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.
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.

Anritsu has developed the NLTL technology on a MMIC that delivers cutting edge performance in an efficient and reliable form factor that was previously impossible. Also known as “Shock Line”, this technology is used in Anritsu’s VNA receivers for the down-conversion of microwave and mm-wave signals into IF frequencies. It provides superior conversion efficiency, improved linearity, increased stability and enhanced reliability. The results are evident to the user as increased dynamic range, improved accuracy, and fewer calibrations.

The NLTL technology allows Anritsu to provide wide variety of solutions to meet the needs of high performance R&D, cost-sensitive manufacturing and portable field applications.

An NLTL is a high-impedance transmission line loaded with varactor diodes at regular intervals. They are capable of generating step-like waveforms that have very sharp fall-times and are rich in harmonics.

<table>
<thead>
<tr>
<th>Product family</th>
<th>Application</th>
<th>NLTL-based advantage</th>
<th>Benefit to user</th>
</tr>
</thead>
<tbody>
<tr>
<td>VectorStar™ MS464xB ME7838x</td>
<td>On-wafer device characterization and research and development</td>
<td>Superior conversion efficiency in microwave and mm-wave bands</td>
<td>Achieve high performance over broader frequency ranges—e.g. 109 dB dynamic range at 110 GHz, 104 dB at 125 GHz and 94 dB at 145 GHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Integrated chip design greatly reduces the temperature variations between and across reflectometer</td>
<td>Longer intervals between calibrations, better measurement accuracy and repeatability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High performance in a very small form factor</td>
<td>Enables direct connection of mm-wave extension module to wafer probe</td>
</tr>
<tr>
<td>ShockLine™</td>
<td>Passive component testing</td>
<td>MMIC based VNA reduces number of internal components, and enhances reliability</td>
<td>Lower maintenance cost, reduced down time and operating costs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improved capability-to-cost ratio enables new applications</td>
<td>Dramatic cost reduction in VNA used for manufacturing test</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Integrated chip design greatly reduces the temperature variations between and across reflectometer</td>
<td>Longer intervals between calibrations, better measurement accuracy and repeatability</td>
</tr>
<tr>
<td>Microwave Site Master™</td>
<td>Field measurement, installation and maintenance</td>
<td>Highest dynamic range and superior accuracy</td>
<td>Unprecedented dynamic range to 110 dB at 40 GHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Superior conversion efficiency in microwave bands</td>
<td>More stable and more linear measurements with longer battery life</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MMIC based VNA reduces number of discrete parts and connectors</td>
<td>Lower maintenance cost, reduced down time and operating costs</td>
</tr>
</tbody>
</table>

For a more detailed explanation of the operation and benefits of NLTL technology, please see the Anritsu White Paper “Modern Architecture Advances Vector Network Analyzer Performance”
Don’t let expired calibrations spoil your data!

ME7838E: 70 kHz to 110 GHz
ME7838A: 70 kHz to 110 GHz (operational to 125 GHz)
ME7838D: 70 kHz to 145 GHz

The VectorStar™ ME7838 Series Broadband Vector Network Analysis System delivers 109 dB of dynamic range at 110 GHz, 104 dB at 125 GHz and 94 dB at 145 GHz for high-sensitivity measurements across 70 kHz to 110 / 125 / 140 GHz (up to 1.1 THz with mm-wave modules) with 0.1 dB and 0.5 degree $S_{21}$ stability over 24 hours. This stable broadband performance means you can make high accuracy measurements all day, with the confidence that your calibration remains rock solid! Spend less time calibrating and more time measuring.

<table>
<thead>
<tr>
<th>Challenge</th>
<th>VectorStar solution provides:</th>
</tr>
</thead>
</table>
| Maximizing frequency range to develop accurate device models | Broadest frequency span 70 kHz to 110/125/145 GHz  
- Obtain the most thorough and accurate broadband measurements  
- Accurate low frequency measurements eliminate the time consuming, error-prone concatenation process across the RF, microwave, and millimeter-wave bands |
| Minimizing accuracy/speed tradeoffs | Industry-leading performance and speed  
- Widest dynamic range of 108 dB at 67 GHz, 109 dB at 110 GHz, 104 dB at 125 GHz, and 94 dB at 145 GHz  
- Direct-connect to probes further enhances overall system performance  
- Fastest measurement speed of 110 ms for 401 points at 10 kHz IFBW |
| Improving stability to increase productivity | Extended test time by reducing calibration frequency  
- Compact integrated frequency extension modules provide enhanced stability as compared with old-style hybrid WG/coax modules  
- $S_{21}$ stability better than 0.1 dB and 0.5 degree over 24 hours  
- Improved stability allows for a single calibration to be performed once for a four hour session or even once a day, resulting in an increase in measurement test time of over 37% in a single four hour session! |
| Protecting early prototypes | Only broadband VNA system with real-time power leveling  
- Power sweep control that provides the best power accuracy and stability to power levels as low as −55 dBm  
- Highly responsive real-time power leveling  
- Real-time power level control of up to 55 dB ensures uncompressed linear data and accurate 1 dB compression measurements |
| Minimizing Size and weight constraints | Smallest/lightest mm-wave modules  
- Compact, lightweight broadband modules for easy, precise, and economical positioning on a wafer probe station  
- Direct mounting to probes minimizes cable loss and improves both performance and stability |

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Solve your toughest design challenges with confidence

MS464xB: 10 MHz to 20, 40, 50 and 70 GHz
Optional low frequency extension to 70 kHz
ME7838x: Broadband systems to 145 GHz
Waveguide band extensions to 1.1 THz

The VectorStar™ VNA offers a new performance benchmark for S-parameter measurements of RF, Microwave, and Millimeter wave devices.

In addition to maintaining a peak level of measurement performance, each VectorStar model can be upgraded to a broader frequency range, higher port count, or additional options fitted. Spec the features you need today, then add new ones in the future as required—without fear of obsolescence or the need to learn a new test system.

<table>
<thead>
<tr>
<th>Challenge</th>
<th>VectorStar solution provides:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reducing design cost and cycle time</td>
<td>Hybrid bridge-coupler VNA architecture</td>
</tr>
<tr>
<td></td>
<td>• DC extrapolation errors in modeling minimized by use of bridge structure for capture of high quality low frequency S-parameter data</td>
</tr>
<tr>
<td></td>
<td>• High frequency data quality assured by use of directional couplers</td>
</tr>
<tr>
<td></td>
<td>• Higher quality measurement data leads to fewer design turns</td>
</tr>
<tr>
<td>Locating impedance problems</td>
<td>Best time domain analysis due to hybrid bridge-coupler design</td>
</tr>
<tr>
<td></td>
<td>• Broader coverage from 70 kHz to 70 / 110 / 125 / 145 GHz provides best combination of accurate and hi-resolution low-pass time domain results</td>
</tr>
<tr>
<td></td>
<td>• Time Domain Analysis provides accurate characterization of impedance profiles due to high quality low frequency S-parameter data</td>
</tr>
<tr>
<td></td>
<td>• 100,000 points provide best-in-class alias-free range and low-pass resolution</td>
</tr>
<tr>
<td>Achieving sufficient dynamic range when DUT constrains RF drive level</td>
<td>Only VNA manufacturer using Nonlinear Transmission Line technology (NLTL)</td>
</tr>
<tr>
<td></td>
<td>• NLTL technology used in receivers provides lower noise floor at high end frequencies, test port noise floor of -110 dBm at 70 GHz and -112 dBm at 110 GHz</td>
</tr>
<tr>
<td></td>
<td>• Use lower drive power and achieve desired dynamic range for low power DUTs</td>
</tr>
<tr>
<td></td>
<td>• Obtain superior dynamic range when secondary source limits RF drive level</td>
</tr>
<tr>
<td>Selecting a VNA for specific application</td>
<td>Capabilities and options for VectorStar support measurements in the fields of:</td>
</tr>
<tr>
<td></td>
<td>• Radar</td>
</tr>
<tr>
<td></td>
<td>• On-wafer device characterization</td>
</tr>
<tr>
<td></td>
<td>• Signal integrity</td>
</tr>
<tr>
<td></td>
<td>• Active and passive components</td>
</tr>
<tr>
<td></td>
<td>• Antenna measurements</td>
</tr>
<tr>
<td></td>
<td>• Materials measurements</td>
</tr>
<tr>
<td>Protecting investment</td>
<td>Complete upgradeability within family</td>
</tr>
<tr>
<td></td>
<td>• Meet budget targets; buy what is needed now and protect investment by upgrading later</td>
</tr>
<tr>
<td></td>
<td>• Spread spending across budget years due to ability to add options or upgrade frequency ranges later</td>
</tr>
<tr>
<td></td>
<td>• Test-set concept permits port-count to be increased when required</td>
</tr>
</tbody>
</table>
**Simple. Economical. High Performance.**

MS46322A: 2-port Economy VNA  
MS46522A: 2-port RF VNA  
MS46524A: 4-port RF VNA

ShockLine™ RF and Microwave VNAs eliminate the need to buy expensive instruments for simple S-parameter measurements. ShockLine delivers good performance to 40 GHz at a substantially lower price. These VNAs are ideal for simple engineering, manufacturing and cost-sensitive education applications.

ShockLine family employs multiple architectures that reduce manufacturing costs, enhance calibration stability and minimize measurement uncertainty.

ShockLine VNAs can be used to measure S-parameters, time domain characteristics and signal integrity of passive 1-port, 2-port, 3-port or 4-port devices.

<table>
<thead>
<tr>
<th>Challenge</th>
<th>ShockLine™ solution provides:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance at Low Price</td>
<td>Three different instrument series at various price and performance levels</td>
</tr>
<tr>
<td>Minimize test times and maximize throughput</td>
<td>Wide dynamic range and fast sweep speed shorten test time and increase throughput</td>
</tr>
<tr>
<td>Calibration stability</td>
<td>Less frequent calibrations as a direct result of the NLTL receivers’ thermal stability</td>
</tr>
<tr>
<td>Better measurement accuracy and repeatability</td>
<td>NLTL sampling yields better noise performance than harmonic mixing at higher RF frequencies</td>
</tr>
<tr>
<td>Locating and troubleshooting problem areas in devices</td>
<td>Easier and faster testing with time domain lowpass and bandpass mode with time gating capability</td>
</tr>
<tr>
<td>Reliable and fast remote control interface</td>
<td>LAN interface is more robust than USB and faster than GPIB</td>
</tr>
<tr>
<td>Reduce Learning Curve</td>
<td>Common GUI and SCPI interface</td>
</tr>
<tr>
<td>Efficient use of rack space</td>
<td>Small form factor (2U) with no display or keypad to conserve space</td>
</tr>
<tr>
<td>Protect investment</td>
<td>Upgradable to higher frequency models while reducing switching costs</td>
</tr>
<tr>
<td>Worry-free purchase</td>
<td>3-year standard warranty and worldwide technical support</td>
</tr>
</tbody>
</table>
**Challenge** | **Site Master solution provides:**
---|---
Ever increasing test frequencies | Broadest frequency span from 1 MHz to 8, 14, 20, 30, and 40 GHz
Microwave testing requires greater dynamic range | Unprecedented dynamic range to 110 dB at 40 GHz for real benchtop performance
Need for maximum productivity in the field | Fastest handheld sweep speed of 650 us/data point for quick field measurements
RF interference in field operations | Highest RF immunity of +17 dBm for operation in harsh RF field environments
Need for accurate field measurements | Unsurpassed directivity in a handheld for maximum field accuracy
Field battery-operated equipment requires recharging | Longest battery life with four hours of operation for the most field uptime on one charge
Reading measurements under harsh field conditions | Largest and highest resolution display (8.4 inch, 800 x 600) for maximum readability in all lighting conditions with an intuitive graphical user touchscreen interface
Calibration for all temperature conditions | Full temperature coax calibration kits from -10 °C to +55 °C for field precision measurement
Maintaining calibration | Widest calibration temperature window of ± 10 °C requiring less recalibrations
Need to measure reflection/transmission loss on long, permanently embedded devices | Unique 2-port swept reflection/transmission loss measurement across the whole frequency range of interest in a quick one-step measurement
Simplifying waveguide calibration | The most pre-loaded waveguide calibration component coefficients in the instrument with ten bands for SSL and SSLT calibrations making it convenient for the customer to quickly make calibrations.
Worry-free purchase | 3-year standard warranty and worldwide technical support
<table>
<thead>
<tr>
<th>Family</th>
<th>VectorStar MS4640B</th>
<th>VectorStar ME7098K</th>
<th>ShockLine MS46522A/MS46524A</th>
<th>ShockLine MS46322A</th>
<th>Microwave Site Master S5220E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applications</td>
<td>Device characterization, research and development</td>
<td>Engineering, manufacturing, education</td>
<td>Engineering, manufacturing, education</td>
<td>Field use</td>
<td></td>
</tr>
<tr>
<td>Device under test type</td>
<td>Active, Passive, Nonlinear, Frequency translated, Pulsed</td>
<td>Passive only</td>
<td>Passive only</td>
<td>Optimized for field use</td>
<td></td>
</tr>
<tr>
<td>Frequency range</td>
<td>10 MHz (70 kHz option) to 20, 40, 50, 70, 110, 145 GHz*</td>
<td>50 KHz to 8.5 GHz</td>
<td>1 MHz to 4, 8, 14, 20, 30, 40 GHz</td>
<td>1 MHz to 8, 14, 20, 30, 40GHz</td>
<td></td>
</tr>
<tr>
<td>Number of ports</td>
<td>2 and 4-port</td>
<td>2-port</td>
<td>2-port</td>
<td>2-port</td>
<td></td>
</tr>
<tr>
<td>Dynamic range (@ 10 Hz IFBW)</td>
<td>122 dB (10 MHz to 2.5 GHz) 124 dB (2.5 GHz to 20 GHz) 122 dB (2.5 GHz to 40 GHz) 114 dB (70 GHz) 109 dB (110 GHz) 94 dB (145 GHz)</td>
<td>100 dB (500 KHz to 3 MHz) 110 dB (3 MHz to 6 GHz) 105 dB (6 to 8 GHz) 90 dB typ (8 to 8.5 GHz)</td>
<td>≥ 85 dB (1 MHz to 20 MHz) ≥ 100 dB (20 MHz to 40 GHz)</td>
<td>≥ 85 dB (1 MHz to 20 MHz) ≥ 100 dB (20 MHz to 40 GHz)</td>
<td></td>
</tr>
<tr>
<td>Trace noise (rms)</td>
<td>4.5 mdB (500 KHz to 20 GHz) 6 dB (20 GHz to 67 GHz) 8 mdB (to 70 GHz)</td>
<td>6 mdB (&lt;8 GHz), 100 Hz IFBW</td>
<td>6 mdB 100 Hz IFBW</td>
<td>6 mdB 100 Hz IFBW</td>
<td></td>
</tr>
<tr>
<td>Port power</td>
<td>-25 to +10 dBm (&lt;10 MHz) -25 to +12 dBm (01 to 2.5 GHz) -20 to +13 dBm (2.5 to 20 GHz) -25 to +9 dBm (20 to 40 GHz) -25 to -3 dBm (70 GHz)</td>
<td>-30 to +15 dBm (0.3 to 6 GHz) -30 to +12 dBm (6 to 8 GHz) -30 to +10 dBm (8 to 8.5 GHz) -30 or 0 dBm (8.5 to 40 GHz)</td>
<td>High State : -3 dBm Low state : -20 dBm</td>
<td>High State : -3 dBm Low state : -20 dBm</td>
<td></td>
</tr>
<tr>
<td>Corrected directivity</td>
<td>&gt;50 dB (20 GHz using 36585K AutoCal) &gt;45 dB (70 GHz using 3657-1 Multi-line cal kit)</td>
<td>&gt; 42 dB</td>
<td>&gt; 42 dB</td>
<td>&gt; 42 dB</td>
<td></td>
</tr>
<tr>
<td>Measurement speed, typical (@widest IFBW)</td>
<td>20 μs/point</td>
<td>70 μs/point</td>
<td>220 μs/point</td>
<td>650 μs/point</td>
<td></td>
</tr>
<tr>
<td>Sweep type</td>
<td>Freq: Lin, CW, Segment Power: Lin, log, and constant power sweep or constant power slope over frequency sweep</td>
<td>Freq: Linear, CW, Segment Power: Linear</td>
<td>Freq: Linear, CW, Segment Power: Linear</td>
<td>Linear</td>
<td></td>
</tr>
<tr>
<td>Max number of points</td>
<td>100,000</td>
<td>20,000</td>
<td>16,000</td>
<td>130, 259, 517, 1033, 2065</td>
<td></td>
</tr>
<tr>
<td>Calibration</td>
<td>SOLT, SSLT, SSST, SOLR, LRL, LRM, A-LRM™, AutoCal, Thru Update</td>
<td>SOLT, SOLR, LRL, LRM, WG, Microstrip</td>
<td>SOLT, SSLT (WG)</td>
<td>SOLT, SSLT (WG)</td>
<td></td>
</tr>
<tr>
<td>Embedding, de-embedding</td>
<td>Yes, including multiple networks and extraction utility</td>
<td>Yes, including multiple networks and extraction utility</td>
<td>Yes, including multiple networks and extraction utility</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Built-in bias tee and step attenuator options</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Marker statistics function</td>
<td>Mean, max, min, standard deviation per trace or over a marker region</td>
<td>Mean, max, min, standard deviation per trace or over a marker region</td>
<td>Mean, max, min, standard deviation per trace or over a marker region</td>
<td>Max, min, peak, valley, delta</td>
<td></td>
</tr>
<tr>
<td>Pass/fail testing</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Remote control</td>
<td>GPIB, LAN, USB</td>
<td>LAN</td>
<td>LAN</td>
<td>LAN, USB</td>
<td></td>
</tr>
<tr>
<td>Programming</td>
<td>SCPI, LabView, LabWindows/CVI, .NET/COM</td>
<td>SCPI, IVI drivers</td>
<td>SCPI, IVI drivers. LabView, LabWindows</td>
<td>SCPI</td>
<td></td>
</tr>
<tr>
<td>Major options</td>
<td>Time domain, Rack Mount, Receiver Offset, Dual Source, IF Digitizer, Noise Figure, PulseView™, DifferentialView™, Direct Access Loops, Active Measurement Suite, 70 kHz Low End Extension</td>
<td>Time Domain, Rack Mount</td>
<td>Time Domain, Rack Mount</td>
<td>Time Domain, Rack Mount</td>
<td></td>
</tr>
<tr>
<td>* Waveguide extensions available to 1.1 THz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above data are highlights, please see individual data sheets for full details</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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