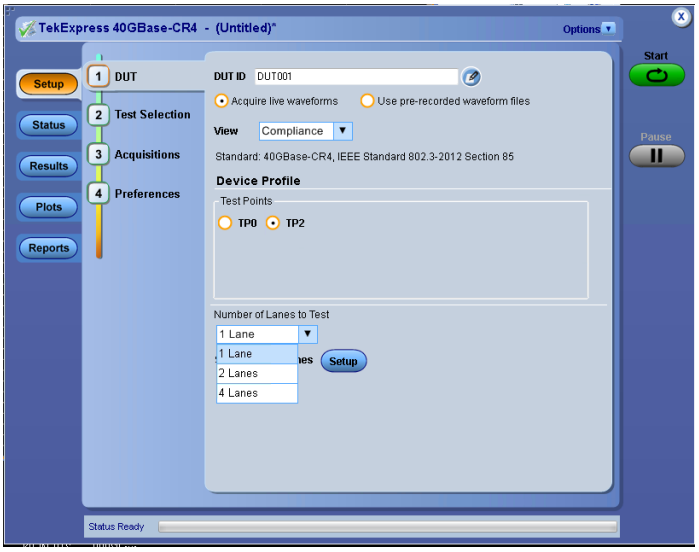
40GBASE-CR4 Debug and Automated Compliance Solution

DPO/DSA/MSO70000 Series Option 40G-CR4 Datasheet



The Tektronix TekExpress® 40GBase-CR4 Debug and Automated Compliance Solution application (Option 40G-CR4) provides design engineers with an easy-to-use automated solution to test and debug 40GBASE-CR4 designs, using off-the-shelf tools, to reduce human-related measurement errors and shorten the design cycle.

Key Features

- Tektronix 40G-CR4 debug and automated compliance solution meets the compliance test and debug needs of engineers working on IEEE 802.3-2012 40GBASE-CR4 designs
- Tektronix 40G-CR4 operates on a real time oscilloscope platform, which is the platform of choice for engineers working on designing their products around 40GBASE-CR4 technology
- Option 40G-CR4 provides both an automation solution (for compliance) and DPOJET option (for debug), saving users up to 80% on testing time as compared to manual testing
- The 40G-CR4 solution provides measurements for electrical characterization of 40GBASE-CR4 signal at TP2 and TP0.
- Design engineers can seamlessly move from compliance testing to a debug environment and use the world-class Tektronix DPOJET debug tool
- A user-defined mode enables flexible parameter control for characterization and margin analysis
- The user-defined mode supports PRBS7, PRBS11, PRBS15, PRBS20, PRBS23, and PRBS31 patterns, and supports PRBS9 and 1010 patterns in compliance mode
- A complete programmatic interface lets users call 40G-CR4 functions using custom automation scripts
- 40G-CR4 provides setup files to load n1n0, PRBS11 and PRBS31 patterns and 40G-CR4 measurements into the oscilloscope and DPOJET, to quickly set the oscilloscope and software to a debug environment
- A new intuitive user interface and framework decreases testing time and learning curve for end users
- Measurements are grouped by the signal types best suited for the measurement, which reduces user intervention
- End-users can connect remotely to a test setup and receive e-mails with measurement results
- 40G-CR4 provides design engineers with many built-in reporting features such as appending the report, auto-incrementing the report name, and including user comments, to tailor the measurement result data to their reporting requirements
- Provides customers with a Tektronix floating license installation option

Applications

Ethernet 40GBASE-CR4 transmitter testing for:

- Device silicon validation
- Cable and connector validation
- System compliance and debug
- Manufacturing test

40GBASE-CR4 technology overview

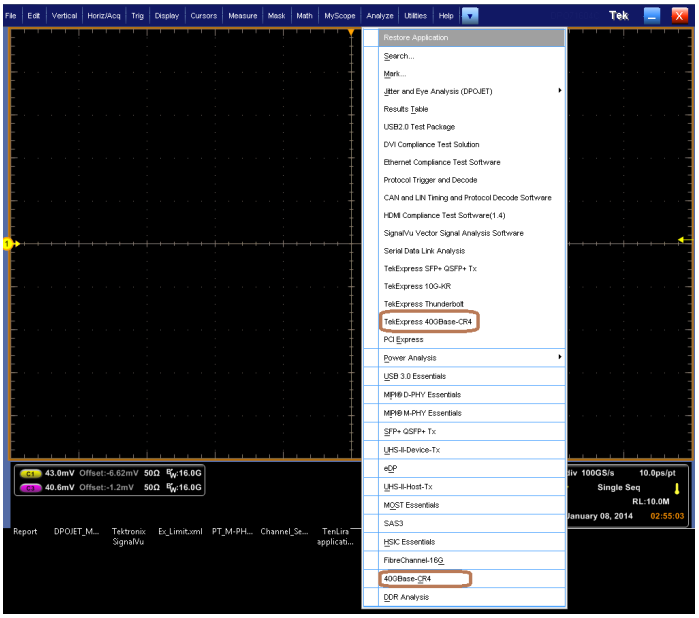
Clause 85 of IEEE 802.3 specification details out 40GBASE-CR4 PMD. The 40GBASE-CR4 is a 40 Gigabit Ethernet technology with a low-swing AC-coupled differential interface. AC coupling at the receiver allows for communication between components operating from different supply voltages. Low-swing differential signaling provides more noise immunity and improved electromagnetic interference (EMI) protection.

The 40GBASE-CR4 signal paths are point-to-point connections, with four differential paths in each direction for a total of eight pairs, or sixteen connections. It uses 4 lanes of shielded, balanced copper cabling between the transmitter and receiver to achieve the required data rate (4 * 10.3125 Gbps). The length of the signal path in 40GBASE-CR4 can range from 0.5 m to 7 m.

The Tektronix TekExpress 40G-CR4 solution addresses transmitter measurements related to:

- Transmitter characteristics at TP2 (Table 85-5 in IEEE 802.3-2012)
- Transmitter characteristics at TP0 (Table 85A-1 in IEEE 802.3-2012)

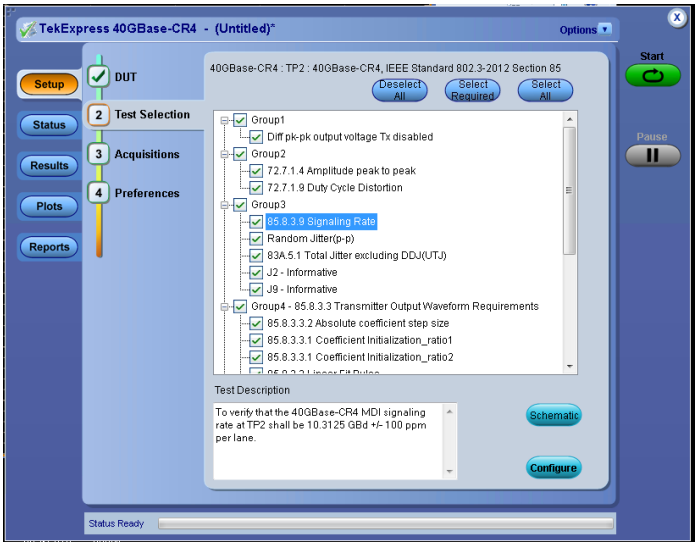
To take measurements of the signal at TP0, engineers will acquire the signal at TP2 and use filter files to de-embed the channel effects between TP2 and TP0. This filter need to be an FIR filter, a .flt file with filter taps stored in the Tektronix FIR Filter file format.



Launch the application from the oscilloscope Analyze menu

TekExpress® 40G-CR4 measurement setup

The new 40G-CR4 solution lets you easily select and run measurements for 40GBASE-CR4 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. A user-defined mode lets customers make changes to the test limits and perform margin testing beyond compliance.

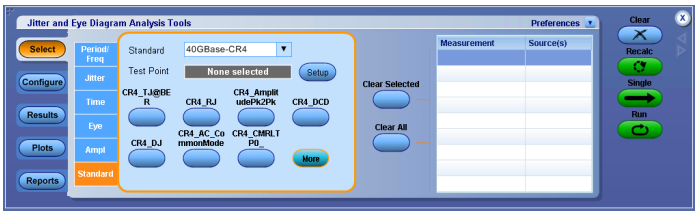


Test selections in the TekExpress Setup menu

DPOJET 40GBASE-CR4 measurement setup

The new 40G-CR4 solution helps customers to easily select measurements for 40GBASE-CR4 testing. All masks, limits, and measurement parameters are automatically configured for the customer. Additionally, customers have the flexibility to change selected measurements and measurement configurations within DPOJET. 40G-CR4 DPOJET options provide a new standard-specific UI.

Signal-specific setup files let design engineers perform measurements on different signal types, letting the engineer go into Analysis and Debug modes.



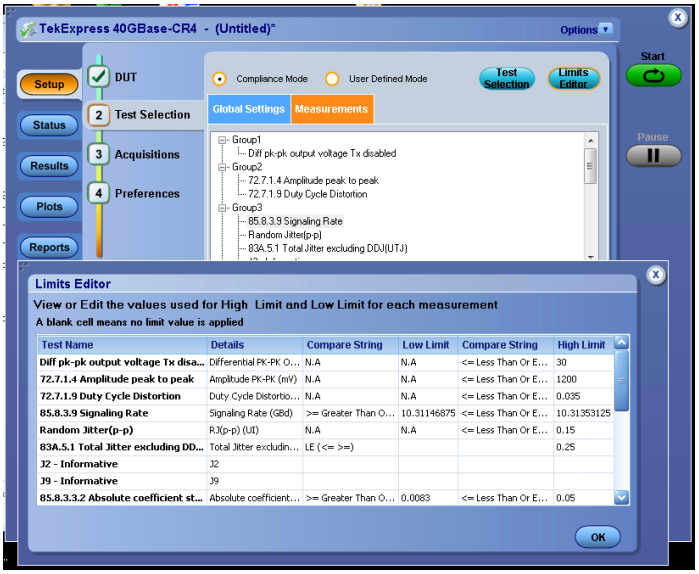
Selecting measurements in the DPOJET application

Simplified measurement setup - save time and resources

Measurement setup and test execution is simple with the 40G-CR4 software. The oscilloscope signal acquisition and measurement analysis are all controlled through the 40G-CR4 automation solution. The Graphical User Interface (GUI) provides an intuitive workflow for measurement setup, testing, and reporting.

Margin testing

40G-CR4 supports design characterization beyond IEEE 802.3-2012 compliance requirements for all measurements. Qualify PHY with flexible control over test configurations such as analysis windows and other parameters. A user-defined mode lets customers make changes to the test limits and perform marginal testing beyond compliance.



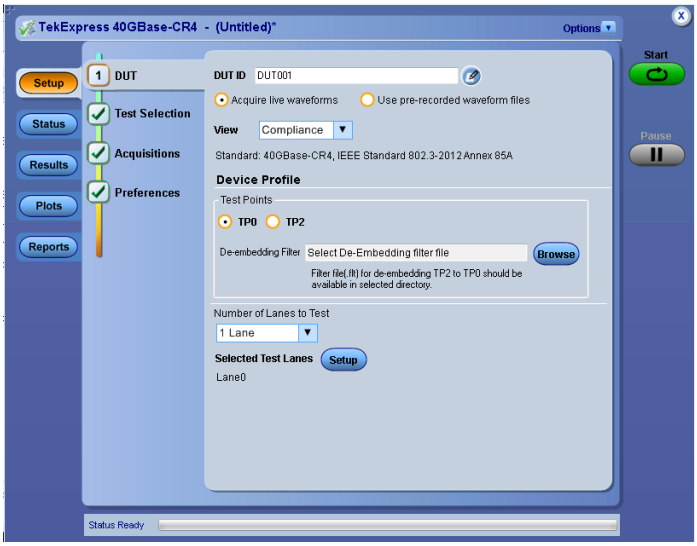
User-defined mode enables flexible parameter control for characterization and margin analysis

Informative measurements

Additional informative measurements have been added to compliance suit which provide design engineers with greater insight into their designs. Additional measurements include Total Jitter, Deterministic Jitter, J2, J9 and Transition Time.

Deembed feature

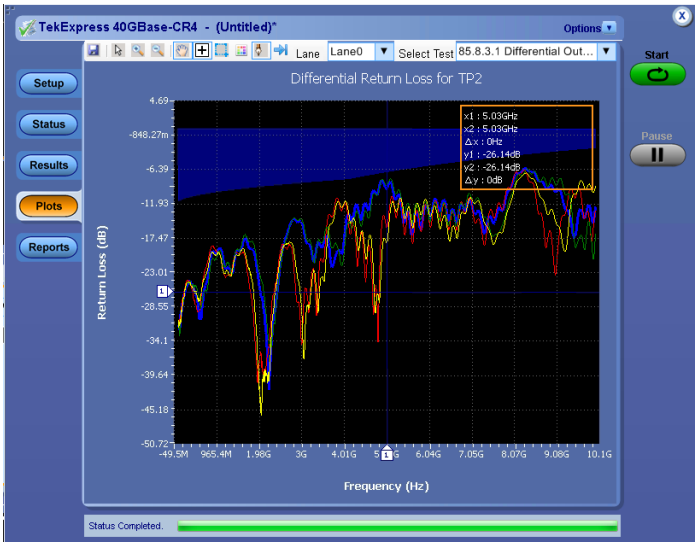
As data rates increase, high-speed serial technologies have introduced new test methodologies and requirements for compliance testing. As technologies such as 40G increase in data rates, the eye is closed and different components such as SMA cables can be de-embedded to get better results. 40G-CR4 provides an option to de-embed the signal using .FLT files.



De-embedding feature available

Return loss support

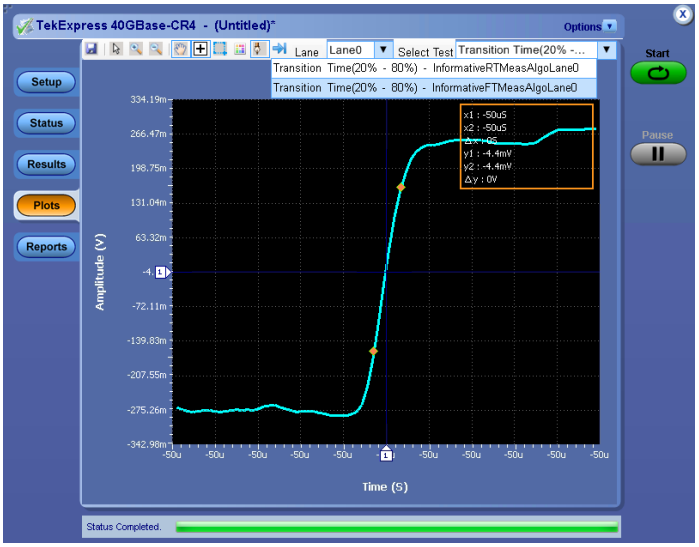
The Tektronix 40G-CR4 solution does not provide an ability to perform Differential Output Return Loss or Common Mode Output Return Loss. The 40G-CR4 solution does provide the ability to take an .s16p file as an input to map the results against limits. This feature provides design engineers an option to use common reporting and plotting mechanism available on one instrument. Users are prompted to provide a path to the .s16p file when they click the Configure button.



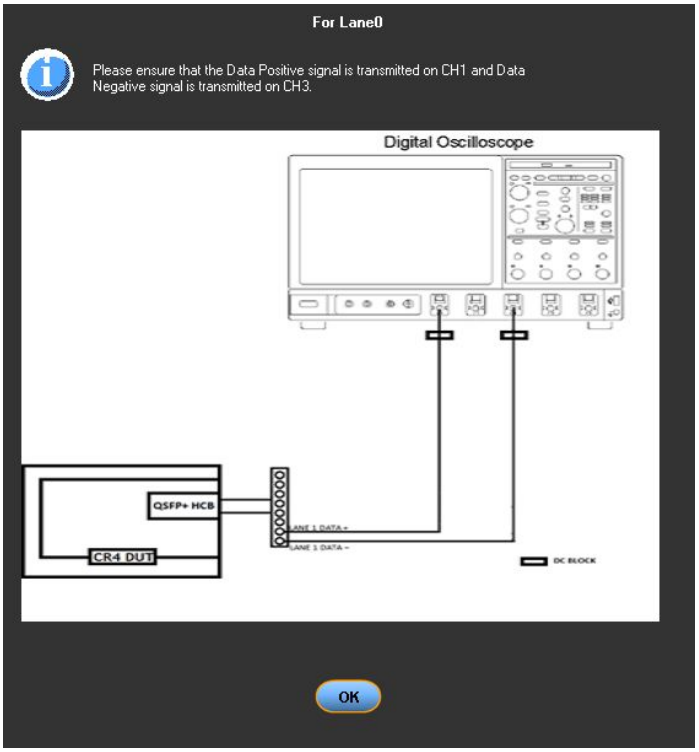
Differential Return Loss measurement plot

Interactive plot

Option 40G-CR4 is equipped with the latest TekExpress interactive plot module. This feature lets you take a look at the signal after a test is performed. With this new plot module, you can move the cursors and find out the delta on the X and Y axis.



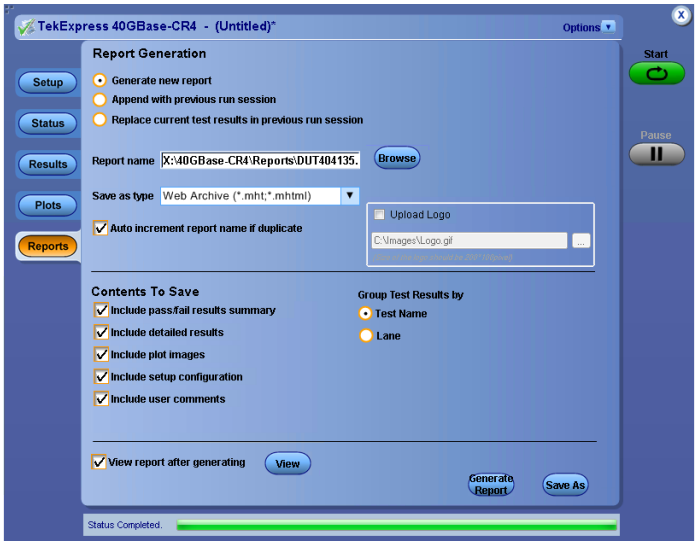
Interactive plot



Popup messages let you configure the DUT to transmit a particular signal type

Report configuration menu

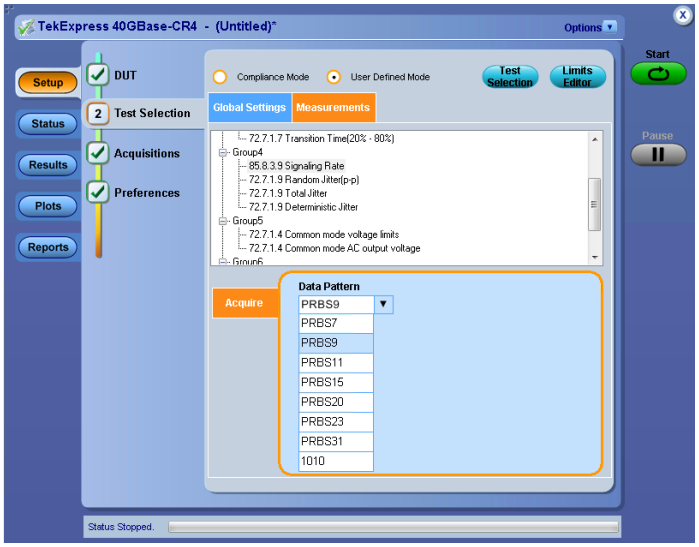
The report configuration menu lets users configure reports, and it provides options such as auto increment, appending, and so on.



Report configuration menu

Multiple pattern support

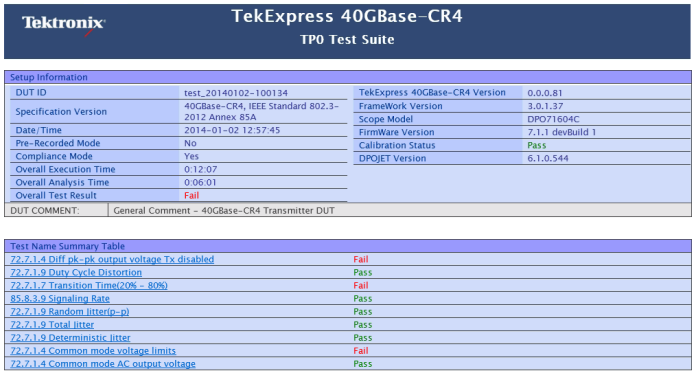
Many products available on the market support patterns over and above what is specified in IEEE 802.3. 40G-CR4 provides multiple patterns in user defined mode to extend testing beyond the IEEE 802.3 requirements. User defined mode supports PRBS7, PRBS11, PRBS15, PRBS20, PRBS23, and PRBS31. 40G-CR4 also provides patterns to support compliance testing, including PRBS9 and 8180.



Multiple pattern support

Pass/Fail report

A summary report in .MHT (MHTML) & .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.



Tektronix

TekExpress 40GBase-CR4

TP0 Test Suite

Setup Information

DUT ID	test_20140102-100134	TekExpress 40GBase-CR4 Version	0.0.0.81
Specification Version	40GBase-CR4, IEEE Standard 802.3-2012 Annex 85A	FrameWork Version	3.0.1.37
Date/Time	2014-01-02 12:57:45	Scope Model	DPO71604C
Pre-Recorded Mode	No	FirmWare Version	7.1.1 devBuild 1
Compliance Mode	Yes	Calibration Status	Pass
Overall Execution Time	0:12:07	DPOJET Version	6.1.0.544
Overall Analysis Time	0:06:01		
Overall Test Result	Fail		
DUT COMMENT:	General Comment - 40GBase-CR4 Transmitter DUT		

Test Name Summary Table

72.7.1.4 Diff pk-pk output voltage Tx disabled	Fail
72.7.1.9 Duty Cycle Distortion	Pass
72.7.1.7 Transition Time(20% - 80%)	Fail
85.8.3.9 Signaling Rate	Pass
72.7.1.9 Random Jitter(p-p)	Pass
72.7.1.9 Total Jitter	Pass
72.7.1.9 Deterministic Jitter	Pass
72.7.1.4 Common mode voltage limits	Fail
72.7.1.4 Common mode AC output voltage	Pass

40G-CR4 test report

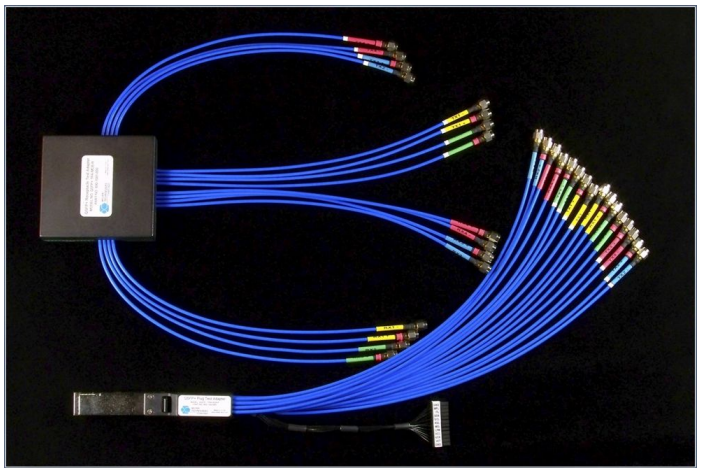
Supported 40GBASE-CR4 measurements

Measurement	Sub claus reference	Value	Unit	TP0	TP2
Signaling rate, per lane	85.8.3.9	10.3125 ±100 ppm	GBd	x	x
Unit interval nominal	85.8.3.9	96.969697	ps	x	x
Differential peak-to-peak output voltage (max) with Tx disabled	-	30	mV	x	x
Common Mode voltage limits	72.7.1.4	0 to 1.9	V	x	x
Differential output return loss	85.8.3.1	See Equation (85-1)	dB	x	x
Common Mode output return loss	72.7.1.6	See Equation (72-6) and (72-7)	dB	x	
Amplitude peak to peak(max)	72.7.1.4	1200	mV		x
Random jitter (p-p)	72.7.1.9	0.15	UI	x	x
Duty cycle distortion	72.7.1.9	0.35	UI	x	x
Total jitter excluding DDJ	83A.5.1 (?)	0.25	UI		x
Total jitter	72.7.1.9	Informative	UI	x	
Deterministic jitter	72.7.1.9	Informative	UI	x	
J2 (Informative)	-	Informative	UI		x
J9 (Informative)	-	Informative	UI		x
Transititon time (20% - 80%)	72.7.1.7	Informative test for TP2 Normative test for TP2	UI	x	x
Transmitter DC amplitude	85.8.3.3	0.34 min, 0.6 max	V	x	x
Linear fit pulse (min)	85.8.3.3	0.63 × Transmitter DC amplitude	V	x	x
Transmitted waveform:					
- max normalized error (linear fit), “e”	85.8.3.3	0.037	-		x
- abs coefficient step size	85.8.3.3.2	0.0083 min, 0.05 max	-		x
- minimum precursor full scale range	85.8.3.3.3	1.54	-		x
- minimum post cursor full scale range	85.8.3.3.3	4	-		x

Probes and fixtures

QSFP+ Host- QSFP+ Host Compliance Board Plug and MCB- QSFP+ Module Compliance Board Receptacle is available from Tektronix. Wilder Technologies manufacture these fixtures however interested users can buy it directly from Tektronix. 40G-CR4 solution will support only single ended input. Differential probes are not supported.

Use TCA-292MM when the application is run on oscilloscopes with a bandwidth greater than or equal to 25 GHz. Use TCA-SMA when the application is run on oscilloscopes with a bandwidth less than 25 GHz.



QSFP+ Host Compliance Board Plug and Module Compliance Board Receptacle fixtures

Ordering information

Model

40G-CR4	40GBASE-CR4 Debug and Automated Compliance Solution.

Order Option 40G-CR4 to preinstall the software on a new Tektronix DPO/DSA/MSO70000 series oscilloscope.

Upgrades

Order an upgrade for an existing oscilloscope:

DPO-UP Opt. 40G-CR4	DPO/DSA/MSO70000 with single license
DPOFL Opt. 40G-CR4	DPO/DSA/MSO70000 with floating license
DPOFT Opt. 40G-CR4	DPO/DSA/MSO70000 with floating trial license

Recommended equipment

Recommended Tektronix oscilloscopes (DPO/DSA/MSO series)	Required software	Accessories	Test fixture
71604C 72004C 72504D 73304D	40G-CR4 DPOJET [1]	TF-DC-BLOCK-KIT	TF-QSFP-TPA-HCB-P

Recommended accessories

QSFP-TX test fixtures

TF-QSFP-TPA-HCB-P	QSFP+ Host Compliance Board Plug
TF-QSFP-TPA-MCB-R	QSFP+ Module Compliance Board Receptacle
TF-QSFP-TPA-PR	QSFP+ Host Compliance Board Plug and Module Compliance Board Receptacle
TF-DC-BLOCK-KIT	DC Block Kit (Quantity 4)

The QSFP+ Host- QSFP+ Host Compliance Board Plug and MCB- QSFP+ Module Compliance Board Receptacle is available from Tektronix. All of these fixtures are available from Wilder Technologies.

Warranty

The 40G-CR4 software is warranted for 90 days.

CE

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.

1 Required to run 40G-CR4.

ASEAN / Australasia (65) 6356 3900
Belgium 00800 2255 4835*
Central East Europe and the Baltics +41 52 675 3777
Finland +41 52 675 3777
Hong Kong 400 820 5835
Japan 81 (3) 6714 3010
Middle East, Asia, and North Africa +41 52 675 3777
People's Republic of China 400 820 5835
Republic of Korea +822 6917 5084, 822 6917 5080
Spain 00800 2255 4835*
Taiwan 886 (2) 2656 6688

Austria 00800 2255 4835*
Brazil +55 (11) 3759 7627
Central Europe & Greece +41 52 675 3777
France 00800 2255 4835*
India 000 800 650 1835
Luxembourg +41 52 675 3777
The Netherlands 00800 2255 4835*
Poland +41 52 675 3777
Russia & CIS +7 (495) 6647564
Sweden 00800 2255 4835*
United Kingdom & Ireland 00800 2255 4835*

Balkans, Israel, South Africa and other ISE Countries +41 52 675 3777
Canada 1 800 833 9200
Denmark +45 80 88 1401
Germany 00800 2255 4835*
Italy 00800 2255 4835*
Mexico, Central/South America & Caribbean 52 (55) 56 04 50 90
Norway 800 16098
Portugal 80 08 12370
South Africa +41 52 675 3777
Switzerland 00800 2255 4835*
USA 1 800 833 9200

* 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.tek.com.

27 Jan 2016 55W-29723-1

www.tek.com

Tektronix®