# TekExpress<sup>®</sup> SFP+ QSFP+ Tx Compliance and Debug Solution Software

Printable Online Help





077-0590-03

TekExpress<sup>®</sup> SFP+ QSFP+ Tx Compliance and Debug Solution Software Printable Online Help



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TekExpress SFP+ QSFP+ Tx Compliance and Debug Solution Online Help, 076-0252-03.

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For product information, sales, service, and technical support:

- In North America, call 1-800-833-9200.
- Worldwide, visit <u>www.tektronix.com</u> to find contacts in your area.

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# **Related documentation**

The following manuals are available as part of the TekExpress SFP+ QSFP+ Tx Compliance and Debug Solution documentation set.

#### Table 1: Product documentation

Item	Purpose	Location
Online Help	In-depth operation and UI help	
PDF of the Online Help	In-depth operation and UI help	+ www.Tektronix.com

#### See also

Technical Support (see page 2)

# Conventions used in help

Online Help uses the following conventions:

- The term "DUT" is an abbreviation for Device Under Test.
- The term "select" is a generic term that applies to the two mechanical methods of choosing an option: using a mouse or using the touch screen.

# **Technical support**

Tektronix values your feedback on our products. To help us serve you better, please send us your suggestions, ideas, or comments on your application or oscilloscope. Contact Tektronix through mail, telephone, or the Web site. See <u>Contacting Tektronix</u> for more information.

When you contact Tektronix Technical Support, please include the following information (be as specific as possible):

#### **General information**

- All instrument model numbers
- Hardware options, if any
- Probes used
- Vour name, company, mailing address, phone number, FAX number
- Please indicate if you would like to be contacted by Tektronix about your suggestion or comments.

#### Application specific information

- Software version number
- Description of the problem such that technical support can duplicate the problem
- If possible, save the setup files for all the instruments used and the application
- If possible, save the TekExpress setup files, log.xml, \*.TekX (session files and folders), and status messages text file
- If possible, save the waveform on which you are performing the measurement as a .wfm file

# Tektronix oscilloscope compatibility

The TekExpress SFP+ QSFP+ Tx application runs on the following Tektronix oscilloscopes:

- DPO/DSA/MSO71604C and DPO/DSA/MSO72004C Series Digital Oscilloscopes
- DPO/DSA72504D and DPO/DSA73304D Series Digital Oscilloscopes

#### See also

Minimum System Requirements (see page 4)

# Minimum system requirements

The following table shows the minimum system requirements needed for an oscilloscope to run TekExpress.

#### Table 2: System requirements

Processor	Same as the oscilloscope		
Operating System	Same as the oscilloscope (Windows 7, 64-bit only)		
Memory	Same as the oscilloscope		
Hard Disk	Same as the oscilloscope		
Display	Same as the oscilloscope <sup>1</sup>		
Firmware	TekScope 6.7.4.3 and later (Windows 7)		
Software	<ul> <li>DPOJET, Jitter and Eye Diagram Analysis Tool, version 6.0.1 or later (64-bit)</li> </ul>		
	<ul> <li>MathWorks MATLAB Runtime 8.0<sup>2</sup> (Windows 7)</li> </ul>		
	IronPython 2.7.3		
	PyVisa 1.0.0.25		
	Microsoft .NET 4.0 Framework		
	<ul> <li>Microsoft Internet Explorer 6.0 SP1 or later</li> </ul>		
	<ul> <li>Microsoft Photo Editor 3.0 or equivalent software for viewing image files</li> </ul>		
	<ul> <li>Adobe Reader 7.0 or equivalent software for viewing portable document format (PDF) files</li> </ul>		
Other Devices	<ul> <li>Microsoft compatible mouse or compatible pointing device</li> </ul>		
	<ul> <li>Four USB ports (two USB ports minimum)</li> </ul>		
	PCI-GPIB or equivalent interface for instrument connectivity <sup>3</sup>		

1 If TekExpress is running on an instrument having a video resolution lower than 800x600 (for example, a sampling oscilloscope), it is recommended that you connect a secondary monitor, which must be enabled before launching the application.

2 MatLab Runtime Compiler is required for performing the Host Output TWDPc test. This test is purchase option SFP-WDP.

<sup>3</sup> If TekExpress is installed on a Tektronix oscilloscope, TekExpress will use the virtual GPIB port for communicating with oscilloscope applications. If external GPIB communication devices such as USB-GPIB-HS or equivalent are used for instrument connectivity, make sure that the Talker Listener utility is enabled in the GPIB menu of the DPO/DSA oscilloscope. For ease of use, connect to an external (secondary) monitor.

#### User access control

On Windows 7 instruments set User Access Control settings to Never Notify. To set User Access Control Settings, go to Control Panel > User Accounts > Change User Access control Settings and set it to Never Notify as shown in the image.



#### See also

Compatibility (see page 3)

# Install the software

The software can be installed on any compatible instrument running Windows 7 (64-bit). See <u>Minimum</u> <u>System Requirements (see page 4)</u> for details.

- **1.** Close all applications.
- 2. Go to the www.tek.com Web site and search for SFP+ QSFP+ Tx to locate the installation file. Download the file SFP+QSFP+Txwebinstaller.exe.
- 3. Double-click the executable file to extract the installation files.

After extraction, the installer launches and the software automatically installs in the following location:

 Windows 7 location: C:\Program Files\Tektronix\TekExpress\TekExpress SFP+ QSFP+ Tx

#### See also

- Minimum System Requirements (see page 4)
- Compatibility (see page 3)

### Activate the license

The SFP+ QSFP+ Tx application runs in Evaluation mode if you do not provide a valid license key. You are allowed 10 free trials in Evaluation mode. Each time you open the application without supplying a valid license key, one of the free trials is used.

An evaluation version of the <u>Host Output TWDPc test (see page 134)</u> is included in the SFP+ QSFP+ Tx installation. You are allowed 10 free trials of this test. Each time you run the test, one of the free trials is used, regardless of how often you open the application. To use this test after the evaluation period, purchase the SFP-WDP option license key.

Activate the license using the Option Installation wizard on the oscilloscope. Instructions for using the Options Installation window to activate licenses for installed applications is provided in the oscilloscope online Help:

1. From the oscilloscope menu bar, click Utilities > Option Installation.

The TekScope Option Installation wizard opens.

2. Press the F1 key on the oscilloscope keyboard to open the Option Installation help topic. Follow the directions in the topic to activate the license.

#### See also

View Version and License Information (see page 7)

# View version and license information

Use the following instructions to view version information for the application and for the application modules such as the Programmatic Interface and the Programmatic Interface Client.

To view version information:

- 1. From the Options menu, select About TekExpress.
- 2. Click the View Version Details link to check the version numbers of the installed test suites.



To view license information:

1. From the oscilloscope Help menu, select About TekScope.

The Options section in the dialog box displays a list of installed options, including SFP+ QSFP+ Tx.

2. To view the Option key, look in the Option installation key section.

#### See also

- Activate the License (see page 6)
- Options Menu (see page 15)

### SFP+ QSFP+ Tx application overview

**NOTE.** The skew between Data+ and Data- in the signal path from the DUT to the oscilloscope will be computed and compensated before running the measurements.

TekExpress is the Tektronix Test Automation Framework, developed to support your current and future test automation needs. TekExpress uses a highly modular architecture that lets you deploy automated test solutions for various standards in a relatively short time.

#### **Key features**

TekExpress SFP+ QSFP+ Tx has the following key features:

- Allows conformance testing to the latest Compliance Test Specification (CTS)
- Reliable Testing:
  - Conformance to SFP+ and QSFP+ interconnect module electrical testing ensures reliable results
  - SFP+ QSFP+ Tx is SFP+ and QSFP+ compliance software
  - Enables execution of the physical-layer (PHY), electrical tests, and SFP+/QSFP+ based electrical measurements
- Automated testing:
  - Minimizes user intervention when conducting time-consuming testing
  - Reduces the time required to conduct testing
- Selective testing:
  - Performs fully-automated testing for transmitter measurements
  - Allows you to select individual tests or test groups in the tree-structure
  - Avoids repeated testing through accurate and reliable results from a single run
- Quick testing:
  - One-button selection of multiple tests ensures faster testing
  - Test margins and statistical information aid analysis to find answers quickly
  - One-button .mht report saves time

- Complete Solution:
  - Wide range of tests for SFP+/QSFP+ Host devices and SFP+/QSFP+ Module devices enables complete validation
  - Complete compliance solution with an elaborate test fixture and signal sources support for SMA cable-based solution provides cost-effective way to perform compliance testing
  - User defined mode supports PRBS7, PRBS11, PRBS15, PRBS20 & PRBS23 in addition to patterns supported in Compliance mode including PRBS9, PRBS31 and 8180
- Customize the setup:
  - Modify the test setup according to the DUT configuration.
  - Run test measurements with different record lengths.
  - Run test measurements with more than one signal.
- Detailed test reporting:
  - Provides a Pass/Fail summary table
  - Provides margin details on each test
  - Provides a consolidated report for all tests
  - Provides additional information such as skew, and signal type selected for each measurement

# Application directories and usage

The application directory and associated files are organized as follows:

퉬 АСР
퉬 Bin
퉬 Compliance Suites
퉬 Documents
퉬 Examples
퉬 ICP
퉬 Images
퉬 Lib
퉬 Report Generator
퉬 SCP
퉬 Tools

The following table lists the default directory names and their usage.

Directory names	Usage		
InstallDir\TekExpress\TekExpress SFP-Tx	Contains the application and associated files		
TekExpress SFP+ QSFP+ Tx\ACP	Contains instrument and SFP+ QSFP+ Tx application-specific interface libraries		
TekExpress SFP+ QSFP+ Tx\Bin	Contains miscellaneous SFP+ QSFP+ Tx application libraries		
TekExpress SFP+ QSFP+ Tx\Compliance Suites	Contains compliance-specific files		
TekExpress SFP+ QSFP+ Tx\Documents	Contains the technical documentation for the SFP+ QSFP+ Tx application		
TekExpress SFP+ QSFP+ Tx\Examples	Contains various support files		
TekExpress SFP+ QSFP+ Tx\ICP	Contains instrument and SFP+ QSFP+ Tx application-specific interface libraries		
TekExpress SFP+ QSFP+ Tx\Images	Contains various Image files		
TekExpress SFP+ QSFP+ Tx\Lib	Contains utility files specific to the SFP+ QSFP+ Tx application		
TekExpress SFP+ QSFP+ Tx\Report Generator	Contains style sheets for report generation		
TekExpress SFP+ QSFP+ Tx\SCP	Contains instrument and SFP+ QSFP+ Tx application-specific interface libraries		
TekExpress SFP+ QSFP+ Tx\Tools	Contains instrument and SFP+ QSFP+ Tx application-specific files		

#### Table 3: Application directories and usage

#### See also

View Test-Related Files (see page 68)

# File name extensions

The TekExpress SFP+ QSFP+ Tx application uses the following file name extensions:

File name extension	Description
.TekX	Session files are saved in this format but the extensions may not be displayed.
.ру	The test sequence file
.xml	The encrypted XML file that contains the test-specific configuration information
	The log file extension is also xml.
.wfm	The test waveform file
.mht	Test result reports are saved in this format by default. Test reports can also be saved in HTML format (see page 56).

#### See also

- View Test-Related Files (see page 68)
- Application Directories and Usage (see page 10)
- Before You Click Start (see page 59)

# Start the application

The first time you open the application after installation, you are required to enter a license key. The application also checks for a file called Resources.xml located in the My TekExpress folder. If this file is not found, the application performs instrument discovery before launching. The Resources.xml file contains information regarding instruments that are available on your network.

**NOTE.** When the application starts, it checks for the appropriate license key. If the valid license key is not present, the application switches to the Evaluation mode. If the application fails to detect the key, it continues to run in Evaluation mode. You are allowed 10 free trials in Evaluation mode. Each time you open the application without supplying a valid license key, one of the free trials is used.

To run the SFP+ QSFP+ Tx application, do one of the following:

- From the TekScope Analyze menu, select **Analyze** > **TekExpress SFP+ QSFP+ Tx**.
- Double-click any saved session file.

While running the application, switch between the oscilloscope screen and SFP+ QSFP+ Tx by clicking the desired window or by using the Alt+Tab key combination. To keep the application window on top, select **Keep On Top** from the <u>Options menu (see page 15)</u>.

**NOTE.** If the application was not terminated properly during the last use, a dialog box asks to recall the previously unsaved session.

#### See also

Activate the License (see page 6)

# **Exit the application**

Use the following method to exit the application:

**NOTE.** Using other methods to exit the application results in abnormal termination of the application.

- 1. Click On the application title bar.
- **2.** Do one of the following:
  - If you have an unsaved session or test setup open, you will be asked to save it before exiting. To save it, click **Yes**. Otherwise click **No**. The application closes.
  - A message box appears asking if you really want to exit TekExpress. To exit, click Yes.

# **Application controls**

Table 4:	Application	controls	descriptions
----------	-------------	----------	--------------

Item	Description	
Options menu (see page 15)	Opens the Options menu for access to global controls	
Panels (see page 19)	Visual frames with sets of related options	
Command buttons	Buttons that initiate an immediate action such as the Start, Stop, Pause, Continue, and Clear command buttons	
Start button		
	Use the Start button to continuously acquire and accumulate measurements. If prior acquired measurements have not been cleared, the new measurements are added to the existing set.	
Stop button	Stop	
	Use the Stop button to abort the test.	
Pause \ Continue button	Pause Continue	
	Use the Pause button to temporarily interrupt the current acquisition. When a test is paused, the button name changes to "Continue."	
Clear button	Clear	
	Use the Clear button to clear all existing measurement results. Adding or deleting a measurement, or changing a configuration parameter of an existing measurement, also clears measurements. This is to prevent the accumulation of measurement statistics or sets of statistics that are not coherent. This button is available only on the <u>Results panel</u> (see page 29).	
Application window move icon	Tek	
	Place the cursor over the three-dot pattern in the upper left corner of the application window. When the cursor changes to a hand, drag the window to the desired location.	

# **Options menu**

The Options menu is located in the upper right corner of the application.

#### The Options menu (see page 16) has the following selections:

Menu	Function	
Default Test Setup	Opens an untitled test setup with defaults selected	
Open Test Setup	Opens a saved test setup	
Save Test Setup	Saves the current test setup selections	
Save Test Setup As	Creates a new test setup based on an existing one	
Open Recent	Displays a menu of recently opened test setups to select from	
Instrument Control Settings (see page 18)	Shows the list of instruments connected to the test setup and allows you to locate and refresh connections to those instruments	
Keep On Top	Keeps the TekExpress SFP+ QSFP+ Tx application on top of other open windows on the desktop	
Email Settings (see page 17)	Use to configure email options for test run and results notifications	
Deskew (see page 152)	Use to deskew channels	
Help	Displays TekExpress Help	
About TekExpress	<ul> <li>Displays application details such as software name, version number, and copyright</li> </ul>	
	Provides access to license information (see page 7) for your SFP+ QSFP+ Tx installation	

Provides a link to the Tektronix Web site



#### See also

Application Controls (see page 15)

# **Email settings**

Use the Email Settings utility to <u>configure email notifications (see page 55)</u> if you want to receive notifications when a test completes, produces an error, or fails. Select the type of test session information to include in the notification, such as test reports and test logs, the email message format, and the email message size limit.

**NOTE.** Recipient email address, sender's address, and SMTP Server are mandatory fields. The ScoreCard and Ayalysis Screenshot options are not available in SFP+ QSFP+ Tx.

Email Settings	
Recipient e-mail Address(es)	
Note: Separate Email	addresses with a comma
Sender's Address	
Email Attachments	Server Configuration
Reports	SMTP Server SMTP Port
ScoreCard	Login
Analysis Screenshot	Password
Status Log OLast 20 Lines OFull Log	Host Name
Email Configuration	
Email Format 💿 HTML OPlain Text	Number of Attempts to Send 1
Max Email Size (MB) 5	Timeout
Email Test Results When complete or on error	Test Email Apply Close

#### See also

- Options Menu (see page 15)
- Select Test Notification Preferences (see page 56)

# Instrument control settings

The Instrument Control Settings dialog box shows the list of resources found on different connections. It serves two purposes:

- Discovers the connected instruments
- Confirms the instrument connection setup

					(
TekExpress Inst	rument Control S	ettings			
Search Criteria			_		
🗖 LAN 🔽 🤆	iPIB 🧮 Serial	Non - VISA Resourc	es		
🔲 TekLink 📃 L	ISB 🔲 VXI		Refresh	TekVISA 300	s
Retrieved Instrum	nents (1)		-		
Connection	Resource	Serial No	Options	Resource Addr	
VISA-GPIB	DP072004C	B130233			
	atabar 05, 2011 13:43	-41			
	CODE 00, 2011 13:43			Close	
					-

Use the Instrument Control Settings feature to <u>search for connected instruments (see page 40)</u> and view instrument connection details. Connected instruments displayed here can be selected for use under Global Settings in the test configuration section. See step 2 of <u>Configure Tests (see page 52)</u> for details.

#### See also

Options Menu (see page 15)

# About panels

TekExpress SFP+ QSFP+ Tx has the following main panels:

#### **Table 5: Application panels**

Panel Name	Purpose
Setup (see page 19)	The Setup panel allows you to configure the test setup. Use this panel to:
	Select device parameters (see page 42).
	Select the test(s) (see page 44).
	Select acquisitions parameters (see page 46) for selected tests.
	Configure the selected tests (see page 52).
	Select test notification preferences (see page 56).
Status (see page 27)	View the acquisition and analysis status of the selected tests, and view test logs.
Results (see page 29)	View a summary of test results and select result viewing preferences.
Reports (see page 30)	Browse for reports, save reports, specify report naming conventions, select content to include (such as summary information, detailed information, user comments, plot images, setup configuration), and select other report viewing options.

#### See also

Application Controls (see page 15)

# Setup panel

The Setup panel has numbered tabs to guide you through the test setup process:

- 1 <u>DUT (see page 20)</u>
- 2 <u>Test Selection (see page 23)</u>
- 3 <u>Acquisitions (see page 24)</u>
- 4 <u>Configuration (see page 25)</u>
- 5 <u>Preferences (see page 26)</u>

By default, only the DUT, Test Selection, Acquisitions, and Preferences tabs are displayed. The Configuration tab is only available if you select the <u>Advanced View (see page 21)</u> option in the DUT tab. Otherwise, configuration settings for tests are available from the Configure button on the Test Selection tab.

Options selected in a preceding tab affect options available in the next tab down. However, you can switch between the tabs in any order if you need to modify test parameters. For more information on using the Setup panel, see <u>Test Setup Overview (see page 42)</u>.

By default, QSFP+ Tx is the selected standard in the DUT tab. Use the Standard drop-down box to select the <u>SFP+ Tx (see page 22)</u> standard.

When you finish making selections in a tab and move to the next tab, the number in the tab title changes to a check mark. If you make changes on a tab that significantly affect the settings set in a preceding tab, the check mark in the tab title of the affected tab is replaced with the number again to indicate that you should check the settings on that tab.

#### See also

- About Panels (see page 19)
- Select Device Parameters (see page 42)
- Select a Test (see page 44)
- Select Acquisitions (see page 46)
- Configure Tests (see page 52)
- Select Test Notification Preferences (see page 56)

TekExpress SFP+ QSFP+ T	x - (Untitled)*	Options 💌
Setup 1 DUT 2 Test Selection 3 Acquisitions esults 4 Preferences	DUT ID       DUT001         • Acquire live waveforms       Use pre-recorded waveform files         View       Compliance         Standard       QSFP+ Tx         Version       SFF-8635 Revision 0.4         Device Profile	Pause
	<ul> <li>Host Module</li> <li>I0GSFP+Cu Direct Attach Cable</li> <li>Number of Lanes to Test</li> <li>Lane Selected Test Lanes Setup</li> <li>Lane0</li> </ul>	

DUT tab, QSFP+ Tx advand	ced view	
TekExpress SFP+ QSFP+ T	x - (Untitled)*	Options
Setup     1     DUT       Status     2     Test Selection       3     Acquisitions       4     Configuration       5     Preferences	DUT ID       DUT001         • Acquire live waveforms       Use pre-recorded waveform files         View       Advanced         Standard       QSFP+ Tx         Version       SFF-8635 Revision 0.4         Device Profile         • Host       Module	Pause
	<ul> <li>IOGSFP+Cu Direct Attach Cable</li> <li>Number of Lanes to Test</li> <li>1 Lane</li> <li>Selected Test Lanes</li> <li>Setup</li> <li>Lane0</li> </ul>	
Status Ready		

TekExpress SI P	+ QSFF+ IX - (OI	uuea)			Options •	Start
Setup 1 DUT	DUT ID	DUT001		1		
Status 2 Test	Selection View	uire live waveforms	) Use pre-reco	rded waveform files		
Results 3 Acqu	<b>lisitions</b> Standar	rd SFP+ Tx 🔻	Version SF	F-8431 Revision 4.1	•	
Reports 4 Pref	erences Device	Profile				
	💽 Но	st 🔵 Module				
	✓ 10G	SFP+Cu Direct Attach Cable				



Acquisitions tab, QSFP+ T	x host profile		
TekExpress SFP+ QSFP+ T	x - (Untitled)	Opti	ons 🔻 🗶
	QSFP+ Tx : Host : SFF-	Start	
Setup	Lane Source	Deskew	
Test Selection	Lane0+ CH1		
Status	LaneO- CH3		Pause
Besults 3 Acquisitions			
Reports 4 Preterences			
	Test News	at-tat	
	Single Ended Output	tVoltage Pange Lang0 : Single Ended Output Voltage	
	Output AC Common	Mode voltage (RMS) ane0 : Output AC Common Mode vo	
	Signal Rise/Fall Tim	ne (20%-80%) Lane0 : Signal Rise/Fall Time (20%-8	
	Data Dependent Jitt	er Lane0 : Data Dependent Jitter Acquis	i i i
	Data Dependent Pu	lse Width Shrinkage Lane0 : Data Dependent Pulse Width	
	Uncorrelated litter	Lane Character Acquisition	
	Acquisition and Save	Options	
	<ul> <li>Save All Waveforms</li> </ul>	s Before Analysis	ers
		Signal Validation	
		Prompt me if signal f	× .
Status Ready			



Preferences tab		
TekExpress SFP+ QSFP+ T	< - (Untitled)*	Options
Setup Status Results Reports DUT Test Selection Acquisitions Configuration 5 Preferences	On Test Failure, stop and notify me of the failure	il gs
Chelus Bandu		
Status Ready		

# **Status panel**

Use the Status panel to track test measurement progress. The Status panel has two tabs: the <u>Test Status</u> (see page 28) tab displays the acquire status and the analysis status of the tests as they are being executed; the Log View tab (shown below) displays a view of the test log.

For more information on using the Status panel, see <u>View the Progress of Analysis (see page 63)</u>.

🔏 TekExpress	SFP+ QSFP+ Tx - (	(Untitled)*	Options
Test	Status Log View		
Setup		Message History	V Show Detailed Log
Status         Initia           05/2         05/2           05/	Ilizing run time environment. T1 (1/13) 01:40:57 : pact: SFF-86 (1/13) 01:40:57 : QSFPConsta (1/13) 01:40:57 : QSFPConsta (1/13) 01:40:57 : Scope Addre (1/13) 01:40:57 : Scope Addre (1/13) 01:40:57 : Scope Addre (1/13) 01:40:57 : Calibration S1 (1/13) 01:40:57 : Calibration S1 (1/13) 01:40:57 : Calibration S1 (1/13) 01:40:57 : Selected Tes (1/13) 01:40:57 : Selected Tes (1/13) 01:40:57 : Selected Tes (1/13) 01:40:58 : SIGNAL_VAI (1/13) 01:40:58 : Total Signal (1/13) 01:40:58 : For Lane0 (1/13) 01:40:58 : Acquiring wa (1/13) 01:40:58 : Acquiring wa	his might take some time. 335 Revision 0.4 2013-05-21 01:40:57.756000 Ints.PRE_RECORDED_MODE : False (] GPIB8:1::INSTR 35:: GPIB8:1::INSTR 35:: GPIB8:1::INSTR 36: MS072004C Build 3 37:: MS072004C Build 3 37:: Magnetic C230691 tatus : PASS Tests: : [Single Ended Output Voltage Range', 'Output 52:: [Single Ended Output Voltage Range', 'Output 53:: [Single Ended Output Voltage Range', 'PRBS 54: Lane0 64: Lane0 65: Coupled PRBS31', 'PRBS31', '8180', 'PRBS 7ypes:4 rveforms for Single Ended Output Voltage Range Ac	ut AC Common Mode voltage (RMS)', AC Common Mode voltage (RMS)', 'S In Mode voltage (RMS)', 'Signal Rise/ (91) quisition for signal AC Coupled PRBS:
	III		
	Auto Scroll		Clear Log Save
Status	Completed.		

#### See also

About Panels (see page 19)

Image: Single Ended Output Voltage Range       Single Ended Output Voltage Range Acquisition       To be started       To be started         Output AC Common Mode voltage (RMS)       Output AC Common Mode voltage (RMS)       Output AC Common Mode voltage (RMS)       To be started       To be started         Signal Rise/Fall Time (20%-80%)       Signal Rise/Fall Time (20%-80%)       Signal Rise/Fall Time (20%-80%)       To be started       To be started         Data Dependent Jitter       Data Dependent Jitter Acquisition       To be started       To be started	irted
Range Acquisition         To be started         To be started           Output AC Common Mode voltage (RMS)         Output AC Common Mode voltage (RMS) Acquisition         To be started         To be started           Signal Rise/Fall Time (20%-80%)         Signal Rise/Fall Time (20%-80%)         Acquisition         To be started         To be started           Data Dependent Jitter         Data Dependent Jitter Acquisition         To be started         To be started	inted
Signal Rise/Fall Time (20%-80%)         Signal Rise/Fall Time (20%-80%)         To be started         To be started           Data Dependent Jitter         Data Dependent Jitter Acquisition         To be started         To be started	
Data Dependent Jitter Data Dependent Jitter Acquisition To be started To be sta	rted
	rted
Data Dependent Pulse Width Shrinkage Data Dependent Pulse Width Shrinkage Acquisition To be started To be started	irted
Uncorrelated Jitter Uncorrelated Jitter Acquisition To be started To be sta	rted
Transmitter Qsq Transmitter Qsq Acquisition To be started To be sta	rted
Eye Mask Hit Ratio Eye Mask Hit Ratio Acquisition To be started To be sta	rted
Voltage Modulation Amplitude (p-p) Voltage Modulation Amplitude (p-p) Acquisition To be started To be started	irted
Transmitter Qsq (for Cu) Transmitter Qsq (for Cu) To be started To be st	irted
Output AC Common Mode voltage (RMS) (for Cu) Output AC Common Mode voltage (RMS) (for Cu) Acquisition To be started To be started	rted
Host Output TWDPc Host Output TWDPc Acquisition To be started To be sta	rted
# **Results panel**

When a test completes, the application switches to the Results panel to display a summary of test results.

**NOTE.** Results of Crosstalk measurements, Total Jitter @ J2, and Total Jitter @ J9 are not included in the overall test results because these measurements are informative only.

Set viewing preferences for this panel from the Preferences menu in the upper right corner. Viewing preferences include showing whether a test passed or failed, summary results or detailed results, and enabling wordwrap. For information on using this panel, see <u>View Test Results (see page 64)</u>.

Overa	all Test Result Live				Preferences 💌		
D	escr	iption	Details	Pass/Fail	Value	Margin	
	-	Signal Rise/Fall Time (20%-80%)	Signal Rise/Fall Time (20%-80%) RiseTime	🥑 Pass	52.9379	18.9379	
		High Limit		N.A	N.A		
		Low Limit		🥑 Pass	34.0		
	Ξ	Signal Rise/Fall Time (20%-80%)	Signal Rise/Fall Time (20%-80%) FallTime	🧭 Pass	46.9951	12.9951	
		High Limit		N.A	N.A		
		Low Limit		🥑 Pass	34.0		
	•	Data Dependent Pulse Width Shrinkage	Data Dependent Pulse Width Shrinkage	🕜 Pass	0.0156	0.0394	
		High Limit		🌍 Pass	0.055		
		Low Limit		N.A	N.A		
	Ξ	Uncorrelated Jitter	Uncorrelated	Pass	0.0041	0.0189	
		High Limit		📀 Pass	0.023		
		Low Limit		N.A	N.A		=
	+	Transmitter Qsq	Transmitter Qsq	📀 Pass	142.8168	92.8168	
	÷	Voltage Modulation	Voltage Modulation	🥑 Pass	497.4027	197.4027	
	÷	Transmitter Qsq (for Cu)	Transmitter Qsq (for Cu)	🥑 Pass	142.8168	79.7168	
	÷	Host Output TWDPc	Host Output TWDPc	📀 Pass	10.3854	0.3146	~

### See also

About Panels (see page 19)

# **Reports panel**

Use the Reports panel to browse for reports, name and save reports, select report content to include, and select report viewing options.

For information on setting up reports, see <u>Select Report Options (see page 56)</u>. For information on viewing reports, see <u>View the Report (see page 65)</u>.

Setup       • Generate new report         • Append with previous run session         • Replace current test results in previous run session	Start
Setup       • Generate new report         • Append with previous run session         • Replace current test results in previous run session	
Append with previous run session     Replace current test results in previous run session	0
Status O Replace current test results in previous run session	
Results Report name X:\SFP+ QSFP+ Tx\Reports\DUT001.r (Browse)	Pause
Reports Save as type Web Archive (*.mht;*.mhtml)	
Auto increment report name if duplicate	
Contents To Save	
✓ Include pass/fail results summary	
✓ Include detailed results	
✓ Include plot images	
✓ Include setup configuration	
✓ Include user comments	
View View report after generating View Senerate Save As	
Status Ready	

## See also

About Panels (see page 19)

# About test setups

TekExpress SFP+ QSFP+ Tx opens with the default setup selected for the default standard (QSFP+). Run a test before or after saving a setup. When you save a setup, the test information, such as the selected oscilloscope, general parameters, acquisition parameters, measurement limits, waveforms (if applicable), and other configuration settings are all saved under the setup name. Use test setups to:

- Run a saved test in prerecorded mode (see page 62).
- View all the information associated with a saved test, including the log file, the history of the test status as it executed, and the results summary. For details, see Recall a Saved Test Setup (see page 32).
- Create a new test setup based on an existing one (see page 32).

#### See also

- About Setting Up Tests (see page 33)
- Save a Test Setup (see page 31)
- Recall a Saved Test Setup (see page 32)

## Save a test setup

Save a test setup before or after running a test using the parameters you want saved. Create a new test setup from any open setup or from the default setup. When you select the default test setup, all parameters are returned to their defaults.

The following instructions start from the default test setup:

- 1. From the Options menu, select **Default Test Setup**.
- 2. Select the desired options in the Setup panel.
- 3. Select the desired report options (see page 56).
- **4.** If desired, run the test to be sure that it captures the desired information. If it does not, edit the parameters.
- 5. From the Options menu, select Save Test Setup.

- About Setting Up Tests (see page 33)
- Test Setup Overview (see page 42)
- View Test-Related Files (see page 68)

# Recall a saved test setup

These instructions are for recalling saved test setups.

- 1. From the Options menu, select **Open Test Setup**.
- 2. In the File Open dialog box, select the desired setup from the list and then click Open.

### See also

- About Test Setups (see page 31)
- Create a New Test Setup Based on an Existing One (see page 32)

## Create a new test setup based on an existing one

Use this method to create a variation on a test setup without having to create the setup from the beginning.

- 1. From the Options menu, select Open Test Setup.
- 2. In the File Open dialog box, select the desired setup from the list and then click Open.
- 3. Modify the parameters as desired.
- 4. From the Options menu, select Save Test Setup As.
- 5. In the File Save As dialog box, enter a test setup name and then click Save.

- About Test Setups (see page 31)
- Select Device Parameters (see page 42)
- Configure Tests (see page 52)
- Select Acquisitions (see page 46)

# About setting up tests

Set up tests using the tabs in the <u>Setup panel (see page 19)</u>. Settings in the DUT tab use a top-down, left-to-right logic flow, so that any parameter that affects or acts as a filter for other parameters appears either above or to the left of the affected parameters.

### Test options: standards, views, and modes

Test options include two standards, QSFP+ Tx and SFP+ Tx (selected in the DUT tab of the Setup panel), two views, Compliance and Advanced (selected in the DUT tab of the Setup panel), and two modes, Compliance and User Defined (selected in the configuration settings of the Setup panel).

The selected standard determines which measurement standard will be used. The selected view determines where the test configuration settings are displayed. The selected mode determines whether you can change test configuration settings to include those that are noncompliant.

#### **Compliance View** selected with **Compliance Mode**

View configuration options in the Test Selection tab of the Setup panel. Tests will run automatically with little or no user intervention. You will not be able to change test parameters to anything that deviates from the compliance standards. The only test configuration parameters that you can change in this mode are the Global Settings.

#### **Compliance View** selected with User-Defined Mode

View configuration options in the Test Selection tab of the Setup panel. Tests will run automatically but you will be able to change the parameters before starting the tests.

### Advanced View selected with Compliance Mode

View configuration options in the Configuration tab of the Setup panel. Tests will run automatically with little or no user intervention. You will not be able to change test parameters to anything that deviates from the compliance standards. The only configuration parameters that you can change in this mode are the Global Settings.

### Advanced View selected with User-Defined Mode

View configuration options in the Configuration tab of the Setup panel. Tests will run automatically but you will be able to change test parameters before starting the tests.

### Supported tests

The application supports the following tests, grouped by profile.

Host Profile Tests

- SFF-8431 Table 11 Output Electrical Specifications at B:
  - <u>Single Ended Output Voltage Range (see page 113)</u>
  - Output AC Common Mode voltage (RMS) (see page 114)

- SFF-8431 Table 12 Jitter and Eye Mask Specifications at B:
  - <u>Crosstalk Source Rise/Fall Time (20%–80%) (see page 115)</u>
  - <u>Crosstalk Source Amplitude (p-p Differential) (see page 116)</u>
  - Signal Rise/Fall Time (20%–80%) (see page 117)
  - Total Jitter (see page 119)
  - Data Dependent Jitter (see page 121)
  - Data Dependent Pulse Width Shrinkage (see page 123)
  - Uncorrelated Jitter (see page 125)
  - Transmitter Qsq (see page 126)
  - Eye Mask Hit Ratio (see page 128)
- SFF-8431 Table 33 Output Specifications at B for Cu:

**NOTE.** The group SFF-8431 Table 33 Output Specifications at B for Cu is associated with the 10GSFP+ Cu Direct Attach Cable device profile (the check box for this profile is located on the DUT tab of the Setup panel). This group of tests is available only when this check box is selected.

- Voltage Modulation Amplitude (p-p) (see page 130)
- Transmitter Qsq (for Cu) (see page 131)
- Output AC Common Mode voltage (RMS) (for Cu) (see page 133)
- Host Output TWDPc (see page 134)

**NOTE.** An evaluation version of the Host Output TWDPc test is included in the SFP+QSFP+Tx installation. You are allowed 10 free trials of this test. Each time you run the test, regardless of how often you open the application, one of the free trials is used. To use this test after the evaluation period, purchase the SFP-WDP option license key.

## Module Profile Tests

- SFF-8431 Table 16 Transmitter Input Electrical Specifications at B:
  - AC Common-Mode Voltage Tolerance (see page 135)
  - Single-Ended Input Voltage Tolerance (see page 136)

- SFF-8431 Table 17 Transmitter Input Tolerance Signal Calibrated at B:
  - <u>Crosstalk Source Rise/Fall Time (20%-80%) (see page 137)</u>
  - Crosstalk Source Amplitude (p-p Differential) (see page 138)
  - Output AC Common-Mode Voltage (RMS) (see page 140)
  - Total Jitter (see page 141)
  - Data Dependent Jitter (see page 143)
  - Data Dependent Pulse Width Shrinkage (see page 145)
  - Uncorrelated Jitter (see page 147)
  - Eye Mask Hit Ratio (see page 148)
- Additional Supported Measurements for QSFP+ only
  - Total Jitter @ J2
  - Total Jitter @ J9

- Test Setup Overview (see page 42)
- Before You Click Start (see page 59)
- About Test Setups (see page 31)

# Equipment connection setup

To run tests, you need the following equipment (for details, see <u>Minimum System Requirements (see page 4)</u>):

- A supported Tektronix oscilloscope (see page 3)
- The device under test
- SFP+ or QSFP+ fixtures

### Table 6: SFP+ and QSFP+ fixtures

Tektronix nomenclature	Description
TF-SFP-TPA-HCB-P	SFP+ Host Compliance Board Plug
TF-SFP-TPA-MCB-R	SFP+ Module Compliance Board Receptacle
TF-SF-TPA-PR	SFP+ Host Compliance Board Plug and Module Compliance Board Receptacle
TF-SFP-TPA- HCB-PK	SFP+ Host Compliance Board Plug Kit with DC Blocks and Termination
TF-SFP-TPA- MCB-RK	SFP+ Module Compliance Board Receptacle Kit with DC Block and Termination
TF-SFP-TPA-PRK	SFP+ Host Module Compliance Board and Module Compliance Board with DC Blocks and Termination
TF-QSFP-TPA- HCB-P	QSFP+ Host Compliance 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

Equipment connections can vary by Device Profile (Host and Module) and by individual test. Refer to the following connection diagrams when setting up equipment for testing.

## **Connection setup for Host tests**

Table 12 Crosstalk Source tests



All other Host tests



Test setup for all measurements other than single-ended output voltage range



Test setup for single ended output voltage range measurement on DPO/DSA70000D series oscilloscopes



Test setup for single ended output voltage range measurement on all oscilloscopes other than DPO/DSA70000D series oscilloscopes

## Connection setup for module tests

Single-Ended Input Voltage Tolerance Test



All other Module tests



## See also

- View Connected Instruments (see page 40)
- About Setting Up Tests (see page 33)
- Oscilloscope Setup (see page 111)

# View connected instruments

Use the Instrument Control Settings dialog box to view or search for connected instruments required for the tests. The application uses TekVISA to discover the connected instruments.

To refresh the list of connected instruments:

- 1. From the Options menu, select Instrument Control Settings.
- 2. In the Search Criteria section of the Instrument Control Settings dialog box, select the connection types of the instruments to search for. By default, only the GPIB resource type is selected but you can select as many types as your system and setup use.

Instrument search is based on the VISA layer but different connected cables determine the resource type, such as LAN, GPIB, USB. For example, if you choose LAN, the search will include all the instruments supported by TekExpress that are communicating over the LAN. If the search does not find any instruments that match a selected resource type, a message appears telling you that no such instruments were found. If you selected more than one resource type for the search, after you close the message window, the application will continue searching for the other selected types.

- 3. Click Refresh. TekExpress searches for connected instruments.
- 4. After discovery, the dialog box lists the instrument-related details based on the selected search criteria. For example, if you selected LAN and GPIB as the search criteria, the application checks for the availability of instruments over LAN, then GPIB.

/	LAN 🗹 GF	1B 🔲 Serial	Non - VISA Res	sources	
	TekLink 🧮 US	iB 🔽 VXI		R	fresh TekVISA 300 s Timeout
	Connection	Resource	Serial No	Options	Resource Addr
•	VISA-GPIB	MSO70604	CHR0007	MTH	
	VISA-LAN	DP05204	PQ000008	MTH	
	VISA-LAN	DP073304C	CHAR05	MTH	
	VISA-LAN	900029100	Q300002	MTH	
	VISA-LAN	DP070804	PQ204	MTH	

The Retrieved Instruments table displays details about the instruments. The time and date of instrument refresh is displayed in the Last Updated field.

- Configure Tests (see page 52)
- Equipment Connection Setup (see page 36)

# Test setup overview

Test setup includes acquisition and configuration parameters, but you can also select report options when setting up tests. Use the options in the <u>Setup panel (see page 19)</u> and <u>Reports panel (see page 30)</u> to select and configure tests.

- 1. Select device parameters (see page 42).
- 2. <u>Select one or more tests (see page 44)</u>.
- 3. <u>Select acquisitions (see page 46)</u>.
- 4. Configure tests (see page 52).
- 5. <u>Set test measurement notification options (see page 56)</u>.
- 6. <u>Select report options (see page 56)</u>.

### See also

- Before You Click Start (see page 59)
- Pre-Run Checklist (see page 61)
- About Running Tests (see page 59)

# Select device parameters

Use the Setup panel DUT tab to select settings for the device under test. Options selected here affect which tests are available in the Test Selection tab.

- 1. In the Setup panel, click the **DUT** tab.
- **2.** If needed, in the DUT ID field, enter the ID for the device. The default value is DUT001. The name in this field appears on reports.
- 3. (Optional) To add comments that will appear at the top of the test Report for the selected DUT, click the note pad icon (
   b) to the right of the DUT ID field and specify a comment up to 256 characters. (To enable or disable comments appearing on the test report, see <u>Select Report Options (see page 56)</u>.)
- 4. Select whether to use a prerecorded waveform file or a live waveform for testing.

If you are rerunning a saved test and select to use a prerecorded waveform file, select the desired run session. For more information, see <u>Run a Saved Test in Prerecorded Mode (see page 62)</u>.

5. For View, select Compliance or Advanced.

**NOTE.** If you select Advanced View, the configuration settings are included in the Setup steps as step 4. If you select Compliance View, the configuration step is not included as a separate step. Access configuration parameters for selected tests from the Configure button in the Test Selection tab.

- 6. For Standard, select QSFP+ Tx or SFP+ Tx. If you select the QSFP+ Tx standard, you can configure which lanes to test as described in step 8.
- 7. For Device Profile, select one:
  - Host (default). Select this option to enable selecting Host tests listed in the Test Selection tab. To include measurements related to an attached copper cable, select the 10GSFP+Cu Direct Attach Cable check box.
  - Module. Select this option to enable selecting Module tests listed in the Test Selection tab.
- **8.** To configure the lane selection:
  - Use the Number of Lanes to Test drop-down box to select 1 Lane, 2 Lanes, or 4 Lanes.
  - Click the Selected Test Lanes Setup button to open the <u>Test Lane Setup dialog (see page 43)</u>. Use the dialog to configure which lanes to test.

- About Setting Up Tests (see page 33)
- Select a Test (see page 44)
- Use Prerecorded Waveforms for Analysis (see page 48)
- Acquire Live Waveforms for Analysis (see page 49)

st Lane Setup dialog			
	8		
Test Lane Setup			
Link Width 1 Lane			
Select the lanes to test			
Lane0 Lane1 Lane2	Lane3		
Select All Deselect All	Cancel OK		

# Select a test

Tests listed in the Test Selection tab depend on whether you selected Host or Module in the DUT tab. The available tests are the same for both standards (QSFP+ Tx and SFP+ Tx). Use these instructions to select the tests to run on the connected DUT. Select tests individually or by group. To see a short description of a test, select the test in the list.

- 1. In the Setup panel, click the Test Selection tab.
- 2. All required tests are selected by default. Click **Deselect All** if you do not want to run all required tests.
- **3.** Select the desired test(s):
  - To select all required tests, click the **Select Required** button.
  - To select all tests in the list, click the **Select All** button.
  - To select an entire test group, select the check box for the test group; tests listed under the group are automatically selected.
  - To select one or more, but not all, tests in a test group, select only the check boxes for the desired tests.

Test Selection Controls

#### Table 7: Setup panel test controls

Button	Description
Configure	When the View type selected in the DUT tab is Compliance, this button opens the configuration section for the selected test. If the View type is Advanced, this button is not displayed.
Schematic	Displays the schematic document for the selected test. Use to verify the test setup before running the test
Deselect	Deselects all tests in the table
Select Required	Selects tests required for compliance and deselects all other tests currently selected
Select All	Selects all tests in the table

- Select Acquisitions (see page 46)
- About Setting Up Tests (see page 33)

# About acquisitions

Use the Acquisitions tab in the Setup panel to view and set <u>acquisition and save options (see page 46)</u> for the selected tests.

The information on the Acquisitions tab is specific to a test suite and gets updated when you change the selected test suite. This tab shows the acquisition details for the tests in the currently selected suite. Other options available depend on whether you selected the QSFP+ Tx or the SFP+ Tx standard, selected to acquire live waveforms (see page 49), or selected to use prerecorded waveform files (see page 48).

For example, the top part of the Acquisitions tab is the data source selection area. The information that appears here depends on the selected standard, the number of lanes to be tested (QSFP+ Tx only), whether you are using prerecorded waveforms or live waveforms, and whether you selected Host profile or Module profile in the DUT tab.

Below the data source selection area is the test acquisition and mapping table. The Acquisitions table shows the test name, acquisition, and signal type used for each test, and the waveform files used for tests run in prerecorded mode.

Column Name	Function
Test Name	Displays the name of the selected test to which the acquisitions apply. One or more tests can perform the same acquisitions.
Acquisition	The acquisition of the waveform for the corresponding test
Signal Type	Shows the acquisition parameters of the signal. This column is displayed only if the <b>Show Acquire Parameters</b> check box is selected in the Acquisition and Save Options section.
Waveform File	Lists the name of the waveform files used for the test. Select waveform files by clicking the button in the row and selecting any waveform file using the standard File Open window. This option is available only when <b>Use</b> <b>pre-recorded waveform files</b> is selected in the Setup panel DUT tab.

### Table 8: Acquisitions table

#### See also

Select Acquisitions (see page 46)

About Setting Up Tests (see page 33)

# **Select acquisitions**

Use the Acquisitions tab in the Setup panel to view and set acquisition parameters for selected tests. Options available depend on whether you are testing using live waveforms or prerecorded waveform files.

- 1. In the Setup panel, click the Acquisitions tab.
- **2.** Do one of the following:
  - For prerecorded waveform files: in the Acquisitions table, locate the row for the desired test and then click the ellipsis button (<sup>(iii)</sup>) in the Waveform FileName column. Select Data Positive (DP) and Data Negative (DN) waveforms for each test.
  - For capturing live waveforms, select the Data Source channels for positive and negative signals if needed.
- **3.** Deskew channels (see page 152).
- 4. Select the acquisition and save options (see page 46).

### See also

- Configure Tests (see page 52)
- About Setting Up Tests (see page 33)
- Test Setup Overview (see page 42)

## Acquisition parameters

Available acquisition options depend on the selected mode (Compliance or User Defined) and the type of waveform being used, live or prerecorded.

#### Table 9: Acquisition and save options

Option	Description		
Show Acquire Parameters	When selected, the signal acquisition parameter for each test displays in the Signal Type column.		
NOTE. The rest of the options in the	nis table are available for live waveform acquisitions only.		
Data Source (+) Data Source (-)	Sets the channels used for positive and negative data sources. When QSFP+ Tx is the selected standard, data sources for each lane to be tested can be configured.		
Signal Validation:	Determines how the application responds to the source signal		

Table 9:	Acquisition	and save	options	(cont.)
----------	-------------	----------	---------	---------

Option	Description
Prompt me if signal fails	If the signal fails, pauses the measurement operation and displays a dialog box with the following options:
	Signal Validation Failed

Invalid Signal, what do you wish to do?

		Continue Skip Test ReAcquire
		<ul><li>Reacquire: Try acquiring the signal again.</li><li>Use Anyway: Use the signal even if it cannot be validated.</li></ul>
		<ul> <li>Skip Test: Abort the test if the signal cannot be validated.</li> </ul>
	Use signal as is—Don't Check	Skips the signal validation process. Does not test the signal for its characteristics
	Skip test if signal fails	Moves to the next test (if applicable) if the signal fails
N	<b>DTE.</b> The following Save options	affect the order in which waveforms are acquired and analyzed.
Sa An	ve All Waveforms Before alysis	Waveforms will be saved before being analyzed.
	,	

## See also

About Acquisitions (see page 45)

Select Acquisitions (see page 46)

# Use prerecorded waveforms for analysis

Use prerecorded waveform files to run saved tests or to run a new test using a saved waveform from another test.

Run a saved test in prerecorded mode (see page 62).

Run a new test using a prerecorded waveform file.

- **1.** Create a new test (see page 31).
- 2. In the DUT tab of the Setup panel, select Use pre-recorded waveform files.
- 3. Change any other DUT parameters as desired (see page 42).
- 4. In the Test Selection tab, select the desired test(s) (see page 44).
- 5. In the Acquisitions tab, locate the Waveform FileName column in the Acquisitions table. Click the ellipsis button () for each test and select Data Positive (DP) and Data Negative (DN) waveforms for each test.
- 6. Change or select other parameters as needed and then click **Start** to run the test.

- Test Setup Overview (see page 42)
- About Acquisitions (see page 45)
- Configure Tests (see page 52)

# Acquire live waveforms for analysis

Use these instructions to set up acquisition for a live waveform.

- 1. Open a saved test setup (see page 32) or create a new one (see page 31).
- 2. In the Setup panel DUT tab, enter the desired DUT in the corresponding field if needed and then select Acquire live waveforms.
- 3. Select other DUT parameters (see page 42) as desired.
- 4. In the Test Selection tab, select the desired test(s) (see page 44).
- 5. In the Acquisitions tab, select the channels for the positive and negative data sources if needed.
- 6. Deskew channels (see page 152) if needed.
- 7. Select other desired acquisition and save options (see page 46).
- 8. <u>Configure the tests (see page 52)</u> if needed and then click **Start** to run the test.

- About Acquisitions (see page 45)
- Select Acquisitions (see page 46)
- Use Prerecorded Waveforms for Analysis (see page 48)

# About configuring tests

Use configuration settings to view and edit the analysis parameters for selected tests.

The Configuration tab shows Global Settings parameters and Measurement parameters.

Global Settings parameters are common for all tests and are applied to all tests in the session until you change the settings or select a different test setup.

TekExpress SFP+ QSFP+ T	x - (Untitled)*	Options 🔹
Setup DUT	Compliance Mode OUser Defined Mode     Selection	Limits Editor
2 Test Selection	Global Settings Measurements	
Status	Instruments Detected	Pause
Results Acquisitions	Real Time Scope M5072004C ( GPIB8::1::INSTR )	
Preferences		
Reports		
	Record Length Data Rate(Gbps)	
	5M T 10.3125 T	
	✓ Use Filter File for De-embedding (All Test except TWDPC)	
	Select Filter File	se
	✓ Use Filter File for De-embedding for TWDPC	
	Select Filter File	se
Status Completed.		

**NOTE.** The Use Filter File for De-embedding (only for TWDPC) check box is available only if the test Host Output TWDPC is selected in the Test Selection tab.

Measurement parameters are specific to the test selected in the tree view section of the configuration settings. Test-specific parameters can include acquisition, analysis, and limit parameters, and certain oscilloscope settings.

Whether you can configure settings depends on which mode you selected, Compliance or User Defined. For more information, see <u>About Setting Up Tests (see page 33)</u>.



**NOTE.** If you selected Compliance View in the DUT tab, you will access test configuration settings using the Configure button in the Test Selection tab. If you selected Advanced View, access test configuration settings from the Configuration tab in the Setup panel.

- Configure Tests
- About Running Tests (see page 59)

# **Configure tests**

Use these instructions for configuring tests.

- **1.** Do one of the following:
  - If you selected Compliance View in the DUT tab, then in the Test Selection tab, select the desired test in the list and click **Configure**.

NOTE. To return to test selection from the Configuration section, click the Test Selection button.

- If you selected Advanced View, click the **Configuration** tab in the Setup panel.
- **2.** Select the desired mode:
  - **Compliance Mode**: Select to use Compliance Mode values. You cannot change most test parameters in Compliance mode but you can view the parameters.
  - User Defined Mode: Select to run tests with custom parameters.
- **3.** To select parameters that apply to all tests selected for the current session, click the **Global Settings** tab and do any of the following:
  - To change the oscilloscope used for testing, in the Instruments Detected section, click in the shaded area opposite Real Time Scope and select the desired instrument from the drop-down list. If the oscilloscope you want is not listed, refresh the list (see page 40).
  - To select a filter file for de-embedding the signal, select the Use Filter File for De-embedding check box. Click the Browse button that appears and select a filter file to use.
  - To select a filter file for de-embedding the signal for Host Output TWDPc tests, select the Use
     Filter File for De-embedding (only for TWDPC) check box. (Available only if the Host Output TWDPc test is selected in the Test Selection tab.) Click Browse and select a filter file to use.
- 4. To change the signal for a specific test (in User Defined Mode), click the **Measurements** tab, select the test in the tree view section and then select the signal type in the Acquire section.
- 5. To view test limits (in Compliance Mode) or change test limits (in User Defined Mode), click the Limits Editor button to access the Limits Editor window.

- Common Test Parameters and Values (see page 53)
- De-embed Using Filter Files (see page 151)
- Select Report Options (see page 56)
- About Setting Up Tests (see page 33)

# **Common test parameters and values**

The following table lists the measurement parameters common to most tests.

**NOTE.** If you change the channel selection for Data+ (DP) and Data– (DN) signals, make sure that you change the corresponding trigger source in the Analyze tab for each of the measurements. If you do not do this, the waveform might not trigger and the measurements might not be completed.

Parameter Type	Parameter and Default Value					
Mode	Determines whether test parameters are in compliance or can be edited					
	Compliance: Most test parameter values cannot be changed.					
	User Defined: Most test parameter values can be changed.					
Global Settings	These settings apply to all tests selected for the current session. You can change only some of these settings.					
	Real Time Scope: Specifies the oscilloscope used for tests					
	<ul> <li>Record Length: Specifies the length of the record (5M is the default)</li> </ul>					
	Use Filter File for De-embedding: When selected, provides a browse button and field for selecting a filter to use to compensate for cable lengths.					
	Use Filter File for De-embedding (only for TWDPC): When selected, provides a browse button and field for selecting a filter to use to compensate for cable lengths.					
	Data Rate: Select the signal data rate as one of 9.95328 Gbps, 10.3125 Gbps (default), 10.51875 Gbps, or 11.10 Gbps.					

#### Table 10: Common parameters and values

Parameter Type	Parameter and	Default Value	е				
Measurements	Acquire:						
	Signal Type selected in th Defined Mod The default s types. For ea are best suite	: Specifies th ne tree view o e allows you signal type var ach test, the a ed to the mea	e signal type f the Measur to perform the ries by test. I application inconsurements (s	of the acqu ements tab. e tests on di Not all tests cludes the <u>si</u> see page 10	isition for the te Running tests i fferent types of support all the s ignal type option 9).	est in User signal. signal ns that	
	Window Size Compliance or 20%.	e (%): Host to Mode. In Use	est Transmitt er Defined Mo	er Qsq only. ode, you car	Set at 10% fo change this to	r 5%	
	different types of measurement hig the Measuremen edit the limit sett Limits Editor View or Edit the v	f comparisons gh and low lin its tab. When ings in the Lin ralues used for F	s. In Complia nits used for f running test mits Editor.	nce Mode, a the test sele s in User De	allows you to vie cted in the tree ofined Mode, yo	ew the view of u can	
	A blank cell means i	no limit value is app	lied				
	Test Name	Details	Compare String	Low Limit	Compare String	High Limit	
	Crosstalk Source	Crosstalk Source A	== Equal To	1000			
	Crosstalk Source	Crosstalk Source Ri	== Equal To	34			
		Crosstalk Source Fa	== Equal To	34			
	Data Dependent	Data Dependent Jit	< Less Than	0.1	> Greater Than 🛛	1.0	
	Data Dependent	Data Dependent Pu	< Less Than	0.055	> Greater Than		
	Eye Mask Hit Ratio	Eye Mask Hit Ratio	< Less Than	5e-5	< Less Than >= Greater Than Or	Equal To	
	Signal Rise/Fall T	Signal Rise Time (pS)	> Greater Than	34	<= Less Than Or Equ	Jal To	
	<b>T</b> 1 1 201	Signal Fall Time (pS)	> Greater Than	34			
	Total Jitter	Total Jitter (UI)	< Less Than	0.28			
						(	ок

#### Table 10: Common parameters and values (cont.)

When running tests in User Defined Mode, the cells in the Limits Editor table are active for editing so you can change parameters.

- Configure Tests (see page 52)
- Select Acquisitions (see page 46)
- De-embed Using Filter Files (see page 151)

# Configure email notification

To be notified by email when a test completes, fails, or produces an error, configure the email settings.

- 1. From the Options menu, select Email Settings to open the Email Settings (see page 56) dialog box.
- 2. (Required) For Recipient email Address(es), enter your email address. To include multiple addresses, separate the addresses with commas.
- **3.** (Required) For Sender's Address, enter the email address used by the instrument. This address consists of the instrument name followed by an underscore followed by the instrument serial number, then the *(a)* symbol and the email server used. For example: DPO72004C B130099@yourcompany.com.
- 4. (Required) In the Server Configuration section, type the SMTP Server address of the Mail server configured at the client location, and the SMTP Port number, in the corresponding fields.

If this server requires password authentication, enter a valid login name, password, and host name in the corresponding fields.

**NOTE.** If any of the above required fields are left blank, the settings will not be saved and email notifications will not be sent.

- 5. In the Email Attachments section, select from the following options:
  - **Reports**: Select to receive the test report with the notification email.
  - Status Log: Select to receive the test status log with the notification email. If you select this option, then also select whether you want to receive the full log or just the last 20 lines.

**NOTE.** The ScoreCard and Analysis Screenshot options are not available in SFP+ QSFP+ Tx.

- 6. In the Email Configuration section, select as desired:
  - Select the message file format to send: HTML (the default) or plain text.
  - Enter a maximum file size for the email message. Messages with attachments larger than this limit will not be sent. The default is 5 MB.
  - To limit the number of attempts the system makes to send a notification, enter the number in the Number of Attempts to Send field. The default is 1. You can also specify a timeout.
- 7. Select the **Email Test Results When complete or on error** check box. Use this check box to quickly enable or disable email notifications.
- 8. To test your email settings, click Test Email.
- 9. To apply your settings, click Apply.
- 10. Click Close when finished.

mail Settings					
Recipient e-mail Address(es)					
Note: Separate Email ao	dresses with a com	ma			
Email Attachments	Server Cont	iguration		SMTP Port	.1
ScoreCard	Login			outri rok	
Analysis Screenshot	Password				
Status Log 💿 Last 20 Lines 🔷 Full Log	Host Name				
Email Configuration					
Email Format 📀 HTML 📀 Plain Text	Number of Attem	pts to Send 1			
Max Email Size (MB) 5	Timeout (Sec)	-1			
		Test Email	Арр	ly	Close
Email Test Results When complete or on error					$\bigcirc$

# Select test notification preferences

Select how you want to be notified by the system when a test measurement fails:

- 1. In the Setup panel, click the Preferences tab.
- 2. Select the following option:
  - On Test Failure, stop and notify me of the failure: Select this option to have the test stop and notify you by email if the test fails. If you select this option, select the Email Test Results when complete or on error check box in the Email Settings dialog box. Click Email Settings and configure the email settings (see page 55) if you have not already done so.

### See also

- About Setting Up Tests (see page 33)
- Select Report Options (see page 56)

# Select report options

Use the <u>Reports panel (see page 30)</u> to select which test information to include in the report, and the naming conventions to use for the report. For example, always give the report a unique name or select to have the same name increment each time you run a particular test. Generally, you would select report options before running a test or when creating and saving test setups. Report settings are included in saved test setups.

In the Reports panel, select from the following report options:

## Table 11: Report options

Setting	Description					
Generate new report	Creates a new report.					
Append with previous run session	Appends the latest test results to the end of the current test results report.					
Replace current test values with the new results	Replaces the previous test results with the latest test results. Newly added tests results are appended to the end of the report.					
Report name	Displays the name and location where the report will be saved when generated. This field is blank by default. The report and related files are stored in the Untitled Session folder located at \My TekExpress\SFP+ QSFP+ Tx\Untitled Session by default. The report file in this folder gets overwritten each time you run a test, and gets deleted when you close the application. To preserve your test results, specify a unique name or select to auto increment the report name, then save the test before running another test or exiting the application. Change the report name or location.					
	Do one of the following:					
	In the Report Name field, type over the current folder path and name.					
	Double-click in the Report Name field and then make selections from the popup keyboard and click the Enter button.					
	Be sure to include the entire folder path, the file name, and the file extension. For example: C:\Documents and Settings\ <your name="" user="">\My Documents\My TekExpress\SFP+ QSFP+ Tx\DUT001_group1.mht.</your>					
	NOTE. You cannot set the file location using the Browse button.					
	Open an existing report.					
	Click <b>Browse</b> , select the report file and then click <b>View</b> at the bottom of the panel.					
Save as type	Saves a report in a file type different from the default. Lists supported file types to choose from.					
	<b>NOTE.</b> If you select a file type different from the default, be sure to change the report file name extension in the Report Name field to match.					
Auto increment report name if duplicate	If the application finds a report with the same name as the one being generated, the application automatically increments the name of the report. For example: DUT001, DUT002, DUT003. This option is enabled by default. This option is not available if Append Reports is selected.					
Include pass/fail results summary	The color block labeled Test Result indicating whether the test passed or failed will be included in the report. For details, see Report Contents in <u>View a Report (see page 65)</u> .					
Include detailed results	The report will include parameters measured, such as Margin, Low Limit, High Limit, Compliance Mode Yes/No, Execution Time, and test-specific Comments generated by the software.					
Include plot images	Screen shots captured from the oscilloscope during test execution that show the waveform and measurement data will be included.					
Include setup configuration	Information about hardware and software used in the test will be included in the summary box at the beginning of the report. Information includes: the oscilloscope model and serial number, firmware version, SPC and factory calibration status, and software versions for applications used in the measurements.					

Setting	Description				
Include user comments	Select to include any comments about the test that you or another user added in the DUT tab of the Setup panel. Comments appear in the Comments section under the summary box at the beginning of each report.				
Append reports	This option adds new report data to the end of an existing report of the same name. This option is disabled by default. This option is not available if the Auto Increment Report Name if Duplicate option is selected.				
View report after generating	Automatically opens the report in your Web browser when the test completes. This option is selected by default.				

- View a Report (see page 65)
- About Setting Up Tests (see page 33)

# About running tests

After selecting and configuring tests, review the <u>pre-run checklist (see page 61)</u> and then click **Start** to perform the tests. The application acquires and analyzes the data, then displays a report when the tests are finished.

While the tests are running, other applications may display windows in the background. The TekScope application takes precedence over other applications, but you can switch to other applications by using the Alt+Tab key combination. To keep the TekExpress SFP+ QSFP+ Tx application on top, select **Keep On Top** from the SFP+ QSFP+ Tx Options menu.

### See also

- Before You Click Start (see page 59)
- About Configuring Tests (see page 50)
- About Setting Up Tests (see page 33)

# Before you click start

Before you run tests for the first time, do the following:

1. Understand where your test files are stored on the instrument.

After you install and launch TekExpress SFP+ QSFP+ Tx, it creates the following folders on the oscilloscope:

- \My Documents\My TekExpress\SFP+ QSFP+ Tx
- \My Documents\My TekExpress\SFP+ QSFP+ Tx\Untitled Session

Every time you launch TekExpress SFP+ QSFP+ Tx, an Untitled Session folder is created in the SFP-Tx folder. The Untitled Session folder is automatically deleted when you exit the SFP+ QSFP+ Tx application. To preserve your test session files, save the test setup before exiting the TekExpress application.



**CAUTION.** Do not modify any of the session files or folders because this may result in loss of data or corrupted session files. Each session has multiple files associated with it. When you save a session, a .TekX file, and a folder named for the session that contains associated files, is created on the oscilloscope X: drive.

2. <u>Map the shared My TekExpress folder (see page 153)</u> as X: (X drive) on the instruments used in test setups running Microsoft Windows Operating System.

The My TekExpress folder has the share name format <domain><user ID>My TekExpress. Or, if the instrument is not connected to a domain, the share name format is <instrument name><user ID>My TekExpress. This shared folder is used to save the waveform files and is used during other file transfer operations.

**NOTE.** If the X: drive is mapped to any other shared folder, the application will display a warning message asking you to disconnect the X: drive manually.

- **3.** Make sure that the My TekExpress folder has read and write access, and that the contents are not set to be encrypted:
  - a. Right-click the folder and select Properties.
  - b. Select the General tab and then click Advanced.
  - c. In the Advanced Attributes dialog box, make sure that the option Encrypt contents to secure data is NOT selected. Example.



4. See the pre-run checklist (see page 61) before you run a test.

- Configure Tests (see page 52)
- View Test-Related Files (see page 68)

- Application Directories and Usage (see page 10)
- File Name Extensions (see page 11)

# **Pre-Run checklist**

Do the following before you click Start to run a test. If this is the first time you are running a test on a setup, refer to the information in Before You Click Start (see page 59).

- 1. Make sure that all the required instruments are properly warmed up (approximately 20 minutes).
- 2. Perform Signal Path Compensation (SPC).
  - a. On the oscilloscope main menu, select the Utilities menu.
  - b. Select Instrument Calibration.
- 3. Deskew channels (see page 152).
- 4. Verify that the application is able to find the DUT. If it cannot, perform a search for connected instruments (see page 40).
  - a. In SFP+ QSFP+ Tx, select the Setup panel and then click the Test Selection tab.
  - b. Select any test and then click Configure.
  - c. In the Configuration section, click Global Settings.
  - **d.** In the Instruments Detected section, click the drop-down arrow to the right of Real Time Scope and make sure that the oscilloscope with the (GPIB8::1::INSTR) designation is in the list.

### See also

Equipment Connection Setup (see page 36)

# Run a saved test in prerecorded mode

Use this option to rerun a complete test using just the oscilloscope and the saved test setup files, provided that you selected to save the captured waveforms when you originally ran the saved test.

**NOTE.** When you run a saved test in prerecorded mode and then save it under the same name, the test results are saved in a new session folder named for the date and time of the session. Any test settings that you changed for the session will be saved as a new test session file and be paired with a folder of the same name. Example. When you open a test setup that has multiple sessions and you select a session from the Run session list in the DUT tab, the settings associated with that test session are restored.

20111017\_143500
 20111017\_143842
 20111017\_144645
 20111017\_144933
 20111017\_143500
 20111017\_143842
 20111017\_143842
 20111017\_144645
 20111017\_144933

Each test session folder has a matching test session file that stores the individual test settings for that session.

- 1. Open a saved test setup (see page 32).
- 2. In the Setup panel, select the DUT tab and then select Use pre-recorded waveform files.

A Run session drop-down list appears that displays the previous saved sessions for this test.

3. From the Run session list, select the session to run.

**NOTE.** If you select a session for which no waveform files were saved, you will receive an error message. Either select another test session or select waveform files to use. For details, see Step 2 of <u>Select</u> Acquisitions (see page 46).

- 4. Click Start.
- 5. To save the test results, session settings, and related files, save the test setup before selecting another test setup or exiting TekExpress SFP+ QSFP+ Tx.

## See also

Use Prerecorded Waveforms for Analysis (see page 48)

# View the progress of analysis

The <u>Status panel (see page 27)</u> displays a record of the test as it is executed. By default, the application switches to this panel after you click the Start button to run a test. Choose from the following two views by selecting the named tab, even while a test is in progress.

Test Status

The Test Status tab presents a collapsible table with information about each test as it is running. To collapse and expand the table, click the expand ( $(\underline{\bullet}/\underline{\bullet})$  collapse button.

Column	Description
Test Name	Name of the test
Acquisition	Describes the type of data being acquired
Acquire Status	Progress of the acquisition:
	To be started
	Completed Acquisition
	Prerecorded waveform
Analysis Status	Progress state of the analysis:
	To be started
	In progress
	Completed
	Aborted

## Table 12: Status tab table

### Log View

The Log View tab provides a list of actions that happen as the test executes. Use this tab to review or troubleshoot tests.

### Table 13: Log view options

Item	Description
Message History	This window timestamps and displays all run messages.
Show Detailed Log	Select this check box to record a detailed history of test execution.
Auto Scroll	Select this check box to have the program automatically scroll down as information is added to the log during the test.
Clear Log	Click this button to clear all messages in the Message History window.
Save	Use to save the log file as a text file for examination. Displays a standard Save File window and saves the status messages in the file that you specify.

### See also

View Test Results (see page 64)

# View test results

When a test completes running, the application switches to the <u>Results panel (see page 29)</u>, which shows a summary of test results. The Overall Test Result is displayed at the top left of the Results table. If all of the tests for the session pass, the overall test result will be Pass. If even one test out of multiple tests fails, the overall test result will show Fail, even if all the other tests passed.

**NOTE.** Results of Crosstalk measurements, Total Jitter (a) J2, and Total Jitter (a) J9 are not included in the Overall Test Results because these measurements are informative only. If any of the Crosstalk tests or Total Jitter (a) J2 and Total Jitter (a) J9 fails, it will not cause the overall test results to fail.

Each test result occupies a row in the Results table. By default, results are displayed in summary format with the measurement details collapsed and with the Pass/Fail column visible. Change the view in the following ways:

- To expand all tests listed, select View Results Details from the Preferences menu in the upper right corner.
- To expand and collapse tests, click the plus and minus buttons.
- To collapse all expanded tests, select **Preferences > View Results Summary**.
- To hide or show the Pass/Fail column, select **Preferences > Show Pass/Fail**.
- To enable or disable the wordwrap feature, select **Preferences > Enable Wordwrap**.
- To expand the width of a column, place the cursor over the vertical line that separates the column from the column to the right. When the cursor changes to a double-ended arrow, hold down the mouse button and drag the column to the desired width.
- To sort the test information by column, click the column head. When sorted in ascending order, a small up arrow is displayed. When sorted in descending order, a small down arrow is displayed.
- To clear all test results displayed, click **Clear**.

- View a Report (see page 65)
- View the Progress of Analysis (see page 63)
### View a report

After the analysis, a report is automatically generated. By default, the report is displayed in your Web browser unless you cleared the **View Report After Generating** check box in the Reports panel before running the test. If you cleared this check box, or to view a different test report, do the following:

1. In the Reports panel, click the Browse button and locate the desired report.

The path to the report displays in the Report Name field.

**NOTE.** If you did not save the test setup after running the report and you either closed the application or you ran another report, the report file was not saved.

2. At the bottom of the Reports panel, click View.

For information on changing the file type, file name, and other report options, see <u>Select Report Options</u> (see page 56).

### **Report contents**

In the report, a table shows the test name, measurement details, test result (pass/fail), mode, and analysis time.

Setup Configuration Information

Setup configuration information is listed in the summary box at the beginning of the report. This information includes the oscilloscope model and serial number, and software versions. To exclude this information from a report, clear the **Include Setup Configuration** check box in the Reports panel before running the test.



### Host Test Report

Setup Information	
DUT ID : DUT001	TekExpress Version SFP+/QSFP+: 3.0.0.79
Spec Version : SFF-8635 Revision 0.4	Scope Model : MSO71604C
Date/Time: 2013-06-12 18:07:47.083000	FW Version : 6.7.4 Build 3
Compliance Mode : True	DPOJet Version : "6.0.1 Build 8"
Overall Execution Time: 0:01:40	Scope Serial Number : B130223
Overall Test Result : Pass	Calibration Status : PASS
DUT Comment :General Comment - QSFP + Transmitter Host DUT	

### User Comments

These appear in the Comments section directly below the summary box at the beginning of the test report. To exclude these comments from a report, clear the Include **User Comments** check box in the Reports panel before running the test.

### Pass/Fail Summary

The Pass/Fail Summary column indicates whether a test passed or failed. If the test passed, the column cell is green. If the test failed, it is red. To exclude this information from a report, clear the **Include Pass/Fail Results Summary** check box in the Reports panel before running the test.

Lane	Measurement Details	Measured Value	Units	Test Result	Margin
Lane0	Single Ended Output Voltage Range Min(V)	-0.3232	v	Fail	-0.0232
Lane0	Single Ended Output Voltage Range Max(V)	0.32	v	Pass	3.68
Lane0	Output AC Common Mode voltage (RMS)	18.9454	mV	Fail	-3.9454
Lane0	Crosstalk Source Rise/Fall Time (20%-80%) RiseTime	51.6238	ps	Fail	-17.6238
Lane0	Crosstalk Source Rise/Fall Time (20%-80%) FallTime	46.3426	ps	Fail	-12.3426

### **Detailed Results**

Includes detailed measurement information, as shown outlined in red in the following example. The Comments column is for test-specific information that isn't covered elsewhere. To exclude this information from a report, clear the **Include Detailed Results** check box in the Reports panel before running the test.

Measured Value	Units	Test Result	Margin	Low Limit	High Limit	Comments
-0.3232	v	Fail	-0.0232	-0.3	N.A	Signal Type :AC Coupled
0.32	v	Pass	3.68	N.A	4.0	PRBS31.
18.9454	mV	Fail	-3.9454	N.A	15.0	Signal Type :PRBS31

#### Plot Images

Plot images are screen shots captured from the oscilloscope during test execution. They show waveform and measurement data. To exclude these from a report, clear the **Include Plot Images** check box in the Reports panel before running the test.



### View test-related files

Files related to tests are stored in the SFP+ QSFP+ Tx folder under the My TekExpress shared folder. In the SFP+ QSFP+ Tx folder, each test setup has a test setup file and a test setup folder, both with the test setup name:



The test setup file is preceded by the SFP-TX icon and usually has no visible file extension.

Inside the test setup folder is another folder named for the DUT ID used in the test sessions. The default is DUT001.

Inside the DUT001 folder are the session folders and files. Each session also has a folder and file pair, both named for the test session using the naming convention (date)\_(time). Each session file is stored outside its matching session folder:

20110520\_154553
20110520\_154713
20110520\_155111
20110520\_155920
20110520\_155920
20110520\_160103
20110520\_154713
20110520\_154713
20110520\_155111
20110520\_155920
20110520\_160103

Each session folder contains image files of any plots generated from running the test session. If you selected to save all waveforms or ran tests using prerecorded waveform files, these are included here.

The first time you run a new, unsaved session, the session files are stored in the Untitled Session folder located at ... My TekExpress\SFP+ QSFP+ Tx. The session setup file is named Untitled. When you name and save the session, the test setup file is given the name you specify and the test-related files are placed in a folder with the same name. A copy of the test files stay in the Untitled Session folder until you run a new test or until you close the SFP+ QSFP+ Tx application.

### See also

■ File Name Extensions (see page 11)

Before You Click Start (see page 59)

## About the programmatic interface

The Programmatic interface allows you to seamlessly integrate the TekExpress test automation application with the high-level automation layer. This also allows you to control the state of the TekExpress application running on a local or a remote computer.

For simplifying the descriptions, the following terminologies are used in this section:

- TekExpress Client: A high-level automation application that communicates with TekExpress using TekExpress Programmatic Interface.
- **TekExpress Server:** The TekExpress application when being controlled by TekExpress Client.

TekExpress leverages .Net Marshalling to enable the Programmatic Interface for TekExpress Client. TekExpress provides a client library for TekExpress clients to use the programmatic interface. The TekExpress client library is inherited from .Net MarshalByRef class to provide the proxy object for the clients. The TekExpress client library maintains a reference to the TekExpress Server and this reference allows the client to control the server state.



### See also

- Requirements for Developing TekExpress Client (see page 70)
- Remote Proxy Object (see page 73)
- Client Proxy Object (see page 74)

# **Requirements for developing TekExpress client**

While developing TekExpress Client, use the TekExpressClient.dll. The client can be a VB .Net, C# .Net, TestStand or Web application. The examples for interfaces in each of these applications are in the Samples folder.

### **References required**

- TekExpressClient.dll has an internal reference to IIdlglib.dll and IRemoteInterface.dll.
- IIdlglib.dll has a reference to TekDotNetLib.dll.
- **IRemoteInterface.dll** provides the interfaces required to perform the remote automations. It is an interface that forms the communication line between the server and the client.
- IIdlglib.dll provides the methods to generate and direct the secondary dialog messages at the client-end.

**NOTE.** The end-user client application does not need any reference to the above mentioned DLL files. It is essential to have these DLLs (IRemoteInterface.dll, IIdlglib.dll and TekDotNetLib.dll) in the same folder as that of TekExpressClient.dll.

### Required steps for a client

The client uses the following steps to use TekExpressClient.dll to programmatically control the server:

Develop a client UI to access the interfaces exposed through the server. This client loads TekExpressClient.dll to access the interfaces. After TekExpressClient.dll is loaded, the client UI can call the specific functions to run the operations requested by the client. When the client is up and running, it does the following to run a remote operation:

- 1. To connect to the server, the client provides the IP address of the PC where the server is running.
- 2. The client locks the server application to avoid conflict with any other Client that may try to control the server simultaneously. "Lock" would also disable all user controls on the server so that server state cannot be changed by manual operation.

If any other client tries to access a server that is locked, it will receive a notification that the server is locked by another client.

- **3.** When the client has connected to and locked the server, the client can access any of the programmatic controls needed to run the remote automations.
- 4. After the client operations finish, the client unlocks the server.

#### See also

About SFP+ QSFP+ Tx Application Commands (see page 80)

### To enable remote access

To access and remotely control an instrument using the TekExpress programmatic interface, you need to change specific firewall settings as follows:

- Access the Windows Control Panel and open the Windows Firewall tool (Start > Control Panel > All Control Panel Items > Windows Firewall).
- 2. Click Advance Settings > Inbound Rules.
- 3. Scroll through the Inbound Rules list to see if the following items (or with a similar name) are shown:
  - TekExpress SFP+ QSFP+ Tx
  - TekExpress



- 4. If both items are shown, you do not need to set up any rules. Exit the Windows Firewall tool.
- 5. If one or both are missing, use the following procedure to run the **New Inbound Rule Wizard** and add these executables to the rules to enable remote access to the TekExpress application.

### Run the New Inbound Rule Wizard

1. Click on New Rule (in Actions column) to start the New Inbound Rule Wizard.

	_		
		Actions	
Action	*	Inbound Rules	•
Allow		🚉 New Rule	
Allow		Y Filter by Profile	۲
Allow		🝸 Filter by State	۲
Allow		🝸 Filter by Group	۲
Allow		View	►

- 2. Verify that Program is selected in the Rule Type panel and click Next.
- **3.** Click **Browse** in the Program panel and navigate to and select one of the following TekExpress applications (depending on the one for which you need to create a rule):

- **4.** TekExpress SFP+ QSFP+ Tx.exe
- 5. TekExpress.exe

**NOTE.** See <u>Application directories and usage (see page 10)</u> for the path to the application files.

- 6. Click Next.
- 7. Verify that Allow the connection is selected in the Action panel and click Next.
- 8. Verify that all fields are selected (Domain, Private, and Public) in the Profile panel and click Next.
- 9. Use the fields in the Name panel to enter a name and optional description for the rule. For example, a name for the TekExpress SFP+ QSF+ Tx application could be TekExpress SFP+ QSFP+ Tx Application. Add description text to further identify the rule.
- 10. Click Finish to return to the main Windows Firewall screen.
- 11. Scroll through the Inbound Rules list and verify that the list shows the rule that you just entered.

P Windows Firewall with Advanced	I Security					
File Action View Help						
🗢 🧼 🔰 📰 😖 👔 🗊						
P Windows Firewall with Advance	Inbound Rules					
Inbound Rules     Outbound Rules	Name	Group	Profile	Enabled	Action	^
Connection Security Rules	☑ TDSCSA8000		All	Yes	Allow	
Monitoring	Teamviewer Remote Control Application		Domain	Yes	Allow	
	Teamviewer Remote Control Application		Domain	Yes	Allow	
	Teamviewer Remote Control Service		Domain	Yes	Allow	
	Teamviewer Remote Control Service		Domain	Yes	Allow	
	🕑 TekExpress PI					
	TekExpress SFP+ QSFP+ Tx		All	Yes	Allow	
	TekmDNSResponder		All	Yes	Allow	

- **12.** Repeat steps 1 through 11 to enter the other TekExpress executable if it is missing from the list. Enter **TekExpress PI** as the name.
- 13. Scroll through the Inbound Rules list and verify that the list shows the rule that you just entered.
- 14. Exit the Windows Firewall tool.

### To use the remote access:

- 1. Obtain the IP address of the instrument on which you are running TekExpress SFP+ QSFP+ Tx. For example, 134.64.235.198.
- 2. On the PC from which you are accessing the remote instrument, use the instrument IP address as part of the TekExpress SFP+ QSFP+ Tx PI code to access that instrument. For example:

object obj = piClient.Connect("134.64.235.198",out clientid);

### Remote proxy object

The server exposes a remote object to let the remote client access and perform the server-side operations remotely. The proxy object is instantiated and exposed at the server-end through marshalling.



The following is an example:

RemotingConfiguration.RegisterWellKnownServiceType (typeof (TekExpressRemoteInterface), "TekExpress Remote interface", WellKnownObjectMode.Singleton);

This object lets the remote client access the interfaces exposed at the server side. The client gets the reference to this object when the client gets connected to the server.

For example,

//Get a reference to the remote object

remoteObject = (IRemoteInterface)Activator.GetObject(typeof(IRemoteInterface), URL.ToString());

# **Client proxy object**

Client exposes a proxy object to receive certain information.



For example,

//Register the client proxy object

```
WellKnownServiceTypeEntry[] e = RemotingConfiguration.GetRegisteredWell-
KnownServiceTypes();
```

```
clientInterface = new ClientInterface();
```

```
RemotingConfiguration.RegisterWellKnownServiceType(typeof(ClientInterface),
"Remote Client Interface", WellKnownObjectMode.Singleton);
```

//Expose the client proxy object through marshalling

```
RemotingServices.Marshal(clientInterface, "Remote Client Inteface");
```

The client proxy object is used for the following:

- To get the secondary dialog messages from the server.
- To get the file transfer commands from the server while transferring the report.

Examples

```
clientObject.clientIntf.DisplayDialog(caption, msg,iconType, btnType);
```

clientObject.clientIntf.TransferBytes(buffer, read, fileLength);

For more information, click the following topic links.

### Secondary Dialog Message Handling



The secondary dialog messages from the Secondary Dialog library are redirected to the client-end when a client is performing the automations at the remote end.

In the secondary dialog library, the assembly that is calling for the dialog box to be displayed is checked and if a remote connection is detected, the messages are directed to the remote end.

#### **File Transfer Events**

When the client requests the transfer of the report, the server reads the report and transfers the file by calling the file transfer methods at the client-end.

## **Client programmatic interface example**

An example of the client programmatic interface is described and shown as follows:

Process flowchart



- 1. Connect to a server or remote object using the programmatic interface provided.
- 2. Get the client ID that is created when connecting to the remote object. This client ID is one of the required parameters to communicate with the server.

**NOTE.** The server identifies the client with this ID only and rejects any request if the ID is invalid.

3. Lock the server for further operations. This disables the application interface.

**NOTE.** You can get values from the server or set values from the server to the client only if the application is locked.

**4.** Register for receiving notifications on status change events on the server. To register you need to give a handler as a parameter.

**NOTE.** Whenever there is a change in the status of the server, all the clients registered with the server receive a notification from the server.

- 5. Select the tests that you want to run through the programmatic interface.
- 6. Set the necessary parameters for each test.
- 7. Run the tests.
- 8. Poll for the status of the application.

**NOTE.** Skip step 8 if you are registered for the status change notification and the status is Ready.

- 9. After completing the tests, get the results.
- 10. Create a report or display the results and verify or process the results.
- **11.** Unlock the server after you complete all the tasks.
- **12.** Disconnect from the remote object.

### Handler of status change notification

- 1. Get the status. If the status is Wait or Error, get the information that contains the title, message description, and the expected responses for the status.
- 2. Perform the actions based on the status information.
- **3.** Set the response as expected.

### See also

- About SFP+ QSFP+ Tx Application Commands (see page 80)
- Program Example (see page 78)

### **Program example**

This program example shows how to communicate between a PC and TekExpress SFP+ QSFP+ Tx remotely.

A typical application does the following:

- 1. Start the application.
- 2. Connect through an IP address.

m\_Client.Connect("localhost") 'True or False

clientID = m\_Client.getClientID

3. Lock the server.

m\_Client.LockServer(clientID)

4. Disable the Popups.

m\_Client.SetVerboseMode(clientID, false)

5. Set the Dut ID.

m\_Client.SetDutId(clientID, "DUT\_Name")

6. Select a measurement.

```
mClient.SelectTest(clientID, "SFP+ Tx", "Host", "Single Ended Output
Voltage Range", true)
```

7. Select a channel.

mClient.SetGeneralParameter(clientID, "SFP+ Tx", "Host", "Single Ended Output Voltage Range", "DP Connected To") 'Measurement selected

8. Configure the selected measurement.

mClient.SetGeneralParameter(clientID, "SFP+ Tx", "Host", "Single Ended Output Voltage Range", "DP Connected to") 'Single Ended Output Voltage Range measurement selected

mClient.SetGeneralParameter(clientID, "SFP+ Tx", "Host", "Single Ended Output Voltage Range", "DN Connected to") 'Single Ended Output Voltage Range measurement mClient.SetGeneralParameter(clientID, "SFP+ Tx", "Host", "Single Ended Output Voltage Range", "Record Length\$2M") 'Single Ended Output Voltage Range measurement

mClient.SetAcquireParameter(clientID, "SFP+ Tx", "Host", "Single Ended Output Voltage Range", "Single Ended output Voltage Range Acquisition & "\$" & "Signal Type" & "\$" & PRBS21") Signal type PRB21 is selected for 'Single Ended Output Voltage Range measurement test

9. Run with set configurations.

m\_Client.Run(clientID)

10. Wait for the test to complete.

DO

Thread.Sleep(500)

m\_Client.Application\_Status(clientID)

Select Case status

Case "Wait"

'Get the Current State Information

```
mClient.GetCurrentStateInfo(clientID, WaitingMsbBxCaption, WaitingMsbBxMes-
sage, WaitingMsbBxButtontexts)
```

'Send the Response

```
mClient.SendResponse(clientID, WaitingMsbBxCaption, WaitingMsbBxMessage,
WaitingMsbBxResponse)
```

End Select

Loop Until status = "Ready"

**11.** After the Test is Complete.

'Save all results values from folder for current run

m\_Client.TransferResult(clientID, logDirname)

'Save all waveforms from folder for current run

m\_Client.TransferWaveforms(clientID, logDirname)

'Save all images from folder for current run

m\_Client.TransferImages(clientID, logDirname)

12. Unlock the server.

m\_Client.UnlockServer(clientID)

- **13.** Disconnect from server.
  - m\_Client.Disconnect()
- **14.** Exit the application.

## About SFP+ QSFP+ Tx application commands

Click a client action below to see the command name, description, parameters, return value, and an example, associated with the action.

Connect through an IP address (see page 86)

Lock the server (see page 87)

Disable the popups (see page 88)

Set or get the DUT ID (see page 89)

Set the configuration parameters for a suite or measurement (see page 90)

Query the configuration parameters for a suite or measurement (see page 92)

Select a measurement (see page 93)

Select a suite (see page 94)

Select a channel (see page 95)

Configure the selected measurement (see page 97)

Run with set configurations or stop the run operation (see page 98)

Handle Error Codes (see page 99)

Get or set the timeout value (see page 100)

Wait for the test to complete (see page 100)

After the test is complete (see page 103)

Save, recall, or check if a session is saved (see page 106)

Unlock the server (see page 107)

Disconnect from server (see page 107)

string id			
Name	Туре	Direction	Description
id	string	IN	Identifier of the client performing the remote function.
Ready: Tes Running: T	t configured and ready to Test running	o start	
Paused: Tes	st paused		
Wait: A pop	pup that needs your inpu	its	
Error: An e	error is occurred		

string dutNa	me		
Name	Туре	Direction	Description
dutName	string	IN	The new DUT ID of the setup
out bool sav Name	ed Type	Direction	Description
Name saved	Type bool	Direction OUT	Description Boolean representing whether the
			current session is saved

This parameter is used as a check in SaveSession() and SaveSessionAs() functions.

string ipAd	dress		
Name	Туре	Direction	Description
ipAddress	string	IN	The ip address of the server to which the client is trying to connect to. This is required to establish the connection between the server and the client.
out string c	lientID		
Name	Туре	Direction	Description
clientid	string	OUT	Identifier of the client that is connected to the server
			clientId = unique number + ipaddress of the client. For example, 1065–192.157.98.70

**NOTE.** If the dutName parameter is null, the client is prompted to provide a valid DUT ID.

**NOTE.** The server must be active and running for the client to connect to the server. Any number of clients can be connected to the server at a time.

**NOTE.** When the client is disconnected, it is unlocked from the server and then disconnected. The id is reused.

### string dutld

Name	Туре	Direction	Description
dutld	string	OUT	The DUT ID of the setup

The dutId parameter is set after the server processes the request.

string device			
Name	Туре	Direction	Description
device	string	IN	Specifies the name of the device
string suite			
Name	Туре	Direction	Description
suite	string	IN	Specifies the name of the suite
string test			
Name	Туре	Direction	Description
test	string	IN	Specifies the name of the test to obtain the pass or fail status
string paramete	erString		
Name	Туре	Direction	Description
parameterString	string	IN	Selects or deselects a test

int rowNr			
Name	Туре	Direction	Description
rowNr	int	IN	Specifies the zero based row index of the sub-measurement for obtaining the result value
			the result value

**NOTE.** When the client tries to lock a server that is locked by another client, the client gets a notification that the server is already locked and it must wait until the server is unlocked. If the client locks the server and is idle for a certain amount of time, then the server is unlocked automatically from that client.

out string[]	status		
Name	Туре	Direction	Description
status	string array	OUT	The list of status messages generated during run
string name			
Name	Туре	Direction	Description
name	string	IN	The name of the session being recalled

The name parameter cannot be empty. If it is empty, the client is prompted to provide a valid name.

**NOTE.** When the run is performed, the status of the run is updated periodically using a timer.

string name	)		
Name	Туре	Direction	Description
name	string	IN	The name of the session being saved
The name pa	arameter cannot be emp	ty. If it is empty, the clien	nt is prompted to provide a valid name.
Once the ses name. Use S	ssion is saved under 'na SaveSessionAs instead.	me' you cannot use this r	nethod to save the session in a different

string name			
Name	Туре	Direction	Description
name	string	IN	The name of the session being recalled

The same session is saved under different names using this method. The name parameter cannot be empty. If it is empty, the client is prompted to provide a valid name.

bool isSelecte	ed		
Name	Туре	Direction	Description
isSelected	bool	IN	Selects or deselects a test
string time			
Name	Туре	Direction	Description
time	string	IN	The time in seconds which refers to the timeout period

The time parameter gives the timeout period, that is the time the client is allowed to be locked and idle. After the timeout period, if the client is still idle, it gets unlocked.

The time parameter should be a positive integer. Else, the client is prompted to provide a valid timeout period.

bool_verbose			
Name	Туре	Direction	Description
_verbose	bool	IN	Specifies whether the verbose mode should be turned ON or OFF

**NOTE.** When the session is stopped, the client is prompted to stop the session and is stopped at the consent.

string filePa	th		
Name	Туре	Direction	Description
filePath	string	IN	The location where the report must be saved in the client
NOTE. If the	e client does not provid	e the location to save the	e report the report is saved at
C:\Program	Files.	e the location to save the	e report, the report is suved at

**NOTE.** When the client is disconnected, the client is unlocked automatically.

out string ca	ption			
Name	Туре	Direction	Description	
caption	string	OUT	The wait state or error state message sent to you	
out string me	essage			
Name	Туре	Direction	Description	
message	string	OUT	The wait state/error state message to you	
out string[] b	outtonTexts			
Name	Туре	Direction	Description	
buttonTexts	string array	OUT	An array of strings containing the possible response types that you can send	
string respor	ise			
Name	Туре	Direction	Description	
response	string	IN	A string containing the response type that can be selected (it must be one of the strings in the string array buttonTexts)	

out string clientID						
Name	Туре	Direction	Description			
clientID	string	OUT	Identifier of the client that is connected to the server			
			clientID = unique number + ipaddress of the client. For example, 1065–192.157.98.70			
			client. For example, 1065–192.157.98.70			

## **Connect through an IP address**

Command name	Parameters	Description	Return Value	Example
Connect()	string ipAddress (see page 81) out string clientID (see page 81)	This method connects the client to the server. <u>Note (see page 82)</u> The client provides the IP address to connect to the server. The server provides a unique client identification number when connected to it.	Return value is either True or False.	<pre>m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL. returnval as boolean returnval = m_Client.Con- nect(ipaddress,m_clientID)</pre>

**NOTE.** The Fail condition for PI commands occurs in any of the following cases:

The server is LOCKED and the message displayed is "Server is locked by another client".

The session is UNLOCKED and the message displayed is "Lock Session to execute the command".

The server is NOTFOUND and the message displayed is "Server not found...Disconnect!".

Command name	Parameters	Description	Return Value	Example
LockSession()	string clientID (see page 86)	This method locks the server. <u>Note (see page 83)</u>	String value that gives the status of the	m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL.
		The client must call this method before running any of the remote automations. The server can be locked by only one client.	operation after it is performed. The return value is "Session Locked" on success.	returnval as string returnval = m_Client.LockServer(clientID)

## Lock the server

**NOTE.** The Fail condition for PI commands occurs in any of the following cases: The server is LOCKED and the message displayed is "Server is locked by another client". The session is UNLOCKED and the message displayed is "Lock Session to execute the command". The server is NOTFOUND and the message displayed is "Server not found...Disconnect!". When none of these fail conditions occur, then the message displayed is "Failed...".

# Disable the popups

SetVerboseMode()         string clientID         This method sets         String that gives	<b>A H H H</b>
(see page 86) bool _verbose (see page 84)the verbose mode to either true or false.the status of the operation after it is performedWhen the value is set to true, any message boxes appearing during the application will be routed to that is controlling TekExpress.When the value wode is set to mode is set to true, the return value is "Verbose will be shown to client".When the value is set to true, any message boxes the application will be routed to that is controlling TekExpress.When Verbose mode is set to false, the return value is "Verbose mode is set to the client machine that is controlling TekExpress.When the value is set to false, all the message boxes are shown on the server machine.When verbose mode is set to false, the return value is "Verbose mode turned off.	m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL. returnval as string <b>Verbose mode is turned on</b> return=m_Client.SetVerbose- Mode(clientID, true) <b>Verbose mode is turned off</b> returnval=m_Client.SetVer- boseMode(clientID, false)

**NOTE.** The Fail condition for PI commands occurs in any of the following cases:

The server is LOCKED and the message displayed is "Server is locked by another client".

The session is UNLOCKED and the message displayed is "Lock Session to execute the command".

The server is NOTFOUND and the message displayed is "Server not found...Disconnect!".

# Set or get the DUT ID

Command name	Parameters	Description	Return Value	Example
SetDutId()	string clientID (see page 86) string dutName (see page 81)	This method changes the DUT ID of the set up. The client must provide a valid DUT ID.	String that gives the status of the operation after it is performed Return value is "DUT Id Changed" on success	m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL. returnval as string return=m_Client.SetDutld(clien- tlD,desiredDutld) <u>Note (see page 82)</u>
GetDutId()	string clientID (see page 86) string dutId (see page 82)	This method gets the DUT ID of the current set up.	String that gives the status of the operation after it is performed	m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL. returnval as string return=m_Client.GetDutid(clien- tID, out DutId)

**NOTE.** The Fail condition for PI commands occurs in any of the following cases:

The server is LOCKED and the message displayed is "Server is locked by another client".

The session is UNLOCKED and the message displayed is "Lock Session to execute the command".

The server is NOTFOUND and the message displayed is "Server not found...Disconnect!".

### Set the configuration parameters for a suite or measurement

Command name	Parameters	Description	Return Value	Example
SetGeneralParame- ter	string clientID (see page 86) string device (see page 82) string suite (see page 82) string test (see page 82) string parameterString (see page 82)	This method sets the number of video lanes for the selected measurement. <b>NOTE.</b> Use this command to select a lane, channel, or source type.	String that gives the status of the operation after it is performed The return value is "" (an empty String) on success.	m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL. returnval as string Select Channel (see page 91) Select Measurement Method (see page 91)
SetAnalyzeParame- ter()	string clientID (see page 86) string device (see page 82) string suite (see page 82) string test (see page 82) string parameterString (see page 82)	This method sets the configuration parameters in the Analyze panel of the Configuration Panel dialog box for a given suite or measurement.	The return value is "" (an empty String) on success.	m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL . returnval as string
SetAcquireParame- ter()	string clientID (see page 86) string device (see page 82) string suite (see page 82) string test (see page 82) string parameterString (see page 82)	This method sets the configuration parameters in the Acquire panel of the Configuration Panel dialog box for a given suite or measurement.	returnVal = remo- teObject.SetAc- quireParameter(id, device, suite, test, parameterString) if ((OP_STATUS) returnVal != OP_STA- TUS.SUCCESS) return Command- Failed(returnVal)	

**NOTE.** The Fail condition for PI commands occurs in any of the following cases:

The server is LOCKED and the message displayed is "Server is locked by another client".

The session is UNLOCKED and the message displayed is "Lock Session to execute the command".

The server is NOTFOUND and the message displayed is "Server not found...Disconnect!".

### Select channel example

returnval=mClient.SetGeneralParameter(clientID, "SFP-Tx", "Host", "Signal Rise/Fall Time (20%-80%)", "Data + Signal connected to Real Time Scope at\$Channel 1")

#### Select measurement method example

returnval=mClient.SetGeneralParameter(clientID, "SFP-Tx", "Host", "Signal Rise/Fall Time (20%-80%)", "Measurement Method\$Automatic")

Configure analyze parameters example		
Parameter	Example	
Record Length	returnval = mClient.SetAcquireParameter(clientID, "SFP-Tx", "Host", "Single Ended Output Voltage Range", "Signal Type\$PRBS31")	
	returnval = mClient.SetAcquireParameter(clientID, "SFP-Tx", "Host", "Single Ended Output Voltage Range", "Record Length\$2M")	

## Query the configuration parameters for a suite or measurement

Command name	Parameters	Description	Return Value	Example
GetGeneralParam- eter()	string clientID (see page 86) string device (see page 82) string suite (see page 82) string test (see page 82) string parame- terString (see page 82)	This method gets the general configuration parameters for a given suite or measurement.	The return value is the general configuration parameter for a given suite or measurement that is set.	m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL. returnval as string Query Channel (see page 93) Query Measurement Method (see page 93)
GetAnalyzeParam- eter()	string clientID (see page 86) string device (see page 82) string suite (see page 82) string test (see page 82) string parame- terString (see page 82)	This method gets the configuration parameters set in the Analyze tab of the Configuration Panel dialog box for a given suite or measurement.	The return value is the configuration parameter set in the Analyze tab of the Configuration Panel dialog box for a given suite or measurement.	m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL . returnval as string
GetAcquireParame- ter()	string clientID (see page 86) string device (see page 82) string suite (see page 82) string test (see page 82) string parame- terString (see page 82)	This method gets the configuration parameters set in the Acquire tab for a given suite or measurement.	The return value is the configuration parameter set in the Acquire tab for a given suite or measurement.	Query Acquire Parameters example (see page 93)

**NOTE.** The Fail condition for PI commands occurs in any of the following cases:

The server is LOCKED and the message displayed is "Server is locked by another client".

The session is UNLOCKED and the message displayed is "Lock Session to execute the command".

The server is NOTFOUND and the message displayed is "Server not found...Disconnect!".

#### Query channel example

returnval=mClient.GetGeneralParameter(clientID, "SFP-Tx", "Host", "<Test/Measurement Name>", "DP connected to")

#### Query measurement method example

returnval=mClient.GetGeneralParameter(clientID, "SFP-Tx", "Host", "<Test/Measurement Name>", "Measurement Method")

Parameter
urumeter

Example

	<ul> <li>A second se</li></ul>
Record Length	returnval = mClient.GetAcquireParameter(clientID, "SFP+ TX", "Host",
	"Single Ended Output Voltage Range", "Record Length\$500K")

### Select a measurement

Command name	Parameters	Description	Return Value	Example
SelectTest()	string clientID (see page 86) string device (see page 82) string suite (see page 82) string test (see page 82) bool isSelected (see page 84)	This method selects or deselects a given test. When this parameter is set to true, you can select a measurement. When this parameter is set to false, you can deselect a measurement.	String that displays the status of the operation after it is performed The return value is "" (an empty String) on success.	<pre>m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL returnval as string Select Measurement (Signal Rise/Fall Time (20%-80%)): returnval=m_Client.Se- lectTest(clientID, "SFP-Tx", "Host", "Signal Rise/Fall Time (20%-80%)", true)</pre>

**NOTE.** The Fail condition for PI commands occurs in any of the following cases: The server is LOCKED and the message displayed is "Server is locked by another client". The session is UNLOCKED and the message displayed is "Lock Session to execute the command". The server is NOTFOUND and the message displayed is "Server not found...Disconnect!". When none of these fail conditions occur, then the message displayed is "Failed...".

# Select a suite

Command name	Parameters	Description	Return Value	Example
SelectSuitet()	string clientID (see page 86) string device (see page 82) string suite (see page 82) bool isSelected (see page 84)	This method selects or deselects a given suite. When this parameter is set to true, you can select a suite. When this parameter is set to false, you can deselect a suite.	String that gives the status of the operation after it is performed The return value is "" (an empty String) on success.	<pre>m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL. returnval as string Select Suite (Default): returnval=m_Client.Se- lectTest(clientID, "SFP-Tx", "Host", true)</pre>

**NOTE.** The Fail condition for PI commands occurs in any of the following cases:

The server is LOCKED and the message displayed is "Server is locked by another client".

The session is UNLOCKED and the message displayed is "Lock Session to execute the command".

The server is NOTFOUND and the message displayed is "Server not found...Disconnect!".

## Select a channel

Command name	Parameters	Description	Return Value	Example
SetGeneralParame- ter()	string clientID (see page 86) string device (see page 82) string suite (see page 82) string test (see page 82) string parame- terString (see page 82)	This method sets the parameters that are not specific to any given test. <b>NOTE.</b> Use this command to select a lane, channel, or source type.	String that gives the status of the operation after it is performed The return value is "" (an empty String) on success.	m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL. returnval as string <u>Select Channel (see page 96)</u> <u>Select Measurement Method</u> (see page 96)
SetAnalyzeParame- ter()	string clientID (see page 86) string device (see page 82) string suite (see page 82) string test (see page 82) string parame- terString (see page 82)	This method sets the configuration parameters in the Analyze tab of the Configuration Panel dialog box for a given suite or measurement.	The return value is "" (an empty String) on success.	m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL. returnval as string
SetAcquireParame- ter()	string clientID (see page 86) string device (see page 82) string suite (see page 82) string test (see page 82) string parame- terString (see page 82)	This method sets the configuration parameters in the Acquire tab of the Configuration Panel dialog box for a given suite or measurement.	returnVal = re- moteObject.Se- tAcquireParam- eter(id, device, suite, test, pa- rameterString) if ((OP_STATUS) returnVal != OP_STA- TUS.SUC- CESS) return Command- Failed(re- turnVal)	

**NOTE.** The Fail condition for PI commands occurs in any of the following cases:

The server is LOCKED and the message displayed is "Server is locked by another client".

The session is UNLOCKED and the message displayed is "Lock Session to execute the command".

The server is NOTFOUND and the message displayed is "Server not found...Disconnect!".

When none of these fail conditions occur, then the message displayed is "Failed...".

### Select channel example

returnval=mClient.SetGeneralParameter(clientID, "SFP+ TX", "Host", "Single Ended Output Voltage Range", "DP Connected to\$CH1")

### Select measurement method example

returnval=mClientSetGeneralParameter(clientID, "SFP+ TX", "Host", "Single Ended Output Voltage Range", "Measurement Method\$Automatic")

Command name	Parameters	Description	Return Value	Example
SetAnalyzeParame- ter()	string clientID (see page 86) string device (see page 82) string suite (see page 82) string test (see page 82) string parame- terString (see page 82)	This method sets the Analyze parameters (Configuration parameters) for a given test.	The return value is "" (an empty String) on success.	m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL. returnval as string
SetAcquireParame- ter()	string clientID (see page 86) string device (see page 82) string suite (see page 82) string test (see page 82) string parame- terString (see page 82)	This method sets the Acquire parameters in the Acquire tab of the Configure Dialog box for a given test.	returnVal = re- moteObject.Se- tAcquireParam- eter(id, device, suite, test, pa- rameterString) if ((OP_STA- TUS) returnVal != OP_STA- TUS.SUC- CESS) re- turn Com- mand- Failed(re- turnVal)	m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL. returnval as string <u>Configure Acquire Parameters</u> for Record Length (see page 98)

## Configure the selected measurement

**NOTE.** The Fail condition for PI commands occurs in any of the following cases:

The server is LOCKED and the message displayed is "Server is locked by another client".

The session is UNLOCKED and the message displayed is "Lock Session to execute the command".

The server is NOTFOUND and the message displayed is "Server not found...Disconnect!".

Configure parameter example	
Parameter	Example
Record Length	returnval = mClient.SetAcquireParameter(clientID, "SFP-Tx", "Host", "Single Ended Output Voltage Range", "Signal Type\$PRBS31")
	returnval = mClient.SetAcquireParameter(clientID, "SFP-Tx", "Host", "Single Ended Output Voltage Range", "Record Length\$2M")

## Run with set configurations or stop the run operation

Command name	Parameters	Description	Return Value	Example
Run()	string clientID (see page 86)	Runs the selected tests. <u>Note (see</u> <u>page 83)</u> After the server is set up and configured, run it remotely using this function.	String that gives the status of the operation after it is performed The return value is "Run started" on success.	m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL. returnval as string returnval=m_Client.Run(clien- tID)
Stop()	<u>string clientID</u> (see page 86)	Stops the currently running tests <u>Note</u> (see page 84)	String that gives the status of the operation after it is performed. The return value is "Stopped" on success.	m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL. returnval as string returnval=m_Client.Stop(clien- tID)

**NOTE.** The Fail condition for PI commands occurs in any of the following cases:

The server is LOCKED and the message displayed is "Server is locked by another client".

The session is UNLOCKED and the message displayed is "Lock Session to execute the command".

The server is NOTFOUND and the message displayed is "Server not found...Disconnect!".

# Handle error codes

The return value of the remote automations at the server-end is OP\_STATUS, which changes to a string value depending on its code and returned to the client. The values of OP\_STATUS are as follows:

Value	Code	Description
FAIL	-1	The operation failed.
SUCCESS	1	The operation succeeded.
NOTFOUND	2	Server not found
LOCKED	3	The server is locked by another client, so the operation cannot be performed.
UNLOCK	4	The server is not locked. Lock the server before performing the operation.
NULL	0	Nothing

Command name	Parameters	Description	Return Value	Example
GetTimeOut()	string clientID (see page 86)	Returns the current timeout period set by the client	String that gives the status of the operation after it is performed The default return value is 1800000.	m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL. returnval as string
				return- val=m_Client.Get- TimeOut()
SetTimeOut()	string clientID (see page 86) string time (see page 84)	Sets a timeout period specified by the client. After this timeout period expires, the server is unlocked automatically.	String that gives the status of the operation after it is performed On success the return value is "TimeOut Period Changed".	m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL. returnval as string return- val=m_Client.Set- TimeOut(clientID, desiredTimeOut)

## Get or set the timeout value

**NOTE.** The Fail condition for PI commands occurs in any of the following cases: The server is LOCKED and the message displayed is "Server is locked by another client". The session is UNLOCKED and the message displayed is "Lock Session to execute the command". The server is NOTFOUND and the message displayed is "Server not found...Disconnect!". When none of these fail conditions occur, then the message displayed is "Failed...".

# Wait for the test to complete

The commands in this group execute while tests are running. The GetCurrentStateInfo() and SendResponse() commands are executed when the application is running and in the wait state.
Command name	Parameters	Description	Return Value	Example
ApplicationStatus()	string_clientID (see page 86)	This method gets the status of the server application.	String value that gives the status of the server	m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL.
		The states at a given time are <u>Ready,</u> Running, Paused,	application	returnval as string returnval=m_Client.Applica- tionStatus(clientID)
		<u>Wait, or Error. (see</u> page 81)		
QueryStatus()	string clientID (see page 86) out string[] status (see page 83)	An interface for the user to transfer Analyze panel status messages from the server to the client.	String that gives the status of the operation after it is performed On success the return value is "Transferred".	m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL. returnval as string returnVal=m_Client.QueryS- tatus(clientID, out statusMes- sages) if ((OP_STATUS)returnVal == OP_STATUS.SUCCESS) return "Status updated_"
				else
				return CommandFailed(re- turnVal)

Command name	Parameters	Description	Return Value	Example
GetCurrentState- Info()	string clientID (see page 86)	This method gets the additional information	This command does not return	m_Client = new Client() //m_Client is a reference to the
<b>NOTE.</b> This command is used when the application is running and is in the wait or error state.	out string caption (see page 85) out string message (see page 85) out string[] buttonTexts (see page 85)	or the states when the application is in Wait or Error state. Except client ID, all the others are Out parameters.	any value. This function populates the Out parameters that are passed when invoking this function.	Client Class in the Client DLL. m_Client.GetCurrentState- Info(clientID, caption,mes- sage, buttonTexts)
SendResponse()	string clientID	After receiving the	This command	m_Client = new Client()
<b>NOTE.</b> This command is used when the application is running and is in the wait or error state.	(see page 86) out string caption (see page 85) out string message (see page 85) string response (see page 85)	additional information using the method GetCurrentState- Info(), the client de- cides which response to send, and then sends the response to the application using this function. The response should be one of the strings that was received earlier as a string array in the GetCurrentStateInfo function. The _cap- tion and _message should match the in- formation received earlier in the GetCur- rentStateInfo function.	does not return any value.	//m_Client is a reference to the Client class in the Client DLL. m_Client.SendResponse(cli- entID, caption,message, response)

**NOTE.** The Fail condition for PI commands occurs in any of the following cases:

The server is LOCKED and the message displayed is "Server is locked by another client".

The session is UNLOCKED and the message displayed is "Lock Session to execute the command".

The server is NOTFOUND and the message displayed is "Server not found...Disconnect!".

When none of these fail conditions occur, then the message displayed is "Failed...".

# After the test is complete

Command name	Parameters	Description	Return Value	Example
GetPassFailSta- tus()	string clientID (see page 86) string device (see page 82) string suite (see page 82) string test (see page 82)	This method gets the pass or fail status of the measurement after test completion. <b>NOTE.</b> Execute this command after completing the measurement.	String that gives the status of the operation after it is performed Returns the pass or fail status in the form of a string	m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL. returnval as string returnval=m_Client.GetPass- FailStatus(clientID, device, suite, "Signal Rise/Fall Time (20%-80%)") //Pass or Fail
GetResultsValue()	string clientID (see page 86) string device (see page 82) string suite (see page 82) string test (see page 82) string parame- terString (see page 82)	This method gets the result values of the measurement after the run.	String that gives the status of the operation after it is performed Returns the result value in the form of a string	m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL. returnval as srting returnval=m_Client.GetRe- sultsValue(clientID, "SFP-Tx", "Host", "Signal Rise/Fall Time (20%-80%)", "Measured Value")
GetResultsValue- ForSubMeasure- ments()	string clientID (see page 86) string device (see page 82) string suite (see page 82) string test (see page 82) string parame- terString (see page 82) int rowNr (see page 83)	This method gets the result values for individual sub- measurements after the run.	String that gives the status of the operation after it is performed Returns the result value in the form of a string	m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL. returnval as string <b>Signal Rise/Fall Time</b> returnval=m_Client.GetRe- sultsValueForSubMeasure- ments(clientID, "SFP-Tx", "Host", "Signal Rise/Fall Time (20%-80%)", "Measured Value",0) //For DP wfm returnval=m_Client.GetRe- sultsValueForSubMeasure- ments(clientID, "SFP-Tx", "Host", "Signal Rise/Fall Time (20%-80%)", "Measured Value",1) //For DN wfm

Command name	Parameters	Description	Return Value	Example
GetReportParame- ter()	string clientID (see page 86) string device	This method gets the general report details such as oscilloscope model, TekExpress version, and SFP+ QSFP+ Tx version.	The return value is the oscilloscope	m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL.
	string device (see page 82)rstring suite (see page 82)rstring test (see page 82)rstring parame- terString (see page 105)r		model, TekExpress version, and SFP+ QSFP+ Tx version.	returnval as string Oscilloscope Model returnval=m_Client.GetRe- portParameter(clientID,"Scope Model") TekExpress Version returnval=m_Client.GetReport- Parameter(clientID,"TekExpress Version") SFP+ QSFP+ Tx Version
				returnval=m_Client.GetReport- Parameter(clientID,"Application Version")
TransferReport()	string clientID (see page 86) string filePath (see page 85)	This method transfers the report generated after the run. The report contains the summary of the run. The client must provide the location where the report is to be saved at the client-end.	String that gives the status of the operation after it is performed Transfers all the result values in the form of a string	m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL. returnval as string returnval=m_Client.TransferRe- port(clientID,"C:\Report")

Command name	Parameters	Description	Return Value	Example
TransferWave- forms()	string clientID (see page 86) string filePath (see page 85)	This method transfers all the waveforms from the folder for the current run. <b>NOTE.</b> Each time you click Start, a folder is created on the X: drive. Transfer the waveforms before clicking Start	String that gives the status of the operation after it is performed Transfers all the waveforms in the form of a string On success the return value is "Transferred"	<pre>m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL. returnval as string returnval=m_Client.Transfer- Waveforms(clientID,"C:\Wave- forms")</pre>
TransferImages()	string clientID (see page 86) od string filePath (see page 85)	This method transfers all the images (screen shots) from the folder for the current run (for a given suite or measurement). <b>NOTE.</b> Each time you click Start, a folder is created in the X: drive. Transfer the waveforms before	String that gives the status of the operation after it is performed Transfers all the images in the form of a string	m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL. returnval as string returnval=m_Client.TransferIm- ages(clientID, "C:\Waveforms")

**NOTE.** The Fail condition for PI commands occurs in any of the following cases:

The server is LOCKED and the message displayed is "Server is locked by another client".

The session is UNLOCKED and the message displayed is "Lock Session to execute the command".

The server is NOTFOUND and the message displayed is "Server not found...Disconnect!".

When none of these fail conditions occur, then the message displayed is "Failed...".

String parameter	erString		
Name	Туре	Direction	Description
parameterString	string	IN	Specifies the oscilloscope model, TekExpress version, and SFP+ QSFP+ Tx version.

## Save, recall, or check if a session is saved

Command name	Parameters	Description	Return Value	Example
CheckSession- Saved()	string clientID (see page 86) out bool saved	This method checks whether the current session	Return value is either True or False	m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL.
	(see page 81)	is saved.		returnval as string
				returnval=m_Client.Check- SessionSaved(m_clientID, out savedStatus)
RecallSession()	string clientID (see page 86) string name	Recalls a saved session. The client provides	String that gives the status of the operation after it	m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL.
	(see page 83)	the session name.	is performed	returnval as string
		The return value is "Session Recalled".	returnval=m_Client.RecallSes- sion(clientID, savedSession- Name)	
SaveSession()	string clientID (see page 86)	Saves the current session. The	String that gives the status of the	m_Client = new Client() //m_Client is a reference to the
	string name (see page 83)	the session name.	is performed	returnval as string
			The return value is "Session Sav- ed"/"Failed".	returnval=m_Client.SaveSes- sion(clientID, desiredSession- Name)
SaveSessionAs()	<u>string clientID</u> (see page 86) string name	Saves the current session under a different name	String that gives the status of the operation after it	m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL.
	(see page 84)	every time this	is performed	returnval as string
		The client provides the session name.	The return value is "Session Saved".	returnval=m_Client.SaveSes- sionAs(clientID, desiredSes- sionName)

**NOTE.** The Fail condition for PI commands occurs in any of the following cases: The server is LOCKED and the message displayed is "Server is locked by another client". The session is UNLOCKED and the message displayed is "Lock Session to execute the command". The server is NOTFOUND and the message displayed is "Server not found...Disconnect!". When none of these fail conditions occur, then the message displayed is "Failed...".

# Unlock the server

Command name	Parameters	Description	Return Value	Example
UnlockSession()	<u>string clientID</u> (see page 86)	This method unlocks the server from the client. The ID of the client to be unlocked must be provided. <u>Note (see page 85)</u>	String that gives the status of the operation after it is performed The return value is "Session Un-Locked".	m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL. returnval as string returnval=m_Client.Unlock- Server(clientID)

**NOTE.** The Fail condition for PI commands occurs in any of the following cases:

The server is LOCKED and the message displayed is "Server is locked by another client".

The session is UNLOCKED and the message displayed is "Lock Session to execute the command".

The server is NOTFOUND and the message displayed is "Server not found...Disconnect!".

When none of these fail conditions occur, then the message displayed is "Failed...".

## **Disconnect from the server**

Command name	Parameters	Description	Return Value	Example
Disconnect()	<u>string clientID</u> (see page 86)	This method disconnects the client from the server. <u>Note (see page 82)</u>	Integer value that gives the status of the operation after it is performed 1 for Success –1 for Failure	m_Client = new Client() //m_Client is a reference to the Client class in the Client DLL. returnval as string returnval=m_Client.Discon- nect(m_clientID)

**NOTE.** The Fail condition for PI commands occurs in any of the following cases:

The server is LOCKED and the message displayed is "Server is locked by another client".

The session is UNLOCKED and the message displayed is "Lock Session to execute the command".

The server is NOTFOUND and the message displayed is "Server not found...Disconnect!".

When none of these fail conditions occur, then the message displayed is "Failed...".

# Signal types used by tests

The following tables list the signal types used by each measurement for the two profiles.

## Host profile

## Table 14: Host profile measurement signal types

Measurement	Compliance mode support	User-Defined Mode support
Single Ended Output Voltage Range	PRBS31	PRBS7, PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31
Output AC Common-Mode Voltage (RMS)	PRBS31	PRBS7, PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31
Cross Talk Source Rise/Fall Time (20%-80%)	8180	PRBS7, PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31, 8180
Cross Talk Source Amplitude (p-p)	8180	PRBS7, PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31, 8180
Signal Rise/Fall Time (20%-80%)	8180	PRBS7, PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31, 8180
Total Jitter	PRBS31	PRBS7, PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31
Total Jitter @ J2	PRBS31	PRBS7, PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31
Total Jitter @ J9	PRBS31	PRBS7, PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31
Data Dependent Jitter	PRBS9	PRBS7, PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31
Data Dependent Pulse Width Shrinkage (DDPWS)	PRBS9	PRBS7, PRBS9, PRBS11, PRBS15
Uncorrelated Jitter	PRBS9	PRBS7, PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31
Transmitter Qsq	8180	PRBS7, PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31, 8180
Eye Mask Hit Ratio	PRBS31	PRBS7, PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31
Voltage Modulation Amplitude (p-p)	8180	PRBS7, PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31, 8180
Transmitter Qsq (for Cu)	8180	PRBS7, PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31, 8180

Measurement	Compliance mode support	User-Defined Mode support
Output AC Common Mode Voltage (RMS) (for Cu)	PRBS31	PRBS7, PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31
Host Output TWDPc	PRBS9	PRBS9

## Module profile

## Table 15: Module profile measurement signal types

Measurement	Compliance mode support	User-defined mode support
AC Common Mode Voltage Tolerance	PRBS31	PRBS7, PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31
Single Ended Input Voltage Tolerance	PRBS31	PRBS7, PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31
Cross Talk Source Rise/Fall Time (20%-80%)	8180	PRBS7, PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31, 8180
Cross Talk Source Amplitude (p-p)	8180	PRBS7, PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31, 8180
Output AC Common-Mode Voltage (RMS)	PRBS31	PRBS7, PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31
Total Jitter	PRBS31	PRBS7, PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31
Total Jitter @ J2	PRBS31	PRBS7, PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31
Total Jitter @ J9	PRBS31	PRBS7, PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31
Data Dependent Jitter	PRBS9	PRBS7, PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31
Data Dependent Pulse Width Shrinkage (DDPWS)	PRBS9	PRBS7, PRBS9, PRBS11, PRBS15
Uncorrelated Jitter	PRBS9	PRBS7, PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31
Eye Mask Hit Ratio	PRBS31	PRBS7, PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31

- Signal Validation Procedure (see page 111)
- Select Acquisitions (see page 46)

## Oscilloscope setup

The following tables show the generalized oscilloscope setup parameters for all tests, except where noted.

Table 16: Horizontal setup				
Mode	Sample Rate	Record Length	Acquisition Mode	
Manual	100 GS/s	5M, 10M	100 GS/s	

#### Table 17: Vertical setup

Channel 1			Channel 2	Channel 2		
Position	Scale	Offset	Position	Scale	Offset	
0	Vertical setup procedure	0	0	Vertical setup procedure	0	

## See also

Signal Validation Procedure (see page 111)

## Signal validation procedure

Each measurement goes through signal validation, signal acquisition, and measurement steps. Before running any measurement, check the signal for validity. To do this, set up the oscilloscope to acquire the signal and then test the signal for its characteristics such as voltage level and/or frequency. Once the characteristics of the signal are correct, the signal is valid and ready for use in compliance measurements. The signal validation procedure is the same for both Host and Module Profile measurements.

SFP+ solution supports three types of signals: PRBS9, PRBS31, and 8180.

**NOTE.** *PRBS20, PRBS23, PRBS31 pattern validation is not done. The signal is assumed to be PRBS20, PRBS23, or PRBS31 respectively.* 

Acquire the signal according to the SFF-8431 specification. The oscilloscope setup differs for each measurement. For all measurements, use the following guidelines to set up the oscilloscope. For the oscilloscope setup for individual tests, see the individual test topics.

After the signal is acquired, the measurement is conducted using either the base oscilloscope, DPOJET, or the TekExpress algorithm library.

### Oscilloscope setup guidelines

The following describes the oscilloscope setup and signal validation measurement for PRBS7, PRBS9, PRBS11, PRBS15, and 8180 signals.

1. Connect the input signal to the appropriate channels. (The channels are those selected as data sources in the Acquisitions tab of the Setup panel.)

The vertical setup routine runs automatically to find the best fitting vertical scale.

Horizontal setup uses these parameters:

- Mode: Manual
- Sample Rate: 100 GS/s
- Record Length: **5M/10M**
- Acquisition Mode: Sample
- 2. On the oscilloscope, set Math1 = (Ch1 Ch3).
- 3. Call the Signal Validation algorithm to verify the signal type.

The signal validation results are returned from the algorithm. If signal validation fails, display a signal validation message.

#### See also

Oscilloscope Setup (see page 111)

## Single-ended output voltage range

Single-ended output voltage range is measured as the single-ended peak-to-peak output voltage for the positive and negative data channels on a single acquisition. This test is one of the SFF-8431 Table 11 Output Electrical Specifications at B tests.

Connect the equipment as shown in the diagram at <u>Connection Setup for Host Tests (see page 37)</u>: All other Host tests.

## **Signal validation**

Signal validation for PRBS31 pattern signals is not done by the SFP+ QSFP+ Tx application. The software assumes that the PRBS31 pattern is valid.

### **Measurement procedure**

Single-ended output voltage range is measured using base DPOJET.

■ Use DPOJET measurement name: Ampl > Max and Ampl > Min for Dp and Dn

### Limits

For each of Dp and Dn: Minimum = -0.3 V; Maximum = 4 V

#### Snapshot and cursor placement details

There will be two snapshots:

- A snapshot of Dp with cursors placed at maximum and minimum voltages of single-ended Pk-Pk measurement value of Dp. Cursor values can be derived using DPOJET: Ampl > Cycle Max and Ampl > Cycle Min for +ve and -ve peak, respectively for Dp.
- A snapshot of Dn with cursors placed at maximum and minimum voltages of single-ended Pk-PK measurement value of Dn. Cursor values can be derived using DPOJET: Ampl > Cycle Max and Ampl > Cycle Min for +ve and -ve peak, respectively for Dn.

- Oscilloscope Setup (see page 111)
- Common Test Parameters and Values (see page 53)

# Output AC Common-Mode voltage (RMS) (Host)

Output AC common-mode voltage is measured as the AC RMS voltage of the common mode ((DP+DN) ÷ 2) signal. This test is one of the SFF-8431 Table 11 Output Electrical Specifications at B tests.

Connect the equipment as shown in the diagram at <u>Connection Setup for Host Tests (see page 37)</u>: All other Host tests.

## **Signal validation**

Signal validation for PRBS31 pattern signals is not done by the SFP+ QSFP+ Tx application. The software assumes that the PRBS31 pattern is valid.

## **Measurement procedure**

Output AC common-mode voltage is measured using the base oscilloscope.

- 1. Math1 =  $(Dp + Dn) \div 2$ . Switch off channels connected to Dp and Dn.
- 2. Draw a histogram bounding box from the top left of the oscilloscope to the bottom right, and choose Histogram Vertical.
- 3. Select Math1 as the histogram source.
- 4. From the Measure menu, select Histogram Measurements > Standard Deviation.
- 5. Do a single step run and measure the mean value of the histogram standard deviation. This is the measurement result.

## Limits

Maximum = 15 mV

## Snapshot and cursor placement details

A snapshot where the histogram on math and the standard deviation value of the histogram is visible on the screen. The standard deviation value visible on the screen should be the value reported in the report. No cursors are required.

- Oscilloscope Setup (see page 111)
- Common Test Parameters and Values (see page 53)

## Crosstalk source Rise/Fall time (20% - 80%) (Host)

Crosstalk source rise/fall time is measured as the 20% - 80% (of VMA) Rise time and 80% - 20% (of VMA) Fall time of the differential Crosstalk Source introduced to the signal. This test is one of the SFF-8431 Table 12 Jitter and Eye Mask Specifications at B tests.

Connect the equipment as shown in the diagram at <u>Connection Setup for Host Tests (see page 37)</u>: Table 12 Crosstalk Source Tests.

## **Signal validation**

For compliance, perform Signal Validation Procedure (see page 111).

### **Measurement procedure**

The crosstalk source rise/fall time measurement is performed using the algorithm library.

### Inputs to algorithm

- Differential waveform obtained on a Math channel using Dp and Dn after deskewing and applying 12 GHz filter
- Signal Type ("SFPPlus.SignalType")

## Algorithm

- Input the differential waveform.
- Obtain values of vHigh and vLow as done in the VMA measurement (averaged over all the patterns found in the waveform).
- Find the position of the rising and falling edges in the input waveform.
- On each rising edge, traverse forward until the first point crossing the upper limit (80%) is found (= End) and traverse backward until the first point crossing the lower limit (20%) is found (= Start).
- On each falling edge, traverse backward until the first point crossing the upper limit (80%) is found (= Start) and traverse forward until the first point crossing the lower limit (20%) is found (= End).
- Transition time is computed as TT = (End Start). This value is averaged across all edges.
- End

## Limits

Target value = 34 ps

### Snapshot and cursor placement details

This measurement has two snapshots: the first with cursors placed at the rise time, the second with cursors placed at the fall time.

- Rise time: Zoom to the cursor positions. Cursor1 = starting point of RT of first rising edge, cursor2 = ending point of RT of first rising edge.
- Fall time: Zoom to the cursor positions. Cursor1 = starting point of FT of first falling edge, cursor2 = ending point of FT of first falling edge.

### See also

- Oscilloscope Setup (see page 111)
- Common Test Parameters and Values (see page 53)

## Crosstalk source amplitude (p-p differential) (Host)

Crosstalk source amplitude is measured as the difference between the nominal one and zero levels, which are defined as voltages measured in the mid 20% of the high (eight 1s) and low (eight 0s) regions respectively, of the differential crosstalk source introduced to the signal. This test is one of the SFF-8431 Table 12 Jitter and Eye Mask Specifications at B tests.

Connect the equipment as shown in the diagram at <u>Connection Setup for Host Tests (see page 37)</u>: Table 12 Crosstalk Source Tests.

## **Signal validation**

For compliance, perform Signal Validation Procedure (see page 111).

#### **Measurement procedure**

The crosstalk source amplitude (p-p differential) measurement is performed using the algorithm library.

#### Inputs to algorithm

Differential waveform obtained on a Math channel using Dp and Dn after deskewing and applying 12 GHz filter

## Algorithm

- Input the differential waveform.
- On the input waveform, identify the regions with the pattern 11111111 or 00000000.
- On each such pattern, measure the mean voltage in the middle 20% of the pattern.

- The mean voltages corresponding to the Signal High regions is taken as vHigh, and the mean voltages corresponding to the Signal Low is taken as vLow. The vHigh and vLow values are averaged across all regions.
- The required result Amplitude is given by, Amplitude = vHigh vLow.
- End

### Limits

Target value = 1000 mV

### Snapshot and cursor placement details

This measurement has one snapshot with cursor1 = +ve high of VMA, cursor2 = -ve high of VMA.

#### See also

- Oscilloscope Setup (see page 111)
- Common Test Parameters and Values (see page 53)

## Signal Rise/Fall time (20% - 80%)

Signal rise/fall time is measured as the 20% - 80% (of VMA) Rise time and 80% - 20% (of VMA) Fall time of the input signal. This test is one of the SFF-8431 Table 12 Jitter and Eye Mask Specifications at B tests.

Connect the equipment as shown in the diagram at <u>Connection Setup for Host Tests (see page 37)</u>: All other Host tests.

#### **Signal validation**

For compliance, perform Signal Validation Procedure (see page 111).

#### **Measurement procedure**

The signal rise/fall time (20% - 80%) measurement is performed using the algorithm library.

#### Inputs to algorithm

- Differential waveform obtained on a Math channel using Dp and Dn after deskewing and applying 12 GHz filter
- Signal Type ("SFPPlus.SignalType")

## Algorithm

- Obtain values of vHigh and vLow as done in the "VMA" measurement. (Averaged over all the patterns found in the waveform.)
- Find the position of rising and falling edges in the input waveform.
- On each rising edge, traverse forward until the first point crossing the upper limit (80%) is found (=End) and traverse backward until the first point crossing the lower limit (20%) is found (= Start).
- On each falling edge, traverse backward until the first point crossing the upper limit (80%) is found (=Start) and traverse forward until the first point crossing the lower limit (20%) is found (=End).
- Compute Transition Time, TT = (End Start) This value is averaged across all edges.
- End

## Limits

Minimum value = 34 ps

### Snapshot and cursor placement details

This measurement has two snapshots: first with cursors placed at the rise time, second with cursors placed at the fall time.

- Rise time: Zoom to the cursor positions. Cursor1 = starting point of RT of first rising edge, cursor2 = ending point of RT of first rising edge.
- Fall time: Fall time: Zoom to the cursor positions. Cursor1 = starting point of FT of first falling edge, cursor2 = ending point of FT of first falling edge.

- Oscilloscope Setup (see page 111)
- Common Test Parameters and Values (see page 53)

## **Total jitter (Host)**

TJ, as used here, is the Level 1 definition for Total Jitter as described in the FC-MJSQ, where TJ is the crossing width, defined as the late time at which the BER is  $10^{-12}$  minus the early time at which the BER is  $10^{-12}$ . This test is one of the SFF-8431 Table 12 Jitter and Eye Mask Specifications at B tests.

Connect the equipment as shown in the diagram at <u>Connection Setup for Host Tests (see page 37)</u>: All other Host tests.

### Signal validation

Signal validation for PRBS31 pattern signals is not done by the SFP+ QSFP+ Tx application. The software assumes that the PRBS31 pattern is valid.

#### **Measurement procedure**

Total jitter is measured using base DPOJET.

- Deskew the Data+ and Data- inputs. Compute the differential signal on Math1 = Dp Dn.
- Use DPOJET TJ@BER measurement on the Math signal and Skew measurement on the single-ended input signals.

## **DPOJET settings**

- Select Tab: Select Jitter > TJ@BER.
  - Configure the source:
    - Click the arrow button in the Source(s) column and configure Source 1 = Math 1 (Dp Dn)
    - Select the Advanced check box and then set Reference Level % relative to Base Top as follows:

Setting	Rise	Fall
High	80%	80%
Mid	50%	50%
Low	20%	20%
Hysteresis	5%	

- Click Close.

- Configure Tab:
  - Edges: Signal Type = **Data**
  - Clock Recovery:
    - Method = PLL Custom BW
    - = PLL Model = Type II
    - Damping = 700 m
    - Loop BW = 4 MHz
    - Click the **Advanced** Button:
      - Nominal Data Rate = **ON**. Bit Rate = **10.3125 Gb/s**
      - Known Data Pattern = **OFF**
      - Click **OK**.
  - = RjDj:

For PRBS9 signal:

- Pattern Type = Repeating
- Pattern Length = **511 UI**
- = BER 1E-= **12** (for J2 BER 1E-= 2.6; for J9 BER 1E-= 9.6)

For PRBS31 signal:

- Pattern Type = Arbitrary
- Window length = 10 UI
- Population = 100
- = BER 1E-= **12** (for J2 BER 1E-= 2.6; for J9 BER 1E-= 9.6)
- Filters: No filters
- General: OFF
- Global:
  - Gating: OFF
  - Quality: **OFF**
  - Population: OFF
- Results Tab: In the Options menu, deselect **Display Units Absolute**.
- Click Single.

### Limits

Maximum value = 0.28 UI

### Snapshot and cursor placement details

No cursors are required because total jitter cannot be shown using cursors or snapshots. Instead, zoom a part of the waveform to see the type of waveform used for the measurement. Zoom the waveform between time 0 and (Horizontal scale  $\div$  10<sup>4</sup>). If the record length is 2M, the number of points in the zoomed part will be 200.

#### See also

- Oscilloscope Setup (see page 111)
- Common Test Parameters and Values (see page 53)

## Data dependent jitter (Host)

DDJ is the range (max – min) of the timing variations measured on the Differential Signal with a crossing level equal to the average value of the entire waveform being measured. The waveform is averaged sufficiently to remove the effects of random jitter and noise in the system. This test is one of the SFF-8431 Table 12 Jitter and Eye Mask Specifications at B tests.

Connect the equipment as shown in the diagram at <u>Connection Setup for Host Tests (see page 37)</u>: All other Host tests.

## **Signal validation**

For compliance, perform Signal Validation Procedure (see page 111).

#### **Measurement procedure**

Data dependent jitter is measured using base DPOJET.

- Deskew the Data+ and Data- inputs. Compute the differential signal on Math1 = Dp Dn
- Use DPOJET DDJ measurement on the Math signal and Skew measurement on the single ended input signals.

## **DPOJET settings**

- Select Tab: select **Jitter**, click **DDJ**.
  - Source configuration:
    - Source = Math 1 (Dp Dn)
    - Select the Advanced check box and then set Reference Level % relative to Base Top as follows:

Setting	Rise	Fall
High	80%	80%
Mid	50%	50%
Low	20%	20%
Hysteresis	5%	

- Click Close.
- Configure Tab:
  - Clock Recovery:
    - Method = PLL-Custom BW
      - PLL Model = **Type II**
      - Damping = 700 m
      - Loop BW = 4 Mhz
    - Click the **Advanced** button:
      - Nominal Data Rate = **ON**. Bit Rate = **10.3125** Gb/s
      - Known Data Pattern = **OFF**
      - Click **OK**.
  - = RjDj:

For PRBS9:

- Pattern Type = Repeating
- Pattern Length = **511 UI**
- **BER 1E-= 12**

For PRBS31:

- Pattern Type = Arbitrary
- Window Length = 10 UI
- = Population = **100**
- **BER 1E-= 12**
- Filters: No filters
- General: OFF
- Global:
  - Gating: OFF
  - Quality: OFF
  - Population: OFF
- Results Tab: In the Options menu, deselect **Display Units Absolute**.
- Click Single.

### Limits

Maximum value = 0.10 UI

#### Snapshot and cursor placement details

No cursors are required because data dependent jitter cannot be shown using cursors or snapshots. Instead, zoom a part of the waveform to see the type of waveform used for the measurement. Zoom the waveform between time 0 and (horizontal scale  $\div$  10<sup>4</sup>). If the record length is 2M, the number of points in the zoomed part will be 200.

#### See also

- Oscilloscope Setup (see page 111)
- Common Test Parameters and Values (see page 53)

## Data dependent pulse width shrinkage (Host)

DDPWS is measured as the difference between one symbol period and the minimum of all the differences between pairs of adjacent edges on the differential signal with a crossing level equal to the average value of the entire waveform being measured. The waveform is averaged sufficiently to remove the effects of random jitter and noise in the system. This test is one of the SFF-8431 Table 12 Jitter and Eye Mask Specifications at B tests.

Connect the equipment as shown in the diagram at <u>Connection Setup for Host Tests (see page 37)</u>: All other Host tests.

#### **Signal validation**

For compliance, perform Signal Validation Procedure (see page 111).

#### **Measurement procedure**

The data dependent pulse width shrinkage measurement is performed using the algorithm library.

#### Inputs to algorithm

Differential waveform obtained on a Math channel using Data+ and Data- after deskewing.

## Algorithm

- Input differential waveform.
- Estimate the UI of the waveform (UI = bit duration).
- Identify all the PRBS9 patterns found in the acquired signal.
- Overlap all the PRBS9 patterns found in the acquisition to get a single averaged PRBS9 pattern.
- Identify the minimum width between adjacent edges of the averaged PRBS9 pattern. [= minimum UI]
- Compute Data Dependent Pulse Width Shrinkage (DDPWS) as: DDPWS = Estimated UI minimum UI.

### Limits

Maximum value = 0.055 UI

#### Snapshot and cursor placement details

This measurement has one zoomed snapshot with cursor1 and cursor2 marking the smallest UI.

- Oscilloscope Setup (see page 111)
- Common Test Parameters and Values (see page 53)

# **Uncorrelated jitter (Host)**

Uncorrelated jitter refers to the component of jitter in the transmitted signal that is not correlated to the transmitter data. The uncorrelated jitter (rms) is given by the RMS value of the standard deviations of the two distributions, namely standard deviation of jitter on rising edge and standard deviation of jitter on falling edge. This test is one of the SFF-8431 Table 12 Jitter and Eye Mask Specifications at B tests.

Connect the equipment as shown in the diagram at <u>Connection Setup for Host Tests (see page 37)</u>: All other Host tests.

### Signal validation

For compliance, perform Signal Validation Procedure (see page 111).

#### **Measurement procedure**

The uncorrelated jitter measurement is performed using the algorithm library.

#### Inputs to algorithm

- Differential waveform obtained on a Math channel using Data+ and Data- after deskewing
- Signal Type ("SFPPlus.SignalType")

#### Algorithm

- Input differential waveform.
- Identify the deviation of each rising and falling edge on the input signal from its ideal location (constructed using UI = 1÷ data rate) (Note: consider the rising and falling edges of a pattern with the longest run of 1s to maintain some uniformity on the edges to measure deviations. If the deviations were measured on all edges, then the deviations are inconsistent for different edges resulting in measurement errors.)
- Find the standard deviation of the deviations of the rising edges. Find the standard deviation of the deviation of the falling edges.
- Compute UJ as follows:

Uncorrelated jitter (rms): = 
$$\sqrt{(\sigma_r^2 + \sigma_f^2)/2}$$

where  $\sigma_r$  is the standard deviation of the jitter on the rising edge

where  $\sigma_{\rm f}$  is the standard deviation of the jitter on the falling edge

End

### Output from algorithm

m\_SFPPlusISDB.Result1Mean.Value = UJ.Mean

### Limits

Maximum value = 0.023 UI

### Snapshot and cursor placement details

No cursors are required. Uncorrelated jitter cannot be shown using cursors or snapshots. Zoom a part of the waveform to see the type of waveform used for the measurement. Zoom the waveform between time 0 and (horizontal scale  $\div$  10<sup>4</sup>). If the record length is 2M, the number of points in the zoomed part will be 200.

## See also

- Oscilloscope Setup (see page 111)
- Common Test Parameters and Values (see page 53)

## **Transmitter Qsq**

Transmitter Qsq is measured on the differential data signal as the inverse of Relative Noise (RN). This test is one of the SFF-8431 Table 12 Jitter and Eye Mask Specifications at B tests.

Connect the equipment as shown in the diagram at <u>Connection Setup for Host Tests (see page 37)</u>: All other tests.

## **Signal validation**

For compliance, perform Signal Validation Procedure (see page 111).

#### **Measurement procedure**

The transmitter Qsq measurement is performed using the algorithm library.

#### Inputs to algorithm

- Differential waveform obtained on a Math channel using Data+ and Data- after deskewing
- Signal Type ("SFPPlus.SignalType");
- Window Width ("SFPPlus.QsqWidth");

## Algorithm

Input differential PRBS waveform

Measure Relative Noise as:

- Compute VMA as given by the VMA algorithm. On the input waveform, identify the regions with the pattern 11111111 or 00000000.
- On each such pattern, measure the AC RMS voltage in the 10% window where the waveform is the flattest.
- The AC RMS in the 11111111 regions is LevelONENoise, and that in 00000000 regions is

LevelZERONoise. Noise (rms) is measured as:  $\sqrt{(levelONEnoise^2 + LevelZEROnoise^2)/2}$ 

$$RN = \frac{2 * Noise(rms)}{VMA}$$

- The required result Tx Qsq is given by Tx Qsq =  $1 \div RN$
- End

## Output from algorithm

- m\_SFPPlusISDB.Result1Mean.Value = TxQsq.Mean
- m\_SFPPlusISDB. Hist1Left.Value = LevelONEnoise window begin
- m\_SFPPlusISDB. Hist1Right.Value = LevelONEnoise window end
- m SFPPlusISDB.HorizontalPos1.Value = position of the waveform where to zoom for LevelONEnoise
- m SFPPlusISDB.HorizontalScale1.Value = scale of Zoom that is to be set for LevelONEnoise
- m SFPPlusISDB. Hist2Left.Value = LevelZEROnoise window begin
- m SFPPlusISDB. Hist2Right.Value = LevelZEROnoise window end
- m SFPPlusISDB.HorizontalPos2.Value = position of the waveform where to zoom for LevelZEROnoise
- m SFPPlusISDB.HorizontalScale2.Value = scale of Zoom that is to be set for LevelZEROnoise

## Limits

Minimum value = 50

## Snapshot and cursor placement details

This measurement has two snapshots with zoom showing one full period of the 8180 pattern. The first snapshot has cursor1 and cursor2 marking the flattest region of the high part of the period. The second snapshot has cursor1 and cursor2 marking the flattest region of the low part of the period.

#### See also

- Oscilloscope Setup (see page 111)
- Common Test Parameters and Values (see page 53)

# Eye mask hit ratio (Host)

The required transmitter pulse shape characteristics are specified in the form of a mask of the transmitter eye diagram (used to measure the number of Mask Hits). Eye mask hit ratio is computed using eye mask hit ratio = (Number of Mask Hits × Signaling Speed)  $\div$  (Number of UIs × Sampling rate). This test is one of the SFF-8431 Table 12 Jitter and Eye Mask Specifications at B tests.

Connect the equipment as shown in the diagram at <u>Connection Setup for Host Tests (see page 37)</u>: All other tests.

### **Signal validation**

Signal validation for PRBS31 pattern signals is not done by the SFP+ QSFP+ Tx application. The software assumes that the PRBS31 pattern is valid.

#### **Measurement procedure**

Eye mask hit ratio is measured using base DPOJET.

- Deskew the Data+ and Data- inputs. Compute the differential signal on Math1 = Dp Dn.
- Use DPOJET Mask Hits measurement on the Math signal and Skew measurement on the single-ended input signals.

#### **DPOJET settings**

- Select Tab: Select Eye >Mask Hits.
  - Configure the Source:
    - Click the arrow button in the Source(s) column and configure Source 1 = Math 1 (Dp–Dn)
    - Select the Advanced check box and then set Reference Level % relative to Base Top as follows:

Setting	Rise	Fall
High	80%	80%
Mid	50%	50%
Low	20%	20%
Hysteresis	5%	

- Click Close.

- Configure Tab:
  - Edges: Signal Type = **Data**
  - Clock Recovery:
    - Method = PLL Custom BW
      - PLL Model = Type II
      - Damping =700 m
      - Loop BW = 4 MHz
    - Click the **Advanced** button:
      - Nominal Data Rate = **ON**. Bit Rate = **10.3125** Gb/s
      - Known Data Pattern = **OFF**
      - Click OK.
    - Click Apply.
  - = RjDJ:

For PRBS9 signal:

- Pattern Type = Repeating
- Pattern Length = **511 UI**
- = BER 1E- = **12**

For PRBS31 signal:

- Pattern Type = Arbitrary
- Window length = 10 UI
- Population = **100**
- = BER 1E-= **12**
- Filters: No filters
- General: OFF
- Global:
  - Gating = **OFF**
  - Quality = **OFF**
  - Population = OFF
- Click **Run**.

NOTE. Run until population crosses 2M.

The Mask Hits DPOJET measurement gives the number of Mask hits. Plug that value into the following formula to obtain the Mask Hit Ratio:

Mask Hit Ratio = Number of Mask Hits × Signaling Speed (10.3125  $e^9$ ) ÷ Number of UIs (Population from DPOJET) × Sampling Rate (50  $e^9$ )

#### Limits

Mask hit ratio of 5 x 10-5

#### Snapshot and cursor placement details

This measurement has one snapshot of the eye mask hit generated in DPOJET. No cursors are required.

#### See also

- Oscilloscope Setup (see page 111)
- Common Test Parameters and Values (see page 53)

## Voltage modulation amplitude (p-p)

Voltage modulation amplitude is measured as the difference between the nominal one and zero levels, which are defined as voltages measured in the mid 20% of the high (eight 1s) and low (eight 0s) regions respectively, of the differential data signal. This test is one of the SFF-8431 Table 33 Output Specifications at B for Cu tests.

Connect the equipment as shown in the diagram <u>Connection Setup for Host Tests (see page 37)</u>: All other Host tests.

#### Signal validation

For compliance, perform Signal Validation Procedure (see page 111).

#### **Measurement procedure**

The voltage modulation amplitude (p-p) measurement is performed using the algorithm library.

#### Inputs to algorithm

- Differential waveform obtained on a Math channel using Data+ and Data- after deskewing
- Signal Type ("SFPPlus.SignalType")

#### Algorithm

- Input differential PRBS waveform.
- On the input waveform identify the regions with the pattern 11111111 or 00000000.
- On each such pattern measure the mean voltage in the middle 20% of the pattern.
- The mean voltages corresponding to the Signal High regions is taken as vHigh and the mean voltages corresponding to the Signal Low is taken as vLow. The vHigh and vLow values are averaged across all regions.
- The required result VMA is given by, VMA = vHigh vLow
- End

### Limits

Minimum value = 300 mV

#### Snapshot and cursor placement details

This measurement has one snapshot with cursor1 = +ve high of VMA, cursor2 = -ve high of VMA.

#### See also

- Oscilloscope Setup (see page 111)
- Common Test Parameters and Values (see page 53)

## Transmitter Qsq (for Cu)

Transmitter Qsq is measured on the differential data signal as the inverse of Relative Noise (RN). RN is measured as  $RN = 2 \times Noise (rms) \div VMA$ . And Noise(rms) = Sq rt ( (LogicONENoise(rms)2 + LogicZERONoise(rms)2) \div 2). This test is one of the SFF-8431 Table 33 Output Specifications at B for Cu tests.

Connect the equipment as shown in the diagram <u>Connection Setup for Host Tests (see page 37)</u>: All other Host tests.

#### Signal validation

For compliance, perform Signal Validation Procedure (see page 111).

#### Measurement procedure

The transmitter Qsq (for Cu) measurement is performed using the algorithm library.

## Inputs to algorithm

- Differential waveform obtained on a Math channel using Data+ and Data- after deskewing
- Signal Type ("SFPPlus.SignalType");

## Algorithm

- Input differential PRBS waveform
- Compute VMA as given by the VMA algorithm. On the input waveform, identify the regions with the pattern 11111111 or 00000000.
- On each such pattern, measure the AC RMS voltage in the 10% window where the waveform is the flattest.
- The AC RMS in the 11111111 regions is LevelONENoise, and that in 00000000 regions is

LevelZERONoise. Measure Noise (rms) as:  $\sqrt{(levelONEnoise^2 + LevelZEROnoise^2)/2}$ 

• Measure Relative Noise as:  $RN = \frac{2 * Noise(rms)}{VMA}$ 

The required result TxQsq is given by  $TxQsq = 1 \div RN$ 

End

## Output from algorithm

m\_SFPPlusISDB.Result1Mean.Value = TxQsq.Mean

## Limits

Minimum value = 63.1

## Snapshot and cursor placement details

This measurement has two snapshots with zoom showing one full period of the 8180 pattern. The first snapshot has cursor1 and cursor2 marking the flattest region of the high part of the period. The second snapshot has cursor1 and cursor2 marking the flattest region of the low part of the period.

- Oscilloscope Setup (see page 111)
- Common Test Parameters and Values (see page 53)

## Output AC Common-Mode voltage (RMS) (for Cu)

Output AC common-mode voltage is measured as the AC RMS voltage of the common-mode ((DP + DN)  $\div$  2) signal. This test is one of the SFF-8431 Table 33 Output Specifications at B for Cu tests.

Connect the equipment as shown in the diagram at <u>Connection Setup for Host Tests (see page 37)</u>: All other Host tests.

### **Signal validation**

Signal validation for PRBS31 pattern signals is not done by the SFP+ QSFP+ Tx application. The software assumes that the PRBS31 pattern is valid.

#### **Measurement procedure**

The output AC common-mode voltage (RMS) (for Cu) measurement is performed using the base oscilloscope.

- 1. Math1 =  $(Dp + Dn) \div 2$ . Switch off channels connected to Dp and Dn.
- 2. Draw a histogram bounding box from top left of the oscilloscope to the bottom right and choose Histogram Vertical.
- 3. Select Math1 as the histogram source.
- 4. From the Measurement menu, select Histogram Measurements > Standard Deviation.
- 5. Do a single step run and measure the mean value of the histogram standard deviation. This is the measurement result.

#### Limits

Maximum = 12 mV

#### Snapshot and cursor placement details

A screen shot where the histogram on math and the standard deviation value of the histogram is visible on the screen. The visible standard deviation value should be the value shown in the report. No cursors are required.

- Oscilloscope Setup (see page 111)
- Common Test Parameters and Values (see page 53)

## Host output TWDPc

**NOTE.** The Host Output TWDPc test is supported only on oscilloscopes that support 100 Gs/s. For details, see Compatibility (see page 3).

TWDP is a measure of the deterministic dispersion penalty due to a particular transmitter with reference emulated multi-mode fibers and receiver. TWDP is initially defined to characterize the performance of a transmitter in optical links. The same concept has been extended to quantify channel performance, especially in high-speed copper links.

This test is one of the SFF-8431 Revision 4.1 Table 33-Host Transmitter Output Specifications at B for Cu tests.

**NOTE.** The TWDPc measurement is supported only on a Ch1–Ch3 combination setup of a C or D series oscilloscope. 100 GS/s RT mode output on Ch2 and Ch4 is not available. Therefore, if Ch1 is not working, the test cannot be performed successfully.

Connect the equipment as shown in the diagram at <u>Connection Setup for Host Tests (see page 37)</u>: All other Host tests.

### **Signal validation**

For compliance, perform Signal Validation Procedure (see page 111).

#### **Measurement procedure**

The Host output TWDPc measurement is performed using the algorithm library.

#### Inputs to algorithm

- Differential waveform obtained on a Math channel using Data+ and Data- after deskewing. Sampled at 3.3 TS/s using IT mode.
- Signal Type ("SFPPlus.SignalType");

## Algorithm

- Input the differential waveform (sampled at 3.3 TS/s IT)
- Down sample the differential input waveform to 16 samples per UI (which is down sampling 20 times)
- Identify all the PRBS9 patterns in the waveform. For each PRBS9 pattern, write all points to a text file and call the SFF8431 x WDP algorithm.

- The required result TWDPc is the average value of the TWDP calculated for each PRBS9 pattern.
- End

#### Output from algorithm

m\_SFFPlusISDB.Result1Mean.Value = Average TWDPc value

#### Limits

Maximum value = 10.7 dBe

#### See also

- Oscilloscope Setup (see page 111)
- Common Test Parameters and Values (see page 53)

## AC Common-Mode voltage tolerance (Module)

Output AC common-mode voltage tolerance is measured as the AC RMS voltage of the common mode ((DP+DN)÷2) signal. This is one of the SFF-8431 Revision 4.1 Table 16 Module Transmitter Input Electrical Specifications at B' tests.

Connect the equipment as shown in the diagram at <u>Connection Setup for ModuleTests (see page 39)</u>: All other Module tests.

#### Signal validation

Automatic signal validation for PRBS31 pattern signals is not done by the SFP+ QSFP+ Tx application. The software assumes that the PRBS31 pattern is valid.

#### **Measurement procedure**

AC common-mode voltage tolerance is measured using the base oscilloscope.

- 1. Generate the AC common-mode waveform on Math1 =  $(Dp + Dn) \div 2$ . Switch off the channels connected to Dp and Dn.
- 2. Add the base oscilloscope measurement Min and Max. Choose Math1 as the source in both cases.
- 3. Perform a single run and read the Min and Max values.

#### Limits

Min (Abs(Min), Abs(Max)) > 15 V (Table 16)

#### Snapshot and cursor placement details

A snapshot of the common-mode voltage is displayed on the oscilloscope.

#### See also

- Oscilloscope Setup (see page 111)
- Common Test Parameters and Values (see page 53)

## Single-Ended input voltage tolerance (Module)

Single-ended input voltage tolerance is measured as the single-ended peak-to-peak input voltage for the positive and negative data channels on a single acquisition. This test is one of the SFF-8431 Revision 4.1 Table 16 Module Transmitter Input Electrical Specifications at B' tests.

Connect the equipment as shown in the diagram at <u>Connection Setup for Module Tests (see page 39)</u>: Single-Ended Input Voltage Tolerance Test.

#### **Signal validation**

Automatic signal validation for PRBS31 pattern signals is not done by the SFP+ QSFP+ Tx application. The software assumes that the PRBS31 pattern is valid.

#### **Measurement procedure**

Single-ended input voltage tolerance is measured using base DPOJET.

- Use DPOJET measurement name: Ampl > Cycle Pk-Pk
- Use DPOJET settings: All default settings

#### Limits

For each of Dp and Dn:

Minimum = -0.3 V

Maximum = 4 V
#### Snapshot and cursor placement details

There will be two snapshots:

- A snapshot of Dp with cursors placed at maximum and minimum voltages of single-ended Pk-Pk measurement value of Dp. Cursor values can be derived using DPOJET: Ampl > Cycle Max and Ampl > Cycle Min for +ve and -ve peak, respectively for Dp.
- A snapshot of Dn with cursors placed at maximum and minimum voltages of single-ended Pk-Pk measurement value of Dn. Cursor values can be derived using DPOJET: Ampl > Cycle Max and Ampl > Cycle Min for +ve and -ve peak, respectively for Dn.

#### See also

- Oscilloscope Setup (see page 111)
- Common Test Parameters and Values (see page 53)

## Crosstalk source Rise/Fall time (20% - 80%) (Module)

Crosstalk source rise/fall time is measured as the 20% - 80% (of VMA) Rise time and 80% - 20% (of VMA) Fall time of the differential crosstalk source introduced to the signal. This test is one of the SFF-8431 Table 17 Module Transmitter Input Tolerance Signal Calibrated at B" tests.

Connect the equipment as shown in the diagram at <u>Connection Setup for ModuleTests (see page 39)</u>: All other Module tests.

#### Signal validation

For compliance, perform Signal Validation Procedure (see page 111).

#### **Measurement procedure**

The crosstalk source rise/fall time (20% - 80%) measurement is performed using the algorithm library.

#### Inputs to algorithm

- Differential waveform obtained on a Math channel using Dp and Dn after deskewing and applying 12 GHz filter
- Signal Type ("SFPPlus.SignalType")

#### Algorithm

- Input differential waveform.
- Obtain values of vHigh and vLow as done in the VMA measurement (averaged over all the patterns found in the waveform).

- Find the position of rising and falling edges in the input waveform.
- On each rising edge, traverse forward until the first point crossing the upper limit (80%) is found (= End) and traverse backward until the first point crossing the lower limit (20%) is found (= Start).
- On each falling edge, traverse backward until the first point crossing the upper limit (80%) is found (= Start) and traverse forward until the first point crossing the lower limit (20%) is found (= End).
- Transition time is computed as TT = (End Start). This value is averaged across all edges.
- End

#### Limits

Target value = 34 ps

#### Snapshot and cursor placement details

This measurement has two snapshots: the first with cursors placed at the rise time, the second with cursors placed at the fall time.

- Rise time: Zoom to the cursor positions. Cursor1 = starting point of RT of first rising edge, cursor2 = ending point of RT of first rising edge.
- Fall time: Zoom to the cursor positions. Cursor1 = starting point of FT of first falling edge, cursor2 = ending point of FT of first falling edge.

Cursor values and zoom positions are provided by the Algorithm library.

#### See also

- Oscilloscope Setup (see page 111)
- Common Test Parameters and Values (see page 53)

## Crosstalk source amplitude (p-p differential) (Module)

Crosstalk source amplitude is measured as the difference between the nominal one and zero levels, which are defined as voltages measured in the mid 20% of the high (eight 1s) and low (eight 0s) regions respectively, of the differential crosstalk source introduced to the signal. This is one of the SFF-8431 Revision 4.1 Table 17 Module Transmitter Input Tolerance Signal Calibrated at B" tests.

Connect the equipment as shown in the diagram at <u>Connection Setup for Module Tests (see page 39)</u>: All other Module tests.

#### Signal validation

For compliance, perform Signal Validation Procedure (see page 111).

#### **Measurement procedure**

The crosstalk source amplitude (p-p differential) measurement is performed using the algorithm library.

#### Inputs to algorithm

Differential waveform obtained on a Math channel using Dp and Dn after deskewing and applying 12 GHz filter

#### Algorithm

- Input differential PRBS waveform.
- On the input waveform, identify the regions with the pattern 11111111 or 00000000.
- On each such pattern, measure the mean voltage in the middle 20% of the pattern.
- The mean voltages corresponding to the Signal High regions is taken as vHigh, and the mean voltages corresponding to the Signal Low is taken as vLow. The vHigh and vLow values are averaged across all regions.
- The required result amplitude is given by, Amplitude = vHigh vLow.
- End

#### Limits

Target value = 1000 mV

#### Snapshot and cursor placement details

This measurement has one snapshot with cursor1 = +ve high of VMA, cursor2 = -ve high of VMA.

- Oscilloscope Setup (see page 111)
- Common Test Parameters and Values (see page 53)

# Output AC Common-Mode voltage (RMS) (Module)

Output AC common-mode voltage is measured as the AC RMS voltage of the common-mode ((DP + DN) $\div$ 2) signal. This test is one of the SFF-8431 Revision 4.1 Table 17 Module Transmitter Input Tolerance Signal Calibrated at B" tests.

Connect the equipment as shown in the diagram at <u>Connection Setup for ModuleTests (see page 39)</u>: All other Module tests.

#### **Signal validation**

Signal validation for PRBS31 pattern signals is not done by the SFP+ QSFP+ Tx application. The software assumes that the PRBS31 pattern is valid.

#### **Measurement procedure**

Output AC common-mode voltage (RMS) is measured using the base oscilloscope.

- 1. Math1 =  $(Dp + Dn) \div 2$ . Switch off channels connected to Dp and Dn.
- 2. Draw a histogram bounding box from the top left of the oscilloscope to the bottom right, and choose Histogram Vertical.
- 3. Select Math1 as the histogram source.
- 4. From the Measure menu, select Histogram Measurements > Standard Deviation.
- 5. Do a single step run and measure the mean value of the histogram standard deviation. This is the measurement result.

#### Limits

Maximum = 15 mV (Table 17)

#### Snapshot and cursor placement details

A snapshot where the histogram on math and the standard deviation value of the histogram is visible on the screen. The standard deviation value visible on the screen should be the value reported in the report. No cursors are required.

- Oscilloscope Setup (see page 111)
- Common Test Parameters and Values (see page 53)

# Total jitter (Module)

Total jitter, as used here, is the Level 1 definition for TJ as described in the FC-MJSQ, where TJ is the crossing width, defined as the late time at which the BER is 10<sup>-12</sup> minus the early time at which the BER is 10<sup>-12</sup>. This test is one of the SFF-8431 Revision 4.1 Table 17 Module Transmitter Input Tolerance Signal Calibrated at B" tests.

Connect the equipment as shown in the diagram at <u>Connection Setup for Module Tests (see page 39)</u>: All other Module tests.

#### Signal validation

Signal validation for PRBS31 pattern signals is not done by the SFP+ QSFP+ Tx application. The software assumes that the PRBS31 pattern is valid.

#### **Measurement procedure**

Total jitter is measured using base DPOJET.

- Deskew the Data+ and Data- inputs. Compute the differential signal on Math1 = Dp Dn.
- Use DPOJET TJ@BER measurement on the Math signal and Skew measurement on the single ended input signals.

#### **DPOJET settings**

- Select Tab: Select Jitter, click TJ@BER.
  - Configure the source:
    - Click the arrow button in the Source(s) column and configure Source 1 = Math 1 (Dp Dn)
    - Select the Advanced check box and then set Reference Level % relative to Base Top as follows:

Setting	Rise	Fall
High	80%	80%
Mid	50%	50%
Low	20%	20%
Hysteresis	5%	

- Click Close.

- Configure Tab:
  - Edges: Signal Type = **Data**
  - Clock Recovery:
    - Method = PLL-Custom BW
    - PLL Model = Type II
    - Damping = 700 m
    - Loop BW = 4 MHz
    - Click the **Advanced** Button:
      - Nominal Data Rate = **ON** Bit Rate = **10.3125 Gb/s**
      - Known Data Pattern = **OFF**
      - Click **OK**.
  - = RjDj:

For PRBS9 signal:

- Pattern Type = Repeating
- = Window length = 511 UI
- = BER 1E-=12 (for J2 BER 1E-= 2.6; for J9 BER 1E-= 9.6)

For PRBS31 signal:

- Pattern Type = Arbitrary
- Window length = 10 UI
- Population = 100
- = BER 1E-=12 (for J2 BER 1E-=2.6; for J9 BER 1E-=9.6)
- Filters: No filters
- General: OFF
- Global:
  - Gating: OFF
  - Quality: **OFF**
  - Population: OFF
- Results Tab: In the Options menu, deselect **Display Units Absolute**.
- Click Single.

#### Limits

Maximum value = 0.28 UI

#### Snapshot and cursor placement details

No cursors are required because total jitter cannot be shown using cursors or snapshots. Instead, zoom a part of the waveform to see the type of waveform used for the measurement. Zoom the waveform between time 0 and (Horizontal scale  $\div$  10<sup>4</sup>). If the record length is 2M, the number of points in the zoomed part will be 200.

#### See also

- Oscilloscope Setup (see page 111)
- Common Test Parameters and Values (see page 53)

## Data dependent jitter (Module)

DDJ is the range (max – min) of the timing variations measured on the differential signal with a crossing level equal to the average value of the entire waveform being measured. The waveform is averaged sufficiently to remove the effects of random jitter and noise in the system. This test is one of the SFF-8431 Revision 4.1 Table 17 Module Transmitter Input Tolerance Signal Calibrated at B" tests.

Connect the equipment as shown in the diagram at <u>Connection Setup for ModuleTests (see page 39)</u>: All other Module tests.

#### **Signal validation**

For compliance, perform Signal Validation Procedure (see page 111).

#### **Measurement procedure**

Data dependent jitter is measured using base DPOJET.

- Deskew the Data+ and Data- inputs. Compute the differential signal on Math1 = Dp Dn
- Use DPOJET DDJ measurement on the Math signal and Skew measurement on the single ended input signals.

#### **DPOJET settings**

- Select Tab: select **Jitter**, click **DDJ**.
  - Source configuration:
    - Source = Math 1 (Ch1 Ch1)
    - Select the Advanced check box and then set Reference Level % relative to Base Top as follows:

Setting	Rise	Fall
High	80%	80%
Mid	50%	50%
Low	20%	20%
Hysteresis	5%	

- Click Close.
- Configure Tab:
  - Clock Recovery:
    - Method = PLL-Custom BW
      - PLL Model = **Type II**
      - Damping = 700 m
      - Loop BW = 4 MHz
    - Click the **Advanced** button:
      - Nominal Data Rate = **ON**. Bit Rate = **10.3125** Gb/s
      - Known Data Pattern = **OFF**
      - Click **OK**.
  - = RjDj:

For PRBS9:

- Pattern Type = Repeating
- Pattern Length = **511 UI**
- **BER 1E-= 12**

For PRBS31:

- Pattern Type = Arbitrary
- Window Length = 10 UI
- = Population = **100**
- = BER 1E-= **12**
- Filters: No filters
- General: OFF
- = Global:
  - Gating: OFF
  - Quality: OFF
  - Population: OFF
- Results Tab: In the Options menu, uncheck **Display Units Absolute**.
- Click Single.

#### Limits

Target value = 0.10 UI

#### Snapshot and cursor placement details

No cursors are required because Data Dependent Jitter cannot be shown using cursors or snapshots. Instead, zoom a part of the waveform to see the type of waveform used for the measurement. Zoom the waveform between time 0 and (Horizontal scale  $\div$  10<sup>4</sup>). If the record length is 2M, the number of points in the zoomed part will be 200.

## Data dependent pulse width shrinkage (Module)

DDPWS is measured as the difference between one symbol period and the minimum of all the differences between pairs of adjacent edges on the Differential Signal with a crossing level equal to the average value of the entire waveform being measured. The waveform is averaged sufficiently to remove the effects of random jitter and noise in the system. This is a SFF-8431 Revision 4.1 Table 17 Module Transmitter Input Tolerance Signal Calibrated at B" test.

Connect the equipment as shown in the diagram at <u>Connection Setup for Module Tests (see page 39)</u>: All other Module tests.

#### Signal validation

For compliance, perform Signal Validation Procedure (see page 111).

#### **Measurement procedure**

The data dependent pulse width shrinkage measurement is performed using the algorithm library.

#### Inputs to algorithm

Differential waveform obtained on a Math channel using Data+ and Data- after deskewing.

#### Algorithm

- Input differential waveform.
- Estimate the UI of the waveform (UI = bit duration).
- Identify all the PRBS9 patterns found in the acquired signal.
- Overlap all the PRBS9 patterns found in the acquisition to get a single averaged PRBS9 pattern.
- Identify the minimum width between adjacent edges of the averaged PRBS9 pattern. [= minimum UI]
- Compute Data Dependent Pulse Width Shrinkage (DDPWS) as: DDPWS = Estimated UI minimum UI.

#### Limits

Target value = 0.055 UI

#### Snapshot and cursor placement details

This measurement has one zoomed snapshot with cursor1 and cursor2 marking the smallest UI.

- Oscilloscope Setup (see page 111)
- Common Test Parameters and Values (see page 53)

# **Uncorrelated jitter (Module)**

Uncorrelated jitter refers to the component of jitter in the transmitted signal that is not correlated to the transmitter data. The uncorrelated jitter (rms) is given by the RMS value of the standard deviations of the two distributions, namely standard deviation of jitter on rising edge and standard deviation of jitter on falling edge. This test is one of the SFF-8431 Table 17 Module Transmitter Input Tolerance Signal Calibrated at B" tests.

Connect the equipment as shown in the diagram at <u>Connection Setup for Module Tests (see page 39)</u>: All other Module tests.

#### Signal validation

For compliance, perform Signal Validation Procedure (see page 111).

#### **Measurement procedure**

The uncorrelated jitter measurement is performed using the algorithm library.

#### Inputs to algorithm

- Differential waveform obtained on a Math channel using Data+ and Data- after deskewing
- Signal Type ("SFPPlus.SignalType")

#### Algorithm

- Input differential waveform.
- Identify the deviation of each rising and falling edge on the input signal from its ideal location (constructed using UI = 1÷ data rate) (Note: consider the rising and falling edges of a pattern with the longest run of 1s to maintain some uniformity on the edges to measure deviations. If the deviations were measured on all edges, then the deviations are inconsistent for different edges resulting in measurement errors.)
- Find the standard deviation of the deviations of the rising edges. Find the standard deviation of the deviation of the falling edges.
- Compute UJ as follows:

Uncorrelated jitter (rms): = 
$$\sqrt{(\sigma_r^2 + \sigma_f^2)/2}$$

where  $\sigma_r$  is the standard deviation of the jitter on the rising edge

where  $\sigma_{\rm f}$  is the standard deviation of the jitter on the falling edge

End

#### Output from algorithm

m\_SFPPlusISDB.Result1Mean.Value = UJ.Mean

#### Limits

Target value = 0.023 UI

#### Snapshot and cursor placement details

No cursors are required. Uncorrelated jitter cannot be shown using cursors or snapshots. Zoom a part of the waveform to see the type of waveform used for the measurement. Zoom the waveform between time 0 and (H-scale  $\div$  10<sup>4</sup>). If the record length is 2M, the number of points in the zoomed part will be 200.

#### See also

- Oscilloscope Setup (see page 111)
- Common Test Parameters and Values (see page 53)

## Eye mask hit ratio (Module)

The required transmitter pulse shape characteristics are specified in the form of a mask of the transmitter eye diagram (used to measure the number of Mask Hits). Eye Mask hit ratio is computed using Eye Mask hit ratio = (Number of Mask Hits × Signaling Speed)  $\div$  (Number of UIs × Sampling rate). This test is one of the SFF-8431 Revision 4.1 Table 17 Module Transmitter Input Tolerance Signal Calibrated at B" tests.

Connect the equipment as shown in the diagram at <u>Connection Setup for Module Tests (see page 39)</u>: All other Module tests.

#### **Signal validation**

Automatic signal validation for PRBS31 pattern signals is not done by the SFP+ QSFP+ Tx application. The software assumes that the PRBS31 pattern is valid.

#### **Measurement procedure**

Eye mask hit ratio is measured using base DPOJET.

- Deskew the Data+ and Data- inputs. Compute the differential signal on Math1 = Dp Dn.
- Use DPOJET Mask Hits measurement on the Math signal and Skew measurement on the single-ended input signals.

#### **DPOJET settings**

- Select Tab: Select Eye >Mask Hits.
  - Configure the Source:
    - Click the arrow button in the Source(s) column and configure Source 1 = Math 1 (Dp–Dn)
    - Select the Advanced check box and then set Reference Level % relative to Base Top as follows:

Setting	Rise	Fall
High	80%	80%
Mid	50%	50%
Low	20%	20%
Hysteresis	5%	

- Click Close.
- Configure Tab:
  - Edges: Signal Type = **Data**
  - Clock Recovery:
    - Method = PLL Custom BW
      - PLL Model = Type II
      - Damping =700 m
      - = Loop BW = 4 MHz
    - Click the **Advanced** button:
      - Nominal Data Rate = **ON**. Bit Rate = **10.3125 Gb/s**
      - Known Data Pattern = **OFF**
      - Click OK.
    - Click Apply.
  - RjDj:

For PRBS9 signal:

- Pattern Type = Repeating
- Pattern Length = **511 UI**
- **BER 1E-= 12**

For PRBS31 signal:

- Pattern Type = Arbitrary
- Window length = 10 UI
- Population = **100**
- **BER 1E- = 12**
- Filters: No filters
- General: OFF
- Global:
  - Gating = **OFF**
  - Quality = **OFF**
  - Population = **OFF**
- Click Run.

NOTE. Run until population crosses 2M.

The Mask Hits DPOJET measurement gives the number of Mask hits. Plug that value into the following formula to obtain the Mask hit ratio:

Mask Hit Ratio = Number of Mask Hits × Signaling Speed (10.3125  $e^9$ ) ÷ Number of UIs (Population from DPOJET) × Sampling Rate (50  $e^9$ )

#### Limits

Mask hit ratio of 5 x  $10^{-5}$ 

#### Snapshot and cursor placement details

This measurement has one snapshot of the eye mask hit generated in DPOJET. No cursors are required.

- Oscilloscope Setup (see page 111)
- Common Test Parameters and Values (see page 53)

# **De-embed using filter files**

TekExpress SFP+ QSFP+ Tx provides an option to de-embed the signal path using filter files. You create the filter files. The filter files are .flt files composed of de-embed filter coefficients for a particular sampling rate. A filter file created for one sampling rate might not work for other sampling rates, so it is important to understand at what sampling rate the measurements are being performed. The following table summarizes the sampling rates used for each measurement.

#### Table 18: Measurement sampling rates

Measurement	Oscilloscope model
	DPO/DSA/MSO C & D Series (>16 GHz BW)
	Input on Ch1 and Ch3
Single-Ended Output Voltage Range	100 GS/s
Output AC Common Mode Voltage (RMS)	—
Host Transmitter Jitter and Eye Mask specifications	
Crosstalk Source Rise/Fall Time (20% – 80%)	100 GS/s
Crosstalk Source Amplitude (p-p differential)	
Signal Rise/Fall Time (20% – 80%)	
Total Jitter (p–p)	
Data Dependent Jitter (p–p)	
Data Dependent Pulse Width Shrinkage (p-p)	
Uncorrelated Jitter (RMS)	
Transmitter Qsa	
Eye Mask Hit Ratio	
Host Transmitter Output Specifications for CU (SFP+	Host supporting direct attached cables)
Voltage Modulation Amplitude (p-p)	_100 GS/s
Transmitter Qsa	
Output AC Common Mode Voltage	
Host Output TWDPc	3.3 TS/s

- Common Test Parameters and Values (see page 53)
- Configure Tests (see page 52)

# **Deskew channels**

If skew is present between positive and negative channels, then the channels need to be deskewed before being used for waveform measurements. TekExpress SFP+ QSFP+ Tx provides support for channel deskew using the following method:

- 1. Determine what the skew is for each channel.
- 2. From the TekScope menu, select Vertical > Deskew.
- 3. In the Deskew/Attenuation window, click the channel (1 4) button for the first channel to be deskewed.
- 4. Click in the Ch(x) Deskew Time entry field and enter the skew. The skew can be +ve or -ve.
- 5. Click the channel button for the next channel and repeat step 4.
- 6. After entering the skew for all the channels that require it, from the Options menu in TekExpress SFP+ QSFP+ Tx, select **Deskew**.
- 7. In the Deskew dialog box, select the desired level:
  - Less than 100 mV signal amplitude: Select this if the signal amplitude is such that the oscilloscope's vertical setting is less than 100 mV/division.
  - **100 mV or greater signal amplitude**: Select this if the signal amplitude is such that the oscilloscope's vertical setting is greater than 100 mV/division.
- 8. Click Read Deskew/Attn.
- 9. When the status in the dialog box indicates the deskew is finished, click Close.

Each input channel has its own deskew settings. Deskew compensates individual channels for probes or cables of different lengths. The instrument applies the delay values after each completed acquisition. The deskew values are saved as part of the instrument setup. The deskew values for the selected channel are retained until you change the probe, you restore a saved setup, or you recall the factory setup.

- Select Acquisitions (see page 46)
- PreRun Checklist (see page 61)

# Map the My TekExpress folder

Follow these steps to map the My TekExpress folder on the instrument:

- 1. Open Windows Explorer.
- 2. From the Windows Explorer menu, click Computer.
- 3. In the menu bar, select Map network drive.
- 4. Select the Drive letter as X: (if there is any previous connection on X:, disconnect it first through Tools > Disconnect Network drive menu of Windows Explorer. Windows 7 users: if you do not see the Tools menu, press the Alt key).
- 5. In the Folder field, enter the remote My TekExpress folder path (for example, \\192.158.97.65\ My TekExpress).

To determine the IP address of the instrument where the My TekExpress folder exists, do the following:

- 1. On the instrument where the My TekExpress folder exists, click Start and select Run.
- 2. Type "cmd" and then press Enter.
- 3. At the command prompt, type "ipconfig" and then press Enter.

- Before You Click Start (see page 59)
- Install the Software (see page 6)

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