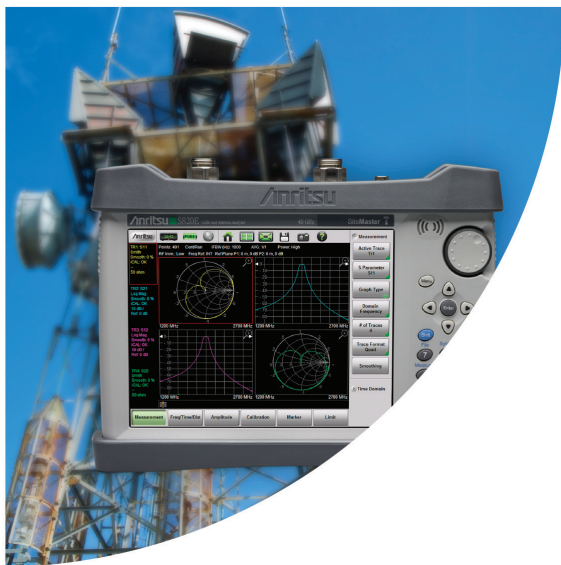


**Anritsu** envision : ensure

# Vector Network Analysis

## Product Portfolio



### VNA Innovation Timeline



**Wiltron 310 Impedance Meter**  
12 GHz coax  
18 GHz WG

In 1965, Anritsu filed the patent that defined the first modern Vector Network Analyzer (VNA).

We are proud to continue that tradition of innovation to the present day—with the world’s first portfolio of VNAs that bring Nonlinear Transmission Line (NLTL) technology to every measurement scenario from on-wafer device characterization to R&D testing to manufacturing and field operations.

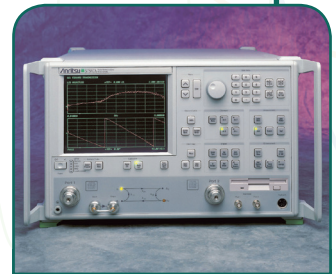
1965

1987

1994



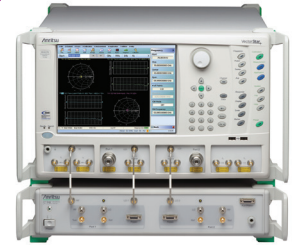
**360A VNA**  
40 MHz to 40 GHz



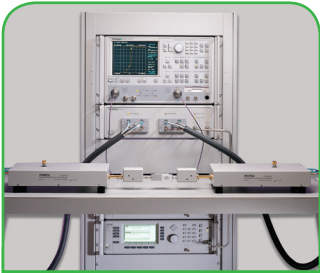
**Lightning™ 37000E**  
40 MHz to 65 GHz



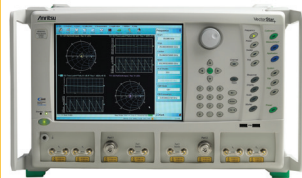
**Site Master™ S820E**  
1 MHz to 40 GHz



**VectorStar® ME7838D**  
70 kHz to 145 GHz



**Broadband and mmWave VNA ME7808**  
40 MHz to 110 GHz



**VectorStar® MS4640A**  
70 kHz to 20, 40, 50 and 70 GHz



**ShockLine™ 2 and 4 Port VNAs**  
50 kHz to 43.5 GHz

2001

2006

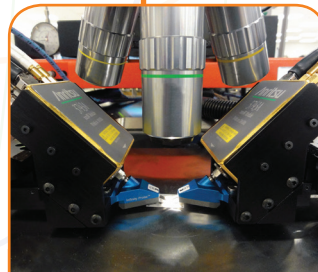
2009

2011

2014



**VNA Master™ MS202/3xA**  
2 MHz to 6 GHz



**VectorStar® ME7838A**  
70 kHz to 110 GHz

### Passive Components

Passive RF and microwave components such as antennas, filters, cables and connectors are used in all types of wireless systems. These types of components typically require basic S-parameter and time domain testing to fully characterize their performance. Vector Network Analyzers (VNAs) are the optimal instrument to make those measurements.

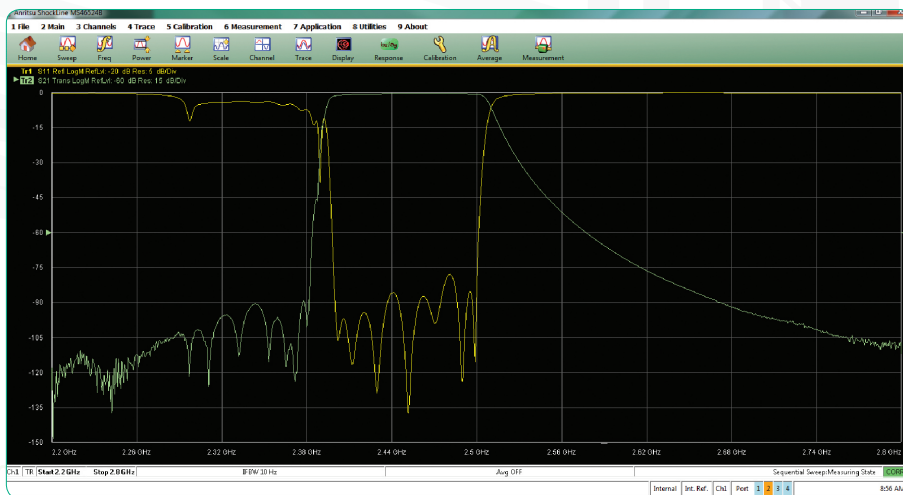
For passive components like connectors, cables, and adapters all that is needed to test them is simple S-parameter measurements.

Anritsu handheld Vector Network Analyzers are designed and optimized for field use and are able to make all of the passive measurements required in the field with high accuracy and repeatability. Distance Domain is standard on every Anritsu handheld VNA or Cable & Antenna Analyzer instrument, allowing users to quickly locate and identify faults within a coaxial or waveguide transmission system. High dynamic range enables easy antenna isolation measurements which is typically required at most sites. The highest RF immunity (+17 dBm) provides high accuracy and quality measurements, unaffected by strong RF/microwave signals which may be present nearby.



The ShockLine family of VNAs from Anritsu offer a broad range of configurations and performance levels to test a wide variety of passive components. Consisting of 1, 2, and 4-port models covering frequencies up to 92 GHz, ShockLine VNAs deliver the flexibility to economically test passive devices from simple cables and connectors all the way up to high performance BTS filters and E-band antennas. All of the ShockLine VNAs share common test software which enables an easy transition between

verifying a device under test with a performance VNA model on the bench, and testing it with an economy model in manufacturing. Designed without embedded touch-screen or keypad, ShockLine VNAs are very small and robust, minimizing space requirements and maximizing uptime.



Band-pass filter measurement with a ShockLine VNA.

Passive Testing Challenges	Our Solutions
<b>Designed for Field Use</b>	
Need to make accurate, reliable measurements in typical outdoor environment with large temperature variations.	Anritsu handheld analyzers utilize Active Thermal Management which enables them to quickly stabilize to typical outdoor environments. This results in reliable measurement accuracy and repeatability in any environment. ▲
Need fully reversing 2-port VNA measurement capability in the field.	Anritsu has several models of handheld 2-port fully reversing VNA analyzers with coverage up to 40 GHz. ▲
Remote sites are often difficult to access, which makes traditional equipment transportation impossible.	Anritsu handheld analyzers are compact and typically weigh less than 7 lbs. Their compact size and weight allows them to be easily carried to remote locations. ▲
Access to AC power not readily available at some sites.	Anritsu handheld analyzers operate from an easily replaceable internal battery when AC power is not available. Spare batteries can be used to extend operation time if needed. ▲
<b>Reduce the Cost of Test</b>	
Need to reduce operating expenses (OPEX). Multiple site visits are very costly and inefficient.	Since 1996 Anritsu has been the leader in handheld test & measurement equipment. Anritsu is the de facto standard around the world. ▲
Need to minimize the cost of test to stay competitive in your industry.	Anritsu offers a wide selection of VNAs to fit a broad range of passive device applications and budget. ● ■ ▲
Cannot afford costly downtime in your production environment.	ShockLine VNAs are compact and more robust without fragile keypad or display. ■
Need a low cost test solution without compromising performance.	You get high performance at a low cost. ■
<b>Ease of Use</b>	
Space is at a premium in the production environment.	Choice of multiple compact packages saves bench space and efficiently uses rack space. ■
Need seamless correlation of results from the design environment to the production environment.	Easily migrate from performance to economy models while moving from design to production. ■
Need simple setup and operation.	Anritsu's easyTest™ software allows users to create work instruction files on a PC, deliver these files by e-mail and then display work instructions on supported instruments and modes. ■ ▲
<b>High Accuracy</b>	
Need to evaluate connector design with highest available resolution.	Unique low-frequency coverage from 70 kHz with up to 100,000 measurement points to achieve the best time domain measurement accuracy. ●
Accurately measure medium and high loss devices. Catch all potential filter feed-throughs in out-of-band regions.	Superior dynamic range, up to 142 dB at 2.5 GHz and 125 dB at 67 GHz. ●
Minimize the need for recalibration for different production line components.	Highest data resolution utilizing 100,000 point for maximum flexibility. Move to different frequency spans and still zoom in on narrow band responses without recalibration. ●
Improve productivity by reducing measurement guard bands utilizing optimum measurement uncertainty.	Best test port characteristic performance with up to 50 dB in directivity, source match and load match performance combined with industry-leading dynamic range provides excellent measurement accuracy. ●

Key to Symbols:

● VectorStar

■ ShockLine

▲ Master Products

## Active Components

Active RF and microwave components such as amplifiers, mixers, and converters are used in many types of wireless systems including cellular, automotive, IoT, and 5G applications. Vector Network Analyzers (VNAs) with source level control and receiver offset functionality can measure many of the typical active device test parameters like gain, distortion, and noise figure.

VectorStar offers a wide range of standard performance and instrument options for optimizing measurements of active devices. The high available power, up to +14 dBm at 20 GHz and +6 dBm at 67 GHz, provides enough power to measure compression properties of high power amplifiers without the need to search for external components. The high receiver compression point, +15 dBm at 70 GHz, often eliminates the need for additional external or internal attenuators.

The ShockLine MS46500B Performance VNAs offer economical capabilities to test simple linear active devices not requiring the performance of VectorStar. ShockLine's optional direct access loops, and bias-Tees (8.5 GHz models), ALC power control and multiple embedded sources enable tests like gain and distortion measurements on simple active devices.

### Active Measurements Suite

When measuring active devices, the Active Measurement Suite options provide a wide range of analysis tools for proper characterization of devices, components and systems. First, there is the choice of two or four internal step attenuators for forward and reverse sweeps. This provides the opportunity to reduce instrument costs when maximum power range control in the reverse direction is not needed. Next, the measurement suite includes internal bias tees allowing component biasing directly through the VNA test port rather than needing external bias tee components. The measurement suite includes gain compression software that greatly simplifies the compression analysis process. With a power sweep configured, the software provides automatic normalization for easy identification of the start in gain roll off. The software also provides the ability to set flags indicating the user defined gain compression points with data provided in graph or tabular format. In addition, the swept power can be programmed for multiple frequencies for full analysis using the multiple frequency gain compression function.

### Noise Figure Measurements

The Noise Figure Measurement Option adds the capability to measure noise figure of active devices from 70 kHz to 145 GHz. The noise figure measurement is based on a cold source technique for improved accuracy. Various levels of match and fixture correction are available for additional enhancement. VectorStar is the only VNA platform optimized for measuring noise figure up to 110 and 145 GHz utilizing a unique receiver for noise figure measurements.



Millimeter-wave noise figure measurements with a VectorStar VNA.

Passive Components

Active Components

Broadband and Millimeter-wave On-wafer

Signal Integrity

## Pulse Measurements

The Anritsu VectorStar MS4640B with PulseView™ option offers the most advanced architecture available in a VNA for pulse measurements. It offers industry-leading performance that eliminates the tradeoffs and limitations of prior test methods. Higher resolution, greater timing accuracy, and longer record lengths coupled with a real-time display give users the performance and confidence needed to meet the most demanding radar pulse measurement requirements. Industry-leading 2.5 ns measurement resolution allows users to get a true view of their device performance and see behavior they may have been missing. Unlike traditional methods, the PulseView option does not require sacrificing dynamic range and accuracy when analyzing devices with narrow duty cycles; users get the same 100 dB dynamic range in all settings.

Active Module/Sub-system Testing Challenges	Our Solutions
<b>High Performance</b>	
Need a high performance analyzer for fast, efficient and accurate device and component measurements in an R&D lab environment.	Wide selection of VNAs to fit a broad range of active device applications and budget. ●
	Programmable source levels for active gain testing. ●
	Enables harmonic distortion testing. ●
	Low noise floor enable noise figure and distortion measurements. ●
	Easily create active device tests using multiple programming methods: SCPI, IVI-C, scripting, easyTest, 3rd party environments such as LabVIEW™. ●■
Design and develop high performance amplifiers quickly and efficiently.	VectorStar provides a wide range of active device characterization including the highest performing pulse analysis, highest frequency noise figure measurements and accurate IMD measurements utilizing non-linear transmission line (NLTL) samplers. ●
	IMDView™ provides the ability to automatically switch between S-parameter measurements and intermodulation characterization using the optional internal second source and combiner. ●
Generate accurate device models using wide bandwidth characterization.	Only VNA with single sweep coverage starting as low as 70 kHz and sweeping up to 110, 125, and 145 GHz through a single coaxial connector. The wide, stable electronic power control to as low as -55 dBm ensures that the device is accurately modeled well within the linear operating region. ●
<b>Reduce the Cost of Test</b>	
Maximize current equipment budgets while protecting the investment for future needs.	The VectorStar platform supports a wide variety of upgrades including higher frequencies, higher port count and increased capabilities. The only VNA platform that provides an upgrade path from a 2-port VNA to a 4-port system with upper frequencies to 70 GHz in baseband and up to 110 or 145 GHz in broadband configuration. Protect investments by purchasing what is needed today and upgrading to additional capabilities when budget and need allows. ●

Key to Symbols: ● VectorStar ■ ShockLine ▲ Master Products

Passive Components

Active Components

Broadband and Millimeter-wave On-wafer

Signal Integrity

## Broadband and Millimeter-wave On-wafer

Semiconductor manufacturing test engineers face increased challenges today related to broadband millimeter-wave (mm-wave) on-wafer testing. Developing accurate models often requires measuring frequencies that range from near DC up to 100+ GHz. Achieving accurate, stable measurements over extended time periods is a challenge for foundries and for fab-less semiconductor companies that require extensive testing of on-wafer devices.

Obtain the most thorough and accurate broadband device characterization while eliminating time-consuming, error prone concatenation process across the RF, microwave, and mm-wave frequency bands. This stable broadband performance means users can make high accuracy measurements all day, with the confidence that calibrations remains rock solid! Spend less time calibrating and more time measuring.

Broadband and Millimeter-wave On-wafer Testing Challenges	Our Solutions
<p>Improve on-wafer measurement performance and add additional mm-Wave bands without having to replace existing probe stations with large, expensive alternatives.</p>	<p>Anritsu's modern architecture provides a solution that is a fraction of the size and weight of other solutions. The mm-wave modules fits on smaller probe stations and may be directly mounted to the probe. The broadband system incorporating the unique NLTL modules offer frequency coverage starting at 70 kHz and operating up to 110, 125, and 145 GHz. ●</p>
<p>Need to eliminate high frequency cable losses and cable instabilities.</p>	<p>ShockLine's mm-wave measurement capability is accomplished using modules tethered to the instrument through 1 m cables, which enables the VNA to provide more power with higher dynamic range at the DUT. ■</p>

Key to Symbols: ● VectorStar ■ ShockLine ▲ Master Products



**MS46524B with E-band frequency option**  
55-92 GHz mm-wave option is the best value on the market for mass production of E-band components.



**Compact and lightweight mm-wave modules**  
Our solution is less than 8% the weight and 2% the volume of other solutions, enabling low cost installation on smaller probe stations.



## Signal Integrity

Today's signal integrity (SI) engineers are challenged to meet high data rates, minimize costs, and close the loop of simulation and measurement. For example, VectorStar MS4640B's industry-leading low-frequency measurement capability, as low as 70 kHz, coupled with upper range as high as 70 or 145 GHz, ensure that simulation-busting DC extrapolation and causality issues are minimized and your simulations match reality.

For lower frequency SI verification and testing, ShockLine MS46500B series offers 2 and 4-port broadband models to 43.5 GHz. VectorStar and ShockLine include a suite of built-in tools for de-embedding single ended or differential test fixtures without the need for external software programs for accurate signal integrity measurements of backplanes, SERDES, and other devices of interest.

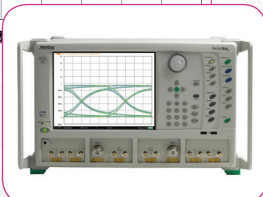
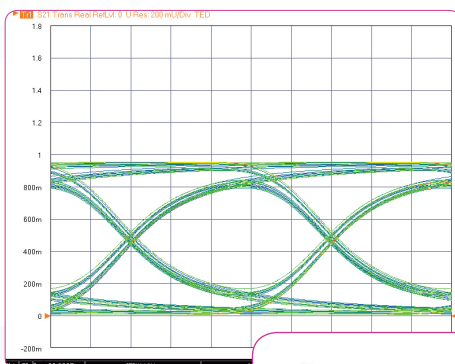
Signal Integrity Testing Challenges	Our Solutions
Perform accurate signal integrity characterization of high speed data channels using quality low frequency measurements with high performance upper frequency coverage.	VectorStar has a low frequency receiver which covers 70 kHz to 2.5 GHz combined with a high frequency receiver operating to 20, 40, 50 and 70 GHz in the baseband unit. By using the best architecture for each band, high performance is achieved at all frequencies including best dynamic range 500 MHz and below. ●
Need to ensure that high speed devices comply to USB 3.1 and Thunderbolt™ 3 test specs.	ShockLine provides verification of latest high speed devices. ■
Interactive eye-diagram characterization for design and debug.	VectorStar with option 47 (Eye Diagram) offers live trace-based eye-diagram capabilities for SI testing. ●
Testing and verifying skew, crosstalk, and other SI specifications.	ShockLine with option 22 (Advanced Time Domain) incorporates third party SI software into the ShockLine software, enabling NEXT, FEXT, and other SI tests. ■

Key to Symbols:

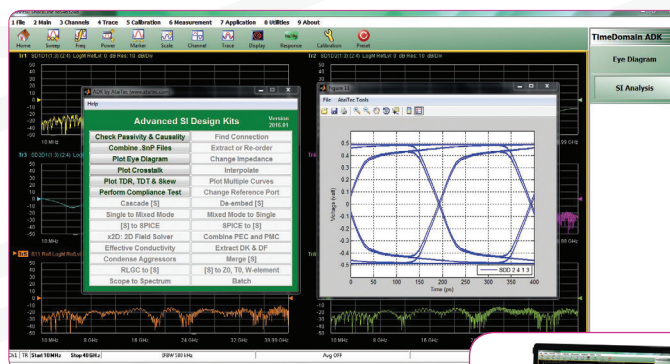
● VectorStar

■ ShockLine

▲ Master Products



**VectorStar VNA**  
Eye diagram measurement has live update with every frequency sweep.



**Shockline VNA**  
SI measurements using advanced time domain.

## Anritsu Vector Network Analyzers



### Bench

**VectorStar  
MS464xB**  
70 kHz to 20/40/50/70 GHz



### Manufacturing

**ShockLine  
1-Port USB VNA  
MS46121A**  
40 MHz to 4 GHz  
150 kHz to 6 GHz



**ShockLine  
Compact USB VNA  
MS46122A**  
1 MHz to 8/20/43.5 GHz

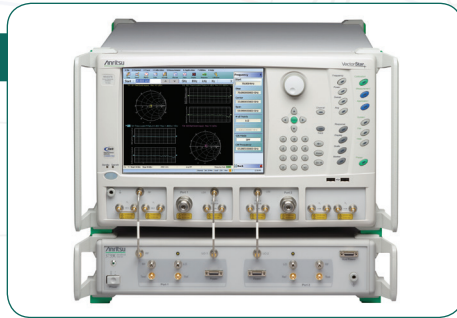


### Field

**VNA Master  
MS202xC**  
5 kHz to 20 GHz

**VectorStar 4 Port  
Broadband VNA  
ME7838A4**

70 kHz to 110/125 GHz



**VectorStar  
Broadband VNA  
ME7838A/E/D**

70 kHz to 110/125/145 GHz  
with banded millimeter-wave  
modules up to 1.1 THz

**ShockLine  
Economy VNA  
MS46322A**

1 MHz to  
4/8/14/20/30/43.5 GHz



**ShockLine  
Performance VNAs  
MS4652xB**

50 kHz to 43.5 GHz  
55 GHz to 92 GHz



**Microwave Site Master  
Handheld Cable &  
Antenna Analyzer  
S82xE**

1 MHz to 40 GHz

Passive Components

Active Components

Broadband and  
Millimeter-wave  
On-wafer

Signal Integrity

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Anritsu utilizes recycled paper and environmentally conscious inks and toner.



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