Tektronix®

TekExpress® 100G-TXE Compliance Solution

Printable Application Help

077-1344-00

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Printable Application Help

www.tek.com
077-1344-00

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

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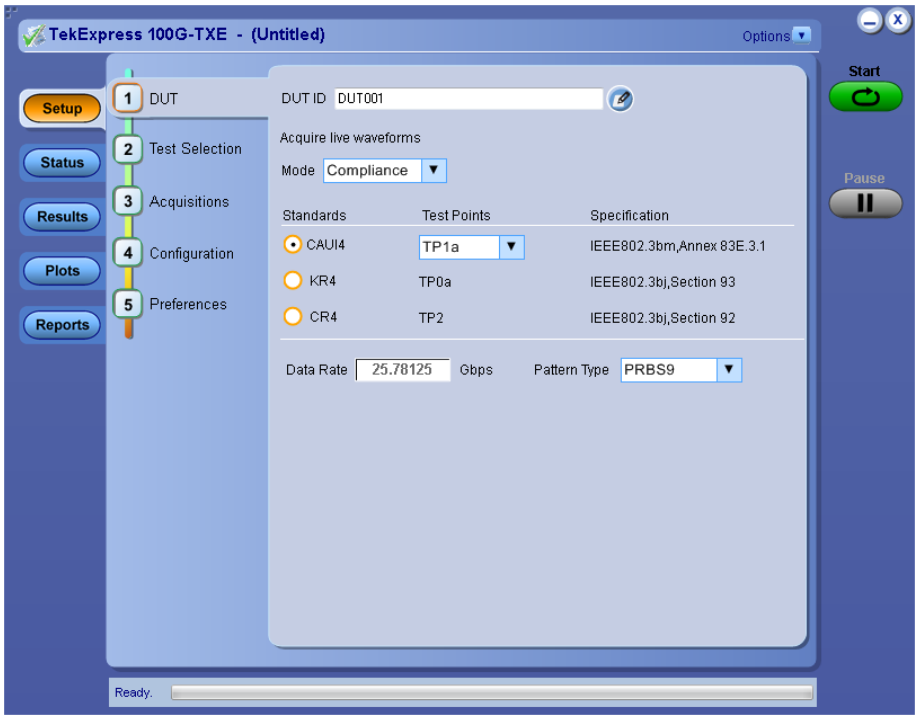


Welcome to the Tektronix 100G-TXE, an Tektronix oscilloscope application software that addresses 100GBASE-CR4, 100GBASE-KR4, and CAUI-4 standards of IEEE. These three electrical standards make up the backbone of the current 100G Ethernet industry, and the TekExpress 100G-TXE automation test solution facilitates turnkey electrical transmitter validation of most 100G Ethernet systems today.

The 100G-TXE solution specifically targets sections 83E of the IEEE 802.3bm standard as well as sections 92 and 93 of the IEEE 802.3bj specification. These tools allow quick verification to these IEEE electrical standards, while offering comprehensive test automation, results margining, data logging, and results reporting in an advanced testing framework.

Key features of TekExpress 100G-TXE include:

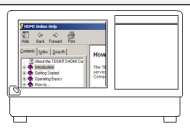
- 100G-TXE offers Transmitter 100GBASE-CR4 time domain transmitter characterization, tracking Table 92-6 Transmitter characteristics at TP2 from the IEEE 802.3bj cabled I/O specification. This offers a checklist approach to performing all jitter, Linear impulse response pulse peak and Signal to Noise and Distortion Ratio measurements, as well as basic AC parametric and timing operations.
- 100G-TXE also incorporates 100GBASE-KR4 time domain transmitter characterization, tracking Table 93-4 Transmitter characteristics at TP0a from the IEEE 802.3bj backplane specification. While the measurements are identical to 100GBASE-CR4, the electrical limits for 100GBASE-KR4 are more stringent.
- 100G-TXE includes a third electrical test suite, for Annex 83E of IEEE 802.3bm, tracking Chip-to-module 100 Gb/s four-lane Attachment Unit Interface (CAUI-4), Table 83E-3.1 at TP1a and Table 83E-3.2 at TP4. The user defined test point selection allows unique test limits relevant to host channel or module validation. The CAUI-4 support offers advanced CTLE scanning provisions to find optimal eye opening/width.

Getting help and support

Related documentation

The following documentation is available as part of the TekExpress® 100G-TXE Solution application.

Table 1: Product documentation

Item	Purpose	Location
Help	Application operation and User Interface help	
PDF of the help	Printable version of the compiled help	 PDF file that ships with 100G-TXE Solution software distribution (*TekExpress 100G-TXE-Automated-Test-Solution-Software-Printable-Help-EN-US.pdf*).

See also *Technical support*

Conventions

Help uses the following conventions:

- The term "Application," and "Software" refers to the TekExpress 100G-TXE Solution application.
- The term "CAUI4" refers to CAUI-4, IEEE 802.3bm standard.
- The term "KR4 / CR4" refers to 100GBASE-KR4 or 100GBASE-CR4, IEEE 802.3bj standard.
- 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.

Table 2: Icon descriptions

Icon	Meaning
	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

Minimum system requirements

The following table shows the minimum system requirements to install and run the TekExpress 100G-TXE solution.

Table 3: System requirements

Component	Description
Oscilloscope	■ Tektronix DSA8300 Digital Serial Analyzer ■ Firmware Version: 6.4.1.0 or greater ■ 80SJNB Software Version: 4.0.8.0 or greater ■ Opt ADVTRIG ■ Opt JNB02
Processor	Same as the oscilloscope
Operating System	Same as the oscilloscope
Memory	Same as the oscilloscope
Hard Disk	Same as the oscilloscope
Display	Super VGA resolution or higher video adapter (800 x 600 minimum video resolution for small fonts or 1024 x 768 minimum video resolution for large fonts). The application is best viewed at 96 dpi display settings [1]
Firmware	■ TekScope 6.4.1.0 or greater (for Windows 7) ■ 80SJNB Software Version: 4.0.8.0 or greater
Software	■ IronPython 2.7.3 installed ■ PyVisa 1.0.0.25 installed ■ Microsoft .NET 4.0 Framework ■ Microsoft Internet Explorer 7.0 SP1 or greater, or other Web browser for viewing reports ■ Adobe Reader software 7.0 or greater for viewing portable document format (PDF) files
Other Devices	■ Microsoft compatible mouse or compatible pointing device. ■ Two USB ports (four USB ports recommended).

[1] If TekExpress is running on an instrument that has a video resolution less than 800x600, connect and configure a second monitor to the instrument.

Instruments and accessories required

100G-TXE application is launched on DSA8300 sampling scope. The following table lists the instruments and accessories required for this application.

Table 4: Instruments and accessories required for 100G-TXE application

Instrument/Accessory	Model number	Quantity
Sampling Oscilloscope	Tektronix DSA8300 Digital Serial Analyzer	1
Sampling oscilloscope modules	80E07, 80E07B 80E08, 80E08B 80E09, 80E09B 80E10, 80E10B	
Clock Recovery Unit	CR286A	1
Module extender cables	80X01 (1 meter) 80X02 (2 meters)	
Phase Reference	82A04B (Optional) [2]	
Other accessories	80A08 accessory kit	

Installing the software

Follow the steps to download and install the latest TekExpress 100G-TXE Solution. See *Minimum system requirements* for compatibility.

1. Go to *www.tek.com*.
2. Click Downloads; Select **DOWNLOAD TYPE** as Software and type 100G-TXE Solution in **MODEL OR KEYWORD** field; Click **Search**.
3. Select the latest version of software and follow the instructions to download. 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 100G-TXE\
5. Select **Application** > **100G-TXE** from the TekScope menu to *launch the application*

[2] Required to reach jitter noise floors below 100fsec

View software version

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

To view version information for 100G-TXE, click button in the TekExpress application and select **About TekExpress**.

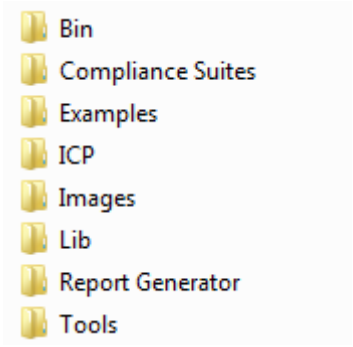
NOTE. *This example shows a typical Version Details dialog box, and may not reflect the actual values as shown when you open this item in the application.*

Application directories

TekExpress 100G-TXE application

The TekExpress 100G-TXE application files are installed at the following location:

C:\Program Files\Tektronix\TekExpress\TekExpress 100G-TXE



The following table lists the application directory names and their purpose.

Table 5: Application directories and usage

Directory names	Usage
Bin	Contains TekExpress 100G-TXE application libraries
Compliance Suites	Contains compliance-specific files
Examples	Contains various support files
ICP	Contains instrument and TekExpress 100G-TXE application-specific interface libraries
Images	Contains images of the TekExpress 100G-TXE application
Lib	Contains utility files specific to the TekExpress 100G-TXE application
Report Generator	Contains style sheets for report generation
Tools	Contains instrument and TekExpress 100G-TXE application-specific files

See also *View test-related files*

File name extensions

File name extensions

The TekExpress 100G-TXE application uses the following file name extensions:

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

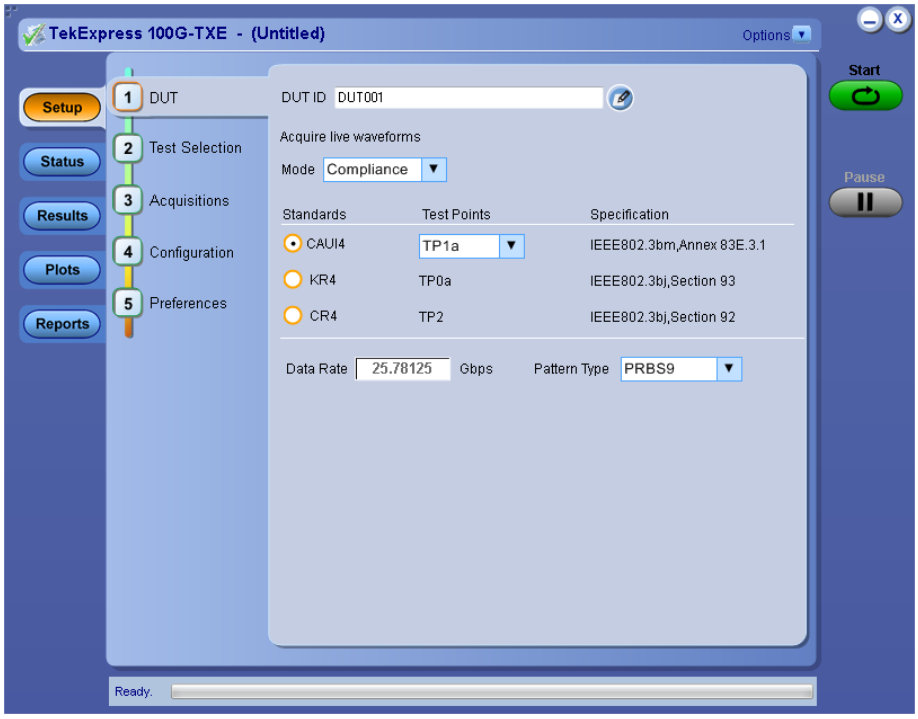
See also *View test-related files*

Application directories

Operating basics

Launch the application

To launch the TekExpress 100G-TXE solution, select **Application > 100G-TXE** from the TekScope menu.



When you launch the application for the first time, the file C:\Users\<username>\Documents\My TekExpress\100G-TXE\Resources.xml is mapped to drive X:. This file contains information about available network-connected instruments. The session files are stored in X:\100G-TXE\. If this file is not found, then the application runs Instrument Discovery Program to detect the network-connected instruments before launching 100G-TXE solution.

If the application is behind the oscilloscope application, click **Application > 100G-TXE** to bring it to the front. To keep the 100G-TXE application window on top, select **Keep On Top** from the 100G-TXE *Options menu*.

See also *Application controls*

Application panel overview

Application panels overview

TekExpress 100G-TXE solution uses panels to group Configuration, Results, and Reports settings. Click any button to open the associated panel. A panel may have one or more tabs that list the selections available in that panel. Controls in a tab can change depending on settings made in the same tab or another tab.

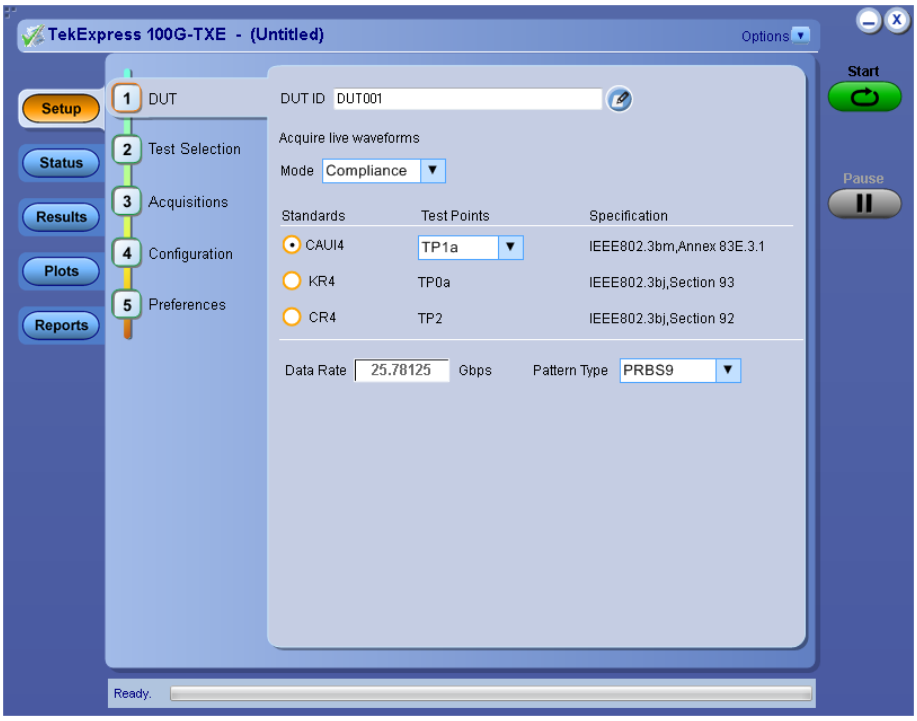


Table 6: Application panels overview

Panel Name	Purpose
Setup panel	The Setup panel shows the test setup controls. Click the **Setup** button to open this panel. Use this panel to: ■ *Set DUT tab parameters* ■ *Select tests* ■ *Set acquisition tab parameters* ■ *Set configuration tab parameters* ■ *Set preferences tab parameters*
Status panel	View the progress and analysis status of the selected tests, and view test logs.
Results panel	View the summary of test results and select result viewing preferences.
Plots panel	Displays the result as a two-dimensional plot for additional measurement analysis.
Reports panel	Browse for reports, save reports as specific file types, specify report naming conventions, replace current test results in the report with the test result(s) of previous run in current session, select report content to include (summary information, detailed information, user comments, setup configuration, application configuration), and select report viewing options.

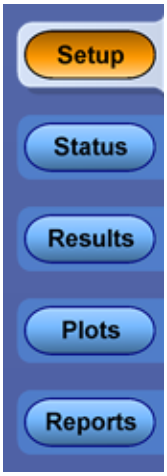
See also *Application controls*

Global application controls

Application controls

This section describes the application controls.

Table 7: Application controls description

Item	Description
Options menu 	To select global application controls.
Test Panel buttons 	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**.

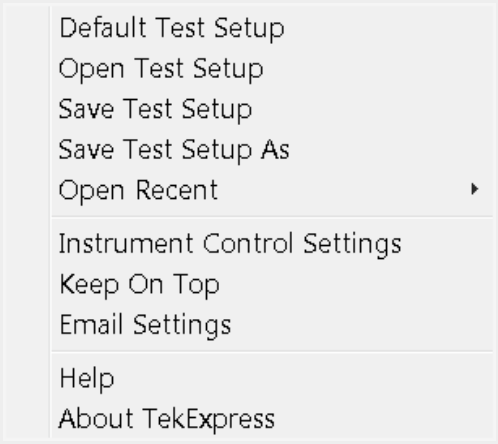
Item	Description
Clear button 	Use the Clear button to clear all existing measurement results. Adding or deleting a measurement, or changing a configuration parameter of an existing measurement, also clears measurements. This is to prevent the accumulation of measurement statistics or sets of statistics that are not coherent. This button is available only on *Results panel*.
Application window move icon 	Place the cursor over the three-dot pattern in the upper left corner of the application window. When the cursor changes to a hand, drag the window to the desired location.
Minimize icon 	Click to minimize the application.
Close icon 	Click to close the application.

See also. *Application panel overview*

Options menu overview

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

Options menu



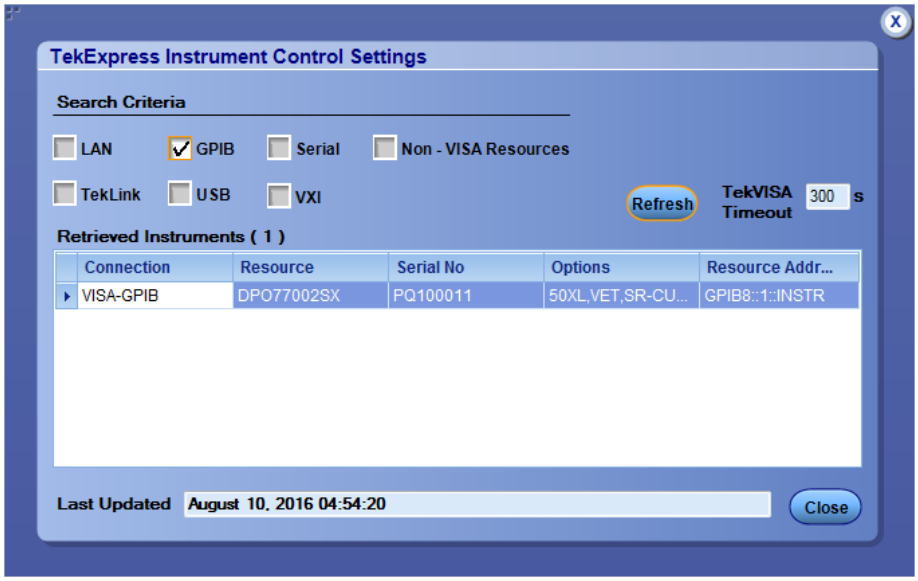
Menu	Function
Default Test Setup	Opens an untitled test setup with defaults selected Acquire Live Waveforms **Mode**: Compliance **Standards**: CAUI4 **Test Point**: TP1a **Specification**: IEEE802.3bm, Annex 83E.3.1 **Data rate**: 25.78125 **Pattern Type**: PRBS9
Open Test Setup	Opens a saved test setup
Save Test Setup	Saves the current test setup
Save Test Setup As	Saves the current test setup with a different file name or file type
Open Recent	Displays the recently opened test setups to open
Instrument Control Settings	Detects, lists, and refreshes the connected instruments found on specified connections (LAN, GPIB, USB, and so on)
Keep On Top	Keeps the TekExpress 100G-TXE application on top of all the application
Email Settings	Use to configure email options for test run and results notifications
Help	Displays the TekExpress 100G-TXE help
About TekExpress	■ Displays application details such as software name, version number, and copyright ■ Provides a link to the end-user license agreement ■ Provides a link to the Tektronix Web site

See also. *Application controls*

TekExpress instrument control settings

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

You can access this dialog box from the **Options** menu.



The connected instruments displayed here can be selected for use under Global Settings in the test configuration section.

NOTE. *Select GPIB (Default) when using TekExpress 100G-TXE application.*

See also. *Options menu overview*

View connected instruments

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

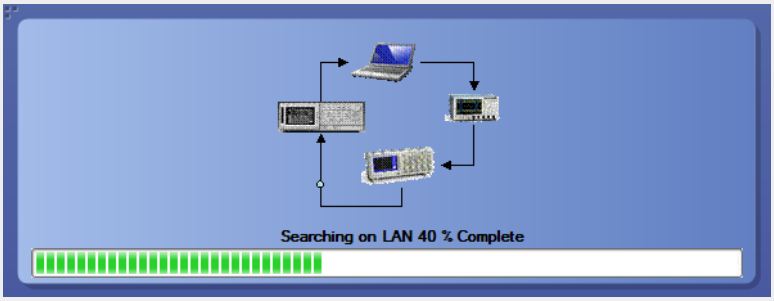
NOTE. *The instruments required for the test setup must be connected and it must be recognized by the application before running the test.*

To refresh the list of connected instruments:

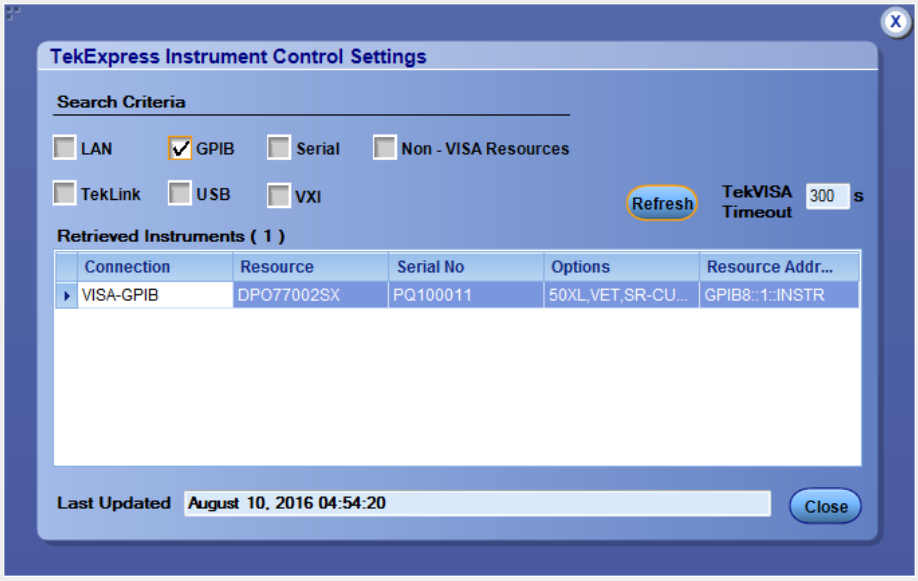
1. From the Options menu, select **Instrument Control Settings**.
2. In the **Search Criteria** section of the Instrument Control Settings dialog box, select the connection types of the instruments to search.

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 TekExpress that are communicating over the LAN.

3. Click **Refresh**. TekExpress searches for connected instruments.



4. After searching, the dialog box lists the instrument-related details based on the search criteria. For example, For the Search Criteria as LAN and GPIB, the application displays all LAN and GPIB instruments connected to the application.



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.

See also. *Equipment connection setup*

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:

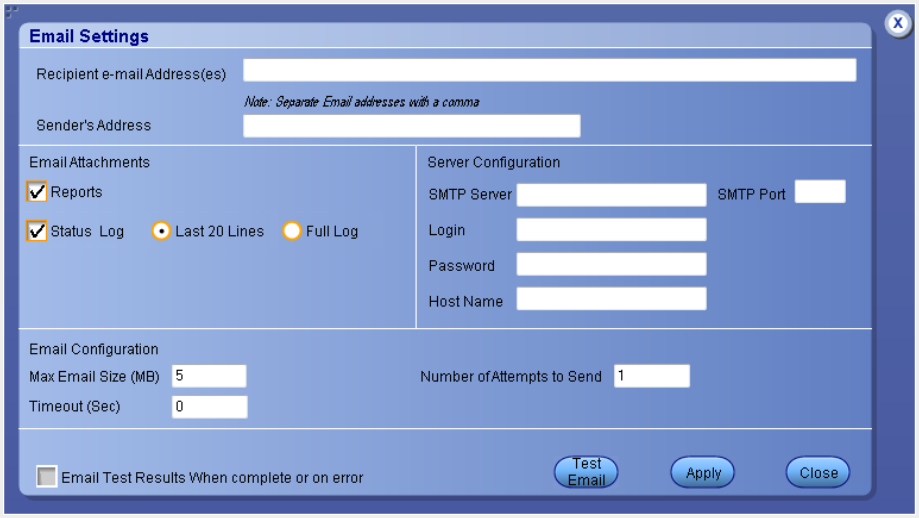
1. Select **Options > Email Settings** to open the *Email Settings* dialog box.
2. (Required) For Recipient email Address(es), enter one or more recipient email addresses. To include multiple addresses, separate the addresses with commas.
3. (Required) For Sender's Address, enter the email address used 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.

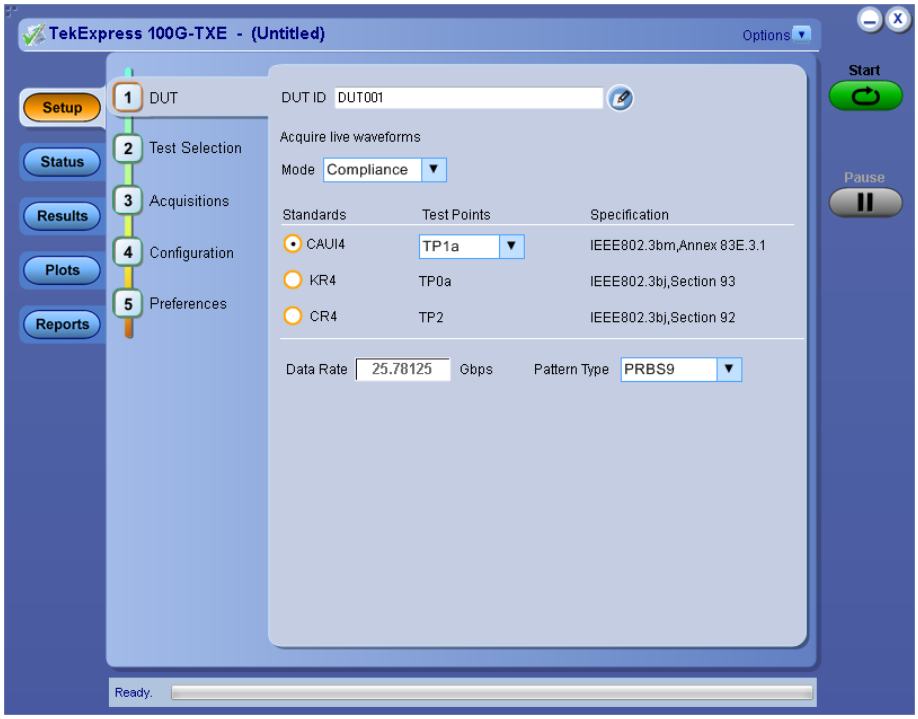
Email Settings



Setup panel

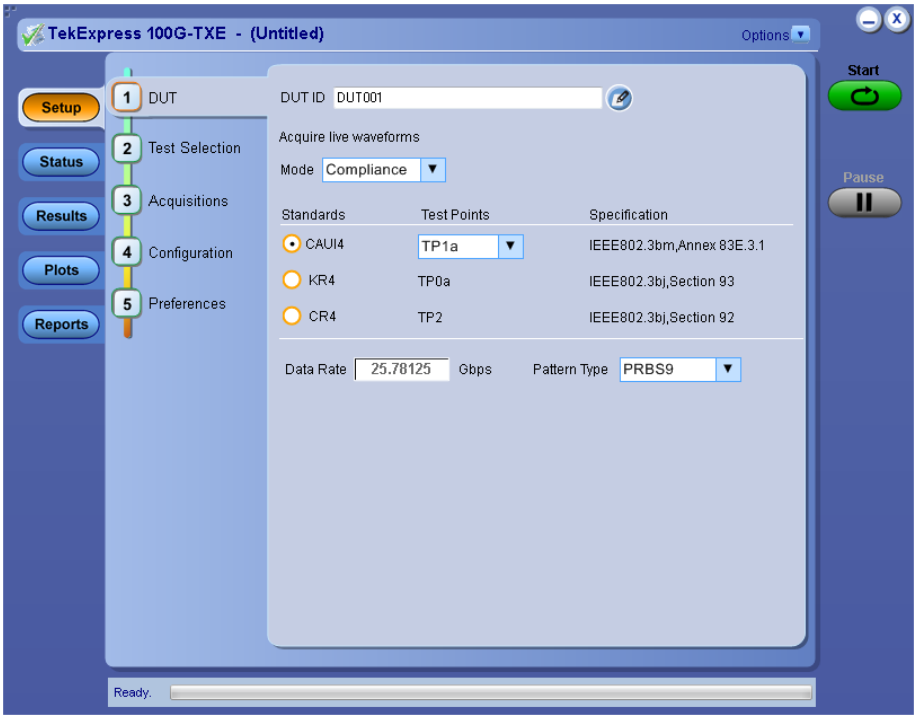
Setup panel overview

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



Set DUT parameters

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.



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

Table 8: DUT tab settings

Setting	Description	
DUT ID	Adds an optional text label for the DUT to reports. The default value is DUT001. The maximum number of characters is 32. You cannot use the following characters in an ID name: (.,..,..., \,/:?"<>|*)	
Comments icon (to the right of the DUT ID field)	Opens Comments dialog box to enter text to add to the report. Maximum size is 256 characters. To enable or disable comments appearing on the test report, see *Select report options*.	
Acquire live waveforms	Perform analysis on live waveforms.	
Mode	■ Compliance ■ User Defined	
Standards	**Test Points**	**Specification**
CAUI4 [1]	TP1a	IEEE802.3bm, Annex 83E.3.1
	TP4	IEEE802.3bm, Annex 83E.3.2
KR4 [2]	TP0a	IEEE802.3bj, Section 93
CR4 [3]	TP2	IEEE802.3bj, Section 92

[1] CAUI4 (CAUI-4) is 100G chip-to-module IEEE 802.3bm interface, operating on four 25 Gb/s lanes.
[2] KR4 (100GBASE-KR4) is an Ethernet IEEE 802.3bj standard for 100G backplanes.
[3] CR4 (100GBASE-CR4) is an Ethernet IEEE802.3bj standard for 100G over twin-axial cables.

Setting	Description
Data Rate	Set the data rate to be tested within the range 18 to 28.05. The default value is 25.78125
Pattern Type	Select the pattern type. The available options are PRBS7, 9, 11, and 15. By default, it is PRBS9.

See also. *Select tests*

Select tests

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

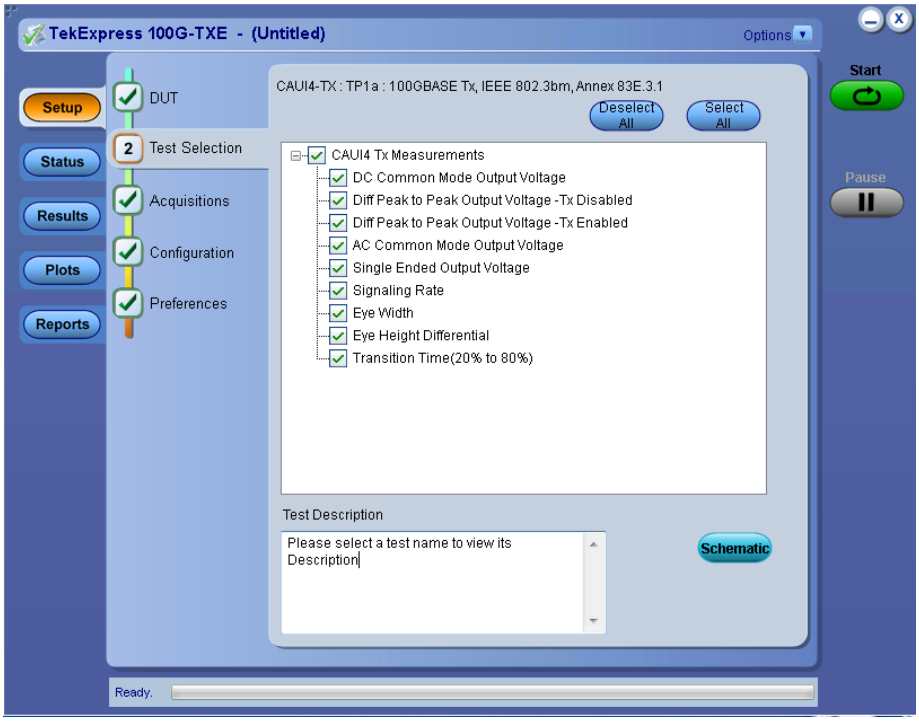


Figure 1: CAUI4 TX measurements

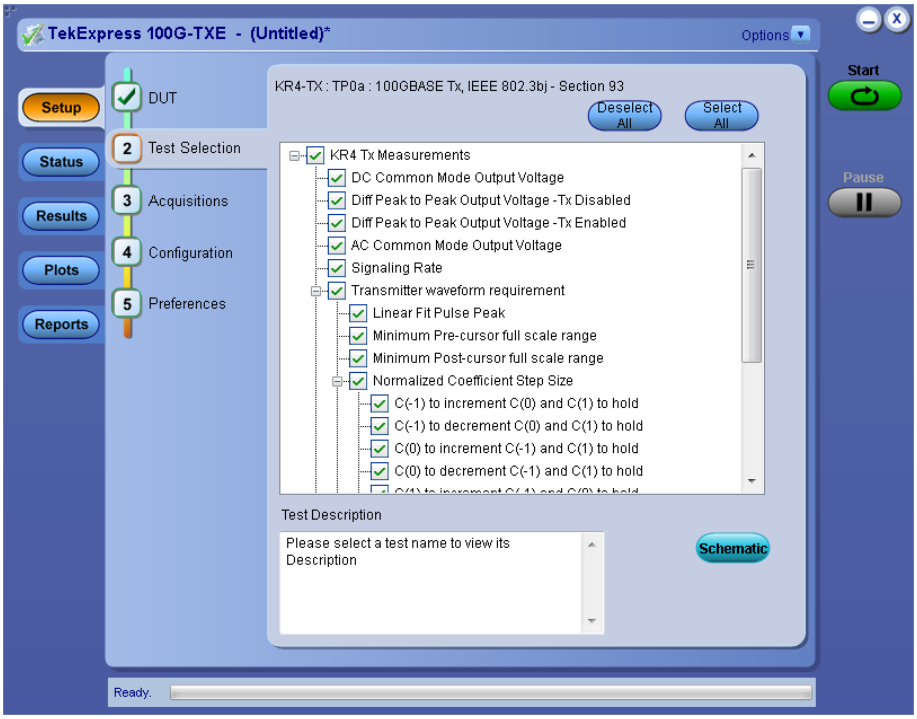


Figure 2: KR4 TX measurements

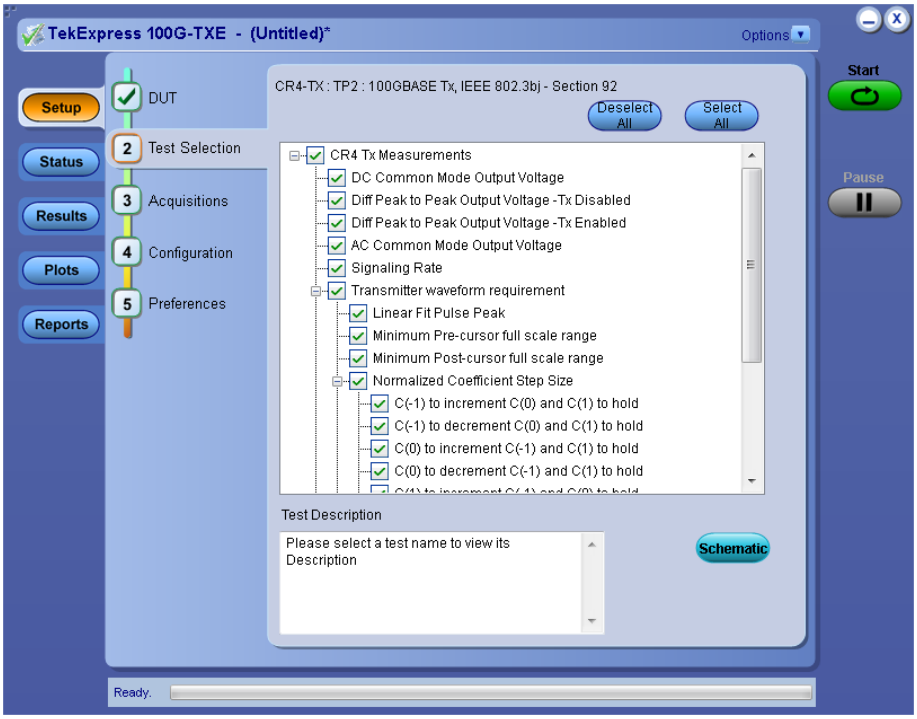


Figure 3: CR4 TX measurements

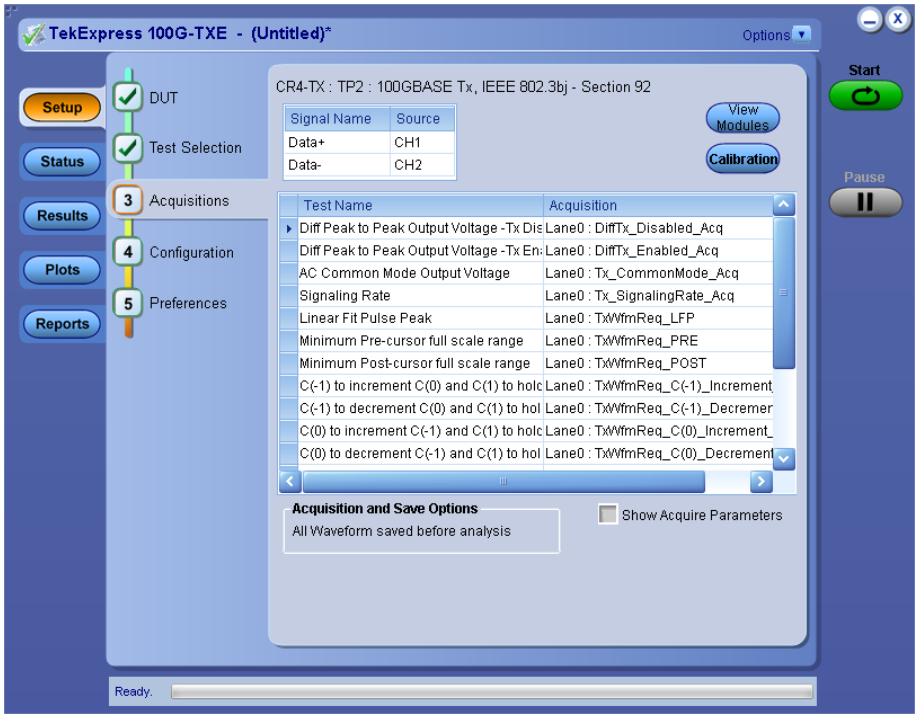
Table 9: Test Selection tab settings

Setting	Description
Tests	Click on a test to select or unselect. Highlight a test to show details in the Test Description pane.
Test Description	Shows brief description of the highlighted test in the Test field.

See also. *Set acquisition tab parameters*

Set acquisition tab parameters

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



NOTE. *100G-TXE application acquires all waveforms needed by each test group before performing analysis.*

Table 10: Acquisitions tab settings

Setting	Description
Show Acquire Parameters	Select to view the acquisition parameters.

TekExpress 100G-TXE 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:\100G-TXE\Untitled Session\<dutid>\<date>_<time>. Images created for each analysis, CSV 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.

Set configuration tab parameters

Use Configuration tab to view and configure the Global Settings and the measurement configurations. The Global Settings and the measurements with configurations available in this tab depends on the Standards selected in the DUT tab.

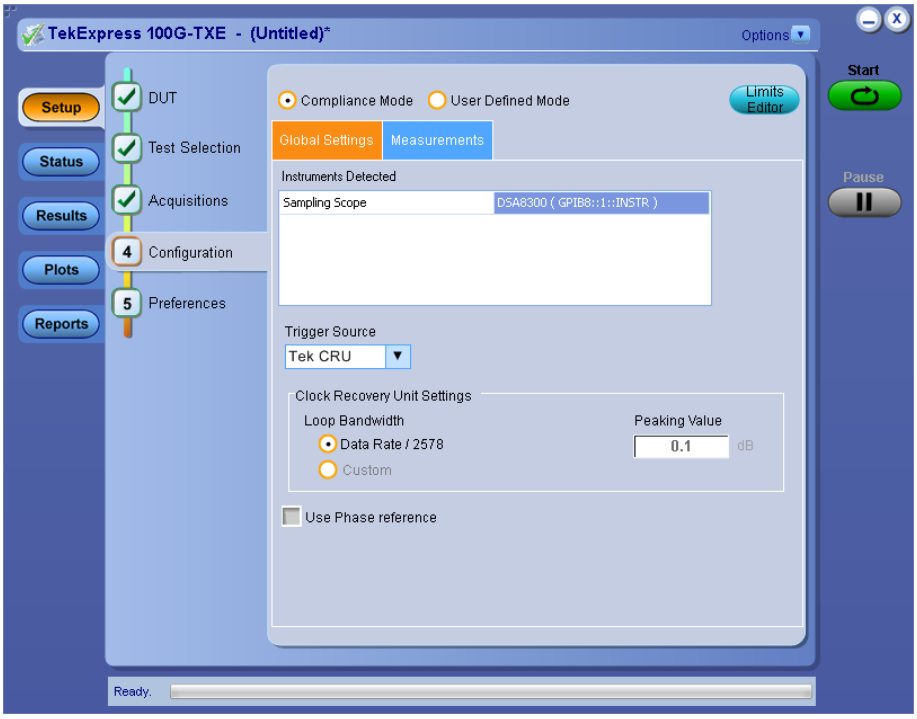


Figure 4: Configuration tab: Global Settings

Table 11: Configuration tab settings

Setting	Description
Compliance Mode	Select compliance mode. By default, Compliance Mode is selected.
User Defined Mode	Select user defined mode
Global Settings	

Setting	Description
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** and click Refresh to update the instrument list. ***NOTE.*** *Verify that the* ***GPIB*** *search criteria (default setting) in the Instrument Control Settings is selected when using TekExpress 100G-TXE application.*
Trigger Source	■ Tek CRU ■ Others
Clock Divider	Select the clock output divider ratio.
Clock Recovery Unit Settings	
Loop Bandwidth	■ Data Rate / 2578 ■ Custom
Peaking Value	Enter the peaking value. It is the degree of allowable peak response (dB) associated with a Phase Locked Loop(PLL) in a CRU.

Setting	Description
CTLE Filter File	Select the CTLE Filter File. **Compliance mode** ■ All(1-9dB): Application will run through all CTLE filters from 1 dB - 9 dB (at TP1a) and 1 dB - 2 dB (at TP4) ■ Best CTLE: After the first run, Best CTLE filter option gets enabled. User can run the measurement with Best CLTE instead of looping through all CTLE filters in the specification. **User Defined mode** ■ User can run the measurement with any specified CTLE filter. The application provides CTLE filters from 0 dB - 9 dB for data rate of 25.78125 Gbps. It is recommended to create custom CTLE filter files for any other data rates. Select the CTLE filters from the drop-down list or Custom to browse and select the custom CTLE filter files. ***NOTE.*** *Custom CTLE filter files is to be named in the format <user defined name>_ndB.flt, where n is the gain of the filter.*
Use Phase reference [4]	Select to extend the capability of the digital serial analyzer sampling oscilloscope by providing low jitter/drift sample position information.

Set preferences tab parameters

Use Preferences tab to set the application action on completion of a measurement.

[4] Phase reference setting is enabled when the phase reference module is connected to the sampling scope. By default, this setting is selected.

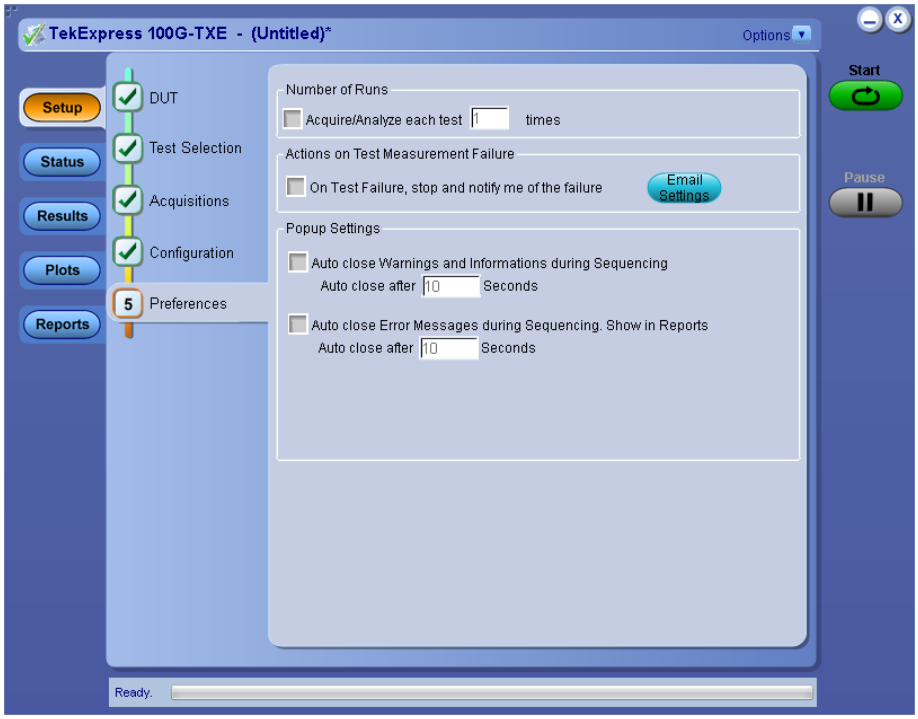


Table 12: Preferences tab settings

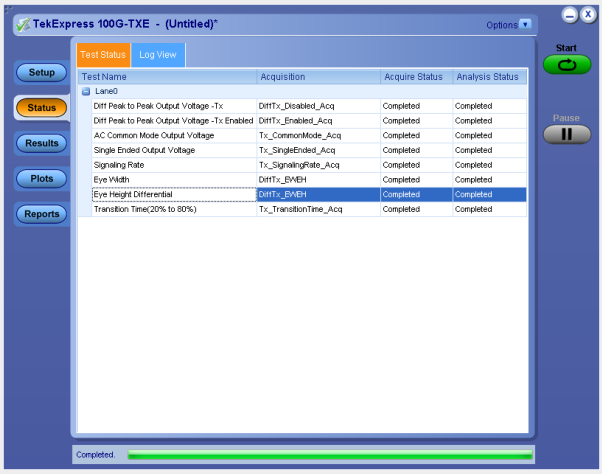
Setting	Description
Number of Runs	
Acquire/Analyze each test <no> times (not applicable to Custom Tests)	Select to repeat the test run by setting the number of times. By default, it is selected with 1 run.
Actions on Test Measurement Failure	
On Test Failure, stop and notify me of the failure	Select to stop the test run on Test Failure, and to get notified via email. By default, it is unselected. Click Email Settings to configure.
Popup Settings	
Auto close Warnings and Informations during Sequencing Auto close after <no> Seconds	Select to auto close warnings/informations during sequencing. Set the Auto close time. By default it is unselected.
Auto close Error Messages during Sequencing. Show in Reports Auto close after <no> Seconds	Select to auto close Error Messages during Sequencing. Set the Auto close time. By default it is unselected.

Status panel

Status panel overview

The Status panel accesses the Test Status and Log View tabs, which provide status on test acquisition and analysis (Test Status tab) and a listing of test tasks performed (Log View tab). The application opens the Test Status tab when you start a test run. You can select the Test Status or the Log View tab to view these items while tests are running.

Test status view



Log view

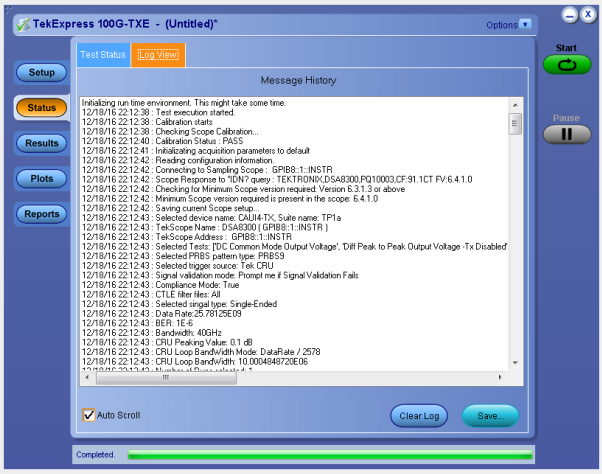


Table 13: Status panel Log View controls

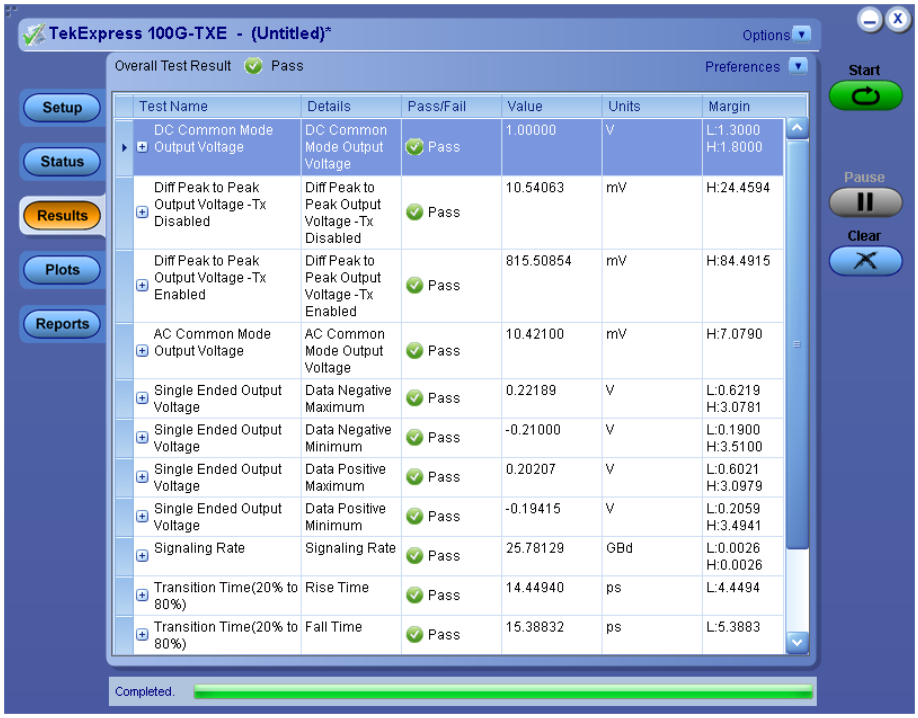
Control	Description
Message History	Lists all executed test operations and timestamp information.
Auto Scroll	Enables automatic scrolling of the log view as information is added to the log during the test.
Clear Log	Clears all messages from the log view.
Save	Saves the log file to a text file. Use the standard Save File window to navigate to and specify the folder and file name to which to save the log text.

See also. *Application panel overview*

Results panel

Results panel overview

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



See also. *View a report*

Application panels overview

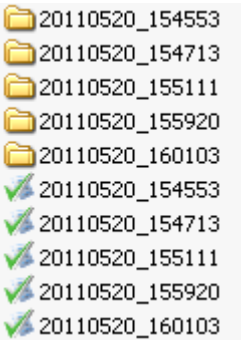
View test-related files

Files related to tests are stored in C:\Users\<username>\Documents\My TekExpress\100G-TXE\. 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 and usually has no visible file name extension.

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

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



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

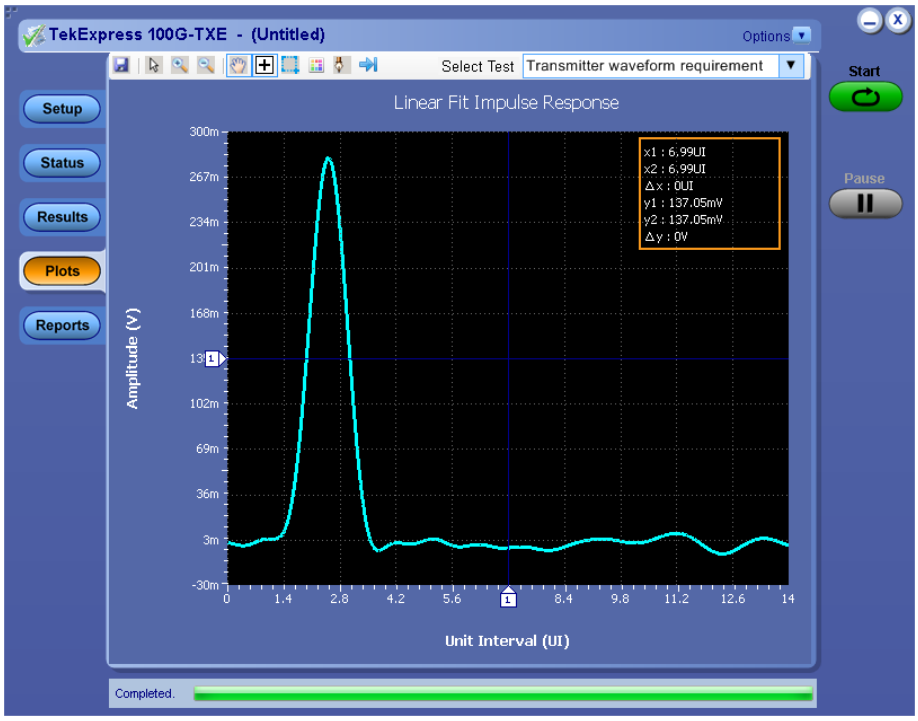
The first time you run a new, unsaved session, the session files are stored in the Untitled Session folder located at ..\My TekExpress\100G-TXE\. When you name and save the session, the files are placed in a folder with the name that you specify. A copy of the test files stay in the Untitled Session folder until you run a new test or until you close the 100G-TXE application.

See also. *File name extensions*

Plots panel

Plots panel overview

The Plots panel displays the result as a two-dimensional plot for additional measurement analysis. The plots are displayed only during run and only for the measurements which supports plots.



Toolbar functions in plot windows. The Plot Toolbar window includes the following functions:

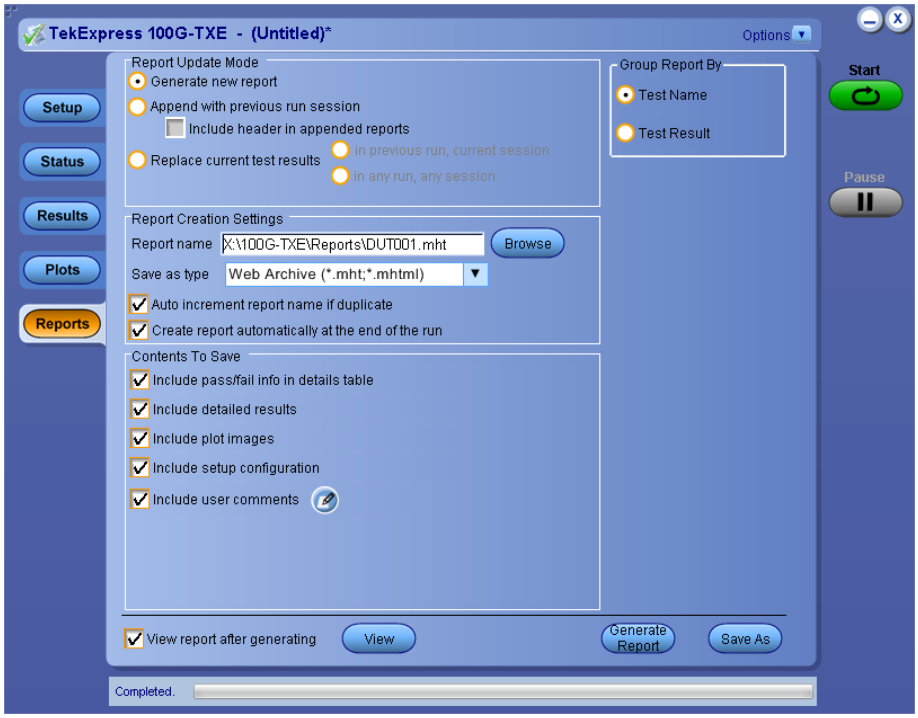
Icon	Functions
 **Save**	Saves the plot.
 **Select & Zoom**	Expands the selected plot area. Left-click and drag the mouse to mark the region on the plot to zoom.
 **Zoom In**	Expands part of the plot (Horizontal and Vertical); the data appears in more detail.
 **Zoom Out**	Contracts part of the plot (Horizontal and Vertical); the data appears in less detail.
 **Pan**	Moves the plot anywhere within the scale.
 **Hide Gridlines**	Hides the gridlines.
 **Reset**	Resets the zoom to 100%.
 **Choose Waveform Colors**	Sets the plot color. Click and select the color in the Color window and click OK. Click in the plot area to apply the color.

Icon	Functions
 **Show/Hide Markers**	Displays or hides the markers
 **UnDock/Dock**	Click to undock/dock the plot window.
Select Test	Select the measurement.

Reports panel

Reports panel overview

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



For information on setting up reports, see *Select report options*. For information on viewing reports, see *View a report*.

See also. *Applications panel overview*

Select report options

Click Reports panel and use the Reports panel controls to select which test result information to include in the report, and the naming conventions to use for the report. For example, always give the report a unique name or select to have the same name increment each time you run a particular test.

Select report options before running a test or when creating and saving test setups. Report settings are included in saved test setups.

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

Table 14: Report options

Setting		Description
Report Update Mode		
Generate new report		Creates a new report. The report can be in either .mht or .pdf file formats.
Append with previous run session		Appends the latest test results to the end of the current test results report.
Include header in appended reports		Select to include header in appended reports
Replace current test results	In previous run, current session	Select to replace current test results in the report with the test result(s) of previous run in current session.
	In any run, any session	Select to replace current test results in the report with the test result(s) in selected run session's report. Click  and select test result of any other run session from another setup.
Report Creation Settings		

Setting	Description
Report name	Displays the name and location from which to open a 100G-TXE report. The default location is at *\My TekExpress\100G-TXE\Untitled Session*. 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. Change the report name or location. Do one of the following: ■ In the Report Path field, type over the current folder path and name. ■ Double-click in the Report Path field and then make selections from the popup keyboard and click the **Enter** button. Be sure to include the entire folder path, the file name, and the file extension. For example: C:\Users\<username>\Documents\My TekExpress\100G-TXE\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. ***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.
Create report automatically at the end of the run	Creates report at the end of the run.
Contents To Save	
Include pass/fail info in details table	Includes pass/fail info in the details table of the report.
Include detailed results	Includes detailed results in the report.
Include plot images	Includes plot images in the report.

Setting	Description
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 added in the DUT tab of the Setup panel. Comments appear in the Comments section, under the summary box at the beginning of each report.
Group Report By	
Test Name	Select to group the tests in the report by test name.
Test Result	Select to group the tests in the report by test results
View report after generating	Automatically opens the report in a Web browser when the test completes. This option is selected by default.
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 report

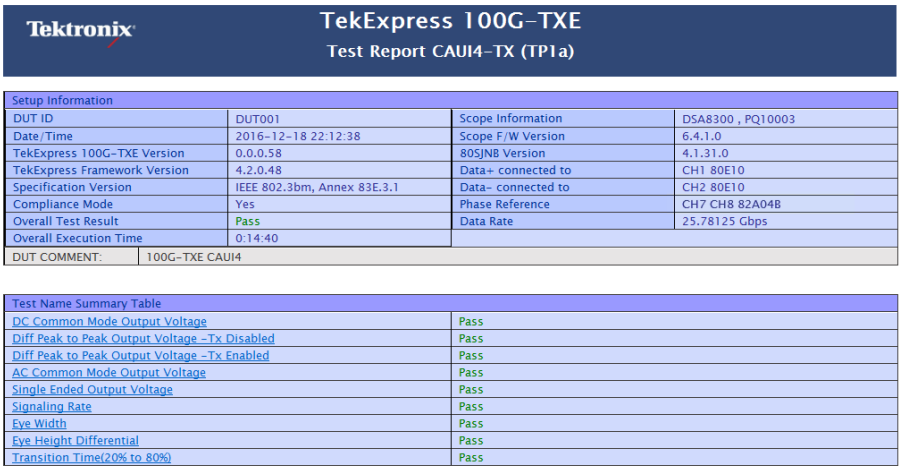
The application automatically generates a report when test execution is complete and displays the report in your default Web browser (unless you cleared the **View Report After Generating** check box in the Reports panel before running the test). If you cleared this check box, or to view a different test report, do the following:

1. Click the **Reports** button.
2. Click the **Browse** button and locate and select the report file to view.
3. In the Reports panel, click **View**.

For information on changing the file type, file name, and other report options, see *Select report options*.

Report contents

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



Tektronix

TekExpress 100G-TXE

Test Report CAUI4-TX (TP1a)

Setup Information			
DUT ID	DUT001	Scope Information	DSA8300 , PQ10003
Date/Time	2016-12-18 22:12:38	Scope F/W Version	6.4.1.0
TekExpress 100G-TXE Version	0.0.0.58	80SJNB Version	4.1.31.0
TekExpress Framework Version	4.2.0.48	Data+ connected to	CH1 80E10
Specification Version	IEEE 802.3bm, Annex 83E.3.1	Data- connected to	CH2 80E10
Compliance Mode	Yes	Phase Reference	CH7 CH8 82A04B
Overall Test Result	Pass	Data Rate	25.78125 Gbps
Overall Execution Time	0:14:40		
DUT COMMENT:	100G-TXE CAUI4		

Test Name Summary Table	
DC Common Mode Output Voltage	Pass
Diff Peak to Peak Output Voltage -Tx Disabled	Pass
Diff Peak to Peak Output Voltage -Tx Enabled	Pass
AC Common Mode Output Voltage	Pass
Single Ended Output Voltage	Pass
Signaling Rate	Pass
Eye Width	Pass
Eye Height Differential	Pass
Transition Time(20% to 80%)	Pass

Setup configuration information

The summary box at the beginning of the report lists setup configuration information. This information includes the oscilloscope model and serial number, electrical module model, and software version numbers of all associated applications.

To exclude this information from a report, clear the **Include Setup Configuration** check box in the Reports panel before running the test.

User comments

If you selected to include comments in the test report, any comments you added in the DUT tab are shown at the top of the report.

See also. *Results panel overview*

View test-related files

Pre-measurement calibration

Pre-measurement calibration guidelines

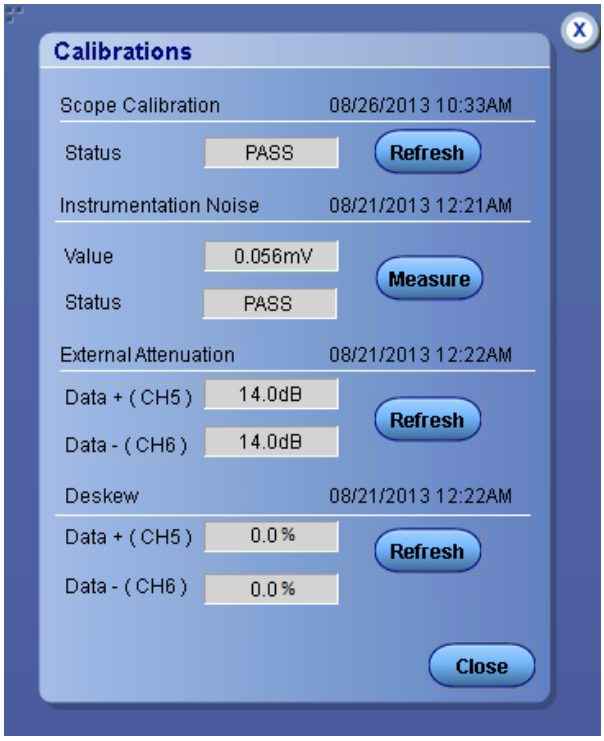
- You need to perform the following calibration procedures before starting a measurement session using the 100G-TXE software, and any time after that you make changes to the setup configuration, such as after installing or moving any sampling modules, cables, or connectors.
- The calibration procedures in this section require specific cables, connectors, and accessories to ensure measurement accuracy. See the *DSA8300 Digital Serial Analyzer Practices for Measurements on 25 Gb/s Signaling Application Note* (Tektronix part number 071-3207-XX) for information on where and how to obtain these parts.
- Perform the procedures in the following order:

  Instrument noise measurement

  Vertical gain calibration

  Deskew calibration (minimize common mode waveform method)

  Deskew calibration (minimize eye crossing method)



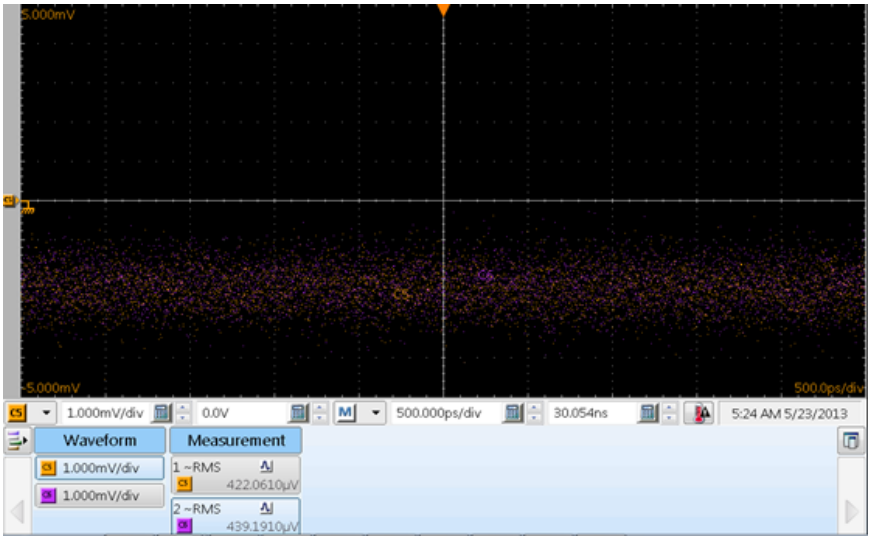
Instrument noise measurement

NOTE. *The following instrument noise measurement procedure assumes that the DUT Data+ and Data– lanes are connected to oscilloscope channels 5 and 6, respectively (80E09/B or 80E10/B Modules). Adjust the procedure accordingly if you connect the Data lanes to other channels for your measurements. This procedure is performed automatically when you click the Measure button under the Calibration Panel in the Acquisition menu.*

Instrumentation noise calibration

1. Disconnect all of the signals that are connected to the sampling oscilloscope.
2. Select **Setup > Vert > waveform C5 and C6** to **On**.
3. Set the Ch 5 and Ch 6 Bandwidth to **40 GHz**.
4. Set the minimum vertical scale per division to **1 mV/div** for Ch 5 and Ch 6.
5. Set the Trigger Source to **Free Run**.
6. Select measurement **Setup > Meas > Meas 1 > Pulse Amplitude: AC RMS**.
7. Set **Setup > Meas > Signal Type: Pulse**.
8. Set **Setups > Meas > Source: C5**.
9. Uncheck the **Use Wfm Database** control for the measurement.
10. Record the Ch 5 RMS value.
11. Select measurement **Setup > Meas > Meas 2 > Pulse Amplitude: AC RMS**.
12. Set **Setup > Meas > Signal Type: Pulse**.
13. Set **Setup > Meas > Source: C6**.
14. Uncheck the **Use Wfm Database** control for the measurement.

15. Record the Ch 6 RMS value as reported in the measurement readout.



16. Use the following formula to calculate noise:

    SQRT ((AC_RMS (C5)^2 + AC_RMS (C6) ^{2}))

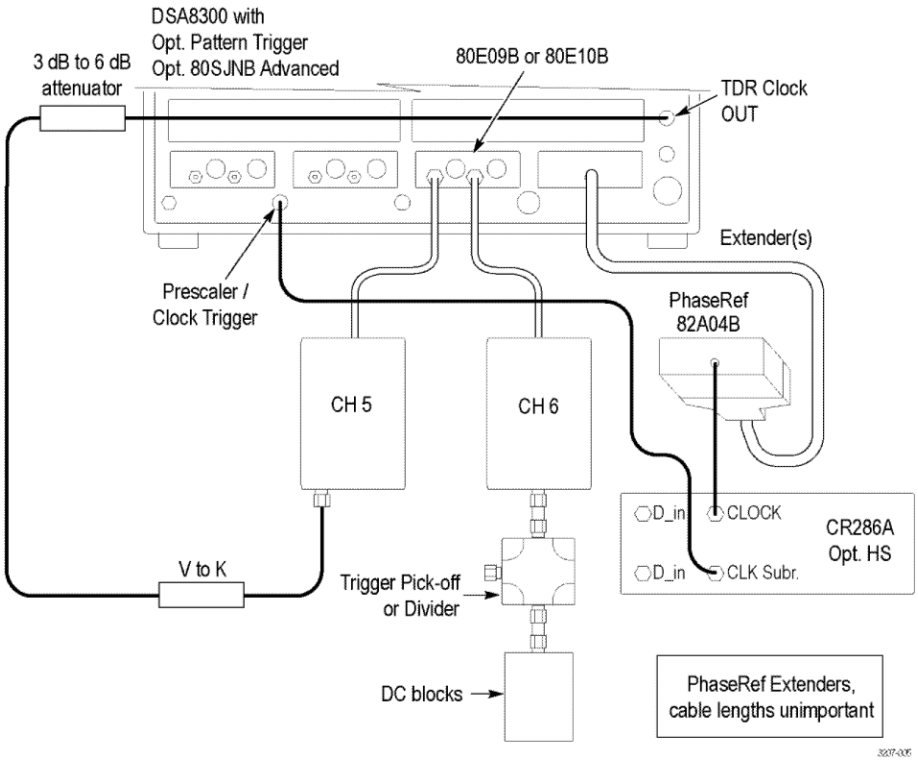
    Noise level measurement should be in the range of **200 µV – 1 mV**.

    If the noise level measurement is not within the limits, perform an oscilloscope compensation and then perform the instrument noise measurement again. If the measured noise level is still outside of the above limits, please contact Tektronix Customer Support.

Vertical gain calibration

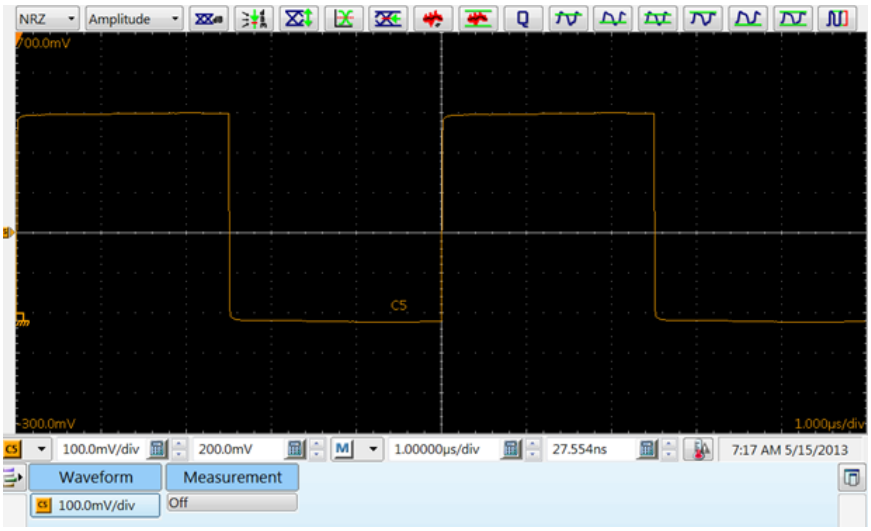
Use the following procedure to calculate the test configuration Vertical Gain:

1. Connect the instrument as shown in the following setup diagram:



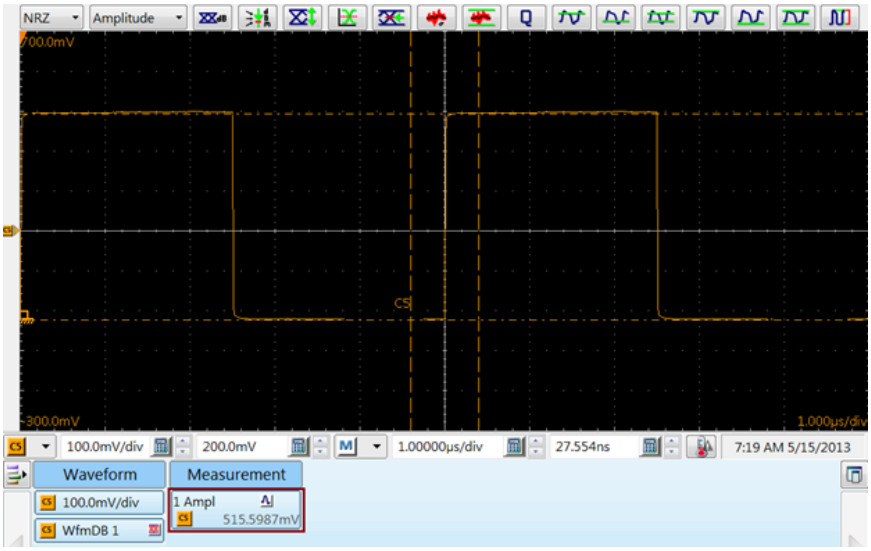
2. Push **Default Setup**.
3. Set **Setup > Mode/Trigger > Trigger Source: TDR**.
4. Set **Setup > Vert > waveform C5** to **On**.
5. Set **Horizontal Scale time/div** to **1 us/div**.
6. Set **Setup > Horz > Record Length > 1000**(samples).
7. Set **Setup > Disp > Style: Show Vectors**.
8. Set oscilloscope Run/Stop state to **Run**.
9. Set **Setup > Acq > Acquisition Mode: Average (16 samples)**.

10. Set **Setup > Vertical > Channel: Offset** (on C5) to**200 mV** to the waveform within the dynamic range.

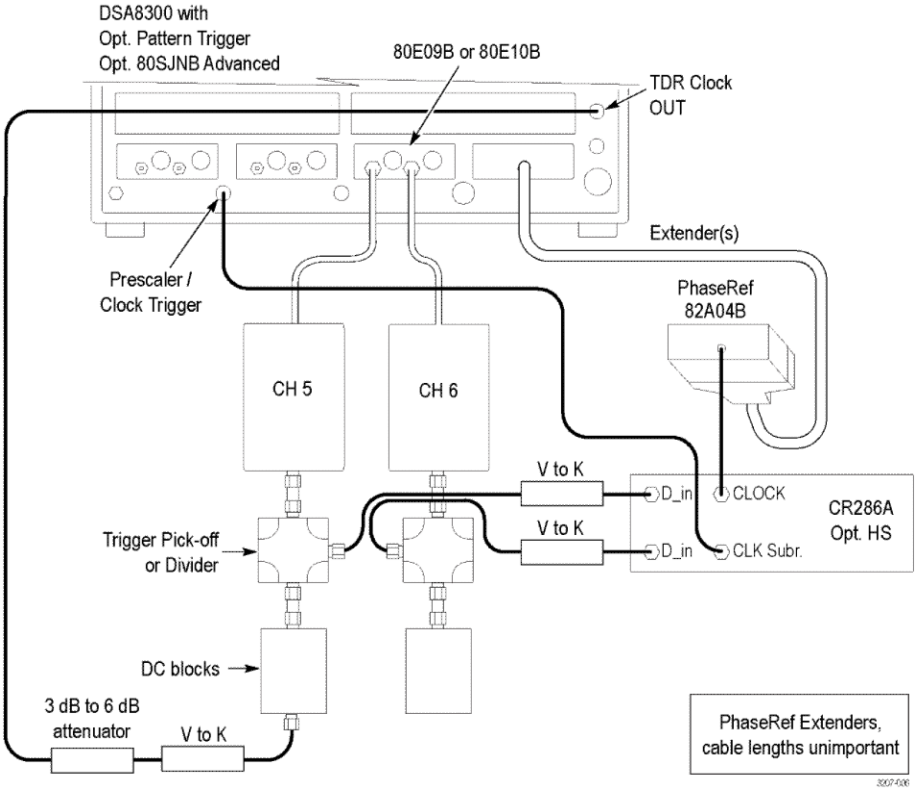


11. Add Amplitude measurement and configure the following settings:
    a. **Setup > Meas > Signal Type: Pulse**
    b. **Setup > Meas > Source: C5**
    c. **Setup > Meas > Pulse Amplitude: Amplitude**
    d. **Setup > Meas > Meas1**: select **On** (The oscilloscope creates this as **Meas1**)
    e. **Setup > Meas > Region** to **On**
    f. **Setup > Meas > Region**: Gates G1 to **46%**
    g. **Setup > Meas > Region: Gates G1: 54%**
    h. **Setup > Meas> Annotations: On**

i. Measure the Amplitude Referenced as shown in the following screen shot.

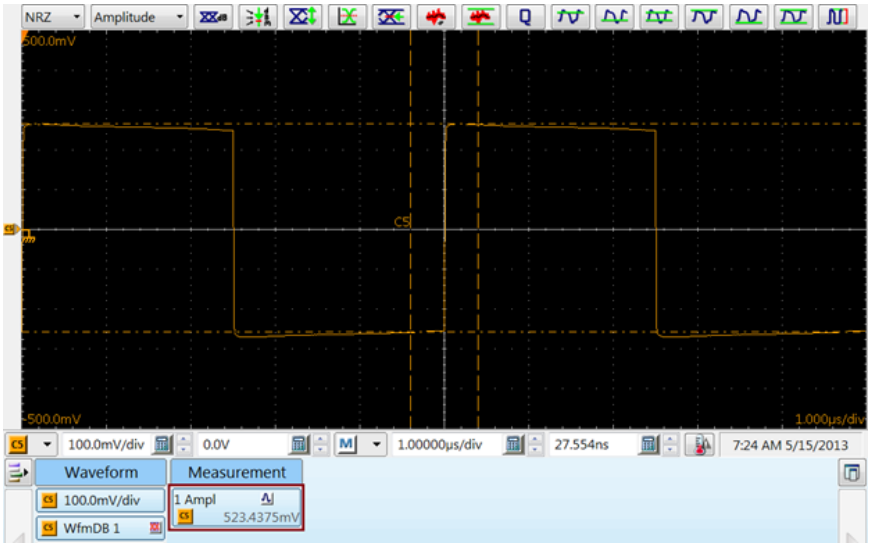


12. Change the instrument connections as shown in the following figure (connect DC block and 6 dB attenuator to Ch 5 and other end to TDR Clock).



13. After making the connections shown in the above figure, measure the amplitude again.

14. Measure the Amplitude Apparent as shown in the following screen shot.



15. Calculate the Gain Correction factor for Channel 5:

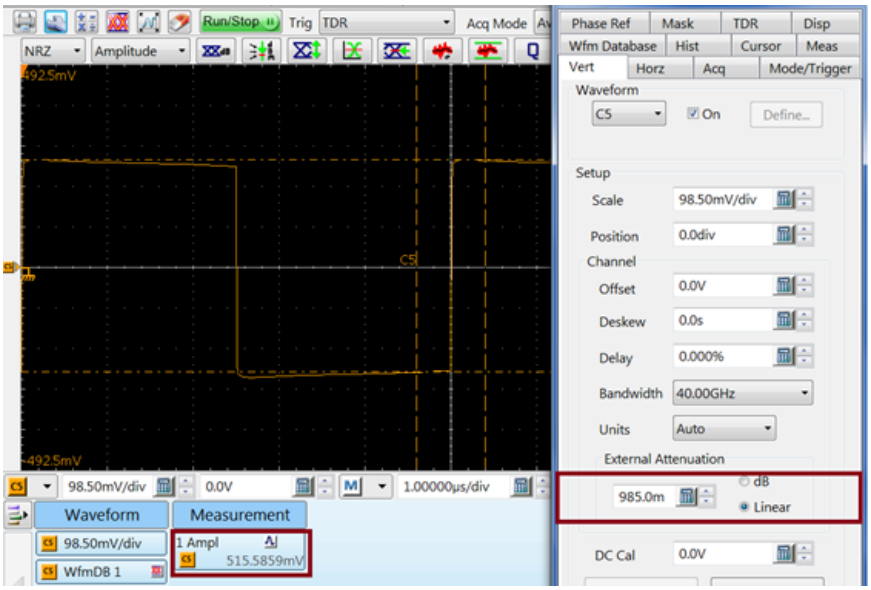
    Channel 5 Gain correction factor = Amplitude_Referenced ÷ Amplitude_Apparent

16. Enter this correction factor into the instrument:

    a. Setup > Vert: set waveform to C5

    b. Set External Attenuation to Linear and

c. Enter the Gain correction factor for Channel 5 into the **External Attenuation** field as shown in the following image.



17. Repeat steps 2 through 16, using Channel 6 instead of Channel 5, to calculate and enter the gain correction factor for Channel 6.

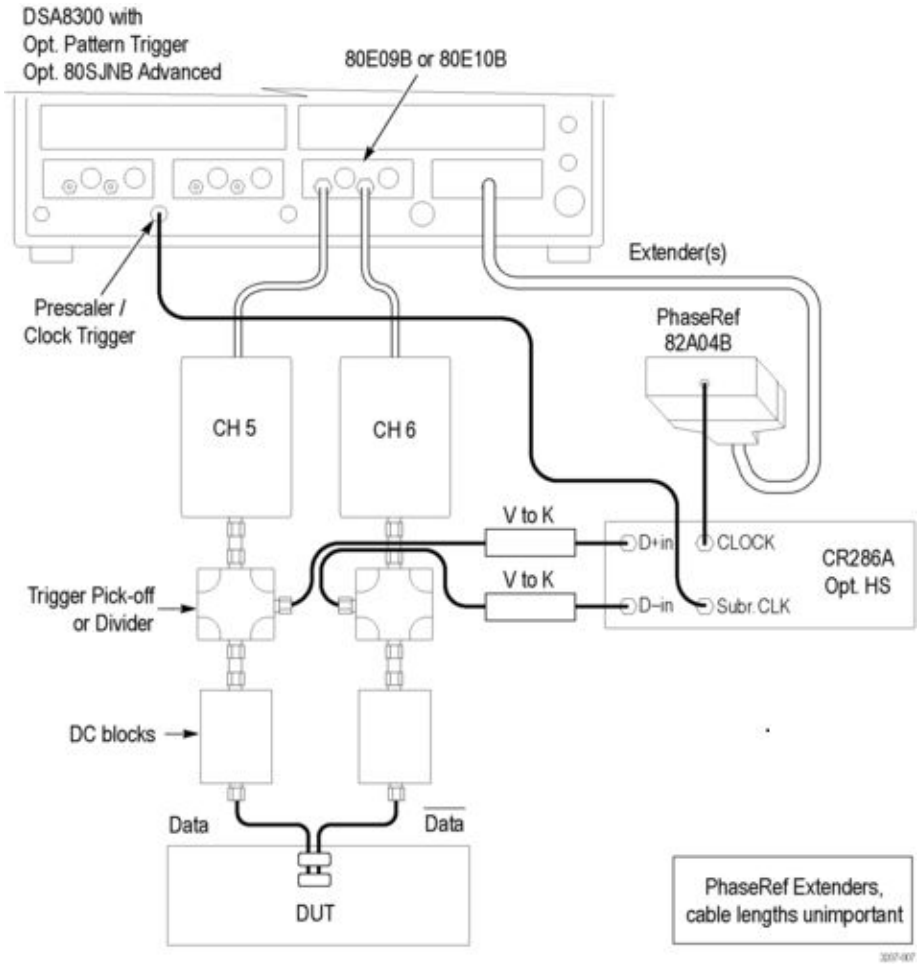
Deskew calibration (minimize common mode waveform method)

NOTE. *This procedure achieves deskew by minimizing the energy of a common mode waveform. This method is less sensitive to large skews, but can provide multiple minima.*

Another method is to minimize the eye-crossing to eye-crossing. The minimize eye crossing method fails for large initial skew, but if the initial skew is less than ½ UI it provides the best result.

Thus the best result is obtained by following the two procedures in the order given here. The user can select just one or the other, depending on the need.

1. Connect the instrument as shown in the following setup diagram:



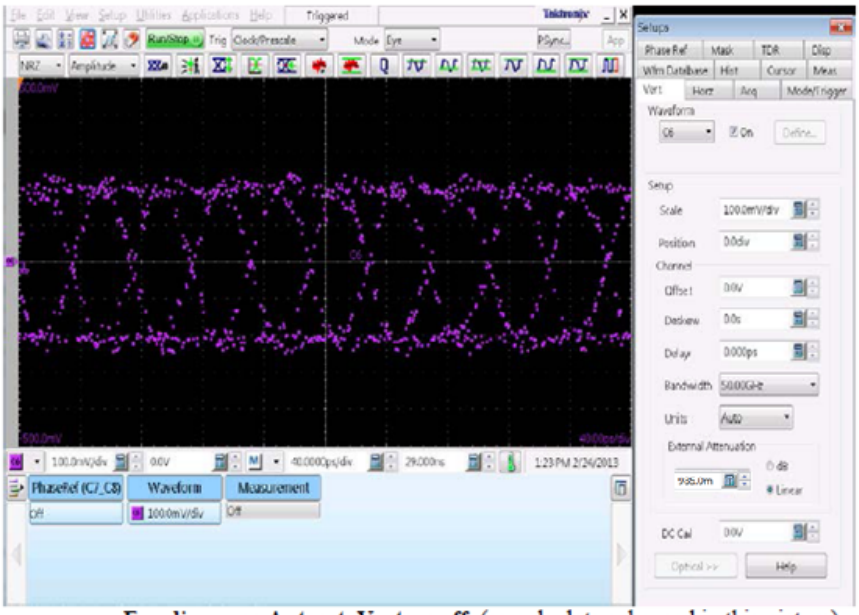
2. Configure the DUT settings:
   a. Set the DUT output for standard operation
   b. Set the DUT to generate a **PRBS9** pattern
3. Configure the oscilloscope channel settings:
   a. **Setup > Mode/Trigger > Trigger Source** to **Clock/Prescale**
   b. Select (enable) **C6** (Channel 6); turn OFF any other channel
   c. **Setup > Acq > Acquisition Mode** to **Sample**
   d. **Setup > Disp > Style**: uncheck **Show Vectors**
   e. **Setup > Meas**: unselect (clear) On for all measurements
   f. Set **Horizontal time/div** to approximately 1 UI/div (for example, 40 ps for 25 Gb/s)
   g. Set **Setup > Horz > Record Length > 1000 [(Samples)]**

h. Select **Utilities > Autoset Properties**: clear (uncheck) Options: Horizontal, click Autoset

i. Close Autoset Properties

j. Set the oscilloscope Run/Stop state to **Run**

4. Observe that dimly visible eye diagrams are visible on the screen. If not, manually set the channel 6 V/div, Vertical Position, and Vertical Offset controls to position the waveform in the middle of the screen, as shown in the following figure:



Eye diagrams Autoset, Vectors off. (sample dots enhanced in this picture)

5. Set**Setup > Vert > Waveform** to **C5**
6. **Set Setup > Vert > C6 Bandwidth** to **40 GHz**
7. **Set Setup > Vert > C5 Bandwidth** to **40 GHz**
8. Verify that both C5 and C6 have the External Attenuation values entered that were determined from the *Vertical gain calibration procedure*.

Pattern trigger settings:

Select **Setup > Mode/Trigger**: click **Pattern Sync/Framescan Setup**

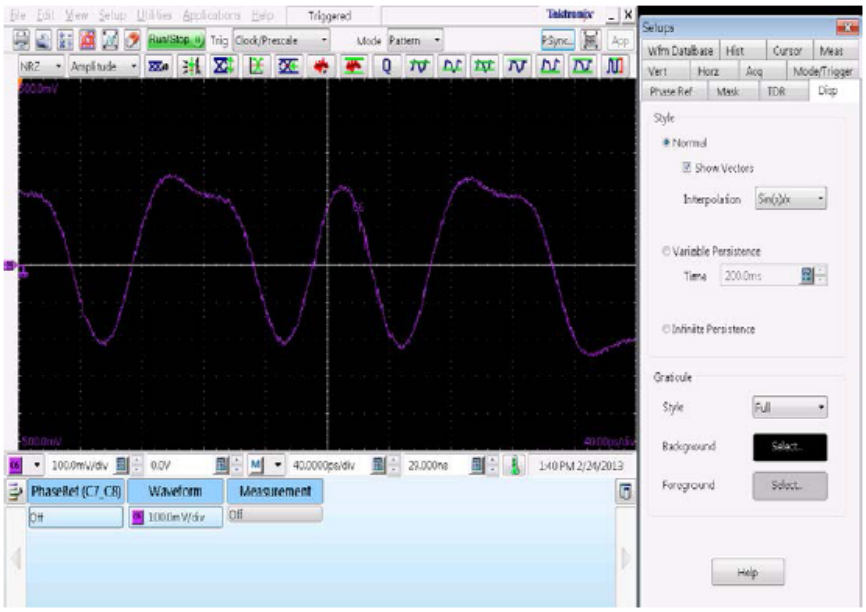
Clear the value in the **Data Rate** field and enter the correct Data Rate value (for example, 25.781Gb/s).

Set the **Pattern Length** field to **511** bits.

Click **AutoSync to selected waveform**.

Click **Close** to exit the **Pattern Sync/Framescan Setup**dialog box.

Select **Setup > Disp**: set Style to **Show Vectors**.



Select **Setups > Vert**: enable channel 6 waveform.

Set channel 6 **Vert Bandwidth** to **40 GHz**.

NOTE. *Observe both C5 and C6 displayed mid-screen, w/o clipping. Both signals should be of similar amplitude – if not, troubleshoot the interconnect to the DUT.*

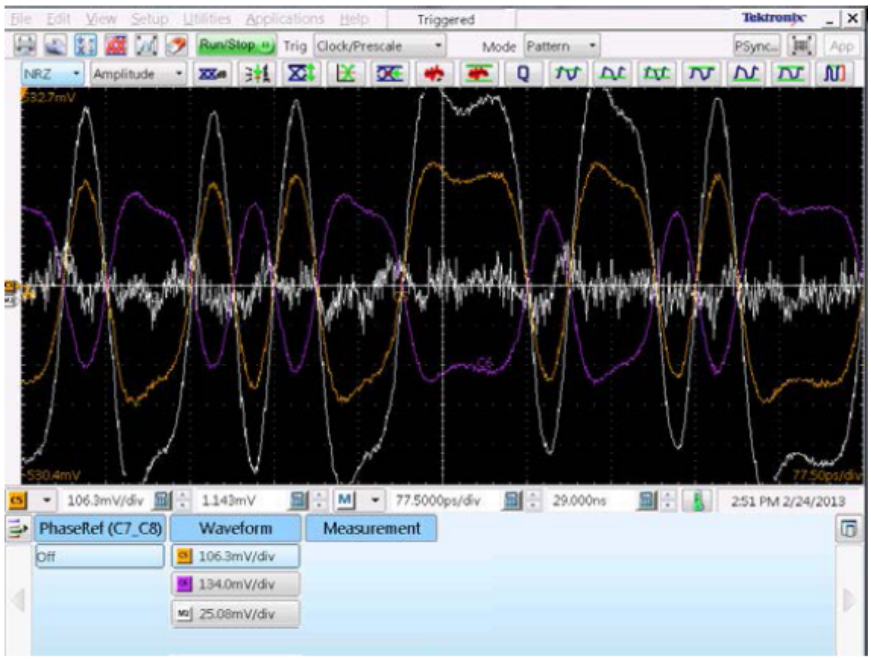
NOTE. *Position the screen such that multiple zero-crossings are seen. An alternative is to slow down time/div such that the longest run-length in the pattern would be no more than 1/3 of the screen. For example, if the pattern is PRBS9, the longest run-length is 9 bits; if the UI is 40 ps, then the duration of the longest RL is 40*9 = 360 ps. Set the time/div to 3*360/10 (for example, approx. 110 ps/div).*

Math measurement M2 settings:

Push the **Math** front-panel button

Define the math waveform **M2** to be **C5+C6**. Click **OK**.

Observe the common-mode waveform as the white trace as shown in the following figure.



Deskew of channel 6 to channel 5:

Select **Setup > Meas** and set the following parameters for the AC RMS measurement:

Set **Meas1** to **On**

Set**Signal Type** to **Pulse**

Set **Source** to **M2**

Set **Pulse Amplitude** to **AC RMS**

Set **Meas1** to **Select**

Setup > Vert > Waveform: Use the Front Panel **Fine** button and the Front Panel knob to set the C6 Adjust Channel: Delay to minimize the size of the M2 (white trace), or type values into the **Delay** window.

Math measurement M1 settings:

Push the **Math** front-panel button

Define the math waveform **M1** to be **C5-C6**. Click **OK**.

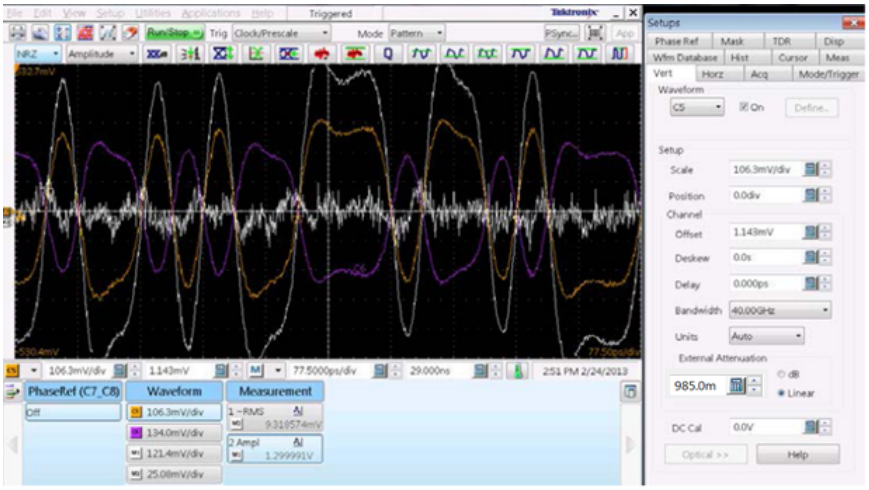
Observe the deskewed differential signal. Adjust M1 V/div if desired. If desired, enable diff. signal Amplitude measurement:

Setup > Meas: set **Signal Type** to **Pulse**

Setup > Meas: set **Source** to **M1**

Setup > Meas: set **Pulse Amplitude** to **Amplitude**

Setup > Meas: set **Meas2** to **On**



NOTE. *External Attenuation and Delay values are in the Vert tab fields.*

• End of Deskew calibration (minimize common mode waveform method) procedure •

• Go to *Deskew calibration (minimize eye crossing method)* procedure •

Deskew calibration (minimize eye crossing method)

NOTE. *This procedure achieves deskew by minimizing the waveform eye-crossing to eye-crossing. The eye crossing method fails for large initial skew, but if the initial skew is less than ½ UI it provides the best result.*

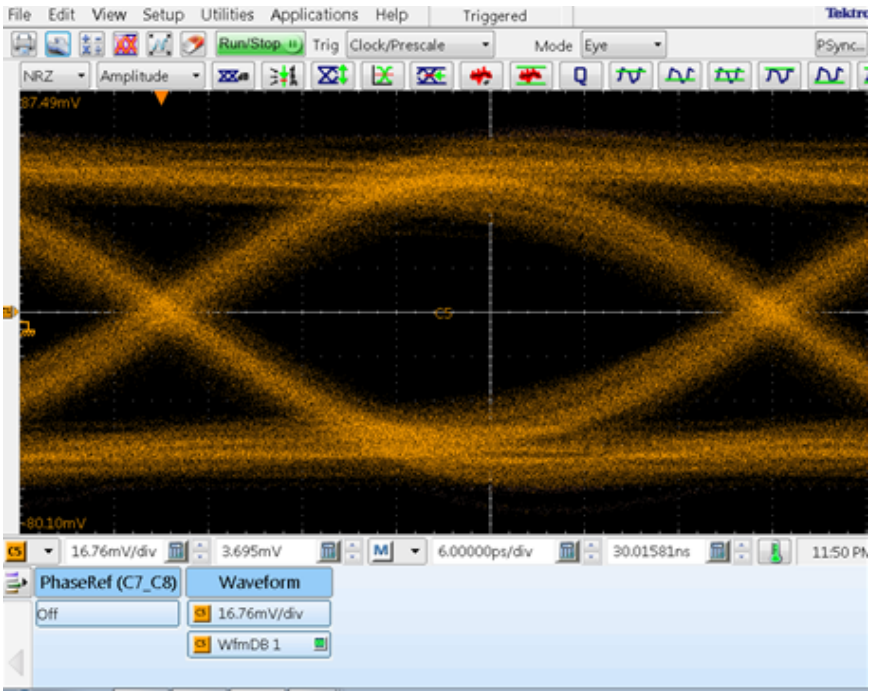
Another method is to minimize the energy of a common mode waveform. The common mode waveform method is less sensitive to large skews, but can provide multiple minima.

The best result is obtained by following the two procedures in the order given (minimize common mode waveform, minimize eye crossing). The user can select just one or the other, depending on the need.

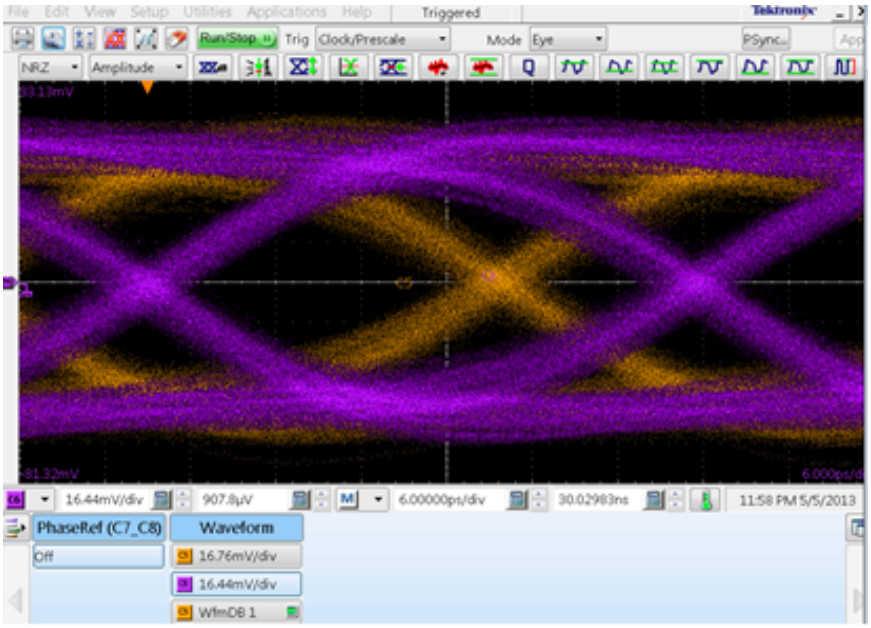
This procedure uses the same connection setup as in the common mode procedure. To fine tune the deskew values by minimizing the interval between eye crossings:

1. Select C5 on front panel
2. Setup > Vert: set waveform-Ch5 to **On**.
3. Set the BW to **40 GHz**.
4. Setup > Horz: set the Bit Rate to the DUT's bit rate (for example, 25.781 Gb/s).
5. Setup > Horz: set the Record Length to any value above **1000** (1000 is the minimum recommended record length. Your measurement requirements may need more than 1000 records).
6. Setup > Horz: set the Horizontal Reference to **0%**.
7. Setup > Mode/Trigger: set the Scope Mode to **Eye**.
8. Setup > Wfm Database (Wfm DB1): select Source as C5; enable (check) **Display**; set Persistence to **Variable**; set Waveforms to **500**; set Display Options to **Intensity**.
9. Set the oscilloscope Run/Stop mode to **Run**.

10. Press **Autoset** front-panel button.



11. Select (enable) **C6** (Channel 6) front panel button.
12. Setup > Wfm Database (Wfm DB2): select Source as **C6**; enable (check) **Display**; set Persistence to **Variable**; set Waveforms to **500**
13. Press **Autoset** front-panel button.



14. Set up a delay measurement between the C5 eye crossing and C6 eye crossing in the Setup > Meas tab:

    a. **Setup > Meas > Select Meas > NRZ Timing > Delay**.

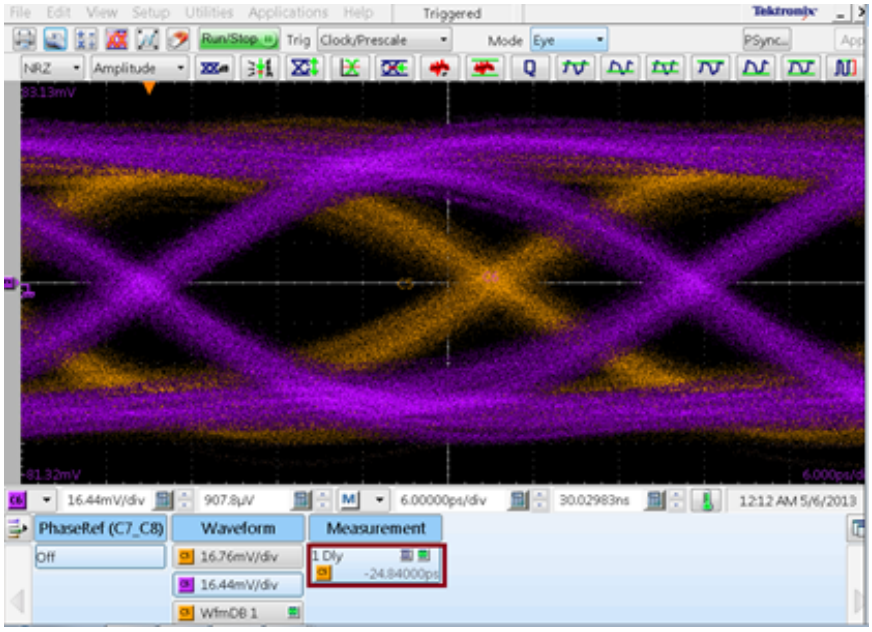
    b. Setup > Meas: click **Source1** and set Source to **C5** on **Main**.

    c. Setup > Meas: set Source Signal Type to **NRZ**.

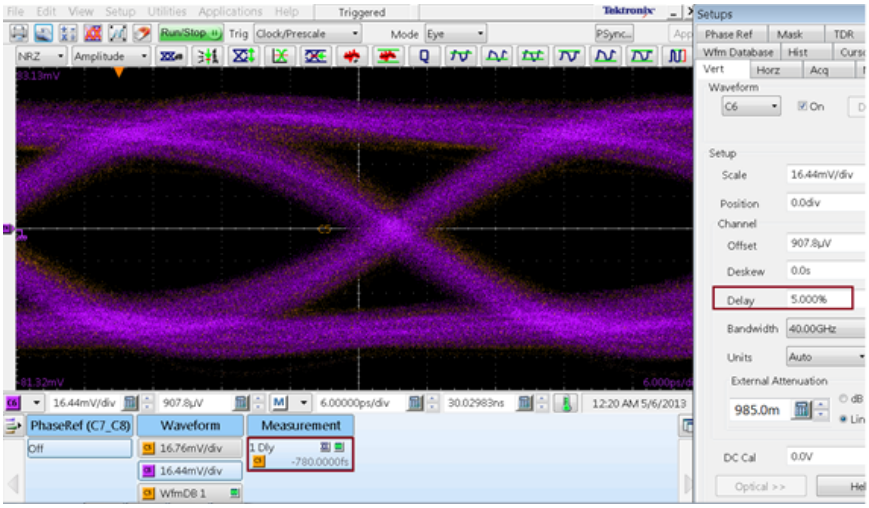
    d. Setup > Meas: set Meas1 to **On**.

    e. Setup > Meas: click **Source2**: set source to **C6** on **Main**.

    f. Setup > Meas: click **Source1**.



15. Setup > Vert: Adjust the **Delay** value to minimize the delay between Ch5 and Ch6 eye crossings. Adjust the C6 channel delay until the delay measurement value becomes less than ¼ UI, as shown in the following image.



• End of Deskew calibration (minimize eye crossing method) procedure •

Equipment connection diagram

Click **Setup** > **Test Selection** > **Schematic** to view the equipment setup diagram(s).

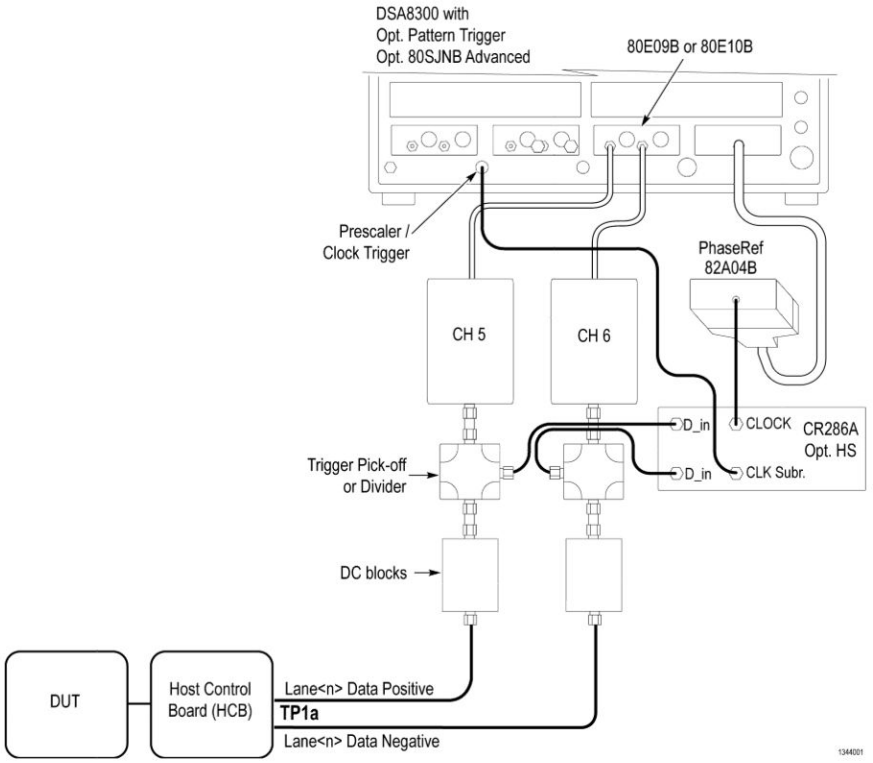


Figure 5: CAUI4 TP1a (Single Ended)

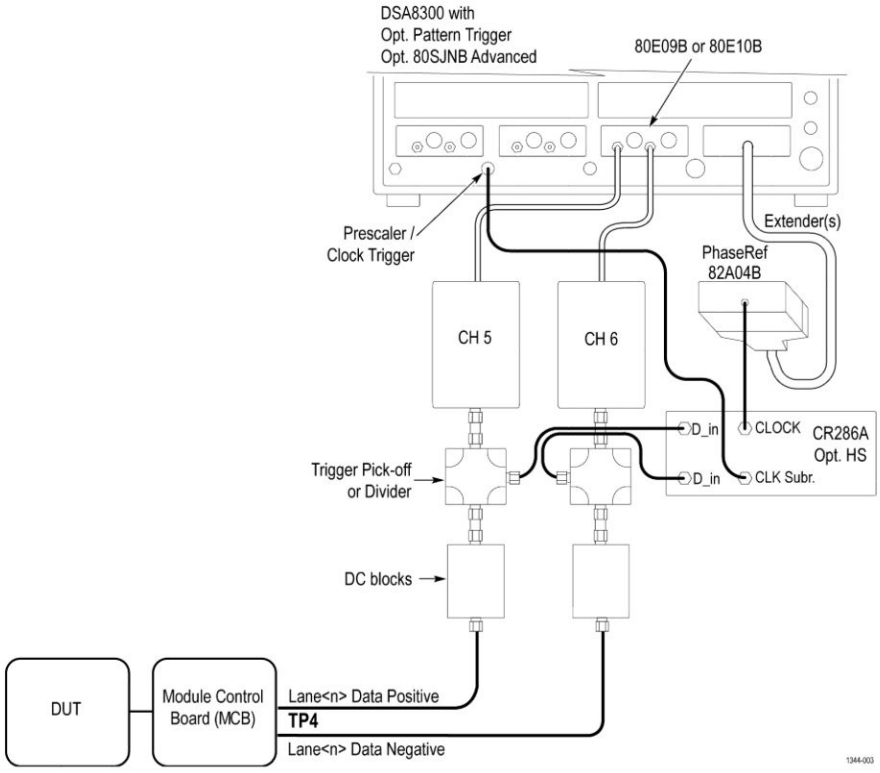


Figure 6: CAUI4 TP4 (Single Ended)

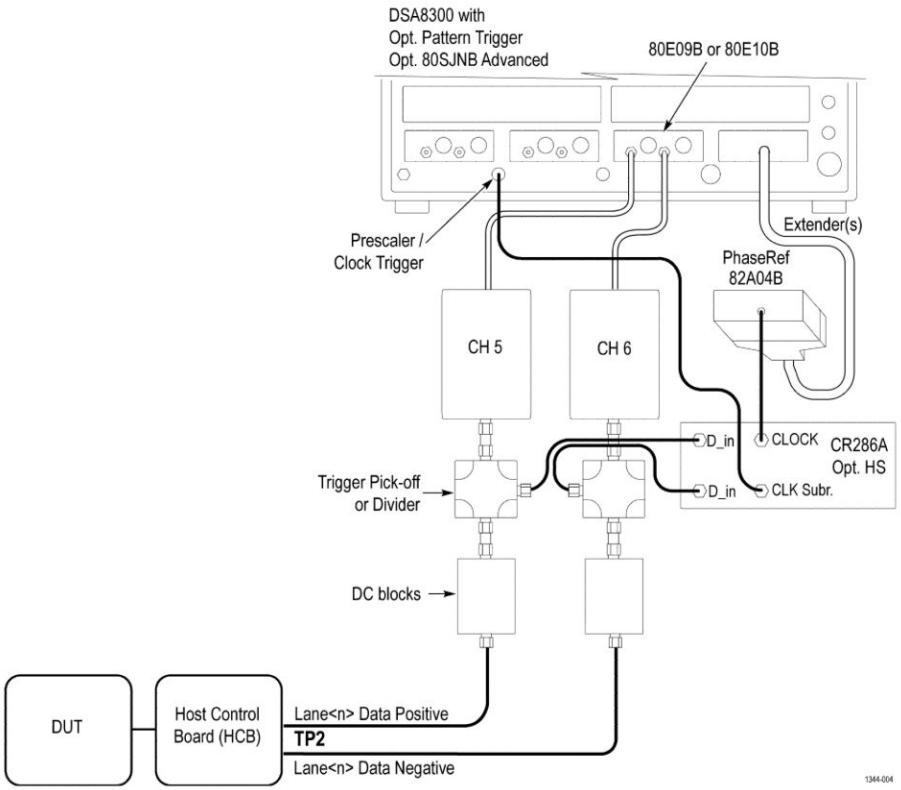


Figure 7: CR4 TP2 (Single Ended)

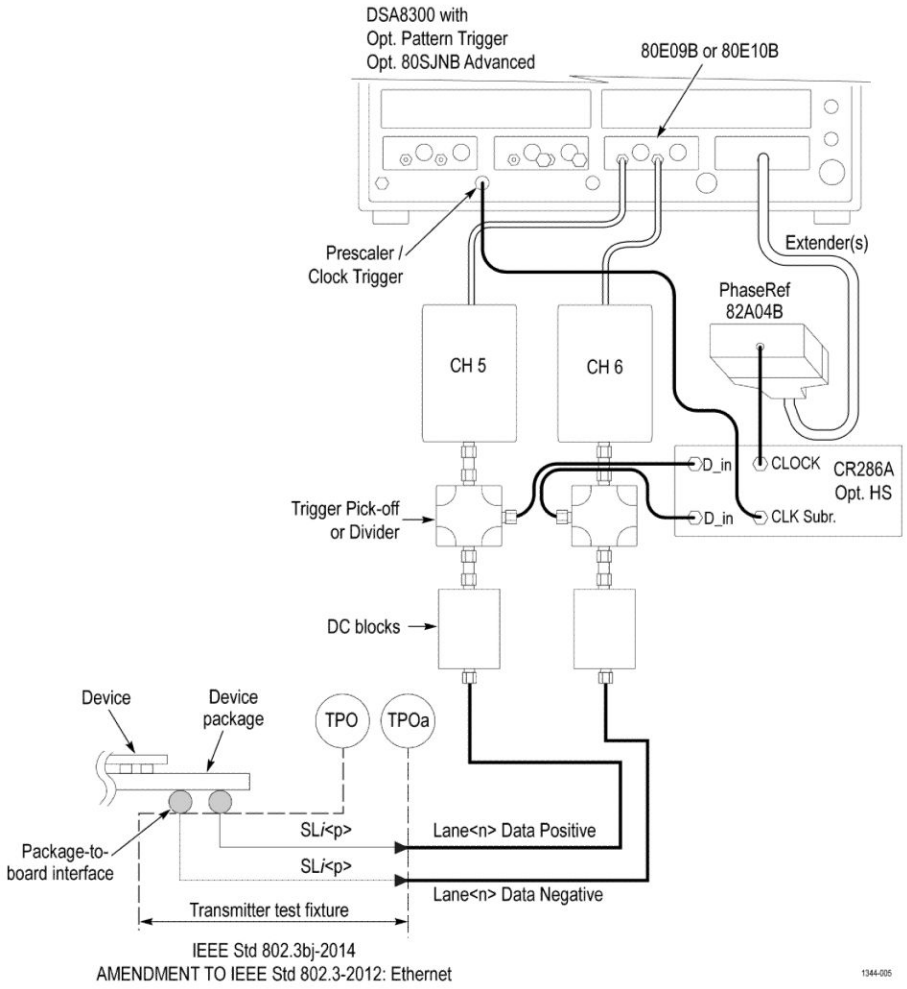


Figure 8: KR4 TP0a (Single Ended)

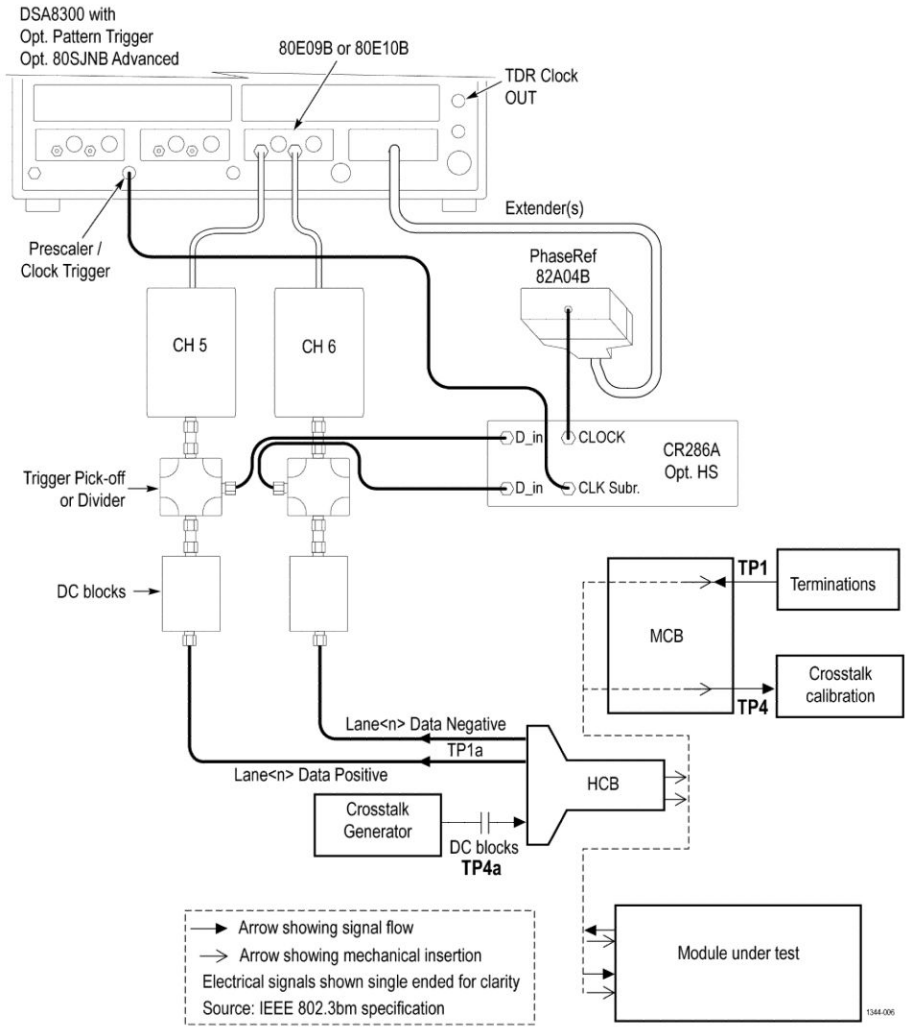


Figure 9: Eye Width / Eye Height TP1a (Single Ended)

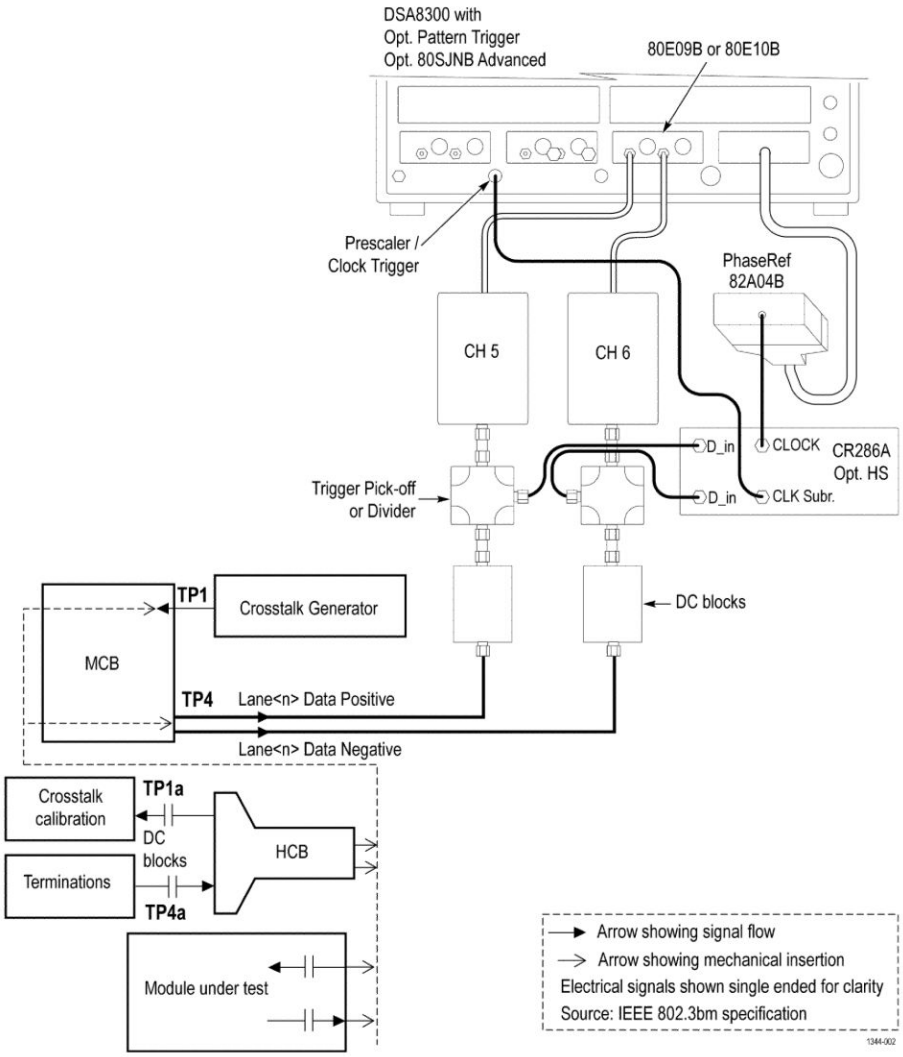


Figure 10: Eye Width / Eye Height TP4 (Single Ended)

Running tests

Select tests, *set acquisition parameters*, *set configuration parameters*, *set preferences parameters*, and click **Start** to run the tests. While tests are running, you cannot access the Setup or Reports panels. To monitor the test progress, switch between the Status panel and the Results panel.

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 **Alt + Tab** key combination. To keep the TekExpress 100G-TXE application on top, select **Keep On Top** from the TekExpress Options menu.

The application displays report when the tests execution is complete.

Prerun checklist

1. Make sure that the instruments are warmed up (approximately 20 minutes) and stabilized.
2. Perform compensation: In the oscilloscope main menu, select **Utilities** > **Instrument Compensation**. Click **Help** in the compensation window for steps to perform instrument compensation.

Saving and recalling test setup

Test setup files overview

Saved test setup information (such as the selected oscilloscope, general parameters, acquisition parameters, measurement limits, waveforms (if applicable), and other configuration settings) are saved under the setup name at **X:\100G-TXE**.

Use test setups to:

- Run a new session, acquiring live waveforms, using a saved test configuration.
- 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.

See also *Save a test setup*

Open (load) a saved test setup

Save a 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 *default test setup*. 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.

Open (load) a saved test setup

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

1. Select **Options > Open Test Setup**.
2. Select the setup from the list and click **Open**. Setup files are located at **X:\100G-TXE**.

See also

About test setups

Create a test setup using an existing one

Create a test setup from default settings

Create a test setup from default settings

To create a test setup using default settings, follow the steps:

1. Select **Options > Default Test Setup**. For default test setup, the parameters are set to the application's default value.
2. Click application *Setup* and set the parameters
3. Click application *Reports* and set the report options
4. Optional: Click **Start** to run the test and verify that it runs correctly and captures the specified test information and reports. If it does not, then edit the parameters and repeat this step until the test runs to your satisfaction
5. Select **Options > Save Test Setup**. Enter the file name and click Save. The application saves the file to X:\100G-TXE\<*session_name*>

Create a test setup using an existing one

To create a test setup using an existing one, follow the steps:

1. Select **Options > Open Test Setup**
2. Select a setup from the list and then click **Open**
3. Click application *Setup* and modify the parameters
4. Click application *Reports* and modify the report options
5. Select **Options > Save Test Setup As**
6. Enter test setup name, and click **Save**

CAUI4 TXE compliance measurements

Signaling rate

This section verifies that the signaling rate (data rate) of the DUT per lane is within the conformable limits according to the specification.

Required test equipment

Minimum system requirements

Equipment connection diagram

Standards	Test points	Specification
CAUI4	TP1a	IEEE 802.3bm, Annex 83E.3.1.1, Table 83E-1
	TP4	IEEE 802.3bm, Annex 83E.3.1.1, Table 83E-3

Inputs

- Data Positive and Data Negative signals to the Clock Recovery module.

Measurement procedure

1. Query the data rate when the clock recovery model is locked.
2. Update the report with Pass/Fail status.

Limits

At TP1a and TP4:

- Lower limit: Configured Date Rate - 100 ppm
- Higher limit: Configured Date Rate + 100 ppm

DC common mode output voltage

This section verifies that the mean of the common mode signal is within the conformable limits according to the specification.

Required test equipment

Minimum system requirements

Equipment connection diagram

Standards	Test points	Specification
CAUI4	TP1a	IEEE 802.3bm, Annex 83E.3.1.2, Table 83E-1
	TP4	IEEE 802.3bm, Annex 83E.3.1.2, Table 83E-3

Measurement procedure

Measure the voltage using external digital multimeter.

Limits

At TP1a: -0.3 V to 2.8 V

At TP4: -0.35 V to 2.85 V

AC common mode output voltage

This section verifies that the RMS value of the common mode signal is within the conformable limits according to the specification.

Required test equipment

Minimum system requirements

Equipment connection diagram

Standards	Test points	Specification
CAUI4	TP1a	IEEE 802.3bm, Annex 83E.3.1.2, Table 83E-1
	TP4	IEEE 802.3bm, Annex 83E.3.1.2, Table 83E-3

Inputs

- Differential signal created using two single ended sources (Positive and Negative) and filtered through fourth order 33 GHz Bessel Thomson filter.

Measurement procedure

1. Create a common mode signal using

$$Math = \frac{(DataPositive + DataNegative)}{2}$$

2. Click **Setup** > **Histogram** and create a vertical histogram on common mode signal.
3. Standard deviation of the histogram is measured as AC common mode voltage.

Limits

At TP1a and TP4:

- Lower limit: NA
- Higher limit: 17.5 mV

Diff peak to peak output voltage - Tx enabled

This section verifies that the peak to peak differential output voltage is within the conformable limits according to the specification.

Required test equipment

Minimum system requirements

Equipment connection diagram

Standards	Test points	Specification
CAUI4	TP1a	IEEE 802.3bm, Annex 83E.3.1.2, Table 83E-1
	TP4	IEEE 802.3bm, Annex 83E.3.1.2, Table 83E-3

Inputs

- Differential of individually filtered (33 GHz filter) signal created using two single ended sources (positive and negative).

Measurement procedure

1. Select **Setup** > **Measurement** and click on **Select Meas**.
2. Select **Pulse Amplitude** > **Pk-Pk** for measuring the peak to peak amplitude.
3. The value of the pk-pk voltage is the differential output voltage (pk-pk).

Limits

At TP1a and TP4:

- Lower limit: NA
- Higher limit: 900 mV

Diff peak to peak output voltage - Tx disabled

This section verifies that the peak to peak differential output voltage when the transmitter is disabled is within the conformable limits according to the specification.

Required test equipment

Minimum system requirements

Equipment connection diagram

Standards	Test points	Specification
CAUI4	TP1a	IEEE 802.3bm, Annex 83E.3.1.2, Table 83E-1

Inputs

- Differential signal created using two single ended sources (Positive and Negative).

Measurement procedure

1. Turn-off the DUT. Select **Setup** > **Measurement** and click on **Select Meas**.
2. Select **Pulse Amplitude** > **Pk-Pk** for measuring the peak to peak amplitude.
3. The value of the pk-pk voltage is the differential output voltage (pk-pk).

Limits

At TP1a:

- Lower limit: NA
- Higher limit: 35 mV

Single ended output voltage

This section verifies that the max and min of data positive and negative signals are within conformable limits as per the specification.

Required test equipment

Minimum system requirements

Equipment connection diagram

Standards	Test points	Specification
CAUI4	TP1a	IEEE 802.3bm, Annex 83E.3.1.2, Table 83E-1

Inputs

- Two single ended sources (Positive and Negative) filtered through fourth order 33 GHz Bessel Thomson filter.

Measurement procedure

1. Acquire a differential filtered signal and calculate the Max and Min.
2. Single Ended output voltage (max) = *DC Common mode voltage* + Max of Single Ended signal (without DC).
3. Single Ended output voltage (min) = *DC Common mode voltage* + Min of Single Ended signal (without DC).
4. Perform Step 2 and 3 on single ended data positive and data negative signals.

Limits

At TP1a:

- Lower limit: -0.4 V
- Higher limit: 3.3 V

Eye width and Eye height

This section verifies that the eye width and eye height are within the conformable limits according to the specification.

Required test equipment

Minimum system requirements

Equipment connection diagram

Standards	Test points	Specification
CAUI4	TP1a	IEEE 802.3bm, Annex 83E.3.1.6, Table 83E-1
	TP4	IEEE 802.3bm, Annex 83E.3.2.1, Table 83E-3

Inputs

- Differential signal created using two single ended sources (Positive and Negative) and filtered through fourth order 33 GHz Bessel Thomson filter.

Calibration:

Before running the Eye width / Eye height measurement, the below setup has to be calibrated with a crosstalk generator, as mentioned in the following settings:

- For Host (TP1a): Calibrate the crosstalk generator at TP4 with target differential peak-to-peak amplitude of 900 mV and target transition time of 12 ps (annex 83E.3.1.6).
- For Module (TP4): Calibrate the crosstalk generator at TP1a with target differential peak-to-peak amplitude of 900 mV and target transition time of 19 ps (annex 83E.3.2.1).

Measurement procedure

Eye width and Eye height calculation

Signal is captured such that it has more than 1e6 edges. Measurements are done using Dual-Dirac jitter model as specified in annex 83E-4.

EW15 = EW6 - 3.19*(RJR + RJL)

Where,

EW15 is the eye width extrapolated to 1e15 probability

EW6 is the eye width at 1e6 probability

RJL is the RMS value of the jitter estimated from CDFL

RJR is the RMS value of the jitter estimated from CDFR

EW15 = EW6 - 3.19*(RN0 - RN1)

Where,

EW15 is the eye width extrapolated to 1e15 probability

EW6 is the eye width at 1e6 probability

RN1 is the RMS value of the noise estimated from CDF1

RN0 is the RMS value of the noise estimated from CDF0

Compliance method to find Eye width and Eye height results

The signal filtered through Bessel Thomson filter is equalized using different CTLE filters (1 dB - 9 dB for Host) and (1 dB - 2 dB for Module). CTLE filter result which has the maximum Eye area (Eye width * Eye height) and passing both Eye height and Eye width results is chosen as reference CTLE filter.

Host (TP1a): The CTLE peaking in the reference receiver shall be set to three values:

1. The recommended CTLE peaking value provided by the host (CTLE 1 dB to 9 dB)
2. The value 1 dB higher if present
3. The value 1 dB lower if present

A compliant host should pass both the eye width and eye height A limit using at least one of the settings and passes eye height B in two or three settings.

Module (TP4): A compliant module has to pass both eye width and eye height at least one of the CTLE settings (CTLE 1 dB to 2 dB).

Limits

At TP1a:

- Eye Width: LL: 0.46 UI and UL: NA
- Eye Height A: LL: 95 mV and UL: NA
- Eye Height B: LL: 80 mV and UL: NA

At TP4:

- Eye Width: LL: 0.57 UI and UL: NA
- Eye Height: LL: 228 mV and UL: NA

Vertical eye closure

This section verifies that the vertical eye closure of the signal is within the conformable limits according to the specification IEEE 802.3bm, and annex 83E. 4.2.1.

Required test equipment

Minimum system requirements

Equipment connection diagram

Inputs

- Differential signal created using two single ended sources (Positive and Negative) and filtered through fourth order 33 GHz Bessel Thomson filter.

Standards	Test points	Specification
CAUI4	TP4	IEEE 802.3bm, Annex 83E.4.2.1, Table 83E-3

Measurement procedure

1. Result of Eye Height@BER is used as prerequisite.
2. Vertical eye closure is calculated using the following formula:

   VEC = 20log(AV/EH15)

   Where,

   VEC is vertical eye closure in dB

   AV is the eye amplitude of the equalized waveform. Eye amplitude is defined as the mean value of logic one minus the mean value of logic zero in the central 5% of the eye

   EH15 is the eye height at BER of 1e-15

Limits

At TP4:

- Lower limit: NA
- Higher limit: 5.5 dB

Transition time

This section verifies that the transition time of the DUT is within the conformable limits according to the specification.

Required test equipment

Minimum system requirements

Equipment connection diagram

Standards	Test points	Specification
CAUI4	TP1a	IEEE 802.3bm, Annex 83E.3.1.5, Table 83E-1
	TP4	IEEE 802.3bm, Annex 83E.3.1.5, Table 83E-3

Inputs

- Differential signal created using two single ended sources (Positive and Negative) and filtered through fourth order 33 GHz Bessel Thomson filter.

Measurement procedure

1. Configure 80SJNB acquisition panel for differential filtered waveform.
2. Find the Nominal Unit interval of the filtered differential signal exported from 80SJNB.
3. Find Voltage High and Low in region 0000011111 for Rise Time, 111111111100000 for fall time. In these regions, take average amplitude in -3UI to -2UI range from edge for voltage low and average amplitude in 2UI to 3UI range from edge for voltage high.
4. Find the transition time in search patterns (000001111 for Rise and 11111111100000 for fall) by taking difference in time from 20% to 80% of the signal amplitude.

Limits

At TP1a:

- Lower limit: 10 ps
- Higher limit: NA

At TP4:

- Lower limit: 12 ps
- Higher limit: NA

CR4 / KR4 TXE compliance measurements

Signaling rate

This section verifies that the signaling rate (data rate) of the DUT per lane is within the conformable limits according to the specification.

Standards	Test points	Specification
CR4	TP2	IEEE 802.3bj, Section 92.8.3.9, Table 92-6
KR4	TP0a	IEEE 802.3bj, Section 93.8.1.2, Table 93-4

Required test equipment

Minimum system requirements

Equipment connection diagram

Inputs

- Data Positive and Data Negative signals to the Clock Recovery module.

Measurement procedure

1. Query the data rate when the clock recovery model is locked.
2. Update the report with Pass/Fail status.

Limits

- Lower limit: Configured Date Rate - 100 ppm
- Higher limit: Configured Date Rate + 100 ppm

DC common mode output voltage

This section verifies that the mean of the common mode signal is within the conformable limits according to the specification.

Standards	Test points	Specification
CR4	TP2	IEEE 802.3bj, Section 92.8.3.1, Table 92-6
KR4	TP0a	IEEE 802.3bj, Section 93.8.1.3, Table 93-4

Required test equipment

Minimum system requirements

Equipment connection diagram

Measurement procedure

Measure the voltage using external digital multimeter.

Limits

CR4	0 V to 1.9 V
KR4	0 V to 1.9 V

AC common mode output voltage

This section verifies that the RMS value of the common mode signal is within the conformable limits according to the specification.

Standards	Test points	Specification
CR4	TP2	IEEE 802.3bj, Section 92.8.3.1, Table 92-6
KR4	TP0a	IEEE 802.3bj, Section 93.8.1.3, Table 93-4

Required test equipment

Minimum system requirements

Equipment connection diagram

Inputs

- Differential signal created using two single ended sources (Positive and Negative) and filtered through fourth order 33 GHz Bessel Thomson filter.

Measurement procedure

1. Create a common mode signal using

$$Math = \frac{(DataPositive + DataNegative)}{2}$$

2. Click **Setup** > **Histogram** and create a vertical histogram on common mode signal.
3. Standard deviation of the histogram is measured as AC common mode voltage.

Limits

CR4	AC Common mode output voltage <= 30 mV RMS with respect to ground
KR4	AC Common mode output voltage <= 12 mV RMS with respect to ground

Diff peak to peak output voltage - Tx enabled

This section verifies that the peak to peak differential output voltage is within the conformable limits according to the specification.

Standards	Test points	Specification
CR4	TP2	IEEE 802.3bj, Section 92.8.3.1, Table 92-6
KR4	TP0a	IEEE 802.3bj, Section 93.8.1.3, Table 93-4

Required test equipment

Minimum system requirements

Equipment connection diagram

Inputs

- Differential of individually filtered (33 GHz filter) signal created using two single ended sources (positive and negative).

Measurement procedure

1. Select **Setup** > **Measurement** and click on **Select Meas**.
2. Select **Pulse Amplitude** > **Pk-Pk** for measuring the peak to peak amplitude.
3. The value of the pk-pk voltage is the differential output voltage (pk-pk).

Limits

CR4	Peak-to-Peak Differential output <= 1200 mV
KR4	Peak-to-Peak Differential output <= 1200 mV

Diff peak to peak output voltage - Tx disabled

This section verifies that the peak to peak differential output voltage when transmitter is disabled is within the conformable limits according to the specification.

Standards	Test points	Specification
CR4	TP2	IEEE 802.3bj, Section 92.8.3.1, Table 92-6
KR4	TP0a	IEEE 802.3bj, Section 93.8.1.3, Table 93-4

Required test equipment

Minimum system requirements

Equipment connection diagram

Inputs

- Differential signal created using two single ended sources (Positive and Negative).

Measurement procedure

1. Turn-off the DUT. Select **Setup** > **Measurement** and click on **Select Meas**.
2. Select **Pulse Amplitude** > **Pk-Pk** for measuring the peak to peak amplitude.
3. The value of the pk-pk voltage is the differential output voltage (pk-pk).

Limits

CR4	Peak-to-Peak Differential output (Tx Disabled) <= 35 mV
KR4	Peak-to-Peak Differential output (Tx Disabled) <= 30 mV

Transmitter waveform requirements

Common procedure for transmitter waveform requirements

This section describes the general procedure to be performed for Transmitter output waveform measurements. Perform the general procedure and the measurement specific procedure for each sub-measurements.

Required test equipment

Minimum system requirements

Equipment connection diagram

Inputs

- Differential signal created using two single ended sources (Positive and Negative) and filtered through fourth order 33 GHz Bessel Thomson filter.

Common procedure for transmitter waveform requirements

1. Configure the DUT to transmit the PRBS 7, 9, 11, or 15 signal continuously at the specified data rate.
2. Process the signal using steps as per specification section 92.8.3.5 to measure the transmitter waveform parameter.

Linear fit pulse peak

This section verifies that the linear fit pulse peak value is within the conformable limits according to the specification.

Standards	Test points	Specification
CR4	TP2	IEEE 802.3bj, Section 92.8.3.5.2, Table 92-6
KR4	TP0a	IEEE 802.3bj, Section 93.8.1.5.2, Table 93-4

Measurement procedure

1. Set the DUT in PRESET mode by setting the coefficients C(0) to maximum, C(-1) and C(1) to zero.
2. Capture the signal and calculate linear fit pulse response coefficients of the signal. The peak value of the linear fit curve is measured as Linear Fit pulse peak.

Limits

CR4	Linear Fit Pulse Peak > 0.45 * Steady state voltage
KR4	Linear Fit Pulse Peak > 0.71 * Steady state voltage

Steady state voltage

This section verifies that the steady state voltage is within the conformable limits according to the specification.

Standards	Test points	Specification
CR4	TP2	IEEE 802.3bj, Section 92.8.3.5.2, Table 92-6
KR4	TP0a	IEEE 802.3bj, Section 93.8.1.5.2, Table 93-4

Measurement procedure

1. Set the DUT in PRESET mode by setting the coefficients C(0) to maximum, C(-1) and C(1) to zero.
2. Capture the signal and calculate linear fit pulse of the signal. The average value of the linear fit curve is measured as Steady state output voltage (DC voltage) of the signal.

Limits

CR4	■ Min: 0.34 V ■ Max: 0.6 V
KR4	■ Min: 0.4 V ■ Max: 0.6 V

Minimum pre-cursor full scale ratio

This section verifies that the minimum pre-cursor equalization ratio is within the conformable limits according to the specification.

Standards	Test points	Specification
CR4	TP2	IEEE 802.3bj, Section 92.8.3.5.5, Table 92-6
KR4	TP0a	IEEE 802.3bj, Section 93.8.1.5.5, Table 93-4

Measurement procedure

1. Set the DUT in PRESET mode and compute the filter coefficients.
2. Set equalizer coefficients C(-1) to zero, C(0) and C(1) to minimum.
3. Calculate equalizer coefficients C(-1), C(0) and C(1). Minimum pre-cursor equalization ratio is calculated as below:

   Min Pre-Cursor Eq Ratio = [C(0) – C(-1)] / [C(0) + C(-1)]

Limits

CR4	Minimum pre cursor equalization ratio >= 1.54
KR4	Minimum pre cursor equalization ratio >= 1.54

Minimum post-cursor full scale ratio

This section verifies that the minimum pre-cursor equalization ratio is within the conformable limits according to the specification.

Standards	Test points	Specification
CR4	TP2	IEEE 802.3bj, Section 92.8.3.5.5, Table 92-6
KR4	TP0a	IEEE 802.3bj, Section 93.8.1.5.5, Table 93-4

Measurement procedure

1. Set the DUT in PRESET mode and compute the filter coefficients.
2. Set equalizer coefficients C(1) to zero, C(0) and C(-1) to minimum.
3. Calculate equalizer coefficients C(-1), C(0) and C(1). Minimum pre-cursor equalization ratio is calculated as below:

   Min Post-Cursor Eq Ratio = [C(0) – C(1)] / [C(0) + C(1)]

Limits

CR4	Minimum post cursor equalization ratio >= 4
KR4	Minimum post cursor equalization ratio >= 4

Normalized coefficient step size

This section verifies that the increment and decrement step size of transmitter equalizer coefficients (C(-1), C(0) and C(1)) of the DUT are in conformable limits according to the specification.

Standards	Test points	Specification
CR4	TP2	IEEE 802.3bj, Section 92.8.3.5.4, Table 92-6
KR4	TP0a	IEEE 802.3bj, Section 93.8.1.5.4, Table 93-4

Measurement procedure

C(-1) Increment step size and **C(-1) Decrement step size**:

1. Set the DUT in PRESET state; acquire the signal and calculate the filter coefficients.
2. Configure all the DUT's transmitter equalizer coefficients to INITIALIZE state.
3. Measure the C(-1) coefficient value and denote as C(-1)_Initilaize
4. Configure the DUT's transmitter equalizer coefficient C(-1) to INCREMENT, C(0) and C(1) to HOLD state.
5. Measure the C(-1) coefficient value and denote as C(-1)_Increment
6. C(-1) Increment step size is calculated as: Δc = C(-1)_Increment – C(-1)_Initialize
7. Configure the DUT's transmitter equalizer coefficient C(-1) to DECREMENT, C(0) and C(1) to HOLD state.

8. Measure the C(-1) coefficient value and denote as C(-1)_Decrement
9. C(-1) Decrement step size is calculated as: Δc = C(-1)_Decrement – C(-1)_Increment

C(0) Increment step size and **C(0) Decrement step size**:

1. Set the DUT in PRESET state; acquire the signal and calculate the filter coefficients.
2. Configure all the DUT's transmitter equalizer coefficients to INITIALIZE state.
3. Measure the C(0) coefficient value and denote as C(0)_Initilaize
4. Configure the DUT's transmitter equalizer coefficient C(0) to INCREMENT, C(-1) and C(1) to HOLD state.
5. Measure the C(0) coefficient value and denote as C(0)_Increment
6. C(0) Increment step size is calculated as: Δc = C(0)_Increment – C(0)_Initialize
7. Configure the DUT's transmitter equalizer coefficient C(0) to DECREMENT, C(-1) and C(1) to HOLD state.
8. Measure the C(0) coefficient value and denote as C(0)_Decrement
9. C(0) Decrement step size is calculated as: Δc = C(0)_Decrement – C(0)_Increment

C(1) Increment step size and **C(1) Decrement step size**:

1. Set the DUT in PRESET state; acquire the signal and calculate the filter coefficients.
2. Configure all the DUT's transmitter equalizer coefficients to INITIALIZE state.
3. Measure the C(1) coefficient value and denote as C(1)_Initilaize
4. Configure the DUT's transmitter equalizer coefficient C(1) to INCREMENT, C(-1) and C(0) to HOLD state.
5. Measure the C(1) coefficient value and denote as C(1)_Increment
6. C(1) Increment step size is calculated as: Δc = C(1)_Increment – C(1)_Initialize
7. Configure the DUT's transmitter equalizer coefficient C(1) to DECREMENT, C(-1) and C(0) to HOLD state.
8. Measure the C(1) coefficient value and denote as C(1)_Decrement
9. C(1) Decrement step size is calculated as: Δc = C(1)_Decrement – C(1)_Increment

Limits

CR4	■ Min: 0.0083 ■ Max: 0.05
KR4	■ Min: 0.0083 ■ Max: 0.05

Signal to noise and distortion ratio

This section verifies that the signal to noise and distortion ratio of the DUT is within the conformable limits according to the specification.

Standards	Test points	Specification
CR4	TP2	IEEE 802.3bj, Section 92.8.3.7, Table 92-6
KR4	TP0a	IEEE 802.3bj, Section 93.8.1.6, Table 93-4

Required test equipment

Minimum system requirements

Equipment connection diagram

Inputs

- Differential signal created using two single ended sources (Positive and Negative) and filtered through fourth order 33 GHz Bessel Thomson filter.

Measurement procedure

1. Capture at least one complete cycle of test pattern PRBSn signal at test point TP0a.
2. Compute the linear fit pulse response p(k) and the linear fit error e(k) from the test signal denoted as σ_e.
3. Invoke 80SJNB and measure Random Noise. This measurement is denoted as σ_n.
4. SNDR is computed by the below formula:

$$SNDR = 10\log_{10}\left(\frac{p_{max}^2}{\sigma_e^2 + \sigma_n^2}\right) \text{ dB}$$

Limits

CR4	SNDR > 26 dB
KR4	SNDR > 27 dB

Output Jitter

Even-odd jitter peak to peak

This section verifies that the value of the even odd jitter is within the conformable limits according to the specification.

Standards	Test points	Specification
CR4	TP2	IEEE 802.3bj, Section 92.8.3.8, Table 92-6
KR4	TP0a	IEEE 802.3bj, Section 93.8.1.7, Table 93-4

Required test equipment

Minimum system requirements

Equipment connection diagram

Inputs

- Differential signal created using two single ended sources (Positive and Negative) and filtered through fourth order 33 GHz Bessel Thomson filter.

Measurement procedure

1. Even-Odd Jitter is defined as the magnitude of the difference between the average deviation of all even numbered transitions and the average deviation of all odd numbered transitions, where even-odd transitions are actual transitions.
2. 80SJNB is used to compute even-odd jitter.

Limits

CR4	Even Odd Jitter <= 0.035 UI
KR4	Even Odd Jitter <= 0.035 UI

Effective bounded and total uncorrelated jitter peak to peak

This section verifies that the jitter components are within the conformable limits according to the specification.

Standards	Test points	Specification
CR4	TP2	IEEE 802.3bj, Section 92.8.3.8, Table 92-6
KR4	TP0a	IEEE 802.3bj, Section 93.8.1.7, Table 93-4

Required test equipment

Minimum system requirements

Equipment connection diagram

Inputs

- Differential signal created using two single ended sources (Positive and Negative) and filtered through fourth order 33 GHz Bessel Thomson filter.

Measurement procedure

1. EBUJ and ERJ are computed using 80SJNB.
2. Effective total uncorrelated jitter is calculated using the equation Effective total uncorrelated jitter = 7.9 * ERJ + EBUJ.

Limits

CR4 and KR4	Effective bounded uncorrelated jitter <= 0.1 UI peak-to-peak
	Effective total uncorrelated jitter <= 0.18 UI peak-to-peak

SCPI commands

About SCPI command

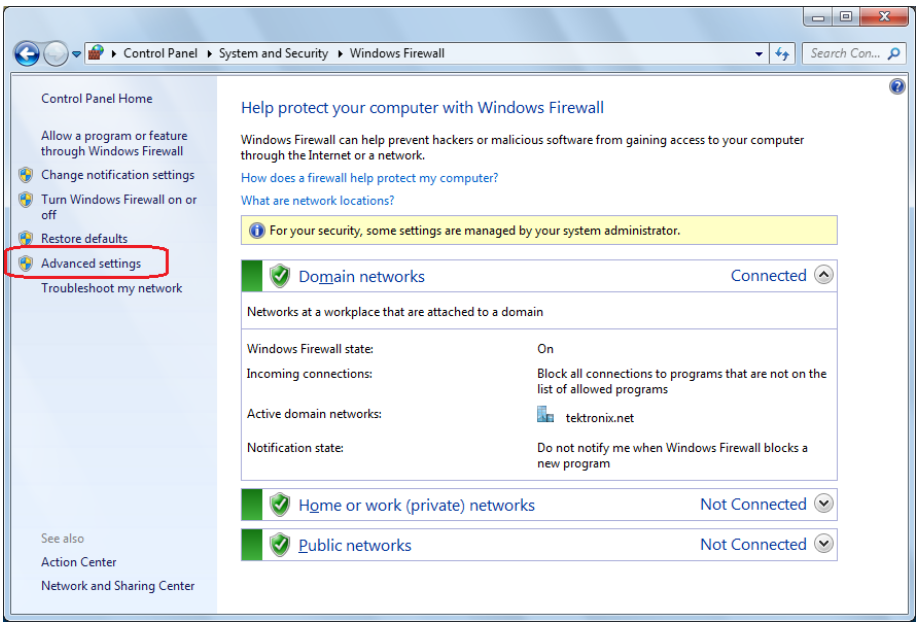
You can use Standard Commands for Programmable Instruments (SCPI) to communicate with the TekExpress application.

Socket configuration for SCPI commands

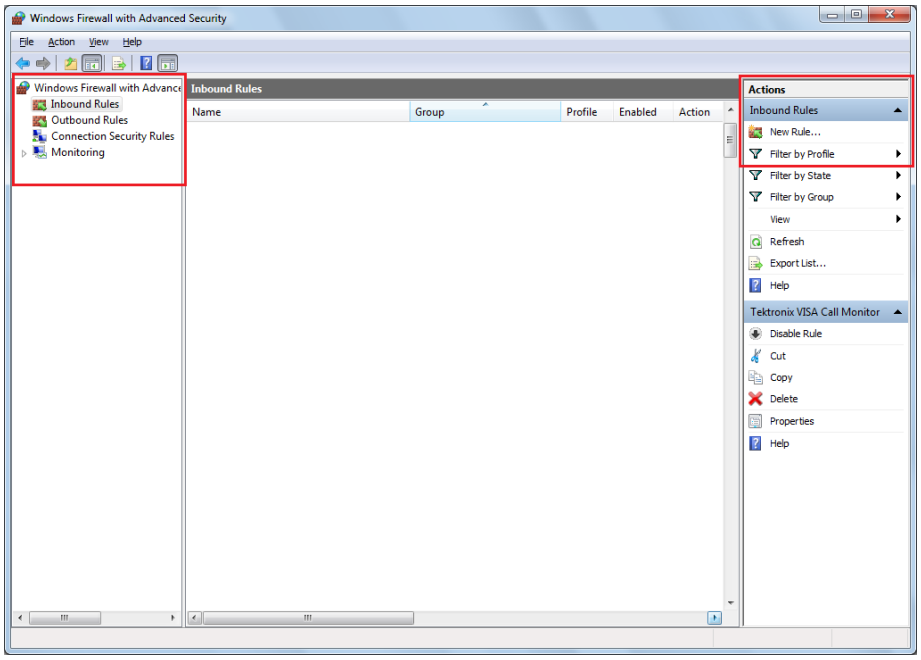
This section describes the steps for TCPIP socket configuration and TekVISA configuration to execute the SCPI commands.

TCPIP socket configuration

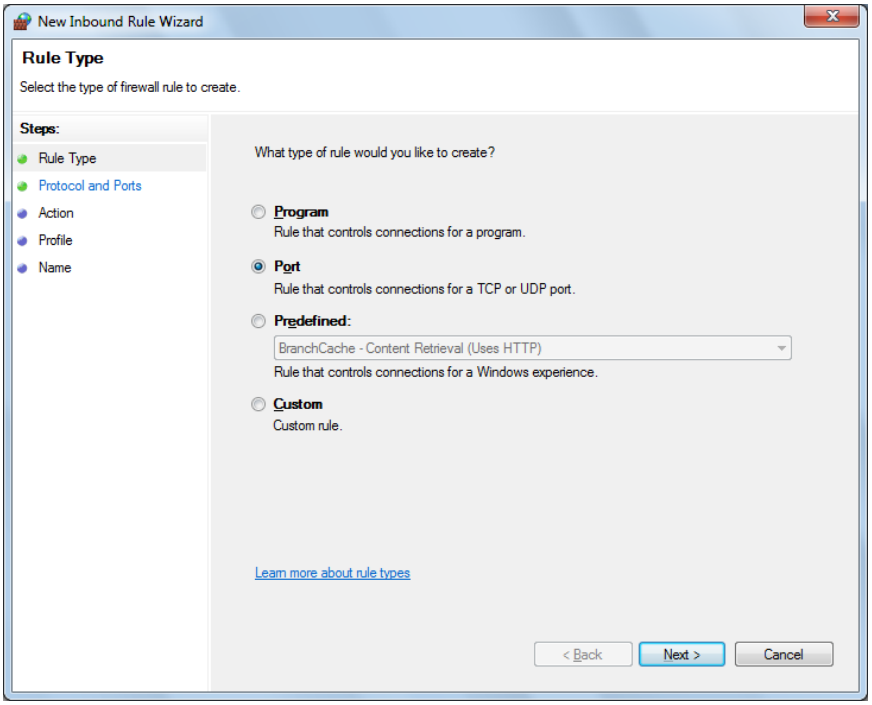
1. Click **Start** > **Control Panel** > **System and Security** > **Windows Firewall** > **Advanced settings**



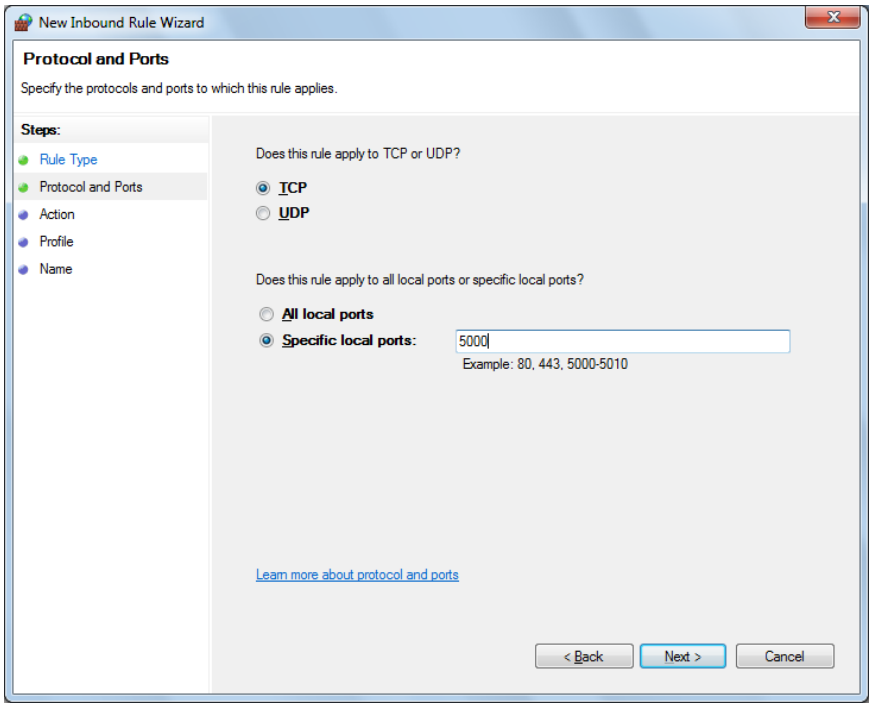
2. In Windows Firewall with Advanced Security menu, select **Windows Firewall with Advanced Security on Local Computer** > **Inbound Rules** and click New Rule…



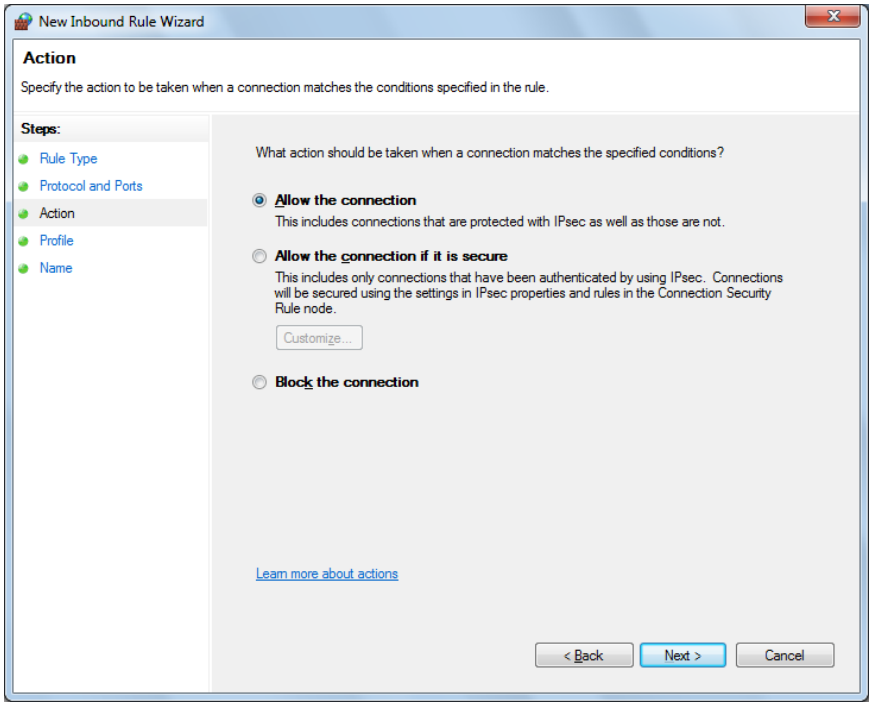
3. In New Inbound Rule Wizard menu
   a. Select **Port** and click **Next**



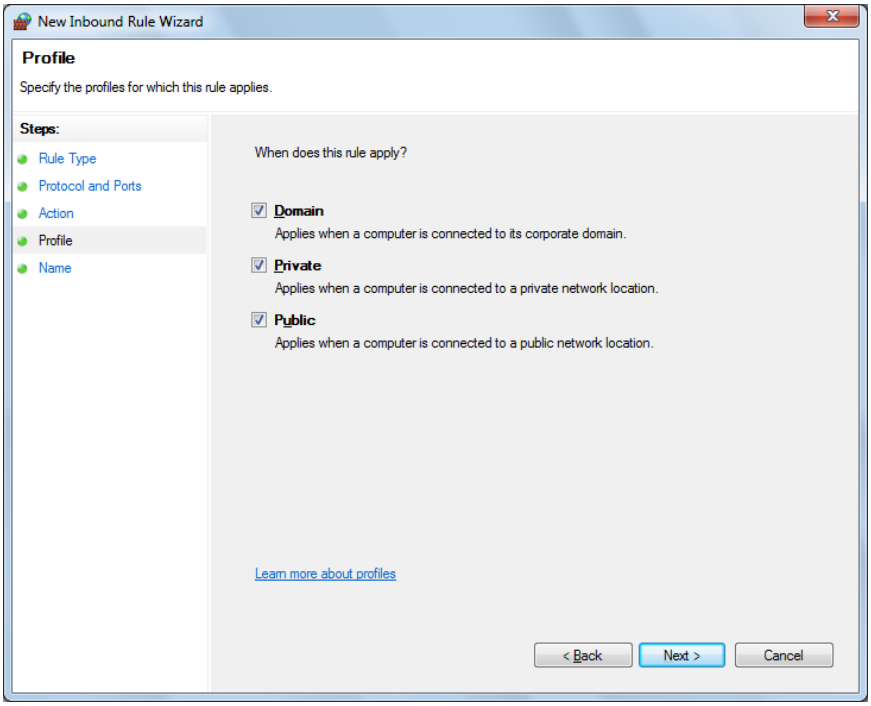
b. Select **TCP** as rule apply and enter 5000 for **Specific local ports** and click **Next**



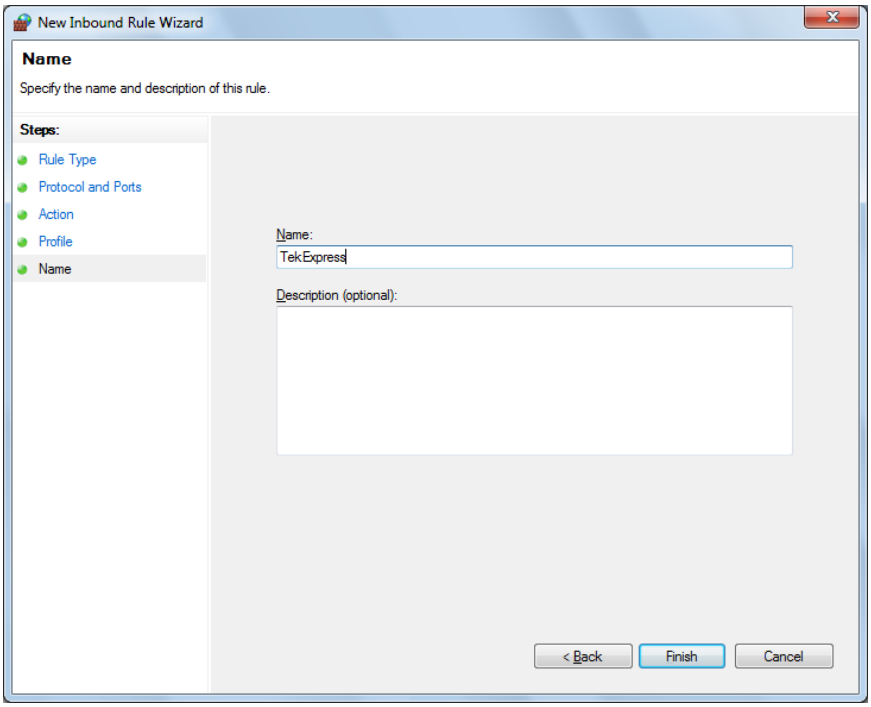
c. Select **Allow the connection** and click **Next**



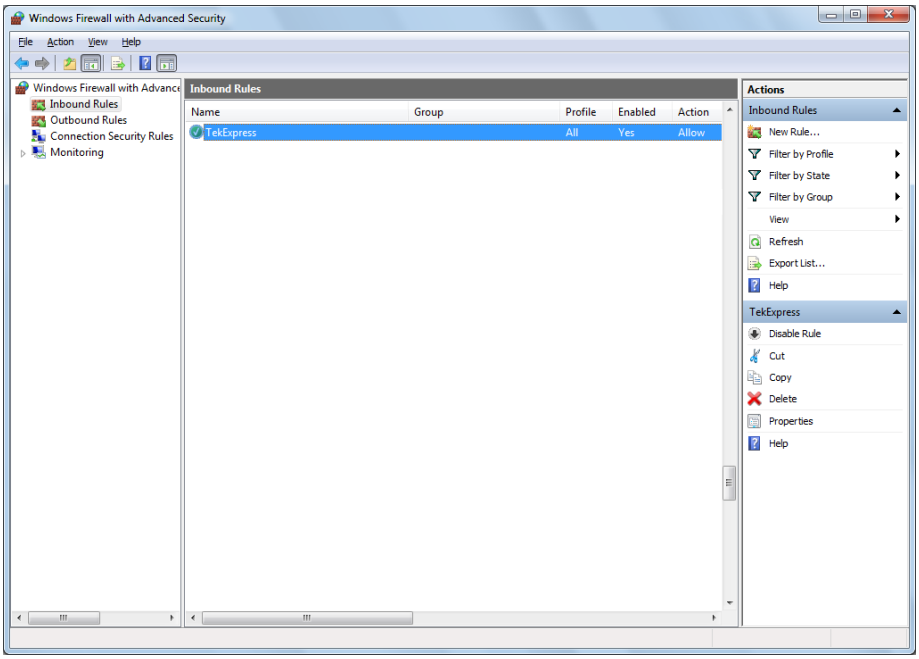
d. Select **Domain, Private, Public** and click **Next**



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

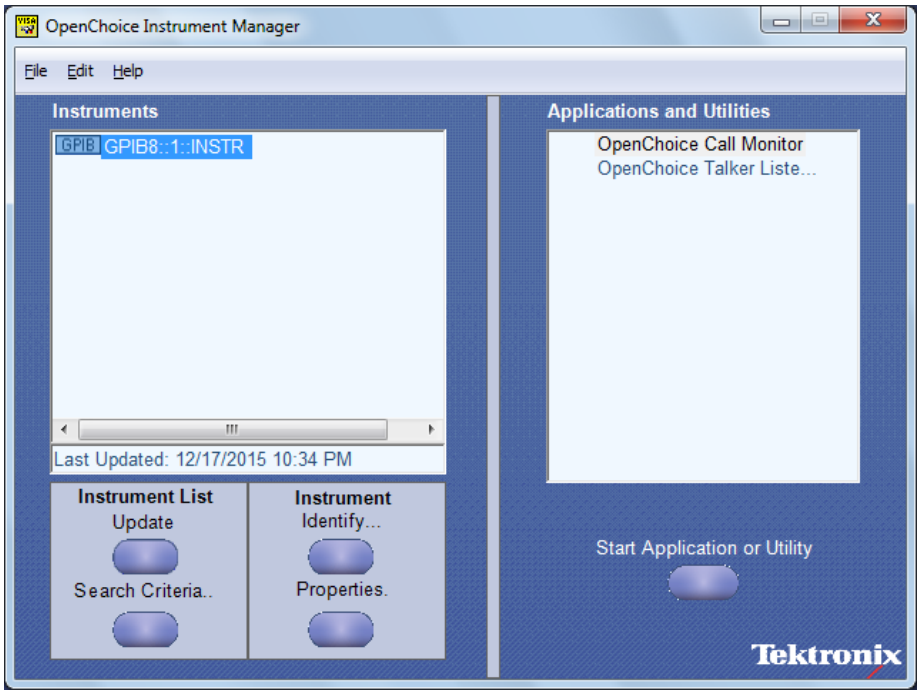


4. Check whether the Rule name is displayed in **Windows Firewall with Advanced Security menu** > **Inbound Rules**



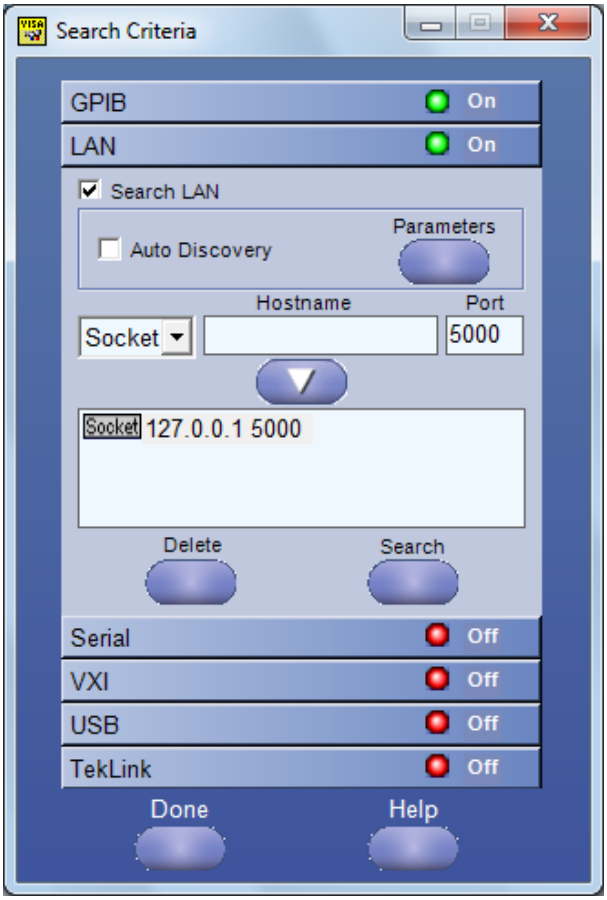
TekVISA configuration

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

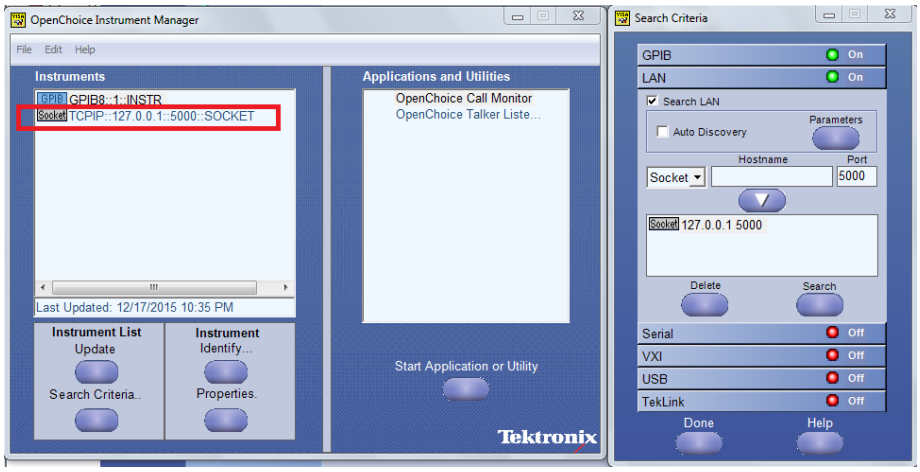


2. Click **Search Criteria**. In Search Criteria menu, click **LAN** to Turn-on. Select **Socket** from the drop-down list, enter the IP address of the TekExpress device in **Hostname** and type **Port** as 5000. Click  to configure the IP address with Port.

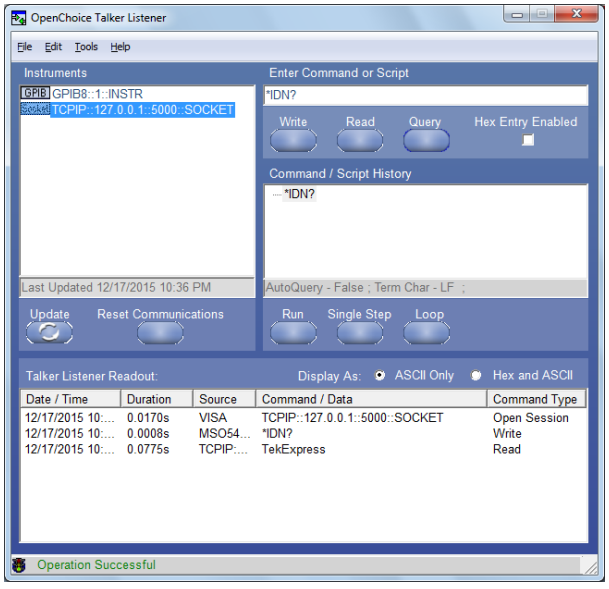
   Enter the Hostname as 127.0.0.1 if the TekVISA and TekExpress application are in the same system, else enter the IP address of the TekExpress application system.



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 Takler 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.



TEKEXP:*IDN?

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

Syntax TEKEXP:*IDN?\n

Inputs NA

Outputs Returns active TekExpress application name running on the scope

TIP. *Click here for examples.*

TEKEXP:*OPC?

This command queries the execution status of the last executed command.

Syntax TEKEXP:*OPC?\n

Inputs NA

Outputs 0 - last command execution is not complete

1 - last command execution is complete

TIP. *Click here for examples.*

TEKEXP:ACQUIRE_MODE

This command sets the acquire mode as live or pre-recorded.

Syntax TEKEXP:ACQUIRE_MODE {LIVE | PRE-RECORDED}\n

Inputs {LIVE | PRE-RECORDED}

Outputs NA

TIP. *Click here for examples.*

TEKEXP:ACQUIRE_MODE?

This command queries the acquire mode type.

Syntax TEKEXP:ACQUIRE_MODE?\n

Inputs NA

Outputs {LIVE | PRE-RECORDED}

TIP. *Click here for examples.*

TEKEXP:EXPORT

This command returns all the bytes of data to the specified file.

Syntax	Outputs
TEKEXP:EXPORT REPORT\n	Returns the report file in bytes
TEKEXP:EXPORT WFM,"<FileName>"\n	Returns the specified waveform file in bytes
TEKEXP:EXPORT IMAGE,"<FileName>"\n	Returns the specified image file in bytes

Inputs FileName - Specifies the file name

TIP. *Click here for examples.*

TEKEXP:INFO?

This command queries the information about the file(s).

Syntax	Outputs
TEKEXP:INFO? REPORT\n	<ReportFileSize>,"<ReportFileName.mht>"
TEKEXP:INFO? WFM\n	<WfmFile1Size>,"<WfmFileName1.wfm>";<WfmFile2Size>,"<WfmFileName2.wfm>";...
TEKEXP:INFO? IMAGE\n	<Image1FileSize>,"<Image1FileName>";<Image2FileSize>,"<Image2FileName>" ;...

TIP. *Click here for examples.*

TEKEXP:INSTRUMENT

This command sets the value for the selected instrument type.

Syntax TEKEXP:INSTRUMENT "<InstrumentType>",<Value>"\n

Inputs InstrumentType

Value

TIP. *Check Command parameters list for InstrumentType and Value parameters.*

Outputs NA

TIP. *Click here for examples.*

TEKEXP:INSTRUMENT?

This command queries the instrument selected for the specified instrument type.

Syntax TEKEXP:INSTRUMENT? "<InstrumentType>"\n

Inputs InstrumentType

TIP. *Check Command parameters list for InstrumentType parameters.*

Outputs Returns the instrument selected for the specified instrument type

TIP. *Click here for examples.*

TEKEXP:LASTERROR?

This command queries the last error string occurred for the current TCP session. If there are no errors since startup, or since the last call to TEKEXP:LASTERROR?\n, this command returns an empty string.

Syntax TEKEXP:LASTERROR?\n

Inputs NA

Outputs <string>

TIP. *Click here for examples.*

TEKEXP:LIST?

This command queries the list of available device, suite, test, version or instrument.

Syntax	Outputs
TEKEXP:LIST? DEVICE\n	Returns the list of available device(s) as comma separated values.
TEKEXP:LIST? SUITE\n	Returns the list of available suite(s) as comma separated values.
TEKEXP:LIST? TEST\n	Returns the list of available test(s) as comma separated values.
TEKEXP:LIST? VERSION\n	Returns the list of available version(s) as comma separated values.
TEKEXP:LIST? INSTRUMENT,"<InstrumentType>"\n	Returns the list of available instruments' for the given Instrument type as comma separated values.

NOTE. *This command returns the list of items within double quotes (""). Iterate the receive procedure until the list ends with double quotes otherwise the next query commands won't work as expected.*

Inputs InstrumentType

TIP. *Check Command parameters list for InstrumentType parameters.*

TIP. *Click here for examples.*

TEKEXP:MODE

This command sets the execution mode as compliance or user defined.

Syntax TEKEXP:MODE {COMPLIANCE | USER-DEFINED}\n

Inputs {COMPLIANCE | USER-DEFINED}

Outputs NA

TIP. *Click here for examples.*

TEKEXP:MODE?

This command queries the execution mode type.

Syntax TEKEXP:MODE?\n

Inputs NA

Outputs {COMPLIANCE | USER-DEFINED}

TIP. *Click here for examples.*

TEKEXP:POPUP

This command sets the response to the active popup shown in the application.

Syntax TEKEXP:POPUP "<PopupResponse>"\n

Inputs PopupResponse

Outputs NA

TIP. *Click here for examples.*

TEKEXP:POPUP?

This command queries the active popup information shown in the application.

Syntax TEKEXP:POPUP?\n

Inputs NA

Outputs Returns the active popup information in the application.

TIP. *Click here for examples.*

TEKEXP:REPORT

This command generates the report for the current session.

Syntax TEKEXP:REPORT GENERATE\n

Inputs GENERATE

Outputs NA

TIP. *Click here for examples.*

TEKEXP:REPORT?

This command queries the queried header field value in the report.

Syntax TEKEXP:REPORT? “<HeaderField>”\n

Inputs HeaderField - Specifies to return the measured value for the indicated test.

TIP. *Check* ***Report*** *for HeaderField parameters.*

Outputs Returns the queried header field value in the report

TIP. *Click here for examples.*

TEKEXP:RESULT?

This command queries the result available in report summary/details table.

Syntax	Outputs
TEKEXP:RESULT? "<TestName>"\n	Return Pass/Fail status of the test.
TEKEXP:RESULT? "<TestName>","<ColumnName>"\n	Returns all the row values of the specified column for the test.
TEKEXP:RESULT? "<TestName>","<ColumnName>",<RowNumber>\n	Returns the column value for the specified row number [1]

[1] Row number starts from zero.

Inputs

TestName - Specifies the name of the test for which to obtain the test result value.

ColumnName - Specifies the column name for the measurement

RowNumber - Specifies the row number of the measurement

TIP. *Check* ***Results*** *panel for TestName, ColumnName, and RowNumber parameters.*

TIP. *Click here for examples.*

TEKEXP:SELECT

This command selects the device, suite, version, or test.

Syntax

TEKEXP:SELECT <string1>,<string2>,<string4>\n

TEKEXP:SELECT TEST,<string3>,<string4>\n

Inputs

<string1> = {DEVICE | SUITE | VERSION}

<string2> = {DeviceName | SuiteName | VersionName}

<string3> = {“<TestName>"| ALL| REQUIRED }

<string4> = {TRUE | FALSE}

TIP. *Check Command parameters list for DeviceName, SuiteName, VersionName, and TestName parameters.*

TIP. *Click here for examples.*

Outputs NA

TEKEXP:SELECT?

This command queries the name of the selected device, suite, version, or test.

Syntax TEKEXP:SELECT? {DEVICE | SUITE | TEST | VERSION}\n

Inputs {DEVICE | SUITE | TEST | VERSION}

Outputs Returns the name of the selected device, suite, version, or test.

TIP. *Click here for examples.*

TEKEXP:SETUP

This command sets the value of the current setup.

Syntax	Outputs
TEKEXP:SETUP DEFAULT\n	Restore to default Setup
TEKEXP:SETUP OPEN,"<SessionName>"\n	Open the session
TEKEXP:SETUP SAVE\n	Save the session
TEKEXP:SETUP SAVE,"<SessionName>"\n	Save the session

Inputs SessionName - The name of the session

TIP. *Click here for examples.*

TEKEXP:STATE

This command sets the execution state of the application.

Syntax TEKEXP:STATE {RUN | STOP | PAUSE | RESUME}\n

Inputs {RUN | STOP | PAUSE | RESUME}

Outputs NA

TIP. *Click here for examples.*

TEKEXP:STATE?

This command queries the current setup state.

Syntax	Outputs
TEKEXP:STATE?	RUNNING | PAUSED | WAIT | ERROR | READY | STOPPED
TEKEXP:STATE? SETUP	SAVED | NOT_SAVED

TIP. *Click here for examples.*

TEKEXP:VALUE

This command sets the value of parameters of type General, Acquire, Analyze, or DUTID.

Syntax

TEKEXP:VALUE GENERAL,"<ParameterName>",“<Value>”\n

TEKEXP:VALUE ACQUIRE,“<TestName>","<AcquireType>", "<ParameterName>",“<Value>”\n

TEKEXP:VALUE ANALYZE,“<TestName>","<ParameterName>".“<Value>” \n

TEKEXP:VALUE DUTID,“<Value>”\n

Inputs

ParameterName - Specifies the parameter name

TestName - Specifies the test name

AcquireType - Specifies the acquire type

Value - Specifes the value to set

TIP. *Check Command parameters list for ParameterName, AcquireType, and Value parameters.*

Outputs

NA

TIP. *Click here for examples.*

TEKEXP:VALUE?

This command queries the value of the parameter for type General, Acquire, Analyze, or DUTID.

Syntax	Outputs
TEKEXP:VALUE? GENERAL,"<ParameterName>"\n	Returns the value of Parameter for type GENERAL
TEKEXP:VALUE? ACQUIRE,“<TestName>", "<AcquireType>","<ParameterName>"\n	Returns the value of Parameter for type ACQUIRE
TEKEXP:VALUE? ANALYZE, “<TestName>","<ParameterName>"\n	Returns the value of Parameter for type ANALYZE
TEKEXP:VALUE? DUTID\n	Returns the DUTID value

Inputs

ParameterName - Specifies the parameter name

TestName - Specifies the test name

AcquireType - Specifies the acquire type

TIP. *Check Command parameters list for ParameterName and AcquireType parameters.*

Outputs

Returns the value of Parameter for type GENERAL | ACQUIRE | ANALYZE | DUTID.

TIP. *Click here for examples.*

Command parameters list

This section provides the parameters list for the SCPI commands.

Parameters	Description
InstrumentType	Specifies the instrument type. Valid values are: ■ Sampling Scope
Value	Specifies the value parameters. ■ For InstrumentType, valid values are: ■ Do not use ■ GPIB8::1::INSTR ■ For DUTID, valid value is: ■ Comment
DeviceName	Specifies the device name. Valid values are: ■ CAUI4-TX ■ KR4-TX ■ CR4-TX
SuiteName	Specifies the suite name. Valid values are: ■ TP1a, TP4 for CAUI4 ■ TP0a for CR4 ■ TP2 for KR4
VersionName	Specifies the version name. Valid values are ■ 100GBASE Tx, IEEE 802.3bm, Annex 83E.3.1 ■ 100GBASE Tx, IEEE 802.3bm, Annex 83E.3.2 ■ 100GBASE Tx, IEEE 802.3bj - Section 93 ■ 100GBASE Tx, IEEE 802.3bj - Section 92

Parameters	Description
TestName for **CAUI4**	■ DC Common Mode Output Voltage ■ Diff Peak to Peak Output Voltage -Tx Disabled ■ Diff Peak to Peak Output Voltage -Tx Enabled ■ AC Common Mode Output Voltage ■ Single Ended Output Voltage ■ Signaling Rate ■ Eye Width ■ Eye Height Differential ■ Transition Time ■ Vertical Eye closure

Parameters	Description
TestName for **KR4**	■ DC Common Mode Output Voltage ■ Diff Peak to Peak Output Voltage -Tx Disabled ■ Diff Peak to Peak Output Voltage -Tx Enabled ■ AC Common Mode Output Voltage ■ Signaling Rate ■ Linear Fit Pulse Peak ■ Minimum Pre-cursor full scale ratio ■ Minimum Post-cursor full scale ratio ■ Normalized Coefficient Step Size ■ Signal To Noise And Distortion Ratio ■ Steady State Voltage ■ Even-Odd Jitter Peak to Peak ■ Effective total uncorrelated jitter peak to peak ■ Effective bounded uncorrelated jitter peak to peak
TestName for **CR4**	■ DC Common Mode Output Voltage ■ Diff Peak to Peak Output Voltage -Tx Disabled ■ Diff Peak to Peak Output Voltage -Tx Enabled ■ AC Common Mode Output Voltage ■ Signaling Rate ■ Linear Fit Pulse Peak ■ Minimum Pre-cursor full scale ratio ■ Minimum Post-cursor full scale ratio ■ Normalized Coefficient Step Size ■ Signal To Noise And Distortion Ratio ■ Steady State Voltage ■ Even-Odd Jitter Peak to Peak ■ Effective total uncorrelated jitter peak to peak ■ Effective bounded uncorrelated jitter peak to peak

ParameterName and Value for General, Acquire and Analyze

Specifies the ParameterName and Value for General, Acquire and Analyze. The configuration parameters available are not same for measurements.

Table 15: ParameterName and Value for General

ParameterName	Value
Report Update Mode	■ New ■ Append ■ Replace
Auto increment report name if duplicate	TRUE or FALSE
Include Pass/Fail Results Summary	TRUE or FALSE
Include Detailed Results	TRUE or FALSE
Include Plot Images	TRUE or FALSE
Include Setup Configuration	TRUE or FALSE
Include User Comments	TRUE or FALSE
Save As Type	■ Web Archive (*.mht;*.mhtml) ■ PDF (*.pdf;) ■ CSV (*.csv;)
View Report After Generating	TRUE or FALSE
Report Group Mode	■ Test Name ■ Test Result
Create report at the end	■ Included ■ Excluded
DUTID Comment	User comment
Run Test More than Once	TRUE or FALSE
Number of Runs	1 to 200
On Failure Stop and Notify	TRUE or FALSE
Timer Warning Info Message Popup	■ "True" ■ "FALSE"
Timer Warning Info Message Popup Duration	1 to 300
Timer Error Message Popup	■ "True" ■ "False"
Timer Error Message Popup Duration	1 to 300

ParameterName	Value
Pattern Type	■ PRBS7 ■ PRBS9 ■ PRBS11 ■ PRBS15
Data Rate	valid value is 18 to 28.05
MODE	■ COMPLIANCE ■ USER-DEFINED
Crosstalk Source	■ True ■ False
RL for Eye	0.25 to 16
CTLE FilterFIle	■ All(1-9dB) ■ CTLE_0dB.flt ■ CTLE_1dB.flt ■ CTLE_2dB.flt ■ CTLE_3dB.flt ■ CTLE_4dB.flt ■ CTLE_5dB.flt ■ CTLE_6dB.flt ■ CTLE_7dB.flt ■ CTLE_8dB.flt ■ CTLE_9dB.flt ■ Custom ■ BestCTLE
Custom Filter Path (when CTLE FilterFIle is Custom)	CTLE filter file path Example: TEKEXP:VALUE GENERAL,"Custom Filter Path","C:\Program Files\Tektronix\TekExpress \TekExpress 100G-TXE\Compliance Suites\CAUI4-TX\TP1a\CTLE Filters\25.78125"
Custom Filter File (to select multiple custom CTLE filter file)	Names of CTLE filter files to select Example: TEKEXP:VALUE GENERAL,"Custom Filter File","CTLE_5dB.flt;CTLE_2dB.flt"

Examples

This section provides the examples for the SCPI commands.

Example	Description
TEKEXP:*IDN?\n	It returns the active TekExpress application name running on the scope.
TEKEXP:*OPC?\n	It returns the last command execution status.
TEKEXP:ACQUIRE_MODE?\n	It returns LIVE when acquire mode is set to live.
TEKEXP:EXPORT REPORT\n	It returns the report file in bytes. This can be written into another file for further analysis.
TEKEXP:INFO? REPORT\n	It returns “100,”ReportFileName.mht””, when 100 is the filesize in bytes for the filename ReportFileName.
TEKEXP:INFO? WFM\n	It returns “100,“WfmFileName1.wfm””;“200,“WfmFileName2.wfm”” when 100 is the filesize in bytes for the filename WfmFileName1.wfm and 200 is the filesize in bytes for the filename WfmFileName2.wfm.
TEKEXP:INSTRUMENT? “Sampling Scope”\n	It returns "DSA8300 (GPIB8::1::INSTR), when DSA8300 (GPIB8::1::INSTR)" is the connected.
TEKEXP:LASTERROR?\n	It returns ERROR: INSTRUMENT_NOT_FOUND, when no instrument is found.
TEKEXP:LIST? DEVICE\n	It returns "CAUI4-TX,KR4-TX,CR4-TX" when CAUI4-TX,KR4-TX, and CR4-TX are the available device.
TEKEXP:LIST? INSTRUMENT,"Sampling Scope"\n	It returns "DSA8300 (GPIB8::1::INSTR)" when DSA8300 is the available instruments.
TEKEXP:MODE COMPLIANCE\n	It sets the execution mode as compliance.
TEKEXP:MODE?\n	It returns COMPLIANCE when the execution mode is compliance.
TEKEXP:POPUP “OK”\n	It sets OK as the response to active popup in the application.
TEKEXP:POPUP?\n	It returns "OK", when OK is the active popup information shown in the application.
TEKEXP:REPORT GENERATE\n	It generates report for the current session.
TEKEXP:REPORT? “Scope Information”\n	It returns "DSA8300" when DSA8300 is the scope model.
TEKEXP:REPORT? “DUT ID”\n	It returns "DUT001" when DNI_DUT001 is the DUT ID.
TEKEXP:SELECT DEVICE, TX_Device, TRUE\n	It selects TX_Device
TEKEXP:SELECT? DEVICE\n	It returns "TX-Device" when TX-Device is the selected device type.
TEKEXP:SETUP DEFAULT\n	It restores the application to default setup.
TEKEXP:STATE STOP\n	It stops the test execution.
TEKEXP:STATE?\n	It returns as READY when the application is ready to run next measurement.
TEKEXP:STATE? SETUP\n	It returns as NOT_SAVED when the current setup is not saved.
TEKEXP:VALUE GENERAL,"Pattern Type", "PRBS9"\n	It sets the signal type parameter value to PRBS9.
TEKEXP:VALUE? GENERAL,"Pattern Type"\n	It returns "PRBS9" when PRBS9 is the Signal Type value.

References

100GBASE-CR4/KR4 PMD sublayers relationship to OSI reference model

The service interface for the PMD supports the exchange of encoded data. The PMD translated the encoded data to and from the signal suitable for the medium. The 100GBASE-CR4/KR4 has four parallel bit streams with each having a nominal signaling rate of 25.87125 GBd.

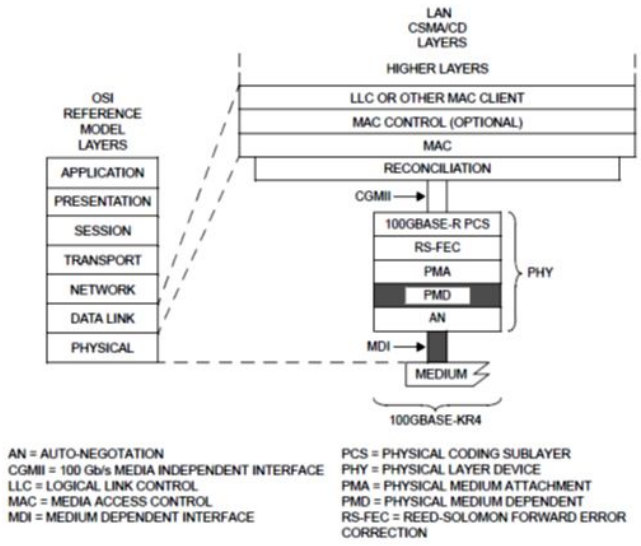


Figure 11: 100GBASE-CR4/KR4 relationship to ISO/IEC OSI

CAUI4

Chip-to-chip four lane attachment unit interface (100Gbps)

The chip-to-chip interface provides electrical characteristics and associated compliance points which can optionally be used when designing systems with electrical interconnect of approximately 25 cm in length.

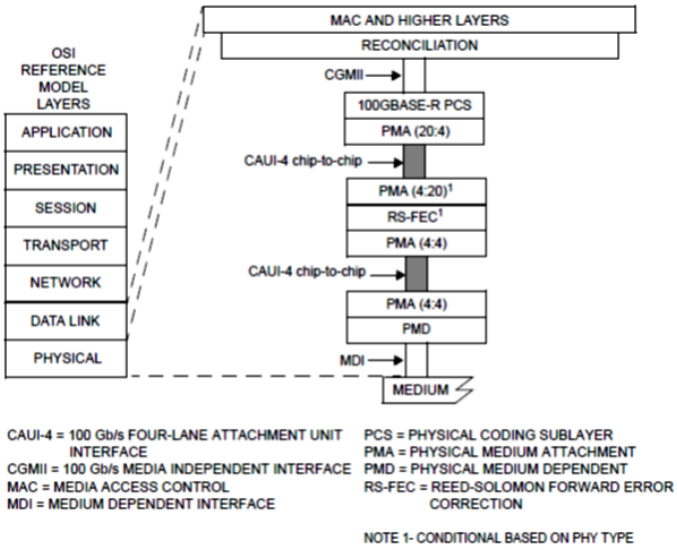


Figure 12: CAUI4 chip-to-chip relationship to the ISO/IEC

The CAUI4 chip-to-chip interface comprises of independent data paths in each direction. Each data path contains four differential lanes which are AC coupled. The nominal signaling rate for each lane is 25.78125 GBd.

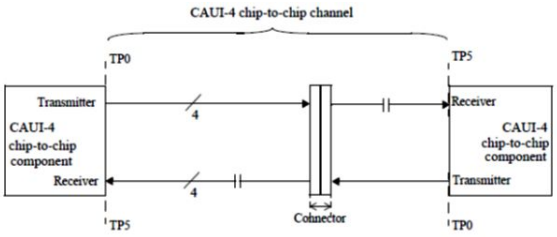


Figure 13: Typical CAUI4 chip-to-chip application

Chip-to-module four lane attachment unit interface (100 Gbps)

The chip-to-module interface provides electrical characteristics and associated compliance points which can optionally be used when designing systems with pluggable module interfaces.

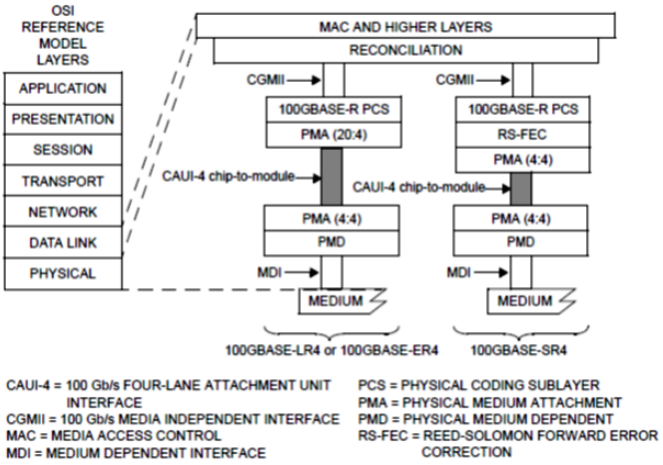


Figure 14: CAUI4 chip-to-module structure

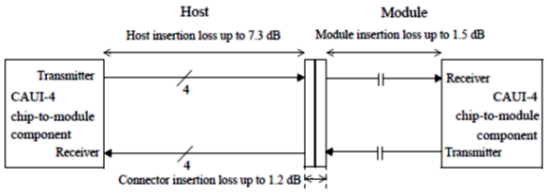


Figure 15: Typical Chip-to-Module application

Clock Recovery Unit (CRU)

Tektronix Clock Recovery Unit is configured with Nominal Data rate (set by user in GUI), Corner frequency of 10 MHz, Slope of 20 dB/decade, i.e, 0 dB peaking, and Lock range of 10 MHz.

The CRU locked data rate value is used as result for Signaling Rate measurement. The following flow diagram gives detailed flow for CRU locking mechanism followed in 100G-TXE application.

Sub-rate clock output of CRU is given to clock pre scale/trigger input of sampling scope. Clock output of CRU is given to phase reference module.

NOTE. *100G-TXE application supports only external Clock Recovery Unit.*

Trigger Source

The clock signal (synchronous to data) can be provided using either Tektronix external CRU, or other source having clock signal in synchronous with data, and perform similar to Tektronix external CRU. If the trigger source is others, then you can configure the clock divider parameter.

Clock divider is the ratio of data rate to frequency of clock signal, fed as input to phase reference. It is used to determine the frequency of phase characterization (used only if phase reference module is present in one of the slot in the main frame).

Phase characterization frequency = Data rate / Clock divider

Phase reference characterization

Phase reference module is not a mandatory requirement for 100G-TXE measurements. If phase reference module is present in any sampling scope slots, then the setup provides a clock signal synchronous with data as input to phase reference module (can use recovered clock from CRU). Phase reference characterization is done with phase correction mode as “triggered” and input frequency equal to frequency of the input clock signal.

NOTE. *The recovered clock frequency from CR286A is half of the data rate, when the data rate is greater than 14.3 Gb/sec.*

The 100G-TXE application uses only one phase reference module; if the system has multiple modules, then the lower numbered slot is used and others are ignored. This slot/channel information is obtained from phase reference source query, using instrument programmatic interface internally.

If there is no phase reference module, then query results in C1C2 (default), and perform an additional query of module’s model number. If the model number is 82A04B, then proceed with phase reference characterization, else skip phase reference characterization.

Parameters

About application parameters

This section describes the 100G-TXE application parameters, and includes the default menu settings.

The parameters for the menus, and options list the selections available for each and include the default values.

Setup panel configuration parameters

DUT tab parameters.

Parameters	Selection	Default Setting
DUTID	-	DUT001
Mode	Compliance, User defined	Compliance
Standards	■ CAUI4 **Test Points** ■ TP1a ■ TP4 ■ KR4 **Test Points** ■ TP0a ■ CR4 **Test Points** ■ TP2	■ CAUI4 - TP1a (Test Points)
Data Rate	18 to 28.05	25.78125 Gbps
Pattern Type	PRBS7, 9, 11, 15	PRBS9

Test Selection tab parameters.

Parameters	Selection	Default Setting
CAUI4 Tx Measurements	■ DC Common Mode Output Voltage (TP1a and TP4) ■ Diff Peak to Peak Output Voltage - Tx Disabled (TP1a) ■ Diff Peak to Peak Output Voltage - Tx Enabled (TP1a and TP4) ■ AC Common Mode Output Voltage (TP1a and TP4) ■ Single Ended Output Voltage (TP1a) ■ Signaling Rate (TP1a and TP4) ■ Eye Width (TP1a and TP4) ■ Eye Height Differential (TP1a and TP4) ■ Vertical Eye closure (TP4) ■ Transition Time(20% to 80%) (TP1a and TP4)	All measurements selected

Parameters	Selection	Default Setting
KR4 Tx Measurements	■ DC Common Mode Output Voltage ■ Diff Peak to Peak Output Voltage - Tx Disabled ■ Diff Peak to Peak Output Voltage - Tx Enabled ■ AC Common Mode Output Voltage ■ Signaling Rate ■ Transmitter waveform requirement ■ Linear Fit Pulse Peak ■ Minimum Pre-cursor full scale range ■ Minimum Post-cursor full scale range ■ Normalized Coefficient Step Size ■ C(-1) to increment C(0) and C(1) to hold ■ C(-1) to decrement C(0) and C(1) to hold ■ C(0) to increment C(-1) and C(1) to hold ■ C(0) to decrement C(-1) and C(1) to hold ■ C(1) to increment C(-1) and C(0) to hold ■ C(1) to decrement C(-1) and C(0) to hold ■ Signal To Noise And Distortion Ratio ■ Steady State Voltage ■ Output Jitter ■ Even-Odd Jitter Peak to Peak ■ Effective bounded uncorrelated jitter peak to peak ■ Effective total uncorrelated jitter peak to peak	All measurements selected

Parameters	Selection	Default Setting
CR4 Tx Measurements	■ DC Common Mode Output Voltage ■ Diff Peak to Peak Output Voltage - Tx Disabled ■ Diff Peak to Peak Output Voltage - Tx Enabled ■ AC Common Mode Output Voltage ■ Signaling Rate ■ Transmitter waveform requirement ■ Linear Fit Pulse Peak ■ Minimum Pre-cursor full scale range ■ Minimum Post-cursor full scale range ■ Normalized Coefficient Step Size ■ C(-1) to increment C(0) and C(1) to hold ■ C(-1) to decrement C(0) and C(1) to hold ■ C(0) to increment C(-1) and C(1) to hold ■ C(0) to decrement C(-1) and C(1) to hold ■ C(1) to increment C(-1) and C(0) to hold ■ C(1) to decrement C(-1) and C(0) to hold ■ Signal To Noise And Distortion Ratio ■ Steady State Voltage ■ Output Jitter ■ Even-Odd Jitter Peak to Peak ■ Effective bounded uncorrelated jitter peak to peak ■ Effective total uncorrelated jitter peak to peak	All measurements selected

Configuration tab parameters.

Table 16: Global settings parameters

Parameters		Selection	Default Setting
Trigger Source		Tek CRU, Others	Tek CRU
Clock Divider ***NOTE.*** *It is the ratio of Signaling Rate to Phase Reference characterisation frequency. This is displayed when Trigger Source selection is Others*		1,2,4,8	2
Clock Recovery Unit Settings	Loop Bandwidth	Data Rate / 2578, Custom (0-12 MHz)	Data Rate / 2578
	Peaking Value	0-6 dB	0.1
Use Phase reference		Select, De-select	De-select

Preferences tab parameters.

Parameters	Selection	Default Setting
Acquire/Analyze each test X times	1 to 200	1
Auto close Warnings and Information during Sequencing Auto close after X Seconds	1 to 300	10
Auto close Error Messages during Sequencing, Show in Reports Auto close after X Seconds	1 to 300	10

Reports panel parameters

Parameters	Selection	Default Setting
Report name	-	x:\100G-TXE\Reports \DUT001.mht
Save as Type	PDF (*.pdf;), Web Archive (*.mht; *.mhtml), CSV (*.csv;)	Web Archive (*.mht; *.mhtml)

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