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Network Analyzers using RVNA and RNVNA software

Operating and Programming manual

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Contents

Contents

Contents

Contents

Contents

Contents

Contents

Contents

Contents

Contents

Contents

Contents

Contents

Contents

Contents

Contents

Contents

Contents

Contents

Contents

Contents

Contents

Contents

Contents

Contents

Contents

Introduction

This manual contains design, specifications, functional overview, and detailed operation procedures for the Copper Mountain Technologies Vector Network Analyzer, to ensure effective and safe use of its technical capabilities.

Maintenance and operation of the Analyzer should be performed by qualified engineers with basic experience in the operation of microwave circuits.

Glossary — The abbreviations which are used in this document.

Web Sites

Copper Mountain Technologies

Scope of Manual

This manual covers for the 1-port Vector Network Analyzer (VNA) controlled by the RVNA software version 22.4.0 and N-port mode of VNA (RNVNA) controlled by the RNVNA software version 22.4.0. The Analyzer models are listed below:

- R60
- R140
- R140B
- R180
- R54
- RNVNA

Safety Instructions

It is highly recommended to follow all safety warnings and precautions provided in this document for operating, servicing, and repairing the Analyzer.

The Analyzer should be used only by skilled and thoroughly trained personnel with the required skills and knowledge of safety precautions.

The Analyzer complies with INSTALLATION CATEGORY II as well as POLLUTION DEGREE 2 as defined in IEC61010–1.

The Analyzer is a MEASUREMENT CATEGORY I (CAT I) device. Do not use the Analyzer as a CAT II, III, or IV device.

The Analyzer has been tested as a stand-alone device and in combination with the accessories supplied by Copper Mountain Technologies, in accordance with the requirements of the standards described in the Declaration of Conformity. If the Analyzer is integrated with another system, compliance with related regulations and safety requirements are to be confirmed by the builder of the system.

Never operate the Analyzer in an environment containing flammable gasses or fumes.

Operators must not remove the cover or any other part of the housing. The Analyzer must not be repaired by the operator. Component replacement or internal adjustment must be performed by qualified maintenance personnel only.

Electrostatic discharge can damage the Analyzer whether connected to or disconnected from the DUT. Static charge can build up on your body and damage sensitive internal components of both the Analyzer and the DUT. To avoid damage from electric discharge, observe the following:

- Always use a desktop anti-static mat under the DUT.
- Always wear a grounding wrist strap connected to the desktop anti-static mat via daisy-chained 1 MΩ resistor.
- PC and DUT connection to protective grounding.

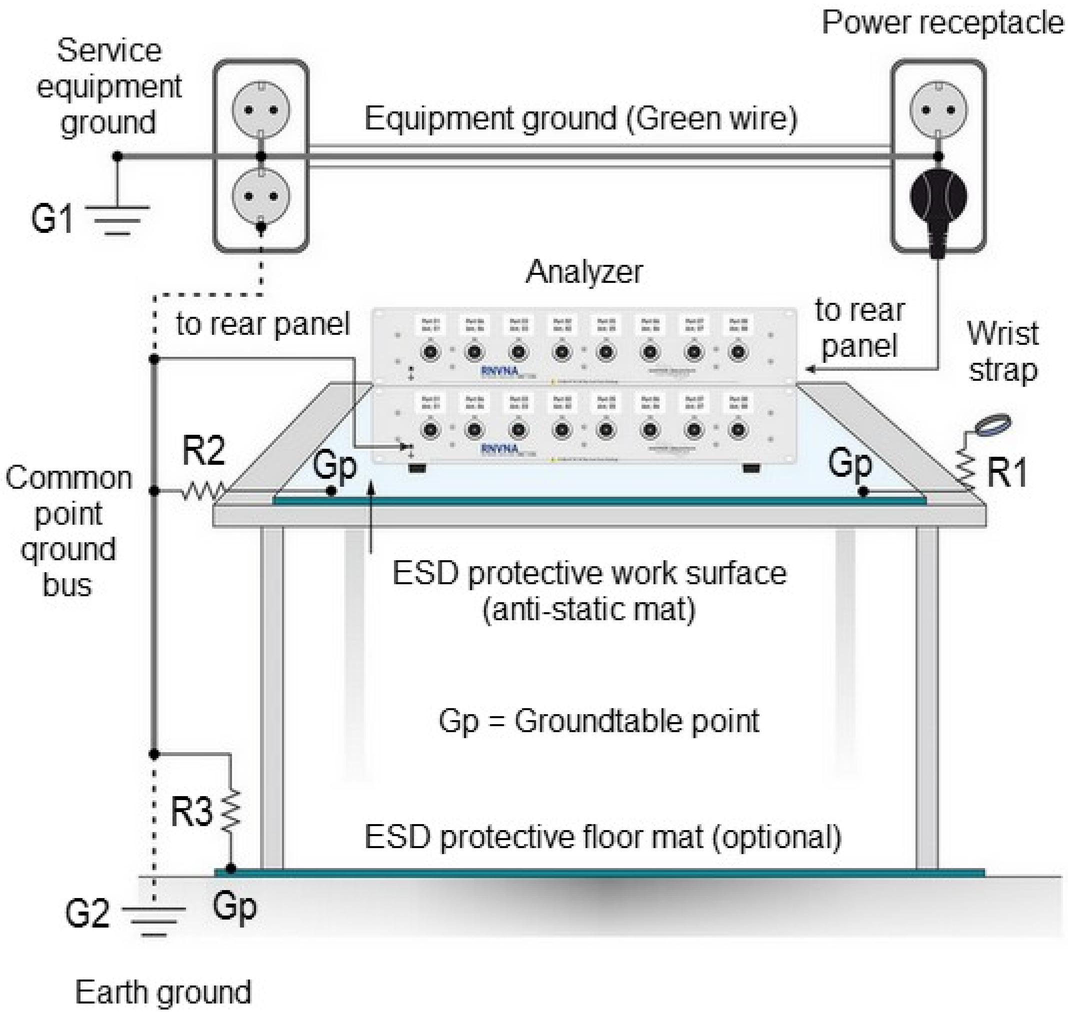
All general safety precautions related to operation of electrically energized equipment must be observed.

WARNING	This sign denotes a hazard. It calls attention to a procedure, practice, or condition that, if not correctly performed or adhered to, could result in injury or death to personnel.
CAUTION	This sign denotes a hazard. It calls attention to a procedure, practice, or condition that, if not correctly performed or

adhered to, could result in damage to or destruction of part or all of the instrument.

NOTE

This sign denotes important information. It calls attention to a procedure, practice, or condition that is essential for the user to understand.



Resistance R1 is a must for wrist straps.

The R1 rating is selected from a range of 1 MΩ.

Resistance values R2 or R3 must comply with the recommendations of the manufacturer of antistatic equipment.

Minimum requirements for the organization of a workstation with protection against electrostatic discharges

General Overview

The Vector Network Analyzer is designed for use in the process of development, adjustment, and testing of various electronic devices in industrial and laboratory facilities, including operation as a component of an automated measurement system. The Analyzer is designed for operation with an external PC, which is not supplied with the Analyzer.

The overview of measurement capabilities of the Analyzer is represented in Measurement capabilities.

The block diagram of the Analyzer is represented in Principle of operation.

Specifications

The specifications of each Analyzer model can be found in its corresponding datasheet.

Measurement Capabilities

Measurement Capabilities

Measured parameters	S11, Cable loss, when using a 1-port VNA. S-parameters when using two or more Analyzers (separately or as a part of an RNVNA): • Sii, where i is a value from 1 to N is taken. • |Sij|, i ≠ j, i and j take a value from 1 to N (N is a number of Analyzers).
Number of measurement channels	Up to 4 logical channels for 1-port VNA. Up to 16 logical channels for RNVNA. Each logical channel is represented on the screen as an individual channel window. A logical channel is defined by such stimulus signal settings as frequency range, number of test points, etc.
Data traces	Up to 4 data traces can be displayed in each channel window for 1-port VNA. Up to 16 data traces can be displayed in each channel window for RNVNA. A data trace represents one of such parameters of the DUT as magnitude and phase of S-parameters, Cable loss.
Memory traces	Each data trace can be saved into memory for further comparison with the current values.
Data display formats	Logarithmic Magnitude, Phase, Expand Phase, Group Delay, SWR, Real, Imag, Linear Magnitude, Smith chart diagram, Polar, Cable loss.

Sweep setup features

Sweep type	Linear frequency sweep, logarithmic frequency sweep, and segment frequency sweep.
Measured points per sweep	From 2 to 100,001 for 1-port VNA. From 2 to 16,001 for RNVNA.
Segment sweep	A frequency sweep within several user-defined segments. Frequency range, number of sweep points, IF bandwidth and measurement delay should be set for each segment.
Power settings	Two modes of output power level. Power levels depending on device.
Sweep trigger	Trigger modes: continuous, single, hold. Trigger sources: internal, external, bus. The availability of this feature depends on the Analyzer model.

Trace display functions

Trace type	Data trace, memory trace, or simultaneous data and memory traces.
Trace math	Data trace modification by math operations: addition, subtraction, multiplication or division of measured complex values and memory data.
Autoscaling	Automatic selection of scale division and reference level value to have the trace most effectively displayed.
Reference level automatic selection	Automatic selection of the reference level. After selection, the data trace shifts vertically so that the reference level crosses the trace in the middle.
Electrical delay	Calibration plane moving to compensate for the delay in the test setup. Compensation for electrical delay in a DUT during measurements of deviation from linear phase.
Phase offset	Phase offset by the specified value in degrees.

Accuracy enhancement

Calibration	Calibration of a test setup (which includes the Analyzer and adapter) significantly increases the accuracy of measurements. Calibration allows to correct the errors caused by imperfections in the measurement system: system directivity, source match, and tracking.
Calibration methods	The following calibration methods are available: • Reflection normalization. • Full one-port calibration. • Normalization of the transmission coefficient module when using two or more vector analyzers (separately or as part of an RNVNA Analyzer). • Full one-port calibration with normalization of the transmission coefficient module. • Full two-port calibration with normalization of the transmission coefficient module.
Reflection normalization	The simplest calibration method. It has low accuracy.
Full one-port calibration	Method of calibration that ensures high accuracy.
Normalization of the transmission coefficient module when using two vector analyzers	The type of calibration that is used when measuring the transmission coefficient module of the DUT when using two or more vector analyzers (separately or as a part of an RNVNA Analyzer) connected to one USB controller. It has low accuracy.
Full one-port calibration with normalization of the transmission coefficient module	The type of calibration that is used for advanced normalization of the gear ratio. It allows to increase the accuracy of measuring the transmission coefficient by taking into account the coordination of the signal source with the measured device.
Full two-port calibration with normalization of the transmission coefficient module	The type of calibration that is used for advanced normalization of the gear ratio. It allows to increase the accuracy of measuring the transmission coefficient by taking into account the coordination of the source and receiver of signals with the measured device.

Factory calibration	The factory calibration of the Analyzer allows performing measurements without additional calibration and reduces the measurement error after reflection normalization.
Mechanical calibration kits	The user can select one of the predefined calibration kits of various manufacturers or define own calibration kits.
Electronic calibration modules	Copper Mountain Technologies' automatic calibration modules (ACM's) make Analyzer calibration faster and easier than traditional mechanical calibration and provides the highest accuracy.
Defining of calibration standards	Different methods of calibration standard defining are available: • standard defining by polynomial model • standard defining by data (S-parameters)
Error correction interpolation	When the user changes such settings as start/stop frequencies and number of points, compared to the settings of calibration, interpolation or extrapolation of the calibration coefficients will be applied.
Port Extension	Calibration plane compensation for delay in the test setup.

Marker functions

Data markers	Up to 16 markers for each trace. A marker indicates stimulus value and the measured value in a given point of the trace.
Reference marker	Enables indication of any maker values as relative to the reference marker.
Marker search	Search for max, min, peak, or target values on a trace.
Marker search additional features	User-definable search range. Functions of specific condition tracking or single operation search.
Setting parameters by markers	Setting of start, stop and center frequencies by the stimulus value of the marker and setting of reference level by the response value of the marker.
Marker math functions	Statistics, bandwidth, flatness, RF filter.
Statistics	Calculation and display of mean, standard deviation and peak-to-peak in a frequency range limited by two markers on a trace.
Bandwidth	Determines bandwidth between cutoff frequency points for an active marker or absolute maximum. The bandwidth value, center frequency, lower frequency, higher frequency, Q value, and insertion loss are displayed.
Flatness	Displays gain, slope, and flatness between two markers on a trace.
RF filter	Displays insertion loss and peak-to-peak ripple of the passband, and the maximum signal magnitude in the stopband. The passband and stopband are defined by two pairs of markers.

Data analysis

Port impedance conversion	The function of conversion of the S-parameters measured at 50 Ω port into the values, which could be determined if measured at a test port with arbitrary impedance. **NOTE**: The function is applicable for reflection coefficients (S11, S22 etc.) measurement only.
De-embedding	The function allows to exclude mathematically the effect of the fixture circuit connected between the calibration plane and the DUT from the measurement result. This circuit should be described by an S-parameter matrix in a Touchstone file. **NOTE**: The function is applicable for reflection coefficients (S11, S22 etc.) measurement only.
Embedding	The function allows to simulate mathematically the DUT parameters after virtual integration of a fixture circuit between the calibration plane and the DUT. This circuit should be described by an S-parameter matrix in a Touchstone file. **NOTE**: The function is applicable for reflection coefficients (S11, S22 etc.) measurement only.
S-parameter conversion	The function allows conversion of the measured S-parameters to the following parameters: reflection impedance and admittance, transmission impedance and admittance, and inverse S-parameters. **NOTE**: The function is applicable for reflection coefficients (S11, S22 etc.) measurement only.

Time domain transformation	The function performs data transformation from frequency domain into response of the DUT to radiopulse in time domain. Time domain span is set by the user arbitrarily from zero to maximum, which is determined by the frequency step. Windows of various forms allow better tradeoff between resolution and level of spurious sidelobes. **NOTE**: The function is applicable for reflection coefficients (S11, S22 etc.) measurement only.
Time domain gating	The function mathematically removes unwanted responses in time domain which allows obtaining frequency response without influence from the fixture elements. The function applies reverse transformation back to frequency domain from the user-defined span in time domain. Gating filter types are bandpass or notch. For better tradeoff between gate resolution and level of spurious sidelobes the following filter shapes are available: maximum, wide, normal and minimum. **NOTE**: The function is applicable for reflection coefficients (S11, S22 etc.) measurement only.

Other features

Analyzer control	Using external personal computer via USB interface.
Familiar graphical user interface	Graphical user interface based on Windows operating system ensures fast and easy Analyzer operation. The software interface of Analyzers is compatible with modern tablet PCs and laptops.
Saving trace data	Saving the traces in graphical format and saving the data in Touchstone and *.CSV (comma separated values) formats on the hard drive are available.

Remote control

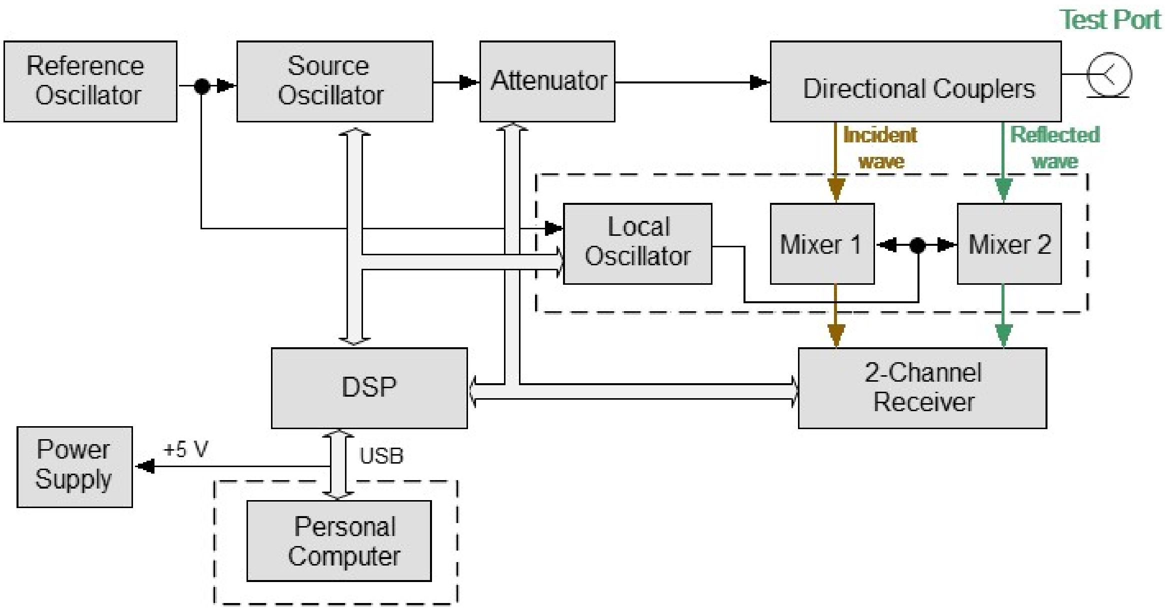
COM/DCOM	Remote control via COM/DCOM. COM automation runs the user program on an Analyzer PC. DCOM automation runs the user program on a LAN-networked PC. Automation of the instrument can be achieved in any COM/DCOM-compatible language or environment, including Python, C++, C#, VB.NET, LabVIEW, MATLAB, Octave, VEE, Visual Basic (Excel) and many others.
Socket	Data transfer between the PC user and the computer that is connected to the device, can be also performed via Socket (TCP, port 5025).

Principles of Operation

The Analyzer consists of the Analyzer Unit, some supplementary accessories, and a personal computer (which is not supplied with the package). The Analyzer Unit is powered and controlled by PC via USB-interface. The block diagram of the Analyzer is presented in figure below.

The Analyzer Unit consists of a source oscillator, a local oscillator, a source power attenuator, a directional coupler and other components which ensure the Analyzer operation. The test port is the source of the test signal. The incident and reflected signals from the directional coupler are supplied into the mixers, where they are converted into IF, and are transferred further to the 2-channel receiver. The 2-channel receiver, after filtration, digitally encodes the signals and supplies them for further processing (filtration, phase difference measurement, magnitude measurement) into the signal processor. The filters for the IF are digital and have passband from 10 Hz to 30 (100) kHz. The combination of the assemblies of directional couplers, mixers, and 2-channel receiver forms two similar signal receivers.

An external PC controls the operation of the components of the Analyzer. To fulfill the S-parameter measurement, the Analyzer supplies the source signal of the assigned frequency from the test port to the DUT, then measures magnitude and phase of the signal reflected by the DUT, and after that compares these results to the magnitude and phase of the source signal.



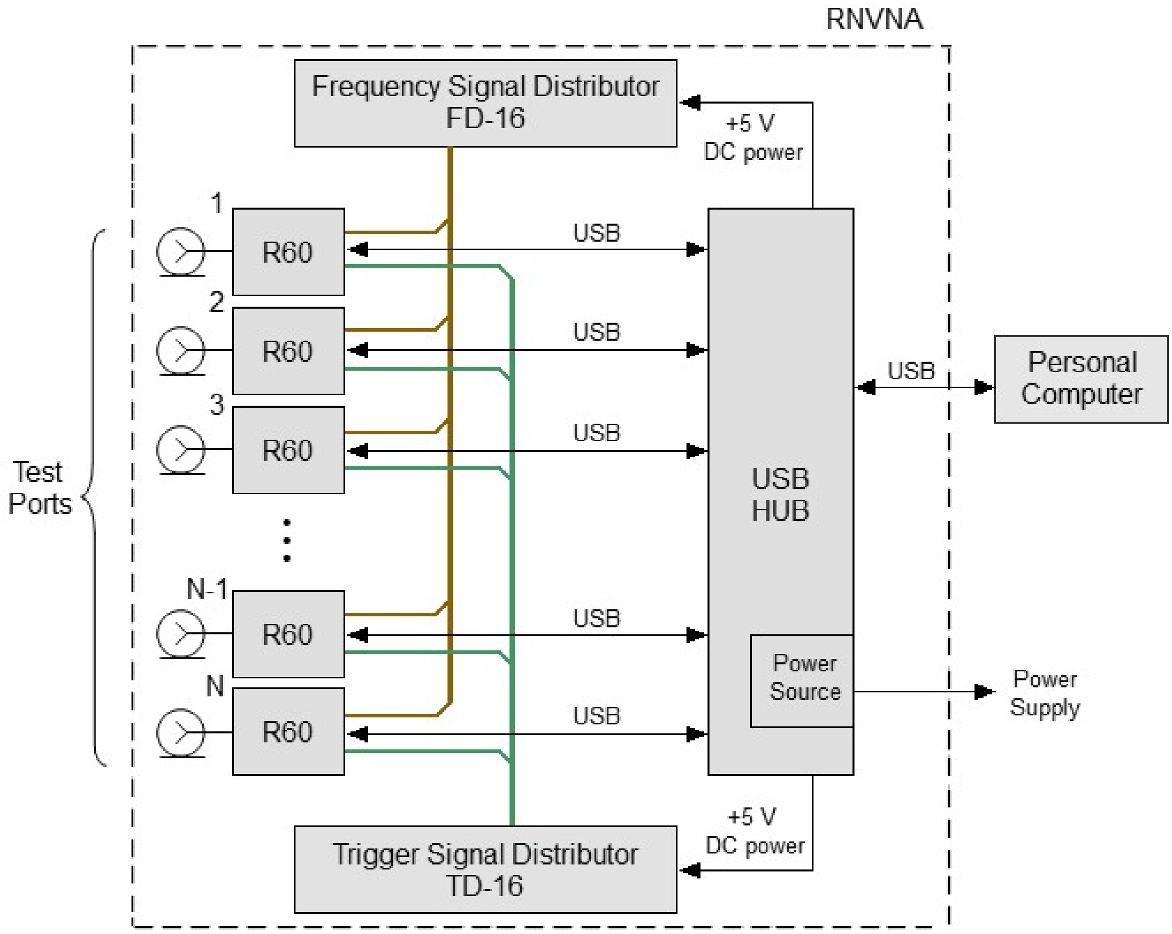
The 1-port VNA block diagram

RNVNA combines up to 16 1-port Analyzers through USB hub with ability to perform S21 and S12 scalar measurements. The hub is connected to the external computer. RNVNA software controls multiple 1-port Analyzers, creating multi-port vector network analyzer.

Optionally, TD-16 trigger signal distributors and FD-16 reference frequency distributors can be used. Using the TD-16 trigger signal distributor make it possible to connect all the analyzers with the common trigger signal bus that allows increase in measurement speed. Using the FD-16 reference frequency signal distributor makes it possible to connect all the analyzers with the common reference frequency signal, allowing increase in measurement accuracy and speed.

At a time, the signal source can be only one analyzer (active). Other analyzers (passive) will work as signal receivers. The analyzer is set to be active depending on the S-parameters measured in the display channel. For example, when measuring parameters S11 and |S21| the first analyzer will be active, when measuring |S12| and S22 — the second one. If the list of S-parameters is indicated in the display channel, several measurements will be made, where analyzers will change their roles.

The block diagram of the RNVNA is presented in figure below.

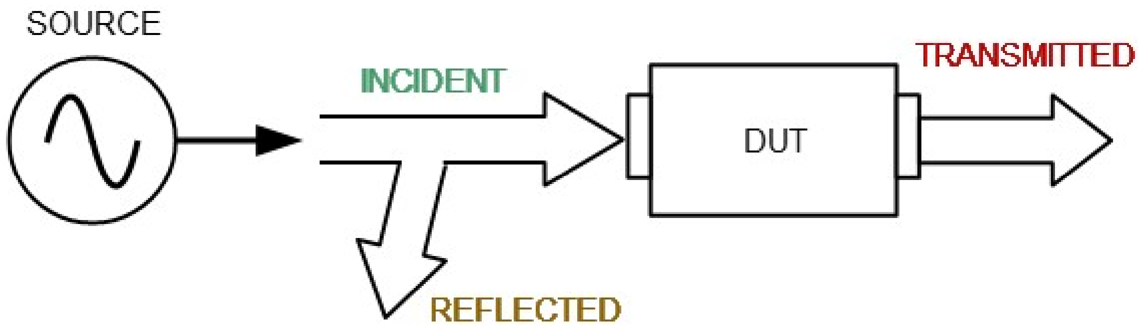


N is number of Analyzers.

RNVNA block diagram

Principle of Measuring S-parameters

The Analyzer emits a test signal (stimulus) out of a port connected to the DUT. The frequency of the test signal changes in the specified range discretely from point to point. At each frequency point, the Analyzer simultaneously measures the magnitude and phase of the signal transmitted through and reflected from the DUT. These are compared with the magnitude and phase of the incident test signal. The Analyzer calculates the S-parameters of the DUT at each frequency point based on this comparison (See figure below).



S-parameter terms

The S-parameter is a relation between the complex magnitudes of two waves:

$$S_{mn} = \frac{outgoing\ wave\ at\ Port\ m}{incoming\ wave\ at\ Port\ n}$$

Providing the $incoming\ wave\ at\ Port$, except n = 0, where $m,\ n$ denote the DUT port number.

In accordance with the measurement plan, the Analyzer performs a frequency sweep in one direction in a specified frequency range. Then, if needed, the Analyzer performs a frequency sweep in reverse direction in a specified frequency range. The frequency changes discretely, according to the number of measuring points specified. S-parameters of the DUT are measured for each measuring point.

1-port Analyzer has one measurement port which operates as a signal source and as a reflected signal receiver. That is why the Analyzer allows measuring only S11 parameter.

RNVNA can have up to 16 1-port Analyzers that allows to measure scalar scattering matrix:

$$S = \begin{bmatrix} S11 & |S12| & \dots & |S1.15| & |S1.16| \\ |S21| & S22 & \dots & |S2.15| & |S2.16| \\ & & & & \\ \dots & & & & \\ & & & & \\ |S15.1| & |S15.2| & \dots & S15.15 & |S15.16| \\ |S16.1| & |S16.2| & \dots & |S16.15| & S16.16 \end{bmatrix}$$

For example:

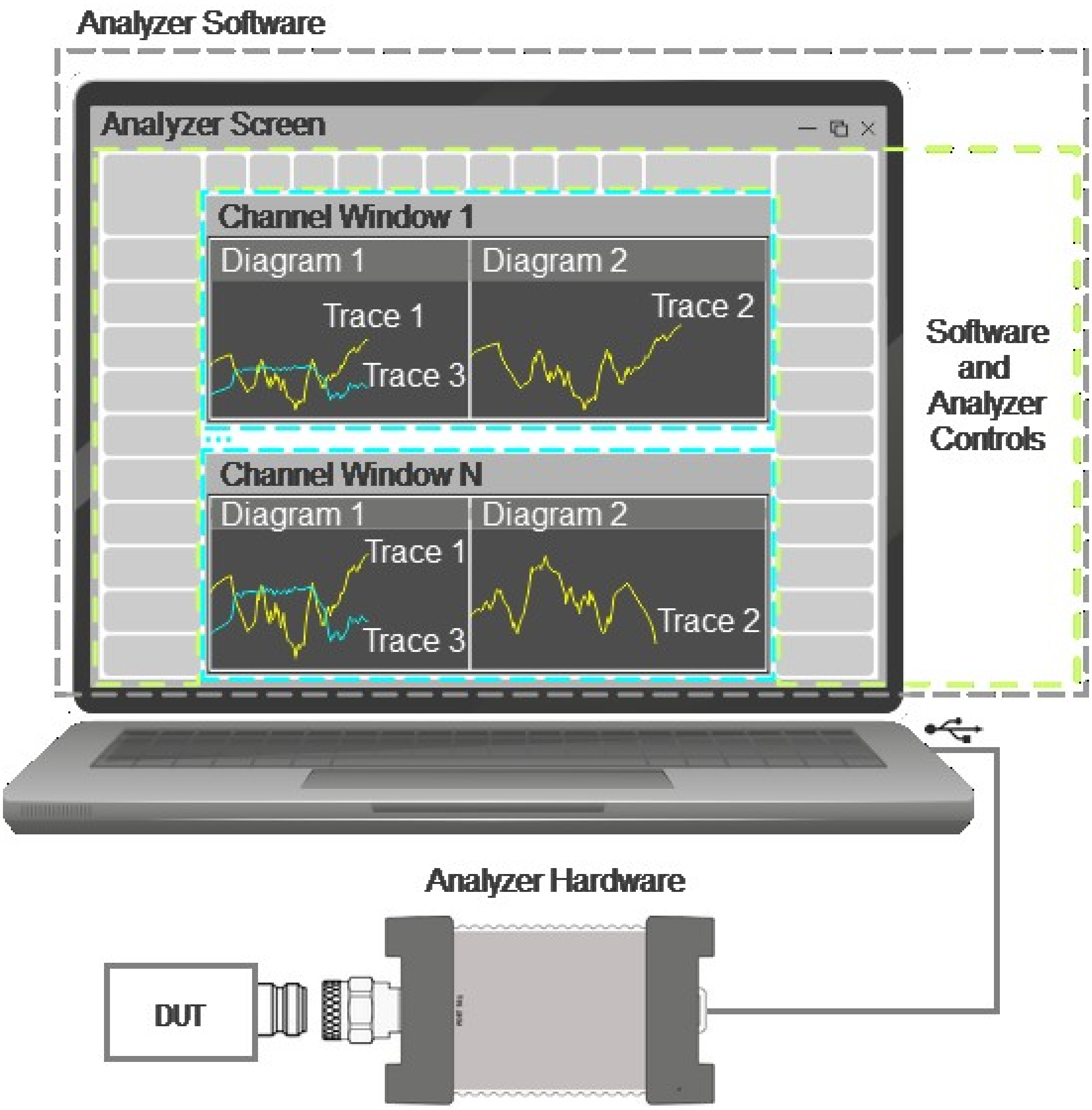
For the measurement of S11, |S21|, ... , |S15.1|, |S16.1| parameters, test Port 1 will operate as a signal source. The incident and reflected waves will be measured by Port 1. The transmitted wave will be measured by Port 2, Port 3, ... Port16. For the measurement of |S12|, S22, ... , |S16.2| parameters, test Port 2 will operate as a signal source. The incident and reflected waves will be measured by Port 2. The transmitted wave will be measured by Port1, Port 3, ... Port16.

When a stimulus is applied to one of the test ports, the Analyzer measures S-parameters, which constitute one column in the S-parameter matrix. To have the full scattering matrix, the sixteen-port Analyzer applies a stimulus to all the test ports one after another.

Summarized Description of Hierarchy

The following hierarchy of measurement, processing, and display tools is used during operation of the Analyzer (See figure below):

- **Analyzer Hardware** makes radio frequency measurements of the DUT parameters and performs primary processing of measurement results.
- **Analyzer Software** (supplied with the Analyzer) controls the operation of the analyzer components and performs the final mathematical processing and display of the measurement results.



Hierarchy of measuring, processing, and displaying tools

Analyzer Software is displayed as **Analyzer Screen** on the control PC screen, which contains the following:

- **Channel Windows** – the diagram area in which the **Channel** is displayed. For a detailed description of the controls, see Channel Window Layout and Functions.
- **Software and Analyzer Controls**: menu bar, analyzer status bar, and software button bar. For a detailed description of the controls, see Screen Layout and Functions.

Channel – a logical analyzer created by the software to perform DUT measurements with set parameters. The Analyzer control software supports up to 4 (1-port Analyzer) and up to 16 (RNVNA) channels simultaneously, processing them one at a time. Thus, the same DUT can be sequentially measured by 4 (1-port Analyzer) and by 16 (RNVNA) logic analyzers with individual settings.

The channel settings are:

- Sweep Type
- Sweep Range
- Number of Points
- Stimulus Power
- Trigger Settings
- IF Bandwidth Setting
- Calibration and Calibration Kits
- Average Setting

The measurement results of the DUT in the channel are displayed in traces.

Trace – a sequence of data points measured (data trace) or memorized (memory trace) by the analyzer, connected by a line. Each channel contains up to 4 different trace for RVNA and up 16 different traces for RNVNA. The trace is characterized by the following parameters:

- Measurement Parameters
- Format and Scale
- Memory Trace
- Smoothing

The following functions apply to the trace:

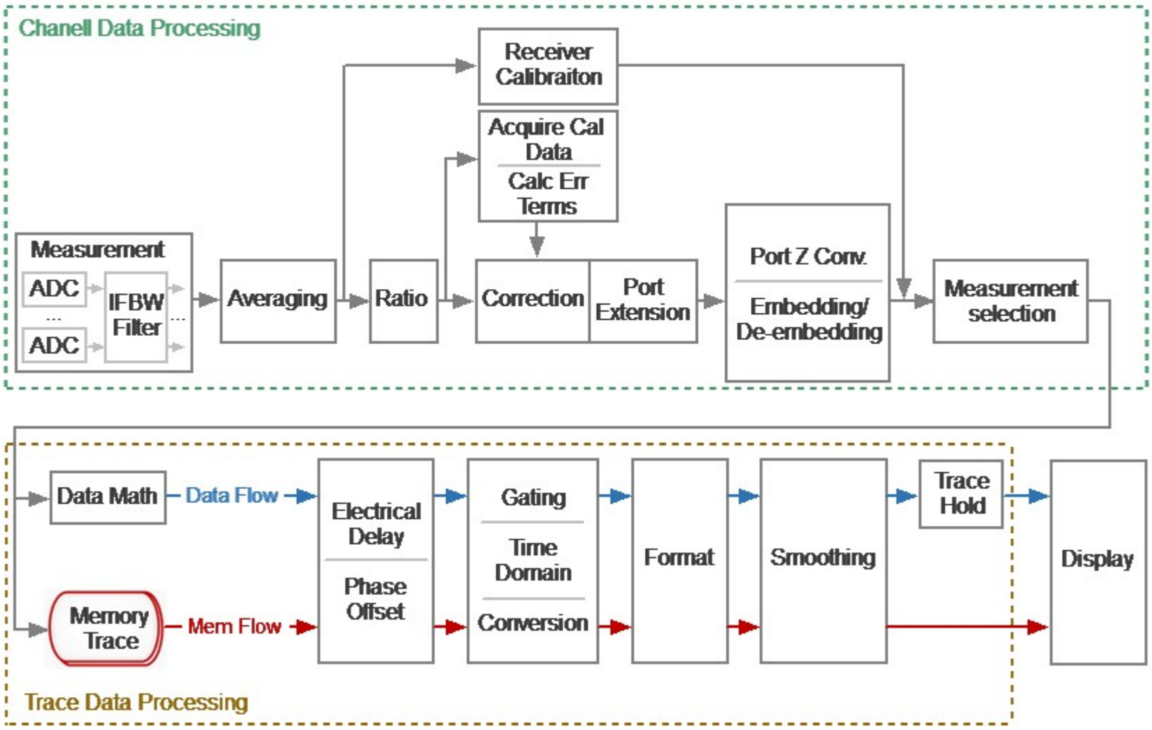
- Markers
- Electrical Delay
- Phase Offset

* Time Domain Gating
* S-Parameter Conversion
* Limit Test

Each channel window can display up to 4 charts for RVNA and up 16 charts for RNVNA simultaneously. Convenient placement of traces in the channel window is designated as **Diagram**. Traces can be placed in a single chart or grouped according to user settings in different charts. For a detailed description of working with diagrams, see Trace Allocation.

Internal Data Processing

The following figure shows a flowchart of the Analyzer's internal data processing flow. For a detailed description of remote control access to internal data arrays see in Internal Data Arrays.



Data Processing Flowchart

The Analyzer's internal data processing consists of the following stages:

- **Measurement** is a converting analog signals of receiver into digital ones (2-channel receiver receive the signal of the incident wave and the signal reflected from the device under test or passed through the DUT for RNVNA). The received analog measurement signals are converted by ADC (analog-to-digital converters) into digital IF signals and transmitted to the digital processor. The digital processor performs a discrete Fourier transform (DFT) of the IF signals. The Analyzer IF bandwidth is equivalent to the bandwidth of the DFT filter. The digital output of each receiver is represented as complex numbers). For more details see Principle of Operation.
- **Averaging** is averaging of the measured data of the receivers for a given number of scan cycles. For more details see Averaging Setting.
- **Receiver Calibration** is a gain correction of individual receivers for absolute measurements.
- **Ratio** is calculating S-parameters by dividing the complex values of two receiver signals. See The Principle of Measuring S-parameters.

- **Acquire Cal Data** is measuring calibration standards. Complex measured data of all standards are stored in memory. For more details see Calibration Methods and Procedures.
- **Calc Error Terms** is calculation of calibration coefficients based on measurement data of calibration standards in accordance with the selected calibration method. Calculated calibration coefficients are stored in memory. After calculating the calibration coefficients, the measurement data of the calibration standards is deleted. For more details see Systematic Errors.
- **Correction** is an application of calibration coefficients to raw S-parameters. At this stage, systematic measurement errors introduced by the analyzer and the measuring setup are eliminated. For more details see Calibration Methods and Procedures.
- **Port extension** is a fixture simulation in which the addition or removal of a transmission line of a given length for each test port is mathematically simulated. This allows to offset the calibration reference plane by the length of the line. For more details see Port Extension.
- **Port Z Conv** is the fixture simulation to convert the reference impedance to an arbitrary impedance value. See Port Reference Impedance (Z) Conversion.
- **De-embedding** is the fixture simulation to eliminate the influence of a certain circuit from the measurement results. See De-embedding.
- **Embedding** is the fixture simulation for embedding some virtual circuit in the measured circuit. See Embedding.
- **Measurement Selector** is a selection of display of measured S-parameter or absolute (receiver) data. Data for the trace is selected from a matrix of corrected S-parameters or corrected receiver data. See Measurement Parameters Settings.
- **Memory Trace** is copying current measurements to memory (S-parameter or receiver data). The software contains a set of cells for storing measurements (memory). Further, the memory data is processed in parallel with the measured data. See Memory Trace Function.
- **Data Math** — mathematical operations between measured data and data in memory. When using trace memory, the operation is performed with active memory. Available functions: add measured data to memory data, subtract memory data from measured data, multiply/divide measured data by memory data. The result of the operation replaces the measured data. See Memory Trace Function.
- **Electrical Delay** is adding/removing a transmission line of a given length without loss for the measurement port. Unlike port extension, the method is applied individually for each trace. See Electrical Delay Setting.
- **Phase Offset** is setting a constant phase offset of the trace. See Phase Offset Setting.

- **Time Domain** is conversion of the measured S-parameter in the frequency domain into the response of the circuit under investigation in the time domain. See Time Domain Transformation.
- **Gating** is a removal of unwanted responses in the time domain. See Time Domain Gating.
- **Conversion (S-parameter conversion function)** is conversion of the measured S-parameter into following ones: impedance (Zr) and admittance (Yr) in reflection measurement, inverse S-parameter (1/S), S-parameter complex conjugate (Conj). See S-Parameter Conversion.
- **Format** is selection of the display format of the measured data on the trace. See Format Setting.
- **Smoothing** is an averaging of adjacent points of the trace by a moving window. See Smoothing Setting.
- **Trace Hold** is holding the maximum or minimum values of the trace. See Trace Hold.
- **Display** — data processing for displaying on the screen in the form of a trace of a given format. Scaling is applied to the traces according to the data format, according to selected reference line position and value and scale/grid settings. See Channel Window Layout and Functions.

Instrument Series

This section describes the different models of Analyzers.

Models of 1-port VNA:

- R60
- R140
- R140B
- R180
- R54

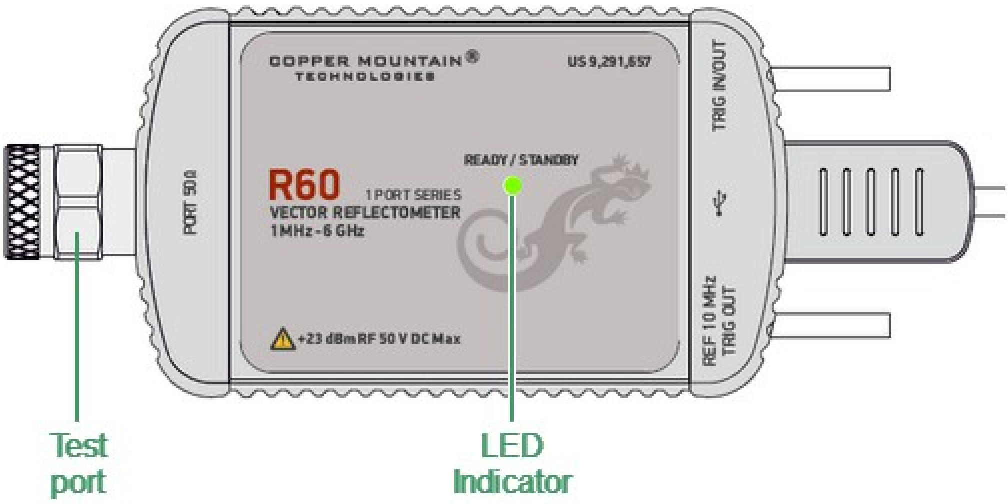
Models N-port mode of VNA:

- RNVNA

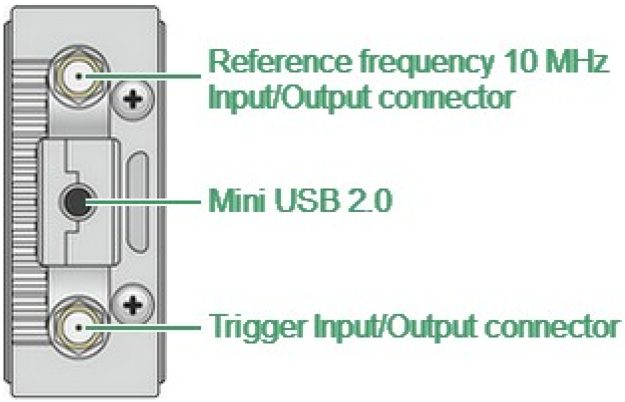
The top panel of each Analyzer are shown further in this section, along with the controls located on those panel.

R60

The top panel view of the Analyzers is represented in the figures below.



R60 top panel



R60 side panel

Part of the R60

Test port

The test port (type-N male 50 Ω) is intended for DUT connection. It is also used as a source of the stimulus signal and as a receiver of the response signal from the DUT.

LED Indicator

The top panel is equipped with the READY/STANDBY LED indicator running in the following modes:

- Green blinking light is standby mode. In this mode the current consumption of the device from the USB port is minimum.
- Green glowing light is normal device operation.

USB Connector

The mini USB 2.0 port is intended for connection to USB port of the personal computer via the supplied USB cable.

Reference Frequency Input/Output Connector

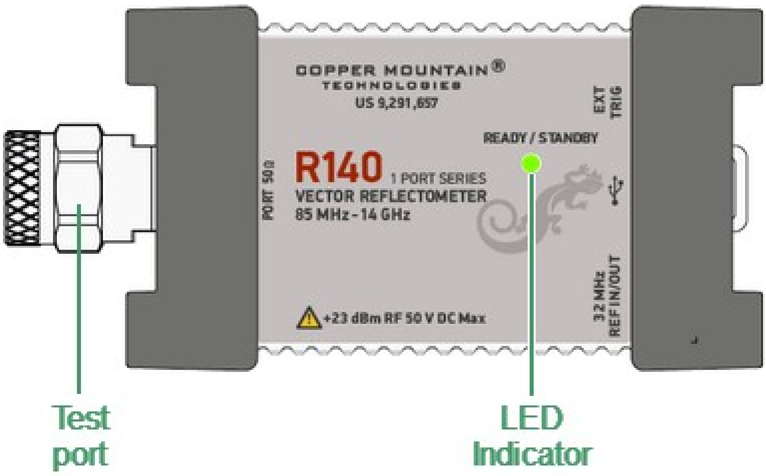
External reference frequency is 10 MHz, input level is 2 dBm ± 2 dB, input impedance is 50 Ohm. Output reference signal level is 3 dBm ± 2 dB into 50 Ohm impedance. Connector type is SMA female.

External Trigger Signal Input/Output Connector

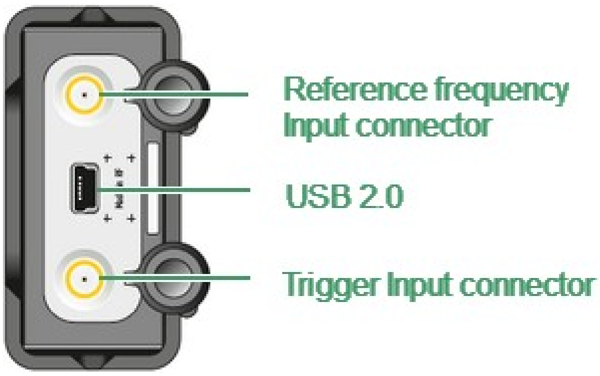
External Trigger Signal Input allows the user to connect an external trigger source. Connector type is SMA female. 3.3v CMOS TTL compatible inputs magnitude have at least 1 µs pulse width. Input impedance is at least 10 kOhm. The External Trigger Signal Output port can be used to provide trigger to an external device. The port outputs various waveforms depending on the setting of the Output Trigger Function: before frequency setup pulse, before sampling pulse, after sampling pulse, ready for external trigger, end of sweep pulse, measurement sweep.

R140

The top panel view of the Analyzers is represented in the figures below.



R140 top panel



R140 side panel

Part of the R140

Test port

The test port (type-N male 50 Ω) is intended for DUT connection. It is also used as a source of the stimulus signal and as a receiver of the response signal from the DUT.

LED Indicator

The top panel is equipped with the READY/STANDBY LED indicator running in the following modes:

- Green blinking light is standby mode. In this mode the current consumption of the device from the USB port is minimum.
- Green glowing light is normal device operation.

USB Connector

The USB 2.0 port is intended for connection to USB port of the personal computer via the supplied USB cable.

Reference Frequency Input Connector

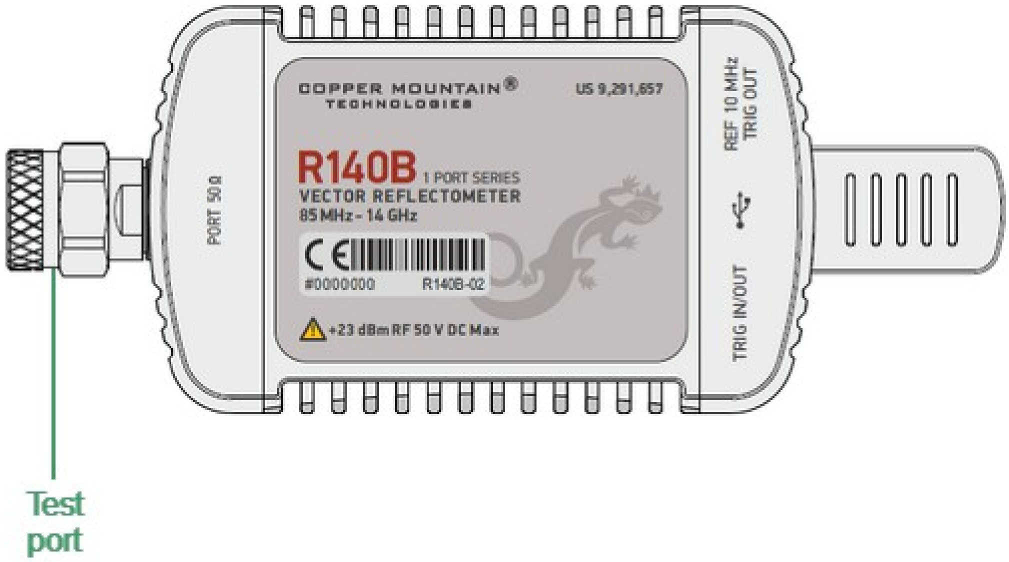
External reference frequency see in its specifications, input level is 2 dBm ± 2 dB, input impedance at «Ref In» is 50 Ω. Connector type is SMA female.

External Trigger Signal Input Connector

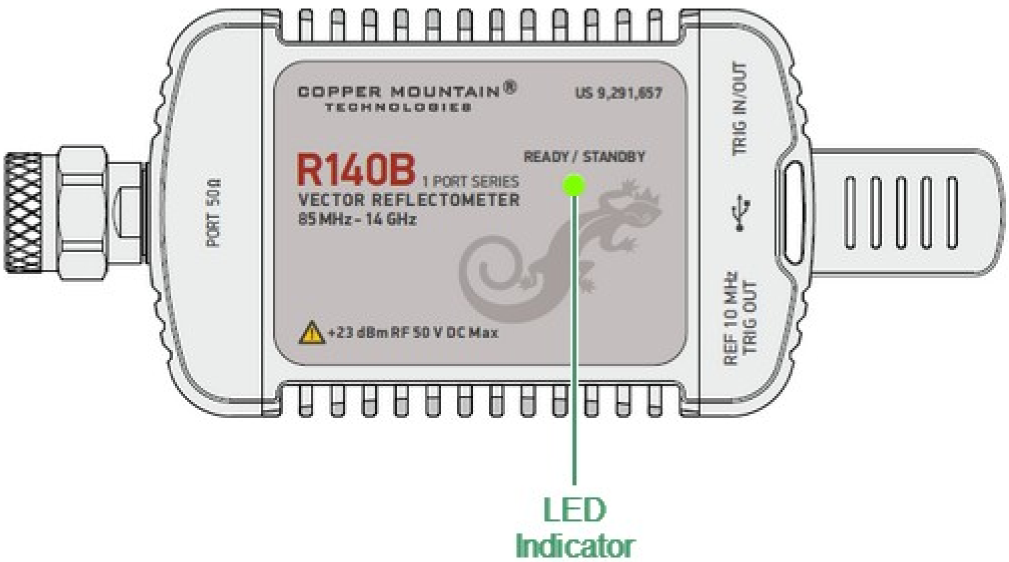
This connector allows the user to connect an external trigger source. Connector type is SMA female. TTL compatible inputs of 3 V to 5 V magnitude have up to 1 us pulse width. Input impedance is at least 10 kΩ.

R140B

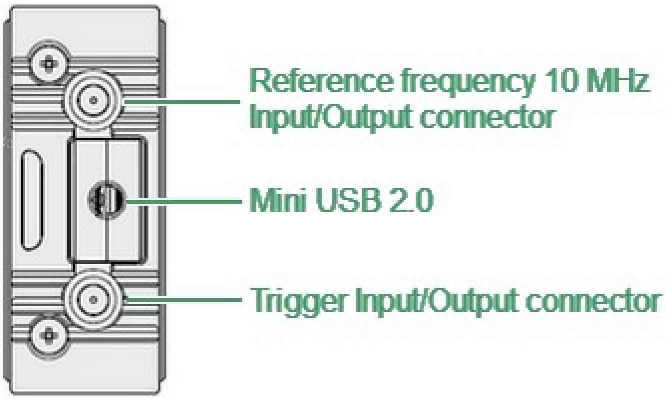
The top panel view of the Analyzers is represented in the figures below.



R140B top panel



R140B rear panel



R140B side panel

Part of the R140B

Test port

The test port is intended for DUT connection. The test port is type-N 50 Ω or 3.5 mm (See Hardware configurations). It is also used as a source of the stimulus signal and as a receiver of the response signal from the DUT.

LED Indicator

The top panel is equipped with the READY/STANDBY LED indicator running in the following modes:

- Green blinking light is standby mode. In this mode the current consumption of the device from the USB port is minimum.
- Green glowing light is normal device operation.

USB Connector

The USB 2.0 port is intended for connection to USB port of the personal computer via the supplied USB cable.

Reference Frequency Input/Output Connector

External reference frequency is 10 MHz, input level is 2 dBm ± 2 dB, input impedance is 50 Ohm. Output reference signal level is 3 dBm ± 2 dB into 50 Ohm impedance. Connector type is SMA female.

External Trigger Signal Input/Output Connector

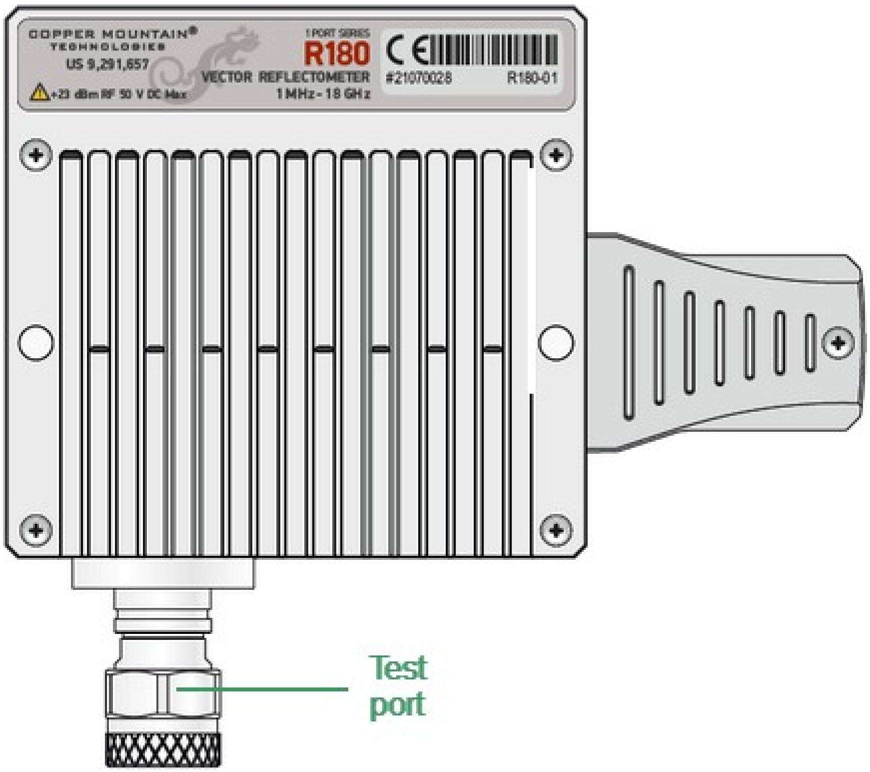
External Trigger Signal Input allows the user to connect an external trigger source. Connector type is SMA female. 3.3v CMOS TTL compatible inputs magnitude have at least 1 μs pulse width. Input impedance is at least 10 kOhm. The External Trigger Signal Output port can be used to provide trigger to an external device. The port outputs various waveforms depending on the setting of the Output Trigger Function: before frequency setup pulse, before sampling pulse, after sampling pulse, ready for external trigger, end of sweep pulse, measurement sweep.

Hardware configurations

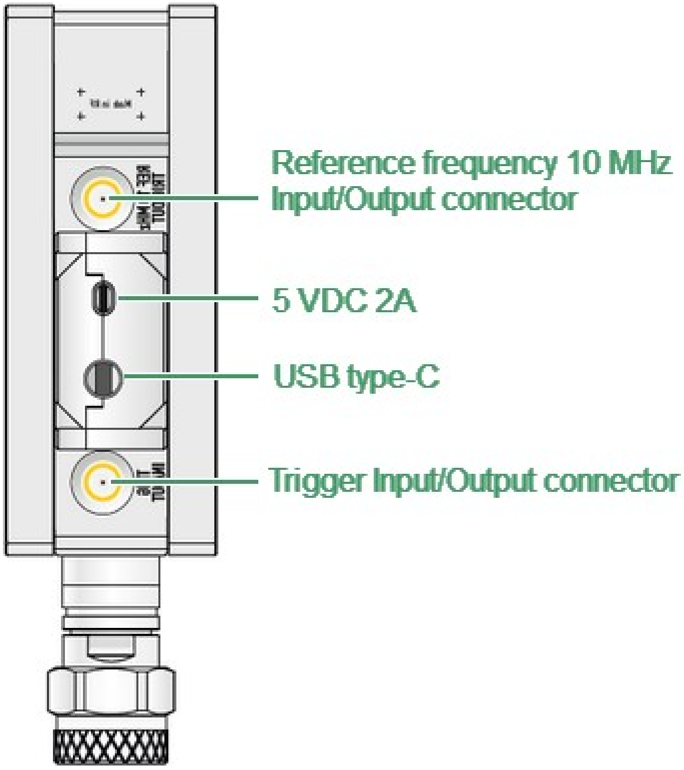
Model	Connector type
R140B-01	Type-N, female
R140B-02	Type-N, male
R140B-11	3.5 mm, female
R140B-12	3.5 mm, male

R180

The top panel view of the Analyzers is represented in the figures below.



R180 top panel



R180 side panel

Part of the R180

Test port

The test port is intended for DUT connection. The test port is type-N male 50 Ω or 3.5 mm (See Hardware configurations). It is also used as a source of the stimulus signal and as a receiver of the response signal from the DUT.

Reference Frequency Input/Output Connector

External reference frequency is 10 MHz, input level is 2 dBm ± 2 dB, input impedance is 50 Ohm. Output reference signal level is 3 dBm ± 2 dB into 50 Ohm impedance. Connector type is SMA female.

USB Connector

The USB type-C port is intended for connection to USB port of the personal computer via the supplied USB cable.

Power Cable Receptacle

The power supply receptacle is intended for an external DC power supply voltage from 4.75 to 5.25 V; alternatively, the power supply can be powered by a battery, including a vehicle battery, through an appropriate vehicle power cable. The DC connection requires a 3.5x1.35 mm plug with positive center conductor.

External Trigger Signal Input/Output Connector

External Trigger Signal Input allows the user to connect an external trigger source. Connector type is SMA female. 3.3v CMOS TTL compatible inputs magnitude have at least 1 µs pulse width. Input impedance is at least 10 kOhm. The External Trigger Signal Output port can be used to provide trigger to an external device. The port outputs various waveforms depending on the setting of the Output Trigger Function: before frequency setup pulse, before sampling pulse, after sampling pulse, ready for external trigger, end of sweep pulse, measurement sweep.

Hardware configurations

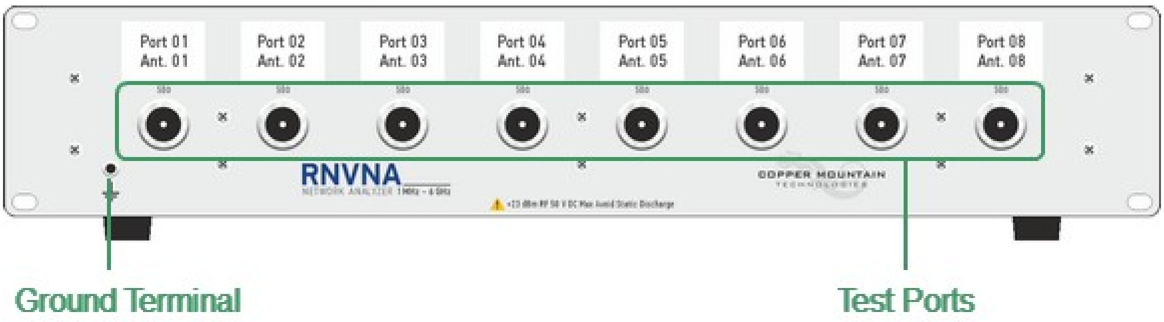
Model	Connector type
R180-01	Type-N, female
R180-11	3.5 mm, female
R180-12	3.5 mm, male

RNVNA

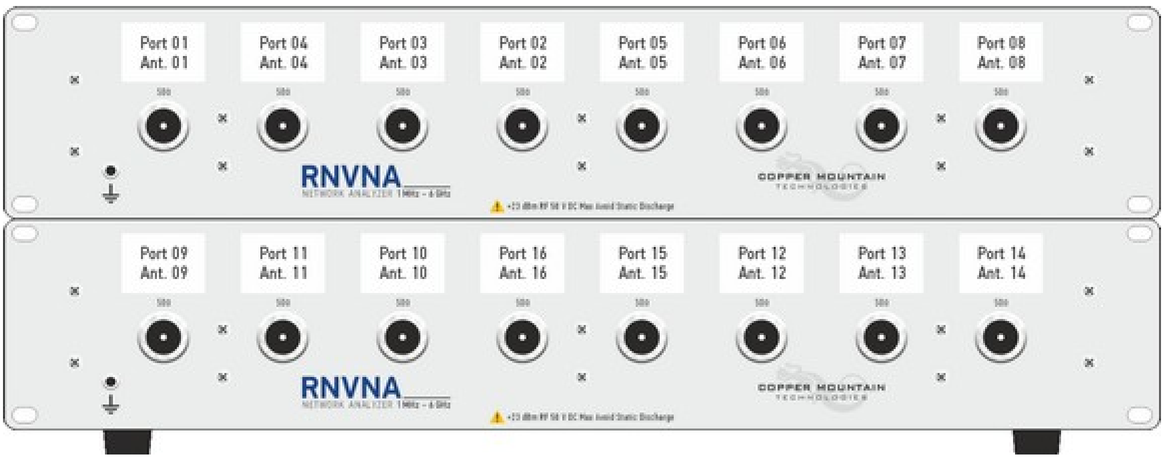
RNVNA software allows using up to sixteen Analyzers simultaneously. This expands the list of parameters to be measured. It allows to additionally measure Scalar transfer coefficient in two directions, for example |S21| and |S12| of the DUT.

The signal source can be only one device (active). The rest of devices (passive) work as a signal receiver. Active device has a green indicator READY/STANDBY, which is located on the top cover. The passive device has at the same time red and green LEDs.

Active instrument is assigned according to the measured S-parameters. For example, when measuring the parameters S11 and S21 the first device will be an active one, when measuring S12 and S22 — the second one. If the channel window has a list of the S-parameters, the software will make a few launches of the scanning.

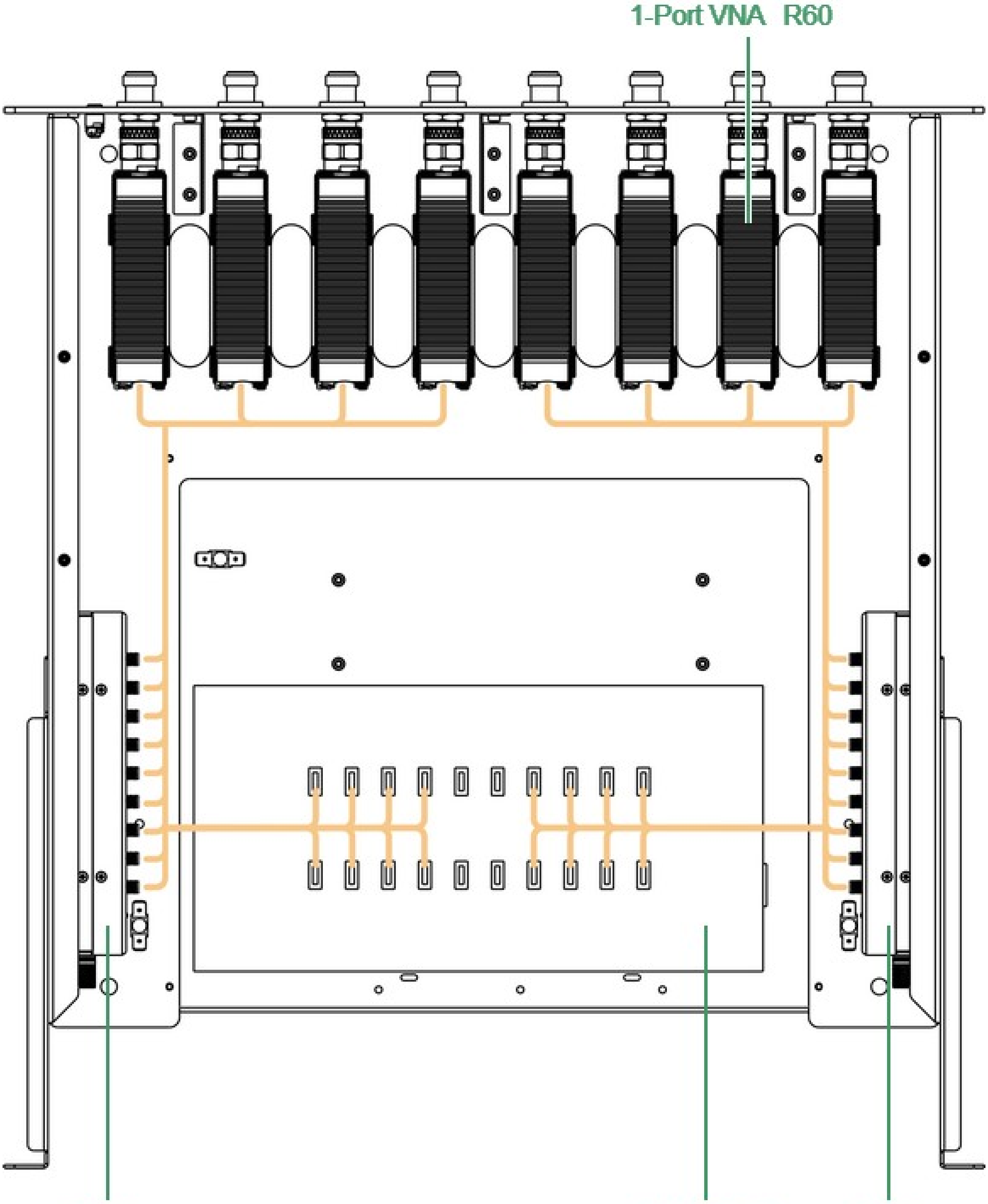


2U chassis



4U chassis

Front panel RNVNA



RNVNA top view

Part of the RNVNA

Test port

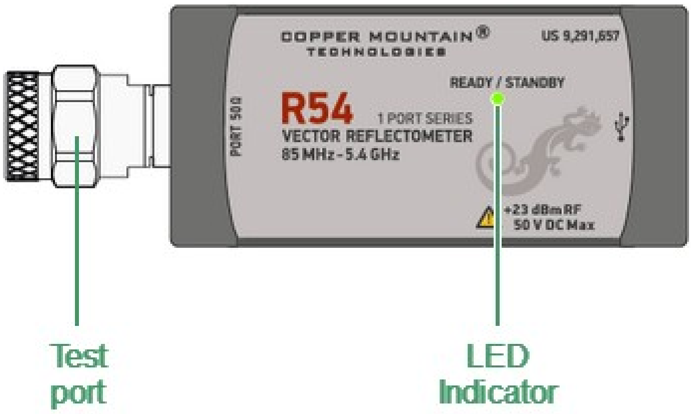
The test port (type-N male 50 Ω) is intended for DUT connection. It is also used as a source of the stimulus signal and as a receiver of the response signal from the DUT.

Ground Terminal

Use the terminal for grounding. Ground terminal allows the user to directly connect the body of the RNVNA Analyzer to the grounding bar in order to ensure electrical safety.

R54

The top panel view of the Analyzers is represented in the figures below.



R60 top panel

R60 side panel

Part of the R54

Test port

The test port (type-N male 50 Ω) is intended for DUT connection. It is also used as a source of the stimulus signal and as a receiver of the response signal from the DUT.

LED Indicator

The top panel is equipped with the READY/STANDBY LED indicator running in the following modes:

- Green blinking light is standby mode. In this mode the current consumption of the device from the USB port is minimum.
- Green glowing light is normal device operation.

USB Connector

The mini USB 2.0 port is intended for connection to USB port of the personal computer via the supplied USB cable.

Preparation for Use

Unpack the Analyzer and other accessories.

Connect the Analyzer to the PC using the USB Cable supplied in the package.

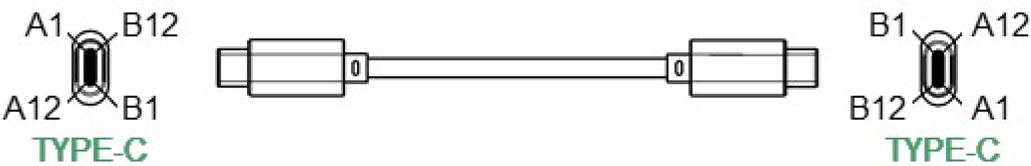
Install the software that will be used to operate the Analyzer (The software can be found on the shipped flash-drive or on the Copper Mountain Technologies website). The software installation procedure is described in Software Installation.

Warm up the Analyzer for the time stated in its datasheet.

Assemble the test setup using cables, connectors, fixtures, etc., which allow DUT connection to the Analyzer.

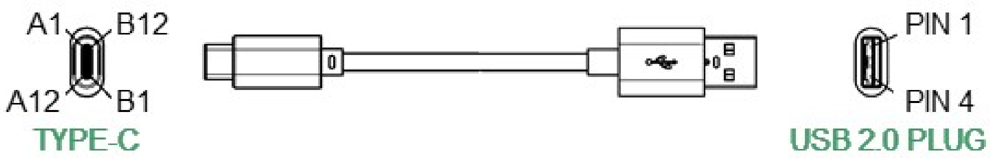
Perform calibration of the Analyzer. Calibration procedure is described in section Calibration and Calibration Kit.

CAUTION To avoid motherboard damage, use USB cables supplied in the package or similar ones according to the specifications shown in figure below (for R180/RP180 only).



PIN ASSIGMENTS				
TYPE C(P1)	SYGNAL NAME	WIRE COLOR	SYGNAL NAME	TYPE C(P2)
A1, B1, A12, B12	GND	BLACK	GND	A1, B1, A12, B12
A4, B4, A9, B9	VBUS	RED	VBUS	A4, B4, A9, B9
A5	CC	BLUE	CC	A5
B5	VCONN	--	VCONN	B5
A6	Dp1	GREEN	Dp1	A6
A7	Dn1	WHITE	Dn1	A7
SHELL	SHIELD	BRAID	SHIELD	SHELL

USB TYPE C TO C 2.0, 3A



PIN ASSIGMENTS				
TYPE C	SYGNAL NAME	WIRE COLOR	USB 2.0	SYGNAL NAME
A1, B1, A12, B12	GND	BLACK	4	GND
A4, B4, A9, B9	VBUS	RED	1	VBUS
A5	CC	--	--	--
B5	VCONN	--	--	--
A6	Dp1	GREEN	3	D+
A7	Dn1	WHITE	2	D-
SHELL	SHIELD	BRAID	SHELL	SHIELD

USB TYPE C TO USB 2.0 A MALE, 3A

Software Installation

The software is installed to the external PC running under Windows operating system. The Analyzer is connected to the external PC via USB interface.

Minimal system requirements for the PC	WINDOWS 7 and Higher 1.5 GHz Processor 2 GB RAM USB 2.0 High Speed

The supplied USB flash drive contains the following software:

Flash drive contents	Setup_RVNA_vXX.Y.Z.exe (RVNA) installer file for 1-port VNA or Setup_RNVNA_vXX.Y.Z.exe (RNVNA) installer file for multiport VNA solutions, where **XX.Y.Z** — software version number: XX — year, Y — quarter of year, Z — version on quarter. **Driver** — folder contains the driver. **Doc** — folder contains documentation.

Software installation procedure is performed in two steps. The first one is the driver installation. The second step comprises installation of the software, documentation and other related files.

Driver installation	Connect the Analyzer to PC via the supplied USB cable. Windows will automatically detect new USB device and will open USB driver installation dialog (Windows 7 and higher) while connecting the Analyzer the first time. In the USB driver installation dialog, click on Browse and specify the path to the driver files, which are contained in the Driver folder on the USB flash drive.
Software and related files installation	Run the RVNA installer file for 1-port VNA or RNVNA installer file for multiport VNA solutions from the supplied USB flash drive. Follow the instructions of the installation wizard.

RNVNA Licensing

RNVNA Software is distributed under commercial license. Each license is tied to RVNAs with particular serial numbers. License is perpetual, and its price depends on the number of instruments configured into RNVNA. Please contact your local Copper Mountain Technologies representative to get a quote.

NOTE	RNVNA License Terms and Conditions are available in the software and on Copper Mountain Technologies website.

License information (Company purchased the license, serial number set, etc.) is in a *.LIC file and shared with a client upon purchase. License importing procedure is described in RNVNA software (See Managing Licenses).

Free license is integrated into RNVNA software and allows to operate with up to 3 Analyzers.

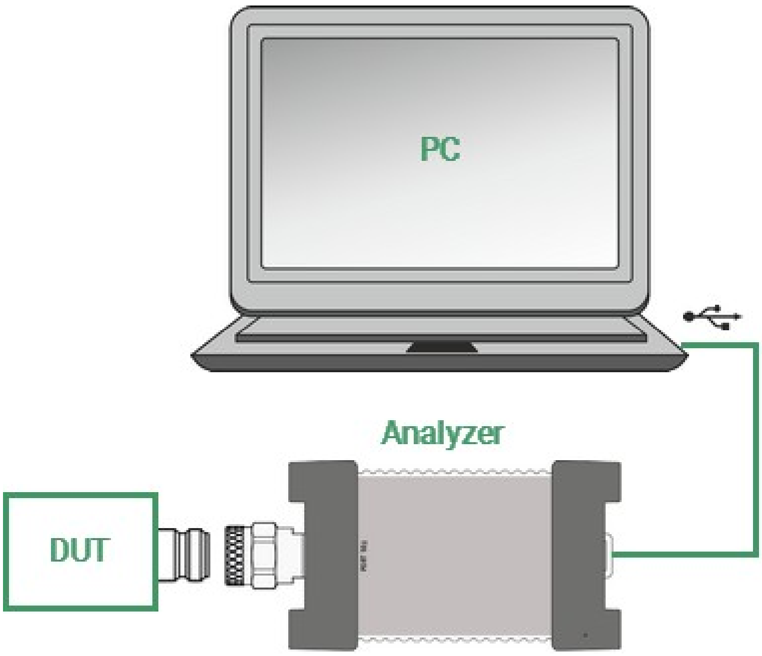
NOTE	Contact your local Copper Mountain Technologies representative in case: • License file is lost or damaged. • 1-port VNA replacement.

Getting Started

This section represents a sample session of the Analyzer. It describes the main techniques of measurement of reflection coefficient parameters of the DUT. SWR and reflection coefficient phase of the DUT will be analyzed.

The instrument sends the stimulus to the input of the DUT and then receives the reflected wave. Generally, in the process of this measurement the output of the DUT should be terminated with a LOAD standard. The results of these measurements can be represented in various formats. The given example represents the measurement of SWR and reflection coefficient phase.

Typical circuit of DUT reflection coefficient measurement is shown in figure below.



Reflection Measurement Circuit

Measuring SWR and reflection coefficient phase:

- Prepare the Analyzer for reflection measurement.
- Set stimulus parameters (frequency range, number of sweep points).
- Set IF bandwidth.
- Set the number of traces to 2, assign measured parameters and display format to the traces.
- Set the scale of the traces.
- Perform calibration of the Analyzer for reflection coefficient measurement.
- Analyze SWR and reflection coefficient phase using markers.

Analyzer Preparation for Reflection Measurement

Turn on the Analyzer and warm it up for the period of time stated in the datasheet.

READY STATE FEATURES	The bottom line of the screen displays the instrument status bar. It should read **Ready**.

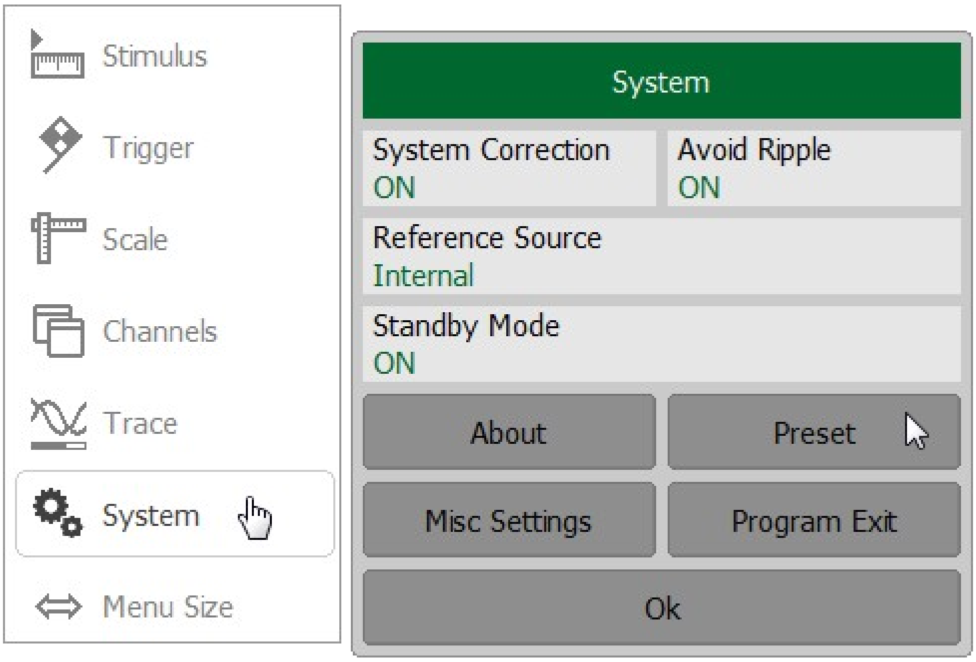
Connect the DUT to the test port of the Analyzer. Use the appropriate adapters for connection of the DUT input to the Analyzer test port if it is impossible to connect the DUT input to the test port directly.

Analyzer Presetting

It is recommended resetting the Analyzer into the initial state before starting measurement session. The initial condition setting is described in Annex.

NOTE	Software can be controlled using mouse or a touchscreen.

To restore the initial state of the Analyzer, use the softkey **System** in the right menu bar. Then in dialog System click softkey **Preset**. Close the dialog System by clicking softkey **Ok**.



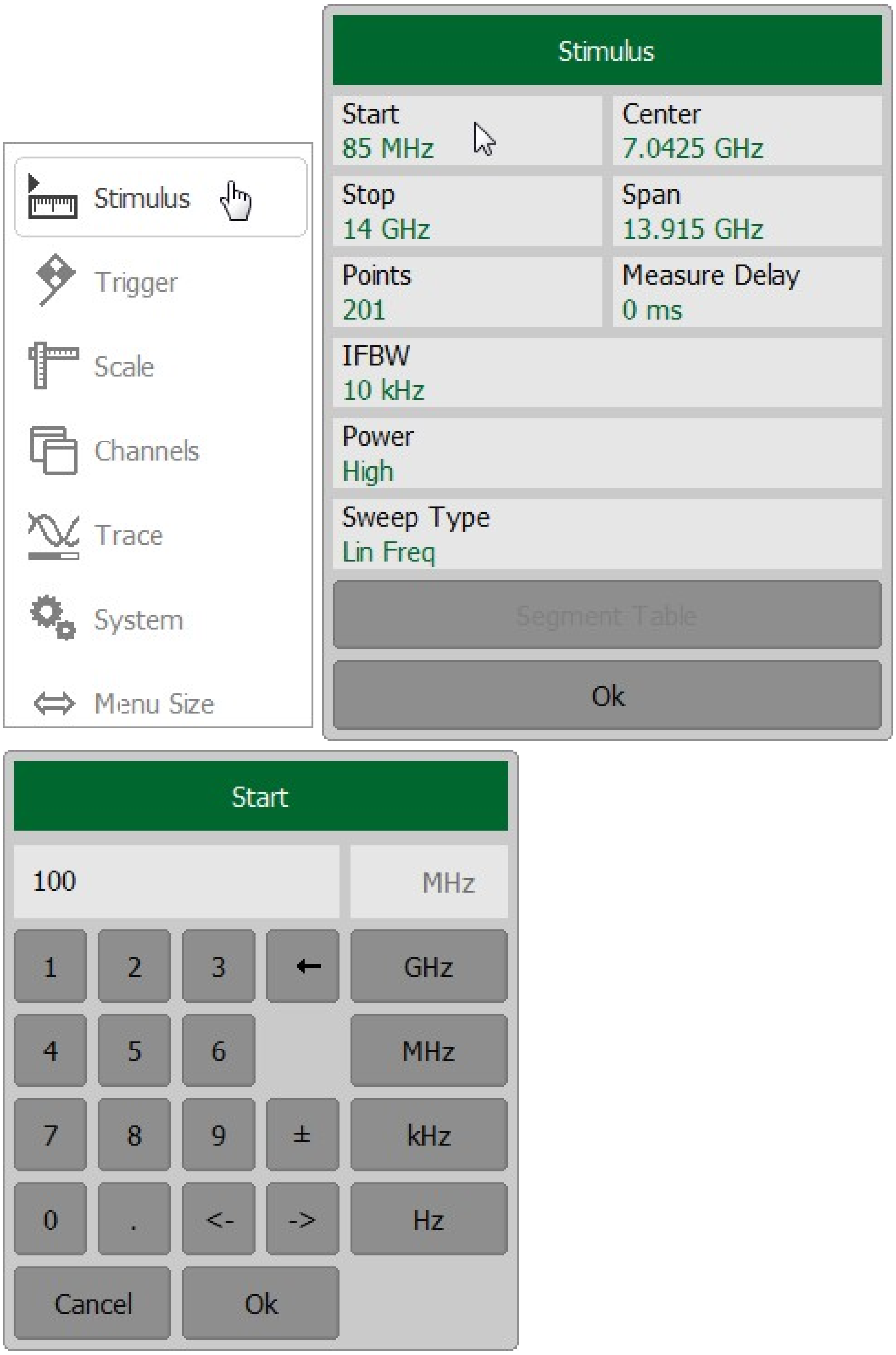
Stimulus Setting

After restoring the preset state of the Analyzer, the stimulus parameters will be as follows:

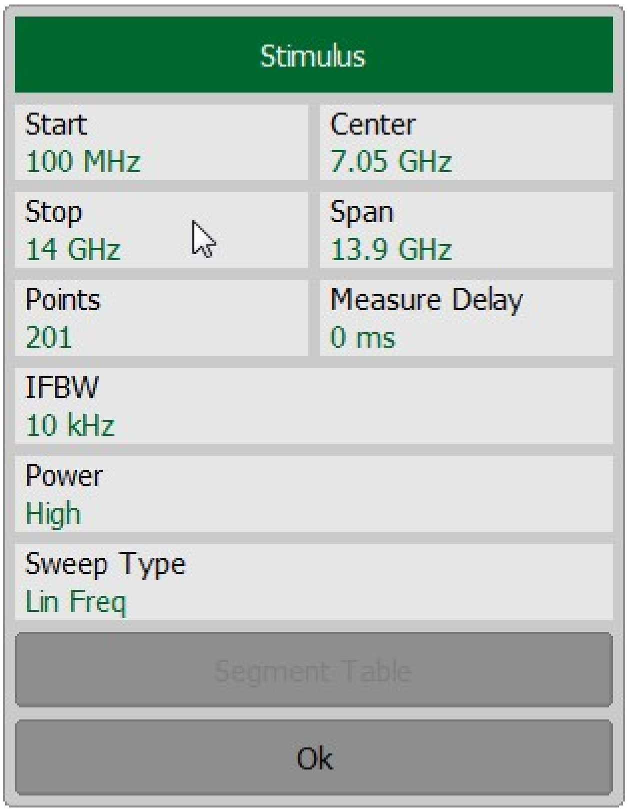
- Full frequency range of the instrument.
- Sweep type is linear.
- Number of sweep points is 201.
- Power level is high.
- IF is 10 kHz.

For the current example, set the frequency range from 100 MHz to 1 GHz.

To set the start frequency of the frequency range to 100 MHz, use the softkey **Stimulus** in the right menu bar. Then select the **Start** field and enter 100 using the on-screen keypad. Complete the setting by clicking **Ok**.


Stimulus
Trigger
Scale
Channels
Trace
System
Menu Size
Stimulus
Start
85 MHz
Center
7.0425 GHz
Stop
14 GHz
Span
13.915 GHz
Points
201
Measure Delay
0 ms
IFBW
10 kHz
Power
High
Sweep Type
Lin Freq
Segment Table
Ok
Start
100
MHz
1
2
3
GHz
4
5
6
MHz
7
8
9
±
kHz
0
.
<-
->
Hz
Cancel
Ok

To set the stop frequency of the frequency range to 1 GHz select the **Stop** field and enter 1000 using the on-screen keypad. Complete the setting clicking **Ok**.

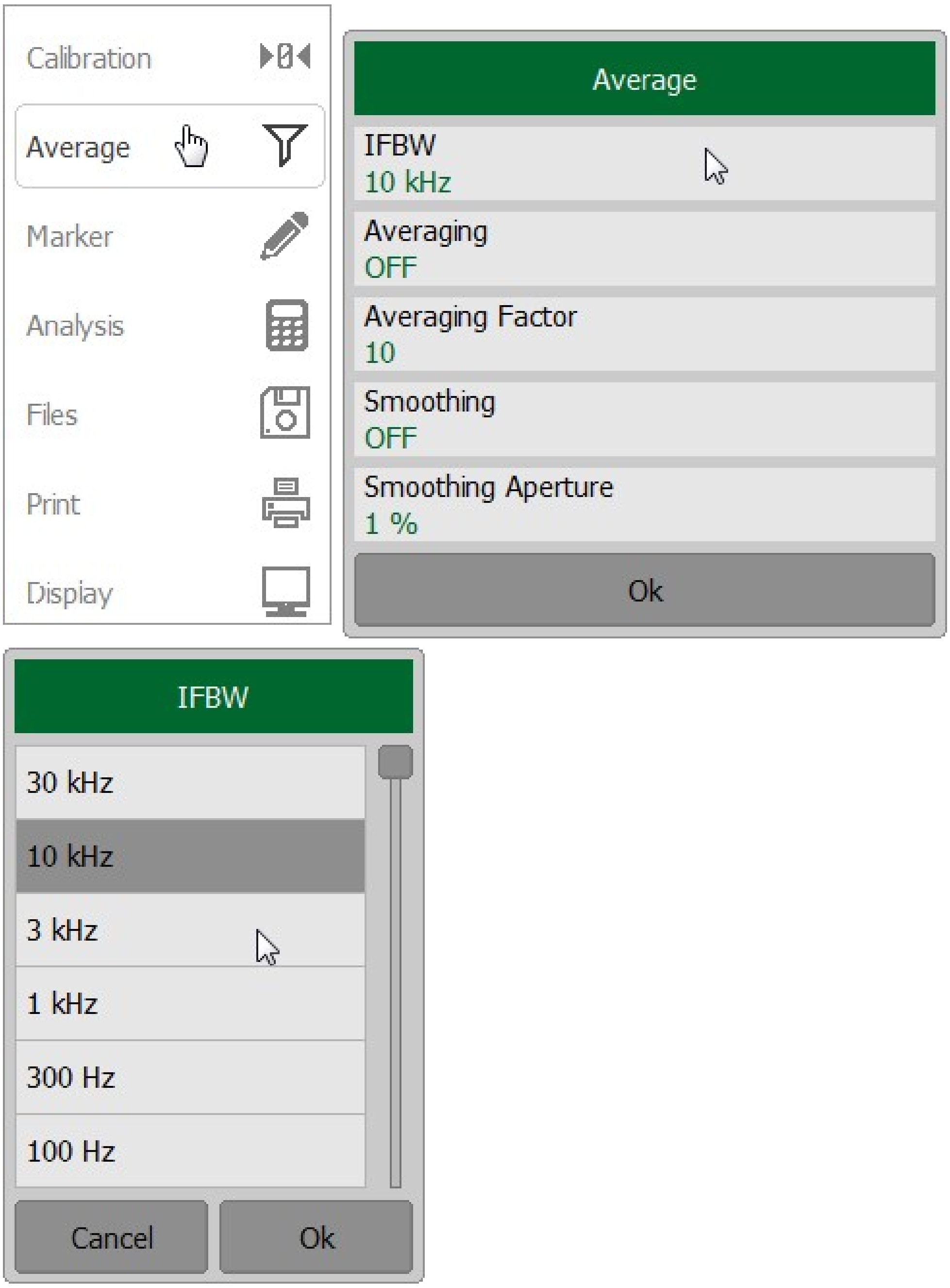


Close the Stimulus dialog by clicking **Ok**.

IF Bandwidth Setting

For the current example, set the IF bandwidth to 3 kHz.

To set the IF bandwidth use the softkey **Average** in the left menu bar. Then select the **IFBW** field in the Average dialog. To set the IF bandwidth in the IFBW dialog use the following softkeys **3 kHz**. Complete the setting by clicking softkey **Ok**.



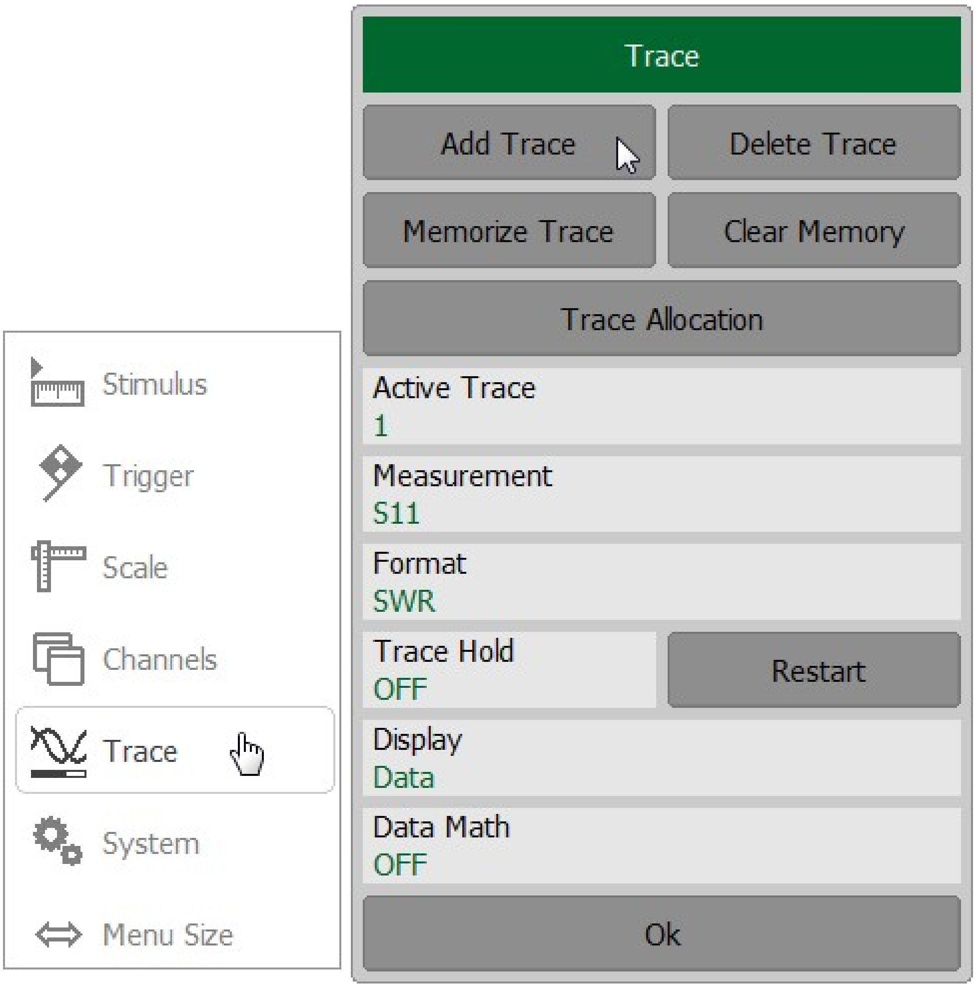
NOTE Also, selecting IF bandwidth could be done by double clicking on the required value in the IFBW.

Number of Traces, Measured Parameter and Display Format Setting

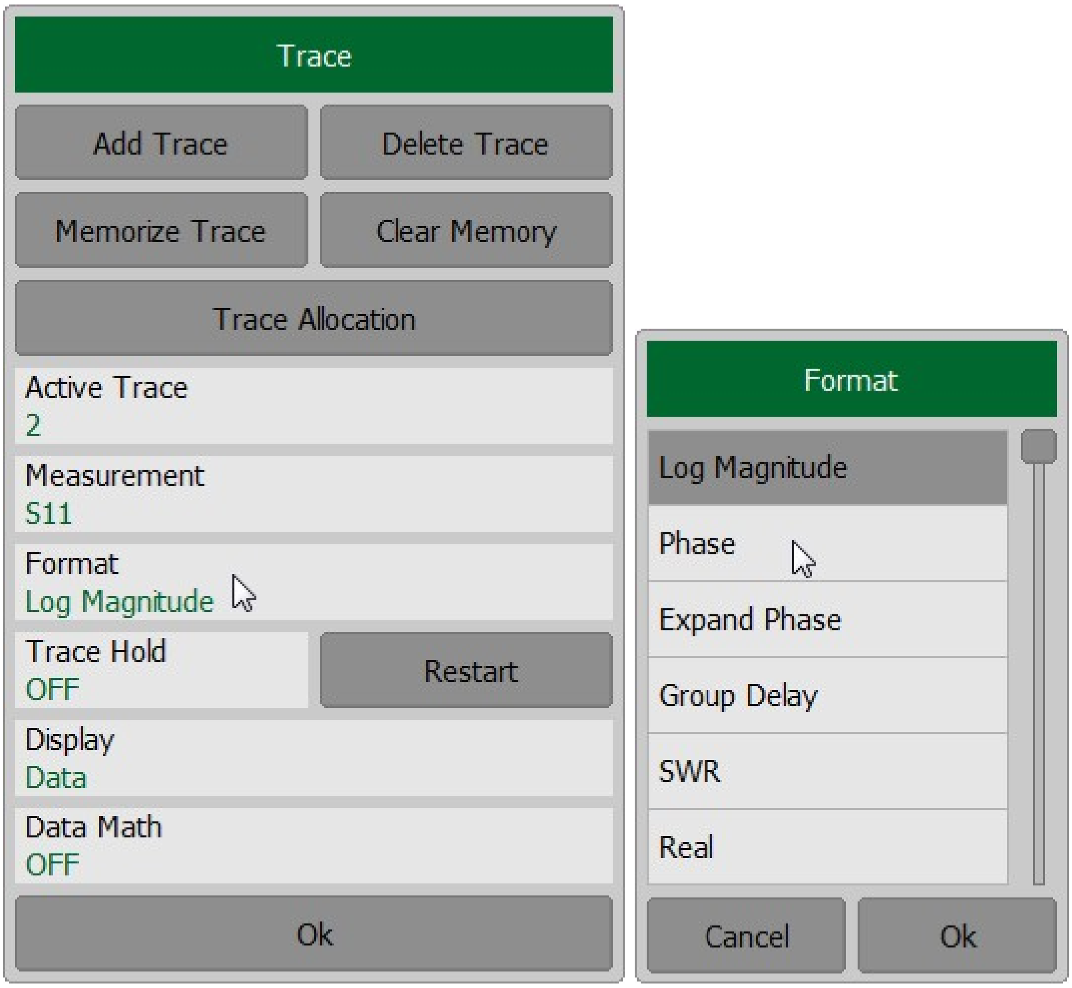
In the current example, two traces are used for simultaneous display of the two parameters (SWR and reflection coefficient phase).

To add the second trace, use the softkey **Trace** in the right menu bar. Then click the softkey **Add Trace** in the Trace dialog.

The added trace automatically becomes active. The active trace is highlighted in the list and on the graph.

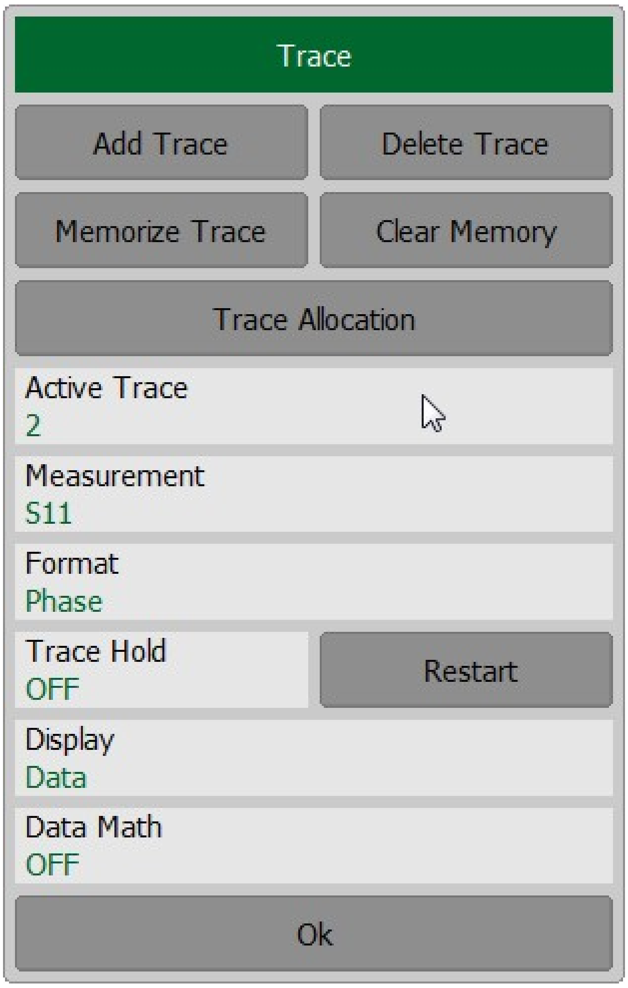


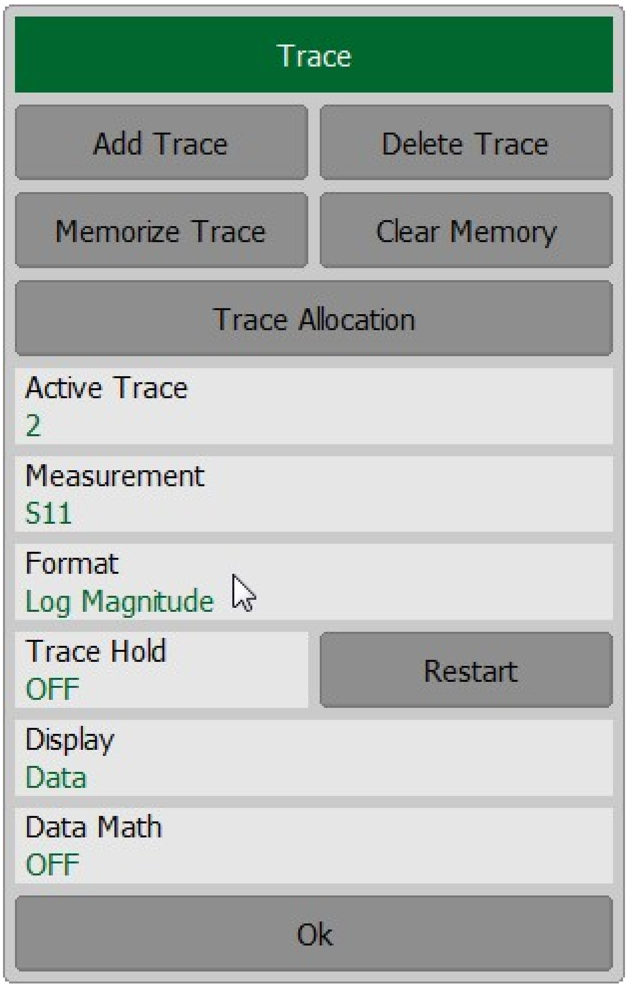
To select the trace display format, click on **Format** field. Set the Phase format by clicking **Phase** field. Complete the setting by clicking softkey **Ok**.

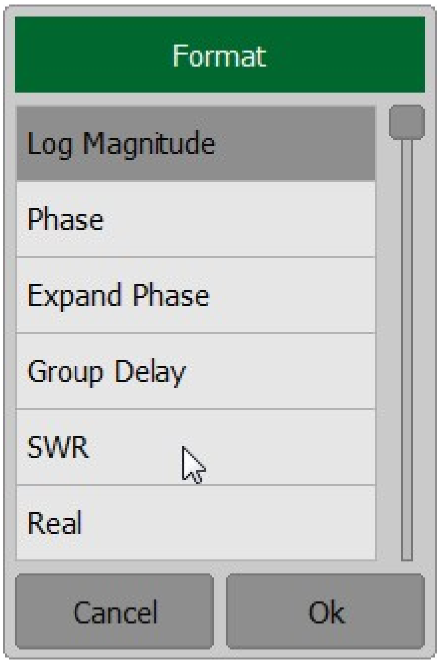


To scroll up and down the formats list clicks on the list field and drag the mouse up or down accordingly.

To select the first trace display format, click on **Active Trace** field, then on **Format** field. In the Format dialog click on **SWR** field. Complete the setting by clicking softkey **Ok**.


Trace
Add Trace
Delete Trace
Memorize Trace
Clear Memory
Trace Allocation
Active Trace
2
Measurement
S11
Format
Phase
Trace Hold
OFF
Restart
Display
Data
Data Math
OFF
Ok



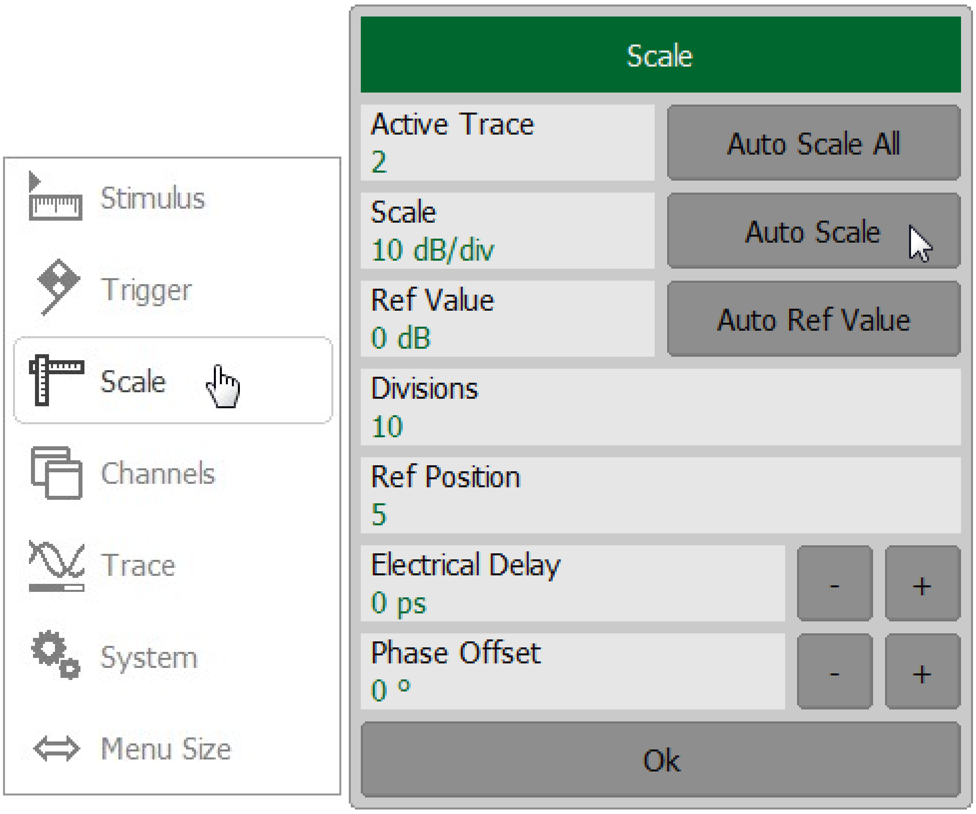


Close the dialogs by clicking softkey **Ok**.

Trace Scale Setting

For a convenience in operation, change the trace scale using automatic scaling function.

To set the scale of the active trace by the autoscaling function use the softkeys **Scale** in the right menu bar. Then click the softkey **Auto Scale**. Complete the setting by clicking softkey **Ok**.



The software will automatically set the scale for the best display of the active trace.

To automatically set the scale for all traces, use the softkeys **Scale > Auto Scale All > Ok**.

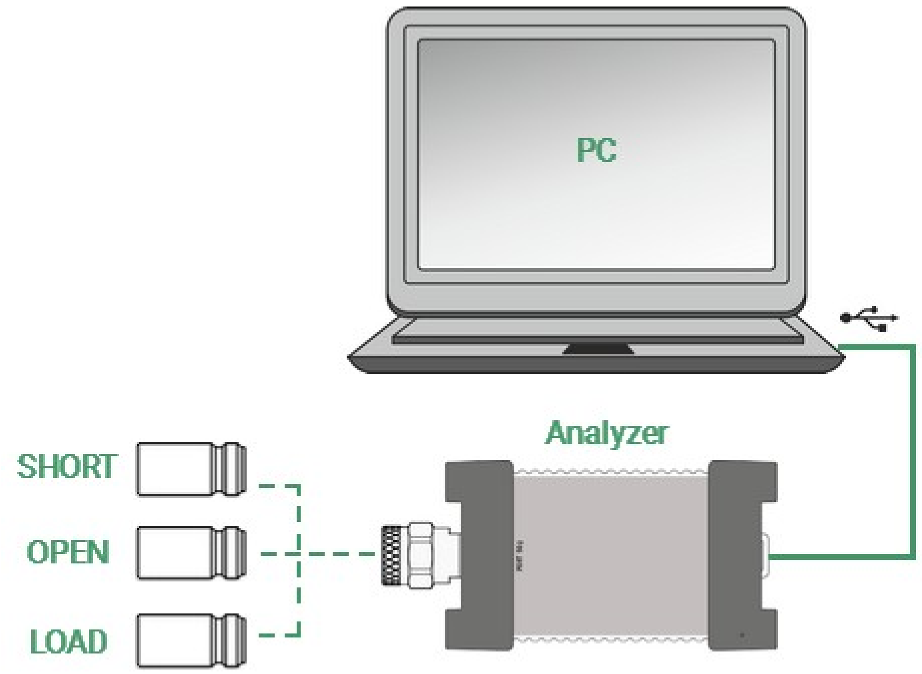
NOTE	To activate a trace, use the **Active Trace** field in the Scale dialog.

Analyzer Calibration for Reflection Coefficient Measurement

Calibration of the entire measurement setup — which includes the Analyzer, cables, and adapters involved for the DUT connection — greatly enhances the accuracy of the measurement.

To perform full one-port calibration, prepare the kit of calibration standards: OPEN, SHORT, and LOAD. To perform proper calibration, select the correct kit type in the software. This kit contains a description and specifications of the standards

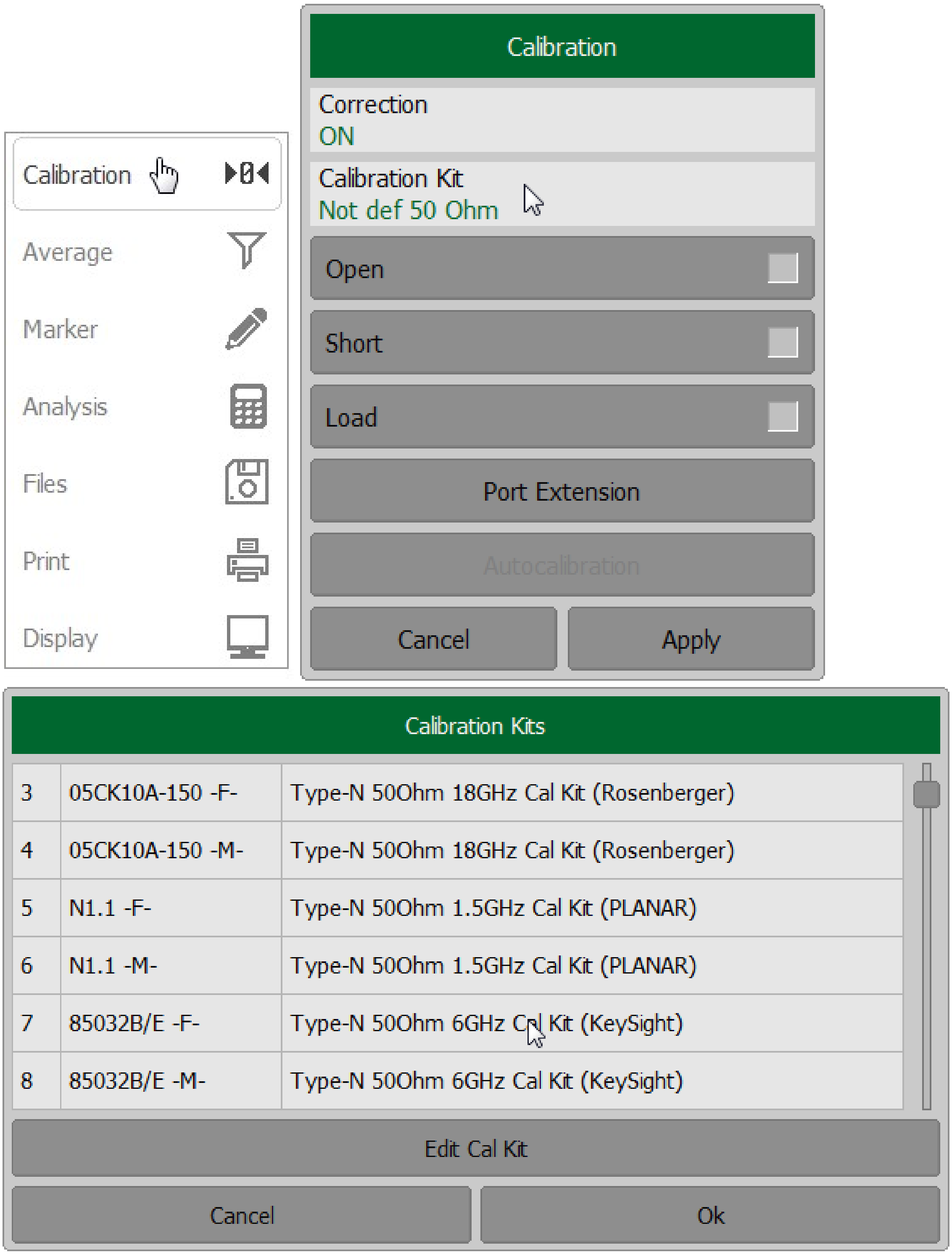
To perform full one-port calibration, connect calibration standards to the test port one after another and perform the measurement, as shown below.



Full one-port calibration circuit

In the current example Keysight 85032B/E calibration kit is used.

To select the calibration kit, use the softkey **Calibration** in the left menu bar. Then click the field **Calibration Kit** in the Calibration dialog.

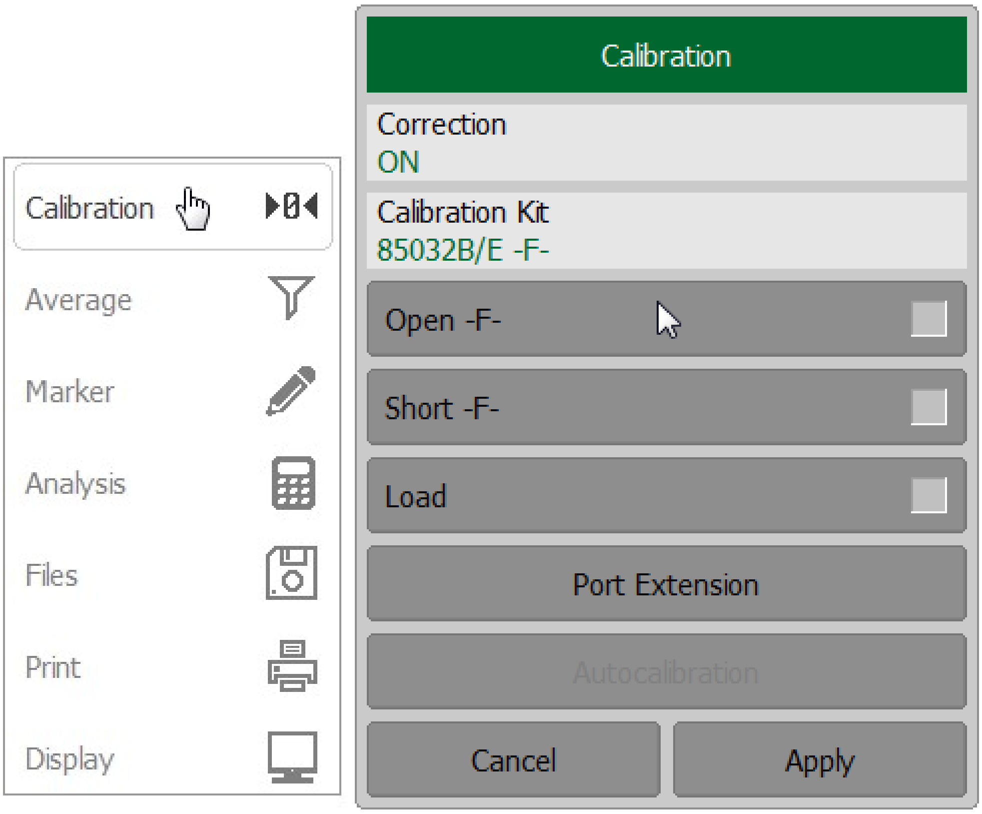


Then select the required kit from the **Calibration Kits** list and complete the setting by clicking softkey **Ok**.

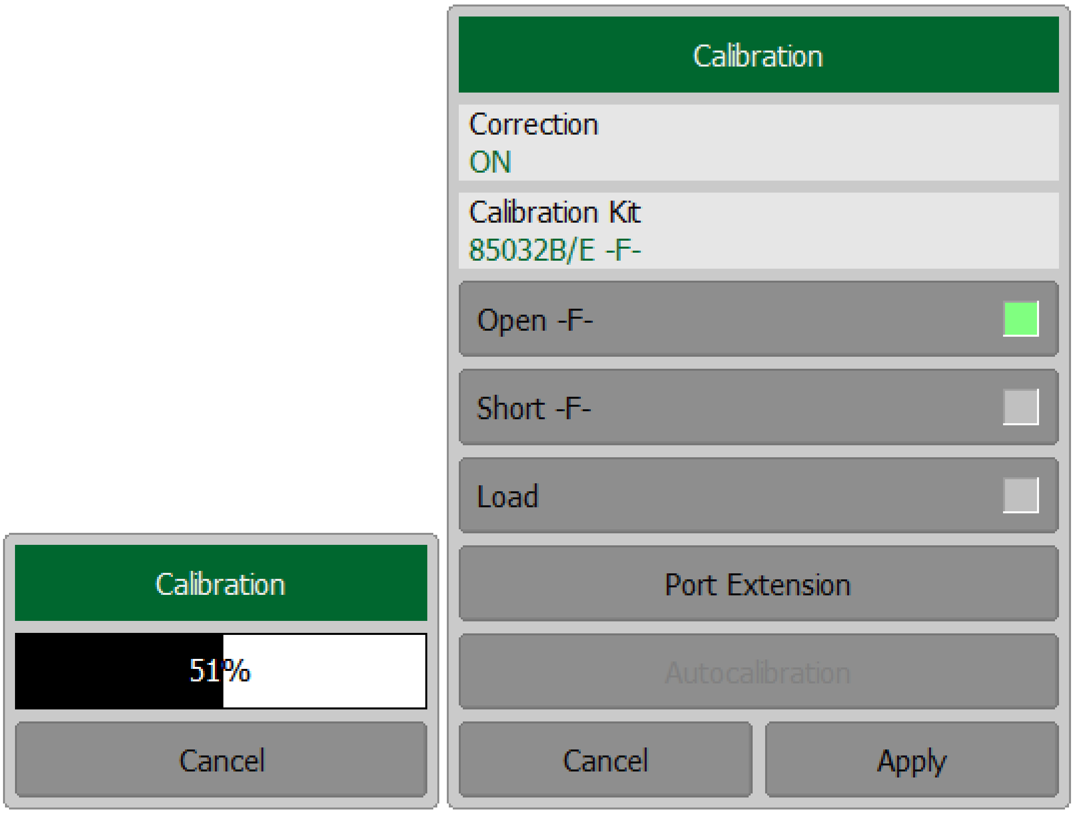
To perform full 1-port calibration, execute measurements of the three standards. After that the table of calibration coefficients will be calculated and saved into the memory of the Analyzer. Before start calibration, disconnect the DUT from the Analyzer.

To perform full 1-port calibration use the softkey **Calibration** in the left menu bar.

Connect an OPEN standard and click **Open** softkey in the Calibration dialog.



After clicking any of the **Open** softkeys, wait until the calibration procedure is completed.



Connect a SHORT standard and click **Short** softkey.

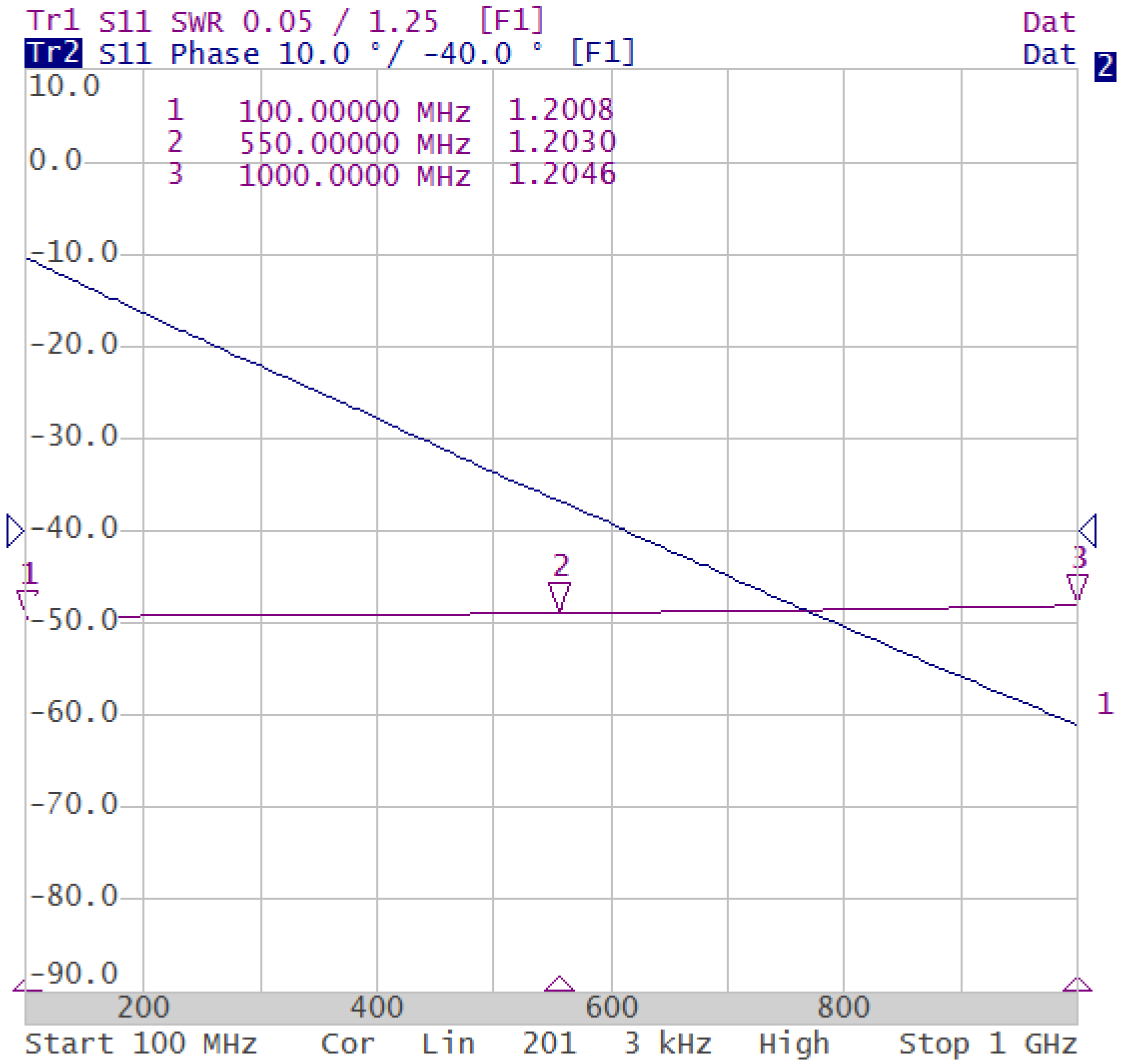
Connect a LOAD standard and click **Load** softkey.

Wait until the calibration procedure is completed.

To complete the calibration and calculate the table of calibration coefficients click **Apply** softkey in the Calibration dialog. Then re-connect the DUT to the Analyzer test port.

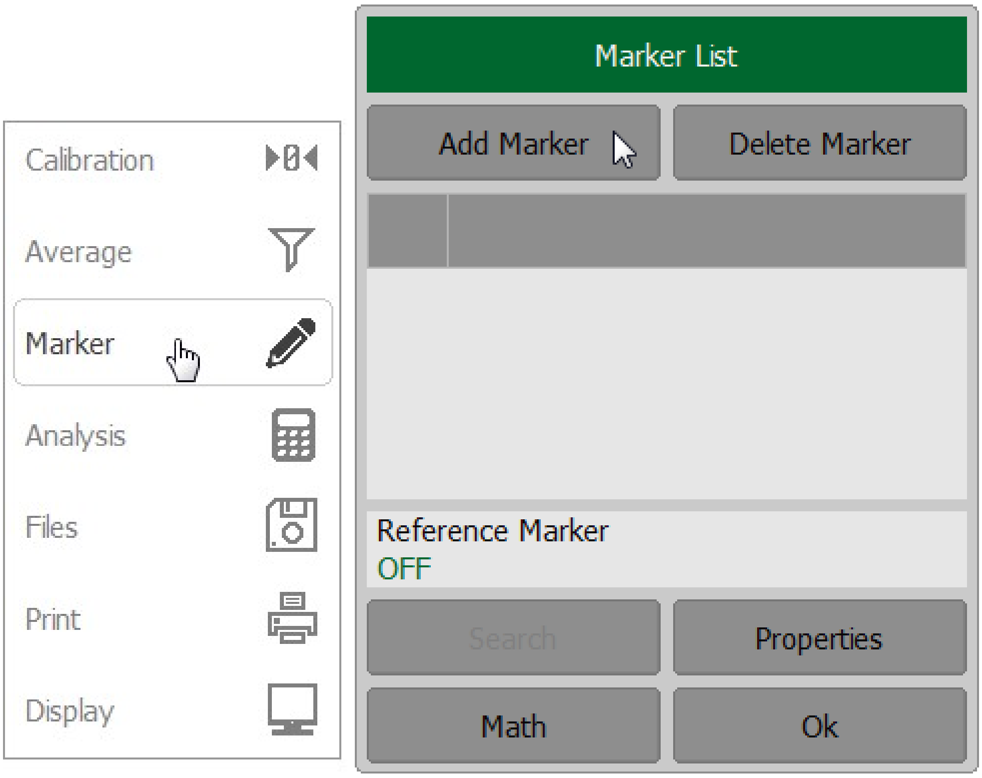
SWR and Reflection Coefficient Phase Analysis Using Markers

This section describes how to determine the measurement values at three frequency points using markers. In the current example, a reflection standard of SWR = 1.2 is used as a DUT. The Analyzer screen view is shown in figure below.

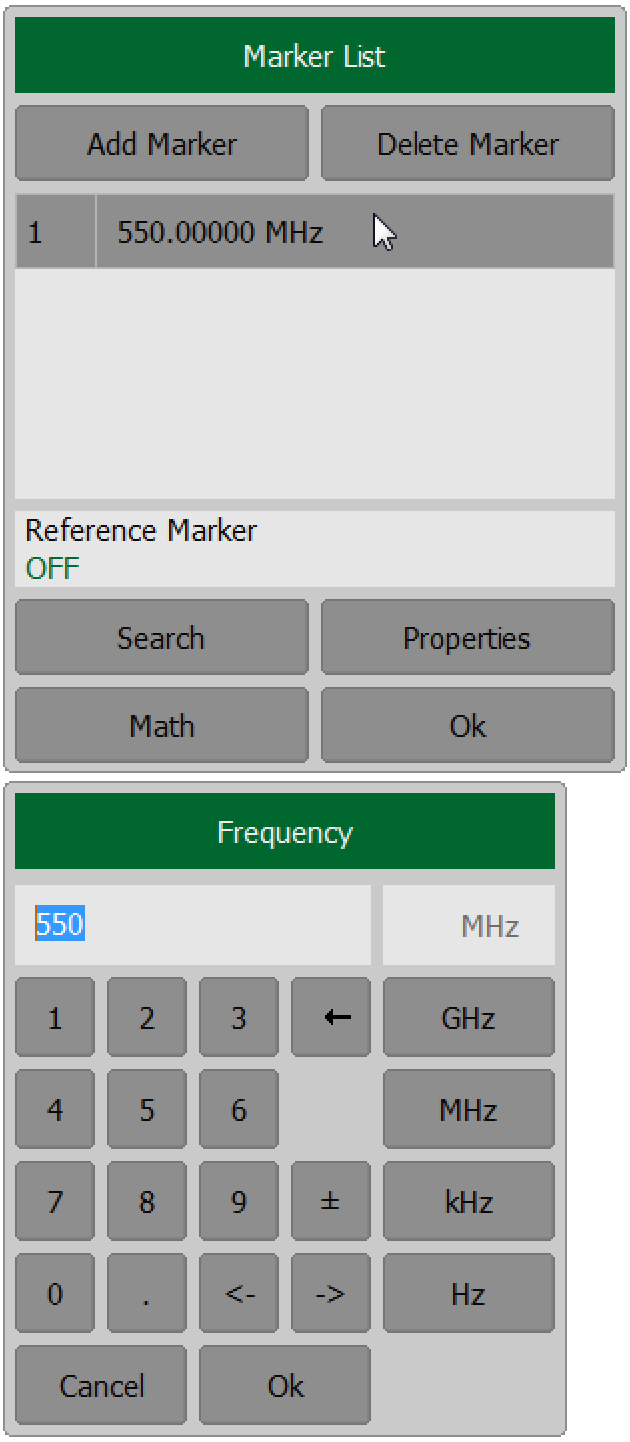


SWR and reflection coefficient phase measurement example

To enable a new marker, use the softkey **Marker** in the left menu bar. Then click the softkey **Add Marker** in the Marker List dialog.



Double click on the marker in the **Marker List** to activate the on-screen keypad and enter the marker frequency value.



Complete the setting by clicking softkey **Ok**.

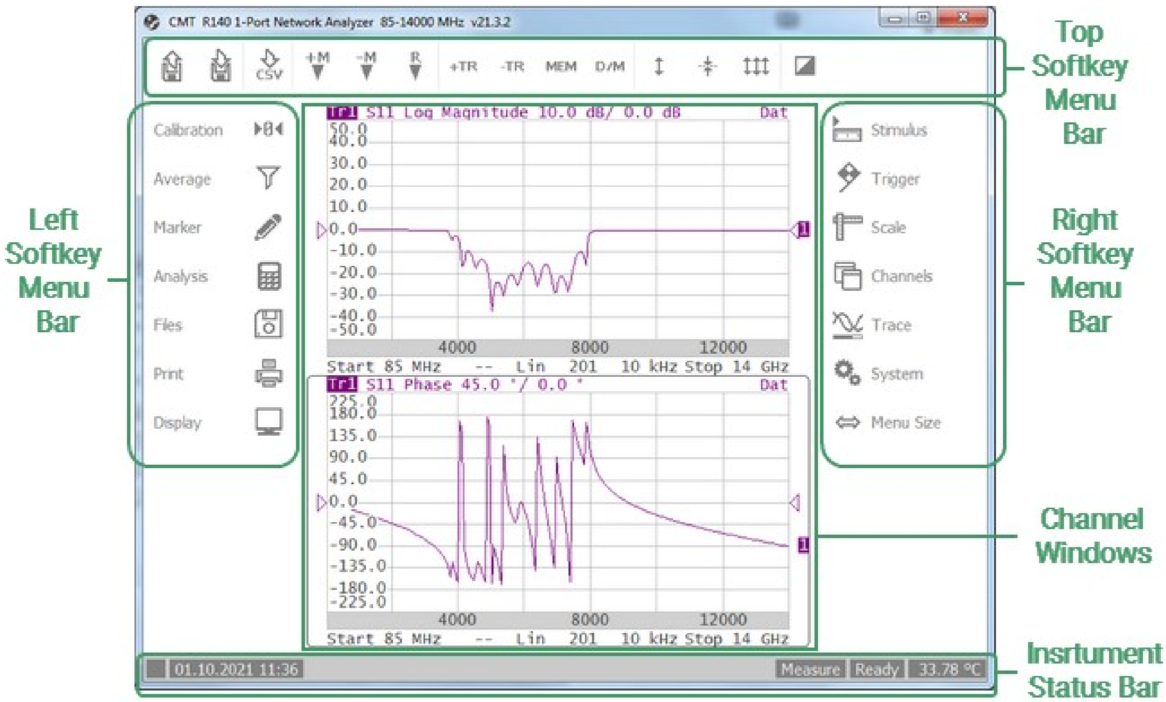
User Interface

The software on the PC screen is displayed as the Analyzer Screen. The Analyzer screen contains:

- Channel windows to display measurement results in the form of traces and numerical values.
- Top menu bar, left and right menu bars to control the Analyzer.
- Instrument status bar to display information about the state of the Analyzer.

A detailed description of the software window elements is given further in this section.

The Analyzer Screen, with the main elements highlighted, is shown in the figure below.



Analyzer screen layout

Left and Right Softkey Menu Bars

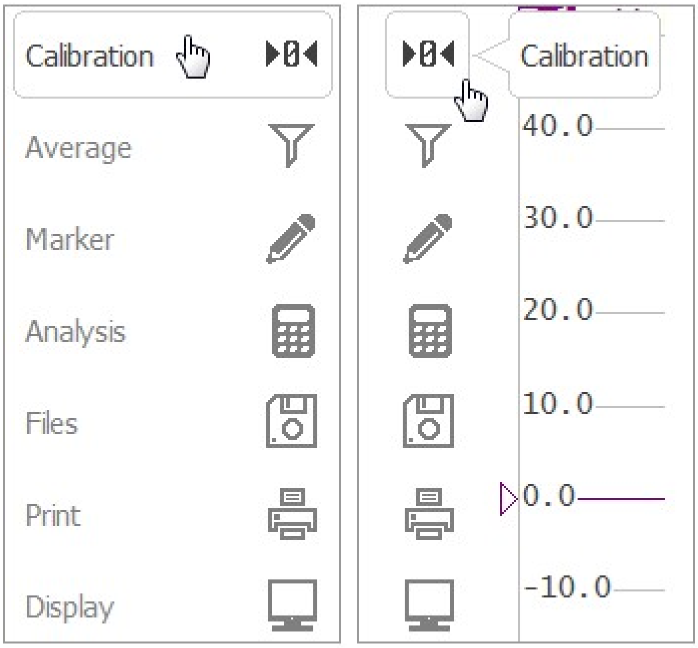
The softkey menu bars in the left and right parts of the screen are the main menu of the software. Each softkey represents one of the submenus. The menu system is multilevel and allows to access to all the functions of the Analyzer.

The menu softkeys can be controlled by a mouse or using a touch screen.

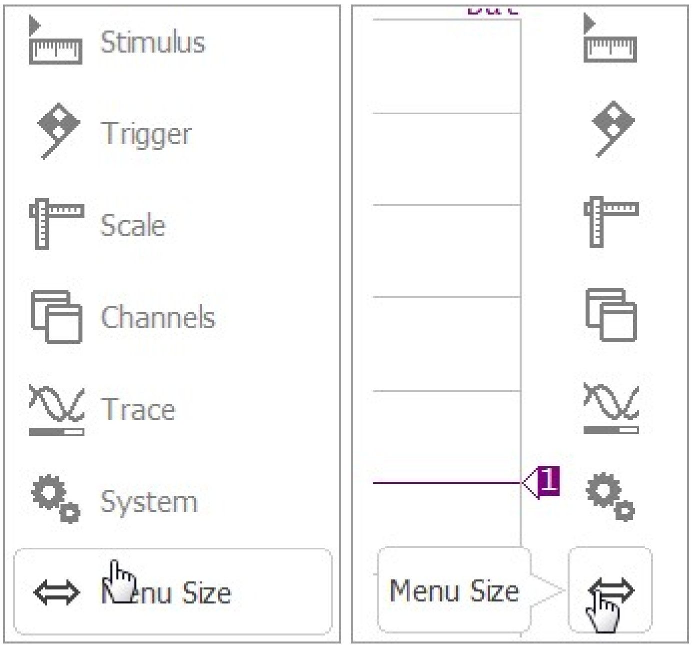
On-screen alphanumeric keypads also support data entering from external PC keyboard. Besides, the menu navigation is done by «Up Arrow», «Down Arrow», «Enter», «Esc» keys on the external keyboard.

To expand the menu bar, click on it and drag the cursor to the right or to the left accordingly. To collapse the menu bar, click on it and drag the cursor to the right or to the left accordingly.

Clicking the softkey **Menu Size** expands or collapses the menu bar.

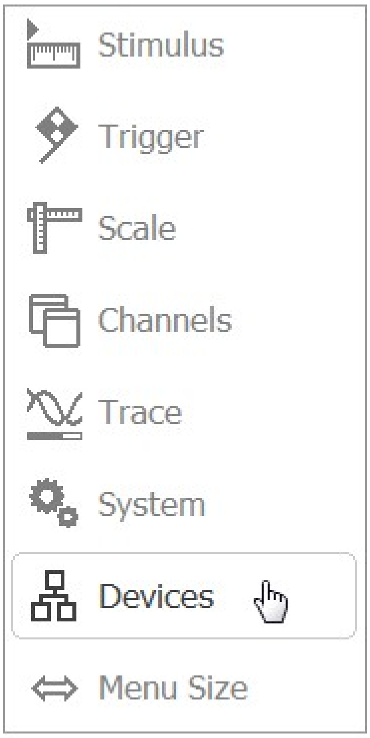


Example of expanded or collapsed left menu bar



Example of expanded or collapsed right menu bar

Right softkey menu bar of RNVNA software contains addition softkey **Devices** (see figure below).



Right softkey menu bar of RNVNA software

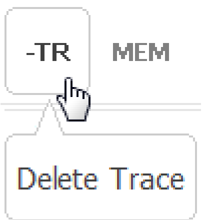
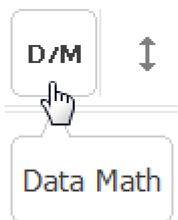
Top Menu Bar

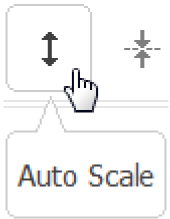
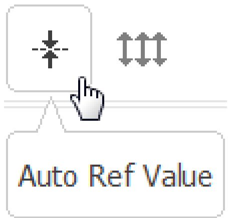
The menu bar contains the functions of the most frequently used softkeys (See figure below).

Top menu bar

Description of the softkeys is given in the table below.

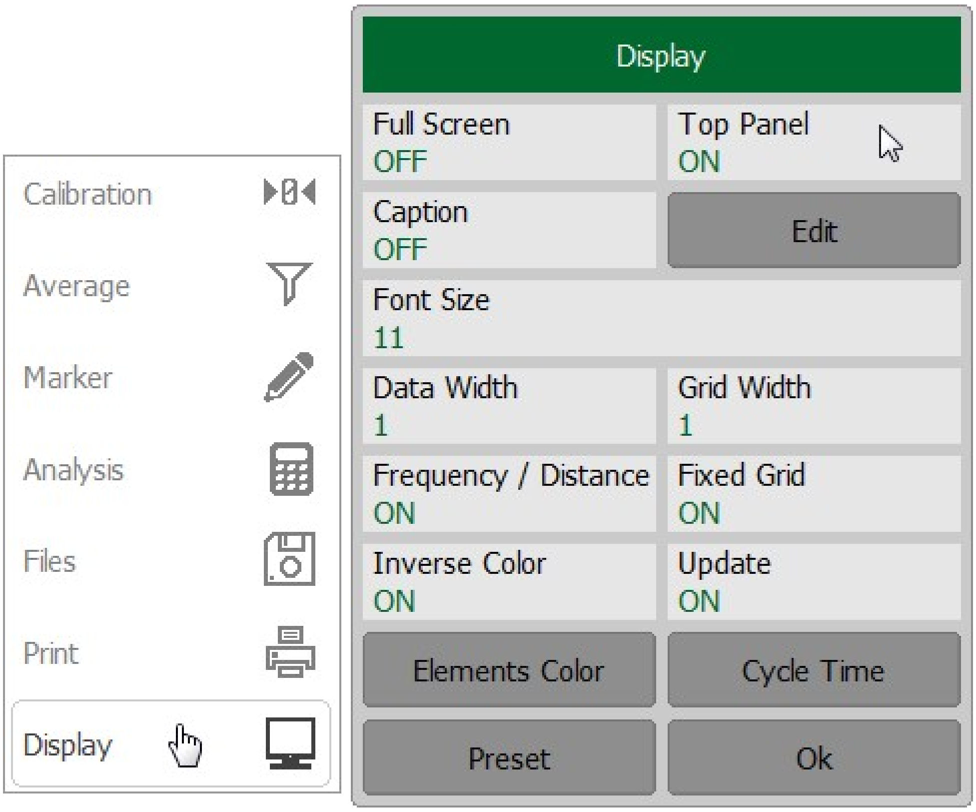
Softkey	Description
	The softkey **Recall State** allows to recall the state from a file of the Analyzer state (See Analyzer State Recalling).
	The softkey **Save State** allows to save the Analyzer state (See Analyzer State Saving). NOTE. Type of saving is set by the user in the dialog form **Save type** (See Analyzer State).
	The softkey **Save Data** allows to save the trace data in CSV format (See Trace Data CSV File).
	The softkeys **Add Marker** and **Delete Marker** add and delete markers on the trace respectively (See Markers).

Softkey	Description
	
	The softkey **Reference Marker** allows to add the reference marker on the trace. To delete the reference marker reclick this key (See Reference Marker).
 	The softkeys **Add Trace** and **Delete Trace** add and delete traces respectively (See Number of Traces).
	The softkey **Memory trace** enables trace saving into memory (See Memory Trace Function).
	The softkey **Data Math** pops up the corresponding dialog form for choosing the math operation type between data traces and memory traces (See Mathematical Operations).

Softkey	Description
	The softkey **Auto Scale** allows to define the trace scale automatically so that the trace of the measured value could fit into the graph entirely (See Automatic Scaling).
	The softkey **Auto Ref Value** executes the automatic selection of the reference level (See Reference Level Automatic Selection).
	The softkey **Auto Scale All** allows to define the trace scale automatically for all traces (See Automatic Scaling).
	The softkey **Inverse Color** allows to change the interface color.

If necessary, **Top Menu Bar** can be hidden.

To show/hide the top menu bar use the softkey **Display > Top panel**.

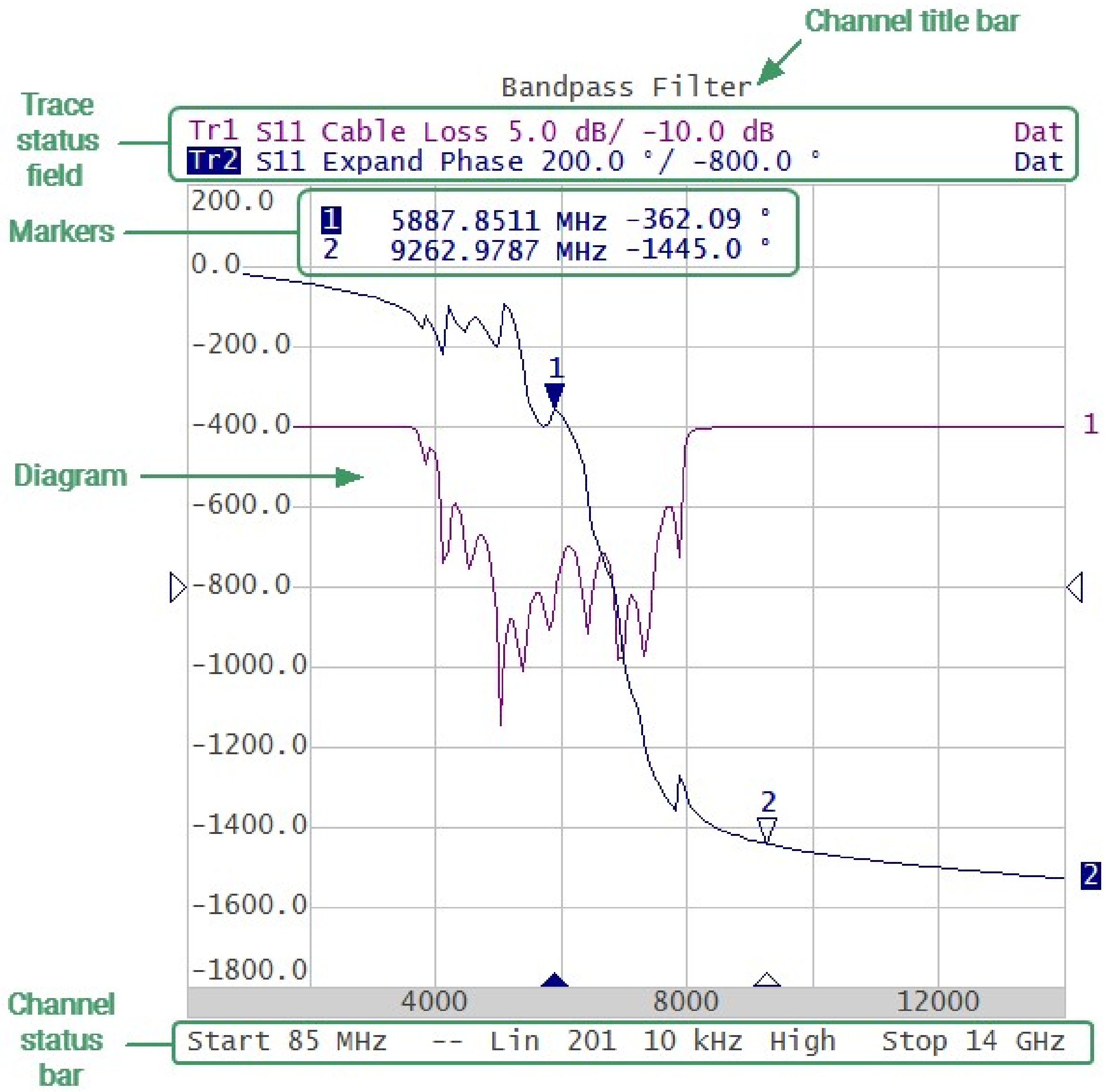


Channel Window Layout and Functions

The channel windows display the measurement results in the form of traces and numerical values. The screen can display simultaneously up to 4 channel windows for RVNA and up to 16 channel windows for RNVNA. The analyzer hardware processes channels sequentially.

In turn, each channel window can display up to 4 traces of the measured parameters for RVNA and up to 16 trace of the measured parameters for RNVNA. If there is more than one trace in a channel window, the way they are displayed can be changed in the diagram (See Trace Layout in the Channel Window).

The general view of the channel window is represented in figure below.



Channel window

Each channel window contains a Channel title (hidden by default) to be defined by the user, Trace status field to display the name and parameters of the traces, Diagram for displaying traces, as well as information about the channel status in the form of the Channel Status Bar. To display the measurement values at the indicated trace points, use the Markers feature.

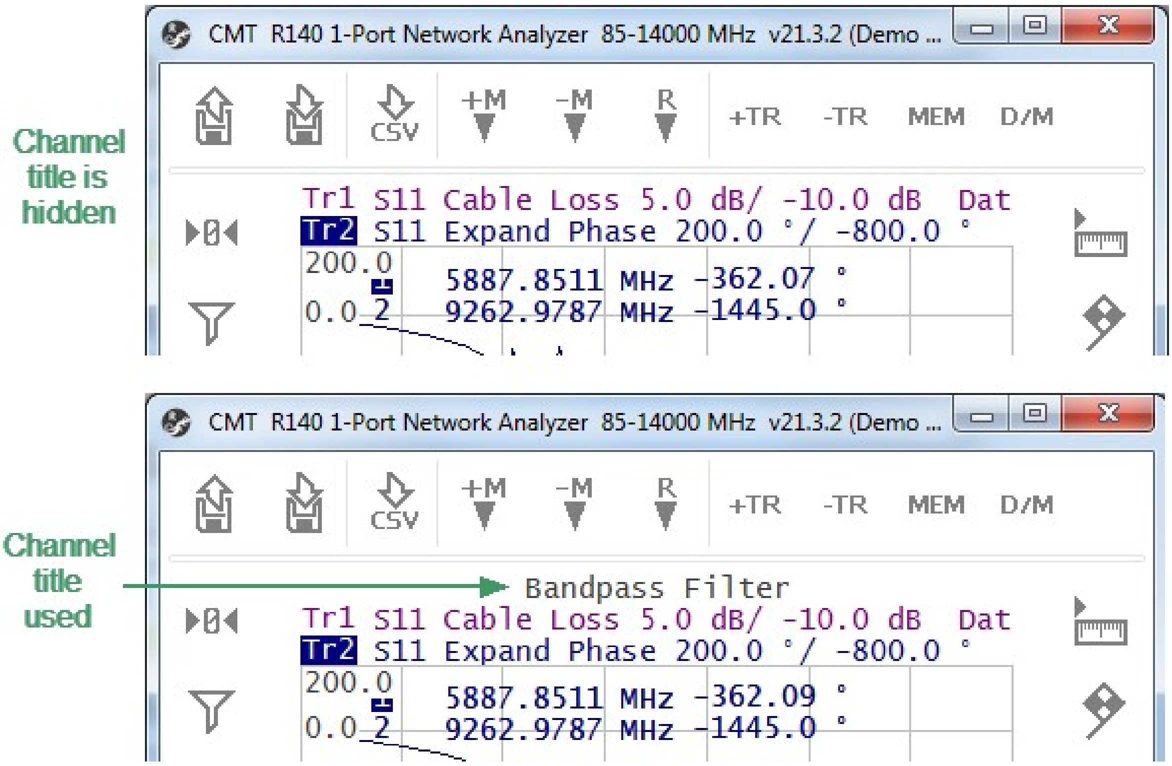
Each window has the following parameters:

- Stimulus signal settings:
    1. Frequency range
    2. Number of Points
    3. Sweep Type
    4. Power level
- IF Bandwidth and average
- Calibration

NOTE	The calibration parameters are applied to the whole the Analyzer and affect all the channel windows.

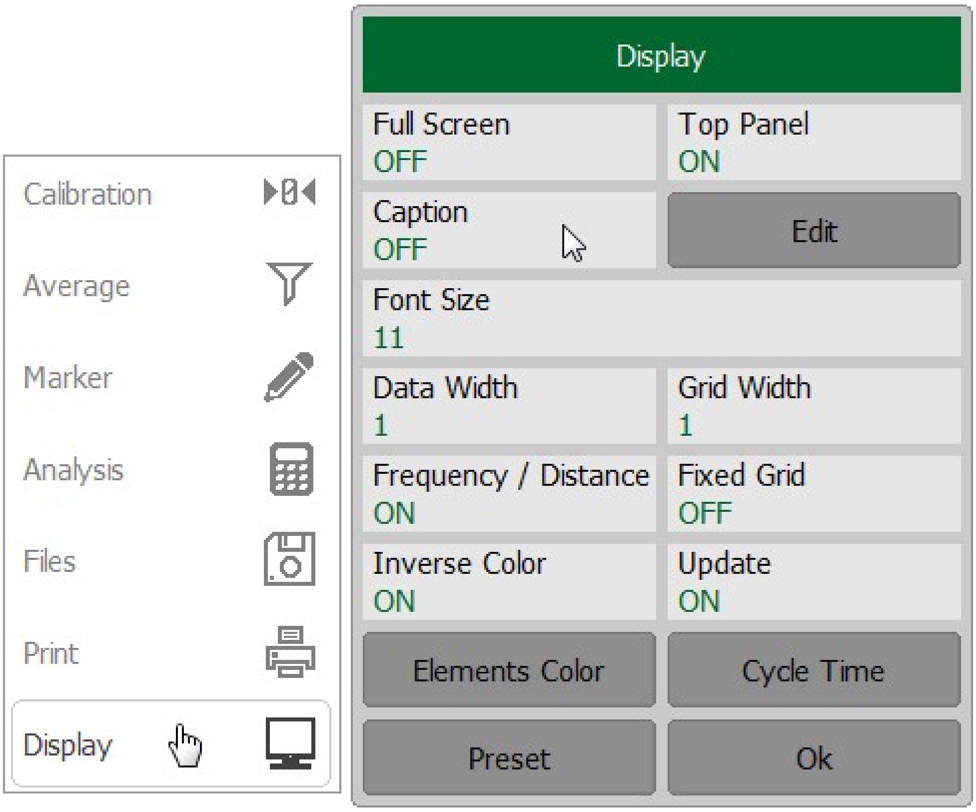
Channel Title Bar

The channel title feature allows for a comment to be entered for each channel window. The channel title bar can be hidden to gain more screen space for the trace diagram.



Channel title bar

To show/hide the channel title bar use the softkey **Display**. Click on **Caption** field in the opened dialog.



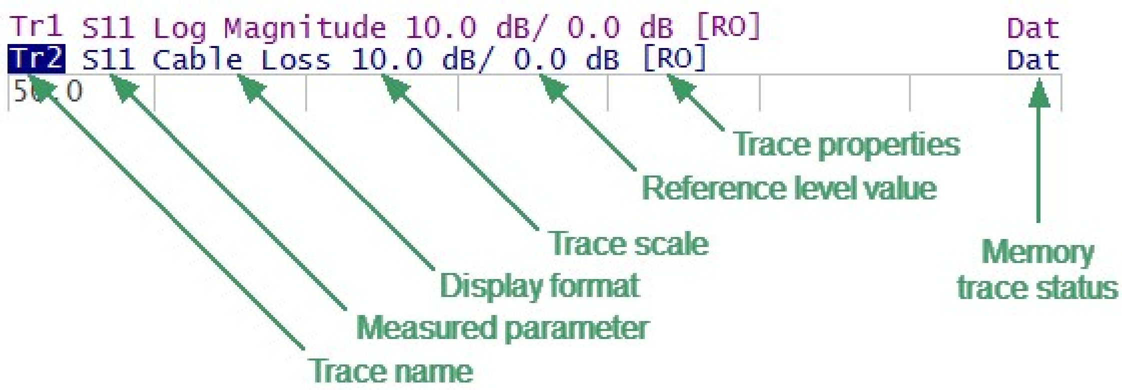
To edit the channel title, click on the softkey **Edit** to recall the on-screen keypad.

SCPI	DISPlay:WINDow:TITLe, DISPlay:WINDow:TITLe:DATA

Trace Status Field

The trace status field displays the name and parameters of a trace. The number of lines in the field depends on the number of traces in the channel.

The trace status field is represented in the figure below.



Trace status field

Each line contains the data on one trace of the channel:

- Trace name from «Tr1» to «Tr4» for RVNA, from «Tr1» to «Tr16» for RNVNA. The active trace name is highlighted in an inverted color.
- Measured parameter:
    1. S11 for 1-port Vector Network Analyzer;
    2. S-parameters when using two or more Analyzers (separately or as a part of an RNVNA):

       — Sii, where a value from 1 to N is taken.

       — |Sij|, i ≠ j, i and j take a value from 1 to N (N is a number of Analyzers).
- Display format, e.g. «Cable Loss» (See Display Format).
- Trace scale in measurement units per division, «e.g. 10 dB/div».
- Reference level value, e.g. «0.0 dB».
- Trace properties is indicated as symbols in square brackets (See Table below).
- Memory trace status, e.g. «Dat» (See Memory Trace Function).

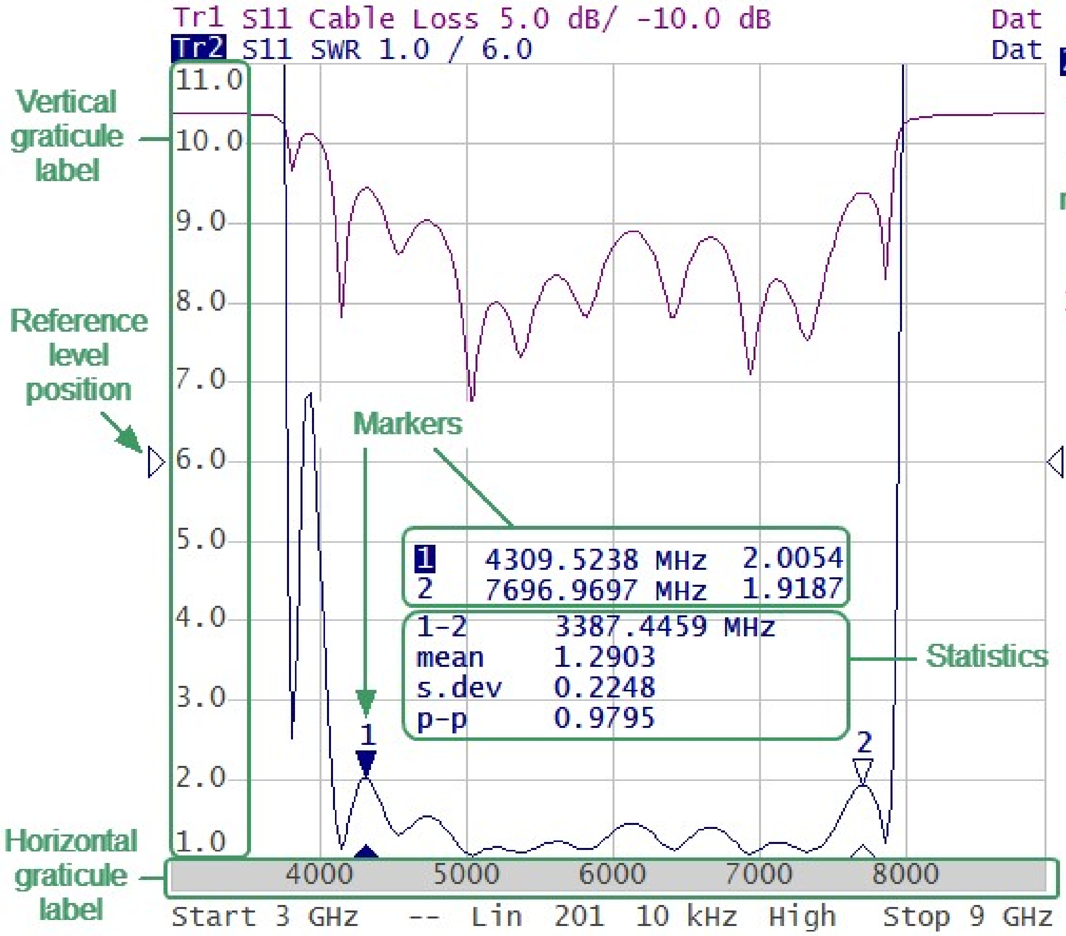
Status	Symbols	Definition
Error Correction	**RO**	OPEN response calibration
	RS	SHORT response calibration
	F1	Full 1-port calibration
	ST	Transmission normalization (RNVNA only)
	F1ST	Full 1-port Calibration with transmission normalization (RNVNA only)
	F2ST	Full 2-port Calibration with transmission normalization (RNVNA only)
	MATH	Equivalent to F2ST Calibration, obtained by mathematical method. (RNVNA only)
Data Analysis	**Z0**	Port impedance conversion
	Dmb	De-embedding
	Emb	Embedding
	Pxt	Port extension
Math Operations	**D+M**	Data + Memory
	D-M	Data - Memory
	D*M	Data * Memory
	D/M	Data / Memory
Maximum Hold	**Max**	Hold of the trace maximum between repeated measurements
Electrical Delay	**Del**	Electrical delay other than zero
Phase Offset	**PhO**	Phase offset value other than zero

Status	Symbols	Definition
Smoothing	**Smo**	Trace smoothing
Gating	**Gat**	Time domain gating
Conversion	**Zr**	Reflection impedance
	Yr	Reflection admittance
	1/S	S-parameter inversion
	Conj	Conjugation
Trace display	**Dat**	Data trace
	Mem	Memory trace
	D&M	Data and memory traces
	Off	Data and memory traces OFF

NOTE The trace status files can be easily modified using the mouse pointer (See Quick Settings Using a Mouse).

Diagram

The graph area in the channel window is called a diagram. The diagram displays traces and numeric data.



Diagram

The diagram contains the following elements:

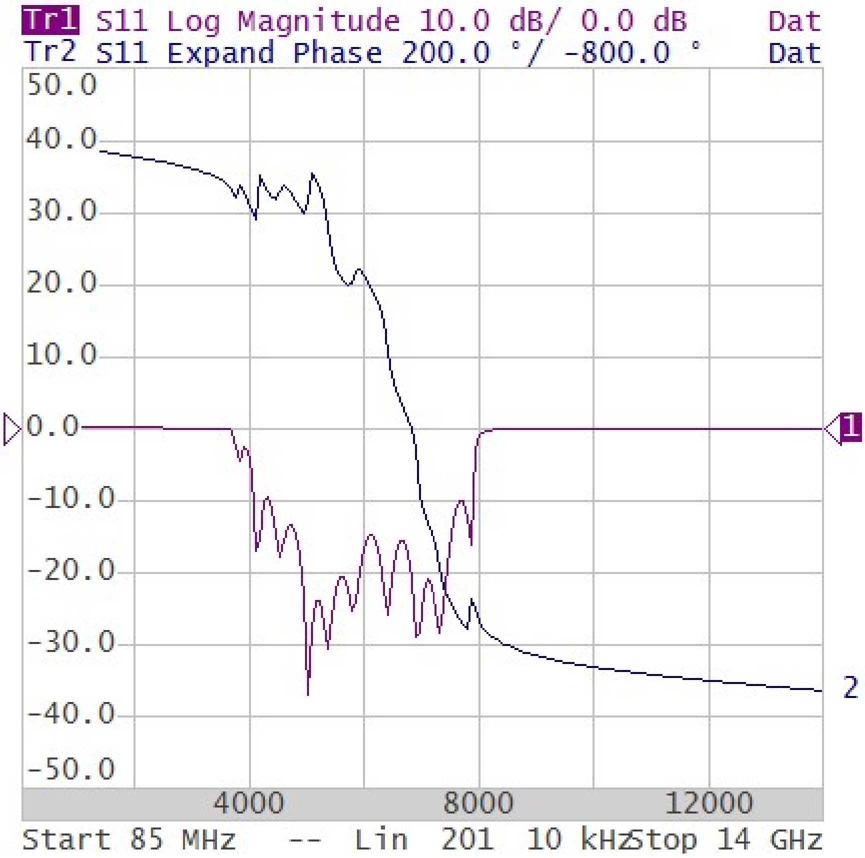
- **Vertical graticule label** displays the vertical axis numeric data for the active trace. The data for all traces can be displayed or hidden to gain more screen space for the trace display.
- **Horizontal graticule label** displays stimulus axis numeric data (frequency, time or distance). The horizontal graticule label can be hidden to gain more screen space for the trace display.
- **Reference level position** indicates the reference level position of the trace.
- **Markers** indicates the measured values at points along the active trace. The markers for all traces can be simultaneously displayed.
- **Marker functions**: statistics, bandwidth, flatness, RF filter.

- **Trace number** allows trace identification when printing in black and white.
- **Current stimulus position** indicator appears when sweep duration exceeds 1 sec.

NOTE	Using the graticule labels, can easily control all the trace parameters by the mouse (See Quick Settings Using a Mouse).

Trace Layout in the Channel Window

If the number of the displayed traces is more than one, the traces can be rearranged. All the traces can be allocated to one diagram or each trace can be displayed on an individual diagram (See figures below). For a detailed description see [Trace Allocation].

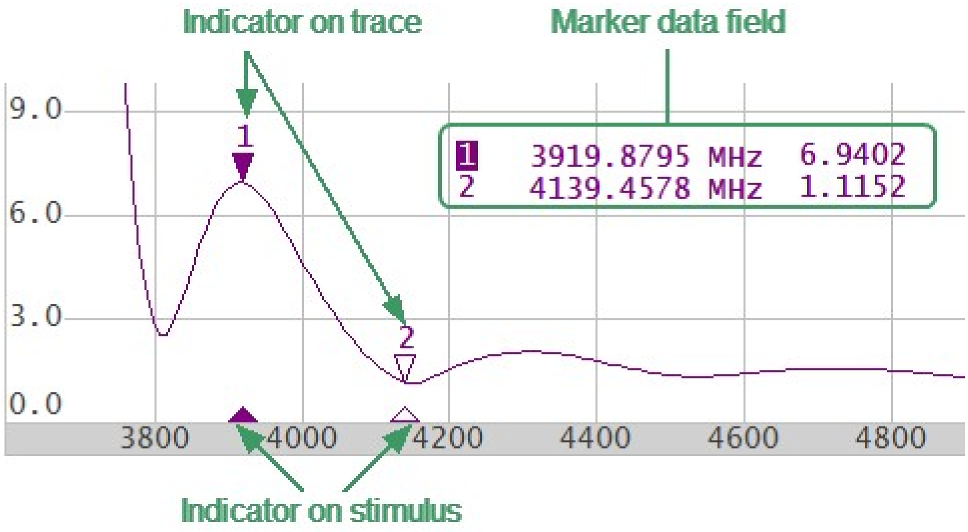


The two traces on one diagram in channel window (sample)

The two traces on two diagrams in channel window (sample)

Markers

The markers indicate the stimulus values and the measured values at selected points of the trace (See figure below).



Markers

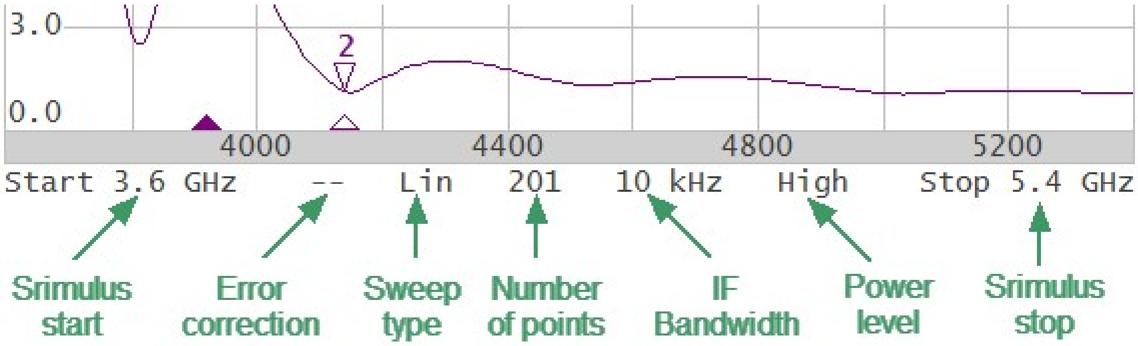
The markers are numbered from 1 to 15. The reference marker is indicated with an R symbol. The active marker is indicated in the following manners:

- Its number is highlighted with inverse color.
- The indicator on the trace is located above the trace.
- The stimulus indicator is fully colored.

The use of markers is described in the Markers.

Channel Status Bar

The channel status bar is located in the bottom part of the channel window (See figure below).



Channel status bar

The channel status bar contains the following elements:

- **Stimulus start** field allows to display and enter the start frequency. This field can be switched to indication of stimulus center frequency, in this case the word Start will change to Center. For a detailed description of stimulus setting, see Sweep Range.
- **Error correction** field displays the integrated status of error correction for S-parameter traces. The values of this field are represented in table below. For a detailed description see Error Correction Status.

Error correction field

Symbol	Definition
--	No calibration data. No calibration was performed.
Cor	Error correction is enabled. The stimulus settings are the same for the measurement and the calibration.
C?	Error correction is enabled. The stimulus settings are not the same for the measurement and the calibration. Interpolation is applied.
C!	Error correction is enabled. The stimulus settings are not the same for the measurement and the calibration. Extrapolation is applied.
Off	Error correction is turned off.

- **Sweep type** field allows for display and selection of the sweep type. The values of this field are represented in the table below. For a detailed description see Sweep Type.

- **Number of points** field allows to display and enter the number of sweep points. The number of sweep points can have the following values: up 2 to 100001 for RVNA and up 2 to 16001 for RNVNA. For a detailed description see Number of Points.

- **IF bandwidth** field allows to display and set the IF bandwidth. The values can be set from 10 Hz to 30 kHz (100 kHz). For a detailed description see IF Bandwidth Setting.

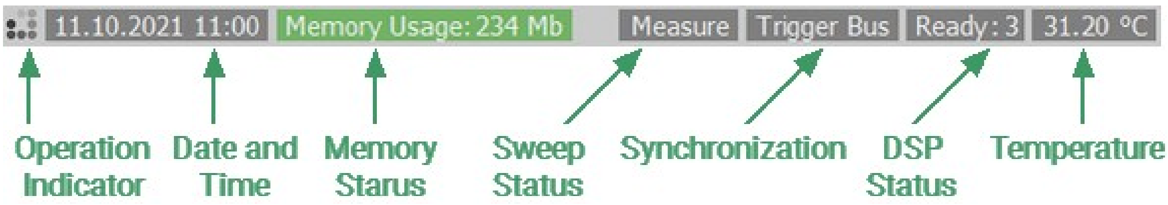
- **Power level** field allows to display and enter the port output power. For a detailed description see Stimulus Power.

- **Stimulus stop** field allows to display and enter the stop frequency. This field can be switched to indication of stimulus span, in this case the word Stop will change to Span. For a detailed description of stimulus setting, see Sweep Range.

Instrument Status Bar

The instrument status bar is located at the bottom of the screen (See figure below). It can contain the following messages (See table below).

RVNA instrument status bar



RNVNA instrument status bar

Messages in the instrument status bar

Field Description	Message	Instrument Status	Note
DSP status	**Not Ready**	No communication between DSP and PC.	
	Loading	DSP firmware is loading.	
	Ready	DSP is running normally.	
	Standby	DSP is in energy saving standby mode.	
	NOTE: For RNVNA, the message additionally contains the number of connected devices.		

Field Description	Message	Instrument Status	Note
Sweep status	**Measure**	Continuous sweep.	For a detailed description see Trigger Settings.
	Hold	A sweep is on hold.	
	External	Waiting for "External" trigger.	
	Bus	Waiting for "Bus" trigger.	
Synchronization (RNVNA only)	**Free run**	Analyzers operates independently and allows to measure DUT reflection only.	For a detailed description see Selecting Analyzers' synchronization mode.
	USB bus	Synchronization is performed by sending special commands to the Analyzer on USB bus.	
	Trigger bus	Synchronization is performed using trigger signals issued by Analyzers.	

Field Description	Message	Instrument Status	Note
Memory status (RNVNA only)	**Memory Usage: XX Mb**	Indication of the memory used by the software. Message background color can be: • Green — more than 200 MB are used. • Yellow — more than 400 MB are used. • Magenta — more than 600 MB are used. • Red — more than 850 MB are used. In case this limit reached, It's impossible to save State File (See Analyzer State and Channel State.).	
Factory calibration error	**System Cal Failure**	Calibration data in ROM has an error. **THE ANALYZER IS DAMAGED AND REQUIRES FACTORY REPAIR.**	
Error correction status	**Correction Off**	Error correction disabled[1].	For a detailed description see Error Correction Disabling.
System correction status	**System Correction Off**	System correction is turned OFF.	For a detailed description see System Correction Setting.

Field Description	Message	Instrument Status	Note
Temperature	**20.00 °C**	Internal device temperature. To switch between °C/°F click on the corresponding field.	
	68.00 °F		
1 Disabling of error correction does not affect factory calibration.			

Setting Measurement Conditions

The section describes how to set the various measurement conditions of the Analyzer.

Measurement procedure

To perform measurements, do the following according to each measurement task:

- Set the number, parameters, and traces of the logical channels involved in the measurements. For a detailed description see Channel and Trace Setting.
- Set the stimulus signal parameters. For a detailed description see Stimulus Settings.
- Assign the measured parameters display format, and scale to the traces. For a detailed description see Measurement Parameters Settings, Format Setting, Scale Settings.
- If necessary, set the related trigger settings. For a detailed description see Trigger Settings.
- Set filtering parameters to improve the signal to noise ratio. For a detailed description see Measurement Optimization.

This section also describes how to quickly set the parameters of the analyzer using a mouse. For a detailed description see Quick Setting Using a Mouse.

Channel and Trace Setting

The RVNA supports up 4 channels and RNVNA supports up 16 channels, each of which allows for measurements with stimulus parameter settings different from the other channels. The parameters related to a logical channel are listed in the table below.

Channel parameters

N	Parameter Description
1	Sweep Type
2	Sweep Range
3	Number of Points
4	Stimulus Power Level
5	Segment Sweep Table
6	Trigger Mode
7	IF Bandwidth
8	Averaging
9	Calibration
10	Fixture Simulator

Each channel window can contain up to 4 different trace for RVNA and up 16 different traces for RNVNA. Each trace is assigned a measured parameter (S-parameter), display format, and other parameters. The parameters related to a trace are listed in the table below.

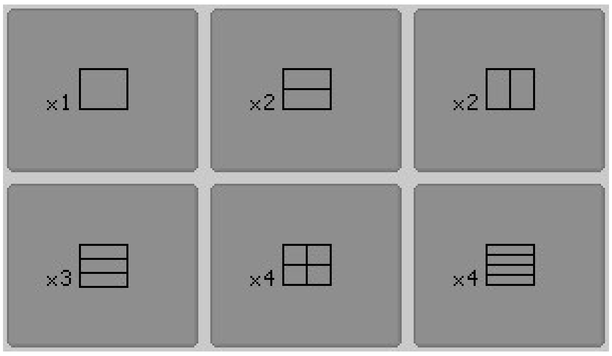
Trace parameters

N	Parameter Description
1	Measured Parameter
2	Display Format
3	Scale Settings
4	Electrical Delay, Phase Offset
5	Memory Trace, Math Operation
6	Smoothing
7	Markers
8	Time Domain
9	Parameter Transformation
10	Limit Test
11	Ripple Limit Test

Channel Allocation

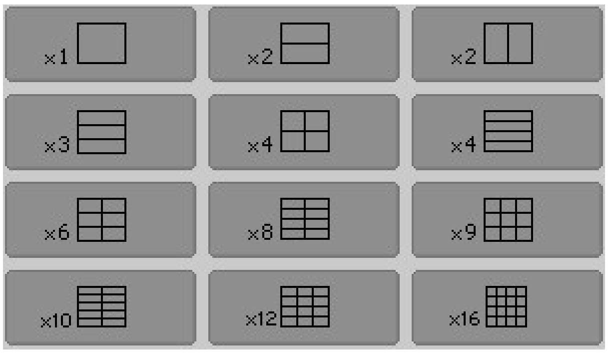
A channel is represented on the screen as an individual channel window. The screen can display from 1 to 4 channel windows for the RVNA and from 1 to 16 channel windows for RNVNA. Simultaneously by default one channel window is opened.

RVNA supports six options of the channel window layout (See figure below).



Channel window layout for RVNA

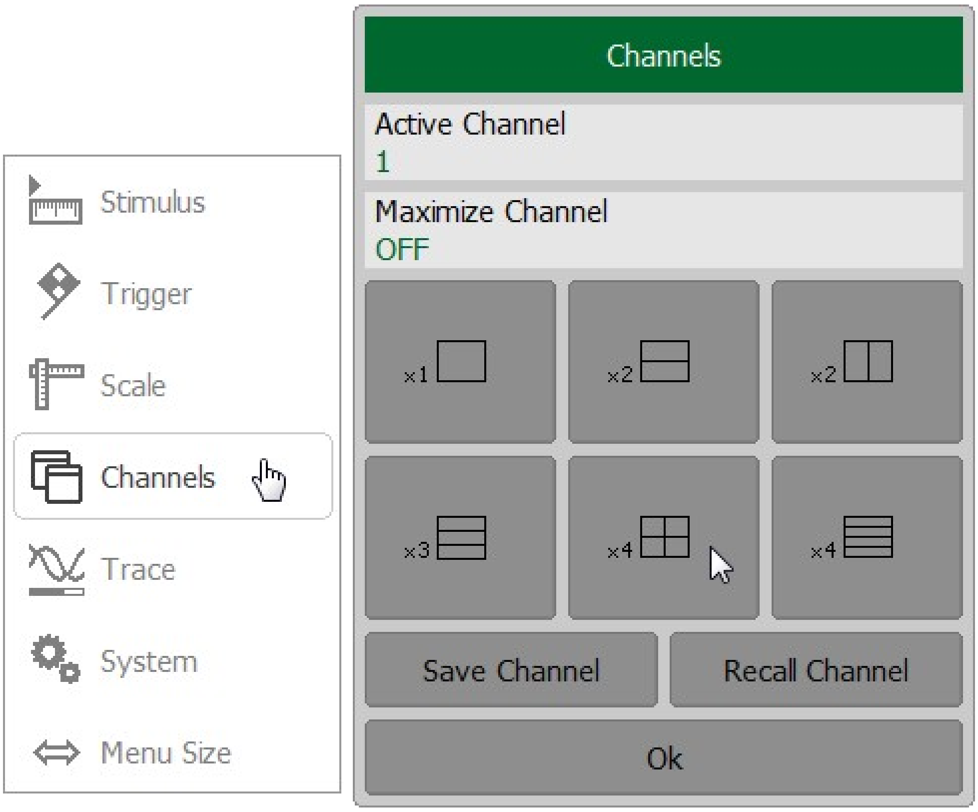
RNVNA supports twelve options of the channel window layout (See figure below).



Channel window layout for RVNA

The channels are allocated on the screen according to their numbers from left to right and from top to bottom. If there are more than one channel window on the screen, one of them is selected as active. The border line of the active window will be highlighted in inverted color.

To set the number of channel windows displayed on the screen use the following softkey in the right menu bar **Channels**. Then select the softkey with the required number and layout of the channel windows.



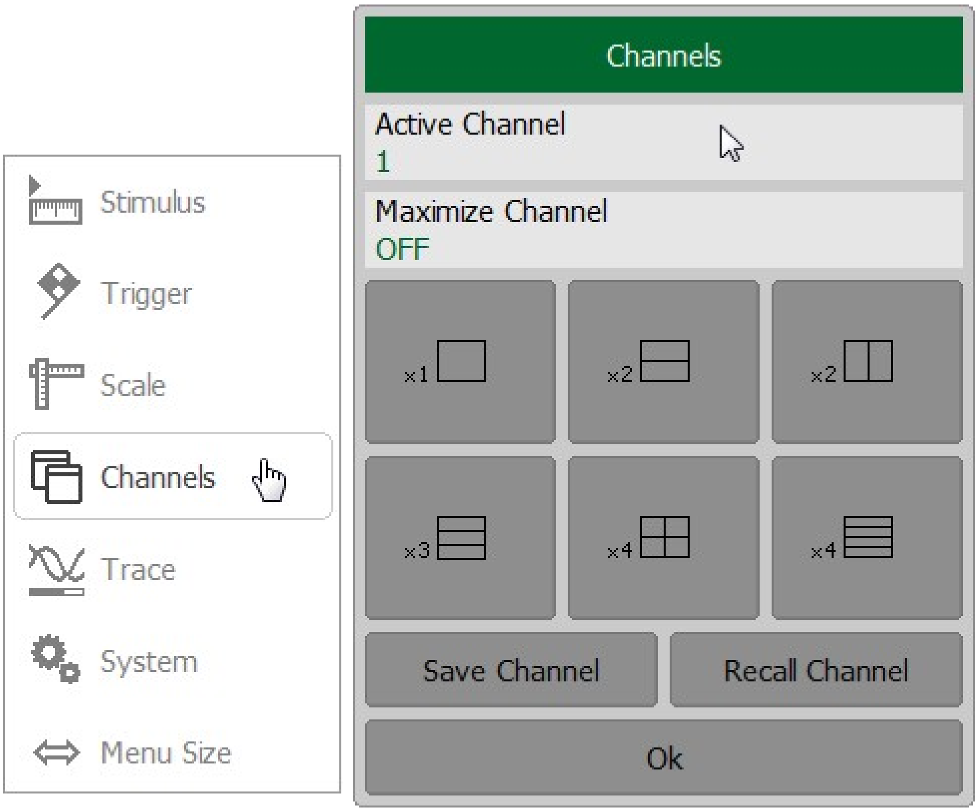
SCPI	DISPlay:SPLit

NOTE	Stimulus parameters and other settings should be configured for each enabled channel window. For a detailed description see Stimulus Settings. The required channel should be activated before setting its parameters or performing calibration. For a detailed description see Selection of Active Channel.

Selection of Active Channel

Channel should be activated before setting channel parameters.

To activate the channel, use the following softkeys in the right menu bar **Channels > Active Channel**. The **Active Channel** field allows viewing the numbers of all channels from 1 to 4 for RVNA and from 1 to 16 for RNVNA. Select the required number of the active channel.



SCPI DISPlay:WINDow:ACTivate

NOTE Channel can also be activated by clicking on its channel window (See Active Channel Selection).

Number of Traces

Each channel window can contain up to 4 different traces for RVNA and up to 16 different traces for RNVNA. Each trace is assigned the display format, scale and other parameters.

The traces can be displayed in one graph, overlapping each other, or in separate graphs of a channel window. The trace settings are made in two steps: trace number setting and trace layout setting in the channel window. By default, a channel window contains one trace. To enable two or more traces, set the number of traces as described below.

All the traces are assigned their individual names, which cannot be changed. The trace name contains its number. The trace names are as follows:

- Tr1, Tr2 ... Tr4 for RVNA.
- Tr1, Tr2 ... Tr16 for RNVNA.

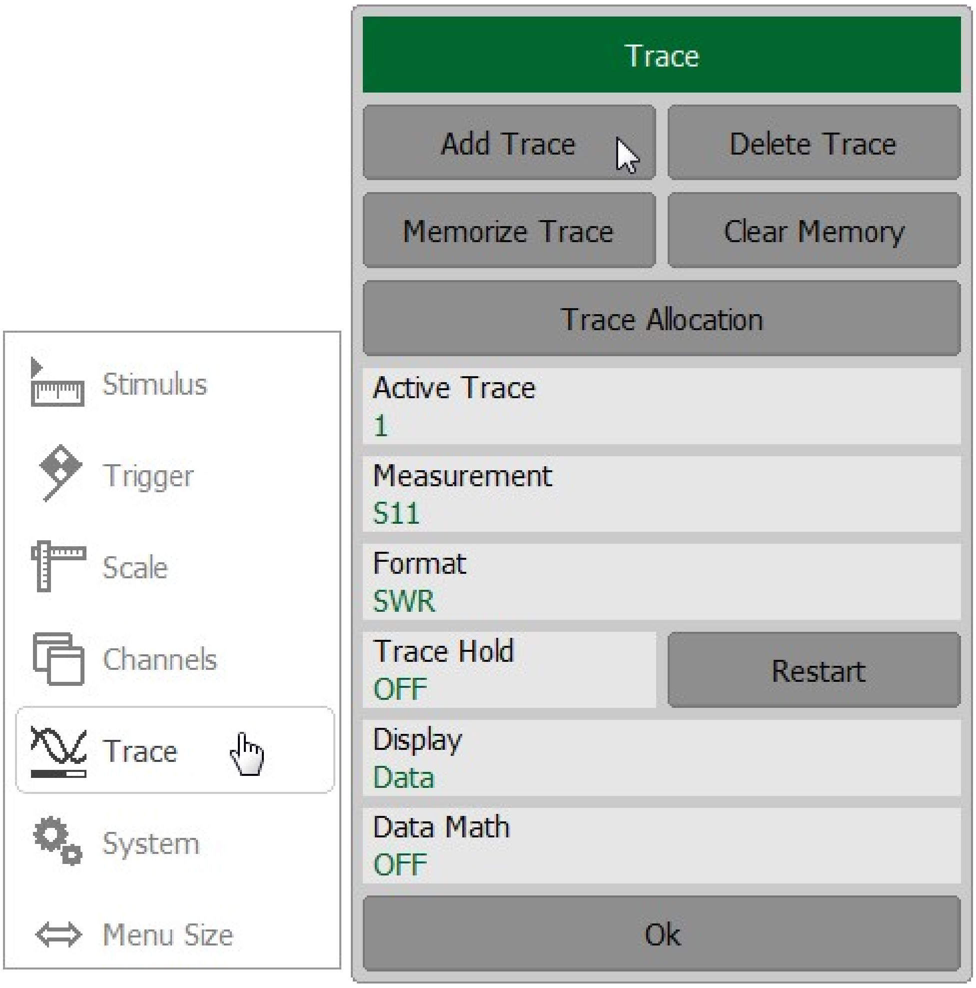
Each trace is assigned some initial settings: measured parameter, format, scale and color, which can be modified. For a detail description see User Interface Setting.

By default, the display format for all the traces is set to Return loss (dB).

By default, the scale is set to 10 dB, reference level value is set to 0 dB, reference level position is in the middle of the graph.

The trace color is determined by its number.

To add a trace, use the following softkeys in the right menu bar **Trace > Add Trace**.

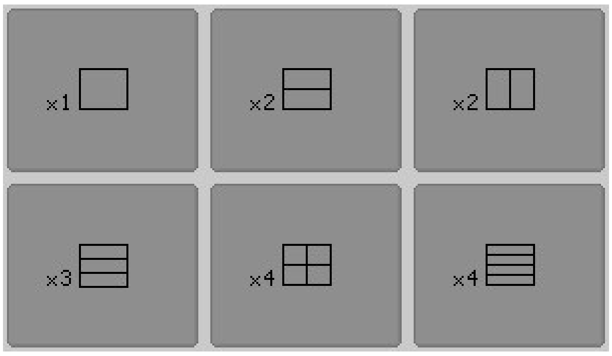


To delete a trace, use the following softkeys in the right menu bar **Trace > Delete Trace**.

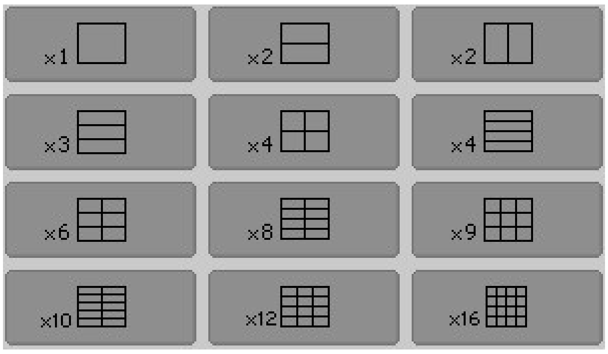
SCPI	CALCulate:PARameter:COUNt

Trace Allocation

By default, traces are displayed overlapping one other in the diagram. If you wish to display the traces in separate diagrams, the number and layout of the diagrams can be set in the channel window as shown below.



Options for diagram placement in the channel for RVNA

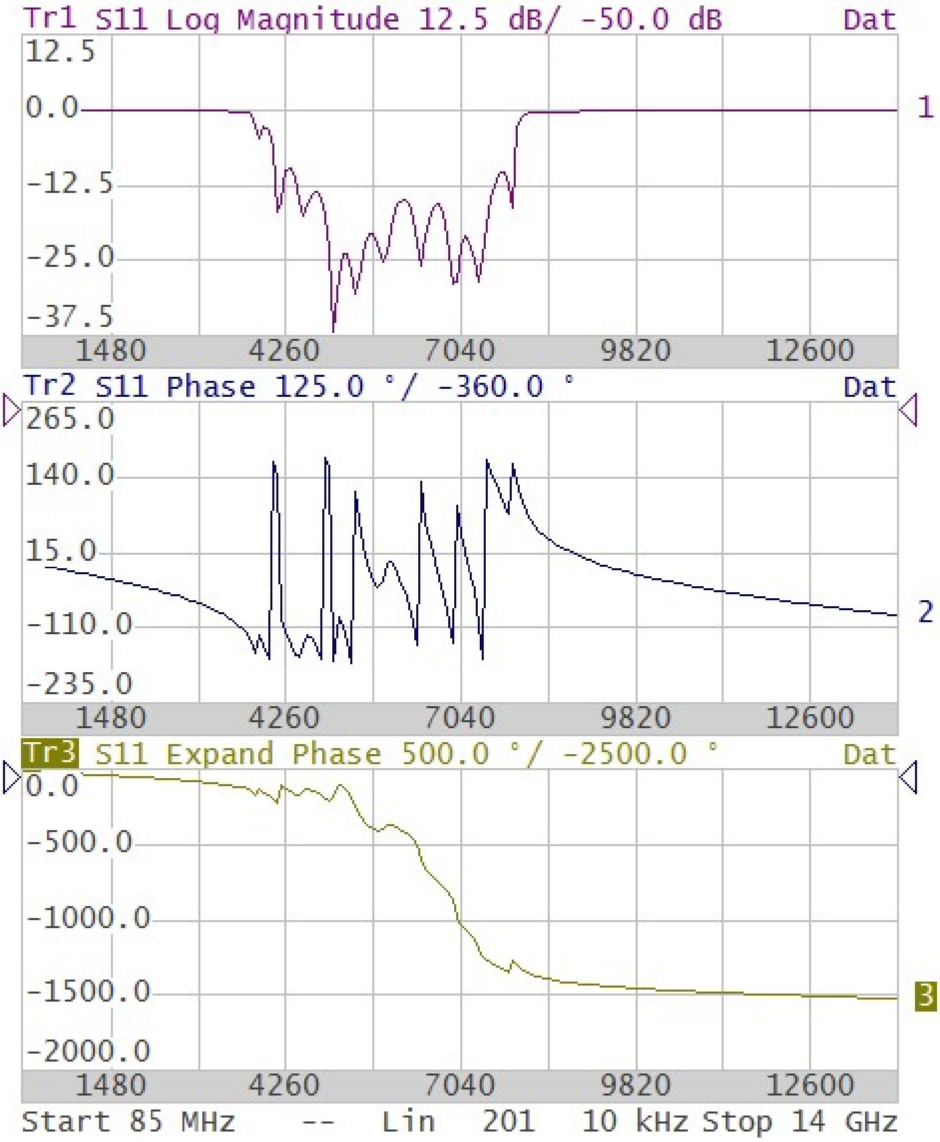


Options for diagram placement in the channel for RNVNA

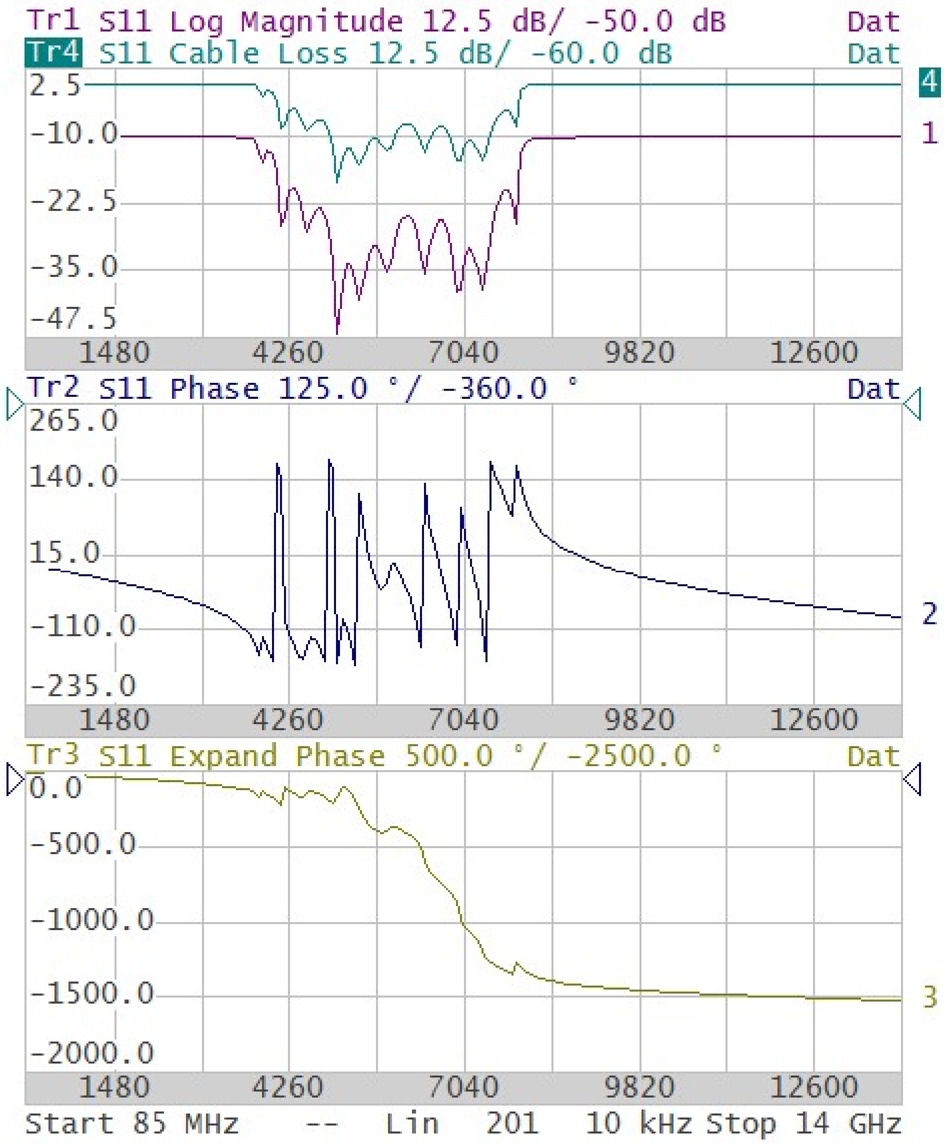
Unlike channel windows, the number of traces and layout of the trace in diagrams are not related. The number of traces and the number of diagrams are set independently.

Placing traces in a diagram:

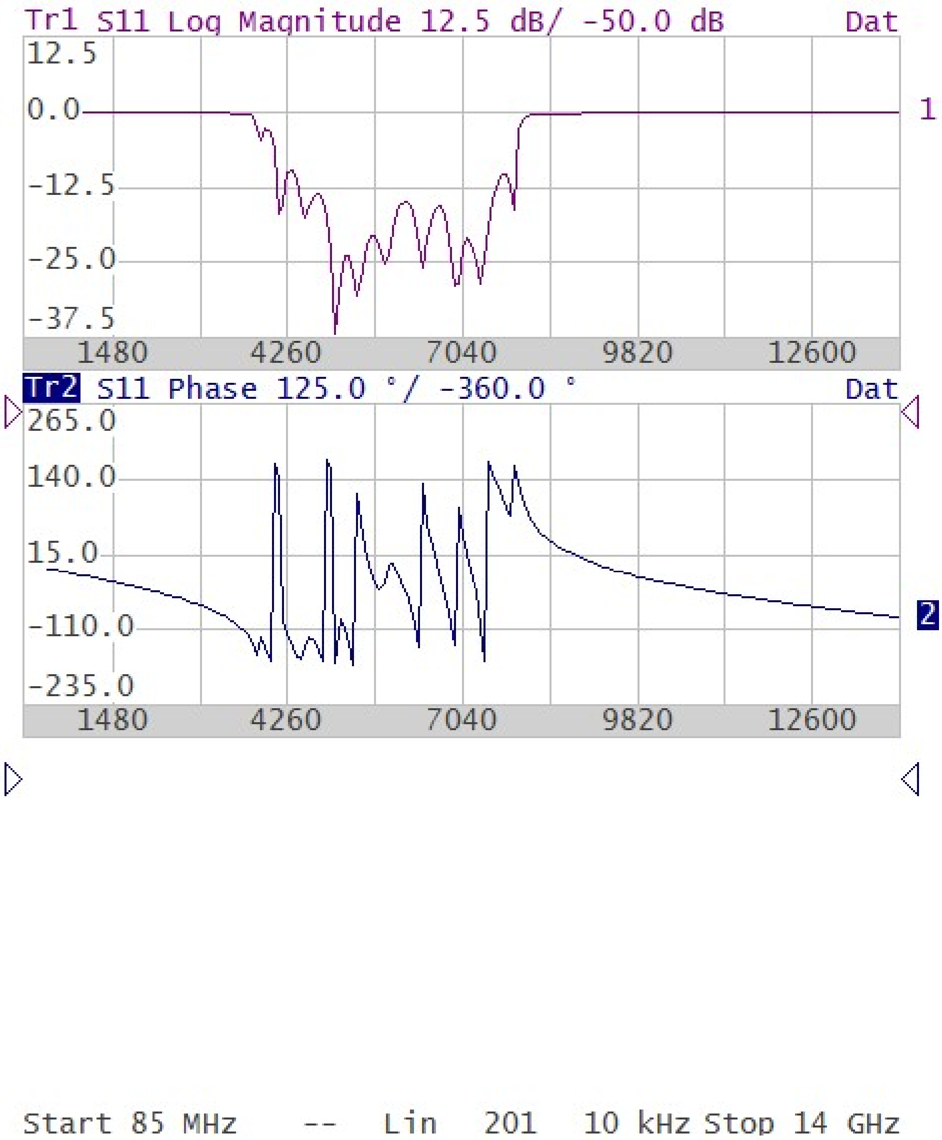
- If the number of traces and the number of diagrams are equal, all the traces will be displayed separately, each in an individual diagram.



- If the number of traces is greater than the number of diagrams, traces will be assigned successively (beginning from the smallest trace number) to the number of available diagrams. When all diagrams are utilized, the process will continue from the first diagram (the following in succession traces will be added in diagrams).



- If the number of traces is smaller than the number of diagrams, empty diagrams will be displayed.

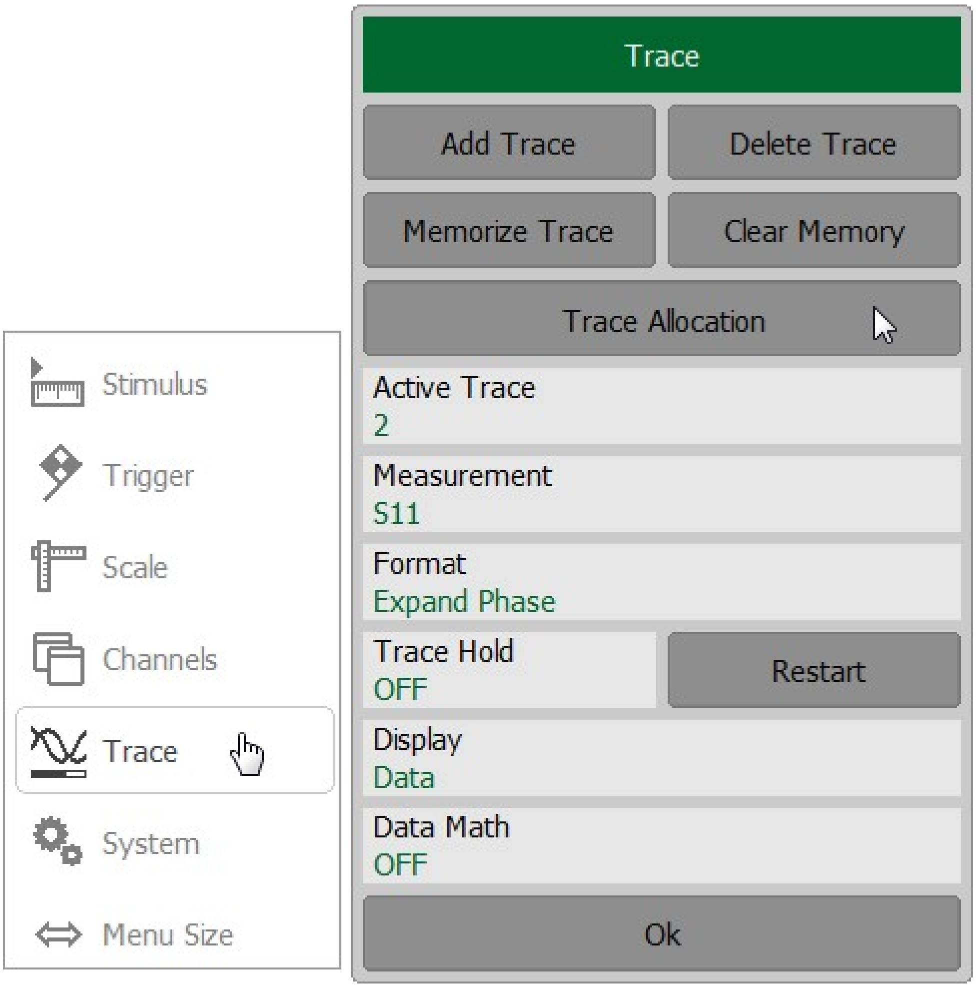


If two or more traces are displayed in one diagram, the vertical scale will be shown for the active trace.

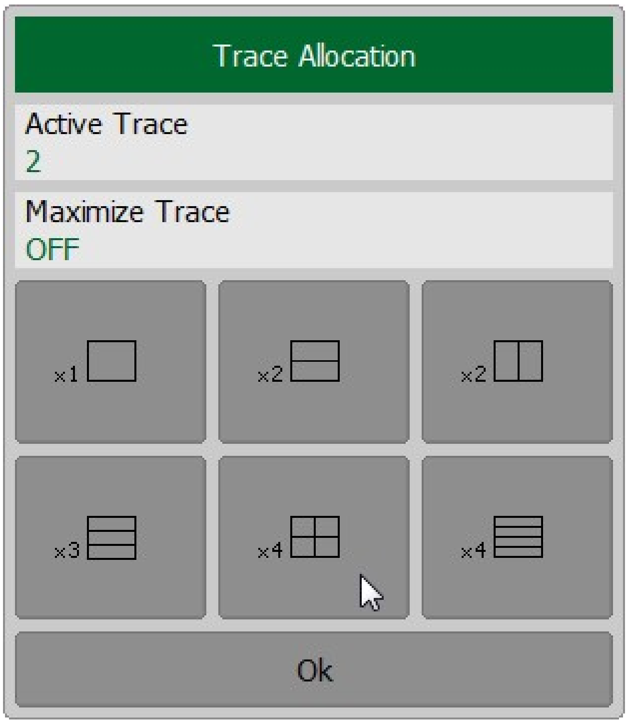
If two or more traces are displayed in one diagram, markers data will be shown for the active trace.

The stimulus axis is the same for all the traces of the channel, except when Time Domain Transformation is applied to some of the traces. In this case, the displayed stimulus axis will correspond to the active trace.

To allocate the traces in diagrams, use the following softkey in the right menu bar **Trace > Trace Allocation**.



Then select the softkey with the required number and layout of the channel windows.

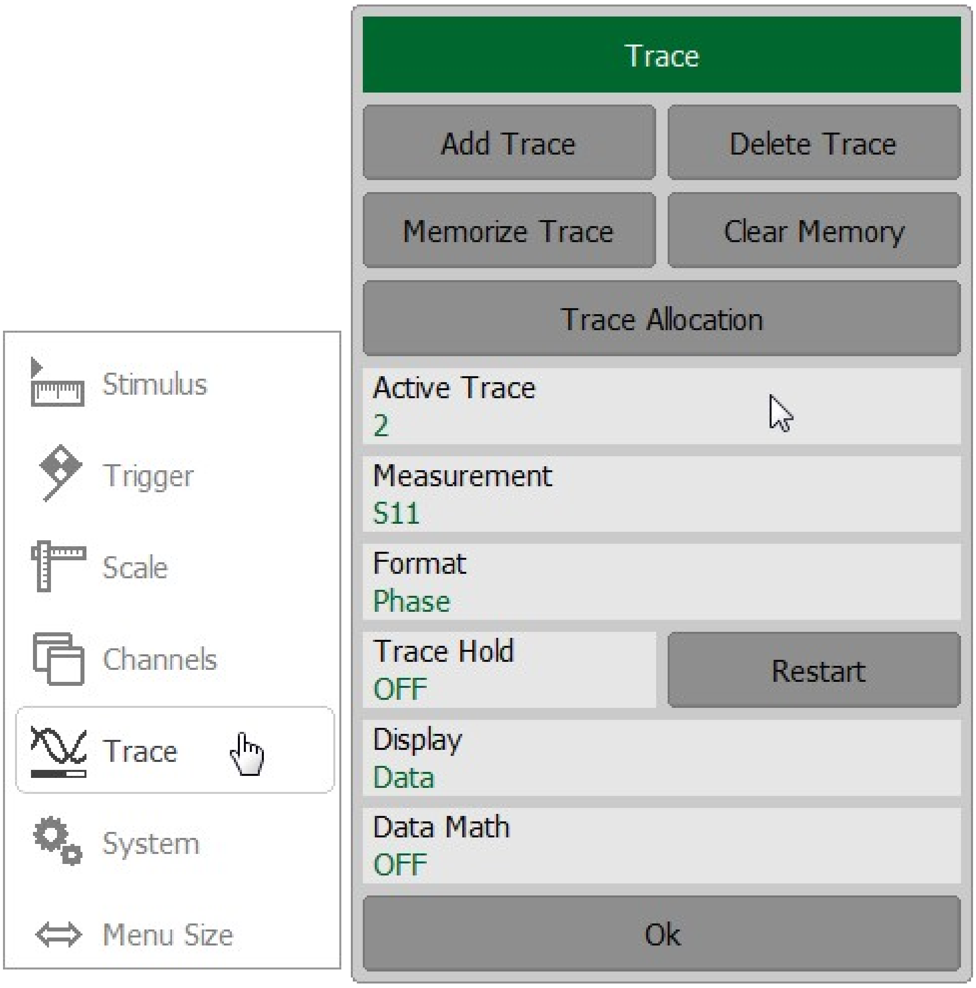


SCPI	DISPlay:WINDow:SPLit

Selection of Active Trace

Trace parameters can be entered for the active trace. Active trace belongs to the active channel, and its name is highlighted in inverted color. Select an active trace before setting the trace parameters.

To select the active trace, use the softkeys in the right menu bar **Trace > Active Trace**.



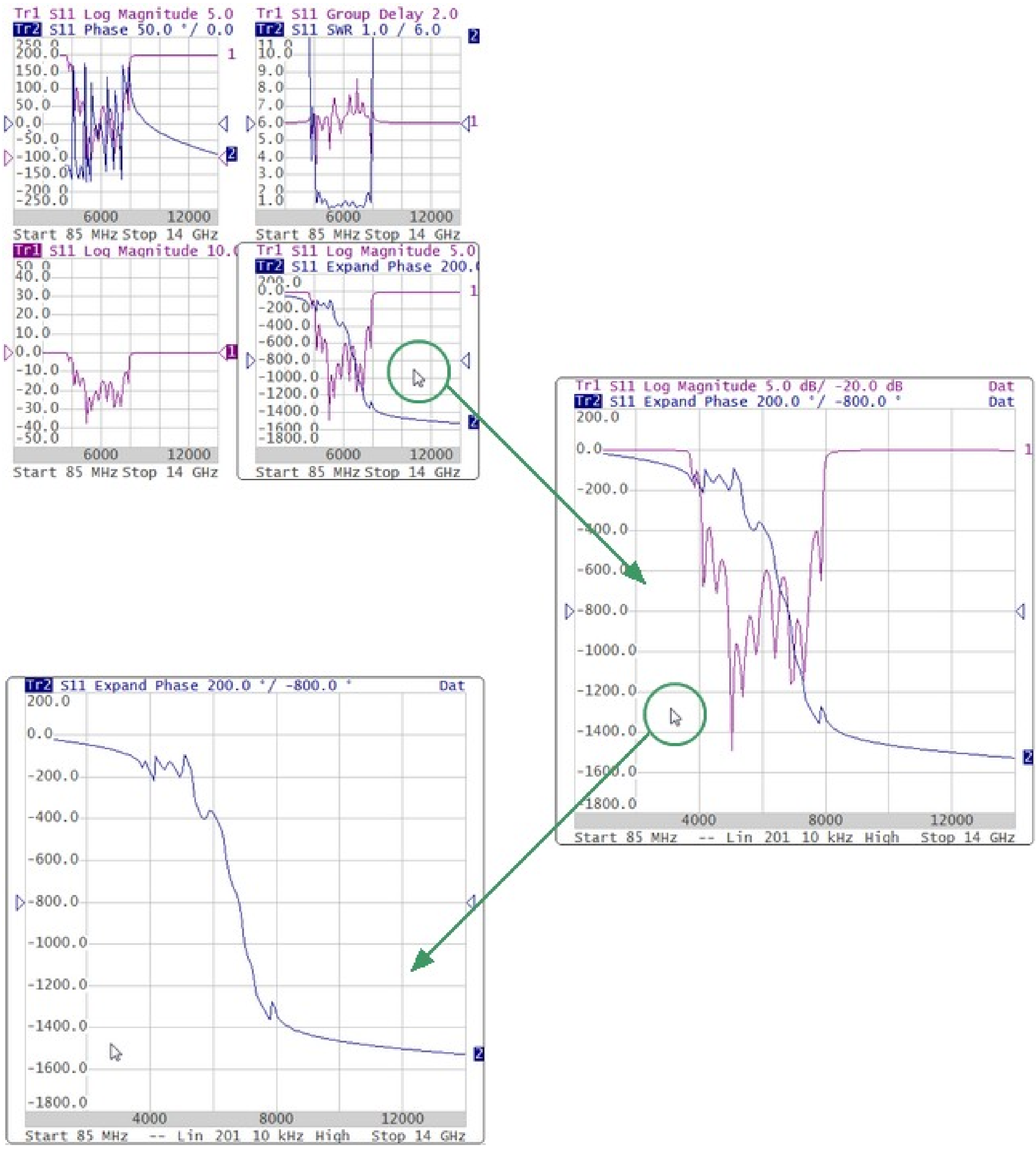
SCPI DISPlay:WINDow:ACTivate, CALCulate:PARameter:SELect

NOTE A trace can be activated by clicking on the trace status bar in the diagram of the software (See Active Trace Selection).

Channel/Trace Window Maximizing

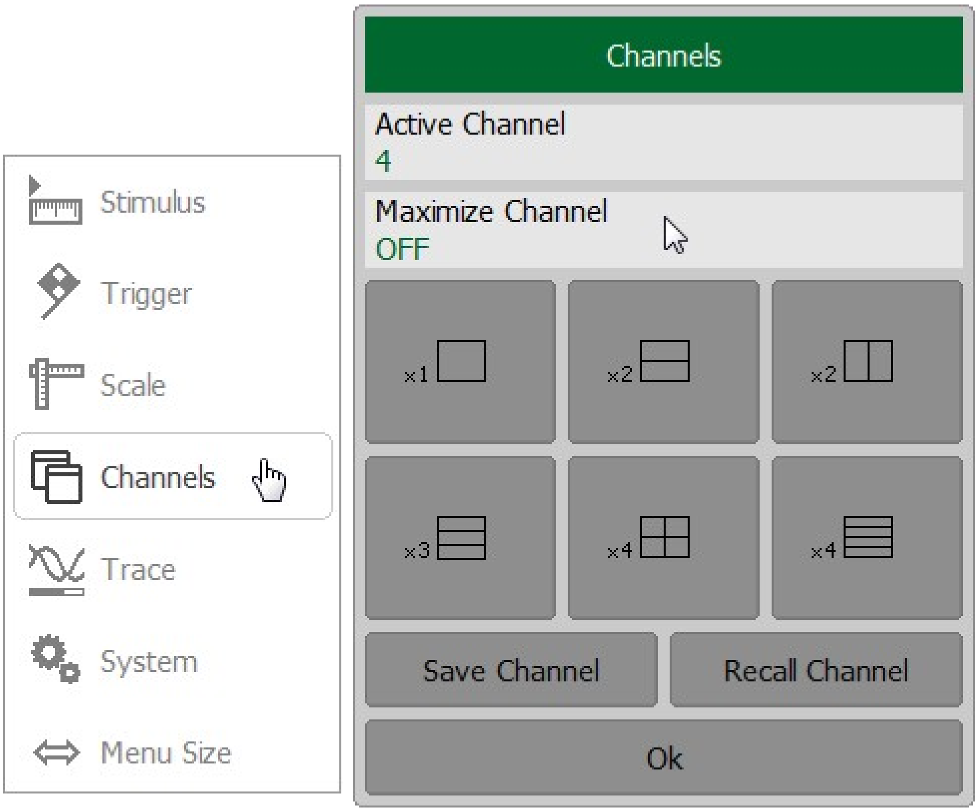
When there are several channel windows displayed, the active channel window can be temporarily expanded to full screen size. The other channel windows will not be visible, but this will not interrupt measurements in those channels.

Similarly, when there are several traces displayed in a channel window, the active trace can be temporarily expanded. The other channel windows will be hidden, and this will interrupt the measurements in those channels.

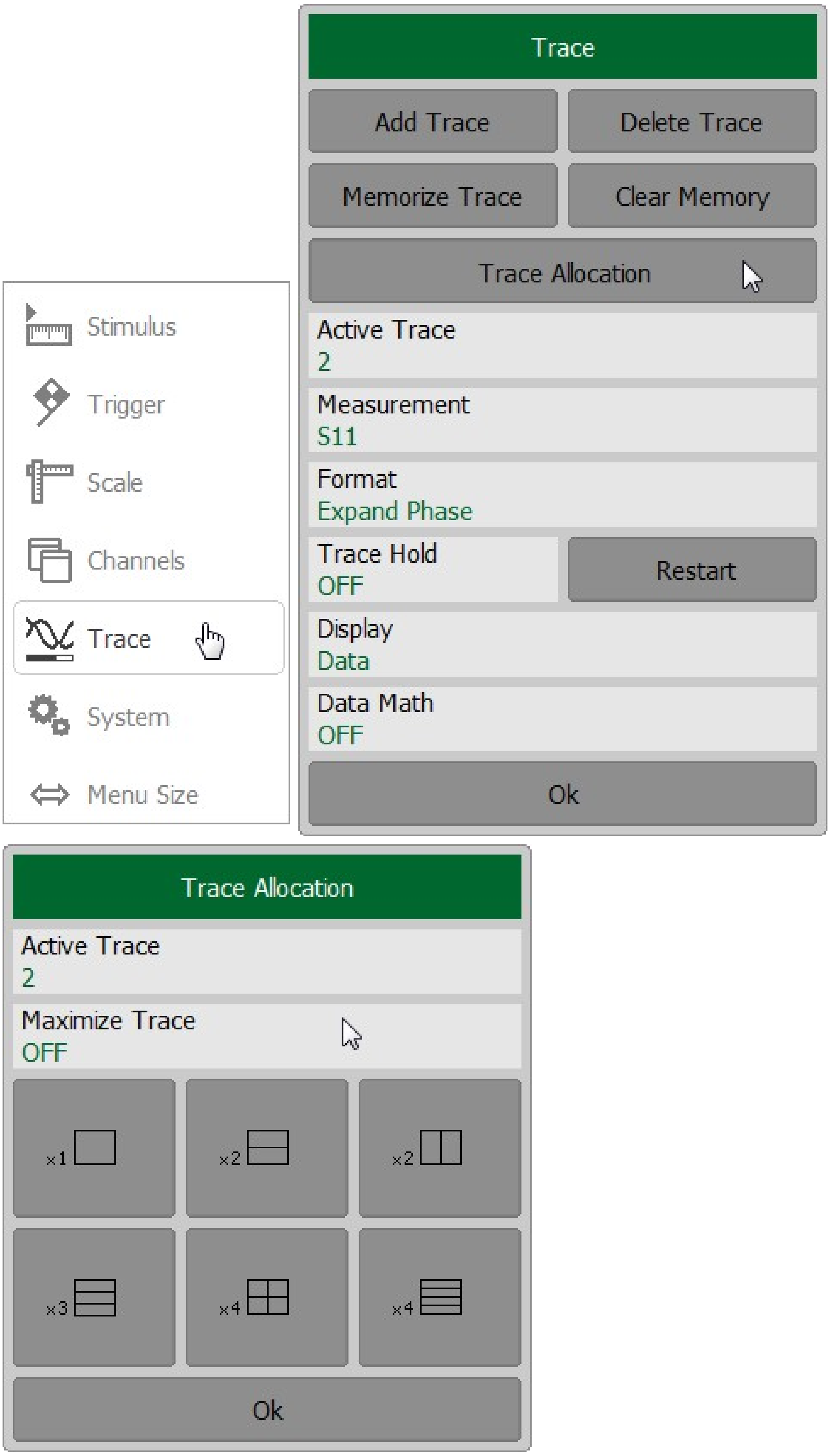


Active Channel/Trace Window Maximizing

To enable/disable active channel maximizing function use the following softkeys **Channel > Maximize Channel**.



To enable/disable active trace maximizing function use the following softkeys **Trace > Trace Allocation > Maximize Trace**.


Trace
Add Trace
Delete Trace
Memorize Trace
Clear Memory
Trace Allocation
Active Trace
2
Measurement
S11
Format
Expand Phase
Trace Hold
OFF
Restart
Display
Data
Data Math
OFF
Ok
Stimulus
Trigger
Scale
Channels
Trace
System
Menu Size
Trace Allocation
Active Trace
2
Maximize Trace
OFF
×1
×2
×2
×3
×4
×4
Ok

SCPI	DISPlay:MAXimize, DISPlay:WINDow:MAXimize

NOTE	Channel and trace maximization can also be controlled achieved by a double click on the channel/trace (See figure above). To return to the initial state, double click on channel/trace.

Stimulus Settings

This section describes how to set the stimulus signal parameters.

Stimulus — a signal with a known amplitude and phase, fed by the Analyzer to the device under test.

The stimulus parameter settings apply to each channel. Before setting the stimulus parameters of a channel the channel must be made active (See Selection of Active Channel).

NOTE	To make maximize measurement accuracy, perform measurements with the same stimulus settings as were used for calibration.

Sweep Type

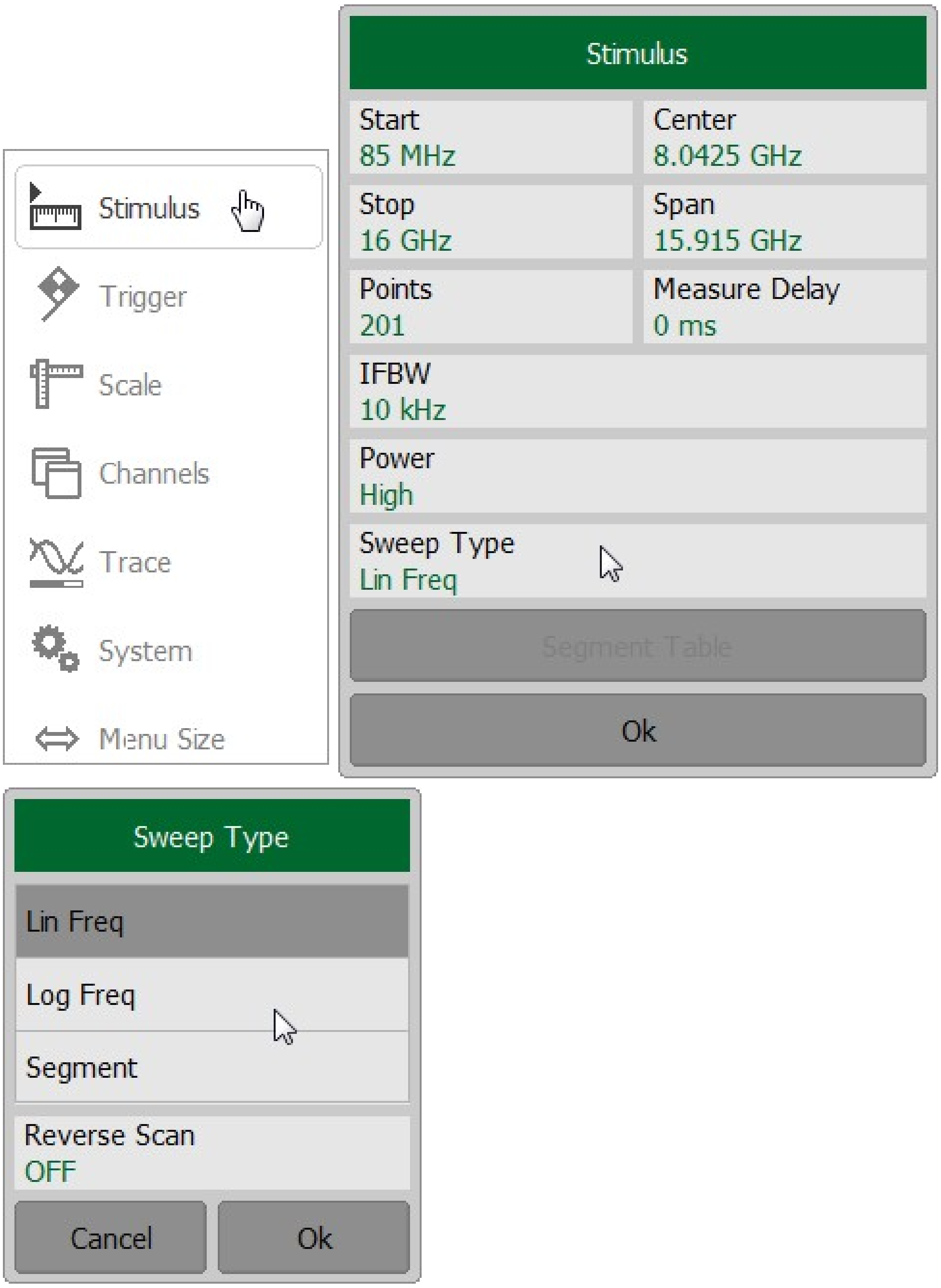
The sweep type determines how the stimulus range is scanned by frequency:

- **Lin Freq** — linear frequency sweeps.
- **Log Freq** — logarithmic frequency sweeps.
- **Segment** — segment sweep mode.

The channel to which the function is applied must be preselected as active (See Selection of Active Channel).

To set the sweep type use the following softkey **Stimulus > Sweep Type** in the right menu bar.

Then select the softkey the required sweep type in the Sweep Type dialog.



SCPI	SENSe:SWEep:TYPE

NOTE	Once segment frequency sweep is selected, the **Segment Table** softkey will become available in Stimulus dialog. Segment table is described in detail in Segment Table Editing.

NOTE	The **Sweep Type** can be selected using the mouse (See Sweep Type Setting).

Sweep Range

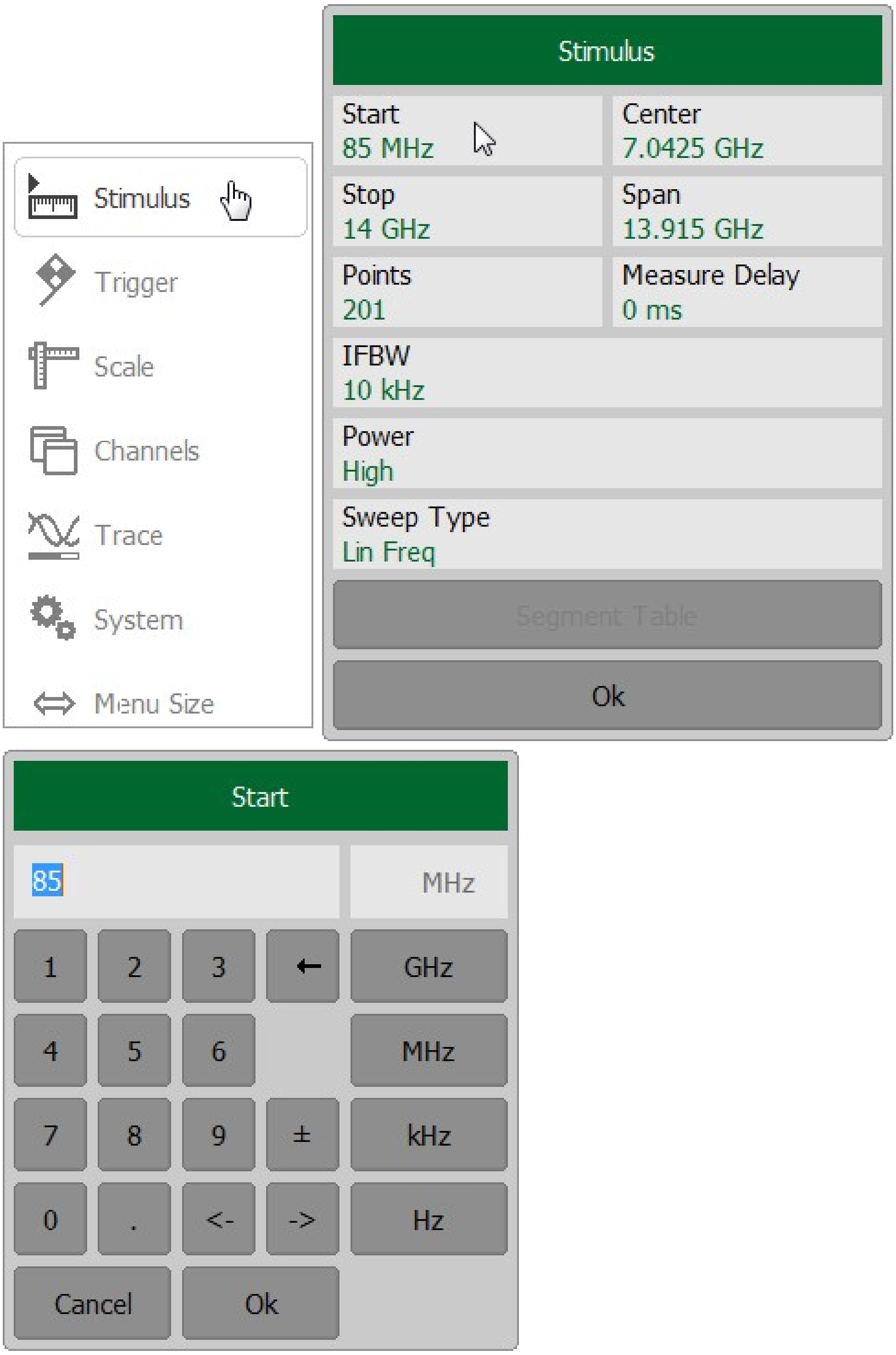
The sweep range should be set for the linear and logarithmic frequency sweeps (Hz).

The sweep range can be set using either Start/Stop or Center/Span values.

The channel to which the function is applied must be preselected as active (See Selection of Active Channel).

To enter the start and stop values of the sweep range use the softkey **Stimulus** in the right menu bar. Then select the **Start**, **Stop**, or **Center**, **Span** field and enter the required values using the on-screen keypad and complete the setting by clicking **Ok** softkey.

Select the measurement units if necessary. The current measurement units are shown to the right from the value entry field.



SCPI	SENSe:FREQuency:STARt, SENSe:FREQuency:STOP, SENSe:FREQuency:SPAN, SENSe:FREQuency:CENTer

NOTE

The **Start, Stop, Center** and **Span** values of the sweep range can be set using the mouse (See Start/Center Value Setting, Stop/Span Value Setting).

Switch between **Start/Center** and **Stop/Span** modes with the mouse (See Switching Between Start/Center and Stop/Span Modes).

Number of Points

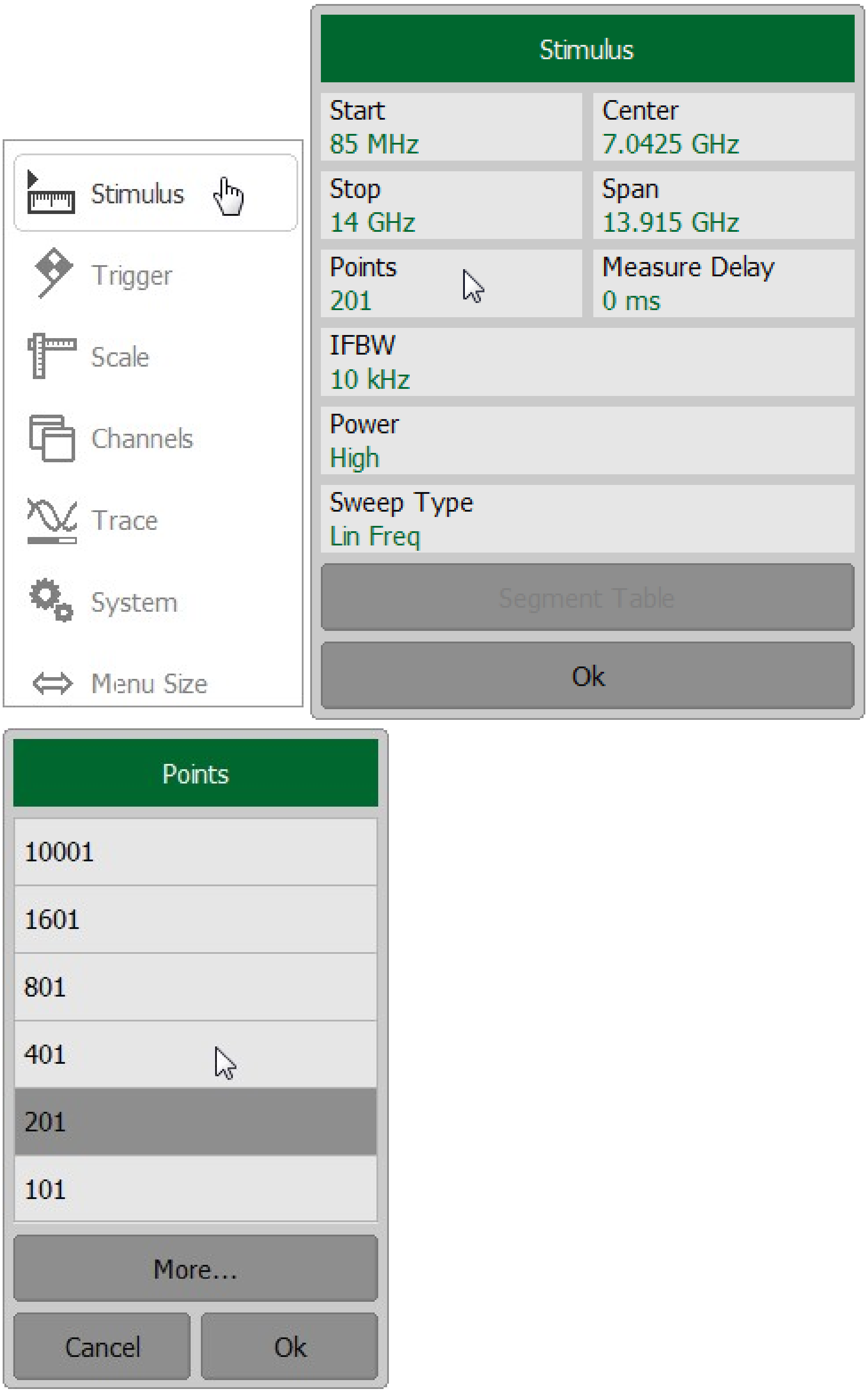
The number of points is the number of measurements gathered in a sweep cycle in the range of stimulus change.

The number of points should be set for the linear and logarithmic frequency sweeps.

Increase the number of points to get a larger trace resolution. To increase measurement performance, reduce the number of points to values that provide an acceptable trace resolution. To maintain high accuracy, the number of points in the calibration and in the actual measurements must be the same.

The channel to which the function is applied must be preselected as active (See Selection of Active Channel).

To enter the start and stop values of the sweep range use the softkey **Stimulus** in the right menu bar. Then click on **Points** field, select the required value from the list and complete the setting by clicking **Ok** softkey.



SCPI	SENSe:SWEep:POINts

NOTE	The number of **Points** can be set using the mouse (See Number of Points Setting).

Stimulus Power

The stimulus power level should be set for the linear and logarithmic frequency sweeps.

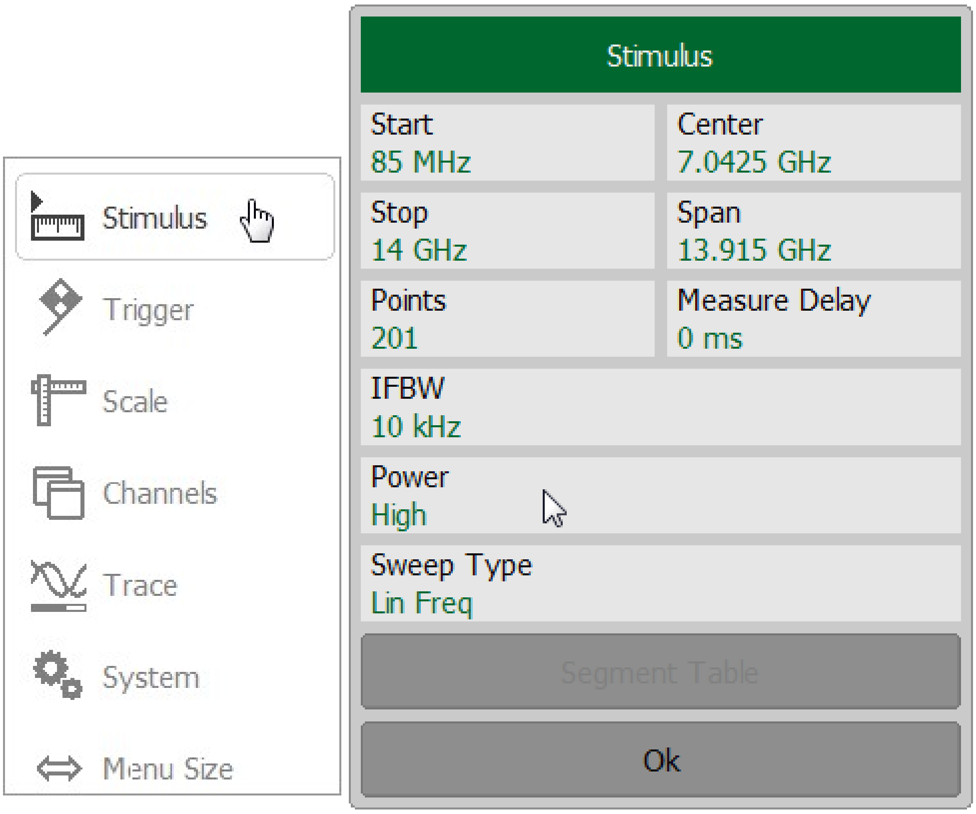
For the segment sweep type, the method of power level setting described in this section can be used only if the same power level is set for all the segments of the sweep. For setting of individual power levels for each segment, see Segment Table Editing.

The channel to which the function is applied must be preselected as active (See Selection of Active Channel).

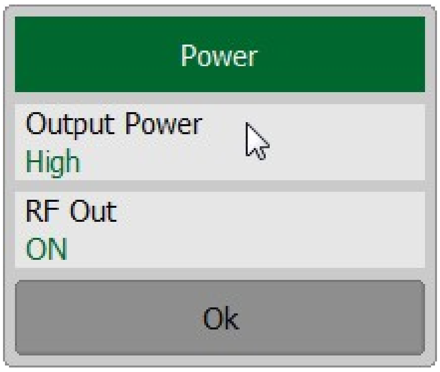
For R54, R140 and R140B models the stimulus power level can be switched between the high and low settings of the power level. High output power corresponds to the source signal power of -10 dBm. Low output power corresponds to -30 dBm.

For R60 and R180 model the stimulus power value is set in the respective field of the channel status bar.

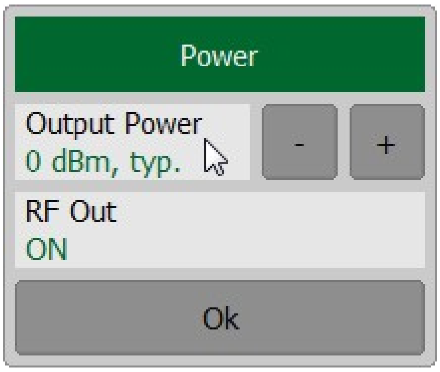
To enter the power level value, use the softkeys **Stimulus > Power** in the right menu bar. Then click **Output Power** field.



If R54, R140 and R140B models are used, it is possible to switch between high and low power settings.



If R60/R180 models are used, it is possible to enter the required value of the output power.



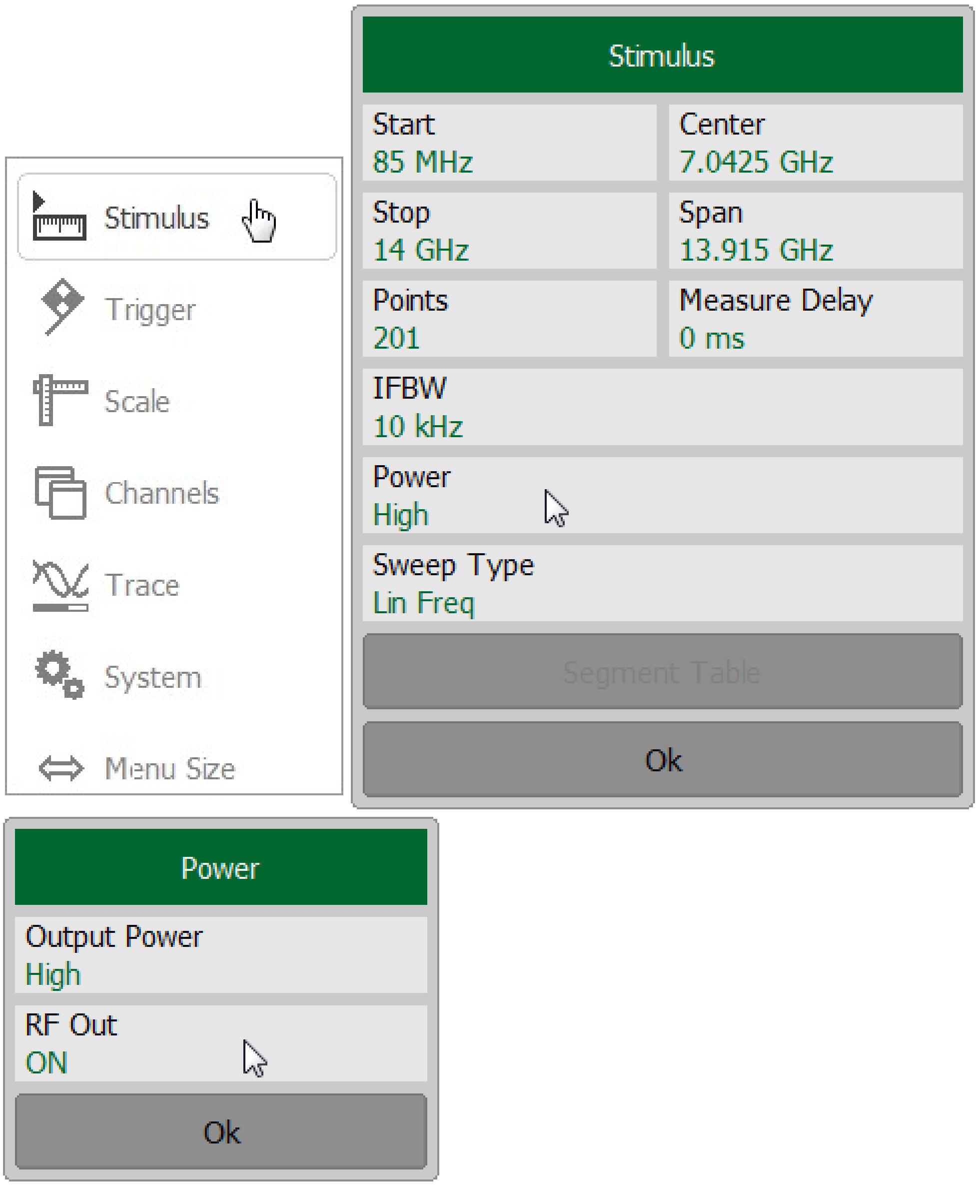
SCPI	SOURce:POWer (R60 and R180 only). SOURce:POWer:STATe (R54, R140 and R140B only).

NOTE	Setting the **Power** level is possible using the mouse (See Power Level Setting).

RF Out

The RF Out function allows for temporary disabling of the stimulus signal. While the stimulus is disabled, measurements cannot be performed.

To turn ON/OFF the RF signal output, use the following softkeys in the right menu bar **Stimulus > Power**. Then click **RF Out** field.



SCPI	OUTPut, SOURce:POWer:STATe (R54, R140 and R140B only).

NOTE	The **RF Out** function is applied to the Analyzer, not to individual channels. Indication of RF Out status appears in the instrument status bar  (See Instrument Status Bar).

Segment Table Editing

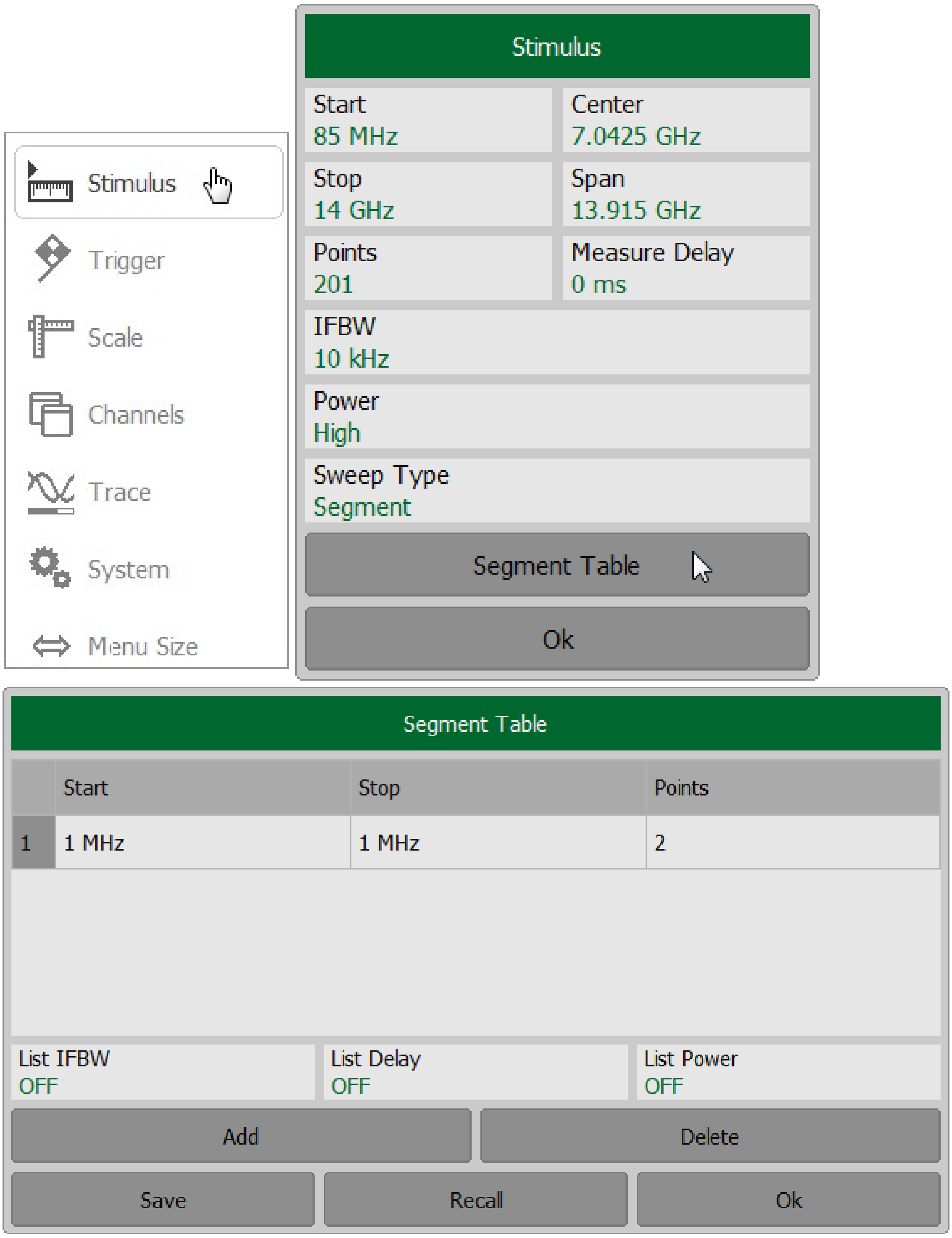
The segment table determines the sweep parameters when segment sweep type is used (See Sweep Type).

Frequency sweep span can be divided into segments. The table has three mandatory columns: start and stop values of the sweep range, number of points, and two or three columns which can be optionally enabled/disabled: IF filter, measurement delay, power level (power level is available only for R60/R180).

The channel to which the function is applied must be preselected as active (See Selection of Active Channel).

Select the **Segment** in sweep type dialog to make the **Segment Table** softkey available (See Sweep Type).

To edit the segment table, use the following softkeys in the right menu bar **Stimulus > Segment Table**.



SCPI SENSe:SEGMent:DATA

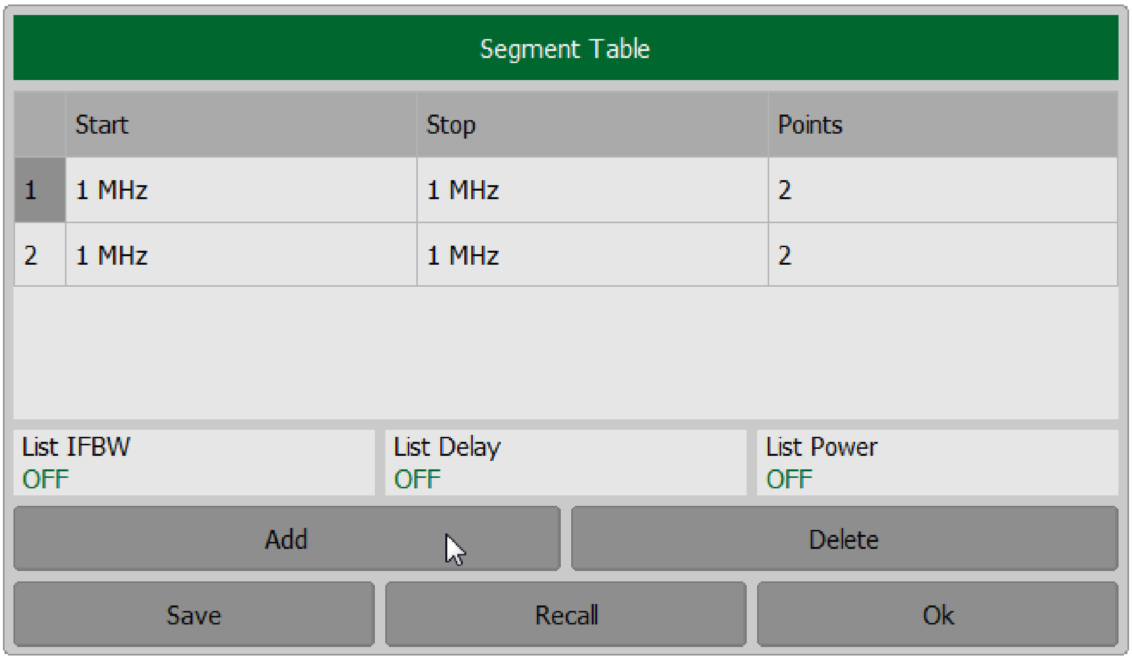
Each table line determines one segment. The table can contain one or several lines. The number of lines is limited by the aggregate number of all segment points, i.e. 100001 — for RVNA, 16001 — for RNVNA.

NOTE	The adjacent segments cannot overlap in the frequency domain.

To add a segment to the segment table, use **Add** softkey.

To delete a segment from the table, use **Delete** softkey.

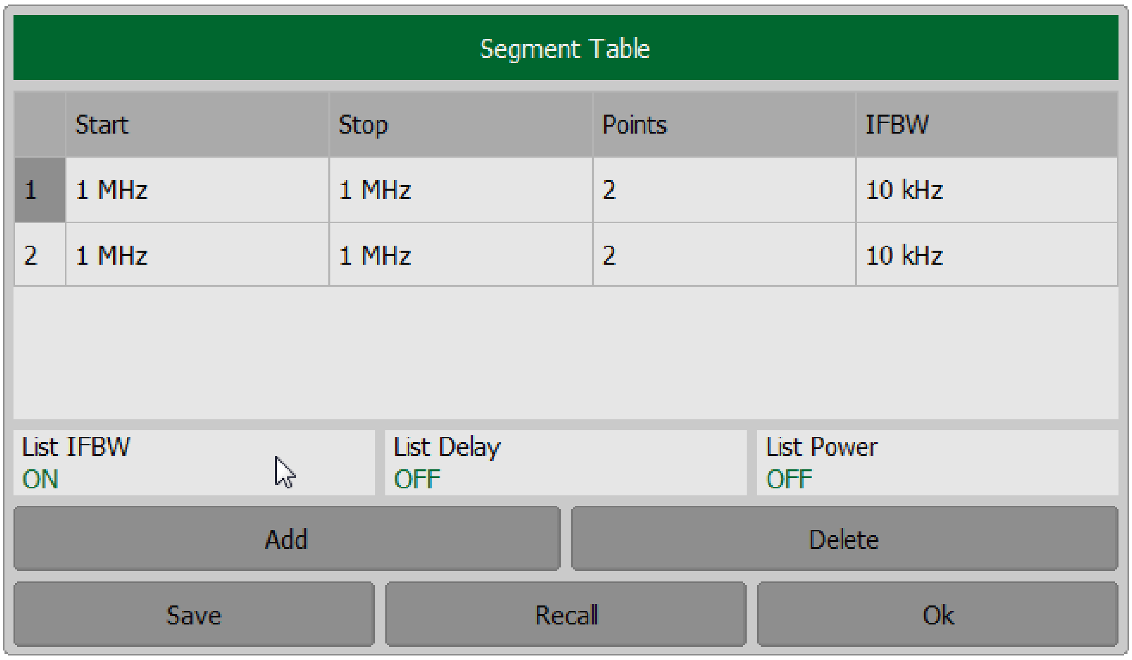
To enter the segment parameters, move the mouse to the respective box and enter the numerical value. To navigate the segment table, «Up Arrow», «Down Arrow », «Left Arrow », «Right Arrow» keys should be used.



For any segment, the following additional parameter columns can be enabled: IF bandwidth, power level, and delay time. If such a column is disabled, the corresponding value set for linear sweep will be used (same for all the segments).

To enable/disable in **Segment Table** dialog:

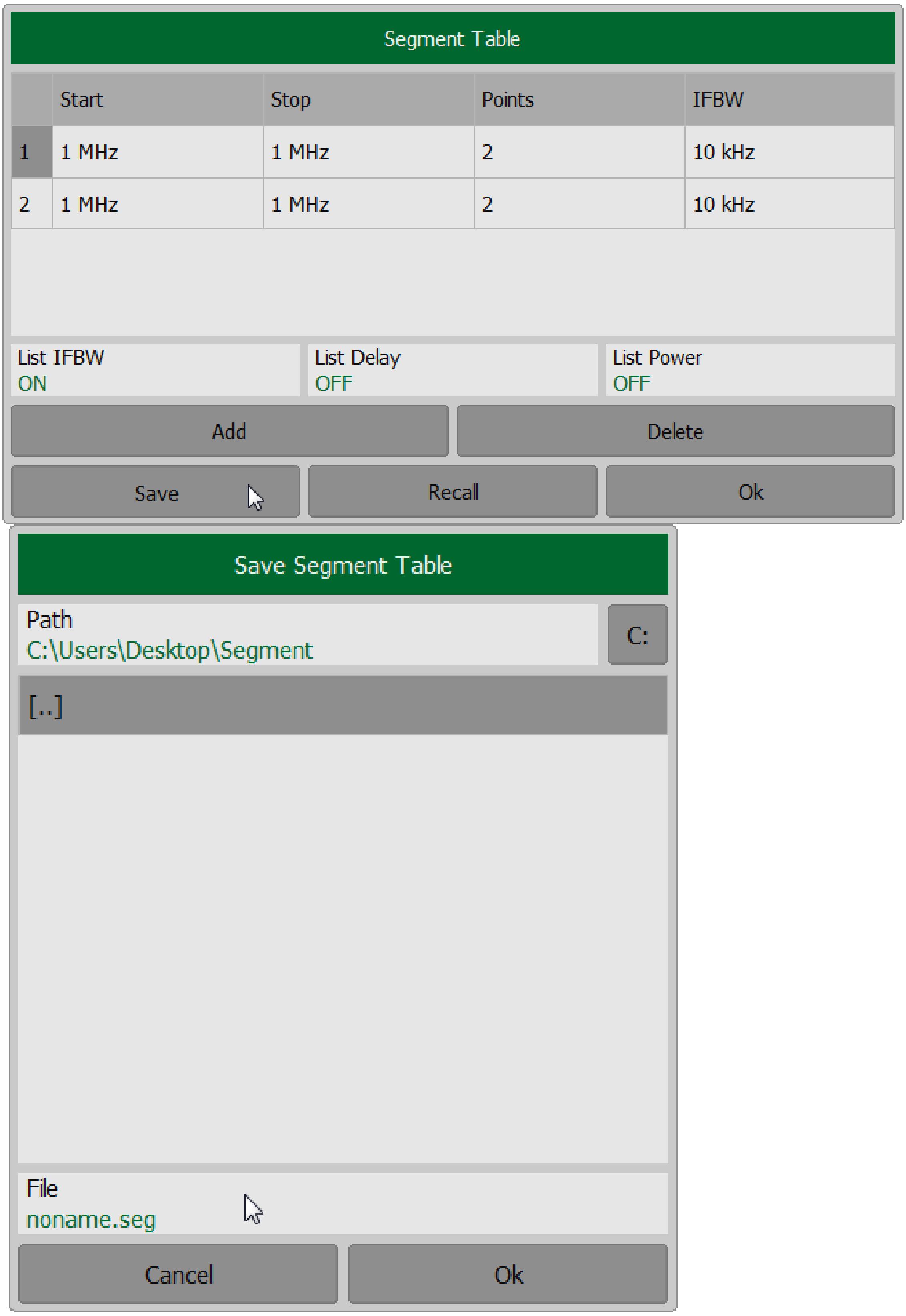
- The IFBW filter column click on the **List IFBW** field.
- The measurement delay column click on the **List Delay** field.
- The power column click on the **List Power** field (only for R60/R180).



The segment table can be saved into *.SEG file to a hard disk and later recalled.

To save the segment table, use **Save** softkey. Select a path and enter the state file name in the pop-up dialog.

To recall the segment table, use **Recall** softkey. Select a path and enter the state file name in the pop-up dialog.



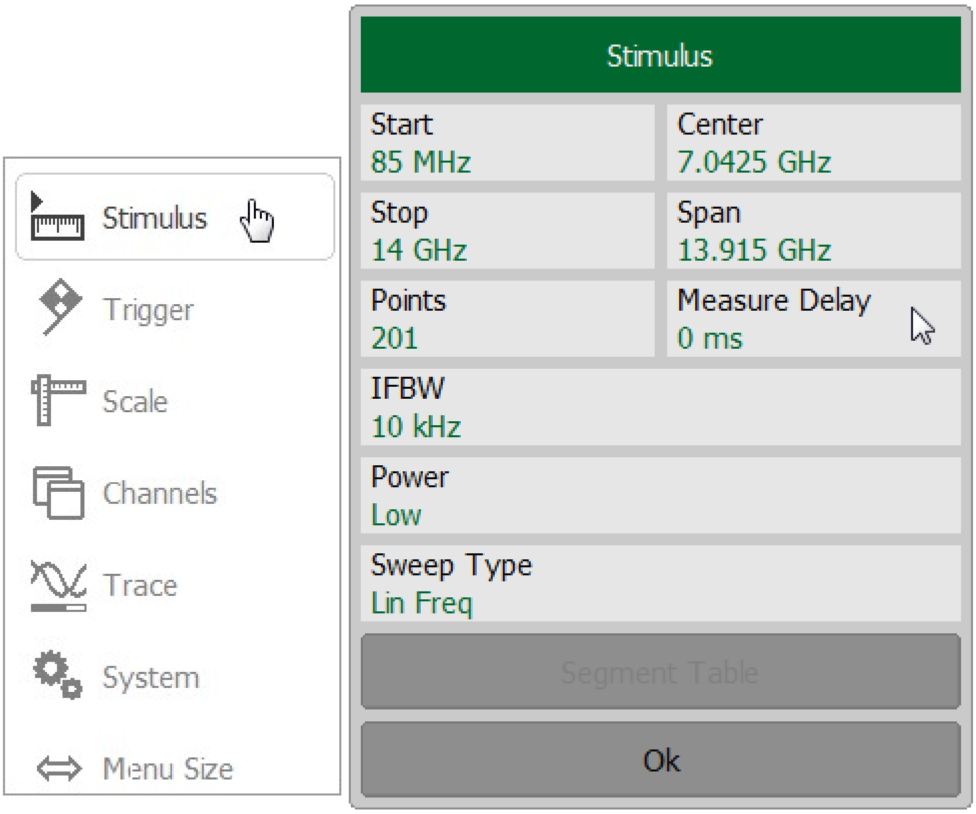
SCPI MMEMory:LOAD:SEGMent, MMEMory:STORe:SEGMent

Measurement Delay

The measurement delay function allows for adding an additional time delay at each measurement point between the moment when the source output frequency becomes stable and the start of the measurement. This capability can be useful for measurements of electrically-long devices.

The channel to which the function is applied must be preselected as active (See Selection of Active Channel).

To set the measurement delay time, use the softkeys **Stimulus > Measure Delay** in the right menu bar. Enter the required values using the on-screen keypad and complete the setting by clicking **Ok** softkey.



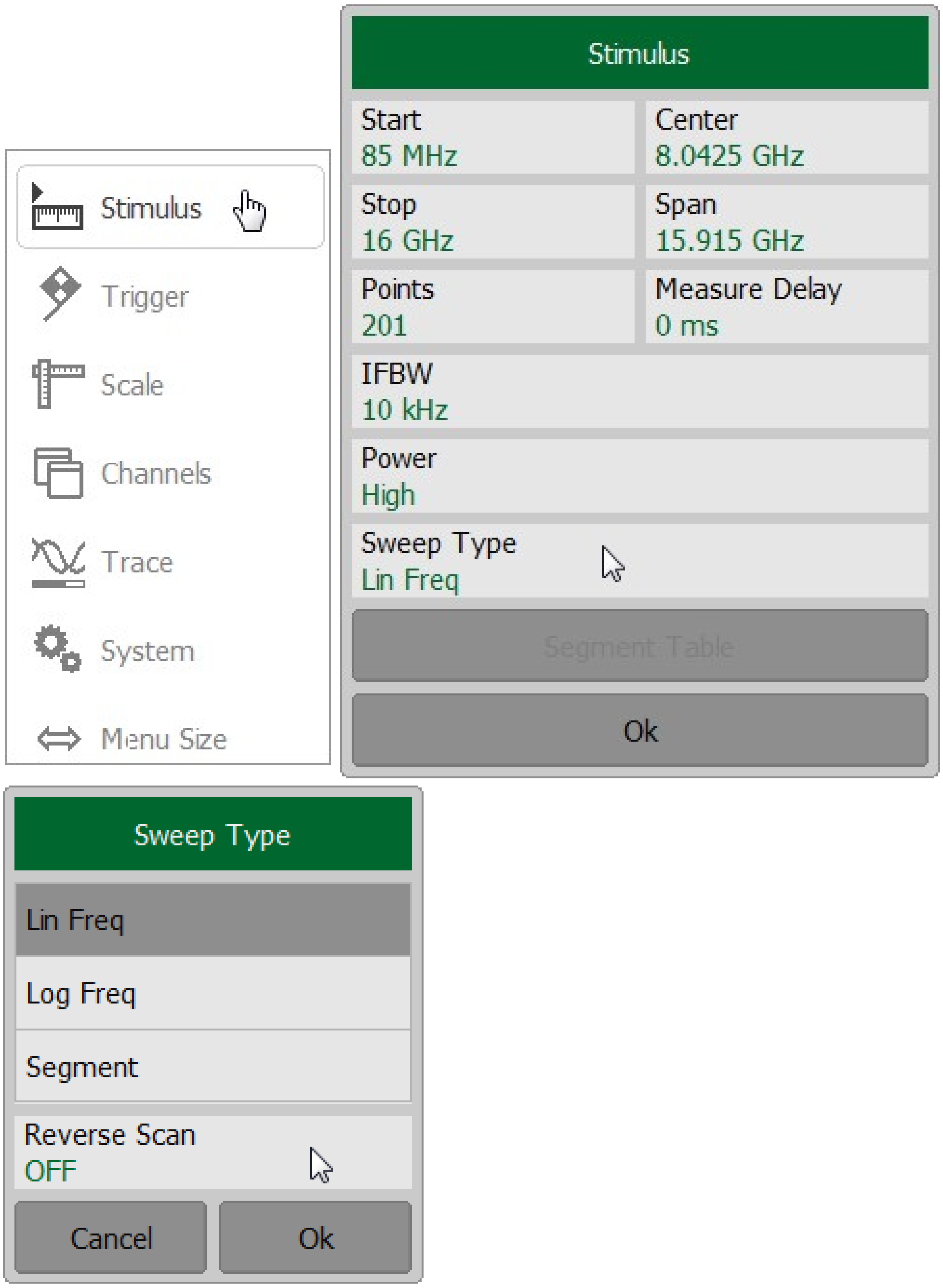
SCPI SENSe:SWEep:POINt:TIME

Reverse Sweep Mode

In the reverse sweep mode, the sweep starts from the stop frequency and stops at the start frequency.

The channel to which the function is applied must be preselected as active (See Selection of Active Channel).

To turn ON/OFF the reverse sweep mode, use the softkeys **Stimulus > Sweep Type** in the right menu bar. Then click **Reverse Scan** field.



Trigger Settings

This section describes the trigger settings.

A trigger is a signal or event that starts the analyzer measurement cycle. The measurement cycle, by default, includes measurement of all opened channels. The analyzer measures the channels sequentially one after another in one measurement cycle.

For a detailed description of trigger state diagram see Trigger State Diagram.

The trigger settings include:

- Selection the trigger source (See Trigger Source).
- Selection channel initialization mode (See Trigger Mode).

An external device can be used as a trigger source. For a detailed description of external trigger settings see External Trigger Settings.

The trigger output of the Analyzer can be a trigger source for other devices (See Trigger Output).

Trigger State Diagram

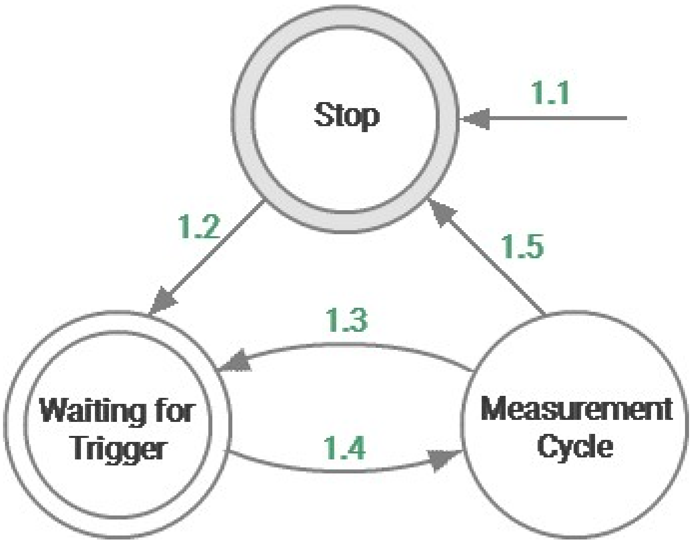
The trigger system operates at two levels: at the analyzer level and at the channel level.

Analyzer States

The Analyzer can be in one of the following three states:

- **Stop** — the Analyzer waits for any channel to enter the **Initiated** state.
- **Waiting for Trigger** — the Analyzer waits for the trigger signal. If the **Internal** trigger source (see Trigger Source) is selected, it is automatically generated.
- **Measurement Cycle** — all initiated channels are measured in turn.

The figure below shows the states of the Analyzer, and the transitions between them.



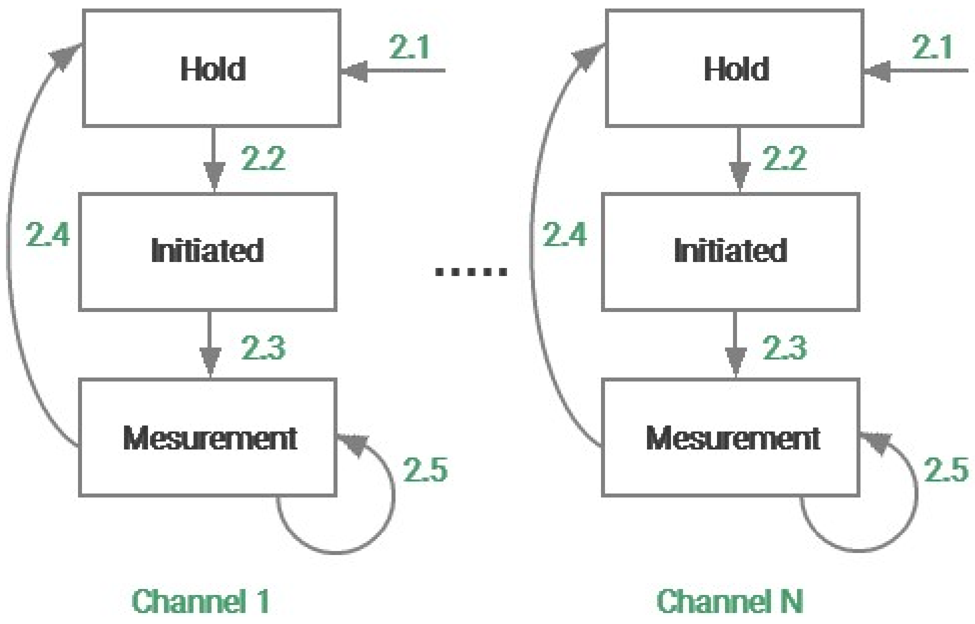
Analyzer states and transitions

Channel States

Channels can be in one of the three following states:

- **Hold** — the channel waits for the initiation. If the continuous initiation mode (see Trigger Mode) is selected, the channel is automatically initiated.
- **Initiated** — the channel waits for the measurement after the trigger signal and measurement of other channels in the queue.
- **Measurement** — the channel is measured.

The figure below shows the channel states, and the transitions between them.



N = 4 for RVNA, N = 16 for RNVNA

Channel states and transitions

The table below describes the transitions between analyzer and channel states.

Transition	Condition	Button	Command
1.1	Power on	—	—
To Stop	Reset	**Preset**	SYSTem:PRESet, *RST

Transition	Condition	Button	Command
	Abort of the current measurement cycle.	**Trigger > Restart**	ABORt
	Changing Analyzer settings by user or by the SCPI command.	For example: **Stimulus > Start**	For example: SENSe:FREQuency:STARt
1.2 Stop –> Waiting for Trigger	One or more channels make the transition 2.2 to the Initiated state.	—	—
1.3 Waiting for Trigger –> Measurement Cycle	Automatically, if the trigger source is set to **Internal**.	**Trigger source > Internal**	TRIGer:SOURce INT
	At a signal arrival at the external trigger input, if the trigger source is set to **External**.	**Trigger source > External**	TRIGer:SOURce EXT
	Upon receipt of SCPI command, if the trigger Source is set to **Bus**.	**Trigger source > Bus**	TRIGer:SOURce BUS TRIGer:SINGle, TRIGer, *TRG
1.4 Measurement Cycle –> Waiting for Trigger	At the end of a measurement cycle, when at least one channel has the **Continuous** initiation mode.	**Trigger > Continuous**	INITiate:CONTinuous ON

Transition	Condition	Button	Command
	After measuring a point, when the **On Point** trigger function is active.	**Ext Trigger > Event > On Point**	TRIGer:POINt ON
1.5 Measurement Cycle –> Stop	At the end of a measurement cycle, when the **Continuous** initiation mode is disabled for all channels.	**Trigger > Hold All Channels**	—
2.1 To Hold	The same condition as transition 1.1	—	—
	When the Initiation Mode of the channel has been set to **Hold**.	**Trigger > Hold**	INITiate:CONTinuous OFF
2.2 Hold –> Initiated	Every time if the **Continuous** initialization mode of the channel is turned on.	**Trigger > Continuous**	INITiate:CONTinuous ON
	Once when the **Single** initiation mode of the channel has been set.	**Trigger > Single**	INITiate
2.3 Initiated –> Measurement	Upon the occurrence of one of the conditions transition 1.3 and after measurement of other channels in the queue.	—	—

Transition	Condition	Button	Command
2.4 Measurement –> Hold	At the end of channel measurement.	—	—
2.5 Repeat measurement			

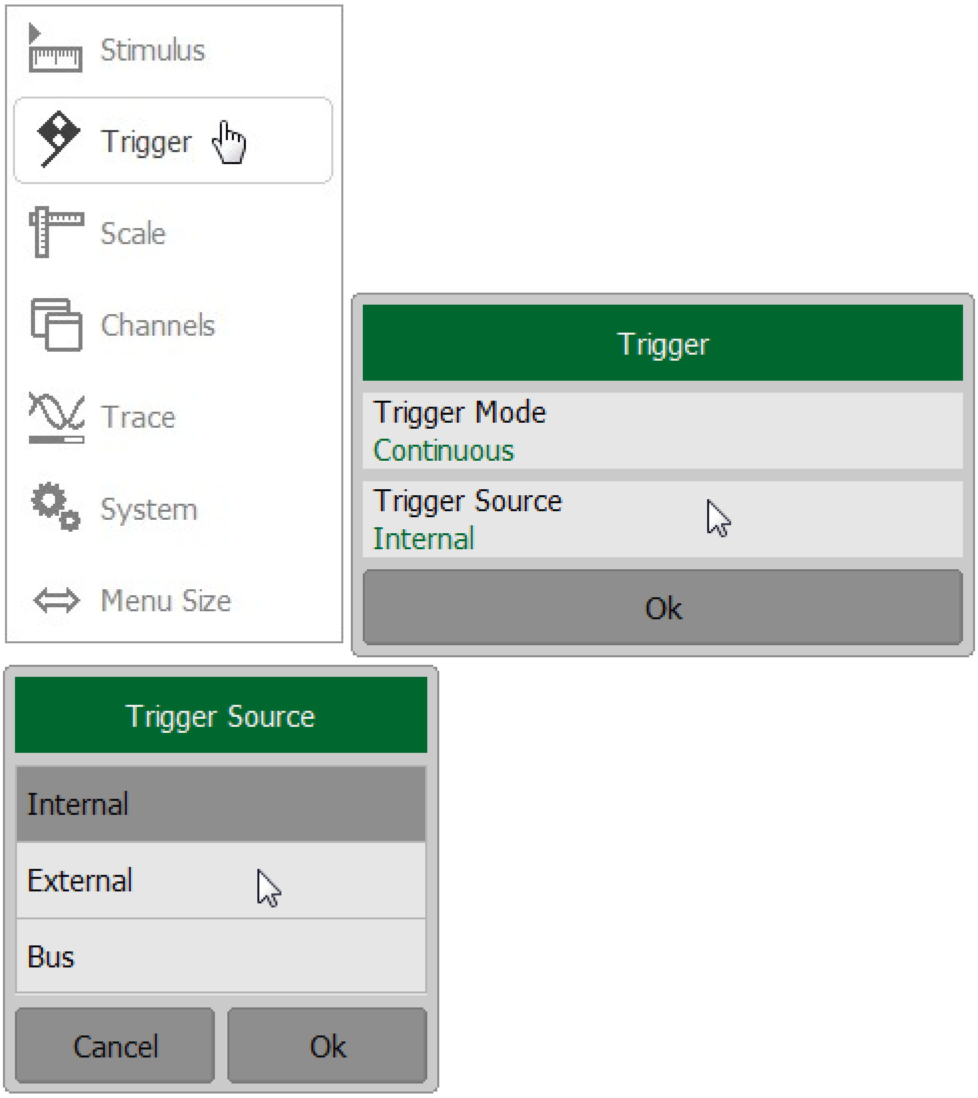
Trigger Source

One of three trigger sources can be selected. This setting works at the analyzer level.

Trigger Source	Function
Internal [default]	The next trigger signal is generated by the Analyzer on completion of each sweep.
External	NOTE. Except R54 and RNVNA in Free bus synchronization mode. A trigger signal is a logic signal at the external trigger source (See External Trigger Settings).
Bus	The trigger signal is generated by a command from the program controlling the Analyzer via SCPI or COM.

To set the trigger source, use the following softkeys **Trigger > Trigger Source**. Then select the required trigger source:

- **Internal**
- **External**
- **Bus**



SCPI [TRIGer:SOURce]

Trigger Mode

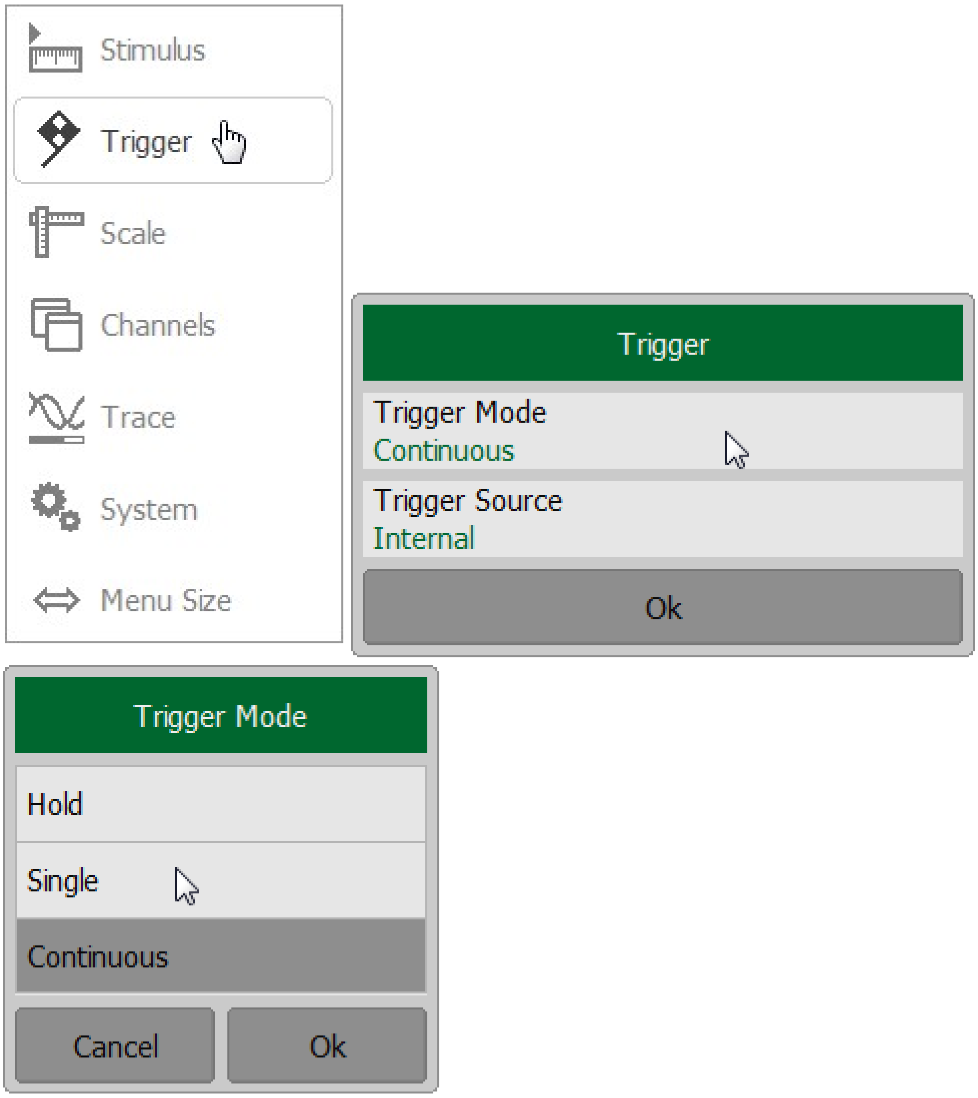
The trigger mode determines the sweep actuation of the channel at a trigger signal detection. A channel can operate in one of the following three trigger modes:

Trigger Mode	Function
Continuous [default]	The channel automatically transits to the Initiated state at the end of each measurement.
Single	The channel is initiated once. At the end of the measurement, the channel goes into the Hold state. For a detailed description see in Single Trigger Mode.
Hold	The channel is idle and not updating.

The channel to which the function is applied must be preselected as active (See Selection of Active Channel).

To set the trigger mode, use the following softkeys **Trigger > Trigger Mode**. Then select the required trigger mode:

- **Hold**
- **Single**
- **Continuous**



SCPI INITiate:CONTinuous, INITiate

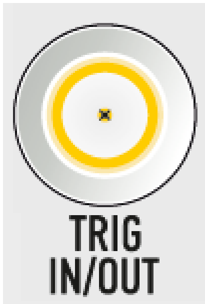
External Trigger Settings

NOTE	This section is not available for R54.

This section describes settings of the external trigger.

R60, R140B and R180 models

The logic signal at the **TRIG IN/OUT** connector on the side panel of the Analyzer is an external trigger signal (See Instrument Series).



External Trigger Signal Connector

To work with an external trigger:

- Select trigger source **External** (See Trigger Source).
- Set the external trigger event, polarity, position and delay (See the subsections in this section).

R140 model

The logic signal at the **EXT TRIG** connector on the side panel of the Analyzer is an external trigger signal (See Instrument Series).

To work with an external trigger select trigger source **External** (See Trigger Source).

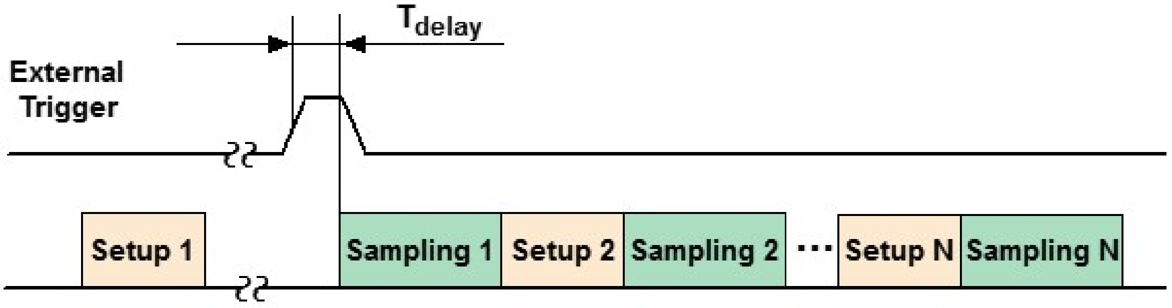
External Trigger Event

NOTE	This section is not available for R140.

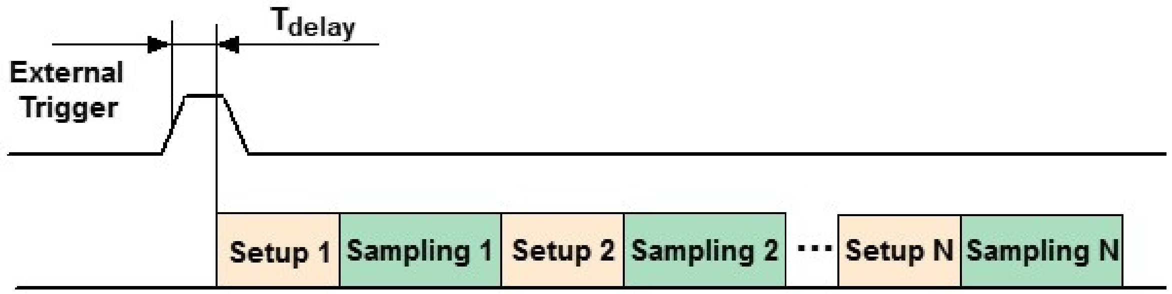
This setting allows to select the external trigger event.

Trigger event	Function
On sweep [default]	One trigger signal starts a full measurement cycle, that is, the measurement of all frequency points of all channels included in the measurement cycle.
On point	One trigger signal starts the measurement of one frequency point of a channel. The next trigger signal starts the measurement of the next frequency point of the channel, and so on.

By default, the external trigger initiates a sweep measurement upon every trigger event (See figure below).

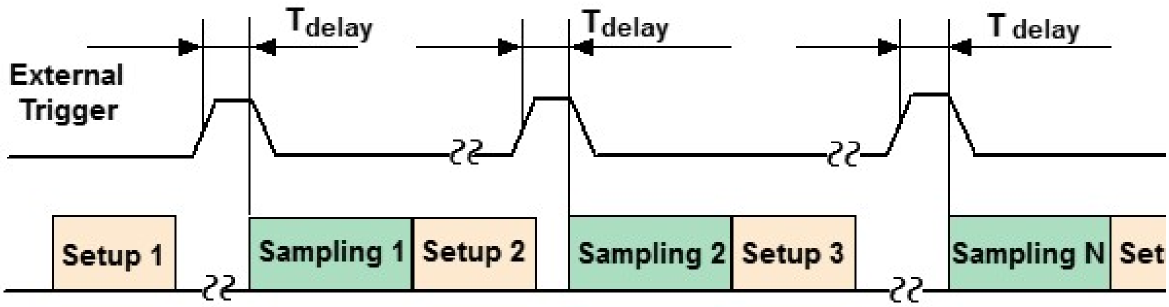


Before Sampling, Point trigger is OFF

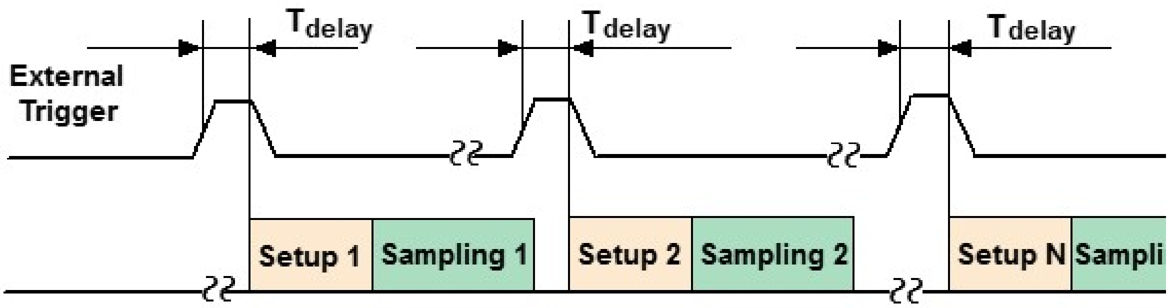


Before Setup, Point trigger is OFF

For the external trigger source, the point trigger feature instead initiates a point measurement upon each trigger event (See figure below).

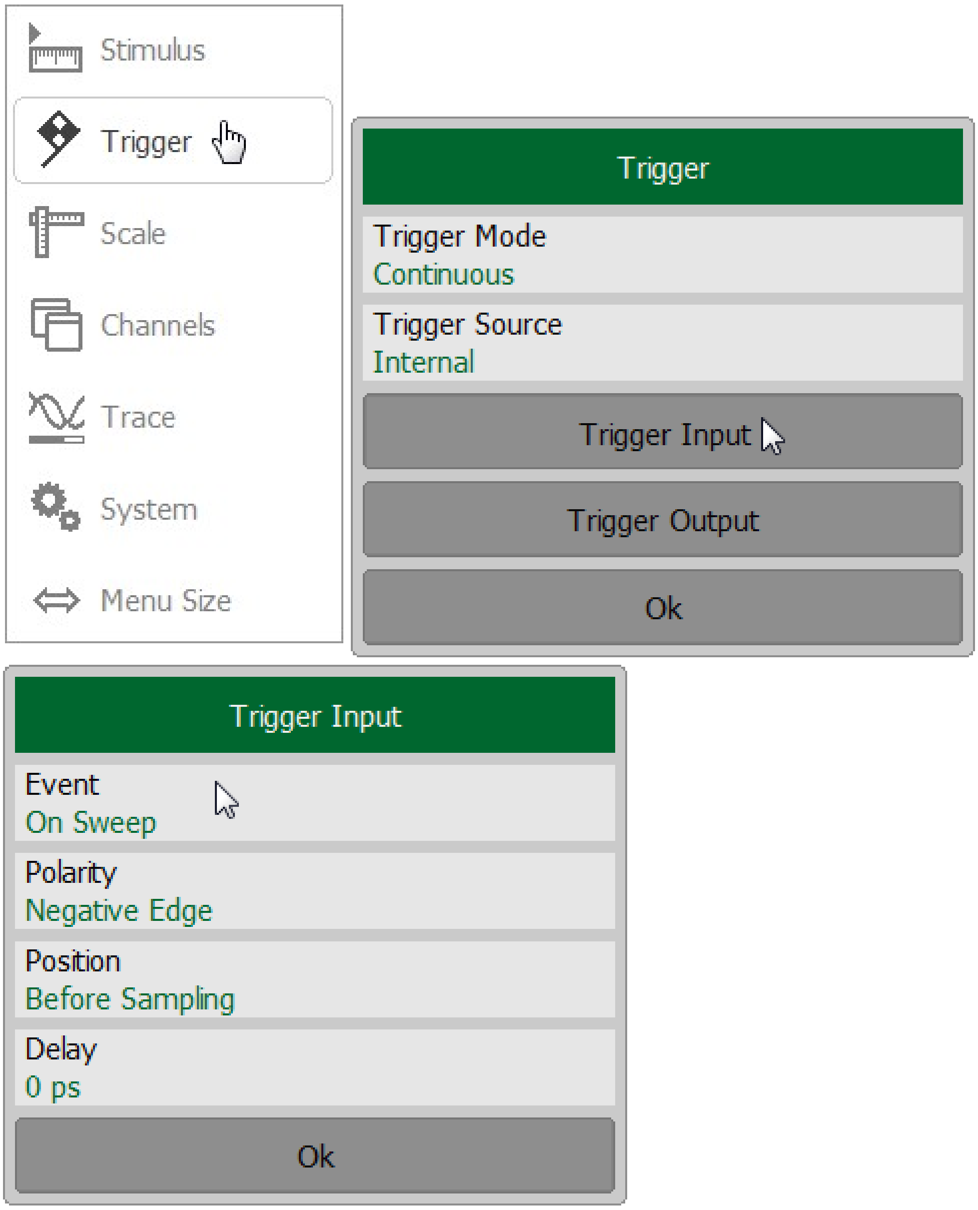


Before Sampling, Point trigger is ON



Before Setup, Point trigger is ON

To enable the point trigger feature for external trigger source, use the following softkeys **Trigger > Trigger Input > Event { On Sweep | On Point }**.



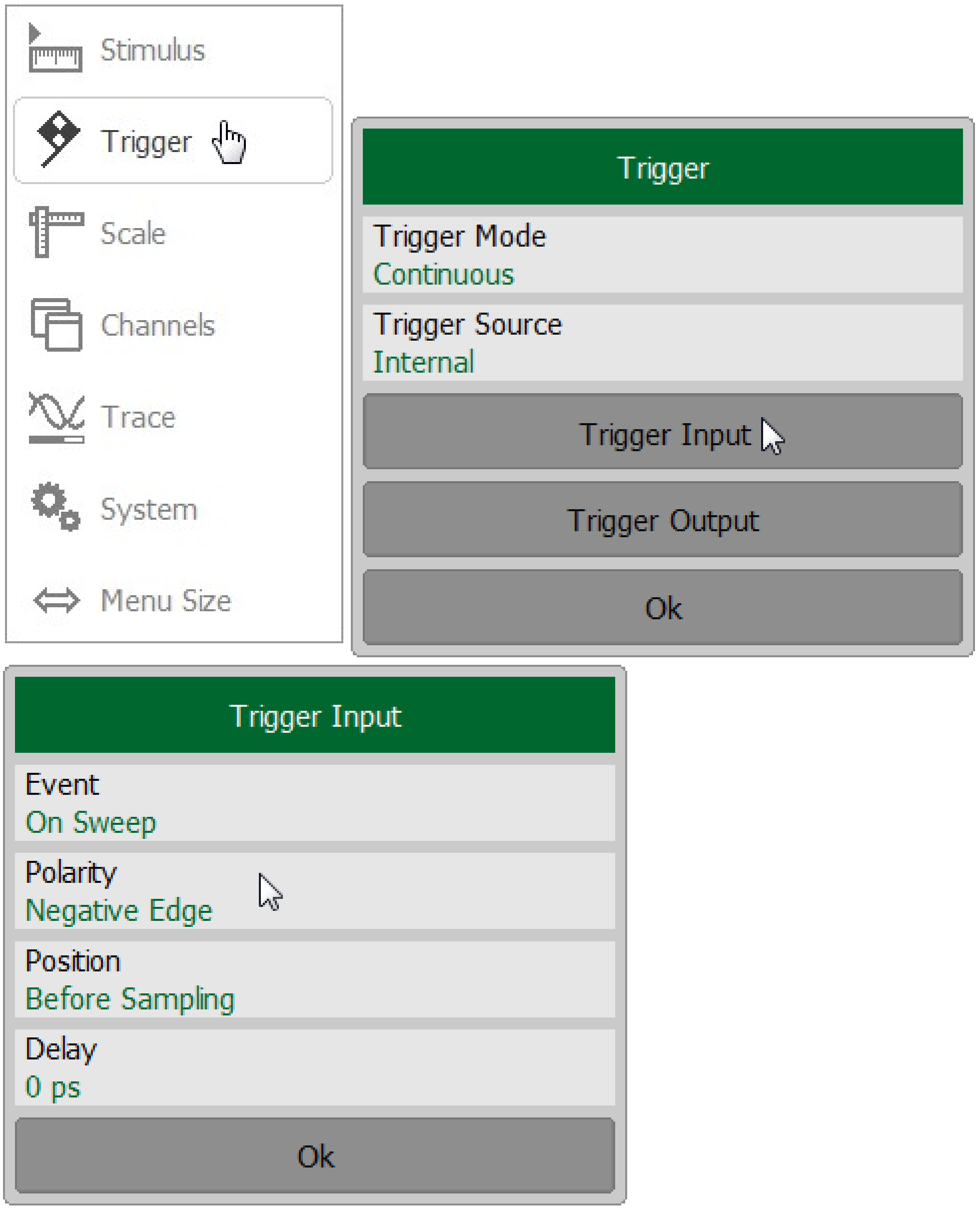
SCPI [TRIGger:POINt]

External Trigger Polarity

NOTE This section is not available for R140.

Trigger polarity	Function
Negative Edge [default]	The negative edge of the input signal of an external trigger is a trigger signal.
Positive Edge	The positive edge of the input signal of an external trigger is a trigger signal.

To select the external trigger polarity, use the following softkeys **Trigger > Trigger Input > Polarity { Negative Edge | Positive Edge }**.

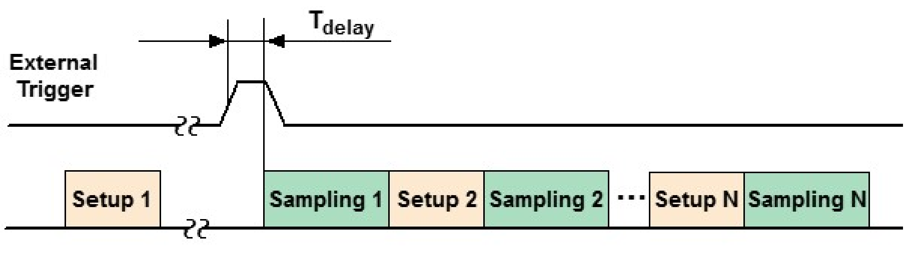
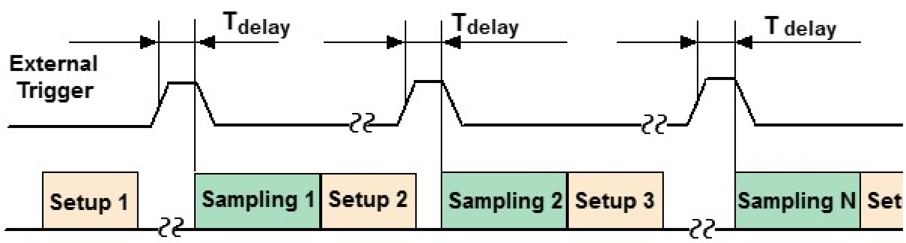


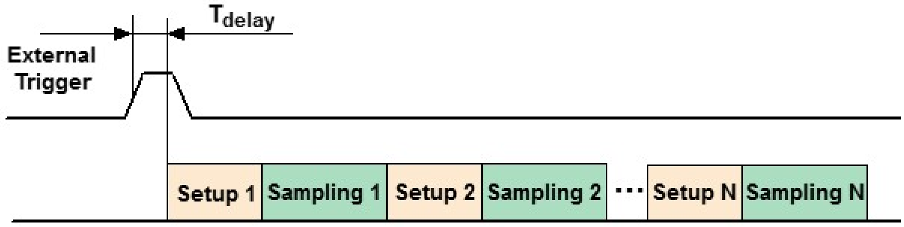
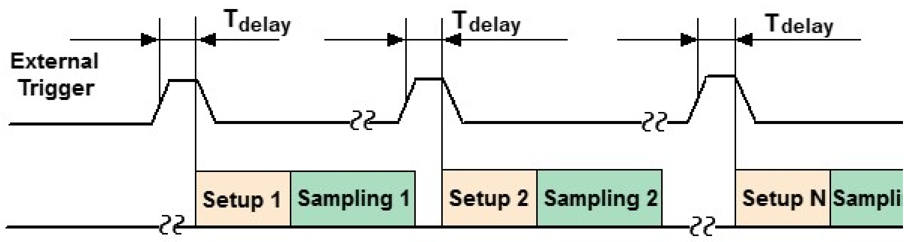
SCPI [TRIGger:EXTernal:SLOPe]()

External Trigger Position

NOTE	This section is not available for R140.

The position of the external trigger determines the moment when the analyzer expects an external trigger signal — before the frequency setup or before measuring (ADC sampling). The frequency setup precedes the measurement for each frequency point.

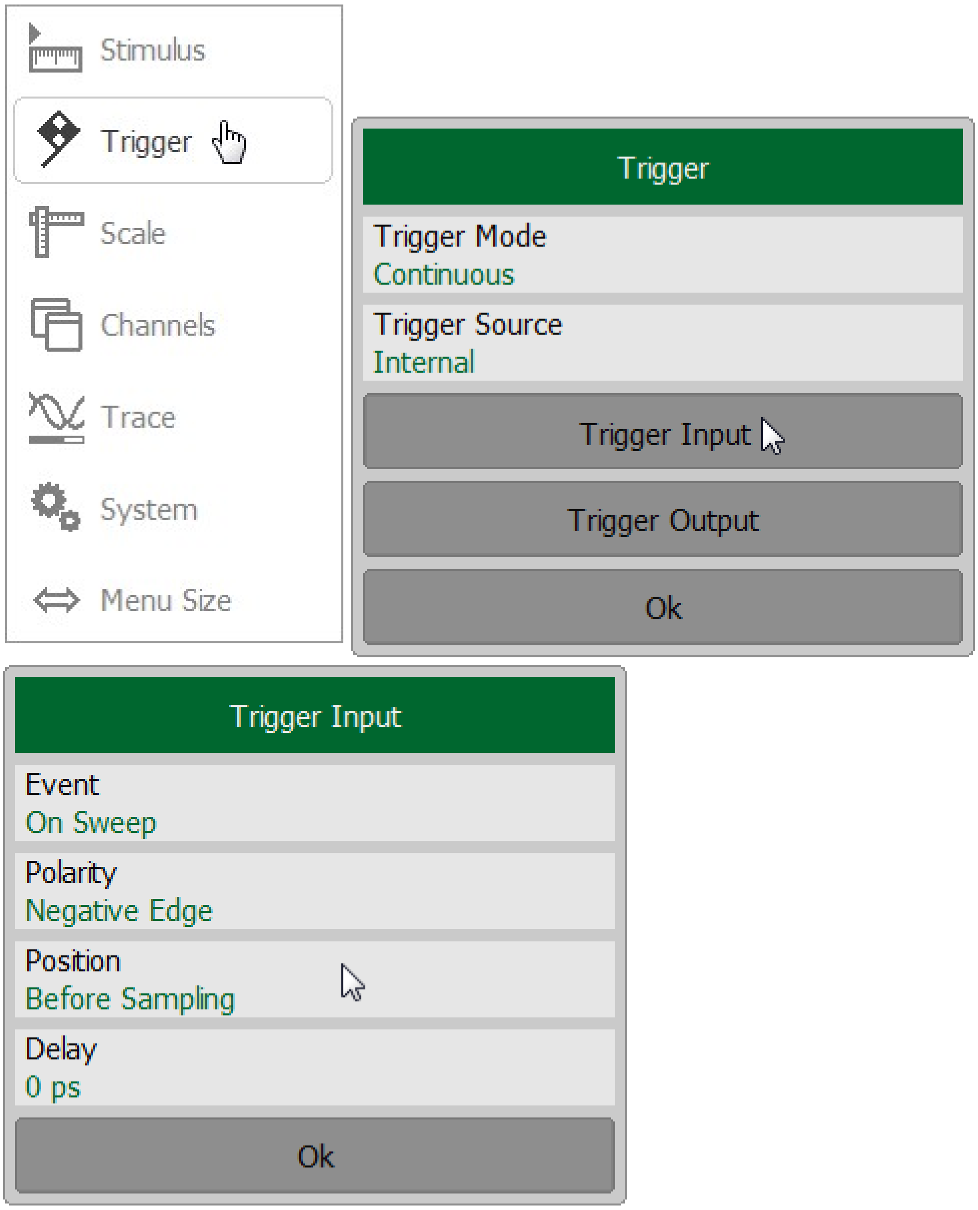
Trigger Position	Function
Before Sampling [default]	The trigger signal is expected before the ADC sampling when the frequency is already set. After sampling the Analyzer automatically transits to the next frequency (See figure below).  Before Sampling, Point trigger is OFF  Before Sampling, Point trigger is ON
Before Setup	The trigger signal is expected before the frequency setup. The frequency setup starts when the trigger signal arrives (See figure below). After the frequency setup is completed, the analyzer begins ADC sampling.

Trigger Position	Function
	 Before Setup, Point trigger is OFF  Before Setup, Point trigger is ON

NOTE

This function is intended for use in conjunction with the **On Point** trigger function. In case of the **On Sweep** trigger function, the trigger position will be performed only for the first sweep point.

To select external trigger polarity, use the following softkeys **Trigger > Trigger Input > Position { Before Sampling | Before Setup }**.

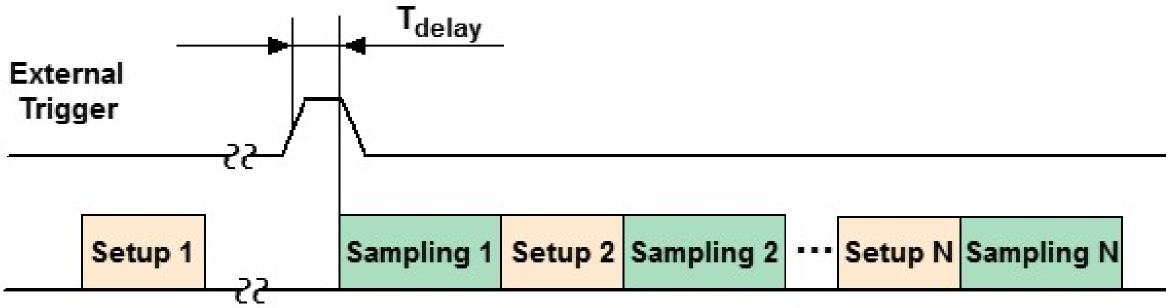


SCPI	TRIGger:EXTernal:POSition

External Trigger Delay

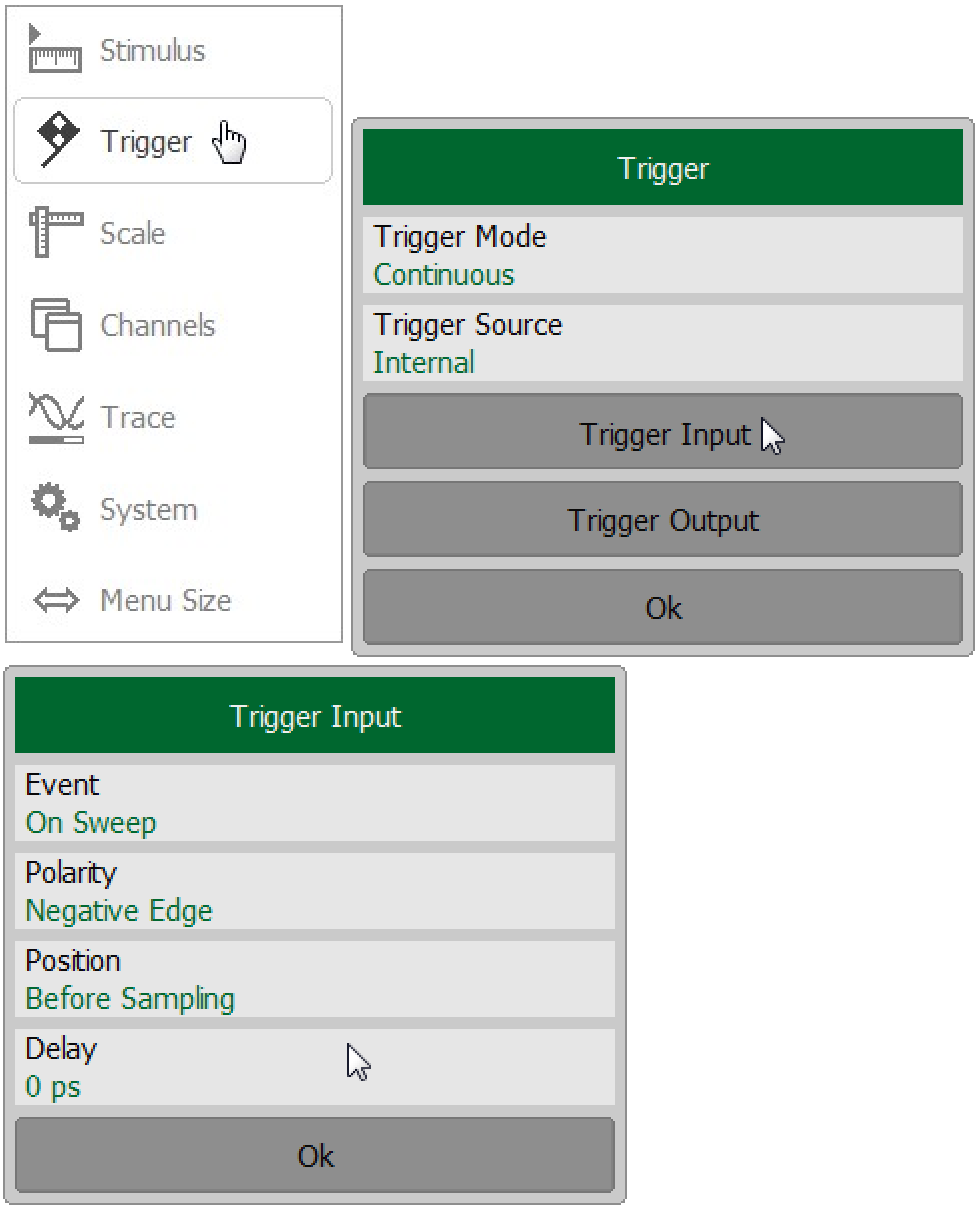
NOTE	This section is not available for R140.

The external trigger delay sets the response delay with respect to the external trigger signal (See figure below). The delay value has range from 0 to 100 sec with resolution 0.1 µsec.



External Trigger Delay

To set the external trigger delay, use the following softkeys **Trigger > Trigger Input > Delay**. Then enter the required values using the on-screen keypad.



SCPI [TRIGger:EXTernal:DELay]

Trigger Output

NOTE	This section is available for R60, R140B and R180.

This section describes settings of the trigger output. The trigger output is a TRIG IN/OUT connector used to output a logical signal from the Analyzer.

External Trigger Output Connector

The trigger output is designed to synchronize external devices with the analyzer measurement cycle.

To work with trigger output:

- Turn on trigger output (See Enabling Trigger Output).
- Set the polarity of the trigger (See Trigger Output Polarity).
- Select the trigger signal condition (See Trigger Output Function).

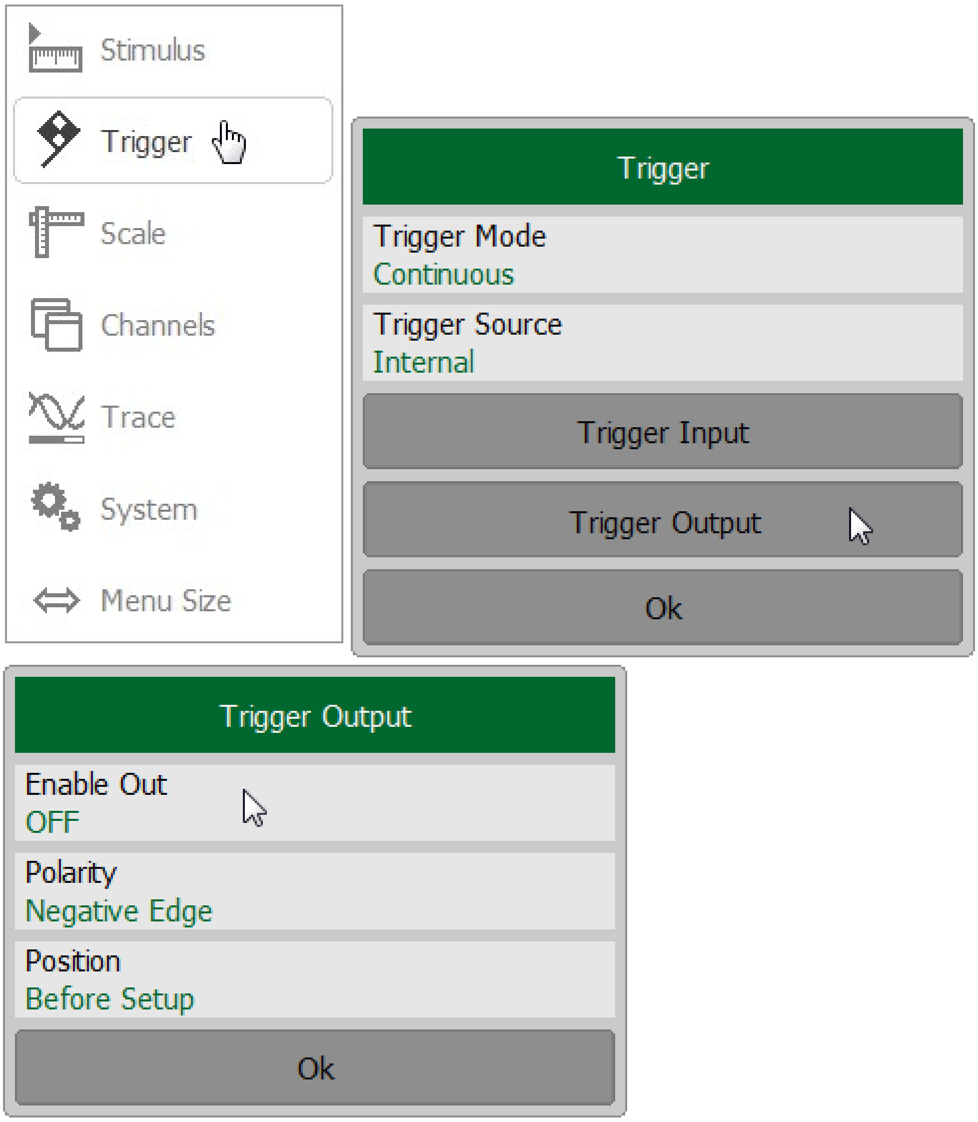
Enabling Trigger Output

Trigger Output	Function
OFF	The trigger output is disabled.
ON	The trigger output is enabled.

NOTE

If the **Ready for Trigger** function is selected (See Trigger Output Function), the trigger source must be set to **External** to enable the trigger output (See Trigger Source).

To enable/disable the trigger output, use the following softkeys **Trigger > Trigger Output > Enable Out**.

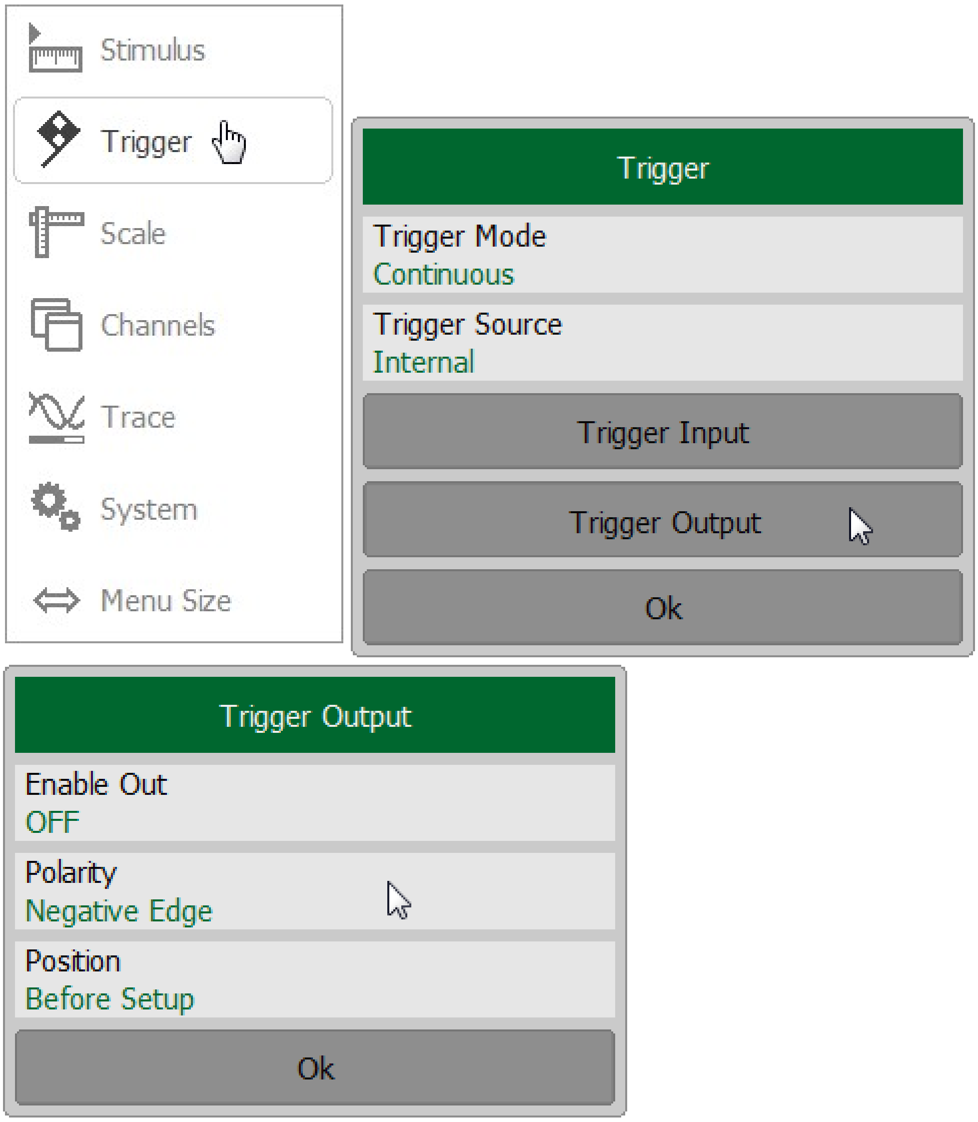


SCPI	TRIGger:OUTPut:STATe

Trigger Output Polarity

Trigger Output Polarity	Function
Negative	The negative edge of the signal at the trigger output corresponds to the event.
Positive	The positive edge of the signal at the trigger output corresponds to the event.

To select the polarity of the trigger output, use the following softkeys **Trigger > Trigger Output > Polarity { Negative Edge | Positive Edge }**.



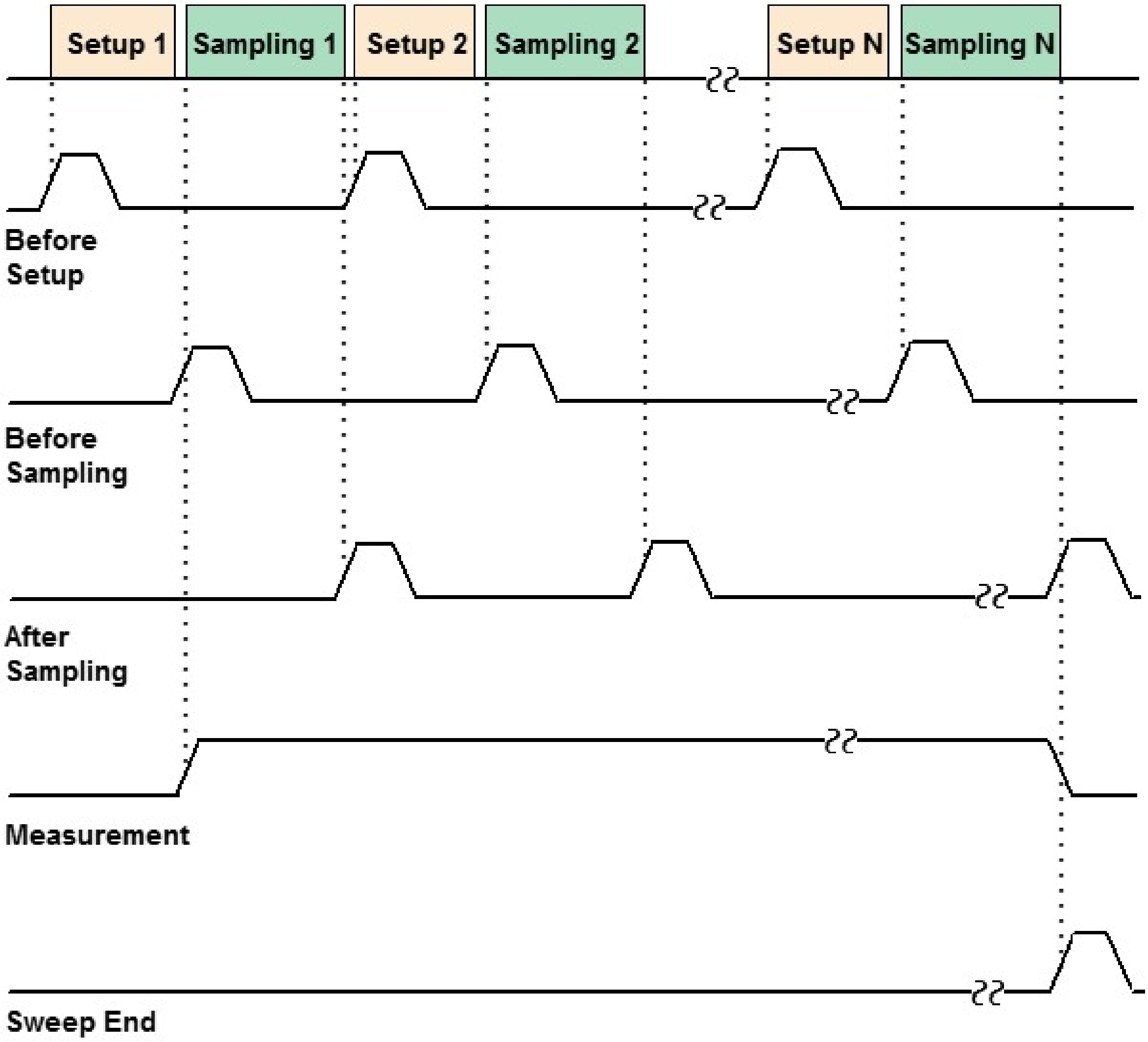
SCPI TRIGger:OUTPut:POLarity

Trigger Output Function

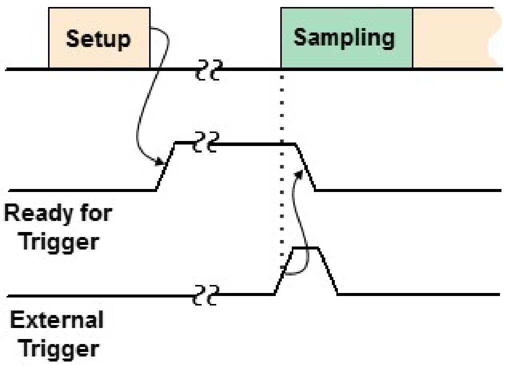
The purpose of the trigger output depends on the selected function.

Trigger Output Function	Function
Before Setup	Single pulse before setup frequency.
Before Sampling	Single pulse before sampling.
After Sampling	Single pulse after sampling.
Ready for Trigger (The function is not available for R140B)	Indicates the ready for external trigger state. The signal position depends on the external trigger position setting. After the arrival of the external trigger the ready for trigger signal is deselected and the measurement has begun.
Sweep End	Single pulse at the end of the sweep.
Measurement	The pulse duration is equal to the duration of the measurement from the first to the last point.

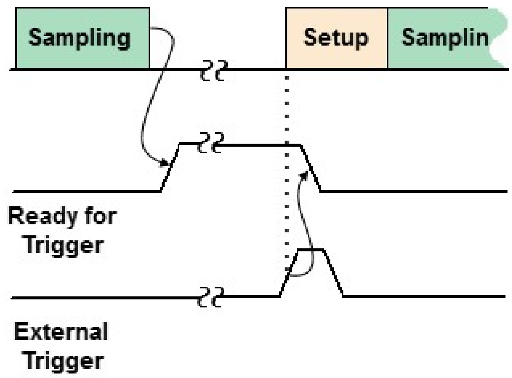
The figures below show the trigger output signal generation, depending on the selected trigger condition.



Trigger Output (except Ready for Trigger)



External Trigger set before sampling

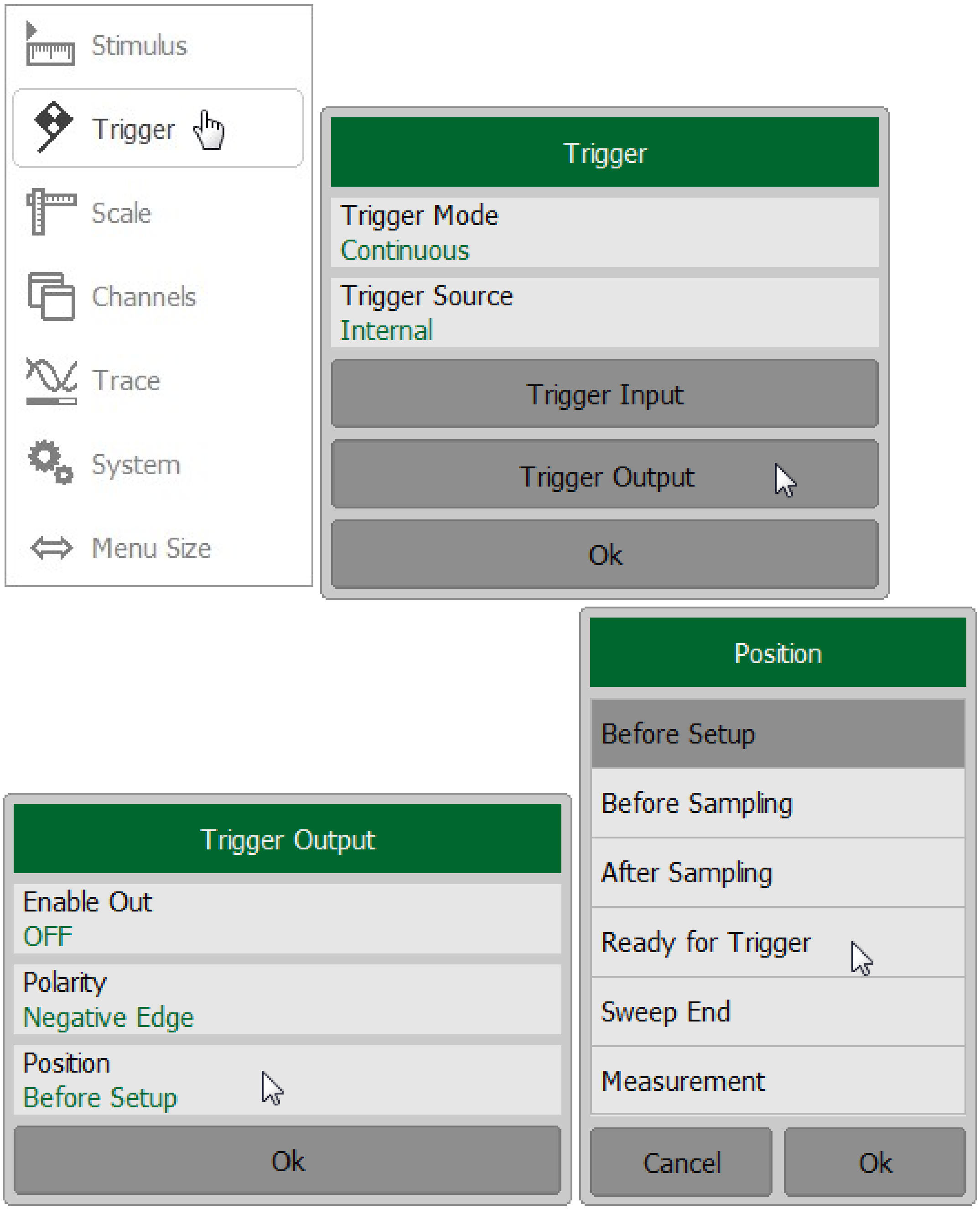


External trigger set before setup

Trigger Output (Ready for Trigger only)

To select the function of the trigger output (See figure above), use the following softkeys **Trigger > Trigger Output > Position {Before Setup | Before Sampling | After Sampling | Ready for Trigger | Sweep End | Measurement}**.

NOTE The function **Ready for Trigger** is not available for R140B.

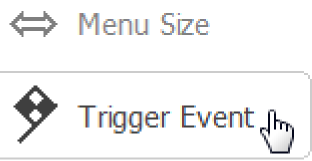


SCPI TRIGger:OUTPut:FUNCtion

Single Trigger Mode

Single trigger mode of channel measurement.

Trigger Event softkey is available in the right menu bar (See figure below).



Trigger Event softkey on right menu bar

To set the single trigger mode, use the following softkeys in the right menu bar Trigger:

- Select trigger mode **Single** (See Trigger Mode).
- Select trigger source **Internal** (See Trigger Source).

To start a single measurement press Trigger Event softkey. At the end of the measurement, the channel goes into the Hold state.

SCPI INITiate

Measurement Parameters Settings

This section describes the settings for the measurement parameter selection. The parameter selection applies to traces within a channel.

The Analyzers allows for:

- S-Parameter measurement (See S-Parameters).
- Absolute power measurement at the receiver input for R60/R180 (See Absolute Measurements).

S-Parameters

1-port Analyzer has one measurement port which operates as a signal source and as a reflected signal receiver. That is why the Analyzer allows measuring only S11 parameter.

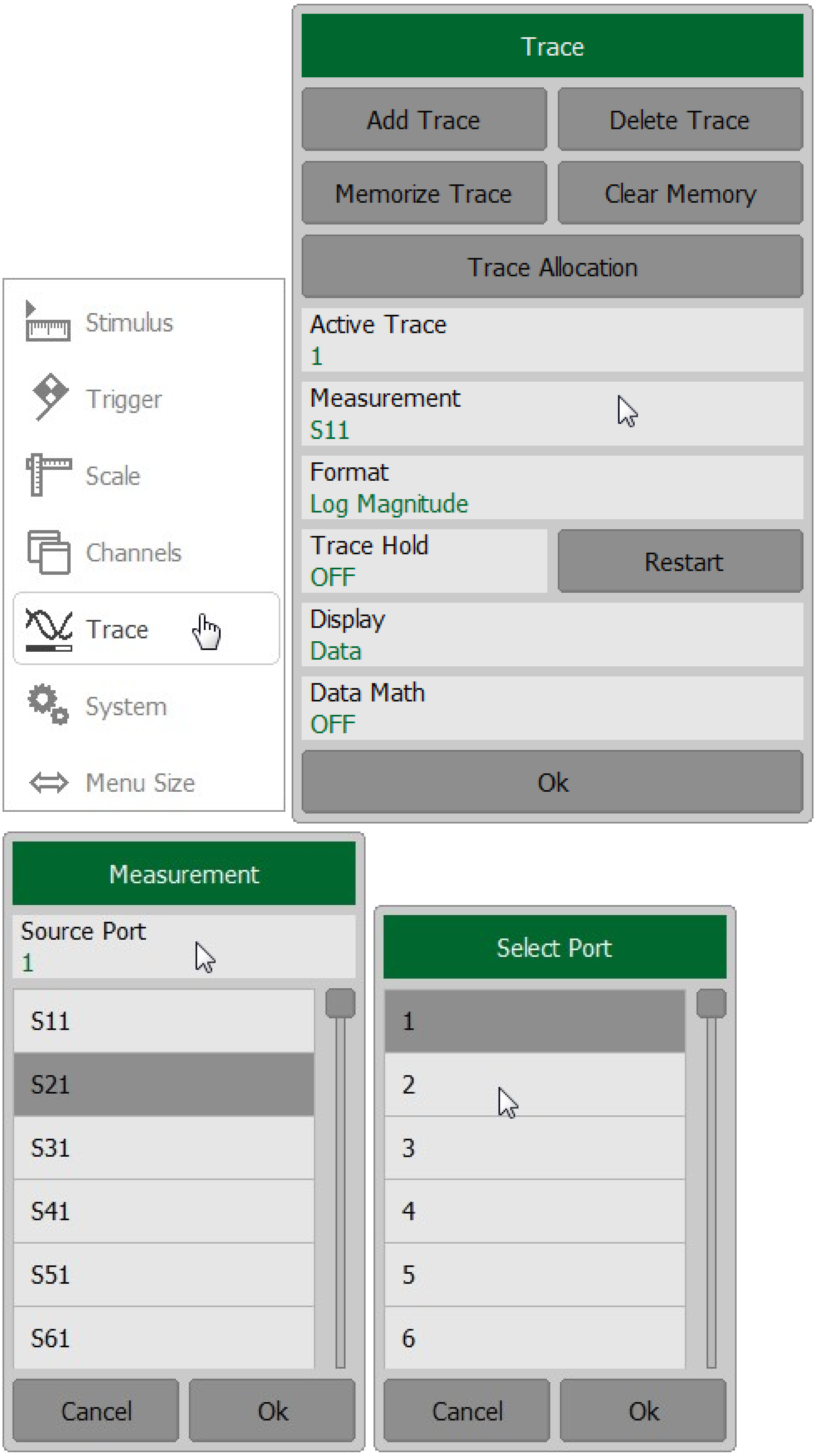
Two or more Analyzers (separately or as a part of an RNVNA) allow measuring S-parameters:

- Sii, where a value from 1 to N is taken.
- |Sij|, i ≠ j, where i and j take a value from 1 to N (N is a number of Analyzers).

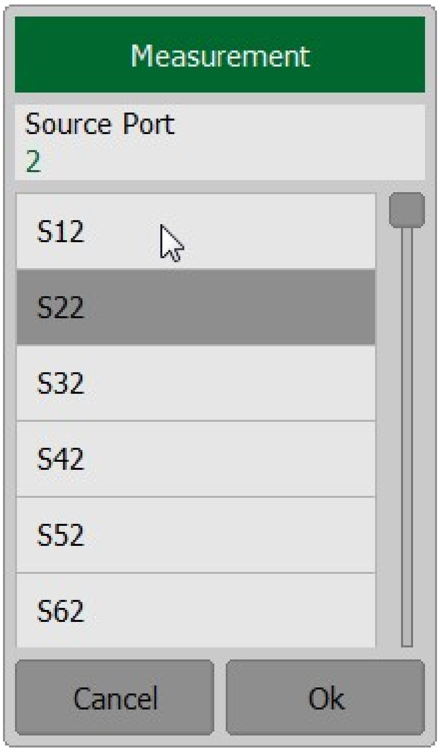
A measured S-parameter for RNVNA is set for each trace. The trace to which the function is applied must be preselected as active (See Active Trace Selection).

For a detailed description of the principle of measuring S-parameters see Principle of measuring S-parameters.

To set the measured parameter for RNVNA, use the following softkeys **Trace > Measurement**. To assign the measured parameters to a trace, click on **Source Port** and select the required port number in the dialog.


Trace
Add Trace
Delete Trace
Memorize Trace
Clear Memory
Trace Allocation
Active Trace
1
Measurement
S11
Format
Log Magnitude
Trace Hold
OFF
Restart
Display
Data
Data Math
OFF
Ok
Stimulus
Trigger
Scale
Channels
Trace
System
Menu Size
Measurement
Source Port
1
S11
S21
S31
S41
S51
S61
Cancel
Ok
Select Port
1
2
3
4
5
6
Cancel
Ok

Then select the required S-parameter from the list in the **Measurement** dialog.



SCPI	CALCulate:PARameter:DEFine

NOTE	Setting the S-parameter is possible using the mouse (See Measurement Parameters Settings).

Absolute Measurements

NOTE	This section is available for R60/R180.

Absolute measurements are measurements of the absolute power of a signal at a receiver input. Unlike relative measurements of S-parameters, which represent a relation between the signals at inputs of two receivers, absolute measurements determine the signal power at the input of one receiver.

The 1-port Analyzer has two independent receivers A and R:

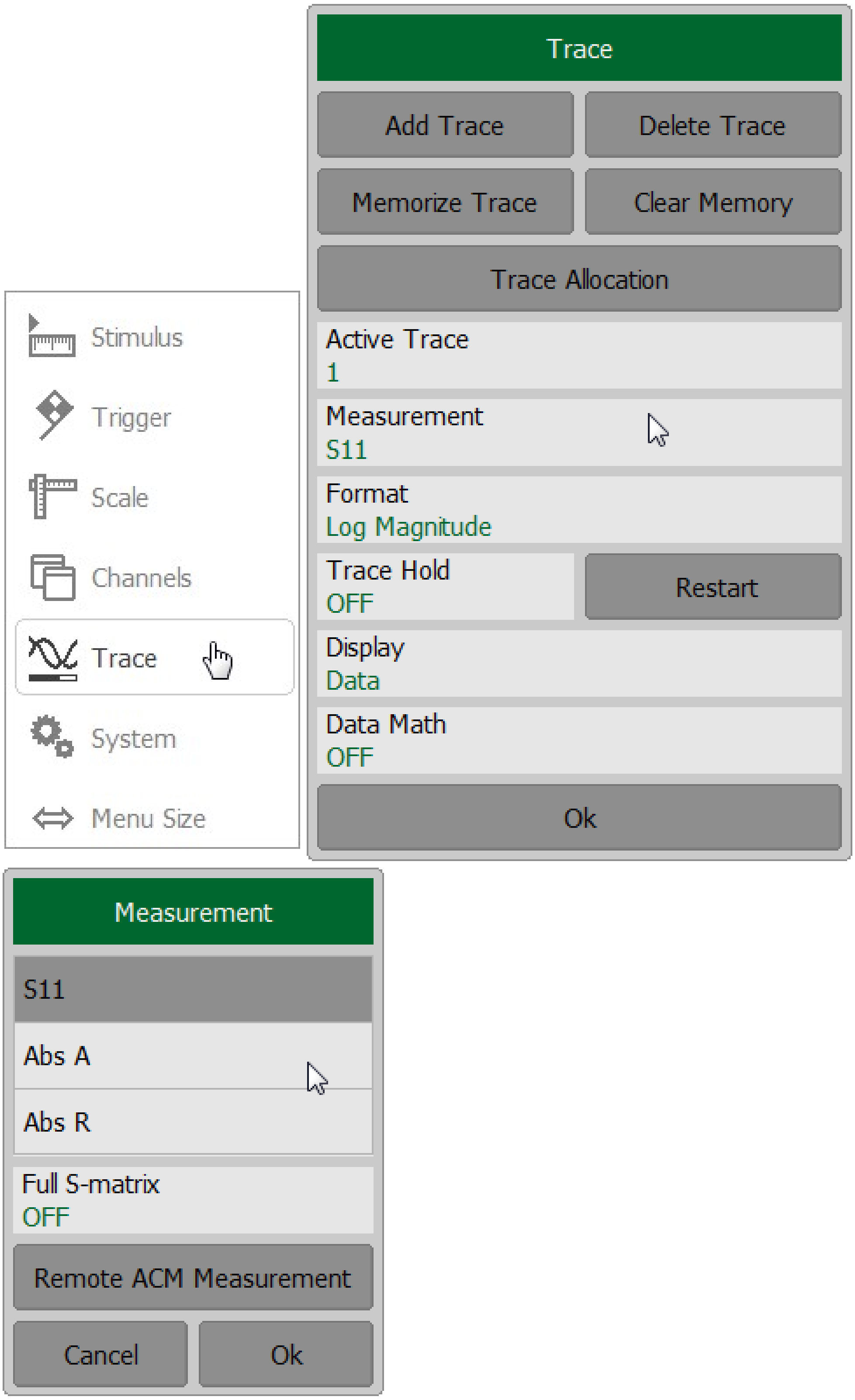
- The R is reference signal receiver.
- The A is test signal receiver.

A measured absolute parameter is set for each trace. The trace to which the function is applied must be preselected as active (See Active Trace Selection).

To set the measured parameter, use the following softkey **Trace > Measurement**.

Then select the required parameter:

- **Abs A** is test signal receiver.
- **Abs R** is reference signal receiver.



SCPI [CALCulate:PARameter:DEFine]()

NOTE	In absolute measurement mode, **dBm** measurement units are used for logarithmic magnitude format, and **W** measurement units are used in linear magnitude format. Other formats are not applicable to absolute measurements.

Format Setting

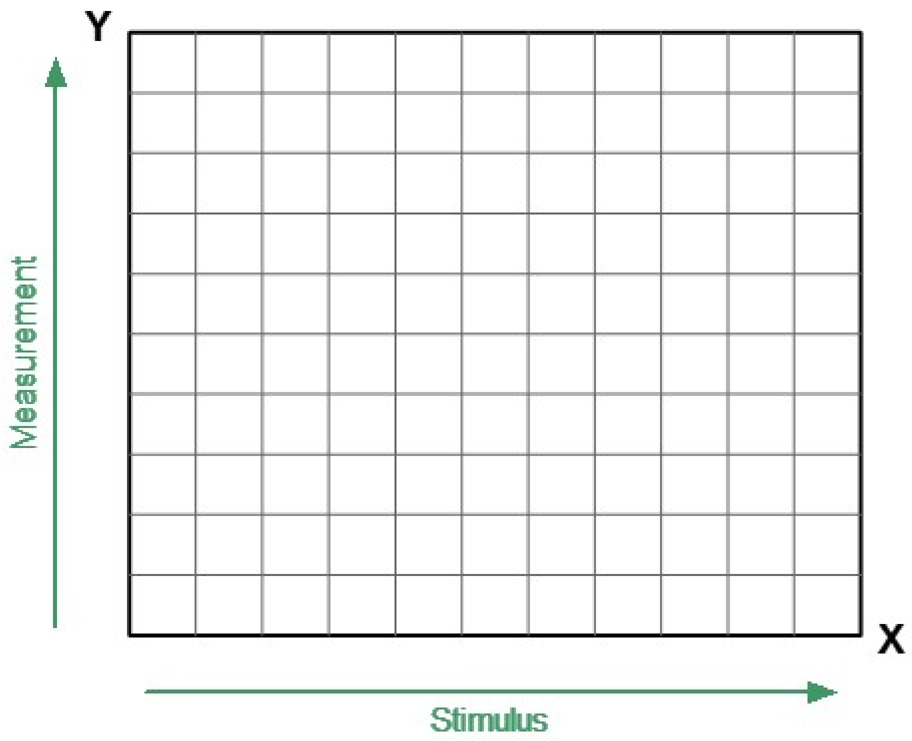
The format setting determines how measured data will be presented on the diagram.

The Analyzer offers three S-parameter measurement display types:

- Rectangular format
- Polar format
- Smith chart format

Rectangular Formats

In this format, stimulus values are plotted along X-axis and the measured data are plotted along Y-axis (See figure below).



Rectangular format

To display complex-valued S-parameters along the scalar Y-axis, it must be transformed into a real number. Rectangular formats involve various types of transformation of an S-parameter

$$S = a + j \cdot b,$$

where a — real part of S-parameter complex value,

b — imaginary part of S-parameter complex value.

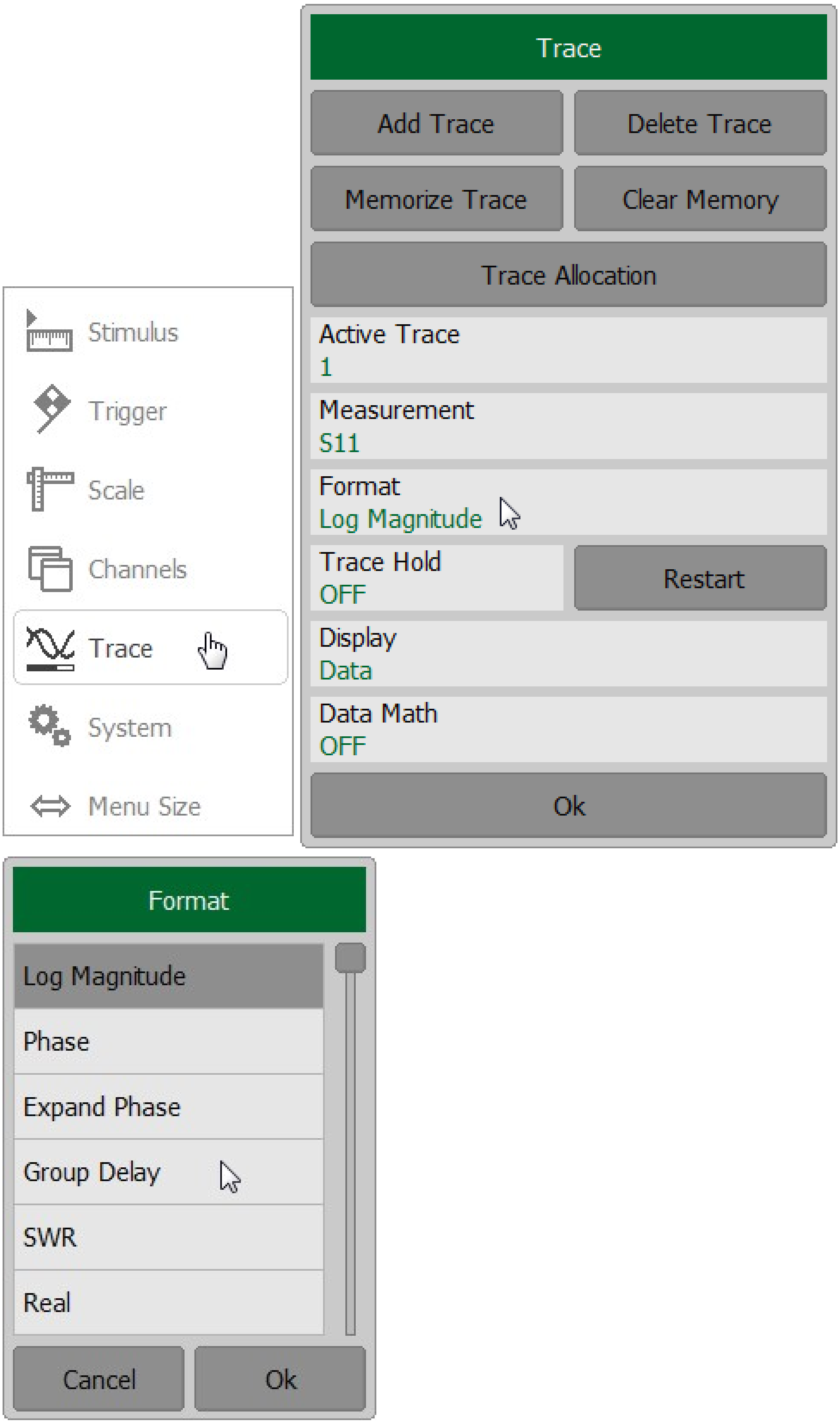
There are eight types of rectangular formats depending on the measured value plotted along Y-axis (See table below).

Rectangular Formats

Format Type Description	Label	Data Type (Y-axis)	Measurement Unit (Y-axis)
Logarithmic Magnitude	**Log Magnitude**	S-parameter logarithmic magnitude: $20 \cdot \log\lvert S\rvert$, $\lvert S\rvert = \sqrt{a^2 + b^2}$	Decibel (dB)
Voltage Standing Wave Ratio	**SWR**	$\frac{1+\lvert S\rvert}{1-\lvert S\rvert}$	Dimensionless value
Phase	**Phase**	S-parameter phase from –180° to +180°: $\frac{180}{\pi} \cdot arctg\frac{b}{a}$	Degree (°)
Expanded Phase	**Expand Phase**	S-parameter phase, measurement range expanded to from below –180° to over +180°	Degree (°)
Group Delay	**Group Delay**	Signal propagation delay within the DUT: $-\frac{d\varphi}{d\omega}$, $\varphi = arctg\frac{b}{a}$, $\omega = 2\pi \cdot f$	Second (sec.)
Linear Magnitude	**Lin Magnitude**	S-parameter linear magnitude: $\sqrt{a^2 + b^2}$	Dimensionless value
Real Part	**Real**	S-parameter real part: $a = re(S)$	Dimensionless value
Imaginary Part	**Imag**	S-parameter imaginary part: $b = im(S)$	Dimensionless value
Cable Loss	**Cable Loss**	$A = 1/2 \cdot (ReturnLoss)$ $A = 10 \cdot log\lvert S\rvert$	Decibel (dB)

The format for each trace of the channel can be selected individually. The trace must be activated before setting the format (See Active Trace Selection).

To set the trace display format use the following softkey **Trace**. In the Trace dialog select the required trace from **Active Trace** and click on **Format** softkey. Then select the required format in the Format dialog.

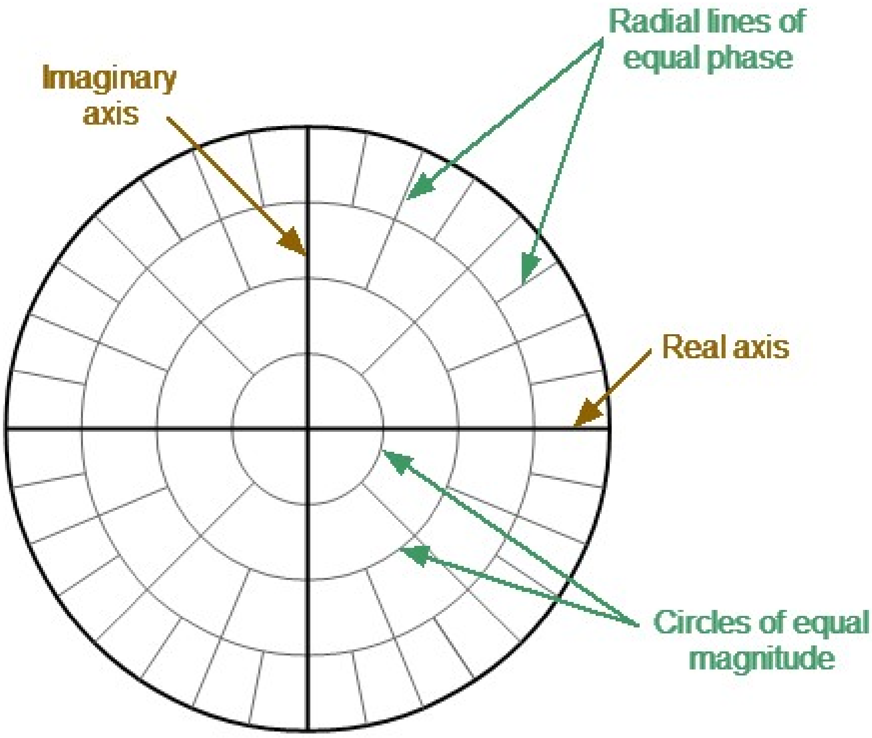


SCPI	CALCulate:FORMat

NOTE	The display format can be set using the mouse (See Display Format Setting).

Polar Format

The Polar format is used to display the amplitude and phase of the reflection coefficient (Γ) when measuring Sii (where a value from 1 to N is taken, N is a number of Analyzers). The complex reflection coefficient values are displayed on the polar diagram in the complex plane. The complex plane is formed by the real horizontal and the imaginary vertical axes. The grid lines correspond to points of equal amplitude and phase (See figure below).

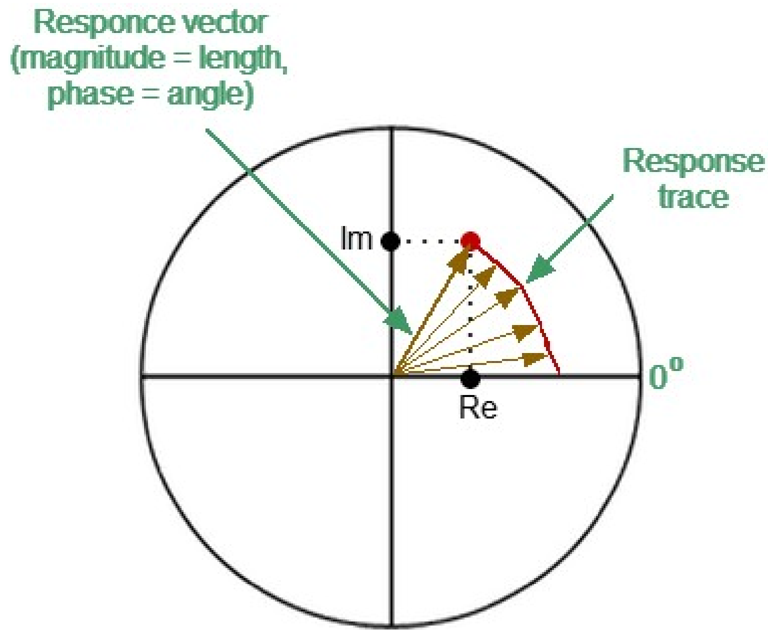


Polar format

NOTE

On circular diagrams (Polar and Smith chart), any point of the trace can be defined in the following two ways (See figure below):

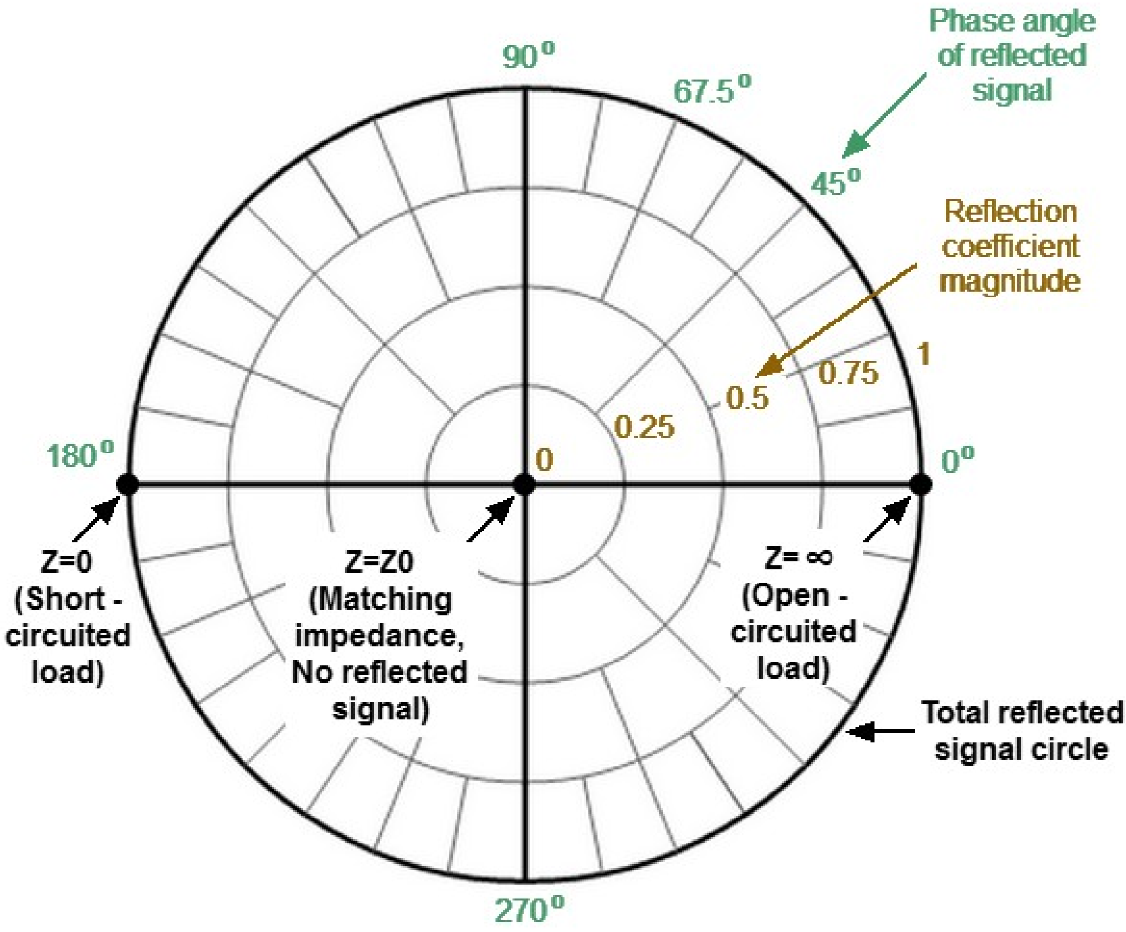
- Coordinates of the point (Re, Im) on the real and imaginary coordinate axes.
- Parameters of the vector directed to the point from the center of the diagram. The length of this vector is equal to the response amplitude, and the angle between the vector and the positive part of the real coordinate axis is equal to the phase of the response. The angle is calculated counterclockwise.



NOTE

Traces on all types of Smith chart and polar format are the same, the analyzer replaces the base grid and default marker format when switching formats.

The Polar format diagram with the characteristic points is shown in the figure below.



Properties of Polar format

Basic properties of the Polar format:

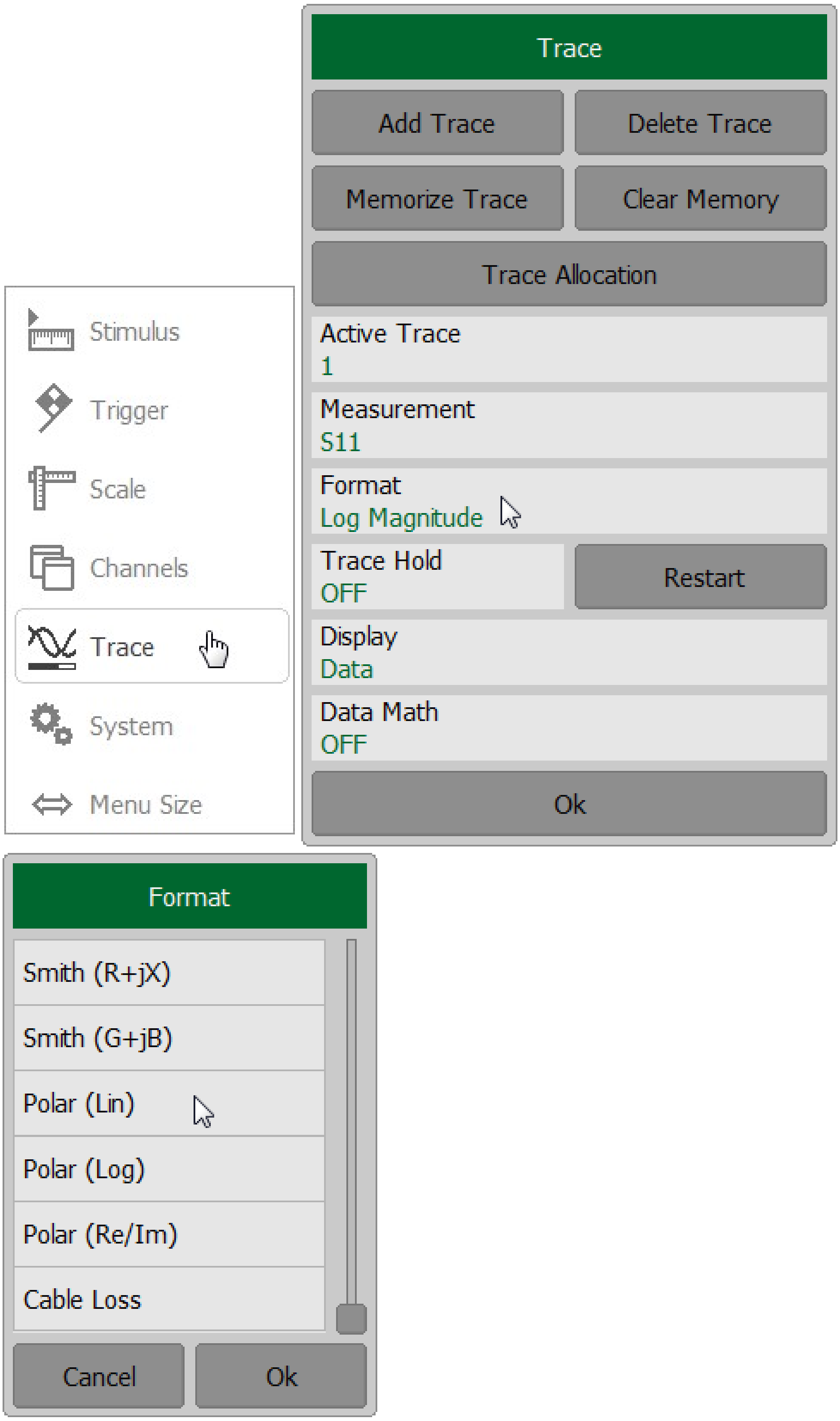
- The center of the diagram corresponds to the reflection coefficient $\Gamma = 0$ (reference impedance Z0 on the input test port of the DUT when measuring Sii, matched circuit, no reflection).
- The outer circle of the diagram corresponds to the reflection coefficient $\Gamma = 1$ (|Sii| = 1, unmatched circuit, total reflection).
- Points with the same amplitude are located on a circle with the center coinciding with the center of the diagram.
- Points with the same phase are located on a line starting from the center.
- At the rightmost point of the horizontal axis, the impedance has an infinitely large value (Open circuited load).
- At the leftmost point of the horizontal axis, the impedance value is zero (Short circuited load).

The polar graph does not have a frequency axis, so frequency is indicated by markers. There are three types of polar formats corresponding to the data displayed by the marker; the traces remain the same for all the format types (See table below).

Format Type Description	**Label**	**Data Displayed by Marker**	**Measurement Unit**
Linear Magnitude and Phase	**Polar (Lin)**	S-parameter linear magnitude	Dimensionless value
		S-parameter phase	Degree (°)
Logarithmic Magnitude and Phase	**Polar (Log)**	S-parameter logarithmic magnitude	Decibel (dB)
		S-parameter phase	Degree (°)
Real and Imaginary Parts	**Polar (Re/Im)**	S-parameter real part	Dimensionless value
		S-parameter imaginary part	Dimensionless value

The format for each trace of the channel can be selected individually. The trace must be activated before setting the format (See Active Trace Selection).

To set the trace display format use the following softkey **Trace**. In the Trace dialog select the required trace from **Active Trace** and click on **Format** softkey. Then select the required format in the Format dialog.



SCPI	CALCulate:FORMat

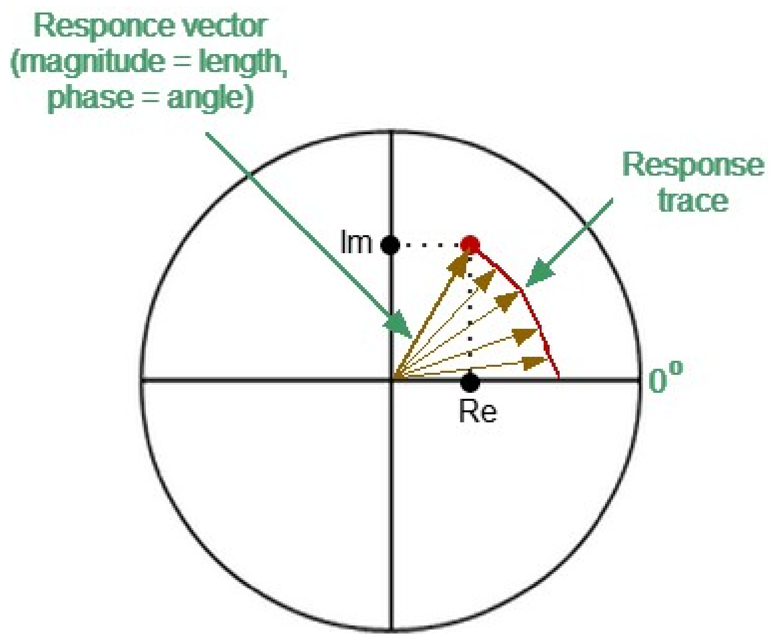
NOTE	The display format can be set using the mouse (See Display Format Setting).

Smith Chart Format

NOTE

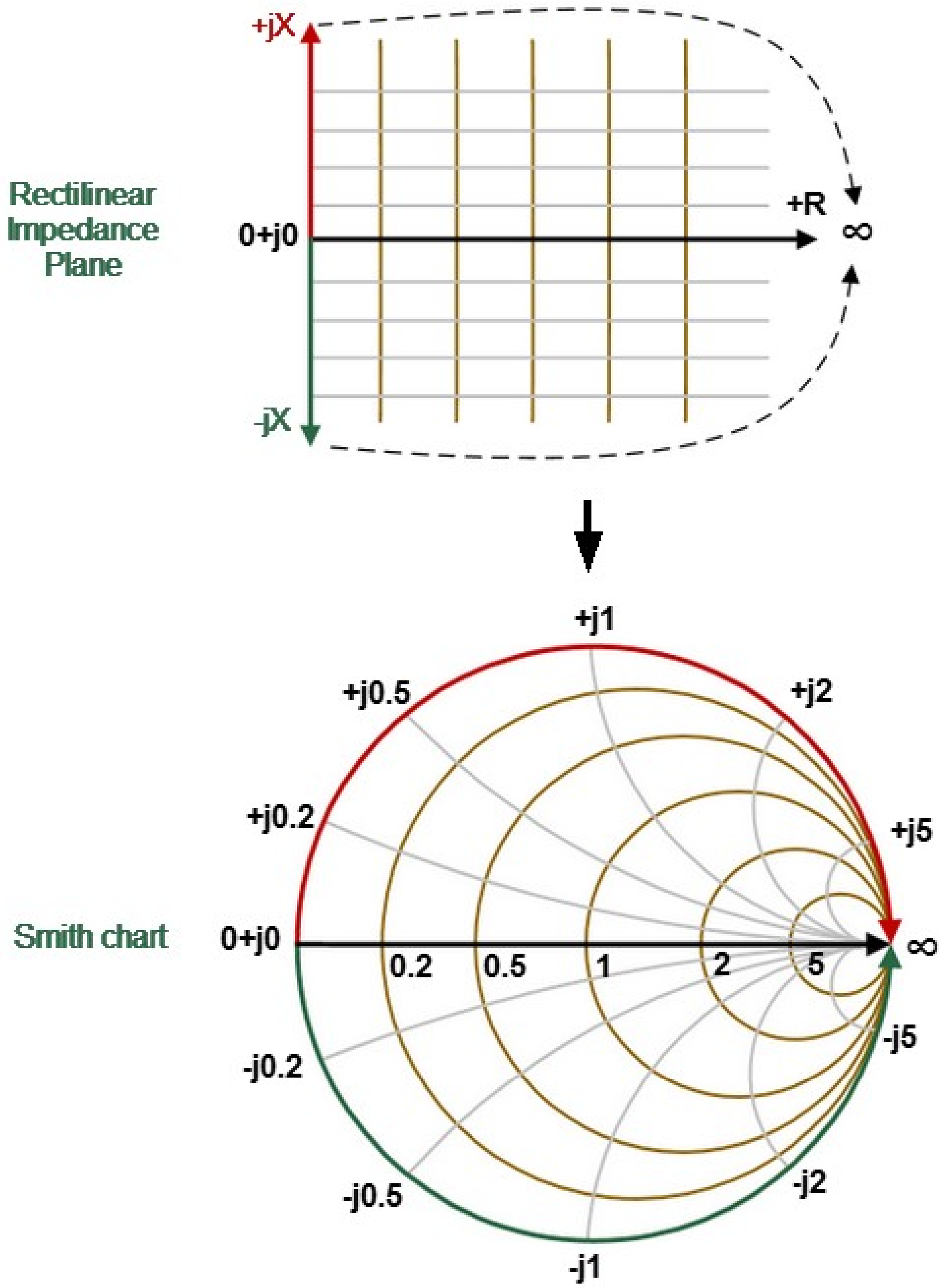
On circular diagrams (Polar and Smith chart), any point of the trace can be defined in the following two ways (See figure below):

- Coordinates of the point (Re, Im) on the real and imaginary coordinate axes.
- Parameters of the vector directed to the point from the center of the diagram. The length of this vector is equal to the response amplitude, and the angle between the vector and the positive part of the real coordinate axis is equal to the phase of the response. The angle is calculated counterclockwise.



The Smith chart is a circular chart on which the measured complex reflection coefficients (Sii, where a value from 1 to N is taken, N is a number of Analyzers) are compared with the normalized impedance of the DUT.

The Smith chart is formed from a rectilinear impedance plane by collapsing the area with positive resistance into a single unit circle (See figure below).



Converting Rectilinear Impedance Plane to Smith Chart

Basic properties of the Smith chart (See figure below):

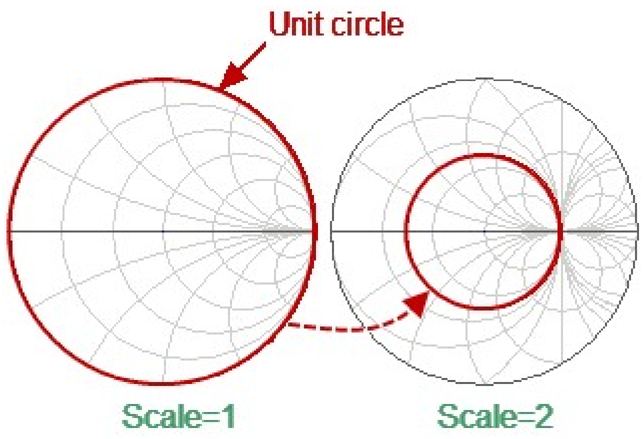
- Each point on the diagram is equivalent to the complex impedance of the DUT:

$$Z = R + jX,$$

  where R — real part of the impedance (resistance), X — imaginary part of the impedance (reactance).

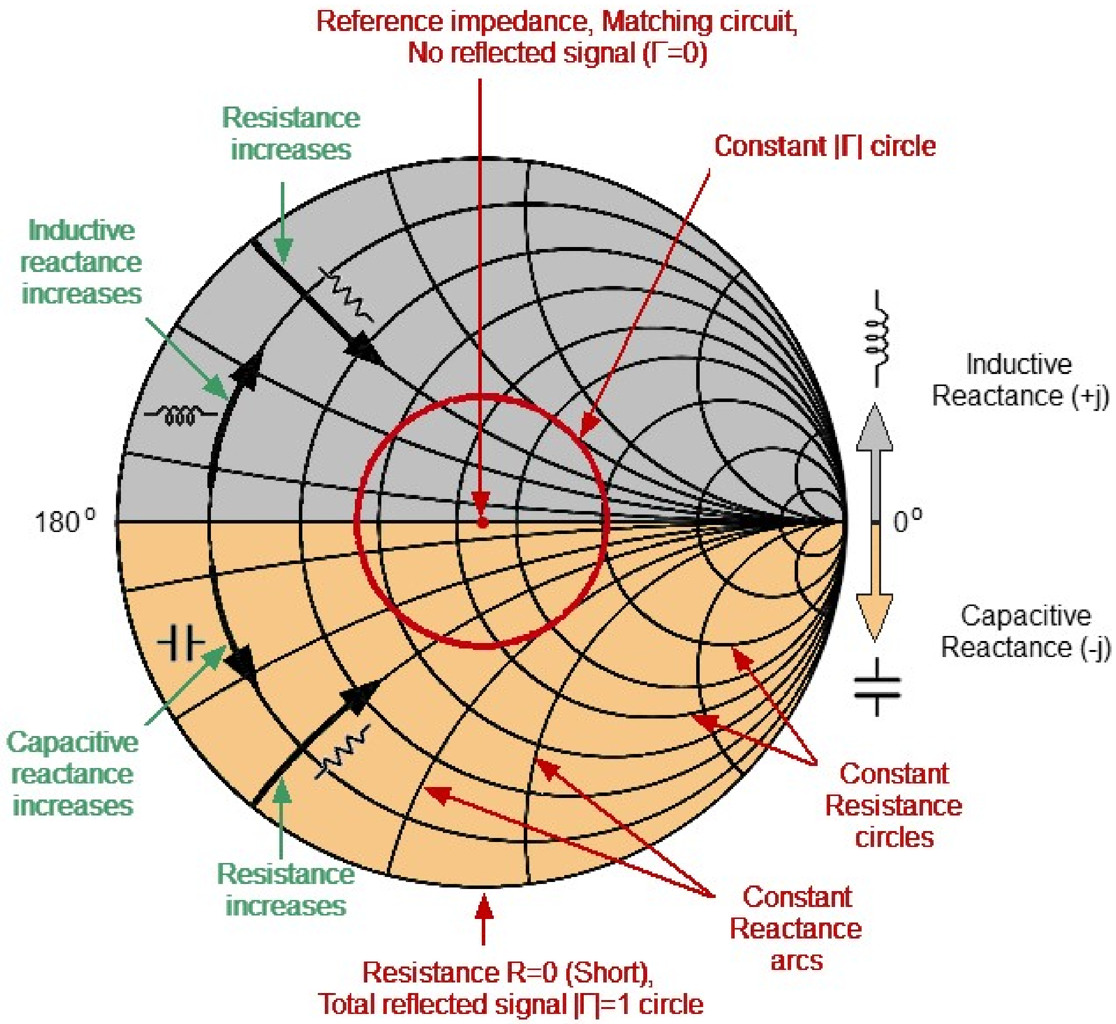
- The horizontal axis is resistance; reactance on this axis is equal to zero.
- Grid lines of the diagram consist of circles of constant resistance and arcs of constant reactance.
- The center of the diagram corresponds to the system reference impedance (Z/Z0 = 1).
- At the rightmost point of the horizontal axis, the impedance has an infinitely large value (Open circuited load).
- At the leftmost point of the horizontal axis, the impedance value is zero (Short circuited load).
- The outer circle of the diagram at scale = 1 (or unit circle) corresponds to a zero resistance value (reactance only). The measured points inside the unit circle correspond to the passive load, the points outside to the active load.

NOTE Location of the unit circle at a scale greater than 1



- The upper and lower halves of the diagram correspond to the positive (inductive) and negative (capacitive) reactive components of impedance.
- Reflection coefficient value (Γ) at any point of the diagram is determined by the distance from it to the center of the diagram. Thus, any circle with the center coinciding with the center of the diagram contains equal values of the modulus of the reflection coefficient. The center of the diagram corresponds to a matched circuit with no reflect signal (Γ = 0). The unit circle diagram corresponds to an unmatched circuit with total reflection |Γ| = 1.

Use the Smith chart to assess circuit mismatch and determine whether the load is resistive, inductive, capacitive, or complex. The Smith chart format is useful for looking for mismatch introduced by parasitic elements connected in series with the DUT.

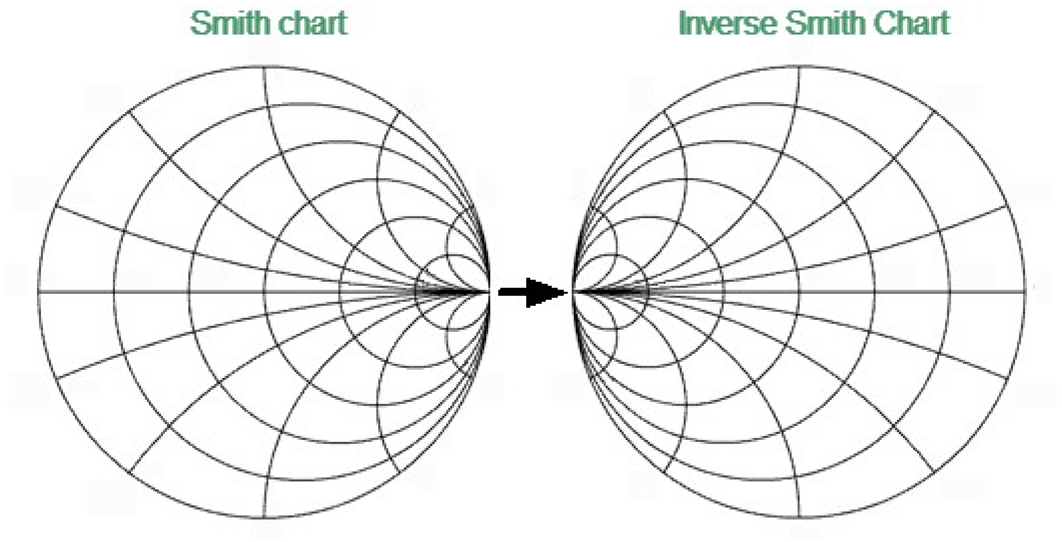


Smith chart properties

Inverse Smith Chart (Complex Admittance)

The Inverse Smith chart is a circular chart on which the measured complex reflection coefficients (Sii, where a value from 1 to N is taken, N is a number of Analyzers) are compared with the normalized DUT admittance. Complex admittance is the inverse of complex impedance.

To build an Inverse Smith chart, mirror the Smith chart on the horizontal axis (See figure below).



Convert Smith Chart to Inverse Smith Chart

Basic properties of the Inverse Smith chart:

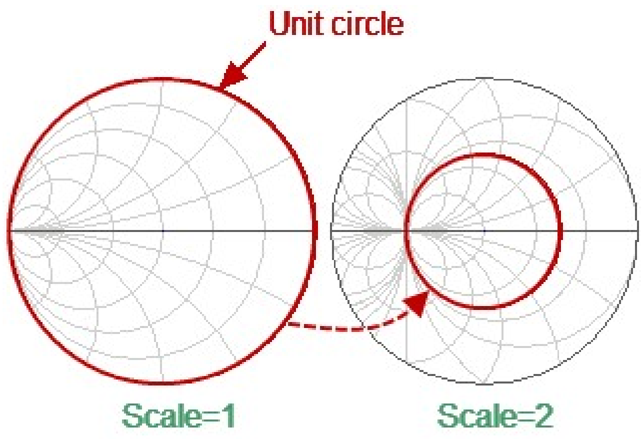
- Each point on the diagram is equivalent to the complex conductance of the DUT:

$$Y = G + jB,$$

  where G — real part of conductivity (conductance), B — imaginary part of conductivity (susceptance).

- The horizontal axis is only conductance; susceptance on this axis is equal to zero.
- The grid lines of the diagram consist of circles of constant conductance width and arcs of constant susceptance width.
- The center of the diagram corresponds to the reference conductivity of the system (Y/Y0 = 1).
- At the leftmost point of the horizontal axis, admittance is infinitely large (Short circuited load).
- At the rightmost point of the horizontal axis, admittance is equal to zero (Open circuited load).
- The outer circle at scale = 1 (or unit circle) corresponds to the zero value of conductance (susceptance only). The measured points inside the unit circle correspond to the passive load, the points outside to the active load.

NOTE	Position of the unit circle at a scale greater than 1



- The upper and lower halves of the diagram correspond to the negative (inductive) and positive (capacitive) reactive components (admittance).
- The reflection coefficient display (Γ) on the Inverse Smith chart coincides with its display on the Smith chart. The center of the diagram corresponds to a matched circuit with no reflected signal (Γ=0). The unit circle diagram corresponds to an unmatched circuit with total reflection |Γ| = 1.

Use the Inverse Smith chart (admittance diagram) to search for a mismatch introduced by the parasitic elements shunting the DUT.

The Smith chart format does not have a frequency axis, so frequency is indicated by markers.

There are five types of Smith chart formats (See table below) corresponding to the data displayed by the marker; the traces remain the same for all the format types.

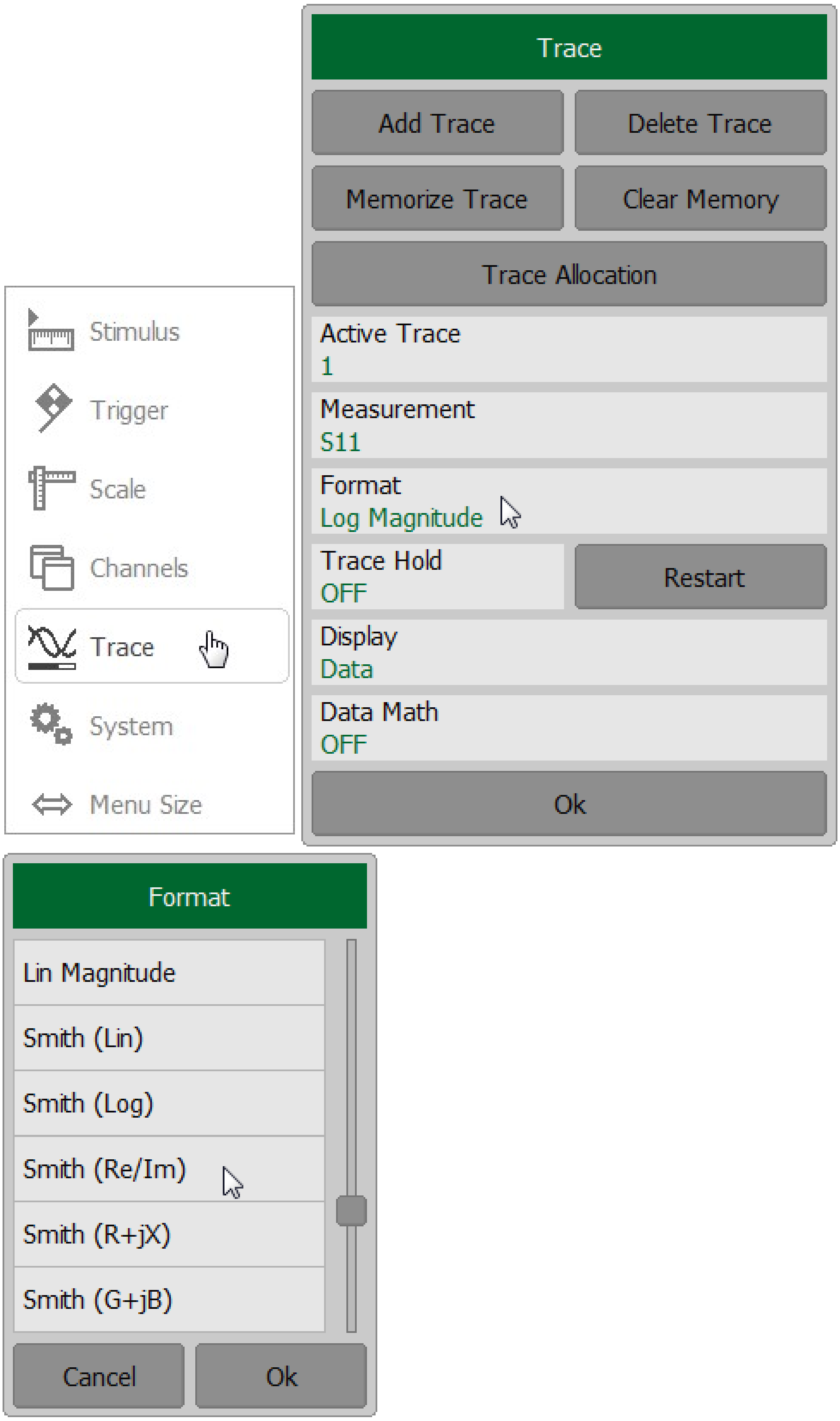
Format Type Description	**Label**	**Data Displayed by Marker**	**Measurement Unit**
Linear Magnitude and Phase	**Smith (Lin)**	S-parameter linear magnitude	Dimensionless value
		S-parameter phase	Degree (°)
Logarithmic Magnitude and Phase	**Smith (Log)**	S-parameter logarithmic magnitude	Decibel (dB)

Format Type Description	Label	Data Displayed by Marker	Measurement Unit
		S-parameter phase	Degree (°)
Real and Imaginary Parts	**Smith (Re/Im)**	S-parameter real part	Dimensionless value
		S-parameter imaginary part	Dimensionless value
Complex Impedance (at Input)	**Smith (R + jX)**	Resistance at input: $R = re(Z_{inp})$ $Z_{inp} = Z_0 \frac{1+S}{1-S}$	Ohm (Ω)
		Reactance at input: $X = im(Z_{inp})$	Ohm (Ω)
		Equivalent capacitance or inductance: $C = -\frac{1}{\omega X}, \quad X < 0$ $L = \frac{X}{\omega}, \quad X > 0$	Farad (F) Henry (H)
Complex admittance (at Input)	**Smith (G + jB)**	Conductance at input: $G = re(Y_{inp})$ $Y_{inp} = \frac{1}{Z0} \cdot \frac{1-S}{1+S}$	Siemens (S)
		Susceptance at input: $B = imp(Y_{inp})$	Siemens (S)

Format Type Description	Label	Data Displayed by Marker	Measurement Unit
		Equivalent capacitance or inductance: $C = \frac{B}{\omega}, \quad B > 0$ $L = -\frac{1}{\omega B}, \quad B < 0$	Farad (F) Henry (H)
Z0 — test port impedance. Z0 setting is described in System Impedance Z0.			

The format for each trace of the channel can be selected individually. The trace must be activated before setting the format (See Active Trace Selection).

To set the trace display format use the following softkey **Trace**. In the Trace dialog select the required trace from **Active Trace** and click on **Format** softkey. Then select the required format in the Format dialog.



SCPI	CALCulate:FORMat

NOTE	The display format can be set using the mouse (See Display Format Setting).

Scale Settings

The section describes how to set the scale for the different available formats.

The scale setting options depend on the selected data display format: rectangular format or circular format. For a detailed description of the scale settings for the different formats, see Rectangular Scale and Circular Scale (Polar and Smith).

It is possible to apply:

- Automatic Scaling function for both formats.
- Reference Level Automatic Selection when using the rectangular format.

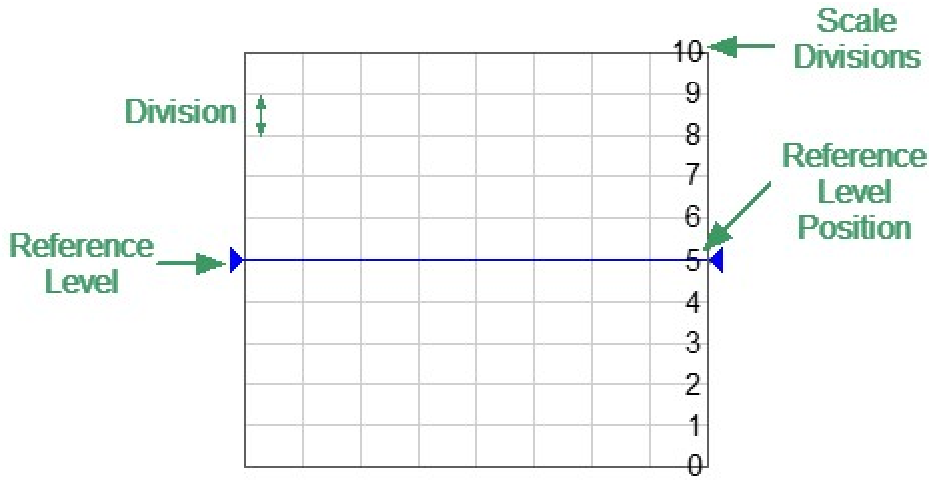
The scaling function is under trace settings.

This section also describes the electric delay setting functions (See Electrical Delay Setting) and phase offsets (See Phase Offset Setting).

Rectangular Scale

For rectangular format, the following parameters can be set (See figure below):

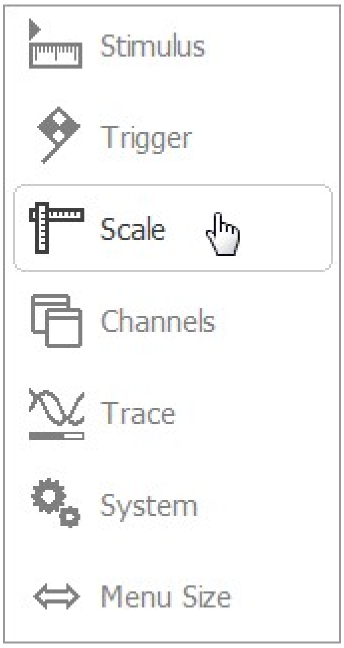
- scale division
- reference level value
- reference level position
- number of scale divisions

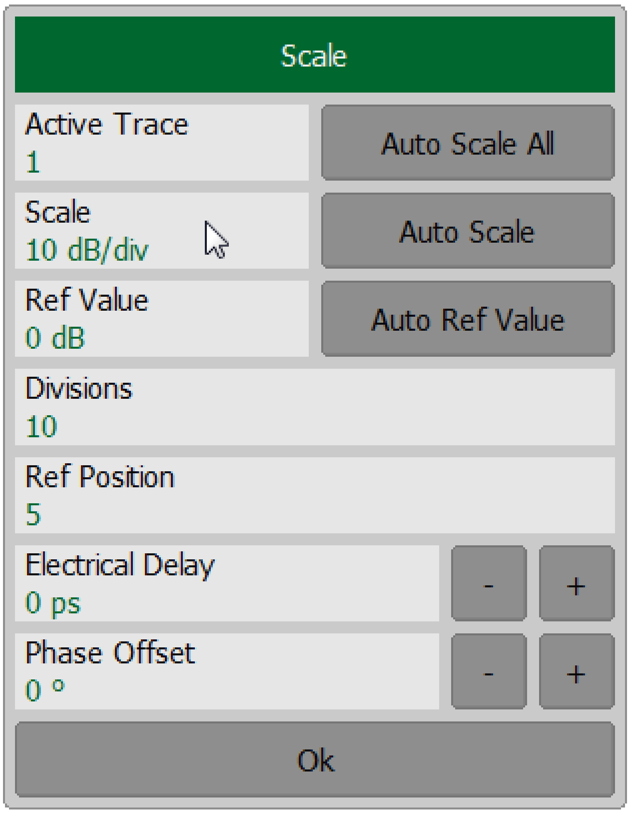


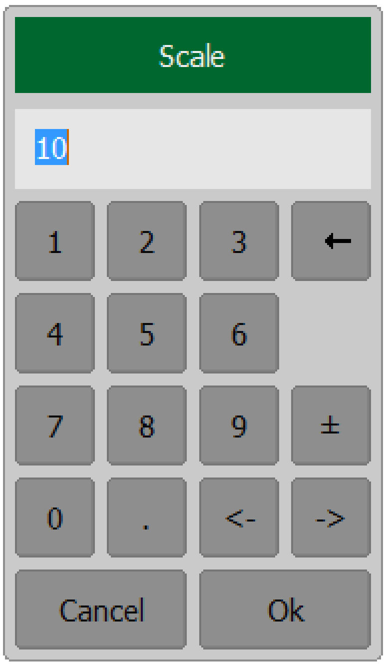
Rectangular scale

The scale of each trace can be set independently. The trace to which the function is applied must be preselected as active (See Active Trace Selection).

To set the scale of a trace use the following softkey **Scale**. Then select the **Scale** field and enter the required value using the on-screen keypad.







To set the reference level select the **Ref Value** field and enter the required value using the on-screen keypad.

To set the position of the reference level select the **Ref Position** field and enter the required value using the on-screen keypad.

To set the number of trace scale divisions select the **Divisions** field and enter the required value using the on-screen keypad.

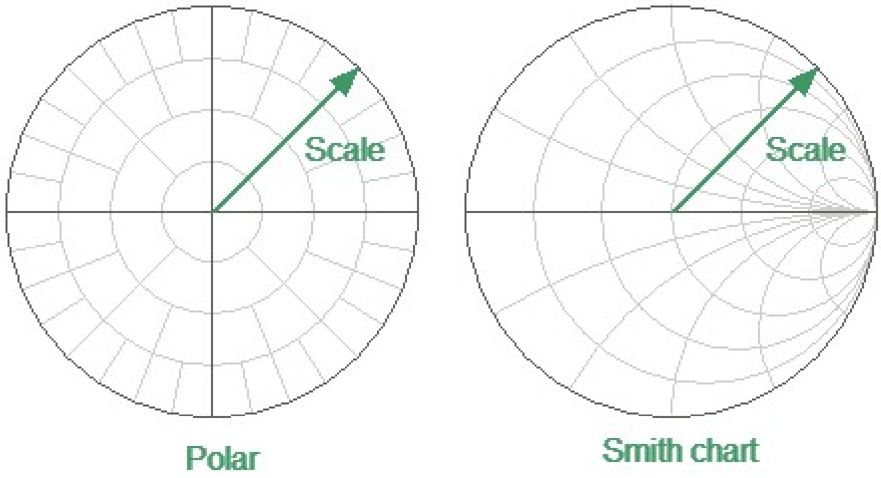
NOTE: The number of scale divisions affects all traces of the channel.

SCPI	DISPlay:WINDow:TRACe:Y:PDIVision, DISPlay:WINDow:TRACe:Y:RLEVel, DISPlay:WINDow:TRACe:Y:RPOSition, DISPlay:WINDow:Y:DIVisions,

NOTE	The trace scale, value of the reference level, and reference level position can be set using the mouse (See Trace Scale Setting).

Circular Scale

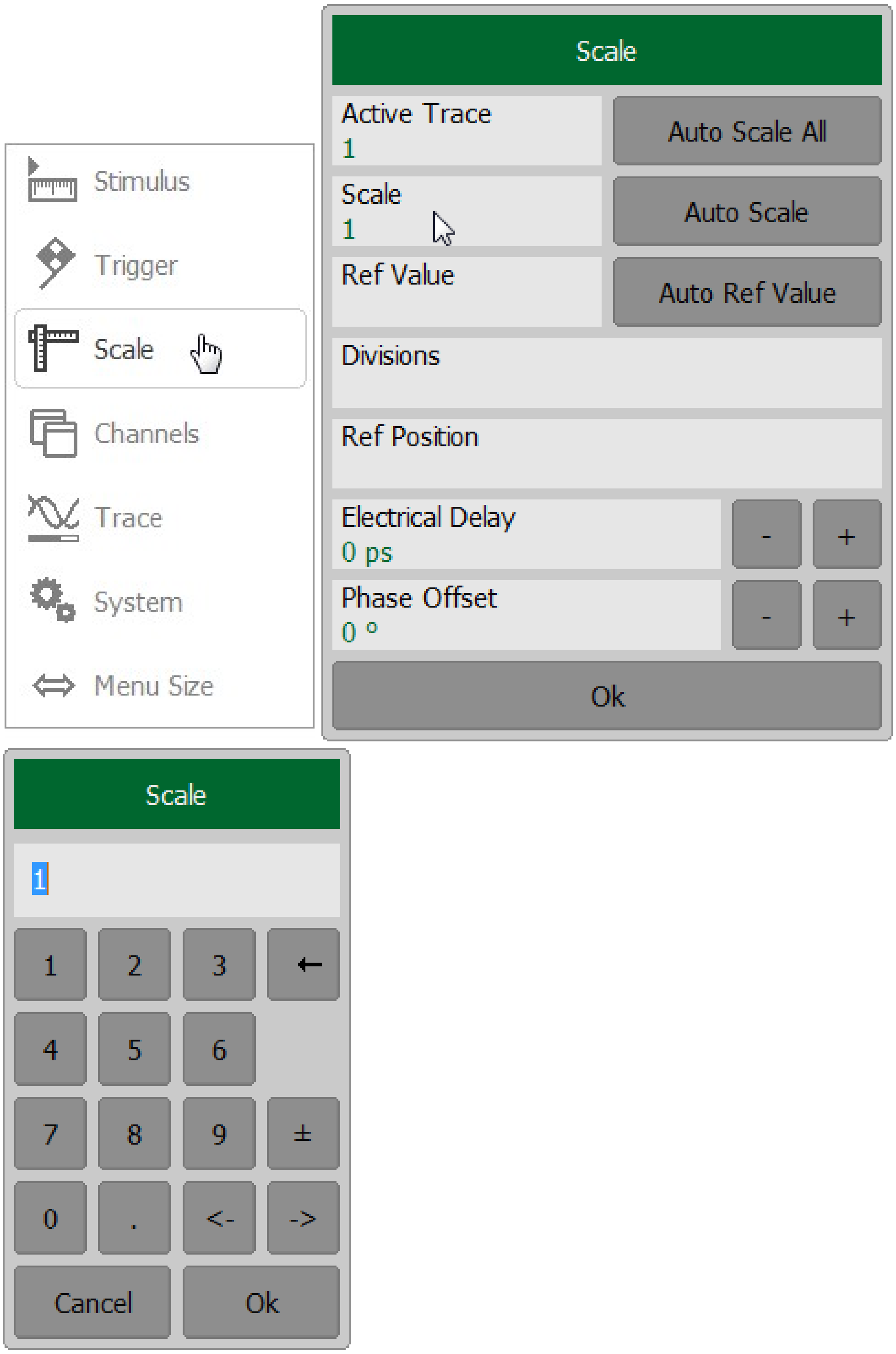
For Polar formats and Smith chart formats, the outer circle value can be set (See figure below).



Circular Scale

The scale of each trace can be set independently. The trace to which the function is applied must be preselected as active (See Active Trace Selection).

To set the scale of a trace use the following softkey **Scale**. Then select the **Scale** field and enter the required value using the on-screen keypad.



SCPI	DISPlay:WINDow:TRACe:Y:PDIVision

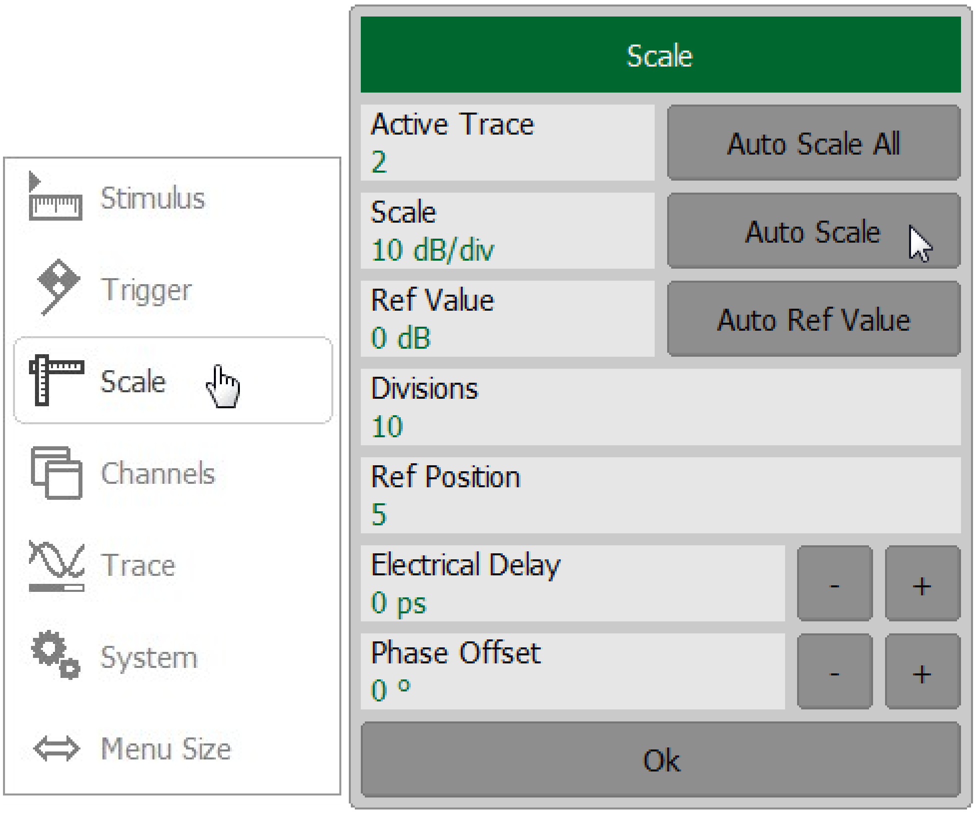
Automatic Scaling

The automatic scaling function automatically adjusts the trace scale so that the trace of the measured value fits into the diagram entirely.

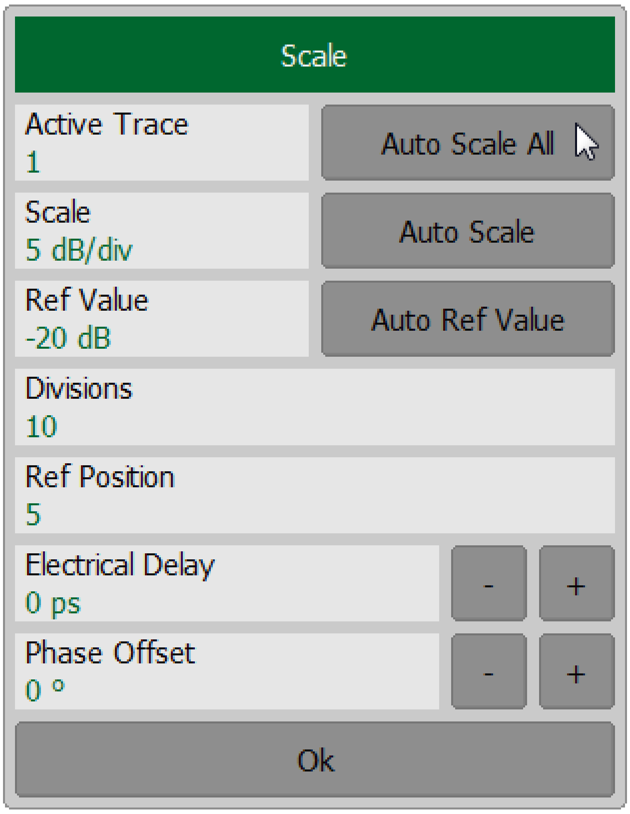
In rectangular format, two parameters are adjustable: scale division and reference level position. In circular format, the outer circle value is adjusted.

The function can be applied to the active trace (See Active Trace Selection) or to all traces of the active channel.

To automatically select the scale of the active trace, use the following softkeys: **Scale > Auto Scale**.



To automatically select the reference level of all traces of the active channel, use the following softkeys: **Scale > Auto Scale All**.



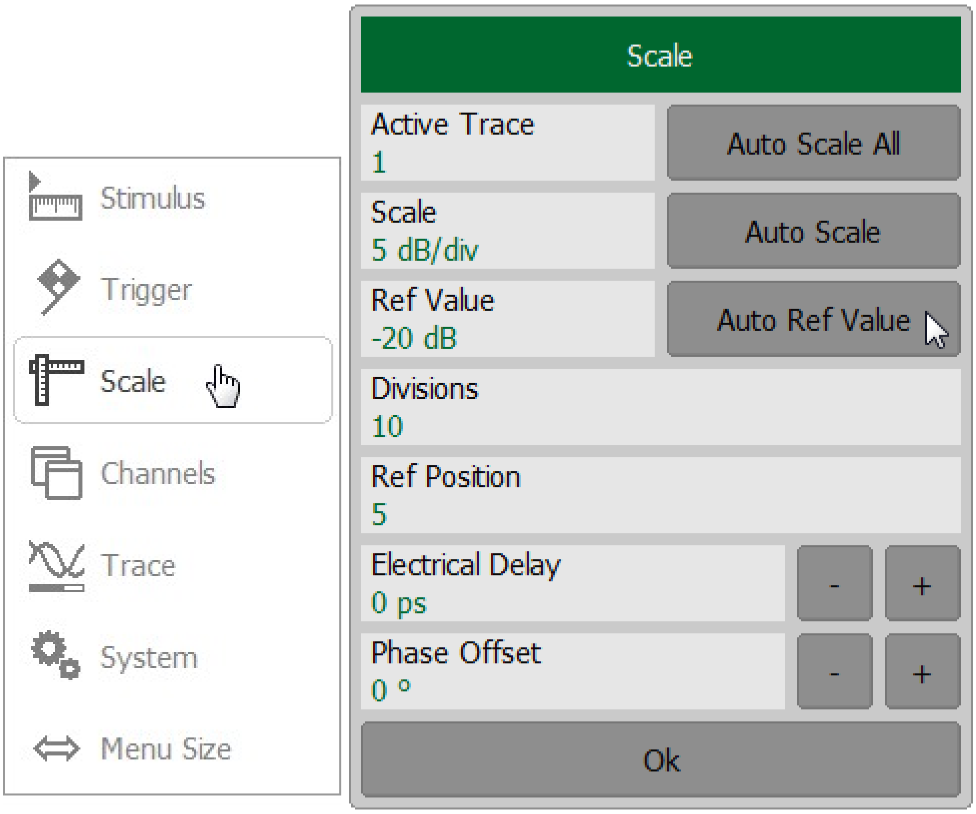
SCPI	DISPlay:WINDow:TRACe:Y:AUTO

NOTE	Setting the automatic scaling is possible using softkeys in top menu bar (See Top Menu Bar).

Reference Level Automatic Selection

This function automatically selects the reference level in rectangular coordinates. After selection, the trace of the measured value shifts vertically so that the reference level crosses the trace in the middle. The scale division is unaffected. The function can be applied to the active trace (See Active Trace Selection) or to all traces of the active channel.

To execute the automatic selection of the reference level, use the following softkeys: **Scale > Auto Ref Value**.



SCPI	DISPlay:WINDow:TRACe:Y:RLEVel:AUTO

NOTE	Setting the automatically selects the reference level is possible using softkeys in top menu bar (See Top Menu Bar).

Electrical Delay Setting

The electrical delay function compensates for the electrical delay of the trace measurement. This function is useful during measurements of phase deviations from linear, for example.

If the electrical delay setting is other than zero, the S-parameter value will be corrected in accordance with the following formula:

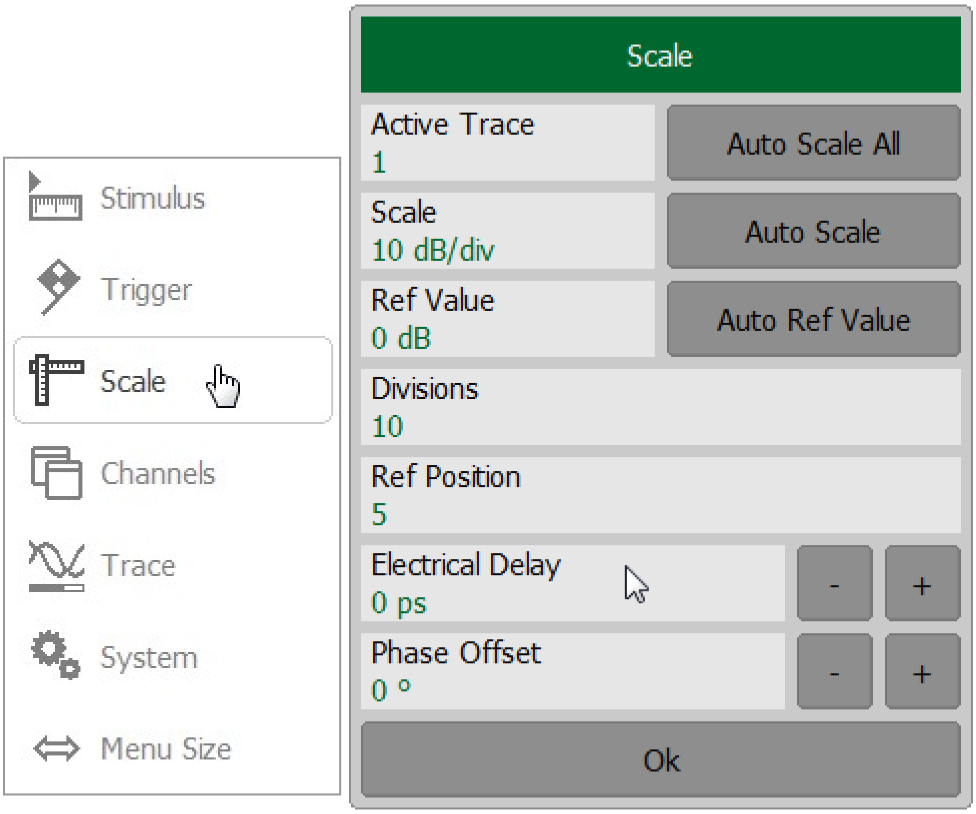
$$S = S_{meas} \cdot e^{j \cdot 2\pi \cdot f \cdot t},$$

where f — frequency, Hz,

t — electrical delay, sec.

The electrical delay is set for each trace independently. The trace to which the function is applied must be preselected as active (See Active Trace Selection).

To set the electrical delay, use the following softkey **Scale**. Then select the **Electrical Delay** field and enter the required value using the on-screen keypad.

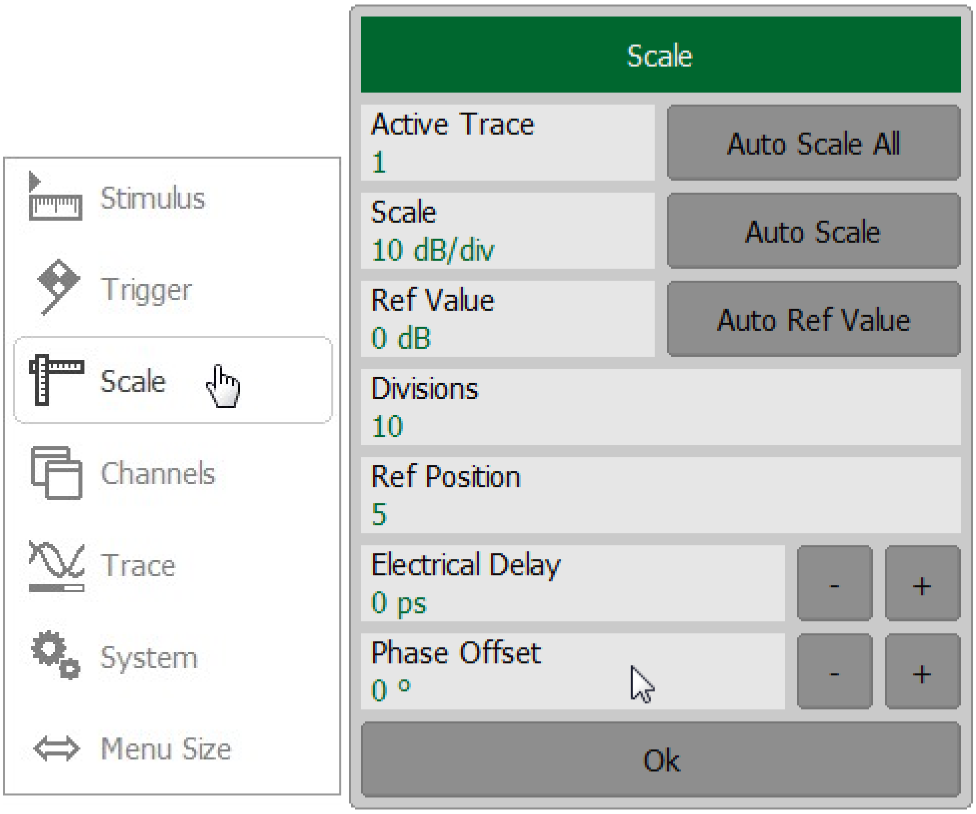


SCPI CALCulate:CORRection:EDELay:TIME

Phase Offset Setting

The phase offset function adds the constant offset to the phase of a trace. The value of the phase offset is set in degrees for each trace independently. The trace must be activated before setting the phase offset (See Active Trace Selection).

To set the phase offset, use the following softkey **Scale**. Then select the **Phase Offset** field and enter the required value using the on-screen keypad.



SCPI	CALCulate:CORRection:EDELay:PHASe

Measurement Optimization

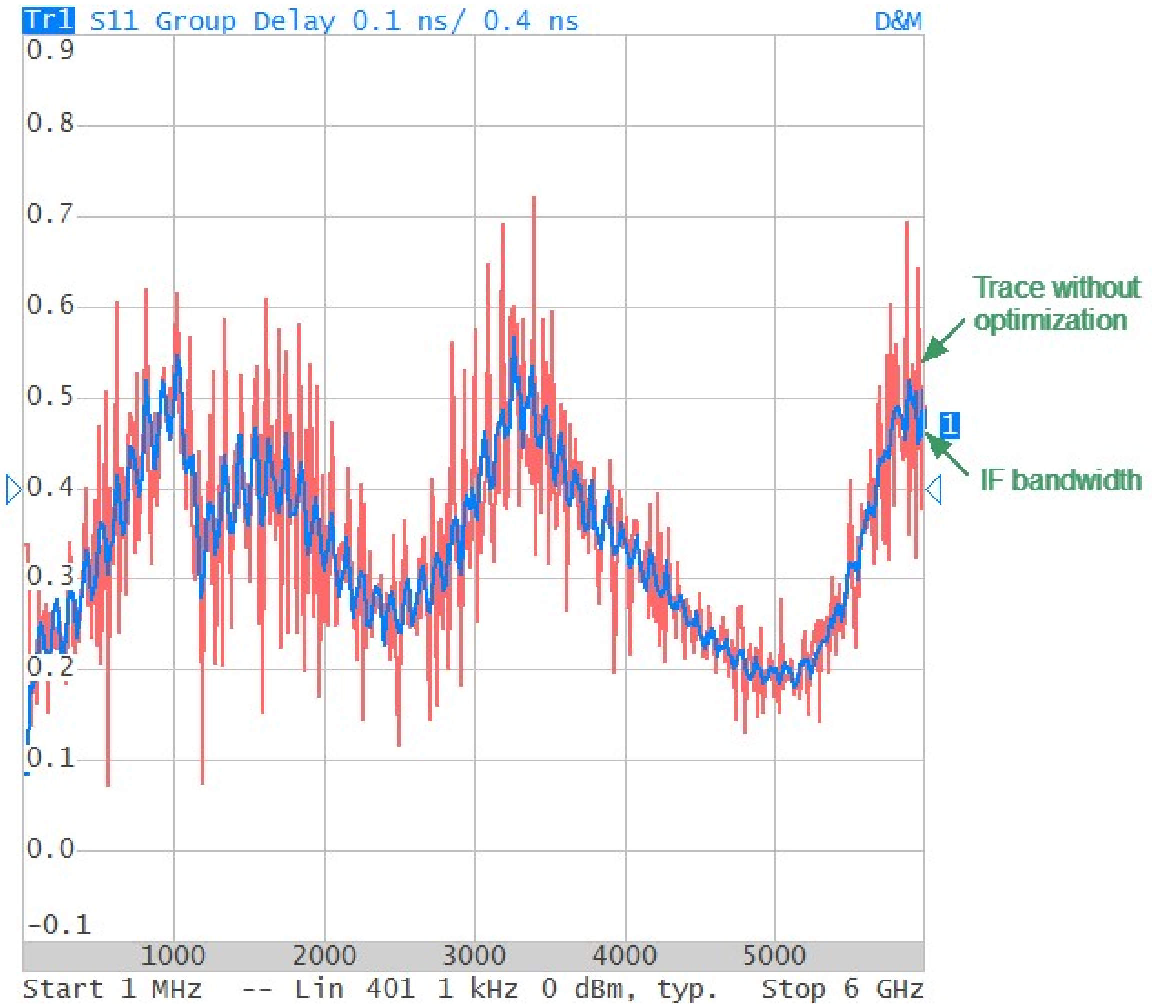
This section describes ways to optimize the measurement:

- Narrowing the IF bandwidth of measurement receivers increases the signal-to-noise ratio and extends the dynamic range of measurements. This increases the value of the sweep time. For a detailed description see IF bandwidth.

- Averaging allows to increase the signal-to-noise ratio and extend the dynamic range of the measurements. Averaging does not increase the value of the sweep time, but the averaging result is complete after N sweeps, where N is an averaging factor. For a detailed description see Averaging.

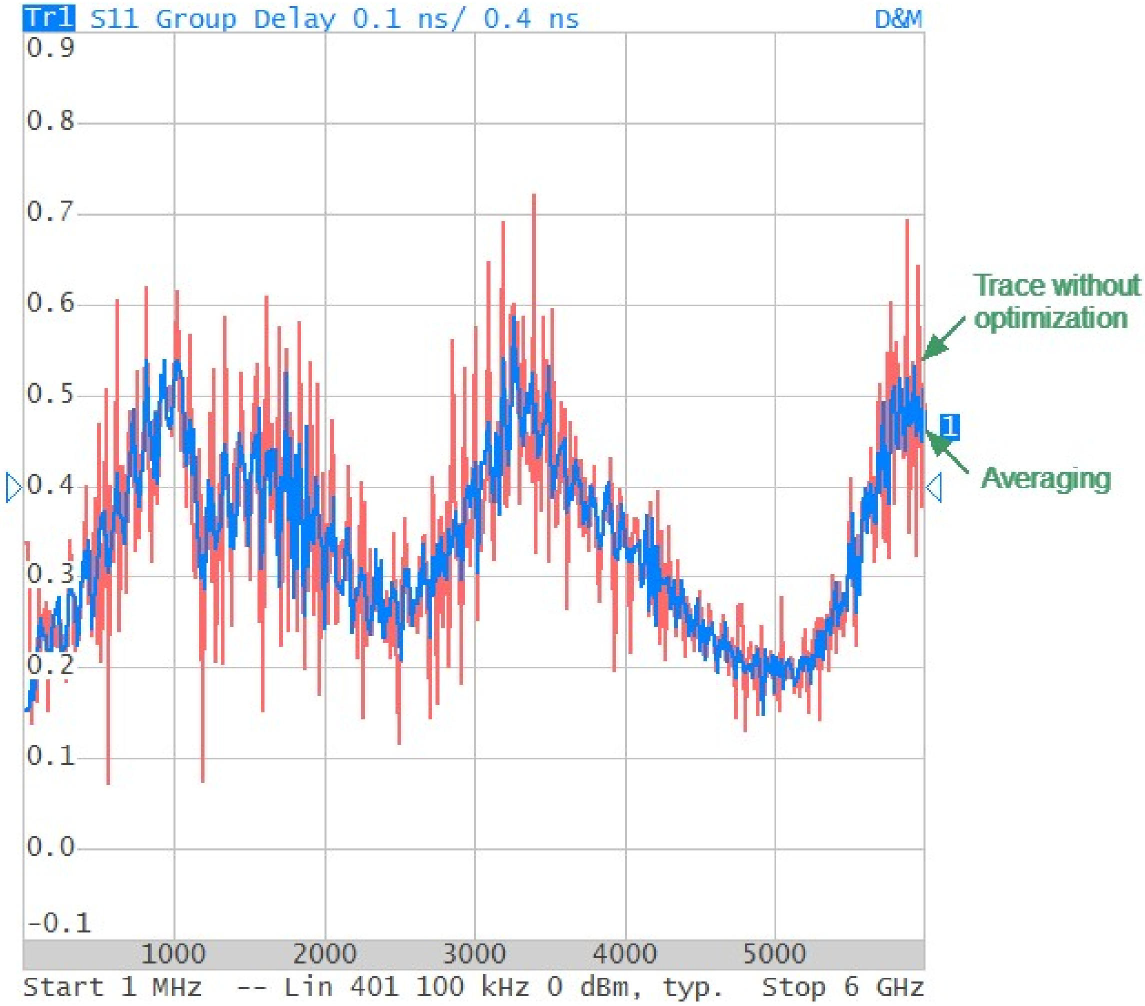
- Smoothing does not change the dynamic range of the measurements but reduces the noise emissions of the signal. For a detailed description see Smoothing.

The figures below show an examples of applying different filtering methods to the signal.



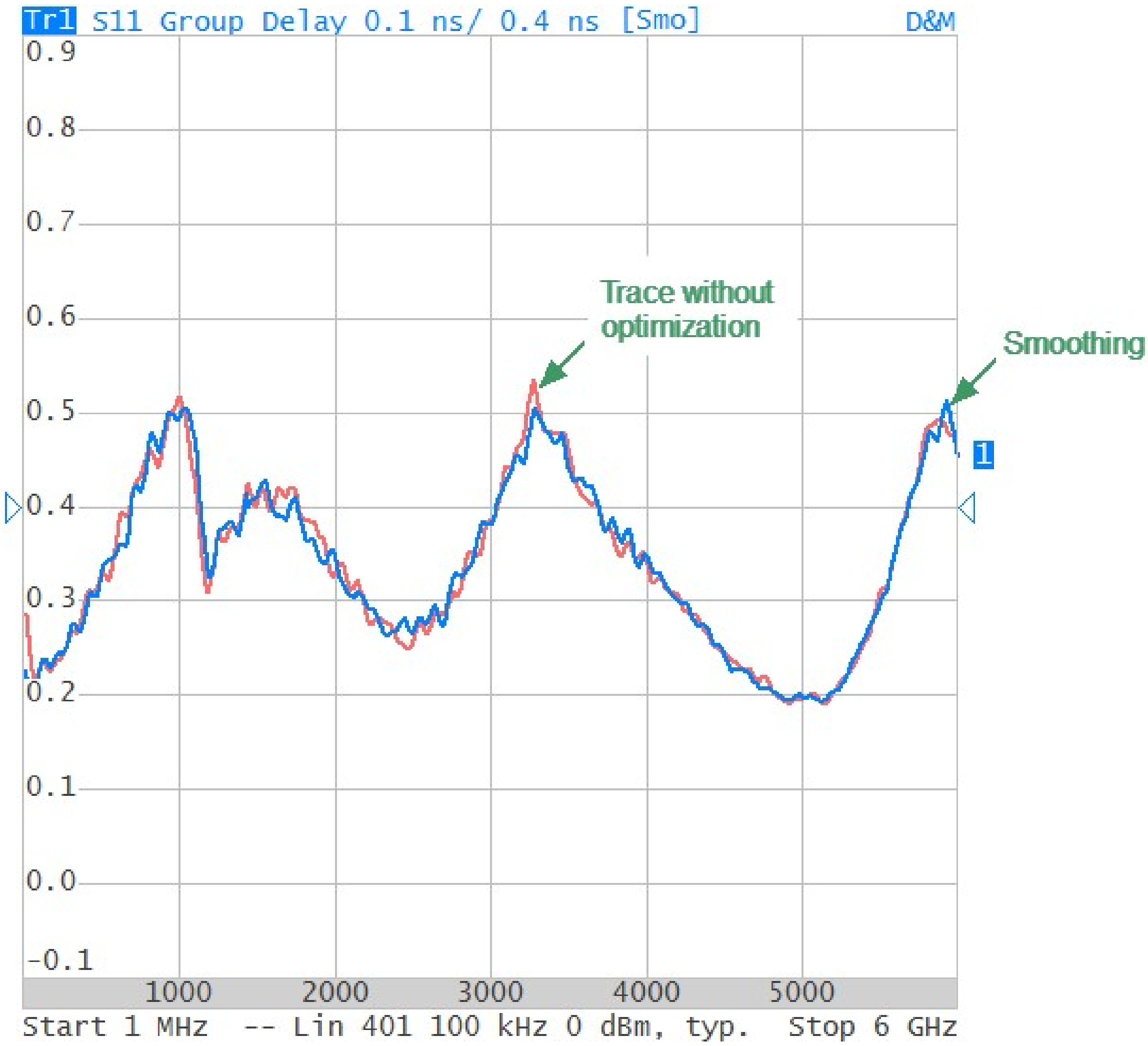
The IF bandwidth is reduced up 100 kHz to 1 kHz.

Example of the application of IF bandwidth optimization



The averaging factor is set to 10.

Example of the application of averaging optimization



The smoothing is applied with an aperture of 2%.

Example of the application of smoothing optimization

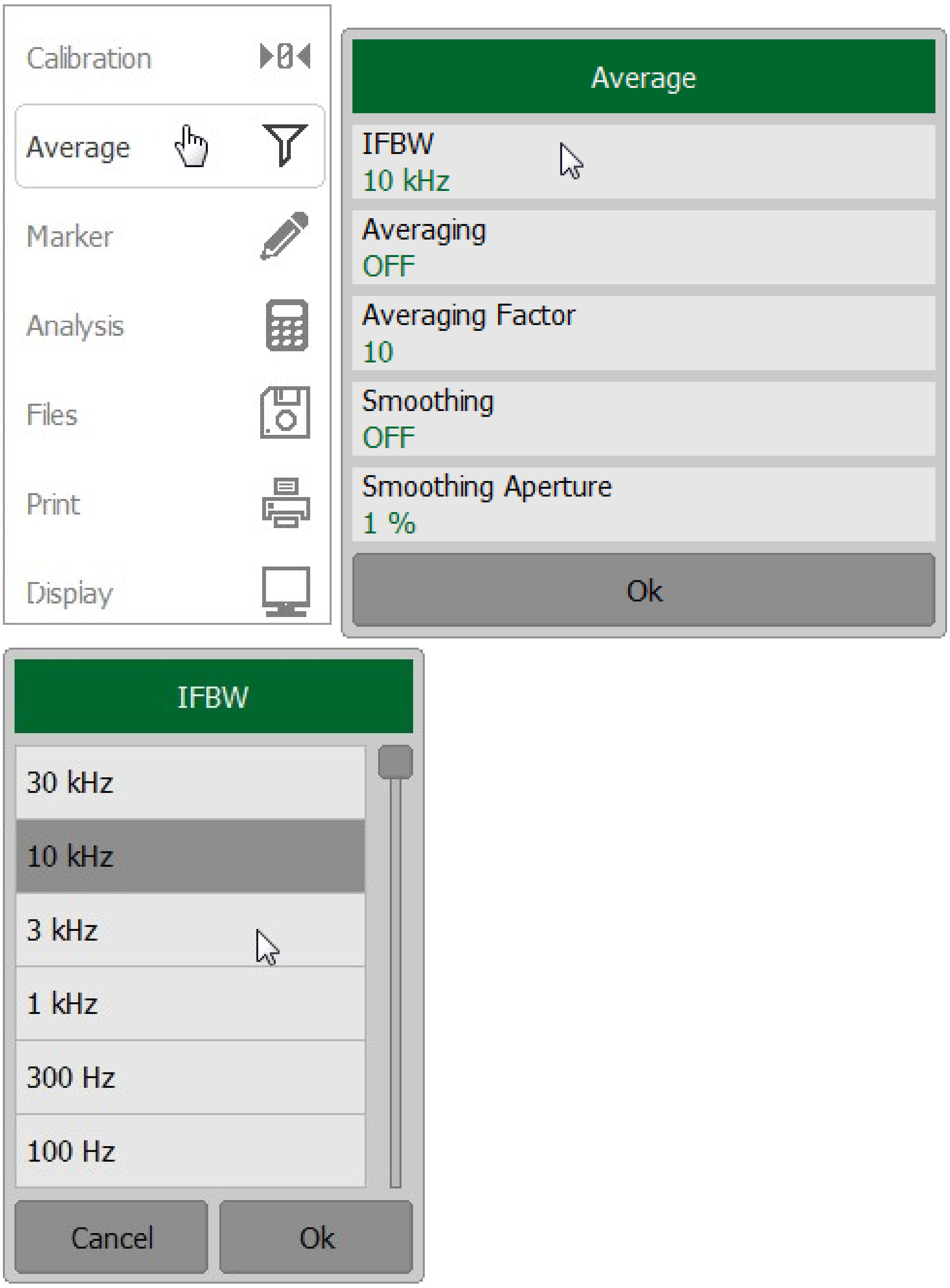
IF Bandwidth Setting

The IF bandwidth setting selects the bandwidth of the receivers. The IF bandwidth value takes value from the following series for 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz for all model and 100 Hz for R60/R180.

Narrowing the IF bandwidth increases the signal-to-noise ratio and extends the dynamic range of measurements. Narrowing the IF bandwidth by 10 will nominally extend the dynamic range by 10 dB. Narrowing the IF bandwidth increases the measurement time.

The IF bandwidth is set for each channel independently. The channel to which the function is applied must be preselected as active (See Active Channel Selection).

To set the IF bandwidth use the following softkey **Average** in the left menu bar. To set the IF bandwidth click on **IFBW** field and select the required value from the list. Complete the setting by clicking **Ok**.



SCPI	SENSe:BANDwidth, SENSe:BWIDth

NOTE	IF bandwidth can be set using the mouse (See IF Bandwidth Setting).

Averaging Setting

Averaging of each measurement point is performed over several sweeps. The benefits of the averaging function are similar to those of IF bandwidth narrowing. It increases the signal-to-noise ratio and extends the dynamic range of measurements.

Averaging of each measurement point is made across multiple sweeps in accordance with the following formula:

$$\begin{cases} M_i = S_i, \quad i = 0 \\ M_i = \frac{((n-1)\cdot M_{i-1} + S_i)}{n}, \quad i > 0,\ n = min\ (i + 1,\ N) \end{cases}$$

where M_i — i-th sweep averaging result,

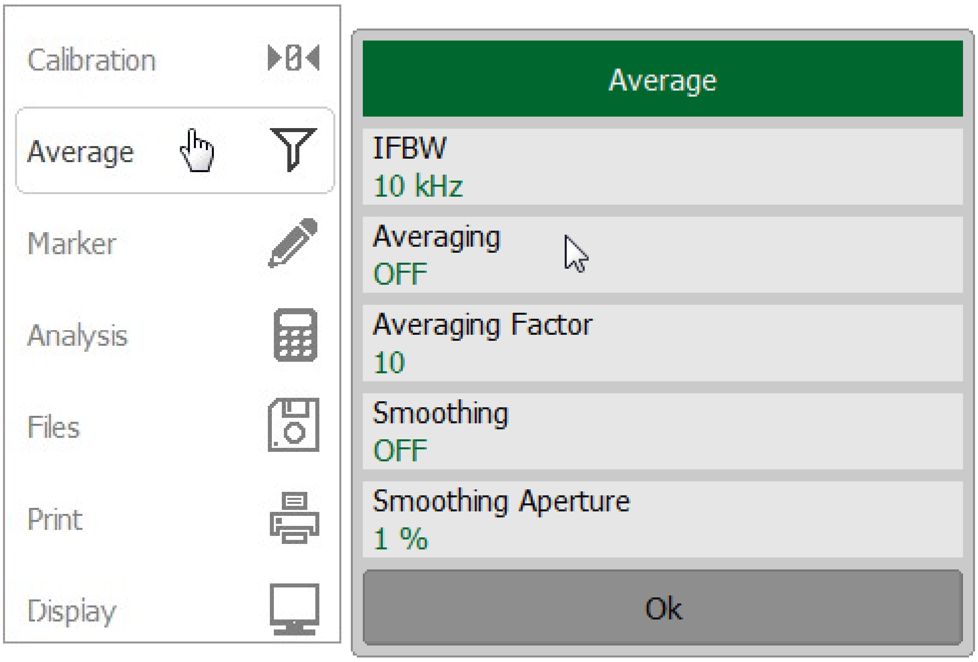
S_i — i-th sweep measurement parameter (S-parameter) value,

N — averaging factor from 1 to 999; the higher the factor value, the stronger the averaging effect.

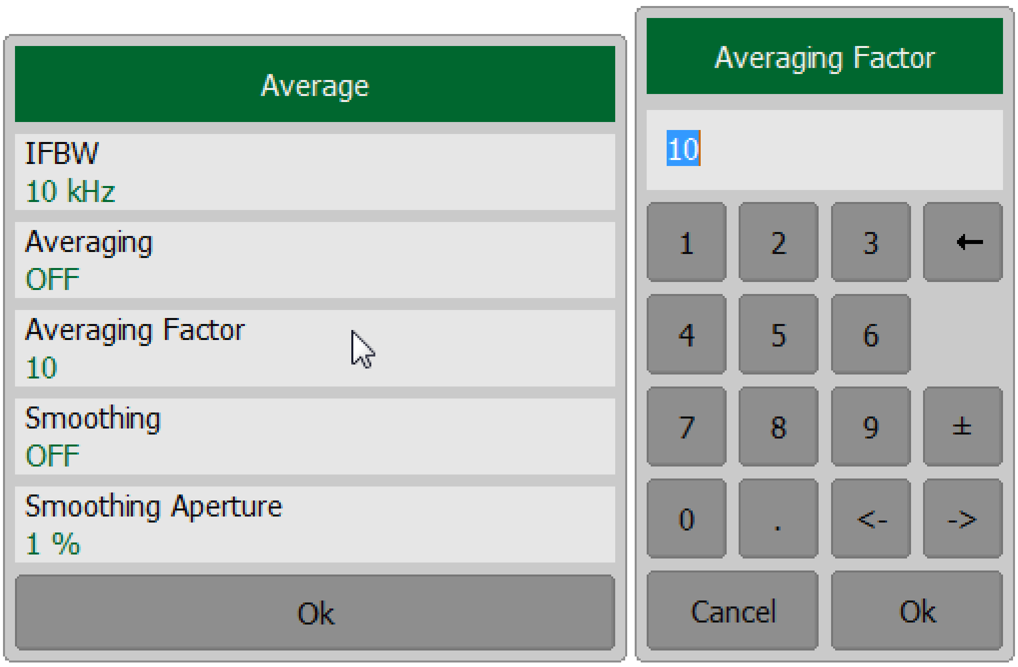
When the averaging function is enabled, the current number of iterations and the averaging factor, e.g. «9/10», will appear in the channel status bar. The averaging process is considered stable when the two numbers are equal.

The averaging should be set for each channel individually. The channel to which the function is applied must be preselected as active (See Active Channel Selection).

To set the averaging use the following softkey **Average** in the left menu bar. To toggle the averaging function ON/OFF, click on **Average** field.



To set the averaging factor click on **Averaging Factor** field and enter the required value using the on-screen keypad.



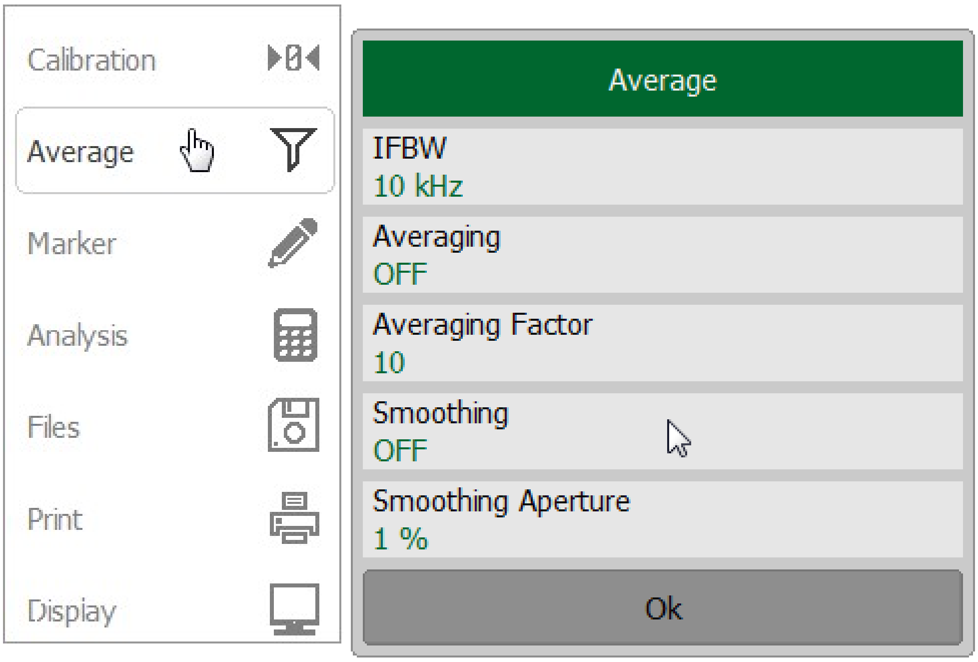
SCPI SENSe:AVERage, SENSe:AVERage:COUNt

Smoothing Setting

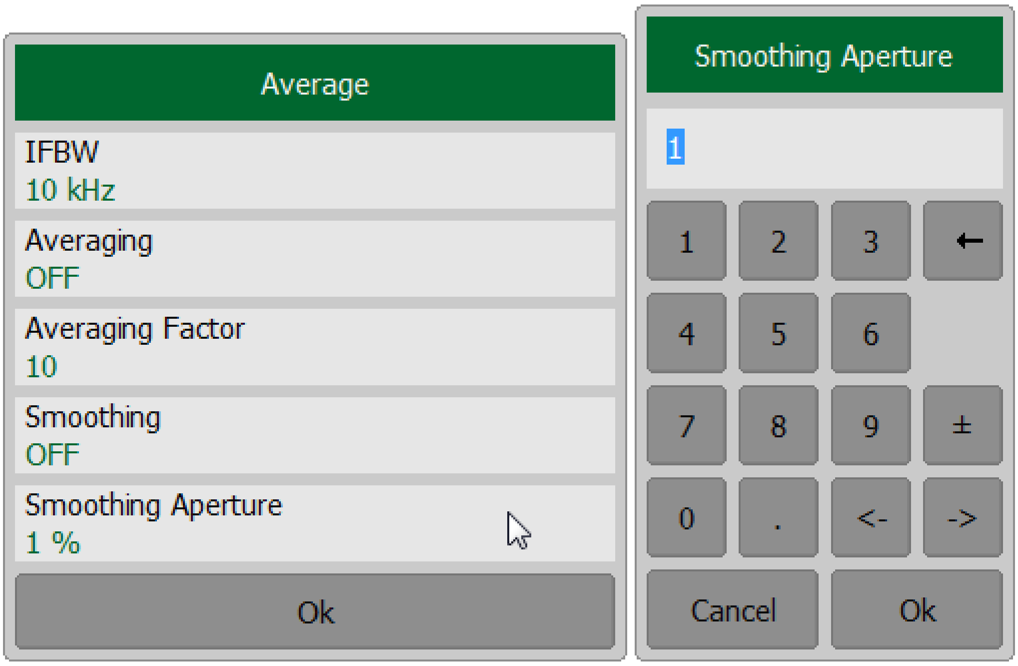
Smoothing averages the adjacent points of the trace by the moving window. The window aperture is set as a percent of the total number of trace points.

Smoothing does not increase the dynamic range of the Analyzer, nor does it increase measurement time. Smoothing helps to reduce noise bursts. Smoothing is set for each trace independently. The trace to which the function is applied must be preselected as active (See Active Trace Selection).

To set the averaging use the following softkey **Average** in the left menu bar. To toggle the averaging function ON/OFF, click on **Smoothing** field.



To set the smoothing aperture click on **Smoothing Aperture** field and enter the required value using the on-screen keypad.



SCPI CALCulate:SMOothing, CALCulate:SMOothing:APERture

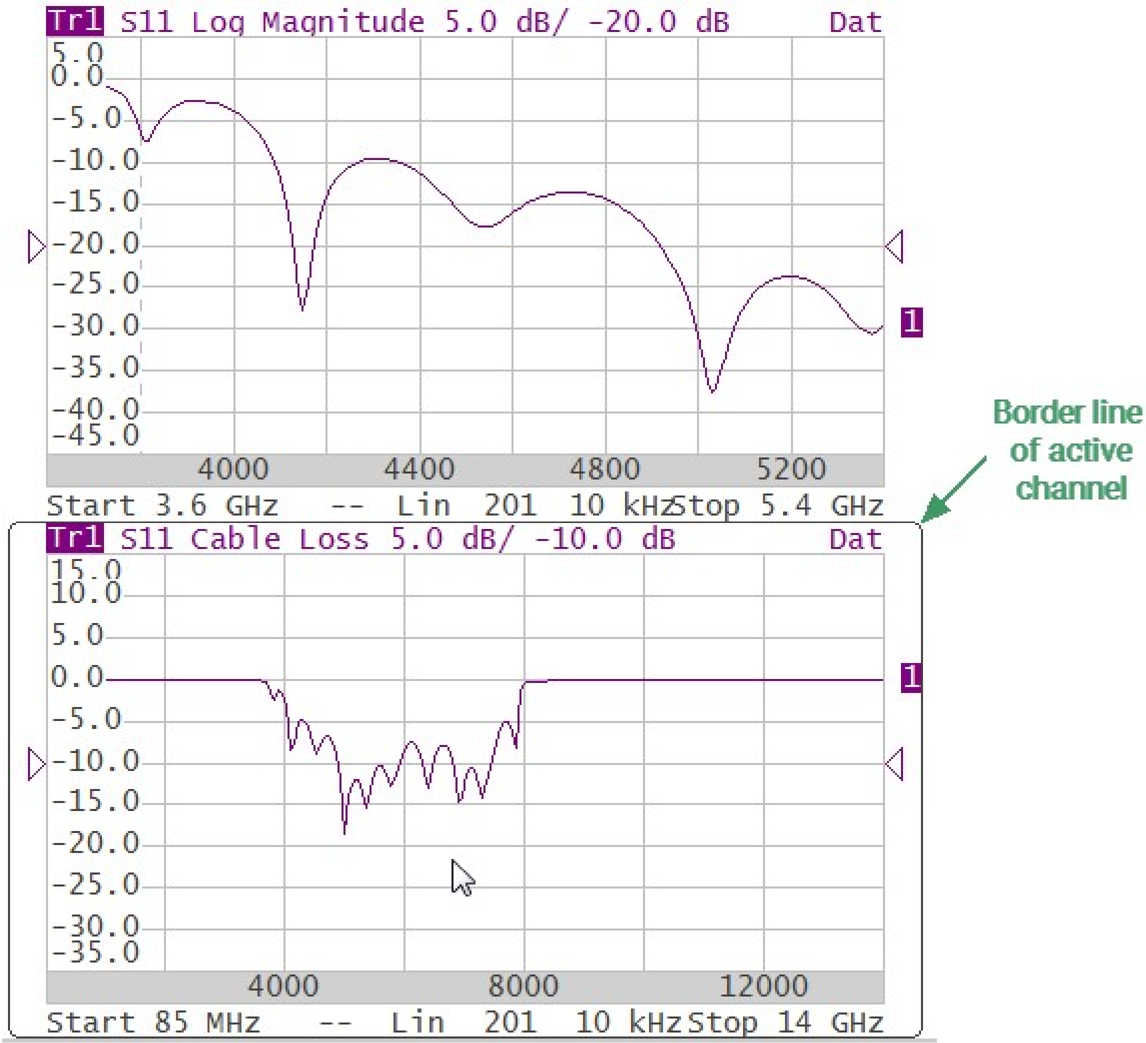
Quick Settings Using a Mouse

This section describes mouse operations, which allows to set the channel parameters quickly and easily. Hovering a mouse pointer over a changeable field in the channel window will lead to changing cursor appearance and prompt popping up.

NOTE	The manipulations described in this section will help to perform the most frequently used settings only. All the channel functions can be accessed via the softkey menu.

Active Channel Selection

The active channel can be selected when two or more channel windows are open. The border line of the active window will be highlighted in a light color. To activate another window, click inside its area.

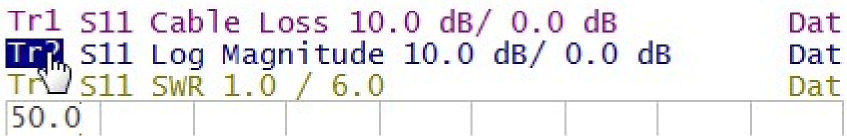


Active Channel Selection

The active channel can be selected using softkeys (See Selection of Active Channel).

Active Trace Selection

The active trace can be selected if the active channel window contains two or more traces. The active trace name is highlighted. To activate a trace, click on the required trace status line, or on any item (trace, marker) having the same color. In the example in the figure below «Tr2» is selected as the active trace.



Active Trace Selection

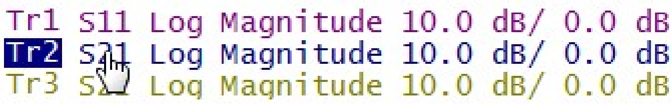
Active trace can be selected using softkeys (See Selection of Active Trace).

Measured Parameter Setting

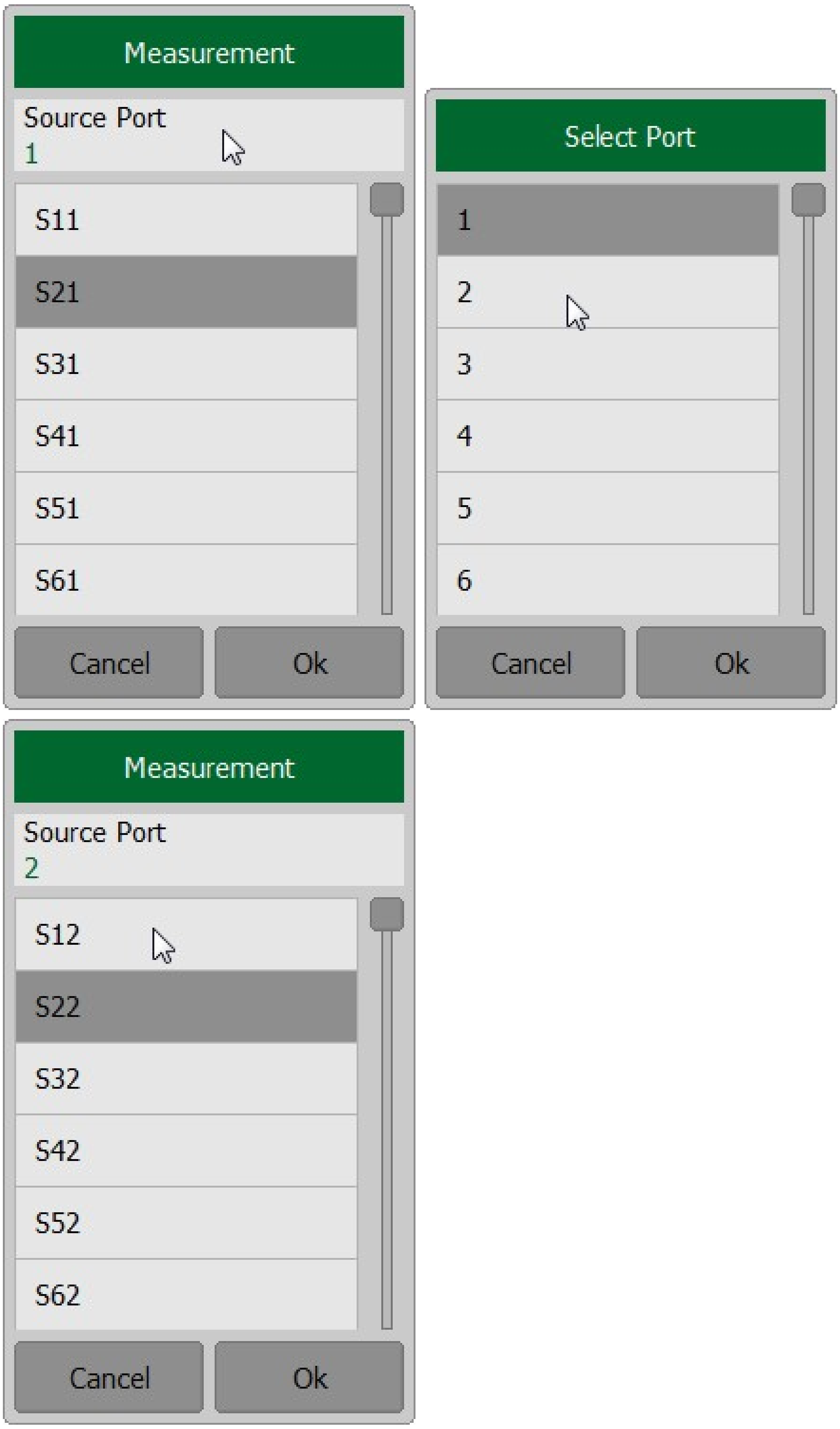
NOTE	This section is for RNVNA only.

A measured parameter (S11, S21, S12 , S22 etc.) is set for each trace. Before selecting the measured parameter, activate the trace first (See Active Trace Selection).

To assign the measured parameters to a trace, click on measured parameter in the trace status field.



Click on **Source Port** field and select the required port number in the dialog. Click on the S-parameter type in the trace status line and select the required parameter in the Measurement dialog. Complete the setting by clicking **Ok** softkey.

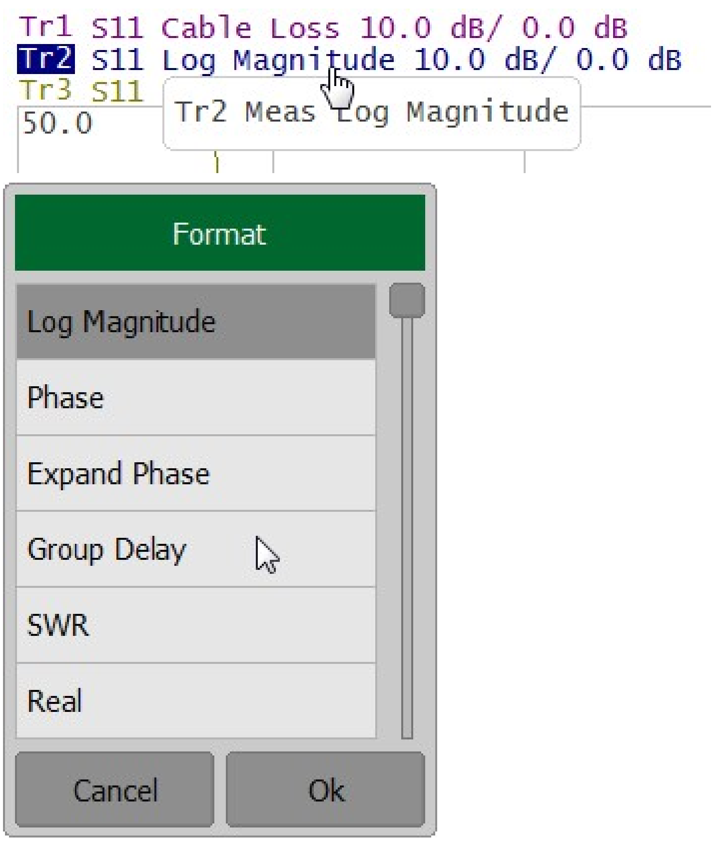


Active measured parameter can be selected using softkeys (See S-Parameters).

Display Format Setting

A trace display format is set for each trace. Before selecting the trace display format, activate the trace first (See Active Trace Selection).

To select the trace display format, click on the format name in the trace status line. Select the required format in the **Format** dialog and complete the setting by clicking **Ok** softkey.



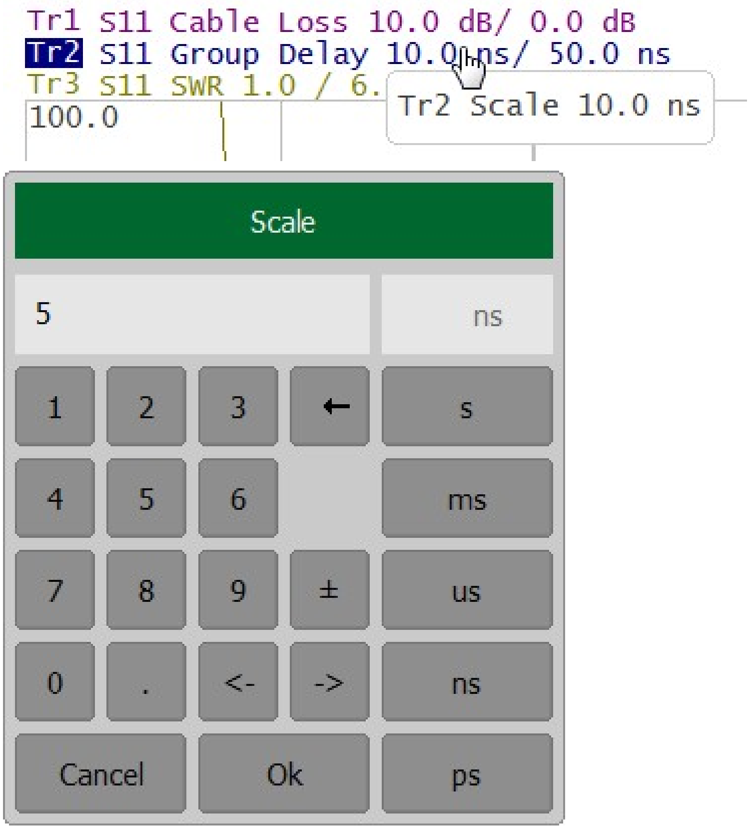
The display format can be set using softkeys (See Format Setting).

Trace Scale Setting

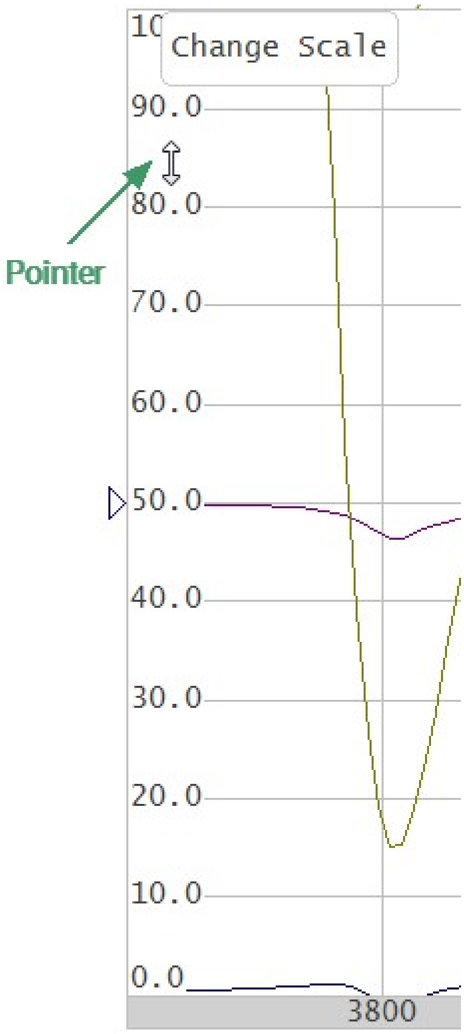
The trace scale, also known as the vertical scale division value, can be set by either of two methods.

The first method: click on the trace scale field in the trace status line and enter the required numerical value.

To select the trace scale, click in the trace scale field of the trace status line. Enter the required numerical value using the on-screen keypad and complete the setting by clicking **Ok** softkey.



The second method: move the mouse pointer over the vertical scale until the pointer icon becomes as shown in the figure. Left click and drag away from the scale center to enlarge the scale, or toward the scale center to reduce the scale.



Trace scale setting on the vertical scale

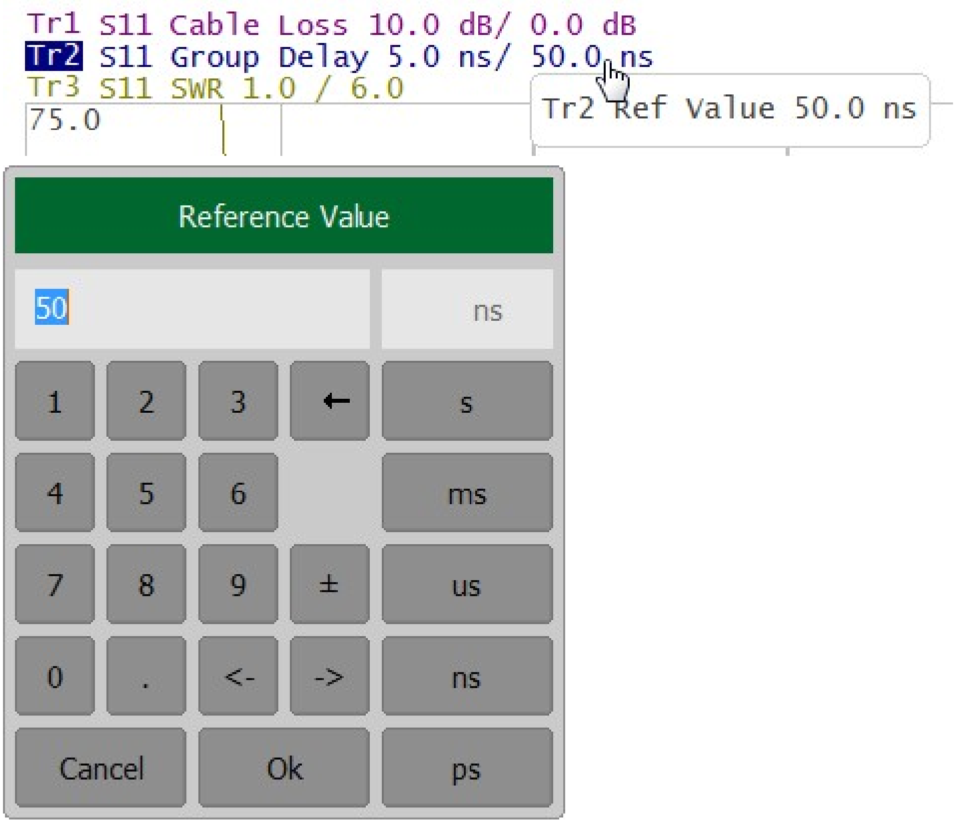
The trace scale can be set using softkeys (See Rectangular Scale).

Reference Level Setting

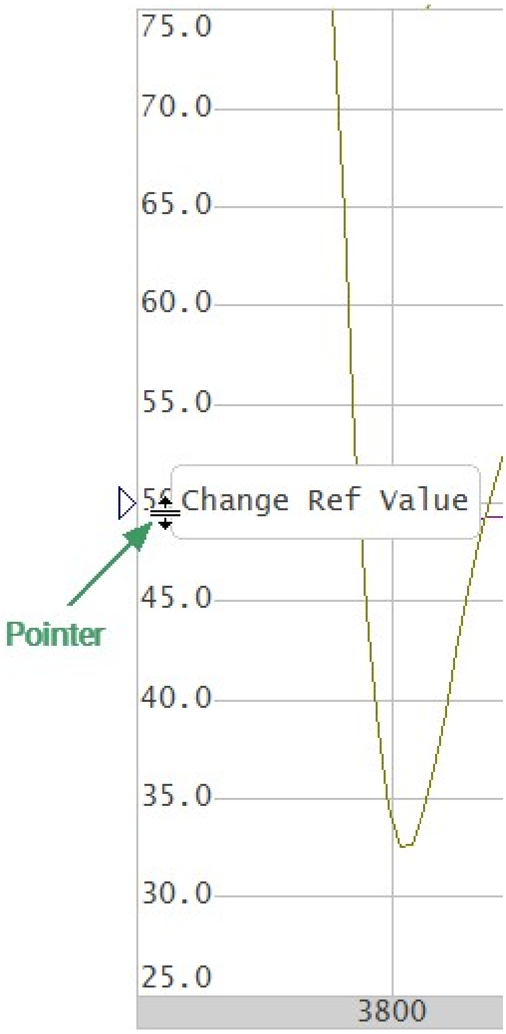
The value of the reference level, which is indicated on the vertical scale by the «▷» and «◁» symbols, can be set by either of two methods.

The first method: click on the reference level field in the trace status line and enter the required numerical value.

To set the value of the reference level click on the reference level field in the trace status line. Enter the required numerical value using the on-screen keypad and complete the setting by clicking **Ok** softkey.



The second method: move the mouse pointer over the vertical scale until the pointer icon becomes as shown in the figure. The pointer should be placed in the center part of the scale. Left click and drag up to increase the reference level value, or down to reduce the value.



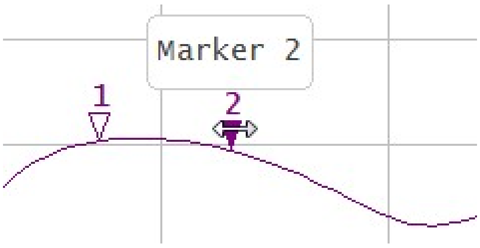
Reference level setting on the vertical scale

The value of the reference level can be set using softkeys (See Rectangular Scale).

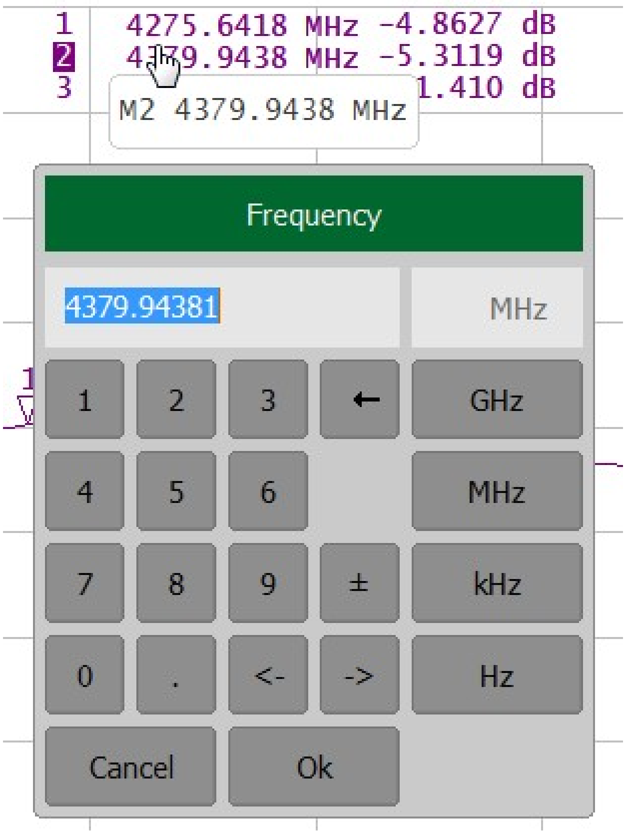
Marker Stimulus Value Setting

The marker stimulus value can be set by dragging the marker or by entering the value from the on-screen keypad.

To drag the marker, move the mouse pointer to one of the marker indicators. The marker will become active, and a pop-up hint with its name will appear near the marker. The marker can be moved either by dragging its indicator or its hint area.



To enter the numerical value of the stimulus in the marker data click on the stimulus value. Then enter the required value using the on-screen keypad.



The marker stimulus value can be set using softkeys (See Marker Stimulus Value Setting).

Switching Between Start/Center and Stop/Span Modes

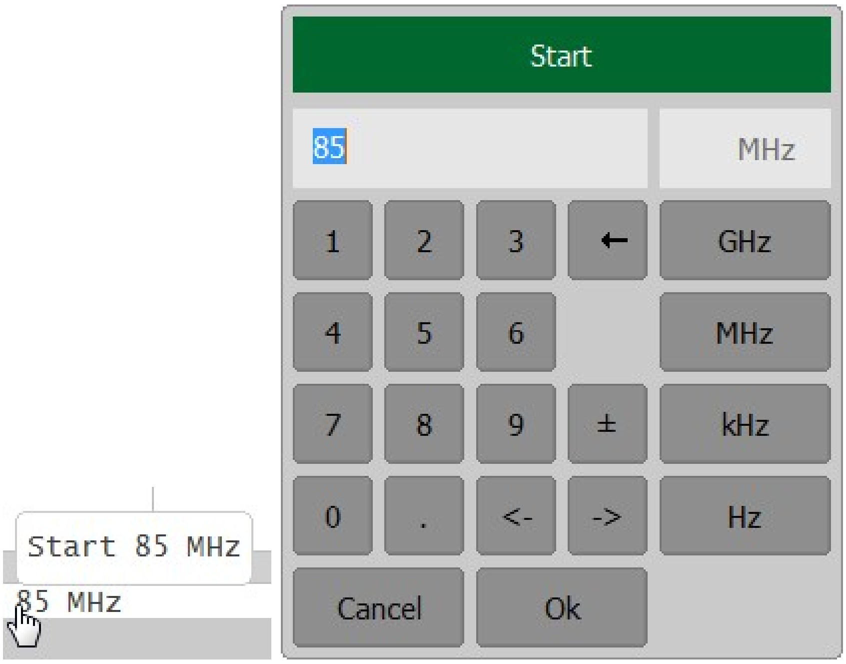
To switch between the modes, Start/Center and Stop/Span, click on the respective field of the channel status bar. Clicking the label «Start» changes it to «Center», and the label «Stop» will change to «Span».

Switching between Start/Center and Stop/Span modes in channel status bar

The layout of the stimulus scale will be changed correspondingly. Switching between modes is possible using softkeys (See Sweep Range).

Start/Center Value Setting

To enter the **Start/Center** numerical values click on the respective field in the channel status bar. Then enter the required value using the on-screen keypad.



The Start/Center values can be set using softkeys (See Sweep Range).

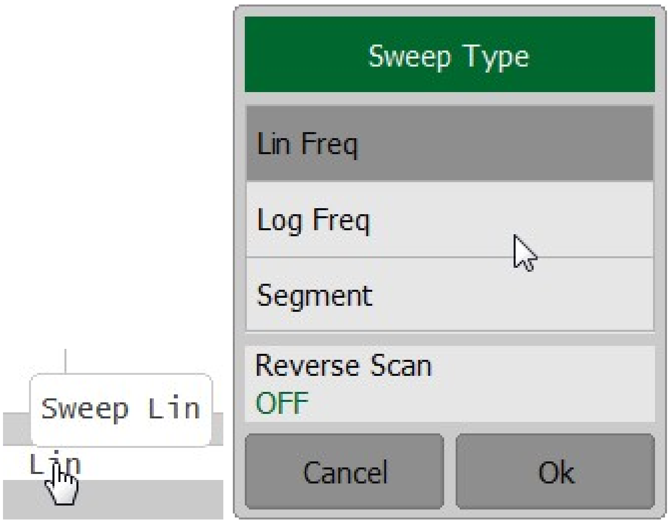
Stop/Span Value Setting

To enter the **Stop/Span** numerical values click on the respective field in the channel status bar. Then enter the required value using the on-screen keypad.

The Stop/Span values can be set using softkeys (See Sweep Range).

Sweep Type Setting

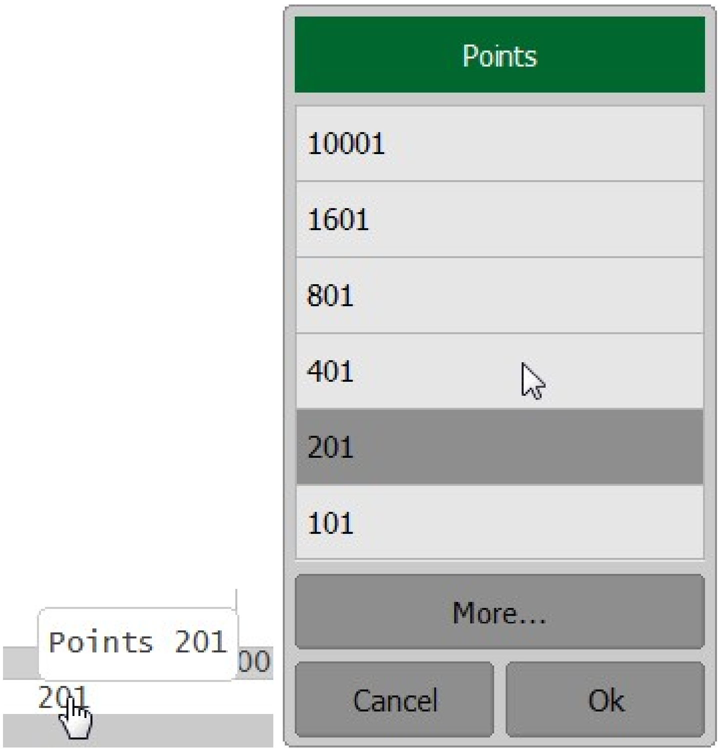
To set the sweep type click in the respective field of the channel status bar. Select the required value in the **Sweep Type** dialog and complete the setting by clicking **Ok** softkey.



The sweep type can be selected using softkeys (See Sweep Type).

Number of Points Setting

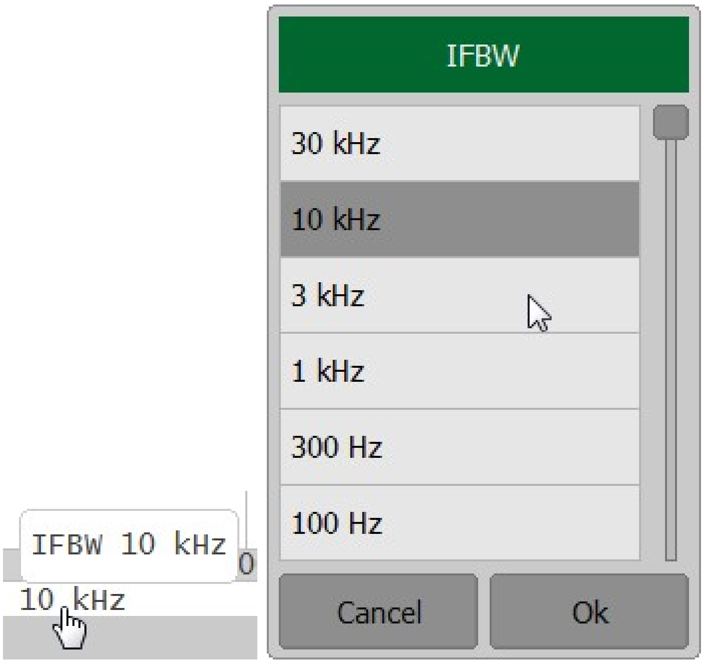
To enter the number of sweep points, click in the respective field of the channel status bar. Select the required value in the **Points** dialog and complete the setting by clicking **Ok** softkey.



The number of points can be set using softkeys (See Number of Points).

IF Bandwidth Setting

To enter the IF bandwidth click in the respective field of the channel status bar. Select the required value in the **IFBW** dialog and complete the setting by clicking **Ok**.

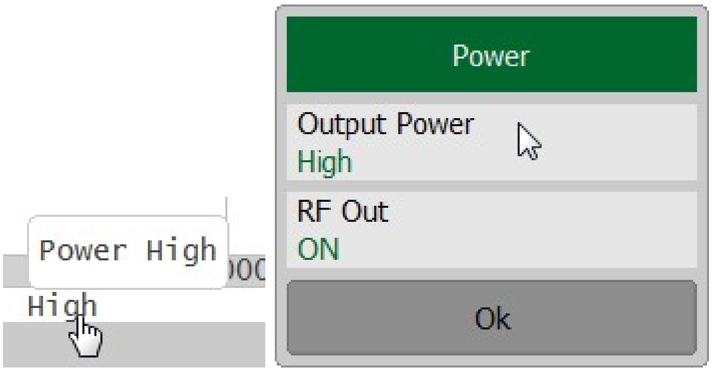


IF bandwidth can be set using softkeys (See IF Bandwidth Setting).

Power Level/RF Out Setting

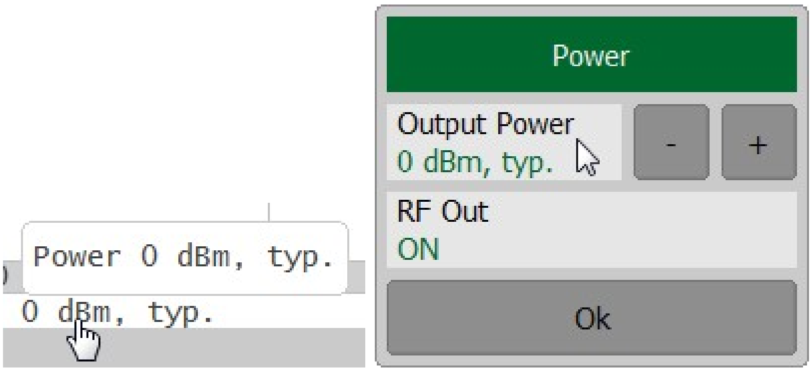
R54 and R140 models

To set the output power level click in the respective field of the channel status bar. It allows to switch between high and low power settings.



R60 and R180 models

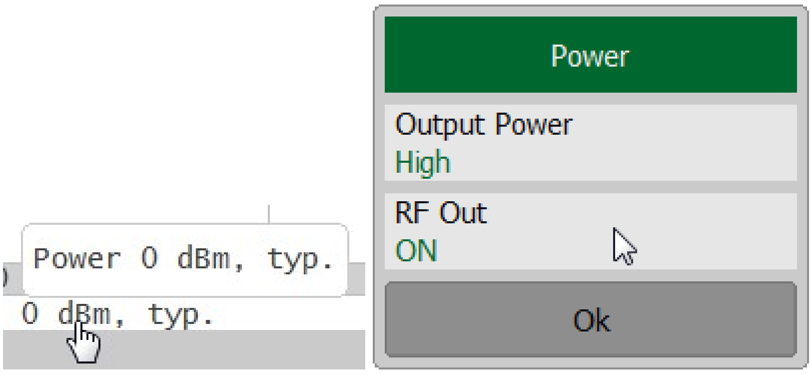
To turn ON/OFF RF Out click in the respective field of the channel status bar. Then click **RF Out** field.



The Power Level can be set using softkeys (See Stimulus Power).

RF Out

To turn ON/OFF RF Out the click in the respective field of the channel status bar. Then enter the required value of the output power.



The RF Out can be set using softkeys (See RF Out).

Calibration and Calibration Kits

Measurement accuracy is affected by errors introduced by the Analyzer and measurement setup. The nature of these errors is varied — some are systematically repeated, and some are random. Calibration is a process used to evaluate systematically repeated errors and mathematically exclude them from the measurement results in the correction process.

NOTE Be sure to properly calibrate if accurate measurements are required. Only a properly calibrated instrument provides the accuracy specified in the data sheet.

The section describes information about calibration, calibration kits and automatic calibration module (ACM):

- General information about calibration (See General Information).
- Working with calibration standards and calibration kits (See Calibration Standards and Calibration Kits).
- Calibration method and procedures (See Calibration Methods and Procedures).
- Working with the automatic calibration module (ACM), which allows for simplification and speeding up of the analyzer calibration process (See Automatic Calibration Module).

General Information

This section details general information about calibration:

- Guidelines for calibration (See Basic Calibration Guidelines).
- Description of measurement errors (See Measurement Errors).
- Error models (See Error Model).
- Calibration steps (See Calibration Steps).

Basic Calibration Guidelines

Follow the guidelines below to perform calibration correctly and reduce accidental errors. Observance of the guidelines will ensure the specified accuracy of the device.

General Guidelines

- Select all fixtures for connecting the DUT and assemble the measuring setup before starting the calibration. Perform calibration in the plane passing through the connectors to which the DUT is connected.
- Calibrate the measuring setup at the same stimulus parameters (frequency range, number of points, stimulus power) at which measurements will be performed. Changing these parameters after calibration may significantly reduce the accuracy of the measurements.
- During calibration, do not set the IF bandwidth wider than planned for measurements.
- Choose a calibration kit according to the type and gender of the DUT connectors.
- The frequency range of the selected calibration kit must correspond to the range in which the calibration is performed.
- When choosing a calibration kit, note that for full one-port calibration the most accuracy will be provided by the calibration kit, in which the parameters of the standards are most accurately defined.
- The calibration kit selected in the Analyzer software must strictly correspond to the one actually being used. The mismatch is unacceptable.
- For easy measurements, it is possible to create custom calibration kits from the available standards or specially manufactured calibration kits to solve specific measuring tasks. To include a standard in a calibration kit, calculate or measure its parameters using a high precision measuring tool. Create a description in the form of a model of standard or S-parameter table of a standard and download this description to the Analyzer software.
- The choice of calibration method depends on the measurement being performed, its accuracy requirements, the permissible calibration labor intensity, and the availability of calibration kits.
- If an additional component (cable, attenuator, adapter) is added to the measurement setup after calibration, recalibrate. Instead of recalibration, it is possible to use the de-embedding function or the port extension function to compensate for the added electrical length (delay) and losses.

Recommendations for Reducing Random Measurement Errors

- To reduce errors introduced by the instrument noise of the Analyzer, it is recommend to increase the source power of the stimulus signal, narrow the IF bandwidth, and apply averaging over several measurement sweep values.

- To reduce errors in the temperature drift of the electrical characteristics of the Analyzer and the components of the measuring setup, it is recommended:

  - To perform measurements in a room with a stable, controlled temperature, at which the technical characteristics of the Analyzer are guaranteed.
  - To recalibrate if the room temperature has changed significantly after calibration.
  - To warm-up the Analyzer for a time determined in the specification before starting the calibration.
  - To keep the calibration standards unpacked in the room where the measurements are taken to stabilize the parameters, before starting the calibration.

- To reduce the connector repeatability errors, it is recommended:

  - To apply proper connector care — connectors must be good and clean (See Connector Care).
  - To use a special wrench with a standardized tightening torque, when connecting the DUT and calibration standards to measurement connectors.
  - To not change the position of the components of the measuring setup in space during or after calibration.
  - To recalibrate if setup components have been rearranged.

Measurement Errors

S-parameter measurements are influenced by various measurement errors, which can be broken down into two categories:

- systematic errors
- random errors

Random errors comprise errors such as noise fluctuations and thermal drift in electronic components, changes in the mechanical dimensions of cables and connectors subject to temperature drift, repeatability of connections, and cable bends. Random errors are unpredictable and hence cannot be estimated and eliminated in calibration. Random errors can be reduced by having the stimulus power at the correct setting, IF bandwidth narrowing, sweep averaging, maintaining a constant environment temperature, observance of the Analyzer warm-up time, careful connector handling, and avoiding cable bending after calibration.

Random errors and related methods of correction are not mentioned further in this section.

Systematic errors are errors caused by imperfections in the components of the measurement system (see Systematic Errors). Such errors occur repeatedly, and their characteristics do not change with time. Systematic errors can be determined and then reduced by performing a mathematical correction of the measurement results.

Calibration is the process of measuring precision devices with predefined parameters to determine systematic errors, and such precision devices are called **calibration standards**. The most commonly used calibration standards are SHORT, OPEN, and LOAD.

The process of mathematical compensation of the systematic errors is called **error correction**.

Systematic Errors

The systematic measurement errors of the Analyzer are divided into the following categories according to their source:

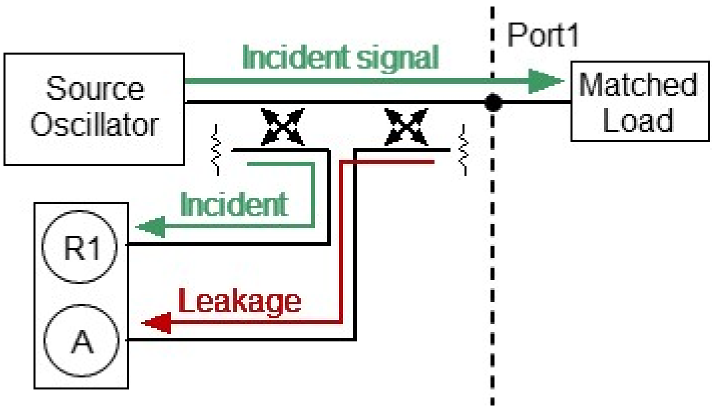
- directivity
- source match
- load match
- reflection tracking
- transmission tracking
- isolation

The measurement results before error correction are called **uncorrected**.

The residual values of the systematic measurement errors after error correction are called **effective**.

Directivity Error

A directivity error (**Ed**) is caused by incomplete separation of the incident signal from the reflected signal by the directional coupler in the source port. In this case, part of the incident signal energy enters the receiver of the reflected signal. Directivity errors do not depend on the characteristics of the DUT, and usually have a greater effect on reflection measurements.

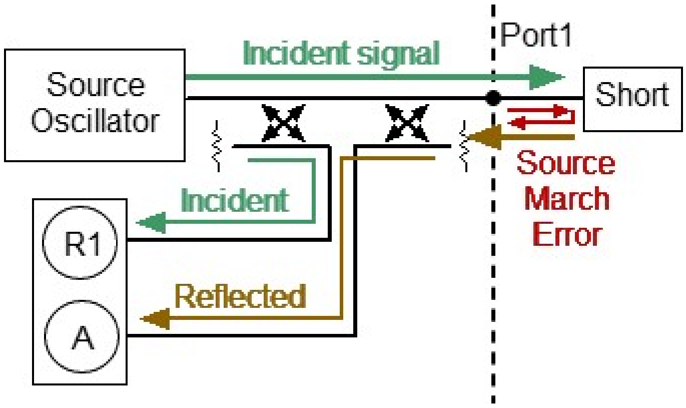


Directivity error

Source Match Error

A source match error (**Es**) is caused by a mismatch between the source port and the input of the DUT. In this case, part of the signal reflected by the DUT reflects at the source port and re-enters the input of the DUT. The error affects both reflection measurement and transmission measurement. Source match errors depend on the difference between the input impedance of the DUT and test port impedance when it functions as a signal source.

Source match errors heavily affect measurements of a DUT with poor input matching.

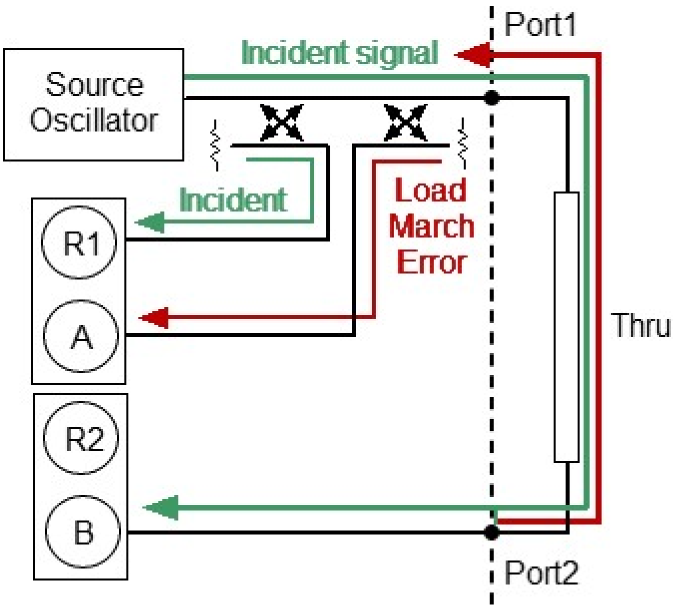


Source match error

Load Match Error

A load match error (**El**) is caused by a mismatch between the receiver port and the output of the DUT. In this case, part of the signal transmitted through the DUT reflects at the receiver port and returns to the output of the DUT. The error occurs during transmission measurements and reflection measurements (for a 2-port DUT). Load match errors depend on the difference between output impedance of the DUT and test port impedance when used as a signal receiver.

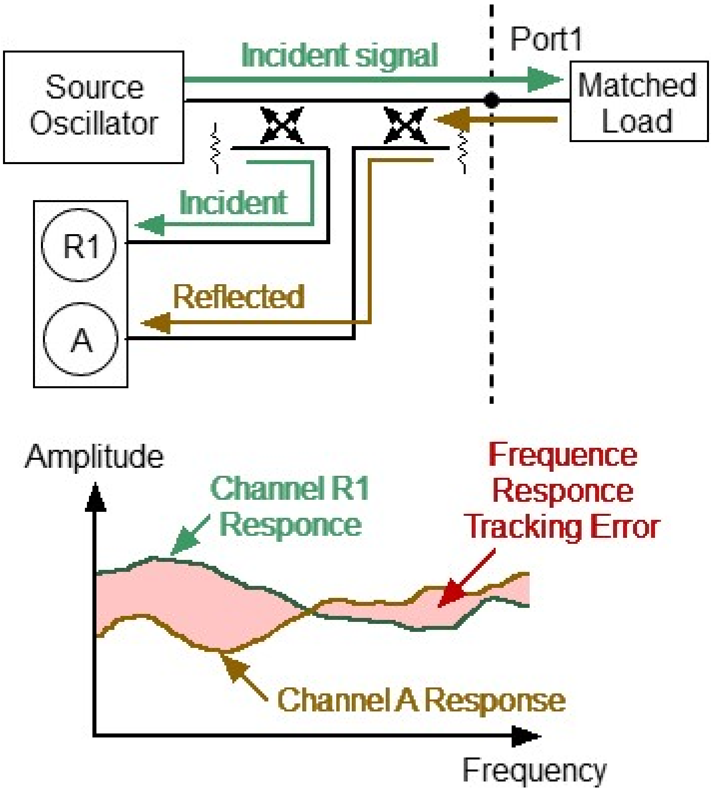
In transmission measurements, the load match error has considerable influence if the output of the DUT is poorly matched. In reflection measurements, the load match error has considerable influence in cases of poor output match and low attenuation between the output and input of the DUT.



Load match error

Reflection Tracking Error

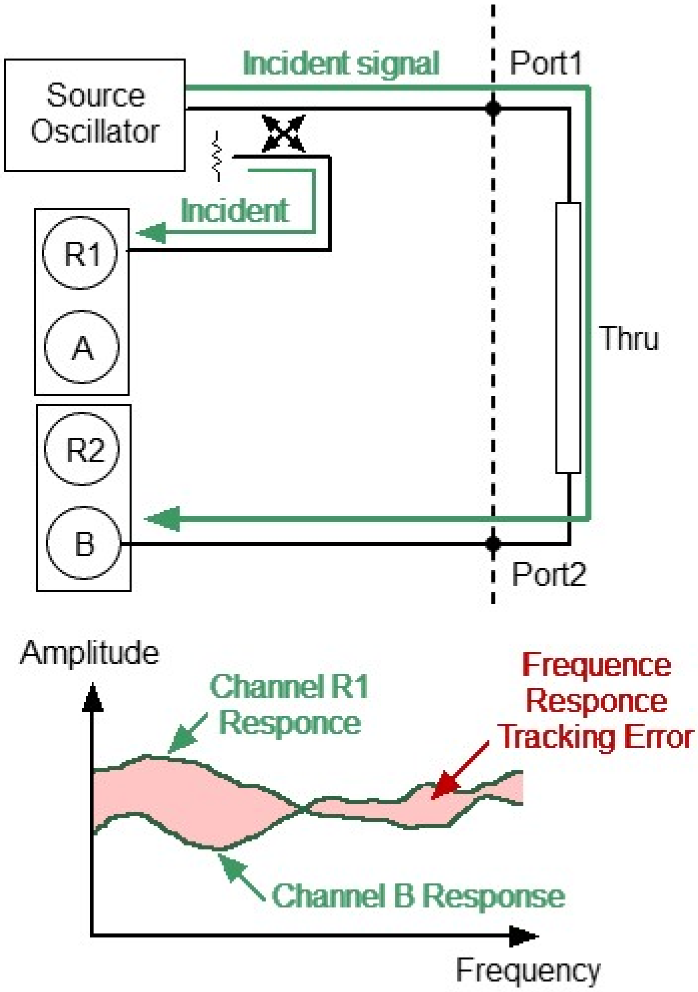
A reflection tracking error (**Er**) is caused by differences in frequency response between the test receiver and the reference receiver of the source port during reflection measurement.



Reflection tracking error

Transmission Tracking Error

A transmission tracking error (**Et**) is caused by differences in frequency response between the test receiver of the receiver port and the reference receiver of the source port during transmission measurement.

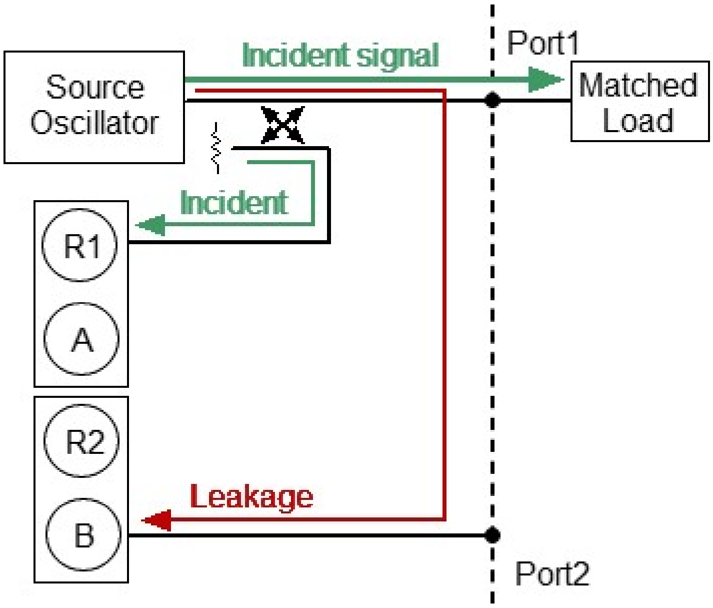


Transmission tracking error

Isolation Error

Isolation error (**Ex**) is caused by a leakage of the signal from the source port to the receiver port bypassing the DUT.

The Analyzer has very good isolation, which allows us to ignore this error for most measurements. Isolation error measurement is an optional step in all types of calibration.



Isolation error

Error Model

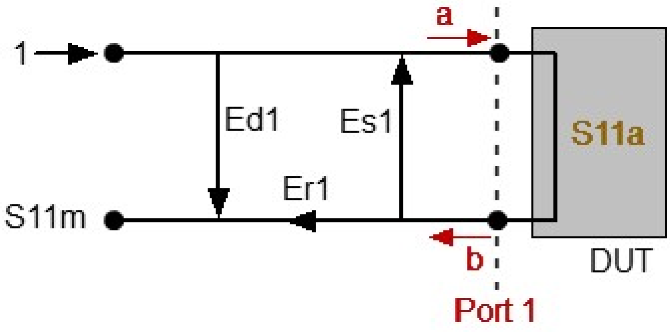
The error model in the form of signal (directed) graphs is used to analyze systematic errors of the Analyzer.

This section describes error models:

- One-Port Error Model.
- Two-Port Error Model (RNVNA only).

One-Port Error Model

Only one port of the Analyzer is used when performing reflection measurements. The signal flow graph of errors for Port 1 is represented in the figure below. For Port 2, the signal flow graph of the errors will be similar.



a — incident wave, b — reflected wave

S11m — reflection coefficient measured value

One-port error model

The measurement result at Port 1 is affected by the following three systematic error terms:

- **Ed1** — directivity.
- **Es1** — source match.
- **Er1** — reflection tracking.

For normalization, the stimulus value is taken equal to 1. All the values used in the model are complex.

After determining all the three error terms — **Ed1, Es1, Er1** — for each measurement frequency by means of a **full one-port calibration**, it is possible to calculate (mathematically eliminate the errors from the measured value S11m) the actual value of the reflection coefficient S11a.

There are simplified methods, which eliminate the effects of only one or two of the three systematic errors.

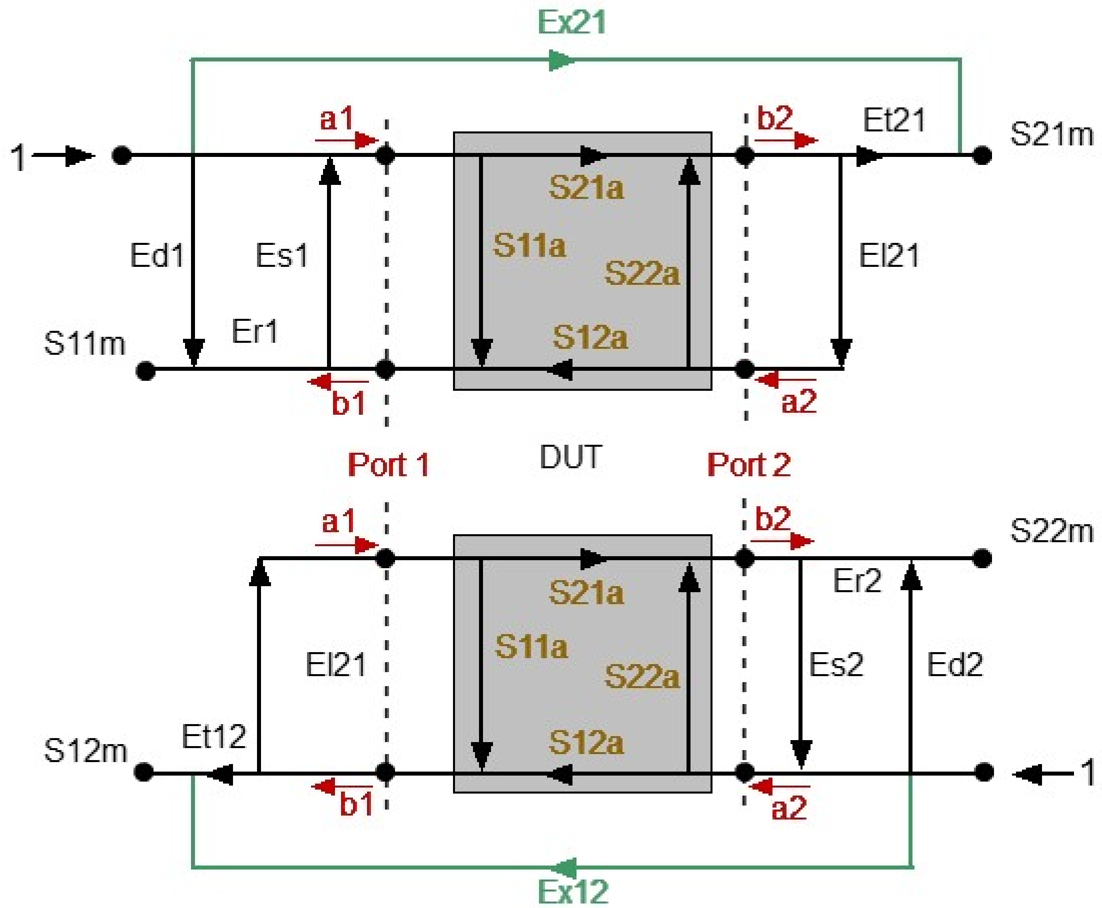
For a detailed description of calibration methods, see Calibration Methods and Procedures.

Two-Port Error Model

NOTE	This section is available for RNVNA.

There are two signal flow graphs considered for two-port measurements. One of the graphs describes the case where Port 1 is the stimulus source, the other graph describes the case where Port 2 is the stimulus source.

The signal flow graphs of error effects in a two-port system are represented in the figure below.



a1, a2 — incident waves, b1, b2 — reflected waves

S11a, S21a, S12a, S22a — actual value of DUT parameters

S11m, S21m, S12m, S22m — measured DUT parameters values

Two-port error model

For normalization the stimulus value is taken equal to 1. All the values used in the model are complex. The measurement result in a two-port system is affected by twelve systematic error terms.

These terms are also described in the table below.

Description	Stimulus Source	
	Port 1	**Port 2**
Directivity	**Ed1**	**Ed2**
Source match	**Es1**	**Es2**
Reflection tracking	**Er1**	**Er2**
Transmission tracking	**Et1**	**Et2**
Load match	**El1**	**El2**
Isolation	**Ex1**	**Ex2**

After determining all twelve error terms for each measurement frequency by means of a **two-port calibration**, it is possible to calculate the actual value of the S-parameters: S11a, S21a, S12a, S22a.

There are simplified methods, which eliminate the effect of only one or several of the twelve systematic error terms.

NOTE

When using a two-port calibration, all four measurements S11m, S21m, S12m, S22m need to be known to determine any S-parameters. That is why updating one or all of the S-parameters necessitates two sweeps: first with Port 1 as a signal source, and then with Port 2 as a signal source.

For a detailed description of calibration methods, see Calibration Methods and Procedures.

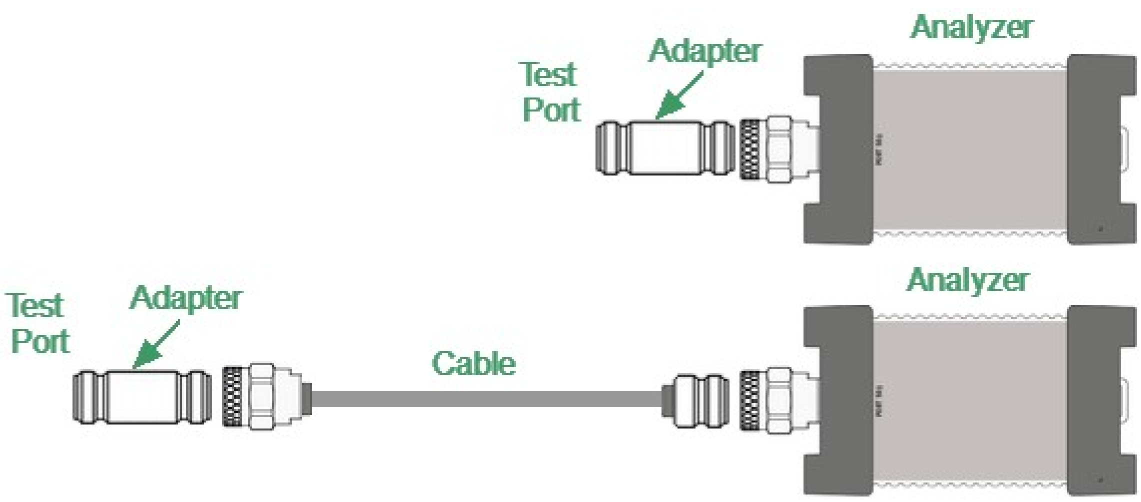
Analyzer Test Port Definition

The test ports of the Analyzer are defined by means of calibration. The test port is a connector accepting a calibration standard in the process of calibration.

A type-N, 3.5 mm NMD connector on the front panel of the Analyzer will be the test port if calibration standards are connected directly to it.

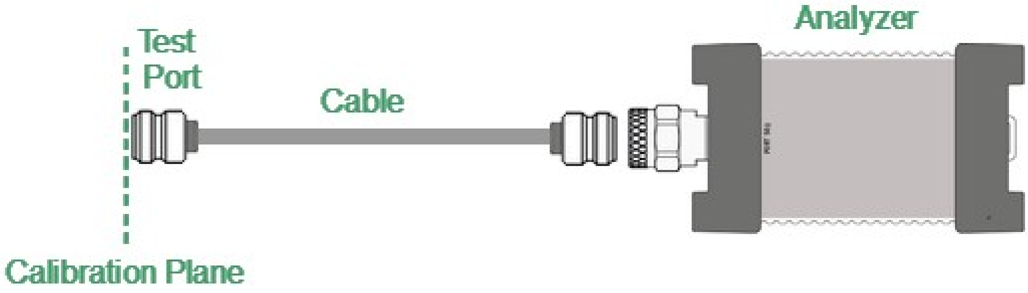
Sometimes it is necessary to connect coaxial cables and/or adapters to the connector(s) on the front panel to interface with a DUT of a different connector type. In such cases, calibration standards are connected to the connector of the cable or adapter.

The figure below represents two cases of test port definition for measurements. The use of cables and/or adapters does not affect the measurement results if they are integrated into the process of calibration.



Test port defining

The term calibration plane is used in some cases. The calibration plane is an imaginary plane located at the ends of the connectors, which accept calibration standards during calibration.



Calibration plane

Calibration Steps

The process of calibration comprises the following steps:

- Selection of a calibration kit matching the connector type of the test port (See Calibration Standards and Calibration Kits). The calibration kit includes such standards as SHORT, OPEN, and LOAD with matched impedance. Magnitude and phase responses i.e. S-parameters of the standards are well known. The characteristics of the standards are represented in the form of an equivalent circuit model, as described in Calibration Standards Model.
- Selection of a calibration method (See Calibration Methods and Procedures) is based on the required accuracy of measurements. The calibration method determines which error terms of the model (or all of them) will be compensated.
- Measurement of the standards within a specified frequency range. The number of measurements depends on the type of calibration.
- The Analyzer compares the measured parameters of the standards against their predefined values. The difference is used for calculation of the calibration coefficients (systematic errors).
- The table of calibration coefficients is saved into the memory of the Analyzer and used for error correction of the measured results of any DUT.

Calibration is always made for a specific channel, as it depends on the channel stimulus settings — particularly on the frequency span. This means that a table of calibration coefficients is being stored for each individual channel.

Calibration Standards and Calibration Kits

Calibration standard

Calibration standards are precision physical devices that serve as a calibration standard for the Analyzer.

Calibration standards have their own specific type, specific gender, specific impedance, standard definition.

Calibration standard definition is a mathematical description of its parameters (See Calibration Standard Definition). During calibration, the Analyzer measures standards and mathematically compares the results to the definitions of those standards. The comparison results are used to determine errors in the measurement system.

The characteristics of real calibration standards have deviations from the ideal values. For example, the ideal SHORT standard must have reflection coefficient magnitude equal to 1.0 and reflection coefficient phase equal to 180° over the whole frequency range. A real SHORT standard has deviations, from these values depending on the frequency. To take into account such deviations a calibration standard model (in the form of an equivalent circuit with predefined characteristics) is used.

Calibration standards can be combined into a calibration kit.

Calibration Kit

A calibration kit is a set of calibration standards with a specific connector type and specific impedance.

The Analyzer provides definitions of calibration kits produced by different manufacturers. The definitions of the calibration kits can be added, and the predefined kits can be modified. Calibration kits editing procedure is described in Calibration Kit Management.

Types of Calibration Standards

Calibration standard type is a category of physical devices used to define the parameters of the standard. The Analyzer supports the following types of the calibration standards:

- OPEN
- SHORT
- LOAD
- THRU (RNVNA only)

Calibration Standards Definition

The Analyzer provides two methods of defining a calibration standard:

- Calibration standard model
- Table of S-parameters

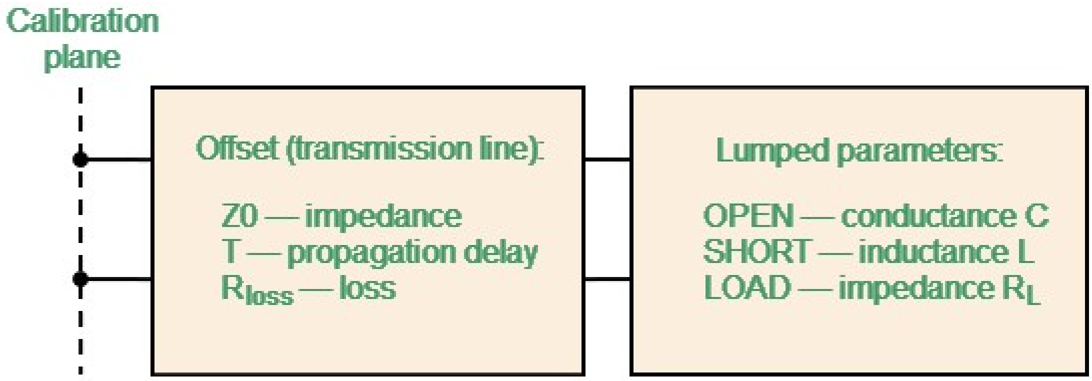
The calibration standards defined by S-parameters are called Data-Based standards.

Each calibration standard is characterized by lower and upper values of the operating frequency. In the process of calibration, the measurements of the calibration standards outside the specified frequency range are ignored.

Calibration Standard Model

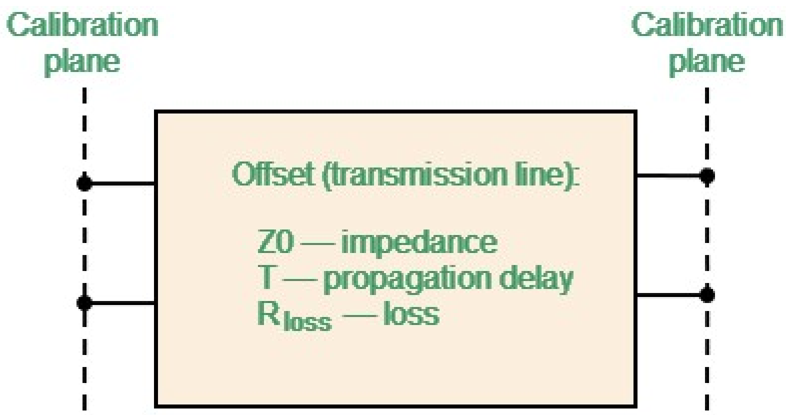
A model of a calibration standard presented as an equivalent circuit is used for determining S-parameters of the standard. The model is employed for standards of OPEN, SHORT, LOAD, THRU types.

A one-port model is used for the standards OPEN, SHORT and LOAD (See [Full One-Port Calibration](#)). This is shown in the figure below.



One-port standard model

The two-port model (RNVNA only) is used for the standard THRU (See figure below).



Two-port standard model

The description of the numeric parameters of an equivalent circuit model of a calibration standard is shown in the table below.

Detailed description of editing parameters of an equivalent circuit model of a calibration standard see in [Calibration Standard Editing](#).

Parameters of the calibration standard equivalent circuit model

Parameter (as in the software)	Parameter Definition
Z0 (Offset Z0)	The characteristic impedance of the transmission line [Ω], serving as the offset. For the coaxial line, specified real value of characteristic impedance, usually equal to 50 Ω or 75 Ω. For waveguide calibration, the special value of 1 Ω is used.
T (Offset Delay)	The offset delay. It is defined as one-way signal propagation time in the transmission line [seconds]. The delay can be measured or mathematically determined by dividing the exact physical length by the propagation velocity in the line. For waveguide, delay is conventionally taken to be equal to the delay of a coaxial line of the same length. The actual signal delay in waveguide is frequency dependent and is calculated in the software. Instead delay, one can specify the length of the offset [meters]. The software calculates the delay according to the formula for a coaxial air line: $$T = \frac{\sqrt{\varepsilon_r} l}{c},$$ where l — line length [m], c — light speed in free space 299792458 [m/s], ε_r — relative permittivity of air 1.000649. The length can be specified instead of the delay provided offset of the calibration standard is a coaxial airline or a waveguide. If the calibration standard manufacturer provides a delay data, it is better to specify delay.
Rloss	The offset loss in one-way propagation due to the skin effect [Ω/sec].

Parameter (as in the software)	Parameter Definition
(Offset Loss)	The loss in a coaxial transmission line is determined by measuring the delay T [sec] and loss L [dB] at 1 GHz frequency. The measured values are used in the following formula: $$R\pi[\Omega/s] = \frac{L[dB] \cdot Z0[\Omega]}{4.3429[dB] \cdot T[s]}$$ The loss in waveguide is typically set to 0 due to its very small influence. However, the software supports a waveguide loss model. If the calibration standard manufacturer provides loss data, it is recommended to specify it.
C (C0, C1, C2, C3)	The fringe capacitance of an OPEN standard, which causes a phase offset of the reflection coefficient at high frequencies. The fringe capacitance model is described as a function of frequency, which is a polynomial of the third degree: $C = C0 + C1 \cdot f + C2 \cdot f^2 + C3 \cdot f^3$, where f — frequency [Hz], $C0$ ... $C3$ — polynomial coefficients. Units: C0[F], C1[F/Hz], C2[F/Hz^2], C3[F/Hz^3].
L (L0, L1, L2, L3)	The residual inductance of a SHORT standard, which causes a phase offset of the reflection coefficient at high frequencies. The residual inductance model is described as a function of frequency, which is a polynomial of the third degree: $L = L0 + L1 \cdot f + L2 \cdot f^2 + L3 \cdot f^3$, where f — frequency [Hz], $L0$ ... $L3$ — polynomial coefficients. Units: L0[H], L1[H/Hz], L2[H/Hz^2], L3[H/Hz^3].

Parameter (as in the software)	Parameter Definition
Media	The offset media. Allows to choose from: • coaxial • waveguide
Width to Height Ratio (H/W)	The waveguide width to height ratio. Used in the waveguide loss model when the loss value is not zero.
Minimum and Maximum Frequency (Fmin, Fmax)	The minimum and maximum standard operating frequency in the coaxial. Used for a calibration using several calibration standards, each of which does not cover entire frequency range. The cut off frequency and the doubled cut off frequency of the waveguide. The cutoff frequency of the waveguide is achieved at a wavelength in the waveguide equal to twice its width. Take care not to confuse this with the minimum and maximum operating frequency of the waveguide, which are usually given by the manufacturer with a margin relative to the cut off frequency.

Data-Based Calibration Standards

The calibration standards defined by data are set using the table of S-parameters. Each line of the table contains frequency and S-parameters of the calibration standard. For one-port standards the table contains the value of only one parameter — S11, and for two-port standards the table contains the values of all the four parameters — S11, S21, S12, S22.

The table of S-parameters can be filled downloaded from a file of Touchstone format. Files with *.S1P extension are used for one-port standards, and files with *.S2P extension are used for two-port standards.

For the Data-Based standards editing, see Calibration Standard Editing.

Gender of Calibration Standard

Gender of a calibration standard is typically denoted on the calibration standard label. The label and the gender of calibration standard respectively, are not accounted by the software and are used for information only. Nevertheless, it is recommended to follow some rules for calibration standard gender designation. A calibration standard can be labeled either with:

- The gender of a calibration standard itself, as –M– for male and –F– for female type of standard.
- The gender of the analyzer port, which the calibration standard is mated to, as (m) for male and (f) for female port types.

For example, same standard can be labeled as **Short –F–** or **Short (m)**.

The Analyzer software uses the first type of designation: the gender of a calibration standard itself denoted as **–M–** for male and **–F–** for female type of standards.

Gender of Calibration Standard

Calibration Kit Management

This section describes how to edit the calibration kit description and add and delete a calibration kit.

The Analyzer provides a table for 50 calibration kits. The first part of the table contains the predefined kits. The second part of the table is for calibration kit added by the user.

A calibration kit redefining can be required for the following purposes:

- To change the port assignment of a standard to ensure connector type (male, female) matching.
- To add a user-defined standard into the kit, e.g. a non-zero-length thru.
- To precise the standard parameters to improve the calibration accuracy.

A new user-defined calibration kit adding can be performed when a required kit is not included in the list of the predefined kits.

The deleting function is available for user-defined calibration kits only.

The restore function is available for predefined calibration kits only.

Any changes made to the calibration kits are automatically saved into the nonvolatile memory of the Analyzer. Clicking the Save button is not required in order to save.

NOTE	Changes to a predefined calibration kit can be cancelled at any time and the initial state will be restored.

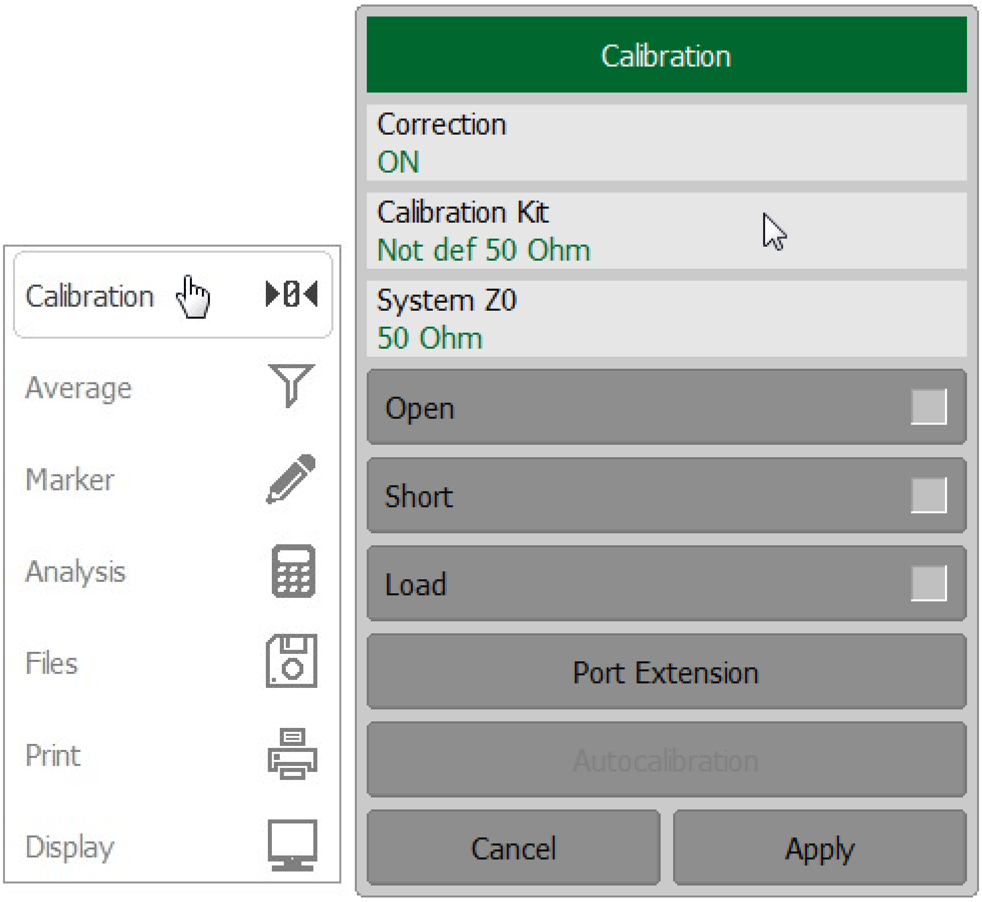
Calibration Kit Selection

The calibration kit employed during a calibration should be selected according to the following procedure. If it is not specified in the list of the predefined calibration kits, it should be added. The procedure of adding and editing of the calibration kits is described in Calibration Kit Selection for Editing.

To achieve the specified measurement accuracy, use a calibration kit with known characteristics.

To select the calibration kit, use the following softkey **Calibration** in the left menu bar. The currently selected calibration kit is indicated on the softkey **Calibration Kit**.

Click this softkey and select the required kit from the list. Complete the setting by clicking **Ok**.



SCPI	SENSe:CORRection:COLLect:CKIT

Calibration Kit Selection for Editing

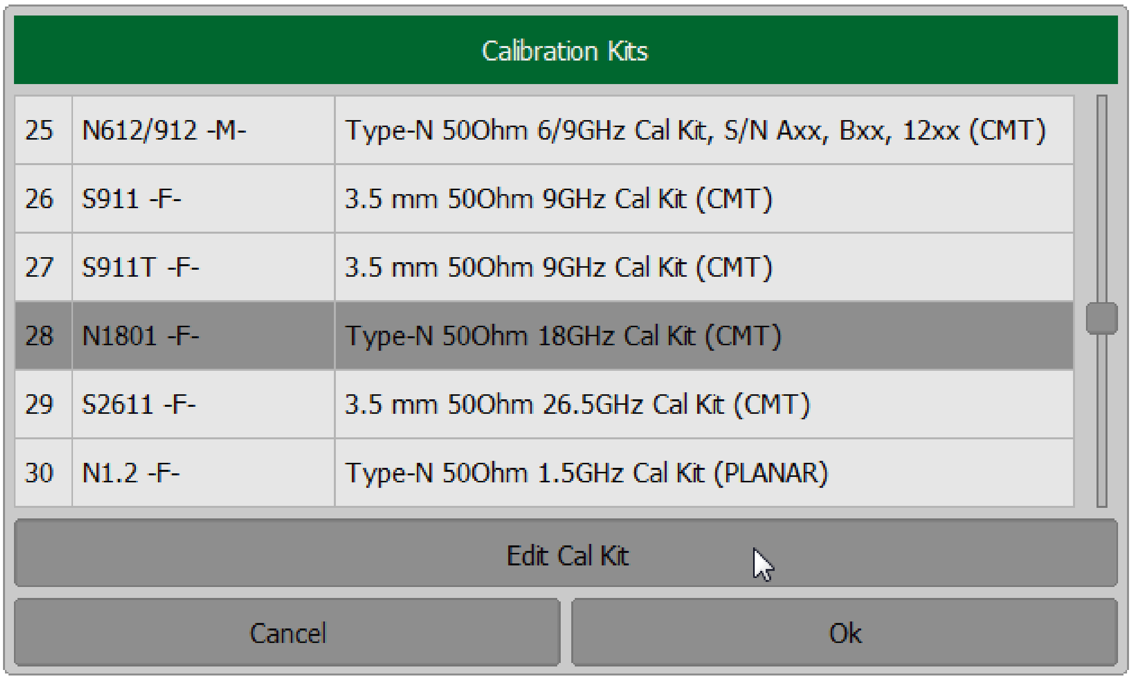
The table of calibration kits allows for selecting and editing of the calibration kits. For a detailed description of calibration kit selection , see Calibration Kit Selection.

The first part of the table contains the predefined kits. The second part of the table is for calibration kit added by the user.

As a result, the editor of the selected calibration kit will open. (See figure). Detailed description of working with the editor see in Calibration Kit Editor.

To edit a calibration kit, highlight its line in the table. Then click **Edit Cal Kit** softkey.

NOTE. To add a custom calibration kit, select any empty row in the table.



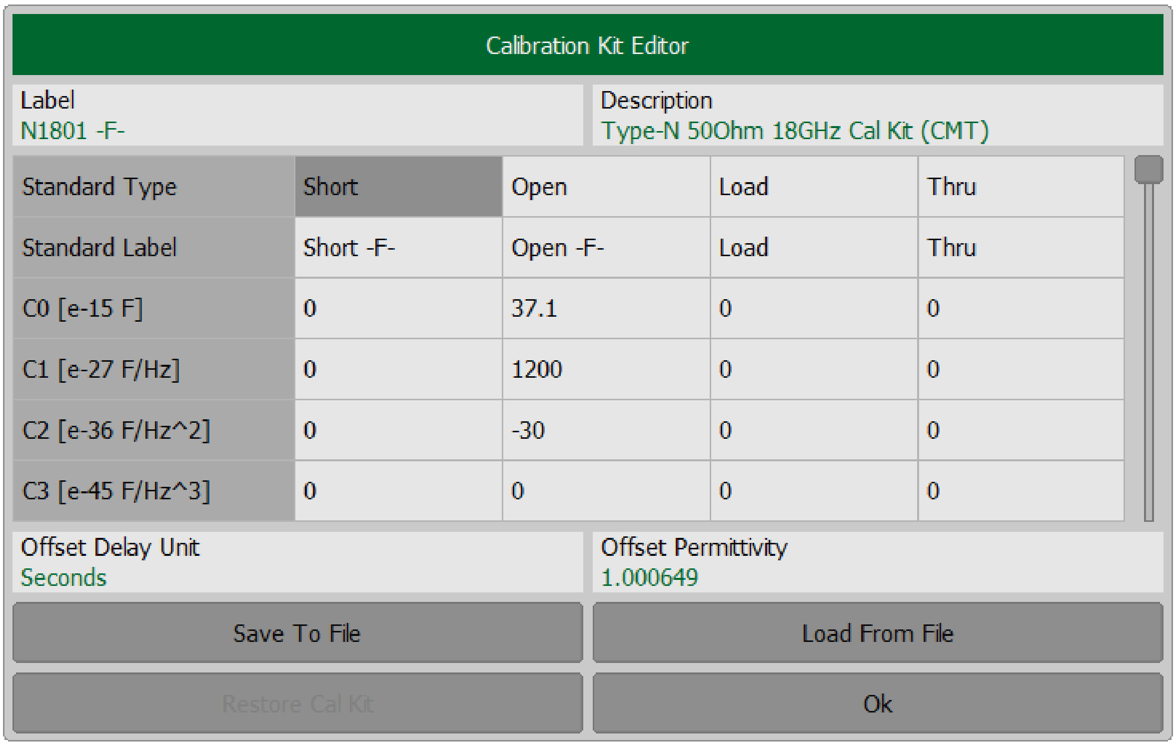
Calibration Kit Editor

Calibration kit editor allows to edit parameters for the selected kit, save/load kit to file and discard changes.

The definitions of the calibration standards included in one calibration kit are listed in the calibration kit editor as shown below.

Calibration kit editor contains (See figure below):

- Label and description of a calibration kit (See Calibration Kit Label and Description Editing).
- General parameter table for standard (See Calibration Standard Editing).
- Offset delay measurement units switching (See Offset Delay Measurement Units Switching).
- Buttons for saving/loading the calibration kit to a file (See Saving Calibration Kit to File and Loading Calibration Kit from File).
- A button to undo changes for a predefined kit, or a button to delete a custom kit (See Predefined Calibration Kit Restoration and User-Defined Calibration Kit Deletion).



Calibration kit editor

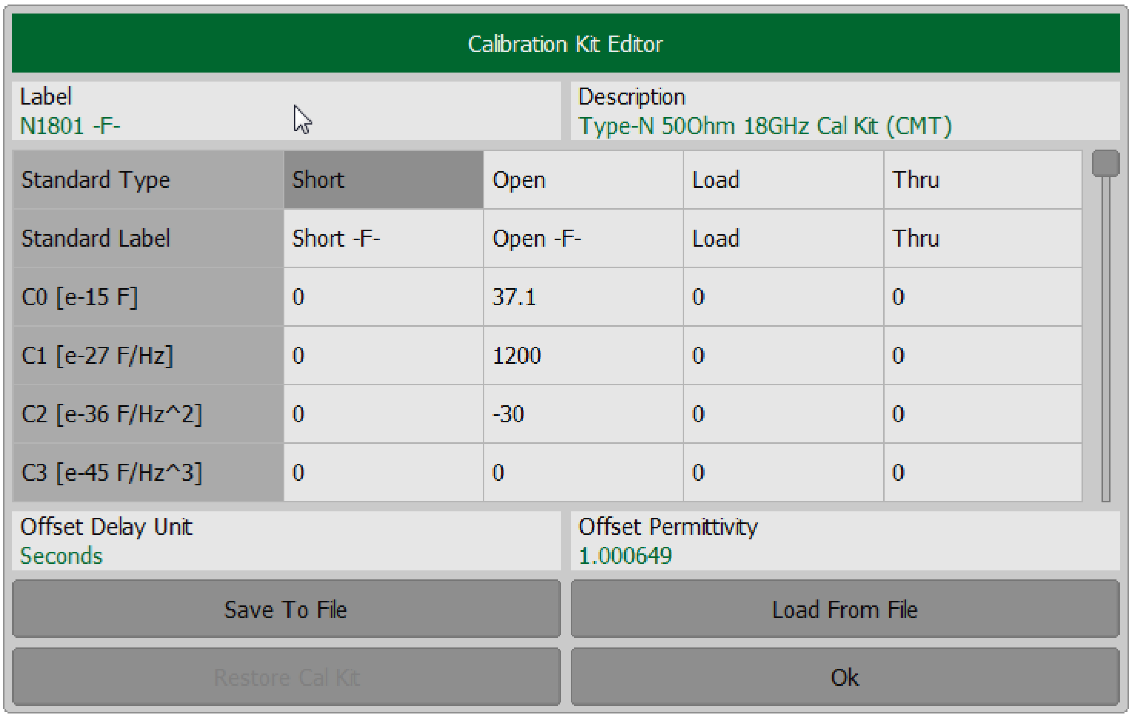
Calibration Kit Label and Description Editing

The label of a calibration kit and its description can be edited in the editor (See above figure). The label appears on the Calibration dialog softkeys. The description is just to provide information.

To edit the label of a calibration kit, click on **Label** field and enter the calibration kit label using the on-screen keypad.

To edit the description of a calibration kit, click on **Description** field and enter the calibration kit description using the on-screen keypad.

To save the settings and close the dialog click **Ok**.



SCPI SENSe:CORRection:COLLect:CKIT:LABel

Calibration Standard Editing

Moving in the table of calibration standard definitions (See above figure) using navigation keys. Enter the parameter values for a calibration kit by using the navigation keys in the table of calibration standard definitions:

Standard Type	Select the standard type: • Open • Short • Load • Thru • Data-Based
Standard Label	Standard labels specified on the calibration menu softkeys.
C0 [e–15 F]	For an OPEN standard, C0 coefficient in the polynomial formula of the fringe capacitance: $C = C0 + C1 \cdot f + C2 \cdot f^2 + C3 \cdot f^3$
C1 [e–27 F/Hz]	For an OPEN standard, C1 coefficient in the polynomial formula of the fringe capacitance.
C2 [e–36 F/Hz^2]	For an OPEN standard, C2 coefficient in the polynomial formula of the fringe capacitance.
C2 [e–45 F/Hz^3]	For an OPEN standard, C3 coefficient in the polynomial formula of the fringe capacitance.
L0 [e–12 H]	For a SHORT standard, L0 coefficient in the polynomial formula of the residual inductance: $L = L0 + L1 \cdot f + L2 \cdot f^2 + L3 \cdot f^3$
L1 [e–24 H/Hz]	For a SHORT standard, L1 coefficient in the polynomial formula of the residual inductance.

L2 [e–33 H/Hz^2]	For a SHORT standard, L2 coefficient in the polynomial formula of the residual inductance.
L2 [e-42 H/Hz^3]	For a SHORT standard, L3 coefficient in the polynomial formula of the residual inductance.
Offset Delay	Offset delay value in one direction (ps). Can be switched to physical length (mm). The parameter is used only for the calibration standard model.
Offset Z0	Offset characteristic impedance value (Ohm). For waveguide must be set to 1 Ohm.
Offset Loss	Offset loss value (GOhm/s). The parameter is used only for the definition of the standard with the help of the calibration standard model.
F min, [MHz]	Minimum operating frequency of the coaxial standard. Lower cutoff frequency of the waveguide standard.
F max, [MHz]	Maximum operating frequency of the coaxial standard. Upper cutoff frequency of the waveguide standard.
Media	Coaxial or Waveguide
H/W	Waveguide height to width ratio.

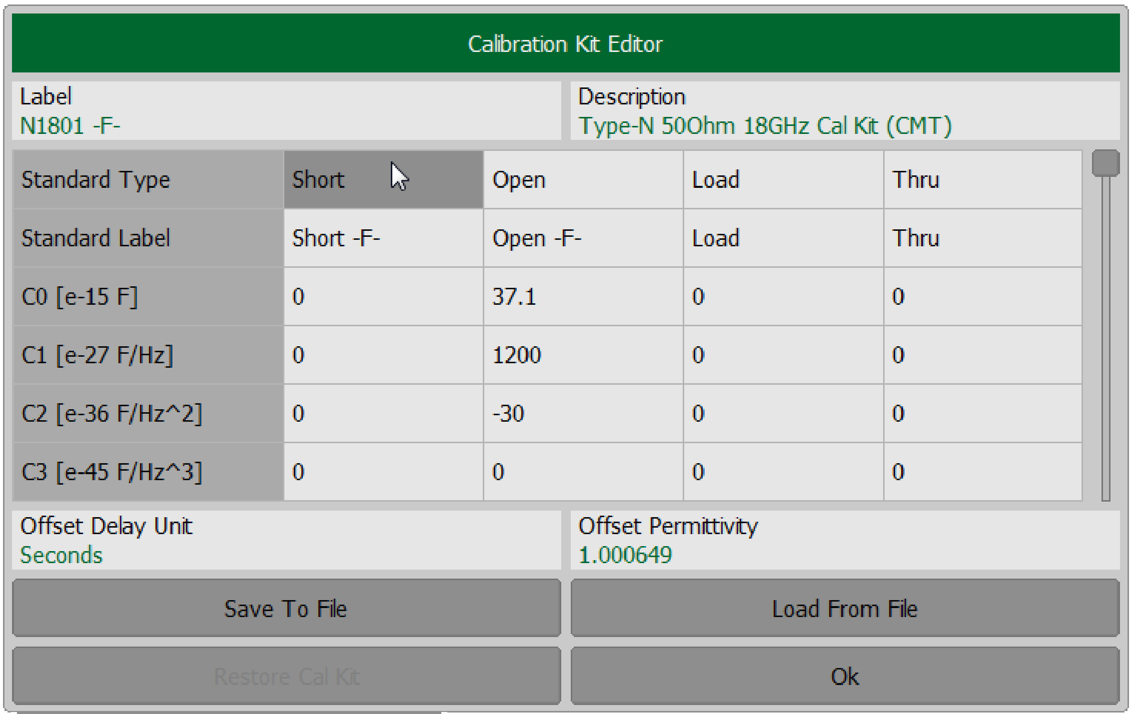
Calibration standard type and label editing

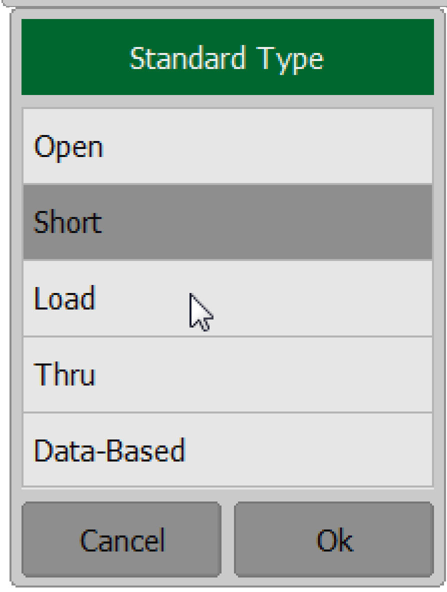
To set the type of a standard, double click on the field with the name of the standard in the Standard Type line and select the type in the opened Standard Type dialog:

- **Open** or **Short** or **Load** or **Thru** — if the standard is described with an equivalent circuit.
- **Data-Dased** — if the standard is described with the Table of S-parameters (See Calibration Standard Defining by S-Parameter File).

To edit the label of a standard, double click on the field in the **Standard Label** line and enter the calibration kit description using the on-screen keypad.

To save the settings and close the dialog click **Ok**.

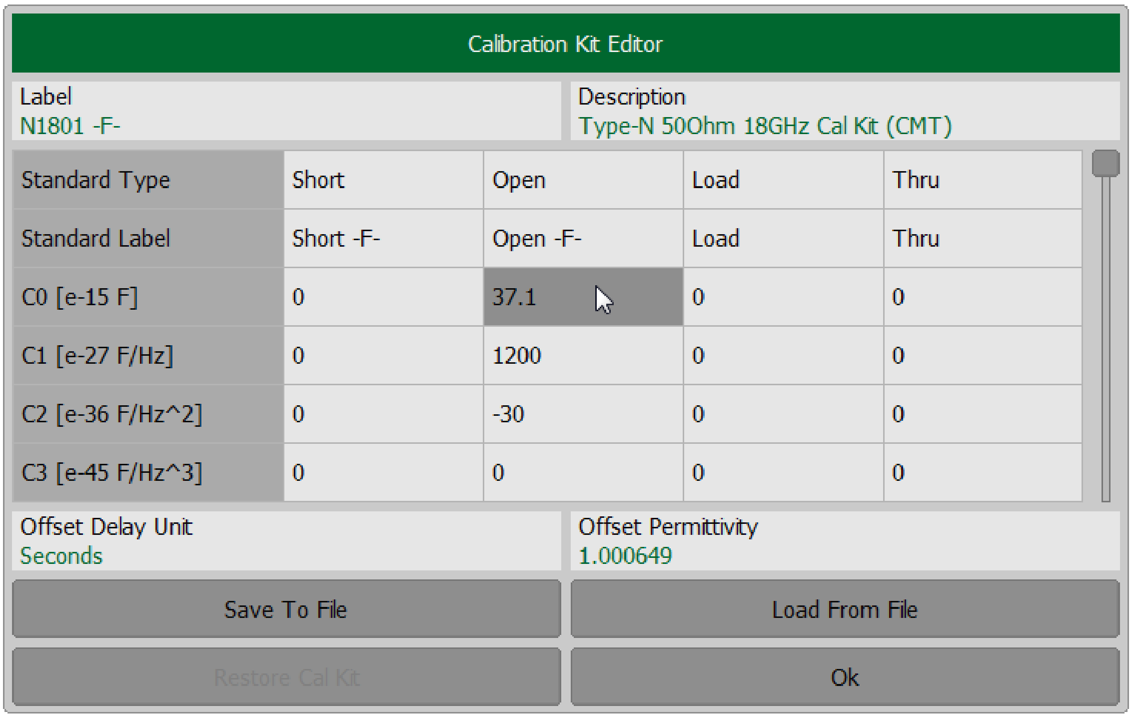




SCPI	SENSe:CORRection:COLLect:CKIT:STAN:TYPE, SENSe:CORRection:COLLect:CKIT:STAN:LABel

Calibration standard parameters editing

To edit the calibration standard parameters, and double click in the table on the corresponding cell. Enter the required value using the on-screen keypad.



SCPI

[SENSe:CORRection:COLLect:CKIT:STAN:C0](), [SENSe:CORRection:COLLect:CKIT:STAN:C1](), [SENSe:CORRection:COLLect:CKIT:STAN:C2](), [SENSe:CORRection:COLLect:CKIT:STAN:C3]()

[SENSe:CORRection:COLLect:CKIT:STAN:L0](), [SENSe:CORRection:COLLect:CKIT:STAN:L1](), [SENSe:CORRection:COLLect:CKIT:STAN:L2](), [SENSe:CORRection:COLLect:CKIT:STAN:L3]()

[SENSe:CORRection:COLLect:CKIT:STAN:DELay]()

[SENSe:CORRection:COLLect:CKIT:STAN:Z0]()

[SENSe:CORRection:COLLect:CKIT:STAN:LOSS]()

[SENSe:CORRection:COLLect:CKIT:STAN:FMINimum](), [SENSe:CORRection:COLLect:CKIT:STAN:FMAXmum]()

[SENSe:CORRection:COLLect:CKIT:STAN:MEDIa]()

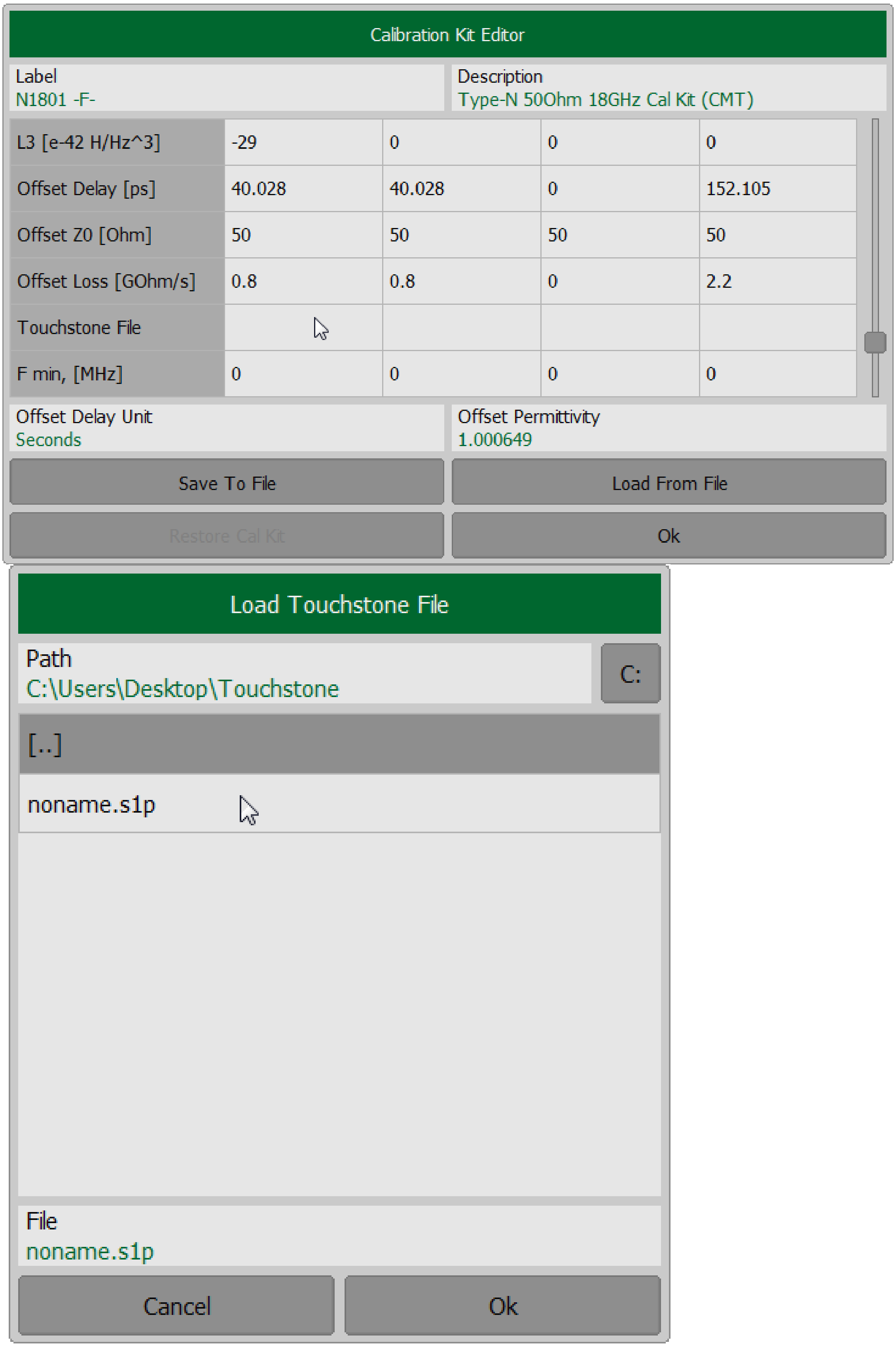
[SENSe:CORRection:COLLect:CKIT:STAN:HWR]()

Calibration Standard Defining by S-Parameter File

Parameters of a calibration standard can be set from an S-parameter file in Touchstone format (See Data-Based Calibration Standards).

To set the calibration standard parameters by S-parameter file double click in the table on the corresponding field in the Touchstone File line.

The table of S-parameters can be filled downloaded from a file of Touchstone format. Files with *.S1P extension are used for one-port standards, and files with *.S2P extension are used for two-port standards.

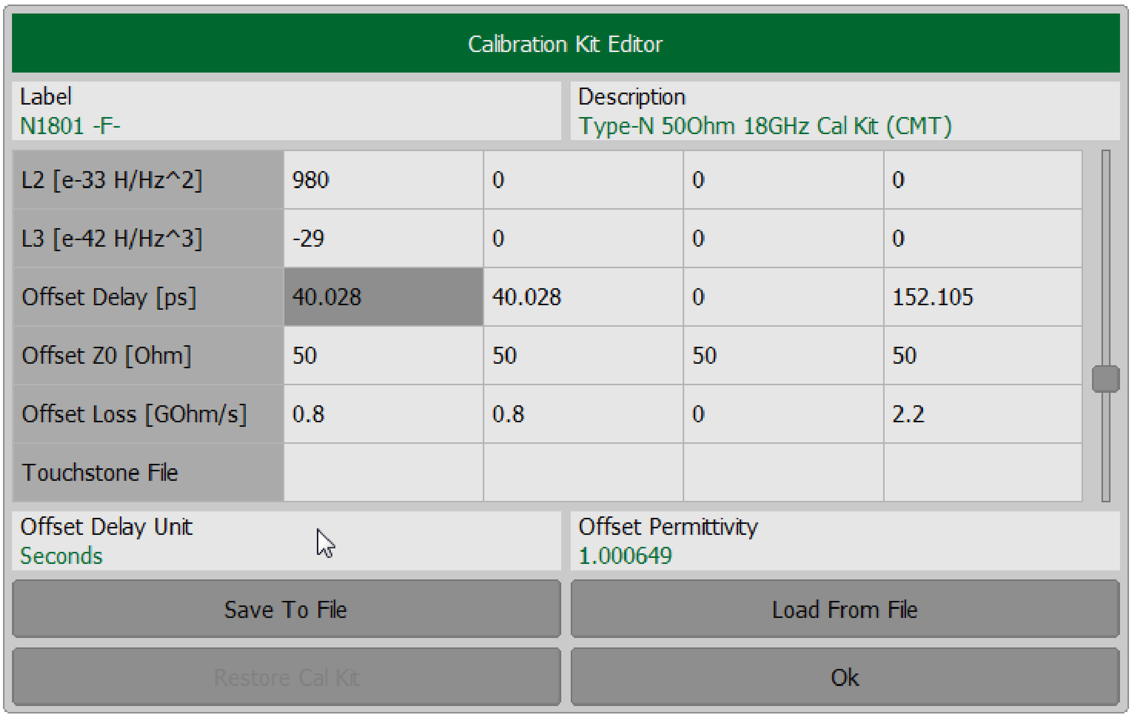

Calibration Kit Editor
Label
N1801 -F-
Description
Type-N 50Ohm 18GHz Cal Kit (CMT)
L3 [e-42 H/Hz^3]
-29
0
0
0
Offset Delay [ps]
40.028
40.028
0
152.105
Offset Z0 [Ohm]
50
50
50
50
Offset Loss [GOhm/s]
0.8
0.8
0
2.2
Touchstone File
F min, [MHz]
0
0
0
0
Offset Delay Unit
Seconds
Offset Permittivity
1.000649
Save To File
Load From File
Restore Cal Kit
Ok
Load Touchstone File
Path
C:\Users\Desktop\Touchstone
C:
[..]
noname.s1p
File
noname.s1p
Cancel
Ok

Offset Delay Measurement Units Switching

To switch the offset delay measurement units in the calibration standard definition table, click the following **Offset Delay Unit** softkey.

To enter the offset permittivity, click the following **Offset Permittivity** softkey. Enter the required value using the on-screen keypad. The offset permittivity is used only for the delay to length conversion. Default value equals the permittivity of air.

To save the settings and close the dialog click **Ok**.



Saving Calibration Kit to File

Saving a calibration kit to file is necessary for copying it to a different line of the table or to a different Analyzer.

This command is not necessary to save changes made by the user to the definitions of the kit, as these changes are saved automatically.

To save a calibration kit to file, click the **Save To File** softkey.

Select a path and enter the file name in the pop-up dialog.

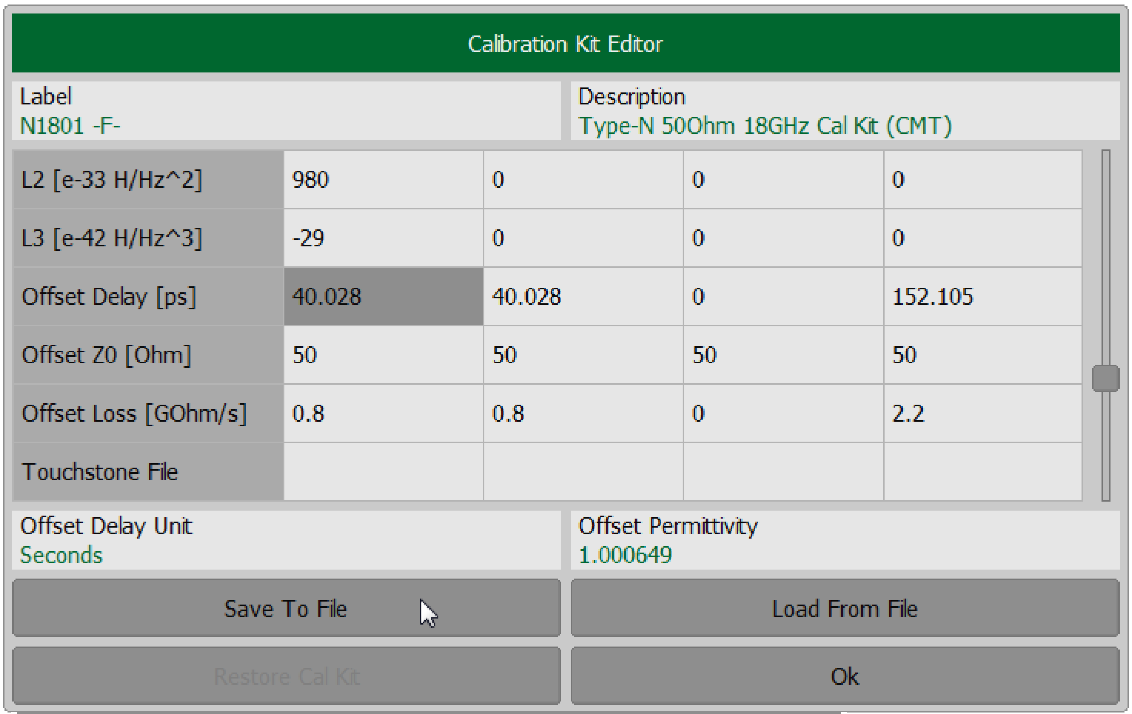
To open directory and activate it, double click on the directory name.

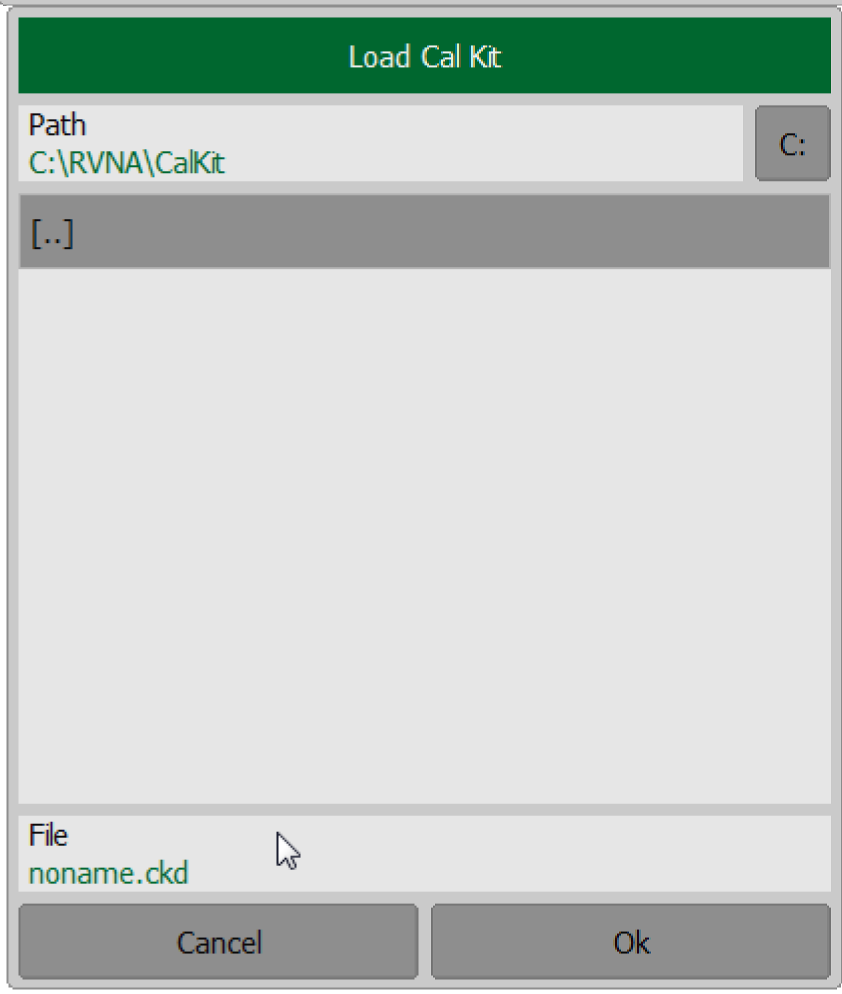
To go up in the directory hierarchy, double click on the "[..]" field.

To select the disk, click the disk letter softkey.

To change the name of the saved file using the on-screen keypad click on the File field.

To save the file, in the Save Cal Kit dialog, click **Ok** softkey.


Calibration Kit Editor
Label
N1801 -F-
Description
Type-N 50Ohm 18GHz Cal Kit (CMT)
L2 [e-33 H/Hz^2] 980 0 0 0
L3 [e-42 H/Hz^3] -29 0 0 0
Offset Delay [ps] 40.028 40.028 0 152.105
Offset Z0 [Ohm] 50 50 50 50
Offset Loss [GOhm/s] 0.8 0.8 0 2.2
Touchstone File
Offset Delay Unit
Seconds
Offset Permittivity
1.000649
Save To File
Load From File
Restore Cal Kit
Ok


Load Cal Kit
Path
C:\RVNA\CalKit
C:
[..]
File
noname.ckd
Cancel
Ok

Loading Calibration Kit from File

Calibration kit files that were created by the previous command can be loaded.

To load a calibration kit to file, click the **Load From File** softkey.

Select a path and enter the file name in the pop-up dialog.

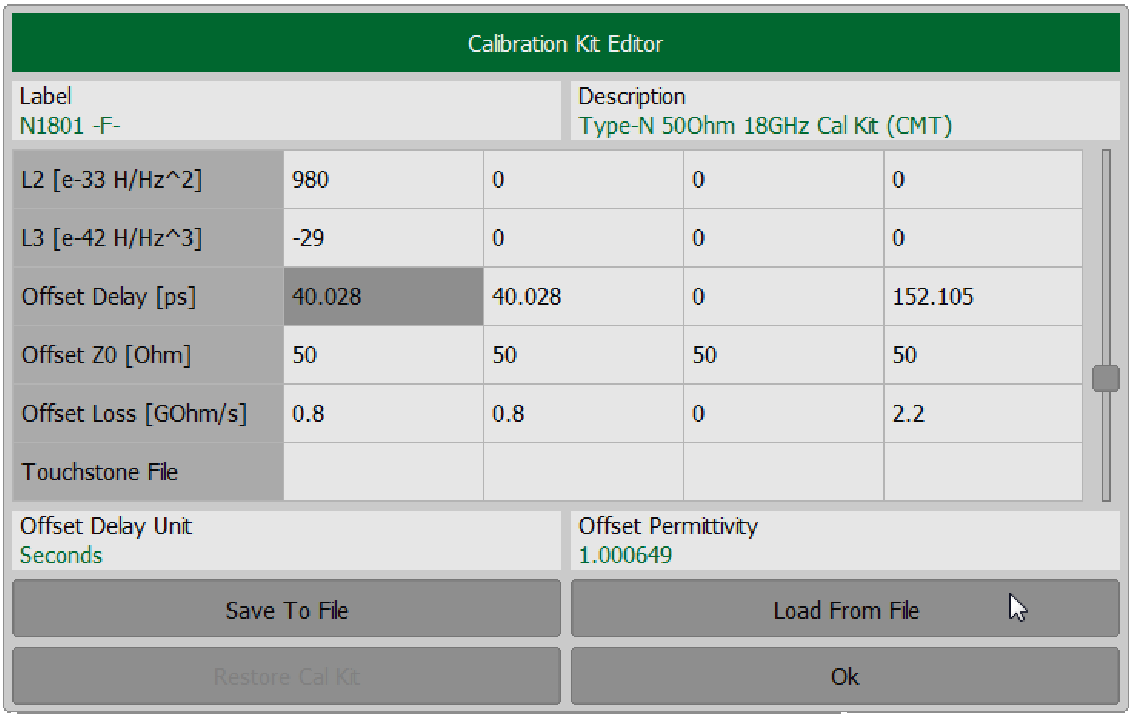
To open directory and activate it, double click on the directory name.

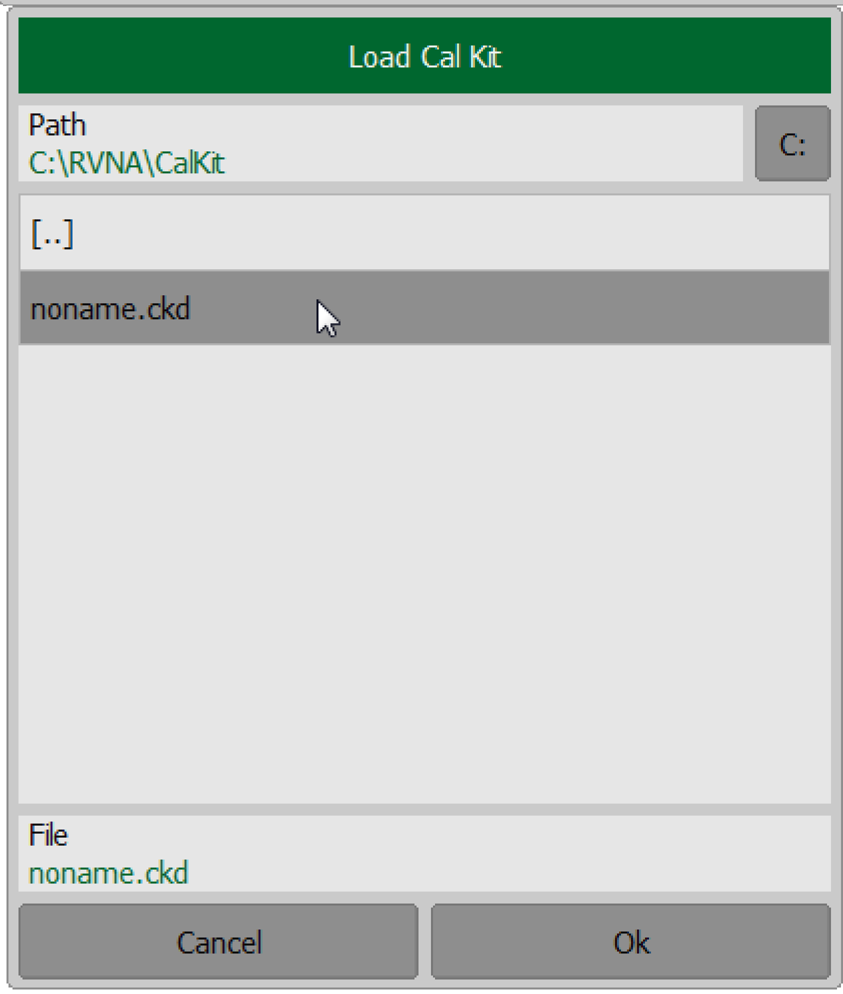
To go up in the directory hierarchy, double click on the "[..]" field.

To select the disk, click the disk letter softkey.

To change the name of the saved file using the on-screen keypad click on the File field.

To save the file, in the Load Cal Kit dialog, click **Ok** softkey.


Calibration Kit Editor
Label
N1801 -F-
Description
Type-N 50Ohm 18GHz Cal Kit (CMT)
L2 [e-33 H/Hz^2] 980 0 0 0
L3 [e-42 H/Hz^3] -29 0 0 0
Offset Delay [ps] 40.028 40.028 0 152.105
Offset Z0 [Ohm] 50 50 50 50
Offset Loss [GOhm/s] 0.8 0.8 0 2.2
Touchstone File
Offset Delay Unit
Seconds
Offset Permittivity
1.000649
Save To File
Load From File
Restore Cal Kit
Ok


Load Cal Kit
Path
C:\RVNA\CalKit
C:
[..]
noname.ckd
File
noname.ckd
Cancel
Ok

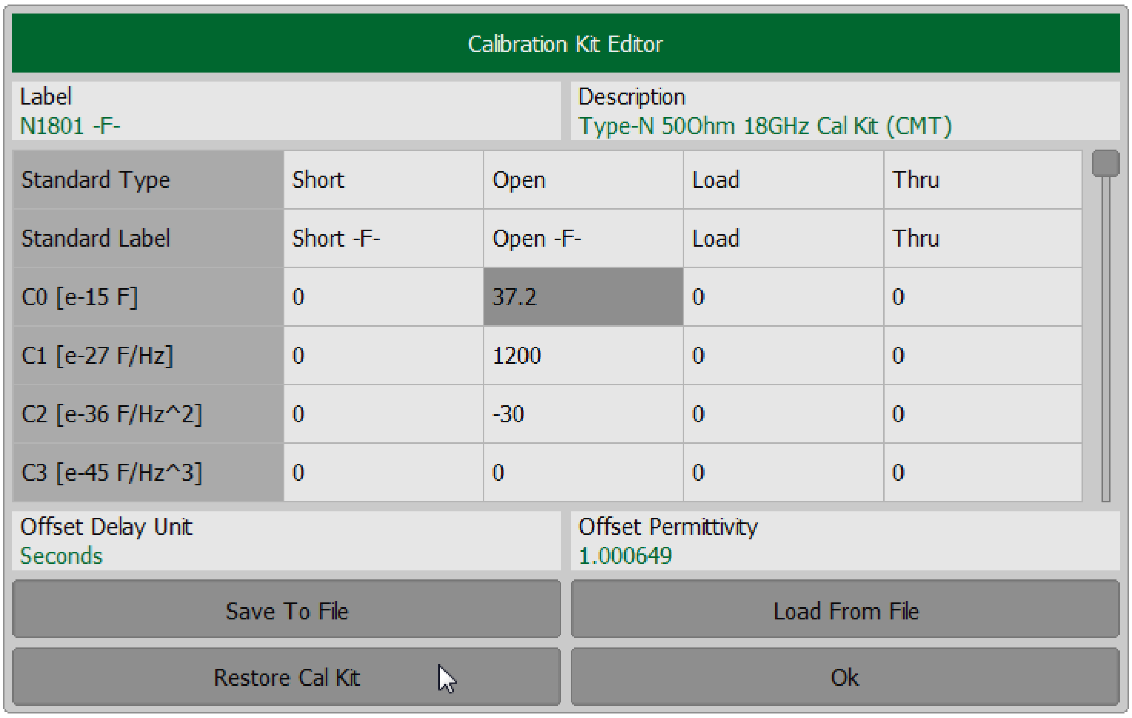
Predefined Calibration Kit Restoration

The restore function is available for predefined calibration kits only.

To cancel the user changes of a predefined calibration kit, use the following softkey **Calibration > Calibration Kit > Edit Cal Kit**.

If the kit parameters differ from the predefined ones, **Restore Cal Kit** softkey becomes available.

To cancel changes, click the **Restore Cal Kit** softkey. Close the dialog by softkey **Ok**.



SCPI SENSe:CORRection:COLLect:CKIT:RESet

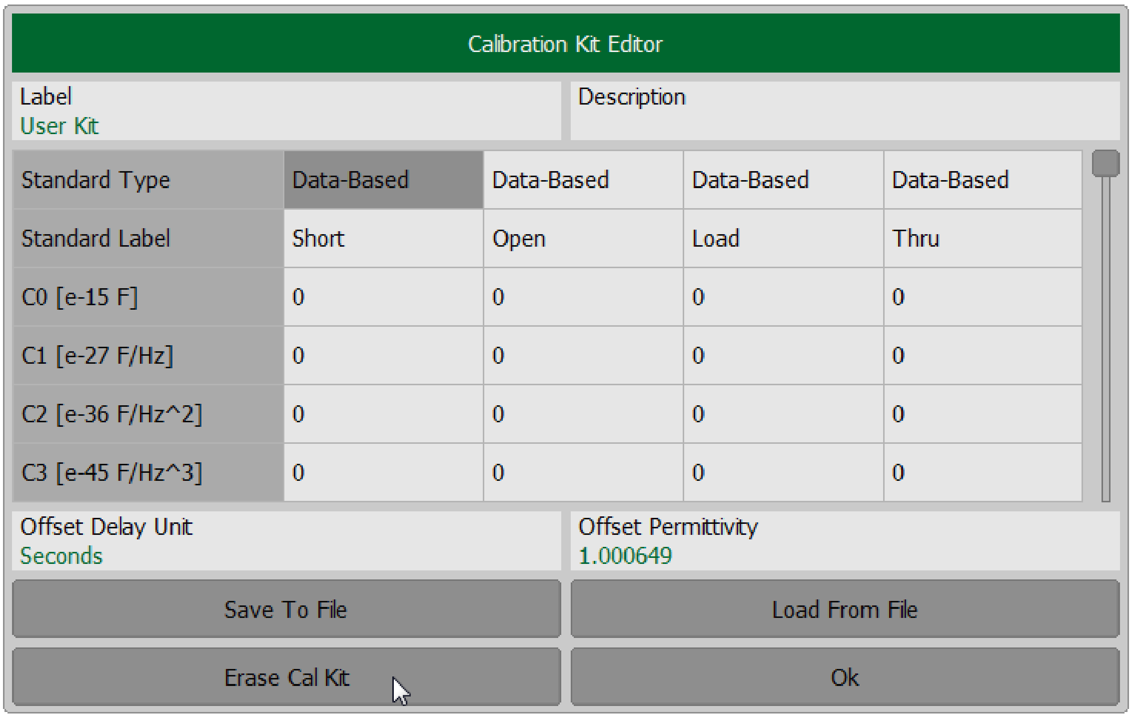
User-Defined Calibration Kit Deletion

The deleting function is available for user-defined calibration kits only.

To cancel the user changes of a predefined calibration kit, use the following softkey **Calibration > Calibration Kit > Edit Cal Kit**.

If the kit parameters differ from the predefined ones, **Erase Cal Kit** softkey becomes available.

To cancel changes, click the **Erase Cal Kit** softkey. Close the dialog by softkey **Ok**.



Calibration Methods and Procedures

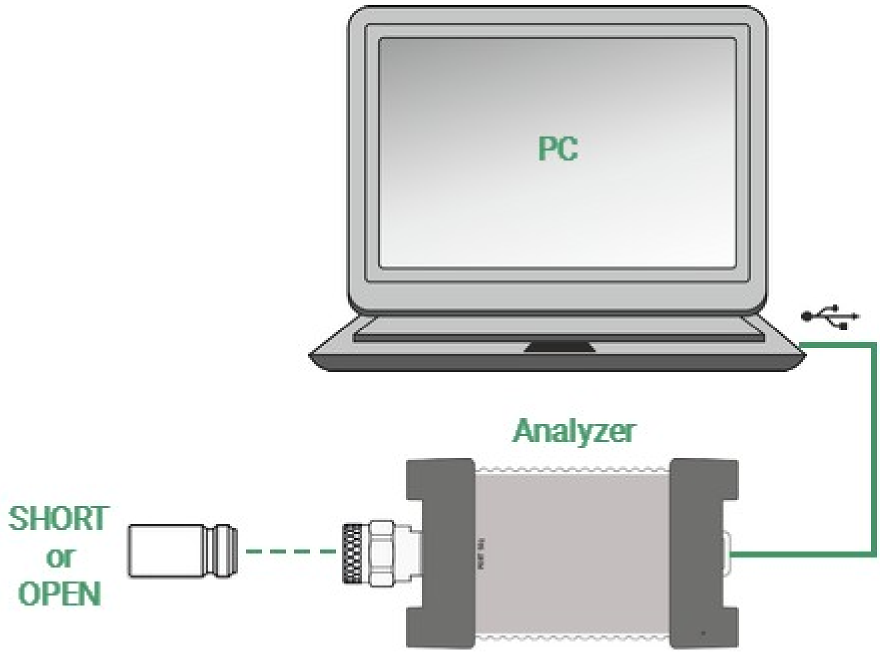
The Analyzer supports several methods of one-port and two-port calibration. The calibration methods vary by quantity and type of the standards being used, by type of error correction, and accuracy. The table below presents an overview of calibration methods.

Calibration Method	Parameters	Standards	Errors	Accuracy
Reflection Normalization	S11	SHORT or OPEN	Er1	Low
Expanded Reflection Normalization	S11	• SHORT or OPEN • LOAD	Er1, Ed1[1]	Low
Full One-Port Calibration	S11	• SHORT • OPEN • LOAD	Er1, Ed1, Es1	High
Scalar Transmission Normalization (RNVNA only)	|S21| or |S12|	THRU	Et1 or Et2	Low
One-Path Two-Port Calibration with Scalar Thru (RNVNA only)	S11, |S21| or S22, |S12|	• SHORT • OPEN • LOAD • THRU	Er1, Ed1, Es1, Et1 [2] or Er2, Ed2, Es2, Et2 [2]	Medium
Full Two-Port Calibration with Scalar Thru (RNVNA only)	S11, |S21| |S12|, S22	• SHORT • OPEN	Er1, Ed1, Es1, Et1, El1[2]	Medium

Calibration Method	Parameters	Standards	Errors	Accuracy
		• LOAD • THRU	Er2, Ed2, Es2, Et2, El2[2]	
1. If optional directivity calibration is performed. 2. If optional isolation calibration is performed. 3. RNVNA Analyzer Ex error is negligible compared to others and is not used in calculations.				

Reflection Normalization

Reflection normalization is the simplest calibration method used for reflection coefficient measurements (S11). Measurement of one standard (SHORT or OPEN) is sufficient to perform this type of calibration (See figure below).



Reflection normalization

This method is called normalization because the measured S-parameter at each frequency point is divided (normalized) by the corresponding S-parameter of the calibration standard. Reflection normalization corrects the reflection tracking error (**Er**) only. This constrains the accuracy of the method.

Normalization eliminates frequency-dependent attenuation and phase offset in the measurement circuit but does not compensate errors of directivity and mismatch.

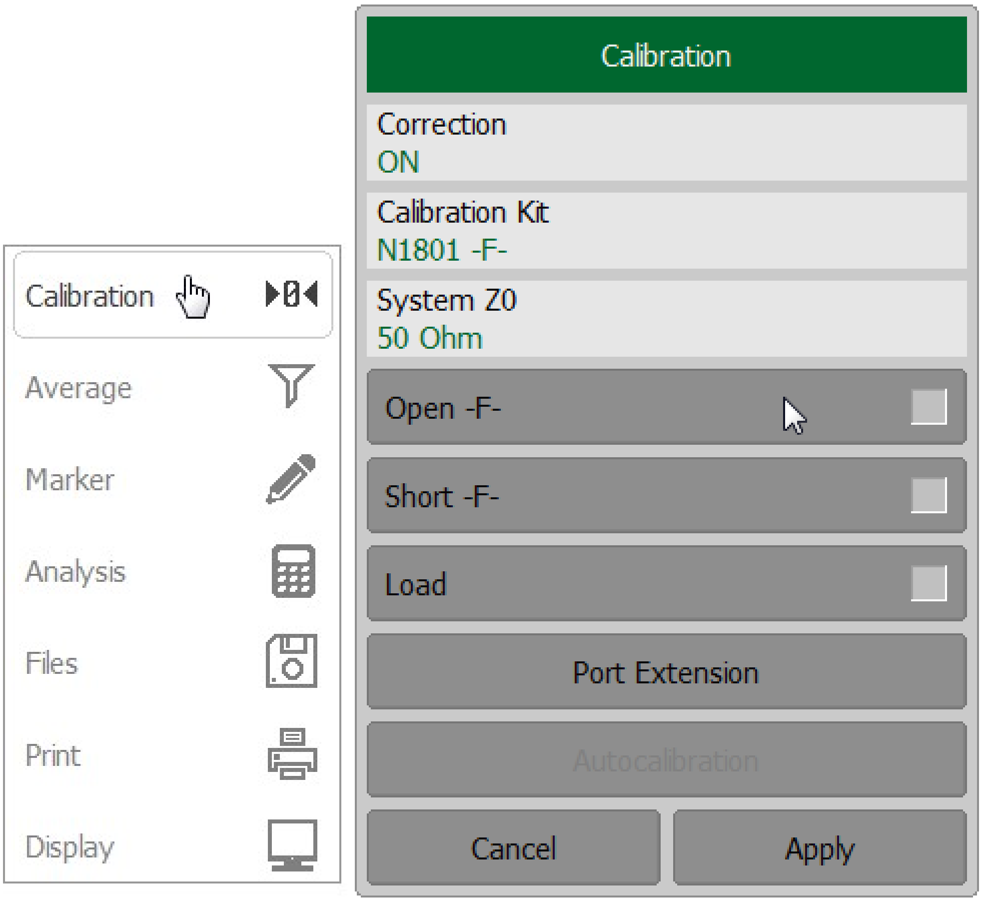
NOTE	Reflection normalization can also be referred to as **response open** or **response short** calibration depending on the standard being used: OPEN or SHORT.

Before starting calibration perform the following settings: select active channel, set the parameters of the channel (frequency range, IF bandwidth, etc.), and select the calibration kit.

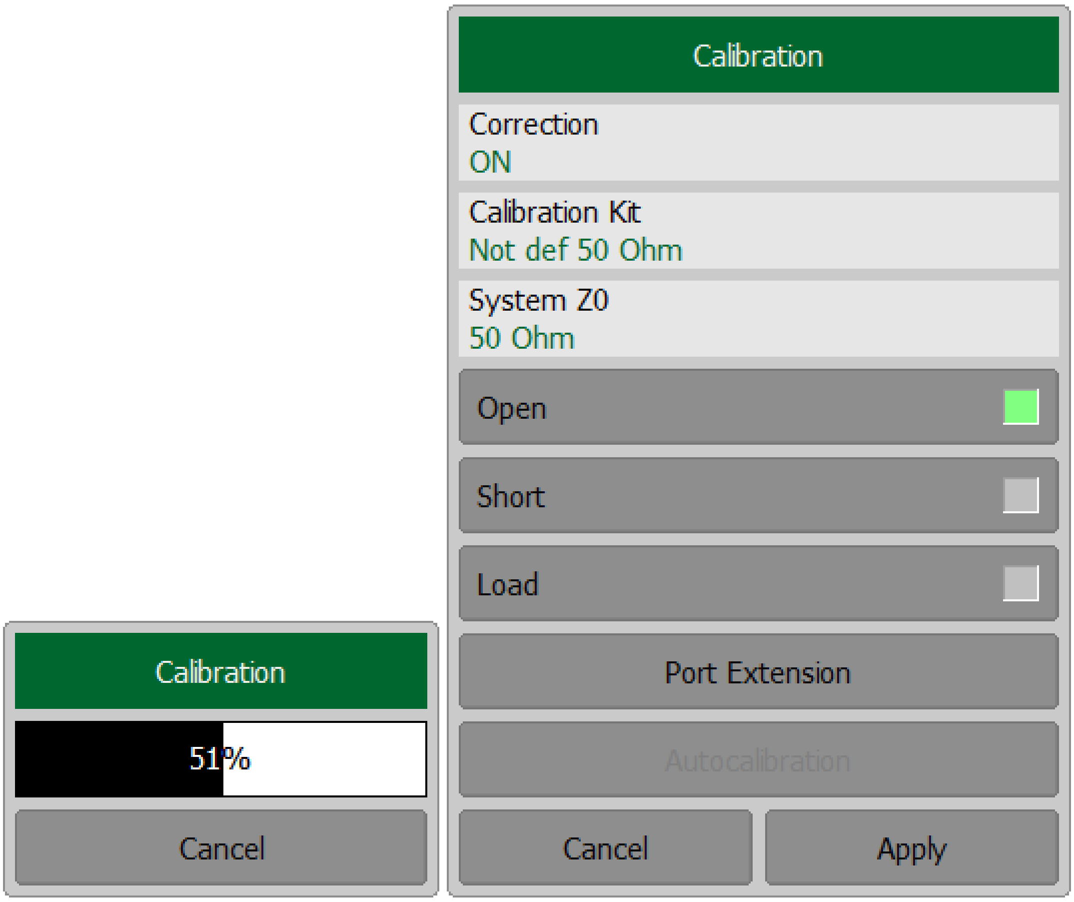
Reflection Normalization for 1-port VNA

To perform reflection normalization, use the following softkey **Calibration** in the left menu bar.

Connect an OPEN or a SHORT standard to the test port as shown in above. Perform measurement using **Open** or **Short** softkey respectively.



During the measurement, a pop-up window will appear in the channel window. It will have Calibration label and will indicate the progress of the measurement. On completion of the measurement, the left part of the **Open** or **Short** softkey will be color highlighted.



To complete the calibration procedure, click **Apply** softkey.

This will activate the process of calibration coefficient table calculation and saving it into the memory.

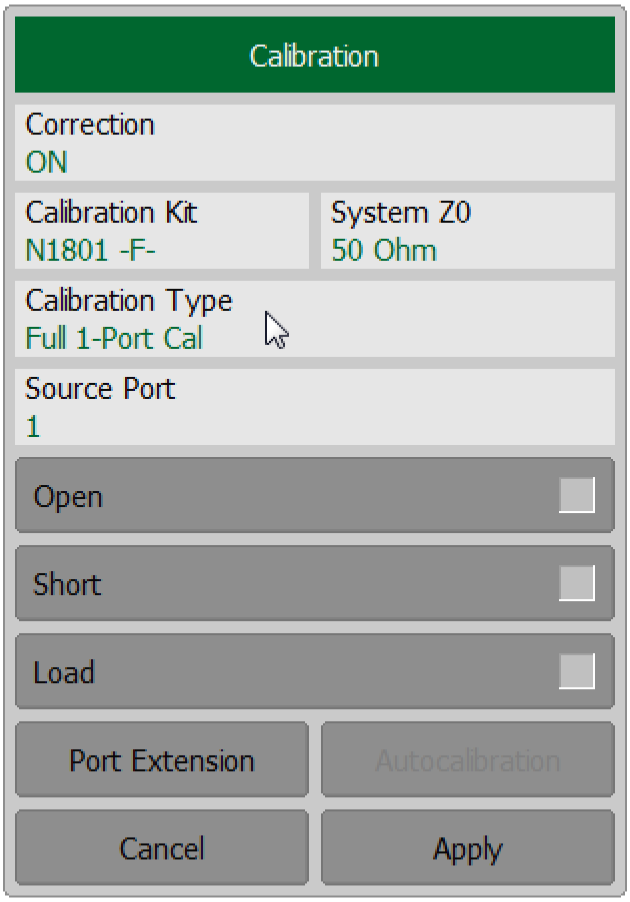
To clear the measurement results of the standards, click **Cancel** softkey. This softkey does not cancel the current calibration. To disable the current calibration, turn off the error correction function (See Error Correction Disabling).

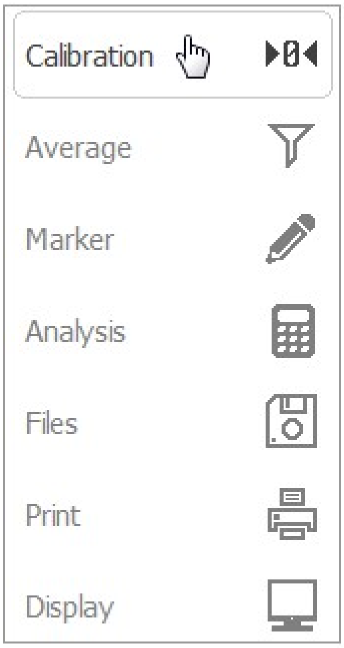
SCPI	SENSe:CORRection:COLLect:METHod:SHORt, SENSe:CORRection:COLLect:SHORt SENSe:CORRection:COLLect:METHod:OPEN, SENSe:CORRection:COLLect:OPEN SENSe:CORRection:COLLect:SAVE, SENSe:CORRection:COLLect:CLEar

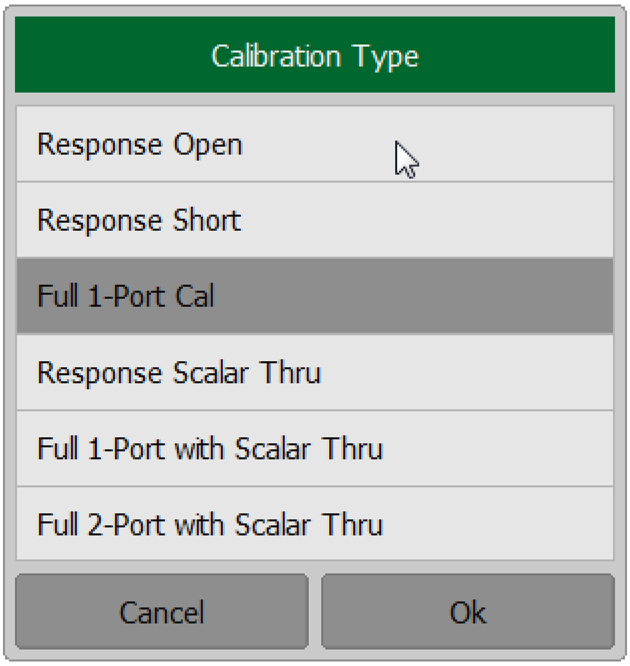
Full One-Port Calibration for RNVNA

To perform reflection normalization, use the softkey **Calibration** in the left menu bar.

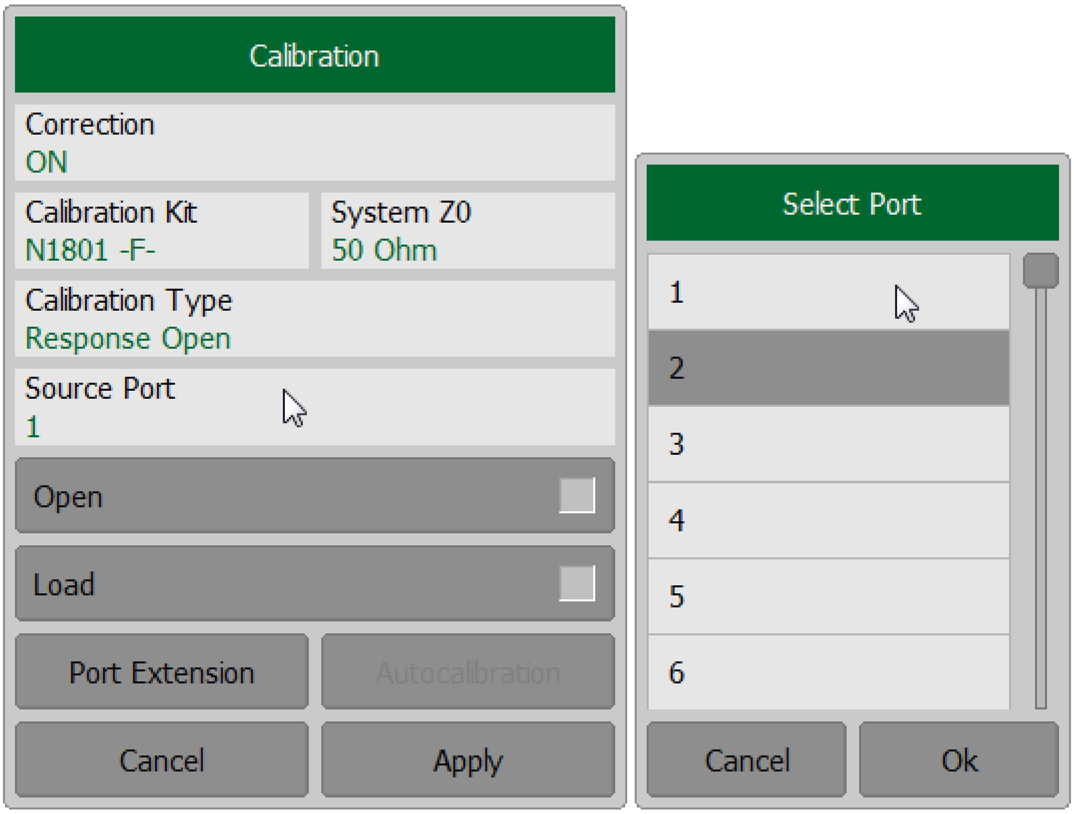
Then click on the **Calibration Type** field. In the dialog Calibration Type select **Response Short** or **Response Open**. Complete the setting by clicking **Ok**.



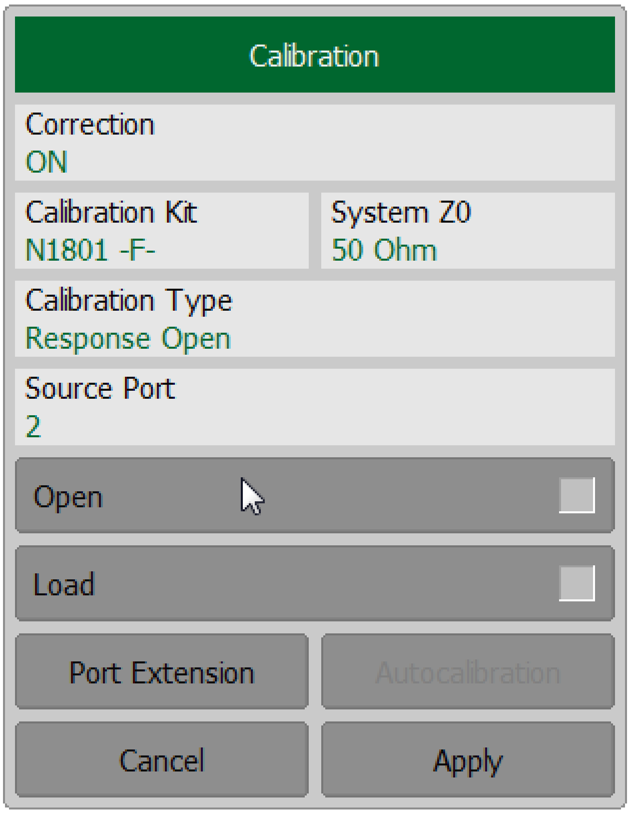




In the dialog Calibration assign a signal source port, click on the **Source Port** field. Then select port in the dialog Select Port.



Connect an OPEN or a SHORT standard to the test port as shown in figure above. Perform measurement using **Open** or **Short** softkey respectively.



During the measurement, a pop-up window will appear in the channel window. It will have Calibration label and will indicate the progress of the measurement. On completion of the measurement, the left part of the **Open** or **Short** softkey will be color highlighted.

To complete the calibration procedure, click **Apply** softkey.

This will activate the process of calibration coefficient table calculation and saving it into the memory.

To clear the measurement results of the standards, click **Cancel** softkey. This softkey does not cancel the current calibration. To disable the current calibration, turn off the error correction function (See Error Correction Disabling).

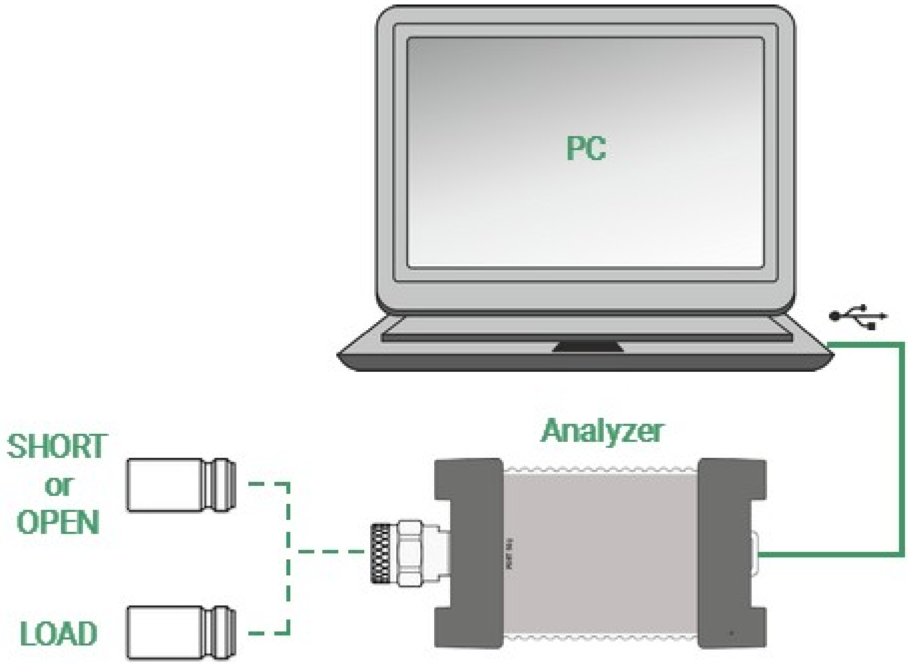
SCPI	SENSe:CORRection:COLLect:METHod:SHORt, SENSe:CORRection:COLLect:SHORt SENSe:CORRection:COLLect:METHod:OPEN, SENSe:CORRection:COLLect:OPEN SENSe:CORRection:COLLect:SAVE, SENSe:CORRection:COLLect:CLEar

NOTE	The calibration status can be checked in the channel status bar (See General error correction status table) or in the trace status field (See Trace error correction status table).

Expanded Reflection Normalization

Expanded reflection normalization is the simplest calibration method used for reflection coefficient measurements (S11). Expanded reflection normalization involves connection of the following two standards to the test port (See figure below):

- SHORT or OPEN.
- LOAD.



Expanded reflection normalization

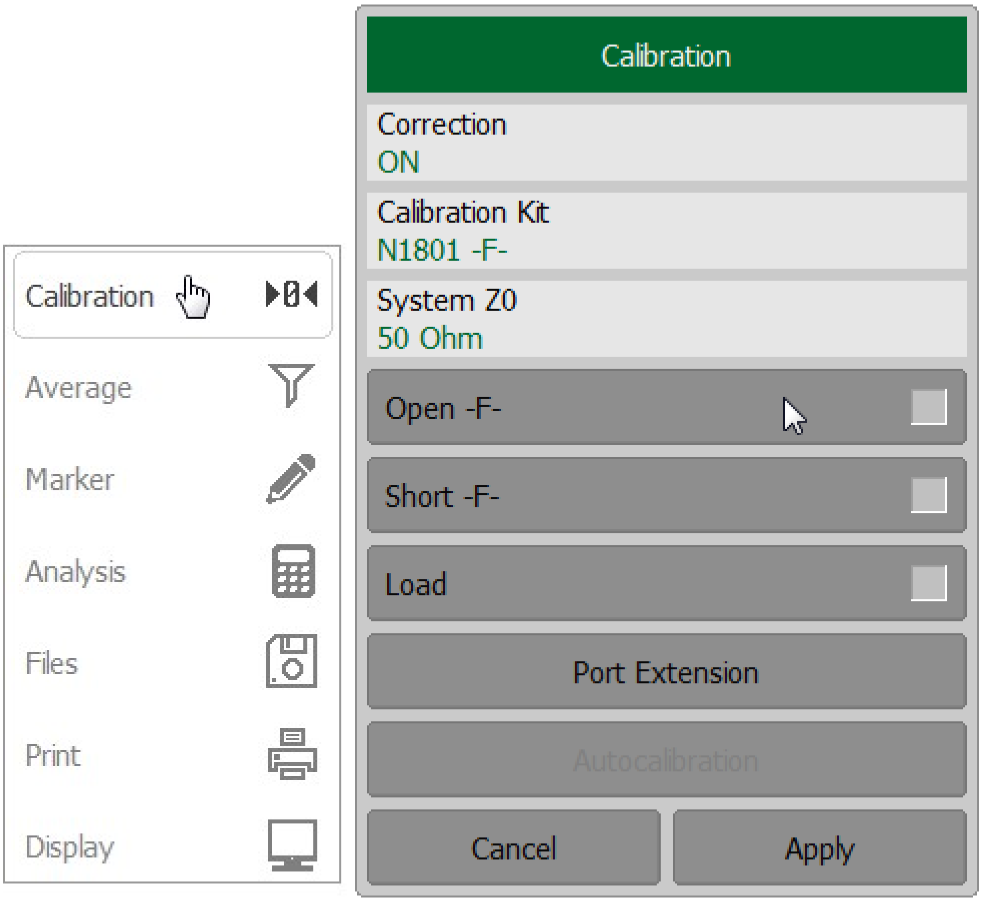
Measurement of the two standards allows for estimation of the reflection tracking error term **Er** and directivity error term – **Ed**. The optional directivity calibration increases the accuracy of the reflection normalization.

Before starting calibration perform the following settings: select active channel, set the parameters of the channel (frequency range, IF bandwidth, etc.), and select the calibration kit.

Reflection Normalization for 1-port VNA

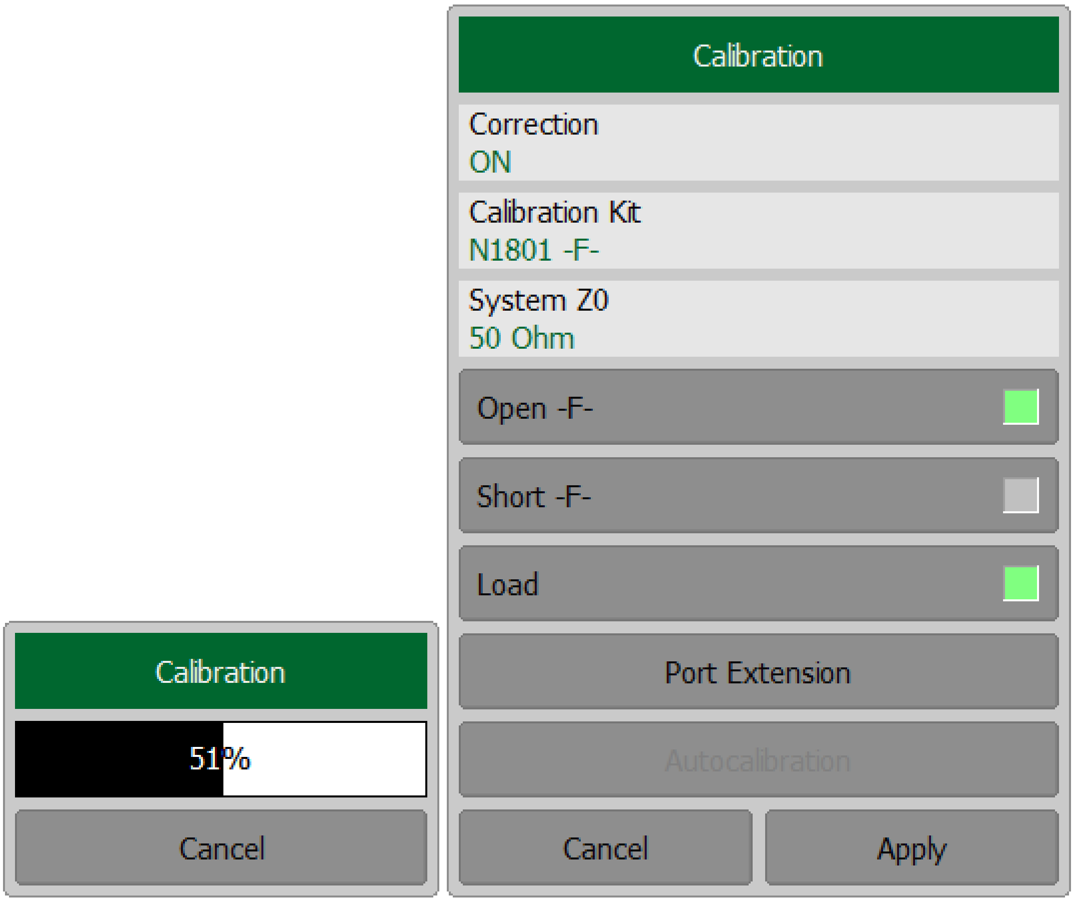
To perform expanded reflection normalization, use the softkey **Calibration** in the left menu bar.

Connect an OPEN or a SHORT standard to the test port as shown in above. Perform measurement using **Open** or **Short** softkey respectively.



During the measurement, a pop-up window will appear in the channel window. It will have Calibration label and will indicate the progress of the measurement. On completion of the measurement, the left part of the **Open** or **Short** softkey will be color highlighted.

Then connect a LOAD standard to the test port as shown in above. Perform measurement using **Load** softkey respectively. On completion of the measurement, the left part of the **Load** softkey will be color highlighted.



To complete the calibration procedure, click **Apply** softkey.

This will activate the process of calibration coefficient table calculation and saving it into the memory.

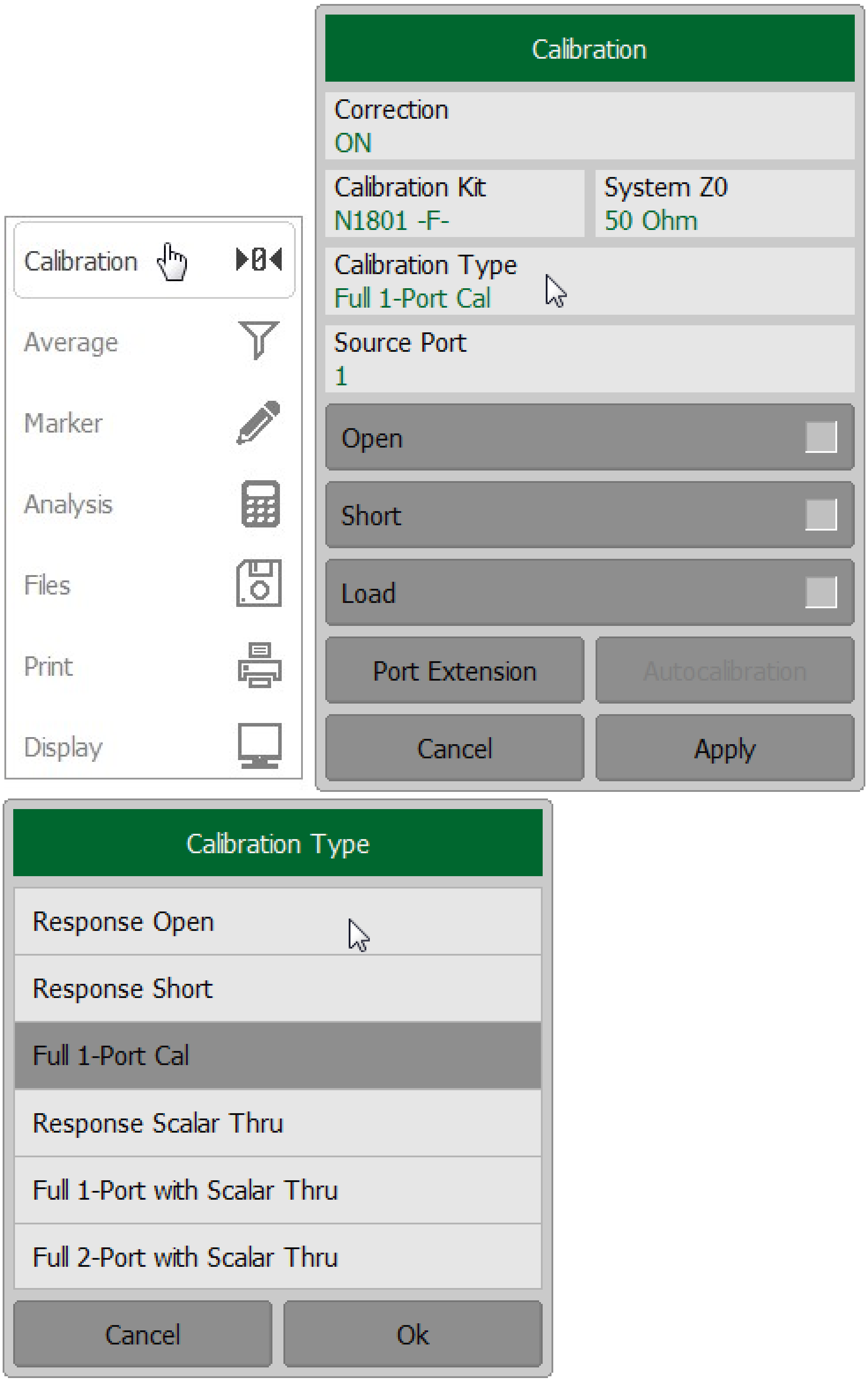
To clear the measurement results of the standards, click **Cancel** softkey. This softkey does not cancel the current calibration. To disable the current calibration, turn off the error correction function (See Error Correction Disabling).

SCPI	SENSe:CORRection:COLLect:METHod:SHORt, SENSe:CORRection:COLLect:SHORt SENSe:CORRection:COLLect:METHod:OPEN, SENSe:CORRection:COLLect:OPEN SENSe:CORRection:COLLect:LOAD SENSe:CORRection:COLLect:SAVE, SENSe:CORRection:COLLect:CLEar

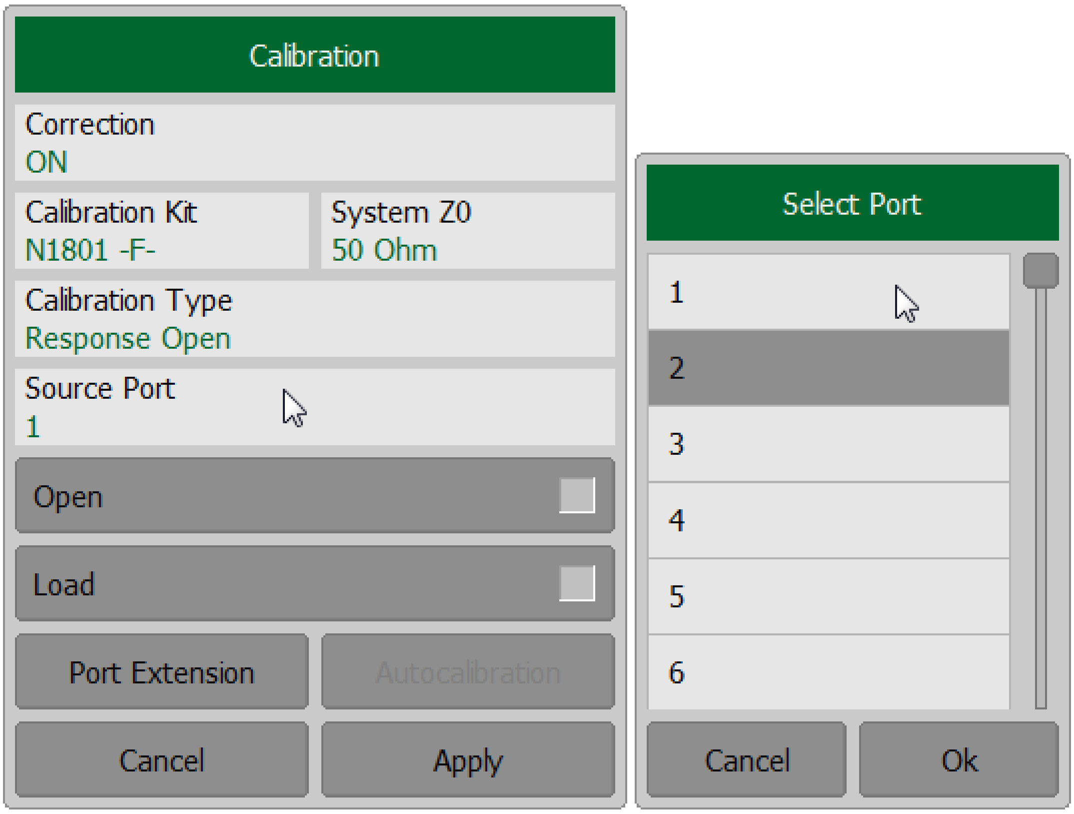
Full One-Port Calibration for RNVNA

To perform reflection normalization, use the softkey **Calibration** in the left menu bar.

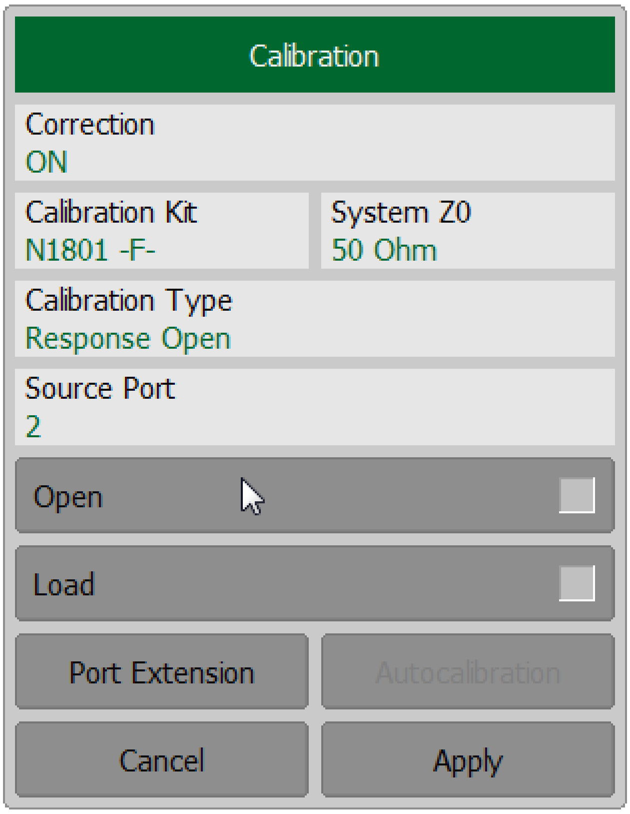
Then click on the **Calibration Type** field. In the dialog Calibration Type select **Response Short** or **Response Open**. Complete the setting by clicking **Ok**.



In the dialog Calibration assign a signal source port, click on the **Source Port** field. Then select port in the dialog Select Port.

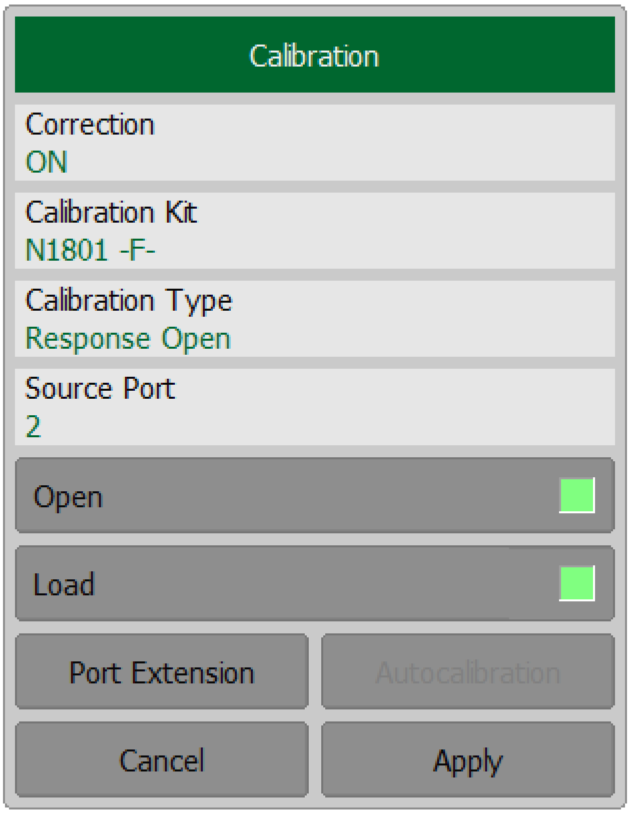


Connect an OPEN or a SHORT standard to the test port as shown in figure above.
Perform measurement using **Open** or **Short** softkey respectively.



During the measurement, a pop-up window will appear in the channel window. It will have Calibration label and will indicate the progress of the measurement. On completion of the measurement, the left part of the **Open** or **Short** softkey will be color highlighted.

Then connect a LOAD standard to the test port as shown in above. Perform measurement using **Load** softkey respectively. On completion of the measurement, the left part of the **Load** softkey will be color highlighted.



To complete the calibration procedure, click **Apply** softkey.

This will activate the process of calibration coefficient table calculation and saving it into the memory.

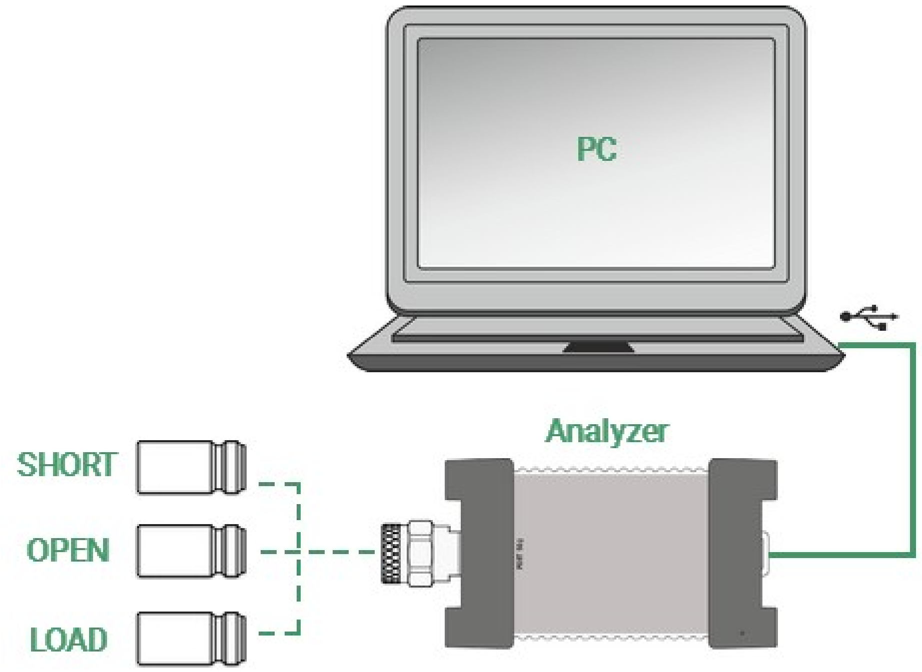
To clear the measurement results of the standards, click **Cancel** softkey. This softkey does not cancel the current calibration. To disable the current calibration, turn off the error correction function (See Error Correction Disabling).

SCPI	SENSe:CORRection:COLLect:METHod:SHORt, SENSe:CORRection:COLLect:SHORt SENSe:CORRection:COLLect:METHod:OPEN, SENSe:CORRection:COLLect:OPEN SENSe:CORRection:COLLect:LOAD SENSe:CORRection:COLLect:SAVE, SENSe:CORRection:COLLect:CLEar

NOTE	The calibration status can be checked in channel status bar (See General error correction status table) or in trace status field (See Trace error correction status table).

Full One-Port Calibration

Full one-port calibration (SOL) is used for reflection coefficient measurements (S11). The three calibration standards (SHORT, OPEN, LOAD) are measured (See figure below) in the process of this calibration. Measurement of the three standards allows for acquisition of all the three error terms (**Ed**, **Es**, and **Er**) of a one-port model. Full one-port calibration is a highly accurate method for 1-port reflection measurements.



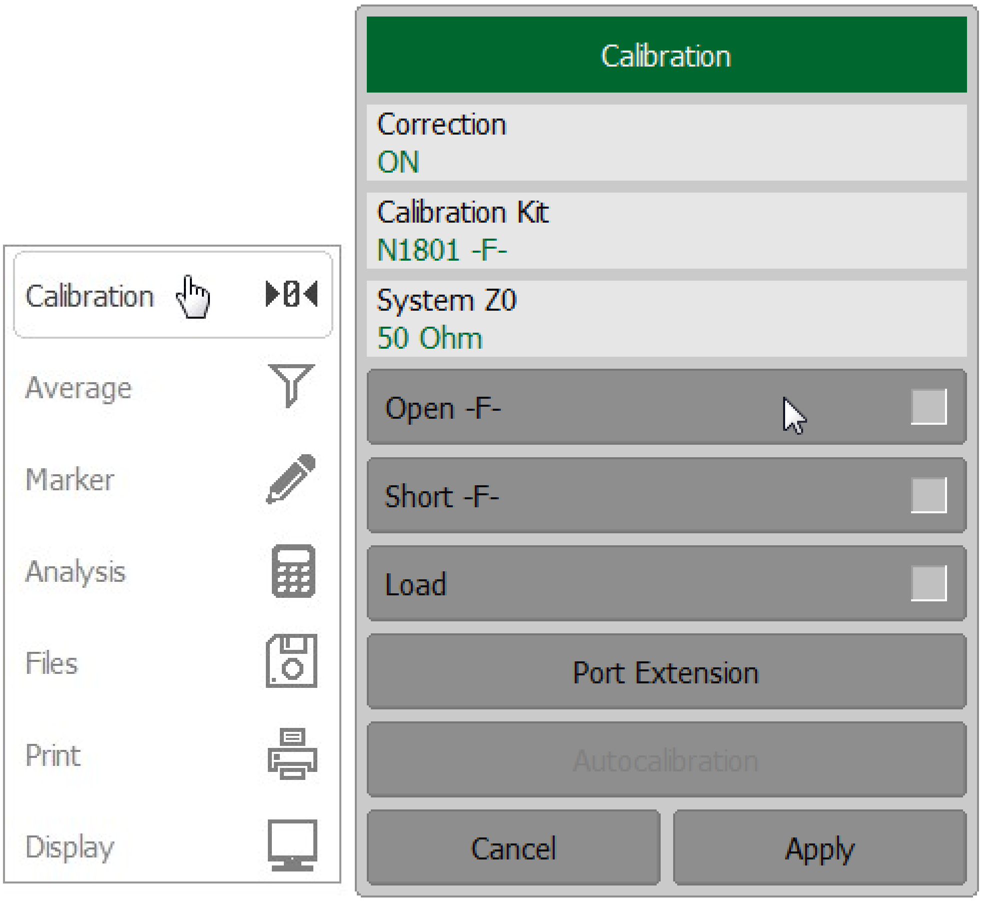
Full one-port calibration

Before starting calibration perform the following settings: select active channel, set the parameters of the channel (frequency range, IF bandwidth, etc.), and select the calibration kit.

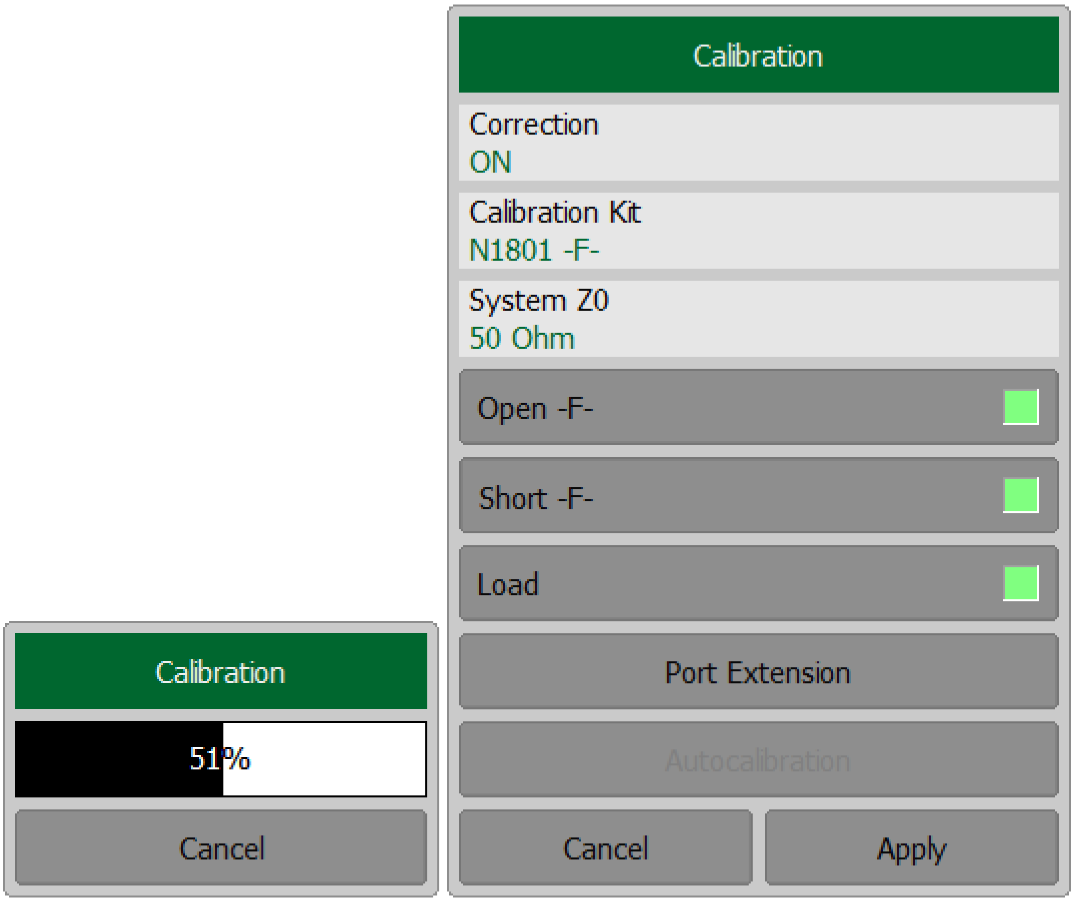
Expanded Reflection Normalization for 1-port VNA

To perform expanded reflection normalization, use the softkey **Calibration** in the left menu bar.

Connect an OPEN, a SHORT and LOAD standards in any sequence to the test port as shown in above. Perform measurement using **Open**, **Short** or **Load** softkey respectively.



During the measurement, a pop-up window will appear in the channel window. It will have Calibration label and will indicate the progress of the measurement. On completion of the measurement, the left part of the **Open**, **Short** or **Load** softkey will be color highlighted.



To complete the calibration procedure, click **Apply** softkey.

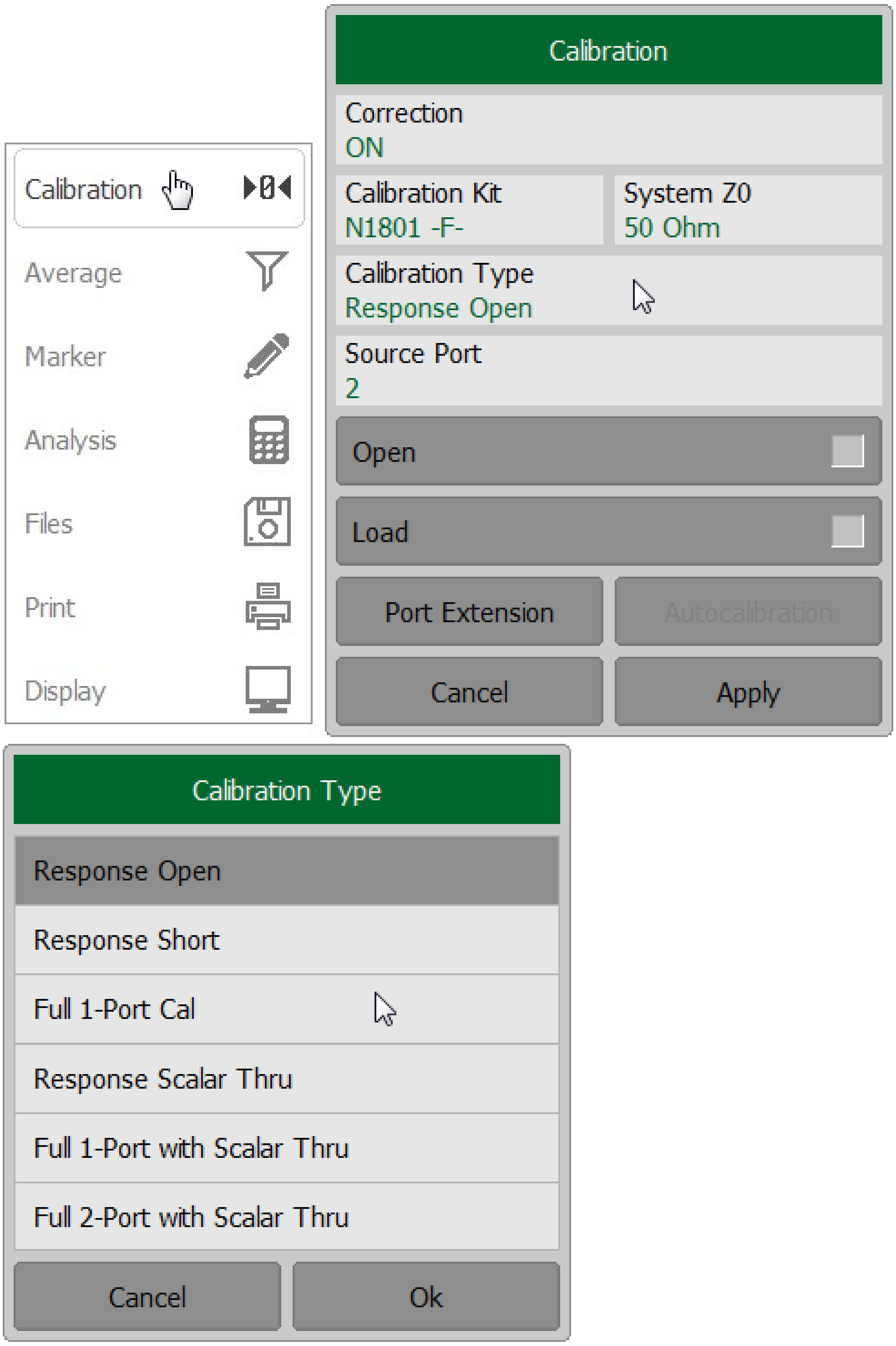
This will activate the process of calibration coefficient table calculation and saving it into the memory.

To clear the measurement results of the standards, click **Cancel** softkey. This softkey does not cancel the current calibration. To disable the current calibration, turn off the error correction function (See Error Correction Disabling).

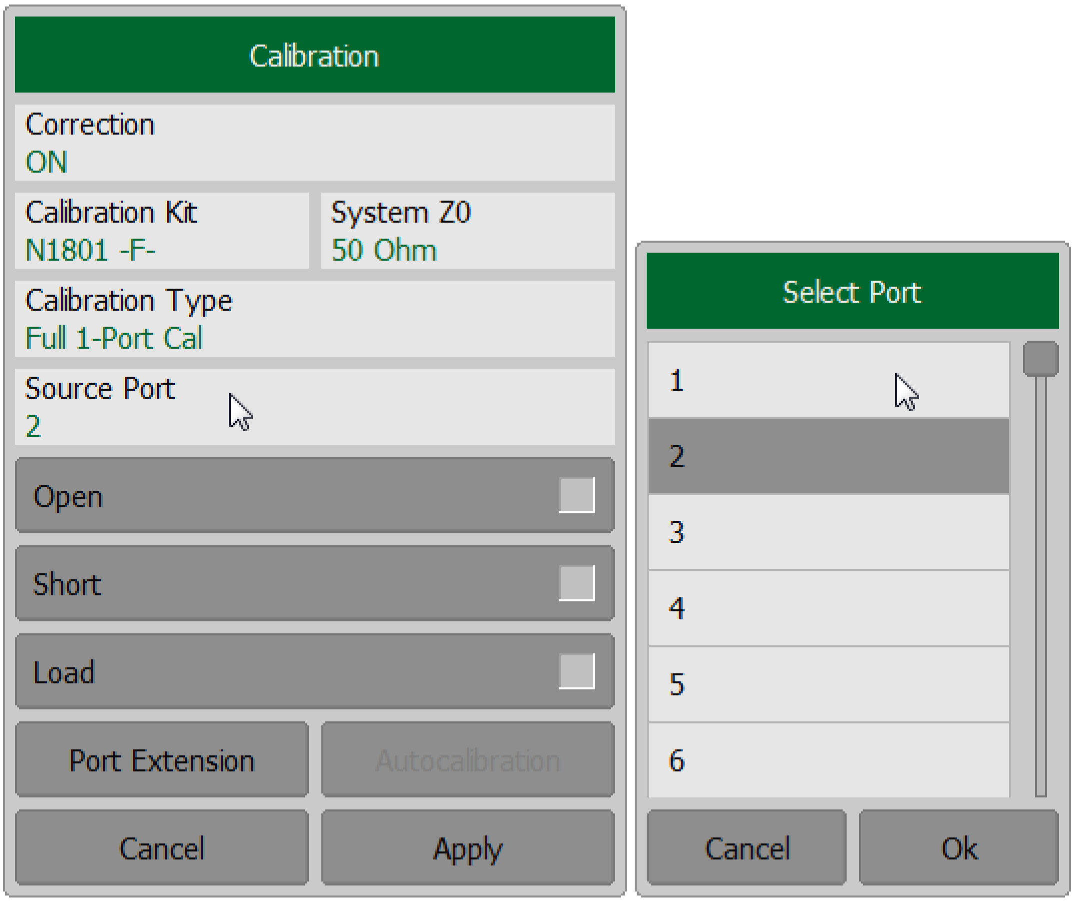
SCPI	SENSe:CORRection:COLLect:METHod:SOLT1 SENSe:CORRection:COLLect:SHORt, SENSe:CORRection:COLLect:OPEN, SENSe:CORRection:COLLect:LOAD SENSe:CORRection:COLLect:SAVE, SENSe:CORRection:COLLect:CLEar

Full One-Port Calibration for RNVNA

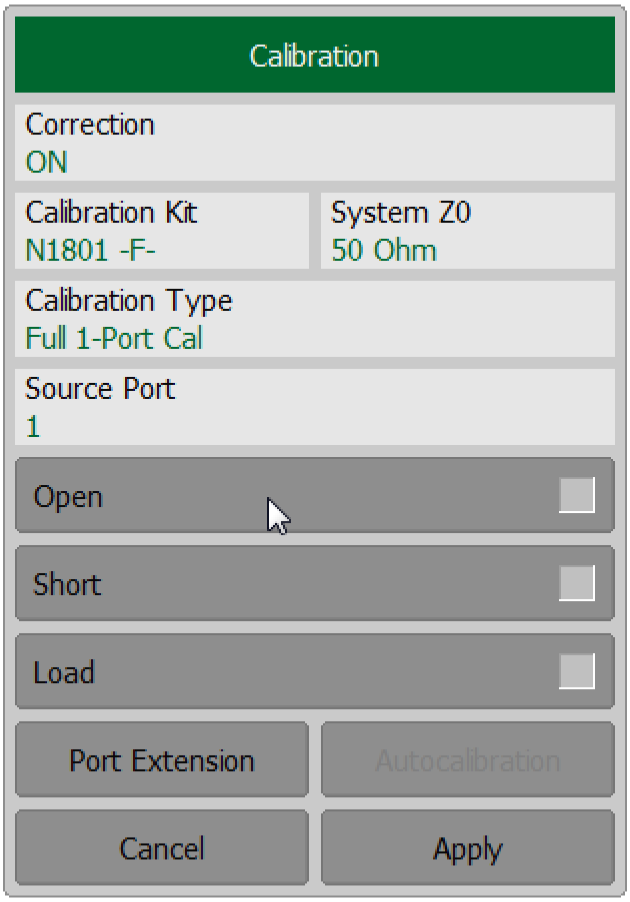
To perform expanded reflection normalization, use the softkey **Calibration** in the left menu bar. Then click on the **Calibration Type** field. In the dialog Calibration Type select **Full 1-Port Cal**. Complete the setting by clicking **Ok**.



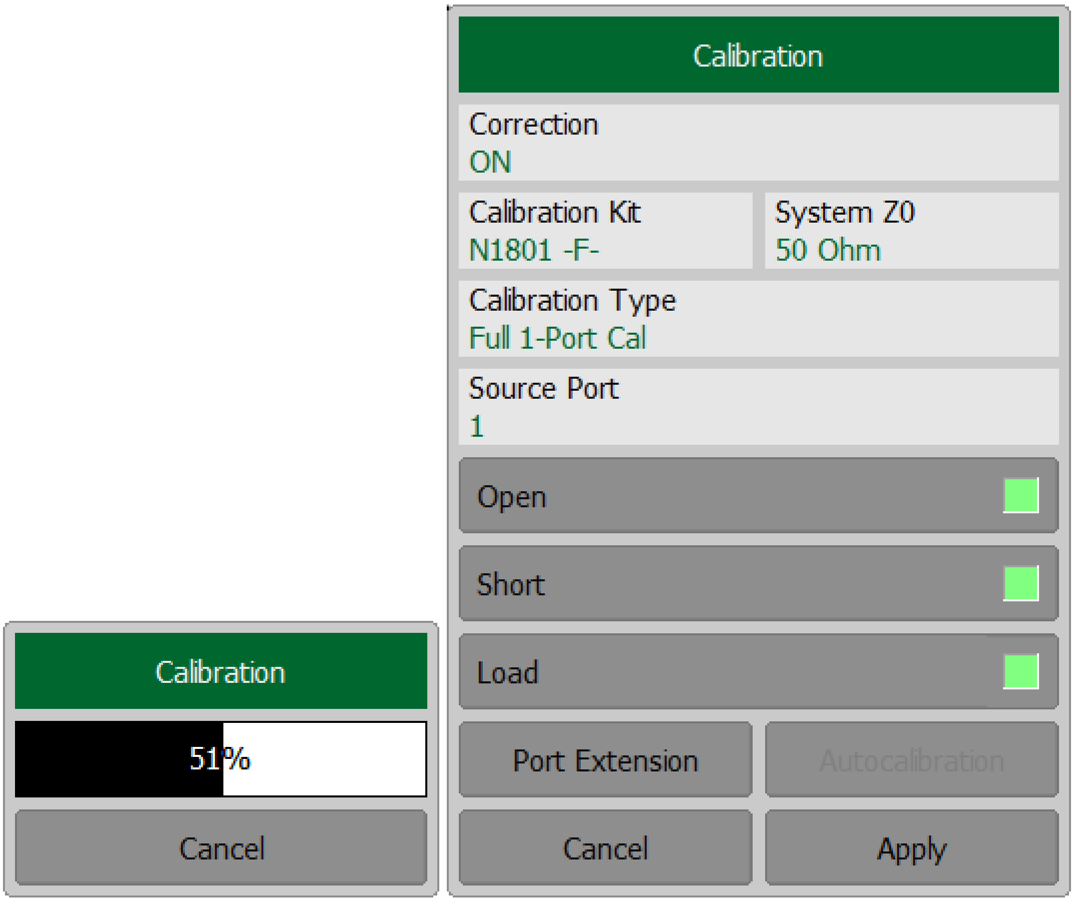
In the dialog Calibration assign a signal source port, click on the **Source Port** field.



Connect an OPEN, a SHORT and LOAD standards in any sequence to the test port as shown in above. Perform measurement using **Open**, **Short** or **Load** softkey respectively.



During the measurement, a pop-up window will appear in the channel window. It will have Calibration label and will indicate the progress of the measurement. On completion of the measurement, the left part of the **Open**, **Short** or **Load** softkey will be color highlighted.



To complete the calibration procedure, click **Apply** softkey.

This will activate the process of calibration coefficient table calculation and saving it into the memory.

To clear the measurement results of the standards, click **Cancel** softkey. This softkey does not cancel the current calibration. To disable the current calibration, turn off the error correction function (See Error Correction Disabling).

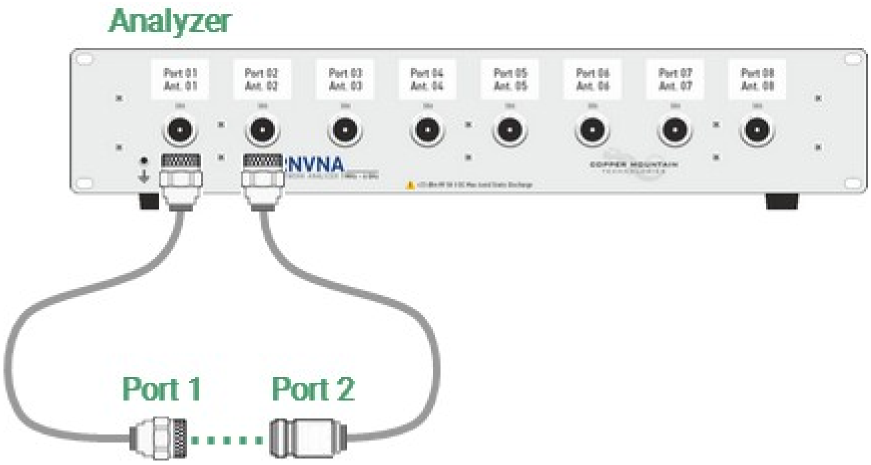
SCPI	SENSe:CORRection:COLLect:METHod:SOLT1 SENSe:CORRection:COLLect:SHORt, SENSe:CORRection:COLLect:OPEN, SENSe:CORRection:COLLect:LOAD SENSe:CORRection:COLLect:SAVE, SENSe:CORRection:COLLect:CLEar

NOTE	The calibration status can be checked in channel status bar (See General error correction status table) or in trace status field (See Trace error correction status table).

Scalar Transmission Normalization

NOTE	This section is available for RNVNA only.

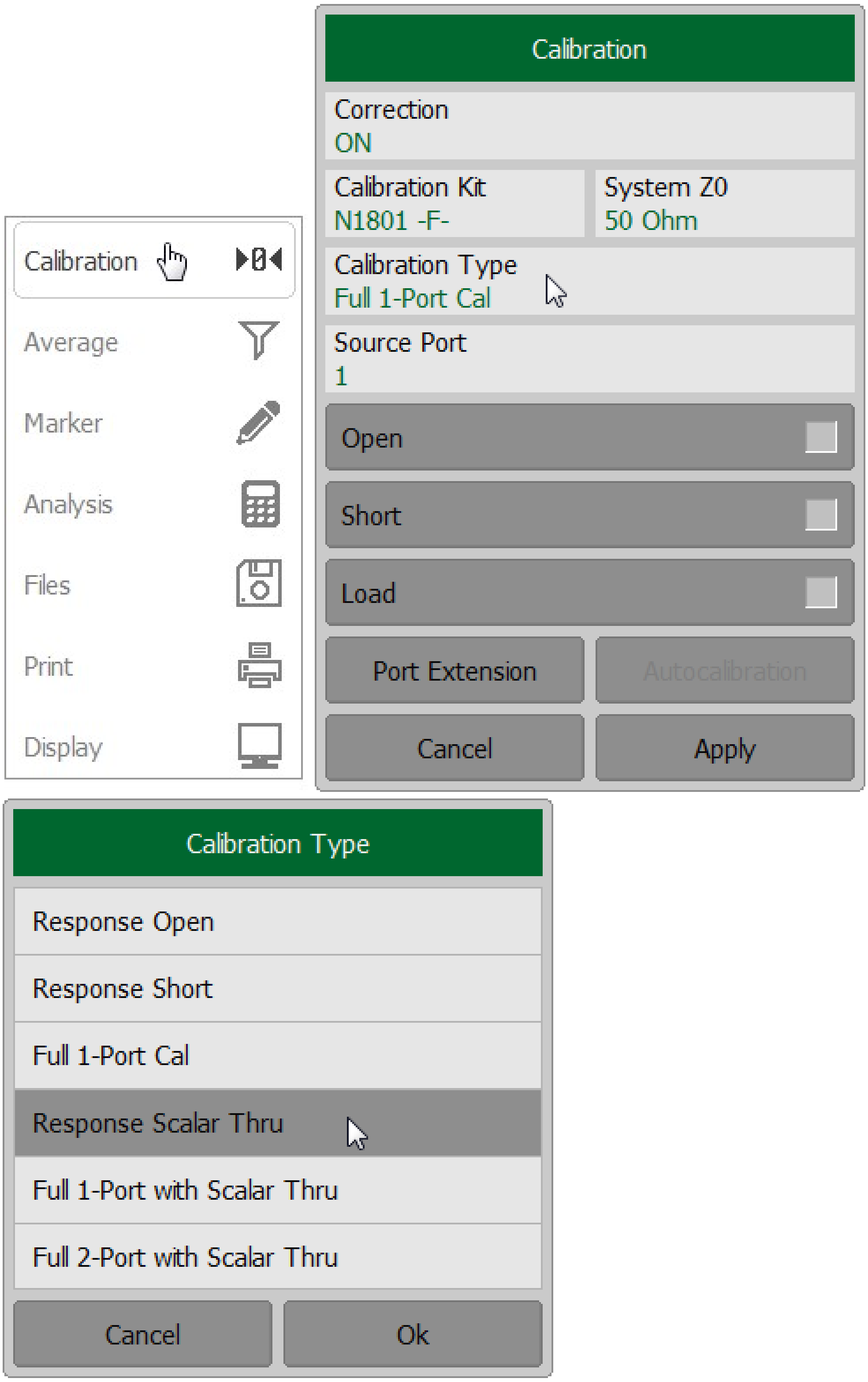
Scalar transmission normalization is used for transmission coefficient measurements (|S21| or |S12|). The one calibration standard (THRU) is measured (See figure below) in the process of this calibration. Transmission normalization corrects the transmission tracking error (**Et**) only. This constrains the accuracy of the method.



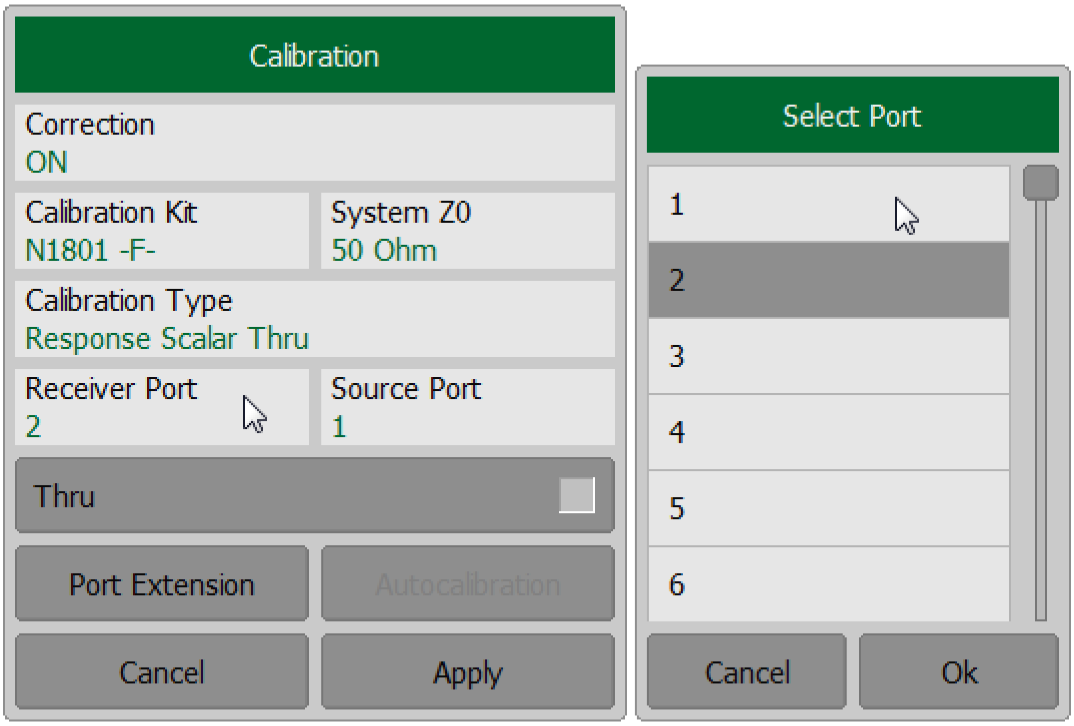
Scalar transmission normalization

Before starting calibration perform the following settings: select active channel, set the parameters of the channel (frequency range, IF bandwidth, etc.), and select the calibration kit.

To perform scalar transmission normalization, use the softkey **Calibration** in the left menu bar. Then click on the **Calibration Type** field. In the dialog Calibration Type select **Response Scalar Thru**. Complete the setting by clicking **Ok**.

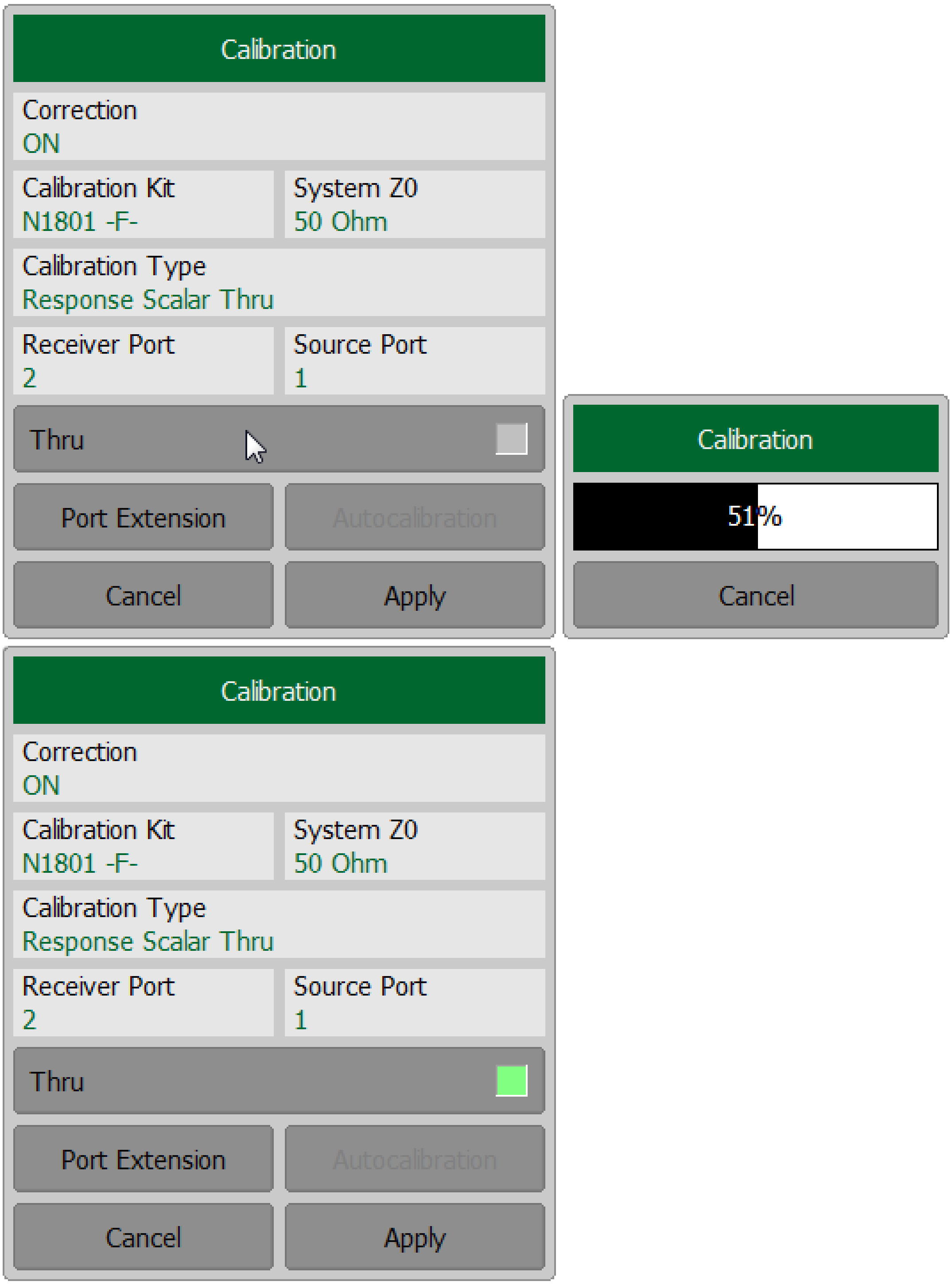


In the Calibration dialog assign the signal receiver port, clicking on the **Receiver Port** field. Then select port in the **Select Port** dialog. Then assign a signal source port in a similar way, clicking on the **Source Port** field.



Connect the analyzers ports by THRU standard.

Press the softkey **Thru** and wait until the measurement is completed. On completion of the measurement, the left part of the **Thru** softkey will be color highlighted.



To apply the calibration results, click **Apply** softkey. This will activate the process of calibration coefficient table calculation and saving it into the memory. The error correction function will also be automatically enabled.

To clear the measurement results of the standard, click **Cancel** softkey. This softkey does not cancel the current calibration. To disable the current calibration, turn off the error correction function (See Error Correction Disabling).

SCPI	SENSe:CORRection:COLLect:METHod:THRU SENSe:CORRection:COLLect:THRU SENSe:CORRection:COLLect:SAVE, SENSe:CORRection:COLLect:CLEar

NOTE	The calibration status can be checked in channel status bar (See General error correction status table) or in trace status field (See Trace error correction status table).

One-Path Two-Port Calibration with Scalar Thru

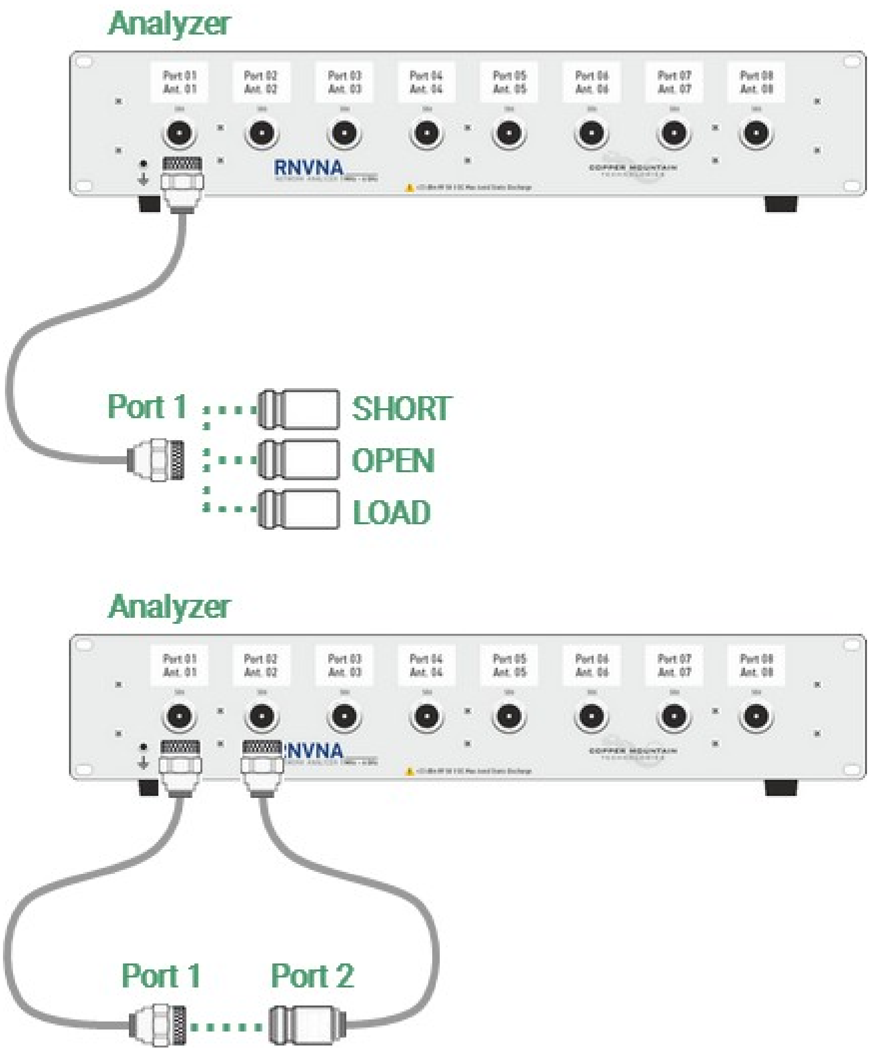
NOTE	This section is available for RNVNA only.

A one-path two-port calibration with scalar thru combines full one-port calibration with scalar transmission normalization. This method allows for a more accurate estimation of transmission tracking error (**Et**) than using transmission normalization.

One-path two-port calibration with scalar thru involves connection of the three standards to the source port of the Analyzer (as for one-port calibration) and a THRU standard connection between the calibrated source port and the other receiver port (See figure below).

One-path two-port calibration with scalar thru allows for correction of **Ed**, **Es**, and **Er** error terms of the source port and a transmission tracking error term (**Et**). This method does not derive source match error term (**El**) of a two-port error model.

NOTE	For isolation calibration, set a narrow IF bandwidth and firmly attach the cables.

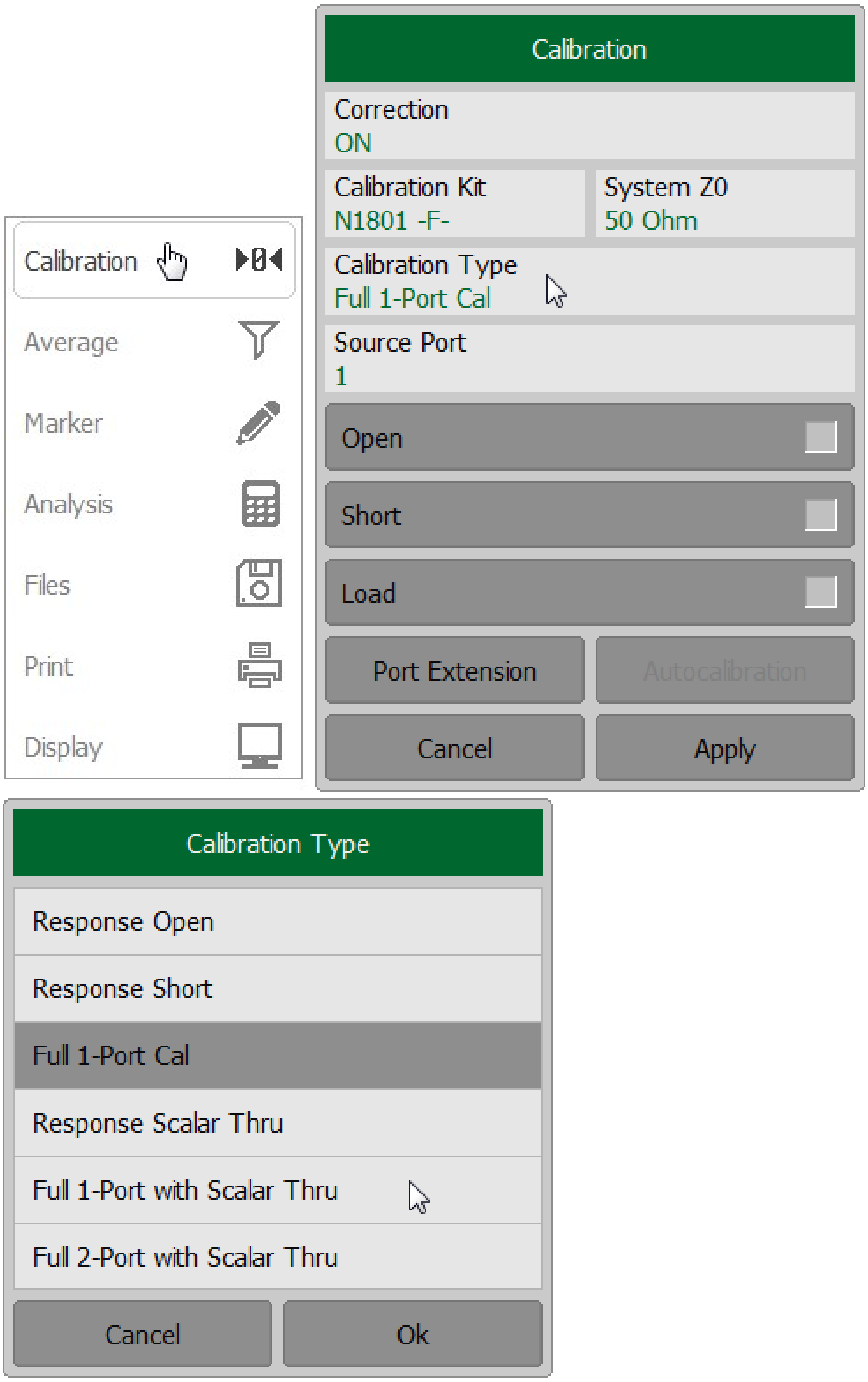


One-path two-port calibration

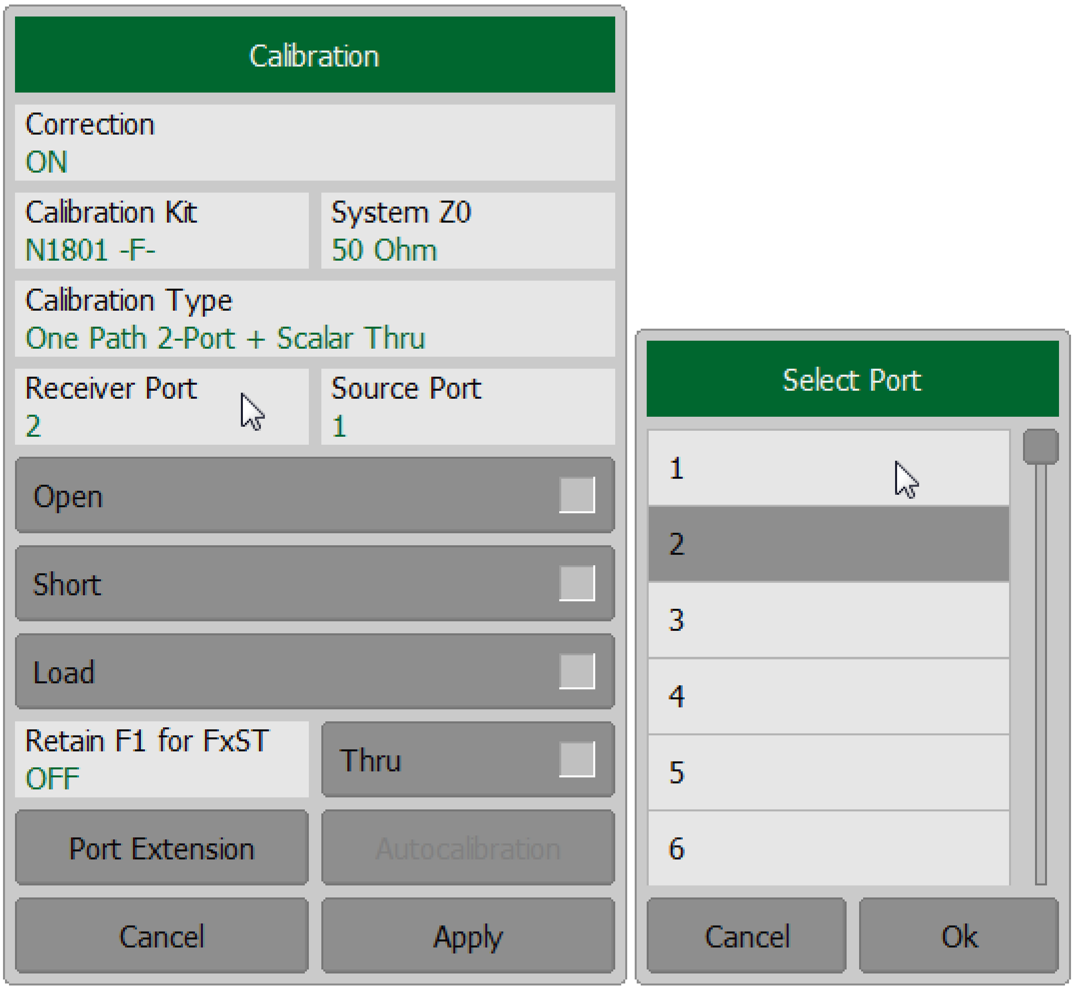
One-path two-port calibration is used for measurements of the parameters of a DUT in one direction, e.g. S11 and S21.

Before starting calibration perform the following settings: select active channel, set the parameters of the channel (frequency range, IF bandwidth, etc.), and select the calibration kit.

To perform one-path two-port calibration with scalar thru (F1ST), use the softkey **Calibration** in the left menu bar. Then click on the **Calibration Type** field. In the dialog Calibration Type select **One Path 2-Port with Scalar Thru**. Complete the setting by clicking **Ok**.

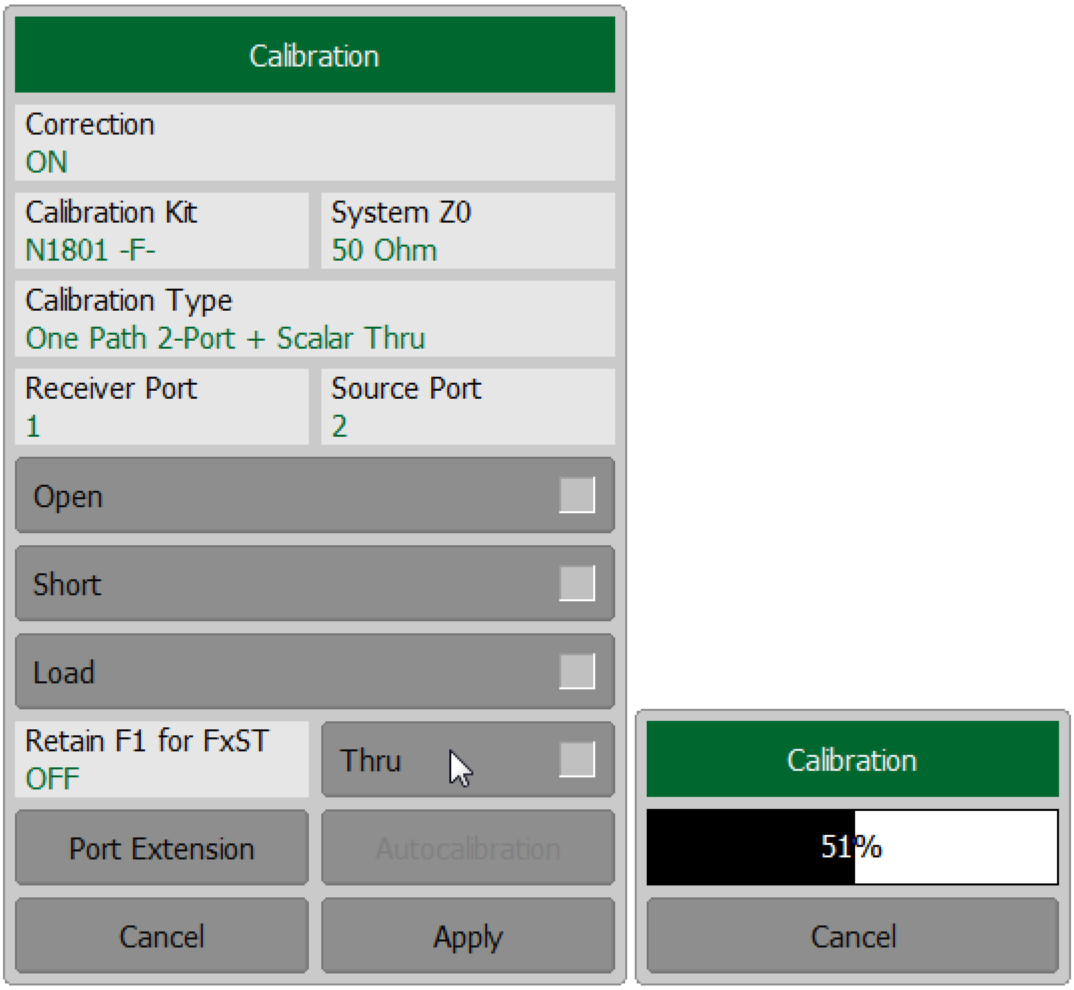


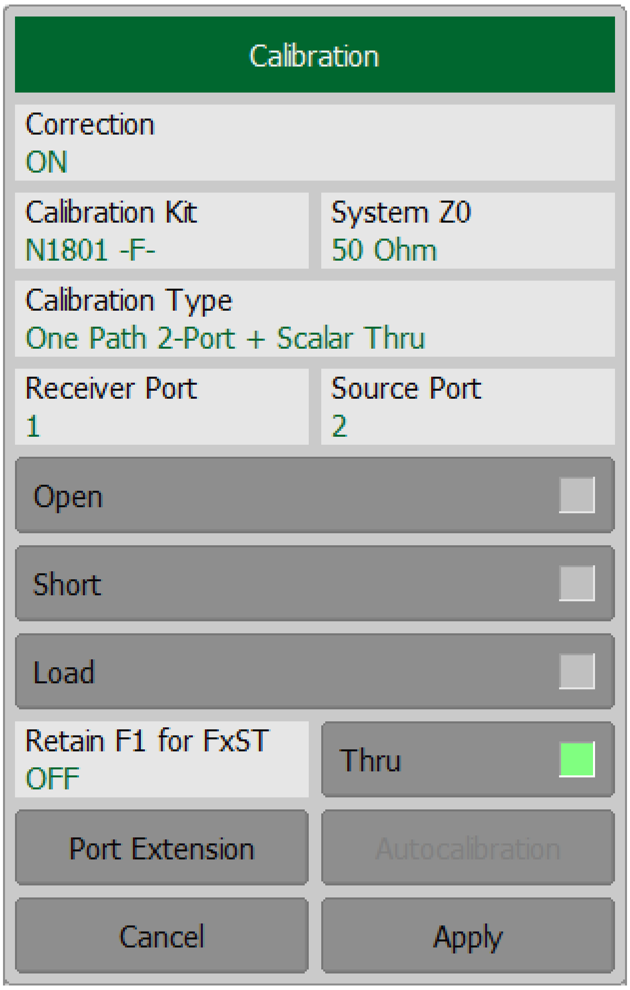
In the Calibration dialog assign a signal receiver port, clicking on the **Receiver Port** field. Then select port in the **Select Port** dialog. Then assign a signal source port in a similar way, clicking on the **Source Port** field.



Connect the Analyzers ports by Thru standard. Press the softkey **Thru** and wait until the measurement is complete.

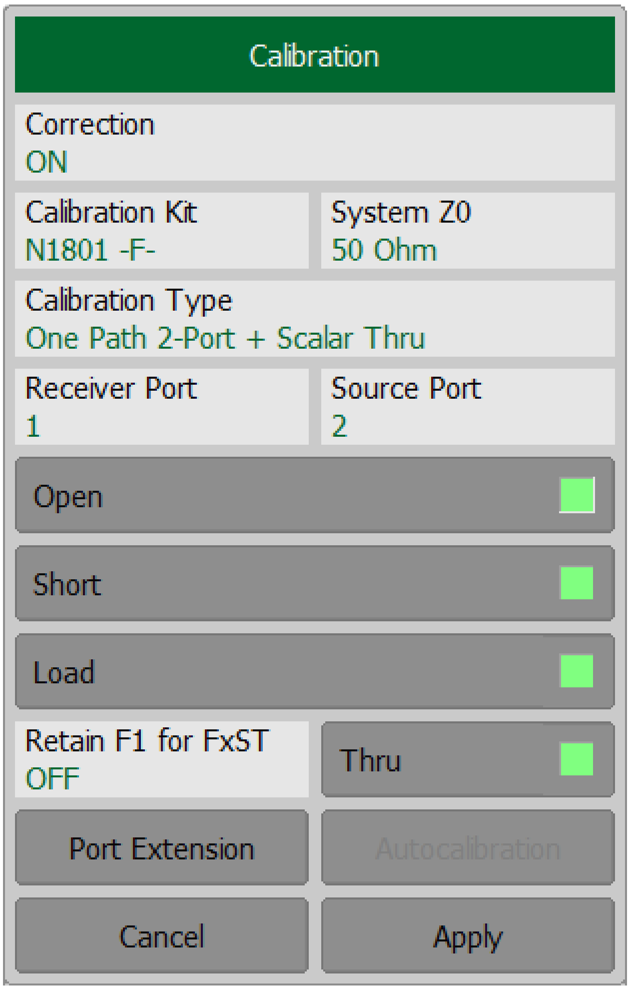
During the measurement, a pop-up window will appear in the channel window. It will have Calibration label and will indicate the progress of the measurement. On completion of the measurement, the left part of the **Thru** softkey will be color highlighted.


Calibration
Correction
ON
Calibration Kit
N1801 -F-
System Z0
50 Ohm
Calibration Type
One Path 2-Port + Scalar Thru
Receiver Port
1
Source Port
2
Open
Short
Load
Retain F1 for FxST
OFF
Thru
Port Extension
Autocalibration
Cancel
Apply
Calibration
51%
Cancel



Connect an OPEN, a SHORT and LOAD standards in any sequence to the test port as shown in above. Perform measurement using **Open**, **Short** or **Load** softkey respectively.

During the measurement, a pop-up window will appear in the channel window. It will have Calibration label and will indicate the progress of the measurement. On completion of the measurement, the left part of the **Open**, **Short** or **Load** softkey will be color highlighted.



To apply the calibration results, click **Apply** softkey. This will activate the process of calibration coefficient table calculation and saving it into the memory. The error correction function will also be automatically enabled.

To clear the measurement results of the standard, click **Cancel** softkey. This softkey does not cancel the current calibration. To disable the current calibration, turn off the error correction function (See Error Correction Disabling).

SCPI	SENSe:CORRection:COLLect:METHod:ERESponse SENSe:CORRection:COLLect:SHORt, SENSe:CORRection:COLLect:OPEN, SENSe:CORRection:COLLect:LOAD, SENSe:CORRection:COLLect:THRU SENSe:CORRection:COLLect:SAVE, SENSe:CORRection:COLLect:CLEar

NOTE	The calibration status can be checked in channel status bar (See General error correction status table) or in trace status field (See Trace error correction status table).

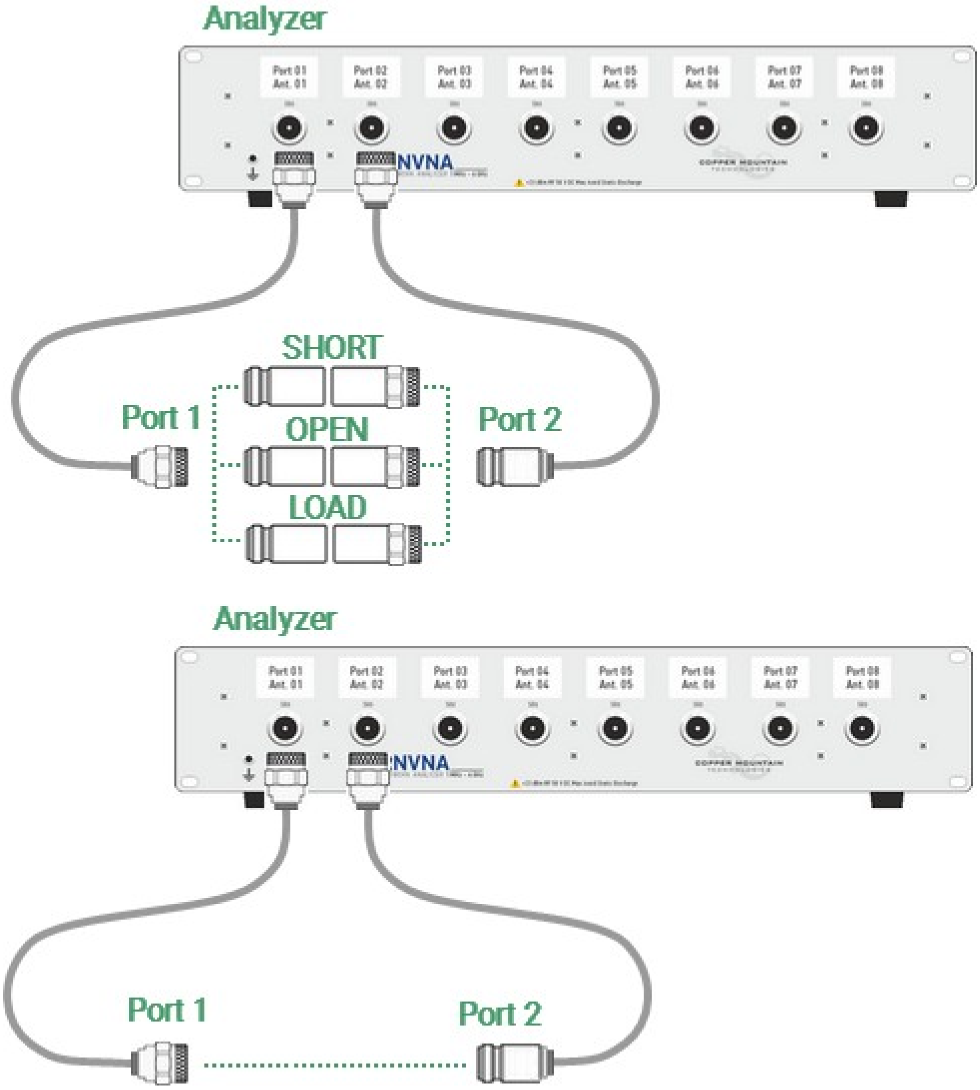
Full Two-Port Calibration with Scalar Thru

NOTE	This section is available for RNVNA only.

A full two-port calibration with scalar thru involves seven connections of standards. This calibration combines two one-port calibrations for each test port with measurement of a THRU standard in both directions (See figure below). An optional isolation calibration can be performed by measurement of two LOAD standards connected to both test ports of the Analyzer.

NOTE	For isolation calibration, set a narrow IF bandwidth and firmly attach the cables.

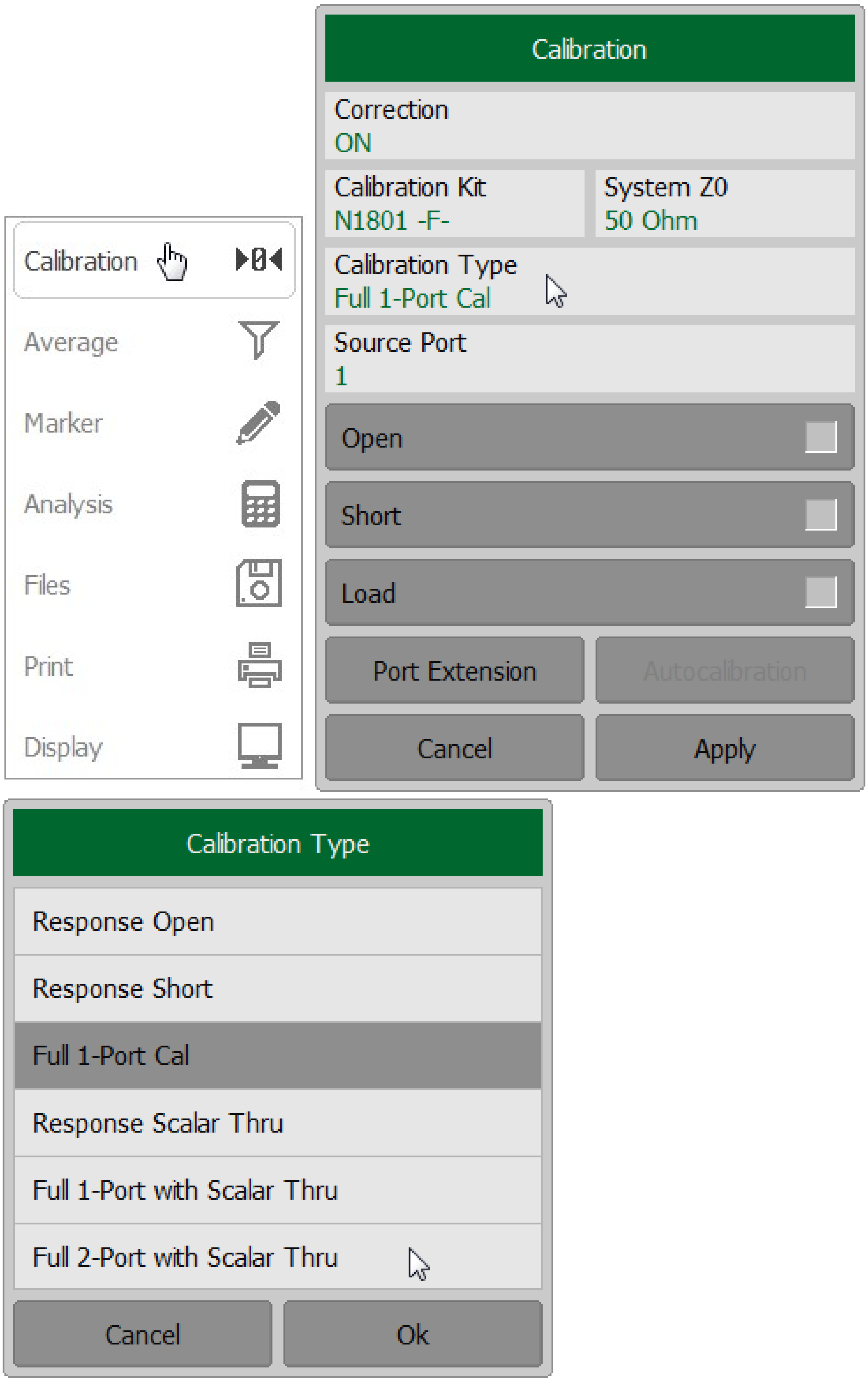
Full two-port calibration with scalar thru allows for correction of all the twelve error terms of a two-port error model: **Ed1, Ed2, Es1, Es2, Er1, Er2, Et1, Et2, El1, El2, Ex1, Ex2** (correction of **Ex1, Ex2** can be omitted).



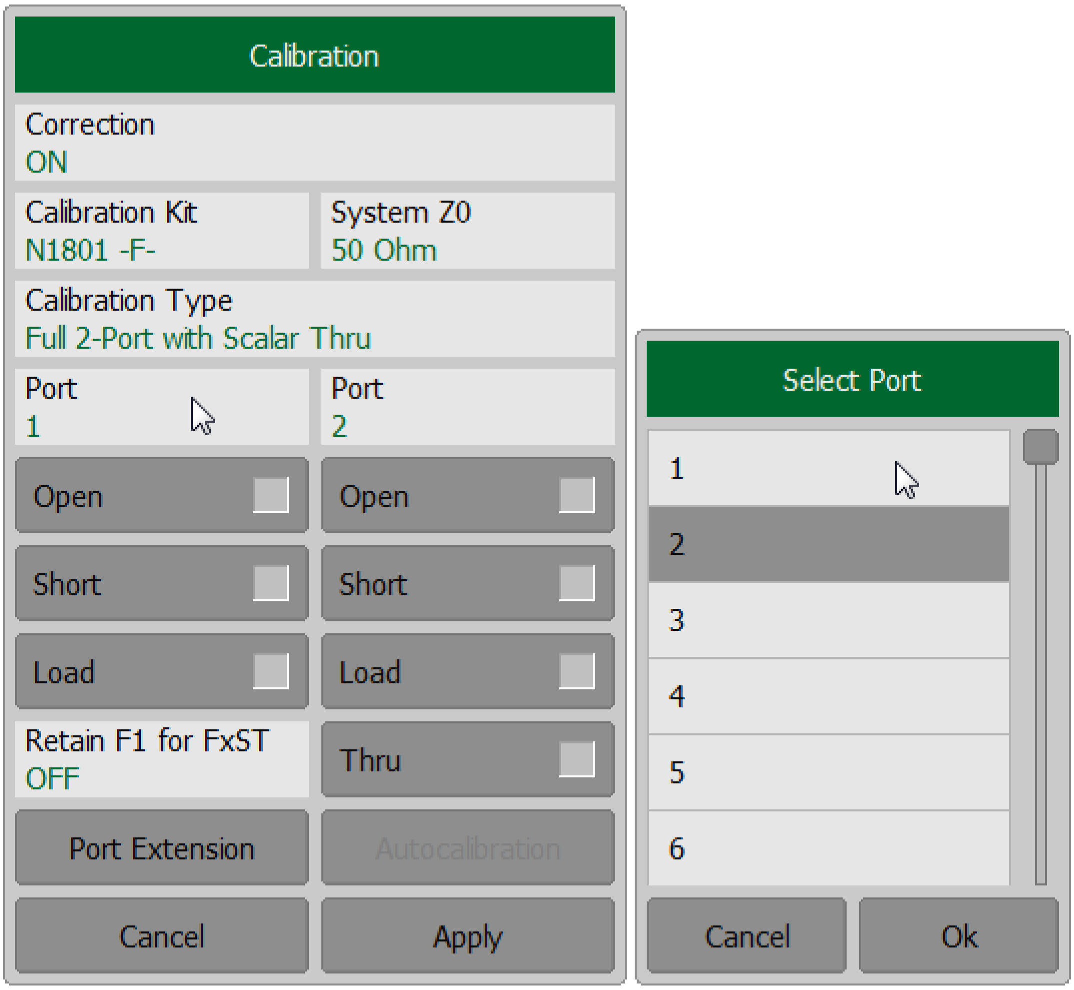
Full two-port calibration

Before starting calibration perform the following settings: select active channel, set the parameters of the channel (frequency range, IF bandwidth, etc.), and select the calibration kit.

To perform full two-port calibration with scalar thru (F2ST), use the softkey **Calibration** in the left menu bar. Then click on the **Calibration Type** field. In the dialog Calibration Type select **Full 2-Port with Scalar Thru**. Complete the setting by clicking **Ok**.



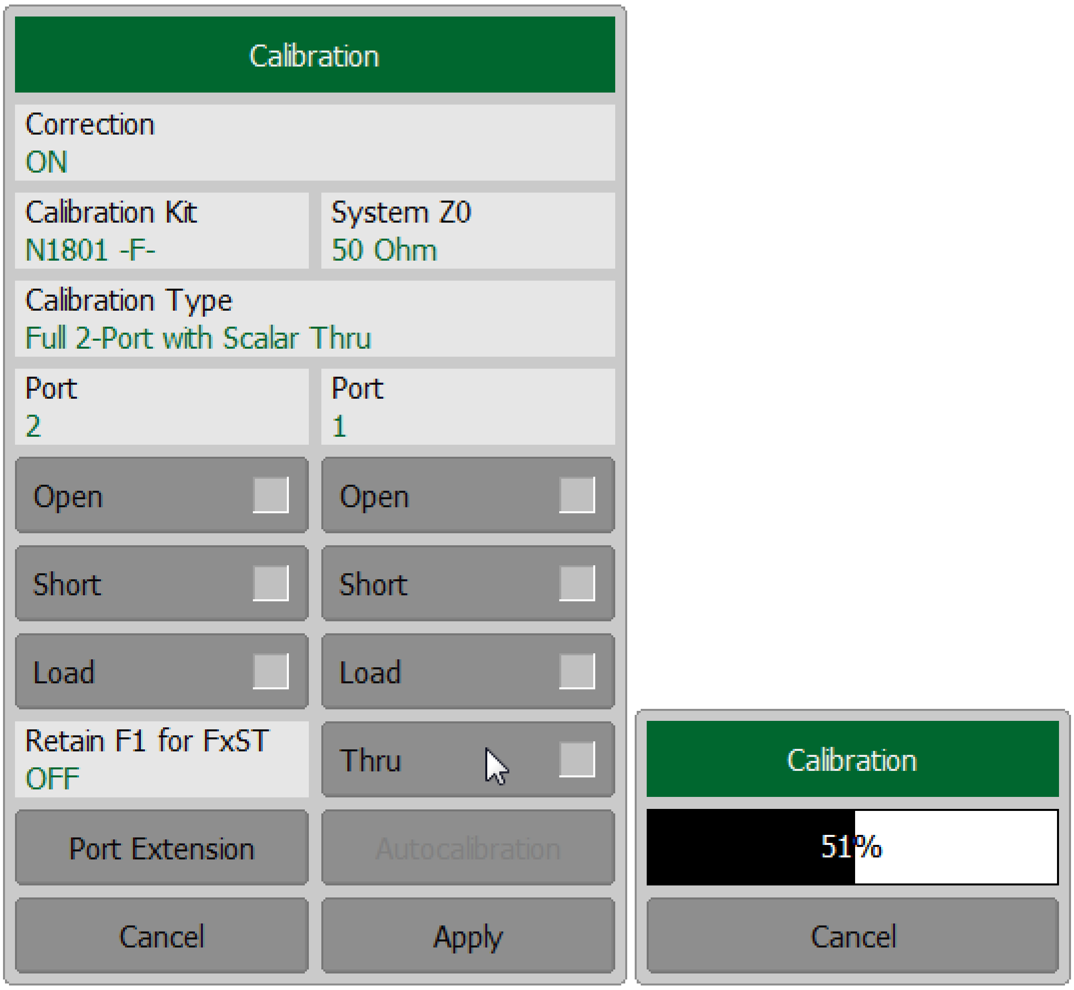
In the **Calibration** dialog, assign a port pair, clicking on the **Port** fields. Then select port in the **Select Port** dialog.

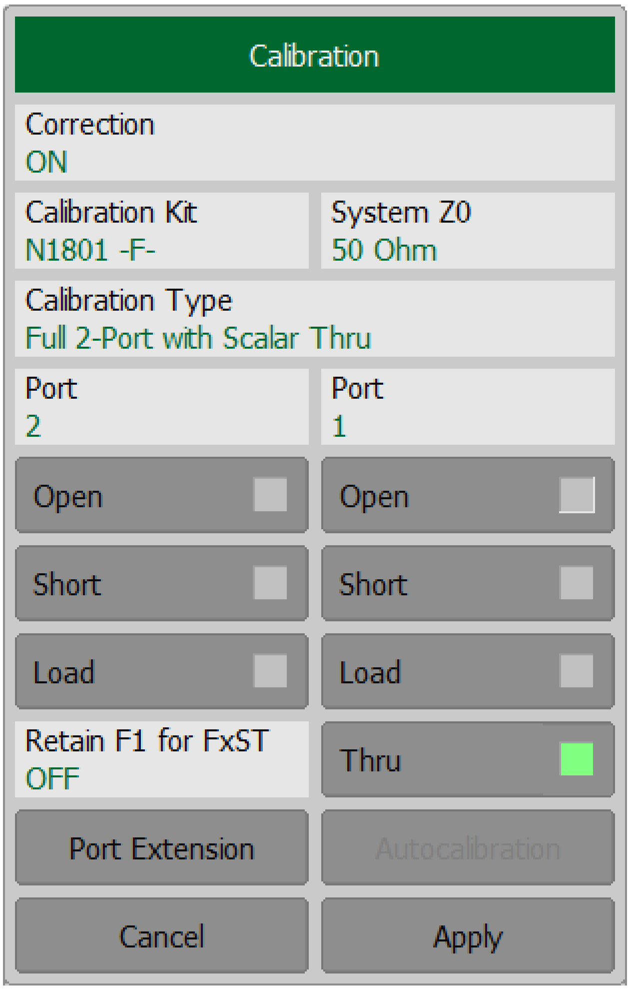


Connect the analyzers ports by THRU standard.

Press the softkey **Thru** and wait until the measurement is complete.

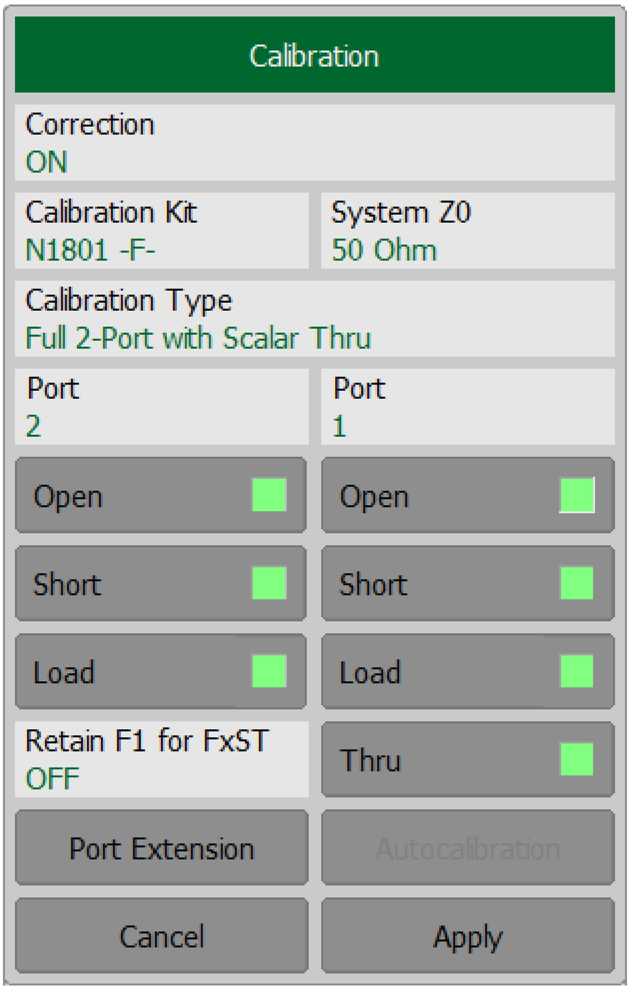
During the measurement, a pop-up window will appear in the channel window. It will have Calibration label and will indicate the progress of the measurement. On completion of the measurement, the left part of the **Thru** softkey will be color highlighted.


Calibration
Correction
ON
Calibration Kit
N1801 -F-
System Z0
50 Ohm
Calibration Type
Full 2-Port with Scalar Thru
Port
2
Port
1
Open
Open
Short
Short
Load
Load
Retain F1 for FxST
OFF
Thru
Port Extension
Autocalibration
Cancel
Apply
Calibration
51%
Cancel



Connect OPEN, SHORT, LOAD standards to the port in any order. Perform measurements, pressing the softkeys **Open**, **Short** or **Load** respectively. During the measurement, a pop-up window will appear in the channel window. It will have Calibration label and will indicate the progress of the measurement. On completion of the measurement, the left part of the corresponding softkey will be color highlighted.

Repeat the measurements for another port.



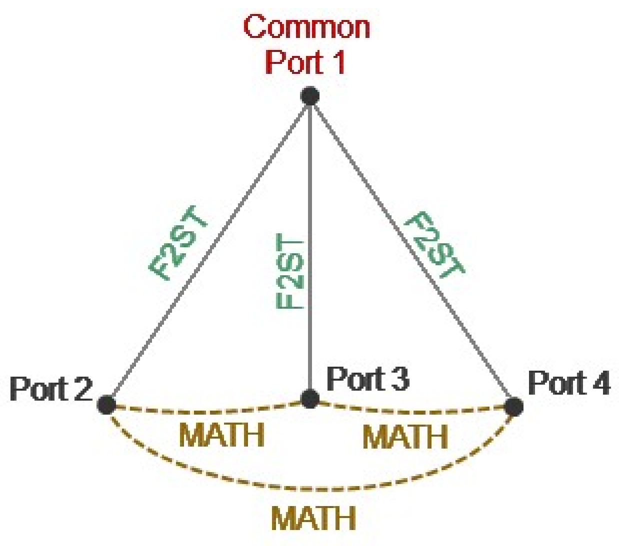
To complete the calibration procedure, click **Apply**.

To clear the measurement results of the standard, click **Cancel**. This softkey does not cancel the current calibration. To disable the current calibration, turn off the error correction function (See Error Correction Disabling).

SCPI	SENSe:CORRection:COLLect:METHod:SOLT2 SENSe:CORRection:COLLect:SHORt, SENSe:CORRection:COLLect:OPEN, SENSe:CORRection:COLLect:LOAD, SENSe:CORRection:COLLect:THRU SENSe:CORRection:COLLect:SAVE, SENSe:CORRection:COLLect:CLEar

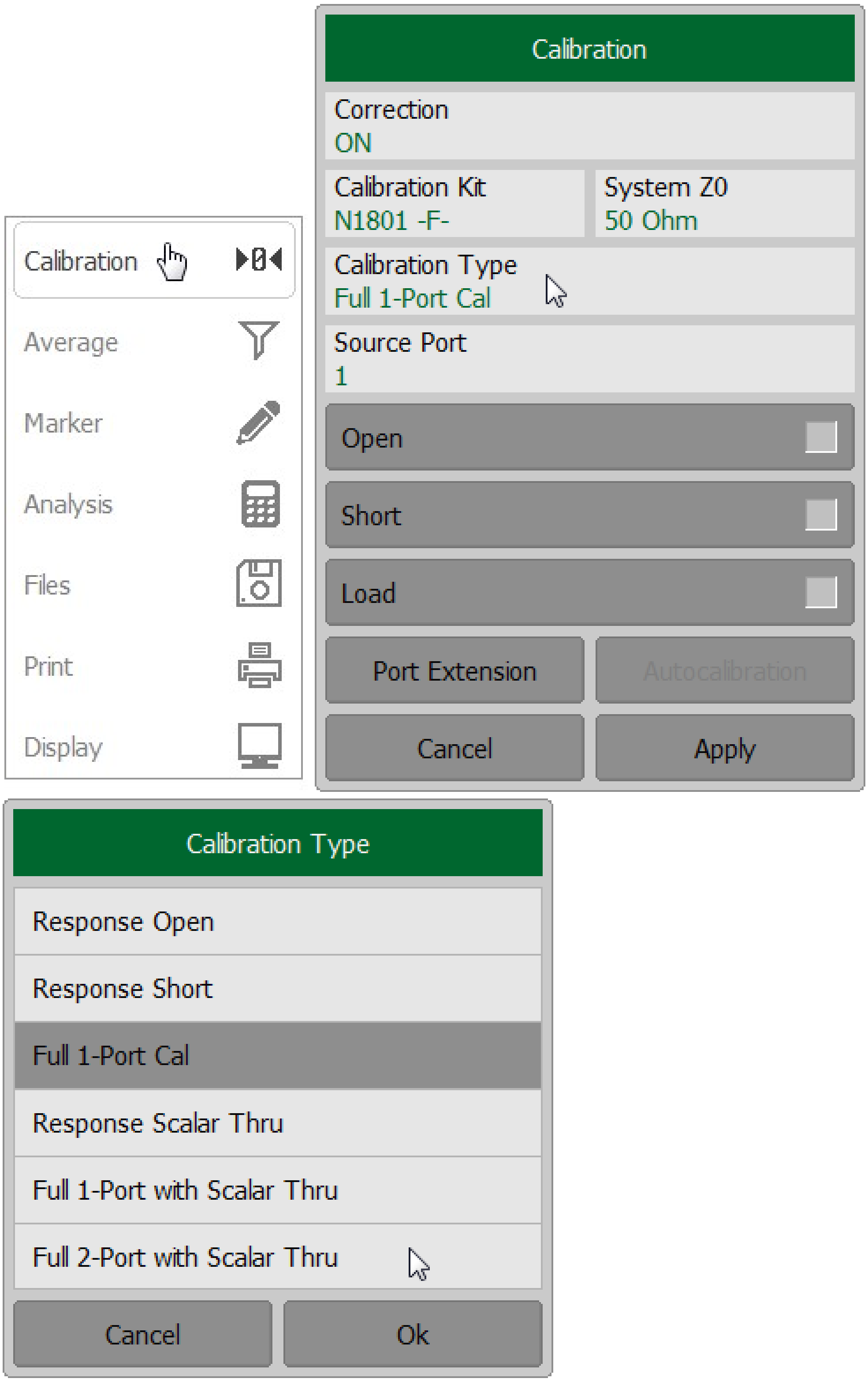
Simplified Full Two-Port Calibration with Scalar Thru (with Calculated Correction Coefficients)

If full two-port calibration with scalar Thru (F2ST) calibrations are performed between the selected common port and other measurement ports, the software calculates the missing calibration coefficients between these ports. This calibration is called **MATH** (see figure below). While this derived correction is less accurate than full two-port calibration with scalar Thru (F2ST) between all the ports pair, it does help reduce error terms.

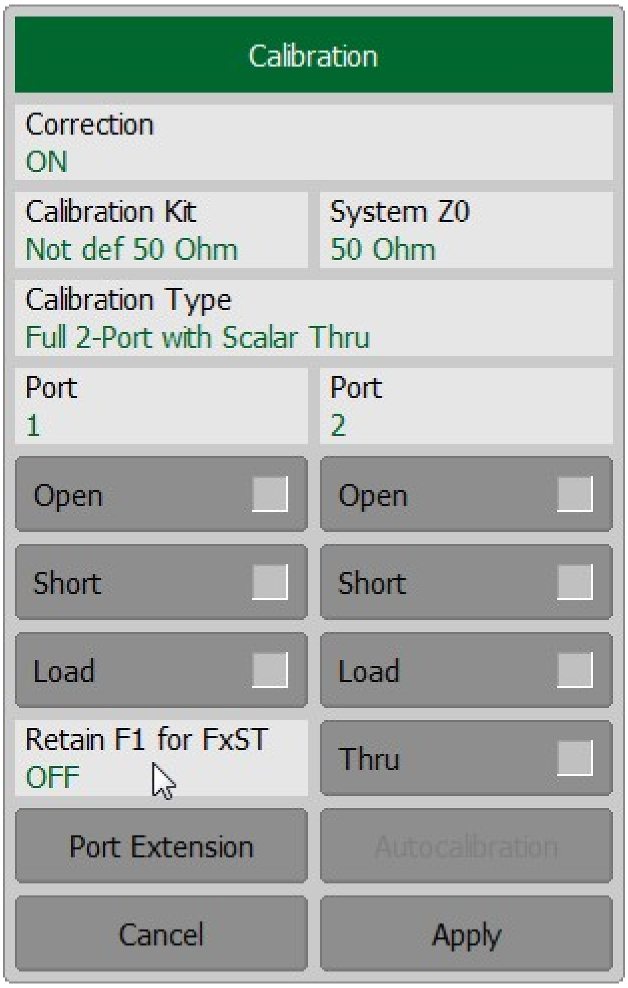


Simplified Full Two-Port Calibration with Scalar Thru (for 4 port)

To perform simplified full two-port calibration with scalar thru (MATH), use the softkey **Calibration** in the left menu bar. Then click on the **Calibration Type** field. In the dialog Calibration Type select **Full 2-Port with Scalar Thru**. Complete the setting by clicking **Ok**.



If calibration is to be performed with a calibration kit, in the **Calibration** window, turn on **Retain F1 for FxST**.



In the **Calibration** dialog, assign a port pair, clicking on the **Port** fields. Then select port in the **Select Port** dialog. Perform full two-port calibration with scalar thru (F2ST) between the selected port pair.

Select the following port pair (with the same common port) and perform full two-port calibration with scalar thru (F2ST) between the selected port pair, and etc.

To complete the calibration procedure, click **Apply**. For calibrated ports status **[F2ST]** is displayed in the trace status field, for the calculated calibration coefficients status **[MATH]** is indicated in the trace status field.

To clear the measurement results of the standard, click **Cancel**. This softkey does not cancel the current calibration. To disable the current calibration, turn off the error correction function (See Error Correction Disabling).

SCPI	SENSe:CORRection:COLLect:METHod:SOLT2 SENSe:CORRection:COLLect:SHORt, SENSe:CORRection:COLLect:OPEN, SENSe:CORRection:COLLect:LOAD, SENSe:CORRection:COLLect:THRU SENSe:CORRection:COLLect:SAVE, SENSe:CORRection:COLLect:CLEar

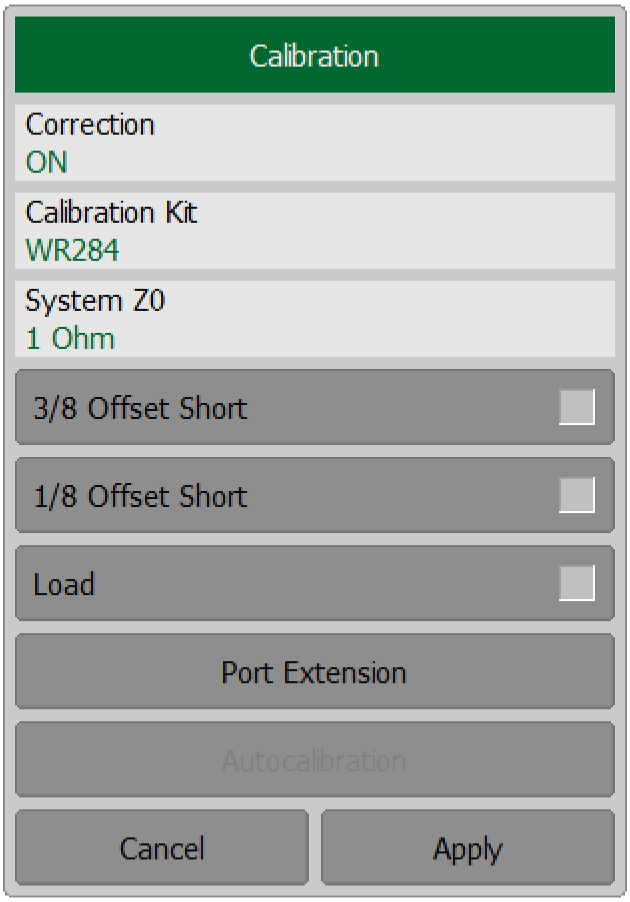
NOTE	The calibration status can be checked in channel status bar (See General error correction status table) or in trace status field (See Trace error correction status table).

Waveguide Calibration

General use and features:

- System Z0 should be set to 1 Ω before calibration. Offset Z0 and terminal impedance in the calibration standard definition also should be set to 1 Ω (See System Impedance Z0).
- Waveguide calibration uses two offset short standards instead of a combination of short and open standards. Typically, 1/8λ0 and 3/8λ0 offset sort standards are used, where λ0 — wave length in waveguide at the mean frequency.

In waveguide calibration, one of two offset short standards must be assigned to the open class. Consequently, the GUI will contain an **Open** button with the label of this short standard.



Automatic Calibration Module

Automatic calibration modules (ACMs) are special devices, which allow for automating the process of calibration. The ACM model is selected according to the parameters of the calibrated Analyzer: the working frequency range, the number of measuring ports, and the type of RF connectors. One of the models is shown in the image below.

Automatic Calibration Module

All ACM models and their specifications are available on the [Copper Mountain Technologies] website. Operating manual of ACM see in [ACM Operating manual].

The ACM offers the following advantages over the traditional SOLT calibration, which uses a mechanical calibration kit:

- Reduces the number of connections of standards. Instead of connecting seven standards, it requires connecting only two ACM connectors.
- Reduces the calibration time.
- Reduces human error probability.
- Provides higher accuracy potentially.

Depending on the model, the ACM has two or four RF connectors for connecting to the test ports of the Analyzer and a USB connector for control.The ACM contains electronic switches, which switch between different reflection and transmission impedance states, as well as memory, which stores precise S-parameters of these impedance states.

After connecting the ACM to the Analyzer, the analyzer software performs the calibration procedure automatically, i.e. switches between different ACM states, measures them, and computes calibration coefficients using the data stored in the ACM memory.

Automatic Calibration Module Features

Calibration Types

The ACM allows the Analyzer software to perform one-path two-port, full one-port or full two-port calibration. Calibration is performed with the click of a button.

Characterization

Characterization is a table of S-parameters for all the states of the ACM switches, stored in the ACM memory. There are two types of characterization: user characterization and factory characterization. The ACM has two memory sections. The first one is write-protected and contains factory characterization. The second memory section allows to store up to three user characterizations. Factory characterization or any of the user characterizations stored in the ACM memory can be selected before calibration. The user characterization option is provided for saving new S-parameters of the ACM after connecting adapters to the ACM ports.

Automatic Orientation

Orientation means relating the ACM ports to the test ports of the Analyzer. While the Analyzer test ports are indicated by numbers, for 2-port ACM, ports are indicated by the letters A and B, for 4-port ACM — A, B, C, D.

Orientation can be defined either manually or automatically. In the case of automatic orientation, the Analyzer software determines the ACM orientation each time prior to its calibration or characterization.

Thermal Compensation

The most accurate calibration is achieved if the ACM temperature is equal to the temperature at which it was characterized. When this temperature changes, certain ACM state parameters may deviate from the parameters stored in the memory. This results in reduction of the ACM calibration accuracy.

To compensate for the thermal error, the ACM features thermal compensation function. Thermal compensation is a software function of the ACM S-parameter correction based on its temperature dependence and the data from the temperature sensor inside the ACM. The temperature dependence of each ACM is determined at the factory and saved into its memory.

Thermal compensation can be enabled or disabled.

Confidence Check

The ACM also implements an additional state — an attenuator, which is not used in calibration. The attenuator is used to check the current calibration performed by ACM or any other method. This is called a confidence check.

In the confidence check mode, the factory measurement of the attenuator is loaded into the memory trace, which may be compared to the measurement being performed by the active trace. The two traces may be compared, and their differences may be evaluated to determine the accuracy of the calibration performed.

For a detailed comparison, the math (division) function can be used for data and memory.

Automatic Calibration Procedure

Before calibrating with ACM, the following settings must be configured:

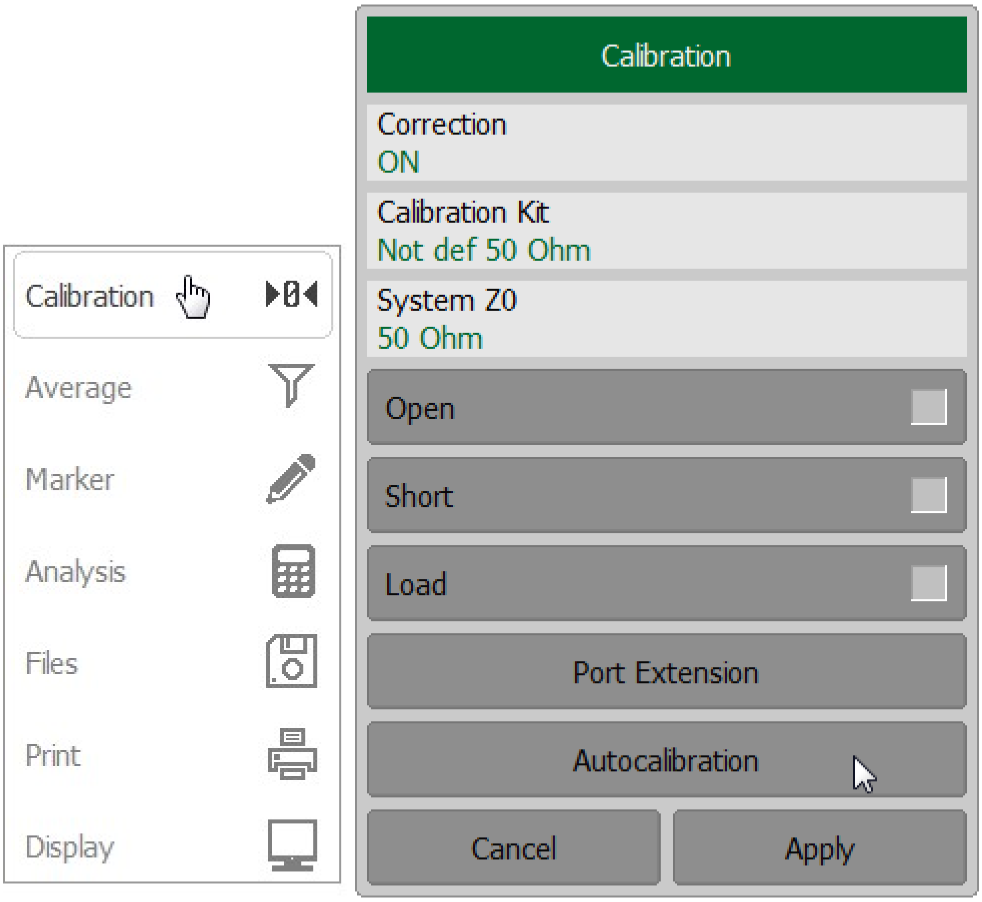
- Activate the channel (See Active Channel Selection).
- Set the channel parameters: frequency range, IFBW, etc. (See Stimulus Settings).
- Connect the USB connector of the ACM to the USB port of the computer.
- Connect the ACM to the Analyzer test port (or ports for RNVNA).

Automatic Calibration Procedure for RVNA

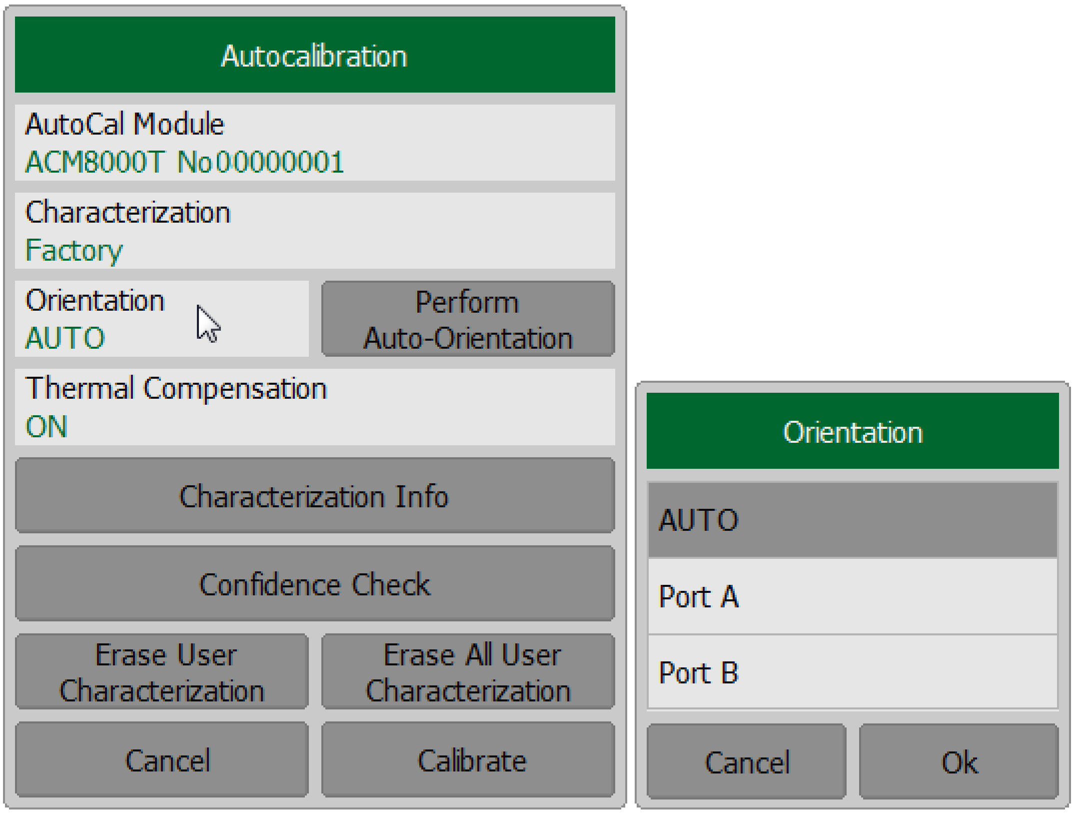
Automatic calibration procedure includes:

- Specifying autoorientation mode and thermal compensation (if needed).
- Performing calibration.

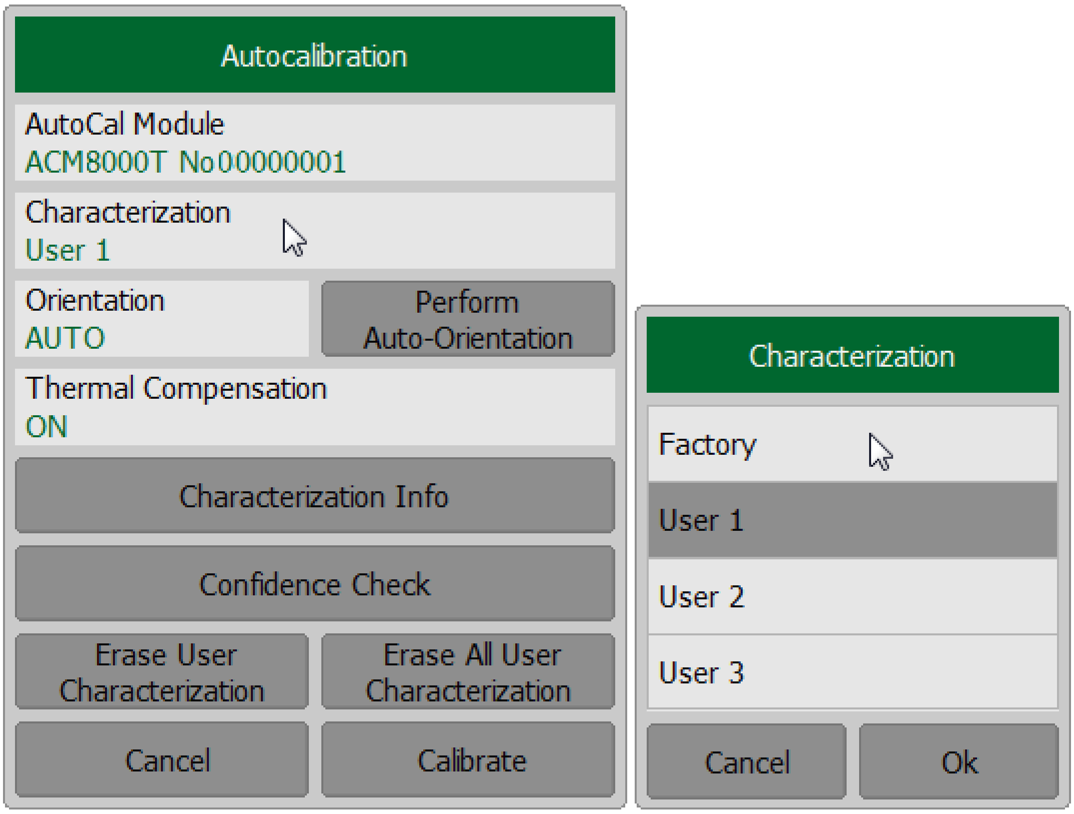
Press **Calibration > Autocalibration** softkeys.



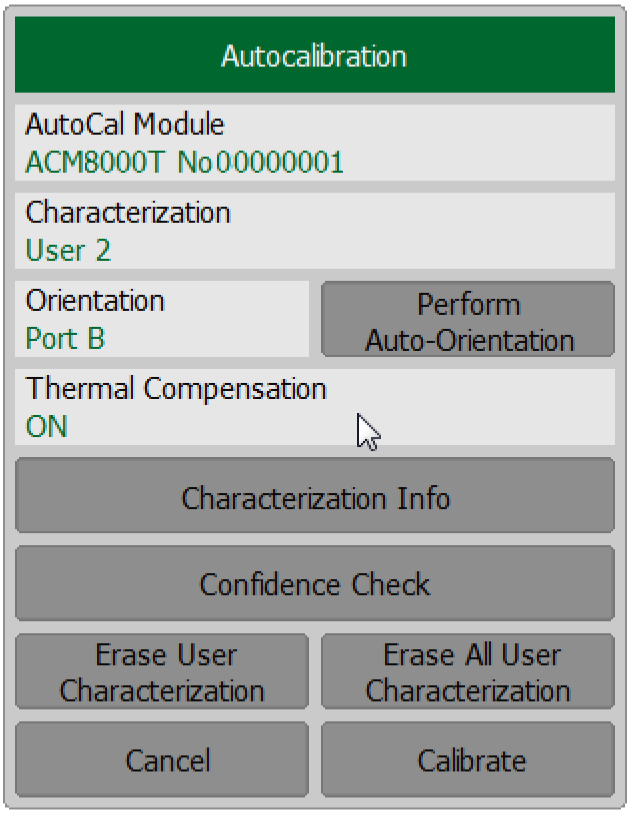
Select manual or automatic orientation of the ACM using **Orientation** field. It is recommended to select **AUTO** orientation. If it is necessary to execute autoorientation before calibration and characterization press the **Perform Auto-Orientation** softkey.



Click on the **Characterization** field and select **Factory** type.



Enable or disable the thermal compensation using **Thermal Compensation** field.



To display detailed information on characterization use **Characterization Info** softkey.

Press the **Calibrate** softkey. Wait till the end of the calibration.

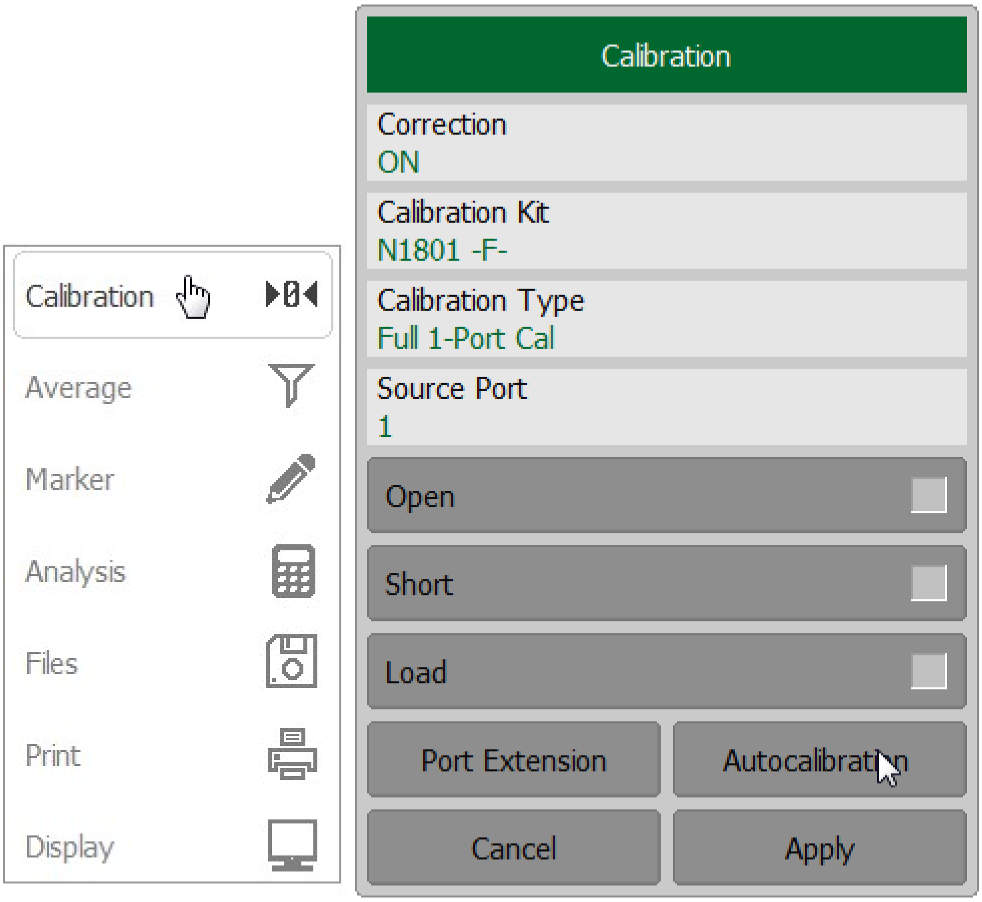
SCPI	SENSe:CORRection:COLLect:ECAL:ORIentation:STATe, SENSe:CORRection:COLLect:ECAL:PATH, SENSe:CORRection:COLLect:ECAL:ORIentation:EXECute SENSe:CORRection:COLLect:ECAL:UCHar SENSe:CORRection:COLLect:ECAL:INFormation SENSe:CORRection:COLLect:ECAL:SOLT1

Automatic Calibration Procedure for RNVNA

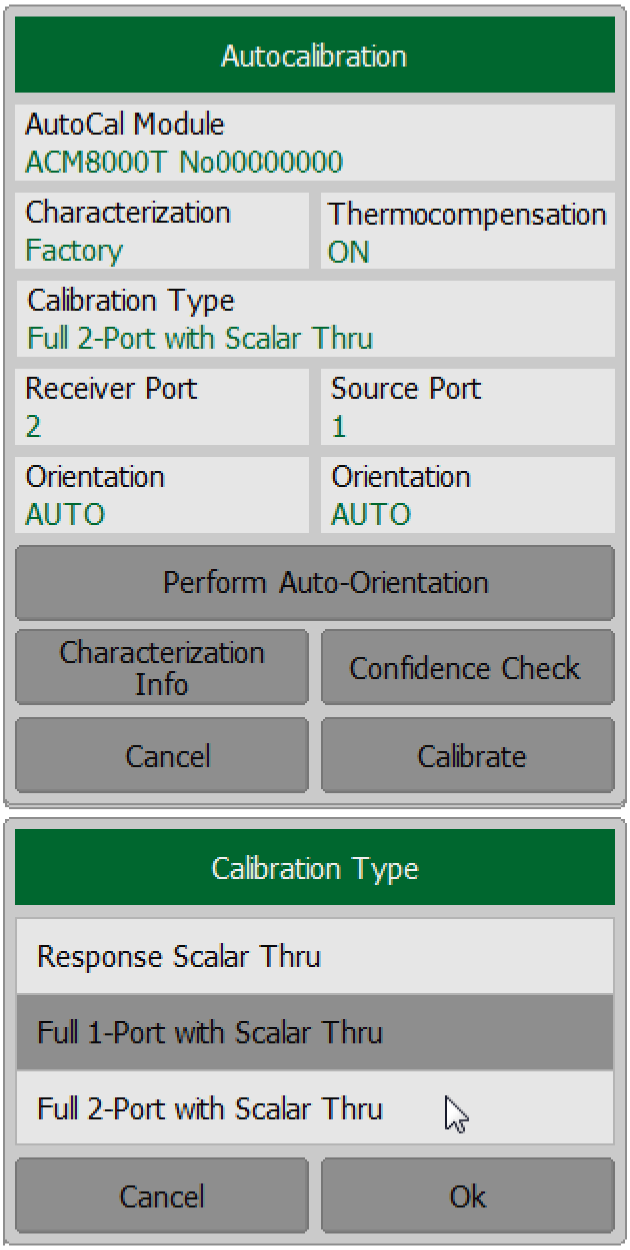
Automatic calibration procedure includes:

- Selecting calibration type.
- Selecting source port and receiver port.
- Specifying autoorientation mode and thermal compensation (if needed).
- Performing calibration.

Press **Calibration > Autocalibration** softkeys.



Select the calibration type by means of clicking on the **Calibration Type** field.



Click on the **Characterization** field and select **Factory** type.

In the dialog windows **Source Port** and **Receiver Port** assign a signal source port and a signal receiver port respectively.

Select manual or automatic orientation of the ACM using **Orientation** field. It is recommended to select **AUTO** orientation. If it is necessary to execute autoorientation before calibration and characterization press the **Perform Auto-Orientation** softkey.

Enable or disable the thermal compensation using **Thermocompensation** field.

To display detailed information on characterization use **Characterization Info** softkey.

Press the **Calibrate** softkey. Wait till the end of the calibration.

SCPI	SENSe:CORRection:COLLect:ECAL:ORIentation:STATe, SENSe:CORRection:COLLect:ECAL:PATH, SENSe:CORRection:COLLect:ECAL:ORIentation:EXECute SENSe:CORRection:COLLect:ECAL:UCHar SENSe:CORRection:COLLect:ECAL:INFormation SENSe:CORRection:COLLect:ECAL:SOLT1, SENSe:CORRection:COLLect:ECAL:SOLT2

NOTE	During autocalibration the message Calibration in Progress... appears in the instrument status bar (See Instrument Status Bar).

NOTE	The calibration status can be checked in or in trace status field (See Trace error correction status table).

Optimization of N-port calibration procedure

NOTE	This section is available for RNVNA only.

To optimize N-port RNVNA calibration in terms of reducing number of connections and providing acceptable accuracy use 1-to-N topology, i.e. perform all the ports calibration relative to the only source port. Calibration factors for the rest of port pairs (i.e. when other ports are used as source port) will be obtained by calculation.

Optimal N-port calibration with 2-port or 4-port ACM should be performed as follows:

- Connect ACM to the Analyzer ports.
- Select source port and receiver port(s). See Automatic Calibration Procedure for RNVNA.
- Enable ACM automatic orientation mode and thermal compensation (if needed).
- Select type of calibration **Full 2-Port with Scalar Thru**.
- One two-port calibration with 2-port ACM or three two-port calibrations with 4-port ACM can be performed in one calibration procedure.
- Disconnect ACM from the Analyzer’s port(s) which were designated as receiver port(s).
- Repeat enabling automatic orientation and calibration stages for all the rest receiver ports.

Confidence Check Procedure

Perform a confidence check if the reliability of the current calibration needs to be verified. This function can be used to check the accuracy of either calibration performed with an ACM or with a mechanical calibration kit.

Connect the ACM to the Analyzer test port (or ports for RNVNA) and connect the USB port of the ACM to the USB port of the PC.

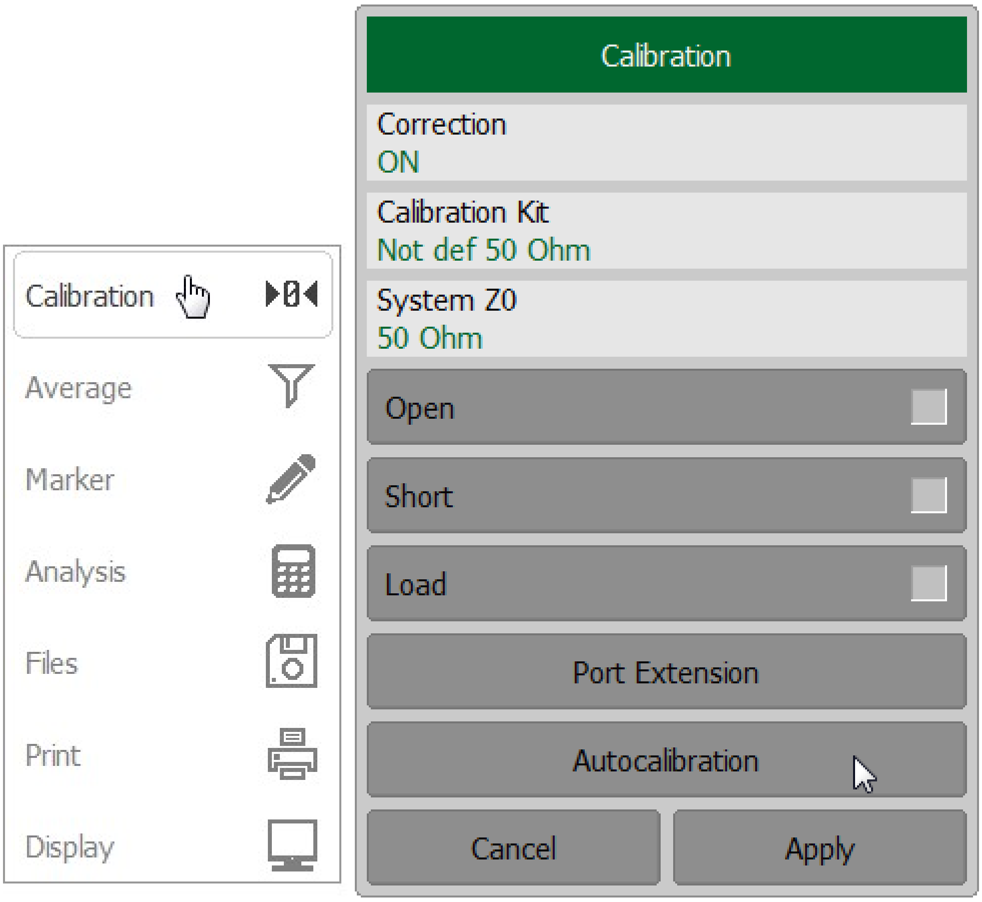
NOTE	When performing a confidence check, it is recommended to connect LOAD standard to all unused ACM ports. LOAD standard are not included in delivery.

Enable the display of the data trace for the needed parameter, for example, S11. It is possible to enable several data traces simultaneously for RNVNA, for example, S11, S22, S21, S12.

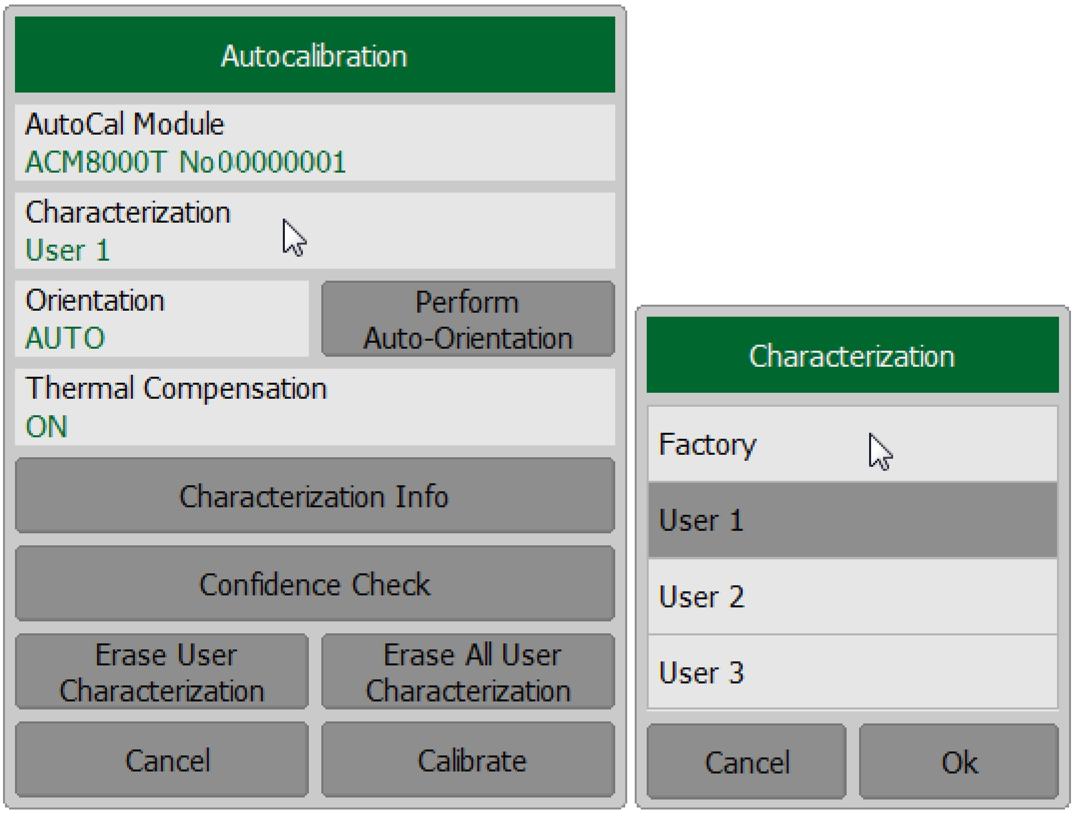
After the measurement is completed, two traces for each S-parameter will be displayed. The measured parameters will be shown as the data trace, and the ACM parameters will be shown as the memory trace.

Compare the data trace and the memory trace of the same parameter, for example, S11. To perform more accurate comparison, enable the function of math operations between data and memory traces (See Mathematical Operations). In the logarithmic magnitude or phase format, use the Data/Memory operation. In the linear magnitude format, use the Data-Memory operation.

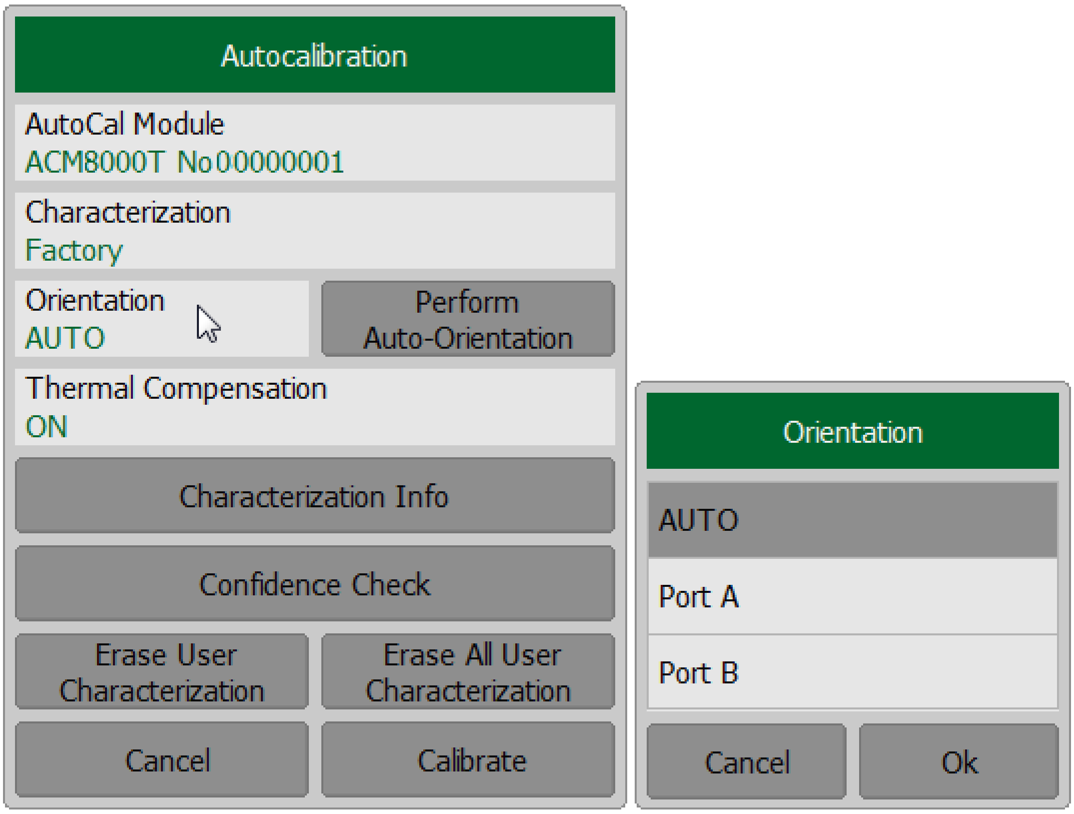
Press **Calibration > Autocalibration** softkeys.



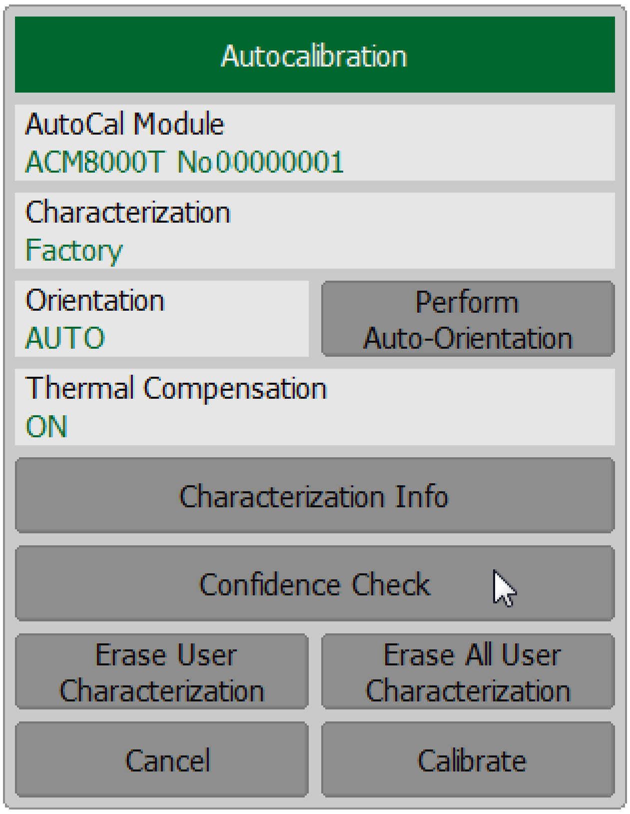
Click on the **Characterization** field and select **Factory** type.



Select a manual or automatic orientation for the ACM using the **Orientation** softkey. It is recommended to select **AUTO** orientation.



Perform a confidence check using the **Confidence Check** softkey.



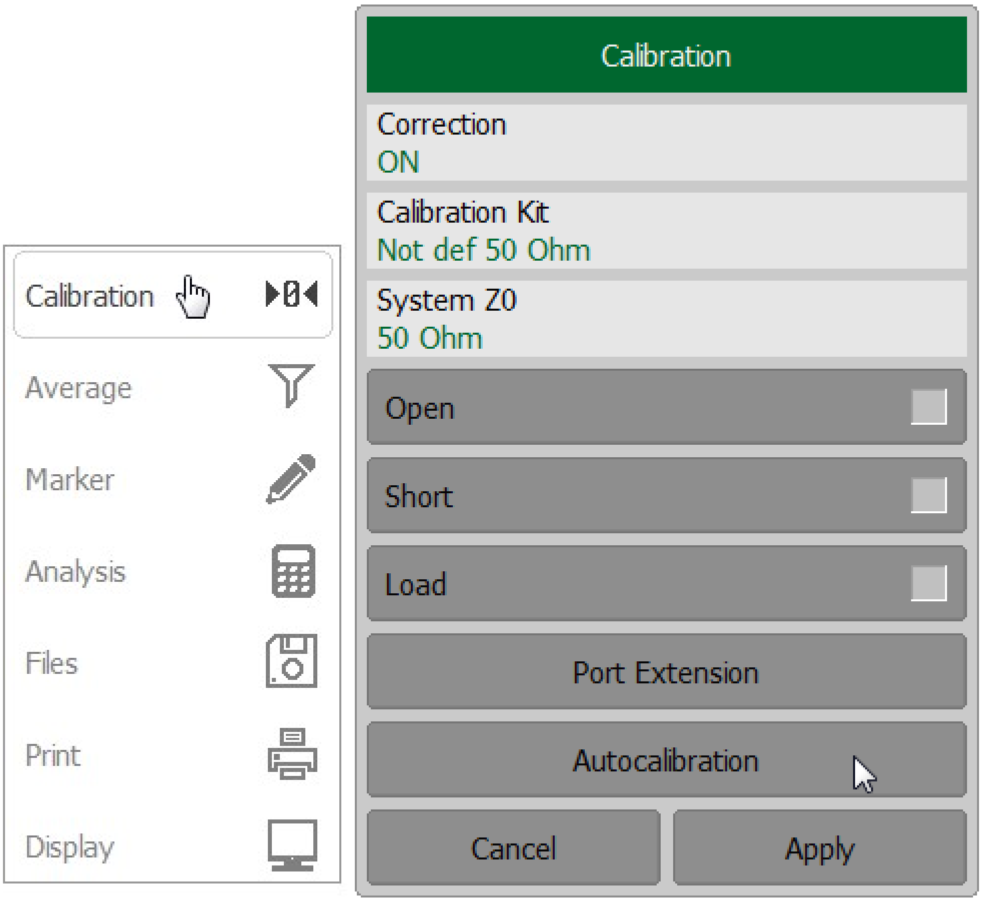
SCPI	SENSe:CORRection:COLLect:ECAL:CHECK:EXECute

Erasing the User Characterization

NOTE This section is available for RVNA only.

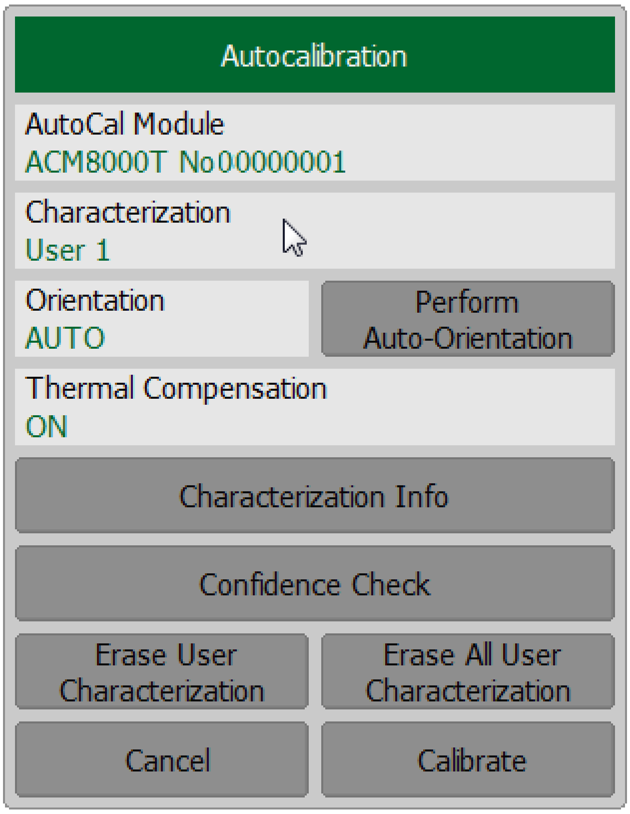
If necessary, it is possible to erase the user characterization in the ACM. The procedure erases all data of selected user characterization, overwriting it with zeros. Factory characterization cannot be erased.

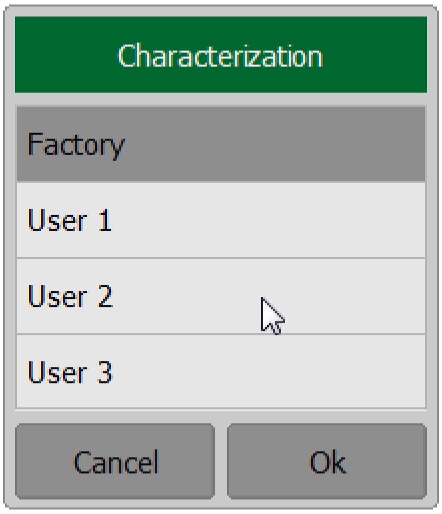
Press **Calibration > Autocalibration** softkeys.

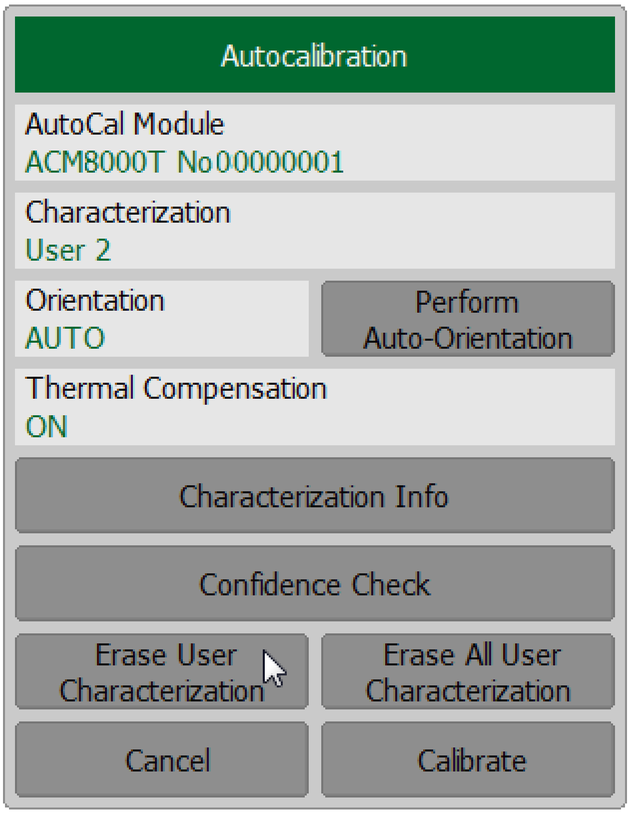


Select the user characterization using the **Characterization** softkey. Perform erase procedure using the **Erase User Characterization** softkey.

To erase all user characterization procedure using the **Erase All User Characterization** softkey.


Autocalibration
AutoCal Module
ACM8000T No00000001
Characterization
User 1
Orientation
AUTO
Perform
Auto-Orientation
Thermal Compensation
ON
Characterization Info
Confidence Check
Erase User
Characterization
Erase All User
Characterization
Cancel
Calibrate


Characterization
Factory
User 1
User 2
User 3
Cancel
Ok


Autocalibration
AutoCal Module
ACM8000T No00000001
Characterization
User 2
Orientation
AUTO
Perform
Auto-Orientation
Thermal Compensation
ON
Characterization Info
Confidence Check
Erase User
Characterization
Erase All User
Characterization
Cancel
Calibrate

Error Correction Status

The error correction status is indicated for each trace individually. There is also a general status of error correction for all traces of a channel.

General error correction status

The general error correction status for all S-parameter traces of a channel is indicted in the specific field on a channel status bar (See table below). For the channel status bar description, see Channel Status Bar.

<table>
<tr><th>Symbol</th><th>Definition</th><th>Note</th></tr>
<tr><td>Cor</td><td>Error correction is enabled. The stimulus settings are the same for the measurement and the calibration.</td><td rowspan="3">If the function is active for all traces — black characters on a gray background.

If the function is active only for some of the traces (other traces are not calibrated) — white characters on a red background.</td></tr>
<tr><td>C?</td><td>Error correction is enabled. The stimulus settings are not the same for the measurement and the calibration. Interpolation is applied.</td></tr>
<tr><td>C!</td><td>Error correction is enabled. The stimulus settings are not the same for the measurement and the calibration. Extrapolation is applied.</td></tr>
<tr><td>Off</td><td>Error correction is turned off.</td><td rowspan="2">For all traces. White characters on a red background.</td></tr>
<tr><td>---</td><td>No calibration data. No calibration was performed.</td></tr>
</table>

Trace error correction status

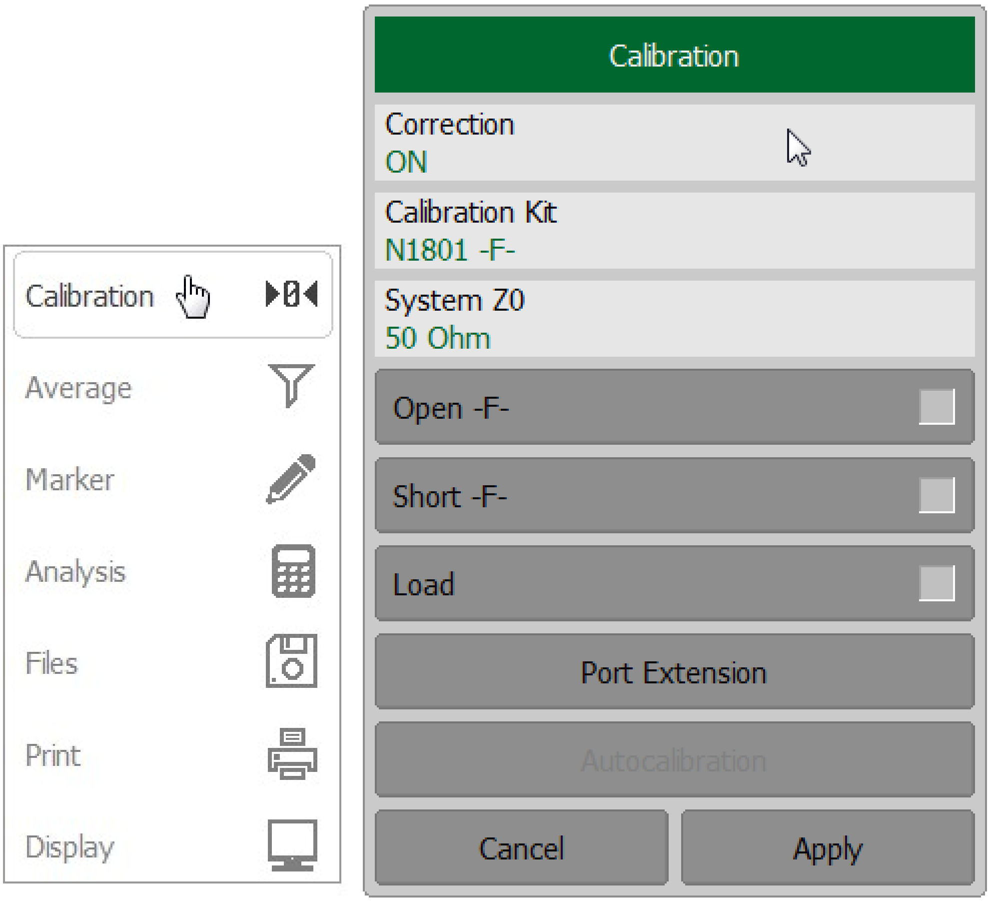
The error correction status for each individual trace is indicated in the trace status field (See table below). For trace status field description, see Trace Status Field.

Symbols	Definition
RO	OPEN response calibration
RS	SHORT response calibration
F1	Full one-port (SOL) calibration
ST	Transmission normalization (RNVNA only)
F1ST	Full one-port calibration with transmission normalization (RNVNA only)
F2ST	Full two-port calibration with transmission normalization (RNVNA only)
MATH	Equivalent to F2ST Calibration, obtained by mathematical method (RNVNA only)

Error Correction Disabling

This feature allows to disable the error correction function, which automatically becomes enabled after completion of calibration by any method.

To disable and enable again the error correction function use the following softkey **Calibration** in the left menu bar. Click on **Correction** field to toggle the on/off settings of the correction state. Close the dialog by clicking **Apply**.



SCPI	SENSe:CORRection:STATe

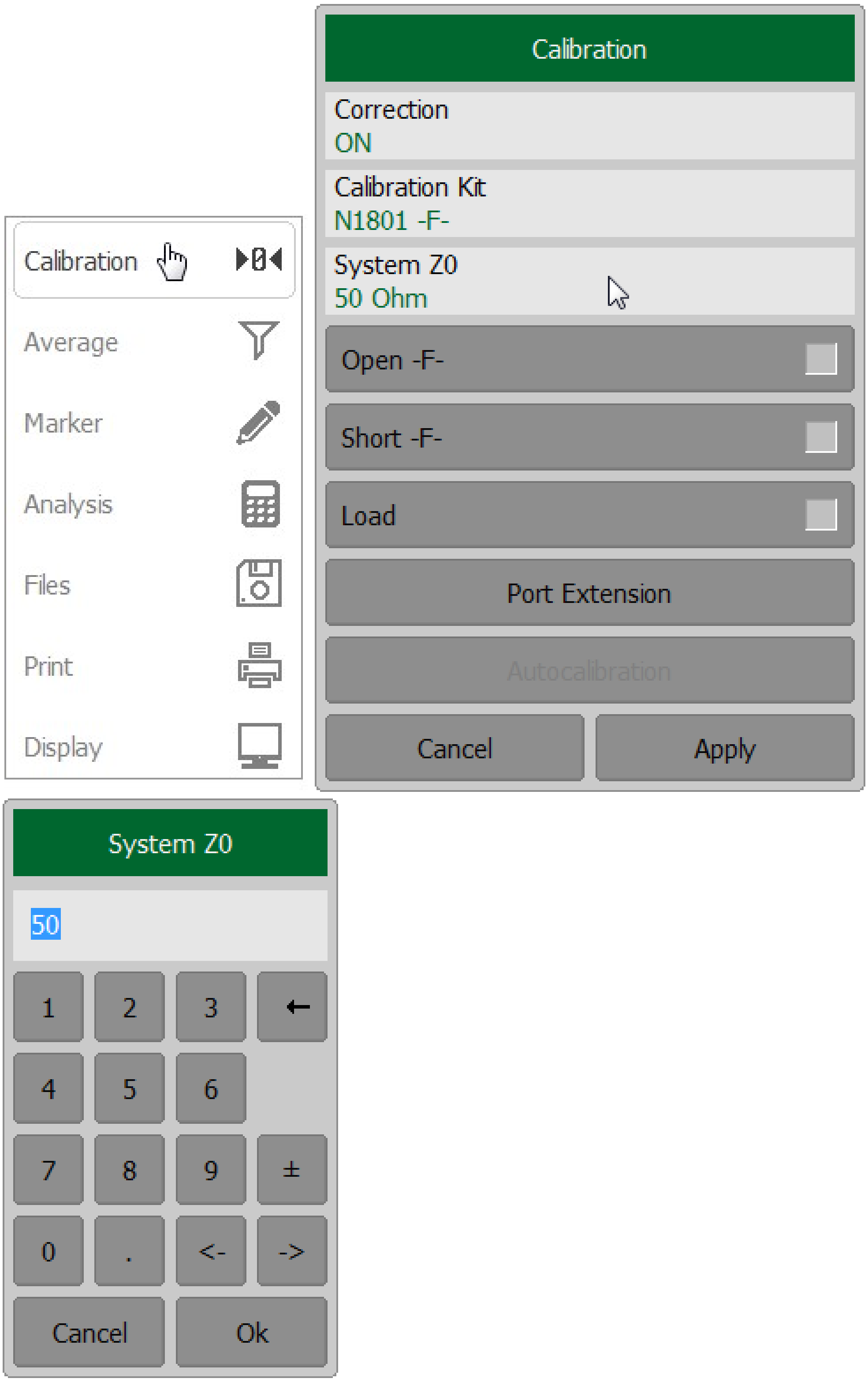
NOTE In case error correction function is switched off, the message Correction Off appears in the instrument status bar (See Instrument Status Bar).

System Impedance Z0

Z0 is the system impedance of a measurement path. Normally, it is equal to the impedance of the calibration standards used for calibration. The Z0 value should be specified before calibration, as it is used for calibration coefficient calculations.

For waveguide calibration, the system impedance must be set to 1 Ω.

To enter the system Z0 values use the softkey **Calibration** in the left menu bar. Click on **System Z0** field and enter the required values using the on-screen keypad and complete the setting by clicking **Ok** softkey.



SCPI SENSe:CORRection:IMPedance

NOTE Selection of calibration kit automatically determines the system impedance Z0 in accordance with the value specified for the kit.

Measurement Data Analysis

The following section describes the process of Measurement Data Analysis using the Analyzer.

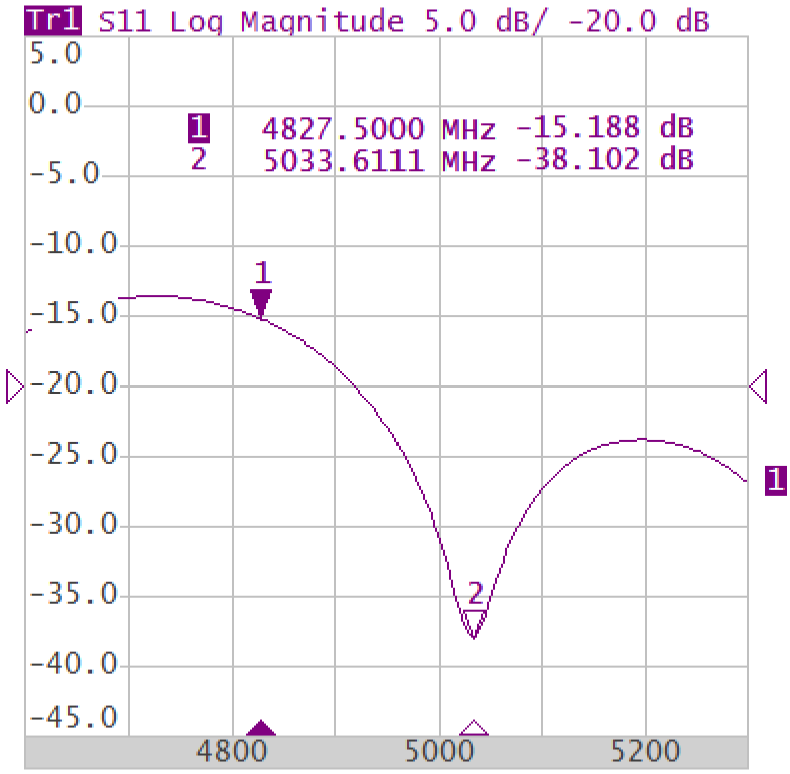
Special software marker tools are used to read and look up the numerical values of the stimulus and the measured value on selected points on the graph. For a detailed description see Markers.

This section also contains information about the various functions and tools used to analyze measurements.

- Memory Trace Function is used to save data traces and perform mathematical operations between memory and data traces.
- Trace Hold is used to hold the maximum or minimum values of the trace.
- Fixture Simulation is used to simulate measurement conditions that differ from real measurement conditions.
- Time Domain Transformation (RVNA only) is used to convert the measured characteristics in the frequency domain into the circuit response in the time domain.
- Time Domain Gating (RVNA only) is used to eliminate unwanted responses in the time domain.
- S-Parameter Conversion (RVNA only) is used to convert the measurement results into different parameters: impedance or admittance in reflection/transmission measurement, inverse S-parameter, equivalent impedance or admittance in transmission shunt measurements, S-parameter complex conjugate.
- A function of pass/fail determination for the trace of the measurement data according to various criteria:
    1. Limit Test is used to compare the trace of the measured value with the limit line.
    2. Ripple Limit Test is used to check the value of the ripple trace with user-defined ripple limits

Markers

A marker is a tool for numerical readout of a stimulus value and value of the measured parameter in a specific point on the trace. Up to 16 markers can be activated on each trace. A trace with two markers is shown in the figure below.



Trace with two markers

The markers allow to perform the following tasks:

- Reading absolute values of a stimulus and a measured parameter in selected points on the trace.
- Reading relative values of a stimulus and a measured parameter related to the reference point.
- Search for specific points on the trace (minimum, maximum, target level, etc.).
- Determining trace parameters (statistics, bandwidth, etc.).
- Editing stimulus parameters using markers.

Markers can have the following indicators:

1 ▽	Symbol and number of the active marker on a trace.
Δ 2	Symbol and number of the inactive marker on a trace.
▲	Symbol of the active marker on a stimulus axis.
Δ	Symbol of the inactive marker on a stimulus axis.

The marker data field contains the marker number, stimulus value, and the measured parameter value. The number of the active marker is highlighted in an inverse color.

The marker data field contents vary depending on the display format (rectangular or circular):

- In rectangular format, the marker shows the measurement parameter value plotted along Y-axis in the active format (See the table below).

Format Type Description	Label	Data Type (Y-axis)	Measurement Unit (Y-axis)
Logarithmic Magnitude	**Log Magnitude**	S-parameter logarithmic magnitude: $20 \cdot \log\lvert S\rvert$, $\lvert S\rvert = \sqrt{a^2 + b^2}$	Decibel (dB)
Voltage Standing Wave Ratio	**SWR**	$\frac{1+\lvert S\rvert}{1-\lvert S\rvert}$	Dimensionless value
Phase	**Phase**	S-parameter phase from –180° to +180°: $\frac{180}{\pi} \cdot arctg\frac{b}{a}$	Degree (°)
Expanded Phase	**Expand Phase**	S-parameter phase, measurement range expanded to from below –180° to over +180°	Degree (°)
Group Delay	**Group**	Signal propagation delay	Second (sec.)

Format Type Description	Label	Data Type (Y-axis)	Measurement Unit (Y-axis)
	Delay	within the DUT: $-\frac{d\varphi}{d\omega}$, $\varphi = arctg\frac{b}{a}$, $\omega = 2\pi \cdot f$	
Linear Magnitude	**Lin Magnitude**	S-parameter linear magnitude: $\sqrt{a^2 + b^2}$	Dimensionless value
Real Part	**Real**	S-parameter real part: $a = re(S)$	Dimensionless value
Imaginary Part	**Imag**	S-parameter imaginary part: $b = im(S)$	Dimensionless value
Cable Loss	**Cable Loss**	$A = 1/2 \cdot (ReturnLoss)$ $A = 10 \cdot log\|S\|$	Decibel (dB)

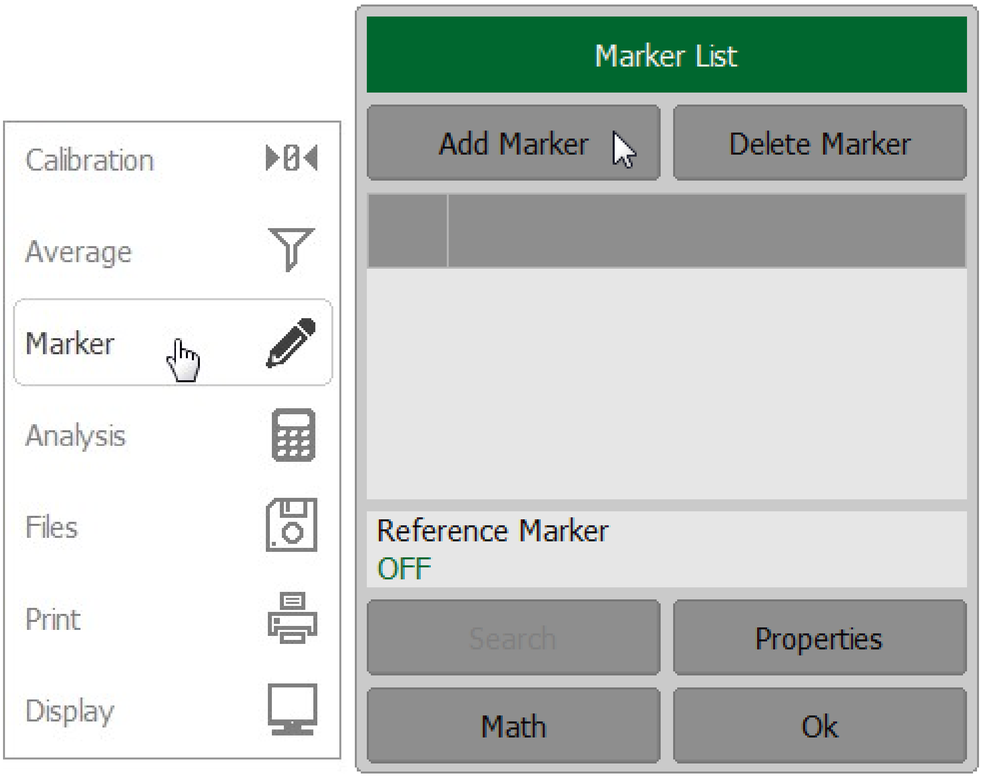
- In circular format, the marker shows three or four values listed in the table below.

Label	Marker Readings (Measurement Unit)			
	Reading 1	**Reading 2**	**Reading 3**	**Reading 4**
Smith (Lin)	Frequency	Linear magnitude	Phase (°)	—
Smith (Log)	Frequency	Logarithmic magnitude (dB)	Phase (°)	—
Smith (Re/Im)	Frequency	Real part	Imaginary part	—
Smith (R + jX)	Frequency	Resistance (Ω)	Reactance (Ω)	Equivalent capacitance or inductance (F/H)

Label	Marker Readings (Measurement Unit)			
	Reading 1	**Reading 2**	**Reading 3**	**Reading 4**
Smith (G + jB)	Frequency	Conductance (S)	Susceptance (S)	Equivalent capacitance or inductance (F/H)
Polar (Lin)	Frequency	Linear magnitude	Phase (°)	—
Polar (Log)	Frequency	Logarithmic magnitude (dB)	Phase (°)	—
Polar (Re/Im)	Frequency	Real part	Imaginary part	—

Marker Addition

To enable a new marker, use the softkeys **Markers > Add Marker** on left menu bar.

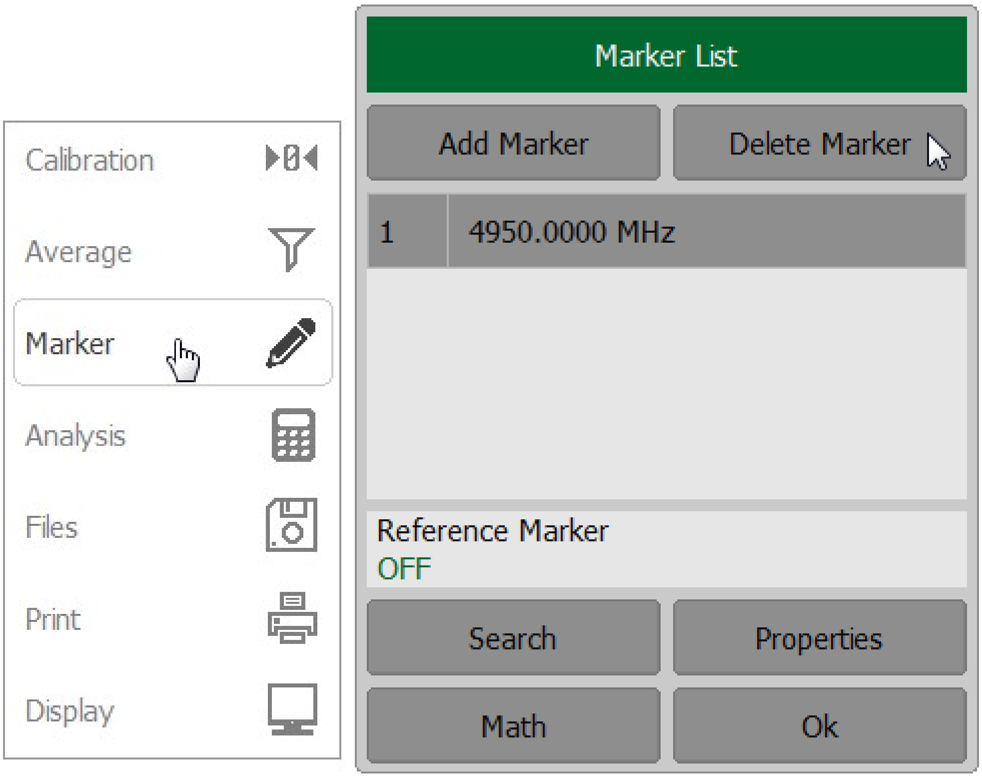


SCPI CALCulate:MARKer

NOTE The new marker appears as the active marker in the middle of the stimulus axis.

Marker Deletion

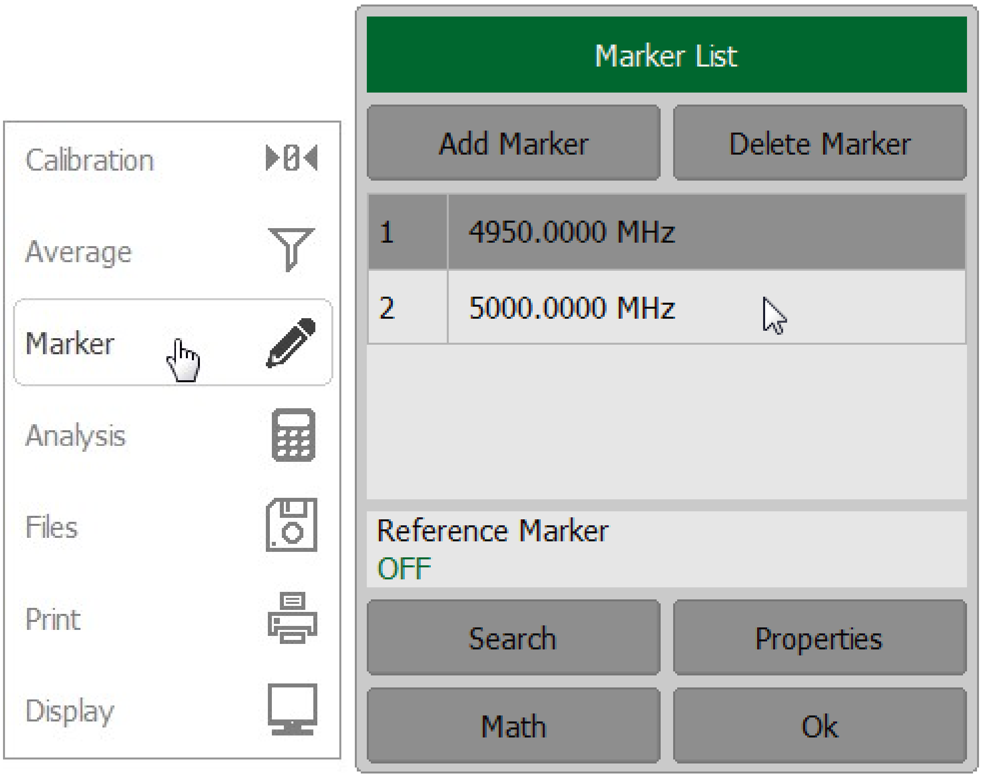
To delete a marker, use the softkeys **Markers > Delete Marker**.



NOTE	The active marker is highlighted in the **Marker List** dialog.

Marker Activation

To activate a marker, use the softkey **Marker**. In the **Marker List** dialog click on the marker number to activate it.



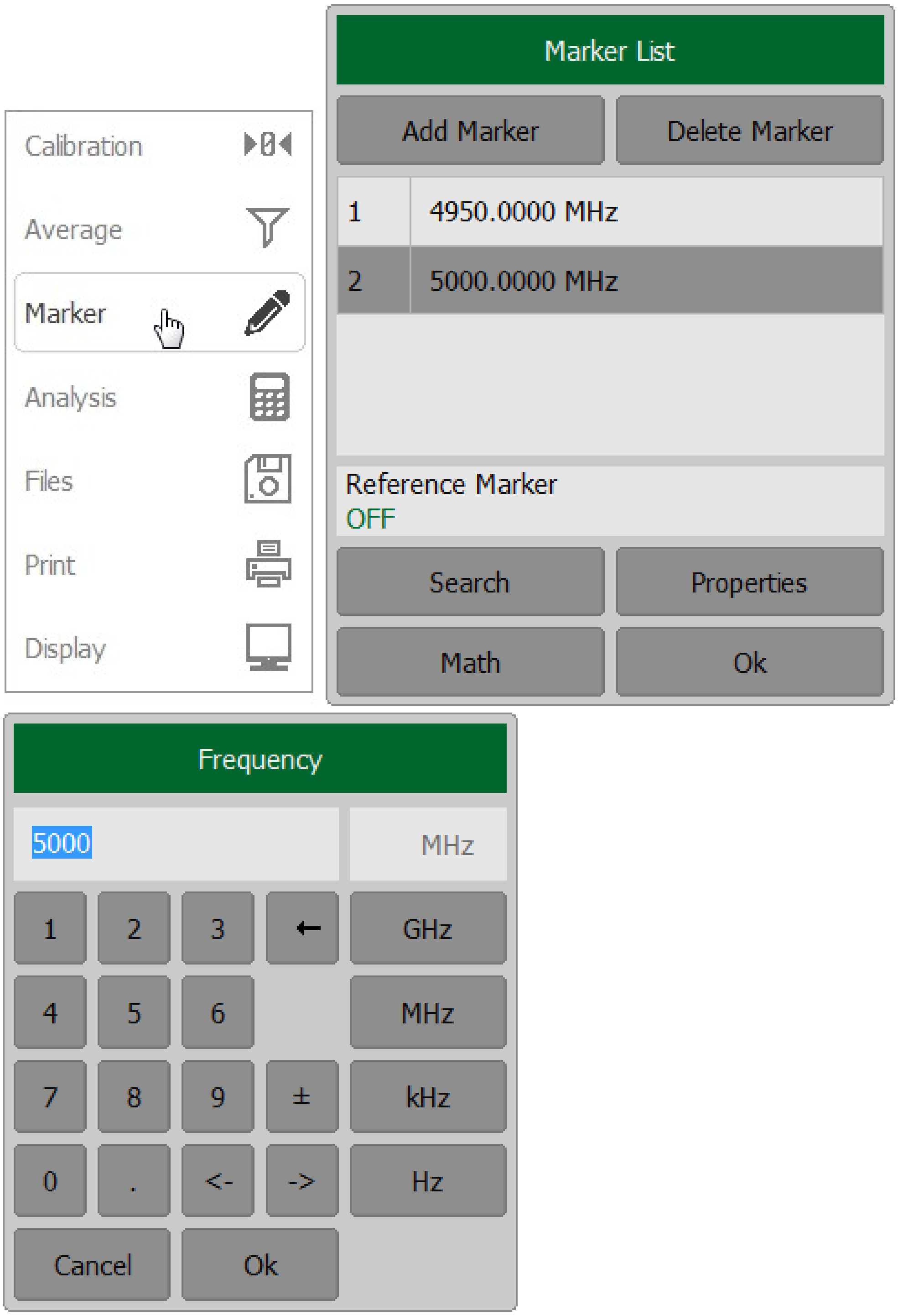
SCPI	CALCulate:MARKer:ACTivate

NOTE	A marker can be activated by clicking on it.

Marker Stimulus Value Setting

The active marker must be selected before setting the marker stimulus value. The stimulus value must be set by entering the numerical value from the keyboard, by arrows, by dragging the marker using the mouse (See Marker Stimulus Value Setting), or by enabling the search function (See Marker Position Search Functions).

To set the marker, use the softkey **Marker**. Select a required marker from the **Marker List** dialog. Double click on the marker stimulus value in the table and enter the stimulus value using the on-screen keypad. Complete the setting by clicking **Ok**.

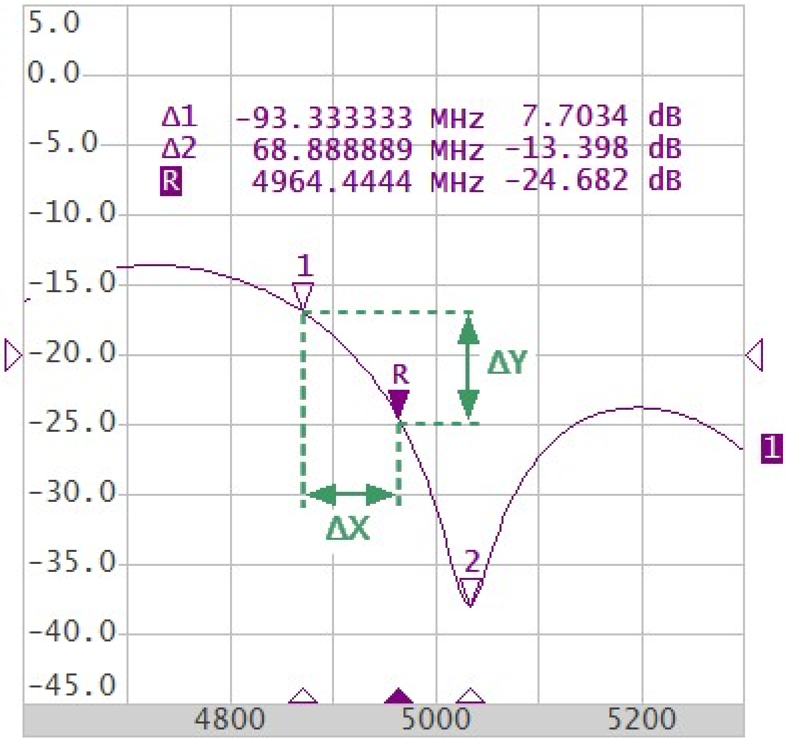


SCPI CALCulate:MARKer:X

NOTE To enter the stimulus numerical value in the marker data field, click on it.

Reference Marker Feature

The reference marker feature allows to view the data relative to the reference marker. Other markers readings are represented as delta relative to the reference marker. The reference marker shows the absolute data and is indicated with «R» symbol instead of a number (See figure below). Enabling of a reference marker turns all the other markers to relative display mode.



Reference marker

Reference marker can be indicated on the trace as follows:

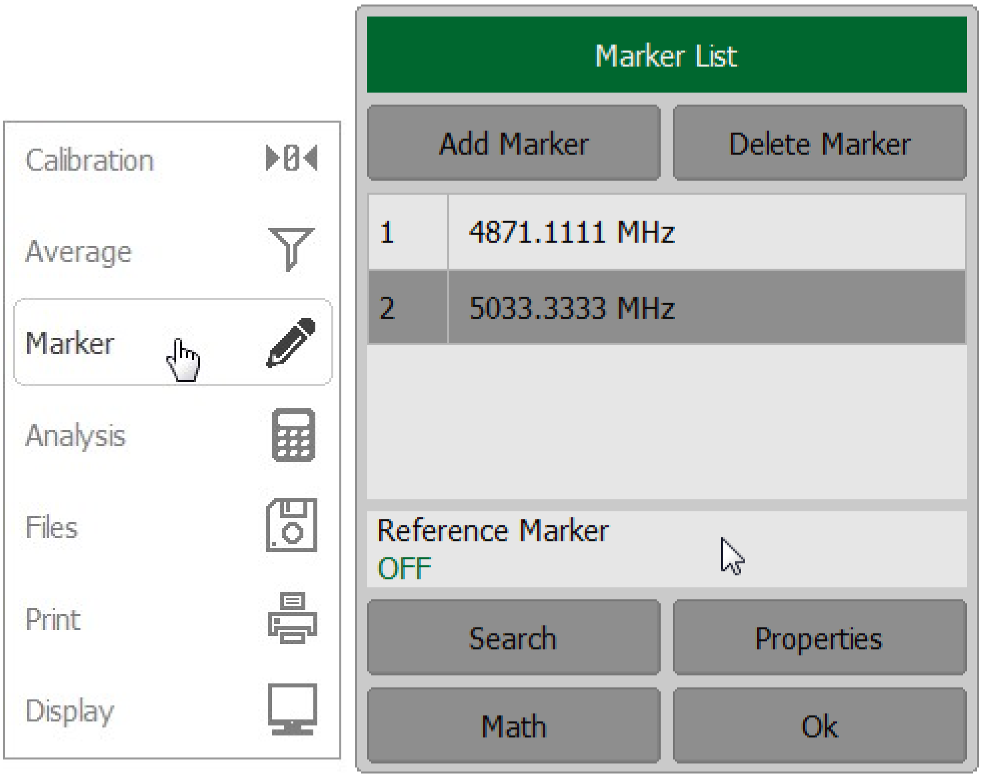
R ∇	Symbol of the active reference marker on a trace.
Δ R	Symbol of the inactive reference marker on a trace.

The reference marker displays the stimulus and measurement absolute values. The rest of the markers display the relative values:

- Stimulus value (ΔX in the figure above) is the difference between the absolute stimulus values of this marker and the reference marker.
- Measured value (ΔY in the figure above) is the difference between the absolute measurement values of this marker and the reference marker.

To enable a new marker, use the softkey **Markers** on left menu bar.

Click on the **Reference Marker** field to toggle the status of the reference marker. The reference marker will be added to/deleted from the marker list and the trace



SCPI	CALCulate:MARKer, CALCulate:MARKer:ACTivate, CALCulate:MARKer:REFerence

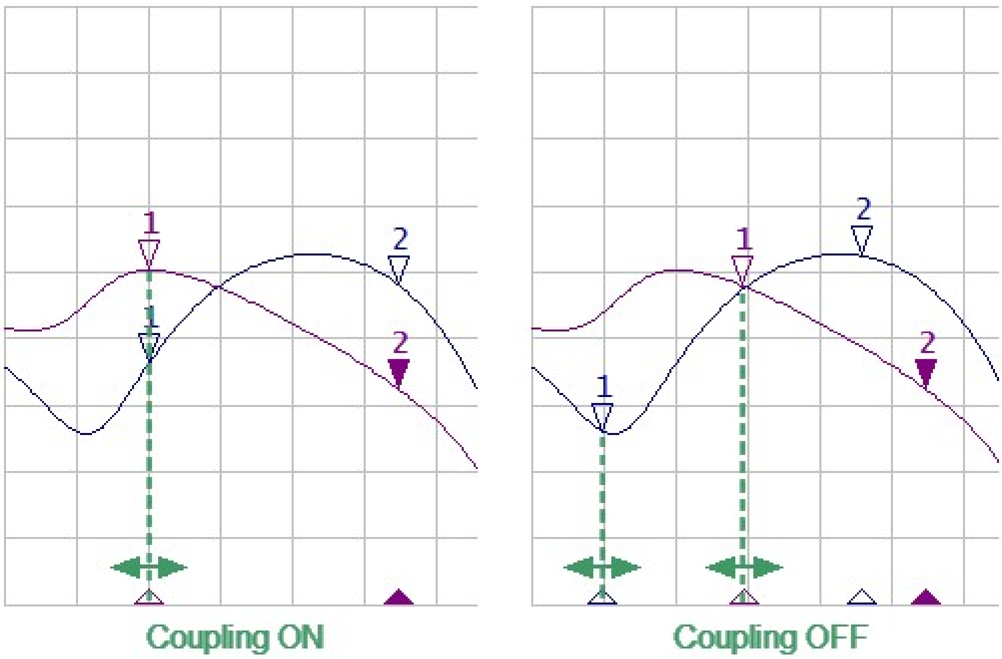
Marker Properties

The following section describes marker properties:

- Marker Coupling Feature is the function that determines the coupling of markers with the same numbers on different traces.
- Marker Value Indication Capacity is the setting of the bit-length of numerical values on markers.
- Multi Marker Data Display is the ability to enable display of the marker data for all traces simultaneously.
- Marker Data Alignment is the ability to align the marker data display on the screen.
- Memory Trace Value Display is the ability to turn on the memory trace marker values if a memory trace is available.

Marker Coupling Feature

The marker coupling feature enables/disables coupling of markers with the same numbers on different traces. If the feature is turned on, the markers with the same numbers will move along the X-axis synchronously on all the traces. If the coupling feature is off, the position of the markers with same numbers along X-axis will be independent (See figure below).

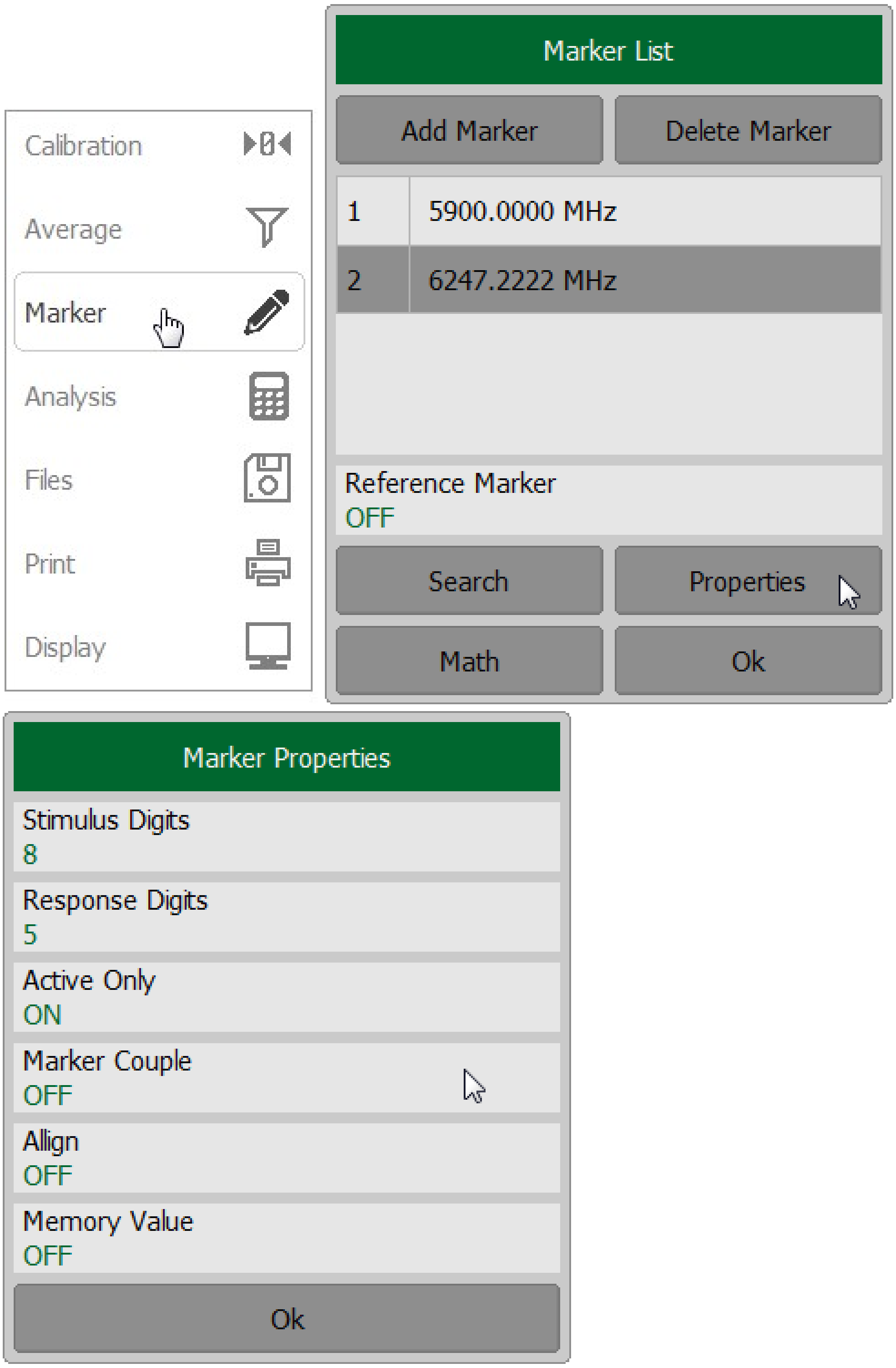


Marker coupling feature

To enable a new marker, use the softkeys **Markers > Properties** on left menu bar.

In the Marker Properties dialog, click on the **Marker Couple** field to toggle between the values.

Close the dialog by clicking **Ok**.



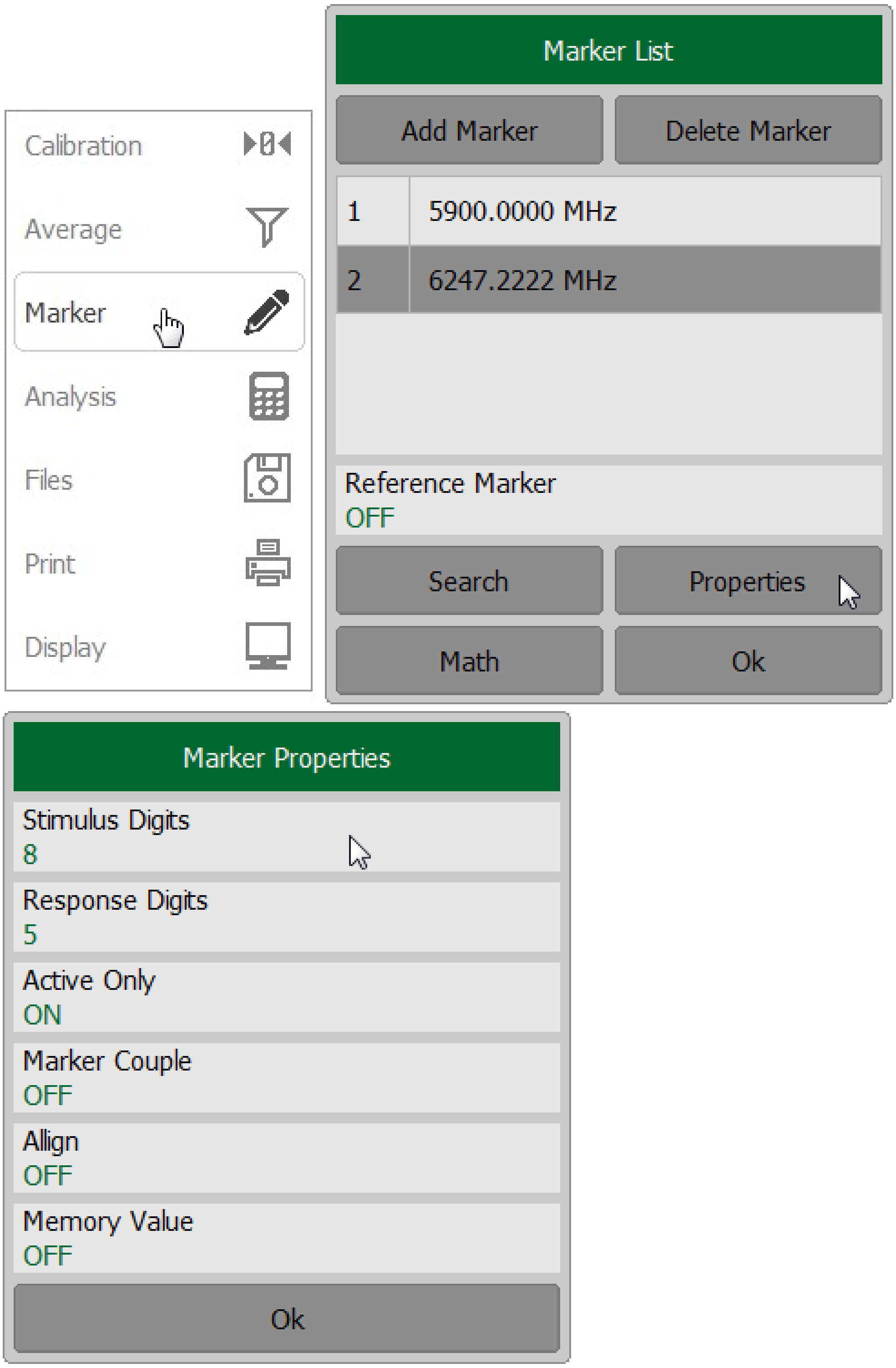
SCPI	CALCulate:MARKer:COUPle

Marker Value Indication Capacity

By default, the marker stimulus values are displayed with 8 decimal digits and marker response values are displayed with 5 decimal digits. These settings can be changed. The stimulus range is from 5 to 10 decimal digits, and the response range is from 3 to 8 decimal digits.

To enable a new marker, use the softkeys **Markers > Properties** on left menu bar.

Click on the **Stimulus Digits** field to enter the number of stimulus decimal digits. Click on the **Response Digits** field to enter the number of response decimal digits. Close the dialog by clicking **Ok**.

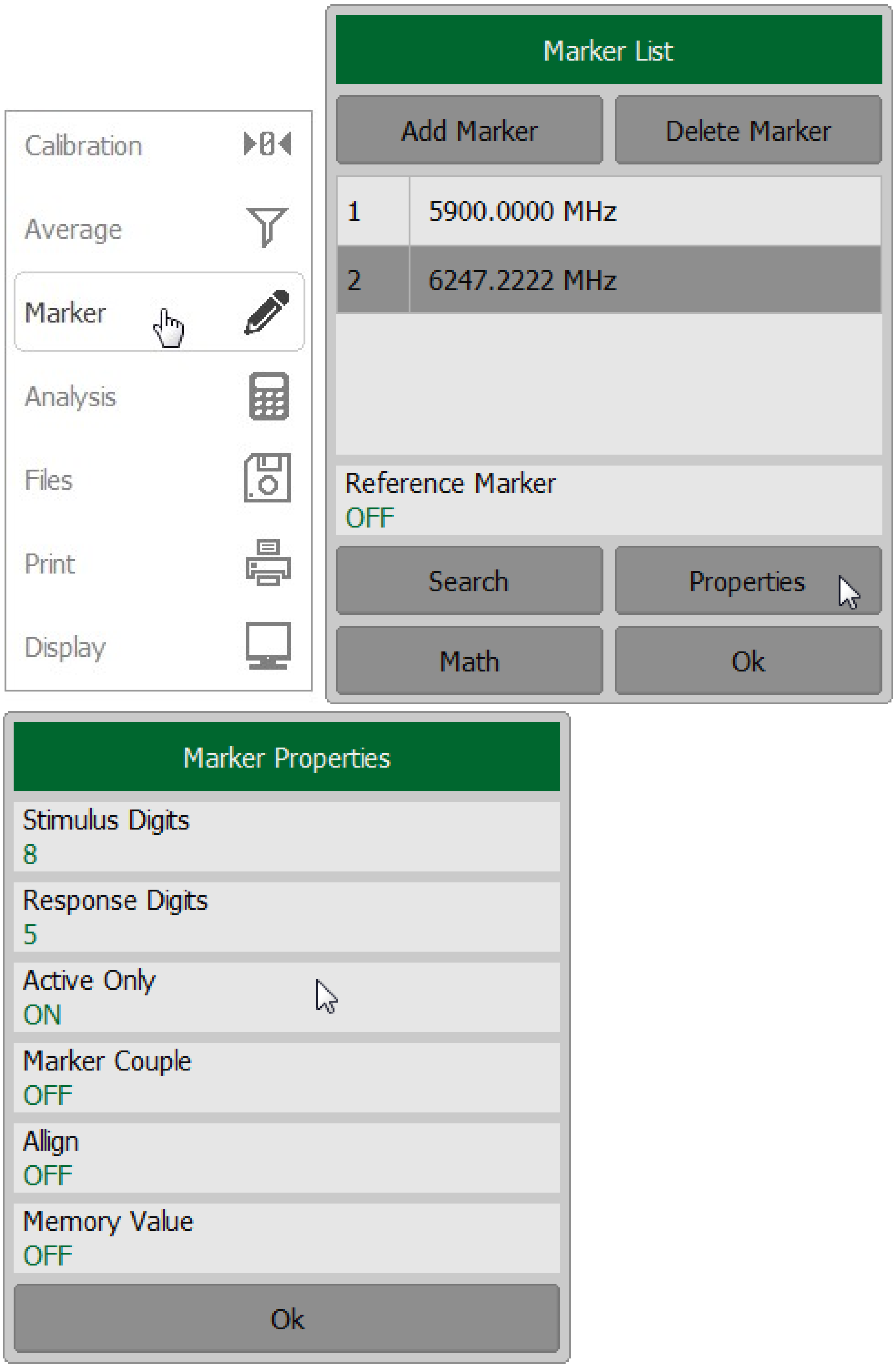

Calibration
Average
Marker
Analysis
Files
Print
Display
Marker List
Add Marker
Delete Marker
1
5900.0000 MHz
2
6247.2222 MHz
Reference Marker
OFF
Search
Properties
Math
Ok
Marker Properties
Stimulus Digits
8
Response Digits
5
Active Only
ON
Marker Couple
OFF
Allign
OFF
Memory Value
OFF
Ok

Multi Marker Data Display

If several overlapping traces are displayed in one diagram, by default only active marker data is displayed on the screen. The display of the marker data for all traces can be enabled simultaneously. The markers for different traces can be distinguished by color. Each marker will be the same color as its trace.

To enable a new marker, use the softkeys **Markers > Properties** on left menu bar. Click in the **Active Only** field.

The **OFF** value stands for multi marker data display mode.



SCPI	DISPlay:WINDow:ANNotation:MARKer:SINGle

NOTE	When multi marker data display is enabled, to avoid data overlapping on the screen, arrange the marker data on the screen (See Marker Data Arrangement).

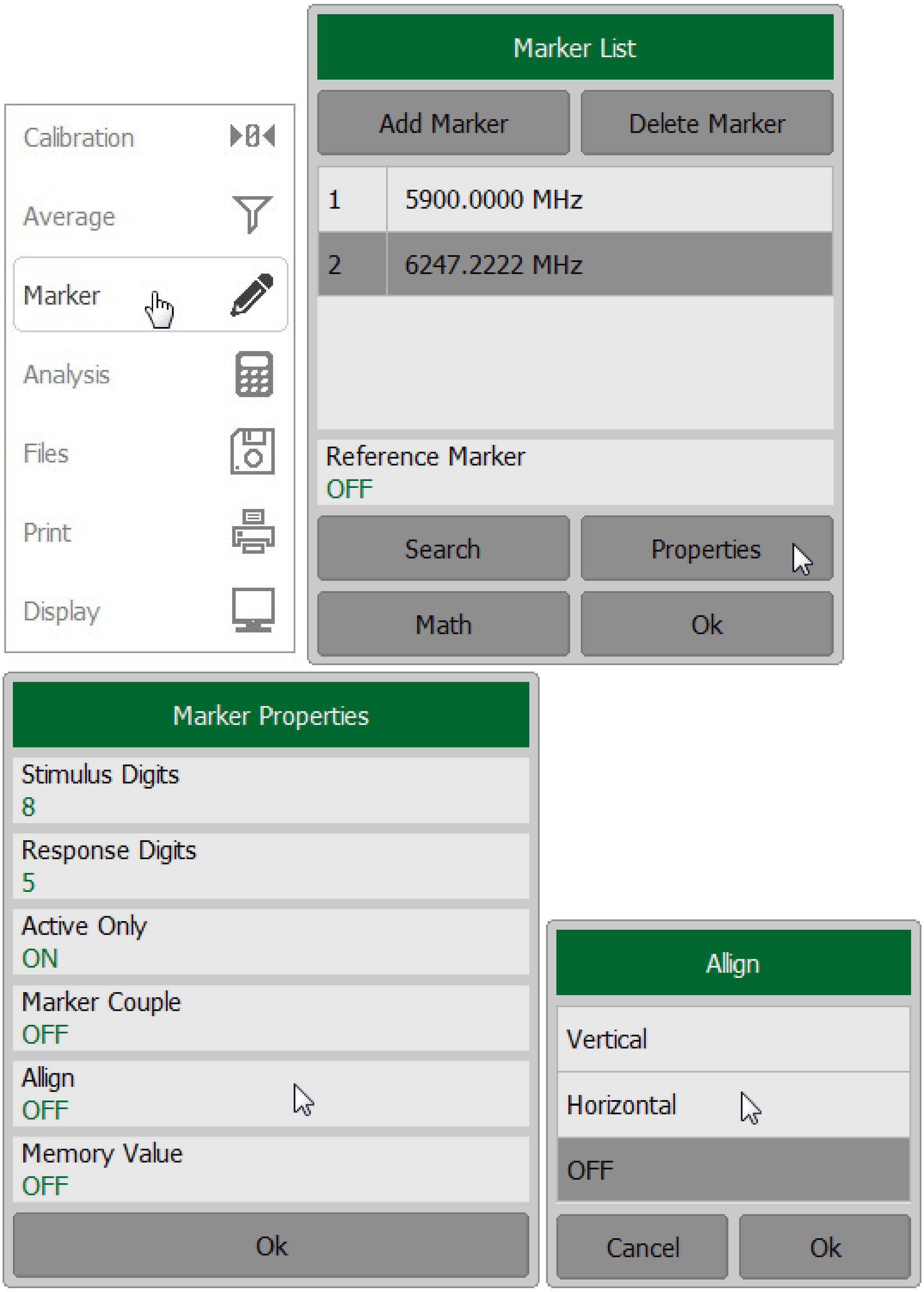
Marker Data Alignment

By default, marker data is displayed independently for each trace. The marker data display can be aligned on the screen. This alignment deactivates the independent marker data layout. In this case, the relative position on the X and Y axes is valid only for the first trace. The marker data of the other traces becomes aligned relatively to the first trace. Two types of alignment are available:

- Vertical — marker data of different traces are displayed one under another.
- Horizontal — marker data of different traces are displayed in line.

To enable a new marker, use the softkeys **Markers > Properties** on left menu bar.

Click in the **Align** field. In the Align dialog, click on the alignment type. Close the dialog by clicking **Ok**.

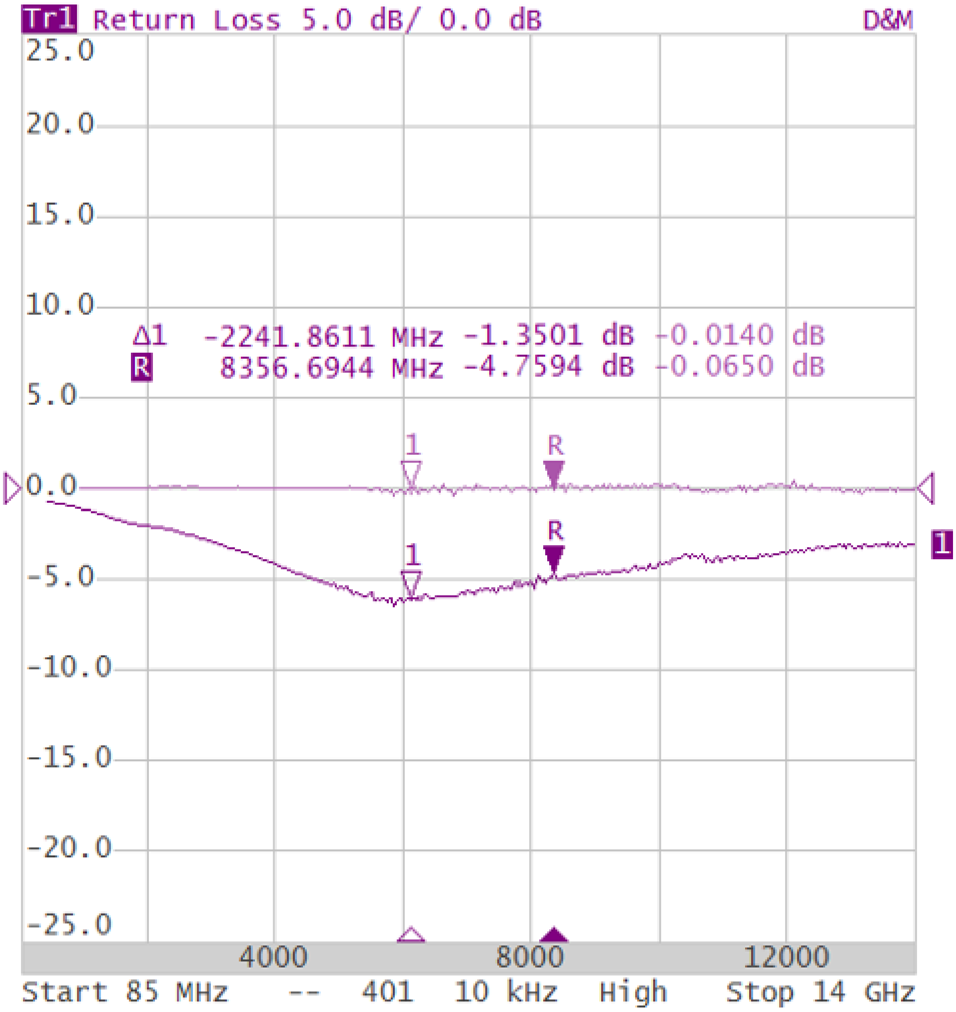


SCPI DISPlay:WINDow:ANNotation:MARKer:ALIGn

Memory Trace Value Display

By default, the marker values of the data traces (not memory traces) are displayed on the screen. The display of memory trace maker values can be enabled, if a memory trace is available.

When the display of memory trace marker values is ON, the marker indicates the stored data at the same time with the current (See figure below). Marker pointers appear on the memory trace are the same as on the data trace. Markers pointers are interactive. They can be moved with the mouse to watch the stored data.

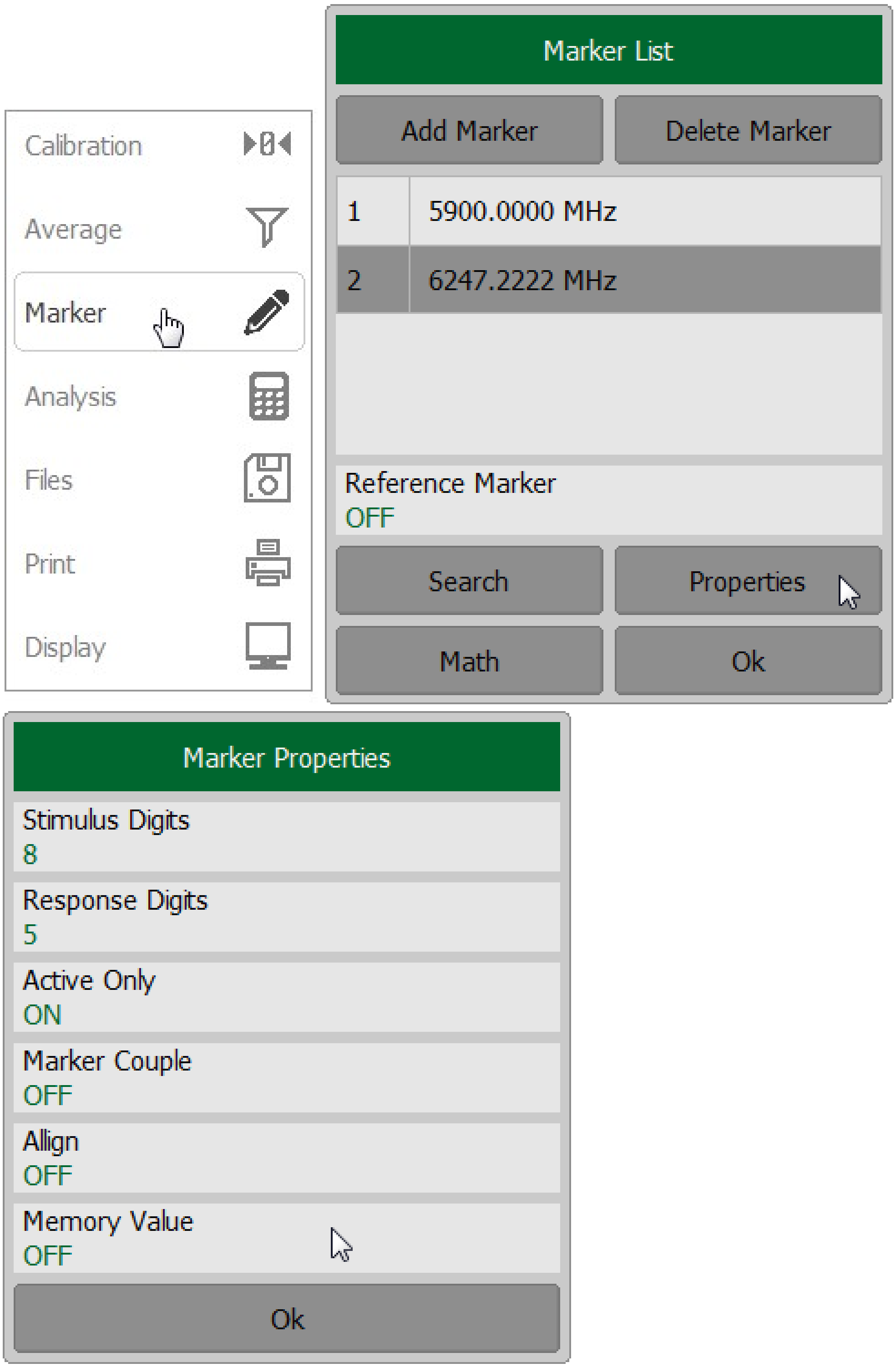


Display of the memory value using markers

To enable/disable the display of memory trace marker values, toggle the following softkeys **Marker > Properties**.

In the Memory Value dialog, click on the **Memory Value** field to toggle between the values.

Close the dialog by clicking **Ok**.



SCPI	[DISPlay:WINDow:TRACe:ANNotation:MARKer:MEMory]()

Marker Position Search Functions

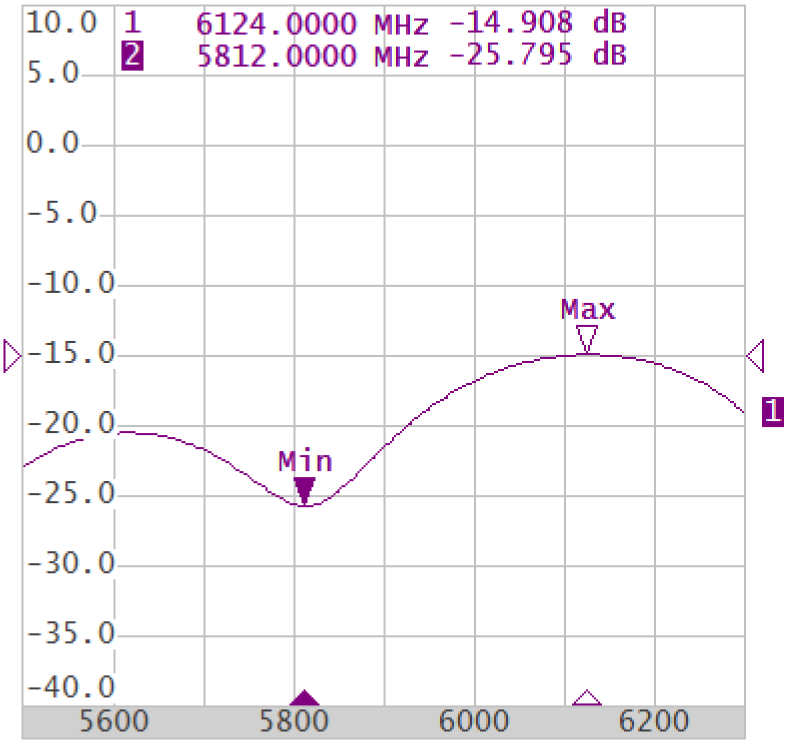
The marker position search function allows to find the following values on a trace:

- Maximum value
- Minimum value
- Peak value
- Target level

This section contains information about search tracking mode (See Search Tracking) and on the function used to set the search range of the marker position (See Search Range).

Maximum and Minimum Search Functions

Maximum and minimum search functions are used to determine the maximum and minimum values of the measured parameter and move the marker to these positions on the trace (See figure below).

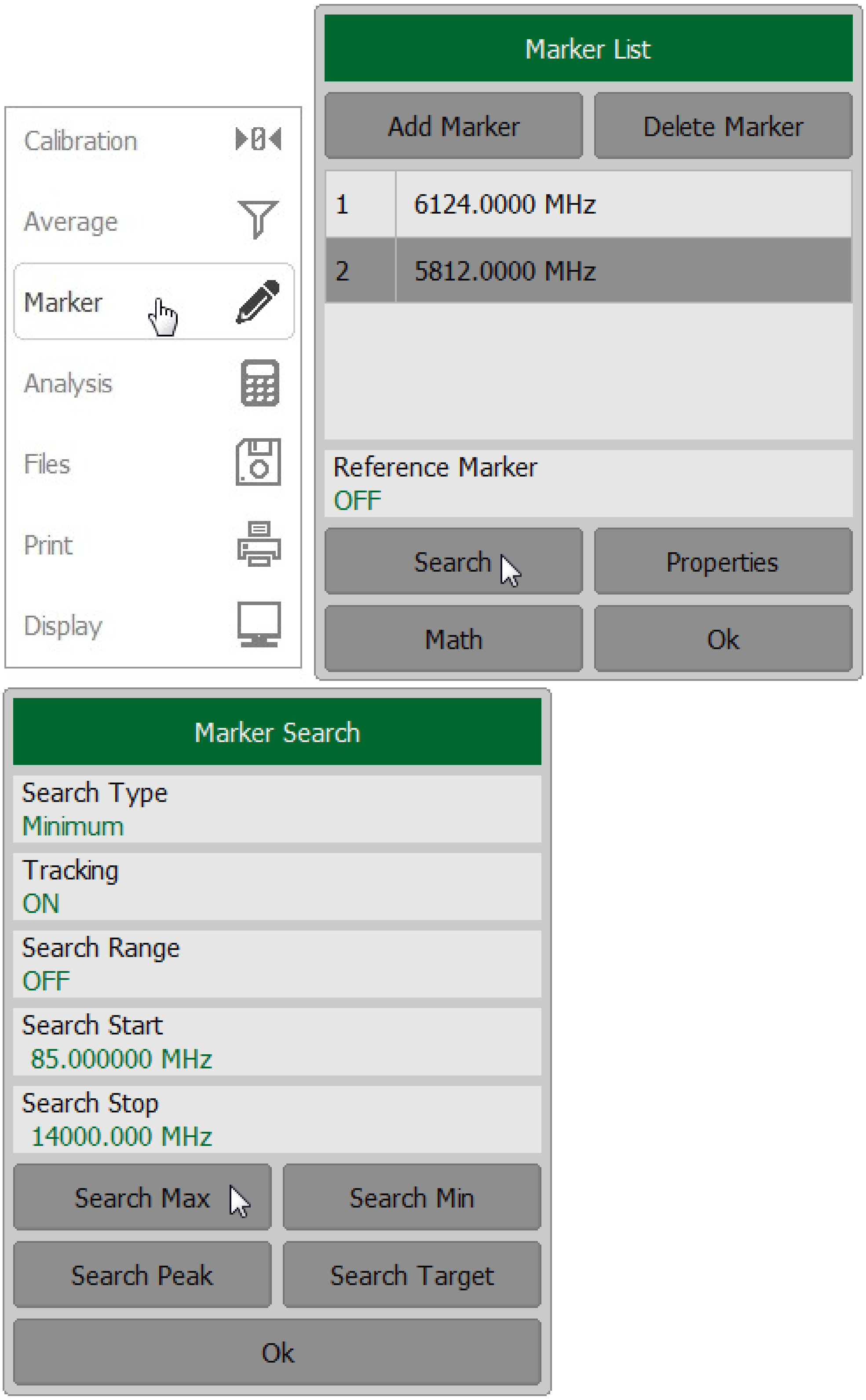


Maximum and minimum search

To enable a new marker, use the softkeys **Markers > Search** on left menu bar.

To find the maximum or minimum values on a trace use the **Search Min** |or **Search Max** softkeys.

The last search type applied to the marker is indicated in the **Search Type** field of the Marker Search dialog.



SCPI CALCulate:MARKer:FUNCtion:EXECute, CALCulate:MARKer:FUNCtion:TYPE

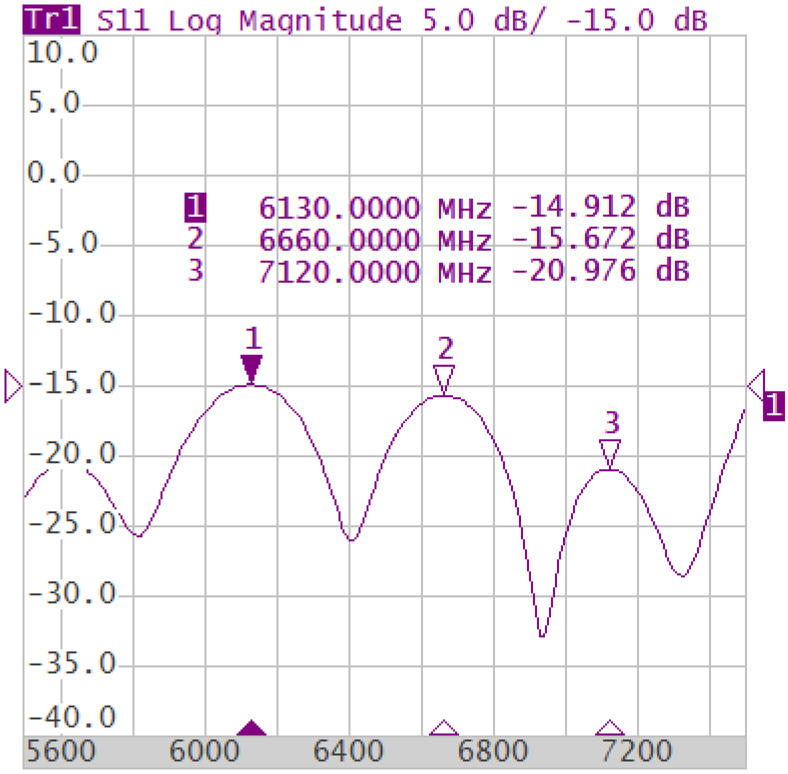
NOTE	Activate the marker before starting maximum or minimum search (See Marker Activation). In Smith chart and polar formats, the search is executed for the first marker value.

Search for Peak

Peak search function is used to determine the peak value of the measured parameter and move the marker to this position on the trace.

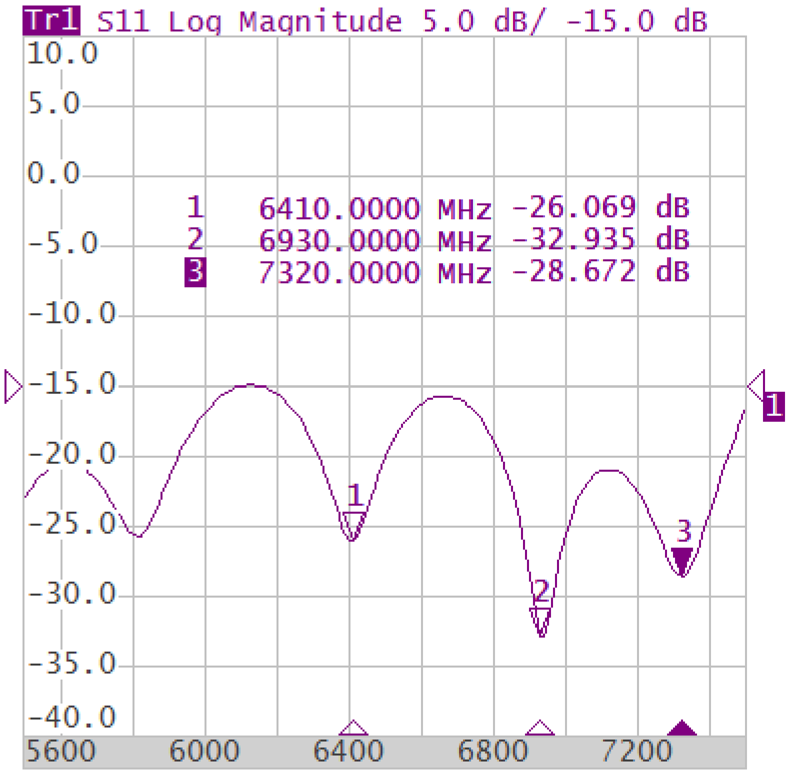
Peak is a local extreme of the trace.

Peak is considered **positive** if the value of the peak is greater than the values of the adjacent points (See figure below).



Positive peaks

Peak is considered **negative** if the value of the peak is smaller than the values of the adjacent points (See figure below).



Negative peaks

Peak excursion is the smallest of the absolute differences between the response values in the peak point and the two adjoining peaks of the opposite polarity.

The peak search is executed only for the peaks meeting the following conditions:

- The peaks must have the polarity (positive, negative, or both) specified by the user.
- The peaks must have a peak deviation no less than the value assigned by the user.

The following options for the peak search are available:

- search for nearest peak
- search for greatest peak
- search for left peak
- search for right peak

The nearest peak is a peak that is located most near to the current position of the marker along the stimulus axis.

The greatest peak is a peak with maximum or minimum value, depending on the current polarity settings of the peak.

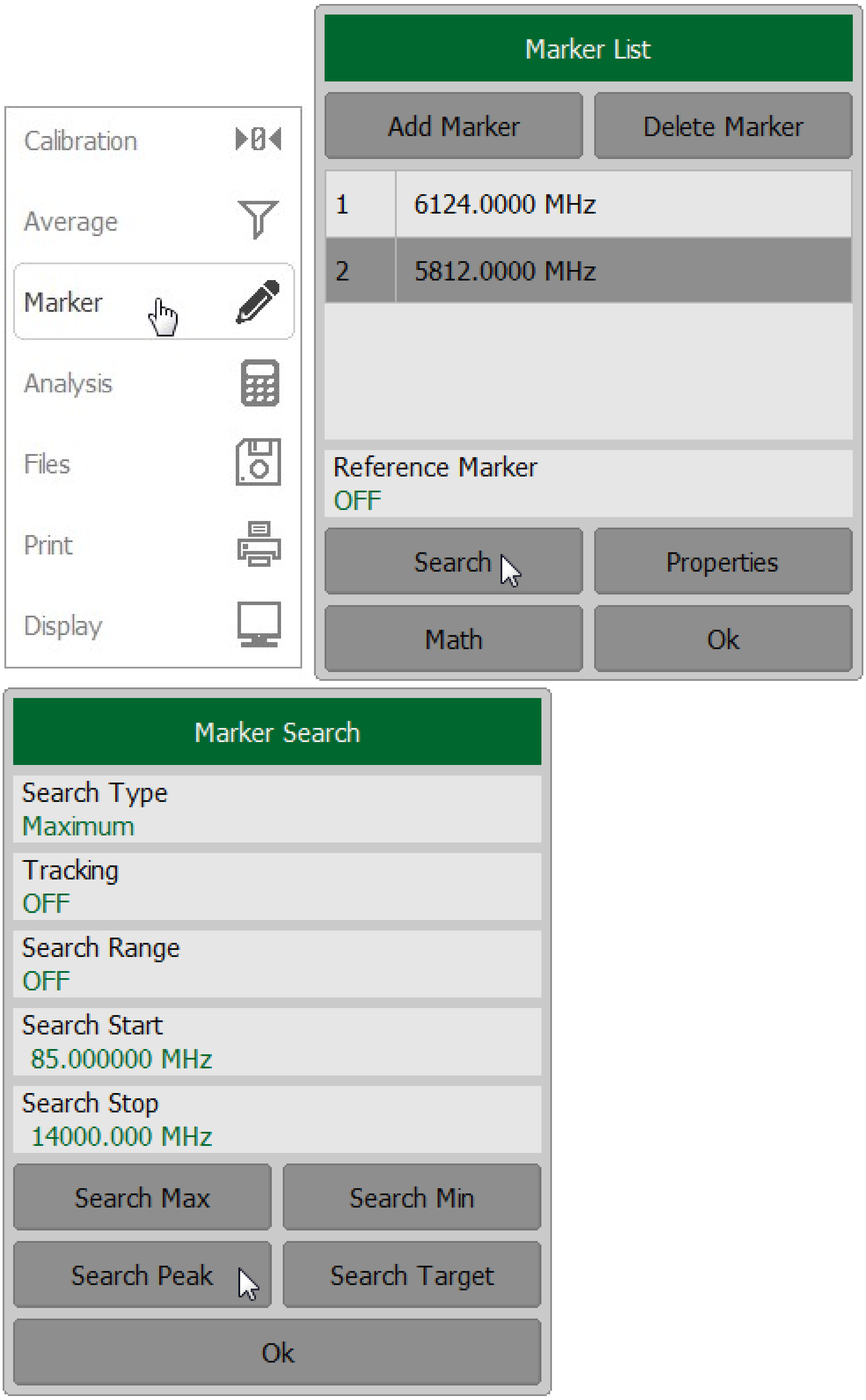
NOTE	Finding the greatest peak is different form finding the maximum or minimum, as the peak cannot be located at the trace’s limit points, even if those points have a maximum or minimum value.

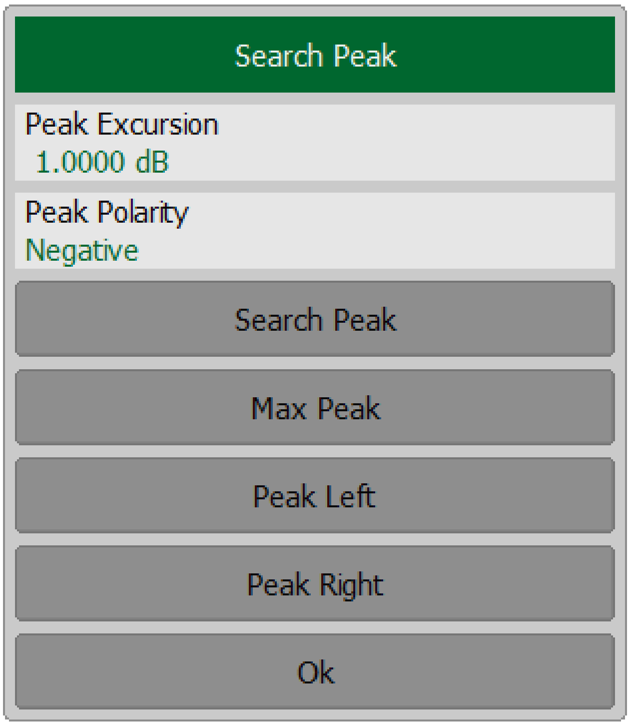
To enable a new marker, use the softkeys **Markers > Search > Search Peak** on left menu bar.

Set the peak excursion value, if necessary, by a click on the **Peak Excursion** field and enter the value using the on-screen keypad. Set the required peak polarity, if necessary, by a click in the **Peak Polarity** field.

Depending on the search function select one of the following softkeys:

- **Search Peak**
- **Max Peak**
- **Peak Left**
- **Peak Right**


Calibration
Average
Marker
Analysis
Files
Print
Display
Marker List
Add Marker
Delete Marker
1
6124.0000 MHz
2
5812.0000 MHz
Reference Marker
OFF
Search
Properties
Math
Ok
Marker Search
Search Type
Maximum
Tracking
OFF
Search Range
OFF
Search Start
85.000000 MHz
Search Stop
14000.000 MHz
Search Max
Search Min
Search Peak
Search Target
Ok



SCPI	CALCulate:MARKer:FUNCtion:EXECute, CALCulate:MARKer:FUNCtion:TYPE, CALCulate:MARKer:FUNCtion:PPOLarity, CALCulate:MARKer:FUNCtion:PPOLarity

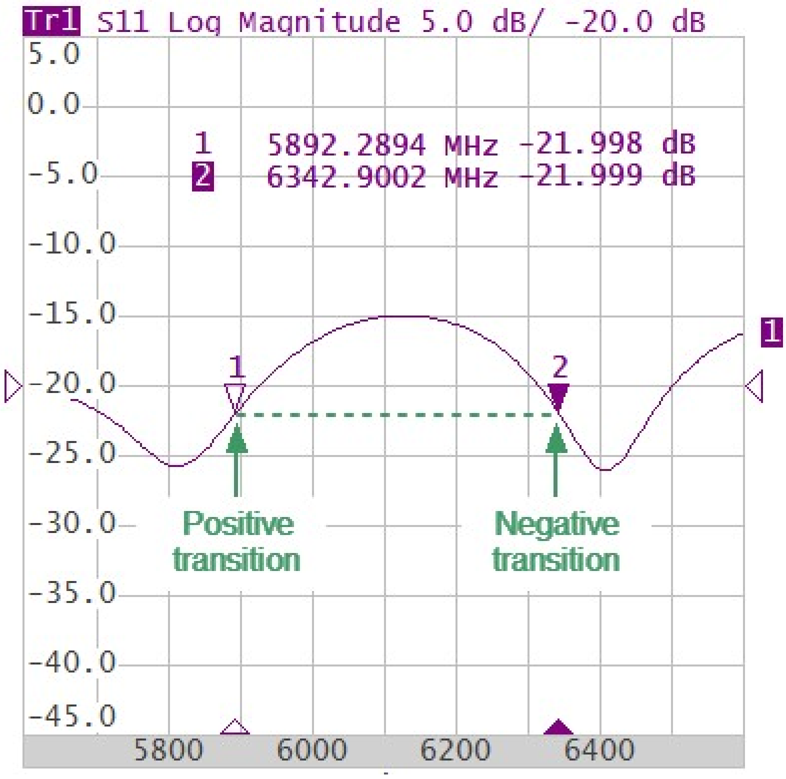
NOTE	Activate the marker before starting maximum or minimum search (See Marker Activation). In Smith chart and Polar formats, the search is executed for the first marker value.

Search for Target Level

The target level search function is used to locate the marker with the given level of the measured parameter (See figure below).

The trace can have two types of transition at the points where the target level crosses the trace:

- Transition type is positive if the function derivative (trace slope) is positive at the intersection point with the target level.
- Transition type is negative if the function derivative (trace slope) is negative at the intersection point with the target level.



Target level search

Target level search is performed only for intersection points that have a user-selected specific transition polarity (positive, negative, or both).

The following options for the target level search are available:

- search for nearest target
- search for left target
- search for right target

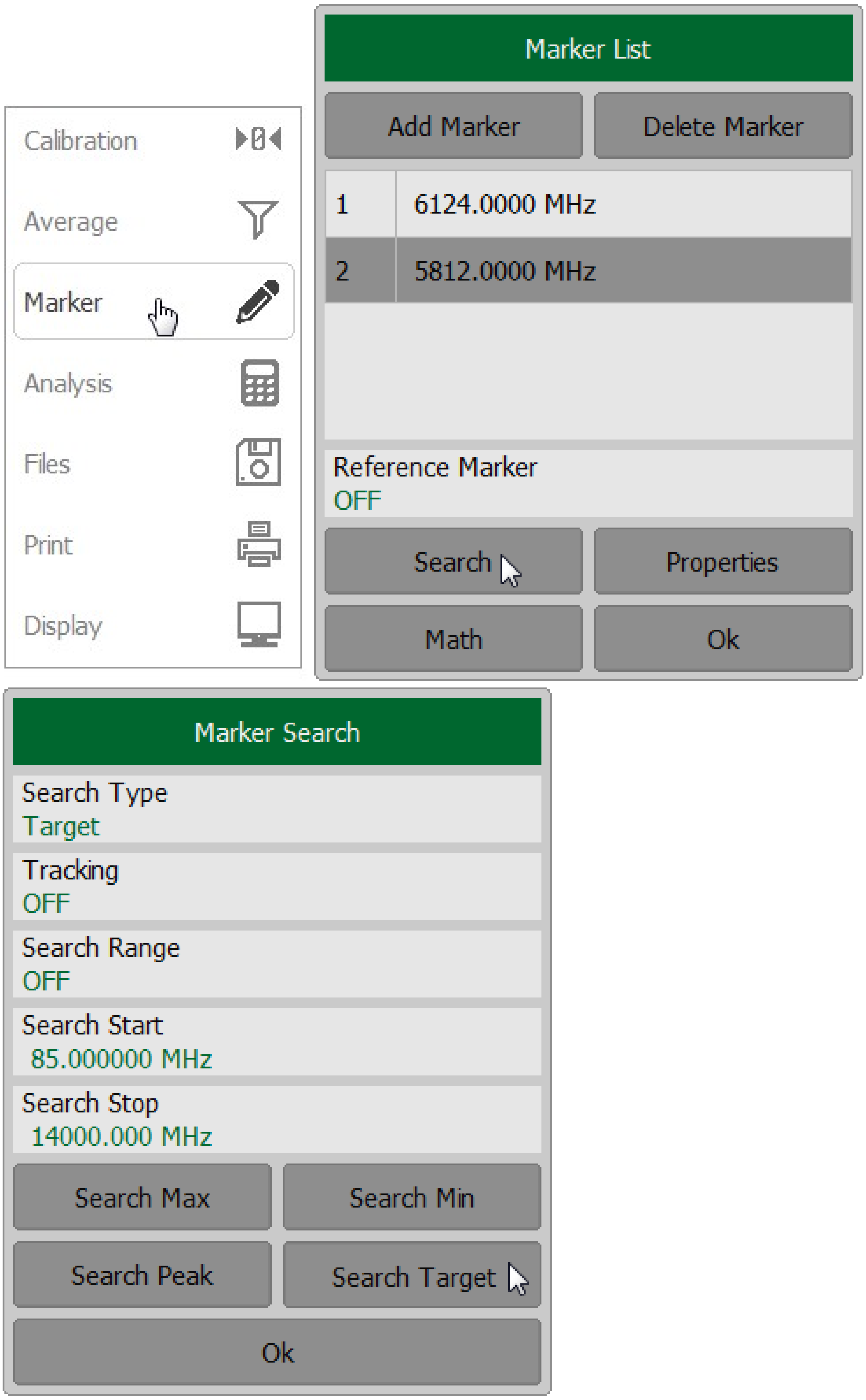
To enable a new marker, use the softkeys **Markers > Search > Search Target** on left menu bar.

To set the target level value click on the **Target Value** field and enter the value using the on-screen keypad.

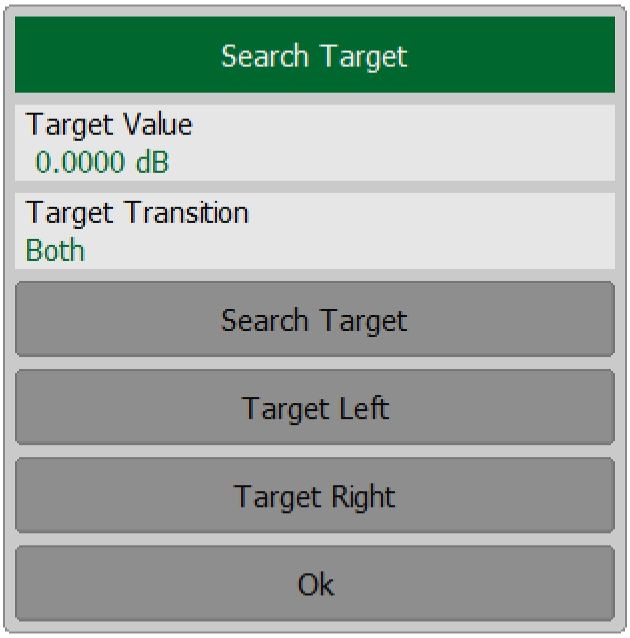
To set the transition type click on the **Target Transition** field.

Depending on the search function select one of the following softkeys:

- **Search Target**
- **Target Left**
- **Target Right**



Calibration
Average
Marker
Analysis
Files
Print
Display
Marker List
Add Marker
Delete Marker
1 6124.0000 MHz
2 5812.0000 MHz
Reference Marker
OFF
Search
Properties
Math
Ok
Marker Search
Search Type
Target
Tracking
OFF
Search Range
OFF
Search Start
85.000000 MHz
Search Stop
14000.000 MHz
Search Max
Search Min
Search Peak
Search Target
Ok



SCPI	CALCulate:MARKer:FUNCtion:EXECute, CALCulate:MARKer:FUNCtion:TYPE, CALCulate:MARKer:FUNCtion:TTRansition, CALCulate:MARKer:FUNCtion:TARGet

NOTE	Activate the marker before starting maximum or minimum search (See Marker Activation). In Smith chart and Polar formats, the search is executed for the first marker value.

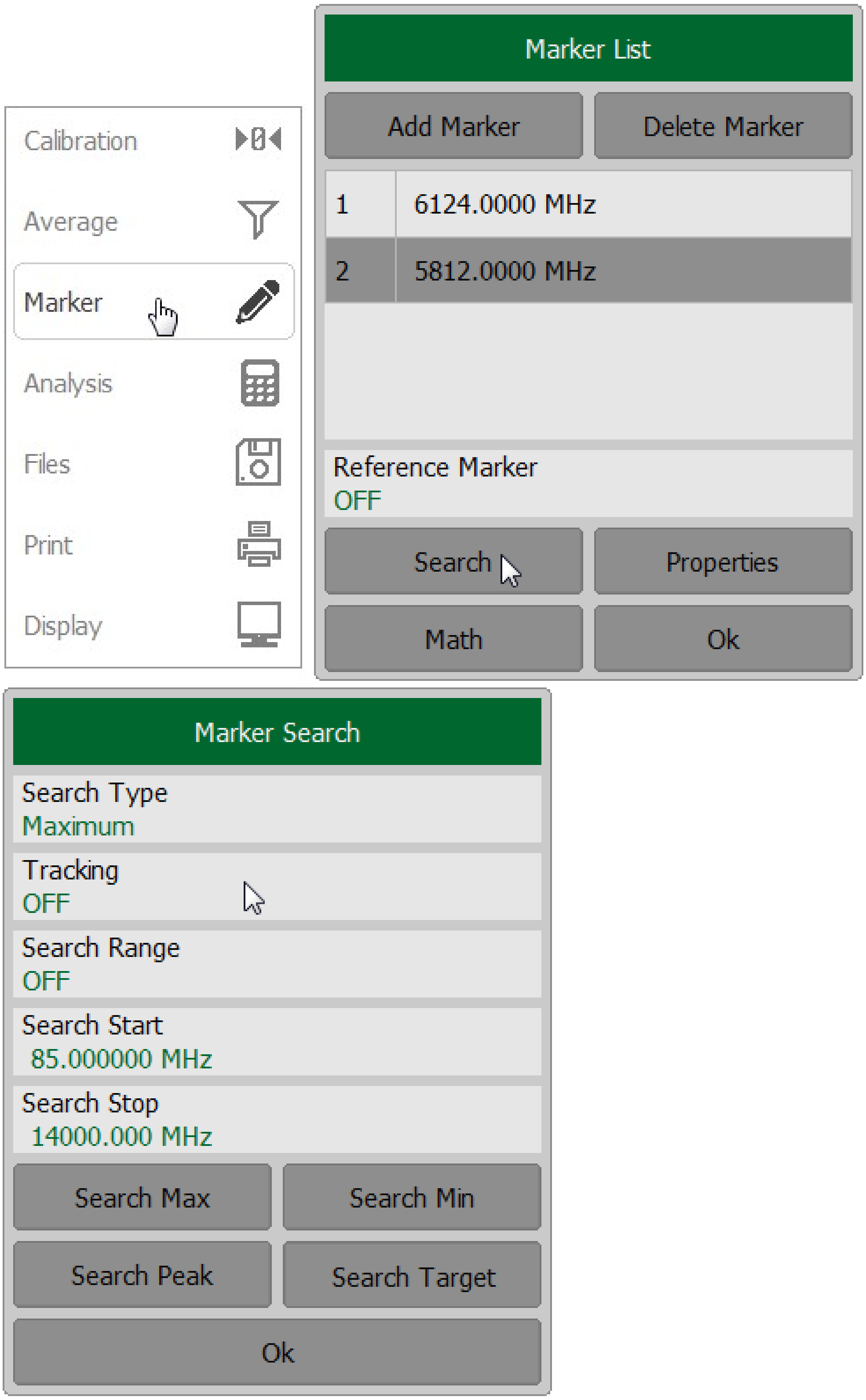
Search Tracking

The marker position search function, by default, can be initiated by any press of the search key. Search tracking mode performs continuous marker position search, until this mode is disabled.

To enable a new marker, use the softkeys **Markers > Search** on left menu bar.

Click on the **Tracking** field to enable/disable the search tracking mode.

Tracking will be performed for the last searched marker search type. The marker search type will be indicated in the **Search Type** field.



SCPI [CALCulate:MARKer:FUNCtion:TRACking]

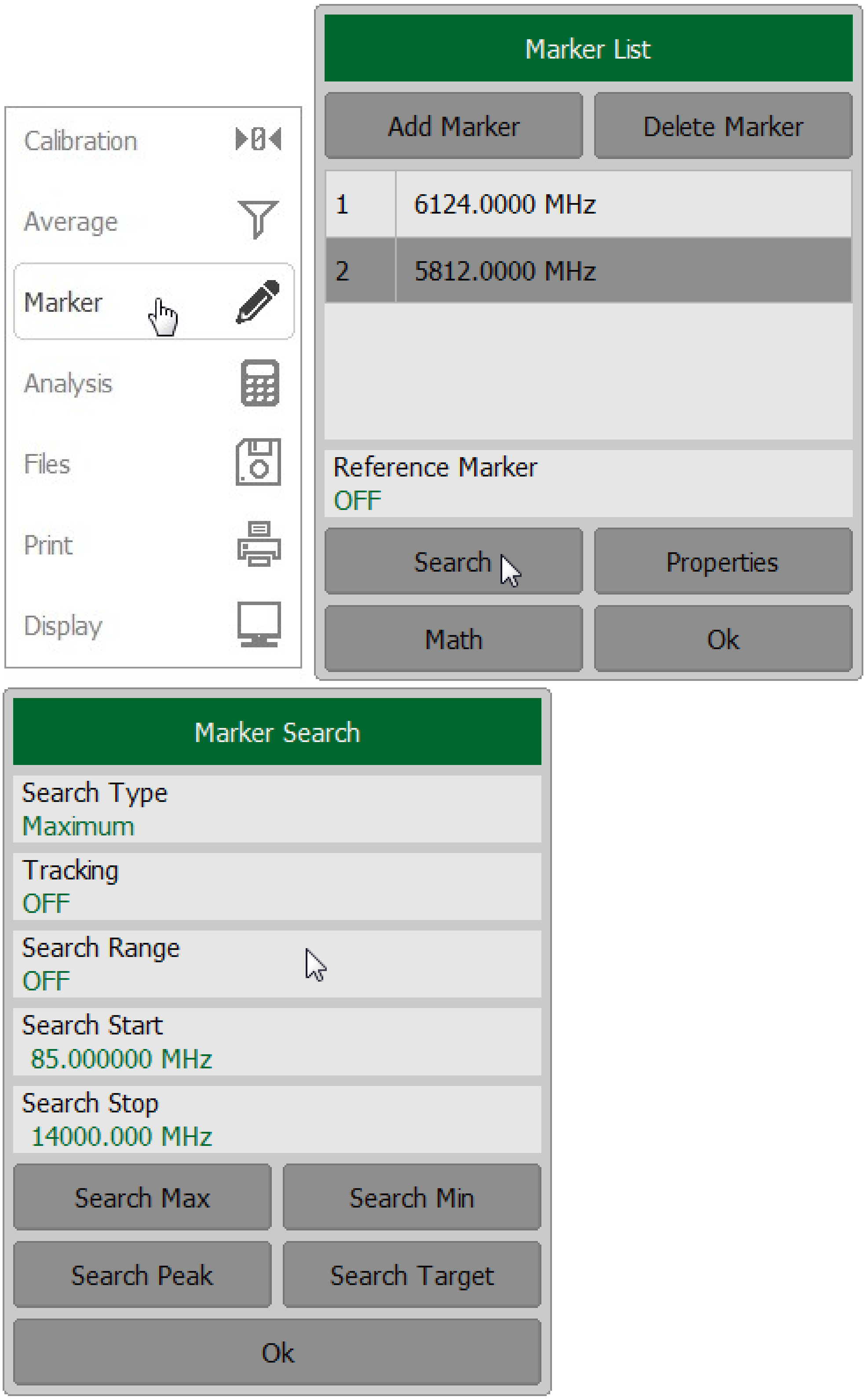
Search Range

The search range for the marker position search can be set by setting the stimulus limits.

To enable a new marker, use the softkeys **Markers > Search** on left menu bar.

Click on the **Search Range** field to enable/disable the search range.

To enter the search range parameters, click on the **Search Start** or **Search Stop** field and enter the stimulus value using the on-screen keypad.



SCPI	CALCulate:MARKer:FUNCtion:DOMain, CALCulate:MARKer:FUNCtion:DOMain:STARt, CALCulate:MARKer:FUNCtion:DOMain:STOP

Marker Math Functions

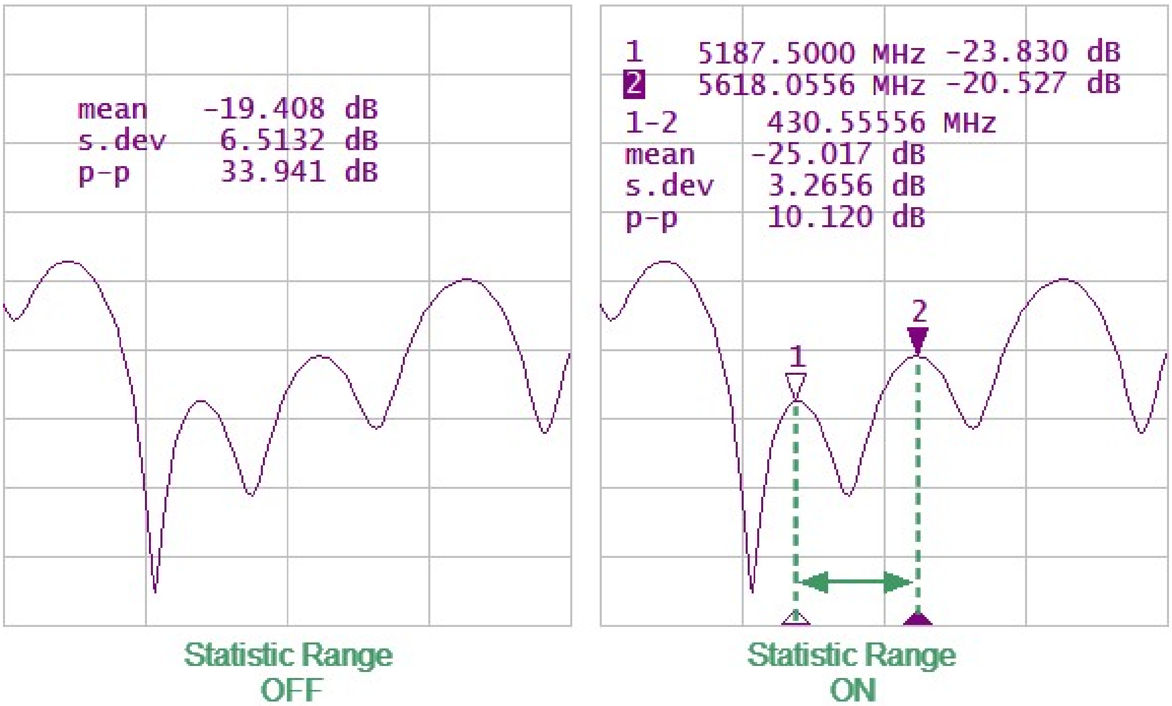
Marker math functions use markers to calculate various trace characteristics. Four marker math functions are available:

- Statistics
- Bandwidth Search
- Flatness
- RF Filter

Trace Statistics

The trace statistics feature allows to determine and view trace parameters, such as mean, standard deviation, and peak-to-peak.

The range of trace statistics can be defined by two markers (See figure below).



Trace statistics

Trace Statistics parameter

Symbol	Definition	Formula
mean	Arithmetic mean	$M = \frac{1}{N} \cdot \sum_{i=1}^{N} x_i$
s.dev	Standard deviation	$\sqrt{\frac{1}{N-1} \cdot \sum_{i=1}^{N} (x_i - M)^2}$
p-p	Peak-to-Peak: difference between the maximum and minimum values	Max – Min

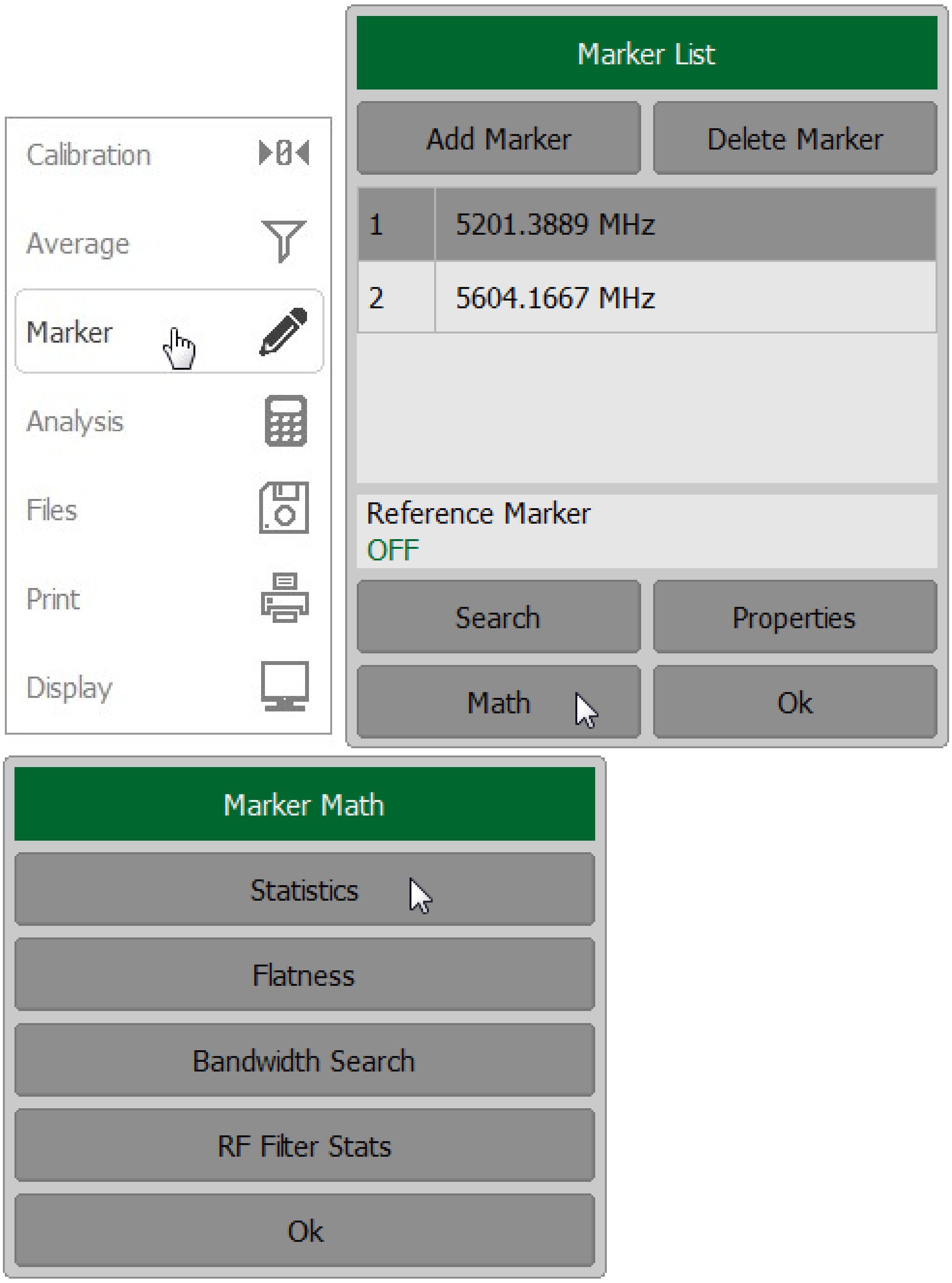
To enable a new marker, use the softkeys **Markers > Math > Statistics** on left menu bar.

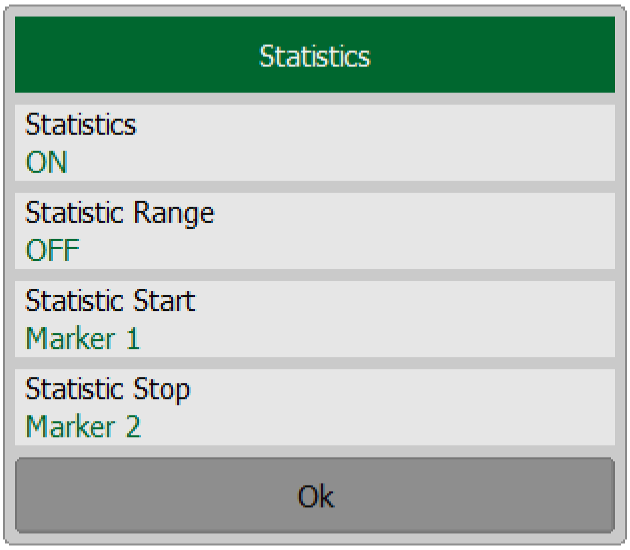
Click on the **Statistics** field to toggle between the ON/OFF status.

To enable/disable statistics range feature click on the **Statistics Range** field to toggle between the on/off status.

The statistics range is set by two markers. If there are no markers in the list, add two markers. Marker adding operation is described in Markers.

Click on the **Statistic Start** or **Statistic Stop** field and select the required marker numbers from the list.

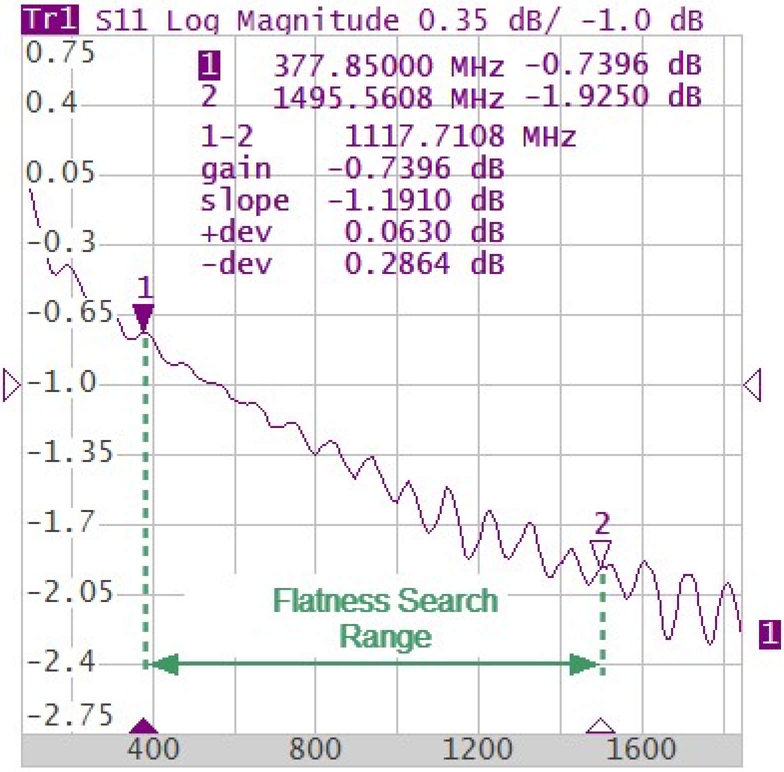

Calibration
Average
Marker
Analysis
Files
Print
Display
Marker List
Add Marker
Delete Marker
1
5201.3889 MHz
2
5604.1667 MHz
Reference Marker
OFF
Search
Properties
Math
Ok
Marker Math
Statistics
Flatness
Bandwidth Search
RF Filter Stats
Ok

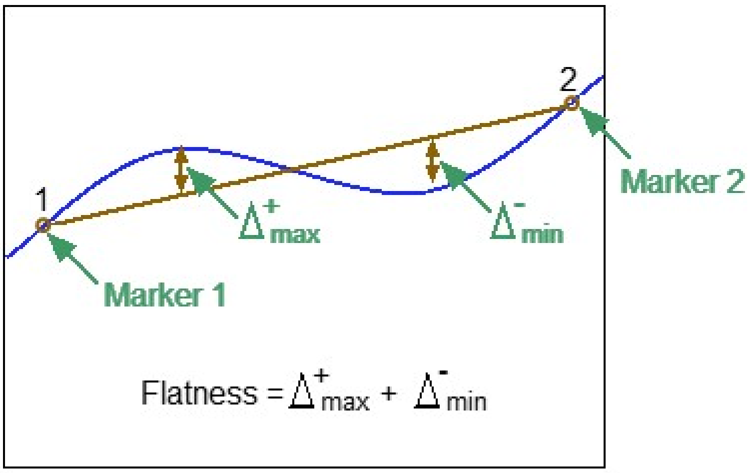


SCPI	CALCulate:MSTatistics, CALCulate:MSTatistics:DOMain, CALCulate:MSTatistics:DOMain:STARt, CALCulate:MSTatistics:DOMain:STOP

Flatness

The flatness search function allows to determine and view the following trace parameters: gain, slope, and flatness. Two markers to specify the flatness search range should be set (See figure below).





Flatness search

Flatness parameters

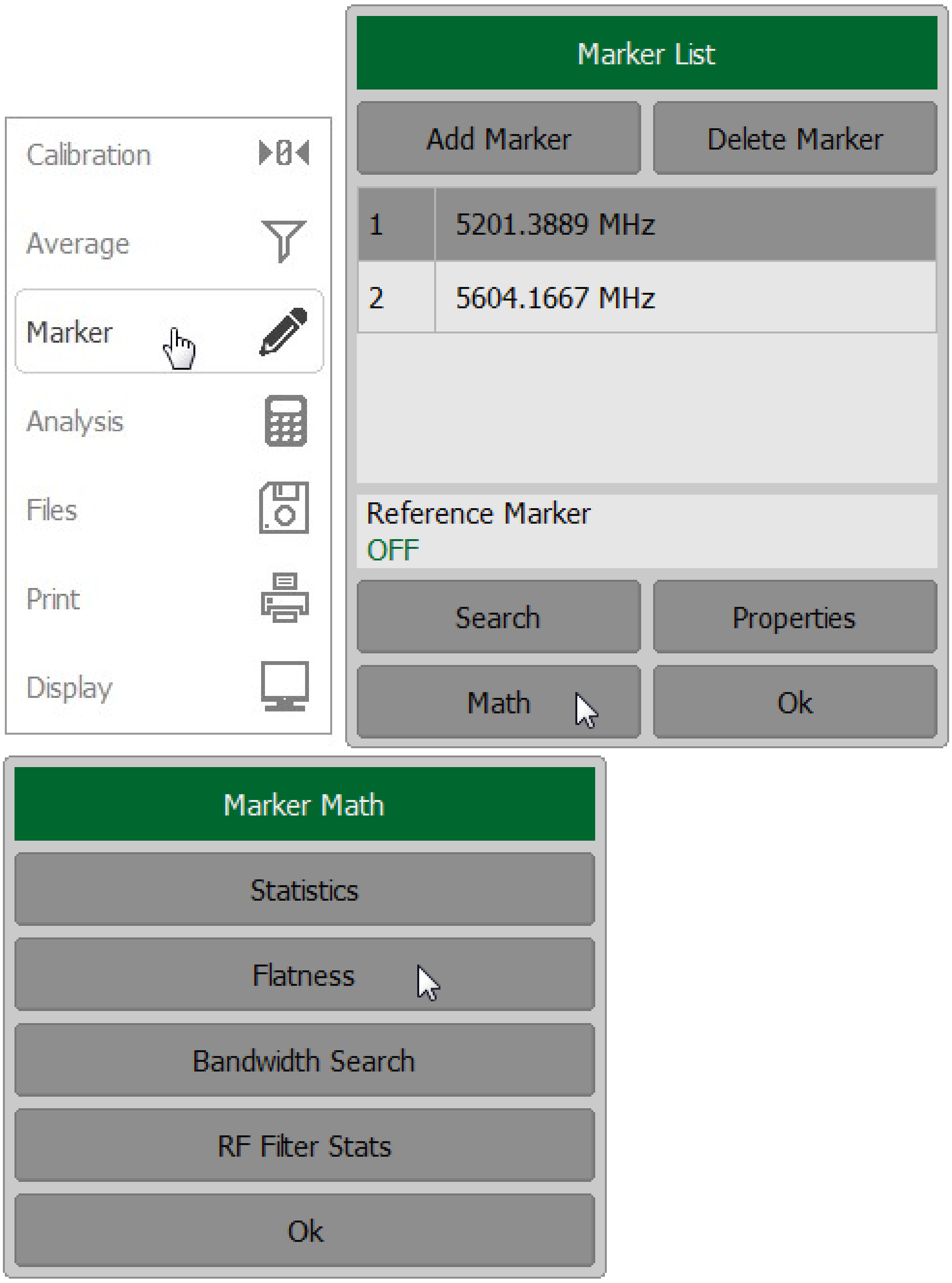
Parameter Description	Symbol	Definition
Gain	**gain**	Marker 1 value.
Slope	**slope**	Difference between marker 2 and marker 1 values.
Flatness	**flat**	Sum of "positive" and "negative" peaks of the trace, which are measured from the line connecting marker 1 and marker 2 (See above figure).

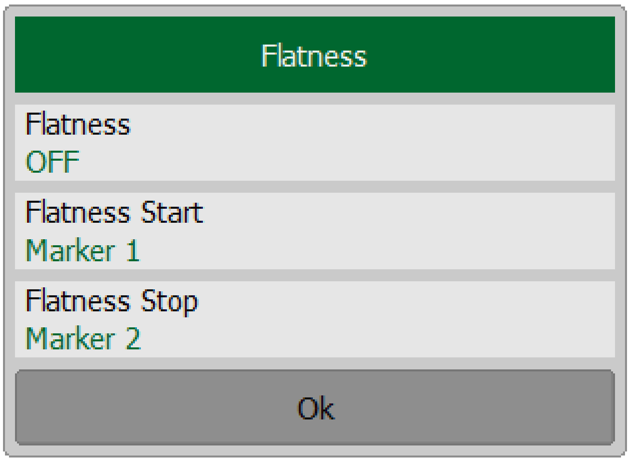
To enable a new marker, use the softkeys **Markers > Math > Flatness** on left menu bar.

Click on the **Flatness** field to toggle between the on/off status.

Flatness range is set by two markers. If there are no markers in the list, add two markers. Marker adding operation is described in Markers.

Click on the **Flatness Start** or **Flatness Stop** field and select the required marker numbers from the list.


Calibration
Average
Marker
Analysis
Files
Print
Display
Marker List
Add Marker
Delete Marker
1 5201.3889 MHz
2 5604.1667 MHz
Reference Marker
OFF
Search
Properties
Math
Ok
Marker Math
Statistics
Flatness
Bandwidth Search
RF Filter Stats
Ok

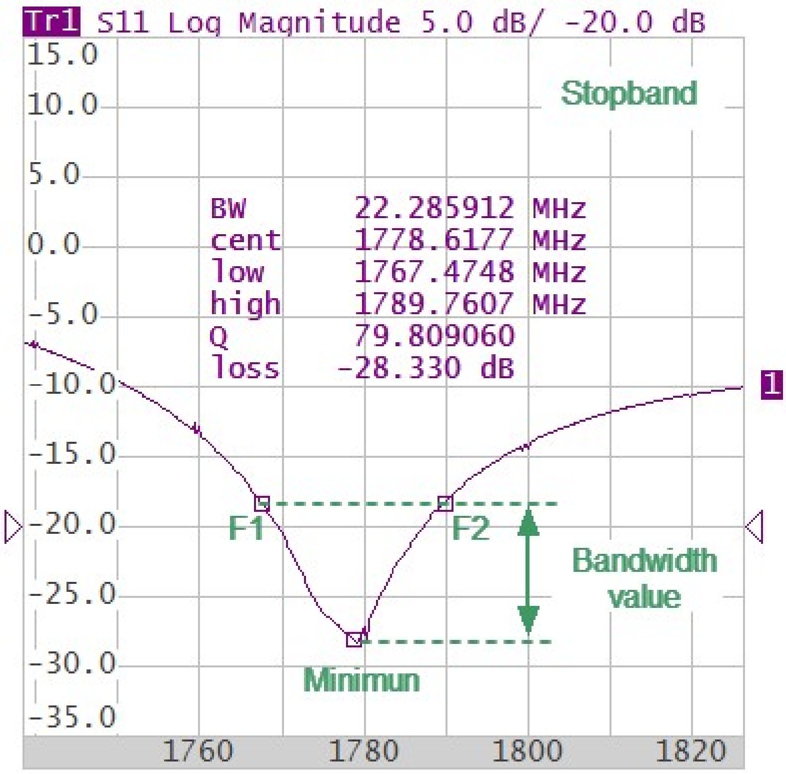

Flatness
Flatness
OFF
Flatness Start
Marker 1
Flatness Stop
Marker 2
Ok

Bandwidth Search

The bandwidth search function allows to determine and view the following parameters of a passband or a stopband: bandwidth, center frequency, lower frequency, higher frequency, Q value, and insertion loss.

The bandwidth search is executed from the reference point. The active marker or the maximum trace value can be selected as the reference. The bandwidth search function detects lower and higher cutoff frequencies that differ from the reference point response by a user-specified bandwidth value.

The figure below shows an example of a stopband search from the minimum reference point.



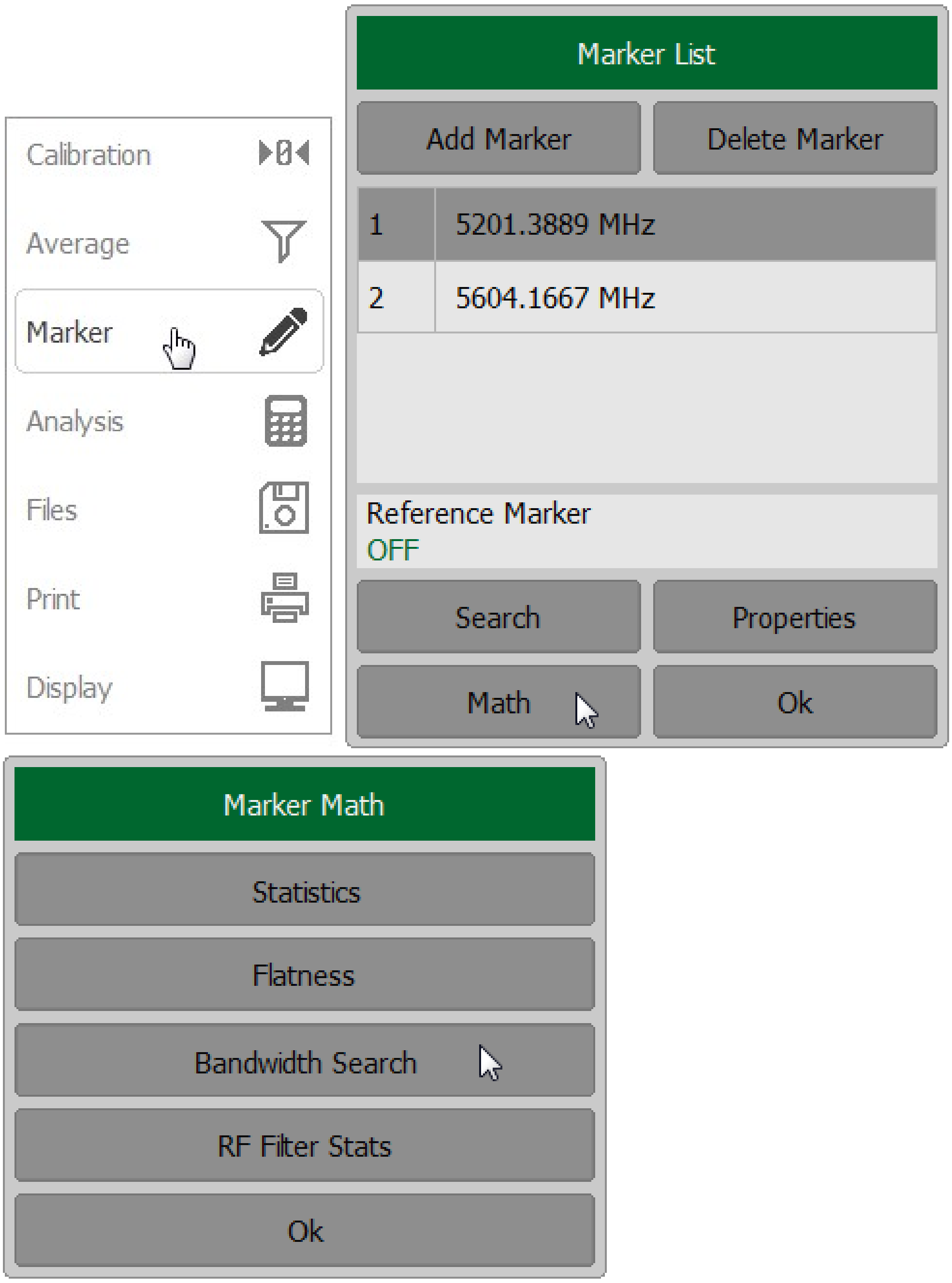
F1 and F2 are the lower and higher cutoff frequencies of the band respectively

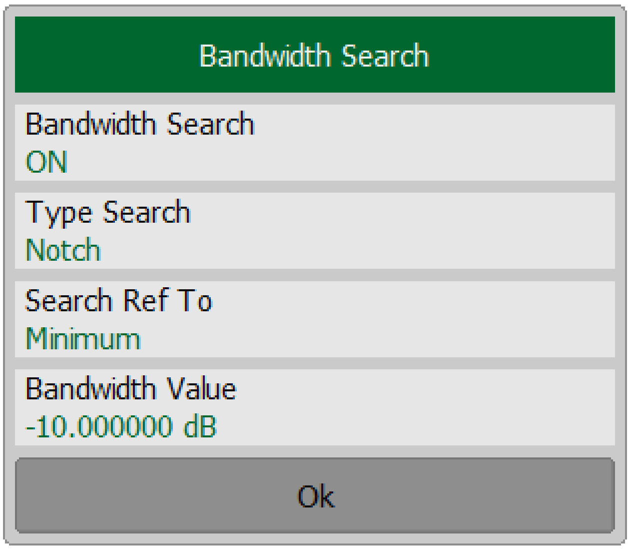
Bandwidth search

Bandwidth parameters

Parameter Description	Symbol	Definition	Formula
Bandwidth	**BW**	The difference between the higher and lower cutoff frequencies.	F2 – F1
Center Frequency	**cent**	The midpoint between the higher and lower cutoff frequencies.	(F1+F2)/ 2
Lower Cutoff Frequency	**low**	The lower frequency point of the intersection of the bandwidth cutoff level and the trace.	F1
Higher Cutoff Frequency	**high**	The higher frequency point of the intersection of the bandwidth cutoff level and the trace.	F2
Quality Factor	**Q**	The ratio of the center frequency to the bandwidth.	cent/BW
Loss	**loss**	The trace measured value in the reference point of the bandwidth search.	—

To enable a new marker, use the softkeys **Markers > Math > Bandwidth Search** on left menu bar.

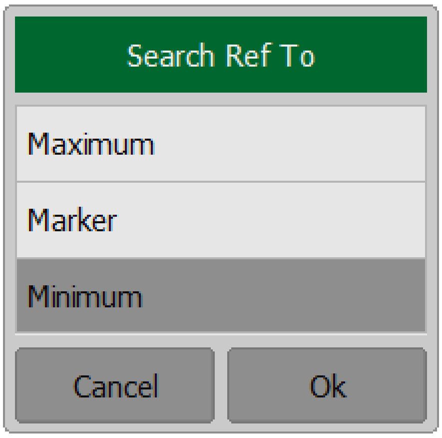

Calibration
Average
Marker
Analysis
Files
Print
Display
Marker List
Add Marker
Delete Marker
1
5201.3889 MHz
2
5604.1667 MHz
Reference Marker
OFF
Search
Properties
Math
Ok
Marker Math
Statistics
Flatness
Bandwidth Search
RF Filter Stats
Ok



Click on the **Bandwidth Search** field to toggle between the ON/OFF status.

Click on the **Type Search** field to set the bandwidth search type. The type toggle between **Bandpass** and **Notch** settings.

To set the search reference point, use the **Search Ref To** field. The type toggle between **Maximum**, **Marker** and **Minimum** settings.

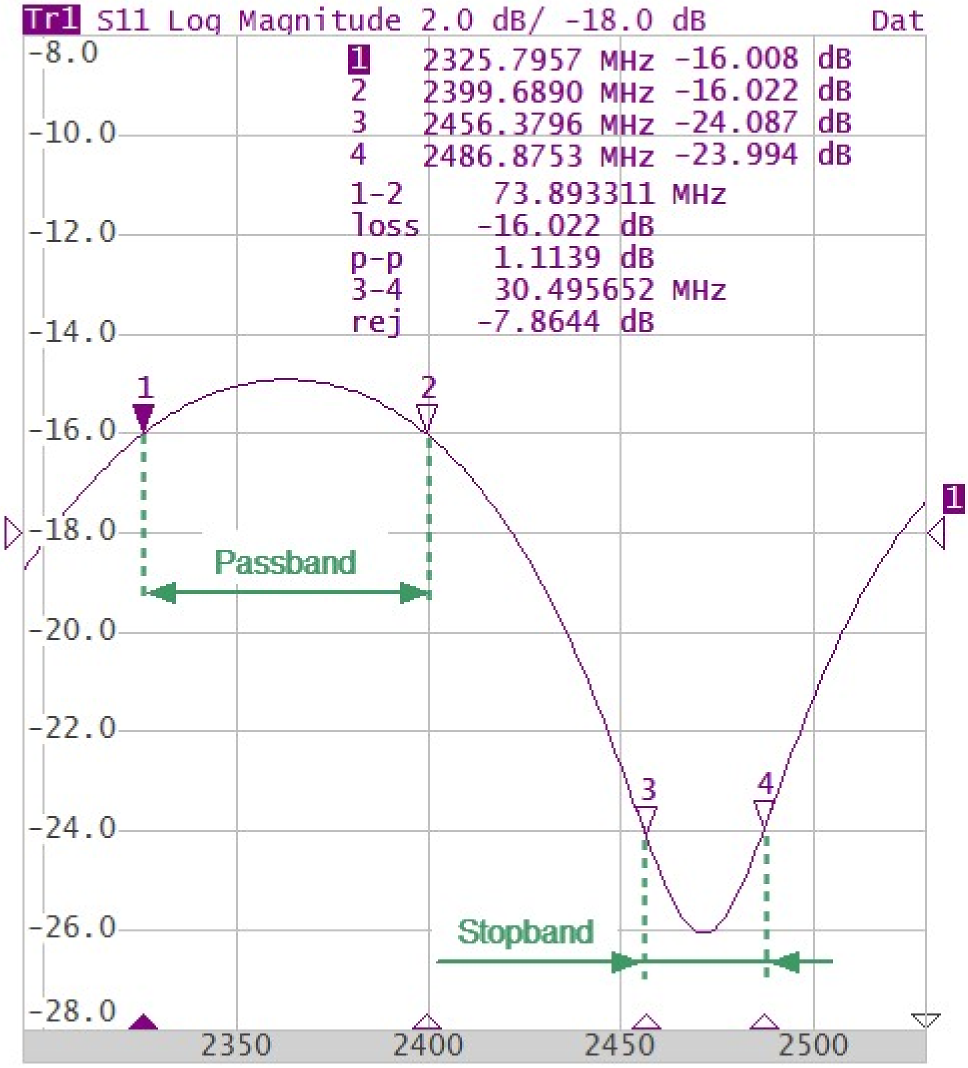


To set the target level value click on the **Bandwidth Value** field and enter the value using the on-screen keypad.

SCPI	CALCulate:MARKer:BWIDth, CALCulate:MARKer:BWIDth:TYPE, CALCulate:MARKer:BWIDth:REFerence, CALCulate:MARKer:BWIDth:THReshold

RF Filter Statistics

The RF filter statistics function allows to determine and view the following filter parameters: loss, peak-to-peak in a passband, and rejection in a stopband. The passband is specified by the first pair of markers, and the stopband is specified by the second pair of markers (See figure below).

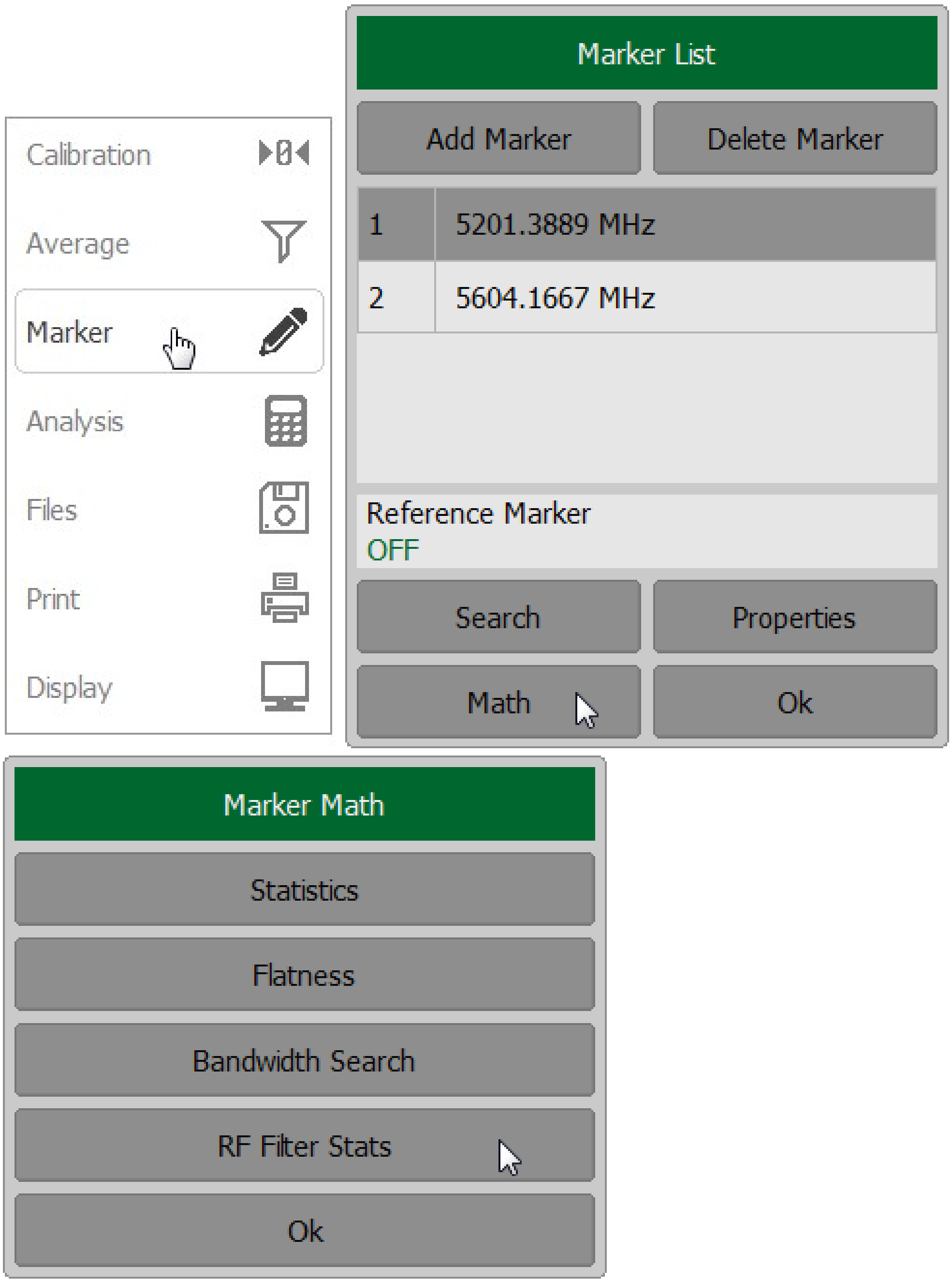


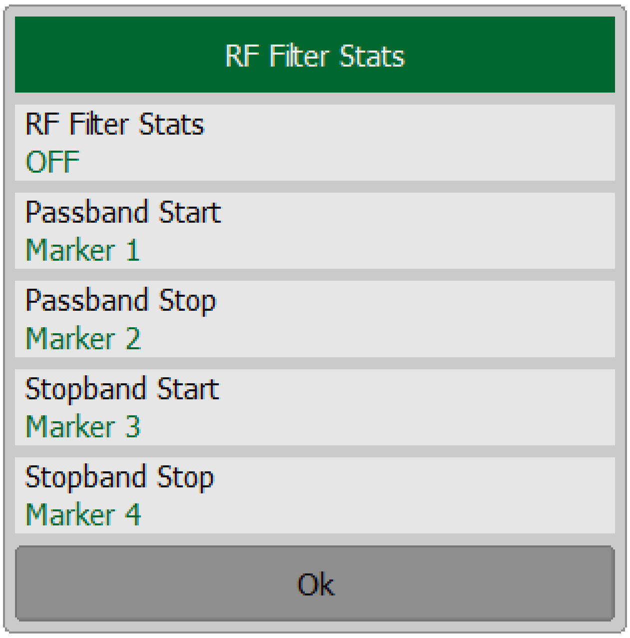
RF filter statistics

RF filter statistics parameters

Parameter Description	Symbol	Definition
Loss in passband	**loss**	Minimum value in the passband.
Peak-to-peak in passband	**p-p**	Difference between maximum and minimum in the passband.
Reject	**rej**	Difference between maximum in stopband and minimum in passband.

To enable a new marker, use the softkeys **Markers > Math > RF Filter Stats** on left menu bar.

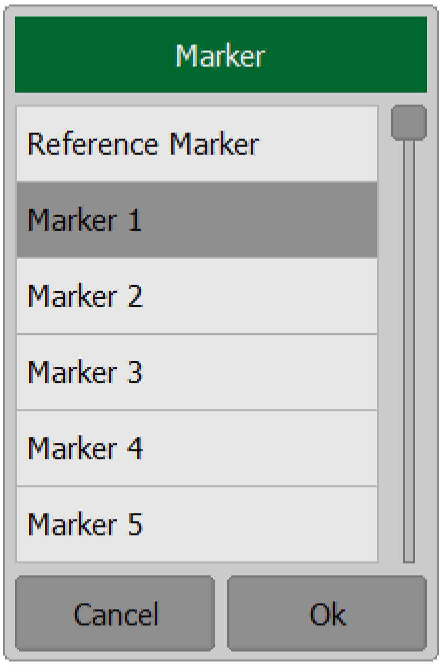

Calibration
Average
Marker
Analysis
Files
Print
Display
Marker List
Add Marker
Delete Marker
1
5201.3889 MHz
2
5604.1667 MHz
Reference Marker
OFF
Search
Properties
Math
Ok
Marker Math
Statistics
Flatness
Bandwidth Search
RF Filter Stats
Ok



Click on the **RF Filter Stats** field to toggle between the ON/OFF status.

To select the markers specifying the passband, use the **Passband Start** or **Passband Stop** softkeys.

To select the markers specifying the stopband, use the **Stopband Start** or **Stopband Stop** softkeys.



Memory Trace Function

An associated memory trace can be created for each data trace. The memory trace is saved at the moment when the corresponding softkey is pressed or a program command is received. After saving the memory trace, the screen displays two traces — data and memory. The following settings of the memory and traces display can be performed:

Display	Trace status field
Data and memory	D&M
Memory only	Mem
Data only	Dat
Data and memory OFF	Off

The memory trace is displayed in the same color as the main data trace, but it is half as bright (color and brightness of data and memory traces can be customized, see User Interface Setting).

The memory trace is used for displaying and mathematical operations with data trace. For a detail description see Mathematical Operations.

The memory trace has the following features of the data trace:

- frequency range
- number of points
- sweep type

The memory trace has the following settings common with the data trace (which if changed, modifies both traces):

- format
- scale
- smoothing
- electrical delay

The following data trace settings (if changed after the memory trace creation) do not influence the memory trace:

- power in frequency sweep mode

- IF bandwidth
- averaging
- calibration

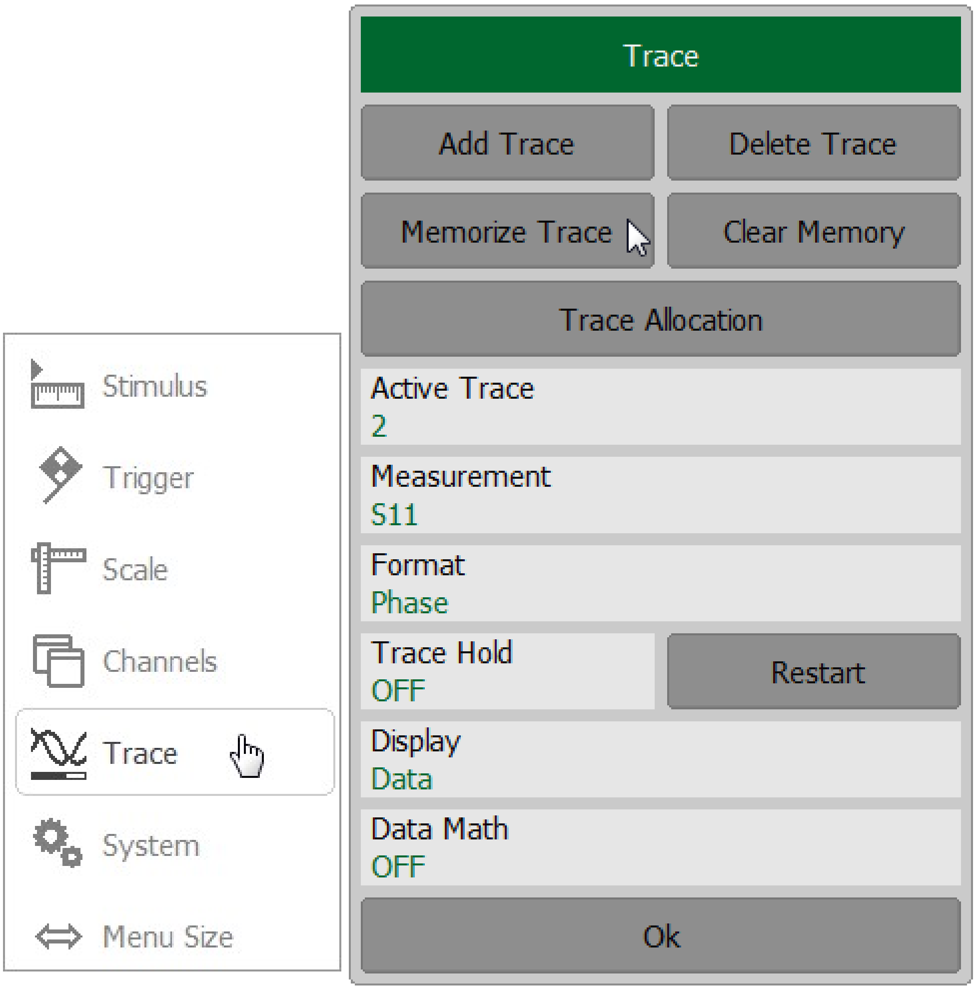
Saving Data Trace into Memory

The function of saving data traces into memory is applied to an individual trace.

The trace to which the function is applied must be preselected as active (See Selection of Active Trace).

Click the **Trace** softkey on right menu bar. If necessary, select the required trace by clicking on **Active Trace** field.

To save trace into memory, click on the **Memorize Trace** softkey. The data will be saved into memory immediately.



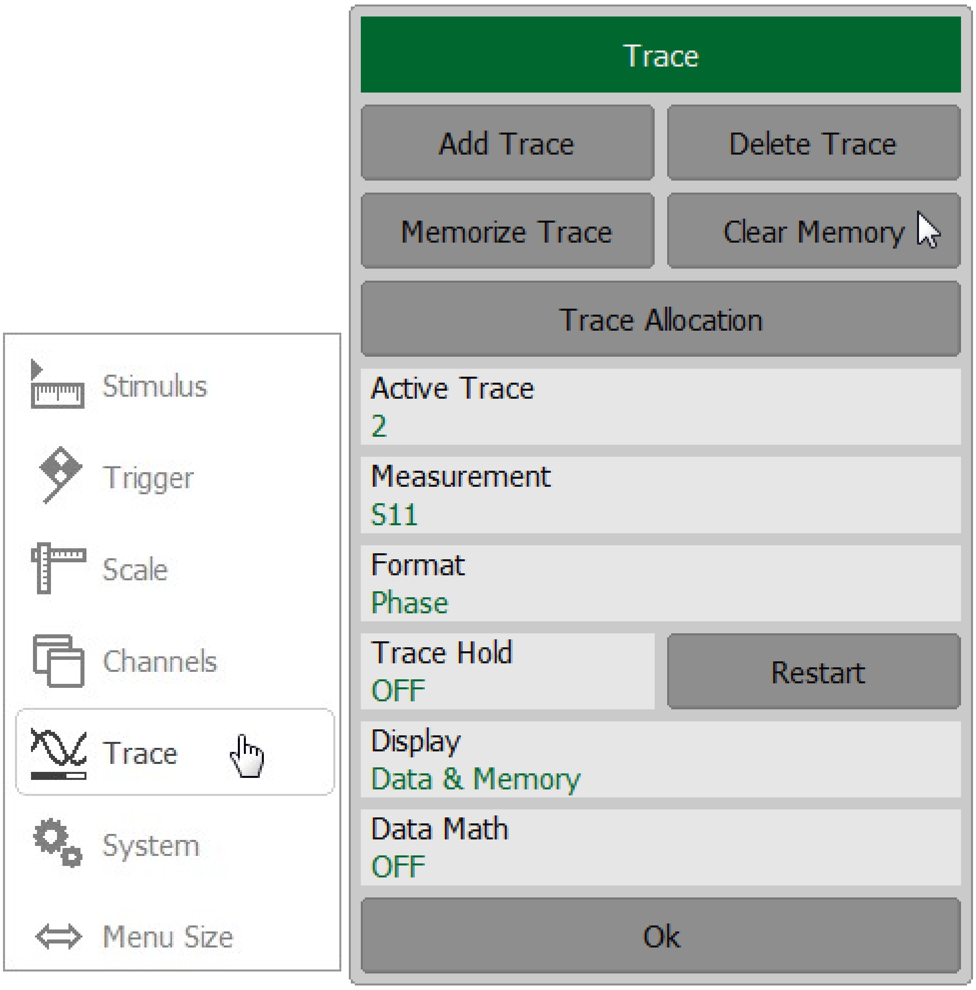
SCPI	CALCulate:MATH:MEMorize

Erasing Memory

The trace to which the function is applied must be preselected as active (See Selection of Active Trace).

Click the **Trace** softkey on right menu bar. If necessary, select the required trace by clicking on **Active Trace** field.

To erase the memory of the trace, click on the **Clear Trace** softkey.

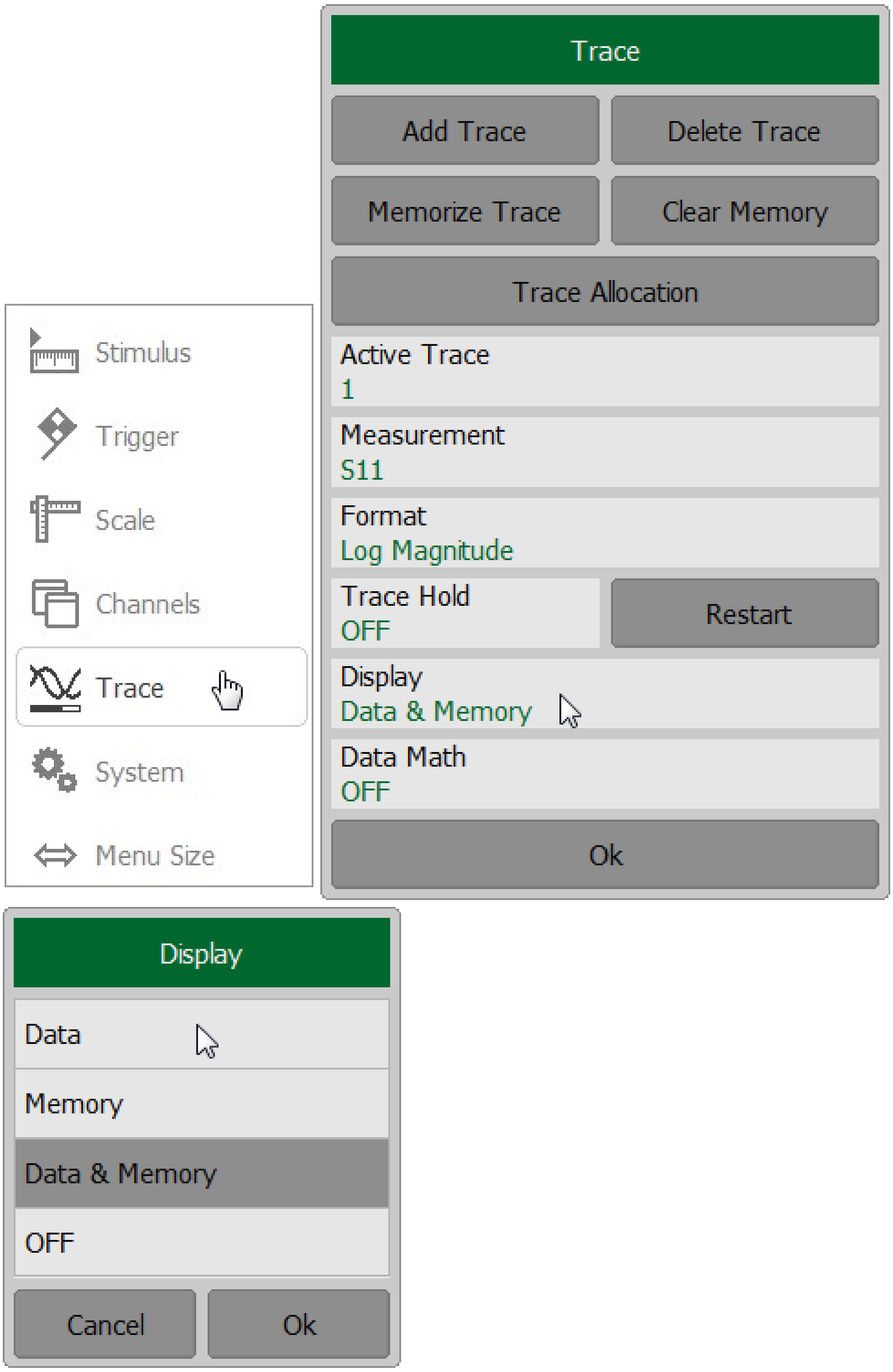


Trace Display Setting

The trace to which the function is applied must be preselected as active (See Selection of Active Trace).

Click the **Trace** softkey on right menu bar. If necessary, select the required trace by clicking on **Active Trace** field.

To set the type of traces to be displayed on the screen, click on the **Display** field and select the required type from the list.



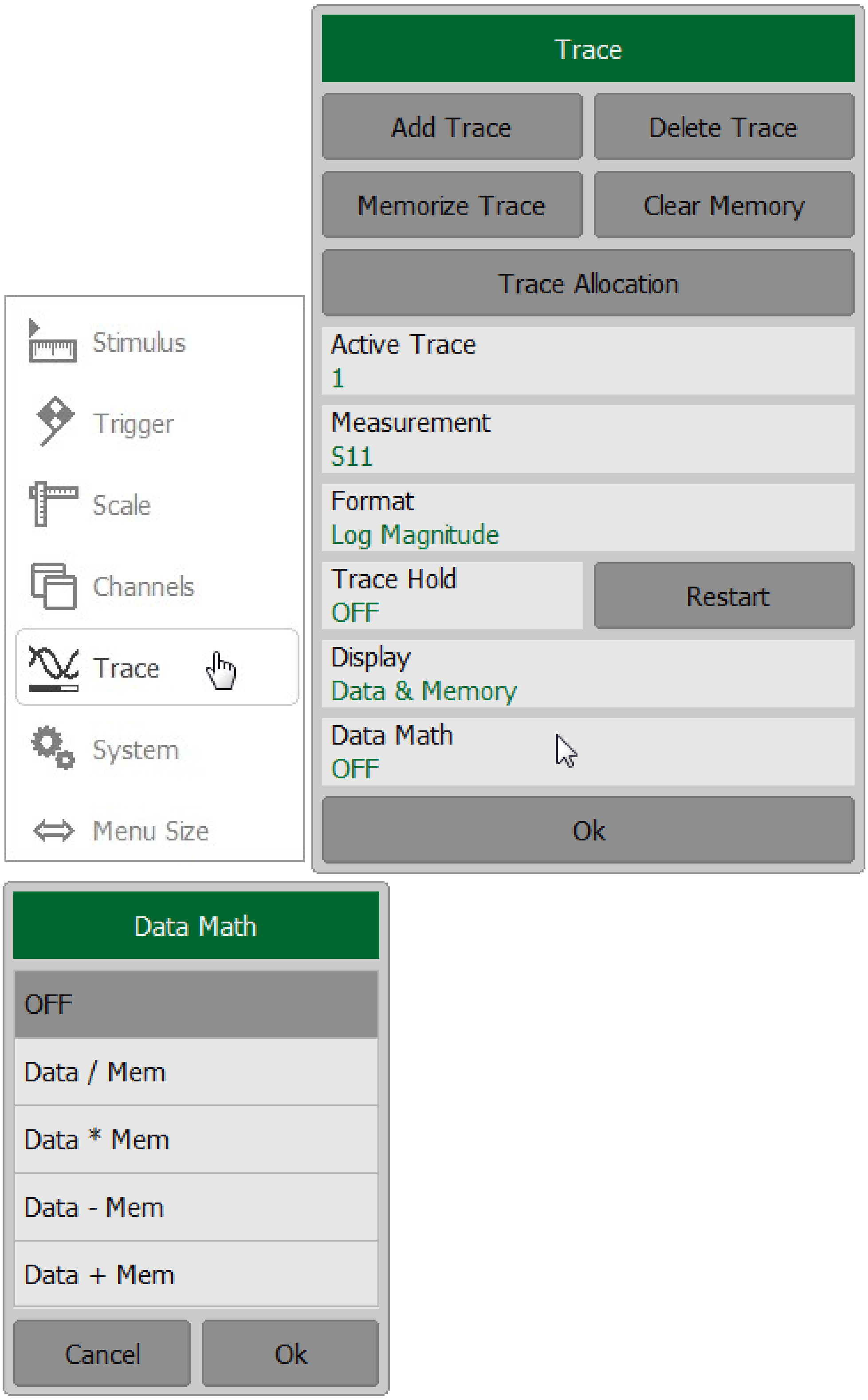
SCPI	DISPlay:WINDow:TRACe:MEMory, DISPlay:WINDow:TRACe:STATe

Mathematical Operations

The memory trace can be used for mathematical operations with the data trace. The mathematical operations are performed on complex values before they are formatted for display. The result of math operation replaces the data trace. The following mathematical operations can be performed:

Data/ Memory	Divides the measured data by the memory data. The trace status field indicates: **D/M**.
Data* Memory	Multiplies the measured data by the memory data. The trace status field indicates: **D*M**.
Data– Memory	Subtracts a memory data from the measured data. The trace status field indicates: **D–M**.
Data+ Memory	Adds the measured data to the memory data. The trace status field indicates: **D+M**.

Click the **Trace** softkey on right menu bar. If necessary, select the required trace by clicking on **Active Trace** field.



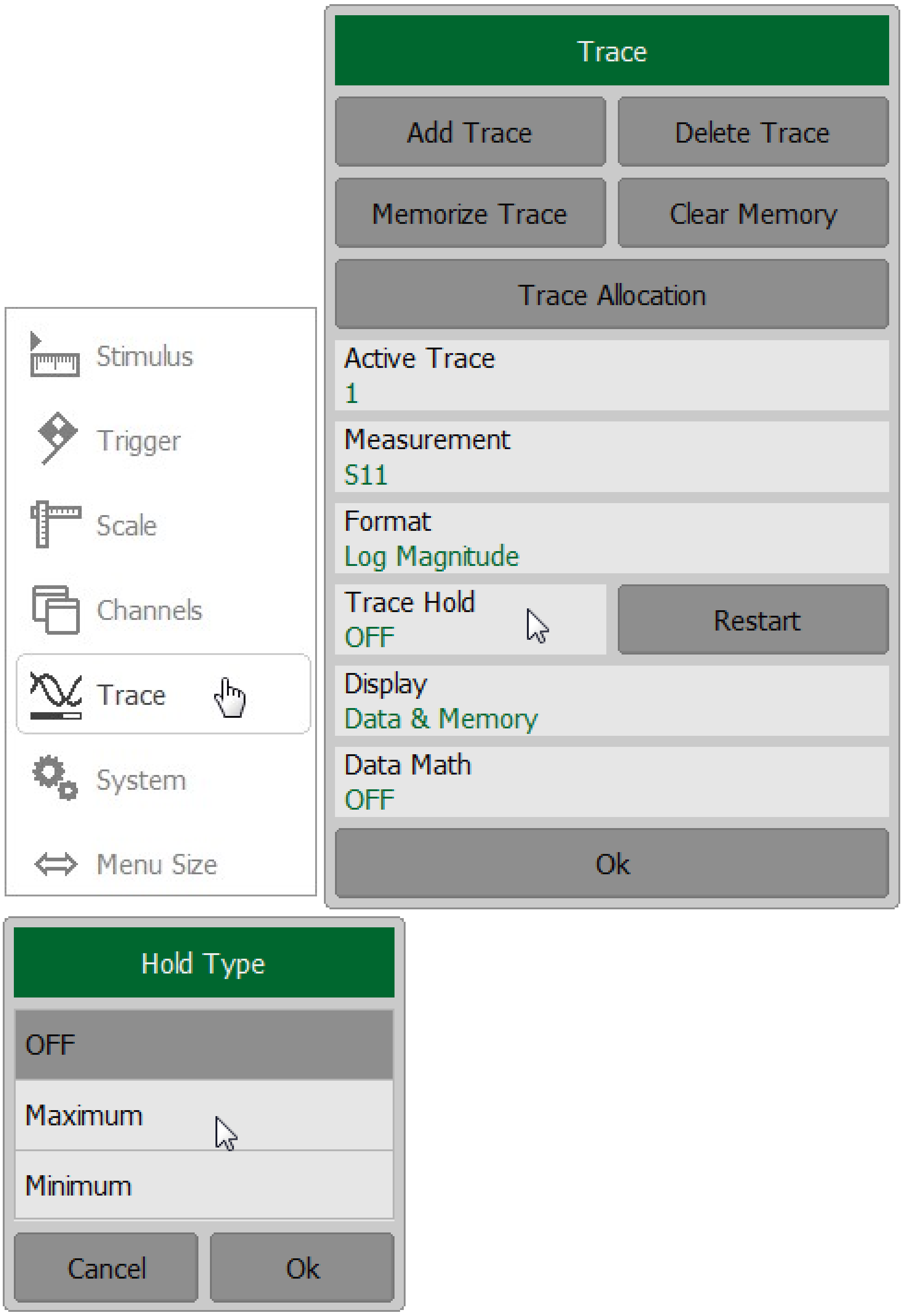
SCPI CALCulate:MATH:FUNCtion

Trace Hold

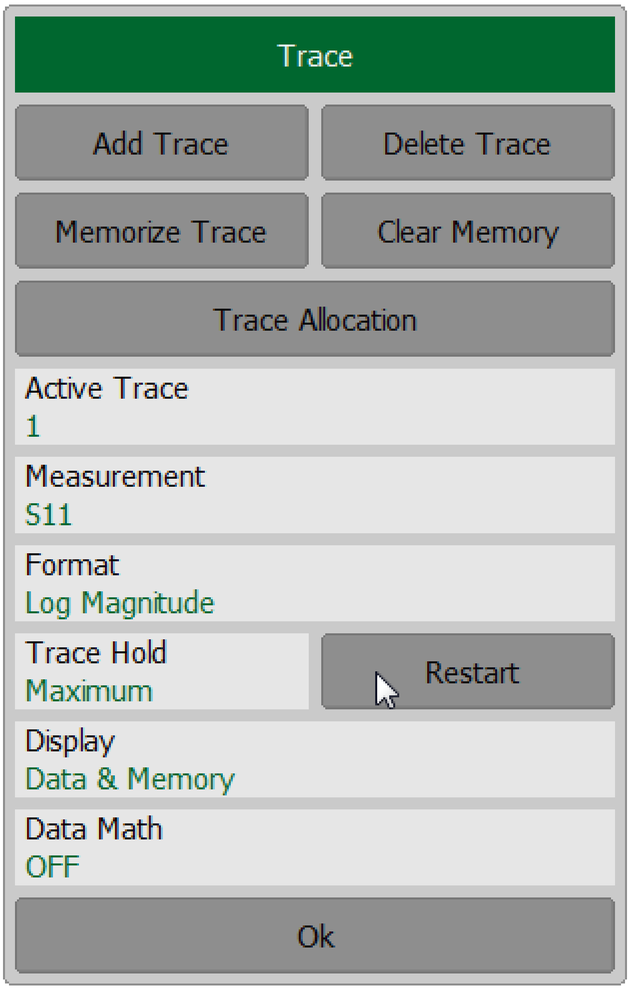
The trace hold function is used to display the maximum or the minimum of any given active measurement instead the real-time data. The held data is displayed as an active trace.

When the function is enabled, the inscription **[Max hold]** or **[Min hold]** appears in the trace status bar (See Trace Status Field).

To toggle the Trace Hold function on/off use the following softkeys **Trace > Trace Hold** in the right menu bar. Then select the required type (**Maximum | Minimum**) from the Hold Type list and complete the setting by clicking **Ok**.


Trace
Add Trace
Delete Trace
Memorize Trace
Clear Memory
Trace Allocation
Active Trace
1
Measurement
S11
Format
Log Magnitude
Trace Hold
OFF
Restart
Display
Data & Memory
Data Math
OFF
Ok
Stimulus
Trigger
Scale
Channels
Trace
System
Menu Size
Hold Type
OFF
Maximum
Minimum
Cancel
Ok

The **Restart** softkey in the Trace menu is used to restart the trace hold.



Fixture Simulation

The fixture simulation functions are a set of software functions for mathematically simulating measurement conditions that are different from the actual measurement conditions. The following conditions can be simulated:

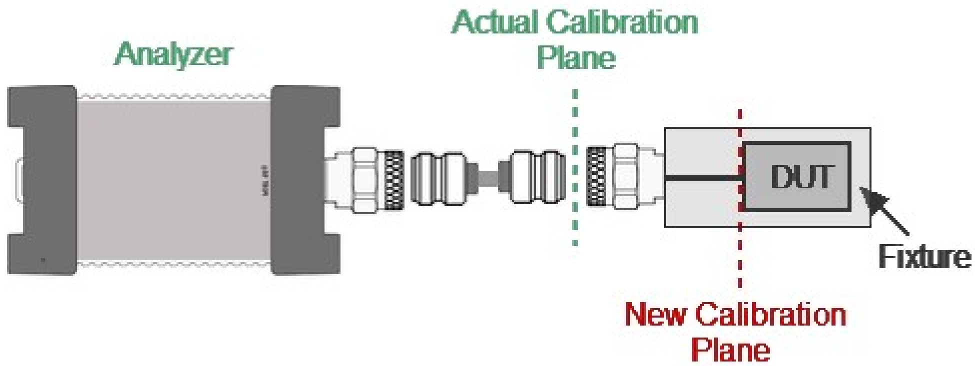
- Port reference impedance conversion
- Circuit de-embedding
- Circuit embedding

The functions are applicable for reflection coefficients (S11, S22 etc.) measurement only.

The channel to which the function is applied must be preselected as active (See Selection of Active Channel). Fixture simulation functions affect all the traces of the channel.

Port Extension

The port extension function moves the calibration plane toward the DUT terminals by the specified electrical delay value. The function is useful when a fixture is used for the DUT connecting and the calibration cannot be performed at the DUT terminals. The calibration plane can be established at coaxial connectors of the fixture and then moved to the DUT terminals using the port extension function (See figure below).



Port extension

The function uses the model of the perfectly matched transmission line with loss with parameters:

- The phase incursion in the line is

$$\Delta\varphi = e^{-j\cdot 2\pi\cdot f\cdot \tau},$$

where f - frequency, Hz,

τ - electrical delay, sec.

- The loss of the line $L(f)$ can be specified by one of the following methods:

1. Frequency-independent loss at DC (L_0)

$$L(f) = L_0.$$

2. Loss determined by the losses in two frequency points (L_0 at DC, and L_1 at frequency F_1)

$$L(f) = L_0 + (L_1 - L_0)\sqrt{\frac{f}{F_1}}$$

3. Loss determined by the losses in three frequency points (L_0 at DC, L_1 at frequency F_1 and L_2 at frequency F_2)

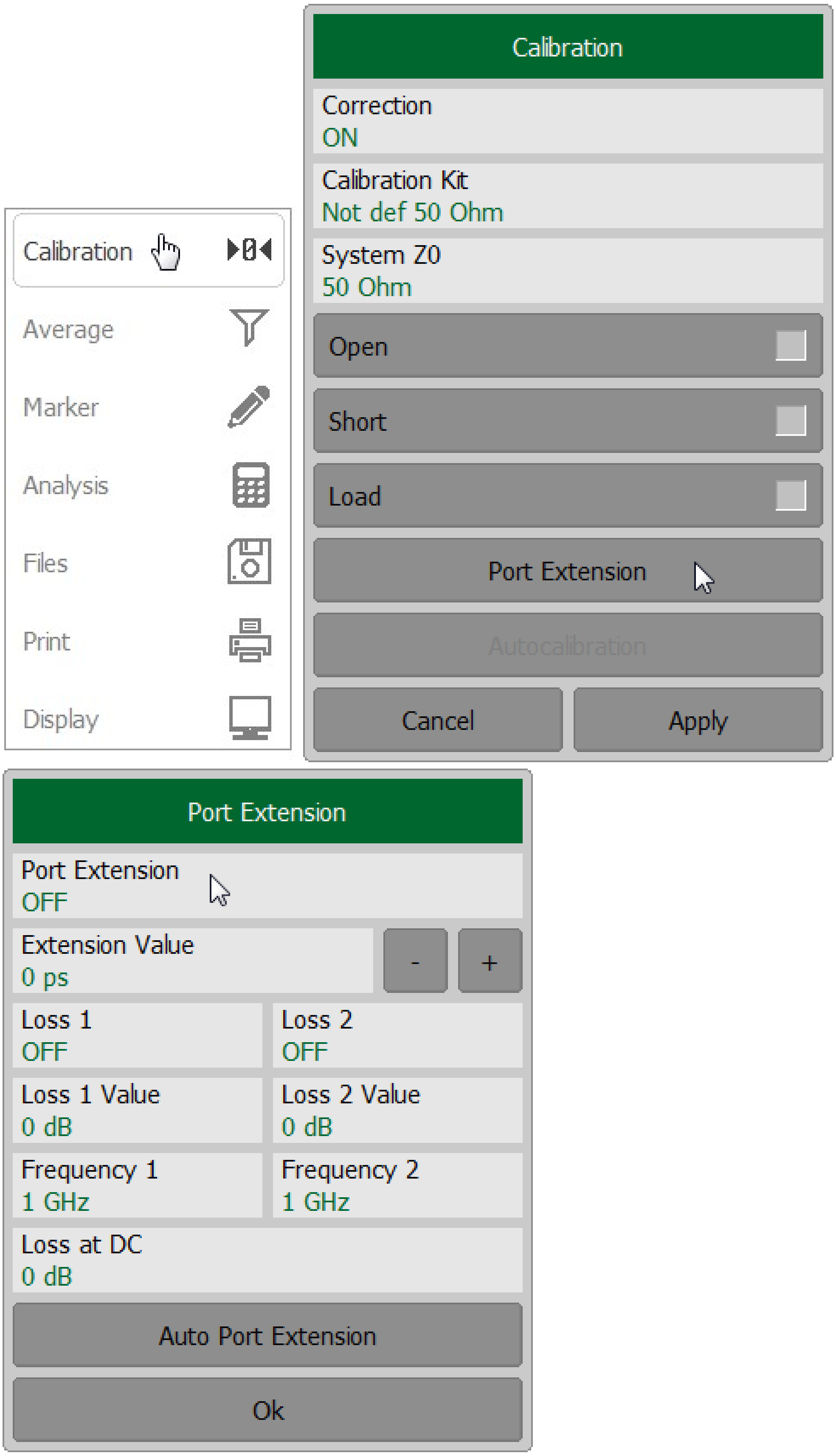
$$L(f) = L_0 + (L_1 - L_0)(\frac{f}{F_1})^n,$$

$$n = \frac{log|\frac{L_1}{L_2}|}{log\frac{F_1}{F_2}}.$$

NOTE The accuracy of the port extension method depends on the fixture used. The closer the fixture parameters are to the model of a perfectly matched transmission line, the higher the accuracy.

To set the Port Extension use the **Calibration > Port Extension** softkeys.

Click on **Port Extension** field to toggle the ON/OFF settings of the Port Extension state.


Calibration
Average
Marker
Analysis
Files
Print
Display
Calibration
Correction
ON
Calibration Kit
Not def 50 Ohm
System Z0
50 Ohm
Open
Short
Load
Port Extension
Autocalibration
Cancel
Apply
Port Extension
Port Extension
OFF
Extension Value
0 ps
-
+
Loss 1
OFF
Loss 2
OFF
Loss 1 Value
0 dB
Loss 2 Value
0 dB
Frequency 1
1 GHz
Frequency 2
1 GHz
Loss at DC
0 dB
Auto Port Extension
Ok

To set the electrical delay for port, use the **Extension Value** field.

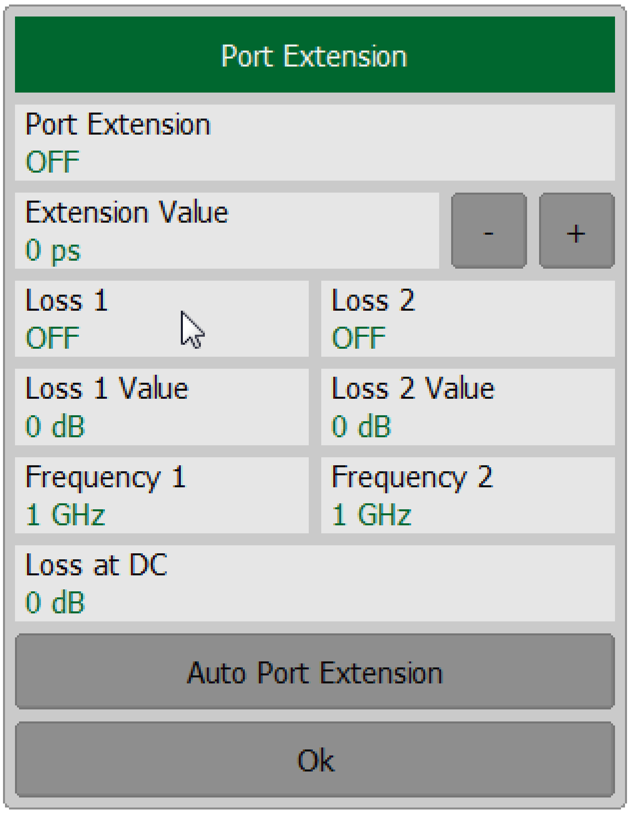
Click on **Loss1** and **Loss 2** field to enable the use of these values in further calculations.

Use **Loss 1 Value** and **Frequency 1** fields to determinate L_0 and F_1.

Use **Loss 2 Value** and **Frequency 2** fields to determinate L_0 and F_2.

Use **Loss at DC** field to determinate L_0.

Close the dialog by clicking **Ok**.



SCPI	SENSe:CORRection:EXTension SENSe:CORRection:EXTension:PORT:TIME SENSe:CORRection:EXTension:PORT:INCLude, SENSe:CORRection:EXTension:PORT:LOSS, SENSe:CORRection:EXTension:PORT:FREQuency SENSe:CORRection:EXTension:PORT:LDC

Automatic Port Extension

The auto port extension function allows for automatic calculation of port extension parameters by measuring a SHORT or an OPEN standard. It is also possible to measure both standards; in this case the average value will be used.

The auto port extension function can be used simultaneously for any number of ports from 1 to the number of actual instrument ports. First select the number of ports and then connect SHORT or OPEN standards to the chosen ports.

In the auto port extension menu, specify the frequency range, which will be taken into account when calculating the port extension parameter. There are three methods of setting the frequency range:

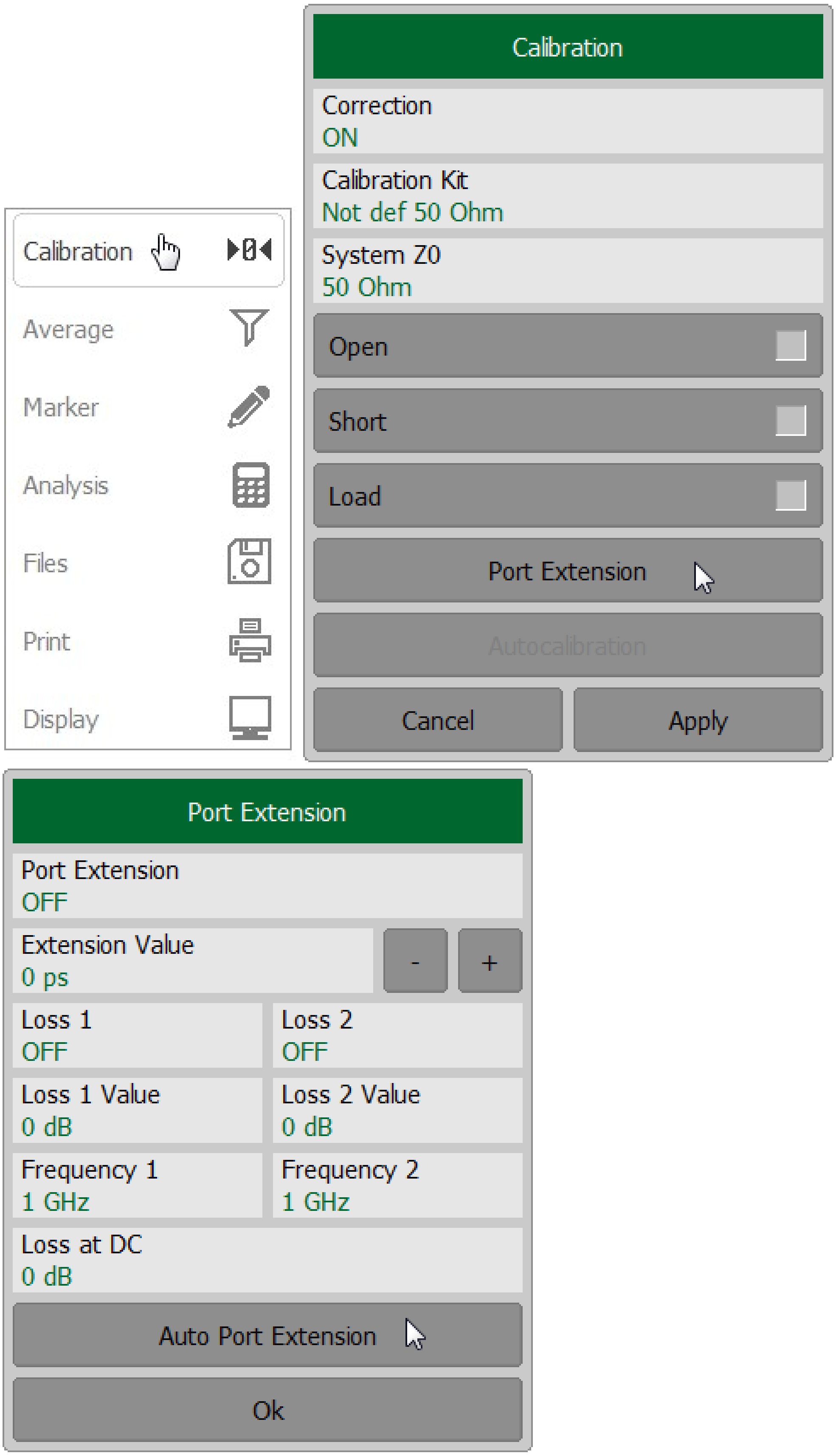
- Current frequency range.
- User-defined frequency range (within current range).
- User-defined frequency point (selected with a marker).

The result of the auto port extension function is the calculation of the electrical delay value. After auto port extension completes, this delay value appears in the corresponding field of the Port Extension dialog, and the port extension function is automatically enabled, if it was disabled.

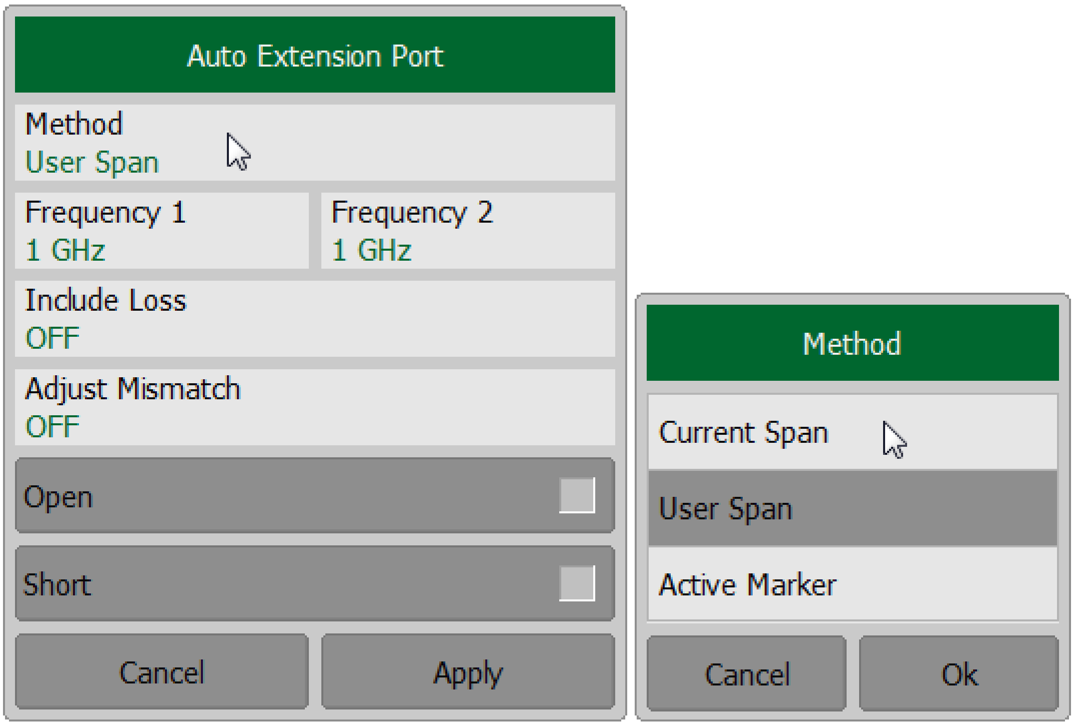
If the **Include Loss** option is enabled prior to the auto port extension function running, the loss values **Loss 1 Value**, **Loss 2 Value** at the respective frequency values **Frequency 1**, **Frequency 2** will be calculated and applied. The **Frequency 1**, **Frequency 2** values are calculated as ¼ and ¾ of the frequency range set by one of the following two methods: current or user defined. If the frequency range is defined by a marker, frequency point **Frequency 2** is not calculated.

If the **Adjust Mismatch** option is enabled prior to the auto port extension function running, the frequency-independent loss at DC, the **Loss at DC** value, is also set. The value of loss at the lower frequency of the current range is used as the **Loss at DC** value.

To apply the auto port extension, use the **Calibration > Port Extension > Auto Port Extension** softkeys.


Calibration
Average
Marker
Analysis
Files
Print
Display
Calibration
Correction
ON
Calibration Kit
Not def 50 Ohm
System Z0
50 Ohm
Open
Short
Load
Port Extension
Autocalibration
Cancel
Apply
Port Extension
Port Extension
OFF
Extension Value
0 ps
-
+
Loss 1
OFF
Loss 2
OFF
Loss 1 Value
0 dB
Loss 2 Value
0 dB
Frequency 1
1 GHz
Frequency 2
1 GHz
Loss at DC
0 dB
Auto Port Extension
Ok

Click on **Method** field to select method of calculation of extension port (**Current Span**, **User Span** or **Active Marker**).



Click on **Include Loss** or **Adjust Mismatch** fields to toggle the ON/OFF status of this settings.

Use **Open** and (or) **Short** softkeys to execute a measurement and calculate extension of port.

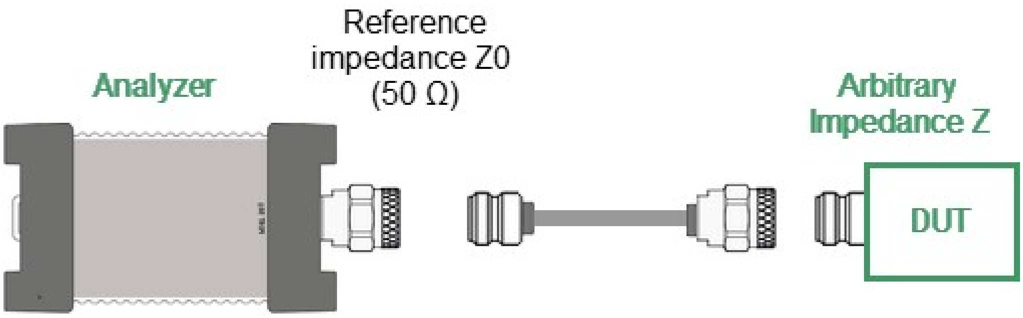
Close the dialog by clicking **Apply** softkey.

SCPI	SENSe:CORRection:EXTension:AUTO:CONFig SENSe:CORRection:EXTension:AUTO:DCOFfset SENSe:CORRection:EXTension:AUTO:LOSS SENSe:CORRection:EXTension:AUTO:MEASure SENSe:CORRection:EXTension:AUTO:RESet SENSe:CORRection:EXTension:AUTO:SAVE SENSe:CORRection:EXTension:AUTO:STARt, SENSe:CORRection:EXTension:AUTO:STOP (If **User Span** is selected as the method of calculation of extension port).

Port Reference Impedance (Z) Conversion

The default reference impedance of a port is equal to the reference impedance of the connectors (50 or 75 Ω). But in the process, it is often required to measure DUT with arbitrary resistance (See example in the figure below), not equal to the reference impedance of a port. In this case, it is possible to convert the reference impedance to an arbitrary impedance value using the software.

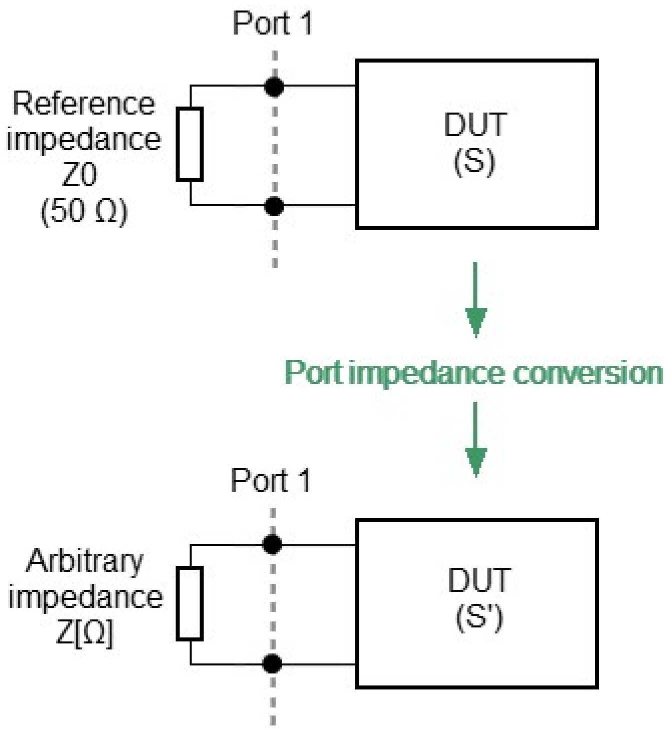
The functions are applicable for reflection coefficients (S11, S22 etc.) measurement only.



Example of measuring a DUT with an arbitrary impedance by the Analyzer with reference impedance 50 Ω

NOTE	The value of the test port impedance is defined in the process of calibration. It is determined by the characteristic impedance of the calibration kit.

Port reference impedance conversion is a function that mathematically converts the matrix of S-parameters measured at the reference impedance of port Z0 to the matrix of S-parameters measured at an arbitrary impedance of port Z (See figure below). The function is also referred to as the renormalization transformation of S-parameters.



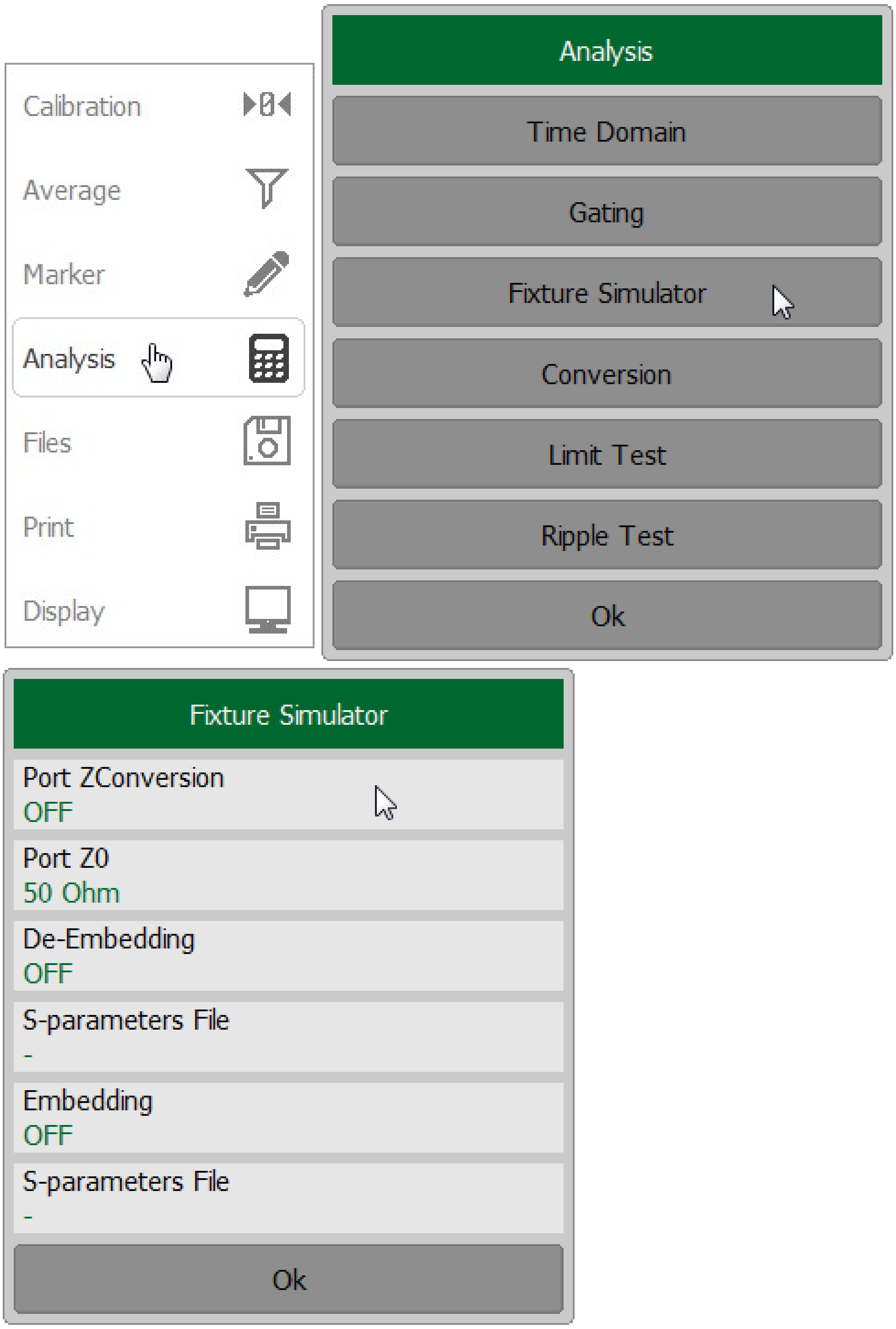
Port reference impedance conversion

Renormalization is based on "A General Waveguide Circuit Theory" (R.B.Marks and D.F.Williams).

To open the fixture simulation menu, use the softkeys **Analysis > Fixture Simulator** on left menu bar.

To enable/disable the port impedance conversion function, click on the **Port Z Conversion** field.

To enter the value of the simulated impedance of Port, click on the **Port Z0** field and enter the value using the on-screen keypad.



SCPI	CALCulate:FSIMulator:SENDed:ZCONversion:STATe, CALCulate:FSIMulator:SENDed:ZCONversion:PORT:Z0

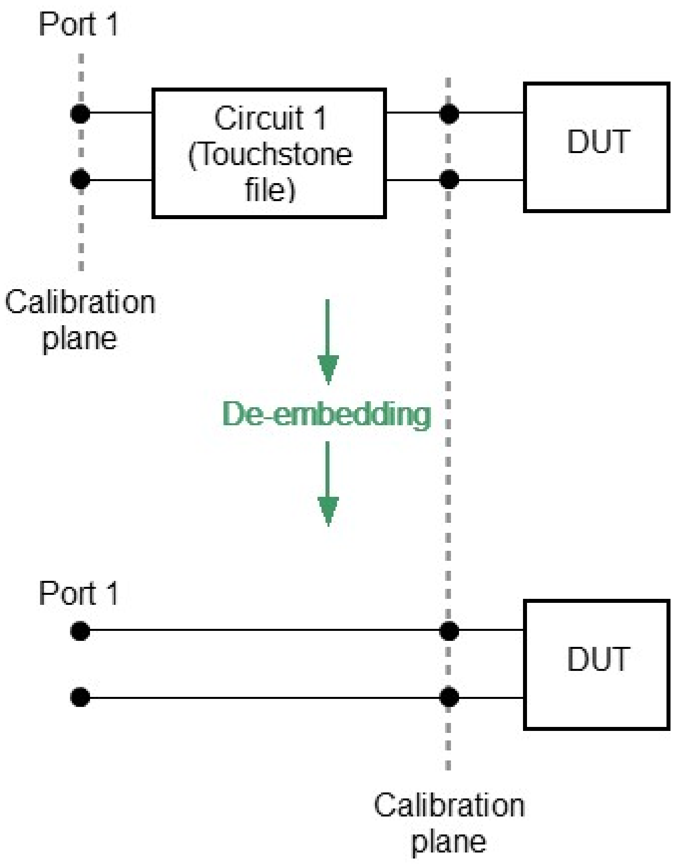
NOTE	The source value of the Z0 port reference impedance (commonly 50 Ω) is defined in the process of the calibration. It is determined by the characteristic impedance of the calibration kit and its value is entered as described in System Impedance Z0.

De-embedding

De-embedding is a function of transforming the S-parameter by eliminating some circuit effect from the measurement results. The functions are applicable for reflection coefficients (S11, S22 etc.) measurement only.

The de-embedding function allows to mathematically exclude the effect of the fixture circuit existing between the calibration plane and the DUT in the real network from the measurement results. The fixture is used for the DUTs, which cannot be directly connected to the test ports.

The de-embedding function shifts the calibration plane closer to the DUT, so as if the calibration has been executed on the network with this circuit removed (See figure below).



De-embedding

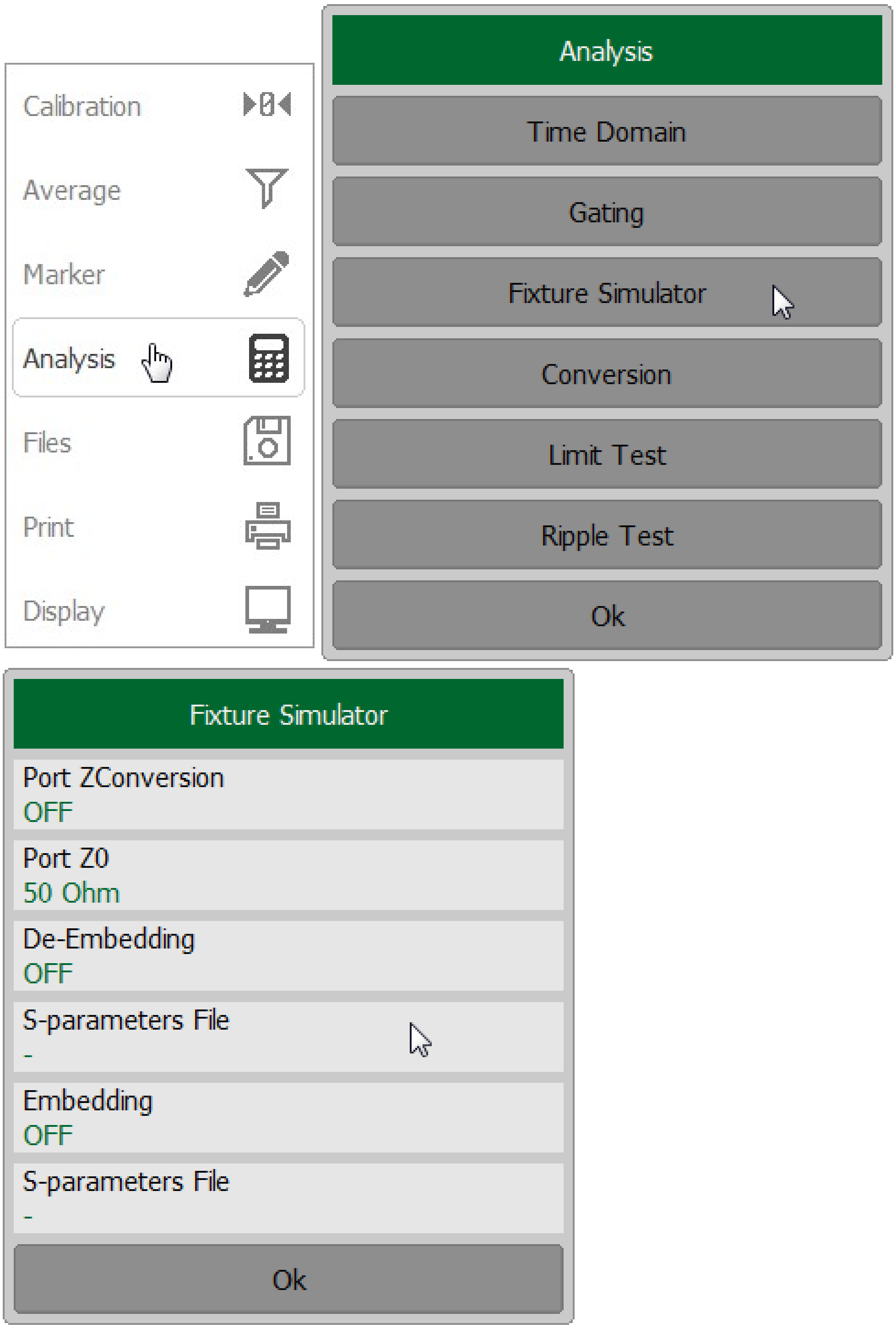
The circuit being removed should be defined in the data file containing S-parameters of that circuit. The circuit should be described as 2-port in Touchstone file (extension *.S2P), which contains the S-parameter table: S11, S21, S12, S22 for a number of frequencies.

To open the fixture simulation menu, use the softkeys **Analysis > Fixture Simulator** on left menu bar.

Click on the **De-Embedding** field to toggle between the ON/OFF status.

Enter the file name of the de-embedded circuit S-parameters of port by clicking on the **S-parameters File** field.

If S-parameters file is not specified, the field of the function activation will be grayed out.



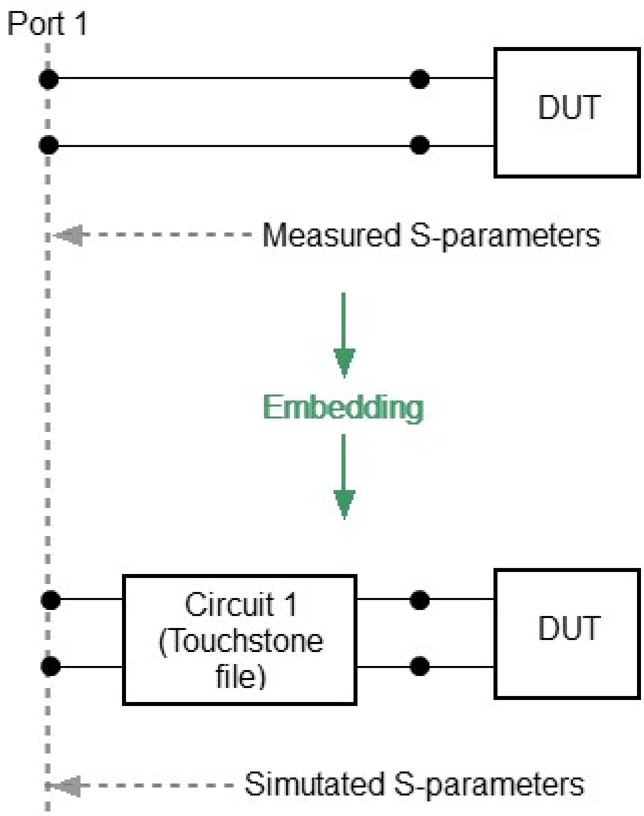
SCPI	CALCulate:FSIMulator:SENDed:DEEMbed:PORT:STATe, CALCulate:FSIMulator:SENDed:DEEMbed:PORT:USER:FILename

Embedding

Embedding is a function of the S-parameter transformation via integration of some virtual circuit into the real network (See figure below). The functions are applicable for reflection coefficients (S11, S22 etc.) measurement only.

The embedding function allows to mathematically simulate the DUT parameters after adding the fixture circuits.

The embedding function is an inverted de-embedding function.



Embedding

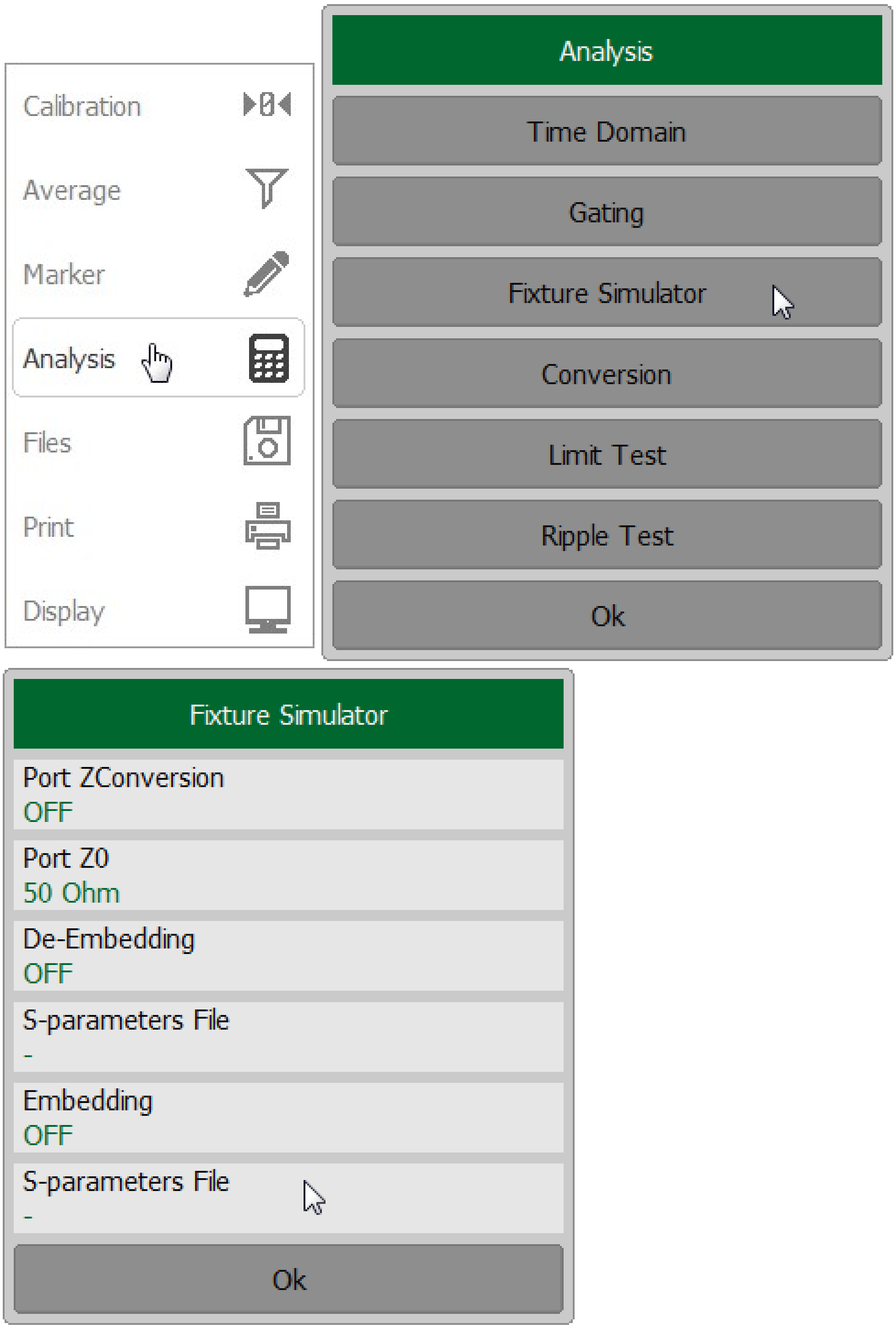
The circuit being integrated should be defined in the data file containing S-parameters of that circuit. The circuit should be described as a 2-port in Touchstone file (extension *.S2P), which contains the S-parameter table: S11, S21, S12, S22 for a number of frequencies.

To open the fixture simulation menu, use the softkeys **Analysis > Fixture Simulator** on left menu bar.

Click on the **Embedding** field to toggle between the ON/OFF status.

Enter the file name of the embedded circuit S-parameters of port by clicking on the **S-parameters File** field.

If S-parameters file is not specified, the field of the function activation will be grayed out.



SCPI	CALCulate:FSIMulator:SENDed:PMCircuit:PORT:STATe, CALCulate:FSIMulator:SENDed:PMCircuit:PORT:USER:FILename

Time Domain Transformation

The Analyzer measures parameters of the DUT in the frequency domain. Time domain transformation is a function of mathematical transformation of the measured parameters in order to obtain the time domain representation. The functions are applicable for reflection coefficients (S11, S22 etc.) measurement only.

The time domain function allows to select the following transformation types:

- **Bandpass** mode simulates the response of the bandpass network to the impulse.
- **Lowpass impulse** mode simulates the response of the lowpass network to the impulse.
- **Lowpass step** mode simulates the response of the lowpass network to the unit step function.

Bandpass mode is applied to the DUTs that do not operate with DC current such as band pass filters. The frequency settings can be arbitrary.

Lowpass mode is applied to the DUTs that operate with DC current such as cables. The DC value is extrapolated from the first few frequency points; however a user has ability to set the DC value manually. The frequency settings are required to be a harmonic frequency grid, where the frequency value at each frequency point is an integer multiple of the start frequency.

The time domain resolution in the lowpass mode is twice as high as in the bandpass mode.

The time domain is a periodic function due to the discrete nature of the frequency response. The time domain ambiguity range is determined by the step in the frequency domain:

$$\Delta T = \frac{1}{\Delta F}; \quad \Delta F = \frac{F_{max} - F_{min}}{N-1}$$

The time domain response has a ringing due to the finite nature of the frequency response. To reduce the ringing the windowing is applied to the frequency response. The time domain transformation function applies the Kaiser window function. The window function selection is a tradeoff between the ringing reducing and the time domain resolution.

The Kaiser window is defined by the β parameter, which smoothly fine-tunes the window shape from minimum (rectangular) to maximum. The user can fine-tune the window shape, or select one of the three pre-programmed windows:

- **Minimum** (rectangular)
- **Normal**
- **Maximum**

Preprogrammed window types

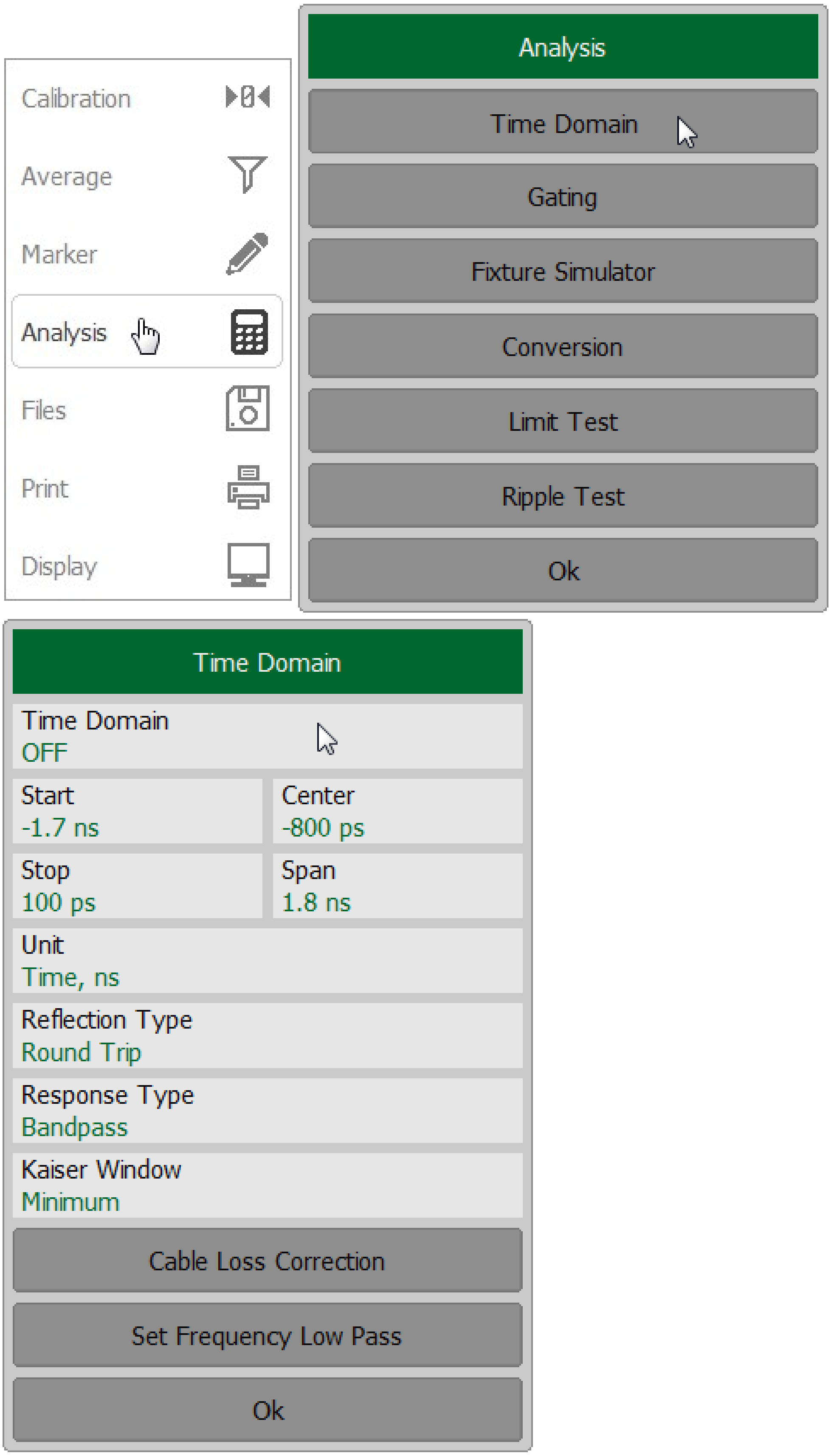
Window	Lowpass Impulse		Lowpass Step	
	Side Lobes Level	Pulse Width (50 %) [1]	Sidelobes Level	Edge Width (10 – 90 %)
Minimum	– 13 dB	$\frac{0.6}{F_{max}-F_{min}}$	– 21 dB	$\frac{0.45}{F_{max}-F_{min}}$
Normal	– 44 dB	$\frac{0.98}{F_{max}-F_{min}}$	– 60 dB	$\frac{0.99}{F_{max}-F_{min}}$
Maximum	– 75 dB	$\frac{1.39}{F_{max}-F_{min}}$	– 70 dB	$\frac{1.48}{F_{max}-F_{min}}$
1 The value in the band pass mode is 2 times the value in the low pass mode.				

NOTE

As the time domain transformation can be applied for separate traces of a channel, the stimulus axis label will be displayed depending on the active trace, in frequency or time units.

Time Domain Transformation Activation

To enable/disable time domain transformation function, use the **Analysis > Time Domain > Time Domain** softkeys on left menu bar.


Calibration
Average
Marker
Analysis
Files
Print
Display
Analysis
Time Domain
Gating
Fixture Simulator
Conversion
Limit Test
Ripple Test
Ok
Time Domain
Time Domain
OFF
Start
-1.7 ns
Center
-800 ps
Stop
100 ps
Span
1.8 ns
Unit
Time, ns
Reflection Type
Round Trip
Response Type
Bandpass
Kaiser Window
Minimum
Cable Loss Correction
Set Frequency Low Pass
Ok

SCPI	CALCulate:TRANsform:TIME:STATe

NOTE	Time domain transformation function is accessible only in linear frequency sweep mode.

Time Domain Transformation Span

To define the span of time domain representation, its start and stop, or center and span values can be set.

If the velocity factor of the measured trace is known, for example in coaxial cable, the time intervals are recalculated into distances.

The transformation function allows setting of the measurement range in time domain within the limits of ambiguity range. The ambiguity range is determined by the measurement step in the frequency domain:

$$\Delta T = \frac{1}{\Delta F} = \frac{N-1}{F_{max}-F_{min}},$$

where N — number of measurement points.

F_{min} — stimulus start frequency.

F_{max} — stimulus stop frequency.

The ambiguity range is recalculated into the maximum operating DTF (Distance to Fault) value:

$$DTF_{max} = \frac{C \cdot V_p \cdot \Delta T}{2} = \frac{C \cdot V_p \cdot (N-1)}{2 \cdot (F_{max}-F_{min})},$$

where C — velocity of light in vacuum;

V_p — cable velocity factor.

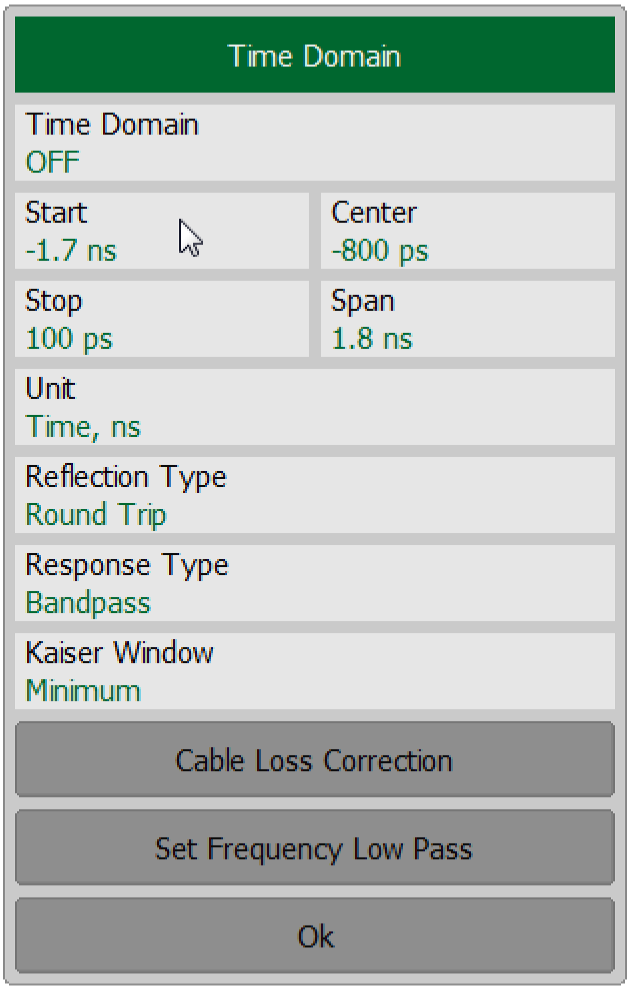
The DTF maximum value can be increased by decreasing the frequency step.

For example, if start frequency is 300 MHz, stop frequency is 600 MHz, the number of points is 10001, and velocity factor is 1, then maximum distance to fault equals is to 4996.5 m, i.e. approximately 5 km.

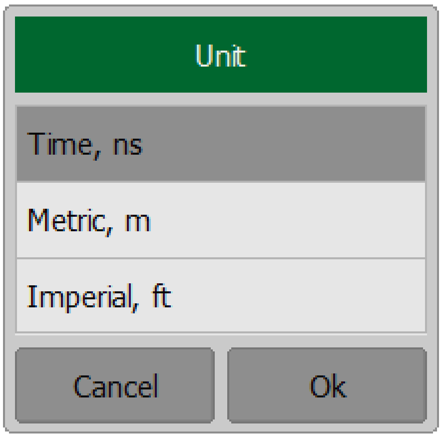
To set the start and stop limits of the time domain range, use the **Analysis > Time Domain** softkeys on left menu bar.

Click on the **Start** or **Stop** field and enter the value using the on-screen keypad.

To set the center and span of the time domain, use the **Center** or **Span** softkeys.



To set the unit of the time domain, click on **Unit** field and select the required type from the Unit list.

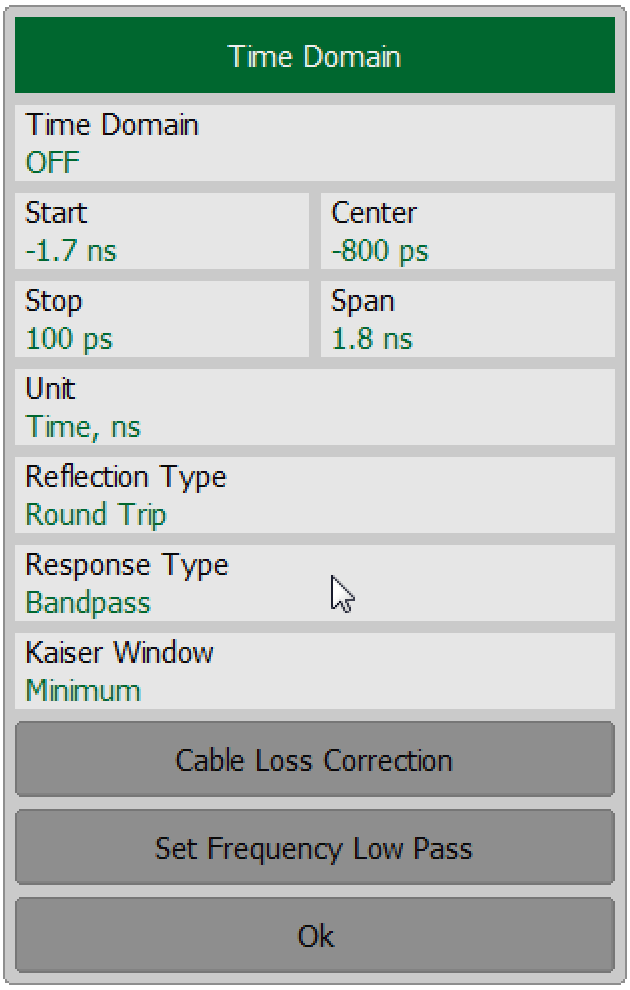


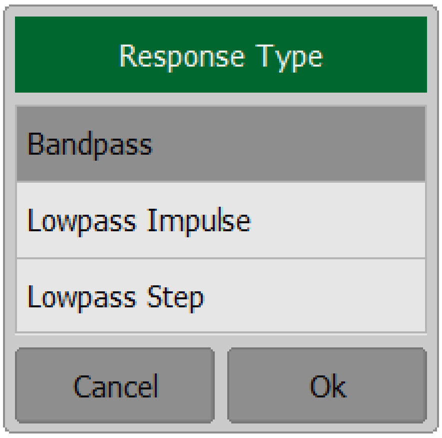
SCPI	CALCulate:TRANsform:TIME:STARt, CALCulate:TRANsform:TIME:STOP CALCulate:TRANsform:TIME:SPAN, CALCulate:TRANsform:TIME:CENTer CALCulate:TRANsform:TIME:UNIT

Time Domain Transformation Type

To set time domain transformation type, use the **Analysis > Time Domain** softkeys on left menu bar.

Click on the **Response Type** field and select the required type from the Response Type list.



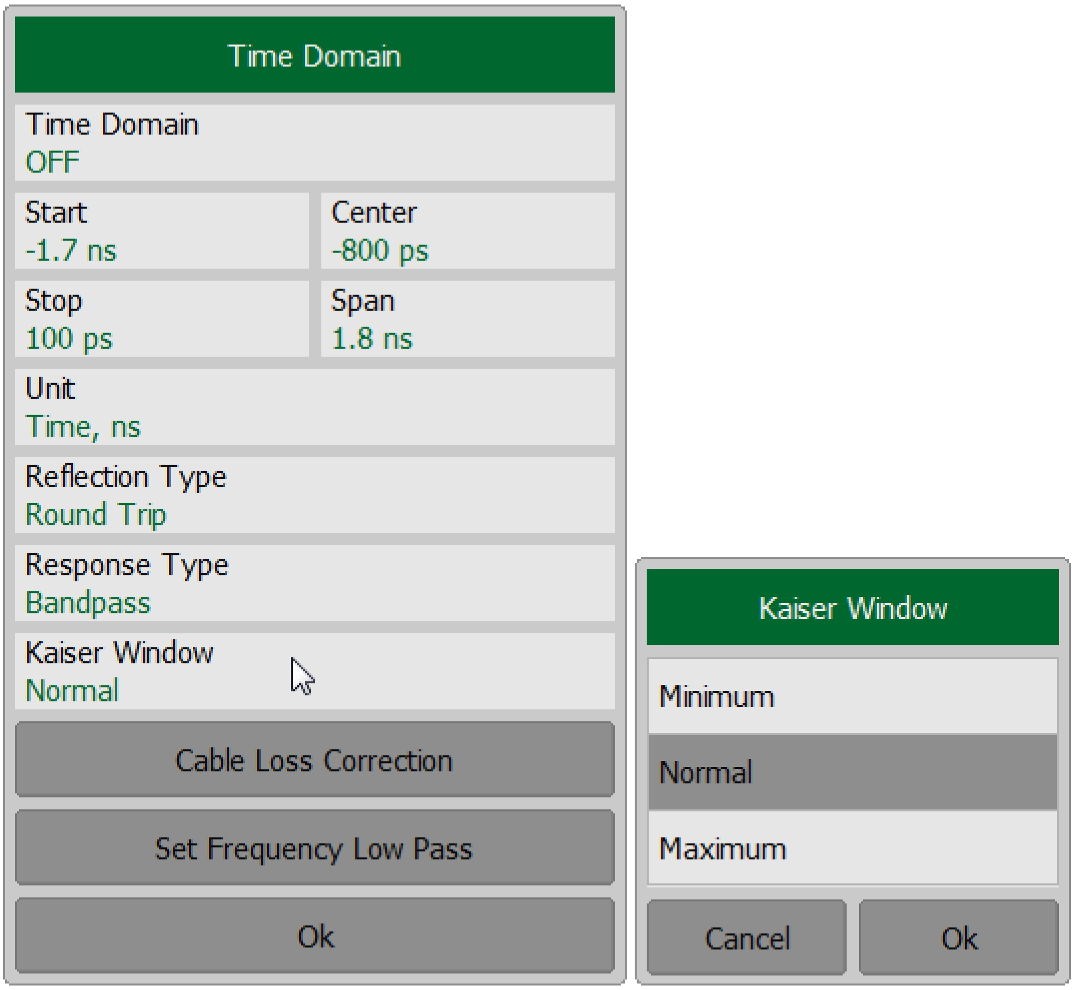


SCPI CALCulate:TRANsform:TIME, CALCulate:TRANsform:TIME:STIMulus

Time Domain Transformation Window Shape Setting

To set window shape, use the **Analysis > Time Domain** softkeys on left menu bar.

Click on the **Kaiser Window** field and select the required type from the Response Type list.

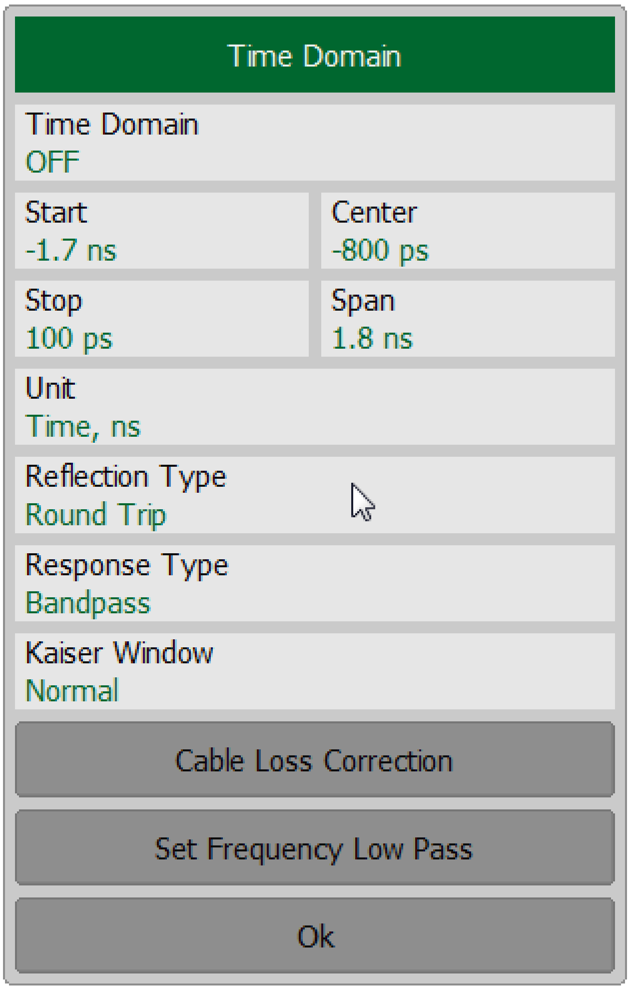


SCPI CALCulate:TRANsform:TIME:KBESsel

Time Domain Transformation Reflection Type

To set window shape, use the **Analysis > Time Domain** softkeys on left menu bar.

Click on the **Reflection Type** field to toggle setting between **Round Trip** or **One way**.



SCPI	CALCulate:TRANsform:TIME:REFLection:TYPE

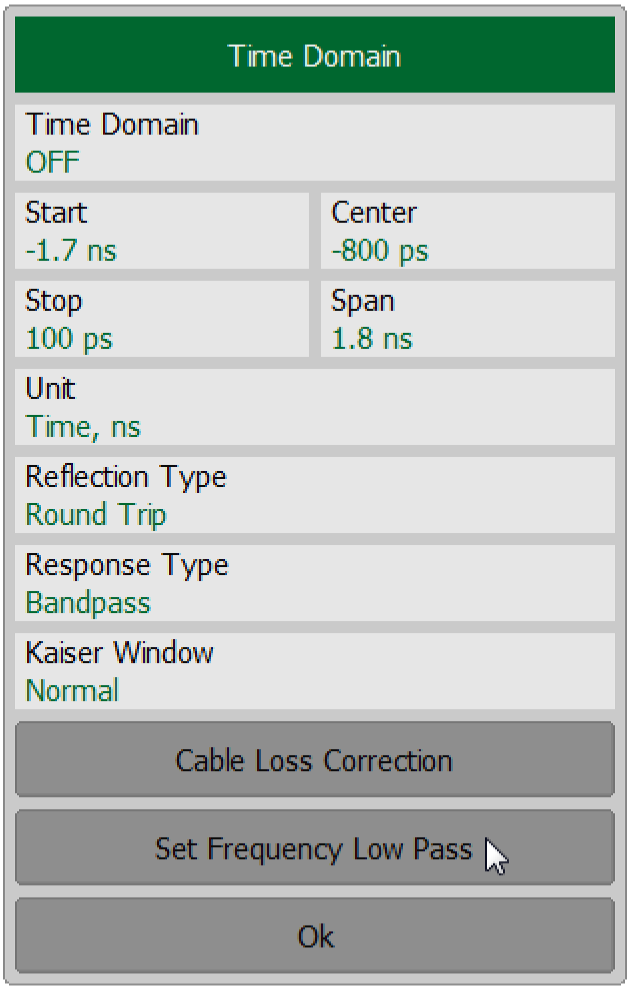
Cable Correction Setting

When the length units are selected the velocity factor setting of the Cable correction function affects the X-axis scale. See Cable Correction Function.

Frequency Harmonic Grid Setting

If lowpass mode is used, the frequency range must be set to a harmonic grid. The frequency values in measurement points are integer multiples of the start frequency Fmin.

To create a harmonic grid for the current frequency range, use the **Analysis > Time Domain > Set Frequency Low Pass** softkeys on left menu bar.



SCPI CALCulate:TRANsform:TIME:LPFRequency

Cable Correction Function

By default, the software does NOT compensate DTF measurements to account for the inherent loss of a cable. However, to make more accurate DTF measurements, the cable loss and velocity factor can be entered using one of the following methods:

- Select a cable type from a list which contains the cable loss in dB/meter and velocity factor.
- Manually enter cable loss and velocity factor for the measurement.

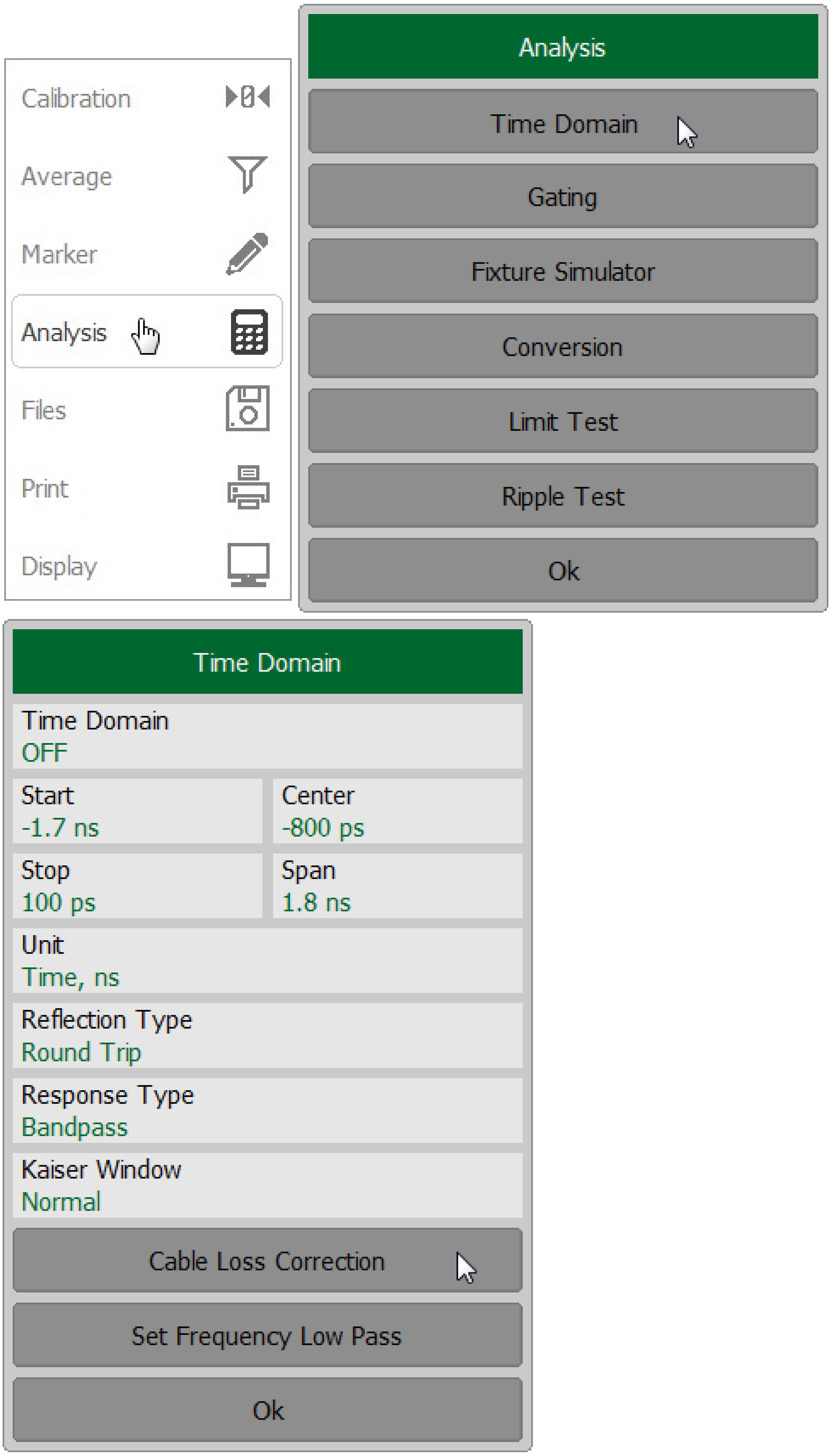
Velocity factor is a property of the physical material of a cable. A VF of 1.0 corresponds to the speed of light in a vacuum, or the fastest VF possible. A polyethylene dielectric cable has VF = 0.66 and a cable with Teflon dielectric has VF = 0.7.

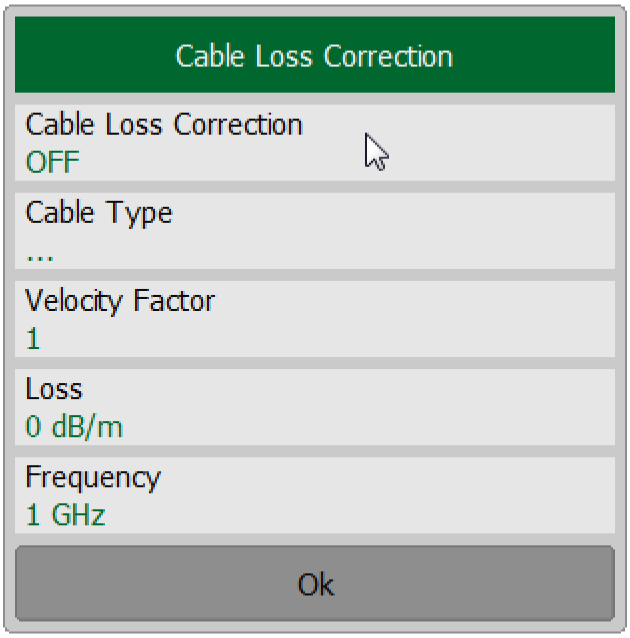
Cable Loss is specified in dB/meter. In addition to the length of the cable, loss is also directly proportional to the frequency of the signal that passes through the cable.

Cable correction function allows to take into account the influence of cable characteristics when taking measurements. The function is disabled by default.

Cable Correction Activation

To enable/disable time domain transformation function, use the **Analysis > Time Domain > Cable Loss Correction > Cable Loss Correction** softkeys.


Calibration
Average
Marker
Analysis
Files
Print
Display
Analysis
Time Domain
Gating
Fixture Simulator
Conversion
Limit Test
Ripple Test
Ok
Time Domain
Time Domain
OFF
Start
-1.7 ns
Center
-800 ps
Stop
100 ps
Span
1.8 ns
Unit
Time, ns
Reflection Type
Round Trip
Response Type
Bandpass
Kaiser Window
Normal
Cable Loss Correction
Set Frequency Low Pass
Ok

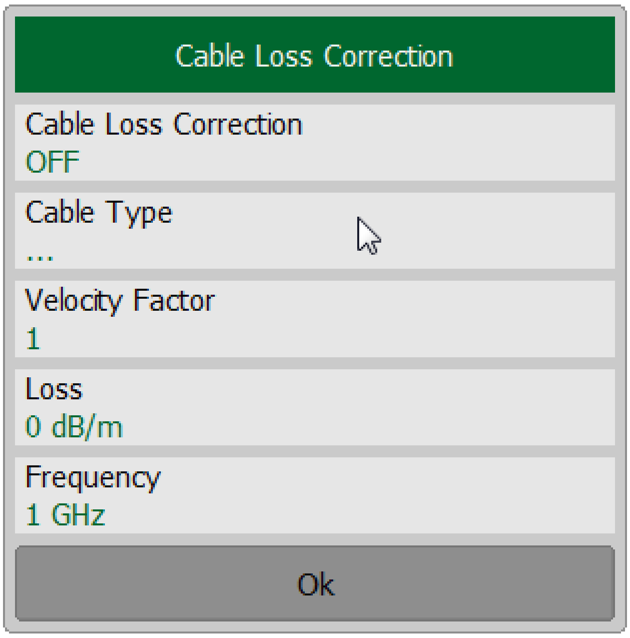


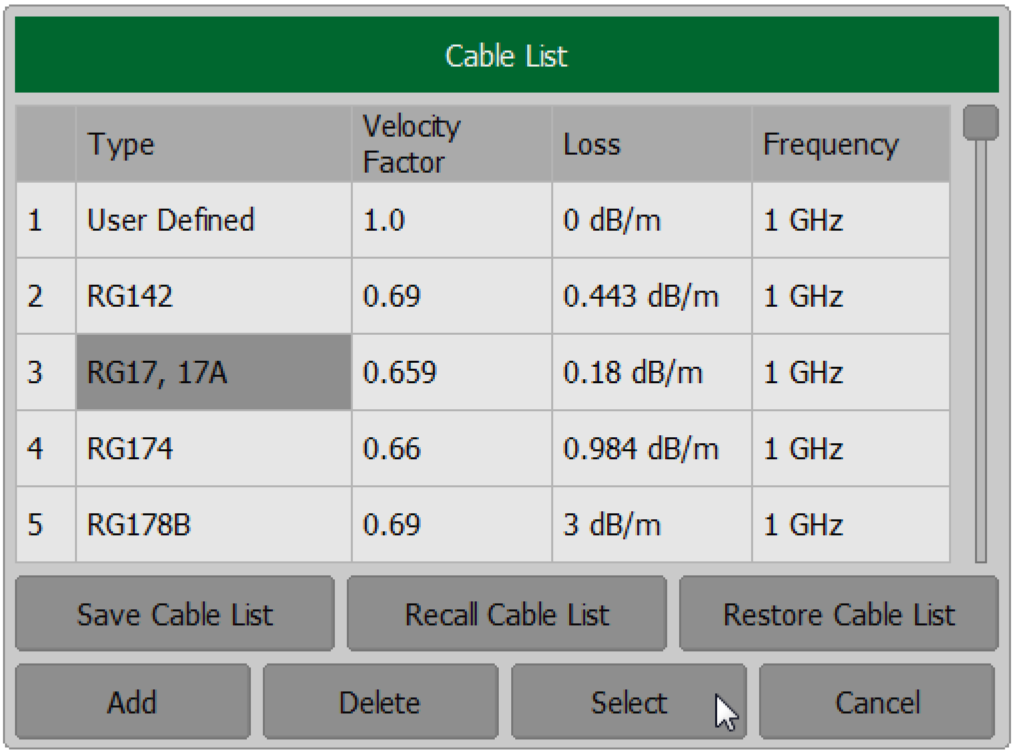
SCPI	SENSe:CORRection:TRANsform:TIME:STATe

Selecting the type of cable

To select the type of cable, click the **Cable Table** field on Cable Loss Correction menu. Select the required item from the table and complete the setting by clicking **Select** softkey.

The selected cable type will be displayed in the **Cable List** field on **Cable Loss Correction** menu.





Editing Table of Cable

By default, the software contains a list of cables in the form of a cable table (See figure below). Each row of the table contains the cable name and the required parameters: velocity factor, cable loss and frequency.

All table fields can be edited.

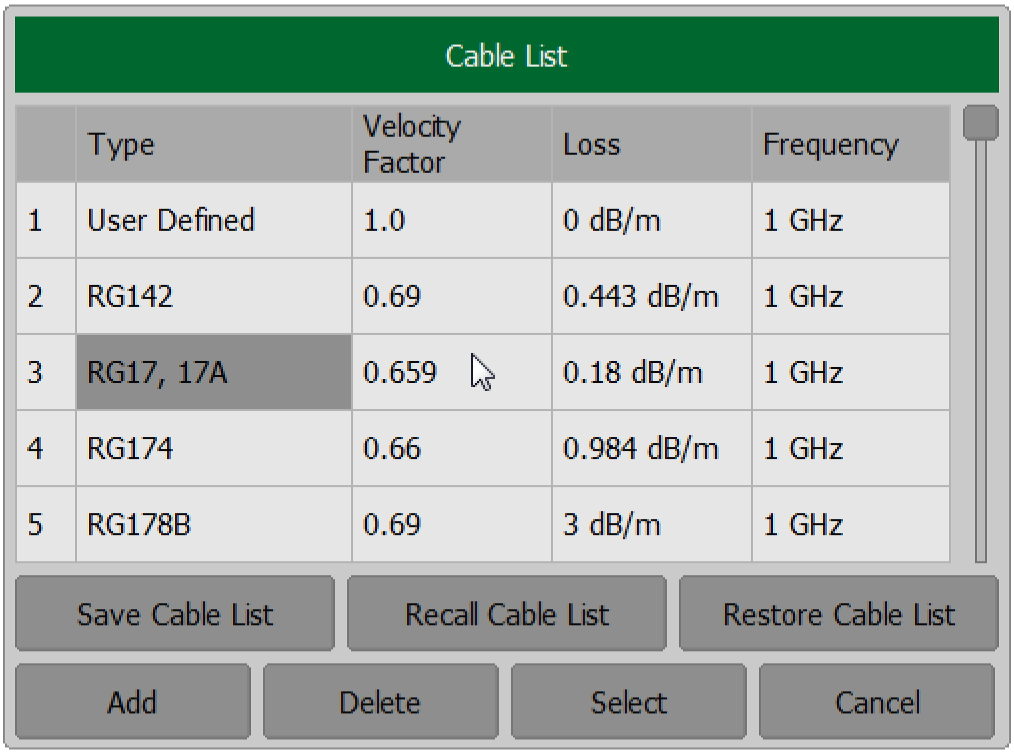
If there is no cable description in the table, it is possible to add it.

	Type	Velocity Factor	Loss	Frequency
1	User Defined	1.0	0 dB/m	1 GHz
2	RG142	0.69	0.443 dB/m	1 GHz
3	RG17, 17A	0.659	0.18 dB/m	1 GHz
4	RG174	0.66	0.984 dB/m	1 GHz
5	RG178B	0.69	3 dB/m	1 GHz

Cable Table

Select the required parameter in the table and double click on the corresponding cell.

Enter the required value **Type**, **Velocity Factor**, **Loss** or **Frequency** using the on-screen keypad.



To add the new cable in the table, use the **Add** softkey.

NOTE: A new cable can be added in the table by specifying its name and parameters in the empty field at the end of the table.

To delete the cable table, use the **Delete** softkey.

To restore the cable table, use the **Restore Cable List** softkey.

To save the cable table in file, use the **Save Cable List** softkey.

To recall the cable table from file, use the **Recall Cable List** softkey.

SCPI [MMEMory:LOAD:CBList]

Manually specify Velocity Factor and Cable Loss

Time and distance are related by velocity. To obtain the accurate mismatch location, it is important to set the right velocity factor of the transmission medium.

By default, the software assumes it to be equal to 1. But in practice, this can be different depending on the characteristics of the transmission line. If the velocity factor of a transmission line is not known, it can be calculated from the dielectric constant value:

$$v_f = \frac{1}{\sqrt{\varepsilon_r}}$$

where ε_r — the dielectric constant value.

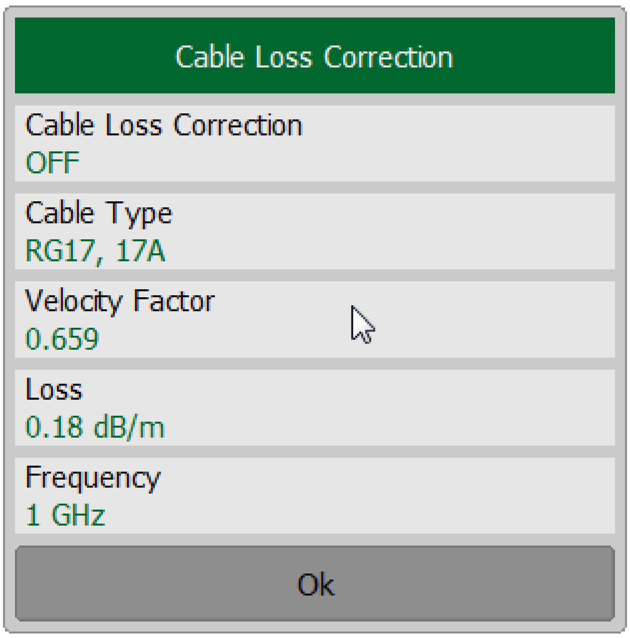
The cable loss is the attenuation a wave experiences when traveling through the cable. The cable loss value is set per meter.

To set the parameters of cable, press the **Analysis > Time Domain > Cable Loss Correction** softkeys.

Click on **Velocity Factor** field to enter the value of velocity factor using the on-screen keypad.

Click on **Loss** field to enter the value of cable loss using the on-screen keypad.

Click on **Frequency** field to enter the value of frequency using the on-screen keypad.



SCPI	SENSe:CORRection:TRANsform:TIME:RVELocity, SENSe:CORRection:TRANsform:TIME:LOSS, SENSe:CORRection:TRANsform:TIME:FREQuency

NOTE	The velocity factor, loss and frequency values can also be set in the cable table.

Time Domain Gating

Time domain gating is a function that mathematically removes unwanted responses in the time domain. The function performs a time domain transformation, selects the region in the time domain, deletes the response inside (or outside) the region and transforms back to the frequency domain. The function allows the user to remove spurious effects of the fixture devices in the frequency response, if the useful signal and spurious signal are separable in the time domain. The function is applicable for reflection coefficients (S11, S22 etc.) measurement only.

The recommended procedure is as follows:

- Use the time domain function for viewing the layout of useful and spurious responses.
- Enable the time domain gating and set the gate position to remove as much of spurious response as possible.
- Disable the time domain function and view the response without spurious effects in frequency domain.

The function involves two types of time domain gating:

- **Bandpass** — removes the response outside the gate span.
- **Notch** — removes the response inside the gate span.

The sharp gate shape leads to ringing effect in the frequency domain. To reduce the ringing the gate shape can be smoothed. The following gate shapes are offered:

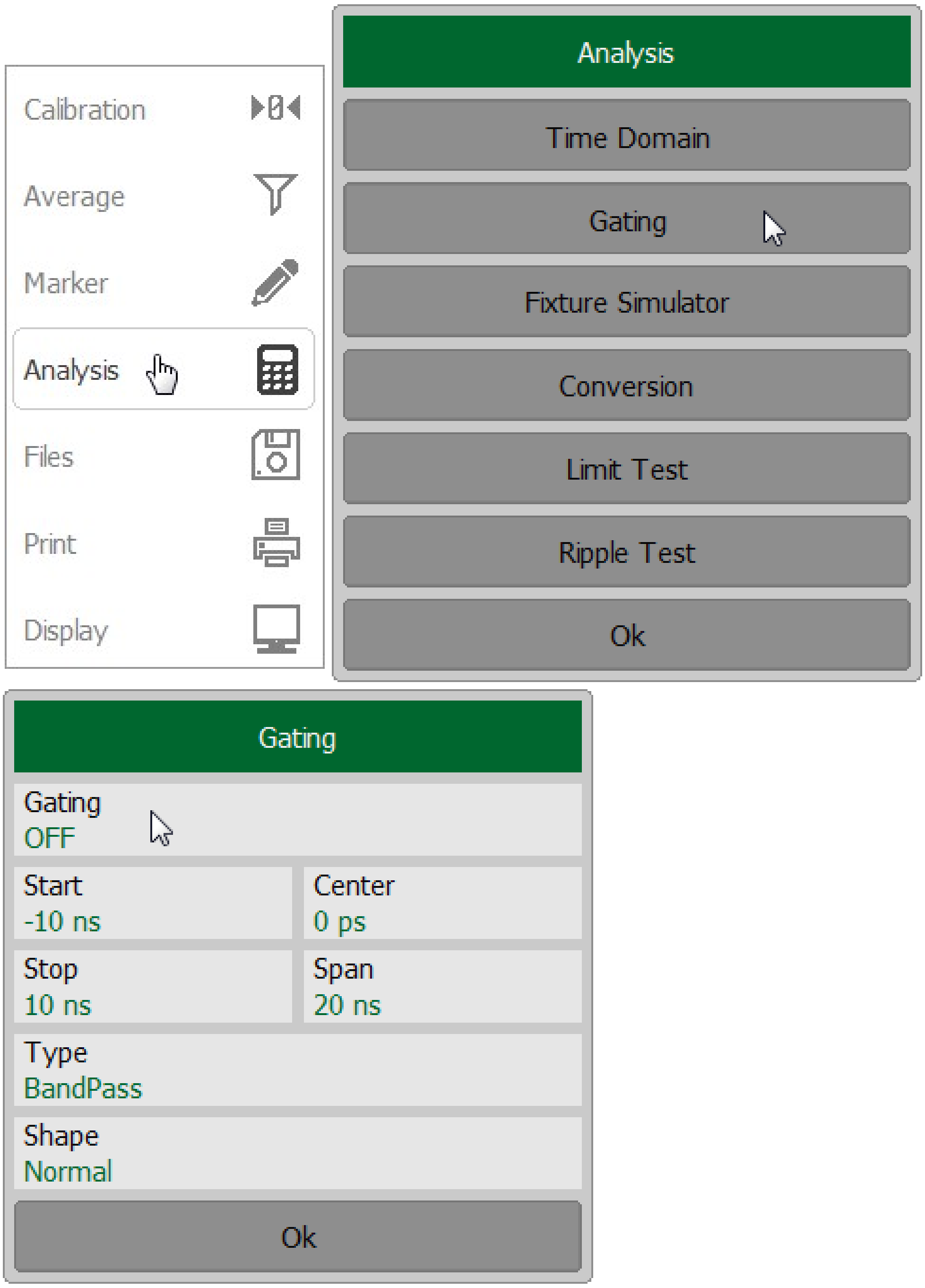
- **Maximum**
- **Wide**
- **Normal**
- **Minimum**

The minimum window has a sharp shape. The maximum window has a more smoothed shape. From minimum to maximum window shape, the sidelobe level increases and the gate resolution decreases. The choice of the window shape is always a trade-off between the gate resolution and the level of spurious sidelobes. The parameters of different window shapes are represented in the table below.

Window Shape	Bandpass Sidelobe Level	Gate Resolution (Minimum Gate Span)
Minimum	– 48 dB	$\frac{2.8}{F_{max}-F_{min}}$
Normal	– 68 dB	$\frac{5.6}{F_{max}-F_{min}}$
Wide	– 57 dB	$\frac{8.8}{F_{max}-F_{min}}$
Maximum	– 70 dB	$\frac{25.4}{F_{max}-F_{min}}$

Time Domain Gate Activation

To enable/disable time domain transformation function, use the **Analysis > Gating > Gating** softkeys on left menu bar.



SCPI	CALCulate:FILTer:TIME:STATe

NOTE	Time domain gating function is accessible only in linear frequency sweep mode.

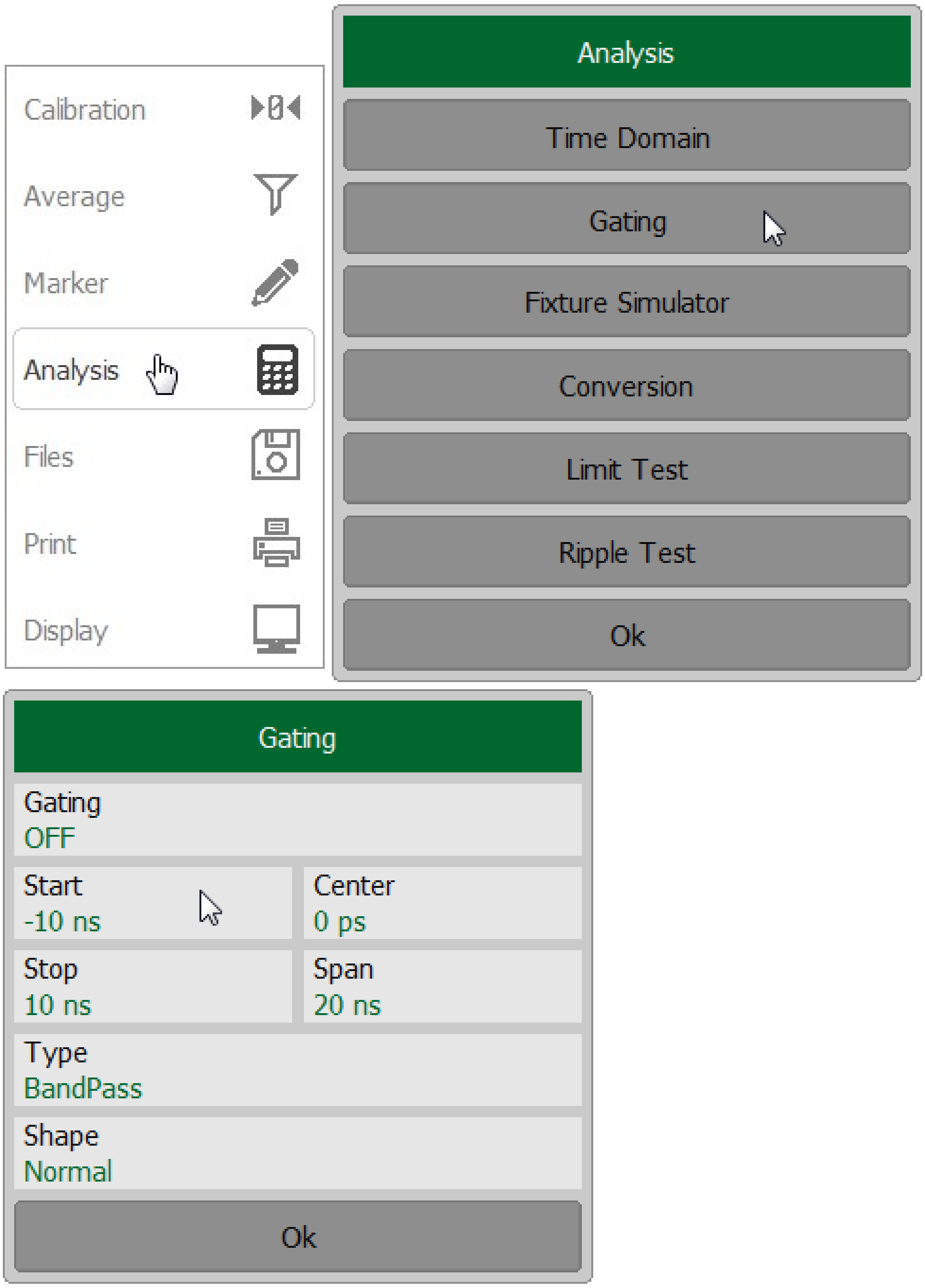
Time Domain Gate Span

To define the span of time domain gate, set its start and stop values.

To set the start and stop limits of the time domain gate, use the **Analysis > Gating > Gating** softkeys on left menu bar.

Click on the **Start** or **Stop** field and enter the value using the on-screen keypad.

To set the center and span of the time domain gate, use the **Center** or **Span** softkeys.

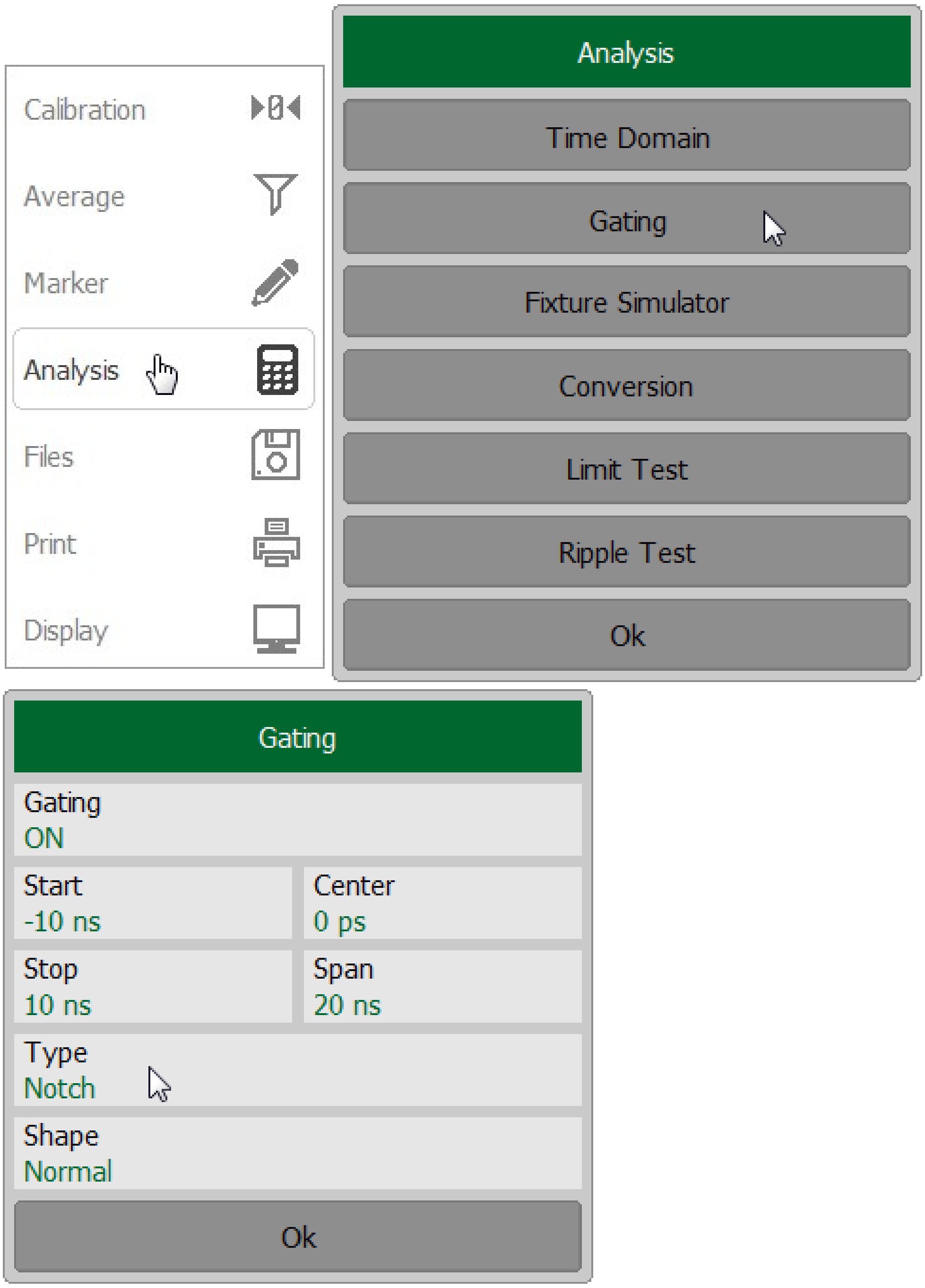


SCPI	CALCulate:FILTer:TIME:STARt, CALCulate:FILTer:TIME:STOP CALCulate:FILTer:TIME:SPAN, CALCulate:FILTer:TIME:CENTer

Time Domain Gate Type

To select the type of the time domain window, use the **Analysis > Gating > Type** softkeys on left menu bar.

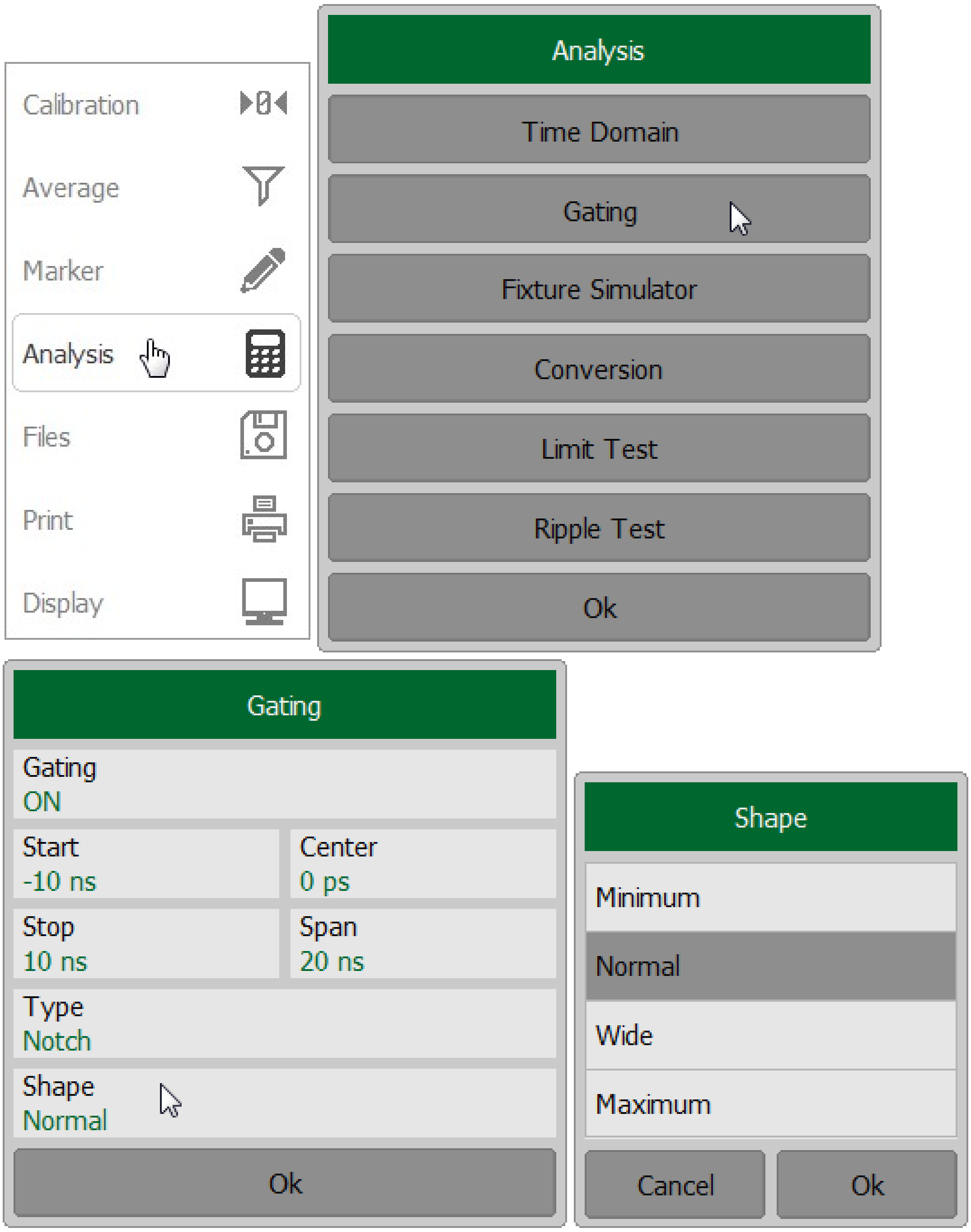
Toggle the type between **Bandpass** and **Notch**.



SCPI	CALCulate:FILTer:TIME

Time Domain Gate Shape Setting

To set the time domain gate shape, use the **Analysis > Gating > Type** softkeys on left menu bar. Select the required shape from the Shape list.



SCPI	CALCulate:FILTer:TIME:SHAPe

S-Parameter Conversion

The S-parameter conversion function allows for the conversion of measurement results (Sii, where i is a value from 1 to N is taken. N is a number of Analyzers.) to the parameters:

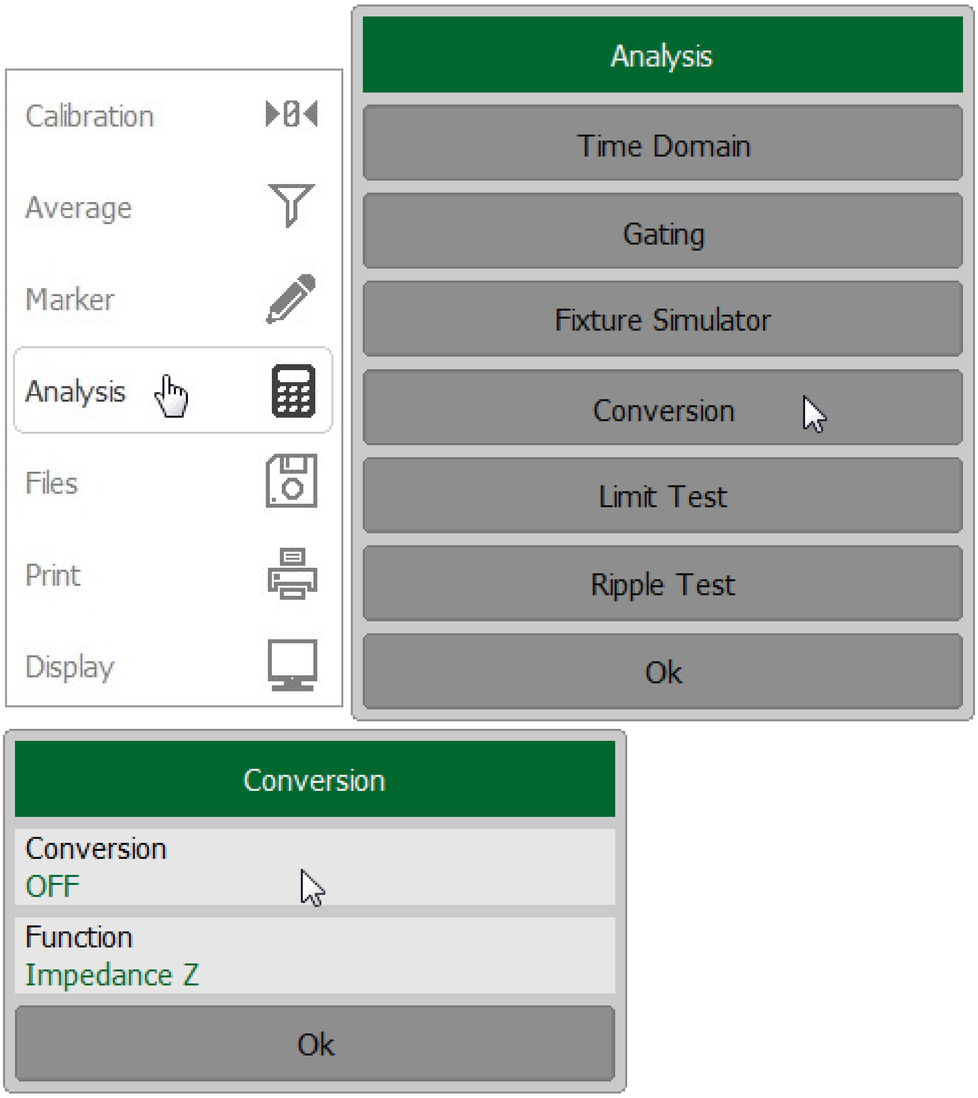
Parameter	Equation
Impedance in reflection measurement (Z_r)	$Zr = Z0 \cdot \frac{1+Sii}{1-Sii}$
Admittance in reflection measurement (Y_r)	$Y_r = \frac{1}{Zr}$
Inverse S-parameter	$\frac{1}{Sii}$
S-parameter complex conjugate	Sii^*
$Z0$ is characteristic impedance of Port. Sii is measured S-parameter (S11, S22 etc.).	

NOTE

Equations for Z_r, Y_r, are approximate. The reason for using the approximate method is the measurement speed, as only one S-parameter is used in the calculations, whereas the general method requires measurement of the full matrix of S-parameters.

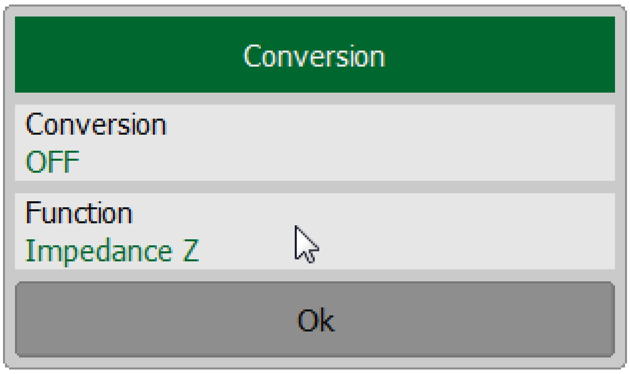
The S-parameter conversion function can be applied to an individual trace of a channel. The trace to which the function is applied must be preselected as active (See Selection of Active Trace).

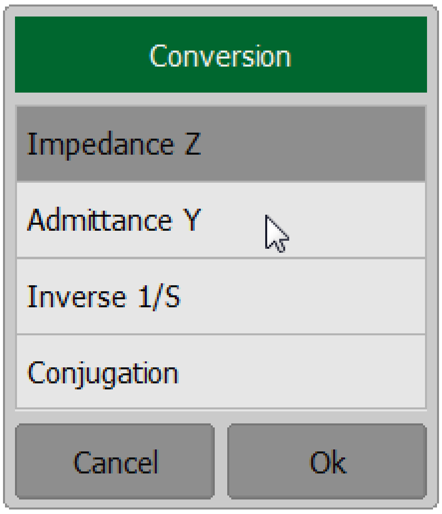
To enable/disable conversion function, use the **Analysis > Conversion > Conversion** softkeys on left menu bar.



Then select the conversion type, click on the **Function** field and select the required value from the list.

The trace format will be changed to **Lin Magnitude**.





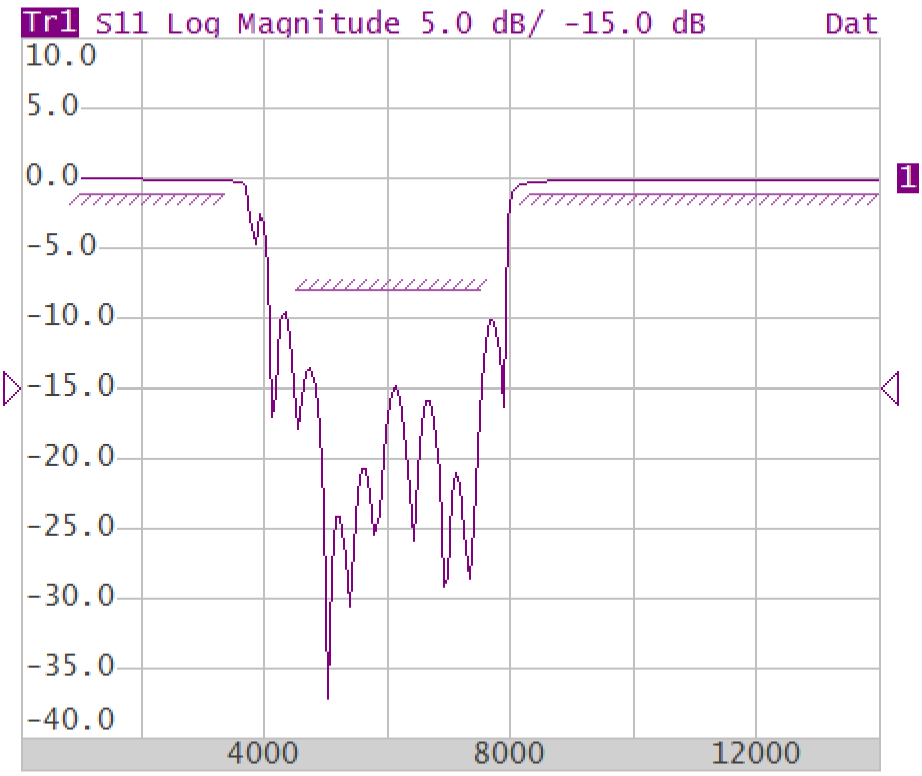
SCPI CALCulate:CONVersion, CALCulate:CONVersion:FUNCtion

NOTE	All conversion types are indicated in the trace status field, if enabled (See Trace Status Field).

Limit Test

The limit test is a function of automatic pass/fail judgment for the trace of the measurement result. The judgment is based on the comparison of the trace to the limit line set by the user.

The limit line can consist of one or several segments (See figure below). Each segment checks the measured value for failure, whether it is an upper or lower limit. The limit line segment is defined by specifying the coordinates of the beginning (X0, Y0) and the end (X1, Y1) of the segment, and the type of the limit. The MAX or MIN limit types check if the trace falls outside of the upper or lower limit respectively.



Limit line

The limit line is set by the user in the limit table. Each row in the table describes one segment of the line. Limit table editing is described below. The table can be saved into a *.LIM file.

The display of the limit lines on the screen can be turned ON/OFF independently of the status of the limit test function.

The result of the limit test is indicated:

- If the measurement result passed the limit test, **Pass** sign will be displayed in green in the center of the window.

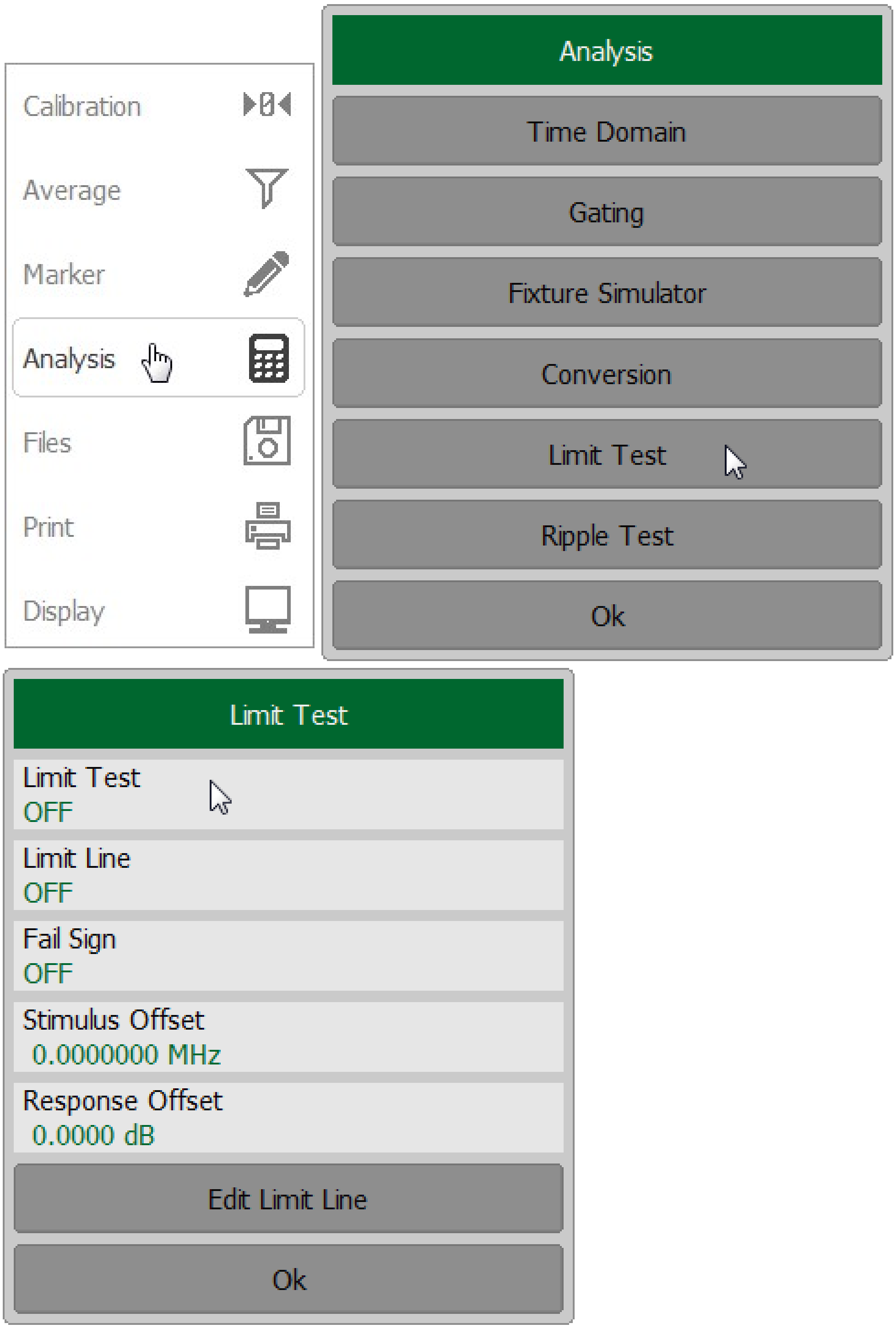
- If the measurement result failed, the result will be indicated in the following ways (See figure below):

    1. **Fail** sign will be displayed in red in the center of the window.
    2. The points of the trace, which failed the test will be highlighted in red.

Test fail indication

Limit Test Enabling/Disabling

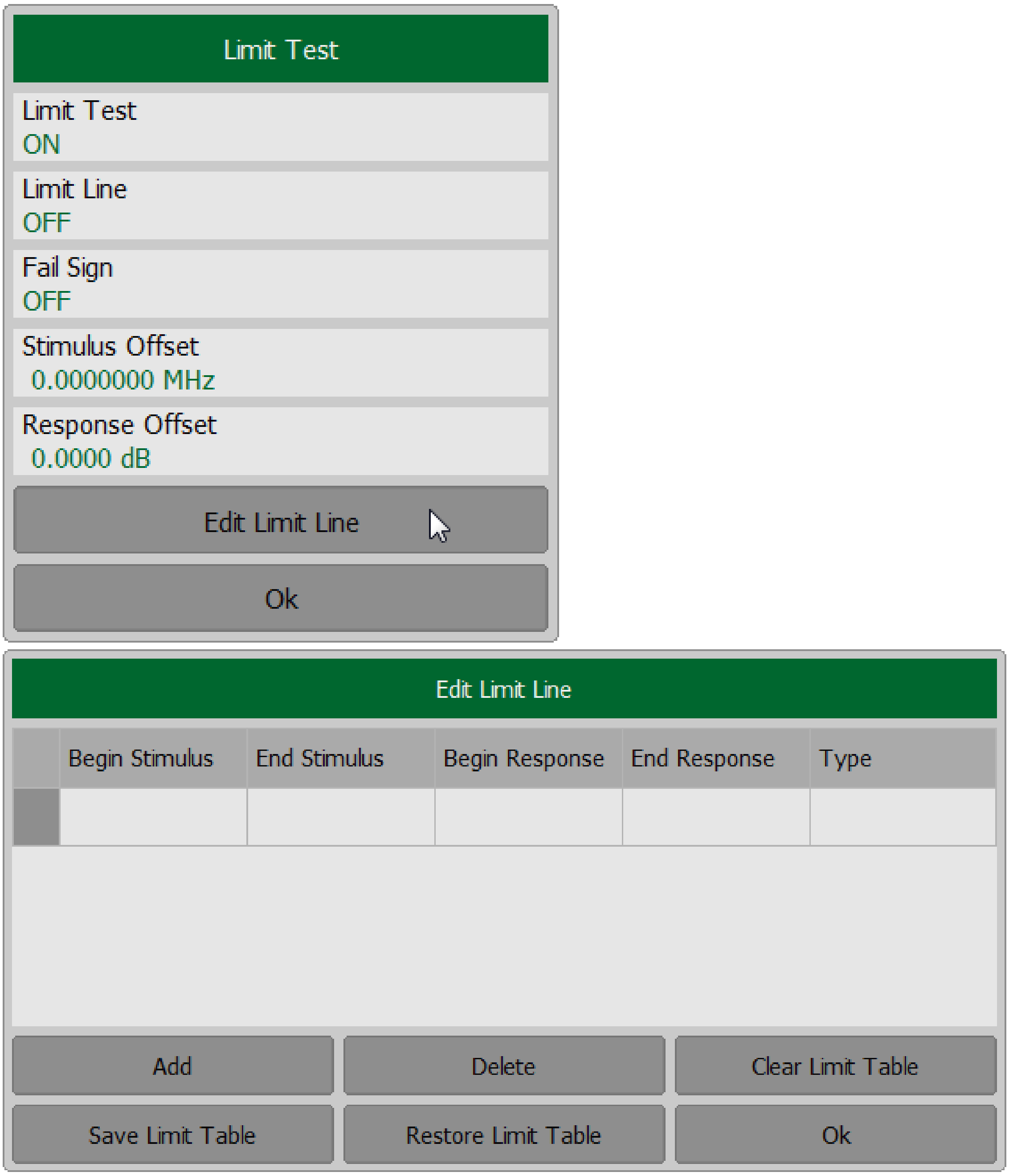
To enable/disable limit test function use the **Analysis > Limit Test > Limit test** softkeys.



SCPI [CALCulate:LIMit]

Limit Line Editing

To access the limit line editing mode, use the **Analysis > Limit Test > Edit Limit Line** softkeys. The Edit Limit Line dialog will appear on the screen.



Navigating within the table to enter the values of the following parameters of a limit test segment:

Begin Stimulus	Stimulus value in the beginning point of the segment.
End Stimulus	Stimulus value in the ending point of the segment.
Begin Response	Response value in the beginning point of the segment.
End Response	Response value in the ending point of the segment.
Type	Select the segment type among the following: • **MAX** — upper limit. • **MIN** — lower limit. • **OFF** — segment not used for the limit test.

Select the required parameter in the table and double click on the corresponding cell.

Enter the required value **Begin Stimulus**, **End Stimulus**, **Begin Response**, **End Response**, and **Type** using the on-screen keypad.

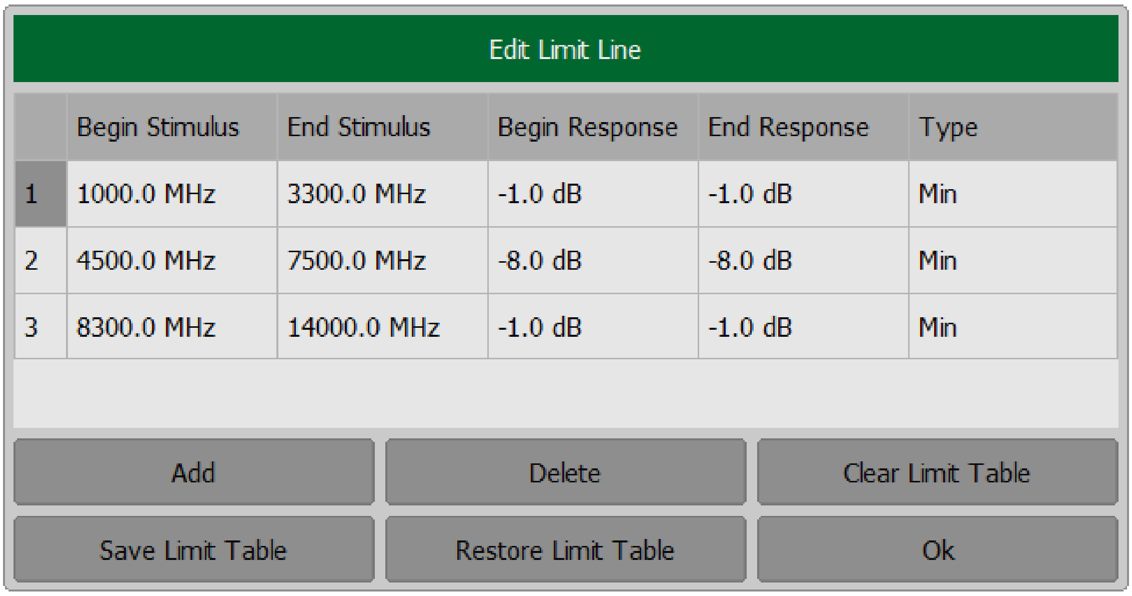
To add a new row in the table click **Add** softkey. The new row will appear below the highlighted one.

To delete a row from the table, click **Delete** softkey. The highlighted row will be deleted.

To clear the entire table, use **Clear Limit Table** softkey.

To save the table into *.LIM file, use **Save Limit Table** softkey.

To open the table from a *.LIM file, use **Restore Limit Table** softkey.

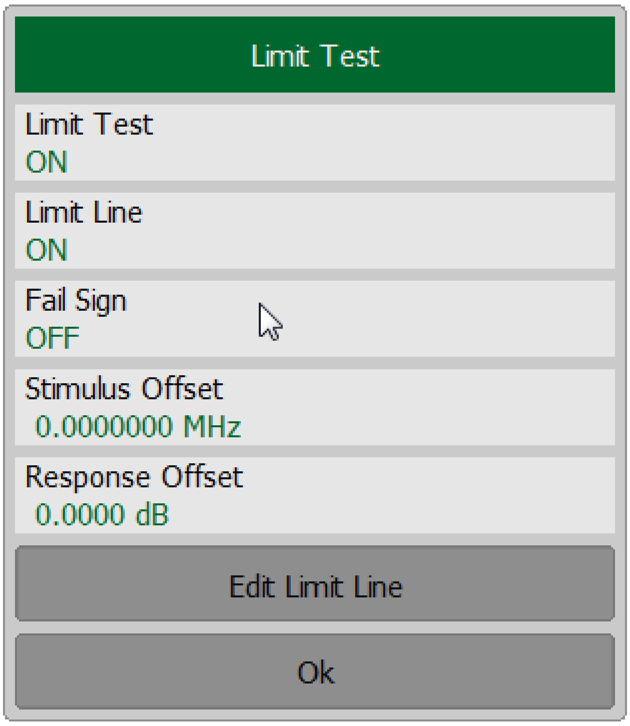


SCPI CALCulate:LIMit:DATA, MMEMory:STORe:LIMit, MMEMory:LOAD:LIMit

Limit test display management

To enable/disable display of a limit line, use the **Analysis > Limit Test > Limit Line** field.

To enable/disable display of fail sign in the center of the diagram, use **Fail Sign** field.



SCPI	CALCulate:LIMit:DISPlay DISPlay:FSIGn

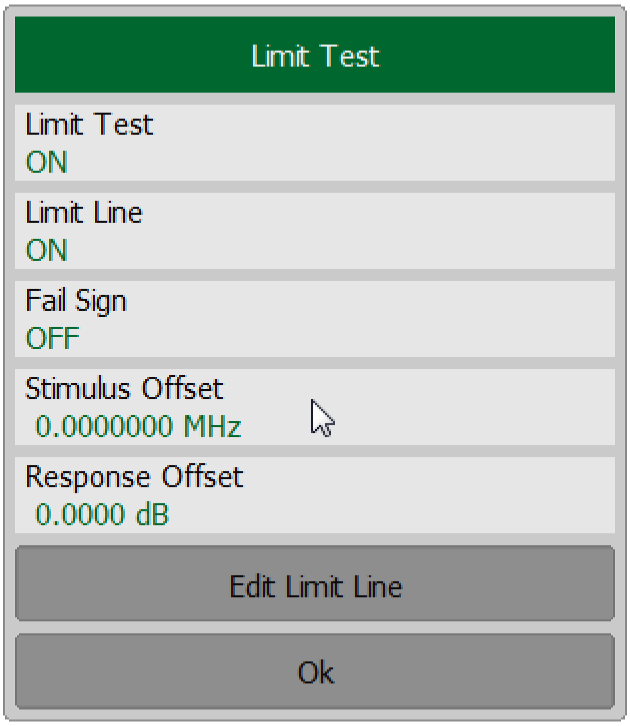
Limit Line Offset

The limit line offset function allows the user to shift the segments of the limit line by the specified value along X and Y axes simultaneously.

To define the limit line offset along X-axis, use the following softkeys **Analysis > Limit Test**.

Click on the **Stimulus Offset** field and enter the value using the on-screen keypad.

To define the limit line offset along Y-axis, click on the **Response Offset** field and enter the value using the on-screen keypad.



SCPI CALCulate:LIMit:OFFSet:STIMulus, CALCulate:LIMit:OFFSet:AMPLitude

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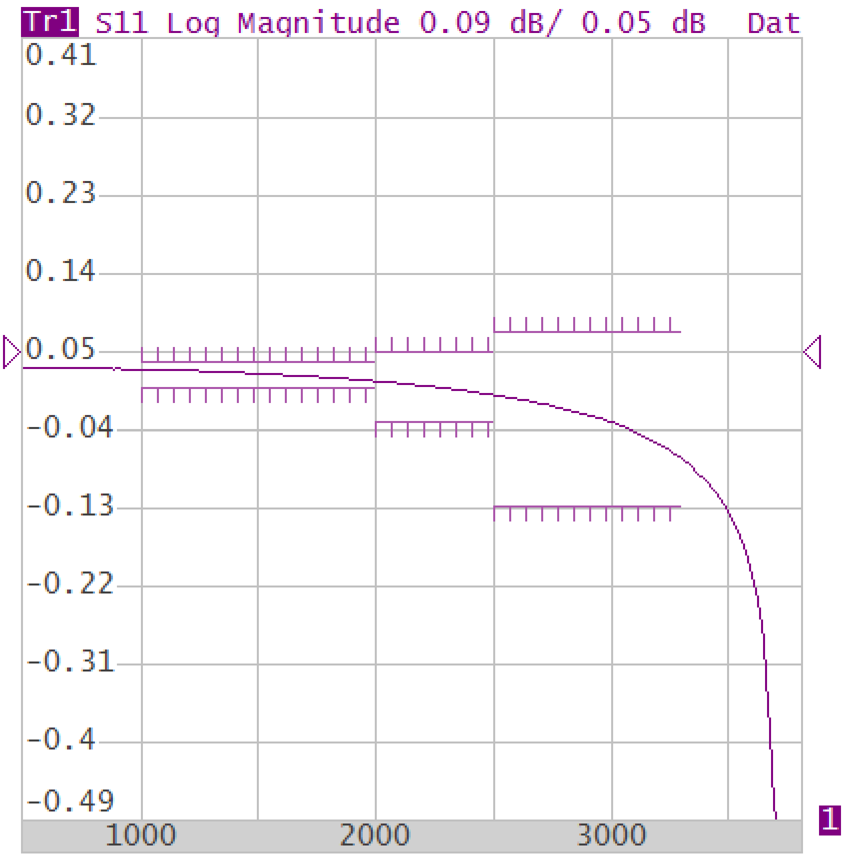
Ripple Limit Test

The ripple limit test is an automatic pass/fail check of the measured trace data. The trace is checked against the maximum ripple value (ripple limit). The ripple value is the difference between the maximum and minimum response of the trace in the trace frequency band.

The ripple limit can include one or more segments (See figure below). Each segment provides the ripple limit for the specific frequency band. A segment is set by the frequency band and the ripple limit value.



Ripple limits

The ripple limit settings are set in the ripple limit table. Each row of the table describes the frequency band of the ripple limit value. The process of ripple limit table editing is described below. The table can be saved into a *.RML file.

The display of the limit lines on the screen can be turned on/off independently of the status of the ripple limit test function.

The result of the limit test is indicated:

- If the measurement result passed the ripple limit test, **Pass** sign will be displayed in green in the center of the window.

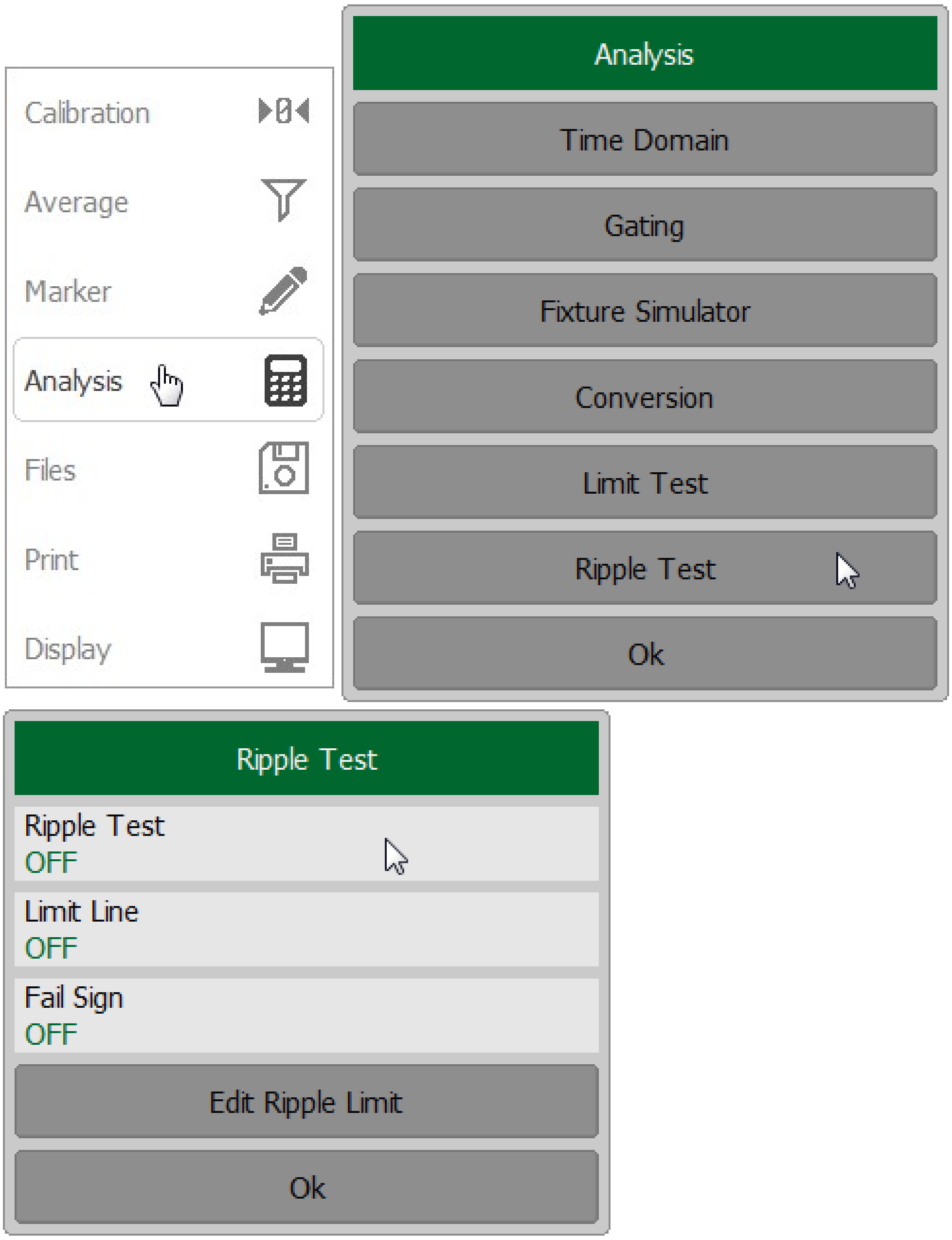
- If the measurement result failed, the result will be indicated in the following ways (See figure below):

  1. **Fail** sign will be displayed in red in the center of the window.
  2. The points of the trace, which failed the test will be highlighted in red.

Test fail indication

Ripple Limit Test Enabling/Disabling

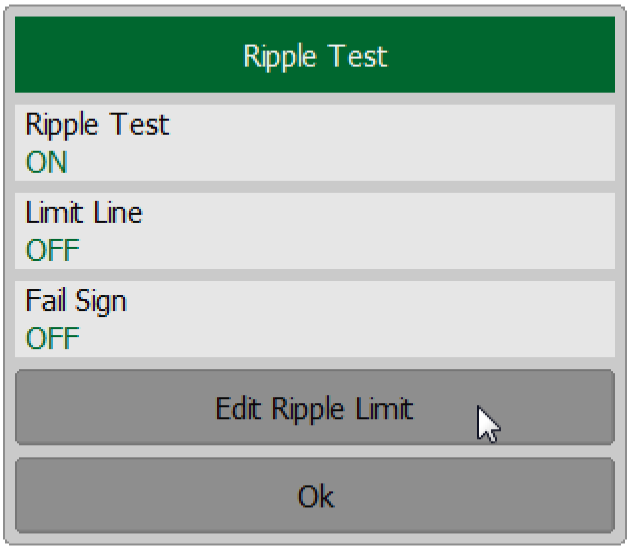
To enable/disable ripple limit test function use the **Analysis > Ripple Test > Ripple test** softkeys.

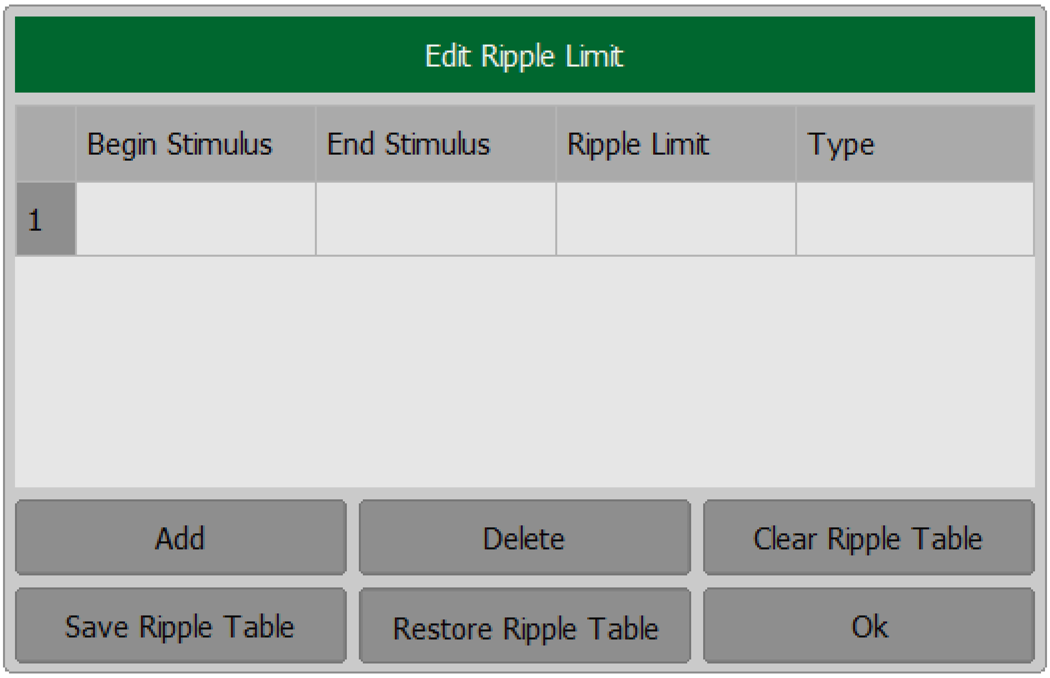


SCPI	CALCulate:RLIMit

Ripple Limit Line Editing

To access the ripple limit line editing mode, use the **Analysis > Ripple Test > Edit Ripple Limit** softkeys. The Edit Ripple Limit dialog will appear on the screen.





Navigating within the table to enter the values of the following parameters of a ripple limit test segment:

Begin Stimulus	Stimulus value in the beginning point of the segment.
End Stimulus	Stimulus value in the ending point of the segment.
Ripple Limit	Ripple limit value.
Type	Select the segment type among the following: • **ON** — band used for the limit test. • **OFF** — band not used for the limit test.

Select the required parameter in the table and double click on the corresponding cell.

Enter the required value **Begin Stimulus**, **End Stimulus**, **Ripple Limit**, and **Type** using the on-screen keypad.

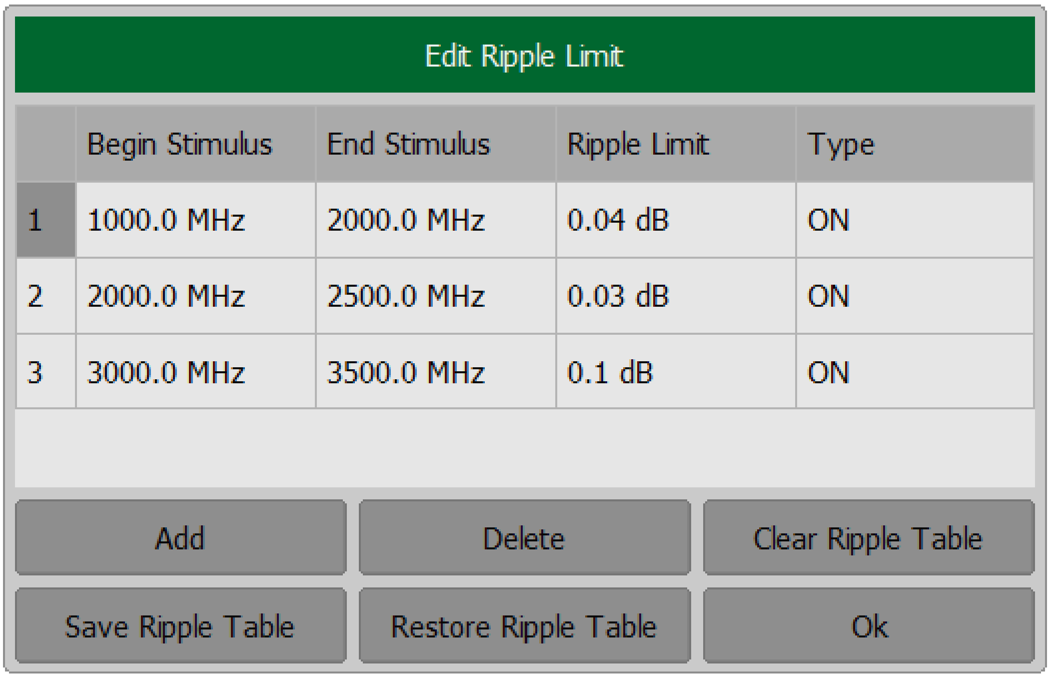
To add a new row in the table click **Add** softkey. The new row will appear below the highlighted one.

To delete a row from the table, click **Delete** softkey. The highlighted row will be deleted.

To clear the entire table, use **Clear Ripple Table** softkey.

To save the table into *.RML file, use **Save Ripple Table** softkey.

To open the table from a *.RML file, use **Restore Ripple Table** softkey.

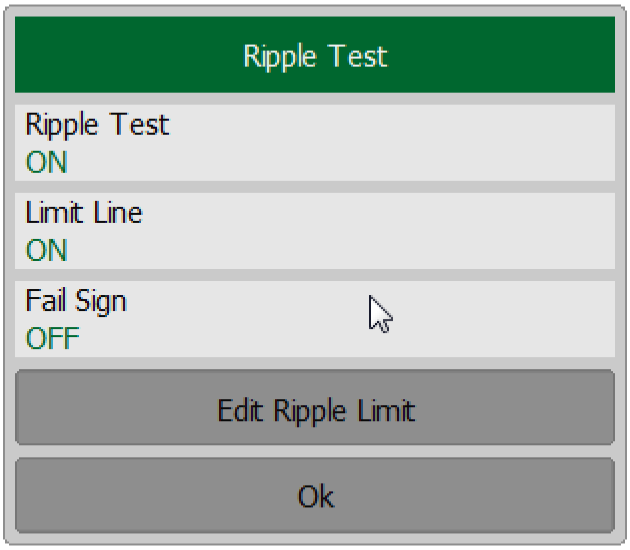


SCPI CALCulate:RLIMit:DATA, MMEMory:STORe:RLIMit, MMEMory:LOAD:RLIMit

Ripple Limit test display management

To enable/disable display of a ripple limit line, use the **Analysis > Ripple Test > Limit Line** field.

To enable/disable display of fail sign in the center of the diagram, use **Fail Sign** field.



SCPI	CALCulate:RLIMit:DISPlay:LINE DISPlay:FSIGn

Cable Loss Measurement

While all cables have inherent loss, weather and time will deteriorate cables and cause even more energy to be absorbed by the cable. This makes less power available to be transmitted.

A deteriorated cable is not usually apparent in a distance to fault (DTF) measurement, where more obvious and dramatic problems are identified. A cable loss measurement is necessary to measure the accumulated losses throughout the length of the cable.

In high-loss conditions, a cable loss measurement becomes “noisy” as the test signal becomes indistinguishable in the device noise floor. This can occur when measuring a very long cable and using relatively high measurement frequencies. To help with this condition, use high power and averaging.

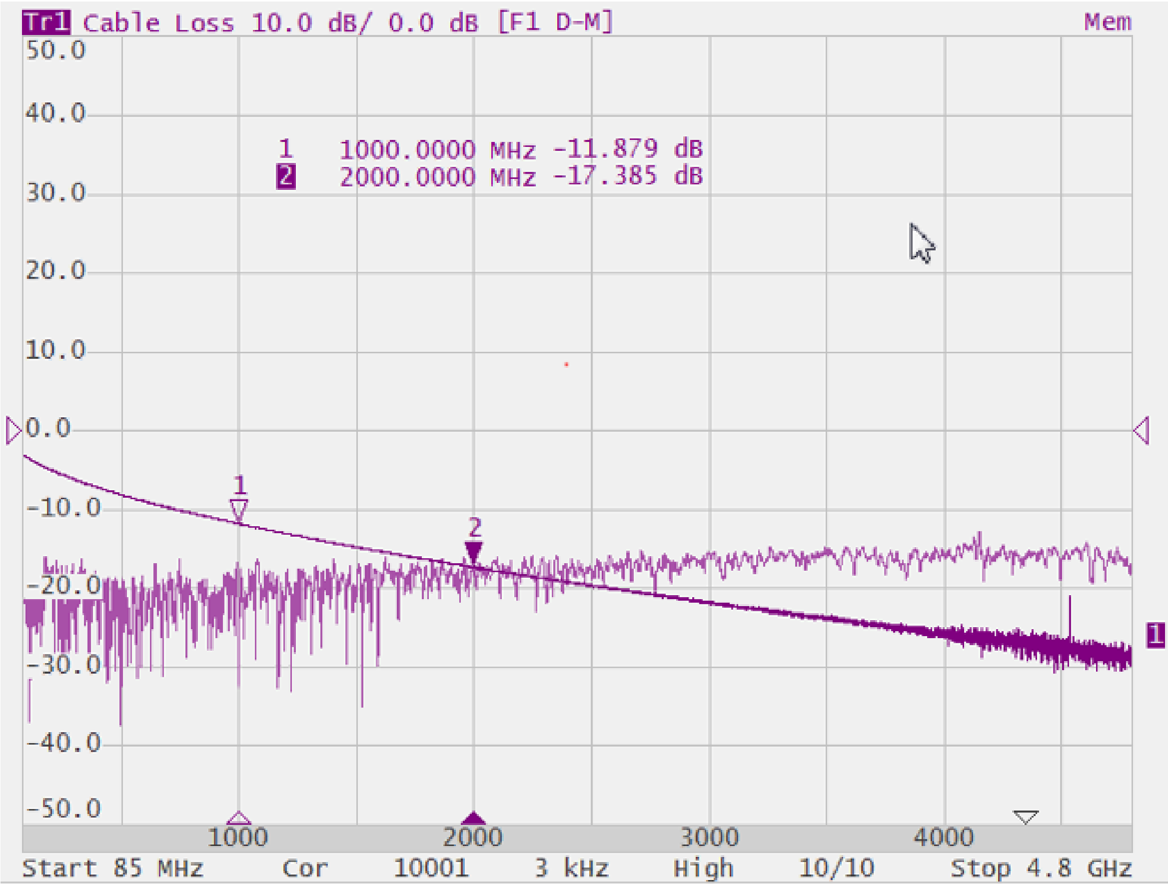
Cable Loss Measurement Algorithm

In order to measure cable loss, perform the following steps:

- Set the device to initial state using the **System > Preset** softkeys.
- Select for the current trace type of measurement **Cable Loss** (See Rectangular Formats).
- Set the **Start** and **Stop** frequency of measurements (See Sweep Range).
- Perform a full 1-port calibration for measuring port (See Full One-Port Calibration).
- Connect the cable to be tested.
- Connect a LOAD at the end of the cable to be tested. This limits the reflections to faults that are located in the cable under test. These reflections are visible on the screen as “ripple” or low-level standing waves and obscure the actual loss of the cable.
- Save the trace data in memory using the **Trace > Memory Trace** softkeys.
- Remove the LOAD and leave the end of the cable to be tested open.
- Press **Trace > Data Math > Data- Mem**. The ripple in the measurement is removed. These minor imperfections in the cable should not be considered in the cable loss measurement.
- Use Averaging to remove random noise from high-loss measurements. To turn on the averaging press the **Average > Averaging** softkeys.

The displayed trace shows the cable loss values in one direction through the cable. A return loss measurement would show the loss for both down the cable and back.

The following example indicates the cable loss for 30-meter coaxial cable with 0.397dB/m loss factor at 1GHz frequency (See figure below).



Cable loss measurement.

State Saving and Data Output

The following section describes the processes of saving and recalling:

- The set parameters of the Analyzer, calibration, measured, and memorized data are stored in the Analyzer status file and can be reloaded (See Analyzer States).
- The states of the individual channels are stored in the internal memory. Up to 4 states can be stored while the Analyzer is running. When the Analyzer is powered off, the contents of the state files are destroyed (See Channel States).
- The calibration of a channel in a *.CAL (See Calibration Saving/Recalling).
- Individual trace data in a *.CSV file (See Trace Data CSV Files).
- Device S-parameters in a Touchstone file (See Trace Data Touchstone Files).

Analyzer State

The Analyzer state, calibration and measured data can be saved on the hard disk to an Analyzer state file and later uploaded back into the Analyzer software. The following four types of saving are available:

State	The Analyzer settings.
State & Cal	The Analyzer settings and the table of calibration coefficients.
State & Trace	The Analyzer settings and data traces[1].
All	The Analyzer settings, table of calibration coefficients, and data traces and memory[1].
1 When recalling the state with saved data traces, the trigger mode will be automatically set to «Hold» so that the recalled traces are not erased by currently measured data.	

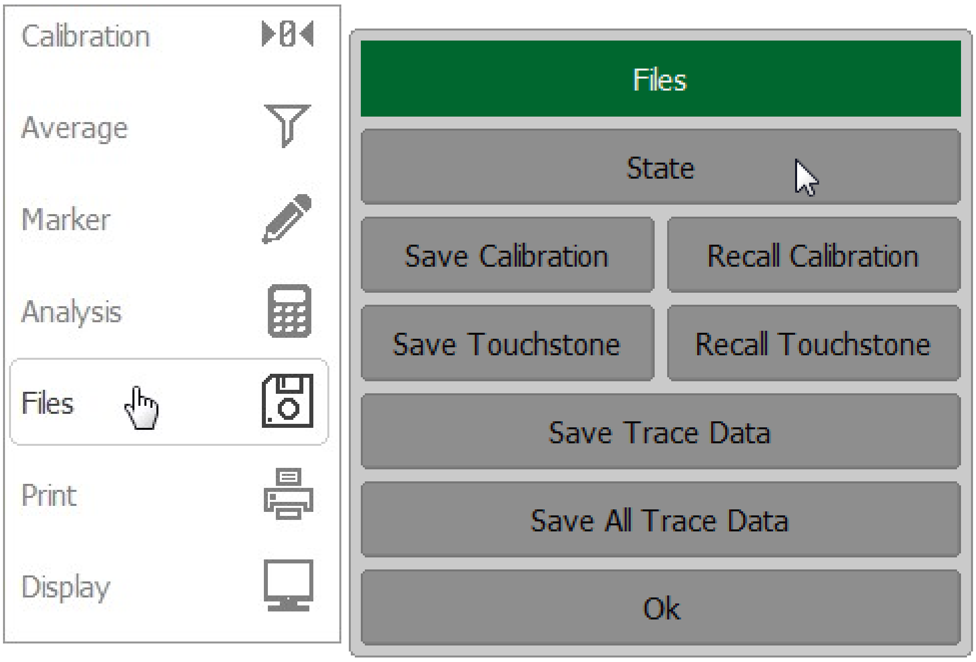
The Analyzer settings that are saved into the Analyzer state file are parameters that can be set in the following submenus of the softkey menu:

- All the parameters in the **Stimulus** submenu.
- All the parameters in the **Scale** submenu.
- All the parameters in the **Channel** submenu.
- All the parameters in the **Trace** submenu.
- All the parameters in the **System** submenu.
- All the parameters in the **Average** submenu.
- All the parameters of the **Markers** submenu.
- All the parameters of the **Analysis** submenu.

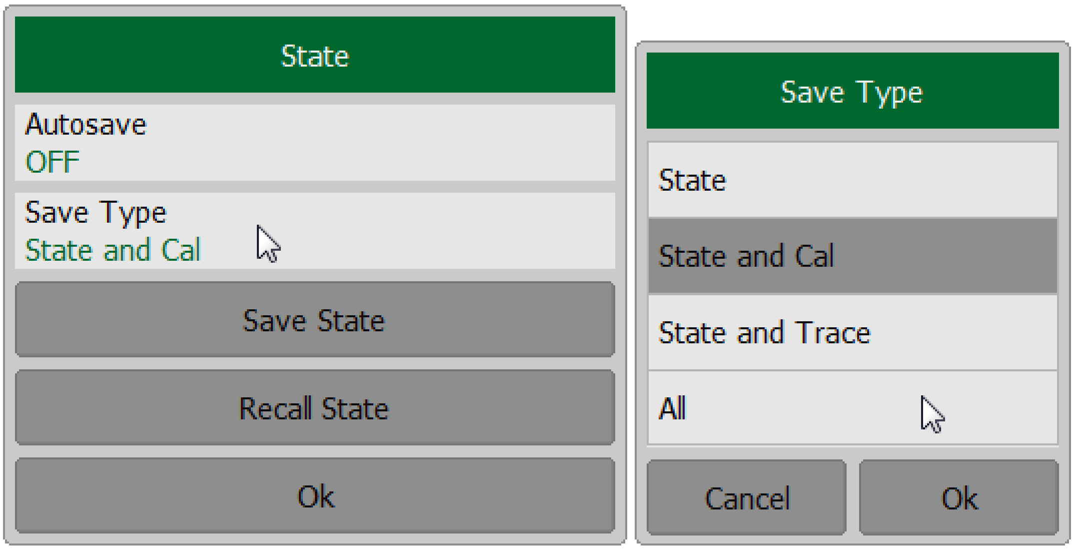
A special **Autosave.cfg** file is used to recall automatically the Analyzer state after start. Automatic state saving mode should be activated for enabling this function.

Analyzer State Saving

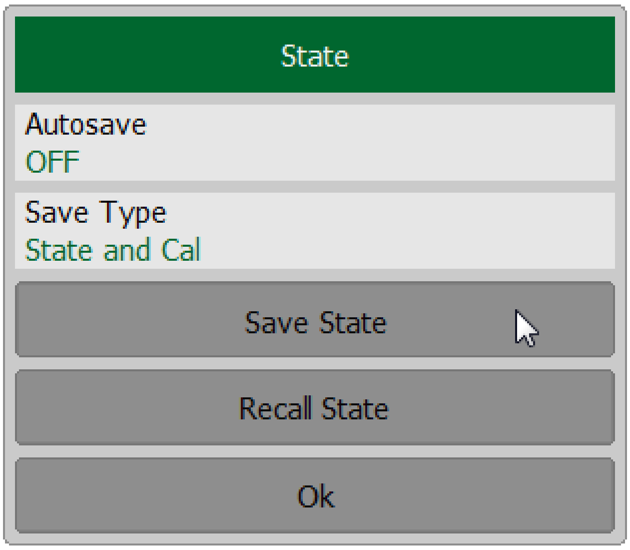
Open the State dialog use the **Files > State** softkeys.



To set type of saving click on the **Save Type** field. Select type in Save Type dialog and click **Ok**.



Click on the **Save State** softkey.



Select a path and enter the state file name in the pop-up dialog.

Navigation in directory tree is available in Save State dialog.

To open a directory and activate it, double click on the directory name.

To go up in the directory hierarchy, double click on the “..” field.

To select the disk, click **Drive** softkey.

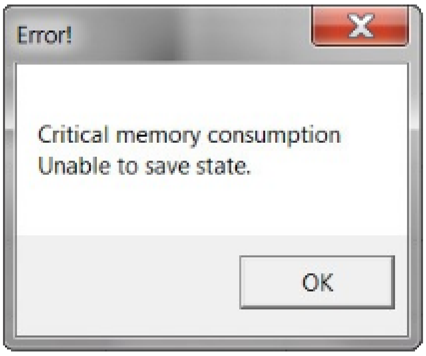
To change the name of the saved state file using the on-screen keypad, click on the **File** field.

To save the state file in the Save State dialog, click **Ok** softkey.

SCPI	MMEMory:STORe:STYPe MMEMory:STORe

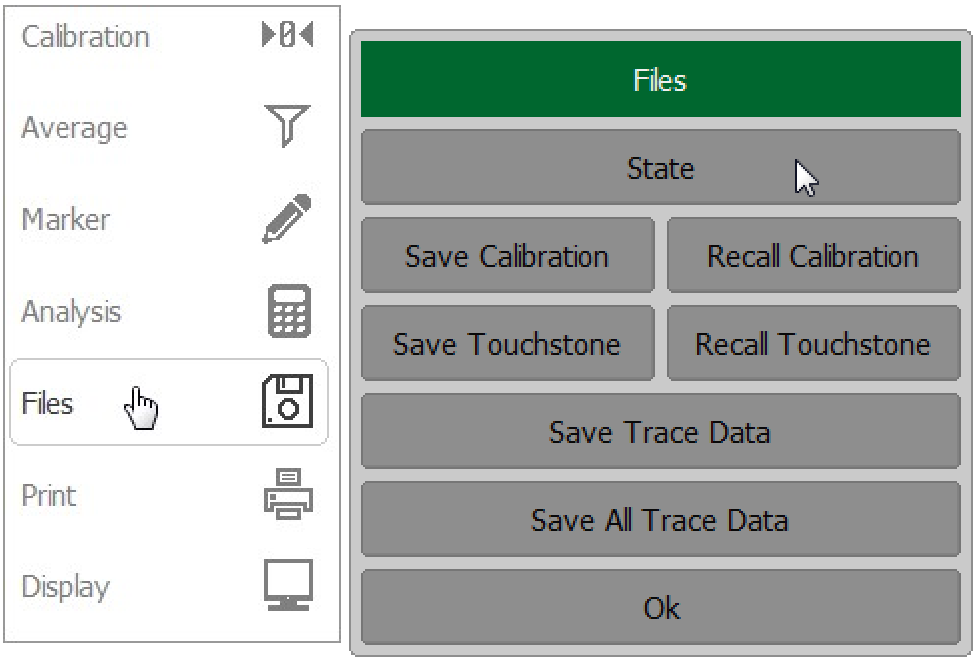
NOTE

The following message will appear on the screen in case of lack of memory (See Instrument Status Bar) when saving state:

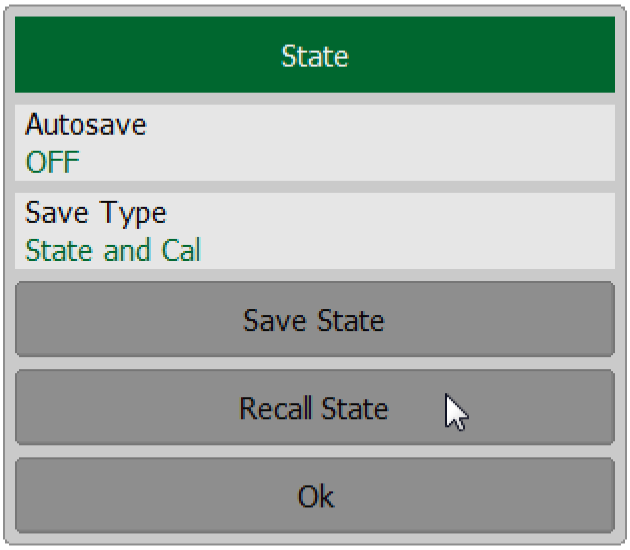


Analyzer State Recalling

Open the State dialog use the **Files > State** softkeys.



Click on the **Recall State** softkey.



Select a path and enter the state file name in the pop-up dialog.

Navigation in directory tree is available in Recall State dialog.

To open a directory and activate it, double click on the directory name.

To go up in the directory hierarchy, double click on the “..” field.

To select the disk, click **Drive** softkey.

To change the name of the saved state file using the on-screen keypad, click on the **File** field.

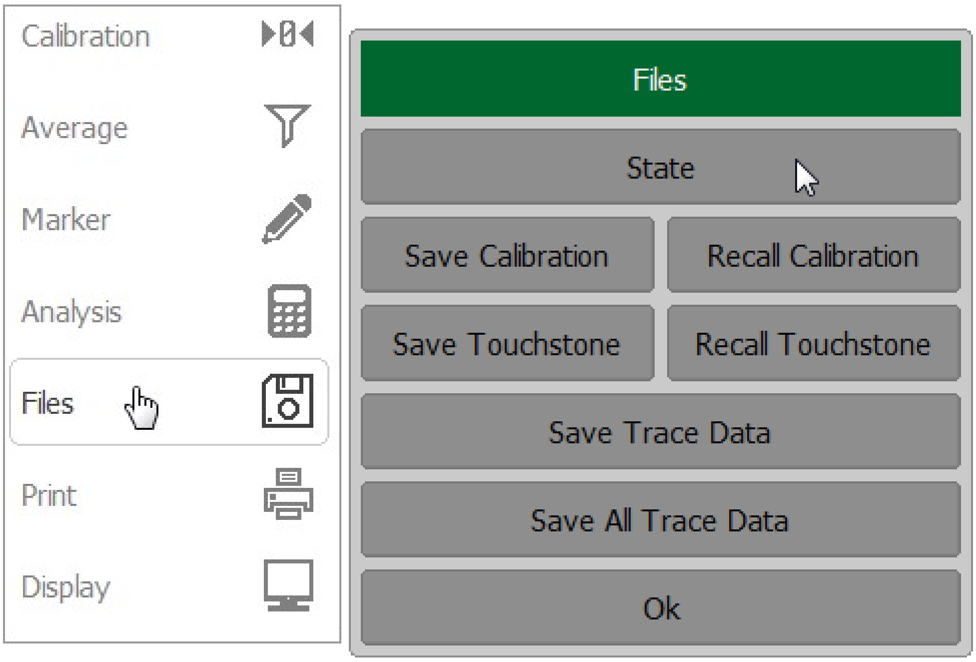
To recall the state file in the Recall State dialog, click **Ok** softkey.

SCPI	MMEMory:LOAD

Autosave and Autorecall State of Analyzer

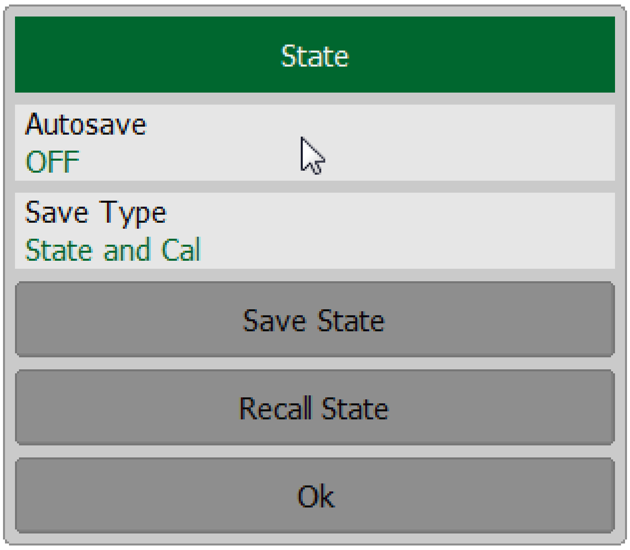
When enabled, this function automatically saves a session upon the existing software and resumes it when the Analyzer is turned on next time. The stored session parameters include the Analyzer settings, table of calibration coefficients, and data and memory traces.

Open the State dialog use the **Files > State** softkeys.



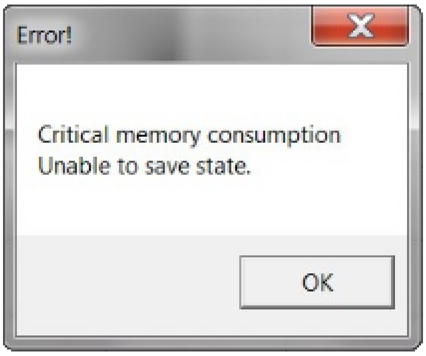
Click in the **Autosave** field. The parameter value will change to ON.

When existing, the state will be saved. The next time the software state will be restored.



NOTE

The following message will appear on the screen in case of lack of memory (See Instrument Status Bar) when saving state:



Channel State

A channel state can be saved into the Analyzer memory.

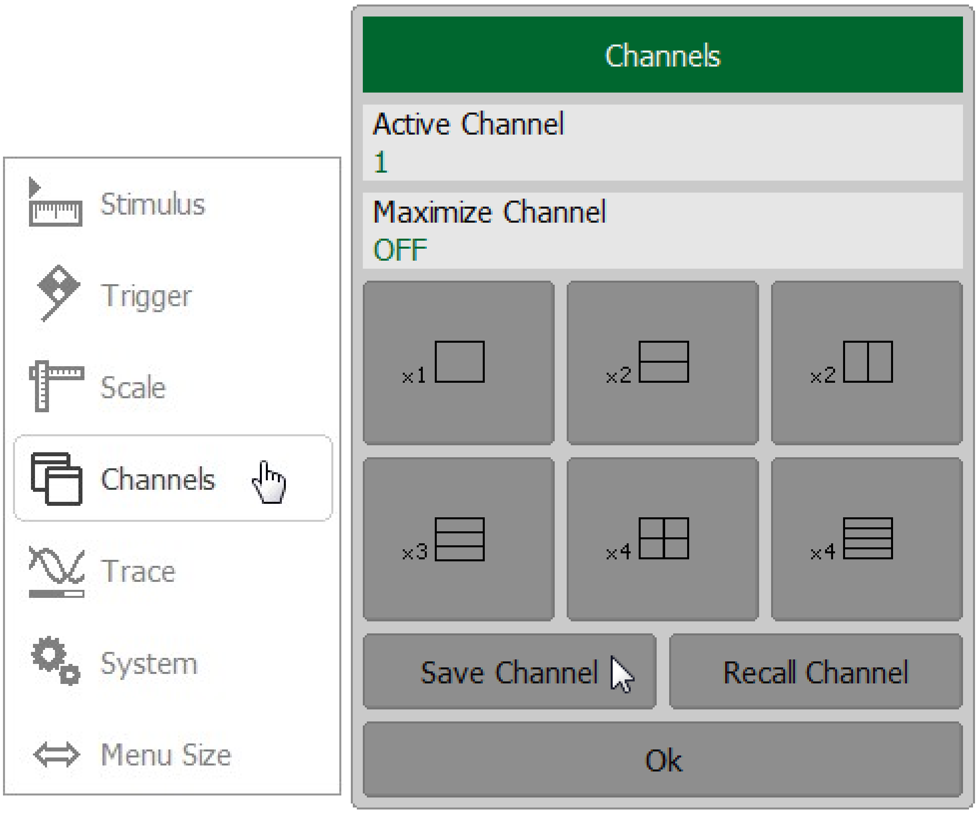
The channel state saving procedure is similar to the Analyzer state saving and the same saving types (See Analyzer State) are applied to the channel state saving.

Unlike the Analyzer state, the channel state is saved into the Analyzer's inner volatile memory (not to the hard disk) and is cleared when the Analyzer is turned off. For channel state storage, there are four memory registers: **A, B, C, D**.

The channel state saving function allows to copy easily the settings of one channel to another one.

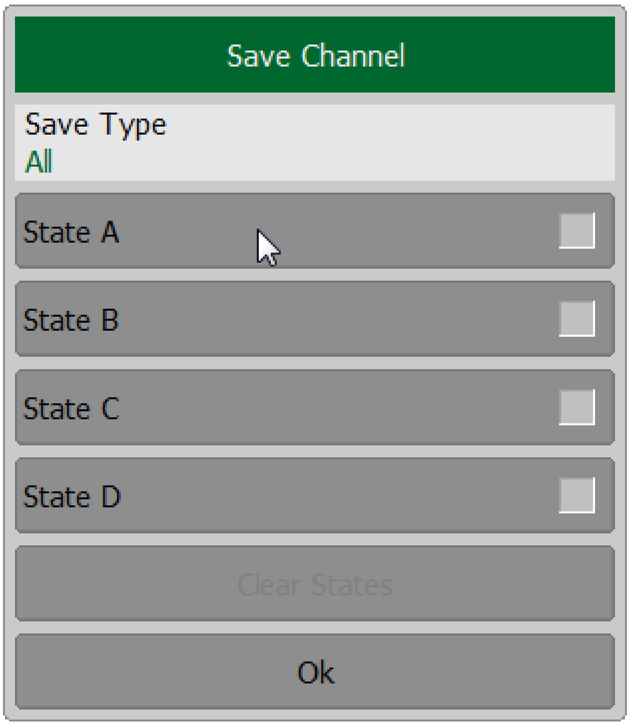
Channel State Saving

To save the channel state use the **Channels > Save Channel** softkeys.

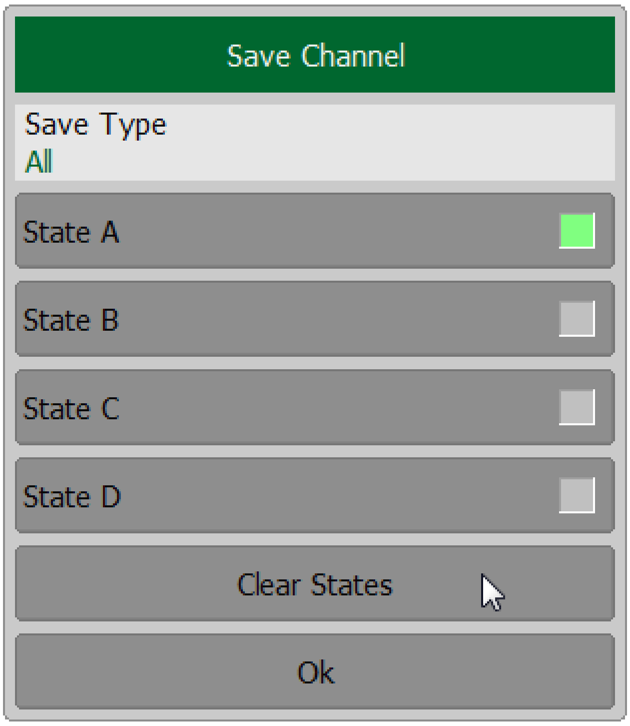


To set a save option, click on **Save Type** field and select type in Save Type dialog (See Analyzer State).

To save the state click **State A | State B | State C | State D** softkey in the Save Channel dialog.



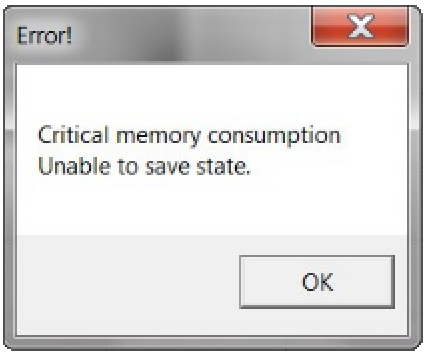
To clear all saved states, click on **Clear States** softkey.



SCPI	MMEMory:STORe:CHANnel MMEMory:STORe:CHANnel:CLEar

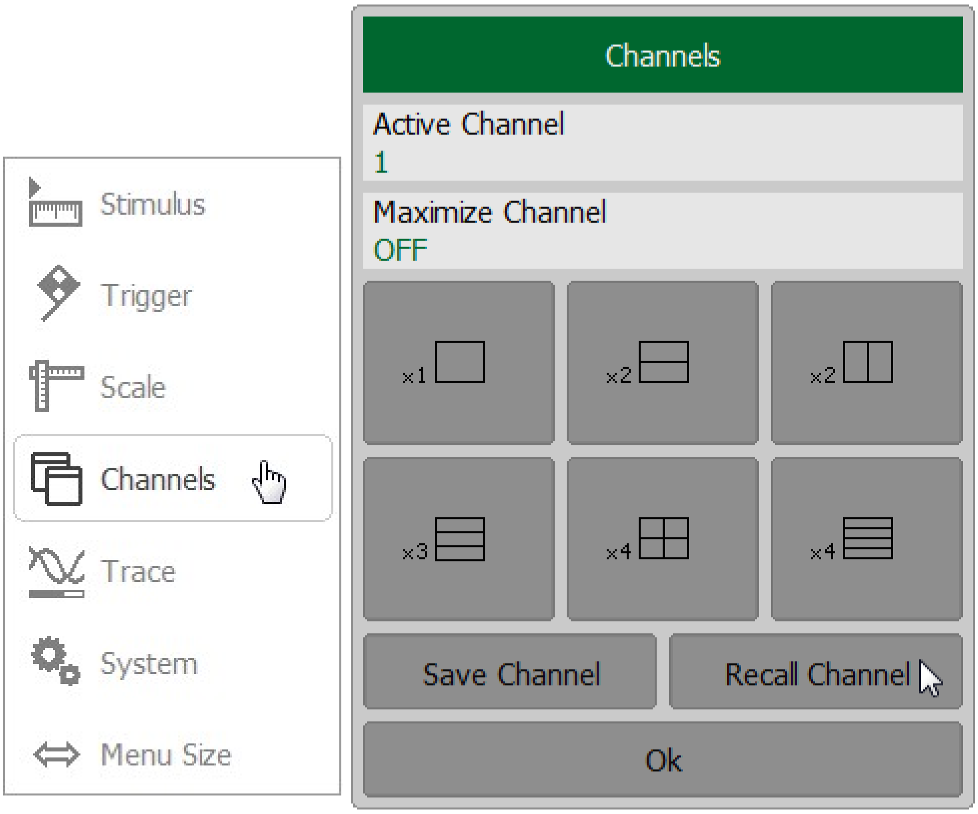
NOTE

The following message will appear on the screen in case of lack of memory (See Instrument Status Bar) when saving state:



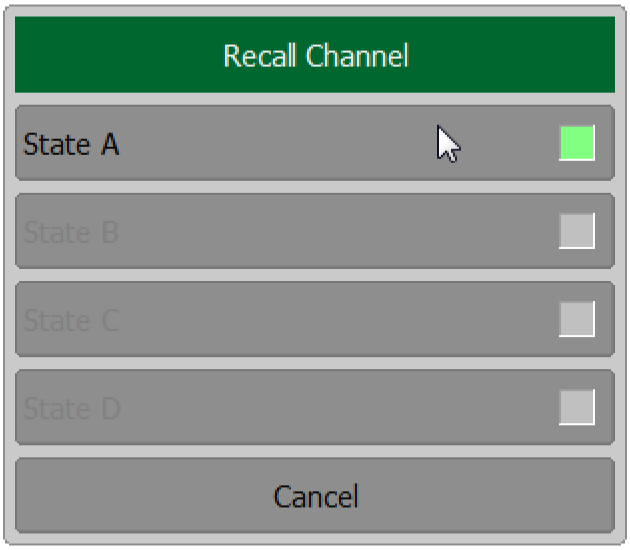
Channel State Recalling

To recall the active channel state use the **Channels > Recall Channel** softkeys.



Click the required softkey of the available **State A | State B | State C | State D**.

If the state with some number was not saved the corresponding softkey will be grayed out.



SCPI	MMEMory:LOAD:CHANnel

Calibration Saving/Recalling

The calibration of a channel can be saved to a file. The file contains the frequency data, calibration coefficients and calibration info. The files have *.CAL extension and are saved in the *\State* subdirectory of the main application directory.

Channel Calibration Saving

To save the channel calibration use the **Files > Save Calibration** softkeys.

Select a path and enter the file name in the pop-up dialog.

Navigation in directory tree is available in Save Calibration dialog.

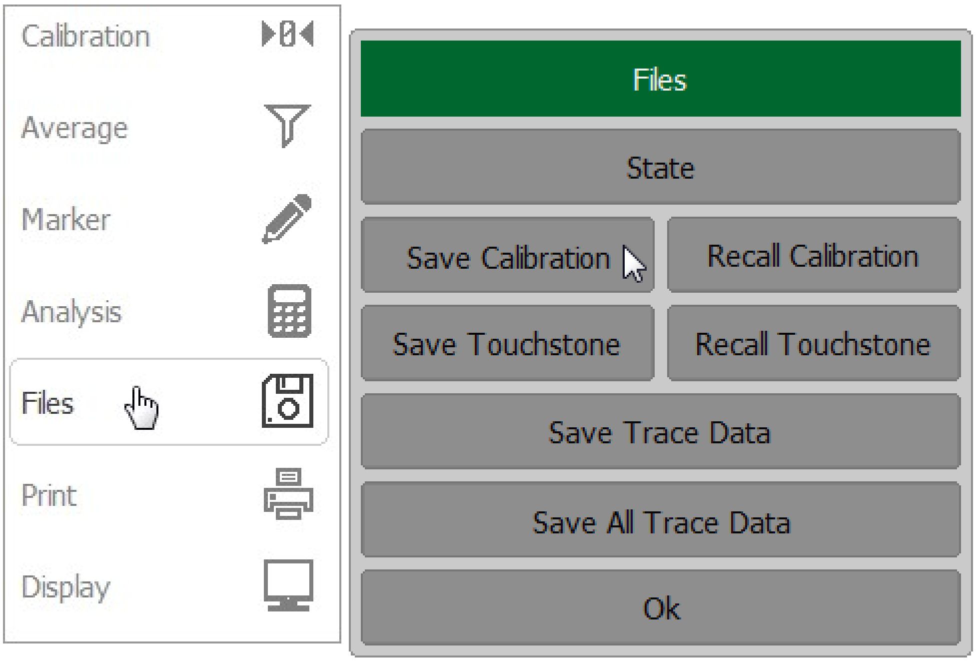
To open a directory and activate it, double click on the directory name.

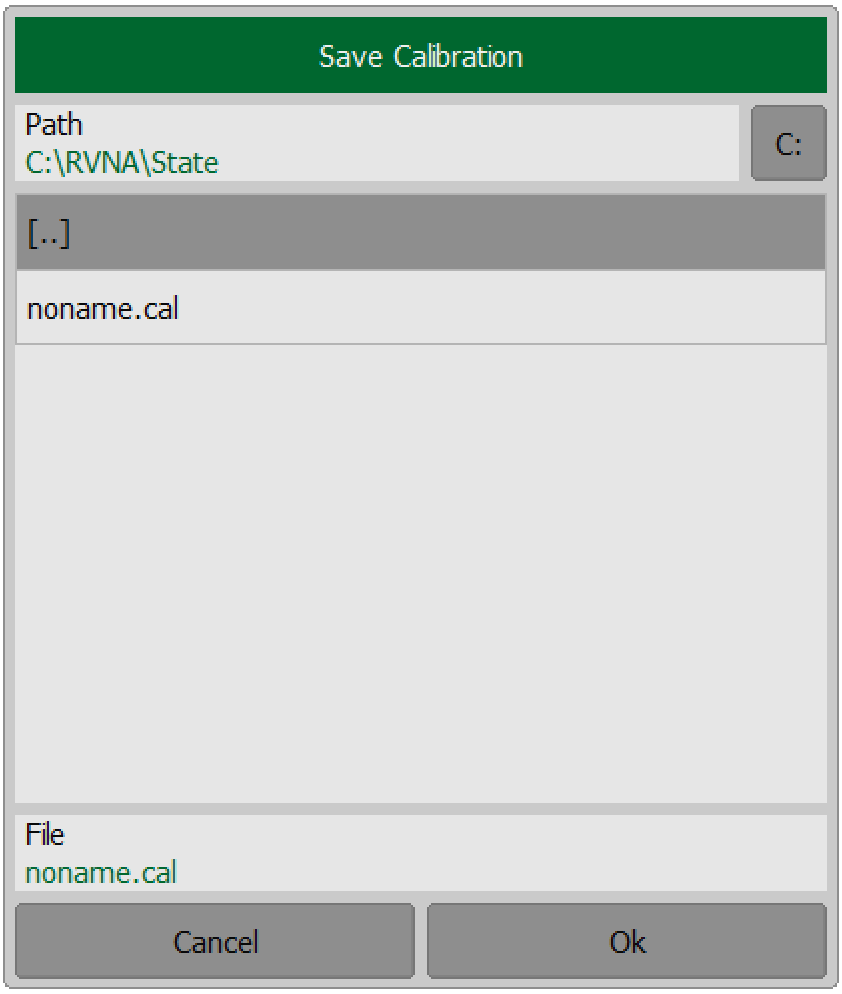
To go up in the directory hierarchy, double click on the "…" field.

To select the disk, click the disk letter softkey.

To change the name of the saved file using the on-screen keypad, double click on the **File** field.

To save the file, in the Save Calibration dialog, click **Ok** softkey.





SCPI MMEMory:STORe:CHANnel:CALibration

Channel Calibration Recalling

To recall the channel calibration use the **Files > Recall Calibration** softkeys.

Select a path and enter the file name in the pop-up dialog.

Navigation in directory tree is available in Recall Calibration dialog.

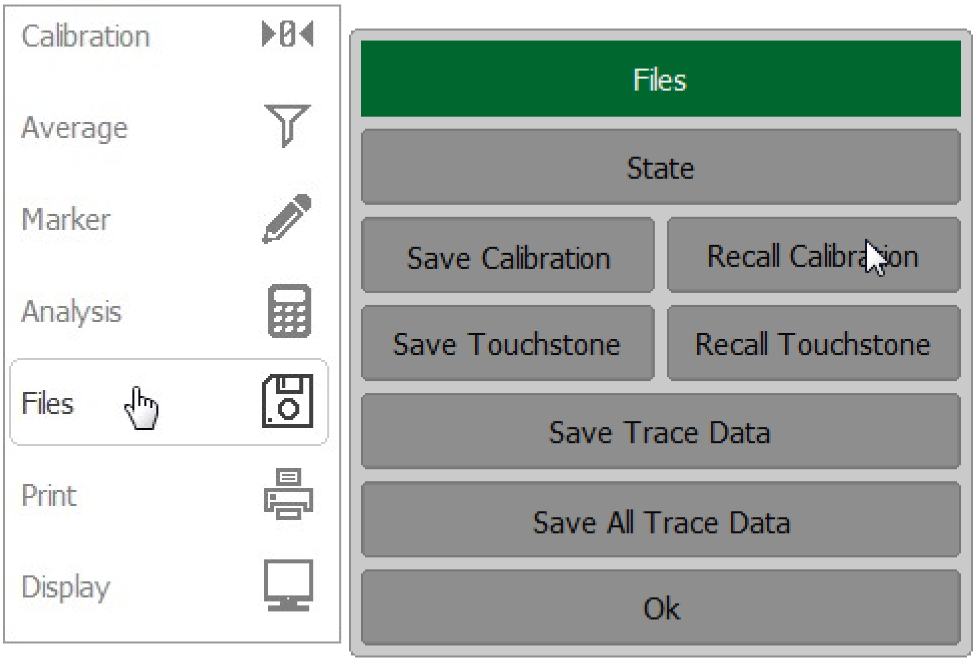
To open a directory and activate it, double click on the directory name.

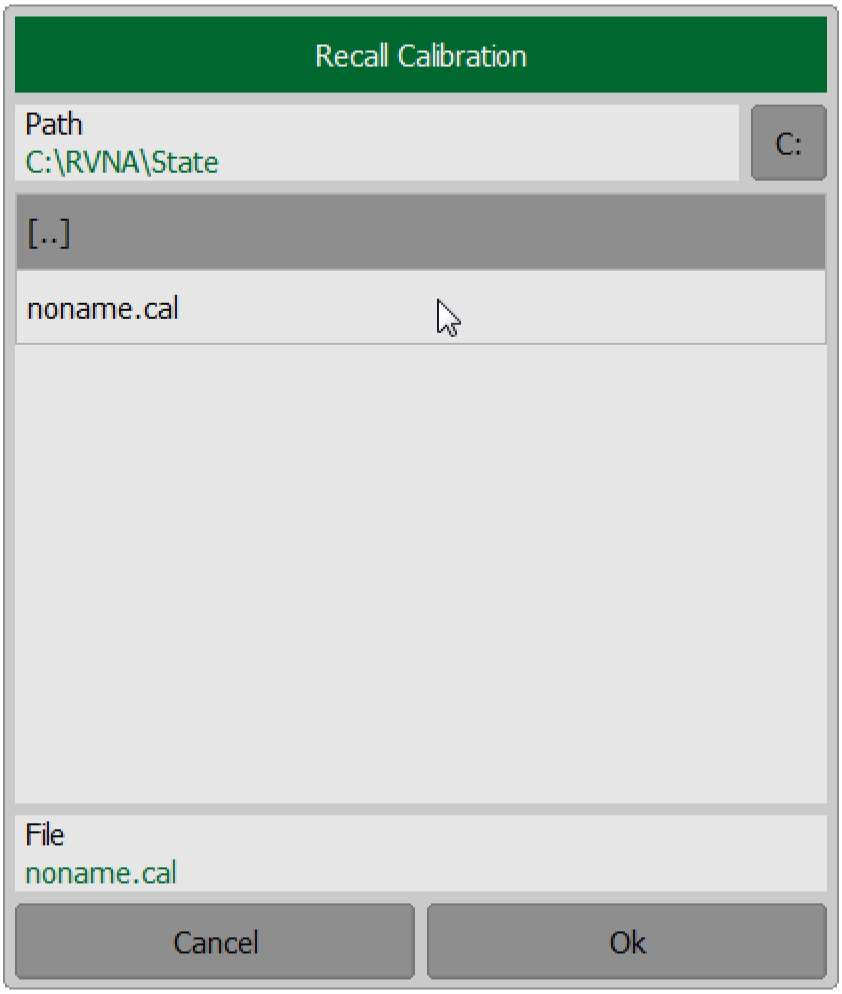
To go up in the directory hierarchy, double click on the "…" field.

To select the disk, click the disk letter softkey.

To change the name of the saved file using the on-screen keypad, double click on the **File** field.

To save the file, in the Recall Calibration dialog, click **Ok** softkey.





SCPI MMEMory:LOAD:CHANnel:CALibration

Trace Data CSV File

Trace data can be saved as a *.CSV file (comma separated values). The *.CSV file contains digital data separated by commas. The active trace stimulus and response values in current format are saved to *.CSV file.

One (active) trace data or all traces of the active channel are saved to the file.

The active trace data is saved to *.CSV in the following format:

F[0],	Data1,	Data2
F[1],	Data1,	Data2
. . .		
F[N],	Data1,	Data2

F[n] — frequency at measurement point n.

Data1 — trace response in rectangular format, real part in Smith chart and polar format.

Data2 — zero in rectangular format, imaginary part in Smith chart and polar format.

Before saving the *.CSV file, activate the trace (See Active Trace Selection).

The all traces of active channel are saved to *.CSV in the following format:

F[0],	Data11,	Data21,	Data22,	Data22,	. . .	Data1N,	Data2N
F[1],	Data11,	Data21,	Data22,	Data22,	. . .	Data1N,	Data2N
. . .							
F[N],	Data11,	Data11,	Data22,	Data22,	. . .	Data1N,	Data2N

F[n] — frequency at measurement point n.

Data1N — trace response in rectangular format, real part in Smith chart and polar format.

Data2N — zero in rectangular format, imaginary part in Smith chart and polar format.

Before saving the *.CSV file, activate the channel (See Active Channel Selection).

CSV File Saving

To save the active trace data, use the **Files > Save Trace Data** softkeys.

Select a path and enter the file name in the pop-up dialog.

Navigation in directory tree is available in Save Trace Data dialog.

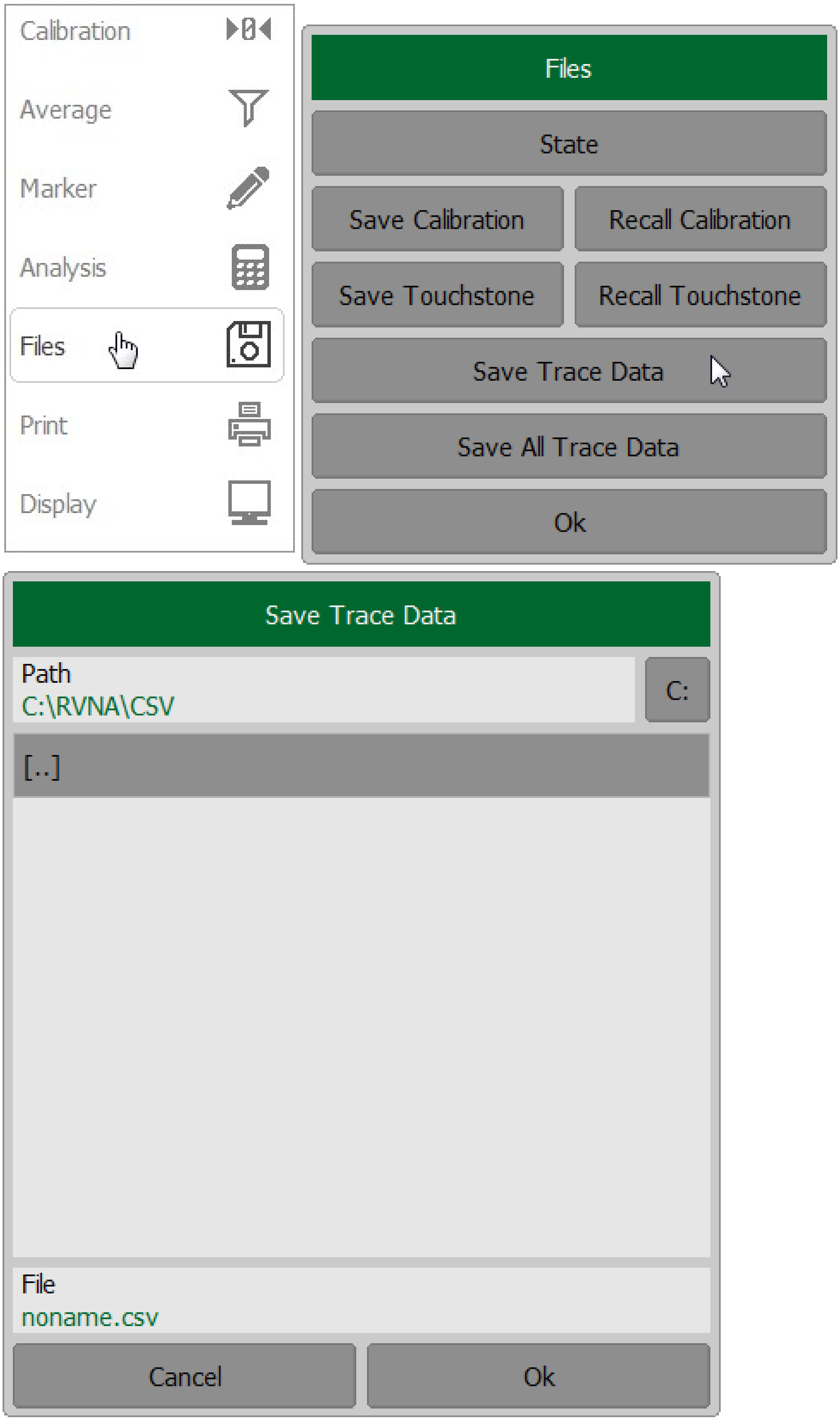
To open a directory and activate it, double click on the directory name.

To go up in the directory hierarchy, double click on the "…" field.

To select the disk, click the disk letter softkey.

To change the name of the saved file using the on-screen keypad, double click on the **File** field.

To save the file, in the Save Trace Data dialog, click **Ok** softkey.



To save all trace data in active channel, use the **Files > Save All Trace Data** softkeys.

Select a path and enter the file name in the pop-up dialog.

Navigation in directory tree is available in Save All Trace Data dialog.

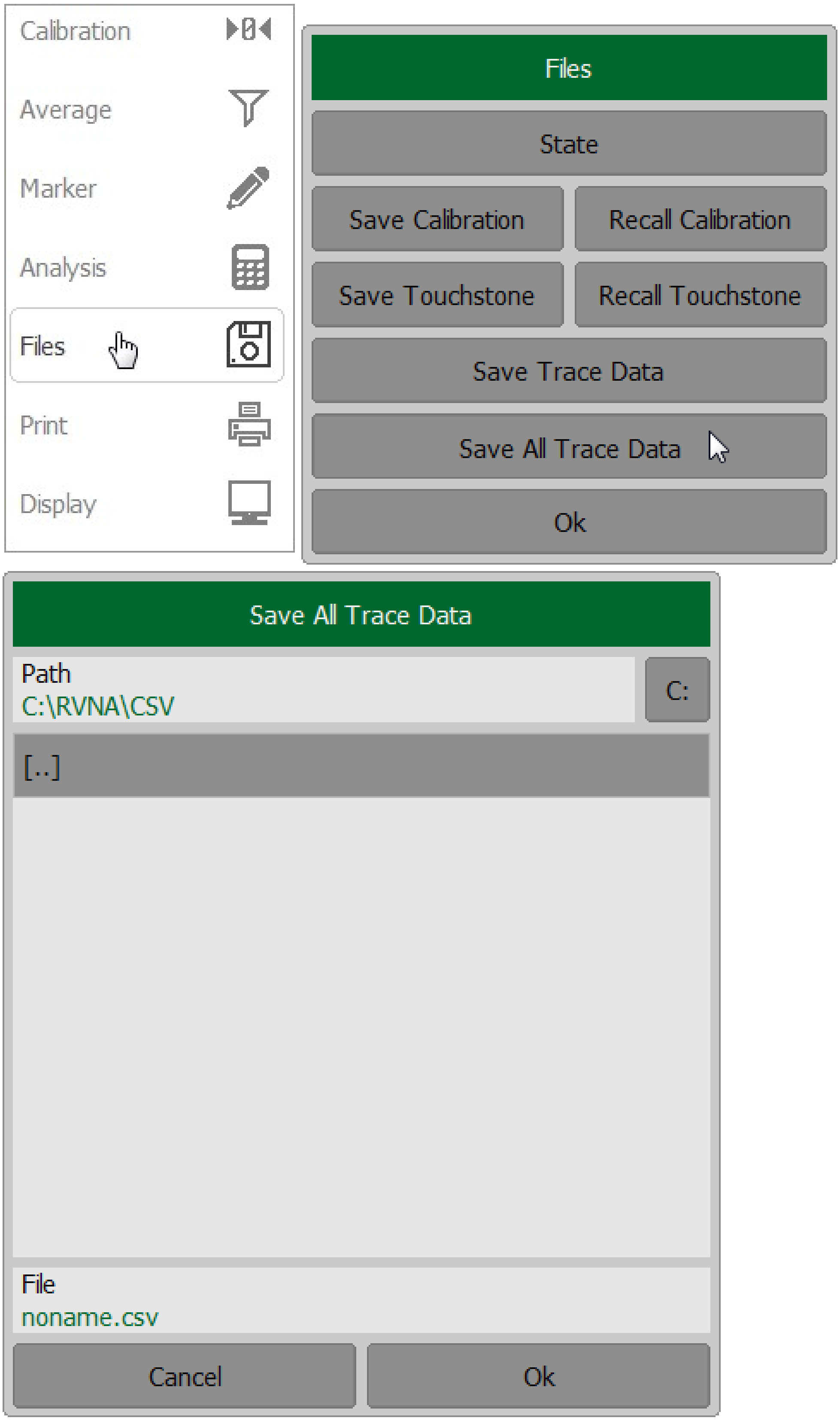
To open a directory and activate it, double click on the directory name.

To go up in the directory hierarchy, double click on the "…" field.

To select the disk, click the disk letter softkey.

To change the name of the saved file using the on-screen keypad, double click on the **File** field.

To save the file, in the Save All Trace Data dialog, click **Ok** softkey.



SCPI [MMEMory:STORe:FDATa]()

Trace Data Touchstone File

The Analyzer allows to save S-parameters to a Touchstone file. Files in this format are typical for most circuit simulator programs. The Touchstone file contains frequency values and S-parameters. Only one (active) trace is saved to the file (See Active Trace Selection).

The Touchstone file saving function is applied to individual channels. Activate the channel to use this function (See Active Channel Selection).

The *.S1P files are used for saving S11 parameters of a one-port device.

The *.S2P files are used for saving all four S-parameters of a two-port device.

The Touchstone file contains comments, header, and trace data lines. The header starts from the «#» symbol. Comments start from the «!» symbol. Comment contains following strings:

- Model, serial number, software version.
- Save date (in dd.mm.yyyy hh:mm:ss format).
- The name of the saved parameters and their units.

The *.S1P Touchstone file for one-port measurements:

! Comments		
# Hz S FMT R Z0		
F[0]	{S11}’	{S11}”
F[1]	{S11}’	{S11}”
	. . .	
F[N]	{S11}’	{S11}”

The *.S2P Touchstone file for two-port measurements:

! Comments								
# Hz S FMT R Z0								
F[0]	{S11}’	{S11}”	{S21}’	{S21}”	{S12}’	{S12}”	{S22}’	{S22}”
F[1]	{S11}’	{S11}”	{S21}’	{S21}”	{S12}’	{S12}”	{S22}’	{S22}”
				. . .				
F[N]	{S11}’	{S11}”	{S21}’	{S21}”	{S12}’	{S12}”	{S22}’	{S22}”

Hz — frequency measurement units (**kHz, MHz, GHz**);

FMT — data format:

- **RI** — real and imaginary parts;

- **MA** — linear magnitude and phase in degrees;
- **DB** — logarithmic magnitude in dB and phase in degrees;

Z0 — reference impedance value;

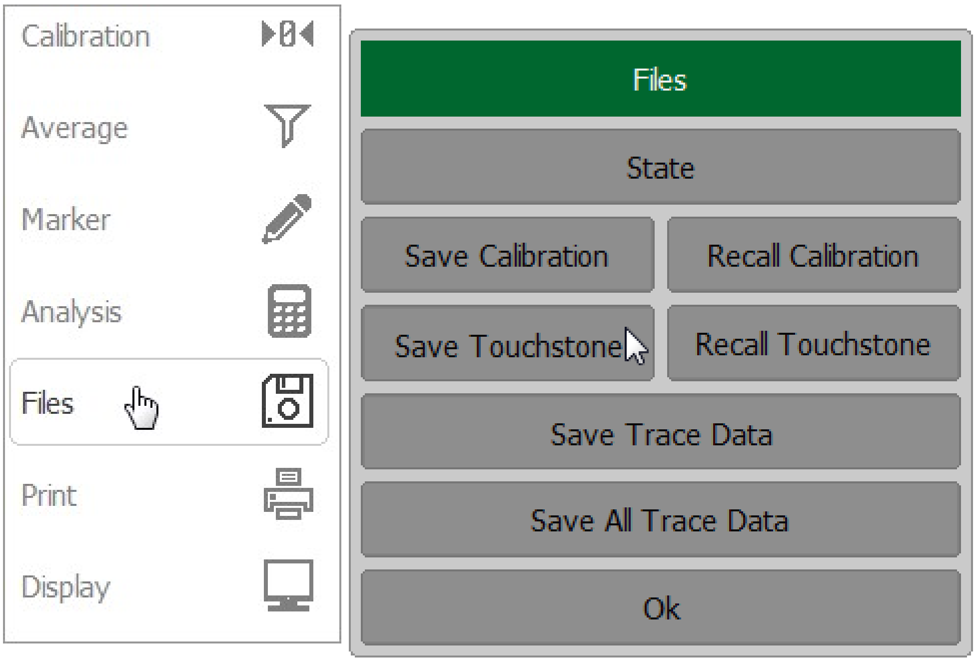
F[n] — frequency at measurement point n;

{…}' — {real part (RI) | linear magnitude (MA) | logarithmic magnitude (DB)};

{…}" — {imaginary part (RI) | phase in degrees (MA) | phase in degrees (DB)}.

Touchstone File Saving

To save the Touchstone format data use the **Files > Save Touchstone** softkeys.



To select the saved Touchstone file format, click on the **Touchstone Format** field and select the required format from the Touchstone Format list. Complete by clicking Ok.

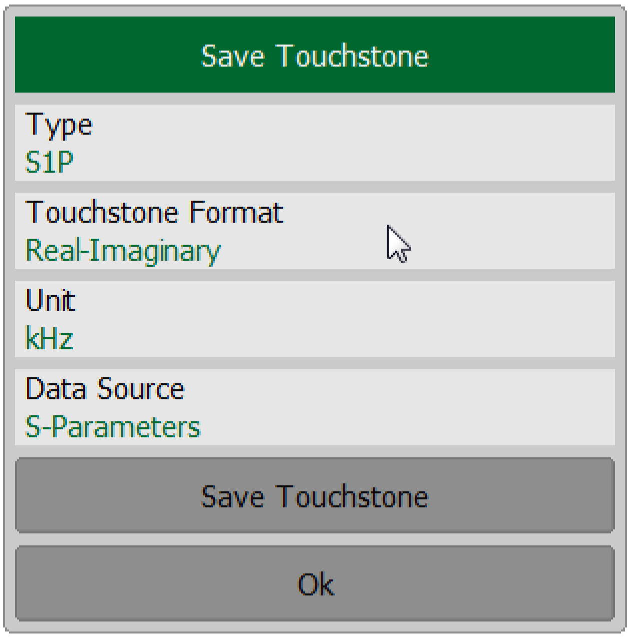
To select the type (S1P or S2P) of Touchstone file, click on the **Type** field.

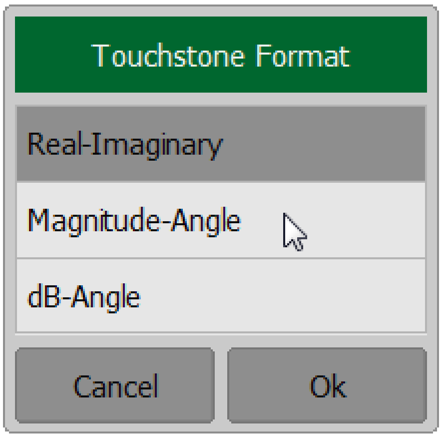
Actual data is used for S11 and zero values for S12, S21, S22.

Click on the **Units** field and select the measurement units if necessary.

To set the data source, click on the **Data Source** field.

NOTE. To save active memory in Touchstone file, first create memory trace (See Memory Trace Function).





Click **Save Touchstone** softkey Save Touchstone dialog.

Select a path and enter the file name in the pop-up dialog.

Navigation in directory tree is available in Save Touchstone dialog.

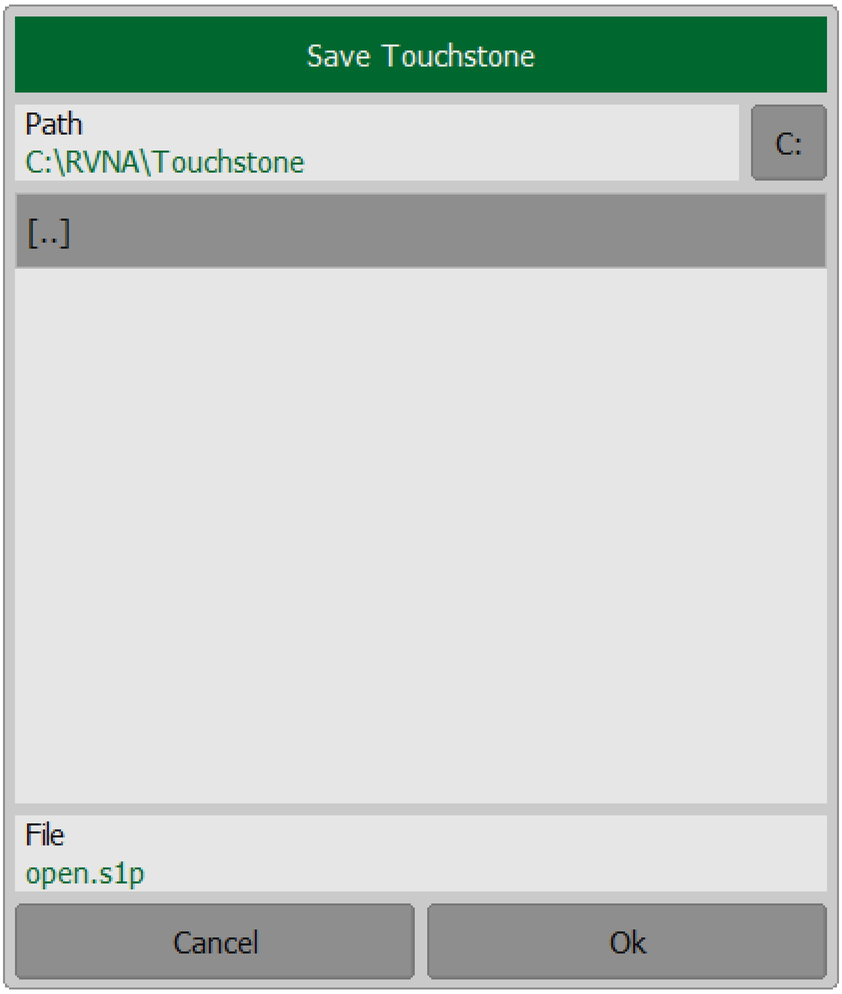
To open directory and activate it, double click on the directory name.

To go up in the directory hierarchy, double click on the "…" field.

To select the disk, click the disk letter softkey.

To change the name of the saved file using the on-screen keypad click on the **File** field.

To save the file, in the Save Touchstone dialog, click **Ok** softkey.

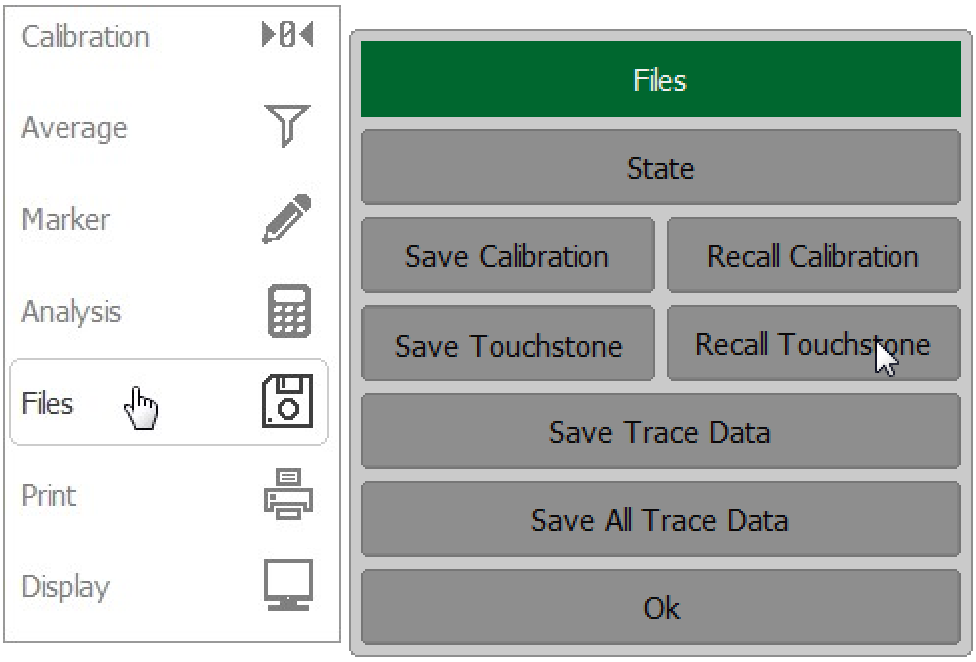


SCPI	MMEMory:STORe:SNP:FORMat MMEMory:STORe:SNP:TYPE:S1P, MMEMory:STORe:SNP:TYPE:S2P MMEMory:STORe:SNP

Touchstone File Recalling

The Analyzer allows to recall data from the Touchstone files. Data can be loaded to memory traces or to data traces. When loading data to data traces, the Analyzer switches to hold mode to avoid writing over the recalled data with current data. When loading data to the memory traces, the sweep hold does not occur.

To recall the data trace, use the **Files > Recall Touchstone** softkeys.

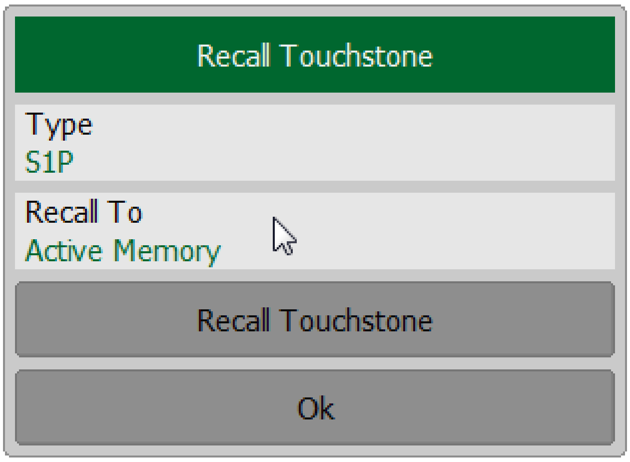


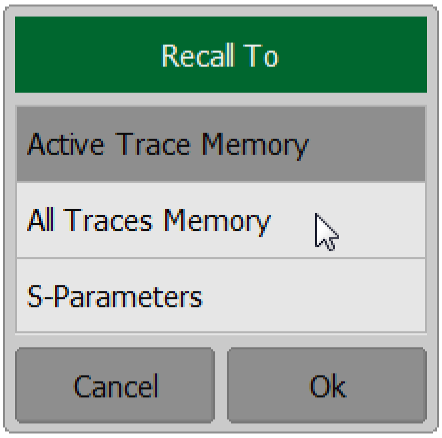
Data can be loaded into the active trace memory, all traces memory or measured by the S parameter.

Then select download option, click on the **Recall To** field:

- **To Active Trace Memory** — loading data to the active trace memory.
- **To All Traces Memory** — loading data to the memory of all traces.
- **To S-parameters** — loading data to all data traces of the channel.

Complete by clicking **Ok** softkey.





Click **Recall Touchstone** softkey in Recall Touchstone dialog.

Select a path and enter the file name in the pop-up dialog.

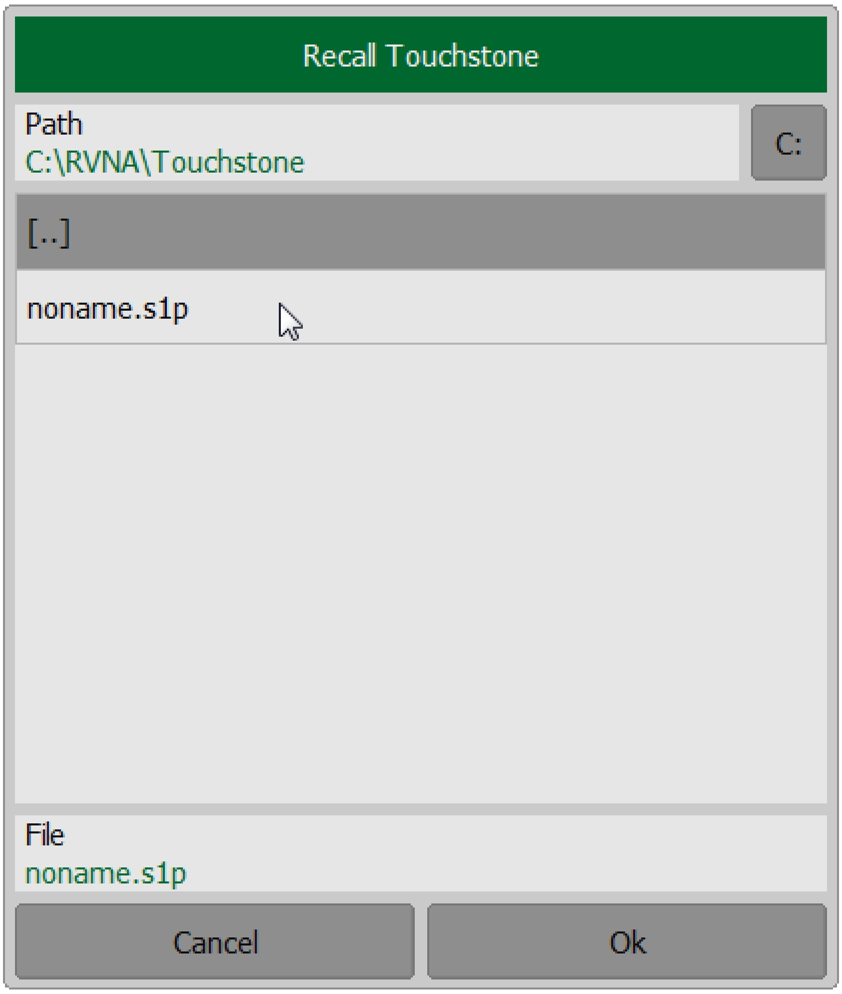
Navigation in directory tree is available in Recall Touchstone dialog.

To open directory and activate it, double click on the directory name.

To go up in the directory hierarchy, double click on the "…" field.

To select the disk, click the disk letter softkey.

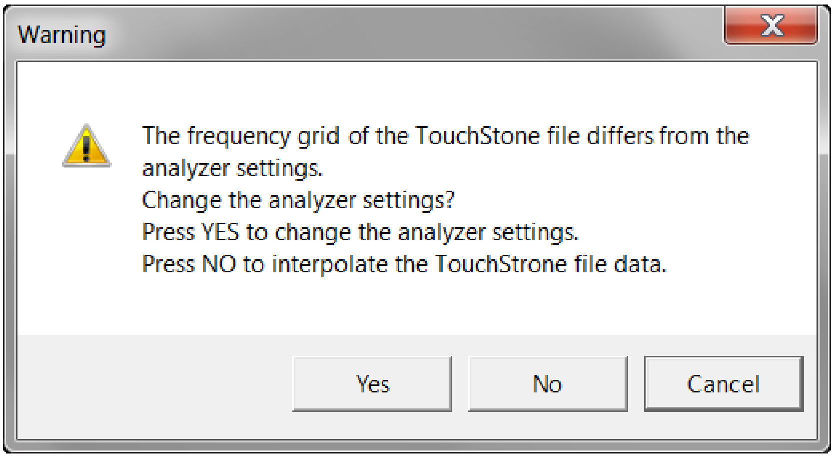
To recall the file in the Recall Touchstone dialog, click **Ok** softkey.



SCPI	MMEMory:LOAD:SNP, MMEMory:LOAD:SNP:TRACe:MEMory

NOTE

If the frequency scale of the Touchstone file does not correspond with the current Analyzer frequency settings, the data is interpolated, or the Analyzer settings are changed. The following message will appear on the screen when saving state:



Managing Devices

NOTE	This section is available for RNVNA.

Devices tab in the right menu bar allows controlling the Analyzers connected to PC.

There is no automatic detection of Analyzers connected to USB. In order to work with RNVNA software, an Analyzer has to be added to Devices List (See Connecting devices to a USB port), its serial number should be in the license file and the license must be activated (See Activating License).

Connecting devices to a USB port

NOTE	This section is available for RNVNA.

When running the software with several devices, each of them is assigned a port number in the order of their connection to the personal computer. If the analyzers were connected to the USB interfaces of the computer before starting the software, the numbering of the ports will follow the internal numbering of the USB host interfaces.

CAUTION	If devices are supposed to use the synchronization mode via the USB bus (e.g. without connected reference frequency and triggers signal of the Analyzers), then all Analyzers must be connected to USB interfaces that are serviced by one controller. Usually, this is a nearby USB port of a personal computer. If, when using USB bus synchronization, the analyzers are connected to different USB controllers within the same computer, the devices cannot be synchronized. A good solution is to use an external USB HUB with its own power supply.

Adding/Removing devices

NOTE	This section is available for RNVNA.

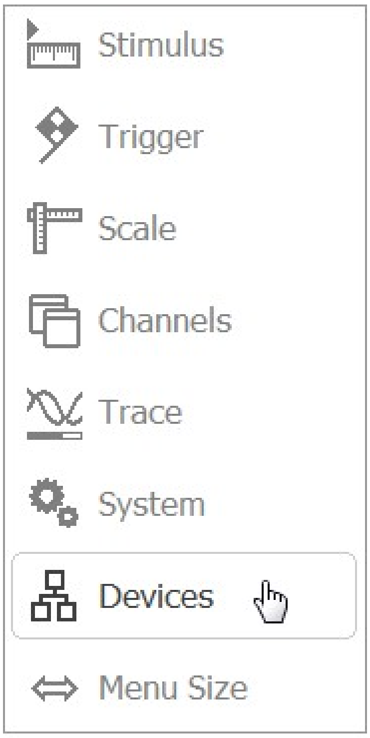
To add a device connected to PC, click on the **Devices > Add Next** softkey.

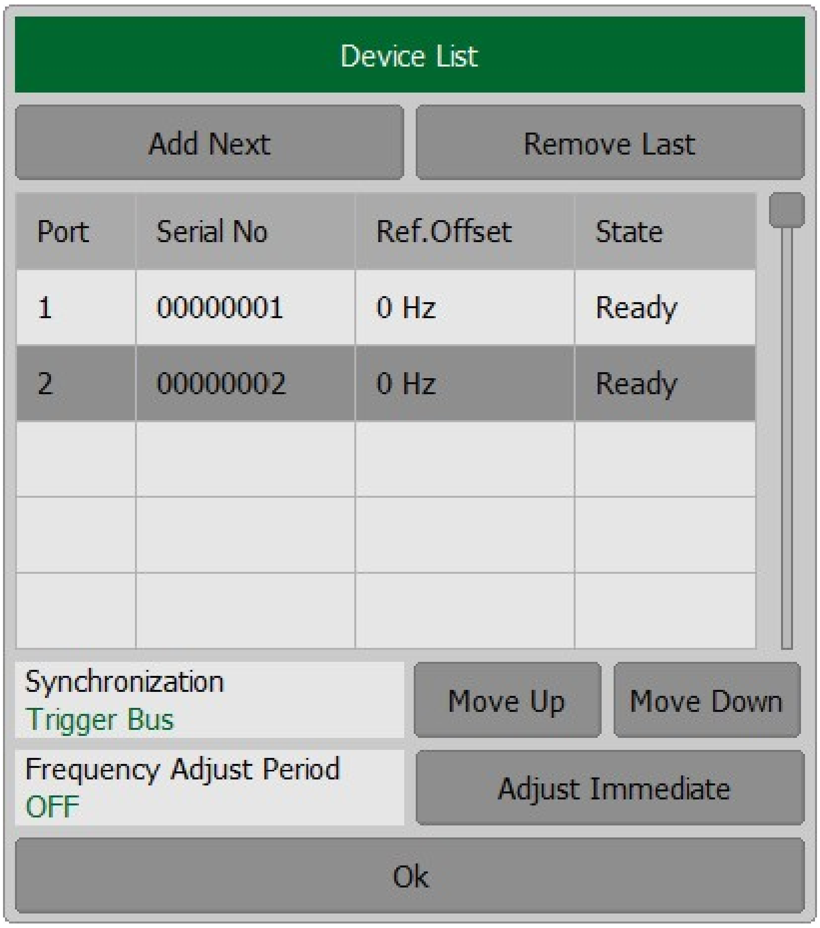
To remove the last device in the list press **Devices > Remove Last** softkey.

List of devices provides with the following information:

- **Port** indicates the port number assigned to each the Analyzer.
- **Serial No** indicates the serial number of the Analyzer.
- **Ref.Offset** indicates current reference frequency offset of Analyzer (See Frequency adjustment of the internal generators).
- **State** indicates Analyzer state (**Ready** — Analyzer is ready for operating, **Not Ready** — no connection with the Analyzer).

Move Up and **Move Down** softkeys move selected Analyzer up and down the list, which allows to designate Analyzer particular port number.





SCPI DEVices:ADDNext, DEVices:REMLast

DEVices:MOVUp, DEVices:MOVDown

Selecting Analyzers' synchronization mode

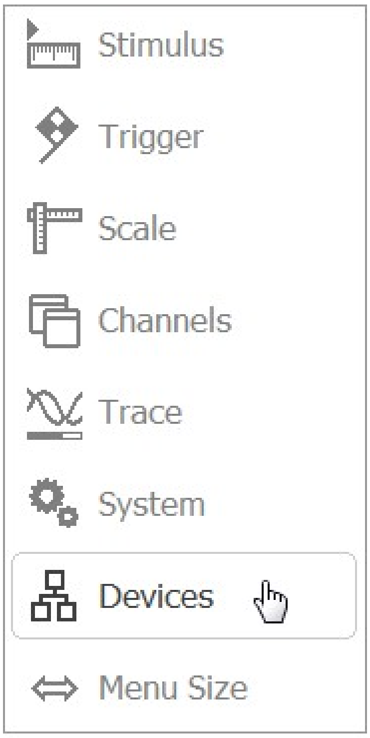
NOTE	This section is available for RNVNA.

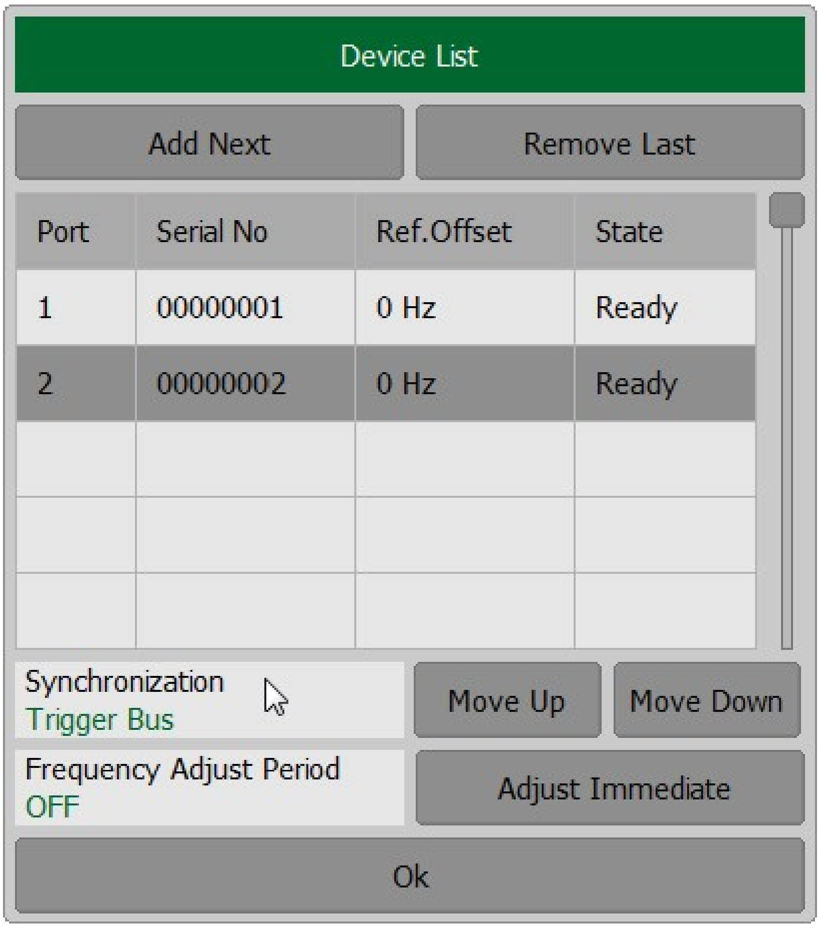
To perform transmission measurement, the Analyzers must operate synchronously. Reflection measurement (e.g. independent measurements) does not require synchronization.

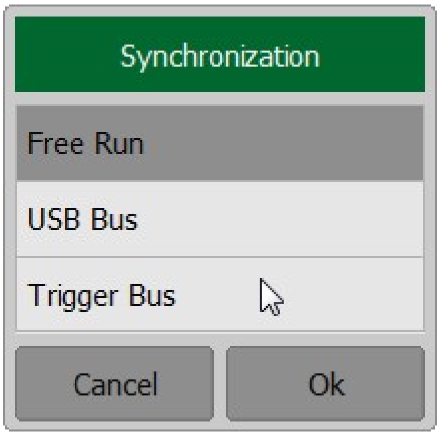
The software allows selection of the following options:

Free Run	Analyzers operate independently and allows to measure DUT reflection only.
USB Bus	Synchronization is performed by sending special commands to the Analyzers through USB bus. This allows measuring reflection and transmission coefficients of a DUT. Analyzers do not have to be connected through trigger bus, but the measurement speed is much lower than in **Trigger bus** synchronization mode.
Trigger Bus	Synchronization is performed by trigger signals issued by Analyzers themselves. The Analyzers trigger input/output signals should be connected through TD-16 distributor, or coaxial cable in case of using 2 Analyzers. This allows to measure reflection and transmission coefficients. Measurement speed is much higher in comparison with the USB bus synchronization mode.

To select the necessary type of synchronization, press the **Devices > Synchronization > Free Run | USB Bus | Trigger Bus** softkeys.


Stimulus
Trigger
Scale
Channels
Trace
System
Devices
Menu Size


Device List
Add Next
Remove Last
Port
Serial No
Ref.Offset
State
1
00000001
0 Hz
Ready
2
00000002
0 Hz
Ready
Synchronization
Trigger Bus
Move Up
Move Down
Frequency Adjust Period
OFF
Adjust Immediate
Ok



SCPI DEVices:METHod

Frequency adjustment of the internal generators

NOTE	This section is available for RNVNA.

Analyzers' internal reference generators have the finite frequency accuracy. When working with several Analyzers in Internal frequency synchronization mode (See Selecting Analyzers' synchronization mode) the output frequency of each of Analyzer must be set relative to the Analyzer designated as port 1 (See Connecting devices to a USB port). This eliminates the error in the measurement of the transmission coefficients due to frequency of a single Analyzer not falling in the bandwidth of the filter of another Analyzer.

By default, adjustment automatically start to work when Analyzers are connected to software. The parameters of the automatic adjustment and its periodicity can be specified by user.

When performing the frequency adjustment, ports of the Analyzers should be connected together directly or via DUT. It is necessary to ensure the attenuation of the signal propagation between ports is not more than 50 dB.

The tuning is performed on the central frequency of the specified frequency range of active channel.

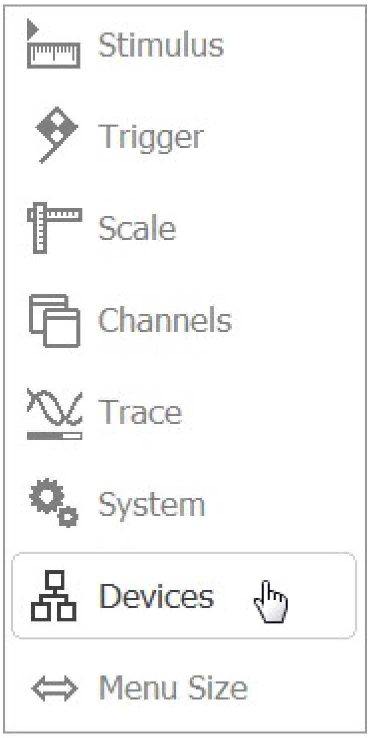
The Analyzer should be warmed up before measuring in order to minimize the temperature drift of reference generators.

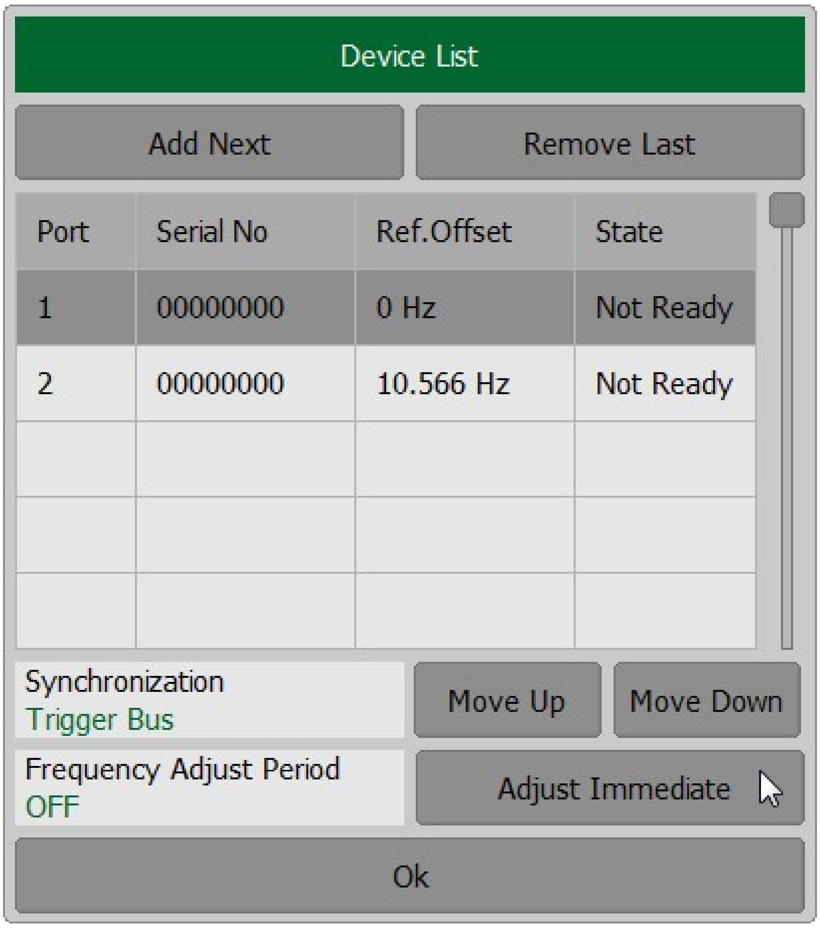
NOTE	In case of **External** or **Linked** frequency synchronization mode is selected, manual frequency tuning is not required. The value of the frequency offset in this case is indicated as 0.

Manual frequency adjustment

To perform manual frequency adjustment, press the **Devices > Adjust Immediate** softkeys.

The frequency offset value of each Analyzer relative to the Analyzer designated as port 1 will be indicated in the **Ref. Offset** column of the **Device List**.





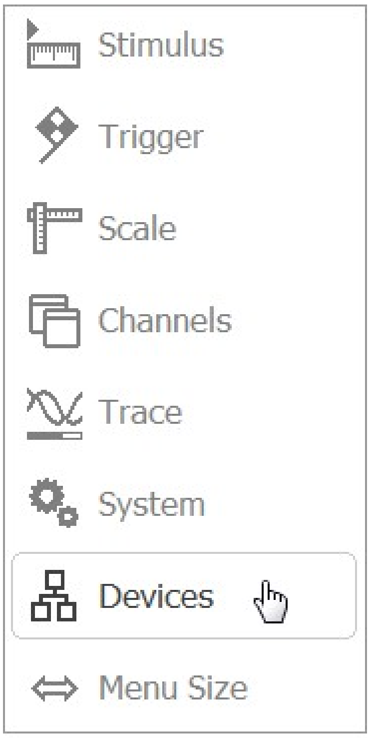
SCPI DEVices:ADJust:Execute

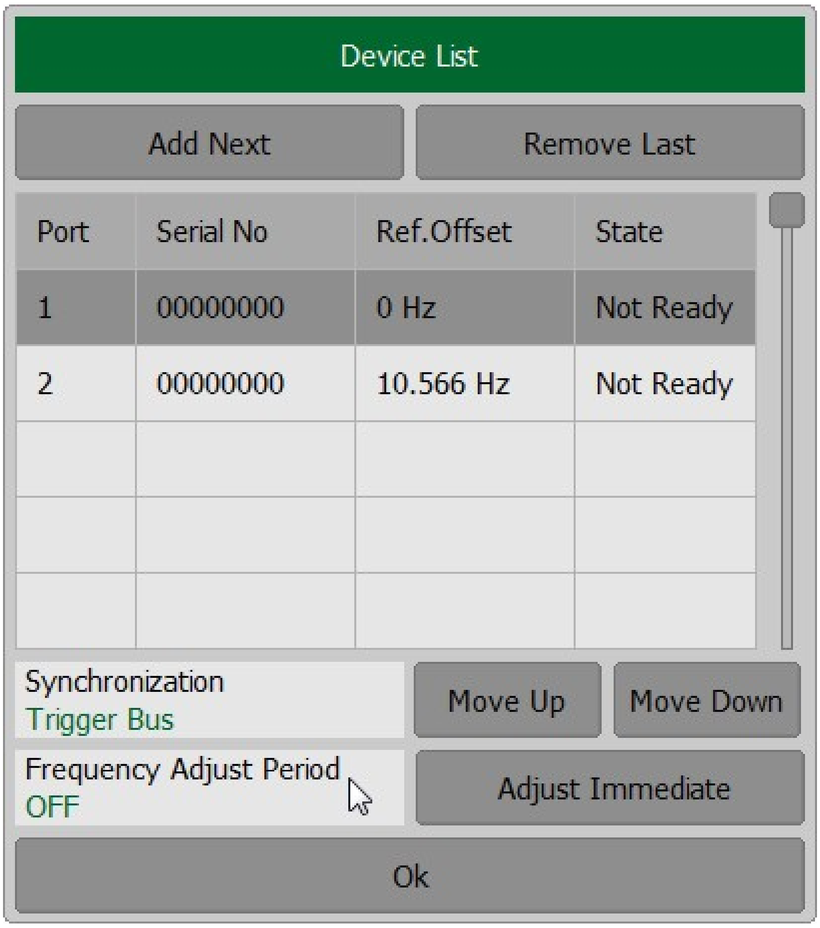
Automatic frequency adjustment

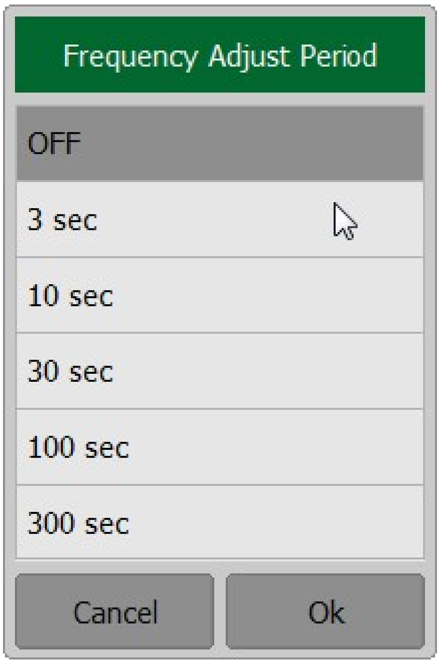
In the automatic frequency adjustment mode, the software performs the adjustment in a specified time interval. The real interval of the adjustment can be longer than specified.

To perform automatic frequency adjustments, press the softkey **Devices** and click the left mouse button on the field **Frequency Adjust Period**.

In dialog window **Frequency Adjust Period** select the time interval and press **Ok** softkey.


Stimulus
Trigger
Scale
Channels
Trace
System
Devices
Menu Size


Device List
Add Next
Remove Last
Port
Serial No
Ref.Offset
State
1
00000000
0 Hz
Not Ready
2
00000000
10.566 Hz
Not Ready
Synchronization
Trigger Bus
Move Up
Move Down
Frequency Adjust Period
OFF
Adjust Immediate
Ok



SCPI	DEVices:ADJust:PERiod

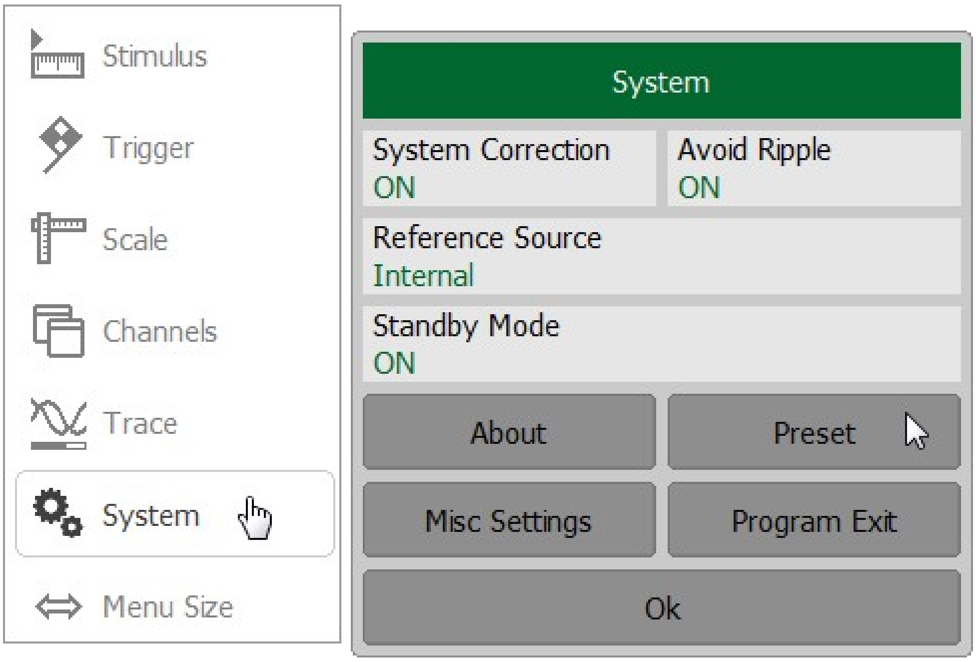
System Settings

Analyzer Presetting

Analyzer presetting feature allows the user to restore the default settings of the instrument.

The default settings of the Analyzer are specified in Default Settings Table.

To restore the initial state of the Analyzer, use the **System > Preset** softkey.



SCPI	SYSTem:PRESet

Graph Printing

This section describes the print/save procedures for graph data.

The print function is provided with the preview feature, which allows to view the image to be printed on the screen, and/or save it to a file.

The graphs can be printed using three different applications:

- MS Word (Windows only).
- Image Viewer for windows (Windows & Linux).
- Save screen shot in *.PNG format using the software menu (Windows & Linux).

NOTE The MS Word application must be installed on the Windows system.

Print color can be selected before the image is transferred to the printing application:

- color (no changes)
- gray scale
- black & white

The image can also be inverted before it is transferred to the printing application.

The current date and time can be added before the image is transferred to the printing application.

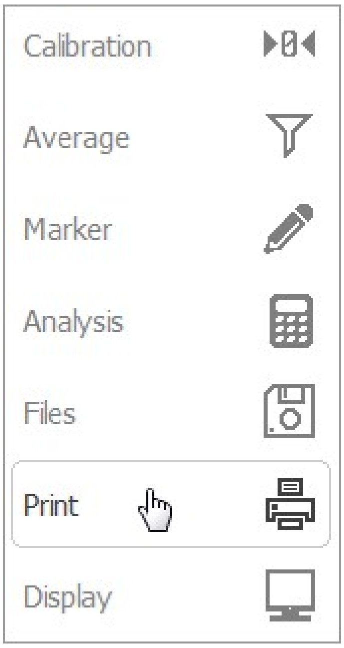
Graph Printing Procedure

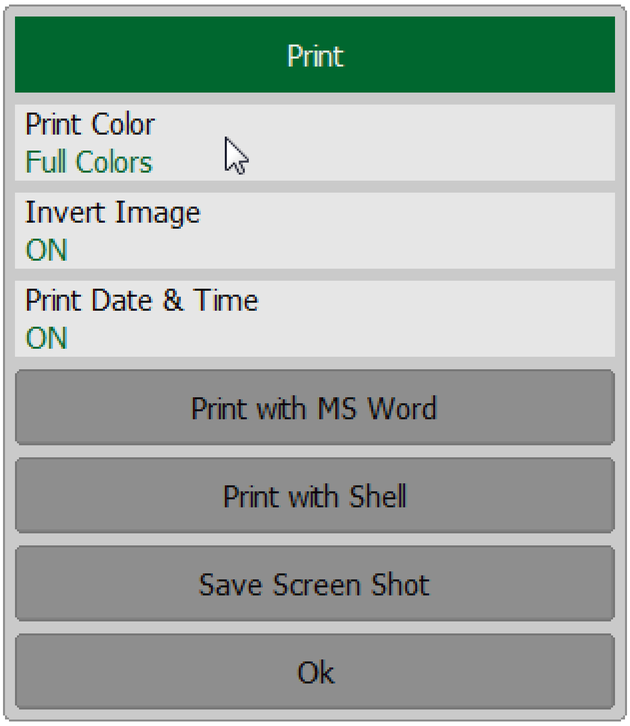
To print channels graph area, click on the **Print** softkey.

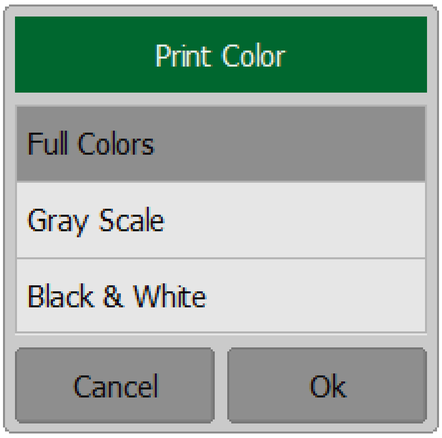
If necessary, select the print color, click on the **Print Color** field and select color in Print Color dialog.

If necessary, invert the image by **Invert Image** field.

If necessary, select printing of date and time by **Print Date& Time** field.







Click on **Print with MS Word | Print with Shell** softkey.

Close Print dialog by clicking **Ok** softkey.

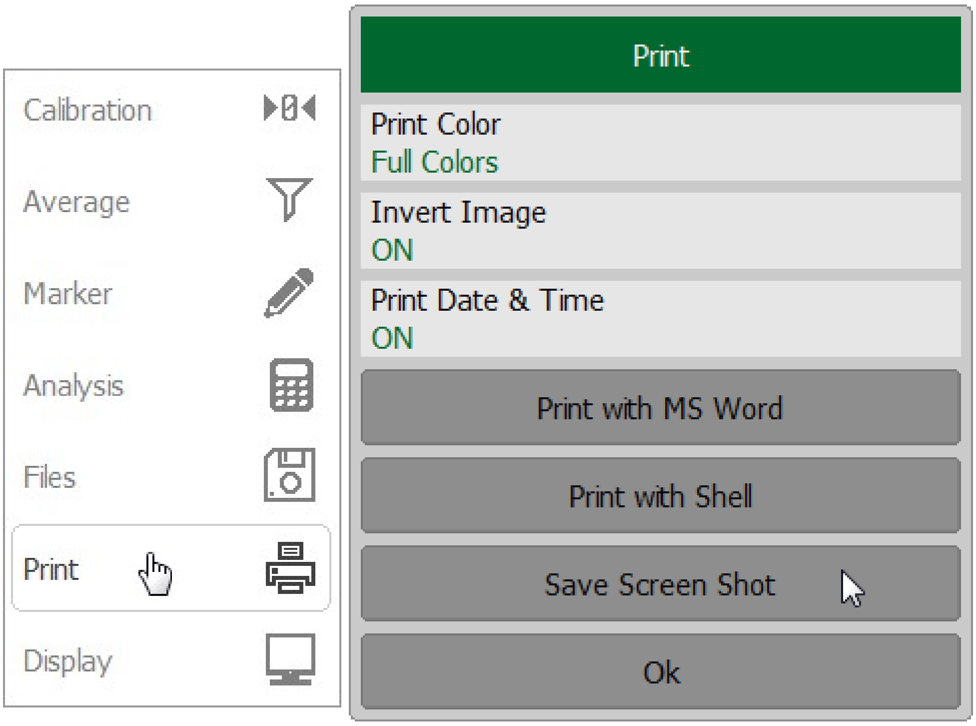
	HCOPy
SCPI	HCOPy:IMAGe, HCOPy:DATE:STAMp, HCOPy:PAINt
	MMEMory:STORe:IMAGe

Quick saving software screen shot

To save screen shot of the channels graph data use the **Print** softkey.

Click **Save Screen Shot** softkey in the Print dialog.

The files will be saved to the Image folder located in the main software folder. The saved files will be automatically assigned the following name "scrXXXXX.png" where XXXXX is automatically incremented ordinal number.



System Correction Setting

The Analyzer is supplied from the manufacturer calibrated with the calibration coefficients stored in its non-volatile memory. The factory calibration is used by default for initial correction of the measured S-parameters. Such calibration is referred to as system calibration, and the error correction is referred to as system correction.

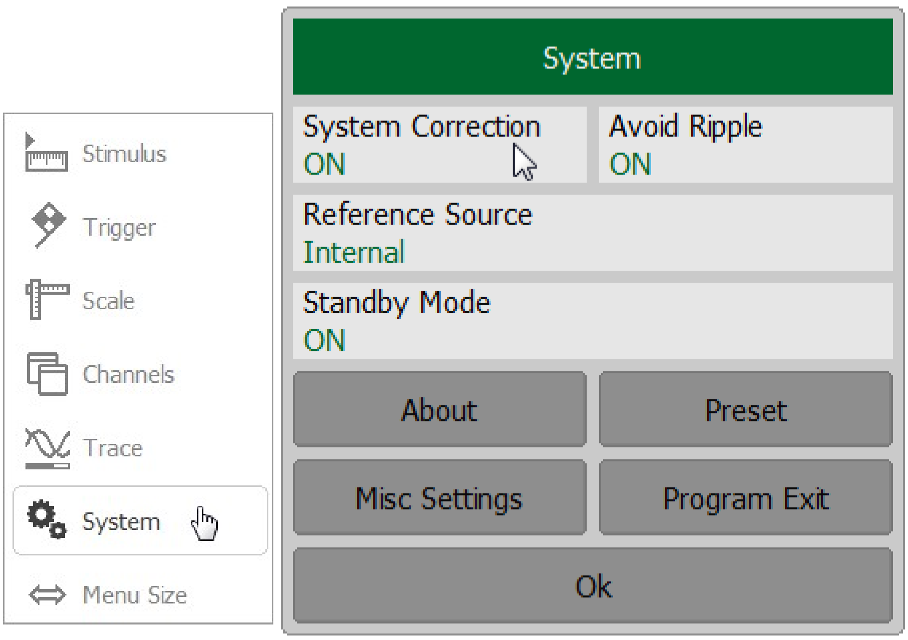
The system correction ensures initial values of the measured S-parameters before the Analyzer is calibrated by the user. The system calibration is performed at the plane of the port physical connectors and leaves out of account the cables and other fixture used to connect the DUT. The measurement accuracy of the Analyzer without its calibration with the user setup is not rated.

Normally, the disabling of the system correction **is not required** for a calibration and further measurements.

The system correction can be disabled only in case the user provided a proper calibration for the Analyzer. The measurement accuracy is determined by user calibration and does not depend on the system correction status. The only rule that should be observed is to disable/enable the system correction before the user calibration, so that the calibration and further measurement could be performed under the same conditions. If system correction is disabled, the message System Correction Off appears in the instrument status bar (See Instrument Status Bar).

To disable/enable the system correction, use the **System** softkey.

Click on the **System Correction** field to toggle between the ON/OFF settings.



SCPI SYSTem:CORRection

Analyzer Model Selection

The Software allows to connect Analyzers as follows:

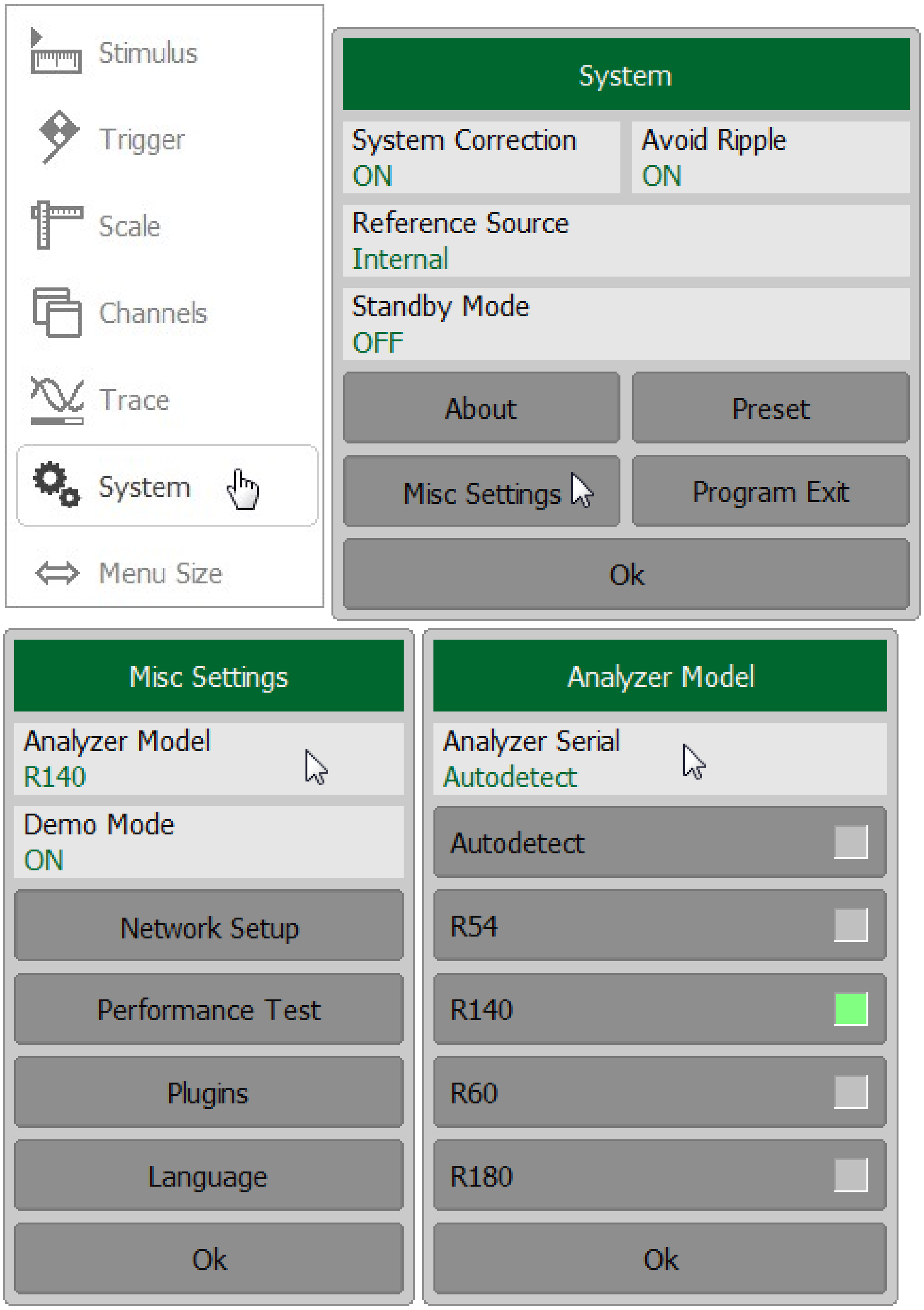
- To any Analyzer connected to USB (Autodetect).
- To a particular Analyzer type, ignoring others.
- To an Analyzer with a particular serial number, ignoring others (RVNA only).

NOTE	To enable RNVNA to operate with an Analyzer, it should be added to Devices List (See Connecting devices to a USB port) and appropriate software license activated (See Activating License).

Analyzer Model Selection for RVNA

To set the model setting use the softkeys **System > Misc Settings > Analyzer Model** and select type.

In case **Analyzer Serial** connection mode is selected, specify Analyzer's serial number by means of the keyboard.

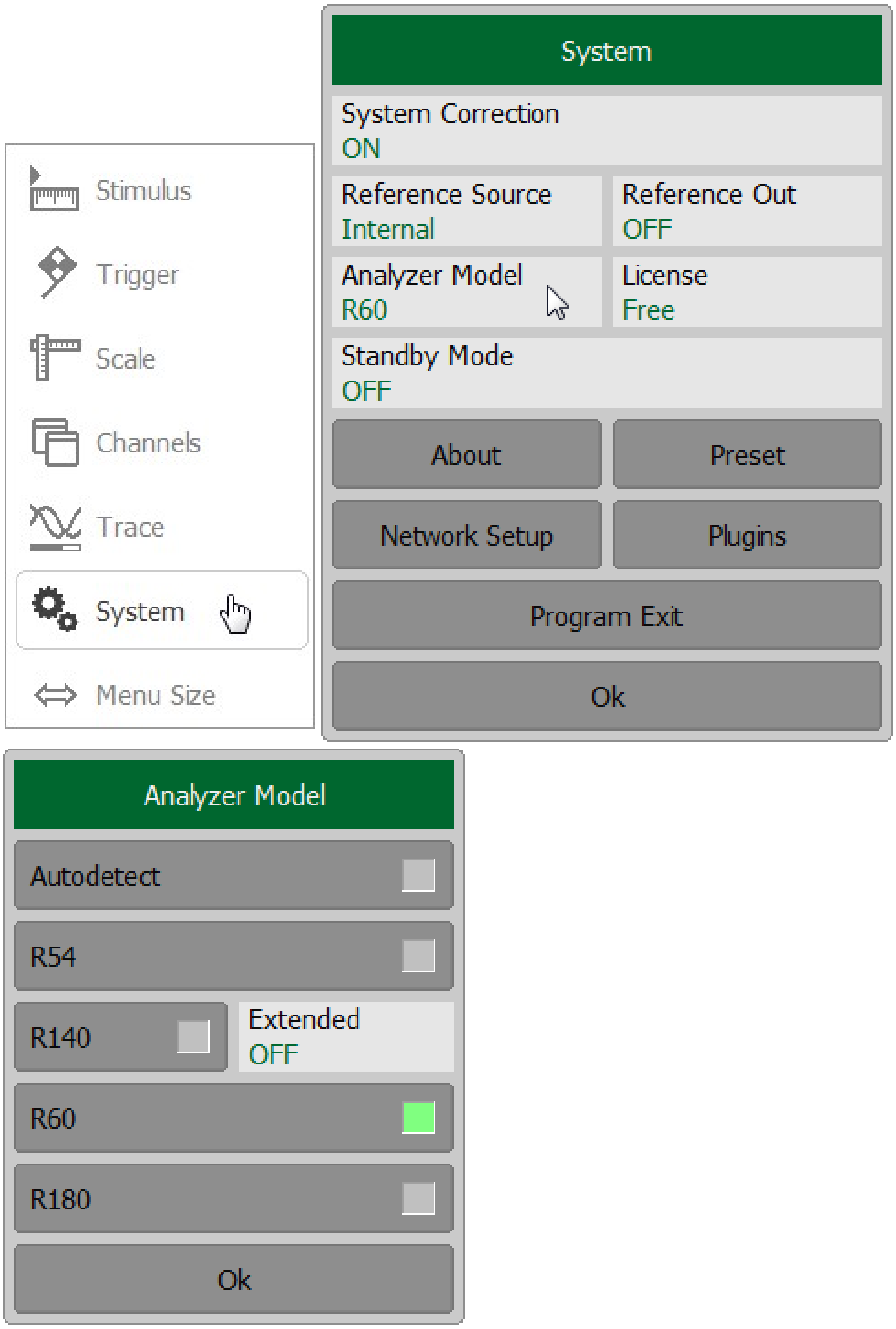


SCPI SYSTem:CONNect:SERial

Analyzer Model Selection for RNVNA

To configure Analyzer model press **System > Analyzer Model** softkey and select appropriate option.

Enabling **Extended** checkbox allows operating with special hardware modification of R140 Analyzer with extended frequency range.


Stimulus
Trigger
Scale
Channels
Trace
System
Menu Size
System
System Correction
ON
Reference Source
Internal
Reference Out
OFF
Analyzer Model
R60
License
Free
Standby Mode
OFF
About
Preset
Network Setup
Plugins
Program Exit
Ok
Analyzer Model
Autodetect
R54
R140
Extended
OFF
R60
R180
Ok

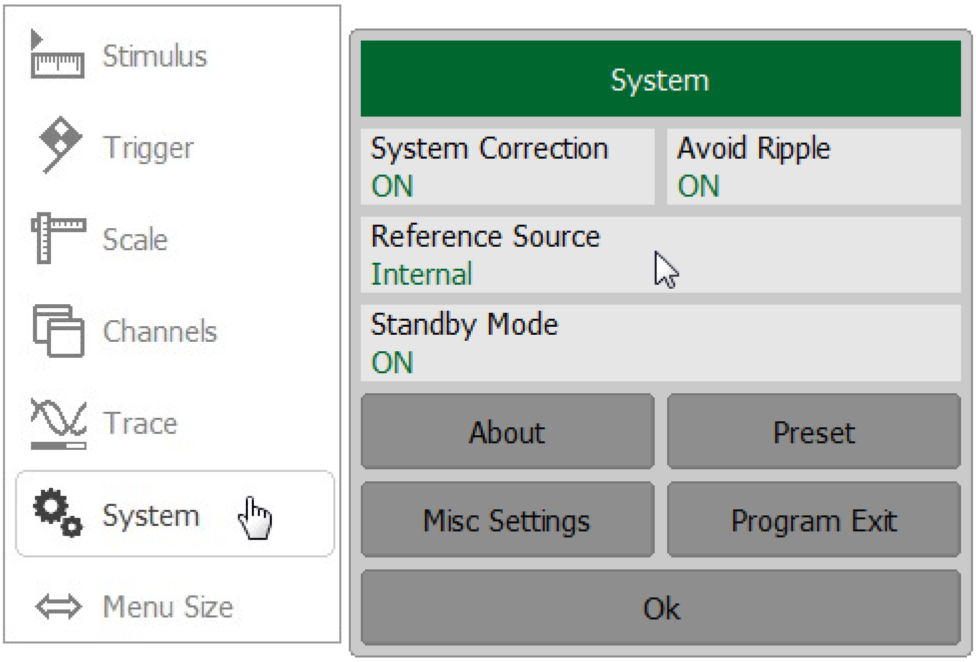
Reference Source Setting

NOTE This section is available for R60, R180.

R60 and R180 Reference Source

The Analyzer can operate either with an internal or external reference frequency (10 MHz) oscillator. Initially, the Analyzer is set to operate using the internal source of the reference frequency. An external high stability oscillator can be used if more accuracy and frequency stability is required. Connect the external oscillator through the 10MHz Reference Input/Output connector on the R60 or R180 side panel. Select the source of reference frequency oscillator in the software.

Press the **System > Reference Source** softkeys and select the reference source.



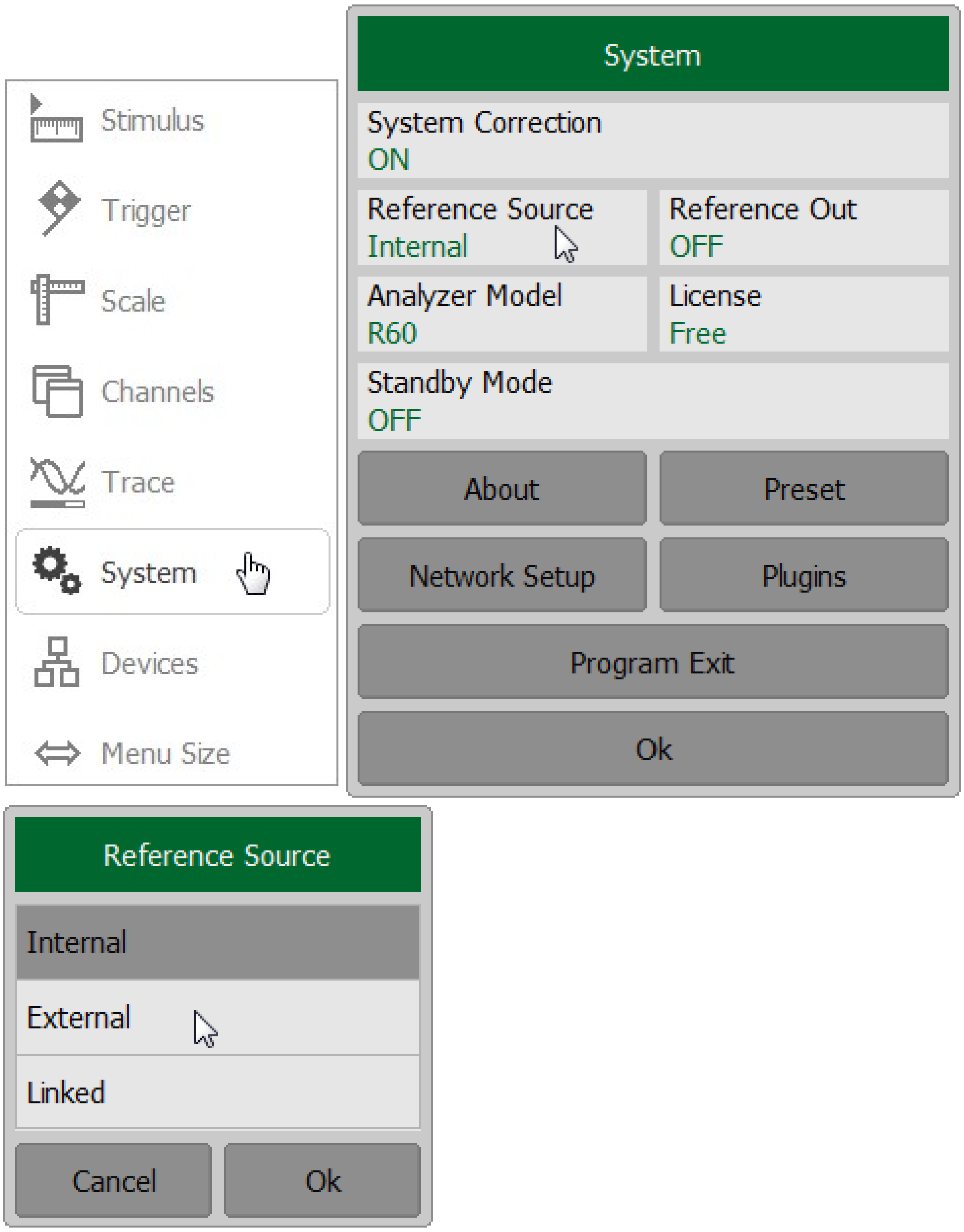
SCPI SENSe:ROSCillator:SOURce

RNVNA Reference Source

While measuring transmission coefficient, one of the Analyzers becomes a signal source and the others are receivers. Analyzers' internal reference generators have finite frequency accuracy. This means there is an arbitrary frequency offset even if signal source and receivers are tuned to the same frequency. Special techniques are required to get rid of this problem.

Mode	Description
Internal	The Analyzers frequency is adjusted manually by searching the maximum of the source signal level (See Frequency adjustment of the internal generators). This mode does not need the Analyzers to be bound together with external reference frequency bus, but measurement speed and accuracy is worse than in **External** or **Linked** mode.
Linked	All the Analyzers reference frequency input/output signals are bound together within FD-16 distributor, or coaxial cable in case of using 2 Analyzers. The Analyzer designated as a port 1 (See Managing Devices) is a reference frequency source, and the others are reference frequency users. Selecting this type of frequency synchronization provides more precise and much measuring than Internal mode.
External	Similar to the **Linked** synchronization mode, but all Analyzers are receiving the reference frequency from arbitrary external reference frequency source.

Press the **System > Reference Source** softkey and select the reference source in Reference Source dialog.



NOTE	When the reference output is turned on, the Analyzer stops working with the reference frequency (10 MHz) oscillator.

Reference Output Setting

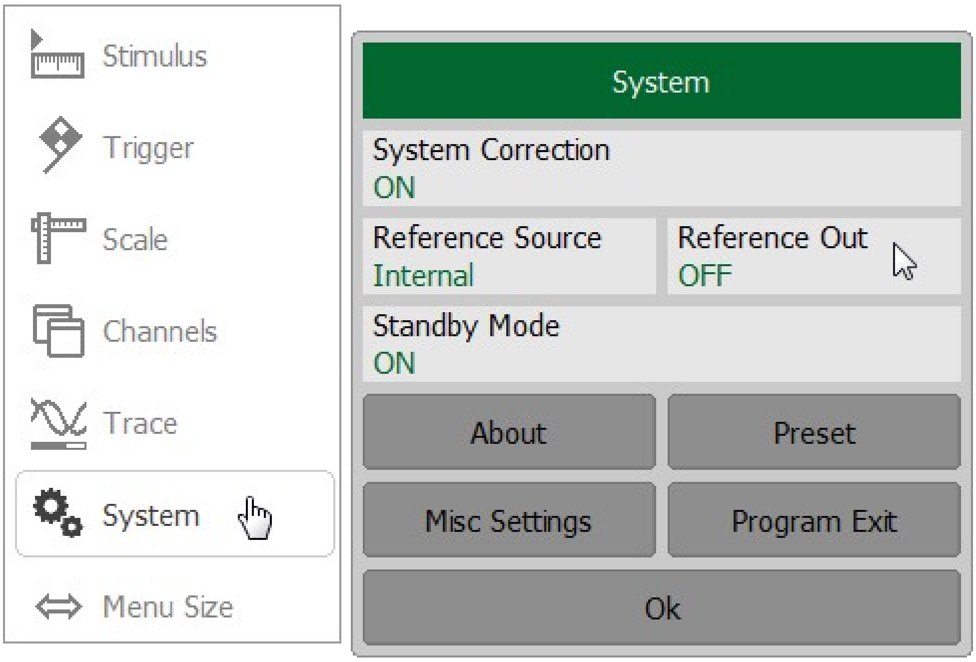
NOTE	This section is available for R60, R180.

The analyzer can be a reference frequency source and used for synchronization. To connect to output reference signal use the 10MHz Reference Input/Output connector on the R60 or R180 side panel.

By default, reference output is turned off.

NOTE	When the reference output is turned ON, the Analyzer stops working with reference frequency (10 MHz) oscillator.

To enable/disable the reference output, use the softkeys **System > Reference Out**.



Managing Licenses

NOTE	This section contains the information about managing licenses to allow RNVNA software to operate with Analyzers.

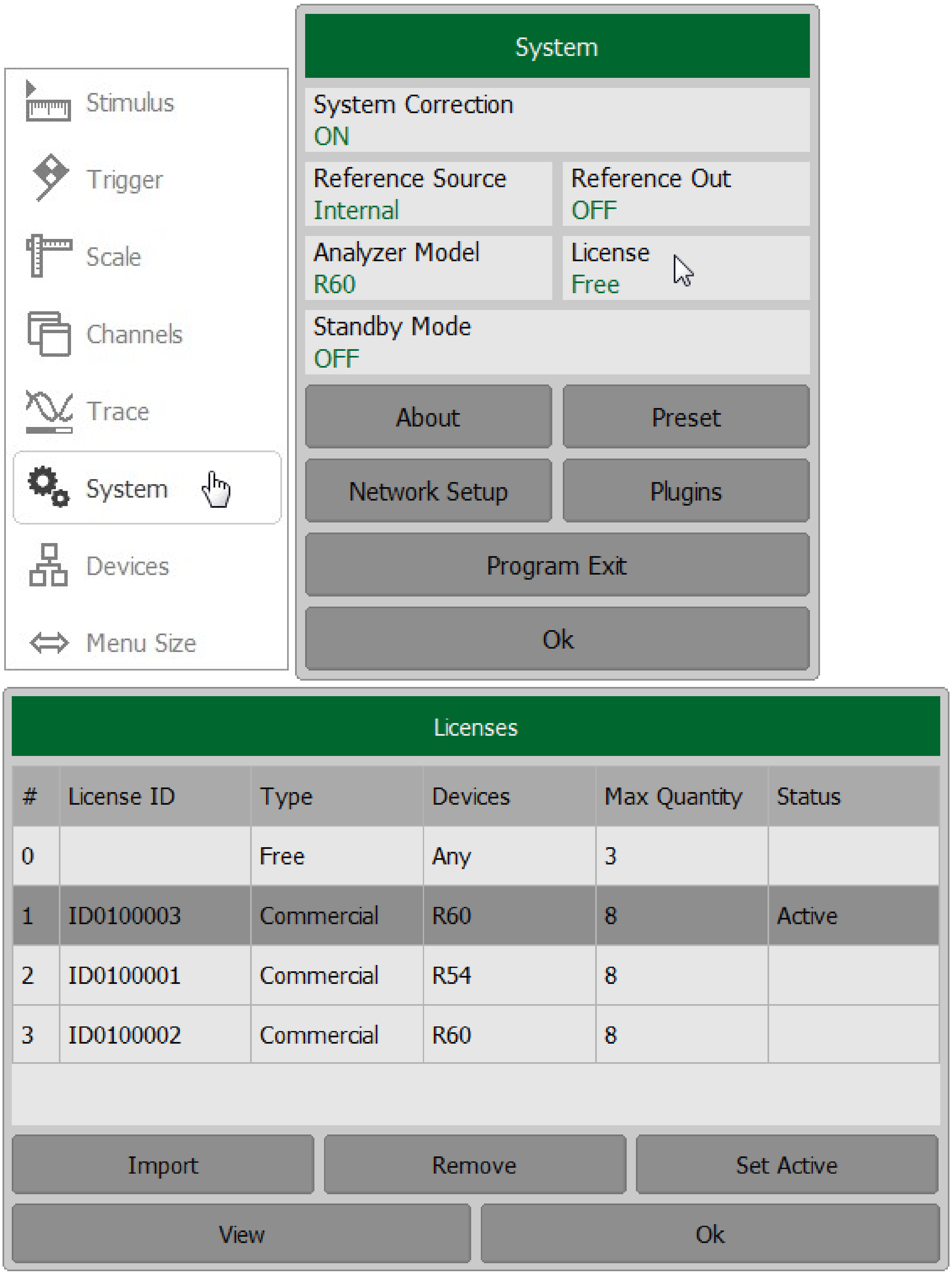
The following types of licenses are available:

- **Free** is up to 3 Analyzers can be connected. This type of license is integrated into RNVNA Software and used by default.
- **Commercial** is paid license is provided with purchase. Up to 16 Analyzers can be specified in the license. Client can have a number of commercial licenses. Each license is distributed in form of a file with the *.LIC extension. This file contains unique identifier, number of the allowed devices and list of serial numbers.

RNVNA can operate with only one of the licenses at a time. Required license should be activated before operating with RNVNA software (See Activating License).

Viewing Licenses

To view available licenses in license table, click **System > License** softkeys.



The Licenses dialog contains the table with the following fields:

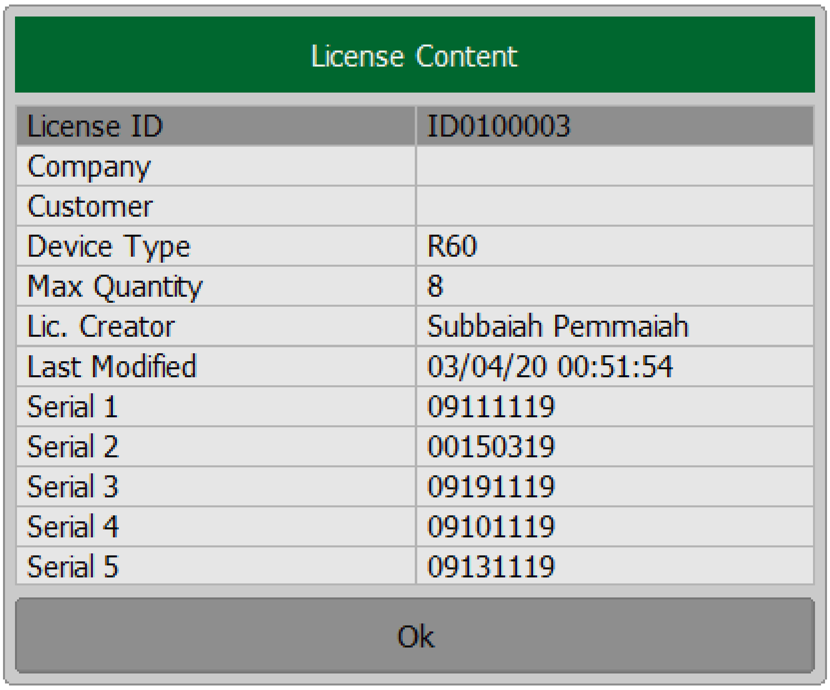
- **License ID** is license number.
- **Type** is type of license (**Free** or **Commercial**).

- **Devices** is type of connected devices:
  - **Any** — if any Analyzer type is accepted.
  - Particular Analyzer model.
- **Max Quantity** is maximum number of Analyzers allowed to operate with.
- **Status** is the indicator of the license status. If the license is active, the sign **Active** will appear in the column. Only one of the licenses can be active at the same time.

Select the required license in the table and click **View** softkey.

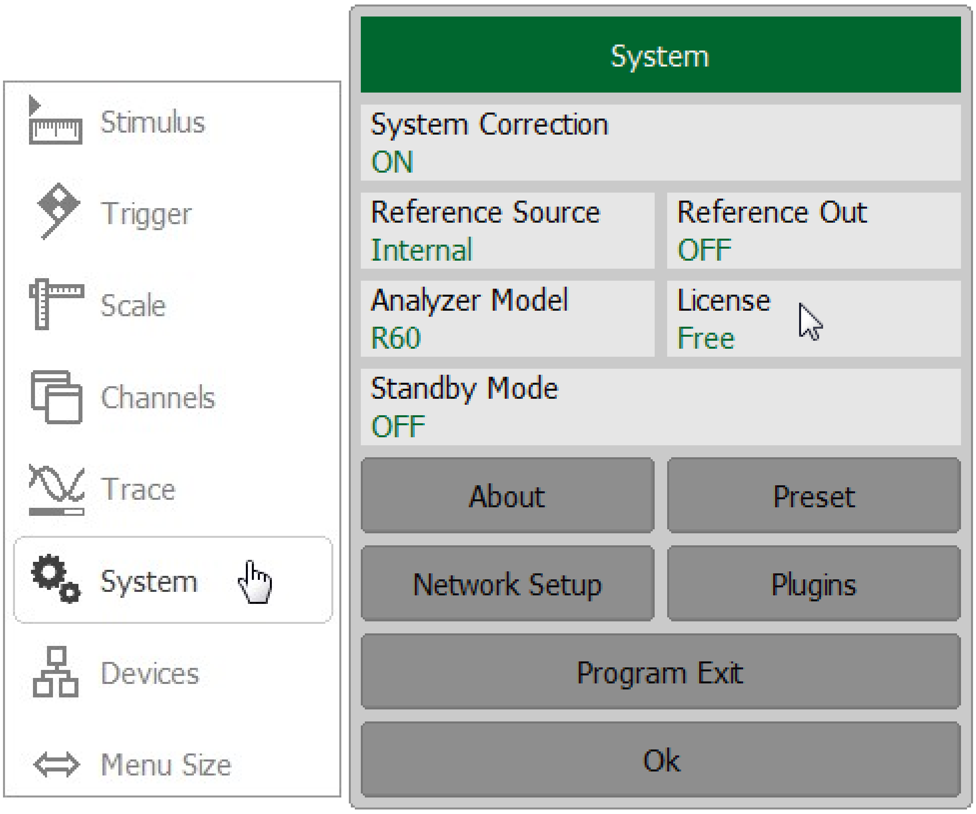
The License Content dialog contains information about the selected license. In addition to information represented in License table, the following data is available:

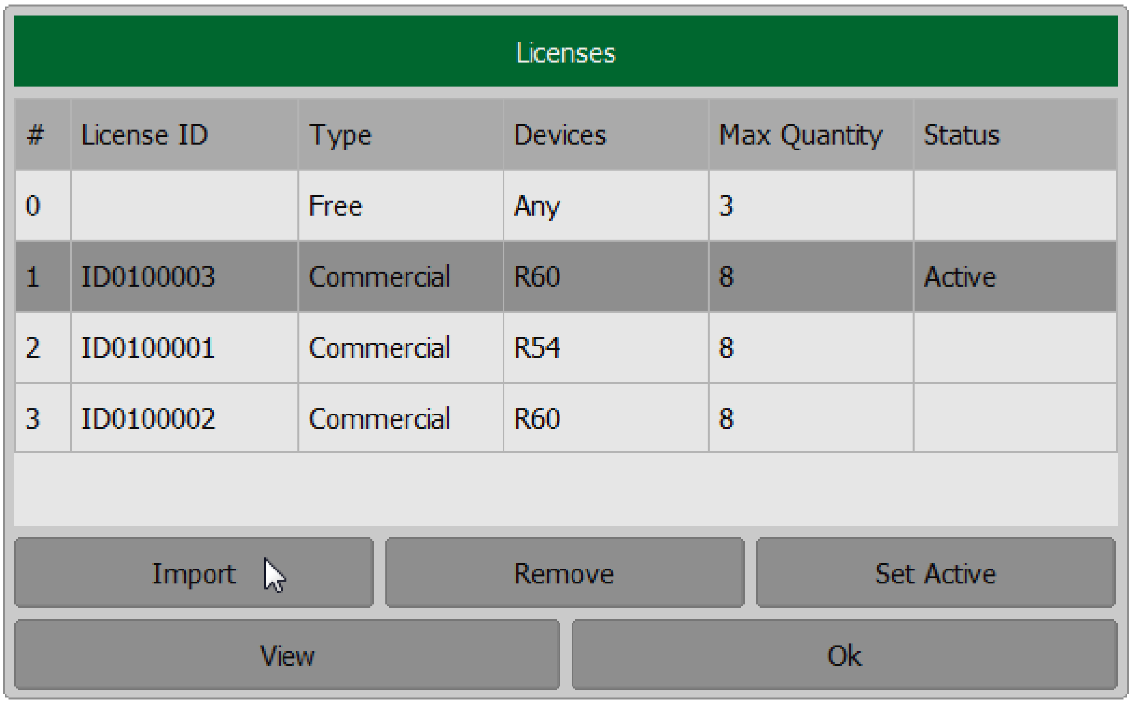
- **License ID** is license number.
- **Company**.
- **Customer** is customer name.
- **Lic. Creator** is name of the person who created or modified the license.
- **Last Modified** is time and date of the last modification of the license.
- **Serial N** is serial number of the Analyzer tied to the license.



Adding License

To add a new license, click **System > License > Import** softkey.





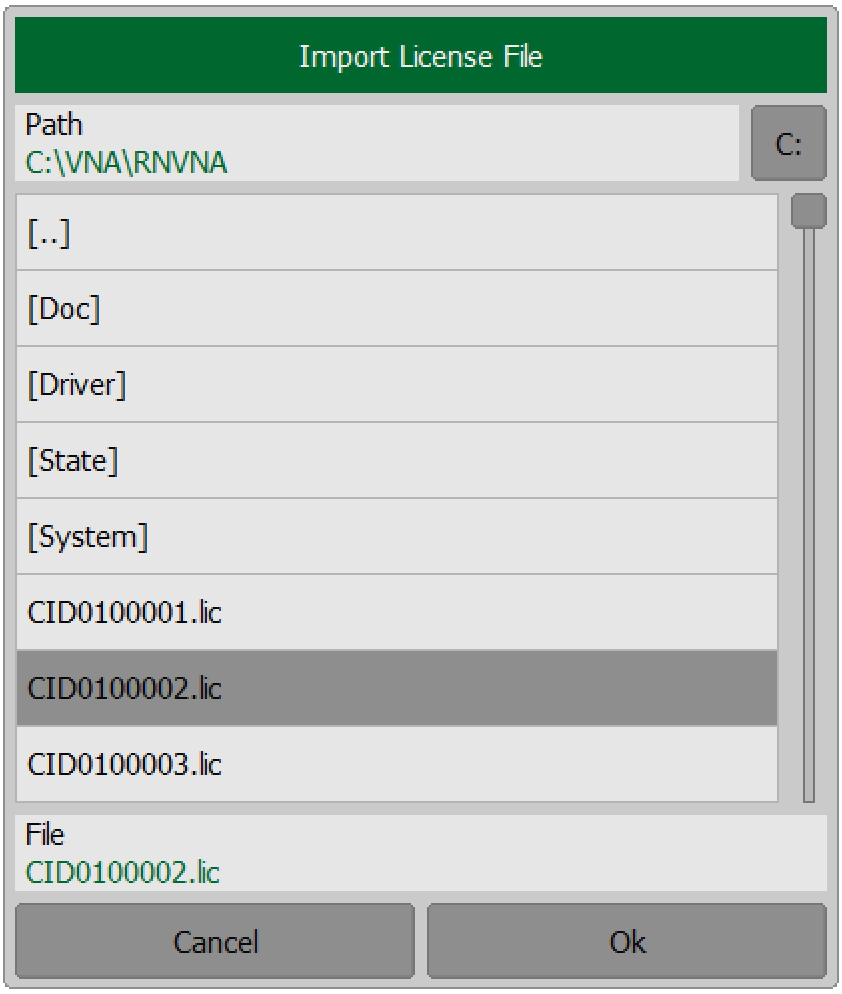
Select a license file path and enter its name in the pop-up dialog.

Navigation in directory tree is available in Import License File dialog.

To open a directory and activate it, double click on the directory name.

To go up in the directory hierarchy, double click on the "…" field.

Click **Ok** softkey.



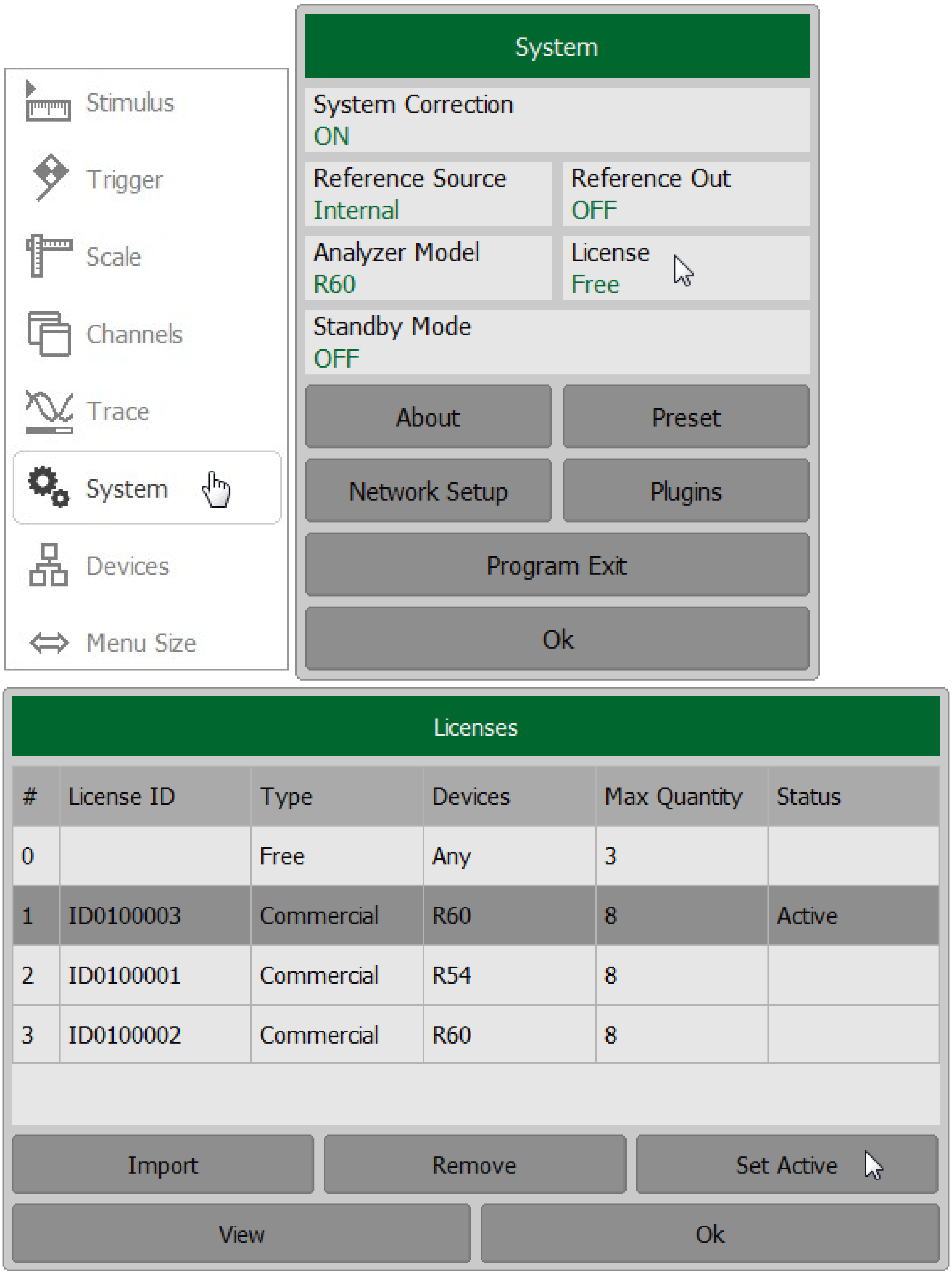
To activate license, press **Set Active** softkey in Licenses dialog (See <u>Activating License</u>).

Activating License

RNVNA software can operate with only one license at a time.

To make the appropriate license active, click the **System > License** softkey.

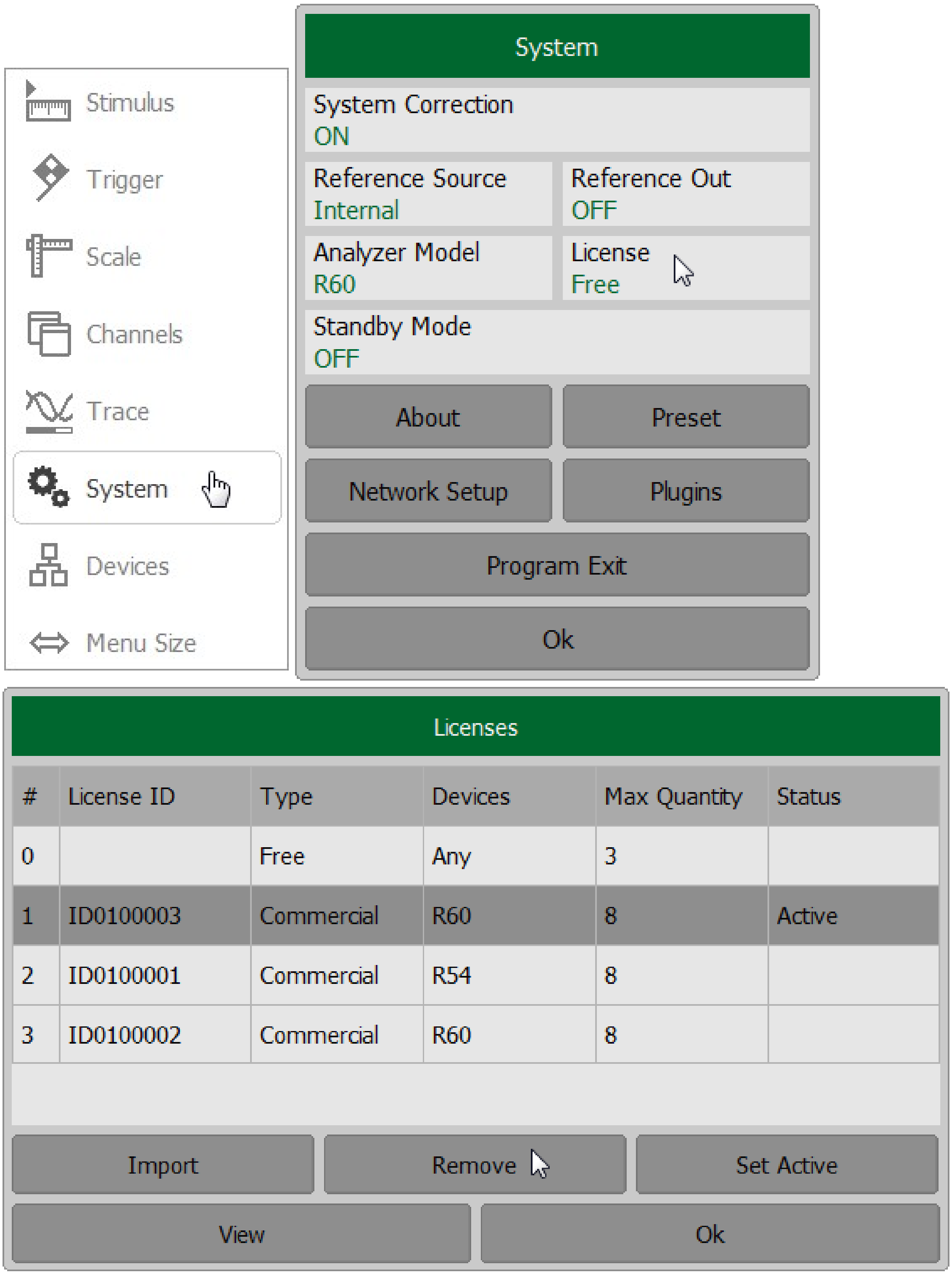
Select the appropriate license and press **Set Active** softkey.


Stimulus
Trigger
Scale
Channels
Trace
System
Devices
Menu Size
System
System Correction
ON
Reference Source
Internal
Reference Out
OFF
Analyzer Model
R60
License
Free
Standby Mode
OFF
About
Preset
Network Setup
Plugins
Program Exit
Ok
Licenses
License ID Type Devices Max Quantity Status
0 Free Any 3
1 ID0100003 Commercial R60 8 Active
2 ID0100001 Commercial R54 8
3 ID0100002 Commercial R60 8
Import
Remove
Set Active
View
Ok

Removing License File

To remove a license file, click the **System > License** softkey.

Select the appropriate license and press **Remove** softkey.


Stimulus
Trigger
Scale
Channels
Trace
System
Devices
Menu Size
System
System Correction
ON
Reference Source
Internal
Reference Out
OFF
Analyzer Model
R60
License
Free
Standby Mode
OFF
About
Preset
Network Setup
Plugins
Program Exit
Ok
Licenses
| License ID | Type | Devices | Max Quantity | Status
0 | | Free | Any | 3 |
1 | ID0100003 | Commercial | R60 | 8 | Active
2 | ID0100001 | Commercial | R54 | 8 |
3 | ID0100002 | Commercial | R60 | 8 |
Import
Remove
Set Active
View
Ok

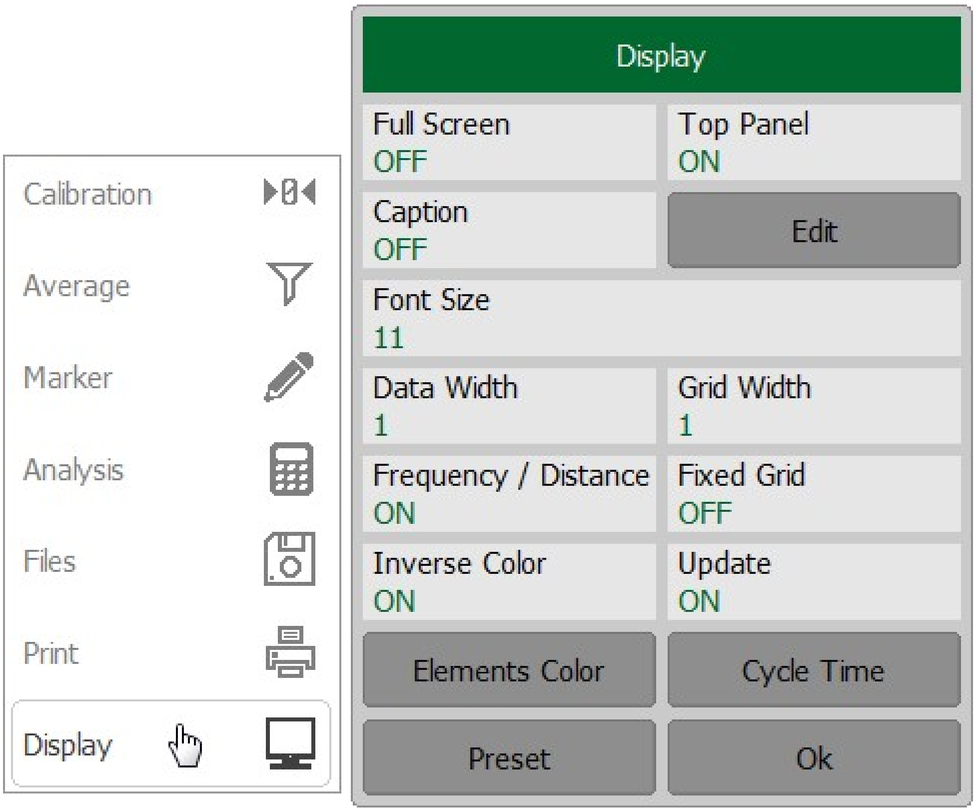
User Interface Setting

The software allows to adjust the following user interface settings:

- Toggle between full screen and window display (See Full Screen).
- The font size of all displayed items (See Font Size).
- Width of data traces, memory traces, graph grid (See Trace and Grid Width).
- Invert color of diagram (See Invert Color of Diagram).
- Show/hide the caption of channel (See Channel Caption Setting).
- Hide/show top menu bar (See Hide/Show Top Menu Bar).
- Hide/show cycle time (See Hide/Show Cycle Time).
- Set color of data and memory traces, markers, background, grid, font, and button (See Color).
- Change horizontal graticule (Hide/Show Horizontal Graticule Label).

If necessary, user interface settings can be reset to default factory settings (See Interface Presetting).

To open System dialog with interface settings, click on **Display** softkey.



Full Screen

The software on the PC screen is displayed as a window. If necessary, use full screen mode.

To toggle between full screen and window display, click on **Full Screen** field.

Hide/Show Top Menu Bar

By default, the top menu bar is located at the top of the screen.

The menu bar can be optionally hidden to gain more screen space for the channel window and is controlled by mouse.

To show/hide the top menu bar, click on **Top Panel** field to toggle between the settings.

Channel Caption Setting

To show/hide the channel title bar click on **Caption** field to toggle between the settings. To edit the channel title, click on the softkey **Edit** to recall the on-screen keypad. For a detain description see in Channel Title Bar.

SCPI	DISPlay:WINDow:TITLe, DISPlay:WINDow:TITLe:DATA

Font Size

The default font size setting for all items is 11.

The font size of all displayed items can be changed. The font size can be changed to any size between 10 to 22.

To change the font size in the channel window, click on **Font Size** field and enter the required value using the on-screen keypad.

Trace and Grid Width

The default data width and grid width are 1.

The width can be set from 1 to 4. The changes made to the width of the data and grid will affect all the channels.

To change the data width and grid width, click on **Data Width** and **Grid Width** fields respectively. Enter the required value using the on-screen keypad.

Invert Color of Diagram

By default, the diagram is in dark color mode. The color mode can be switched to light mode.

To change the color of the background of the graph click on **Inverse Color** field to toggle between the on/off settings.

SCPI	DISPlay:IMAGe

Interface Presetting

All set user interface settings can be reset.

To restore the default factory settings, use the softkey **Preset**.

SCPI	DISPlay:COLor:RESet

Hide/Show Horizontal Graticule Label

Horizontal graticule label is located at the down of the screen. The horizontal graticule label can be hidden to gain more screen space for the trace display.

To hide/show horizontal graticule label, click on the **Frequency / Distance** field.

To change the color of data and memory traces and markers, activate the trace, clicking on the **Active Trace** field. Then select displayed items to customize, clicking on **Data Trace, Memory Trace** or **Marker** softkeys. Select the color.

To change the color of other settings, click the softkey with the corresponding name. Select the color.

Screen Update Setting

Screen updating can be disabled to reduce the sweep time. This function can be useful when remotely controlling the Analyzer via COM/DCOM interfaces.

To enable/disable the screen updating, click on the **Update** field.

A single trace update is possible when screen update is disabled. Click on the trace with the mouse or hover the mouse over the graticule labels.

SCPI	DISPlay:ENABle, DISPlay:UPDate

Fixed Grid

The setting sets the number of divisions of the channel window grid along the horizontal axis equal to 10.

To turn ON/OFF the fixed grid, click on the **Fixed Grid** field.

Hide/Show Cycle Time

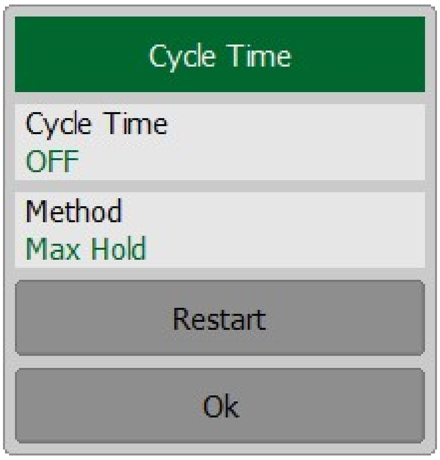
By default, the sweep time isn't displayed in the instrument status bar. It can be enabled if necessary. Depending on the selected method, cycle time can be defined as an average value or as a maximum hold.

Click on the **Cycle Time** softkey.

To enable/disable the display of the scan cycle time in the instrument status bar, click on the **Cycle Time** field.

To toggle between method, click on **Method** field.

The **Restart** softkey is used to restart the cycle time definition and reset the previous values.



Color traces, markers, background, grid, font, and button color

The color of data and memory traces, markers, the background, the grid, the font and the button can be changed if necessary.

To change the color by categories of displayed items, click on the **Elements Color** softkey.

To change the color of data and memory traces and markers, activate the trace, clicking on the **Active Trace** field. Then select displayed items to customize, clicking on **Data Trace**, **Memory Trace** or **Marker** softkeys. Select the color.

To change the color of other settings, click the softkey with the corresponding name. Select the color.

SCPI	DISPlay:COLor:TRACe:DATA DISPlay:COLor:TRACe:MEMory DISPlay:COLor:BACK DISPlay:COLor:GRATicule

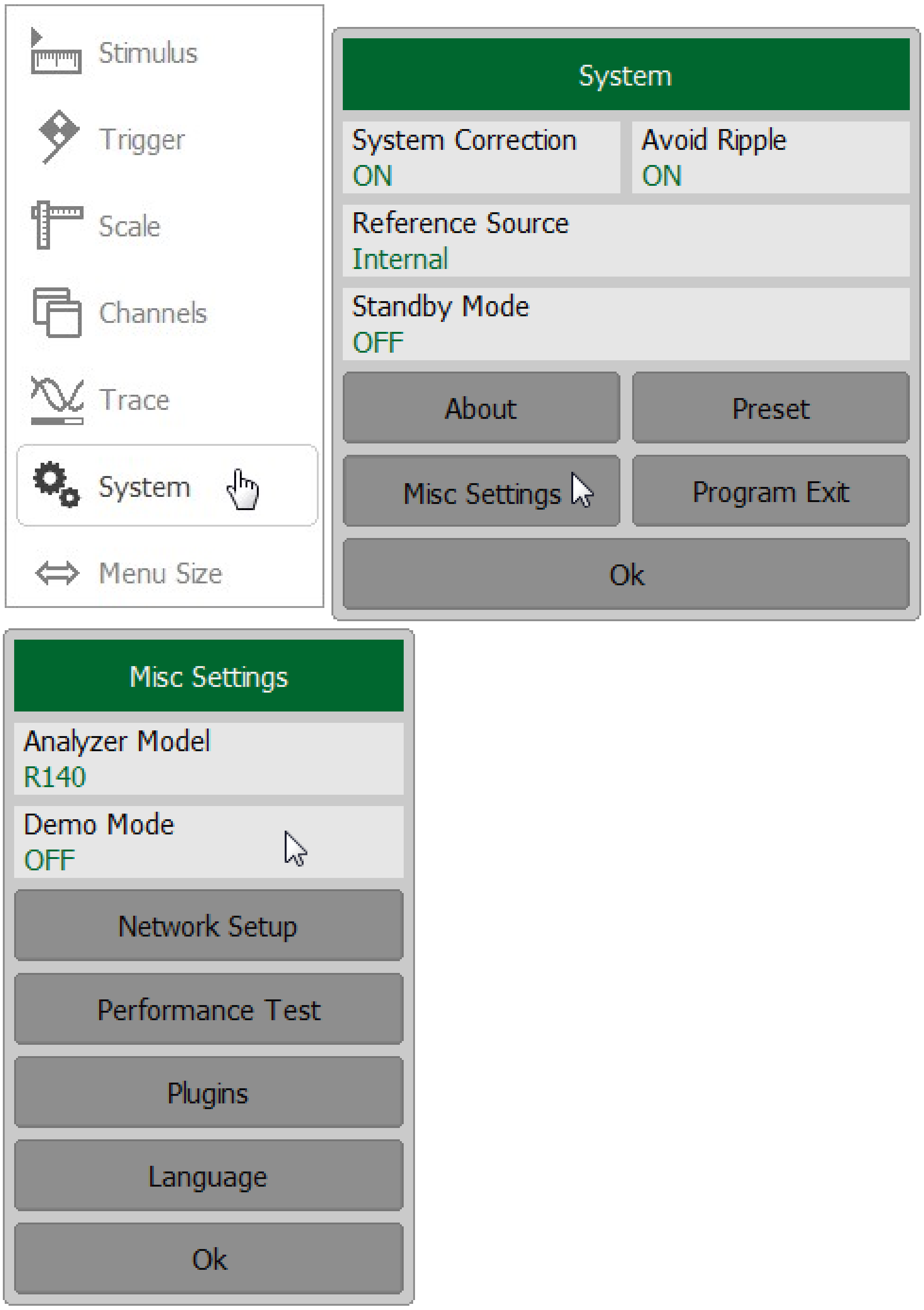
Demo Mode

Demo mode is designed to simulate DUT measurement. The measurement results of the DUT are pre-recorded in the software memory. Any analyzer model can be selected from the list of supported devices in demo mode (See Analyzer Model).

NOTE	The simulation of the Analyzer in demo mode may differ from the real measurements of the analyzer. For example, the accuracy of the sweep time dependence on the IF filter setting is not guaranteed.

WARNING	The software restarts automatically when the demo mode state changes.

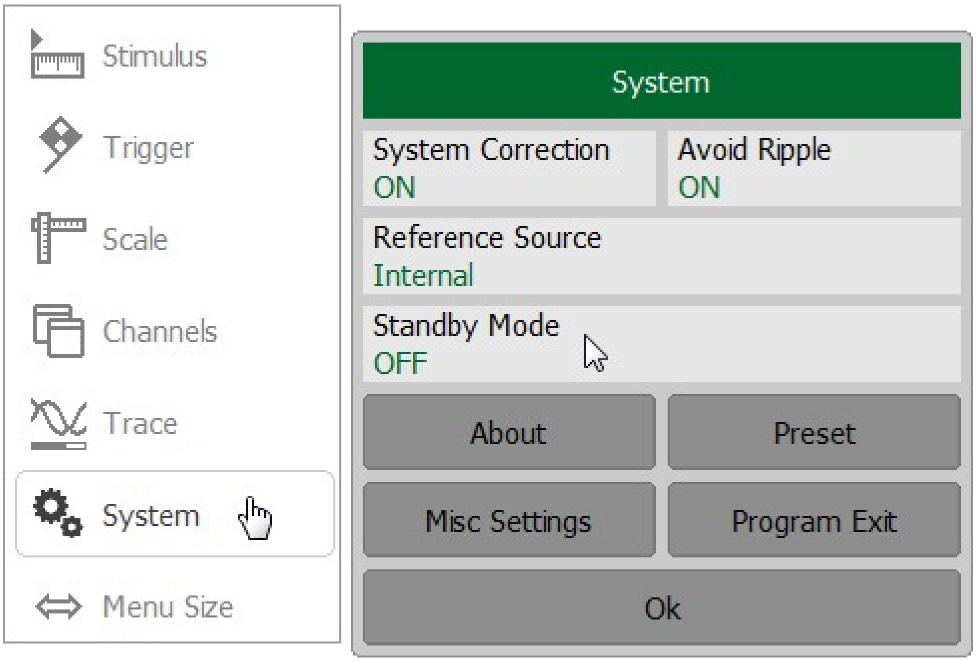
To enable/disable the demo mode, use the softkeys **System > Misc Settings > Demo Mode**.


Stimulus
Trigger
Scale
Channels
Trace
System
Menu Size
System
System Correction
ON
Avoid Ripple
ON
Reference Source
Internal
Standby Mode
OFF
About
Preset
Misc Settings
Program Exit
Ok
Misc Settings
Analyzer Model
R140
Demo Mode
OFF
Network Setup
Performance Test
Plugins
Language
Ok

Standby Mode

Standby mode allows to switch the Analyzer to power saving mode. In standby mode Analyzer is disconnected from software.

To enable/disable the power saving mode, use the softkeys **System > Standby Mode**.



SCPI SYSTem:STANdby

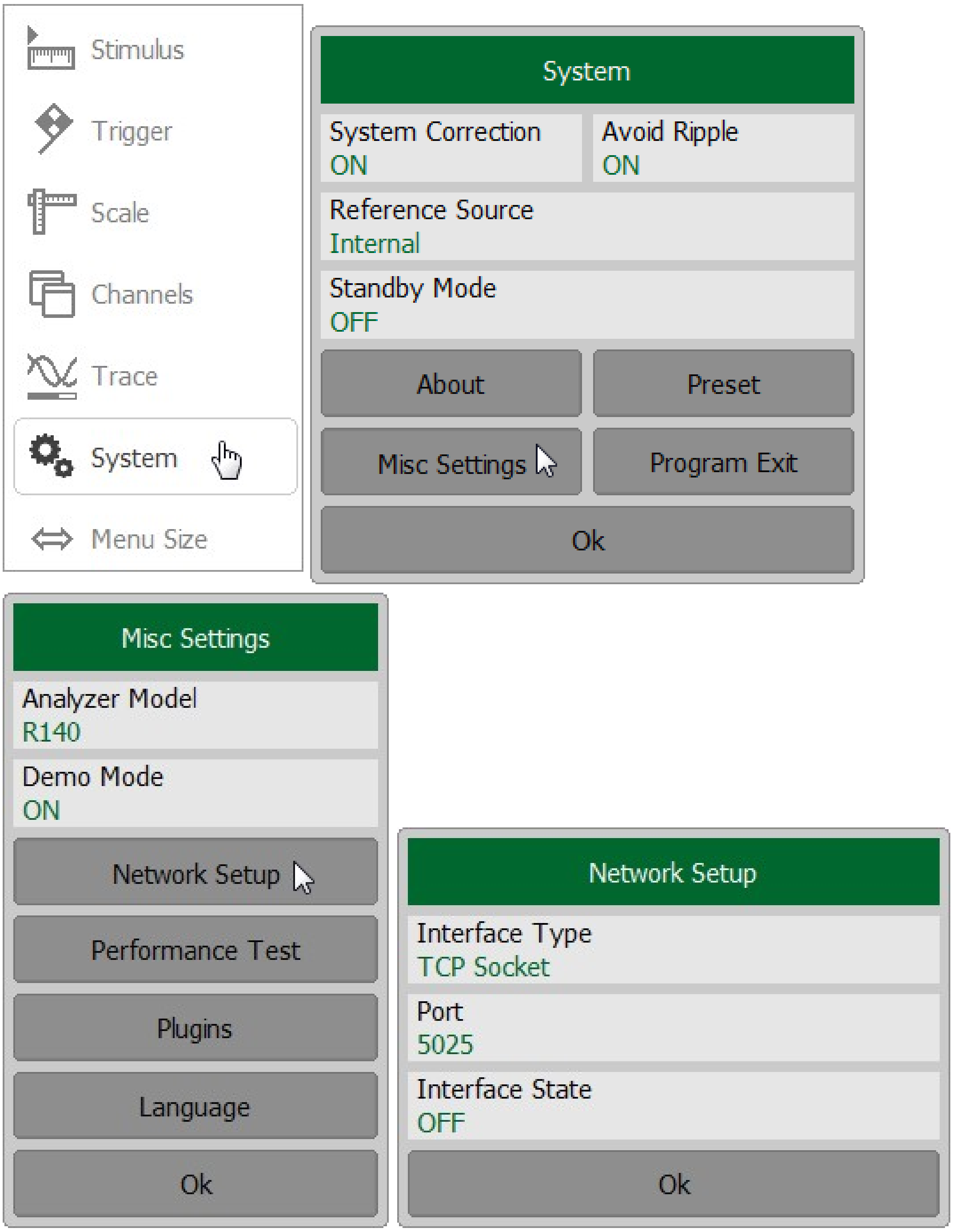
Network Setup

Network Setup is used to enable remote control of the Analyzer.

Open the Network Setup dialog use the **System > Misc Settings > Network Setup** softkeys.

If necessary, specify the port number, click on the **Port** field and and enter the required value using the on-screen keypad.

To enable/disable remote control of the Analyzer via a network using Socket interface, click on the **Interface State** softkey.



NOTE	When specifying the port number, make sure that it is not busy performing another process. For more information about remote control of the Analyzer, see in Programming.

Performance Test

NOTE	This section is available RVNA only.

The performance test is done to verify that the performance of the Analyzer is up to the published specifications.

A performance test of the Analyzer should be performed in accordance with Performance Test Instructions.

Download VNA performance test from https://coppermountaintech.com/download-free-vna-software-and-documentation/.

Open the Performance Test dialog, use the **System > Misc Settings > Performance Test** softkeys.

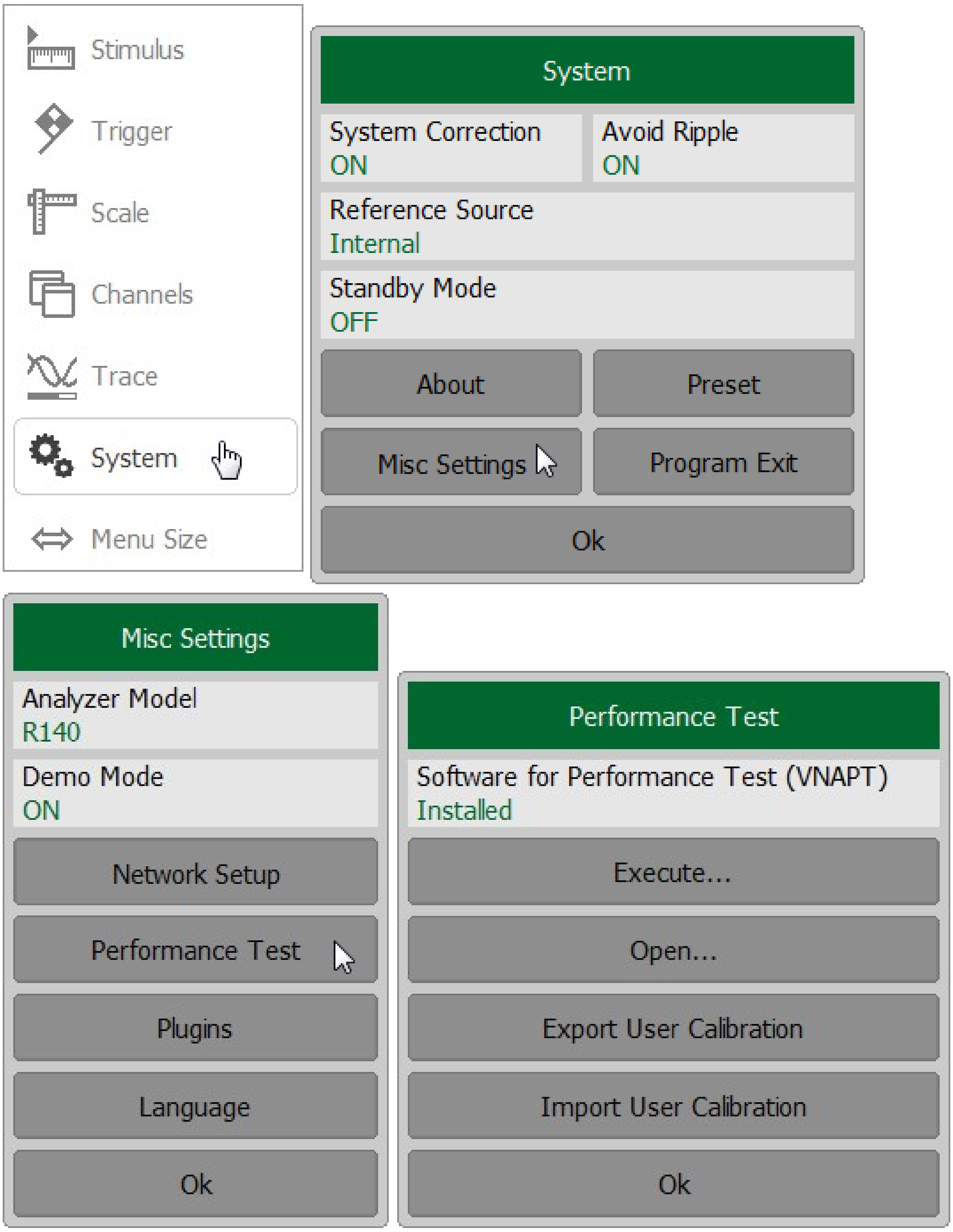
NOTE. If VNA performance test is not installed on PC, all menu buttons will be disabled.

To start VNA performance test, click on the **Execute...** softkey.

To open report, click on the **Open...** softkey.

To save the user calibration use the **Export User Calibration** softkey.

To recall the user calibration use the **Import User Calibration** softkey.


Stimulus
Trigger
Scale
Channels
Trace
System
Menu Size
System
System Correction
ON
Avoid Ripple
ON
Reference Source
Internal
Standby Mode
OFF
About
Preset
Misc Settings
Program Exit
Ok
Misc Settings
Analyzer Model
R140
Demo Mode
ON
Network Setup
Performance Test
Plugins
Language
Ok
Performance Test
Software for Performance Test (VNAPT)
Installed
Execute...
Open...
Export User Calibration
Import User Calibration
Ok

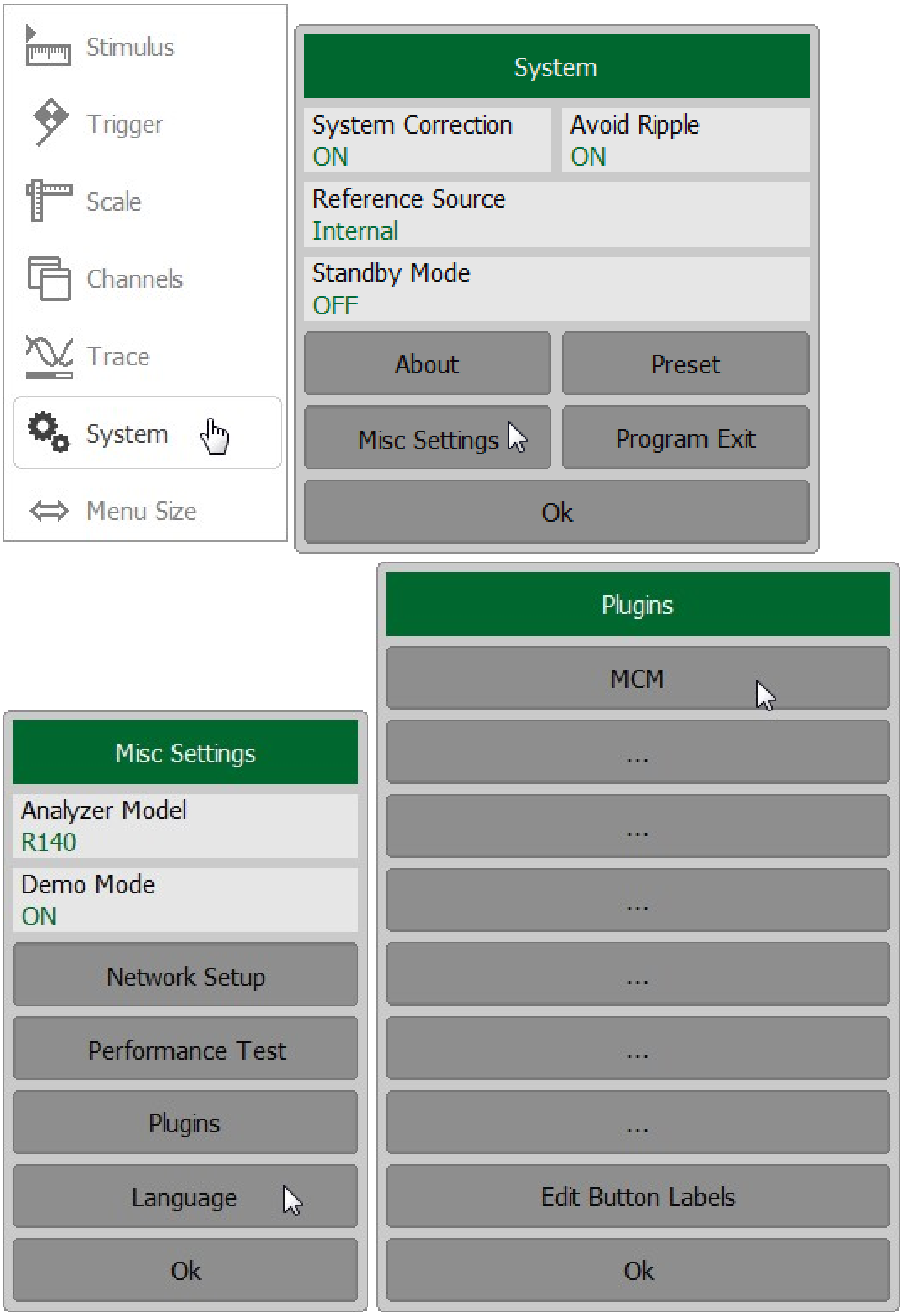
Plugins

A plugin is an executable file that performs the user defined function using COM automation or SCPI commands of the VNA application. Create own plugin or download the plugin from the Copper Mountain Technologies website. Place the plugin in *Plugins* subdirectory of the main application directory.

Open the Plugins dialog, use the **System > Misc Settings > Plugins** softkeys.

The name of the executable file will appear on the softkey in the Plugins dialog.

To launch the plugin, click the softkey with its name.


Stimulus
Trigger
Scale
Channels
Trace
System
Menu Size
System
System Correction
ON
Avoid Ripple
ON
Reference Source
Internal
Standby Mode
OFF
About
Preset
Misc Settings
Program Exit
Ok
Plugins
MCM
...
...
...
...
...
...
Edit Button Labels
Ok
Misc Settings
Analyzer Model
R140
Demo Mode
ON
Network Setup
Performance Test
Plugins
Language
Ok

Language

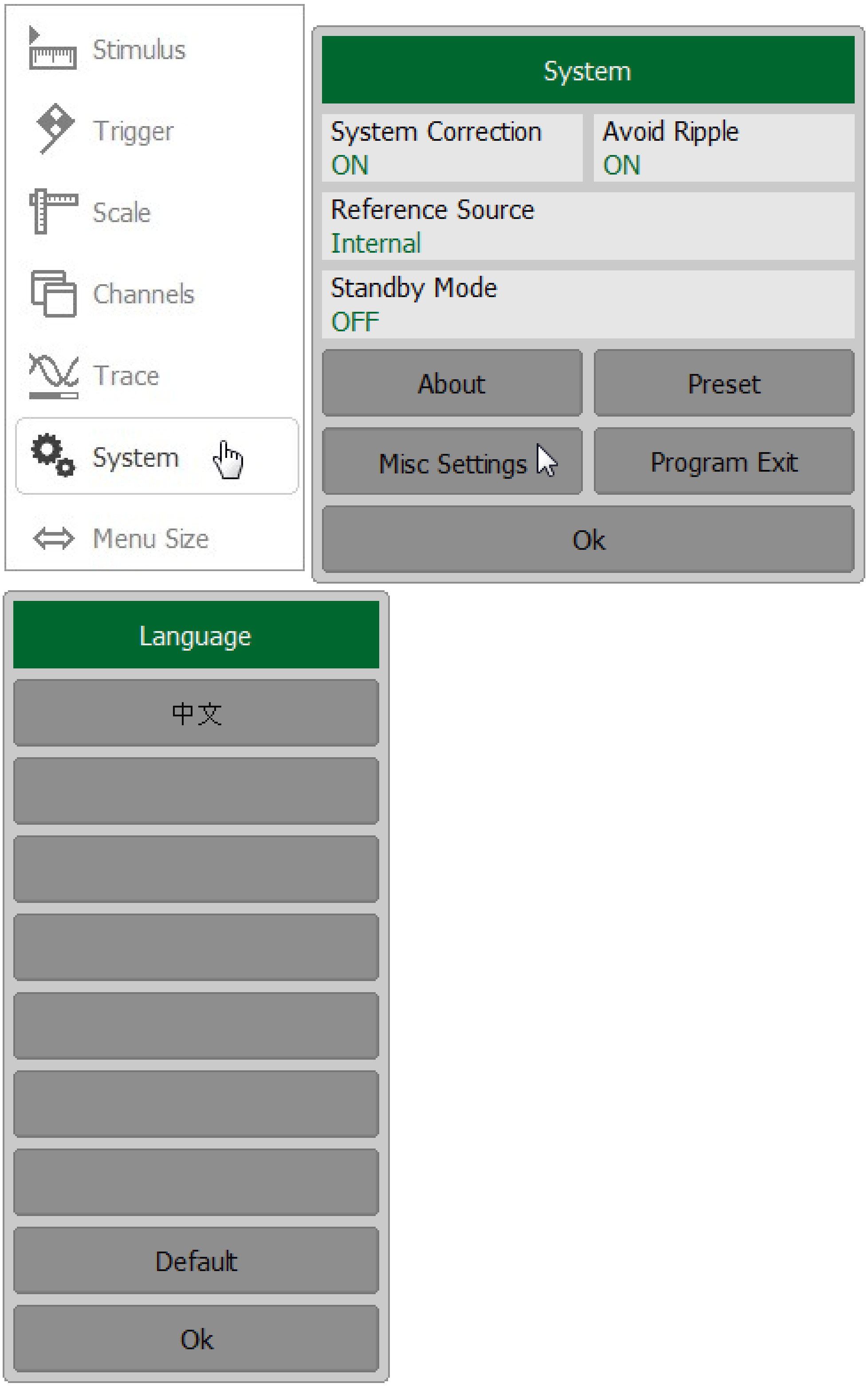
The default language for software is English. The software can be localized for any language.

To add the required language, see Create a Localized Language File.

To select the interface language, use the **System > Misc Settings > Language** softkeys.

Then choose the language.

To restore the default language, use the **Default** softkey.


Stimulus
Trigger
Scale
Channels
Trace
System
Menu Size
System
System Correction
ON
Avoid Ripple
ON
Reference Source
Internal
Standby Mode
OFF
About
Preset
Misc Settings
Program Exit
Ok
Language
中文
Default
Ok

Create a Localized Language File

To localize, do the following:

- Find the lang_template.txt file in the VNA application home directory in the *Lang* folder of the main application directory;
- Rename this file to the lang_xx.txt format, where xx is the two-letter language name. For example, lang_ch.txt — for Chinese language, lang_sp.txt — for Spanish language, etc.
- Open lang_xx.txt file.
- Find the "Name" field in the file. Enter the name of the language into which all text will be translated in the field to the right of the equal sign. For example:

  Name=中文
- Enter the translation of the other fields. For example:

  "Default"="缺省"

Rules for inputting translation text:

- To change the translation of the field, fill the field to the right of the equal sign and use two quotation marks. For example:

  "Default"=""
- To enter empty text, use two quotation marks. For example:

  "Default"=""
- To keep the word unchanged, leave the field blank. For example:

  "Default"=

  or

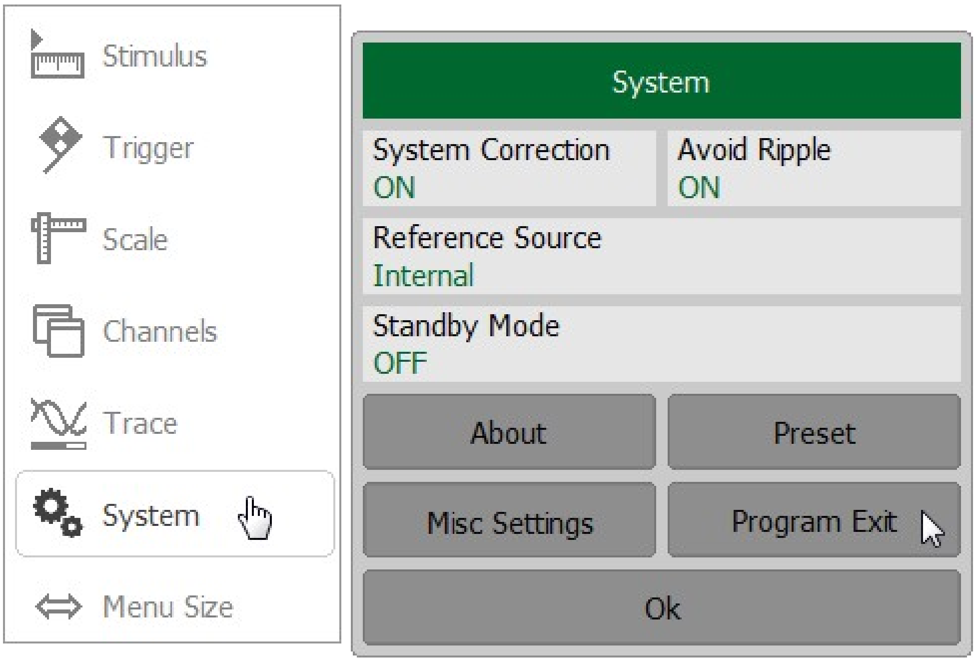
  "Default"

WARNING	Do not change the field to the left of the equal sign. This can cause the software to malfunction.

The language code will appear on the softkey in the Language menu after renaming the file and restarting the application. To apply localization, press the softkey with the language code. The application will restart, and the inscriptions on the interface elements will change to the localized inscriptions (See Language).

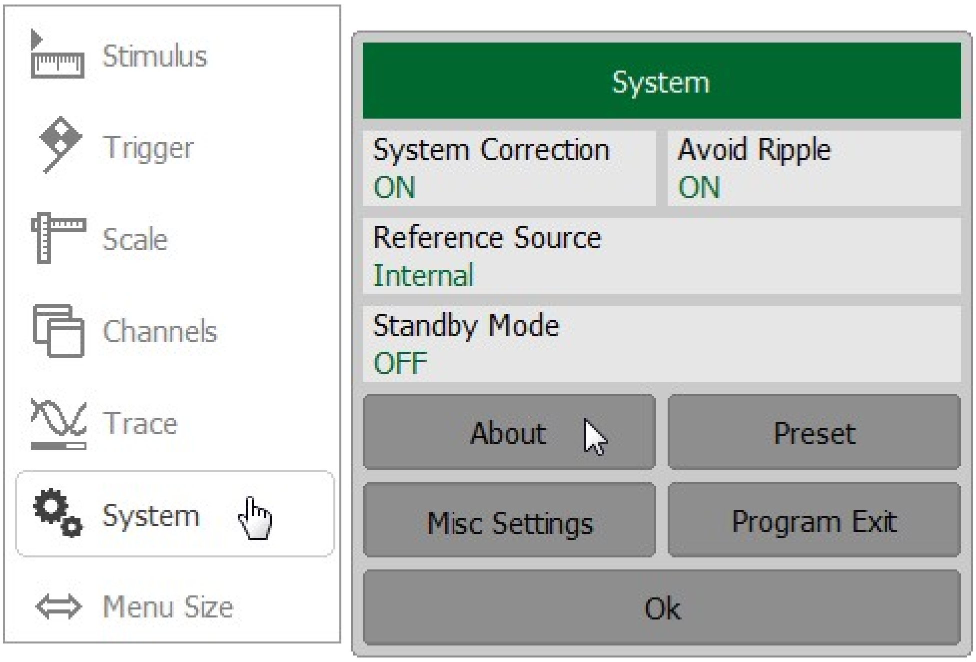
Program Exit

To exit the program, use the softkeys **System > Program Exit**.



About

To get the information about software version, hardware revision and serial number of the Analyzer use the following softkeys in the right menu bar **System > About**.



Programming

This section contains information about the Analyzer remote control and its data communication, carried out by means of user program through a computer network.

This section describes programing of the Analyzer using SCPI commands or COM/DCOM technology. SCPI commands are primarily described in this manual. A corresponding COM command description is provided at the end of each SCPI command description.

SCPI (Standard Commands for Programmable Instruments) defines a standard for syntax and commands to use in controlling programmable instruments. SCPI commands are ASCII textual strings that are sent to the Analyzer program over the LAN physical layer using the TCP/IP Socket network protocol. These protocols can also be used within a single PC when using the IP address 127.0.0.1 or *localhost*.

TCP/IP Socket is a general-purpose network protocol. The user program can connect to the Analyzer using the TCP/IP Socket protocol both directly and through the VISA library.

VISA (Virtual Instrument Software Architecture) library is a widely used software input-output interface for measuring and testing equipment. It is a library of functions for C/C++, C#, Visual Basic, MATLAB, LabVIEW and others. The VISA library unifies access to all measuring instruments, regardless of the protocol and physical layer used. The VISA library is available on the websites of many companies for free download. There are versions of VISA library for Windows, Linux, Mac OS.

COM/DCOM (Component Object Model/Distributed Component Object Model) is a program technology developed by Microsoft. The COM/DCOM technology establishes a program interface between the analyzer program and the user program. The analyzer program acts as a COM server. The user program acts as a COM client. COM is used within a single PC. DCOM is used over a LAN.

References

Standard Commands for Programmable Instruments (SCPI) http://www.ivifoundation.org/specifications

VISA specifications, http://www.ivifoundation.org/specifications

Connection Setup

To enable remote control of the Analyzer, turn on the Socket server in the settings of the Analyzer's program. The default TCP/IP port number of each protocol can be changed optionally.

TCP/IP Socket is a general-purpose protocol.

Typically, the user program (client) uses VISA library to establish the connection. When using the VISA library, the client selects the protocol by specifying it in the VISA address of the Analyzer.

The VISA library hides the details of protocol implementation from the client and provides a uniform I/O interface.

After a connection has been established by the client, the latter can send SCPI commands and read the results of the measurements. The command set is the same for both protocols and is described in Command Reference.

The client must specify the Analyzer's PC IP address or network name in the VISA address string. The analyzer and user programs can be run on the same PC. In this case, the client specifies the IP address as 127.0.0.1 or *localhost*.

Multiple Analyzer programs can be executed on the same PC (when several USB blocks are connected). In this case, the user must specify a unique TCP/IP port number in the settings of each Analyzer program.

One analyzer program does not limit the number of simultaneously connected clients. Clients themselves are responsible for the absence of conflicts in the remote control of the Analyzer. For more details about locks, see the VISA manual.

Analyzer Setting

Ethernet interface is part of the equipment of a personal computer that connects to the device "R54", "R140", "R140B", "R60" or "R180".

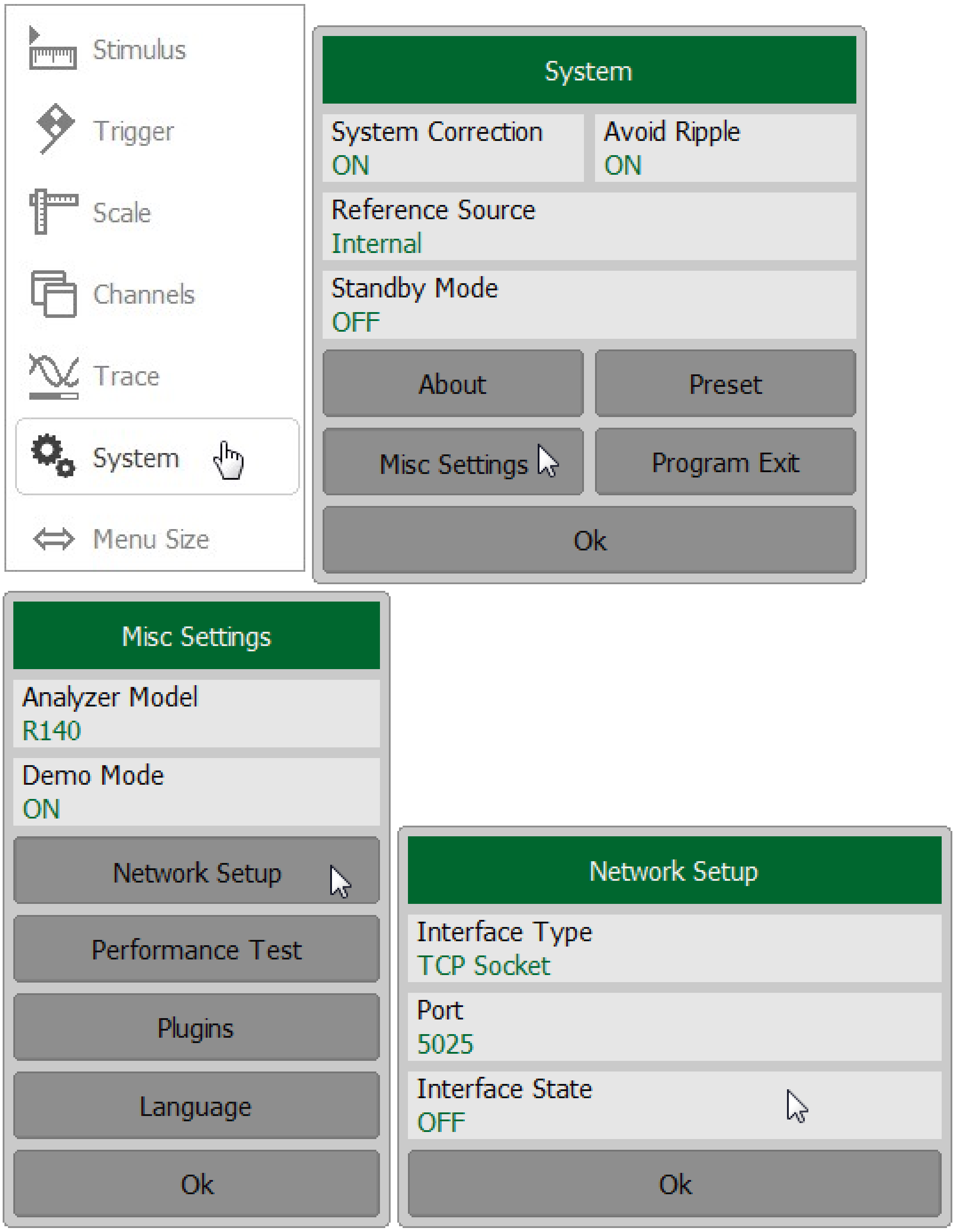
Data transfer between the PC user and the computer that is connected to the device, is performed via Socket protocol (TCP, port 5025).

Connect the device to a PC in the local Ethernet network of your company.

Activate the function of remote control via Socket protocol on your Analyzer as described below.

To enable/disable remote control via Socket protocol use the following softkeys:

System > Misc Settings > Network Setup >Interface State > ON/OFF.


Stimulus
Trigger
Scale
Channels
Trace
System
Menu Size
System
System Correction
ON
Avoid Ripple
ON
Reference Source
Internal
Standby Mode
OFF
About
Preset
Misc Settings
Program Exit
Ok
Misc Settings
Analyzer Model
R140
Demo Mode
ON
Network Setup
Performance Test
Plugins
Language
Ok
Network Setup
Interface Type
TCP Socket
Port
5025
Interface State
OFF
Ok

Client Setting

Typically, the client uses the VISA library to establish connection to the Analyzer software. The easiest way to configure the network connection with the Analyzer is using a special utility from VISA package (for example, NI-MAX, Keysight Connection Expert).

Following the manual for the above utilities, add a new network device — specifying the network name or IP address of the Analyzer's PC — and the protocol. Once successfully connected to the Analyzer, the VISA address of the Analyzer will be automatically generated and displayed. Use this VISA address in the client program in order to open the connection.

The format of the VISA address for the Socket protocols

Socket	TCPIP[board]::*host address*::*port*::SOCKET

Examples of VISA address for Socket protocols

Socket	TCPIP0::192.168.0.1::5025::SOCKET TCPIP0::localhost::5025::SOCKET

If the client is a user program that does not use the VISA library, then the only available protocol is the TCP/IP Socket protocol. In this case, the user program establishes a connection using the IP address of the Analyzer's Socket server.

The format of the IP address of the Analyzer's Socket server

Socket	*host address:port*

Examples of the IP address of the Analyzer's Socket serve

Socket	192.168.0.1:5025 localhost:5025

VISA Library

Using the VISA (Virtual Instrument Software Architecture) library is the most common approach. The VISA library is a widely used software input-output interface in the field of testing and measurement for controlling devices from a PC. It is a library of functions for C/C ++, C #, Visual Basic, MATLAB, LabVIEW and others.

The VISA Library unifies access to all measuring instruments, regardless of the protocol and equipment used.

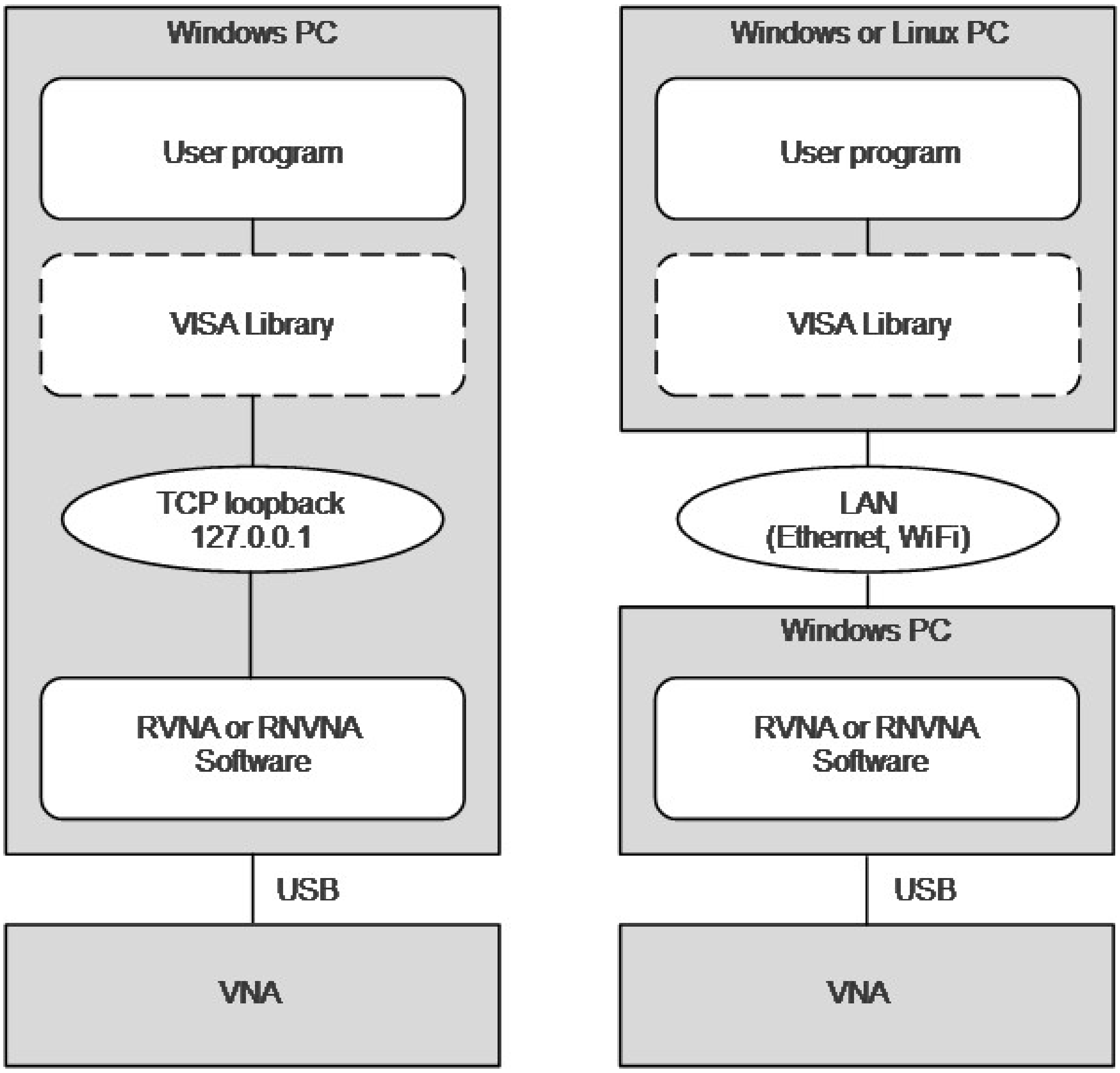
The VISA library is installed on the client side, on the PC where the user program is executed. The VISA library is available on the websites of many companies for free download. There are versions for Linux, Mac OS, Windows.

Network and Local Configuration

A network configuration involves executing a user program and the Analyzer program on different PCs connected by a local area network.

The local configuration involves executing the user program and the analyzer program on the single PC.

The figure below shows the local configuration on the left and the network configuration on the right.



Local configuration is possible due to the standard TCP/IP stack function — TCP loopback. The TCP loopback function allows network applications to communicate in a standard way within a single PC. The most widely used IP address in the TCP loopback mechanism is 127.0.0.1. It is also possible to use the symbolic name *localhost* instead of the numeric address 127.0.0.1.

NOTE	The network configuration does not restrict the client in choice of OS. The local configuration limits the client in choice of OS — only Windows.

Connecting Multiple Analyzers to Single Computer

The section describes in detail how to configure remote control of multiple analyzer programs executed simultaneously on a single PC (provided several USB analyzer hardware units connected to the single PC).

- It is recommended to create a separate folder for each Analyzer with the software. This allows to save individual settings for each Analyzer.
- It is recommended that each copy of the software be linked to a specific hardware unit by its serial number or model (See at the end of this section).
- Assign a unique TCP/IP port number for each copy of the software for the Socket protocol used. For example, if TCP/IP is used, assign port 5025 to the first Analyzer, 5026 to the second, and so on. When assigning a port number, the user must ensure that the port number is not in use by other programs.
- Use the Analyzer's address in the user program with the mandatory indication of the TCP/IP port number assigned to the Analyzer, as in the examples given.

Examples of the VISA address for the Socket protocols with the indication of the TCP/IP port

Socket	TCPIP0::192.168.0.1::5025::SOCKET TCPIP0::192.168.0.1::5026::SOCKET

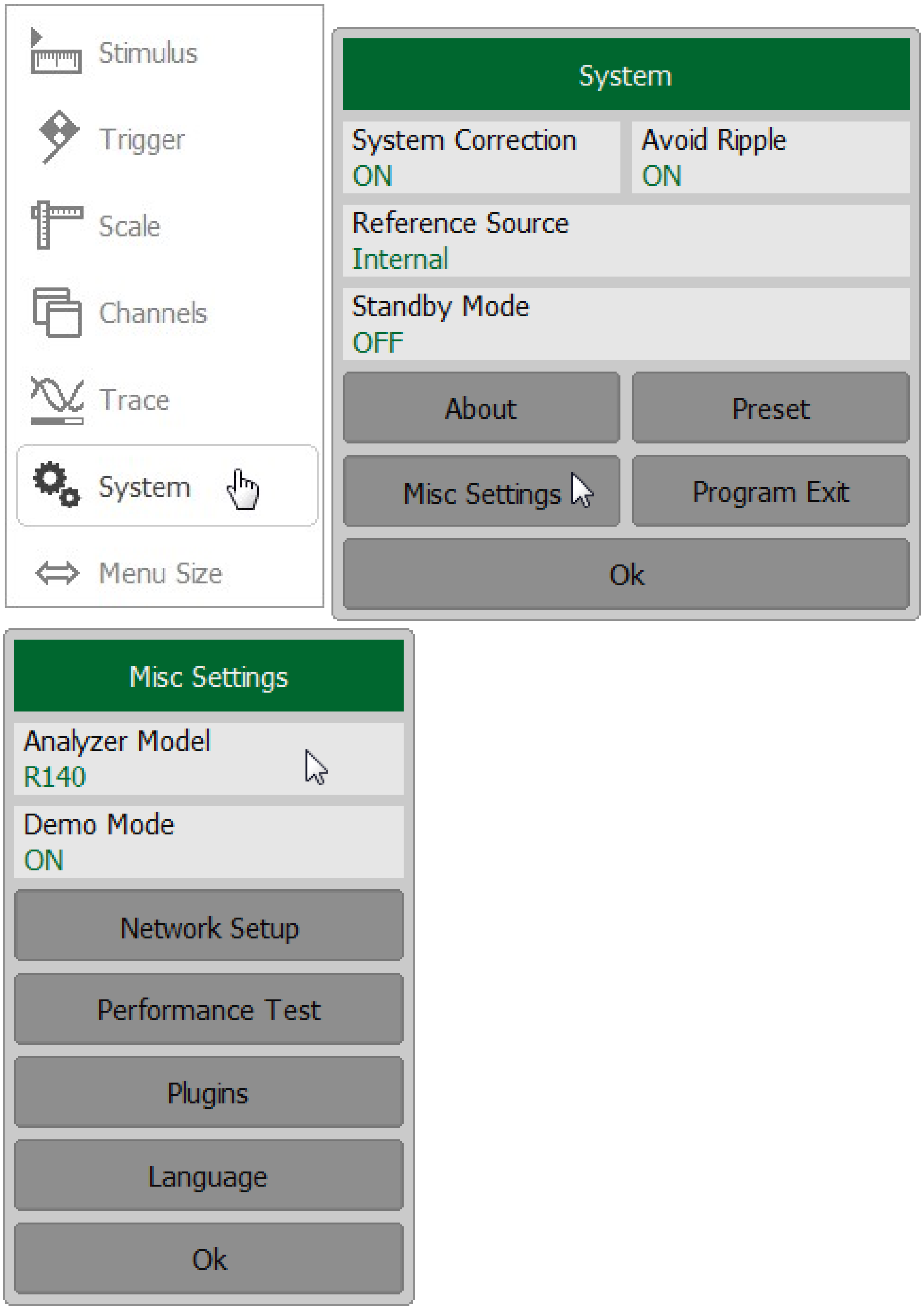
Examples of the TCP/IP address of the Analyzer's Socket server with the indication of the port

Socket	192.168.0.1:5025 192.168.0.1:5026

To link the Analyzer program to the analyzer model, press the **System > Misc Settings > Analyzer Model** softkeys.

To link the RVNA software to the Analyzer serial number, press the **System > Misc Settings > Analyzer Model > Analyzer Serial** softkeys.

The RNVNA software links to the Analyzer serial number, press the Devices softkey.


Stimulus
Trigger
Scale
Channels
Trace
System
Menu Size
System
System Correction
ON
Avoid Ripple
ON
Reference Source
Internal
Standby Mode
OFF
About
Preset
Misc Settings
Program Exit
Ok
Misc Settings
Analyzer Model
R140
Demo Mode
ON
Network Setup
Performance Test
Plugins
Language
Ok

SCPI Overview

The Analyzer implements a set of commands based on the standard SCPI-1999 (Standard Commands for Programmable Instruments). This is a set of instructions for the exchange of textual messages.

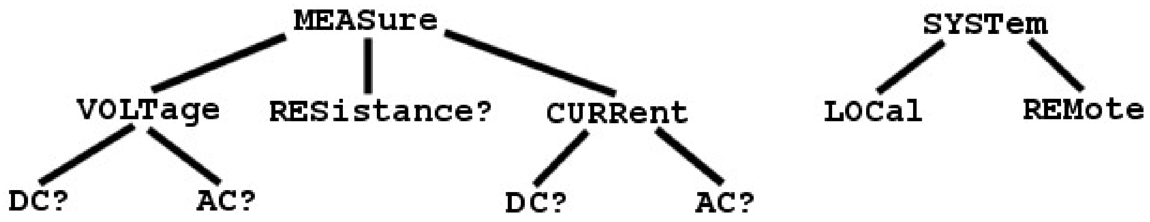
SCPI was developed by the SCPI Consortium (currently supported by the IVI Foundation). The main details of the SCPI standard are described further on. More information about the SCPI standard can be downloaded from the IVI Foundation website.

Messages

The SCPI is a text message-oriented protocol. The commands are sent as character messages. One message can contain one or several commands. The answer from the instrument is read out as a text message by default. Optionally, an instrument can be programmed to output binary data.

Command Tree

The SCPI commands are organized in a tree structure. For example:



Each tree structure forms a functional system. The base of the tree is called the root, e.g. MEASure and SYSTem. Each functional system can have subsystems of lower level. The final nodes are called leaves. The entire sequence from root to leaf makes up the command. For example, part of the SOURCe functional system looks as follows:

```
:SOURce
        :POWer
               :CENTer
                      :STARt
                      :SPAN
                      :STOP
                      [:LEVel]
                             :SLOPe
                             [:DATA]
                                    :STATe
```

This SOURce branch has several levels, where CENTer, STARt, SPAN, STOP, DATA, STATe are the leaves, which represent the following six commands:

:SOURce:POWer:CENTer

:SOURce:POWer:STARt

:SOURce:POWer:SPAN

:SOURce:POWer:STOP

:SOURce:POWer[:LEVel]:SLOPe[:DATA]

:SOURce:POWer[:LEVel]:SLOPe:STATe

The tree can contain subsystems and leaves with the same names if they belong to different branches, e.g. CENTer leaf is on the tips of different branches:

```
:SOURce                                 :SENSe
        :POWer                                  :FREQuency
                :CENTer                                 :CENTer
```

Subsystems

A colon (':') separates the subsystems. The subsystems which follow the colon are on a lower level. For example, in command:

:SOURce:POWer:STARt

the start power STARt is a part of the POWer subsystem, which is a part of the SOURce subsystem. The stop power is also a part of the :SOURce:POWer subsystem. It is specified by:

:SOURce:POWer:STOP

The first colon in the line can be omitted, for example:

SOURce:POWer:STOP

Optional Subsystems

Some subsystems can be specified as optional, if omission of such a subsystem will not lead to ambiguity. This means that the subsystem can be omitted in the command line. The optional subsystems are bracketed ("[]"). For example, if the full command specification is written as:

SOURce:POWer[:LEVel]:SLOPe[:DATA]

subsystems LEVel and DATA are optional. Therefore, both commands are valid:

SOURce:POWer:LEVel:SLOPe:DATA

SOURce:POWer:SLOPe

Long and Short Formats

Each keyword in a command specification has a long format and a short format. The short format of a command is indicated by capital letters. For example, a command specification:

SENSe:FREQuency:CENTer

can be written as:

SENS:FREQ:CENT

SENS:FREQ:CENTer

Only one form can be used at a time, as combining forms will be incorrect. For example, the following specification is incorrect:

:SENS:FREQuen:CEN

Case Sensitivity

The commands are not case sensitive. Upper case and lower case letters are only used to indicate the long and short formats of a command specification. For example, the following commands are equivalent:

SENS:FREQ:STAR

sens:freq:star

Parameters

The commands can have parameters. The parameters are separated from the command by a space. If a command has several parameters, they are separated by commas (',').

Numeric Values

The numeric values are integers or real numbers. These parameters can have measurement units. For example:

SENS:FREQ 1000000000

SENS:FREQ 1000 MHz

SENS:FREQ 1 GHz

SENS:FREQ 1E9

Multiplier Prefixes

The SCPI standard allows specification of the numeric values with multiplier prefix to the measurement units.

Prefix	Multiplier
A	1e-18
F	1e-15
P	1e-12
N	1e-9
U	1e-6
M	1e-3
K	1e3
MA	1e6
G	1e9
T	1e12
PE	1e15
EX	1e18

There are two exceptions to the above designation: prefix M in combination with HZ or OHM means 1e6 (Mega), and not 1e–3 (milli), i.e. MHZ means Megahertz, same as MAHZ.

Notations

The SCPI standard allows numeric value specification in different notations. Decimal notation is used by default. To use other notations, specify the numeric values in the following way:

Notation	Prefix	Example
Binary	**#B**	#B11001010 = 202_{10}
Octal	**#Q**	#Q107 = 71_{10}
Hexadecimal	**#H**	#H10FF = 4351_{10}

Booleans

The booleans can assume two values: logical yes and logical no (ON and OFF), and are specified in command as:

ON or 1 — logical yes

OFF or 0 — logical no

For example:

DISPlay:ENABle OFF

DISPlay:ENABle 0

Character Data

The SCPI standard allows specification of parameters as character data, as in the following command:

TRIGger:SOURce {BUS|IMMediate|EXTernal}

where "BUS", "IMMediate", "EXTernal" is the possible values of the character data.

The character data has a long and short format, and the formats are specified in accordance with the same rules as described in Long and Short Formats.

Apart from that, the character data can be combined with numerical parameters. For example:

SENSe:FREQuency:STARt {MINimum|MAXimum|<value>}

The following specifications are acceptable:

SENSe:FREQuency:STARt MIN

SENSe:FREQuency:STARt maximum

SENSe:FREQuency:STARt 1000000

String Parameters

In some cases, the Analyzer can accept parameters made of character strings. Such strings are enclosed with single quotes (') or double quotes ("). For example, the file name in the state saving command:

MMEMory:STORe "state01.sta"

Numeric Lists

The numeric lists (<numeric list>) are used to specify a variable number of numerical parameters, for example:

CALC:LIMit:DATA 2,1,1E9,3E9,0,0,2,1E9,3E9,–3,–3

Query Commands

The query commands read out the parameter values from the Analyzer. After a query command has been sent, the response should return via remote control interface.

The query commands have a question mark ('?') at the end of the command. Many of the commands have two forms. The form with a question mark writes the parameter, the form without a question mark reads out the parameter. For example:

SENSe:FREQuency:STARt 1MHz

SENSe:FREQuency:STARt?

Numeric Suffixes

The Analyzer contains several items of the same type, such as 16 channels, each of which in turn contains 16 traces, etc. A numeric suffix is used to denote the item number in a command. The suffix is added to the keyword of the item (channel, trace, etc). For example, in the following specification the channel number <Ch> and trace number <Tr> indicate the channel and trace, to which this command is addressed:

CALCulate<Ch>:PARameter<Tr>:DEFine

According to this specification, the command referred to the trace 2 of the channel 1 will be written as follows:

CALC1:PAR2:DEF

The numeric suffix can be omitted. In this case, it is 1 by default. For example, the following commands are equivalent:

CALC:PAR:DEF

CALC1:PAR1:DEF

Compound Commands

It is possible to enter more than one command in the same command line. The commands in the line are separated by a semicolon (';'). The specification of the first command is valid for the following command, except for the last leaf before the semicolon. For example:

SENS:FREQ:STAR 1 MHZ;STOP 2MHZ

To start the next command from the highest level of the structure, begin the command using a colon (':'):

SENS:FREQ:STAR 1 MHZ;:CALC:PAR:DEF S21

IEEE488.2 Common Commands Overview

A SCPI compatible Analyzer must support a set of common commands of the IEEE488.2 standard. These commands start with an asterisk ('*'). The list of such commands can be seen below:

*CLS

*ESE

*ESE?

*ESR?

*IDN?

*OPC

*OPC?

*RST

*SRE

*SRE?

*STB?

*TRG

*WAI

These commands are used for resetting, state queries, etc.

For additional information of functions see IEEE488.2 Common Commands.

String Terminator

The <new line> character (ASCII 10) in the last data byte of the command string is used as a command terminator. The string of instructions sent to the instrument is executed after the instruction terminator is received.

COM/DOM Overview

COM stands for Component Object Model. This programming technology was developed by Microsoft for two purposes:

- The model provides the specification for interaction of binary modules created in different programming languages.
- The model defines the interfacing between a client application and a server application running either on the same PC or on two different PCs. In the latter case, the technology has DCOM abbreviation — Distributed COM.

Automation Server

The network analyzer executable module contains a built-in COM server that enables other programs to access its functionality. The COM server was developed in conformity with the *COM automation specification*. COM automation is a technology that allows control over the COM server by the programs written in both traditional compiling programming languages and interpreting programming languages, such as VBScript. This enables the server applications to make their functionality accessible to many more clients.

Registering COM Server

To register the COM server of the analyzer, run the executable module from the command prompt with the */regserver* keyword. To unregister the COM server of the analyzer, run the executable module from the command prompt with the */unregserver* keyword. Administrative rights are required to register/unregister COM server. The user also has the ability to register the COM server during the software installation procedure.

Example of the COM server registration command:

```
RVNA.exe /regserver
```

Automation Controllers

Automation controllers are client programs, which use internal functionality of the COM servers. Automation controller programs are developed by users for writing their own add-ons for the system.

User programs can be written in different languages:

- Programming languages with built-in COM support, such as Visual Basic®, Delphi, Java.
- Universal programming languages, such as C, C++.
- Microsoft Excel and Word office applications as they include built-in programming language Visual Basic for Applications®.
- Program generators, such as National Instruments LabVIEW®, MathWorks MATLAB® or HP–VEE.

Examples represented in this Manual are written in Visual Basic (VB).

See examples written in VB, and C++ languages in COM Programming Examples.

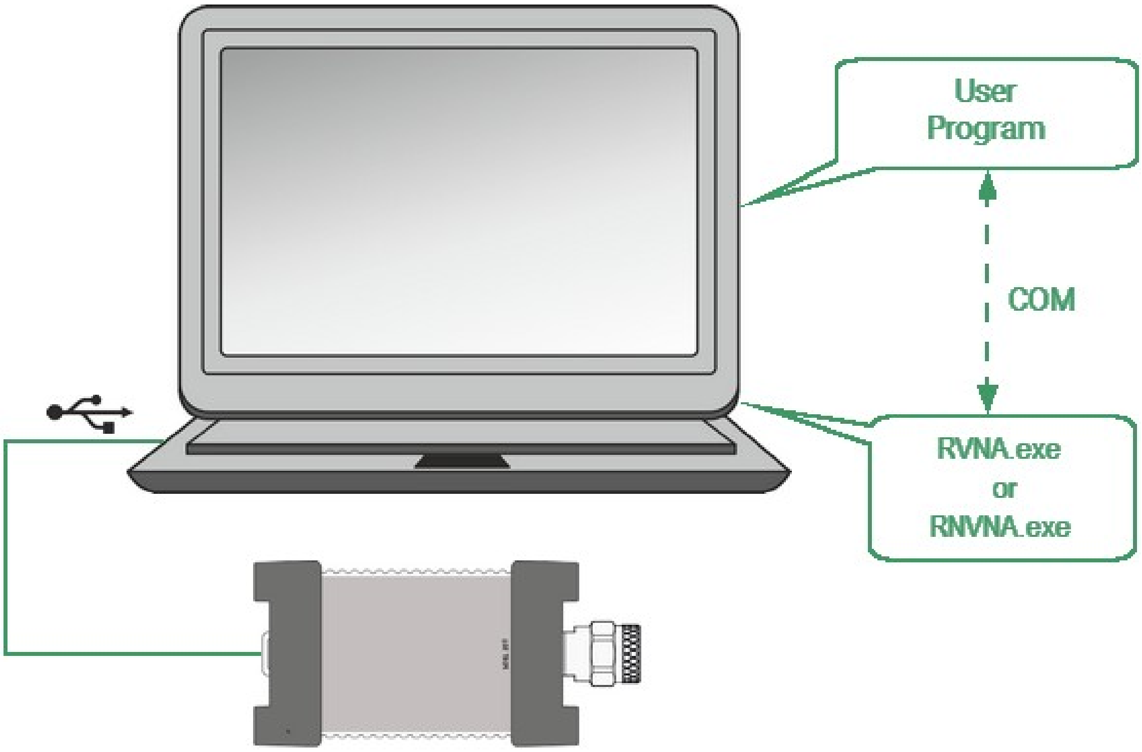
Examples written in VBA (Excel), C++, MATLAB, Python, and other languages are available at www.coppermountaintech.com. Source code of examples are also located in the Programming Examples\COM\ folder of the application installation folder.

A Labview Driver is also included in the Labview subfolder of the Programming Examples\COM\ folder, and can be downloaded separately from www.coppermountaintech.com. The Labview Driver contains examples of its use.

Local and Remote Server

The network analyzer executable module can function either as a local server or as a remote server of COM automation.

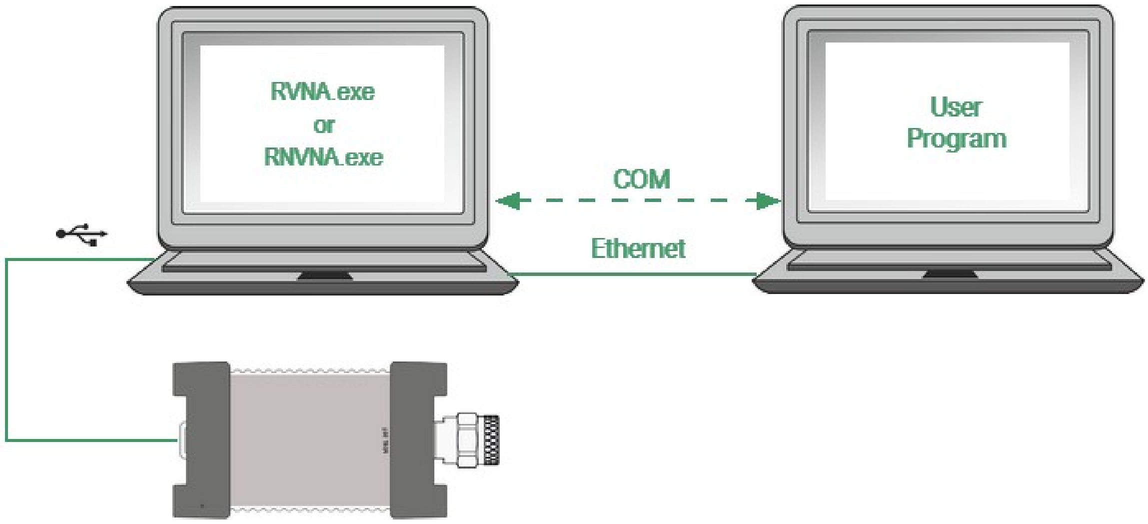
The **Local server** runs on the same PC with the automation controller and each of the programs is executed as an individual application in a separate window. COM technology is used in this case (See figure below).



COM technology

The **Remote server** and the automation controller run on different PCs connected by LAN. DCOM (Distributed COM) technology is used in this case (See figure below). When using DCOM, configure the local network by means of DCOM Windows tools.

The same automation controller is used for the both COM and DCOM technology. Some changes to the user program may be required in operators, which establish connection with the server. Moreover, DCOM technology requires additional settings of the LAN performed by the LAN administrator.



DCOM technology

DCOM Setup

The next section describes the settings for controlling the Analyzer via a network from a remote PC using DCOM technology.

Instrument Setup

A PC with a connected USB Analyzer must be connected to the local network and configured as a member of a domain or a member of a working group for managing DCOM technology. The network administrator must join the analyzer or control computer to a domain in the first case. An administrator or user assigns a workgroup name and adds user accounts in the second case.

The user category "everyone" has access to DCOM objects of the device. For the working group, the “everyone” user category includes those users with local accounts in the device. In the domain, the "everyone" user category includes users with local accounts, as well as all domain users, even if they do not have local accounts.

The device is configured in one of two ways:

- Join the device to a domain, which makes network connections of domain users to the device easier.
- When using a workgroup, start by creating local accounts on the device for each user who will have access to DCOM objects. The local user account in the device must match the local account on its remote computer (login, password).

Remote Computer Setup

A **remote computer** is a user's computer from which the analyzer is remotely controlled via a local network.

Copy the RVNA.exe file to the remote computer from the analyzer with a built-in computer or from the computer controlling the USB Analyzer. Run this file once with the /regserver keyword, and the COM server will register on the remote computer. After that, the file can be deleted.

To replace COM technology with DCOM technology, use one of two methods:

- Make changes to the source code of the programs.
- Change the DCOM settings on the remote computer using the dcomcnfg.exe utility.

The first method requires modifying the CreateObject statement. This operator requires an explicit inclusion of the network name of the device or its IP address, for example:

```
Set app = CreateObject("RVNA.Applcation", "o304-000123")
Set app = CreateObject("RVNA.Applcation", "192.168.1.149")
```

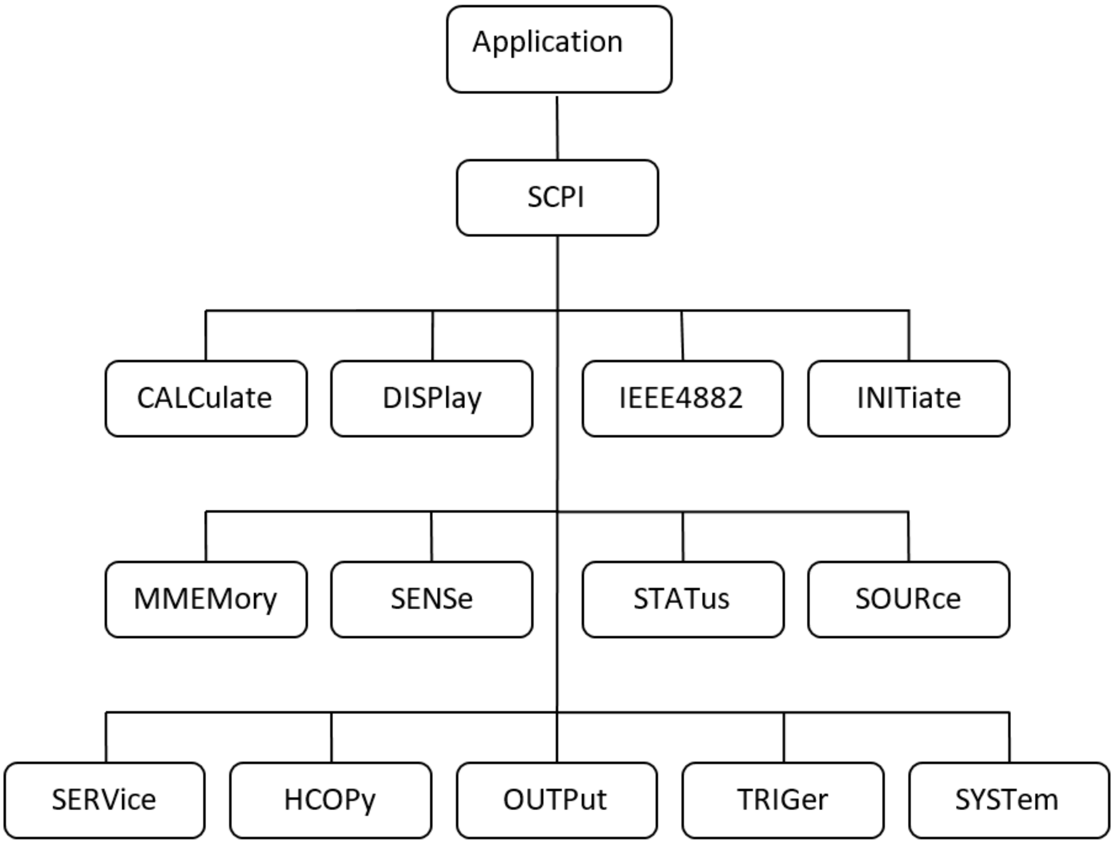
The network name of the device can be found in the system properties (Start> Control Panel> System> Computer Name).

The second method is to indicate the location of the COM server RVNA.exe using the dcomcnfg.exe utility. Run the specified utility on the remote computer, which is usually located in the C:\WINDOWS\SYSTEM32 folder:

- Go to Component "Services > Computers > My Computer > DCOM Setup".
- Find the "RVNA Object" in the list and open the "Properties" dialog.
- Click the "Location" tab, deselect the "Run application on this computer" check box, and select the "Run application on the following computer" check box.
- Then, enter the network name of the device.

Structure of COM Objects

The COM server contains several objects, which provide different functionality of the server. The COM objects of the Analyzer executable module are organized in a hierarchical structure. The figure below shows the main COM objects, which comprise the first three levels of the hierarchical structure of the COM server. COM objects provide various methods and properties, which allow access to the server functions, as well as allowing access to the objects of the lower levels.



The structure of COM objects

The Object Application is at the top of the hierarchy of the COM server. Access to the lower level objects is implemented via higher level objects.

NOTE

The hierarchy of COM objects and their names are borrowed from the SCPI command system, an alternative remote control technology of the Analyzer. Commands in SCPI have a chain hierarchical structure, for example:

```
CALCulate:PARameter:DEFine S11
```

The same command in COM is as follows:

```
app.SCPI.CALCulate.PARameter.DEFine = "S11"
```

Accessing the Application Object

To establish connection with the COM server application, create an object reference in the client program. In COM programming, the object reference needs to be acquired preliminarily, to be used later to access the object functionality. To define an object, perform the following:

- Declare a variable as an object.
- Create a COM Object and assign it to this variable.

To declare a variable, use the *Dim* operator or another declaration statement (*Public*, *Private* or *Static*). The variables used for references should be *Variant, Object*, or a type of specific object. For example, the following three operators declare an app variable:

```
Dim app
Dim app as Object
Dim app as RVNA.Application
```

Use the Set operator and *CreateObject* (*ObjectName*, *HostName*) function to assign a specific object to a variable.

ObjectName	Object name is always equal to "RVNA.Applcation"
HostName	Network name of the PC hosting the COM server. This parameter is not specified in the case of a local server.

For example, the following operators create an *Application* object and assign it to app variable:

```
Set app = CreateObject("RVNA.Applcation")
Set app = CreateObject("RVNA.Applcation", "Analyzer_Name")
Set app = CreateObject("RVNA.Applcation", "192.168.1.149")
```

NOTE	The first form of the operator is used to create the reference to the local COM server, the second and third forms are used to create the reference to the remote DCOM server.

To allow access to the objects of a lower level on the hierarchy, these objects are specified after the reference to the higher level object and separated from it by a dot. For example:

```
Dim SystObj
Set SystObj = app.SCPI.SYSTem
```

COM objects can have indices. For example, *CALCulate*, *INITiate*, *SENSe*, *SOURce* objects represent various aspects of the 16 measurement channels of the Analyzer. Therefore, it is necessary to write the channel index from 1 to 16 to acquire the data of these objects. For example:

```
Set SensObj1 = app.SCPI.SENSe(1)
Set SensObj2 = app.SCPI.SENSe(2)
```

Visual Basic allows omitting of such indices; in this case, the indices are considered as equal to 1. For example, the following VB operators are equivalent:

```
Set SensObj = app.SCPI.SENSe(1)
Set SensObj = app.SCPI.SENSe
```

NOTE

The models of vector network analyzers working with the RVNA executable module share the same COM object. The name of COM object is RVNA Application.

For example, the commands for creating a COM server for an Analyzer is:

```
Set app = CreateObject("RVNA.Applcation")
```

For backwards compatibility, the old name is preserved for creating COM object for each model. The user can use the old and new name of the COM object interchangeably, since they all create the same COM object. For example:

```
Set app = CreateObject("RVNA.Applcation")
Set app = CreateObject("R54.Applcation")
Set app = CreateObject("R60.Applcation")
Set app = CreateObject("R140.Applcation")
Set app = CreateObject("R140B.Applcation")
Set app = CreateObject("R180.Applcation")
```

Object Methods

Objects have methods. Methods are actions that can be applied to objects. The object methods are specified after the object name and separated from it by a dot.

The following example shows the *PRESet* method of *SYSTem* object. This method sets the Analyzer to the preset condition:

```
app.SCPI.SYSTem.PRESet
```

Object Properties

Along with methods, objects have properties. Properties are object characteristics that can be set or read out. The object properties are specified after the object name and separated from it by a dot.

To modify an object characteristic, write the value of the corresponding property. To define an object characteristic, read out the value of its property. The following example shows the setting of the *POINts* property of the *SWEep* object, i.e. the number of sweep points:

```
app.SCPI.SENSe.SWEp.POINts = 201
```

NOTE	Some object properties cannot be written, and some object properties cannot be read. In such cases, the properties are indicated as "read only" or "write only".

Error Handling

You can use different approaches to error handling in the VB program:

- Check the value of the Err.Number variable after execution of the VB operator, which contains the call to the COM server object.
- Use On Error GoTo VB operator.

These approaches are represented in the examples below. The following operator causes an error in VB program as "*S13*" value of the *DEFine* property is incorrect.

```
app.SCPI.PARameter.DEFine = "S13"
```

In the first example, the value of the *Err.Number* variable is checked after execution of the VB operator, which contains the call to the COM server object. The On Error Resume Next directive instructs VB not to interrupt the program execution when the error is detected, but to pass control to the next operator in natural order.

```
Dim app
Public Sub HandleError1()
Set app = CreateObject("RVNA.Application")
On Error Resume Next
app.SCPI.PARameter.DEFine = "S13"
If Err.Number <> 0 Then
    Msg = "Error # " & Str(Err.Number) & " was generated by " &_
    Err.Source & Chr(13) & Err.Description
    Msg Box Msg,,"Error"
End If
...
End Sub
```

In the second example, the *On Error GoTo Err Handler* directive instructs VB to interrupt the program execution when the error is detected and to pass control to *Err Handler* label.

```
Dim app
Public Sub HandleError2()
Set app = CreateObject("RVNA.Application")
```

```
On Error GoTo Err Handler
app.SCPI.PARameter.DEFine = "S13"
...
Exit Sub
Err Handler:
    Msg = "Error # " & Str(Err.Number) & " was generated by " &_
    Err.Source & Chr(13) & Err.Description
    Msg Box Msg,,"Error"
End Sub
```

COM Automation Data Types

In COM automation contains the following data types, which can be used for client-to-server communication:

Long	32-bit signed integer, value range from –2147483648 to 2147483647.
Double	64-bit double-precision floating point, value range from 1.79769313486232E308 to –4.94065645841247E–324 for negative values, and from 4.94065645841247E–324 to 1.79769313486232E308 for positive values.
Boolean	16-bit integer, two values "0" is false, "1" is true.
String	Variable-length string.
Variant	Can be either a value of arbitrary type or an array of values of arbitrary type. In this case, the term "arbitrary type" means any allowed type of COM automation. A variable contains information about its type and array size (if it is an array). It is used for communication of data arrays between a client and a server.

Measurement Data Arrays

Measurement data can be either complex values or real values. This depends on the format selected by the user. For example, the data is real in logarithmic magnitude format and complex in polar format.

The measurement data is transferred in a Variant type variable, which represents a Double type array. Two adjacent array cells are used to transfer one complex measurement. To transfer one real measurement, two adjacent array cells are used, but the second cell is always equal to 0. Thus, measurement data array size is a double number of the measurement points.

Measurement 1		Measurement 2			Measurement N	
Real	Imag	Real	Imag	...	Real	Imag

Array of complex measurements

Measurement 1		Measurement 2			Measurement N	
Value	0	Value	0	...	Value	0

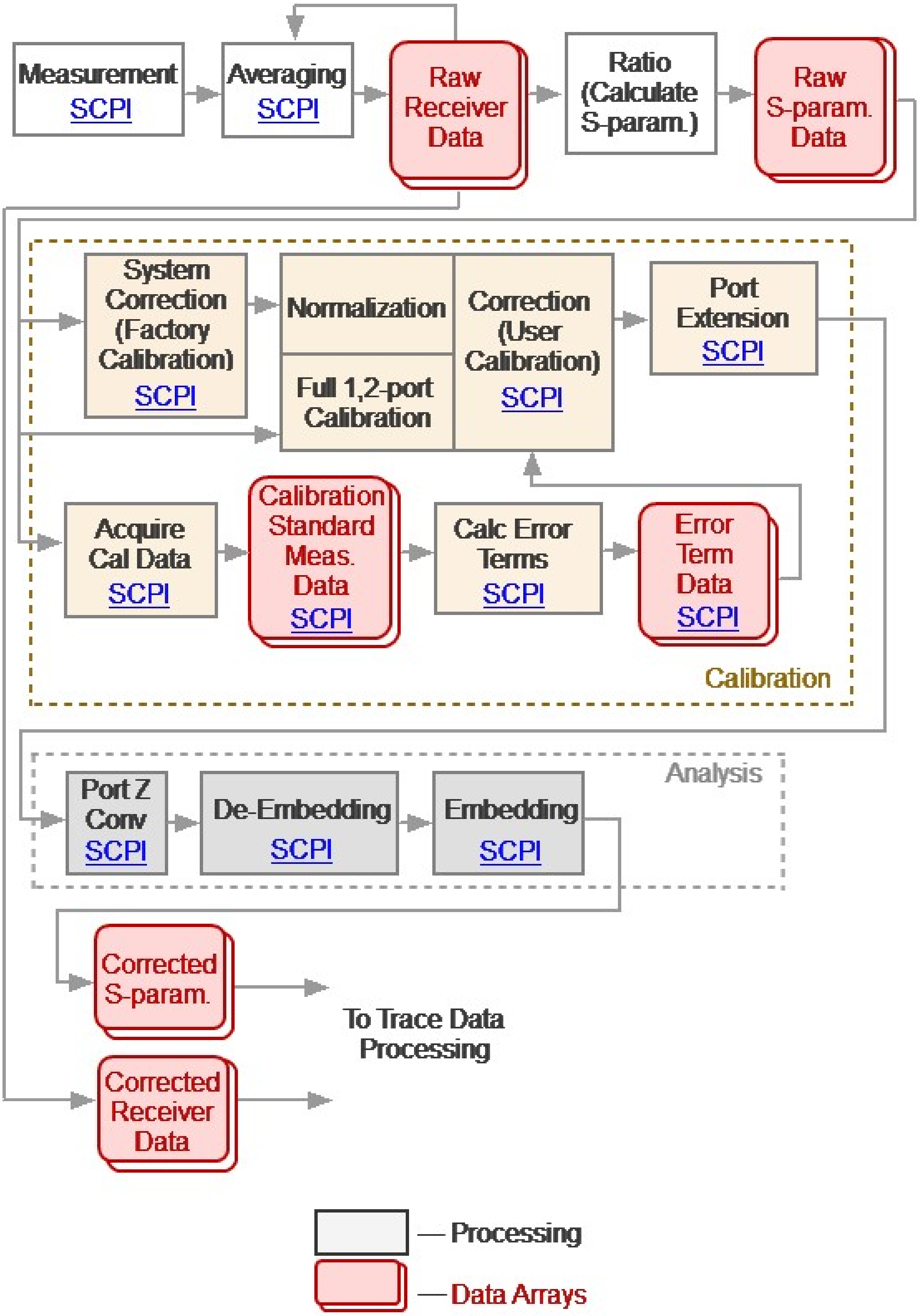
Array of real measurements

Internal Data Arrays

This section describes the internal data arrays, access to them, as well as their position in the internal data flow of the Analyzer (See figure below). For a description of internal data processing, see Internal Data Processing. To search for SCPI commands related to arrays and processes, click "SCPI" in the figures below.

Channel Data Processing

All internal arrays of channel data processing (See figure below) contain the number of elements equal to twice the number of stimulus points. Each measurement point is represented in the array by a pair of adjacent elements. The odd elements of the array contain the real part of the data, the even ones contain the imaginary part of the data.



Channel Data Processing

Channel data processing of the Analyzer consists of the following arrays:

- **Raw Receivers Data Arrays** are obtained as a result of analog-to-digital conversion and digital filtering of analog signals received by the receivers. If averaging is enabled, then the array elements are averaged pointwise over N sweep cycles. Array data is not available for reading using the SCPI command.
- **Raw S-param. Data Arrays** are obtained by calculating the ratio of the signals two receivers. Array data is not available for reading using the SCPI command.
- **Calibration Standard Meas. Data Arrays** are temporary arrays that contain the results of the performed measurements of the calibration standards. Upon completion of the calibration process, after calculating the error terms, the arrays are cleared. Array data is available for reading or writing using the SCPI commands SENS:CORR:COLL:DATA:XXXX.
- **Error Term Data Arrays** are obtained as a result of processing measurements of calibration standards. Arrays are used in the correction when error terms are applied to the measured S-parameters. Array data is available for reading or writing using the SCPI command SENS:CORR:COEF.

NOTE	Error terms will be interpolated if, for example, the number of measurement points or stimulus settings for measurements and during calibration differ. In this case, the SENS:CORR:COEF command will read the interpolated data from the array.

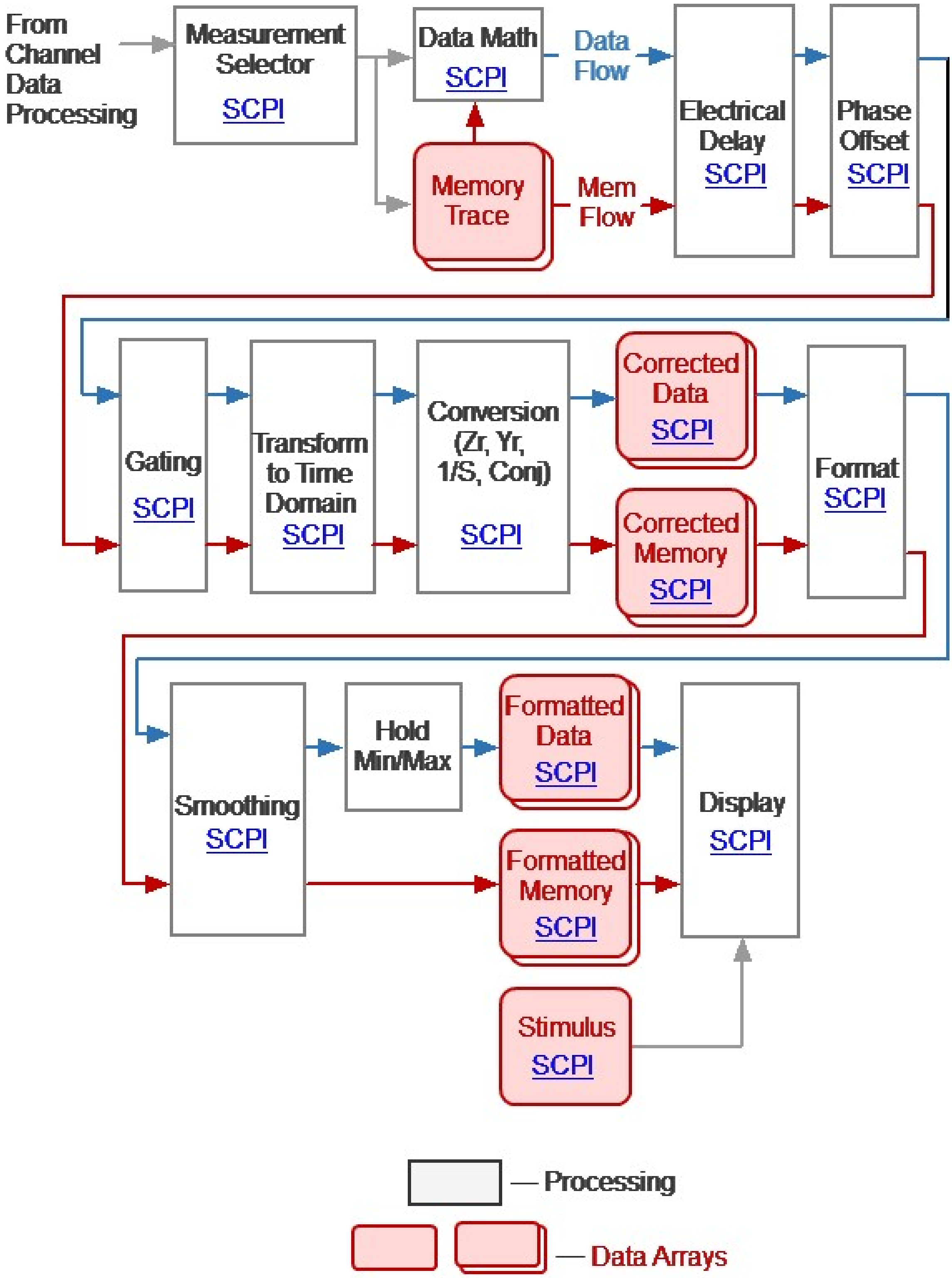
- **Corrected Receivers Data Arrays** are obtained as a result of the correction of the raw receiver data if the receivers are calibrated. This data is displayed on the screen if absolute measurements are selected. Array data is not available for reading using the SCPI command.
- **Corrected S-param. Data Arrays** are obtained from raw S-parameter arrays by performing the following operations: Correction, Port Extension, Port Z conversion, Embedding/De-embedding, General Conversion. Array data is not available for reading using the SCPI command.

Trace Data Processing

The following data arrays: Memory Trace, Corrected Data, and Corrected Memory, Formatted Data, and Formatted Memory (See figure below) contain the number of elements equal to twice the number of stimulus points. Each measurement point is represented in the array by a pair of adjacent elements. The stimulus data array has the number of elements equal to the number of stimulus points.

In the following data arrays: Memory Trace, Corrected Data, and Corrected Memory, the odd array elements contain the real part of the data, the even ones contain the imaginary part of the data.

The arrays of Formatted Data and Formatted Memory, depending on the selected data format, contain data of various types (See table).



Trace Data Processing

- **Memory Trace** is the measurement (S-parameter or receiver data) of the associated trace is copied to the array. The array is saved in memory as the result of activating the "Data-> Memory" function. The memory can be used both for display and for math operations in conjunction with data. SCPI commands for accessing this array are absent.

NOTE	Math memory operations are performed between the complex data of the current measurements and the memory, not between their formatted values (memory traces and data traces).

NOTE	The memory arrays are processed in parallel with the measurement data array in subsequent processing stages. For example, the formatting has the same effect on the data trace as it does on the memory trace.

- **Corrected Data Array** is obtained from the corrected S-parameter arrays or the corrected receiver data arrays as a result of performing the following operations: Trace Math, Electrical Delay, Phase Offset, Gating, Transform to Time Domain, and Conversion S-parameters. Arrays contain data that has been processed, with the exception of formatting. Array data is available for reading or writing using the SCPI command CALC:DATA:SDAT.

- **Corrected Memory Arrays** is obtained from the Trace Memory arrays as a result of performing the following operations: Electrical Delay, Phase Offset, Gating, Transform to Time Domain, and Conversion S-parameters. Arrays contain data that has been processed, with the exception of formatting. Array data is available for reading or writing using the SCPI command CALC:DATA:SMEM.

- **Formatted Data Array** is obtained by formatting the corrected data array and applying smoothing and hold operations to it. Arrays contain data that is ready to be displayed as a trace. Depending on the data format, the arrays contain two values for each measuring point (See table). Array data is available for reading or writing using the SCPI command CALC:DATA:FDAT.

- **Formatted Memory Data Arrays** are obtained by formatting corrected memory arrays and applying the smoothing operation to them. Arrays contain data that is ready to be displayed as a trace. Depending on the data format, the arrays contain two values for each measuring point (See table). Array data is available for reading or writing using the SCPI command CALC:DATA:FMEM.

- **Stimulus Data Array** contains the channel stimulus values for all measurement points. The data is available for reading using the SCPI command SENS:FREQ:DATA?.

Command Reference

Conventions

The following conventions are used throughout this section.

Syntax

The following symbols are used in command syntax:

<table>
<tr><td><></td><td>Identifiers enclosed in angular brackets indicate that a particular type of data must be specified.</td></tr>
<tr><td>[]</td><td>Parts enclosed in square brackets can be omitted.</td></tr>
<tr><td>{}</td><td>Parts enclosed in curly brackets indicate that you must select one of the items in this part. Individual items are separated by a vertical bar "|".</td></tr>
<tr><td>Space</td><td>Space separates commands from parameters.</td></tr>
<tr><td>,</td><td>Comma separates adjacent parameters.</td></tr>
<tr><td>…</td><td>Ellipses indicate that parameters in that part are omitted.</td></tr>
</table>

Identifiers

<table>
<tr><th>Identifier</th><th>Parameter</th><th>Description</th></tr>
<tr><td><numeric></td><td>Number</td><td>{<integer>|<real>}</td></tr>
<tr><td><frequency></td><td>Frequency</td><td><numeric>{[HZ]|KHZ|MHZ|GHZ}</td></tr>
<tr><td><power></td><td>Power</td><td><numeric>{[DBM]|DBMW|DBW|KW|W|MW|UW|NW}</td></tr>
<tr><td><time></td><td>Time</td><td><numeric>{[S]|MS|US|NS|PS|FS}</td></tr>
<tr><td><phase></td><td>Phase</td><td><numeric>{[DEG]|MADEG|KDEG|MDEG|UDEG}</td></tr>
<tr><td><stimulus></td><td>Stimulus</td><td>{<frequency>|<power>|<time>}</td></tr>
</table>

Identifier	Parameter	Description
<numeric list>	Numeric List	<numeric 1>,<numeric 2>,...<numeric N>
<bool>	Boolean parameter	{0|1|ON|OFF}
<char>	Character parameter	Predefined set of character strings without quotes
<port>	Port Number	<integer>
<string>	String parameter	Quoted string

Equivalent COM Command

The Analyzer command system description is based on the SCPI command system because this system is used primarily in this manual. In addition, the structure of COM objects and their names are borrowed from the SCPI command system. In this manual, COM commands are presented as equivalent to SCPI commands. The description of COM commands shows differences in their function from SCPI commands. If the SCPI command does not have a COM equivalent, this is noted in its description.

SCPI Command Tree

ABORt	Aborts all sweeps.
CALCulate	Data processing (conversion, electrical delay, phase offset, gating, fixture simulation, smoothing, time domain), trace analysis, limit tests, markers, trace memory, math, statistic, trace data transfer.
DISPlay	Display settings.
FORMat	Trace format.
HCOPy	Hard copy printing.
IEEE488.2	IEEE488.2 Common commands.
INITiate	Channel initiation mode.
MMEMory	File operations.
OUTP	RF power ON/OFF.
SENSe	Averaging, calibration, calibration kit management, port extension, IFBW setting, frequency settings, sweep settings, frequency offset, channel data transfer.
SERVice	Read active channel/trace/marker number, Analyzer capabilities.
SOURce	Power settings, power calibration.
STATus	Status reporting system.
SYSTem	System settings and preset.
TRIGger	Trigger system.

IEEE488.2 Common Commands

The set of common commands of IEEE488.2 standard. These commands start with an asterix ("*").

Command	Description		COM analog
*CLS	Status System	Clear status	+
*ESE		Event status enable	-
*ESR?		Event status enable register	-
*IDN?		Identify	+
*OPC		Operation complete command	+
*OPC?		Operation complete query	+
*RST		Reset	+
*SRE		Service request enable	-
*STB?		Status byte query	-
*TRG		Trigger signal	+
*WAI		Wait	+

*CLS

SCPI Command

*CLS

Description

Clears the following:

- Error Queue.
- Status Byte Register.
- Standard Event Status Register.
- Operation Status Event Register.
- Questionable Status Event Register.
- Questionable Limit Status Event Register.
- Questionable Limit Channel Status Event Register.

no query

Target

Status Reporting System

Equivalent Softkeys

None

Equivalent COM Command

SCPI.IEEE4882.CLS

Syntax

app.SCPI.IEEE4882.CLS

Type

Method

Back to IEEE488.2 Common Commands

*ESE

SCPI Command

*ESE <numeric>

*ESE?

Description

Sets or reads out the value of the Standard Event Status Enable Register.
command/query

Target

Status Reporting System

Parameter

<numeric> 0 to 255

Query Response

<numeric>

Preset Value

0

Equivalent Softkeys

None

Equivalent COM Command

None

Back to IEEE488.2 Common Commands

*ESR?

SCPI Command

*ESR?

Description

Reads out the value of the Standard Event Status Register. Executing this command clears the register value.
query only

Target

Status Reporting System

Query Response

<numeric>

Equivalent Softkeys

None

Equivalent COM Command

None

Back to IEEE488.2 Common Commands

*IDN?

SCPI Command

*IDN?

Description

Reads out the Analyzer identification string.
query only

Target

Analyzer

Query Response

The identification string in format: <manufacturer>, <model>, <serial number>, <software version>/<hardware version>.

For example: CMT, R140, 00000001, 21.4.1/1.0

Equivalent Softkeys

None

Equivalent COM Command

SCPI.IEEE4882.IDN

NAME

Syntax

StrName = app.NAME

Type

String (read only)

Back to IEEE488.2 Common Commands

*OPC

SCPI Command

*OPC

Description

Sets the OPC bit (bit 0) of the Standard Event Status Register at the completion of all pending operations. The pending operation caused by the command TRIG:SING only.
no query

Target

Status Reporting System

Equivalent Softkeys

None

Equivalent COM Command

SCPI.IEEE4882.OPC

Syntax

Value = app.SCPI.IEEE4882.OPC

app.SCPI.IEEE4882.OPC = Dummy

Type

Long (read/write)

Back to IEEE488.2 Common Commands

*OPC?

SCPI Command

*OPC?

Description

Reads out the "1" at the completion of all pending operations. The query blocks the execution of the user program until execution of all previous instructions. The query *OPC? can be used for waiting for the end of a sweep initiated by the command TRIG:SING.
query only

Target

Analyzer

Query Response

1

Related Commands

TRIG:SING

Equivalent Softkeys

None

Equivalent COM Command

SCPI.IEEE4882.OPC

Syntax

Value = app.SCPI.IEEE4882.OPC

app.SCPI.IEEE4882.OPC = Dummy

Type

Long (read/write)

Back to IEEE488.2 Common Commands

*RST

SCPI Command

*RST

Description

Restores the default settings of the Analyzer. There is difference from presetting the Analyzer with SYST:PRES command – in this case all channels are set to Hold.
no query

Target

Analyzer

Related Commands

SYST:PRES

Equivalent Softkeys

None

Equivalent COM Command

SCPI.IEEE4882.RST

Syntax

app.SCPI.IEEE4882.RST

Type

Method

Back to IEEE488.2 Common Commands

*SRE

SCPI Command

*SRE <numeric>

*SRE?

Description

Sets or reads out the value of the Service Request Enable Register.
command/query

Target

Status Reporting System

Parameter

<numeric> 0 to 255

Query Response

<numeric>

Preset Value

0

Equivalent Softkeys

None

Equivalent COM Command

None

Back to IEEE488.2 Common Commands

*STB?

SCPI Command

*STB?

Description

Reads out the value of the Status Byte Register.
query only

Target

Status Reporting System

Query Response

<numeric>

Equivalent Softkeys

None

Equivalent COM Command

None

Back to IEEE488.2 Common Commands

*TRG

SCPI Command

*TRG

Description

Generates a trigger signal and initiates a sweep under the following conditions.

1. Trigger source is set to the BUS (set by the command TRIG:SOUR BUS), otherwise an error occurs, and the command is ignored.

2. Analyzer must be in the trigger waiting state, otherwise (the analyzer is in the measurement state or hold state) an error occurs, and the command is ignored.

The command is completed immediately after the generation of the trigger signal.

no query

Target

Analyzer

Related Commands

TRIG:SOUR

INIT

INIT:CONT

Equivalent Softkeys

None

Equivalent COM Command

SCPI.IEEE4882.TRG

Syntax

app.SCPI.IEEE4882.TRG

Type

Method

Back to IEEE488.2 Common Commands

*WAI

SCPI Command

*WAI

Description

Waits till the completion of all pending commands. The only command that can be pending is the TRIG:SING command. In absence of a pending command TRIG:SING the command *WAI is equivalent to an empty operation. A query that follows the command *WAI blocks the execution of the user program till the completion of the command TRIG:SING, similarly to the query *OPC?.
no query

Target

Analyzer

Related Commands

TRIG:SING

Equivalent Softkeys

None

Equivalent COM Command

SCPI.IEEE4882.WAI

Syntax

app.SCPI.IEEE4882.WAI

Type

Method

NOTE	Since COM server executes commands sequentially and any operation is complete before COM server returns control the WAI command doesn't wait anything.

Back to IEEE488.2 Common Commands

ABOR

SCPI Command

ABORt

Description

Aborts the sweep. The channels in the Single trigger initiation mode transfer to the Hold state. The channels in the Continuous trigger initiation mode transfer to the trigger waiting state. If the trigger source is set to Internal, the channel immediately starts a new sweep.
no query

Related Commands

INIT:CONT

Equivalent Softkeys

Stimulus > Trigger > Restart

Equivalent COM Command

SCPI.ABORt

Syntax

app.SCPI.ABORt

Type

Method

CALCulate

Command	Description		COM analog
CALC:CONV	S-parameter Conversion	Conversion ON/OFF	+
CALC:CONV:FUNC		Conversion type	+
CALC:CORR:EDEL:TIME	Electrical Delay	Electrical delay	+
CALC:CORR:OFFS:PHAS	Phase Offset	Value of the phase offset	+
CALC:DATA:FDAT?	Data Transfer	Formatted data array	+
CALC:TRAC:DATA:FDAT?			+
CALC:DATA:FMEM?		Formatted memory array	+
CALC:TRAC:DATA:FMEM?			+
CALC:DATA:SDAT?		Corrected data array	+
CALC:TRAC:DATA:SDAT?			+
CALC:DATA:SMEM?		Corrected memory array	+
CALC:TRAC:DATA:SMEM?			+

Command	Description		COM analog
CALC:DATA:XAX?		X-axis values array	+
CALC:FILT:TIME	Gating	Gate type	+
CALC:FILT:TIME:CENT		Gate center	+
CALC:FILT:TIME:SHAP		Gate shape	+
CALC:FILT:TIME:SPAN		Gate span	+
CALC:FILT:TIME:STAR		Gate start	+
CALC:FILT:TIME:STAT		Gating function ON/OFF	+
CALC:FILT:TIME:STOP		Gate stop	+
CALC:FORM	Channel and Trace Settings	Trace format	+
CALC:PAR:COUN		Number of traces in the channel	+
CALC:PAR:SEL		Active trace number (write)	+
CALC:FSIM:SEND:DEEM:PORT:STAT	Two-port Network De-embedding	De-embedding for specified port ON/OFF	+

Command	Description		COM analog
CALC:FSIM:SEND:DEEM:PORT:USER:FIL		Name of *.S2P touchstone file of the de-embedded circuit	+
CALC:FSIM:SEND:PMC:PORT:STAT	Two-port Network Embedding	Embedding for specified port ON/OFF	+
CALC:FSIM:SEND:PMC:PORT:USER:FIL		Name of *.S2P Touchstone file of the embedded circuit	+
CALC:FSIM:SEND:ZCON:PORT:Z0	Port Impedance Conversion	Z0 Real part, Imaginary part is "0"	+
CALC:FSIM:SEND:ZCON:STAT		Port Z conversion ON/OFF	+
CALC:FUNC:DATA?	Trace Analysis	Analysis result data array	+
CALC:FUNC:DOM		Arbitrary sweep range ON/OFF	+
CALC:FUNC:DOM:COUP		Coupling range ON/OFF	+
CALC:FUNC:DOM:STAR		Analysis range start	+
CALC:FUNC:DOM:STOP		Analysis range stop	+
CALC:FUNC:EXEC		Execute analysis	+

Command	Description		COM analog
CALC:FUNC:PEXC		Lower limit for the peak excursion value	+
CALC:FUNC:POIN?		Number of points (data pairs)	+
CALC:FUNC:PPOL		Peak polarity	+
CALC:FUNC:TARG		Target level	+
CALC:FUNC:TTR		Transition type	+
CALC:FUNC:TYPE		Analysis type	+
CALC:LIM	Limit Test	Limit test ON/OFF	+
CALC:LIM:DATA		Limit line table	+
CALC:LIM:DISP		Limits display ON/OFF	+
CALC:LIM:FAIL?		Limit test result	+
CALC:LIM:OFFS:AMPL		Limit line Y-offset	+
CALC:LIM:OFFS:STIM		Limit line X-offset	+

Command	Description		COM analog
CALC:LIM:REP:ALL?		Limit test result report	+
CALC:LIM:REP:POIN?		Failed points	+
CALC:LIM:REP?		Stimulus values of failed points	+
CALC:MARK	Marker Properties	Marker ON/OFF	+
CALC:MARK:ACT		Sets active marker	+
CALC:MARK:COUN		Number of markers	+
CALC:MARK:COUP		Coupling of markers ON/OFF	+
CALC:MARK:REF		Reference marker ON/OFF	+
CALC:MARK:X		Stimulus value of marker	+
CALC:MARK:Y?		Response value of marker	+
CALC:MARK:BWID	Bandwidth Search	Bandwidth search ON/OFF	+
CALC:MARK:BWID:DATA?		Bandwidth search result	+
CALC:MARK:BWID:REF		Reference of search	+

Command	Description		COM analog
CALC:MARK:BWID:THR		Bandwidth threshold value	+
CALC:MARK:BWID:TYPE		Type of search	+
CALC:MARK:FUNC:DOM	Marker Search	Arbitrary search range ON/OFF	+
CALC:MARK:FUNC:DOM:STAR		Start of the marker search range	+
CALC:MARK:FUNC:DOM:STOP		Stop of the marker search range	+
CALC:MARK:FUNC:EXEC		Executes search	+
CALC:MARK:FUNC:PEXC		Peak excursion value	+
CALC:MARK:FUNC:PPOL		Peak polarity	+
CALC:MARK:FUNC:TARG		Target value	+
CALC:MARK:FUNC:TRAC		Marker search tracking ON/OFF	+
CALC:MARK:FUNC:TTR		Type of target transition	+
CALC:MARK:FUNC:TYPE		Search type	+

Command	Description		COM analog
CALC:MARK:SET	Marker Functions	Sets item value according to the position of the marker	+
CALC:MATH:FUNC	Memory Trace Function	Math operation	+
CALC:MATH:MEM		Data => Memory	+
CALC:MATH:DEL		Clear memory	+
CALC:MST	Statistic	Math statistics ON/OFF	+
CALC:MST:DATA?		Math statistics data	+
CALC:MST:DOM		Partial frequency range ON/OFF	+
CALC:MST:DOM:STAR		Marker specifying start of frequency range	+
CALC:MST:DOM:STOP		Marker specifying stop of frequency range	+
CALC:PAR:DEF	Measurement Setting	Measurement parameter of a trace	+
CALC:RLIM	Ripple Limit Test	Ripple limit test ON/OFF	+

Command	Description		COM analog
CALC:RLIM:DATA		Ripple limit line table	+
CALC:RLIM:DISP:LINE		Ripple Limit line display ON/OFF	+
CALC:RLIM:FAIL?		Ripple limit test result	+
CALC:RLIM:REP?		Ripple limit test result report	+
CALC:SMO	Smoothing	Trace smoothing ON/OFF	+
CALC:SMO:APER		Smoothing aperture	+
CALC:TRAN:TIME	Setting Time Domain Parameters	Selects Bandpass/Lowpass type	+
CALC:TRAN:TIME:CENT		Time domain center	+
CALC:TRAN:TIME:IMP:WIDT		Impulse Width	+
CALC:TRAN:TIME:KBES		Kaiser-Bessel β	+
CALC:TRAN:TIME:LPFR		Sets requency Lowpass	+
CALC:TRAN:TIME:REFL:TYPE		Selects One way/Round trip	+
CALC:TRAN:TIME:SPAN		Time domain Span	+

Command	Description		COM analog
CALC:TRAN:TIME:STAR		Time domain Start	+
CALC:TRAN:TIME:STOP		Time domain Stop	+
CALC:TRAN:TIME:STAT		Time domain transformation ON/OFF	+
CALC:TRAN:TIME:STEP:RTIM		Step rise time	+
CALC:TRAN:TIME:STIM		Selects Impulse/Step type	+
CALC:TRAN:TIME:UNIT		Time domain Unit	+

CALC:CONV

SCPI Command

CALCulate<Ch>[:SELected]:CONVersion[:STATe] {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:CONVersion[:STATe]?

Description

Turns the S–parameter conversion function ON/OFF.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Commands

CALC:CONV:FUNC

Equivalent Softkeys

Analysis > Conversion > Conversion

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.CONVersion.STATe

Syntax

Status = app.SCPI.CALCulate(Ch).SELected.CONVersion.STATe

app.SCPI.CALCulate(Ch).SELected.CONVersion.STATe = true

Type

Boolean (read/write)

Back to CALCulate

CALC:CONV:FUNC

SCPI Command

CALCulate<Ch>[:SELected]:CONVersion:FUNCtion <char>

CALCulate<Ch>[:SELected]:CONVersion:FUNCtion?

Description

Sets or reads out the S-parameter conversion function type.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

<char> Specifies parameter:

IMPedance	Equivalent transmission or reflection impedance, depending on the parameter S11 or S21
ADMittance	Equivalent transmission or reflection conductance, depending on the parameter S11 or S21
INVersion	Inverse S-parameter
CONJugation	S-parameter conjugate

Query Response

{IMP|ADM|INV|CONJ}

Preset Value

IMP

Equivalent Softkeys

Analysis > Conversion > Function { Impedance Z | Admittance Y | Inverse 1/S | Conjugation }

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.CONVersion.FUNCtion

Syntax

Param = app.SCPI.CALCulate(Ch).SELected.CONVersion.FUNCtion

app.SCPI.CALCulate(Ch).SELected.CONVersion.FUNCtion ="INV"

Type

String (read/write)

Back to CALCulate

CALC:CORR:EDEL:TIME

SCPI Command

CALCulate<Ch>[:SELected]:CORRection:EDELay:TIME <time>

CALCulate<Ch>[:SELected]:CORRection:EDELay:TIME?

Description

Sets or reads out the value of the electrical delay.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

<time> the electrical delay value from –10 to 10

Unit

sec (second)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Equivalent Softkeys

Scale > Electrical Delay

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.CORRection.EDELay.TIME

Syntax

Value = app.SCPI.CALCulate(Ch).SELected.CORRection.EDELay.TIME

app.SCPI.CALCulate(Ch).SELected.CORRection.EDELay.TIME = 1e–9

Type

Double (read/write)

Back to CALCulate

CALC:CORR:OFFS:PHAS

SCPI Command

CALCulate<Ch>[:SELected]:CORRection:OFFSet:PHASe <phase>

CALCulate<Ch>[:SELected]:CORRection:OFFSet:PHASe?

Description

Sets or reads out the value of the phase offset.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

<phase> the phase offset value from –360 to 360

Unit

° (degree)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Equivalent Softkeys

Scale > Phase Offset

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.CORRection.OFFSet.PHASe

Syntax

Value = app.SCPI.CALCulate(Ch).SELected.CORRection.OFFSet.PHASe

app.SCPI.CALCulate(Ch).SELected.CORRection.OFFSet.PHASe = 360

Type

Double (read/write)

Back to CALCulate

CALC:DATA:FDAT?

SCPI Command

CALCulate<Ch>[:SELected]:DATA:FDATa?

Description

Reads out the formatted data array.

The formatted data array is the data, whose processing is completed including the formatting as the last step. Such data represent the data trace values as they are shown on the screen.

The array size is 2N, where N is the number of measurement points.

For the n–th point, where n from 1 to N:

<numeric 2n–1> Value 1 depends on the trace format (see table below);

<numeric 2n> Value 2 depends on the trace format (see table below).Reads out or writes the formatted data array.

Trace Format	Value 1	Value 2
Log Mag	Logarithmic magnitude, dB	0
SWR	Voltage standing wave ratio	0
Phase	Phase, deg	0
Expand Phase	Expanded phase, deg	0

Trace Format	Value 1	Value 2
Group Delay	Group delay, sec	0
Lin Mag	Linear magnitude	0
Real	Real part	0
Imag	Imaginary part	0
Smith (Log/Phase)	Logarithmic magnitude, dB	Phase, deg
Smith (Lin/Phase)	Linear magnitude	Phase, deg
Smith (Real/Imag)	Real part	Imaginary part
Smith (R + jX)	Impedance (real part), Ohm	Impedance (imaginary part), Ohm
Smith (G + jB)	Admittance (real part), S	Admittance (imaginary part), S
Polar (Log/Phase)	Logarithmic magnitude, dB	Phase, deg
Polar (Lin/Phase)	Linear magnitude	Phase, deg
Polar (Real/Imag)	Real part	Imaginary part

Note: When data is being written it is recommended to hold the sweep before and update the screen after write.

query only

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Query Response

<numeric 1>, <numeric 2>, …<numeric 2N>

Related Commands

CALC:FORM

FORM:DATA

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.DATA.FDATa

Syntax

Data = app.SCPI.CALCulate(Ch).SELected.DATA.FDATa

Type

Variant (array of Double) (read)

Back to CALCulate

CALC:DATA:FMEM?

SCPI Command

CALCulate<Ch>[:SELected]:DATA:FMEMory?

Description

Reads out the formatted memory array.

The formatted memory array is the data, whose processing is completed including the formatting as the last step. Such data represent the memory trace values as they are shown on the screen.

The array size is 2N, where N is the number of measurement points.

For the n–th point, where n from 1 to N:

<numeric 2n–1> Value 1 depends on the trace format (see table below);

<numeric 2n> Value 2 depends on the trace format (see table below).

Trace Format	**Value 1**	**Value 2**
Log Mag	Logarithmic magnitude, dB	0
SWR	Voltage standing wave ratio	0
Phase	Phase, deg	0
Expand Phase	Expanded phase, deg	0

Trace Format	Value 1	Value 2
Group Delay	Group delay, sec	0
Lin Mag	Linear magnitude	0
Real	Real part	0
Imag	Imaginary part	0
Smith (Log/Phase)	Logarithmic magnitude, dB	Phase, deg
Smith (Lin/Phase)	Linear magnitude	Phase, deg
Smith (Real/Imag)	Real part	Imaginary part
Smith (R + jX)	Impedance (real part), Ohm	Impedance (imaginary part), Ohm
Smith (G + jB)	Admittance (real part), S	Admittance (imaginary part), S
Polar (Log/Phase)	Logarithmic magnitude, dB	Phase, deg
Polar (Lin/Phase)	Linear magnitude	Phase, deg
Polar (Real/Imag)	Real part	Imaginary part

Note: When data is being written it is recommended to hold the sweep before and update the screen after write.

query only

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Query Response

<numeric 1>, <numeric 2>, …<numeric 2N>

Related Commands

CALC:MATH:MEM

CALC:FORM

FORM:DATA

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.DATA.FMEMory

Syntax

Data = app.SCPI.CALCulate(Ch).SELected.DATA.FMEMory

app.SCPI.CALCulate(Ch).SELected.DATA.FMEMory = Data

Type

Variant (array of Double) (read)

Back to CALCulate

CALC:DATA:SDAT?

SCPI Command

CALCulate<Ch>[:SELected]:DATA:SDATa?

Description

Reads out the corrected data array. The corrected data array is the data, whose processing is completed excluding the formatting as the last step. Such data represent S–parameter complex values. The array size is 2N, where N is the number of measurement points. For the n–th point, where n from 1 to N: <numeric 2n–1> the real part of corrected measurement; <numeric 2n> the imaginary part of corrected measurement. **Note**: When data is being written it is recommended to hold the sweep before and update the screen after write.
query only

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Query Response

<numeric 1>, <numeric 2>, …<numeric 2N>

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.DATA.SDATa

Syntax

Data = app.SCPI.CALCulate(Ch).SELected.DATA.SDATa

app.SCPI.CALCulate(Ch).SELected.DATA.SDATa = Data

Type

Variant (array of Double) (read)

Back to CALCulate

CALC:DATA:SMEM?

SCPI Command

CALCulate<Ch>[:SELected]:DATA:SMEMory?

Description

Reads out the corrected memory array.

The corrected memory array is the data, whose processing is completed excluding the formatting as the last step. Such data represent S–parameter complex values.

The array size is 2N, where N is the number of measurement points.

For the n–th point, where n from 1 to N:

<numeric 2n–1> the real part of corrected measurement memory;

<numeric 2n> the imaginary part of corrected measurement memory.

Note: When data is being written it is recommended to hold the sweep before and update the screen after write.

query only

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Query Response

<numeric 1>, <numeric 2>, …<numeric 2N>

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.DATA.SMEMory

Syntax

Data = app.SCPI.CALCulate(Ch).SELected.DATA.SMEMory

app.SCPI.CALCulate(Ch).SELected.DATA.SMEMory = Data

Type

Variant (array of Double) (read)

Back to CALCulate

CALC:DATA:XAX?

SCPI Command

CALCulate<Ch>[:SELected]:DATA:XAXis?

Or

CALCulate<Ch>:TRACe<Tr>:DATA:XAXis?

Description

Reads out the X-axis values array. The X-axis values array is the frequency, power or time values array depending on the trace setup. The array contains real values. The array size is N, where N is the number of measurement points. For the n–th point, where n from 1 to N: <numeric n> the X-axis value.
query only

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

<Tr>={[1]|2|3|4}

<Tr>={[1] … |16} (in N-port mode only)

Query Response

<numeric 1>, <numeric 2>, …<numeric N>

Related Commands

SENS:SWE:TYPE

CALC:TRAN:TIME:STAT

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.DATA.XAXis

SCPI.CALCulate(Ch).TRACe(Tr).DATA.XAXis

Syntax

Data = app.SCPI.CALCulate(Ch).SELected.DATA.XAXis

Data = app.SCPI.CALCulate(Ch).Trace(Tr).DATA.XAXis

Type

Variant (array of Double) (read/write)

Back to CALCulate

CALC:FILT:TIME

SCPI Command

CALCulate<Ch>[:SELected]:FILTer[:GATE]:TIME[:TYPE] <char>

CALCulate<Ch>[:SELected]:FILTer[:GATE]:TIME[:TYPE]?

Description

Sets or reads out the gate type of the gating function.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

<char> Specifies the gate type:

BPASs	Bandpass type
NOTCh	Notch type

Query Response

{BPAS|NOTC}

Preset Value

BPAS

Equivalent Softkeys

Analysis > Gating > Type

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.FILTer.GATE.TIME.TYPE

Syntax

Param = app.SCPI.CALCulate(Ch).SELected.FILTer.GATE.TIME.TYPE

app.SCPI.CALCulate(Ch).SELected.FILTer.GATE.TIME.TYPE = "bpas"

Type

String (read/write)

Back to CALCulate

CALC:FILT:TIME:CENT

SCPI Command

CALCulate<Ch>[:SELected]:FILTer[:GATE]:TIME:CENTer <time>

CALCulate<Ch>[:SELected]:FILTer[:GATE]:TIME:CENTer?

Description

Sets or reads out the gate center value of the gating function.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

<time> the center value of the gate, the range varies depending on the frequency span and the number of points

Unit

sec (second)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.FILTer.GATE.TIME.CENTer

Syntax

Value = app.SCPI.CALCulate(Ch).SELected.FILTer.GATE.TIME.CENTer

app.SCPI.CALCulate(Ch).SELected.FILTer.GATE.TIME.CENTer = 1e–8

Type

Double (read/write)

Back to CALCulate

CALC:FILT:TIME:STAR

SCPI Command

CALCulate<Ch>[:SELected]:FILTer[:GATE]:TIME:STARt <time>

CALCulate<Ch>[:SELected]:FILTer[:GATE]:TIME:STARt?

Description

Sets or reads out the gate start value of the gating function.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

<time> the start value of the gate, the range varies depending on the frequency span and the number of points

Unit

sec (second)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

-1e–8

Equivalent Softkeys

Analysis > Gating > Start

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.FILTer.GATE.TIME.STARt

Syntax

Value = app.SCPI.CALCulate(Ch).SELected.FILTer.GATE.TIME.STARt

app.SCPI.CALCulate(Ch).SELected.FILTer.GATE.TIME.STARt = 1e–8

Type

Double (read/write)

Back to CALCulate

CALC:FILT:TIME:SHAP

SCPI Command

CALCulate<Ch>[:SELected]:FILTer[:GATE]:TIME:SHAPe <char>

CALCulate<Ch>[:SELected]:FILTer[:GATE]:TIME:SHAPe?

Description

Sets or reads out the gate shape of the gating function.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

<char> Specifies the gate shape:

MAXimum	Maximum shape
WIDE	Wide shape
NORMal	Normal shape
MINimum	Minimum shape

Query Response

{MAX|WIDE|NORM|MIN}

Preset Value

NORM

Equivalent Softkeys

Analysis > Gating > Shape > {Maximum | Wide | Normal | Minimum}

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.FILTer.GATE.TIME.SHAPe

Syntax

Param = app.SCPI.CALCulate(Ch).SELected.FILTer.GATE.TIME.SHAPe

app.SCPI.CALCulate(Ch).SELected.FILTer.GATE.TIME.SHAPe = "MAX"

Type

String (read/write)

Back to CALCulate

CALC:FILT:TIME:SPAN

SCPI Command

CALCulate<Ch>[:SELected]:FILTer[:GATE]:TIME:SPAN <time>

CALCulate<Ch>[:SELected]:FILTer[:GATE]:TIME:SPAN?

Description

Sets or reads out the gate span value of the gating function.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

<time> the span value of the gate, the range varies depending on the frequency span and the number of points

Unit

sec (second)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

2e–8

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.FILTer.GATE.TIME.SPAN

Syntax

Value = app.SCPI.CALCulate(Ch).SELected.FILTer.GATE.TIME.SPAN

app.SCPI.CALCulate(Ch).SELected.FILTer.GATE.TIME.SPAN = 1e–8

Type

Double (read/write)

Back to CALCulate

CALC:FILT:TIME:STAT

SCPI Command

CALCulate<Ch>[:SELected]:FILTer[:GATE]:TIME:STATe {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:FILTer[:GATE]:TIME:STATe?

Description

Turns the gating function ON/OFF.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Analysis > Gating > Gating

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.FILTer.GATE.TIME.STATe

Syntax

Status = app.SCPI.CALCulate(Ch).SELected.FILTer.GATE.TIME.STATe

app.SCPI.CALCulate(Ch).SELected.FILTer.GATE.TIME.STATe = Status

Type

Boolean (read/write)

Back to CALCulate

CALC:FILT:TIME:STOP

SCPI Command

CALCulate<Ch>[:SELected]:FILTer[:GATE]:TIME:STOP <time>

CALCulate<Ch>[:SELected]:FILTer[:GATE]:TIME:STOP?

Description

Sets or reads out the gate stop value of the gating function.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

<time> the stop value of the gate, the range varies depending on the frequency span and the number of points

Unit

sec (second)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

+1e–8

Equivalent Softkeys

Analysis > Gating > Stop

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.FILTer.GATE.TIME.STOP

Syntax

Value = app.SCPI.CALCulate(Ch).SELected.FILTer.GATE.TIME.STOP

app.SCPI.CALCulate(Ch).SELected.FILTer.GATE.TIME.STOP = 1e–7

Type

Double (read/write)

Back to CALCulate

CALC:FORM

SCPI Command

CALCulate<Ch>[:SELected]:FORMat <char>

CALCulate<Ch>[:SELected]:FORMat?

Description

Sets or reads out the trace format.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}
<Ch>={[1] … |16} (in N-port mode only)

Parameter

<char> Specifies the trace format:

MLOGarithmic	Logarithmic magnitude
PHASe	Phase
GDELay	Group delay time
SLINear	Smith chart format (Lin)
SLOGarithmic	Smith chart format (Log)
SCOMplex	Smith chart format (Real/Imag)
SMITh	Smith chart format (R + jX)
SADMittance	Smith chart format (G + jB)
PLINear	Polar format (Lin)

PLOGarithmic	Polar format (Log)
POLar	Polar format (Real/Imag)
MLINear	Linear magnitude
SWR	Voltage standing wave ratio
REAL	Real part
IMAGinary	Imaginary part
UPHase	Expanded phase
DRLOSs	DFT Logarithmic magnitude (obsolete, write only) useMLOG+Time Domain
DSWR	DFT in SWR chart format (obsolete, write only) use SWR+Time Domain
RLOSs	Retutn Loss (obsolete, write only) use MLOG
CLOS	Cable Loss - Logarithmic magnitude

Query Response

{MLOG|PHAS|UPH|GDEL|SWR|REAL|IMAG|MLIN|SLIN|SLOG|SCOM|SMITh|SADM|PLIN|PLOG|POL|CLOS}

Preset Value

MLOG

Equivalent Softkeys

Trace > Format> Log Magnitude | Phase | Expand Phase | Group Delay | SWR | Real | Imag | Lin Magnitude | Smith (Lin) | Smith (Log) | Smith (Re/Im) | Smith (R+jX) | Smith (G+jB) | Polar (Lin) | Polar (Log) | Polar (Re/Im) Cable Loss

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.FORMat

Syntax

Param = app.SCPI.CALCulate(Ch).SELected.FORMat

app.SCPI.CALCulate(Ch).SELected.FORMat = "PHAS"

Type

String (read/write)

Back to CALCulate

CALC:FSIM:SEND:DEEM:PORT:STAT

SCPI Command

CALCulate<Ch>:FSIMulator:SENDed:DEEMbed:PORT<Pt>:STATe {OFF|ON|0|1}

CALCulate<Ch>:FSIMulator:SENDed:DEEMbed:PORT<Pt>:STATe?

Description

Turns the 2-port network de–embedding function for specified port ON/OFF.
command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

<Pt>=1

<Pt>={[1] … |16}

Parameter

{ON|1}	ON De–embedding function ON
{OFF|0}	OFF De–embedding function ON

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Analysis > Fixture Simulator > De–Embedding

Equivalent COM Command

SCPI.CALCulate(Ch).FSIMulator.SENDed.DEEMbed.PORT(Pt).STATe

Syntax

Status = app.SCPI.CALCulate(Ch).FSIMulator.SENDed.DEEMbed.STATe

app.SCPI.CALCulate(Ch).FSIMulator.SENDed.DEEMbed.STATe = True

Type

Boolean (read/write)

Back to CALCulate

CALC:FSIM:SEND:DEEM:PORT:USER:FIL

SCPI Command

CALCulate<Ch>:FSIMulator:SENDed:DEEMbed:PORT<Pt>:USER:FILename <string>

CALCulate<Ch>:FSIMulator:SENDed:DEEMbed:PORT<Pt>:USER:FILename?

Description

Sets or reads out the name of the *.S2P file of the de-embedded circuit of the 2-port network de-embedding function. The file contains the circuit S-parameters in Touchstone format. **Note**: If the full path of the file is not specified, the \FixtureSim subdirectory of the application directory will be searched for the file.
command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

<Pt>=1

<Pt>={[1] … |16}

Parameter

<srting>, up to 256 characters

Equivalent Softkeys

Analysis > Fixture Simulator > S–parameters File (De–Embedding)

Equivalent COM Command

SCPI.CALCulate(Ch).FSIMulator.SENDed.DEEMbed.PORT(Pt). USER.FILename

Syntax

File = app.SCPI.CALCulate(Ch).FSIMulator.SENDed.DEEMbed.PORT(Pt).USER.FILename

app.SCPI.CALCulate(Ch).FSIMulator.SENDed.DEEMbed.PORT(Pt).USER.FILename = "network.S2P"

Type

String (read/write)

Back to CALCulate

CALC:FSIM:SEND:PMC:PORT:STAT

SCPI Command

CALCulate<Ch>:FSIMulator:SENDed:PMCircuit:PORT<Pt>:STATe {OFF|ON|0|1}

CALCulate<Ch>:FSIMulator:SENDed:PMCircuit:PORT<Pt>:STATe?

Description

Turns the 2-port network embedding function for each port ON/OFF.
command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

<Pt>=1

<Pt>={[1] … |16}

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Analysis > Fixture Simulator > Embedding

Equivalent COM Command

SCPI.CALCulate(Ch).FSIMulator.SENDed.PMCircuit.PORT(Pt).STATe

Syntax

Status = app.SCPI.CALCulate(Ch).FSIMulator.SENDed.DEEMbed.PORT(Pt).STATe

app.SCPI.CALCulate(Ch).FSIMulator.SENDed.DEEMbed.PORT(Pt).STATe = True

Type

Boolean (read/write)

Back to CALCulate

CALC:FSIM:SEND:PMC:PORT:USER:FIL

SCPI Command

CALCulate<Ch>:FSIMulator:SENDed:PMCircuit:PORT<Pt>:USER:FILename <string>

CALCulate<Ch>:FSIMulator:SENDed:PMCircuit:PORT<Pt>:USER:FILename?

Description

Sets or reads out the name of the *.S2P file of the embedded circuit of the 2-port network embedding function. The file contains the circuit S-parameters in Touchstone format. **Note**: If the full path of the file is not specified, the \FixtureSim subdirectory of the application directory will be searched for the file.
command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

<Pt>=1

<Pt>={[1] … |16}

Parameter

<srting>, up to 256 characters

Equivalent Softkeys

Analysis > Fixture Simulator > S–parameters File (Embedding)

Equivalent COM Command

SCPI.CALCulate(Ch).FSIMulator.SENDed.PMCircuit.PORT(Pt).USER.FILename

Syntax

File = app.SCPI.CALCulate(Ch).FSIMulator.SENDed.PMCircuit.PORT(Pt).USER.FILename

app.SCPI.CALCulate(Ch).FSIMulator.SENDed.PMCircuit.PORT(Pt).USER.FILename = "network.S2P"

Type

String (read/write)

Back to CALCulate

CALC:FSIM:SEND:ZCON:PORT:Z0

SCPI Command

CALCulate<Ch>:FSIMulator:SENDed:ZCONversion:PORT<Pt>:Z0[:R] <numeric>

CALCulate<Ch>:FSIMulator:SENDed:ZCONversion:PORT<Pt>:Z0[:R]?

Description

Sets or reads out the value of the impedance of the port impedance conversion function. The function sets the real part and zeros the imaginary part of the port impedance.
command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

<Pt>=1

<Pt>={[1] … |16}

Parameter

<impedance> the impedance value from 1e–6 to 1e10

Unit

Ω (Ohm)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

50 Ω

Equivalent Softkeys

Analysis > Fixture Simulator > Port Z0

Equivalent COM Command

SCPI.CALCulate(Ch).FSIMulator.SENDed.ZCONversion.PORT(Pt).Z0.R

Syntax

Value = app.SCPI.CALCulate(Ch).FSIMulator.SENDed.ZCONversion.PORT(Pt).Z0.R

app.SCPI.CALCulate(Ch).FSIMulator.SENDed.ZCONversion.PORT(Pt).Z0.R = 50

Type

Double (read/write)

Back to CALCulate

CALC:FSIM:SEND:ZCON:STAT

SCPI Command

CALCulate<Ch>:FSIMulator:SENDed:ZCONversion:STATe {OFF|ON|0|1}

CALCulate<Ch>:FSIMulator:SENDed:ZCONversion:STATe?

Description

Turns the port impedance conversion function ON/OFF.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Analysis > Fixture Simulator > Port ZConversion

Equivalent COM Command

SCPI.CALCulate(Ch).FSIMulator.SENDed.ZCONversion.STATe

Syntax

Status = app.SCPI.CALCulate(Ch).FSIMulator.SENDed.ZCONversion.STATe

app.SCPI.CALCulate(Ch).FSIMulator.SENDed.ZCONversion.STATe = True

Type

Boolean (read/write)

Back to CALCulate

CALC:FUNC:DATA?

SCPI Command

CALCulate<Ch>[:SELected]:FUNCtion:DATA?

Description

Reads out the data array, which is the CALC:FUNC:EXEC command analysis result. The array size is 2N, where N is the number of points. For the n–th point, where n from 1 to N: <numeric 2n–1> the response value in n-th measurement point; <numeric 2n> the stimulus value in n-th measurement point. Always set to 0 for the analysis of mean value, standard deviation, and peak-to-peak value.
query only

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Query Response

<numeric 1>, <numeric 2>, …<numeric 2N>

Related Commands

CALC:FUNC:EXEC

CALC:FUNC:POIN?

FORM:DATA

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.FUNCtion.DATA

Syntax

Data = app.SCPI.CALCulate(Ch).SELected.FUNCtion.DATA

Type

Variant (array of Double) (read only)

Back to CALCulate

CALC:FUNC:DOM

SCPI Command

CALCulate<Ch>[:SELected]:FUNCtion:DOMain[:STATe] {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:FUNCtion:DOMain[:STATe]?

Description

Specifies whether an arbitrary range or the entire sweep range is used when the CALC:FUNC:EXEC command is executed.
command/query

Target

All traces of channel <Ch> (if the coupling is set to ON by the CALC:FUNC:DOM:COUP command), All traces of channel <Ch> (if the coupling is set to ON by the CALC:FUNC:DOM:COUP command),

Or

The active trace of channel <Ch> (if otherwise),

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

Select the following:

{ON|1}	Arbitrary range
{OFF|0}	Entire sweep range

Query Response

{0|1}

Preset Value

0

Related Commands

CALC:FUNC:EXEC

CALC:FUNC:DOM:COUP

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.FUNCtion.DOMain.STATe

Syntax

Status = app.SCPI.CALCulate(Ch).SELected.FUNCtion.DOMain.STATe

app.SCPI.CALCulate(Ch).SELected.FUNCtion.DOMain.STATe = true

Type

Boolean (read/write)

Back to CALCulate

CALC:FUNC:DOM:COUP

SCPI Command

CALCulate<Ch>[:SELected]:FUNCtion:DOMain:COUPle {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:FUNCtion:DOMain:COUPle?

Description

If the arbitrary range is turned ON by the CALC:FUNC:DOM command, specifies whether all traces of the channel use the same range (coupling) or if each trace uses an individual range when the CALC:FUNC:EXEC command is executed.
command/query

Target

All traces of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

1

Related Commands

CALC:FUNC:EXEC

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.FUNCtion.DOMain.COUPle

Syntax

Status = app.SCPI.CALCulate(Ch).SELected.FUNCtion.DOMain.COUPle

app.SCPI.CALCulate(Ch).SELected.FUNCtion.DOMain.COUPle = Status

Type

Boolean (read/write)

Back to CALCulate

CALC:FUNC:DOM:STAR

SCPI Command

CALCulate<Ch>[:SELected]:FUNCtion:DOMain:STARt <stimulus>

CALCulate<Ch>[:SELected]:FUNCtion:DOMain:STARt?

Description

Sets the start value of the analysis range of the CALC:FUNC:EXEC command.
command/query

Target

All traces of channel <Ch> (if the coupling is set to ON by the CALC:FUNC:DOM:COUP command),

Or

The active trace of channel <Ch> (if otherwise),

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

<stimulus> the start value of analysis range

Unit

Hz |s |dBm

Query Response

<numeric>

Preset Value

0

Related Commands

CALC:FUNC:DOM

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.FUNCtion.DOMain.STARt

Syntax

Value = app.SCPI.CALCulate(Ch).SELected.FUNCtion.DOMain.STARt

app.SCPI.CALCulate(Ch).SELected.FUNCtion.DOMain.STARt = 1e9

Type

Double (read/write)

Back to CALCulate

CALC:FUNC:DOM:STOP

SCPI Command

CALCulate<Ch>[:SELected]:FUNCtion:DOMain:STOP <stimulus>

CALCulate<Ch>[:SELected]:FUNCtion:DOMain:STOP?

Description

Sets the stop value of the analysis range of the CALC:FUNC:EXEC command.
command/query

Target

All traces of channel <Ch> (if the coupling is set to ON by the CALC:FUNC:DOM:COUP command),

Or

The active trace of channel <Ch> (if otherwise),

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

<stimulus> the start value of analysis range

Unit

Hz |s |dBm

Query Response

<numeric>

Preset Value

0

Related Commands

CALC:FUNC:DOM

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.FUNCtion.DOMain.STOP

Syntax

Value = app.SCPI.CALCulate(Ch).SELected.FUNCtion.DOMain.STOP

app.SCPI.CALCulate(Ch).SELected.FUNCtion.DOMain.STOP = 2e9

Type

Double (read/write)

Back to CALCulate

CALC:FUNC:EXEC

SCPI Command

CALCulate<Ch>[:SELected]:FUNCtion:EXECute

Description

Executes the analysis specified by the CALC:FUNC:TYPE command. The analysis result can be read out by the CALC:FUNC:DATA? command.
no query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Related Commands

CALC:FUNC:TYPE

CALC:FUNC:DATA?

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.FUNCtion.EXECute

Syntax

app.SCPI.CALCulate(Ch).SELected.FUNCtion.EXECute

Type

Method

Back to CALCulate

CALC:FUNC:PEXC

SCPI Command

CALCulate<Ch>[:SELected]:FUNCtion:PEXCursion <numeric>

CALCulate<Ch>[:SELected]:FUNCtion:PEXCursion?

Or

CALCulate<Ch>:TRACe<Tr>:FUNCtion:PEXCursion <numeric>

CALCulate<Ch>:TRACe<Tr>:FUNCtion:PEXCursion?

Description

Sets the lower limit for the peak excursion value when executing the peak search with the CALC:FUNC:EXEC command.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

<response> the lower limit of the peak excursion value, varies depending on the data format

Unit

dB |° |s

Query Response

<numeric>

Preset Value

3.0

Related Commands

CALC:FUNC:EXEC

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.FUNCtion.PEXCursion

Syntax

Value = app.SCPI.CALCulate(Ch).SELected.FUNCtion.PEXCursion

app.SCPI.CALCulate(Ch).SELected.FUNCtion.PEXCursion = 1.5

Type

Double (read/write)

Back to CALCulate

CALC:FUNC:POIN?

SCPI Command

CALCulate<Ch>[:SELected]:FUNCtion:POINts?

Description

Reads out the number of points (data pairs) of the analysis result by the CALC:FUNC:EXEC command. Always reads out 1, when the search is executed for the maximum, minimum, mean, standard deviation, peak, and peak-to-peak values. The actual number of points is read out, when the search is executed for all peak or all targets.
query only

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Query Response

<numeric>

Related Commands

CALC:FUNC:EXEC

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.FUNCtion.POINts

Syntax

Value = app.SCPI.CALCulate(Ch).SELected.FUNCtion.POINts

Type

Long (read only)

Back to CALCulate

CALC:FUNC:PPOL

SCPI Command

CALCulate<Ch>[:SELected]:FUNCtion:PPOLarity <char>

CALCulate<Ch>[:SELected]:FUNCtion:PPOLarity?

Description

Selects the polarity when performing the peak search with the CALC:FUNC:EXEC command.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

<char> Specifies the polarity:

POSitive	Positive peaks
NEGative	Negative peaks
BOTH	Both positive peaks and negative peaks

Query Response

{POS|NEG|BOTH}

Preset Value

POS

Related Commands

CALC:FUNC:EXEC

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.FUNCtion.PPOLarity

Syntax

Param = app.SCPI.CALCulate(Ch).SELected.FUNCtion.PPOLarity

app.SCPI.CALCulate(Ch).SELected.FUNCtion.PPOLarity = "NEG"

Type

String (read/write)

Back to CALCulate

CALC:FUNC:TARG

SCPI Command

CALCulate<Ch>[:SELected]:FUNCtion:TARGet <numeric>

CALCulate<Ch>[:SELected]:FUNCtion:TARGet?

Description

Selects the target level when performing the search for the trace and the target level crosspoints with the CALC:FUNC:EXEC command.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

<response> the target value, varies depending on the data format

Unit

dB |° |s

Query Response

<numeric>

Preset Value

0

Related Commands

CALC:FUNC:EXEC

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.FUNCtion.TARGet

Syntax

Value = app.SCPI.CALCulate(Ch).SELected.FUNCtion.TARGet

app.SCPI.CALCulate(Ch).SELected.FUNCtion.TARGet = –10

Type

Double (read/write)

Back to CALCulate

CALC:FUNC:TTR

SCPI Command

CALCulate<Ch>[:SELected]:FUNCtion:TTRansition <char>

CALCulate<Ch>[:SELected]:FUNCtion:TTRansition?

Description

Selects the transition type when performing the search for the trace and the target level crosspoints with the CALC:FUNC:EXEC command.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

<char> Specifies the transition:

POSitive	Positive peaks
NEGative	Negative peaks
BOTH	Both positive peaks and negative peaks

Query Response

{POS|NEG|BOTH}

Preset Value

POS

Related Commands

CALC:FUNC:EXEC

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.FUNCtion.TTRansition

Syntax

Param = app.SCPI.CALCulate(Ch).SELected.FUNCtion.TTRansition

app.SCPI.CALCulate(Ch).SELected.FUNCtion.TTRansition = "both"

Type

String (read/write)

Back to CALCulate

CALC:FUNC:TYPE

SCPI Command

CALCulate<Ch>[:SELected]:FUNCtion:TYPE <char>

CALCulate<Ch>[:SELected]:FUNCtion:TYPE?

Description

Selects the type of analysis executed with the CALC:FUNC:EXEC command.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

<char> Specifies the transition:

PTPeak	Peak–to–peak (difference between the maximum value and the minimum value)
STDEV	Standard deviation
MEAN	Mean value
MAXimum	Maximum value
MINimum	Minimum value
PEAK	Search for peak
APEak	Search for all the peaks
ATARget	Search for all targets

Query Response

{PTP|STDEV|MEAN|MAX|MIN|PEAK|APE|ATAR}

Preset Value

PTP

Related Commands

CALC:FUNC:EXEC

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.FUNCtion.TYPE

Syntax

Param = app.SCPI.CALCulate(Ch).SELected.FUNCtion.TYPE

app.SCPI.CALCulate(Ch).SELected.FUNCtion.TYPE = "STDEV"

Type

String (read/write)

Back to CALCulate

CALC:LIM

SCPI Command

CALCulate<Ch>[:SELected]:LIMit[:STATe] {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:LIMit[:STATe]?

Description

Turns the limit test ON/OFF.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Analysis > Limit Test > Limit Test

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.LIMit.STATe

Syntax

Status = app.SCPI.CALCulate(Ch).SELected.LIMit.STATe

app.SCPI.CALCulate(Ch).SELected.LIMit.STATe = true

Type

Boolean (read/write)

Back to CALCulate

CALC:LIM:DATA

SCPI Command

CALCulate<Ch>[:SELected]:LIMit:DATA <numeric list>

CALCulate<Ch>[:SELected]:LIMit:DATA?

Description

Sets the data array, which is the limit line in the limit test function.

The array size is 1 + 5N, where N is the number of limit line segments.

For the n–th point, where n from 1 to N:

<numeric 1> the number of limit line segments N is from 0 to 100. Setting 0 clears the limit line.

<numeric 5n–3> type of the n–th limit line segment:

0: Off.

1: Upper limit

2: Lower limit

3: Single Point limit

<numeric 5n–2> the stimulus value in the start point of the n-th segment

<numeric 5n–1> the stimulus value in the end point of the n-th segment

<numeric 5n–0> the response value in the start point of the n-th segment

<numeric 5n+1> the response value in the end point of the n-th segment

Note: If the array size is not 1 + 5N, where N is <numeric 1>, an error occurs. If <numeric 5n–3> is less than 0 or more than 2, an error occurs. When <numeric 5n–2>, <numeric 5n–1>, <numeric 5n–0>, and <numeric 5n+1> elements are out of allowable range, the value is set to the limit, which is closer to the specified value.

command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Query Response

<numeric 1>, <numeric 2>, …<numeric 5N+1>

Related commands

FORM:DATA

Equivalent Softkeys

Analysis > Limit Test > Edit Limit Line

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.LIMit.DATA

Syntax

Data = app.SCPI.CALCulate(Ch).SELected.LIMit.DATA

app.SCPI.CALCulate(Ch).SELected.LIMit.DATA = Array(1,2,800,900,–10,–10)

Type

Variant (array of Double) (read/write)

Back to CALCulate

CALC:LIM:DISP

SCPI Command

CALCulate<Ch>[:SELected]:LIMit:DISPlay[:STATe] {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:LIMit:DISPlay[:STATe]?

Description

Turns the limit line display of the limit test function ON/OFF.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Analysis > Limit Test > Limit Line

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.LIMit.DISPlay.STATe

Syntax

Status = app.SCPI.CALCulate(Ch).SELected.LIMit.DISPlay.STATe

app.SCPI.CALCulate(Ch).SELected.LIMit.DISPlay.STATe = true

Type

Boolean (read/write)

Back to CALCulate

CALC:LIM:FAIL?

SCPI Command

CALCulate<Ch>[:SELected]:LIMit:FAIL?

Description

Reads out the limit test result.
query only

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

1	Fail
0	Pass

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.LIMit.FAIL

Syntax

Status = app.SCPI.CALCulate(Ch).SELected.LIMit.FAIL

Type

Boolean (read/write)

Back to CALCulate

CALC:LIM:OFFS:AMPL

SCPI Command

CALCulate<Ch>[:SELected]:LIMit:OFFSet:AMPLitude <numeric>

CALCulate<Ch>[:SELected]:LIMit:OFFSet:AMPLitude?

Description

Sets and reads out the value of the limit line offset along the Y-axis.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

<response> the value of the limit line offset along Y–axis, varies depending on the data format.

Unit

dB |° |s

Query Response

<numeric>

Preset Value

0

Equivalent Softkeys

Analysis > Limit Test > Response Offset

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.LIMit.OFFSet.AMPLitude

Syntax

Value = app.SCPI.CALCulate(Ch).SELected.LIMit.OFFSet.AMPLitude

app.SCPI.CALCulate(Ch).SELected.LIMit.OFFSet.AMPLitude = –10

Type

Double (read/write)

Back to CALCulate

CALC:LIM:OFFS:STIM

SCPI Command

CALCulate<Ch>[:SELected]:LIMit:OFFSet:STIMulus <stimulus>

CALCulate<Ch>[:SELected]:LIMit:OFFSet:STIMulus?

Description

Sets and reads out the value of the limit line offset along the X-axis.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

<stimulus> the value of the limit line offset along X–axis

Unit

Hz | s | dBm

Query Response

<numeric>

Preset Value

0

Equivalent Softkeys

Analysis > Limit Test >Stimulus Offset

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.LIMit.OFFSet.STIMulus

Syntax

Value = app.SCPI.CALCulate(Ch).SELected.LIMit.OFFSet.STIMulus

app.SCPI.CALCulate(Ch).SELected.LIMit.OFFSet.STIMulus = 1e6

Type

Double (read/write)

Back to CALCulate

CALC:LIM:REP:ALL?

SCPI Command

CALCulate<Ch>[:SELected]:LIMit:REPort:ALL?

Description

Reads out the limit test result report. The array size is 4N, where N is the number of measurement points. For the n–th point, where n from 1 to N: <numeric 4n–3> the stimulus value in the n-th point; <numeric 4n–2> the limit test result in the n-th point; –1: No limit 0: Fail 1: Pass <numeric 4n–1> the upper limit value in the n–th point (0 — if there is no limit) <numeric 4n–0> the lower limit value in the n–th point (0 — if there is no limit)
query only

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Query Response

<numeric 1>, <numeric 2>, …<numeric 4N>

Related Commands

FORM:DATA

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.LIMit.REPort.ALL

Syntax

Data = app.SCPI.CALCulate(Ch).SELected.LIMit.REPort.ALL

Type

Variant (array of Double) (read only)

Back to CALCulate

CALC:LIM:REP:POIN?

SCPI Command

CALCulate<Ch>[:SELected]:LIMit:REPort:POINts?

Description

Reads out the number of the measurement points that failed the limit test. The stimulus data array of these points can be read out by the CALC:LIM:REP? command.
query only

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Query Response

<numeric>

Related Commands

CALC:LIM:REP?

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.LIMit.REPort.POINts

Syntax

Cnt = app.SCPI.CALCulate(Ch).SELected.LIMit.REPort.POINts

Type

Long (read only)

Back to [CALCulate]

CALC:LIM:REP?

SCPI Command

CALCulate<Ch>[:SELected]:LIMit:REPort[:DATA]?

Description

Reads out the data array, which is the stimulus values of the measurement points that failed the limit test. The array size is set by the CALC:LIM:REP:POIN? command.
query only

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Query Response

<numeric 1>, <numeric 2>,…<numeric N>

Related Commands

CALC:LIM:REP:POIN?

FORM:DATA

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.LIMit.REPort.DATA

Syntax

Data = app.SCPI.CALCulate(Ch).SELected.LIMit.REPort.DATA

Type

Variant (array of Double) (read only)

Back to [CALCulate]

CALC:MARK

SCPI Command

CALCulate<Ch>[:SELected]:MARKer<Mk>[:STATe] {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:MARKer<Mk>[:STATe]?

Description

Turns the marker ON/OFF. Turning ON a marker with the number from 1 to 15 will turn ON all the markers of smaller numbers. Turning OFF a marker with the number from 1 to 15 will turn OFF all the markers of greater numbers (except of the reference marker with number 16). Turning ON/OFF the reference marker with number 16 does not turn ON/OFF the markers with the numbers from 1 to 15, but switchs these markers between relative and absolute measurement mode.
command/query

Target

Marker <Mk> of the active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

<Mk>={[1] … |16}

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Markers > Add Marker | Remove Marker

Markers > Reference Marker

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer(Mk).STATe

Syntax

Status = app.SCPI.CALCulate(Ch).SELected.MARKer(Mk).STATe

app.SCPI.CALCulate(Ch).SELected.MARKer(Mk).STATe = true

Type

Boolean (read/write)

Back to CALCulate

CALC:MATH:DEL

SCPI Command

CALCulate<Ch>[:SELected]:MATH:DELete

Description

Removes the data from the memory trace.
command only

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Equivalent Softkeys

Trace > Clear Memory

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MATH.DELete

Syntax

app.SCPI.CALCulate(Ch).SELected.MATH.DELete

Type

Method

Back to CALCulate

CALC:MATH:FUNC

SCPI Command

CALCulate<Ch>[:SELected]:MATH:FUNCtion <char>

CALCulate<Ch>[:SELected]:MATH:FUNCtion?

Description

Selects the math operation between the data trace and the memory trace. The math result replaces the data trace. If the memory trace does not exist, the command is ignored.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

<char> Specifies the math operation:

DIVide	Division Data / Mem
MULTiply	Multiplication Data x Mem
ADD	Addition Data + Mem
SUBTract	Subtraction Data – Mem
NORMal	No math

Query Response

{NORM|SUBT|DIV|ADD|MULT}

Preset Value

NORM

Related Commands

CALC:MATH:MEM

Equivalent Softkeys

Trace > Data Math > { Data/Mem | Data*Mem | Data+Mem | Data–Mem | OFF }

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MATH.FUNCtion

Syntax

Param = app.SCPI.CALCulate(Ch).SELected.MATH.FUNCtion

app.SCPI.CALCulate(Ch).SELected.MATH.FUNCtion = "DIV"

Type

String (read/write)

Back to CALCulate

CALC:MATH:MEM

SCPI Command

CALCulate<Ch>[:SELected]:MATH:MEMorize

Description

Copies the measurement data to the memory trace. Automatically turns on the display the memory trace.
no query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Equivalent Softkeys

Trace > Memorize Trace

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MATH.MEMorize

Syntax

app.SCPI.CALCulate(Ch).SELected.MATH.MEMorize

Type

Method

Back to CALCulate

CALC:MARK:ACT

SCPI Command

CALCulate<Ch>[:SELected]:MARKer<Mk>:ACTivate

Description

Sets the active marker. If the marker is not ON, this function will turn the marker ON. Turning ON a marker with the number from 1 to 15 will turn ON all the markers of smaller numbers. Turning ON the reference marker with number 16 does not turn ON the markers with the numbers from 1 to 15, but switchs these markers to the relative measurement mode.
no query

Target

Marker <Mk> of the active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

<Mk>={[1] … |16}

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer(Mk).ACTivate

Syntax

app.SCPI.CALCulate(Ch).SELected.MARKer(Mk).ACTivate

Type

Method

Back to [CALCulate]

CALC:MARK:BWID

SCPI Command

CALCulate<Ch>[:SELected]:MARKer:BWIDth[:STATe] {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:MARKer:BWIDth[:STATe]?

Description

Turns the bandwidth search function ON/OFF.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Markers > Math > Bandwidth Search > Bandwidth Search

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer(1).BWIDth.STATe

Syntax

Status = app.SCPI.CALCulate(1).SELected.MARKer.BWIDth.STATe

app.SCPI.CALCulate(1).SELected.MARKer.BWIDth.STATe = true

Type

Boolean (read/write)

WARNING	Object MARKer has an index of 1, which can be omitted in Visual Basic, but it cannot be omitted in other programming languages.

Back to CALCulate

CALC:MARK:BWID:DATA?

SCPI Command

CALCulate<Ch>[:SELected]:MARKer<Mk>:BWIDth:DATA?

Description

Reads out the bandwidth search result. The bandwidth search can performed relatively to the marker <Mk>, or relatively to the absolute maximum value of the trace (in this case the number of the marker is ignored), what is set by the CALC:MARK:BWID:REF command. The data include 4 elements: <numeric 1> Bandwidth; <numeric 2> Center frequency; <numeric 3> Q value; <numeric 4> Loss. **Note**: If the bandwidth search is impossible, all the read out values are 0. If the search is performed relatively to a maker, which is OFF, an error occurs.
query only

Target

Marker <Mk> of the active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

<Mk>={[1] … |16}

Query Response

<numeric 1>, <numeric 2>, …<numeric 4>

Related Commands

CALC:MARK:BWID:REF

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer(Mk).BWIDth.DATA

Syntax

Data = app.SCPI.CALCulate(Ch).SELected.MARKer(Mk).BWIDth.DATA

Type

Variant (array of Double) (read only)

Back to CALCulate

CALC:MARK:BWID:REF

SCPI Command

CALCulate<Ch>[:SELected]:MARKer:BWIDth <char>

CALCulate<Ch>[:SELected]:MARKer:BWIDth:REFerence?

Description

Selects the reference for the bandwidth search function: marker or absolute maximum value of the trace.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

<char> Choose from:

MARKer	Bandwidth search relative to the marker
MAXimum	Bandwidth search relative to the absolute maximum of the trace
MINimum	Bandwidth search relative to the absolute minimum of the trace

Query Response

{MAX|MARK|MIN}

Preset Value

MAX

Equivalent Softkeys

Markers > Math > Bandwidth Search > Search Ref To

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer(1).BWIDth.REFerence

Syntax

Param = app.SCPI.CALCulate(1).SELected.MARKer.BWIDth.REFerence

app.SCPI.CALCulate(1).SELected.MARKer.BWIDth.REFerence = "marker"

Type

String (read/write)

WARNING	Object MARKer has an index of 1, which can be omitted in Visual Basic, but it cannot be omitted in other programming languages.

Back to CALCulate

CALC:MARK:BWID:THR

SCPI Command

CALCulate<Ch>[:SELected]:MARKer<Mk>:BWIDth:THReshold <numeric>

CALCulate<Ch>[:SELected]:MARKer<Mk>:BWIDth:THReshold?

Description

Sets the bandwidth search threshold value.
command/query

Target

Marker <Mk> of the active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

<Mk>={[1] … |16}

Parameter

<response> the bandwidth definition value, the range varies depending on the data format.

Unit

dB |° |s

Query Response

<numeric>

Preset Value

-3.0

Equivalent Softkeys

Markers > Math > Bandwidth Search > Bandwidth Value

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer(1).BWIDth.THReshold

Syntax

Value = app.SCPI.CALCulate(1).SELected.MARKer(Mk).BWIDth. THReshold

app.SCPI.CALCulate(1).SELected.MARKer(Mk).BWIDth.THReshold = –6.0

Type

Double (read/write)

WARNING	Object MARKer has an index of 1, which can be omitted in Visual Basic, but it cannot be omitted in other programming languages.

Back to CALCulate

CALC:MARK:BWID:TYPE

SCPI Command

CALCulate<Ch>[:SELected]:MARKer:BWIDth:TYPE <char>

CALCulate<Ch>[:SELected]:MARKer:BWIDth:TYPE?

Description

Sets the type of the bandwidth search function.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

<char> Specifies the type of the bandwidth:

BPASs	Bandpass
NOTCh	Notch

Query Response

{BPAS|NOTC}

Preset Value

BPAS

Equivalent Softkeys

Markers > Math > Bandwidth Search > Type Search

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer(1).BWIDth.TYPE

Syntax

Param = app.SCPI.CALCulate(1).SELected.MARKer.BWIDth.TYPE

app.SCPI.CALCulate(1).SELected.MARKer.BWIDth.TYPE = "notc"

Type

String (read/write)

WARNING	Object MARKer has an index of 1, which can be omitted in Visual Basic, but it cannot be omitted in other programming languages.

Back to CALCulate

CALC:MARK:COUN

SCPI Command

CALCulate<Ch>[:SELected]:MARKer:COUNt <numeric>

CALCulate<Ch>[:SELected]:MARKer:COUNt?

Description

Sets the number of turned ON markers. **Note**: Choosing 16 turns on the reference marker and sets the markers 1 to 15 to the relative values.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

<numeric>, range from 0 to 16

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer(1).COUNt

Syntax

MarkerCnt = app.SCPI.CALCulate(1).SELected.MARKer.COUNt

app.SCPI.CALCulate(1).SELected.MARKer.COUNt = 5

Type

Long (read/write)

WARNING	Object MARKer has an index of 1, which can be omitted in Visual Basic, but it cannot be omitted in other programming languages.

Back to CALCulate

CALC:MARK:COUP

SCPI Command

CALCulate<Ch>[:SELected]:MARKer:COUPle {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:MARKer:COUPle?

Description

Turns the marker coupling between traces ON/OFF. When coupled, the markers of different traces but with the same number track the X-axis position.
command/query

Target

All the traces of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

1

Equivalent Softkeys

Marker > Properties > Marker Couple

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer(1).COUPle

Syntax

Status = app.SCPI.CALCulate(1).SELected.MARKer.COUPle

app.SCPI.CALCulate(1).SELected.MARKer.COUPle = false

Type

Boolean (read/write)

WARNING	Object MARKer has an index of 1, which can be omitted in Visual Basic, but it cannot be omitted in other programming languages.

Back to CALCulate

CALC:MARK:FUNC:DOM

SCPI Command

CALCulate<Ch>[:SELected]:MARKer:FUNCtion:DOMain[:STATe] {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:MARKer:FUNCtion:DOMain[:STATe]?

Description

Turns the state of the arbitrary range when executing the marker search ON/OFF. If the state of an arbitrary range is ON, marker search is performed in the range specified by the CALC:MARK:FUNC:DOM:STAR, CALC:MARK:FUNC:DOM:STOP commands. Otherwise, the search is performed over the entire sweep range.
command/query

Target

All traces of channel <Ch> (if the marker search range coupling is set to ON by the CALC:MARK:COUP command),

Or

The active trace of channel <Ch> (if otherwise),

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

{ON|1}	Marker search range ON
{OFF|0}	Marker search range OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Markers > Search > Search Range

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer(Mk).FUNCtion.DOMain.STATe

Syntax

Status = app.SCPI.CALCulate(1).SELected.MARKer.FUNCtion.DOMain.STATe

app.SCPI.CALCulate(1).SELected.MARKer.FUNCtion.DOMain.STATe = true

Type

Boolean (read/write)

WARNING	Object MARKer has an index of 1, which can be omitted in Visual Basic, but it cannot be omitted in other programming languages.

Back to CALCulate

CALC:MARK:FUNC:DOM:STAR

SCPI Command

CALCulate<Ch>[:SELected]:MARKer:FUNCtion:DOMain:STARt <stimulus>

CALCulate<Ch>[:SELected]:MARKer:FUNCtion:DOMain:STARt?

Description

Sets or reads out the start value of the marker search range.
command/query

Target

All traces of channel <Ch> (if the marker search range coupling is set to ON by the CALC:MARK:COUP command),

Or

The active trace of channel <Ch> (if otherwise),

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

<stimulus> the start value of the marker search

Unit

Hz | s | dBm

Query Response

<numeric>

Preset Value

Lower limit of the analyzer frequency range

Equivalent Softkeys

Markers > Search > Search Start

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer(Mk).FUNCtion.DOMain.STARt

Syntax

Value = app.SCPI.CALCulate(1).SELected.MARKer.FUNCtion.DOMain.STARt

app.SCPI.CALCulate(1).SELected.MARKer.FUNCtion.DOMain.STARt = 1e6

Type

Double (read/write)

WARNING	Object MARKer has an index of 1, which can be omitted in Visual Basic, but it cannot be omitted in other programming languages.

Back to CALCulate

CALC:MARK:FUNC:DOM:STOP

SCPI Command

CALCulate<Ch>[:SELected]:MARKer:FUNCtion:DOMain:STOP <stimulus>

CALCulate<Ch>[:SELected]:MARKer:FUNCtion:DOMain:STOP?

Description

Sets or reads out the stop value of the marker search range.
command/query

Target

All traces of channel <Ch> (if the marker search range coupling is set to ON by the CALC:MARK:COUP command),

Or

The active trace of channel <Ch> (if otherwise),

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

<stimulus> the stop value of the marker search

Unit

Hz | s | dBm

Query Response

<numeric>

Preset Value

Upper limit of the analyzer frequency range

Equivalent Softkeys

Markers > Search > Search Stop

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer(Mk).FUNCtion.DOMain.STOP

Syntax

Value = app.SCPI.CALCulate(1).SELected.MARKer.FUNCtion.DOMain.STOP

app.SCPI.CALCulate(1).SELected.MARKer.FUNCtion.DOMain.STOP = 1e6

Type

Double (read/write)

WARNING	Object MARKer has an index of 1, which can be omitted in Visual Basic, but it cannot be omitted in other programming languages.

Back to CALCulate

CALC:MARK:FUNC:EXEC

SCPI Command

CALCulate<Ch>[:SELected]:MARKer<Mk>:FUNCtion:EXECute

Description

Executes the marker search according to the specified criterion. The type of the marker search is set by the CALC:MARK:FUNC:TYPE command.
no query

Target

Marker <Mk> of the active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

<Mk>={[1] … |16}

Related Commands

CALC:MARK:FUNC:TYPE

CALC:MARK:FUNC:DOM

Equivalent Softkeys

Markers > Search > {Search Max | Search Min}

Markers > Search > Search Peak > {Search Peak | Max Peak | Peak Left | Peak Right}

Markers > Search > Search Target > {Search Target | Target Left | Target Right}

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer(Mk).FUNCtion.EXECute

Syntax

Data = app.SCPI.CALCulate(Ch).SELected.MARKer(Mk).FUNCtion.EXECute

Type

Method

Back to CALCulate

CALC:MARK:FUNC:PEXC

SCPI Command

CALCulate<Ch>[:SELected]:MARKer<Mk>:FUNCtion:PEXCursion <numeric>

CALCulate<Ch>[:SELected]:MARKer<Mk>:FUNCtion:PEXCursion?

Description

Sets or reads out the peak excursion value when the marker peak search is performed by the CALC:MARK:FUNC:EXEC command.
command/query

Target

Marker <Mk> of the active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

<Mk>={[1] … |16}

Parameter

<response> the peak excursion value, the range varies depending on the data format

Unit

dB | ° | s

Query Response

<numeric>

Preset Value

1

Equivalent Softkeys

Markers > Search > Search Peak > Peak Excursion

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer(Mk).FUNCtion.PEXCursion

Syntax

Value = app.SCPI.CALCulate(Ch).SELected.MARKer(Mk).FUNCtion.PEXCursion

app.SCPI.CALCulate(Ch).SELected.MARKer(Mk).FUNCtion.PEXCursion = 3.0

Type

Double (read/write)

Back to CALCulate

CALC:MARK:FUNC:PPOL

SCPI Command

CALCulate<Ch>[:SELected]:MARKer<Mk>:FUNCtion:PPOLarity <char>

CALCulate<Ch>[:SELected]:MARKer<Mk>:FUNCtion:PPOLarity?

Description

Selects the peak polarity when the marker peak search is performed by the CALC:MARK:FUNC:EXEC command.
command/query

Target

Marker <Mk> of the active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

<Mk>={[1] … |16}

Parameter

<char> Specifies the peak polarity:

POSitive	Positive polarity
NEGative	Negative polarity
BOTH	Both positive polarity and negative polarity

Query Response

{POS|NEG|BOTH}

Preset Value

POS

Related Commands

CALC:MARK:FUNC:EXEC

Equivalent Softkeys

Markers > Search > Search Peak > Peak Polarity > {Positive | Negative | Both}

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer(Mk).FUNCtion.PPOLarity

Syntax

Param = app.SCPI.CALCulate(Ch).SELected.MARKer(Mk).FUNCtion.PPOLarity

app.SCPI.CALCulate(Ch).SELected.MARKer(Mk).FUNCtion.PPOLarity = "neg"

Type

String (read/write)

Back to CALCulate

CALC:MARK:FUNC:TARG

SCPI Command

CALCulate<Ch>[:SELected]:MARKer<Mk>:FUNCtion:TARGet <numeric>

CALCulate<Ch>[:SELected]:MARKer<Mk>:FUNCtion:TARGet?

Description

Sets or reads out the target value when the marker target search is performed by the CALC:MARK:FUNC:EXEC command.
command/query

Target

Marker <Mk> of the active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

<Mk>={[1] … |16}

Parameter

<response> the target value, the range varies depending on the data format

Unit

dB | ° | s

Query Response

<numeric>

Preset Value

0

Equivalent Softkeys

Markers > Search > Search Target > Target Value

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer(Mk).FUNCtion.TARGet

Syntax

Value = app.SCPI.CALCulate(Ch).SELected.MARKer(Mk).FUNCtion.TARGet

app.SCPI.CALCulate(Ch).SELected.MARKer(Mk).FUNCtion.TARGet = –10

Type

Double (read/write)

Back to CALCulate

CALC:MARK:FUNC:TRAC

SCPI Command

CALCulate<Ch>[:SELected]:MARKer<Mk>:FUNCtion:TRACking {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:MARKer<Mk>:FUNCtion:TRACking?

Description

Turns the marker search tracking ON/OFF.
command/query

Target

Marker <Mk> of the active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

<Mk>={[1] … |16}

Parameter

{ON|1}	ON Marker search tracking ON
{OFF|0}	OFF Marker search tracking OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Markers > Search > Tracking

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer(Mk).FUNCtion.TRACking

Syntax

Status = app.SCPI.CALCulate(Ch).SELected.MARKer(Mk).FUNCtion.TRACking

app.SCPI.CALCulate(Ch).SELected.MARKer(Mk).FUNCtion.TRACking = true

Type

Boolean (read/write)

Back to CALCulate

CALC:MARK:FUNC:TTR

SCPI Command

CALCulate<Ch>[:SELected]:MARKer<Mk>:FUNCtion:TTRansition <char>

CALCulate<Ch>[:SELected]:MARKer<Mk>:FUNCtion:TTRansition?

Description

Selects the type of the target transition when the marker transition search is performed by the CALC:MARK:FUNC:EXEC command.
command/query

Target

Marker <Mk> of the active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

<Mk>={[1] … |16}

Parameter

<char> Specifies the type of the target transition:

POSitive	Positive target transition
NEGative	Negative target transition
BOTH	Both positive target transition and negative target transition

Query Response

{POS|NEG|BOTH}

Preset Value

POS

Related Commands

CALC:MARK:FUNC:EXEC

Equivalent Softkeys

Marker > Search > Search Target > Target Transition > {Positive | Negative | Both}

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer(Mk).FUNCtion.TTRansition

Syntax

Param = app.SCPI.CALCulate(Ch).SELected.MARKer(Mk).FUNCtion.TTRansition

app.SCPI.CALCulate(Ch).SELected.MARKer(Mk).FUNCtion.TTRansition = "neg"

Type

String (read/write)

Back to CALCulate

CALC:MARK:FUNC:TYPE

SCPI Command

CALCulate<Ch>[:SELected]:MARKer<Mk>:FUNCtion:TYPE <char>

CALCulate<Ch>[:SELected]:MARKer<Mk>:FUNCtion:TYPE?

Description

Selects the type of the marker search, which is performed by the CALC:MARK:FUNC:EXEC command.
command/query

Target

Marker <Mk> the active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

<Mk>={[1] … |16}

Parameter

<char> Specifies the type of the marker search:

MAXimum	Maximum value search
MINimum	Minimum value search
PEAK	Peak search
LPEak	Peak search to the left from the marker
RPEak	Peak search to the right from the marker
TARGet	Target search
LTARget	Target search to the left from the marker
RTARget	Target search to the right from the marker

Query Response

{MAX|MIN|PEAK|LPE|RPE|TARG|LTAR|RTAR}

Preset Value

MAX

Related Commands

CALC:MARK:FUNC:EXEC

Equivalent Softkeys

Markers > Search > {Search Max | Search Min}

Markers > Search > Search Peak > {Search Peak | Max Peak | Peak Left | Peak Right}

Markers > Search > Search Target > {Search Target | Target Left | Target Right}

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer(Mk).FUNCtion.TYPE

Syntax

Param = app.SCPI.CALCulate(Ch).SELected.MARKer(Mk).FUNCtion.TYPE

app.SCPI.CALCulate(Ch).SELected.MARKer(Mk).FUNCtion.TYPE = "MIN"

Type

String (read/write)

Back to CALCulate

CALC:MARK:REF

SCPI Command

CALCulate<Ch>[:SELected]:MARKer:REFerence[:STATe] {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:MARKer:REFerence[:STATe]?

Description

Turns the reference marker ON/OFF. When the reference marker is turned ON, all the values of the other markers turn to relative values.
command/query

Target

Marker <Mk> the active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

<Mk>={[1] … |16}

Parameter

{ON|1}	Reference marker ON
{OFF|0}	Reference marker OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Markers > Reference Marker

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer(1).REFerence.STATe

Syntax

Status = app.SCPI.CALCulate(1).SELected.MARKer.REFerence.STATe

app.SCPI.CALCulate(1).SELected.MARKer.REFerence.STATe = true

Type

Boolean (read/write)

WARNING	Object MARKer has an index of 1, which can be omitted in Visual Basic, but it cannot be omitted in other programming languages.

Back to CALCulate

CALC:MARK:SET

SCPI Command

CALCulate<Ch>[:SELected]:MARKer<Mk>:SET <char>

Description

Sets the value of the specified item to the value of the position of the marker.
no query

Target

Marker <Mk> of the active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

<Mk>={[1] … |16}

Parameter

<char> Specifies the type of the marker search:

STARt	Sweep start value set to the stimulus value of the marker position.
STOP	Sweep stop value set to the stimulus value of the marker position.
CENTer	Sweep center value set to the stimulus value of the marker position.
RLEVel	Reference value set to the response value of the marker position.

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer(Mk).SET

Syntax

app.SCPI.CALCulate(Ch).SELected.MARKer(Mk).POSition = "STOP"

app.SCPI.CALCulate(Ch).SELected.MARKer(Mk).SET = "STOP"

Type

String (read/write)

Back to CALCulate

CALC:MARK:X

SCPI Command

CALCulate<Ch>[:SELected]:MARKer<Mk>:X <stimulus>

CALCulate<Ch>[:SELected]:MARKer<Mk>:X?

Description

Sets or reads out the stimulus value of the marker.
command/query

Target

Marker <Mk> of the active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

<Mk>={[1] … |16}

Parameter

<stimulus> the stimulus value of the marker, the range is from the stimulus start value to the stimulus stop value currently set

Unit

Hz | s | dBm

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

Stimulus center value

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer(Mk).X

Syntax

Value = app.SCPI.CALCulate(Ch).SELected.MARKer(Mk).X

app.SCPI.CALCulate(Ch).SELected.MARKer(Mk).X = 1e9

Type

Double (read/write)

Back to CALCulate

CALC:MARK:Y?

SCPI Command

CALCulate<Ch>[:SELected]:MARKer<Mk>:Y?

Description

Reads out the response value of the marker. If the reference marker is turned ON, the values of the markers from 1 to 15 are read out as relative values to the reference marker. The data include 2 elements: <numeric 1> real number in rectangular format, real part in polar and Smith chart formats; <numeric 2> 0 in rectangular format, imaginary part in polar and Smith chart formats.
query only

Target

Marker <Mk> of the active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)<Mk>={[1] … |16}

Query Response

<numeric 1>, <numeric 2>

Related Commands

CALC:MARK:REF

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer(Mk).Y

Syntax

Data = app.SCPI.CALCulate(Ch).SELected.MARKer(Mk).Y

Type

Variant (array of Double) (read only)

Back to CALCulate

CALC:MST

SCPI Command

CALCulate<Ch>[:SELected]:MSTatistics[:STATe] {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:MSTatistics[:STATe]?

Description

Turns the math statistics display ON/OFF.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

{ON|1}	Statistics display ON
{OFF|0}	Statistics display OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Markers > Math > Statistics > Statistics

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MSTatistics.STATe

Syntax

Status = app.SCPI.CALCulate(Ch).SELected.MSTatistics.STATe

app.SCPI.CALCulate(Ch).SELected.MSTatistics.STATe = true

Type

Boolean (read/write)

Back to CALCulate

CALC:MST:DATA?

SCPI Command

CALCulate<Ch>[:SELected]:MSTatistics:DATA?

Description

Reads out the math statistics values. The statistics function is applied either over the whole range, or within the range specified by the CALC:MST:DOM command (the range limits are determined by two markers). The data include 3 elements: <numeric 1> Mean value; <numeric 2> Standard deviation; <numeric 3> Peak–to–peak (difference between the maximum value and the minimum value).
query only

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Query Response

<numeric 1>, <numeric 2>, numeric 3>

Related Commands

CALC:MST:DOM

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MSTatistics.DATA

Syntax

Data = app.SCPI.CALCulate(Ch).SELected.MSTatistics.DATA

Type

Variant (array of Double) (read only)

Back to CALCulate

CALC:MST:DOM

SCPI Command

CALCulate<Ch>[:SELected]:MSTatistics:DOMain[:STATe] {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:MSTatistics:DOMain[:STATe]?

Description

Selects either the partial frequency range or the entire frequency range to be used for math statistic calculation. The partial frequency range is limited by two markers.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

Choose from:

{ON|1}	Statistics range ON
{OFF|0}	Statistics range OFF

Query Response

{0|1}

Preset Value

0

Related Commands

CALC:MST:DOM:STAR

CALC:MST:DOM:STOP

Equivalent Softkeys

Markers > Math > Statistics > Statistics Range

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MSTatistics.DOMain.STATe

Syntax

Status = app.SCPI.CALCulate(Ch).SELected.MSTatistics.STATe

app.SCPI.CALCulate(Ch).SELected.MSTatistics.STATe = true

Type

Boolean (read/write)

Back to CALCulate

CALC:MST:DOM:STAR

SCPI Command

CALCulate<Ch>[:SELected]:MSTatistics:DOMain[:MARKer]:STARt <numeric>

CALCulate<Ch>[:SELected]:MSTatistics:DOMain[:MARKer]:STARt?

Description

Sets or reads out the number of the marker, which specifies the start frequency of the math statistics range.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

<numeric> marker number from 1 to 16

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

1

Equivalent Softkeys

Markers > Math > Statistics > Statistics Start

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MSTatistics.DOMain.MARKer.STARt

Syntax

MkrNum =
app.SCPI.CALCulate(Ch).SELected.MSTatistics.DOMain.MARKer.STARt

app.SCPI.CALCulate(Ch).SELected.MSTatistics.DOMain.MARKer.STARt = 3

Type

Long (read/write)

Back to CALCulate

CALC:MST:DOM:STOP

SCPI Command

CALCulate<Ch>[:SELected]:MSTatistics:DOMain[:MARKer]:STOP <numeric>

CALCulate<Ch>[:SELected]:MSTatistics:DOMain[:MARKer]:STOP?

Description

Sets or reads out the number of the marker, which specifies the stop frequency of the math statistics range.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

<numeric> marker number from 1 to 16

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

2

Equivalent Softkeys

Markers > Math > Statistics > Statistics Stop

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MSTatistics.DOMain.MARKer.STOP

Syntax

MarkerNum = app.SCPI.CALCulate(Ch).SELected.MSTatistics.DOMain.MARKer.STOP

app.SCPI.CALCulate(Ch).SELected.MSTatistics.DOMain.MARKer.STOP = 4

Type

Long (read/write)

Back to CALCulate

CALC:PAR:COUN

SCPI Command

CALCulate<Ch>:PARameter:COUNt <numeric>

CALCulate<Ch>:PARameter:COUNt?

Description

Sets or reads out the number of traces in the channel.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1] … |16} (in N-port mode only)

Parameter

<numeric> The number of the traces in the channel from 1 to 16

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

1

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).PARameter(1).COUNt

Syntax

TraceNum = app.SCPI.CALCulate(1).PARameter.COUNt

app.SCPI.CALCulate(1).PARameter.COUNt = 2

Type

Long (read/write)

WARNING	Object PARameter has an index of 1, which can be omitted in Visual Basic, but it cannot be omitted in other programming languages.

Back to CALCulate

CALC:PAR:DEF

SCPI Command

CALCulate<Ch>:PARameter<Tr>:DEFine <char>

CALCulate<Ch>:PARameter<Tr>:DEFine?

Description

Selects the measurement parameter of the trace.
command/query

Target

Trace <Tr> of channel <Ch>,

<Tr>={[1]|2|3|4}

<Ch>={[1]|2|3|4}

<Tr>={[1]…|16} (in N-port mode only)

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<char> Specifies parameter:

S11	S-parameter
A	Test receiver (R60/R180 only)
R	Reference receiver (R60/R180 only)
S21|...|S16.1|...|S1.16|... |S16.16	S-parameter (in N-port mode only)

Query Response

{ S11|A|B} (1-port VNA)

{ S11|S21|...|S16.1|... |S16.16} (in N-port mode only)

Equivalent Softkeys

Trace > Measurement > S11 | A | B (1-port VNA)

Trace > Measurement > S11 | S21 | S12 | S22 …|S16.1|...|S1.16|... |S16.16 (in N-port mode only)

Equivalent COM Command

SCPI.CALCulate(Ch).PARameter(Tr).DEFine

Syntax

StrMeas = app.SCPI.CALCulate(Ch).PARameter(Tr).DEFine

app.SCPI.CALCulate(Ch).PARameter(Tr).DEFine = "S11"

Type

String (read/write)

Back to CALCulate

CALC:PAR:SEL

SCPI Command

CALCulate<Ch>:PARameter<Tr>:SELect

Description

Selects the active trace in the channel. **Note**: If the trace number is greater than the number of the traces displayed in the channel, an error occurs, and the command is ignored.
no query

Target

Trace <Tr> of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

<Tr>={[1]|2|3|4}

<Tr>={[1]…|16} (in N-port mode only)

Related Commands

CALC:PAR:COUN

Equivalent Softkeys

Trace > Active Trace

Equivalent COM Command

SCPI.CALCulate(Ch).PARameter(Tr).SELect

Syntax

app.SCPI.CALCulate(Ch).PARameter(Tr).SELect

Type

Method

Back to CALCulate

CALC:RLIM

SCPI Command

CALCulate<Ch>[:SELected]:RLIMit[:STATe] {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:RLIMit[:STATe]?

Description

Turns the ripple limit test ON/OFF.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

Choose from:

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Analysis > Ripple Test > Ripple Test

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.RLIMit.STATe

Syntax

Status = app.SCPI.CALCulate(Ch).SELected.RLIMit.STATe

app.SCPI.CALCulate(Ch).SELected.RLIMit.STATe = true

Type

Boolean (read/write)

Back to CALCulate

CALC:RLIM:DATA

SCPI Command

CALCulate<Ch>[:SELected]:RLIMit:DATA <numeric list>

CALCulate<Ch>[:SELected]:RLIMit:DATA?

Description

Sets the data array, which is the limit line for the ripple limit function. The array size is 1 + 4N, where N is the number of limit line segments. For the n–th point, where n from 1 to N: <numeric 1> the number of limit line segments N is the integer from 0 to 12. Setting 0 clears the limit line. <numeric 4n–2> type of the n–th limit line segment 0: Off. 1: On <numeric 4n–1> the stimulus value in the beginning point of the n–th segment <numeric 4n–0> the stimulus value in the end point of the n–th segment <numeric 4n+1> the ripple limit value of the n–th segment. **Note**: If the array size is not 1 + 4N, where N is <numeric 1>, an error occurs. If <numeric 4n–2> is less than 0 or more than 1, an error occurs. When <numeric 4n–1>, <numeric 4n–0>, and <numeric 4n+1> elements are out of allowable range, the value is set to the limit, which is closer to the specified value.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Query Response

<numeric 1>, <numeric 2>, …<numeric 4N+1>

Equivalent Softkeys

Analysis > Ripple Test > Edit Ripple Limit

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.RLIMit.DATA

Syntax

Data = app.SCPI.CALCulate(Ch).SELected.RLIMit.DATA

app.SCPI.CALCulate(Ch).SELected.RLIMit.DATA = Array(1,1,800,900,10)

Type

Variant (array of Double) (read only)

Back to CALCulate

CALC:RLIM:DISP:LINE

SCPI Command

CALCulate<Ch>[:SELected]:RLIMit:DISPlay:LINE {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:RLIMit:DISPlay:LINE?

Description

Turns the ripple limit line display ON/OFF.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

Choose from:

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Analysis > Ripple Test > Ripple Limit

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.RLIMit.DISPlay.LINE

Syntax

Status = app.SCPI.CALCulate(Ch).SELected.RLIMit.DISPlay.LINE

app.SCPI.CALCulate(Ch).SELected.RLIMit.DISPlay.LINE = true

Type

Boolean (read/write)

Back to CALCulate

CALC:RLIM:FAIL?

SCPI Command

CALCulate<Ch>[:SELected]:RLIMit:FAIL?

Description

Reads out the ripple limit test result.
query only

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

1	Fail
0	Pass

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.RLIMit.FAIL

Syntax

Status = app.SCPI.CALCulate(Ch).SELected.RLIMit.FAIL

Type

Boolean (read/write)

Back to CALCulate

CALC:RLIM:REP?

SCPI Command

CALCulate<Ch>[:SELected]:RLIMit:REPort[:DATA]?

Description

Reads out the data array, which is the ripple limit test result. The array size is 1+3N, where N is the number of ripple limit bands. For the n–th point, where n from 1 to N: <numeric 1> N total number of the bands <numeric 3n–1> n number of the band <numeric 3n–0> Ripple value in the n–th band <numeric 3n+1> Ripple limit test result in the n–th band: 0 — Pass 1 — Fail
query only

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Query Response

<numeric 1>, <numeric 2>, …<numeric 3N+1>

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.RLIMit.REPort.DATA

Syntax

Data = app.SCPI.CALCulate(Ch).SELected.RLIMit.REPort.DATA

Type

Variant (array of Double) (read only)

Back to CALCulate

CALC:SMO

SCPI Command

CALCulate<Ch>[:SELected]:SMOothing[:STATe] {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:SMOothing[:STATe]?

Description

Turns the trace smoothing ON/OFF.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

Choose from:

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Average > Smoothing

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.SMOothing.STATe

Syntax

Status = app.SCPI.CALCulate(Ch).SELected.SMOothing.STATe

app.SCPI.CALCulate(Ch).SELected.SMOothing.STATe = true

Type

Boolean (read/write)

Back to [CALCulate]

CALC:SMO:APER

SCPI Command

CALCulate<Ch>[:SELected]:SMOothing:APERture <numeric>

CALCulate<Ch>[:SELected]:SMOothing:APERture?

Description

Sets or reads out the smoothing aperture when performing smoothing function.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<numeric> the smoothing aperture from 0.01 to 20

Unit

% (percent)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

1

Equivalent Softkeys

Average > Smoothing Aperture

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.SMOothing.APERture

Syntax

Value = app.SCPI.CALCulate(Ch).SELected.SMOothing.APERture

app.SCPI.CALCulate(Ch).SELected.SMOothing.APERture = 1.5

Type

Double (read/write)

Back to CALCulate

CALC:TRAC:DATA:FDAT?

SCPI Command

CALCulate<Ch>:TRACe<Tr>:DATA:FDATa?

Description

Reads out the formatted data array. The formatted data array is the data, whose processing is completed, including the formatting as the last step. Such data represent the data trace values as they are shown on the screen. The array size is 2N, where N is the number of measurement points. For the n–th point, where n from 1 to N: <numeric 2n–1> real number in rectangular format, real part in polar and Smith chart formats; <numeric 2n> 0 in rectangular format, imaginary part in polar and Smith chart formats.
query only

Target

The specified trace <Tr> of channel <Ch>,

<Tr>={[1]|2|3|4}

<Ch>={[1]|2|3|4}

<Tr>={[1]…|16} (in N-port mode only)

<Ch>={[1]…|16} (in N-port mode only)

Query Response

<numeric 1>,<numeric 2>,…<numeric 2N>

Related Commands

CALC:DATA:FDAT

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).TRACe(Tr).DATA.FDATa

Syntax

Dim Data As Variant

Data = app.SCPI.CALCulate(Ch).Trace(Tr).DATA.FDATa

Type

Double (read only)

Back to CALCulate

CALC:TRAC:DATA:FMEM?

SCPI Command

CALCulate<Ch>:TRACe<Tr>:DATA:FMEMory?

Description

Reads out the formatted memory array. The formatted memory array is the data, whose processing is completed including the formatting as the last step. Such data represent the memory trace values as they are shown on the screen. The array size is 2N, where N is the number of measurement points. For the n–th point, where n from 1 to N: <numeric 2n–1> real number in rectangular format, real part in polar and Smith chart formats; <numeric 2n> 0 in rectangular format, imaginary part in polar and Smith chart formats.
query only

Target

The specified trace <Tr> of channel <Ch>,

<Tr>={[1]|2|3|4}

<Ch>={[1]|2|3|4}

<Tr>={[1]…|16} (in N-port mode only)

<Ch>={[1]…|16} (in N-port mode only)

Query Response

<numeric 1>,<numeric 2>,…<numeric 2N>

Related Commands

CALC:DATA:FMEM

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).TRACe(Tr).DATA.FMEMory

Syntax

Dim Data As Variant

Data = app.SCPI.CALCulate(Ch).Trace(Tr).DATA.FMEMory

Type

Double (read only)

Back to CALCulate

CALC:TRAC:DATA:SDAT?

SCPI Command

CALCULATE<CH>:TRACE<TR>:DATA:SDATA?

Description

Reads out the corrected data array. The corrected data array is the data, whose processing is completed excluding the formatting as the last step. Such data represent S–parameter complex values. The array size is 2N, where N is the number of measurement points. For the n–th point, where n from 1 to N: <numeric 2n–1> the real part of corrected measurement; <numeric 2n> the imaginary part of corrected measurement.
query only

Target

The specified trace <Tr> of channel <Ch>,

<Tr>={[1]|2|3|4}

<Ch>={[1]|2|3|4}

<Tr>={[1]…|16} (in N-port mode only)

<Ch>={[1]…|16} (in N-port mode only)

Query Response

<numeric 1>,<numeric 2>,…<numeric 2N>

Related Commands

CALC:DATA:SDAT

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).TRACe(Tr).DATA.SDATa

Syntax

Dim Data As Variant

Data = app.SCPI.CALCulate(Ch). Trace(Tr).DATA.SDATa

Type

Double (read only)

Back to CALCulate

CALC:TRAC:DATA:SMEM?

SCPI Command

CALCulate<Ch>:TRACe<Tr>:DATA:SMEMory?

Description

Reads out the corrected memory array. The corrected memory array is the data, whose processing is completed excluding the formatting as the last step. Such data represent S–parameter complex values. The array size is 2N, where N is the number of measurement points. For the n–th point, where n from 1 to N: <numeric 2n–1> the real part of corrected measurement memory; <numeric 2n> the imaginary part of corrected measurement memory.
query only

Target

The specified trace <Tr> of channel <Ch>,

<Tr>={[1]|2|3|4}

<Ch>={[1]|2|3|4}

<Tr>={[1]…|16} (in N-port mode only)

<Ch>={[1]…|16} (in N-port mode only)

Query Response

<numeric 1>,<numeric 2>,…<numeric 2N>

Related Commands

CALC:DATA:SMEM

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).TRACe(Tr).DATA.SMEMory

Syntax

Dim Data As Variant

Data = app.SCPI.CALCulate(Ch).Trace(Tr).DATA.SMEMory

Type

Double (read only)

Back to CALCulate

CALC:TRAN:TIME

SCPI Command

CALCulate<Ch>[:SELected]:TRANsform:TIME[:TYPE] <char>

CALCulate<Ch>[:SELected]:TRANsform:TIME[:TYPE]?

Description

Selects the transformation type for the time domain transformation function: Bandpass or Lowpass.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<char> Specifies the transformation type:

BPASs	Bandpass
LPASs	Lowpass

Query Response

{BPAS|LPAS}

Preset Value

BPAS

Equivalent Softkeys

Analysis > Time Domain > Response Type > {Bandpass | Lowpass Step | Lowpass Impulse}

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.TRANsform.TIME.TYPE

Syntax

Param = app.SCPI.CALCulate(Ch).SELected.TRANsform.TIME.TYPE

app.SCPI.CALCulate(Ch).SELected.TRANsform.TIME.TYPE = "STEP"

Type

String (read/write)

Back to CALCulate

CALC:TRAN:TIME:CENT

SCPI Command

CALCulate<Ch>[:SELected]:TRANsform:TIME:CENTer <time>

CALCulate<Ch>[:SELected]:TRANsform:TIME:CENTer?

Description

Sets or reads out the time domain center value when the time domain transformation function is turned ON.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<time> the time domain center value, the range varies depending on the specified frequency range and the number of points

Unit

sec (second)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

1

Related Commands

CALC:TRAN:TIME:UNIT

Equivalent Softkeys

Analysis > Time Domain > Center

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.TRANsform.TIME.CENTer

Syntax

Value = app.SCPI.CALCulate(Ch).SELected.TRANsform.TIME.CENTer

app.SCPI.CALCulate(Ch).SELected.TRANsform.TIME.CENTer = 1e–8

Type

Double (read/write)

Back to CALCulate

CALC:TRAN:TIME:IMP:WIDT

SCPI Command

CALCulate<Ch>[:SELected]:TRANsform:TIME:IMPulse:WIDTh <time>

CALCulate<Ch>[:SELected]:TRANsform:TIME:IMPulse:WIDTh?

Description

Sets or reads out the impulse width (time domain transformation resolution), coupled with the Kaiser–Bessel window shape β parameter. The impulse width setting changes the β parameter and setting of β parameter changes the impulse width.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<time> the impulse width, the range varies depending on the specified frequency range and the number of points

Unit

sec (second)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.TRANsform.TIME.IMPulse.WIDTh

Syntax

Value = app.SCPI.CALCulate(Ch).SELected.TRANsform.TIME.IMPulse.WIDTh

app.SCPI.CALCulate(Ch).SELected.TRANsform.TIME.IMPulse.WIDTh = 1e–8

Type

Double (read/write)

Back to CALCulate

CALC:TRAN:TIME:KBES

SCPI Command

CALCulate<Ch>[:SELected]:TRANsform:TIME:KBESsel <numeric>

CALCulate<Ch>[:SELected]:TRANsform:TIME:KBESsel?

Description

Sets or reads out the β parameter, which controls the Kaiser–Bessel window shape when performing the time domain transformation.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<numeric> β parameter from 0 to 13

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

6

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.TRANsform.TIME.KBESsel

Syntax

Value = app.SCPI.CALCulate(Ch).SELected.TRANsform.TIME.KBESsel

app.SCPI.CALCulate(Ch).SELected.TRANsform.TIME.KBESsel = 13

Type

Double (read/write)

Back to CALCulate

CALC:TRAN:TIME:LPFR

SCPI Command

CALCulate<Ch>[:SELected]:TRANsform:TIME:LPFRequency

Description

Changes the frequency range to the harmonic grid in order to match with the Lowpass type of the time domain transformation function.
no query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Equivalent Softkeys

Analysis > Time Domain > Set Frequency Low Pass

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.TRANsform.TIME.LPFRequency

Syntax

app.SCPI.CALCulate(Ch).SELected.TRANsform.TIME.LPFRequency

Type

Method

Back to CALCulate

CALC:TRAN:TIME:REFL:TYPE

SCPI Command

CALCulate<Ch>[:SELected]:TRANsform:TIME:REFLection:TYPE <char>

CALCulate<Ch>[:SELected]:TRANsform:TIME:REFLection:TYPE?

Description

Selects the reflection distance, either one way or round trip for the time domain transformation function.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<char> Choose from:

RTRip	Round Trip
OWAY	One Way

Query Response

{RTR|OWAY}

Preset Value

RTR

Equivalent Softkeys

Analysis > Time Domain >Reflection Type > {Round Trip | One Way}

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.TRANsform.TIME.REFLection.TYPE

Syntax

Param = app.SCPI.CALCulate(Ch).SELected.TRANsform.TIME.REFLection.TYPE

app.SCPI.CALCulate(Ch).SELected.TRANsform.TIME.REFLection.TYPE = "RTR"

Type

String (read/write)

Back to CALCulate

CALC:TRAN:TIME:SPAN

SCPI Command

CALCulate<Ch>[:SELected]:TRANsform:TIME:SPAN <time>

CALCulate<Ch>[:SELected]:TRANsform:TIME:SPAN?

Description

Sets or reads out the time domain span value when the time domain transformation function is turned ON.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<time> the time domain span value, the range varies depending on the specified frequency range and the number of points

Unit

sec (second)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

2e-8

Equivalent Softkeys

Analysis > Time Domain > Span

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.TRANsform.TIME.SPAN

Syntax

Value = app.SCPI.CALCulate(Ch).SELected.TRANsform.TIME.SPAN

app. SCPI.CALCulate(Ch).SELected.TRANsform.TIME.SPAN = 1e–8

Type

Double (read/write)

Back to CALCulate

CALC:TRAN:TIME:STAR

SCPI Command

CALCulate<Ch>[:SELected]:TRANsform:TIME:STARt <time>

CALCulate<Ch>[:SELected]:TRANsform:TIME:STARt?

Description

Sets or reads out the time domain start value when the time domain transformation function is turned ON.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<time> the time domain start value, the range varies depending on the specified frequency range and the number of points

Unit

sec (second)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

-1e-8

Equivalent Softkeys

Analysis > Time Domain > Start

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.TRANsform.TIME.STARt

Syntax

Value = app.SCPI.CALCulate(Ch).SELected.TRANsform.TIME.STARt

app.SCPI.CALCulate(Ch).SELected.TRANsform.TIME.STARt = 1e–8

Type

Double (read/write)

Back to CALCulate

CALC:TRAN:TIME:STOP

SCPI Command

CALCulate<Ch>[:SELected]:TRANsform:TIME:STOP <time>

CALCulate<Ch>[:SELected]:TRANsform:TIME:STOP?

Description

Sets or reads out the time domain stop value when the time domain transformation function is turned ON.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<time> the time domain stop value, the range varies depending on the specified frequency range and the number of points

Unit

sec (second)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

+1e-8

Equivalent Softkeys

Analysis > Time Domain > Stop

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.TRANsform.TIME.STOP

Syntax

Value = app.SCPI.CALCulate(Ch).SELected.TRANsform.TIME.STOP

app.SCPI.CALCulate(Ch).SELected.TRANsform.TIME.STOP = 2e–8

Type

Double (read/write)

Back to CALCulate

CALC:TRAN:TIME:STAT

SCPI Command

CALCulate<Ch>[:SELected]:TRANsform:TIME:STATe {OFF|ON|0|1}

CALCulate<Ch>[:SELected]:TRANsform:TIME:STATe?

Description

Turns the time domain transformation function ON/OFF.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Analysis > Time Domain > Time Domain

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.TRANsform.TIME.STATe

Syntax

Status = app.SCPI.CALCulate(Ch).SELected.TRANsform.TIME.STATe

app.SCPI.CALCulate(Ch).SELected.TRANsform.TIME.STATe = true

Type

Boolean (read/write)

Back to CALCulate

CALC:TRAN:TIME:STEP:RTIM

SCPI Command

CALCulate<Ch>[:SELected]:TRANsform:TIME:STEP:RTIMe <time>

CALCulate<Ch>[:SELected]:TRANsform:TIME:STEP:RTIMe?

Description

Sets or reads out the rise time of the step signal (time domain transformation resolution), coupled with the Kaiser–Bessel window shape β parameter. The impulse width setting changes the β parameter and setting of β parameter changes the impulse width.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<time> the impulse width, the range varies depending on the specified frequency range and the number of points

Unit

sec (second)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.TRANsform.TIME.STEP.RTIMe

Syntax

Value = app.SCPI.CALCulate(Ch).SELected.TRANsform.TIME.STEP.RTIMe

app.SCPI.CALCulate(Ch).SELected.TRANsform.TIME.STEP.RTIMe = 1e–8

Type

Double (read/write)

Back to CALCulate

CALC:TRAN:TIME:STIM

SCPI Command

CALCulate<Ch>[:SELected]:TRANsform:TIME:STIMulus <char>

CALCulate<Ch>[:SELected]:TRANsform:TIME:STIMulus?

Description

Selects the stimulus type for the time domain transformation function: impulse or step. The stimulus type is valid for the Lowpass devices. For the Bandpass devices the impulse type is always used.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<char> Specifies the stimulus type:

IMPulse	Impulse
STEP	Step

Query Response

{IMP|STEP}

Preset Value

IMP

Equivalent Softkeys

Analysis > Time Domain > Response Type > {Bandpass | Lowpass Step | Lowpass Impulse}

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.TRANsform.TIME.STIMulus

Syntax

Param = app.SCPI.CALCulate(Ch).SELected.TRANsform.TIME.STIMulus

app.SCPI.CALCulate(Ch).SELected.TRANsform.TIME.STIMulus = "STEP"

Type

String (read/write)

Back to CALCulate

CALC:TRAN:TIME:UNIT

SCPI Command

CALCulate<Ch>[:SELected]:TRANsform:TIME:UNIT <char>

CALCulate<Ch>[:SELected]:TRANsform:TIME:UNIT?

Description

Selects the transformation unit for the time domain transformation function: seconds, meters, feet.
command/query

Target

The active trace of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<char> Choose from:

SEConds	Seconds
METers	Meters
FEET	Feet

Query Response

{SEC|MET|FEET}

Preset Value

SEC

Equivalent Softkeys

Analysis > Time Domain > Unit > Time, ns | Metric, m | Imperial, ft

---

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.TRANsform.TIME.UNIT

Syntax

Param = app.SCPI.CALCulate(Ch).SELected.TRANsform.TIME.UNIT

app.SCPI.CALCulate(Ch).SELected.TRANsform.TIME.UNIT = "MET"

Type

String (read/write)

Back to CALCulate

DEVices

Command	Description		COM analog
DEV:ADDN	Managing Devices	Add device (N-port mode only)	+
DEV:COUN?		Number of connected devices (N-port mode only)	+
DEV:MOVD		Move up the device (N-port mode only)	+
DEV:MOVU		Move down the device (N-port mode only)	+
DEV:READ?		Readiness of the device (N-port mode only)	+
DEV:ADJ:EXEC		Adjust Immediate (N-port mode only)	+
DEV:ADJ:PER		Frequency automatic adjustment period (N-port mode only)	+
DEV:PORT:OFF		Reference frequency correction value (N-port mode only)	+
DEV:REML		Remove last (N-port mode only)	+
DEV:SER?		Serial number of the device (N-port mode only)	+
DEV:METH?		Device synchronization method (N-port mode only)	+

DEV:ADDN

SCPI Command

DEVices:ADDNext

Description

Additing one more device to configuration. (in N-port mode only)
no query

Equivalent Softkeys

Devices > Add Next

Equivalent COM Command

SCPI.DEVices.ADDNext

Syntax

app.SCPI.DEVices.ADDNext

Type

Method

Back to DEVices

DEV:COUN?

SCPI Command

DEVices:COUNt

Description

Number of connected devices in the configuration. (in N-port mode only)
query only

Equivalent Softkeys

None

Equivalent COM Command

SCPI.DEVices.COUNt

Syntax

Dim Value As Long

Value = app.SCPI.DEVices.COUNt

Type

Long (read only)

Back to DEVices

DEV:MOVD

SCPI Command

DEVices:MOVDown <numeric>

Description

Moving the device from the position Port into position Port+1. (in N-port mode only)
no query

Equivalent Softkeys

Devices > Move Down

Equivalent COM Command

SCPI.DEVices.MOVDown(Port)

Syntax

app.SCPI.DEVices.MOVDown(Port)

Type

Method

Back to DEVices

DEV:MOVU

SCPI Command

DEVices:MOVUp <numeric>

Description

Moving the device from the position Port into position Port-1. (in N-port mode only)
no query

Equivalent Softkeys

Devices > Move Up

Equivalent COM Command

SCPI.DEVices.MOVUp(Port)

Syntax

app.SCPI.DEVices.MOVUp(Port)

Type

Method

Back to DEVices

DEV:READ?

SCPI Command

DEVices:READy? <numeric>

Description

Readiness of the device associated with port Port. (in N-port mode only)
query only

Equivalent Softkeys

None

Equivalent COM Command

SCPI.DEVices.READy(Port)

Syntax

app.SCPI.DEVices.READy(Port)

Type

Boolean (read only)

Back to DEVices

DEV:ADJ:EXEC

SCPI Command

DEVices[:REFerence]:ADJust:Execute

Description

Adjustment of the reference frequency of all devices relative to the first in the list. (in N-port mode only)
no query

Equivalent Softkeys

Devices > Adjust Immediate

Equivalent COM Command

SCPI.DEVices.REFerence.ADJust.Execute

Syntax

app.SCPI.DEVices.REFerence.ADJust.Execute

Type

Method

Back to DEVices

DEV:ADJ:PER

SCPI Command

DEVices[:REFerence]:ADJust:PERiod <numeric>

Description

Frequency automatic adjustment period. (in N-port mode only)
command/query

Parameter

<numeric> Value of Frequency automatic adjustment period

Unit

sec

Equivalent Softkeys

Devices > Frequency Adjust Period { OFF | 3 | 10 | 30 | 100 | 300 }

Equivalent COM Command

SCPI.DEVices.REFerence.ADJust.Period

Syntax

app.SCPI.DEVices.REFerence.ADJust.Period

Type

Long (read/write)

Back to DEVices

DEV:PORT:OFF

SCPI Command

DEVices[:REFerence]:PORT<Pt>:OFFset <numeric>

DEVices[:REFerence]:PORT<Pt>:OFFset?

Description

Reference frequency correction value. (in N-port mode only)
command/query

Parameter

<numeric> Offset of Reference Frequency

Unit

Hz

Equivalent Softkeys

None

Equivalent COM Command

SCPI.DEVices. REFerence.Offset(Port)

Syntax

app.SCPI.DEVices.REFerence.Offset(Port)

Type

Double (read/write)

Back to DEVices

DEV:REML

SCPI Command

DEVices:REMLast

Description

Removing one more device to configuration. (in N-port mode only)
no query

Equivalent Softkeys

Devices > Remove Last

Equivalent COM Command

SCPI.DEVices.REMLast

Syntax

app.SCPI.DEVices.REMLast

Type

Method

Back to DEVices

DEV:SER?

SCPI Command

DEVices:SERial? <numeric>

Description

Serial number of the device associated with Port. (in N-port mode only)
query only

Parameter

<numeric> Port Number {[1]|2|3|4... 16}

Equivalent Softkeys

None

Equivalent COM Command

SCPI.DEVices.SERial(Port)

Syntax

Dim Value As String

Value = app.SCPI.DEVices.SERial(Port)

Type

String (read only)

Back to DEVices

DEV:METH?

SCPI Command

DEVices[:SYNChronization]:METHod <char>

DEVices[:SYNChronization]:METHod?

Description

Device synchronization method. (in N-port mode only)
command/query

Parameter

<char> choose from:

FREE	Independent operation of devices. No synchronization
USB	Independent operation of devices. No synchronization
TRIG	Device Synchronization via Trigger Bus

Out of Range

The command is ignored.

Query Response

{FREE|USB|TRIG}

Preset Value

USB

Equivalent Softkeys

Devices > Synchronization { Free Run | USB Bus | Trig Bus }

Equivalent COM Command

SCPI.DEVices.SYNChronization.Method

Syntax

app.SCPI.DEVices. SYNChronization.Method

Type

Property (read/write)

Back to DEVices

DISPlay

Command	Description		COM analog
DISP:COL:BACK	Color Settings	Background color	+
DISP:COL:GRAT		Grid and graticule label color	+
DISP:COL:TRAC:DATA		Data trace color	+
DISP:COL:TRAC:MEM		Memory trace color	+
DISP:IMAG		Colors inversion	+
DISP:COL:RES	Interface Settings	Resets display settings to default	+
DISP:ENAB		Display update ON/OFF	+
DISP:MAX		Maximizes the channel window ON/OFF	+
DISP:UPD		One-time display update	+
DISP:WIND:MAX		Maximizes the trace in channel ON/OFF	+
DISP:WIND:TITL		Channel title display ON/OFF	+

Command	Description		COM analog
DISP:WIND:TITL:DATA		Channel title label	+
DISP:FSIG	Limit Test, Ripple Limit Test	"Fail" sign display ON/OFF	+
DISP:WIND:ANN:MARK:ALIG	Marker Properties	Marker annotation alignment	+
DISP:WIND:ANN:MARK:SING		Active marker only ON/OFF	+
DISP:WIND:TRAC:ANN:MARK:POS:X		X-position of marker annotation	+
DISP:WIND:TRAC:ANN:MARK:POS:Y		Y-position of marker annotation	+
DISP:WIND:TRAC:ANN:MARK:MEM		The state of the memory value display on the marker	+
DISP:SPL	Channel and Trace Settings	Number and Layout of channels	+
DISP:WIND:ACT		Active channel number (write)	+
DISP:WIND:SPL		Allocation of traces in the channel window	+
DISP:WIND:TRAC:MEM	Memory Trace Function	Memory trace display ON/OFF	+

Command	Description		COM analog
DISP:WIND:TRAC:STAT		Data trace display ON/OFF	+
DISP:WIND:TRAC:Y:AUTO	Scale	Auto scale	+
DISP:WIND:TRAC:Y:RLEV:AUTO		Auto Reference Level	-
DISP:WIND:TRAC:Y:PDIV		Scale per division	+
DISP:WIND:TRAC:Y:RLEV		Reference line value	+
DISP:WIND:TRAC:Y:RPOS		Reference line position	+
DISP:WIND:Y:DIV		Number of the scale divisions	+

DISP:COL:BACK

SCPI Command

DISPlay:COLor:BACK <numeric 1>,<numeric 2>,<numeric 3>

DISPlay:COLor:BACK?

Description

Sets or reads out the background color for trace display.
command/query

Parameter

<numeric 1>	Red value R from 0 to 255
<numeric 2>	Green value G from 0 to 255
<numeric 3>	Blue value B from 0 to 255

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric 1>, <numeric 2>, <numeric 3>

Preset Value

0,0,0

Equivalent Softkeys

Display > Interface Elements Color > Background

Equivalent COM Command

SCPI.DISPlay.COLor.BACK

Syntax

Data = app.SCPI.DISPlay.COLor.BACK

app.SCPI.DISPlay.COLor.BACK = Array(255, 255, 255)

Type

Variant (array of long) (read/write)

Back to DISPlay

DISP:COL:GRAT

SCPI Command

DISPlay:COLor:GRATicule <numeric 1>,<numeric 2>,<numeric 3>

DISPlay:COLor:GRATicule?

Description

Sets or reads out the grid and the graticule label color for trace display.
command/query

Parameter

<numeric 1>	Red value R from 0 to 255
<numeric 2>	Green value G from 0 to 255
<numeric 3>	Blue value B from 0 to 255

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric 1>, <numeric 2>, <numeric 3>

Preset Value

160,160,164

Equivalent Softkeys

Display > Interface Elements Color > Grid

Equivalent COM Command

SCPI.DISPlay.COLor.GRATicule

Syntax

Data = app.SCPI.DISPlay.COLor.GRATicule

app.SCPI.DISPlay.COLor.GRATicule = Array(128, 128, 128)

Type

Variant (array of long) (read/write)

Back to DISPlay

DISP:COL:RES

SCPI Command

DISPlay:COLor:RESet

Description

Restores the display settings to the default values.
no query

Equivalent Softkeys

Display > Preset

Equivalent COM Command

SCPI.DISPlay.COLor.RESet

Syntax

app.SCPI.DISPlay.COLor.RESet

Type

Method

Back to DISPlay

DISP:COL:TRAC:DATA

SCPI Command

DISPlay:COLor:TRACe<Tr>:DATA <numeric 1>,<numeric 2>,<numeric 3>

DISPlay:COLor:TRACe<Tr>:DATA?

Description

Sets or reads out the data trace color.
command/query

Target

Trace <Tr>,

<Tr>={[1]|2|3|4}

<Tr>={[1]…|16} (in N-port mode only)

Parameter

<numeric 1>	Red value R from 0 to 255
<numeric 2>	Green value G from 0 to 255
<numeric 3>	Blue value B from 0 to 255

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric 1>, <numeric 2>, <numeric 3>

Preset Value

Varies depending on the trace number.

Equivalent Softkeys

Display > Interface Elements Color > Data Trace

Equivalent COM Command

SCPI.DISPlay.COLor.TRACe(Tr).DATA

Syntax

Data = app.SCPI.DISPlay.COLor.TRACe(Tr).DATA

app.SCPI.DISPlay.COLor.TRACe(Tr).DATA = Array(255, 255, 0)

Type

Variant (array of long) (read/write)

Back to DISPlay

DISP:COL:TRAC:MEM

SCPI Command

DISPlay:COLor:TRACe<Tr>:MEMory <numeric 1>,<numeric 2>,<numeric 3>

DISPlay:COLor:TRACe<Tr>:MEMory?

Description

Sets or reads out the data trace color.
command/query

Target

Trace <Tr>,

<Tr>={[1]|2|3|4}

<Tr>={[1]…|16} (in N-port mode only)

Parameter

<numeric 1>	Red value R from 0 to 255
<numeric 2>	Green value G from 0 to 255
<numeric 3>	Blue value B from 0 to 255

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric 1>, <numeric 2>, <numeric 3>

Preset Value

Varies depending on the trace number.

Equivalent Softkeys

Display > Interface Elements Color > Memory Trace

Equivalent COM Command

SCPI.DISPlay.COLor.TRACe(Tr).MEMory

Syntax

Data = app.SCPI.DISPlay.COLor.TRACe(Tr).MEMory

app.SCPI.DISPlay.COLor.TRACe(Tr).MEMory = Array(255, 255, 0)

Type

Variant (array of long) (read/write)

Back to DISPlay

DISP:ENAB

SCPI Command

DISPlay:ENABle {OFF|ON|0|1}

DISPlay:ENABle?

Description

Turns the display update ON/OFF.
command/query

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

1

Equivalent Softkeys

Display > Update

Equivalent COM Command

SCPI.DISPlay.ENABle

Syntax

Status = app.SCPI.DISPlay.ENABle

app.SCPI.DISPlay.ENABle = true

Type

Boolean (read/write)

Back to DISPlay

DISP:FSIG

SCPI Command

DISPlay:FSIGn {OFF|ON|0|1}

DISPlay:FSIGn?

Description

Turns the "Fail" sign display ON/OFF when performing limit test or ripple limit test.
command/query

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Analysis > Limit Test > Fail Sign

Analysis > Ripple Test > Fail Sign

Equivalent COM Command

SCPI.DISPlay.FSIGn

Syntax

Status = app.SCPI.DISPlay.FSIGn

app.SCPI.DISPlay.FSIGn = true

Type

Boolean (read/write)

Back to DISPlay

DISP:IMAG

SCPI Command

DISPlay:IMAGe <char>

DISPlay:IMAGe?

Description

Turns the inversion of display colors of the trace area ON/OFF.
command/query

Parameter

<char> Choose from:

NORMal	Normal display
INVert	Inverted color display

Query Response

{NORM|INV}

Preset Value

NORM

Equivalent Softkeys

Display > Inverse Color

Equivalent COM Command

SCPI.DISPlay.IMAGe

Syntax

Param = app.SCPI.DISPlay.IMAGe

app.SCPI.DISPlay.IMAGe = "INV"

Type

String (read/write)

Back to DISPlay

DISP:MAX

SCPI Command

DISPlay:MAXimize {OFF|ON|0|1}

DISPlay:MAXimize?

Description

Turns the maximization of the active channel window ON/OFF.
command/query

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Channels > Maximize Channel

Equivalent COM Command

SCPI.DISPlay.MAXimize

Syntax

Status = app.SCPI.DISPlay.MAXimize

app.SCPI.DISPlay.MAXimize = true

Type

Boolean (read/write)

Back to DISPlay

DISP:SPL

SCPI Command

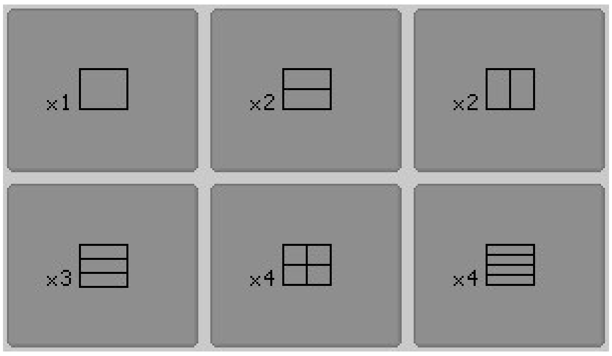
DISPlay:SPLit <numeric>

DISPlay:SPLit?

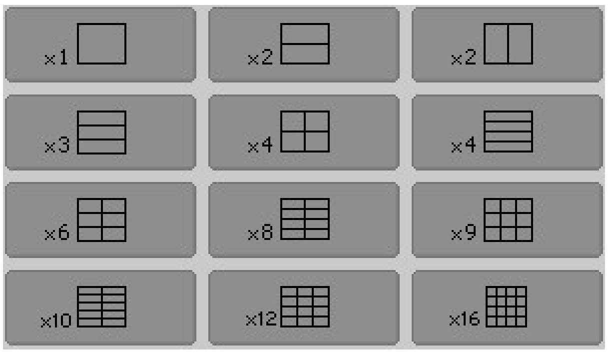
Description

Sets or reads out the number of channels and channel layout on the screen. The channel layouts on the screen is shown below.
command/query

Channel window layout on the screen



Channel window layout for RVNA



Channel window layout for RVNA

Parameter

<numeric> the code of the channel window layout from 1 to 16. Note: the layout code does not correspond to the number of channels.

Query Response

<numeric>

Preset Value

1

Equivalent Softkeys

Channels

Equivalent COM Command

SCPI.DISPlay.SPLit

Syntax

Value = app.SCPI.DISPlay.SPLit

app.SCPI.DISPlay.SPLit = 2

Type

Long (read/write)

Back to DISPlay

DISP:UPD

SCPI Command

DISPlay:UPDate[:IMMediate]

Description

Updates the display once when the display update is set to OFF by the DISP:ENAB command.
no query

Related Commands

DISP:ENAB

Equivalent Softkeys

None

Equivalent COM Command

SCPI.DISPlay.UPDate.IMMediate

Syntax

app.SCPI.DISPlay.REFResh.IMMediate

app.SCPI.DISPlay.UPDate.IMMediate

Type

Method

Back to DISPlay

DISP:WIND:ACT

SCPI Command

DISPlay:WINDow<Ch>:ACTivate

Description

Sets the active channel. **Note**: Trying to set an active channel that is not displayed with the DISP:SPL command will produce an error.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Related Commands

DISP:SPL

Equivalent Softkeys

Channels > Active Channel

Equivalent COM Command

SCPI.DISPlay.WINDow(Ch).ACTivate

Syntax

app.SCPI.DISPlay.WINDow(Ch).ACTivate

Type

Method

Back to DISPlay

DISP:WIND:ANN:MARK:ALIG

SCPI Command

DISPlay:WINDow<Ch>:ANNotation:MARKer:ALIGn[:TYPE] <char>

DISPlay:WINDow<Ch>:ANNotation:MARKer:ALIGn[:TYPE]?

Description

Sets or reads out the alignment of the marker annotation when the active marker only feature is turned OFF by the DISP:WIND:ANN:MARK:SING command.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<char> Choose from:

VERTical	Vertical alignment
HORizontal	Horizontal alignment
NONE	No alignment

Query Response

{NONE|VERT|HOR}

Preset Value

NONE

Related Commands

DISP:WIND:ANN:MARK:SING

Equivalent Softkeys

Marker > Properties > Align > { Vertical | Horizontal | OFF }

Equivalent COM Command

SCPI.DISPlay.WINDow(Ch).ANNotation.MARKer.ALIGn.TYPE

Syntax

Param = app.SCPI.DISPlay.WINDow(Ch).ANNotation.MARKer.ALIGn.TYPE

app.SCPI.DISPlay.WINDow(Ch).ANNotation.MARKer.ALIGn.TYPE = "VERT"

Type

String (read/write)

Back to DISPlay

DISP:WIND:ANN:MARK:SING

SCPI Command

DISPlay:WINDow<Ch>:ANNotation:MARKer:SINGle[:STATe] {OFF|ON|0|1}

DISPlay:WINDow<Ch>:ANNotation:MARKer:SINGle[:STATe]?

Description

Selects display of either the active trace markers or all trace markers.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<char> Choose from:

{ON|1}	Active trace markers
{OFF|0}	All trace markers

Query Response

{0|1}

Preset Value

1

Equivalent Softkeys

Markers > Properties > Active Only

Equivalent COM Command

SCPI.DISPlay.WINDow(Ch).ANNotation.MARKer.SINGle.STATe

Syntax

Status = app.SCPI SCPI.DISPlay.WINDow(Ch).ANNotation.MARKer.SINGle.STATe

app.SCPI SCPI.DISPlay.WINDow(Ch).ANNotation.MARKer.SINGle.STATe = tru

Type

Boolean (read/write)

Back to DISPlay

DISP:WIND:MAX

SCPI Command

DISPlay:WINDow<Ch>:MAXimize {OFF|ON|0|1}

DISPlay:WINDow<Ch>:MAXimize?

Description

Turns the active trace maximization inside the specified channel ON/OFF.
command/query

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Trace > Trace Allocation > Maximize Trace

Equivalent COM Command

SCPI.DISPlay.WINDow(Ch).MAXimize

Syntax

Status = app.SCPI.DISPlay.WINDow(Ch).MAXimize

app.SCPI.DISPlay.WINDow(Ch).MAXimize = true

Type

Boolean (read/write)

Back to DISPlay

DISP:WIND:SPL

SCPI Command

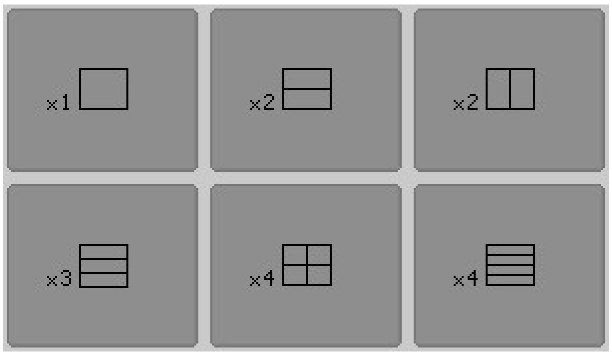
DISPlay:WINDow<Ch>:SPLit <numeric>

DISPlay:WINDow<Ch>:SPLit?

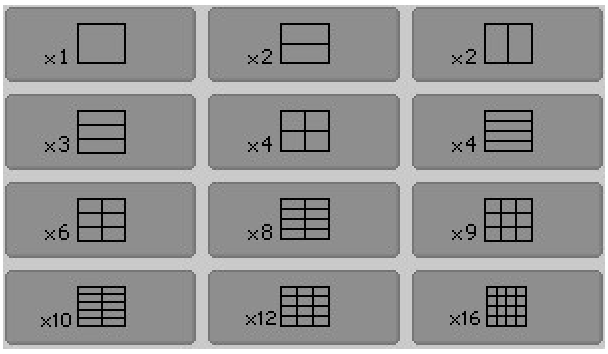
Description

Sets or reads out the number of the graph layout in the channel window. The graph layout in the channel window is shown below. **Note**: This function does not determine the number of traces in the channel window; the CALC:PAR:COUN command sets the number of traces.
command/query

Graph layout in the channel window



RVNA



Options for diagram placement in the channel for RNVNA

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<numeric> the number of the graph layout from 1 to 16

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

1

Equivalent Softkeys

Trace > Trace Allocation

Equivalent COM Command

SCPI.DISPlay.SPLit

Syntax

Value = app.SCPI.DISPlay.SPLit

app.SCPI.DISPlay.SPLit = 2

Type

Long (read/write)

Back to DISPlay

DISP:WIND:TITL

SCPI Command

DISPlay:WINDow<Ch>:TITLe[:STATe] {OFF|ON|0|1}

DISPlay:WINDow<Ch>:TITLe[:STATe]?

Description

Turns the channel title display ON/OFF.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Display > Caption

Equivalent COM Command

SCPI.DISPlay.WINDow(Ch).TITLe.STATe

Syntax

Status = app.SCPI.DISPlay.WINDow(Ch).TITLe.STATe

app.SCPI.DISPlay.WINDow(Ch).TITLe.STATe = true

Type

Boolean (read/write)

Back to DISPlay

DISP:WIND:TITL:DATA

SCPI Command

DISPlay:WINDow<Ch>:TITLe:DATA <string>

DISPlay:WINDow<Ch>:TITLe:DATA?

Description

Sets or reads out the channel title label.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<string>, up to 256 characters

Query Response

<string>

Preset Value

Empty string

Equivalent Softkeys

Display > Edit

Equivalent COM Command

SCPI.DISPlay.WINDow(Ch).TITLe.DATA

Syntax

Text = app.SCPI.DISPlay.WINDow(Ch).TITLe.DATA

app.SCPI.DISPlay.WINDow(Ch).TITLe.DATA = "Network 1"

Type

String (read/write)

Back to DISPlay

DISP:WIND:TRAC:ANN:MARK:POS:X

SCPI Command

DISPlay:WINDow<Ch>:TRACe<Tr>:ANNotation:MARKer:POSition:X <numeric>

DISPlay:WINDow<Ch>:TRACe<Tr>:ANNotation:MARKer:POSition:X?

Description

Sets or reads out the display position of the marker annotation on the X-axis by a percentage of the display width.
command/query

Target

Trace <Tr> of channel <Ch>,

<Tr>={[1]|2|3|4}

<Ch>={[1]|2|3|4}

<Tr>={[1]…|16} (in N-port mode only)

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<numeric> the display position of the marker value on the X–axis from 0 to 100

Unit

% (percent)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Equivalent Softkeys

None

Equivalent COM Command

SCPI.DISPlay.WINDow(Ch).TRACe(Tr).ANNotation.MARKer.POSition.X

Syntax

Value =
app.SCPI.DISPlay.WINDow(Ch).TRACe(Tr).ANNotation.MARKer.POSition.X

app.SCPI.DISPlay.WINDow(Ch).TRACe(Tr).ANNotation.MARKer.POSition.X = 50

Type

Double (read/write)

Back to DISPlay

DISP:WIND:TRAC:ANN:MARK:POS:Y

SCPI Command

DISPlay:WINDow<Ch>:TRACe<Tr>:ANNotation:MARKer:POSition:Y <numeric>

DISPlay:WINDow<Ch>:TRACe<Tr>:ANNotation:MARKer:POSition:Y?

Description

Sets or reads out the display position of the marker annotation on the Y-axis by a percentage of the display height.
command/query

Target

Trace <Tr> of channel <Ch>,

<Tr>={[1]|2|3|4}

<Ch>={[1]|2|3|4}

<Tr>={[1]…|16} (in N-port mode only)

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<numeric> the display position of the marker value on the Y–axis from 0 to 100

Unit

% (percent)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Equivalent Softkeys

None

Equivalent COM Command

SCPI.DISPlay.WINDow(Ch).TRACe(Tr).ANNotation.MARKer.POSition.Y

Syntax

Value =
app.SCPI.DISPlay.WINDow(Ch).TRACe(Tr).ANNotation.MARKer.POSition.Y

app.SCPI.DISPlay.WINDow(Ch).TRACe(Tr).ANNotation.MARKer.POSition.Y = 50

Type

Double (read/write)

Back to DISPlay

DISP:WIND:TRAC:ANN:MARK:MEM

SCPI Command

DISPlay:WINDow<Ch>:TRACe<Tr>:ANNotation:MARKer:MEMory <bool>

DISPlay:WINDow<Ch>:TRACe<Tr>:ANNotation:MARKer:MEMory?

Description

Turns ON/OFF the state of the memory value display on the marker. **Note**: If the memory trace does not exist, an error occurs, and the command is ignored.
command/query

Target

Trace <Tr> of channel <Ch>,

<Tr>={[1]|2|3|4}

<Ch>={[1]|2|3|4}

<Tr>={[1]…|16} (in N-port mode only)

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<bool> Specifies the memory value display:

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Markers > Properties > Memory Value

Equivalent COM Command

SCPI.DISPlay.WINDow(Ch).TRACe(Tr).ANNotation.MARKer.MEMory

Syntax

Status = app.SCPI.DISPlay.WINDow(Ch).TRACe(Tr).ANNotation. MARKer. MEMory

app.SCPI.DISPlay.WINDow(Ch).TRACe(Tr).ANNotation. MARKer. MEMory = true

Type

Boolean (read/write)

Back to DISPlay

DISP:WIND:TRAC:MEM

SCPI Command

DISPlay:WINDow<Ch>:TRACe<Tr>:MEMory[:STATe] {OFF|ON|0|1}

DISPlay:WINDow<Ch>:TRACe<Tr>:MEMory[:STATe]?

Description

Turns the memory trace display ON/OFF. **Note**: If the memory trace does not exist, an error occurs, and the command is ignored.
command/query

Target

Trace <Tr> of channel <Ch>,

<Tr>={[1]|2|3|4}

<Ch>={[1]|2|3|4}

<Tr>={[1]…|16} (in N-port mode only)

<Ch>={[1]…|16} (in N-port mode only)

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Trace > Display > {Memory | Data & Memory} (ON)

Trace > Display > {Data | OFF} (OFF)

Equivalent COM Command

SCPI.DISPlay.WINDow(Ch).TRACe(Tr).MEMory.STATe

Syntax

Status = app.SCPI.DISPlay.WINDow(Ch).TRACe(Tr).MEMory.STATe

app.SCPI.DISPlay.WINDow(Ch).TRACe(Tr).MEMory.STATe = true

Type

Boolean (read/write)

Back to DISPlay

DISP:WIND:TRAC:STAT

SCPI Command

DISPlay:WINDow<Ch>:TRACe<Tr>:STATe {OFF|ON|0|1}

DISPlay:WINDow<Ch>:TRACe<Tr>:STATe?Description

Turns the data trace display ON/OFF.
command/query

Target

Trace <Tr> of channel <Ch>,

<Tr>={[1]|2|3|4}
<Ch>={[1]|2|3|4}
<Tr>={[1]…|16} (in N-port mode only)
<Ch>={[1]…|16} (in N-port mode only)

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

1

Equivalent Softkeys

Trace > Display > {Data | Data & Memory} (ON)

Trace > Display > {Memory | OFF} (OFF)

Equivalent COM Command

SCPI.DISPlay.WINDow(Ch).TRACe(Tr).STATe

Syntax

Status = app.SCPI.DISPlay.WINDow(Ch).TRACe(Tr).STATe

app.SCPI.DISPlay.WINDow(Ch).TRACe(Tr).STATe = false

Type

Boolean (read/write)

Back to DISPlay

DISP:WIND:TRAC:Y:AUTO

SCPI Command

DISPlay:WINDow<Ch>:TRACe<Tr>:Y[:SCALe]:AUTO

Description

Executes the auto scale function for the trace. The function automatically sets both the PDIVision and the RLEVel values.
no query

Target

Trace <Tr> of channel <Ch>,

<Tr>={[1]|2|3|4}

<Ch>={[1]|2|3|4}

<Tr>={[1]…|16} (in N-port mode only)

<Ch>={[1]…|16} (in N-port mode only)

Equivalent Softkeys

Scale > Auto Scale

Equivalent COM Command

SCPI.DISPlay.WINDow(Ch).TRACe(Tr).Y.SCALe.AUTO

Syntax

app.SCPI.DISPlay.WINDow(Ch).TRACe(Tr).Y.SCALe.AUTO

Type

Method

Back to DISPlay

DISP:WIND:TRAC:Y:RLEV:AUTO

SCPI Command

DISPlay:WINDow<Ch>:TRACe<Tr>:Y[:SCALe]:RLEVel:AUTO

Description

Executes the auto reference function for the trace. The function automatically sets the RLEVel value.
no query

Target

Trace <Tr> of channel <Ch>,

<Tr>={[1]|2|...16}

<Ch>={[1]|2|...16}

Related Commands

DISP:WIND:TRAC:Y:RLEV

Equivalent Softkeys

Scale > Auto Ref Value

Equivalent COM Command

None

Back to DISPlay

DISP:WIND:TRAC:Y:PDIV

SCPI Command

DISPlay:WINDow<Ch>:TRACe<Tr>:Y[:SCALe]:PDIVision <numeric>

DISPlay:WINDow<Ch>:TRACe<Tr>:Y[:SCALe]:PDIVision?

Description

Sets or reads out the trace scale. Sets the scale per division when the data format is in the rectangular format. Sets the full scale value when the data format is in the Smith chart format or the polar format.
command/query

Target

Trace <Tr> of channel <Ch>,

<Tr>={[1]|2|3|4}

<Ch>={[1]|2|3|4}

<Tr>={[1]…|16} (in N-port mode only)

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<response> the scale value from 10E–18 to 1E18

Out of Range

Sets the value of the limit, which is closer to the specified value.

Out of Range

Sets the value of the limit, which is closer to the specified value

Query Response

<numeric>

Preset Value

Varies depending on the format.

Logarithmic Magnitude: 10 dB/Div

Phase: 40 °/Div

Expand Phase: 100 °/Div

Group Delay: 10e–9 s/Div

Smith Chart, Polar, SWR: 1 /Div

Linear Magnitude: 0.1 /Div

Real part, Imaginary part: 0.2 /Div

Equivalent Softkeys

Scale > Scale

Equivalent COM Command

SCPI.DISPlay.WINDow(Ch).TRACe(Tr).Y.SCALe.PDIVision

Syntax

Value = app.SCPI.DISPlay.WINDow(Ch).TRACe(Tr).Y.SCALe.PDIVision

app.SCPI.DISPlay.WINDow(Ch).TRACe(Tr).Y.SCALe.PDIVision = 20

Type

Double (read/write)

Back to DISPlay

DISP:WIND:TRAC:Y:RLEV

SCPI Command

DISPlay:WINDow<Ch>:TRACe<Tr>:Y[:SCALe]:RLEVel <numeric>

DISPlay:WINDow<Ch>:TRACe<Tr>:Y[:SCALe]:RLEVel?

Description

Sets the value of the reference line (response value on the reference line). For the rectangular format only.
command/query

Target

Trace <Tr> of channel <Ch>,

<Tr>={[1]|2|3|4}

<Ch>={[1]|2|3|4}

<Tr>={[1]…|16} (in N-port mode only)

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<response> the scale value from 10E–18 to 1E18

Out of Range

Sets the value of the limit, which is closer to the specified value.

Unit

dB |° |s

Query Response

<numeric>

Preset Value

0 (except for SWR: 1)

Equivalent Softkeys

Scale > Ref Value

Equivalent COM Command

SCPI.DISPlay.WINDow(Ch).TRACe(Tr).Y.SCALe.RLEVel

Syntax

Value = app.SCPI.DISPlay.WINDow(Ch).TRACe(Tr).Y.SCALe.RLEVel

app.SCPI.DISPlay.WINDow(Ch).TRACe(Tr).Y.SCALe.RLEVel = 10

Type

Double (read/write)

Back to DISPlay

DISP:WIND:TRAC:Y:RPOS

SCPI Command

DISPlay:WINDow<Ch>:TRACe<Tr>:Y[:SCALe]:RPOSition <numeric>

DISPlay:WINDow<Ch>:TRACe<Tr>:Y[:SCALe]:RPOSition?

Description

Sets the position of the reference line. For the rectangular format only.
command/query

Target

Trace <Tr> of channel <Ch>,

<Tr>={[1]|2|3|4}

<Ch>={[1]|2|3|4}

<Tr>={[1]…|16} (in N-port mode only)

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<numeric> the reference line position from 0 to the number of the scale divisions (set by the DISP:WIND:Y:DIV command, 10 by default)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

5 (except for SWR: 0)

Equivalent Softkeys

Scale > Ref Position

Equivalent COM Command

SCPI.DISPlay.WINDow(Ch).TRACe(Tr).Y.SCALe.RPOSition

Syntax

Value = app.SCPI.DISPlay.WINDow(Ch).TRACe(Tr).Y.SCALe.RPOSition

app.SCPI.DISPlay.WINDow(Ch).TRACe(Tr).Y.SCALe.RPOSition = 10

Type

Long (read/write)

Back to DISPlay

DISP:WIND:Y:DIV

SCPI Command

DISPlay:WINDow<Ch>:Y[:SCALe]:DIVisions <numeric>

DISPlay:WINDow<Ch>:Y[:SCALe]:DIVisions?

Description

Sets the number of the vertical scale divisions. For the rectangular format only.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<numeric> the number of the vertical scale divisions from 4 to 30

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

10

Resolution

2

Equivalent Softkeys

Scale > Divisions

Equivalent COM Command

SCPI.DISPlay.WINDow(Ch).Y.SCALe.DIVisions

Syntax

Value = app.SCPI.DISPlay.WINDow(Ch).Y.SCALe.DIVisions

app.SCPI.DISPlay.WINDow(Ch).Y.SCALe.DIVisions = 12

Type

Long (read/write)

Back to DISPlay

FORMat

Command	Description		COM analog
FORM:BORD	Data Transfer	Byte order	-
FORM:DATA		Text or binary transfer format	-

FORM:BORD

SCPI Command

FORMat:BORDer <char>

FORMat:BORDer?

Description

Sets or reads out the transfer order of each byte in data when the binary data transfer format is set by the FORM:DATA command. **Note**: The x86 compatible processors use the little-endian format.	
command/query	

Parameter

<char> Choose from:

NORMal	Normal (big-endian format)
SWAPped	Swapped (little-endian format)

Query Response

{NORM|SWAP}

Preset Value

NORM

Related Commands

FORM:DATA

Equivalent Softkeys

None

Equivalent COM Command

None

Back to FORMat

FORM:DATA

SCPI Command

FORMat:DATA <char>

FORMat:DATA?

Description

Sets or reads out the data transfer format when responding to the following queries:

- CALC:DATA:FDAT?
- CALC:DATA:FMEM?
- CALC:DATA:SDAT?
- CALC:DATA:SMEM?
- CALC:FUNC:DATA?
- CALC:LIM:DATA?
- CALC:LIM:REP?
- CALC:LIM:REP:ALL?
- CALC:RLIM:DATA?
- CALC:RLIM:REP?
- SENS:FREQ:DATA?
- SENS:SEGM:DATA?

Note: The command is applicable with the TCP/IP protocol. The command is NOT applicable with the TCP/IP Socket protocol.

command/query

Parameter

<char> Choose from:

ASCii	Character format
REAL	Binary format (IEEE–64 floating point)
REAL32	Binary format (IEEE–32 floating point)

Query Response

{ASC|REAL|REAL32}

Preset Value

ASC

Related Commands

FORM:BORD

Equivalent Softkeys

None

Equivalent COM Command

None

Back to FORMat

HCOPy

Command	Description		COM analog
HCOP	Printing	Quick print	+
HCOP:DATE:STAM		Date and time stamp ON/OFF	+
HCOP:IMAG		Inverted color of image	+
HCOP:PAIN		Color chart for image printout	+
HCOP:RECT		Size of the image printout	-

HCOP

SCPI Command

HCOPy[:IMMediate]

Description

Prints out the image displayed on the screen without previewing.
no query

Equivalent Softkeys

None

Equivalent COM Command

SCPI.HCOPy.IMMediate

Syntax

app.SCPI.HCOPy.IMMediate

Type

Method

Back to HCOPy

HCOP:DATE:STAM

SCPI Command

HCOPy:DATE:STAMp {OFF|ON|0|1}

HCOPy:DATE:STAMp?

Description

Turns the date and time printout in the upper right corner of the image ON/OFF.
no query

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Responser

{0|1}

Preset Value

1

Equivalent Softkeys

Print > Print Date & Time

Equivalent COM Command

SCPI.HCOPy.DATE.STAMp

Syntax

Status = app.SCPI.HCOPy.DATE.STAMp

app.SCPI.HCOPy.DATE.STAMp = False

Type

Boolean (read/write)

Back to HCOPy

HCOP:IMAG

SCPI Command

HCOPy:IMAGe <char>

HCOPy:IMAGe?

Description

Sets or reads out the inverted color image printout.
command/query

Parameter

<char> Choose from:

NORMal	Normal printout
INVert	Inverted color printout

Query Response

{NORM|INV}

Preset Value

NORM

Equivalent Softkeys

Print > Invert Image

Equivalent COM Command

SCPI.HCOPy.IMAGe

Syntax

Param = app.SCPI.HCOPy.IMAGe

app.SCPI.HCOPy.IMAGe = "INV"

Type

String (read/write)

Back to HCOPy

HCOP:PAIN

SCPI Command

HCOPy:PAINt <char>

HCOPy:PAINt?

Description

Sets or reads out the color chart for the image printout.
command/query

Parameter

<char> Choose from:

COLor	Color printout
GRAY	Grayscale printout
BW	Black&white printout

Query Responser

{COL|GRAY|BW}

Preset Value

BW

Equivalent Softkeys

Print > Print Color

Equivalent COM Command

SCPI.HCOPy.PAINt

Syntax

Param = app.SCPI.HCOPy.PAINt

app.SCPI.HCOPy.PAINt = "COL"

Type

String (read/write)

Back to HCOPy

HCOP:RECT

SCPI Command

HCOPy:RECTangle <width>,<height>

HCOPy:RECTangle?

Description

Sets or reads out size of the image printout.
command/query

Parameter

<width>	width of the printout
<height>	height of the printout

Query Responser

<numeric 1>,<numeric 2>

Equivalent Softkeys

None

Equivalent COM Command

None

Back to HCOPy

INITiate

Command	Description		COM analog
INIT	Trigger	Initiates channel once	+
INIT:CONT		Continuous channel initiation mode ON/OFF	+

INIT

SCPI Command

INITiate<Ch>[:IMMediate]

Description

Puts the channel into the Trigger Waiting state for one trigger event. The channel should be in the hold state, otherwise an error occurs, and the command is ignored. The channel goes into Hold as a result of the command INIT:CONT OFF. If the Internal trigger source is selected by the command TRIG:SOUR INT, then the command initiates a sweep in the single channel, otherwise the channel goes to Waiting for a Single Trigger mode. Upon receipt of a trigger from the selected source, the sweep starts for the channels awaiting trigger. On completion of the sweep the channel goes to the Hold state.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Related Commands

TRIG:SOUR

Equivalent Softkeys

Trigger > Trigger Mode > Single

Equivalent COM Command

SCPI.INITiate(Ch).IMMediate

Syntax

app.SCPI.INITiate(Ch).IMMediate

Type

Method

Back to INITiate

INIT:CONT

SCPI Command

INITiate<Ch>:CONTinuous {OFF|ON|0|1}

INITiate<Ch>:CONTinuous?

Description

Turns the continuous trigger initiation mode ON/OFF. When the continuous initiation mode is turned ON: • If the Internal trigger source is selected by the command TRIG:SOUR INT, then the channel continuously sweeps. • If the trigger source selected is one other than the internal, then the channel goes to the trigger waiting state. Upon receipt of a trigger from the selected source, the sweep starts for the channels awaiting trigger. On completion of the sweep the channel goes to the trigger waiting state. When the continuous trigger initiation mode is turned OFF the channel is in the Hold state, to initiate a sweep use the INIT command.
command /query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

Specifies the continuous trigger initiation mode:

{ON|1}	ON
{OFF|0}	OFF

Query Responser

{0|1}

Preset Value

1

Related Commands

TRIG:SOUR

Equivalent Softkeys

Trigger > Trigger Mode > Continuous

Trigger > Trigger Mode > Hold

Equivalent COM Command

SCPI.INITiate(Ch).CONTinuous

Syntax

Status = app.SCPI.INITiate(Ch).CONTinuous

app.SCPI.INITiate(Ch).CONTinuous = False

Type

Boolean (read/write)

Back to INITiate

MMEMory

Command	Description		COM analog
MMEM:COPY	Disk Operations	Copies the file	+
MMEM:DEL		Deletes the file	+
MMEM:MDIR		Creates a directory	+
MMEM:TRAN?		Transfers the contents of the file	-
MMEM:LOAD	Save/Recall Analyzer State, Calibration	Recalls the Analyzer state	+
MMEM:LOAD:CHAN		Recalls the channel state from memory register	+
MMEM:LOAD:CHAN:CAL		Recalls the channel calibration	+
MMEM:STOR		Saves the Analyzer state	+
MMEM:STOR:CHAN		Saves the channel state in memory register	+
MMEM:STOR:CHAN:CAL		Saves the channel calibration	+
MMEM:STOR:CHAN:CLE		Clears memory registers	+
MMEM:STOR:STYP		Saving type	+

Command	Description		COM analog
MMEM:LOAD:CKIT	Calibration Kit Management	Recalls calibration kit definition from the file	+
MMEM:STOR:CKIT		Save calibration kit definition to the file	+
MMEM:LOAD:LIM	Limit Test	Recalls limit table from file	+
MMEM:STOR:LIM		Saves limit table into file	+
MMEM:LOAD:RLIM	Ripple Limit Test	Recalls ripple limit table from file	+
MMEM:STOR:RLIM		Saves ripple limit table into file	+
MMEM:LOAD:SEGM	Stimulus Settings	Recalls the segment table file	+
MMEM:STOR:SEGM		Saves the segment table to a file	+
MMEM:LOAD:SNP	Save S-parameters to Touchstone File	Loads file to S-parameters	+
MMEM:LOAD:SNP:TRAC:MEM		Loads file to the memory trace	+
MMEM:LOAD:SNP:FREQ		Enables the frequency setting from a Touchstone file when it loaded	-
MMEM:STOR:SNP		Saves channel data	+

Command	Description		COM analog
MMEM:STOR:SNP:FORM		Data format	+
MMEM:STOR:SNP:TYPE:S1P		Sets 1-port file type and port number	+
MMEM:STOR:SNP:TYPE:S2P		Sets 2-port file type and ports number	+
MMEM:STOR:FDAT	Save Trace Data to CSV File	Saves CSV file	+
MMEM:LOAD:CBL	Recall Cable List	Recalls cable list from file	-
MMEM:STOR:IMAG	Saving Display Image	Saves the screen to BMP or PNG file	+

MMEM:COPY

SCPI Command

MMEMory:COPY <string1>,<string2>

Description

Copies a file.
no query

Parameter

<string1> Source file name

<string2> Destination file name

Equivalent Softkeys

None

Equivalent COM Command

SCPI.MMEMory.COPY(Src, Dst)

Syntax

app.SCPI.MMEMory.COPY(Src, Dst)

Type

Method

Back to MMEMory

MMEM:DEL

SCPI Command

MMEMory:DELete <string>

Description

Deletes a file.
no query

Parameter

<string> File name

Equivalent Softkeys

None

Equivalent COM Command

SCPI.MMEMory.DELete(File)

Syntax

app.SCPI.MMEMory.DELete(File)

Type

Method

Back to MMEMory

MMEM:LOAD

SCPI Command

MMEMory:LOAD[:STATe] <string>

Description

Recalls the specified Analyzer state file. The file must be saved by the MMEM:STOR command. **Note**: If the full path of the file is not specified, the \State subdirectory of the application directory will be searched. The Analyzer state file has *.STA extension by default.
no query

Parameter

<string> File name

Equivalent Softkeys

Files >State > Recall State

Equivalent COM Command

SCPI.MMEMory.LOAD.STATe

Syntax

app.SCPI.MMEMory.LOAD.STATe = File

Type

String (write only)

Back to MMEMory

MMEM:LOAD:CBL

SCPI Command

MMEMory:LOAD:CBList <string>

Description

Recalls the cable list from the file. **Note**: If the full path of the file is not specified, the \Cable subdirectory of the application directory will be searched. The Analyzer state file has *.CBL extension by default.
no query

Parameter

<string> File name

Equivalent Softkeys

Time Domain > Cable Loss Correction Cable Type > Recall Cable List

Equivalent COM Command

None

Back to MMEMory

MMEM:LOAD:CHAN

SCPI Command

MMEMory:LOAD:CHANnel[:STATe] <char>

Description

Recalls the Analyzer state for the active channel from the memory register. The state must be saved in one of the four memory registers using the MMEM:STOR:CHAN command.
no query

Target

Active channel set by the DISP:WIND:ACT command.

Parameter

<char> Choose from:

A	Recall from register A
B	Recall from register B
C	Recall from register C
D	Recall from register D

Equivalent Softkeys

Channels > Recall Channel > {State A | B | C | D}

Equivalent COM Command

SCPI.MMEMory.LOAD.CHANnel.STATe

Syntax

app.SCPI.MMEMory.LOAD.CHANnel.STATe = "A"

Type

String (write only)

Back to [MMEMory]

MMEM:LOAD:CHAN:CAL

SCPI Command

MMEMory:LOAD:CHANnel<ch>:CALibration <string>

Description

Recalls the calibration for the specified channel from the file. The file must be saved using the MMEM:STOR:CHAN:CAL command. **Note**: If the full path of the file is not specified, the \State subdirectory of the application directory will be searched. The Analyzer calibration file has *.CAL extension by default.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<string> File name

Equivalent Softkeys

Files > Recall Calibration

Equivalent COM Command

SCPI.MMEMory.LOAD.CALibration

Syntax

app.SCPI.MMEMory.LOAD.CALibration = File

Type

String (write only)

Back to MMEMory

MMEM:LOAD:CKIT

SCPI Command

MMEMory:LOAD:CKIT<Ck> <string>

Description

Recalls the definition file for the calibration kit. The file must be saved using the MMEM:STOR:CKIT command. **Note**: If the full path of the file is not specified, the \CalKit subdirectory of the application directory will be searched. The limit table file has *.CKD extension by default.
no query

Target

Calibration kit <Ck>,

<Ck>={[1]|2|...J}, where J – the number of the calibration kit (up to 50)

Parameter

<string> File name

Equivalent Softkeys

None

Equivalent COM Command

SCPI.MMEMory.LOAD.CKIT(Ck)

Syntax

app.SCPI.MMEMory.LOAD.CKIT(Ck) = File

Type

String (write only)

Back to MMEMory

MMEM:LOAD:LIM

SCPI Command

MMEMory:LOAD:LIMit <string>

Description

Recalls the limit table file. The file must be saved using the MMEM:STOR:LIM command. **Note**: If the full path of the file is not specified, the \Limit subdirectory of the application directory will be searched. The limit table file has *.LIM extension by default.
no query

Target

Active trace of the active channel set by the CALC:PAR:SEL command.

Parameter

<string> File name

Equivalent Softkeys

Analysis > Limit Test > Edit Limit Line > Restore Limit Table

---

Equivalent COM Command

SCPI.MMEMory.LOAD.LIMit

Syntax

app.SCPI.MMEMory.LOAD.LIMit = File

Type

String (write only)

Back to MMEMory

MMEM:LOAD:RLIM

SCPI Command

MMEMory:LOAD:RLIMit <string>

Description

Recalls the ripple limit table file. The file must be saved using the MMEM:STOR:RLIM command. **Note**: If the full path of the file is not specified, the \Limit subdirectory of the application directory will be searched. The ripple limit file has *.RLM extension by default.
no query

Target

Active trace of the active channel set by the CALC:PAR:SEL command.

Parameter

<string> File name

Equivalent Softkeys

Analysis > Ripple Test > Edit Ripple Limit > Restore Ripple Table

---

Equivalent COM Command

SCPI.MMEMory.LOAD.RLIMit

Syntax

app.SCPI.MMEMory.LOAD.RLIMit = File

Type

String (write only)

Back to MMEMory

MMEM:LOAD:SEGM

SCPI Command

MMEMory:LOAD:SEGMent <string>

Description

Recalls the segment table file. The file must be saved using the MMEM:STOR:SEGM command. **Note**: If the full path of the file is not specified, the \Segment subdirectory of the application directory will be searched. The segment file has *.SEG extension by default.
no query

Target

Active channel set by the DISP:WIND:ACT command.

Parameter

<string> File name

Equivalent Softkeys

Stimulus > Segment Table > Recall

Equivalent COM Command

SCPI.MMEMory.LOAD.SEGMent

Syntax

app.SCPI.MMEMory.LOAD.SEGMent = File

Type

String (write only)

Back to MMEMory

MMEM:LOAD:SNP

SCPI Command

MMEMory:LOAD:SNP[:DATA] <string>

Description

Loads the Touchstone file with the specified name to the measured S–parameters of the active channel. The touchstone file types 1, 2-port (file extensions S1P, S2P) are supported. On completion of the command, the channel goes to the hold state. **Note**: If the full path of the file is not specified, the \Touchstone subdirectory of the application directory will be searched. The file has *.SNP extension by default.
no query

Target

The active channel, set by the DISP:WIND:ACT command.

Parameter

<string> File name

Equivalent Softkeys

Files > Recall Touchstone > Recall Touchstone > Recall Touchstone

---

Equivalent COM Command

SCPI.MMEMory.LOAD.SNP.DATA

Syntax

app.SCPI.MMEMory.LOAD.SNP.DATA = File

Type

String (write only)

Back to MMEMory

MMEM:LOAD:SNP:FREQ

SCPI Command

MMEMory:LOAD:SNP:FREQuency[:STATe] {OFF|ON|0|1}

MMEMory:LOAD:SNP:FREQuency[:STATe]?

Description

Determines whether frequency is set from touchstone file or not when the file is loaded by the command MMEM:LOAD:SNP. If this setting is OFF then the touchstone file data is interpolated or extrapolated.
command/query

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

None

Equivalent COM Command

None

Back to MMEMory

MMEM:LOAD:SNP:TRAC:MEM

SCPI Command

MMEMory:LOAD:SNP:TRACe<Tr>:MEMory <string>

Description

Loads the Touchstone file with the specified name to the memory trace. The Touchstone file types 1, 2 port (file extensions S1P, S2P) are supported. The current measured S-parameter of the data trace selects the appropriate S-parameter from the Touchstone file. After loading, the display of memory trace is automatically switched on.
no query

Target

Trace <Tr>,

<Tr>={[1]|2|3|4}

<Tr>={[1]…|16} (in N-port mode only)

Active channel set by the DISP:WIND:ACT command.

Parameter

<string> File name

Equivalent Softkeys

Files > Recall Touchstone > Recall Touchstone > Recall To > Active Trace Memory

---

Equivalent COM Command

SCPI.MMEMory.LOAD.SNP.TRACe(Tr).MEMory

Syntax

app.SCPI.MMEMory.LOAD.SNP.TRACe(Tr).MEMory = File

Type

String (write only)

Back to [MMEMory]

MMEM:MDIR

SCPI Command

MMEMory:MDIRectory <string>

Description

Creates a new directory.
no query

Parameter

<string> Directory full name

Equivalent Softkeys

None

Equivalent COM Command

SCPI.MMEMory.MDIRectory

Syntax

app.SCPI.MMEMory.MDIRectory = Path

Type

String (write only)

Back to MMEMory

MMEM:STOR

SCPI Command

MMEMory:STORe[:STATe] <string>

Description

Saves the Analyzer state into a file. **Note**: If the full path of the file is not specified, the \State subdirectory of the application directory will be searched. The state file has *.STA extension by default.
no query

Parameter

<string> File name

Equivalent Softkeys

Files > State > Save State

Equivalent COM Command

SCPI.MMEMory.STORe.STATe

Syntax

app.SCPI.MMEMory.STORe.STATe = File

Type

String (write only)

Back to MMEMory

MMEM:STOR:CHAN

SCPI Command

MMEMory:STORe:CHANnel[:STATe] <char>

Description

Saves the Analyzer state of the items set for the active channel into one of the four memory registers.
no query

Target

Active channel set by the DISP:WIND:ACT command.

Parameter

<char> Choose from:

A	Save to register A
B	Save to register B
C	Save to register C
D	Save to register D

Equivalent Softkeys

Channels > Save Channel > {State A | B | C | D}

Equivalent COM Command

SCPI.MMEMory.STORe.CHANnel.STATe

Syntax

app.SCPI.MMEMory.STORe.CHANnel.STATe = "A"

Type

String (write only)

Back to MMEMory

MMEM:STOR:CHAN:CAL

SCPI Command

MMEMory:STORe:CHANnel<ch>:CALibration <string>

Description

Stores the calibration of the specified channel to the file. The file must be recaled by the MMEM:LOAD:CHAN:CAL command **Note**: If the full path of the file is not specified, the \State subdirectory of the application directory will be searched. The Analyzer calibration file has *.CAL extension by default.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<string> File name

Equivalent Softkeys

Files > Save Calibration

Equivalent COM Command

SCPI.MMEMory.STORe.CALibration

Syntax

app.SCPI.MMEMory.STORe.CALibration = File

Type

String (write only)

Back to MMEMory

MMEM:STOR:CHAN:CLE

SCPI Command

MMEMory:STORe:CHANnel:CLEar

Description

Clears the memory of the channel state saved using the MMEM:STOR:CHAN command.
no query

Equivalent Softkeys

Channels > Save Channel > Clear States

Equivalent COM Command

SCPI.MMEMory.STORe.CHANnel.CLEar

Syntax

app.SCPI.MMEMory.STORe.CHANnel.CLEar

Type

Method

Back to MMEMory

MMEM:STOR:CKIT

SCPI Command

MMEMory:STORe:CKIT<Ck> <string>

Description

Saves the definition file for the calibration kit. **Note**: If the full path of the file is not specified, the \CalKit subdirectory of the application directory will be searched. The calibration kit definition file has *.CKD extension by default.
no query

Target

Calibration kit <Ck>,

<Ck>={[1]|2|...J}, where J – the number of the calibration kit (up to 50)

Parameter

<string> File name

Equivalent Softkeys

None

Equivalent COM Command

SCPI.MMEMory.STORe.CKIT(Ck)

Syntax

app.SCPI.MMEMory.STORe.CKIT(Ck) = File

Type

String (write only)

Back to MMEMory

MMEM:STOR:FDAT

SCPI Command

MMEMory:STORe:FDATa <string>

Description

Saves the data of one or several traces to a CSV file. **Note**: If the full path of the file is not specified, the \CSV subdirectory of the application directory will be searched. The file has *.CSV extension by default.
no query

Active trace of the active channel set by the CALC:PAR:SEL command

Parameter

<string> File name

Equivalent Softkeys

Files > Save Trace Data

Equivalent COM Command

SCPI.MMEMory.STORe.FDATa

Syntax

app.SCPI.MMEMory.STORe.FDATa = File

Type

String (write only)

Back to MMEMory

MMEM:STOR:IMAG

SCPI Command

MMEMory:STORe:IMAGe <string>

Description

Saves the display image in BMP or PNG format into a file. **Note**: If the full path of the file is not specified, the \Image subdirectory of the application directory will be searched. If the file has *.PNG extension, the file had PNG format, in all the other cases the file has BMP format.
no query

Parameter

<string> File name

Equivalent Softkeys

Print > Print with Shell

Equivalent COM Command

SCPI.MMEMory.STORe.IMAGe

Syntax

app.SCPI.MMEMory.STORe.IMAGe = File

Type

String (write only)

Back to MMEMory

MMEM:STOR:LIM

SCPI Command

MMEMory:STORe:LIMit <string>

Description

Saves the limit table into a file. **Note**: If the full path of the file is not specified, the \Limit subdirectory of the application directory will be searched. The file has *.LIM extension by default.
no query

Target

Active trace of the active channel set by the CALC:PAR:SEL command.

Parameter

<string> File name

Equivalent Softkeys

Analysis > Limit Test > Edit Limit Line > Save Limit Table

Equivalent COM Command

SCPI.MMEMory.STORe.LIMit

Syntax

app.SCPI.MMEMory.STORe.LIMit = File

Type

String (write only)

Back to MMEMory

MMEM:STOR:RLIM

SCPI Command

MMEMory:STORe:RLIMit <string>

Description

Saves the ripple limit table into a file. **Note**: If the full path of the file is not specified, the \Limit subdirectory of the application directory will be searched. The ripple limit file has *.RLM extension by default.
no query

Target

Active trace of the active channel set by the CALC:PAR:SEL command

Parameter

<string> File name

Equivalent Softkeys

Analysis > Ripple Test > Edit Ripple Limit > Save Ripple Table

---

Equivalent COM Command

SCPI.MMEMory.STORe.RLIMit

Syntax

app.SCPI.MMEMory.STORe.RLIMit = File

Type

String (write only)

Back to MMEMory

MMEM:STOR:SEGM

SCPI Command

MMEMory:STORe:SEGMent <string>

Description

Saves the segment table into a file. **Note**: If the full path of the file is not specified, the \Segment subdirectory of the application directory will be searched. The segment file has *.SEG extension by default.
no query

Target

Active channel set by the DISP:WIND:ACT command.

Parameter

<string> File name

Equivalent Softkeys

Stimulus > Segment Table > Save

Equivalent COM Command

SCPI.MMEMory.STORe.SEGMent

Syntax

app.SCPI.MMEMory.STORe.SEGMent = File

Type

String (write only)

Back to MMEMory

MMEM:STOR:SNP

SCPI Command

MMEMory:STORe:SNP[:DATA] <string>

Description

Saves the measured S–parameters of the active channel into a Touchstone file. The file type (1–port or 2–port) is set by the MMEM:STOR:SNP:TYPE:S1P and MMEM:STOR:SNP:TYPE:S2P commands. 1–port type file saves one reflection parameter: S11 or S22. 2-port type file saves all the four parameters: S11, S21, S12, S22. **Note**: If the full path of the file is not specified, the \Touchstone subdirectory of the application directory will be searched. The file has *.SNP extension by default.
no query

Target

Active channel set by the DISP:WIND:ACT command.

Parameter

<string> File name

Equivalent Softkeys

Files > Save Touchstone > Save Touchstone

Equivalent COM Command

SCPI.MMEMory.STORe.SNP.DATA

Syntax

app.SCPI.MMEMory.STORe.SNP.DATA = File

Type

String (write only)

Back to MMEMory

MMEM:STOR:SNP:FORM

SCPI Command

MMEMory:STORe:SNP:FORMat <char>

MMEMory:STORe:SNP:FORMat?

Description

Sets or reads out the data format for the S-parameter saved using the MMEM:STOR:SNP command.
command/query

Target

Active channel set by the DISP:WIND:ACT command

Parameter

<char> Choose from:

DB	Logarithmic Magnitude / Angle format
MA	Linear Magnitude / Angle format
RI	Real part /Imaginary part format

Query Response

{RI|DB|MA}

Preset Value

RI

Equivalent Softkeys

Files > Save Touchstone > Touchstone Format

Equivalent COM Command

SCPI.MMEMory.STORe.SNP.FORMat

Syntax

Param = app.SCPI.MMEMory.STORe.SNP.FORMat

app.SCPI.MMEMory.STORe.SNP.FORMat = "DB"

Type

String (write only)

Back to MMEMory

MMEM:STOR:SNP:TYPE:S1P

SCPI Command

MMEMory:STORe:SNP:TYPE:S1P <port>

MMEMory:STORe:SNP:TYPE:S1P?

Description

Sets or reads out the 1-port Touchstone file type (*.S1P) and the port number when saving S–parameters using the MMEM:STOR:SNP command.
command/query

Parameter

<port> port number from 1 to 2

Query Response

<numeric>

Preset Value

1

Equivalent Softkeys

Files > Save Touchstone > Type > S1P

Equivalent COM Command

SCPI.MMEMory.STORe.SNP.TYPE.S1P

Syntax

Value = app.SCPI.MMEMory.STORe.SNP.TYPE.S1P

app.SCPI.MMEMory.STORe.SNP.TYPE.S1P = 2

Type

Long (read/write)

Back to MMEMory

MMEM:STOR:SNP:TYPE:S2P

SCPI Command

MMEMory:STORe:SNP:TYPE:S2P <rcvport>, <srcport>

MMEMory:STORe:SNP:TYPE:S2P?

Description

Sets or reads out the 2-port Touchstone file type (*.S2P) and the port number when saving S–parameters using the MMEM:STOR:SNP command.
command/query

Parameter

<rcvport>	the number of the receiver port from 1 to 2
<srcport>	the number of the source port 1

Query Response

<numeric1>, <numeric2>

Equivalent Softkeys

Files > Save Touchstone > Type > S2P

Equivalent COM Command

SCPI.MMEMory.STORe.SNP.TYPE.S2P

Syntax

Value = app.SCPI.MMEMory.STORe.SNP.TYPE.S2P

app.SCPI.MMEMory.STORe.SNP.TYPE.S2P = Array(1, 2)

Type

Variant (array of long) (read/write)

Back to [MMEMory]

MMEM:STOR:STYP

SCPI Command

MMEMory:STORe:STYPe <char>

MMEMory:STORe:STYPe?

Description

Selects the type of the Analyzer or channel state saving using the MMEM:STOR or MMEM:STOR:CHAN command.
command/query

Parameter

<char> Choose from:

STATe	Measurement conditions
CSTate	Measurement conditions and calibration tables
DSTate	Measurement conditions and data traces
CDSTate	Measurement conditions, calibration tables and data traces

Query Response

{STAT|CST|DST|CDST}

Preset Value

CST

Equivalent Softkeys

Files > State> Save Type

Equivalent COM Command

SCPI.MMEMory.STORe.STYPe

Syntax

Param = app.SCPI.MMEMory.STORe.STYPe

app.SCPI.MMEMory.STORe.STYPe = "STATe"

Type

String (write only)

Back to MMEMory

MMEM:TRAN?

SCPI Command

MMEMory:TRANsfer? <string>

Description

Transfers the contents of a specified file from the Analyzer to the external PC. **Note**: The command is not applicable with the TCP/IP Socket protocol. The file must be 20 Mbytes or less.
command/query

Parameter

<string> the file name with the full path

Query Response

Block data transfer format. For example:

#6001000<binary block 1000 bytes>

#6	Symbol # introduces the data block. The next number indicates how many of the following digits describe the length of the data block;
001000	Length of the data block;

Equivalent Softkeys

None

Equivalent COM Command

None

Back to MMEMory

OUTP

SCPI Command

OUTPut[:STATe] {OFF|ON|0|1}

OUTPut[:STATe]?

Description

Turns the RF signal output ON/OFF. Measurements cannot be performed when the RF signal output is turned OFF.
command/query

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

1

Equivalent Softkeys

Stimulus > Power > RF Out Off

Equivalent COM Command

SCPI.OUTPut.STATe

Syntax

Status = app.SCPI.OUTPut.STATe

app.SCPI.OUTPut.STATe = False

Type

Boolean (read/write)

SENSe

Command	Description		COM analog
SENS:AVER	Averaging	Averaging ON/OFF	+
SENS:AVER:CLE		Restart averaging	+
SENS:AVER:COUN		Averaging factor	+
SENS:BAND	IFBW	IF bandwidth	+
SENS:BWID		IF bandwidth	+
SENS:CORR:CLE	Misc Calibration Commands	Clears the table of calibration factors	+
SENS:CORR:COLL:CLE		Clears data of calibration standards	+
SENS:CORR:STAT		S-parameter error correction state	+
SENS:CORR:TYPE?		Information about trace (calibration type, number of ports)	+

Command	Description		COM analog
SENS:CORR:COEF	Read/Write Calibration Coefficients	Calibration coefficient data	+
SENS:CORR:COEF:METH:OPEN		Selects Response Open method	+
SENS:CORR:COEF:METH:SHOR		Selects Response Short method	+
SENS:CORR:COEF:METH:SOLT1		Selects full one-port method	+
SENS:CORR:COEF:METH:THRU		Selects Response Thru method	-
SENS:CORR:COEF:SAVE		Enables calibration coefficients	+
SENS:CORR:COLL:CKIT	Calibration Kit Management	Calibration kit selection	+
SENS:CORR:COLL:CKIT:LAB		Calibration kit label	+
SENS:CORR:COLL:CKIT:RES		Remove or restore a calibration kit	+
SENS:CORR:COLL:CKIT:STAN:C0	Calibration Standard Definition	Capacitance C0 (Open)	+
SENS:CORR:COLL:CKIT:STAN:C1		Capacitance C1 (Open)	+

Command	Description		COM analog
SENS:CORR:COLL:CKIT:STAN:C2		Capacitance C2 (Open)	+
SENS:CORR:COLL:CKIT:STAN:C3		Capacitance C3 (Open)	+
SENS:CORR:COLL:CKIT:STAN:DEL		Offset delay	+
SENS:CORR:COLL:CKIT:STAN:FMAX		Max frequency	+
SENS:CORR:COLL:CKIT:STAN:FMIN		Min frequency	+
SENS:CORR:COLL:CKIT:STAN:HWR		Waveguide height to width ratio value	-
SENS:CORR:COLL:CKIT:STAN:L0		Inductance L0 (Short)	+
SENS:CORR:COLL:CKIT:STAN:L1		Inductance L1 (Short)	+
SENS:CORR:COLL:CKIT:STAN:L2		Inductance L2 (Short)	+
SENS:CORR:COLL:CKIT:STAN:L3		Inductance L3 (Short)	+
SENS:CORR:COLL:CKIT:STAN:LAB		Standard label	+
SENS:CORR:COLL:CKIT:STAN:LOSS		Offset loss	+

Command	Description		COM analog
SENS:CORR:COLL:CKIT:STAN:MEDI		Media	-
SENS:CORR:COLL:CKIT:STAN:TYPE		Standard type	+
SENS:CORR:COLL:CKIT:STAN:Z0		Offset Z0	+
SENS:CORR:COLL:DATA:LOAD	Read/Write Measurement of Calibration Standards	Measurement array of Load (1-port VNA only)	+
SENS:CORR:COLL:DATA:OPEN		Measurement array of Open (1-port VNA only)	+
SENS:CORR:COLL:DATA:SHOR		Measurement array of Short (1-port VNA only)	+
SENS:CORR:COLL:ECAL:INF?	Automatic Calibration Module	Information about connected module	+
SENS:CORR:COLL:ECAL:ORI:EXEC		Auto-Orientation procedure	+
SENS:CORR:COLL:ECAL:ORI:STAT		Auto-Orientation ON/OFF	+
SENS:CORR:COLL:ECAL:CHECK:EXEC		Confidence check	+
SENS:CORR:COLL:ECAL:PATH		Manual module orientation	+

Command	Description		COM analog
SENS:CORR:COLL:ECAL:SOLT1		Procedure of one-port calibration	+
SENS:CORR:COLL:ECAL:SOLT2		Procedure of full two-port calibration	+
SENS:CORR:COLL:ECAL:UCH		Characterization number	+
SENS:CORR:COLL:LOAD	Measurement of Calibration Standards	Load	+
SENS:CORR:COLL:OPEN		Open	+
SENS:CORR:COLL:SHOR		Short	+
SENS:CORR:COLL:THRU		Thru	+
SENS:CORR:COLL:METH:ERES	Calibration Method	One path two-port	+
SENS:CORR:COLL:METH:OPEN		Response Open	+
SENS:CORR:COLL:METH:SHOR		Response Short	+
SENS:CORR:COLL:METH:SOLT1		Full one-port (SOL)	+
SENS:CORR:COLL:METH:SOLT2		Full two-port (SOLT)	+

Command	Description		COM analog
SENS:CORR:COLL:METH:THRU		Response Thru	+
SENS:CORR:COLL:METH:TYPE?		Calibration method query.	+
SENS:CORR:COLL:SAVE	Calibration Completion	Calibration completion	+
SENS:CORR:EXT	Port Extension	Port extension ON/OFF	+
SENS:CORR:EXT:PORT:FREQ		Values of "Frequency1" and "Frequency2"	+
SENS:CORR:EXT:PORT:INCL		Loss compensation ON/OFF	+
SENS:CORR:EXT:PORT:LDC		Value "Loss at DC"	+
SENS:CORR:EXT:PORT:LOSS		Loss compensation ON/OFF	+
SENS:CORR:EXT:PORT:TIME		Extension Port n	+
SENS:CORR:EXT:AUTO:CONF	Auto Port Extension	Frequency range configuration	+
SENS:CORR:EXT:AUTO:DCOF		"Loss at DC" value ON/OFF	+
SENS:CORR:EXT:AUTO:LOSS		"Loss1" and "Loss2" values ON/OFF	+

Command	Description		COM analog
SENS:CORR:EXT:AUTO:MEAS		Measurement of Short or Open	+
SENS:CORR:EXT:AUTO:SAVE		Set port extension parameters	+
SENS:CORR:EXT:AUTO:RES		Restart averaging between Short and Open	+
SENS:CORR:EXT:AUTO:STAR		Start frequency of user span	+
SENS:CORR:EXT:AUTO:STOP		Stop frequency of user span	+
SENS:CORR:IMP	System Impedance Setting	System Z0	+
SENS:CORR:TRAN:TIME:FREQ	Cable Correction	Frequency at which cable loss specified	+
SENS:CORR:TRAN:TIME:LOSS		Cable loss	+
SENS:CORR:TRAN:TIME:RVEL		Cable velocity factor	+
SENS:CORR:TRAN:TIME:STAT		Cable correction ON/OFF	+
SENS:CABL:SEL		Selection of the cable in the cable list	-

Command	Description		COM analog
SENS:CABL:COUN		Number of cables in the cable list	-
SENS:FREQ:DATA?	Data Transfer	Stimulus data	+
SENS:FREQ:CENT	Stimulus Settings	Center frequency	+
SENS:FREQ:SPAN		Span frequency	+
SENS:FREQ:STAR		Start power	+
SENS:FREQ:STOP		Stop power	+
SENS:SEGM:DATA		Segment sweep table	+
SENS:SWE:POIN		Number of points	+
SENS:SWE:POIN:TIME		Point delay	+
SENS:SWE:TYPE		Sweep type	+
SENS:ROSC:SOUR	Analyzer Parameters	Reference source	+

SENS:AVER

SCPI Command

SENSe<Ch>:AVERage[:STATe] {OFF|ON|0|1}

SENSe<Ch>:AVERage[:STATe]?

Description

Turns the measurement averaging function ON/OFF.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Commands

SENS:AVER:COUN

Equivalent Softkeys

Average > Averaging

Equivalent COM Command

SCPI.SENSe(Ch).AVERage.STATe

Syntax

Status = app.SCPI.SENSe(Ch).AVERage.STATe

app.SCPI.SENSe(Ch).AVERage.STATe = False

Type

Boolean (read/write)

Back to SENSe

SENS:AVER:CLE

SCPI Command

SENSe<Ch>:AVERage:CLEar

Description

Restarts the averaging process when the averaging function is turned ON.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Related Commands

SENS:AVER

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SENSe(Ch).AVERage.CLEar

Syntax

app.SCPI.SENSe(Ch).AVERage.CLEar

Type

Method

Back to SENSe

SENS:AVER:COUN

SCPI Command

SENSe<Ch>:AVERage:COUNt <numeric>

SENSe<Ch>:AVERage:COUNt?

Description

Sets or reads out the averaging factor when the averaging function is turned ON.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<numeric> the averaging factor from 1 to 999

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

10

Related Commands

SENS:AVER

Equivalent Softkeys

Average > Averaging Factor

Equivalent COM Command

SCPI.SENSe(Ch).AVERage.COUNt

Syntax

Value = app.SCPI.SENSe(Ch).AVERage.COUNt

app.SCPI.SENSe(Ch).AVERage.COUNt = 2

Type

Long (read/write)

Back to SENSe

SENS:BAND

SCPI Command

SENSe<Ch>:BANDwidth[:RESolution] <frequency>

SENSe<Ch>:BANDwidth[:RESolution]?

Description

Sets or reads out the IF bandwidth.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<frequency> the IF bandwidth value

Unit

Hz (Hertz)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

10 kHz

Resolution

In steps of 10, 30, 100, 300, 1000, 3000, 10000, 30000

Related Commands

SENS:BWID — similar command

Equivalent Softkeys

Average > IFBW

Equivalent COM Command

SCPI.SENSe(Ch).BANDwidth.RESolution

Syntax

Value = app.SCPI.SENSe(Ch).BANDwidth.RESolution

app.SCPI.SENSe(Ch).BANDwidth.RESolution = 100

Type

Double (read/write)

Back to SENSe

SENS:BWID

SCPI Command

SENSe<Ch>:BWIDth[:RESolution] <frequency>

SENSe<Ch>:BWIDth[:RESolution]?

Description

Sets or reads out the IF bandwidth.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<frequency> the IF bandwidth value

Unit

Hz (Hertz)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

10 kHz

Resolution

In steps of 10, 30, 100, 300, 1000, 3000, 10000, 30000

Related Commands

SENS:BAND — similar command

Equivalent Softkeys

Average > IFBW

Equivalent COM Command

SCPI.SENSe(Ch).BANDwidth.RESolution

Syntax

Value = app.SCPI.SENSe(Ch).BANDwidth.RESolution

app.SCPI.SENSe(Ch).BANDwidth.RESolution = 100

Type

Double (read/write)

Back to SENSe

SENS:CABL:SEL

SCPI Command

SENSe<Ch>:CABLe:SELect <numeric>

Description

Selection of the cable and setting its parameters in the channel.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

Parameter

<numeric> the cable number in cable list

Related Commands

[MMEM:LOAD:CBL]

[SENS:CABL:COUN]

Equivalent Softkeys

Analysis > Time Domain > Cable Loss Correction Cable Type > Select

---

Equivalent COM Command

None

Back to SENSe

SENS:CABL:COUN

SCPI Command

SENSe:CABLe:COUNt?

Description

Returns the number of cables in the cable list.
query only

Target

Cable List

Related Commands

MMEM:LOAD:CBL

Equivalent Softkeys

None

Equivalent COM Command

None

Back to SENSe

SENS:CORR:CLE

SCPI Command

SENSe<Ch>:CORRection:CLEar

Description

Clears the calibration coefficient table.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.CLEar

Syntax

app.SCPI.SENSe(Ch).CORRection.CLEar

Type

Method

Back to SENSe

SENS:CORR:COEF

SCPI Command

SENSe<Ch>:CORRection:COEFficient[:DATA] <char>,<rcvport>,<srcport>,<numeric list>

SENSe<Ch>:CORRection:COEFficient[:DATA]? <char>,<rcvport>,<srcport>

Description

Writes or reads out the calibration coefficient data array.

The array size is 2N, where N is the number of measurement points. For the n–th point, where n from 1 to N:

<numeric 2n–1> real part of the calibration coefficients;

<numeric 2n> imaginary part of the calibration coefficients.

Note: The written calibration coefficients become effective only after the SENS:CORR:COEF:SAVE command is executed.

command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<char> Specifies the Error term:

ER	Reflection tracking
ED	Directivity
ES	Source match

<rcvport>, the number of the receiver port = 1

<srcport>, the number of the source port = 1

<numeric list> the calibration coefficient array

Query Response

<numeric 1>, <numeric 2>, …<numeric 2N>

Related Commands

SENS:CORR:COEF:SAVE

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COEFficient.DATA(Str, Pt_r, Pt_s)

Syntax

Data = app.SCPI.SENSe(Ch).CORRection.COEFficient. DATA(Str,Pt_r, Pt_s)

app.SCPI.SENSe(Ch).CORRection.COEFficient.DATA(Str, Pt_r, Pt_s) = Data

Type

Variant (array of Double) (read/write)

Back to SENSe

SENS:CORR:COEF:METH:OPEN

SCPI Command

SENSe<Ch>:CORRection:COEFficient:METHod[:RESPonse]:OPEN <port>

Description

Selects the port and sets the response calibration (Open) type when the written calibration coefficients are made effective by the SENS:CORR:COEF:SAVE command.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<port>	the number of the port = 1

Related Commands

SENS:CORR:COEF:SAVE

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COEFficient.METHod.RESPonse.OPEN

Syntax

Port = 1

app.SCPI.SENSe(Ch).CORRection.COEFficient.METHod.RESPonse.OPEN = Port

Type

Long (write only)

Back to SENSe

SENS:CORR:COEF:METH:SHOR

SCPI Command

SENSe<Ch>:CORRection:COEFficient:METHod[:RESPonse]:SHORt <port>

Description

Selects the port and sets the response calibration (Short) type when the written calibration coefficients are made effective by the SENS:CORR:COEF:SAVE command.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<port>	the number of the port = 1

Related Commands

SENS:CORR:COEF:SAVE

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COEFficient.METHod.RESPonse.SHORt

Syntax

Port = 1

app.SCPI.SENSe(Ch).CORRection.COEFficient.METHod.RESPonse.SHORt = Port

Type

Long (write only)

Back to [SENSe]

SENS:CORR:COEF:METH:SOLT1

SCPI Command

SENSe<Ch>:CORRection:COEFficient:METHod:SOLT1 <port>

Description

Selects the port and sets the full one-port calibration type when the written calibration coefficients are made effective by the SENS:CORR:COEF:SAVE command.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<port>	the number of the port = 1

Related Commands

SENS:CORR:COEF:SAVE

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COEFficient.METHod.SOLT1

Syntax

Port = 1

app.SCPI.SENSe(Ch).CORRection.COEFficient.METHod.SOLT1= Port

Type

Long (write only)

Back to SENSe

SENS:CORR:COEF:METH:THRU

SCPI Command

SENSe<Ch>:CORRection:COEFficient:METHod[:RESPonse]:THRU <rcvport>, <srcport>

Description

Selects the ports and sets the response calibration (Thru) type when the written calibration coefficients are made effective by the SENS:CORR:COEF:SAVE command. (in N-port mode only)
no query

Target

Channel <Ch>,

<Ch>={[1]|2|...16}

Parameter

<rcvport>	The number of the receiver port from 1 to 16
<srcport>	The number of the source port from 1 to 16

Out of Range

If the same port numbers are specified, an error occurs.

Related Commands

SENS:CORR:COEF:SAVE

Equivalent Softkeys

None

Equivalent COM Command

None

Back to [SENSe]

SENS:CORR:COEF:SAVE

SCPI Command

SENSe<Ch>:CORRection:COEFficient:SAVE

Description

Enables the written calibration coefficients depending on the selected calibration type. On completion of the command, the error correction automatically turns ON. Executing this command before all necessary calibration coefficients have been written will result in an error and the command will be ignored.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Related Commands

Calibration type selection:

SENS:CORR:COEF:METH:OPEN

SENS:CORR:COEF:METH:SHOR

SENS:CORR:COEF:METH:SOLT1

SENS:CORR:COEF:METH:THRU (in N-port mode only)

Calibration coefficient writing:

SENS:CORR:COEF

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COEFficient.SAVE

Syntax

app.SCPI.SENSe(Ch).CORRection.COEFficient.SAVE

Type

Method

Back to SENSe

SENS:CORR:COLL:CKIT

SCPI Command

SENSe<Ch>:CORRection:COLLect:CKIT[:SELect] <numeric>

SENSe<Ch>:CORRection:COLLect:CKIT[:SELect]?

Description

Sets or reads out the number of the selected calibration kit in the table of calibration kits.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<numeric> the number of the calibration kit from 1 to 50

Query Response

<numeric>

Preset Value

1

Equivalent Softkeys

Calibration > Calibration Kit > Cal Kit n

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.CKIT.SELect

Syntax

Dim Value As Long

Value = app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.SELect

app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.SELect = 3

Type

Long (read/write)

Back to SENSe

SENS:CORR:COLL:CKIT:LAB

SCPI Command

SENSe<Ch>:CORRection:COLLect:CKIT:LABel <string>

SENSe<Ch>:CORRection:COLLect:CKIT:LABel?

Description

Sets or reads out the calibration kit label.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<string>, up to 254 characters

Query Response

<string>

Equivalent Softkeys

Calibration > Calibration Kit > Edit Cal Kit > Label

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.CKIT.LABel

Syntax

Dim Lab As String

Lab = app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.LABel

app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.LABel = "User1"

Type

String (read/write)

Back to SENSe

SENS:CORR:COLL:CKIT:RES

SCPI Command

SENSe<Ch>:CORRection:COLLect:CKIT:RESet

Description

Resets the calibration kit to the factory settings. Restores the predefined calibration kit. Removes the user defined calibration kit.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Equivalent Softkeys

Calibration > Calibration Kit > Edit Cal Kit > Restore Cal Kit

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.CKIT.RESet

Syntax

app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.RESet

Type

Method

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:C0

SCPI Command

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:C0 <numeric>

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:C0?

Description

Sets or reads out the C0 value for the open calibration standard.
command/query

Target

Standard <Std> of the calibration kit specified for channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

<Std>={[1]|2|...K}, where K – the number of the standards in the calibration kit

Parameter

<numeric> the CO value from –1E18 to 1E18

Unit

1E–15 F (Farad)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Equivalent Softkeys

Calibration > Calibration Kit > Edit Cal Kit > C0 [e–15 F]

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).C0

Syntax

Value = app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).C0

app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).C1 = 100

Type

Double (read/write)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:C1

SCPI Command

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:C1 <numeric>

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:C1?

Description

Sets or reads out the C1 value for the open calibration standard.
command/query

Target

Standard <Std> of the calibration kit specified for channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

<Std>={[1]|2|...K}, where K – the number of the standards in the calibration kit

Parameter

<numeric> the C1 value from –1E18 to 1E18

Unit

1E–27 F/Hz (Farad/Hertz)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Equivalent Softkeys

Calibration > Calibration Kit > Edit Cal Kit > C1 [e–27 F/Hz]

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).C1

Syntax

Value = app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).C1

app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).C0 = 100

Type

Double (read/write)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:C2

SCPI Command

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:C2 <numeric>

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:C2?

Description

Sets or reads out the C2 value for the open calibration standard.
command/query

Target

Standard <Std> of the calibration kit specified for channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

<Std>={[1]|2|...K}, where K – the number of the standards in the calibration kit

Parameter

<numeric> the arbitrary impedance value from –1E18 to 1E18

Unit

1E–36 F/Hz2 (Farad/Hertz2)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Equivalent Softkeys

Calibration > Calibration Kit > Edit Cal Kit > C2 [e–36 F/Hz^2]

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).C2

Syntax

Value = app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).C2

app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).C2 = 100

Type

Double (read/write)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:C3

SCPI Command

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:C3 <numeric>

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:C3?

Description

Sets or reads out the C3 value for the open calibration standard.
command/query

Target

Standard <Std> of the calibration kit specified for channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

<Std>={[1]|2|...K}, where K – the number of the standards in the calibration kit

Parameter

<numeric> the arbitrary impedance value from –1E18 to 1E18

Unit

1E–45 F/Hz3 (Farad/Hertz3)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Equivalent Softkeys

Calibration > Calibration Kit > Edit Cal Kit > C3 [e–45 F/Hz^3]

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).C3

Syntax

Value = app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).C3

app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).C3 = 100

Type

Double (read/write)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:DEL

SCPI Command

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:DELay <numeric>

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:Delay?

Description

Sets or reads out the offset delay value for the calibration standard.
command/query

Target

Standard <Std> of the calibration kit specified for channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

<Std>={[1]|2|...K}, where K — the number of the standards in the calibration kit

Parameter

<numeric> the offset delay value form –1E18 to 1E18

Unit

s (second)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Equivalent Softkeys

Calibration > Calibration Kit > Edit Cal Kit > Offset Delay

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).DELay

Syntax

Value = app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).DELay

app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).DELay = 93E–12

Type

Double (read/write)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:FMAX

SCPI Command

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:FMAXimum <numeric>

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:FMAXimum?

Description

Sets or reads out the maximum frequency limit of the calibration standard.
command/query

Target

Standard <Std> of the calibration kit specified for channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

<Std>={[1]|2|...N}, where N — the number of the standards in the calibration kit

Parameter

<numeric> the maximum frequency limit form 0 to 1E14

Unit

Hz (Hertz)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Equivalent Softkeys

Calibration > Calibration Kit > Edit Cal Kit > F max

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).FMAXimum

Syntax

Value = app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).FMAXimum

app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).FMAXimum = 3E9

Type

Double (read/write)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:FMIN

SCPI Command

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:FMINimum <numeric>

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:FMINimum?

Description

Sets or reads out the minimum frequency limit of the calibration standard.
command/query

Target

Standard <Std> of the calibration kit specified for channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

<Std>={[1]|2|...N}, where N — the number of the standards in the calibration kit

Parameter

<numeric> the minimum frequency limit form 0 to 1E14

Unit

Hz (Hertz)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Equivalent Softkeys

Calibration > Calibration Kit > Edit Cal Kit > F min

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).FMINimum

Syntax

Value = app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).FMINimum

app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).FMINimum = 3E9

Type

Double (read/write)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:HWR

SCPI Command

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:HWRatio <numeric>

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:HWRatio?

Description

Sets or reads out the waveguide height to width ratio value for the calibration standard.
command/query

Target

Standard <Std> of the calibration kit specified for channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

<Std>={[1]|2|...K}, where K — the number of the standards in the calibration kit

Parameter

<numeric> the waveguide height to width ratio value

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Equivalent Softkeys

Calibration > Calibration Kit > Edit Cal Kit > H/W

Equivalent COM Command

None

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:L0

SCPI Command

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:L0 <numeric>

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:L0?

Description

Sets or reads out the L0 value for the short calibration standard.
command/query

Target

Standard <Std> of the calibration kit specified for channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

<Std>={[1]|2|...K}, where K — the number of the standards in the calibration kit

Parameter

<numeric> the L0 value from –1E18 to 1E18

Unit

1E–12 H (Henry)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Equivalent Softkeys

Calibration > Calibration Kit > Edit Cal Kit > L0 [e–12 H]

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).L0

Syntax

Value = app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).L0

app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).L0 = 100

Type

Double (read/write)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:L1

SCPI Command

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:L1 <numeric>

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:L1?

Description

Sets or reads out the L1 value for the short calibration standard.
command/query

Target

Standard <Std> of the calibration kit specified for channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

<Std>={[1]|2|...K}, where K — the number of the standards in the calibration kit

Parameter

<numeric> the L0 value from –1E18 to 1E18

Unit

1E–24 H/Hz (Henry/Hertz)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Equivalent Softkeys

Calibration > Calibration Kit > Edit Cal Kit > L1 [e–24 H/Hz]

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).L1

Syntax

Value = app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).L1

app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).L1 = 100

Type

Double (read/write)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:L2

SCPI Command

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:L2 <numeric>

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:L2?

Description

Sets or reads out the L2 value for the short calibration standard.
command/query

Target

Standard <Std> of the calibration kit specified for channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

<Std>={[1]|2|...K}, where K — the number of the standards in the calibration kit

Parameter

<numeric> the L2 value from –1E18 to 1E18

Unit

1E–33 H/Hz2 (Henry/Hertz2)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Equivalent Softkeys

Calibration > Calibration Kit > Edit Cal Kit > L2 [e–33 H/Hz^2]

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).L2

Syntax

Value = app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).L2

app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).L2 = 100

Type

Double (read/write)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:L3

SCPI Command

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:L3 <numeric>

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:L3?

Description

Sets or reads out the L3 value for the short calibration standard.
command/query

Target

Standard <Std> of the calibration kit specified for channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

<Std>={[1]|2|...K}, where K — the number of the standards in the calibration kit

Parameter

<numeric> the L3 value from –1E18 to 1E18

Unit

1E–42 H/Hz3 (Henry/Hertz3)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Equivalent Softkeys

Calibration > Calibration Kit > Edit Cal Kit > L3 [e–42 H/Hz3]

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).L3

Syntax

Value = app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).L3

app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).L3 = 100

Type

Double (read/write)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:LAB

SCPI Command

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:LABel?

Description

Sets or reads out the label for the calibration standard.
command/query

Target

Standard <Std> of the calibration kit specified for channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

<Std>={[1]|2|...K}, where K — the number of the standards in the calibration kit

Parameter

<string>, up to 254 characters

Query Response

<string>

Equivalent Softkeys

Calibration > Calibration Kit > Edit Cal Kit > Standard Label

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).LABel

Syntax

Lab = app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).LABel

app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).LABel = "Open"

Type

String (read/write)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:LOSS

SCPI Command

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:LOSS <loss>

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:LOSS?

Description

Sets or reads out the offset loss value for the calibration standard.
command/query

Target

Standard <Std> of the calibration kit specified for channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

<Std>={[1]|2|...K}, where K — the number of the standards in the calibration kit

Parameter

<loss> the offset loss value from –1E18 to 1E18

Unit

Ω/s (Ohm/second)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Equivalent Softkeys

Calibration > Calibration Kit > Edit Cal Kit > Offset Loss

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).LABel

Syntax

Lab = app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).LABel

app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).LABel = "Open"

Type

String (read/write)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:MEDI

SCPI Command

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:MEDIa {COAX|WAVE}

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:MEDIa?

Description

Sets or reads out the media value for the calibration standard.
command/query

Target

Standard <Std> of the calibration kit specified for channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

<Std>={[1]|2|...K}, where K — the number of the standards in the calibration kit

Parameter

COAX	Coaxial
WAVE	Waveguide

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

{COAX|WAVE}

Preset Value

COAX

Equivalent Softkeys

Calibration > Calibration Kit > Edit Cal Kit > Media

Equivalent COM Command

None

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:TYPE

SCPI Command

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:TYPE?

Description

Sets or reads out the type of calibration standard.
command/query

Target

Standard <Std> of the calibration kit specified for channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

<Std>={[1]|2|...K}, where K — the number of the standards in the calibration kit

Parameter

<char> Specifies the type of calibration standard:

OPEN	Open
SHORt	Short
LOAD	Load
THRU	Thru
DATA	Data-based

Query Response

{OPEN|SHOR|LOAD|THRU|DATA}

Equivalent Softkeys

Calibration > Calibration Kit > Edit Cal Kit > Standard Type

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).TYPE

Syntax

Param = app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).TYPE

app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).TYPE = "OPEN"

Type

String (read/write)

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:Z0

SCPI Command

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:Z0 <impedance>

SENSe<Ch>:CORRection:COLLect:CKIT:STAN<Std>:Z0?

Description

Sets or reads out the offset Z0 value for the calibration standard.
command/query

Target

Standard <Std> of the calibration kit specified for channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

<Std>={[1]|2|...K}, where K — the number of the standards in the calibration kit

Parameter

<impedance> the offset Z0 value from –1E18 to 1E18

Unit

Ω (Ohm)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

50 or 75 Ω, depending on the selected calibration kit

Equivalent Softkeys

Calibration > Calibration Kit > Edit Cal Kit > Offset Z0

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).Z0

Syntax

Value = app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).Z0

app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).Z0 = 50

Type

Double (read/write)

Back to SENSe

SENS:CORR:COLL:CLE

SCPI Command

SENSe<Ch>:CORRection:COLLect:CLEar

Description

Clears the measurement data of the calibration standards.
command only

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Equivalent Softkeys

Calibration > { Open | Short | Load } > Cancel

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.CLEar

Syntax

app.SCPI.SENSe(Ch).CORRection.COLLect.CLEar

Type

Method

Back to SENSe

SENS:CORR:COLL:DATA:LOAD

SCPI Command

SENSe<Ch>:CORRection:COLLect:DATA:LOAD <port>,<numeric list>

SENSe<Ch>:CORRection:COLLect:DATA:LOAD? <port>

Description

Writes or reads out the array of the load calibration standard measurement for the port <port>. The array size is 2N, where N is the number of measurement points. For the n–th point, where n from 1 to N: <numeric 2n–1> real part of the measurement <numeric 2n> imaginary part of the measurement (1-port VNA only)
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

Parameter

<port>	The port number 1
<numeric list>	The data array of the load standard measurement

Query Response

<numeric 1>, <numeric 2>, …<numeric 2N>

Related Commands

SENS:CORR:COLL:LOAD

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.DATA.LOAD(Pt)

Syntax

app.SCPI.SENSe(Ch).CORRection.COLLect.DATA.LOAD (Pt)

app.SCPI.SENSe(Ch).CORRection.COLLect.DATA.LOAD (Pt) = Data

Type

Variant (array of Double) (read/write)

Back to SENSe

SENS:CORR:COLL:DATA:OPEN

SCPI Command

SENSe<Ch>:CORRection:COLLect:DATA:OPEN <port>,<numeric list>

SENSe<Ch>:CORRection:COLLect:DATA:OPEN? <port>

Description

Writes or reads out the array of the open calibration standard measurement for the port <port>. The array size is 2N, where N is the number of measurement points. For the n–th point, where n from 1 to N: <numeric 2n–1> real part of the measurement <numeric 2n> imaginary part of the measurement (1-port VNA only)
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

Parameter

<port>	The port number 1
<numeric list>	The data array of the open standard measurement

Query Response

<numeric 1>, <numeric 2>, …<numeric 2N>

Related Commands

SENS:CORR:COLL:OPEN

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.DATA.OPEN(Pt)

Syntax

Data = app.SCPI.SENSe(Ch).CORRection.COLLect.DATA.OPEN(Pt)

app.SCPI.SENSe(Ch).CORRection.COLLect.DATA.OPEN(Pt) = Data

Type

Variant (array of Double) (read/write)

Back to SENSe

SENS:CORR:COLL:DATA:SHOR

SCPI Command

SENSe<Ch>:CORRection:COLLect:DATA:SHORt <port>,<numeric list>

SENSe<Ch>:CORRection:COLLect:DATA:SHORt? <port>

Description

Writes or reads out the array of the short calibration standard measurement for the port <port>. The array size is 2N, where N is the number of measurement points. For the n–th point, where n from 1 to N: <numeric 2n–1> real part of the measurement <numeric 2n> imaginary part of the measurement (1-port VNA only)
command/query

Target

Channel <Ch>,

<Ch>={[1]\|2\|3\|4}

Parameter

<port>	The port number 1
<numeric list>	The data array of the short standard measurement

Query Response

<numeric 1>, <numeric 2>, …<numeric 2N>

Related Commands

SENS:CORR:COLL:SHOR

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.DATA.SHORt(Pt)

Syntax

Data = app.SCPI.SENSe(Ch).CORRection.COLLect.DATA.SHORt(Pt)

app.SCPI.SENSe(Ch).CORRection.COLLect.DATA.SHORt(Pt) = Data

Type

Variant (array of Double) (read/write)

Back to SENSe

SENS:CORR:COLL:ECAL:INF?

SCPI Command

SENSe:CORRection:COLLect:ECAL:INFormation?

Description

Gets information on the Automatic Calibration Module connected to the Analyzer.
query only

Target

Automatic Calibration Module

Query Response

The query returns information in a string with comma separated fields.

Automatic Calibration Module Information:

- Model Name
- Serial Number
- Current Temperature of Automatic Calibration Module

Selected Characterization Information:

- Characterization
- Characterization Date and Time
- Frequency Start
- Frequency Stop
- Number of Points
- Characterization Temperature
- PortA Connector
- PortB Connector
- PortA Adapter
- PortB Adapter
- Analyzer

- Location
- Operator

Equivalent Softkeys

Calibration > AutoCal > Characterization Info

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.ECAL.INFormation

Syntax

ID = app.SCPI.SENSe(1).CORRection.COLLect.ECAL.INFormation

Type

String (read only)

Back to SENSe

SENS:CORR:COLL:ECAL:CHECK:EXEC

SCPI Command

SENSe<Ch>:CORRection:COLLect:ECAL:CHECK:EXECute

Description

Executing confidence check.
command only

Target

AutoCal module

(Ch – arbitrary number 1 to 4)

Equivalent Softkeys

Calibration > Autocalibration > Confidence Check

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.ECAL.CHECK.Execute

Syntax

app.SCPI.SENSe(Ch).CORRection.COLLect.ECAL.CHECK. Execute

Type

Method

Back to SENSe

SENS:CORR:COLL:ECAL:ORI:EXEC

SCPI Command

SENSe:CORRection:COLLect:ECAL:ORIentation:EXECute

Description

Executes the Auto-Orientation procedure of the AutoCal Module. The AutoCal Module must be connected to the ports of Analyzer.
command only

Target

AutoCal Module

Equivalent Softkeys

Calibration > Autocalibration > Perform Auto-Orientation

Equivalent COM Command

SCPI.SENSe.CORRection.COLLect.ECAL.ORIenation.Execute

Syntax

app.SCPI.SENSe.CORRection.COLLect.ECAL. ORIentation. Execute

Type

Method

Back to SENSe

SENS:CORR:COLL:ECAL:ORI:STAT

SCPI Command

SENSe:CORRection:COLLect:ECAL:ORIentation:STATe {OFF|ON|0|1}

SENSe:CORRection:COLLect:ECAL:ORIentation:STATe?

Description

Turns the Auto-Orientation function ON/OFF when the AutoCal Module calibration is executed.
command/query

Target

AutoCal Module

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Calibration > AutoCalibration > Orientation > Auto-Orientation

---

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.ECAL.ORIenation.STATe

Syntax

Status = app.SCPI.SENSe(1).CORRection.COLLect.ECAL.ORIentation.STATe

app.SCPI.SENSe(1).CORRection.COLLect.ECAL.ORIentation.STATe = False

Type

Boolean (read/write)

Back to SENSe

SENS:CORR:COLL:ECAL:PATH

SCPI Command

SENSe:CORRection:COLLect:ECAL:PATH <numeric1>,<numeric2>

SENSe:CORRection:COLLect:ECAL:PATH? <numeric1>

Description

Sets or reads out the AutoCal module port number which is connected to a specified port of the Network Analyzer.
command/query

Target

AutoCal Module

Parameter

<numeric1>	Network Analyzer Port Number
<numeric2>	AutoCal Module Port Number: 1- Port A of AutoCal Module 2- Port B of AutoCal Module

Query Response

<numeric>

Equivalent Softkeys

Calibration > AutoCal > Orientation > Port n

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.ECAL.PATH(Pt)

Syntax

Value = app.SCPI.SENSe(1).CORRection.COLLect.ECAL.PATH(Pt)

app.SCPI.SENSe(1).CORRection.COLLect.ECAL.PATH(Pt) = 2

Type

Long (read/write)

Back to SENSe

SENS:CORR:COLL:ECAL:SOLT1

SCPI Command

SENSe<Ch>:CORRection:COLLect:ECAL:SOLT1 <numeric>

Description

Executes one-port calibration of the specified port of the specified channel using the AutoCal module.
command only

Target

app.SCPI.SENSe(Ch).CORRection.COLLect.ECAL.CHECK. Execute

Parameter

<numeric>	Port Number=1

Equivalent Softkeys

Calibration > Autocalibration > Calibrate

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.ECAL.SOLT1

Syntax

app.SCPI.SENSe(Ch).CORRection.COLLect.ECAL.SOLT1 = Port

Type

Long (read/write)

Back to SENSe

SENS:CORR:COLL:ECAL:SOLT2

SCPI Command

SENSe<Ch>:CORRection:COLLect:ECAL:SOLT2 <numeric1>,<numeric2>

Description

Executes the one path 2–port calibration in both directions of the specified ports of selected channel (Ch) using the AutoCal module. (in N-port mode only) <Data(0)> the number of the receiver port <Data(1)> the number of the source port
command only

Target

Channel <Ch>,

<Ch>={[1]|2|...16} (in N-port mode only)

Parameter

Port number from 1 to 16. The array elements can not contain the same port numbers.

Equivalent Softkeys

Calibration > AutoCalibration > Calibrate

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.ECAL.SOLT2

Syntax

app.SCPI.SENSe(Ch).CORRection.COLLect.ECAL.SOLT2 = Array(2, 1)

Type

Variant (array of long)(write only)

Back to SENSe

SENS:CORR:COLL:ECAL:UCH

SCPI Command

SENSe:CORRection:COLLect:ECAL:UCHar <char>

SENSe:CORRection:COLLect:ECAL:UCHar?

Description

Sets or reads out the characterization number used when executing AutoCal (factory or user characterizations).
command/query

Target

AutoCal Module

Parameter

<char> Specifies the stimulus type:

CHAR0	Factory characterization
CHAR1	User characterization 1
CHAR2	User characterization 2
CHAR3	User characterization 3

Query Response

{CHAR0|CHAR1|CHAR2|CHAR3}

Preset Value

CHAR0

Equivalent Softkeys

Calibration > AutoCalibration > Characterization

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.ECAL.UCHar

Syntax

Param = app.SCPI.SENSe(1).CORRection.COLLect.ECAL.UCHar

app.SCPI.SENSe(1).CORRection.COLLect.ECAL.UCHar = "CHAR0"

Type

String (read/write)

Back to SENSe

SENS:CORR:COLL:LOAD

SCPI Command

SENSe<Ch>:CORRection:COLLect[:ACQuire]:LOAD <numeric>

Description

Measures the calibration data of the load standard for the specified port. **Note**: The command starts the measurement for the channel independently of the trigger and trigger source settings. The command waits for the completion of the measurement.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only).

Parameter

Port number is 1,

1-16 (in N-port mode only).

Equivalent Softkeys

Calibration > Load

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.ACQuire.LOAD

Syntax

app.SCPI.SENSe(Ch).CORRection.COLLect.ACQuire.LOAD = Port

Type

Long (write only)

Back to SENSe

SENS:CORR:COLL:OPEN

SCPI Command

SENSe<Ch>:CORRection:COLLect[:ACQuire]:OPEN <numeric>

Description

Measures the calibration data of the open standard for the specified port. **Note**: The command starts the measurement for the channel independently of the trigger and trigger source settings. The command waits for the completion of the measurement.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

Port number is 1,

1-16 (in N-port mode only).

Equivalent Softkeys

Calibration > Open

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.ACQuire.OPEN

Syntax

app.SCPI.SENSe(Ch).CORRection.COLLect.ACQuire.OPEN = Port

Type

Long (write only)

Back to SENSe

SENS:CORR:COLL:SAVE

SCPI Command

SENSe<Ch>:CORRection:COLLect:SAVE

Description

Calculates the calibration coefficients from the calibration standards measurements depending on the selected calibration type. The calibration type is selected by one of commands SENS:CORR:COLL:METH:XXXX. On completion of the command, all the calibration standards measurements are cleared, and the error correction automatically turns ON. At the attempt to execute this command before all the needed standards are measured, an error occurs, and the command is ignored.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Related Commands

Calibration type selection:

SENS:CORR:COLL:METH:XXXX

Calibration standards measurement:

SENS:CORR:COLL:LOAD

SENS:CORR:COLL:OPEN

SENS:CORR:COLL:SHOR

Equivalent Softkeys

Calibration > { Open | Short | Load } > Apply

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.SAVE

Syntax

app.SCPI.SENSe(Ch).CORRection.COLLect.SAVE

Type

Method

Back to SENSe

SENS:CORR:COLL:SHOR

SCPI Command

SENSe<Ch>:CORRection:COLLect[:ACQuire]:SHORt <port>

Description

Measures the calibration data of the short standard for the specified port. **Note**: The command starts the measurement for the channel independently of the trigger and trigger source settings. The command waits for the completion of the measurement.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

Port number is 1,

1-16 (in N-port mode only).

Equivalent Softkeys

Calibration > Short

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.ACQuire.SHORt

Syntax

app.SCPI.SENSe(Ch).CORRection.COLLect.ACQuire.SHORt = Port

Type

Long (write only)

Back to SENSe

SENS:CORR:COLL:THRU

SCPI Command

SENSe<Ch>:CORRection:COLLect[:ACQuire]:THRU <numeric1>,<numeric2>

Description

Measures the calibration data of the thru standard between the source port and the receiver port. (in N-port mode only) **Note**: The property writing starts the measurement for the channel independently of the trigger initiation and trigger source settings. The function of the property writing waits for the completion of the measurement.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

Port number is 1-16

Equivalent Softkeys

Calibration > Thru

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.ACQuire.THRU

Syntax

app.SCPI.SENSe(Ch).CORRection.COLLect.ACQuire.THRU = Array(Rcv, Src)

NOTE	The array contains 2 elements: • Data(0) is the number of the receiver port. • Data(1) is the number of the source port.

Type

Variant (array of Long) (write only)

Back to SENSe

SENS:CORR:COLL:METH:ERES

SCPI Command

SENSe<Ch>:CORRection:COLLect:METHod:ERESponse <numeric1>,<numeric2t>

Description

Selects the ports and sets the one path 2-port calibration type for the calculation of the calibration coefficients on completion of the calibration executed by the SENS:CORR:COLL:SAVE command. (in N-port mode only)
no query

Target

Channel <Ch>,

<Ch>={[1]…|16}(in N-port mode only).

Parameter

Port number from 1 to 16. The array elements can not contain the same port numbers.

Out of Range

If the same port numbers are specified, an error occurs.

Related Commands

SENS:CORR:COLL:SAVE

Equivalent Softkeys

Calibration > Calibration type > One Path 2-Port with Scalar Thru

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.METHod.ERESponse

Syntax

app.SCPI.SENSe(Ch).CORRection.COLLect.METHod.ERESponse = Array(2, 1)

NOTE	The array contains 2 elements: • Data(0) is the number of the receiver port. • Data(1) is the number of the source port.

Type

Variant (array of Long) (write only)

Back to SENSe

SENS:CORR:COLL:METH:OPEN

SCPI Command

SENSe<Ch>:CORRection:COLLect:METHod[:RESPonse]:OPEN <numeric>

Description

Selects the port and sets the response calibration (Open) type for the calculation of the calibration coefficients on completion of the calibration executed by the SENS:CORR:COLL:SAVE command.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

Port number is 1,

1-16 (in N-port mode only)

Related Commands

SENS:CORR:COLL:SAVE

Equivalent Softkeys

None (1-port VNA)

Calibration > Calibration type > Response Open (in N-port mode only)

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.METHod.RESPonse.OPEN

Syntax

app.SCPI.SENSe(Ch).CORRection.COLLect.METHod.RESPonse.OPEN = 1

Type

Long (write only)

Back to SENSe

SENS:CORR:COLL:METH:SHOR

SCPI Command

SENSe<Ch>:CORRection:COLLect:METHod[:RESPonse]:SHORt <numeric>

Description

Selects the port and sets the response calibration (Short) type for the calculation of the calibration coefficients on completion of the calibration executed by the SENS:CORR:COLL:SAVE command.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

Port number is 1,

1-16 (in N-port mode only)

Related Commands

SENS:CORR:COLL:SAVE

Equivalent Softkeys

None (1-port VNA)

Calibration > Calibration type > Response Short (in N-port mode only)

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.METHod.RESPonse.SHORt

Syntax

app.SCPI.SENSe(Ch).CORRection.COLLect.METHod.RESPonse.SHORt = 1

Type

Long (write only)

Back to SENSe

SENS:CORR:COLL:METH:SOLT1

SCPI Command

SENSe<Ch>:CORRection:COLLect:METHod:SOLT1 <port>

Description

Selects the port and sets the full one-port (SOL) calibration type for the calculation of the calibration coefficients on completion of the calibration executed by the SENS:CORR:COLL:SAVE command.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<port>	The number of the port = 1

Related Commands

SENS:CORR:COLL:SAVE

Equivalent Softkeys

None (1-port VNA)

Calibration > Calibration type > Full 1-Port Cal (in N-port mode only)

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.METHod.SOLT1

Syntax

app.SCPI.SENSe(Ch).CORRection.COLLect.METHod.SOLT1 = 1

Type

Long (write only)

Back to SENSe

SENS:CORR:COLL:METH:SOLT2

SCPI Command

SENSe<Ch>:CORRection:COLLect:METHod:SOLT2 <numeric1>,<numeric2>

Description

Selects the port and sets the full two-port (SOLT) calibration type for the calculation of the calibration coefficients on completion of the calibration executed by the SENS:CORR:COLL:SAVE command. (in N-port mode only)
no query

Target

Channel <Ch>,

<Ch>={[1]|2|...16} (in N-port mode only)

Parameter

Port number is 1,

1-16 (in N-port mode only)

Out of Range

If the same port numbers are specified, an error occurs.

Related Commands

SENS:CORR:COLL:SAVE

Equivalent Softkeys

Calibration > Calibration type > Full 2-Port Cal with Scalar Thru

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.METHod.SOLT2

Syntax

app.SCPI.SENSe(Ch).CORRection.COLLect.METHod.SOLT2 = Array(2, 1)

NOTE	The array contains 2 elements: • Data(0) is the number of the receiver port. • Data(1) is the number of the source port.

Type

Variant (array of Long) (write only)

Back to SENSe

SENS:CORR:COLL:METH:THRU

SCPI Command

SENSe<Ch>:CORRection:COLLect:METHod[:RESPonse]:THRU <numeric1>,<numeric2>

Description

Selects the ports and sets the response calibration (Thru) type for the calculation of the calibration coefficients on completion of the calibration executed by the SENS:CORR:COLL:SAVE command. (in N-port mode only)
no query

Target

Channel <Ch>,

<Ch>={[1]|2|...16} (in N-port mode only)

Parameter

Port number is 1,

1-16 (in N-port mode only)

Out of Range

If the same port numbers are specified, an error occurs.

Related Commands

SENS:CORR:COLL:SAVE

Equivalent Softkeys

Calibration > Calibration type > Response Scalar Thru

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.METHod.RESPonse.THRU

Syntax

app.SCPI.SENSe(Ch).CORRection.COLLect.METHod.RESPonse.THRU = Array(2,1)

NOTE	The array contains 2 elements: • Data(0) is the number of the receiver port. • Data(1) is the number of the source port.

Type

Variant (array of Long) (write only)

Back to SENSe

SENS:CORR:COLL:METH:TYPE?

SCPI Command

SENSe<Ch>:CORRection:COLLect:METHod:TYPE?

Description

Reads out the calibration method selected for the calculation of the calibration coefficients on completion of the calibration executed by the SENS:CORR:COLL:SAVE command.
query only

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Query Response

ST	Scalar Thru (in N-port mode only)
RO	Response (Open)
RS	Response (Short)
F1	Full one-port calibration
F1ST	Full 1-port calibration + Scalar Thru (in N-port mode only)
F2ST2	Full 2-port calibration + Scalar Thru (in N-port mode only)
MATH	Calculated Full 2-port calibration + Scalar Thru (in N-port mode only)
NONE	Not defined

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.METHod.TYPE

Syntax

Param = app.SCPI.SENSe(Ch).CORRection.COLLect.METHod.TYPE

Type

String (read only)

Back to SENSe

SENS:CORR:EXT

SCPI Command

SENSe<Ch>:CORRection:EXTension[:STATe] {OFF|ON|0|1}

SENSe<Ch>:CORRection:EXTension[:STATe]?

Description

Turns the port extension function ON/OFF.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Calibration > Port Extension >Port Extension

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.EXTension.STATe

Syntax

Status = app.SCPI.SENSe(Ch).CORRection.EXTension.STATe

app.SCPI.SENSe(Ch).CORRection.EXTension.STATe = True

Type

Boolean (read/write)

Back to SENSe

SENS:CORR:EXT:AUTO:CONF

SCPI Command

SENSe<Ch>:CORRection:EXTension:AUTO:CONFig {CSPN|AMKR|USPN}

SENSe<Ch>:CORRection:EXTension:AUTO:CONFig?

Description

Specifies the frequency range used for calculation of the results of the Auto Port Extension function.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...16}

Parameter

CSPN	Uses current frequency span.
AMKR	Uses the frequency of the active marker. This is applied to Loss 1 and Loss 2 is ignored.
USPN	Uses arbitrary frequency range.

Query Response

{CSPN|AMKR|USPN}

Preset Value

CSPN

Equivalent Softkeys

Calibration > Port Extension > Auto Port Extension > Method {Current Span | Acive Marker | User Span}

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.EXTension.AUTO.CONFig

Syntax

Value = app.SCPI.SENSe(Ch).CORRection.EXTension.AUTO.CONFig = "CSPN"

Type

String (read/write)

Back to SENSe

SENS:CORR:EXT:AUTO:DCOF

SCPI Command

SENSe<Ch>:CORRection:EXTension:AUTO:DCOFfset {OFF|ON|0|1}

SENSe<Ch>:CORRection:EXTension:AUTO:DCOFfset?

Description

Turns the usage of "Loss at DC" value for the results of the auto port extension function ON/OFF.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...16}

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Calibration > Port Extension > Auto Port Extension > Adjust Mismatch {ON/OFF}

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.EXTension.AUTO.DCOFfset

Syntax

Status = app.SCPI.SENSe(Ch).CORRection.EXTension.AUTO.DCOFfset = 1

Type

Boolean (read/write)

Back to SENSe

SENS:CORR:EXT:AUTO:LOSS

SCPI Command

SENSe<Ch>:CORRection:EXTension:AUTO:LOSS {OFF|ON|0|1}

SENSe<Ch>:CORRection:EXTension:AUTO:LOSS?

Description

Turns the usage of "Loss1"and "Loss2" values for the results of the auto port extension function ON/OFF.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...16}

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Calibration > Port Extension > Auto Port Extension > Include Loss {ON/OFF}

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.EXTension.AUTO.LOSS

Syntax

Status = app.SCPI.SENSe(Ch).CORRection.EXTension.AUTO.LOSS = 1

Type

Boolean (read/write)

Back to SENSe

SENS:CORR:EXT:AUTO:MEAS

SCPI Command

SENSe<Ch>:CORRection:EXTension:AUTO:MEASure {SHORt|OPEN}

Description

Performs measurement of the standard "SHORT" or "OPEN", automatically calculates and sets the parameters of the Port Extension. When two consecutive measurements of "SHORT" and "OPEN" are performed the results of these measurements are averaged.
command

Target

Channel <Ch>,

<Ch>={[1]|2|...16}

Parameter

SHORt	Measures "SHORT" standard
OPEN	Measures "OPEN" standard

Equivalent Softkeys

Calibration > Port Extension > Auto Port Extension > Short | Open

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.EXTension.AUTO.MEASure.OPEN

SCPI.SENSe(Ch).CORRection.EXTension.AUTO.MEASure. SHORt

Syntax

app.SCPI.SENSe(Ch).CORRection.EXTension.AUTO.OPEN

app.SCPI.SENSe(Ch).CORRection.EXTension.AUTO.SHORT

Type

Method

Back to SENSe

SENS:CORR:EXT:AUTO:RES

SCPI Command

SENSe<Ch>:CORRection:EXTension:AUTO:RESet

Description

Deletes the finished measurement data of the OPEN and SHORT standards of the auto port extension function. Allows to start averaging again between the SHORT and OPEN standards.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...16}

Equivalent Softkeys

Calibration > Port Extensions > Auto Port Extension > Cancel

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.EXTension.AUTO.RESet

Syntax

app.SCPI.SENSe(Ch).CORRection.EXTension.AUTO.RESet

Type

Method

Back to SENSe

SENS:CORR:EXT:AUTO:SAVE

SCPI Command

SENSe<Ch>:CORRection:EXTension:AUTO:SAVE

Description

Performs calculations after SHORT and OPEN measurements and sets port extension parameters.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...16}

Equivalent Softkeys

Calibration > Port Extensions > Auto Port Extension > Apply

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.EXTension.AUTO.SAVE

Syntax

app.SCPI.SENSe(Ch).CORRection.EXTension.AUTO.SAVE

Type

Method

Back to SENSe

SENS:CORR:EXT:AUTO:STAR

SCPI Command

SENSe<Ch>:CORRection:EXTension:AUTO:STARt <frequency>

SENSe<Ch>:CORRection:EXTension:AUTO:STARt?

Description

Sets or reads out the start value of the user span of the auto port extension function.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...16}

Parameter

<frequency> the user span start

Unit

Hz (Hertz)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

The Analyzer's lowest frequency.

Related Commands

SENS:CORR:EXT:AUTO:CONF

Equivalent Softkeys

Calibration > Port Extensions > Auto Port Extension > Frequency 1

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.EXTension.AUTO.STARt

Syntax

Value = app.SCPI.SENSe(Ch).CORRection.EXTension.AUTO.STARt = 1e8

Type

Double (read/write)

Back to SENSe

SENS:CORR:EXT:AUTO:STOP

SCPI Command

SENSe<Ch>:CORRection:EXTension:AUTO:STOP <frequency>

SENSe<Ch>:CORRection:EXTension:AUTO:STOP?

Description

Sets or reads out the stop value of the user span of the auto port extension function.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...16}

Parameter

<frequency> the user span stop

Unit

Hz (Hertz)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

The Analyzer's lowest frequency.

Related Commands

SENS:CORR:EXT:AUTO:CONF

Equivalent Softkeys

Calibration > Port Extensions > Auto Port Extension > Frequency 2

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.EXTension.AUTO.STOP

Syntax

Value = app.SCPI.SENSe(Ch).CORRection.EXTension.AUTO.STOP = 1e9

Type

Double (read/write)

Back to SENSe

SENS:CORR:EXT:PORT:FREQ

SCPI Command

SENSe<Ch>:CORRection:EXTension:PORT<Pt>:FREQuency{[1]|2} <frequency>

SENSe<Ch>:CORRection:EXTension:PORT<Pt>:FREQuency{[1]|2}?

Description

Sets or reads out the values of the frequency 1 and frequency 2 to calculate the loss for the port extension function.
command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

<Pt>=1

<Pt>={[1]…|16} (in N-port mode only)

Parameter

<frequency> the frequency value:

from 85E6 to 5.4E9 (R54),

from 85E6 to 14E9 (R140, R140B),

from 1e6 to 6e9 (R60),

from 1e6 to 18e9 (R180)

Unit

Hz (Hertz)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

1E9

Equivalent Softkeys

Calibration > Port Extension > {Freq1 | Freq2}

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.EXTension.PORT(Pt).FREQuency(Ls)

Syntax

Status = app.SCPI.SENSe(Ch).CORRection.EXTension.STATe

app.SCPI.SENSe(Ch).CORRection.EXTension.STATe = True

Type

Boolean (read/write)

Back to SENSe

SENS:CORR:EXT:PORT:INCL

SCPI Command

SENSe<Ch>:CORRection:EXTension:PORT<Pt>:INCLude{[1]|2}[:STATe] {OFF|ON|0|1}

SENSe<Ch>:CORRection:EXTension:PORT<Pt>:INCLude{[1]|2}[:STATe]?

Description

Turns the loss compensation of loss 1 and loss 2 for the port extension function ON/OFF.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

<Pt>=1

<Pt>={[1]…|16} (in N-port mode only)

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Calibration > Port Extension > {Loss1 | Loss2}

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.EXTension.PORT(Pt).INCLude(Ls).STATe

Syntax

Status= app.SCPI.SENSe(Ch).CORRection.EXTension.PORT(Pt).INCLude(Ls).STATe

app.SCPI.SENSe(Ch).CORRection.EXTension.PORT(Pt).INCLude(Ls).STATe = True

Type

Boolean (read/write)

Back to SENSe

SENS:CORR:EXT:PORT:LDC

SCPI Command

SENSe<Ch>:CORRection:EXTension:PORT<Pt>:LDC <loss>

SENSe<Ch>:CORRection:EXTension:PORT<Pt>:LDC?

Description

Sets or reads out the loss value at DC for the port extension function.
command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|3|4}
<Ch>={[1]…|16} (in N-port mode only)
<Pt>=1
<Pt>={[1]…|16} (in N-port mode only)

Parameter

<loss> the loss value from –200 to 200

Unit

dB (decibel)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Equivalent Softkeys

Calibration > Port Extension > Loss at DC

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.EXTension.PORT(Pt).LDC

Syntax

Value = app.SCPI.SENSe(Ch).CORRection.EXTension.PORT(Pt).LDC

app.SCPI.SENSe(Ch).CORRection.EXTension.PORT(Pt).LDC = 10

Type

Double (read/write)

Back to SENSe

SENS:CORR:EXT:PORT:LOSS

SCPI Command

SENSe<Ch>:CORRection:EXTension:PORT<Pt>:LOSS{[1]|2} <loss>

SENSe<Ch>:CORRection:EXTension:PORT<Pt>:LOSS{[1]|2}?

Description

Sets or reads out the values of loss 1 and loss 2 for the port extension function.
command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

<Pt>=1

<Pt>={[1]…|16} (in N-port mode only)

Parameter

<loss> the loss value from –200 to 200

Unit

dB (decibel)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Equivalent Softkeys

Calibration > Port Extension > {Loss 1 Value | Loss 2 Value}

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.EXTension.PORT(Pt).LOSS(Ls)

Syntax

Value = app.SCPI.SENSe(Ch).CORRection.EXTension.PORT(Pt).LOSS(Ls)

app.SCPI.SENSe(Ch).CORRection.EXTension.PORT(Pt).LOSS(Ls) = 10

Type

Double (read/write)

Back to SENSe

SENS:CORR:EXT:PORT:TIME

SCPI Command

SENSe<Ch>:CORRection:EXTension:PORT<Pt>:TIME <time>

SENSe<Ch>:CORRection:EXTension:PORT<Pt>:TIME?

Description

Sets or reads out the electrical delay value for the port extension function.
command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

<Pt>=1

<Pt>={[1]…|16} (in N-port mode only)

Parameter

<time> the electrical delay value from –10 to 10

Unit

sec (second)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Equivalent Softkeys

Calibration > Port Extension > Extension Value

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.EXTension.PORT(Pt).TIME

Syntax

Value = app.SCPI.SENSe(Ch).CORRection.EXTension.PORT(Pt).TIME

app.SCPI.SENSe(Ch).CORRection.EXTension.PORT(Pt).TIME = 10E-9

Type

Double (read/write)

Back to SENSe

SENS:CORR:IMP

SCPI Command

SENSe:CORRection:IMPedance[:INPut][:MAGNitude] <impedance>

SENSe:CORRection:IMPedance[:INPut][:MAGNitude]?

Description

Sets or reads out the system impedance Z0 of analyzer port.
command/query

Parameter

<numericimpedance> the Z0 value from 0.001 to 10 000.

Unit

Ω (Ohm)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

50 Ω

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.IMPedance.INPut.MAGNitude

Syntax

Value = app.SCPI.SENSe(1).CORRection.IMPedance.INPut.MAGNitude

app.SCPI.SENSe(1).CORRection.IMPedance.INPut.MAGNitude = 50

Type

Double (read/write)

WARNING	Object SENSe has an index of 1, which can be omitted in Visual Basic, but it cannot be omitted in other programming languages.

Back to SENSe

SENS:CORR:STAT

SCPI Command

SENSe<Ch>:CORRection:STATe {OFF|ON|0|1}

SENSe<Ch>:CORRection:STATe?

Description

Turns the S-parameter error correction ON/OFF.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Calibration > Correction

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.STATe

Syntax

Status = app.SCPI.SENSe(Ch).CORRection.STATe

app.SCPI.SENSe(Ch).CORRection.STATe = True

Type

Boolean (read/write)

Back to SENSe

SENS:CORR:TRAN:TIME:FREQ

SCPI Command

SENSe<Ch>:CORRection:TRANsform:TIME:FREQuency <frequency>

SENSe<Ch>:CORRection:TRANsform:TIME:FREQuency?

Description

Sets or reads out the frequency value at which the cable loss is specified for the cable correction function when the time domain transformation function is turned on.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<frequency> the frequency value.

Unit

Hz (Hertz)

Query Response

<numeric>

Preset Value

1 GHz

Equivalent Softkeys

Analysis > Time Domain > Cable Loss Correction > Frequency

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.TRANsform.TIME.FREQuency

Syntax

Value = app.SCPI.SENSe(Ch).CORRection.TRANsform.TIME.FREQuency

app.SCPI.SENSe(Ch).CORRection.TRANsform.TIME.FREQuency = 2000.0

Type

Double (read/write)

Back to SENSe

SENS:CORR:TRAN:TIME:LOSS

SCPI Command

SENSe<Ch>:CORRection:TRANsform:TIME:LOSS <numeric>

SENSe<Ch>:CORRection:TRANsform:TIME:LOSS?

Description

Sets or reads out the cable loss value for the cable correction function when the time domain transformation function is turned ON.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<numeric> the cable loss value

Unit

dB/m (decibell / meter)

Query Response

<numeric>

Preset Value

0 dB/m

Equivalent Softkeys

Analysis > Time Domain > Cable Loss Correction > Loss

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.TRANsform.TIME.LOSS

Syntax

Value = app.SCPI.SENSe(Ch).CORRection.TRANsform.TIME.LOSS

app.SCPI.SENSe(Ch).CORRection.TRANsform.TIME.LOSS = 0.25

Type

Double (read/write)

Back to SENSe

SENS:CORR:TRAN:TIME:RVEL

SCPI Command

SENSe<Ch>:CORRection:TRANsform:TIME:RVELocity <numeric>

SENSe<Ch>:CORRection:TRANsform:TIME:RVELocity?

Description

Sets or reads out the cable relative wave speed velocity for the cable correction function, when the time domain transformation function is turned ON.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<numeric> the cable velocity factor

Query Response

<numeric>

Preset Value

1.0

Equivalent Softkeys

Analysis > Time Domain > Cable Loss Correction > Velocity Factor

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.TRANsform.TIME.RVELocity

Syntax

Value = app.SCPI.SENSe(Ch).CORRection.TRANsform.TIME.RVELocity

app.SCPI.SENSe(Ch).CORRection.TRANsform.TIME.RVELocity = 0.66

Type

Double (read/write)

Back to SENSe

SENS:CORR:TRAN:TIME:STAT

SCPI Command

SENSe<Ch>:CORRection:TRANsform:TIME:STATe <bool>

SENSe<Ch>:CORRection:TRANsform:TIME:STATe?

Description

Turns the cable correction ON/OFF when the time domain transformation function is turned ON.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Analysis > Time Domain > Cable Loss Correction > Cable Loss Correction

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.TRANsform.TIME.STATe

Syntax

Status = app.SCPI.SENSe(Ch).CORRection.TRANsform.TIME.STATe

app.SCPI.SENSe(Ch).CORRection.TRANsform.TIME.STATe = True

Type

Boolean (read/write)

Back to SENSe

SENS:CORR:TYPE?

SCPI Command

SENSe<Ch>:CORRection:TYPE<Tr>?

Description

Reads the information about the calibration type and the number of ports to which the calibration is applied for the specified trace. The response format is as follows.
query only

Target

Trace <Tr> of channel <Ch>,

<Tr>={[1]|2|3|4}

<Ch>={[1]|2|3|4}

<Tr>={[1]…|16} (in N-port mode only)

<Ch>={[1]…|16} (in N-port mode only)

Query Response

{ST|RO|RS||F1|F1ST|F2ST|MATH|NONE},<srcport>,<rcvport>

Where:

ST	Scalar Thru (in N-port mode only)
RO	Response (Open)
RS	Response (Short)
F1	Full 1–port calibration
F1ST	Full 1–port calibration + Scalar Thru (in N-port mode only)
F2ST	Full 2-port calibration + Scalar Thru

	(in N-port mode only)
MATH	Calculated Full 2-port calibration + Scalar Thru (in N-port mode only)
NONE	Not defined

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.TYPE(Tr)

Syntax

CallInfo = app.SCPI.SENSe(Ch).CORRection.TYPE(Tr)

Type

Variant: array of Variants (read only)

Back to SENSe

SENS:FREQ:DATA?

SCPI Command

SENSe<Ch>:FREQuency:DATA?

Description

Reads out the frequency array of the measurement points. The array size is N, where N is the number of measurement points. For the n–th point, where n from 1 to N: <numeric n> the frequency value at the n–th measurement point
query only

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Query Response

<numeric 1>, <numeric 2>, …<numeric N>

The data transfer format depends on the FORM:DATA command setting.

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SENSe(Ch).FREQuency.DATA

Syntax

Data = app.SCPI.SENSe(Ch).FREQuency.DATA

Type

Variant (array of Double) (read only)

Back to SENSe

SENS:FREQ:CENT

SCPI Command

SENSe<Ch>:FREQuency:CENTer <frequency>

SENSe<Ch>:FREQuency:CENTer?

Description

Sets or reads out the stimulus center value of the sweep range for linear or logarithmic sweep type.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<frequency> the stimulus center value:

from 85E6 to 5.4E9 (R54),

from 85E6 to 14E9 (R140, R140B),

from 1e6 to 6e9 (R60),

from 1e6 to 18e9 (R180)

Unit

Hz (Hertz)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

The center frequency of the Analyzer.

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SENSe(Ch).FREQuency.CENTer

Syntax

Value = app.SCPI.SENSe(Ch).FREQuency.CENTer

app.SCPI.SENSe(Ch).FREQuency.CENTer = 1E9

Type

Double (read/write)

Back to SENSe

SENS:FREQ:SPAN

SCPI Command

SENSe<Ch>:FREQuency:SPAN <frequency>

SENSe<Ch>:FREQuency:SPAN?

Description

Sets or reads out the stimulus span value of the sweep range for linear or logarithmic sweep type.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<frequency> the stimulus span value:

from 0 to 5.315E9 (R54),

from 0 to 13.915E9 (R140, R140B),

from 0 to 5.999e9 (R60),

from 0 to 17.999e9 (R180)

Unit

Hz (Hertz)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

The maximum frequency span of the Analyzer

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SENSe(Ch).FREQuency.SPAN

Syntax

Value = app.SCPI.SENSe(Ch).FREQuency.SPAN

app.SCPI.SENSe(Ch).FREQuency.SPAN = 2E9

Type

Double (read/write)

Back to SENSe

SENS:FREQ:STAR

SCPI Command

SENSe<Ch>:FREQuency:STARt <frequency>

SENSe<Ch>:FREQuency:STARt?

Description

Sets or reads out the stimulus start value of the sweep range for linear or logarithmic sweep type.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<frequency> the stimulus start value:

from 85E6 to 5.4E9 (R54),

from 85E6 to 14E9 (R140, R140B),

from 1e6 to 6e9 (R60),

from 1e6 to 18e9 (R180)

Unit

Hz (Hertz)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

The minimum frequency span of the Analyzer

Equivalent Softkeys

Stimulus > Start Frequency

Equivalent COM Command

SCPI.SENSe(Ch).FREQuency.STARt

Syntax

Value = app.SCPI.SENSe(Ch).FREQuency.STARt

app.SCPI.SENSe(Ch).FREQuency.STARt = 1E6

Type

Double (read/write)

Back to SENSe

SENS:FREQ:STOP

SCPI Command

SENSe<Ch>:FREQuency:STOP <frequency>

SENSe<Ch>:FREQuency:STOP?

Description

Sets or reads out the stimulus stop value of the sweep range for linear or logarithmic sweep type.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...16}

Parameter

<frequency> the stimulus stop value within the frequency limits of the analyzer.

Unit

Hz (Hertz)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

The maximum frequency limit of the Analyzer.

Equivalent Softkeys

Stimulus > Stop

Equivalent COM Command

SCPI.SENSe(Ch).FREQuency.STOP

Syntax

Value = app.SCPI.SENSe(Ch).FREQuency.STOP

app.SCPI.SENSe(Ch).FREQuency.STOP = 1E6

Type

Double (read/write)

Back to SENSe

SENS:ROSC:SOUR

SCPI Command

SENSe:ROSCillator:SOURce <char>

SENSe:ROSCillator:SOURce?

Description

Sets or reads out an internal or external source of the 10 MHz reference frequency.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<char> Choose from:

INTernal	Internal source of the reference frequency
EXTernal	External source of the reference frequency

Query Response

{INT|EXT}

Preset Value

INT

Equivalent Softkeys

System > Reference Source

Equivalent COM Command

SCPI.SENSe(Ch).ROSCillator.SOURce

Syntax

Param = app.SCPI.SENSe(Ch).ROSCillator.SOURce

app.SCPI.SENSe(Ch).ROSCillator.SOURce = "EXT"

Type

String (read/write)

Back to SENSe

SENS:SEGM:DATA

SCPI Command

SENSe<Ch>:SEGMent:DATA <numeric list>

SENSe<Ch>:SEGMent:DATA?

Description

Sets or reads out the array of the segment sweep table.

The array has the following format:

{<Buf>, <Flag1>, <Flag2>, <Flag3>, <Flag4>, <Flag5>, <N>,
<Start 1>, <Stop 1>, <NOP 1> [,<IFBW 1>] [,<Pow 1>] [,<Del 1>] [,<Time 1>],
<Start 2>, <Stop 2>, <NOP 2> [,<IFBW 2>] [,<Pow 2>] [,<Del 2>] [,<Time 2>],
…
<StartN>, <StopN>, <NOP N> [,<IFBW N>] [,<Pow N>] [,<Del N>] [,<TimeN>]}

<Buf> : Always 5,

<Flag1> Stimulus start setting (0 – start/stop, 1 – center/span),

<Flag2> Setting of the <IFBW> field (0 – disabled, 1 – enabled),

<Flag3> Setting of the <Pow> field (0 – disabled, 1 – enabled),

<Flag4> Setting of the <Del> field (0 – disabled, 1 – enabled),

<Flag5> Setting of the <Time> field (0 – disabled, 1 – enabled),

<N> Number of segments,

<Start n> Start value of the n–th segment,

<Stop n> Stop value of the n–th segment,

<NOP n> Number of points of the n–th segment,

<IFBW n> IF bandwidth of the n–th segment (if enabled), <Pow n> Power of the n–th segment (if enabled), <Del n> Measurement delay of the n–th segment (if enabled), <Time n> Reserved for future use (if enabled)
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}
<Ch>={[1]…|16} (in N-port mode only)

Query Response

<numeric 1>,<numeric 2>,…<numeric 7+M×N>

Where:

N – the number of the segments,

M – depends on the values of the flags:

M = 3 + <Flag2> + <Flag3> + <Flag4> + <Flag5>

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SENSe(Ch).SEGMent.DATA

Syntax

Data = app.SCPI.SENSe(Ch).SEGMent.DATA

app.SCPI.SENSe(Ch).SEGMent.DATA = Data

Type

Variant (array of Double) (read/write)

Back to SENSe

SENS:SWE:POIN

SCPI Command

SENSe<Ch>:SWEep:POINts <numeric>

SENSe<Ch>:SWEep:POINts?

Description

Sets or reads out the number of measurement points.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<numeric> the number of measurement points

from 2 to 100001

from 2 to 16001 (in N-port mode only)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

201

Equivalent Softkeys

Stimulus > Points

Equivalent COM Command

SCPI.SENSe(Ch).SWEep.POINts

Syntax

Value = app.SCPI.SENSe(Ch).SWEep.POINts

app.SCPI.SENSe(Ch).SWEep.POINts = 1001

Type

Long (read/write)

Back to SENSe

SENS:SWE:POIN:TIME

SCPI Command

SENSe<Ch>:SWEep:POINt:TIME <time>

SENSe<Ch>:SWEep:POINt:TIME?

Description

Sets or reads out the delay before measurement in each measurement point.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<time> the measurement delay value from 0 to 0.3 sec.

Resolution

5E–6

Unit

sec (second)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Equivalent Softkeys

Stimulus > Measure Delay

Equivalent COM Command

SCPI.SENSe(Ch).SWEep.POINt.TIME

Syntax

Value = app.SCPI.SENSe(Ch).SWEep.POINt.TIME

app.SCPI.SENSe(Ch).SWEep.POINt.TIME = 5E-6

Type

Double (read/write)

Back to SENSe

SENS:SWE:TYPE

SCPI Command

SENSe<Ch>:SWEep:TYPE <char>

SENSe<Ch>:SWEep:TYPE?

Description

Sets or reads out the sweep type.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} ((in N-port mode only)

Parameter

<char> Specifies the sweep type:

LINear	Linear frequency sweep
LOGarithmic	Logarithmic frequency sweep
SEGMent	Segment frequency sweep

Query Response

{LIN|LOG|SEGM}

Preset Value

LIN

Equivalent Softkeys

Stimulus > Sweep Type

Equivalent COM Command

SCPI.SENSe(Ch).SWEep.TYPE

Syntax

Param = app.SCPI.SENSe(Ch).SWEep.TYPE

app.SCPI.SENSe(Ch).SWEep.TYPE = "LOG"

Type

String (read/write)

Back to SENSe

SERVice

Command	Description		COM analog
SERV:CHAN:ACT?	Channel and Trace Settings	Active channel number (read)	+
SERV:CHAN:TRAC:ACT?		Active trace number (read)	+
SERV:CHAN:COUN?	Analyzer Capabilities	Maximum number of channels	+
SERV:CHAN:TRAC:COUN?		Maximum number of traces in the channel	+
SERV:PORT:COUN?		Ports number	+
SERV:SWE:FREQ:MAX?		Upper limit of frequency	+
SERV:SWE:FREQ:MIN?		Lower limit of frequency	+
SERV:SWE:POIN?		Maximum number of points	+

SERV:CHAN:ACT?

SCPI Command

SERVice:CHANnel:ACTive?

Description

Reads out the active channel number.
query only

Query Response

<numeric> from 1 to 4

<numeric> from 1 to 16 (in N-port mode only)

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SERVice.CHANnel.ACTive

Syntax

Value = app.SCPI.SERVice.CHANnel.ACTive

Type

Long (read only)

Back to SERVice

SERV:CHAN:COUN?

SCPI Command

SERVice:CHANnel:COUNt?

Description

Reads out the maximum number of the Analyzer channels.
query only

Query Response

<numeric>

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SERVice.CHANnel.COUNt

Syntax

Value = app.SCPI.SERVice.CHANnel.COUNt

Type

Long (read only)

Back to SERVice

SERV:CHAN:TRAC:ACT?

SCPI Command

SERVice:CHANnel<Ch>:TRACe:ACTive?

Description

Reads out the active trace number of the channel.
query only

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Query Response

<numeric> from 1 to 4

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SERVice.CHANnel(Ch).TRACe.ACTive

Syntax

Value = app.SCPI.SERVice.CHANnel(Ch).TRACe.ACTive

Type

Long (read only)

Back to SERVice

SERV:CHAN:TRAC:COUN?

SCPI Command

SERVice:CHANnel:TRACe:COUNt?

Description

Reads out the maximum number of traces in the channel.
query only

Query Response

<numeric>

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SERVice.CHANnel.TRACe.COUNt

Syntax

Value = app.SCPI.SERVice.CHANnel.TRACe.COUNt

Type

Long (read only)

Back to SERVice

SERV:PORT:COUN?

SCPI Command

SERVice:PORT:COUNt?

Description

Reads out the number of Analyzer ports.
query only

Query Response

<numeric>

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SERVice.PORT.COUNt

Syntax

Value = app.SCPI.SERVice.PORT.COUNt

Type

Long (read only)

Back to SERVice

SERV:SWE:FREQ:MAX?

SCPI Command

SERVice:SWEep:FREQuency:MAXimum?

Description

Reads out the upper limit of the Analyzer measurement frequency.
query only

Query Response

<numeric>

Unit

Hz (Hertz)

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SERVice.SWEep.FREQency.MAXimum

Syntax

Value = app.SCPI.SERVice.SWEep.FREQency.MAXimum

Type

Double (read only)

Back to SERVice

SERV:SWE:FREQ:MIN?

SCPI Command

SERVice:SWEep:FREQuency:MINimum?

Description

Reads out the lower limit of the Analyzer measurement frequency.
query only

Query Response

<numeric>

Unit

Hz (Hertz)

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SERVice.SWEep.FREQency.MINimum

Syntax

Value = app.SCPI.SERVice.SWEep.FREQency.MINimum

Type

Double (read only)

Back to SERVice

SERV:SWE:POIN?

SCPI Command

SERVice:SWEep:POINts?

Description

Reads the maximum number of Analyzer measurement points.
query only

Query Response

<numeric>

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SERVice.SWEep.POINts

Syntax

Value = app.SCPI.SERVice.SWEep.POINts

Type

Long (read only)

Back to SERVice

SOURce

Command	Description		COM analog
SOUR:POW	Stimulus Settings	Power level for a frequency sweep (only for R60, R180).	+
SOUR:POW:STAT		Power level for a frequency sweep (only for R54, R140 and R140B).	+

SOUR:POW

SCPI Command

SOURce<Ch>:POWer[:LEVel][:IMMediate][:AMPLitude] {MIN|MAX|<power>}

SOURce<Ch>:POWer[:LEVel][:IMMediate][:AMPLitude]?

Description

Sets or reads out the power level for the frequency sweep type (only for R60, R180).
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<power> the power level within the power limits of the analyzer.

Unit

dBm (decibels above 1 milliwatt)

Resolution

0.05 dBm

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0 dBm

Equivalent Softkeys

Stimulus > Power > Output Power

Equivalent COM Command

SCPI.SOURce(Ch).POWer.LEVel.IMMediate.AMPLitude

Syntax

Dim Value As Double

Value = app.SCPI.SOURce(Ch).POWer.LEVel.IMMediate.AMPLitude

app.SCPI.SOURce(Ch).POWer.LEVel.IMMediate.AMPLitude = -10

Type

Double

Back to SOURce

SOUR:POW:STAT

SCPI Command

SOURce<Ch>:POWer[:LEVel]:STATe <char>

SOURce<Ch>:POWer[:LEVel]:STATe?

Description

Sets or reads out the power level for the frequency sweep (high or low) and turns the RF signal output OFF (for R54, R140, R140B only).
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<char> specifies the power level for the frequency sweep for R54, R140 and R140B:

HIGH	High output power.
LOW	Low output power.
ROFF	RF Out is OFF

Out of Range

Error occurs. The command is ignored.

Query Response

{HIGH|LOW|ROFF}

Preset Value

HIGH

Equivalent Softkeys

Stimulus > Power

Equivalent COM Command

SCPI.SOURce(Ch).POWer.LEVel.STATe

Syntax

Dim Value As String

Value = app.SCPI.SOURce(Ch).POWer.LEVel.STATe

app.SCPI.SOURce(Ch).POWer.LEVel.STATe = “LOW”

Type

String

Back to SOURce

STATus

Command	Description		COM analog
STAT:OPER?	Status System	Operation Status Event Register query	+
STAT:OPER:COND?		Operation Status Condition Register query	+
STAT:OPER:ENAB		Operation Status Enable Register	+
STAT:OPER:NTR		Negative transition filter of Operation Status Register	+
STAT:OPER:PTR		Positive transition filter of Operation Status Register	+
STAT:PRES		Resets status registers	+
STAT:QUES:COND?		Questionable Status Condition Register query	+
STAT:QUES:ENAB		Questionable Status Enable Register	+
STAT:QUES:LIM:CHAN:COND?		Questionable Limit Channel Status Condition Register query	+

Command	Description		COM analog
STAT:QUES:LIM:CHAN:ENAB		Questionable Limit Channel Status Enable Register	+
STAT:QUES:LIM:CHAN:NTR		Negative transition filter of Questionable Limit Channel Status Register	+
STAT:QUES:LIM:CHAN:PTR		Positive transition filter of Questionable Limit Channel Status Register	+
STAT:QUES:LIM:CHAN?		Questionable Limit Channel Status Event Register query	+
STAT:QUES:LIM:COND?		Questionable Limit Status Condition Register query	+
STAT:QUES:LIM:ENAB		Questionable Limit Status Enable Register	+
STAT:QUES:LIM:NTR		Negative transition filter of Questionable Limit Status Register	+
STAT:QUES:LIM:PTR		Positive transition filter of Questionable Limit Status Register	+

Command	Description		COM analog
STAT:QUES:LIM?		Questionable Limit Status Event Register query	+
STAT:QUES:NTR		Negative transition filter of Questionable Status Register	+
STAT:QUES:PTR		Positive transition filter of Questionable Status Register	+
STAT:QUES:RLIM:CHAN:COND?		Questionable Ripple Limit Channel Status Condition Register query	+
STAT:QUES:RLIM:CHAN:ENAB		Questionable Ripple Limit Channel Status Enable Register	+
STAT:QUES:RLIM:CHAN:NTR		Negative transition filter of Questionable Ripple Limit Channel Status Register	+
STAT:QUES:RLIM:CHAN:PTR		Positive transition filter of Questionable Ripple Limit Channel Status Register	+
STAT:QUES:RLIM:CHAN?		Questionable Ripple Limit Channel Status Event Register query	+

Command	Description		COM analog
STAT:QUES:RLIM:COND?		Questionable Ripple Limit Status Condition Register query	+
STAT:QUES:RLIM:ENAB		Questionable Ripple Limit Status Enable Register	+
STAT:QUES:RLIM:NTR		Negative transition filter of Questionable Ripple Limit Status Register	+
STAT:QUES:RLIM?		Questionable Ripple Limit Status Event Register query	+
STAT:QUES?		Questionable Status Event Register query	+

STAT:OPER?

SCPI Command

STATus:OPERation[:EVENt]?

Description

Reads out the value of the Operation Status Event Register.
query only

Target

Status Reporting System

Query Response

<numeric>

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.OPERation.EVENt

Syntax

Value = app.SCPI.STATus.OPERation.EVENt

Type

Long (read/write)

Back to STATus

STAT:OPER:COND?

SCPI Command

STATus:OPERation:CONDition?

Description

Reads out the value of the Operation Status Condition Register.
query only

Target

Status Reporting System

Query Response

<numeric>

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.OPERation.CONDition

Syntax

Value = app.SCPI.STATus.OPERation.CONDition

Type

Long (read/write)

Back to STATus

STAT:OPER:ENAB

SCPI Command

STATus:OPERation:ENABle <numeric>

STATus:OPERation:ENABle?

Description

Sets or reads out the value of the Operation Status Enable Register.
command/query

Target

Status Reporting System

Parameter

<numeric> from 0 to 65535

Out of Range

Bit–to–bit AND with numeric 65535

Query Response

<numeric>

Preset Value

0

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.OPERation.ENABle

Syntax

Value = app.SCPI.STATus.OPERation.ENABle

app.SCPI.STATus.OPERation.ENABle = Value

Type

Long (read/write)

Back to STATus

STAT:OPER:NTR

SCPI Command

STATus:OPERation:NTRansition <numeric>

STATus:OPERation:NTRansition?

Description

Sets or reads out the value of the Negative transition filter of the Operation Status Register.
command/query

Target

Status Reporting System

Parameter

<numeric> from 0 to 65535

Out of Range

Bit–to–bit AND with numeric 65535

Query Response

<numeric>

Preset Value

0

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.OPERation.NTRansition

Syntax

Value = app.SCPI.STATus.OPERation.NTRansition

app.SCPI.STATus.OPERation.NTRansition = Value

Type

Long (read/write)

Back to STATus

STAT:OPER:PTR

SCPI Command

STATus:OPERation:PTRansition <numeric>

STATus:OPERation:PTRansition?

Description

Sets or reads out the value of the Positive transition filter of the Operation Status Register.
command/query

Target

Status Reporting System

Parameter

<numeric> from 0 to 65535

Out of Range

Bit–to–bit AND with numeric 65535

Query Response

<numeric>

Preset Value

65535

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.OPERation.PTRansition

Syntax

Value = app.SCPI.STATus.OPERation.PTRansition

app.SCPI.STATus.OPERation.PTRansition = Value

Type

Long (read/write)

Back to STATus

STAT:PRES

SCPI Command

STATus:PRESet

Description

Resets all the status registers to the factory settings.
no query

Target

Status Reporting System

Query Response

<numeric>

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.PRESet

Syntax

app.SCPI.STATus.PRESet

Type

Method

Back to STATus

STAT:QUES:COND?

SCPI Command

STATus:QUEStionable:CONDition?

Description

Reads out the value of the Questionable Status Condition Register.
query only

Target

Status Reporting System

Query Response

<numeric>

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.QUEStionable.CONDition

Syntax

Value = app.SCPI.STATus.QUEStionable.CONDition

Type

Long (read only)

Back to STATus

STAT:QUES:ENAB

SCPI Command

STATus:QUEStionable:ENABle <numeric>

STATus:QUEStionable:ENABle?

Description

Sets or reads out the value of the Questionable Status Enable Register.
command/query

Target

Status Reporting System

Parameter

<numeric> from 0 to 65535

Out of Range

Bit–to–bit AND with numeric 65535

Query Response

<numeric>

Preset Value

0

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.QUEStionable.ENABle

Syntax

Value = app.SCPI.STATus.QUEStionable.ENABle

app.SCPI.STATus.QUEStionable.ENABle = Value

Type

Long (read only)

Back to STATus

STAT:QUES:LIM:CHAN:COND?

SCPI Command

STATus:QUEStionable:LIMit:CHANnel<Ch>:CONDition?

Description

Reads out the value of the Questionable Limit Channel Status Condition Register.
query only

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Query Response

<numeric>

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.QUEStionable.LIMit.CHANnel(Ch).CONDition

Syntax

Value = app.SCPI.STATus.QUEStionable.LIMit.CHANnel(Ch).CONDition

Type

Long (read only)

Back to STATus

STAT:QUES:LIM:CHAN:ENAB

SCPI Command

STATus:QUEStionable:LIMit:CHANnel<Ch>:ENABle <numeric>

STATus:QUEStionable:LIMit:CHANnel<Ch>:ENABle?

Description

Sets or reads out the value of the Questionable Limit Channel Status Enable Register.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<numeric> from 0 to 65535

Out of Range

Bit–to–bit AND with numeric 65535

Query Response

<numeric>

Preset Value

0

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.QUEStionable.LIMit.CHANnel(Ch).ENABle

Syntax

Value = app.SCPI.STATus.QUEStionable.LIMit.CHANnel(Ch).ENABle

app.SCPI.STATus.QUEStionable.LIMit.CHANnel(Ch).ENABle = Value

Type

Long (read/write)

Back to STATus

STAT:QUES:LIM:CHAN:NTR

SCPI Command

STATus:QUEStionable:LIMit:CHANnel<Ch>:NTRansition <numeric>

STATus:QUEStionable:LIMit:CHANnel<Ch>:NTRansition?

Description

Sets or reads out the value of the Negative transition filter of the Questionable Limit Channel Status Register.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<numeric> from 0 to 65535

Out of Range

Bit–to–bit AND with numeric 65535

Query Response

<numeric>

Preset Value

0

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.QUEStionable.LIMit.CHANnel(Ch).NTRansition

Syntax

Value = app.SCPI.STATus.QUEStionable.LIMit.CHANnel(Ch).NTRansition

app.SCPI.STATus.QUEStionable.LIMit.CHANnel(Ch).NTRansition = Value

Type

Long (read/write)

Back to STATus

STAT:QUES:LIM:CHAN:PTR

SCPI Command

STATus:QUEStionable:LIMit:CHANnel<Ch>:PTRansition <numeric>

STATus:QUEStionable:LIMit:CHANnel<Ch>:PTRansition?

Description

Sets or reads out the value of the Positive transition filter of the Questionable Limit Channel Status Register.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<numeric> from 0 to 65535

Out of Range

Bit–to–bit AND with numeric 65535

Query Response

<numeric>

Preset Value

65535

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.QUEStionable.LIMit.CHANnel(Ch).PTRansition

Syntax

Value = app.SCPI.STATus.QUEStionable.LIMit.CHANnel(Ch).PTRansition

app.SCPI.STATus.QUEStionable.LIMit.CHANnel(Ch).PTRansition = Value

Type

Long (read/write)

Back to STATus

STAT:QUES:LIM:CHAN?

SCPI Command

STATus:QUEStionable:LIMit:CHANnel<Ch>[:EVENt]?

Description

Reads out the value of the Questionable Limit Channel Status Event Register.
query only

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Query Response

<numeric>

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.QUEStionable.LIMit.CHANnel(Ch).EVENt

Syntax

Value = app.SCPI.STATus.QUEStionable.LIMit.CHANnel(Ch).EVENt

Type

Long (read only)

Back to STATus

STAT:QUES:LIM:COND?

SCPI Command

STATus:QUEStionable:LIMit:CONDition?

Description

Reads out the value of the Questionable Limit Status Condition Register.
query only

Target

Status Reporting System

Query Response

<numeric>

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.QUEStionable.LIMit.CONDition

Syntax

Value = app.SCPI.STATus.QUEStionable.LIMit.CONDition

Type

Long (read only)

Back to STATus

STAT:QUES:LIM:ENAB

SCPI Command

STATus:QUEStionable:LIMit:ENABle <numeric>

STATus:QUEStionable:LIMit:ENABle?

Description

Sets or reads out the value of the Questionable Limit Status Enable Register.
command/query

Target

Status Reporting System

Parameter

<numeric> from 0 to 65535

Out of Range

Bit–to–bit AND with numeric 65535

Query Response

<numeric>

Preset Value

0

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.QUEStionable.LIMit.ENABle

Syntax

Value = app.SCPI.STATus.QUEStionable.LIMit.ENABle

app.SCPI.STATus.QUEStionable.LIMit.ENABle = Value

Type

Long (read/write)

Back to STATus

STAT:QUES:LIM:NTR

SCPI Command

STATus:QUEStionable:LIMit:NTRansition <numeric>

STATus:QUEStionable:LIMit:NTRansition?

Description

Sets or reads out the value of the Negative transition filter of the Questionable Limit Status Register.
command/query

Target

Status Reporting System

Parameter

<numeric> from 0 to 65535

Out of Range

Bit–to–bit AND with numeric 65535

Query Response

<numeric>

Preset Value

0

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.QUEStionable.LIMit.NTRansition

Syntax

Value = app.SCPI.STATus.QUEStionable.LIMit.NTRansition

app.SCPI.STATus.QUEStionable.LIMit.NTRansition = Value

Type

Long (read/write)

Back to STATus

STAT:QUES:LIM:PTR

SCPI Command

STATus:QUEStionable:LIMit:PTRansition <numeric>

STATus:QUEStionable:LIMit:PTRansition?

Description

Sets or reads out the value of the Positive transition filter of the Questionable Limit Status Register.
command/query

Target

Status Reporting System

Parameter

<numeric> from 0 to 65535

Out of Range

Bit–to–bit AND with numeric 65535

Query Response

<numeric>

Preset Value

65535

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.QUEStionable.LIMit.PTRansition

Syntax

Value = app.SCPI.STATus.QUEStionable.LIMit.PTRansition

app.SCPI.STATus.QUEStionable.LIMit.PTRansition = Value

Type

Long (read/write)

Back to STATus

STAT:QUES:LIM?

SCPI Command

STATus:QUEStionable:LIMit[:EVENt]?

Description

Reads out the value of the Questionable Limit Status Event Register.
query only

Target

Status Reporting System

Query Response

<numeric>

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.QUEStionable.LIMit.EVENt

Syntax

Value = app.SCPI.STATus.QUEStionable.LIMit.EVENt

Type

Long (read only)

Back to STATus

STAT:QUES:NTR

SCPI Command

STATus:QUEStionable:NTRansition <numeric>

STATus:QUEStionable:NTRansition?

Description

Sets or reads out the value of the Negative transition filter of the Questionable Status Register.
command/query

Target

Status Reporting System

Parameter

<numeric> from 0 to 65535

Out of Range

Bit–to–bit AND with numeric 65535

Query Response

<numeric>

Preset Value

0

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.QUEStionable.NTRansition

Syntax

Value = app.SCPI.STATus.QUEStionable.NTRansition

app.SCPI.STATus.QUEStionable.NTRansition = Value

Type

Long (read/write)

Back to STATus

STAT:QUES:PTR

SCPI Command

STATus:QUEStionable:PTRansition <numeric>

STATus:QUEStionable:PTRansition?

Description

Sets or reads out the value of the Positive transition filter of the Questionable Status Register.
command/query

Target

Status Reporting System

Parameter

<numeric> from 0 to 65535

Out of Range

Bit–to–bit AND with numeric 65535

Query Response

<numeric>

Preset Value

65535

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.QUEStionable.PTRansition

Syntax

Value = app.SCPI.STATus.QUEStionable.PTRansition

app.SCPI.STATus.QUEStionable.PTRansition = Value

Type

Long (read/write)

Back to STATus

STAT:QUES:RLIM:CHAN:COND?

SCPI Command

STATus:QUEStionable:RLIMit:CHANnel<Ch>:CONDition?

Description

Reads out the value of the Questionable Ripple Limit Channel Status Condition Register.
query only

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Query Response

<numeric>

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.QUEStionable.RLIMit.CHANnel(Ch).CONDition

Syntax

Value = app.SCPI.STATus.QUEStionable.RLIMit.CHANnel(Ch).CONDition

Type

Long (read only)

Back to STATus

STAT:QUES:RLIM:CHAN:ENAB

SCPI Command

STATus:QUEStionable:RLIMit:CHANnel<Ch>:ENABle <numeric>

STATus:QUEStionable:RLIMit:CHANnel<Ch>:ENABle?

Description

Sets or reads out the value of the Questionable Ripple Limit Channel Status Enable Register.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<numeric> from 0 to 65535

Out of Range

Bit–to–bit AND with numeric 65535

Query Response

<numeric>

Preset Value

0

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.QUEStionable.RLIMit.CHANnel(Ch).ENABle

Syntax

Value = app.SCPI.STATus.QUEStionable.RLIMit.CHANnel(Ch).ENABle

app.SCPI.STATus.QUEStionable.RLIMit.CHANnel(Ch).ENABle = Value

Type

Long (read/write)

Back to STATus

STAT:QUES:RLIM:CHAN:NTR

SCPI Command

STATus:QUEStionable:RLIMit:CHANnel<Ch>:NTRansition <numeric>

STATus:QUEStionable:RLIMit:CHANnel<Ch>:NTRansition?

Description

Sets or reads out the value of the Negative transition filter of the Questionable Ripple Limit Channel Status Register.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<numeric> from 0 to 65535

Out of Range

Bit–to–bit AND with numeric 65535

Query Response

<numeric>

Preset Value

0

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.QUEStionable.RLIMit.CHANnel(Ch).NTRansition

Syntax

Dim Value As Long

Value = app.SCPI.STATus.QUEStionable.RLIMit.CHANnel(Ch).NTRansition

app.SCPI.STATus.QUEStionable.RLIMit.CHANnel(Ch).NTRansition = Value

Type

Long (read/write)

Back to STATus

STAT:QUES:RLIM:CHAN:PTR

SCPI Command

STATus:QUEStionable:RLIMit:CHANnel<Ch>:PTRansition <numeric>

STATus:QUEStionable:RLIMit:CHANnel<Ch>:PTRansition?

Description

Sets or reads out the value of the Positive transition filter of the Questionable Ripple Limit Channel Status Register.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Parameter

<numeric> from 0 to 65535

Out of Range

Bit–to–bit AND with numeric 65535

Query Response

<numeric>

Preset Value

65535

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.QUEStionable.RLIMit.CHANnel(Ch).PTRansition

Syntax

Value = app.SCPI.STATus.QUEStionable.RLIMit.CHANnel(Ch).PTRansition

app.SCPI.STATus.QUEStionable.RLIMit.CHANnel(Ch).PTRansition = Value

Type

Long (read/write)

Back to STATus

STAT:QUES:RLIM:CHAN?

SCPI Command

STATus:QUEStionable:RLIMit:CHANnel<Ch>[:EVENt]?

Description

Reads out the value of the Questionable Ripple Limit Channel Status Event Register.
query only

Target

Channel <Ch>,

<Ch>={[1]|2|3|4}

<Ch>={[1]…|16} (in N-port mode only)

Query Response

<numeric>

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.QUEStionable.RLIMit.CHANnel(Ch).EVENt

Syntax

Value = app.SCPI.STATus.QUEStionable.RLIMit.CHANnel(Ch).EVENt

Type

Long (read only)

Back to STATus

STAT:QUES:RLIM:COND?

SCPI Command

STATus:QUEStionable:RLIMit:CONDition?

Description

Reads out the value of the Questionable Ripple Limit Status Condition Register.
query only

Target

Status Reporting System

Query Response

<numeric>

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.QUEStionable.RLIMit.CONDition

Syntax

Value = app.SCPI.STATus.QUEStionable.RLIMit.CONDition

Type

Long (read only)

Back to STATus

STAT:QUES:RLIM:ENAB

SCPI Command

STATus:QUEStionable:RLIMit:ENABle <numeric>

STATus:QUEStionable:RLIMit:ENABle?

Description

Sets or reads out the value of the Questionable Ripple Limit Status Enable Register.
command/query

Target

Status Reporting System

Parameter

<numeric> from 0 to 65535

Out of Range

Bit–to–bit AND with numeric 65535

Query Response

<numeric>

Preset Value

65535

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.QUEStionable.RLIMit.ENABle

Syntax

Value = app.SCPI.STATus.QUEStionable.RLIMit.ENABle

app.SCPI.STATus.QUEStionable.RLIMit.ENABle = Value

Type

Long (read/write)

Back to STATus

STAT:QUES:RLIM:NTR

SCPI Command

STATus:QUEStionable:RLIMit:NTRansition <numeric>

STATus:QUEStionable:RLIMit:NTRansition?

Description

Sets or reads out the value of the Negative transition filter of the Questionable Ripple Limit Status Register.
command/query

Target

Status Reporting System

Parameter

<numeric> from 0 to 65535

Out of Range

Bit–to–bit AND with numeric 65535

Query Response

<numeric>

Preset Value

0

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.QUEStionable.RLIMit.NTRansition

Syntax

Value = app.SCPI.STATus.QUEStionable.RLIMit.NTRansition

app.SCPI.STATus.QUEStionable.RLIMit.NTRansition = Value

Type

Long (read/write)

Back to STATus

STAT:QUES:RLIM:PTR

SCPI Command

STATus:QUEStionable:RLIMit:PTRansition <numeric>

STATus:QUEStionable:RLIMit:PTRansition?

Description

Sets or reads out the value of the Positive transition filter of the Questionable Ripple Limit Status Register.
command/query

Target

Status Reporting System

Parameter

<numeric> from 0 to 65535

Out of Range

Bit–to–bit AND with numeric 65535

Query Response

<numeric>

Preset Value

65535

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.QUEStionable.RLIMit.PTRansition

Syntax

Value = app.SCPI.STATus.QUEStionable.RLIMit.PTRansition

app.SCPI.STATus.QUEStionable.RLIMit.PTRansition = Value

Type

Long (read/write)

Back to STATus

STAT:QUES:RLIM?

SCPI Command

STATus:QUEStionable:RLIMit[:EVENt]?

Description

Reads out the value of the Questionable Ripple Limit Status Event Register.
query only

Target

Status Reporting System

Query Response

<numeric>

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.QUEStionable.RLIMit.EVENt

Syntax

Value = app.SCPI.STATus.QUEStionable.RLIMit.EVENt

Type

Long (read only)

Back to STATus

STAT:QUES?

SCPI Command

STATus:QUEStionable[:EVENt]?

Description

Reads out the value of the Questionable Status Event Register.
query only

Target

Status Reporting System

Query Response

<numeric>

Equivalent Softkeys

None

Equivalent COM Command

SCPI.STATus.QUEStionable.EVENt

Syntax

Value = app.SCPI.STATus.QUEStionable.EVENt

Type

Long (read only)

Back to STATus

SYSTem

Command	Description		COM analog
SYST:CORR	Analyzer Parameters	System correction ON/OFF	+
SYST:DATE		Current date	+
SYST:READ?		Analyzer readiness status	+
SYST:TEMP:SENS?		Reads the Analyzer temperature	+
SYST:TERM		Analyzer software shutdown	+
SYST:TIME		Current time	+
SYST:STAN		Standby mode	+
SYST:CONN:SER	Analyzer Capabilities	Analyzer Serial N (1-port VNA only)	-
SYST:COMM:ECAL:IMP	Automatic Calibration Module	Impedance state of module port	+
SYST:COMM:ECAL:TEMP:SENS?		Module temperature	+
SYST:COMM:ECAL:THRU		"THRU" module state (N-port mode only)	+
SYST:ERR?	Status System	Reads the error message queue	-

Command	Description		COM analog
SYST:HIDE	Interface Settings	Minimizes the Analyzer window	+
SYST:LOC		Sets the local mode	+
SYST:REM		Sets the remote mode	+
SYST:RWL		Sets the remote mode with lock	+
SYST:SHOW		Restores the Analyzer window	+
SYST:PRES	Presets	Reset to default settings	+

SYST:COMM:ECAL:IMP

SCPI Command

SYSTem:COMMunicate:ECAL:IMPedance <port>,<char>

SYSTem:COMMunicate:ECAL:IMPedance? <port>

Description

Sets or reads out the impedance state of the specified port of the AutoCal module.
command/query

Parameter

<port> : Port number of the AutoCal module

<char> Specifies the math operation:

OPEN	OPEN impedance state
SHORt	SHORT impedance state
LOAD	LOAD impedance state
LOAD2	LOAD2 impedance state
OPEN2	OPEN2 impedance state

Query Response

{OPEN|SHOR|LOAD|THRU|LOAD2|OPEN2}

Preset Value

LOAD

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SYSTem.COMMunicate.ECAL.IMPedance(Pt)

Syntax

Param = app.SCPI.SYSTem.COMMunicate.ECAL.IMPedance(Pt)

app.SCPI.SYSTem.COMMunicate.ECAL.IMPedance(Pt) = "OPEN"

Type

String (read/write)

Back to SYSTem

SYST:COMM:ECAL:TEMP:SENS?

SCPI Command

SYSTem:COMMunicate:ECAL:TEMPerature:SENSor?

Description

Reads out the temperature of the AutoCal module connected to the Analyzer.
query only

Target

AutoCal module

Unit

°C (degrees Celsius)

Query Response

<numeric>

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SYSTem.COMMunicate.ECAL.TEMPerature.SENSor

Syntax

Value = app.SCPI.SYSTem.COMMunicate.ECAL.TEMPerature.SENSor

Type

Double (read)

Back to SYSTem

SYST:COMM:ECAL:THRU

SCPI Command

SYSTem:COMMunicate:ECAL:THRU <port1>,<port2>

Description

Sets the THRU state between the specified 2 ports of the AutoCal module. (N-port mode only)
command only

Parameter

<port1>	The first port number of the AutoCal module
<port2>	The second port number of the AutoCal module

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SYSTem.COMMunicate.ECAL.THRU(Pt1, Pt2)

Syntax

app.SCPI.SYSTem.COMMunicate.ECAL.THRU(1, 2)

Type

Method

Back to SYSTem

SYST:CONN:SER

SCPI Command

SYSTem:CONNect:SERial[:NUMBer] <numeric>

SYSTem:CONNect:SERial[:NUMBer] <numeric>?

Description

Sets or reads out serial number of the Analyzer to which the software is connected. (1-port VNA only)
command/query

Parameter

<number> serial number

Where: “0” is autodetect (software connects to any Analyzer).

Query Response

<numeric>

Equivalent Softkeys

System > Analyzer Model >Analyzer Serial

Equivalent COM Command

None

Back to SYSTem

SYST:CORR

SCPI Command

SYSTem:CORRection[:STATe] {OFF|ON|0|1}

SYSTem:CORRection[:STATe]?

Description

Turns the system correction ON/OFF. The system correction is the factory full one-port calibration performed at the port connectors.
command/query

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

1

Equivalent Softkeys

System > System Correction

Equivalent COM Command

SCPI.SYSTem.CORRection.STATe

Syntax

Status = app.SCPI.SYSTem.CORRection.STATe

app.SCPI.SYSTem.CORRection.STATe = False

Type

Boolean (read/write)

Back to SYSTem

SYST:DATE

SCPI Command

SYSTem:DATE <numeric 1>,<numeric 2>,<numeric 3>

SYSTem:DATE?

Description

Sets or reads out the current date.
command/query

Parameter

<numeric 1>	Year from 1900 to 2100
<numeric 2>	Month from 1 to 12
<numeric 3>	Day from 1 to 31

Query Response

<numeric 1>, <numeric 2>, <numeric 3>

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SYSTem.DATE

Syntax

Data = app.SCPI.SYSTem.DATE

app.SCPI.SYSTem.DATE = Array(2009, 9, 9)

Type

Variant (array of long) (read/write)

Back to SYSTem

SYST:ERR?

SCPI Command

SYSTem:ERRor[:NEXT]?

Description

Reads out the error message when executing SCPI commands, from the FIFO (First In First Out) error queue stored in the Analyzer. The read out error is deleted from the error queue. The *CLS command clears the error queue. The maximum size of the queue is 100 messages.
command/query

Query Response

<numeric>, <string>

Where:

<numeric> — error code,

<string> — error message.

If there is no error in the queue, "0, No error" is read out.

Equivalent Softkeys

None

Equivalent COM Command

None

Back to SYSTem

SYST:HIDE

SCPI Command

SYSTem:HIDE

Description

Minimizes the Analyzer main window, removing it from the desktop.
no query

Related Commands

SYST:SHOW

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SYSTem.HIDE

Syntax

app.SCPI.SYSTem.HIDE

Type

Method

Back to SYSTem

SYST:LOC

SCPI Command

SYSTem:LOCal

Description

Sets the Analyzer to the local operation mode, when all the keys on the front panel, mouse, and touch screen are active.
no query

Related Commands

SYST:REM

SYST:RWL

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SYSTem.LOCal

Syntax

app.SCPI.SYSTem.LOCal

Type

Method

Back to SYSTem

SYST:PRES

SCPI Command

SYSTem:PRESet

Description

Resets the Analyzer to default settings. **Note**: The difference from the*RST: command is that the trigger is set to the Continuous trigger mode.
no query

Related Commands

*RST

Equivalent Softkeys

System > Preset > OK

Equivalent COM Command

SCPI.SYSTem.PRESet

Syntax

app.SCPI.SYSTem.PRESet

Type

Method

Back to SYSTem

SYST:READy?

SCPI Command

SYSTem:READy[:STATe]?

Description

Reads out the Analyzer readiness status. 1 indicates that the Analyzer is ready. 0 indicates that the Analyzer is not ready. The state is ready after the initialization is completed. Initialization occurs after connecting and turning on the Analyzer hardware or after starting the software. Initialization takes about 10-15 seconds.
query only

Query Response

{0|1}, 1 — the Analyzer is ready, 0 — the Analyzer is not ready.

Equivalent Softkeys

None

Equivalent COM Command

Ready

Syntax

State = app.Ready

Type

Boolean (read only)

Back to SYSTem

SYST:REM

SCPI Command

SYSTem:REMote

Description

Sets the Analyzer to the remote operation mode, when all the keys on the front panel, mouse, and the touch screen are not active, except for one key labeled "Return to Local". Pushing this button will reset the Analyzer to the local operation mode.
no query

Related Commands

SYST:LOC

SYST:RWL

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SYSTem.REMote

Syntax

app.SCPI.SYSTem.REMote

Type

Method

Back to SYSTem

SYST:RWL

SCPI Command

SYSTem:RWLock

Description

Sets the Analyzer to the remote operation mode, when all the keys on the front panel, mouse, and touch screen are not active. Only SYST:LOC or SYST:REM command can release this remote operation mode.
no query

Related Commands

SYST:LOC

SYST:REM

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SYSTem.RWLock

Syntax

app.SCPI.SYSTem.RWLock

Type

Method

Back to SYSTem

SYST:SHOW

SCPI Command

SYSTem:SHOW

Description

Restores the Analyzer window hidden by SYST:HIDE.
no query

Related Commands

SYST:HIDE

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SYSTem.SHOW

Syntax

app.SCPI.SYSTem.SHOW

Type

Method

Back to SYSTem

SYST:STAN

SCPI Command

SYSTem:STANdby[:STATe] {OFF|ON}

SYSTem:STANdby[:STATe]?

Description

Standby state of the Analyzer.
command/query

Parameter

<char> Choose from:

{ON|1}	Analyzer in Standby mode
{OFF|0}	Analyzer in Normal mode

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

System -> Standby Mode

Equivalent COM Command

SCPI.SYSTem.STANdby

Syntax

State = app.SCPI.SYSTem.STANdby

app.SCPI.SYSTem.STANdby = False

Type

Boolean

Back to SYSTem

SYST:TEMP:SENS?

SCPI Command

SYSTem:TEMPerature:SENSor<Idx>?

Description

Reads out the specified sensor temperature inside the Analyzer.
query only

Target

Analyzer

Parameter

<numeric> : Sensor number

Unit

°C (degrees Celsius)

Query Response

<numeric>

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SYSTem.TEMPerature.SENSor(Idx)

Syntax

Value = app.SCPI.SYSTem.TEMPerature.SENSor(1)

Type

Double (read only)

WARNING	Object SENSor has an index of 1, which can be omitted in Visual Basic, but it cannot be omitted in other programming languages.

Back to SYSTem

SYST:TERM

SCPI Command

SYSTem:TERMinate

Description

Terminates the Analyzer software.
no query

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SYSTem.TERMinate

Syntax

app.SCPI.SYSTem.TERMinate

Type

Method

Back to SYSTem

SYST:TIME

SCPI Command

SYSTem:TIME <numeric 1>,<numeric 2>,<numeric 3>

SYSTem:TIME?

Description

Sets or reads out the current time.
command/query

Parameter

<numeric 1>	Hours from 0 to 23
<numeric 2>	Minutes from 0 to 59
<numeric 3>	Seconds from 0 to 59

Query Response

<numeric 1>, <numeric 2>, <numeric 3>

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SYSTem.TIME

Syntax

Data = app.SCPI.SYSTem.TIME

app. app.SCPI.SYSTem.TIME = Array(15, 20, 30)

Type

Variant (array of long) (read/write)

Back to SYSTem

TRIGger

Command	Description		COM analog
TRIG	Trigger Settings	Generates the trigger signal	+
TRIG:SING		Generates the trigger signal. The command is pending until the sweep end	+
TRIG:SOUR		Trigger source	+
TRIG:STAT?		Current state of the trigger system	+
TRIG:WAIT		Waits for the specified trigger state to be reached	+
TRIG:EXT:DEL	External Trigger Settings	Response delay to the external trigger	+
TRIG:EXT:SLOP		Trigger polarity	+
TRIG:EXT:POS		Trigger position	+
TRIG:POIN		Point trigger ON/OFF	+
TRIG:OUTP:FUNC	Trigger Output Settings	Trigger output function	+
TRIG:OUTP:POL		Trigger polarity	+
TRIG:OUTP:STAT		Trigger output ON/OFF	+

TRIG

SCPI Command

TRIGger[:SEQuence][:IMMediate]

Description

Generates a trigger signal and initiates a sweep under the following conditions: 1. Trigger source is set to the BUS (set by the command TRIG:SOUR BUS), otherwise an error occurs, and the command is ignored. 2. Analyzer must be in the trigger waiting state, otherwise (the analyzer is in the measurement state or in the hold state) an error occurs, and the command is ignored. The command is completed immediately after the generation of the trigger signal (does not wait the end of a sweep).
no query

Related Commands

TRIG:SOUR BUS

INIT:CONT

INIT

Equivalent Softkeys

None

Equivalent COM Command

SCPI.TRIGger.SEQuence.IMMediate

Syntax

app.SCPI.TRIGger.SEQuence.IMMediate

Type

Method

Back to TRIGger

TRIG:EXT:DEL

SCPI Command

TRIGger[:SEQuence]:EXTernal:DELay <time>

TRIGger[:SEQuence]:EXTernal:DELay?

Description

Sets or reads out the response delay with respect to the external trigger signal.
command/query

Parameter

<time> the delay value from 0 to 100 sec.

Unit

sec (second)

Query Response

<numeric>

Preset Value

0

Out of Range

Sets the value of the limit, which is closer to the specified value.

Related Commands

TRIG:SOUR EXT

Equivalent Softkeys

Trigger > Trig Input > Delay

Equivalent COM Command

SCPI.TRIGger.SEQuence.EXTernal.Delay

Syntax

Param = app.SCPI.TRIGger.EXTernal.Delay

app.SCPI.TRIGger.INPut.EXTernal.Delay = 0

Type

Double (read/write)

Back to TRIGger

TRIG:EXT:SLOP

SCPI Command

TRIGger[:SEQuence]:EXTernal:SLOPe <char>

TRIGger[:SEQuence]:EXTernal:SLOPe?

Description

Sets or reads out the polarity of the external trigger.
command/query

Parameter

<char> Choose from:

POSitive	Positive edge
NEGative	Negative edge

Query Response

{POS|NEG}

Preset Value

NEG

Related Commands

TRIG:SOUR

Trigger > Trigger Input >Polarity {Negative edge | Positive edge}

Equivalent COM Command

SCPI.TRIGger.SEQuence.EXTernal.SLOPe

Syntax

Param = app.SCPI.TRIGger.EXTernal.SLOPe

app.SCPI.TRIGger.INPut.EXTernal.SLOPe = "POS"

Type

String (read/write)

Back to TRIGger

TRIG:EXT:POS

SCPI Command

TRIGger[:SEQuence]:EXTernal:POSition <char>

TRIGger[:SEQuence]:EXTernal:POSition?

Description

Selects the position of the external trigger. The Analyzer waits for external trigger: • Before sampling, when the frequency of the stimulus port has been set. • Before the frequency setup and subsequent measurement. The frequency change of the stimulus port begins when the external trigger arrives. Depending on the command TRIG:POIN the external trigger wait occurs before each point or before the first point of the full sweep cycle.
command/query

Parameter

<char> Choose from:

BSAM	Before sampling
BSET	Before frequency setup

Query Response

{BSAM|BSET}

Preset Value

BSAM

Related Commands

TRIG:SOUR

Equivalent Softkeys

Trigger > Trig Input > Position {Before sampling | Before setup}

Equivalent COM Command

SCPI.TRIGger.SEQuence.EXTernal.POSition

Syntax

Param = app.SCPI.TRIGger.EXTernal.POSition

app.SCPI.TRIGger.INPut.EXTernal.POSition = "BSAM"

Type

String (read/write)

Back to TRIGger

TRIG:OUTP:FUNC

SCPI Command

TRIGger:OUTPut:FUNCtion <char>

TRIGger:OUTPut:FUNCtion?

Description

Selects the trigger output function. The trigger output outputs various waveforms depending on the setting of the Output Trigger Function (See the Trigger Output Function). **Note.** The function **Ready for trigger** is not available for R140B.
command/query

Parameter

<char> Choose from:

BSET	Before frequency setup pulse
BSAM	Before sampling pulse
ASAM	After sampling pulse
RTRG	Ready for trigger signal (except R140B)
ESWP	End of sweep pulse
MEAS	Measurement sweep signal

Query Response

{BSET|BSAM|ASAM|RTGR|ESWP|MEAS}

Preset Value

RTRG

Related Commands

TRIG:OUTP:STAT

Equivalent Softkeys

Trigger > Trigger Output > Position > {Before setup | Before sampling | After sampling | Ready for trigger | Sweep End | Measurement}

Equivalent COM Command

SCPI.TRIGger.OUTPut.FUNCtion

Syntax

Param = app.SCPI.TRIGger.OUTPut.FUNCtion

app.SCPI.TRIGger.INPut.OUTPut.FUNCtion = "ESWP"

Type

String (read/write)

Back to TRIGger

TRIG:OUTP:POL

SCPI Command

TRIGger:OUTPut:POLarity <char>

TRIGger:OUTPut:POLarity?

Description

Sets or reads out the polarity of the trigger output.
command/query

Parameter

<char> Choose from:

POSitive	Positive edge
NEGative	Negative edge

Query Response

{POS|NEG}

Preset Value

NEG

Related Commands

TRIG:OUTP:FUNC

Equivalent Softkeys

Trigger > Trigger Output > Polarity {Negative edge | Positive edge}

Equivalent COM Command

SCPI.TRIGger.OUTPut.POLarity

Syntax

Param = app.SCPI.TRIGger.OUTPut.POLarity

app.SCPI.TRIGger.INPut.OUTPut.POLarity = "NEG"

Type

String (read/write)

Back to TRIGger

TRIG:OUTP:STAT

SCPI Command

TRIGger:OUTPut:STATe {OFF|ON|0|1}

TRIGger:OUTPut:STATe?

Description

Turns the trigger output ON/OFF.
command/query

Parameter

Specifies the trigger output function state:

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Commands

TRIG:OUTP:FUNC

Equivalent Softkeys

Trigger > Trigger Output > Enable Out {ON/OFF}

Equivalent COM Command

SCPI.TRIGger.OUTPut.STATe

Syntax

Param = app.SCPI.TRIGger.OUTPut.STATe

app.SCPI.TRIGger.INPut.OUTPut.STATe = True

Type

Boolean (read/write)

Back to TRIGger

TRIG:POIN

SCPI Command

TRIGger[:SEQuence]:POINt {OFF|ON|0|1}

TRIGger[:SEQuence]:POINt?

Description

Turns the point trigger feature ON/OFF. When the point trigger is turned ON, the external trigger response is the single point. When the point trigger feature is turned OFF, the external trigger response is the entire sweep.
command/query

Parameter

Specifies the point trigger function state:

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Related Commands

TRIG:SOUR EXT

Equivalent Softkeys

Trigger > Triggger Input > Event {On Sweep | On Point}

Equivalent COM Command

SCPI.TRIGger.SEQuence.POINt

Syntax

Status = app.SCPI.TRIGger.SEQuence.POINt

app.SCPI.TRIGger.SEQuence.POINt = True

Type

Boolean (read/write)

Back to TRIGger

TRIG:SING

SCPI Command

TRIGger[:SEQuence]:SINGle

Description

Generates a trigger signal and initiates a sweep under the following conditions.

- Trigger source is set to the BUS (set by the command TRIG:SOUR BUS), otherwise an error occurs and the command is ignored.
- Analyzer must be in the trigger waiting state, otherwise (the Analyzer is in the measurement state or in the hold state) an error occurs, and the command is ignored.

As opposed to the TRIG command this command is pending till the end of the sweep. The end of the sweep initiated by the TRIG:SING command can be waited using the *OPC? query.

no query

Related Commands

TRIG:SOUR

INIT:CONT

INIT

Equivalent Softkeys

None

Equivalent COM Command

SCPI.TRIGger.SEQuence.SINGle

Syntax

app.SCPI.TRIGger.SEQuence.SINGle

Type

Method

Back to TRIGger

TRIG:SOUR

SCPI Command

TRIGger[:SEQuence]:SOURce <char>

TRIGger[:SEQuence]:SOURce?

Description

Sets or reads out the sweep trigger source.
command/query

Parameter

<char> Choose from:

INTernal	Internal
EXTernal	External
BUS	Bus

Query Response

{INT|EXT|BUS}

Preset Value

INT

Related Commands

TRIG

TRIG:SING

*TRG

Equivalent Softkeys

Trigger > Trigger Source > {Internal | External | Bus}

Equivalent COM Command

SCPI.TRIGger.SEQuence.SOURce

Syntax

app.SCPI.TRIGger.SEQuence.SOURce

app.SCPI.TRIGger.SEQuence.SOURce = "BUS"

Type

String (read/write)

Back to TRIGger

TRIG:STAT?

SCPI Command

TRIGger[:SEQuence]:STATus?

Description

Reads out the current state of the Analyzer trigger system.
query only

Parameter

HOLD	Stop
MEAS	Measurement Cycle
WAIT	Waiting for trigger
NOTREADY	Not Ready

Equivalent Softkeys

None

Equivalent COM Command

SCPI.TRIGger.SEQunce.STATe

Syntax

Param = app.SCPI.TRIGger.SEQuence.STATe

Type

String (read/write)

Back to TRIGger

TRIG:WAIT

SCPI Command

TRIGger[:SEQuence]:WAIT <char>

Description

Delays the execution by the analyzer of the next command till the specified state of the analyzer has been reached (see options below). A query that follows the TRIG:WAIT command blocks the execution of the user program till the specified state of the analyzer has been reached. The command can be used to wait for the end of the sweep initiated by the commands TRIG, *TRG or initiated by the external trigger signal. If the continuous initiation mode is turned ON by the command INIT:CONT ON, then the parameter of the command must be WAIT, otherwise HOLD.
no query

Parameter

<char> Choose from:

HOLD	Waits for the "Hold" state
MEASure	Waits for the "Measure" state
WTRG	Waits for the "Trigger Waiting" state

Related Commands

TRIG

*TRG

TRIG:SOUR EXT

Equivalent Softkeys

None

Equivalent COM Command

SCPI.TRIGger.SEQuence.WAIT(STATus)

Syntax

app.SCPI.TRIGger.SEQuence.WAIT(“HOLD”)

Type

Method

Back to TRIGger

Programming Tips

This section gives recommendations for programming in certain specific situations.

Program Sweep Initiation and Waiting

The simplest method of program sweep initiation and waiting for sweep completion can be implemented by using the commands TRIG:SING and *OPC?.

The command TRIG:SING generates a trigger signal and starts sweeping under the following conditions:

- The program trigger source is selected by command TRIG:SOUR BUS.
- The Analyzer should be in the trigger waiting state, otherwise (Analyzer is sweeping, or Analyzer is in the hold state) an error occurs, and the command is ignored.

The transition of the Analyzer to the trigger waiting state depends on the state of the continuous initiation mode, which is set by command INIT:CONT. Provided that the continuous initiation mode is ON, the Analyzer automatically transits to the trigger waiting state when the program trigger source has been selected, and then each time at the end of a sweep. Provided that the continuous initiation mode is OFF, the Analyzer transits to the trigger waiting state for single time upon receiving the command INIT.

The command TRIG:SING remains pending until the end of sweep. This allows use the *OPC? query for the waiting the end of sweep.

Example 1. Program starts sweeping in all channels and waits for completion. The channels are swept one by one in turn. The continuous initiation mode must be enabled (after PRESET, for example).

TRIG:SOUR BUS <loop>: TRIG:SING *OPC? ...	Selects the program trigger source and transits the analyzer to the trigger waiting state. Starts sweep. Waits for the end of the sweep.

After sweep completion the Analyzer returns to the trigger waiting state, and then the next trig:sing command can be sent.

Example 2. The program starts the sweep in one channel and waits for completion, then starts a sweep in another channel and waits for completion. The number of channels must be set to 2.

TRIG:SOUR BUS INIT1:CONT OFF INIT2:CONT OFF <loop>: INIT1 TRIG:SING *OPC? ... INIT2 TRIG:SING *OPC? ...	Selects the program trigger source. Puts channel 1 to the hold state. Puts channel 2 to the hold state. Puts channel 1 to the trigger waiting state. Starts sweep in channel 1. Waits for the end of the sweep. Puts channel 2 to the trigger waiting state. Starts sweep in channel 2. Waits for the end of the sweep.

After sweep completion on one channel the Analyzer returns to the hold state and sweep initiation for another channel is then available.

Using External Trigger

If the trigger source is set to External by the command TRIG:SOUR EXT, the sweep starts at the arrival of the signal on the external trigger input.

The Analyzer must be in the trigger waiting state when the trigger signal arrives, otherwise the signal is ignored but no error is detected.

When using the external trigger input, the hardware trigger output can also be used to determine the end of the sweep. The TRIG:WAIT command can be used if there is a need to determine the end of the sweep using the program.

Example 3. The program puts the Analyzer into external trigger waiting. Then program waits for the sweep completion. The continuous initiation mode must be enabled (after PRESET, for example).

TRIG:SOUR EXT	Selects the external trigger source and transits the Analyzer to the trigger waiting state.
<loop>:	
TRIG:WAIT ENDM	Waits for the end of the sweep.
*OPC?	Any query is required to block program.
...	

After sweep completion the Analyzer returns to the trigger waiting state, and then the next external trigger signal starts a new sweep.

Waiting for Calibration Commands

Depending on the sweep settings the calibration commands may have a long execution time, as they start the sweep and wait for it to complete. These commands are:

SENS:CORR:COLL:XXXX

SENS:CORR:COLL:ECAL:XXXX

SENS:CORR:COLL:ECAL:ORI:EXEC

The user program can stop execution until the end of these commands using any query, the *OPC? for example.

VISA Timeout Considerations

Using the *OPC? or any other query when waiting for an operation to complete can lead to VISA timeout. The program must set the timeout to a value no less than the expected sweep time. For example:

```
viSetAttribute(instr, VI_ATTR_TMO_VALUE, 5000);
```

If a timeout has occurred, the Analyzer remains in the waiting state and does not respond to the next commands. The program must check the timeout condition and recover the Analyzer in case of the timeout. The recover code must include the Device Clear operation (viClear). The viClear function clears the device input and output buffers. Optionally, the recover code can include other operations, for example abort the current sweep or clear reporting status system.

```
status = viQueryf(instr, "TRIG:SING;*OPC?\n", "%*t");

if (status == VI_ERROR_TMO)

{

    viClear(instr);
    viPrintf(instr, "ABORt\n");
    viPrintf(instr, "*CLS\n");

}
```

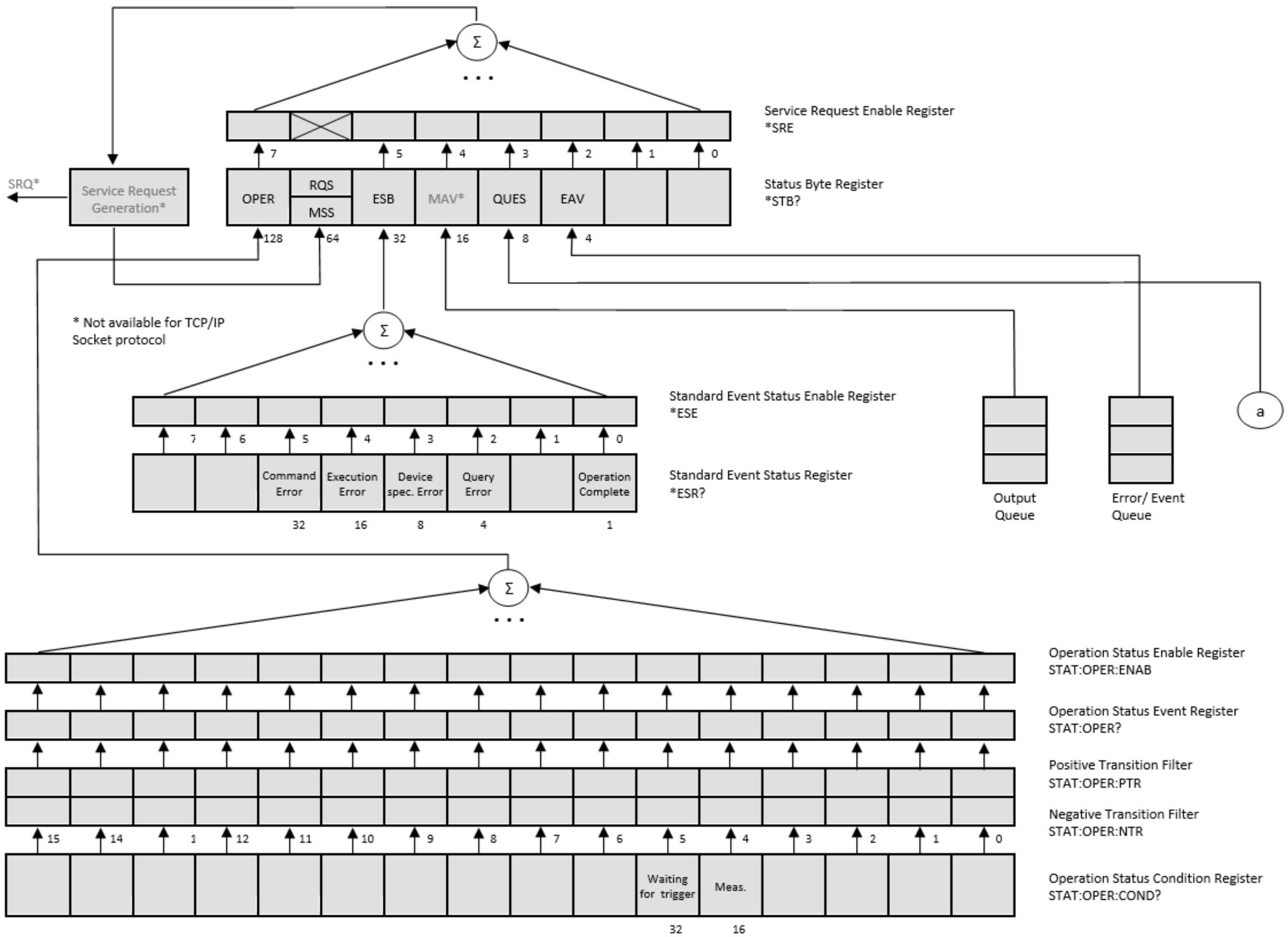
Receiving Data Arrays in Text Format

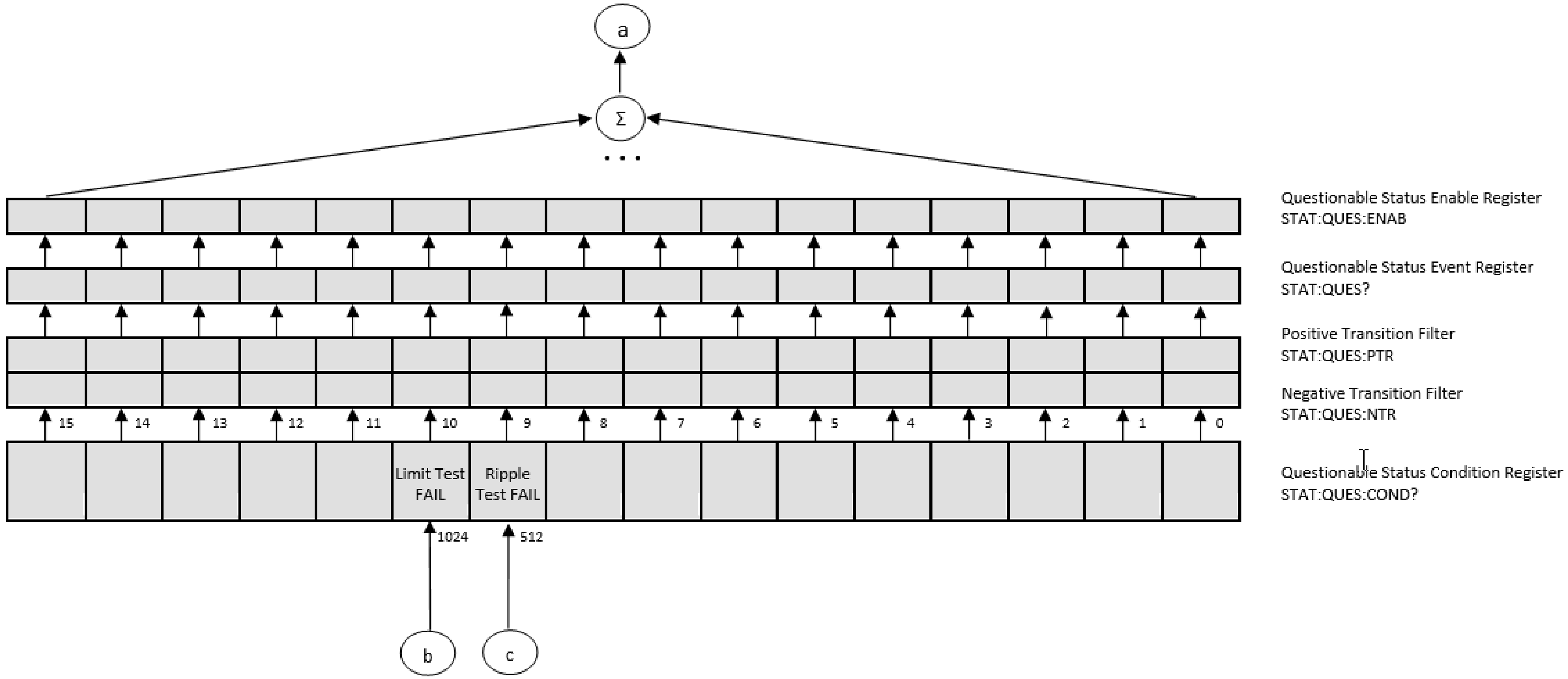
By default, the data from the Analyzer is transmitted in text form. The VISA library has built-in facilities for receiving an array of data from the Analyzer. The example assumes that the size of the array is sufficient to receive a number of elements equal to twice the number of points.

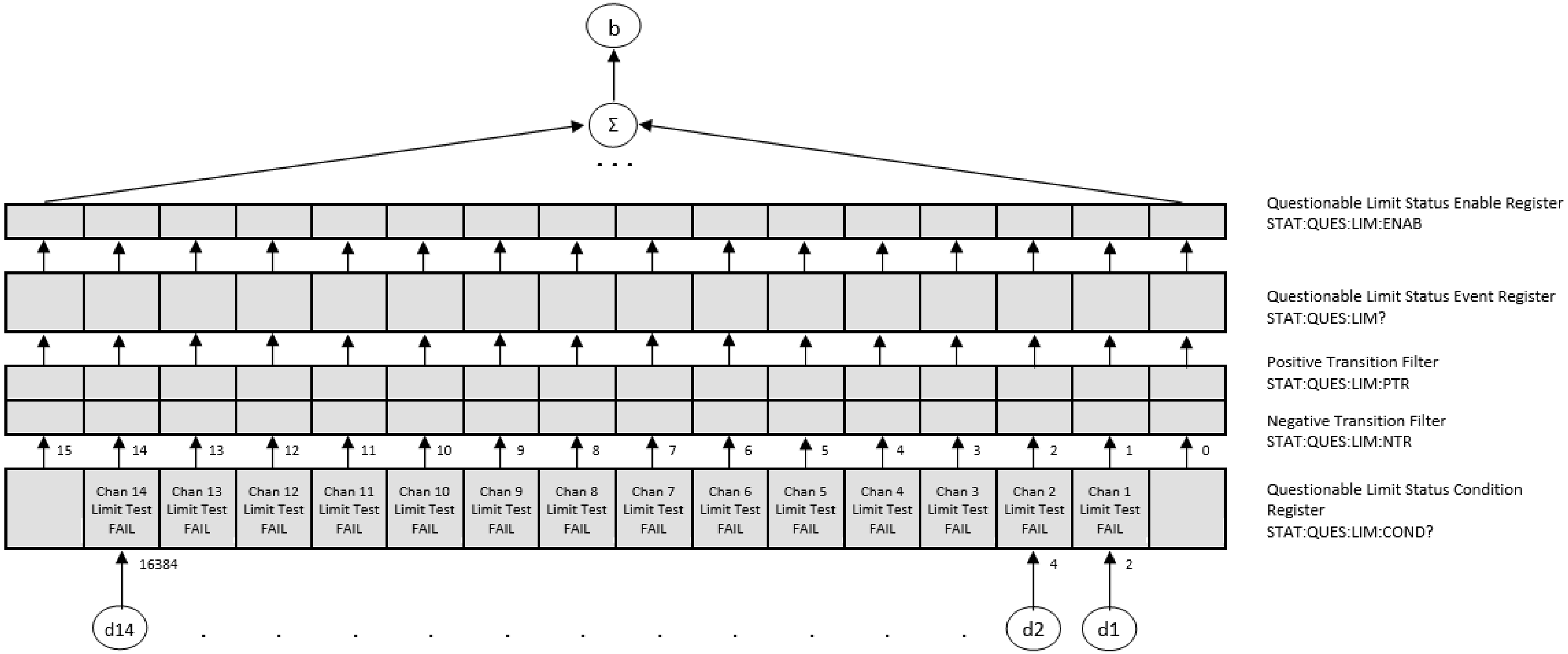
Example of receiving a data array in text format:

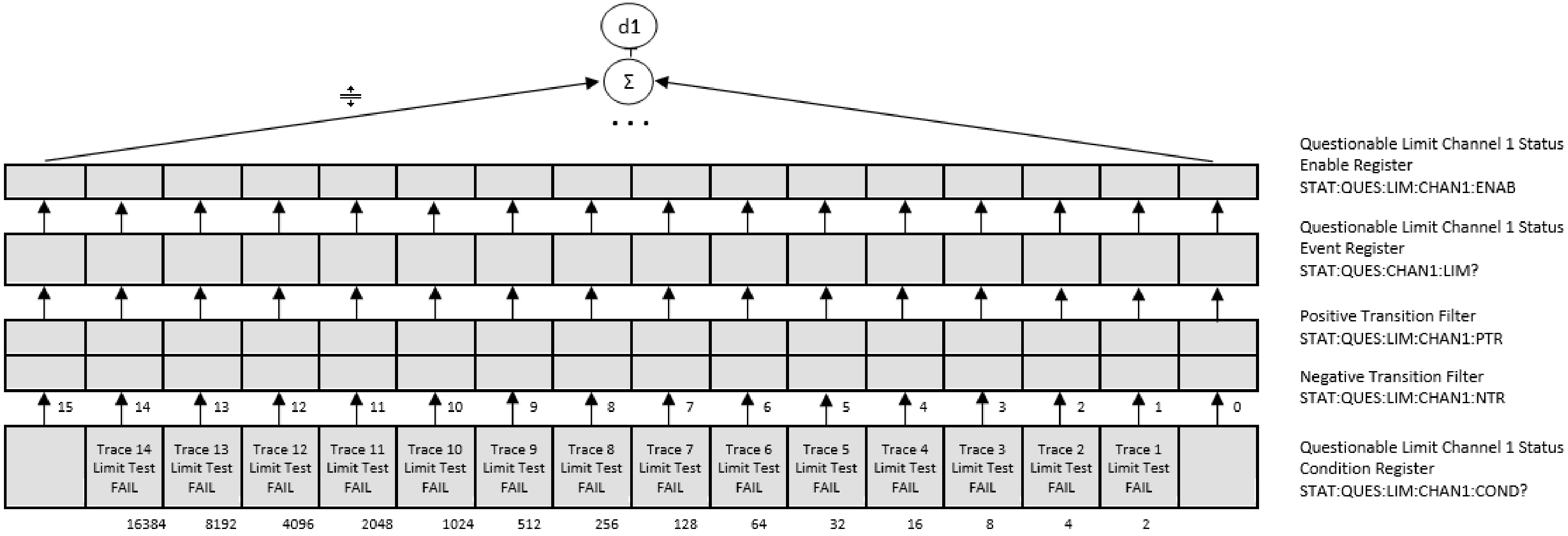
```
double data[NOP * 2];

ViUInt32 retCount;

...

retCount = sizeof(data) / sizeof(double);

viQueryf(instr, "CALC:DATA:SDAT?\n", "%,#lf", &retCount, data);

    // retCount now contains the actual number of elements
```

IEEE488.2 Status Reporting System

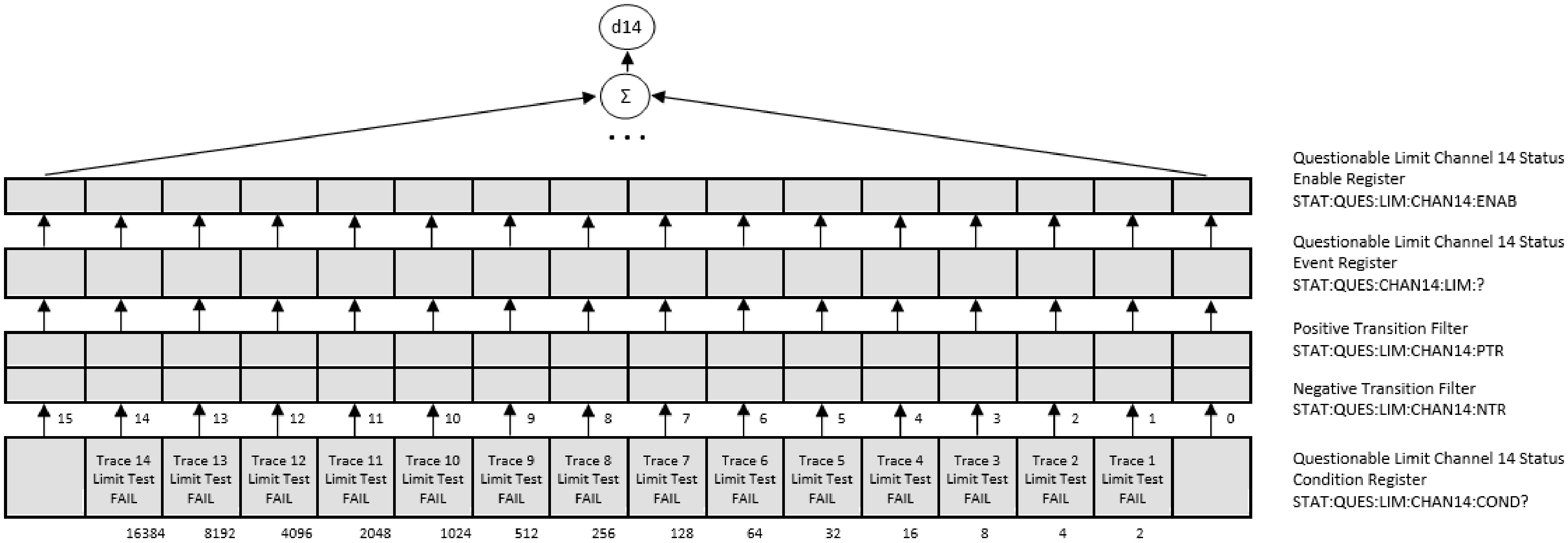


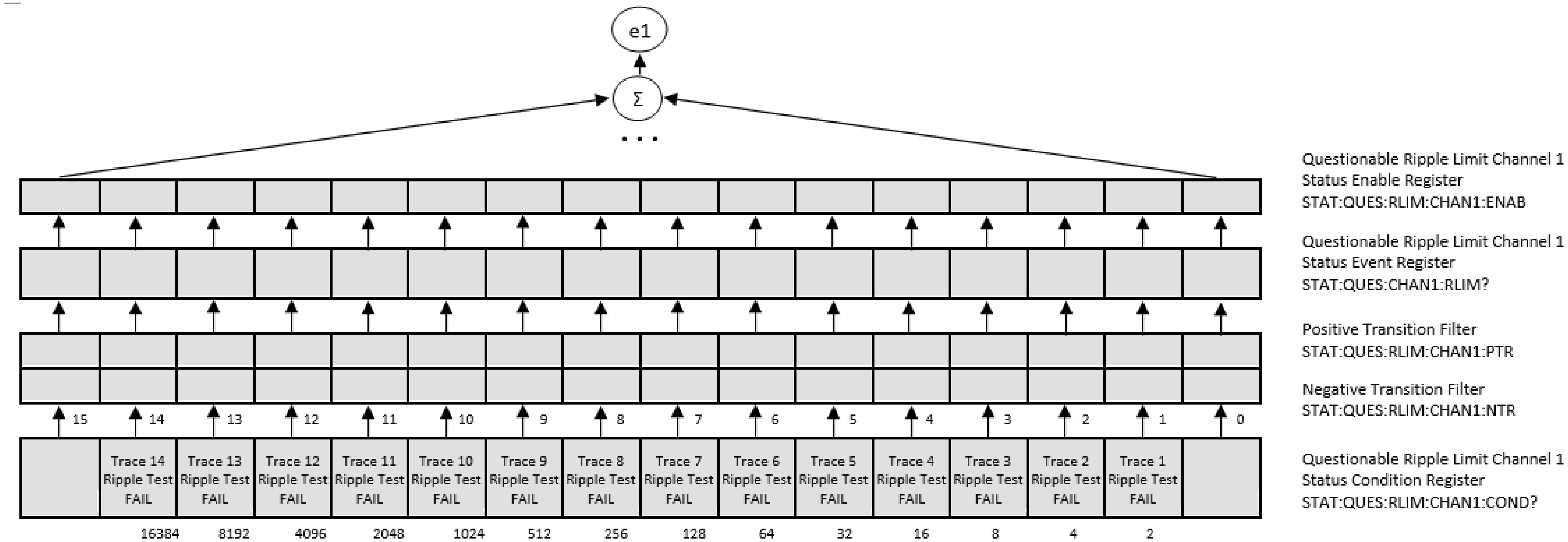

a
Σ
Questionable Status Enable Register
STAT:QUES:ENAB
Questionable Status Event Register
STAT:QUES?
Positive Transition Filter
STAT:QUES:PTR
Negative Transition Filter
STAT:QUES:NTR
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Limit Test FAIL
Ripple Test FAIL
Questionable Status Condition Register
STAT:QUES:COND?
1024
512
b
c

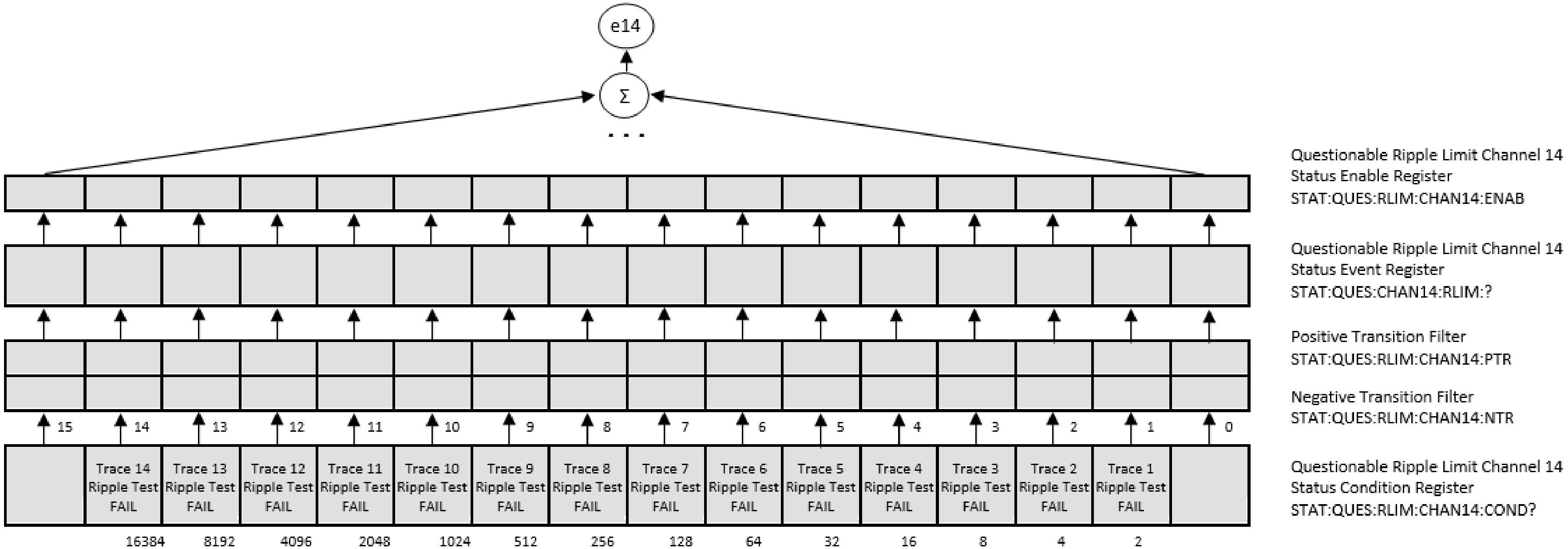

b
Σ
Questionable Limit Status Enable Register
STAT:QUES:LIM:ENAB
Questionable Limit Status Event Register
STAT:QUES:LIM?
Positive Transition Filter
STAT:QUES:LIM:PTR
Negative Transition Filter
STAT:QUES:LIM:NTR
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Chan 14 Limit Test FAIL
Chan 13 Limit Test FAIL
Chan 12 Limit Test FAIL
Chan 11 Limit Test FAIL
Chan 10 Limit Test FAIL
Chan 9 Limit Test FAIL
Chan 8 Limit Test FAIL
Chan 7 Limit Test FAIL
Chan 6 Limit Test FAIL
Chan 5 Limit Test FAIL
Chan 4 Limit Test FAIL
Chan 3 Limit Test FAIL
Chan 2 Limit Test FAIL
Chan 1 Limit Test FAIL
Questionable Limit Status Condition Register
STAT:QUES:LIM:COND?
16384
4
2
d14
d2
d1



d1
Σ
Questionable Limit Channel 1 Status Enable Register
STAT:QUES:LIM:CHAN1:ENAB
Questionable Limit Channel 1 Status Event Register
STAT:QUES:CHAN1:LIM?
Positive Transition Filter
STAT:QUES:LIM:CHAN1:PTR
Negative Transition Filter
STAT:QUES:LIM:CHAN1:NTR
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Trace 14 Limit Test FAIL
Trace 13 Limit Test FAIL
Trace 12 Limit Test FAIL
Trace 11 Limit Test FAIL
Trace 10 Limit Test FAIL
Trace 9 Limit Test FAIL
Trace 8 Limit Test FAIL
Trace 7 Limit Test FAIL
Trace 6 Limit Test FAIL
Trace 5 Limit Test FAIL
Trace 4 Limit Test FAIL
Trace 3 Limit Test FAIL
Trace 2 Limit Test FAIL
Trace 1 Limit Test FAIL
Questionable Limit Channel 1 Status Condition Register
STAT:QUES:LIM:CHAN1:COND?
16384 8192 4096 2048 1024 512 256 128 64 32 16 8 4 2


d14
Σ
Questionable Limit Channel 14 Status
Enable Register
STAT:QUES:LIM:CHAN14:ENAB
Questionable Limit Channel 14 Status
Event Register
STAT:QUES:CHAN14:LIM:?
Positive Transition Filter
STAT:QUES:LIM:CHAN14:PTR
Negative Transition Filter
STAT:QUES:LIM:CHAN14:NTR
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Trace 14 Limit Test FAIL
Trace 13 Limit Test FAIL
Trace 12 Limit Test FAIL
Trace 11 Limit Test FAIL
Trace 10 Limit Test FAIL
Trace 9 Limit Test FAIL
Trace 8 Limit Test FAIL
Trace 7 Limit Test FAIL
Trace 6 Limit Test FAIL
Trace 5 Limit Test FAIL
Trace 4 Limit Test FAIL
Trace 3 Limit Test FAIL
Trace 2 Limit Test FAIL
Trace 1 Limit Test FAIL
Questionable Limit Channel 14 Status
Condition Register
STAT:QUES:LIM:CHAN14:COND?
16384
8192
4096
2048
1024
512
256
128
64
32
16
8
4
2


e1
Σ
Questionable Ripple Limit Channel 1
Status Enable Register
STAT:QUES:RLIM:CHAN1:ENAB
Questionable Ripple Limit Channel 1
Status Event Register
STAT:QUES:CHAN1:RLIM?
Positive Transition Filter
STAT:QUES:RLIM:CHAN1:PTR
Negative Transition Filter
STAT:QUES:RLIM:CHAN1:NTR
Questionable Ripple Limit Channel 1
Status Condition Register
STAT:QUES:RLIM:CHAN1:COND?
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Trace 14 Ripple Test FAIL
Trace 13 Ripple Test FAIL
Trace 12 Ripple Test FAIL
Trace 11 Ripple Test FAIL
Trace 10 Ripple Test FAIL
Trace 9 Ripple Test FAIL
Trace 8 Ripple Test FAIL
Trace 7 Ripple Test FAIL
Trace 6 Ripple Test FAIL
Trace 5 Ripple Test FAIL
Trace 4 Ripple Test FAIL
Trace 3 Ripple Test FAIL
Trace 2 Ripple Test FAIL
Trace 1 Ripple Test FAIL
16384
8192
4096
2048
1024
512
256
128
64
32
16
8
4
2


e14
Σ
Questionable Ripple Limit Channel 14
Status Enable Register
STAT:QUES:RLIM:CHAN14:ENAB
Questionable Ripple Limit Channel 14
Status Event Register
STAT:QUES:CHAN14:RLIM:?
Positive Transition Filter
STAT:QUES:RLIM:CHAN14:PTR
Negative Transition Filter
STAT:QUES:RLIM:CHAN14:NTR
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Trace 14 Ripple Test FAIL
Trace 13 Ripple Test FAIL
Trace 12 Ripple Test FAIL
Trace 11 Ripple Test FAIL
Trace 10 Ripple Test FAIL
Trace 9 Ripple Test FAIL
Trace 8 Ripple Test FAIL
Trace 7 Ripple Test FAIL
Trace 6 Ripple Test FAIL
Trace 5 Ripple Test FAIL
Trace 4 Ripple Test FAIL
Trace 3 Ripple Test FAIL
Trace 2 Ripple Test FAIL
Trace 1 Ripple Test FAIL
Questionable Ripple Limit Channel 14
Status Condition Register
STAT:QUES:RLIM:CHAN14:COND?
16384
8192
4096
2048
1024
512
256
128
64
32
16
8
4
2

Error Codes

Name	Description
100	Command error
101	Unmatched quote
102	Unmatched bracket
103	Invalid value in numeric list
104	Data type error
106	Numeric parameter overflow
107	Wrong units in numeric data
108	Parameter not allowed
109	Missing parameter
110	Command header error
114	Header suffix out of range
200	Execution error
201	Invalid channel index
202	Invalid trace index
203	Invalid marker index
204	Marker is not enabled
205	Invalid save type specifier
206	Invalid sweep type specifier
207	Invalid trigger source specifier
208	Invalid measurement parameter specifer

Name	Description
209	Invalid format specifier
210	Invalid data math specifier
211	Trigger ignored
212	Invalid trigger source
213	Init ignored
214	Invalid limit data
215	Invalid segment dat
216	Invalid standard type specifier
217	Invalid conversion specifier
218	Invalid gating shape specifier
219	Invalid gating type specifier
220	Parameter Error
221	Invalid port index
222	Data out of range
223	No Calibration Measurement Data
224	Illegal parameter value
225	Calibration Kit Definition Error
230	ACM Auto-Orientation Error
231	ACM Orientation Settings Error
232	AutoCal Execution Error
233	ACM Frequency Settings Error

Name	Description
234	ACM Characterization Error
235	Frequency Range Exceeds ACM Characterization Frequency Range
236	AutoCal Module Reading Error
237	Incorrect set of measured parameters
238	Calibration Execution Error
239	TRIG:SING interrupted
240	Analyzer not ready
241	AutoCal Module not ready
251	Invalid trigger scope specifier
252	Invalid trigger polarity specifier
253	Invalid trigger position specifier
256	File not found
300	Device-specific error
302	Status reporting system error
400	Query error
403	Query error: no data
404	Query truncated
410	Query Interrupted

SCPI Programming Examples

Example. Program Written in C

The following program shows the control over the Analyzer using the C language with the VISA library.

The Analyzer address is passed as a parameter in the command line at the start of the program. For more detail on VISA Resource Name, see the VISA library documentation.

Program description:

1. Sets up communication with the Analyzer.

2. Reads out and displays the Analyzer information string.

3. Sets some parameters for the Analyzer.

4. Triggers the measurement and waits for sweep completion.

5. Reads out the measurement data and the frequency values at the measurement points.

6. Displays the measurement data

```
// Example.cpp

//

// VISA Header: visa.h (must be included)

// VISA Library: visa32.lib (must be linked with)

#include "stdafx.h"

#include "visa.h"

int main(int argc, char* argv[])

{

        ViStatus status; // Error checking

        ViSession defaultRM, instr; // Communication channels
```

```
ViUInt32 retCount; // Return count from string I/O
ViByte buffer[255]; // Buffer for string I/O
ViUInt32 temp;
int NOP = 21; // Number of measurement points
const int maxCnt = 100; // Maximum reading count
double Data[maxCnt*2]; // Measurement data array
double Freq[maxCnt]; // Frequency array
if (argc < 2)
{
    printf("\nUsage: Example <VISA address>\n\n");
    printf("VISA address examples:\n");
    printf(" TCPIP::nnn.nnn.nnn.nnn::5025::SOCKET\n");
    printf(" TCPIP::hostname::5025::SOCKET\n");
    return –1;
}
status = viOpenDefaultRM(&defaultRM);
if (status < VI_SUCCESS)
{
    printf("Can't initialize VISA\n");
    return –1;
}
    status = viOpen(defaultRM, argv[1], VI_NULL, VI_NULL, &instr);
if (status < VI_SUCCESS)
```

```
{
    printf("Can't open VISA address: %s\n", argv[1]);
    return –1;
}
//
// Set the answer timeout
//
viSetAttribute(instr, VI_ATTR_TMO_VALUE, 5000);
//
// Enable the terminal character
//
viSetAttribute(instr, VI_ATTR_TERMCHAR_EN, VI_TRUE);
viSetAttribute(instr, VI_ATTR_TERMCHAR, '\n');
//
// Read ID string from Analyzer
//
viPrintf(instr, "*IDN?\n");
viRead(instr, buffer, sizeof(buffer), &retCount);
printf("*IDN? Returned %d bytes: %.*s\n\n", retCount, retCount, buffer);
//
// Set up the Analyzer
//
viPrintf(instr, "SYST:PRES\n");
```

```
viPrintf(instr, "SENS:SWE:POIN %d\n", NOP);
viPrintf(instr, "CALC:PAR1:DEF S21\n");
viPrintf(instr, "CALC:PAR1:SEL\n");
viPrintf(instr, "CALC:FORM MLOG\n");
viPrintf(instr, "SENS:BAND 10\n");
//
// Trigger measurement and wait for completion
//
viPrintf(instr, ":TRIG:SOUR BUS\n");
viPrintf(instr, ":TRIG:SING\n");
viQueryf(instr, "*OPC?\n", "%d", &temp);
//
// Read out measurement data
//
retCount = maxCnt * 2;
viQueryf(instr, "CALC:DATA:FDAT?\n", "%,#lf", &retCount, Data);
retCount = maxCnt;
viQueryf(instr, "SENS:FREQ:DATA?\n", "%,#lf", &retCount, Freq);
//
// Display measurement data
//
printf("%20s %20s %20s\n", "Frequency", "Data1", "Data2");
for (int i = 0; i < NOP; i++)
```

```
{
        printf("%20f %20f %20f\n", Freq[i], Data[i*2], Data[i*2+1]);
}
status = viClose(instr);
status = viClose(defaultRM);
return 0;
}
```

Example. Program Written in LabView

The following program shows the control over the Analyzer using LabView language with the VISA library.

Seen below is the block diagram of the program and front panel of the program with the program execution result.

The front panel contains the entry field for the Analyzer name "VISA Resource Name". For more detail on VISA Resource Name see the VISA library documentation.

The user must enter the Analyzer address, select the trace format in the "Format" field, and click the "Run" button. As the result of the program, the Analyzer information string will be displayed, and the measurement trace will be plotted.

Program description:

1. Sets up communication with the Analyzer.

2. Reads out and displays the Analyzer information string.

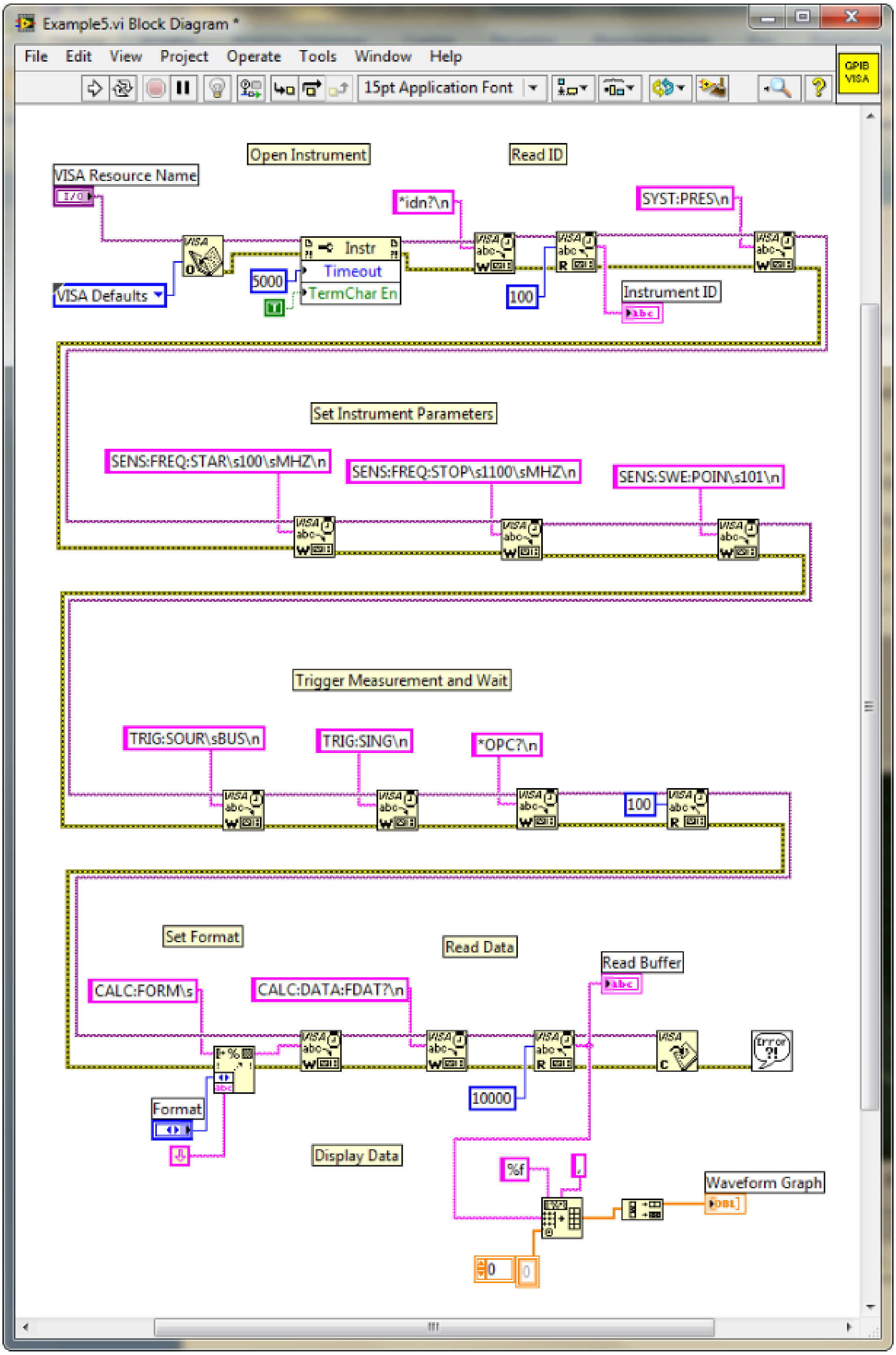
3. Sets some parameters of the Analyzer.

4. Generates the trigger and waits for the sweep completion.

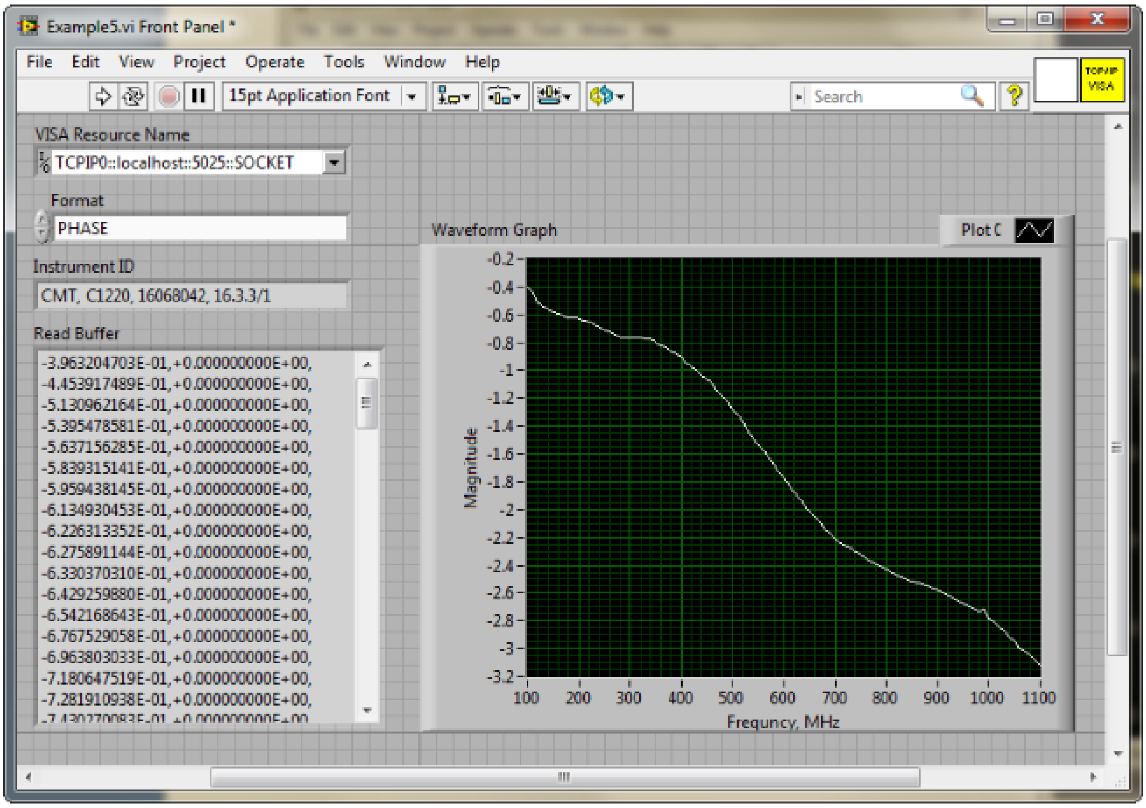
5. Sets the trace format to the format entered by the user in the "Format" field.

6. Reads out the measurement data.

7. Displays the measurement data.



Example5.vi Block Diagram *
File Edit View Project Operate Tools Window Help
15pt Application Font
Open Instrument
Read ID
VISA Resource Name
*idn?\n
SYST:PRES\n
Instr
Timeout
TermChar En
5000
VISA Defaults
100
Instrument ID
Set Instrument Parameters
SENS:FREQ:STAR\s100\sMHZ\n
SENS:FREQ:STOP\s1100\sMHZ\n
SENS:SWE:POIN\s101\n
Trigger Measurement and Wait
TRIG:SOUR\sBUS\n
TRIG:SING\n
*OPC?\n
100
Set Format
Read Data
Read Buffer
CALC:FORM\s
CALC:DATA:FDAT?\n
10000
Format
Display Data
%f
,
Waveform Graph
0


Example5.vi Front Panel *
File Edit View Project Operate Tools Window Help
15pt Application Font
Search
VISA Resource Name
TCPIP0::localhost::5025::SOCKET
Format
PHASE
Instrument ID
CMT, C1220, 16068042, 16.3.3/1
Read Buffer
-3.963204703E-01,+0.000000000E+00,
-4.453917489E-01,+0.000000000E+00,
-5.130962164E-01,+0.000000000E+00,
-5.395478581E-01,+0.000000000E+00,
-5.637156285E-01,+0.000000000E+00,
-5.839315141E-01,+0.000000000E+00,
-5.959438145E-01,+0.000000000E+00,
-6.134930453E-01,+0.000000000E+00,
-6.226313352E-01,+0.000000000E+00,
-6.275891144E-01,+0.000000000E+00,
-6.330370310E-01,+0.000000000E+00,
-6.429259880E-01,+0.000000000E+00,
-6.542168643E-01,+0.000000000E+00,
-6.767529058E-01,+0.000000000E+00,
-6.963803033E-01,+0.000000000E+00,
-7.180647519E-01,+0.000000000E+00,
-7.281910938E-01,+0.000000000E+00,
Waveform Graph
Plot 0
Magnitude
Frequncy, MHz

COM Programming Examples

Example. Instrument Information String Readout

The following program reads out and displays on the screen the instrument information string – the Name property of the COM object. The string contains the following fields:

<manufacturer>, <model>, <serial number>, <software version>/<hardware version>.

For example:

COPPER MOUNTAIN TECHNOLOGIES, R140, 00000001, 21.4.1/1.1

```
Dim app As Object

Sub Example1()

Set app = CreateObject("RVNA.Application")

ID = app.Name

MsgBox ("Information string read out: " + ID)

End Sub
```

Example. Checking the Instrument Ready State

Normally, the user control program starts when the Analyzer executable module is running, the instrument booting is completed, and the instrument is ready for use. In some cases, it is recommended to check if the instrument is ready for use. The instrument may be not ready for use if it is not connected to PC via USB cable. Moreover, if the analyzer executable module has not been started in advance, the CreateObject function will automatically start the application and then within about 10 seconds the instrument booting will be in progress. The instrument will not be ready for use until the booting is completed. The Ready property is used to check if the instrument is ready for use.

The following program checks the Ready property right after a COM object has been created. If the RVNA.exe or RNVNA.exe application has been started in advance and the booting is completed, “Analyzer is ready” will be displayed. If the Ready property value is False, 10 second delay is activated for the case the RVNA.exe RNVNA.exe application has been started by the COM object creation. In 10 seconds the program rechecks the Ready property. If the value is True, “Analyzer is ready” will be displayed, if otherwise, “Analyzer is not ready” will be displayed, what means the instrument is not connected to LAN or it is not connected to PC via USB cable.

```
Dim app As Object

Sub Example2()

Set app = CreateObject("RVNA.Application")

If app.Ready = False Then
    Application.Wait (Now + TimeValue("0:00:10"))
    If app.Ready = False Then
        MsgBox ("Analyzer is not ready")
        Exit Sub
    End If
End If

MsgBox ("Analyzer is ready")

End Sub
```

Example. Setting the Measurement Parameters

The following program shows the setting of some measurement parameters. First, the instrument is reset to the factory settings. Then the following parameters are set:

- Two channel windows are opened and allocated one above the other.
- The number of traces is set to 2 in the first channel window.
- For the first channel the stimulus parameters are set as follows: the frequency range from 100 MHz to 1.2 GHz, the number of measurement points 401.
- For the second channel the stimulus parameters are set as follows: the frequency range from 800 MHz to 900 MHz, the number of points 51, IF bandwidth 100 Hz, output power — low.
- In the first channel window SWR format is set for the trace 1, logarithmic magnitude format is set for the trace 2.
- In the second channel window: logarithmic magnitude format is set for the single trace. Then the auto scale function is called for this trace.

```
Dim app As Object

Public Sub Example3()
Set app = CreateObject("RVNA.Application")

app.SCPI.SYSTem.PRESet
app.SCPI.DISPlay.Split = 2
app.SCPI.Calculate(1).Parameter.Count = 2
app.SCPI.SENSe(1).Frequency.Start = 100000000
app.SCPI.SENSe(1).Frequency.STOP = 1200000000
app.SCPI.SENSe(1).SWEep.Points = 401
app.SCPI.SENSe(2).Frequency.Start = 800000000
app.SCPI.SENSe(2).Frequency.STOP = 900000000
app.SCPI.SENSe(2).SWEep.Points = 51
app.SCPI.SENSe(2).BANDwidth.RESolution = 100
app.SCPI.Source(2).Power.LEVel.STATe = ”LOW”
app.SCPI.Calculate(1).Parameter(1).Select
app.SCPI.Calculate(1).Selected.Format = "SWR"
app.SCPI.Calculate(1).Parameter(2).Select
app.SCPI.Calculate(1).Selected.Format = "MLOG"
app.SCPI.Calculate(2).Parameter(1).Select
app.SCPI.Calculate(2).Selected.Format = "MLOG"
app.SCPI.DISPlay.Window(2).TRACe(1).Y.SCALe.AUTO

End Sub
```

Example. Measurement Data Acquisition

The following program shows data array acquisition with further writing into a file. The program also shows the method of a sweep triggering and waiting for the sweep completion.

Three variables F, M, P are declared in the second string of the code. They are used for arrays of frequency values (Hz), magnitude values (dB), and phase values (degree) respectively.

After the instrument has been reset to the factory settings, two operators are used for the sweep triggering and waiting for the sweep completion:

app.SCPI.TRIGger.SEQuence.Source = "BUS"

app.SCPI.TRIGger.SEQuence.Single

The first operator sets the LAN bus command or the COM/DCOM interface command as a trigger source. It aborts the sweep and switches the instrument to waiting for a trigger. The second operator is used for a new sweep triggering and waiting for the sweep completion.

NOTE	Unlike the SCPI.TRIGger.SEQuence.IMMediate and SCPI.IEEE4882.TRG commands, which are completed immediately after a trigger generation, the SCPI.TRIGger.SEQuence.Single command is not completed until the end of the sweep. Using the SCPI.TRIGger.SEQuence.Single command is the simplest way to set the waiting for the sweep completion.

On completion of the sweep, three arrays are read out: frequency values, magnitude values and phase values. Before the magnitude and phase arrays are read out, the corresponding trace format is set.

The array size of frequency F is equal to the number of measurement points, and the array size of magnitude M and phase P is equal to the double number of measurement points (See Measurement Data Arrays). In rectangular formats (for magnitude and phase) the measurement data are real numbers located in even cells of the array. Odd cells of the array contain 0.

On completion of the program, the frequency, magnitude and phase values for each measurement point are written string by string into the file named TESTFILE.

```
Dim app As Object
Dim F, M, P

Public Sub Example4()
Set app = CreateObject("RVNA.Application")

app.SCPI.SYSTem.PRESet

app.SCPI.TRIGger.SEQuence.Source = "BUS"
app.SCPI.TRIGger.SEQuence.Single

F = app.SCPI.SENSe.Frequency.Data

app.SCPI.Calculate.Selected.Format = "MLOG"
M = app.SCPI.Calculate.Selected.Data.FDATa

app.SCPI.Calculate.Selected.Format = "PHASe"
P = app.SCPI.Calculate.Selected.Data.FDATa

Open "TESTFILE" For Output As #1

For i = LBound(F) To UBound(F)
   Print #1, F(i), M(i * 2), P(i * 2)
Next i

Close #1
End Sub
```

Example. Measurement Data Acquisition

The following C++ program represents an example of the measurement parameter setting, as well as acquisition and display of the measurement data array. The program also shows a method of the sweep triggering and waiting for the sweep completion.

```
//------------------------------------------------------------------------

// Simple example of using COM object of RVNA.exe application.

// This example is console application. GUI is not used in this example to

// simplify the program. Error processing is very restricted too.

#include "stdafx.h"

//------------------------------------------------------------------------

// Generate description of COM object of RVNA.exe application.

#import "RVNA.exe" no_namespace

//------------------------------------------------------------------------

int _tmain(int argc, _TCHAR* argv[])

{

    IRVNAPtr        pNWA;                         // Pointer to COM object of RVNA.exe

    CComVariant Data;                             // Variable for measurement data

    // Init COM subsystem

    HRESULT hr = CoInitialize(NULL);

    if(hr != S_OK) return -1;

    // Create COM object

    hr = pNWA.CreateInstance(__uuidof(RVNA));

    if(hr != S_OK) return -1;

    // Preset network analyzer

    pNWA->SCPI->SYSTem->PRESet();
```

```
// Set frequency start to 1 GHz
pNWA->SCPI->SENSe[1]->FREQuency->STARt = 1e9;
// Set frequency stop to 1.2 GHz
pNWA->SCPI->SENSe[1]->FREQuency->STOP = 1.2e9;
// Set number of measurement points to 51
pNWA->SCPI->SENSe[1]->SWEep->POINts = 51;
// Set trigger source to GPIB/LAN bus or COM interface
pNWA->SCPI->TRIGger->SEQuence->SOURce = "bus";
// Trigger measurement and wait
pNWA->SCPI->TRIGger->SEQuence->SINGle();
// Get measurement data (array of complex numbers)
Data = pNWA->SCPI->CALCulate[1]->SELected->DATA->FDATa;
// Display measurement data.
// Data is array of NOP * 2 (number of measurement points).
// Where n is an integer between 0 and NOP - 1.
// Data(n*2)        : Primary value at the n-th measurement point.
// Data(n*2+1) : Secondary value at the n-th measurement point. Always 0
// when the data format is not the Smith chart or the polar.
CComSafeArray<double> mSafeArray;
if (mSafeArray.Attach(Data.parray) == S_OK)
{
    for (unsigned int n = 0; n < mSafeArray.GetCount() / 2; ++n)
        {
            printf("%+.9E\t%+.9E\n",
            mSafeArray.GetAt(n*2),
            mSafeArray.GetAt(n*2+1));
        }
    mSafeArray.Detach();
    }
    printf("Press ENTER to exit.\n");
    getc(stdin);
```

```
    // Release COM object
    pNWA.Release();
    CoUninitialize();
    return 0;
}
```

Maintenance and Storage

The following section describes the proper maintenance and storage procedures for the Analyzer.

Maintenance Procedures

This section describes the guidelines and procedures of maintenance, which will ensure fault-free operation of the Analyzer.

The maintenance of the Analyzer consists of cleaning the instrument, factory calibrations, and regular performance tests.

Instrument Cleaning

This section provides the cleaning instructions required for maintaining proper operation of the Analyzer.

To remove contamination from parts other than test ports or any connectors of the Analyzer, wipe them gently with a soft cloth that is dry or wetted with a small amount of water and wrung tightly.

It is essential to always keep the test ports clean, as any dust or stains on them can significantly affect the measurement capabilities of the instrument. To clean the test ports (as well as other connectors of the Analyzer), use the following procedure:

- Using compressed air, remove or loosen the contamination particles.
- Clean the connectors using a lint-free cleaning cloth wetted with a small amount of ethanol and isopropyl alcohol (when cleaning a female connector, avoid snagging the cloth on the center conductor contact fingers by using short strokes).
- Dry the connector with low-pressure compressed air.

Always completely dry a connector before using it.

Never use water or abrasives for cleaning any connectors on the Analyzer. Do not allow alcohol contact on the surface of the connector.

When connecting male-female coaxial connectors, always use a calibrated torque wrench.

WARNING	Never perform cleaning of the instrument if the power cable is connected to the power outlet. Never clean the internal components of the instrument.

Factory Calibration

Factory calibration is a regular calibration performed by the manufacturer or an authorized service center. It is recommended sending the Analyzer for factory calibration every three years.

Factory calibration is a full one-port Analyzer calibration. It can be performed in two following modes: with high output power and with low output power. The calibration coefficients employed during the Analyzer operation correspond to the selected mode of the output power.

The factory calibration of the Analyzer allows performing measurement without additional calibration and reduces the measurement error for reflection normalization.

Storage Instructions

Before first use, store the Analyzer in the factory package at a room temperature between 0 and +40 ºC and a relative humidity up to 80% (at 25 ºC).

After the analyzer has been removed from the factory packaging, it should be stored at a room temperature between +10 and +35 ºC and relative humidity up to 80% (at 25 ºC).

Be sure to keep the storage facilities free from dust, acidic or alkaline fumes, volatile gases, and other chemicals, which can cause corrosion.

Annexes

Default Settings Table

Default values defined in the process of the initial factory setup.

Parameter Description	Default Setting	Parameter Setting Object
Touchstone Data Format	RI - Real-Imaginary	Analyzer
Allocation of Channels	1	Analyzer
Active Channel Number	1	Analyzer
Marker Value Identification Capacity (Stimulus)	8 digits	Analyzer
Marker Value Identification Capacity (Response)	5 digits	Analyzer
Vertical Divisions	10	Channel
Channel Title Bar	OFF	Channel
Channel Title	Empty	Channel
Traces per Channel	1	Channel
Active Trace Number	1	Channel
Sweep Type	Linear	Channel
Number of Sweep Points	201	Channel
Stimulus Start Frequency	Instrument min.	Channel
Stimulus Stop Frequency	Instrument max.	Channel
Stimulus Power Level	High	Analyzer

Parameter Description	Default Setting	Parameter Setting Object
Stimulus IF Bandwidth	10 kHz	Channel
Sweep Measurement Delay	0 sec.	Channel
Sweep Range Setting	Start / Stop	Channel
Number of Segments	1	Channel
Points per Segment	2	Channel
Segment Start Frequency	Instrument min.	Channel
Segment Stop Frequency	Instrument min.	Channel
Segment Sweep IF Bandwidth	10 kHz	Channel
Segment Sweep Delay (Table Display)	OFF	Channel
Segment Sweep IFBW (Table Display)	OFF	Channel
Trigger Mode	Continuous	Analyzer
Table of Calibration Coefficients	Empty	Channel
Error Correction	ON	Analyzer
Trace Scale	10 dB/division	Trace
Reference Level Value	0 dB	Trace
Reference Level Position	5 Div.	Trace
Phase Offset	0°	Trace
Electrical Delay	0 sec.	Trace

Parameter Description	Default Setting	Parameter Setting Object
Trace Display Format	Return Loss (dB)	Trace
Start Distance	-1.49 m	Trace
Stop Distance	1.49 m	Trace
Time Domain Kaiser Window	Normal	Channel
Number of Markers	0	Trace

Safety Instructions

Carefully read the following safety instructions before putting the Module into operation. Observe all the precautions and warnings provided in this Manual for all the phases of operation, service, and repair of the Module.

Observe all general safety precautions related to the operation of electrically energized equipment.

WARNING

The Module should be used only by skilled and thoroughly trained personnel with the required skills and knowledge of safety precautions.

Connect the body of the controlling PC and the body of the VNA (the post marked ⏚) to be used with the Module before starting operation.

Exceeding maximum input power of the RF signal or maximum DC voltage specified on the front panel of the Module can result in the Module breaking down.

Never operate the Module if the USB cable is damaged.

Protection from electrostatic discharge

WARNING

Make sure to protect the work area from electrostatic discharge.

Electrostatic discharge can damage the Module when connected or disconnected from the VNA, during the connectors cleaning, or during visual inspection.

Static charge can build up on the body and damage the sensitive circuits of internal components of both the Module and the VNA being calibrated. To avoid damage from electric discharge, observe the following:

- Always discharge the static charge accumulated on the body before touching the Module or any other sensitive to static electricity devices.
- Always use a desktop anti-static mat under the DUT.

- Always wear a grounding wrist strap connected to the desktop anti-static mat via daisy-chained 1MΩ resistor.

Definitions of safety symbols used on the instrument and in the manual are listed below.

WARNING	This sign denotes a hazard. It calls attention to a procedure, practice, or condition that, if not correctly performed or adhered to, could result in injury or death to personnel.
CAUTION	This sign denotes a hazard. It calls attention to a procedure, practice, or condition that, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the instrument.
NOTE	This sign denotes important information. It calls attention to a procedure, practice, or condition that is essential for the user to understand.

General Overview

The Module is designed for calibration (error correction) of Vector Network Analyzers in automatic mode.

Calibration is performed by automatically connecting the reflection and transmission impedance states to the VNA test ports.

Calibration determines systematic errors in accordance with the VNA model. The process of mathematical compensation (numerical reduction) for measurement systematic errors is called error correction.

Using the Module instead of a mechanical calibration kit has several advantages, which ensure high measurement accuracy and a longer service life of the VNA test ports. The measurement accuracy is achieved using precision Module standards (states) descriptions, by the stability of the selected configuration, and by the application of temperature drift functions and self-diagnosis in the form of confidence check. Single module connection during calibration allows to:

- Extend the VNA ports service life.
- Reduce technical staff workload and risk of human error.
- Make the measurement process most efficient.

The Module control protocol is based on the USBTMC-USB488 standard.

Modification

The Module differ in operating frequency range and in the number of ports. Their functional features are briefly described in the table below and in Appendix A.

During calibration, the Modules are controlled by the VNA software installed on the connected PC. The USB 2.0 interface is used for control.

The Modules feature several hardware configurations depending on the connector types of PORT A, PORT B and, if available, PORT C and PORT D. To view the possible connector type front and side views for each Module, click on the name of the desired Module in the table below.

The Module delivery package is specified in Delivery Kit.

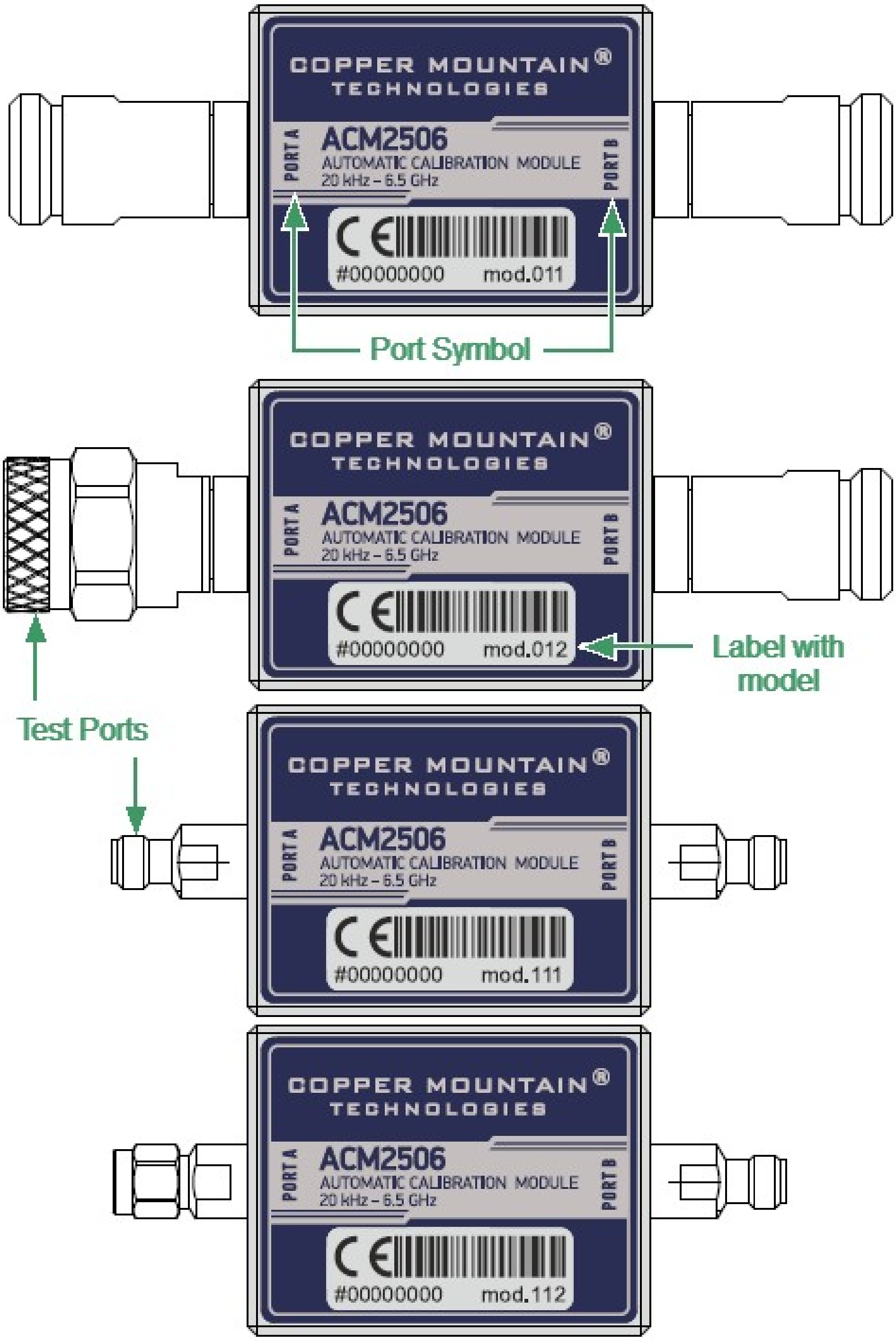
Functional Features

Module	Frequency range
50 Ohm two-port Modules	
ACM2506	20 kHz to 6.5 GHz
ACM2509	20 kHz to 9 GHz
ACM2520	100 kHz to 20 GHz
ACM2543	10 MHz to 44 GHz
ACM6000T	20 kHz to 6 GHz
ACM8000T	100 kHz to 8 GHz
75 Ohm two-port Modules	
ACM2708	20 kHz to 8 GHz
ACM4000T	20 kHz to 4 GHz
50 Ohm four-port Modules	
ACM4509	100 kHz to 9 GHz

Module	Frequency range
ACM4520	100 kHz to 20 GHz
ACM8400T	100 kHz to 8 GHz
1 The upper frequency point of ACM2520 and ACM4520 with type N connectors is 18 GHz. 2 The upper frequency point of ACM2543 with 2.92 mm connectors is 40 GHz.	

ACM2506

The front panels of the different models of ACM2506 are shown in the figure below.



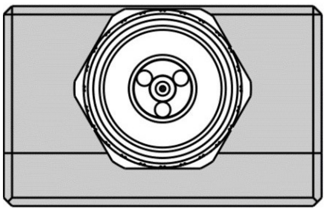
Front panel ACM2506

Parts of the ACM2509

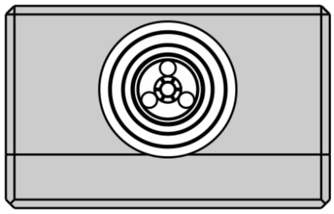
Test port

The test ports are designed for connection to VNA being calibrated. The VNA connectors, the cross sections of which were calibrated, are referred to as its test ports.

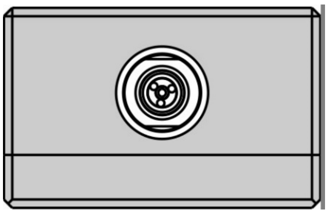
The Modules connectors are shown in figures below.



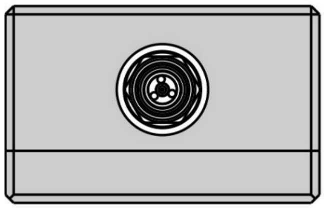
Type N, male



Type N, female

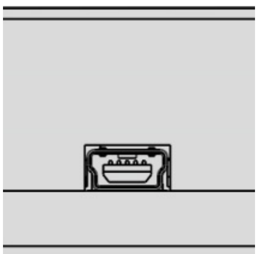


3.5 mm, male



3.5 mm, female

Mini USB Connector (on side panel)



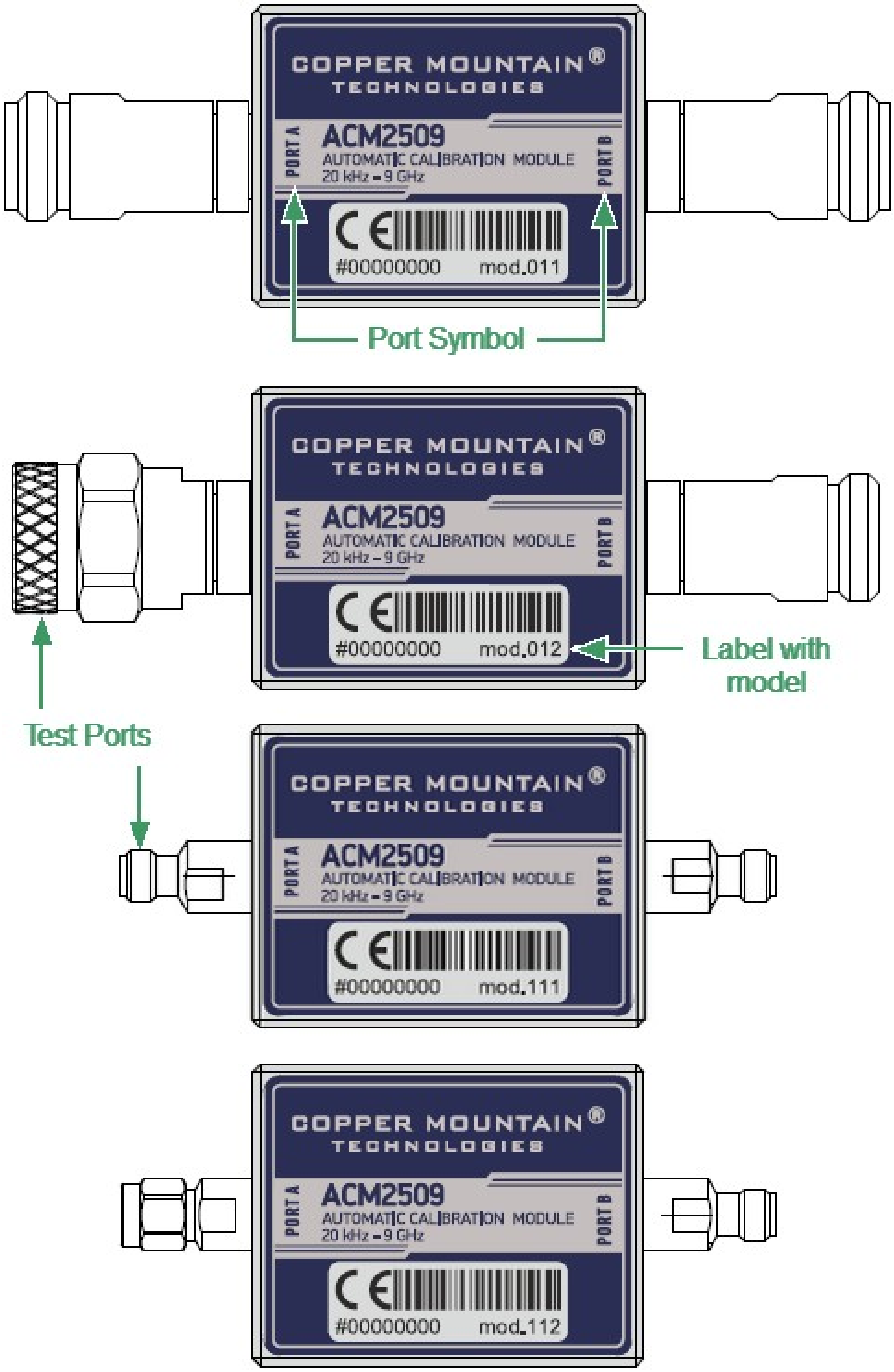
The mini USB connector is located at the side panel of the Module and is intended for the Module connection to the controlling PC. The Module is powered using the USB cable.

Hardware configurations

Model	Connector type	
	Port A	Port B
ACM2506-011	type N, female	type N, female
ACM2506-012	type N, male	type N, female
ACM2506-111	3.5 mm, female	3.5 mm, female
ACM2506-112	3.5 mm, male	3.5 mm, female

ACM2509

Front panel of different models of ACM2506 are shown in figure below.



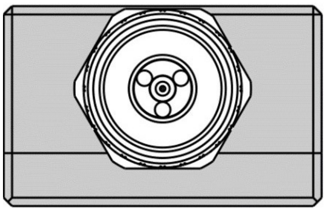
Front panel ACM2509

Parts of Module

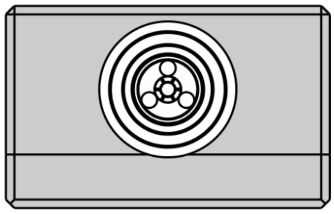
Test port

The test ports are designed for connection to VNA being calibrated. The VNA connectors, the cross sections of which were calibrated, are referred to as its test ports.

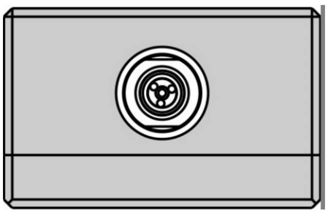
The Modules connectors are shown in figures below.



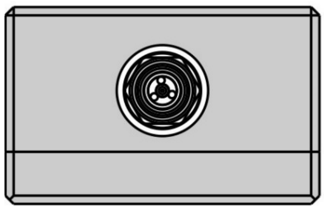
Type N, male



Type N, female

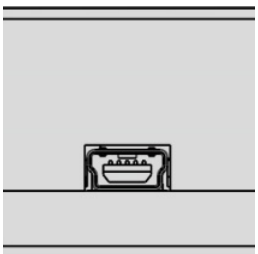


3.5 mm, female



3.5 mm, male

Mini USB Connector (on side panel)



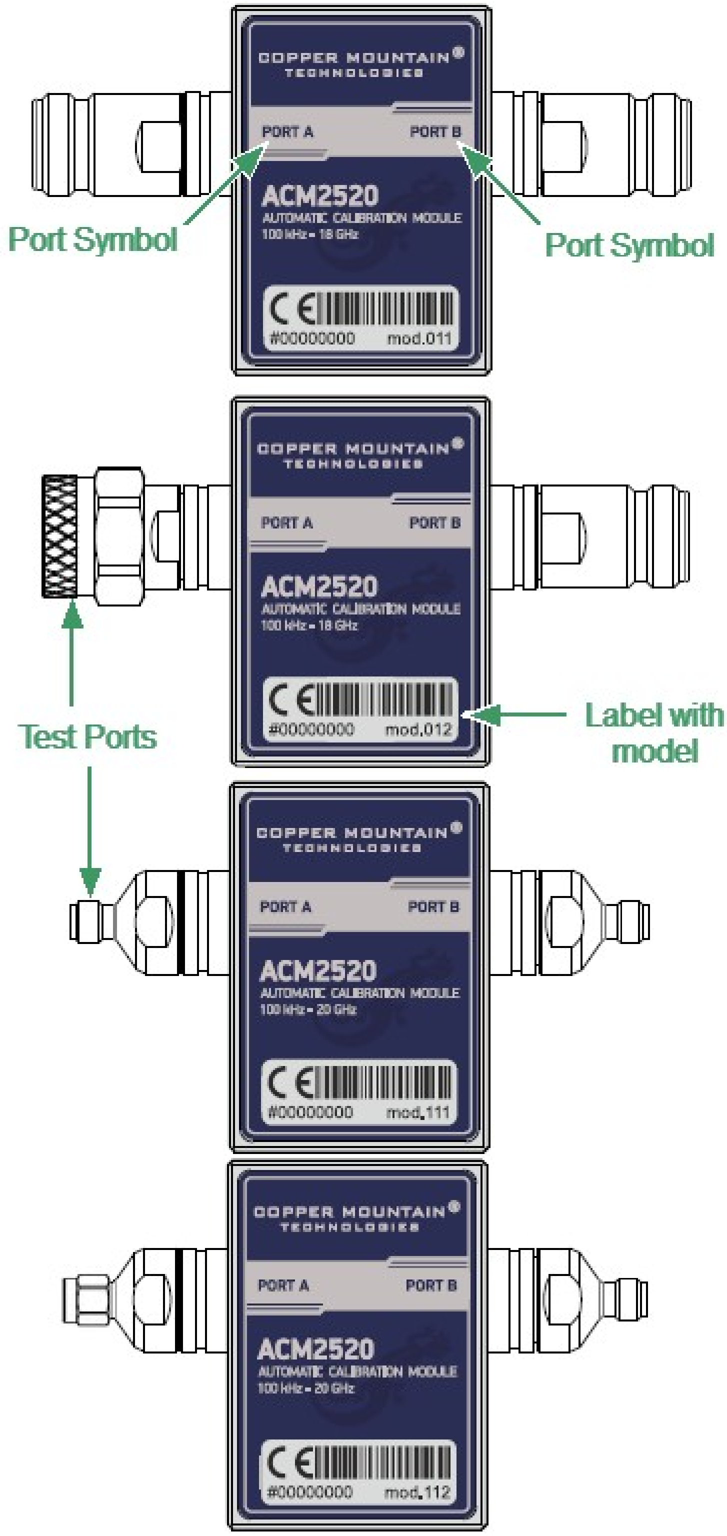
The mini USB connector is located on the side panel of the Module and is intended for the Module connection to the controlling PC. The Module is powered using the USB cable.

Hardware configurations

Model	Connector type	
	Port A	Port B
ACM2509-011	type N, female	type N, female
ACM2509-012	type N, male	type N, female
ACM2509-111	3.5 mm, female	3.5 mm, female
ACM2509-112	3.5 mm, male	3.5 mm, female

ACM2520

The front panels of the different models of ACM2520 are shown in the figure below.



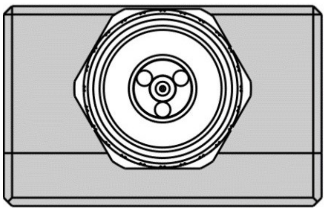
Front panel ACM2520

Parts of Module

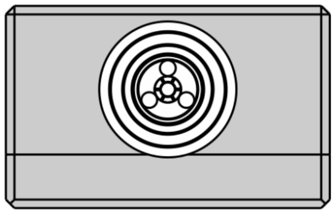
Test port

The test ports are designed for connection to VNA being calibrated. The VNA connectors, the cross sections of which were calibrated, are referred to as its test ports.

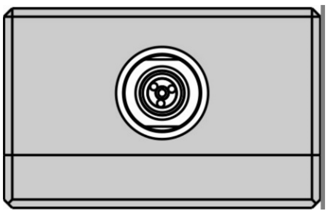
The Modules connectors are shown in figures below.



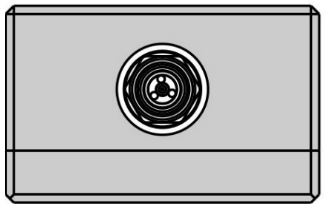
Type N, male



Type N, female

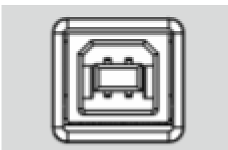


3.5 mm, female



3.5 mm, male

Connector (on side panel)



The connector is located on the top of the Module and is intended for the Module connection to the controlling PC. The Module is powered using the USB cable.

LED Status Indicator (on rear panel)

NOTE	LED Status Indicator is located under the label and is visible only during operation.

The LED indicates the following statuses:

- Blinking green and red LED mean testing LED and indicating external power supply voltage presence.

- Red LED indicator means warm-up mode of the Module. The time required for operating mode setting is automatically counted from the moment of the Module connection using USB. If the Module is disconnected during setting and reconnected again, then the countdown counter starts from the beginning.

  Additional red LED may indicate the Module connection loss with the PC. In this case, check the Module connection with software (the **Autocalibration** softkey should be active), if there is no connection, disconnect the USB cable from the Module and repeat the connection.

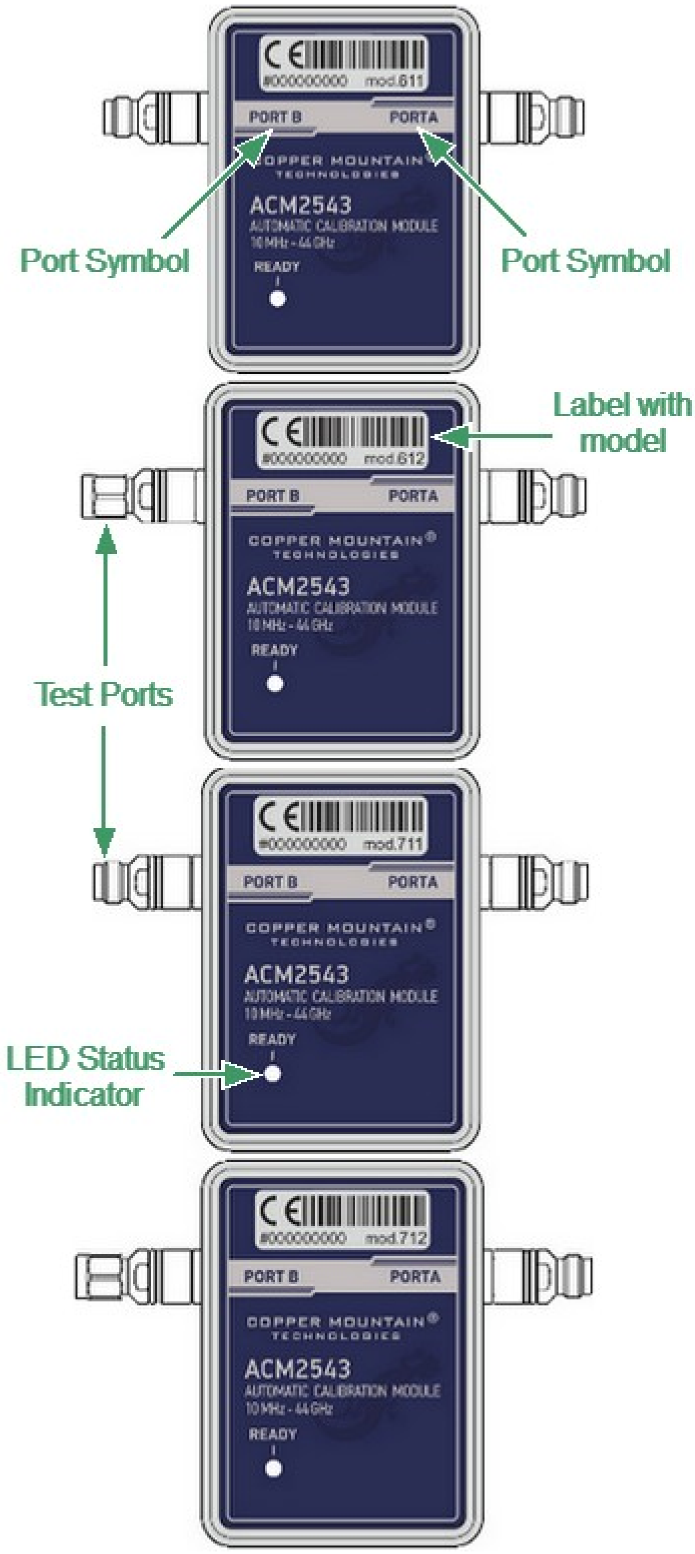
- Green LED indicator means the Module is ready for operation.

Hardware configurations

Model	Connector type	
	Port A	Port B
ACM2520-011	type N, female	type N, female
ACM2520-012	type N, male	type N, female
ACM2520-111	3.5 mm, female	3.5 mm, female
ACM2520-112	3.5 mm, male	3.5 mm, female

ACM2543

The rear panels of the different models of ACM2543 are shown in the figure below.

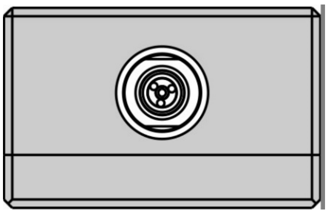


Rear panel ACM2543

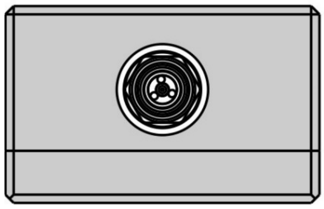
Parts of Module

Test port

The test ports are designed for connection to VNA being calibrated. The VNA connectors, the cross sections of which were calibrated, are referred to as its test ports. The Modules connectors are shown in figures below.



2.4 mm (2.92 mm), female



2.4 mm (2.92 mm), male

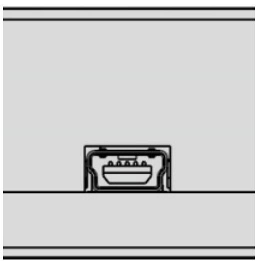
LED Status Indicator

The LED indicates the following statuses:

- Blinking green and red LED mean testing LED and indicating external power supply voltage presence.
- Red LED indicator means warm-up mode of the Module. The time required for operating mode setting is automatically counted from the moment of the Module connection using USB. If the Module is disconnected during setting and reconnected again, then the countdown counter starts from the beginning.

  Additional red LED may indicate the Module connection loss with the PC. In this case, check the Module connection with software (the **Autocalibration** softkey should be active), if there is no connection, disconnect the USB cable from the Module and repeat the connection.
- Green LED indicator means the Module is ready for operation.

Mini USB Connector (on side panel)



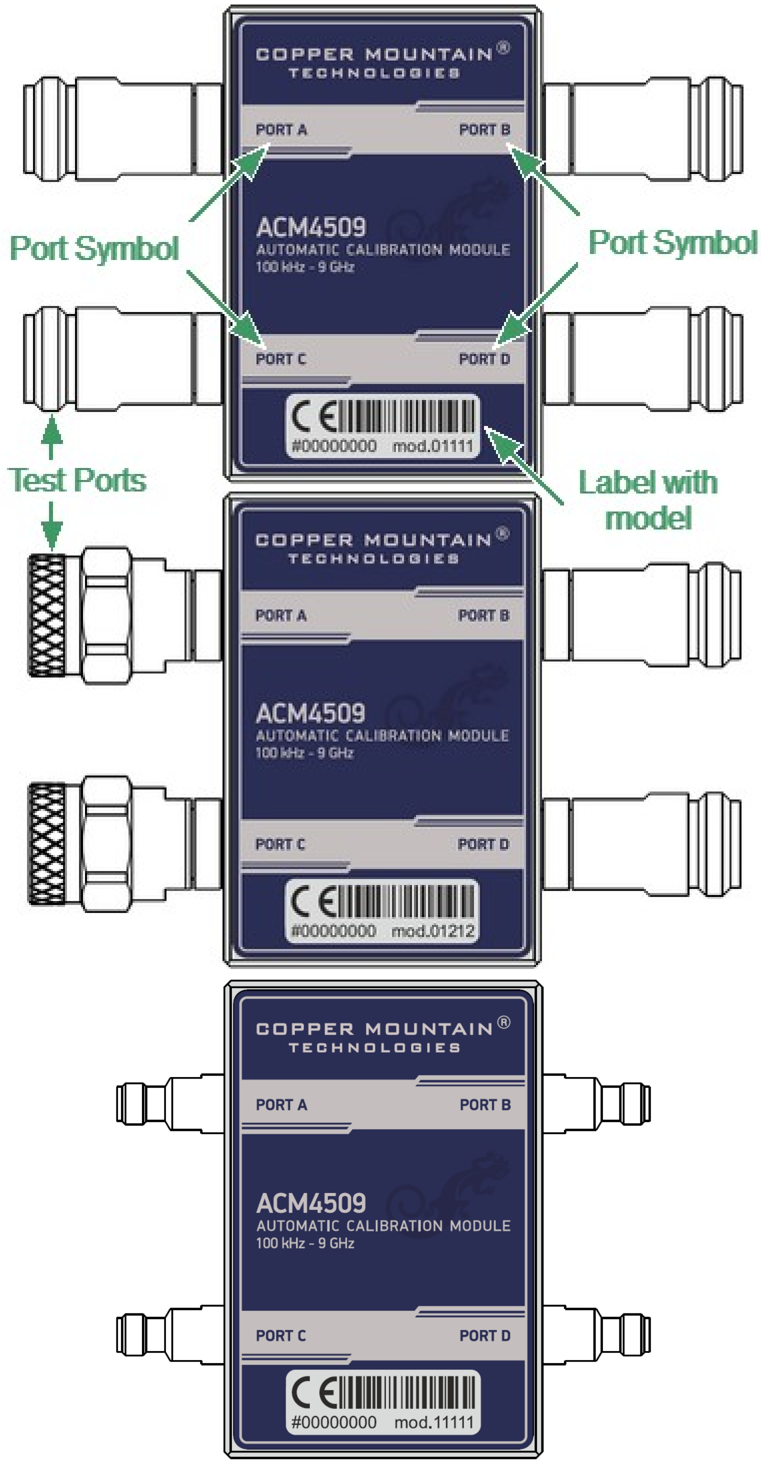
The connector is located on the top of the Module and is intended for the Module connection to the controlling PC. The Module is powered using the USB cable.

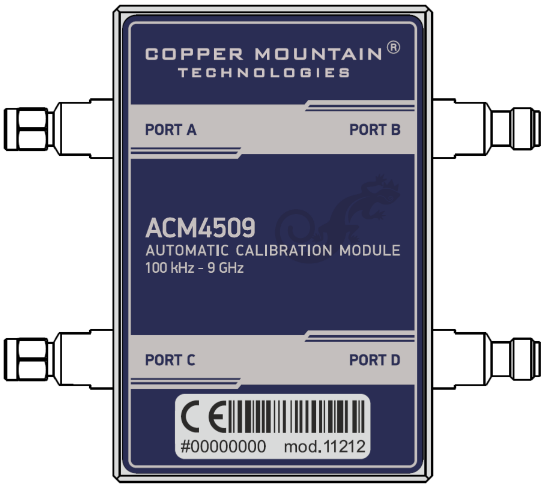
Hardware configurations

Model	Connector type	
	Port A	Port B
ACM2543-611	2.92 mm, female	2.92 mm, female
ACM2543-612	2.92 mm, male	2.92 mm, female
ACM2543-711	2.4 mm, female	2.4 mm, female
ACM2543-712	2.4 mm, male	2.4 mm, female

ACM4509

The front panels of the different models of ACM4509 are shown in the figure below.





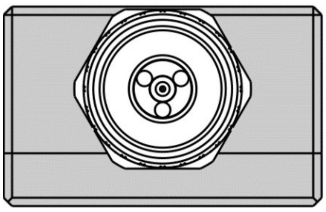
Front panel ACM4509

Parts of Module

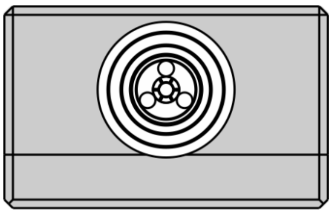
Test port

The test ports are designed for connection to VNA being calibrated. The VNA connectors, the cross sections of which were calibrated, are referred to as its test ports.

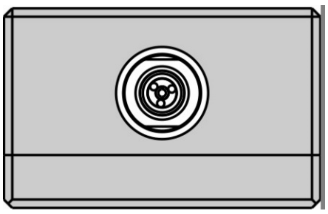
The Modules connectors are shown in figures below.



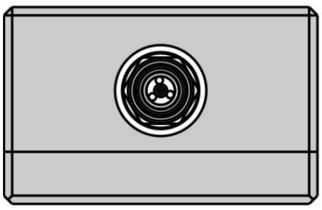
Type N, male



Type N, female

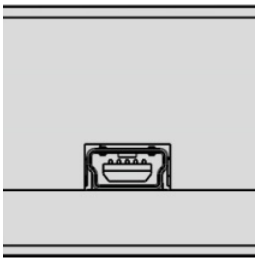


3.5 mm, female



3.5 mm, male

Mini USB Connector (on side panel)



The mini USB connector is located on the bottom of the Module and is intended for the Module connection to the controlling PC. The Module is powered using the USB cable.

LED Status Indicator (on rear panel)

NOTE	LED Status Indicator is located under the label and is visible only during operation.

The LED indicates the following statuses:

- Blinking green and red LED mean testing LED and indicating external power supply voltage presence.
- Red LED indicator means warm-up mode of the Module. The time required for operating mode setting is automatically counted from the moment of the Module connection using USB. If the Module is disconnected during setting and reconnected again, then the countdown counter starts from the beginning.

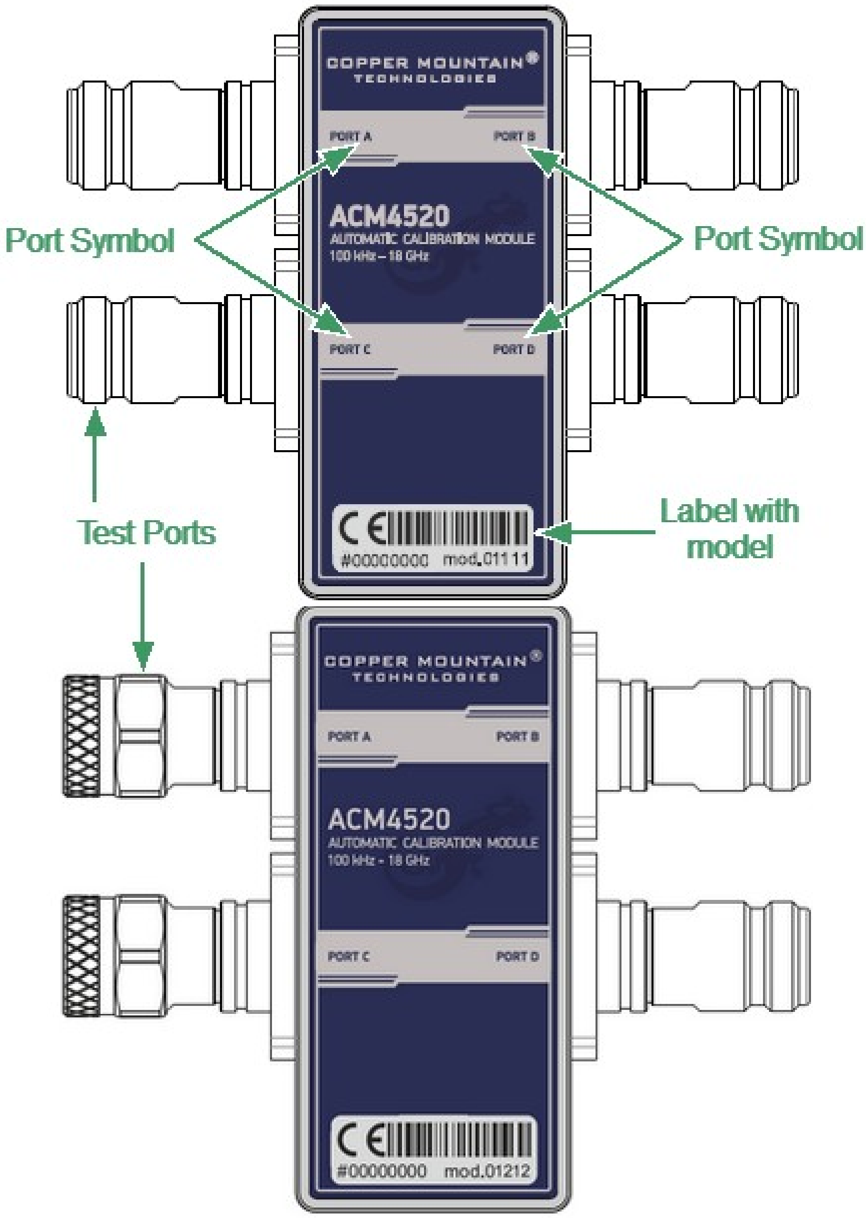
  Additional red LED may indicate the Module connection loss with the PC. In this case, check the Module connection with software (the **Autocalibration** softkey should be active), if there is no connection, disconnect the USB cable from the Module and repeat the connection.
- Green LED indicator means the Module is ready for operation.

Hardware configurations

Model	Connector type	
	Port A/C	Port B/D
ACM4509-01111	type N, female	type N, female
ACM4509-01212	type N, male	type N, female
ACM509-11111	3.5 mm, female	3.5 mm, female
ACM4509-11212	3.5 mm, male	3.5 mm, female

ACM4520

The front panels of the different models of ACM4520 are shown in the figure below.



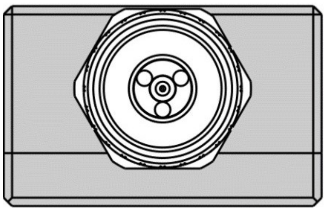
Front panel ACM4520

Parts of Module

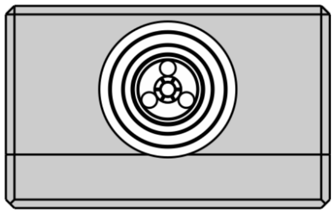
Test port

The test ports are designed for connection to VNA being calibrated. The VNA connectors, the cross sections of which were calibrated, are referred to as its test ports.

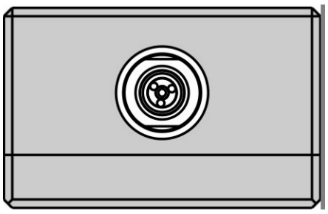
The Modules connectors are shown in figures below.



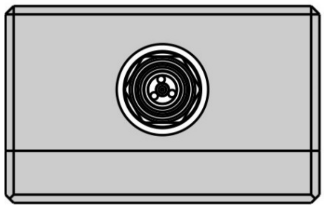
Type N, male



Type N, female

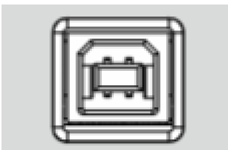


3.5 mm, female



3.5 mm, male

Connector (on side panel)



The connector is located on the bottom of the Module and is intended for the Module connection to the controlling PC. The Module is powered using the USB cable.

LED Status Indicator (on rear panel)

NOTE	LED Status Indicator is located under the label and is visible only during operation.

The LED indicates the following statuses:

- Blinking green and red LED mean testing LED and indicating external power supply voltage presence.
- Red LED indicator means warm-up mode of the Module. The time required for operating mode setting is automatically counted from the moment of the Module connection using USB. If the Module is disconnected during setting and reconnected again, then the countdown counter starts from the beginning.

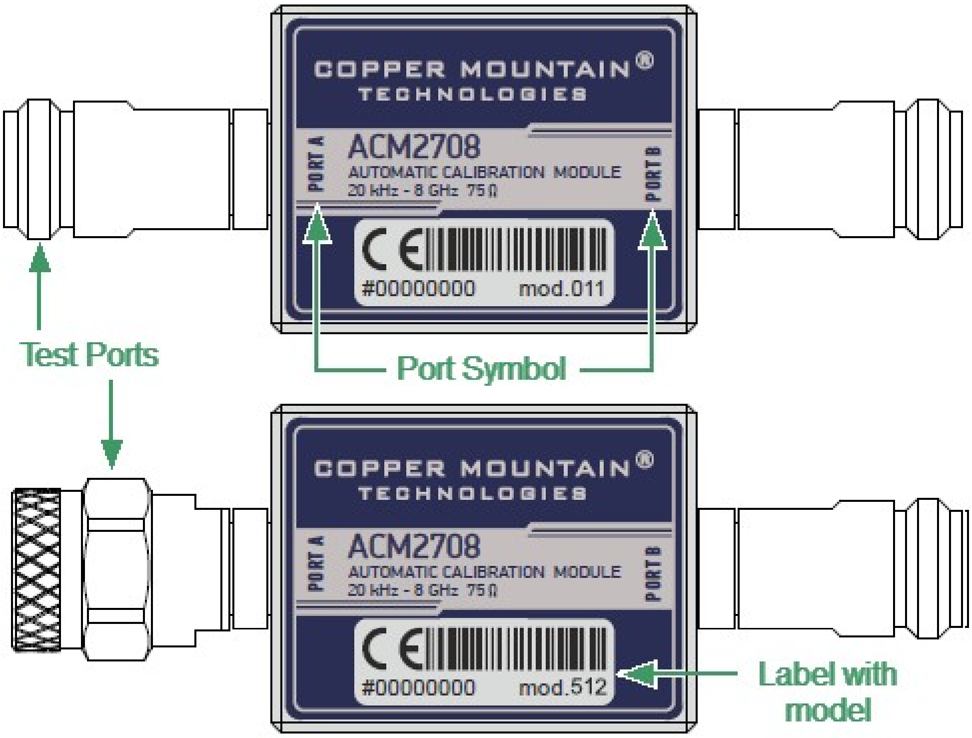
  Additional red LED may indicate the Module connection loss with the PC. In this case, check the Module connection with software (the **Autocalibration** softkey should be active), if there is no connection, disconnect the USB cable from the Module and repeat the connection.
- Green LED indicator means the Module is ready for operation.

Hardware configurations

Model	Connector type	
	Port A/C	Port B/D
ACM4520-01111	type N, female	type N, female
ACM4520-01212	type N, male	type N, female
ACM4520-11111	3.5 mm, female	3.5 mm, female
ACM4520-11212	3.5 mm, male	3.5 mm, female

ACM2708

The front panels of the different models of ACM2708 are shown in the figure below.



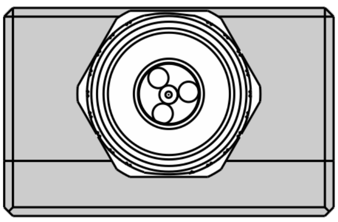
Front panel ACM2708

Parts of Module

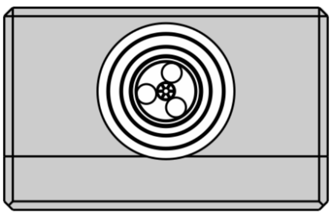
Test port

The test ports are designed for connection to VNA being calibrated. The VNA connectors, the cross sections of which were calibrated, are referred to as its test ports.

The Modules connectors are shown in figures below.

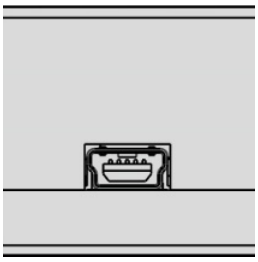


Type N 75, male



Type N 75, female

Connector (on side panel)



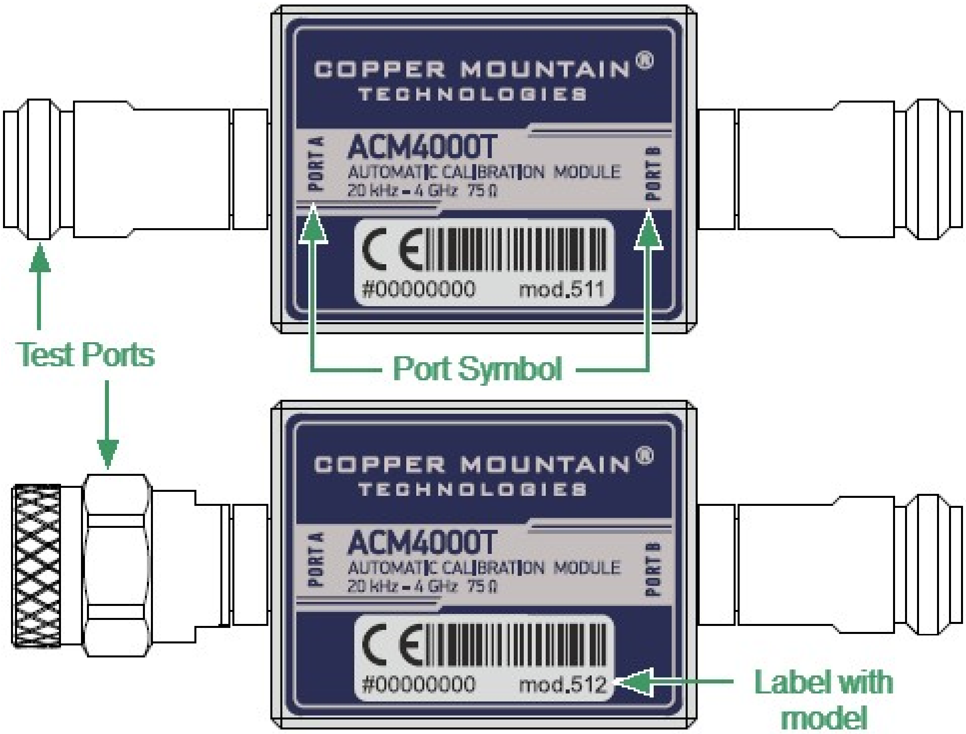
The connector is located on the bottom of the Module and is intended for the Module connection to the controlling PC. The Module is powered using the USB cable.

Hardware configurations

Model	Connector type	
	Port A	Port B
ACM2708-511	type N 75, female	type N 75, female
ACM2708-512	type N 75, male	type N 75, female

ACM4000T

The front panels of the different models of ACM4000T are shown in the figure below.



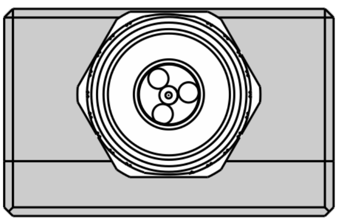
Front panel ACM4000T

Parts of Module

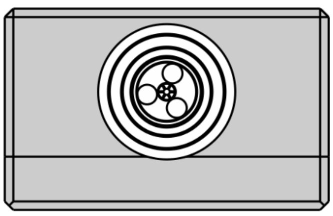
Test port

The test ports are designed for connection to VNA being calibrated. The VNA connectors, the cross sections of which were calibrated, are referred to as its test ports.

The Modules connectors are shown in figures below.

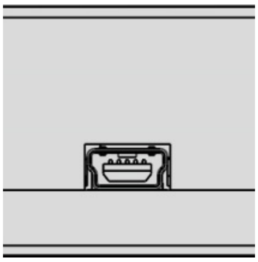


Type N 75, male



Type N 75, female

Connector (on side panel)



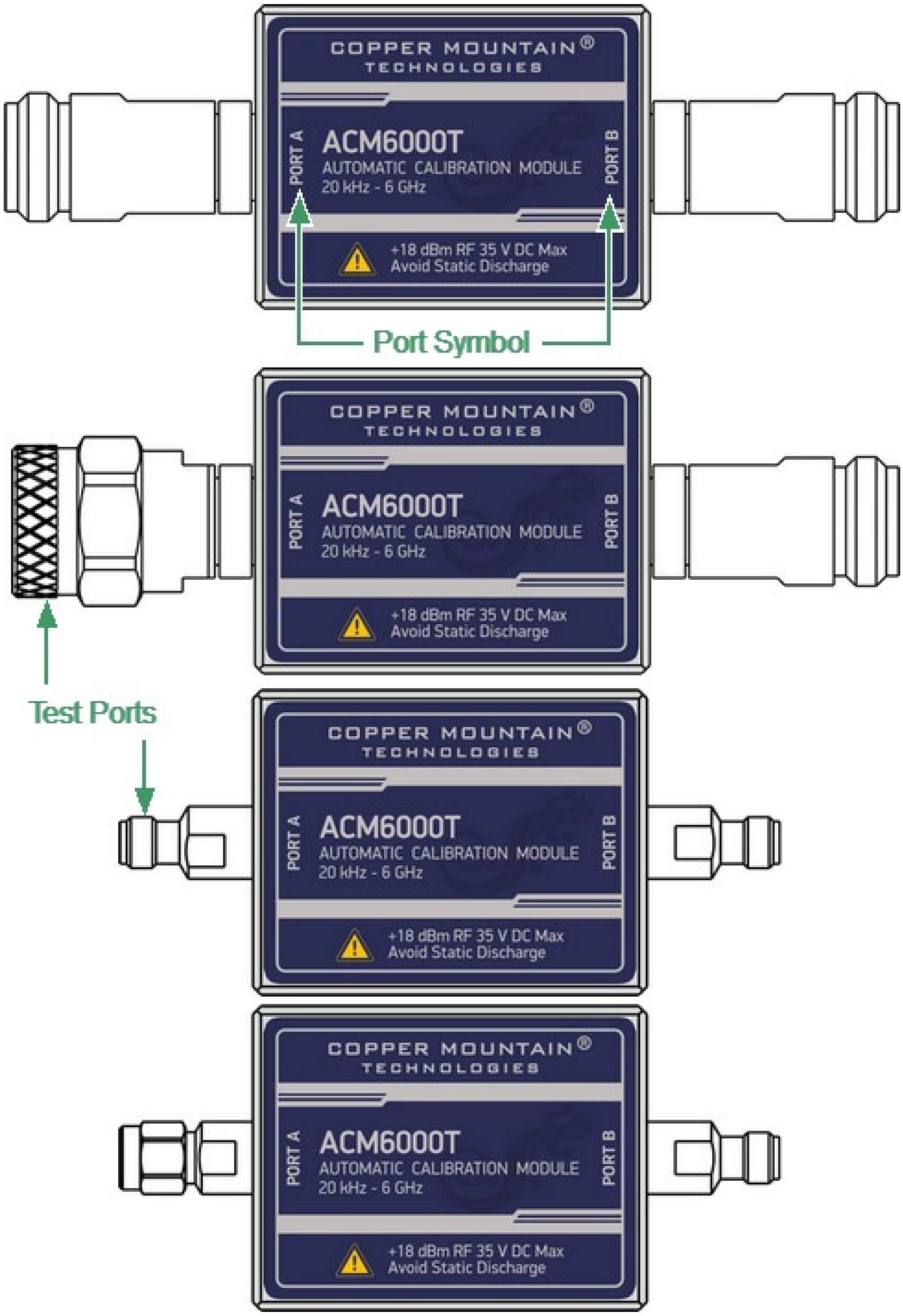
The connector is located on the bottom of the Module and is intended for the Module connection to the controlling PC. The Module is powered using the USB cable.

Hardware configurations

Model	Connector type	
	Port A	Port B
ACM4000T-511	type N 75, female	type N 75, female
ACM4000T-512	type N 75, male	type N 75, female

ACM6000T

The front panels of the different models of ACM6000T are shown in the figure below.



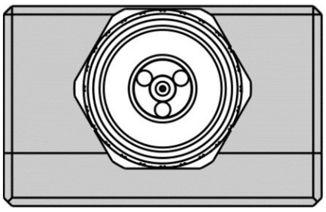
Front panel ACM6000T

Parts of Module

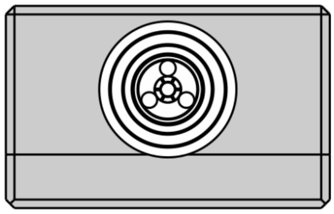
Test port

The test ports are designed for connection to VNA being calibrated. The VNA connectors, the cross sections of which were calibrated, are referred to as its test ports.

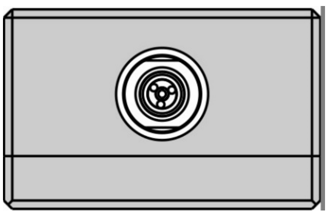
The Modules connectors are shown in figures below.



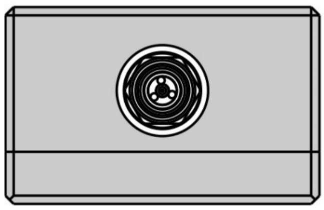
Type N, male



Type N, female

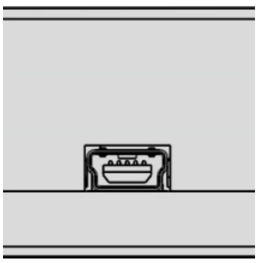


3.5 mm, female



3.5 mm, male

Connector (on side panel)



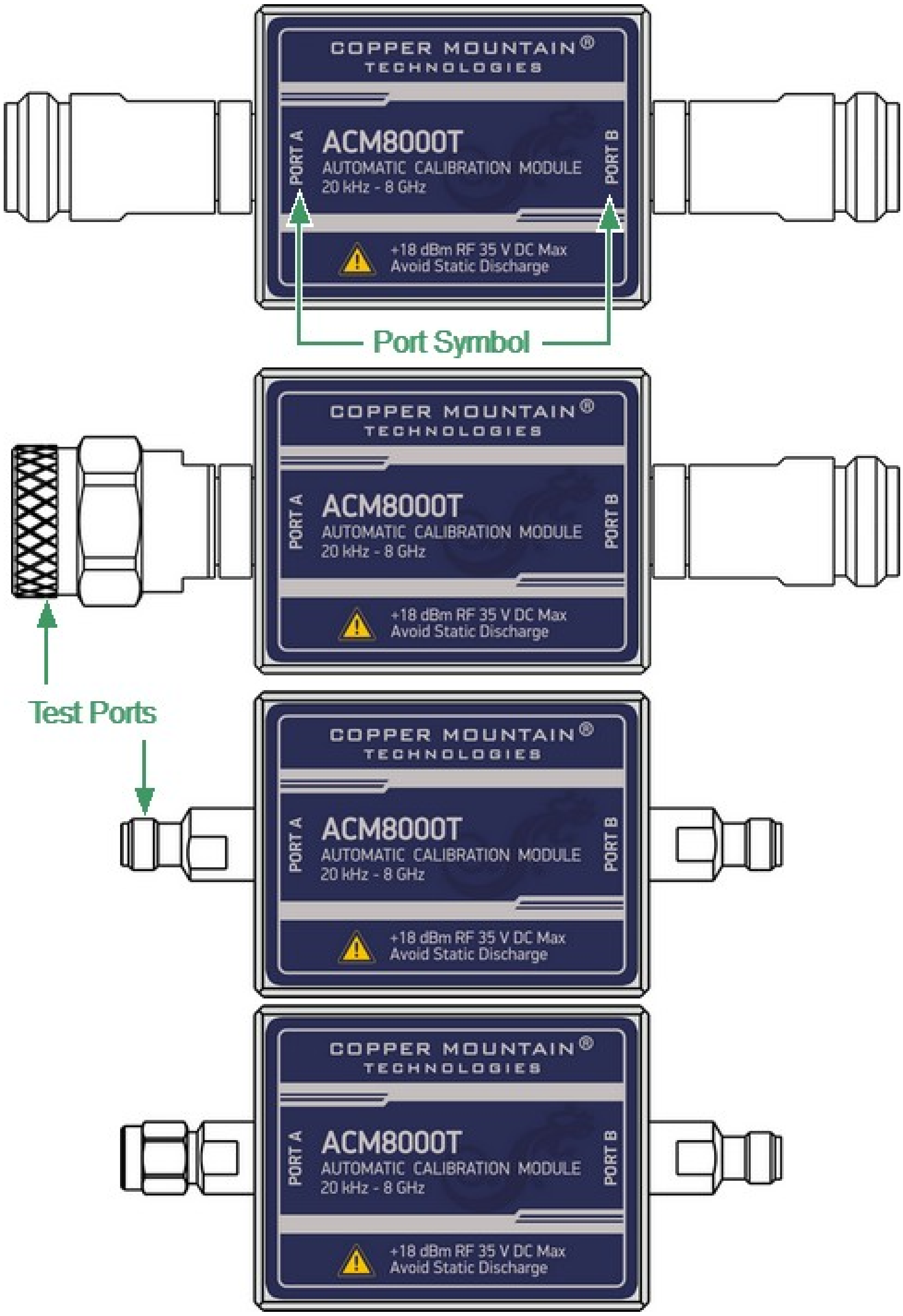
The connector is located on the bottom of the Module and is intended for the Module connection to the controlling PC. The Module is powered using the USB cable.

Hardware configurations

Model	Connector type	
	Port A	Port B
ACM6000T-011	type N, female	type N, female
ACM6000T-012	type N, male	type N, female
ACM6000T-111	3.5 mm, female	3.5 mm, female
ACM6000T-112	3.5 mm, male	3.5 mm, female

ACM8000T

The front panels of the different models of ACM8000T are shown in the figure below.



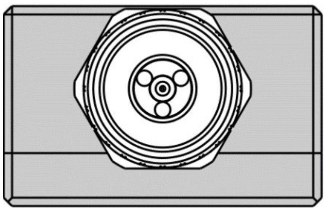
Front panel ACM8000T

Parts of Module

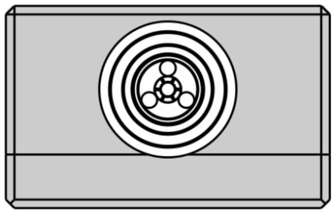
Test port

The test ports are designed for connection to VNA being calibrated. The VNA connectors, the cross sections of which were calibrated, are referred to as its test ports.

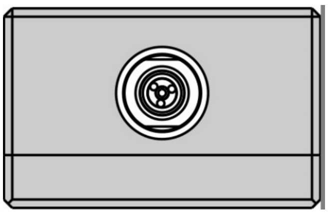
The Modules connectors are shown in figures below.



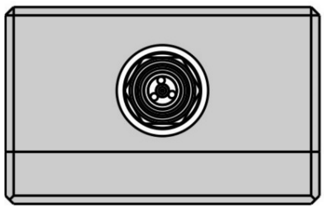
Type N, male



Type N, female

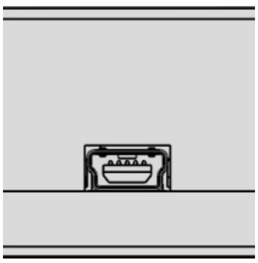


3.5 mm, female



3.5 mm, male

Connector (on side panel)



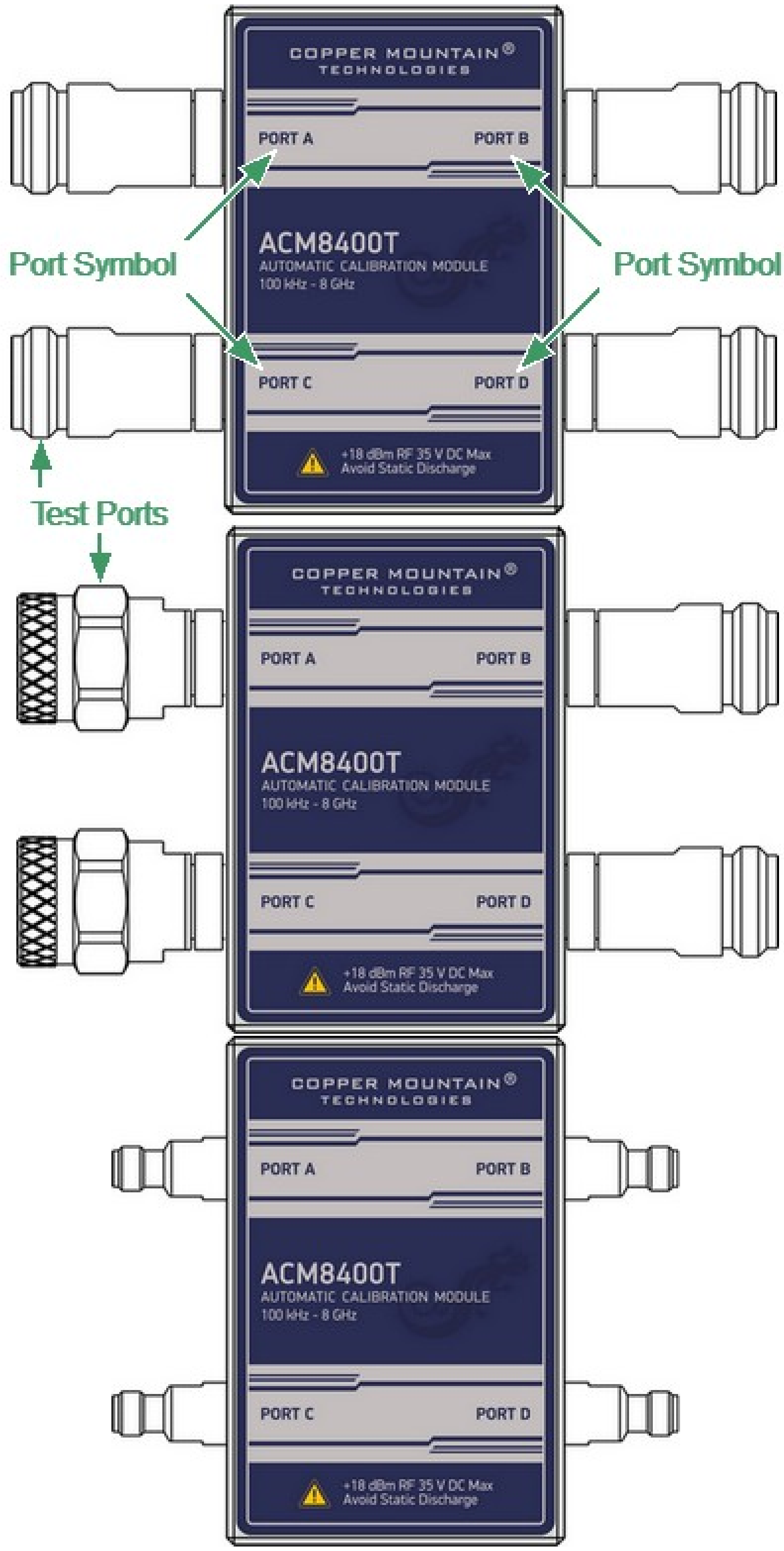
The connector is located on the bottom of the Module and is intended for the Module connection to the controlling PC. The Module is powered using the USB cable.

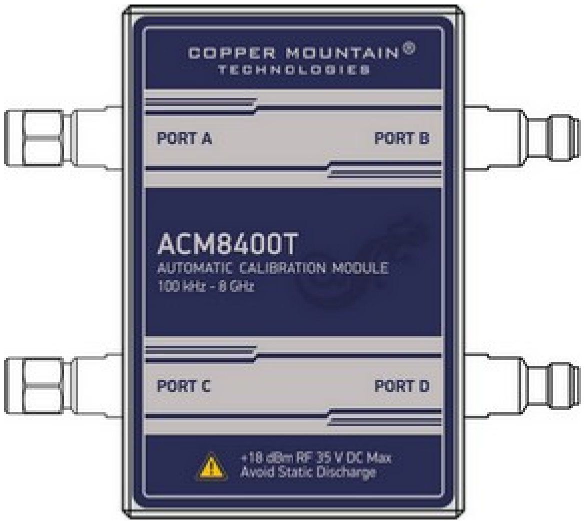
Hardware configurations

Model	Connector type	
	Port A	Port B
ACM8000T-011	type N, female	type N, female
ACM8000T-012	type N, male	type N, female
ACM8000T-111	3.5 mm, female	3.5 mm, female
ACM8000T-112	3.5 mm, male	3.5 mm, female

ACM8400T

The front panels of the different models of ACM8400T are shown in the figure below.





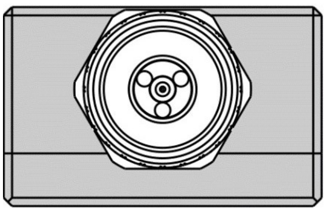
Front panel ACM8400T

Parts of Module

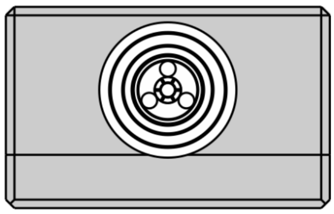
Test port

The test ports are designed for connection to VNA being calibrated. The VNA connectors, the cross sections of which were calibrated, are referred to as its test ports.

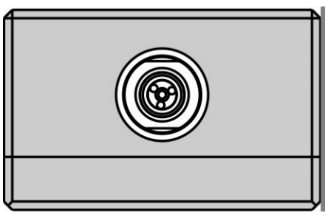
The Modules connectors are shown in figures below.



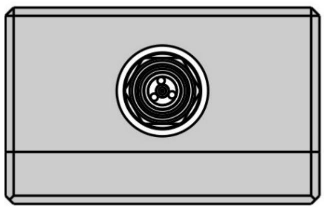
Type N, male



Type N, female

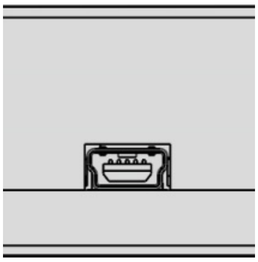


3.5 mm, female



3.5 mm, male

Connector (on side panel)



The connector is located on the bottom of the Module and is intended for the Module connection to the controlling PC. The Module is powered using the USB cable.

LED Status Indicator (on rear panel)

NOTE	LED Status Indicator is located under the label and is visible only during operation.

The LED indicates the following statuses:

- Blinking green and red LED mean testing LED and indicating external power supply voltage presence.
- Red LED indicator means warm-up mode of the Module. The time required for operating mode setting is automatically counted from the moment of the Module connection using USB. If the Module is disconnected during setting and reconnected again, then the countdown counter starts from the beginning.

  Additional red LED may indicate the Module connection loss with the PC. In this case, check the Module connection with software (the **Autocalibration** softkey should be active), if there is no connection, disconnect the USB cable from the Module and repeat the connection.
- Green LED indicator means the Module is ready for operation.

Hardware configurations

Model	Connector type	
	Port A/C	Port B/D
ACM8400T-01111	type N, female	type N, female
ACM8400T-01212	type N, male	type N, female
ACM8400T-11111	3.5 mm, female	3.5 mm, female
ACM8400T-11212	3.5 mm, male	3.5 mm, female

Protective Housing

The protective housing is designed to protect the test ports and the USB connector of the automatic calibration module (ACM) from mechanical influences.

The protective housing is removable. The collapsible design allows for quick installation.

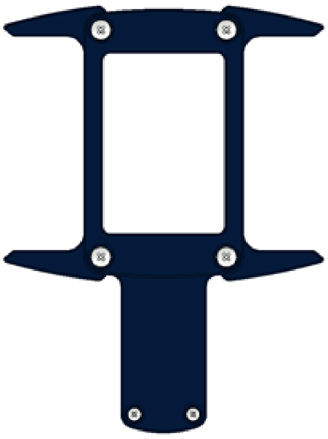
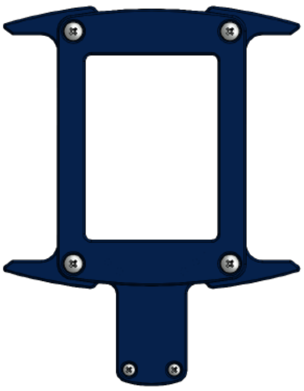
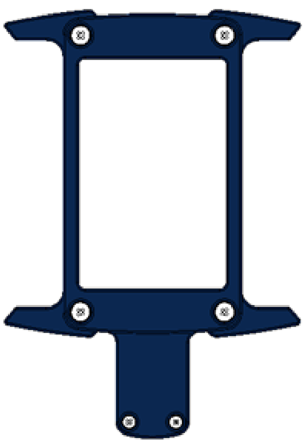
The protective housing is non-repairable.

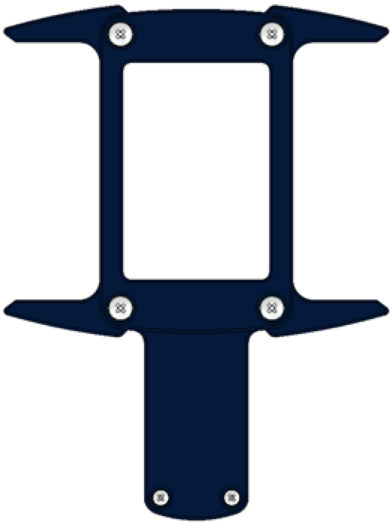
NOTE	The protective housing is not intended for use in extreme environments. Do not bend or stretch the protective housing during use.

The appearance of the protective cover is determined by the modification of the module (See table below).

ACM protective housing

Housing Model	Compatible ACM models
ACM2509 	ACM2506-111, ACM2506-112, ACM2509-111, ACM2509-112, ACM6000T-111,ACM6000T-112, ACM8000T-111, ACM8000T-112
ACM2509 	ACM2506-011, ACM2506-012, ACM2509-011, ACM2509-012, ACM2708-011, ACM2708-111, ACM6000T-011,ACM6000T-012, ACM8000T-011, ACM8000T-012, ACM4000T-511, ACM4000T-512

Housing Model	Compatible ACM models
ACM2520 	ACM2520-011, ACM2520-012, ACM2520-111, ACM2520-112
ACM2543 	ACM2543-611, ACM2543-612, ACM2543-711, ACM2543-712
ACM4509 	ACM4509-01111, ACM4509-01212, ACM4509-11111, ACM4509-11212, ACM84000T-01111, ACM84000T-01212, ACM84000T-11111, ACM84000T-11212

Housing Model	Compatible ACM models
ACM4520 	ACM4520-01111, ACM4520-01212, ACM4520-11111, ACM4520-11212

Delivery Kit

The delivery kit for the Module is represented in table below.

Name	Quantity, pcs
Automatic calibration module	1
USB cable	1
Envelope with ACM certificate of calibration and statement of calibration due date	1
Protective housing	1
1. A specific model of Module is selected in the order. 2. The operating manual is not included in the delivery kit , and can be accessed at www.coppermountaintech.com. 3. The protective housing can be ordered separately.	

NOTE	Use the protective housing to protect the test port and USB connector of the Module from mechanical influences (see Protective Housing).

Specifications

The specifications of each Module can be found in its datasheet.

Measurement Capabilities

The VNA software controlling the Module features a wide range of functions. They are briefly described below. See the VNA operating manual for more detailed information.

Automatic Calibration

Calibration	Calibration of a test setup (which includes the VNA, cables, and adapters) significantly increases the accuracy of measurements. Calibration allows for correction of errors caused by imperfections in the measurement system: system directivity, source and load match, tracking, and isolation.
Automatic calibration of VNA	The Module enables calibration in one click. The calibration is performed fully automatically, including switching between different module states, their measurements, and calibration coefficients calculation, as the software uses the data stored in the Module memory.
Calibration methods	All Modules support the following calibration methods: • Full one-port calibration. • One-path two-port calibration. • Full two-port calibration.
Full one-port calibration	The method of calibration performed for one-port reflection measurements. It ensures high accuracy.
One-path two-port calibration	The method of calibration performed for reflection and one-way transmission measurements. For example, for measuring S11 and S21 only. It ensures high accuracy for reflection measurements, and reasonable accuracy for transmission measurements.

Full two-port calibration	The method of calibration performed for full S parameter matrix measurement of a two-port DUT. This method is also known as SOLT: Short, Open, Load, Thru. It ensures high accuracy.

Characterization

Characterization	Characterization is a table of S-parameters of all the states of the Module switches, stored in its memory. The Module has two memory sections. The first one is write-protected and contains factory characterization. The second memory section allows to store up to three user characterizations. Before calibration, it is possible to select factory characterization or one of the user characterizations.
Factory characterization	Factory characterization is performed during the Module manufacturing. The factory characterization data is stored in the write-protected section of the Module memory.
User characterization	The user characterization option is provided for saving new S-parameters of the Module after connecting adapters to its ports. Up to three different characterizations can be created. The user characterization can be performed using the VNA software. The characterization data is stored in the Module memory section, which can be overwritten.

Automatic Orientation

Orientation	Orientation refers to the Module ports in relation to the test ports of the VNA. While the VNA ports are indicated by numbers, the Module ports are indicated by the letters A, B, C and D.
Orientation method	Manual or automatic orientation method can be selected.
Automatic orientation	For automatic orientation, the VNA software determines the Module orientation each time prior to its calibration or characterization.

Thermal Compensation

Thermal compensation	Thermal compensation is a software function of S-parameters correction based on known temperature dependence data and the temperature sensor data inside the Module. Temperature dependence of each Module with factory characterization is determined during its manufacture and stored in its memory. It is possible to enable or disable thermal compensation function.
Thermal compensation of user characterization	Thermal compensation of user characterization is based on coefficients obtained during the Module manufacture. If the operating frequency range and/or the number of frequency points of the user and factory characterization are not the same, linear interpolation of thermal compensation coefficients is used for user characterization data.

Confidence Check

Confidence check	The confidence check is a test of the current calibration, performed either by the Module, or by any other method. The confidence check features simultaneous indication of attenuator S-parameters measured and stored in the Module memory. Math (division) function for data and memory is used for a detailed comparison.

Automation

Operating modes	The Module is controlled using the USB interface. CMT's VNA software or VISA library must be installed at the controlling PC. The VISA comprehensive library allows controlling measurement equipment in almost all programming languages, i.e. C/C++, Visual Basic, MATLAB, LabVIEW, etc. The Module features the USBTMC USB488 standard control protocol. The Programming Manual includes descriptions of commands used for controlling.

Principle of Operation

The Module contains several different transmission and reflection impedance states, as well as electronic changeover switches, two or four RF connectors, and a USB connector. RF connectors are intended for connecting to VNA test ports, and a USB connector is intended for controlling.

Module	States
ACM2506, ACM2509, ACM2708, ACM4000T, ACM6000T	6 reflection states (three for each port), a THRU, and an attenuator.
ACM2520	8 reflection states (four for each port), a THRU, and an attenuator.
ACM2543, ACM8000T	10 reflection states (five for each port), a THRU, and an attenuator.
ACM4509, ACM8400T	16 reflection states (four for each port), a THRU, and an attenuator.
ACM4520	12 reflection states (three for each port), a THRU, and an attenuator.

Calibration is performed by automatically connecting internal transmission and reflection impedance states to the VNA test ports.

Calibration allows determining systematic errors according to the VNA model. The data obtained after calibration is used to correct S-parameter measurement results to increase measurement accuracy.

Block diagrams of Modules are represented in Module Block Diagrams.

Types of Calibration Standards

Calibration standards are physical devices with known parameters used for VNA calibration, with the purpose of calculating systematic errors and further correcting the measurement results.

OPEN, SHORT, and LOAD are the reflection standards, and THRU is the transmission standard (transmission connection).

The Module includes four types of calibration standards:

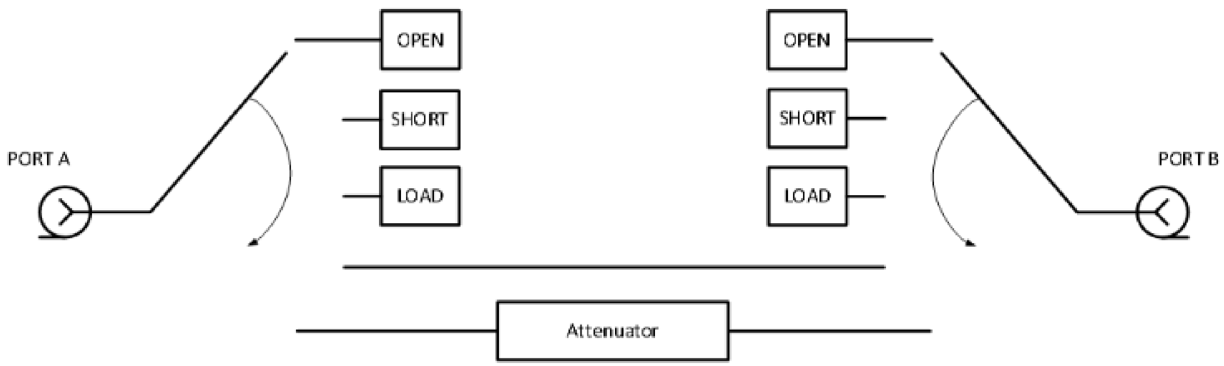
- OPEN
- SHORT
- LOAD
- THRU

Attenuator

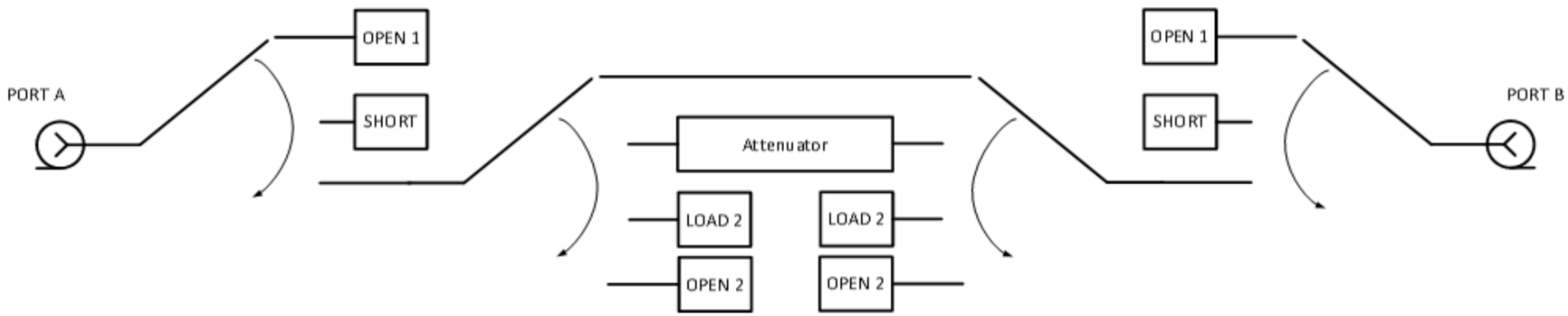
The Module features additional attenuator state, which is not used during calibration. The attenuator is used for checking calibration quality using a special confidence check function, which allows for comparing of the measured S-parameters of attenuator with the parameters stored in the Module memory.

Module Block Diagrams

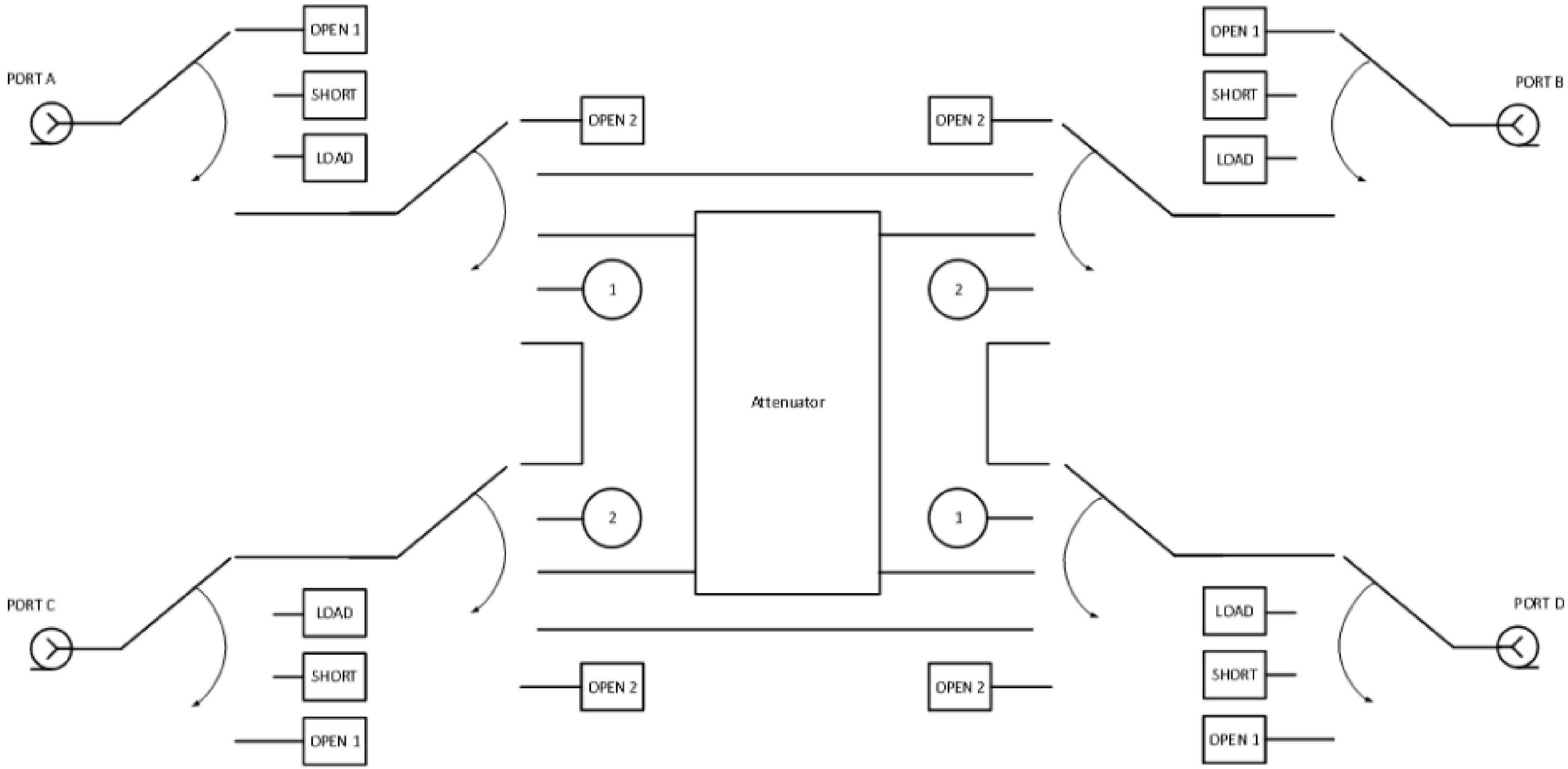
Module block diagrams are shown in figures below.



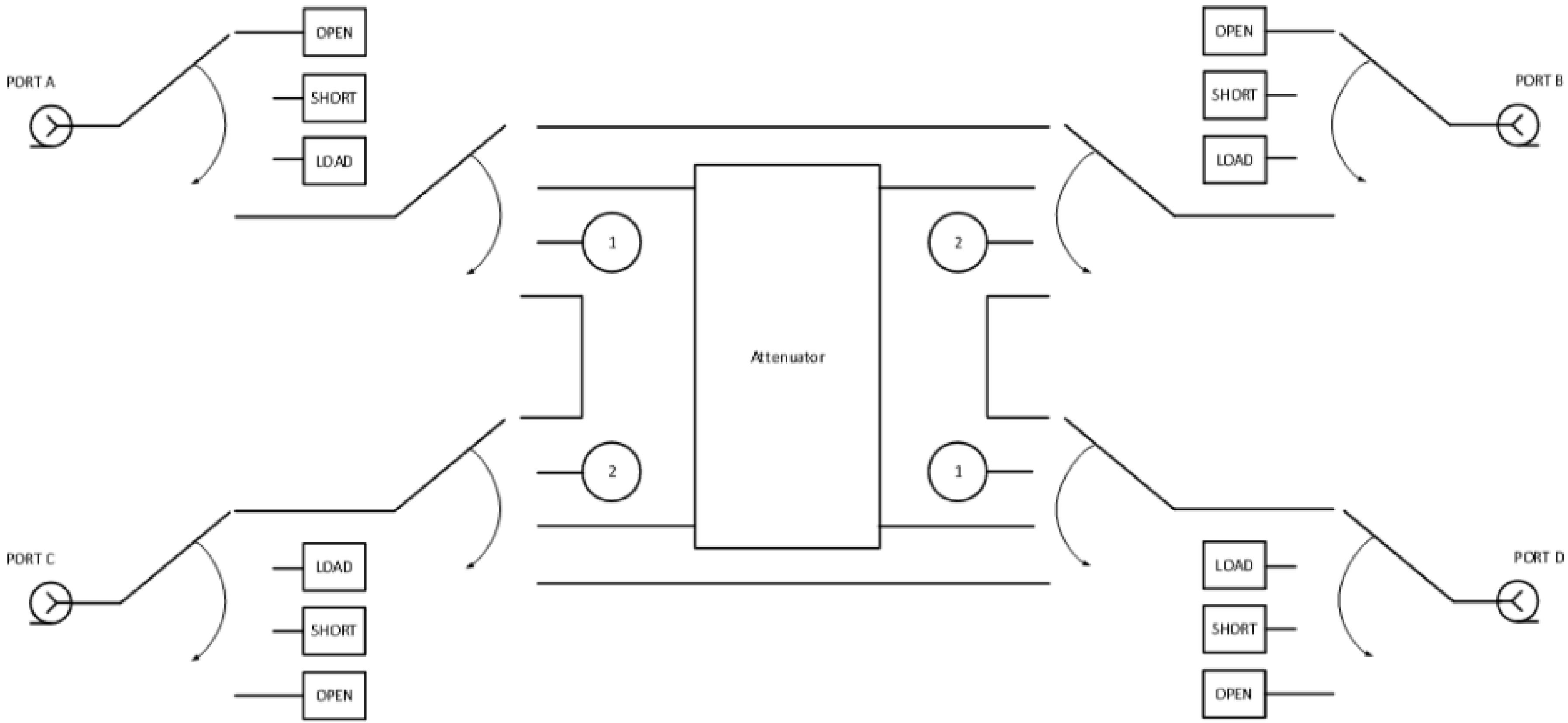
Block diagram of ACM2506 and ACM2509



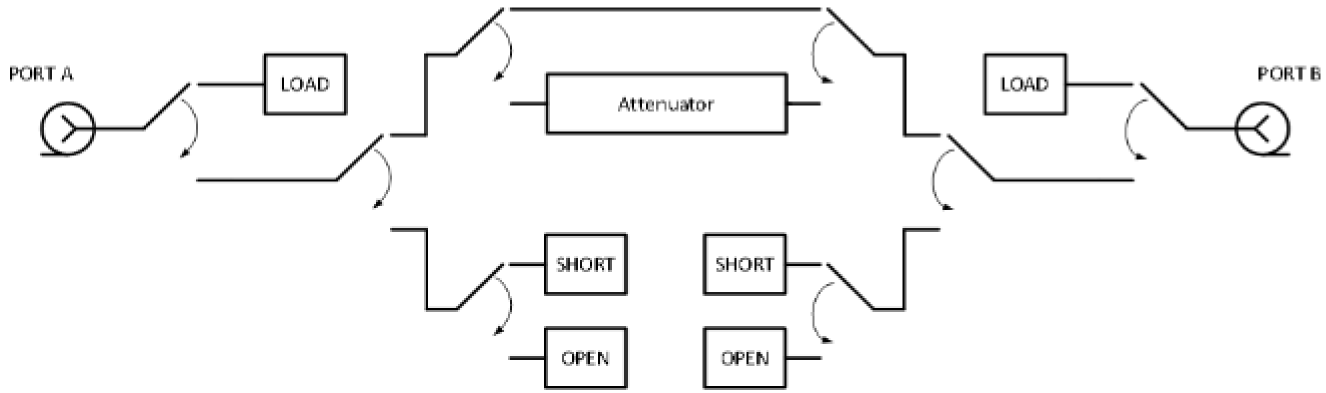
Block diagram of ACM2520



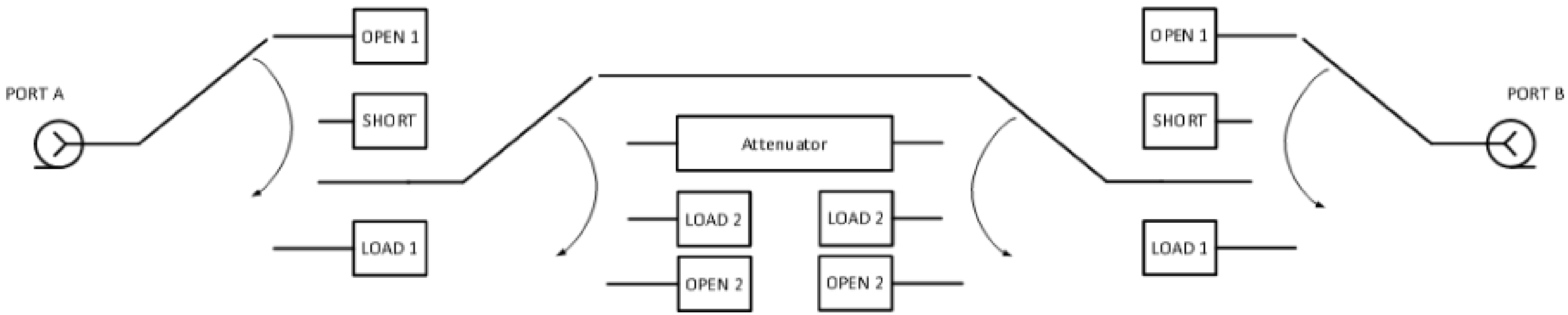
Block diagram of ACM4509 and ACM8400T



Block diagram of ACM4520



Block diagram of ACM2708, ACM4000T and ACM6000T



Block diagram of ACM8000T and ACM2543

Preparation for Use

Unpack the Module and other accessories.

CAUTION	Please keep packaging to safely ship the instrument for annual calibration!

The following section describes the process of preparing the ACM for use:

- Operating Restrictions.
- Installation.
- Software.

Operating Restrictions

The accuracy of calibration using the Module largely depends on proper handling of the Module while preparing it for use. Keep all connectors clean and undamaged to increase the Module's service life. Dirty or damaged connector can deteriorate accuracy characteristics and materially affect the VNA calibration results.

Before starting operation, perform the following activities to prevent the Module damage:

- Visually inspect the connectors, the Module housing, and the USB cable from the delivery kit for damages and contamination. If foreign particles are detected on the connectors, perform cleaning according to the procedure in Cleaning Connectors. Do not operate the Module if mechanical connector damage is detected. Damaged Modules should be discarded to prevent further damage of other good connectors.
- Visually inspect the connectors, which will be connected to the Module, for damages and contamination. If foreign particles are detected on the connectors, perform cleaning according to the procedure in Cleaning Connectors.
- If necessary, gauge the connectors using the procedure described in Gauging Connectors, which describes connection of the Module and devices connected to it.

Pay special attention to the connection sequence. Proper connection sequence prevents central and external conductors damage, ensures maximum measurement results repeatability, and excludes the most common VNA measurement error, i.e. bad connection. The recommended connection sequence is shown in Connecting and Disconnecting Devices.

The main cause of measurement accuracy deterioration is the change of ambient conditions between the calibration and DUT measurement. The ambient conditions are described in Ambient Conditions Control.

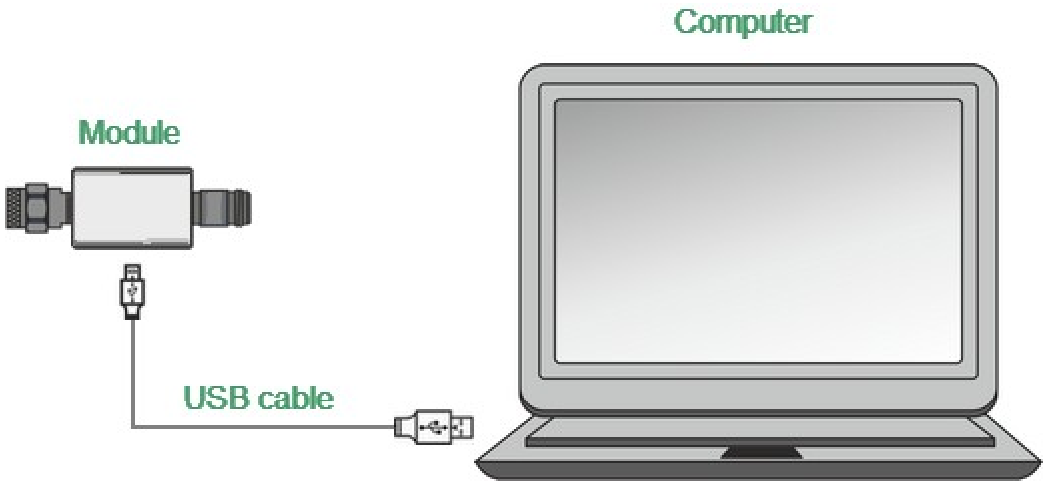
Installation

Unpack the Module and place the Module in the work area.

Take necessary precautions to protect against electrostatic discharge in the work area.

Keep the Module in operating conditions for no less than two hours if it was stored in any other ambient conditions.

Connect the Module using the USB cable. Warm the Module up for no less than 15 minutes. The warm-up connection procedure is shown in the figure below.



Module connection to PC

Typical Module connection diagrams for VNA calibration are shown in Connection Diagrams.

Software

The Module is controlled by the Copper Mountain Technologies VNA software. Minimum technical requirements to the PC and the description of software installation are described in the VNA Operating Manual.

The VNA software automatically detects the connected Module and makes the Autocalibration menu available. Special Module selection is not generally required.

If the menu is not active:

1. Shut down all the open VNA software windows.
2. Disconnect the Module from the USB cable for one minute, then reinsert the cable.
3. Restart the VNA software, making sure that the VNA software functions properly according to the VNA Operating Manual.
4. Connect the Module again, making sure that the model and serial number match the Module connected.

Driver installation

The USB driver is automatically installed when the Module is first connected to the USB port.

Operation Procedure

This section describes how to work with the Module:

- Connection diagrams to perform calibration.
- Module work session.
- Parameters setting.

Connection Diagrams

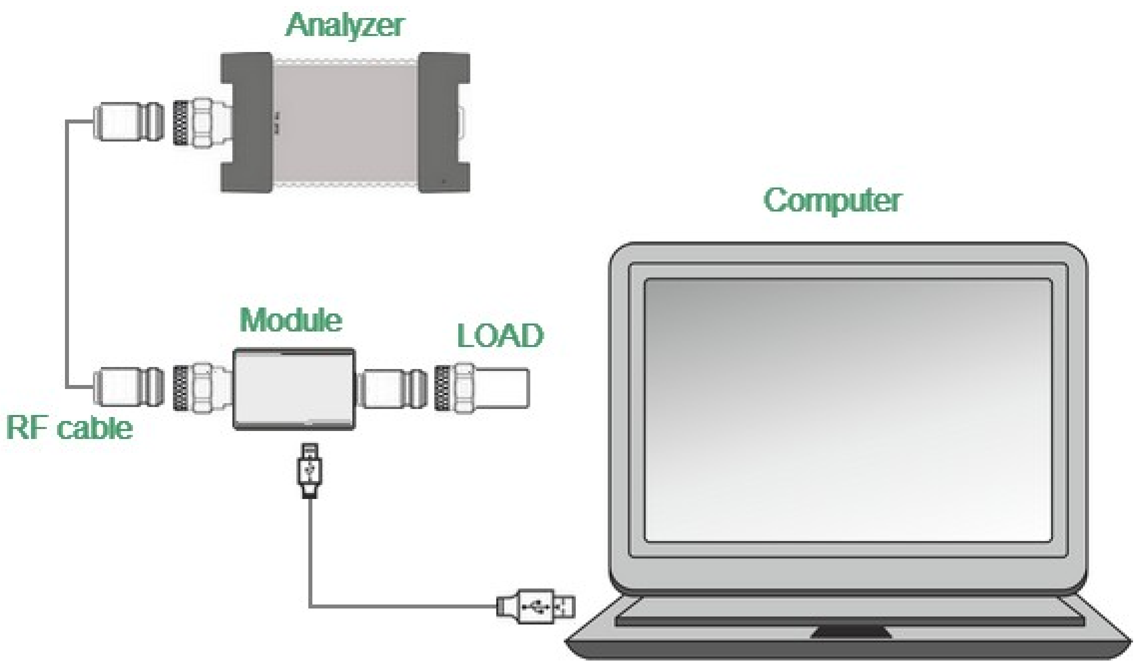
The following are connection diagrams for calibrations:

- Full One-Port Calibration
- One-Path Two-Port and Full Two-Port Calibration (RNVNA only)

Full One-Port Calibration

In order to perform calibration, it is recommended to connect a LOAD to a free port of the Module. The LOAD is not included in the delivery kit.

Typical connection diagram for full one-port calibration is shown in figure below.



Module connection diagram for performing full one-port calibration

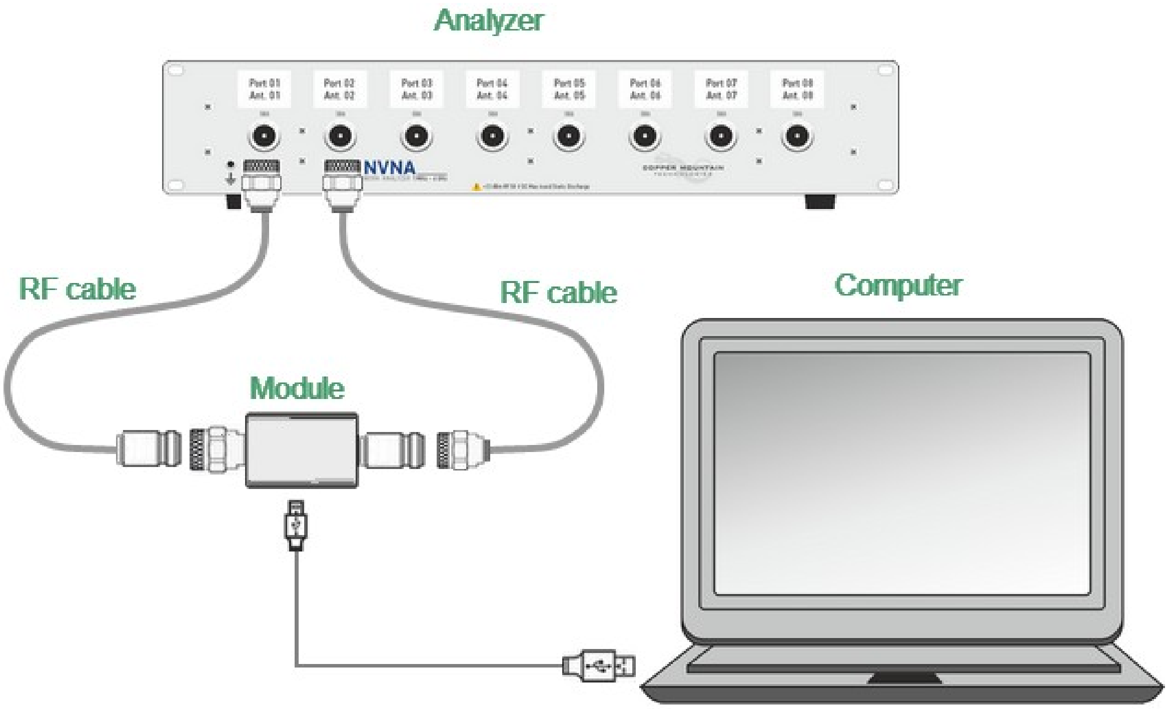
To prevent the cable from damage and improve the stability, it is recommended to use additional protection metrology-grade adapters (these adapters are not shown in figure).

WARNING	Use a torque wrench to tighten the male connector nut. Use a spanner to prevent the connected devices from rotation.

One-Path Two-Port and Full Two-Port Calibration

NOTE	This section is available for RNVNA only.

Typical connection diagram for one-path two-port with scalar THRU and full two-port calibration with scalar THRU is shown in figure below.



Module connection diagram for performing one-path two-port and full two-port calibration

Module Work Session

This section includes the example of the Module work session. Perform the following activities to calibrate all types of VNAs:

- Locate the Module at the work site and warm it up for at least 15 minutes.
- Set up the VNA parameters, at which calibration and DUT parameters measurement will be performed.
- Assemble a test setup.
- Connect the Module (typical connection diagrams are shown in Connection Diagrams).
- Perform the required calibration.
- Disconnect the Module and connect the DUT in its place.

Module Preparation for Calibration

Locate the Module on the work bench, switch it on, and warm it up for at least the period of time indicated in the datasheet. If the model used is equipped with an LED status indicator, wait until the LED is green.

WARNING	The technical specifications will correspond to the stated specifications only after the operating mode setup time is over.

Module readiness indication	The VNA software can automatically detect the connected Module. After the Module connection, the VNA software makes the Autocalibration menu available.

Parameters Setting

Before starting measurements and calibration, set up the following VNA parameters:

- Set up default parameters.
- Select the traces and assign measured S-parameters to them.
- Set up the frequency range and the number of frequency points.
- Set up the output power level at no more than -5 dBm.
- Set up the IF bandwidth.

These parameters are set up in the VNA software. The setting procedure is described in detail in the VNA Operating Manual.

Calibration

The following section describes the process of calibrating ACMs.

Module Advantages

Calibration involving the Module has several advantages compared to conventional calibration with a kit of mechanical calibration standards:

- Only one connection required.
- Reduced calibration time.
- Less probability of operator’s mistakes.
- Less wear of VNA test ports connectors.

Measurement Errors

Different measurement errors affect the results of VNA S-parameter measurements. The measurement errors can be divided into two categories:

- Systematic errors.
- Random errors.

Random errors are:

- Noise fluctuations and thermal drift in electronic components.
- Changes in the mechanical dimensions of cables and connectors subject to temperature drift.
- Repeatability of connections and cable bends.

Random errors are unpredictable and hence cannot be estimated and eliminated in calibration. Certain measures can be taken to reduce the random error:

- Proper source power selection.
- Narrower IF bandwidth.
- Constant ambient temperature.
- Proper warm-up time.
- Careful handling of connectors.
- Fewer cable bends after calibration.
- Sage of torque wrench to tighten the male connector nut and spanner to prevent the connected devices from rotation.

Systematic errors occur when the test setup components are not in ideal conditions. They are repeatable, and their characteristics do not change in time. Systematic errors can be calculated, and their value can be reduced mathematically by measurement results correction.

Calibration Types

The Modules enable three types of calibration:

- Full one-port calibration
- One-path two-port calibration (RNVNA only)
- Full two-port calibration (RNVNA only)

The calibration procedure is described in Calibration Procedure.

Full One-Port Calibration

The three calibration standards are measured in the process of this calibration:

- SHORT
- OPEN
- LOAD

Full one-port calibration features high accuracy.

One-Path Two-Port Calibration

NOTE	This section is available for RNVNA only.

One-path two-port calibration combines full one-port calibration and extended transmission normalization. This calibration type features higher accuracy of measuring frequency response flatness compared to transmission normalization.

One-path two-port calibration requires connection of three calibration standards to the source port, just as in one-port calibration, as well as a connection of the THRU calibration standard between the calibrated source port and the receiver port.

Full Two-Port Calibration

NOTE	This section is available for RNVNA only.

Full two-port calibration requires connection of seven calibration standards:

- Two OPEN calibration standards.
- Two SHORT calibration standards.
- Two LOAD calibration standards.
- One two-port THRU calibration standard.

This calibration type combines two one-port calibrations for each test port with the measurement of transmission and reflection of a THRU standard in both directions.

Full two-port calibration features high accuracy.

Thermal Compensation

Thermal compensation is a software function of the Module parameters correction using the data of internal temperature sensor and data on temperature dependence.

The Module temperature dependence data are the thermal compensation coefficients of magnitude and phase of reflection or transmission coefficients for different Module states stored in its memory.

The compensated magnitude value M_c, dB, is calculated using the following formula:

$$M_c = M \cdot k_m \cdot (T_{char} - T)$$

where M — magnitude before compensation, dB,

k_m — thermal compensation coefficient magnitude, dB/ºC,

T_{char} — temperature at Module characterization, ºC,

T — current temperature inside the Module housing, ºC.

Compensated phase value, P_c°, is calculated using the following formula:

$$P_c = P \cdot k_p \cdot (T_{char} - T)\ ,$$

where P — phase value before compensation, º

k_p — thermal compensation coefficient phase, º/ºC,

T_{char} — temperature at Module characterization, ºC,

T — current temperature inside the Module housing, ºC,

Temperature dependence of S-parameters of each Module is measured at the factory and stored in its memory.

Thermal compensation can be applied to the factory or user characterization data.

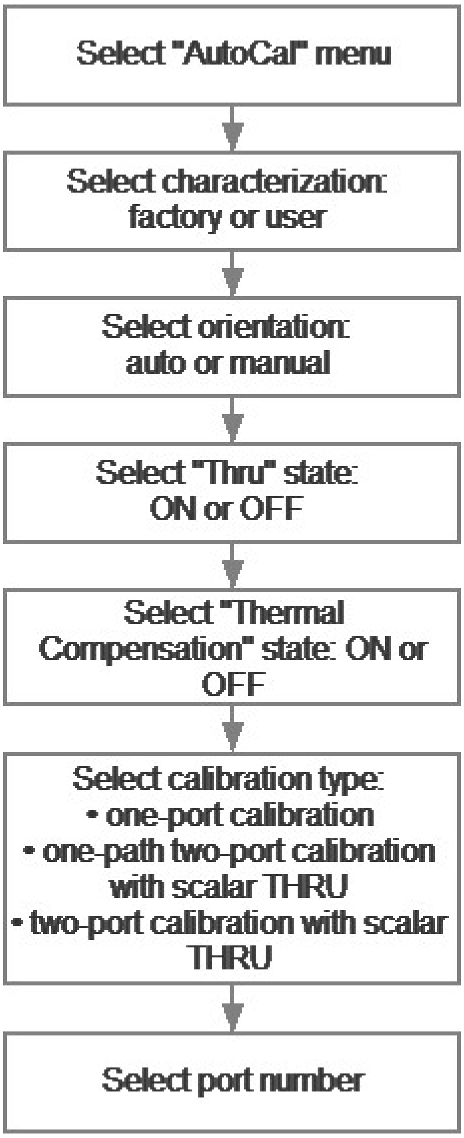
The thermal compensation function can be enabled or disabled.

Calibration Procedure

Calibration is performed in fully automatic mode. The calibration procedure is the following:

1. Press the calibration softkey in the software main menu.
2. Select automatic calibration in the resulting menu. The autocalibration softkey becomes active after the Module connection (typical connection diagrams are shown in Connection Diagrams).
3. Select the Module orientation method by pressing the orientation softkey.
4. Select the thru algorithm state. The thru algorithm can be either enabled or disabled.
5. Select the thermal compensation function state. The thermal compensation function can be either enabled or disabled.
6. If necessary, display the detailed information on characterization. .
7. Select the calibration type: one-port or two-port (RNVNA only).
8. Specify the port for full one-port calibration, two ports for full two-port calibration (RNVNA only).
9. Wait until calibration is completed.

The automatic calibration algorithm is shown in the figure below.



Autocalibration algorithm

The calibration will be performed automatically: the standards from the Module set will be connected to VNA in sequence under the VNA software control. Then the calibration coefficients table will be calculated and stored in the VNA memory.

When calibration is completed, certain icons will be indicated in the status bars of reflection and transmission coefficients traces:

- **[F1]** — full one-port calibration.
- **[F1ST]** — full one-port calibration with scalar THRU (RNVNA only).
- **[F2ST]** — full two-port calibration with scalar THRU (RNVNA only).

Detailed information on calibration using the Module and the names of all softkeys for all VNAs can be found in the VNA Operating and Programming Manual.

Confidence Check

Confidence check is a test of current calibration performed either using the Module or any other method.

The Module features an additional attenuator state that is not used during calibration. The attenuator is intended for checking calibration by means of a special software function, which enables comparison of measured attenuator S-parameters and the values stored in the Module memory.

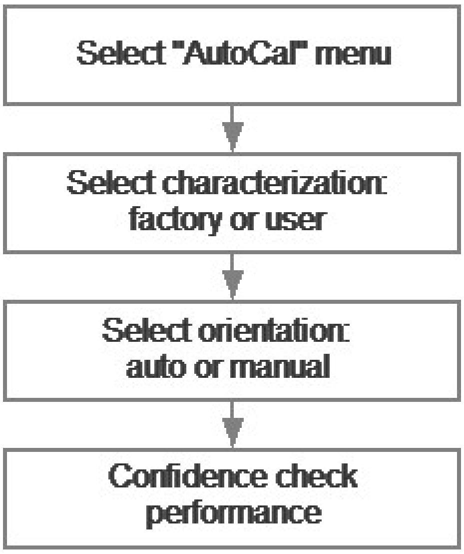
Confidence check procedure

1. Press the calibration softkey in the software main menu.
2. Select automatic calibration in the resulting menu.
3. Press the characterization selection softkey in the autocalibration menu.
4. Select factory characterization or one of three user characterizations in the characterization menu.
5. Select the Module orientation method by pressing the orientation softkey in the autocalibration menu. It is recommended to use automatic orientation.
6. Press the «Confidence Check» softkey in the autocalibration menu.
7. Wait until the confidence check is completed.

The confidence check will be performed automatically. Two traces for each S-parameter will be displayed after measurement. The measured parameters will be indicated on the data trace, and the parameters from the Module memory will be indicated on the memory trace.

Compare the data and memory traces to evaluate whether the calibration was successful. Also, the function of math operations with memory traces for a finer trace comparison can be used.

Confidence check algorithm is shown in the figure below.



Algorithm of confidence check using the Module

Detailed information on the Module confidence check and the names of all softkeys for all VNAs can be found in the VNA Operating and Programming Manual.

NOTE	When performing Full one-port calibration on the unused ACM port, LOAD standard must be connected.

Automation

The Module supports remote control using third party software. The control function is implemented by means of USB protocol. The VISA library must be installed on the PC for interaction.

The library allows for controlling of measuring equipment in almost any programming language, i.e. C/C++, Visual Basic, MATLAB, LabVIEW, etc. The VISA laboratory supports multiple interfaces and protocols, including USBTMC-USB488 based protocol implemented in the Module.

For detailed information on control functions, see the VNA Operating and Programming Manual.

Maintenance

This section establishes the procedure and rules of maintenance, enabling constant Module operational readiness.

The purpose of Module maintenance is to control its performance parameters and secure its service life.

Maintenance Procedure

The Maintenance Procedure is as follows:

- Maintenance Activities
- Cleaning Connectors
- Gauging Connectors
- Connecting and Disconnecting Devices
- Cleaning and Care of the Protective Housing
- Ambient Conditions Control
- Verification

Maintenance Activities

The Module maintenance includes the following activities:

- Inspection.
- Functional test.

The inspection should be done every time before and after the Module is used.

The inspection comprises:

- Checking components against the delivery kit list.
- Cleaning dust and dirt from external surfaces of the Module. To clean the Module’s external surfaces, use dry or slightly wet cloth. Do not clean the Module inside.
- Cleaning connectors as described in Cleaning Connectors.

Functional test should be carries out once per 100 connections.

The functional test includes:

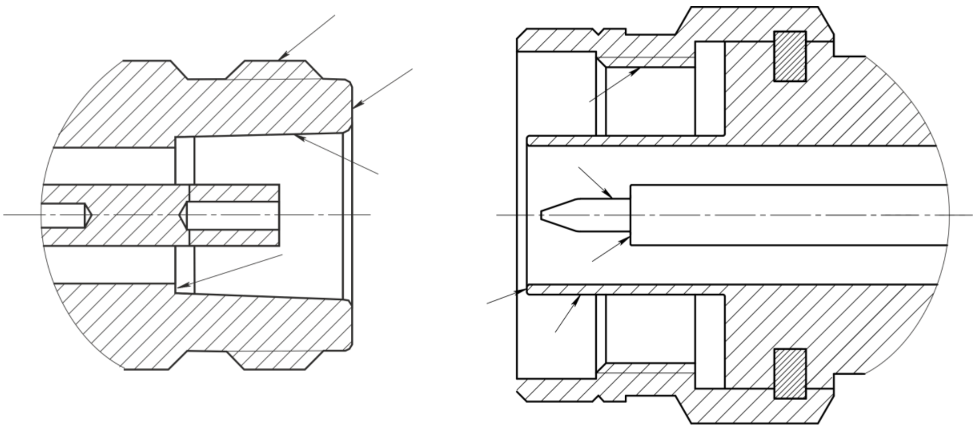
- Inspection.
- Module connectors gauging as described in Gauging Connectors.
- Confidence check.

Cleaning Connectors

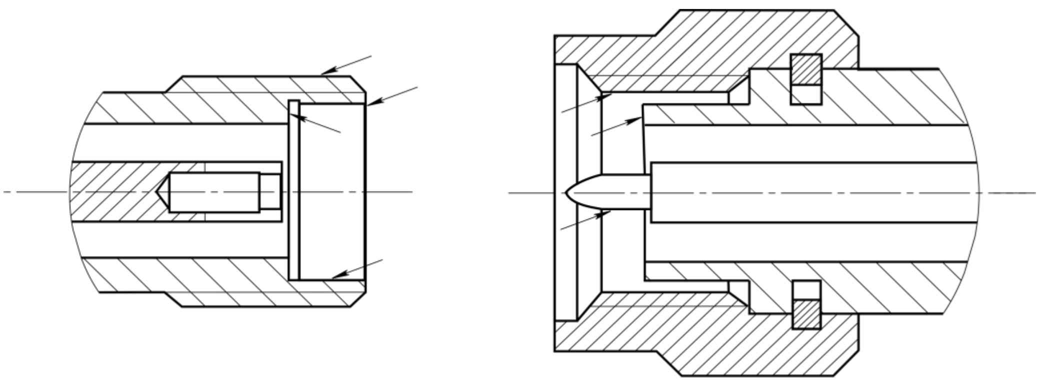
Clean the connectors before and after connecting the Module.

The procedure of cleaning connectors:

1. Wipe the connector surfaces as shown by the arrows in the figures below with a swab dipped in alcohol.



Type N connectors



2.4 mm, 2.92 mm, 3.5 mm connectors

2. Use compressed air to clean another internal connector surface.
3. Let the alcohol dry on the connector surfaces.
4. Visually inspect the connectors to make sure that no particles or residue remain.
5. Repeat the cleaning procedure if necessary.

WARNING

NEVER use metal items for cleaning connectors.

NEVER wipe the center conductors of female connectors. They should be blown with compressed air.

Gauging Connectors

Gauge the connectors before using the Module for the first time, and regularly during operation.

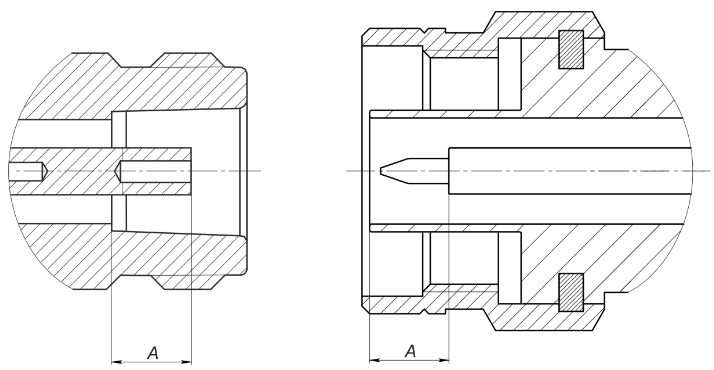
The first gauging of connectors obtains pin depth, which can be used during the Module operation to evaluate its changing.

Gauge the connectors again if:

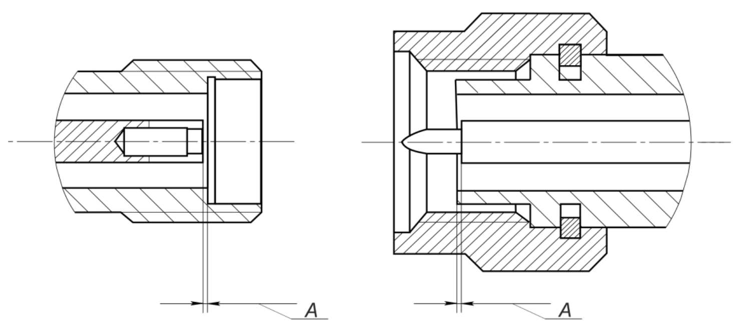
- A visual inspection or Module calibration results suggest that the connector may have defects or damages.
- The device connectors used with the Module are damaged or their pin depth values are out of range for this type of connectors.
- After every 100 connections.

Use gauges for coaxial connectors in compliance with their operating instructions or use multi-purpose tools for linear measurements (for example, micrometer, dial indicator, etc.) to gauge the connectors.

The pin depth of the connectors “PORT A”, “PORT B” and, if available, “PORT C” and “PORT D” are subject to verification. Only measure the A pin depth of type N connectors and 3.5 mm connectors (See figures below).



Type N connectors (female and male)



2.4 mm, 2.92 mm, 3.5 mm connectors (female and male)

The A pin depth value of Module ports connectors must be within the following ranges:

Connectors type	Pin depth range
Type N, female	5.18 to 5.26 mm
Type N, male	5.28 to 5.36 mm
2.4 mm, 2.92 mm, 3.5 mm, male	- 0.08 to 0.00 mm
2.4 mm, 2.92 mm, 3.5 mm, female	- 0.08 to 0.00 mm

The A pin depth value ranges for connectors of other devices are be indicated in their operating manuals.

WARNING

If the pin depth values of the gauged connectors are out of the specified range, such connectors are subject to repair (See Routine Repairs). A device with such connectors is discarded.

Connecting and Disconnecting Devices

The Module connectors should be connected in the following order:

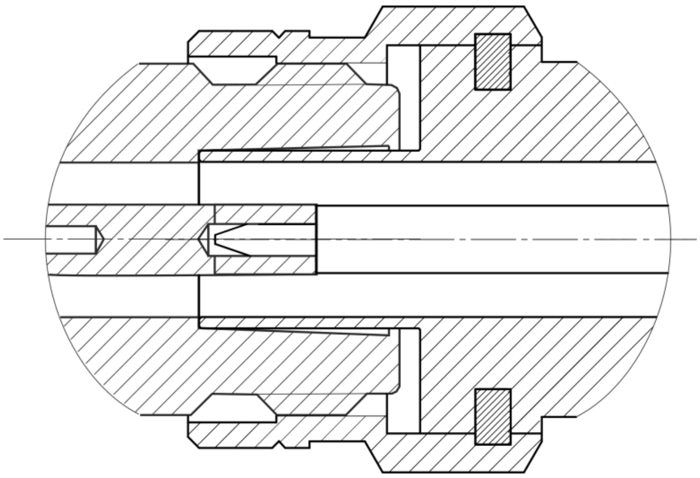
1. Fix the housing of one of the devices being connected. This is necessary to avoid its displacement during connection. Fix the device by any of the following ways:

   - By clamps or wrenches.
   - By weight or configuration of the device itself.
   - By holding the device by hand

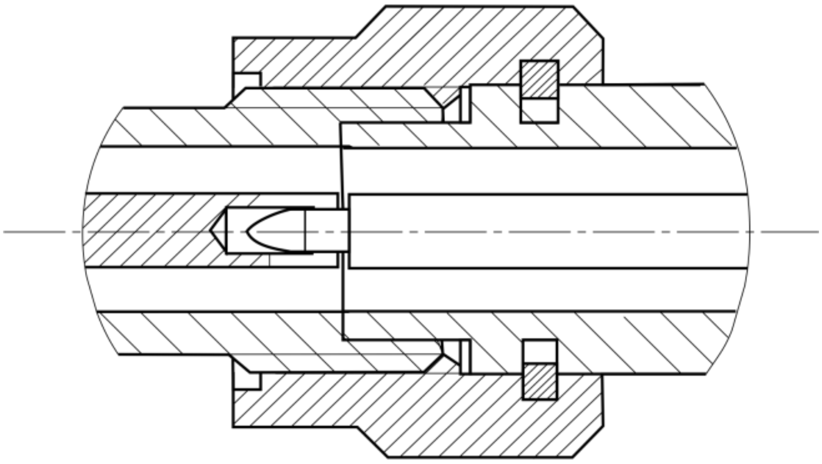
2. Carefully align the connectors of the connected devices.

3. While holding the device being connected, tighten the male connector nut finger tight. Mating plane surfaces of center conductors and outer conductors have to make uniform light contact as shown in the figures below.

4. Tighten the male connector nut using the appropriate torque wrench (the torque value depends on the connector type), while holding the device being connected manually or by using an open-end wrench to keep it from turning. Finally, tighten the male connector nut by holding the wrench at the end of the handle. Tighten the connection just to the torque wrench break point.



Type N connectors (female on the left, male on the right)



2.4 mm, 2.92 mm, 3.5 mm connectors (female on the left, male on the right)

Disconnect the connectors in the following order:

1. Using the torque wrench, which was used for tightening, loosen the male connector nut, while holding the device by hand or an open-end wrench to prevent it from turning.

2. While holding the device so that the connector's center conductor was at the same straight line as it was connected, turn the male connector nut. Pull the connectors straight apart.

WARNING	Do not use alcohol, alkali, or acid for cleaning.

Cleaning and Care of the Protective Housing

The protective housing is not intended for use in extreme environments. Do not bend or stretch the protective housing during use.

Clean the protective housing with a lint-free cloth, slightly dampened with water. Clean the protective housing when it is disassembled.

WARNING	Do not use alcohol, alkali, or acid for cleaning.

Ambient Conditions Control

The measurement accuracy can be severely affected by the change of environmental conditions (especially ambient temperature) between the VNA calibration and the DUT measurements.

The measurements should be performed at an ambient temperature within ±1 °C of the temperature at the time VNA calibration.

Verification

Copper Mountain Technologies recommends following the industry’s best practices and user quality policies to determine the ACM verification period. Consider frequency of use, environmental conditions, and storage procedures. The suggested verification interval is 1-3 years.

Routine Repairs

Only authorized routine repair or repair by the licensed company is permitted. The repair method is non-differential.

Routine repairs	Repairs performed to enable or restore the device performance, which includes replacement and/or recovery of separate parts.
Non-differential method	The method of repairs at which the restored constituent parts do not belong to the specific device instance.

Storage Instructions

Module can be stored in the factory packaging at 0 to +40 ºC and a relative humidity of up to 80% (at 25 ºC). After the factory packaging is removed, the Module should be stored at +10 to +35 ºC and relative humidity up to 80% (at 25 ºC).

Keep the storage facilities free from dust, fumes of acids and alkalis, aggressive gases, and other chemicals, which can cause corrosion.

Transportation

Load and unload the Module packages carefully, avoiding shock and packaging damage. Use the markings on the package to place the Modules correctly during transportation.

The Modules must be shipped in any closed vehicle at temperature from -50 to +70 ºC, a relative humidity of 95% (at 30 ºC), and an atmospheric pressure of 70 to 106.7 kPa (537 to 800 mm Hg).

The Modules can be shipped in packages in conditions excluding any exposure to mechanical or package damage during transportation.

Cargo holds, railway cars, containers, and truck beds, utilized for shipment of the Module should be free from any traces of cement, coal, chemicals, etc. When shipped by air, the products should be kept in aircraft sealed compartments.

Instruction for Use of the Protective Housing

Procedure for installing (removing) the protective housing:

1. Unscrew using a PH1(PZ1) screwdriver:
   - 4 pcs. M3×22 screws on the ACM cover. Remove the ACM cover (See figure below).
   - 2 pcs. M2×18 screws and 2pcs. M2×10 screws on the USB connector cover. Remove the cover.
2. Install (remove) the ACM with the USB cable plugged in. The USB cable must be disconnected from the computer. The orientation of the instrument and the legs of the housing must comply with the figure below.

NOTE For the ACM2509, turn the legs over for convenient wrench access to the Type-N connectors.

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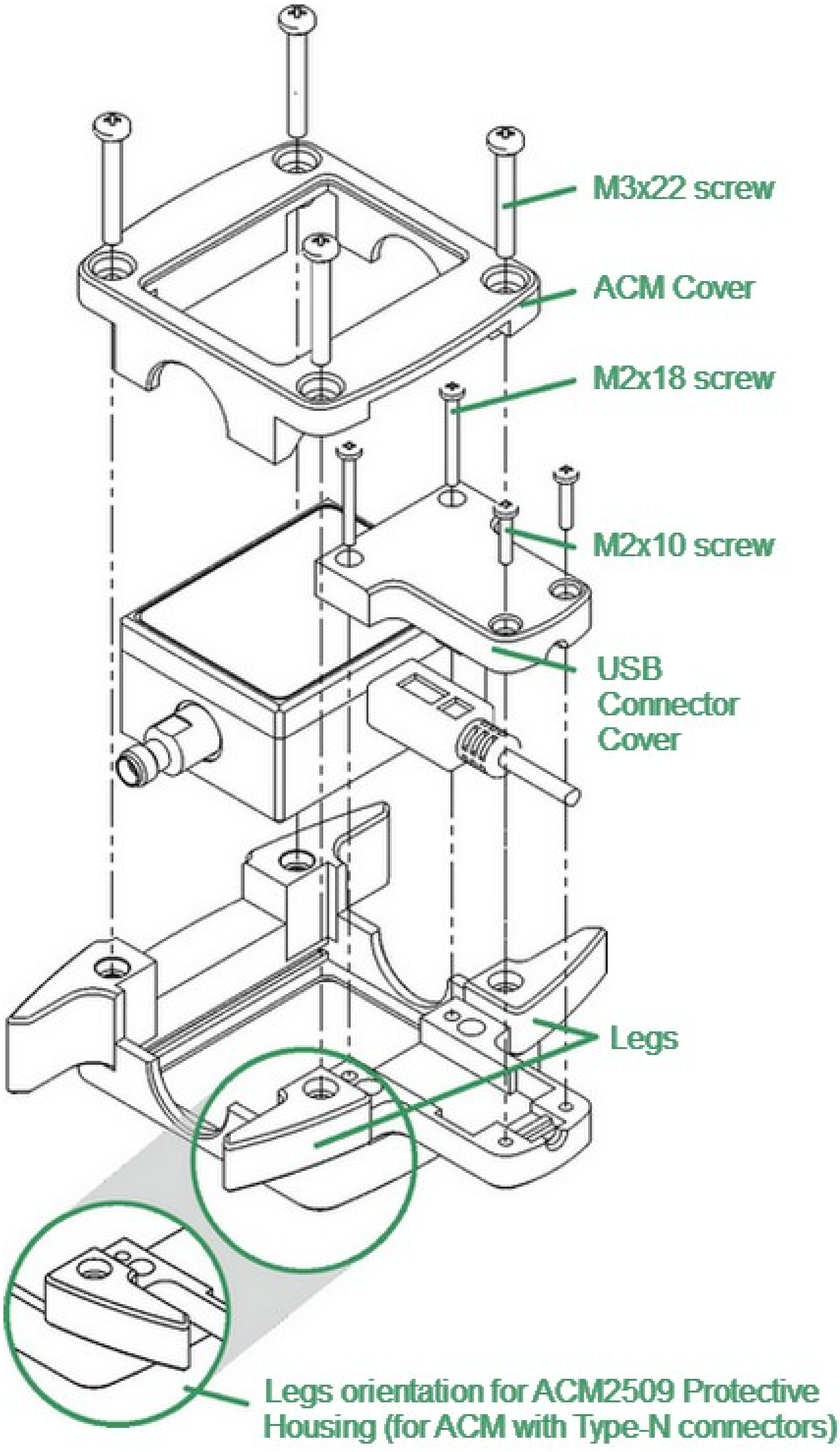
3. Install the USB connector cover, then the ACM cover, using the same screws.

NOTE The head of the screw should be slightly recessed. Tighten without using force, making sure not to allow the material to bulge on opposite side.



Example of housing installation (for ACM2509-011)

Connector Care

When working at frequencies above a few tens of megahertz, the quality and reliability of connections should be monitored more carefully than at lower frequencies. At radio frequencies (RF) and above, the integrity of the transmission line must be maintained throughout the connection, which highlights the importance of the mechanical and electrical compatibility of the connectors.

RF connectors are designed to join devices together as seamlessly as possible. To mate properly, the outer conductor mating surfaces must be clean and flat, and the inner conductor surfaces should come very close together. Even perfectly clean, unused connectors can cause trouble if they are mechanically outside the scope of the specifications. Using a connector gauge is essential, since the critical tolerance in precision microwave connectors is very small.

CAUTION	Damaged or dirty connectors can significantly degrade measurements. To continue to get the best performance from equipment and extend the life of the connectors, perform regular inspections, gauge mechanical tolerances, and clean the RF connectors.

CAUTION	A damaged or out-of-spec connector can destroy the other good connector in just one connection. No device should be used if the connectors are found to be out of the specification.

This document contains operating and maintenance instructions for RF connectors:

- Handling and storage
- Cleaning
- Gauging
- Connecting and disconnecting

NOTE	Explore this document and the documentation for gauging before beginning operation with RF connectors.

Handling and storage

Connectors need to be handled carefully. They should be stored in a safe environment. Always install protective plastic end caps on the connectors of the device when they are not in use.

Keep connectors clean (see Cleaning). Avoid touching the connector mating surfaces with your fingers. Use gloves when working with the connectors to avoid contamination from dirt or grease and to improve accuracy of measurement.

CAUTION	Do not touch mating plane surfaces. Grease and microscopic dirt particles are difficult to remove from these surfaces.

Inspect connectors before mating using a magnifying glass. Check for scratches on the plating, worn mating surfaces, metal particles in the threads or on the mating surfaces, and bent or misaligned conductor centers.

CAUTION	No device should be used if the center connector conductor is bent or broken. No device should be used if the connector has deformed threads.

Holding the connector in your hand or cleaning the connector with compressed air can significantly change its temperature. Wait for the connector temperature to stabilize before using it for calibration or measurement.

Wear a grounding wrist strap and cover the working table with a grounded, conductive mat. This helps to protect devices from electrostatic discharge (ESD).

Connector lifetime:

- All connectors have a limited lifetime. This means that connectors can become defective due to wear during normal use. For best results, all connectors should be inspected and maintained to maximize their lifetime.
- A visual inspection should be performed each time the connectors are mated. Metal particles from connector threads often find their way onto the mating surface during connection or disconnection.

Gauging

Gauging connectors not only provides assurance of proper mechanical tolerances, and thus connector performance, but also indicates when there is potential for causing damage to another connector.

Connector gauging should be performed before the instrument is first used, and during regular operation.

The first gauging of connectors obtains the pin depth, which can be used during operation with the module to evaluate its changes.

Gauge the connectors if:

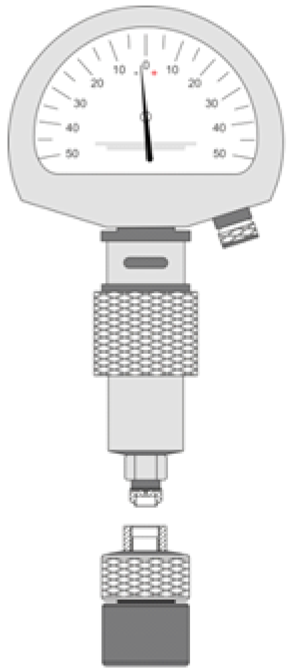
- the device (instrument, calibration standard, cable, adapter, attenuator, or other RF item with coaxial connectors) is being used for the first time.
- visual inspection of the Analyzer calibration suggests that the connector may have defects or damage.
- the connectors of the device used with the Analyzer are damaged, or their pin depth values are out of the range for this type of connector.
- the device is shared with someone else.
- after every 100 connections or as often as experience suggests.

The procedure for connector gauging is as follows (See figure):

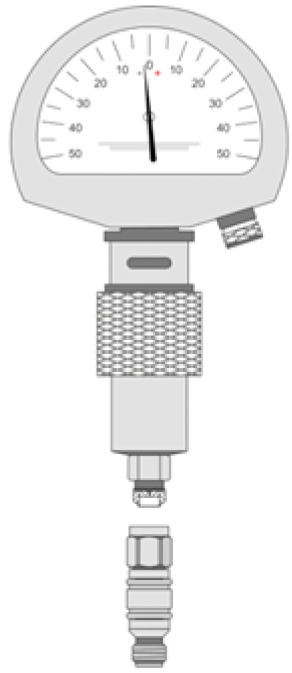
1. Select the proper gauge for your connector.
2. Inspect and clean the gauge, the gauge master, and the connectors to be gauged.
3. Zero the connector gauge before use (according to the gauge documentation).
4. Gauge the connector: while holding the gauge by the barrel, carefully connect the connector under test to the gauge. Read the gauge indicator dial value to determine recession or protrusion and compare the readings with the device specifications (See the figure and table below).

NOTE	Use multiple measurements and keep records of readings.

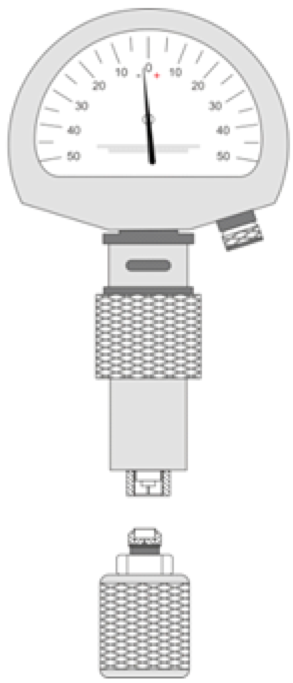
NOTE	Never use an out of specification connector. Do not hold connector gauge by the dial.



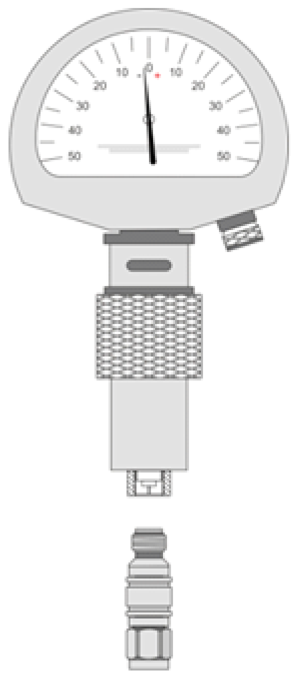
Gauge Master, male



Connectors, male

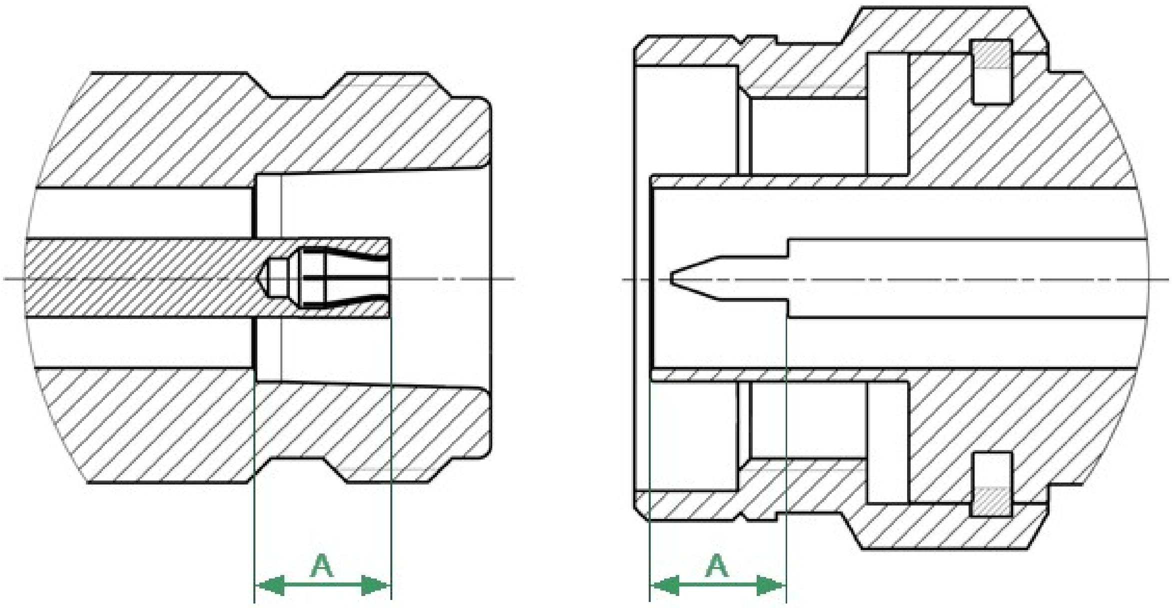


Gauge Master, female

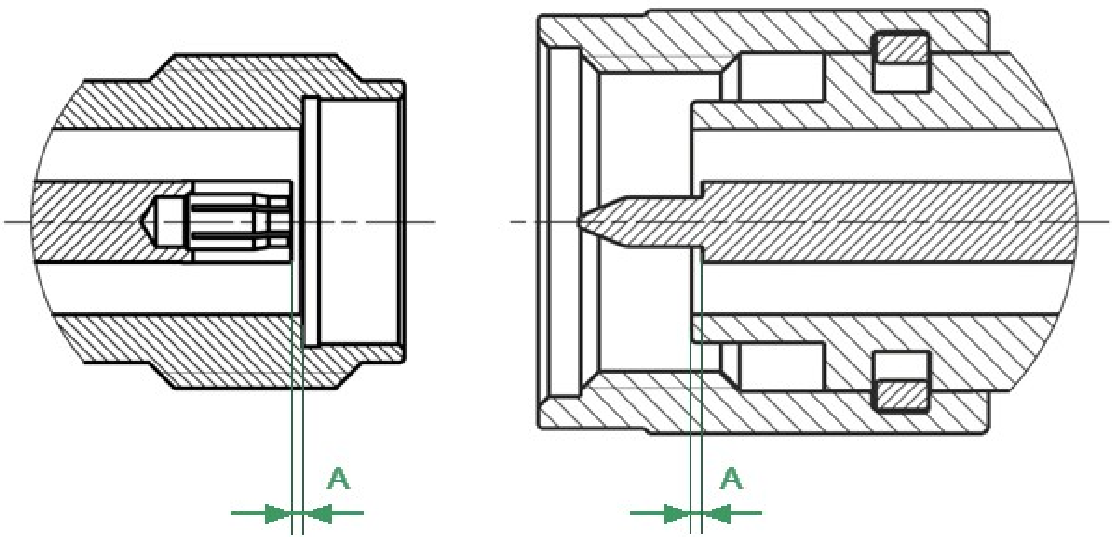


Connectors, female

Example of Gauging Connectors



Type-N Connectors (female and male)



3.5 mm NMD Connectors (female and male)

Mechanical Requirements for Measured Connectors

The A pin depth value of connector

Connector type	A pin acceptable depth range
Type-N, female	5.18 to 5.26 mm
Type-N, male	5.28 to 5.36 mm
2.4 mm NMD, female 3.5 mm NMD, female	-0.08 to 0.00 mm
2.4 mm NMD, male 3.5 mm NMD, male	-0.08 to 0.00 mm

If the pin depth values of the gauged connectors are out of the acceptable range, the connectors may be eligible to be sent in for repair.

Cleaning

Cleaning off any contamination on the connector mating plane surfaces and threads can extend the lifetime of the connector and improve the quality of calibration and measurement.

Remove loose particles from threads and mating surfaces of the connectors with low-pressure air or nitrogen. Using a compressor is not recommended (air filtration is required), it is safer to use a can. Compressed air is the safest method for cleaning connectors with air dielectrics. Wear safety glasses when cleaning.

If further cleaning is required, a lint-free cleaning swab can be moistened with isopropyl alcohol and applied lightly. If desired, you may clean the connector with a dry cleaning swab without alcohol first. If contamination is still present, use alcohol. Use minimum amount of alcohol.

Only clean connectors with alcohol when there is no power cord connected, ensuring that the instrument is in a well-ventilated area. Allow all residual alcohol moisture to evaporate, and the fumes to dissipate prior to powering up the instrument.

If the connector is still contaminated, use a very small toothpick with a small amount of alcohol applied. Use a magnifying glass when using a toothpick to clean, and apply extreme care to avoid damaging the connector.

CAUTION

Never use any metal objects or any abrasives to clean the connectors.

Never use high pressure air (>60 psi).

Never allow alcohol into connector support beads. If alcohol unintentionally enters connector support beads, allow the connector to dry for at least 8 hours.

Avoid using too much pressure on the center conductor, as swab fibers can become tangled in the center of the female conductor. When the alcohol evaporates, use compressed air to ensure that the surface is clean.

CAUTION

Never apply lateral force to the center conductor.

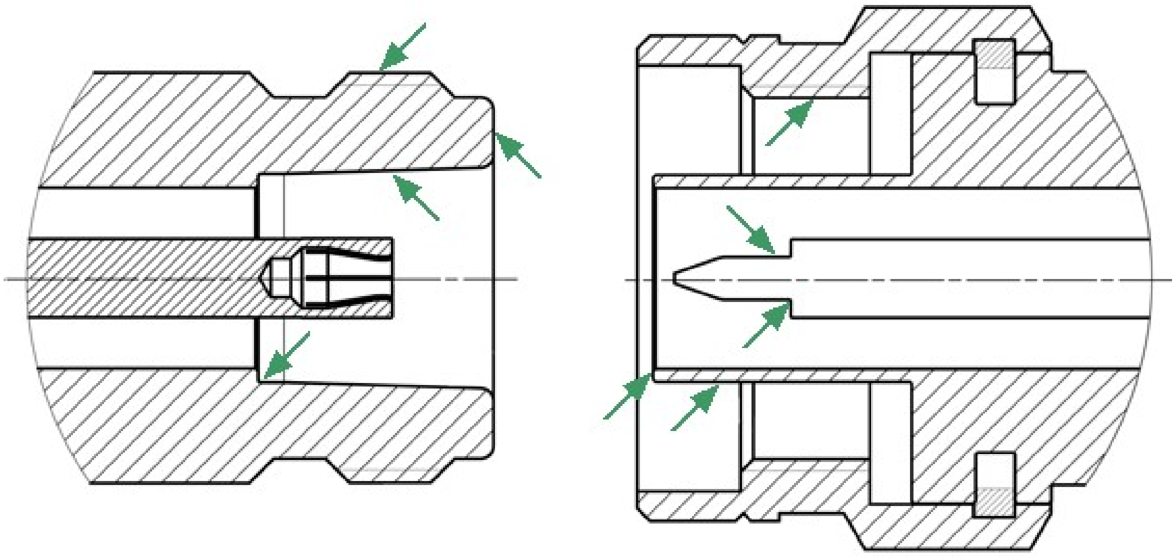
Never wipe the center conductors of the female connectors. They should be cleaned with compressed air.

Connector cleaning should be performed as follows:

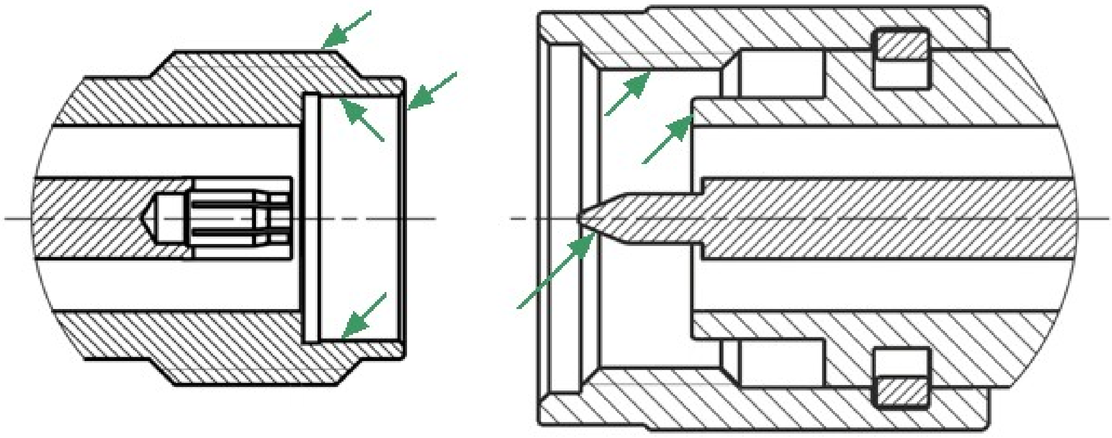
1. Wipe the connector surfaces with the swab moistened with alcohol as shown by arrows (See figures below).
2. Use compressed air to clean the other internal connector surfaces.
3. Let the alcohol evaporate.
4. Visually inspect the connectors to make sure that no particles or residue remain.
5. Repeat the cleaning procedure if necessary.
6. If cleaning does not correct any issues, the connector should not be used for measurements.

When cleaning connectors:

- Always use protective eyewear when using compressed air or nitrogen.
- Keep isopropyl alcohol away from heat, sparks, and flame. Use with adequate ventilation. Avoid contact with eyes, skin, and clothing.
- Avoid electrostatic discharge (ESD). Wear a grounding wrist strap (with a 1 MOhm series resistor) when cleaning connectors.



Type-N Connectors (female and male)



3.5 mm NMD Connectors (female and male)

Procedure for Cleaning Connectors

Connecting and Disconnecting

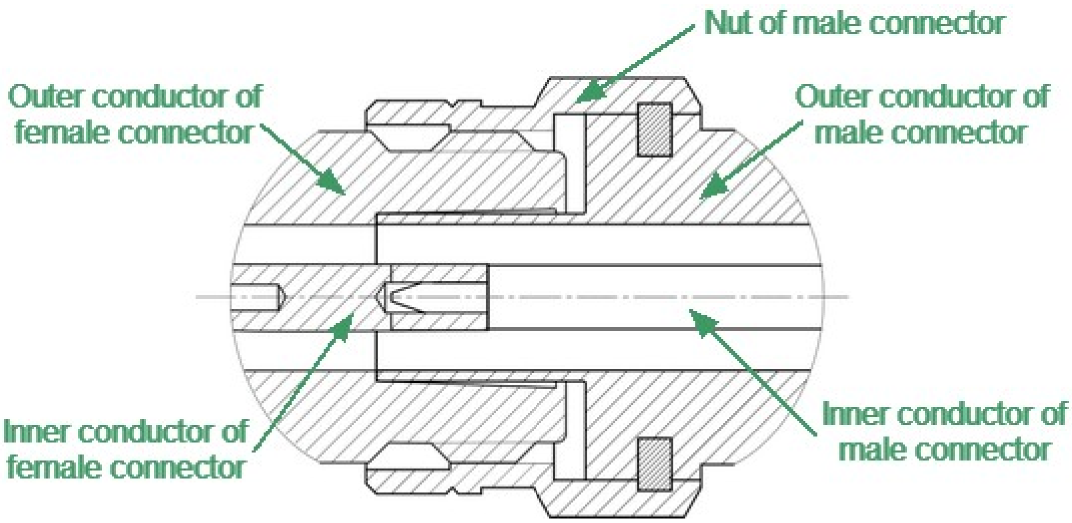
When operating the Analyzer, it is often necessary to connect various devices to each other: cables to analyzer measurement ports, junctions to cables, calibration tools to junctions or analyzer ports, devices under test to ports, etc.

Connecting

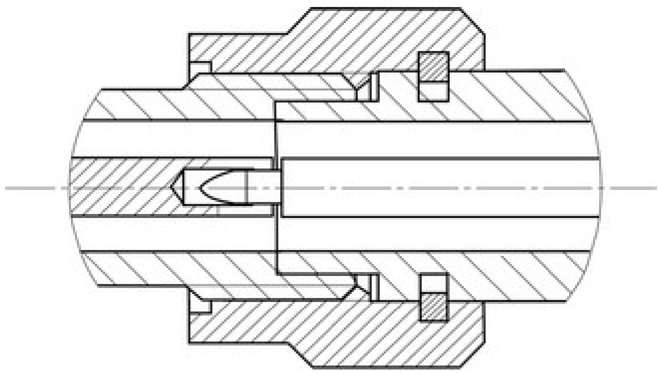
Connect devices with coaxial connectors in the following sequence to ensure maximum repeatability of measurement results, as well as to prevent breakage:

1. Carefully align the connectors of the devices being connected.

2. While holding the device that is being connected, tighten the male connector nut manually. The mating plane surfaces of the center conductors and the outer conductors must make uniform light contact, as shown in figure below.



Type-N connectors (female on the left, and male on the right)

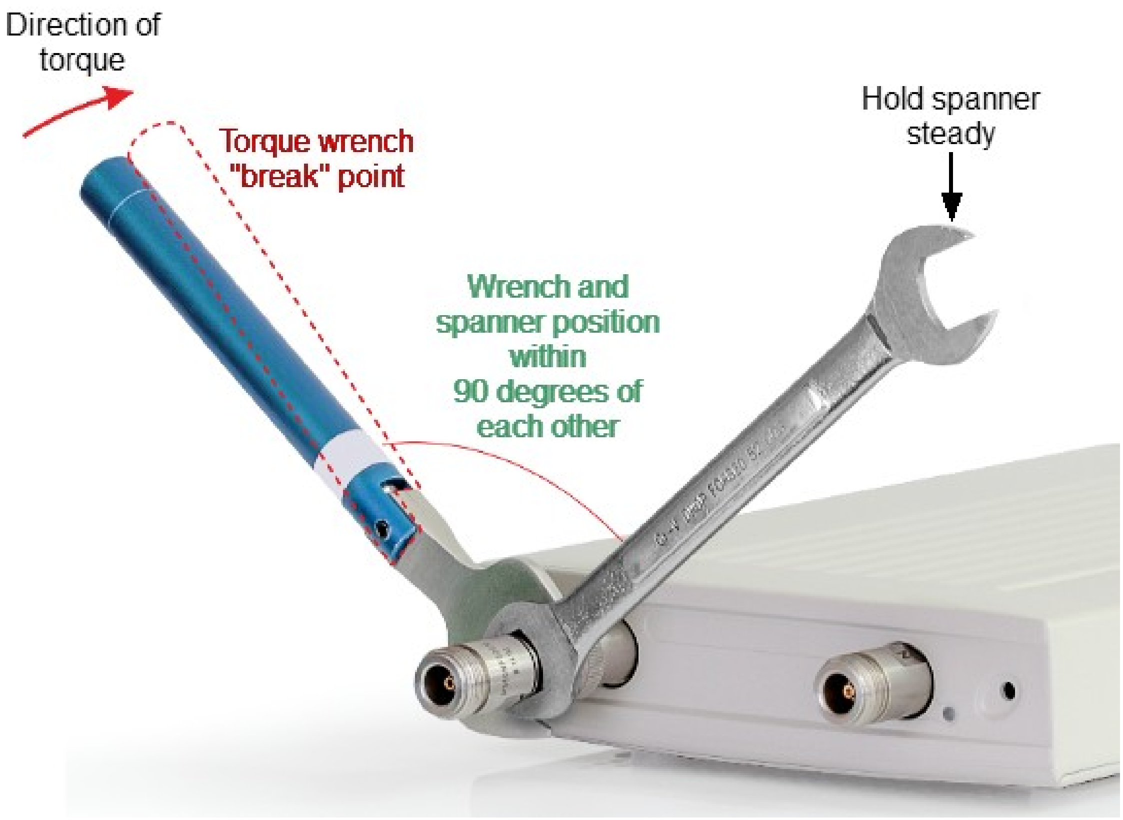


3.5 mm NMD connectors (female on the left, and male on the right)

Connecting example

3. Tighten the male connector nut using the appropriate torque wrench while holding the device being connected, or hold the device by using an open-end spanner to keep it from rotating. Position the wrench and spanner within 90 degrees of each other before applying force. Finally, tighten the male connector nut by holding the wrench at the end of the handle. Tighten the connection just to the torque wrench “break” point (See figures below).

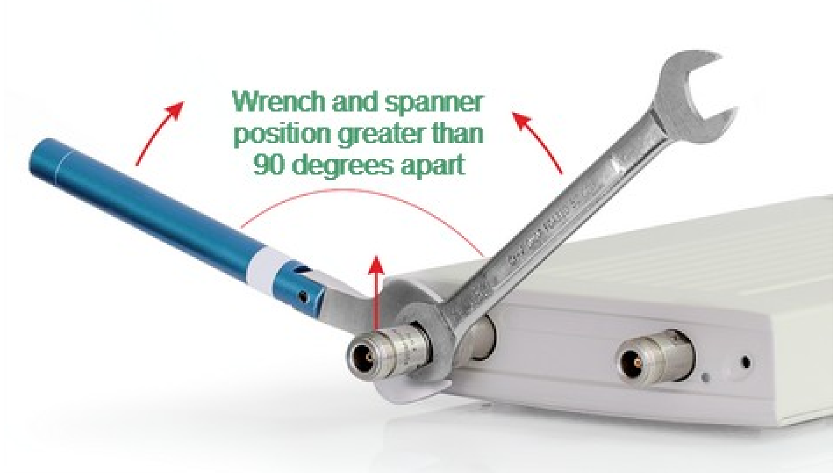
Hold the torque wrench by the end of the handle when tightening. The torque value depends on the connector type (See table below).



Correct torque wrench and spanner positions

CAUTION

The wrench and spanner should not be positioned more than 90 degrees apart. A larger degree of separation can cause excessive misalignment of the connectors.



Incorrect usage of torque wrench and spanner (too much lift on connection).

Recommended Torque Values

Connector type	Recommended torque values
Type-N	1.1 to 1.7 N·m (12 in. lbs)
2.4 mm NMD, 3.5 mm NMD, 1.85 mm NMD	0.8 to 1.0 N·m (8 in. lbs)
SMA	0.56 N·m (5 in. lbs)

CAUTION

The jumper cables will be damaged if more than 0.9 N·m of torque is applied to their SMA connectors.

Do not exceed the permissible torque value.

CAUTION	When making and breaking connections, connector mating surfaces should not rotate. Rotate the nut of the male connector only. Avoid rotating the devices. Use a suitable torque wrench.

CAUTION	Never cross-thread the connection. Never twist the connector body to make the connection. Never mate the connectors of incompatible types.

Disconnecting

Disconnect the connectors in the following order:

1. Using the torque wrench used for tightening, loosen the male connector nut while holding the device, or hold the device with an open-end wrench to prevent it from turning.
2. Turn the male connector nut while holding the device so that the connector center conductor remains in the same straight line position as it was connected. Pull the connectors straight apart.

Glossary

Prefixes

μ	micro (10^{-6})
m	milli (10^{-3})
k	kilo (10^{3})
M	Mega (10^{6})
G	Giga (10^{9})

Number / Symbols

Ω	ohm
dB	decibel
dBm	decibels above 1 milliwatt
W	Watt
F	Farad
H	Henry
Hz	Hertz
m	meter
sec	second
V	Volt

ACM	Automatic Calibration Module
CMT	Copper Mountain Technologies
CW	Continuous Wave
DC	Direct Current
DSP	Digital Signal Processor
DUT	Device Under Test
IF	Intermediate Frequency
LED	Light-emitting diode
PC	Personal Computer
RF	Radio Frequency
SCPI	Standard Commands for Programmable Instruments
S-parametrs	Scattering parameters of linear electrical network
SOLT	Short-Open-Load-Through Calibration
SWR	Standing Wave Ratio
USB	Universal Serial Bus
VNA	Vector Network Analyzer

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