Application Brief

VNA Signal Integrity Measurement Challenges

Anritsu
envision : ensure

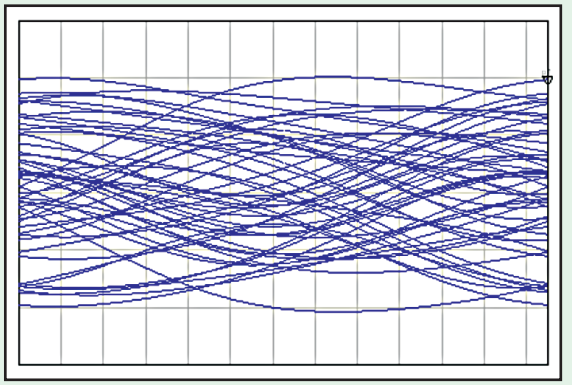
Eliminating High-Speed Interconnect Bottlenecks

Cloud computing and mobile internet services are causing large increases in network traffic. The instantaneous traffic rates at internet data centers have reached 1 Tbit/s and device interconnects are becoming transmission bottlenecks. Assuring signal integrity at high data rates while minimizing cost requires closing the loop of simulation and measurement during the design stage.

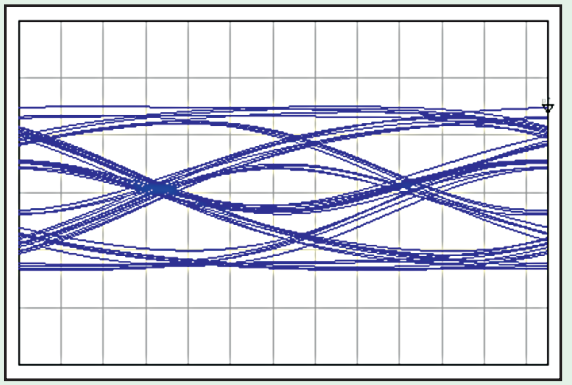
Today's Challenges:

Compliance to standards	Designs for speeds exceeding 20 Gbit/s require test solutions with frequencies ranging from near DC to 43.5, 70 or even 110 GHz in a single sweep. Minimizing measurement uncertainty ensures compliance to new standards.
Correlating simulation and measurement	Accurate models help accelerate your design cycle. Poor causality results in reduced confidence in simulations. Minimizing DC extrapolation errors improves model accuracy and leads to better agreement with 3-D EM simulators. Poor quality low frequency S-parameter data can lead to erroneous eye diagram simulations. Concatenating measured data from multiple VNAs is time consuming and often introduces errors.
Cost/performance tradeoffs	Higher data rates introduce new design challenges like skin effects and dielectric loss on PC boards, along with the trade-offs of vias, stackups, and connector pins. Accurate measurements provide the confidence to make performance/cost decisions.
Test fixture de-embedding	Many passivity/causality problems are due to poor calibration and de-embedding methods. High fixture loss may affect the accuracy and repeatability of de-embedding.
Changing measurement needs over time	Increasing bit rates or moving from passive device or linear active device measurement to non-linear device measurement can lead to the need for expensive new test equipment purchases.

Simulated Eye Diagrams using Measured S-Parameter Data



20 Gbit/s transmission with 0.5 dB insertion loss error at 10 MHz



Using accurate low frequency S-parameter data reveals a compliant eye-pattern that is 85% open

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Anritsu VectorStar® and ShockLine™ VNAs Resolve High-Speed Interconnect Bottlenecks

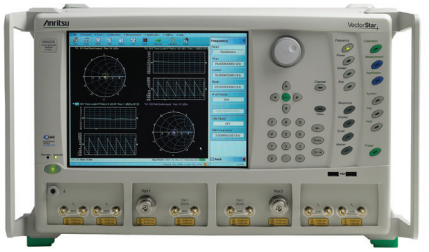
The VectorStar MS4640B Series offers the best VNA performance across the widest frequency bandwidth. Direct broadband measurements from practically DC to greater than 110 GHz with high accuracy time domain and wide dynamic range frequency domain measurements make VectorStar the ideal tool for Signal Integrity (SI) designers characterizing the highest speed data channels.

For lower speed data channels, the ShockLine MS46500B series is an excellent VNA with time and frequency domain measurement capabilities similar to VectorStar for SI applications.

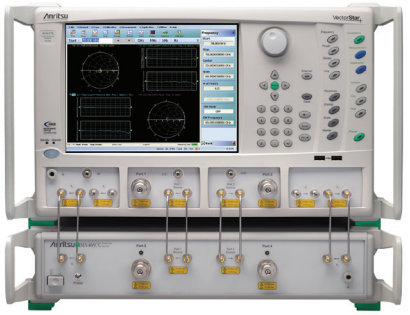
For transmission, reflection, NEXT and FEXT measurements on high speed balanced transmission lines and connectors, VectorStar and ShockLine both offer 2 and 4-port solutions.

Feature	Benefit
Broadband frequency spans **ShockLine – 50 kHz to 43.5 GHz** **VectorStar – 70 kHz to 70/100/145 GHz**	• Obtain the most thorough and accurate broadband measurements • Eliminate the time consuming, error prone concatenation process across the RF, microwave, and millimeter-wave bands
Highest performance S-parameter measurements down to nearly DC	• Accelerate your design cycle with reduced risk of DC extrapolation errors in your modeling • Eliminate the need for concatenation of low and high frequency VNAs • Simulate eye diagrams with confidence
Best time domain analysis	• VectorStar gives the broadest coverage from 70 kHz to 70/110/145 GHz providing the best combination of accuracy and hi-res low pass time domain results • VectorStar can capture up to 100,000 points providing best-in-class alias-free range • ShockLine 500B series delivers 50 kHz to 8.5/20/43.5 GHz frequency coverage with a maximum of 20000 points for excellent time domain accuracy and resolution.
Widest range of calibration and de-embedding techniques	• Improves ability to locate discontinuities, impedance changes, and crosstalk issues • Newer more flexible and repeatability-tolerant methods help resolve complex 28+ Gbit/s problems
Eye diagram options provide signal integrity simulation analysis	• VectorStar simultaneously displays Eye, TDR, and S-parameters on the VNA; no need to switch between VNA measurements and PC based measurements • ShockLine with Option 22 can plot NEXT, FEXT, and skew as well as eye diagrams for convenient SI analysis
Configurability and upgradability	• Buy what's needed now and protect your VectorStar investment by upgrading later or spread spending across budget years • Add DifferentialView™ and second source option to VectorStar for true mode stimulus measurements and also benefit from a continuous measurement display while actively editing key parameters • ShockLine 500B series VNAs come in multiple frequency ranges (8.5, 20, 43.5 GHz) to match the requirements of different SI applications • VectorStar and ShockLine share a common software interface, easing the transition between one family to the other from the lab to production

MS4640B VectorStar Series
70 kHz to 20/40/50/70/110/145 GHz



VectorStar Series Expandable
4-port solution 70 kHz to 70 GHz



Shockline MS46500B series 2 and
4-port 43.5 GHz VNAs

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