Tektronix®

TekExpress® SFP+ QSFP+ Tx Compliance and Debug Solution Software

Application Help

077-0590-06

Tektronix®

TekExpress® SFP+ QSFP+ Tx Compliance and Debug Solution Software

Application Help

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077-0590-06

Contacting Tektronix

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

- In North America, call 1-800-833-9200.
- Worldwide, visit to *www.tek.com* find contacts in your area.

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Welcome

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.

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.

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 and 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

Getting help and support

Product documents

Use the product documents for more information on the application functions, understand the theory of operation, how to remotely program or operate the application, and do other tasks.

Table 1: TekExpress Application documents

To learn about	Use this document
How to use the application How to remotely control the instrument	TekExpress SFP+ QSFP+ Help PDF version of this document can be downloaded from *www.tek.com/downloads* Compiled HTML (CHM) version is integrated with the application. Press **F1** key from the keyboard to start the help. Tektronix Part Number: 077-xxxx-xx

Conventions

This application help uses the following conventions:

- The term "Application," and "Software" refers to the TekExpress SFP+ QSFP+ application.
- The term “DUT” is an abbreviation for Device Under Test.
- The term “select” is a generic term that applies to the two methods of choosing a screen item (button control, list item): using a mouse or using the touch screen.
- A **Note** identifies important information.

Table 2: Icons used in the help

Icon	Description
	This icon identifies important information
	This icon identifies conditions or practices that could result in loss of data.
	This icon identifies additional information that will help you use the application more efficiently.

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 *Contacting Tektronix* at the front of this document for contact 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
- Modules used
- Your 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

Getting started

Hardware requirements

Minimum system requirements

The following table describes the minimum system requirements for the TekExpress SFP+ QSFP+ application.

Table 3: Minimum system requirements

Instruments	Description
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 [1]
Firmware	TekScope 10.3.3 for non-SX series digital oscilloscopes TekScope 10.3.0 for SX series digital oscilloscopes
Software	• DPOJET, Jitter and Eye Diagram Analysis Tool, version 10.0.0.35 or later (64-bit) • MathWorks MATLAB Runtime 8.0 [2] (Windows 7) • IronPython 2.7.3 • PyVisa 1.0.0.25 • Microsoft .NET 4.0 Framework • Microsoft Internet Explorer 6.0 SP1 or later • Microsoft Photo Editor 3.0 or equivalent software for viewing image files • Adobe Reader 7.0 or equivalent software for viewing portable document format (PDF) files
Other Devices	• Microsoft compatible mouse or compatible pointing device • Four USB ports (two USB ports minimum) • PCI-GPIB or equivalent interface for instrument connectivity [3]

Supported instruments

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
- DPO/MSO72304DX, DPO/MSO72504DX, and DPO/MSO73304DX Series Digital Oscilloscopes
- DPO70000SX Series Digital Oscilloscopes

[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.

[3] 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.

See also

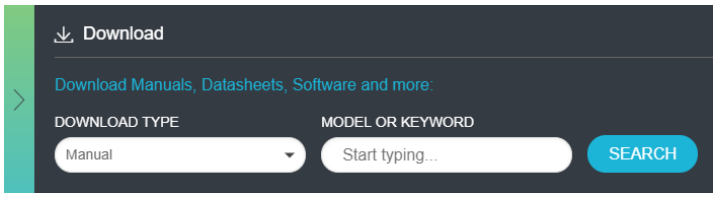
Minimum system requirements on page 13

Software requirements

Downloading and installing the software

Complete the following steps to download and install the latest TekExpress SFP+ QSFP+ application.

1. Go to *www.tek.com*.
2. Click **Downloads**. In the Downloads menu, select DOWNLOAD TYPE as Software and enter the application name in the MODEL OR KEYWORD field and click **SEARCH**.



3. Select the latest version of software and follow the instructions to download the software. Copy the executable file into the oscilloscope.
4. Double-click the executable and follow the on-screen instructions.

   The software is installed at `C:\Program Files\Tektronix\TekExpress\TekExpress SFP+ QSFP+`.
5. Select **Application** > **TekExpress SFP+ QSFP+** from the Oscilloscope menu, to open the application.

Activate the license

Activate the license using the **Option Installation** wizard in the TekScope application:

1. In the **TekScope** application menu bar, click **Utilities** > **Option Installation**. The TekScope Option Installation wizard opens.
2. Push the **F1** key on the oscilloscope keyboard to open the Option Installation help topic.
3. Follow the directions in the help topic to activate the license.

View software version and license key details

To view version information of the application, click **Options > About TekExpress**.

Setting up the test environment

Setting up tests

Set up tests using the tabs in the *Setup panel*. 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:
  - *Single Ended Output Voltage Range*
  - *Output AC Common Mode voltage (RMS)*
- SFF-8431 Table 12 Jitter and Eye Mask Specifications at B:
  - *Crosstalk Source Rise/Fall Time (20%–80%)*
  - *Crosstalk Source Amplitude (p-p Differential)*
  - *Signal Rise/Fall Time (20%–80%)*
  - *Total Jitter*
  - *Data Dependent Jitter*
  - *Data Dependent Pulse Width Shrinkage*
  - *Uncorrelated Jitter*
  - *Transmitter Qsq*

- *Eye Mask Hit Ratio*

- 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)*
  - *Transmitter Qsq (for Cu)*
  - *Output AC Common Mode voltage (RMS) (for Cu)*
  - *Host Output TWDPc*

    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*
  - *Single-Ended Input Voltage Tolerance*
- SFF-8431 Table 17 Transmitter Input Tolerance Signal Calibrated at B:
  - *Crosstalk Source Rise/Fall Time (20%-80%)*
  - *Crosstalk Source Amplitude (p-p Differential)*
  - *Output AC Common-Mode Voltage (RMS)*
  - *Total Jitter*
  - *Data Dependent Jitter*
  - *Data Dependent Pulse Width Shrinkage*
  - *Uncorrelated Jitter*
  - *Eye Mask Hit Ratio*
- Additional Supported Measurements for QSFP+ only
  - Total Jitter @ J2
  - Total Jitter @ J9

Instrument connection setup

To run tests, you need the following instrument (for details, see *Minimum System Requirements*):

- A *supported Tektronix oscilloscope*.
- The device under test
- SFP+ or QSFP+ fixtures

Table 4: 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

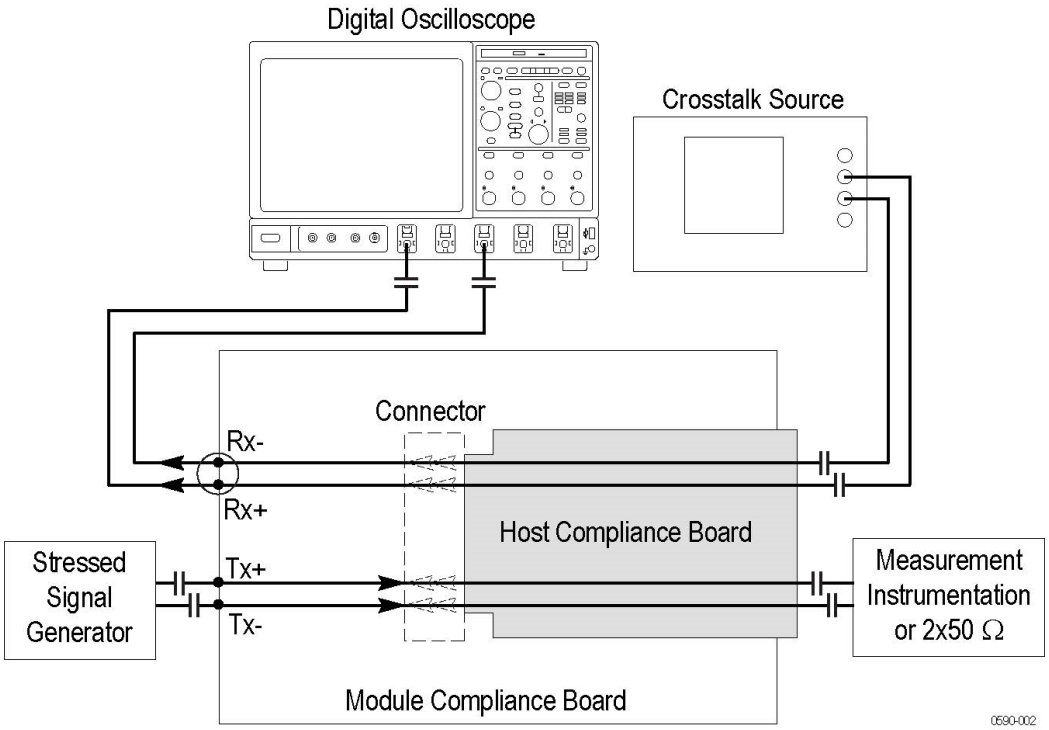
Table continued…

Tektronix nomenclature	Description
TF-SFP-TPAHCB-PK	SFP+ Host Compliance Board Plug Kit with DC Blocks and Termination
TF-SFP-TPAMCB-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-TPAHCB-P	QSFP+ Host Compliance Plug
TF-QSFP-TPAMCB-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

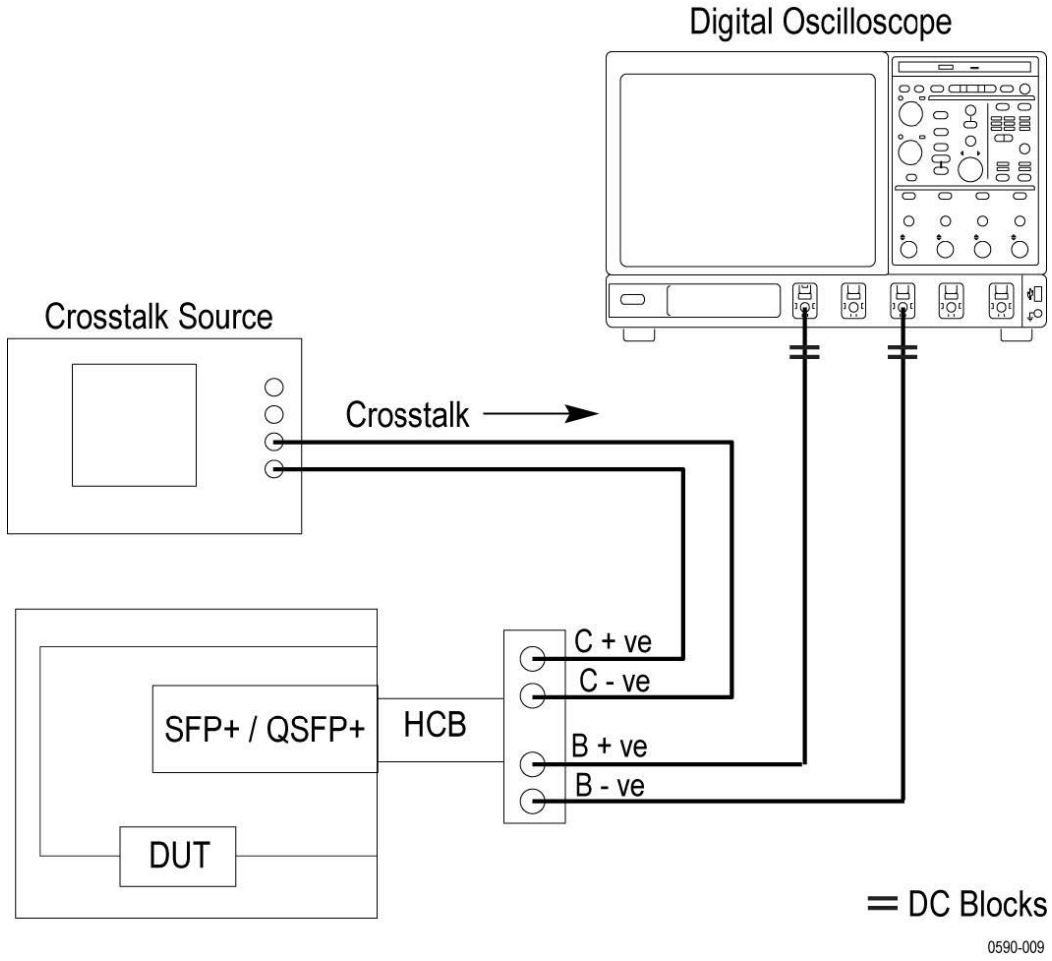
Equipment connections can vary by Device Profile (Host and Module) and by individual test. Refer to the following connection diagrams when setting up equipment for testing.

Connection setup for host tests

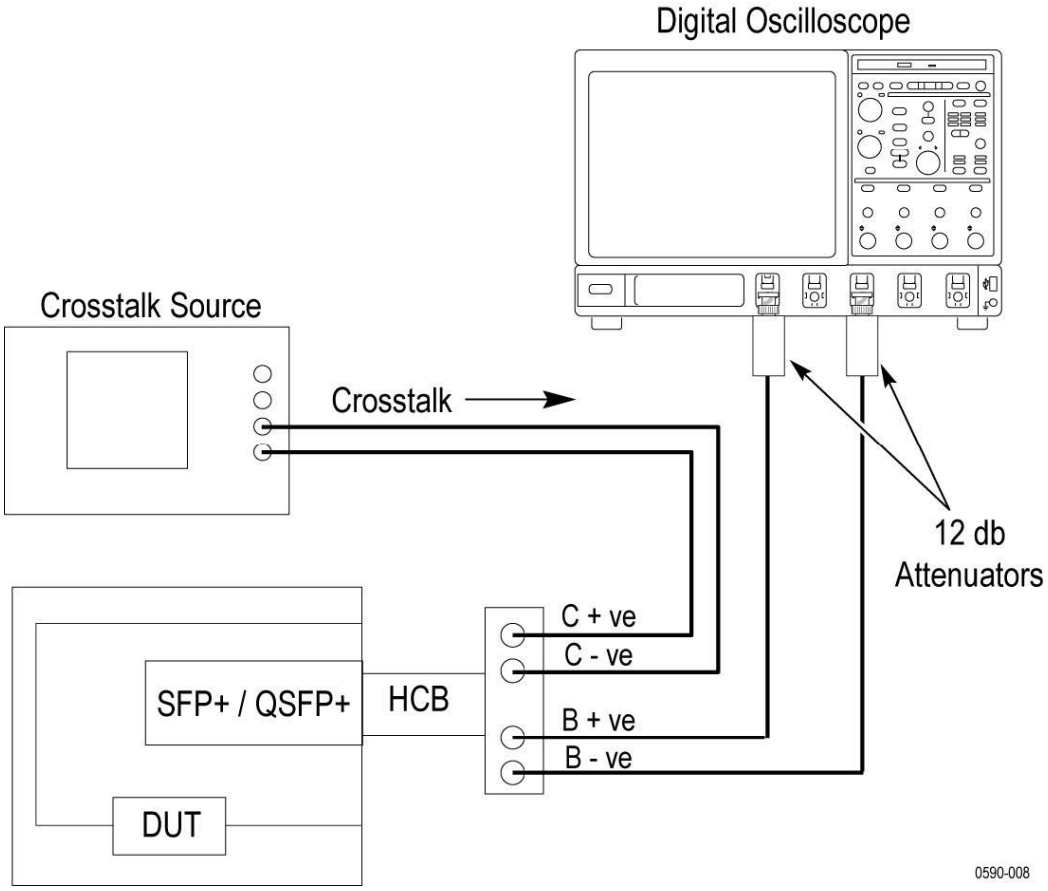
- Table 12 Crosstalk Source tests



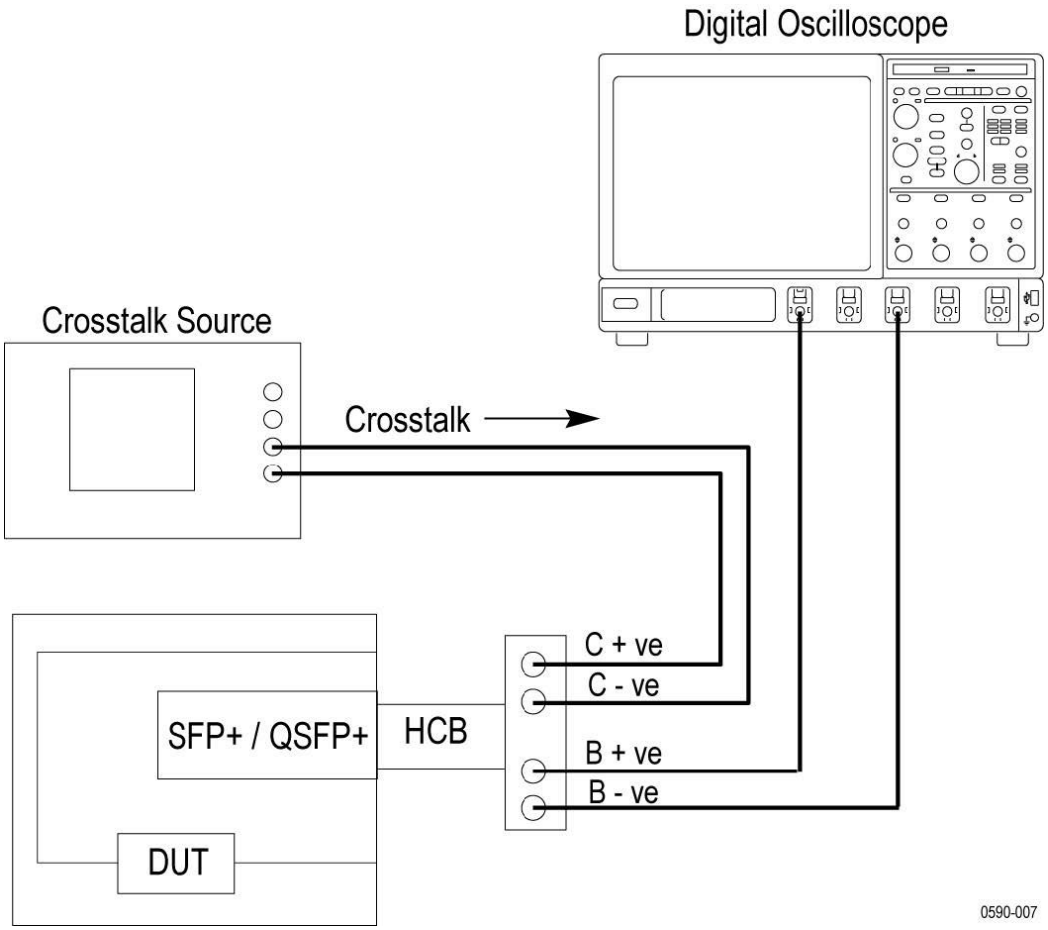
- All other Host tests



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



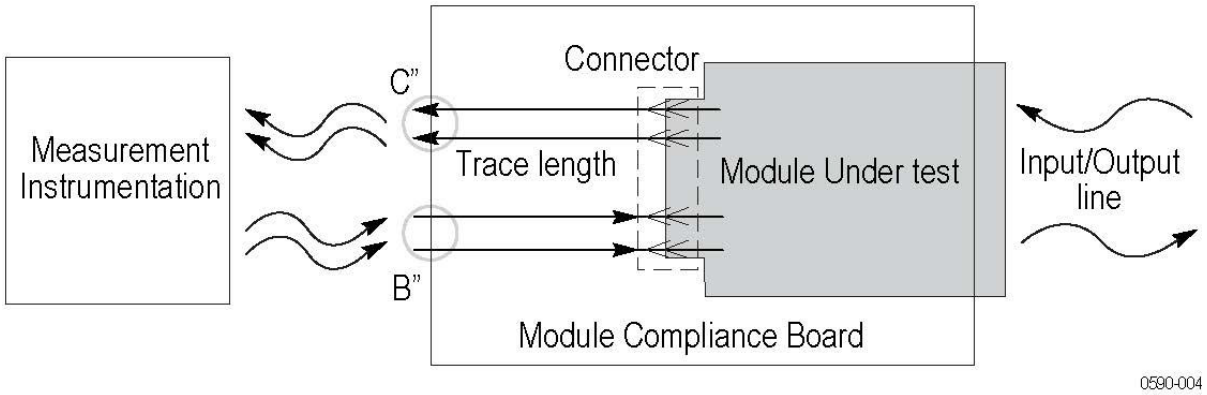
Test setup for single ended output voltage range measurement on DPO/DSA70000D series oscilloscopes



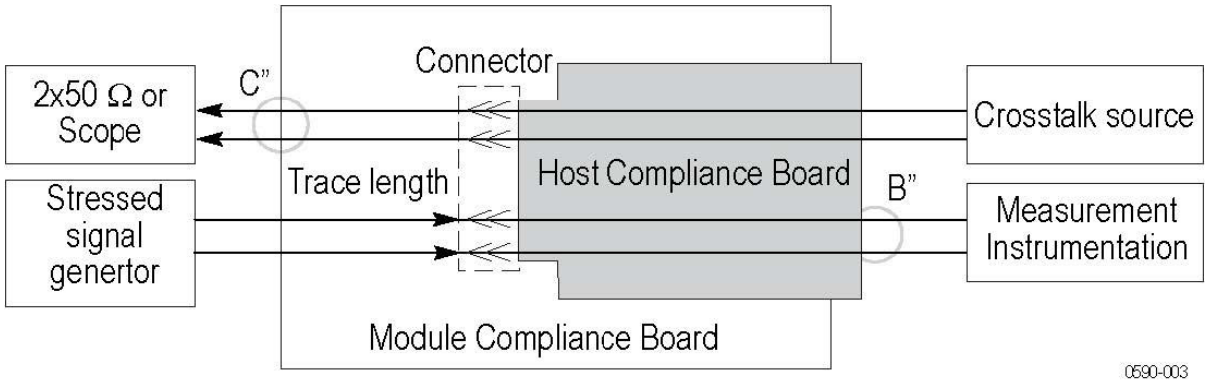
Test setup for single ended output voltage range measurement on all oscilloscopes other than DPO/DSA70000D series oscilloscopes

Connection setup for module tests

- Single-Ended Input Voltage Tolerance Test



- All other Module tests



Test setup overview

A test setup includes configuration parameters and report options. Use the options in the *Setup panel* and *Reports panel* to select and configure tests.

1. *Select the DUT parameters*
2. *Select one or more tests*
3. *Select acquisitions*
4. *Configure test parameters*
5. *Select test notification preferences*
6. *Select report options*

Search instruments connected to the application

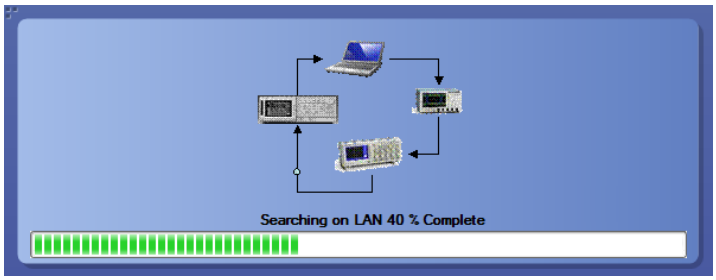
Use the TekExpress Instrument Control Settings dialog box to search the instruments (resources) connected to the application. The application uses TekVISA to discover the connected instruments.

Note: The instruments required for the test setup must be connected and detected by the application, before running the test.

To refresh the list of connected instruments:

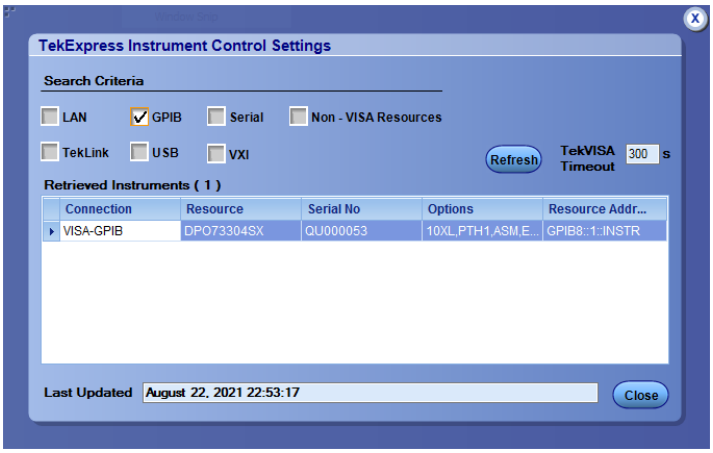
1. Select **Options > Instrument Control Settings**.
2. In the **Search Criteria** section of the **Instrument Control Settings** dialog box, select the connection types of the instruments to search. Instrument search is based on the VISA layer, but different connections determine the resource type, such as LAN, GPIB, and USB. For example, if you choose LAN, the search will include all the instruments supported by the TekExpress that are communicating over the LAN.
3. Click **Refresh**. The TekExpress application searches for the connected instruments.

Search status of the instruments connected to LAN



4. When the search is complete, a dialog box lists the instrument-related details based on the search criteria. For example, for the Search Criteria as GPIB, the application displays all the GPIB instruments connected to the application.

   TekExpress Instrument Control Settings window.



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

Running tests

After selecting and configuring tests, review the *pre-run checklist* 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.

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.

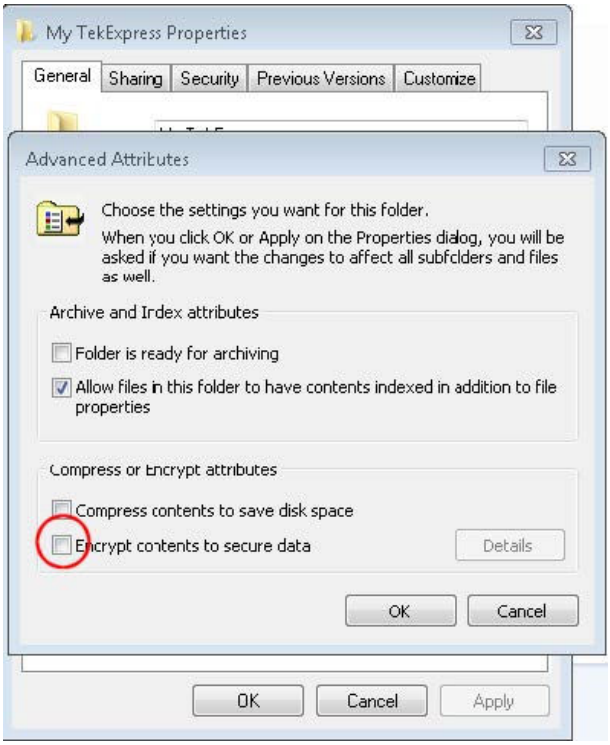
   CAUTION: Do not modify any of the session files or folders because this may result in loss of data or corrupted session files. Each session has multiple files associated with it. When you save a session, a .TekX file, and a folder named for the session that contains associated files, is created on the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

2. *Map the shared My TekExpress folder* 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* before you run a test.

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*.

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*.
4. Verify that the application is able to find the DUT. If it cannot, *perform a search for connected instruments*.
   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.

Starting the application

To start the TekExpress SFP+ QSFP+, select from the oscilloscope menu bar **Applications > TekExpress SFP+ QSFP+**.

During start, a "My TekExpress" folder is created in the Documents folder of the current user and gets mapped to "X" drive. When the application is closed properly, the "X" drive gets unmapped. Session files are then stored inside the `X:\SFP+ QSFP+` folder. If this file is not found, the application runs an instrument discovery program to detect connected instruments before starting TekExpress SFP+ QSFP+.

To keep the TekExpress SFP+ QSFP+ application on top of any application, select **Keep On Top** from the *options menu*. If the application goes behind the oscilloscope application, select **Applications >TekExpress SFP+ QSFP+** to bring the application to the front.

Application controls

This section describes the application controls with functionality and its details.

Table 5: Application control description

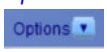
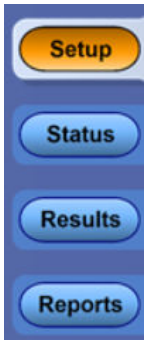
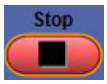
Item	Description
Options menu 	Menu to display global application controls.
Test panel 	Controls that open tabs for configuring test settings and options.
Start / Stop button  	Use the **Start** button to start the test run of the measurements in the selected order. If prior acquired measurements are not cleared, then new measurements are added to the existing set. The button toggles to the Stop mode while tests are running. Use the **Stop** button to abort the test.
Pause / Continue button 	Use the **Pause** button to pause the acquisition. When a test is paused, this button changes as **Continue**.
Clear button 	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 *Results panel*. **Note:** This button is visible only when there are results data on the panel.
Application window move icon 	Place the cursor over the top of the application window to move the application window to the desired location
Minimize icon 	Minimizes the application.
Close icon 	Close the application.

Table continued…

Item	Description
Mini view / Normal view  	Mini view displays the run messages with the time stamp, progress bar, Start / Stop button, and Pause / Continue button. The application moves to mini view when you click the **Start** button.

Options menu functions

To access the **Options** menu, click  in the upper-right corner of the application. It has the following selections:

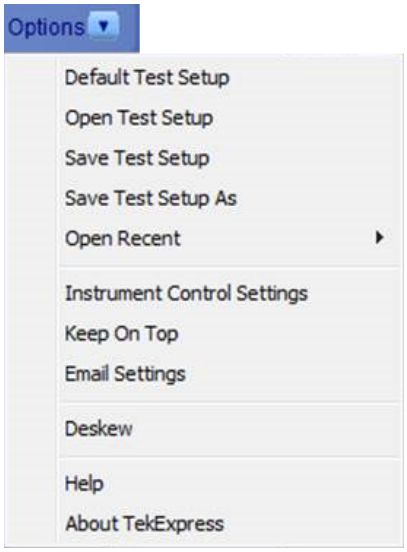


Table 6: Options menu settings

Menu	Function
Default Test Setup	Opens a new test setup with default configurations.
Open Test Setup	Opens a previously saved test setup. Displays the list of previously saved test setup file names. Make the selection and click **OK** to open the test setup.
Save Test Setup	Saves the current test configurations with the specified file name.
Save Test Setup As	Saves the current test setup with a different file name or file type.
Open Recent	Displays the recently opened test setup file names. Make the selection and click **OK** to open the test setup.
Instrument Control Settings	Detects, lists, and refreshes the connected instruments found on the specified connections (LAN, GPIB, USB, Serial, Non-VISA Resources, TekLink, and VXI).
Keep On Top	Always keeps the TekExpress SFP+ QSFP+ application on top of all the applications.
Email Settings	Configures email options for test run and result notifications.
Deskew	Loads oscilloscope channel deskew settings into the application.
Help	Displays the TekExpress SFP+ QSFP+ help.

Table continued…

Menu	Function
About TekExpress	Displays the application name, version, and hyperlink to end the user license agreement.

Configure email settings

Use the **Email Settings** utility to get notified by email when a measurement completes or produces any error condition. Follow the steps to configure email settings:

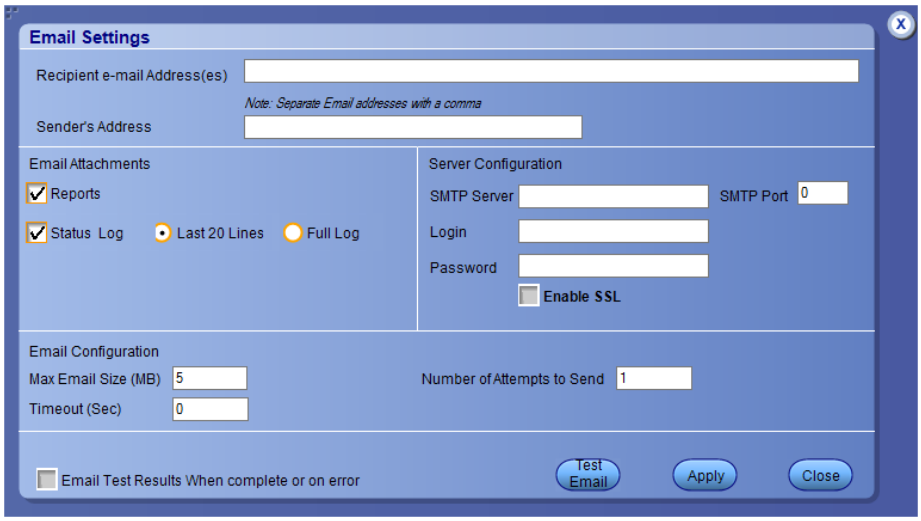


Figure 1: Email settings window

1. Select **Options > Email Settings** to open the Email Settings dialog box.
2. (Required) For **Recipient email Address(es)**, enter one or more recipient email addresses. 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 @ symbol, and the email server ID. For example: user@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.

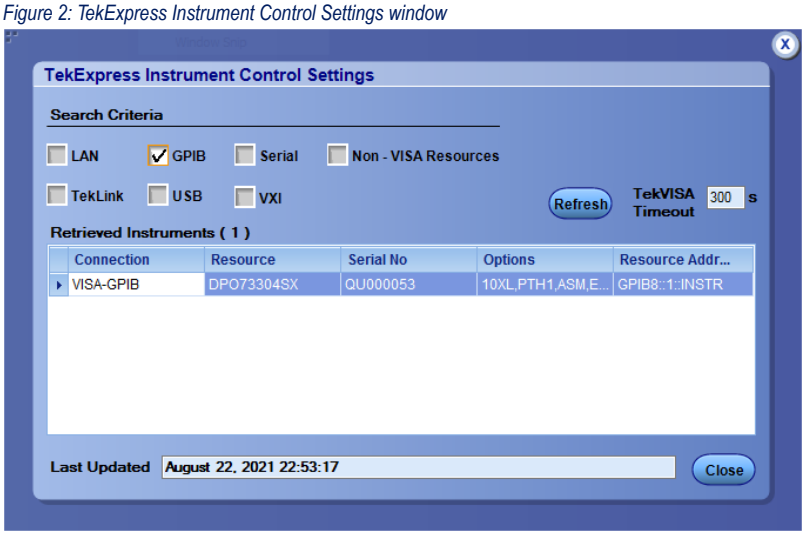
   Note: If any of the above required fields are left blank, the settings will not be saved, and email notifications will not be sent.
5. In the **Email Attachments** section, select from the following options:
   - **Reports**: Select to receive the test report with the notification email.
   - **Status 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.
6. In the **Email Configuration** section:
   - 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.
   - Enter the number in the Number of Attempts to Send field, to limit the number of attempts that the system makes to send a notification. The default is 1. You can also specify a timeout period.
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.

TekExpress instrument control settings

Use the **TekExpress Instrument Control Settings** dialog box to search the instruments (resources) connected to the application. You can use the **Search Criteria** options to search the connected instruments depending on the connection type. The details of the connected instrument is displayed in the Retrieved Instruments window.

To access, click **Options** > **Instrument Control Settings**. Select **GPIB** as search criteria for TekExpress application and click **Refresh**. The connected instruments displayed in the Retrieved Instruments window and can be selected for use under Global Settings in the test configuration section.

Figure 2: TekExpress Instrument Control Settings window



See also

Options menu functions on page 28

Setup panel: Configure the test setup

The Setup panel contains sequentially ordered tabs that help you guide through the test setup and execution process.

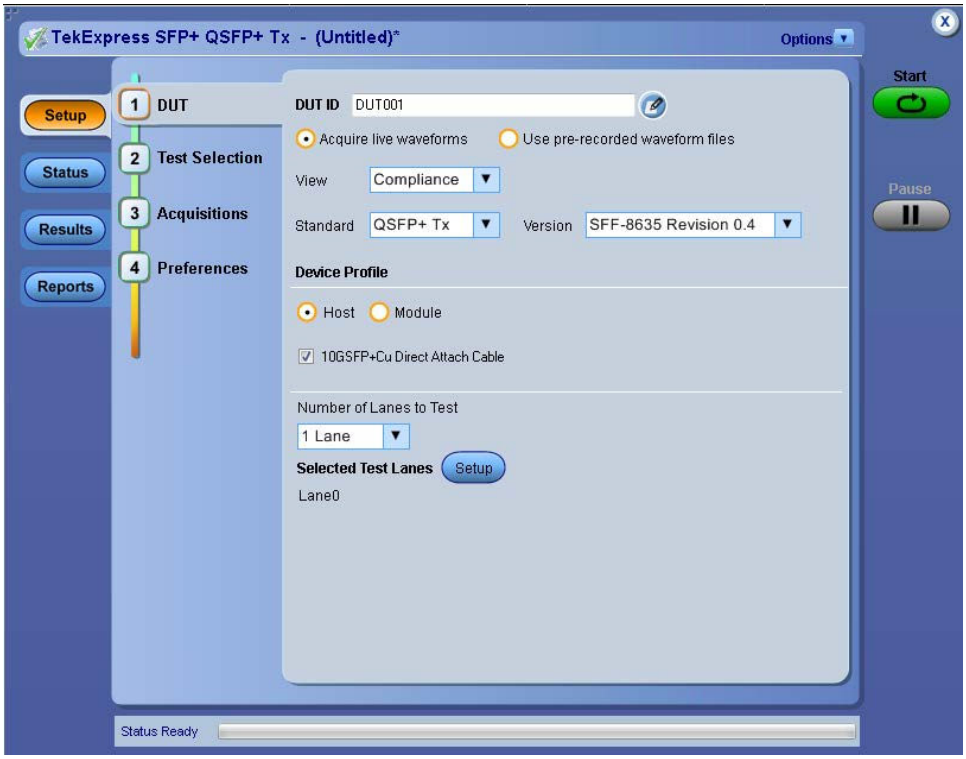


Figure 3: DUT tab, QSFP+ Tx compliance view

Figure 4: DUT tab, QSFP+ Tx advanced view

Figure 5: DUT tab, SFP+ Tx compliance view

DUT: Set DUT settings

Use the DUT tab to select parameters for the device under test. These settings are global and apply to all tests of current session. DUT settings also affect the list of available tests in the Test Selection tab.

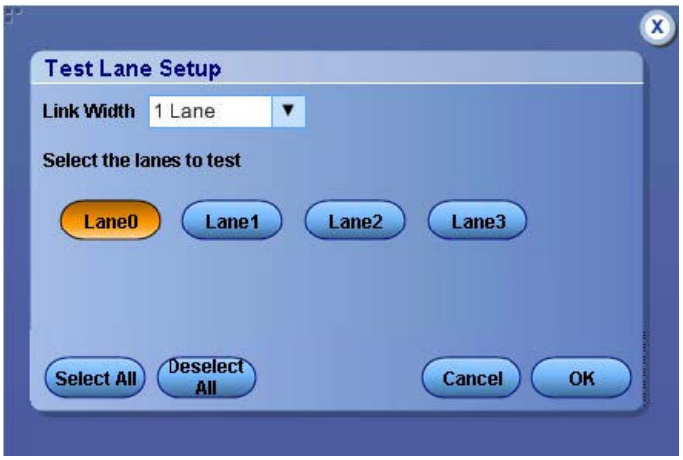
Figure 6: DUT tab

Click **Setup** > **DUT** to access the DUT parameters:

Table 7: DUT tab configuration

Setting	Description
DUT ID	Adds an optional text label for the DUT to reports. The default value is DUT001. The maximum number of characters supported is 32. You cannot use the characters (.,..,...,\,/:?"<>|*) in an ID name.
Comments icon (to the right of the DUT ID field)	Opens a comments dialog box which allows you to enter optional text to add to a report. You can enter a maximum number of 256 characters. Refer *Select report generation options* on page 47 to enable or disable comments which displays on the test report.
Acquire live waveforms	Acquire active signals from the DUT for measurement and analysis.
Use prerecorded waveform files	Run tests on a saved waveform. Also refer *Load a saved test setup*.
View	Select the View type from the drop-down: • Compliance • Advanced **Note:** If you select Advanced View, the configuration settings are included in the Setup steps. If you select Compliance View, the configuration step is not included as a

Table continued…

Setting	Description
	separate step. Access configuration parameters for selected tests from the Configure button in the Test Selection tab.
Standard	Select the mode from the drop-down: • SFP+ Tx • QSFP+ Tx
Version	Displays the version of testing specification
Host	Select this option to enable 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. **Note:** The **Host** device profile is enabled by default.
Module	Select this option to enable Module tests listed in the Test Selection tab.
Number of Lanes to Test	Select the Number of Lanes to Test from the drop-down • 1 Lane • 2 Lanes • 4 Lanes
Selected Test Lanes	Click the Selected Test Lanes Setup button to open the Test Lane Setup dialog. Use the dialog to configure which lanes to test. 

Test Selection: Select the tests

Use the Test Selection tab to select the tests. The test measurements available depends on the settings selected in the DUT tab.

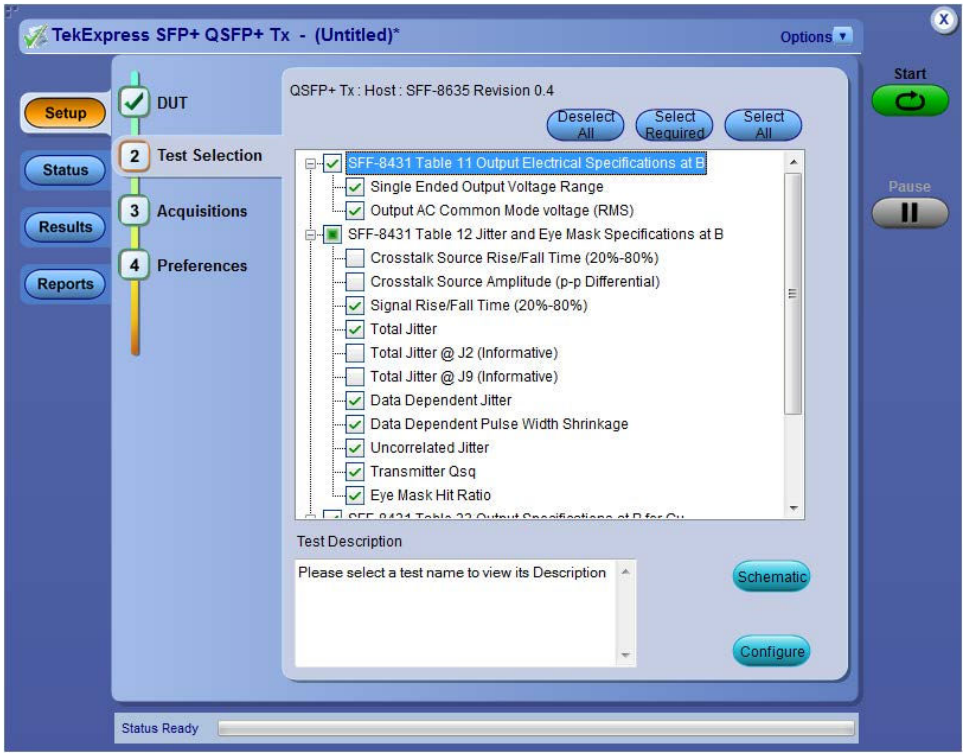


Figure 7: Test selection tab

Table 8: Test Selection tab configuration

Setting	Description
Deselect All, Select All	Deselect or select all tests in the list.
Select Required	Selects all test required to pass compliance.
Schematic	Displays equipment connection setup for the selected measurements. You need to select at least a measurement before you click the Schematic.
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.
Test selection field	Lists available test and if they are selected to run. Click in the box adjacent to a test to select or unselect a test.
Test Description	Shows a description of the selected test.

Acquisitions: Set waveform acquisition settings

Use Acquisitions tab to view the test acquisition parameters. The contents displayed on this tab depends on the DUT type and the tests selected.

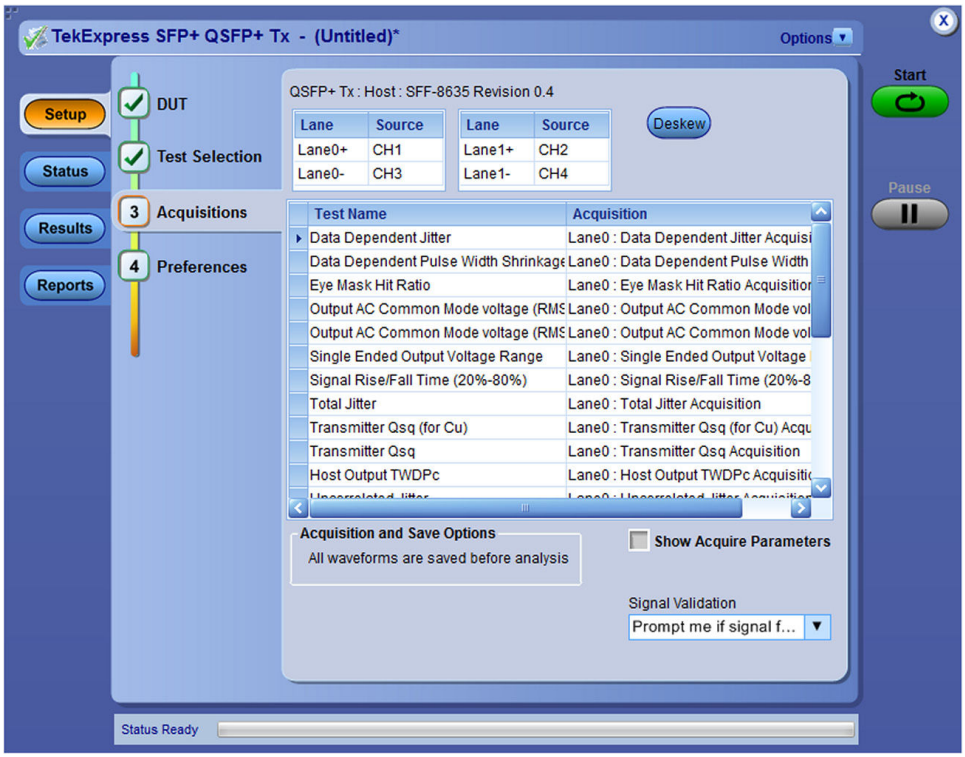


Figure 8: Acquisition tab

Table 9: Acquisitions tab configuration

Setting	Description
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.
Deskew	Provides the option of setting deskew values on the scope either in an automated way or manual way.
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 **Show Acquire Parameters** 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 **Use pre-recorded waveform files** is selected in the Setup panel DUT tab.
Acquisition and Save Options	All waveforms are saved before analysis.

Table continued…

Setting		Description
Show Acquire Parameters		When selected, the signal acquisition parameter for each test displays in the Signal Type column.
Signal Validation		Determines how the application responds to the source signal **Note:** Signal validation is valid only for Live acquisitions
	Prompt me if signal fails	If the signal fails, pauses the measurement operation and displays a dialog box with the following options:  • **Reacquire**: Try acquiring the signal again. • **Use Anyway**: Use the signal even if it cannot be validated. • **Skip Test**: Abort the test if the signal cannot be validated.
	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

TekExpress SFP+ QSFP+ application saves all acquisition waveforms to files by default. Waveforms are saved in a unique folder for each session (a session is started when you click the Start button). The folder path is `X:\TekExpress SFP+ QSFP+\Untitled Session\<dutid>\<date>_<time>`. Images created for each analysis, XML files with result values, reports, and other information specific to that particular execution are also saved in this folder.

Saving a session moves the session file contents from the Untitled Session folder to the specified folder name and changes the session name to the specified name.

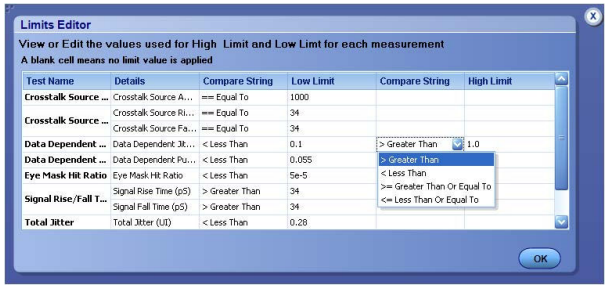
Configuration: Set measurement limits for tests

Use Configuration tab to view and configure the Global Settings and the measurement configurations. The measurement specific configurations available in this tab depends on the selections made in the DUT panel and Test Selection panel.

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.

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.

Table 10: Configuration tab: Common parameters

Settings	Description
Limit Editor	Displays the upper and lower limits for the applicable measurement using different types of comparisons. 

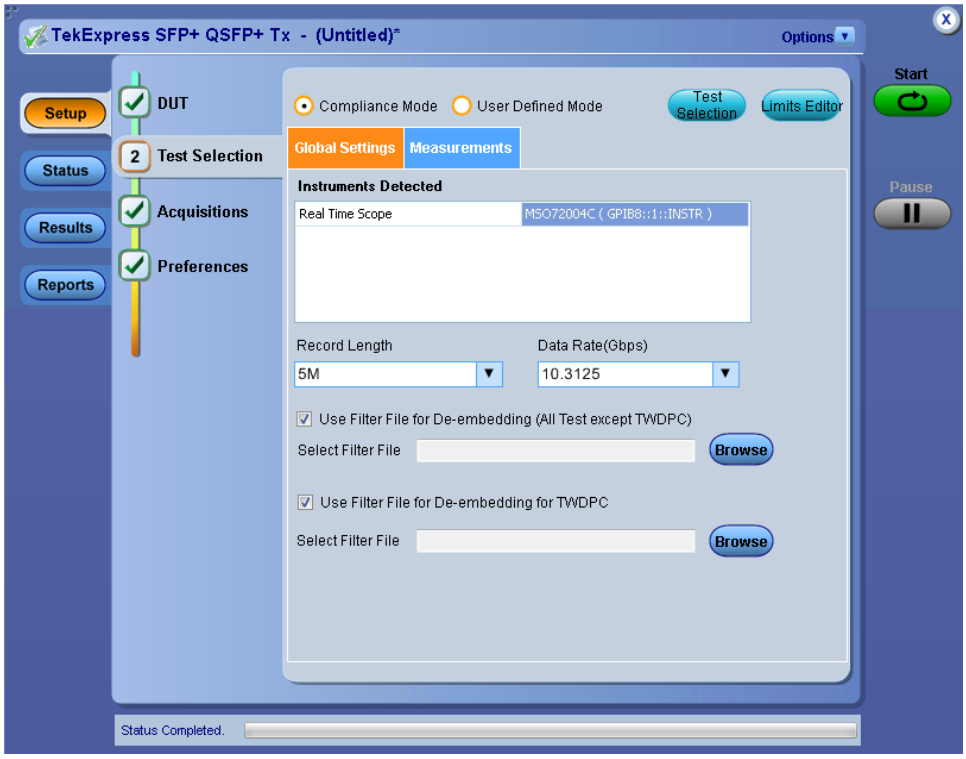


Figure 9: Configuration tab: Global Settings

Table 11: Configuration tab: Global Settings configuration

Setting	Description
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.
Instruments Detected	Displays the instruments connected to this application. Click on the instrument name to open a list of available (detected) instruments. Select **Options** > **Instrument Control Settings** to refresh the connected instrument list refer TekExpress instrument control settings.
Record Length	Specifies the length of the record (5M is the default)
Data Rate	Select the signal data rate as one of 9.95328 Gbps, 10.3125 Gbps (default), 10.51875 Gbps, or 11.10 Gbps.
Use Filter File for De-embedding (All Test except TWDPC)	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 for TWDPC	When selected, provides a browse button and field for selecting a filter to use to compensate for cable lengths.

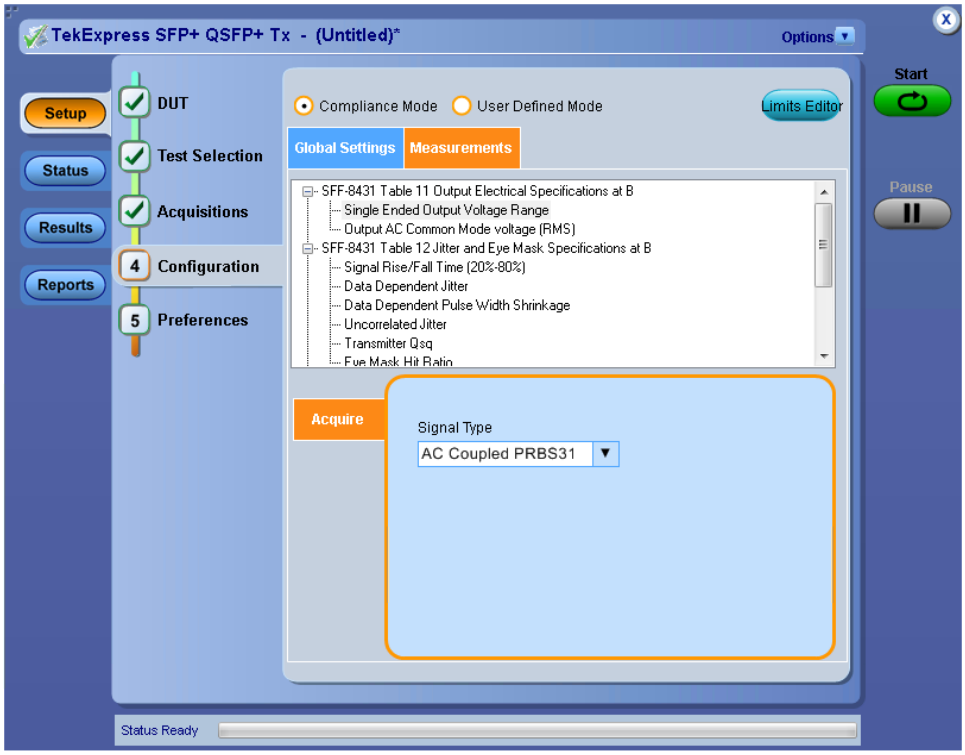


Figure 10: Configuration tab: Measurement

Table 12: Configuration tab: Measurements configuration

Setting	Description
Measurements	

Table continued…

Setting		Description
Acquire		
	Signal Type	Specifies the signal type of the acquisition for the test selected in the tree view of the Measurements tab. Running tests in User Defined Mode allows you to perform the tests on different types of signal. The default signal type varies by test. Not all tests support all the signal types. For each test, the application includes the signal type options that are best suited to the measurements.
	Window Size (%)	Host test Transmitter Qsq only. Set at 10% for Compliance Mode. In User Defined Mode, you can change this to 5% or 20%.

Preferences: Set the test run preferences

Use **Preferences** tab to set the application action on completion of a measurement. The **Preferences** tab has the feature to enable or disable certain options related to the measurement execution.

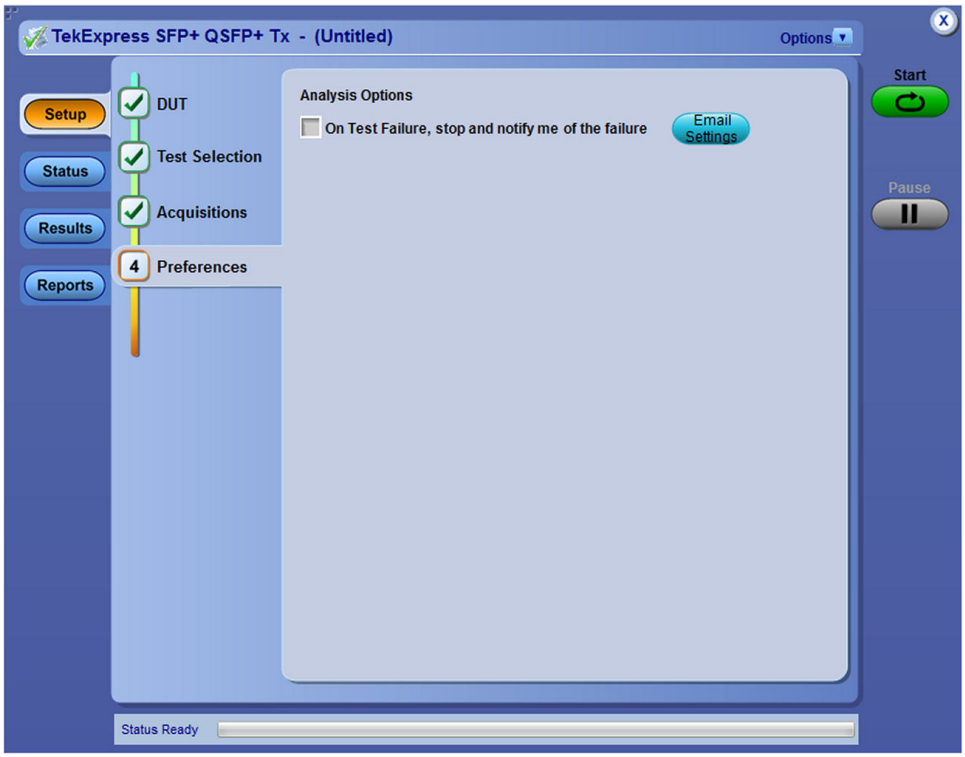


Figure 11: Preferences tab

Refer the below table for the options available in the **Preferences** tab:

Table 13: Preferences tab settings

Setting	Description
On Test Failure, stop and notify me of the failure	Select to stop the test run on Test Failure, and to get notified via email. By default, it is unselected. Click **Email Settings** to configure the email settings to receive notifications.

Status panel: View the test execution status

The Status panel contains the **Test Status** and **Log View** tabs, which provides status on the test acquisition and analysis (Test Status) and listing of test tasks performed (Log View tab). The application opens the **Test Status** tab when you start to execute the test. Select the **Test Status** or the **Log View** tab to view these items while the test execution is in progress.

View test execution status

The tests are grouped and displayed based on the Clock and Data lane. It displays the tests along with the acquisition type, acquire, and analysis status of the tests. In pre-recorded mode, **Acquire Status** is not valid.

The **Test Status** tab presents a collapsible table with information about each test as it is running. Use the symbols to expand () and collapse () the table rows.

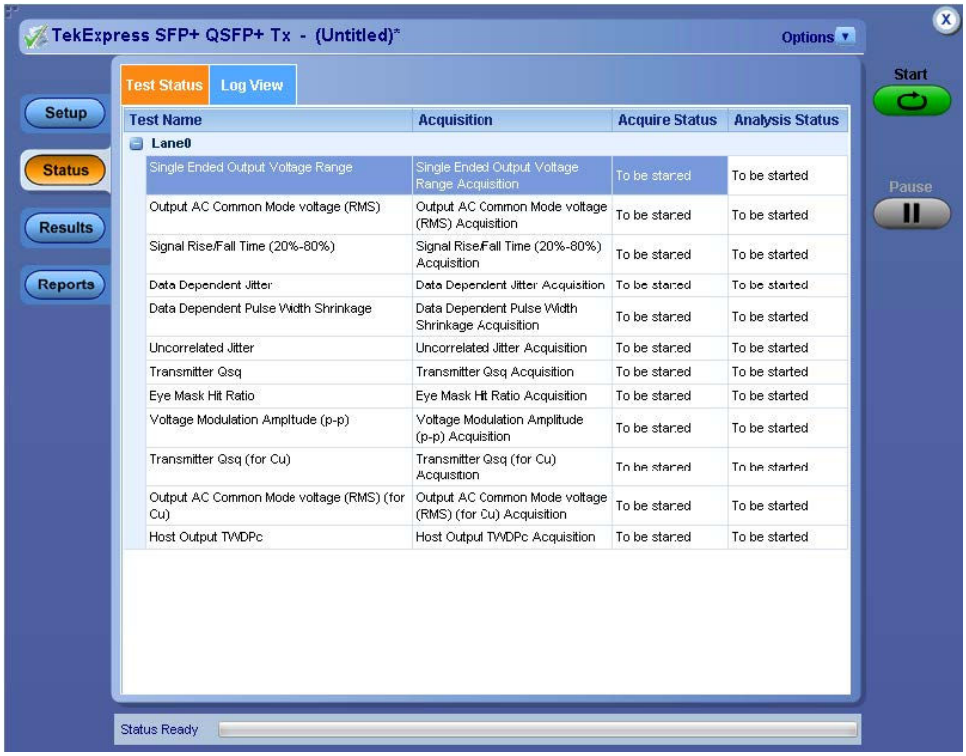


Figure 12: Test execution status view in Status panel

Table 14: Test execution status table headers

Table Header	Description
Test Name	Displays the measurement name.
Acquisition	Describes the type of data being acquired.
Acquire Status	Displays the progress state of the acquisition: • To be started • Completed Acquisition • Prerecorded waveform

Table continued…

Table Header	Description
Analysis Status	Displays the progress state of the analysis: • To be started • In progress • Completed • Aborted

View test execution logs

The Test Status tab displays the detailed execution status of the tests. Also, displays each and every execution step in detail with its timestamp information. The log details can be used to troubleshoot and resolve any issue/bug which is blocking the test execution process.

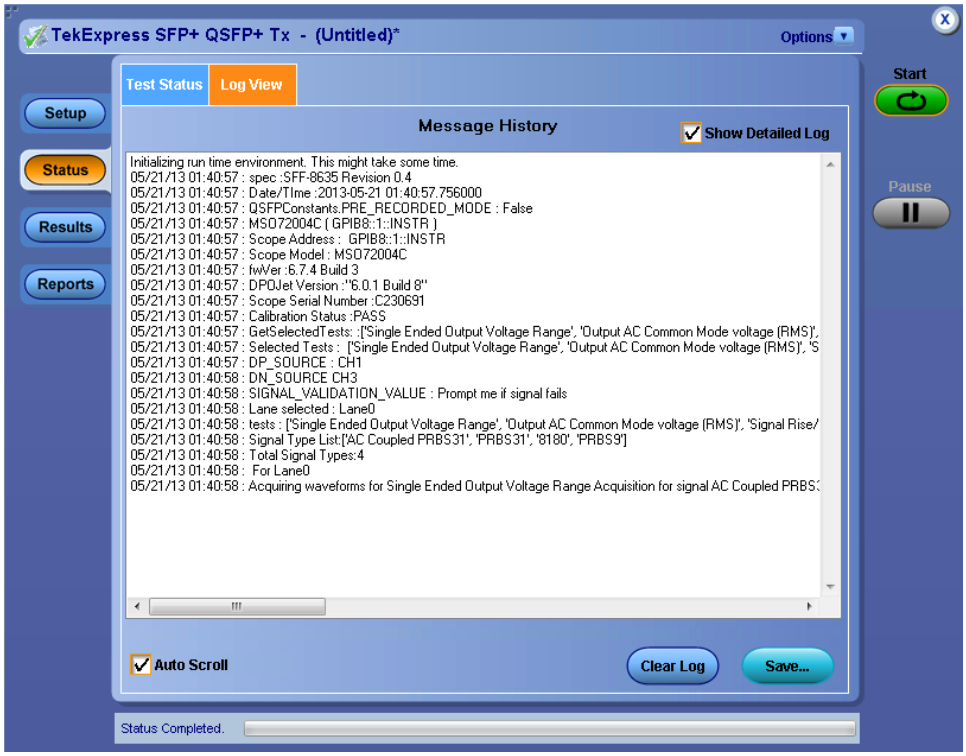


Figure 13: Log view in Status panel

Table 15: Status panel settings

Control	Description
Message History	Lists all the executed test operations and timestamp information.
Auto Scroll	Enables automatic scrolling of the log view as information is added to the log during the test execution.
Clear Log	Clears all the messages from the log view.
Save	Saves the log file into a text file format. Use the standard Save File window to navigate to and specify the folder and file name to save the log text.
Show Detailed Log	Select the check box to record a detailed history of test execution.

Results panel: View summary of test results

When a test execution is complete, the application automatically opens the **Results** panel to display a summary of test results.

In the Results table, each test result occupies a row. By default, results are displayed in summary format with the measurement details collapsed and with the Pass/Fail column visible.

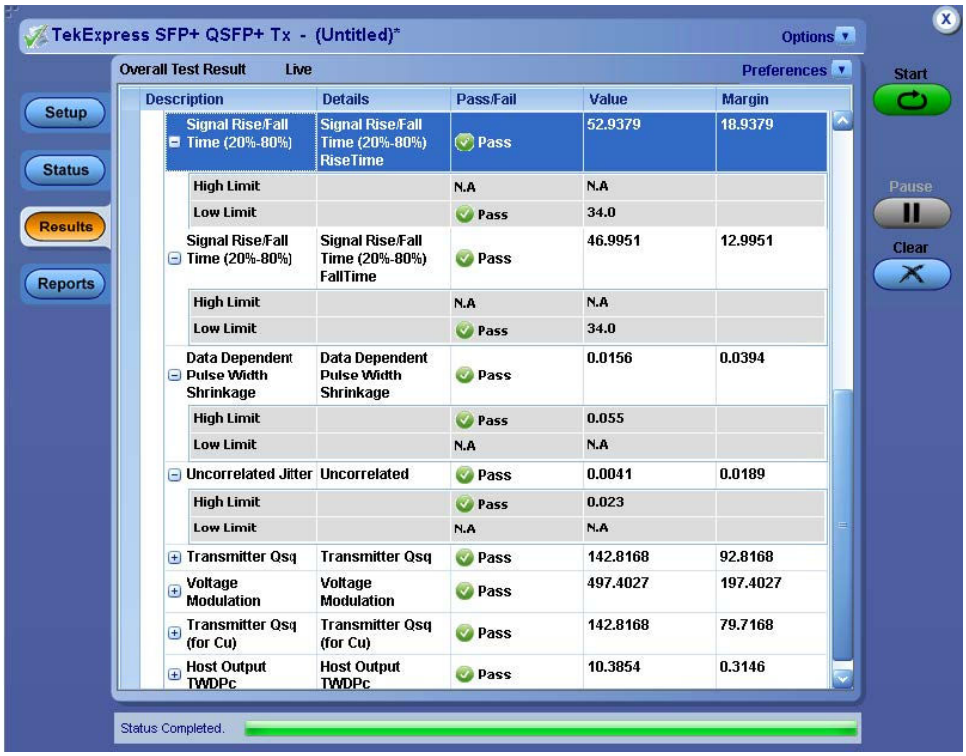


Figure 14: Results panel with measurement results

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. If any of the Crosstalk tests or Total Jitter @ J2 and Total Jitter @ J9 fails, it will not cause the overall test results to fail.

Click icon on each measurement in the row to expand and to display the minimum and maximum parameter values of the measurement.

Filter the test results

Each column in the result table can be customized and displayed by enabling or disabling any column as per your requirement. You can change the view in the following ways:

- To remove or restore the Pass/Fail column, select **Preferences** > **Show Pass/Fail**.
- To collapse all expanded tests, select **Preferences** > **View Results Summary**.
- To expand all the listed tests, select **View Results Details** from the **Preferences menu** in the upper right corner.
- To enable or disable the wordwrap feature, select **Preferences** > **Enable Wordwrap**.
- To view the results grouped by lane or test, select the corresponding item from the **Preferences** menu.
- 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 clear all test results displayed, click **Clear**.

Reports panel: Configure report generation settings

Click **Reports** panel to configure the report generation settings and select the test result information to include in the report. You can use the Reports panel to configure report generation settings, select test content to include in reports, generate the report, view the report, browse for reports, name and save reports, and select report viewing options.

Select report generation options

This section describes the report generation settings you can configure in the Reports panel. Select report settings before running a test or when creating and saving test setups. Report settings configured are included in saved test setups.

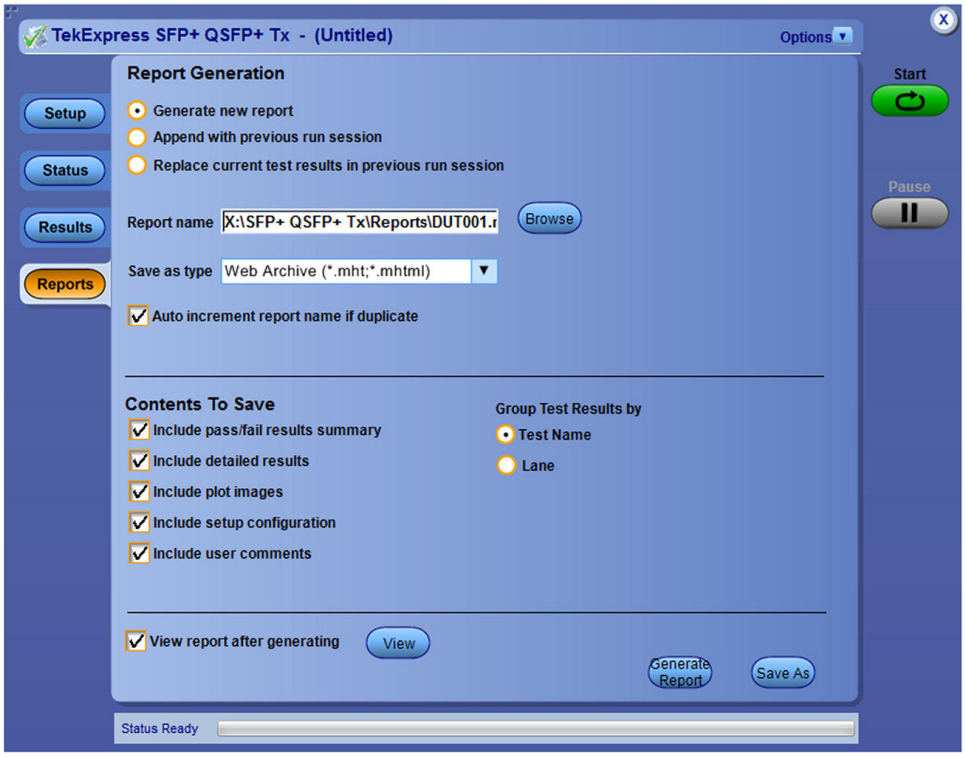


Figure 15: Reports panel

Report Update Mode Settings

Table 16: Report Update Mode Settings

Control	Description
Report Generation	
Generate new report	Each time when you click **Run** and when the test execution is complete, it will create a new report. The report can be in either .mht, .pdf, or .csv file formats.
Append with previous run session	Appends the latest test results to the end of the current test results report. Each time when you click this option and run the tests, it will run the previously failed tests and replace the failed test result with the new pass test result in the same report.
Replace current test in previous run session	Replaces the previous test results with the latest test results. Results from newly added tests are appended to the end of the report.

Table continued…

Control	Description
Report name	Displays the name and path of the TekExpress SFP+ QSFP+ report. The default location is at `\My Documents>\My TekExpress\SFP+ QSFP+\Reports`. The report file in this folder gets overwritten each time you run a test unless you specify a unique name or select to auto increment the report name. **To change the report name or location, do one of the following:** • In the Report Path field, type the current folder path and name. • Double-click in the Report Path field and then make selections from the popup keyboard and click **Enter**. Be sure to include the entire folder path, the file name, and the file extension. For example: `C:\Documents and Settings\your user name\My Documents\My TekExpress\SFP+ QSFP+\DUT001.mht`. **Note:** You cannot set the file location using the Browse button. **Open an existing report** Click **Browse**, locate and select the report file and then click **View** at the bottom of the panel.
Save as type	Saves a report in the specified file type, selected from the drop-down list. The report is saved in .csv, .pdf, or .mht. **Note:** 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	Sets the application to automatically increment the name of the report file if the application finds a file with the same name as the one being generated. For example: DUT001, DUT002, DUT003. This option is enabled by default.
Contents To Save	
Include pass/fail results summary	Select to include pass/fail information in the details table of the report.
Include detailed results	Select to include detailed results in the report.
Include plot images	Select to include the plot images in the report.
Include setup configuration	Sets the application to include hardware and software information in the summary box at the top of the report. Information includes: the oscilloscope model and serial number, the oscilloscope firmware version, and software versions for applications used in the measurements.
Include user comments	Select to include any comments about the test that you or another user have added in the DUT tab of the Setup panel. Comments appear in the Comments section, below the summary box at the beginning of each report.
Group Test Results by	
Test Name	Select to group the test results based on the test name in the report.
Lane	Select to group the test results based on the Lanes in the report
Other settings in report panel	
View report after generating	Automatically opens the report in a Web browser when the test execution is complete. This option is selected by default.

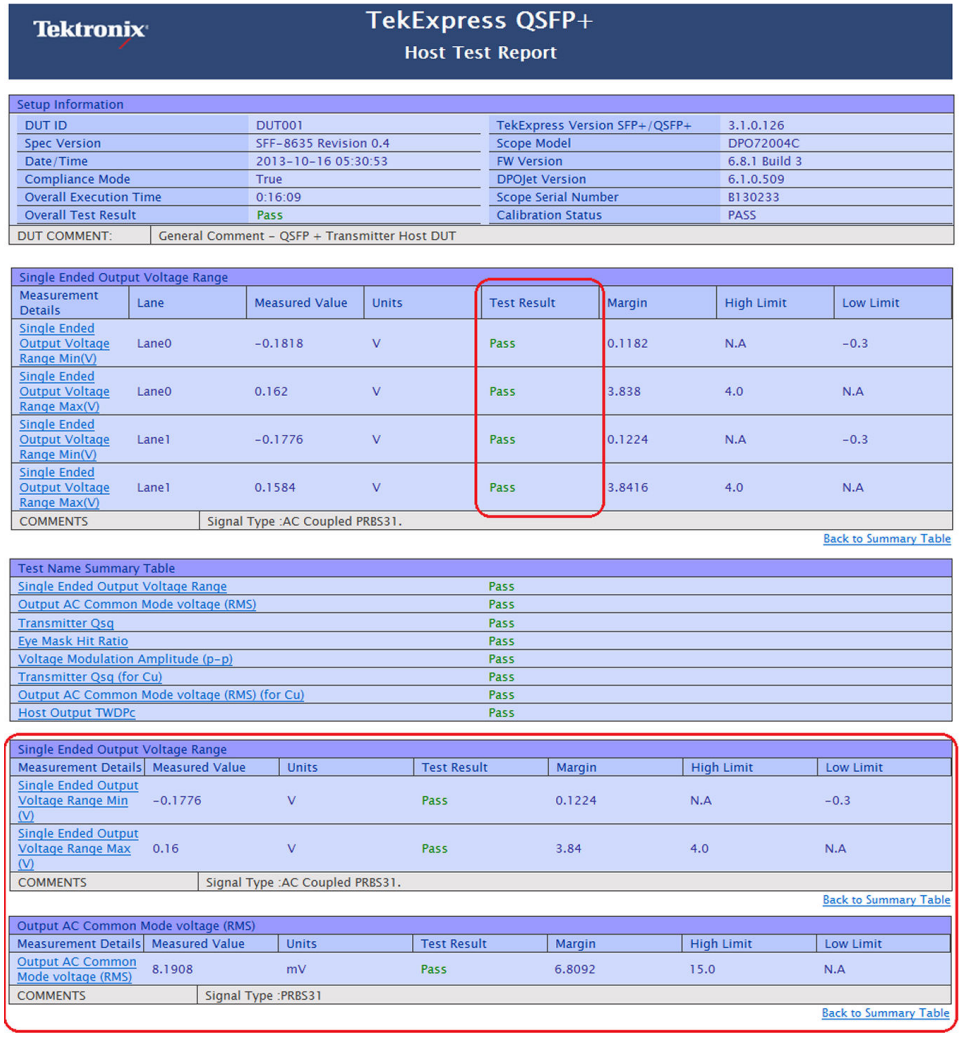
Table continued…

Control	Description
View	Click to view the most current report.
Generate Report	Generates a new report based on the current analysis results.
Save As	Specify a name for the report.

View a generated report

Sample report and its contents

A report shows detailed results and plots, as set in the Reports panel.



TekExpress QSFP+
Host Test Report

Setup Information

DUT ID	DUT001	TekExpress Version SFP+/QSFP+	3.1.0.126
Spec Version	SFF-8635 Revision 0.4	Scope Model	DPO72004C
Date/Time	2013-10-16 05:30:53	FW Version	6.8.1 Build 3
Compliance Mode	True	DPOJet Version	6.1.0.509
Overall Execution Time	0:16:09	Scope Serial Number	B130233
Overall Test Result	Pass	Calibration Status	PASS
DUT COMMENT:	General Comment - QSFP + Transmitter Host DUT		

Single Ended Output Voltage Range

Measurement Details	Lane	Measured Value	Units	Test Result	Margin	High Limit	Low Limit
Single Ended Output Voltage Range Min(V)	Lane0	-0.1818	V	Pass	0.1182	N.A	-0.3
Single Ended Output Voltage Range Max(V)	Lane0	0.162	V	Pass	3.838	4.0	N.A
Single Ended Output Voltage Range Min(V)	Lane1	-0.1776	V	Pass	0.1224	N.A	-0.3
Single Ended Output Voltage Range Max(V)	Lane1	0.1584	V	Pass	3.8416	4.0	N.A
COMMENTS	Signal Type :AC Coupled PRBS31.						

Back to Summary Table

Test Name Summary Table

Single Ended Output Voltage Range	Pass
Output AC Common Mode voltage (RMS)	Pass
Transmitter Qsq	Pass
Eye Mask Hit Ratio	Pass
Voltage Modulation Amplitude (p-p)	Pass
Transmitter Qsq (for Cu)	Pass
Output AC Common Mode voltage (RMS) (for Cu)	Pass
Host Output TWDPc	Pass

Single Ended Output Voltage Range

Measurement Details	Measured Value	Units	Test Result	Margin	High Limit	Low Limit
Single Ended Output Voltage Range Min (V)	-0.1776	V	Pass	0.1224	N.A	-0.3
Single Ended Output Voltage Range Max (V)	0.16	V	Pass	3.84	4.0	N.A
COMMENTS	Signal Type :AC Coupled PRBS31.					

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Output AC Common Mode voltage (RMS)

Measurement Details	Measured Value	Units	Test Result	Margin	High Limit	Low Limit
Output AC Common Mode voltage (RMS)	8.1908	mV	Pass	6.8092	15.0	N.A
COMMENTS	Signal Type :PRBS31					

Back to Summary Table

Figure 16: Report

Setup Information	The summary box at the beginning of the report lists setup configuration information. This information includes the oscilloscope model and serial number, optical module model and serial number, and software version numbers of all associated applications.
Test Name Summary Table	The test summary table lists all the tests which are executed with its result status.
Measurement	The measurement table displays the measurement related details with its parameter value.
User comments	If you had selected to include comments in the test report, any comments you added in the DUT tab are shown at the top of the report.

Saving and recalling test setup

Overview

You can save the test setup and recall it later for further analysis. Saved setup includes the selected oscilloscope, general parameters, acquisition parameters, measurement limits, waveforms (if applicable), and other configuration settings. The setup files are saved under the setup name at **X:\TekExpress SFP+ QSFP+**

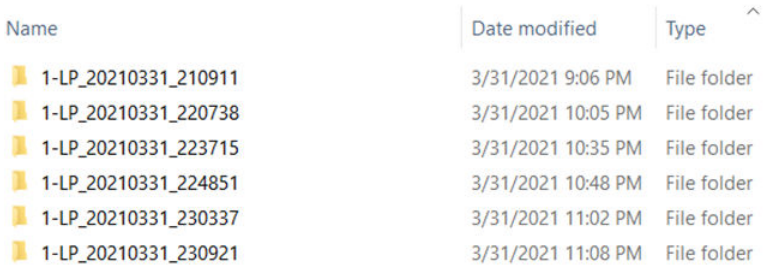


Figure 17: Example of Test Setup File

Use test setups to:

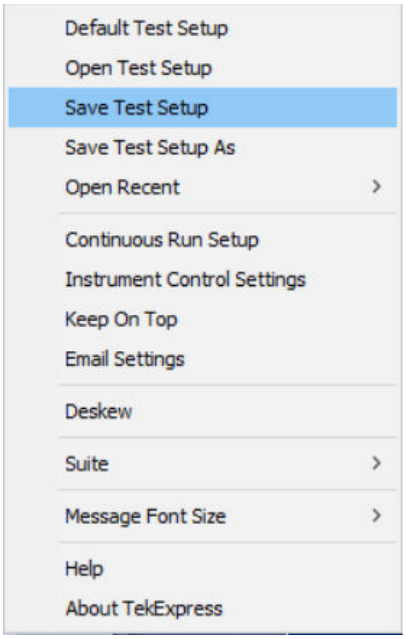
- Recall a saved configuration.
- Run a new session or acquire live waveforms.
- Create a new test setup using an existing one.
- View all the information associated with a saved test, including the log file, the history of the test status as it executed, and the results summary.
- Run a saved test using saved waveforms.

Note: Images that are shown in this Saving and recalling test setup chapter are for illustration purpose only and it may vary depending on the TekExpress application.

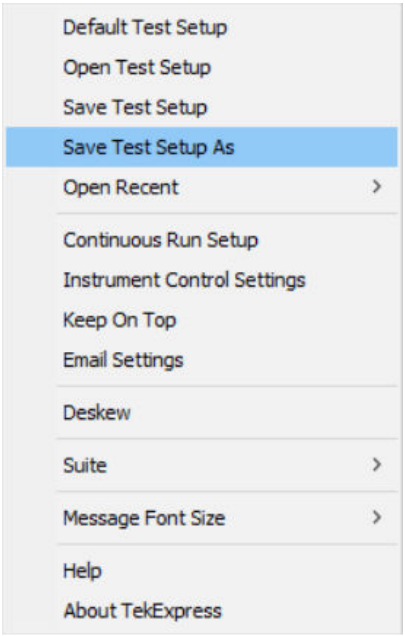
Save the configured test setup

You can save a test setup before or after running a test. You can create a test setup from already created test setup or using a default test setup. When you save a setup, all the parameters, measurement limits, waveform files (if applicable), test selections, and other configuration settings are saved under the setup name. When you select the default test setup, the parameters are set to the application's default value.

- Select **Options > Save Test Setup** to save the opened setup.



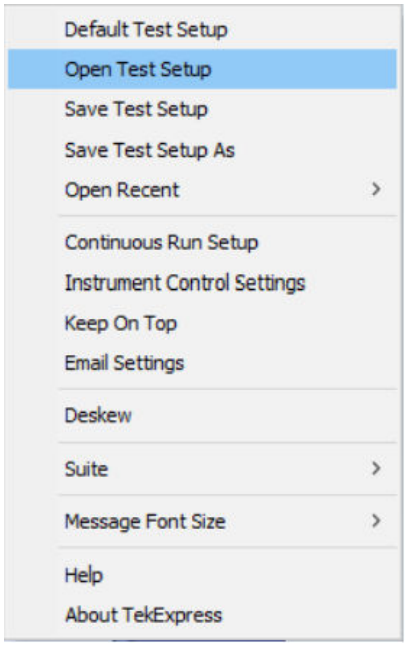
- Select **Options > Save Test Setup As** to save the setup with different name.



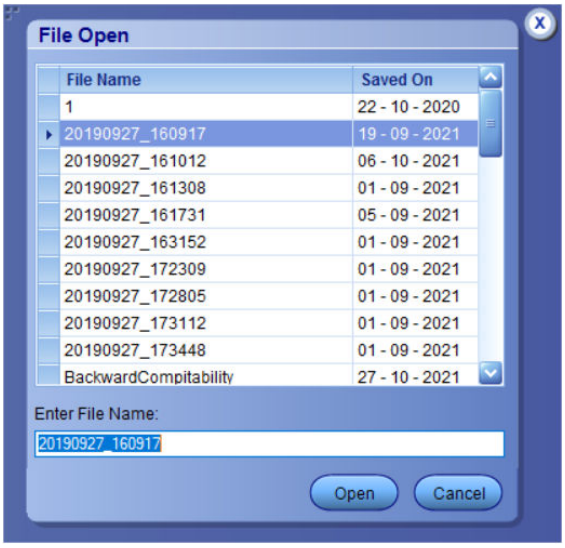
Load a saved test setup

To open (load) a saved test setup, do the following:

- Select **Options > Open Test Setup**.



- From the **File Open** menu, select the setup file name from the list and click **Open**.

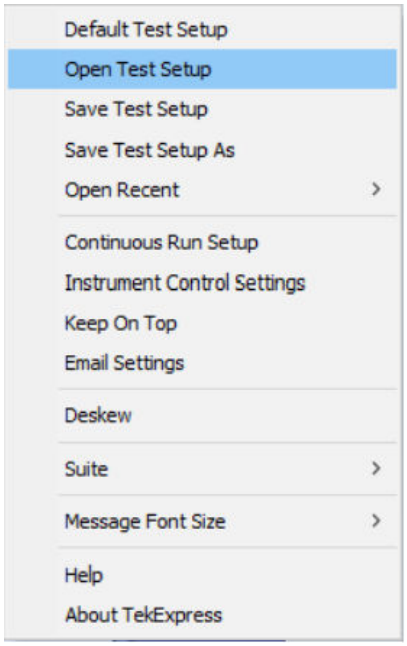


Note: Parameters that are set for the respective test setup will enable after opening the file.

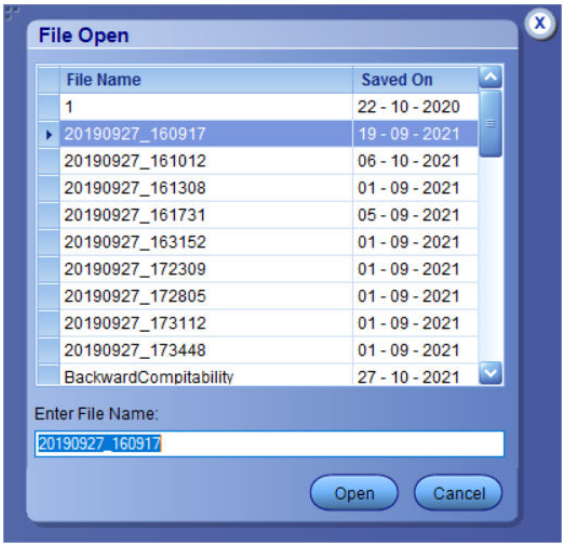
Perform a test using pre-run session files

Complete the following steps to load a test setup from a pre-run session:

1. Select **Options > Open Test Setup**.

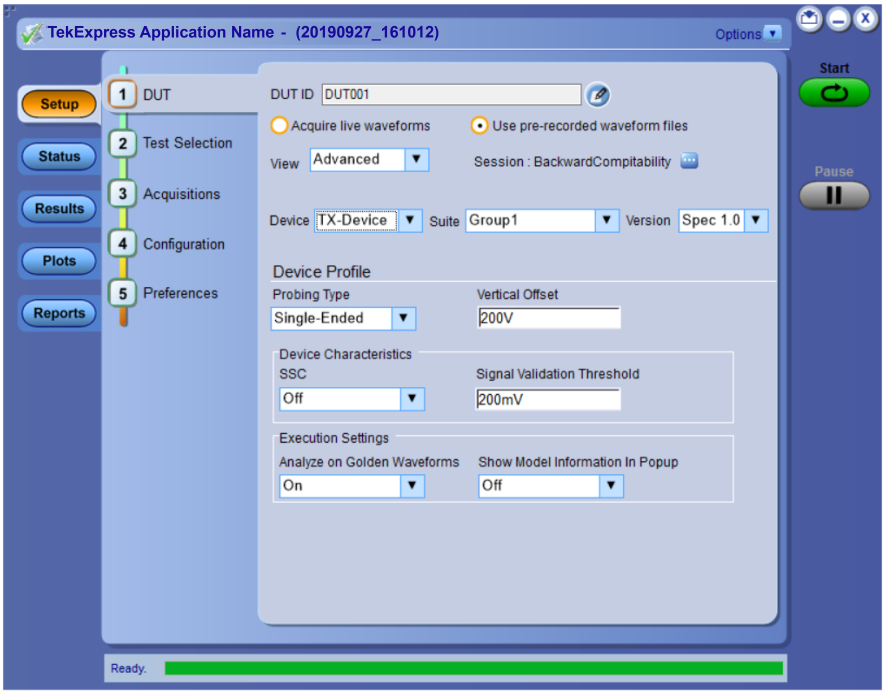


2. From the **File Open** menu, select a setup from the list and then click **Open**.

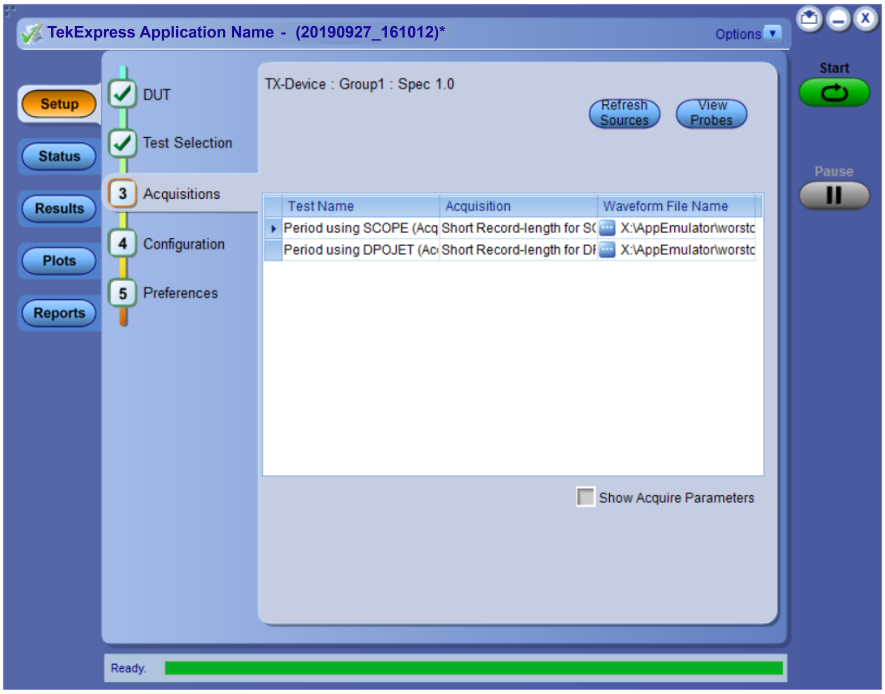


Note: Parameters that are set for the respective test setup will enable after opening the file.

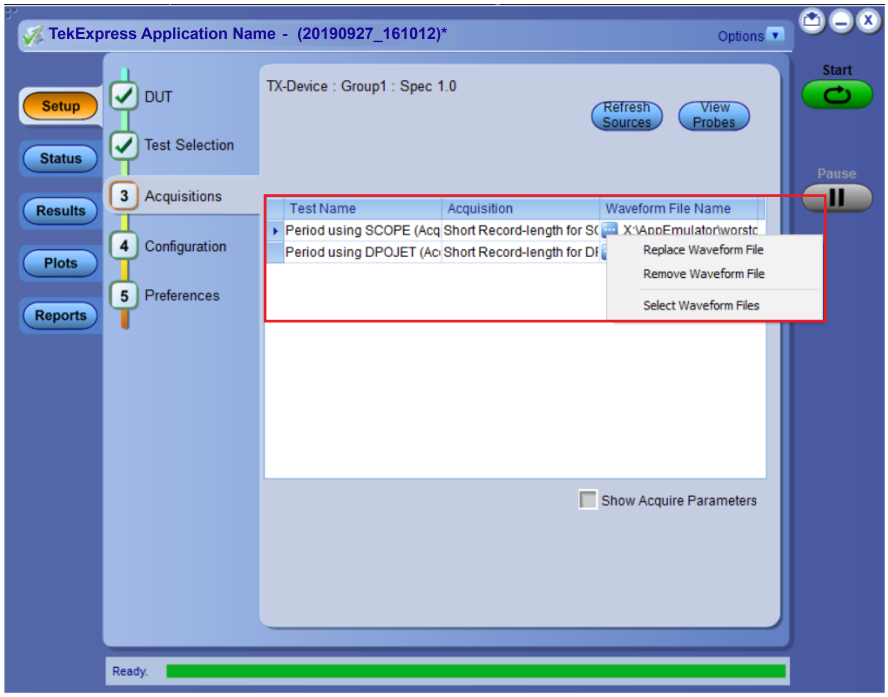
3. Switch the mode to **Use Pre-recorded waveform files** in the DUT panel.



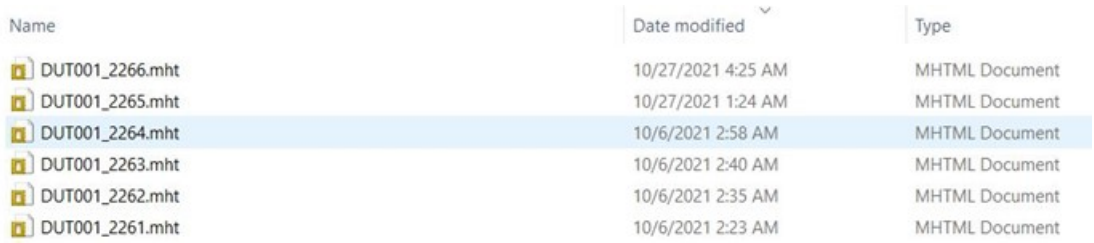
4. Select the required waveforms from the selected setup in the **Acquisitions** tab and click **Start**.



5. The selected waveform file can be removed/replaced by clicking on the ( ) icon.

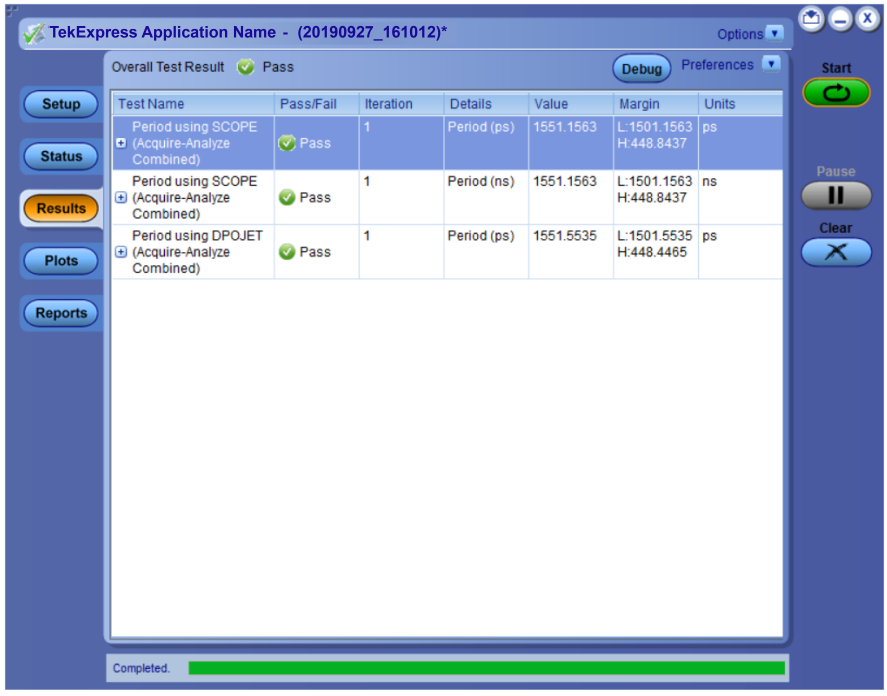


6. After successful completion of the test, the waveform report files are stored at `X:\<Application Name>\Reports`.



Name	Date modified	Type
DUT001_2266.mht	10/27/2021 4:25 AM	MHTML Document
DUT001_2265.mht	10/27/2021 1:24 AM	MHTML Document
DUT001_2264.mht	10/6/2021 2:58 AM	MHTML Document
DUT001_2263.mht	10/6/2021 2:40 AM	MHTML Document
DUT001_2262.mht	10/6/2021 2:35 AM	MHTML Document
DUT001_2261.mht	10/6/2021 2:23 AM	MHTML Document

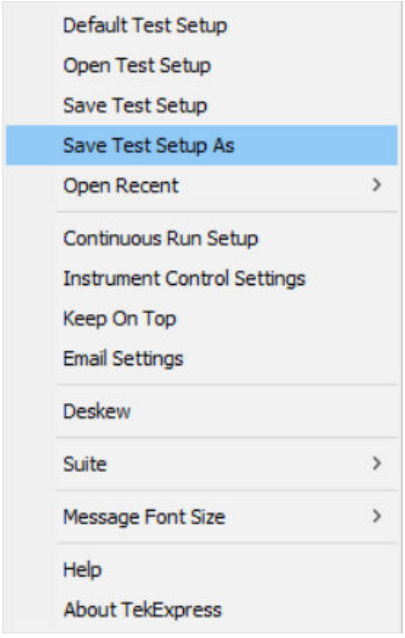
7. The overall test result status after completion of the test execution is displayed in the Results Panel.



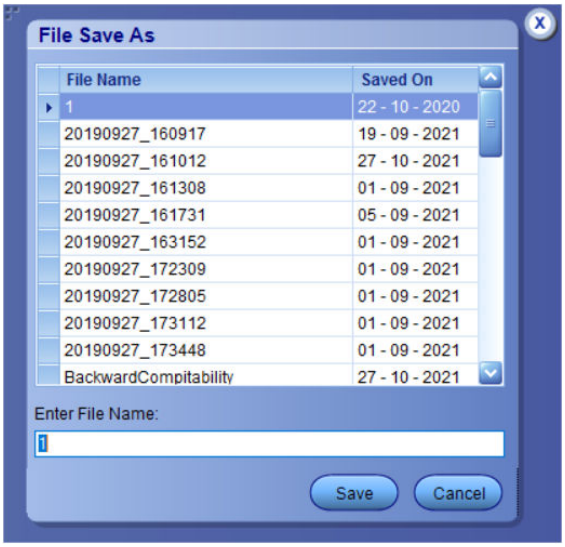
Save the test setup with a different name

To save a test setup with a different name, follow the steps:

1. Select **Options > Save Test Setup As**.



2. Enter the new test setup name and click **Save**.

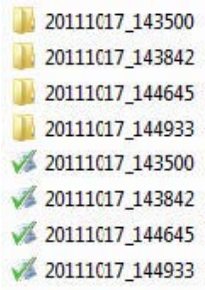


Run a saved test in prerecorded mode

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.



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.
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 Select Acquisitions.
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.

SCPI Commands

About SCPI command

You can use the Standard Commands for Programmable Instruments (SCPI) to communicate remotely with the TekExpress application. Complete the TCPIP socket configuration and the TekVISA configuration in the oscilloscope or in the device where you are executing the script.

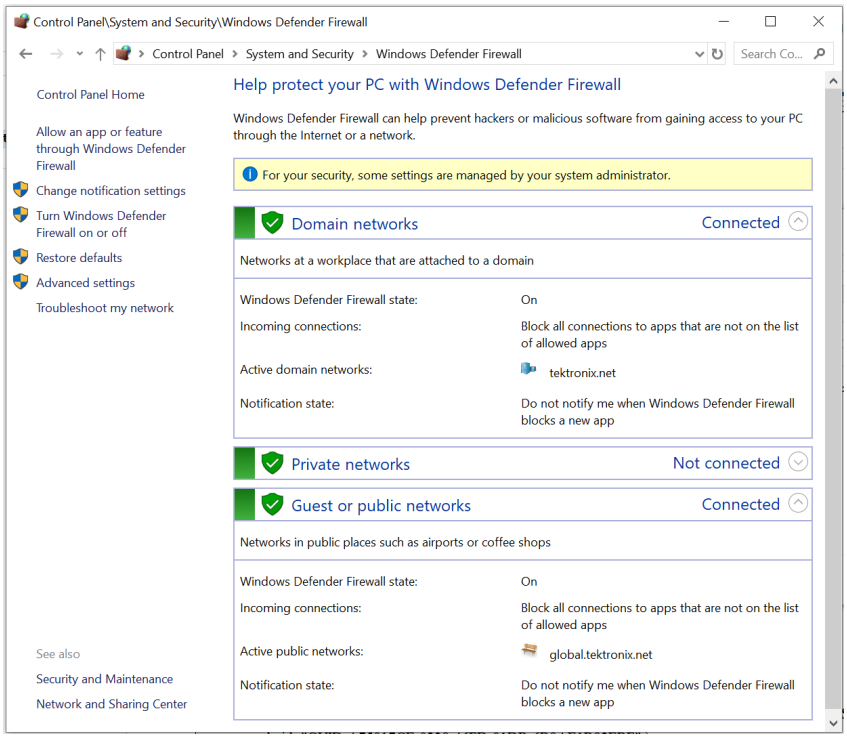
Note: If you are using an external PC to execute the remote interface commands, then install TekVISA in the PC to make the configurations.

Socket configuration for SCPI commands

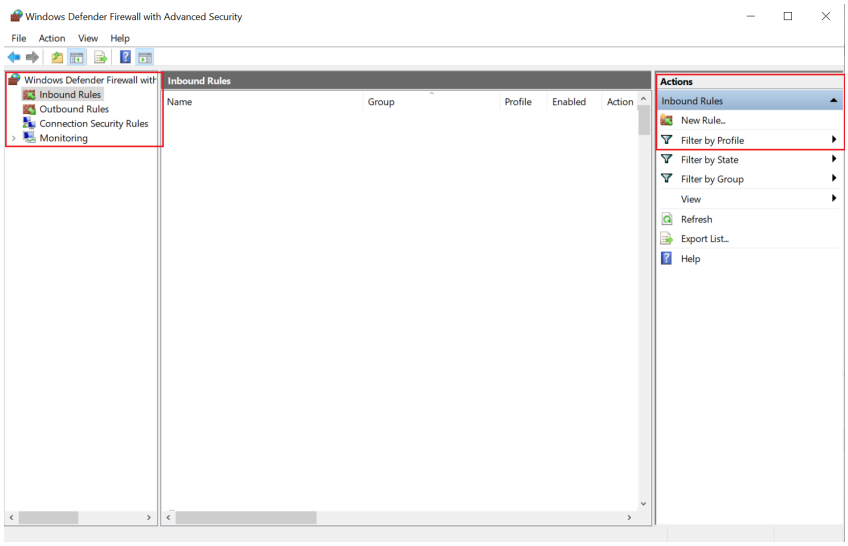
This section describes the steps to configure the TCPIP socket configuration in your script execution device and the steps to configure the TekVISA configuration in the oscilloscope to execute the SCPI commands.

TCPIP socket configuration

1. Click **Start** > **Control Panel** > **System and Security** > **Windows Firewall** > **Advanced settings**.

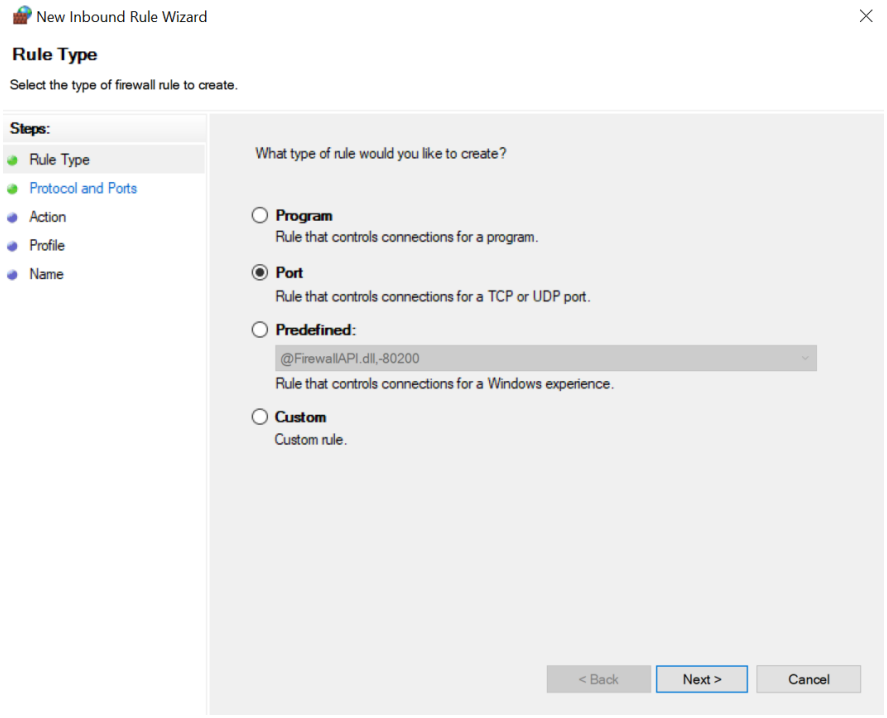


2. In Windows Firewall with Advanced Security menu, select **Windows Firewall with Advanced Security on Local Computer** > **Inbound Rules** and click **New Rule...**

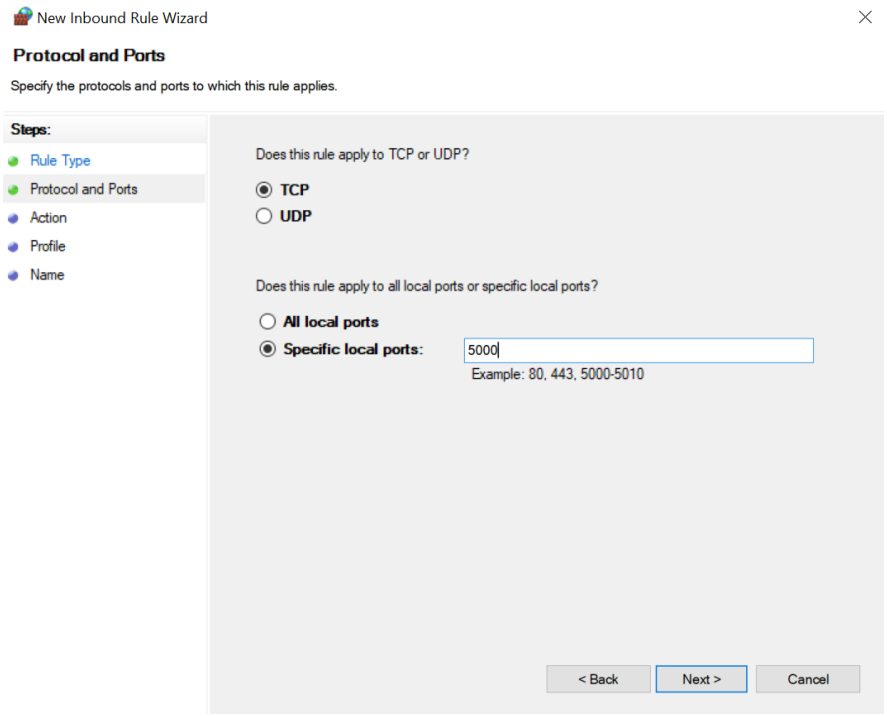


3. In **New Inbound Rule Wizard** menu

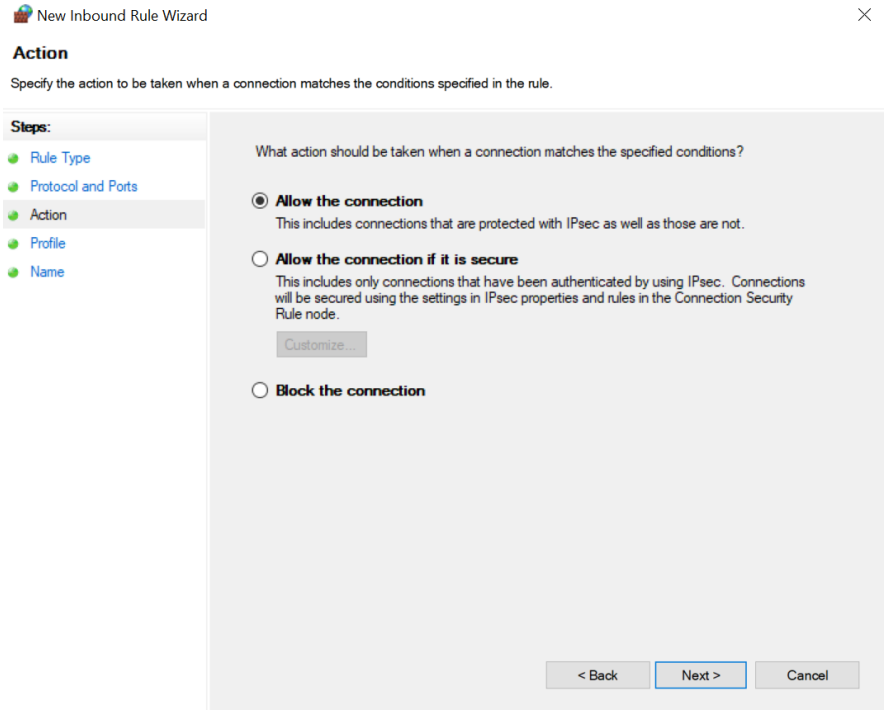
   a. Select **Port** and click **Next**.



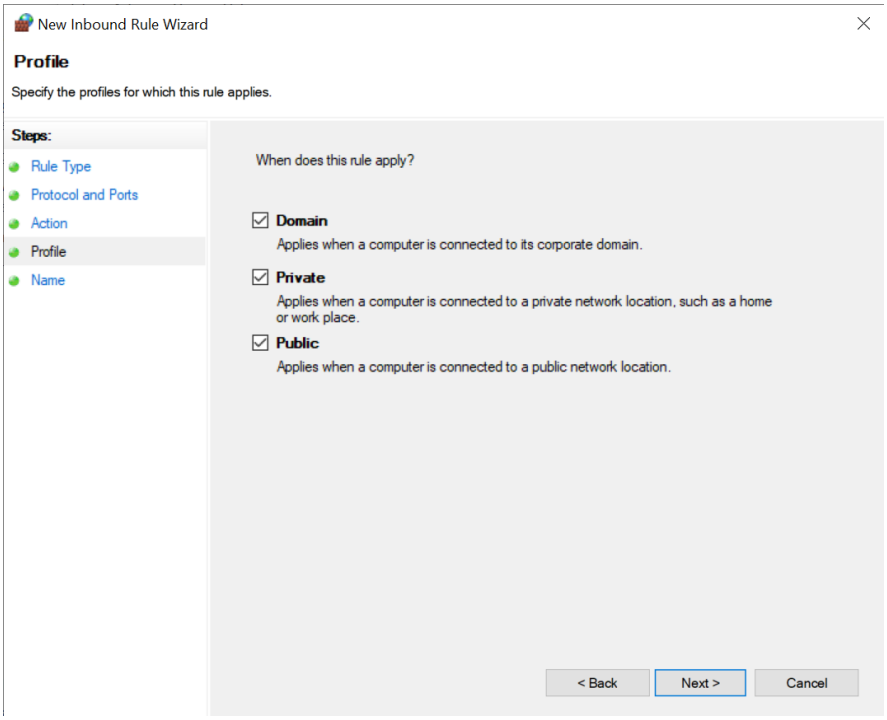
   b. Select **TCP** as rule apply, enter 5000 for **Specific local ports** and click **Next**.



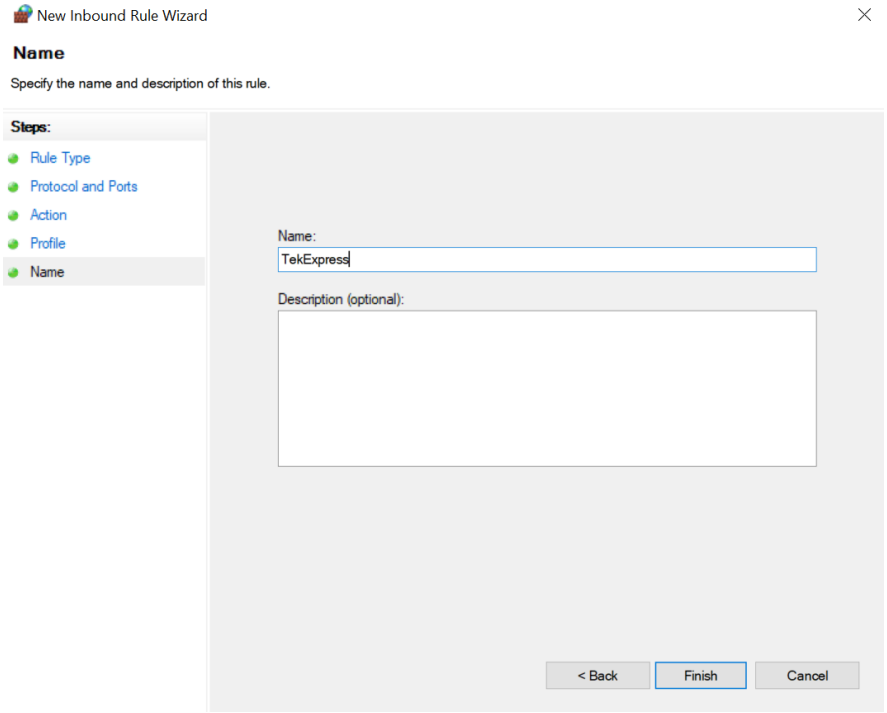
c. Select **Allow the connection** and click **Next**.



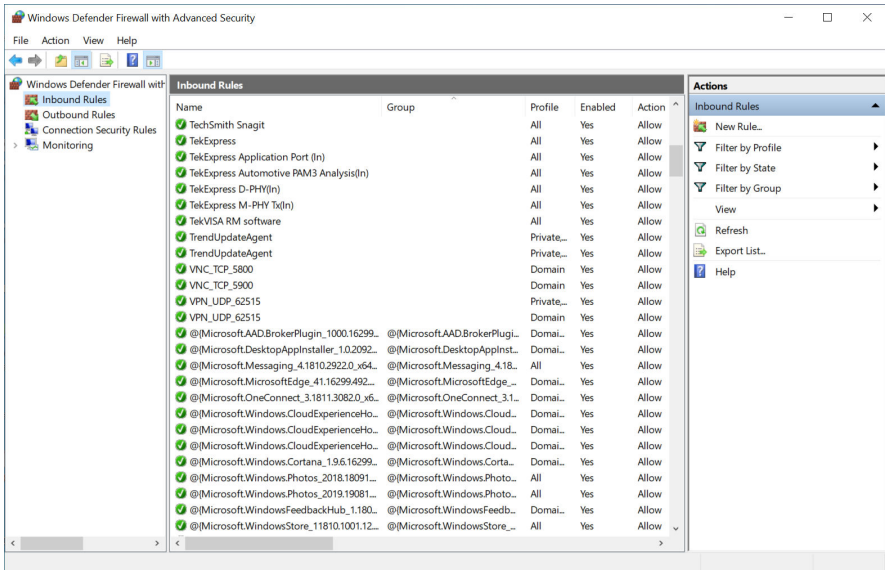
d. Select **Domain, Private, Public** checkbox and click **Next**.



e. Enter **Name**, Description (optional), and click **Finish**.

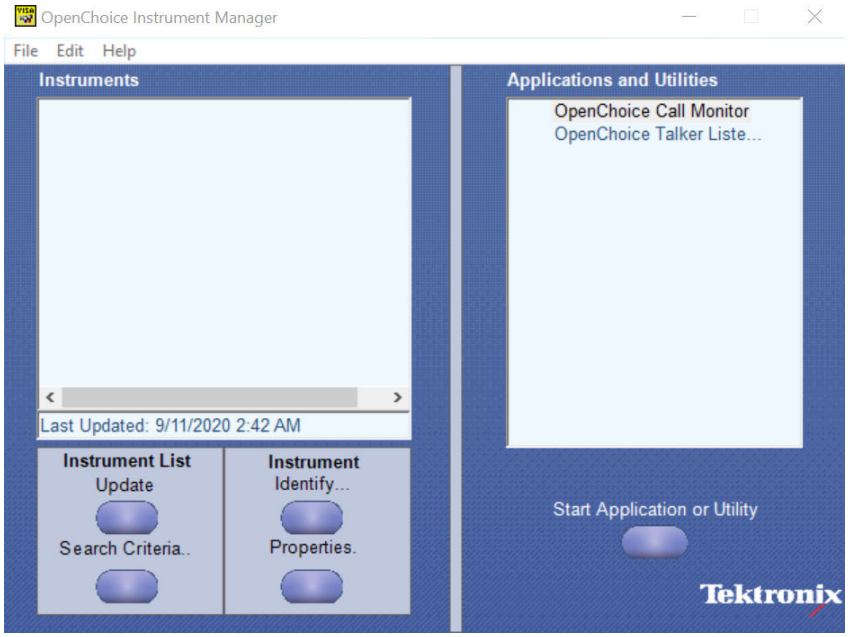


4. Check whether the Rule name is displayed in **Windows Firewall with Advanced Security menu** > **Inbound Rules**.



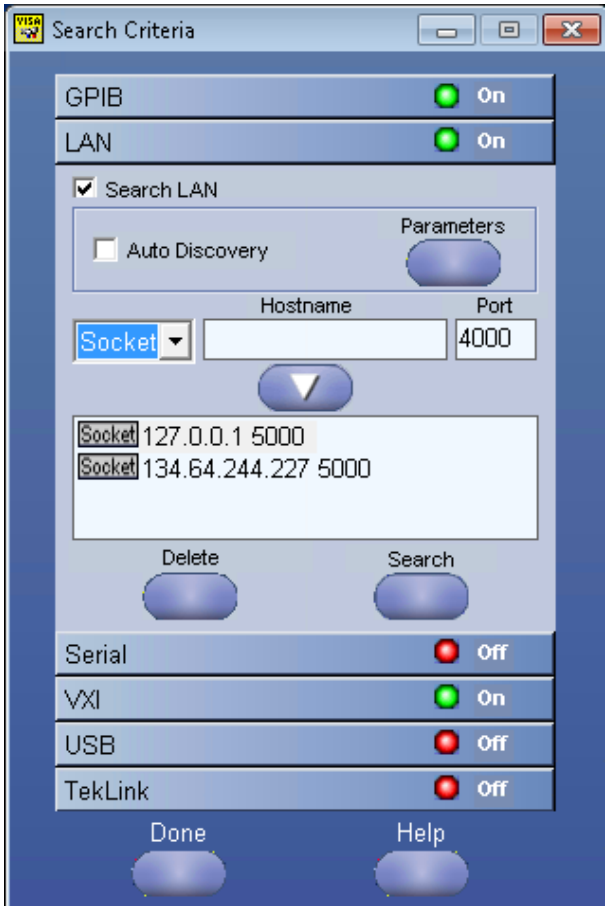
TekVISA configuration

1. Click **Start** > **All Programs** > **TekVISA** > **OpenChoice Instrument Manager**.

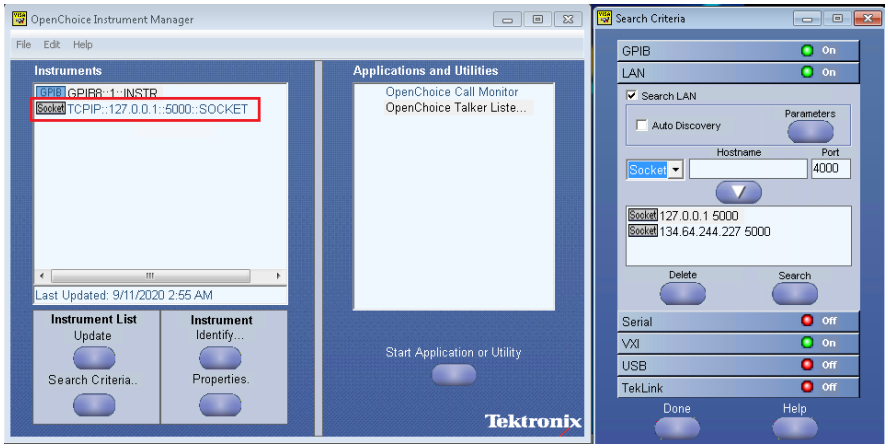


2. Click **Search Criteria**. In **Search Criteria** menu, click **LAN** to Turn-on. Select **Socket** from the drop-down list, enter the IP address of the TekExpress device in **Hostname** and type **Port** as 5000. Click  to configure the IP address with Port.

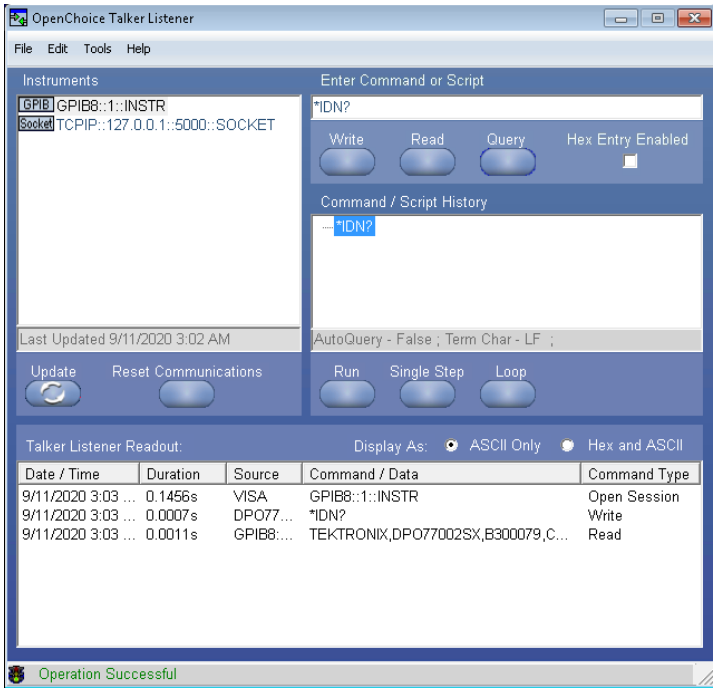
   Enter the Hostname as 127.0.0.1 if the TekVISA and TekExpress application are in the same system, else enter the IP address of the oscilloscope where the TekExpress application is running.



3. Click **Search** to setup the TCPIP connection with the host. Check whether the TCPIP host name is displayed in **OpenChoice Instrument Manager** > **Instruments**.



4. Double-click **OpenChoice Talker Listener** and enter the Command *IDN? in command entry field and click **Query**. Check that the Operation is successful and Talker Listener Readout displays the Command / Data.



Set or query the device name of application

This command sets or queries the device name of the application.

Syntax

`TEKEXP:SELECT DEVICE,"<DeviceName>"` (Set)

`TEKEXP:SELECT? DEVICE` (Query)

Command arguments

Argument Name	Argument Type
<DeviceName> • QSFP+ Tx • SFP+ Tx	<String> NA

Returns

<String>

Examples

`TEKEXP:SELECT DEVICE,"<DeviceName>"` command sets the device name of the application.

`TEKEXP:SELECT? DEVICE` command returns the selected device name of the application.

Set or query the suite name of the application

This command sets or queries the suite name of the application.

Syntax

`TEKEXP:SELECT SUITE,"<SuiteName>"` (Set)

`TEKEXP:SELECT? SUITE` (Query)

Command arguments

Argument Name	Argument Type and value	Description
<SuiteName> • Host • Module	<String> NA	It is the name of the suite on the DUT panel of the application.

Returns

<String>

Examples

`TEKEXP:SELECT SUITE,"<SuiteName>"` command sets the suite name of the application.

`TEKEXP:SELECT? SUITE` command returns the selected suite of the application.

Set or query the test name of the application

This command selects or deselects the specified test name of the application.

Syntax

`TEKEXP:SELECT TEST,"<TestName>",<Value>` (Set)

`TEKEXP:SELECT TEST,"<ALL>"` (Set)

`TEKEXP:SELECT? TEST` (Query)

Command arguments

Test Name	Value
Host • Single Ended Output Voltage Range • Output AC Common Mode voltage (RMS) • Crosstalk Source Rise/Fall Time (20%-80%) • Crosstalk Source Amplitude (p-p Differential) • Signal Rise/Fall Time (20%-80%) • Total Jitter • Total Jitter @ J2 (Informative) • Total Jitter @ J9 (Informative) • Data Dependent Jitter • Data Dependent Pulse Width Shrinkage • Uncorrelated Jitter • Transmitter Qsq • Eye Mask Hit Ratio • Voltage Modulation Amplitude (p-p) • Transmitter Qsq (for Cu) • Output AC Common Mode voltage (RMS) (for Cu) • Host Output TWDPc	{True | False} or {1 | 0} It represents selected or unselected. Where, True or 1 - Selected False or 0 - Unselected
Module • Single Ended Input Voltage Tolerance • AC Common Mode Voltage Tolerance • Crosstalk Source Rise/Fall Time (20%-80%) • Crosstalk Source Amplitude (p-p Differential) • Total Jitter • Total Jitter @ J2 (Informative) • Total Jitter @ J9 (Informative) • Data Dependent Jitter • Data Dependent Pulse Width Shrinkage • Uncorrelated Jitter • Eye Mask Hit Ratio • Output AC Common Mode voltage (RMS)	{True | False} or {1 | 0} It represents selected or unselected. Where, True or 1 - Selected False or 0 - Unselected

Returns

{True | False} or {1 | 0}

Examples

`TEKEXP:SELECT TEST,"<TestName>",1` command selects the specified test in the Test Panel.

`TEKEXP:SELECT TEST,"<ALL>"` command select all the tests in the Test Panel.

`TEKEXP:SELECT? TEST` command returns the list of selected tests.

Set or query the version name of the application

This command sets or queries the version name of the application.

Syntax

`TEKEXP:SELECT VERSION,”<VersionName>”` (Set)

`TEKEXP:SELECT? VERSION` (Query)

Command arguments

Argument Name	Argument Type	Valid Values
<VersionName> • SFF-8635 Revision 0.4	<String> • NA	It is the name of the version on the DUT panel of the application.

Returns

<String>

Examples

`TEKEXP:SELECT VERSION,”<VersionName>”` command sets the version name of application.

`TEKEXP:SELECT? VERSION` command returns the version name of application.

Set or query the general parameter values

This command sets or queries the general parameter values of the application.

Syntax

`TEKEXP:VALUE GENERAL,"<ParameterName>","<Value>"` (Set)

`TEKEXP:VALUE? GENERAL,"<ParameterName>"` (Query)

Command arguments

Table 17: Command arguments for general settings

Parameter Name	Value
Direct Attached Cable Cu	• Enabled • Disabled
Device Type	• QSFP+ Tx • SFP+ Tx
Suite Type	• Host • Module

Table continued…

Parameter Name	Value
Record Length	• 9.95328 • 10.3125 • 10.51875 • 11.10
Apply Filter	• Yes • No
Filter File Path (.flt file)	Filter path (User filter file path)
Apply Filter for TWDPc	• Yes • No
Filter File Path for TWDPc (.flt file)	Filter path (User filter file path)

Returns

<NRf> or <String>

Examples

`TEKEXP:VALUE GENERAL,"<ParameterName>","<Value>"` command set the value for the specified general parameter.

`TEKEXP:VALUE? GENERAL,"<ParameterName>"` command returns the value for the specified general parameter.

Set or query the acquire parameter values

This command sets or queries the acquire parameter values of the application.

Syntax

`TEKEXP:VALUE ACQUIRE,”<TestName>",”<AcquireType>”,”<ParameterName>","<ParameterValue>"` (Set)

`TEKEXP:VALUE? ACQUIRE,”<TestName>",”<AcquireType>”,”<ParameterName>"` (Query)

Command arguments

Test Name	Acquire Type	Parameter Name	Parameter Values
Host			
Single Ended Output Voltage Range	Single Ended Output Voltage Range Acquisition	Signal Type	• Single Ended PRBS7 • Single Ended PRBS9 • Single Ended PRBS11 • Single Ended PRBS15 • Single Ended PRBS20 • Single Ended PRBS23 • Single Ended PRBS31
Output AC Common Mode voltage (RMS)	Output AC Common Mode voltage (RMS) Acquisition		• PRBS7 • PRBS9 • PRBS11 • PRBS15 • PRBS20 • PRBS23 • PRBS31
Crosstalk Source Rise/Fall Time (20%-80%)	Crosstalk Source Rise/Fall Time (20%-80%) Acquisition		• Crosstalk 8180 • Crosstalk PRBS7 • Crosstalk PRBS9 • Crosstalk PRBS11 • Crosstalk PRBS15 • Crosstalk PRBS20 • Crosstalk PRBS23
Crosstalk Source Amplitude (p-p Differential)	Crosstalk Source Amplitude (p-p Differential) Acquisition		
Signal Rise/Fall Time (20%-80%)	Signal Rise/Fall Time (20%-80%) Acquisition		• 8180 • PRBS7 • PRBS9 • PRBS11 • PRBS15 • PRBS20 • PRBS23

Table continued…

Test Name	Acquire Type	Parameter Name	Parameter Values
			• PRBS31
Total Jitter	Total Jitter Acquisition	Signal Type	• PRBS7 • PRBS9 • PRBS11 • PRBS15 • PRBS20 • PRBS23 • PRBS31
		BER	Range(2-18)
Total Jitter @ J2 (Informative)	Total Jitter @ J2 (Informative) Acquisition	Signal Type	• PRBS7 • PRBS9 • PRBS11 • PRBS15 • PRBS20 • PRBS23 • PRBS31
Total Jitter @ J9 (Informative)	Total Jitter @ J9 (Informative) Acquisition		
Data Dependent Jitter	Data Dependent Jitter Acquisition		
Data Dependent Pulse Width Shrinkage	Data Dependent Pulse Width Shrinkage Acquisition		• PRBS7 • PRBS9 • PRBS11 • PRBS15
Uncorrelated Jitter	Uncorrelated Jitter Acquisition		• PRBS7 • PRBS9 • PRBS11 • PRBS15 • PRBS20 • PRBS23 • PRBS31
Transmitter Qsq	Transmitter Qsq Acquisition		• 8180 • PRBS7 • PRBS9 • PRBS11 • PRBS15 • PRBS20 • PRBS23 • PRBS31
Eye Mask Hit Ratio	Eye Mask Hit Ratio Acquisition		• PRBS7

Table continued…

Test Name	Acquire Type	Parameter Name	Parameter Values
			• PRBS9 • PRBS11 • PRBS15 • PRBS20 • PRBS23 • PRBS31
Voltage Modulation Amplitude (p-p)	Voltage Modulation Amplitude (p-p) Acquisition		• 8180 • PRBS7 • PRBS9 • PRBS11 • PRBS15 • PRBS20 • PRBS23 • PRBS31
Transmitter Qsq (for Cu)	Transmitter Qsq (for Cu) Acquisition		
Output AC Common Mode voltage (RMS) (for Cu)	Output AC Common Mode voltage (RMS) (for Cu) Acquisition		• PRBS7 • PRBS9 • PRBS11 • PRBS15 • PRBS20 • PRBS23 • PRBS31
Host Output TWDPc	Host Output TWDPc Acquisition		

Test Type	Acquire Type	Parameter Name	Parameter Values
Module			
Single Ended Input Voltage Tolerance	Single Ended Input Voltage Tolerance Acquisition	Signal Type	• Single Ended PRBS7 • Single Ended PRBS9 • Single Ended PRBS11 • Single Ended PRBS15 • Single Ended PRBS20 • Single Ended PRBS23 • Single Ended PRBS31
AC Common Mode Voltage Tolerance	AC Common Mode Voltage Tolerance Acquisition		• PRBS7 • PRBS9 • PRBS11 • PRBS15 • PRBS20

Table continued…

Test Type	Acquire Type	Parameter Name	Parameter Values
			• PRBS23 • PRBS31
Crosstalk Source Rise/Fall Time (20%-80%)	Crosstalk Source Rise/Fall Time (20%-80%) Acquisition		• Crosstalk 8180 • Crosstalk PRBS7 • Crosstalk PRBS9 • Crosstalk PRBS11 • Crosstalk PRBS15 • Crosstalk PRBS20 • Crosstalk PRBS23
Crosstalk Source Amplitude (p-p Differential)	Crosstalk Source Amplitude (p-p Differential) Acquisition		
Total Jitter	Total Jitter Acquisition	Signal Type	• PRBS7 • PRBS9 • PRBS11 • PRBS15 • PRBS20 • PRBS23 • PRBS31
		BER	Range(2-18)
Total Jitter @ J2 (Informative)	Total Jitter @ J2 (Informative) Acquisition	Signal Type	• PRBS7 • PRBS9 • PRBS11 • PRBS15 • PRBS20 • PRBS23 • PRBS31
Total Jitter @ J9 (Informative)	Total Jitter @ J9 (Informative) Acquisition		
Data Dependent Jitter	Data Dependent Jitter Acquisition		
Data Dependent Pulse Width Shrinkage	Data Dependent Pulse Width Shrinkage Acquisition		• PRBS7 • PRBS9 • PRBS11 • PRBS15
Uncorrelated Jitter	Uncorrelated Jitter Acquisition		• PRBS7 • PRBS9 • PRBS11 • PRBS15 • PRBS20 • PRBS23 • PRBS31
Eye Mask Hit Ratio	Eye Mask Hit Ratio Acquisition		
Output AC Common Mode voltage (RMS)	Output AC Common Mode voltage (RMS) Acquisition		

Returns

<Nrf>

Examples

`TEKEXP:VALUE ACQUIRE,”<TestName>",”<AcquireType>”,"<ParameterName>","<ParameterValue>"` command sets the value for the specified test and its acquire parameter.

`TEKEXP:VALUE? ACQUIRE,”<TestName>",”<AcquireType>”,"<ParameterName>"` command returns the value for the specified test and its acquire parameter.

Set or query the analyze parameter values

This command sets or queries the analyze parameter values of the application.

Syntax

`TEKEXP:VALUE ANALYZE,”<TestName>","<ParameterName>","<ParameterValue>"` (Set)

`TEKEXP:VALUE? ANALYZE,”<TestName>","<ParameterName>"` (Query)

Command arguments

Test Name	Parameter Name	Values
Transmitter Qsq	Window Width (%)	• 5 • 10 • 20
Transmitter Qsq (for Cu)		

Returns

<Nrf>

Examples

`TEKEXP:VALUE ANALYZE,”<TestName>","<ParameterName>","<ParameterValue>"` command set the value for the specified test and its analyze parameter.

`TEKEXP:VALUE? ANALYZE,”<TestName>","<ParameterName>"` command returns the value for the specified test and its analyze parameter.

Query the available devices in the DUT panel of the application

Syntax

`TEKEXP:LIST? DEVICE` (Query)

Command arguments

Device	Device Type and value	Description
<Device>	<String> • QSFP+ Tx • SFP+ Tx	It is the name of the device on the DUT panel of the application.

Returns

<String>

Examples

`TEKEXP:LIST? DEVICE` command returns the list of available devices.

Query the available suites for the selected device

This command queries the list of available suites for the selected device as comma separated values.

Syntax

`TEKEXP:LIST? SUITE` (Query)

Command arguments

Device and Suite Type	Description
QSFP+ Tx • Host • Module SFP+ Tx • Host • Module	It is the name of the suites for the selected device.

Returns

<String>

Examples

`TEKEXP:LIST? SUITE` command returns the list of available suites for the selected device.

Query the list of available tests of the application

This command queries the list of available tests of the application for the selected device as comma separated values.

Syntax

`TEKEXP:LIST? TEST` (Query)

Command arguments

Test Name	String
Host	• Single Ended Output Voltage Range • Output AC Common Mode voltage (RMS) • Crosstalk Source Rise/Fall Time (20%-80%) • Crosstalk Source Amplitude (p-p Differential) • Signal Rise/Fall Time (20%-80%) • Total Jitter

Table continued…

Test Name	String
	• Total Jitter @ J2 (Informative) • Total Jitter @ J9 (Informative) • Data Dependent Jitter • Data Dependent Pulse Width Shrinkage • Uncorrelated Jitter • Transmitter Qsq • Eye Mask Hit Ratio • Voltage Modulation Amplitude (p-p) • Transmitter Qsq (for Cu) • Output AC Common Mode voltage (RMS) (for Cu) • Host Output TWDPc
Module	• Single Ended Input Voltage Tolerance • AC Common Mode Voltage Tolerance • Crosstalk Source Rise/Fall Time (20%-80%) • Crosstalk Source Amplitude (p-p Differential) • Total Jitter • Total Jitter @ J2 (Informative) • Total Jitter @ J9 (Informative) • Data Dependent Jitter • Data Dependent Pulse Width Shrinkage • Uncorrelated Jitter • Eye Mask Hit Ratio • Output AC Common Mode voltage (RMS)

Returns

<String>

Examples

`TEKEXP:LIST? TEST` command returns the list of available tests for the selected device.

Query the available version names of the application

This command queries the list of available version names of the application for the selected device as comma separated values.

Syntax

`TEKEXP:LIST? VERSION` (Query)

Returns

<String>

Examples

`TEKEXP:LIST? VERSION` command returns the list of version names for the selected device.

Query the list of available instruments based on the specified instrument type

This command queries the list of available instruments based on the specified instrument type.

Syntax

`TEKEXP:LIST? INSTRUMENT,"<InstrumentType>"` (Query)

Command argument

Argument Name	Argument value
<InstrumentType>	<String>

Returns

<String>

Examples

`TEKEXP:LIST? INSTRUMENT,"Real Time Scope"` command returns the list of available instruments based on the real time scope type.

Set or query the IP address of the instrument based on the specified instrument type

This command sets or queries the IP address of the instrument based on the specified instrument type.

Syntax

`TEKEXP:INSTRUMENT? "<InstrumentType>"` (Query)

`TEKEXP:INSTRUMENT, "<InstrumentType>","<Value>"` (Set)

Command argument

Argument Name	Argument Type
<InstrumentType>	<String>
<Value>	<String> TCPIP::XXX.XX.XXX.XXX::INSTR

Returns

<String>

Examples

`TEKEXP:INSTRUMENT? "<InstrumentType>"` command returns the IP address of the oscilloscope.

`TEKEXP:INSTRUMENT, "<InstrumentType>","<value>"` command sets the oscilloscope to the specified IP address.

Query the information of the generated report file

This command queries the information of the generated report file in the format "<FileSize>","<FileName>".

Pre-requisite

A session should be run earlier and the report should be generated to get the information of the report.

Syntax

`TEKEXP:INFO? REPORT` (Query)

Returns

<FileSize>:: <String>

<FileName>:: <String>

Examples

`TEKEXP:INFO? REPORT` command returns the information of the generated report in the format ("1215","DUT001.mht").

Query the information of the generated waveform files

This command queries the information of the generated waveform files in the format.

<File1Size,"File1Name">.

If there are more than one waveform, the waveform file names are displayed with the comma separated values in the format

<File1Size,"File1Name">,<File2Size,"File2Name">.

Syntax

`TEKEXP:INFO? WFM` (Query)

Returns

<FileSize>:: <String>

<FileName>:: <String>

Examples

`TEKEXP:INFO? WFM` command returns the information of the generated waveform in the format (20000858,"X:\SFP+ QSFP+\Untitled Session\DUT001\20200916_041609\Iter1_Short Record-length for SCOPE Period_NoSSC_DIFF.wfm").

Query the information of the generated image files

This command queries the information of the generated image files in the format.

<File1Size,"File1Name">.

If there are more than one image, the image file names are displayed with the comma separated values in the format

<File1Size,"File1Name">,<File2Size,"File2Name">.

Syntax

`TEKEXP:INFO? IMAGE` (Query)

Returns

<FileSize>:: <String>

<FileName>:: <String>

Examples

`TEKEXP:INFO? IMAGE` command returns the information of the generated image in the format (109058, "X:\SFP+ QSFP+ \Untitled Session\DUT001\20200916_041609\Iter1_Short Record-length for SCOPE Period_NoSSC_DIFF.png";22794,"X:\SFP+ QSFP+ \UntitledSession\DUT001\20 200916_041609\ScopePeriodPlot_Iteration1WithCursor.png").

Query the active TekExpress application name

This command queries the active TekExpress application name running on the oscilloscope.

Syntax

`TEKEXP:*IDN?` (Query)

Returns

<String>

Examples

`TEKEXP:*IDN?` command returns the active TekExpress application name running on the oscilloscope.

Set or query the DUTID of application

This command sets or queries the DUTID of the application.

Syntax

`TEKEXP:VALUE DUTID,"<Value>"` (Set)

`TEKEXP:VALUE? DUTID` (Query)

Command arguments

Argument Name	Argument Type
<Value>	<String>

Returns

<String>

Examples

`TEKEXP:VALUE DUTID,"DUT001"` command sets the DUTID of the application to DUT001.

`TEKEXP:VALUE? DUTID` command returns the DUTID of the application.

Sets or query the acquire mode status

This command sets or queries the acquire mode status.

Syntax

`TEKEXP:ACQUIRE_MODE <Mode>` (Set)

`TEKEXP:ACQUIRE_MODE?` (Query)

Command arguments

Argument Name	Argument value
<Mode>	• LIVE • PRE-RECORDED

Returns

LIVE | PRE-RECORDED

Examples

`TEKEXP:ACQUIRE_MODE LIVE` command sets the acquire mode to the Live mode.

`TEKEXP:ACQUIRE_MODE?` command returns the current acquire mode.

Set or query the execution mode status

This command sets or queries the execution mode status.

Syntax

`TEKEXP:MODE <Mode>` (Set)

`TEKEXP:MODE?` (Query)

Command arguments

Argument Name	Argument value
<Mode>	• COMPLIANCE • USER-DEFINED

Returns

COMPLIANCE | USER-DEFINED

Examples

`TEKEXP:MODE COMPLIANCE` command sets the execution mode to the compliance mode.

`TEKEXP:MODE?` command returns the current execution mode.

Generate the report for the current session

This command generates the report for the current session.

Syntax

`TEKEXP:REPORT GENERATE`(Set)

Arguments

N/A

Examples

`TEKEXP:REPORT GENERATE` command generates the report for the current session.

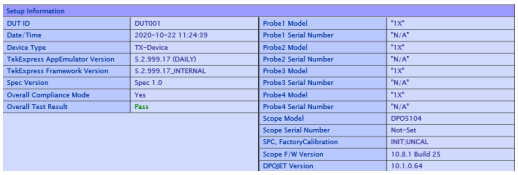
Query the value of specified report header field in the report

This command queries the value of specified report header field in the report.

Syntax

`TEKEXP:REPORT? ”<Device Field>”` (Query)

Command arguments

Argument Name	Argument Type
<Device Field> Device field is the header name of each field in the setup information section of the report. 	<String>

Setup Information			
DUT ID	DUT001	Probe1 Model	"1X"
Date/Time	2020-10-22 11:24:39	Probe1 Serial Number	"N/A"
Device Type	TX-Device	Probe2 Model	"1X"
TekExpress AppEmulator Version	5.2.999.17 (DAILY)	Probe2 Serial Number	"N/A"
TekExpress Framework Version	5.2.999.17_INTERNAL	Probe3 Model	"1X"
Spec Version	Spec 1.0	Probe3 Serial Number	"N/A"
Overall Compliance Mode	Yes	Probe4 Model	"1X"
Overall Test Result	Pass	Probe4 Serial Number	"N/A"
		Scope Model	DPO5104
		Scope Serial Number	Not-Set
		SPC, FactoryCalibration	INIT,UNCAL
		Scope F/W Version	10.8.1 Build 25
		DPOJET Version	10.1.0.64

Returns

<String>

Examples

`TEKEXP:REPORT? "DUT ID"` command returns the value of DUT ID field in the report.

Query the value of specified result detail available in report summary/details table

This command queries the value of specified result detail available in report summary/details table.

Syntax

`TEKEXP:RESULT? "<TestName>"` (Query)

`TEKEXP:RESULT? "<TestName>","<ColumnName>"` (Query)

`TEKEXP:RESULT? "<TestName>","<ColumnName>",<RowNumber>` (Query)

Command arguments

Argument Name	Argument Type
<TestName> It is the test name of which the details are required in the report.	<String>
<ColumnName> It is the column header name of which the details are required in the report.	<String>
<RowNumber> It is the row number of which the details are required in the report.	<String>

Returns

<String>

Examples

`TEKEXP:RESULT? "<TestName>"` will return the pass fail status of test.

`TEKEXP:RESULT? "<TestName>","<ColumnName>"` will return all the row values of specific column for the test with comma separated values.

`TEKEXP:RESULT? "<TestName>","<ColumnName>",<RowNumber>` will return the column value of specified row number.

Restore the setup to default settings

This command restores the setup to default settings.

Syntax

`TEKEXP:SETUP Default`(Set)

Arguments

N/A

Examples

`TEKEXP:SETUP Default` command restores the setup to default settings.

Save the setup

This command saves the setup.

Syntax

`TEKEXP:SETUP Save`(Set)

Examples

`TEKEXP:SETUP Save` command saves the setup.

Save the settings to a specified session

This command saves the settings to a specified session.

Syntax

`TEKEXP:SETUP Save,"<SessionName>"`

Command arguments

Argument Name	Argument value
<SessionName>	<String>

Examples

`TEKEXP:SETUP Save,"<SessionName>"` command saves the settings to a specified session.

Open the setup from a specified session

This command opens the setup from a specified session.

Syntax

`TEKEXP:SETUP Open,"<SessionName>"`(Set)

Command arguments

Argument Name	Argument value
<SessionName>	<String>

Examples

`TEKEXP:SETUP Open,"<SessionName>"` command opens the setup from a specified session.

Query the current setup file name

This command queries the current setup file name.

Syntax

`TEKEXP:SETUP? CURRENT` (Query)

Returns

<String>

Examples

`TEKEXP:SETUP? CURRENT` command returns the current setup file name.

Run/stop/pause/resume the selected measurements execution in the application

This command run/stop/pause/resume the selected measurements execution in the application.

Syntax

`TEKEXP:STATE <operation mode>` (Set)

Command arguments

Argument Name	Argument value
<operation mode>	• RUN • STOP • PAUSE • RESUME

Returns

RUN | STOP | PAUSE | RESUME

Examples

`TEKEXP:STATE RUN` command runs the execution for the selected measurements.

Query the current measurement execution status

This command queries the current measurement execution status.

Syntax

`TEKEXP:STATE?` (Query)

Returns

RUNNING | PAUSED | WAIT | ERROR | READY

Examples

`TEKEXP:STATE?` command returns the current measurement execution status.

Query whether the current setup is saved or not saved

This command queries whether the current setup is saved or not saved.

Syntax

`TEKEXP:STATE? SETUP` (Query)

Returns

Saved or Not-Saved

Examples

`TEKEXP:STATE? SETUP` command returns whether the current setup is saved or not saved.

Exit or close the application

The command exits or close the application

Syntax

`TEKEXP:EXIT`(Set)

Examples

`TEKEXP:EXIT` command close the application.

Query the status of the previous command execution

This command queries whether the previous command execution is completed successfully.

Syntax

`TEKEXP:*OPC?` (Query)

Returns

{0 | 1} or {True | False}

1 or True indicates that command execution is successful.

0 or False indicates that command execution is failed.

Examples

`TEKEXP:*OPC?` command returns whether the previous command operation is completed successfully.

Query the last error occurred

This command queries the last error occurred.

Syntax

`TEKEXP:LASTERROR?` (Query)

Returns

<String>

Examples

`TEKEXP:LASTERROR?` command returns the last error occurred.

Set or query the popup details

This command sets or queries the popup details.

Syntax

`TEKEXP:POPUP?` (Query)

`TEKEXP:POPUP "<PopupResponse>"` (Set)

Command arguments

Argument Name	Argument value
<PopupResponse>	• Yes • No

Returns

The pop-up details return in the following format:

"<Tittle>","<message>","<response1>,<response2>".

Where,

<Tittle> :: <String>

<message> :: <String>

<response1>,<response2> :: <String>

Examples

`TEKEXP:POPUP?` command returns the popup details in following format ": "Do you really want to exit TekExpress?";Responses: "Yes, No".

`TEKEXP:POPUP "Yes"` command sets the popup response to Yes.

Sets or query the limit values in the limits editor window

This command sets or queries the limit values in the limits editor window.

Syntax

`TEKEXP:VALUE LIMIT,<TestName>,<LimitHeader>,<Value1>,<CompareString>,<Value2>`(Set)

`TEKEXP:VALUE? LIMIT,<TestName>,<LimitHeader>` (Query)

Returns

<String> or <NRf>

Examples

`TEKEXP:VALUE LIMIT,<TestName>,<LimitHeader>,<Value1>,<CompareString>,<Value2>` command sets the limits value for the specified testname and limit header.

`TEKEXP:VALUE? LIMIT,<TestName>,<LimitHeader>` command returns the limits value for the specified testname and limit header.

Set or query the waveform file recalled for the specified test name and acquire type

This command set or queries the waveform file recalled for the specified test name and acquire type.

If there are more than one waveform, the waveform file names are displayed with the symbol "$" separated values in the format

<WaveformFileName1$ WaveformFileName2>.

Syntax

`TEKEXP:VALUE WFMFILE,<TestName>,<AcquireType>,<WaveformFileName>` (Set)

`TEKEXP:VALUE? WFMFILE,<TestName>,<AquireType>` (Query)

Returns

<String>

Examples

`TEKEXP:VALUE WFMFILE,<TestName>,<AquireType>,<WaveformFileName>` command recalls the sepcified waveform file for the specified testname and acquire type.

`TEKEXP:VALUE? WFMFILE,<TestName>,<AquireType>` command returns the waveform file name recalled for the specified testname and acquire type.

Set or query the enable/disable status of Verbose function

This command sets or queries the enable/disable status of Verbose function.

Syntax

`TEKEXP:VALUE VERBOSE,"<Value>"` (Set)

`TEKEXP:VALUE? VERBOSE` (Query)

Arguments

Argument Name	Argument value
<Value>	{True | False} or {1 | 0} It represents enabled or disabled. Where, • True or 1 - enabled • False or 0 - disabled

Returns

{True | False} or {0 | 1}

Examples

`TEKEXP:VALUE VERBOSE,"<Value>"` command enable or disable the Verbose function.

`TEKEXP:VALUE? VERBOSE` command returns the enable or disable status of Verbose function.

Query the enable or disable status of Continuous run function.

This command queries the enable or disable status of Continuous run function.

Syntax

`TEKEXP:VALUE? GENERAL,"Enable Continuous Run"` (Query)

Returns

{True | False} or {0 | 1}

Where,

1 or True indicates that the continuous run function is enabled.

0 or False indicates that the continuous run function is disabled.

Examples

`TEKEXP:VALUE? GENERAL,"Enable Continuous Run"` command returns the enable or disable status of continuous run function.

Set or query the enable/disable status of Continuous Run function

This command sets or queries the enable/disable status of Continuous Run function.

Syntax

`TEKEXP:VALUE ContinuousRun,"<Value>"` (Set)

`TEKEXP:VALUE? ContinuousRun` (Query)

Arguments

Argument Name	Argument value
<Value>	{True | False} or {1 | 0} It represents enabled or disabled. Where, • True or 1 - enabled • False or 0 - disabled

Returns

{True | False} or {0 | 1}

Examples

`TEKEXP:VALUE? ContinuousRun` command returns the enable or disable status of Continuous run function.

`TEKEXP:VALUE ContinuousRun,"<Value>"` command enable or disable the Continuous run function.

Set or query the continuous run duration time value

This command sets or queries the continuous run duration time value.

Syntax

`TEKEXP:VALUE? ContinuousRun_Duration` (Query)

`TEKEXP:VALUE ContinuousRun_Duration,"<Value>"` (Set)

Arguments

Argument Name	Argument value
<Value>	Infinite | hh:mm Infinite sets the radio on button to infinite. hh:mm sets the continuous run duration to the specified time in hours and minutes. The minimum time duration you can set is 00:30.

Returns

Infinite | hh:mm

Examples

`TEKEXP:VALUE? ContinuousRun_Duration` command returns the continuous run duration time value.

`TEKEXP:VALUE ContinuousRun_Duration,"<Value>"` command sets the continuous run duration time value.

Set or query the session create option in the continuous run function

This command sets or queries the option for session creation in the continuous run function.

Syntax

`TEKEXP:VALUE? ContinuousRun_RunSessionOptions` (Query)

`TEKEXP:VALUE ContinuousRun_RunSessionOptions,"Value"` (Set)

Arguments

Argument Name	Argument value
<Value>	NewSession | SameSession_ClearResults NewSession - creates new session for each run. SameSession_ClearResults - Clears the test results of the current session and starts the test execution. The session results will be added in the same session, by erasing the previous run results.

Returns

NewSession | SameSession_ClearResults

Examples

`TEKEXP:VALUE? ContinuousRun_RunSessionOptions` command returns the option for session creation in the continuous run function.

`TEKEXP:VALUE ContinuousRun_RunSessionOptions,"Value"` command sets the option for session creation in the continuous run function.

Set or query the View report after generating option status

This command sets or queries the enable/disable status of the View report after generating function.

Syntax

`TEKEXP:VALUE? GENERAL,"View Report After Generating"` (Query)

`TEKEXP:VALUE GENERAL,"View Report After Generating",<value>` (Set)

Arguments

Argument Name	Argument value
<Value>	{True | False} or {1 | 0} It represents enabled or disabled. Where, • True or 1 - enabled • False or 0 - disabled

Returns

{True | False} or {0 | 1}

Examples

`TEKEXP:VALUE? GENERAL,"View Report After Generating"` command returns the enable or disable status of view report after generating option.

`TEKEXP:VALUE GENERAL,"View Report After Generating",<value>` command enable or disable the view report after generating option.

Returns the report as XML string

This command returns the report as XML string.

Syntax

`TEKEXP:REPORTASXML?` (Query)

Returns

<String>

Examples

`TEKEXP:REPORTASXML?` command returns the report XML string.

Copies all the images from current run session to the given destination location

This command copies all the images from current run session to the given destination location.

Syntax

`TEKEXP:COPYIMAGES <DestinationPath>` (Set)

Command argument

<DestinationPath> :: <String>

Returns

NA

Examples

`TEKEXP:COPYIMAGES C:\Temp` command copies all the images from current run session to the mentioned location.

Selects the specified test(s) and deselect all other tests

This command selects the specified test(s) and deselect all other tests.

Syntax

`TEKEXP:SELECTID <"TestID">` (Set)

Command argument

Argument Name	Argument value
TestID	String

Returns

NA

Examples

`TEKEXP:SELECTID "11101"` This command select the test associated with the ID and deselects all other tests in the application.

`TEKEXP:SELECTID "11101,11102"` This command selects the tests associated with the IDs and other tests will be deselected.

Returns the complete information about the selected test

This command returns the complete information about the selected test.

The information includes application name, TestID, Device selected, Suite selected, version, Test name, Test description.

Syntax

`TEKEXP:TESTINFO?` (Query)

Returns

<String>

Examples

`TEKEXP:TESTINFO?` This command returns the following details:

<TekExpress> <Test Id="11101" Device="TX-Device" Suite="Group1" Version="Spec 1.0" Name="Algorithm Library Measurement" Description="This is Algorithm Library measurement test. Refer Section-B of TekExpress SampleApp Development Guide for more details.

Set the default session

Sets the application configurations to default value.

Syntax

`TEKEXP:SESSION DEFAULT` (set)

Examples

`TEKEXP:SESSION DEFAULT`, sets the application configurations to default value.

Save the run/config sessions

Enter the name to save/config the session.

Syntax

`TEKEXP:SESSION SAVE,"Session Name"` (set)

Command arguments

Argument Name	Argument value
<Session Name>	<String>

Examples

`TEKEXP:SESSION SAVE,"Session Name"` saves the session.

Load the run/config session

Load the selected config/run session.

Syntax

`TEKEXP:SESSION LOAD, "Session Name"` (set)

Command arguments

Argument Name	Argument value
<Session Name>	<String>

Examples

`TEKEXP:SESSION LOAD, "Session Name"`, load the selected config/run session.

Delete the run/config session

Deletes the selected config/run session.

Syntax

`TEKEXP:SESSION DELETE, "Session1, Session2"` (set)

Command arguments

Argument Name	Argument value
<Session Name>	<String>

Examples

`TEKEXP:SESSION DELETE, "Session1, Session2"`, deletes the selected config/run session.

Run the run/config saved session

Run the selected config/run session.

Syntax

`TEKEXP:SESSION RUN, "Session Name's separated by comma"` (set)

Command arguments

Argument Name	Argument value
<Session Name>	<String>
Session Name's separated by comma (to run the multiple run sessions)	<String>

Examples

`TEKEXP:SESSION RUN, "Session Name's separated by comma"`, runs the selected config/run session.

Query the available list in the run/config session

Returns the list of available config/run session.

Syntax

`TEKEXP:SESSION? LIST`

Returns

Returns the list of available config/run session.

Examples

`TEKEXP:SESSION? LIST`, returns the list of available config/run session.

Query the current run/config session

Returns the selected config/run session.

Syntax

`TEKEXP:SESSION? CURRENT`

Returns

Returns the selected config/run session.

Examples

`TEKEXP:SESSION? CURRENT`, returns the selected config/run session.

Override the run/config session

Overrides the selected config/run session.

Syntax

`TEKEXP:SESSION SAVE,"SessionName", "True"` (set)

Command arguments

Argument Name	Argument Type	Argument Value
<Session Name>	<String>	{True | False} or {1 | 0} It represents enabled or disabled. Where, • True or 1 - enabled • False or 0 - disabled

Returns

{True | False} or {0 | 1}

Examples

`TEKEXP:SESSION SAVE,"SessionName", "True"`, overrides the selected config/run session.

SFP+ QSFP+ Tx tests

Testing procedures and examples

Signal types used by tests

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

Host profile

Table 18: 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)		
Crosstalk Source Rise/Fall Time (20%-80%)	8180	PRBS7, PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31, 8180
Crosstalk Source Amplitude (p-p)		
Signal Rise/Fall Time (20%-80%)		
Total Jitter	PRBS31	PRBS7, PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31
Total Jitter @ J2		
Total Jitter @ J9		
Data Dependent Jitter	PRBS9	PRBS7, PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31
Data Dependent Pulse Width Shrinkage (DDPWS)		PRBS7, PRBS9, PRBS11, PRBS15
Uncorrelated Jitter		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)		
Output AC Common Mode voltage (RMS) (for Cu)	PRBS31	PRBS7, PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31
Host Output TWDPc	PRBS9	PRBS9

Module profile

Table 19: 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		

Table continued…

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

Oscilloscope setup

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

Table 20: Horizontal setup

Mode	Sample Rate	Record Length	Acquisition Mode
Manual	100 GS/s	5M, 10M	100 GS/s

Table 21: Vertical setup

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

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.

Host test: SFF-8431 table 11 tests

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 *Connection Setup for Host Tests*: 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.

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 *Connection Setup for Host Tests*: 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) ÷ 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.

Host test: SFF-8431 table 12 tests

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 *Connection Setup for Host Tests*: Table 12 Crosstalk Source Tests.

Signal validation

For compliance, perform *Signal Validation Procedure*.

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

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 *Connection Setup for Host Tests*: Table 12 Crosstalk Source Tests.

Signal validation

For compliance, perform *Signal Validation Procedure*.

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.

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 *Connection Setup for Host Tests*: All other Host tests.

Signal validation

For compliance, perform *Signal Validation Procedure*.

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.

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 *Connection Setup for Host Tests*: 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 ÷ 10^4). If the record length is 2M, the number of points in the zoomed part will be 200.

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 *Connection Setup for Host Tests*: All other Host tests.

Signal validation

For compliance, perform *Signal Validation Procedure*.

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 ÷ 10^4). If the record length is 2M, the number of points in the zoomed part will be 200.

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 *Connection Setup for Host Tests*: All other Host tests.

Signal validation

For compliance, perform *Signal Validation Procedure*.

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.

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 *Connection Setup for Host Tests*: All other Host tests.

Signal validation

For compliance, perform *Signal Validation Procedure*.

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:

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

where σr is the standard deviation of the jitter on the rising edge

where σf 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 ÷ 10^4). If the record length is 2M, the number of points in the zoomed part will be 200.

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 *Connection Setup for Host Tests*: All other tests.

Signal validation

For compliance, perform *Signal Validation Procedure*.

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
- 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: $\sqrt{(levelONEnoise^2 + LevelZEROnoise^2)/2}$

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

- Measure Relative Noise as:

  The required result Tx Qsq is given by Tx Qsq = 1 ÷ 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

Table continued…

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.

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) ÷ (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 *Connection Setup for Host Tests*: 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.

Host test: SFF-8431 table 33 tests

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 *Connection Setup for Host Tests*: All other Host tests.

Signal validation

For compliance, perform *Signal Validation Procedure*.

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.

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 × Noise (rms) ÷ VMA. And Noise(rms) = Sq rt ((LogicONENoise(rms)2 + LogicZERONoise(rms) 2) ÷ 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 *Connection Setup for Host Tests*: All other Host tests.

Signal validation

For compliance, perform *Signal Validation Procedure*.

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: $\sqrt{(levelONEnoise^2 + LevelZEROnoise^2)/2}$

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

- Measure Relative Noise as:

  The required result TxQsq is given by TxQsq = 1 ÷ 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.

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) ÷ 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 *Connection Setup for Host Tests*: 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) ÷ 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.

Host output TWDPc

Note: The Host Output TWDPc test is supported only on oscilloscopes that support 100 Gs/s. For details, see *Compatibility*.

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 *Connection Setup for Host Tests*: All other Host tests.

Signal validation

For compliance, perform Signal Validation Procedure.

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

Module test: SFF-8431 table 16 tests

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 *Connection Setup for Module Tests*: 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) ÷ 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 theMin andMax 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.

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 *Connection Setup for Module Tests*: 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.

Module test: SFF-8431 table 17 tests

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 *Connection Setup for Module Tests*: All other Module tests.

Signal validation

For compliance, perform *Signal Validation Procedure*.

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.

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 *Connection Setup for Module Tests*: All other Module tests.

Signal validation

For compliance, perform *Signal Validation Procedure*.

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.

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)÷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 *Connection Setup for Module Tests*: 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) ÷ 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.

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 10–12 minus the early time at which the BER is 10–12. 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 *Connection Setup for Module Tests*: 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 ÷ 10^4). If the record length is 2M, the number of points in the zoomed part will be 200.

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 *Connection Setup for Module Tests*: All other Module tests.

Signal validation

For compliance, perform *Signal Validation Procedure*.

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**
    - Window 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

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 ÷ 10^4). 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 *Connection Setup for Module Tests*: All other Module tests.

Signal validation

For compliance, perform *Signal Validation Procedure*.

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.

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 *Connection Setup for Module Tests*: All other Module tests.

Signal validation

For compliance, perform *Signal Validation Procedure*.

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:

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

  where σr is the standard deviation of the jitter on the rising edge

  where σf 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 ÷ 10^4). If the record length is 2M, the number of points in the zoomed part will be 200.

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) ÷ (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 *Connection Setup for Module Tests*: 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**, click **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}

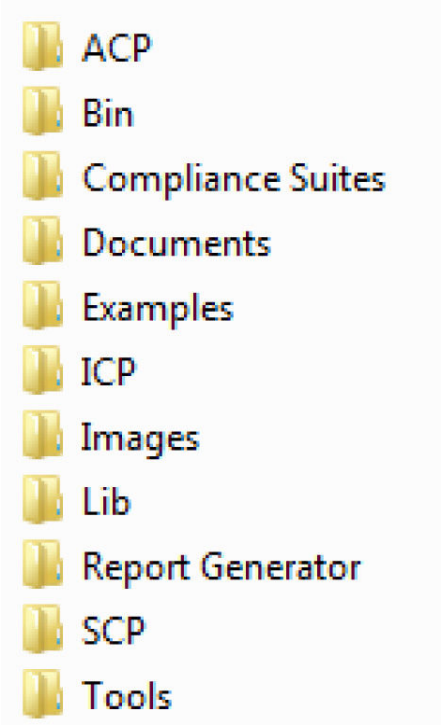
Snapshot and cursor placement details

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

References

Application directories

You can find the application files at *C:\Program Files\Tektronix\TekExpress SFP+ QSFP+*. The application directory and associated files are organized as follows:



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

Table 22: Application directories and usage

Directory names	Usage
ACP	Contains instrument and application specific interface libraries
Bin	Contains application libraries
Compliance Suites	Contains test suite specific files
Documents	Contains the technical documents of the application.
Examples	Contains various support files
ICP	Contains instrument and application specific interface libraries
Images	Contains images of the application
Lib	Contains utility files specific to the application
Licenses	Contains all the license files
Report Generator	Contains style sheets for report generation
SCP	Contains instrument and application specific interface libraries
Tools	Contains instrument and application specific files

File name extensions

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

Table 23: File name extension

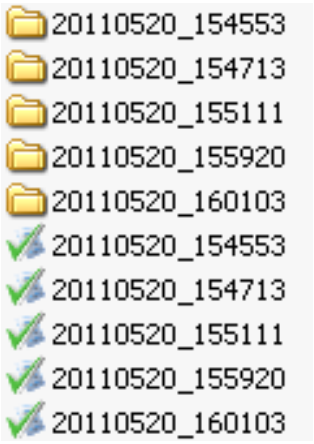
File name extension	Description
*.TekX	Application session files (the extensions may not be displayed)
*.py	Python sequence file.
*.xml	Test-specific configuration information (encrypted) files. Application log files
*.csv	Test result reports Plot data
*.mht	Test result reports (default) Test reports can also be saved in HTML format
*.pdf	Test result reports Application help document
*.xslt	Style sheet used to generate reports
*.png	Captured images
.wfm	Test waveform file

View test-related files

Files related to tests are stored in My Documents\TekExpress SFP+ QSFP+\Untitled session folder. Each test setup in this folder has both a test setup file and a test setup folder, both with the test setup name. The test setup file is preceded by the TekExpress icon.

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:



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 X:\TekExpress SFP+ QSFP+. When you name and save the session, the files are placed in a folder with the name that you specify. A copy of the test files stay in the Untitled Session folder until you run a new test or until you close the application.

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 24: Measurement sampling rates

Measurement	Oscilloscope model
	DPO/DSA/MSO C, D, DX, and SX 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

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.

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**.

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