COPPER MOUNTAIN®
TECHNOLOGIES

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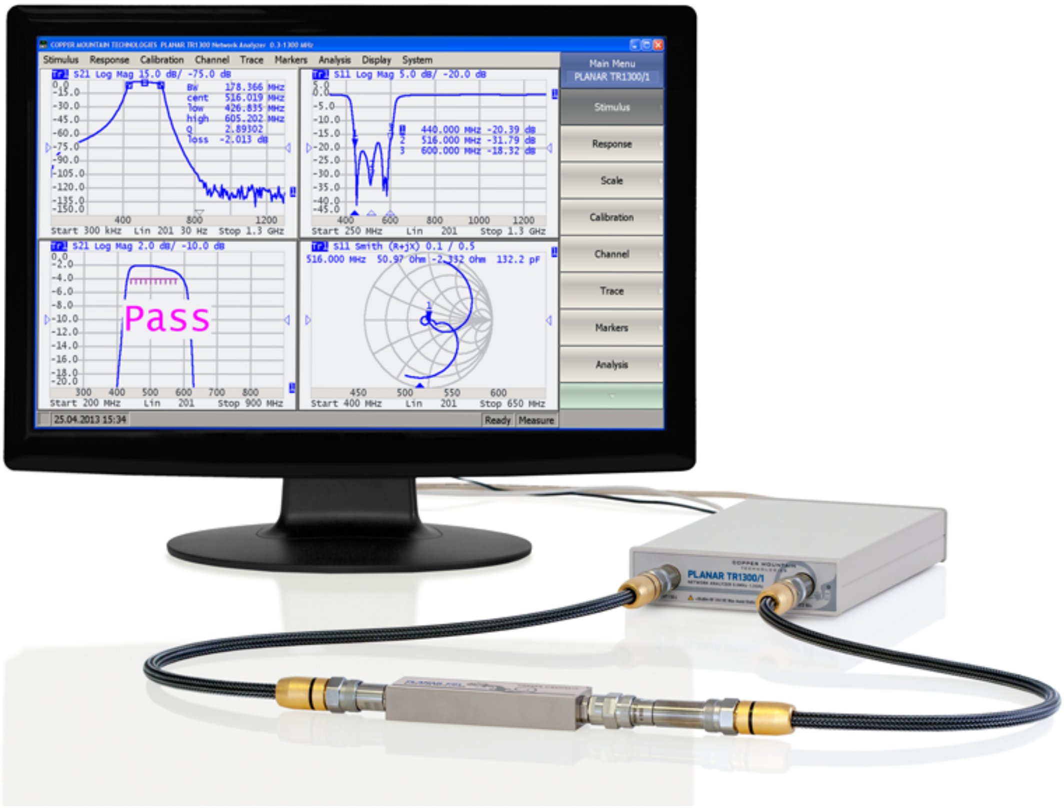
Network Analyzers using TRVNA software

Operating and Programming manual



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Introduction

This manual contains design, specifications, functional overview, and detailed operation procedures for the 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.

This Operating Manual corresponds to TRVNA software version 23.2.0

Glossary — The abbreviations which are used in this document.

Web Sites

Copper Mountain Technologies

Scope of Manual

This manual covers the two-port models of the Copper Mountain Technologies Network Analyzers controlled by the TRVNA software. The Analyzer models are listed below:

- TR1300/1
- TR5048
- TR7530

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.
- Connect the post marked ⏚ on the body of the Analyzer to the common ground of the test station.

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

Definitions of safety symbols used on the instrument and in the manual are listed below.

⚠ Refers to the Manual if the instrument is marked with this symbol.

|	On (Supply).
○	Off (Supply).
⏊	A chassis terminal; a connection to the instrument’s chassis, which includes all exposed metal surfaces.
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 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

Measured parameters	S11, S21 Absolute power of the incident, reflected or transmitted DUT signals.
Number of measurement channels	Up to 9 channels. Each channel is represented on the screen as an individual channel window. Each channel has its own stimulus signal settings such as frequency range, number of test points, power level, etc.
Data traces	Up to 8 data traces can be displayed in each channel window. A data trace represents one of the following parameters of the DUT: S-parameters, response in time domain, input power response.
Memory traces	Each of the 8 data traces can be saved into memory for further comparison with the current values. Up to 8 memory traces can be created for each data trace.
Data display formats	Logarithmic magnitude, linear magnitude, phase, expanded phase, group delay, SWR, real part, imaginary part, Smith chart format, and polar format.

Sweep setup features

Sweep type	Linear, logarithmic, and segment frequency sweep, when the stimulus power is a fixed value.
Power sweep	Linear power sweep when the frequency is a fixed value.
Measured points per sweep	From 2 to 16,001 for TR1300/1. From 2 to 200,001 for TR5048 and TR7530.
Segment sweep	A frequency sweep within several user-defined segments. Frequency range, number of points, source power, and IF bandwidth can be set for each segment.

Power settings	Source power from -55 dBm to +5 dBm (from -55 dBm to +3 dBm TR1300/1) with resolution of 0.05 dB. In frequency sweep mode the power slope can be set to up to 2 dB/GHz to compensate high frequency attenuation in cables.
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 display	Data trace, memory trace, or simultaneous data and memory traces.
Trace math	Data trace modification by math operations: addition, subtraction, multiplication or division between the data, and memory traces.
Autoscaling	Automatic selection of the 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	Linear phase correction according the specified electrical delay.
Phase offset	Phase offset by the specified value in degrees.

Accuracy enhancement

Calibration	Calibration of a test setup (which includes the Analyzer, cables, and adapters) significantly increases the accuracy of measurements. Calibration allows correction of errors caused by imperfections in the measurement system: directivity, source, and load match, tracking, and isolation.
Calibration methods	The following calibration methods of various sophistication and accuracy enhancement are available: • reflection and transmission normalization • full one-port calibration (SOL) • one-path two-port calibration
Reflection and transmission normalization	The simplest calibration method. It provides limited accuracy.
Full one-port calibration (SOL)	Method of calibration performed for one-port reflection measurements. It ensures high accuracy.
One-path two-port calibration	Method of calibration performed for reflection S11 and one-way transmission measurements S21. It ensures high accuracy for reflection measurements, and reasonable accuracy for transmission measurements.
Mechanical calibration kits	It is possible to select one of the predefined calibration kits of various manufacturers or define additional ones.
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 definition are available: • standard definition by polynomial model • data-based standard (full S-parameter characterization data)

Error correction interpolation	When such settings as start/stop frequencies and number of points are changed, compared to the settings of calibration, interpolation or extrapolation of the calibration coefficients will be applied (Extrapolation is not recommended).
Port Extension	Calibration plane compensation for delay in the test setup.

Supplemental calibration methods

Power calibration	Method of the port power calibration which allows to maintain more stable power levels at the DUT input. The calibration requires connection of an external USB power meter.

Marker functions

Data markers	Up to 16 markers for each trace. A marker indicates the stimulus value and measurement result at a given point of the trace.
Reference marker	Enables indication of any maker value as relative to the reference marker.
Marker search	Search for max, min, peak, or target values on a trace.
Marker search additional features	User-defined search range. Available as either a tracking marker, or as a one-time search.
Setting parameters by markers	Setting of start, stop, and center frequencies from the marker frequency, and setting of reference level by the measurement result of the marker.
Marker math functions	Statistics, bandwidth, flatness, RF filter.
Statistics	Calculation and display of mean, standard deviation and peak-to-peak values of the 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	This function converts S-parameters measured at the Analyzer's nominal port impedance into values which would be found if measured at arbitrary port impedance.
De-embedding	This function allows mathematical exclusion of the effects of the fixture circuit connected between the calibration plane and the DUT. This circuit should be described by an S-parameter matrix in a Touchstone file.
Embedding	This function allows mathematical simulation of the DUT parameters after virtual insertion 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.
S-parameter conversion	This function allows conversion of the measured S-parameters to the following parameters: reflection impedance and admittance, transmission impedance and admittance, and inverse S-parameters.
Time domain transformation	This function performs transformation from frequency domain into response of the DUT to various stimulus types in time domain. Modeled stimulus types: bandpass impulse, lowpass impulse, and lowpass step. Time domain span is set arbitrarily from zero to maximum, which is determined by the frequency steps. Various window shapes allow optimizing the tradeoff between resolution and the level of spurious sidelobes.
Time domain gating	This function mathematically removes unwanted responses in time domain, allowing for measurement of the frequency response without the influence of selected fixture elements. Gating filter types: bandpass or notch. For better tradeoff between gate resolution and the level

	of spurious sidelobes the following filter shapes are available: maximum, wide, normal, and minimum.

Mixer / converter measurements

Scalar mixer / converter measurements	The scalar method allows measurement of scalar transmission S-parameters of mixers and other devices having different input and output frequencies. No external mixers or other devices are required. The scalar method employs port frequency offset when there is a difference between receiver frequency and source frequency.
Automatic adjustment of frequency offset	This function performs automatic frequency offset adjustment when scalar mixer/converter measurements are performed to compensate for LO frequency inaccuracies internal to the DUT.

Other features

Familiar graphical user interface	Intuitive graphical user interface ensures fast and easy Analyzer operation.
Printout/saving of traces	The traces and data printout function has a preview feature. Previewing, saving, and printing can be performed using MS Word, Image Viewer for Windows, or the Analyzer Print Wizard.
Linux OS support	The Linux version of the analyzer software is designed to run on x86 PCs running Linux. NOTE: Tests must be performed to determine if the Analyzer software is compatible with a particular version of Linux.

Remote control

COM/DCOM	Remote control via COM/DCOM. COM automation is used when the user program is running on the local PC. DCOM automation is used when the user program is running on the 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 others.
SCPI	Remote control using textual commands SCPI (Standard Commands for Programmable Instruments). Text messages are delivered over PC networks using HiSLIP or TCP/IP Socket network protocols. VISA Library is recommended to support HiSLIP protocol. The TCP/IP Socket protocol can be supported by the VISA library or directly programmed in any language or environment that supports TCP/IP Sockets. The VISA library is free and widely used software in the field of testing and measurement.

Principles of Operation

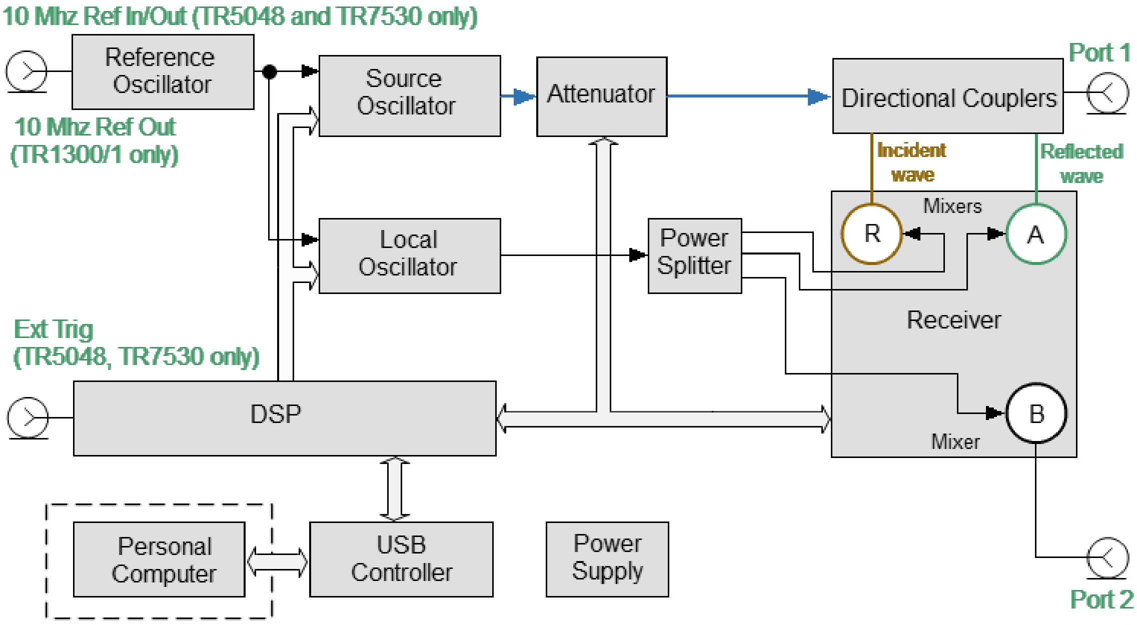
A Vector Network Analyzer (VNA) is a tool for accurate measurement of complex transmission and reflection coefficients (S-parameters) of a Device Under Test (DUT).

The Analyzers described in this manual are USB VNAs. These VNAs consist of an RF measurement module (Analyzer) and supplied processing software — an application which runs on a Windows or Linux based PC or laptop, connected to the Analyzer's hardware via a USB interface. This application controls the RF measurement module, receives and post-processes received raw data and presents the calibrated results to the user in a variety of graphical formats.

For a detailed description of different models of Analyzers see Instrument Series.

The complete specification and supported features list are given in the datasheet of the corresponding Analyzer

The block diagram of the Analyzer is represented in figure below.



The block diagram of the Analyzer

The Analyzer consists of the following functional blocks: a Reference Oscillator, a Source Oscillator, a Local Oscillator, a power control Attenuator, a Power Splitter, Directional Couplers, a three-channel Receiver, a digital signal processor (DSP), a USB Controller and a Power Supply.

A tunable Source Oscillator is the test signal source. The Source Oscillator is based on digital frequency synthesizers. This provides a wide frequency range, set frequency step, and necessary stability for the test signal.

An internal Reference Oscillator provides the Source Oscillator with a stable reference signal.

The Local Oscillator (LO) generates signals using digital frequency synthesizers at an offset from the Source Oscillator which is equal to the Intermediate Frequency (IF) which will be digitized by the VNA IF circuit. The Local Oscillator is the source of the LO signal for the mixers of receiver.

The Power Splitter distributes the LO signal between the three Mixers.

A programmable Attenuator controls the power level of the test signal. This Attenuator is an executive unit of the automatic power control system. For example, when a power calibration has been completed, the Power Correction function uses this Attenuator. Also, the Analyzer can sweep over the output power range at a fixed frequency of test signal using this Attenuator. The user controls the Attenuator by setting the signal power level at the output of the test port. For the power sweep mode, the user sets the range of signal power levels at the output of the measurement port.

After the Attenuator, the test signal passes through the Directional Couplers to Port 1 of the Analyzer. Port 1 is the source of the test signal. The test signal from the signal source goes through the DUT to the connector of the port 2. Port 2 is the receiver of the test signal.

Directional Couplers separate the incident wave and reflected wave of the test signal. The signals from the directional couplers and the signal from the receiver port 2 are supplied into the mixers, where they are converted into first IF 0.3125 MHz (TR5048, TR7530) or 5.037 MHz (TR1300/1), and are transferred further to the 3-Channel receiver:

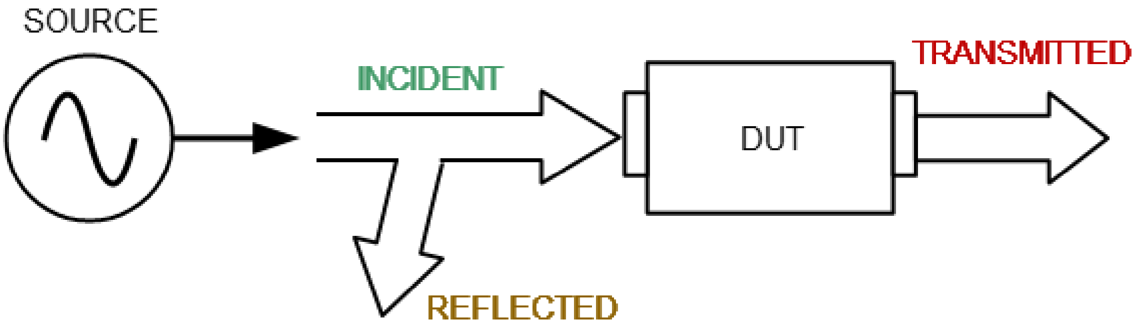
- The reference receiver R processes the incident wave.
- A measuring receiver A processes the reflected wave.
- A measuring receiver B processes the signal transmitted through a DUT to Port 2.

The 3-Channel receiver, after filtration, produces the signal of the second IF, then digitally encodes it and supplies data into the DSP. The DSP performs primary signal processing (filtering, phase difference estimation, magnitude measurement). The user-selected Bandwidth of the second IF is applied by the DSP filter and has a passband from 10 Hz to 30 kHz.

After the primary signal processing, the DSP transmits the information to the control software (TRVNA) running on an external PC. Communication is provided by a USB controller. This software performs the final signal processing and displays the measurement results on the screen of the PC.

The Principle of Measuring S-parameters

The DUT is connected to the Analyzer ports. The Analyzer emits a test signal (stimulus) out of a source port. Simultaneously, all ports of the Analyzer are receivers. 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.

For a two-port DUT, the full scattering matrix is measured:

$$S = \begin{bmatrix} S11 & S12 \\ S21 & S22 \end{bmatrix}$$

The construction feature of TR Analyzer is that Port 1 is a source port and receiver, and Port 2 is only a receiver (See Principles of Operation) . Thus, the Analyzer can only measure S11 and S21 simultaneously with one DUT connection.

To measure S11 and S21 parameters, connect Port 1 to the input of the DUT, and Port 2 to the output of the DUT. The incident and reflected waves will be measured by Port 1. The transmitted wave will be measured by Port 2.

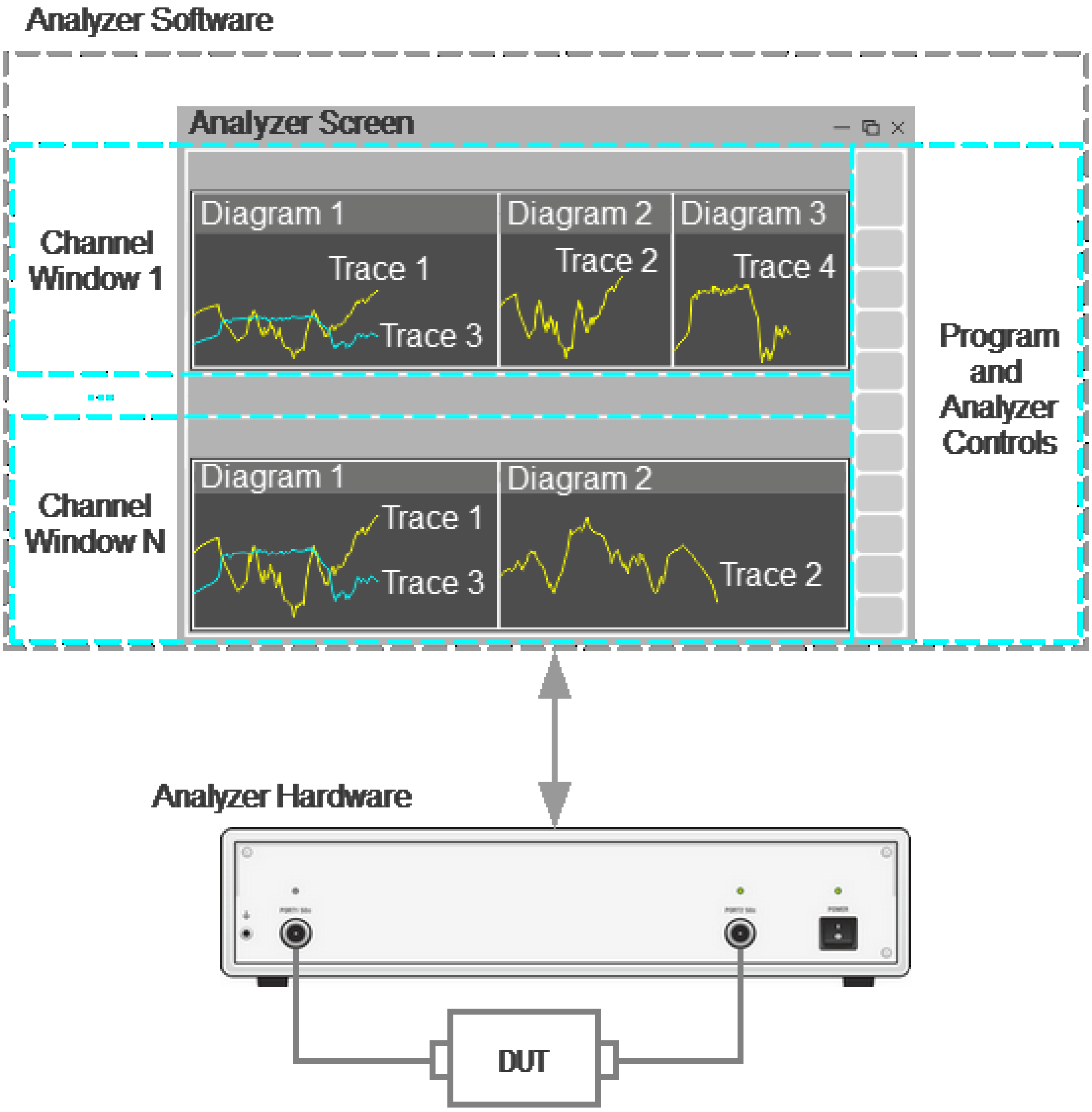
To measure S12 and S22 parameters, reconnect the DUT. Connect Port 1 to the output of the DUT, and Port 2 to the input of the DUT. The incident and reflected waves will be measured by Port 2. The transmitted wave will be measured by Port 1.

This way, using two connections of the DUT, you can measure full scattered matrix of a two-port DUT.

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.
- **Program and Analyzer Controls**: menu bar, analyzer status bar, and program button bar. For a detailed description of the controls, see Screen Layout and Functions.

Channel is a logical analyzer created by the control program to perform DUT measurements with set parameters. The analyzer control software supports up to 9 channels simultaneously, processing them one at a time. Thus, the same DUT can be sequentially measured by 9 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 is a sequence of data points measured (data trace) or memorized (memory trace) by the analyzer, connected by a line. Each channel contains up to 8 Traces. The trace is characterized by the following parameters:

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

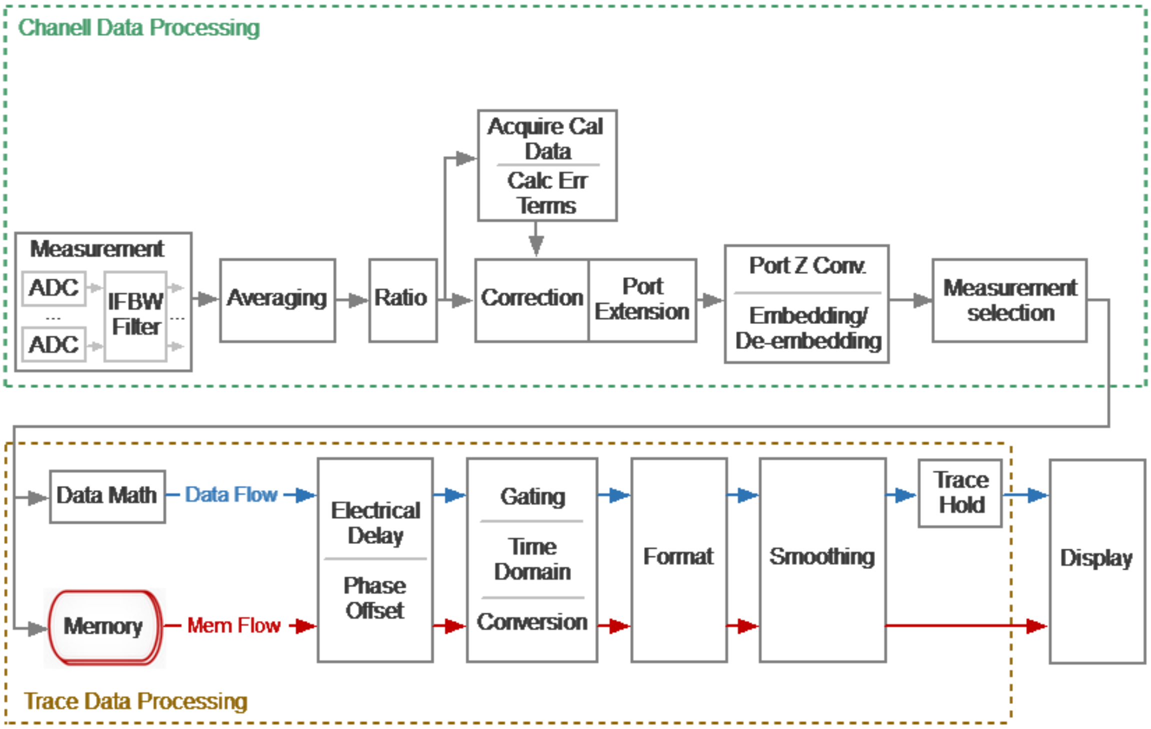
The following functions are applied to the trace:

- Markers
- Electrical Delay
- Phase Offset
- Time Domain Gating
- S-Parameter Conversion
- Limit Test

Each channel window can display up to 8 charts 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 Internal Data Arrays.



Data Processing Flowchart

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

- **Measurement** is converting analog signals of receivers into digital ones (receiver R receive the signal of the incident wave, receiver A receive the signal reflected from the device under test, receiver B receive the signal passed through the DUT). The received analog measurement signals are converted by ADC (analog-to-digital converters) into digital IF signals and 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 an averaging of the measured data of the receivers for a given number of scan cycles. For more details see Averaging Setting.
- **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 a 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** is an array of memory cells formed in the analyzer software. Current measurement data (S-parameter or receiver data) can be stored in the memory cell and recalled for later use. It is possible to stored up to 8 of these memory traces for each data trace. 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 memory cells, 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, impedance (Zt) and admittance (Yt) in transmission 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.

Preparation for Use

Unpack the Analyzer and other accessories.

CAUTION	Please keep packaging to safely ship the instrument for annual calibration!

First, connect the earth terminal to the earth protection.

Install the TRVNA software from the shipped flash-drive or www.coppermountaintech.com on the PC that will be used to operate of the Analyzer. The software installation procedure is described in Software Installation.

Connect the Analyzer to a 100 to 240 VAC 50/60 Hz power source by means of the external power supply supplied with the instrument. Connect the USB-port of the Analyzer to the PC using the USB Cable supplied in the package.

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 procedures are described in Calibration and Calibration Kit.

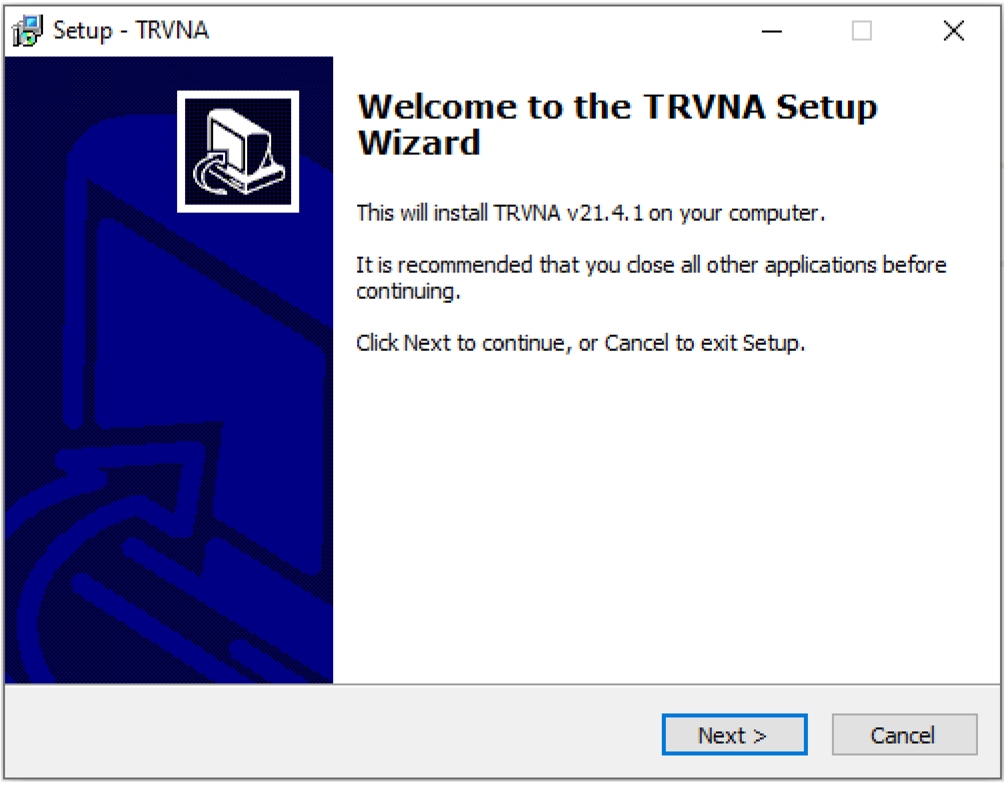
Software Installation

Minimal system requirements	x86 compatible PC running WINDOWS or LINUX WINDOWS 7 or higher LINUX Ubuntu 14.04, Linux Mint 17, Linux Debian 8.9 or higher 1.5 GHz Minimum Clock Speed 2 GB RAM Minimum USB 2.0 High Speed

Windows installation procedure

Find the analyzer software installer file Setup_TRVNA_vX.X.X.exe in the shipped flash-drive or download it from www.coppermountaintech.com. Where X.X.X stands for version number.

Run the Setup_TRVNA_vX.X.X.exe installer file. Follow the instructions of the installation wizard.



Welcome to the TRVNA Setup Wizard

This will install TRVNA v21.4.1 on your computer.

It is recommended that you close all other applications before continuing.

Click Next to continue, or Cancel to exit Setup.

Installation wizard

Default installation paths for files in WINDOWS

Software components	Path
TRVNA.exe	C:\VNA\TRVNA
VNA driver	C:\VNA\TRVNA\Driver
Documentation	C:\VNA\TRVNA\Doc
Programming Examples	C:\VNA\TRVNA\Programming Examples and Guides
Data Files	C:\VNA\TRVNA

Linux installation procedure

1. Download the analyzer software file CMT_TRVNA_X.X.X_x86_64.appimage from www.coppermountaintech.com, where X.X.X is stands for version number.
2. Make it executable

   ```
   chmod a+x TRVNA_X.X.X_x86_64.AppImage
   ```

3. Run

   ```
   $ ./TRVNA_X.X.X_x86_64.AppImage
   ```

   First time app will ask to enter root password for adding permissions for working with USB devices. You can do it by yourself by adding file /etc/udev/rules.d/cmt.rules containing:

   ```
   SUBSYSTEM=="usb", ATTRS{idVendor}=="2226", MODE="0666"
   SUBSYSTEM=="usb_device", ATTRS{idVendor}=="2226", MODE="0666"
   ```

Operating and Programming manual is the same as for the Windows application, except that COM automation does not apply. Download it from www.coppermountaintech.com.

User’s data file location:

```
$ ~/.vna-portable/drive_c/users/<user>/Application Data/TRVNA
```

Running More Than One Device on a PC in Linux

Up to 16 environment configurations can be used. It's allowed to store individual settings for different devices without copy application:

```
$ ./TRVNA_X.X.X_x86_64.AppImage -Conf=1
$ ./TRVNA_X.X.X_x86_64.AppImage -Conf=2
```

All application settings stored in Linux current user's folder:

```
$ ~/.vna-portable
```

User's settings for all configurations stored inside it:

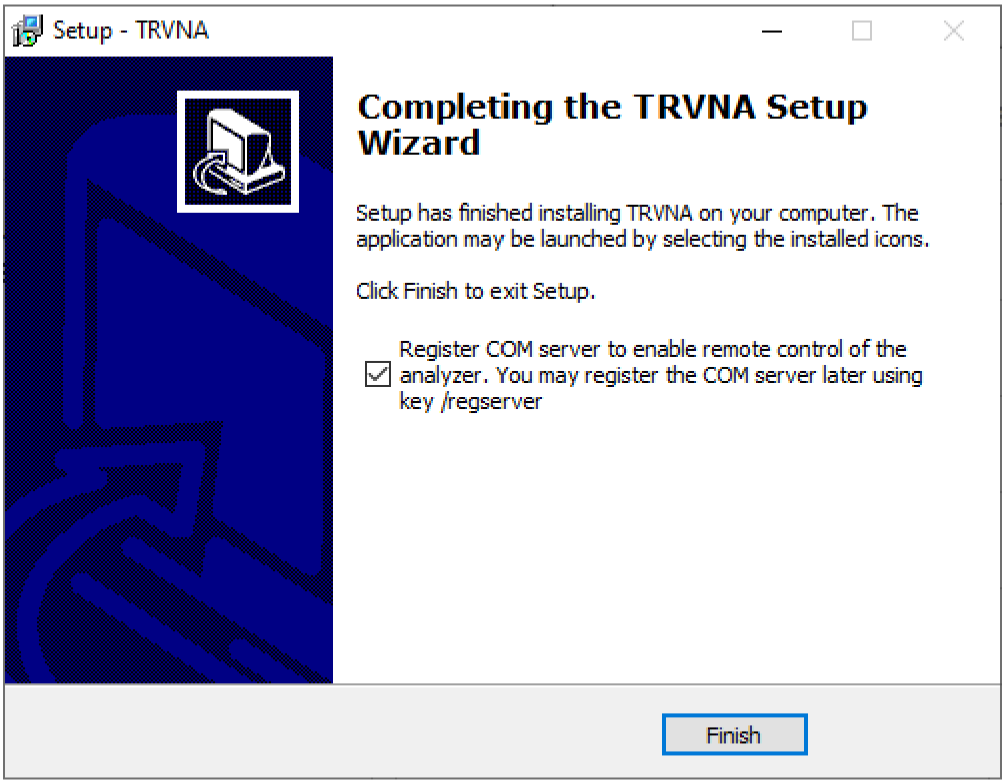
```
$ ~/.vna-portable/drive_c/users/<user>/Application Data/TRVNA
```

```
$ ~/.vna-portable/drive_c/users/<user>/Application Data/TRVNA.1
$ ~/.vna-portable/drive_c/users/<user>/Application Data/TRVNA.2
```

Registering COM Server

Registration of the COM server is required when using COM automation. If using SCPI automation or if automation is not required, registration can be skipped.

Registration of the COM server is performed during the installation of the analyzer software. The COM server registration window is shown in the figure below.



Completing the TRVNA Setup Wizard

Setup has finished installing TRVNA on your computer. The application may be launched by selecting the installed icons.

Click Finish to exit Setup.

☑ Register COM server to enable remote control of the analyzer. You may register the COM server later using key /regserver

Registering COM Server

Registration can be done after installing the software. To register the COM server, run the executable module TRVNA 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 following is an example of the COM server registration command:

```
TRVNA.exe /regserver
```

Instrument Series

Compact two-port VNA models that deliver metrology grade performance in a more economical package that excludes the stimulus source for Port 2 (receive only). As a result, a number of additional analyzer functions are excluded: Vector Mixer Calibration, TRL Calibration, Receiver Calibration, General S-Parameter Conversion.

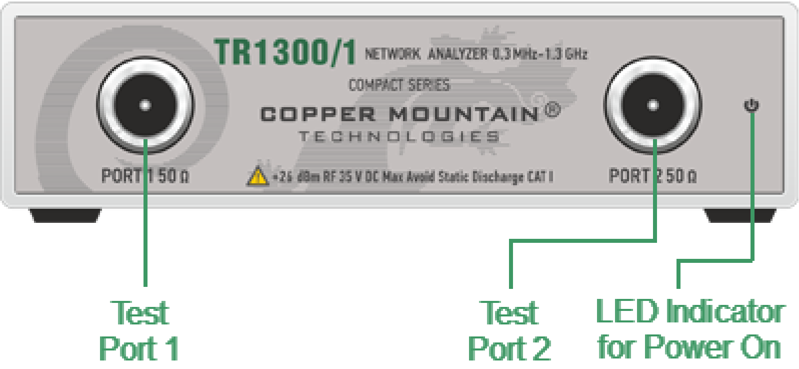
This section describes the TR Analyzers of compact series:

- TR1300/1
- TR5048, TR7530

The front and rear panels of each analyzer are shown further in this section, along with the controls located on those panels.

TR1300/1, Front Panel

The front view of the Analyzers is represented in the figure below.


TR1300/1 NETWORK ANALYZER 0.3 MHz-1.3 GHz
COMPACT SERIES
COPPER MOUNTAIN®
TECHNOLOGIES
PORT 1 50 Ω
+26 dBm RF 35 V DC Max Avoid Static Discharge CAT I
PORT 2 50 Ω
Test Port 1
Test Port 2
LED Indicator for Power On

TR1300/1 front panel

Part of front panel

LED Indicator for Power On

LED Indicator for Power On is lit when the power switch located on the rear panel is turned on.

Test Ports

The type-N 50 Ω test port 1 and test port 2 are intended for DUT connection. Test port 1 is used as a source of the stimulus signal and receiver of the incident and reflected wave signals. Test port 2 is used as a receiver of the response signal of the DUT.

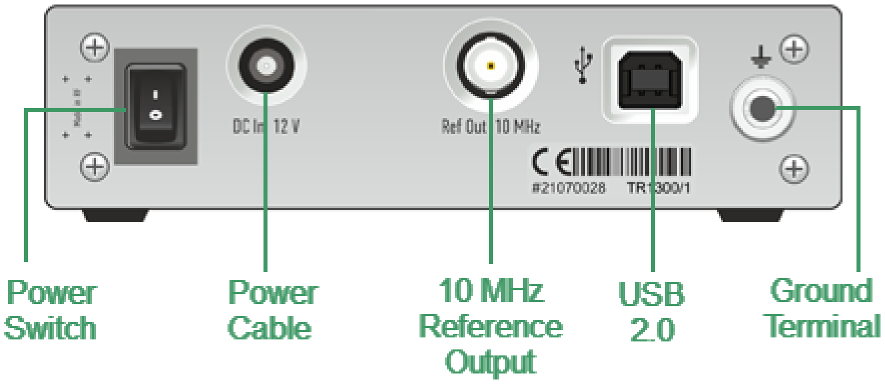
If the DUT is connected to test port 1 of the Analyzer, it is possible to measure the reflection parameter S11 of the DUT. If the DUT is connected to both test ports of the Analyzer, it is possible to measure S11 and S21 of the DUT.

CAUTION

Do not exceed the maximum allowed power of the input RF signal (or maximum DC voltage) indicated on the front panel. This may lead to damage of the Analyzer.

Rear Panel

The rear view of the Analyzers is represented in the figure below.



TR1300/1 rear panel

Parts of rear panel

Power Cable Receptacle

The power supply receptacle is intended for an external DC power supply voltage from 9 to 15 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.

Power Switch

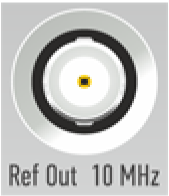
The analyzer can be turned on/off at any time. The VNA loads its operating firmware from the PC each time upon powering up. The process will take approximately 10 seconds, after which the analyzer will be ready for operation.

The power switch serves as the disconnecting device (device that cuts off power supply) of the VNA. The power supply must be cut off to avoid such danger as electric shock, during prolonged non-use of the device.

NOTE

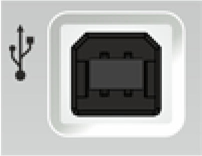
The USB driver will be installed onto the PC when the analyzer is turned on for the first time. The driver installation procedure is described in Software Installation. Some PCs may require re-installation of the driver in case of change of the USB port.

Reference Frequency Output Connector



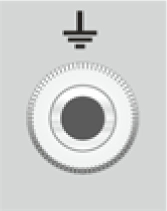
External reference frequency is 10 MHz. Output reference signal level is 3 dBm ± 2 dB into 50 Ω impedance. Connector type is BNC female.

USB 2.0 High Speed Port



The USB port is intended for connection to an external PC.

Ground Terminal

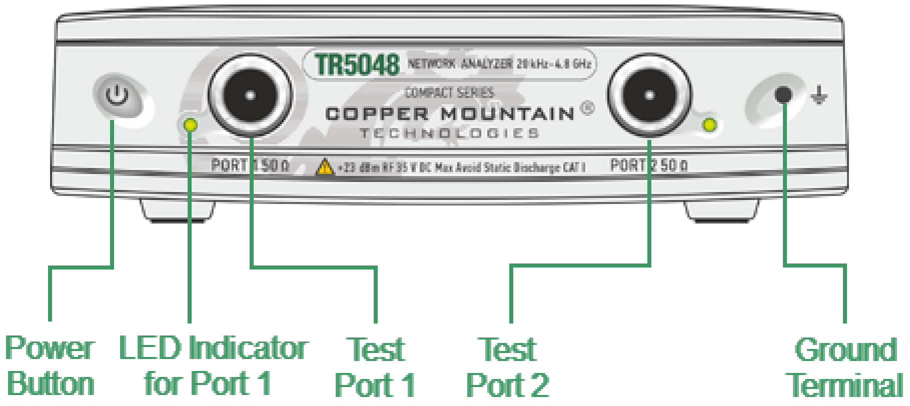


To avoid electric shock, use this terminal for grounding.

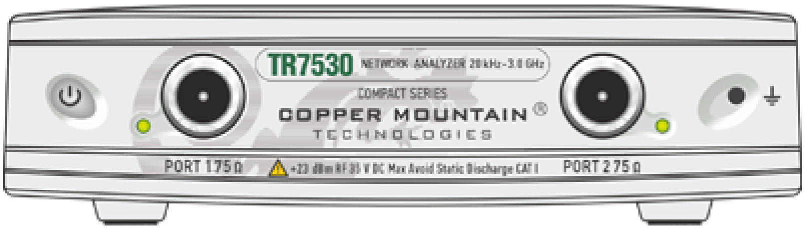
The Ground terminal allows to connect directly the body of the Analyzer to the test station ground in order to ensure electrical safety.

TR5048, TR7530, Front Panel

The front view of the Analyzers is represented in the figures below.


TR5048 NETWORK ANALYZER 20 kHz–4.8 GHz
COMPACT SERIES
COPPER MOUNTAIN® TECHNOLOGIES
PORT 1 50 Ω
+23 dBm RF 35 V DC Max Avoid Static Discharge CAT I
PORT 2 50 Ω
Power Button
LED Indicator for Port 1
Test Port 1
Test Port 2
Ground Terminal

TR5048 front panel


TR7530 NETWORK ANALYZER 20 kHz–3.0 GHz
COMPACT SERIES
COPPER MOUNTAIN® TECHNOLOGIES
PORT 1 75 Ω
+23 dBm RF 35 V DC Max Avoid Static Discharge CAT I
PORT 2 75 Ω

TR7530 front panel

Part of front panel

Power Button

Switches the Analyzer ON and OFF.

The analyzer can be turned on/off at any time. The VNA loads its operating firmware from the PC each time upon powering up. The process will take approximately 10 seconds, after which the analyzer will be ready for operation.

NOTE

The USB driver will be installed onto the PC when the analyzer is turned on for the first time. The driver installation procedure is described in Software Installation. Some PCs may require re-installation of the driver in case of change of the USB port.

Test Ports

The type-N 50 Ω (type-N 75 Ω) test port 1 and test port 2 are intended for DUT connection. Test port 1 is used as a source of the stimulus signal and receiver of the incident and reflected wave signals. Test port 2 is used as a receiver of the response signal of the DUT.

If the DUT is connected to test port 1 of the Analyzer, it is possible to measure the reflection parameter S11 of the DUT.

If the DUT is connected to both test ports of the Analyzer, it is possible to measure S11 and S21 of the DUT.

Port 1 LED is lit when the port is a stimulus source.

CAUTION

Do not exceed the maximum allowed power of the input RF signal (or maximum DC voltage) indicated on the front panel. This may lead to damage of the Analyzer.

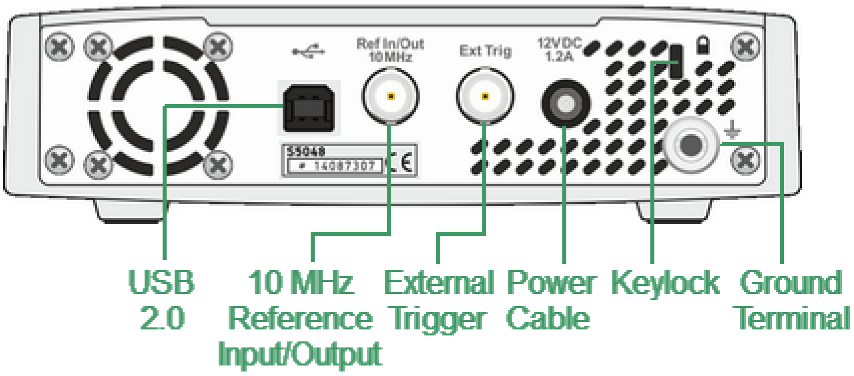
Ground Terminal

Use the terminal for grounding.

To avoid damage from electric discharge, connect the ground terminal on the body of the Analyzer to a reliable earth ground shared with the DUT in the test environment.

Rear Panel

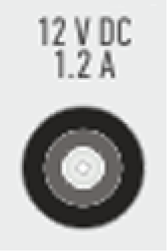
The rear view of the Analyzers is represented in the figure below.



TR5048, TR7530 rear panel

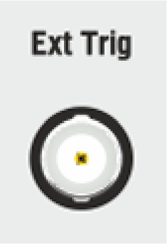
Parts of rear panel

Power Cable Receptacle



The power supply receptacle is intended for an external DC power supply voltage from 9 to 15 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 Input Connector



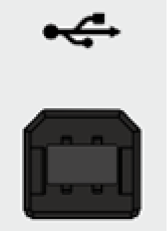
This connector allows to connect an external trigger source. Connector type is BNC female. For input and signal parameters, see instrument specification.

Reference Frequency Input/Output Connector

Ref In/Out
10 MHz

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

USB 2.0 High Speed Port



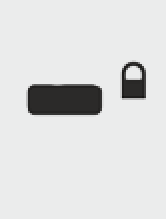
The USB port is intended for connection to an external PC.

Ground Terminal

To avoid electric shock, use the this terminal for grounding.

The Ground terminal allows to connect directly the body of the Analyzer to the test station ground in order to ensure electrical safety.

Keylock



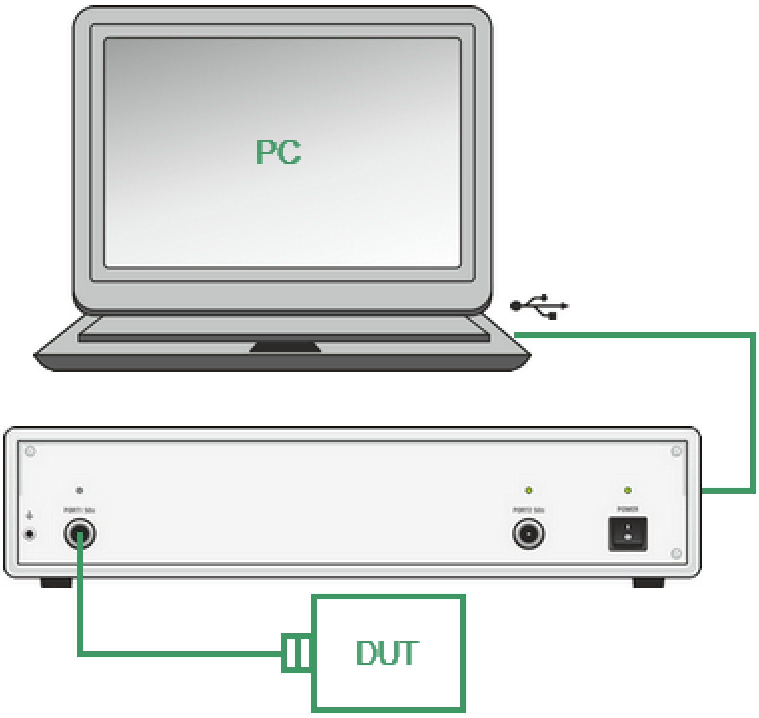
A Kensington lock (K-Slot) is part of an anti-theft system.

Getting Started

This section is organized as a sample session of the Analyzer. It describes the main techniques for measurement, by example measuring of the reflection coefficient parameters of the DUT. SWR and reflection coefficient phase of the DUT will be analyzed.

In this example, only one test port of the analyzer is used for reflection coefficient measurement. The instrument sends the stimulus to the input of the DUT and then receives the reflected wave. If the DUT is a two-port device, its unused port should be terminated with a LOAD standard. The results of these measurements can be represented in various formats.

A typical setup for reflection coefficient measurement is shown below.



Reflection Measurement Circuit

To measure SWR and reflection coefficient phase of the DUT in the given example, go through the following steps:

- Prepare the Analyzer for reflection measurement.
- Set stimulus parameters (frequency range, number of 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 one-port calibration.
- Analyze SWR and reflection coefficient phase using markers.

NOTE	The analyzer can be controlled via softkey panel located on the right-hand part of the screen. The analyzer also allows to perform quick control by the mouse (See Quick Setting Using a Mouse).

Analyzer Preparation for Reflection Measurement

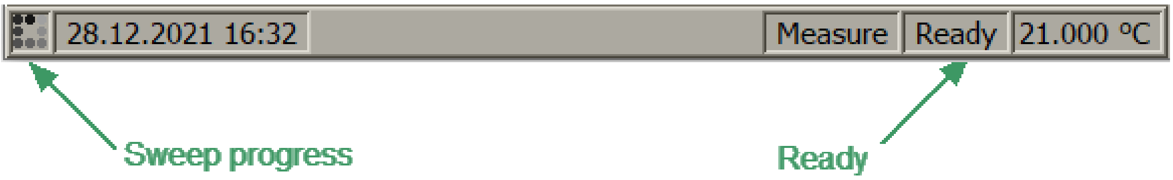
Turn on the Analyzer and warm it up for the period of time stated in its specifications (40 minutes typically).

Ready status indication

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

Sweep progress indication

The sweep indicator in the left-hand part of instrument status bar should display sweep progress



28.12.2021 16:32 | Measure | Ready | 21.000 °C

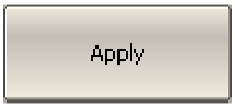
Connect the DUT to Port 1 of the Analyzer. The DUT can be connected directly to the port if the type of connectors are the same and the gender is opposite. Otherwise use the appropriate cables and adapters for connection of the DUT input to the Analyzer test port. Use a calibrated torque wrench for tightening the connectors.

Analyzer Presetting

Before starting the measurement session, reset the analyzer to the initial condition. The initial condition setting is described in Default Settings Table.

NOTE

Softkeys controlling the Analyzer are located on the vertical panel on the right side of the analyzer screen (See Softkey Bar).



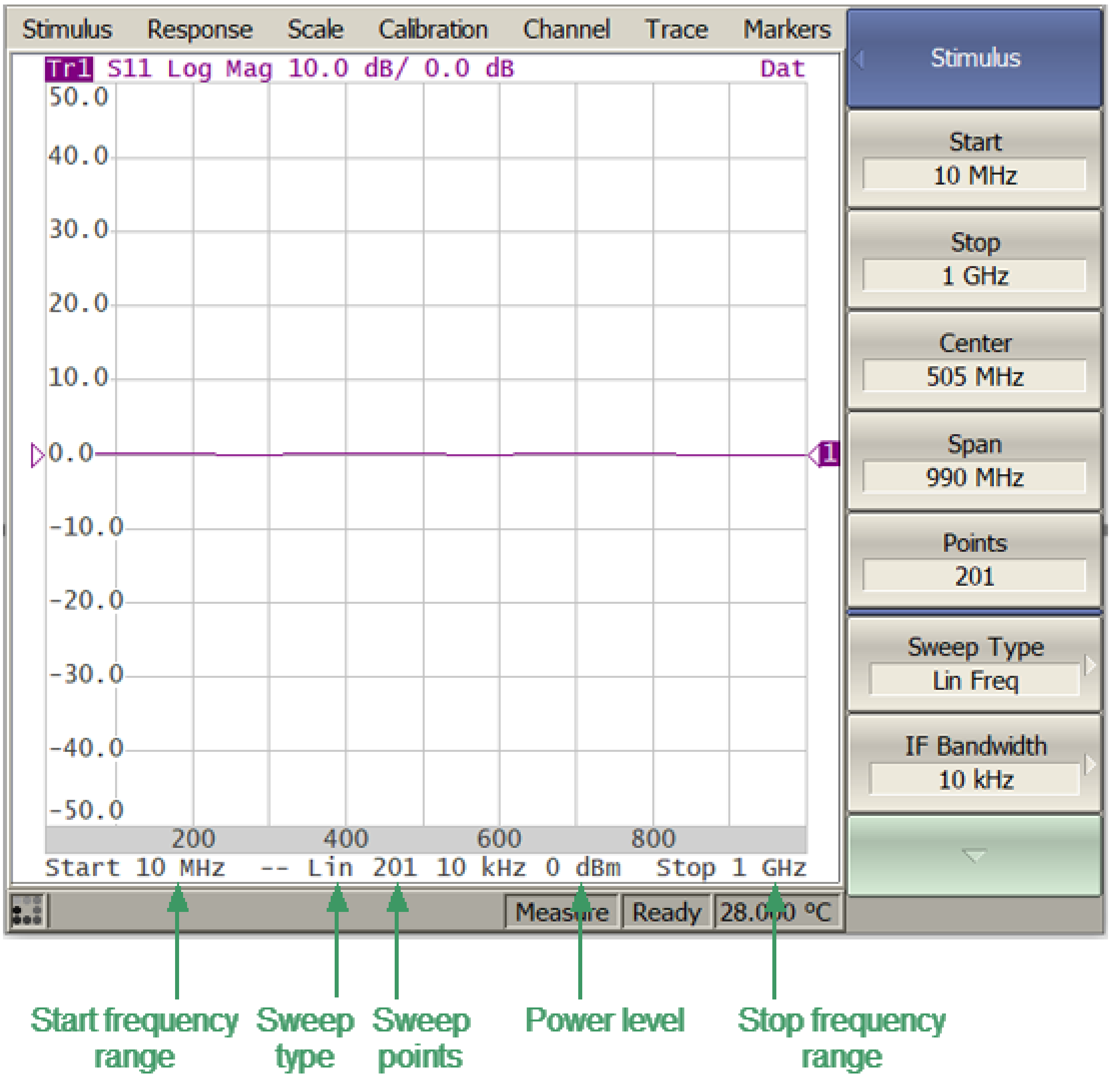
To restore the initial condition of the Analyzer, use the following softkeys:

System > Preset > Apply

Stimulus Setting

After presetting the Analyzer, the stimulus parameters will be as follows:

- Full frequency range of the instrument (See table below).
- Linear sweep type.
- 201 points.
- Power level of 0 dBm.



Tr1 S11 Log Mag 10.0 dB/ 0.0 dB Dat

Start 10 MHz -- Lin 201 10 kHz 0 dBm Stop 1 GHz

Measure Ready 28.000 °C

Start 10 MHz

Stop 1 GHz

Center 505 MHz

Span 990 MHz

Points 201

Sweep Type Lin Freq

IF Bandwidth 10 kHz

Settable parameters in the channel status bar

Analyzer	Frequency range
TR5048	20 kHz to 4.8 GHz
TR7530	20 kHz to 3.0 GHz
TR1300/1	300 kHz to 1.3 GHz

For the current example, set the frequency range to from 10 MHz to 1 GHz.

To set the start frequency of the frequency range to 10 MHz, use the following softkeys:

Stimulus > Start

Then enter «1», «0» from the keyboard. Complete the setting by pressing the capital key «M».

To set the stop frequency of the frequency range to 1 GHz, use the following softkeys:

Stimulus > Stop

Then enter «1» from the keyboard. Complete the setting by pressing «G» key.

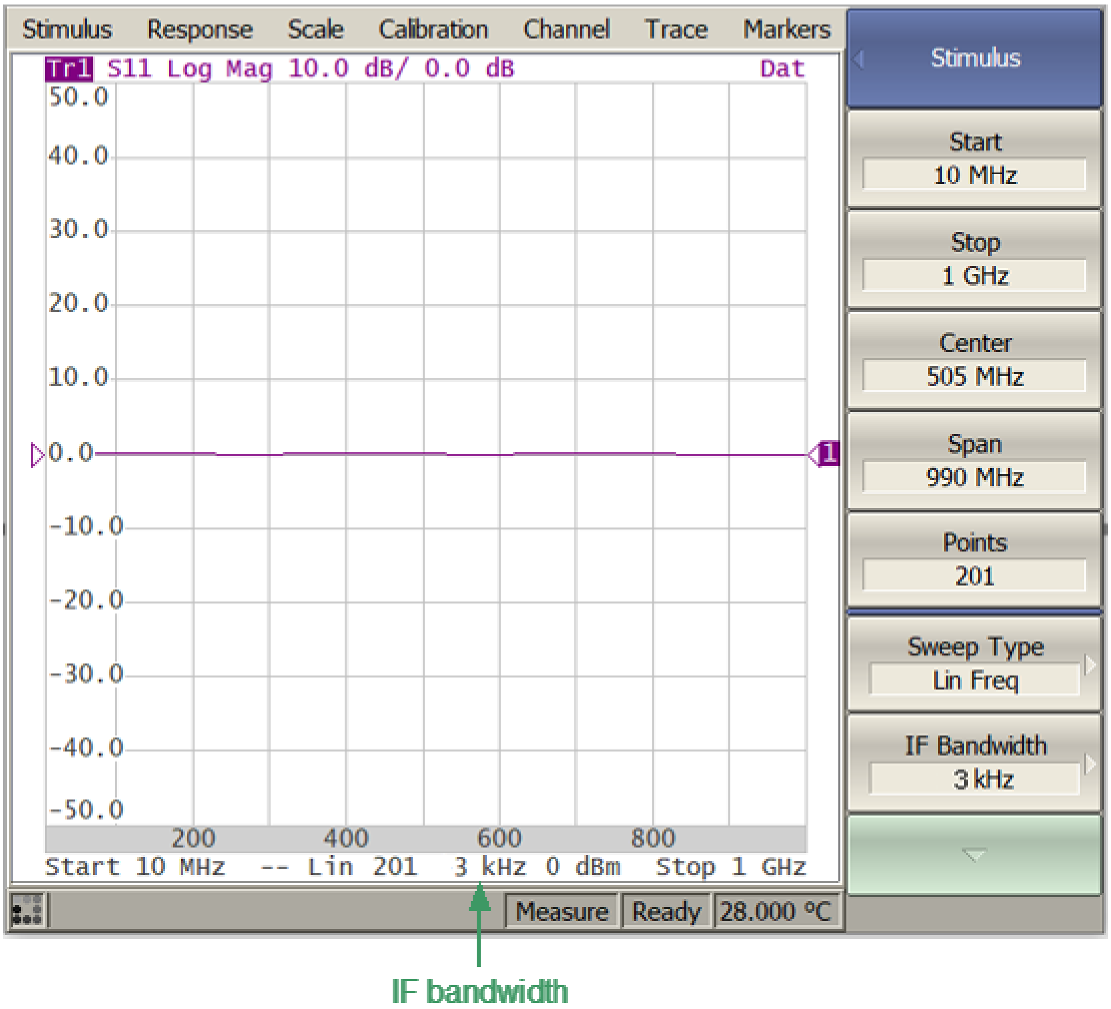
To return to the main menu, click the top softkey (colored in blue).

NOTE

The **Start** and **Stop** values of the frequency range can be set using the mouse (See Sweep Start Setting).

IF Bandwidth Setting

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



Start 10 MHz -- Lin 201 3 kHz 0 dBm Stop 1 GHz

Stimulus

Start 10 MHz

Stop 1 GHz

Center 505 MHz

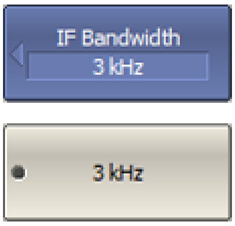
Span 990 MHz

Points 201

Sweep Type Lin Freq

IF Bandwidth 3 kHz

IF bandwidth value in the channel status bar



IF Bandwidth 3 kHz

● 3 kHz

To set the IF bandwidth to 3 kHz, use the following softkeys:

Stimulus > IF Bandwidth > 3 kHz

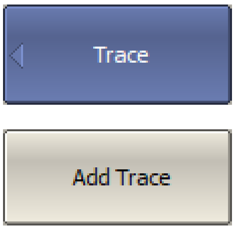
To return to the main menu, click the top softkey (colored in blue).

NOTE

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

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).

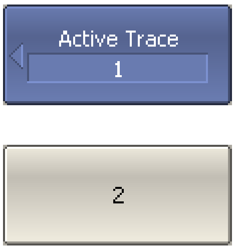


To add the second trace, use the following softkeys:

Trace > Add Trace

To return to the main menu, click the top softkey (colored in blue).

Activate the trace before assigning the measurement parameters.



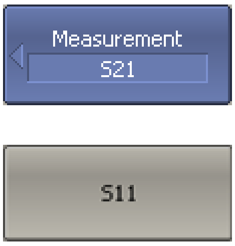
To activate the second trace, use the following softkeys:

Trace > Active Trace > 2

To return to the main menu, click the top softkey (colored in blue).

NOTE The active trace can be selected using the mouse (See Active Trace Selection).

Assign the S11-parameter to the second trace. This parameter is already assigned to the first trace by default.



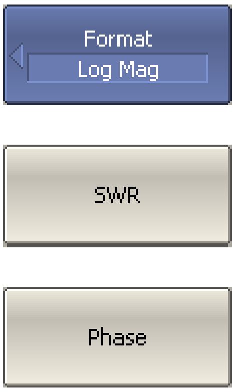
To assign a parameter to the trace, use the following softkeys:

Response > Measurement > S11

NOTE

The measured parameter can be set using the mouse (See Measured Data Setting).

Then, assign SWR display format to the first trace and the reflection coefficient phase display format to the second trace.



To set the active trace display format, use the following softkeys:

Response > Format > SWR (for the first trace),

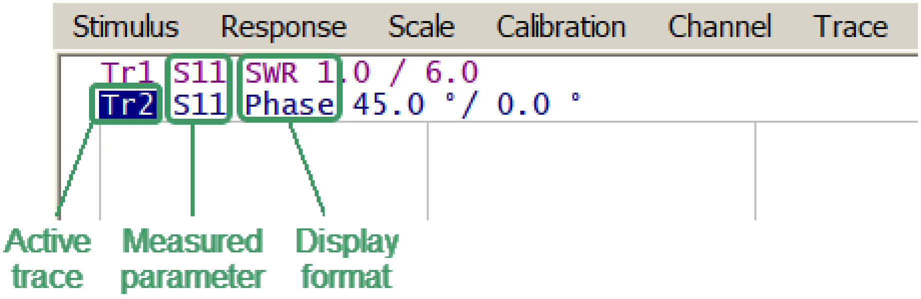
Response > Format > Phase (for the second trace).

To return to the main menu, click the top softkey (colored in blue).

NOTE

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

The set parameters will be displayed in the trace status bar (See figure below).

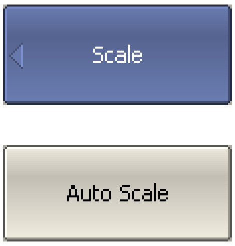


```
Tr1 S11 SWR 1.0 / 6.0
Tr2 S11 Phase 45.0 °/ 0.0 °
```

Settable parameters in the trace status field

Trace Scale Setting

For convenience of operation, change the trace scale using automatic scaling function (See Automatic Scaling).



To set the scale of the active trace by the auto-scaling function, use the following softkeys:

Scale > Auto Scale

To return to the main menu, click the top softkey (colored in blue).

NOTE

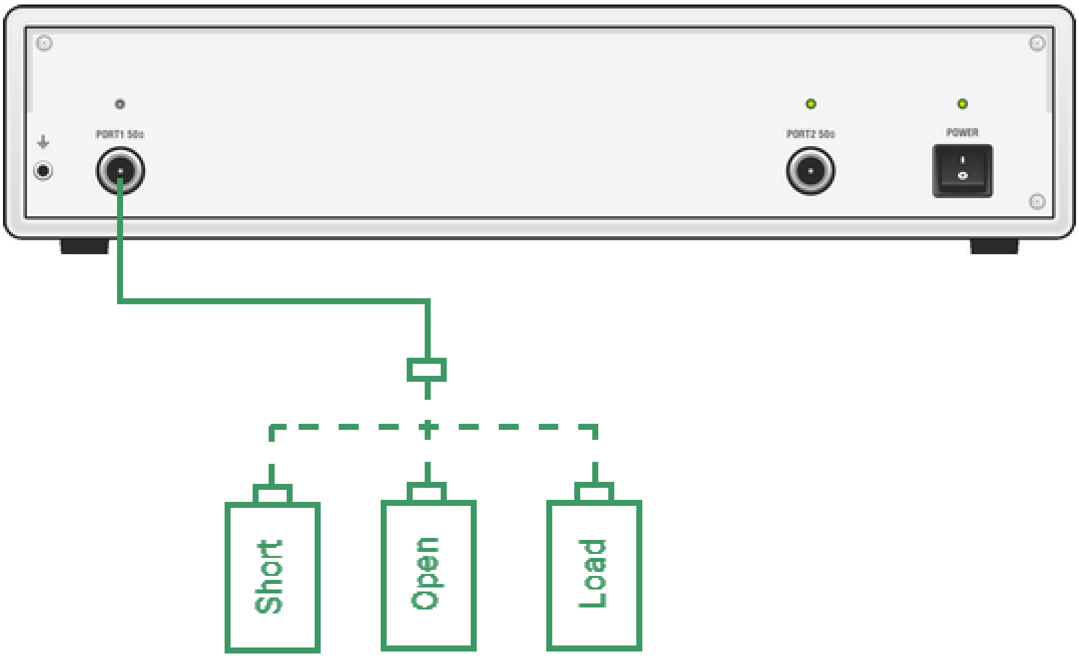
The trace scale can also be set manually using the softkeys or using the mouse (Setting with softkeys is described in Rectangular Scale, setting by mouse in Trace Scale Setting).

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.

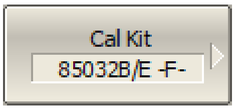
To perform full one-port calibration, prepare the kit of calibration standards: OPEN, SHORT and LOAD. To perform proper calibration, select the correct kit type in the program. This kit contains a description and specifications of the standards

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



Full one-port calibration circuit

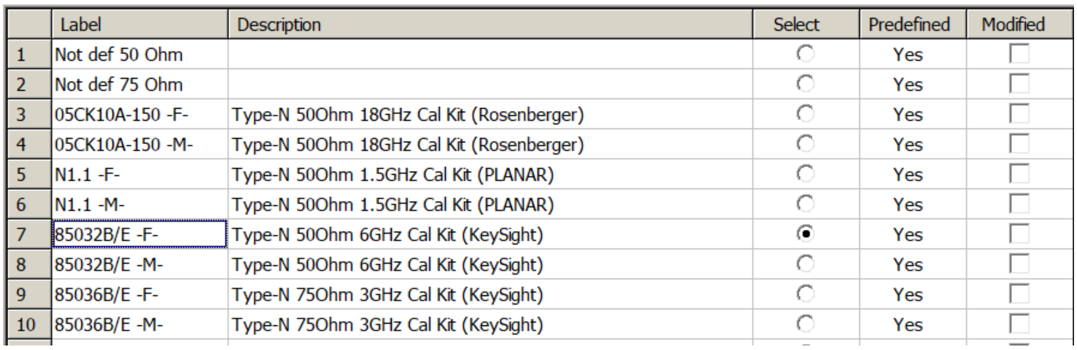
An Keysight 85032E calibration kit is used in this example.



To select the calibration kit, use the following softkeys:

Calibration > Cal Kit

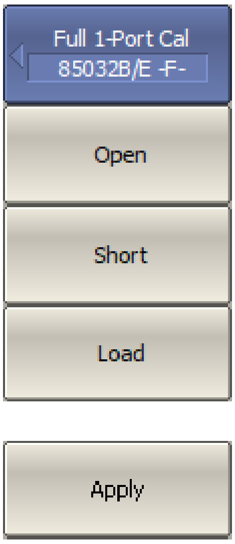
Then select the kit being used from the table at the bottom of the screen (See figure below).



	Label	Description	Select	Predefined	Modified
1	Not def 50 Ohm		○	Yes	□
2	Not def 75 Ohm		○	Yes	□
3	05CK10A-150 -F-	Type-N 50Ohm 18GHz Cal Kit (Rosenberger)	○	Yes	□
4	05CK10A-150 -M-	Type-N 50Ohm 18GHz Cal Kit (Rosenberger)	○	Yes	□
5	N1.1 -F-	Type-N 50Ohm 1.5GHz Cal Kit (PLANAR)	○	Yes	□
6	N1.1 -M-	Type-N 50Ohm 1.5GHz Cal Kit (PLANAR)	○	Yes	□
7	85032B/E -F-	Type-N 50Ohm 6GHz Cal Kit (KeySight)	●	Yes	□
8	85032B/E -M-	Type-N 50Ohm 6GHz Cal Kit (KeySight)	○	Yes	□
9	85036B/E -F-	Type-N 75Ohm 3GHz Cal Kit (KeySight)	○	Yes	□
10	85036B/E -M-	Type-N 75Ohm 3GHz Cal Kit (KeySight)	○	Yes	□

Calibration kits list

To perform full one-port calibration (SOL), execute measurements of the three standards in turn. After completion, the table of calibration coefficients will be calculated and saved into the memory of the Analyzer. Before starting calibration, disconnect the DUT from the Analyzer.



To perform full one-port calibration, use the following softkeys:

Calibration > Calibrate > Full 1-Port Cal

Connect an OPEN standard and click **Open**.

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, a checkmark will appear in the left part of the softkey.

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

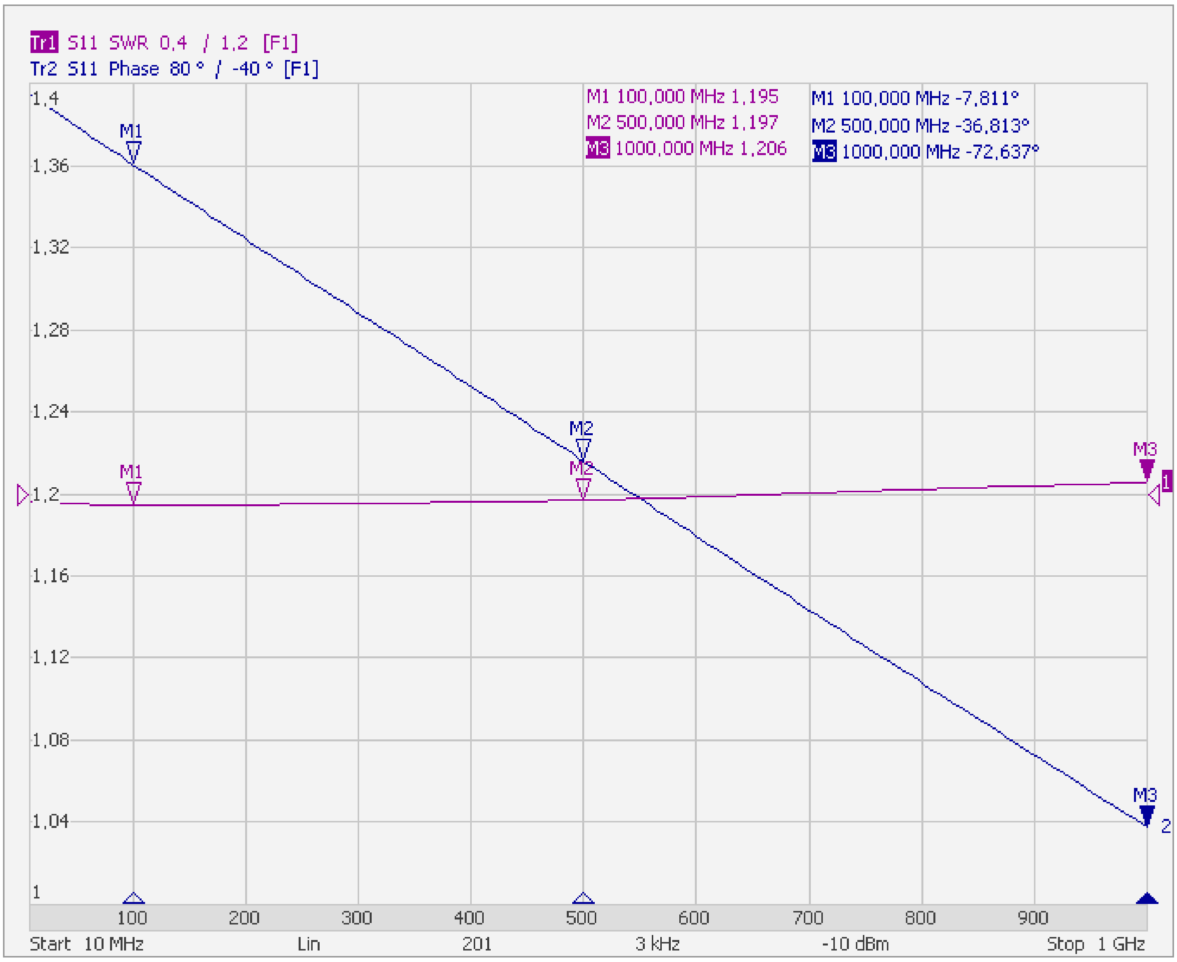
Connect a LOAD standard and click **Load**.

To complete the calibration procedure and calculate the table of calibration coefficients, click the **Apply** softkey.

Connect the DUT to the calibrated analyzer port again after calibration is done.

SWR and Reflection Coefficient Phase Analysis Using Markers

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



Tr1 S11 SWR 0,4 / 1,2 [F1]
Tr2 S11 Phase 80 ° / -40 ° [F1]

M1 100,000 MHz 1,195
M2 500,000 MHz 1,197
M3 1000,000 MHz 1,206

M1 100,000 MHz -7,811°
M2 500,000 MHz -36,813°
M3 1000,000 MHz -72,637°

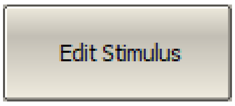
Start 10 MHz Lin 201 3 kHz -10 dBm Stop 1 GHz

SWR and reflection coefficient phase measurement example

To create a new marker, use the following softkeys:

Markers > Add Marker

A new marker is placed in the center of the stimulus axis and assigned to be active. To edit just created marker, use the following soft keys:



Markers > Edit Stimulus

Then enter the frequency value in the input field in the graph, e.g. to enter frequency 100 MHz, press «1», «0», «0» and «M» keys on the keypad.

Repeat the above procedure three times to enable three markers at different frequency points.

NOTE	For more details on working with markers, see Markers, Markers, Marker Stimulus Value Setting.

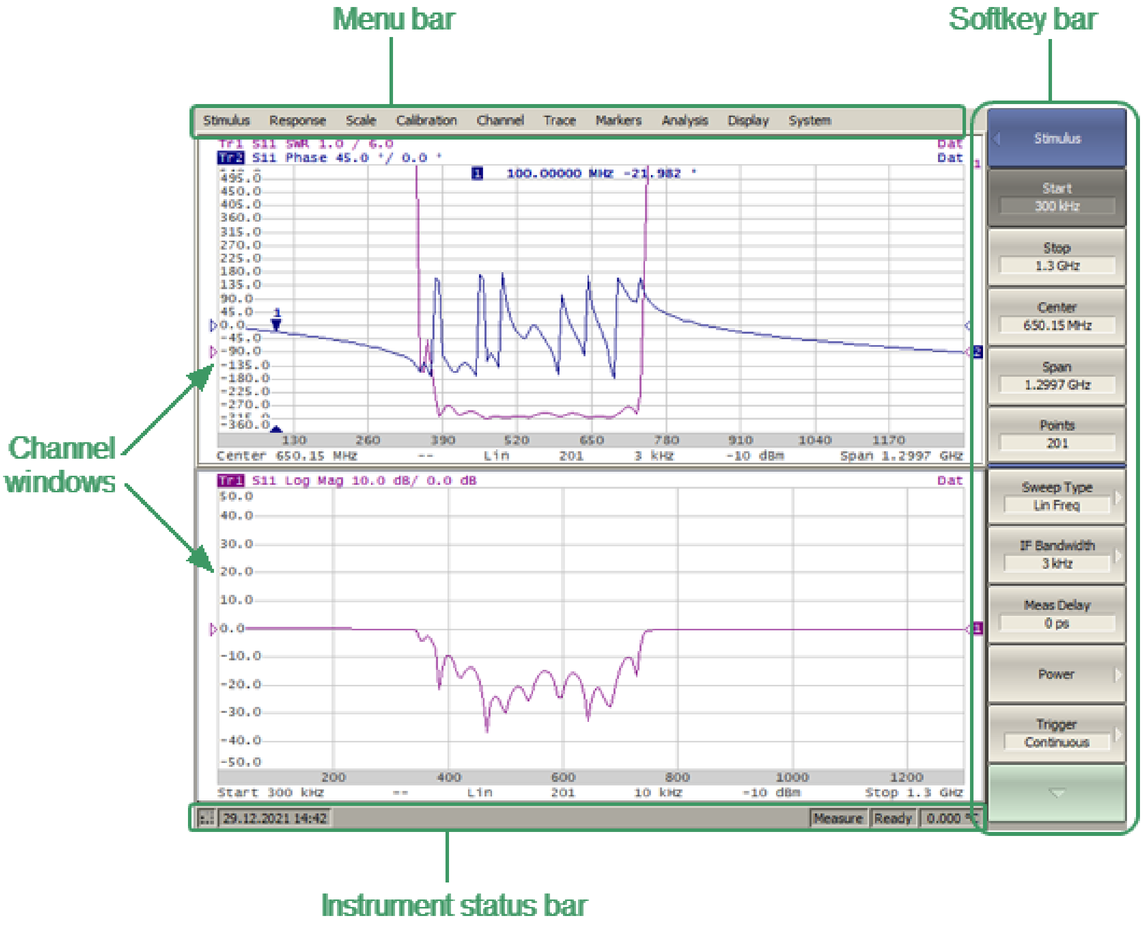
User Interface

The control program 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.
- Menu bar and Softkey bar to control the Analyzer.
- Instrument status bar to display information about the state of the Analyzer.

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

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



Tr1 S11 SWR 1.0 / 6.0 Dat
Tr2 S11 Phase 45.0 °/ 0.0 ° Dat
1 100.00000 MHz -21.982 °
Center 650.15 MHz -- Lin 201 3 kHz -10 dBm Span 1.2997 GHz

Tr1 S11 Log Mag 10.0 dB/ 0.0 dB Dat
Start 300 kHz -- Lin 201 10 kHz -10 dBm Stop 1.3 GHz

29.12.2021 14:42

Stimulus
Start 300 kHz
Stop 1.3 GHz
Center 650.15 MHz
Span 1.2997 GHz
Points 201
Sweep Type Lin Freq
IF Bandwidth 3 kHz
Meas Delay 0 ps
Power
Trigger Continuous

Analyzer screen layout

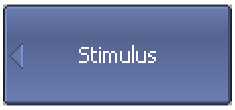
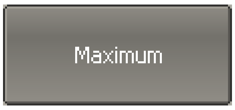
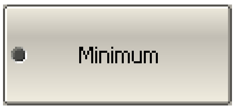
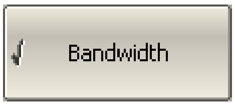
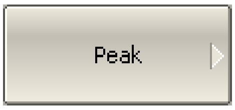
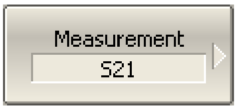
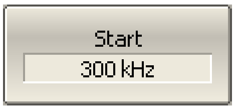
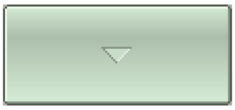
Softkey Bar

The softkey bar is along the right side of the Analyzer screen and allows easy access to all software functions. The softkey bar consists of sub-levels organized in a hierarchical structure. Each sublevel contains a set of softkeys corresponding to the selected function of the Analyzer.

The softkeys bar can be navigated using a mouse.

Alternatively, the softkeys bar can be navigated using the «↑», «↓», «←», «→», «Enter», «Esc», and «Home» keys on an external keyboard.

The types of softkeys are described below:

	The top softkey is the title key. It allows returning to the previous level of the softkey bar. If it is displayed in blue, the keyboard can be used to navigate within the softkey bar.
	If the softkey is highlighted in dark gray, pressing the «Enter» key on the keyboard will activate this softkey. The highlight can be shifted from key to key using «↑» and «↓» arrows on the keyboard.
	A large dot on the softkey indicates the current selection in a list of alternative settings.
	A checkmark in the left part of the softkey indicates an active function, which can be switched on/off.
	Softkeys with right arrows provide access to a lower sub-level.
	The right arrow softkeys provide access to the lower sublevel, and the selected function is indicated in the text field.
	Softkeys with a value field allow for entering/selection of the numerical settings.
	This navigation softkey appears when the softkey bar overflows the menu screen area. The softkey bar can be scrolled through with this softkey.

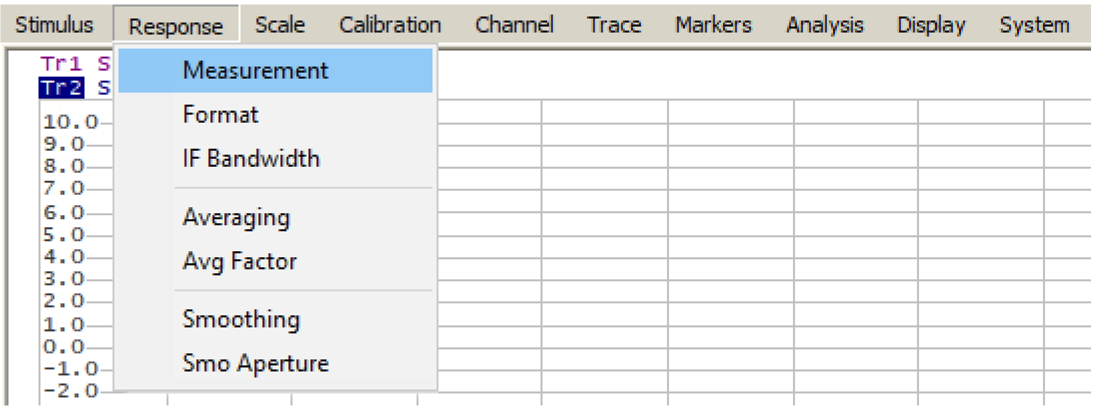
In addition to «↑», «↓», the «←», «→», «Esc», «Home» keys can be used to navigate the softkey bar:

- «←» key brings up the upper level of the bar
- «→» key brings up the lower level of the bar, if there is a highlighted softkey with a right arrow
- «Esc» key functions similarly to the «←» key
- «Home» key brings up the top-level of the softkey bar
- «Space» key is similar to «Enter» key

NOTE The above keys of the keyboard allow navigation within the softkey bar only if there is no active entry field. In this case the menu title softkey is highlighted in blue.

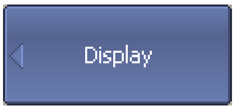
Menu Bar

The dropdown menu bar is located at the top of the screen (See figure below). This is menu providing direct access to certain sub-levels of the softkey bar. It contains the most frequently used softkeys' functions.



Menu Bar

The menu bar can be optionally hidden to gain more screen space for the channel window.

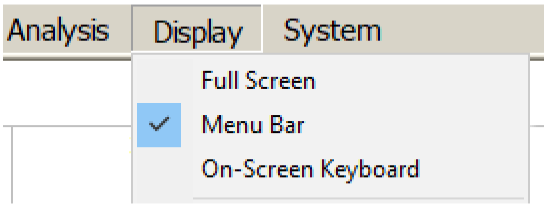


To hide the menu bar, use the following softkeys:

Display > Menu Bar

NOTE

The menu bar can be hide in menu bar tab:

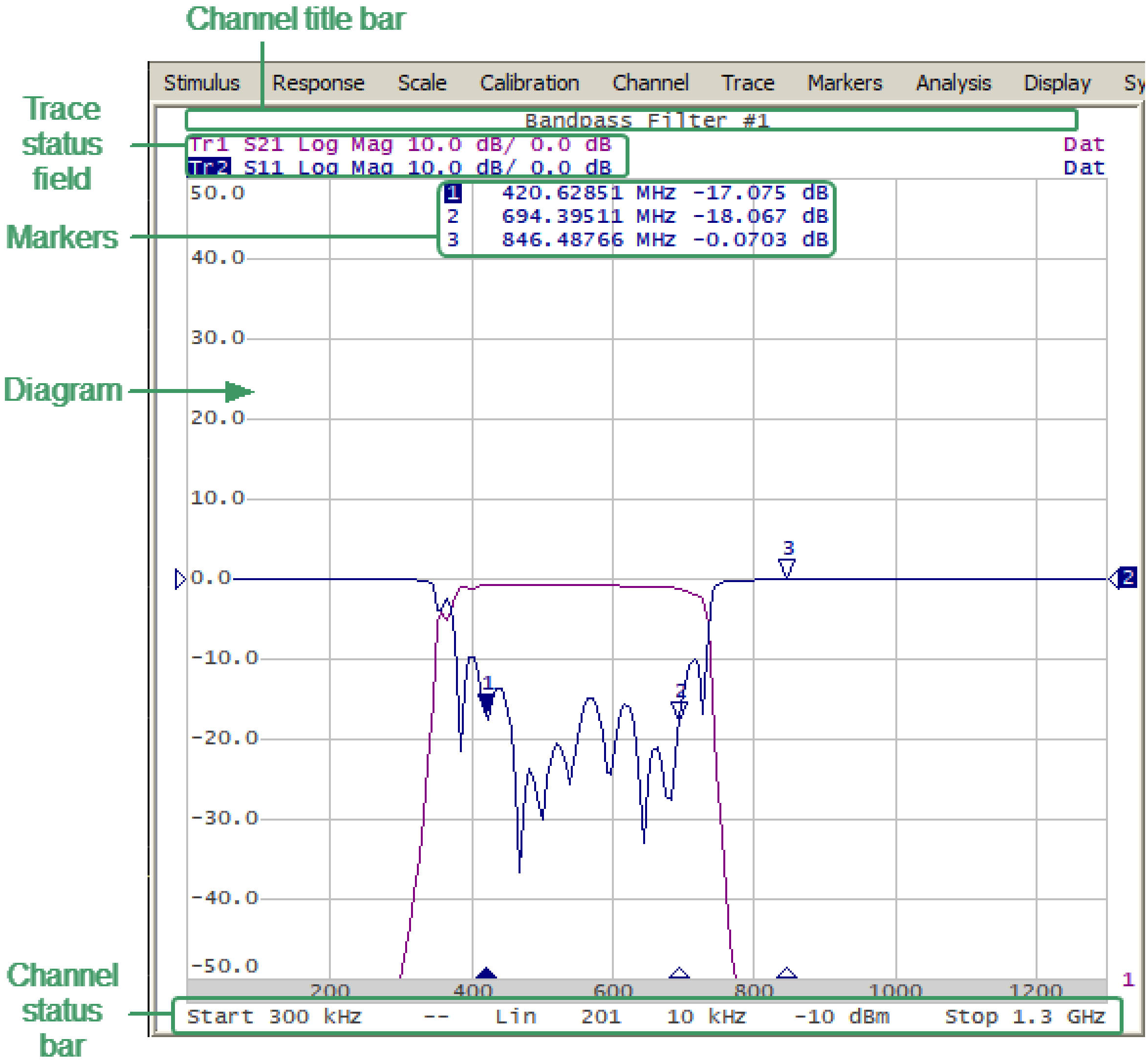


Channel Window Layout and Functions

The channel window displays the measurement results in the form of traces and numerical values. The screen can display up to 9 channel windows simultaneously. Each window corresponds to one channel. The analyzer hardware processes channels sequentially.

In turn, each channel window can display up to 8 traces of measured parameters. 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 the figure below.



Bandpass Filter #1

```
Tr1 S21 Log Mag 10.0 dB/ 0.0 dB                         Dat
Tr2 S11 Log Mag 10.0 dB/ 0.0 dB                         Dat
```

```
1    420.62851 MHz -17.075 dB
2    694.39511 MHz -18.067 dB
3    846.48766 MHz -0.0703 dB
```

```
Start 300 kHz    --    Lin    201    10 kHz    -10 dBm    Stop 1.3 GHz
```

Channel Window

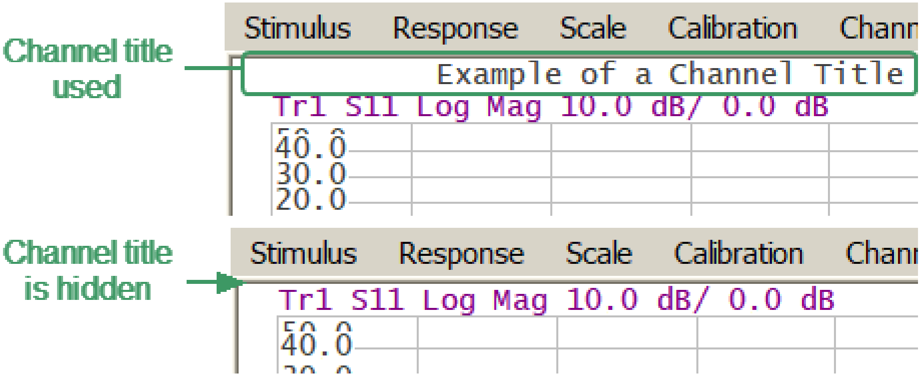
Each channel window contains a Channel title (hidden by default) to be defined by the user, Trace status field to display the name and parameters of the traces, Diagram for displaying traces, as well as information about the channel status in the form of the Channel Status Bar. To display the measurement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

A channel can be considered to be a separate logical analyzer with the following settings:

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

Channel Title Bar

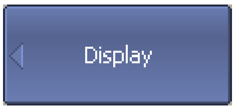
The channel title feature allows a comment to be entered for each channel window. The channel title bar can be hidden to gain more screen space for the trace diagram.



Example of a Channel Title

Tr1 S11 Log Mag 10.0 dB/ 0.0 dB

Channel title bar



To show/hide the channel title bar, use the following softkeys:

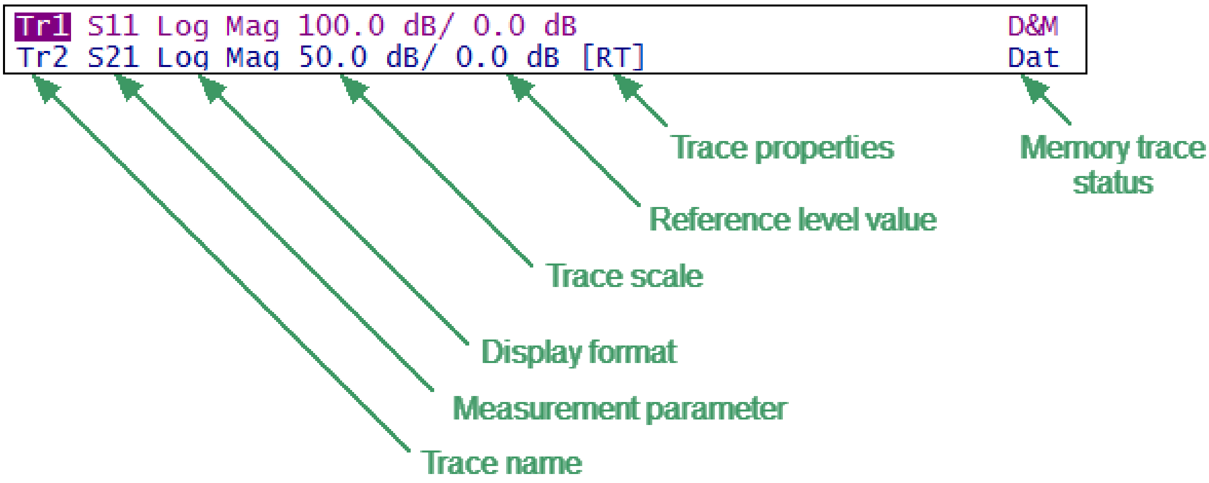
Display > Title Label

When the channel title bar is enabled, the channel title edit mode can be accessed by clicking on it.

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 active traces in the channel. The trace status field is represented in the figure below.



```
Tr1 S11 Log Mag 100.0 dB/ 0.0 dB           D&M
Tr2 S21 Log Mag 50.0 dB/ 0.0 dB [RT]       Dat
```

Trace status field

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

- Trace name from «Tr1» to «Tr8». The active trace name is highlighted in an inverted color.
- Measured parameter: S11, S21 or absolute power value: Abs A, Abs B, Abs R.
- Display format, e.g. «Log Mag» (See Display Format).
- Trace scale in measurement units per scale division, e.g. «10.0 dB/».
- Reference level value, e.g. «►0.00 dB», where «►» is the symbol of the reference level.
- Trace properties is indicated as symbols in square brackets (See table below).

Status	Symbols	Definition
Error Correction	**RO**	OPEN response calibration
	RS	SHORT response calibration
	RT	THRU response calibration
	OP	One-path two-port calibration

Status	Symbols	Definition
	F1	Full one-port SOL calibration
Data Analysis	**Z0**	Port impedance conversion
	Dmb	Fixture de-embedding
	Emb	Fixture embedding
	Pxt	Port extension
Trace Hold	No indication	Trace hold OFF
	Max Hold	Hold the maximum value
	Min Hold	Hold the minimum value
Math Operations	**D+M**	Data + Memory
	D–M	Data – Memory
	D*M	Data * Memory
	D/M	Data / Memory
Electrical Delay	**Del**	Electrical delay other than zero
Phase Offset	**PhO**	Phase offset value other then zero
Smoothing	**Smo**	Trace smoothing
Gating	**Gat**	Time domain gating
Conversion	**Zr**	Reflection impedance
	Zt	Transmission impedance

Status	Symbols	Definition
	Yr	Reflection admittance
	Yt	Transmission admittance
	1/S	S-parameter inversion
	Conj	Conjugation

- Memory trace status, e.g. «Dat» (See Memory Trace Function).

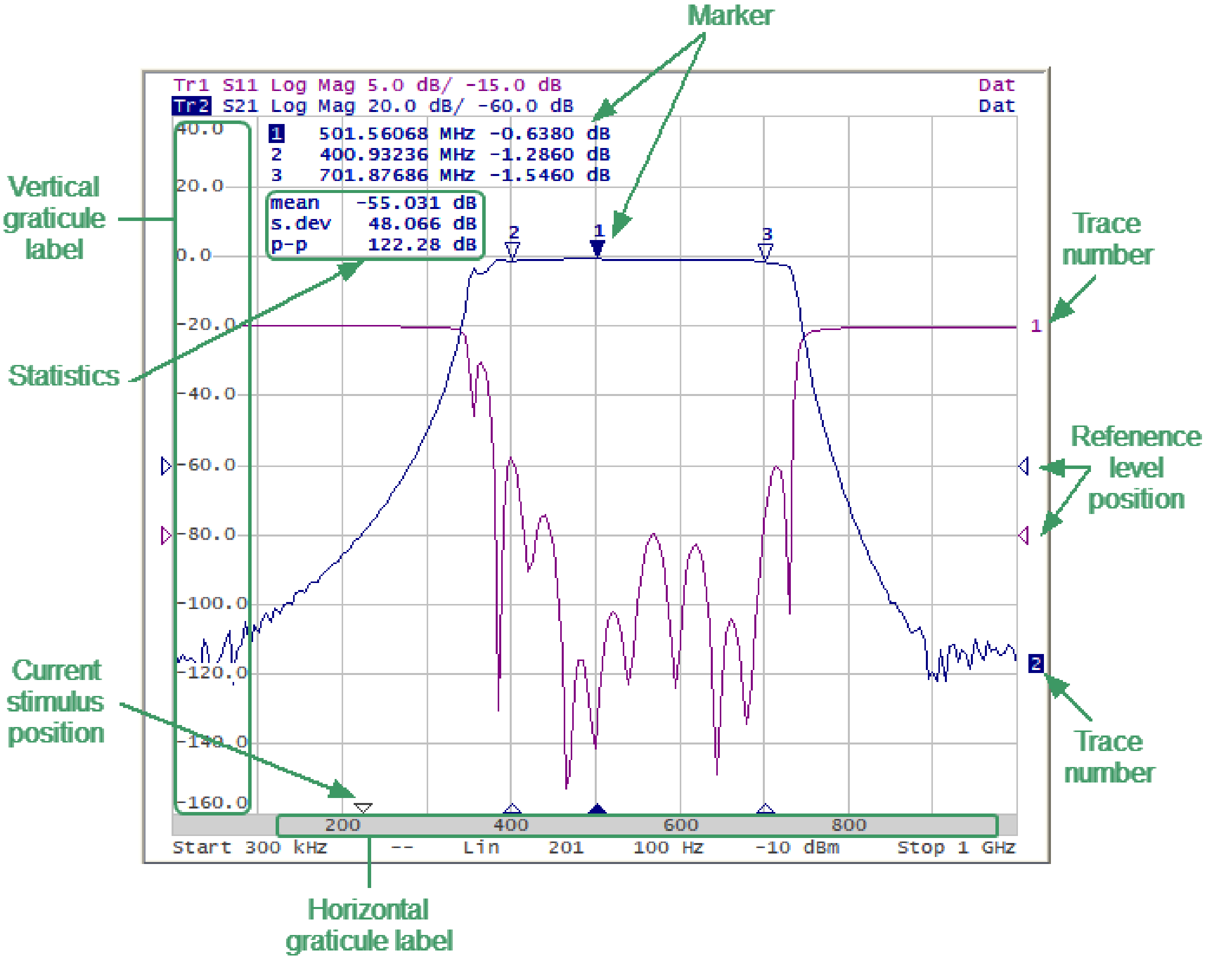
Status	Symbols	Definition
Trace Display	**Dat**	Data trace only, memory exists
	D&M	Data and memory traces
	Mem	Memory trace
	Off	Data and memory traces OFF

NOTE

Using the trace status field, the trace parameters can be easily modified using the mouse (as described in Quick Setting Using a Mouse).

Diagram

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



```
Tr1 S11 Log Mag 5.0 dB/ -15.0 dB                      Dat
Tr2 S21 Log Mag 20.0 dB/ -60.0 dB                     Dat
1   501.56068 MHz -0.6380 dB
2   400.93236 MHz -1.2860 dB
3   701.87686 MHz -1.5460 dB
mean    -55.031 dB
s.dev    48.066 dB
p-p     122.28 dB
Start 300 kHz   --   Lin   201   100 Hz   -10 dBm   Stop 1 GHz
```

Diagram

The diagram contains the following elements:

- **Vertical graticule label** displays the vertical axis numeric data for the active trace.
- **Horizontal graticule label** displays stimulus axis numeric data (frequency, power level or time). 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.

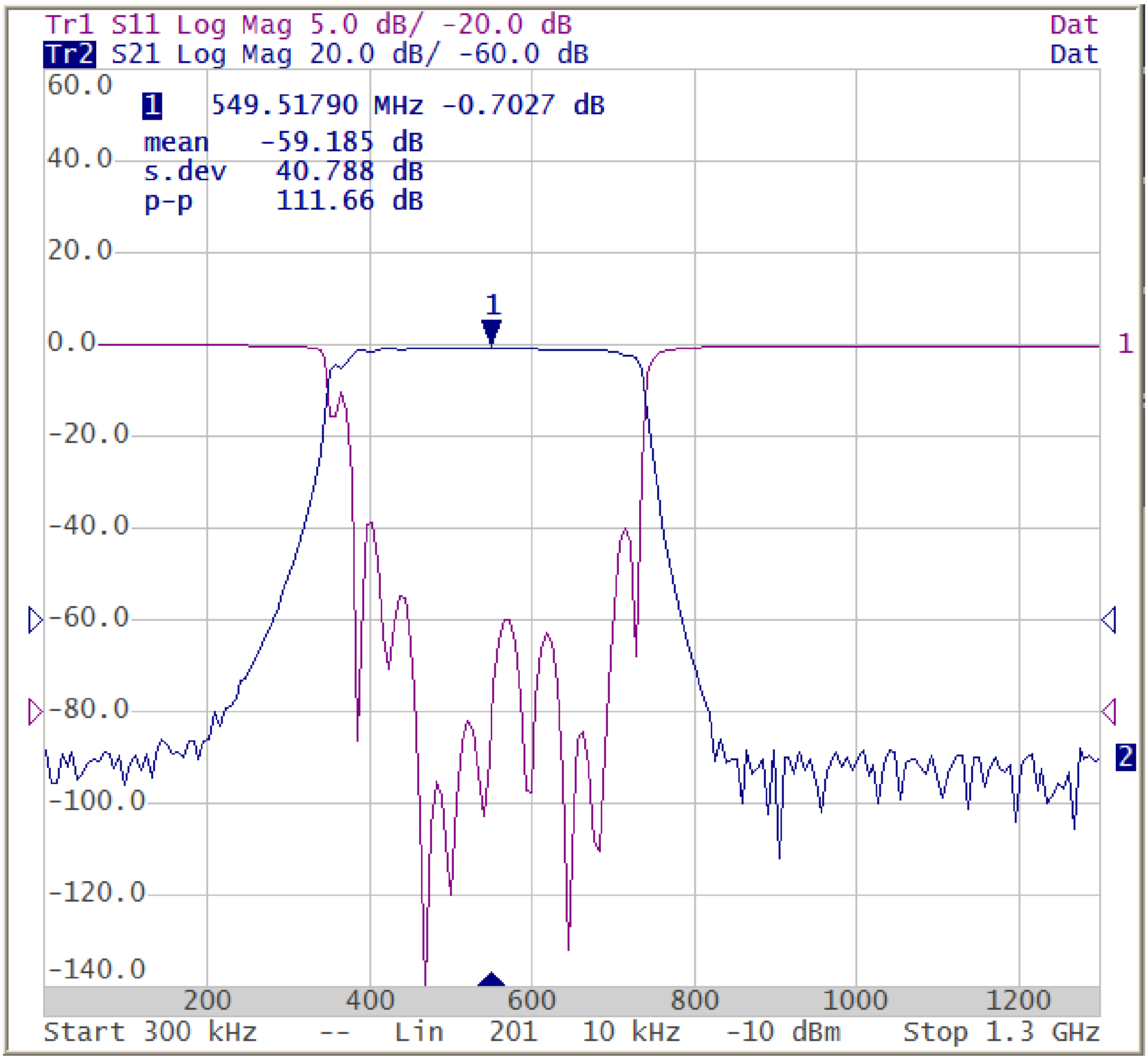
- **Trace number** allows trace identification when printing in black and white.
- **Current stimulus position** indicator appears when sweep duration exceeds 1.5 sec.

NOTE

Using the graticule labels, the trace parameters can be easily modified using the mouse (as described in Quick Setting Using a Mouse).

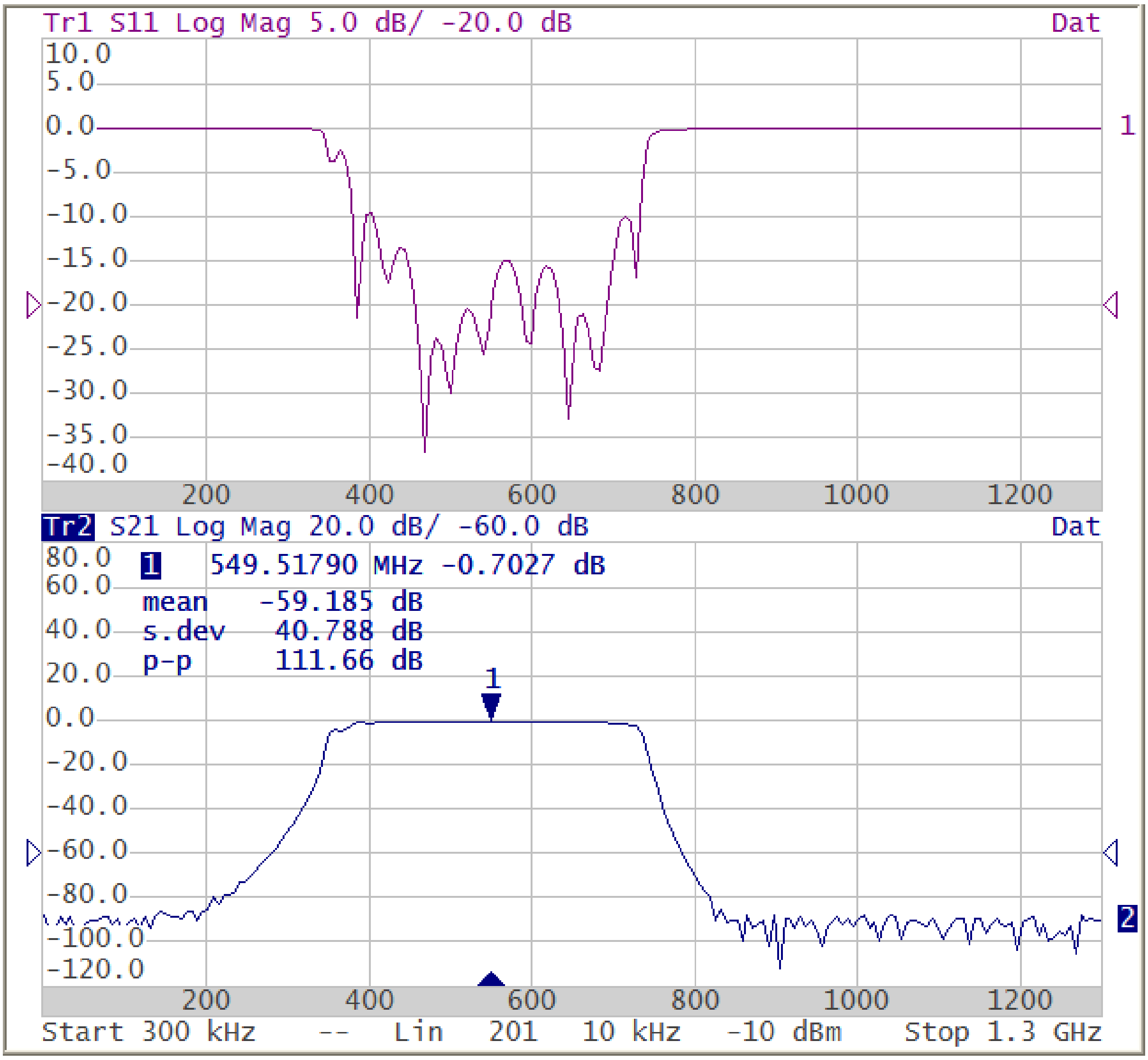
Trace Layout in the Channel Window

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 detail description of trace allocation see Trace Allocation.



```
Tr1 S11 Log Mag 5.0 dB/ -20.0 dB                              Dat
Tr2 S21 Log Mag 20.0 dB/ -60.0 dB                             Dat
1     549.51790 MHz -0.7027 dB
mean     -59.185 dB
s.dev     40.788 dB
p-p       111.66 dB
Start 300 kHz   --   Lin   201   10 kHz   -10 dBm   Stop 1.3 GHz
```

All traces in one diagram (sample)

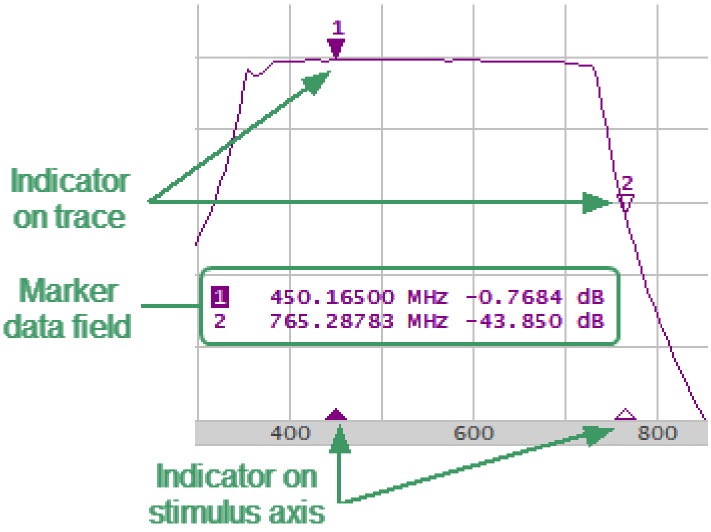


```
Tr1 S11 Log Mag 5.0 dB/ -20.0 dB                               Dat
Tr2 S21 Log Mag 20.0 dB/ -60.0 dB                              Dat
     1    549.51790 MHz -0.7027 dB
     mean    -59.185 dB
     s.dev    40.788 dB
     p-p      111.66 dB
Start 300 kHz    --   Lin   201   10 kHz   -10 dBm     Stop 1.3 GHz
```

Each trace on an individual diagram (sample)

Markers

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



```
1   450.16500 MHz  -0.7684 dB
2   765.28783 MHz  -43.850 dB
```

Markers

The markers are numbered from 1 to 15. The reference marker is indicated with an **R** symbol.

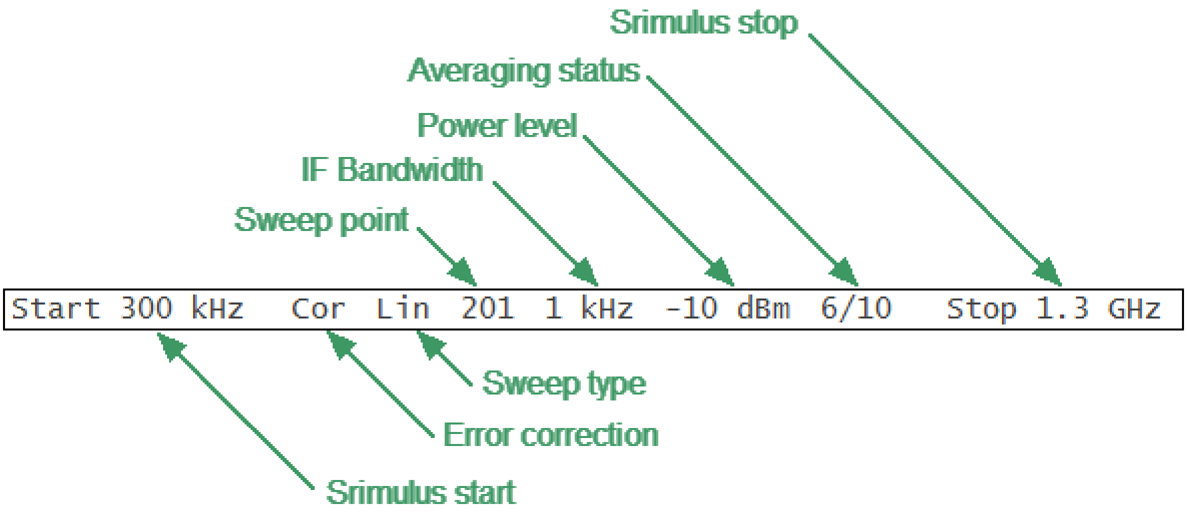
The active marker is indicated in the following manners:

- its number is highlighted with inverse color
- the stimulus indicator is fully colored

NOTE 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

It contains the following elements:

- **Stimulus start** field allows display and entry of the start frequency or power, depending on the sweep type. This field can be switched to indicate the stimulus center frequency, in this case the word «Start» will change to «Center». For a detailed description of stimulus setting, see Sweep Range.

- **Number of Points** field allows display and entry of the number of sweep points. The number of points can be set from 2 to 16001. For a detailed description see Number of Points.

- **Sweep type** field allows 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.

Symbol	Definition
Lin	Linear frequency sweep
Log	Logarithmic frequency sweep
Seg	Segment frequency sweep
Pow	Power sweep

Symbol	Definition
Voltmeter	Vector Voltmeter

- **IF bandwidth** field allows display and setting of the IF bandwidth. The values can be set from the 10 Hz to 30 kHz. For a detailed description see IF Bandwidth Setting.
- **Power level** field allows display and entry of the port output power. In power sweep mode, the field switches to indicate the CW frequency of the source. For a detailed description see Stimulus Power.
- **Stimulus stop** field allows display and entry of the stop frequency or power, depending on the sweep type. 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.
- **Error correction** field displays the integrated status of error correction for S-parameter traces and the integrated status of power correction for all the traces. The values of this field are represented in the table below. For a detailed description see Error Correction Status.

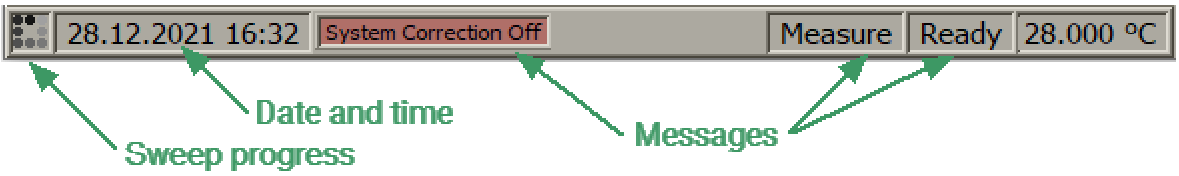
Symbol	Definition
--	No calibration data. No calibration was performed.
Cor	Error correction is enabled. The stimulus settings are the same for the measurement and the calibration.
C?	Error correction is enabled. The stimulus settings are not the same for the measurement and the calibration. Interpolation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

Symbol	Definition
PC!	Power correction is enabled. The stimulus settings are not the same for the measurement and the calibration. Extrapolation is applied.

- **Averaging status** field displays the averaging status, if this function is enabled. The first number is the averaging current counter value, the second one is the averaging factor. For a detailed description see Averaging Setting.

Instrument Status Bar

The instrument status bar is located at the bottom of the screen.



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.	
Sweep status	**Measure**	A sweep is in progress.	For a detailed description see Trigger Settings.
	Hold	A sweep is on hold.	
	Bus	Waiting for Bus trigger.	
RF signal	**RF Off**	Stimulus signal output is turned OFF.	For a detailed description see RF Out Function.
Display update	**Update Off**	Display update is turned OFF.	For a detailed description see Screen Update Setting.
System correction	**System Correction Off**	System correction is turned OFF.	For a detailed

Field Description	Message	Instrument Status	Note
status			description see System Correction Setting.
Factory calibration error	**System Cal Failure!** **Power Failure!**	Calibration data in ROM has an error. **THE ANALYZER IS DAMAGED AND REQUIRES FACTORY REPAIR.**	
External power meter status	**Power Sensor: Error**	Error connecting an external power meter to the analyzer via USB.	For a detailed description see Power Meter Setting.
Overload Protection	**Port <n> Overload!**	Port n overload.	For a detailed description see Power Trip Function.

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 Analyzer supports 9 channels, each of which allows measurements with stimulus parameter settings different from the other channels. The parameters related to a 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	Power Slope Feature
6	CW Frequency
7	Segment Sweep Table
8	Trigger Mode (TR5048 and TR7530 only)
9	IF Bandwidth
10	Averaging
11	Calibration
12	Fixture Simulator

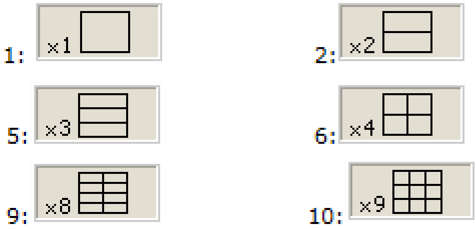
Each channel window can contain up to 8 different traces. Each trace is assigned a measured parameter (S-parameter), display format, and other parameters. The parameters related to a trace are listed in the table below.

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 up to 9 channel windows simultaneously. By default, one channel window opens. If two or more channel windows need to be opened, one of the layouts shown below can be selected. The available options for number and layout of the channel windows on the screen are as follows:



Channel window layout

In accordance with the layouts, the channel windows do not overlap each other. The channels open sequentially from low to high.

NOTE

For each open channel window, set the stimulus parameters, adjust other settings, and perform calibration. For a detailed description see Stimulus Settings.

Before changing a channel parameter setting or performing calibration of a channel, ensure that the channel is selected as active. For a detailed description see Selection of Active Trace/Channel.

The measurements are executed for open channel windows sequentially. Measurements for any hidden channel windows are not performed.

To set the channel window layout, use the following softkeys:

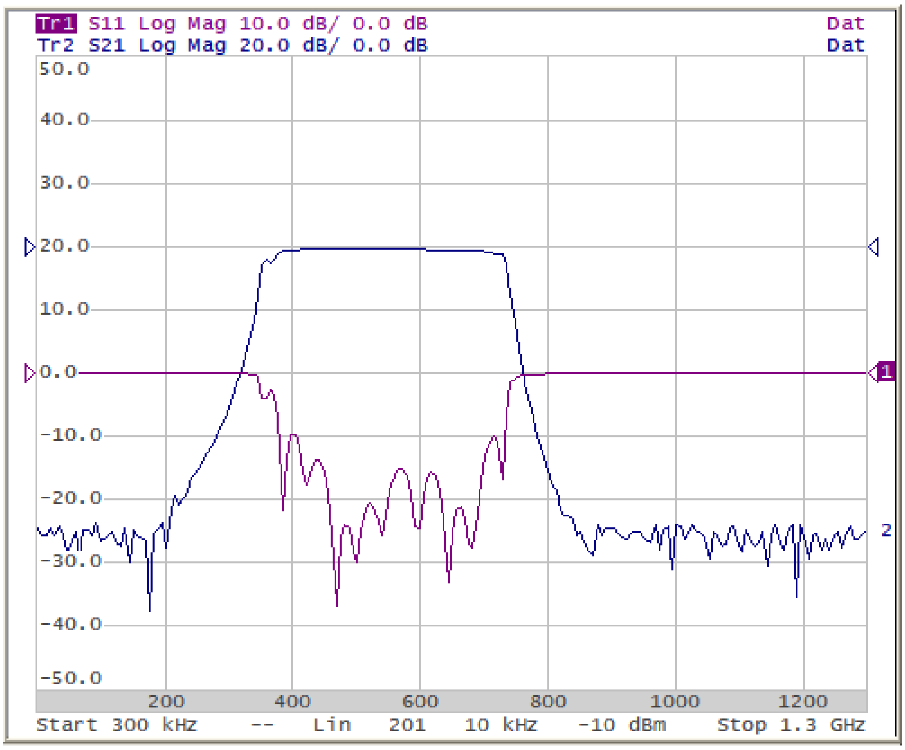
Channel > Allocate Channels

Then select the required number and layout of the channel windows in the menu.

SCPI DISPlay:SPLit

Number of Traces

Each channel window can contain up to 8 different traces. Each trace is assigned the measured parameter S11 or S21, display format, and other parameters.



Tr1 S11 Log Mag 10.0 dB/ 0.0 dB
Tr2 S21 Log Mag 20.0 dB/ 0.0 dB
Dat
Dat
50.0
40.0
30.0
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
1
2
200
400
600
800
1000
1200
Start 300 kHz -- Lin 201 10 kHz -10 dBm Stop 1.3 GHz

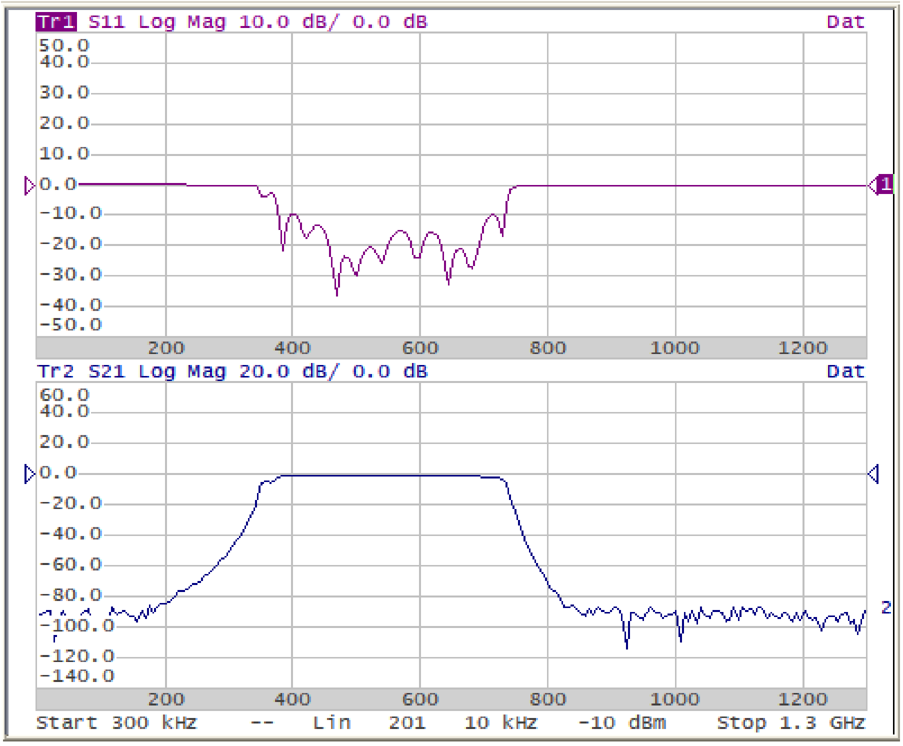
Two traces in one diagram

All traces are assigned individual names, which cannot be changed. The trace name contains its number. The trace names are as follows: **Tr1, Tr2, ... Tr9**.

Each trace is assigned the following initial settings: measured parameter, format, scale, and color, which can be modified:

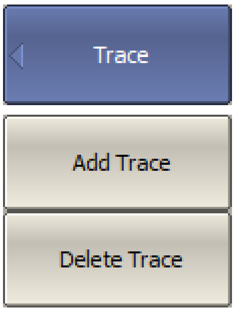
- By default, the measured parameters of the first two graphs are assigned the following values: **S11, S21**. When adding new traces, the assigned parameters will be cyclically repeated. For a detailed description of changing measured parameter see S Parameter.
- By default, the display format for all traces is set to logarithmic magnitude (dB). For a detailed description of changing display format see Format Setting.
- By default, the scale parameters are set as follows: division is set to 10 dB, reference level value is set to 0 dB, and the reference level position is in the middle of the diagram. For a detailed description of changing scale parameters see Scale Settings.
- The trace color is determined by its number. This color can be changed. For a detailed description of changing color see Set Color.

The trace settings are made in two steps: trace number and trace layout within the channel window. The traces can be displayed in one diagram, overlapping each other, or in separate diagrams of a channel window, see Trace Allocation.



Two traces in two diagrams

By default, the channel window contains one trace. If two or more traces need to be enabled, the number of traces can be set as described below.



To set the number of the traces, use the following softkeys:

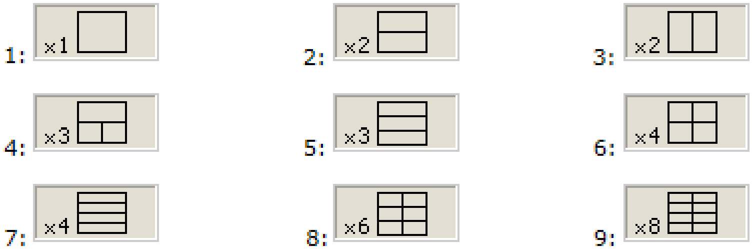
Trace > Add Trace

Trace > Delete Trace

SCPI CALCulate:PARameter:COUNt

Trace Allocation

By default, traces are displayed overlapping one another 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.

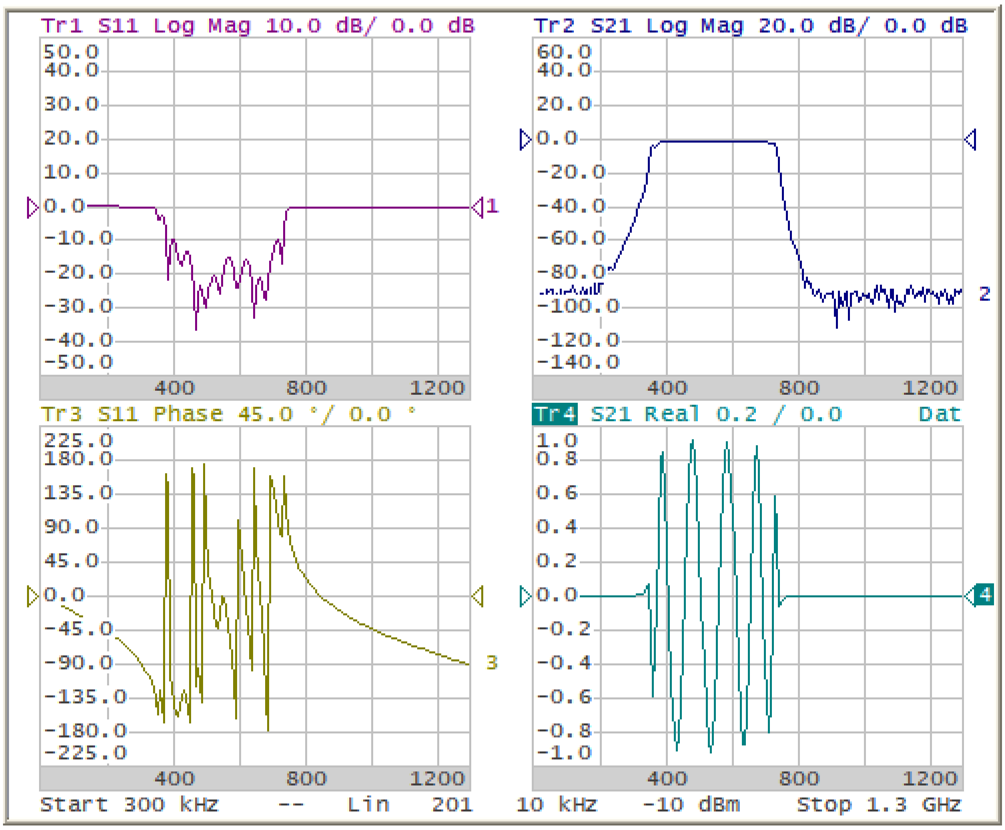


Options for diagram placement in the channel

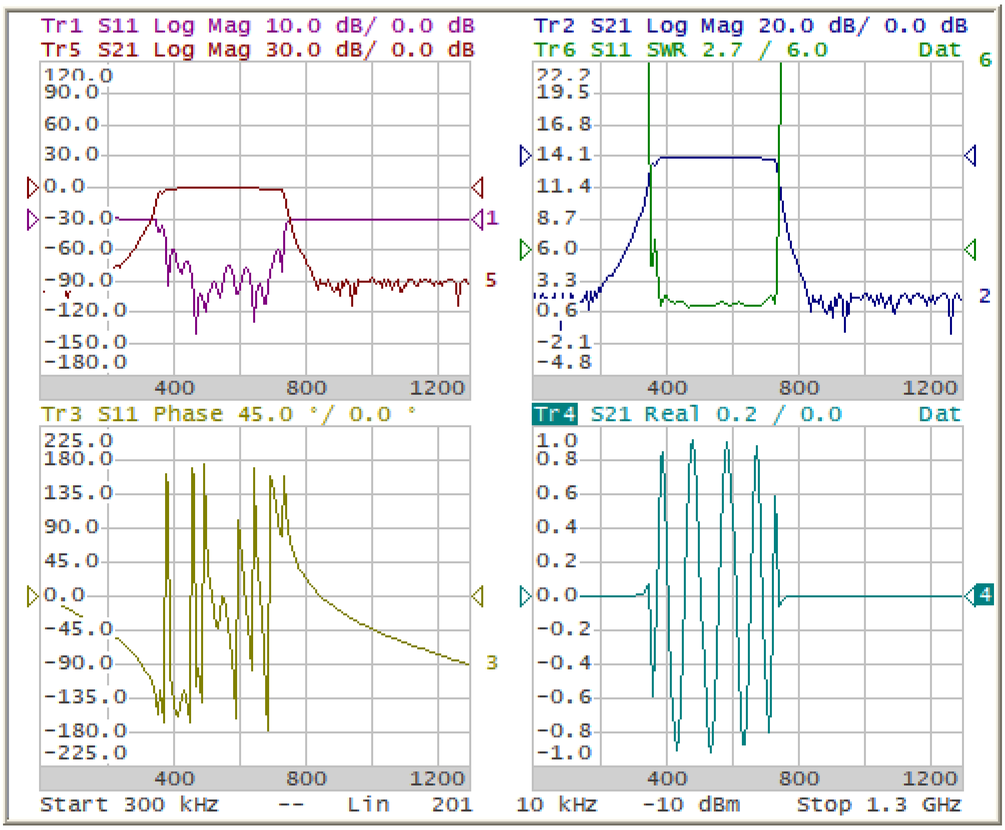
Unlike channel windows, the number of traces and layout of the trace in diagrams are not related. The number of traces and the number of diagrams are set independently.

Placing traces in a diagram:

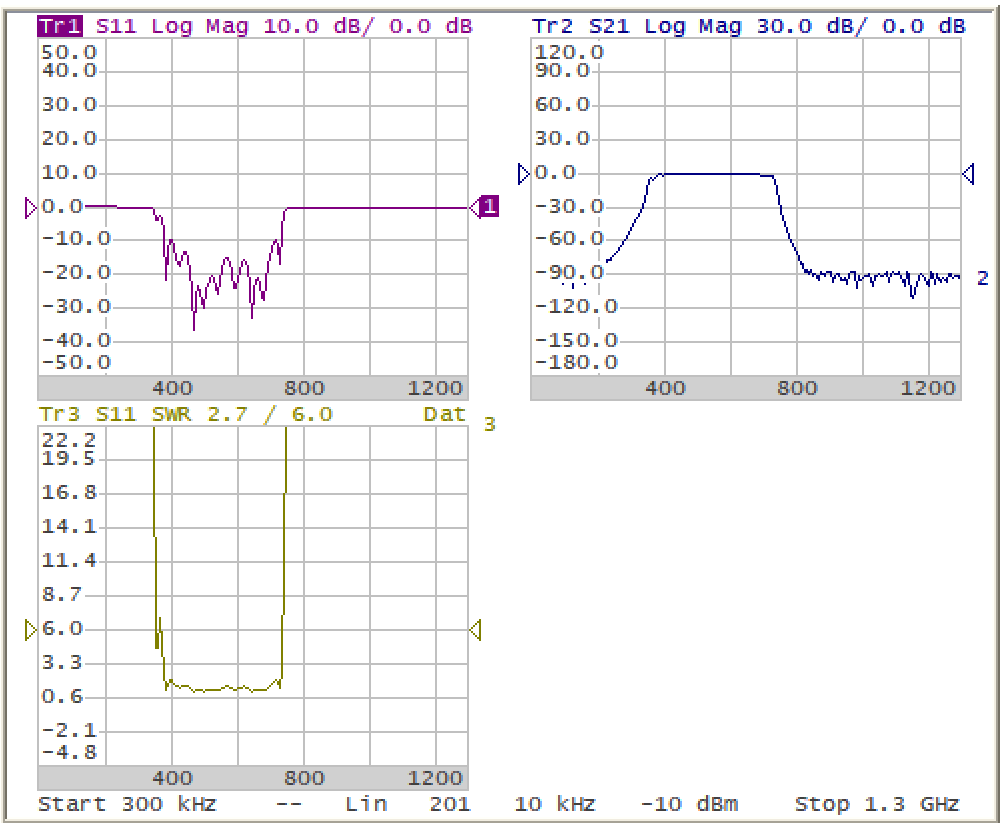
- If the number of traces and the number of diagrams are equal, all the traces will be displayed separately, each in an individual diagram.



- 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.

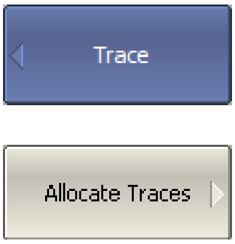


If two or more traces are displayed in one diagram, the vertical scale will be shown for the active trace.

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

NOTE	There is the option for displaying marker data for the active trace marker only (See Multi Marker Data Display).

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 softkeys:

Trace > Allocate Traces

Then select the desired number and layout of separate diagrams in the menu.

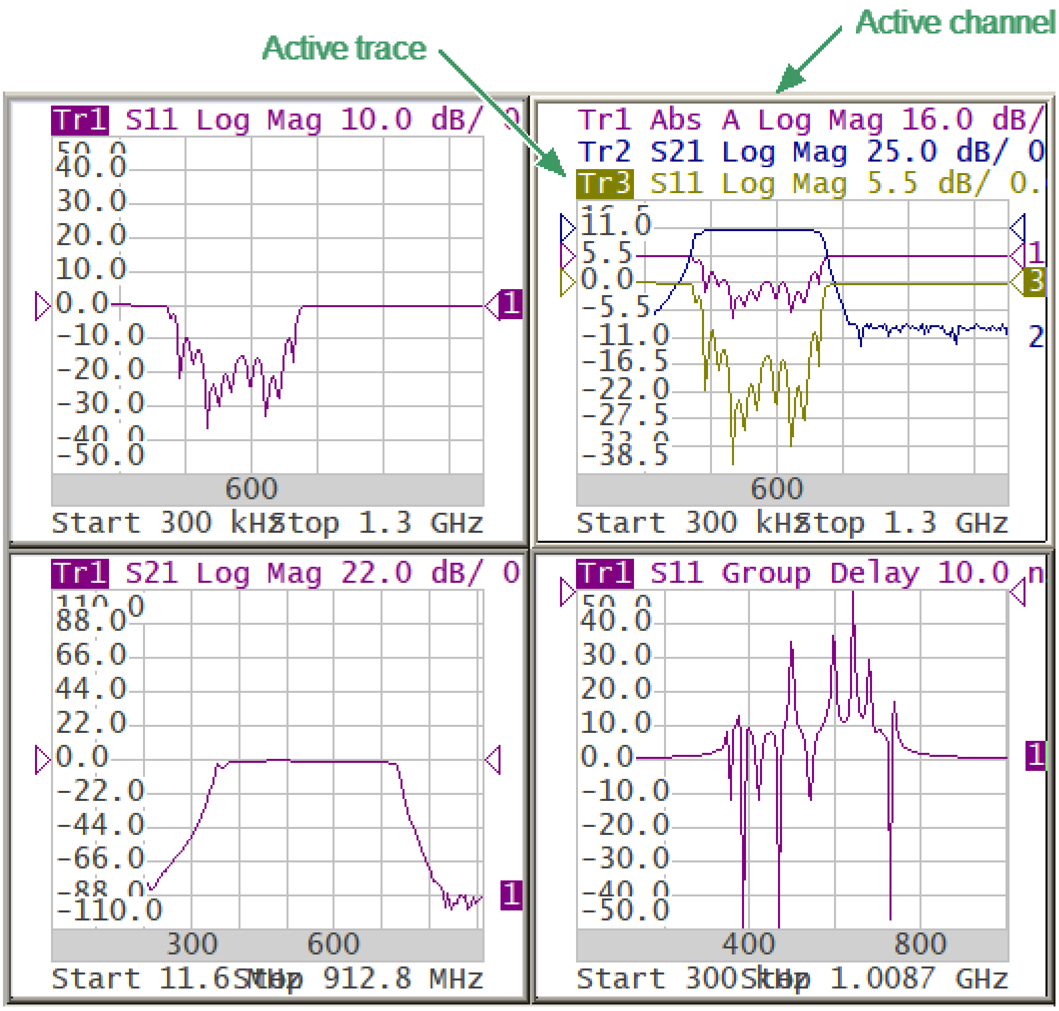
SCPI DISPlay:WINDow:SPLit

Selection of Active Trace/Channel

The selected control commands are applied to the active channel or the active trace, respectively.

The boundary line of the active channel window is highlighted in a light color. The active trace belongs to the active channel and its title is highlighted in an inverse color.

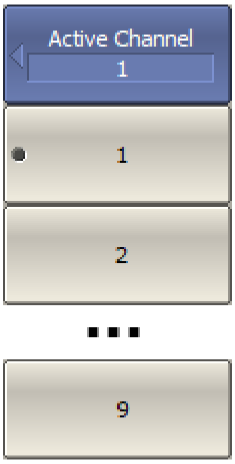
Before setting the parameters of a channel or trace, that channel or trace needs to be activated.


Active trace

Active channel

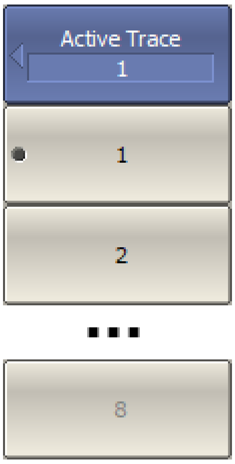
Tr1 S11 Log Mag 10.0 dB/ 0
Start 300 kHz Stop 1.3 GHz
Tr1 Abs A Log Mag 16.0 dB/
Tr2 S21 Log Mag 25.0 dB/ 0
Tr3 S11 Log Mag 5.5 dB/ 0.
Start 300 kHz Stop 1.3 GHz
Tr1 S21 Log Mag 22.0 dB/ 0
Start 11.6 MHz Stop 912.8 MHz
Tr1 S11 Group Delay 10.0 n
Start 300 kHz Stop 1.0087 GHz

Active Trace/Channel



To activate the channel, use the following softkeys:

Channel > Active Channel > [1 | 2 | ... 9]



To activate the trace, use the following softkeys:

Trace > Active Trace > [1 | 2 | ... 8]

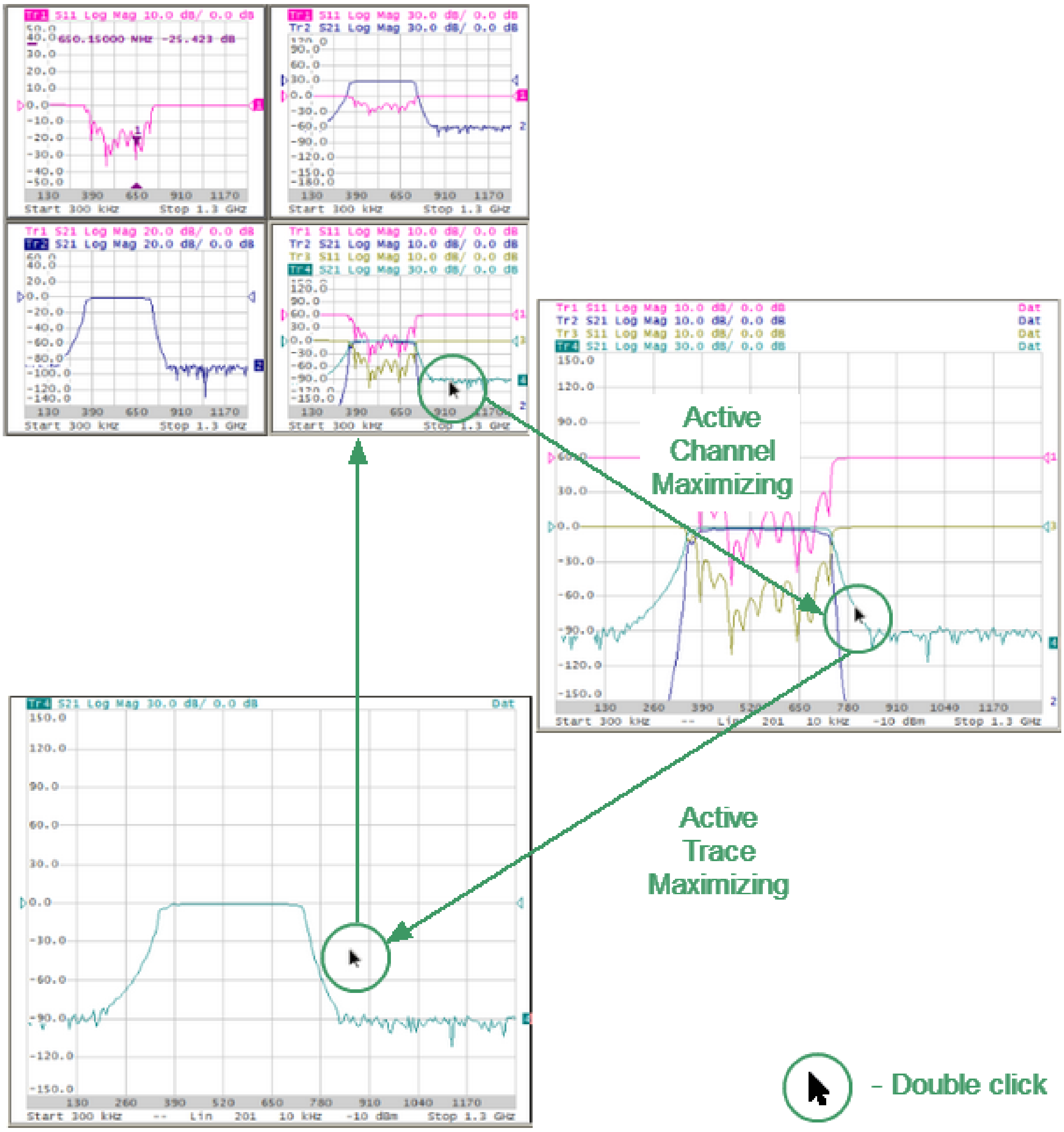
SCPI DISPlay:WINDow:ACTivate

CALCulate:PARameter:SELect

NOTE Active trace/channel can be selected using the mouse (See Active Trace Selection and Active Channel Selection).

Trace/Channel Window Maximizing

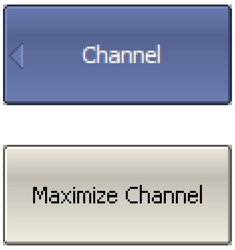
When there are several channel windows displayed, the active channel window can be temporarily expanded to full screen size. The other channel windows will not be visible, but this will not interrupt measurements in those channels.



Tr1 S11 Log Mag 10.0 dB/ 0.0 dB
Tr2 S21 Log Mag 10.0 dB/ 0.0 dB
Tr3 S11 Log Mag 10.0 dB/ 0.0 dB
Tr4 S21 Log Mag 30.0 dB/ 0.0 dB
Start 300 kHz
Stop 1.3 GHz
Active Channel Maximizing
Active Trace Maximizing
- Double click

Active Channel/Trace Window Maximizing

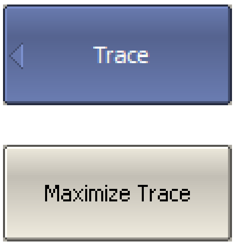
Similarly, when there are several traces displayed in a channel window, the active trace can be temporarily expanded. The other traces will not be visible, but this will not interrupt measurement of those traces.



To enable/disable active channel maximizing function, use the following softkeys:

Channel > Maximize Channel

SCPI DISPlay:MAXimize



To enable/disable active trace maximizing function, use the following softkeys:

Trace > Maximize Trace

SCPI DISPlay:WINDow:MAXimize

NOTE Channel/trace window maximization can also be controlled achieved by a double click on the channel/trace. To return to the initial state, double click on channel/trace.

Stimulus Settings

This section describes how to set the stimulus signal parameters.

Stimulus is 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 Trace/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 (linear frequency sweeps, logarithmic frequency sweeps or segment sweep mode).
- By power (linear power sweep).

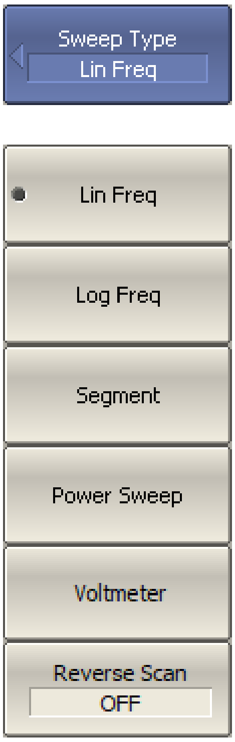
Reverse Sweep Mode

By default, the stimulus sweep starts from the start value of sweep range and stops at the stop value. In the reverse sweep mode, the sweep starts from the stop frequency and stops at the start frequency. The function applies to any sweep type (frequency, power, segment).

Vector Voltmeter

This mode allows measuring the raw vector (amplitude and phase) data at a single CW frequency, as well as the ratio of modules and the phase difference of the signals between the two measurement ports (A/B or B/A measurement). For a detail description of voltmeter see Vector Voltmeter.

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



To set the sweep type, use the following softkeys:

Stimulus > Sweep Type

Then select the sweep type:

- **Lin Freq** — Linear frequency sweep
- **Log Freq** — Logarithmic frequency sweep
- **Segment** — Segment frequency sweep
- **Power Sweep** — Power sweep
- **Voltmeter** — Vector Voltmeter Mode
- **Reverse Scan** — Reverse Sweep Mode

SCPI SENSe:SWEep:TYPE

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) and for the linear power sweep (dBm).

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 Trace/Channel).

To enter the start and stop values of the sweep range, use the following softkeys:

Stimulus > Start

Stimulus > Stop

SCPI SENSe:FREQuency:STARt, SENSe:FREQuence:STOP

SOURce:POWer:STARt, SOURce:POWer:STOP

To enter center and span values of the sweep range, use the following softkeys:

Stimulus > Center

Stimulus > Span

SCPI SENSe:FREQuency:CENTer, SENSe:FREQuence:SPAN

SOURce:POWer:CENTer, SOURce:POWer:SPAN

NOTE If power sweep is activated, the values on the **Start, Stop, Center** and **Span** softkeys will be represented in **dBm**.

NOTE

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

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

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

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, and for the linear power sweep.

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 Trace/Channel).

To enter the number of points, use the following softkeys:

Stimulus > Points

SCPI SENSe:SWEep:POINt

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

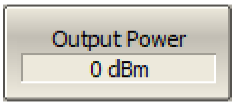
Stimulus Power

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 Trace/Channel).

Power


Output Power
0 dBm

To enter the power level value, use the following softkeys:

Stimulus > Power > Output Power

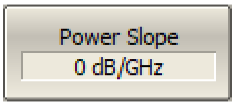
SCPI SOURce:POWer

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

Power Slope Feature

The power slope feature allows compensation of power loss with increasing frequency in the connecting cables. The power slope can be set for the linear, logarithmic, and segment frequency sweep types.

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



To enter the power slope value, use the following softkeys:

Stimulus > Power > Power Slope

SCPI SOURce:POWer:SLOPe

CW Frequency

The CW frequency setting determines the fixed frequency for the linear power sweep.

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

To enter the CW frequency value, use the following softkeys:

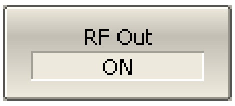
Stimulus > Power > CW Freq

SCPI SENSe:FREQuence

NOTE CW frequency value can be set using the mouse (See Power Level/CW Frequency Setting).

RF Out Function

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

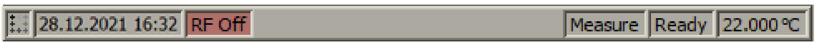


To disable/enable stimulus, use the following softkeys:

Stimulus > Power > RF Out

SCPI OUTPut

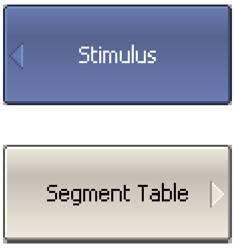
NOTE The **RF Out** function is applied to the Analyzer, not to individual channels. Indication of RF Out status appears in the instrument status bar (See Instrument Status Bar)



Segment Table Editing

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

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

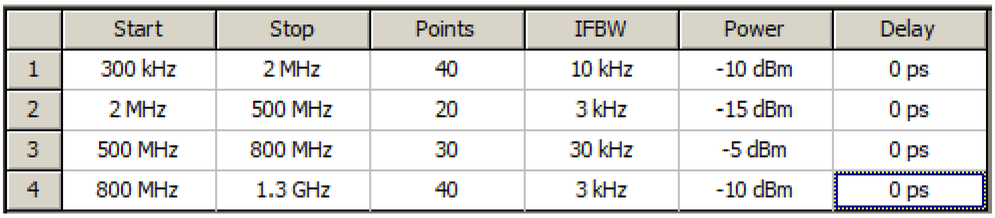


To open the segment table, use the following softkeys:

Stimulus > Segment Table

When switching to the **Segment Table** submenu, the segment table will open in the lower part of the application. When exiting the **Segment Table** submenu, the segment table will be hidden.

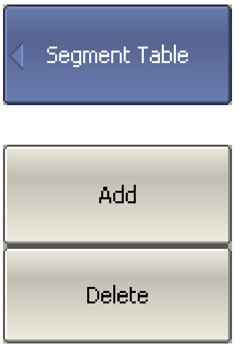
The segment table layout is shown below (See figure below). The table has three mandatory columns: start frequency, stop frequency, and number of points, and three columns which can be optionally enabled/disabled: IF bandwidth, power level, and delay time.



	Start	Stop	Points	IFBW	Power	Delay
1	300 kHz	2 MHz	40	10 kHz	-10 dBm	0 ps
2	2 MHz	500 MHz	20	3 kHz	-15 dBm	0 ps
3	500 MHz	800 MHz	30	30 kHz	-5 dBm	0 ps
4	800 MHz	1.3 GHz	40	3 kHz	-10 dBm	0 ps

The segment table

Each row describes one segment. The table can contain one or more rows. The number of segments is limited only by the instrument's maximum number of points.



To add a segment to the table, click the **Add** softkey. The new segment row will be entered below the highlighted one.

To delete a segment, click the **Delete** softkey. The highlighted segment will be deleted.

For any segment it is necessary to set the mandatory parameters: frequency range (start and stop) and number of points. The frequency range can be set either as Start / Stop, or as Center / Span.

To set the frequency range representation mode, click the **Freq Mode** softkey to select between the **Start/Stop** and **Center/Span** options.

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 the IF bandwidth column, click the **List IFBW** softkey.

To enable the power level column, click the **List Power** softkey.

To enable the delay time column, click the **List Delay** softkey.

SCPI SENSe:SEGMent:DATA

To set a parameter, click on its value field and enter the value. To navigate in the table, use the keys on the keyboard («↑», «↓», «←», «→»).

NOTE Adjacent segments must not overlap in the frequency domain.

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

To save the segment table, click the **Save** softkey.

Then enter the file name in the appeared dialog.

To recall the segment table, click **Recall** softkey.

Then select the file name in the appeared dialog.

SCPI MMEMory:LOAD:SEGMent

MMEMory:STORe:SEGMent

Measurement Delay

The measurement delay function allows 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 and narrowband circuits with a transient period longer than the measurement in one point.

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

To set the measurement delay time, use the following softkeys:

Stimulus > Meas Delay

SCPI SENSe:SWEep:POINt:TIME

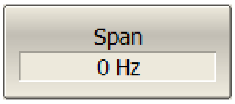
CW Time Sweep Mode

In the CW time sweep mode, the Analyzer displays measured data as a function of time when the stimulus frequency is fixed. This function is automatically turned on when the Stimulus Span is set to zero.

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

To enable CW time sweep mode, set the Span value to zero using the following softkeys:

Stimulus > Span



A horizontal scale will then display the time.

Set **Stimulus > Center** to the frequency under test.

Other sweep settings (number of points, power level, IF bandwidth) can be set arbitrarily, depending on the measurement task.

In the CW time sweep mode, the following elements change from frequency representation to temporal representation:

- stimulus axis labels
- marker stimulus value
- SCPI commands response:

  CALC:DATA:XAX?

  CALC:TRAC:DATA:XAX?

  CALC:MARK:X

NOTE

The sweep time is determined by the following formula:

$$T_{st} = N\left(\frac{1.2}{IFBW} + T_{md} + T_{hw}\right),$$

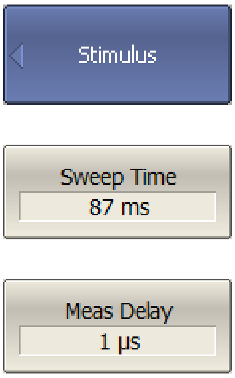
where N — number of points,

$IFBW$ — IF bandwidth,

T_{md} — measurement delay,

T_{hw} — hardware delay (depends on the Analyzer model and cannot be changed).

The Analyzer automatically calculates the sweep time value based on the current settings: number of points, IF bandwidth, measurement delay. An arbitrary value can be set for sweep time, in this case, the Analyzer corrects the measurement delay value. To set the minimum possible sweep time, set the measurement delay to zero.



To set the sweep time value, use the following softkeys:

Stimulus > Sweep Time

To set the measurement delay, use the following softkeys:

Stimulus > Meas Delay

The sweep time should not be confused with the measurement cycle time displayed in the Analyzer status bar (See Hide/Show Cycle Time). The table below shows the difference between sweep time and cycle time.

	Sweep Time value	**Cycle Time value**
Method	Theoretically estimated	Actually measured
Scope	One channel	All sweeping channels
Range	From the first sweep point to the last sweep point, excluding the time between sweeps	Between the start points of two consecutive measurement cycles, including the time between sweeps

If one channel is open, the sweep time and cycle time are close. The difference is that the sweep time value does not include the delay between the sweeps.

Trigger Settings

This section describes the trigger settings.

A trigger is a signal or an event that starts the analyzer measurement cycle. The measurement cycle includes sequential measurement of all opened channels one after another. Before measurement of all channels is complete, all additional triggers are ignored. The trigger source determines where the trigger signals come from. The trigger initiation mode determines how many trigger signals the Analyzer will accept.

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

The trigger settings include:

- Selection of the trigger source (See Trigger Source).
- Selection of the trigger initiation mode (See Trigger Initiation Mode).

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

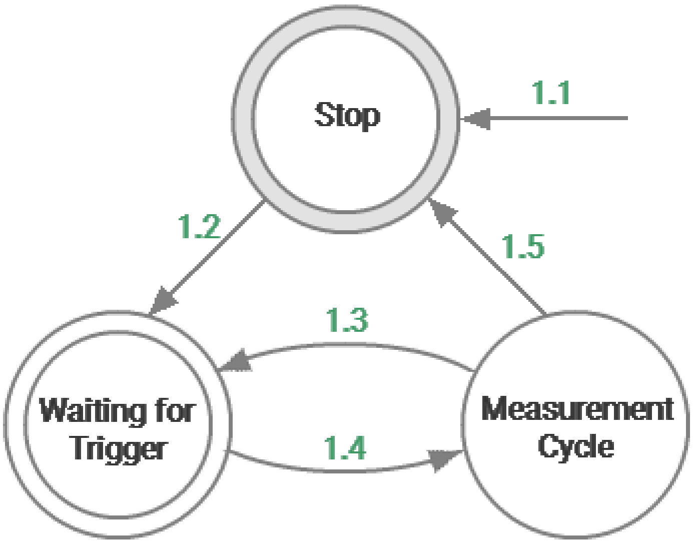
Trigger State Diagram

The trigger system operates at the analyzer level.

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

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

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



Analyzer states and transitions

The table below describes the transitions between analyzer states.

Transition	Condition	Button	Command
1.1 To Stop	Power on	—	—
	Reset	**System > Preset**	SYSTem:PRESet, *RST
	Abort of the current measurement cycle.	—	ABORt
	Changing Analyzer settings by user or by the SCPI command.	For example: **Stimulus > Start**	For example: SENSe:FREQuency:STARt
	When the trigger initiation mode has been set to **Hold**.	**Stimulus > Trigger > Hold**	INITiate:CONT OFF
1.2 Stop –> Waiting for Trigger	Every time if the trigger initiation mode has been set to **Continuous**.	**Stimulus > Trigger > Continuous**	INITiate:CONT ON
	Once when the trigger initiation mode has been set to **Single**.	**Stimulus > Trigger > Single**	INITiate

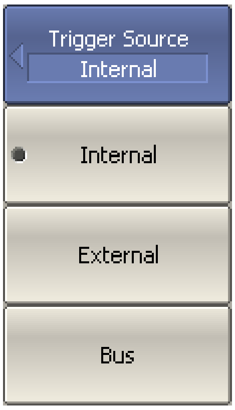
Transition	Condition	Button	Command
1.3 Waiting for Trigger –> Measurement Cycle	Automatically, if the trigger source is set to **Internal**.	**Stimulus > Trigger > Trigger source > Internal**	TRIGger:SOURce INTernal
	At a signal arrival at the external trigger input, if the trigger source is set to **External**. (except TR1300)	**Stimulus > Trigger > Trigger source > External**	TRIGger:SOURce EXTternal
	Upon receipt of SCPI command, if the trigger source is set to **Bus**.	**Stimulus > Trigger > Trigger source > Bus**	TRIGger:SOURce BUS TRIGger:SINGle, TRIGger, *TRG
1.4 Measurement Cycle –> Waiting for Trigger	At the end of a measurement cycle, when the trigger initiation mode has been set to **Continuous**.	**Stimulus > Trigger > Continuous**	INITiate:CONT ON
	After measuring a point, when the **On Point** trigger function is active.	**Stimulus > Trigger > Ext Trigger > Event > On Point**	—

Transition	Condition	Button	Command
	(except TR1300)		
1.5 Measurement Cycle –> Stop	At the end of a measurement cycle, when the **Continuous** trigger initiation mode is disabled.	—	—

Trigger Source

The trigger source determines where the trigger signals originate. One of three trigger sources can be selected. This setting works at the analyzer level.

Trigger Source	Function
Internal [default]	The Analyzer generates a trigger signal automatically when needed.
External (except TR1300/1 model)	A trigger signal is a logic signal at the external trigger input (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:

Stimulus > Trigger > Trigger Source

Then select the required trigger source:

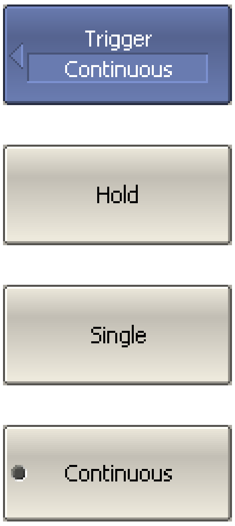
- **Internal**
- **External** (except TR1300/1 model)
- **Bus**

SCPI TRIGger:SOURce

Trigger Initiation Mode

The trigger initiation mode determines how many trigger signals the Analyzer will accept. The trigger system can operate in one of the following three modes (See the table below).

Trigger Initiation Mode	Function
Continuous [default]	The Analyzer accepts an infinite number of trigger signals, the measurement cycle is executed every time a trigger signal is detected. The measurement cycle includes sequential measurement of all opened channels one after another.
Single	The Analyzer accepts one trigger signal. One measurement cycle is executed at one trigger signal detection after the mode has been enabled. The measurement cycle includes sequential measurement of all opened channels one after another.The trigger system turns to Stop state after the measurement cycle is complete.
Hold	The Analyzer accepts no trigger signals. The trigger system is in Stop state.



To set the trigger initiation mode, use the following softkeys:

Stimulus > Trigger

Then select the required trigger initiation mode:

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

SCPI INITiate:CONTinuous

INITiate

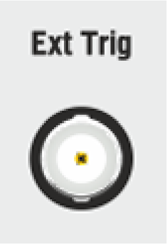
External Trigger Settings

NOTE

The availability of external trigger input and this function settings depends on the Analyzer model. TR1300/1 model does not have this input and settings.

This section describes settings of the external trigger.

The logic signal at the **Ext Trig** on the rear panel of the analyzer is an external trigger signal (See Instrument Series).



External Trigger Signal Connector

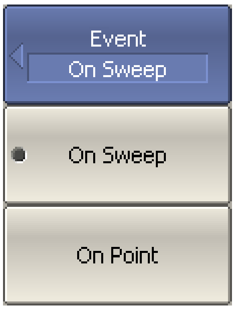
To work with an external trigger:

- Select trigger source **External** (See Trigger Source).
- Set the external trigger event, polarity, position and delay (See the subsection below).

External Trigger Event

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.



To select an external trigger event, use the following softkeys:

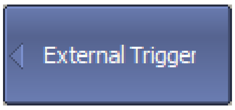
Stimulus > Trigger > External Trigger > Event

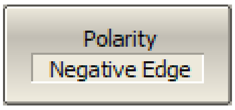
Then select the required external trigger event:

- **On Sweep**
- **On Point**

External Trigger Polarity

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 external trigger polarity, use the following softkeys:

Stimulus > Trigger > External Trigger > Polarity

Select the required external trigger polarity:

- **Negative Edge**
- **Positive Edge**

External Trigger Position

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.

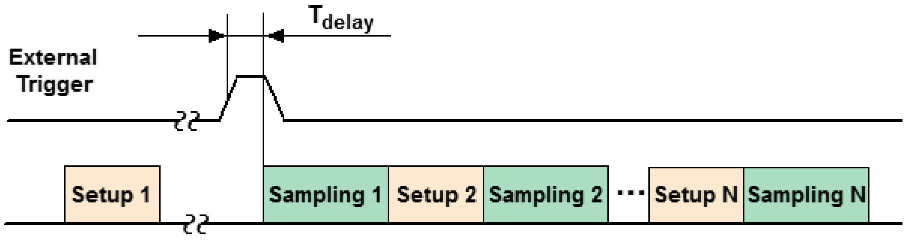
<table>
<tr><th>Trigger Position</th><th>Function</th></tr>
<tr><td>

Before Sampling

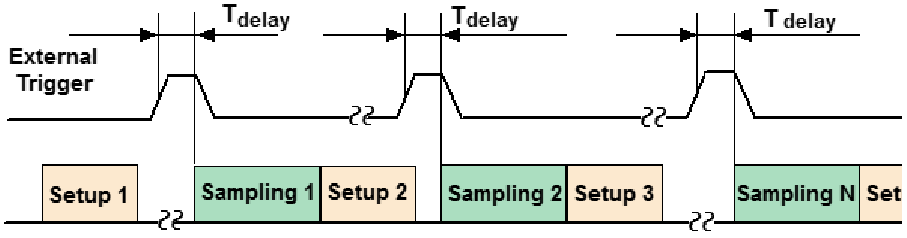
[default]

</td><td>

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 bellow).



External Trigger Delay Before Sampling, Point trigger is OFF



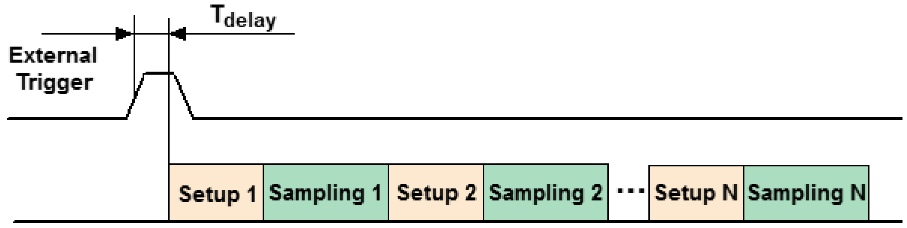
External Trigger Delay Before Sampling, Point trigger is ON

</td></tr>
<tr><td>

Before Setup

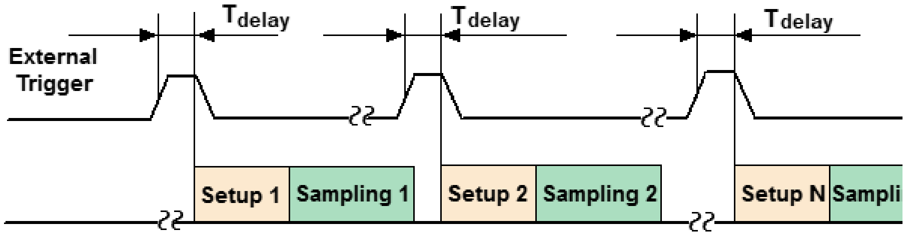
</td><td>

The trigger signal is expected before the frequency setup. The frequency setup starts when the trigger signal arrives (See figure bellow). After the frequency setup is completed, the analyzer begins ADC sampling.



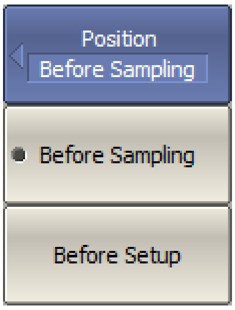
External Trigger Delay Before Setup, Point trigger is OFF

</td></tr>
</table>

Trigger Position	Function
	 T delay T delay T delay External Trigger Setup 1 Sampling 1 Setup 2 Sampling 2 Setup N Sampli External Trigger Delay 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 position, use the following softkeys:

Stimulus > Trigger > External Trigger > Position

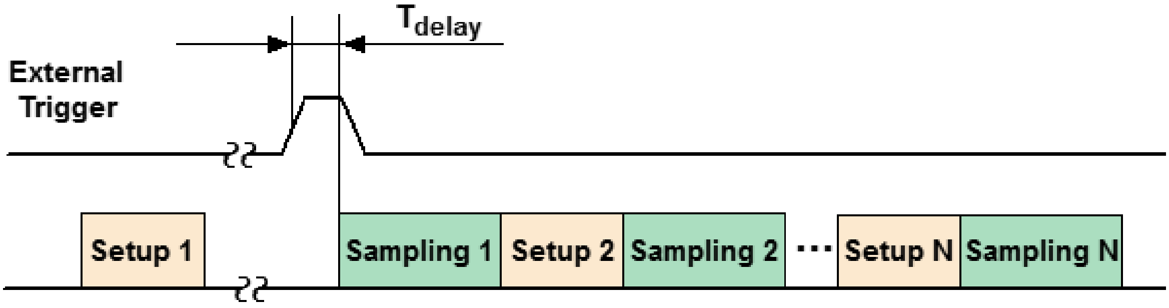
Then select the required external trigger position:

- **Before Sampling**
- **Before Setup**

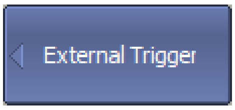
External Trigger Delay

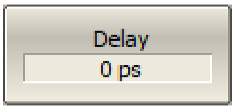
The external trigger delay sets the response delay with respect to the external trigger signal (See figure below).

The delay range and resolution depend on the Analyzer model (See corresponding datasheet).



External Trigger Delay





To set the external trigger delay, use the following softkeys:

Stimulus > Trigger > External Trigger > Delay

Measurement Parameters Settings

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

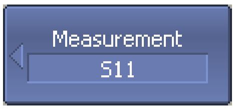
The Analyzers allows:

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

S-Parameters

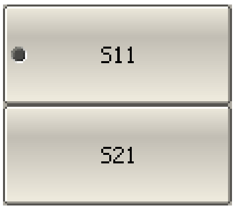
A measured S-parameter (S11, S21) is set for each trace. The trace to which the function is applied must be preselected as active (See Selection of Active Trace/Channel).

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



To set the measured parameter, use the following softkey:

Response > Measurement



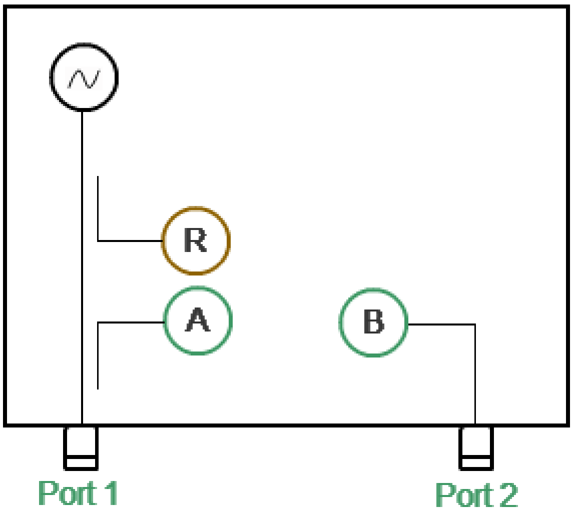
Then select the desired parameter by the corresponding softkey.

SCPI CALCulate:PARameter:DEFine

NOTE Measured data can be set using the mouse (See Measured Data Setting).

Absolute Measurements

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 TR series two-port analyzer has three independent receivers: A, B, R (See figure below).

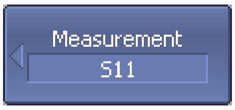


Analyzer block diagram

The R is a reference signal receiver. The A and B are test signal receivers. The A and R receivers are located in Port 1. The B receiver is located in Port 2. There are three types of absolute measurements (See table below).

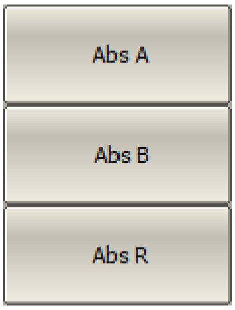
Symbols	Definition
A	Test signal receiver A (Source Port 1)
B	Test signal receiver B (Source Port 1)
R	Reference signal receiver R (Source Port 1)

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



To select absolute measurement, click softkeys:

Response > Measurement



Then select the required parameter:

- **Abs A**
- **Abs B**
- **Abs R**

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

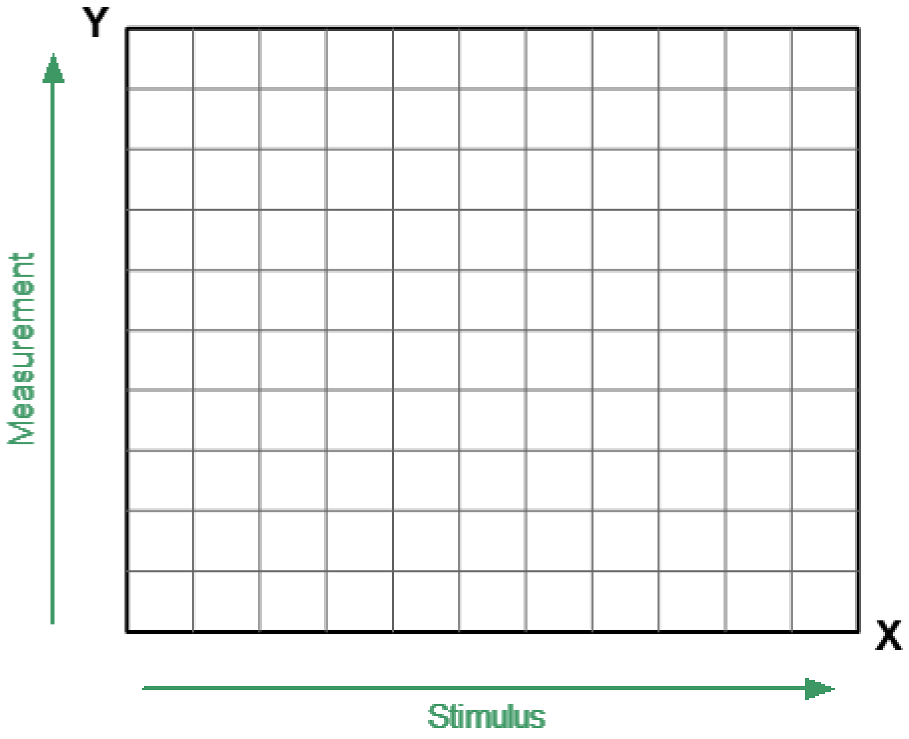
The format setting determines how measured data will be presented on the diagram.

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,

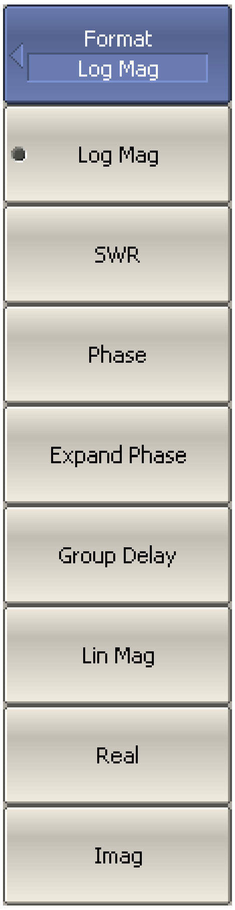
b — imaginary part of S-parameter complex value.

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 Mag**	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 Mag**	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

The format for each trace of the channel can be selected individually. The trace must be activated before setting the format.



To choose a rectangular format, use the following softkey:

Response > Format

Then select the desired format:

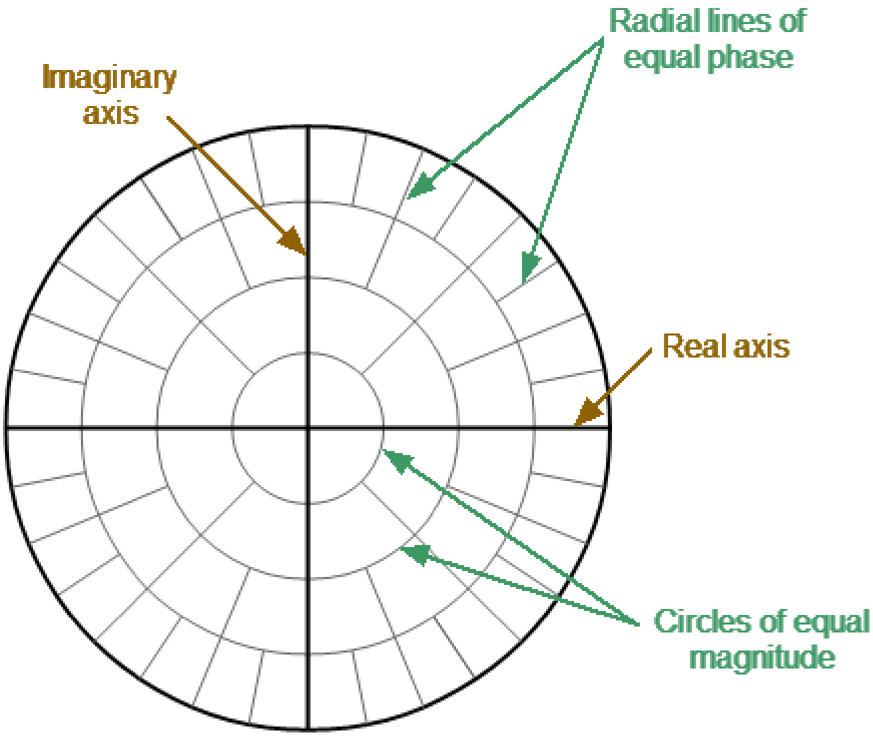
- **Log Mag** — Logarithmic magnitude
- **SWR** — Voltage Standing Wave Ratio
- **Phase**
- **Expanded Phase**
- **Group delay**
- **Lin Mag** — Linear magnitude
- **Real** — Real part
- **Imag** — Imaginary part

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 S11. 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).

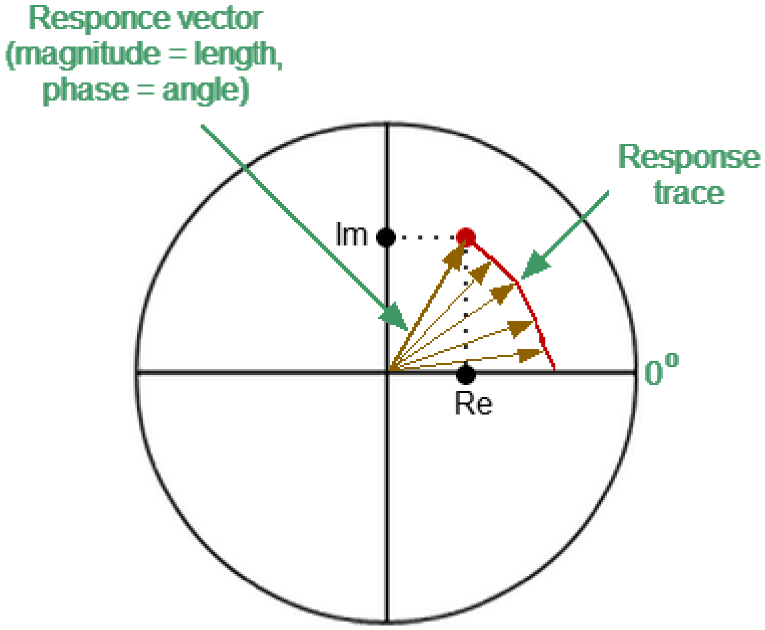


Polar format

NOTE

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

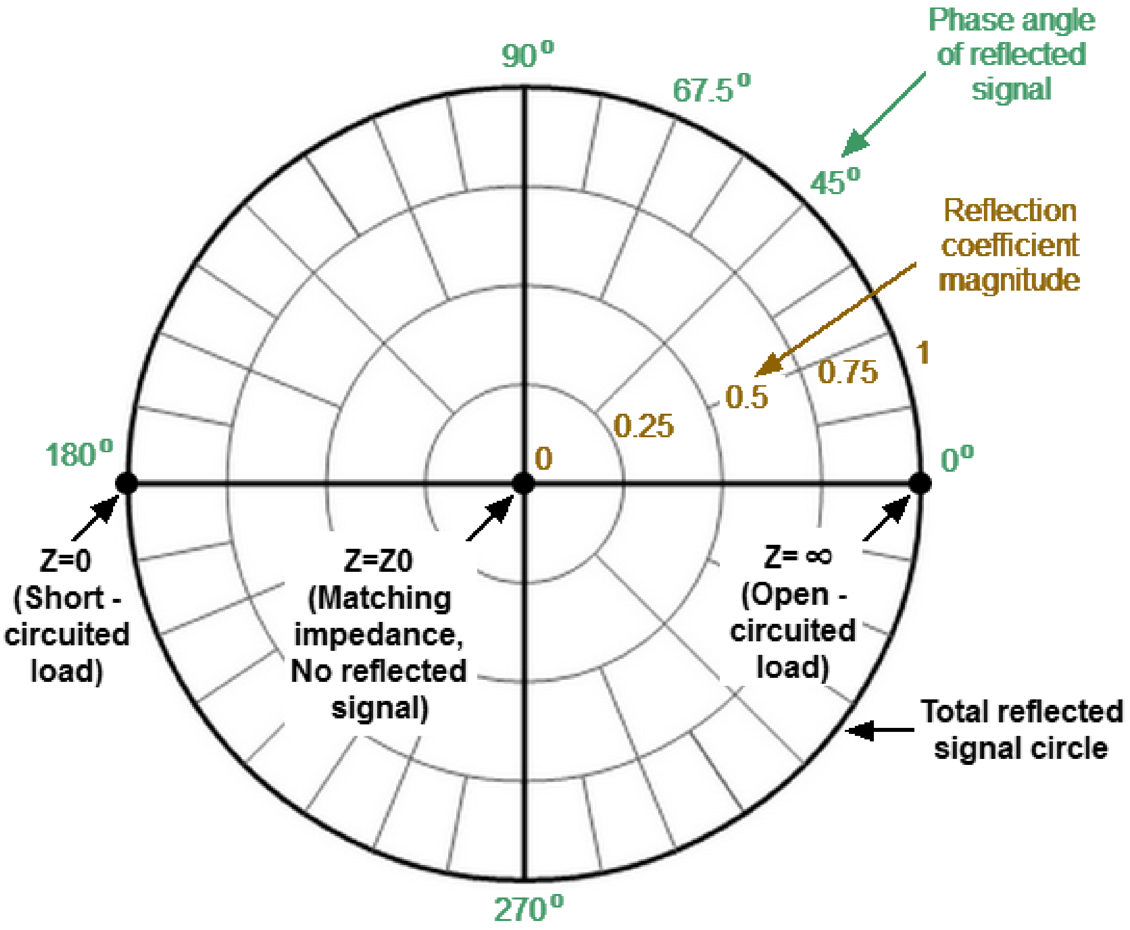
- Coordinates of the point (Re, Im) on the real and imaginary coordinate axes.
- Parameters of the vector directed to the point from the center of the diagram. The length of this vector is equal to the response amplitude, and the angle between the vector and the positive part of the real coordinate axis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


Phase angle of reflected signal
90°
67.5°
45°
Reflection coefficient magnitude
1
0.75
0.5
0.25
0
180°
0°
270°
Z=0 (Short - circuited load)
Z=Z0 (Matching impedance, No reflected signal)
Z= ∞ (Open - circuited load)
Total reflected signal circle

Properties of Polar format

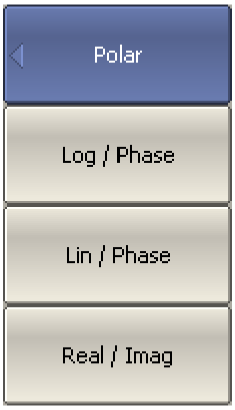
Basic properties of the Polar format:

- The center of the diagram corresponds to the reflection coefficient Γ = 0 (reference impedance Z0 on the input test port of the DUT when measuring S11, matched circuit, no reflection).
- The outer circle of the diagram corresponds to the reflection coefficient Γ = 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 bellow).

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.



To choose a Polar format, use the following softkeys:

Response > Format > Polar

Then select the desired format:

- **Log/Phase** — Logarithmic magnitude and phase
- **Lin/Phase** — Linear magnitude and phase
- **Real/Imag** — Real and imaginary parts

SCPI CALCulate:FORMat

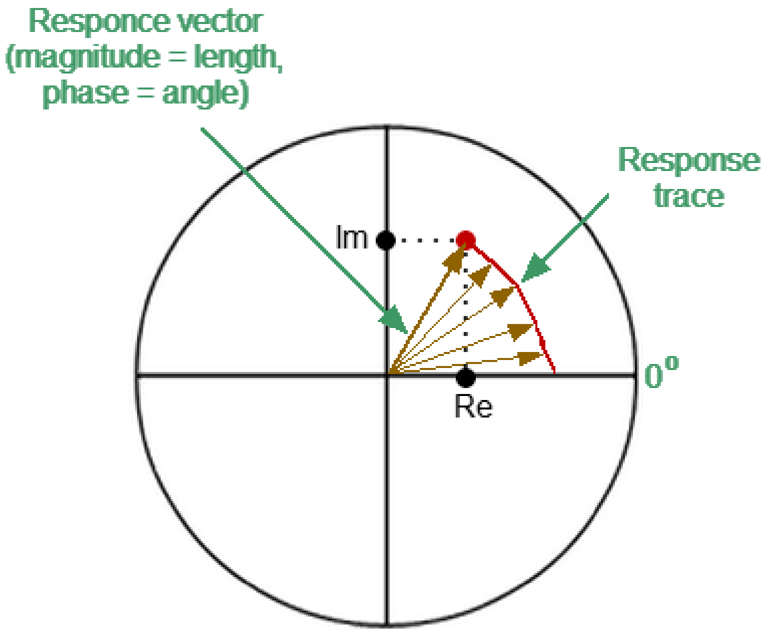
NOTE The display format can be set using the mouse (See Display Format Setting).

Smith Chart Format

NOTE

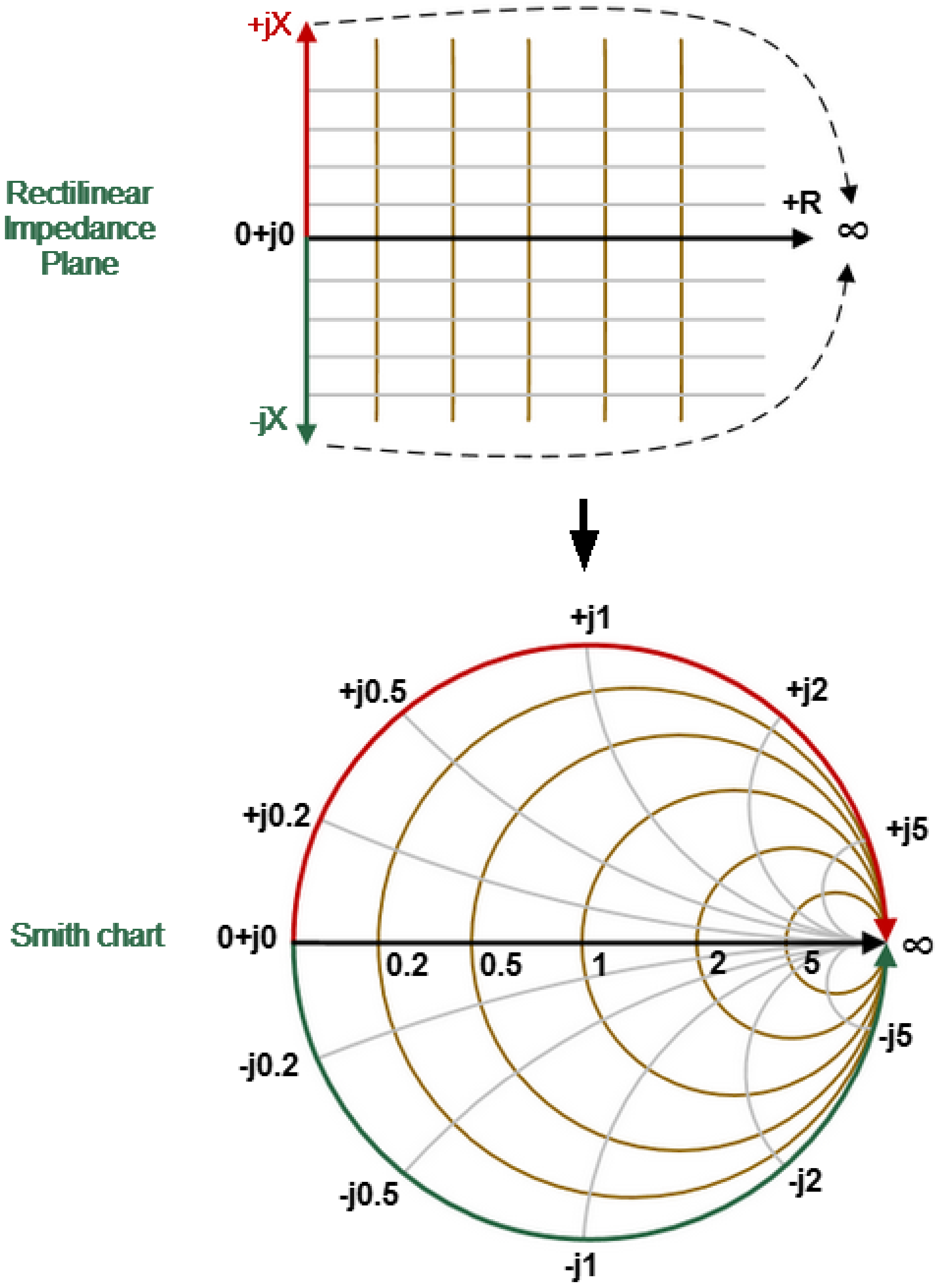
On circular diagrams (Polar and Smith chart), any point of the trace can be defined in the following two ways (See figure below):

- 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 (S11) 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:

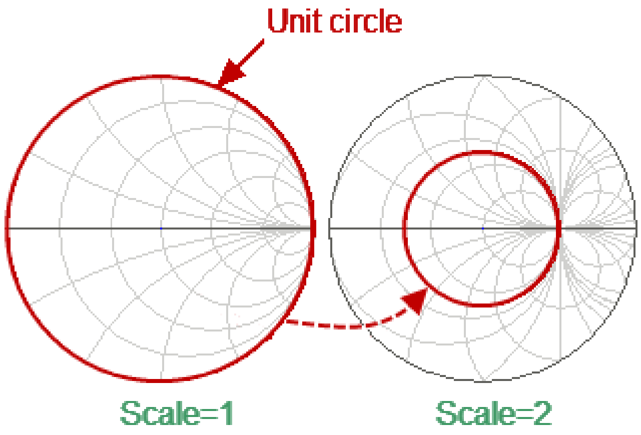
$$Z = R + jX,$$

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 constance 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.

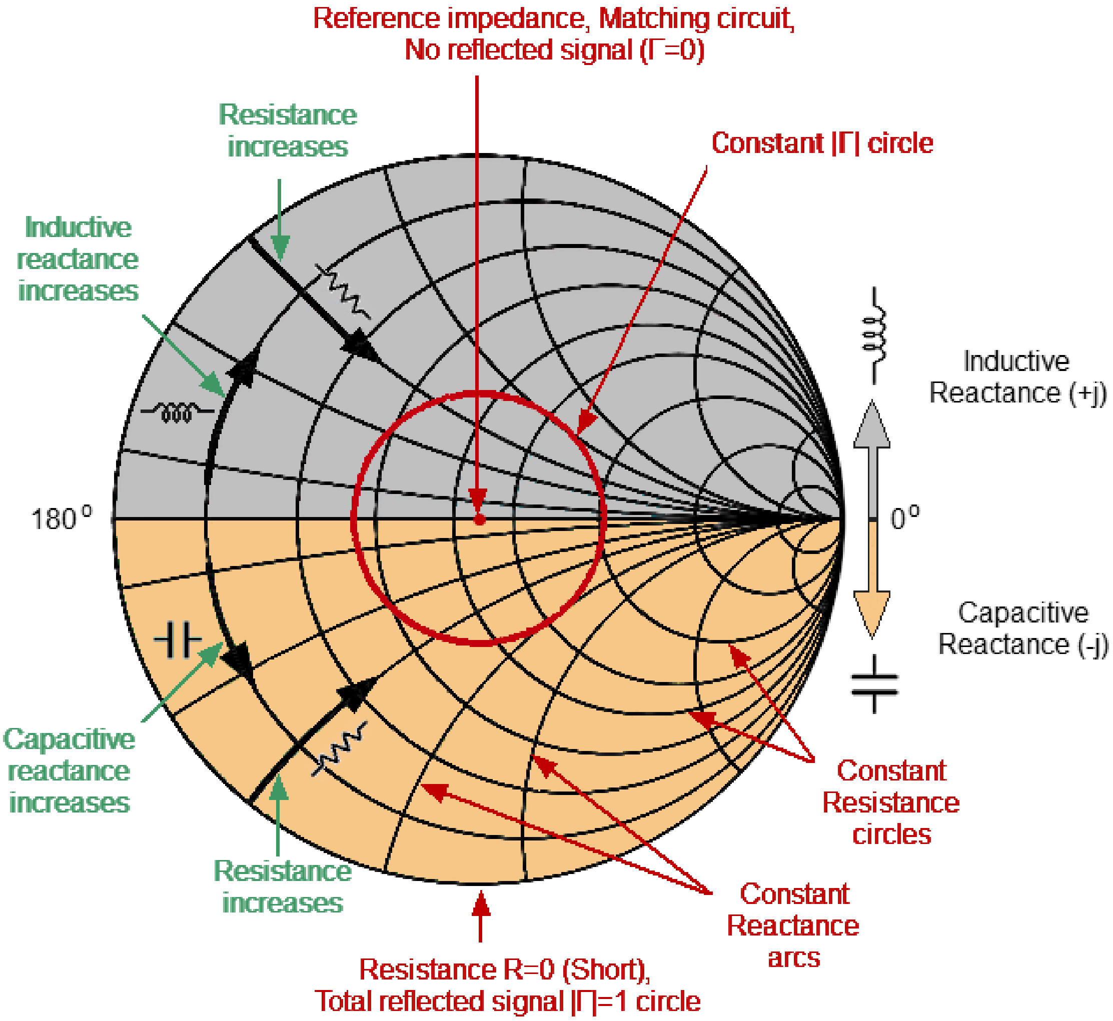
NOTE

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, capactive, or complex. The Smith chart format is useful for looking for mismatch introduced by parasitic elements connected in series with the DUT.

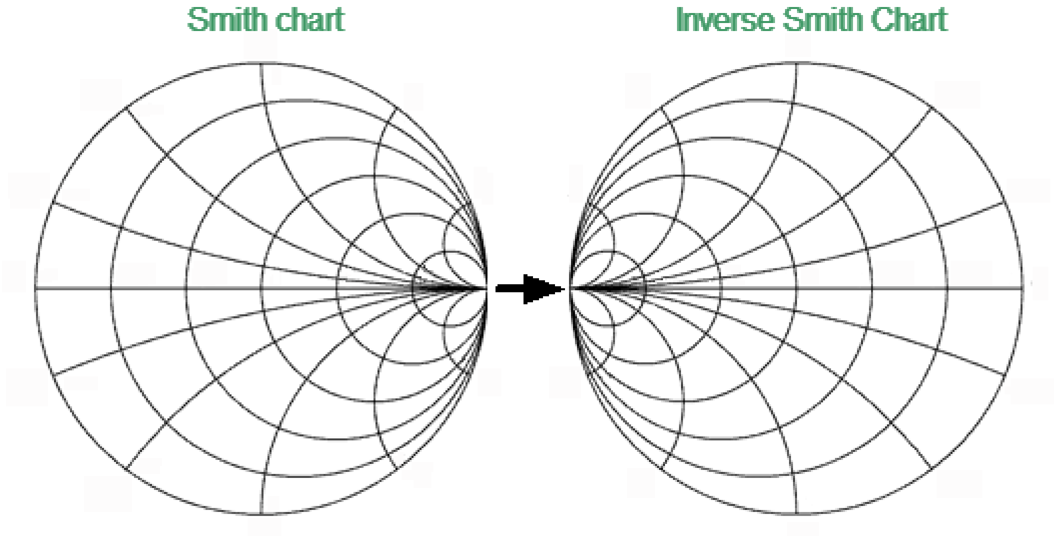

Reference impedance, Matching circuit,
No reflected signal (Γ=0)
Resistance increases
Constant |Γ| circle
Inductive reactance increases
Inductive Reactance (+j)
180°
0°
Capacitive Reactance (-j)
Capacitive reactance increases
Constant Resistance circles
Resistance increases
Constant Reactance arcs
Resistance R=0 (Short), Total reflected signal |Γ|=1 circle

Smith chart properties

Inverse Smith Chart (Complex Admittance)

The Inverse Smith chart is a circular chart on which the measured complex reflection coefficients (S11) 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:

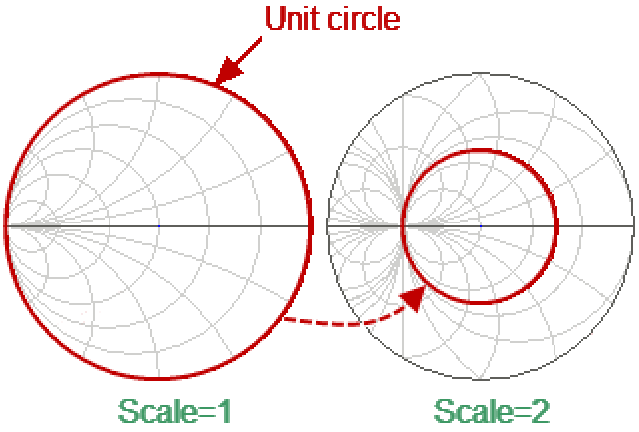
  $$Y = G + jB,$$

  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 widthand 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 coresonds 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.

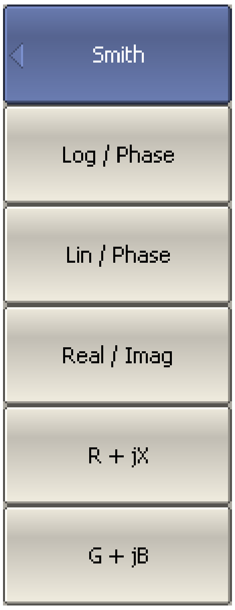
The Smith chart format does not have a frequency axis, so frequency is indicated by markers.

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)
		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)

Format Type Description	Label	Data Displayed by Marker	Measurement Unit
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)
		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.



To choose a Smith chart format, use the following softkeys:

Response > Format > Smith

Then select the desired format:

- **Log/Phase** — Logarithmic magnitude and phase
- **Lin/Phase** — Linear magnitude and phase
- **Real/Imag** — Real and imaginary parts
- **R+jX** — Complex impedance (at input)
- **G+jB** — Complex admittance (at input)

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 the Automatic Scaling function for both formats.

When using the rectangular format, the Reference Level Automatic Selection function is also available.

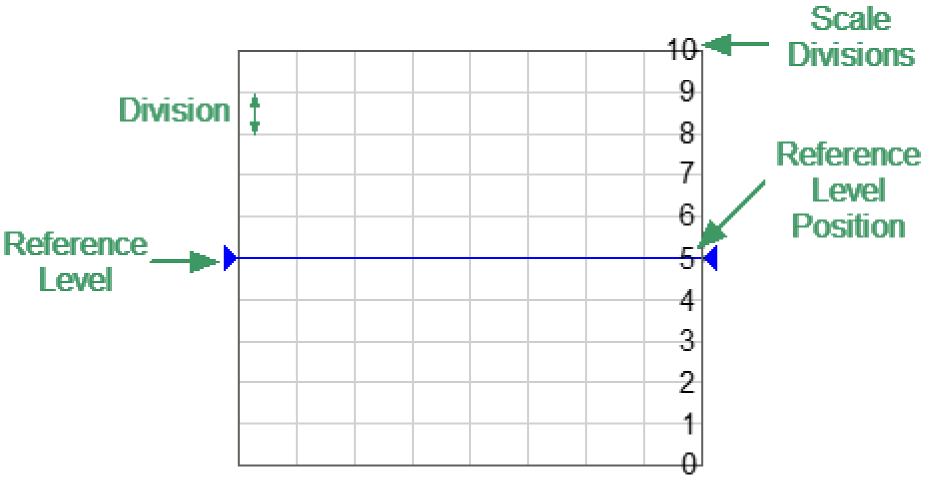
The scaling function is under trace settings.

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

Rectangular Scale

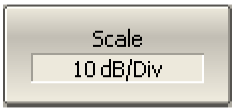
For rectangular format, the following parameters can be set (See figure below):

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



Rectangular scale

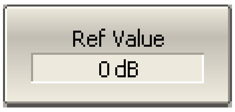
The scale of each trace can be set independently. The trace to which the function is applied must be preselected as active (See Selection of Active Trace/Channel).



To set the scale of a trace, use the following softkeys:

Scale > Scale

SCPI DISPlay:WINDow:TRACe:Y:PDIVision



To set the reference level, use the following softkeys:

Scale > Ref Value

SCPI DISPlay:WINDow:TRACe:Y:RLEVel

To set the position of the reference level, use the following softkeys:

Scale > Ref Position

SCPI DISPlay:WINDow:TRACe:Y:RPOSition

To set the number of trace scale divisions, use the following softkeys:

Scale > Divisions

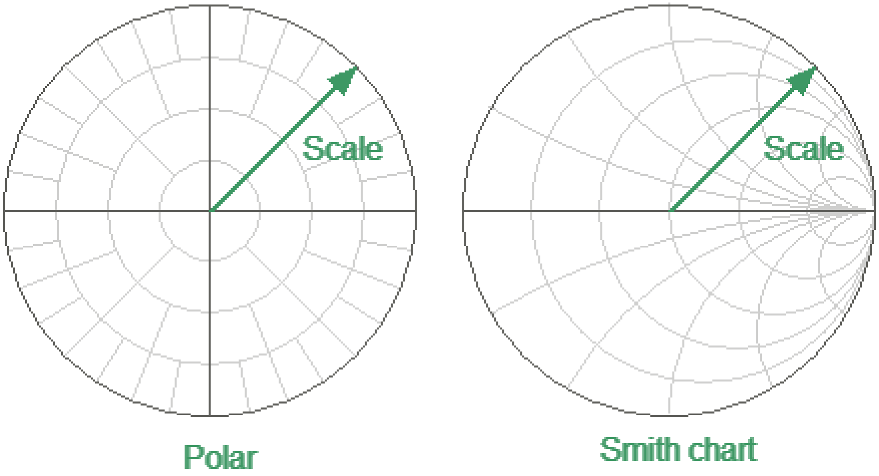
NOTE: The number of scale divisions affects all traces of the channel.

SCPI DISPlay:WINDow:Y:DIVisions

NOTE The trace scale, value of the reference level, and reference level position can be set using the mouse (See Quick Setting Using a Mouse).

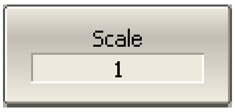
Circular Scale

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 Selection of Active Trace/Channel).



To set the scale of the circular graphs, use the following softkeys:

Scale > Scale

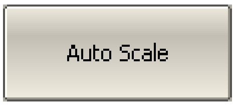
SCPI DISPlay:WINDow:TRACe:Y:PDIVision

Automatic Scaling

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

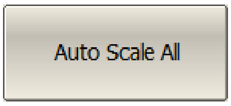
In rectangular format, two parameters are adjustable: scale division and reference level position. In circular format, the outer circle value is adjusted.

The function can be applied to the active trace 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

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.

To automatically select the reference level of the active trace, use the following softkeys:

Scale > Auto Ref Value

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:

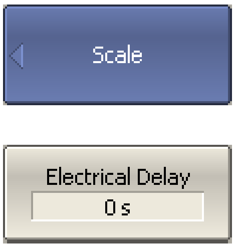
$$S = S_{meas} \cdot e^{j \cdot 2\pi \cdot f \cdot t},$$

where f — frequency, Hz,

t — electrical delay, sec.

The electrical delay can be specified in seconds.

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



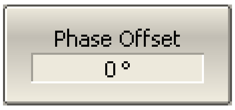
To set the electrical delay in seconds, use the following softkeys:

Scale > Electrical Delay

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.



To set the phase offset, use the following softkeys:

Scale > Phase Offset

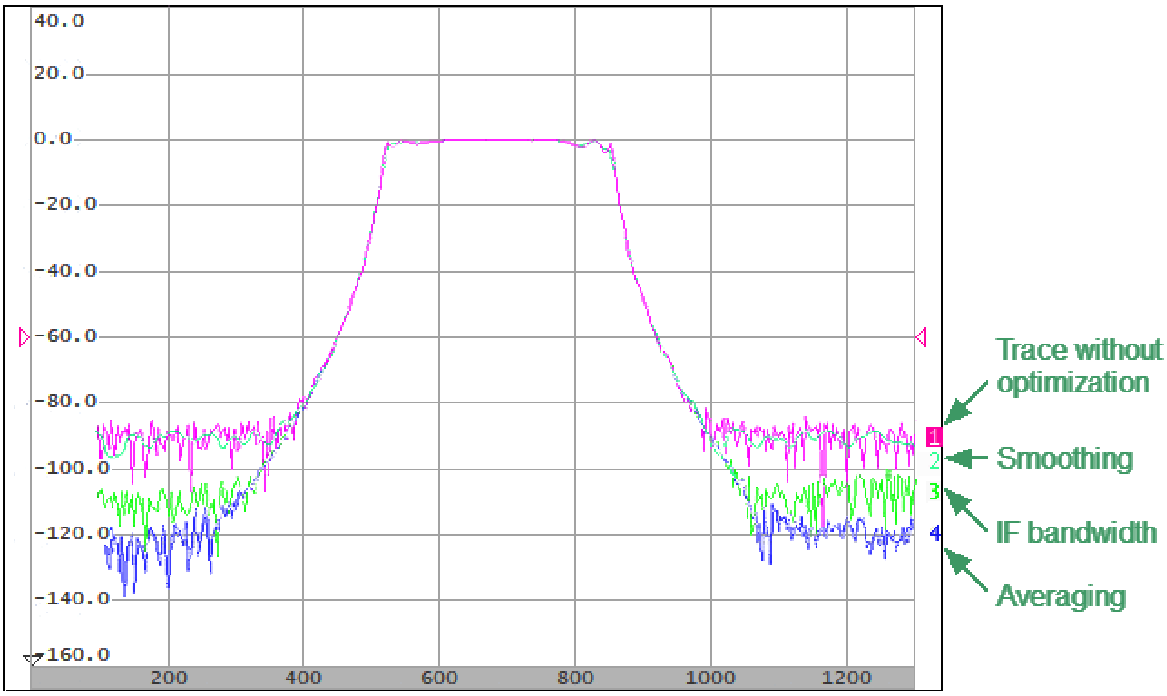
SCPI CALCulate:CORRection:EDELay:PHASe

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 figure below shows an example of applying different filtering methods to the signal: the IF bandwidth is reduced by a factor of 10, averaging factor is set to 100, and smoothing is applied with an aperture of 2%.



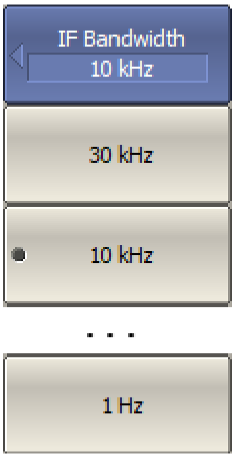
Example of the application of different measurement optimization

IF Bandwidth Setting

The IF bandwidth setting selects the bandwidth of the receivers. The IF bandwidth can take on the following values: 1 Hz, 3 Hz, 5 Hz, 10 Hz, 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz.

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 Selection of Active Trace/Channel).



To set the IF bandwidth, use the following softkeys:

Response > IF Bandwidth

Then select the desired IF bandwidth by the corresponding softkey.

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:

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

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 Selection of Active Trace/Channel).

To toggle the averaging function on/off, use the following softkeys:

Response > Averaging

SCPI SENSe:AVERage

To set the averaging factor, use the following softkeys:

Response > Avg Factor

SCPI 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 Selection of Active Trace/Channel).

To toggle the smoothing function ON/OFF, use the following softkeys:

Response > Smoothing

SCPI CALCulate:SMOothing

To set the smoothing aperture, use the following softkeys:

Response > Smo Aperture

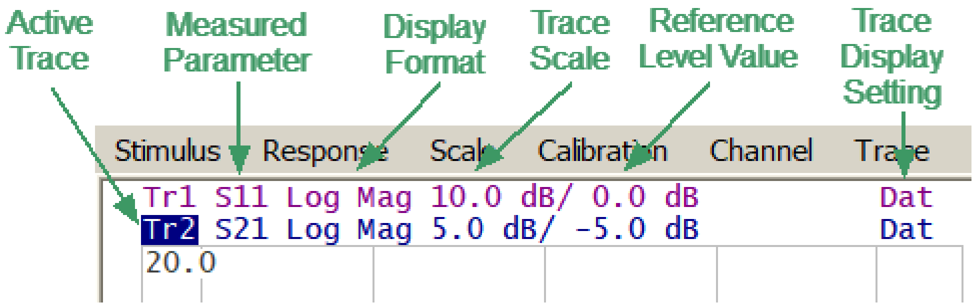
SCPI CALCulate:SMOothing:APERture

Quick Settings Using a Mouse

This section describes mouse operations, which allows to set the channel parameters quickly and easily. In a channel window, when hovering over the field where a channel parameter can be modified, the mouse pointer will change its icon to indicate edit mode. In text and numerical fields, edit mode will be indicated by underlined symbols.

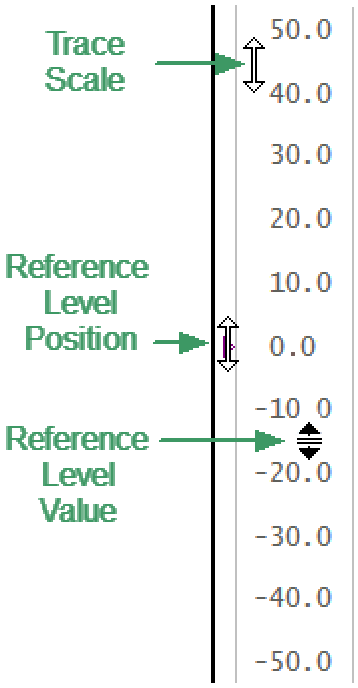
NOTE The mouse operations described in this section help to adjust the most frequently used settings. The complete set of channel functions can be accessed via the softkey bar.

The figures below show areas and labels for quick parameter setting.

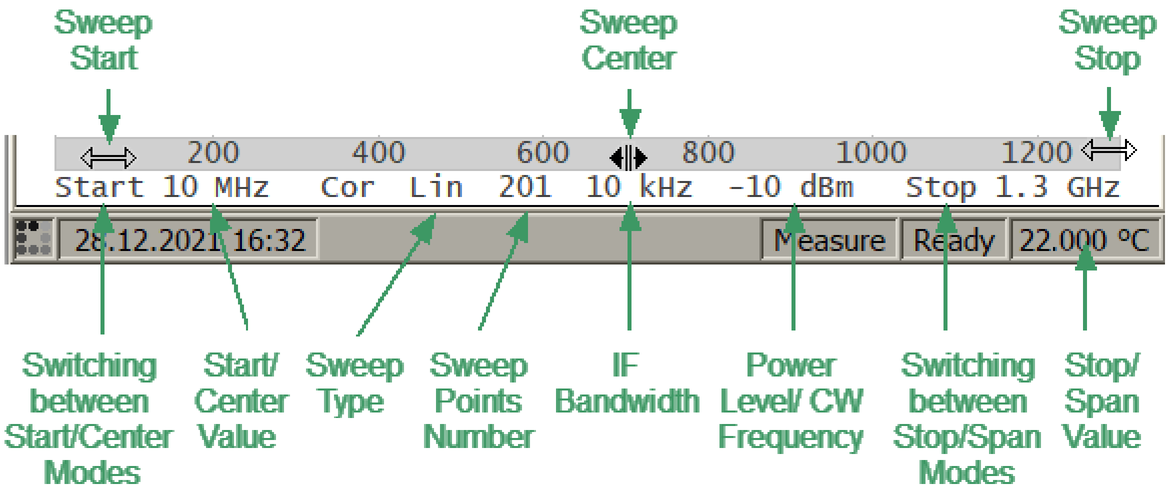


```
Tr1 S11 Log Mag 10.0 dB/ 0.0 dB      Dat
Tr2 S21 Log Mag 5.0 dB/ -5.0 dB      Dat
20.0
```

Quick Parameter Setting in the Trace Status Field

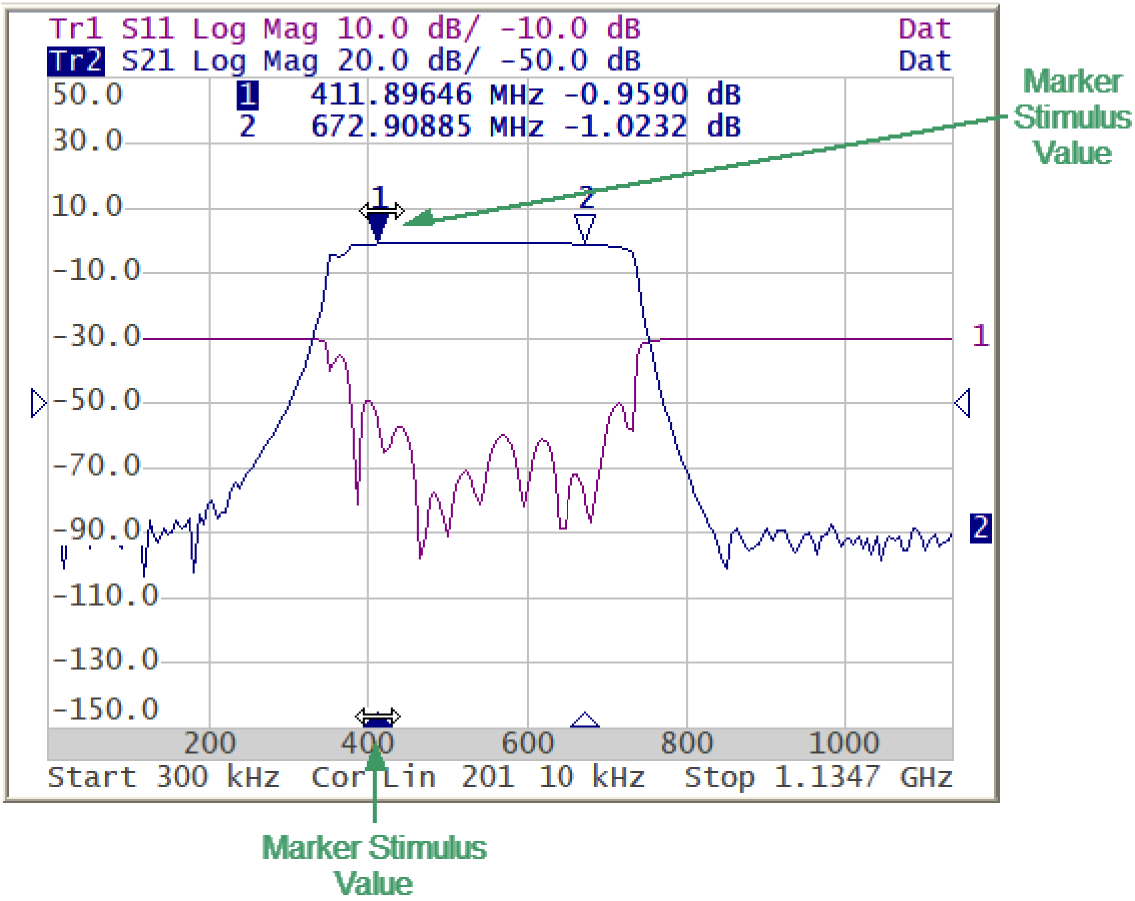


Quick Parameter Setting on the Vertical Graticule Label



```
Start 10 MHz   Cor  Lin  201  10 kHz  -10 dBm   Stop 1.3 GHz
28.12.2021 16:32                         Measure  Ready  22.000 °C
```

Quick Parameter Setting on the Channel Status Bar

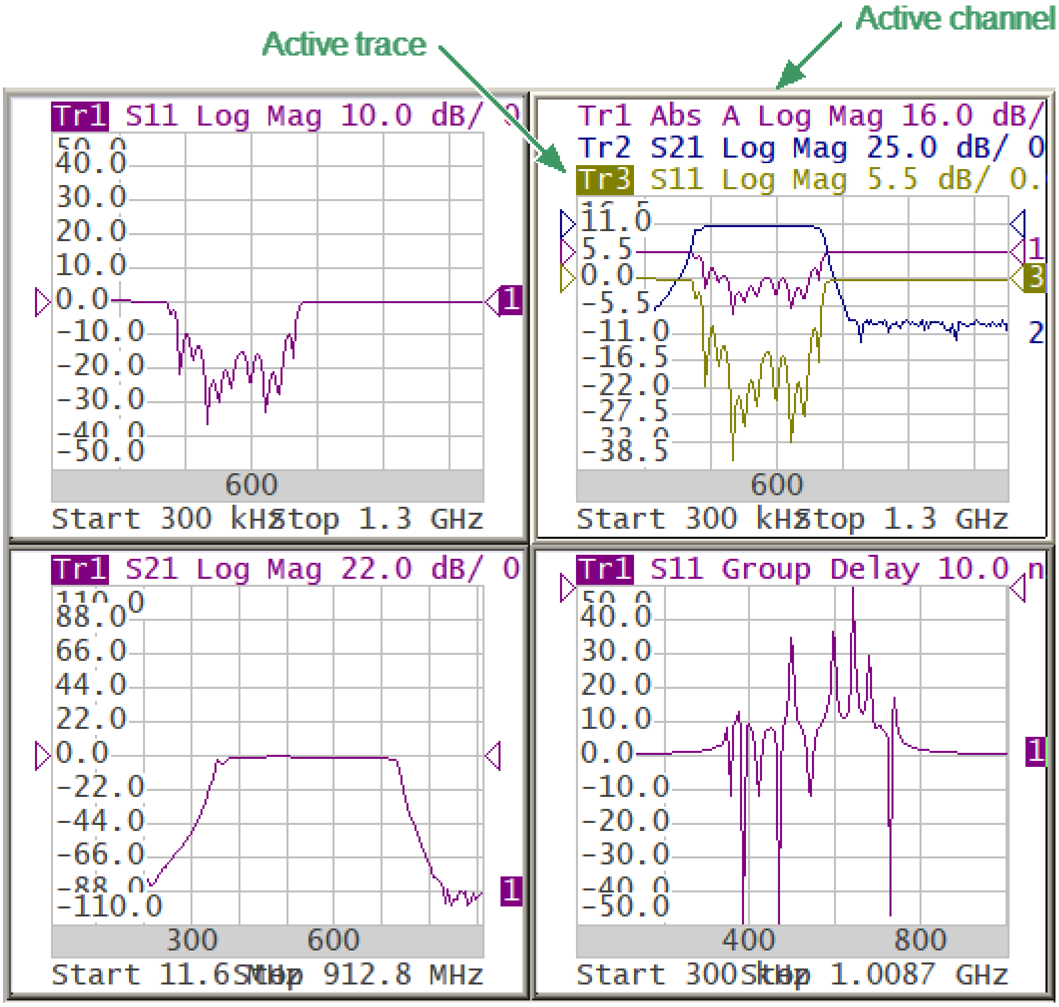


```
Tr1 S11 Log Mag 10.0 dB/ -10.0 dB                  Dat
Tr2 S21 Log Mag 20.0 dB/ -50.0 dB                  Dat
        1    411.89646 MHz -0.9590 dB
        2    672.90885 MHz -1.0232 dB
Start 300 kHz  Cor Lin 201  10 kHz  Stop 1.1347 GHz
```

Quick Parameter Setting on Markers

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 trace

Active channel

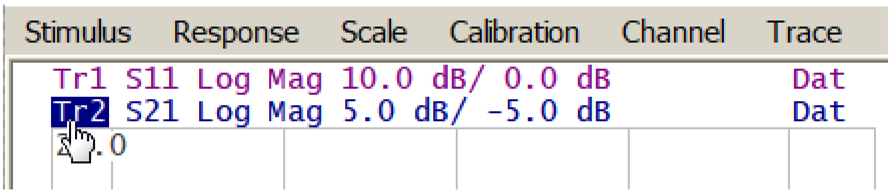
Tr1 S11 Log Mag 10.0 dB/ 0
Start 300 kHz Stop 1.3 GHz
Tr1 Abs A Log Mag 16.0 dB/
Tr2 S21 Log Mag 25.0 dB/ 0
Tr3 S11 Log Mag 5.5 dB/ 0.
Start 300 kHz Stop 1.3 GHz
Tr1 S21 Log Mag 22.0 dB/ 0
Start 11.6 MHz Stop 912.8 MHz
Tr1 S11 Group Delay 10.0 n
Start 300 kHz Stop 1.0087 GHz

Active Trace/Channel Selection

The active channel can be selected using softkeys (See Selection of Active Trace/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.



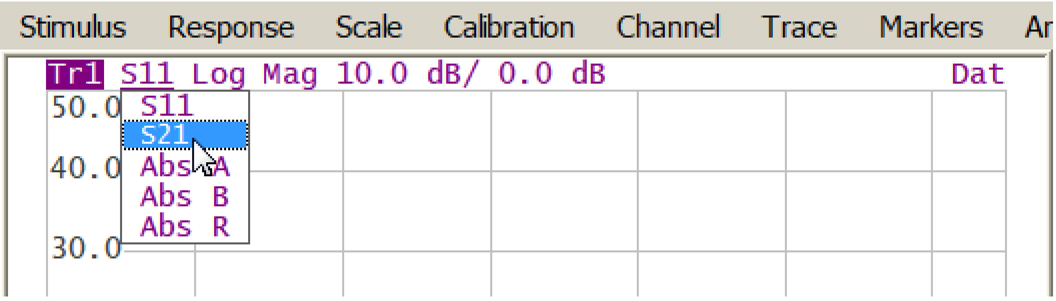
```
Tr1 S11 Log Mag 10.0 dB/ 0.0 dB        Dat
Tr2 S21 Log Mag 5.0 dB/ -5.0 dB        Dat
```

Active Trace Selection

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

Measured Parameter Setting

To assign the measured parameters (S11, S21, Abs A, Abs B, Abs R) to a trace, click on the parameter name in the trace status line and select the required parameter in the drop-down menu.

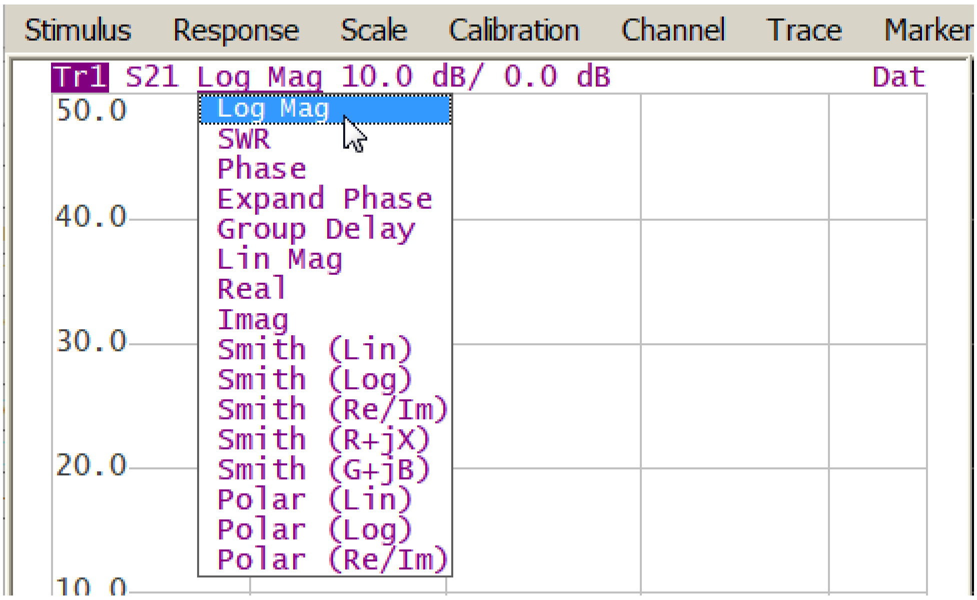


Measured Parameter Setting

Measured data can be set using softkeys (See S-Parameters).

Display Format Setting

To select the trace display format, click on the display format field in the trace status line and select the desired format in the drop-down menu.



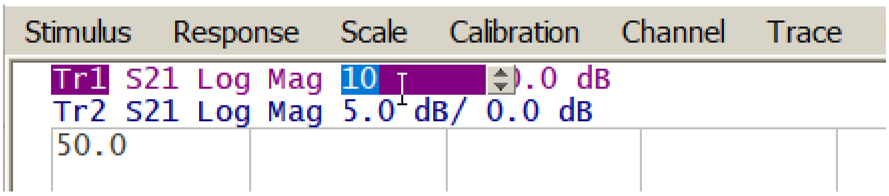
Display Format Setting

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.

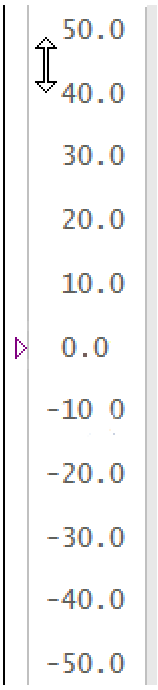
The first method: click on the trace scale field in the trace status line and enter the required numerical value.



```
Tr1 S21 Log Mag 10          ).0 dB
Tr2 S21 Log Mag 5.0 dB/ 0.0 dB
50.0
```

Trace scale setting in the trace status line

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 top or bottom parts of the scale, at approximately 10% of the scale height from the top or bottom of the scale. 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

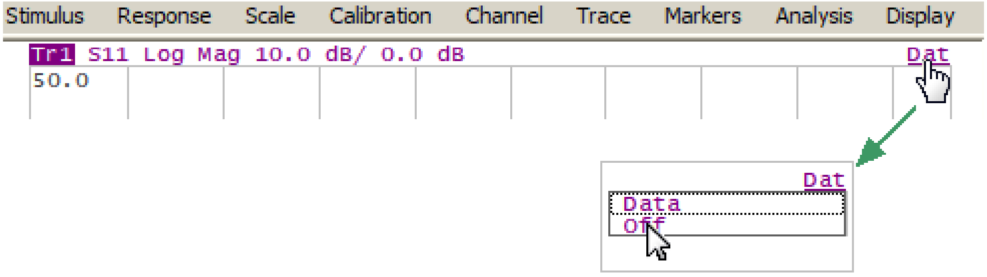
The trace scale can be set using softkeys (See Rectangular Scale).

Trace Display Setting

The type of traces that will be displayed on the screen can be selected from the drop-down menu by clicking on the corresponding field in the trace status line.

If there are no saved memory traces, the type of traces can be selected from (See figure below):

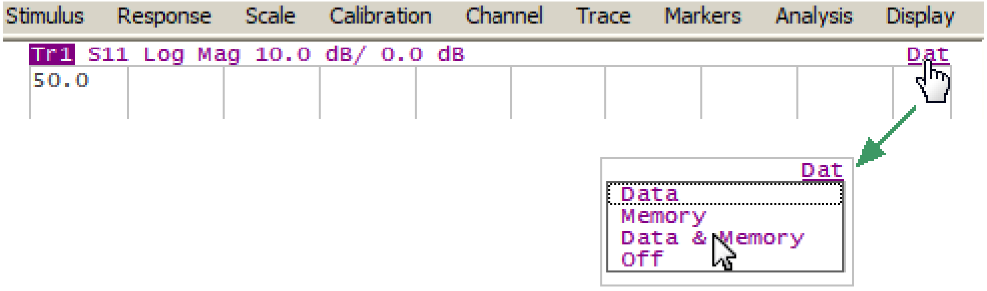
- Data
- OFF



Trace display setting in the trace status line (no saved memory traces)

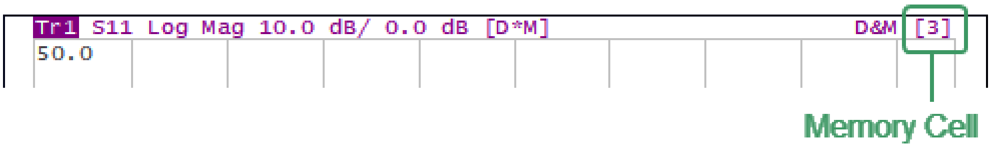
If there are saved memory traces (See Memory Trace Function), the type of traces can be selected (See figure below):

- Data
- Memory
- Data & Memory
- OFF



Trace display setting in the trace status line (there are saved memory traces)

For **Memory** and **Date & Memory** settings of the memory and traces display can save in memory cells, the memory cell number is displayed near type of traces (See figure below).



Tr1 S11 Log Mag 10.0 dB/ 0.0 dB [D*M] D&M [3]

50.0

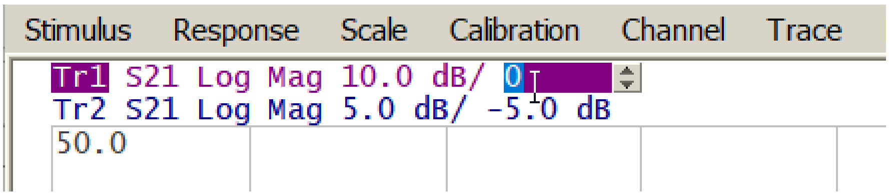
Memory cell number in the trace status line

The type of traces can be set using softkeys (See Memory Trace Function).

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.

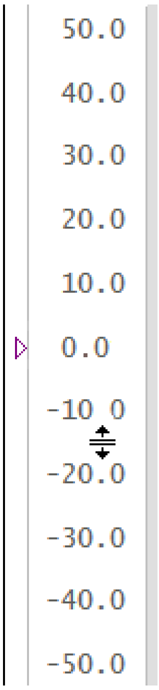
The first method: click on the reference level field in the trace status line and enter the required numerical value.



```
Tr1 S21 Log Mag 10.0 dB/ 0
Tr2 S21 Log Mag 5.0 dB/ -5.0 dB
50.0
```

Reference level setting in the trace status line

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.

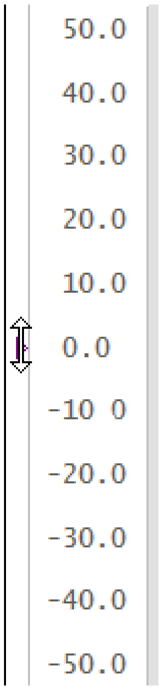


Reference level setting on the vertical scale

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

Reference Level Position

The reference level position, indicated on the vertical scale by «►» and «◄» symbols, can be set in the following way: locate the mouse pointer on a reference level symbol until it becomes as shown in the figure,then drag and drop the reference level symbol to the desired position.

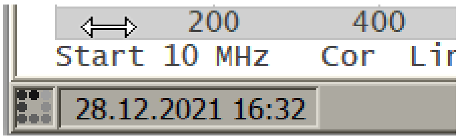


Setting Ref Level Pos on the vertical scale

The reference level position can be set using softkeys (See Rectangular Scale).

Sweep Start Setting

Move the mouse pointer over the stimulus scale until it becomes as shown in the figure. The pointer should be placed in the left part of the scale, at approximately 10% of the scale length from the left. Left click and drag right to increase the sweep start value or left to reduce the value.

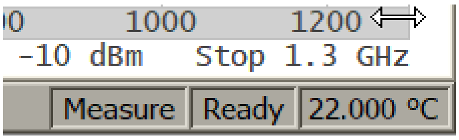


Sweep start setting on the Stimulus Scale

The start value of the sweep range can be set using softkeys (See Sweep Range).

Sweep Stop Setting

Move the mouse pointer over the stimulus scale until it becomes as shown in the figure. The pointer should be placed in the right part of the scale, at approximately 10% of the scale length from the right. Left click and drag right to increase the sweep stop value or left to reduce the value.



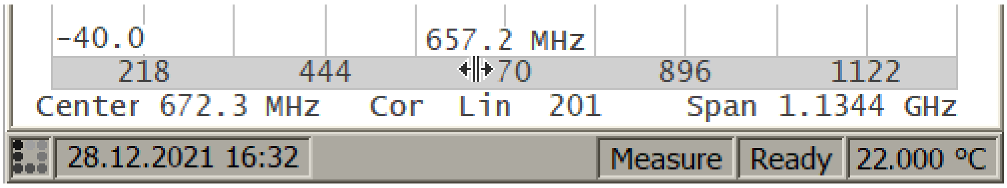
-10 dBm Stop 1.3 GHz

Sweep stop setting on the Stimulus scale

The stop value of the sweep range can be set using softkeys (See Sweep Range).

Sweep Center Setting

Move the mouse pointer over the stimulus scale until it becomes as shown in the figure. The pointer should be placed in the center part of the scale. Left click and drag right to increase the sweep center value or left to reduce the value.

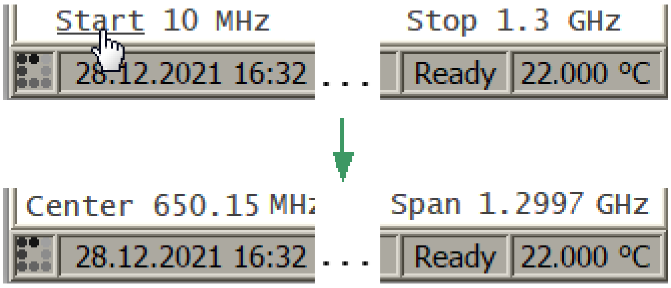


Sweep center setting on the stimulus scale

The center value of the sweep range can be set using softkeys (See Sweep Range).

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».



Start 10 MHz ... Stop 1.3 GHz
28.12.2021 16:32 ... Ready 22.000 °C

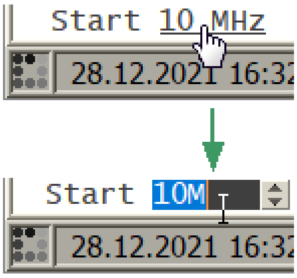
Center 650.15 MHz ... Span 1.2997 GHz
28.12.2021 16:32 ... Ready 22.000 °C

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 values, activate the respective field in the channel status bar by clicking the numerical value.

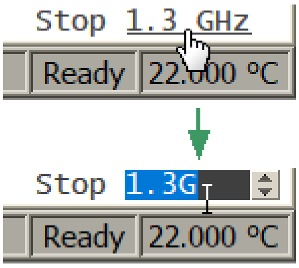


Setting the Start/Center value in the channel status bar

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

Stop/Span Value Setting

To enter the Stop/Span values, activate the respective field in the channel status bar by clicking the numerical value.



Stop 1.3 GHz

Ready | 22.000 °C

Stop 1.3G

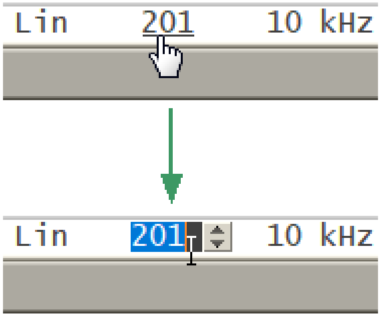
Ready | 22.000 °C

Setting the Stop/Span value in the channel status bar

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

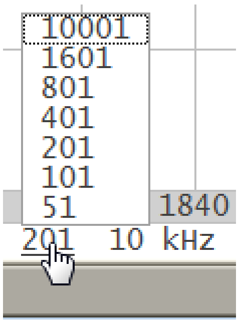
Number of Points Setting

To enter the number of points, activate the input field by clicking the left mouse button on the number of points field in the channel status bar (See figure below).



Setting the number of points value in the channel status bar

To select the number of points from the drop-down menu, make the right mouse click on this field (See figure below).

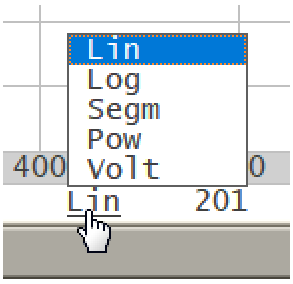


Selecting the number of points value in the channel status bar

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

Sweep Type Setting

To set the sweep type, left click on the respective field in the channel status bar and select the required type in the drop-down menu.



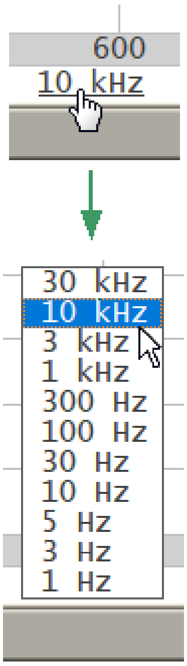
Selecting the sweet type value in the channel status bar

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

IF Bandwidth Setting

IF bandwidth can be set by selection in the drop-down menu.

To activate the drop-down menu, click on the IF bandwidth field in the channel status bar.



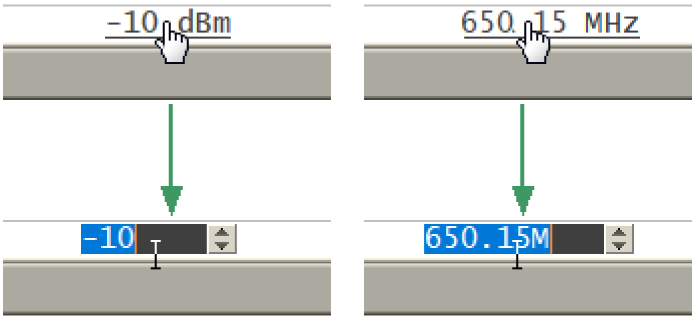
IF Bandwidth Selecting in drop-down menu

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

Power Level/CW Frequency Setting

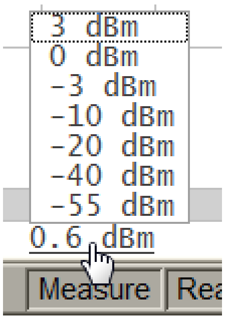
To enter the Power Level/CW Frequency, activate the input field by clicking the left mouse button on the Power Level/CW Frequency field in the channel status bar.

The parameter displayed in the field depends on the current sweep type: in frequency sweep mode, the power level value can be entered; in power sweep mode, the CW frequency value can be entered (See figure below).



Setting the Power Level/CW Frequency in the channel status bar

In frequency sweep mode, the Power Level can be select from the drop-down menu, make the right mouse click on this field (See figure below).



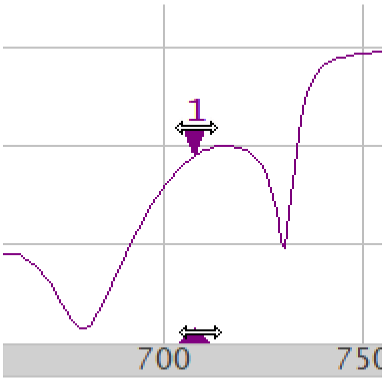
Selecting the Power Level in the channel status bar

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

Marker Stimulus Value Setting

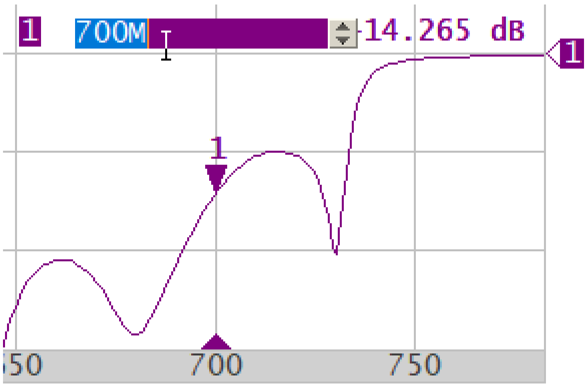
The marker stimulus value can be set by either a click and drag operation, or by entering the value using numerical keys of the keyboard.

To drag the marker, first move the mouse pointer on one of the marker indicators until it becomes as shown in the figures below.



Setting the marker value using drag and drop

To enter the numerical value of the stimulus, activate its field by clicking it in the marker data line.



Setting the marker value in the marker data line

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

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).
- Power calibration with an external power meter, to maintain an accurate power level at the DUT input (See Power Calibration).
- Working with the automatic calibration module (ACM), which allows 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 SOLT calibrations 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 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.
- For the SOLT calibrations, it is recommended to use ACM (Automatic Calibration Module) to reduce:
  - the labor intensity of the calibration without loss of accuracy
  - wear of connectors
  - operator errors

- 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:

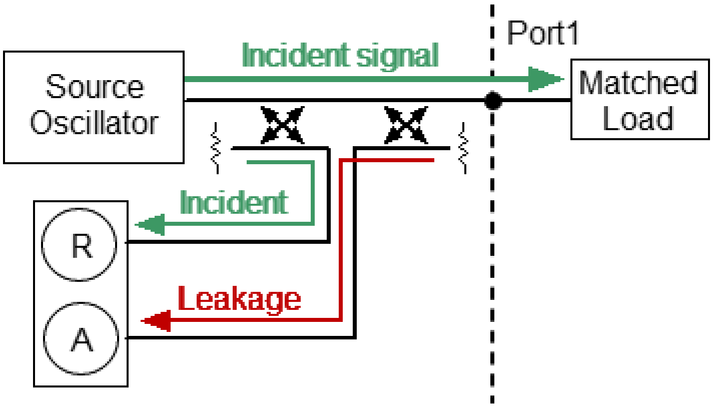
- directivity
- source match
- load match
- reflection tracking
- transmission tracking
- isolation

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 1. 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.

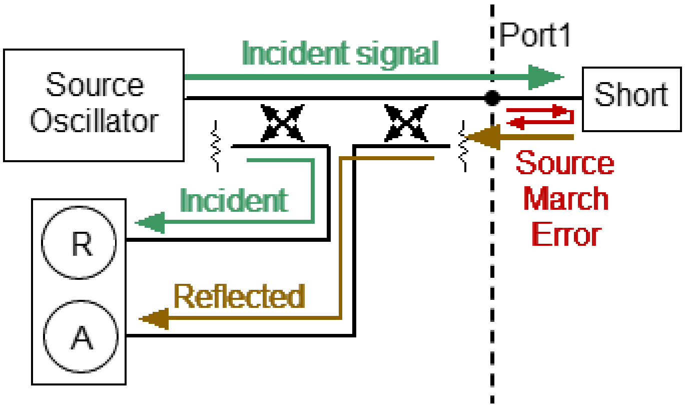


Directivity error

Source Match Error

A source match error (**Es**) is caused by a mismatch between the source port 1 and the input of the DUT. In this case, part of the signal reflected by the DUT reflects at the source port 1 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 1 impedance when it functions as a signal source.

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

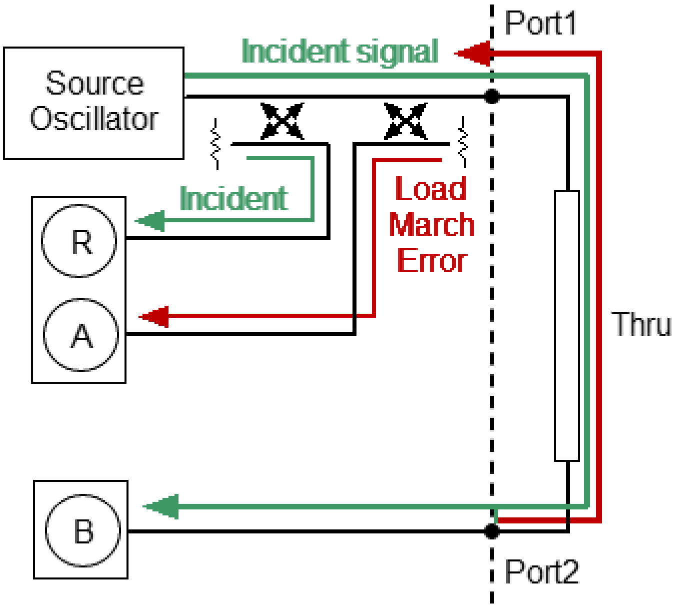


Source match error

Load Match Error

A load match error (**El**) is caused by a mismatch between the receiver port 2 and the output of the DUT. In this case, part of the signal transmitted through the DUT reflects at the receiver port 2 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 receiver port 2 impedance.

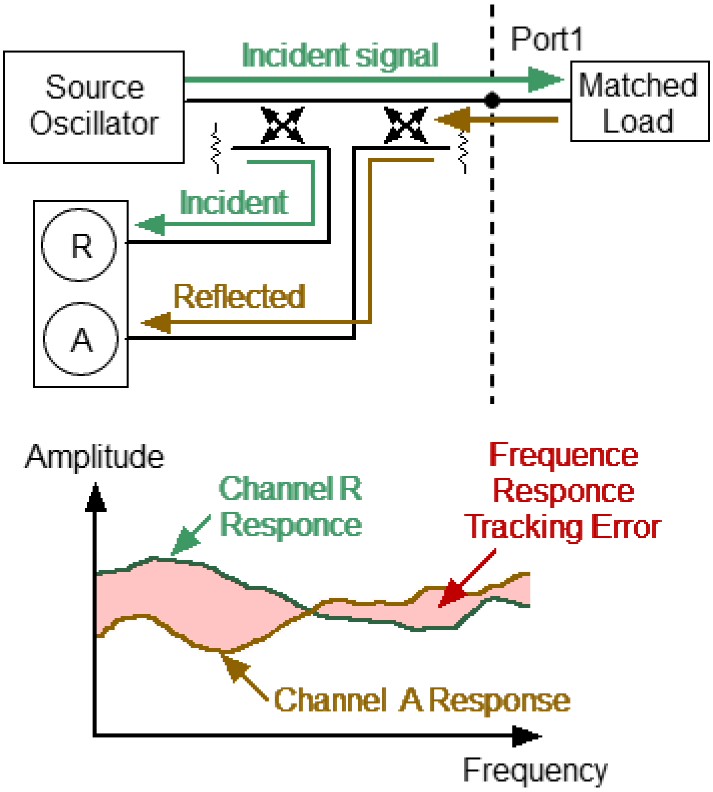
In transmission measurements, the load match error has considerable influence if the output of the DUT is poorly matched. In reflection measurements, the load match error has considerable influence in cases of poor output match and low attenuation between the output and input of the DUT.



Load match error

Reflection Tracking Error

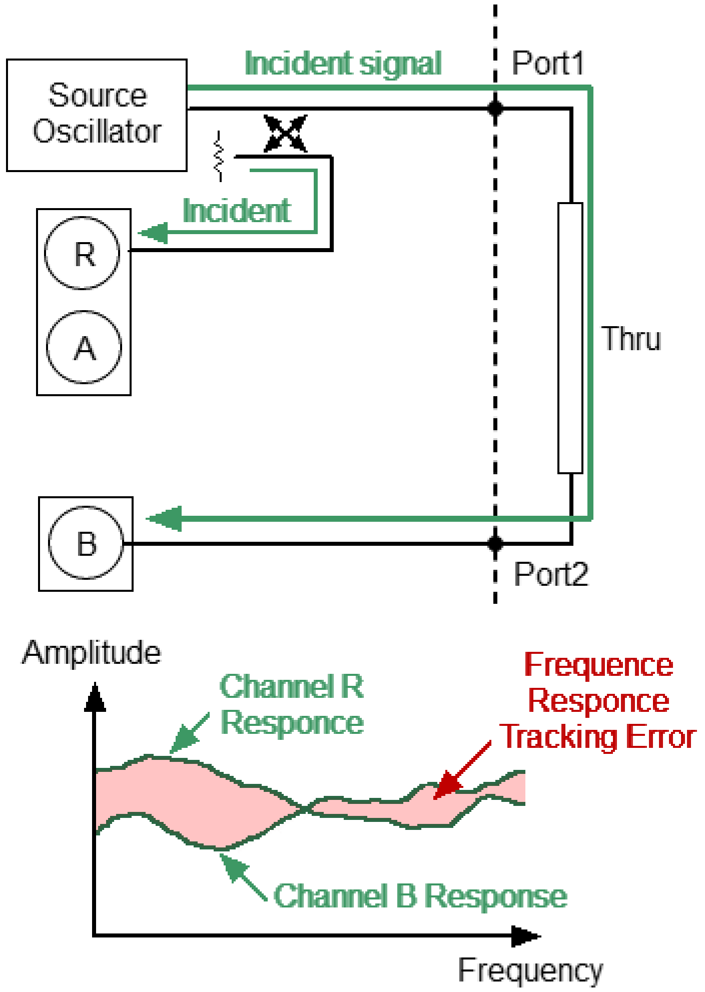
A reflection tracking error (**Er**) is caused by differences in frequency response between the test receiver and the reference receiver of the source port 1 during reflection measurement.



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 1 during transmission measurement.

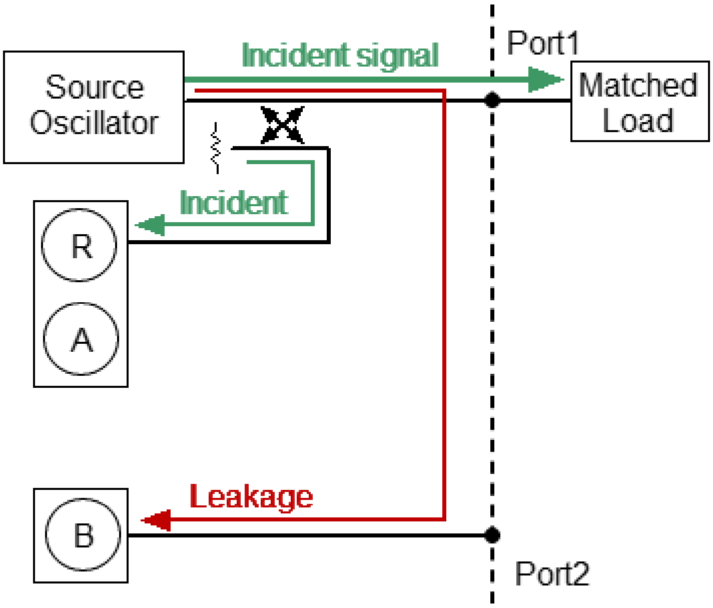


Transmission tracking error

Isolation Error

Isolation error (**Ex**) is caused by a leakage of the signal from the source port 1 to the receiver port 2 bypassing the DUT.

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



Isolation error

Error Model

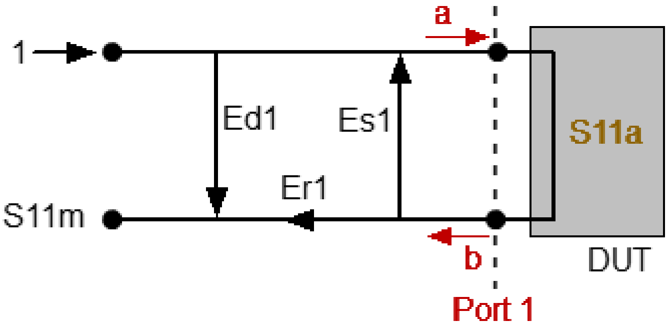
The error model in the form of signal (directed) graphs is used to analyze systematic errors of the Analyzer.

This section describes following error models:

- One-Port Error Model
- One-Path Two-Port Error Model

One-Port Error Model

Only Port 1 of the Analyzer is used when performing reflection measurements. The signal flow graph of errors for Port 1 is represented in the figure below.



a — incident wave, b — reflected wave

S11a — reflection coefficient actual value

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 elimimate the errors from the measured value S11m) the actual value of the reflection coefficient S11a.

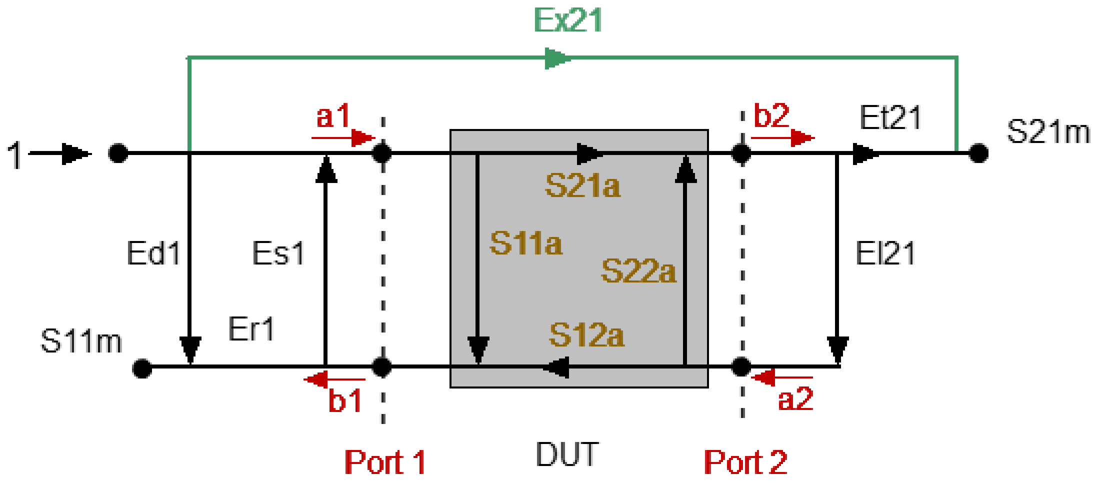
There are simplified methods, which eliminate the effects of only one or two of the three systematic errors.

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

One-Path Two-Port Error Model

For a one-path measurement of the reflection coefficient and the transmission coefficient of a two-port DUT, the two ports of the Analyzer are used.

The signal flow graph of errors effect in a one-path two-port system is represented in the figure below.



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

S11a, S21a — actual value of DUT parameters

S11m, S21m — measured DUT parameters values

One-path 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 one-path two-port system is affected by six systematic error terms.

These terms are also described in the table below.

Description	Error
Directivity	**Ed1**
Source match	**Es1**
Reflection tracking	**Er1**
Transmission tracking	**Et1**
Load match	**El1**
Isolation	**Ex1**

After determination of the four error terms (Ed1, Es1, Er1, Et1) for each measurement frequency by means of a one-path two-port calibration, it is possible to calculate the true value of the S11a. The calibration does not take into account El1 error and takes into account optional Ex1, that is why the measured value of S21m will become closer to the true value of S21a with the improvement of the source match and increasing the isolation.

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

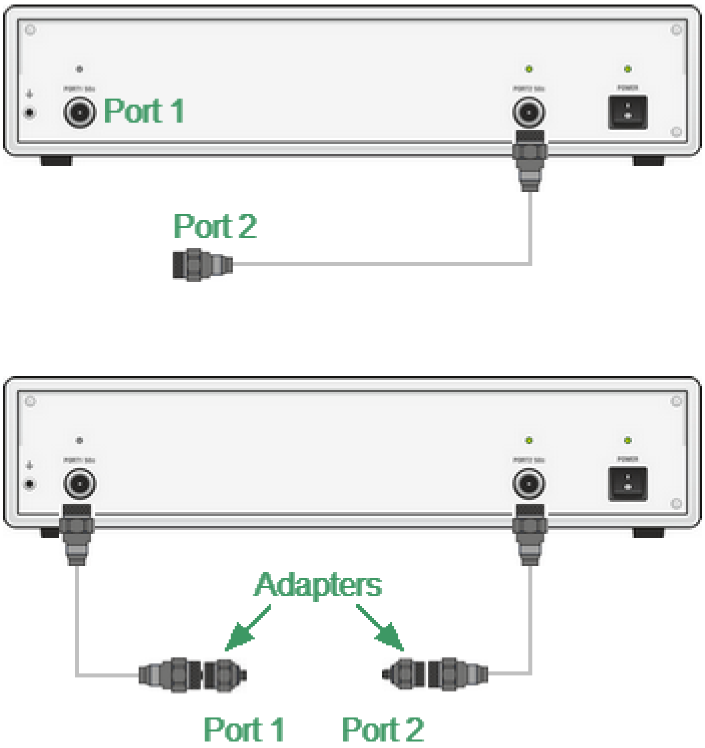
Analyzer Test Port Definition

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 connector on the front panel of the Analyzer will be the test port if the calibration standards are connected directly to it.

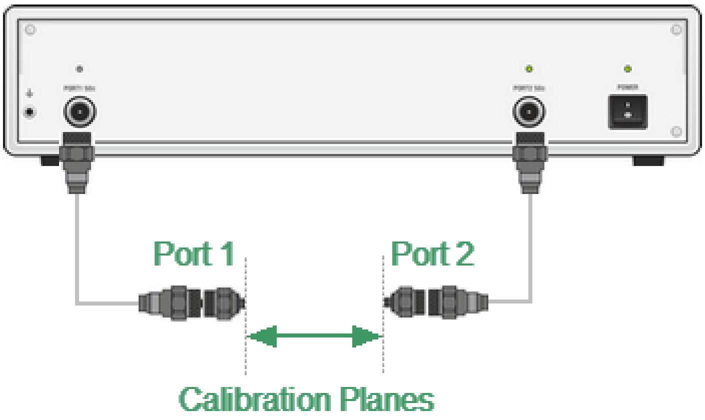
Sometimes it is necessary to connect coaxial cable and/or adapter to the connector(s) on the front panel for connection of the DUT with a different connector type. In such cases connect calibration standards to the connector of the cable or adapter.

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



Test port defining

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



Calibration planes

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. The S-parameters of these standards must be precisely defined using an equivalent circuit model or an S-parameter table (See Calibration Standard Definition).
- 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
- standard defined by data (S-parameters)

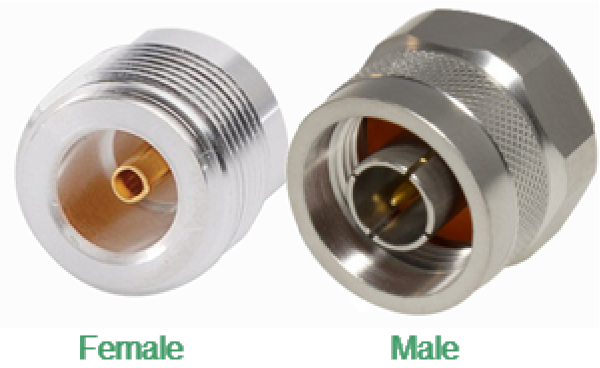
Gender of Calibration Standard

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 Standard Definition

The Analyzer provides two methods of defining a calibration standard:

- Calibration standard model
- Table of S-parameters

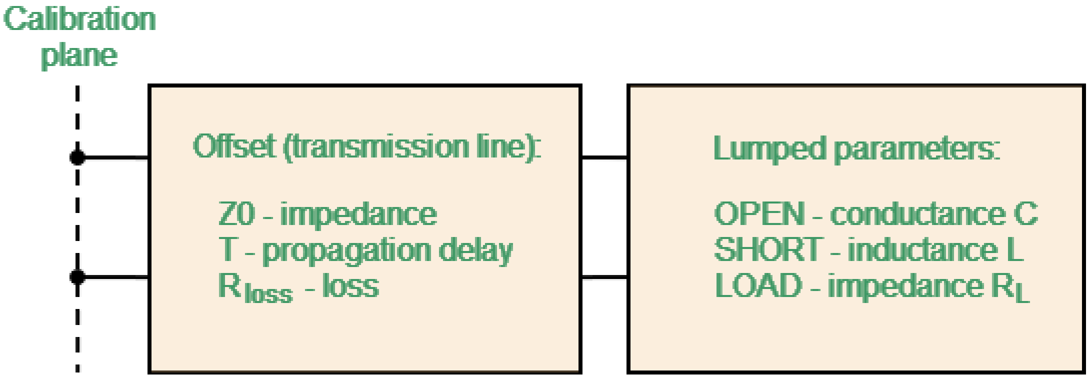
The calibration standards defined by S-parameters are called Data-Based standards.

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

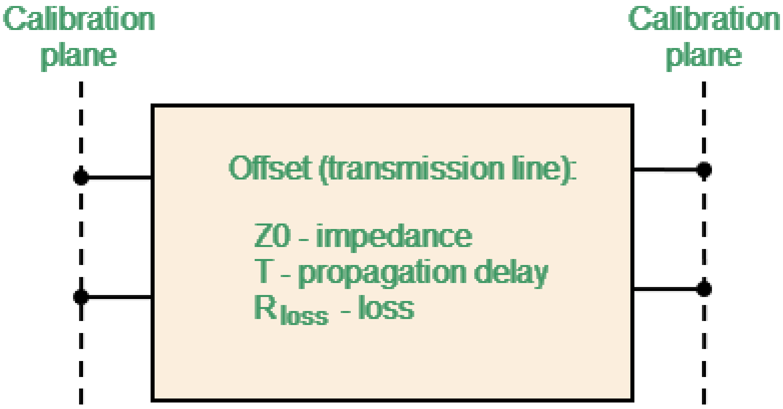
A model of a calibration standard presented as an equivalent circuit is used for determining S-parameters of the standard. The model is employed for standards of OPEN, SHORT, LOAD, THRU types.

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 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.

Parameters of the calibration standard equivalent circuit model

Parameter (as in the program)	**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.
T (Offset Delay)	The offset delay. It is defined as one-way propagation time (in seconds) from the calibration plane to the circuit with lumped parameters or to the other calibration plane. Each standard delay can be measured or mathematically determined by dividing the exact physical length by the propagation velocity.
Rloss (Offset Loss)	The offset loss in one-way propagation due to the skin effect [Ω/sec]. 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: $R\text{п}[\Omega/s] = \frac{L[dB]\cdot Z0[\Omega]}{4.3429[dB]\cdot T[s]}$
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].

Parameter (as in the program)	Parameter Definition
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].
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.

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.

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 kits added by the user.

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

- to add a user-defined standard into the kit
- 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.

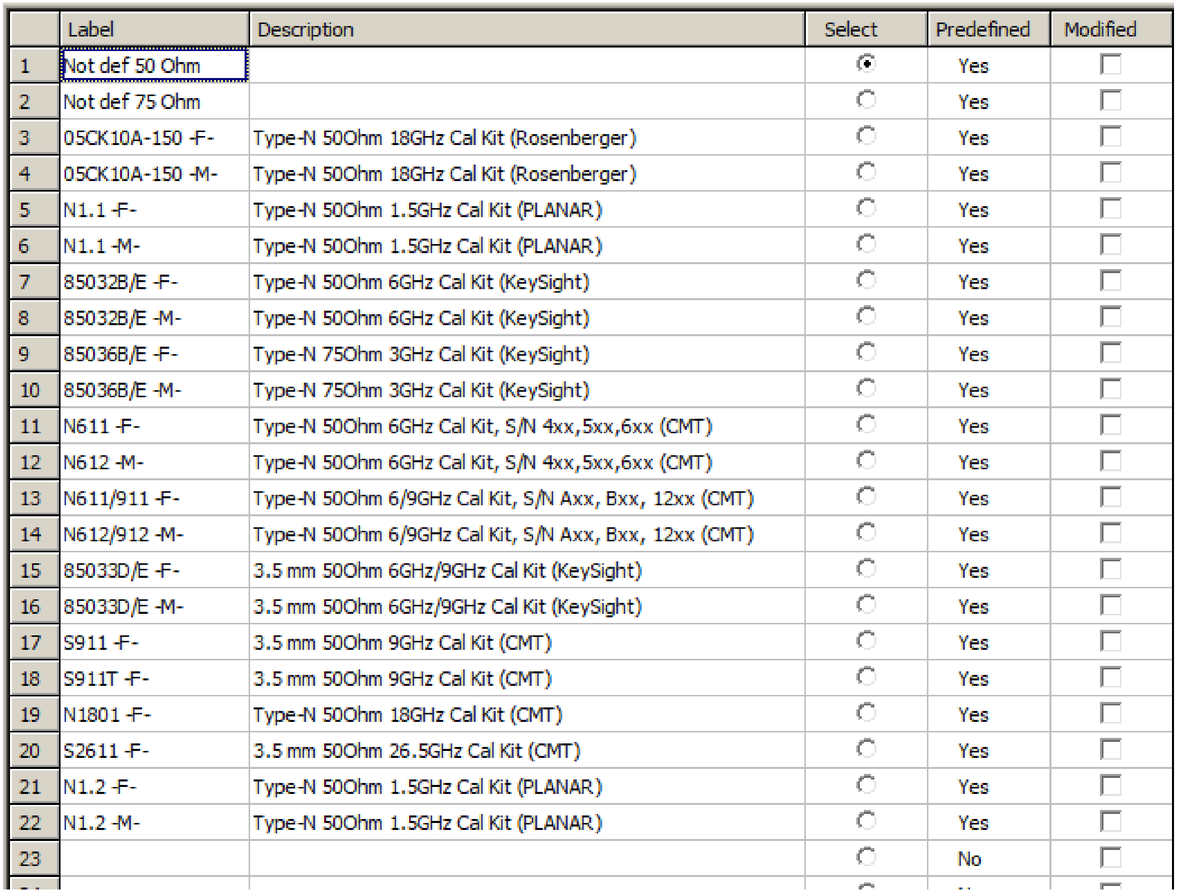
Any changes made to the calibration kits are automatically saved into the nonvolatile memory of the Analyzer. Clicking the **Save** button is not required in order to save.

NOTE

Changes to a predefined calibration kit can be cancelled at any time and the initial state will be restored by a **Restore Cal Kit** softkey.

Calibration Kit Selection

The Analyzer provides memory space for 50 calibration kits. The first two items are the calibration kits with indefinite parameters. Next 20 items are the kits with manufacturer-defined parameters, available in the Analyzer by default. The available calibration kits include the Rosenberger, KeySight, CMT, and others kits (See figure below). The other 28 items are the empty templates offered for calibration kit definition by the user.



	Label	Description	Select	Predefined	Modified
1	Not def 50 Ohm		●	Yes	□
2	Not def 75 Ohm		○	Yes	□
3	05CK10A-150 -F-	Type-N 50Ohm 18GHz Cal Kit (Rosenberger)	○	Yes	□
4	05CK10A-150 -M-	Type-N 50Ohm 18GHz Cal Kit (Rosenberger)	○	Yes	□
5	N1.1 -F-	Type-N 50Ohm 1.5GHz Cal Kit (PLANAR)	○	Yes	□
6	N1.1 -M-	Type-N 50Ohm 1.5GHz Cal Kit (PLANAR)	○	Yes	□
7	85032B/E -F-	Type-N 50Ohm 6GHz Cal Kit (KeySight)	○	Yes	□
8	85032B/E -M-	Type-N 50Ohm 6GHz Cal Kit (KeySight)	○	Yes	□
9	85036B/E -F-	Type-N 75Ohm 3GHz Cal Kit (KeySight)	○	Yes	□
10	85036B/E -M-	Type-N 75Ohm 3GHz Cal Kit (KeySight)	○	Yes	□
11	N611 -F-	Type-N 50Ohm 6GHz Cal Kit, S/N 4xx,5xx,6xx (CMT)	○	Yes	□
12	N612 -M-	Type-N 50Ohm 6GHz Cal Kit, S/N 4xx,5xx,6xx (CMT)	○	Yes	□
13	N611/911 -F-	Type-N 50Ohm 6/9GHz Cal Kit, S/N Axx, Bxx, 12xx (CMT)	○	Yes	□
14	N612/912 -M-	Type-N 50Ohm 6/9GHz Cal Kit, S/N Axx, Bxx, 12xx (CMT)	○	Yes	□
15	85033D/E -F-	3.5 mm 50Ohm 6GHz/9GHz Cal Kit (KeySight)	○	Yes	□
16	85033D/E -M-	3.5 mm 50Ohm 6GHz/9GHz Cal Kit (KeySight)	○	Yes	□
17	S911 -F-	3.5 mm 50Ohm 9GHz Cal Kit (CMT)	○	Yes	□
18	S911T -F-	3.5 mm 50Ohm 9GHz Cal Kit (CMT)	○	Yes	□
19	N1801 -F-	Type-N 50Ohm 18GHz Cal Kit (CMT)	○	Yes	□
20	S2611 -F-	3.5 mm 50Ohm 26.5GHz Cal Kit (CMT)	○	Yes	□
21	N1.2 -F-	Type-N 50Ohm 1.5GHz Cal Kit (PLANAR)	○	Yes	□
22	N1.2 -M-	Type-N 50Ohm 1.5GHz Cal Kit (PLANAR)	○	Yes	□
23			○	No	□

List of calibration kits

The calibration kit employed during 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 the calibration kits is described in Operations on Table of Calibration Kits.

To open the list of the calibration kits (See figure below), use the following softkeys:

Calibration > Cal Kit

NOTE

Label **-M-** or **-F-** in the description of the kit denotes the gender of the calibration standard connector, male or female respectively (See Gender of Calibration Standard).

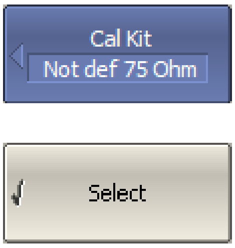
Calibration Kit Selection for Editing

Move the highlighting to the required line in the calibration kit (See figure above) table using "↑" and "↓" arrows and click on the **Enter** softkey.

NOTE

The dot in the radio button of **Select** field does not matter for the kit selection for editing, it selects the calibration kit for calibration.

Calibration Kit Selection for Calibration



Highlight the required line in the list of the calibration kits and use the following softkey:

Calibration > Cal Kit > Select

Or double-click the radio button in the **Select** column.

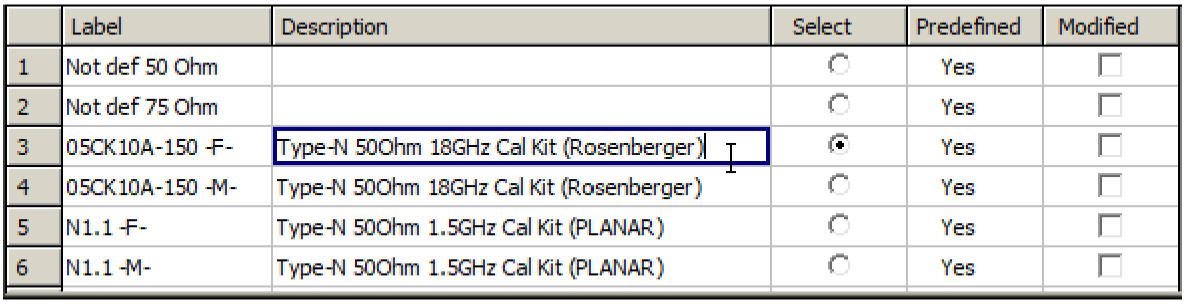
NOTE

Make sure the selected calibration kit is marked with a dot.

Operations on Table of Calibration Kits

The table of calibration kits allows for selecting and editing of the calibration kits (See figure below).

The calibration kit currently selected for calibration is the kit available for editing (See Calibration Kit Selection). The **Label** and **Description** fields can be edited directly in the table, just click on the field with the mouse and enter a new value.

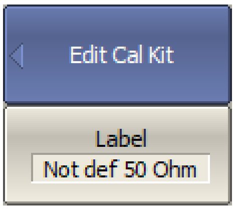


	Label	Description	Select	Predefined	Modified
1	Not def 50 Ohm		○	Yes	□
2	Not def 75 Ohm		○	Yes	□
3	05CK10A-150 -F-	Type-N 50Ohm 18GHz Cal Kit (Rosenberger)	●	Yes	□
4	05CK10A-150 -M-	Type-N 50Ohm 18GHz Cal Kit (Rosenberger)	○	Yes	□
5	N1.1 -F-	Type-N 50Ohm 1.5GHz Cal Kit (PLANAR)	○	Yes	□
6	N1.1 -M-	Type-N 50Ohm 1.5GHz Cal Kit (PLANAR)	○	Yes	□

Editing Table of Calibration Kits

Calibration Kit Label Editing

Label of a calibration kit can be edited also with the softkey.



Edit Cal Kit

Label: Not def 50 Ohm

To edit the label of a calibration kit, use the following softkeys:

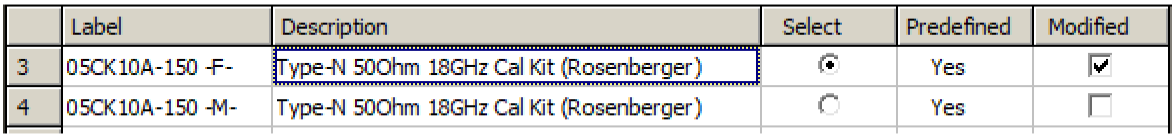
Calibration > Cal Kit > Edit Cal Kit > Label

Then click the softkey and enter the calibration kit label in the values field.

SCPI SENSe:CORRection:COLLect:CKIT:LABel

Predefined Calibration Kit Restoration

The modified calibration kit is marked as "Modified" in the calibration kits table (See figure below). It is possible to restore only predefined calibration kits. Select the calibration kit to be restored in the table of calibration kits.



	Label	Description	Select	Predefined	Modified
3	05CK10A-150 -F-	Type-N 50Ohm 18GHz Cal Kit (Rosenberger)	●	Yes	☑
4	05CK10A-150 -M-	Type-N 50Ohm 18GHz Cal Kit (Rosenberger)	○	Yes	□

Modified Calibration Kit

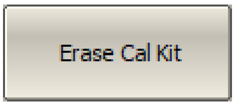
To cancel the user changes of a predefined calibration kit, use the following softkeys:

Calibration > Cal Kit > Restore Cal Kit

SCPI SENSe:CORRection:COLLect:CKIT:RESet

Deleting a Kit from Calibration Kit Table

The deleting function is available for user-defined calibration kits only. A predefined calibration kit cannot be erased. Select the calibration kit to be deleted in the table of calibration kits.

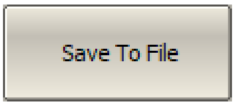


To delete a calibration kit from the table of calibration kits, use the following softkey:

Calibration > Cal Kit > Erase Cal Kit

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. Select the calibration kit to be saved in the table of calibration kits.



To save a calibration kit to file, click the following softkey:

Save to File

SCPI MMEMory:STORe:CKIT

Loading Calibration Kit from File

Calibration kit files that were created by the previous command can be loaded. Select the required line to be loaded in the table of calibration kits.

To load a calibration kit form file, click the following softkey:

Load from File…

SCPI MMEMory:LOAD:CKIT

Calibration Standard Editing

A calibration standard editing is required to precise the standard parameters to improve the calibration accuracy or when create custom calibration kit.

To change the calibration standard definitions, press the softkeys:

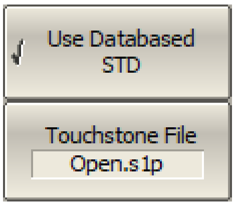
Calibration > Cal Kit > Edit Cal Kit

Then edit the following parameters.

The Analyzer provides two method of defining a calibration standard:

- Calibration Standard Model — the standard defined as an equivalent circuit. The model is employed for standards of OPEN, SHORT, LOAD, THRU types.
- Data-Based Calibration Standards — the standard defined by S-parameters. To use it, a Touchstone file with a calibration standard definition must be uploaded.

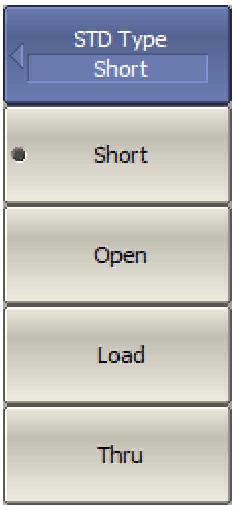
Calibration Standard Defined by Data-based (S-parameter)



To use the standard defined by S-parameters:

- Upload the definition file of the standard, use the **Touchstone File** softkey.
- To enable/disable the use of the uploaded standard, use the **Use Databased STD** softkey.

Calibration Standard Defined by Model (equivalent circuit)



To set the type of a standard defined as an equivalent circuit, use the **STD Type** softkey.

Then select the following standards:

- **Short**
- **Open**
- **Load**
- **Thru**

SCPI

SENSe:CORRection:COLLect:CKIT:STAN:TYPE

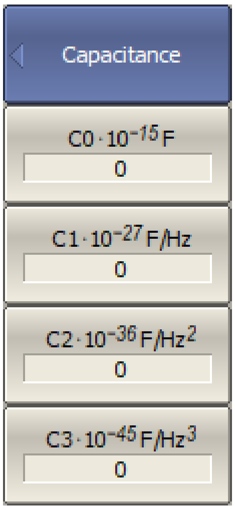
SENSe:CORRection:COLLect:CKIT:STAN:LABel (Remote Only)

For an OPEN standard, the values fringe capacitance of the OPEN model are specified. This model is described by the following polynomial of the third order:

$$C = C0 + C1 \cdot f + C2 \cdot f^2 + C3 \cdot f^3 \ ,$$

where f — frequency [Hz],

C0…C3 — polynomial coefficients.



$C0 \cdot 10^{-15}$ F: 0

$C1 \cdot 10^{-27}$ F/Hz: 0

$C2 \cdot 10^{-36}$ F/Hz^2: 0

$C3 \cdot 10^{-45}$ F/Hz^3: 0

To set the coefficients in the polynomial formula of the fringe capacitance, use the **Capacitance** softkey.

Then set the coefficients in the value fields of the following softkeys:

- **C0 10^{-15} F**
- **C1 10^{-27} F/Hz**
- **C2 10^{-36} F/Hz^2**
- **C2 10^{-45} F/Hz^3**

SCPI

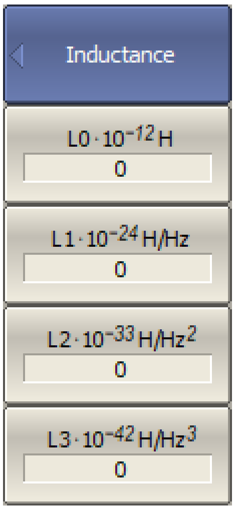
SENSe:CORRection:COLLect:CKIT:STAN:C0,
SENSe:CORRection:COLLect:CKIT:STAN:C1,
SENSe:CORRection:COLLect:CKIT:STAN:C2,
SENSe:CORRection:COLLect:CKIT:STAN:C3

For a SHORT standard, the values of the residual inductance of the SHORT model are specified. This model is described by the following polynomial of the third order:

$$L = L0 + L1 \cdot f + L2 \cdot f^2 + L3 \cdot f^3,$$

where f — frequency [Hz],

L0…L3 — polynomial coefficients.


Inductance
$L0 \cdot 10^{-12}$ H
0
$L1 \cdot 10^{-24}$ H/Hz
0
$L2 \cdot 10^{-33}$ H/Hz^{2}
0
$L3 \cdot 10^{-42}$ H/Hz^{3}
0

To set the coefficients in the polynomial formula of the residual inductance, use the **Inductance** softkey.

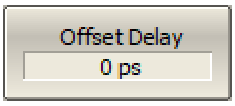
Then set the coefficients in the value fields of the following softkeys:

- **L0 10^{-12} H**
- **L1 10^{-24} H/Hz**
- **L2 10^{-33} H/Hz^{2}**
- **L2 10^{-42} H/Hz^{3}**

SCPI SENSe:CORRection:COLLect:CKIT:STAN:L0, SENSe:CORRection:COLLect:CKIT:STAN:L1, SENSe:CORRection:COLLect:CKIT:STAN:L2, SENSe:CORRection:COLLect:CKIT:STAN:L3

Transmission Line Parameters

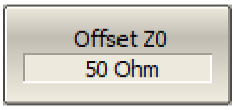
Offset delay value in one direction(s). The parameter is used only for the calibration standard defined by model.


Offset Delay
0 ps

To set the offset delay, use the **Offset Delay** softkey.

SCPI SENSe:CORRection:COLLect:CKIT:STAN:DELay

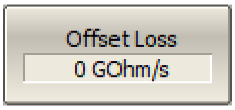
Offset characteristic impedance value (Ω). The parameter is used for the definition of the standards by model.


Offset Z0
50 Ohm

To set the offset characteristic impedance value, use the **Offset Z0** softkey.

SCPI SENSe:CORRection:COLLect:CKIT:STAN:Z0

Offset loss value (Ω/s). The parameter is used only for the calibration standard defined by model.


Offset Loss
0 GOhm/s

To set the offset loss value, use the **Offset Loss** softkey.

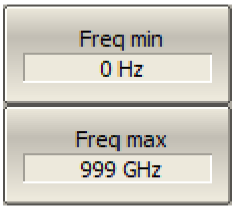
SCPI SENSe:CORRection:COLLect:CKIT:STAN:LOSS

Operating Frequency of Calibration Standard

The parameter is used for the definition of the standard by model and data-based.

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:

- Fmin is minimum operating frequency of the standard.
- Fmax is maximum operating frequency of the standard.



To set minimum / maximum operating frequency of the calibration standard, use the **Freq min**, **Freq max** softkeys.

SCPI SENSe:CORRection:COLLect:CKIT:STAN:FMINimum, SENSe:CORRection:COLLect:CKIT:STAN:FMAXmum

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 • LOAD (if optional directivity is performed)	Er1, Ed1[1]	Low
Transmission Normalization	S21	• THRU • 2 LOADs (if optional isolation calibration is performed)	Et1, Ex1[2]	Low
Full One-Port Calibration	S11	• SHORT • OPEN • LOAD	Er1, Ed1, Es1	High
One-Path Two-Port Calibration	S11, S21	• SHORT • OPEN • LOAD • THRU • 2 LOADs (if optional isolation calibration is performed)	Er1, Ed1, Es1, Et1, Ex1[2]	Medium

Calibration Method	Parameters	Standards	Errors	Accuracy
1. If optional directivity calibration is performed. 2. If optional isolation calibration is performed.				

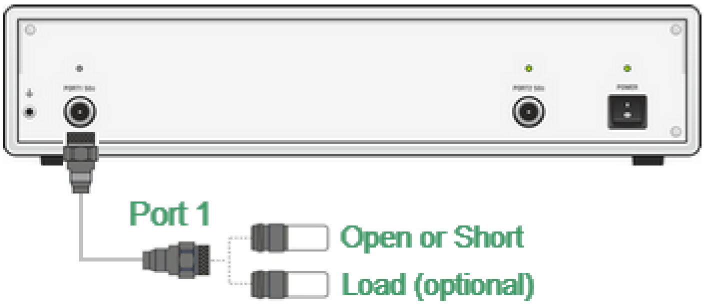
Reflection Normalization

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). 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.

NOTE

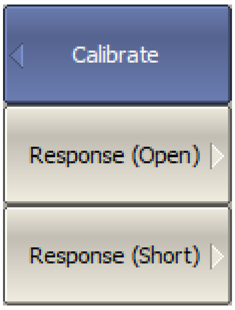
Reflection normalization can also be referred to as **response open** or **response short** calibration depending on the standard being used: OPEN or SHORT.

An optional LOAD standard measurement can be performed to correct the directivity error (**Ed**). The optional directivity calibration increases the accuracy of the reflection normalization.



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.



To open reflection normalization submenu, use the following softkeys:

Calibration > Calibrate > Response (Open) | Response (Short)

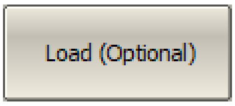
SCPI [SENSe:CORRection:COLLect:METHod:OPEN]

[SENSe:CORRection:COLLect:METHod:SHORt]

Connect an OPEN or a SHORT standard to the test port 1 as shown in above figure. Perform measurement using the **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, a checkmark will appear in the left part of the softkey.



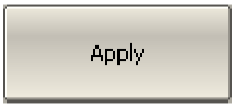
To perform the optional directivity calibration, connect a LOAD standard to the test port 1 as shown in the above figure and perform measurement using **Load (Optional)** softkey.

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, a checkmark will appear in the left part of the softkey.

SCPI SENSe:CORRection:COLLect:OPEN

SENSe:CORRection:COLLect:SHORt

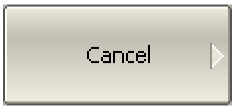
SENSe:CORRection:COLLect:LOAD



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

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.

SCPI SENSe:CORRection:COLLect:SAVE



To clear the measurement results of the standards, 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: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).

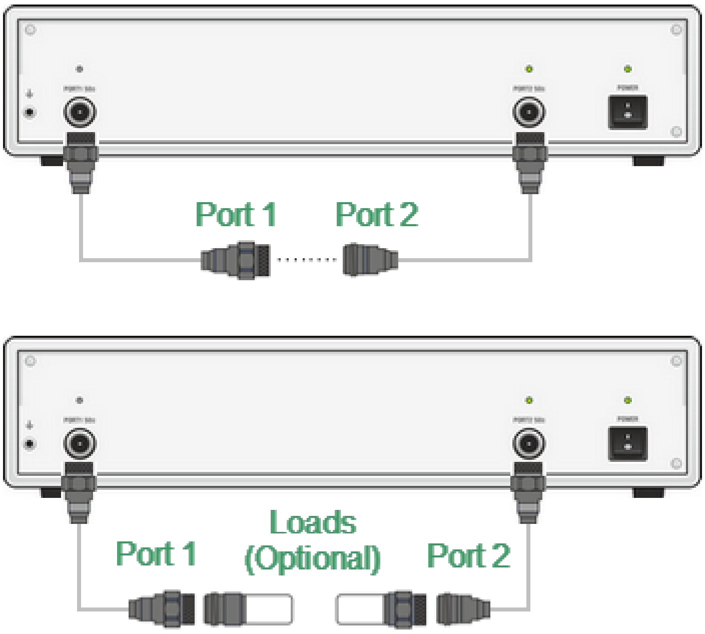
Transmission Normalization

Transmission normalization is the simplest calibration method used for transmission coefficient measurements (S21). Measurement of one THRU standard is sufficient to perform this type of calibration (See figure below). 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. Transmission normalization corrects the transmission tracking error (**Et)** only. This constrains the accuracy of the method.

NOTE Transmission normalization can also be referred to as **response thru** calibration.

An optional isolation calibration can be performed by measurement of two LOAD standards connected to both test ports of the analyzer. In this case, the isolation error (**Ex**) is additionally corrected in the transmission normalization.

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



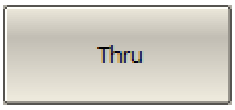
Transmission normalization

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 open transmission normalization submenu, use the following softkeys:

Calibration > Calibrate > Response (Thru)

SCPI SENSe:CORRection:COLLect:METHod:THRU

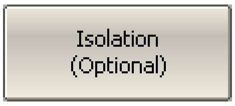


Connect a THRU standard between the test ports. If the port connectors allow through connection connect them directly (zero electrical length thru). Perform measurement using the **Thru** softkey.

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, a checkmark will appear in the left part of the softkey.

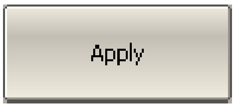
SCPI SENSe:CORRection:COLLect:THRU



To perform the optional isolation calibration, connect two LOAD standards to the test ports as shown in the above figure and enable measurement using the **Isolation (Optional)** softkey.

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.

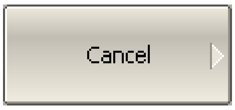
On completion of the measurement, a checkmark will appear in the left part of the softkey.



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

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.

SCPI SENSe:CORRection:COLLect:SAVE



To clear the measurement results of the standard, click Cancel.

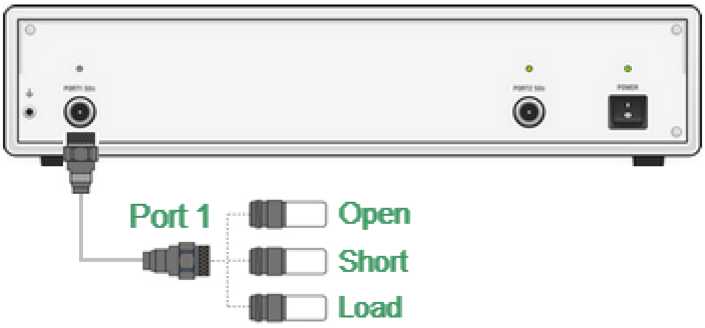
This softkey does not cancel the current calibration. To disable the current calibration, turn OFF the error correction function (See Error Correction Disabling).

SCPI SENSe:CORRection:COLLect: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).

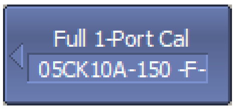
Full One-Port Calibration

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 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

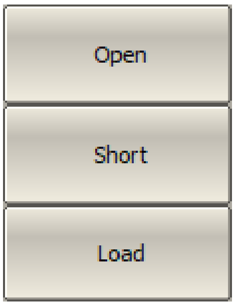
Before starting calibration perform the following settings: select active channel, set the parameters of the channel (frequency range, IF bandwidth, etc.), and select the calibration kit.


Full 1-Port Cal
05CK10A-150 -F-

To open full one-port calibration submenu, use the following softkeys:

Calibration > Calibrate > Full 1-Port Cal

SCPI SENSe:CORRection:COLLect:METHod:SOLT1



Connect SHORT, OPEN, and LOAD standards to the selected test port in any consequence as shown in the above figure. Perform measurements clicking the softkey **Open, Short, Load** corresponding to the connected standard.

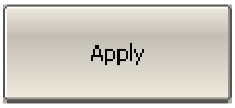
During the measurement, a pop up window will appear in the channel window. It will have **Calibration** label and will indicate the progress of the measurement.

On completion of the measurement, a checkmark will appear in the left part of the softkey.

SCPI SENSe:CORRection:COLLect:OPEN

SENSe:CORRection:COLLect:SHORt

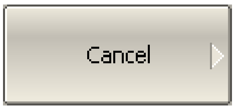
SENSe:CORRection:COLLect:LOAD



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

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.

SCPI SENSe:CORRection:COLLect:SAVE



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).

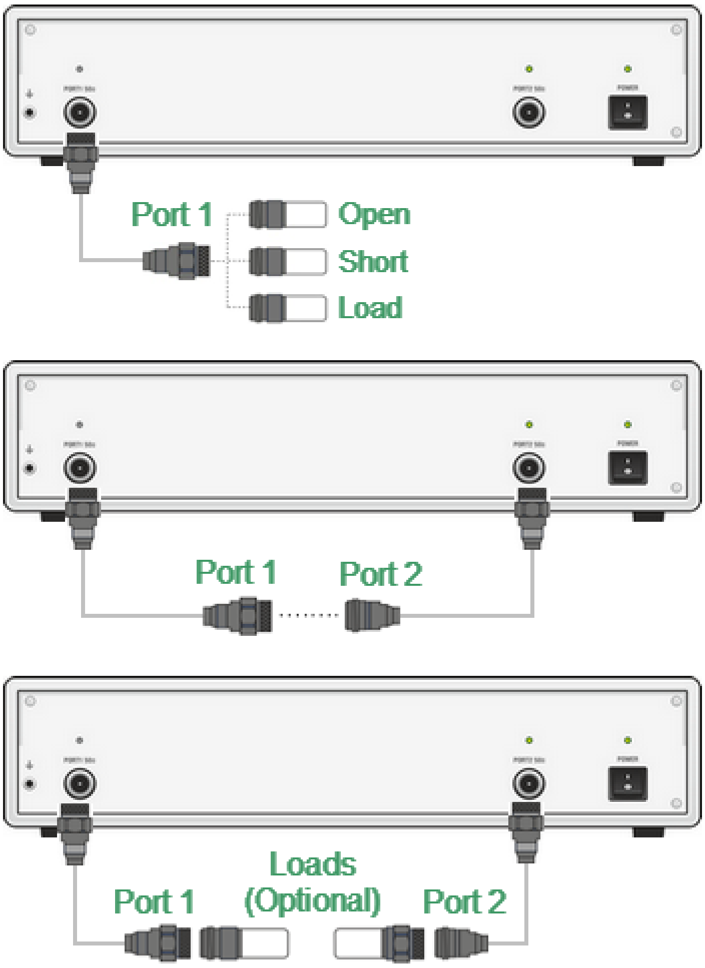
SCPI SENSe:CORRection:COLLect:CLEar

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

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

One-path two-port calibration 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

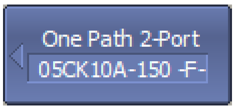
One-path two-port calibration allows correction of **Ed**, **Es**, and **Er** error terms of the source port and a transmission tracking error term (**Et**). This method does not derive source match error term (**El**) of a two-port error model.

An optional isolation calibration can be performed by measurement of two LOAD standards connected to both test ports of the analyzer. In this case, the isolation error (**Ex**) is additionally corrected in the one-path two-port calibration.

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

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

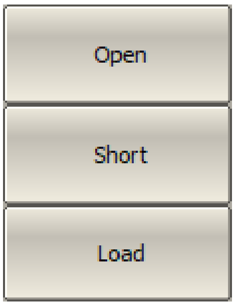
Before starting calibration perform the following settings: select active channel, set the parameters of the channel (frequency range, IF bandwidth, etc.), and select the calibration kit.



To open one-path two-port calibration submenu, use the following softkeys:

Calibration > Calibrate > One Path 2-Port Cal

SCPI SENSe:CORRection:COLLect:METHod:ERESponse



Connect SHORT, OPEN, and LOAD standards to the selected test port in any consequence as shown in the above figure. Perform measurements clicking the softkey **Open, Short, Load** corresponding to the connected standard.

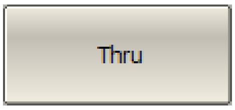
During the measurement, a pop up window will appear in the channel window. It will have **Calibration** label and will indicate the progress of the measurement.

On completion of the measurement, a checkmark will appear in the left part of the softkey.

SCPI SENSe:CORRection:COLLect:OPEN

SENSe:CORRection:COLLect:SHORt

SENSe:CORRection:COLLect:LOAD

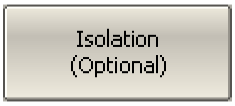


Connect a THRU standard between the test ports. If the port connectors allow through connection, connect them directly (zero electrical length thru). Perform measurement using the **Thru** softkey.

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, a checkmark will appear in the left part of the softkey.

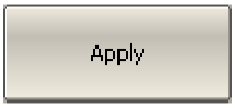
SCPI SENSe:CORRection:COLLect:THRU



To perform the optional isolation calibration, connect two LOAD standards to the test ports as shown in the above figure and enable measurement using the **Isolation (Optional)** softkey.

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.

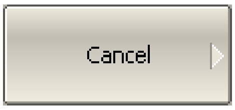
On completion of the measurement, a checkmark will appear in the left part of the softkey.



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

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.

SCPI SENSe:CORRection:COLLect:SAVE



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:CLEar

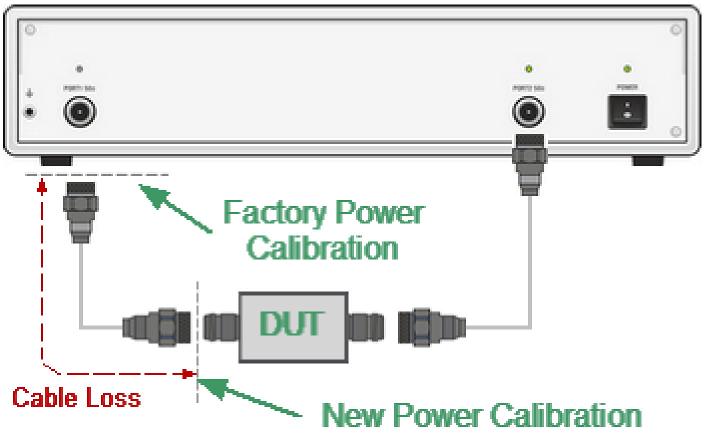
NOTE

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).

Power Calibration

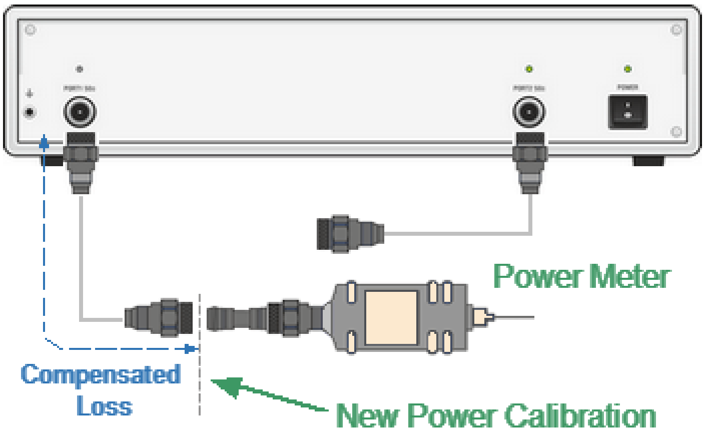
The Analyzer ensures a steady power level at test port 1 with the specified accuracy. The power level is defined between the instrument's minimum and maximum output power level.

A DUT is connected to the Analyzer by cables (see figure below), which have some losses. The power calibration allows maintaining a more accurate power level at a DUT input, adjusted to the use of the cables.



Power Calibration

The power calibration is performed by an external power meter connected to the cables' end which will be later connected to the DUT input. After the power calibration is complete, power correction automatically turns on. Later it is possible to disable or enable again the power correction function.



Power Calibration with external power meter

The power calibration is performed for each channel individually.

NOTE

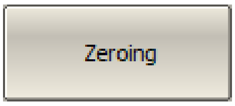
The power correction status is indicated in the channel status bar (See Channel Status Bar).

Power Calibration Procedure

Perform connection and setting of an external power meter as described in Power Meter Setting. Connect the sensor to test port 1 of the Analyzer and perform calibration as described below.

To open power calibration submenu, use the following softkeys:

Calibration > Calibrate > Power Calibration

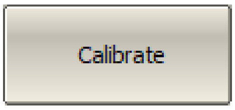


To zero power meter, use the following softkeys:

Calibration > Power Calibration > Zeroing

NOTE

The power meter sensor can be connected to the port, as during zero setting the output signal of the port is turned OFF.



To execute power calibration, use the following softkeys:

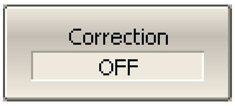
Calibration > Power Calibration > Calibrate

SCPI SOURce:POWer:PORT:CORRection:DATA? (Remote Only)

NOTE

After the power calibration is complete, power correction automatically turns ON.

Power Correction Setting



To enable/disable power correction, use the following softkeys:

Calibration > Power Calibration > Correction [ON | OFF]

SCPI SOURce:POWer:PORT:CORRection

Automatic Calibration Module

Automatic calibration modules (ACMs) are special devices, which allow to automate 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 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.

The ACM has two RF connectors for connecting to the test ports of a two-port 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 TRVNA software to perform full one-port or one-path 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.

The software allows to perform a user characterization and save the data to the ACM with the click of a button. To do this, the Analyzer test ports should be calibrated in configuration compatible with 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, the ACM ports are indicated by the letters A and B.

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.

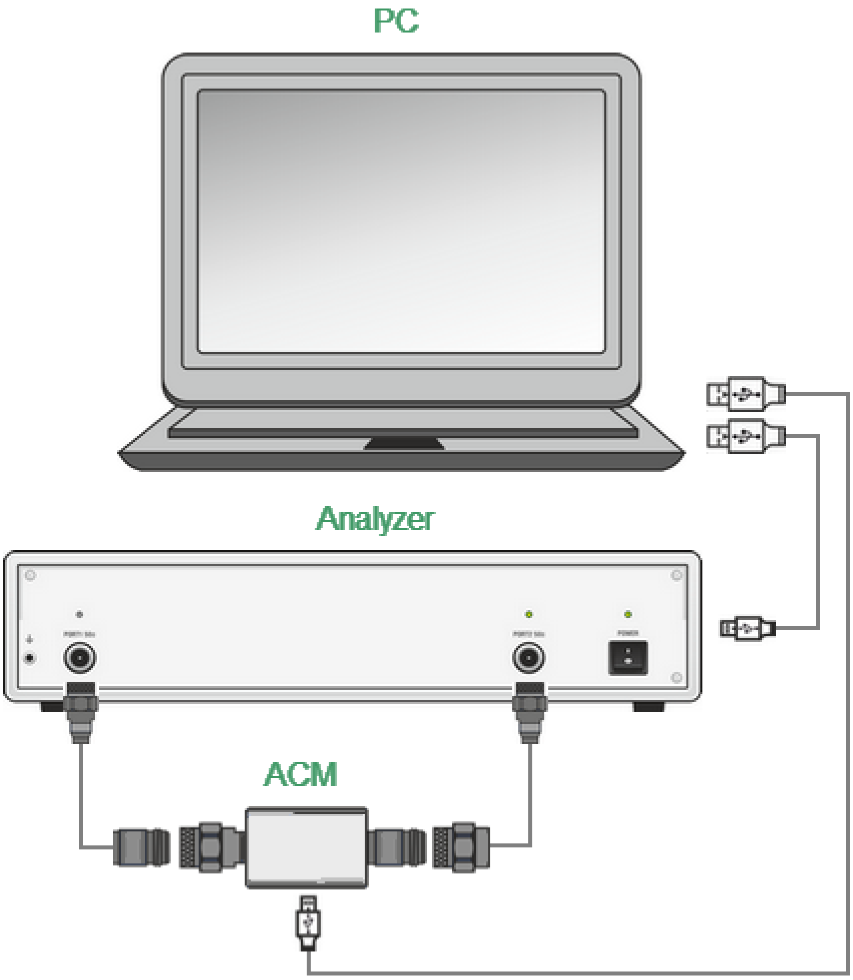
For a detailed comparison, the math (division) function can be used for data and memory.

Automatic Calibration Procedure

Settings Before Calibrating

Before calibrating the Analyzer with the ACM, perform some settings, i.e. activate a channel and set channel parameters (frequency range, IF bandwidth, etc.).

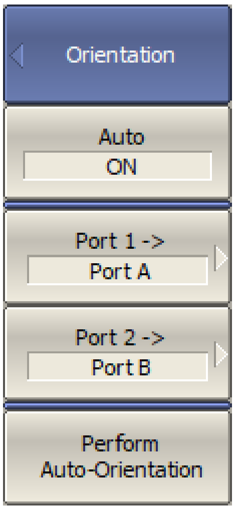
Connect the ACM to the Analyzer test ports and connect the USB port of the ACM to the USB port of the PC.



Calibration Connection

To open automatic calibration submenu, use the following softkeys:

Calibration > AutoCal



When selecting manual or automatic orientation for ACM, it is recommended to select the automatic orientation.

To enable auto orientation for ACM before performing each automatic calibration, use the following softkeys:

Orientation > Auto [ON | OFF]

To manually select the orientation, turn OFF **Auto**.

Use the **Port n -> {Port A | Port B | Port C | Port D}** softkeys to relate the analyzer test ports with the ACM ports.

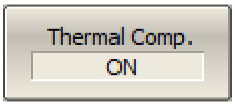
Regardless of the other settings, automatic orientation is performed immediately by clicking the **Perform Auto-Orientation** softkey.

SCPI

SENSe:CORRection:COLLect:ECAL:ORIentation:STATe

SENSe:CORRection:COLLect:ECAL:ORIentation:EXECute

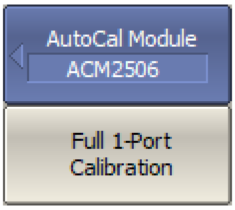
SENSe:CORRection:COLLect:ECAL:PATH



Enable or disable the thermal compensation using the **Thermal Comp. [ON | OFF]** softkey.

One/Two-Port Calibration Procedure

For a one/two-port calibration, connect any ports of the ACM to the ports to be calibrated on the Analyzer.



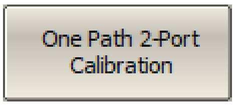
To perform full one-port calibration, click the **Full 1-Port Calibration** softkey.

Wait until calibration is complete.

During the measurement standards, pop-up windows will appear in the channel window. They will have a **Calibration** label and will indicate the progress of the measurement of the standards.

The instrument status bar will indicate **Calibration in progress...** when the automatic calibration is in progress.

SCPI SENSe:CORRection:COLLect:ECAL:SOLT1



To perform one path two-port calibration, click the **One Path 2-Port Calibration** softkey.

Wait until calibration is complete.

During the measurement standards, pop-up windows will appear in the channel window. They will have a **Calibration** label and will indicate the progress of the measurement of the standards.

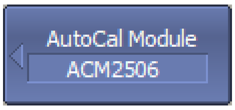
The instrument status bar will indicate **Calibration in progress...** when the automatic calibration is in progress.

SCPI SENSe:CORRection:COLLect:ECAL:SOLT2

User Characterization Procedure

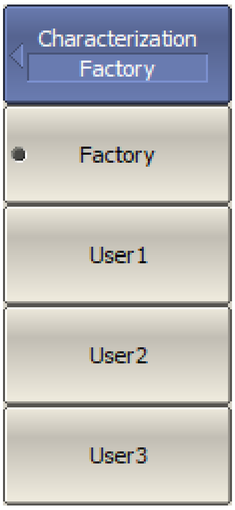
User characterization of ACM is required when modifying ACM connectors with adapters. The characterization is performed for the new ACM configuration, which includes adapters. To ensure calibration accuracy it is not recommended to disconnect and reconnect the adapters back after characterization until calibration is complete. TR analyzers cannot perform ACM characterization with adapters because it requires a full two-port calibration. TR analyzers can use user characterizations performed with another analyzer.

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.



To open automatic calibration submenu, use the following softkeys:

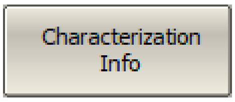
Calibration > AutoCal



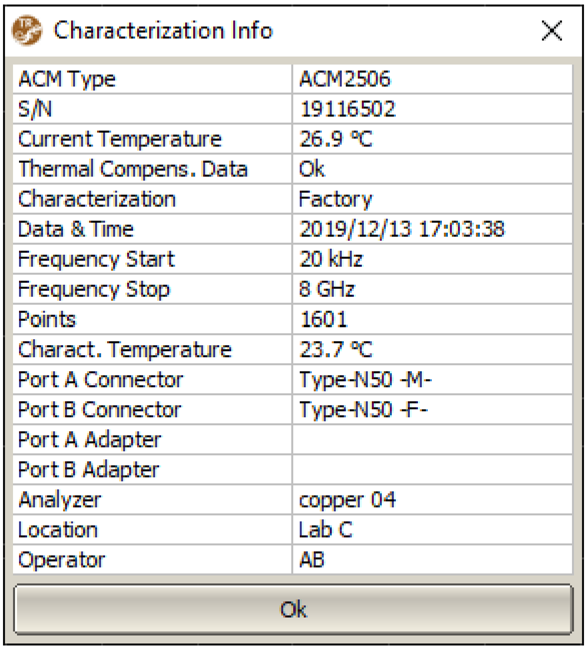
To select characterization, use the following softkeys:

Characterization > [Factory | User1 | User2 | User3]

SCPI SENSe:CORRection:COLLect:ECAL:UCHar



To display detailed information on characterization, click **Characterization Info** softkey, then a pop-up window will appear:

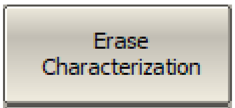


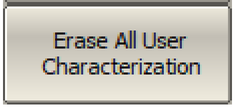
ACM Type	ACM2506
S/N	19116502
Current Temperature	26.9 °C
Thermal Compens. Data	Ok
Characterization	Factory
Data & Time	2019/12/13 17:03:38
Frequency Start	20 kHz
Frequency Stop	8 GHz
Points	1601
Charact. Temperature	23.7 °C
Port A Connector	Type-N50 -M-
Port B Connector	Type-N50 -F-
Port A Adapter	
Port B Adapter	
Analyzer	copper 04
Location	Lab C
Operator	AB

SCPI SENSe:CORRection:COLLect:ECAL:INFormation?

Erasing the User Characterization

Select the user characterization to be erased using the **Characterization** softkey.





Perform erase procedure using the **Erase Characterization** softkey.

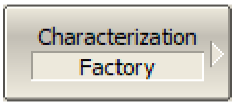
To erase all user characterizations, use the **Erase All User Characterization** softkey.

Confidence Check Procedure

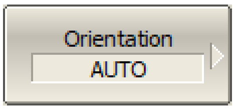
Perform a confidence check if the reliability of the current calibration needs to be verified. This function can be used to check the accuracy of either calibration performed with an ACM or with a mechanical calibration kit.

Connect the ACM to the Analyzer test ports and connect the USB port of the ACM to the USB port of the PC.

Enable the display of the data trace for the needed parameter, for example, S21. It is possible to enable several data traces simultaneously, for example, S11, S21.



Select characterization using the **Characterization** softkey.



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

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 S21. 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.

The conclusion on whether the current calibration provides sufficient accuracy or not is made by the user.

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.

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.

Trace Error Correction Status

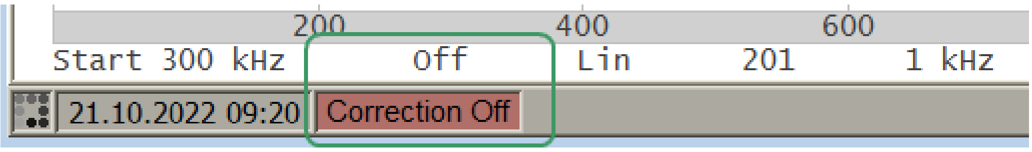
The error correction status is indicated for each trace individually. This status is indicated in the trace status field (See table below). For trace status field description, see Trace Status Field.

Symbols	Definition
RO	OPEN response calibration
RS	SHORT response calibration
RT	THRU response calibration
F1	Full one-port (SOL) calibration
OP	One-path two-port calibration

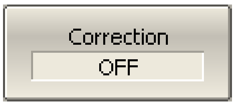
If the trace status bar is not the status of error correction, the calibration for the measured parameter is missing.

Error Correction Disabling

This feature allows to disable the error correction function, which automatically becomes enabled after completion of calibration by any method.



Disabled error correction function



To disable and enable the error correction function, use the following softkeys:

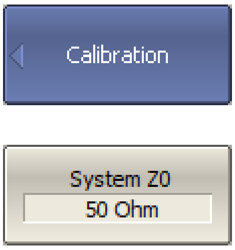
Calibration > Correction [ON | OFF]

SCPI SENSe:CORRection:STATe

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.

Manual Z0 Setting



To set the system impedance Z0, use the following softkeys:

Calibration > System Z0

SCPI SENSe:CORRection:IMPedance

NOTE The selection of the calibration kit automatically determines the system impedance 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.

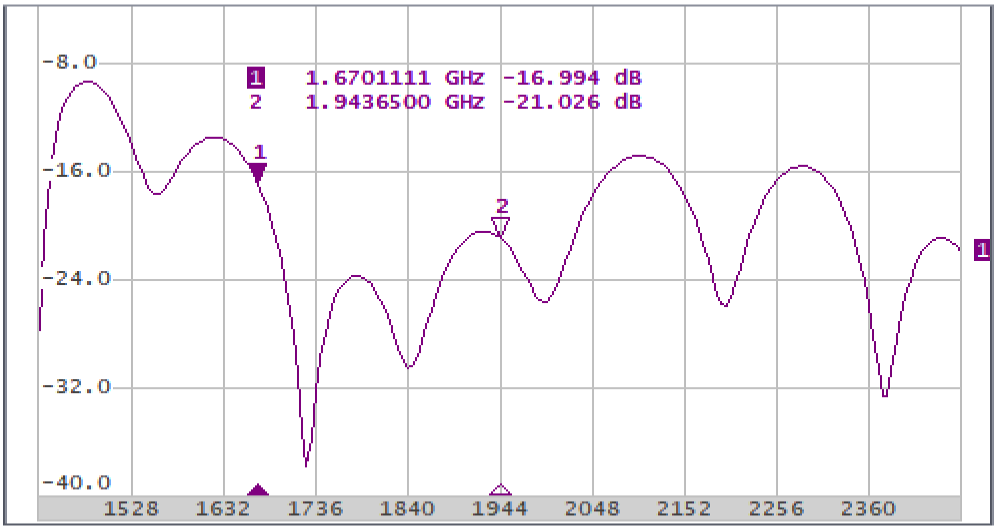
Special software marker tools are used to read and look up the numerical values of the stimulus and the measured value on selected points on the graph. For a detailed description see Markers.

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 is used to convert the measured characteristics in the frequency domain into the circuit response in the time domain.
- Time Domain Gating is used to eliminate unwanted responses in the time domain.
- S-Parameter Conversion is used to convert the measurement results into different parameters: impedance or admittance in reflection/transmission measurement, inverse S-parameter, 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.
2 ▽	Symbol and number of the inactive marker on a trace.
▲	Symbol of the active marker on a stimulus axis.
∆	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 Mag**	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 Mag**	S-parameter linear magnitude: $\sqrt{a^2 + b^2}$	Dimensionless value
Real Part	**Real**	S-parameter real part: $a = re(S)$	Dimensionless value

Format Type Description	Label	Data Type (Y-axis)	Measurement Unit (Y-axis)
Imaginary Part	**Imag**	S-parameter imaginary part: $b = im(S)$	Dimensionless value

- In circular format, the marker shows two or three values listed in the table below.

Label	Marker Readings (Measurement Unit)		
	Reading 1	Reading 2	Reading 3
Smith (Lin)	Linear magnitude	Phase (°)	—
Smith (Log)	Logarithmic magnitude (dB)	Phase (°)	—
Smith (Re/Im)	Real part	Imaginary part	—
Smith (R + jX)	Resistance (Ω)	Reactance (Ω)	Equivalent capacitance or inductance (F/H)
Smith (G + jB)	Conductance (S)	Susceptance (S)	Equivalent capacitance or inductance (F/H)
Polar (Lin)	Linear magnitude	Phase (°)	—
Polar (Log)	Logarithmic magnitude (dB)	Phase (°)	—
Polar (Re/Im)	Real part	Imaginary part	—

Marker Addition

To enable a new marker, use the following softkeys:

Markers > Add Marker

SCPI [CALCulate:MARKer](#)

NOTE The new marker appears as the active marker in the middle of the stimulus axis. The input field for the marker stimulus value is activated.

Marker Deletion

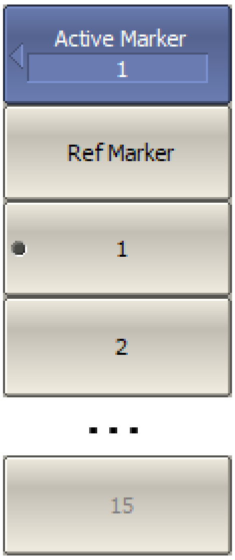
To delete a marker, use the following softkeys:

Markers > Remove Marker

To delete all the markers, use the following softkeys:

Markers > Remove All Markers

Marker Activation



To activate a marker by its number, use the following softkeys:

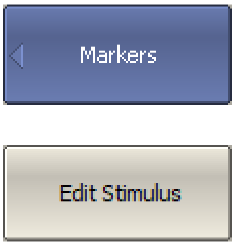
Markers > Active Marker > n

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 stimulus value, use the following softkeys:

Markers > Edit Stimulus

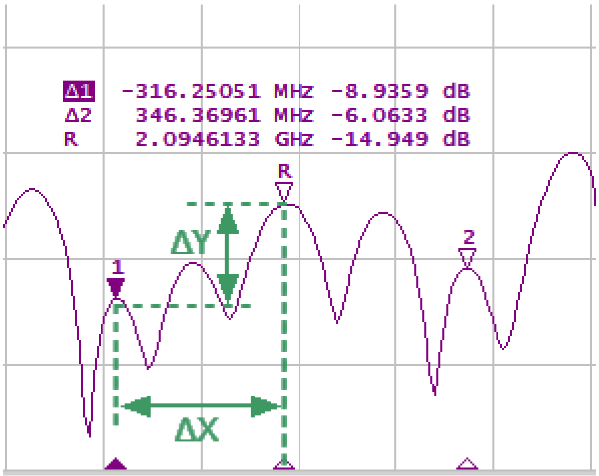
or click on the stimulus value field using the mouse.

Then, enter the value using the numerical keys on the keypad, by «↑», «↓» arrows.

SCPI CALCulate:MARKer:X

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.



```
Δ1  -316.25051 MHz  -8.9359 dB
Δ2   346.36961 MHz  -6.0633 dB
R    2.0946133 GHz  -14.949 dB
```

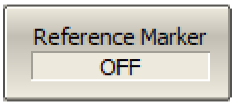
Reference marker

Reference marker can be indicated on the trace as follows:

R ▼	Symbol of the active reference marker on a trace.
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/disable the reference marker, use the following softkeys:

Markers > Reference Marker

SCPI CALCulate:MARKer

CALCulate:MARKer:ACTivate

CALCulate:MARKer:REFerence

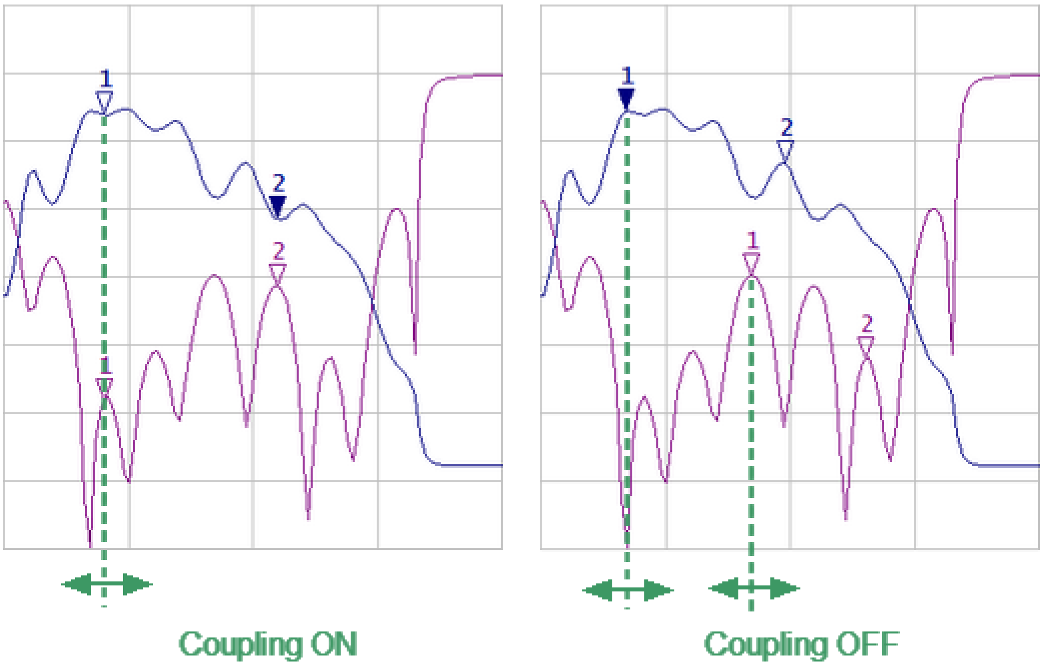
Marker Properties

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 Arrangement is the ability to rearrange the marker data display on the screen.
- 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

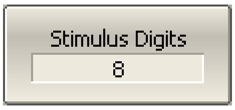
To enable/disable the marker coupling feature, use the following softkeys:

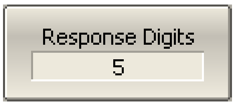
Markers > Properties > Marker Couple

SCPI CALCulate:MARKer:COUPle

Marker Value Indication Capacity

By default, the marker stimulus values are displayed with 8 decimal points and marker response values are displayed with 5 decimal points. These settings can be changed.


Stimulus Digits
8


Response Digits
5

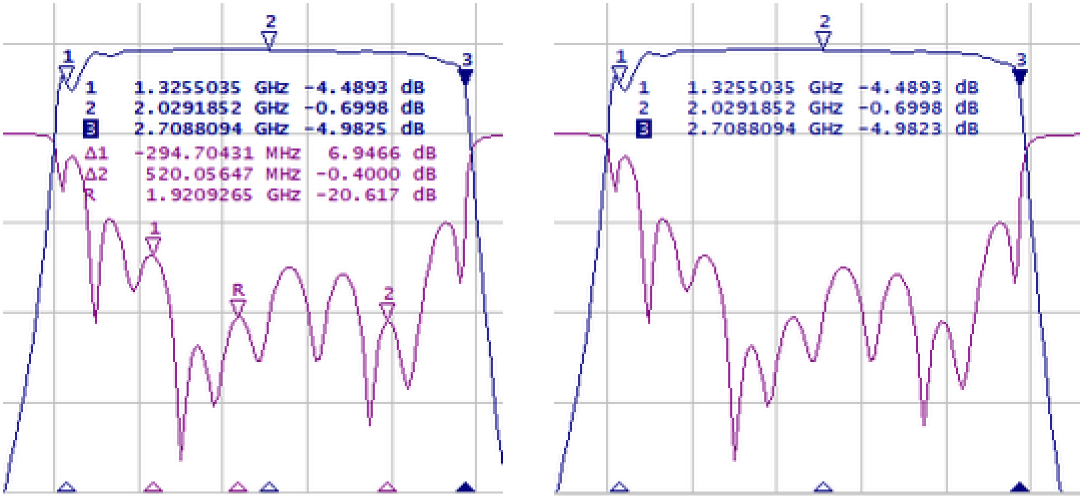
To set the marker value indication capacity, use the following softkeys:

Markers > Properties > Stimulus Digits

Markers > Properties > Response Digits

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.



```
1    1.3255035 GHz -4.4893 dB
2    2.0291852 GHz -0.6998 dB
3    2.7088094 GHz -4.9825 dB
Δ1  -294.70431 MHz  6.9466 dB
Δ2   520.05647 MHz -0.4000 dB
R    1.9209265 GHz -20.617 dB
```

```
1    1.3255035 GHz -4.4893 dB
2    2.0291852 GHz -0.6998 dB
3    2.7088094 GHz -4.9823 dB
```

Marker Data of All Traces

Active Only

Marker data display

To enable/disable the multi marker data display, toggle the softkey:

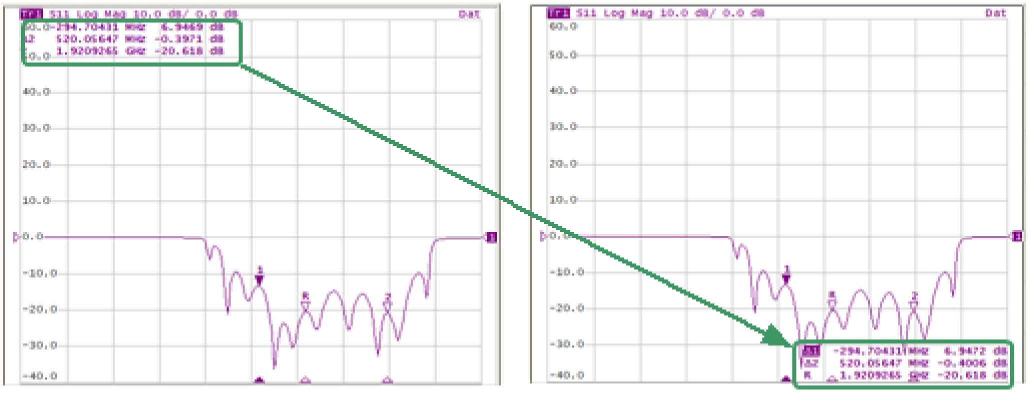
Markers > Properties > Active Only

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 Arrangement

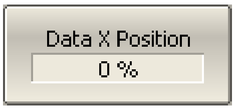
By default, marker data is displayed in the upper left corner of the screen. The marker data display can be rearranged on the screen. The marker data position on the screen is shown using two parameters - relative position on the X and Y axes, in percent. Zero percent is in the upper left corner, 100% is in the lower right corner (See figure below). Marker data position for each trace is set separately. This allows to avoid data overlapping on the screen.

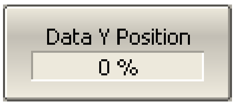


Data X Position = 0%
Data Y Position = 0%

Data X Position = 100%
Data Y Position = 100%

Marker data arrangement example





To arrange the marker data on the screen, enter the relative position on the X and Y axes, using the following softkeys:

Markers > Marker Properties > Data X Position

Markers > Marker Properties > Data Y Position

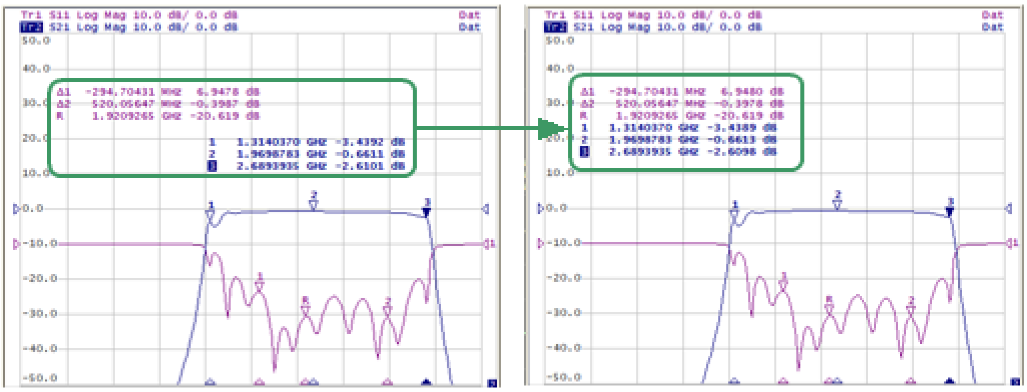
SCPI DISPlay:WINDow:TRACe:ANNotation:MARKer:POSition:X, DISPlay:WINDow:TRACe:ANNotation:MARKer:POSition:Y

NOTE The marker data can also be drag-and-dropped using the mouse.

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:

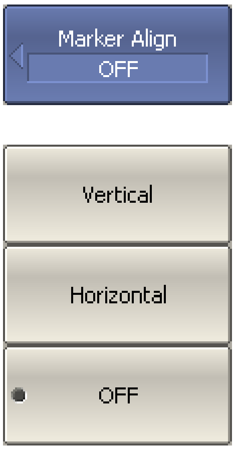
- Vertical — marker data of different traces are displayed one under another.
- Horizontal — marker data of different traces are displayed in line.


Tr1 S11 Log Mag 10.0 dB/ 0.0 dB Dat
Tr2 S21 Log Mag 10.0 dB/ 0.0 dB Dat
50.0
40.0
30.0
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
Δ1 -294.70431 MHz 6.9478 dB
Δ2 520.05647 MHz -0.3987 dB
R 1.9209265 GHz -20.619 dB
1 1.3140370 GHz -3.4392 dB
2 1.9698783 GHz -0.6611 dB
3 2.6893935 GHz -2.6101 dB
Tr1 S11 Log Mag 10.0 dB/ 0.0 dB Dat
Tr2 S21 Log Mag 10.0 dB/ 0.0 dB Dat
Δ1 -294.70431 MHz 6.9480 dB
Δ2 520.05647 MHz -0.3978 dB
R 1.9209265 GHz -20.619 dB
1 1.3140370 GHz -3.4189 dB
2 1.9698783 GHz -0.6613 dB
3 2.6893935 GHz -2.6098 dB

Alignment OFF

Alignment is Vertical

Marker data alignment example



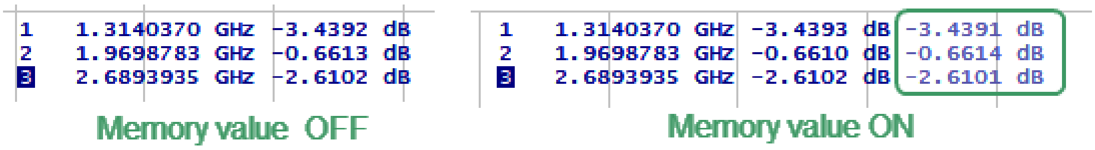
To set the marker data alignment, use the following softkeys:

Markers > Marker Properties > Align > [Vertical | Horizontal | OFF]

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.



```
1    1.3140370 GHz  -3.4392 dB
2    1.9698783 GHz  -0.6613 dB
3    2.6893935 GHz  -2.6102 dB
```

```
1    1.3140370 GHz  -3.4393 dB  -3.4391 dB
2    1.9698783 GHz  -0.6610 dB  -0.6614 dB
3    2.6893935 GHz  -2.6102 dB  -2.6101 dB
```

Memory trace value display

To enable/disable the display of memory trace marker values, toggle the softkey:

Marker > Maker Properties > Memory Value [ON | OFF]

Marker Position Search Functions

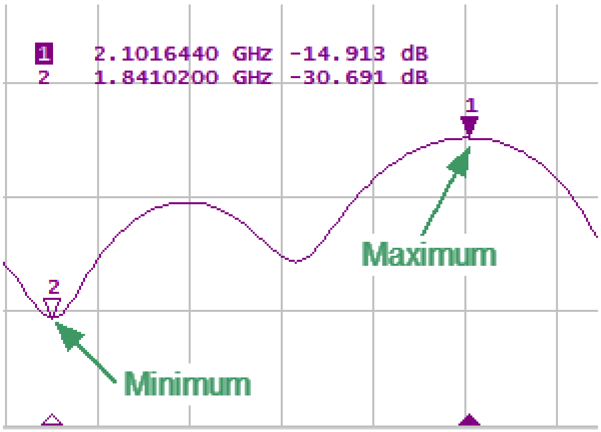
The marker position search function allows to find the following values on a trace:

- 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).



```
1   2.1016440 GHz  -14.913 dB
2   1.8410200 GHz  -30.691 dB
```

Maximum and minimum search

To find the maximum or minimum values on a trace, use the following softkeys:

Markers > Marker Search > Maximum

Markers > Marker Search > Minimum

SCPI CALCulate:MARKer:FUNCtion:EXECute

CALCulate:MARKer:FUNCtion:TYPE

NOTE Activate the marker before starting maximum or minimum search (See Marker Activation).

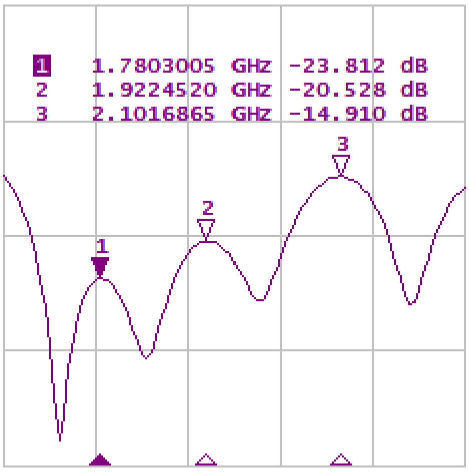
In Smith chart and polar formats, the search is executed for the first marker value.

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.

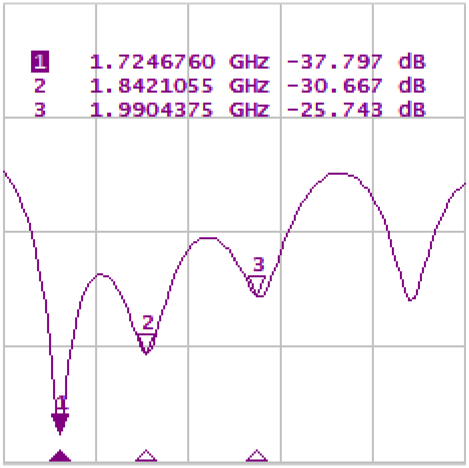
Peak is considered **positive** if the value of the peak is greater than the values of the adjacent points (See figure below).



```
1   1.7803005 GHz  -23.812 dB
2   1.9224520 GHz  -20.528 dB
3   2.1016865 GHz  -14.910 dB
```

Positive peaks

Peak is considered **negative** if the value of the peak is smaller than the values of the adjacent points (See figure below).



```
1   1.7246760 GHz  -37.797 dB
2   1.8421055 GHz  -30.667 dB
3   1.9904375 GHz  -25.743 dB
```

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.

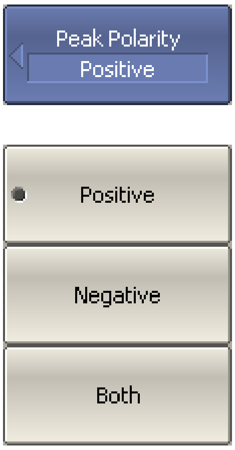
The following options for the peak search are available:

- 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 set the polarity of the peak, use the following softkeys:

Markers > Marker Search > Peak > Peak Polarity > [Positive | Negative | Both]

SCPI CALCulate:MARKer:FUNCtion:PPOLarity

To enter the peak excursion value, use the following softkeys:

Markers > Marker Search > Peak > Peak Excursion

Then enter the value using the numerical keypad.

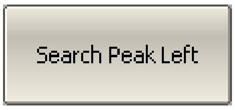
SCPI CALCulate:MARKer:FUNCtion:PEXCursion

To activate the nearest peak search, use the following softkeys:

Markers > Marker Search > Peak > Search Peak

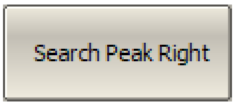
To activate the greatest peak search, use the following softkeys:

Markers > Marker Search > Peak > Search Max Peak



To activate the left peak search, use the following softkeys:

Markers > Marker Search > Peak > Search Peak Left



To activate the left peak search, use the following softkeys:

Markers > Marker Search > Peak > Search Peak Right

SCPI CALCulate:MARKer:FUNCtion:TYPE

CALCulate:MARKer:FUNCtion:EXECute

NOTE Activate the marker before starting maximum or minimum search (See Marker Activation).

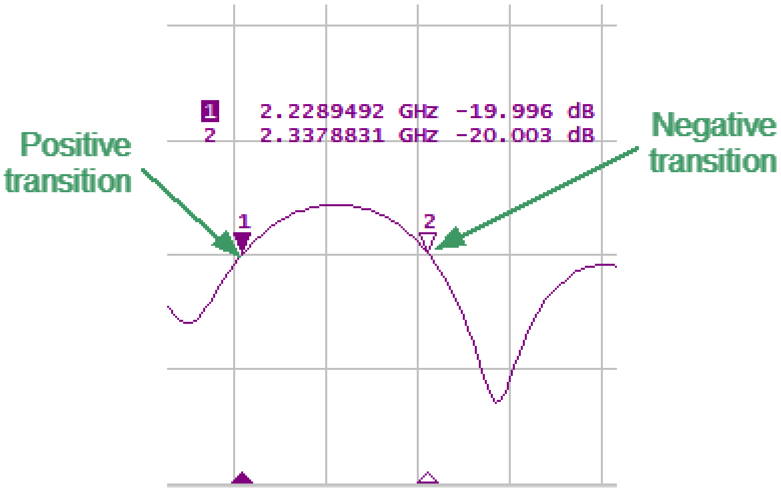
In Smith chart and Polar formats, the search is executed for the first marker value.

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.

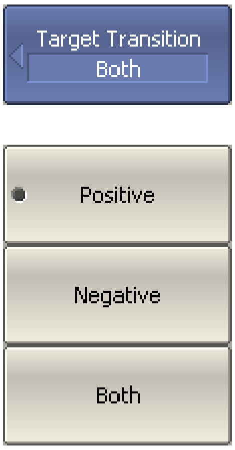


Target level search

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:

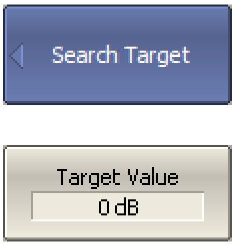
- search for nearest target
- search for left target
- search for right target



To set the transition polarity, use the following softkeys:

Markers > Marker Search > Target > Target Transition > [Positive | Negative | Both]

SCPI CALCulate:MARKer:FUNCtion:TTRansition



To enter the target level value, use the following softkeys:

Markers > Marker Search > Target > Target Value

Then enter the value using the numerical keypad.

SCPI CALCulate:MARKer:FUNCtion:TARGet

To activate the nearest target search, use the following softkeys:

Markers > Marker Search > Target > Search Target

To activate the left target search, use the following softkeys:

Markers > Marker Search > Target > Search Target Left

To activate the right target search, use the following softkeys:

Markers > Marker Search > Target > Search Target Right

SCPI CALCulate:MARKer:FUNCtion:TYPE

CALCulate:MARKer:FUNCtion:EXECute

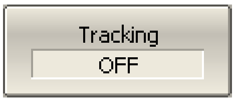
NOTE

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/disable search tracking mode, use the following softkeys:

Markers > Marker Search > Tracking [ON | OFF]

SCPI CALCulate:MARKer:FUNCtion:TRACking

Search Range

The search range for the marker position search can be set by setting the stimulus limits. This function includes the following additional features:

- Search range coupling, which allows to define the same search range for all the traces of a channel.
- Vertical line indication of the search range limits.

To enable/disable the search range, use the following softkeys:

Markers > Marker Search > Search Range [ON | OFF]

SCPI CALCulate:MARKer:FUNCtion:DOMain

To set the search range limits, use the following softkeys:

Markers > Marker Search > Search Start

Markers > Marker Search > Search Stop

SCPI CALCulate:MARKer:FUNCtion:DOMain:STARt, CALCulate:MARKer:FUNCtion:DOMain:STOP

Marker Math Functions

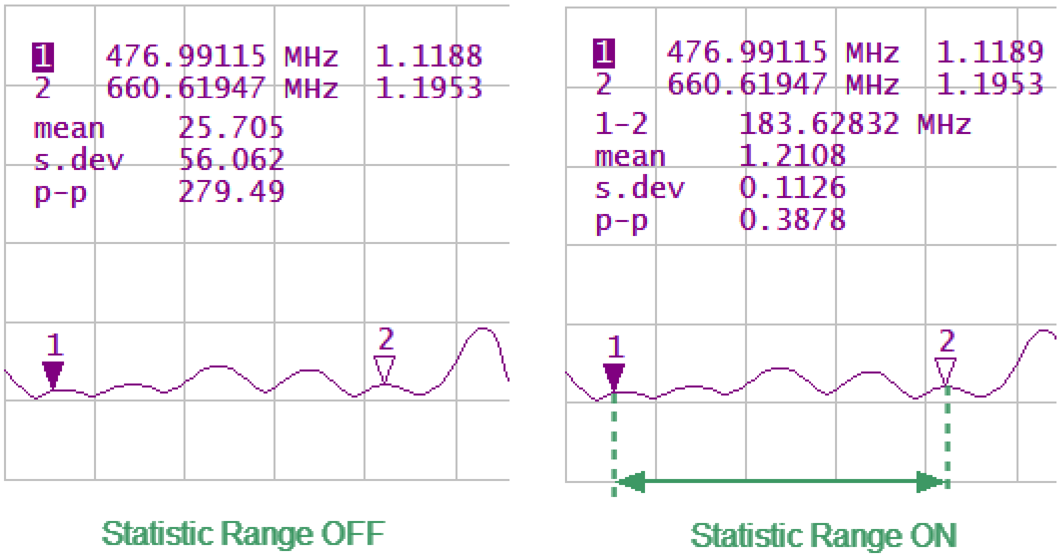
Marker math functions use markers to calculate various trace characteristics. Four marker math functions are available:

- 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).



```
1   476.99115 MHz  1.1188
2   660.61947 MHz  1.1953
mean     25.705
s.dev    56.062
p-p      279.49
```

Statistic Range OFF

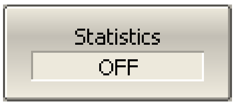
```
1   476.99115 MHz  1.1189
2   660.61947 MHz  1.1953
1-2      183.62832 MHz
mean     1.2108
s.dev    0.1126
p-p      0.3878
```

Statistic Range ON

Trace statistics

Trace Statistics parameter

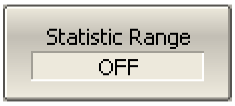
Symbol	Definition	Formula
mean	Arithmetic mean	$M = \frac{1}{N} \cdot \sum_{i=1}^{N} x_i$
s.dev	Standard deviation	$\sqrt{\frac{1}{N-1} \cdot \sum_{i=1}^{N} (x_i - M)^2}$
p-p	Peak-to-Peak: difference between the maximum and minimum values	Max – Min



To enable/disable trace statistics function, use the following softkeys:

Markers > Marker Math > Statistics > Statistics [ON | OFF]

SCPI CALCulate:MSTatistics



To enable/disable trace statistics range, use the following softkeys:

Markers > Marker Math > Statistics > Statistic Range [ON | OFF]

SCPI CALCulate:MSTatistics:DOMain

To set the start/stop markers of the statistics range, use the following softkeys:

Markers > Marker Math > Statistics > Statistic Start

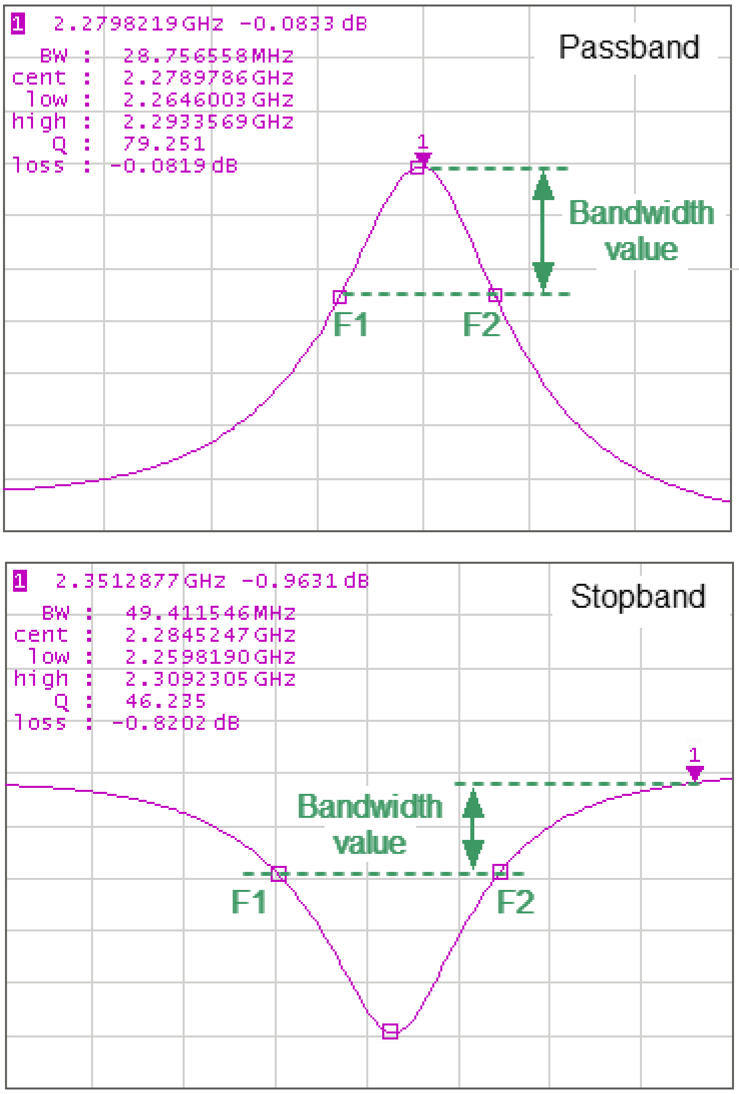
Markers > Marker Math > Statistics > Statistic Stop

SCPI CALCulate:MSTatistics:DOMain:STARt, CALCulate:MSTatistics:DOMain:STOP

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 (See figure below).

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 (usually – 3 dB).



```
1  2.2798219 GHz -0.0833 dB
  BW :  28.756558 MHz
cent :  2.2789786 GHz
 low :  2.2646003 GHz
high :  2.2933569 GHz
   Q :  79.251
loss : -0.0819 dB
```

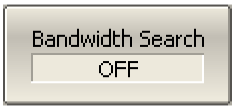
```
1  2.3512877 GHz -0.9631 dB
  BW :  49.411546 MHz
cent :  2.2845247 GHz
 low :  2.2598190 GHz
high :  2.3092305 GHz
   Q :  46.235
loss : -0.8202 dB
```

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.	—

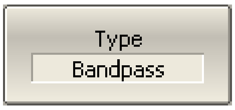


To enable/disable bandwidth search function, use the following softkeys:

Markers > Marker Math > Bandwidth Search > Bandwidth Search

SCPI CALCulate:MARKer:BWIDth

CALCulate:MARKer:BWIDth:DATA? (Remote only)

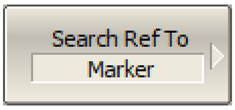


Set the bandwidth search type by softkeys:

Markers > Marker Math > Bandwidth Search > Type

The type and the softkey label toggle between **Bandpass** and **Notch** settings.

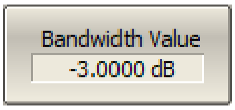
SCPI CALCulate:MARKer:BWIDth:TYPE



To set the search reference point, use the following softkeys:

Markers > Marker Math > Bandwidth Search > Search Ref To > [Marker | Maximum | Minimum]

SCPI CALCulate:MARKer:BWIDth:REFerence



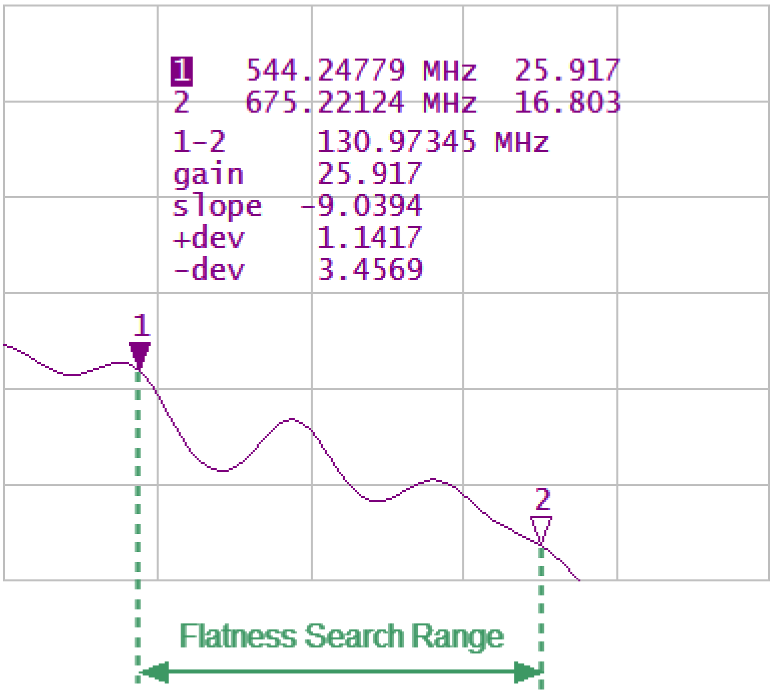
To enter the bandwidth value, use the following softkeys:

Markers > Marker Math > Bandwidth Search > Bandwidth Value

SCPI CALCulate:MARKer:BWIDth:THReshold

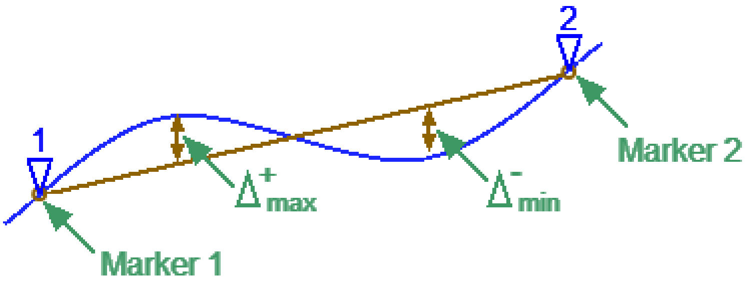
Flatness

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).



```
1   544.24779 MHz  25.917
2   675.22124 MHz  16.803
1-2       130.97345 MHz
gain      25.917
slope    -9.0394
+dev      1.1417
-dev      3.4569
```

Flatness Search



$$\text{Flatness} = \Delta^{+}_{max} + \Delta^{-}_{min}$$

Flatness parameters determination

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/disable the flatness search function, use the following softkeys:

Markers > Marker Math > Flatness > Flatness

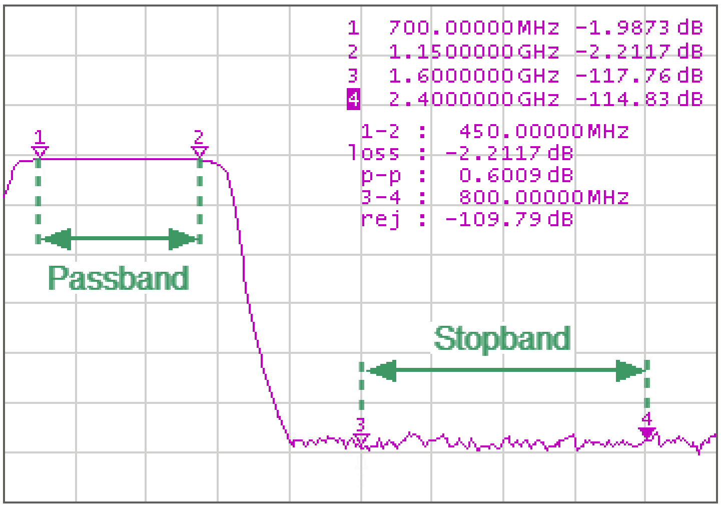
To select the markers specifying the flatness search range, use softkeys:

Markers > Marker Math > Flatness > Flatness Start

Markers > Marker Math > Flatness > Flatness Stop

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).

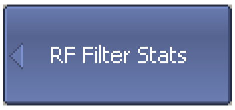


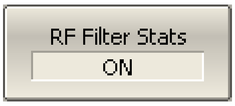
```
1   700.00000MHz  -1.9873 dB
2   1.1500000GHz  -2.2117 dB
3   1.6000000GHz  -117.76 dB
4   2.4000000GHz  -114.83 dB
 1-2 :   450.00000MHz
loss : -2.2117 dB
 p-p :   0.6009 dB
 3-4 :   800.00000MHz
 rej : -109.79 dB
```

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/disable the RF filter statistics function, use the following softkeys:

Markers > Marker Math > RF Filter Stats > RF Filter Stats

To select the markers specifying the passband, use the following softkeys:

Markers > Marker Math > RF Filter Stats > Passband Start

Markers > Marker Math > RF Filter Stats > Passband Stop

To select the markers specifying the stopband, use the following softkeys:

Markers > Marker Math > RF Filter Stats > Stopband Start

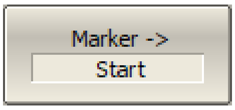
Markers > Marker Math > RF Filter Stats > Stopband Stop

Marker Functions

Using the current position of a marker, the following parameter settings can be set:

- stimulus start
- stimulus stop
- stimulus center
- reference level

Activate the marker before adjusting these settings (See Marker Activation).

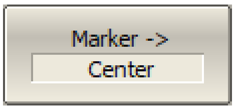


To set the stimulus start, use the following softkeys:

Markers > Marker Functions > Marker–>Start

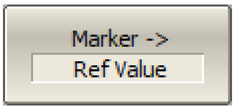
To set the stimulus stop, use the following softkeys:

Markers > Marker Functions > Marker–>Stop



To set the stimulus center, use the following softkeys:

Markers > Marker Functions > Marker–>Center



To set the reference level, use the following softkeys:

Markers > Marker Functions > Marker–>Ref Value

SCPI CALCulate:MARKer:SET

To set reference marker to the active marker point, use the following softkeys:

Markers > Marker Functions > Marker–>Ref Marker

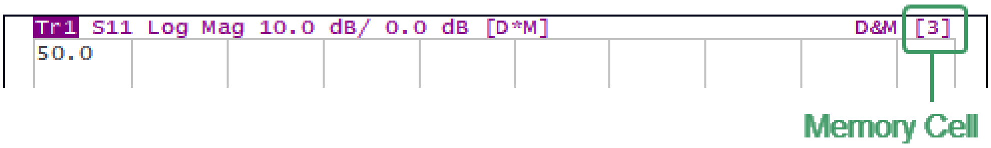
Memory Trace Function

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 memory trace is displayed in the same color as the associated data trace, but its brightness is twice as low.

The following settings of the memory and traces display can be performed:

Trace Display	Trace status field
Data and memory	**D&M**
Memory only	**Mem**
Data only	**Dat**
Data and memory OFF	**Off**

Up to eight associated memory traces can be saved for each data trace. The first memory trace will be saved into memory cell 1. The second memory trace will be saved into memory cell 2 etc. The memory cell number is displayed near type of traces (See figure below).



```
Tr1 S11 Log Mag 10.0 dB/ 0.0 dB [D*M]                    D&M [3]
50.0
```

Memory cell number in the trace status line

The memory trace is used for displaying and mathematical operations with data trace. For a detail description see Mathematical Operations.

Since complex measurement data is saved in memory, not their graphical representation. Consequently:

- Mathematical operations are carried out between the current and stored S-parameters.
- The memory trace changes similar to an associated data trace when the settings are changed, such as Format, Electrical delay, Time domain, etc.

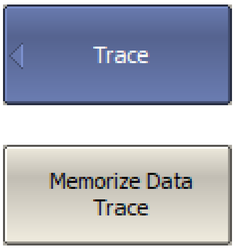
If the changes occurred after the memory trace was created, the following data trace parameters do not affect the memory trace:

- frequency range
- number of points
- sweep type
- power in frequency sweep mode
- frequency in power sweep mode
- measured parameter (S-parameter)
- IF bandwidth
- calibration

Saving Data Trace into Memory

The function of saving data traces into memory is applied to an individual trace.

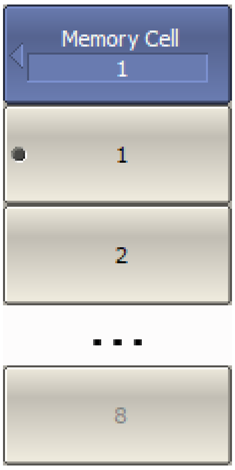
The trace to which the function is applied must be preselected as active (See Selection of Active Trace/Channel).



To save an active data trace into the memory, use the following softkeys:

Trace > Memorize Data Trace

SCPI CALCulate:MATH:MEMorize



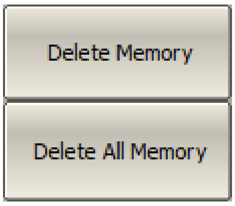
To activate a memory trace, use the following softkeys:

Trace > Memory Cell

Then select the memory cell.

Memory Trace Deleting

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



To erase the memory of the active trace, use the following softkeys:

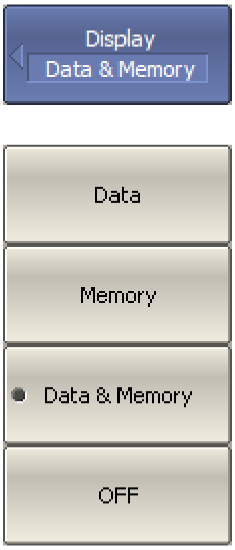
Trace > Delete Memory

To clear all memory traces, use the following softkeys:

Trace > Delete All Memory

Trace Display Setting

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



To set the type of traces to be displayed on the screen, use the following softkeys:

Trace > Display > [Data | Memory | Data & Memory | OFF]

SCPI DISPlay:WINDow:TRACe:MEMory

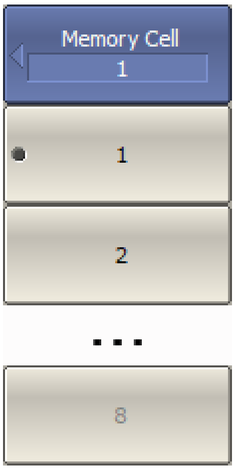
DISPlay:WINDow:TRACe:STATe

NOTE Trace display setting can be set using the mouse (See Trace Display Setting).

Mathematical Operations

The memory trace active 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:

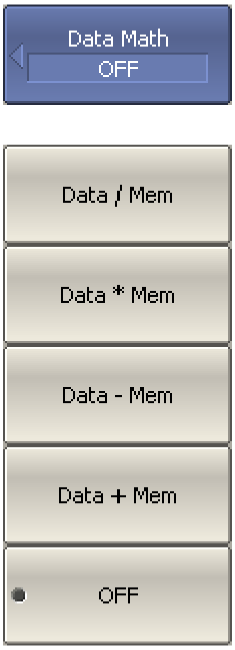
Data/ Memory	Divides the measured data by the memory data. The trace status field indicates: **D/M**.
Data* Memory	Multiplies the measured data by the memory data. The trace status field indicates: **D*M**.
Data– Memory	Subtracts a memory data from the measured data. The trace status field indicates: **D–M**.
Data+ Memory	Adds the measured data to the memory data. The trace status field indicates: **D+M**.



To activate a memory trace, use the following softkeys:

Trace > Memory Cell

Then select the memory cell.



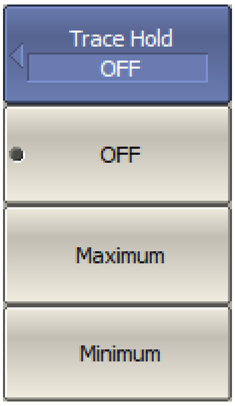
To access math operations, use the following softkeys:

Trace > Data Math > [Data / Mem | Data * Mem | Data – Mem | Data + Mem | OFF]

SCPI CALCulate:MATH:FUNCtion

Trace Hold

The trace hold function is used to hold the maximum or minimum values of the trace. When the function is enabled, the maximum or the minimum of any active measurement displays instead of the real-time data, and the inscription **[Max hold]** or **[Min hold]** appears in the trace status bar (See Trace Status Field).



To turn ON/OFF trace hold function press the following softkeys:

Trace > Trace Hold

Select the hold type:

- **OFF**
- **Maximum**
- **Minimum**

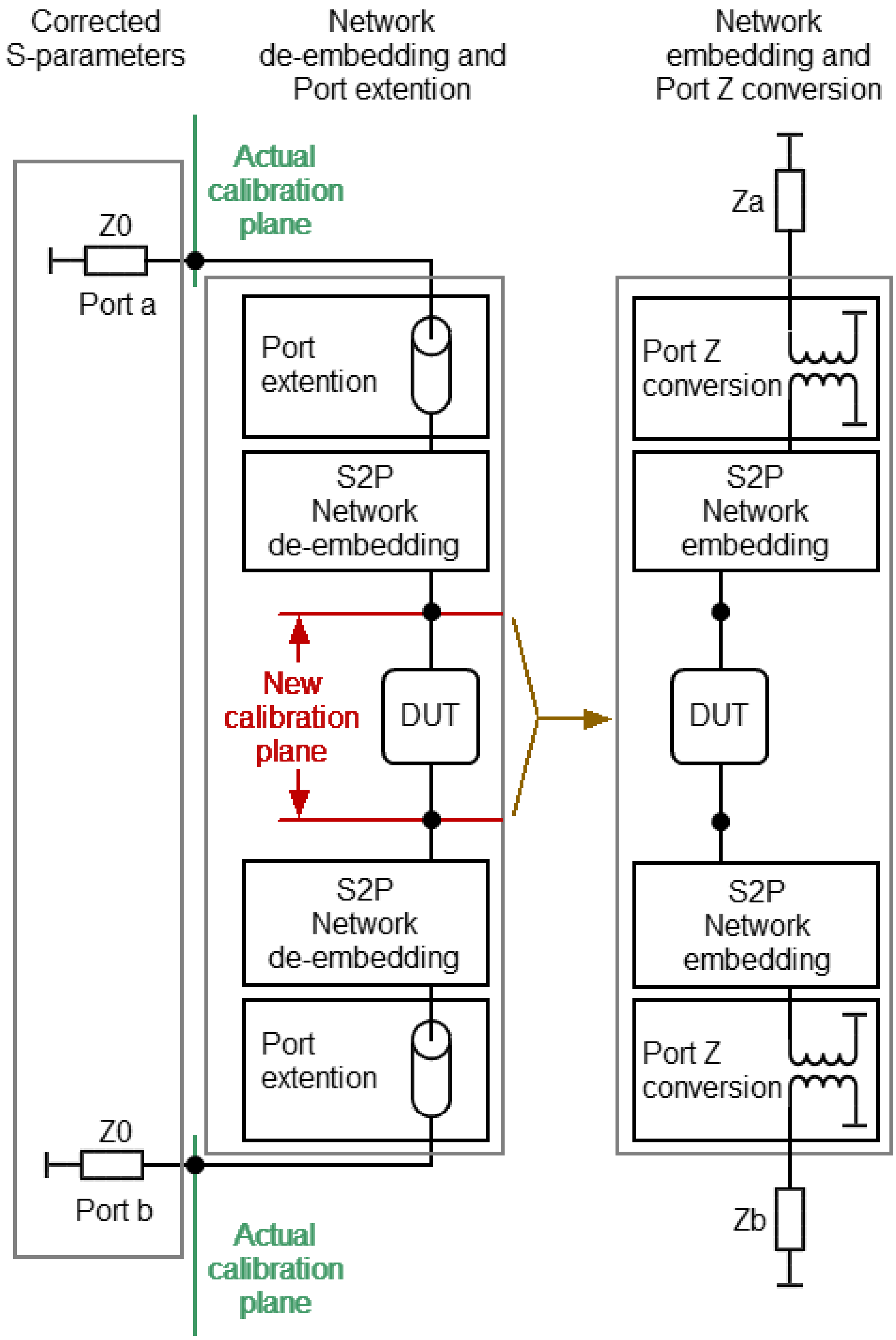
The **Restart** softkey is used to restart the trace hold.

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:

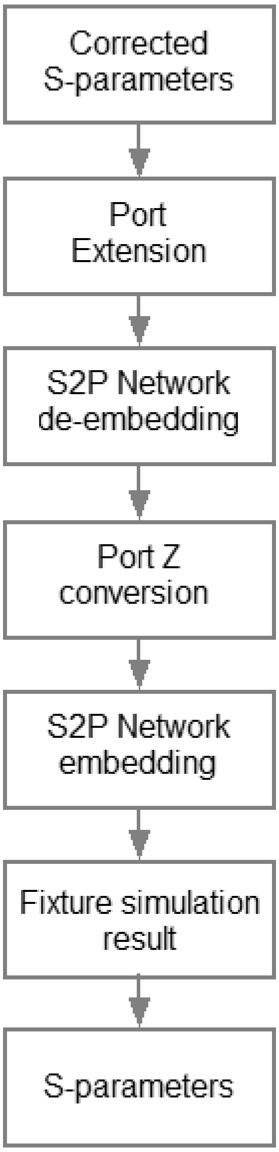
- Port Extension or Automatic Port Extension
- Port reference impedance conversion
- Circuit de-embedding
- Circuit embedding

The logic diagram of the fixture simulation function is shown in the figure below.



Logic diagram of fixture simulation function

The data processing flow diagram of the fixture simulation feature is shown in the the figure below.

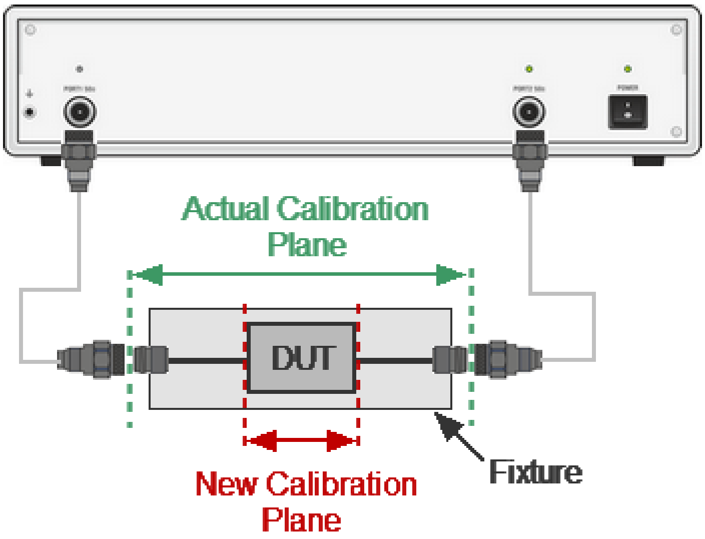


Data processing flow diagram of fixture simulation function

The channel to which the function is applied must be preselected as active (See Selection of Active Trace/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

$$\Delta\varphi = e^{-j\cdot 2\pi\cdot f\cdot \tau},$$

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)

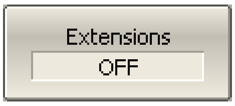
$$L(f) = L_0 + (L_1 - L_0)\sqrt{\frac{f}{F_1}}$$

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 is.



To enable the port extension function, use the following softkeys:

Calibration > Port Extensions > Extensions [ON | OFF]

SCPI SENSe:CORRection:EXTension

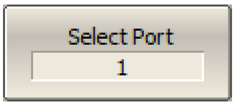
To set the electrical delay for each port, use the following softkeys:

Extension Port1 or **Extension Port2**

SCPI SENSe:CORRection:EXTension:PORT:TIME

To open the menu of the losses, use the following softkeys:

Calibration > Port Extensions >Loss

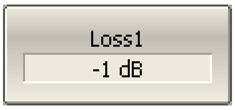


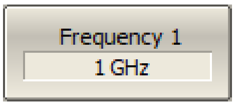
To select the port in menu, use softkey:

Select Port [1 | 2]

Enter the L_1, F_1 values and enable the use of these values in further calculations using the following softkeys:

Loss1 [ON | OFF]

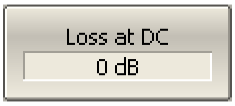




Loss1

Frequency 1

Perform the same steps for L_2, F_2.



Enter the L_0 value using the following softkey:

Loss at DC

SCPI SENSe:CORRection:EXTension:PORT:INCLude

SENSe:CORRection:EXTension:PORT:FREQuency

SENSe:CORRection:EXTension:PORT:LOSS

SENSe:CORRection:EXTension:PORT:LDC

Automatic Port Extension

NOTE

The construction feature of TR analyzers (see Principles of Operation) is that port 1 is a source port and receiver, and port 2 is only a receiver. In this regard, the Auto Port Extension function is applicable only to port1.

The auto port extension function allows 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.

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).

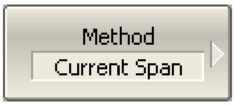
The result of the auto port extension function is the calculation of the electrical delay value. After auto port extension completes, this delay value appears in the corresponding field of the **Port Extension** menu, and the port extension function is automatically enabled if it was disabled.

If the **Include Loss** option is enabled prior to the auto port extension function running, the loss values **Loss1**, **Loss2** at the respective frequency values **Frequence1**, **Frequence2** will be calculated and applied. The **Frequence1**, **Frequence2** 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 **Frequence2** 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 the loss at the lower frequency of the current range is used as the **Loss at DC** value.

To open the menu of the auto port extension function, use the following softkeys:

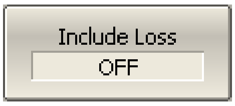
Calibration > Port Extensions > Auto Port Extension



Then select the frequency range:

Method [Current Span | Active Marker | User Span]

SCPI SENSe:CORRection:EXTension:AUTO:CONFig



Enable the include loss function **Loss1, Loss2**, if required:

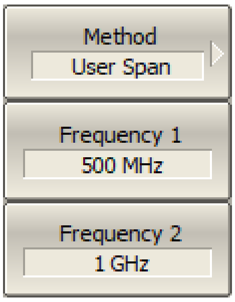
Include Loss [ON | OFF]

Enable adjust mismatch function **Loss at DC**, if required:

Adjust Mismatch [ON | OFF]

SCPI SENSe:CORRection:EXTension:AUTO:LOSS

SENSe:CORRection:EXTension:AUTO:DCOFfset

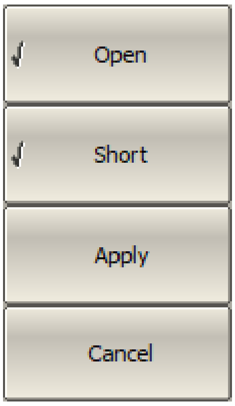


When using **User Span** method, select frequency range, using the following softkeys:

Frequence 1

Frequence 2

SCPI SENSe:CORRection:EXTension:AUTO:STARt, SENSe:CORRection:EXTension:AUTO:STOP



Execute the auto port extension function after connecting OPEN or SHORT standard to the port. Perform measurements clicking the softkey **Open** or **Short** corresponding to the connected standard. During the measurement, a pop up window will appear in the channel window. It will have **Auto Port Extension** label and will indicate the progress of the measurement.

On completion of the measurement, a checkmark will appear in the left part of the softkey.

If both measurements have been performed, the result will appear as the average value of the two.

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

To clear the measurement results of the standard, click **Cancel**.

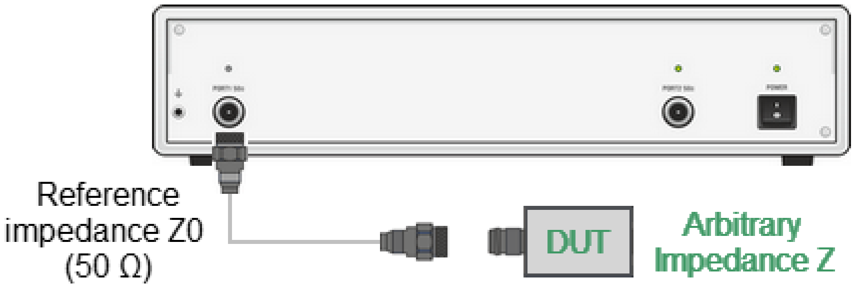
SCPI SENSe:CORRection:EXTension:AUTO:MEASure

SENSe:CORRection:EXTension:AUTO:SAVE

SENSe:CORRection:EXTension:AUTO:RESet

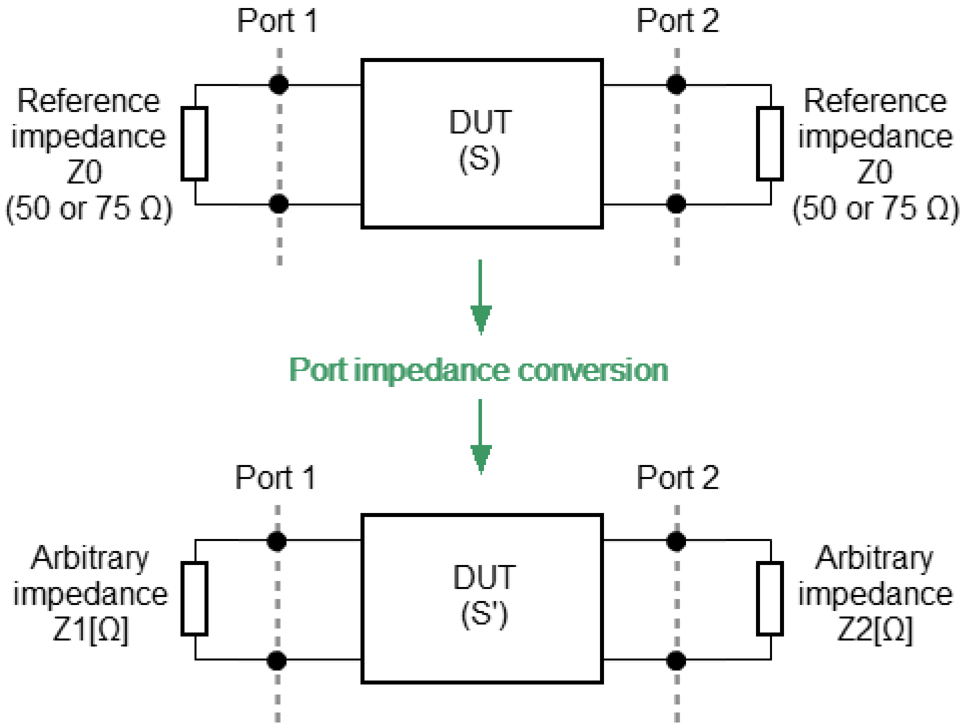
Port Reference Impedance (Z) Conversion

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 program.



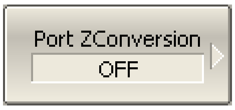
Measurement of DUT with arbitrary impedance

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 Z1 (See figure below). The function is also referred to as the renormalization transformation of S-parameters.



Port reference impedance conversion

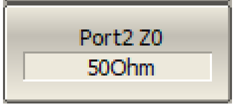
NOTE The source value of the Z0 port reference impedance (commonly 50 Ω) is defined in the process of the calibration. It is determined by the characteristic impedance of the calibration kit and its value is entered as described in System Impedance Z0.



To enable/disable the port reference impedance conversion function, use the following softkeys:

Analysis > Fixture Simulator > Port Z Conversion > Port Z Conversion [ON | OFF]

SCPI CALCulate:FSIMulator:SENDed:ZCONversion:STATe

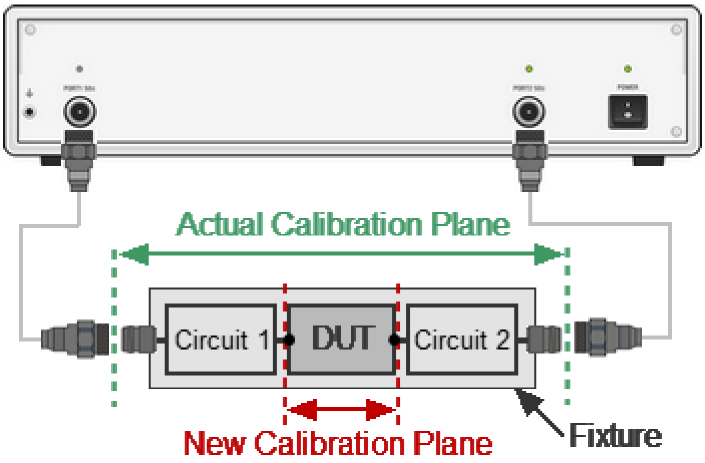


To enter the value of the simulated impedance of Port n, use the **Port 1 Z0** and **Port 2 Z0** softkeys.

SCPI CALCulate:FSIMulator:SENDed:ZCONversion:PORT:Z0

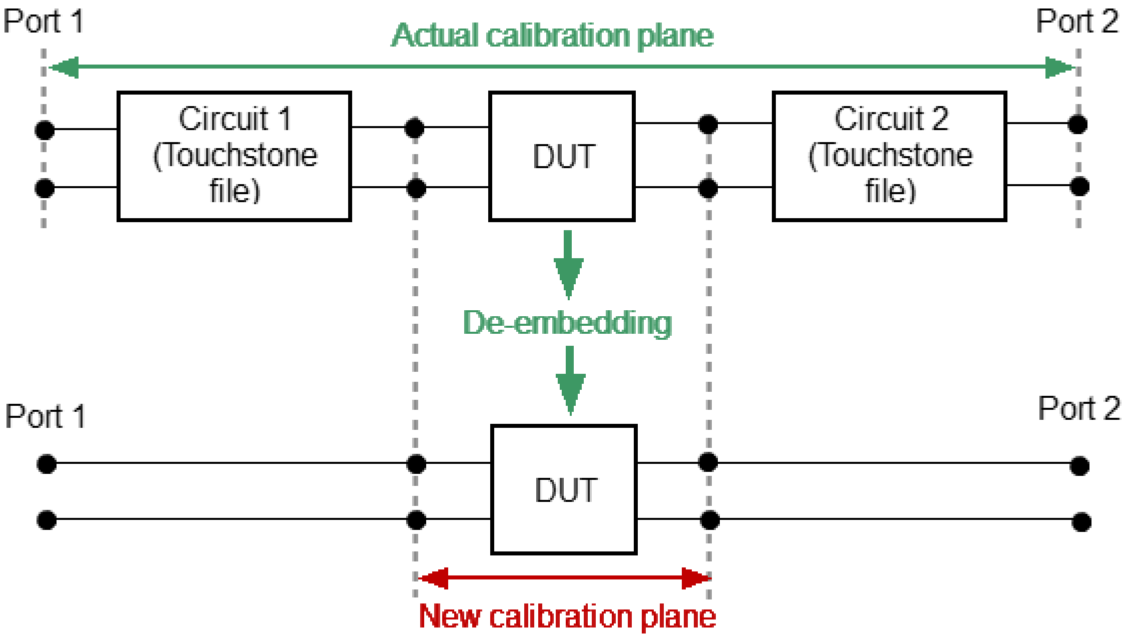
De-embedding

De-embedding is a function of transforming the S-parameter by eliminating some circuit effect from the measurement results. 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. This method is similar in meaning but mathematically more rigorous than port expansion.



De-embedding

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 process

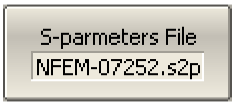
The circuit being removed should be defined in the data file containing S-parameters of that circuit. The circuit should be described as 2-port in Touchstone file (extension *.S2P), which contains the S-parameter table: S11, S21, S12, S22 for a number of frequencies.

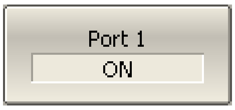
NOTE

The S-matrices of all de-embedding circuits are oriented so that the S11 is directed to the Analyzer port and S22 directed to the DUT.

To open the de-embedding function submenu, use the following softkeys:

Analysis > Fixture Simulator > De-Embedding





If the S-parameters file is not specified, the softkey for Port n activation will be grayed out.

To enter the file name of the de-embedded circuit S-parameters of Port n, use the following softkeys:

Analysis > Fixture Simulator > De-Embedding > S-parameters File

To enable/disable the de-embedding function for Port n, use the following softkeys:

Analysis > Fixture Simulator > De-Embedding > Port n [ON | OFF]

SCPI

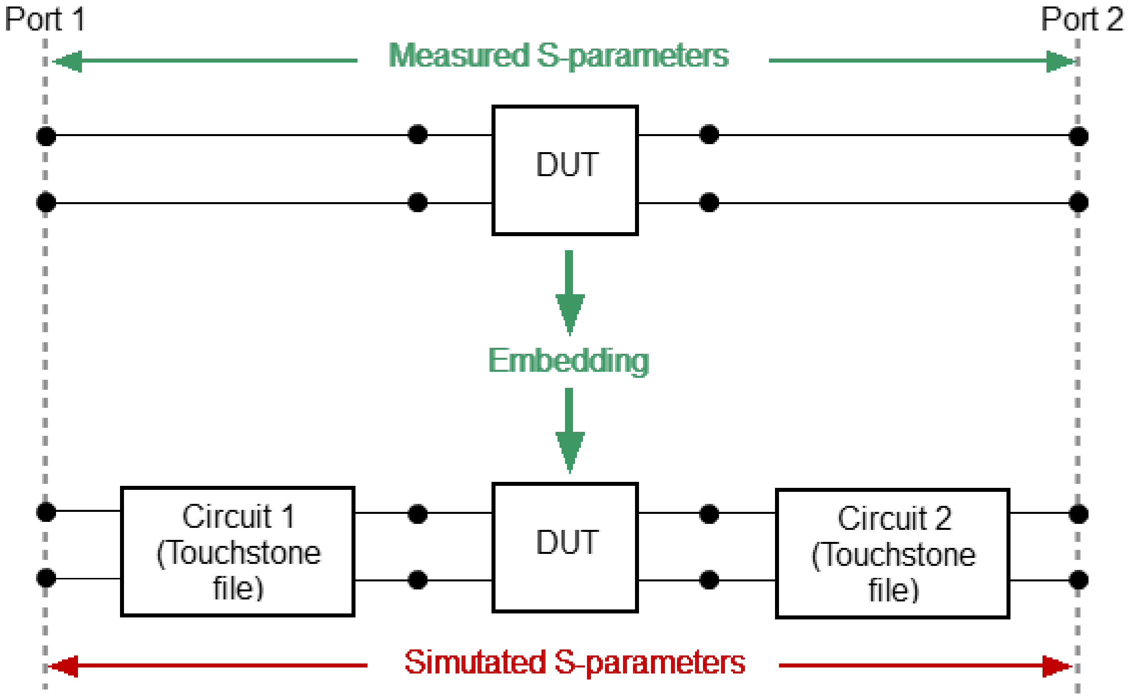
CALCulate:FSIMulator:SENDed:DEEMbed:PORT:STATe

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 embedding function allows to mathematically simulate the DUT parameters after adding the fixture circuits.

The embedding function is an inverted de-embedding function.

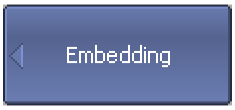


Embedding

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.

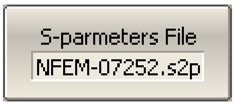
NOTE

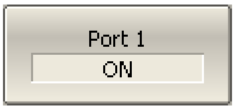
The S-matrices of all embedding circuits are oriented so that the S11 is directed to the Analyzer port and S22 directed to the DUT.



To open the embedding function submenu, use the following softkeys:

Analysis > Fixture Simulator > Embedding





If the S-parameters file is not specified, the softkey for Port n activation will be grayed out.

To enter the file name of the embedded circuit S-parameters of Port n, use the following softkeys:

Analysis > Fixture Simulator > Embedding > S-parameters File

To enable/disable the embedding function for Port n, use the following softkeys:

Analysis > Fixture Simulator > Embedding > Port n.

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.

Time domain function simulates Time-Domain Reflectometry. The meaning of which is to influence the DUT with a pulsed or step signal, followed by the analysis of the reflected signal. The magnitude, duration, and shape of the reflected signal determine the nature of the impedance variation in the DUT. The Analyzer does not affect the DUT either in pulses or steps. Instead, a Chirp-Z transform algorithm is used to calculate time information from the frequency measurements. The Chirp-Z transform is a generalization of the Fourier transform that allows the user to set arbitrary transform start and stop values.

The time domain transformation can be activated for separate traces of a channel. The current frequency parameters (S11, S21) of the trace will be transformed into the time domain.

Transformation Types

The time domain function supports 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.

The time domain resolution in the lowpass mode is twice as high as in the bandpass mode. The bandpass mode determines the distance to the discontinuity, but does not provide information about the nature of the discontinuity. The lowpass mode determines the distance to the discontinuity, and provides information about the nature of the discontinuity (open or short circuit, for example). The lowpass step mode is useful for the impedance measurement along the distance.

Bandpass mode is applied to the DUTs that do not operate with DC current such as band pass filters. The frequency settings in the bandpass mode can be arbitrary.

Lowpass mode is applied to the DUTs that operate with DC current such as cables.

The frequency settings in the lowpass mode is required to be a harmonic frequency grid, where the frequency value at each frequency point is an integer multiple of the start frequency. The Analyzer has the ability to set the harmonic frequency grid from the current frequency settings with one click.

In lowpass mode, the value of the DUT response at DC is extrapolated from the first few frequency points.

Transformation Unambiguity Range

The time domain response is a periodic function due to the discrete nature of the frequency response. The time domain unambiguity range is determined by the step in the frequency domain:

$$\Delta T = \frac{1}{\Delta F}; \quad \Delta F = \frac{F_{stop} - F_{start}}{N-1},$$

where F_{start} – start frequency of the sweep range,

F_{stop} – stop frequency of the sweep range,

N – number of points.

Windowing

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	Side Lobes Level	Edge Width
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	$\frac{1.48}{F_{max}-F_{min}}$

X-axis Representation

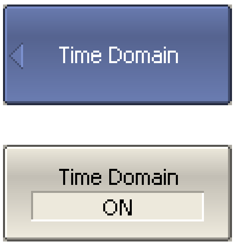
The X-axis units can be set in seconds or distance units (meters or feet). When the distance units are selected the velocity factor is used to compute the distance from time. The velocity factor setting is located in the Cable correction function (See Cable Correction Function).

The two types of reflection can be selected: round trip or one way. The round trip setting shows the total time or distance that the signal travels in both directions along the DUT. The one-way setting shows the time or distance the signal travels in one direction along the DUT.

NOTE	As the time domain transformation can be applied for separate traces of a channel, the x-axis units and round trip / one way type depends on the active trace selected.

The time domain transformation is applied for separate traces of a channel. The trace to which the function is applied must be preselected as active (See Selection of Active Trace/Channel).

Transformation Activation



To enable/disable time domain transformation function, use the following softkeys:

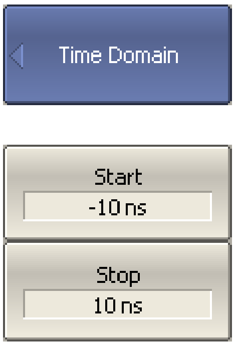
Analysis > Time Domain > Time Domain [ON | OFF]

SCPI CALCulate:TRANsform:TIME:STATe

NOTE Time domain transformation function is accessible only in linear frequency sweep mode.

Transformation Span

To define the span of time domain representation, its start and stop, or center and span values can be set.

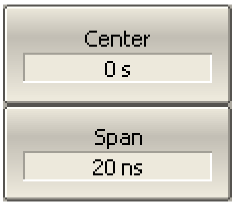


To set the start and stop limits of the time domain range, use the following softkeys:

Analysis > Time Domain > Start

Analysis > Time Domain > Stop

SCPI CALCulate:TRANsform:TIME:STARt, CALCulate:TRANsform:TIME:STOP

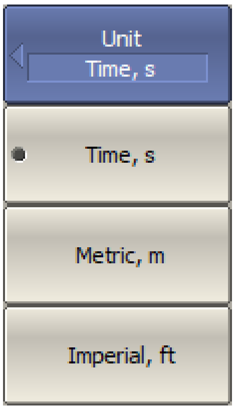


To set the center and span of the time domain, use the following softkeys:

Analysis > Time Domain > Center

Analysis > Time Domain > Span

SCPI CALCulate:TRANsform:TIME:CENTer, CALCulate:TRANsform:TIME:SPAN

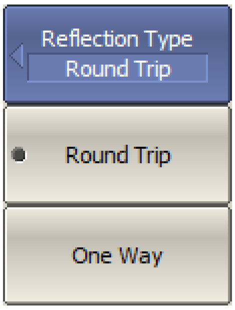


To set the unit of the time domain, use the following softkeys:

Analysis > Time Domain > Unit > [Time, s | Metric, m | Imperial, ft]

SCPI CALCulate:TRANsform:TIME:UNIT

Reflection Type

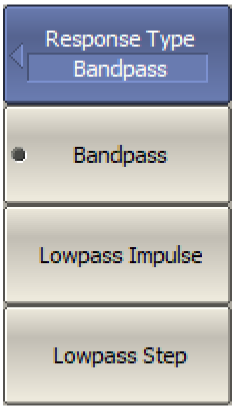


To set the time domain reflection type, use the following softkeys:

Analysis > Time Domain > Reflection Type > [Round Trip | One Way]

SCPI CALCulate:TRANsform:TIME:REFLection:TYPE

Transformation Type


Response Type: Bandpass

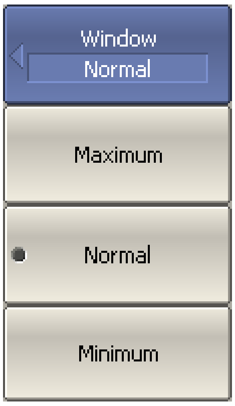
To set the time domain transformation type, use the following softkeys:

Analysis > Time Domain > Type > [Bandpass | Lowpass Impulse | Lowpass Step]

SCPI CALCulate:TRANsform:TIME

CALCulate:TRANsform:TIME:STIMulus

Transformation Window Shape Setting


Window: Normal

To select one of the three pre-programmed windows, use the following softkeys:

Analysis > Time Domain > Window > [Minimum | Normal | Maximum]

If the window shape is set using the impulse width or Kaiser β parameter, a large dot will appear on the **Custom** softkey.

Impulse Width: 975.6 ps

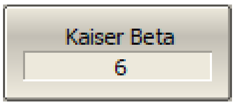
To set the window shape for the specific impulse width or front edge width, use the following softkeys:

Analysis > Time Domain > Window > Impulse Width

The setting values are limited by the specified frequency range. The bottom limit corresponds to the value implemented in the minimum (rectangular) window. The top limit corresponds to the value implemented in the maximum window.

SCPI CALCulate:TRANsform:TIME:IMPulse:WIDTh

CALCulate:TRANsform:TIME:STEP:RTIMe



To set the window shape for the specific β-parameter of the Kaiser-Bessel filter, use the following softkeys:

Analysis > Time Domain > Window > Kaiser Beta

The available β values are from 0 to 13:

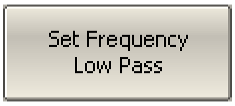
- "0" corresponds to minimum window.
- "6" corresponds to normal window.
- "13" corresponds to maximum widow.

SCPI CALCulate:TRANsform:TIME:KBESsel

NOTE The impulse width and β of the Kaiser-Bessel filter are the dependent parameters. When setting one of the parameters the other one will be adjusted automatically.

Lowpass Mode Settings

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.



To create a harmonic grid for the current frequency range, use the following softkeys:

Analysis > Time Domain > Set Frequency Low Pass

SCPI CALCulate:TRANsform:TIME:LPFRequency

NOTE

The frequency range will be transformed as follows:

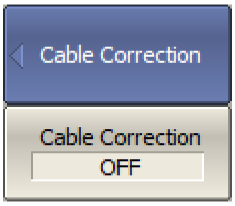
If $F_{stop} > N*F_{low}$	If $F_{stop} < N*F_{low}$
$F_{start} = F_{stop} / N$	$F_{start}= F_{low}$, $F_{stop} = N * F_{low}$

where F_{low} – the lower frequency limit of the analyzer.

Cable Correction Function

Cable correction function allows to take into account the influence of cable characteristics during transform in the time domain. The function contains the cable velocity factor and the cable loss in dB/m. The cable loss value is indicated at the specified frequency. All values can be set manually or selected from the table of predefined cables. The velocity factor is used to convert the time units to the distance units. The cable loss value, together with the frequency, are used to compensate for the attenuation in the cable, so that, for example, the response to an open circuit is unity. The cable correction function is disabled by default.

Cable Correction Activation



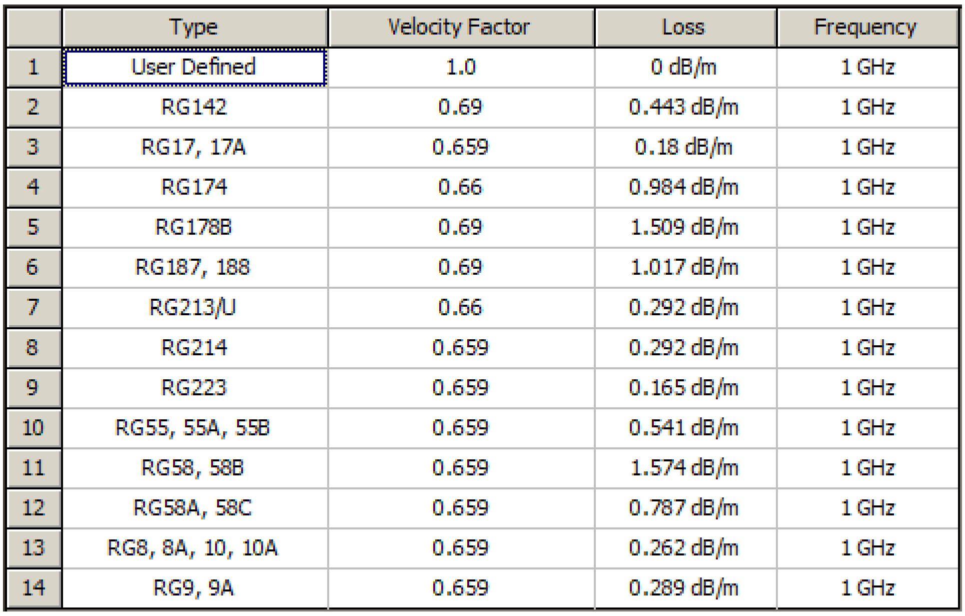
To enable/disable cable correction function of the time domain transformation function, use the following softkeys:

Analysis > Time Domain > Cable Correction > Cable Correction [ON | OFF]

SCPI SENSe:CORRection:TRANsform:TIME:STATe

Cable List

The program contains the predefined cable list (See figure below). Each row of the list contains the cable name and the following parameters: velocity factor, cable loss and frequency.

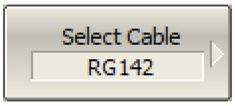


	Type	Velocity Factor	Loss	Frequency
1	User Defined	1.0	0 dB/m	1 GHz
2	RG142	0.69	0.443 dB/m	1 GHz
3	RG17, 17A	0.659	0.18 dB/m	1 GHz
4	RG174	0.66	0.984 dB/m	1 GHz
5	RG178B	0.69	1.509 dB/m	1 GHz
6	RG187, 188	0.69	1.017 dB/m	1 GHz
7	RG213/U	0.66	0.292 dB/m	1 GHz
8	RG214	0.659	0.292 dB/m	1 GHz
9	RG223	0.659	0.165 dB/m	1 GHz
10	RG55, 55A, 55B	0.659	0.541 dB/m	1 GHz
11	RG58, 58B	0.659	1.574 dB/m	1 GHz
12	RG58A, 58C	0.659	0.787 dB/m	1 GHz
13	RG8, 8A, 10, 10A	0.659	0.262 dB/m	1 GHz
14	RG9, 9A	0.659	0.289 dB/m	1 GHz

Cable List

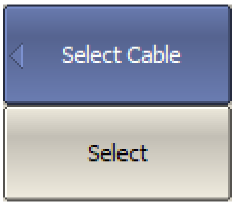
All list fields can be edited. Changes are saved automatically.

If there is no cable description in the table, it is possible to add it. To do this, create a new row in the table using the **Add New Cable** button and enter its name and parameters.



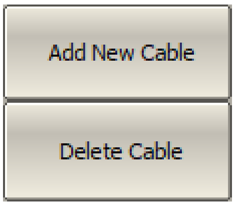
To open the cable list, use the following softkeys:

Analysis > Time Domain > Cable Correction > Select Cable

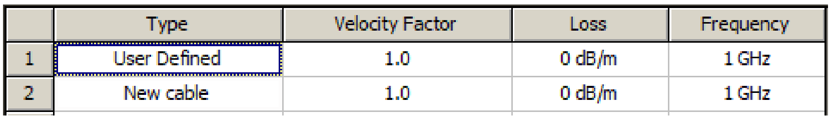


To select the cable in list, use the **Select** softkey.

NOTE: Make sure that the name of the selected cable appears in the text field of the **Select Cable** softkey.



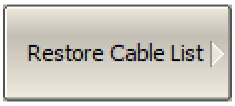
To add the new cable in the list, use the **Add New Cable** softkey. The new cable will be added to the line following the highlighted one.



	Type	Velocity Factor	Loss	Frequency
1	User Defined	1.0	0 dB/m	1 GHz
2	New cable	1.0	0 dB/m	1 GHz

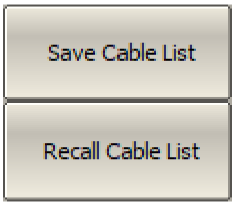
New cable in cable list (example)

To delete cable table, use the **Delete Cable** softkey.



To restore cable table, use the following softkeys:

Restore Cable > OK



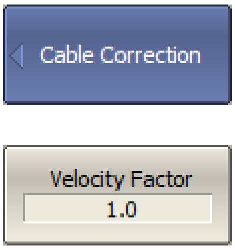
To save cable list in file, use the **Save Cable List** softkey.

To load cable list in file, use the **Load Cable List** softkey.

SCPI MMEMory:LOAD:CBList

Velocity Factor

Velocity factor is used to calculate distance along a cable from the cable delay value. If the cable correction function is disabled, the software assumes it to be equal to 1. To obtain the accurate mismatch location in a cable, it is important to set the right velocity factor of the cable.



To set the velocity cable, use the following softkeys:

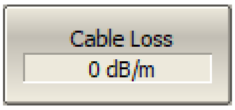
Analysis > Time Domain > Cable Correction > Velocity Factor

SCPI SENSe:CORRection:TRANsform:TIME:RVELocity

NOTE The velocity factor value can also be set by the selecting the cable in the cable list.

Cable Loss

The cable loss value is used to compensate the signal attenuation in a cable. The cable loss value is set in dB per meter.



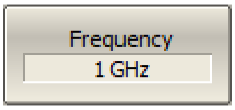
To set the cable loss, use the following softkeys:

Analysis > Time Domain > Cable Correction > Cable Loss

SCPI SENSe:CORRection:TRANsform:TIME:LOSS

NOTE The cable loss value can also be set by the selecting the cable in the cable list.

Frequency

	To set the frequency, at which the cable loss is specified, use the following softkeys: **Analysis > Time Domain > Cable Correction > Frequency**
SCPI	SENSe:CORRection:TRANsform:TIME:FREQuency

Frequency
1 GHz

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 selected region and transforms back to the frequency domain. The function allows the user to remove spurious effects of the fixture in the frequency domain, if the useful signal and spurious signal are separable in the time domain.

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 gate:

- **Bandpass** — removes the response outside the time gate span.
- **Notch** — removes the response inside the time gate span.

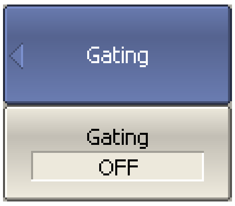
The sharp gate shape leads to ringing effect in the frequency domain. To reduce the ringing the gate shape can be smoothed. The following gate shapes are offered:

- **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	$\frac{2.8}{F_{stop}-F_{start}}$
Normal	– 68 dB	$\frac{5.6}{F_{stop}-F_{start}}$
Wide	– 57 dB	$\frac{8.8}{F_{stop}-F_{start}}$
Maximum	– 70 dB	$\frac{25.4}{F_{stop}-F_{start}}$

Gate Activation



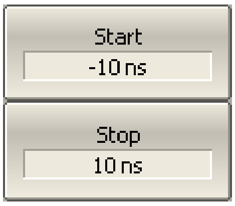
To enable/disable the time domain gating function, toggle the following softkey:

Analysis > Gating > Gating [ON | OFF]

SCPI CALCulate:FILTer:TIME:STATe

NOTE Time domain gating function is accessible only in linear frequency sweep mode.

Gate Span

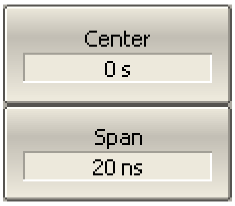


To the start and stop of the time domain gate, use the following softkeys:

Analysis > Gating > Start

Analysis > Gating > Stop

SCPI CALCulate:FILTer:TIME:STARt, CALCulate:FILTer:TIME:STOP



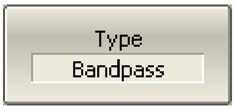
To set the center and span of the time domain gate, use the following softkeys:

Analysis > Gating > Center

Analysis > Gating > Span

SCPI CALCulate:FILTer:TIME:CENTer, CALCulate:FILTer:TIME:SPAN

Gate Type

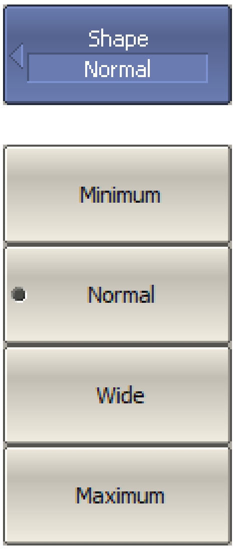


To select the type of the time domain window, use the following softkeys:

Analysis > Gating > Type > [Bandpass | Notch]

SCPI CALCulate:FILTer:TIME

Gate Shape Setting



To set the time domain gate shape, use the following softkeys:

Analysis > Gating > Shape > [Minimum | Normal | Wide | Maximum]

SCPI CALCulate:FILTer:TIME:SHAPe

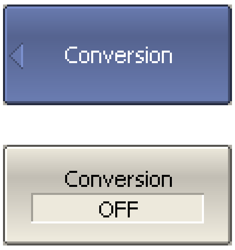
S-Parameter Conversion

The S-parameter conversion function allows the conversion of measurement results (S11 or S21) to the following parameters:

Parameter	Equation
Impedance in reflection measurement (Z_r)	$Zr = Z_{01} \cdot \frac{1+S_{11}}{1-S_{11}}$
Admittance in reflection measurement (Y_r)	$Y_r = \frac{1}{Z_r}$
Impedance in transmission measurement (Z_t)	$Z_t = \frac{2 \cdot \sqrt{Z_{01} \cdot Z_{02}}}{S_{21}} - (Z_{01} + Z_{02})$
Admittance in transmission measurement (Y_t)	$Y_t = \frac{1}{Z_t}$
Inverse S-parameter for reflection and transmission measurements respectively	$\frac{1}{S_{11}}$ and $\frac{1}{S_{21}}$
S-parameter complex conjugate	S_{11}^* and S_{21}^*
Z_{01} is characteristic impedance of port 1. Z_{02} is characteristic impedance of port 2. S_{11} and S_{21} are measured S-parameters (1 and 2 are the port identifiers).	

NOTE Equations for Z_r, Z_t, Y_r, Y_t are approximate. The reason for using the approximate method is the measurement speed, as only one S-parameter is used in the calculations.

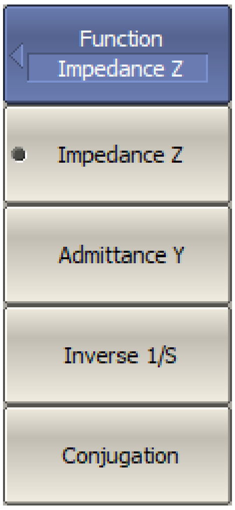
The S-parameter conversion function can be applied to an individual trace of a channel. The trace to which the function is applied must be preselected as active (See Selection of Active Trace/Channel).



To enable/disable the conversion, use the following softkeys:

Analysis > Conversion > Conversion

SCPI CALCulate:CONVersion



To select the conversion type, use the following softkeys:

Analysis > Conversion > Function

Then select the required function:

- **Impedance Z**
- **Admittance Y**
- **Inverse 1/S**
- **Conjugation**

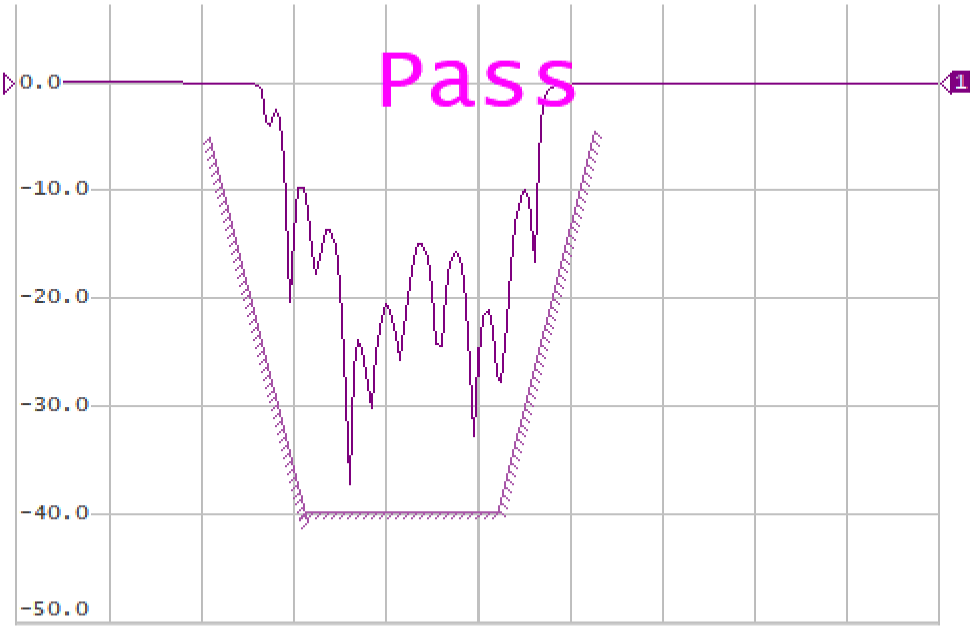
SCPI CALCulate:CONVersion:FUNCtion

NOTE All conversion types are indicated in the trace status field, when enabled.

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

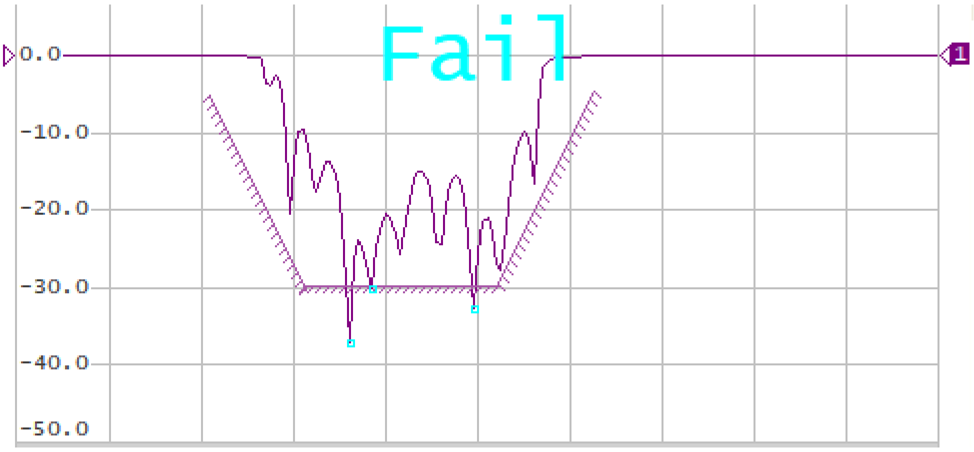
The limit line is set by the user in the limit table. Each row in the table describes one segment of the line. Limit table editing is described below. The table can be saved into a *.LIM file.

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 in the center of the window:

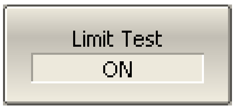
- If the measurement result passed the limit test **Pass** sign will be displayed in green (See figure above).
- If the measurement result failed **Fail** sign will be displayed in red. The points of the trace, which failed the test will be highlighted in red (See figure below).

The fail sign can be disabled using the **Fail Sign** softkey.



Test fail indication

Limit Test Enabling/Disabling

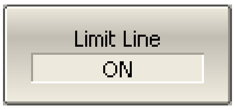


To enable/disable limit test function, use the following softkeys:

Analysis > Limit Test > Limit Test [ON | OFF]

SCPI CALCulate:LIMit

Limit Test Display Management



To enable/disable display of a limit line, use the following softkeys:

Analysis > Limit Test > Limit Line [ON | OFF]

To enable/disable display of fail sign in the center of the diagram, use **Fail Sign** softkey.

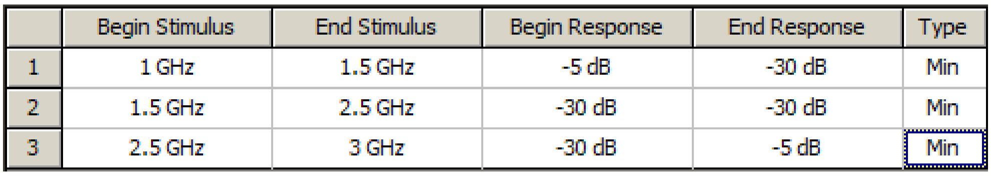
SCPI CALCulate:LIMit:DISPlay

DISPlay:FSIGn

Limit Line Editing

In the editing mode the limit table will appear in the lower part of the screen (See figure below). The limit table will be hidden when quitting the submenu.

The Limit Line table fields can be edited directly in the table, just click on the field with the mouse and enter a new value.

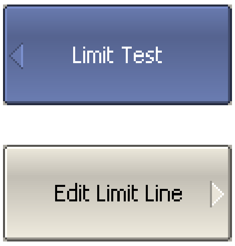


	Begin Stimulus	End Stimulus	Begin Response	End Response	Type
1	1 GHz	1.5 GHz	-5 dB	-30 dB	Min
2	1.5 GHz	2.5 GHz	-30 dB	-30 dB	Min
3	2.5 GHz	3 GHz	-30 dB	-5 dB	Min

Limit line table

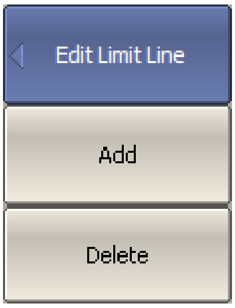
Navigating within the table to enter the values of the following parameters of a limit test segment:

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.



To access the limit line editing mode, use the following softkeys:

Analysis > Limit Test > Edit Limit Line



To add a new row in the table, click **Add**. The new row will appear below the highlighted one.

To delete a row from the table, click **Delete**. The highlighted row will be deleted.

SCPI CALCulate:LIMit:DATA

To clear the entire table, use the **Clear Limit Table** softkey.

To save the table into *.LIM file, use the **Save Limit Table** softkey.

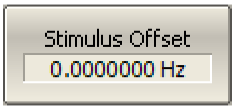
SCPI MMEMory:STORe:LIMit

To open the table from a *.LIM file, use the **Restore Limit Table** softkey.

SCPI MMEMory:LOAD:LIMit

Limit Line Offset

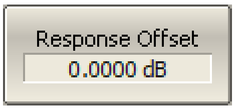
The limit line offset function allows the user to shift the segments of the limit line by the specified value along X and Y axes simultaneously.



To define the limit line offset along X-axis, use the following softkeys:

Analysis > Limit Test > Limit Line Offsets > Stimulus Offset

SCPI CALCulate:LIMit:OFFSet:STIMulus



To define the limit line offset along Y-axis, use the following softkeys:

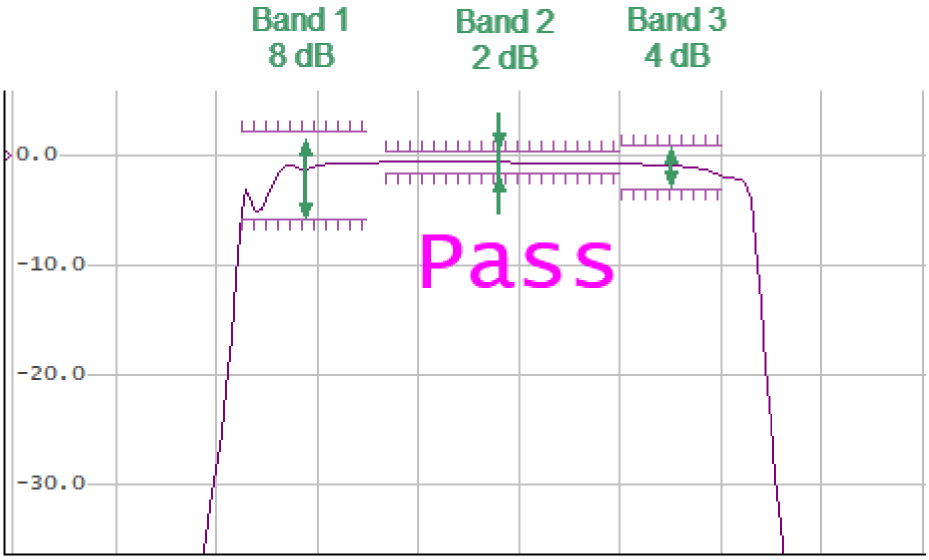
Analysis > Limit Test > Limit Line Offsets > Response Offset

SCPI CALCulate:LIMit:OFFSet:AMPLitude

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

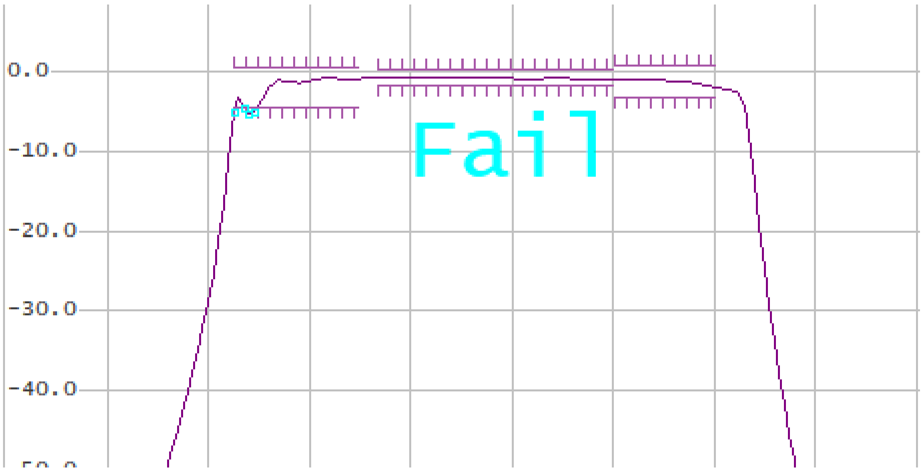
The ripple limit settings are set in the ripple limit table. Each row of the table describes the frequency band of the ripple limit value. The process of ripple limit table editing is described below. The table can be saved into a *.RML file.

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 ripple limit test is indicated in the center of the window:

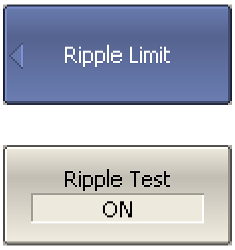
- If the measurement result passed the ripple limit test **Pass** sign will be displayed in green (See figure above).
- If the measurement result failed **Fail** sign will be displayed in red. The points of the trace, which failed the test will be highlighted in red (See figure below).

The fail sign can be disabled using the **Fail Sign** softkey.



Test fail indication

Ripple Limit Enabling/Disabling



To enable/disable ripple limit test function, use the following softkeys:

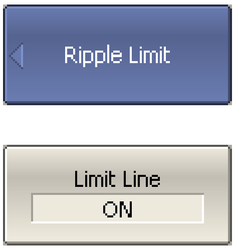
Analysis > Ripple Limit > Ripple Test [ON | OFF]

SCPI

CALCulate:RLIMit

CALCulate:RLIMit:REPort? (Remoty only)

Ripple Limit Test Display Management



To enable/disable display of the ripple limit line, use the following softkeys:

Analysis > Ripple Limit > Limit Line [ON | OFF]

SCPI CALCulate:RLIMit:DISPlay:LINE

To enable/disable display of fail sign in the center of the diagram, use **Fail Sign** softkey.

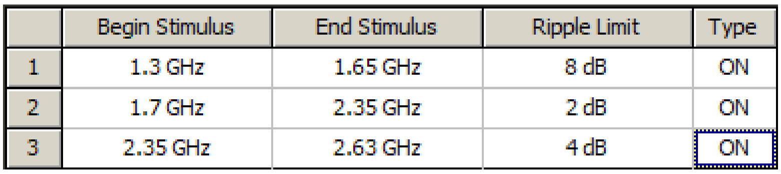
SCPI

DISPlay:FSIGn

CALCulate:RLIMit:FILE? (Remote only)

Ripple Limit Editing

In the editing mode, the limit table will appear in the lower part of the screen (See figure below). The limit table will be hidden when exiting the submenu.



	Begin Stimulus	End Stimulus	Ripple Limit	Type
1	1.3 GHz	1.65 GHz	8 dB	ON
2	1.7 GHz	2.35 GHz	2 dB	ON
3	2.35 GHz	2.63 GHz	4 dB	ON

Ripple limit table

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 ripple limit test. • **OFF** — band not used for the limit test.

To access the ripple limit editing mode, use the following softkeys:

Analysis > Ripple Limit > Edit Ripple Limit

To add a new row in the table, click **Add**. The new row will appear below the highlighted one.

To delete a row from the table, click **Delete**. The highlighted row will be deleted.

SCPI CALCulate:RLIMit:DATA

To clear the entire table, use the **Clear Ripple Limit Table** softkey.

To save the table into *.RML file, use the **Save Ripple Limit Table** softkey.

SCPI MMEMory:STORe:RLIMit

To open the table from a *.RML file, use the **Recall Ripple Limit Table** softkey.

SCPI MMEMory:LOAD:RLIMit

Special Measurement Modes

This section describes the measurements that use optional equipment, as well as special function

- The vector voltmeter (VVM) function available only on the TR series Analyzers, which replaces the traditional Vector Voltmeter in measurements (See Vector Voltmeter).
- Measurement of frequency conversion devices (See Mixer Measurements).

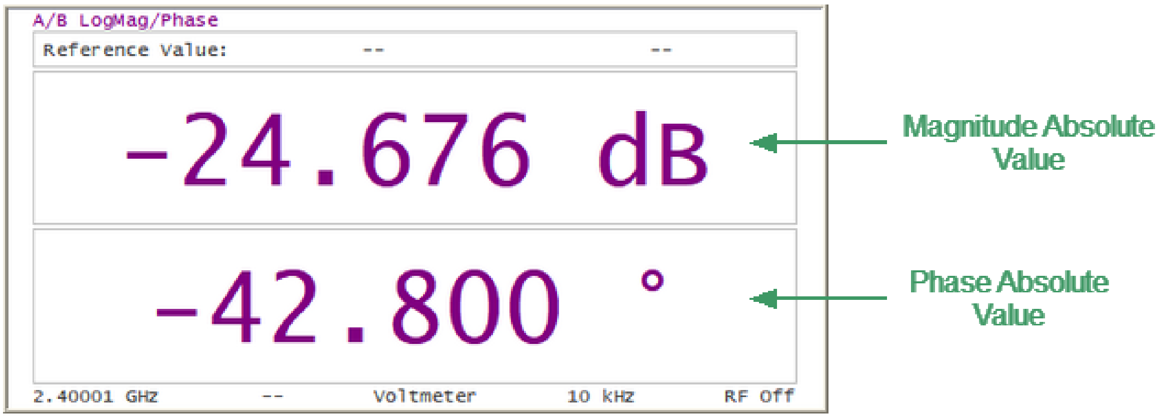
Vector Voltmeter

The TR series Analyzer contains a vector voltmeter (VVM) function designed to replace the traditional vector voltmeter in measurements. This function allows measuring the raw vector (amplitude and phase) data at a single CW frequency, as well as the ratio of modules and the phase difference of the signals between the two measurement ports (A/B or B/A measurement). The most common practical application of this feature is where many cables must be matched for identical phase shift versus frequency.

When using a VVM function, the absolute values of the measured amplitude and phase can be obtained. Measurements can also be performed relative to the stored data. The Analyzer can store a measurement from a reference cable or component and make further measurements on other similar components to determine the consistency of the components to one another. Saving a reference normalizes the results to the current measurement.

NOTE

A distinction should be made between the terms "Relative measured values" and "Absolute measured values" referred to in this section with the terms "Relative measurements of S-parameters" and "Absolute measurements". In this section "Relative measured values" are amplitude and phase measurements normalized to a reference value in memory or a reference receiver. "Absolute measured values" are amplitude and phase measurements without normalization. "Relative Measurements" are VVM measurements performed with normalization.



A/B LogMag/Phase

Reference Value: -- --

-24.676 dB

-42.800 °

2.40001 GHz -- Voltmeter 10 kHz RF Off

Magnitude Absolute Value

Phase Absolute Value

Vector Voltmeter Display

The analyzer's VVM function also provides additional capabilities not available with the traditional VVM:

- The Analyzer has a source and couplers built-in therefore it can measure reflection or transmission of a DUT directly without additional external items.

- Voltmeter data table allows to store measurement data from multiple DUTs and compare them to a reference response.

In practice, the VVM function is especially useful for measurements in systems where cable lengths must have a precise phase relationship to each other. For example, in phased array antennas.

The analyzer provides four types of measurements with the Vector Voltmeter:

- **S11** — one-port reflection measurement using the built-in source and couplers.
- **S21** — two-port transmission measurement using the built-in source and couplers.
- **A/B** — ratioed receiver measurement using external source.
- **B/A** — ratioed receiver measurement using external source.

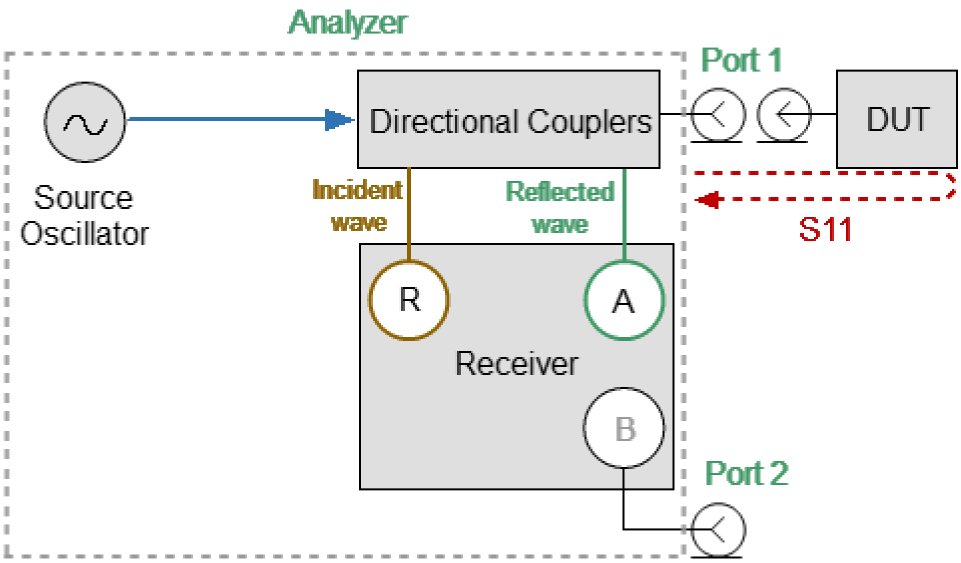
S11 Reflection Measurement (One-port method)

This method is used to validate the proper electrical length of any low loss (< 20dB) DUT, such as when accurately trimming a cable according to a reference sample.

The block diagram of the measuring setup in the reflection measurement mode is shown in the figure below. The R receiver measures the incident signal out of the source. The A receiver measures the reflected signal from the end of the DUT. Ratio (A/R) calculation allows determining the phase shift of the DUT or cable.

Nearly all of the energy in the input signal is reflected off the end of the unterminated cable. The cable measured return loss is twice the one-way loss. The phase shift of the measured reflected signal is equal to twice the one-way phase shift of the cable.

When absolute magnitude and phase are measured, a full one-port calibration (SOL) is used to ensure accurate results. If the relative value of amplitude and phase is being measured, no calibration is required.



Reflection Measurement

Example

Trimming a cable using this method:

- An unterminated reference cable is connected to Port1 and measured. The Analyzer allows saving the measurement of the reference cable as a reference value, then measurements of untrimmed cables will be compared with it.
- Remove the reference cable from Port1 and connect an unterminated untrimmed cable. Carefully trim the cable until the phase shift reads zero. The attached cable's electrical length is now matched to the reference cable.

NOTE

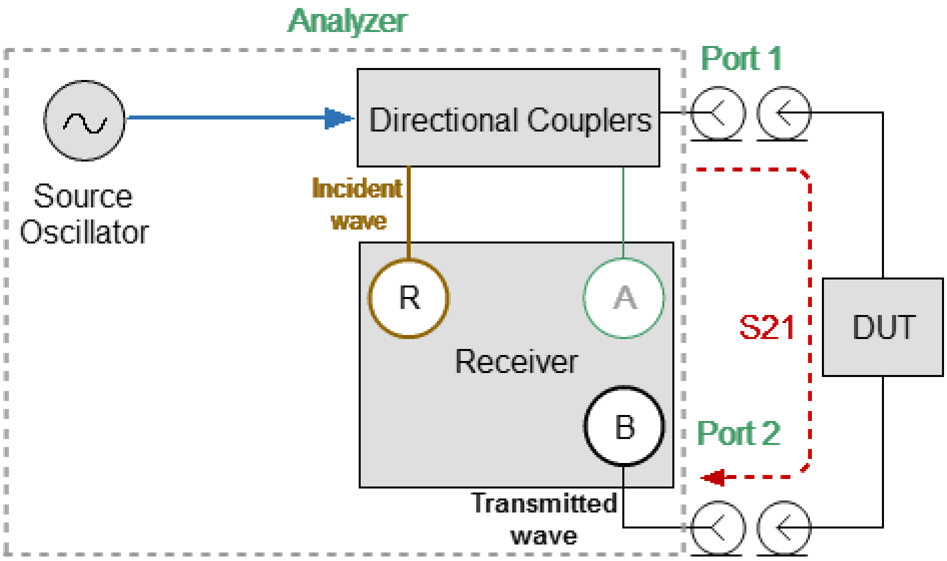
The electrical length of the untrimmed cable must be within 180° of the reference cable because the displayed phase changes within ±180°.

S21 Transmission Measurement (Two-port Method)

This method is used to measure the electrical length of DUTs with high losses (>20 dB) as it has a high dynamic measurement range for them. The analyzer's signal source is transmitted out the Port1, through the DUT, and into Port 2.

The block diagram of the measuring setup in the transmission measurement mode is shown in the figure below. The R receiver measures the incident signal out of the source. The B receiver measures the signal transmitted through the DUT. Ratio (B/R) calculation allows determining the phase shift of the DUT or cable.

A positive amplitude value represents the gain of the DUT, a negative value represents the loss of the DUT. The phase value is the difference in phase between Port1 and Port2.



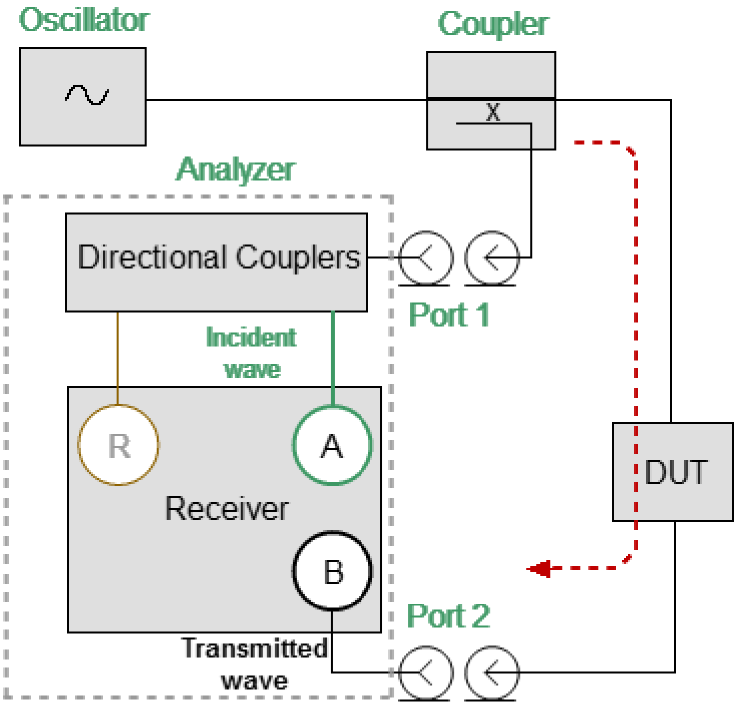
Transmission Measurement

When absolute magnitude and phase are measured, a one-path two-port calibration is used to ensure accurate results. If the relative value of amplitude and phase is being measured, no calibration is required.

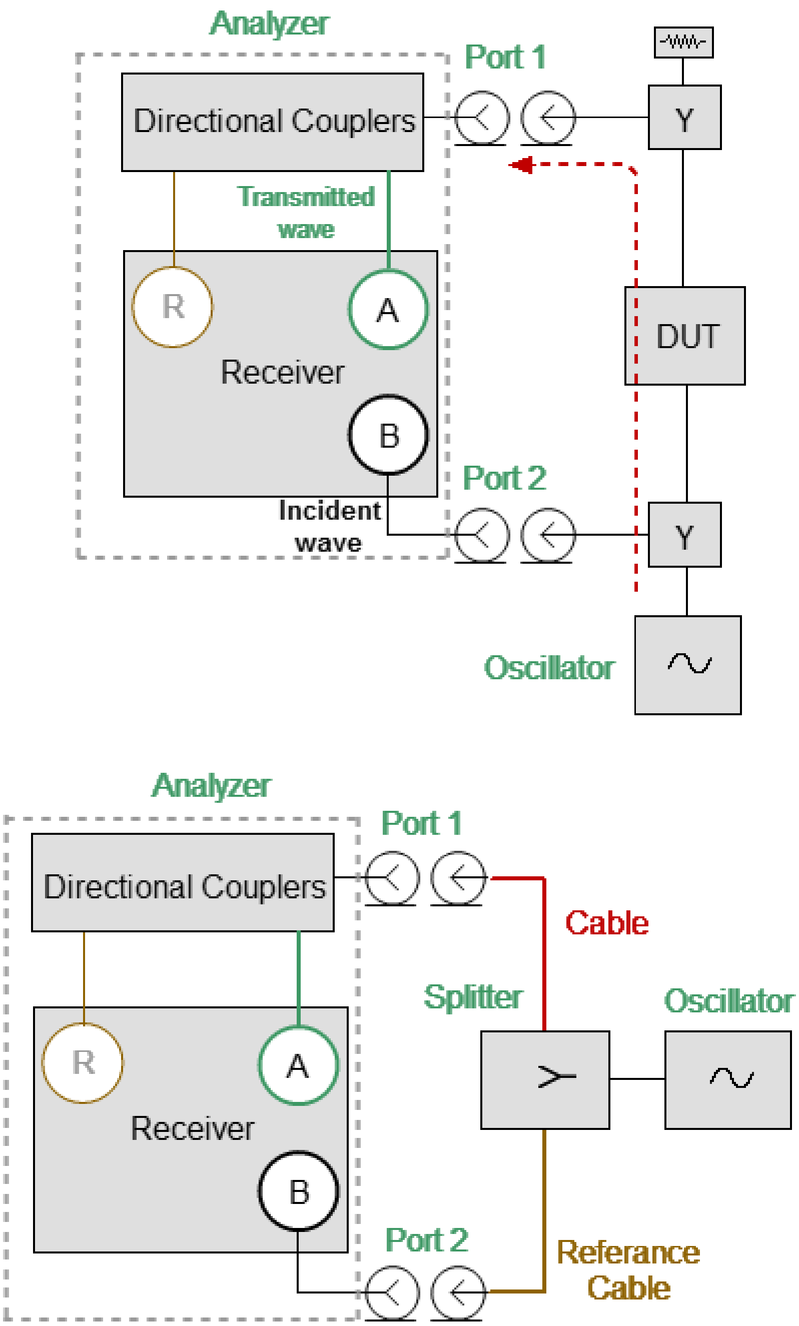
A/B or B/A Measurements

This mode is used in the measurement setup that requires the external CW frequency oscillator and accessories. In this mode, the Analyzer replaces the traditional vector voltmeter. Receivers A and B are used to make relative measurements. One of the receivers (A or B) that measures the signal applied to the DUT is the reference and the other measures the DUT response.

The block diagrams of various measurement setups in B/A and A/B measurement mode is shown in the figures below.



B/A Measurements



A/B Measurements

Vector error correction is not available for A/B or B/A measurements. Measurement results can be improved by adding 3dB or 6dB attenuators to each measurement port (A and B) if the measured results are unstable or unreliable. The reference value is retained after adding attenuators.

Relative Measurements Procedure

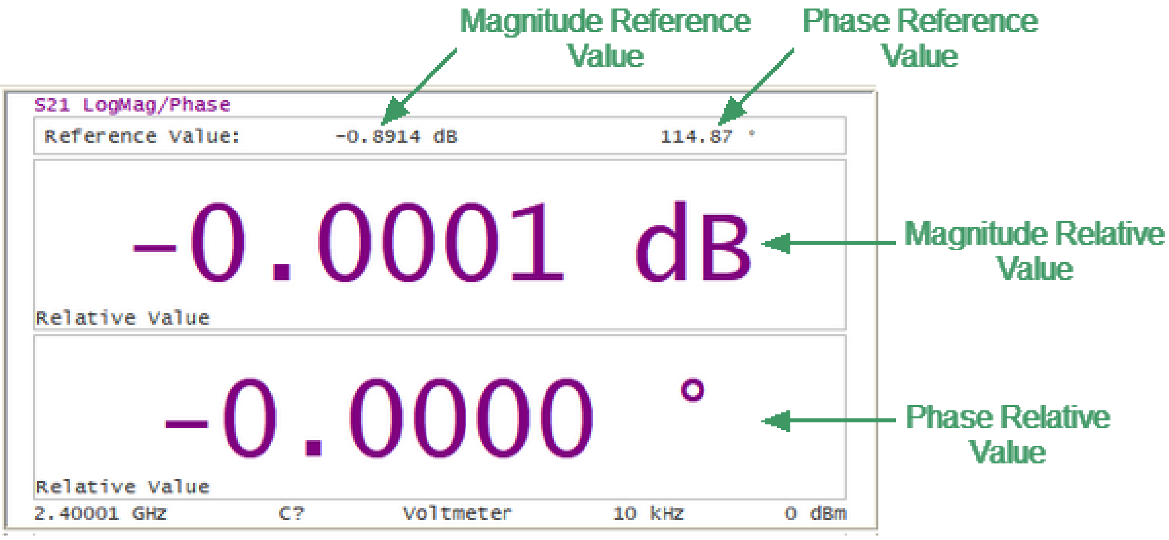
1. Set the CW frequency, measurement type and format. The following measurement format can be selected:
   - Logarithm Magnitude/Phase
   - Linear Magnitude/Phase
   - SWR
   - Impedance

The measurement format can be changed at any time. If the reference value was saved in a specific format, when the format is changed, the reference value is automatically converted to the new measurement format.

2. No vector error correction is required for relative measurements.

3. Connect the first DUT. If this is a reference DUT, save its measurement value as a reference.

4. After saving the reference value, the measured data display changes (See figure below):
   - The reference value is displayed at the top of the voltmeter display.
   - Instead of measured absolute values, relative values are displayed, which are the difference between the current measurement and the stored reference value (normalized data).

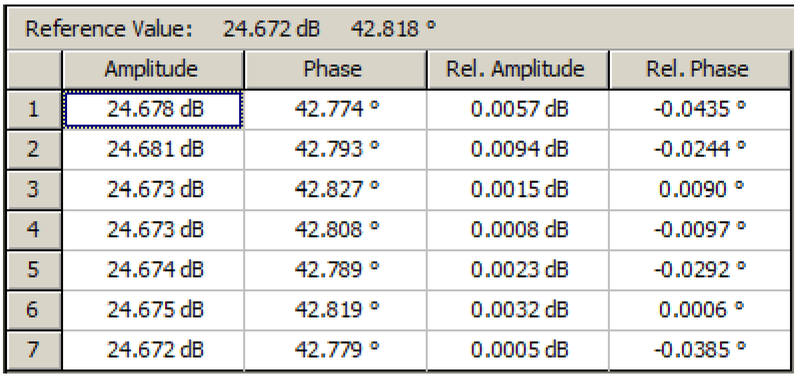


```
S21 LogMag/Phase
Reference Value:        -0.8914 dB              114.87 °

        -0.0001 dB
Relative Value

          -0.0000  °
Relative Value
2.40001 GHz     C?     Voltmeter     10 kHz     0 dBm
```

Relative Measurements Display

5. Next, the DUTs are measured, which are to be compared with the reference DUT. The DUTs are measured sequentially, one after the other. Their relative measurement results will be based on the stored reference value.

6. For ease of use, measurement values can be displayed as a table. After saving the reference value, both absolute and relative measured values will be presented in the table.



Reference Value: 24.672 dB 42.818 °

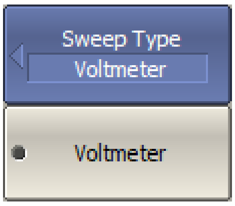
	Amplitude	Phase	Rel. Amplitude	Rel. Phase
1	24.678 dB	42.774 °	0.0057 dB	-0.0435 °
2	24.681 dB	42.793 °	0.0094 dB	-0.0244 °
3	24.673 dB	42.827 °	0.0015 dB	0.0090 °
4	24.673 dB	42.808 °	0.0008 dB	-0.0097 °
5	24.674 dB	42.789 °	0.0023 dB	-0.0292 °
6	24.675 dB	42.819 °	0.0032 dB	0.0006 °
7	24.672 dB	42.779 °	0.0005 dB	-0.0385 °

Voltmeter Data Table

7. The reference value stored in memory can be changed or cleared. Clear the reference value memory using the **Clear Reference** softkey. When the current measurement is desired as the new reference value, use the **Save Reference** softkey.

8. Clearing the reference value while using the table view will clear all of the relative measurement values in the table. After saving the new reference value, the relative measurement values will be recalculated and displayed relative to the new reference value.

Selection VVM Mode



To select VVM mode, use the following softkeys:

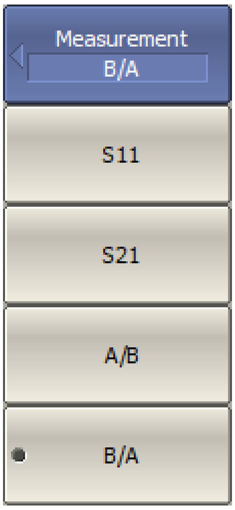
Stimulus > Sweep Type > Voltmeter

SCPI SENSe:SWEep:TYPE

Type of Measurement

To open VVM submenu, use the following softkeys:

Stimulus > Vector Voltmeter



To select the type of measurement, use the following softkeys:

Stimulus > Vector Voltmeter > Measurement > [S11 | S21 | A/B | B/A]

Where:

- **S11** — one-port reflection measurement
- **S21** — two-port transmission measurement
- **A/B** — ratioed receiver measurement (Port1/Port2)
- **B/A** — ratioed receiver measurement (Port2/Port1)

SCPI SENSe:VVM:TYPE

Format

To select the format of measurement, use the following softkeys:

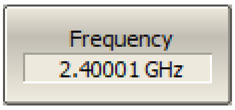
Stimulus > Vector Voltmeter > Format

Then select the required format:

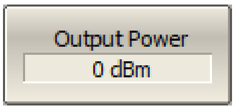
- **LogMag/Phase**
- **LinMag/Phase**
- **SWR**
- **Impedance**

SCPI SENSe:VVM:FORMat

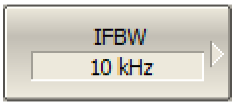
Measurement Conditions



To set CW frequency, use the **Frequence** softkey.



Output power is set for S11, S21 measurements. To set output power, use the **Output Power** softkey.



To set the IF bandwidth, use the following softkeys:

Stimulus > Vector Voltmeter > IF Bandwidth

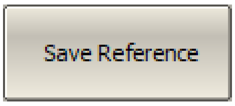
Then select the desired IF bandwidth by the corresponding softkey.

SCPI SENSe:VVM:FREQuency

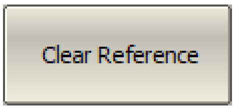
SOURce:POWer

SENSe:BANDwidth or SENSe:BWIDth

Reference Value



To store a reference value from current measurements, use the **Save Reference** softkey.



To clear the reference value memory, use the **Clear Reference** softkey.

SCPI SENSe:VVM:REFerence:MEMorize

SENSe:VVM:REFerence:CLEar

SENSe:VVM:REFerence:DATA? (Remote only)

Voltmeter Data Table

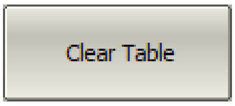
To open Voltmeter Data Table submenu, use the following softkeys:

Stimulus > Vector Voltmeter > Voltmeter Data Table

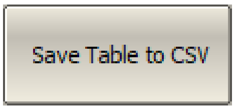
To add data to the last row of a table, use the **Add Data** softkey.

To add data to a selected table row, use the **Insert Data** softkey.

To delete a table row, use the **Remove Data** softkey.



To completely clear the table, use the **Clear Table** softkey.



To save table data to CSV file, use the **Save Table to CSV** softkey. Enter the file name in the dialog that appears.

SCPI SENSe:VVM:TABLe:MEMorize

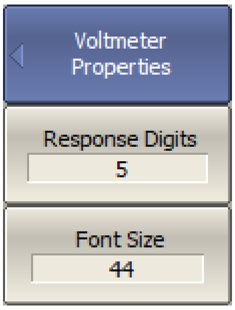
SENSe:VVM:TABLe:REMove

SENSe:VVM:TABLe:CLEar

SENSe:VVM:TABLe:SAVE

SENSe:VVM:TABLe:DATA? (Remote only)

Properties



Response Digits
5

Font Size
44

To set Vector Voltmeter properties, use the following softkeys:

Stimulus > Vector Voltmeter > Properties

Then set the following parameters, use the following softkeys:

- **Response Digits**

NOTE By default, the response values are displayed with 5 decimal points. These settings can be changed from 3 to 12.

- **Font Size**

NOTE The font size of the response value can be changed to any size between 8 to 72 (default 44).

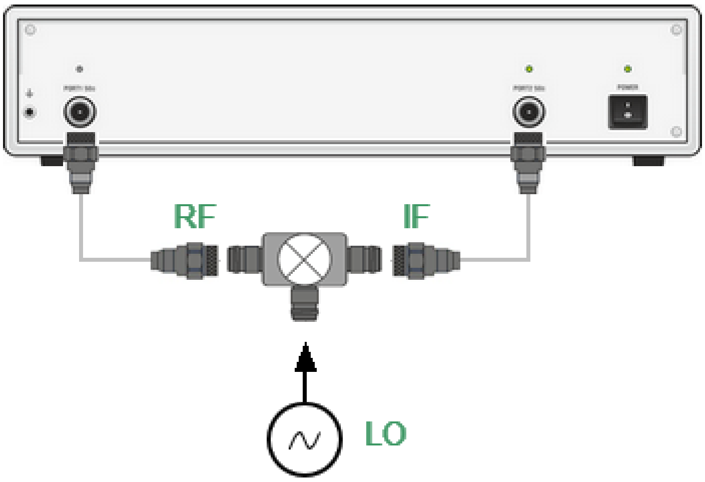
SCPI VVM:RESolution

VVM:FONT

Mixer Measurements

The Analyzer allows to perform measurements of mixers and other frequency converting devices using scalar method.

The **scalar method** allows measurement of the scalar transmission S-parameters of frequency converting devices. Phase and group delay measurements are not accessible in this mode. The advantage of this method is the simplicity of measurement setup (no additional equipment necessary). See figure below.



Scalar mixer measurement setup

The scalar measurement method is based on frequency offset mode. Frequency offset mode enables a frequency offset between the Analyzer test ports as described in detail in Frequency Offset Mode.

Frequency Offset Mode

The frequency offset mode allows S-parameter measurement of frequency converting devices, including vector reflection measurements and scalar transmission measurements. In this context, frequency converting devices include both frequency shifting devices such as mixers and converters, as well as devices dividing or multiplying frequency.

This measurement mode is based on a frequency offset between the ports. The frequency offset is defined for each port using three coefficients: multiplier, divider, and offset. These coefficients allow to calculate a port frequency relative to the basic frequency range:

$$F_{port} = \frac{M}{D} F_{base} + F_{ofs}$$

where:

M — multiplier,

D — divider,

F_{ofs} — offset,

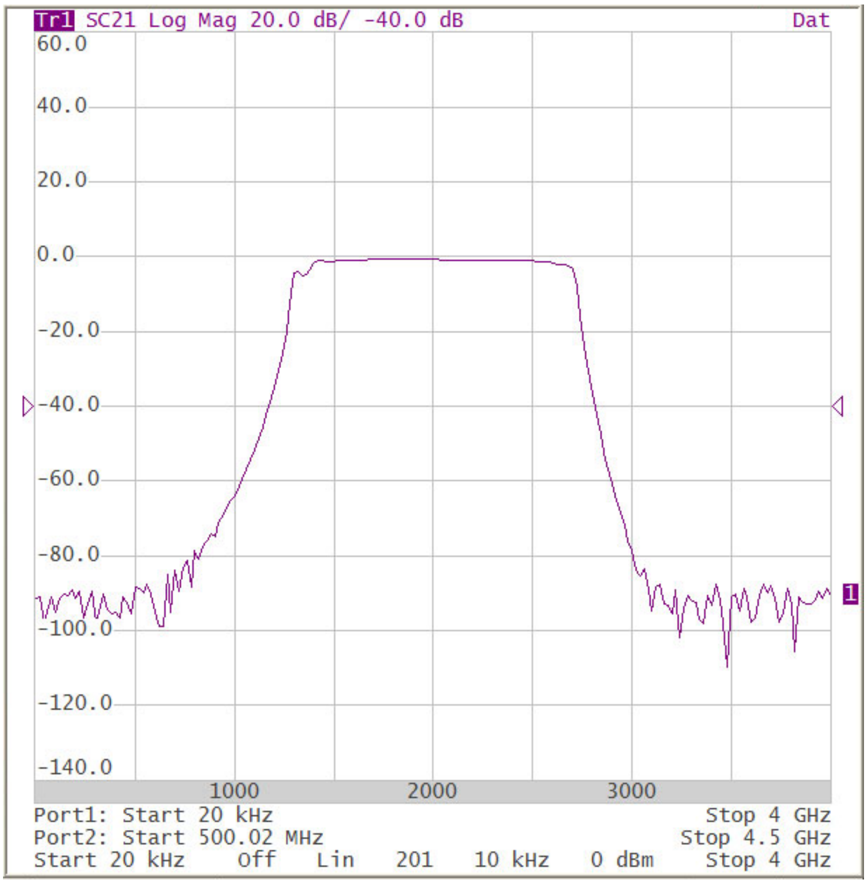
F_{base} — basic frequency.

In most cases, it is sufficient to apply an offset to only one of the ports, leaving the other one at the basic frequency (*M*=1, *D*=1, F_{ofs}=0).

Below there are some examples of offset coefficient calculation for different types of frequency conversion. Here the mixer RF input is connected to Port 1, and the mixer IF output is connected to Port 2. The basic frequency range is set to the mixer RF frequency range, and the first port of the Analyzer does not use frequency offset. The second port of the Analyzer is set to the IF frequency range and uses frequency offset mode as follows:

1. IF = RF – LO	Port 2: *M* = 1, *D* = 1, F_{ofs} = – LO.
2. IF = LO – RF	Port 2: *M*= – 1, *D* = 1, F_{ofs} = LO.
3. IF = RF + LO	Port 2: *M* = 1, *D* = 1, F_{ofs} = LO.

In frequency offset mode, the bottom part of the channel window will indicate each port’s frequency span (See figure below).

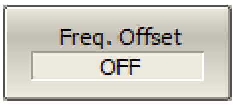


```
Tr1 SC21 Log Mag 20.0 dB/ -40.0 dB                          Dat
```

```
Port1: Start 20 kHz                                    Stop 4 GHz
Port2: Start 500.02 MHz                              Stop 4.5 GHz
Start 20 kHz     Off    Lin    201    10 kHz    0 dBm  Stop 4 GHz
```

Channel window in frequency offset mode

The **Start** and **Stop** softkeys display the result of the frequency offset calculation using **Multiplier**, **Divider** and **Offset** values.



To enable/disable frequency offset mode, use the following softkeys:

Stimulus > Freq. Offset > Freq. Offset [ON | OFF]

SCPI

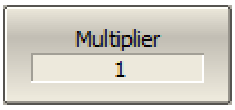
SENSe:OFFSet

SENSe:OFFSet:PORT:DATA? (Remote only)

To enter offset coefficients for each Port, use the following softkeys:

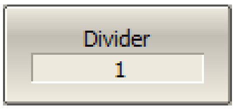
Stimulus > Freq. Offset > Port1

Stimulus > Freq. Offset > Port2



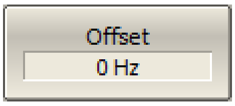
To enter offset coefficients of multiplier, use the **Multiplier** softkey.

SCPI SENSe:OFFSet:PORT:MULTiplier



To enter offset coefficients of divider, use the **Divider** softkey.

SCPI SENSe:OFFSet:PORT:DIVisor

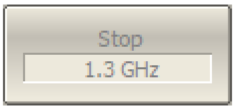


To enter the basic frequency range offset, use the **Offset** softkey.

SCPI SENSe:OFFSet:PORT:OFFSet

To read the start of a frequency range, use the **Start** softkey.

SCPI SENSe:OFFSet:PORT:STARt?



To read the stop of a frequency range, use the **Stop** softkey.

SCPI SENSe:OFFSet:PORT:STOP?

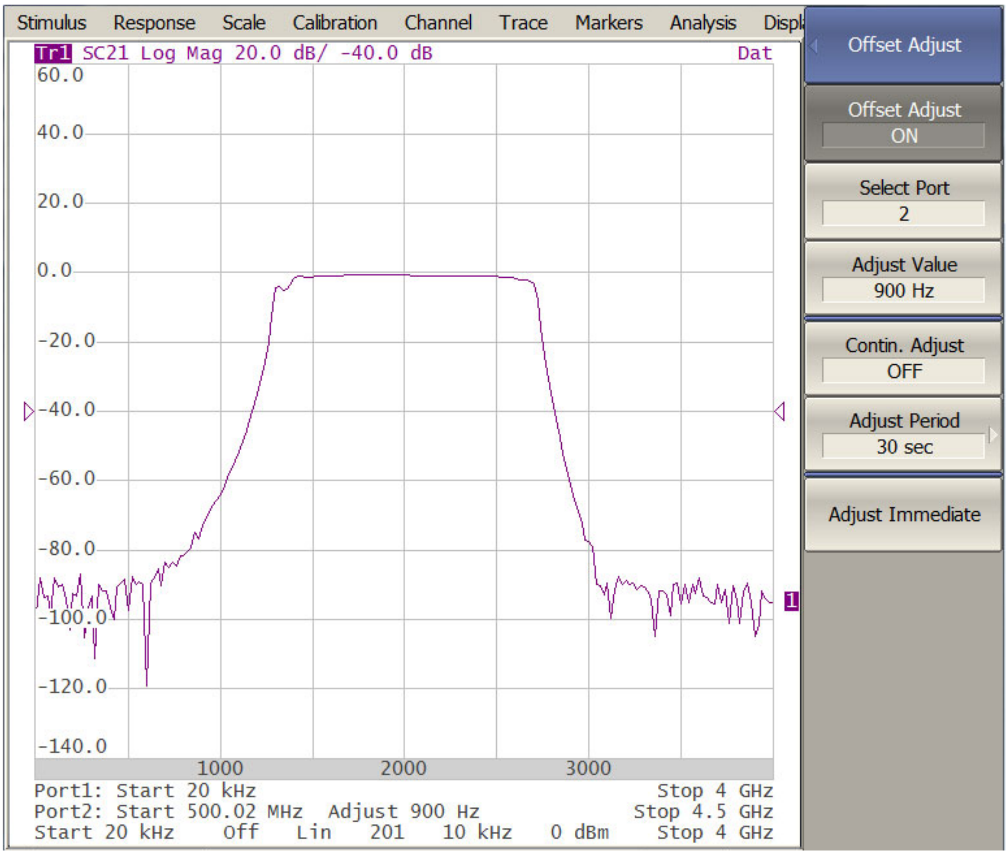
Automatic Adjustment of Offset Frequency

When performing mixer measurements in frequency offset mode, the offset frequency must be set so that it is equal to the LO frequency. A small difference between the frequencies of the analyzer and the external LO source (frequency error) reduces the measurement accuracy.

To reduce the frequency error, it is common to synchronize the analyzer and the external LO source with a common 10 MHz reference (see Reference Frequency Oscillator Selection).

If for some reason it is not possible to synchronize the analyzer and an external source, then the **automatic offset adjustment function** can be used.

The function measures the frequency error and sets the adjust value. The analyzer uses a pair of ports (path) in the automatic offset adjustment procedure: one port as source and another port as receiver. The frequency offset between ports is adjusted for maximum response. The resulting adjust value is then applied to one of the ports. The offset adjust value is indicated in the line of the respective port in the channel window (See figure below). The function can be started by the user by pressing a button or programmed to run periodically.



```
Tr1 SC21 Log Mag 20.0 dB/ -40.0 dB                    Dat
```

Offset Adjust: ON
Select Port: 2
Adjust Value: 900 Hz
Contin. Adjust: OFF
Adjust Period: 30 sec

```
Port1: Start 20 kHz                              Stop 4 GHz
Port2: Start 500.02 MHz  Adjust 900 Hz         Stop 4.5 GHz
Start 20 kHz     Off    Lin    201    10 kHz   0 dBm   Stop 4 GHz
```

Frequency offset mode in conjunction with automatic adjustment of the offset frequency

Automatic adjustment is made within a ±500 kHz range from the offset frequency set by the user. The typical residual error of automatic offset adjustment depends on the current IF filter bandwidth (See table below).

Typical residual error of automatic offset adjustment

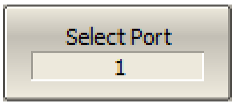
IF filter bandwidth	**Typical residual error of automatic offset adjustment**
10 kHz	500 Hz
3 kHz	50 Hz
1 kHz	15 Hz
300 Hz	5 Hz
100 Hz	2 Hz

Settings of Automatic Offset Adjustment function

To enable/disable automatic offset adjustment function, use the following softkeys:

Stimulus > Freq. Offset > Offset Adjust > Offset Adjust [ON | OFF]

SCPI SENSe:OFFSet:ADJust



To select the port number to which the frequency adjust is applied, use the following softkeys:

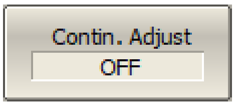
Stimulus > Freq. Offset > Offset Adjust > Select Port n

SCPI SENSe:OFFSet:ADJust:PORT

To enter the offset adjustment value, use the following softkeys:

Stimulus > Freq. Offset > Offset Adjust > Adjust Value

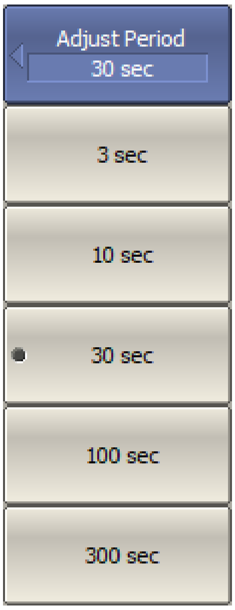
SCPI SENSe:OFFSet:ADJust:VALue



To enable/disable continuous adjustment, use the following softkeys, use the following softkeys:

Stimulus > Freq. Offset > Offset Adjust > Contin. Adjust [ON | OFF]

SCPI SENSe:OFFSet:ADJust:CONTinuous



To enter the time interval for continuous adjustment, use the following softkeys:

Stimulus > Freq. Offset > Offset Adjust > Adjust Period

Where to select the desired time interval.

SCPI SENSe:OFFSet:ADJust:CONTinuous:PERiod

To initiate a single adjustment, use the following softkeys:

Stimulus > Freq. Offset > Offset Adjust > Adjust Immediate

SCPI SENSe:OFFSet:ADJust:EXECute

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).
- 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 program. 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[1].

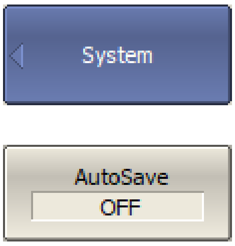
[1] When recalling the state with saved data traces, the trigger mode will be automatically set to «Hold» so that the recalled traces are not erased by currently measured data.

The Analyzer settings that are saved into the Analyzer state file are parameters that can be set in the following sub-levels of the softkey bar:

- All the parameters in the **Stimulus**.
- All the parameters in the **Response**.
- All the parameters in the **Scale**.
- All the parameters in the **Calibration**.
- All the parameters in the **Channel**.
- All the parameters in the **Trace**
- All the parameters of the **Markers**.
- All the parameters of the **Analysis**.
- All the parameters of the **Display**.

A special **Last.cfg** file is used to recall automatically the Analyzer state after start. Automatic state saving mode should be activated for enabling this function.

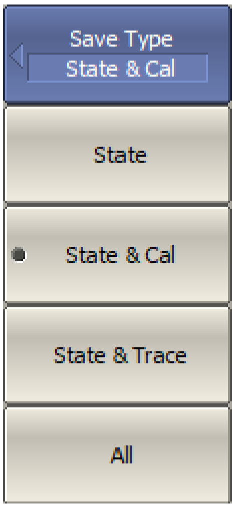
Analyzer Automatic State Saving/Recalling



To turn the automatic state saving mode ON, use the following softkeys:

System > AutoSave [ON | OFF]

Analyzer State Saving

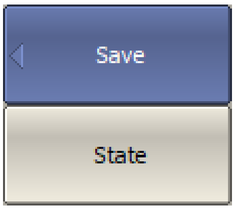


To set the type of saving, use the following softkeys:

System > Save > Save Type

Then select the required save type:

- **State**
- **State & Cal**
- **State & Trace**
- **All**



To save the state, use the following softkeys:

System > Save > State

SCPI MMEMory:STORe:STYPe

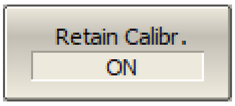
MMEMory:STORe

Analyzer State Recalling

To recall the state from an Analyzer state file, use the following softkeys:

System > Recall > State

Select the state file name in the pop up dialog.



By default, when the state is recalling, the program resets the table of calibration coefficients.

To retain the current table of calibration coefficients, use the following softkeys:

System > Recall > Retain Calibr. [ON | OFF]

Retain calibration works only for the saved types **State** or **State & Trace**.

SCPI MMEMory:LOAD

Channel State

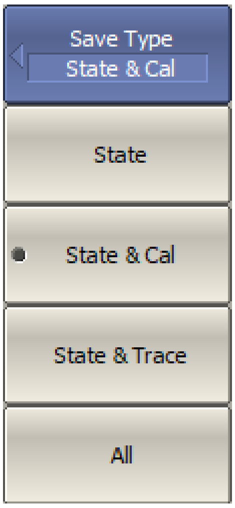
A channel state can be saved into the Analyzer memory.

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



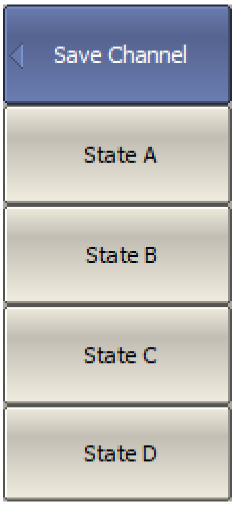
To set the type of saving, use the following softkeys:

System > Save > Save Type

Then select the required save type:

- **State**
- **State & Cal**
- **State & Trace**
- **All**

SCPI MMEMory:STORe:STYPe



To save a state into one of the four memory registers, use the following softkeys:

System > Save > Channel > State [A | B | C | D]

To save the state click the certain softkey. A check mark in the left part of the softkey indicates that the state with the corresponding letter is already saved.

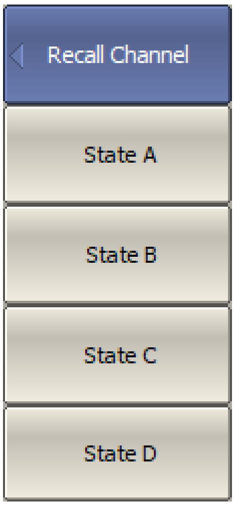
SCPI MMEMory:STORe:CHANnel

To clear the all channel state, use the following softkeys:

System > Save > Channel > Clear States

SCPI MMEMory:STORe:CHANnel:CLEar

Channel State Recalling



To recall the active channel state, use the following softkeys:

System > Recall > Channel > State [A | B | C | D]

Click the required softkey from those available.

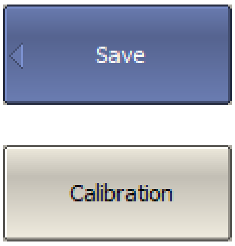
If the state with a certain letter was not saved, the corresponding softkey will be grayed out.

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 following softkeys:

System > Save > Calibration

SCPI [MMEMory:STORe:CHANnel:CALibration]

Channel Calibration Recalling

To recall the channel calibration, use the following softkeys:

System > Recall > Calibration

SCPI [MMEMory:LOAD:CHANnel:CALibration]

Trace Data CSV File

Trace data can be saved as a *.CSV file. The *.CSV file contains digital data separated by commas. One (active) trace data or all traces of the active channel are saved to the file.

The *.CSV file contains comment and trace data lines. Comments start from the «!» symbol.

Before saving the *.CSV file, activate the desired channel (See Active Channel Selection). Next, set the trace type, value delimiter type, and other parameters in the **Save Trace Data** submenu (See the table below). If only the active trace will be saved, activate the desired trace (See Active Trace Selection). Then, click the **Save...** button to save the values to the file.

Parameter	Definition
Scope	Type of trace to be saved: • **Active** trace. • **All Traces** — all traces of the active channel.
Format	Data save format: • **Displayed**— the format in which the trace is set (See Format Setting). • **Real-Imag** — real and imaginary parts. • **dB-Angle** — logarithmic magnitude in dB and phase in degrees.
Comment	Enable/disable the entry in the comment file. The comment contains 3 lines: 1. Model, serial number, software version. 2. Save date (in the dd.mm.yyyy hh:mm:ss format). 3. The name of the saved parameters and their dimensionality.
Stimulus	Enable/disable recording to the file frequency at measurement point.

Parameter	Definition
Decimal Separator	The type of delimiters between stored values, as well as the type of decimal separator: • **System** — delimiters defined in regional settings are used. • **Point** — decimal separator is point, value separator is comma.

The active trace data is saved to *.CSV in the following format:

```
! COPPER MOUNTAIN TECHNOLOGIES, {model}, {serial number}, {TRVNA version}

! Date: dd.mm.yyyy hh:mm:ss

! Stimulus(Hz), {parameter [dimension]}

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.

The all traces of active channel are saved to *.CSV in the following format:

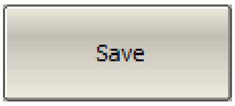
```
! COPPER MOUNTAIN TECHNOLOGIES, {model}, {serial number}, {TRVNA
version}

! Date: dd.mm.yyyy hh:mm:ss

! Stimulus(Hz), {parameter 1 [dimension]}, ... {parameter N [dimension]}

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.

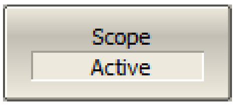
Data2N — zero in rectangular format, imaginary part in Smith chart and polar format.

Editing saving parameters



To open save trace submenu , use the following softkeys:

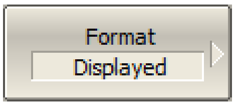
System > Save > Save Trace Data



To select the type of trace, use the **Scope** softkey.

Then select the required type:

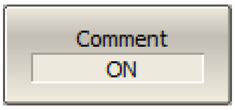
- **Active**
- **All Traces**



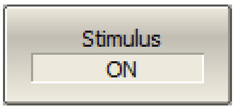
To select the format for saving data, use the **Format** softkey.

Then select the required format:

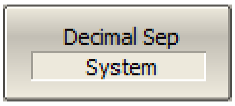
- **Displayed**
- **Real-Imag**
- **dB-Angle**



To enable/disable recording in the header file, use the **Comment** softkey.



To enable/disable writing to a file frequency at measurement point, use the **Stimulus** softkey.

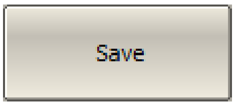


To select the type of separators, use the **Decimal Sep** softkey.

Then select the required format:

- **System**
- **Point**

CSV File Saving



To save the trace data, use the following softkeys:

System > Save > Save Trace Data > Save

Enter the file name in the dialog that appears.

SCPI MMEMory:STORe:FDATa

Trace Data Touchstone File

The Analyzer allows saving 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.

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.

NOTE

The Analyzer allows the measurement of only S11 and S21 parameters. When *.S2P is saved, the missing S-parameters S12 and S22 are filled in as zeroes.

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}"    0      0      0      0

F[1]     {S11}'   {S11}"   {S21}'   {S21}"    0      0      0      0

. . .

 F[N]    {S11}'   {S11}"   {S21}'   {S21}"    0      0      0      0
```

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;

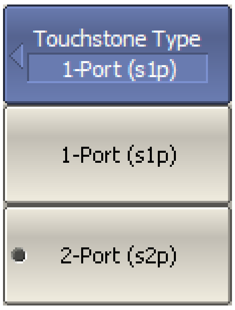
Z0 — reference impedance value;

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 select the saving type, use the following softkeys:

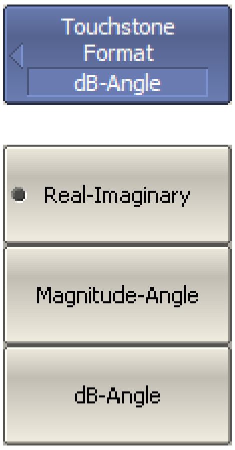
System > Save > Touchstone File > Type

Then select the required Touchstone type:

- **1-Port (s1p)**
- **2-Port (s2p)**

SCPI MMEMory:STORe:SNP:TYPE:S1P

MMEMory:STORe:SNP:TYPE:S2P



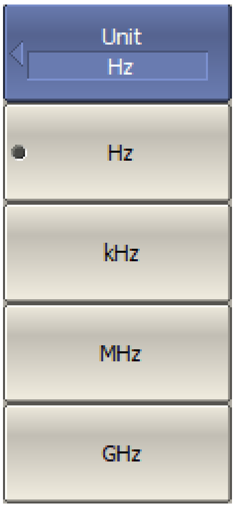
To select the data format, use the following softkeys:

System > Save > Touchstone File > Format

Then select the required Touchstone format:

- **Real-Imaginary**
- **Magnitude-Angle**
- **dB-Angle**

SCPI MMEMory:STORe:SNP:FORMat



To select unit of Touchstone file data, use the following softkeys:

System > Save > Touchstone File > Unit

Then select the required unit.

To save file to the hard disk, use the following softkeys:

System > Save > Touchstone File > Save

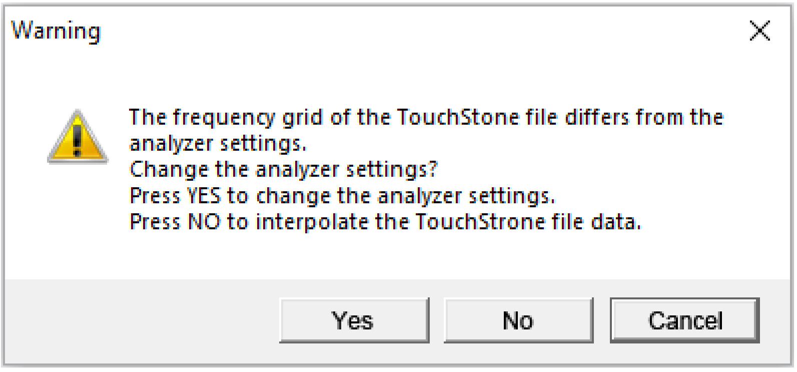
Enter the file name in the dialog that appears.

SCPI [MMEMory:STORe:SNP]

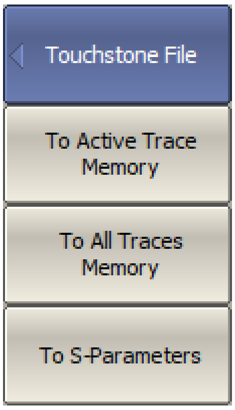
Touchstone File Recalling

The Analyzer allows recalling 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.

If the frequency scale of the Touchstone file does not correspond with the current analyzer frequency settings, the user is prompted to choose between interpolating the data on recall or changing the analyzer settings.


Warning

The frequency grid of the TouchStone file differs from the analyzer settings.
Change the analyzer settings?
Press YES to change the analyzer settings.
Press NO to interpolate the TouchStrone file data.



Load the data from the Touchstone file using one of the softkeys:

System > Recall > Touchstone File

Then select the required data loading method:

- **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.

Enter the file name in the dialog that appears.

SCPI

MMEMory:LOAD:SNP

MMEMory:LOAD:SNP:FREQency

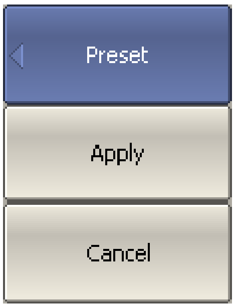
MMEMory:LOAD:SNP:TRACe:MEMory

System Settings

Analyzer Presetting

The Analyzer presetting feature allows to restore the default settings of the Analyzer.

The default settings of the analyzer are specified in Default Settings Table.



To preset the Analyzer, use the following softkeys:

System > Preset > Apply

SCPI	SYSTem:PRESet

Printing

This section describes the print procedure 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 only).
- Print Wizard of the Analyzer (Windows & Linux).

NOTE The MS Word application must be installed on the Windows system.

NOTE The Print Wizard requires at least one printer to be installed in Windows.

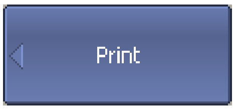
Print color can be selected before the image is transferred to the printing application:

- color (no changes)
- gray scale
- black & white

The image can also be inverted before it is transferred to the printing application.

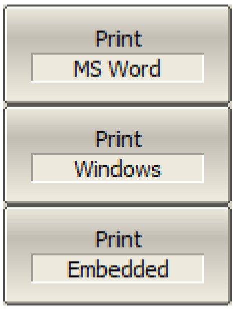
The current date and time can be added before the image is transferred to the printing application.

Printing Procedure



To open a print menu, use the following softkeys:

System > Print

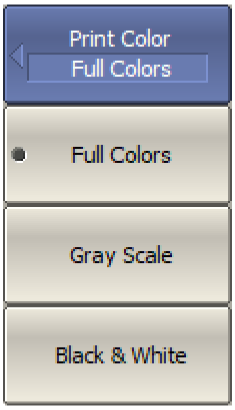


Then select the printing application:

- **Print: MS Word**
- **Print: Windows**
- **Print: Embedded**

SCPI HCOPy

MMEMory:STORe:IMAGe



To select the print color, use the following softkeys:

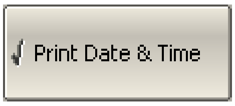
System > Print > Print Color

Then select the required color:

- **Full Colors**
- **Gray Scale**
- **Black & White**

SCPI HCOPy:PAINt

If necessary, invert the image, use the **Invert Image** softkey.



If necessary, select printing of date and time, use the **Print Date & Time** softkey.

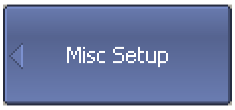
SCPI HCOPy:IMAGe

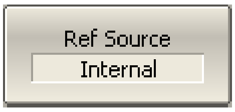
HCOPy:DATE:STAMp

Reference Frequency Oscillator Selection

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 connector on the rear panel. Select the source of reference frequency oscillator in the software.

These two modes can be toggled in the softkey bar.





To select the reference frequency oscillator, use the following softkeys:

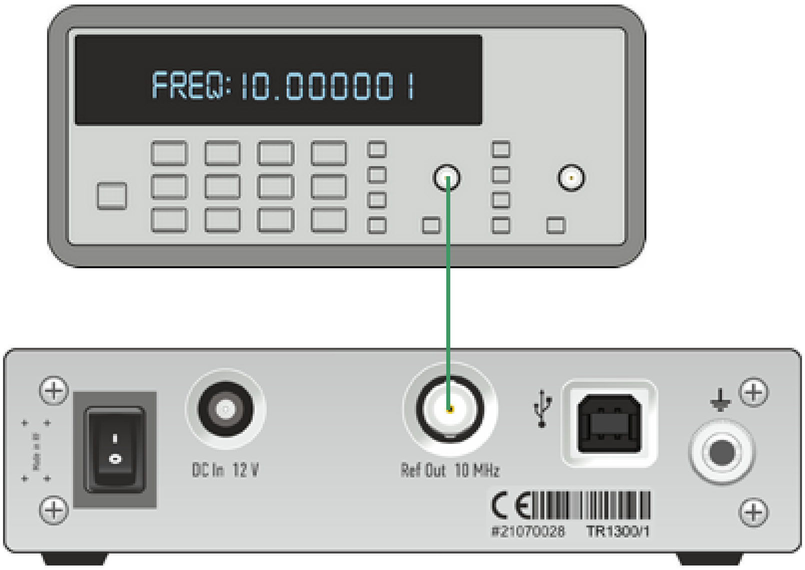
System > Misc Setup > Ref Source [Internal | External]

SCPI SENSe:ROSCillator:SOURce

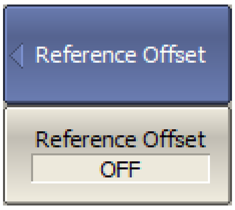
Reference Frequency Offset

NOTE This section is available for TR1300/1 only. The TR1300/1 analyzer operates with an internal reference frequency (10 MHz) oscillator only.

The frequency reference offset function can be used if a more accurate reference frequency is required. Connect an external frequency counter to the 10MHz Reference Output connector on the Analyzer's rear panel. Measure the actual value of the reference frequency. Enable the reference offset function and enter the measured reference frequency value. The deviation of the reference frequency will be compensated.



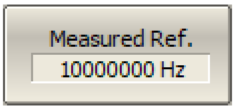
Reference frequency measurement



To enable the reference offset function, use the following softkeys:

System > Misc Setup > Reference Offset [ON | OFF]

SCPI SOURce:REFerence:STATe



To enter the value measured by the frequency counter, use the following softkeys:

System > Misc Setup > Measured Ref.

SCPI SOURce:REFerence:FREQuency

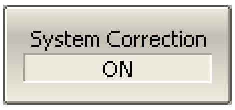
System Correction Setting

The Analyzer is supplied by the manufacturer calibrated with calibration coefficients stored in its non-volatile memory. The factory calibration is used by default for the initial correction of the measured S-parameters. Such calibration is referred to as system calibration, and 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. System calibration is performed on the plane of the physical port connectors and does not account for the cables and other fixtures used to connect the DUT. The measurement accuracy of the Analyzer with a user setup prior to calibration is not rated.

Normally, disabling the system correction setting is **not required** for calibration and further measurements.

The system correction can be disregarded only when a proper calibration has been performed for the Analyzer. If user calibration has been performed, the measurement accuracy of the Analyzer is determined by user calibration and does not depend on the system correction status. If the user calibration has not been performed, then enabling/disabling system calibration would have an impact on measurements. If system correction is disabled, this is indicated in the instrument status bar.



To disable/enable the system correction, use the following softkeys:

System > Misc Setup > System Correction [ON | OFF]

SCPI SYSTem:CORRection

Overload Protection

NOTE This section is not available for TR1300/1.

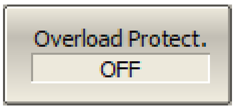
Port overload can occur when testing active devices. The power trip function is a safety feature to keep the analyzer's port from overloading. The function is triggered when the port safety power level is exceeded. When triggered, this function disables the stimulus signal and displays the following message in the instrument status bar: Port <n> Overload! (where <n> is the number of the port). The message has a red background.

After the overload trips, resolve the issue causing the overload, and then manually re-enable the stimulus via the submenu:

Stimulus> Power> RF Out [On]

The power trip function can be enabled or disabled by the user. By default, it is disabled. In this mode, the stimulating signal is not disabled; in case of overload, only the message is displayed. When the overload condition is resolved, the overload indication disappears automatically after 2 seconds. In the event of a transient overload, the 2-second persistence enables the user to take notice. Display of the overload warning cannot be disabled by the user.

The ON/OFF state of power trip function is retained in subsequent sessions and does not depend on the **Preset** softkey.

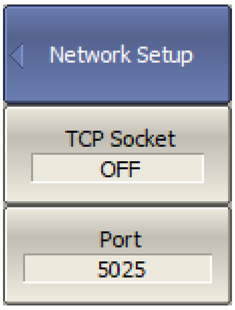


To enable the power trip function, use the following softkeys:

System > Misc Setup > Overload Protect. [ON | OFF]

Network Setup

Network setup are used to enable remote control of the Analyzer.



TCP Socket
OFF

Port
5025

To enable/disable remote control of the Analyzer via a network using TCP/IP Socket protocol on, use the following softkeys:

System > Misc Setup > Network Setup > Socket Server > [ON | OFF]

If necessary, specify the port number use the following softkeys:

System > Misc Setup > Network Setup > Socket Port

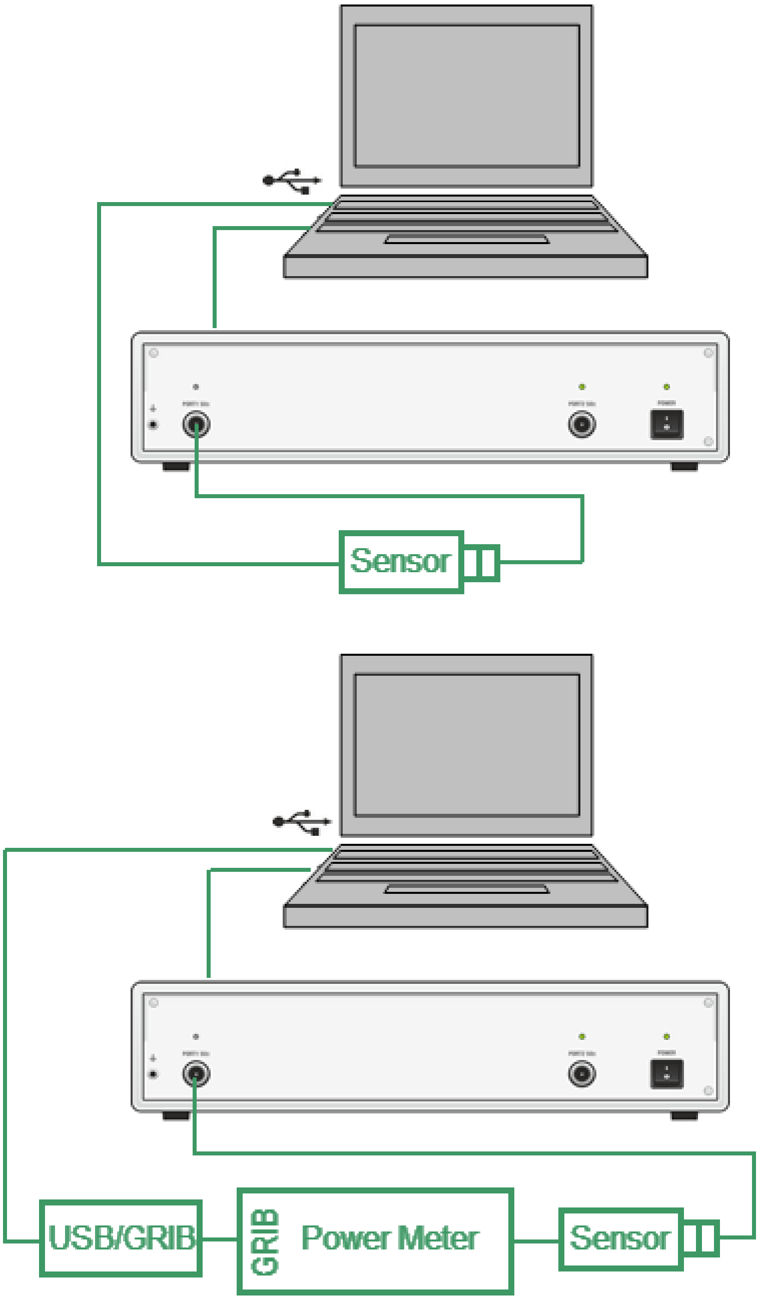
Set port number.

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.

Power Meter Settings

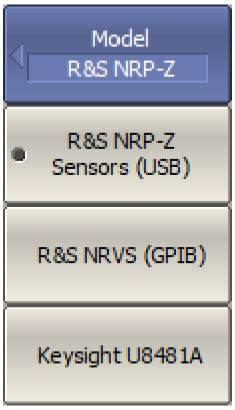
An external power meter can be connected to the Analyzer to perform a power calibration of the test port. Connect the power meter to the PC directly via USB port or via USB/GPIB adapter. Then, install the power meter software. The list of power meters supported by the Analyzer is shown in the table below.



Power meter setup example

Supported power meters

Power Sensor	Designation in the VNA Software	Connection Type	Additional Software
R&S®NRP-Z Power Sensors	R&S NRP-Z Sensors (USB)	USB	• R&S®NRP-Toolkit for Windows • VXIplug&play x64 or x86 driver rsnrpz
R&S®NRVS Power Meter plus R&S®NRV-Z Power Sensors	R&S NRVS (GRIB)	GPIB or USB via GPIB/USB Adapter	• VISA Library from any vendor (visa32.dll) • GPIB/USB Adapter driver (if needed)
Keysight U8481A Power Sensor	Keysight U8481A	USB	VISA Library from any vendor (visa32.dll)

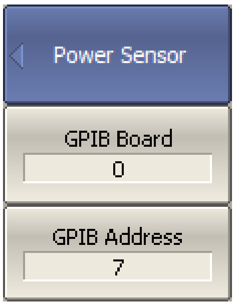


To select the power meter, use the following softkeys:

System > Misc Setup > Power Sensor > Model

Then select the required power meter:

- **R&S NRP-Z Sensors (USB)**
- **R&S NRVS (GRIB)**
- **Keysight U8481A**



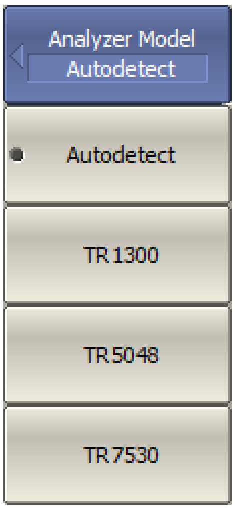
If an R&S NRVS GPIB power meter is selected, set the GPIB board address and the power meter address in the bus, using the following softkeys:

System > Misc Setup > Power Meter Setup > GPIB Board

System > Misc Setup > Power Meter Setup > GPIB Address

Analyzer Model

The analyzer model is detected automatically when connected. If necessary, the analyzer model can be set manually.



To manually enter the analyzer model, use the following softkeys:

System > Misc Setup > Analyzer Model

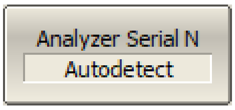
Select an analyzer model from the list.

NOTE

The message **Not Ready** appears in the state status bar if the manually entered analyzer model does not match the connected device model. Further operation of the Analyzer is not possible.

Analyzer Serial Number

The serial number of the Analyzer is read automatically when connected. If necessary, the serial number can be set manually.



To manually enter the analyzer serial number, use the following softkeys:

System > Misc Setup > Analyzer Serial N

Enter the 10-digit serial number of the Analyzer.

SCPI SYSTem:CONNection:SERial

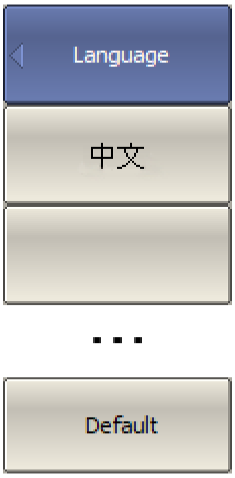
WARNING

The message **Not Ready** appears in the state status bar if the manually entered analyzer model does not match the connected device model. Further operation of the Analyzer is not possible.

Language

The default language for software is English. The program interface can be localized for any language. Localization is done by placing the language file in the "Lang" folder of the TRVNA program. The process of creation and placement of this file by the user is described in the section Creation of localization file. Also, contact technical support at coppermountaintech.com website for ordering a language file.

The language code is displayed on the softkey in the language menu after placing the corresponding language file in the "Lang" folder. For example, the softkey displays the localization for Chinese in the figure below.



To select the interface language, use the following softkeys:

System > Misc Setup > Language

Then choose the language.

To restore the default language, use the **Default** softkey.

The application will restart and the inscriptions on the interface elements will change to the localized inscriptions after pressing the softkey with the language code.

Creation of localization file

The localization file is a means of adapting the interface of the TRVNA software to different languages. The localization file matches the English names of interface elements with names in any language. A localization file is a text file that can be opened and edited with a text editor such as Notepad.

To localize, do the following:

- Find the lang_template.txt file in the TRVNA application home directory in the *Lang* folder.
- Rename this file to the lang_xxx.txt format, where xxx is the language name. For example, lang_ch.txt — for Chinese language, lang_sp.txt — for Spanish language, etc.
- Open the lang_xxx.txt file with a text editor.
- 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

or

  Name=Español

- Enter the translation of the other fields. For example:

  "Default"="缺省"

or

  "Default"="Defecto"

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:

  "Connected"="Conectado"

- 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 name 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 name. The application will restart, and the inscriptions on the interface elements will change to the localized inscriptions (See Language).

User Interface Setting

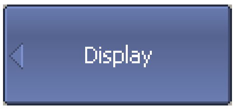
The software allows to adjust the following user interface settings:

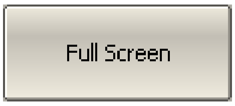
- Toggle between full screen and window display (See Full Screen).
- The font size of all displayed items (See Font Size).
- Width of data traces, memory traces, graph grid (See Lines).
- Set color of data and memory traces, markers, background, grid (See Color).
- Invert color of diagram (See Invert Color of Diagram).
- Hide/show menu bar (See Hide/Show Menu Bar).
- Change horizontal graticule (See Hide/Show Frequence Label).
- Hide/show cycle time (See Hide/Show Cycle Time).
- Interface presetting (See Interface Presetting).

The user interface settings are automatically saved and will be restored the next time the analyzer is turned on. No particular saving procedure is required. If necessary, user interface settings can be reset to default factory settings (See Interface Presetting).

Full Screen

The control program on the PC screen is displayed as a window. If necessary, use full screen mode.



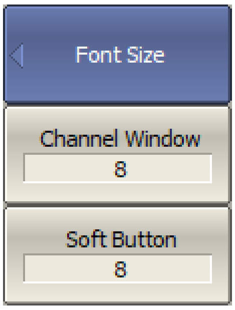


To toggle between full screen and window display, use the following softkeys:

Display > Full Screen

Font Size

The font size of all displayed items can be changed to any size between 8 to 22 (default 11).



To change the font size by categories of displayed items, use the following softkeys:

Display > Font Size

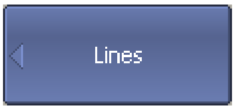
Select displayed items to customize:

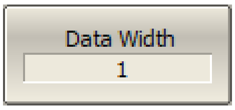
- **Channel Window**
- **Soft Buttons**

Then select the font size from 8 to 22.

Lines

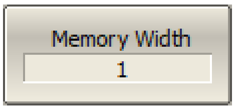
The width of data and memory traces and grid can be changed. The width ranges from 1 to 4 pixels.





To change the width of a data trace, use the following softkeys:

Display > Lines > Data Width



To change the width of a memory trace, use the following softkeys:

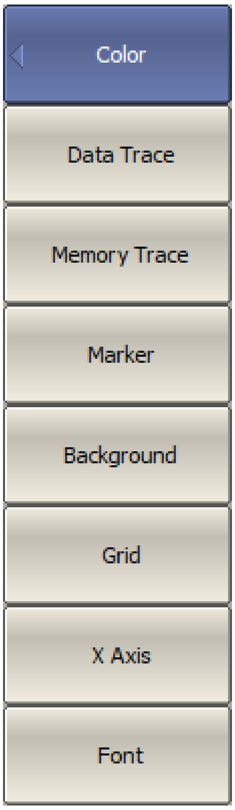
Display > Lines > Memory Width

To change the width of a grid, use the following softkeys:

Display > Lines > Grid Width

Color

The color of data and memory traces, markers, the background, and the grid can be changed if necessary.



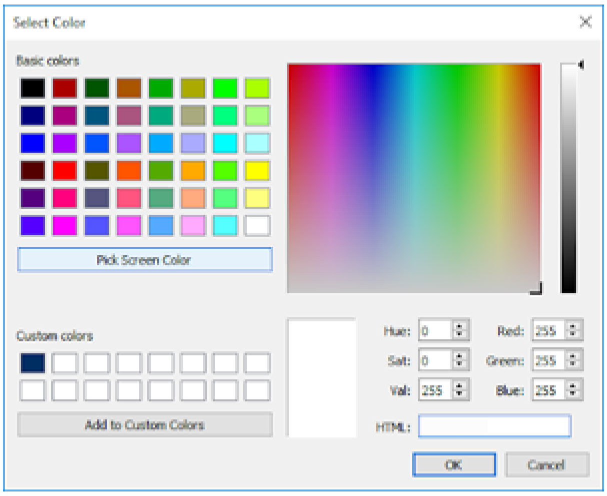
To change the color by categories of displayed items, use the following softkeys:

Display > Color

Select displayed items to customize:

- **Data Trace**
- **Memory Trace**
- **Marker**
- **Background**
- **Grid**
- **X Axis**
- **Font**

The color setting for the different displayed items is identical. Clicking the softkey of the selected item is moving to the MS color palette. Select color and click OK.

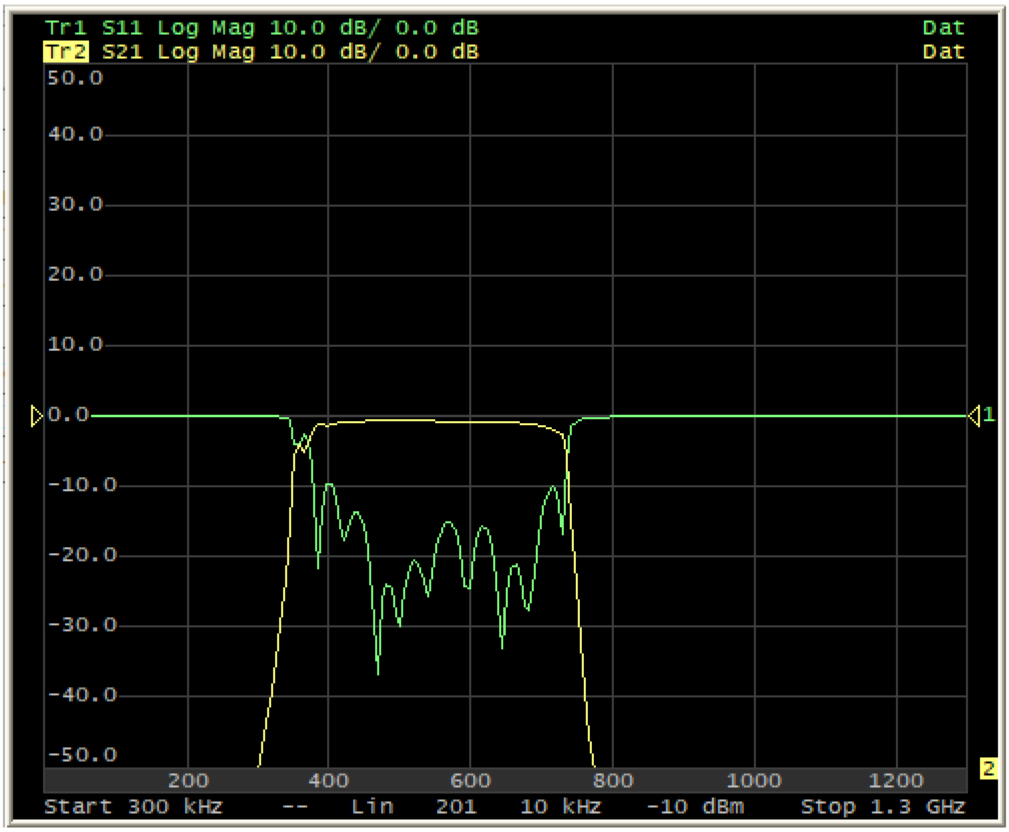


Hue: 0
Sat: 0
Val: 255
Red: 255
Green: 255
Blue: 255
HTML:

	The changes made to the color of the active data/memory traces will affect all the data/memory traces with the same number in other channels.
SCPI	DISPlay:COLor:BACK DISPlay:COLor:GRATicule DISPlay:COLor:TRACe:DATA DISPlay:COLor:TRACe:MEMory

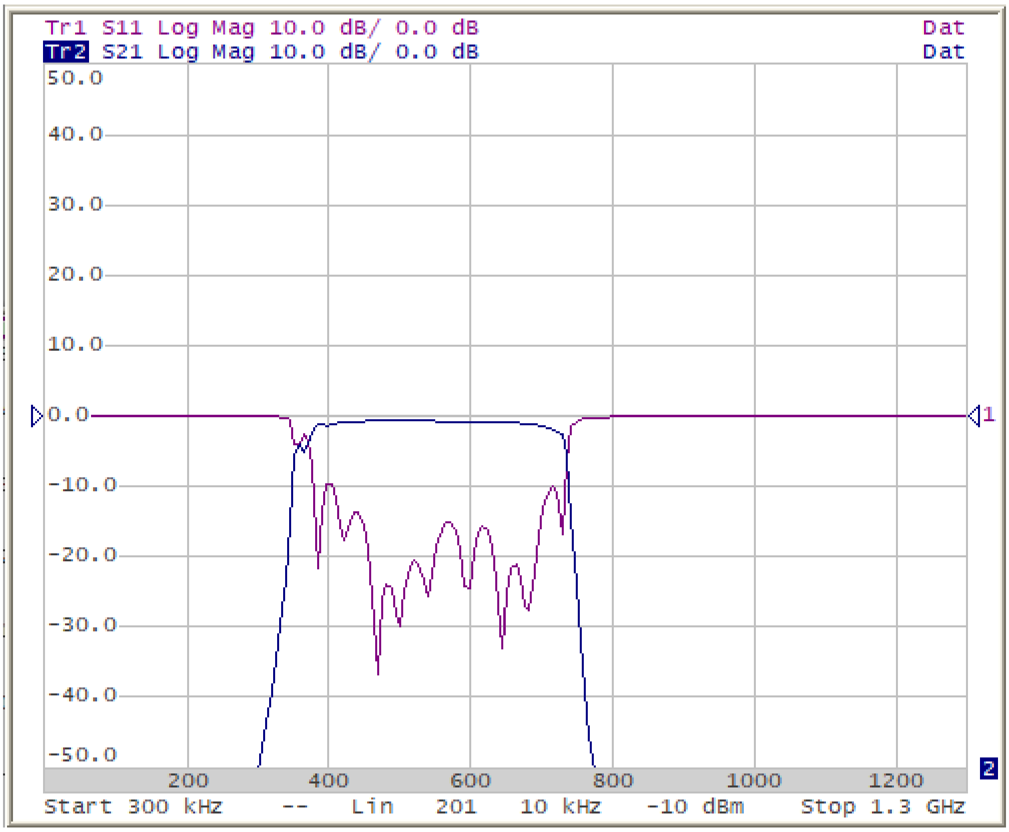
Invert Color of Diagram

By default, the diagram is in dark color mode. The color mode can be switched to light mode.

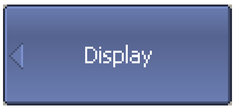


```
Tr1 S11 Log Mag 10.0 dB/ 0.0 dB                    Dat
Tr2 S21 Log Mag 10.0 dB/ 0.0 dB                    Dat
Start 300 kHz  --  Lin  201  10 kHz  -10 dBm  Stop 1.3 GHz
```

Dark Mode of Diagram (by default)



Light Color Mode of Diagram



To change the color mode of diagram, use the following softkeys:

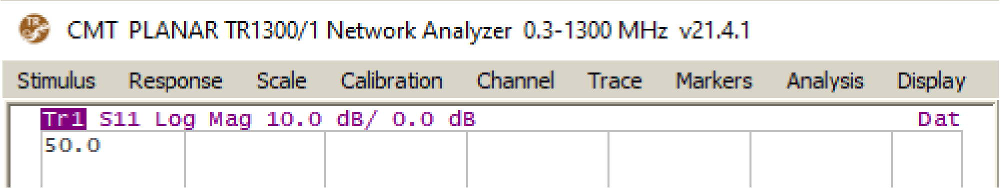
Display > Invert Color

SCPI DISPlay:IMAGe

Hide/Show Menu Bar

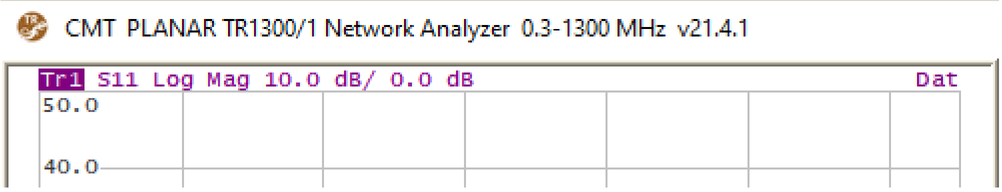
By default, the menu bar is located at the top of the screen (See figure below).

The menu bar can be optionally hidden to gain more screen space for the channel window, and is controlled by mouse.


CMT PLANAR TR1300/1 Network Analyzer 0.3-1300 MHz v21.4.1

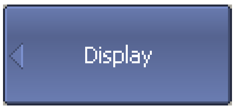
Tr1 S11 Log Mag 10.0 dB/ 0.0 dB Dat

Menu bar ON


CMT PLANAR TR1300/1 Network Analyzer 0.3-1300 MHz v21.4.1

Tr1 S11 Log Mag 10.0 dB/ 0.0 dB Dat

Menu bar OFF

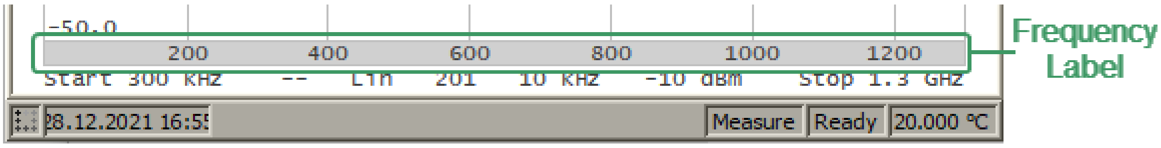


To hide/show the menu bar, use the following softkeys:

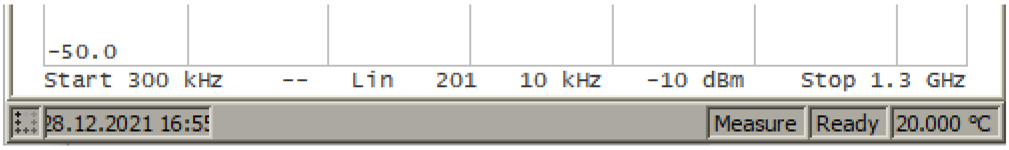
Display > Menu Bar

Hide/Show Frequency Label

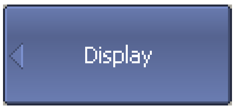
Horizontal frequency label is located at the down of the screen (See figure below). The frequency label can be hidden to gain more screen space for the trace display.

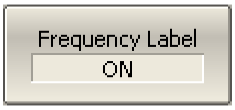


Horizontal frequency label ON



Horizontal frequency label OFF





To hide/show frequency label, use the following softkeys:

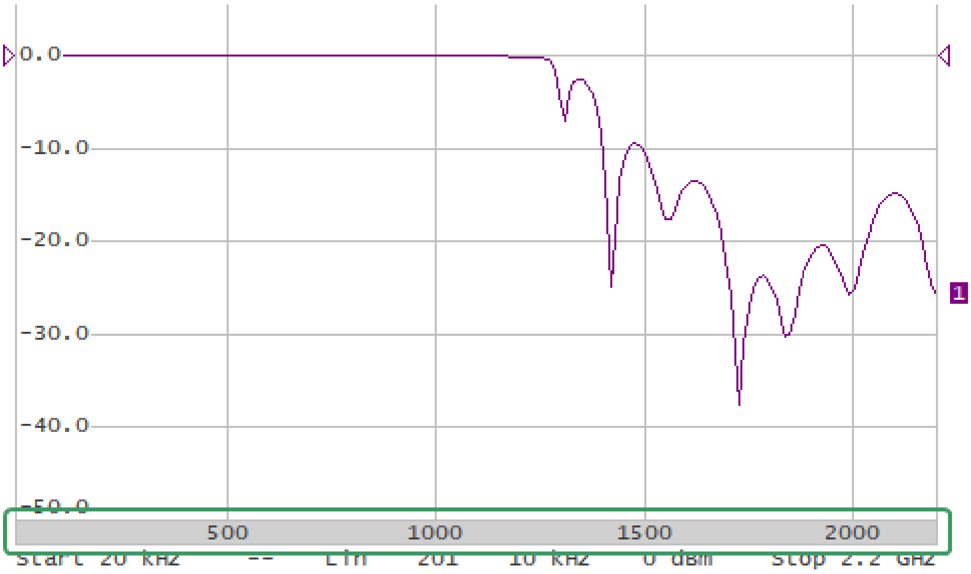
Display > Frequency Label [ON | OFF]

Fixed Grid

For the convenience of reading traces, the diagram area has a scale grid (See Diagram). The horizontal graticule label displays stimulus axis numeric data.

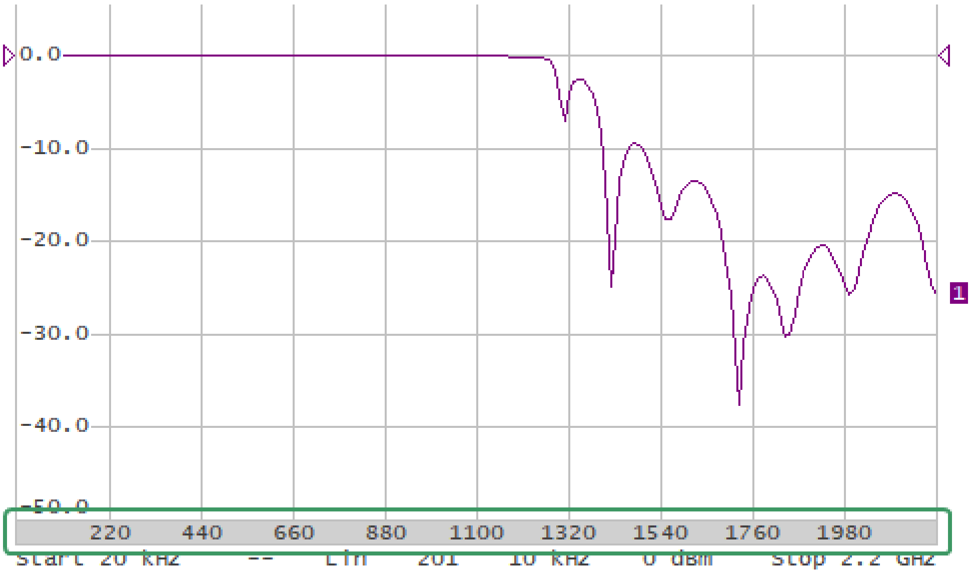
The analyzer provides two grid display modes for the stimulus axis — flexible grid or fixed grid.

In flexible grid mode, scale grid options are selected automatically (See figure below).

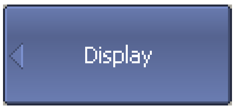


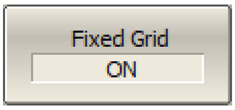
Flexible Grid Mode

In fixed grid mode, the diagram area along the stimulus axis is always divided into 10 equal divisions (See figure below). Stimulus axis numeric data is calculated automatically based on the sweep range.



Fixed Grid Mode



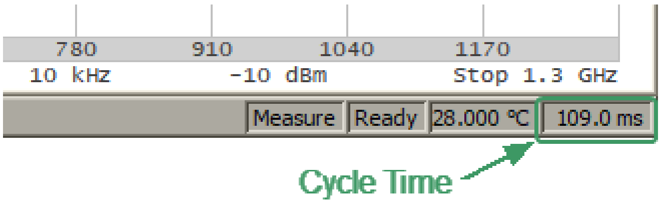


To enable fixed grid mode, use the following softkeys:

Display > Fixed Grid [ON | OFF]

Hide/Show Cycle Time

By default, the cycle time isn't displayed in the Analyzer 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.

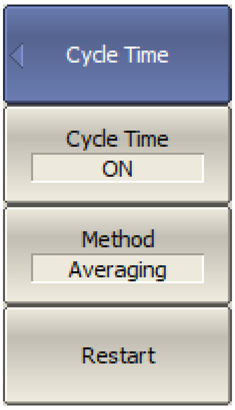


Cycle time ON

The measurement cycle time displayed in the Analyzer status bar should not be confused with the sweep time. The table below shows the difference between cycle time and sweep time.

	Cycle Time value	Sweep Time value
Method	Actually measured	Theoretically estimated
Scope	All sweeping channels	One channel
Range	Between the start points of two consecutive measurement cycles, including the time between sweeps	From the first sweep point to the last sweep point, excluding the time between sweeps

If one channel is open, the sweep time and cycle time are close. The difference is that the sweep time value does not include the delay between the sweeps.



To enable/disable the display of the cycle time in the analyzer status bar, use the following softkeys:

Display > Cycle Time > Cycle Time [ON | OFF]

To select the method of determining the cycle time, use the following softkeys:

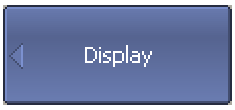
Display > Cycle Time > Method [Averaging | Max Hold]

The **Restart** softkey is used to restart the cycle time definition and reset the previous values.

Screen Update Setting

Screen updating can be disabled to reduce the sweep time. This function can be useful when remotely controlling the Analyzer.

A single screen update is possible when screen update is disabled. Click on the diagram for this.



To disable the screen updating, use the following softkeys:

Display > Update [ON | OFF]

SCPI

DISPlay:ENABle

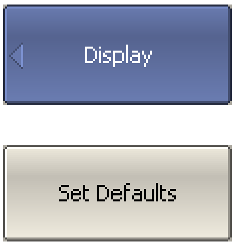
DISPlay:UPDate (Remote only)

NOTE

If screen updating is off, the message **Update Off** appears in the instrument status bar.

Interface Presetting

All set user interface settings can be reset.



To restore the interface settings to the default factory settings, use the following softkeys:

Display > Set Defaults

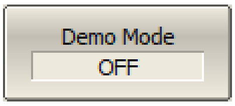
SCPI DISPlay:COLor:RESet

Demo Mode

Demo mode is designed to simulate DUT measurement. The measurement results of the DUT are pre-recorded in the program 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 following softkeys:

System > Misc Setup > Demo Mode [ON | OFF]

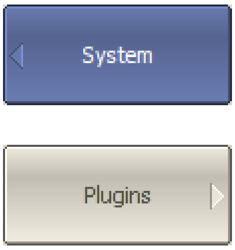
SCPI SYSTem:DEMO:LOCK

SYSTem:DEMO:STATe

SYSTem:DEMO:UNLOck

Plugins

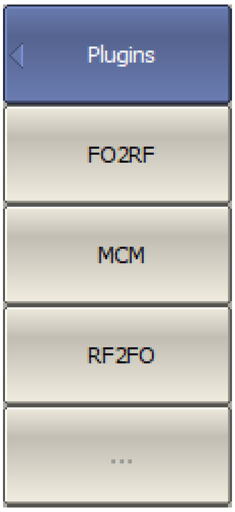
A plugin is an executable file that performs the user defined function using COM automation or SCPI commands of the VNA apllication. Create own plugin or download the plugin from the coppermountaintech.com website. Place the plugin in the VNA application home directory in the "plugins" folder.



The **Plugin** softkey will become active after placing the plugin in the specified folder.

To launch the plugin, enter the "plugins" menu using the following softkeys:

System > Plugin

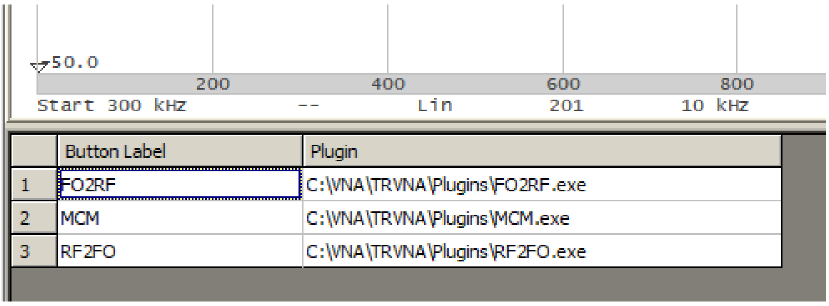


The name of the executable file will appear on the button in the "plugins" menu.

To launch the plugin, click the softkey with its name.

The label on the plugin button is edited in the plugins table. To open the plugin table, use the following softkeys:

System > Plugin > Edit Button Labels

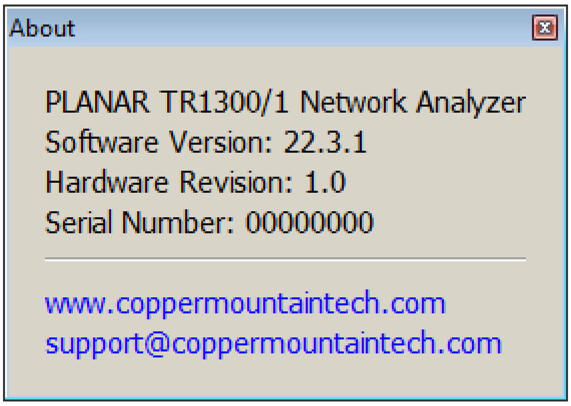


	Button Label	Plugin
1	FO2RF	C:\VNA\TRVNA\Plugins\FO2RF.exe
2	MCM	C:\VNA\TRVNA\Plugins\MCM.exe
3	RF2FO	C:\VNA\TRVNA\Plugins\RF2FO.exe

Plugin table

About

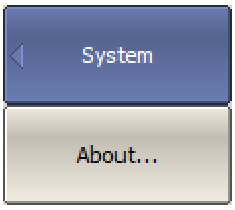
The analyzer model name, serial number, software and hardware versions, can be found in the System menu.


About

PLANAR TR1300/1 Network Analyzer
Software Version: 22.3.1
Hardware Revision: 1.0
Serial Number: 00000000

www.coppermountaintech.com
support@coppermountaintech.com

About



To request information, use the following softkeys:

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 programming of the Analyzer using SCPI commands or COM/DCOM technology. The SCPI commands are described in this manual as basic. The description of the equivalent COM command is provided at the end of the description of each SCPI command.

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 TCP Socket server in the settings of the analyzer's program. The default TCP/IP port number of protocol can be changed optionally.

TCP/IP Socket is a general-purpose protocol. For analyzers of the TR series, data transfer is carried out using the TCP/IP Socket protocol only.

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 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.

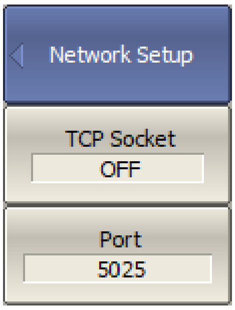
Analyzer Setting

For remote access to the Analyzer, make the following settings in its program:

- Enable Socket server.
- Configure the TCP/IP port number (optional).

NOTE

Configuring the TCP/IP port number is necessary only where several analyzer programs are simultaneously executed on the same PC, and these programs require remote control. In other cases, leave the default TCP/IP port number — 5025.



Network Setup

TCP Socket: OFF

Port: 5025

To enable/disable remote control of the Analyzer via a network using TCP/IP Socket protocol on, use the following softkeys:

System > Misc Setup > Network Setup > Socket Server > {ON/OFF}

If necessary, specify the port number using the following softkeys:

System > Misc Setup > Network Setup > Socket Port

Set port number.

Client Setting

Typically, the client uses the VISA library to establish connection to 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 protocol

Socket	TCPIP[board]::*host address*::*port*::SOCKET

Examples of VISA address for Socket protocol

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 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 server

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.

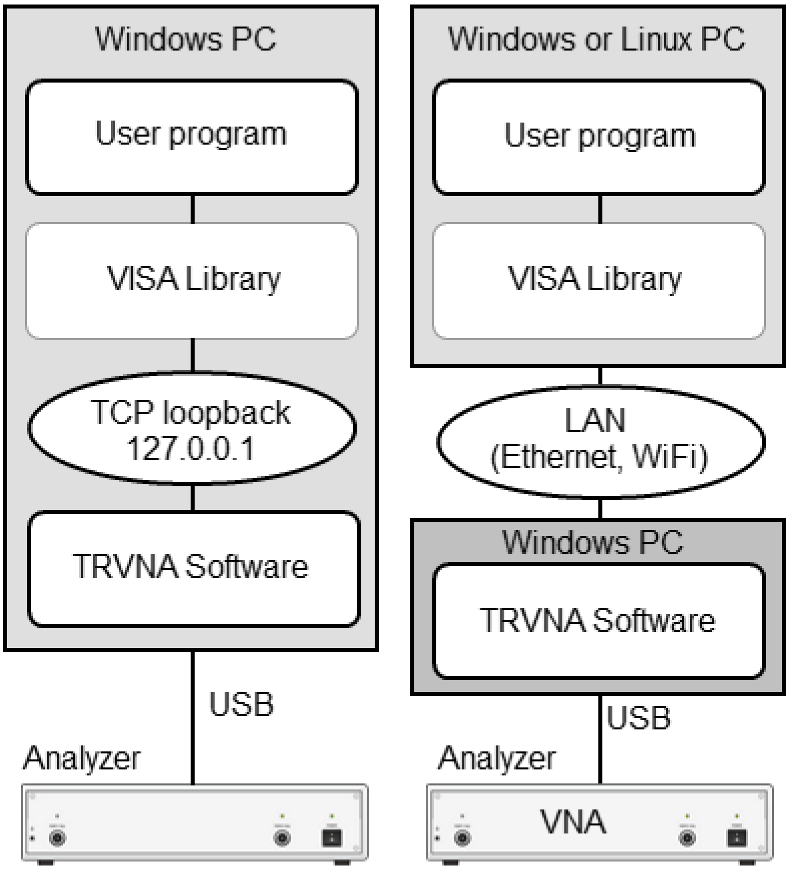
The VISA library is installed on the client side, on the PC where the user program is executed. The VISA library is available on the websites of many companies for free download. There are versions for Linux, Mac OS, Windows.

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.



Network and Local Configuration

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 i*nstead 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).

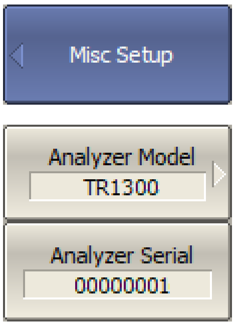
- It is recommended to create a separate folder for each Analyzer with the software. This allows to save individual settings for each Analyzer.
- It is recommended that each copy of the software be linked to a specific hardware unit by its serial number or model (See at the end of this section).
- Assign a unique TCP/IP port number for each copy of the software for the Socket protocol used. For example, 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 protocol 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 following softkeys:

System > Misc Setup > Analyzer Model

To link the analyzer program to the analyzer serial number, press the following softkeys:

System > Misc Setup > Analyzer Serial

Features of using the Socket protocol

This section describes methods for writing custom programs related to the features of using the Socket protocol. It is assumed that the user program works through the VISA library.

The brief list of individual features is given below:

1. The terminal character <newline> in the commands sent to the Analyzer.
2. The terminal character <newline> in the analyzer's responses.
3. Support for the IEEE488.2 *Status Reporting System*.
4. Support the transfer of binary data.

Then, a detailed description of each item is given.

Terminal Character in Messages to Analyzer

The user program sends variable-length text messages to the analyzer. The end of the message, according to IEEE488.2, is terminated either by protocol means (not by a symbol), or by the symbol <*newline*> ('\n', 0x0A, 10), or both methods together.

The Socket protocol does not have a mechanism for transmitting the end of the message by protocol means. This creates the mandatory requirement for programs sending commands to analyzer send a <newline> character at the end of the message.

NOTE	For the graphical language LabVIEW when using the Socket protocol to be able to enter the symbol <*newline*> at the end of the message, right-click on the string constant and enable **'\' Codes Display**. The <*newline*> character is entered as **'\n'**.

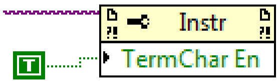
NOTE	For the textual languages it is recommended to use to the symbol <*newline*> at the end of the message.

Terminal Character in Analyzer Responses

When using the Socket protocol, the analyzer terminates messages only with the <newline> symbol, since the Socket protocol does not have the protocol defined end of message (not symbolic).

When using the Socket protocol, the following setting for the VISA library should be made so that it correctly determines the end of the message from the Analyzer. The user program must set the attribute VI_ATTR_TERMCHAR_EN to TRUE (completion of the read operation when the <newline> character is received).

Examples of setting up the VISA library using the Socket protocol

C/C++	viSetAttribute(instr, VI_ATTR_TERMCHAR_EN, VI_TRUE);
LabVIEW	

IEEE488.2 Status Reporting System

The Socket protocol only partially supports the analyzer's IEEE488.2 Status Reporting System described in the appendix. The Socket protocol does not support the following functions:

- The MAV (message available) bit in the Status Byte.
- SRQ (service request) generation — request from the Analyzer, implemented by callback functions in the VISA library.
- Read the Status Byte using the dedicated function — viReadSTB.

Transfer of Binary Data

By default, data from the Analyzer is sent in text form. To increase the speed of the data exchange, the user has the option to enable binary data transfer. The transfer of binary data is enabled by the FORMat:DATA command and is effective for commands that transfer large data amounts. A list of such commands is given in the description of the FORMat:DATA command.

The Socket protocol does not provide a protocol defined end of a message (not symbolic). Therefore, the Socket protocol does not always support VISA formatted input of the binary data (depends on VISA realization), since it uses the <newline> byte as the end of the message, which can occur in binary data.

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.

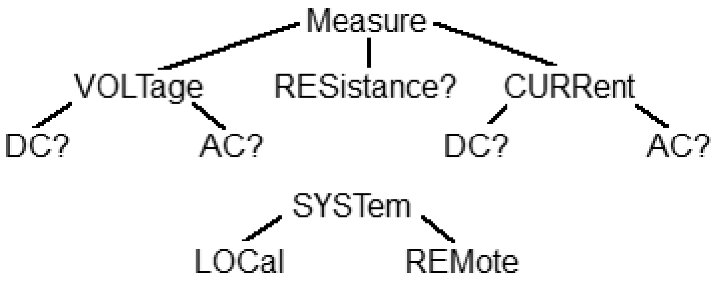
SCPI was developed by the SCPI Consortium (currently supported by the IVI Foundation). The main details of the SCPI standard are described further on. More information about the SCPI standard can be downloaded from the IVI Foundation website.

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 {INTernal|EXTernal|BUS}
```

where "BUS", "INTernal", "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.

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:

```
TRVNA.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.

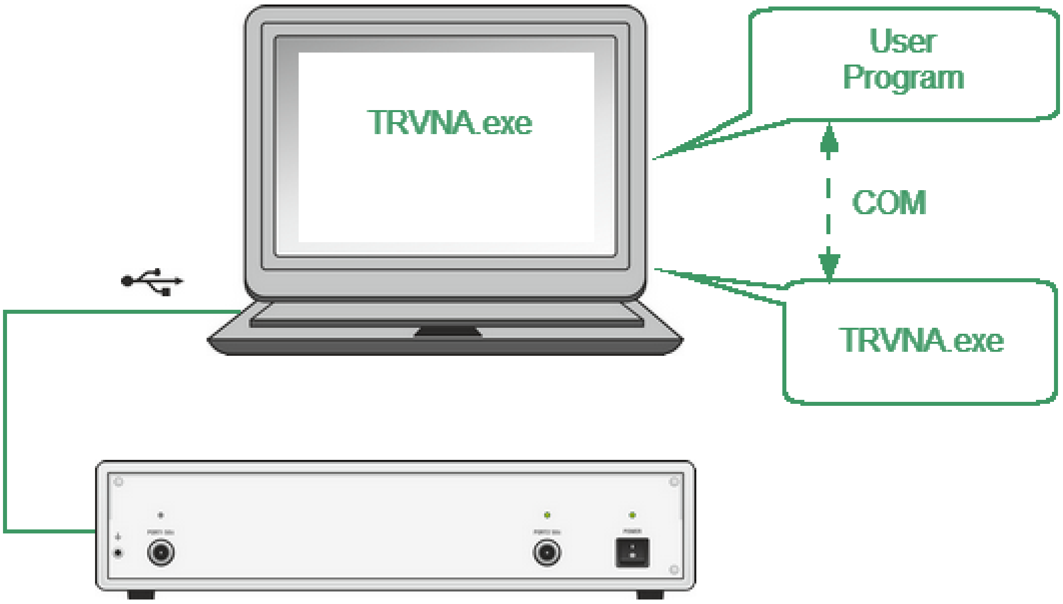
Examples written in VBA (Excel), C++, MATLAB, Python, and other languages are available at www.coppermountaintech.com. Source code of examples are also located in the Programming Examples\COM\ folder of the application installation folder.

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.

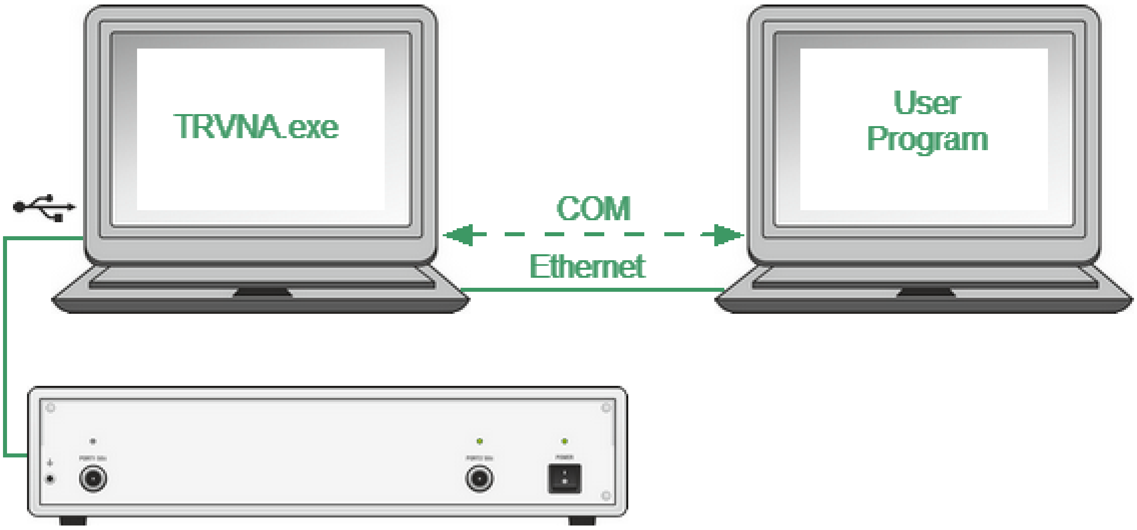
The **Local server** runs on the same PC with the automation controller and each of the programs is executed as an individual application in a separate window. COM technology is used in this case (See figure below).



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 TRVNA.exy 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("TRVNA.Applcation", "tr1300-000123")
Set app = CreateObject("TRVNA.Applcation.Applcation", "192.168.1.149")
```

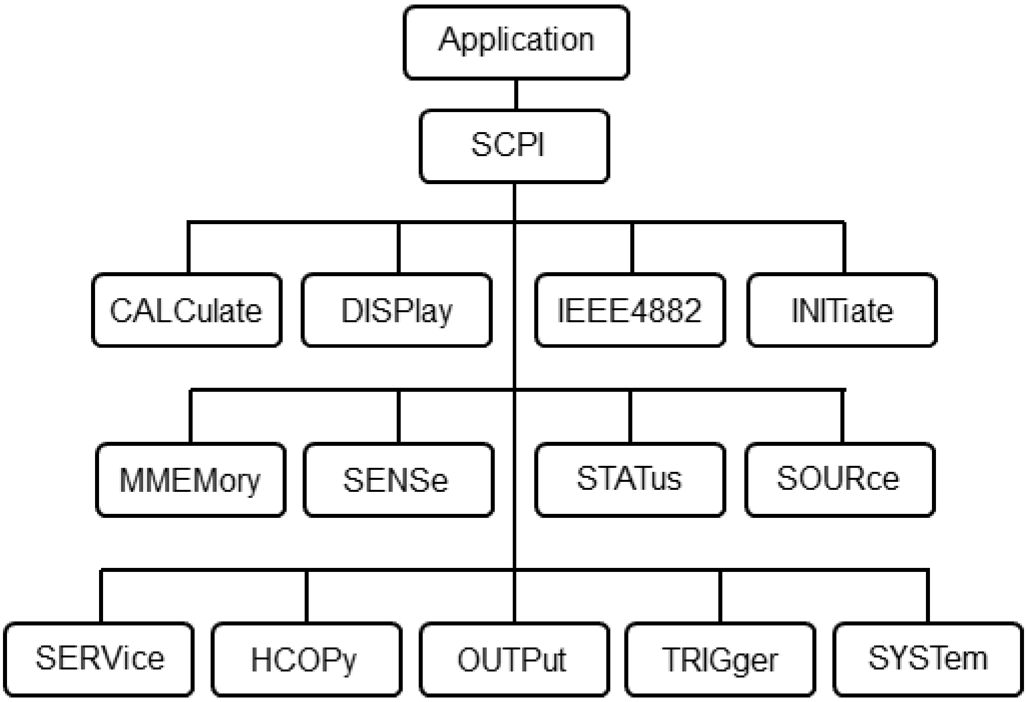
The network name of the device can be found in the system properties (Start> Control Panel> System> Computer Name).

The second method is to indicate the location of the COM server TRVNA.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 "TRVNA 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 TRVNA.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 "TRVNA.Application"
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("TRVNA.Application")
Set app = CreateObject("TRVNA.Application", "Analyzer_Name")
Set app = CreateObject("TRVNA.Application", "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 TRVNA executable module share the same COM object. The name of COM object is TRVNA.Application.

For example, the command for creating a COM server for an Analyzer is:

```
Set app = CreateObject("TRVNA.Application")
```

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("TRVNA.Application")
Set app = CreateObject("TR5048.Applcation")
Set app = CreateObject("TR7530.Applcation")
Set app = CreateObject("TR1300.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("TRVNA.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
    MsgBox Msg,,"Error"
End If
...
End Sub
```

In the second example, the *On Error GoTo ErrHandler* directive instructs VB to interrupt the program execution when the error is detected and to pass control to *ErrHandler* label.

```
Dim app
Public Sub HandleError2()
Set app = CreateObject("TRVNA.Applcation")
```

```
On Error GoTo ErrHandler
app.SCPI.PARameter.DEFine = "S13"
...
Exit Sub
ErrHandler:
    Msg = "Error # " & Str(Err.Number) & " was generated by " &_
    Err.Source & Chr(13) & Err.Description
    MsgBox 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

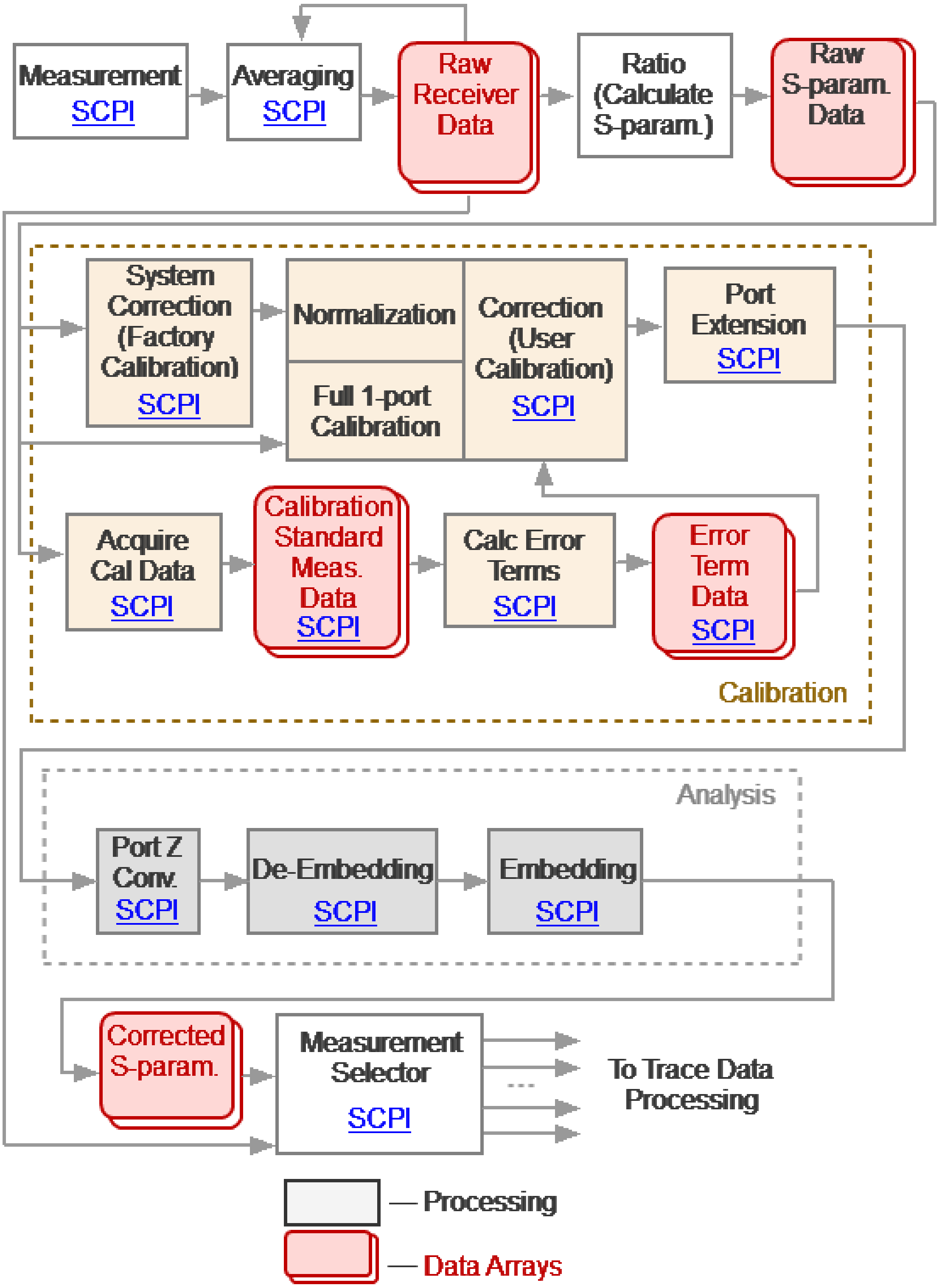
Array of real measurements

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.
- **Raw S-param. Data Arrays** are obtained by calculating the ratio of the signals two receivers.
- **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

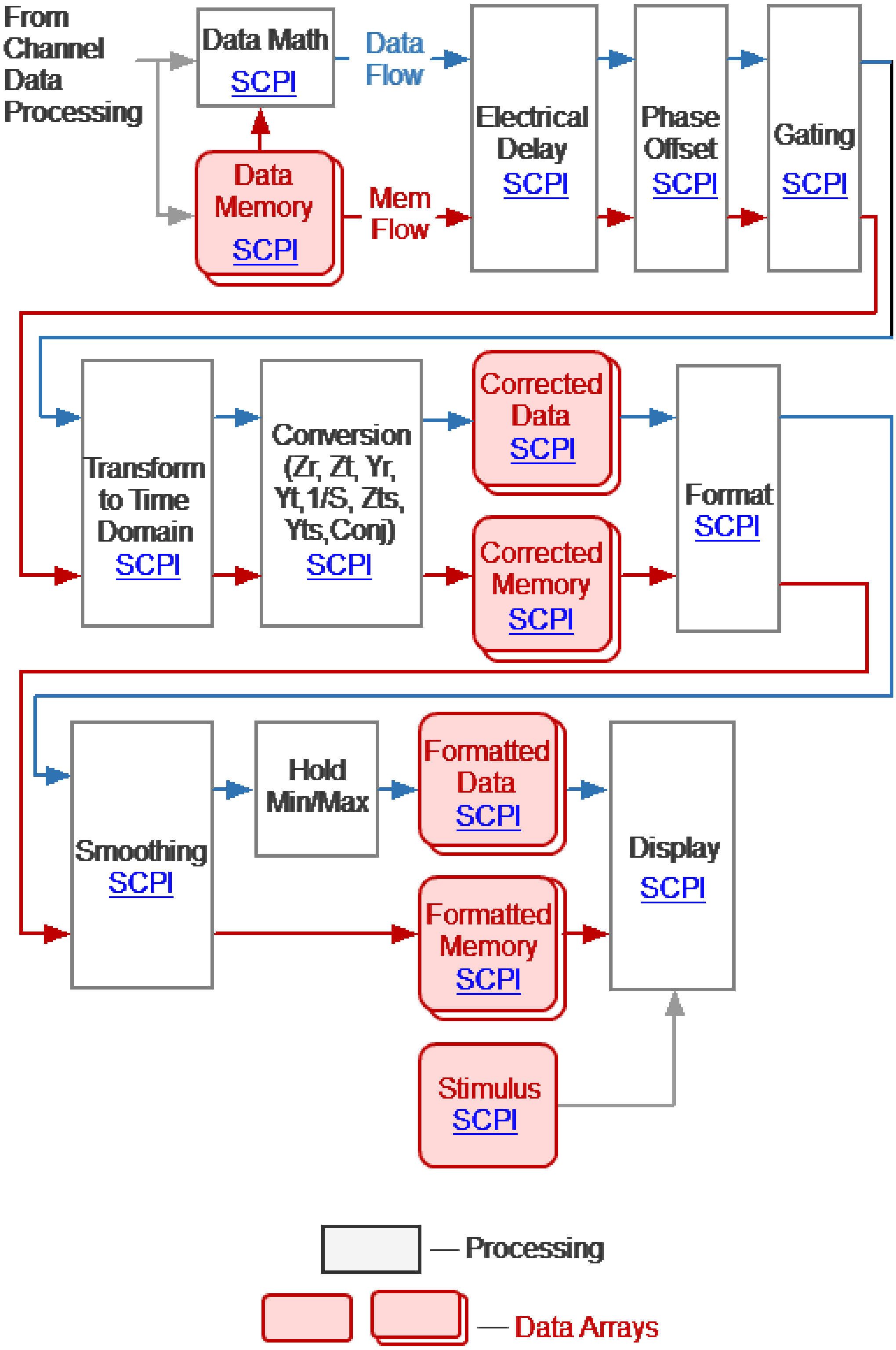
Error terms will be interpolated if, for example, the number of measurement points or stimulus settings for measurements and during calibration differ. In this case, the SENS:CORR:COEF command will read the interpolated data from the array.

- **Corrected 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.

The following data arrays: Data Memory, 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: Data Memory, 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

- **Data Memory** is the queue of memory arrays. The next array is saved in Data Memory as the result of activating the "Data-> Memory" function. The measurement

(S-parameter or receiver data) of the associated trace is copied to the array. The Data Memory depth (size) is eight. The memory can be used both for display and for math operations in conjunction with data. Active memory is selected for math operation 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. In subsequent stages of processing, the number of memory arrays equal to the Data Memory depth is used.

- **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, except for formatting. Array data is available for reading or writing using the SCPI command CALC:DATA:SDAT.

- **Corrected Memory Arrays** is obtained from the Data 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:

<>	Identifiers enclosed in angular brackets indicate that a particular type of data must be specified.
[]	Parts enclosed in square brackets can be omitted.
{}	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 "|".
Space	Space separates commands from parameters.
,	Comma separates adjacent parameters.
…	Ellipses indicate that parameters in that part are omitted.

Identifiers

Identifier	Parameter	Description
<numeric>	Number	{<integer>|<real>}
<frequency>	Frequency	<numeric>{[HZ]|KHZ|MHZ|GHZ}
<power>	Power	<numeric>{[DBM]|DBMW|DBW|KW|W|MW|UW|NW}
<time>	Time	<numeric>{[S]|MS|US|NS|PS|FS}
<phase>	Phase	<numeric>{[DEG]|MADEG|KDEG|MDEG|UDEG}
<stimulus>	Stimulus	{<frequency>|<power>|<time>}

Identifier	Parameter	Description
<logmag>	Log Amplitude	<numeric>[DB]
<response>	Response	{<logmag>|<phase>|<time>}
<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, trace hold, smoothing, time domain), trace analysis, limit tests, markers, trace memory, math, statistic, trace data transfer.
DISPlay	Display settings.
FORMat	Trace format.
HCOPy	Hardcopy 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	
*CLS	Status System	Clear status
*ESE		Standard Event Status Enable Register
*ESR?		Standard Event Status Register
*IDN?		Identify
*OPC		Operation complete command
*OPC?		Operation complete query
*RST		Reset
*SRE		Service Request Enable Register
*STB?		Status Byte Register
*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>/<firmware version>.

For example: CMT, TR1300/1, 00000101, 22.3.1/1.0

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

None

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

None

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 for the execution of all commands sent before this command.
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

None

Equivalent COM Command

SCPI.ABORt

Syntax

app.SCPI.ABORt

Type

Method

CALCulate

Command	Description	
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:DATA:FMEM		Formatted memory array
CALC:DATA:SDAT		Corrected data array
CALC:DATA:SMEM		Corrected memory array
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

Command	Description	
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
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

Command	Description	
CALC:FSIM:SEND:ZCON:PORT:Z0	Port Impedance Conversion	Z0 (port impedance value)
CALC:FSIM:SEND:ZCON:STAT		Port Z conversion ON/OFF
CALC:FUNC:DATA?	Trace Analysis	Analysis result data
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
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

Command	Description	
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
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

Command	Description	
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
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

Command	Description	
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
CALC:MARK:SET	Marker Functions	Sets item value according to the position of the marker
CALC:MATH:DEL	Memory Trace Function	Removes memory traces
CALC:MATH:FUNC		Math operation
CALC:MATH:MEM		Data => Memory
CALC:MST	Statistic	Math statistics ON/OFF
CALC:MST:DATA?		Math statistics data

Command	Description	
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
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 Band-pass/Low-pass type
CALC:TRAN:TIME:CENT		Time domain center

Command	Description	
CALC:TRAN:TIME:IMP:WIDT		Impulse Width
CALC:TRAN:TIME:KBES		Kaiser-Bessel β
CALC:TRAN:TIME:LPFR		Sets requency Low-Pass
CALC:TRAN:TIME:REFL:TYPE		Selects One way/Round trip
CALC:TRAN:TIME:SPAN		Time domain Span
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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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

Out of Range

Error occurs. The command is ignored.

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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 <numeric list>

CALCulate<Ch>[:SELected]:DATA:FDATa?

Or

CALCulate<Ch>:TRACe<Tr>:DATA:FDATa <numeric list>

CALCulate<Ch>:TRACe<Tr>:DATA:FDATa?

Description

Reads out or writes 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)

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.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Tr>={[1]|2|...8}

<Ch>={[1]|2|...9}

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

SCPI.CALCulate(Ch).TRACe(Tr).DATA.FDATa

Syntax

Data = app.SCPI.CALCulate(Ch).SELected.DATA.FDATa

app.SCPI.CALCulate(Ch).SELected.DATA.FDATa = Data

Data = app.SCPI.CALCulate(Ch).Trace(Tr).DATA.FDATa

app.SCPI.CALCulate(Ch).Trace(Tr).DATA.FDATa = Data

Type

Variant (array of Double) (read/write)

Back to CALCulate

CALC:DATA:FMEM

SCPI Command

CALCulate<Ch>[:SELected]:DATA:FMEMory <numeric list>

CALCulate<Ch>[:SELected]:DATA:FMEMory?

Or

CALCulate<Ch>:TRACe<Tr>:DATA:FMEMory <numeric list>

CALCulate<Ch>:TRACe<Tr>:DATA:FMEMory?

Description

Reads out or writes 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.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Tr>={[1]|2|...8}

<Ch>={[1]|2|...9}

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

SCPI.CALCulate(Ch).TRACe(Tr).DATA.FMEMory

Syntax

Data = app.SCPI.CALCulate(Ch).SELected.DATA.FMEMory

app.SCPI.CALCulate(Ch).SELected.DATA.FMEMory = Data

Data = app.SCPI.CALCulate(Ch).Trace(Tr).DATA.FMEMory

app.SCPI.CALCulate(Ch).Trace(Tr).DATA.FMEMory = Data

Type

Variant (array of Double) (read/write)

Back to CALCulate

CALC:DATA:SDAT

SCPI Command

CALCulate<Ch>[:SELected]:DATA:SDATa <numeric list>

CALCulate<Ch>[:SELected]:DATA:SDATa?

Or

CALCulate<Ch>:TRACe<Tr>:DATA:SDATa <numeric list>

CALCulate<Ch>:TRACe<Tr>:DATA:SDATa?

Description

Reads out or writes 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.

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Tr>={[1]|2|...8}
<Ch>={[1]|2|...9}

Query Response

<numeric 1>, <numeric 2>, …<numeric 2N>

Related Commands

FORM:DATA

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.DATA.SDATa

SCPI.CALCulate(Ch).TRACe(Tr).DATA.SDATa

Syntax

Data = app.SCPI.CALCulate(Ch).SELected.DATA.SDATa

app.SCPI.CALCulate(Ch).SELected.DATA.SDATa = Data

Data = app.SCPI.CALCulate(Ch).Trace(Tr).DATA.SDATa

app.SCPI.CALCulate(Ch).Trace(Tr).DATA.SDATa = Data

Type

Variant (array of Double) (read/write)

Back to CALCulate

CALC:DATA:SMEM

SCPI Command

CALCulate<Ch>[:SELected]:DATA:SMEMory <numeric list>

CALCulate<Ch>[:SELected]:DATA:SMEMory?

Or

CALCulate<Ch>:TRACe<Tr>:DATA:SMEMory <numeric list>

CALCulate<Ch>:TRACe<Tr>:DATA:SMEMory?

Description

Reads out or writes 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 Sparameter 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

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

Or

CALCulate<Ch>:TRACe<Tr> — trace <Tr> of channel <Ch>,

<Tr>={[1]|2|...8}

<Ch>={[1]|2|...9}

Query Response

<numeric 1>, <numeric 2>, …<numeric 2N>

Related Commands

CALC:MATH:MEM

FORM:DATA

Equivalent Softkeys

None

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.DATA.SMEMory

SCPI.CALCulate(Ch).TRACe(Tr).DATA.SMEMory

Syntax

Data = app.SCPI.CALCulate(Ch).SELected.DATA.SMEMory

app.SCPI.CALCulate(Ch).SELected.DATA.SMEMory = Data

Data = app.SCPI.CALCulate(Ch).Trace(Tr).DATA.SMEMory

app.SCPI.CALCulate(Ch).Trace(Tr).DATA.SMEMory = Data

Type

Variant (array of Double) (read/write)

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>,

<Tr>={[1]|2|...8}

<Ch>={[1]|2|...9}

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 only)

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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

Analysis > Gating > Center

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: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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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

Analysis > Gating > Span

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: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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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: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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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

Query Response

{MLOG|PHAS|GDEL|SLIN|SLOG|SCOM|SMIT|SADM|PLIN|PLOG|POL|MLIN|SWR|REAL|IMAG|UPH}

Preset Value

MLOG

Equivalent Softkeys

Responce > Format > {Log Mag | Phase | Group Delay | Lin Mag | SWR | Real | Imag | Phase Exp}

Responce > Format > Smith > {Log/Phase | Lin/Phase | Real/Imag | R+jX | G+jB}

Responce > Format > Polar > {Log/Phase | Ling/Phase | Real/Imag}

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|...9}
<Pt>={[1]|2}

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Analysis > Fixture Simulator > De–Embedding > Port n {ON/OFF}

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 \FixtireSim subdirectory of the application directory will be searched for the file.

command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|...9}

<Pt>={[1]|2}

Parameter

<srting>, up to 256 characters

Equivalent Softkeys

Analysis > Fixture Simulator > De–Embedding > S–parameters File

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|...9}
<PT>={[1]|2}

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Analysis > Fixture Simulator > Embedding > Port n {ON/OFF}

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 \FixtireSim subdirectory of the application directory will be searched for the file.

command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|...9}

<Pt>={[1]|2}

Parameter

<srting>, up to 256 characters

Equivalent Softkeys

Analysis > Fixture Simulator > Embedding > User File

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.
command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|...9}

<Pt>={[1]|2}

Parameter

<numeric> 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 Z Conversion > Port n 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

The channel <Ch>={[1]|2|...9}

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Analysis > Fixture Simulator > Port Z Conversion > Port Z Conversion {ON/OFF}

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

Query Response

<numeric 1>, <numeric 2>, …<numeric 2N>

The data transfer format depends on the FORM:DATA command setting.

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),

Or

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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|...9}

Parameter

{ON|1}	Coupling ON
{OFF|0}	Coupling OFF

Query Response

{0|1}

Preset Value

0

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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 <response>

CALCulate<Ch>[:SELected]: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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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 <response>

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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

Sets or reads out the transition type when using the CALC:FUNC:EXEC command to search crosspoints the trace and the target level (the ATARget analysis type is specified by the CALC:FUNC:TYPE command).

command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

<char> Specifies the transition with:

<char> specifies the transition:

POSitive	positive edges
NEGative	negative edges
BOTH	positive and negative edges

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

<char> specifies the type of analysis:

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

{ON|1}	Limit test function ON
{OFF|0}	Limit test function 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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

{ON|1}	Limit line display ON
{OFF|0}	Limit line display 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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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 only)

Back to CALCulate

CALC:LIM:OFFS:AMPL

SCPI Command

CALCulate<Ch>[:SELected]:LIMit:OFFSet:AMPLitude <response>

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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 > Limit Line Offsets > 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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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 > Limit Lines Offsets > 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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

Query Response

<numeric 1>, <numeric 2>,…<numeric N>

The data transfer format depends on the FORM:DATA command setting.

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. **Note**: 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 switches these markers between relative and absolute measurement mode.
command/query

Target

Marker <Mk> of the active trace of channel <Ch>,

<Ch>={[1]|2|...9}

<Mk>={[1] … |16}

Parameter

{ON|1}	Marker ON
{OFF|0}	Marker 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:MARK:ACT

SCPI Command

CALCulate<Ch>[:SELected]:MARKer<Mk>:ACTivate

Description

Sets the active marker.

Note: 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 switches these markers to the relative measurement mode.

no query

Target

Marker <Mk> of the active trace of channel <Ch>,

<Ch>={[1]|2|...9}

<Mk>={[1] … |16}

Equivalent Softkeys

Markers > Active Marker > Marker n

Markers > Reference Marker

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

{ON|1}	Bandwidth search function ON
{OFF|0}	Bandwidth search function OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Markers > Marker Math > Bandwidth Search > Bandwidth Search

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer.BWIDth.STATe

Syntax

Status = app.SCPI.CALCulate(Ch).SELected.MARKer.BWIDth.STATe

app.SCPI.CALCulate(Ch).SELected.MARKer.BWIDth.STATe = true

Type

Boolean (read/write)

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 be 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|...9}

<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:REFerence <char>

CALCulate<Ch>[:SELected]:MARKer:BWIDth:REFerence?

Description

Selects the reference for the bandwidth search function: marker or absolute maximum/minimum value of the trace.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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 > Marker Math > Bandwidth Search > Search Ref To

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer.BWIDth.REFerence

Syntax

Param = app.SCPI.CALCulate(Ch).SELected.MARKer.BWIDth.REFerence

app.SCPI.CALCulate(Ch).SELected.MARKer.BWIDth.REFerence = "marker"

Type

String (read/write)

Back to CALCulate

CALC:MARK:BWID:THR

SCPI Command

CALCulate<Ch>[:SELected]:MARKer<Mk>:BWIDth:THReshold <response>

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|...9}

<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 > Marker Math > Bandwidth Search > Bandwidth Value

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer.BWIDth.THReshold

Syntax

Value = app.SCPI.CALCulate(Ch).SELected.MARKer.BWIDth.THReshold

app.SCPI.CALCulate(Ch).SELected.MARKer.BWIDth.THReshold = –6.0

Type

Double (read/write)

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

<char> specifies the type of the bandwidth:

BPASs	Bandpass
NOTCh	Notch

Query Response

{BPAS|NOTC}

Preset Value

BPAS

Equivalent Softkeys

Markers > Marker Math > Bandwidth Search > Type

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer.BWIDth.TYPE

Syntax

Param = app.SCPI.CALCulate(Ch).SELected.MARKer.BWIDth.TYPE

app.SCPI.CALCulate(Ch).SELected.MARKer.BWIDth.TYPE = "notc"

Type

String (read/write)

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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.COUNt

Syntax

MarkerCnt = app.SCPI.CALCulate(Ch).SELected.MARKer.COUNt

app.SCPI.CALCulate(Ch).SELected.MARKer.COUNt = 5

Type

Long (read/write)

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|...9}

Parameter

{ON|1}	Marker coupling ON
{OFF|0}	Marker coupling OFF

Query Response

{0|1}

Preset Value

1

Equivalent Softkeys

Marker > Properties > Marker Couple

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer.COUPle

Syntax

Status = app.SCPI.CALCulate(Ch).SELected.MARKer.COUPle

app.SCPI.CALCulate(Ch).SELected.MARKer.COUPle = false

Type

Boolean (read/write)

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:FUNC:DOM:COUP command),

Or

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

{ON|1}	Arbitrary range
{OFF|0}	Entire sweep range

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Markers > Marker Search > Search Range

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer(Mk).FUNCtion.DOMain.STATe

Syntax

Status = app.SCPI.CALCulate(Ch).SELected.MARKer(1).FUNCtion.DOMain.STATe

app.SCPI.CALCulate(Ch).SELected.MARKer(1).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:FUNC:DOM:COUP command),

Or

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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 > Marker Search > Search Start

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer(Mk).FUNCtion.DOMain.STARt

Syntax

Value = app.SCPI.CALCulate(Ch).SELected.MARKer(1).FUNCtion.DOMain.STARt

app.SCPI.CALCulate(Ch).SELected.MARKer(1).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:FUNC:DOM:COUP command),

Or

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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 > Marker Search > Search Stop

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MARKer(Mk).FUNCtion.DOMain.STOP

Syntax

Value = app.SCPI.CALCulate(Ch).SELected.MARKer(1).FUNCtion.DOMain.STOP

app.SCPI.CALCulate(Ch).SELected.MARKer(1).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|...9}

<Mk>={[1] … |16}

Related Commands

CALC:MARK:FUNC:TYPE

CALC:MARK:FUNC:DOM

Equivalent Softkeys

Markers > Marker Search > {Maximum | Minimum}

Markers > Marker Search > Peak > {Search Peak | Search Max Peak | Search Peak Left | Search Peak Right}

Markers > Marker Search > Target > {Search Target | Search Target Left | Search 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 <response>

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|...9}

<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 > Marker 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|...9}

<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 > Marker 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 <response>

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|...9}

<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

0

Equivalent Softkeys

Markers > Marker 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|...9}

<Mk>={[1] … |16}

Parameter

{ON|1}	marker search tracking ON
{OFF|0}	marker search tracking OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Markers > Marker 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|...9}

<Mk>={[1] … |16}

Parameter

<char> specifies the transition with:

POSitive	positive edges
NEGative	negative edges
BOTH	positive and negative edges

Query Response

{POS|NEG|BOTH}

Preset Value

POS

Related Commands

CALC:MARK:FUNC:EXEC

Equivalent Softkeys

Marker > Marker 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> of the active trace of channel <Ch>,

<Ch>={[1]|2|...9}

<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 > Marker Search > {Maximum | Minimum}

Markers > Marker Search > Peak > {Search Peak | Search Max Peak | Search Peak Left | Search Peak Right}

Markers > Marker Search > Target > {Search Target | Search Target Left | Search 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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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.REFerence.STATe

Syntax

Status = app.SCPI.CALCulate(Ch).SELected.MARKer.REFerence.STATe

app.SCPI.CALCulate(Ch).SELected.MARKer.REFerence.STATe = true

Type

Boolean (read/write)

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|...9}

<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

Markers > Marker Functions > {Marker–>Start | Marker–>Stop | Marker –>Center | Marker–>Ref Value}

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|...9}

<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

Markers > Edit Stimulus

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|...9}

<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:MATH:DEL

SCPI Command

CALCulate<Ch>[:SELected]:MATH:DELete

Description

Removes all memory traces in the selected channel <Ch>.
no query

Target

The selected channel <Ch>,

<Ch>={[1] … |9}

Equivalent Softkeys

Trace > Delete All 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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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|DIV|MULT|SUBT|ADD}

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

Equivalent Softkeys

Trace > Memorize Data Trace

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MATH.MEMorize

Syntax

app.SCPI.CALCulate(Ch).SELected.MATH.MEMorize

Type

Method

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

{ON|1}	Statistics display ON
{OFF|0}	Statistics display OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Markers > Marker 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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

Query Response

<numeric 1>, <numeric 2>, numeric 3>

Related Commands

CALC:MST

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

Choose from:

{ON|1}	Partial frequency range
{OFF|0}	Entire frequency range

Query Response

{0|1}

Preset Value

0

Related Commands

CALC:MST:DOM:STAR

CALC:MST:DOM:STOP

Equivalent Softkeys

Markers > Marker Math > Statistics > Statistics Range

Equivalent COM Command

SCPI.CALCulate(Ch).SELected.MSTatistics.DOMain.STATe

Syntax

Status = app.SCPI.CALCulate(Ch).SELected.MSTatistics.DOMain.STATe

app.SCPI.CALCulate(Ch).SELected.MSTatistics.DOMain.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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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 > Marker 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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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 > Marker 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

The channel <Ch>,

<Ch>={[1]|2|...9}

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.COUNt

Syntax

TraceNum = app.SCPI.CALCulate(Ch).PARameter.COUNt

app.SCPI.CALCulate(Ch).PARameter.COUNt = 2

Type

Long (read/write)

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|...8}

<Ch>={[1]|2|...9}

Parameter

<char> specifies parameter:

S11, S21	S-parameter
A, B	Test receivers
R	Reference receiver

Query Response

{S11|S21|A|B|R}

Preset Value

Depends on the trace number:

Tr1, Tr3, Tr5, Tr7	"S11"
Tr2, Tr4, Tr6, Tr8	"S21"

Equivalent Softkeys

Responce > Measurement > {S11 | S21 | Abs A | Abs B | Abs R}

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>,

<Tr>={[1]|2|...8}

<Ch>={[1]|2|...9}

Related Commands

CALC:PAR:COUN

SERV:CHAN:TRAC:ACT?

Equivalent Softkeys

Active 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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

Choose from:

{ON|1}	Ripple limit test ON
{OFF|0}	Ripple limit test OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Analysis > Ripple Limit > 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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

Query Response

<numeric 1>, <numeric 2>, …<numeric 4N+1>

Related Commands

FORM:DATA

Equivalent Softkeys

Analysis > Ripple Limit > 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/write)

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

Choose from:

{ON|1}	Ripple limit line ON
{OFF|0}	Ripple limit line OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Analysis > Ripple Limit > Limit Line

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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 only)

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

Query Response

<numeric 1>, <numeric 2>, …<numeric 3N+1>

The data transfer format depends on the FORM:DATA command setting.

Related Commands

FORM:DATA

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

Choose from:

{ON|1}	Trace smoothing ON
{OFF|0}	Trace smoothing OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Response > 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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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

Response > Smo 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: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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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 Impulse | Lowpass Step}

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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

Analysis > Time Domain > Window > Impulse Width

(when the transformation type is set to Bandpass or Lowpass Impulse)

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 Kaise-Bessel window shape when performing the time domain transformation.
command/query

Target

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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

Analysis > Time Domain > Window > Kaiser Beta

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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

Related Commands

CALC:TRAN:TIME:UNIT

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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

Related Commands

CALC:TRAN:TIME:UNIT

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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

Related Commands

CALC:TRAN:TIME:UNIT

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

{ON|1}	Time domain transformation ON
{OFF|0}	Time domain transformation 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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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

Analysis > Time Domain > Window > Impulse Width

(when the transformation type is set to Lowpass Step)

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: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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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 Impulse | Lowpass Step}

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

CALCulate<Ch>[:SELected] — active trace of channel <Ch>,

<Ch>={[1]|2|...9}

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, s | 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

DISPlay

Command	Description	
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
DISP:WIND:TITL:DATA		Channel title label

Command	Description	
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:MEM		Memory value display on the marker 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: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
DISP:WIND:TRAC:STAT		Data trace display ON/OFF
DISP:WIND:TRAC:Y:AUTO	Scale	Auto scale

Command	Description	
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 > Properties > 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 > 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 > Set Defaults

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|...8}

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 > 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|...8}

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 > 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}	Display update ON
{OFF|0}	Display update 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}	Fail sign display ON
{OFF|0}	Fail sign display OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Analysis > Limit Test > Fail Sign

Analysis > Ripple Limit > 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 > Invert 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

Target

The active channel set by the command DISP:WIND:ACT.

Parameter

{ON|1}	Maximization ON
{OFF|0}	Maximization OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Channel > 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

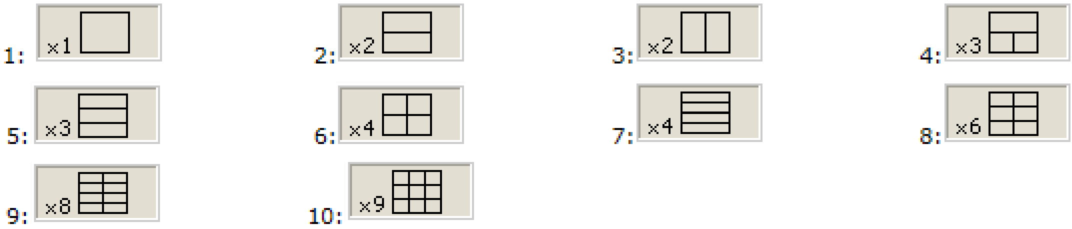
DISPlay:SPLit <numeric>

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



Parameter

<numeric> the code of the channel window layout from 1 to 10

NOTE	The layout code does not correspond to the number of channels.

Query Response

<numeric>

Preset Value

1

Equivalent Softkeys

Channel > Allocate 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|...9}

Related Commands

DISP:SPL

SERV:CHAN:ACT?

Equivalent Softkeys

Channel > 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|...9}

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

Markers > 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|...9}

Parameter

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

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

{ON|1}	Maximization ON
{OFF|0}	Maximization OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Trace > 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?

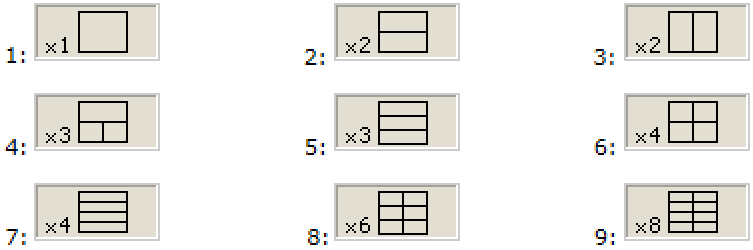
Description

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



Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

<numeric> the number of the graph layout from 1 to 9

NOTE	The layout code does not correspond to the number of traces.

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 > Allocate Traces

Equivalent COM Command

SCPI.DISPlay.WINDow(Ch).SPLit

Syntax

Value = app.SCPI.DISPlay.WINDow(Ch).SPLit

app.SCPI.DISPlay.WINDow(Ch).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|...9}

Parameter

{ON|1}	Channel title display ON
{OFF|0}	Channel title display OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Display > Title Label

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|...9}

Parameter

<string>, up to 256 characters (quoted string)

Query Response

<string>

Preset Value

"" (Empty string)

Equivalent Softkeys

None

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: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|...8}

<Ch>={[1]|2|...9}

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: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|...8}

<Ch>={[1]|2|...9}

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

Markers > Properties > Data X Position

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|...8}

<Ch>={[1]|2|...9}

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

Markers > Properties > Data Y Position

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: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|...8}

<Ch>={[1]|2|...9}

Parameter

{ON|1}	Memory trace display ON
{OFF|0}	Memory trace display 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|...8}
<Ch>={[1]|2|...9}

Parameter

{ON|1}	Data trace display ON
{OFF|0}	Data trace display 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|...8}

<Ch>={[1]|2|...9}

Related Commands

DISP:WIND:TRAC:Y:PDIV

DISP:WIND:TRAC:Y:RLEV

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:PDIV

SCPI Command

DISPlay:WINDow<Ch>:TRACe<Tr>:Y[:SCALe]:PDIVision <response>

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|...8}

<Ch>={[1]|2|...9}

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

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 <response>

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|...8}

<Ch>={[1]|2|...9}

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|...8}

<Ch>={[1]|2|...9}

Parameter

<numeric> the reference line position from 0 to the number of the scale divisions (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|...9}

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	
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:DATA:XAX?

CALC:FUNC:DATA?

CALC:LIM:DATA?

CALC:LIM:REP?

CALC:LIM:REP:ALL?

CALC:RLIM:DATA?

CALC:RLIM:REP?

SENS:CORR:COEF?

SENS:CORR:COLL:DATA:LOAD?

SENS:CORR:COLL:DATA:OPEN?

SENS:CORR:COLL:DATA:SHOR?

SENS:CORR:COLL:DATA:THRU:MATCh?

SENS:CORR:COLL:DATA:THRU:TRAN?

SENS:FREQ:DATA?

SENS:OFFS:PORT:DATA?

SENS:SEGM:DATA?

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	
HCOP	Printing	Quick print
HCOP:ABOR		Aborts the printout
HCOP:DATE:STAM		Date and time stamp ON/OFF
HCOP:IMAG		Inverted color of image
HCOP:PAIN		Color chart for image printout
HCOP:RECT		Image printout size

HCOP

SCPI Command

HCOPy[:IMMediate]

Description

Prints out the image displayed on the screen without previewing.

no query

Equivalent Softkeys

System > Print > Print Embedded

Equivalent COM Command

SCPI.HCOPy.IMMediate

Syntax

app.SCPI.HCOPy.IMMediate

Type

Method

Back to HCOPy

HCOP:ABOR

SCPI Command

HCOPy:ABORt

Description

Aborts the printout.
no query

Equivalent Softkeys

None

Equivalent COM Command

SCPI.HCOPy.ABORt

Syntax

app.SCPI.HCOPy.ABORt

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.
command/query

Parameter

{ON|1}	Date & time printout ON
{OFF|0}	Date & time printout OFF

Query Response

{0|1}

Preset Value

1

Equivalent Softkeys

System > 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

System > 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 Response

{COL|GRAY|BW}

Preset Value

BW

Equivalent Softkeys

System > 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	
INIT	Trigger	Sets trigger initiation mode to Single.
INIT:CONT		Continuous trigger initiation mode ON/OFF

INIT

SCPI Command

INITiate[:IMMediate]

Description

Sets trigger initiation mode to single. The Analyzer puts into a single trigger waiting state.

Channels should be in the hold state, otherwise an error occurs (error code 213), and the command is ignored. Channels goes into Hold as a result of the command INIT:CONT OFF.

Upon receipt of a trigger from the selected source, the sweep starts in turn for the all channels. On completion of the sweep, all channels goes to the Hold state.

The command is completed before the end of the sweep.

no query

Target

Analyzer

Related Commands

TRIG:SOUR

INIT:CONT

Equivalent Softkeys

Stimulus > Trigger > Single

Equivalent COM Command

SCPI.INITiate.IMMediate

Syntax

app.SCPI.INITiate.IMMediate

Type

Method

Back to INITiate

INIT:CONT

SCPI Command

INITiate:CONTinuous {OFF|ON|0|1}

INITiate: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.

command /query

Target

Analyzer

Parameter

Specifies the continuous trigger initiation mode:

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

1

Related Commands

TRIG:SOUR

INIT

Equivalent Softkeys

Stimulus > Trigger > Continuous

Stimulus > Trigger > Hold

Equivalent COM Command

SCPI.INITiate.CONTinuous

Syntax

Status = app.SCPI.INITiate.CONTinuous

app.SCPI.INITiate.CONTinuous = False

Type

Boolean (read/write)

Back to INITiate

MMEMory

Command	Description	
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:CBL	Cable Correction	Recalls the cable list
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

Command	Description	
MMEM:STOR:CHAN:CLE		Clears memory registers
MMEM:STOR:STYP		Saving type
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:FREQ		Enables the frequency setting from a Touchstone file when it loaded

Command	Description	
MMEM:LOAD:SNP:TRAC:MEM		Loads file to the memory trace
MMEM:STOR:SNP		Saves channel data
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: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 (quoted string)

<string2> destination file name (quoted string)

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 (quoted string)

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

System > 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

Target

Cable list

Parameter

<string> file name (quoted string)

Equivalent Softkeys

Analysis > Time Domain > Cable Correction > Select Cable > 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

System > Recall > Channel > State > { State A | State B | State C | State 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|...9}

Parameter

<string> file name

Equivalent Softkeys

System > 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|...50}

Parameter

<string> file name (quoted string)

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 (quoted string)

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 (quoted string)

Equivalent Softkeys

Analysis > Ripple Limit > Edit Ripple Limit > Restore Ripple Limit 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 (quoted string)

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 one-, two-port (file extensions *.S1P, *.S2P) are supported. On completion of the command, the trigger system goes to the Stop state.
no query

Target

The active channel set by the DISP:WIND:ACT command.

Parameter

<string> file name (quoted string)

Equivalent Softkeys

System > Recall > Touchstone File > To S-Parameters

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 one-, two-port (file extensions *.S1P, *.S2P) are supported. The current measured S-parameter of 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

The specified memory trace <Tr> of active channel,

<Tr>={[1]|2|...8}

Active channel set by the DISP:WIND:ACT command.

Parameter

<string> file name

Equivalent Softkeys

System > Recall > Touchstone File > 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 (quoted string)

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 (quoted string)

Related Commands

MMEM:STOR:STYP

Equivalent Softkeys

System > 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

Related Commands

MMEM:STOR:STYP

Equivalent Softkeys

System > 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.

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|...9}

Parameter

<string> file name

Equivalent Softkeys

System > 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

Target

Analyzer

Equivalent Softkeys

System > 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|...50}

Parameter

<string> file name (quoted string)

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 CSV formatted data into a 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

Target

Active trace of the active channel, set by the CALC:PAR:SEL command.

Parameter

<string> file name (quoted string)

Equivalent Softkeys

System > Save > 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

Target

Analyzer

Parameter

<string> file name (quoted string)

Equivalent Softkeys

System > Print > Print Windows > Save as…

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 (quoted string)

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 (quoted string)

Equivalent Softkeys

Analysis > Ripple Limit > Edit Ripple Limit > Save Ripple Limit 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 (quoted string)

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 (one-port or two-port) is set by the following commands: MMEM:STOR:SNP:TYPE:S1P, MMEM:STOR:SNP:TYPE:S2P. One–port type file saves one reflection parameter: S11. Two–port type file saves two parameters: S11, S21.

Note: If the full path of the file is not specified, the \FixtureSim 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 (quoted string)

Equivalent Softkeys

System > Save > Touchstone File > Save

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

System > Save > Touchstone File > 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

Selects the one-port Touchstone file type (*.S1P) when saving the measured S-parameters using the MMEM:STOR:SNP command. The port number is always 1.
command/query

Parameter

<port> the port number is always 1

Query Response

<numeric>

Preset Value

1

Equivalent Softkeys

System > Save > Touchstone File > Type > 1-Port (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 = 1

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 two-port Touchstone file type (*.S2P) and the port number when saving S-parameters using the MMEM:STOR:SNP command.

command/query

Parameter

<rcvport>	The port number of the receiver port is always 2
<srcport>	The port number of the source port is always 1

Query Response

<numeric1>, <numeric2>

Equivalent Softkeys

System > Save > Touchstone File > Type > 2-Port (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
DSTate	Measurement conditions and data
CDSTate	Measurement conditions, calibration, data and memory

Query Response

{STAT|CST|DST|CDST}

Preset Value

CST

Related Commands

MMEM:STOR

MMEM:STOR:CHAN

Equivalent Softkeys

System > Save > 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 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

Target

Analyzer

Parameter

{ON|1}	RF signal output ON
{OFF|0}	RF signal output 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	
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)
SENS:CORR:COEF	Read/Write Calibration Coefficients	Calibration coefficient data
SENS:CORR:COEF:METH:ERES		Selects one-path two-port method
SENS:CORR:COEF:METH:OPEN		Selects Response Open method

Command	Description	
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:ORD:LOAD?	Reads the standard number in the calibration kit	Load
SENS:CORR:COLL:CKIT:ORD:OPEN?		Open
SENS:CORR:COLL:CKIT:ORD:SHOR?		Short
SENS:CORR:COLL:CKIT:ORD:THRU?		Thru
SENS:CORR:COLL:CKIT:STAN:C0	Calibration Standard Definition	Capacitance C0 (Open)
SENS:CORR:COLL:CKIT:STAN:C1		Capacitance C1 (Open)

Command	Description	
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
SENS:CORR:COLL:CKIT:STAN:MEDI		Media type
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	
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
SENS:CORR:COLL:DATA:OPEN		Measurement array of Open
SENS:CORR:COLL:DATA:SHOR		Measurement array of Short
SENS:CORR:COLL:DATA:THRU:MATC		Reflection measurement array of Thru
SENS:CORR:COLL:DATA:THRU:TRAN		Transmission measurement array of Thru
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:PATH		Manual module orientation
SENS:CORR:COLL:ECAL:SOLT1		Procedure of one-port calibration
SENS:CORR:COLL:ECAL:SOLT2		Procedure of one path two-port calibration

Command	Description	
SENS:CORR:COLL:ECAL:UCH		Characterization number
SENS:CORR:COLL:ECAL:CHECK:EXEC		Executes the confidence check
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:THRU		Response Thru
SENS:CORR:COLL:METH:TYPE?		Calibration method query.
SENS:CORR:COLL:SAVE	Calibration Completion	Calibration completion

Command	Description	
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		Values of "Loss 1" and "Loss 2"
SENS:CORR:EXT:PORT:TIME		Electrical delay value
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
SENS:CORR:EXT:AUTO:MEAS		Measurement of Short or Open
SENS:CORR:EXT:AUTO:RES		Restart averaging between Short and Open
SENS:CORR:EXT:AUTO:SAVE		Complete measurements of Short or Open
SENS:CORR:EXT:AUTO:STAR		Start frequency of user span

Command	Description	
SENS:CORR:EXT:AUTO:STOP		Stop frequency of user span
SENS:CORR:IMP	System Impedance Setting	System Z0
SENS:CABL:COUN?	Cable Correction	Number of cables in the list
SENS:CABL:SEL		Cable selection
SENS:CORR:TRAN:TIME:FREQ		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:FREQ:DATA?	Data Transfer	Frequency array of the measurement points
SENS:FREQ	Stimulus Settings	Fixed frequency for a power sweep
SENS:FREQ:CENT		Center frequency
SENS:FREQ:SPAN		Span frequency

Command	Description	
SENS:FREQ:STAR		Start frequency
SENS:FREQ:STOP		Stop frequency
SENS:SEGM:DATA		Segment sweep table
SENS:SWE:POIN		Number of points
SENS:SWE:POIN:TIME		Point delay
SENS:SWE:TYPE		Sweep type
SENS:OFFS:ADJ	Mixer Measurements	Frequency offset adjust ON/OFF
SENS:OFFS:ADJ:CONT		Continuous offset adjust ON/OFF
SENS:OFFS:ADJ:CONT:PER		Adjust period
SENS:OFFS:ADJ:EXEC		Executes adjustment once
SENS:OFFS:ADJ:PORT		Adjusted Port
SENS:OFFS:ADJ:VAL		Adjust Value
SENS:OFFS		Frequency offset ON/OFF

Command	Description	
SENS:OFFS:PORT:DATA?		Port offset data

Command	Description		
SENS:OFFS:PORT:DIV		Port offset settings	Divisor
SENS:OFFS:PORT:MULT			Multiplier
SENS:OFFS:PORT:OFFS			Offset
SENS:OFFS:PORT:STAR			Start
SENS:OFFS:PORT:STOP			Stop
SENS:ROSC:SOUR	Analyzer Parameters	Reference source	
SENS:VVM:DATA?	Vector Volmeter Mode	Measurement result data	
SENS:VVM:FORM		Data format	
SENS:VVM:FREQ		Operating frequency	
SENS:VVM:REF:CLE		Clears the reference value	
SENS:VVM:REF:DATA?		Reference values data	
SENS:VVM:REF:MEM		Memorizes the reference value	

Command	Description	
SENS:VVM:TABL:CLE		Clears the table
SENS:VVM:TABL:DATA?		Data table
SENS:VVM:TABL:INS		Inserts a row into the table
SENS:VVM:TABL:MEM		Saves measurements to the table
SENS:VVM:TABL:REM		Removes a table row
SENS:VVM:TABL:SAVE		Saves the table into *.CSV file
SENS:VVM:TYPE		Sets measured parameter

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|...9}

Parameter

{ON|1}	Averaging ON
{OFF|0}	Averaging OFF

Query Response

{0|1}

Preset Value

0

Related Commands

SENS:AVER:COUN

Equivalent Softkeys

Response > 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|...9}

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|...9}

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

Response > Avg 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|...9}

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

Response > IF Bandwidth

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|...9}

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

Response > IF Bandwidth

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:COUN?

SCPI Command

SENSe:CABLe:COUNt?

Description

Returns the number of cables in the cable list.
query only

Target

Cable List

Equivalent Softkeys

None

Equivalent COM Command

None

Back to SENSe

SENS:CABL:SEL

SCPI Command

SENSe<Ch>:CABLe:SELect <numeric>

Description

Selects a cable from the cable list.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

<numeric> the cable number in cable list

Related Commands

SENS:CABL:COUN

Equivalent Softkeys

Analysis > Time Domain > Cable Correction > Select Cable > Select

Equivalent COM Command

None

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|...9}

Parameter

<char> specifies the Error term:

ER	Reflection tracking
ED	Directivity
ES	Source match
ET	Transmission tracking
EX	Isolation

EL	Load match

<rcvport> the number of the receiver port from 1 to 2

<srcport> the number of the source port = 1

<numeric list> the calibration coefficient array

When ES, ER, or ED is used, the numbers of the ports <rcvport> and <srcport> must be the same. When EL, ET, or EX is used, the numbers of the ports <rcvport> and <srcport> must be different.

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:CLE

SCPI Command

SENSe<Ch>:CORRection:CLEar

Description

Clears the calibration coefficient table.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

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:METH:ERES

SCPI Command

SENSe<Ch>:CORRection:COEFficient:METHod:ERESponse <rcvport>,<srcport>

Description

Selects the ports and sets the one-path two-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|...9}

Parameter

<rcvport> The number of the receiver port is always 2

<srcport> The number of the source port is always 1

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

SCPI.SENSe(Ch).CORRection.COEFficient.METHod.ERESponse

Syntax

Ports = Array(2, 1)

app.SCPI.SENSe(Ch).CORRection.COEFficient.METHod.ERESponse = Ports

Type

Variant (array of long) (write only)

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|...9}

Parameter

<port>	The number of the port is always 1

Out of Range

An error occurs..

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|...9}

Parameter

<port>	The number of the port is always 1

Out of Range

An error occurs..

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|...9}

Parameter

<port>	The number of the port is always 1

Out of Range

An error occurs..

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

Back to Command Finder (From User Interface)

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.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

<rcvport>	The number of the receiver port is always 2
<srcport>	The number of the source port is always 1

Out of Range

If an incorrect port number is specified, an error occurs. If the same port numbers are specified, an error occurs.

Related Commands

SENS:CORR:COEF:SAVE

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COEFficient.METHod.RESPonse.THRU

Syntax

Ports = Array(1, 2)

app.SCPI.SENSe(Ch).CORRection.COEFficient.METHod.RESPonse.THRU = Ports

Type

Variant (array of Long) (write only)

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|...9}

Related Commands

Calibration type selection:

SENS:CORR:COEF:METH:ERES

SENS:CORR:COEF:METH:OPEN

SENS:CORR:COEF:METH:SHOR

SENS:CORR:COEF:METH:THRU

SENS:CORR:COEF:METH:SOLT1

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:CORRection:COLLect:CKIT[:SELect] <numeric>
```

```
SENSe:CORRection:COLLect:CKIT[:SELect]?
```

Description

Sets or reads out the number of the selected calibration kit in the table of calibration kits.
command/query

Parameter

<numeric> the number of the calibration kit from 1 to 50

Query Response

<numeric>

Preset Value

1

Out of Range

Error occurs. The command is ignored.

Equivalent Softkeys

Calibration > Cal Kit > Cal Kit n > Select

Equivalent COM Command

```
SCPI.SENSe(Ch).CORRection.COLLect.CKIT.SELect
```

Syntax

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:CORRection:COLLect:CKIT:LABel <string>

SENSe:CORRection:COLLect:CKIT:LABel?

Description

Sets or reads out the calibration kit label.
command/query

Target

Selected calibration kit

Parameter

<string>, up to 254 characters (quoted string)

Query Response

<string>

Preset Value

Varies depending on the number of the calibration kit.

Equivalent Softkeys

Calibration > Cal Kit > Edit Cal Kit > Label

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.CKIT.LABel

Syntax

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:ORD:LOAD?

SCPI Command

SENSe:CORRection:COLLect:CKIT:ORDer:LOAD? <numeric>

Description

Reads out the number of the LOAD standard in the calibration kit used to measure the port 1.
query only

Target

Selected calibration kit

Parameter

<numeric>	The number of the calibration standard

Out of Range

If the specified standard number is greater than the number of standards in the kit, an error occurs. If the specified standard number is not the LOAD standard number, an error occurs.

Query Response

<numeric>

Equivalent Softkeys

None

Equivalent COM Command

None

Back to SENSe

SENS:CORR:COLL:CKIT:ORD:OPEN?

SCPI Command

SENSe:CORRection:COLLect:CKIT:ORDer:OPEN? <numeric>

Description

Reads out the number of the OPEN standard in the calibration kit used to measure the port 1.
query only

Target

Selected calibration kit

Parameter

<numeric>	The number of the calibration standard

Out of Range

If the specified standard number is greater than the number of standards in the kit, an error occurs. If the specified standard number is not the OPEN standard number, an error occurs.

Query Response

<numeric>

Equivalent Softkeys

None

Equivalent COM Command

None

Back to SENSe

SENS:CORR:COLL:CKIT:ORD:SHOR?

SCPI Command

SENSe:CORRection:COLLect:CKIT:ORDer:SHORt? <numeric>

Description

Reads out the number of the SHORT standard in the calibration kit used to measure the port 1.
query only

Target

Selected calibration kit

Parameter

<numeric>	The number of the calibration standard

Out of Range

If the specified standard number is greater than the number of standards in the kit, an error occurs. If the specified standard number is not the SHORT standard number, an error occurs.

Query Response

<numeric>

Equivalent Softkeys

None

Equivalent COM Command

None

Back to SENSe

SENS:CORR:COLL:CKIT:ORD:THRU?

SCPI Command

SENSe:CORRection:COLLect:CKIT:ORDer:THRU? <numeric>

Description

Reads out the number of the THRU standard in the calibration kit used to measure between the port 1 and port 2.
query only

Target

Selected calibration kit

Parameter

<numeric>	The number of the calibration standard

Out of Range

If the specified standard number is greater than the number of standards in the kit, an error occurs. If the specified standard number is not the THRU standard number, an error occurs.

Query Response

<numeric>

Equivalent Softkeys

None

Equivalent COM Command

None

Back to SENSe

SENS:CORR:COLL:CKIT:RES

SCPI Command

SENSe:CORRection:COLLect:CKIT:RESet

Description

Resets the predefined calibration kit to the factory settings. Removes the user defined calibration kit.
no query

Target

Selected calibration kit

Equivalent Softkeys

Calibration > 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:CORRection:COLLect:CKIT:STAN<Std>:C0 <numeric>

SENSe: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,

<Std>={[1]|2|...N}, where N is the number of the standards in the calibration kit

Parameter

<numeric> the C0 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 > Cal Kit > Edit Cal Kit > Capacitance > C0 10–15 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:CORRection:COLLect:CKIT:STAN<Std>:C1 <numeric>

SENSe: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,

<Std>={[1]|2|...N}, where N is 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 > Cal Kit > Edit Cal Kit > Capacitance > C1 10^{-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:CORRection:COLLect:CKIT:STAN<Std>:C2 <numeric>

SENSe: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,

<Std>={[1]|2|...N}, where N is the number of the standards in the calibration kit

Parameter

<numeric> the C2 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 > Cal Kit > Edit Cal Kit > Capacitance > C2 10^{-36} F/Hz2

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:CORRection:COLLect:CKIT:STAN<Std>:C3 <numeric>

SENSe: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,

<Std>={[1]|2|...N}, where N is the number of the standards in the calibration kit

Parameter

<numeric> the C3 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 > Cal Kit > Edit Cal Kit > Capacitance > C3 10^{-45} F/Hz3

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:CORRection:COLLect:CKIT:STAN<Std>:DELay <numeric>

SENSe: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,

<Std>={[1]|2|...N}, where N is 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 > Cal 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:CORRection:COLLect:CKIT:STAN<Std>:FMAXimum <numeric>

SENSe: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,

<Std>={[1]|2|...N}, where N is 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 > Cal Kit > Edit Cal Kit > Freq 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:CORRection:COLLect:CKIT:STAN<Std>:FMINimum <numeric>

SENSe: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,

<Std>={[1]|2|...N}, where N is 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 > Cal Kit > Edit Cal Kit > Freq 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|…|9}

<Std>={[1]|2|...K}, where K is 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

None

Equivalent COM Command

None

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:L0

SCPI Command

SENSe:CORRection:COLLect:CKIT:STAN<Std>:L0 <numeric>

SENSe: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,

<Std>={[1]|2|...N}, where N is 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 > Cal Kit > Edit Cal Kit > Inductance > L0 10^{-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:CORRection:COLLect:CKIT:STAN<Std>:L1 <numeric>

SENSe: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,

<Std>={[1]|2|...N}, where N is 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 > Cal Kit > Edit Cal Kit > Inductance > L1 10^{-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:CORRection:COLLect:CKIT:STAN<Std>:L2 <numeric>

SENSe: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,

<Std>={[1]|2|...N}, where N is 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 > Cal Kit > Edit Cal Kit > Inductance > L2 10–33 H/Hz2

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:CORRection:COLLect:CKIT:STAN<Std>:L3 <numeric>

SENSe: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,

<Std>={[1]|2|...N}, where N is 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 > Cal Kit > Edit Cal Kit > Inductance > L3 10–42 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:CORRection:COLLect:CKIT:STAN<Std>:LABel <string>

SENSe: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,

<Std>={[1]|2|...N}, where N is the number of the standards in the calibration kit

Parameter

<string>, up to 254 characters

Query Response

<string>

Equivalent Softkeys

None

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:CORRection:COLLect:CKIT:STAN<Std>:LOSS <numeric>

SENSe: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,

<Std>={[1]|2|...N}, where N is the number of the standards in the calibration kit

Parameter

<numeric> 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 > Cal Kit > Edit Cal Kit > Offset Loss

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).LOSS

Syntax

Value = app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).LOSS

app.SCPI.SENSe(Ch).CORRection.COLLect.CKIT.STAN(Std).LOSS = 700E6

Type

Double (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 media type of the calibration standard.
command/query

Target

Standard <Std> of the calibration kit specified for channel <Ch>,

<Ch>={[1]|2|…|9}

<Std>={[1]|2|...K}, where K is the number of the standards in the calibration kit

Parameter

COAX	Coaxial
WAVE	Waveguide

Out of Range

An error occurs if the specified media type is not COAX or WAVE.

Query Response

{COAX|WAVE}

Preset Value

COAX

Equivalent Softkeys

None

Equivalent COM Command

None

Back to SENSe

SENS:CORR:COLL:CKIT:STAN:TYPE

SCPI Command

SENSe:CORRection:COLLect:CKIT:STAN<Std>:TYPE <char>

SENSe:CORRection:COLLect:CKIT:STAN<Std>:TYPE?

Description

Sets or reads out the type of calibration standard <Std> in the selected calibration kit.
command/query

Target

Standard <Std> of the calibration kit,

<Std>={[1]|2|...N}, where N is 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

Query Response

{OPEN|SHOR|LOAD|THRU}

Equivalent Softkeys

Calibration > Cal Kit > Edit Cal Kit > STD Type > {Open | Short | Load | Thru}

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:CORRection:COLLect:CKIT:STAN<Std>:Z0 <numeric>
```

```
SENSe: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,

<Std>={[1]|2|...N}, where N is the number of the standards in the calibration kit

Parameter

<numeric> 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 > Cal 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.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Equivalent Softkeys

Calibration > Calibrate > {Response (Open) | Response (Short) | Response (Thru) | Full 1–Port Cal | One Path 2–Port Cal} > 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 <numeric list>

SENSe<Ch>:CORRection:COLLect:DATA:LOAD?

Description

Writes or reads out the array of the load calibration standard measurement for the port 1.

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

command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

<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

Data = 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 <numeric list>

SENSe<Ch>:CORRection:COLLect:DATA:OPEN?

Description

Writes or reads out the array of the open calibration standard measurement for the port 1.

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

command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

<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 <numeric list>

SENSe<Ch>:CORRection:COLLect:DATA:SHORt?

Description

Writes or reads out the array of the short calibration standard measurement for the port 1.

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

command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

<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:DATA:THRU:MATC

SCPI Command

SENSe<Ch>:CORRection:COLLect:DATA:THRU:MATCh <numeric list>

SENSe<Ch>:CORRection:COLLect:DATA:THRU:MATCh?

Description

Writes or reads out the array of the reflection measurement of the THRU standard connected between the receiver port 2 and the source port 1.

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

command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

<numeric list>	The data array of the reflection measurements using the THRU standard

Query Response

<numeric 1>, <numeric 2>, …<numeric 2N>

Related Commands

SENS:CORR:COLL:THRU

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.DATA.THRU.MATCh(Pt_r,Pt_s)

Syntax

Data = app.SCPI.SENSe(Ch).CORRection.COLLect.DATA.THRU.MATCh(Pt_r, Pt_s)

app.SCPI.SENSe(Ch).CORRection.COLLect.DATA.THRU.MATCh(Pt_r, Pt_s) = Data

Type

Variant (array of Double) (read/write)

Back to SENSe

SENS:CORR:COLL:DATA:THRU:TRAN

SCPI Command

SENSe<Ch>:CORRection:COLLect:DATA:THRU:TRANsmission <numeric list>

SENSe<Ch>:CORRection:COLLect:DATA:THRU:TRANsmission?

Description

Writes or reads out the array of the transmission measurement performed between the receiver port 2 and the source port 1 using the thru standard.

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

command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

<numeric list>	The data array of the transmission measurements using the thru standard

Query Response

<numeric 1>, <numeric 2>, …<numeric 2N>

Related Commands

SENS:CORR:COLL:THRU

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.DATA.THRU.TRANsmission(Pt_r, Pt_s)

Syntax

Data = app.SCPI.SENSe(Ch).CORRection.COLLect.DATA.THRU.TRANsmission(Pt_r, Pt_s)

app.SCPI.SENSe(Ch).CORRection.COLLect.DATA.THRU.TRANsmission(Pt_r, Pt_s) = Data

Type

Variant (array of Double) (read/write)

Back to SENSe

SENS:CORR:COLL:ECAL:CHECK:EXEC

SCPI Command

SENSe<Ch>:CORRection:COLLect:ECAL:CHECK:EXECute

Description

Executes the confidence check of the calibration coefficients of the specified channel using the AutoCal module.

The command sets the AutoCal Module to the special internal state, reads the S-parameters of this state from the AutoCal Module and sets memory traces so that they can be compared with actual measured data. Comparison is carried out visually by the user.

no query

Target

AutoCal module

(<Ch> is arbitrary number 1 to 9)

Equivalent Softkeys

Calibration > AutoCal > 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:INF?

SCPI Command

SENSe:CORRection:COLLect:ECAL:INFormation?

Description

Gets information on the AutoCal Module connected to the Network Analyzer.
query only

Target

AutoCal Module

Query Response

The query returns information in a string with comma separated fields.

Autocal Module Information:

- Model Name
- Serial Number
- Current Temperature of AutoCal Module

Selected Characterization Information:

- Characterization Name
- Characterization Date and Time
- Min Frequency
- Max Frequency
- 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(Ch).CORRection.COLLect.ECAL.INFormation

Type

String (read only)

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

Target

AutoCal Module

Equivalent Softkeys

Calibration > AutoCal > Orientation > 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}	Auto-Orientation function ON
{OFF|0}	Auto-Orientation function OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Calibration > AutoCal > Orientation > Auto {ON/OFF}

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.ECAL.ORIenation.STATe

Syntax

Status = app.SCPI.SENSe(Ch).CORRection.COLLect.ECAL.ORIentation.STATe

app.SCPI.SENSe(Ch).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 3- Port C of AutoCal Module 4- Port D of AutoCal Module

Query Response

<numeric>

Equivalent Softkeys

Calibration > AutoCal > Orientation > Port 1 –> {Port A | Port B | Port C | Port D}

Calibration > AutoCal > Orientation > Port 2 –> {Port A | Port B | Port C | Port D}

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.ECAL.PATH(Pt)

Syntax

Value = app.SCPI.SENSe(Ch).CORRection.COLLect.ECAL.PATH(Pt)

app.SCPI.SENSe(Ch).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 <port>

Description

Executes one-port calibration of the port 1 of the specified channel using the AutoCal module.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

<port>	Port 1

Equivalent Softkeys

Calibration > AutoCal > Full 1-Port AutoCal

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:ERESponse <port2>,<port1>

Description

Executes one path two-port calibration between the 2 ports of the specified channel using the AutoCal module.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|...16}

Parameter

<port1>	The port number is always 1
<port2>	The port number is always 2

Equivalent Softkeys

Calibration > AutoCal > One Path 2–Port Cal

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

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 > AutoCal > Characterization > {Factory | User 1 | User 2 | User 3}

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.ECAL.UCHar

Syntax

Param = app.SCPI.SENSe(Ch).CORRection.COLLect.ECAL.UCHar

app.SCPI.SENSe(Ch).CORRection.COLLect.ECAL.UCHar = "CHAR0"

Type

String (read/write)

Back to SENSe

SENS:CORR:COLL:LOAD

SCPI Command

SENSe<Ch>:CORRection:COLLect[:ACQuire]:LOAD <port>

Description

Measures the calibration data of the load standard for the port 1. **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. The command blocks the execution of the subsequent commands until the completion of the measurement.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

<port>	The number of the port is always 1

Equivalent Softkeys

Calibration > Calibrate > Response (Open) > Load (Optional)

Calibration > Calibrate > Response (Short) > Load (Optional)

Calibration > Calibrate > Full 1–Port Cal > Load

Calibration > Calibrate > One Path 2–Port Cal > Load

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.ACQuire.LOAD

Syntax

app.SCPI.SENSe(Ch).CORRection.COLLect.ACQuire.LOAD = 1

Type

Long (write only)

Back to SENSe

SENS:CORR:COLL:METH:ERES

SCPI Command

SENSe<Ch>:CORRection:COLLect:METHod:ERESponse <rcvport>,<srcport>

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.

no query

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

<rcvport>	The number of the receiver port is always 2
<srcport>	The number of the source port is always 1

Out of Range

If an incorrect port number is specified, an error occurs. If the same port numbers are specified, an error occurs. The command is ignored.

Related Commands

SENS:CORR:COLL:SAVE

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.METHod.ERESponse

Syntax

app.SCPI.SENSe(Ch).CORRection.COLLect.METHod.ERESponse = Array(2, 1)

Type

Variant (array of Long) (write only)

Back to SENSe

SENS:CORR:COLL:METH:OPEN

SCPI Command

SENSe<Ch>:CORRection:COLLect:METHod[:RESPonse]:OPEN <port>

Description

Selects the port 1 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|...9}

Parameter

<port>	The number of the port is always 1

Related Commands

SENS:CORR:COLL:SAVE

Out of Range

Error occurs. The command is ignored.

Equivalent Softkeys

None

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 <port>

Description

Selects the port 1 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|...9}

Parameter

<port>	The number of the port is always 1

Related Commands

SENS:CORR:COLL:SAVE

Out of Range

Error occurs. The command is ignored.

Equivalent Softkeys

None

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 1 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|...9}

Parameter

<port>	The number of the port is always 1

Related Commands

SENS:CORR:COLL:SAVE

Out of Range

Error occurs. The command is ignored.

Equivalent Softkeys

None

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:THRU

SCPI Command

SENSe<Ch>:CORRection:COLLect:METHod[:RESPonse]:THRU <rcvport>,<srcport>

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.

no query

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

<rcvport>	The number of the receiver port is always 2
<srcport>	The number of the source port is always 1

Out of Range

If an incorrect port number is specified, an error occurs. If the same port numbers are specified, an error occurs. The command is ignored.

Related Commands

SENS:CORR:COLL:SAVE

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.METHod.RESPonse.THRU

Syntax

app.SCPI.SENSe(Ch).CORRection.COLLect.METHod.RESPonse.THRU = Array(2,1)

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|...9}

Query Response

RESPO	Response (Open)
RESPS	Response (Short)
RESPT	Response (Thru)
SOLT1	Full one-port calibration
1PATH	One path two-port calibration
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:COLL:OPEN

SCPI Command

SENSe<Ch>:CORRection:COLLect[:ACQuire]:OPEN <port>

Description

Measures the calibration data of the open standard for the port 1.

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. The command blocks the execution of the subsequent commands until the completion of the measurement.

no query

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

<port>	The number of the port is always 1

Out of Range

Error occurs. The command is ignored.

Equivalent Softkeys

Calibration > Calibrate > Response (Open) > Open

Calibration > Calibrate > Full 1–Port Cal > Open

Calibration > Calibrate > One Path 2–Port Cal > Open

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.ACQuire.OPEN

Syntax

app.SCPI.SENSe(Ch).CORRection.COLLect.ACQuire.OPEN = 1

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|...9}

Related Commands

Calibration type selection:

SENS:CORR:COLL:METH:OPEN

SENS:CORR:COLL:METH:SHOR

SENS:CORR:COLL:METH:THRU

SENS:CORR:COLL:METH:ERES

SENS:CORR:COLL:METH:SOLT1

Calibration standards measurement:

SENS:CORR:COLL:LOAD

SENS:CORR:COLL:OPEN

SENS:CORR:COLL:SHOR

SENS:CORR:COLL:THRU

Equivalent Softkeys

Calibration > Calibrate > {Response (Open) | Respose (Short) | Response (Thru) | Full 1-Port Cal | One Path 2-Port Cal} > 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 port 1. **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. The command blocks the execution of the subsequent commands until the completion of the measurement.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

<port>	The number of the port is always 1

Out of Range

Error occurs. The command is ignored.

Equivalent Softkeys

Calibration > Calibrate > Response (Short) > Short

Calibration > Calibrate > Full 1–Port Cal > Short

Calibration > Calibrate > One Path 2–Port Cal > Short

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.ACQuire.SHORt

Syntax

app.SCPI.SENSe(Ch).CORRection.COLLect.ACQuire.SHORt = 1

Type

Long (write only)

Back to SENSe

SENS:CORR:COLL:THRU

SCPI Command

SENSe<Ch>:CORRection:COLLect[:ACQuire]:THRU <rcvport>,<srcport>

Description

Measures the calibration data of the thru standard between the receiver port <rcvport> and the source port <srcport>.

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. The command blocks the execution of the subsequent commands until the completion of the measurement.

no query

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

<rcvport>	The number of the receiver port is always 2
<srcport>	The number of the source port is always 1

Out of Range

If an incorrect port number is specified, an error occurs. If the same port numbers are specified, an error occurs. The command is ignored.

Equivalent Softkeys

Calibration > Calibrate > Response (Thru) > Thru

Calibration > Calibrate > One Path 2–Port Cal > Thru

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.COLLect.ACQuire.THRU

Syntax

app.SCPI.SENSe(Ch).CORRection.COLLect.ACQuire.THRU= Array(2, 1)

Type

Variant (array of Long) (write 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|...9}

Parameter

{ON|1}	Port extension function ON
{OFF|0}	Port extension function OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Calibration > Port Extensions > Extension {ON | OFF}

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|...9}

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 | Active 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|...9}

Parameter

{ON|1}	"Loss at DC" value is used
{OFF|0}	"Loss at DC" value is not used

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|...9}

Parameter

{ON|1}	"Loss1"and "Loss2" values are used
{OFF|0}	"Loss1"and "Loss2" values are not used

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" for the results of the auto port extension function. This command is executed for port 1 only. When two consecutive measurements of "SHORT" and "OPEN" are performed the results of these measurements are averaged by the command SENS:CORR:EXT:AUTO:SAVE.
command

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

SHORt	Measures "SHORT" standard
OPEN	Measures "OPEN" standard

Equivalent Softkeys

Calibration > Port Extension > Auto Port Extension > {Measure Short | Measure 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|...9}

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. The measurements are performed by command SENS:CORR:EXT:AUTO:MEAS. When two consecutive measurements of SHORT and OPEN are performed the results of these measurements are averaged.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

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|...9}

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 Extension > 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|...9}

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 Extension > 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|...9}

<Pt>={[1]|2}

Parameter

<frequency> the frequency 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

1E9

Equivalent Softkeys

Calibration > Port Extensions > Loss > {Frequency 1 | Frequency 2}

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.EXTension.PORT(Pt).FREQuency(Ls)

Syntax

Value = app.SCPI.SENSe(Ch).CORRection.EXTension.PORT(Pt).FREQuency(Ls)

app.SCPI.SENSe(Ch).CORRection.EXTension.PORT(Pt).FREQuency(Ls) = 100E6

Type

Double (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

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|...9}

<Pt>={[1]|2}

Parameter

{ON|1}	Loss compensation ON
{OFF|0}	Loss compensation OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Calibration > Port Extensions > Loss > Loss 1 {ON | OFF}

Calibration > Port Extensions > Loss > Loss 2 {ON | OFF}

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 <numeric>

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|...9}

<Pt>={[1]|2}

Parameter

<numeric> 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 Extensions > Loss > 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} <numeric>
```

```
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|...9}

<Pt>={[1]|2}

Parameter

<numeric> 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 Extensions > Loss > Loss 1 {Value}

Calibration > Port Extensions > Loss > 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|...9}
<Pt>={[1]|2}

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 Extensions > Extension Port 1 {Value}

Calibration > Port Extensions > Extension Port 2 {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] <numeric>

SENSe:CORRection:IMPedance[:INPut][:MAGNitude]?

Description

Sets or reads out the system impedance Z0 of all Analyzer ports.
command/query

Target

Analyzer

Parameter

<numeric> the Z0 value from 0.001 to 1000.

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

Calibration > System Z0

Equivalent COM Command

SCPI.SENSe(Ch).CORRection.IMPedance.INPut.MAGNitude

Syntax

Value = app.SCPI.SENSe.CORRection.IMPedance.INPut.MAGNitude

app.SCPI.SENSe.CORRection.IMPedance.INPut.MAGNitude = 50

Type

Double (read/write)

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|...9}

Parameter

{ON|1}	Error correction ON
{OFF|0}	Error correction OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Calibration > Correction {ON | OFF}

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|...9}

Parameter

<frequency> the frequency value.

Unit

Hz (Hertz)

Query Response

<numeric>

Preset Value

1 GHz

Equivalent Softkeys

Analysis > Time Domain > Cable 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 = 1E9

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|...9}

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 Correction > Cable 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|...9}

Parameter

<numeric> the cable velocity factor

Query Response

<numeric>

Preset Value

1.0

Equivalent Softkeys

Analysis > Time Domain > Cable 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 = 0.68

Type

Double (read/write)

Back to SENSe

SENS:CORR:TRAN:TIME:STAT

SCPI Command

SENSe<Ch>:CORRection:TRANsform:TIME:STATe {OFF|ON|0|1}

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|...9}

Parameter

{ON|1}	Cable correction ON
{OFF|0}	Cable correction OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Analysis > Time Domain > Cable Correction > Cable Correction {ON | OFF}

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|...8}

<Ch>={[1]|2|...9}

Query Response

{RESPO|RESPS|RESPT|SOLT1|SOLT2|1PATH|NONE},<srcport>,<rcvport>

Where <Type> is:

RESPO	Response (Open)
RESPS	Response (Short)
RESPT	Response (Thru)
SOLT1	Full one-port calibration
1PATH	One path two-port calibration
NONE	Not defined

<rcvport>, the number of the receiver port from 1 to 2

<srcport>, the number of the source port is 1

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

SCPI Command

```
SENSe<Ch>:FREQuency[:CW] <frequency>

SENSe<Ch>:FREQuency[:FIXed] <frequency>

SENSe<Ch>:FREQuency[:CW]?

SENSe<Ch>:FREQuency[:FIXed]?
```

Description

Sets or reads out the fixed frequency value when the power sweep type is selected.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

<frequency> the frequency 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 minimum frequency limit of the analyzer.

Equivalent Softkeys

Stimulus > Power > CW Freq

Equivalent COM Command

SCPI.SENSe(Ch).FREQuency.CW

Syntax

Value = app.SCPI.SENSe(Ch).FREQuency.CW

app.SCPI.SENSe(Ch).FREQuency.CW = 1E9

Type

Double (read/write)

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|...9}

Parameter

<frequency> the stimulus center 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 center frequency of the analyzer

Equivalent Softkeys

Stimulus > Center

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: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|...9}

Query Response

<numeric 1>, <numeric 2>, …<numeric N>

The data transfer format depends on the FORM:DATA command setting.

Related Commands

FORM:DATA

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: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|...9}

Parameter

<frequency> the stimulus span value from 0 to the maximum frequency span 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 span of the analyzer

Equivalent Softkeys

Stimulus > Span

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|...9}

Parameter

<frequency> the stimulus start 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 minimum frequency span of the analyzer

Equivalent Softkeys

Stimulus > Start

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|...9}

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:OFFS

SCPI Command

SENSe<Ch>:OFFSet[:STATe] {OFF|ON|0|1}

SENSe<Ch>:OFFSet[:STATe]?

Description

Turns the frequency offset feature ON/OFF.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

{ON|1}	Frequency offset ON
{OFF|0}	Frequency offset OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Stimulus > Freq. Offset > Freq. Offset {ON | OFF}

Equivalent COM Command

SCPI.SENSe(Ch).OFFSet.STATe

Syntax

Status = app.SCPI.SENSe(Ch).OFFSet.STATe

app.SCPI.SENSe(Ch).OFFSet.STATe = True

Type

Boolean (read/write)

Back to SENSe

SENS:OFFS:ADJ

SCPI Command

SENSe<Ch>:OFFSet:ADJust[:STATe] {OFF|ON|0|1}

SENSe<Ch>:OFFSet:ADJust[:STATe]?

Description

Turns the frequency offset adjust function ON/OFF.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

{ON|1}	Frequency offset adjust ON
{OFF|0}	Frequency offset adjust OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Stimulus > Freq. Offset > Offset Adjust > Offset Adjust {ON | OFF}

Equivalent COM Command

SCPI.SENSe(Ch).OFFSet.ADJust.STATe

Syntax

Status = app.SCPI.SENSe(Ch).OFFSet.ADJust.STATe

app.SCPI.SENSe(Ch).OFFSet.ADJust.STATe = True

Type

Boolean (read/write)

Back to SENSe

SENS:OFFS:ADJ:CONT

SCPI Command

SENSe<Ch>:OFFSet:ADJust:CONTinuous[:STATe] {ON|OFF|1|0}

SENSe<Ch>:OFFSet:ADJust:CONTinuous[:STATe]?

Description

Sets or reads out the ON/OFF state of the continuous frequency offset adjust feature.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

{ON|1}	Continuous frequency offset adjust ON
{OFF|0}	Continuous frequency offset adjust OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Stimulus > Freq. Offset > Offset Adjust > Contin. Adjust

Equivalent COM Command

SCPI.SENSe(Ch).OFFSet.ADJust.CONTinuous.STATe

Syntax

Status = app.SCPI.SENSe(Ch).OFFSet.ADJust.CONTinuous.STATe

app.SCPI.SENSe(Ch).OFFSet.ADJust.CONTinuous.STATe = True

Type

Boolean (read/write)

Back to SENSe

SENS:OFFS:ADJ:CONT:PER

SCPI Command

SENSe<Ch>:OFFSet:ADJust:CONTinuous:PERiod <numeric>

SENSe<Ch>:OFFSet:ADJust:CONTinuous:PERiod?

Description

Sets or reads out the period for continuous offset adjust feature.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

<numeric> the period for continuous offset adjust feature:

1 – 3 sec

2 – 10 sec

3 – 30 sec

4 – 100 sec

5 – 300 sec

Query Response

<numeric>

Preset Value

3

Equivalent Softkeys

Stimulus > Frequency Offset > Offset Adjust > Auto Adjust Period {3 sec | 10 sec | 30 sec | 100 sec | 300 sec}

Equivalent COM Command

SCPI.SENSe(Ch).OFFSet.ADJust.CONTinuous.PERiod

Syntax

Value = app.SCPI.SENSe(Ch).OFFSet.ADJust.PERiod

app.SCPI.SENSe(Ch).OFFSet.ADJust.PERiod = 1

Type

Long (read/write)

Back to SENSe

SENS:OFFS:ADJ:EXEC

SCPI Command

SENSe<Ch>:OFFSet:ADJust:EXECute

Description

Executes the frequency offset adjust procedure once and sets the value of the frequency adjust when the frequency offset feature is ON.
command

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Equivalent Softkeys

Stimulus > Frequency Offset > Offset Adjust > Adjust Immediate

Equivalent COM Command

SCPI.SENSe(Ch).OFFset.ADJust.EXECute

Syntax

app.SCPI.SENSe(Ch).OFFset.ADJust.EXECute

Type

Method

Back to SENSe

SENS:OFFS:ADJ:PORT

SCPI Command

SENSe<Ch>:OFFSet:ADJust:PORT <numeric>

SENSe<Ch>:OFFSet:ADJust:PORT?

Description

Sets or reads out the port number for frequency offset adjust feature.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

<numeric> port number 1 to 2

Query Response

<numeric>

Preset Value

1

Out of Range

Sets the value of the limit, which is closer to the specified value.

Equivalent Softkeys

Stimulus > Freq. Offset > Offset Adjust > Select Port

Equivalent COM Command

SCPI.SENSe(Ch).OFFset.ADJust.PORT

Syntax

Value = app.SCPI.SENSe(Ch).OFFset.ADJust.PORT

app.SCPI.SENSe(Ch).OFFset.ADJust.PORT = 2

Type

Long (read/write)

Back to SENSe

SENS:OFFS:ADJ:VAL

SCPI Command

SENSe<Ch>:OFFSet:ADJust:VALue <hertz>

SENSe<Ch>:OFFSet:ADJust:VALue?

Description

Sets or reads out the value of the offset adjust. The value is added to the frequency offset of the port set by the SENS:OFFS:ADJ:PORT command. The value is automatically adjusted when the SENS:OFFS:ADJ:EXEC command is executed.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

<hertz> adjust value of the offset adjust feature from –5E5 to 5E5.

Unit

Hz (Hertz)

Query Response

<numeric>

Preset Value

0

Out of Range

Sets the value of the limit, which is closer to the specified value.

Equivalent Softkeys

Stimulus > Freq. Offset > Offset Adjust > Adjust Value

Equivalent COM Command

SCPI.SENSe(Ch).OFFSet.ADJust.VALue

Syntax

Value = app.SCPI.SENSe(Ch).OFFSet.ADJust.VALue

app.SCPI.SENSe(Ch).OFFSet.ADJust.VALue = 1000

Type

Double (read/write)

Back to SENSe

SENS:OFFS:PORT:DATA?

SCPI Command

SENSe<Ch>:OFFSet:PORT<Pt>[:FREQuency]:DATA?

Description

Reads out the array of the frequency points of port <Pt> when the frequency offset feature is ON. The offset type is always "PORT".

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 point

query only

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|...9}

<Pt>={[1]|2}

Query Response

<numeric 1>, <numeric 2>, …<numeric N>

Related Commands

FORM:DATA

SENS:OFFS

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SENSe(Ch).OFFSet.PORT(Pt).FREQuency.DATA

Syntax

Data = app.SCPI.SENSe(Ch).OFFSet.PORT(Pt).FREQuency.DATA

Type

Variant (array of Double) (read only)

Back to SENSe

SENS:OFFS:PORT:DIV

SCPI Command

SENSe<Ch>:OFFSet:PORT<Pt>[:FREQuency]:DIVisor <numeric>

SENSe<Ch>:OFFSet:PORT<Pt>[:FREQuency]:DIVisor?

Description

Sets or reads out the basic frequency range divisor of port <Pt> when the frequency offset feature is ON. The offset type is always "PORT".
command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|...9}

<Pt>={[1]|2}

Parameter

<numeric> divisor from 1 to 1000

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

1

Related Commands

SENS:OFFS

Equivalent Softkeys

Stimulus > Freq. Offset > Port n > Divider

Equivalent COM Command

SCPI.SENSe(Ch).OFFSet.PORT(Pt).FREQuency.DIVisor

Syntax

Value = app.SCPI.SENSe(Ch).OFFset.PORT(Pt).FREQuency.DIVisor

app.SCPI.SENSe(Ch).OFFset.PORT(Pt).FREQuency.DIVisor = 2

Type

Double (read/write)

Back to SENSe

SENS:OFFS:PORT:MULT

SCPI Command

SENSe<Ch>:OFFSet:PORT<Pt>[:FREQuency]:MULTiplier <numeric>

SENSe<Ch>:OFFSet:PORT<Pt>[:FREQuency]:MULTiplier?

Description

Sets or reads out the basic frequency range multiplier of port <Pt> when the frequency offset feature is ON. The offset type is always "PORT".
command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|...9}

<Pt>={[1]|2}

Parameter

<numeric> multiplier from –1000 to 1000

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

1

Related Commands

SENS:OFFS

Equivalent Softkeys

Stimulus > Freq. Offset > Port n > Multiplier

Equivalent COM Command

SCPI.SENSe(Ch).OFFSet.PORT(Pt).FREQuency.MULTiplier

Syntax

Value = app.SCPI.SENSe(Ch).OFFset.PORT(Pt).FREQuency.MULTiplier

app.SCPI.SENSe(Ch).OFFset.PORT(Pt).FREQuency.MULTiplier = 2

Type

Double (read/write)

Back to SENSe

SENS:OFFS:PORT:OFFS

SCPI Command

SENSe<Ch>:OFFSet:PORT<Pt>[:FREQuency]:OFFSet <frequency>

SENSe<Ch>:OFFSet:PORT<Pt>[:FREQuency]:OFFSet?

Description

Sets or reads out the basic frequency range offset of port <Pt> when the frequency offset feature is ON. The offset type is always "PORT".

command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|...9}

<Pt>={[1]|2}

Parameter

<frequency> offset from –1e12 to 1e12

Unit

Hz (Hertz)

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

0

Related Commands

SENS:OFFS

Equivalent Softkeys

Stimulus > Freq. Offset > Port n > Offset

Equivalent COM Command

SCPI.SENSe(Ch).OFFSet.PORT(Pt).FREQuency.OFFSet

Syntax

Value = app.SCPI.SENSe(Ch).OFFset.PORT(Pt).FREQuency.OFFSet

app.SCPI.SENSe(Ch).OFFset.PORT(Pt).FREQuency.OFFSet = 1e9

Type

Double (read/write)

Back to SENSe

SENS:OFFS:PORT:STAR

SCPI Command

```
SENSe<Ch>:OFFSet:PORT<Pt>[:FREQuency]:STARt <frequency>
```

```
SENSe<Ch>:OFFSet:PORT<Pt>[:FREQuency]:STARt?
```

Description

Sets or reads out the frequency sweep start of port <Pt> when the frequency offset feature is ON. The offset type is always "PORT".
command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|...9}

<Pt>={[1]|2}

Parameter

<frequency> frequency sweep start of port <Pt>

Unit

Hz (Hertz)

Query Response

<numeric>

Related Commands

SENS:OFFS

Equivalent Softkeys

Stimulus > Freq. Offset > Port n > Start

Equivalent COM Command

SCPI.SENSe(Ch).OFFSet.PORT(Pt).FREQuency.STARt

Syntax

Value = app.SCPI.SENSe(Ch).OFFset.PORT(Pt).FREQuency.STARt

Type

Double (read/write)

Back to SENSe

SENS:OFFS:PORT:STOP

SCPI Command

SENSe<Ch>:OFFSet:PORT<Pt>[:FREQuency]:STOP <frequency>

SENSe<Ch>:OFFSet:PORT<Pt>[:FREQuency]:STOP?

Description

Sets or reads out the frequency sweep stop of port <Pt> when the frequency offset feature is ON. The offset type is always "PORT".

command/query

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|...9}

<Pt>={[1]|2}

Parameter

<frequency> frequency sweep stop of port <Pt>

Unit

Hz (Hertz)

Query Response

<numeric>

Related Commands

SENS:OFFS

Equivalent Softkeys

Stimulus > Freq. Offset > Port n > Stop

Equivalent COM Command

SCPI.SENSe(Ch).OFFSet.PORT(Pt).FREQuency.STOP

Syntax

Value = app.SCPI.SENSe(Ch).OFFset.PORT(Pt).FREQuency.STOP

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

Analyzer

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 > Misc Setup > Ref 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|...9}

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

Stimulus > Segment Table

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|...9}

Parameter

<numeric> the number of measurement points from 2 to maximum limit of the analyzer.

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|...9}

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 > Meas 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|...9}

Parameter

<char> specifies the sweep type:

LINear	Linear frequency sweep
LOGarithmic	Logarithmic frequency sweep
SEGMent	Segment frequency sweep
POWer	Power sweep
VVM	Vector Voltmeter mode

Query Response

{LIN|LOG|SEGM|POW|VVM}

Preset Value

LIN

Equivalent Softkeys

Stimulus > Sweep Type > {Lin Freq | Log Freq | Segment | Power Sweep | Voltmeter}

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

SENS:VVM:DATA?

SCPI Command

SENSe<Ch>:VVM:DATA?

Description

Reads out the value of the vector voltmeter measurement. If a reference value is specified, the return value is read relatively to it.

The data include 2 elements:

<numeric 1>	Magnitude value, depending on the data format or SWR value
<numeric 2>	Phase value or zero in SWR format

query only

Target

Channel <Ch>,

<Ch>={[1]|2|...|9}

Query Response

<numeric 1>, <numeric 2>

Related Commands

SENS:VVM:FORM

SENS:VVM:REF:MEM

SENS:VVM:REF:CLE

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SENSe(Ch).VVM.DATA

Syntax

Data = app.SCPI.SENSe(Ch).VVM.DATA

Type

Variant (Double array) (read only)

Back to SENSe

SENS:VVM:FORM

SCPI Command

SENSe<Ch>:VVM:FORMat <char>

SENSe<Ch>:VVM:FORMat?

Description

Sets or reads out the data format in vector voltmeter mode.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...|9}

Parameter

<char> choose from:

LOGP	Log magnitude and phase
LINP	Linear magnitude and phase
SWR	Voltage standing wave ratio
IMP	Impedance value

Out of Range

Error occurs. The command is ignored.

Query Response

{LOGP|LINP|SWR|IMP}

Preset Value

LOGP

Equivalent Softkeys

Stimulus > Vector Voltmeter > Format > {LogMag/Phase | LinMag/Phase | SWR | Impedance}

Equivalent COM Command

SCPI.SENSe(Ch).VVM.FORMat

Syntax

Param = app.SCPI.SENSe(Ch).VVM.FORMat

app.SCPI.SENSe(Ch).VVM.FORMat = "LOGP"

Type

String (read/write)

Back to SENSe

SENS:VVM:FREQ

SCPI Command

SENSe<Ch>:VVM:FREQuency[:CW] <numeric>

SENSe<Ch>:VVM:FREQuency[:CW]?

Description

Sets or reads out the operating frequency in the vector voltmeter mode.

command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...|9}

Parameter

<numeric> the frequency value.

Unit

Hz (Hertz)

Query Response

<numeric>

Equivalent Softkeys

Stimulus > Vector Voltmeter > Frequency

Equivalent COM Command

SCPI.SENSe(Ch).VVM.FREQuency.CW

Syntax

Value = app.SCPI.SENSe(Ch).VVM.FREQuency.CW

app.SCPI.SENSe(Ch).VVM.FREQuency.CW = 200000000

Type

Double (read/write)

Back to SENSe

SENS:VVM:REF:CLE

SCPI Command

SENSe<Ch>:VVM:REFerence:CLEar

Description

Clears the reference value of the vector voltmeter.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|...|9}

Equivalent Softkeys

Stimulus > Vector Voltmeter > Clear Reference

Equivalent COM Command

SCPI.SENSe(Ch).VVM.REFerence.CLEar

Syntax

app.SCPI.SENSe(Ch).VVM.REFerence.CLEar

Type

Method

Back to SENSe

SENS:VVM:REF:DATA?

SCPI Command

SENSe<Ch>:VVM:REFerence:DATA?

Description

Reads out the reference value of the vector voltmeter measurement.

The data include 2 elements:

<numeric 1>	Magnitude value, depending on the data format or SWR value;
<numeric 2>	Phase value or zero in SWR format.

query only

Target

Channel <Ch>,

<Ch>={[1]|2|...|9}

Query Response

<numeric 1>, <numeric 2>

Related Commands

SENS:VVM:FORM

SENS:VVM:REF:MEM

SENS:VVM:REF:CLE

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SENSe(Ch).VVM.REFerence.DATA?

Syntax

Data = app.SCPI.SENSe(Ch).VVM.REFerence.DATA

Type

Variant (Double array) (read only)

Back to SENSe

SENS:VVM:REF:MEM

SCPI Command

SENSe<Ch>:VVM:REFerence:MEMorize

Description

Memorizes the reference value of the vector voltmeter.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|...|9}

Equivalent Softkeys

Stimulus > Vector Voltmeter > Save Reference

Equivalent COM Command

SCPI.SENSe(Ch).VVM.REFerence.MEMorize

Syntax

app.SCPI.SENSe(Ch).VVM.REFerence.MEMorize

Type

Method

Back to SENSe

SENS:VVM:TABL:CLE

SCPI Command

SENSe<Ch>:VVM:TABLe:CLEar

Description

Clears all data from the vector voltmeter measurement table.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|...|9}

Related Commands

SENS:VVM:TABL:MEM

SENS:VVM:TABL:INS

SENS:VVM:TABL:REM

Equivalent Softkeys

Stimulus > Vector Voltmeter > Data Table > Clear Table

Equivalent COM Command

SCPI.SENSe(Ch).VVM.TABLe.CLEar

Syntax

app.SCPI.SENSe(Ch).VVM.TABLe.CLEar

Type

Method

Back to SENSe

SENS:VVM:TABL:DATA?

SCPI Command

SENSe<Ch>:VVM:TABLe:DATA

Description

Returns data table of the vector voltmeter.

The array has the following format:

{<Flag1>, <N>,

<Abs.Mag 1>, <Abs.Phase 1> [,<Rel.Mag 1>] [,<Rel.Phase 1>],

…

<Abs.Mag N>, <Abs.Phase N> [,<Rel.Mag N>] [,<Rel.Phase N>]},

Where:

<Flag1> reference value, "0" is not specified, "1" is specified, N – rows number in the data table;

<Abs.Mag i>, <Abs.Phase i> – measurement data of a vector voltmeter;

[,<Rel.Mag i>] [,<Rel.Phase i>] – measurement data relative to the reference value (if specified).

query only

Target

Channel <Ch>,

<Ch>={[1]|2|...|9}

Query Response

<numeric 1>,<numeric 2>,…<numeric 2+N×(2+M×2)>

Where:

N – number of table rows,

M – flag value Flag1

Related Commands

SENS:VVM:TABL:CLE

SENS:VVM:TABL:MEM

SENS:VVM:TABL:REM

SENS:VVM:TABL:INS

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SENSe(Ch).VVM.TABLe.DATA

Syntax

Data = app.SCPI.SENSe(Ch).VVM.TABLe.DATA

Type

Variant (Double array) (read only)

Back to SENSe

SENS:VVM:TABL:INS

SCPI Command

SENSe<Ch>:VVM:TABLe:MEMorize

Description

Inserts a row of data into the table with the current measurement of a vector voltmeter.

<numeric> The row number in the table where new data will be inserted.

no query

Target

Channel <Ch>,

<Ch>={[1]|2|...|9}

Related Commands

SENS:VVM:TABL:MEM

SENS:VVM:TABL:INS

SENS:VVM:TABL:REM

Equivalent Softkeys

Stimulus > Vector Voltmeter > Data Table > Insert Data

Equivalent COM Command

SCPI.SENSe(Ch).VVM.TABLe.INSert(Index)

Syntax

app.SCPI.SENSe(Ch).VVM.TABLe.INSert(Index)

Type

Method (Index as long)

Back to SENSe

SENS:VVM:TABL:MEM

SCPI Command

SENSe<Ch>:VVM:TABLe:MEMorize

Description

Saves measurements of the vector voltmeter to the table.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|...|9}

Related Commands

SENS:VVM:TABL:CLE

SENS:VVM:TABL:INS

SENS:VVM:TABL:REM

Equivalent Softkeys

Stimulus > Vector Voltmeter > Data Table > Add Data

Equivalent COM Command

SCPI.SENSe(Ch).VVM.TABLe.MEMorize

Syntax

app.SCPI.SENSe(Ch).VVM.TABLe.MEMorize

Type

Method

Back to SENSe

SENS:VVM:TABL:REM

SCPI Command

SENSe<Ch>:VVM:TABLe:REMove <numeric>

Description

Removes a table row with a vector voltmeter measurement index.

<numeric>	The row number in the table which will be removed.

no query

Target

Channel <Ch>,

<Ch>={[1]|2|...|9}

Related Commands

SENS:VVM:TABL:CLE

SENS:VVM:TABL:MEM

SENS:VVM:TABL:INS

Equivalent Softkeys

Stimulus > Vector Voltmeter > Data Table > Remove Data

Equivalent COM Command

SCPI.SENSe(Ch).VVM.TABLe.REMove(Index)

Syntax

app.SCPI.SENSe(Ch).VVM.TABLe.REMove(Index)

Type

Method (Index as long)

Back to SENSe

SENS:VVM:TABL:SAVE

SCPI Command

SENSe<Ch>:VVM:TABLe:SAVE <string>

Description

Saves the table into *.CSV file. **Note**: If the full path of the file is not specified, the \CSV subdirectory of the main directory will be searched for the file. The file has *.CSV extension by default.
no query

Target

Channel <Ch>,

<Ch>={[1]|2|...|9}

Parameter

<string> file name (quoted string)

Equivalent Softkeys

Stimulus > Vector Voltmeter > Data Table > Save Table to CSV

Equivalent COM Command

SCPI.SENSe(Ch).VVM.TABLe.SAVE(Name)

Syntax

app.SCPI.SENSe(Ch).VVM.TABLe.SAVE("Test.csv")

Type

Method (Name as string)

Back to SENSe

SENS:VVM:TYPE

SCPI Command

SENSe<Ch>:VVM:TYPE <char>

SENSe<Ch>:VVM:TYPE?

Description

Sets or reads out the measured parameter in vector voltmeter mode.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...|9}

Parameter

<char> choose from:

S11	Reflection parameter
S21	Transmission parameter
A/B	The ratio of the receivers signals A to B, an external frequency generator is used
B/A	The ratio of the receivers signals B to A, an external frequency generator is used

Out of Range

Error occurs. The command is ignored.

Query Response

{S11|S21|A/B|B/A}

Preset Value

S11

Equivalent Softkeys

Stimulus > Vector Voltmeter > Measurement > {S11 | S21 | A/B | B/A}

Equivalent COM Command

SCPI.SENSe(Ch).VVM.TYPE

Syntax

```
Param = app.SCPI.SENSe(Ch).VVM.TYPE
app.SCPI.SENSe(Ch).VVM.TYPE = "A/B"
```

Type

String (read/write)

Back to SENSe

SERVice

Command	Description	
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

Target

Analyzer

Query Response

<numeric> from 1 to 9

Related Commands

DISP:WIND:ACT

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

Target

Analyzer

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|...9}

Query Response

<numeric> from 1 to 9

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

Target

Analyzer

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

Target

Analyzer

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

Target

Analyzer

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

Target

Analyzer

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

Target

Analyzer

Query Response

<numeric>

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SERVice.SWEep.POINts

Syntax

Value = app.SCPI.SERVice.SWEep.POINts

Type

Double (read only)

Back to SERVice

SOURce

Command	Description	
SOUR:POW	Stimulus Settings	Power level for a frequency sweep
SOUR:POW:CENT		Center power
SOUR:POW:SLOP		Power slope value
SOUR:POW:SPAN		Span power
SOUR:POW:STAR		Start power
SOUR:POW:STOP		Stop frequency
SOUR:POW:PORT:CORR	Power Calibration	Power correction ON/OFF
SOUR:POW:PORT:CORR:DATA?		Power correction data
SOUR:REF:FREQ	Analyzer Parameters	Measured reference frequency value
SOUR:REF:STAT		Reference frequency offset ON/OFF

SOUR:POW

SCPI Command

SOURce<Ch>:POWer[:LEVel][:IMMediate][:AMPLitude] <power>

SOURce<Ch>:POWer[:LEVel][:IMMediate][:AMPLitude]?

Description

Sets or reads out the power level for the frequency sweep type.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

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

```
Value = app.SCPI.SOURce(Ch).POWer.LEVel.IMMediate.AMPLitude

app.SCPI.SOURce(Ch).POWer.LEVel.IMMediate.AMPLitude = -10
```

Type

Double (read/write)

Back to SOURce

SOUR:POW:CENT

SCPI Command

SOURce<Ch>:POWer:CENTer <power>

SOURce<Ch>:POWer:CENTer?

Description

Sets or reads out the center value of the power sweep type.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

<power> the power level within the power limits of the analyzer.

Unit

dBm (decibels above 1 milliwatt)

Resolution

0.025 dBm

Out of Range

Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

Depends on the Analyzer

Equivalent Softkeys

Stimulus > Center

Equivalent COM Command

SCPI.SOURce(Ch).POWer.CENTer

Syntax

Value = app.SCPI.SOURce(Ch).POWer.CENTer

app.SCPI.SOURce(Ch).POWer.CENTer = 5

Type

Double (read/write)

Back to SOURce

SOUR:POW:PORT:CORR

SCPI Command

SOURce<Ch>:POWer:PORT<Pt>:CORRection[:STATe] {OFF|ON|0|1}

SOURce<Ch>:POWer:PORT<Pt>:CORRection[:STATe]?

Description

Turns the port 1 power correction ON/OFF.
command/query

Target

Port 1 of channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

{ON|1}	Power correction ON
{OFF|0}	Power correction OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

Calibration > Power Calibration > Correction {ON | OFF}

Equivalent COM Command

SCPI.SOURce(Ch).POWer.PORT(Pt).CORRection.STATe

Syntax

Status = app.SCPI.SOURce(Ch).POWer.PORT(Pt).CORRection.STATe

app.SCPI.SOURce(Ch).POWer.PORT(Pt).CORRection.STATe = True

Type

Boolean (read/write)

Back to SOURce

SOUR:POW:PORT:CORR:DATA?

SCPI Command

SOURce<Ch>:POWer:PORT<Pt>:CORRection:DATA?

Description

Reads out the port 1 power correction array (result of power calibration).

Note: If the array size is not 1 + 2N, where N is equal to <numeric 1>, an error occurs. If the <numeric 2n> and <numeric 2n+1> values are out of the allowable range, the value of the limit, which is closer to the specified value will be set.

query only

Target

Port <Pt> of channel <Ch>,

<Ch>={[1]|2|...9}

<Pt>={[1]|2}

Parameter

The array size is NOP, where NOP is the number of measurement points.

For the n-th point, where n from 1 to NOP:

<numeric n>	power correction value of the n-th point

Query Response

<numeric 1>, <numeric 2>, …<numeric NOP>

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SOURce(Ch).POWer.PORT(Pt).CORRection.DATA

Syntax

Data = app.SCPI.SOURce(Ch).POWer.PORT(Pt).CORRection.DATA

Type

Variant (array of Double) (read only)

Back to SOURce

SOUR:POW:SLOP

SCPI Command

SOURce<Ch>:POWer[:LEVel]:SLOPe[:DATA] <power>

SOURce<Ch>:POWer[:LEVel]:SLOPe[:DATA]?

Description

Sets or reads out the power slope value for the frequency sweep type.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

<power> the power slope value from –2 to +2

Unit

dB/GHz (decibel/gigahertz)

Resolution

0.1

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 > Power > Power Slope

Equivalent COM Command

SCPI.SOURce(Ch).POWer.LEVel.SLOPe.DATA

Syntax

Value = app.SCPI.SOURce(Ch).POWer.LEVel.SLOPe.DATA

app.SCPI.SOURce(Ch).POWer.LEVel.SLOPe.DATA = 0.2

Type

Double (read/write)

Back to SOURce

SOUR:POW:SPAN

SCPI Command

SOURce<Ch>:POWer:SPAN <power>

SOURce<Ch>:POWer:SPAN?

Description

Sets or reads out the power span when the power sweep type is active.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

<power> the power sweep span value from 0 to maximum limit 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

Depends on the analyzer

Equivalent Softkeys

Stimulus > Span

Equivalent COM Command

SCPI.SOURce(Ch).POWer.SPAN

Syntax

Value = app.SCPI.SOURce(Ch).POWer.SPAN

app.SCPI.SOURce(Ch).POWer.SPAN = 50

Type

Double (read/write)

Back to SOURce

SOUR:POW:STAR

SCPI Command

SOURce<Ch>:POWer:STARt <power>

SOURce<Ch>:POWer:STARt?

Description

Sets or reads out the power sweep start value when the power sweep type is active.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

<power> the power sweep start value 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

Depends on the analyzer

Equivalent Softkeys

Stimulus > Start

Equivalent COM Command

SCPI.SOURce(Ch).POWer.STARt

Syntax

Value = app.SCPI.SOURce(Ch).POWer.STARt

app.SCPI.SOURce(Ch).POWer.STARt = -5

Type

Double (read/write)

Back to SOURce

SOUR:POW:STOP

SCPI Command

SOURce<Ch>:POWer:STOP <power>

SOURce<Ch>:POWer:STOP?

Description

Sets or reads out the power sweep stop value when the power sweep type is active.
command/query

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

Parameter

<power> the power sweep stop value 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

Depends on the analyzer

Equivalent Softkeys

Stimulus > Stop

Equivalent COM Command

SCPI.SOURce(Ch).POWer.STOP

Syntax

Value = app.SCPI.SOURce(Ch).POWer.STOP

app.SCPI.SOURce(Ch).POWer.STOP = 0

Type

Double (read/write)

Back to SOURce

SOUR:REF:FREQ

SCPI Command

SOURce:REFerence:FREQuency <frequency>

SOURce:REFerence:FREQuency?

Description

Sets or reads out the reference frequency value measured by the external frequency counter. The value is entered to calculate the analyzer frequency reference deviation compensation when the reference frequency offset feature is ON.

Note: TR1300/1 model only

command/query

Target

Analyzer

Parameter

<frequency> the reference frequency value measured by the external frequency counter.

Unit

Hz (Hertz)

Out of Range

The reference frequency deviation is allowed from -1000 to 1000 Hz. Sets the value of the limit, which is closer to the specified value.

Query Response

<numeric>

Preset Value

10 MHz

Equivalent Softkeys

System > Misc Setup > Reference Offset > Measured Ref.

Equivalent COM Command

SCPI.SOURce.REFerence.FREQuency

Syntax

Value = app.SCPI.SOURce.REFerence.FREQuency

app.SCPI.SOURce.REFerence.FREQuency = 1E7

Type

Double (read/write)

Back to SOURce

SOUR:REF:STAT

SCPI Command

SOURce:REFerence[:CORRection]:STATe {OFF|ON|0|1}

SOURce:REFerence[:CORRection]:STATe?

Description

Turns the reference frequency offset function ON/OFF.

Note: TR1300/1 model only.

command/query

Target

Analyzer

Parameter

{ON|1}	Reference frequency offset function ON
{OFF|0}	Reference frequency offset function OFF

Query Response

{0|1}

Preset Value

0

Equivalent Softkeys

System > Misc Setup > Reference Offset > Reference Offset {ON | OFF}

Equivalent COM Command

SCPI.SOURce.REFerence.CORRection.STATe

Syntax

Status = app.SCPI.SOURce.REFerence.CORRection.STATe

app.SCPI.SOURce.REFerence.CORRection.STATe = True

Type

Boolean (read/write)

Back to SOURce

STATus

Command	Description	
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
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

Command	Description	
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
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

Command	Description	
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
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:PTR		Positive 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 only)

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 only)

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/write)

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|...9}

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|...9}

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|...9}

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|...9}

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 Condition Register.
query only

Target

Channel <Ch>,

<Ch>={[1]|2|...9}

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|...9}

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|...9}

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|...9}

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|...9}

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|...9}

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	
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:CONN:SER	Analyzer Capabilities	Analyzer Serial N
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
SYST:ERR?	Status System	Reads the error message queue
SYST:HIDE	Interface Settings	Minimizes the Analyzer window

Command	Description	
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:DEMO:LOCK		Demo mode lock
SYST:DEMO:STAT		Demo mode ON/OFF
SYST:DEMO:UNLO		Demo mode unlock
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

Target

AutoCal module

Parameter

<port> port number of the AutoCal module

<char> specifies the impedance state:

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 only)

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.

no query

Target

AutoCal module

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

None

Back to SYSTem

SYST:CONN:SER

SCPI Command

SYSTem:CONNection:SERial:[NUMBer] <numeric>

SYSTem:CONNection:SERial:[NUMBer]?

Description

Connects the current program instance to the analyzer with specified serial number. If there is no analyzer with the specified serial number, the program goes into the NOT READY state. In order to allow the program to connect to the analyzer with any serial number, write 0 with this command.

The query returns the serial number of the connected analyzer.

command/query

Parameter

<numeric> serial number of 8 digits, or 0 (auto-detect, software connects to any Analyzer)

Query Response

<numeric>

Preset Value

0 (auto-detect)

Equivalent Softkeys

System > Misc Setup > 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

Target

Analyzer

Parameter

{ON|1}	ON
{OFF|0}	OFF

Query Response

{0|1}

Preset Value

1

Equivalent Softkeys

System > Misc Setup > System Correction {ON | OFF}

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

Target

Analyzer

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(2021, 9, 9)

Type

Variant (array of long) (read/write)

Back to SYSTem

SYST:DEMO:LOCK

SCPI Command

SYSTem:DEMO:LOCK

Description

Demo mode lock in TRVNA program interface. **Note**: The demo mode will turn OFF and the program will restart, if the demo mode was enabled.
no query

Target

Analyzer

Related Commands

SYST:DEMO:UNLO

SYST:DEMO:STAT

Equivalent Softkeys

None

Equivalent COM Command

None

Back to SYSTem

SYST:DEMO:STAT

SCPI Command

SYSTem:DEMO:STATe

SYSTem:DEMO:STATe?

Description

Sets or reads out the analyzer demo mode ON/OFF state. If the mode is changed, the TRVNA program is restarted. **Note**: The SCPI connection is lost when the TRVNA program is restarted. Reconnection to the program is required.
command/query

Target

Analyzer

Parameter

{ON|1}	Demo mode ON
{OFF|0}	Demo mode OFF

Query Response

{0|1}

Preset Value

0

Related Commands

SYST:DEMO:UNLO

SYST:DEMO:LOCK

Equivalent Softkeys

System > Misc Setup > Demo Mode {ON | OFF}

Equivalent COM Command

None

Back to SYSTem

SYST:DEMO:UNLO

SCPI Command

SYSTem:DEMO:UNLOck

Description

Demo mode unlock in TRVNA program interface.
no query

Target

Analyzer

Related Commands

SYST:DEMO:LOCK

SYST:DEMO:STAT

Equivalent Softkeys

None

Equivalent COM Command

None

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

Target

Analyzer

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

Hides the Analyzer main window, removing it from the desktop.

no query

Target

Analyzer

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

Target

Analyzer

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 initiation mode is set to Continuous.
no query

Target

Analyzer

Related Commands

*RST

Equivalent Softkeys

System > Preset > Apply

Equivalent COM Command

SCPI.SYSTem.PRESet

Syntax

app.SCPI.SYSTem.PRESet

Type

Method

Back to SYSTem

SYST:READ?

SCPI Command

SYSTem:READy[:STATe]?

Description

Reads out the Analyzer readiness status. 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

Target

Analyzer

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

Target

Analyzer

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 commands can release this remote operation mode.

no query

Target

Analyzer

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 command.
no query

Target

Analyzer

Related Commands

SYST:HIDE

Equivalent Softkeys

None

Equivalent COM Command

SCPI.SYSTem.SHOw

Syntax

app.SCPI.SYSTem.SHOw

Type

Method

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

<numerical> : is ignored (reserved)

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

Target

Analyzer

Equivalent Softkeys

System > Exit > Exit

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

Target

Analyzer

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	
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

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

Target

Analyzer

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: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

*OPC?

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

Selects the trigger source (See options below).

If the Continuous trigger initiation mode is enabled with the command INIT:CONT ON, the INTernal choice leads to continuous sweep. The choice of another option switches the analyzer to the trigger waiting state from the corresponding source.

If the Continuous trigger initiation mode is disabled with the command INIT:CONT OFF, the reaction to INIT command is different. Selecting INTernal leads to a single sweep in response to the command INIT, selection another option puts the analyzer in a single trigger waiting state in response to the INIT command.

command/query

Parameter

<char> choose from:

INTernal	Internal
EXTernal	External (hardware trigger input; except TR1300/1 model)
BUS	Bus (program)

Query Response

{INT|EXT|BUS}

Preset Value

INT

Related Commands

INIT

INIT:CONT

TRIG:SING

*TRG

Equivalent Softkeys

Stimulus > 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

Equivalent Softkeys

None

Equivalent COM Command

SCPI.TRIGger.SEQunce.STATus

Syntax

Param = app.SCPI.TRIGger.SEQuence.STATus

Type

String (read/write)

Back to TRIGger

TRIG:WAIT

SCPI Command

```
TRIGger[:SEQuence]:WAIT <char>
```

Description

Delays the execution of the next command until the specified state of the analyzer trigger system is reached (see options below).

The analyzer trigger system can be "Stop", "Waiting for Trigger", or "Measurement Cycle". When the Continuous initiation mode is turned OFF (INIT:CONT OFF), the trigger system transits between all three states. When the Continuous initiation mode is turned ON (INIT:CONT ON), the trigger system transits between the "Waiting for Trigger" and "Measurement Cycle" states.

This command is useful for waiting for a sweep end initiated by the TRIG, *TRG commands or initiated by the external trigger signal, because the *OPC? command cannot be used. (The *OPC? command can wait the sweep end initiated by the TRIG:SING command only).

no query

Parameter

<char> choose from:

HOLD	Waits for the "Stop" state
MEASure	Waits for the "Measurement Cycle" state
WAIT	Waits for the "Waiting for Trigger" 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

VVM

Command	Description	
VVM:FONT	Vector Volmeter Mode	VVM font size
VVM:RES		Number of indication symbols of VVM

VVM:FONT

SCPI Command

VVM[:DISPlay]:FONT[:SIZE] <numeric>

VVM[:DISPlay]:FONT[:SIZE]?

Description

Sets or reads out the font size for indication in the vector voltmeter mode.
command/query

Parameter

Font size from 3 to 72

Query Response

<numeric>

Preset value

36

Equivalent Softkeys

Stimulus > Vector Voltmeter > Properties > Font Size

Equivalent COM Command

SCPI.SENSe(Ch).VVM.DISPlay.FONT.SIZE

Syntax

Data = app.SCPI.SENSe(Ch).VVM.DISPlay.FONT.SIZE

app.SCPI.SENSe(Ch).VVM.DISPlay.FONT.SIZE = 72

Type

Long (read/write)

Back to VVM

VVM:RES

SCPI Command

VVM[:DISPlay]:RESolution <numeric>

VVM[:DISPlay]:RESolution?

Description

Sets or reads out number of indication symbols in the vector voltmeter mode.
command/query

Parameter

Number of significant symbols from 3 to 12

Query Response

<numeric>

Preset value

5

Equivalent Softkeys

Stimulus > Vector Voltmeter > Properties > Response Digits

Equivalent COM Command

SCPI.SENSe(Ch).VVM.DISPlay.RESolution

Syntax

Data = app.SCPI.SENSe(Ch).VVM.DISPlay.RESolution

app.SCPI.SENSe(Ch).VVM.DISPlay.RESolution = 8

Type

Long (read/write)

Back to VVM

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 using the command *OPC? query for the waiting the end of sweep.

Example. 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	Selects the program trigger source and transits the analyzer to the trigger waiting state.
<loop>:	
TRIG:SING	Starts sweep.
*OPC?	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.

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. 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);
```

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
```

Receiving Data Arrays Binary Format

The transfer of data from the analyzer in binary form reduces the amount of data transferred and the transmission time. To enable binary data transfer, use the FORM: DATA command. The list of commands that support the transfer of binary data is given in the description of the FORM: DATA command.

Binary data is transmitted as a block having a header followed by data. Block format:

#	8	<Data Size>	<Binary Data>

Where: **#** — the character '#',

8 — the character '8',

<Data Size> — 8 bytes, the symbolic representation of the number of bytes in binary data.

For example:

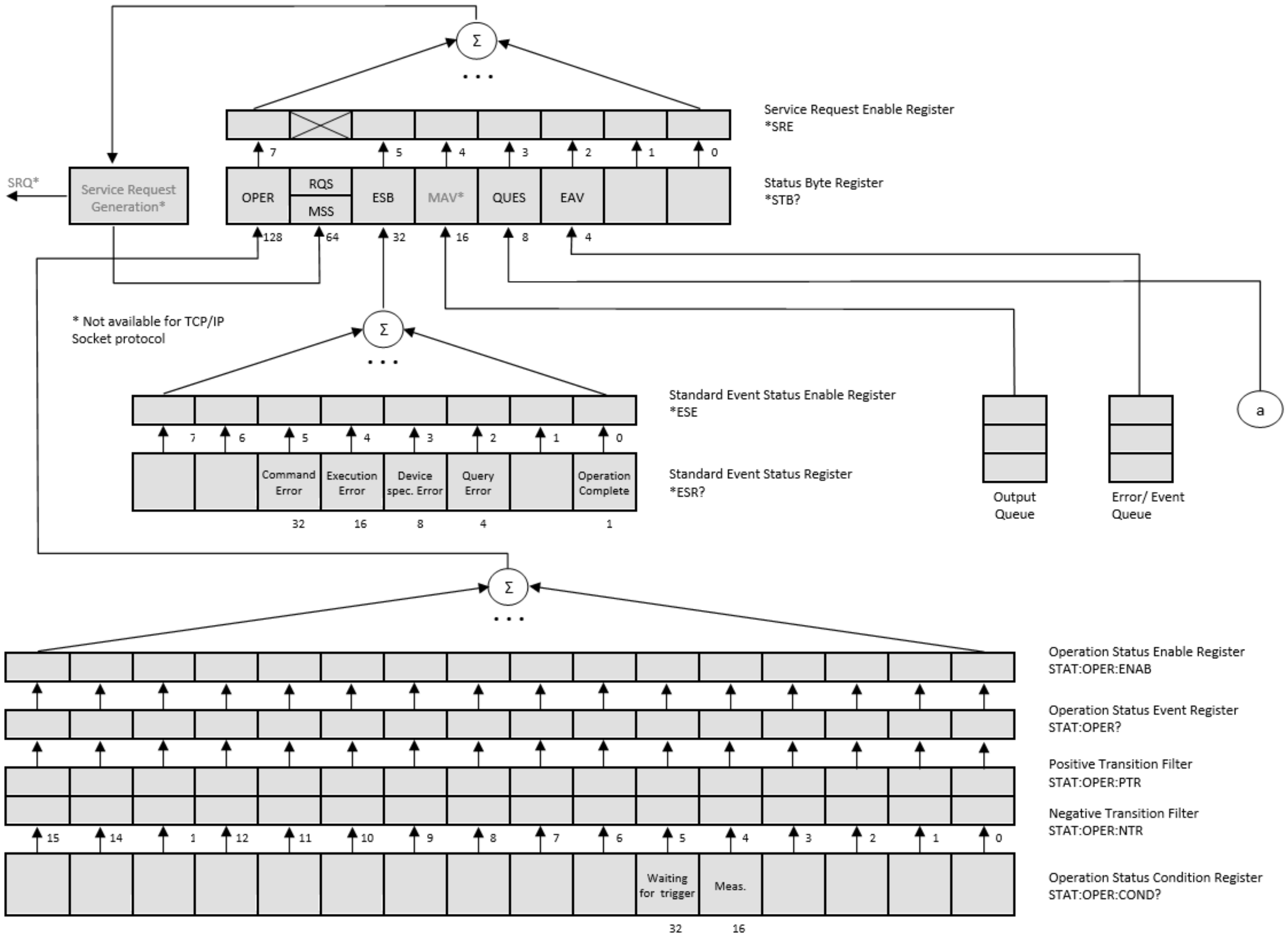
#800003216<Binary Data>

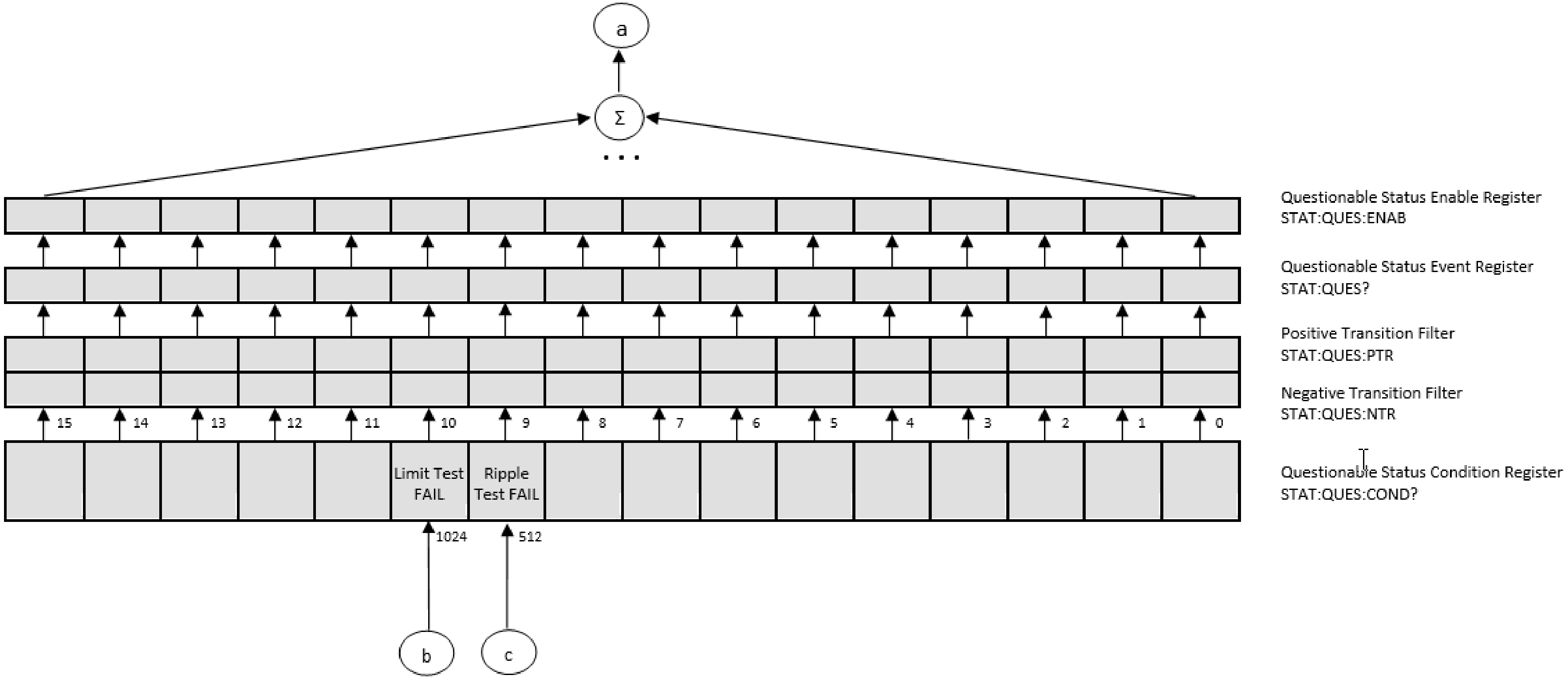
The VISA library has built-in tools for receiving binary data from the analyzer. The example assumes that the size of the array is sufficient to receive a number of elements equal to twice the number of points.

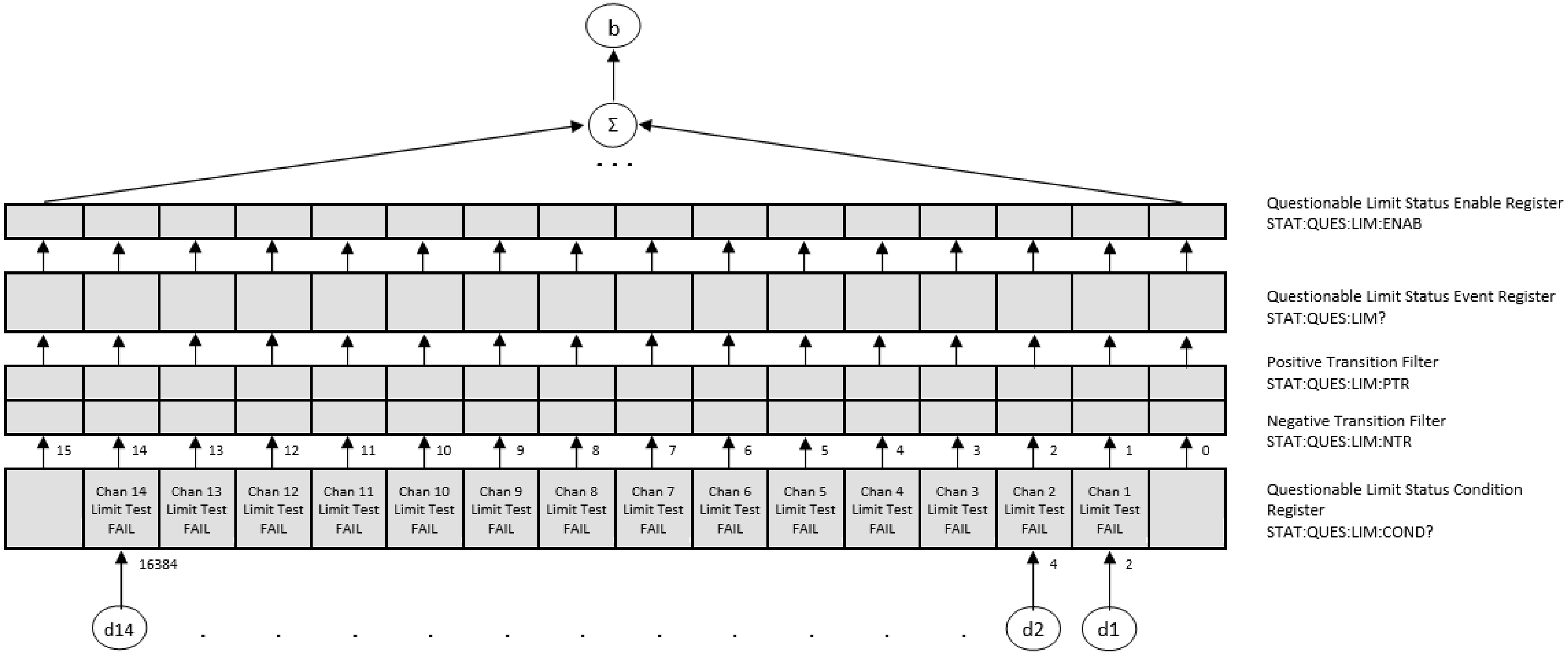
Example. Receiving binary data array in C/C ++:

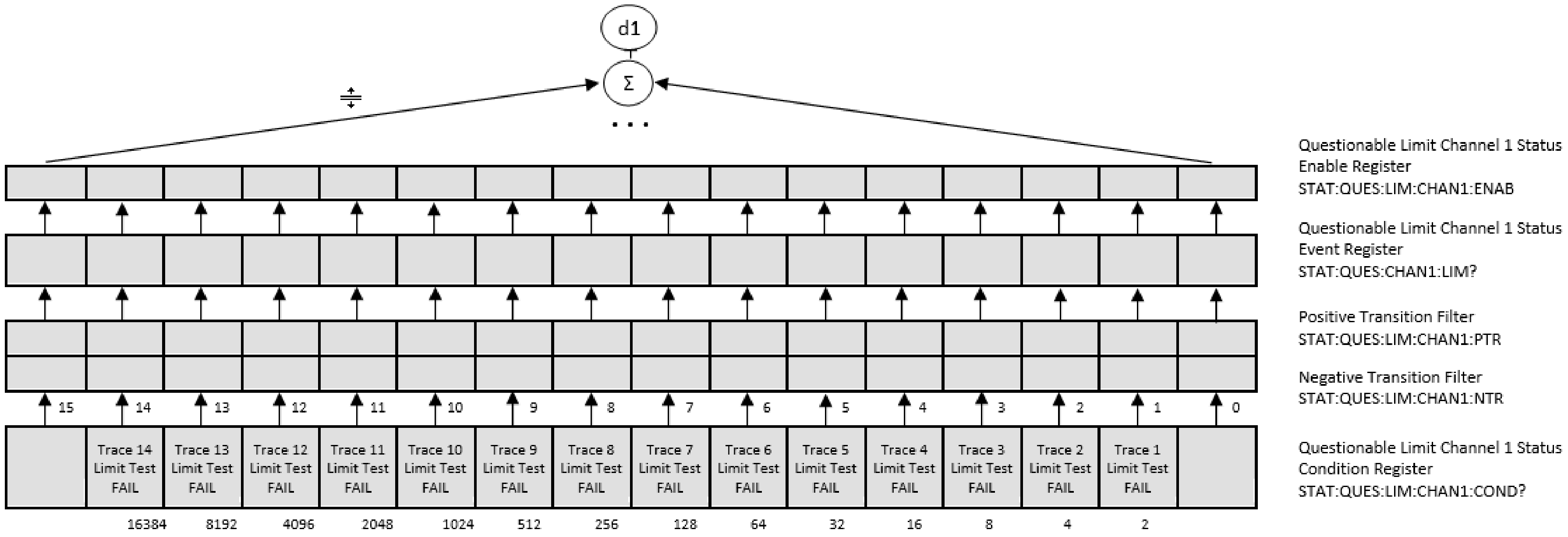
```
double DataArray[1000];
ViUInt32 retCount;
...
viPrintf(instr, "FORM:DATA REAL\n");
retCount = sizeof(DataArray) / sizeof(double);
viQueryf(instr, "CALC:DATA:FDAT?\n", "%#Zb", &retCount, DataArray);
// retCount now contains the actual number of elements read
```

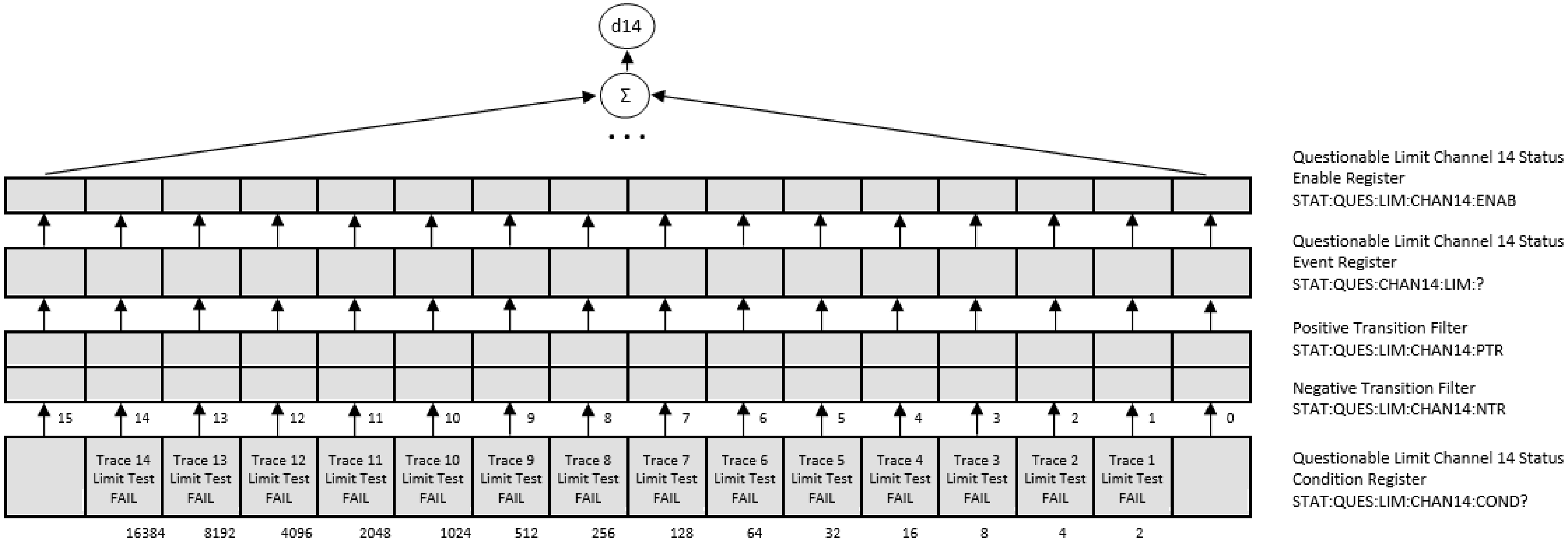
IEEE488.2 Status Reporting System

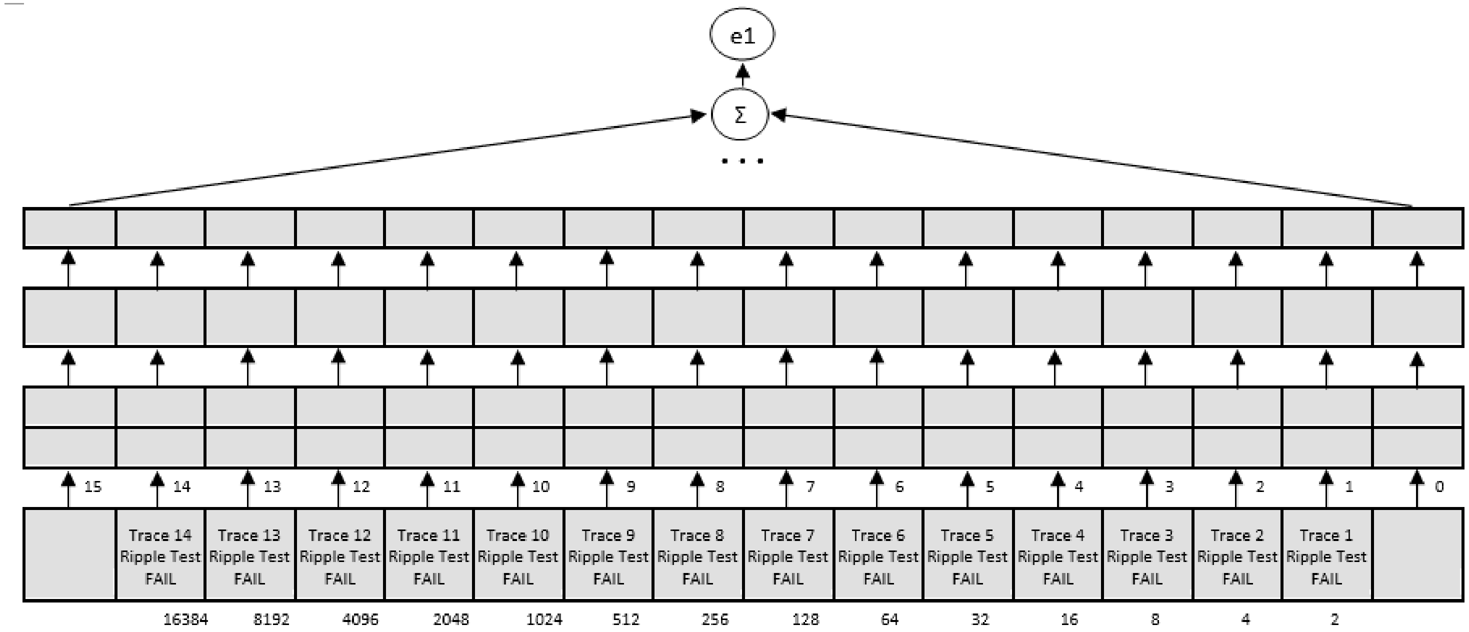



a
Σ
. . .
Questionable Status Enable Register
STAT:QUES:ENAB
Questionable Status Event Register
STAT:QUES?
Positive Transition Filter
STAT:QUES:PTR
Negative Transition Filter
STAT:QUES:NTR
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Limit Test FAIL
Ripple Test FAIL
Questionable Status Condition Register
STAT:QUES:COND?
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



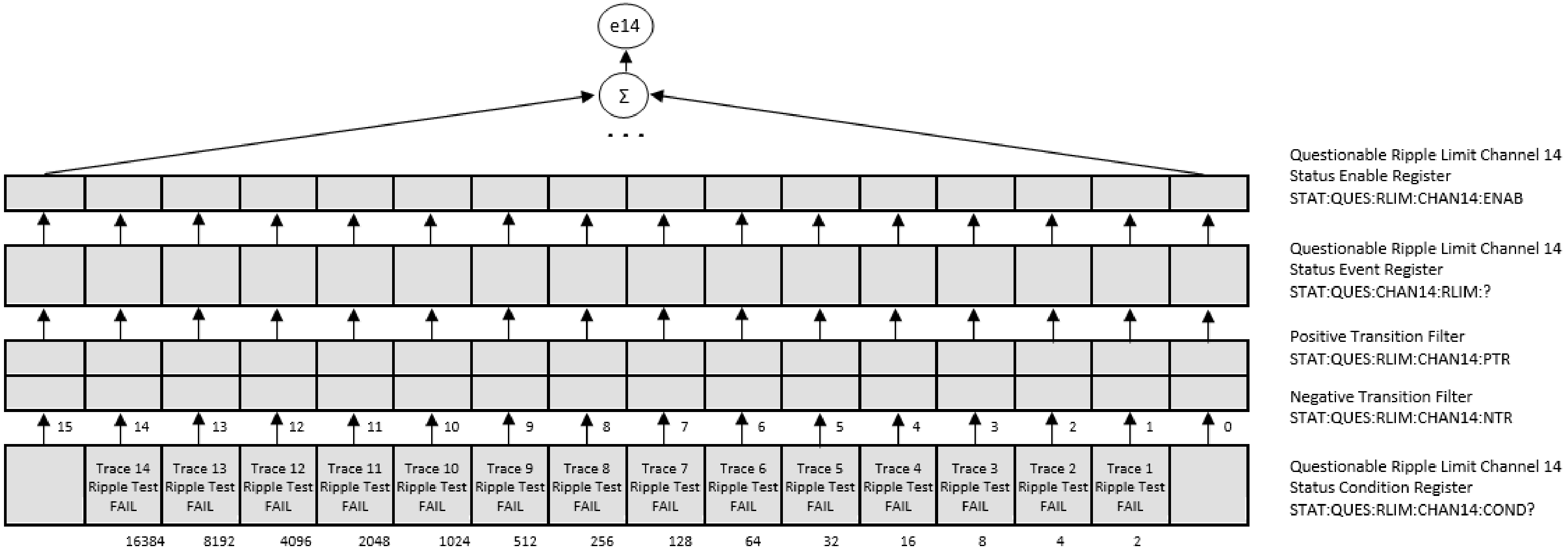
Questionable Ripple Limit Channel 1
Status Enable Register
STAT:QUES:RLIM:CHAN1:ENAB

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?


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 active
205	Invalid save type specifier
206	Invalid sweep type specifier
207	Invalid trigger source specifier
208	Invalid measurement parameter specifier
209	Invalid format specifier

Name	Description
210	Invalid data math specifier
211	Trigger ignored
213	Init ignored
214	Invalid limit data
215	Invalid segment data
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	Invalid extension method specifier
224	Illegal parameter value
253	Invalid trigger position specifier
300	Device-specific error
302	Status reporting system error

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.

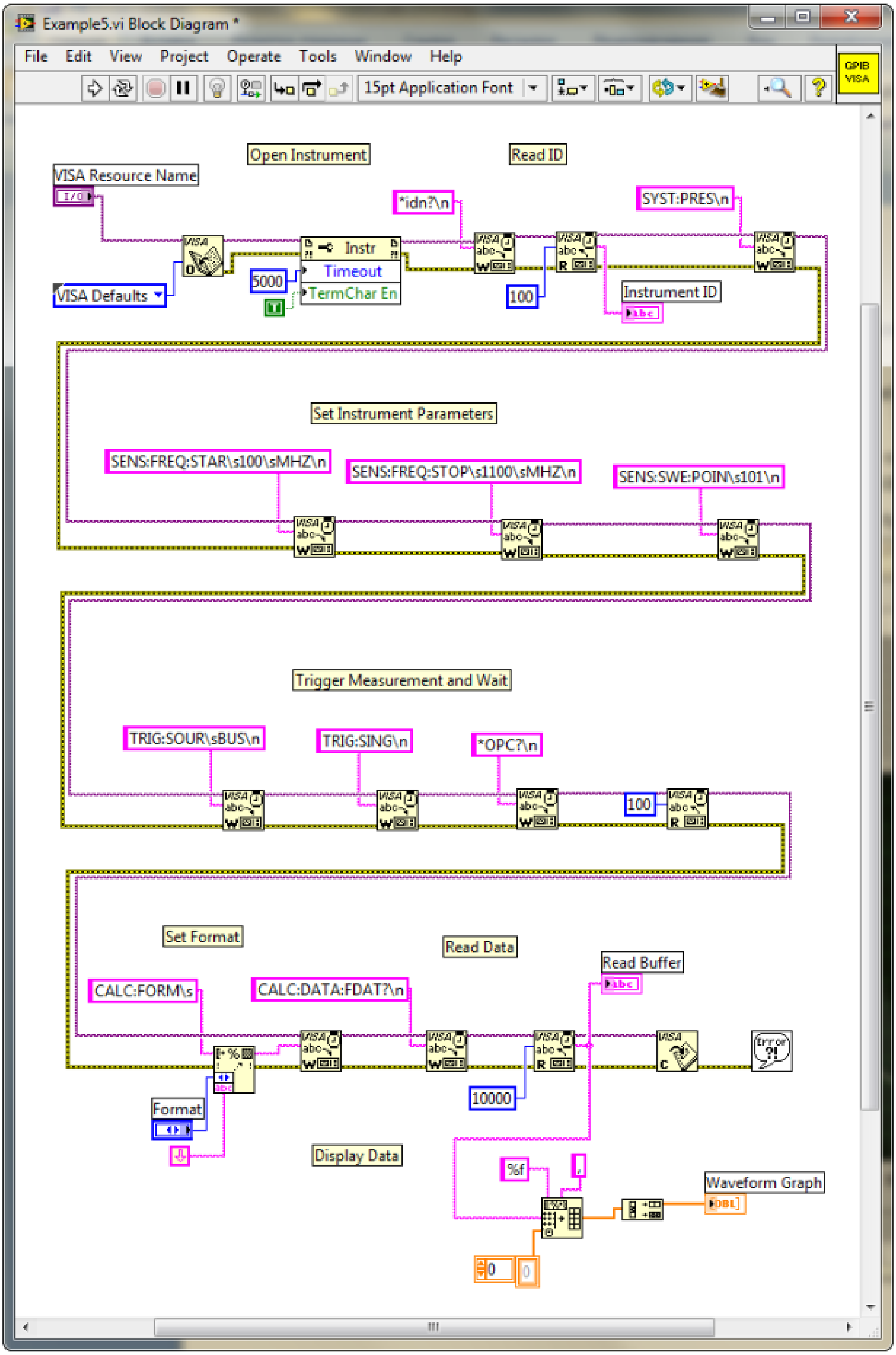
3. Sets some parameters of the Analyzer.

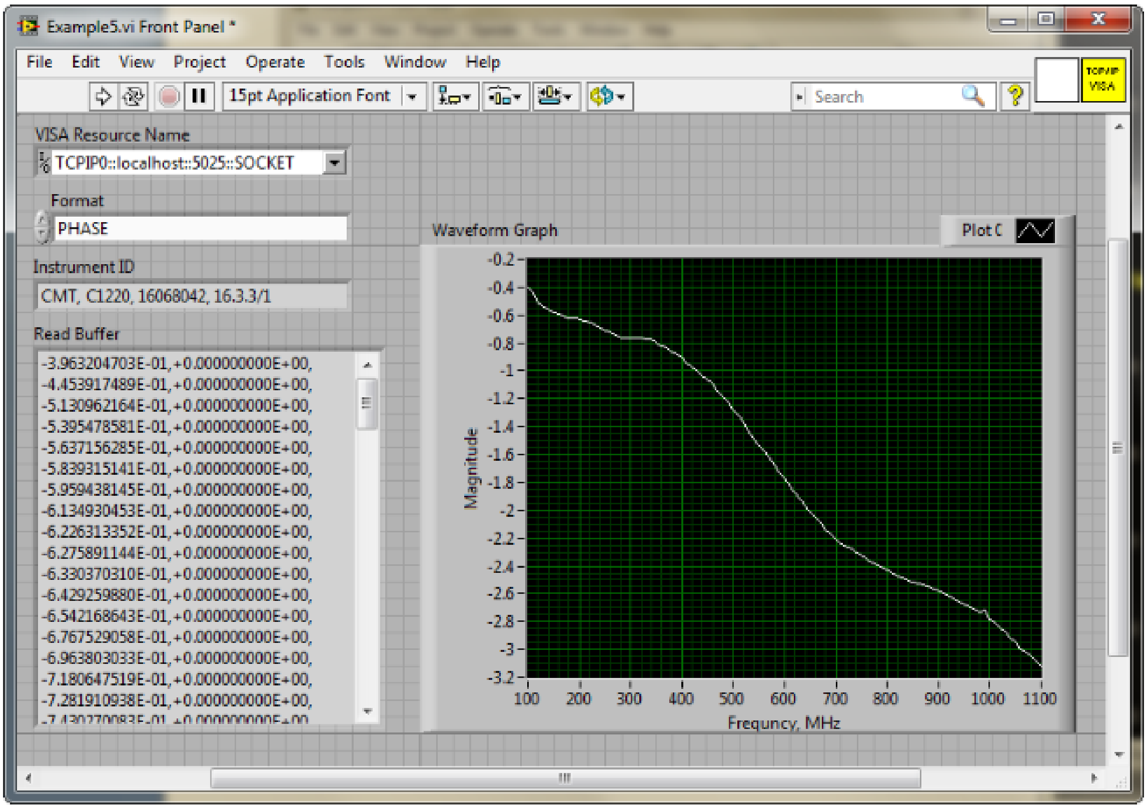
4. Generates the trigger and waits for the sweep completion.

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
GPIB VISA
Open Instrument
Read ID
VISA Resource Name
I/O
*idn?\n
SYST:PRES\n
Instr
Timeout
TermChar En
5000
VISA Defaults
100
Instrument ID
abc
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
abc
CALC:FORM\s
CALC:DATA:FDAT?\n
10000
Format
Display Data
%f
,
Waveform Graph
DBL
0
0



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,
-7.430270083E-01,+0.000000000E+00
```

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, TR1300, 00000001, 22.2.1/2.0

```
Dim app As Object

Sub Example1()

Set app = CreateObject("TRVNA.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 TRVNA.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 TRVNA.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("TRVNA.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, stimulus power –10 dBm..
- In the first channel window: S11 measurement is set for the trace 1, S21 measurement is set for the trace 2. The Smith chart format is set for the both traces.
- In the second channel window: S21 measurement and logarithmic magnitude format are 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("TRVNA.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.IMMediate.AMPlitude = -10
app.SCPI.Calculate(1).Parameter(1).DEFine = "S11"
app.SCPI.Calculate(1).Parameter(2).DEFine = "S21"
app.SCPI.Calculate(1).Parameter(1).Select
app.SCPI.Calculate(1).Selected.Format = "SMIT"
app.SCPI.Calculate(1).Parameter(2).Select
app.SCPI.Calculate(1).Selected.Format = "SMIT"
app.SCPI.Calculate(2).Parameter(1).DEFine = "S21"
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("TRVNA.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 TRVNA.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 TRVNA.exe application.

#import  "TRVNA.exe"  no_namespace

//--------------------------------------------------------------------------

int _tmain(int argc, _TCHAR* argv[])

{

   IRVNAPtr          pNWA;                           // Pointer to COM object of TRVNA.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 to send the analyzer for factory calibration every three years.

Performance Test

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.

The performance test period is one year.

Download VNA performance test from https://coppermountaintech.com/download-free-vna-software-and-documentation/.

Storage Instructions

Before first use, store the Analyzer in the factory package at a temperature from -50 ºC to+70 ºC (-58 °F to 158 °F) and relative humidity up to 90% at 25 ºC (77 °F).

After the analyzer has been removed from the factory packaging and while being used, it should be stored at a temperature from+5 ºC to+40 ºC and relative humidity up to 90% at 25 ºC (1 °F to 104 °F).

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
Data Saving Type	State and Calibration	Analyzer
Touchstone Data Format	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
Reference Frequency Source	Internal	Analyzer
Trigger Signal Source	Internal	Analyzer
System Correction	ON	Analyzer
Allocation of Traces	×1 □	Channel
Vertical Divisions	10	Channel
Channel Title Bar	OFF	Channel
Channel Title	Empty	Channel
«FAIL» Label Display (Limit Test)	OFF	Channel

Parameter Description	Default Setting	Parameter Setting Object
Segment Sweep Frequency Axis Display	Frequency Order	Channel
Traces per Channel	1	Channel
Active Trace Number	1	Channel
Marker Coupling	OFF	Channel
Sweep Type	Linear Frequency	Channel
Number of Points	201	Channel
Stimulus Start Frequency	Instrument Min.	Channel
Stimulus Stop Frequency	Instrument Max.	Channel
Stimulus CW Frequency	Middle of Freq Range of Instrument	Channel
Stimulus Start Power Level	Instrument Min.	Channel
Stimulus Stop Power Level	Instrument Max.	Channel
Stimulus Power Level	0 dBm	Channel
Stimulus Power Slope	0 dBm	Channel
Stimulus IF Bandwidth	10 kHz	Channel
Sweep Measurement Delay	0 sec.	Channel
Sweep Range Setting	Start / Stop	Channel
Number of Segments	1	Channel

Parameter Description	Default Setting	Parameter Setting Object
Points per Segment	2	Channel
Segment Start Frequency	Instrument Min.	Channel
Segment Stop Frequency	Instrument Min.	Channel
Segment Sweep Power Level	0 dBm	Channel
Segment Sweep IF Bandwidth	10 kHz	Channel
Segment Sweep Measurement Delay	0 sec.	Channel
Segment Sweep Power Level (Table Display)	OFF	Channel
Segment Sweep IF Bandwidth (Table Display)	OFF	Channel
Segment Sweep Measurement Delay (Table Display)	OFF	Channel
Segment Sweep Range Setting	Start / Stop	Channel
Averaging	OFF	Channel
Averaging Factor	10	Channel
Trigger Mode	Continuous	Channel
Table of Calibration Coefficients	Empty	Channel
Error Correction	OFF	Channel
Port Z Conversion	OFF	Channel

Parameter Description	Default Setting	Parameter Setting Object
Port 1 Simulated Impedance	Instrument Nominal	Channel
Port 2 Simulated Impedance	Instrument Nominal	Channel
Port 1 De-embedding	OFF	Channel
Port 2 De-embedding	OFF	Channel
Port 1 De-embedding S-parameter File	Empty	Channel
Port 2 De-embedding S-parameter File	Empty	Channel
Port 1 Embedding	OFF	Channel
Port 2 Embedding	OFF	Channel
Port 1 Embedding User File	Empty	Channel
Port 2 Embedding User File	Empty	Channel
Measurement Parameter	S11	Trace
Trace Scale	10 dB / Div.	Trace
Reference Level Value	0 dB	Trace
Reference Level Position	5 Div.	Trace
Data Math	OFF	Trace
Phase Offset	0°	Trace
Electrical Delay	0 sec.	Trace

Parameter Description	Default Setting	Parameter Setting Object
S-parameter Conversion	OFF	Trace
S-parameter Conversion Function	Z: Reflection	Trace
Trace Display Format	Logarithmic Magnitude (dB)	Trace
Time Domain Transformation	OFF	Trace
Time Domain Transformation Start	–10 nsec.	Trace
Time Domain Transformation Stop	10 nsec.	Trace
Time Domain Kaiser-Beta	6	Trace
Time Domain Transformation Type	Bandpass	Trace
Time Domain Gate	ON	Trace
Time Domain Gate Start	–10 ns	Trace
Time Domain Gate Stop	10 ns	Trace
Time Domain Gate Type	Bandpass	Trace
Time Domain Gate Shape	Normal	Trace
Smoothing	OFF	Trace
Smoothing Aperture	1%	Trace
Trace Display Mode	Data	Trace

Parameter Description	Default Setting	Parameter Setting Object
Limit Test	OFF	Trace
Limit Line Display	OFF	Trace
Defined Limit Lines	Empty	Trace
Number of Markers	0	Trace
Marker Position	Middle of Freq Range of Instrument	Trace
Marker Search	Maximum	Trace
Marker Tracking	OFF	Trace
Marker Search Target	0 dB	Trace
Marker Search Target Transition	Both	Trace
Marker Search Peak Polarity	Positive	Trace
Marker Search Peak Excursion	1 dB	Trace
Bandwidth Parameter Search	OFF	Trace
Marker Search Bandwidth Value	–3 dB	Trace
Marker Search Range	OFF	Trace
Marker Search Start	0	Trace
Marker Search Stop	0	Trace

ACM Operating manual

This Operating Manual contains information on design, specifications, functional overview, and detailed operation procedures of the Copper Mountain Technologies Automatic Calibration Modules (hereinafter referred to as Modules). Use the navigation tools on the left of the window to access the sections.

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.

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	Supported calibrations	Features
50 Ohm two-port Modules			
ACM2506	20 kHz to 6.5 GHz	Full one-port One-path two-port	Unknown thru Thermal compensation User characterization Automatic orientation Confidence check
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	Full one-port One-path two-port	Unknown thru Thermal compensation User characterization

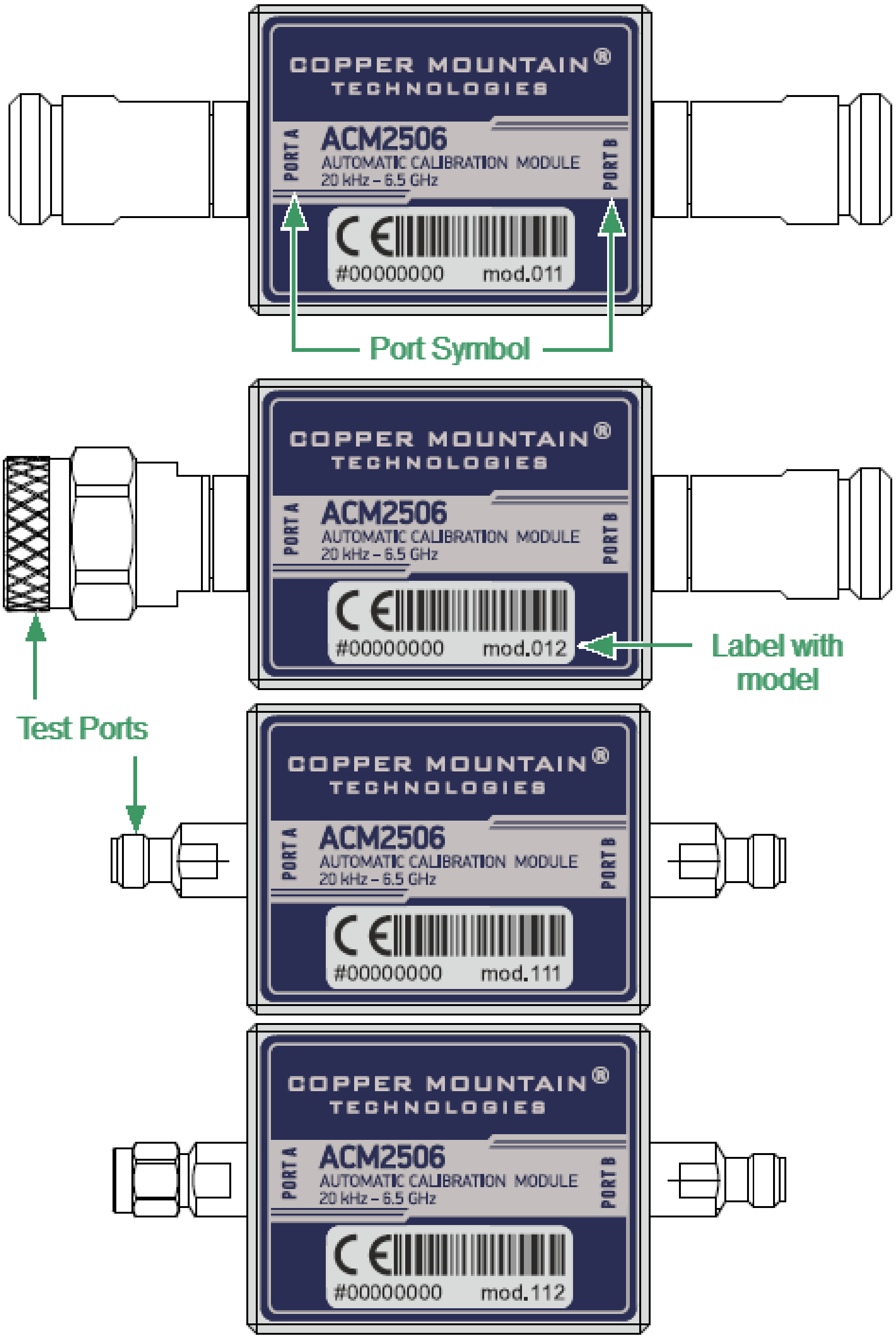
Module	Frequency range	Supported calibrations	Features
ACM4000T	20 kHz to 4 GHz		Automatic orientation Confidence check
50 Ohm four-port Modules			
ACM4509	100 kHz to 9 GHz	Full one-port One-path two-port	Unknown thru Thermal compensation User characterization Automatic orientation Confidence check
ACM4520	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.



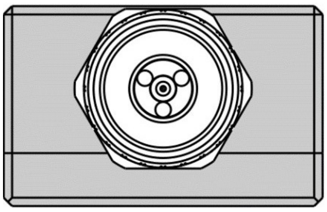
Front panel ACM2506

Parts of the ACM2509

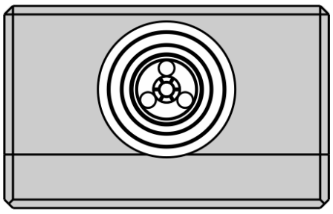
Test Port

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.

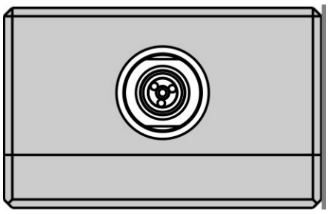
The Modules connectors are shown in figures below.



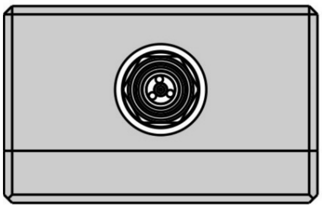
Type N, male



Type N, female

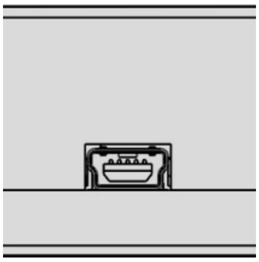


3.5 mm, male



3.5 mm, female

Mini USB Connector (on side panel)



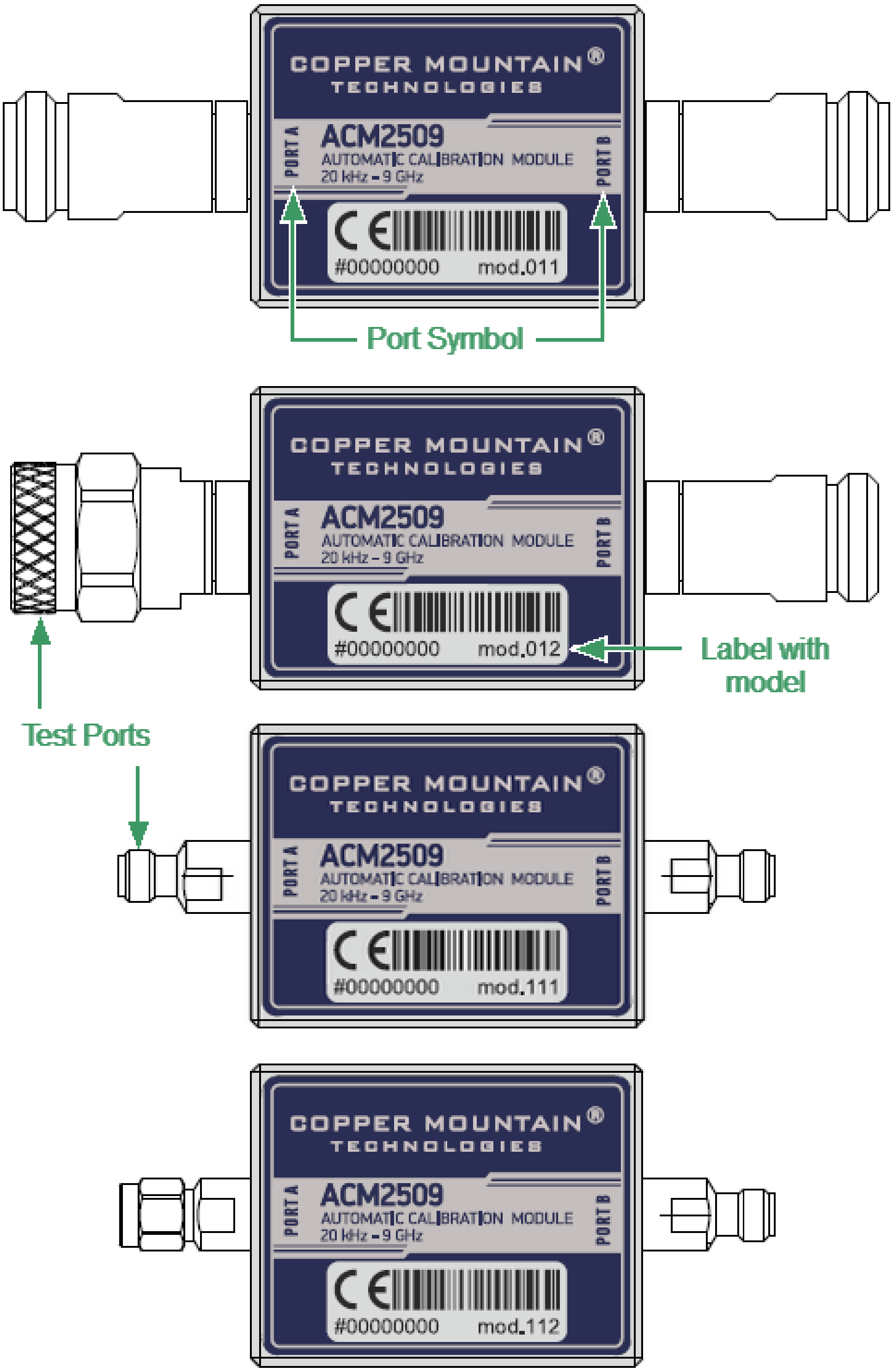
The mini USB connector is located at the side panel of the Module and is intended for the Module connection to the controlling PC. The Module is powered using the USB cable.

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.



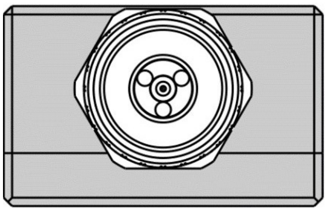
Front panel ACM2509

Parts of Module

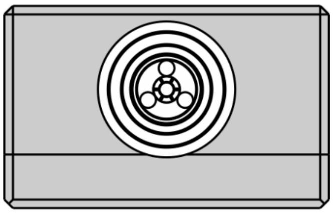
Test Port

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.

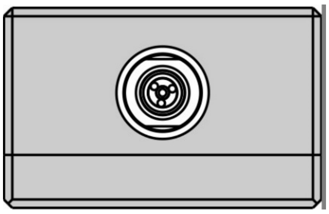
The Modules connectors are shown in figures below.



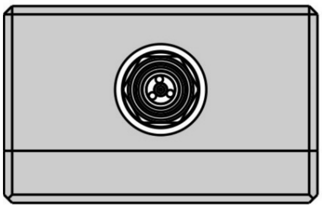
Type N, male



Type N, female

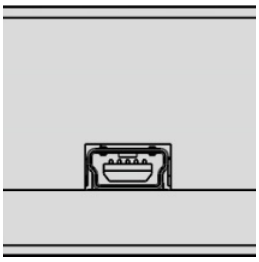


3.5 mm, female



3.5 mm, male

Mini USB Connector (on side panel)



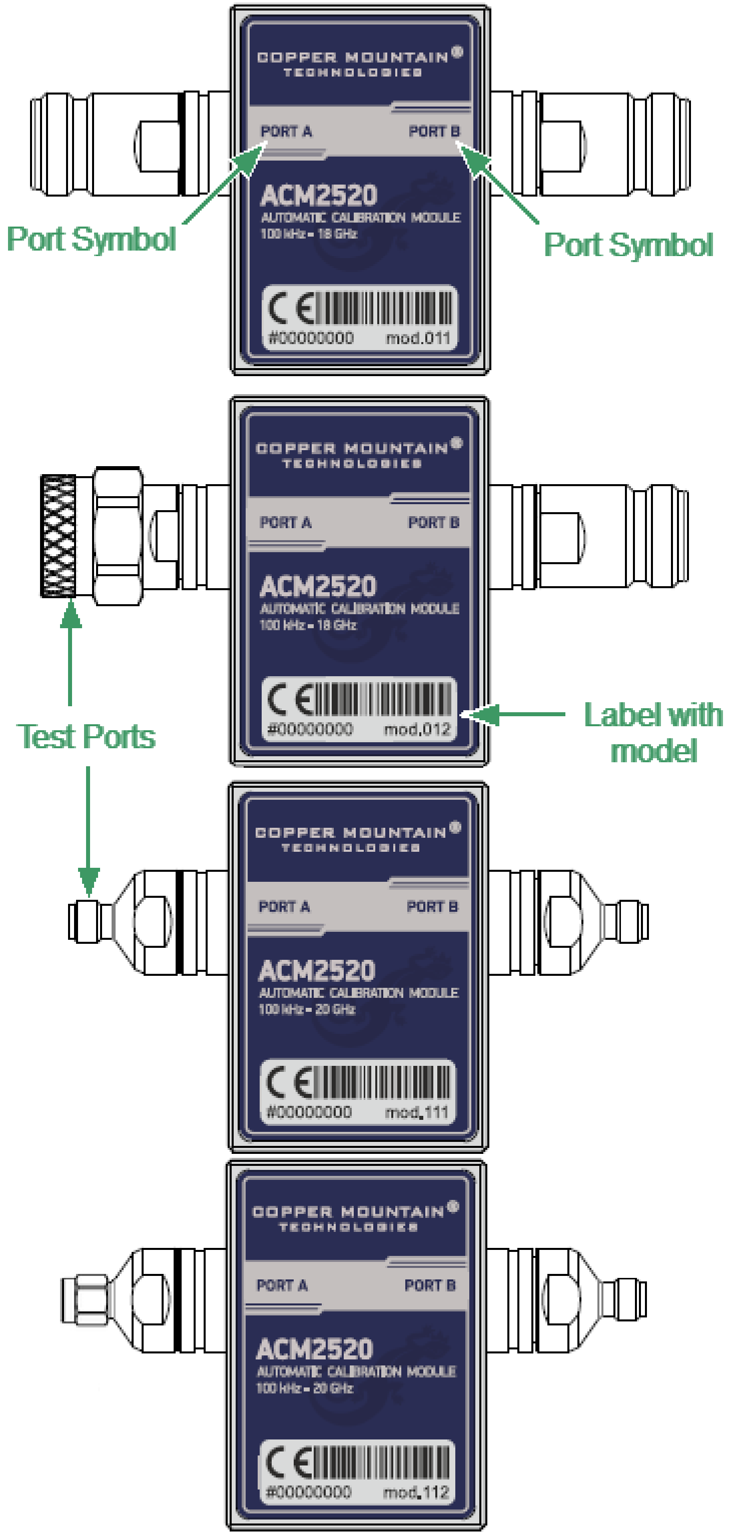
The mini USB connector is located on the side panel of the Module and is intended for the Module connection to the controlling PC. The Module is powered using the USB cable.

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.



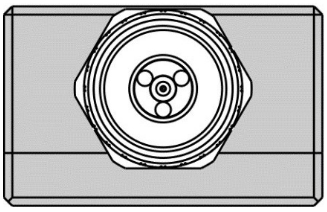
Front panel ACM2520

Parts of Module

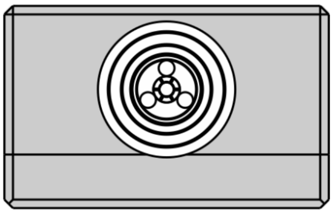
Test Port

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.

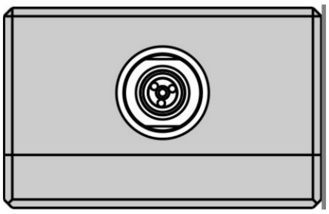
The Modules connectors are shown in figures below.



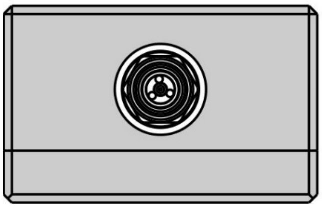
Type N, male



Type N, female

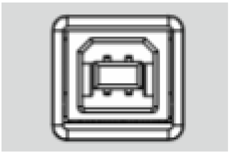


3.5 mm, female



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.

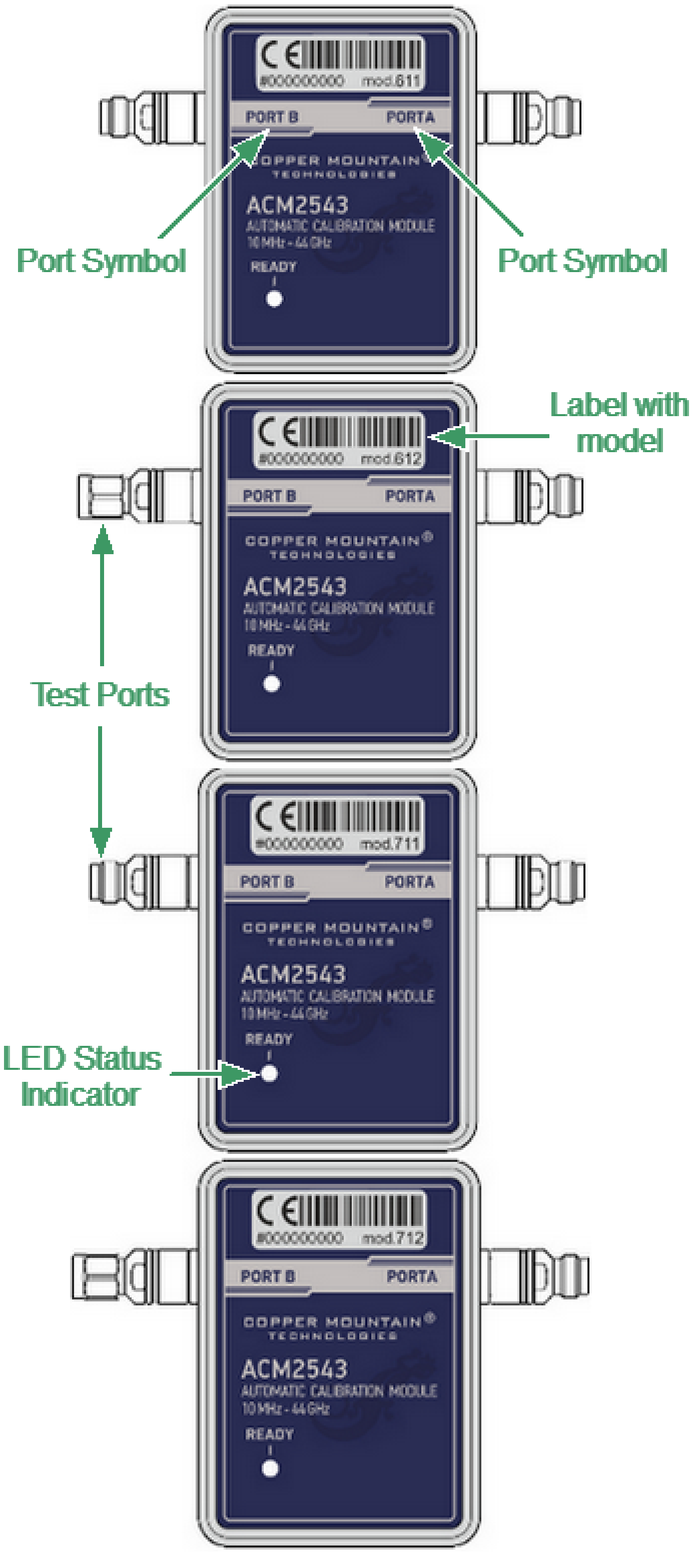
- Green LED indicator means the Module is ready for operation.

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.

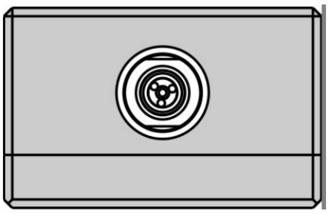


Rear panel ACM2543

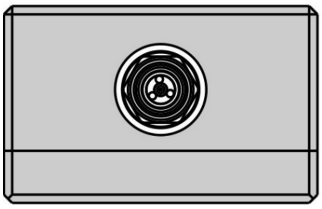
Parts of Module

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

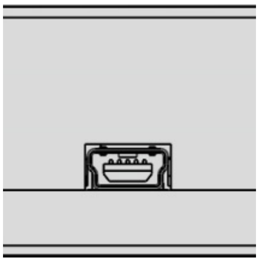
LED Status Indicator

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)



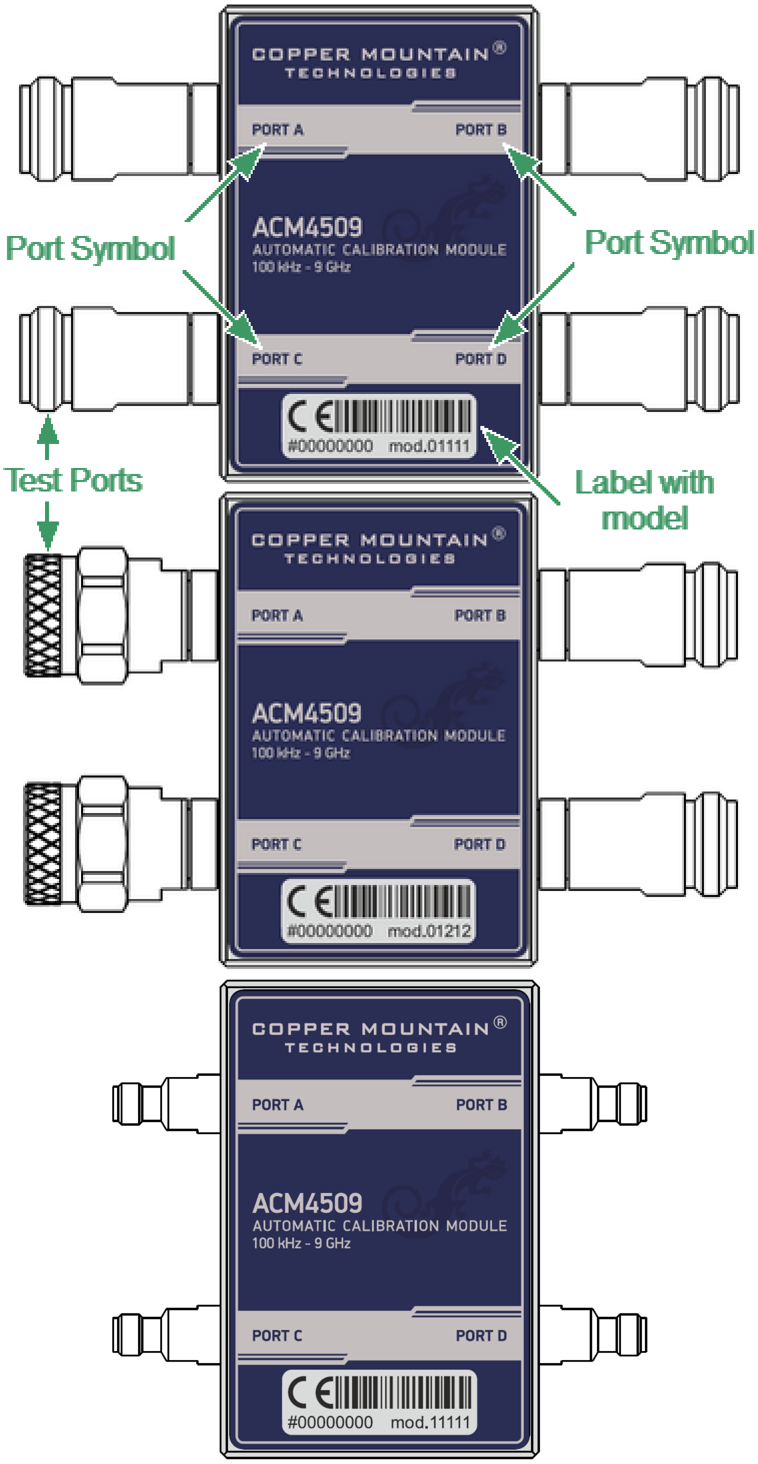
The connector is located on the top of the Module and is intended for the Module connection to the controlling PC. The Module is powered using the USB cable.

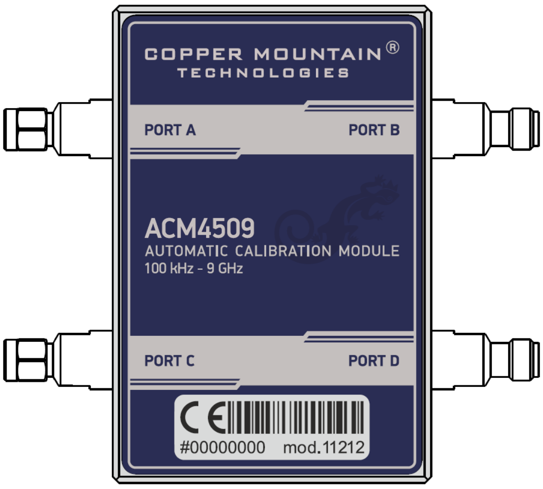
Hardware Configurations

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.





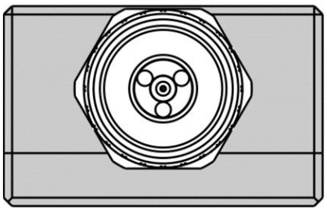
Front panel ACM4509

Parts of Module

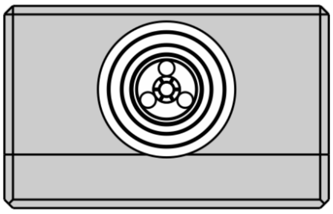
Test Port

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.

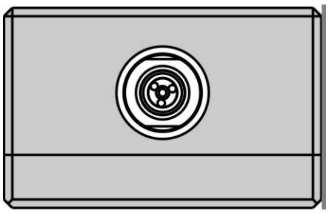
The Modules connectors are shown in figures below.



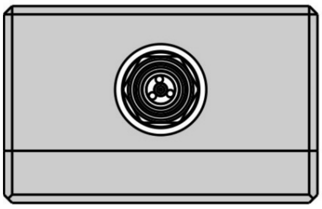
Type N, male



Type N, female

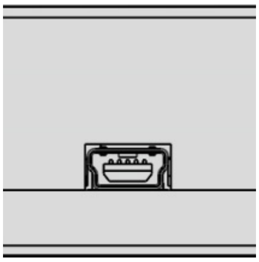


3.5 mm, female



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.

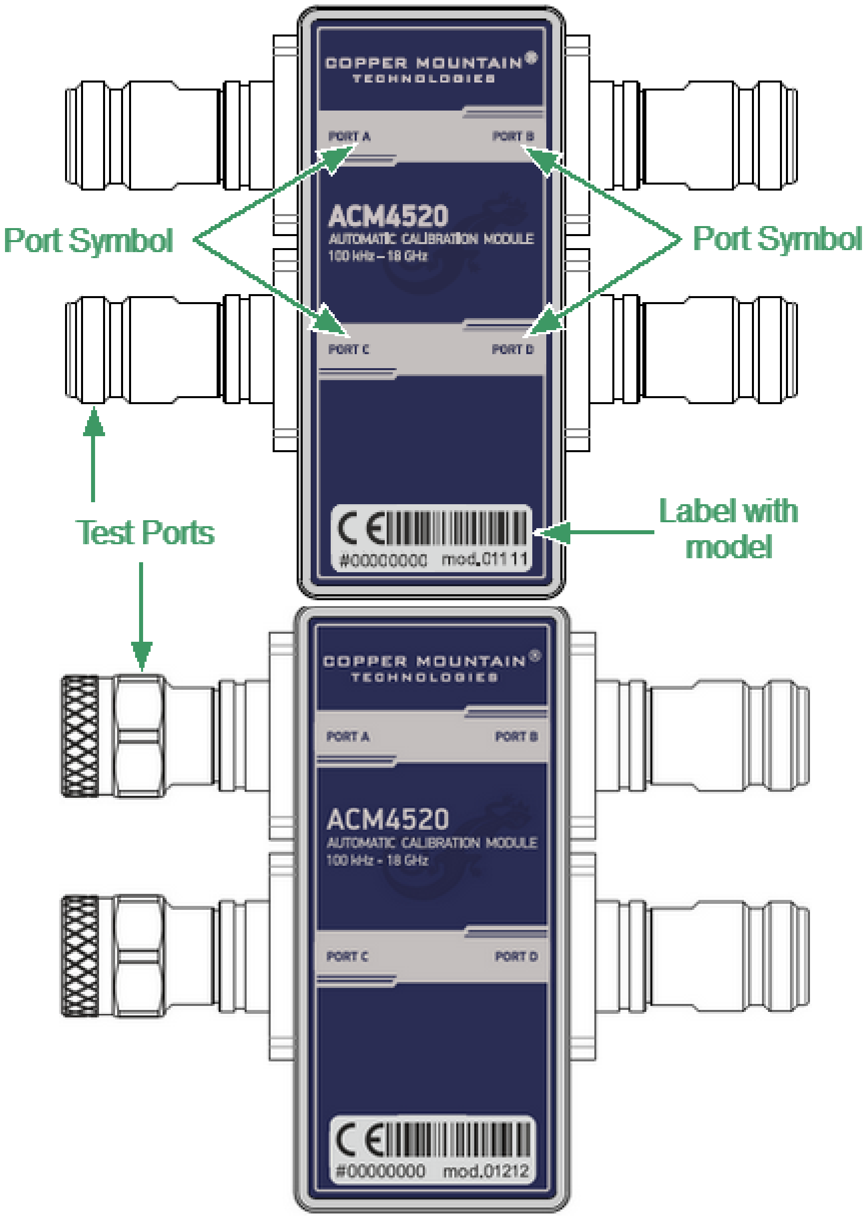
  Additional red LED may indicate the Module connection loss with the PC. In this case, check the Module connection with software (the **Autocalibration** softkey should be active), if there is no connection, disconnect the USB cable from the Module and repeat the connection.
- Green LED indicator means the Module is ready for operation.

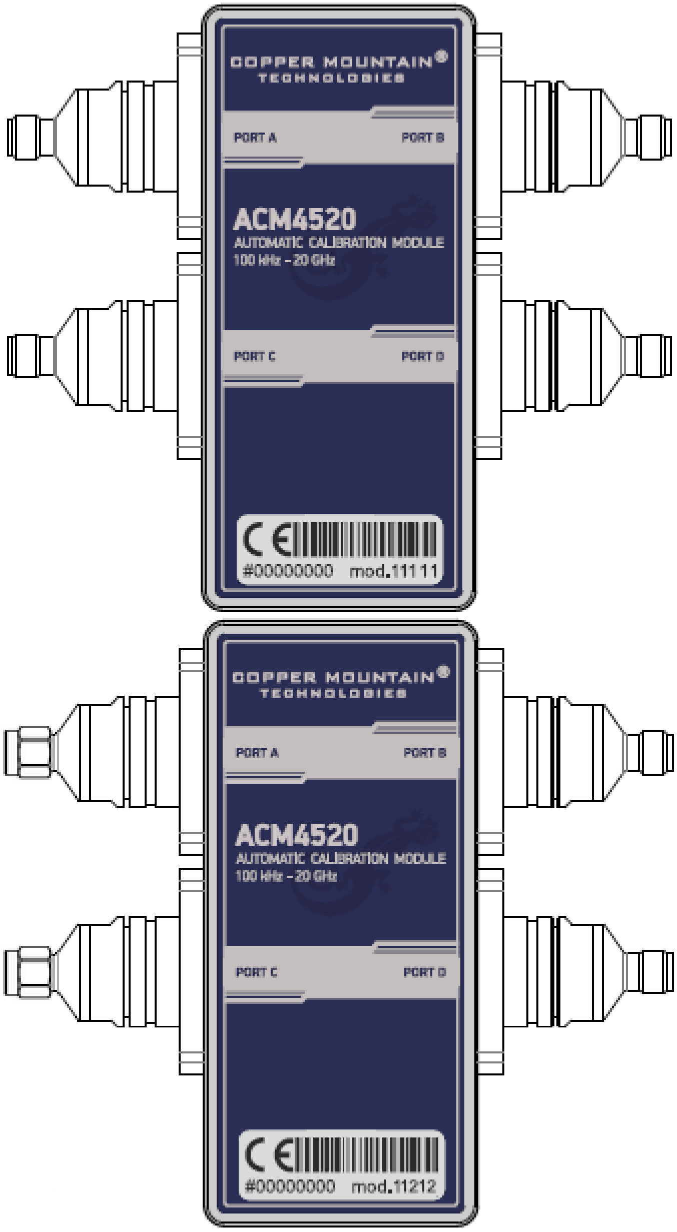
Hardware Configurations

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.





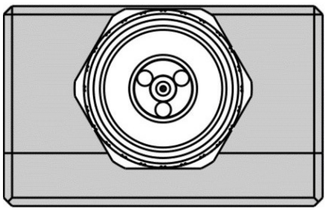
Front panel ACM4520

Parts of Module

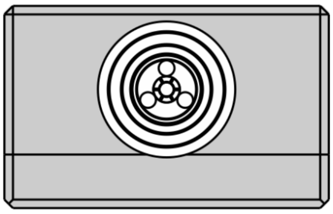
Test Port

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.

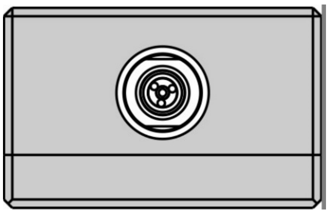
The Modules connectors are shown in figures below.



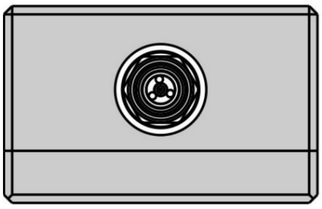
Type N, male



Type N, female

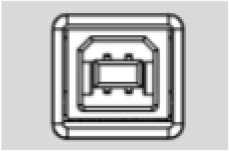


3.5 mm, female



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.

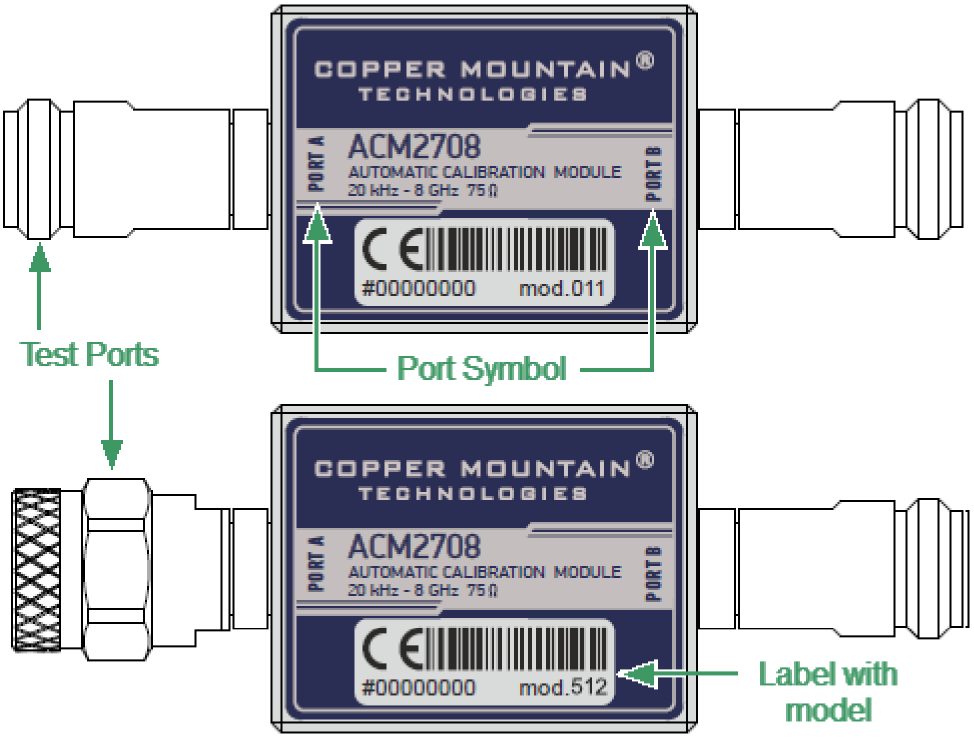
  Additional red LED may indicate the Module connection loss with the PC. In this case, check the Module connection with software (the **Autocalibration** softkey should be active), if there is no connection, disconnect the USB cable from the Module and repeat the connection.
- Green LED indicator means 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.



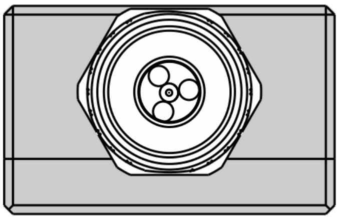
Front panel ACM2708

Parts of Module

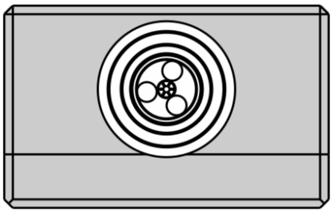
Test Port

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.

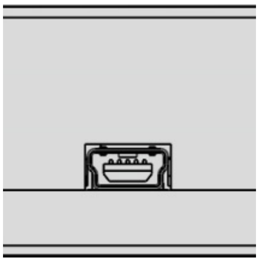


Type N 75, male



Type N 75, female

Connector (on side panel)



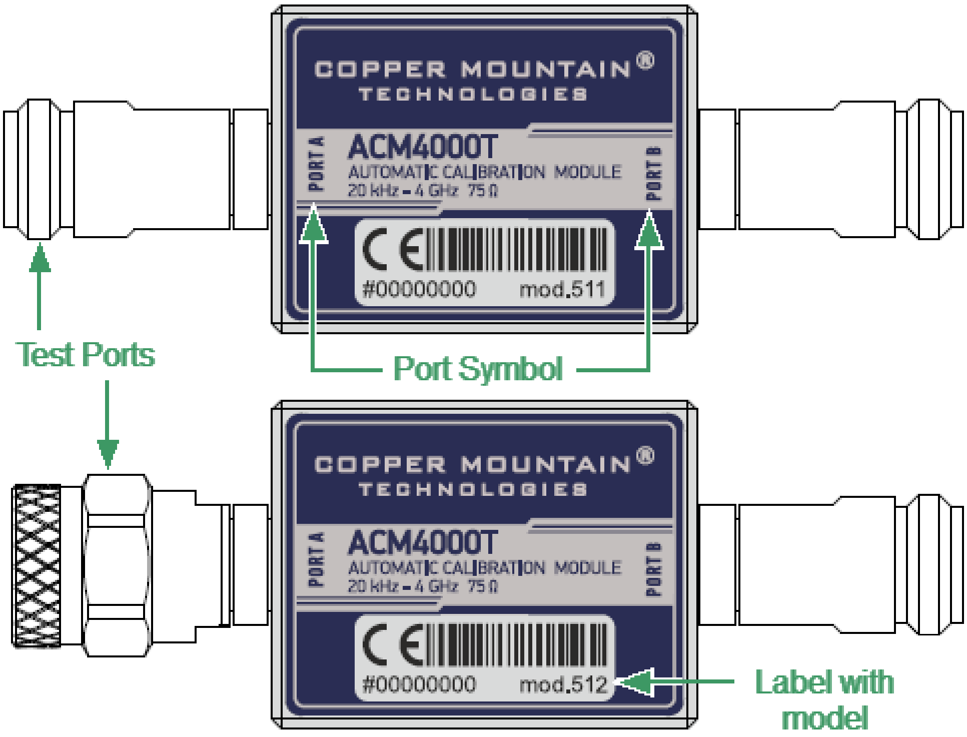
The connector is located on the bottom of the Module and is intended for the Module connection to the controlling PC. The Module is powered using the USB cable.

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.



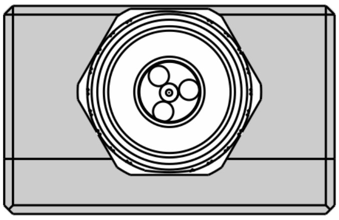
Front panel ACM4000T

Parts of Module

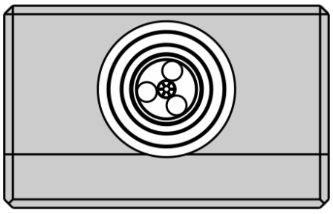
Test Port

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.

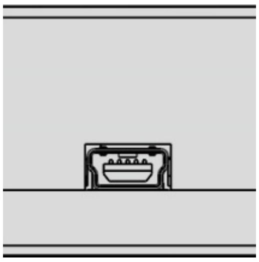


Type N 75, male



Type N 75, female

Connector (on side panel)



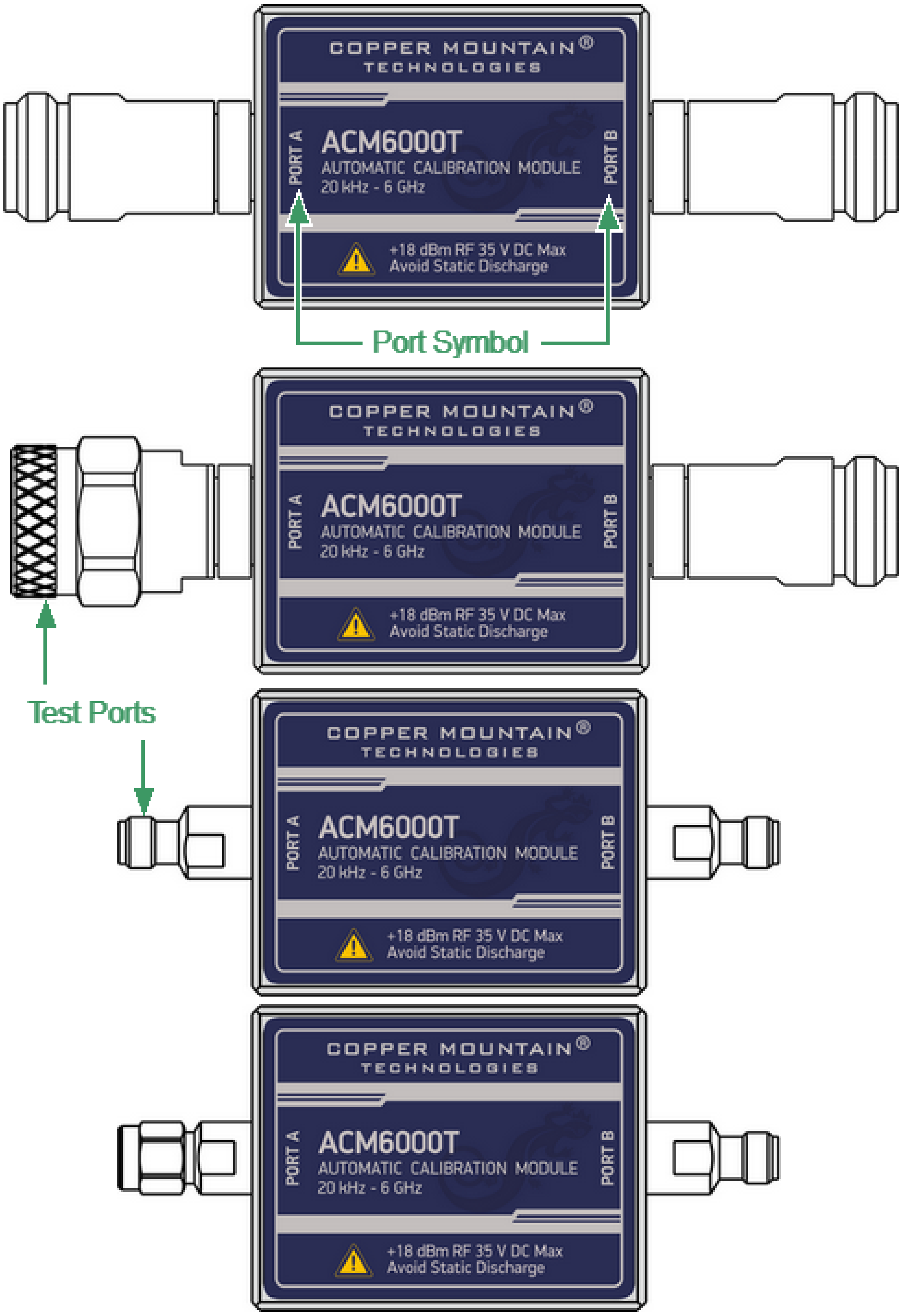
The connector is located on the bottom of the Module and is intended for the Module connection to the controlling PC. The Module is powered using the USB cable.

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.



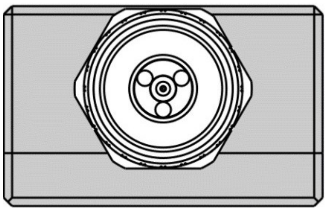
Front panel ACM6000T

Parts of Module

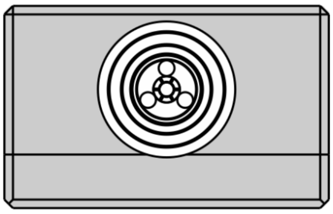
Test Port

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.

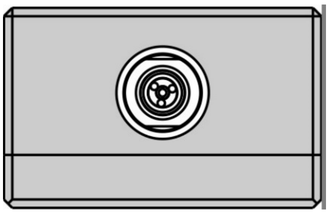
The Modules connectors are shown in figures below.



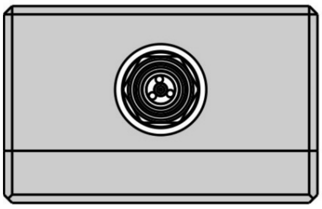
Type N, male



Type N, female

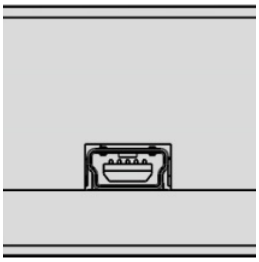


3.5 mm, female



3.5 mm, male

Connector (on side panel)



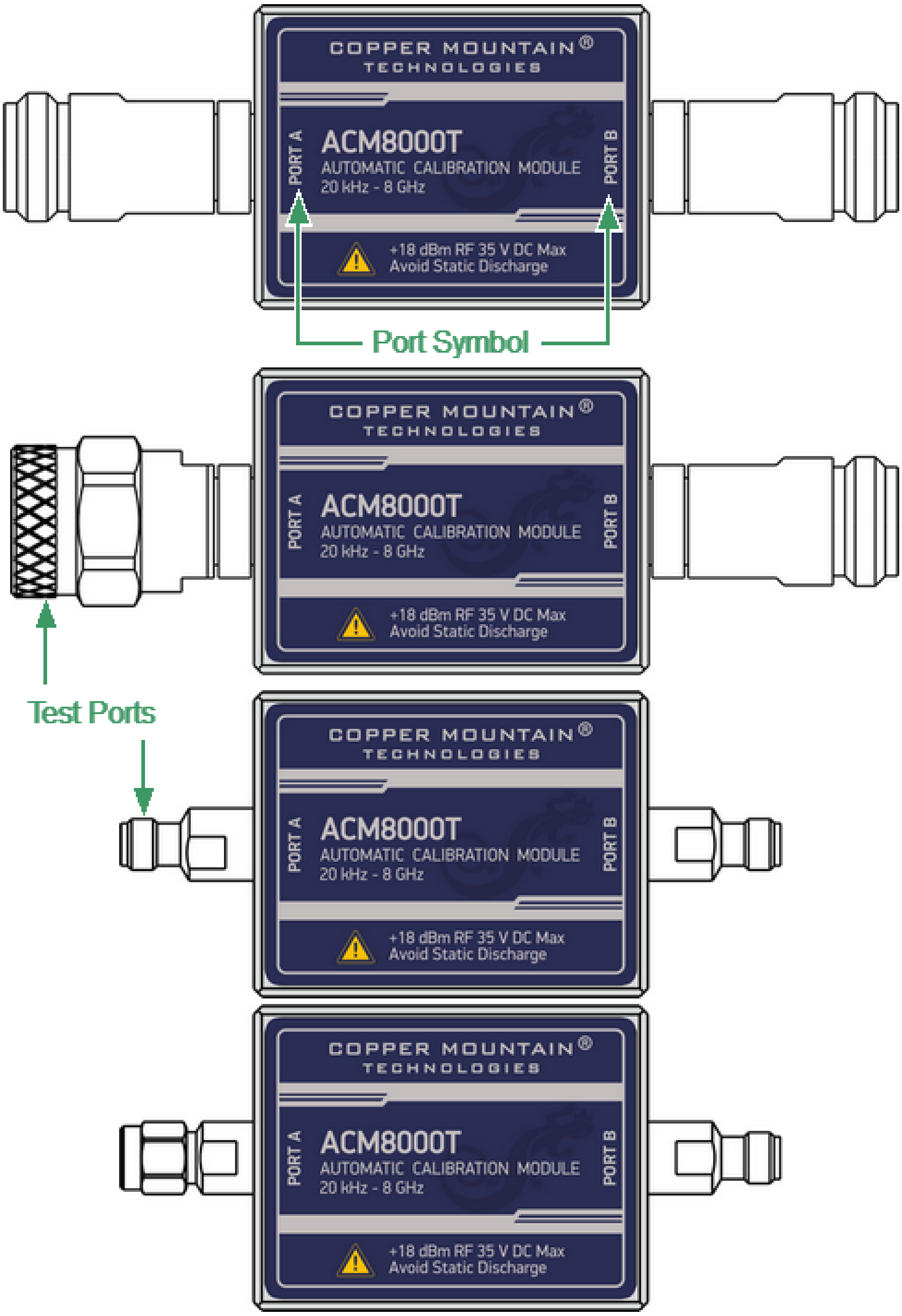
The connector is located on the bottom of the Module and is intended for the Module connection to the controlling PC. The Module is powered using the USB cable.

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.



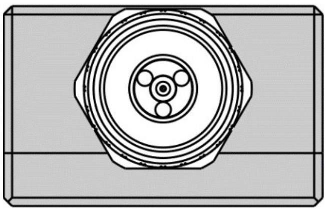
Front panel ACM8000T

Parts of Module

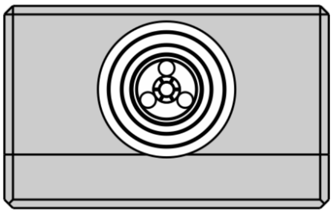
Test Port

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.

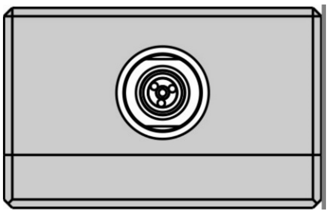
The Modules connectors are shown in figures below.



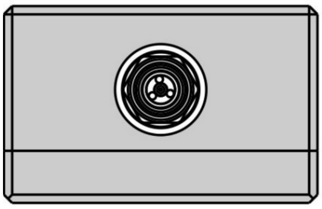
Type N, male



Type N, female

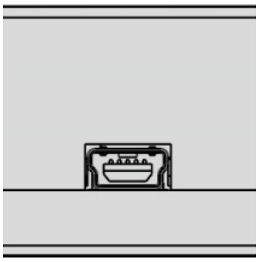


3.5 mm, female



3.5 mm, male

Connector (on side panel)



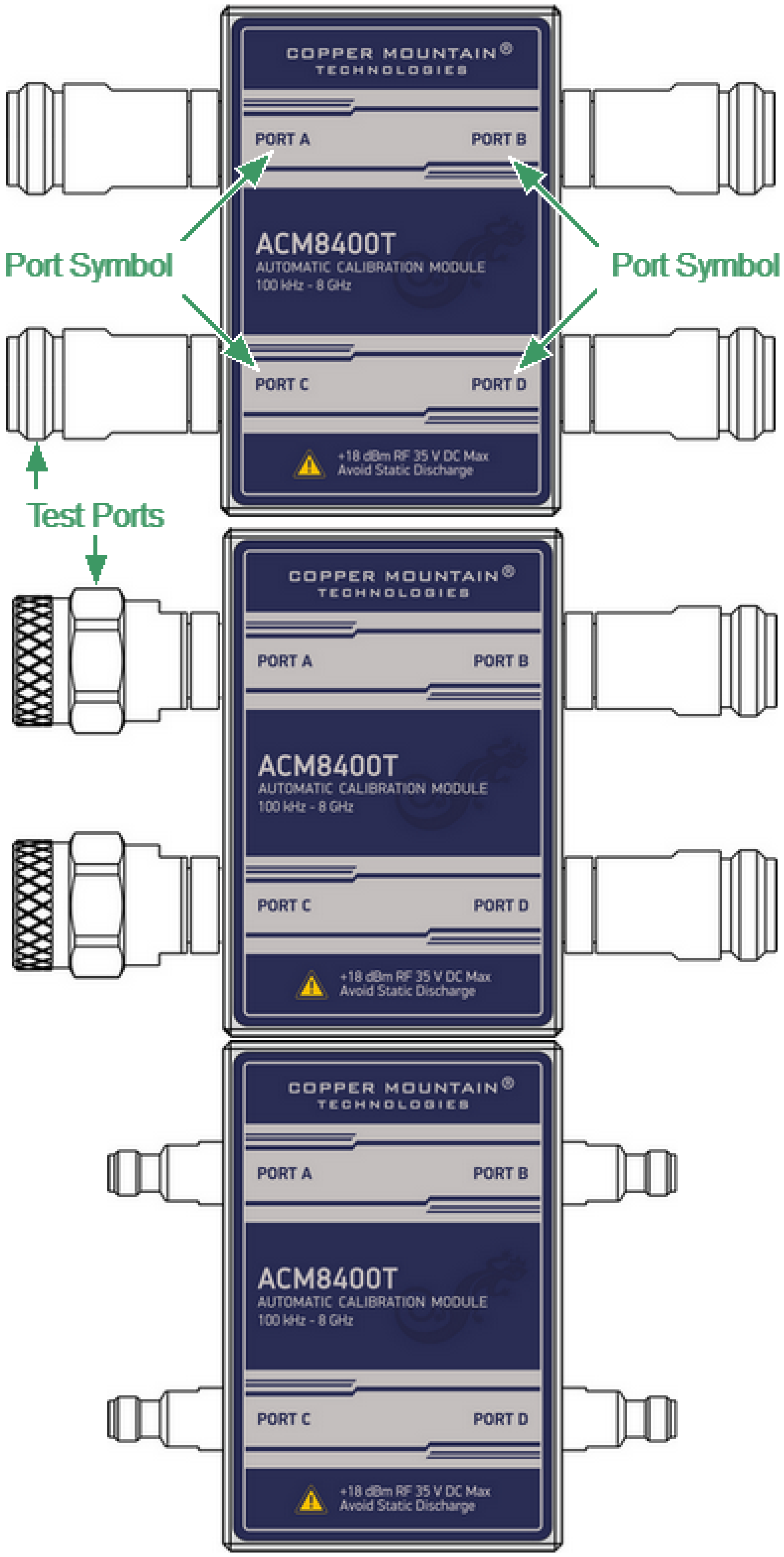
The connector is located on the bottom of the Module and is intended for the Module connection to the controlling PC. The Module is powered using the USB cable.

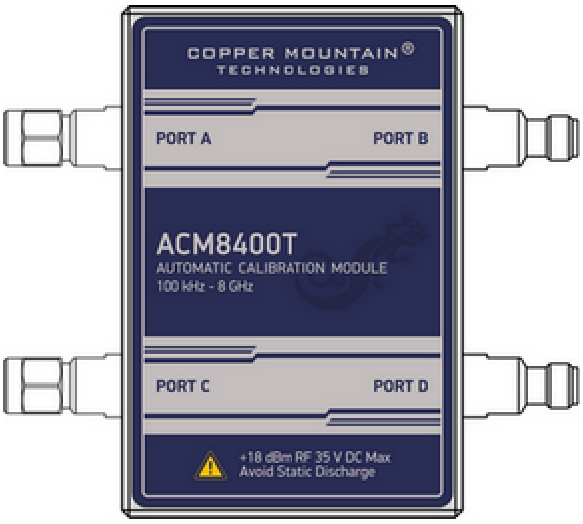
Hardware Configurations

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.





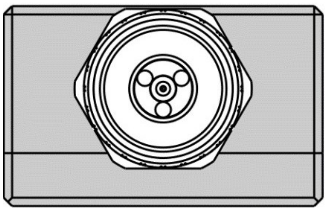
Front panel ACM8400T

Parts of Module

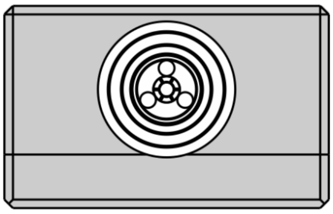
Test Port

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.

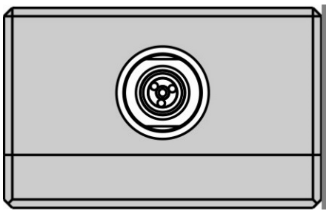
The Modules connectors are shown in figures below.



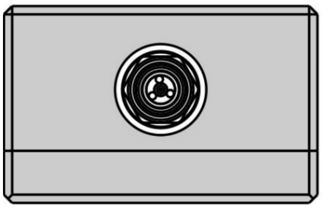
Type N, male



Type N, female

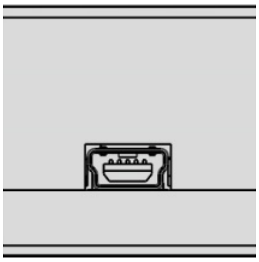


3.5 mm, female



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.

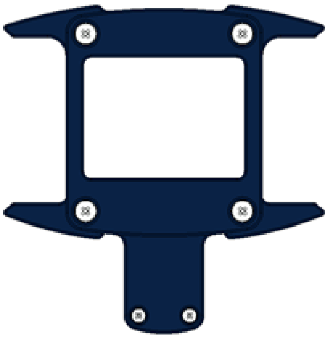
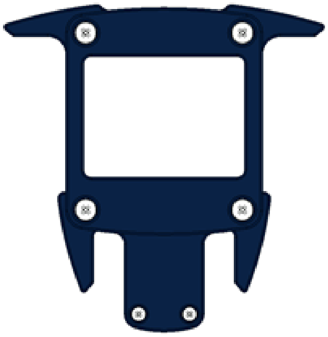
The protective housing is removable. The collapsible design allows for quick installation.

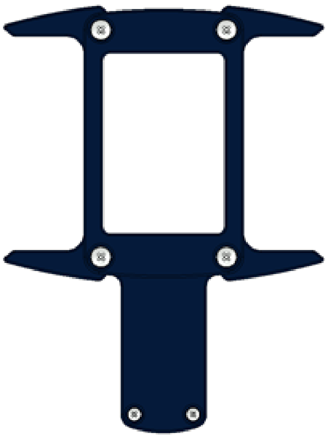
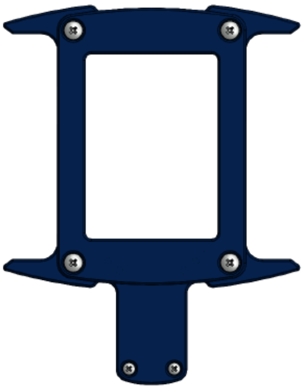
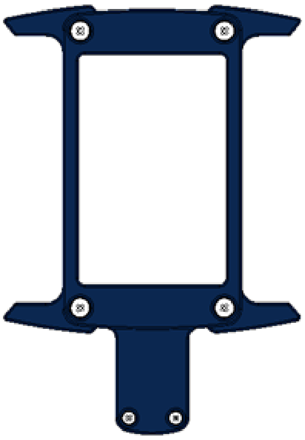
The protective housing is non-repairable.

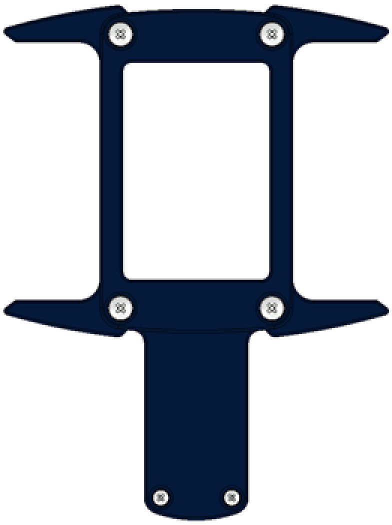
NOTE	The protective housing is not intended for use in extreme environments. Do not bend or stretch the protective housing during use.

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 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.

Unknown thru	The usage of a reciprocal two-port device with loss values of no more than 10 dB for full -port calibration enables correction of VNA parameters for measuring parameters of non-insertion devices. Non-insertion devices are the devices that have same-gender connectors of any type, and different-gender or same-gender connectors of different types. The Module memory stores S-parameters of the thru which are used for calibration coefficients calculation. The said parameters are not applied for the Unknown Thru algorithm.

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:

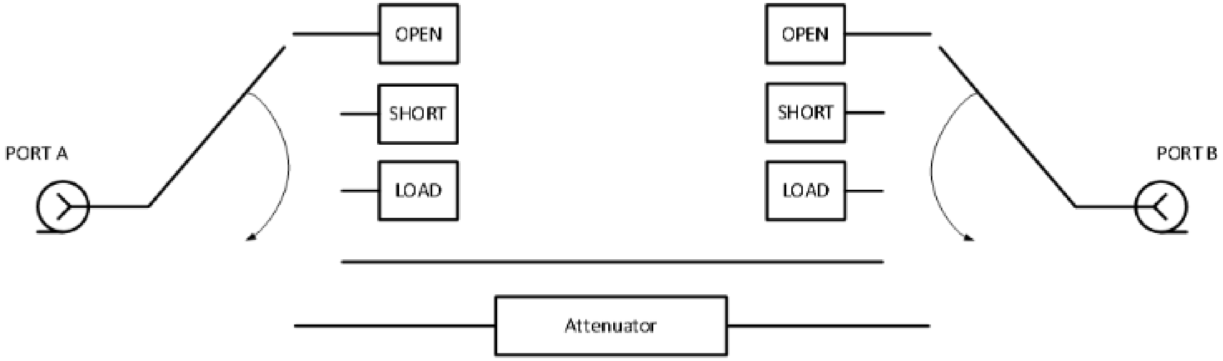
- OPEN
- SHORT
- LOAD
- THRU

Attenuator

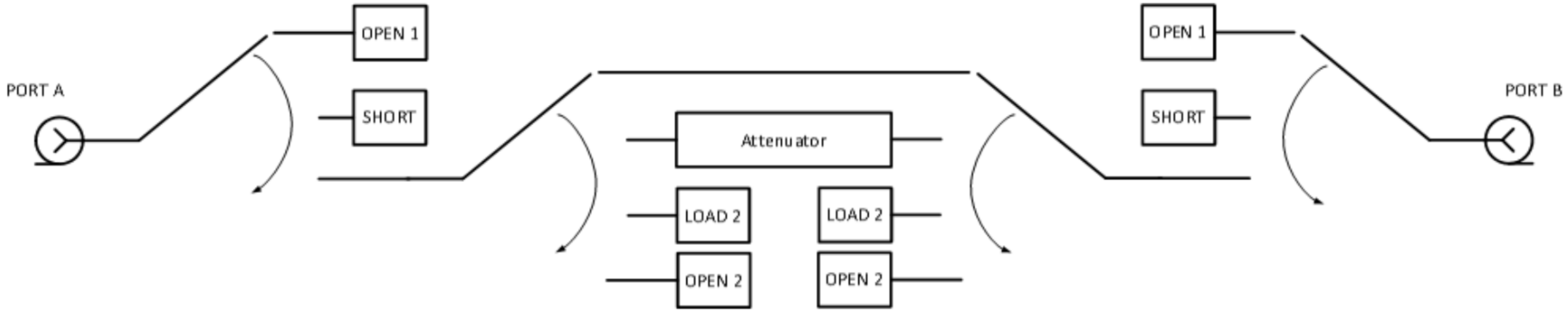
The Module features additional attenuator state, which is not used during calibration. The attenuator is used for checking calibration quality using a special confidence check function, which allows for comparing of the measured S-parameters of attenuator with the parameters stored in the Module memory.

Module Block Diagrams

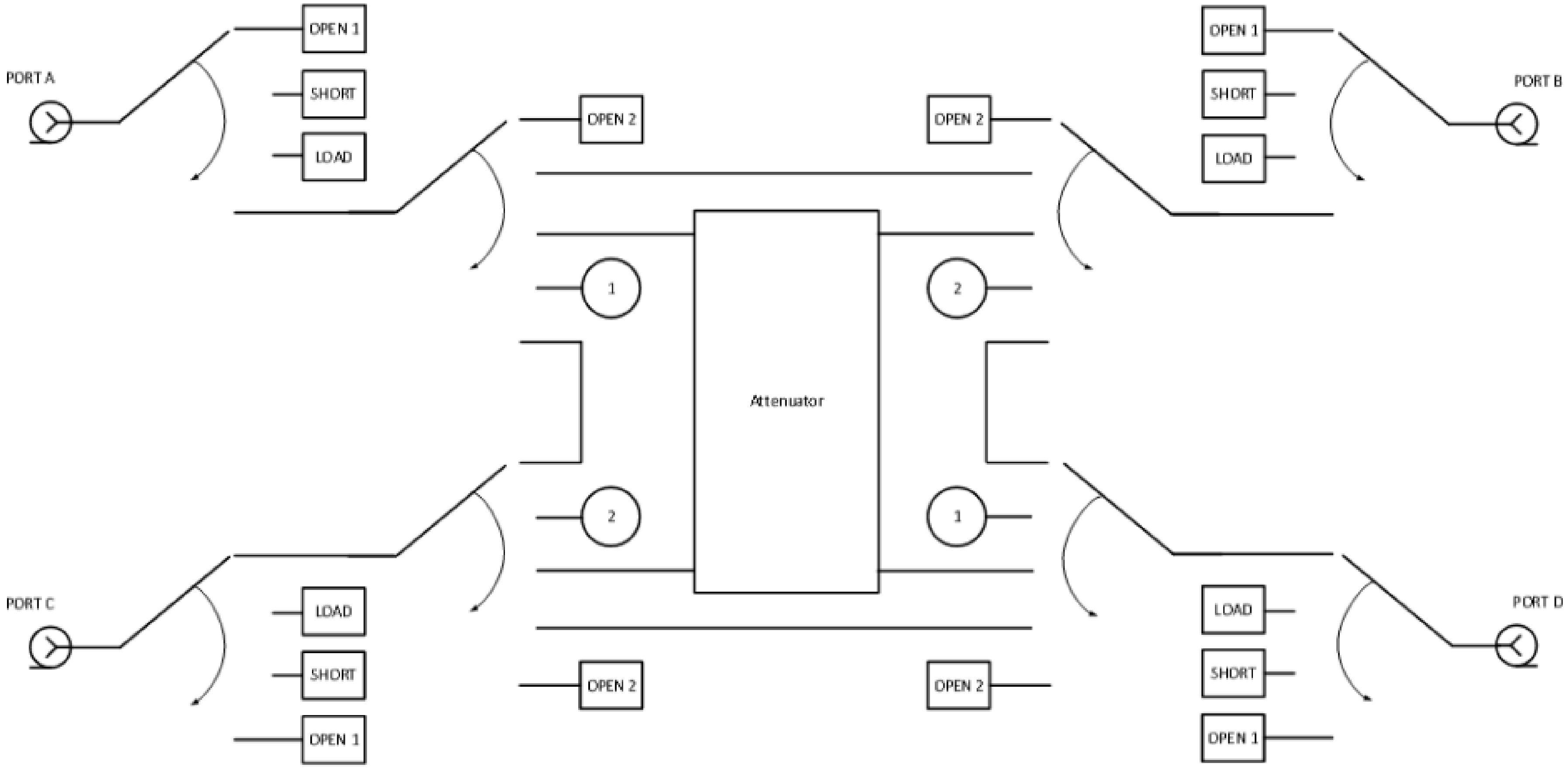
Module block diagrams are shown in figures below.



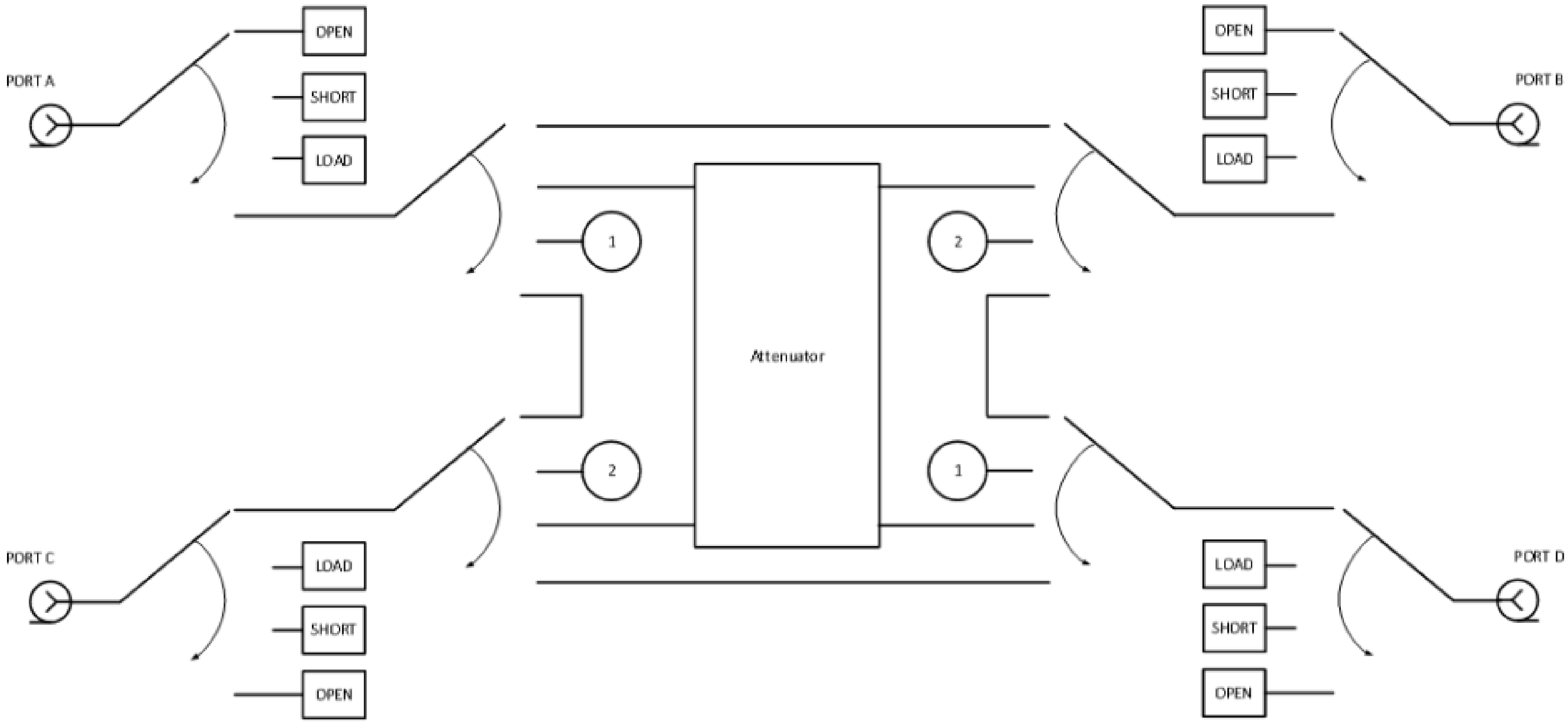
Block diagram of ACM2506 and ACM2509



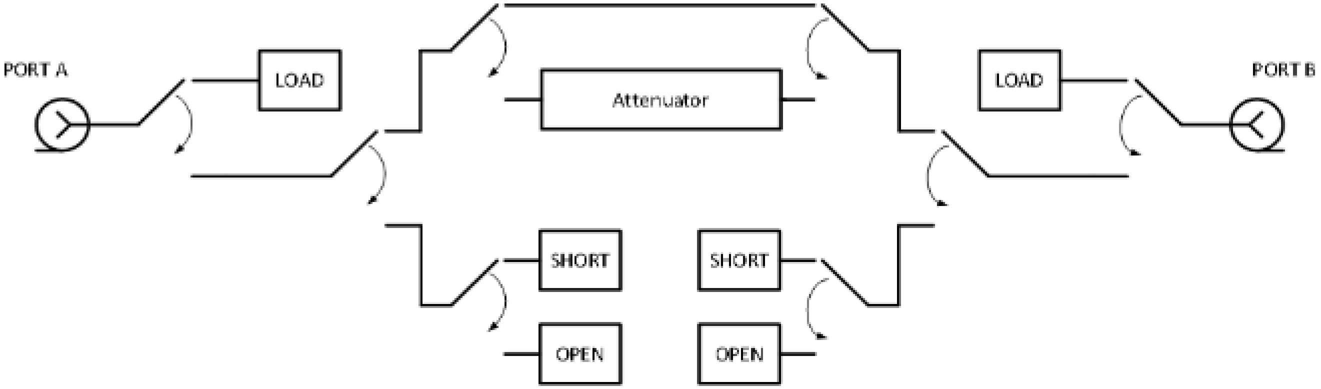
Block diagram of ACM2520



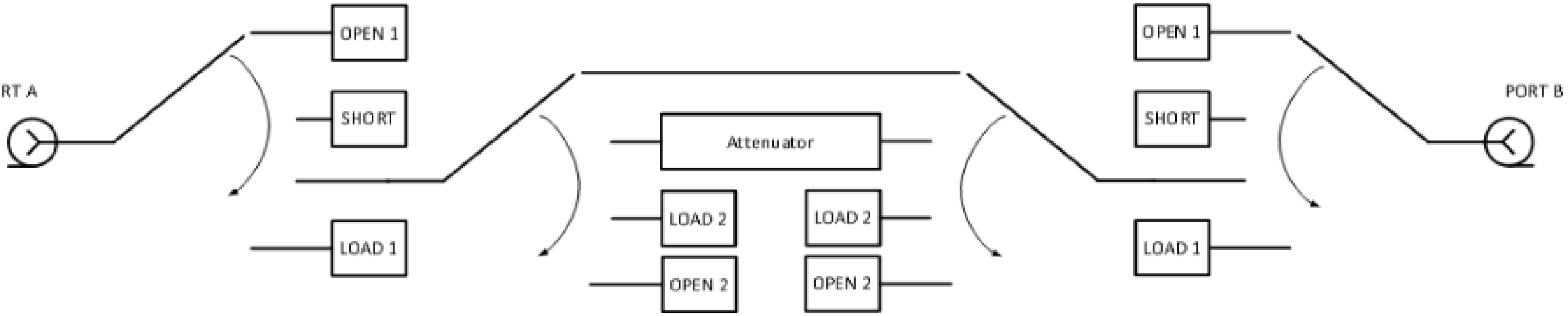
Block diagram of ACM4509 and ACM8400T



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.

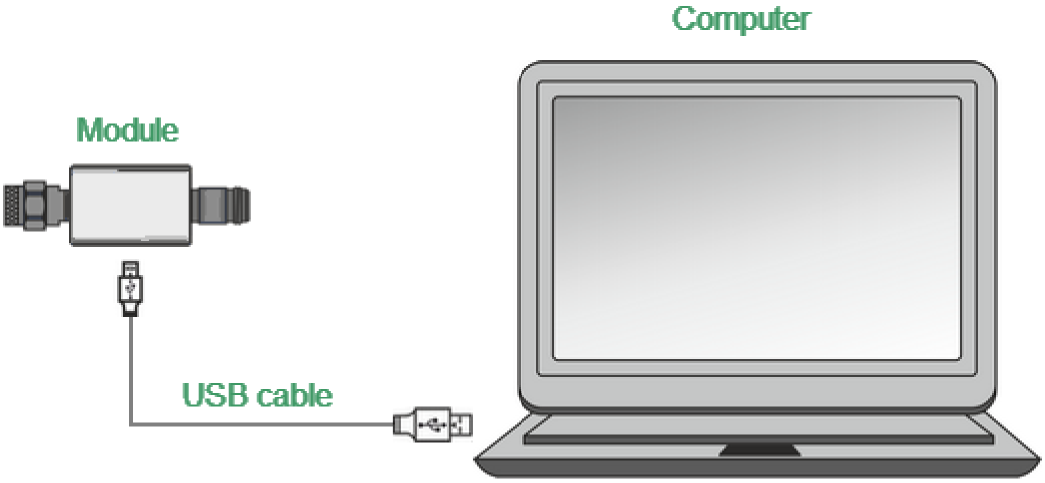
Installation

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

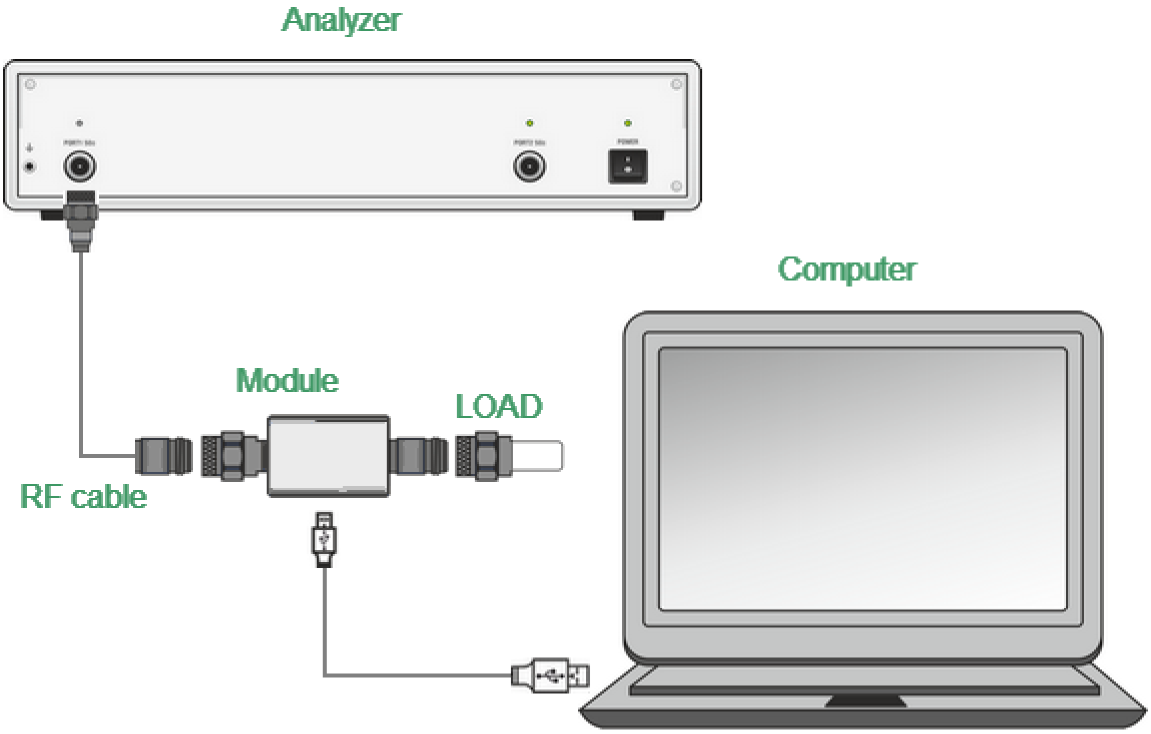
The following are connection diagrams for calibrations:

- Full One-Port CalibrationOne-Path Two-Port

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.



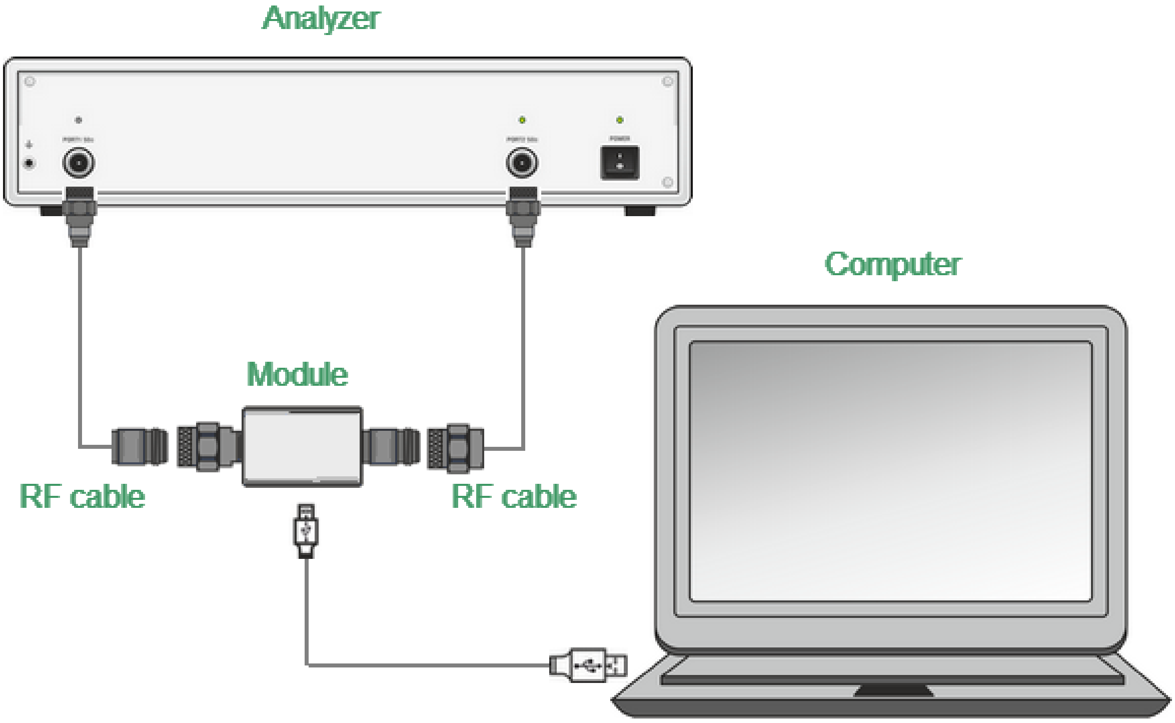
Module Connection Diagram for Performing Full One-port Calibration

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

Typical connection diagram for one-path two-port is shown in figure below.



Module Connection Diagram for Performing One-path Two-port and Full Two-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.

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

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

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.

Unknown Thru

UNKNOWN THRU is used in one-path two-port calibration. The calibration type with an UNKNOWN THRU is called SOLR, which refers to Short, Open, Load, Reciprocal.

Any arbitrary reciprocal two-port device with unknown parameters can be used as an UNKNOWN THRU.

There are two basic requirements to the UNKNOWN THRU:

- The first requirement applies to the transmission coefficient of the THRU. It should satisfy the reciprocity condition (S21 = S12), which holds for almost any passive network. Do not use a THRU with a loss higher than 20 dB, as it can reduce the calibration accuracy.
- The second requirement is knowledge of the approximate electrical length of the UNKNOWN THRU within an accuracy of 1/4 of the wavelength at the maximum calibration frequency. This requirement, however, can be omitted if the following frequency step size condition is met:

$$\Delta F < \frac{1}{4 \cdot \tau_0} ,$$

where τ_0 is a delay of reciprocal two-port device.

In this case, the VNA software can automatically determine electrical length (delay) of a reciprocal two-port device.

A thru, implemented inside the Module using an electronic switch, features loss. Make sure the exact thru parameters are known, or use an UNKNOWN THRU algorithm to obtain the required calibration accuracy.

The Module allows the use of both variants. Its memory stores S-parameters of the thru, which are used for calculation of calibration coefficients. The above parameters are not used if the UNKNOWN THRU algorithm is applied.

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_cº , 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.

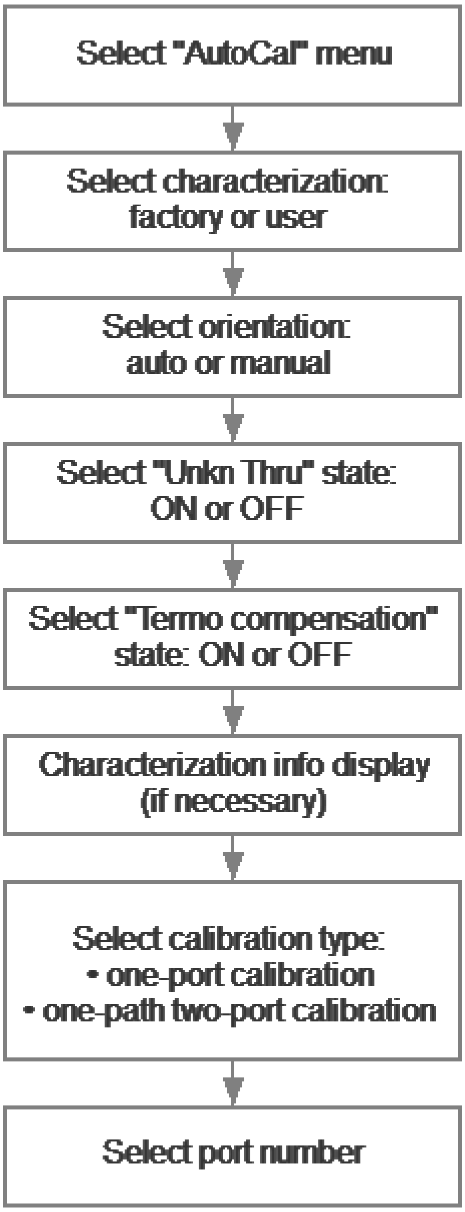
Calibration Procedure

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. Press the characterization softkey.
4. Select factory characterization or one of three user characterizations (user characterization procedure is described in User Characterization Procedure) in the characterization menu.
5. Select the Module orientation method by pressing the orientation softkey.
6. Select the unknown thru algorithm state. The unknown thru algorithm can be either enabled or disabled.
7. Select the thermal compensation function state. The thermal compensation function can be either enabled or disabled.
8. If necessary, display the detailed information on characterization. The information can be displayed by pressing the respective softkey in the autocalibration menu.
9. Select the calibration type: one-port or two-port.
10. Specify the port for full one-port calibration.
11. Wait until calibration is completed.

The automatic calibration algorithm is shown in the figure below.


Select "AutoCal" menu
Select characterization: factory or user
Select orientation: auto or manual
Select "Unkn Thru" state: ON or OFF
Select "Termo compensation" state: ON or OFF
Characterization info display (if necessary)
Select calibration type:
• one-port calibration
• one-path two-port calibration
Select port number

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.
- **[OP]** — one-path two-port calibration.

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.

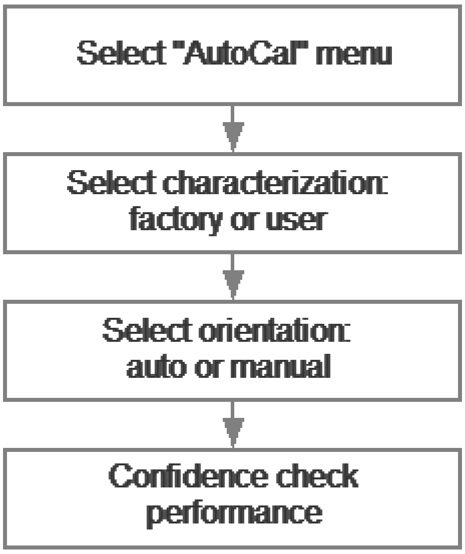
Confidence Check Procedure

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.


Select "AutoCal" menu
Select characterization: factory or user
Select orientation: auto or manual
Confidence check performance

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.

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:

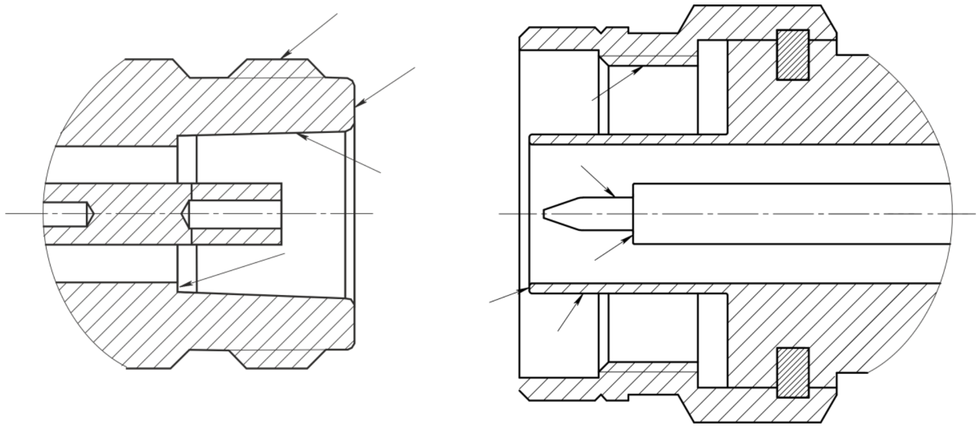
- Inspection.
- Module connectors gauging as described in Gauging Connectors.
- Confidence check.

Cleaning Connectors

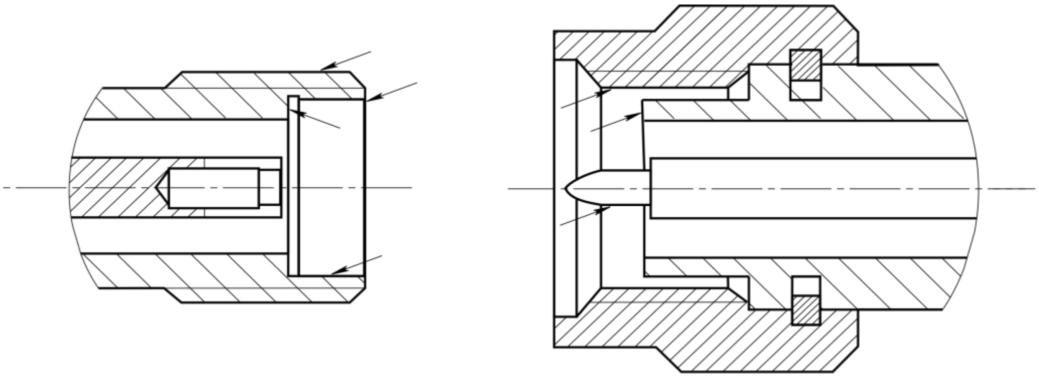
Clean the connectors before and after connecting the Module.

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.

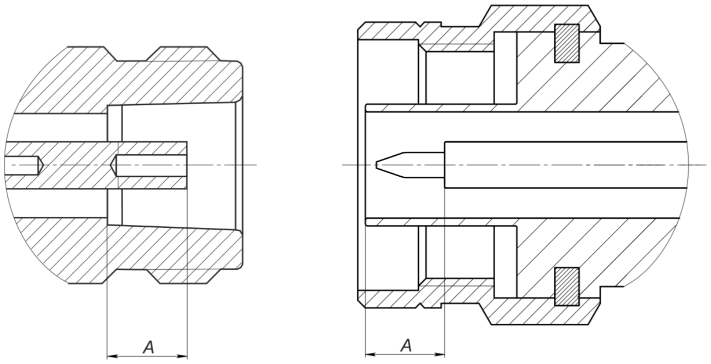
The first gauging of connectors obtains pin depth, which can be used during the Module operation to evaluate its changing.

Gauge the connectors again if:

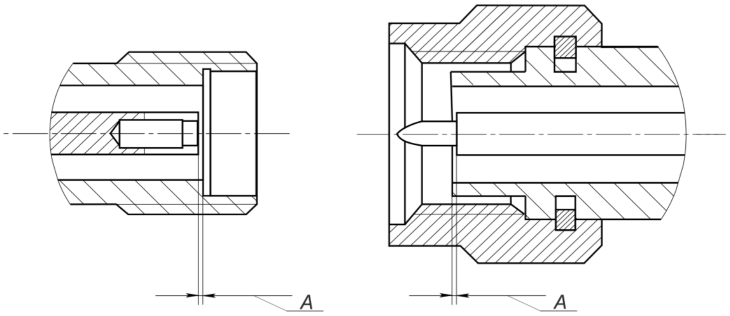
- A visual inspection or Module calibration results suggest that the connector may have defects or damages.
- The device connectors used with the Module are damaged or their pin depth values are out of range for this type of connectors.
- After every 100 connections.

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:

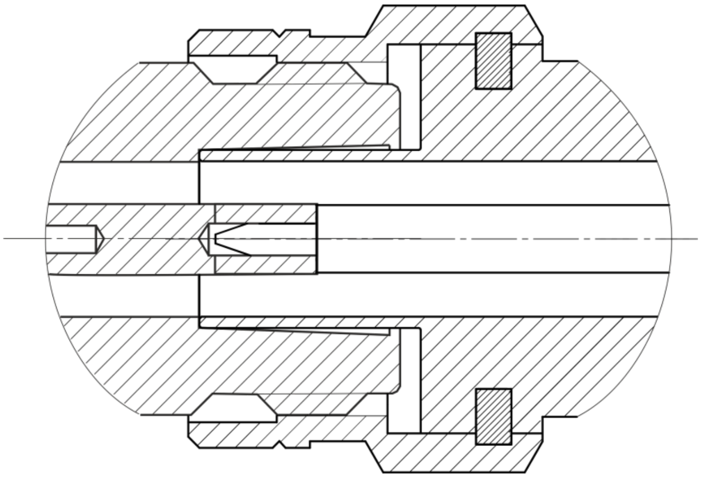
1. Fix the housing of one of the devices being connected. This is necessary to avoid its displacement during connection. Fix the device by any of the following ways:

   - By clamps or wrenches.
   - By weight or configuration of the device itself.
   - By holding the device by hand

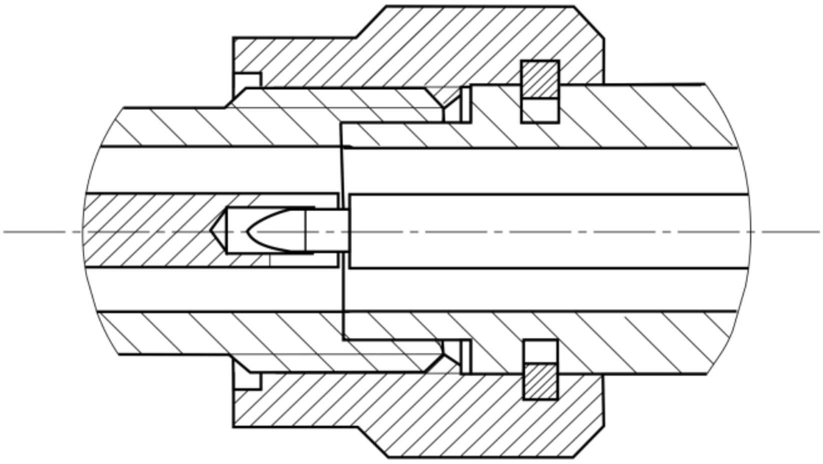
2. Carefully align the connectors of the connected devices.

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 -50 to +70 ºC (-58 °F to 158 °F), a relative humidity of 90% at 25 ºC (77 °F). After the Module has been removed from the factory packaging and while being used, it should be stored at a temperature from+5 ºC to+40 ºC and relative humidity up to 90% at 25 ºC (1 °F to 104 °F).

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 (-58 °F to 158 °F), a relative humidity of 90% at 25 ºC (77 °F).

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

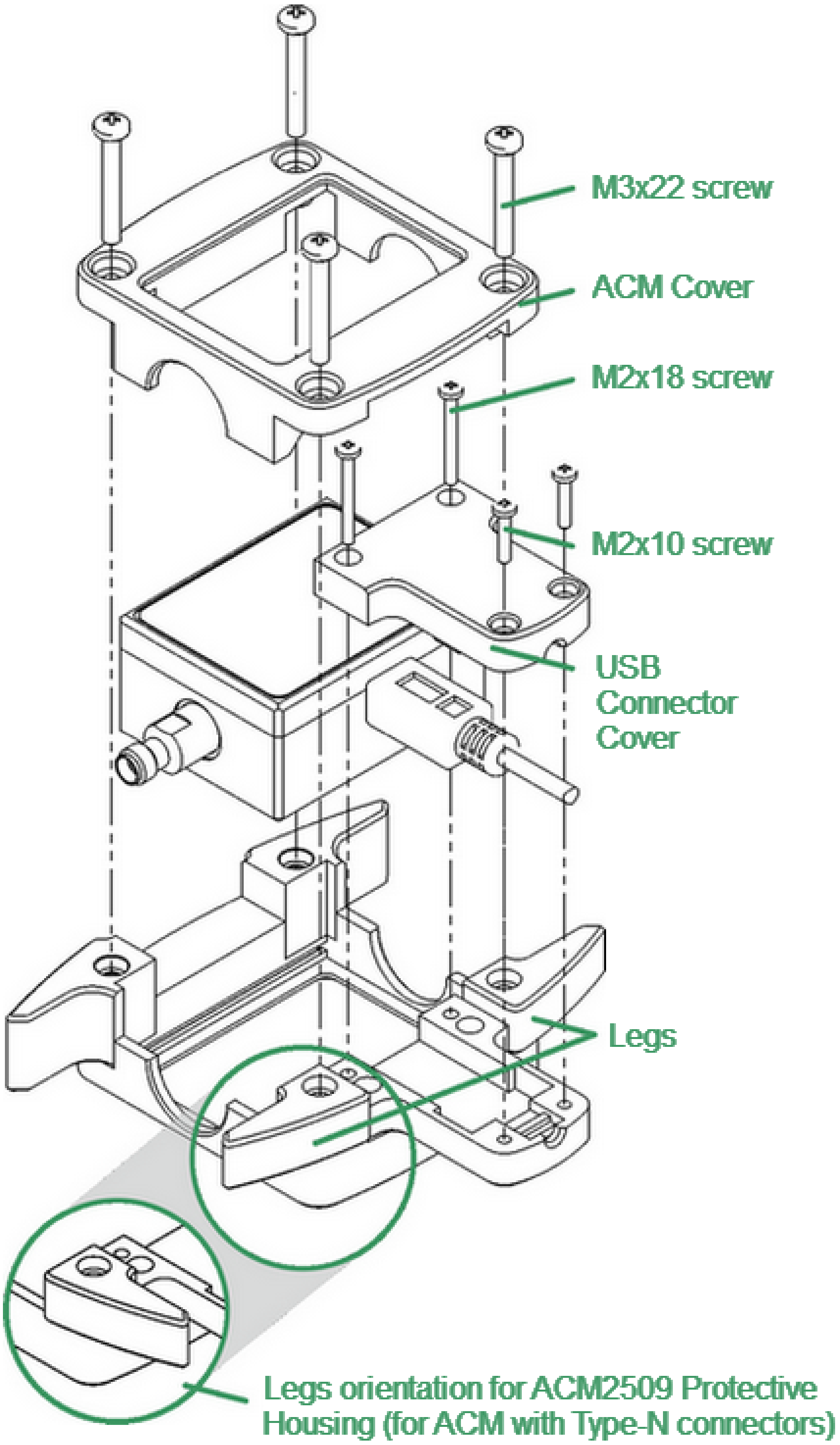
Procedure for installing (removing) the protective housing:

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.

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.


M3x22 screw
ACM Cover
M2x18 screw
M2x10 screw
USB Connector Cover
Legs
Legs orientation for ACM2509 Protective Housing (for ACM with Type-N connectors)

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:

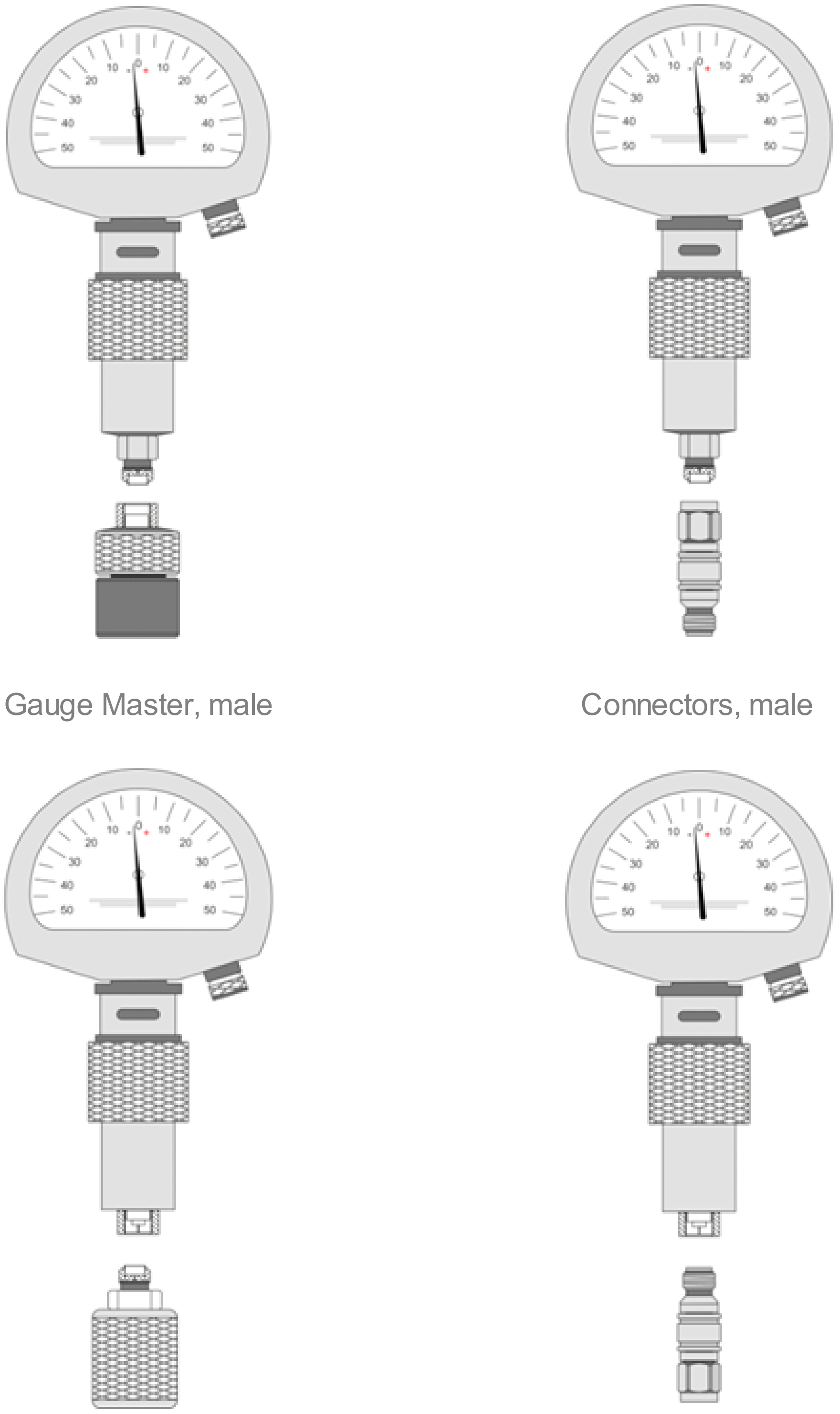
- the device (instrument, calibration standard, cable, adapter, attenuator, or other RF item with coaxial connectors) is being used for the first time.
- visual inspection of the Analyzer calibration suggests that the connector may have defects or damage.
- the connectors of the device used with the 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.



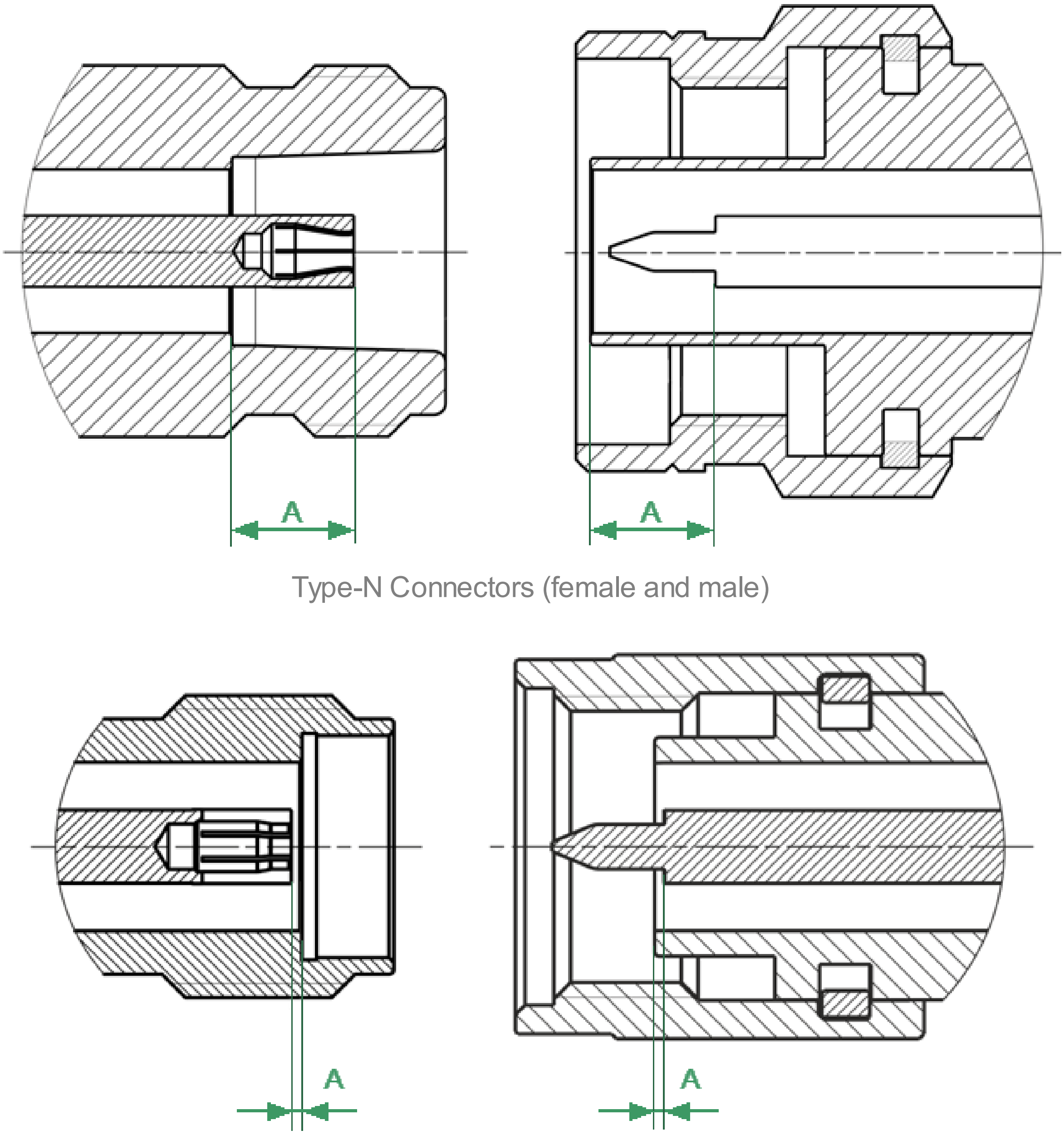
Gauge Master, male

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.

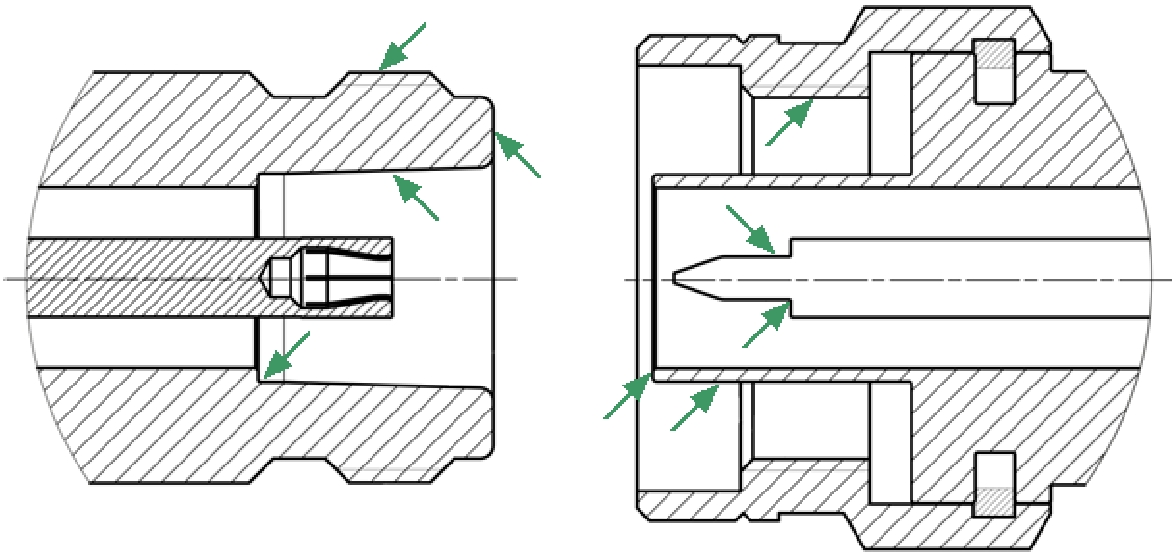
Never wipe the center conductors of the female connectors. They should be cleaned with compressed air.

Connector cleaning should be performed as follows:

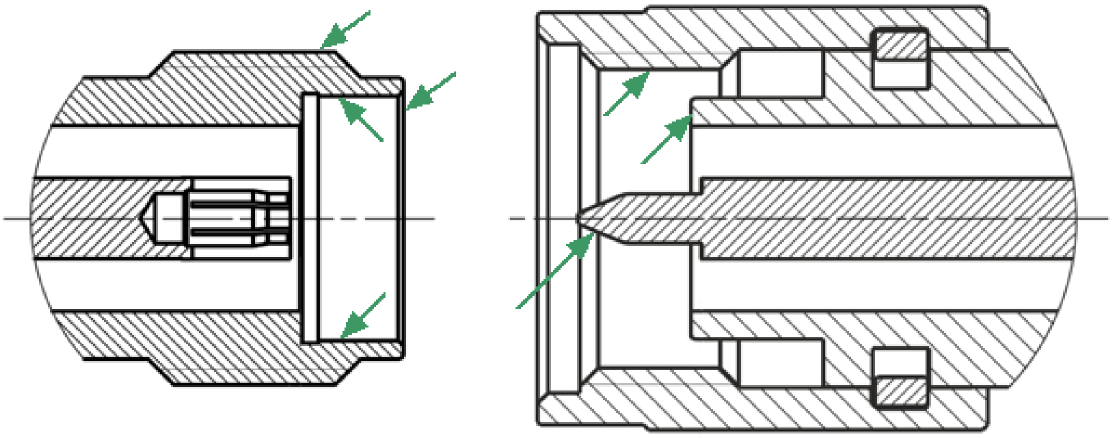
1. Wipe the connector surfaces with the swab moistened with alcohol as shown by arrows (See figures below).
2. Use compressed air to clean the other internal connector surfaces.
3. Let the alcohol evaporate.
4. Visually inspect the connectors to make sure that no particles or residue remain.
5. Repeat 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

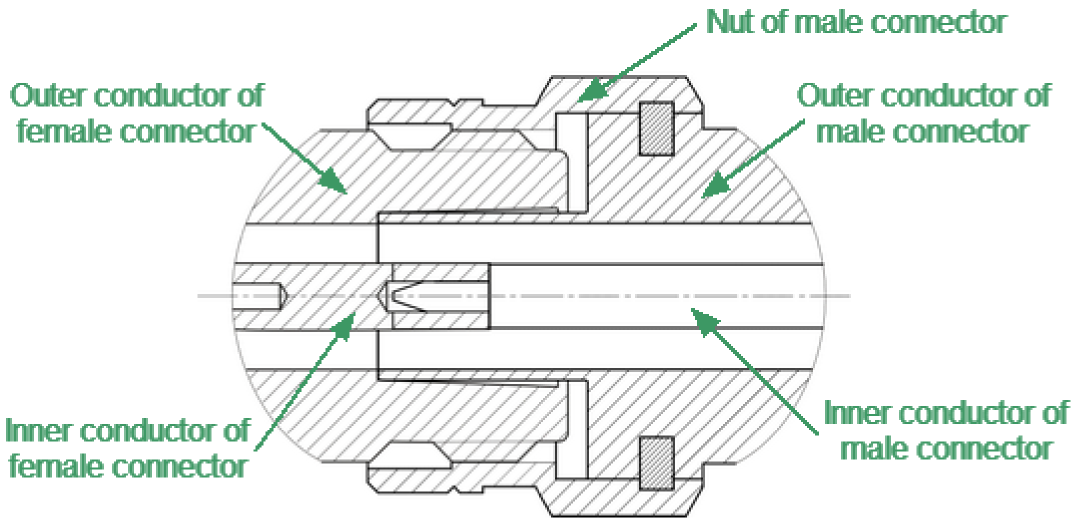
When operating the Analyzer, it is often necessary to connect various devices to each other: cables to analyzer measurement ports, junctions to cables, calibration tools to junctions or analyzer ports, devices under test to ports, etc.

Connecting

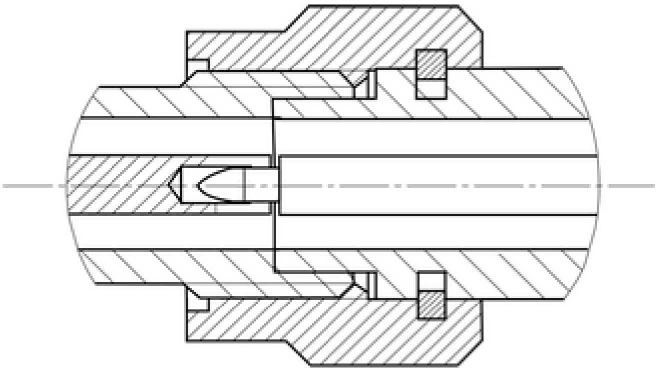
Connect devices with coaxial connectors in the following sequence to ensure maximum repeatability of measurement results, as well as to prevent breakage:

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.


Nut of male connector
Outer conductor of female connector
Outer conductor of male connector
Inner conductor of female connector
Inner conductor of male connector

Type-N connectors (female on the left, and male on the right)

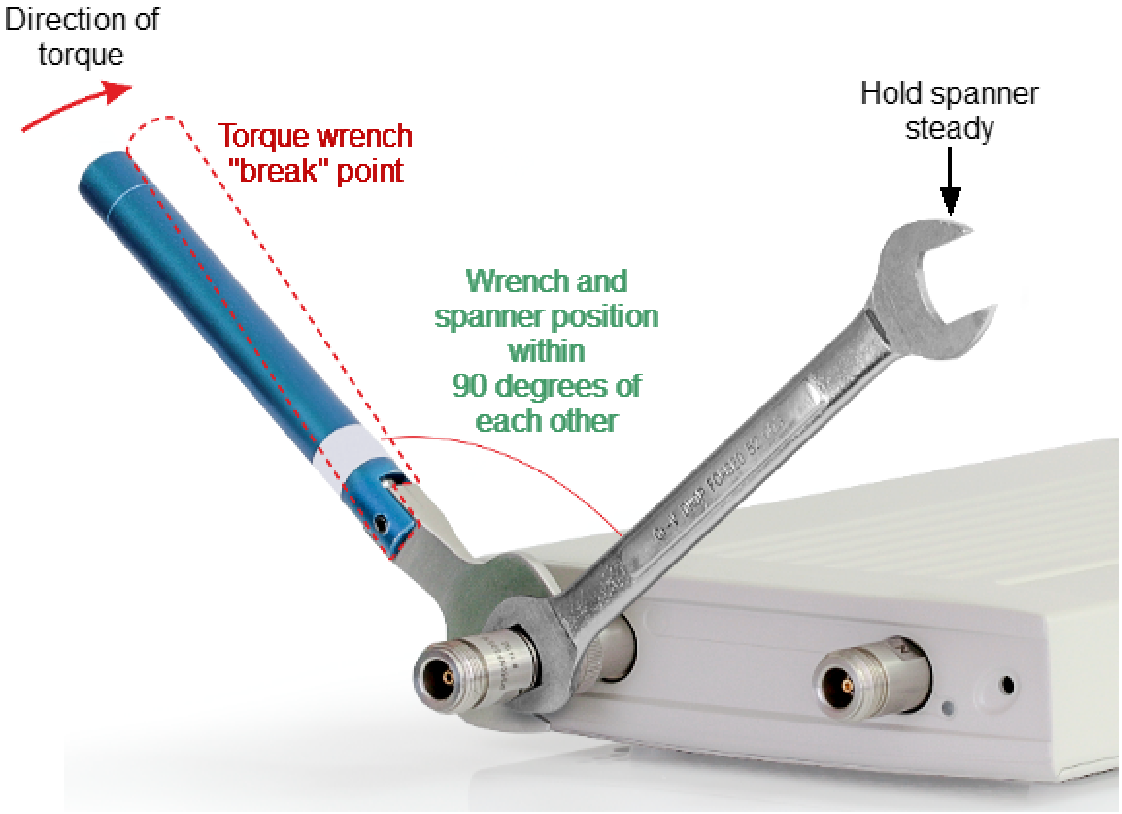


3.5 mm NMD connectors (female on the left, and male on the right)

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).

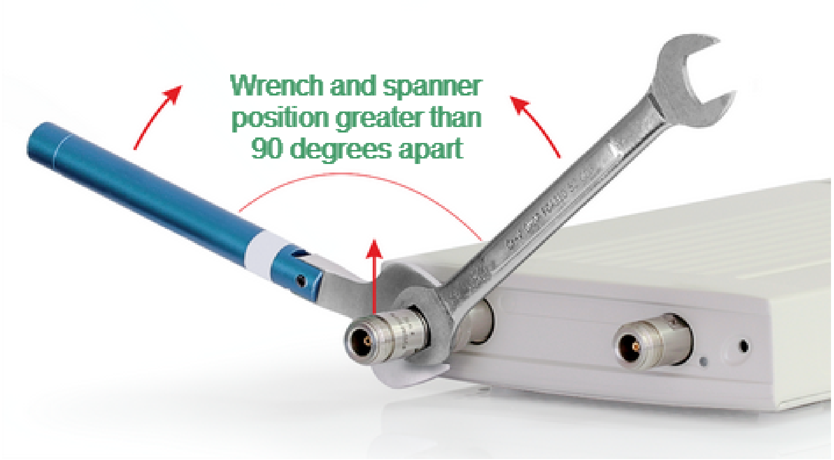
Hold the torque wrench by the end of the handle when tightening. The torque value depends on the connector type (See table below).


Direction of torque
Torque wrench "break" point
Hold spanner steady
Wrench and spanner position within 90 degrees of each other

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
LRL	Line-Reflect-Line calibration
PC	Personal Computer
RF	Radio Frequency
SCPI	Standard Commands for Programmable Instruments
S-parametrs	Scattering parameters of linear electrical network
SOL	Short-Open-Load Calibration
SWR	Standing Wave Ratio
USB	Universal Serial Bus
VNA	Vector Network Analyzer

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