PLANAR 808/1

Vector Network Analyzer

COPPER MOUNTAIN
TECHNOLOGIES

KEY FEATURES

- Frequency range: 100 kHz – 8 GHz
- Measured parameters: S_{11}, S_{21} ... S_{44}
- Two independent signal sources
- Wide output power range: -60 dBm to +10 dBm
- >150 dB dynamic range (1 Hz IF bandwidth)
- Time domain and gating conversion included
- Frequency offset mode, including vector mixer calibration measurements
- Measurement time per point: 100 μs per point
- Up to 16 logical channels with 16 traces each
- Multiple precision calibration methods and automatic calibration
- Up to 500,001 measurement points
- Fixture simulation
- COM/DCOM compatible for LabView and automation programming

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Real Performance, Real Value.

Advanced

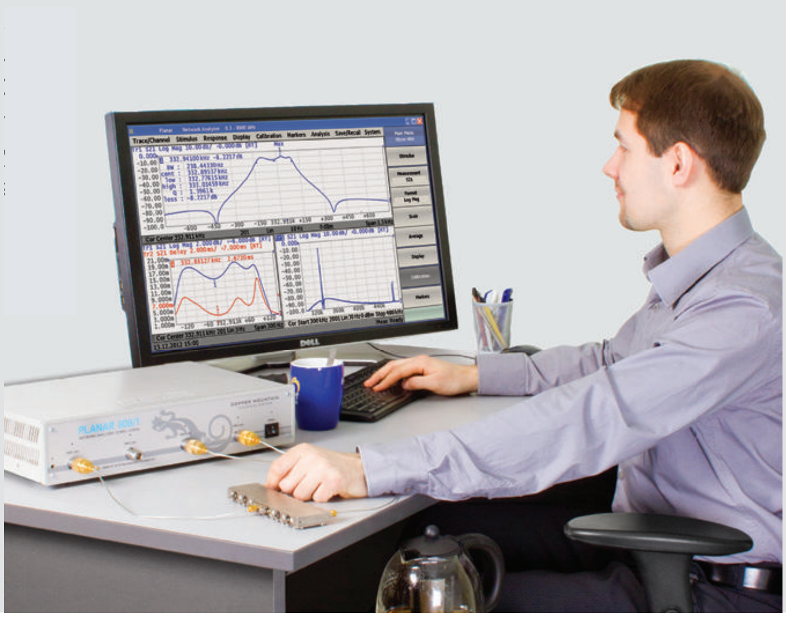
CMT analyzers take advantage of breakthrough advances in RF technology as well as the faster processing power, larger display, and more reliable performance of an external PC, while also simplifying maintenance of the analyzer.

Accurate

Our VNAs are made with high standards. Every instrument is lab-grade quality, with a wide dynamic range, low noise floor, high resolution sweep, and a variety of other advanced features. The metrology of the Planar 808/1 delivers real measurement accuracy and reliability.

Cost Effective

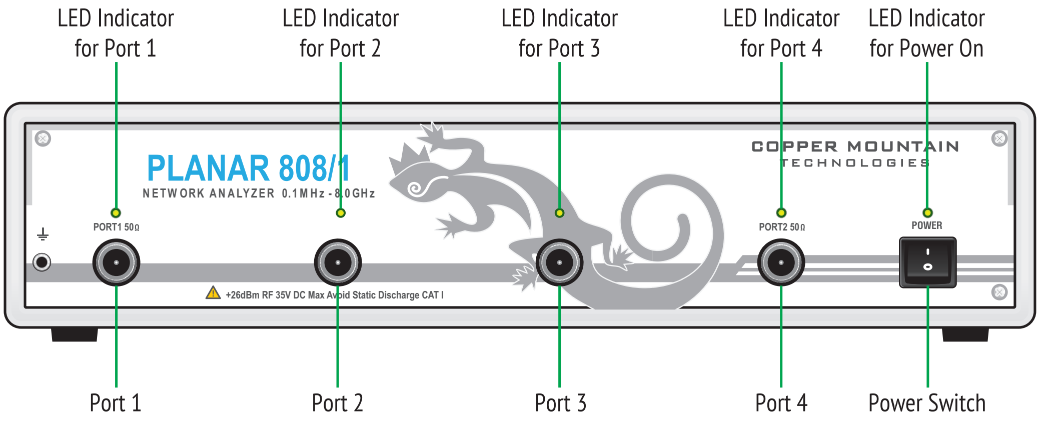
CMT VNAs are flexible, easy to maintain, and are well-suited for lab, production, field, and secure testing environments. With every bit of performance of traditional analyzers, but at a fraction of the cost, now every engineer and technician can have a highly accurate VNA.



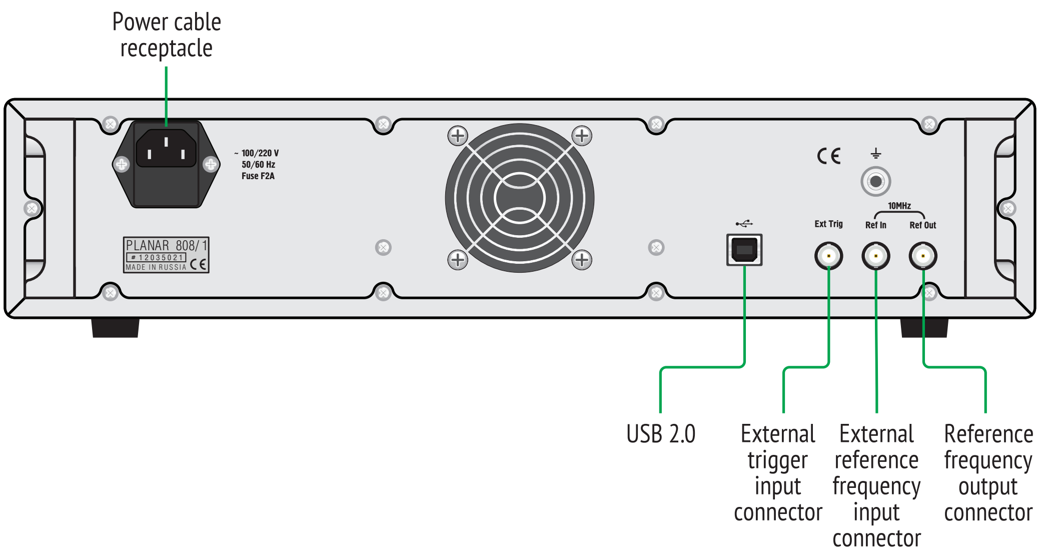
The Planar 808/1 VNA is an S-parameter vector network analyzer designed for operation with an external PC. It connects to any Windows-based computer via USB and delivers accurate testing and measurement through a platform that reduces points of data transfer and keeps up with advancing technology.

This analyzer is an excellent solution for performing the full range of magnitude and phase measurements over the frequency from 100 kHz to 8.0 GHz. This brochure outlines the features that are standard on the device.

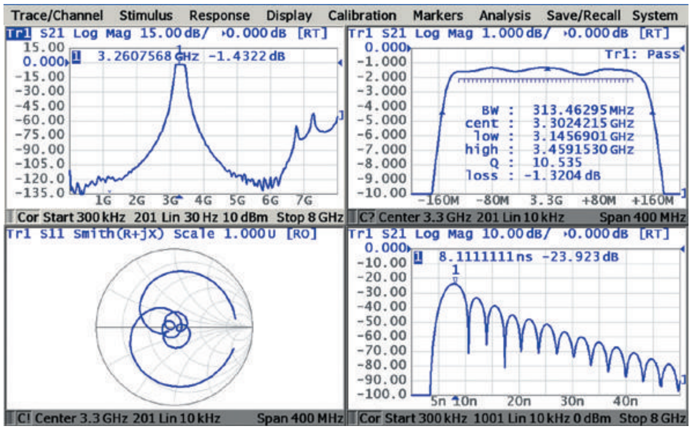
Front Panel

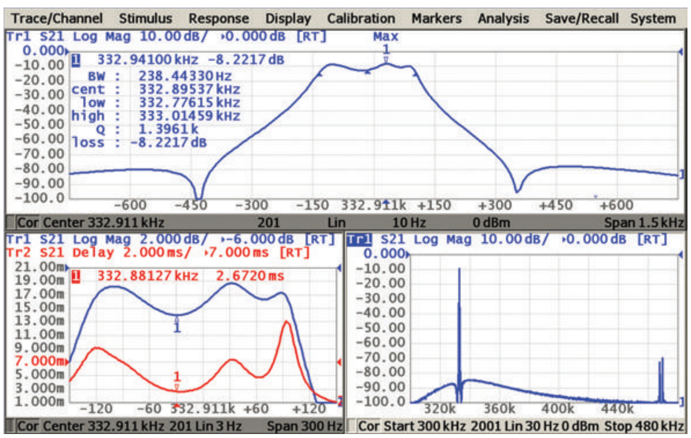


Rear Panel



Measurement Capabilities





Measured parameters

S_{11}, S_{12}, S_{13}, S_{14}, S_{21}, S_{22}, S_{23}, S_{24}, S_{31}, S_{32}, S_{33}, S_{34}, S_{41}, S_{42}, S_{43}, S_{44} and the absolute power of the reference and received signals at the port.

Number of measurement channels

Up to 16 independent logical channels: each logical channel is represented on the screen as an individual channel window. A logical channel is defined by such stimulus signal settings as frequency range, number of test points, or power level.

Data traces

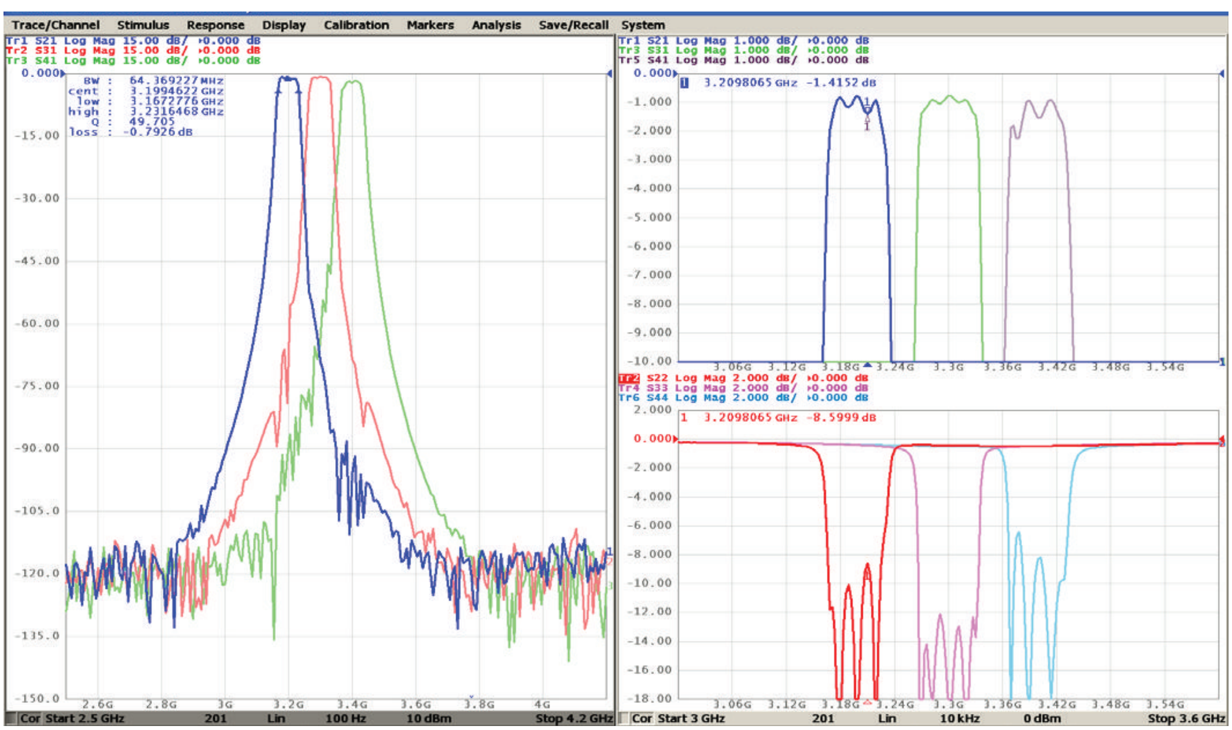
Up to 16 data traces can be displayed in each channel window. A data trace represents parameters of a DUT such as the S-parameters, response in time domain, and input power response.

Memory traces

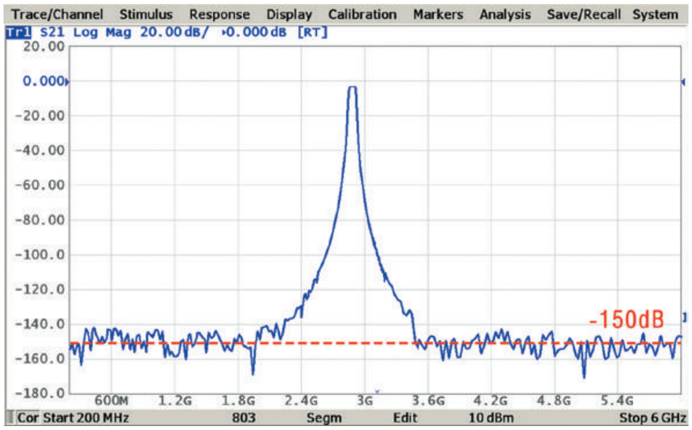
Each of the 16 data traces can be saved into memory for further comparison with the current values.

Data display formats

Logarithmic magnitude, linear magnitude, phase, expanded phase, group delay, SWR, real part, imaginary part, Smith chart diagram and polar diagram display formats are available.

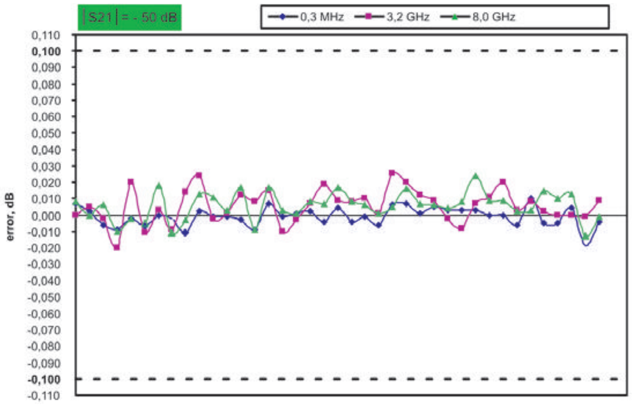


Dynamic Range



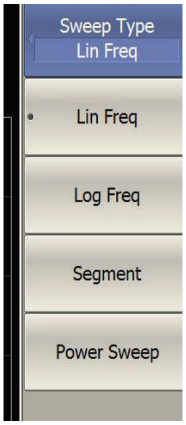
Typical dynamic range of 150 dB is achieved through the entire frequency range (at 1 Hz IF bandwidth). Seen here is the maximum dynamic range achieved when using IFBW 1 Hz and an output power level of 10 dBm.

Low Measurement Errors



CMT devices have a low variation between a large pool of manufactured instruments. Low trace noise allows for particularly high-precision measurements. This graph shows the variation of the absolute value of the measurement error of S_{21} and S_{12} when the value of $|S_{21}|$ and $|S_{12}|$ is -50 dB, using 42 different Planar 804/1 VNAs, which is the 2-port version of the Planar 808/1 VNA. With the model's specificed accuracy of ± 0.1 dB, the trace clearly shows that the variation within the device pool is well below that figure, which confirms the precision of the instrument.

Sweep Features



Sweep type
Linear frequency sweep, logarithmic frequency sweep, and segment frequency sweep occur when the stimulus power is a fixed value. Linear power sweep occurs when frequency is a fixed value.

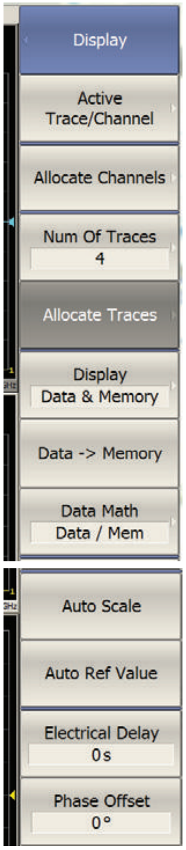
Measured points per sweep
Set by the user from 2 to 500,001.

Segment sweep features
A frequency sweep within several independent user-defined segments. Frequency range, number of sweep points, source power, and IF bandwidth should be set for each segment.

Power
Source power from −60 dBm to +10 dBm with resolution of 0.05 dB. In frequency sweep mode, the power slope can be set to up to 2 dB/GHz for compensation of high frequency attenuation in connection wires.

Sweep trigger
Trigger modes: continuous, single, or hold.
Trigger sources: internal, manual, external, bus

Trace Functions



Trace display
Data trace, memory trace, or simultaneous indication of data and memory traces.

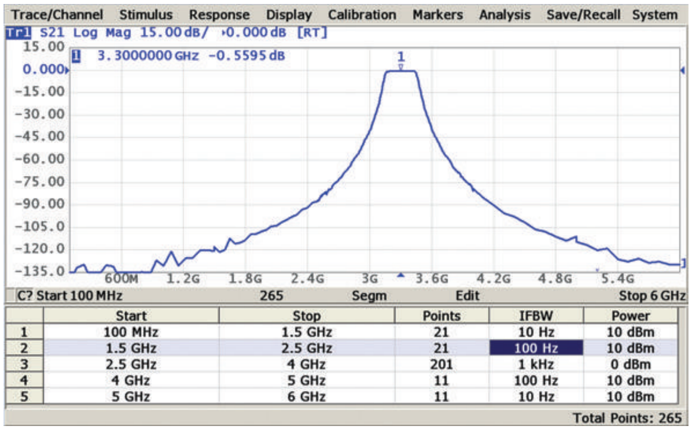
Trace math
Data trace modification by math operations: addition, subtraction, multiplication or division of measured complex values and memory data.

Autoscaling
Automatic selection of scale division and reference level value allow the most effective display of the trace.

Electrical delay
Calibration plane moving to compensate for the delay in the test setup. Compensation for electrical delay in a device under test (DUT) during measurements of deviation from linear phase.

Phase offset
Phase offset is defined in degrees.

Frequency Scan Segmentation

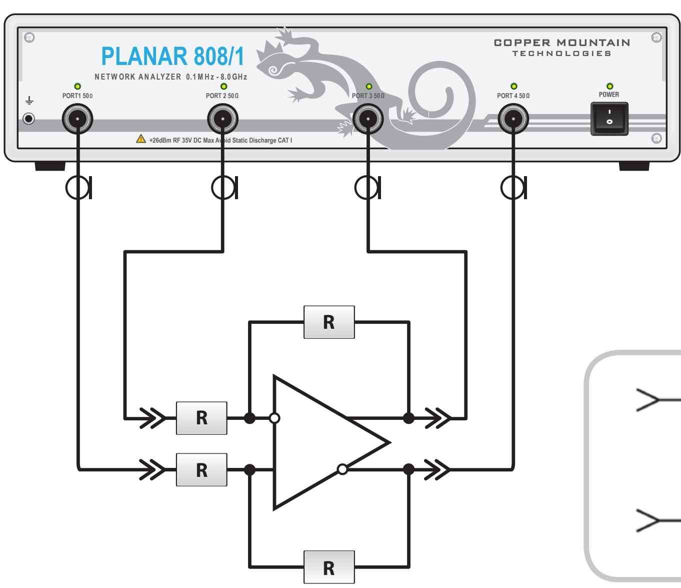


Planar 808/1 has a large frequency range with the option of frequency scan segmentation. This allows optimal use of the device, for example, to achieve the maximum dynamic range while maintaining high measurement speed.

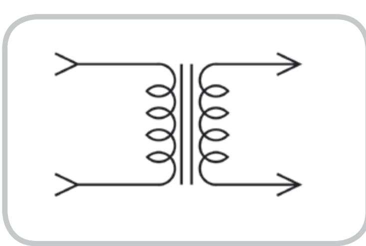
Power Scanning and Compression Point Recognition

The power sweep feature turns compression point recognition, one of the most fundamental and complex amplifier measurements, into a simple and accurate operation.

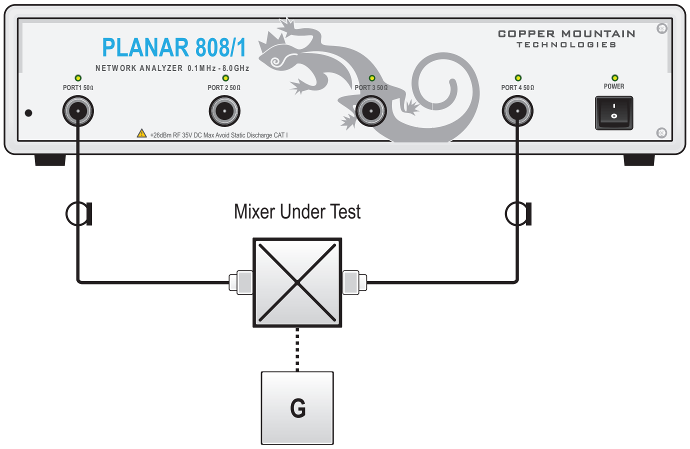
Balanced Measurements



This function enables evaluation of devices with balanced ports, for instance, differential amplifiers or transformers, as pictured here.



Mixer/Converter Measurements

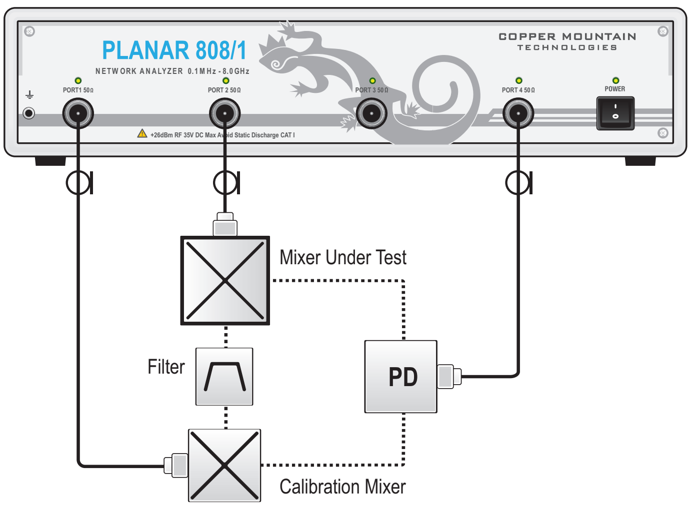


Scalar mixer / converter measurements

The scalar method allows the user to measure only the magnitude of the transmission coefficient of the mixer and other frequency translating devices. No external mixers or other devices are required. The scalar method employs port frequency offset when there is a difference between the source port frequency and the receiver port frequency.

Scalar mixer / converter calibration

This is the most accurate method of calibration applied for measurements of mixers in frequency offset mode. The OPEN, SHORT, and LOAD calibration standards are used. An external power meter should be connected to the USB port directly or via USB/GPIB adapter.

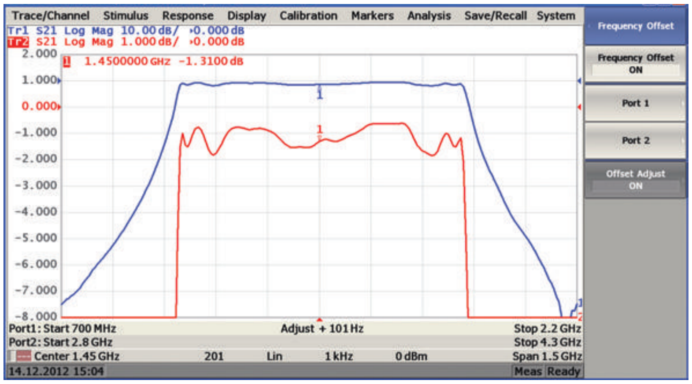


Vector mixer / converter measurements

The vector method allows the measurement of both the magnitude and phase of the mixer transmission coefficient. Here, the second internal source of the VNA is being used as the LO common for the external mixer and mixer under test.

Vector mixer /converter calibration

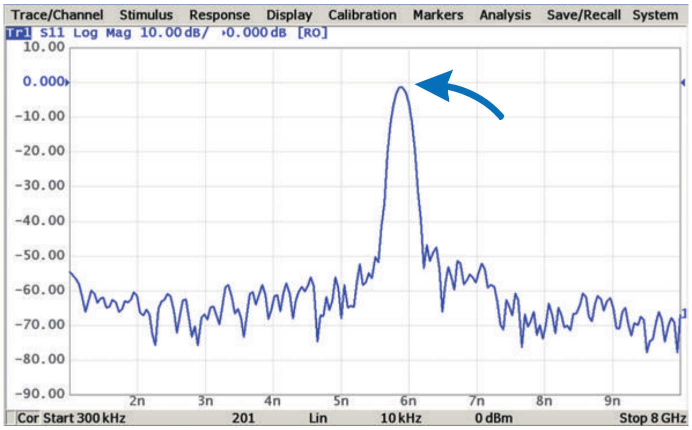
This method of calibration is applied for vector mixer measurements. OPEN, SHORT and LOAD calibration standards are used.



Automatic frequency offset adjustment

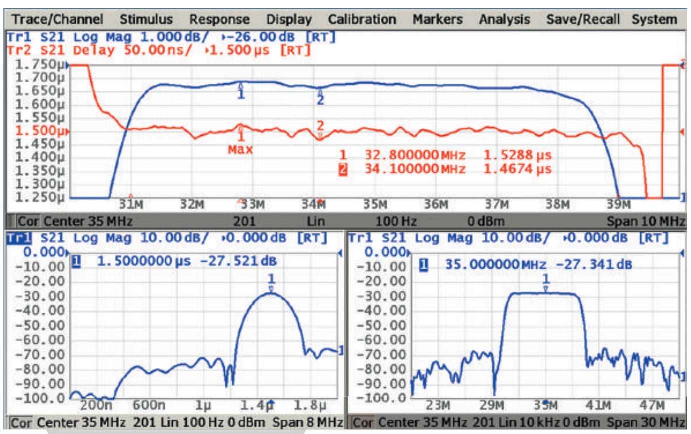
The function performs automatic frequency offset adjustment when the scalar mixer / converter measurements are performed to compensate for internal LO setting inaccuracy in the DUT.

Time Domain Measurements

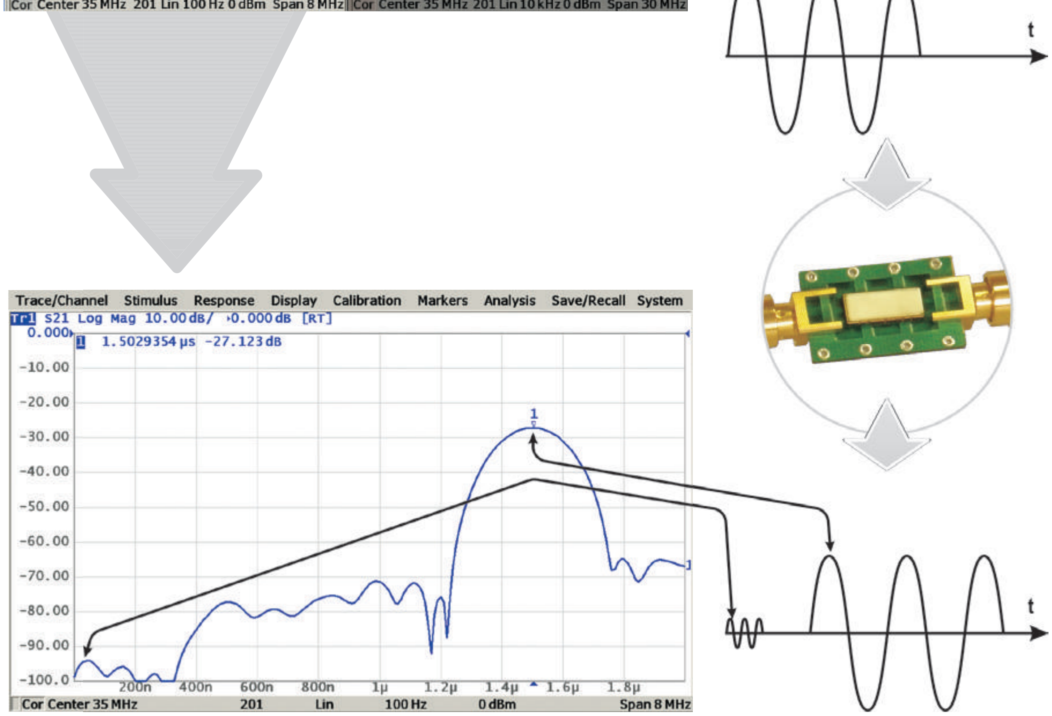


This function performs data transformation from the frequency domain into a response of the DUT to various stimulus types in the time domain. Modeled stimulus types include: bandpass, lowpass impulse, and lowpass step.

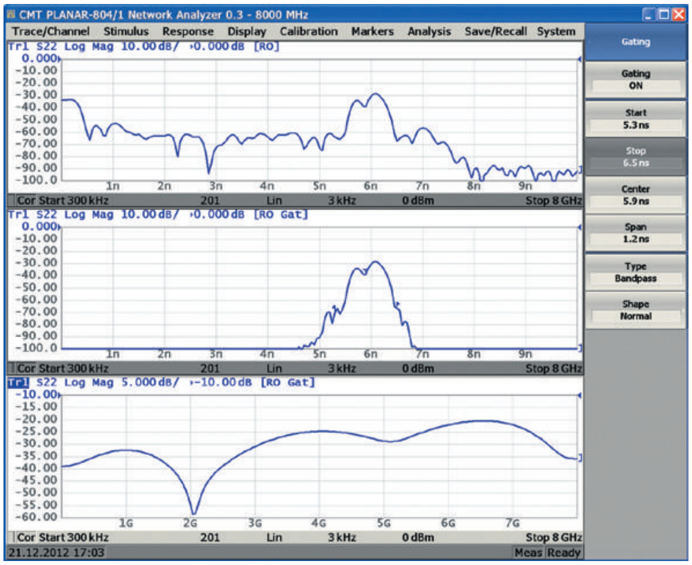
Time domain span is set by the user arbitrarily from zero to maximum, which is determined by the frequency step. Windows of various forms are used for better tradeoff between resolution and level of spurious sidelobes.



Time domain analysis can measure the parameters of SAW filters such as the signal time delay and feedthrough signal suppression.



Time Domain Gating

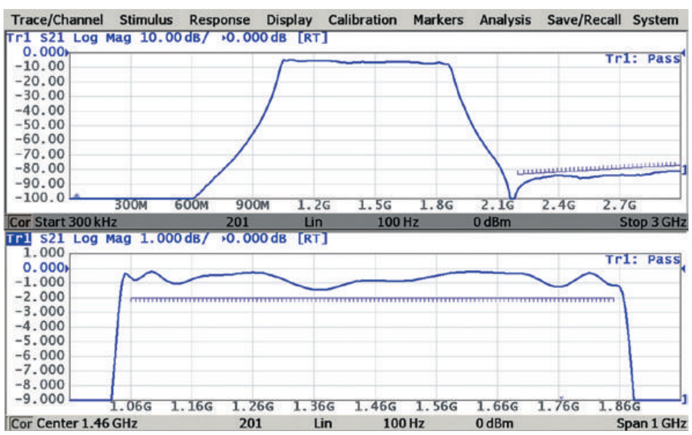


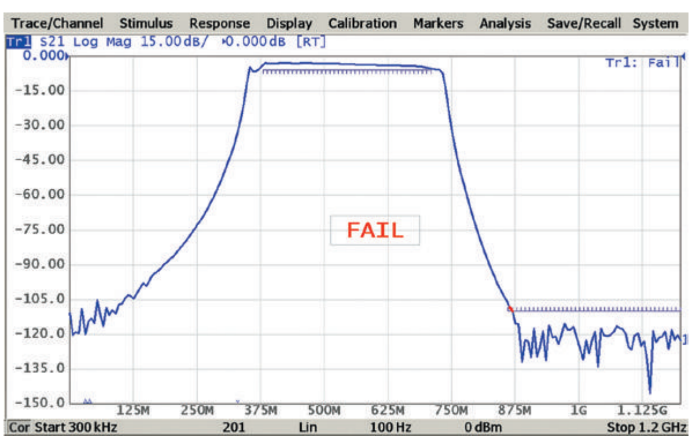
This function mathematically removes unwanted responses in the time domain, which allows the user to obtain frequency response without influence from fixture elements.

This function applies reverse transformation back to the frequency domain after cutting out the user-defined span in time domain. Gating filter types include bandpass or notch. For a better tradeoff between gate resolution and level of spurious sidelobes, the following filter shapes are available: maximum, wide, normal and minimum.

Applications of these features include, but are not limited to, measurement of SAW filter parameters like filter time delay or forward transmission attenuation.

Limit Testing

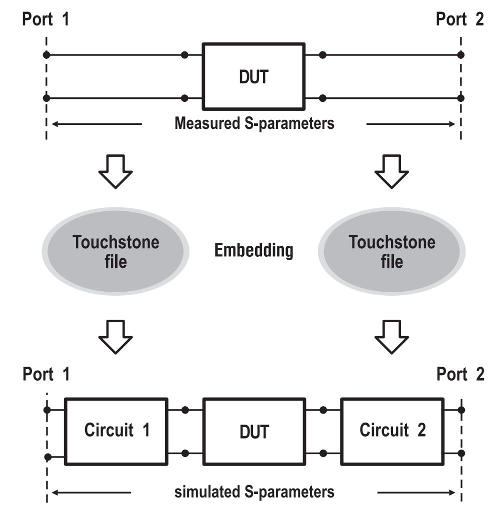




Limit testing is a function of automatic pass/fail judgment for the trace of the measurement results. The judgment is based on the comparison of the trace to the limit line set by the user and can consist of one or several segments.

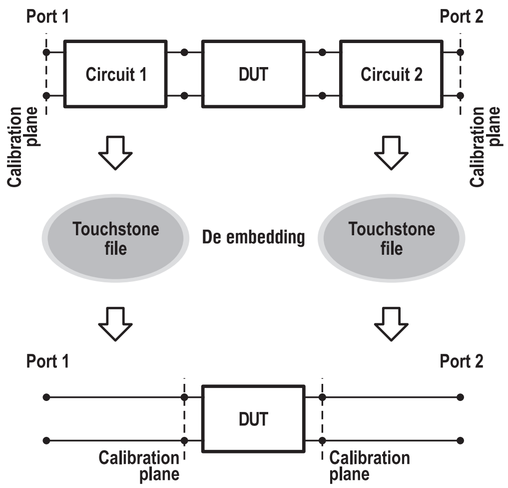
Each segment checks the measurement value for failing either the upper or lower limit, or both. The limit line segment is defined by specifying the coordinates of the beginning (X0, Y0) and the end (X1, Y1) of the segment, and type of the limit. The MAX or MIN limit types check if the trace falls outside of the upper or lower limit, respectively.

Embedding



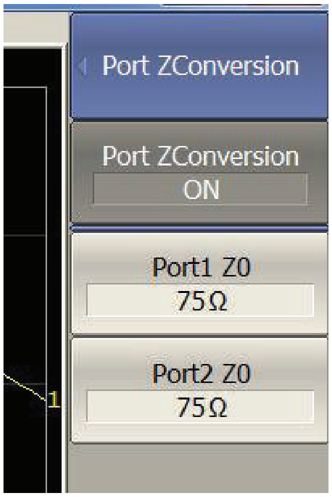
Embedding allows the user to mathematically simulate DUT parameters by virtually integrating a fixture circuit between the calibration plane and the DUT. This circuit should be described by an S-parameter matrix in a Touchstone file.

De-Embedding



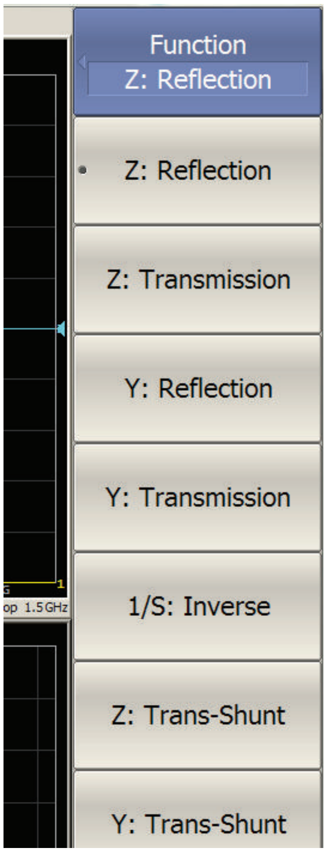
De-embedding mathematically excludes the effect of the fixture circuit connected between the calibration plane and the DUT from the measurement results. This circuit should be described by an S-parameter matrix in a Touchstone file.

Port Impedance Conversion



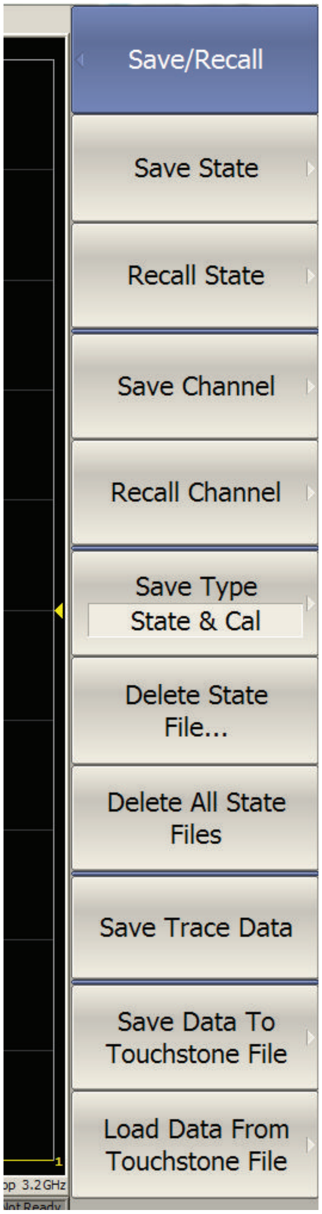
This function converts the S-parameters measured at the 50 Ω port into values, which can be determined if measured at a test port with arbitrary impedance.

S-Parameter Conversion



This function converts measured S-parameters to the following parameters: reflection impedance and admittance, transmission impedance and admittance, and inverse S-parameters.

Data Output



Analyzer State
All state, calibration and measurement data can be saved to an Analyzer state file on the external PC's hard disk and later uploaded back into the software program. The following four types of saving are available: State, State & Cal, Stat & Trace, or All.

Channel State
A channel state can be saved into the VNA memory. The channel state saving procedure is similar to Analyzer state saving, and the same saving types are applied to the channel state saving. Unlike the Analyzer state, the channel state is saved into the VNA's inner volatile memory (not to the hard disk) and is cleared when the power to the VNA is turned off. For channel state storage, there are four memory registers: A, B, C, and D. The channel state saving allows the user to easily copy the settings of one channel to another.

Trace Data CSV File
The VNA can save individual trace data as a CSV file (comma separated values). The active trace stimulus and response values in current format are saved to *.CSV file. Only one trace data are saved to the file.

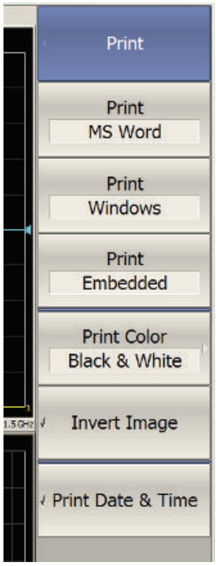
Trace Data Touchstone File
S-parameters can be easily saved to a Touchstone file, which contains the frequency values and S-parameters. The Touchstone format is typical for most circuit simulator programs.

File Saving

File Type	Number of Ports	Number of S-Parameters Saved
*.s1p	1	1
*.s2p	2	4
*.s3p	3	9
*.s4p	4	16

The file formats at left can be used for saving *.sNp files given N number of ports. Only one (active) trace data are saved to the file. The Touchstone file saving function is applied to individual active channels.

Data Saving



Screenshot capture

The print function is provided with the preview feature, which allows the user to view the image to be printed on the screen, and/or save it to a file. Screenshots can be printed using three different applications: MS Word, Image Viewer for Windows, or the Print Wizard of the VNA.

Each screenshot can be printed in color, grayscale, black and white, or inverted for visibility or ink use. The current date and time can be added to each capture before it is transferred to the printing application, resulting in quick and easy test reporting.

Measurement Automation

COM/DCOM compatible

Planar 808/1 software is COM/DCOM compatible, which allows the unit to be used as a part of an ATE station and other special applications. COM/DCOM automation is used for remote control and data exchange with the user software.

The VNA software runs as the COM/DCOM server, and the user program runs as COM/DCOM client. The COM client runs on the VNA PC. The DCOM client runs on a separate PC connected via LAN.

LabView compatible

The device and its software are fully compatible with LabView applications, for ultimate flexibility in user-generated programming and automation.

Accuracy Enhancement

Calibration

Calibration of a test setup (which includes the VNA, cables, and adapters) significantly increases the accuracy of measurements. Calibration allows for correction of the errors caused by imperfections in the measurement system: system directivity, source and load match, tracking and isolation.

Calibration methods

The following calibration methods of various sophistication and accuracy enhancement level are available:

- reflection and transmission normalization
- full 1-port calibration
- 1-path 2-port calibration
- full 2-port, 3-port, and 4-port calibration

Reflection and transmission normalization

This is the simplest calibration method; however, it provides reasonably low accuracy compared to other methods.

Full 1-port calibration

Method of calibration performed for 1-port reflection measurements. It ensures high accuracy.

1-path 2-port calibration

Method of calibration performed for reflection and one-way transmission measurements, for example for measuring S_{11} and S_{21} only. It ensures high accuracy for reflection measure-ments, and mean accuracy for transmission measurements.

Full 2-port, 3-port, or 4-port calibration

This method of calibration is performed for full S-parameter matrix measurement of a 2-port, 3-port, or 4-port DUT, ensuring high accuracy.

TRL calibration

Method of calibration performed for full S-parameter matrix measurement of a 2-port, 3-port, or 4-port DUT. It ensures higher accuracy than 2-port calibration. LRL and LRM modifications of this calibration method are available.

Mechanical Calibration Kits

The user can select one of the predefined calibration kits of various manufacturers or define his own calibration kits.

Electronic Calibration Modules

Electronic, or automatic, calibration modules offered by CMT make VNA calibration faster and easier than traditional mechanical calibration.

Sliding load calibration standard

The use of the sliding load calibration standard allows significant increase in calibration accuracy at high frequencies compared to the fixed load calibration standard.

“Unknown” Thru calibration standard

The use of a generic 2-port reciprocal circuit instead of a Thru in full calibration between any two ports allows the user to calibrate the VNA for measuring"non-insertable" devices.

Defining calibration standards

Different methods of calibration standard defining are available:

- standard defining by polynomial model
- standard defining by data (S-parameters)

Error correction interpolation

When the user changes any settings such as the start/stop frequencies and number of sweep points from the settings at the moment of calibration, interpolation or extrapolation of the calibration coefficients will be applied.

Supplemental Calibration Methods

Power calibration

Power calibration allows more stable maintainance of the power level setting at the DUT input. An external power meter should be connected to the USB port directly or via USB/GPIB adapter.

Receiver calibration

This method calibrates the receiver gain at the absolute signal power measurement.

Technical Specifications

MEASUREMENT RANGE		Spans entire frequency range
Impedance		50 Ω
Test port connector		N-type, female
Number of test ports		4
Frequency range		100 kHz to 8.0 GHz
Full CW frequency accuracy		$\pm 5 \times 10^{-6}$
Frequency setting resolution		1 Hz
Number of measurement points		1 to 500,001
Measurement bandwidths		1 Hz to 30 kHz (with 1/1.5/2/3/5/7 steps)
	From 100 kHz to 300 kHz	**From 300 kHz to 8.0 GHz**
Dynamic range (IF bandwidth 10 Hz)	115 dB, typ. 125 dB	135 dB, typ. 140

MEASUREMENT ACCURACY		
Accuracy of transmission measurements (magnitude / phase)[1]		
+5 dB to +15 dB	0.2 dB / 2°	
-50 dB to +5 dB	0.1 dB / 1°	
	From 100 kHz to 300 kHz	**From 300 kHz to 8.0 GHz**
-70 dB to -50 dB	1.5 dB / 10°	0.2 dB / 2°
		From 300 kHz to 8.0 GHz
-90 dB to -70 dB		1.0 dB / 6°
Accuracy of reflection measurements (magnitude / phase)[1]		
-15 dB to 0 dB	0.4 dB / 3°	
-25 dB to -15 dB	1.0 dB / 6°	
-35 dB to -25 dB	3.0 dB / 20°	
Trace stability	**From 100 kHz to 300 kHz**	**From 300 kHz to 8.0 GHz**
Trace noise magnitude (IF bandwidth 3 kHz)	5 mdB rms	1 mdB rms
Temperature dependence (per one degree of temperature variation)	0.02 dB	

EFFECTIVE SYSTEM DATA[1]	
Effective directivity	46 dB
Effective source match	40 dB
Effective load match	46 dB

[1] Applies over the temperature range 73°F ±9°F (23°C ±5°C) after 40 minutes of warming up, with less than 1°C deviation from the 1-path 2-port calibration temperature at output power of -5 dBm and 10 Hz IF bandwidth.

TEST PORT

	From 100 kHz to 300 kHz	From 300 kHz to 8.0 GHz
Directivity (without system error correction)	15 dB	18 dB
Trace noise magnitude (IF bandwidth 3 kHz)	5 mdB rms	1 mdB rms

TEST PORT OUTPUT

	From 100 kHz to 6.0 GHz	From 6.0 GHz to 8.0 GHz
Match (without system error correction)	18 dB	
Power range	-60 dBm to +10 dBm	-60 dBm to +5 dBm
Power accuracy	± 1.5 dB	
Power resolution	0.05 dB	

	From 300 kHz to 8.0 GHz
Harmonics distortion (at 0 dBm output power)	-25 dBc
Non-harmonic spurious (at 0 dBm output power)	-30 dBc

TEST PORT INPUT

Match (without system error correction)	18 dB
Damage level	+26 dBm
Damage DC voltage	35 V

	From 100 kHz to 300 kHz	From 300 kHz to 8.0 GHz
Noise level (defined as the rms value of the specified noise floor, IF bandwidth 10 Hz)	-105 dBm	-125 dBm

MEASUREMENT SPEED

Measurement time per point	100 µs
Source to receiver port switchover time	10 ms

Typical cycle time vs. number of measurement points

		Number of points			
		51	201	401	1601
Start 100 kHz, stop 10 MHz, IF bandwidth 30 kHz	Uncorrected	13.1 ms	51.3 ms	102.3 ms	408.3 ms
	Full 2-port calibration	45.5 ms	122.0 ms	230.5 ms	840.5 ms
Start 10 MHz, stop 8.0 GHz, IF bandwidth 30 kHz	Uncorrected	6.5 ms	21.1 ms	40.5 ms	157.7 ms
	Full 2-port calibration	32.4 ms	61.7 ms	100.3 ms	333.0 ms

GENERAL DATA

External reference frequency	10 MHz
Input level	2 dBm ± 3 dB
Input impedance at 10 MHz input	50 Ω
Connector type	BNC female
Output reference signal	
Output reference signal level at 50 Ω impedance	3 dBm ± 2 dB
OUT 10 MHz connector type	BNC female
Atmospheric tolerances	
Operating temperature range	+41°F to +104°F (+5°C to +40°C)
Storage temperature range	-49°F to +131°F (-45°C to +55°C)
Humidity	90% at 77°F (25°C)
Atmospheric pressure	84 to 106.7 kPa
Calibration interval	3 years
External PC system requirements	
Operating system	WINDOWS XP, VISTA, 7, 8
CPU frequency	1 GHz
RAM	512 MB
Power supply	
Power supply	110-240 V, 50/60 Hz
Power consumption	60 W
Physical specifications	
Dimensions (L x W x H)	12.8 x 16.3 x 3.8 in (324 x 415 x 96 mm)
Weight	19.8 lbs (9 kg)

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