# **Tektronix**<sup>®</sup>

# CEI-VSR Compliance and Debug Solution

V TekExpress CEI-VSR - (Unti	itled)"		Options	
Setup 1 DUT	DUT ID DUT	01		Start
Status Test Selection	Acquire live wa View	compliance		
Results Acquisitions	Specification	CEI-28G-VSR Spec 8.0		
4 Preferences	Test Point	Host To Module (TP1a)		
	Data Rate	27.952 V Gbps 25.781 27.952 28.050		

TekExpress® CEI-VSR user interface for PHY measurements

### **CEI-VSR Compliance and Debug Solution**

The new CEI-VSR solution helps customers to easily select measurements for CEI-28G-VSR testing. Simple and easy-to-use measurement setup helps customers perform all measurements with a single button click. Automation options help customers meet their compliance needs and generate detailed reports. User-defined mode lets customers make changes to the test limits and perform margin testing beyond compliance.

 With an industry-leading intrinsic jitter of less than 100 femtoseconds for extremely accurate device characterization, the DSA8300 Series provides comprehensive support for Electrical and Optical Communications Standards.

#### **Key features**

- Option CEI-VSR enables both an automation solution (for compliance) and 80SJNB Option (for debug)
- Option CEI-VSR works on Tektronix DSA8300 Series oscilloscopes; it allows you to automate setup and quickly generate reports
- Meets compliance needs of CEI-28G-VSR Host-To-Module (H2M) and Module-To-Host (M2H)
- Supports PRBS9 pattern for all measurements, and in addition, supports 8180 pattern for transition time measurement.
- VEC (Vertical Eye Closure) measurement is provided as an informative test under the H2M section
- Option CEI-VSR determines the optimal value of CTLE peaking, which is required by the CEI 28G Very Short Reach for the H2M interface.

The best CTLE filter is chosen from the given set of filters and used for performing the measurement.

- Peaking Value and Loop BW are configurable and help to achieve better measurement accuracy
- Under user defined mode, users can configure BER and rely on the feature available to perform this complex measurement
- Detailed test reports with margin and statistical information aid analysis
- User-defined mode enables flexible parameter control for characterization and margin analysis
- Complete programmatic interface available; users can call CEI-VSR functions using their automation scripts
- Design engineers can utilize many built-in reporting features, such as Appending the Report, Auto-incrementing the Report, including user comments and more to tailor their reporting requirements.
- CEI-VSR Compliance Solution performs Automatic Signal Validation before performing tests and throws an error if the signal does not meet acceptable limits.

#### Applications

CEI-VSR transmitter testing for:

- Device silicon validation
- Product developers (Product Design, Validation, Debug and Compliance)
- System compliance and debug
- Manufacturing test

### **Technology overview**

Electrical interconnect (chip-to-chip, chip-to-module, board-to-board in the box), electrical backplane and short (<15 m) Infiniband-grade passive cables must support systems fronted with optical 100 Gb/s signaling in standards such as 100GbE Optical (802.3ba) and OTN. Original system designs accomplished this by using 10x10G electrical signaling which has been developed previously to support 10 Gb/s optical links (802.3ae, for example).

# **Optical Internetworking Forum - Common Electrical Interface - 28G-VSR (CEI-28G-VSR)**

This clause details the requirements for the CEI-28G-VSR very short reach high speed chip-module electrical I/O of nominal baud rates of 19.60 Gsym/ s to 28.05 Gsym/s. A compliant device must meet all of the requirements listed below. The electrical I/O is based on high speed, low voltage logic, and connections are point-to-point balanced differential pairs. The electrical IA is based on channel loss and jitter budgets. It defines the characteristics required to communicate between CEI-28G-VSR drivers and CEI-28G-VSR receivers using copper signal traces on a printed circuit board, a mated connector pair and copper signal traces inside an optical module. These characteristics are normative for the devices and informative for the channel. A 'length' is effectively defined in terms of its attenuation and phase response rather than its physical length. CEI-28G-VSR devices from different manufacturers shall be interoperable.

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. The Implementation Agreement for Optical Internetworking Forum Common Electrical Interface (OIF CEI) 3.0 specifies the tests and limits for these devices.

The use of pluggable optical transceivers is a common practice in equipment developed for the communications market. Developing interoperable pluggable IO (input/output) solutions that keeps up with the demanding bandwidth needs of industry is critical to enabling next generation equipment that supports the communications service providers. The 28G-VSR channel consists of 100  $\Omega$  differential PCB traces, vias, one connector and AC coupling capacitors. The 28G-VSR IA is intended to be used for Very Short Reach channels with up to 10 dB loss at Nyquist rate and is being initially targeted for the next generation of optical modules having retimed interfaces operating at 25 - 28 Gb/s.

### Simplified instrument setup

Setup and test execution is simple with the CEI-VSR software. The oscilloscope acquisition and analysis are all controlled through the CEI-VSR automation solution. The Graphical User Interface (GUI) provides an intuitive workflow for setup and testing.

V TekExpress CEI-VSR - (Unt	itled)*	Options 💌	
Setup	CEI-28G VSR : Host To Module : Spec 8.0 Deselect All Required	Select All	Start
Status     2 Test Selection       Results     Acquisitions       Reports     4 Preferences	Host to Module     Baud Rate     Common Mode Noise RKS     Common Mode Noise RKS     Vertical Eye closure (Informative)     Vertical Eye closure (Informative)     Common Mode Voltage     Eye width at 10e-15 Probability (EW15)     Eye Height at 10e-15 Probability (EH15)		Pause
	Test Description		
	The differential voltage pk-pk is measured including any tranmitted de-emphasis. The DC block is connected to the scope modules to measure the AC signals only.	Schematic	
Status Completed.			

TekExpress® CEI-VSR measurement setup

# **Test configurations**

Design characterization is supported beyond CEI-28G-VSR compliance requirements for all measurements. Qualify PHY with flexible control over test configurations such as analysis windows and other parameters. Userdefined mode lets customers make changes to the test limits and perform marginal testing beyond compliance.

etup 🗸 DUT	• Compliance Mode	User Defined	Mode	Test Selection	Limits Editor	s
2 Test Selection	Global Settings Me	asurements				
Acquisitions Acquisitions 4 Preferences	Host to Module     Baud Rate     Differential Volta     Common Mode     Transition time     Vertical Eye clo     Common Mode	age Pk-Pk Noise RMS 20/80% sure Voltage				
Limits Editor View or Edit the values used t	for High Limitan	d Low Limit for e	ach meası	urement		
Limits Editor View or Edit the values used I A blank cell means no limit value is Test Name	for High Limit an applied Details	d Low Limit for e	ach measu Low Limit	rement Compare String	High Limit	
Limits Editor View or Edit the values used 1 A blank cell means no limit value is Test Name Baud Rate	for High Limit an applied Details Baud Rate(Gbps)	d Low Limit for each of the second se	ach measu Low Limit 19.59	Compare String	High Limit 28.05	
Limits Editor View or Edit the values used I A blank cell means no limit value is Test Name Baud Rate Differential Voltage Pk-Pk	for High Limit an applied Details Baud Rate(Gbps) Differential Voltage	d Low Limit for en Compare String >= Greater Than O <= Less Than Or E	ach measu Low Limit 19.59 900	Compare String <= Less Than Or E N.A	High Limit 28.05 N.A	
Limits Editor View or Edit the values used i A blank cell means no limit value is Test Name Baud Rate Differential Yoltage PK-PK Common Mode Noise RM5	for High Limit an applied Details Baud Rate(Gbps) Differential Voltage Common Mode Nois	d Low Limit for er Compare String >= Greater Than O <= Less Than Or E <= Less Than Or E	Low Limit 19.59 900 17.0	compare String <= Less Than Or E N.A N.A	High Limit 28.05 N.A N.A	
Limits Editor View or Edit the values used I A blank cell means no limit value is Test Name Baud Rate Differential Yolkage PK-PK Common Mode Noise RMS Leanstinn June - 20/096	for High Limit an applied Details Baud Rate(Gbps) Differential Voltage Common Mode Nois Rise Time(ps)	d Low Limit for er Compare String >= Greater Than O <= Less Than Or E >= Greater Than O	Low Limit 19.59 900 17.0 10	Compare String <= Less Than Or E N.A N.A N.A	High Limit 28.05 N.A N.A N.A	
Limits Editor View or Edit the values used A blank cell means no limit value is Test Name Baud Rate Differential Voltage Pk-Pk Common Mode Noise RMS Transition time - 20/80%	for High Limit an applied Details Baud Rate(Gbps) Differential Voltage Common Mode Nois Rise Time(ps) Fall Time(ps)	d Low Limit for er Compare String >= Greater Than O <= Less Than Or E >= Greater Than O >= Greater Than O	ach measu 19.59 900 17.0 10	Compare String <= Less Than Or E N.A N.A N.A N.A N.A	High Limit 28.05 N.A N.A N.A N.A N.A	
Limits Editor View or Edit the values used I A blank cell means no limit value is Test Name Baud Rate Differential Voltage Pk-Pk Common Mode Noise RM5 Transition time - 20/80% Vertical Eye closure	for High Limit an applied Details Baud Rate(Gbps) Differential Voltage Common Mode Nois Rise Time(ps) Fall Time(ps) Vertical Eye closure	d Low Limit for ex Compare String >= Greater Than O <= Less Than Or E >= Greater Than O <= Less Than Or E <= Less Than Or E	Low Limit 19.59 900 17.0 10 10 6.5	Compare String <= Less Than Or E N.A N.A N.A N.A N.A	High Limit 28.05 N.A N.A N.A N.A N.A N.A	
Limits Editor View or Edit the values used I A blank cell means no limit value is Test Name Baud Rate Differential Yoltage Pk-Pk Common Mode Noise RM5 Transition time - 20/80% Vertical Eye closure Common Mode Voltage	for High Limit an applied Details Baud Rate(Gbps) Differential Volkage Common Mode Nois Rise Time(ps) Fall Time(ps) Fall Time(ps) Vertical Eye closure Common Mode Vok	d Low Limit for ex Compare String >= Greater Than O <= Less Than Or F >= Greater Than O >= Greater Than O >= Greater Than O >= Greater Than O	Low Limit 19.59 900 17.0 10 10 6.5 -0.3	Compare String <= Less Than Or E N.A N.A N.A N.A N.A <= Less Than Or E	High Limit 28.05 N.A N.A N.A N.A N.A N.A 2.8	
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Margin testing

# **User-defined mode**

Under user-defined mode, users can configure BER and rely on off-theshelf products to perform this complex measurement rather than developing custom lab setup, reducing testing time and complexity.



User configurable BER

# Automatic selection of CTLE filter

Option CEI-VSR determines the optimal value of CTLE peaking, which is required by the CEI 28G Very Short Reach for the Host-to-Module interface. The best CTLE filter is chosen from the given set of filters and used for performing the measurement. Peaking Value and Loop BW are configurable and helps in better measurement accuracy.

• Compliance Mode	User Defined Mode	Test Selection	Limits Editor
Global Settings Measurer	nents		
Instruments Detected			
Sampling Scope	DSA8300 ( GPIB0::2::I	NSTR )	
CTLE Filter File (1 - 8)			
All			
All	gs		
sdlaCtle_JNB_1dB.flt		Peaking Value	
sdlaCtle_JNB_2dB.flt		0.1	dB
sdlaCtle_JNB_3dB.flt			
sdlaCtle_JNB_4dB.flt			
sdlaCtle_JNB_5dB.flt			
sdlaCtle_JNB_6dB.flt		DED	
sdlaCtle_JNB_6dB.flt sdlaCtle_JNB_7dB.flt		BER	046

CEI-28G-VSR measurements covered in Tektronix CEI-VSR solution

Parameters	CEI-28G-VSR H2M	CEI-28G-VSR M2H
Baudrate	1.1	1.1
Rise times / fall times	1.3.2	1.3.3
Differential output voltage	1.3.2	1.3.3
Output Common mode voltage	1.3.2	1.3.3
TX Common Mode Noise RMS	1.3.2	1.3.3
UUGJ-Uncorrelated Unbounded Gaussian Jitter		
UBHPJ-Uncorrelated Bounded High Probability Jitter		
Eye width (EW15)	1.3.2	1.3.3
Eye height (EH15)	1.3.2	1.3.3
Vertical eye closure		1.3.3

#### **Calibration parameter**

Design engineers working on their next generation 28G products are given access to various calibration parameters like Deskew, External Attenuation, etc., to make sure results are as accurate as possible.

Calibrations			X
Scope Calibratio	on	08/26/2013 10:33AM	
Status	PASS	Refresh	
Instrumentation	Noise	08/21/2013 12:21AM	
Value	0.056mV		
Status	PASS	Measure	
External Attenuat	tion	08/21/2013 12:22AM	
Data + ( CH5 )	14.0dB	Refresh	
Data - ( CH6 )	14.0dB	Terresit	
Deskew		08/21/2013 12:22AM	
Data + (CH5)	0.0%	Refresh	
Data - ( CH6 )	0.0%		
		Close	

Calibration dialog

# Setup diagram



\* See application note 071-3207-XX for information about the cables and interconnect accessories required for this setup.

<sup>‡</sup> Or 80N01 Extender

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Setup Information

# TekExpress CEI-VSR TekExpress CEI-VSR Host To Module Test Report

DUT ID	DUT001	Scope Model	DSA8300
Date/Time	2013-08-06 04:01:33	Scope Serial Number	PQ10003
TekExpress Version	CEI-VSR:1.0.0.47 Framework:3.0.0.20	Scope F/W Version	6.2.1.1
Execution Mode	Live	D+ connected to	CH5 "80E10"
Overall Compliance Mode	Yes	D- connected to	CH6 "80E10"
Overall Execution Time	0:04:08	Phase Reference connected to	CH7 "82A04B"
Overall Test Result	Fail		
DUT Comment:		General Comment – CEI–VSR	
Test Name Summary Table			
Baud Rate		Informative	
Differential Voltage Pk-Pk		Pass	
Common Mode Noise RMS		Pass	
Transition time - 20/80%		Pass	
Vertical Eye closure		Informative	

Pass

Fail

Fail

Pass/Fail report

Common Mode Voltage

Eye width at 10e-15 Probability (EW15)

Eye Height at 10e-15 Probability (EH15)

For more information, refer to the Application Note *Practices for Measurements on 25 Gb/s Signaling* on the Tektronix Web site at www.tektronix.com.

#### **Summary report**

A summary report in .MHT (MHTML) or PDF format with Pass/Fail status is automatically generated after tests complete. The report includes test configuration details, waveform plots, and margin analysis to provide more insight into your design.



Back to Summary Table

# Ordering information

# CEI-VSR - OIF CEI 3.0 Compliance Solution for DSA8300

To order with oscilloscope	Oscilloscope Option DSA8300 Order CEI-VSR
To upgrade an oscilloscope	Oscilloscope Option DSA8300 DSA83UP CEI-VSR

# Software options

Option CEI-VSR	OIF CEI 3.0 Compliance Solution for DSA8300
Option JNB01	80SJNB Advanced
Option ADVTRIG	Advanced triggers with pattern sync

#### **CEI-VSR** Datasheet

#### **Recommended accessories**

DC block	4 kHz-65 GHz, 2.4 mm connectors, male/female (available from Picosecond Pulse Labs, P/N 5509-205-224)
Pick-off T	2.4 mm, female/male/female (available from Picosecond Pulse Labs, P/N 5361-237-14DB)
Cables:	50 GHz, 2.4 mm, male connectors
	65 GHz, 1.85 mm, male connectors
	National Instrument GPIB-USB-HS - GPIB Controller for Hi-Speed USB
Adapters:	1.85 mm male, to 2.92 mm female
	2.4 mm male, to 2.92 mm female

#### **Recommended products**

BERTScope clock recovery	CR286A
Remote sampling oscilloscope module	80E10B - 8000 Series, dual-channel, 50 GHz remote electrical sampling module w/TDR, or
	80E09B - 8000 Series, dual-channel, 60 GHz remote electrical sampling module
Phase reference module	82A04B - 8000 Series, phase reference module
Module extender cables	80X01 & 80X02 (1 each) - 8000 Series, electrical module extender cable
	(Please contact Product Marketing for availability and status)

CE Marking Not Applicable.

(SRI) (SRI)

Tektronix is registered to ISO 9001 and ISO 14001 by SRI Quality System Registrar.



Product(s) complies with IEEE Standard 488.1-1987, RS-232-C, and with Tektronix Standard Codes and Formats.

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\* European toll-free number. If not accessible, call: +41 52 675 3777

For Further Information. Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit www.tektronix.com.

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