameterized using a shortcut link or directly via Windows command prompt.

Command Line Interface

I ZNrun Calibration Client	
ROHDE&SCHWARZ	
Commandline Usage:	
-i IP_ADDRESS,ip=IP_ADDRESS	(Default: localhost) IP address of the ZNrun server.
-c COVERAGE,coverage=COVERAGE	(Default: GENERIC_CALIBRATION) DUT_RELATED_CALIBRATION GENERIC_CALIBRATION USER_DEFINED_CALIBRATION FULL_CALIBRATION
-1 NAME,load=NAME	Load Measurement Execution Unit 'NAME'. Already existing units will be re-loaded.
check=VERSION	Check that the loaded Measurement Execution Unit has correct 'VERSION'.
-u NAME,use=NAME	Use existing Measurement Execution Unit 'NAME'.
-e,edit	Start in edit mode for user defined calibration.
noautoconnect	Do not connect to single Measurement Execution Units automatically.
noconnectiontest	Do not test cable connections before calibrating.
help	Display this help screen.
CI	ose Application

Figure 5-1: Help screen of the ZNrun Calibration Client

The help screen is displayed on erroneous command-line arguments or if the '--help' parameter is used. It offers text selection and copy to clipboard [CTRL]+[C] functional-ity.

Command-line examples

ZNrunCalibrationClient.exe --ip=192.168.1.42 --load="DUT3425" -c DUT RELATED CALIBRATION

- Connect to the ZNrun Server running at IP address 192.168.1.42
- Create, load and use a MEU named DUT3425
- Conduct a DUT-related calibration in step-by-step mode

ZNrunCalibrationClient.exe --ip=192.168.1.42 --noautoconnect
--edit

- Connect to the ZNrun Server running at IP address 192.168.1.42.
- Do not connect to a MEU that is already loaded. Instead, the ZNrun Calibration Client presents a dialog that lets you choose the MEU to load or connect to.
- Start in calibration task mode.

```
ZNrunCalibrationClient.exe --load="DUT3425" --check="v 2.0"
--edit
```

- Connect to ZNrun Server running on the same machine
- Create, load and use a MEU named DUT3425
- Make sure that the loaded version was saved under version v 2.0 and that its content was not modified.
- Start in calibration task mode.

Note that you have to use quotation signs if a command line argument contains whitespace characters (e.g. "v 2.0").

5.4 Execution of Calibration Steps

The GUI in calibration step mode is separated into two major parts:

- List of calibration steps
- Connection scheme of the current calibration step



- 1 = Name of the MEU
- 2 = List of calibration steps
- 2a = Step backward
- 2b = Step forward
- 2c = Current calibration step
- 3 = Connection scheme of the current calibration step

- 3a = Graphical representation of connecting instruction
- 3b = Unique name of the calibration device
- 3c = Changed indicator modified connection related to the previous step
- 4 = Perform calibration step

Keyboard shortcuts can be used to navigate through the list of calibration steps and to trigger calibration step procedures.

Table 5-1: ZNrun Calibration Client: Keyboard shortcuts

Keyboard shortcut	Related user control	Description
$\leftarrow or \downarrow$	2a	Step forward through list of cali- bration steps
\rightarrow or \uparrow	2b	Step backward through list of cali- bration steps
Pos1	-	Go to the beginning of list
End	-	Go to the end of list
Enter	3b	Perform calibration of current step

5.5 Representation of the Calibration Devices

The connection scheme shows a graphical representation of the calibration unit/kit and how cables have to be connected to the measurement devices.



Figure 5-3: 8-port calibration unit

Cables can be marked with user-defined names and up to three colors. Once you have connected all cables, press the calibration button. A symbol in the upper right corner of each of calibration step represents the result of the calibration procedure. If successful,

Representation of the Calibration Devices

a green check mark is displayed. An exclamation mark in a yellow triangle represents an error. In addition, a tooltip provides further information about the result.

If a calibration step was successfully executed, the dialog automatically proceeds to the next calibration step. Cable connections that have to be changed are marked with a blue "change indicator". For example, in Calibration using a calibration unit: step 1 successfully executed four of eight connections have to be changed before the step can be executed.

Before performing the calibration step, the application runs an automatic connection test. If an invalid or missing connection is detected, this connection is marked with a blinking red color mark and the calibration is canceled. For example, in Calibration using a calibration unit: wrong connection in step 2 connection between calibration unit port 6 and measurement test port "ZV-Z82 4" is invalid.



Figure 5-4: Calibration using a calibration unit: before step 1



Figure 5-5: Calibration using a calibration unit: step 1 successfully executed



Figure 5-6: Calibration using a calibration unit: wrong connection in step 2



Figure 5-7: Calibration using a calibration kit

5.6 Reporting

After the calibration has been successfully executed, a report can be generated in PDF format. The report provides information about the individual calibration steps, comprising:

• General information such as current date, operator name and optional comments

• A list of **actions** (represented by execution timestamp, action description and result) including both user actions and automatic actions such as requesting information about client and server version.

OHDEAS	CHWARZ			
Nrun Calibr	ation - EpcosDemoOhneSP21	r		
	< 1."	2. 3		>
		c	alibration Report	
	PDF 1	23,0403	Cient schware :	Disademan and 100. Columnation
	<u></u>	15.teda	Competition Things are at 127 0.01	PublickeyTolemional
		102803	Server software	Deutliever Version 0300 Cutum neutral Puttickly/Section
	08.03.2013	135805	Loading Measurement Execution Livit	
Date			appendix of the second s	
Date	Tester	135895	Creating have nom Measurement Execution Line.	1.9
Date Name of Operators	Testic	135895	Setup	
Date Name of Operators Comment	Testic	135805	Setup Reductify and PCR algorithms processor and Danage for calculation Steps	Trate
Date Name of Operators Cognoret	Teste	135805 135805 135805 135805 135805	Creating new train Intersystement processor unit. Setup ReductiVumberOfCalatestonDeps Prepare for calaboston TpcosDemoChredB2T Precario calaboston taccoDemoChredB2T	Trans Erk
Date Name of Operators Cognoret Report Clar	Tester militare:sev-log.auf	135895 135895 135825 135455 135455 135038	Crating new nom mass-energi passer pro- Setap Reduct/Tumbe/OKaltarkov/Stepi Negari for calibration Topo/StemoChrud/827 Proparti calibration reps Topo/StemoChrud/827 Lescuing calibration reps Totos/SumOChrud/827	Trat Dik Dik Dik
Date Name of Operator Cognoent Report (Ber	Teste 19 States syn-Log-Log	135995 135995 135995 13595 13595 13595 13595	Change new two wassement parcept one Setup RequestrumberOfCatbetor/Seps Pergaré for calencion TpportBem02ee450T Require calencion rates TpcortBem02ee451T Leecung calencion rates TwordBen31T Executing calencion rates TwordBen31 Executing calencion rates TwordBen32	ros Trais pick de Abortes due to failed poirt denoection test.
Date Name of Operator Cognoent Report (Ber	Tester rylisleres inp-log-cod Choore for same and locense	135805 135805 135805 135855 13585 135058 145058 145058 145058	Unany new two transversion parcing of the Setap Reductive MeterOcalasticity Res Pepare to calastics ("peoplemocDemoSol" People calastics tests "become directive Incursting addression tests" Executing addression tests ("Manufated" Executing addression tests ("Manufated" Execu	res Files Ré Réstats due to faillet point desmechan test. Fé

Figure 5-8: Report generation view

6 ZNrun Measurement Client

The R&S ZNrun installer comes with a measurement execution client implementation that can be accessed via the Windows Start menu item "R&S ZNrun [version] > ZNrun Measurement Client".

The ZNrun Measurement Client provides a clean and simple graphical user interface which allows to control the execution of a pre-configured

MeasurementExecutionUnit. In addition it provides a remote control interface that allows to control the measurement execution via SCPI commands. A plug-in interface enables user-defined extensions such as the creation of custom log files and reports.

	FEM_DUT_#623478278	3			
30:00.109	-	1 Step			
-	Ok				
(PP)	13 22 54 FEM DUT #623478277	08			
NEXT	13.22.50 FEM_DUT_#623478276	04			-
\sim	13:22:48 FEM_DUT_#623478275	Cit.			
	13.22.46 FEM_DUT_#623478274	CR			
	13:22:43 FEM_DUT_#623478273	C4			
	13.22.41 PEM_DUT_#623476272	08			
	13:22:37 FEM_DUT_#623478271	04			
	13.22.36 FEM_DUT_#623478270	~			
	13.22:31 FEM_DUT_#623478269	CA.			
	13:22:25 FEM_DUT_#623478268	Ca.			
	13 22 25 FEM_DUT_+623476267	CR.			
	13.22.23 FEM_DUT_4623478266	C8			
	13:22:20 FEM_DUT_#623478265	Ċk.			
	13.22:17 FEM_DUT_#623478264	çe			
a	00	80	100 % 7	 	
	Xh				

Figure 6-1: ZNrun Measurement Client

6.1 Basic Functions

The "Load Measurement Execution Unit Setup" allows to re-/load a Measurement Execution Unit. Re-/loading a Measurement Execution Unit re-/initializes the related measurement devices.

The Measurement Steps of the Measurement Cycle defined by the Measurement Execution Unit are displayed as table rows. The table columns represent the Measurement Step name, "Next" and "Disabled?" switches (see Advanced Features), and the path to the "File" where the results of the Measurement Step shall be stored.

A spinner control allows to specify the number *n* of Measurement Cycles to be executed.

The "Start / Continue", "Pause" and "Stop" buttons allow a basic control of the Measurement Cycle execution. When the "Start" button is pressed, the client executes the Measurement Cycle *n* times or until the "Pause" or "Stop" button is pressed. "Continue" resumes a paused execution.

The stop watch allows to measure the execution time.

Errors that occur during the loading or execution phase are shown in status row on the bottom of the dialog. If an error occurs during the execution of a particular MeasurementStep, this step is marked in red. In addition, a tooltip shows the error text.

6.2 Advanced Features

In addition to the Basic Functions described above, the ZNrun Measurement Client offers advanced functionality to control the execution of MeasurementCycles. These functions are:

- Stepwise Execution
- Breakpoints at Measurement Steps
- Disabled Measurement Steps

Measurement Steps can be executed step by step. To initiate this mode, press "Step" button or set a breakpoint at that Measurement Step and press "Start" button. If a Measurement Cycle is paused at a breakpoint, the execution can be resumed by using "Step" or "Continue" button. Breakpoints are set by a mouse click on "Next" column of a MeasurementStep in the list view. A red dot in "Next" column represents an active breakpoint. A blue arrow shows the Measurement Step to be executed next when the "Step" button is pressed.

Measurement Steps can be disabled by activating the checkbox in the "Disabled?" column.

Glossary: Frequently used terms

С

Configuration phase: State of a measurement execution unit in which you can set, change or remove configuration data. It is not possible to calibrate devices or execute measurements in this state.

Connection plan: A connection plan describes the HF connections between the test ports of the measurement devices and the measurement adapter carrying the DUT (DUT measurement plan). Formally, the ConnectionPlan data structure links a MeasurementDevices to a DUTMeasurementPlan.

D

DUT measurement plan: The DUTMeasurementPlan data structure describes the device under test (including the measurement adapter) and the parameters to be measured. It corresponds to a particular type of DUT and does **not** contain any information about the measurement devices to be used.

Ε

Execution phase: State of a measurement execution unit in which the measurements – described by the configuration data – can be run. In this state, the configuration data cannot be modified and is the basis for calculating the measurement cycle. The measurement cycle can be steered using the IMeasurementControl interface.

Μ

Measurement cycle: Represents the measurement process which is calculated from the configuration data of the measurement execution unit. The cycle consists of a sequence of measurement steps. It is possible to label the cycle with a unique identifier which allows distinguishing successive cycles.

Measurement devices: The MeasurementDevices data structure describes a set of measurement devices that can be used to measure a DUT (vector network analyzers, switch matrices, calibration units). It includes information about the connections between VNAs and switch matrices, but does **not** contain any information about potential measurement objects and the parameters to be measured (see DUT measurement plan).

Measurement execution unit: A measurement execution unit represents a measuring task for a DUT with all measurement equipment and properties. Technically, it is an instance of IMeasurementExecutionUnit on the ZNrun Server, holding the three database components MeasurementDevices, DUTMeasurementPlan and ConnectionPlan (see measurement devices, DUT measurement plan and connection plan, respectively). The database is managed by the MEU and is the basis for all measurement executions.

Measurement step: Container for stimulus portgroup measurements. A measurement step is non-interruptible but can function as a breakpoint in a measurement cycle. All stimulus port group measurements within a measurement step are executed in parallel.

S

Stimulus port group measurement: A specific measurement, defined by a set of measurement parameters, a group of DUT ports and a stimulus description. User-specific actions (provided by plug-ins) can be hooked onto stimulus port group measurements.