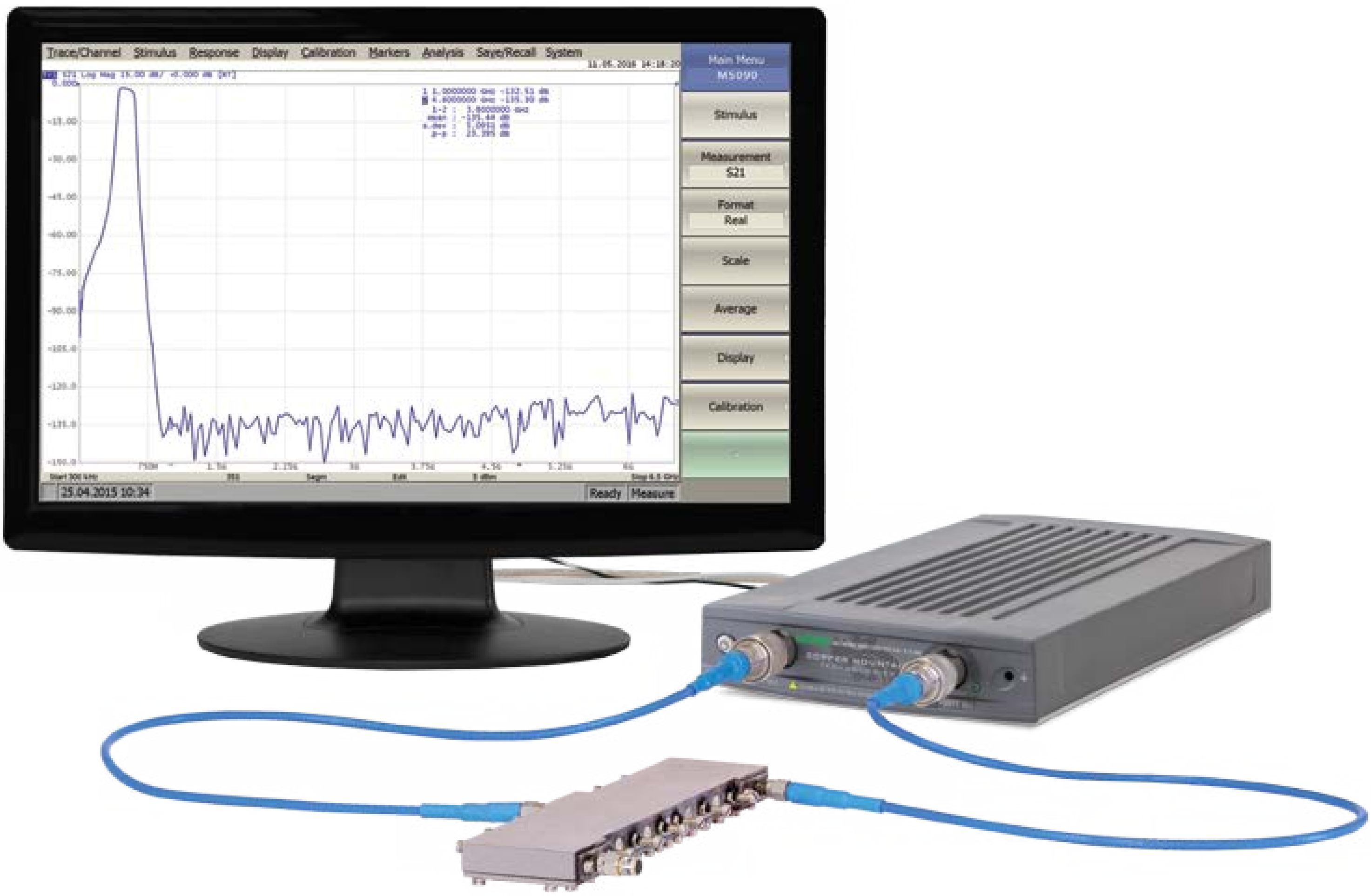
Compact Series

M Models

COPPER MOUNTAIN™
TECHNOLOGIES



- **Frequency range:** 300 kHz - 18 GHz
- **Wide output power adjustment range:** -55 dBm to +5 dBm*
- **Dynamic range:** 130 dB (10 Hz IF bandwidth) typ.
- **Measurement time per point:** 70 μs per point, min typ.*
- Up to **16 logical channels with 16 traces** each max
- **Automation programming** in LabView, Python, MATLAB, .NET, etc.
- Models available in **50 Ohm**
- Up to **200,001 measurement points**
- Multiple **precision calibration** methods and automatic calibration

** Depending on model*

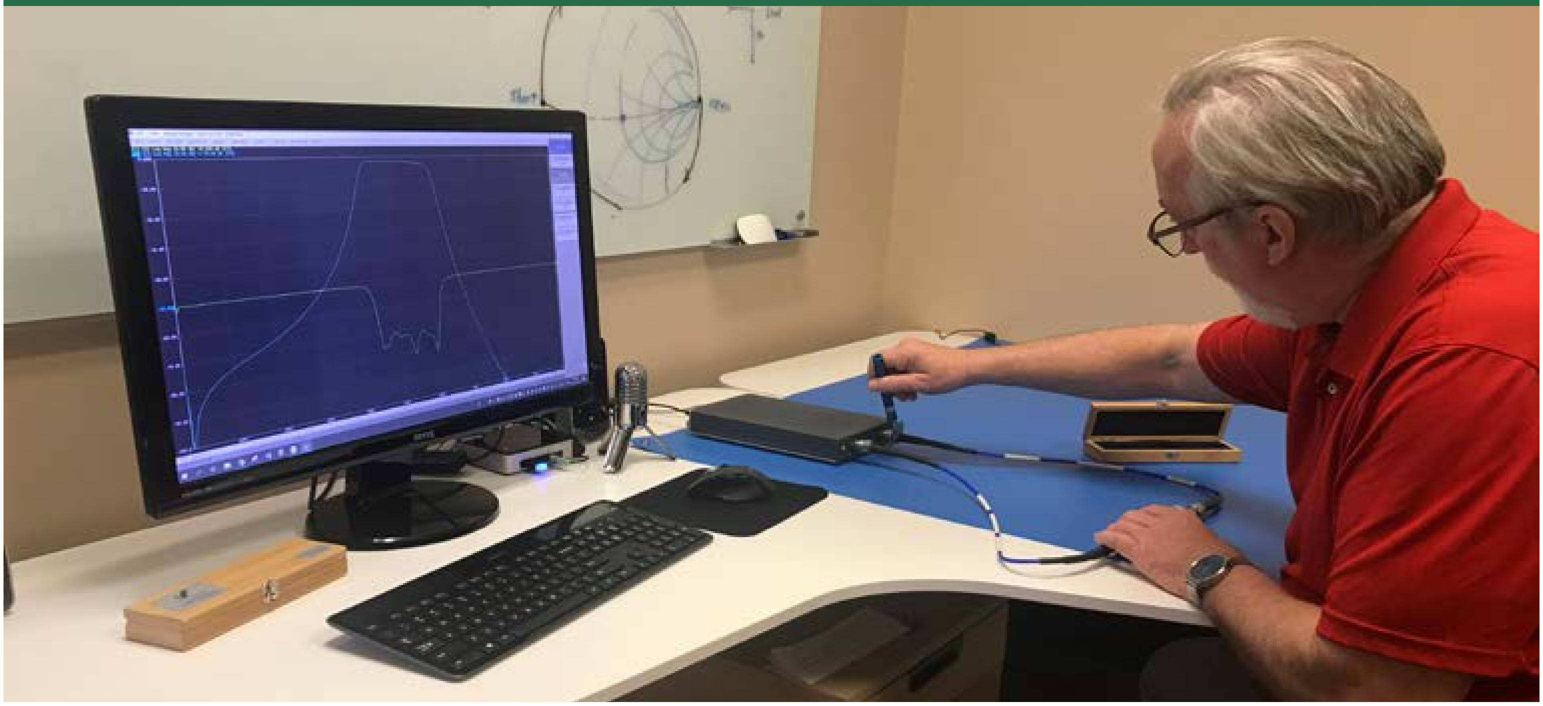
EXTEND YOUR REACH™

USA: +1.317.222.5400
info@coppermountaintech.com

631 E. New York St | Indianapolis, IN | 46202
www.coppermountaintech.com

Singapore: +65.6323.6546
Latin America: +1.954.706.5920

Small Size, Basic Software Features



M Series VNAs deliver metrology-grade performance in a more economical package that excludes a number of advanced features: Vector Mixer Calibration, TRL Calibration, Frequency Offset, Time Domain, and Gating. These Vector Network Analyzers are small, can be powered by battery, and are ideal for use in laboratory and production testing in a variety of applications including filter tuning, antenna test and characterization, amplifier testing, etc.

Copper Mountain Technologies' USB VNAs are next generation analyzers designed to meet the needs of 21st Century engineers. Our VNAs include an RF measurement module and a processing module, a software application which runs on a Windows or Linux PC, laptop, or tablet, connecting to the measurement hardware via USB interface.

This innovative approach delivers high measurement accuracy and enables users to take advantage of faster processors, newer computers and larger displays. USB VNAs have lower Total Cost of Ownership and fewer potential failure points. These instruments are smaller and lighter, can go almost anywhere, are very easy to share and eliminate the need for data purging or hard drive removal in secure environments.

The Whole Solution

Warranty, Service, & Repairs

All our products come with a standard three-year warranty from date of shipment. During that time we will repair or replace any product malfunctioning due to defective parts or labor.

While we pride ourselves on quality of our instruments, should your VNA malfunction for any reason, we will gladly offer a loaner unit while we service yours. With our USB VNAs where all data is stored on your PC, a simple swap of the measurement module assures uninterrupted workflow. So you will experience little or no downtime.

Our engineers are an extension of your team

Our team of applications engineers, service technicians, and metrology scientists are here to help you with technical support, application-specific recommendations, annual performance testing, and troubleshooting or repair of your CMT instruments.

Our engineers will work with your team to augment your in-house capabilities. We can write custom applications and test software, develop test automation scripts and help with integrated RF system testing. We can design and provide an RF switching network specific to your requirements; electro-mechanical, solid-state, or PIN diode-based. If the S-parameter measurement fixture involves challenging conditions for repeatability and accuracy we can assist with measurement uncertainty analysis.

An extensive library of technical materials including application notes, tips on performing VNA measurements, sample automation scripts, and how-to videos are available on our website www.coppermountaintech.com and YouTube channel, CopperMountainTech.

Annual Calibration

Copper Mountain Technologies' Indianapolis calibration laboratory is accredited in accordance with the recognized international standard ISO/IEC 17025:2017 and meets the requirements of ANSI/NCSL Z540-1994-1. All reference standards and equipment in the laboratory are traceable to National Institute of Standards and Technology (NIST) or international equivalent.

Should you prefer to perform the annual testing yourself or use a third party, contact us for information or questions on performing these procedures. Additionally, the VNA Performance Test (VNAPT) software application is available for third party laboratories without restriction. Use of VNAPT to execute performance tests is optional, but the software is designed to automate and streamline VNA performance testing, including automatic generation of test reports. Please contact Copper Mountain Technologies or your local distributor for recommended calibration options.

"CMT devices are lightweight, compact and a necessary tool for technical sales or engineers on the go. The software interface allows users to test RF products with any standard computer system. This is a revolution and a relief in terms of space occupied in the lab, measurement reliability and dynamic range. CMT provides the highest level of timely and attentive customer care."

Jessy Cavazos
Industry Director, Frost & Sullivan

Software Application

Software application is part of the VNA

The software application takes raw measurement data from the data acquisition (measurement) module and recalculates into S-parameters in multiple presentation formats utilizing proprietary algorithms. These new and advanced calibration and other accuracy enhancing algorithms were developed by our metrology experts. Our software can be downloaded free from our website, used on an unlimited number of PCs using either Linux or Windows operating systems, and enables easy VNA integration with other software applications and automation.

The software application features a fully functioning Demo Mode, which can be used for exploring VNAs' features and capabilities without an actual measurement module connected to your PC.

Measurement Capabilities

Measured parameters:
S_{11}, S_{21}, S_{12}, S_{22}
All models also measure 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 one of such parameters of the DUT as S-parameters or 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 130 dB is achieved from 300 kHz through the top of the frequency range (at 10 Hz IF bandwidth). Seen here is the maximum dynamic range achieved when using IFBW 1 Hz and an output power level of 5 dBm.

Sweep Features

Sweep type: Linear frequency sweep and logarithmic frequency sweep are performed with fixed output power. Linear power sweep is performed at a fixed frequency.

Measured points per sweep: Set by the user from 2 to 200,001.

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

Output Power: Source power from -55 dBm to +5 dBm with a resolution of 0.05 dB. In frequency sweep mode power slope can be set up to 2 dB/GHz to compensate for high frequency attenuation in fixture cables.

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 to have the trace most effectively displayed.

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

Phase offset
Defined in degrees.

Software Application

Frequency Scan Segmentation

The VNA has a large frequency range with the option of frequency scan segmentation. This allows for optimal use of the device to realize the maximum dynamic range while maintaining high measurement speed.

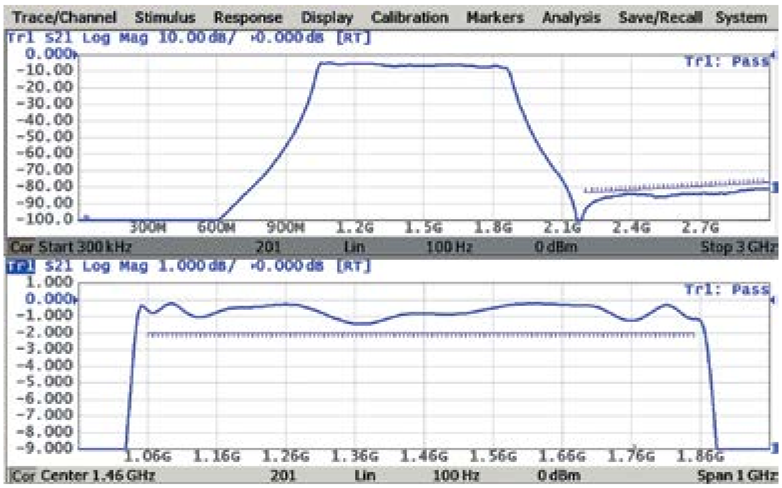
Power Scanning & Compression Point Recognition

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

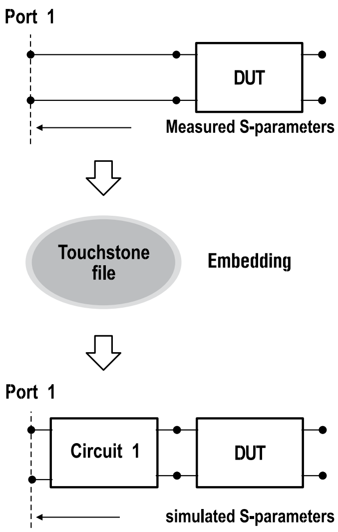
Limit Testing

Limit testing is a function for automatic pass/fail based on measurement results. Pass/fail is based on 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.

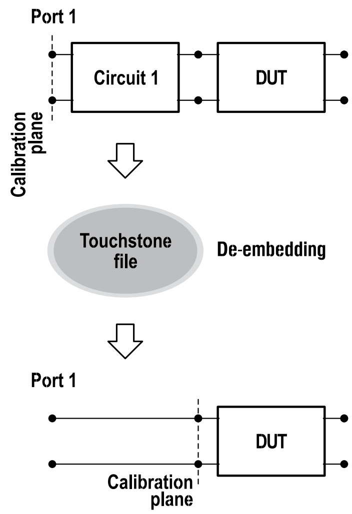


Embedding



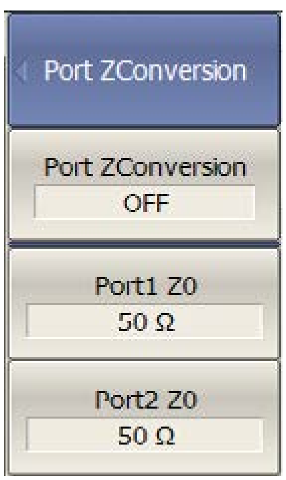
Allows the user to mathematically simulate the DUT parameters after virtual connection through a fixture circuit between the calibration plane and the DUT. This circuit is described by an S-parameter matrix in a Touchstone file.

De-Embedding



Allows users to mathematically exclude from the measurement result the effect of the fixture circuit connected between the calibration plane and a DUT. 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 a 50Ω port into values which would be seen if measured at a test port with arbitrary impedance.

S-Parameter Conversion

This function allows for conversion of measured S-parameters to the following parameters: reflection impedance and admittance, transmission impedance and admittance, and inverse S-parameters.

Software Application

Data Output

Analyzer State

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

Channel State

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

Trace Data CSV File

The Analyzer allows the user to save an individual trace's data as a CSV file (comma separated values). The active trace stimulus and response values, in its current format are saved to a *.CSV file.

Trace Data Touchstone File

Allows the user to save S-parameters to a Touchstone file. The Touchstone file contains frequency values and S-parameters. Files of this format are industry-standard for most circuit simulator programs. The .s2p files are used for saving all S-parameters of a device. The .s1p files are used for saving S_{11} or S_{22} parameters of a 1-port device. The Touchstone file saving function is applied to individual channels. In addition, the software can be used as a Touchstone file viewer, which allows the user to graphically display and work with previously saved Touchstone files.

Screenshot capture

A print function is provided with a preview feature, which allows for viewing 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 Analyzer. Each screenshot can be printed in color, grayscale, black and white, or inverted for visibility or to save ink. 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.

Calibration

User 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.

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

- Reflection & transmission normalization
- Full one-port calibration
- One-path two-port calibration
- Full two-port calibration

Reflection and transmission normalization
This is the simplest calibration method; however, it provides reduced accuracy compared to other methods.

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

One-path two-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 measurements, and moderate accuracy for transmission measurements.

Full two-port calibration
This method of calibration is performed for full S-parameter matrix measurement of a two-port DUT, ensuring high accuracy.

Mechanical Calibration Kits
The user can select one of the predefined calibration kits of various manufacturers or define a new calibration kit.

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

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

"Unknown" thru calibration standard
The use of a generic two-port reciprocal circuit instead of a characterized Thru in full two-port calibration allows the user to calibrate the VNA for measurement of "non-insertable" devices.

Defining of calibration standards
Different methods of calibration standard definition are available: standard definition by polynomial model and standard definition by data (S-parameters).

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

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

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

Automation

Automation Languages

We maintain code examples and guides in the following languages:

- MATLAB
- Visual Basic (Excel)
- C++*
- Python*
- LabVIEW
- And many more

*Available for use with Linux operating system

Measurement Automation

COM/DCOM interface
The VNA software provides a COM/DCOM (ActiveX) interface, allowing the instrument to be used as a part of a larger test system and in other specialized applications. The VNA program runs as a COM/DCOM server, while the user program runs as a client. COM/DCOM is able to be used with Windows OS only.

SCPI via TCP Socket
Alternatively a TCP socket is provided for automation from either localhost--the same machine running the VNA software application--or from a second PC connected by an IP network. The SCPI command is largely compatible with legacy instruments, maximizing code reuse for existing test automation platforms. SCPI via TCP Socket is able to be used with either Windows or Linux operating systems.

SCPI via HiSlip
Based on VXI-11, the HiSlip interface uses the same SCPI command set but further allows for instrument discovery and provides ease of automation through Visa library of your choice. SCPI via HiSlip is able to be used with either Windows or Linux operating systems.

LabVIEW compatible
The device and its software are fully compatible with LabView applications, for ultimate flexibility in user-generated programming and automation. LabVIEW is able to be used with Windows OS only.

Our command set is modeled after industry-standard legacy equipment; porting code is straightforward and we can help.
Complete installation of any CMT software comes with multiple programming examples and guides installed in the C:\VNA\S2VNA\Programming Examples and Guides directory on Windows or ~/Documents/VNA directory on Linux.

CMT software includes many features that other vendors offer as options, including S-parameter Embedding and De-Embedding. No integrated PC means faster data processing turnaround and regular updates that are easy to install. Less complexity in the VNA leads to fewer points of failure that cost you production/development time.

Plugins can add wide ranges of functionality and can be developed upon request. Examples include streamlined production applications, functionality to trigger with external generators, and virtual circuit matching modeling.

Automation Features

- Segmented frequency sweeps
- Linear/logarithmic sweeps
- Power sweeps
- Multiple trace formats
- 16 channels max. with up to 16 traces each
- Marker math
- Limit tests

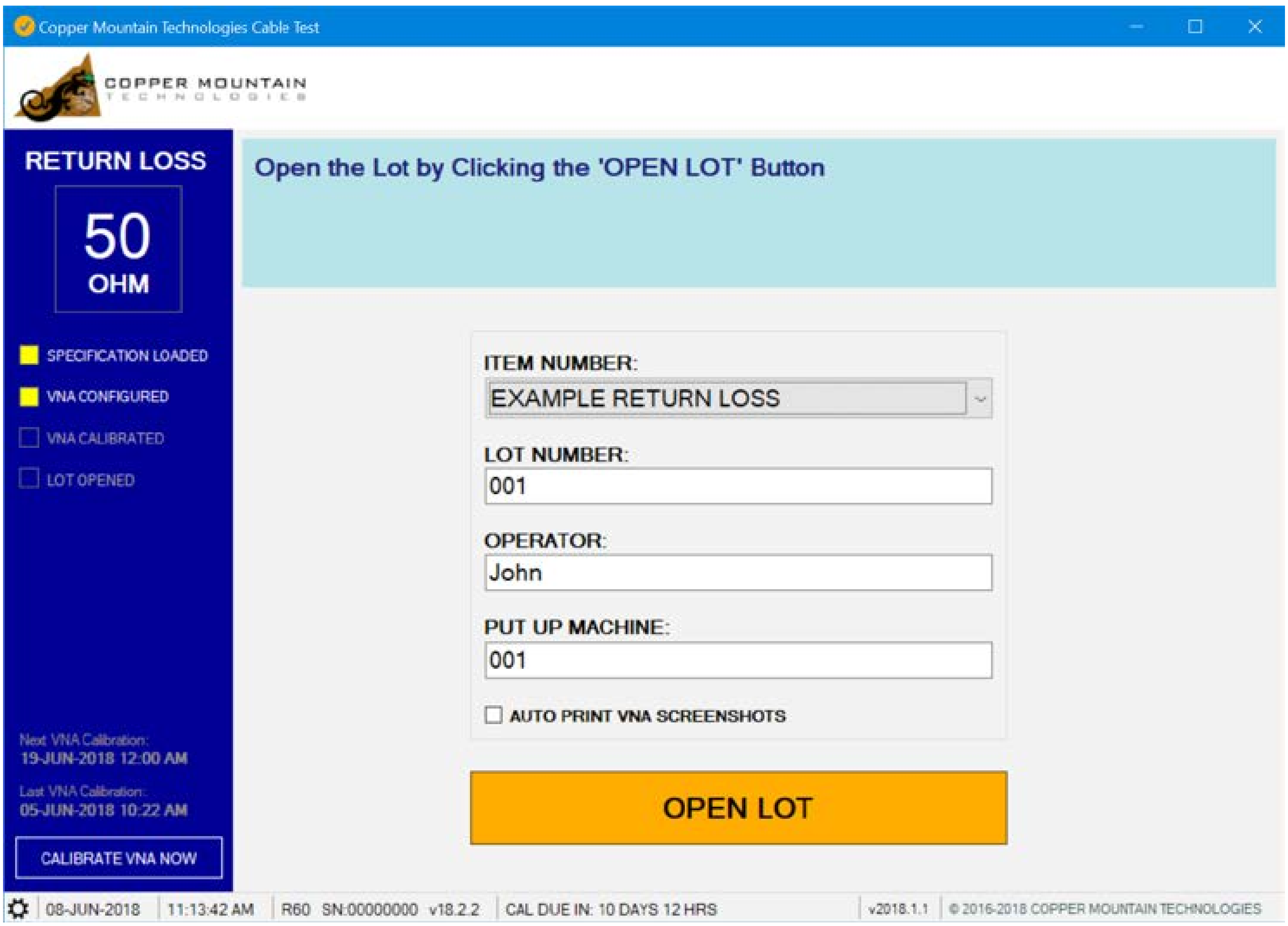
Software Plug-Ins

All Copper Mountain Technologies VNAs include support for executable software add-on modules or plug-ins. With plug-ins, customers and CMT support engineers can develop extensions to the base software launched from inside the main application menu. Place your executable into the /Plug-ins/ subfolder of your VNA's installation path, and then use the System->Plug-ins menu sequence to launch.

Most plug-ins are developed based on specific customer's needs. We also offer source code for many plug-ins to help you get started with creating your own plug-ins or as a jumping off point for automation projects.

Our most popular plug-in, Manufacturing Test, supports incorporating VNA software into your manufacturing QMS:

- Streamline production test processes.
- Ensure consistency of test process across multiple operators and workstations.
- Easily create and manage pass/fail limits across multiple workstations. Pass/fail limits and instrument configuration are stored in a human-readable plaintext "specifications" file which can be maintained by an authorized test engineer.
- Organize test results for subsequent retrieval and analysis.



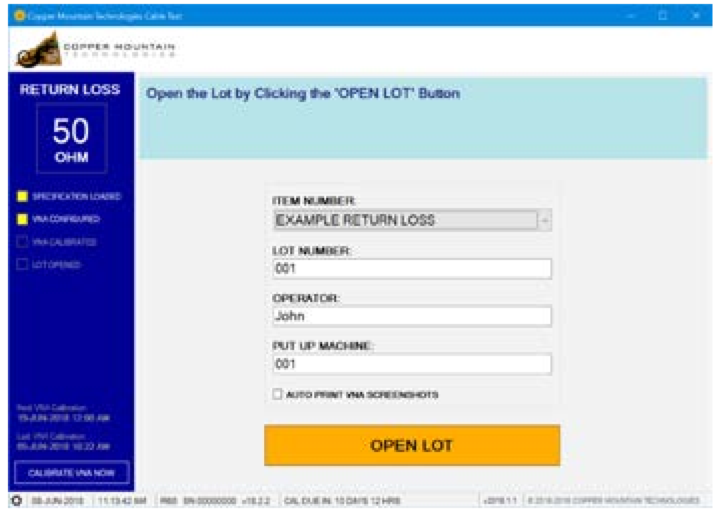
Manufacturing Plug-In

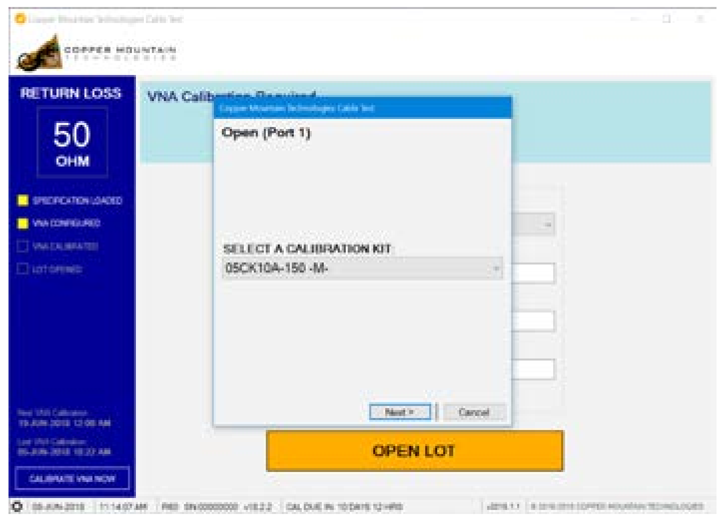
The Manufacturing Test Plug-in is a core application designed for the manufacturing test environment. Nearly any aspect of the core application can be customized by CMT to fit your specific production line needs. Whether producing antennas, cables, or any other device, this plug-in automates production testing by integrating the VNA into your manufacturing line QMS.

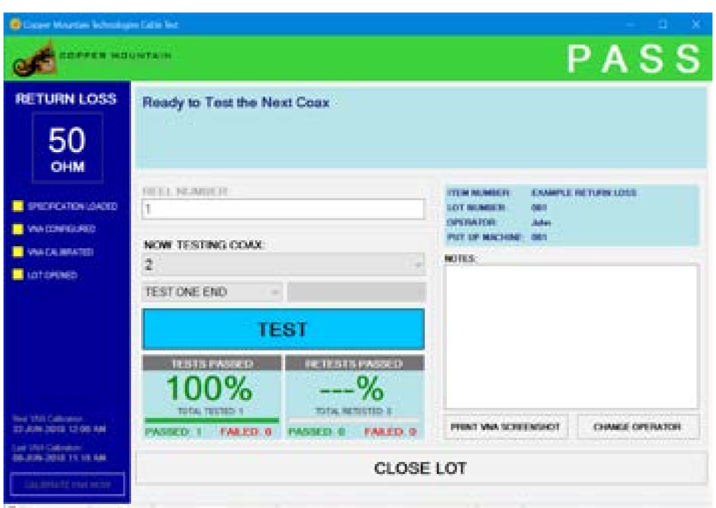
VNA configuration and various parameters are determined from specification files that are tailored for each model or part number being tested. The VNA is automatically configured when the operator selects a part or model number. These specification files can be created and edited by a production line engineer. VNA configuration can be easily specified using the normal VNA software user interface and saving a state file or by writing a SCPI command script.

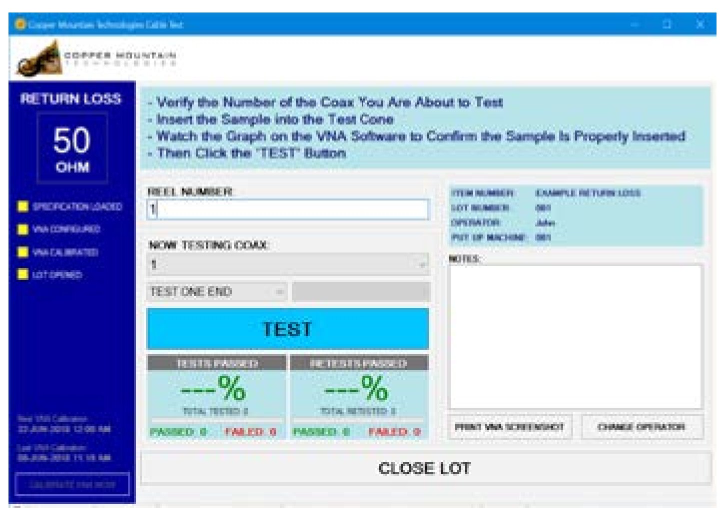
The plug-in is easy-to-use and intuitive for any operator. When using the plug-in, the operator enters production work order information such as Work Order Number, Part/Model Number, and Operator ID. These fields can be customized by CMT as required to meet your production testing needs. This information is saved along with pass/fail results and measurement data of each device tested.

Once the work order information has been entered, the plug-in walks the operator step-by-step through the VNA calibration process. Photos of the calibration kit connections needed for each step are presented to the operator.









On-screen instructions guide the operator through each step of the work order testing process. If a device fails a test, the operator has the option to re-test. Test statistics are displayed and recorded. While testing a work order, VNA screenshots can be saved or printed. The operator closes the work order once all devices have been tested.

Test results are organized by date, time, and work order number and are saved in CSV (Comma-Separated Values) files. Results include work order information, pass/fail status, and complete measurement data for each device. VNA screenshots can also be saved. A yield file is saved which records summary and statistical information about the work order.

Normal manual VNA operations, such as moving markers and reading marker information, are available for an engineer to diagnose production line issues when necessary.

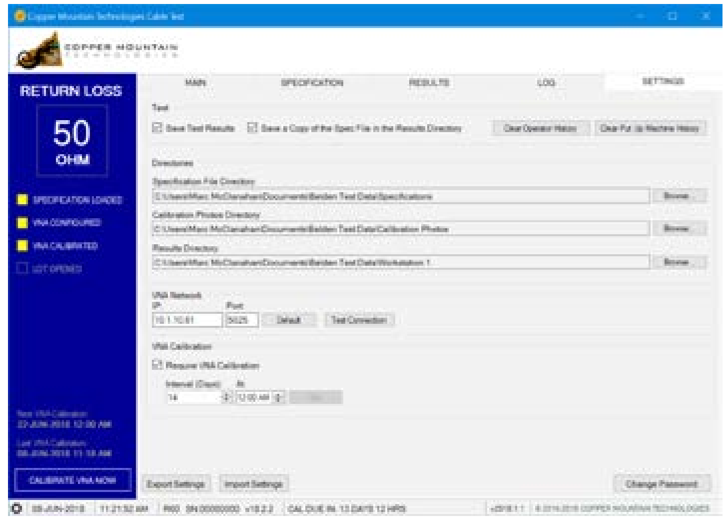
There are two versions of the Manufacturing Test Plug-in available – one for testing antennas and devices and another for testing cables. The cable test version has the following additional features:

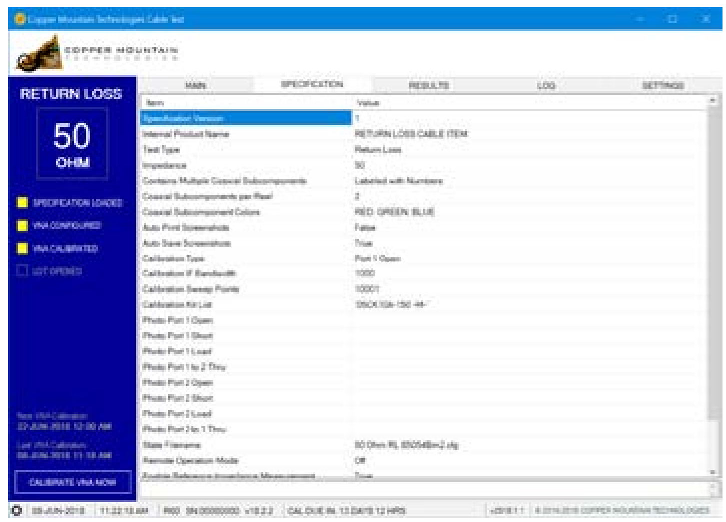
- Recalibration is required only when test parameters change, such as when a different part is being tested.
- Recalibration can also be enforced by specifying the interval in days between calibration.
- Automated cable reference impedance measurement is included.
- Testing can be lot-based instead of work-order based.
- The operator can write notes about the lot being tested.
- Operators can change without closing the lot.
- Settings are password protected.

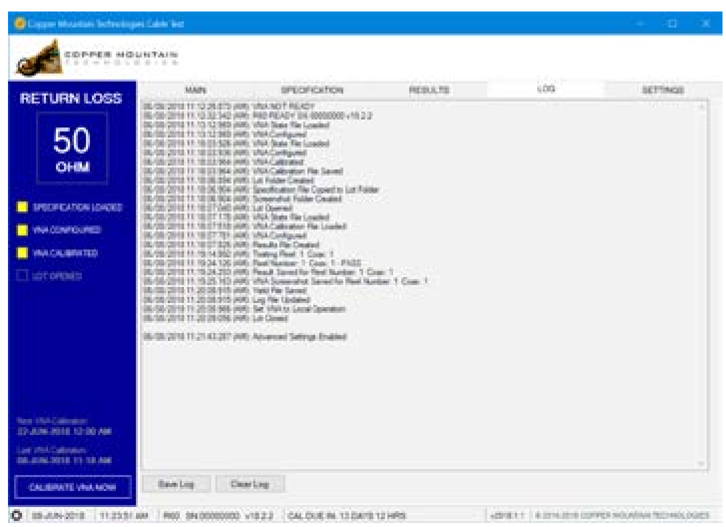
Site license for the Manufacturing Test Plug-in is $4995. Additional customization fees may apply based on your specific requirements.

Minimum test station PC requirements:

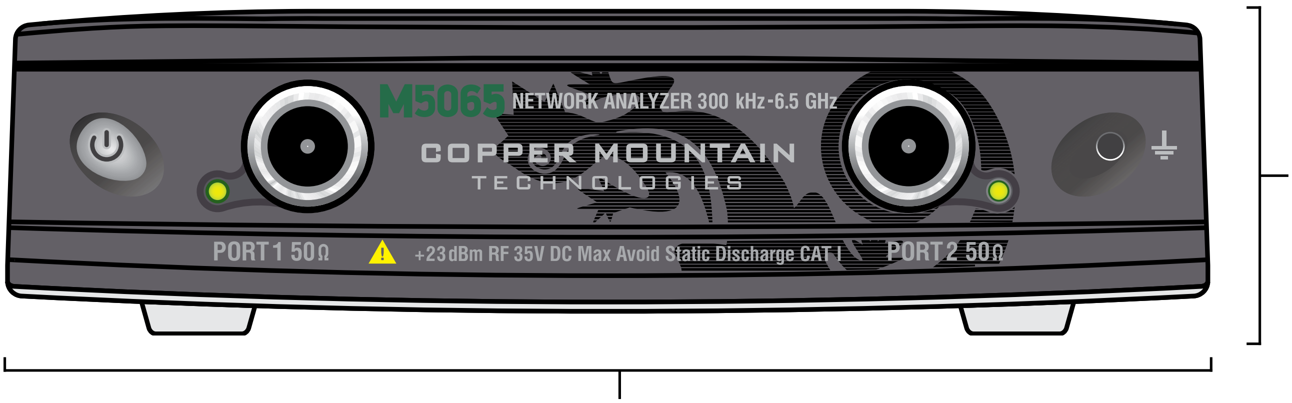
- Windows 7 or 10
- .NET Framework 4.5.2 or Higher
- 1.5 GHz Processor
- 2 GB RAM
- USB 2.0 High Speed
- 1920 x 1080 Displays (two displays per test station recommended)







M5065 Specifications[1]



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Primary Specifications

Impedance	50 Ohm
Test port connector	type N, female
Number of test ports	2
Direct access	-
Frequency extender compatible	-
Frequency range	300 kHz to 6.5 GHz
Full frequency accuracy	±5·10^{-6}
Frequency resolution	1 Hz
Number of measurement points	2 to 200,001
Measurement bandwidths (with 1/1.5/2/3/5/7 steps)	1 Hz to 100 kHz
Dynamic range[2]	125 dB (130 dB typ.)

Measurement Accuracy

Accuracy of transmission measurements[4]	Magnitude / Phase
0 dB to +10 dB	±0.2 dB / ±2°
-45 dB to 0 dB	±0.1 dB / ±1°
-65 dB to -45 dB	±0.2 dB / ±2°
-85 dB to -65 dB	±1.0 dB / ±6°
Accuracy of reflection measurements[5]	Magnitude / Phase
-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 noise magnitude (IF bandwidth 3 kHz)	0.002 dB rms
Temperature dependence	0.02 dB/°C

Effective System Data

300 kHz to 6.5 GHz	
Directivity	46 dB
Source match	40 dB
Load match	46 dB
Reflection tracking	±0.10 dB
Transmission tracking	±0.08 dB

Uncorrected System Performance

300 kHz to 6.5 GHz	
Directivity	15 dB
Source match	15 dB
Load match	15 dB

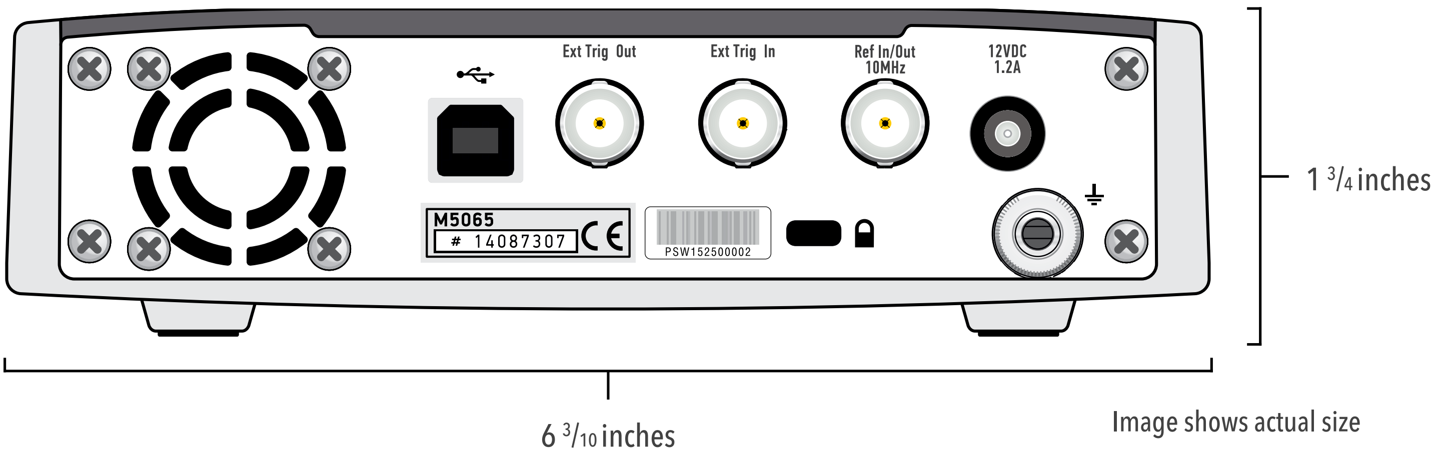
Test Port Output

Power range	-55 dBm to +5 dBm
Power accuracy	±1.5 dB
Power resolution	0.05 dB
Harmonic distortion[6]	-20 dBc
Non-harmonic spurious[6]	-20 dBc

Test Port Input

Noise floor	-130 dBm/Hz
Damage level	+23 dBm
Damage DC voltage	35 V

[1] All specifications subject to change without notice. [2] The dynamic range is defined as the difference between the specified maximum power level and the specified noise floor. The specification applies at 10 Hz IF bandwidth. [3] Reflection and transmission measurement accuracy applies over the temperature range of (73 ± 9) °F or (23 ± 5) °C after 40 minutes of warming-up, with less than 1 °C deviation from the full two-port calibration temperature, at output power of -5 dBm. Frequency points have to be identical for measurement and calibration (no interpolation allowed). [4] Transmission specifications are based on a matched DUT, and IF bandwidth of 10 Hz. [5] Reflection specifications are based on an isolating DUT. [6] Specification applies over entire frequency range, at output power of 0 dBm.



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Measurement Speed

Time per point	70 µs typ.
Port switchover time	1 ms

Frequency Reference Input

Port	10 MHz Ref In/Out
External reference frequency	10 MHz
Input level	-1 dBm to 5 dBm
Input impedance	50 Ohm
Connector type	BNC, female

Frequency Reference Output

Port	10 MHz Ref In/Out
Internal reference frequency	10 MHz
Output reference signal level at 50 Ohm impedance	1 dBm to 5 dBm
Connector type	BNC, female

Trigger Input

Port	Ext Trig In
Input level	
Low threshold voltage	0.5 V
High threshold voltage	2.7 V
Input level range	0 V to + 5 V
Pulse width	≥2 µs
Polarity	positive or negative
Input impedance	≥10 kOhm
Connector type	BNC, female

Trigger Output

Port	Ext Trig Out
Maximum output current	20 mA
Output level	
Low level voltage	0.0 V
High level voltage	3.5 V
Polarity	positive or negative
Connector type	BNC, female

System & Power

Operating system	Windows 7 and above
CPU frequency	1.0 GHz
RAM	512 MB
Interface	USB 2.0
Connector type	USB B
Power supply	110-240 V, 50/60 Hz
Power consumption	14 W
Input power	9 V DC to 15 V DC
Input power consumption DC	12 W

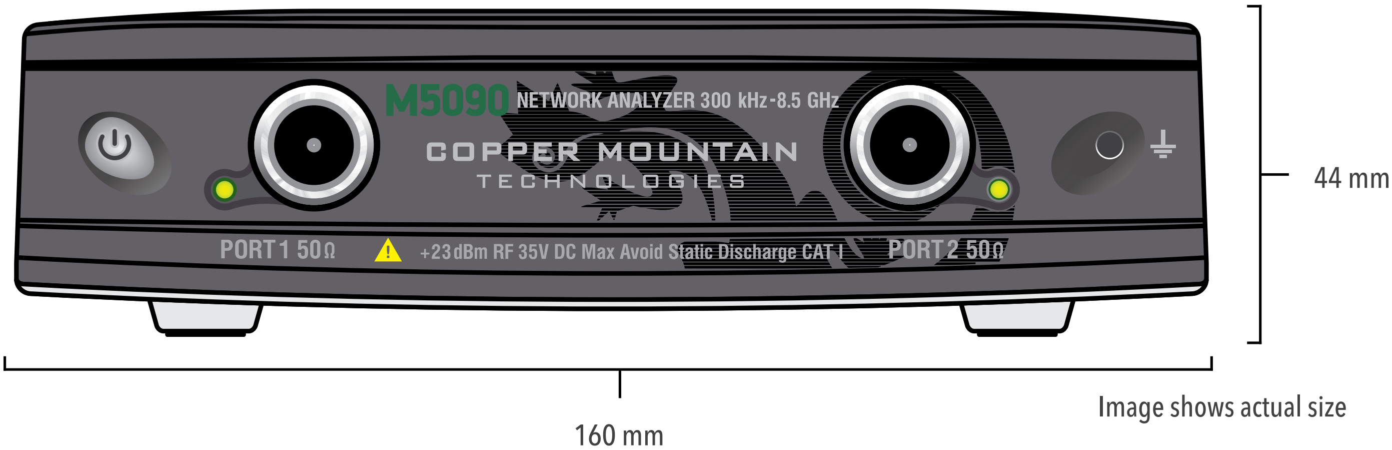
Factory Adjustment

Recommended factory adjustment interval	3 years

Environmental Specifications

Operating temperature	+5 °C to +40 °C (41 °F to 104 °F)
Storage temperature	-50 °C to +70 °C (-58 °F to 158 °F)
Humidity	90 % at 25 °C (77 °F)
Atmospheric pressure	70.0 kPa to 106.7 kPa

M5090 Specifications[1]



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Primary Specifications

Impedance	50 Ohm
Test port connector	type N, female
Number of test ports	2
Direct access	-
Frequency extender compatible	-
Frequency range	300 kHz to 8.5 GHz
Full frequency accuracy	$\pm 5 \cdot 10^{-6}$
Frequency resolution	1 Hz
Number of measurement points	2 to 200,001
Measurement bandwidths (with 1/1.5/2/3/5/7 steps)	1 Hz to 100 kHz
Dynamic range[2]	
300 kHz to 6.5 GHz	125 dB (130 dB typ.)
6.5 GHz to 8.0 GHz	120 dB (125 dB typ.)
8.0 GHz to 8.5 GHz	115 dB (120 dB typ.)

Effective System Data

300 kHz to 8.5 GHz	
Directivity	46 dB
Source match	40 dB
Load match	46 dB
Reflection tracking	±0.10 dB
Transmission tracking	±0.08 dB

Uncorrected System Performance

300 kHz to 6.5 GHz	
Directivity	15 dB
Source match	15 dB
Load match	15 dB
6.5 GHz to 8.5 GHz	
Directivity	12 dB
Source match	15 dB
Load match	15 dB

Measurement Accuracy

Accuracy of transmission measurements[4]	Magnitude / Phase
300 kHz to 6.5 GHz	
0 dB to +10 dB	±0.2 dB / ±2°
-45 dB to 0 dB	±0.1 dB / ±1°
-65 dB to -45 dB	±0.2 dB / ±2°
-85 dB to -65 dB	±1.0 dB / ±6°
6.5 GHz to 8.0 GHz	
0 dB to +10 dB	±0.2 dB / ±2°
-40 dB to 0 dB	±0.1 dB / ±1°
-60 dB to -40 dB	±0.2 dB / ±2°
-80 dB to -60 dB	±1.0 dB / ±6°
8.0 GHz to 8.5 GHz	
0 dB to +10 dB	±0.2 dB / ±2°
-35 dB to 0 dB	±0.1 dB / ±1°
-55 dB to -35 dB	±0.2 dB / ±2°
-75 dB to -55 dB	±1.0 dB / ±6°
Accuracy of reflection measurements[5]	Magnitude / Phase
-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 noise magnitude (IF bandwidth 3 kHz)	0.002 dB rms
Temperature dependence	0.02 dB/°C

Test Port Output

Power range	
300 kHz to 8.0 GHz	-55 dBm to +5 dBm
8.0 GHz to 8.5 GHz	-55 dBm to +3 dBm
Power accuracy	±1.5 dB
Power resolution	0.05 dB
Harmonic distortion[6]	-20 dBc
Non-harmonic spurious[6]	
300 kHz to 6.5 GHz	-20 dBc
6.5 GHz to 8.5 GHz	-15 dBc

[1] All specifications subject to change without notice. [2] The dynamic range is defined as the difference between the specified maximum power level and the specified noise floor. The specification applies at 10 Hz IF bandwidth. [3] Reflection and transmission measurement accuracy applies over the temperature range of (73 ± 9) °F or (23 ± 5) °C after 40 minutes of warming-up, with less than 1 °C deviation from the full two-port calibration temperature, at output power of -5 dBm. Frequency points have to be identical for measurement and calibration (no interpolation allowed). [4] Transmission specifications are based on a matched DUT, and IF bandwidth of 10 Hz. [5] Reflection specifications are based on an isolating DUT. [6] Specification applies over entire frequency range, at output power of 0 dBm.

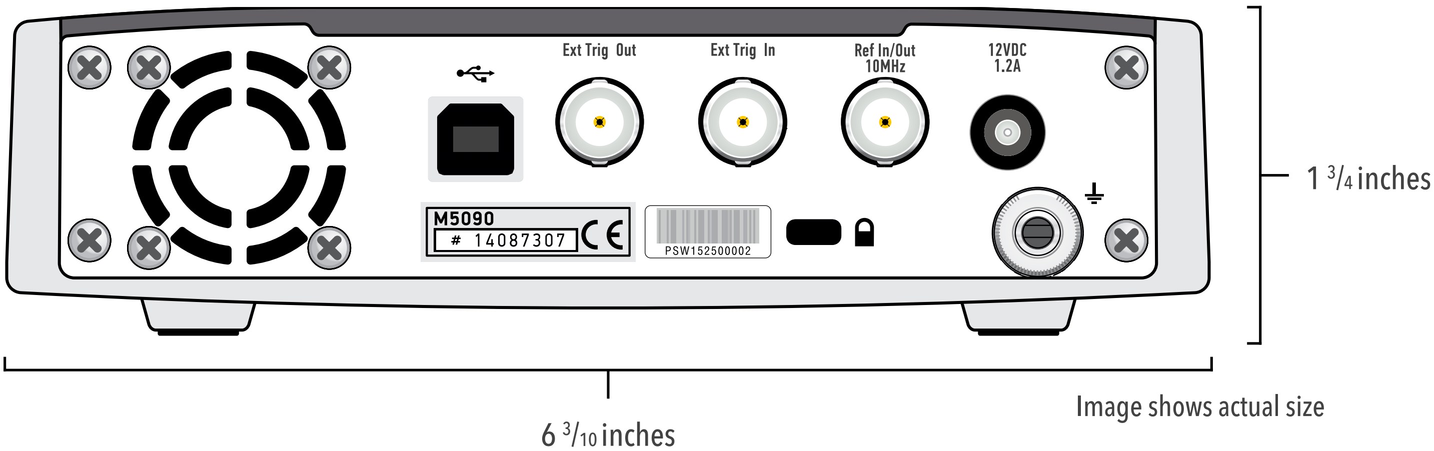


Image shows actual size

Test Port Input

Noise floor	
300 kHz to 6.5 GHz	-130 dBm/Hz
6.5 GHz to 8.0 GHz	-125 dBm/Hz
8.0 GHz to 8.5 GHz	-122 dBm/Hz
Damage level	+23 dBm
Damage DC voltage	35 V

Measurement Speed

Time per point	70 µs typ.
Port switchover time	1 ms

Frequency Reference Input

Port	10 MHz Ref In/Out
External reference frequency	10 MHz
Input level	-1 dBm to 5 dBm
Input impedance	50 Ohm
Connector type	BNC, female

Frequency Reference Output

Port	10 MHz Ref In/Out
Internal reference frequency	10 MHz
Output reference signal level at 50 Ohm impedance	1 dBm to 5 dBm
Connector type	BNC, female

Frequency Trigger Input

Port	Ext Trig In
Input level	
Low threshold voltage	0.5 V
High threshold voltage	2.7 V
Input level range	0 V to + 5 V
Pulse width	≥2 µs
Polarity	positive or negative
Input impedance	≥10 kOhm
Connector type	BNC, female

Frequency Trigger Output

Port	Ext Trig Out
Maximum output current	20 mA
Output level	
Low level voltage	0.0 V
High level voltage	3.5 V
Polarity	positive or negative
Connector type	BNC, female

System & Power

Operating system	Windows 7 and above
CPU frequency	1.0 GHz
RAM	512 MB
Interface	USB 2.0
Connector type	USB B
Power supply	110-240 V, 50/60 Hz
Power consumption	14 W
Input power	9 V DC to 15 V DC
Input power consumption DC	12 W

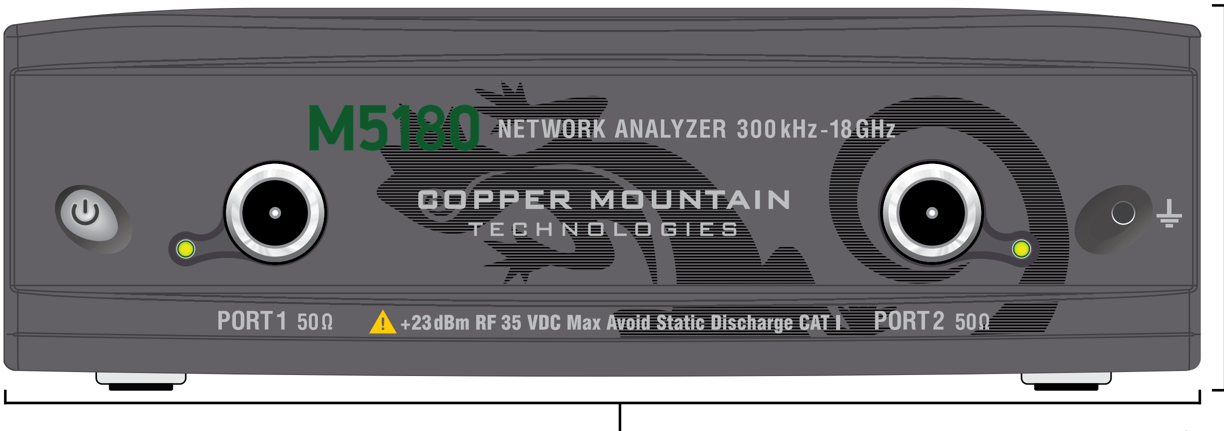
Factory Adjustment

Recommended factory adjustment interval	3 years

Environmental Specifications

Operating temperature	+5 °C to +40 °C (41 °F to 104 °F)
Storage temperature	-50 °C to +70 °C (-58 °F to 158 °F)
Humidity	90 % at 25 °C (77 °F)
Atmospheric pressure	70.0 kPa to 106.7 kPa

M5180 Specifications[1]



65 mm/2.5 inches

200 mm/7.9 inches

Image shows 78% scale

Primary Specifications

Impedance	50 Ohm
Test port connector	type N, female
Number of test ports	2
Frequency range	300 kHz to 18 GHz
Full frequency accuracy	$\pm 5 \cdot 10^{-6}$
Frequency resolution	1 Hz
Number of measurement points	2 to 200,001
Measurement bandwidths (with 1/1.5/2/3/5/7 steps)	1 Hz to 300 kHz
Dynamic range[2]	
300 kHz to 10 MHz	115 dB
10 MHz to 7 GHz	130 dB (135 dB typ.)
7 GHz to 12 GHz	125 dB (130 dB typ.)
12 GHz to 16 GHz	122 dB (125 dB typ.)
16 GHz to 18 GHz	116 dB (120 dB typ.)
Crosstalk[2a]	
300 kHz to 5 GHz	-
5 GHz to 7.5 GHz	-120 dB typ.
7.5 GHz to 8.5 GHz	-110 dB typ.
8.5 GHz to 15 GHz	-120 dB typ.
15 GHz to 18 GHz	-100 dB typ.

Effective System Data

300 kHz to 10 GHz	
Directivity	46 dB
Source match	40 dB
Load match	46 dB
Reflection tracking	±0.10 dB
Transmission tracking	±0.08 dB
10 GHz to 18 GHz	
Directivity	42 dB
Source match	38 dB
Load match	42 dB
Reflection tracking	±0.10 dB
Transmission tracking	±0.08 dB

Measurement Accuracy

Accuracy of transmission measurements[4]	Magnitude / Phase
300 kHz to 10 MHz	
0 dB to +10 dB	±0.2 dB / ±2°
-35 dB to 0 dB	±0.1 dB / ±1°
-55 dB to -35 dB	±0.2 dB / ±2°
-75 dB to -55 dB	±1.0 dB / ±6°
10 MHz to 7 GHz	
0 dB to +10 dB	±0.2 dB / ±2°
-50 dB to 0 dB	±0.1 dB / ±1°
-70 dB to -50 dB	±0.2 dB / ±2°
-90 dB to -70 dB	±1.0 dB / ±6°
7 GHz to 16 GHz	
0 dB to +10 dB	±0.2 dB / ±2°
-45 dB to 0 dB	±0.1 dB / ±1°
-65 dB to -45 dB	±0.2 dB / ±2°
-85 dB to -65 dB	±1.0 dB / ±6°
16 GHz to 18 GHz	
0 dB to +5 dB	±0.2 dB / ±2°
-40 dB to 0 dB	±0.1 dB / ±1°
-60 dB to -40 dB	±0.2 dB / ±2°
-80 dB to -60 dB	±1.0 dB / ±6°
Accuracy of reflection measurements[5]	Magnitude / Phase
300 kHz to 10 GHz	
-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°
10 GHz to 18.0 GHz	
-15 dB to 0 dB	±0.5 dB / ±4°
-25 dB to -15 dB	±1.5 dB / ±10°
-35 dB to -25 dB	±5.5 dB / ±30°
Trace noise magnitude (IF bandwidth 3 kHz)	
300 kHz to 9 GHz	0.002 dB rms
9 GHz to 18 GHz	0.004 dB rms
Temperature dependence	
300 kHz to 7 GHz	0.02 dB/°C
7 GHz to 18 GHz	0.04 dB/°C

[1] All specifications subject to change without notice. [2] The dynamic range is defined as the difference between the specified maximum power level and the specified noise floor. The specification applies at 10 Hz IF bandwidth. [2a] Uncorrected crosstalk is defined at maximum specified output power level. Dynamic range of the analyzer may be limited on the lower end by either crosstalk or noise floor. [3] Reflection and transmission measurement accuracy applies over the temperature range of (73 ± 9) °F or (23 ± 5) °C after 40 minutes of warming-up, with less than 1 °C deviation from the full two-port calibration temperature, at output power of 0 dBm. Frequency points have to be identical for measurement and calibration (no interpolation allowed). [4] Transmission specifications are based on a matched DUT, and IF bandwidth of 10 Hz. [5] Reflection specifications are based on an isolating DUT. [6] Specification applies over entire frequency range, at output power of 0 dBm.

Uncorrected System Performance

300 kHz to 7 GHz	
Directivity	15 dB
Source match	12 dB
Load match	15 dB
7 GHz to 14 GHz	
Directivity	10 dB
Source match	10 dB
Load match	12 dB
14 GHz to 16 GHz	
Directivity	8 dB
Source match	10 dB
Load match	12 dB
16 GHz to 18 GHz	
Directivity	6 dB
Source match	10 dB
Load match	12 dB

Test Port Output

Power range	
300 kHz to 16 GHz	-40 dBm to +10 dBm
16 GHz to 18 GHz	-40 dBm to +6 dBm
Power accuracy	±1.5 dB
Power resolution	0.05 dB
Harmonic distortion[6]	-15 dBc
Non-harmonic spurious[6]	
300 kHz to 16 GHz	-20 dBc
16 GHz to 18 GHz	-15 dBc

Test Port Input

Noise floor	
300 kHz to 10 MHz	-115 dBm/Hz
10 MHz to 7 GHz	-130 dBm/Hz (135 dBm/Hz typ.)
7 GHz to 12 GHz	-125 dBm/Hz (130 dBm/Hz typ.)
12 GHz to 16 GHz	-122 dBm/Hz (127 dBm/Hz typ.)
16 GHz to 18 GHz	-120 dBm/Hz (125 dBm/Hz typ.)
Damage level	+23 dBm
Damage DC voltage	35 V

Measurement Speed

Time per point	30 µs typ.
Port switchover time	0.2 ms

Frequency Reference Input

Port	10 MHz Ref In/Out
External reference frequency	10 MHz
Input level	-1 dBm to 5 dBm
Input impedance	50 Ohm
Connector type	BNC, female

Frequency Reference Output

Port	10 MHz Ref In/Out
Internal reference frequency	10 MHz
Output reference signal level at 50 Ohm impedance	1 dBm to 5 dBm
Connector type	BNC, female

Frequency Trigger Input

Port	Ext Trig In
Input level	
Low threshold voltage	0.5 V
High threshold voltage	2.7 V
Input level range	0 V to + 5 V
Pulse width	≥2 µs
Polarity	positive or negative
Input impedance	≥10 kOhm
Connector type	BNC, female

Frequency Trigger Output

Port	Ext Trig Out
Maximum output current	20 mA
Output level	
Low level voltage	0.0 V
High level voltage	3.5 V
Polarity	positive or negative
Connector type	BNC, female

System & Power

Operating system	Windows 7 and above
CPU frequency	1.0 GHz
RAM	512 MB
Interface	USB 2.0
Connector type	USB B
Power supply	110-240 V, 50/60 Hz
Power consumption	32 W
Input power	9 V DC to 15 V DC
Input power consumption DC	25 W

Factory Adjustment

Recommended factory adjustment interval	3 years

Environmental Specifications

Operating temperature	+5 °C to +40 °C (41 °F to 104 °F)
Storage temperature	-50 °C to +70 °C (-58 °F to 158 °F)
Humidity	90 % at 25 °C (77 °F)
Atmospheric pressure	70.0 kPa to 106.7 kPa

Technology is supposed to move. It's supposed to change and update and progress. It's not meant to sit stagnant year after year simply because that's how things have always been done.

The engineers at Copper Mountain Technologies are creative problem solvers. They know the people using VNAs don't just need one giant machine in a lab. They know that VNAs are needed in the field, requiring portability and flexibility. Data needs to be quickly transferred, and a test setup needs to be easily automated and recalled for various applications. The engineers at Copper Mountain Technologies are rethinking the way VNAs are developed and used.

Copper Mountain Technologies' VNAs are designed to work with the Windows or Linux PC you already use via USB interface. After installing the test software, you have a top-quality VNA at a fraction of the cost of a traditional analyzer. The result is a faster, more effective test process that fits into the modern workspace. This is the creativity that makes Copper Mountain Technologies stand out above the crowd.

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631 E. New York St | Indianapolis, IN | 46202
www.coppermountaintech.com

USA: +1.317.222.5400
Singapore: +65.6323.6546
Latin America: +1.954.706.5920

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