Vector Network Analyzer Use in Antenna Measurement Systems

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Increased Need for Antenna Measurements

Antennas are a key element in any communication or radar system. As higher frequencies are considered for automotive radar or for 5G communication systems, beam widths shrink and path loss increases, making accurate characterization of radiation patterns essential. This is especially true in systems utilizing simple or massive multiple input, multiple output (MIMO) antenna designs, where over the air (OTA) testing is the only practical means to verify performance. As a result, engineers need cost effective, simple to use antenna measurement solutions for measuring and characterizing antenna systems.

Today's Challenges	Solution
Dynamic range to overcome path loss at mmWave frequencies	VectorStar and ShockLine VNA families use Anritsu's patented Non Linear Transmission Line (NLTL) technology. NLTL allows for over 100 dB of dynamic range through mmWave frequencies for very small signal applications.
Limiting dynamic range losses when a measurement cannot be done close to the Antenna Under Test	VectorStar and ShockLine VNAs come in a variety of form factors. Anritsu VNA mmWave modules are a fraction of the size of alternative mmWave modules on the market providing a smaller footprint and easier access for direct connections to the Antenna Under Test.
Vector Network Analyzer (VNA) integration and configurations can be a time sink and error prone for less experienced users	The ShockLine MS46522B-082 is a banded VNA from 55 GHz to 92 GHz that comes ready to use out of the box. Anritsu's VNAs combined with Diamond Engineering Inc. Automated Measurement System (DAMS) software can be easily utilized for antenna measurement applications.
A cost effective way of bringing mmWave antennas to mass market	Anritsu VNAs achieve microwave and millimeter wave frequency by using a patented "VNA on a chip" architecture. This technology is less costly than alternatives and reduces module size thereby reducing installation costs.
Fast measurements with enough data to accurately characterize an Antenna Under Test	VectorStar comes with an optical Fast CW option that enables ~200k measurements/second on each receiver with a buffer of 60 million measurements. For users that require even more data, Advanced Fast CW is also an available option. Advanced Fast CW can measure 100 million measurement/second on each receiver with a buffer of 800 million measurements. Both options allow for enough data to quickly and accurately measure antenna performance.

Radiation Pattern Using Measured DAMS Data

2-D Polar plot of a horn antenna at 60 GHz

3-D Spherical-pattern plot of a horn antenna at 60 GHz

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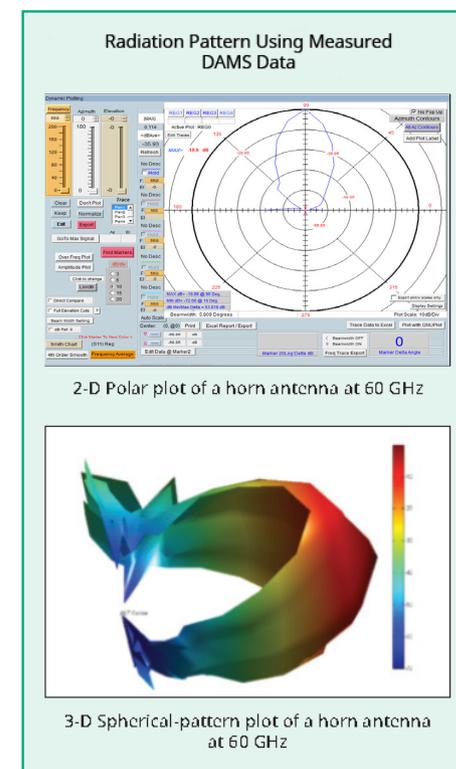
Anritsu Vector Network Analyzers Enable Low Cost Antenna Characterization Measurements

VectorStar® MS4640B Vector Network Analyzer family provides maximum performance for antenna measurements. VectorStar is available with a wide range of swept frequency choices from 70 kHz to 70/110/125/145 GHz with a single coaxial test port, covering most of the current communication standards and all of the proposed 5G standards.

VectorStar provides flexibility for all antenna application spaces. Fast CW and Advanced Fast CW option provide a powerful tool for measuring antenna performance. With up to 120 dB (rms) measured noise floor, VectorStar's high sensitivity can easily measure very low signals. For antenna measurements that require pulse measurements, VectorStar has a PulseView option. It can be configured for various types of signal generation and also comes with receiver gating to isolate intended signals only.

ShockLine™ Vector Network Analyzers are available in a variety of frequencies and performance levels. ShockLine VNAs are ideal for price sensitive customers that want to reduce the cost of tests without sacrificing quality. ShockLine Vector Network Analyzer software has special features like a maximum efficiency and kQ product measurement that provides real time measurements of antennas used for wireless power transfer applications.

For E-Band antenna measurements, the ShockLine MS46522B with option 82 comes with tethered modules. The tethered module architecture of the E-band VNA is very well suited for antenna measurement applications. The source/receiver modules are small and lightweight enough to connect directly to the antenna under test. This puts all the critical measurement circuitry as close to the DUT as possible minimizing issues like RF loss and measurement instability due to cabling.

MS4647B Example Noise Floor (standard configuration)
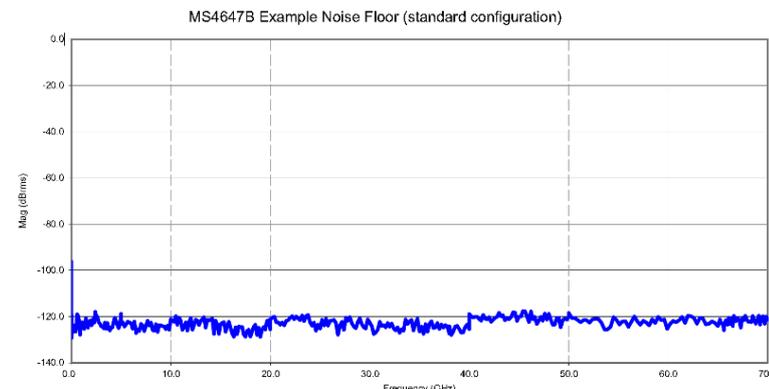
VectorStar Dynamic Range from 70 kHz to 70 GHz

ShockLine MS46522B-082B E-band Module

VectorStar mmWave Module

ShockLine MS46522B-082B Setup with DAMS

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