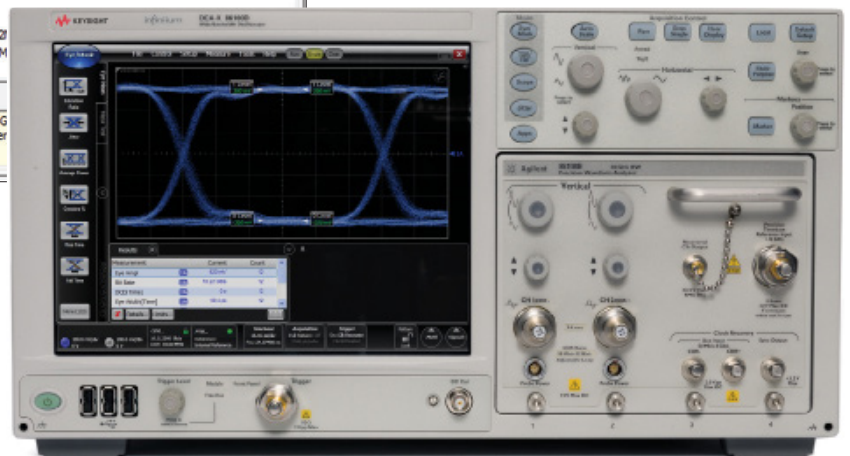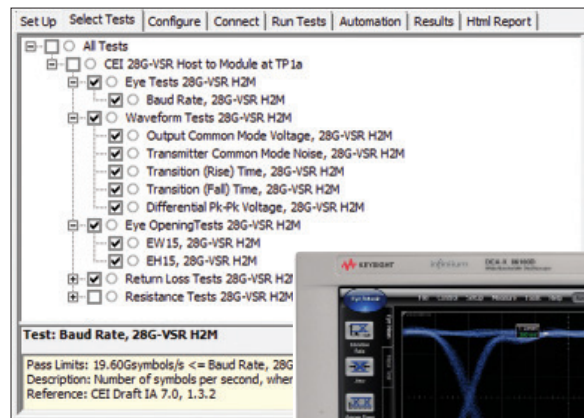# N1012A OIF CEI 3.0 Compliance and Debug Application for 86100D DCA-X Oscilloscopes

Reduce Your OIF CEI 3.0
and VSR Test Times from
Hours to Minutes

Data Sheet

Introduction

Rapidly increasing worldwide demand for video and data transfer is placing new requirements for network expansion. Designers are creating innovative network elements that allow up to 100 Gb/s, which will be delivered using four lanes of 25-28 Gb/s. Extra challenges abound when transferring these signals on printed circuit boards, even for short distances. The Implementation Agreement for Optical Internetworking Forum Common Electrical Interface (OIF CEI) 3.0 specifies the tests and limits for these devices.

These parameters can take a full day when characterized manually, and the recalculation of factors and CTLE values adds to the time the designer spends on testing. Keysight Technologies, Inc. has created the N1012A OIF CEI 3.0 Compliance and Debug Application for you to simplify measurement of these transmitter parameters and to obtain full results to test limits in a few minutes. This will keep you focused on getting your products to market knowing that your results are built on the heritage and consistency of Keysight measurement technology.

Easy-to-use compliance application that enables you to:

– Quickly set up equipment and make transmitter measurements

– Test your device to compliance or chosen limits

– Debug your device using custom configurations

– Remove effects of cables and fixtures

– Automatically determine optimal value of CTLE Peaking

– Generate reports to share with others

Transform Complexity into Simplicity

Satisfying the broad requirements of the OIF CEI 3.0 and VSR Implementation Agreements can be very complex. The data rates for each interface have a range, rather than a fixed rate common to many standards. The test list between each OIF CEI interface varies as do the test limits; some limits depend upon previous measurements to perform the final calculations. Designers need to satisfy requirements on highly-advanced integrated circuits, host boards and modules when operating over long, medium, short and very short reaches. An extract from the 28G-SR specification table from the CEI 3.0 Implementation Agreement is on the right.

| Characteristic	Symbol	MIN	TYP	MAX	UNIT
Baud Rate	T-Baud	19.90		28.05	Gsym/s
Output differential voltage	T_Vdiff	800		1200	mVppd
Differential resistance	T_Rd	80	100	120	Ω
Differential termination resistance mismatch (see table 1-3)	T_Rdm			10	%
Output rise and fall time (20% to 80%)	T_tr, T_tf	8			ps
Common mode noise	T_Ncm			12	mVrms
Differential output return loss	T_SDD22			−6	dB
Common mode output return loss	T_SCC22			−4	dB
Output common mode voltage	T_Vcm	−100		1700	mV

Hosts and modules have unique interface connectors and require compliance boards to enable connection to test equipment as shown here. Designers endeavor to minimize the trace lengths on the compliance boards and cable lengths.
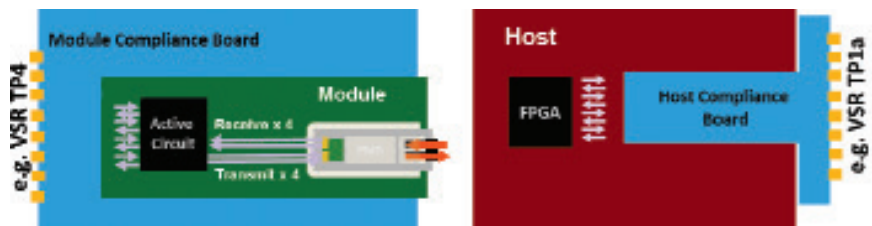
By pairing your test fixture or compliance board with the 86100D, 86108B and N1012A software, you will have the simplest and most powerful solution available to optimize your designs and offer the best products to customers. Phase trimmers and a pair of cables complement your set up for the most consistent and accurate measurements. You can easily remove the effects of cables or fixtures through intuitive Configure choices.
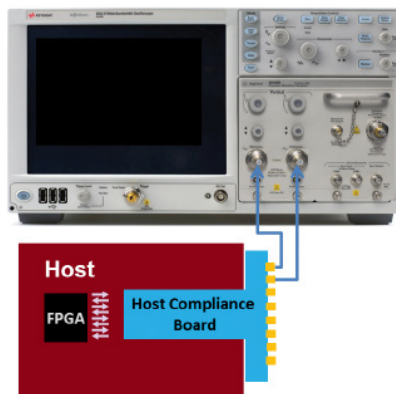

Development and characterization of advanced integrated circuits is time-consuming and expensive. Designers utilize test boards similar to the one on the right to fully characterize their parts for use in their own circuits or in their customer's circuits.

3
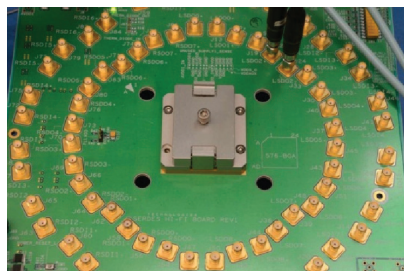
# Debug and Verify Your Designs Quickly and Easily

Choose Your Hardware

Configure your oscilloscope for a single module (on the right) or multi-module (listed in ordering guide). Connect your device through the recommended phase trimmers and you now have access to measurements with intrinsic jitter as low as 45 fs. Also have the PNA available for return loss and differential to common mode measurements.
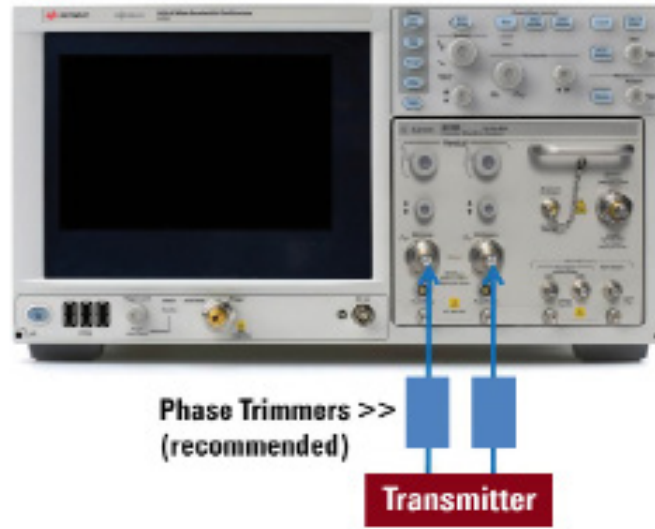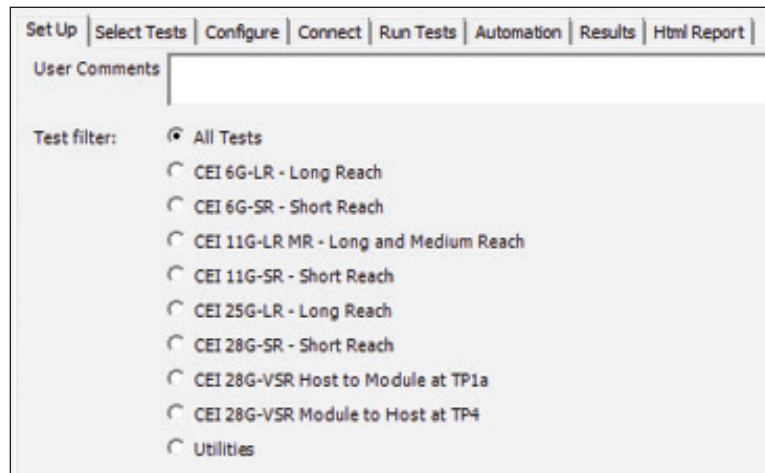

Configure Your Measurements

Customize parameters that are specific to your set-up such as baud rate and attenuation. Use default values or enter your own for settings such as number of samples or patterns taken and peaking for CTLE. Choose Normal mode to test within compliance limits and choose Debug mode to test to your custom limits.
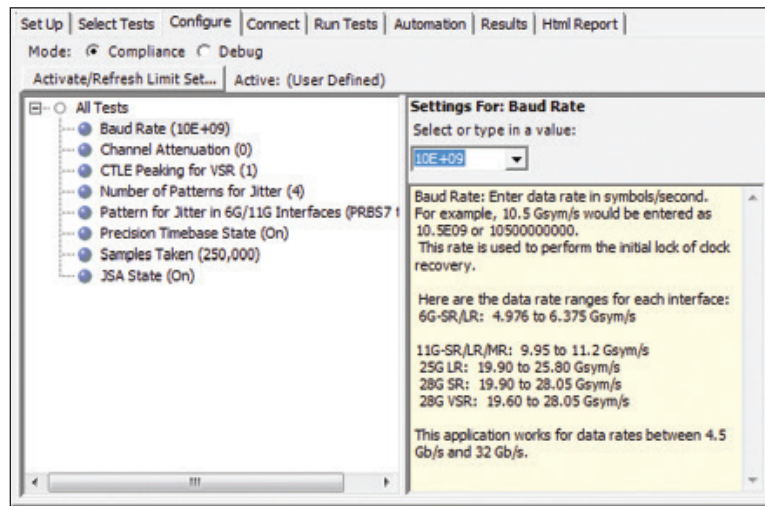

Select Any CEI 3.0 or VSR Interface

The N1012A OIF CEI Compliance Application covers all eight CEI 3.0 and VSR interfaces, which include rates from 4.9 Gb/s to 28.1 Gb/s. Click on the desired interface and the appropriate tests are offered in Select Tests.

Choose from Over 115 Tests

All tests required for each of the eight interfaces are available. You may click on all tests, a group of tests or individual tests. The full test name appears in the test list, and also is shown in the test results and reports. A description of the test and reference to the CEI Implementation Agreement are shown for each test.
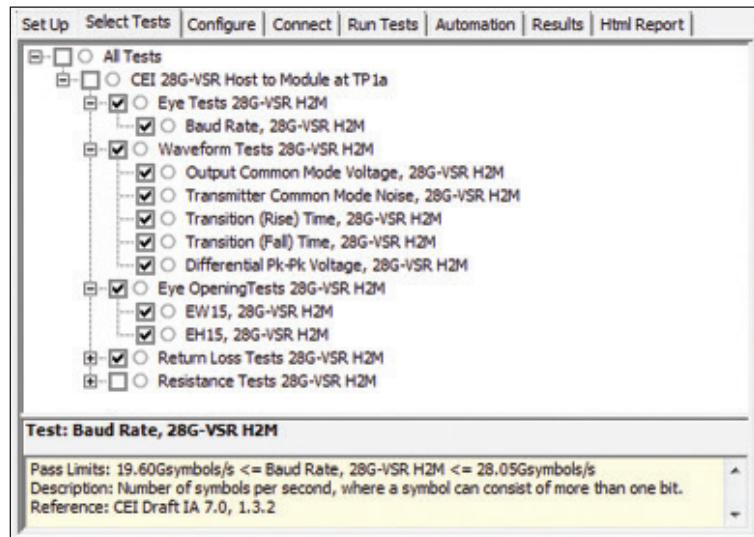
Measure Challenging Parameters Fast

Simply follow the steps and click Run Tests. The N1012A and the DCA will automatically measure your device.

Use a wide range of modules such as the 86108 and N1045A. Characterize jitter for PRBS31 signals with integrated Option 401. Remove the effects of cables and fixtures by using convenient Configure choices.
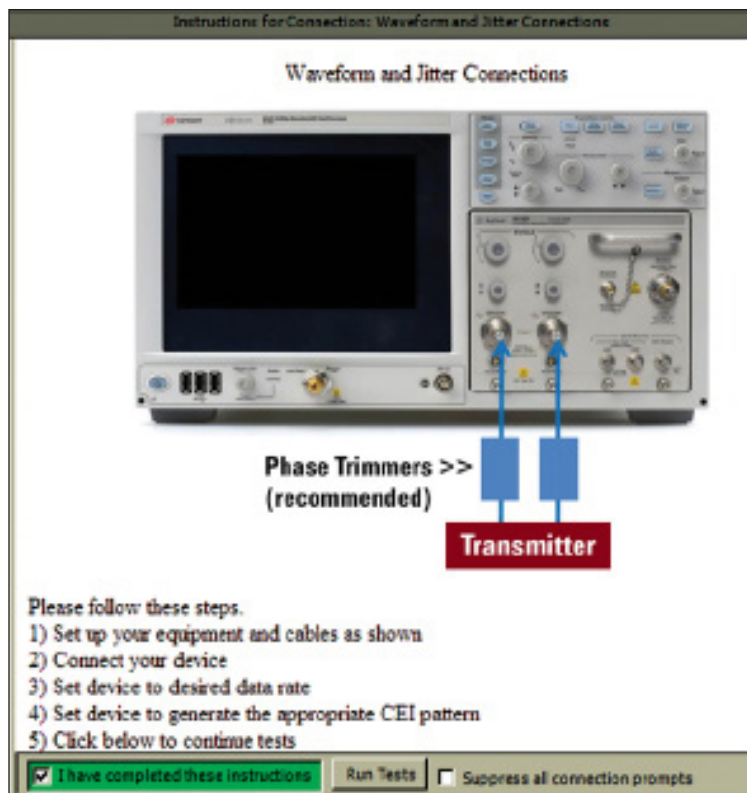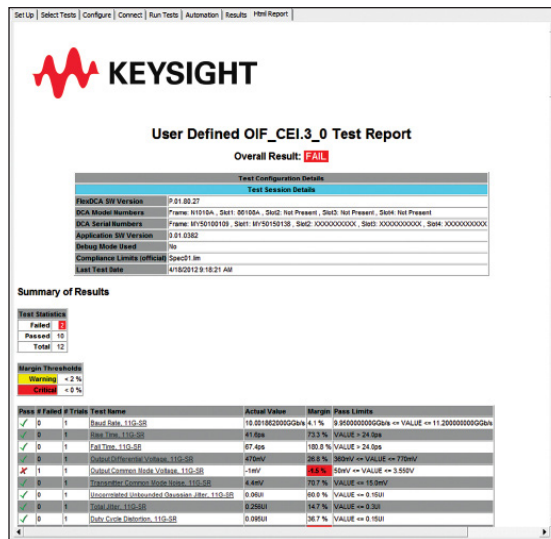
# Debug and Verify Your Designs Quickly and Easily (continued)

Obtain Concise Compliance Report

Users and customers are interested in the performance of your device. Share a report that shows the test conditions, summary of pass/fail, summary of all tests, and details for each test. Many include an appropriate screen shot of the measured parameter.


See Device Performance in One View

In a few minutes, you'll have test results showing which parameters passed or failed, and the margin compared to limits. These results will provide immediate insights into how you'll need to improve your design to meet the challenging tests in the CEI 3.0 Implementation Agreements.
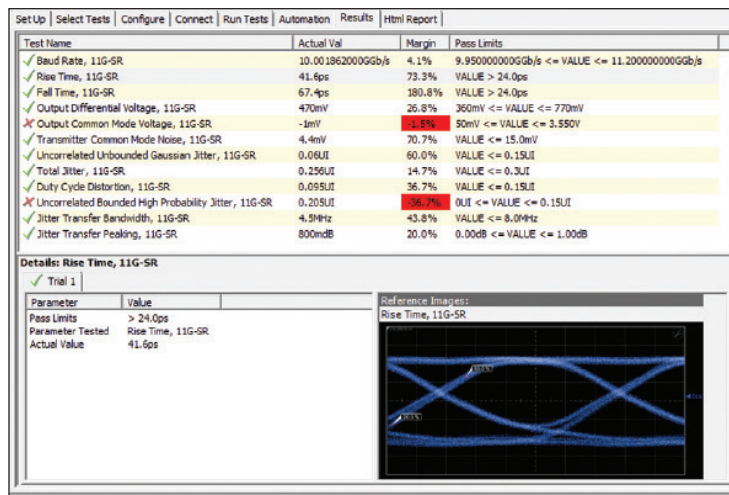
## Control Your Device or Other Equipment

The Automation tab enables you to enter commands to control external devices or equipment, and to further sequence your tests or to control timing.
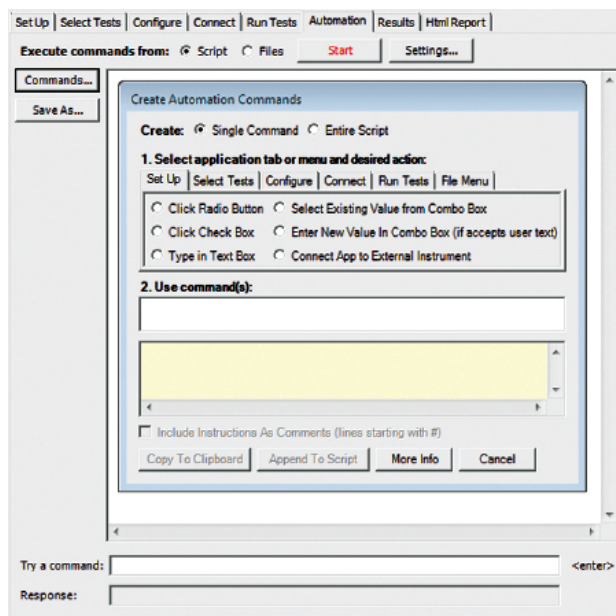
More Features to Further Streamline Your Development

Configure Your Solution in Many Ways

The hardware and software architecture provides wide flexibility. You may install FlexDCA and the N1012A on the oscilloscope, both on your PC or split between them. This enables you to use your PC for more processing power and other applications, or to have all measurement capability consolidated into a compact solution. The PNA can be controlled by the PC or by the DCA
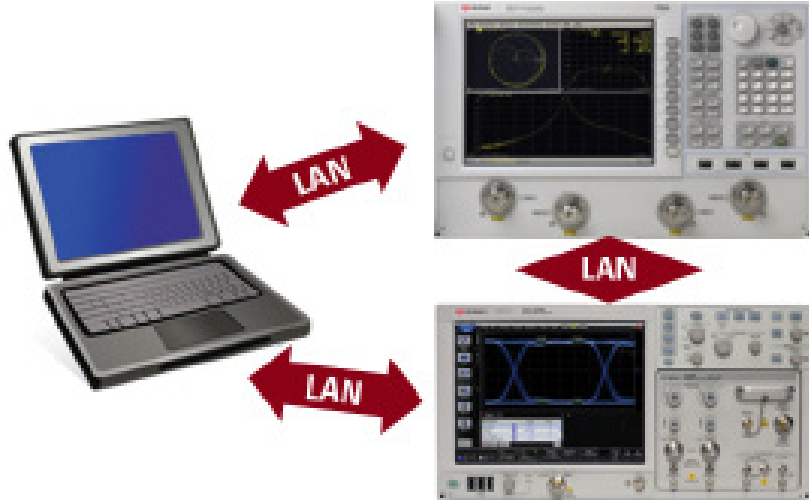
Choose CTLE Peaking Automatically

Enjoy the convenience of the N1012A determining the optimal value of CTLE (continuous time linear equalizer) peaking, which is required by the CEI 28G Very Short Reach for the Host-to-Module interface. The values for gain, zero and poles are calculated for you and used in the optimization.

Conveniently De-Skew Your Cables

Skew between the true and complement signals can degrade your measured performance. While you need to characterize performance with DUT skew included, the N1012A guides you to quickly de-skew your cables for best results.
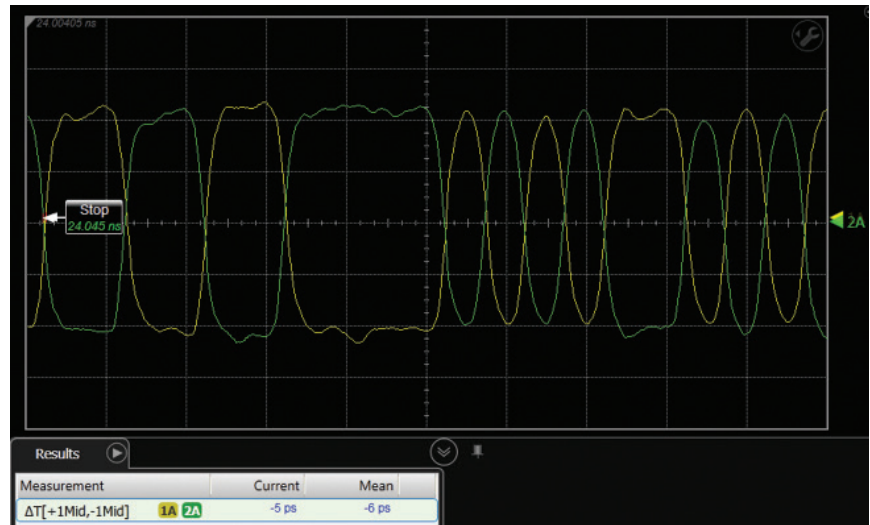
....Or Manually Select the CTLE Peaking

The CEI 28G Very Short Reach Module-to-Host interface requires a peaking value of 1 dB or 2 dB. Select the value from the manual utility. Whether automatic or manual, you'll put your best eye forward for your customers.
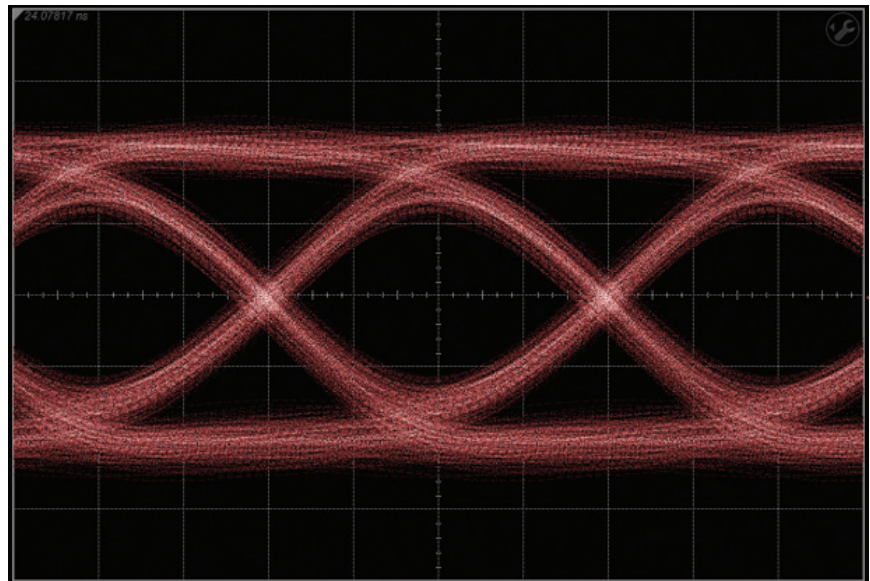
Characterize Over 115 Parameters

The OIF CEI 3.0 Implementation Agreement includes many challenging tests. The table below shows each of the six present interfaces plus the 2 VSR interfaces that have reached at least Draft 10, and the tests that are required by these Implementation Agreements. The N1012A measures all of these parameters; empty cells indicate that parameter is not required for that interface.

|	Parameter	CEI 6G-SR	CEI 6G-LR	CEI-11G-SR	CEI-11G-LR/MR	CEI-28G-SR	CEI-25G-LR	CEI-28G-VSR H2M	CEI-28G VSR M2H
Measured on DCA	Baud rate	6.4.1	7.4.1	8.3.1	9.3.1	10.3.1	11.3.1	13.1	13.1
	Rise times / fall times	6.4.1	7.4.1	8.3.1	9.3.1	10.3.1	11.3.1	13.3.2	13.3.3
	Differential output voltage		7.4.1	8.3.1	9.3.1	10.3.1	11.3.1	13.3.2	13.3.3
	Output common mode voltage	6.4.1	7.4.1	8.3.1	9.3.1	10.3.1	11.3.1	13.3.2	13.3.3
	Transmitter common mode noise	6.4.1	7.4.1	8.3.1	9.3.1	10.3.1	11.3.1	13.3.2	13.3.3
	Eye mask	6.4.1	7.4.1	8.3.1	9.3.1				
	Uncorrelated unbounded Gaussian jitter (RJ)			8.3.1	9.3.1	10.3.1	11.3.1		
	Uncorrelated bounded high probability jitter	6.4.1	7.4.1	8.3.1	9.3.1	10.3.1	11.3.1		
	Duty cycle distortion	6.4.1	7.4.1	8.3.1	9.3.1	10.3.1	11.3.1		
	Total jitter	6.4.1	7.4.1	8.3.1	9.3.1	10.3.1	11.3.1		
	UUGJ – FIR off and on					12.1	12.1		
	UBHPJ – FIR off and on					12.1	12.1		
	DCD – FIR off and on					12.1	12.1		
	Total jitter – FIR off and on					12.1	12.1		
	Eye width (EW15)							13.3.2	13.3.3
	Eye height (EH15)							13.3.2	13.3.3
	Vertical eye closure								13.3.3
	Jitter transfer BW			8.4					
	Jitter transfer peaking			8.4					
PNA	Differential output return loss	6.4.1	7.4.1	8.3.1	9.3.1	10.3.1	11.3.1	13.3.2	13.3.3
	Common mode output return loss	6.4.1	7.4.1	8.3.1	9.3.1	10.3.1	11.3.1		
	CM to differential conversion loss							13.3.2	13.3.3
	Differential to CM Conversion Loss							13.3.2	13.3.3
DMM	Differential resistance	6.4.1	7.4.1	8.3.1	9.3.1	10.3.1	11.3.1		
	Differential termination mismatch			8.3.1	9.3.1	10.3.1	11.3.1	13.3.2 (1 MHz)	13.3.3 (1 MHz)

Choose Industry–Leading Solutions

Keysight offers a wide range of electrical and optical test solutions to address current and emerging communications standards. For OIF CEI 3.0 and VSR, you may choose a solution that covers only the lower data rates or choose a solution that covers all rates; these are separated into columns in the table below. Each row shows the recommended configuration of hardware and software to measure the many parameters. The multi-module approach is useful for designers that may already own a mainframe or module.

		CEI 6G-LR/SR CEI 11G-LR/MR/SR	CEI 6G-LR/SR CEI 11G-LR/MR/SR CEI 25G-LR CEI 28G-SR/VSR
Digital Communications Analyzer	Oscilloscope mainframe	86100D DCA-X 86100D-ETR Extended trigger 86100D-200 Enhanced jitter analysis 86100D-201 Advanced waveform analysis	
	Single plug-in module	86108A 86108B LBW/232	86108B HBW / 232
	Multi-module	86112A, N1045A, or 54754A 86107A, any option N4877A-216	N1045A, 86117A, or 86118A-H01 86107A, any option N4877A-232
	Software	FlexDCA software, A.02.02, or later N1012A 86100DU-400 for Jitter Transfer 86100DU-401 for PRBS31 Keysight I/O Libraries, 16.3 or higher	
	Matched cable set (1)	86108B-CA3	86108B-CA2
	Phase trimmers (2)	86108B-PT3	86108B-PT2
	DC blocks (2)	86108B-DC3	86108B-DC2
	Pick-offs (2)	N4915A-015	N4915A-015
	Performance network analyzer	N5230C 140/145, N5241A or other 4-port PNA's greater than 13 GHz PLTS Studio N1930B	N5224A, N5244A or other 4-port PNA's greater than 32 GHz PLTS Studio N1930B
	Impedance analysis		For VSR: 4294A or E5061B
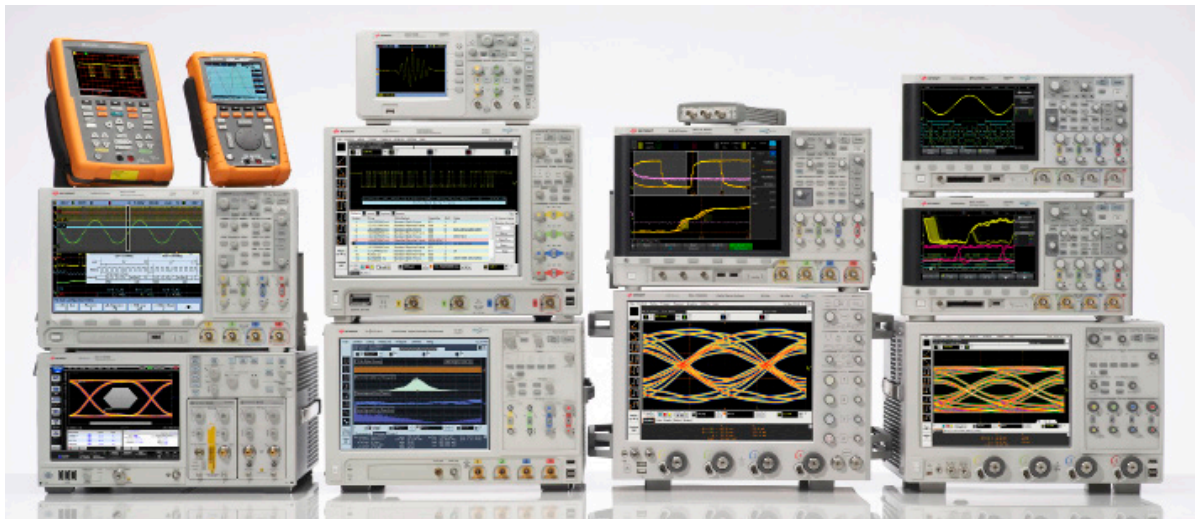
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