TELEDYNE LECROY
Everywhereyoulook™

SPARQ™
Signal Integrity Network Analyzer

High-bandwidth,
Multi-port S-parameters

SPARQ: S-PARAMETERS QUICK

Key Features

- **Provides complete S-parameter measurements on up to 12 ports**
- **Measures from DC to 40 GHz**
- **One-button-press internal OSLT calibration**
- **Analyzes in both frequency and time domain**
- **Produces mixed-mode and single-ended simulation-ready S-parameters**
- **Remove effects from fixtures, connectors and launches using either Time Gating or S-parameter de-embedding**
- **Inherent TDR/TDT capability and preview modes for quick checks and debugging**
- **Characterizes crosstalk of multi-lane differential structures**
- **Available at a fraction of the cost of other network analyzer solutions**

The SPARQ™ signal integrity network analyzers connect directly to the device under test (DUT) and to PC-based software through a single USB connection for quick, multi-port S-parameter measurements.

SPARQ is the ideal instrument for characterizing multi-port devices common in signal integrity applications at a fraction of the cost of traditional methods.
It is ideal for:

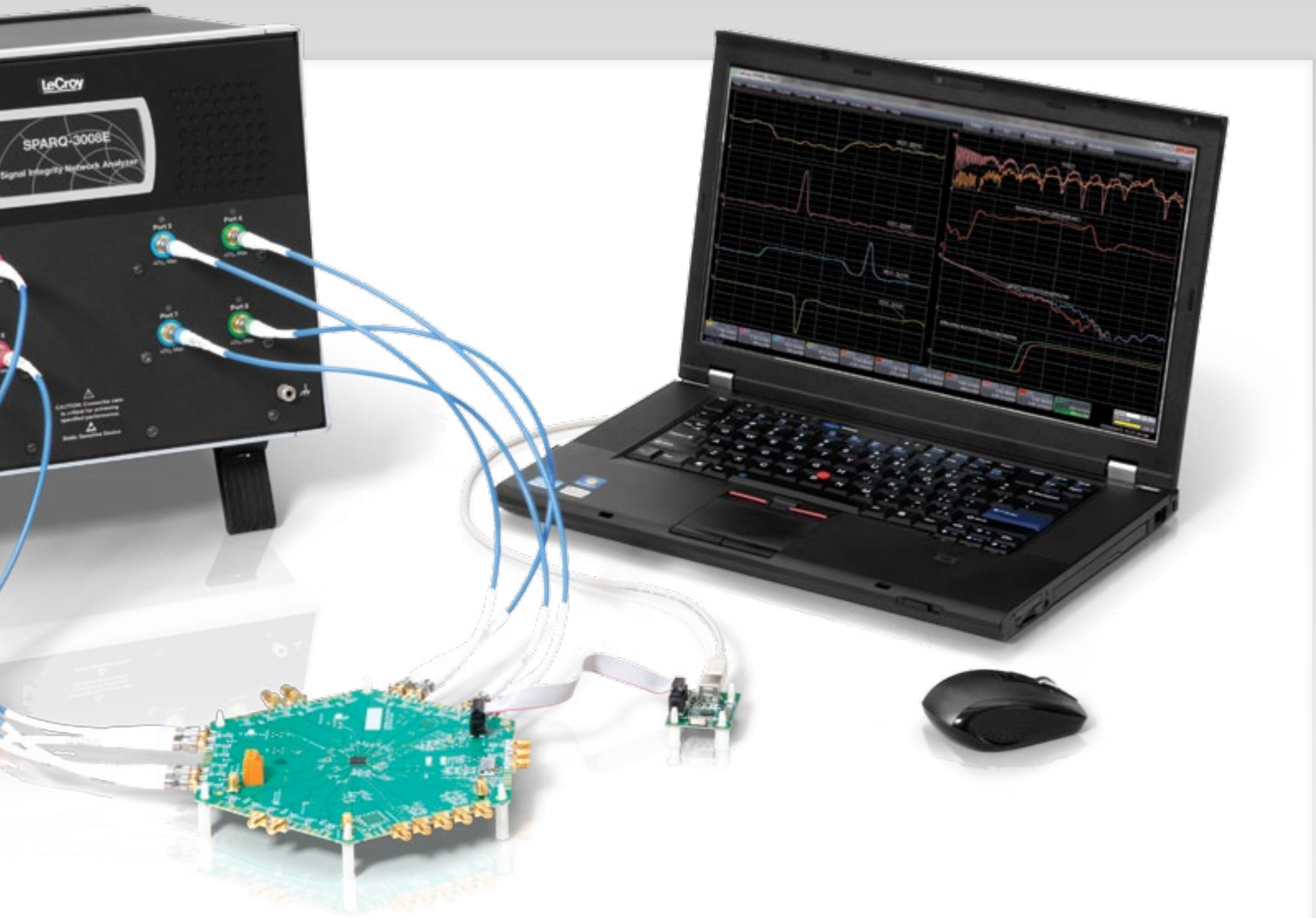
- **Development of measurement-based simulation models**
- **Design validation**
- **Compliance testing**
- **High-performance TDR**
- **PCB testing**
- **Portable measurement requirements**

High-bandwidth, Multi-port S-parameters for the Masses

S-parameter measurements are most often produced by the vector network analyzer (VNA), a difficult instrument that is beyond many budgets. SPARQ is very affordable and simplifies measurements, making S-parameters accessible to all.

PC-based, Small and Portable

Traditional instruments that produce S-parameters are large and fundamentally stationary. The SPARQ, in contrast, is small, lightweight and portable. It connects to any standard PC through a USB 2.0 interface, allowing SPARQ to run where computing power is easily upgraded.



S-parameters, Quick

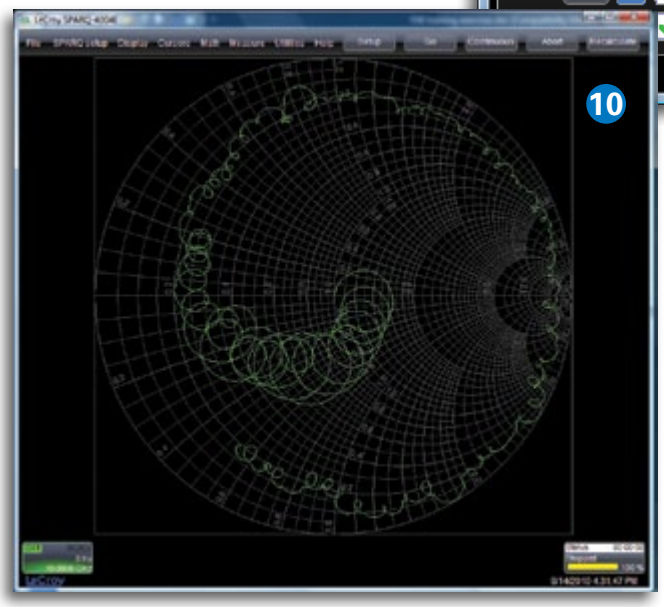
VNA measurements begin with the unpleasant and complex task of calibration. This involves multiple connections that can produce misleading results due to operator error. The SPARQ provides calibrated measurements with a single connection to the DUT and offers simple setup choices. Start and complete the entire measurement with a single button press.

Internal Calibration

SPARQ takes a revolutionary approach to calibration by building in calibration standards. This enables measurements to be made eliminates the need for additional expensive electronic calibration (ECAL) modules. Calibration proceeds quickly without user intervention, so one can calibrate often without resorting to the use of out-of-date saved calibrations.

THE SIGNAL INTEGRITY TOOLS YOU EXPECT

1. Differential- and common-mode step response at input and output ports
2. Mixed-mode return loss to 40 GHz
3. TDR traces shown during measurement
4. Differential- and common-mode insertion loss to 40 GHz
5. Mode conversion step responses
6. Differential- and common-mode impedance vs. electrical length
7. Rise time normalization for all time domain results
8. Up to 16 measurements can be displayed simultaneously
9. Independent zoom control over each trace
10. Smith chart display alone, or with individual S-parameter plots



The SPARQ signal integrity network analyzer displays time and frequency domain measurement results simultaneously.

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Includes the Tools That You Expect

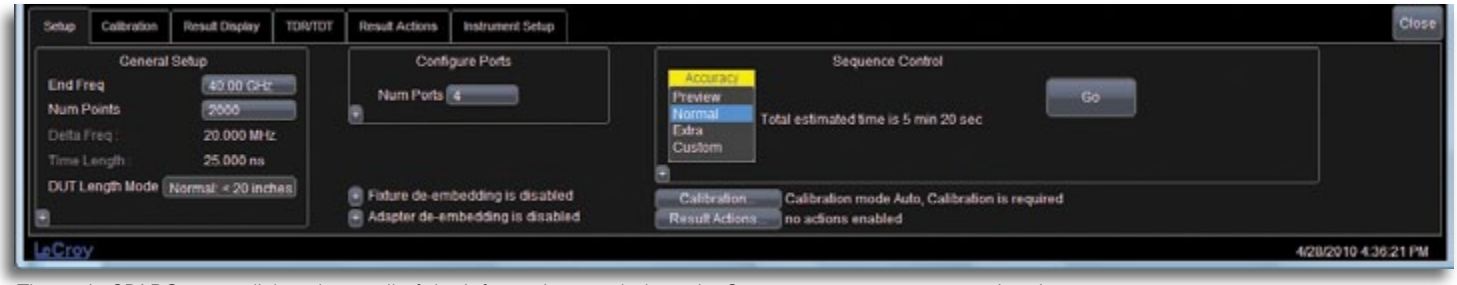
A signal integrity network analyzer should include well-integrated tools for providing measurement and analysis in both time and frequency domains. Signal integrity requires more than just S-parameters; the time domain offers important insight as it shows the performance of the S-parameter models in simulation.

SPARQ includes standard all of the hardware and software tools needed to make signal integrity measurements right out of the box.

These tools include capabilities that cost extra on most instruments. Mixed-mode S-parameter conversion and port renumbering, passivity, reciprocity and causality enforcement are all standard. Built-in time domain views like impedance, rho, step response and impulse response are included as well. All time domain results can be normalized to your system rise time.

The SPARQ hardware includes calibrated cables for each port, calibrated female 2.92 mm connectors for each port for adapting the connector gender, a universal wrench for holding most popular connector sizes, and a precision torque wrench.

DESIGNED FOR EASE-OF-USE



The main SPARQ setup dialog shows all of the information needed to take S-parameter measurements in minutes.

Streamlined Setup

The simple setup shown in the main setup screen above is all that is needed to configure a SPARQ measurement. You provide the frequencies and number of ports and then go. Helper information like time length assist in frequency spacing choices, and DUT length mode choices control the pulser repetition rate for faster measurements. Various measurement sequence control modes allow for trade-offs between precision and speed, and helper information provides an estimate of the measurement time. All measurements proceed automatically without user intervention. Advanced screens are easily accessible for extra capability.

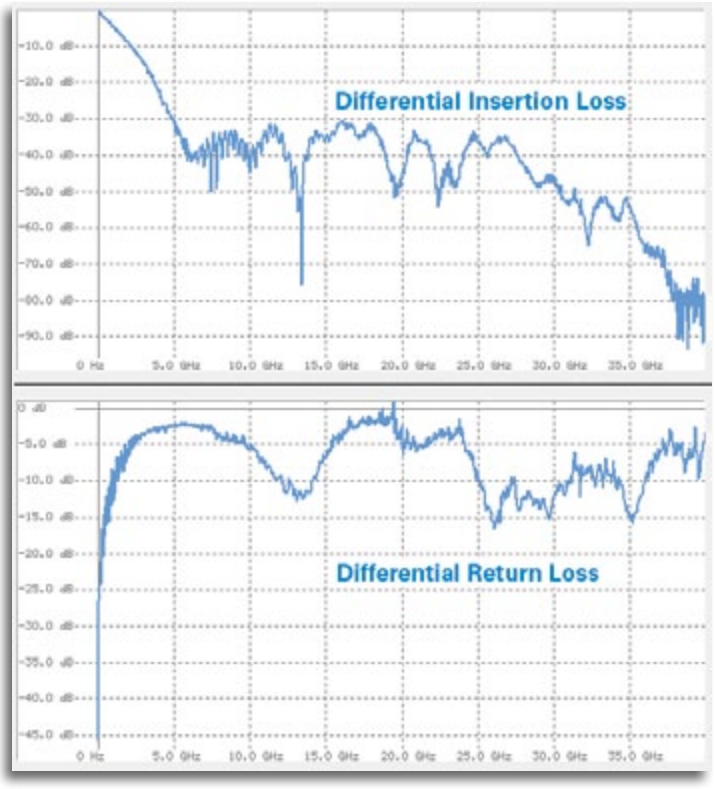
Mixed-mode S-parameters

Measurements encountered in signal integrity applications are often differential-mode or common-mode. SPARQ makes these mixed-mode measurements straightforward through the use of both graphical and tabular displays so there is no doubt about the format of the measurement results.

SPARQ easy to understand dialogs ensure that your mixed-mode S-parameters are properly formatted and avoids errors.

The Next Generation of TDR/TDT

The SPARQ is designed with different capabilities than instruments you might have used in the past. The SPARQ's built-in calibration makes the measurement easy and

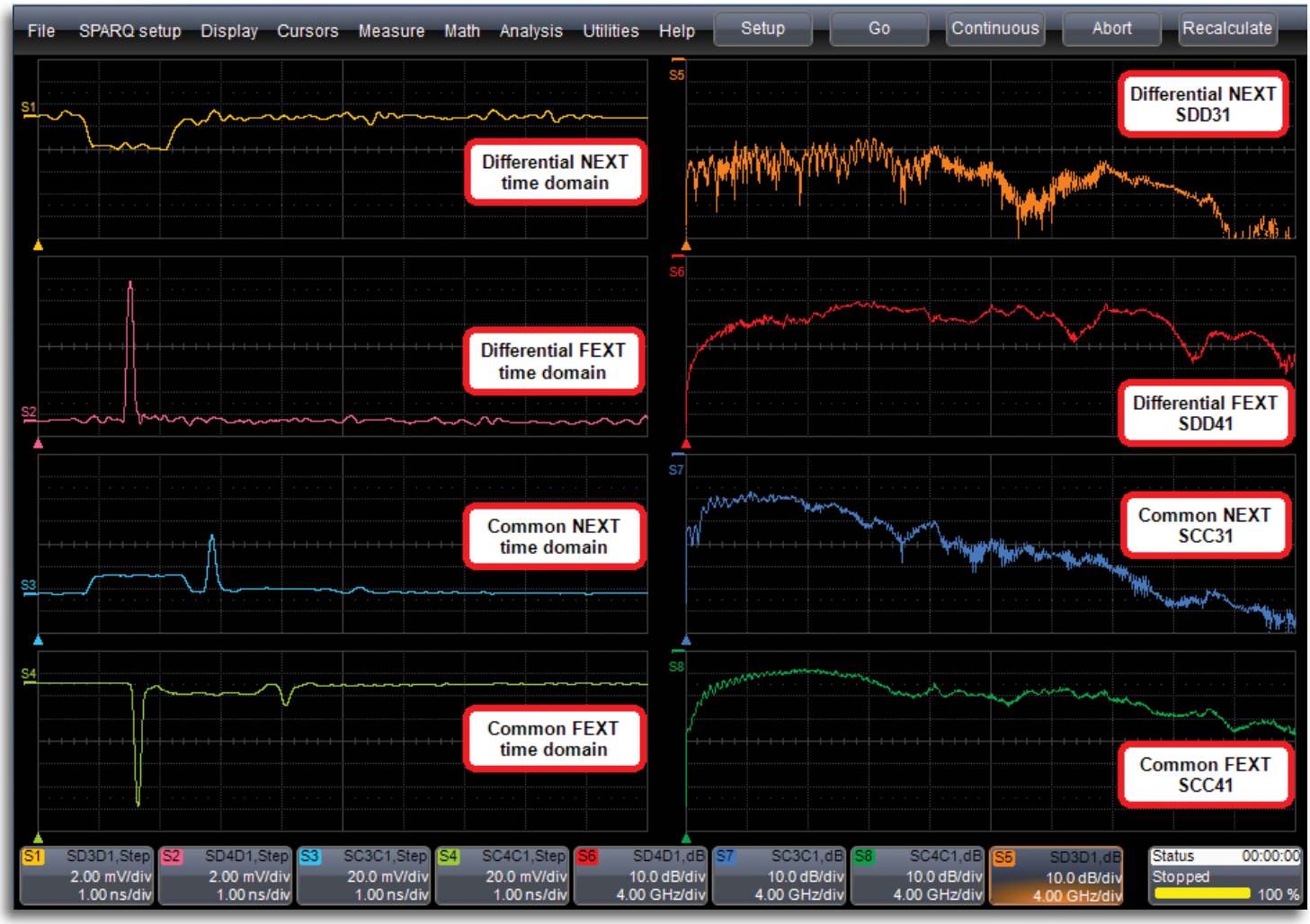


SPARQ mixed-mode measurements are useful for determining the quality of high-speed channels.

fast without trading off calibration accuracy. Older TDR/TDT based instruments claimed to be easier than frequency domain instruments, but sacrificed calibration for ease-of-use.

The SPARQ is designed for high dynamic range with its unprecedented 6 ps pulser rise time and the Teledyne LeCroy patented coherent interleaved sampling (CIS) time base. This time base removes time base nonlinearity endemic to equivalent time sampling and enables fast averaging that is at least ten times faster than traditional TDR/TDT methods. The result is high-frequency measurements with much higher dynamic range than previously possible.

MULTI-LANE CROSSTALK MEASUREMENTS



8 and 12-port SPARQs measure both near-end and far-end crosstalk (NEXT and FEXT). In this screenshot, both time-domain and S-parameters are displayed for the differential and common signal crosstalk.

Characterize Crosstalk on Multi-lane Devices

Crosstalk has become a challenging signal integrity effect due to the increasing use of multi-lane differential signaling. Multi-lane signaling has become pervasive, and is used in standards such as, PCIe Gen3, Serial Rapid IO, InfiniBand, and 40/100 GBASE Ethernet. The densities of signal lines and via fields in backplanes, connectors and interconnects has become a key source of signal integrity issues leading to closed eyes and excessive jitter. Signal integrity engineers find that they must attempt to both predict and understand these issues when designing multi-lane differential circuits and interconnects to avoid time-consuming design modifications and costly respins. The 12-port SPARQ can measure the full S-parameter matrix of 3-lane differential structures. Such measurements can be used in aggressor-victim-aggressor studies. 8-port SPARQs can measure structures with 2 differential lanes, for aggressor-victim simulations. With either the 8 or 12-port SPARQ, users can simultaneously measure differential near-end crosstalk (NEXT) and far-end crosstalk (FEXT), and view the results in both the time and frequency domains.

SIMULATION READY S-PARAMETERS

From Measurement Directly to Simulation

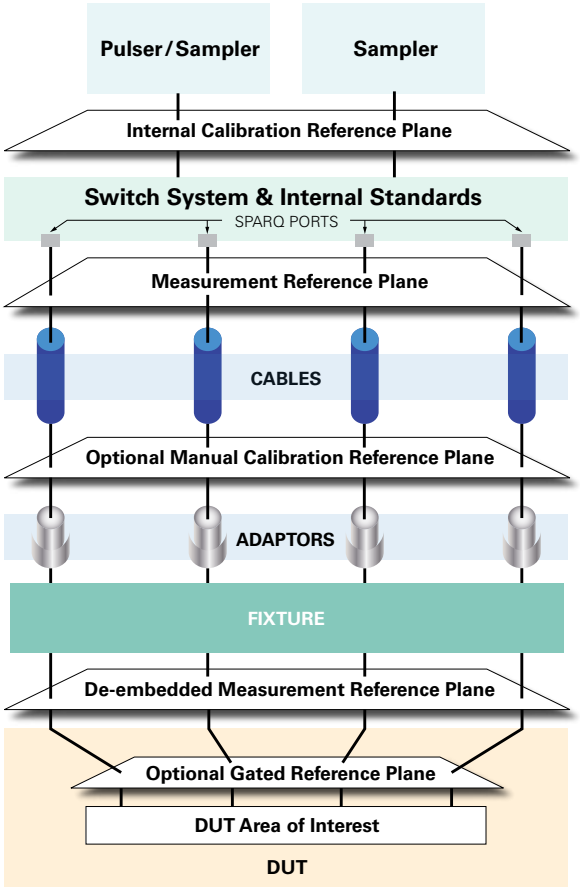
S-parameters present many difficulties for time domain simulators. These difficulties come from the two ends of the frequency spectrum. Lack of a DC point and truncation of the high frequency content causes simulation problems. Since it is based in the time domain, SPARQ provides a DC measurement point and 40 GHz frequency content so that simulators come up with the right answer. SPARQ provides enforcements of passivity, causality and reciprocity to ensure physical measurement results and provides time domain views so that time domain behavior is verified right at the time of measurement to ensure proper simulation results.

Built-in De-embedding

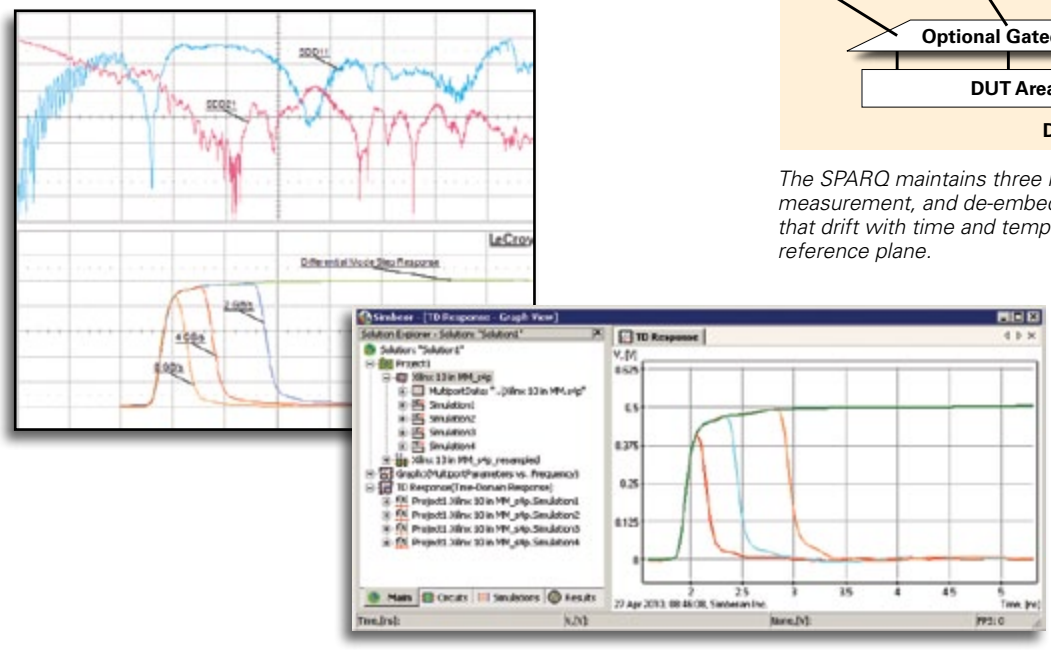
DUT connection and de-embedding present two major, related problems in S-parameter measurements. SPARQ allows the user to de-embed cables, adaptors and fixtures automatically from the measurements to extract the S-paramaters of the DUT. SPARQ utilizes its internal calibration capability and provides fully de-embedded device measurements; no external software tools are required. In situations where direct calibration to a new reference plane is desired, the user can use manual calibration techniques such as open-short-load-thru (OSLT) and save and recall these calibrations.

Built-in Time Gating

With the SPARQ, time gating can be used to determine the S-parameters of their DUT without effects caused by connectors and launches that are necessary to connect the DUT to a network analyzer. The gating can be performed using either an impedance peeling algorithm or by simple port extension. In addition to returning the S-parameters of the gated region, then S-parameters of the excluded regions are saved as S2P files.



The SPARQ maintains three reference planes – calibration, measurement, and de-embedded DUT. It keeps items that drift with time and temperature behind the calibration reference plane.



SPARQ based S-parameters show strong correlation with simulations that use these models as shown in the above comparison of SPARQ time domain displays and a Simbeor® simulation. Also shown are the SDD11 and SDD21 measurements acquired by the SPARQ.

Simbeor is a trademark of Simberian® Inc.

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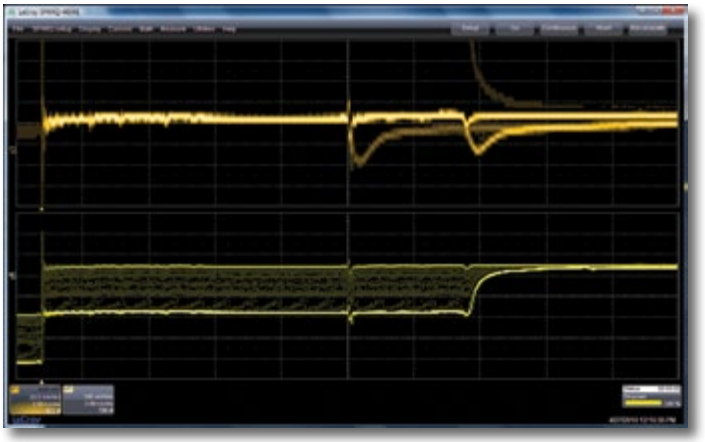
Advanced Features that Prevent Mistakes and Wasted Time

A frustrating situation is to find that after spending the time to calibrate and take S-parameter measurements, something is wrong either because of a mistake or a poor connection. Sometimes it is hours or days before the problem is detected; that is hours or days of suspect data in use.

Because SPARQ is TDR/TDT based, it can be used to provide basic troubleshooting before you get too far into the measurement. By driving the SPARQ in its native TDR/TDT mode, engineers can pinpoint and isolate intermittent problems quickly.



Raw TDR mode persistence showing added near- and far-end capacitance (upper grid) and the effect of wiggling a bad cable (lower grid).

SPARQ also offers preview modes: quick measurement modes that are useful for identification of measurement problems both in the time and frequency domain. A fully calibrated four-port preview measurement takes about three minutes from DUT connection to result display.

"Time-domain measurements" mean that all of the measurement information is contained in acquisitions of step responses taken under various conditions. This is unlike frequency domain instruments which use frequency sweeps. The SPARQ allows the storing and recalling of all of the time-domain acquisitions performed during measurement so that later you can recall the data and even change the measurement conditions like changing the number of frequency points or configuring for mixed-mode conversions. Results are recalculated based on the saved information without resorting to repeat measurements.

Rugged and Reliable Design

SPARQ utilizes high-frequency, highly reliable internal switches to route signals from pulser/sampler modules to internal calibration standards and to the device under test. SPARQ uses these switches to park the inputs to a 50 Ohm load during down time to help protect against electrostatic discharge (ESD).

SPARQ utilizes precision 2.92 mm connectors at its connection ports. It ships with high phase-stability, low-loss cables to maintain its high dynamic range to 40 GHz. These cables provided with every unit are color-coded and calibrated. Color coding helps you visually keep track of correct cable connection. Of course, the user can use any type of cable or probe desired that connects via 2.92 mm or SMA.

The SPARQ utilizes high-precision 2.92 mm connectors—these can be mated with precision SMA connectors.

SIGNAL INTEGRITY STUDIO

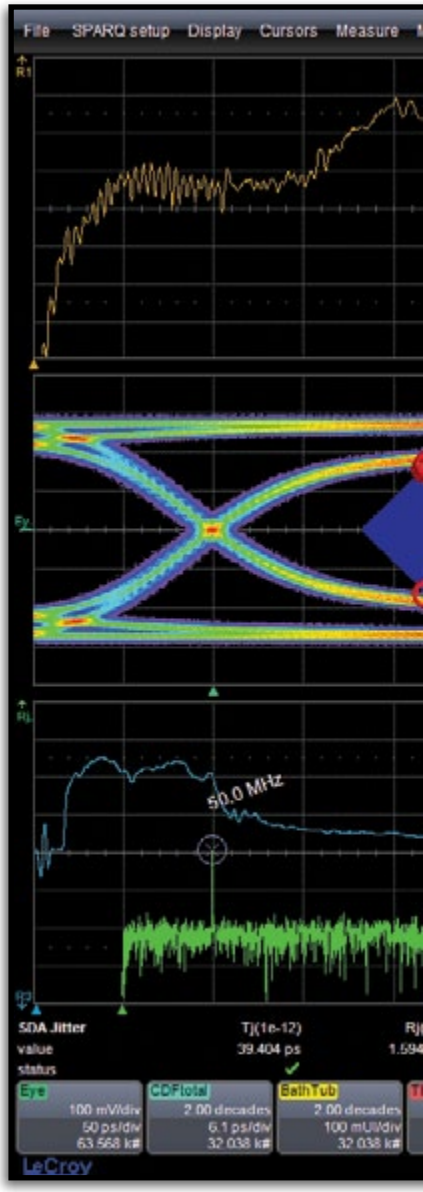
Key Features

- **Seamless integration with Teledyne LeCroy SPARQ™ S-parameter measurements**
- **Full signal integrity analysis of equalized receiver signal**
- **Fast eye diagramming**
- **Advanced jitter analysis**
- **Co-simulation of measured and/or modeled network characteristics**
- **De-embedding and emulation of channel and fixture responses**
- **Emulation of CTLE, DFE & FFE equalizers and PLL**
- **Available as standalone software with USB license key or as an option installed on a Teledyne LeCroy SPARQ**

End-to-end Signal Integrity Workstation

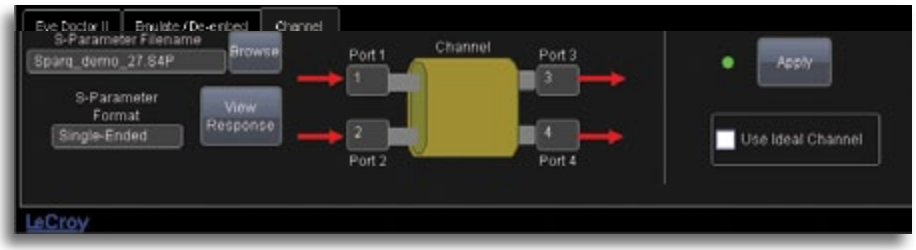
Signal Integrity Studio combines S-parameter measurements, channel and equalizer modeling and eye diagramming and jitter analysis in a single affordable software package. "SI Studio" is available as a standalone version or as an option for a Teledyne LeCroy SPARQ series network analyzer.

With Signal Integrity Studio, users analyze the effects that impedance mismatches, losses, emphasis and equalization choices have on signal integrity characteristics of a device under test. S-parameters measured from an imported Touchstone file are used to emulate or de-embed a channel. Models for emphasis and equalization and a simulated waveform are configured by the user, and the resulting eye diagram can be viewed and analyzed to provide insight into the eye closure and jitter characteristics of the DUT and receiver design.



See Effects of Measured S-parameters Immediately

Signal Integrity Studio works seamlessly with the SPARQ v Series Signal Integrity Network Analyzers. S-parameters measured live by the SPARQ link directly to user's configuration for channel and fixture emulation or de-embedding configuration. As the SPARQ acquires new S-parameters, the application rapidly shows the affect of the newly acquired measurements. The SPARQ measures 40 GHz S-parameters with single button press operation at a fraction of the price of a VNA, and is available in 2-, 4-, 8- and 12-port versions.



Channels are de-embedded or emulated using either modeled or measured S-parameters.

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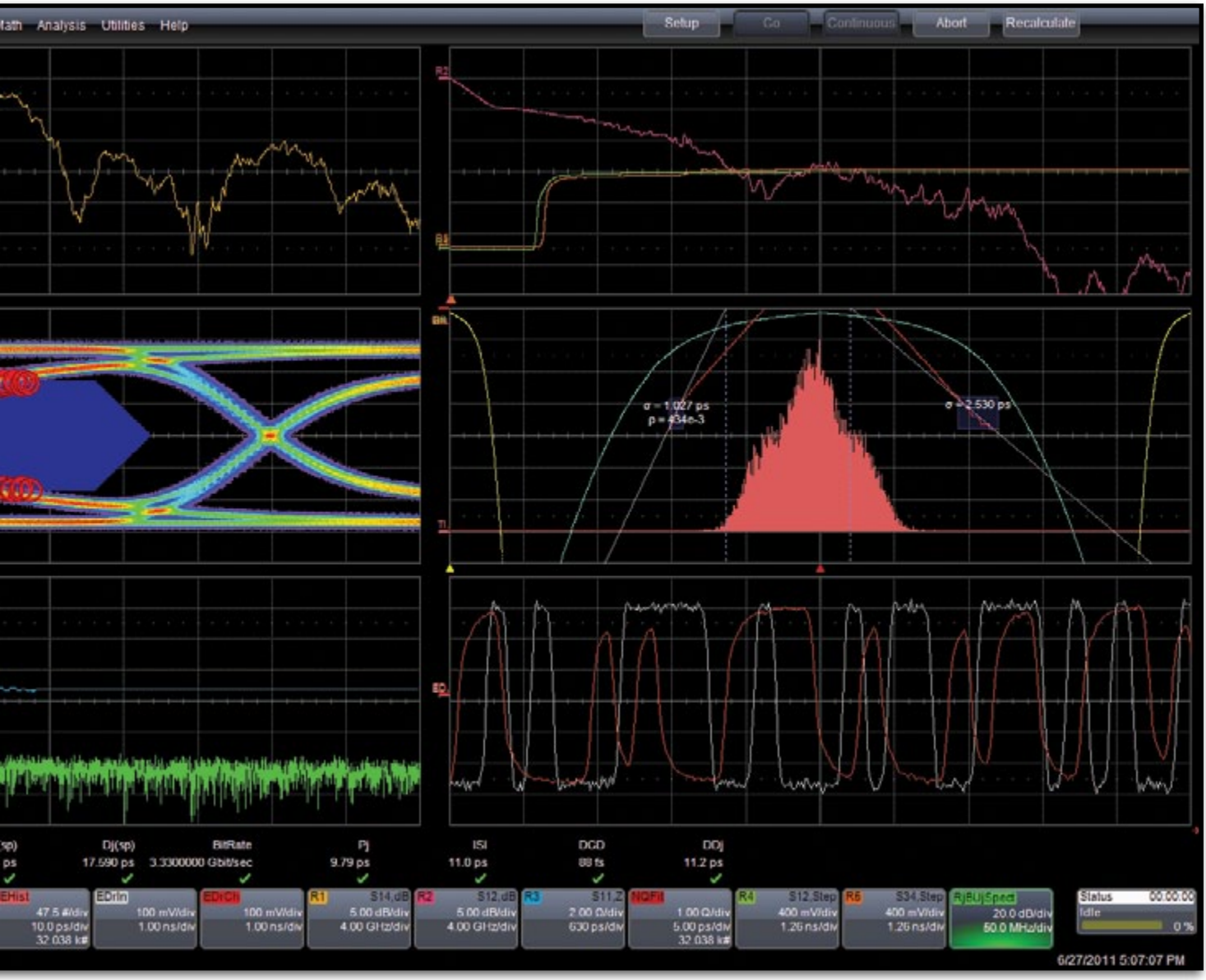
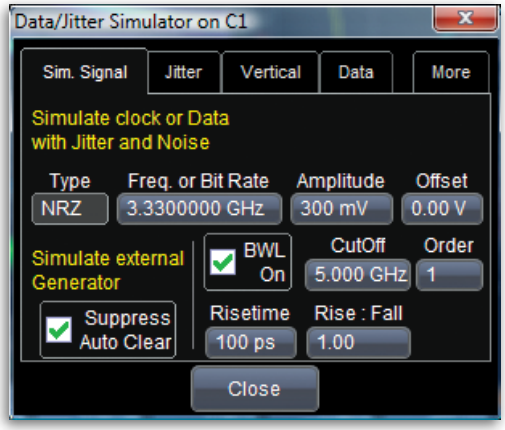


Signal Integrity Studio enhances the modeling and simulation capabilities of the Teledyne LeCroy SPARQ application, adding eye and jitter measurements.

Simulate Serial Data Patterns with Impairments

Signal Integrity Studio analysis begins with a long serial data pattern output from the built-in simulator. Serial data waveform types include NRZ, RZ, bpNZ and clock. Impairments such as vertical noise, horizontal jitter, overshoot/undershoot, periodic jitter aggressors and ISI can be configured. Waveforms previously saved on Teledyne LeCroy oscilloscopes can be used as a signal source.



SI Studio utilizes a versatile built-in simulator as a signal source

FROM MEASUREMENT TO SIMULATION

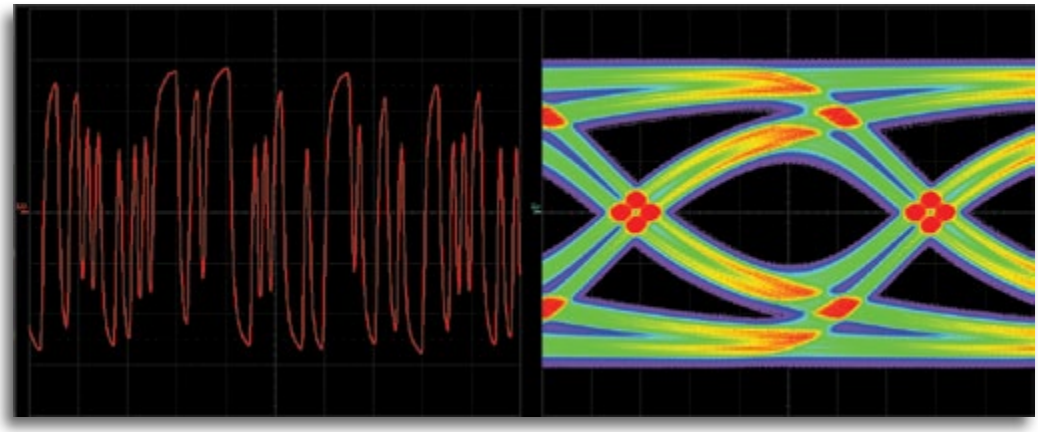
Determine Optimal Equalizer Settings

Users can open up closed eyes via a simple GUI for configuring pre-emphasis, de-emphasis, continuous time linear equalization (CTLE), feed forward equalization (FFE) or decision feedback equalization (DFE) filters, and standard or customizable PLL settings. Users can configure settings manually, or allow the software to configure automatically.

Equalizer and pre/de-emphasis (not shown) are easily modeled via SI Studio's "EyeDoctor II" dialogs.

Rapidly Measure Eye Diagrams

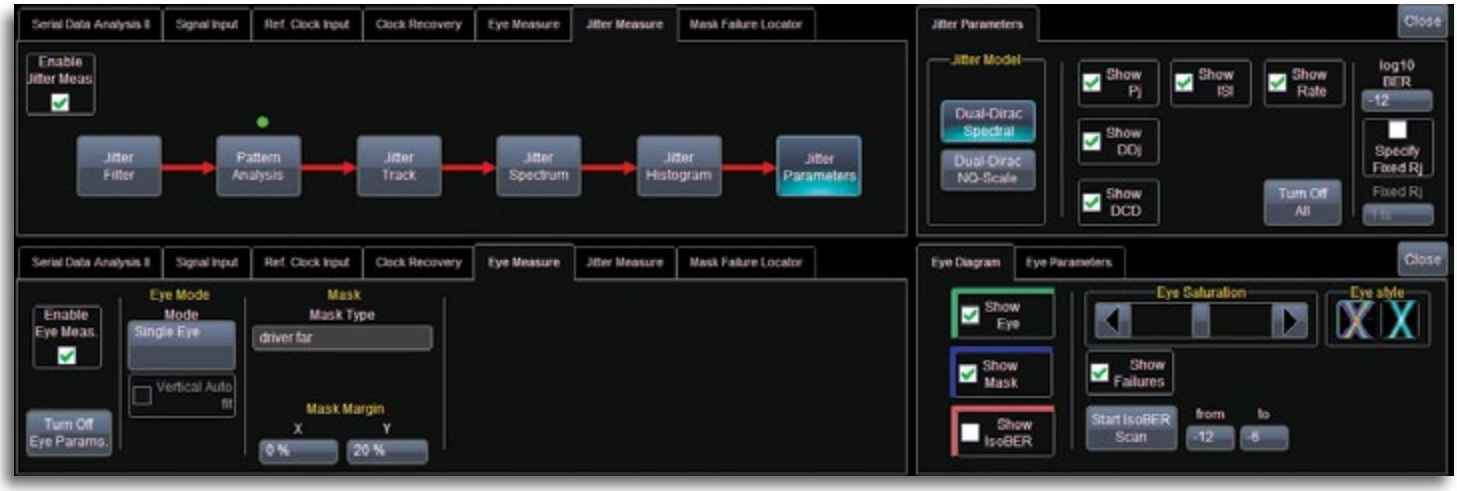
The equalized signal is rapidly sliced into component unit intervals and an eye diagram created that is available for analysis. Users can display up to 11 eye diagram measurements, and perform mask testing to determine if the channel and equalizer settings result in a compliant eye.



With SI Studio, users can see what the waveform would look like after channel impairments, and view the corresponding eye

Analyze Jitter in Time and Frequency Domains

Signal Integrity Studio has >15 views of jitter to give insight into the affects of jitter aggressors and consequences of signal integrity issues in the design of the channel and equalizer. Jitter analysis includes standard Tj, Rj and Dj dual-dirac model measurements, jitter spectrum, jitter histogram and more.



A rich set of jitter and eye diagram analysis tools yield deep insight signal integrity issues of the device under test.

visit teledynelecroy.com/SIStudio

Standalone Operation

Customers who purchase SPARQ-SISTUDIO can access Signal Integrity Studio capabilities via a USB license key that ships with each order. Users can make measurements with the SPARQ, and then use the application software with its Studio features while "untethered" from the SPARQ. This mode of operation allows users to recalculate their S-parameters and re-analyze eye and jitter characteristics without the SPARQ hardware.

Seamless Integration with Teledyne LeCroy SPARQ

SI Studio is available as a software option for the Teledyne LeCroy SPARQ. Purchase SPARQ-SISTUDIO along with your SPARQ to give all users who connect to the SPARQ access to Signal Integrity Studio capabilities. When connected to a SPARQ that includes the SI STUDIO option, S-parameters can be measured and immediately used in simulations to study the signal integrity characteristics of a device under test.

SI Studio Features

Simulator	
Signal Type	**Serial Data:** NRZ, RZ, bpNZ and clock
Signal Characteristics	Frequency, Amplitude, Risetime, Overshoot, Undershoot, Spike, Vertical Noise, Horizontal jitter, Periodic Jitter, ISI
Emphasis	Pre-emphasis or De-emphasis, Auto-add, Auto-remove, Custom setting of up to 8 taps
De-embedding / Emulation	Emulate or De-embed channel using Touchstone 1.0 S-parameter file measured on connected Teledyne LeCroy SPARQ or imported from SPARQ or VNA
Equalizer	**CTLE:** Auto-set boost, or custom settings for DC gain, zero frequency, pole 1 frequency, pole 2 frequency **FFE:** Auto-find levels and tap values for user-selectable taps/precursor taps, or manually set values **DFE:** Auto-find levels and tap values for user-selectable taps/precursor taps, or manually set values and erasure delta **PLL:** Select from predefined software PLLs, including FC Golden, PCIe, DVI, FB-DIMM, USB3.0 SS or custom set
Eye Measurements	Eye Height, Eye Width, Eye Amplitude, Eye Crossing, One Level, Mask outs BER, Mask Hits, Zero Level, Avg Power
Jitter Measurements	**Scalar:** Tj, Rj, Dj, DDj, DCD, Pj, ISI **Waveforms:** Jitter Spectrum, Jitter vs Time (JitterTrack), Dj Extraction, Jitter Distribution, Qfit, Jitter CDF, Bathtub Curve, Filtered Jitter, ISOBER Analysis
Additional	See Teledyne LeCroy SPARQ datasheet for additional software specifications

DESIGN VALIDATION TO COMPLIANCE TESTING

Compliance Testing

SPARQ satisfies numerous transmitter, receiver, cable and fixture compliance testing requirements for standards such as:

- SATA TxRx Tests
- PCI Express
- SAS PHY Tests
- Fibre Channel
- USB
- DisplayPort
- HDMI

SPARQ can perform all tests currently made with TDR or VNA instruments—only easier. Some tests that SPARQ performs include:

- Impedance
- Return Loss
- Impedance Imbalance
- Insertion Loss
- Crosstalk (near- and far-end)
- Differential- to common-mode conversion
- Common- to differential-mode conversion
- Intra-pair skew
- Voltage transfer functions

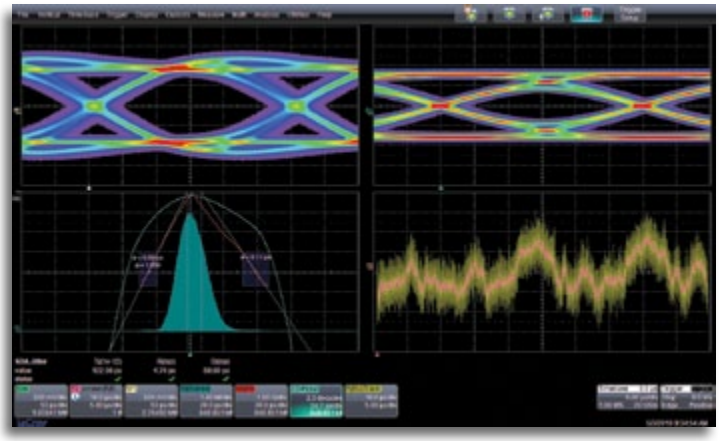
All measurements can be made in differential-mode, common-mode or single-ended, as applicable.

Printed Circuit Board Testing

Specifications for printed circuit boards are moving rapidly higher in frequency. The use of high-speed signaling on many boards involves more demanding tests than in the past. SPARQ measures all high-speed PCB specifications such as:

- Propagation velocity
- Dielectric constant
- Impedance
- Loss
- Skew

It performs all of these measurements for differential- and common-mode as well as single-ended, where applicable. SPARQ is much easier to operate than all other solutions and its 40 GHz upper frequency preserves your investment for many years.



SPARQ produced S-parameters are shown here working with Teledyne LeCroy oscilloscope based tools like the popular serial data analysis (SDA) and Eye Doctor™ tools in a co-simulation environment to predict the behavior and equalization requirements of a high-speed serial channel.

Seamless Integration with Other Signal Integrity Test and Measurement Tools

Teledyne LeCroy offers industry leading performance in digital oscilloscopes for signal integrity applications. The Eye Doctor analysis software utilizes S-parameters to de-embed and embed channels, connectors, cables and fixtures in serial data analysis. These tools operate directly on acquired waveforms in real time. When used in conjunction with Teledyne LeCroy's serial data analysis (SDA) software, the reference plane for eye diagram and jitter measurements can be moved to an ideal location (transmitter output) or to a standardized location for compliance testing (far-end of a compliance test channel). Additionally, SPARQ can aid in the design of transmitter and receiver equalizers by giving the user the ability to emulate the known channel response and simulate the effects of different equalizers.

SPECIFICATIONS

Model Specific Specifications

Model	3012E	3008E	3004E	3002E	4004E	4002E	3002M	4002M
Ports	12	8	4	2	4	2	2	2
Calibration	Internal, Automatic						Manual	Manual
Operating Frequency	DC - 30 GHz				DC - 40 GHz		DC - 30 GHz	DC - 40 GHz
S-parameter Measurements	Single-ended and mixed mode (calculated)							
Calibration Method	OSLT							
Connector Type	2.92 mm							

Standard Measurement Capability

Frequency Domain Displays	Magnitude, Phase, Real and Imaginary
Time Domain Displays	Impulse Response, Step Response, Rho, Z – normalized to specified rise time
Result Displays	Up to 16 measurements displayed simultaneously
Display Modes	Smith Chart, single, dual, tandem, triple, quad, quattro, hex, octal
De-embedding Modes	User cables, adaptors, and optional fixture
File Outputs	Touchstone 1.0
Result Actions	Auto-save and e-mail

Pulser / Sampler and Time base

Step Amplitude	200 mV (nominal top-base, 50 Ω termination)	
Rise Time	6 ps 20–80% typical — as measured by sampler	
Input Voltage Range	+/-2V pk maximum (Exceeding may cause damage)	
Noise	-50 dBm (no averaging, bandwidth limited to 40 GHz)	
Repetition Rate	5 MHz (normal DUT length mode) and 1 MHz (long DUT length mode) @ 30% duty cycle	
Hardware Averaging	Fast Averaging at 10 Million Points/Second	
Acquisition Rate	Normal DUT Length Mode: 250 acquisitions/second, nominal Long DUT Length Mode: 50 acquisitions/second, nominal	
Acquisition Duration	Normal DUT Length Mode: 50 ns; Long DUT Length Mode: 250 ns	
Dynamic Range	77 + 0.26 f – 1.33 $\sqrt{(f)}$ – 20 Log(f); (typical, f in GHz; > 48 dB at 30 GHz in 'Normal' sequence control mode)	77 + 0.272 f – 0.931 $\sqrt{(f)}$ – 20 Log(f); (typical, f in GHz; > 50 dB at 40 GHz in `Normal´ sequence control mode)
Time Base Type	Coherent Interleaved Sampling (CIS)	
Equivalent Time Sample Rate	204.8 GS/s	
Jitter	≤ 300 fs rms	

Internal Switching Relays

Frequency Rating	40 GHz
Rated Life	2 million actuations per contact
Insertion Loss	< 1.1 dB at 40 GHz
VSWR	< 1.8 @ 40 GHz
Switching Variation	Insertion loss: 0.05 dB, 0.9 °, VSWR 0.087 @ 40 GHz
Single Relay Port-port Isolation	> 50 dB @ 40 GHz (pulser / sampler port-port isolation > 100 dB @ 40 GHz)

Environmental

Temperature (Operating)	5 °C to 40 °C (Internal Calibration valid 20 °C – 30 °C)
Humidity (Operating)	Maximum relative humidity 80% for temperatures up to 30 °C, decreasing linearly to 50% relative humidity at 40 °C
Altitude (Operating)	Up to 10,000 ft (3,048 m) at or below 30 °C

Physical Dimensions

Dimensions	11.10" H x 13.07" W x 13.6" D (282 x 332 x 345 mm)		7" H x 13" W x 13" D (178 x 330 x 330 mm)	
Shipping Dimensions	20 7/8" H x 21 1/16" W x 19" D (530.2 x 534 x 482.6 mm)		12" H x 25" W x 20.5" D (305 x 635 x 521 mm)	
Weight	26.1 lbs (11.84 kg)	23.2 lbs (10.52 kg)	17 lbs. (7.711 kg)	14.78 lbs. (6.70 kg)
Shipping Weight	35.75 lbs (16.21 kg)	32.5 lbs (14.75 kg)	29 lbs. (13.17 kg)	26.78 (12.14 kg)

Power Requirements

Voltage	100 to 240 VAC (±10%) at 50/60 Hz; Automatic AC voltage selection
Max. Power Consumption	80 W (80 VA) (Operating Mode), 7 W (Standby)

Recommended PC Configuration

Operating System	Microsoft Vista® or Windows® 7, 64-bit (Note: The SPARQ application will run on Windows® 32 bit operating systems, but S-parameter calculation time will be impaired)	
Processor	Intel® Core™ i7 or better	Intel® Core™2 Duo @ 2.4 GHz or better
Memory	4 GB RAM or better	
Hard Drive	2 GB available free space	
Display Resolution	1280 x 780	
Connectivity	USB 2.0 High-speed	

ORDERING INFORMATION

Product Description	Product Code
Signal Integrity Network Analyzers	
30 GHz, 12-port, Internal Calibration, Signal Integrity Network Analyzer	SPARQ-3012E
30 GHz, 8-port, Internal Calibration, Signal Integrity Network Analyzer	SPARQ-3008E
30 GHz, 4-port, Internal Calibration, Signal Integrity Network Analyzer	SPARQ-3004E
30 GHz, 2-port, Internal Calibration, Signal Integrity Network Analyzer	SPARQ-3002E
30 GHz, 2-port, Manual Calibration, Signal Integrity Network Analyzer	SPARQ-3002M
40 GHz, 4-port, Internal Calibration, Signal Integrity Network Analyzer	SPARQ-4004E
40 GHz, 2-port, Internal Calibration, Signal Integrity Network Analyzer	SPARQ-4002E
40 GHz, 2-port, Manual Calibration, Signal Integrity Network Analyzer	SPARQ-4002M

Options and Accessories

Signal Integrity Studio	SPARQ-SISTUDIO
2 x 40 GHz Cables	SPARQ-C402
4 x 40 GHz Cables	SPARQ-C404
Manual Calibration Kit	SPARQ-OSLT
Soft Carrying Case	SPARQ-SFTC

Included with Standard Configuration

Color-coded, serialized, calibrated cables, one per port

Accessory Kit including female 2.92 mm adaptors (one per port), universal wrench, torque wrench, and USB memory stick containing software and calibration data

Calibration and Performance Certificate

Power Cord (country appropriate)

USB Cable

Soft Carrying Case (2 and 4-port models)

Warranty and Service

3-year Warranty Under Terms of Instrument Use

Customer Service

Teledyne LeCroy instruments are designed, built and tested to ensure high reliability. In the unlikely event you experience difficulties our instruments are warranted for three years under normal usage conditions.

Teledyne LeCroy provides optional services to keep your SPARQ providing accurate measurements year after year.

This warranty includes:

- No charge for return shipping
- Long-term 7-year support
- Upgrade to latest software at no charge
- Optional service contracts for SPARQ calibration and extended warranty
- Economically priced upgrades to higher port-count models

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1-800-5-LeCroy
teledynelecroy.com

Local sales offices are located throughout the world.
Visit our website to find the most convenient location.