TekExpress® USB Automated Solutions

Printable Online Help

077-0350-04

Tektronix

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www.tektronix.com
077-0350-04

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Contacting Tektronix

Tektronix, Inc.
14150 SW Karl Braun Drive
P.O. Box 500
Beaverton, OR 97077
USA

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

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

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General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

While using this product, you may need to access other parts of a larger system. Read the safety sections of the other component manuals for warnings and cautions related to operating the system.

To Avoid Fire or Personal Injury

Connect and disconnect properly. Connect the probe output to the measurement instrument before connecting the probe to the circuit under test. Connect the probe reference lead to the circuit under test before connecting the probe input. Disconnect the probe input and the probe reference lead from the circuit under test before disconnecting the probe from the measurement instrument.

Observe all terminal ratings. To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

Do not operate without covers. Do not operate this product with covers or panels removed.

Do not operate with suspected failures. If you suspect that there is damage to this product, have it inspected by qualified service personnel.

Avoid exposed circuitry. Do not touch exposed connections and components when power is present.

Terms in This Manual

These terms may appear in this manual:

WARNING. *Warning statements identify conditions or practices that could result in injury or loss of life.*

CAUTION. *Caution statements identify conditions or practices that could result in damage to this product or other property.*

Using Online Help

Select Help from the menu to open the help file. An electronic copy of the help file is located in the Documents directory on the 063-4068-XX DVD.

Tables of Contents (TOC) tab: Organizes the Help into book-like sections. Select a book icon to open a section; select any of the topics listed under the book.

Index tab: Enables you to scroll a list of alphabetical keywords. Select the topic of interest display the appropriate help page.

Search tab: Allows a text-based search.

Follow these steps:

1. Type the word or phrase you want to find in the search box. If the word or phrase is not found, try the Index tab.
2. Choose a topic in the lower box, and then select the Display button.

General Help Functions

- Select the Print button from the Help topics menu bar to print a topic.
- To return to the previous window, select the Back button.
- Use hyperlinks to jump from one topic to another.
- If the Back button is grayed out or a jump is not available, choose the Help Topics button to return to the originating help folder.

Related Documentation

The following documentation is included with the software:

- *DPOJET SuperSpeed (USB 3.0) Setup Library Methods of Implementation (MOI) for Verification, Debug and Characterization*, Tektronix part number 077-0266-xx.
- TekExpress USB Online Help (PDF version), Tektronix part number 077-0350-XX.

Conventions

The online help uses the following conventions:

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

Table 1: 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.

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

General Information

- All instrument model numbers.
- Hardware options, if any.
- Probes used.
- 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 applicable instruments and applications.
- If possible, save the application setup files, log.xml and status messages text file.
- If possible, save the waveform on which you are performing the measurement as a .wfm file.

Forward the information to technical support using one of these methods:

- E-mail – techsupport@tektronix.com
- FAX – (503) 627-5695

What Is New in This Release

This version of TekExpress® USB provides the following feature enhancements:

- Flexible user interface allows selecting individual filters for de-embedding, embedding, and equalization
- SSC Measurements controlled through a single UI control
- Select or deselect individual tests when using the USB-IF test method
- Automatically detect TriMode™ P7500 series probes
- New Configuration panel features:
  - DUT specific AFG configuration for pattern toggle
  - Automatically save channel waveforms (see page 99).
  - Support common mode measurements with TriMode P7500 series probes
  - Automatically recover oscilloscope settings when 'CP0-CP1 Toggle using' is set to 'Do not use'
  - Extended probing configurations (Single Ended (Ch1-Ch3), Single Ended (Ch2–Ch4))

Accessories

About the Test Fixture

For host testing. TF-USB3-A-P (for best signal quality) or for more mechanical flexibility use TF-USB-B-R (with included 13 cm USB 3.0 Cable - Part number 174-5772-00). For precision De-Embed of TF-USB3-A plug fixture, order TF-USB3-AB-KIT (includes Cal Kit).

For device testing. TF-USB3-A-R (includes short USB 3.0 Cable).

Supported Probes

The following probes support TekExpress USB application:

- P7313 SMA differential probe
- P7500 Tri-Mode probe

Minimum System Requirements

Table 2: System requirements

Processor	Pentium 4/M or equivalent processor.
Operating System	Microsoft Windows 7 or Windows XP Service Pack 2.
Memory	512 MB of memory.
Hard Disk	Approximately 2 GB of available hard-disk space for the recommended installation, which includes full TekExpress installation and distributed components.
Drive	DVD drive
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].
Software	■ TekExpress Framework (version 2.0.0.190 or later) installed. ■ SigTest 3.1.34 or later installed. ■ DPOJET Jitter and Eye Analysis Tool (version 3.5.0.17 or later) with Advanced Jitter and Eye analysis (DJA option) installed. ■ (Optional- required for USB3 testing) SuperSpeed USB DPOJET Module (DPOJET option USB3) ■ Microsoft Internet Explorer 7.0 or later. ■ Adobe Reader 6.0 or equivalent software for viewing portable document format (PDF) files. ■ (Optional) Serial Data Link Analysis (SDLA) software for Channel De-Embed, for custom filter development.
Other Devices	■ Microsoft compatible mouse or compatible pointing device. ■ Two USB ports (four USB ports recommended). ■ PCI-GPIB or equivalent interface for instrument connectivity [2].

1 If TekExpress is running on an instrument that has a video resolution lower than 800x600, it is recommended to connect and enable a secondary monitor before launching the application.

2 If TekExpress is installed on a Tektronix oscilloscope, TekExpress cannot use the virtual GPIB port to communicate with oscilloscope applications. If using external devices for instrument connectivity (such as USB-GPIB adapters or equivalent), enable the Talker Listener utility in the GPIB menu of the Tektronix MSO/DPO/DSA oscilloscope.

Application Directories and Usage

TekExpress USB is installed the following directory path, depending on the Windows operating system.

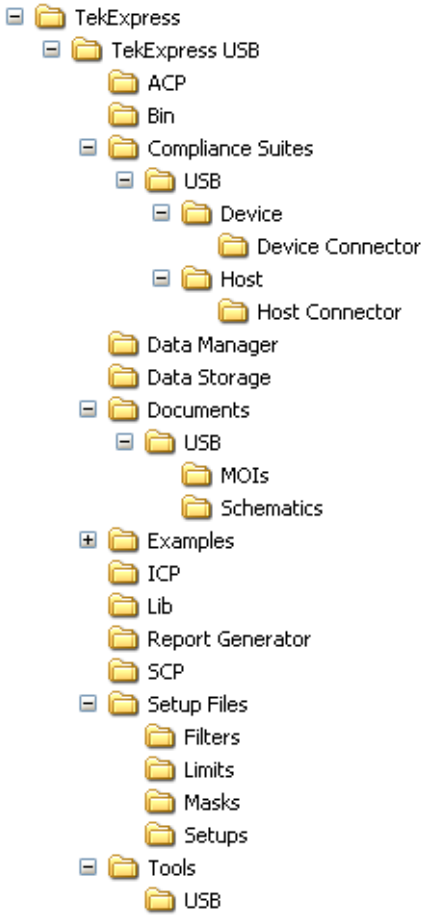
- For Windows 7:

  `C:\Program Files (x86)\Tektronix\TekExpress\TekExpress USB`

- For Windows XP and Windows XP-Embedded:

  `C:\Program Files\Tektronix\TekExpress\TekExpress USB`

The application directory and associated files are organized as follows:



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

Table 3: Default directory names and their usage

Directory names	Usage
InstallDir\TekExpress	Contains the TekExpress application and associated files.
\TekExpress\TekExpress USB	Contains files specific to TekExpress USB.
\TekExpress USB\Compliance Suites	Contains compliance specific sequence files. The folders under this directory represent the devices to be tested.
\TekExpress USB\Compliance Suites\USB	Includes the Device and Host Transmitter folders.
\TekExpress USB\Compliance Suites\USB\Device	Includes the “Device Connector” folder.
\TekExpress USB\Compliance Suites\USB\Device\Device Connector	Contains application specific files for Device.
\TekExpress USB\Compliance Suites\USB\Host	Includes the “Host Connector” folder.
\TekExpress USB\Compliance Suites\USB\Host\Host Connector	Contains application specific files for Host.
\TekExpress USB\ACP \TekExpress USB\SCP \TekExpress USB\ICP	Includes instrument and application specific interface libraries of TekExpress.
\TekExpress USB\Data Manager \TekExpress USB\Data Storage \TekExpress USB\Report Generator	Includes the result management specific libraries of TekExpress are present in these folders.
\TekExpress USB\Documents	Includes the Method of Implementation documents and technical documentation for the application.
\TekExpress USB\Bin \TekExpress USB\Lib \TekExpress USB\Tools	Includes the miscellaneous libraries of TekExpress.

See Also:

File Name Extensions (see page 9)
How To Activate the License (see page 9)
View Test Related Files (see page 37)
Saved Channel Waveform File Names (see page 99)

File Name Extensions

The software uses the following file name extensions:

File name extension	Description
.TekX	The saved session information file.
.seq	The test sequence file.
.xml	The encrypted XML file that contains the test specific configuration information. The log file extension is also xml.
.mht	The test report.
.PDF	The PDF file that details the method of implementation for the test.
.msk	The mask file.
.flt	The filter file.
.html	The html file.

See Also:

Application Directories and Usage (see page 7)
Saved Channel Waveform File Names (see page 99)

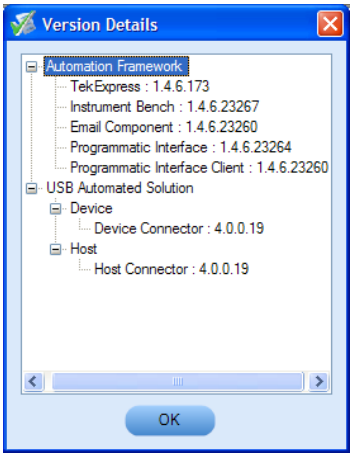
How to Activate the License

Follow the steps below to activate the license:

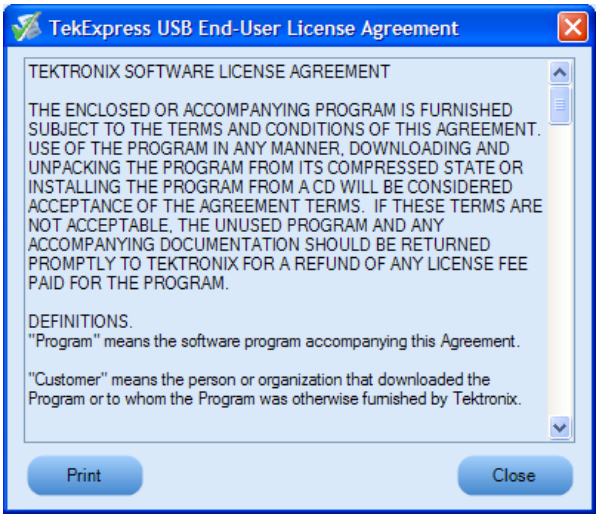
NOTE. *Check that your TekExpress USB dongle is installed on your host system before activating the license.*

1. Click **Help > About** to view the license information.

2. Click the **View Version Details** link to check the version numbers of the installed test suites.



3. Click the **View End-User License Agreement** link to open the following Tektronix Software License Agreement window. Click **Print** to print the License Agreement.



4. Click **License Info** to view the available software options. This window shows the license key and the various options with their status (active or inactive) with the current license key.

5. If you are activating the license for the first time, the license key field is empty. To activate the license, connect the USB dongle to your computer, enter the license key provided in the license key certificate, and click **Activate**. If the activation is successful, a  sign is displayed next to the license key field.

6. If you are reactivating the license, click **Reactivate**, enter the new license key and click **Activate**.

See Also:

Application Directories and Usage (see page 7)
File Name Extensions (see page 9)

Before You Click Run

After you first launch TekExpress, it creates the following folders on your computer:

- `\My Documents\My TekExpress`

NOTE. *Verify that the "My TekExpress" folder has read and write access permission.*

NOTE. *If a user with a different Windows login ID launches TekExpress, a new `My TekExpress` folder is created for that user in the `My Documents` folder.*

- `\My Documents\My TekExpress\USB`.
- `\My Documents\My TekExpress\USB\Untitled Session`. Every time the `USB.exe` is launched an `Untitled Session` folder is created under `USB` folder. The `Untitled Session` folder is deleted when you exit TekExpress.

CAUTION. *Each session has multiple files associated with it. Do not modify any of the session files and/or folders as this may result in loss of data or corrupted session files.*

- The `My TekExpress` folder is created as a shared folder with share name as `<domain><user ID> My TekExpress` (or if the PC is not connected to domain then share name is `<Computer name><user ID> My TekExpress`).

NOTE. *If the X: drive is mapped as a Local Disk and you want to map X: to a shared network location on a PC on which TekExpress is running, you need to manually unmap the Local Disk X: using the command (subst x: /d) from the command prompt and then manually map X: on the oscilloscope to desired network location.*

- The above shared folder is mapped as X: (X drive) on the PC where TekExpress is running.

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

Do the following before you click Run:

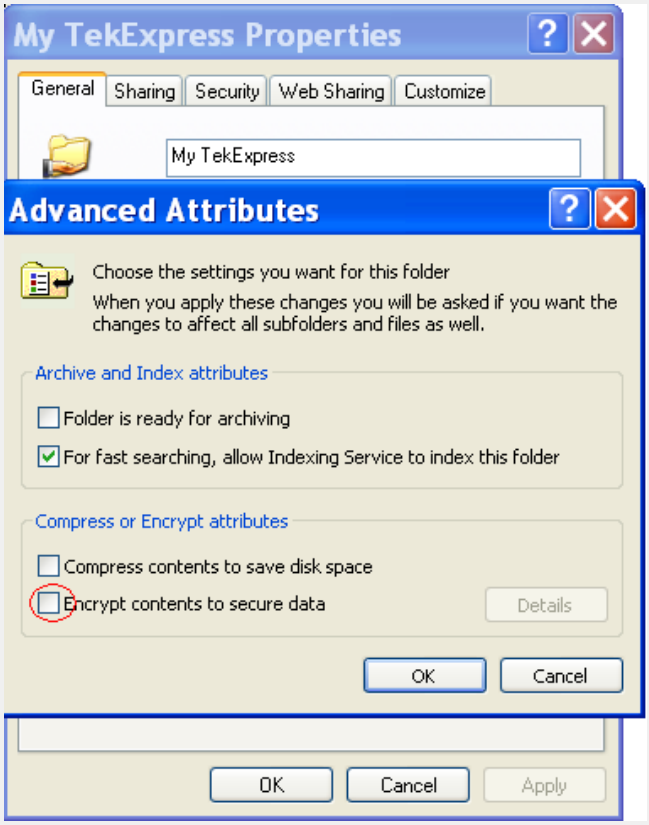
NOTE. *Check that the network connectivity is enabled on the PC running TekExpress.*

1. Map the shared `My TekExpress` folder as X: (X drive) on all test setup instruments that are running the Microsoft Windows operating system. The instruments save the waveform files or any other file transfer operations to the share folder.
2. Right click the `My TekExpress` folder and open the **Properties** dialog box.
3. Select the **General** tab and then **Advanced**.
4. In the **Advanced Attributes** window, ensure that the option **Encrypt contents to secure data** is NOT selected. Click here to view the picture.
5. Make sure that all the required instruments are properly warmed up, and that Signal Path Compensation (SPC) is performed.

Mapping My TekExpress Folder

To map the My TekExpress folder on the instruments, follow the steps below:

1. Open Windows Explorer.
2. From the Windows Explorer menu, select **Tools > Map Network drive**.
3. Select the Drive letter as X: (if there is any previous connection on X:, disconnect it first through **Tools > Disconnect Network drive** menu of Windows Explorer).
4. In the Folder field, enter remote `My TekExpress` folder path (for example, \\192.158.97.65\My TekExpress).
5. To determine the IP address of the PC where "My TekExpress" folder exists, do the following:
   - Select **Start > Run** menu on the PC where My TekExpress folder exists.
   - Enter `cmd` and press **Enter**.
   - Enter `ipconfig` in the command prompt field and press **Enter**.



To find SPC, do the following:

1. On the oscilloscope main menu, click **Utilities** menu.
2. Click **Instrument Calibration** option.

TekExpress Application Overview

TekExpress is the Tektronix Compliance Test Automation Framework, developed to support current and future test automation needs of customers. It is a highly modular architecture that enables deploying automated test solutions for various serial standards in a relatively short time.

The TekExpress USB application (Opt. USB-TX) is the automated version of USB3.0 measurements from DPOJET Timing and Analysis tool. With TekExpress USB, Tektronix provides Fully-Automated Tx solution for verification, characterization, and debug.

Key Features

The following are the key features of TekExpress USB application:

- Comprehensive test coverage
- Precise debugging and troubleshooting
- Accurate and reliable results
- Integrated Signal Test Tool (Sigtest Tool software installation is required; available from the USB-IF.)

Starting the Application

To start the application, do one of the following:

- Click **Start > Programs > Tektronix > TekExpress > TekExpress USB**. Other applications follow similar pattern.
- Double click the icon  on the desktop.
- If you want to restore a previously saved session, double-click the session file stored under `My TekExpress\USB`.

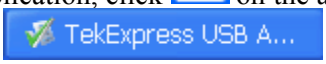
When the application is launched it displays the splash screen providing launch information. The application also checks for the presence and validity of the USB dongle.

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

See Also:

Resizing the Application Window (see page 17)
Exiting the Application (see page 17)

Resizing the Application Window

- To minimize the application, click  on the application title bar. To restore the application to its previous size, select 

in the Windows task bar.
- To maximize the application, click  . To restore it to previous size, click  on the application title bar.

See Also:

Starting the Application (see page 16)
Exiting the Application (see page 17)

Exiting the Application

To exit the application, do one of the following:

- Click **File > Exit**.
- Click  on the application title bar.

See Also:

Starting the Application (see page 16)
Resizing the Application Window (see page 17)

Global Controls

The menus and controls that appear outside the individual tabs are called “Global Controls”. These controls specify the devices to be tested.

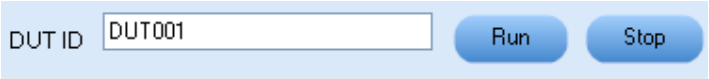


Table 4: Controls and functions

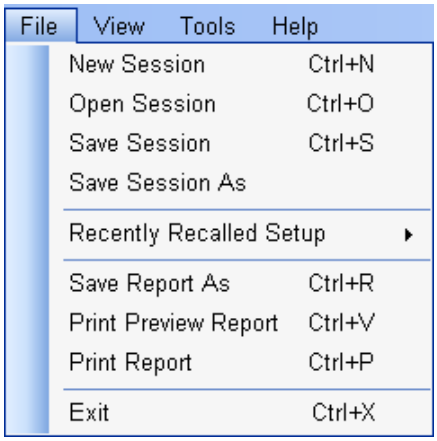
Control name	Function
DUT ID	The device ID is specified at the global level and the information is stored in the default location for all data files. This field cannot be empty and does not allow these special characters (.,..,...,\,/:?”<>|*). The maximum number of characters is 32.
	Run, pause, resume and stop the tests.

File Menu

See Also:

View Menu (see page 20)
Tools Menu (see page 20)
Help Menu (see page 23)

Click **File** on the application menu bar.



The File menu has the following selections:

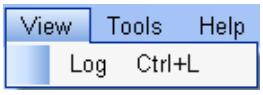
Menu	Function
New Session	Starts a default session of TekExpress.
Open Session	Opens a saved session.
Save Session	Saves the session.
Save Session As	Saves a session in a different name.
Recently Recalled Setup	Lists all the recent and previously recalled setup files.
Save Report As	Saves the report in user specified location.
Print Preview Report	Previews the report before printing.
Print Report	Opens the Windows “Print” dialog box.
Exit	Closes the application.

See Also:

View Menu (see page 20)
Tools Menu (see page 20)
Help Menu (see page 23)

View Menu

Click **View** on the application menu bar.



The View menu has the following selections:

Menu	Function
Log	Opens the log (log.xml) file in the default viewer.

See Also:

File Menu (see page 19)
Tools Menu (see page 20)
Help Menu (see page 23)

Tools Menu

Click **Tools** on the application menu bar.

The Tools menu has the following selections:

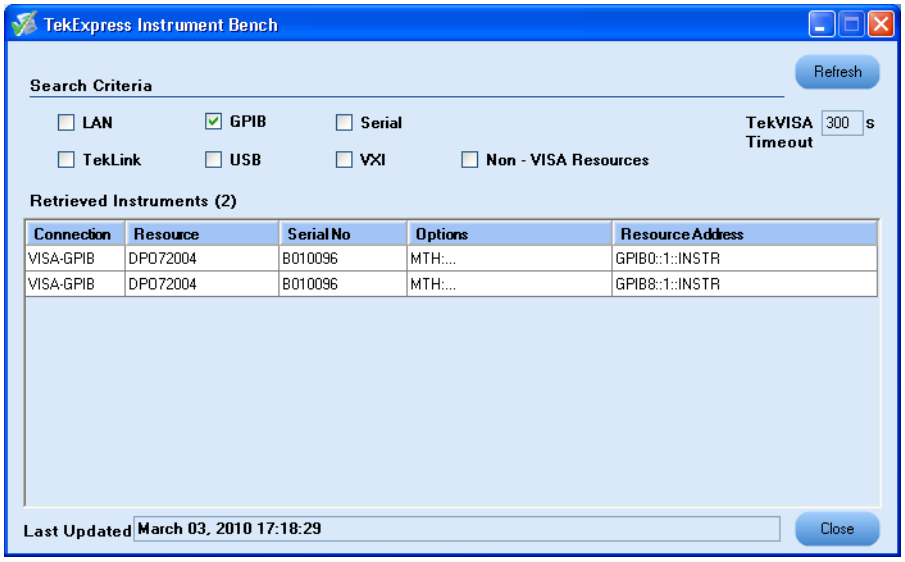
Menu	Function
Instrument Bench	Opens a dialog box showing the list of instruments attached to the test setup.
Email Settings (see page 22)	Opens a dialog box showing e-mail setting details.

Tools > Instrument Bench

The Instrument Bench window shows the list of VISA and NonVISA resources found on different interfaces/connections. It serves two purposes at the launch of TekExpress:

- Discovers the connected instruments.
- Confirms the instrument connection setup.

When you click **Tools > Instrument Bench**, the following dialog box is displayed:



- **Search Criteria**: The various connections on which you can search. **NonVISA Resources** are the instruments that cannot be searched using TekVISA.
- **Retrieved Instruments**: Displays the count and details of instruments that were discovered.
- **Last Updated**: Displays the time when the last time search was performed.
- **TekVISA Refresh Timeout (Seconds)**: This time out specifies the maximum time that TekExpress can wait for TekVISA update.

NOTE. *TekExpress uses TekVISA for instrument search. Make sure that TekVISA is running on your system before you refresh the instrument bench window.*

Table 5: Retrieved Resources properties in the Instrument Bench window

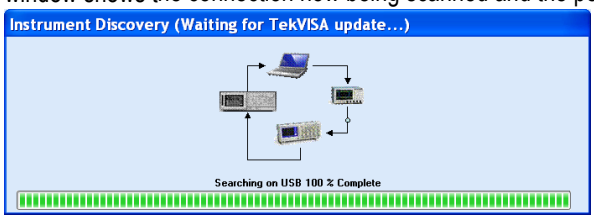
Title	Description
Connection	Shows the type of connection with the instrument.
Resource	Shows the name of the resource.
Serial Number	Shows the serial number of the resource.

Table 5: Retrieved Resources properties in the Instrument Bench window (cont.)

Title	Description
Options	Shows the options available on the instrument. [1]
Resource Address	Shows IP Address/Port number of the resource.

[1] The options column displays the options that fit in the field. To view complete options on the instrument, move the mouse cursor over the option.

Table 6: Button controls on Instrument Bench dialog box

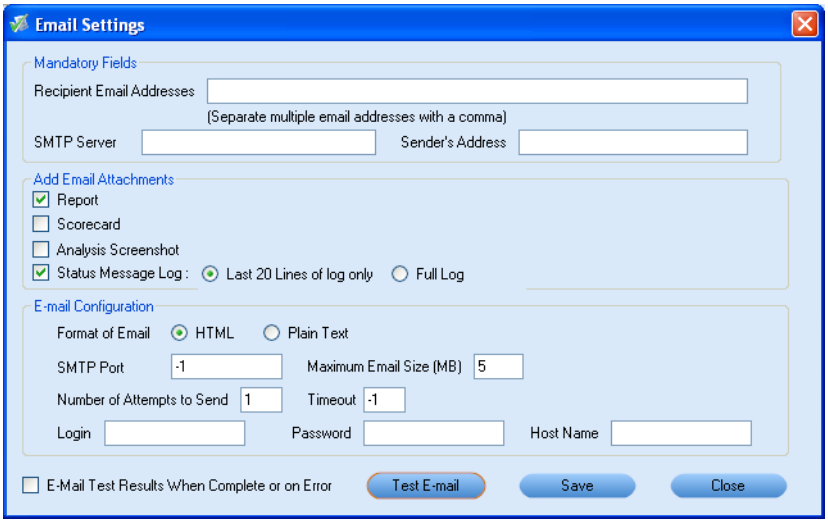
Button	Function
Refresh	The application searches on the selected connection for resources. While searching resources it shows the Instrument Bench discovery window. The Instrument Discovery window shows the connection now being scanned and the percentage of task completed. 
Close	Closes the dialog box.

Tools > E-mail Settings

Use the E-mail Settings utility to configure and set the e-mail options. The following fields are mandatory for receiving e-mail messages from TekExpress:

1. Recipient Email Addresses. For example, User@domain.com.
2. Sender Address.
3. SMTP Server address of the Mail server configured at client location.

If any of these fields are left blank, the settings are not saved and e-mail messages will not be sent.



Select the option “E-mail Test Results When Complete or on Error” has to be checked to receive the e-mail. The attachment list depends on what you have selected while configuring the e-mail setup.

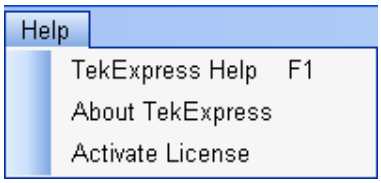
NOTE. *Among the e-mail attachments, the Analysis Screenshot is not yet functional.*

See Also:

File Menu (see page 19)
View Menu (see page 20)
Help Menu (see page 23)
Deskewing Real Time Oscilloscopes (see page 25)

Help Menu

Click **Help** on the application menu bar.



The Help menu has the following selections:

Selection	Function
TekExpress Help	Displays TekExpress Help (F1).
About TekExpress	Displays application details such as software name, version number and copyright.
Activate License	Displays available software options and also about license activation.

See Also:

File Menu (see page 19)
View Menu (see page 20)
Tools Menu (see page 20)

Deskew Real Time Oscilloscopes

Use the following procedure to deskew direct input SMA channels on a real time oscilloscope.

NOTE. *DPOJET has an automatic deskew option under* ***Analyze > Jitter And Eye Analysis > Deskew****. Refer to your DPOJET online help for information on how to deskew the channels.*

1. Run Signal Path Compensation (SPC) on the oscilloscope.
2. Connect a SMA Power Splitter (preferred) or SMA 50 Ω coaxial "T" connector to the Fast Edge output of the oscilloscope.
3. Connect SMA cables from each of the two channels to be deskewed to the power splitter (or SMA coaxial "T" connector). It is best to use matched cables when making high speed serial measurements. **It is important to use the same cables that will be used for subsequent measurements**.
4. Select **Default Setup**, and then select **Autoset** on the oscilloscope front panel.
5. Set the oscilloscope for 70% to 90% full screen amplitude on both channels. Center both traces so that they overlap.
6. Make sure that volts/div, position, and offset are identical for the two channels being deskewed.
7. Set the time/div to approximately 100 ps/div or less, with sample rate at 1 ps/pt. These settings are not critical, but should be close.
8. Set the horizontal acquisition mode to average, which provides a more stable display.
9. Select **Deskew** from the **Vertical** menu.
10. Verify that the reference channel (typically CH1 or CH2) is set to 0 ps deskew.
11. In the deskew control window, select the channel to deskew (typically CH3 or CH4). Adjust the deskew to overlay the rising edge as best as possible.

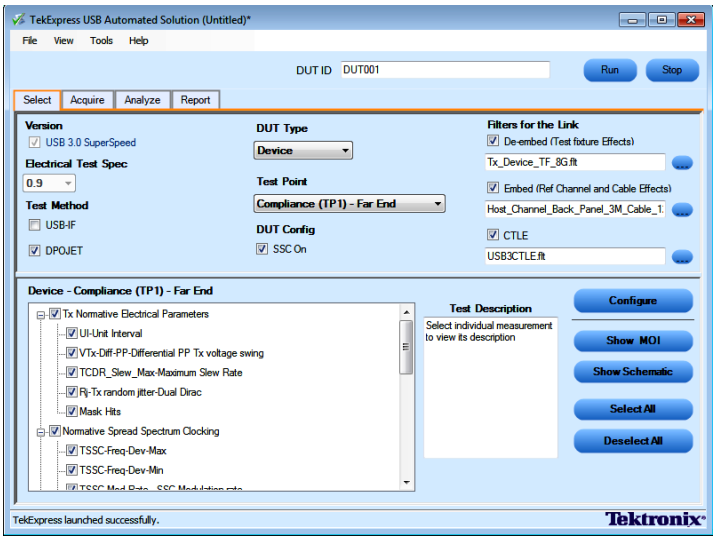
NOTE. *Typical values are in the 10's of ps or less with cables connected directly from Fast Edge to SMA inputs. If you are using a switch box (for example, Keithley), deskew the complete path from where the test fixture connects, through the switch, and into the oscilloscope. Deskew values in these cases may be as much as 30 ps or more.*

NOTE. *There can be significant differences in the skew between two TCA-SMA adapters. If you find that a system requires a very large correction, obtain a pair of TCA-SMA adapters that closely match each other to reduce the amount of correction.*

NOTE. *TekExpress retains the user configured Deskew values, and does not override the values during test runs.*

Select the Test(s)

The Select panel lets you select the USB tests to configure and run.



This panel provides the following functions:

Version

USB 3.0 SuperSpeed is the default version selected.

Electrical Test Spec

0.9 is the default value for electrical test specification.

Test Method

Select DPOJET or USB-IF as appropriate for the measurement you want to run. If you select the USB-IF option, a drop-down list appears showing the SigTest Tool software version installed on your computer.

Select DUT Type

Select the Device or Host of the device to test.

DUT Config

Select SSC tests based on your DUT configuration. If your DUT supports SSC, run the tests with 'SSC on' selected.

Test Point Selection

Select the appropriate test point location. For example, Compliance[TP1]-Far End, or TX Pin-Near End. Only the compliance test point is available when SigTest is selected.

Filter for the Link

Enhanced filter file selection based on selected DUT Type and Test Point.

Measurements are grouped according to standard specifications such as Tx Informative Electrical Parameters (see page 27), Normative Speed Spectrum Clocking (see page 27), Tx Normative Eye Mask (see page 27), and LFPS measurement (see page 28).

Once you select a row, the following options are available:

Table 7: Button controls on the Select panel

Button	Description
	Opens the configuration panel for the selected test.
	Opens the PDF file for the method of implementation (MOI) for the selected test.
	Opens the schematic for the selected test. This is useful to verify the test setup before running the test.
	Selects all tests in the table.
	Deselects all tests in the table.
	Indicates that the system has low hard disk memory space.

Tx Informative Electrical Parameters

Includes UI-Unit Interval, VTx-Diff-PP-Differential PP Tx voltage swing, TCDR_Slew_Max-Maximum Slew Rate, Rj-Tx-random jitter-Dual Dirac, and Mask Hits measurements.

Normative Speed Spectrum Clocking

Includes TSSC-Freq-Dev-Max, TSSC-Freq-Dev-Min, TSSC-Mod-Rate-SSC Modulation rate, and TSSC USB Profile measurements.

Tx-Normative Eye Mask

Includes TJ-Tx total jitter-Dual Dirac at 10E-12 BER, DJ-Tx-deterministic Jitter-Dual Dirac, Eye Height- Transmitter Eye Mask, and Width@BER measurements.

LFPS Measurement

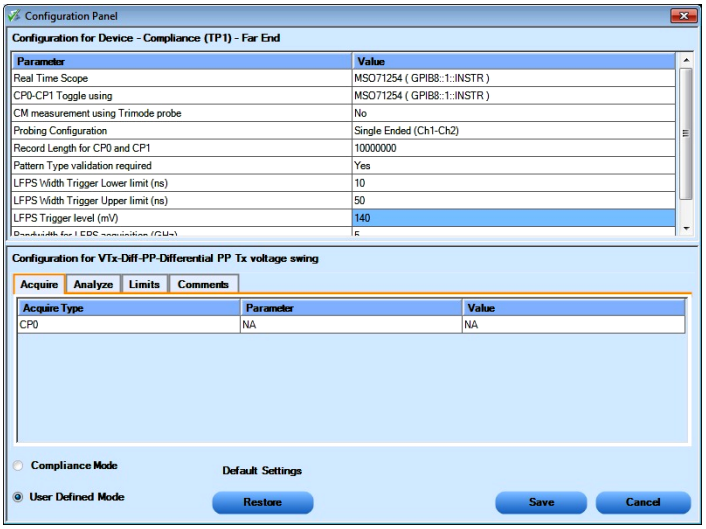
Includes LFPS Duty Cycle, LFPS Fall Time, LFPS Rise Time, LFPS TPeriod, LFPS TBurst, LFPS TRepeat, LFPS Vcm-AC, and LFPS VTx-DIFF-PP mesurements.

See Also:

View and Select Connected Instruments (see page 31)
Configure and Run the Tests (see page 28)
View the Progress of Analysis (see page 34)
View the Report (see page 36)
View Test Related Files (see page 37)

Configure and Run the Test(s)

The configuration panel controls let you create, view, and edit the parameters associated with the acquisition and the analysis of the selected test. In the Select panel, click **Configure**.



The Configure panel lets you configure acquisition and analysis parameters.

NOTE. *Select different filter files under the Filter Selection option for different test suites.*

The upper part of the Configure panel has general parameters that are common for all the tests under the selected test suite that are editable.

- Select the appropriate instrument.
- Select the Probing Configuration.

- Select an appropriate parameter for “CP0–CP1 Toggle using” (AWG/AFG/Scope/Do Not Use).
- Select to enable Pattern type validation. Selecting Yes enables the process of validating that each test pattern is correct. Selecting No skips the test pattern validation.

The lower part of the Configure panel has test specific parameters.

NOTE. *If any of the test parameters are grayed, it means that these parameters cannot be modified in the compliance mode. When you switch to the user defined mode, these parameters are editable.*

Table 8: Test parameters

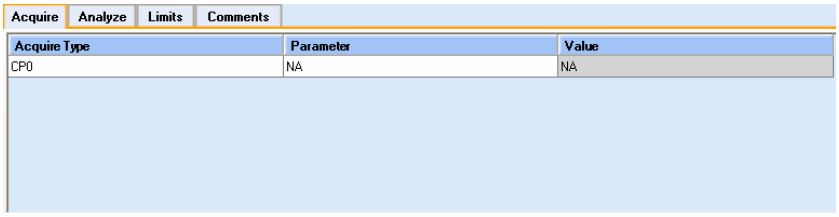
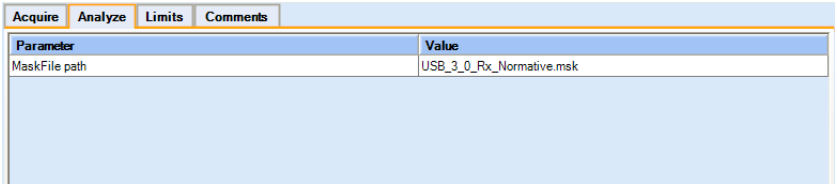
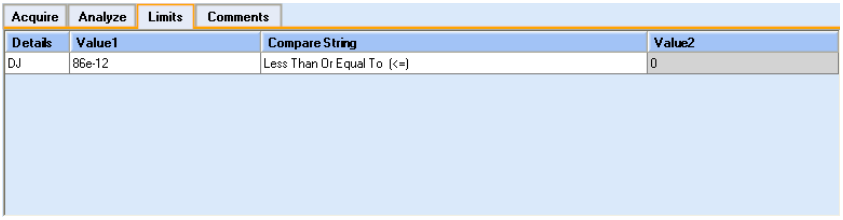
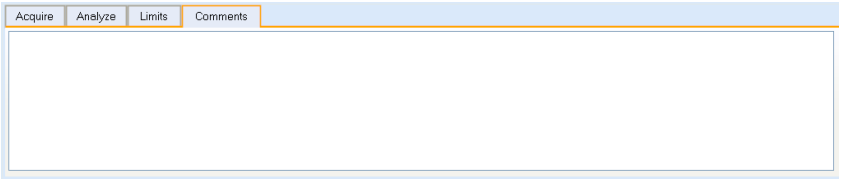
Parameters to configure	Description
Acquire 	Shows the various parameters related to acquisition of a selected test. These parameters can vary from one test to another.
Analyze 	Shows the various parameters related to analysis of a selected test. The Analyze parameters shows the default analysis parameters for the selected test. Refer to: Using NonStandard Waveform Mask
Limits 	Applies to a specific test. It shows the measurement limits using different types of comparisons.

Table 8: Test parameters (cont.)

Parameters to configure	Description
Comments 	Enter a descriptive comment up to 256 characters long for the selected test.
Compliance settings	
	Restores the default settings.
	Saves all changes made in the Configuration Panel and closes the dialog box.
	Closes the dialog box and without apply changes.

Click **Run** in the Select panel to run the selected tests.

Refer to the following table for different test limit comparisons:

Table 9: Different test limit comparisons

Comparison string	Description
EQ(==)	Equal to
NE(!=)	Not equal to
GT(>)	Greater than
LT(<)	Less than
GE(>=)	Greater than or Equal to
LE(<=)	Less than or Equal to
GTLT(> <)	Greater than and Less than
GELE(>= <=)	Greater than or equal to and Less than or equal to
GELT(>= <)	Greater than or equal to and Less than
GTLE(> <=)	Greater than and Less or equal to
LTGT(< >)	Less than and Greater than
LEGE(<= >=)	Less than or equal to and Greater than or equal to
LEGT(<= >)	Less than or equal to and Greater than
LTGE(< >=)	Less than and Greater than or equal to

See Also:

View and Select Connected Instruments (see page 31)

Select the Tests (see page 26)
View the Progress of Analysis (see page 34)
View the Report (see page 36)
View Test Related Files (see page 37)

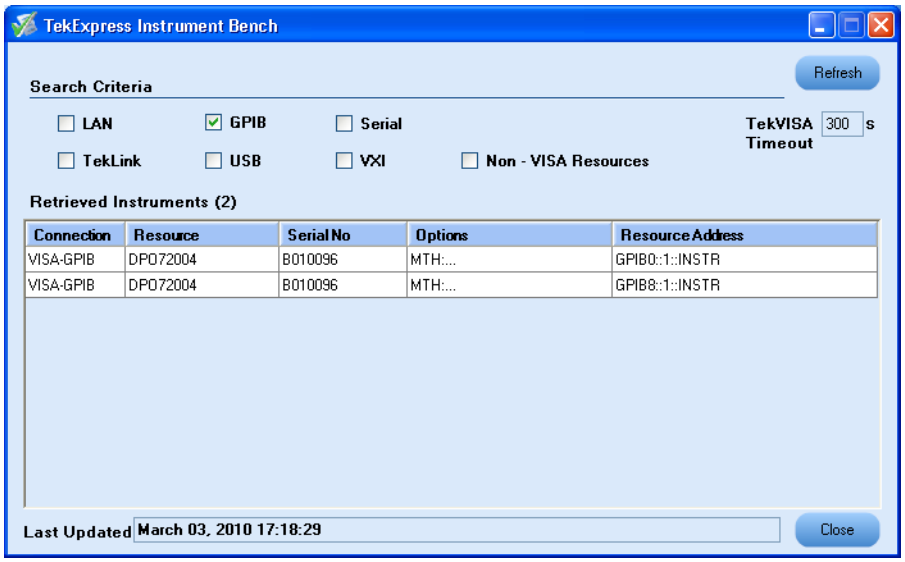
View and Select Connected Instruments

Viewing Connected Instruments

The **Tools > Instrument Bench** menu item lets you discover connected instruments required for the tests. The application uses TekVISA to discover the connected instruments. Once the search is finished, the Instrument Bench dialog box resumes operation and lists the instrument-related details based on the selected search criteria.

NOTE. *When the TekVISA Instrument Manager checks for connected instruments, the Instrument Bench dialog box does not respond.*

For example, if you select LAN and GPIB as the search criteria in the Instrument Bench dialog box and click Refresh, the TekVISA Instrument Manager checks for the instruments available over LAN and GPIB and the details of the instrument are displayed in the **Retrieved Instruments** table.

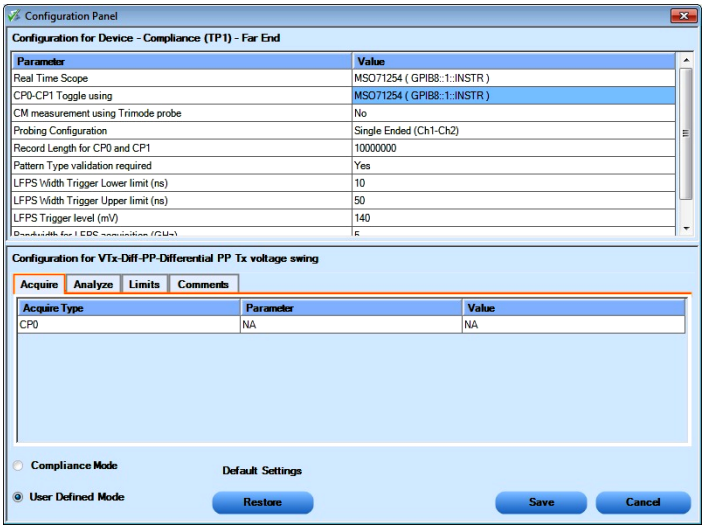


Use the **TekVISA Timeout (Seconds)** field, to set a time period within which if the TekVISA Instrument Manager does not find the instruments, the TekExpress application resumes operation.

If you choose NonVISA resources, all the instruments supported by TekExpress but not communicating over the VISA layer can be searched.

Selecting Connected Instruments

Use the Configuration panel to view a list of connected instruments. The upper part of the panel displays the general parameters for the tests under the selected test suite.



NOTE. *The list of instruments displayed is specific to the selected test suite. It does not show all the connected instruments.*

See Also:

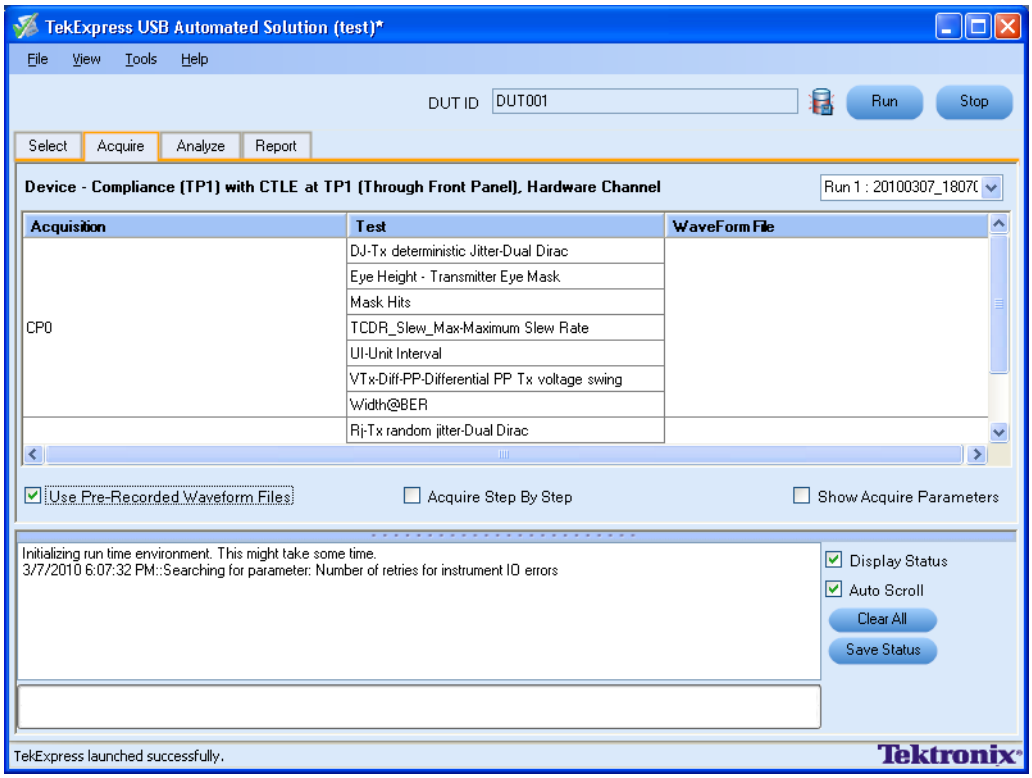
Configure and Run the Tests (see page 28)
Select the Tests (see page 26)
View the Progress of Analysis (see page 34)
View the Report (see page 36)
View Test Related Files (see page 37)

Use the Prerecorded Waveform for Analysis

The Acquire tab shows unique acquisitions, acquisition parameters, acquisition status, and prerecorded waveform files of the selected test suite. The Acquire panel is specific to a suite and is updated every time the selected test suite is changed. This panel shows the acquisition details for the tests in the selected suite. The tests with the common acquisition parameters are grouped together and shown as a single acquisition.

Column name	Function
Status	Test acquisition status of the running test passed at intervals.
Test	Name of the tests performing acquisitions. One or more tests can perform the same acquisitions.

Column name	Function
Acquisition	Acquisition name
Waveform File(s)	Prerecorded waveform files of unique acquisitions. Select waveform files by selecting browse on individual cells. You can select any waveform file using the standard file open window.



The following Acquire source options are available:

- **Use Pre-Recorded Waveform files**: Toggles on or off the waveform file column in the acquisition table. When you save a session and then select this option, the DUT ID text box changes to a drop-down list, in which you can select the DUT ID up to the point where the session was saved. A drop-down box appears above the Waveform file column, showing the run details, including the date and time of each run. If you select a run, corresponding data for that run will be populated (such as the selected test, the test configuration settings, and the test summary status).

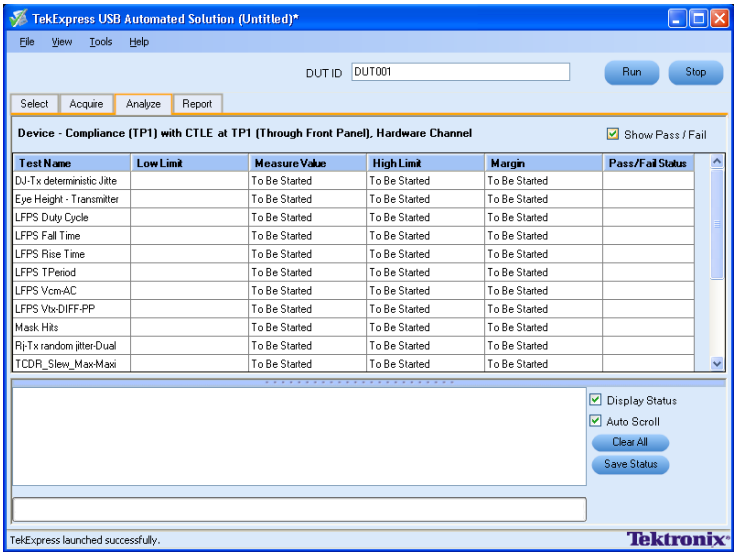
NOTE. *To select the waveform files manually, select all the waveform (.wfm) files required for the measurement. To select multiple files, hold down the Ctrl key to enable selecting multiple files in the File Open dialog screen. If any required files are not selected, the measurement may not run properly.*

- **Acquire Step by Step**: Selecting this option prompts you at the end of each acquisition before continuing to the next one.
- **Show Acquire Parameters**: On enabling this option, the acquisition parameters for each unique acquisition are displayed in the acquisition table.

When you select "Use Pre-Recorded Waveform Files", the first column shows the waveform type and the second column shows the tests that use that waveform type for analysis.

View the Progress of Analysis

Use the Analyze panel to view the progress of the analysis. As the analysis of each test is complete, the result value is updated.



Analysis Table

The table contains the following:

- The test name.
- The status of the tests that are being run.
- The measured, limit and margin values of the tests.

The tests that are not yet started are shown with a “To be Started” status. The Status Messages panel shows a summarized status of the running tests.

The **Status Messages** window timestamps all run time messages and displays them. You can do the following:

- **Display Status**: Enable/Disable status messages.
- **Auto Scroll**: Scrolls status messages automatically.
- **Clear All**: Clear all status messages in Status Window.
- **Save Status**: Save all status messages in text file. Displays a standard save file window and saves the status messages in the user specified file.

NOTE. *You can resize and/or dock/undock the Status Messages window.*

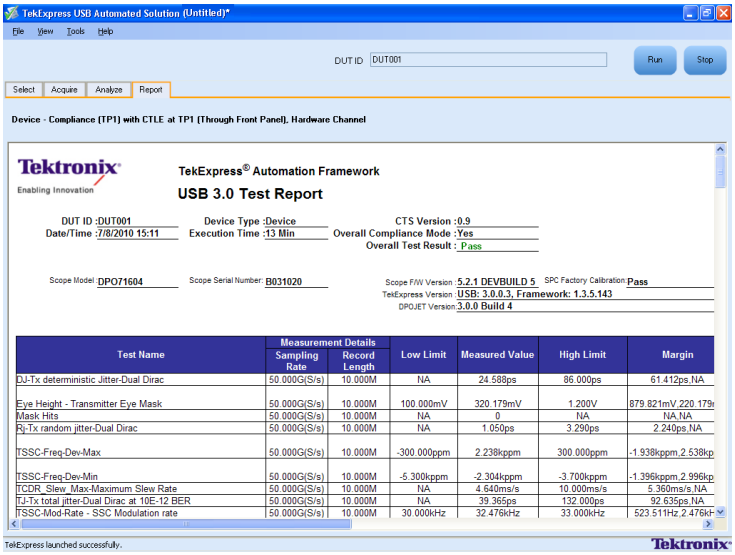
See Also:

Configure and Run the Tests (see page 28)
Select the Tests (see page 26)
View and Select Connected Instruments (see page 31)
View the Report (see page 36)
View Test Related Files (see page 37)

View the Report

After the analysis, a report is automatically generated and displayed in the report panel. The report shows the results of the tests, including device information and pass/fail status of each test. The following screen is an example report of a test run using only DPOJET software.

The Report View Area contains an mht report. Select any area of the report and copy it to the clipboard to make it available to other applications.



See Also:

Select the Tests (see page 26)
Configure and Run the Tests (see page 28)
View and Select Connected Instruments (see page 31)
View the Progress of Analysis (see page 34)
View Test Related Files (see page 37)

View Test Related Files

All the test related files for selected tests are always saved at `My Documents\My TekExpress\USB\Untitled Session`.

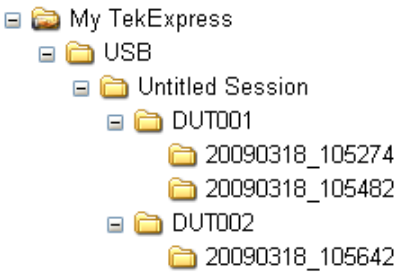
When you save a session, it is saved with the session name to the path `My Documents\My TekExpress\USB\SessionName` for future references.

The current session is stored in the same path as "Untitled Session" until you save it.

WARNING. *Do not save a session file as "Untitled Session" or "Backup," as these are application-specific file names. The application will delete these files when you exit the application.*

A session folder can contain results for more than one DUT, and a DUT folder can contain more than one run data folder marked by date-time stamp as folder name.

Here is an example image of data storage:



See Also:

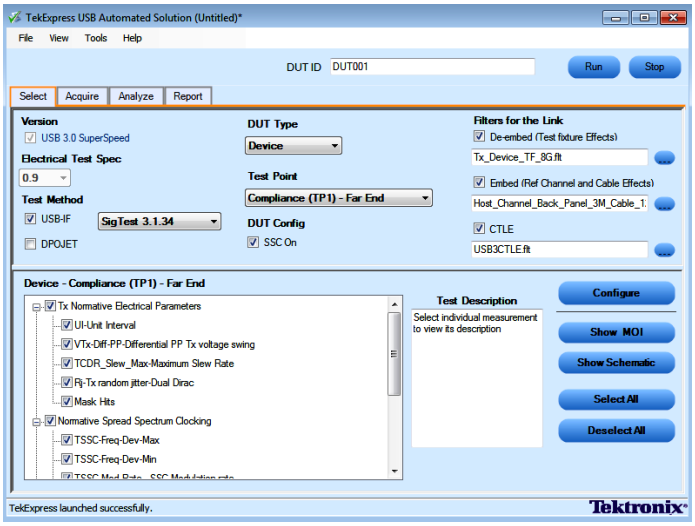
Select the Tests (see page 26)
Configure and Run the Tests (see page 28)
View and Select Connected Instruments (see page 31)
View the Progress of Analysis (see page 34)
Application Directories and Usage (see page 7)

Select and Run a Test Using SigTest Software (USB-IF)

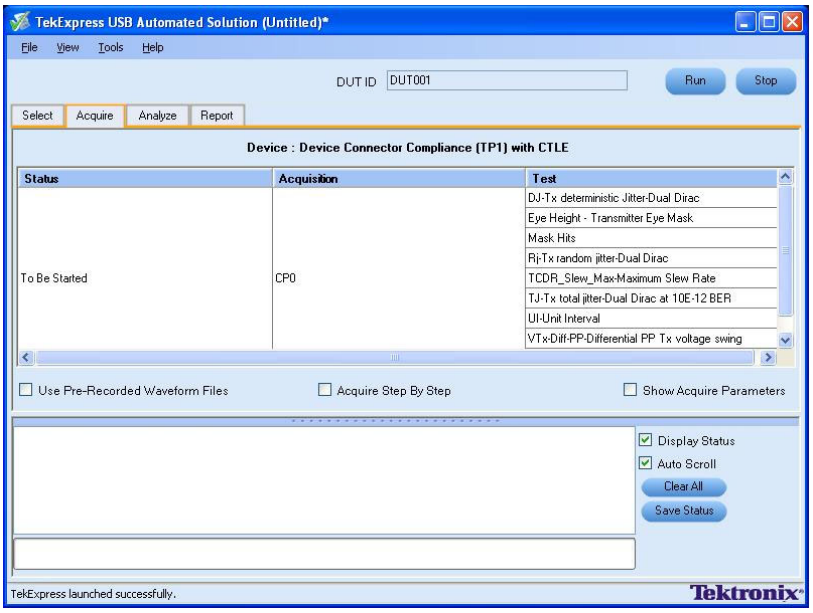
Select and run a test using the USB-IF software. The steps are same as running a test using the DPOJET software. See How To Select the Tests (see page 26).

1. Select Test Method **USB-IF** in the Select Panel. and browse to the latest version of USB-IF installed on your machine.

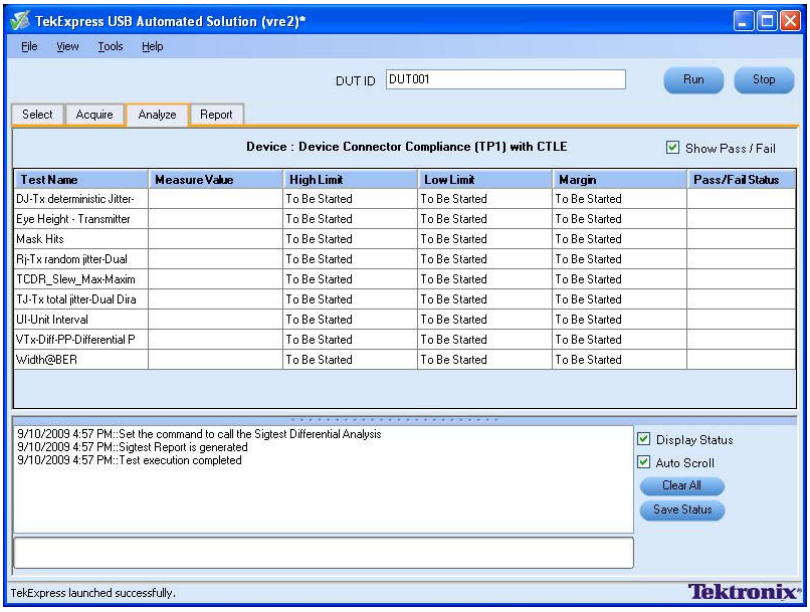
NOTE. *The Test Method option is disabled if you have not installed USB-IF software (SigTest) on your instrument or PC.*



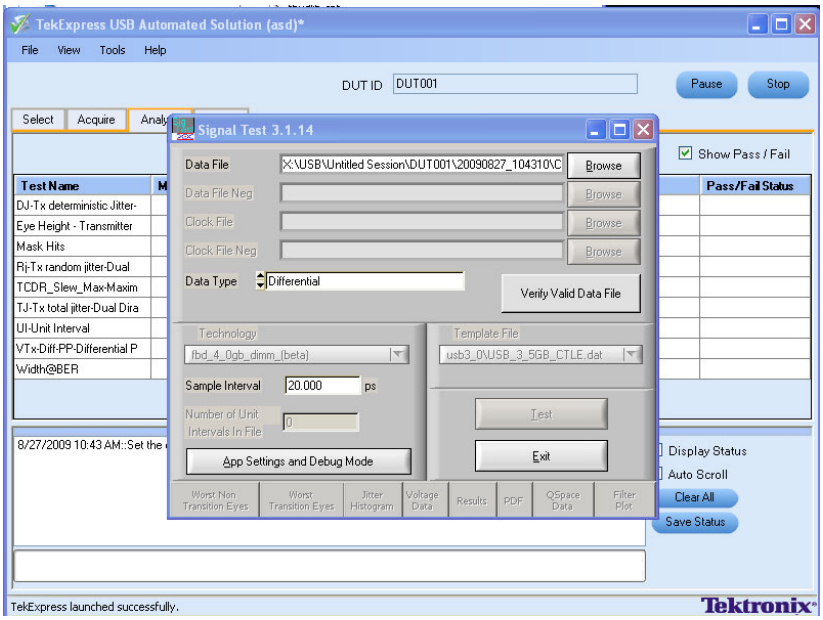
2. Click **Run**. While running, the application automatically switches to the Acquire tab and shows the acquisition status.



3. The Analyze tab displays the Measured, High and Low limit values.

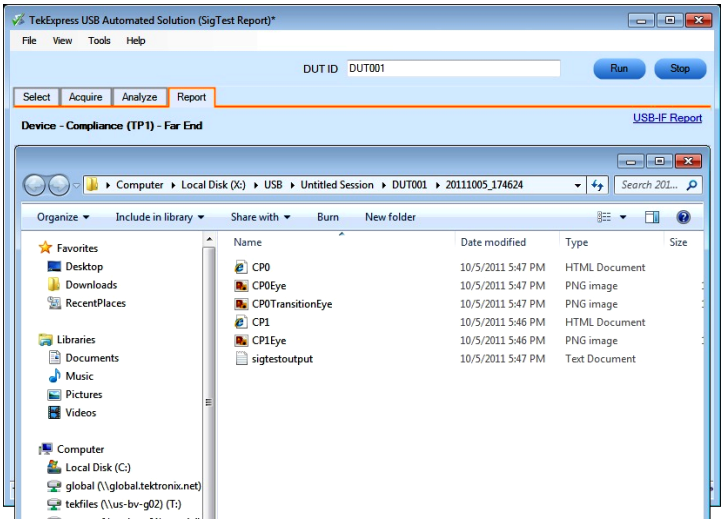


4. A SigTest dialog box appears to show that the application is using SigTest as the test method to perform the analysis.



5. During test execution, once the analysis is completed, SigTest application automatically closes and generates a report with the details. Click **USB-IF Report** link on the TekExpress Report tab to view the report location. Double-click the .html file to view the test report.

NOTE. *Results shown in the TekExpress report tab are results from DPOJET.*

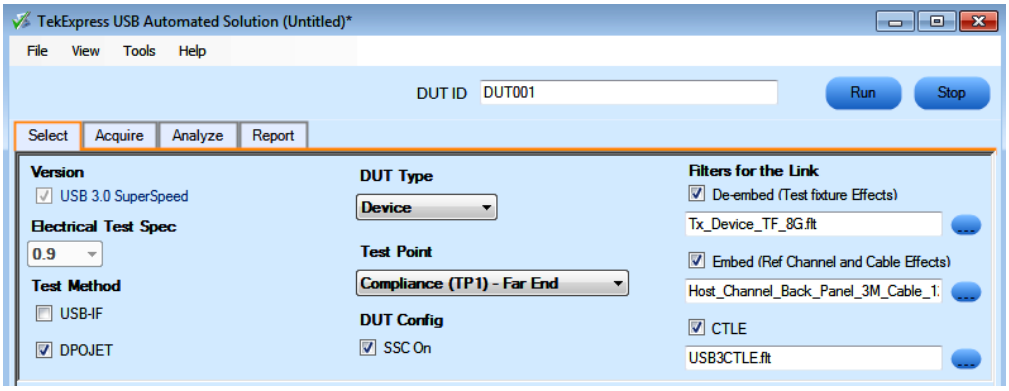


Use Filters

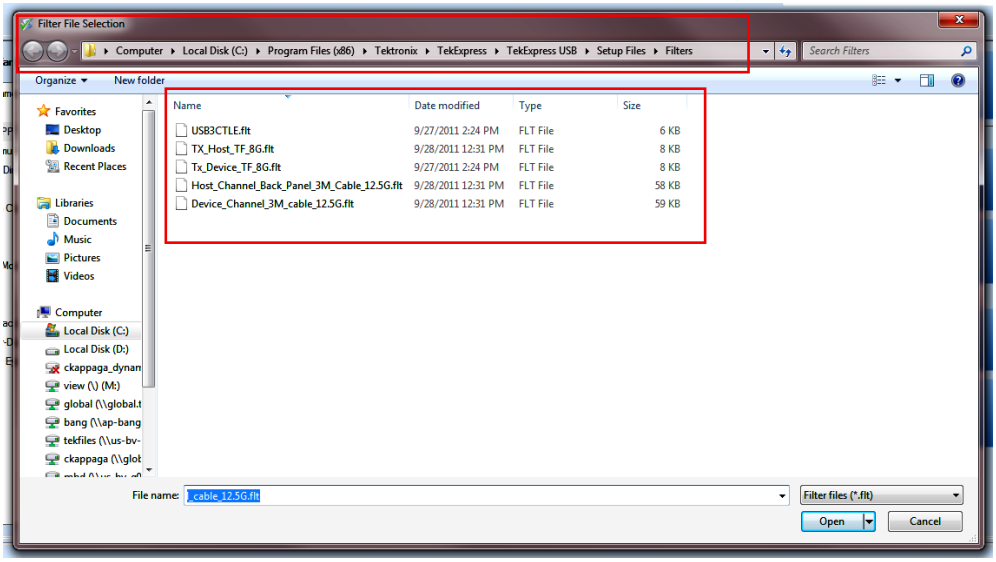
Using a Nonstandard Filter

Use the following procedure to select a nonstandard filter file.

1. Click the **Select** tab.



2. Click the **Filters for the Link** browse button to view the location of filter files from which to select.



3. Select a file and click **Open**.

NOTE. *The filter files are located in the TekExpress Filters folder.*

For Microsoft Windows 7, the Filters folder file path is:

C:\Program Files (x86)\Tektronix\TekExpress\TekExpress USB\Setupfiles\Filters

For Microsoft Windows XP or Windows XP Embedded, the Filters folder file path is:

C:\Program Files\Tektronix\TekExpress\TekExpress USB\Setupfiles\Filters

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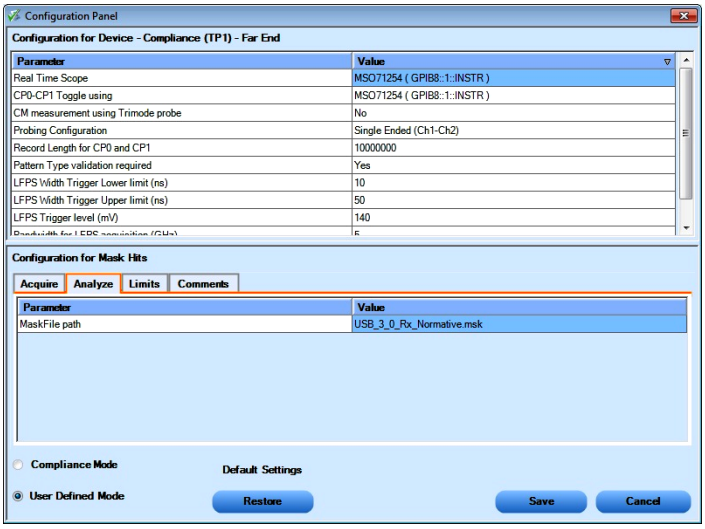
Using a Nonstandard Waveform Mask

To use a nonstandard mask file, follow this procedure:

1. Select the Mask Hits test in the Select panel and click Configure.
2. Click the Analyze tab in the Configure panel.
3. Enter the mask file name in the Analyze tab of the Configuration panel as shown. Click **Save**.



NOTE. *The mask files are located in the TekExpress Masks folder.*

For Microsoft Windows 7, the Masks folder file path is:

C:\Program Files (x86)\Tektronix\TekExpress\TekExpress USB\Setupfiles\Masks

For Microsoft Windows XP or Windows XP Embedded, the Masks folder file path is:

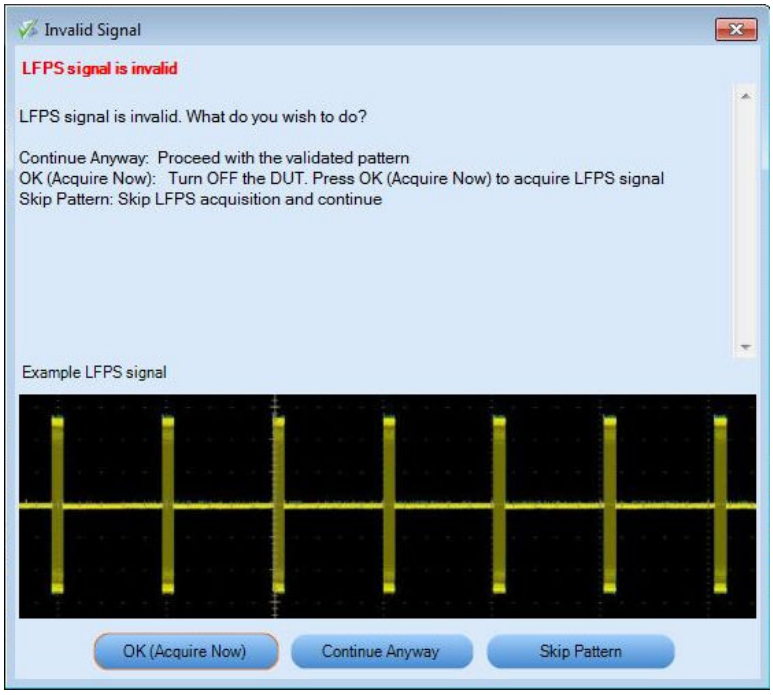
C:\Program Files\Tektronix\TekExpress\TekExpress USB\Setupfiles\Masks

See Also:

De-Embeding and Channel Embedding Overview (see page 87)
SDLA Filter Creation Requirements (see page 93)

LFPS Pattern Type Validation

When the Pattern type validation is set to Yes, during the acquisition of LFPS pattern, a validation occurs. If the pattern is valid, the measurement continues normally. If the pattern is invalid, the following pop up displays.



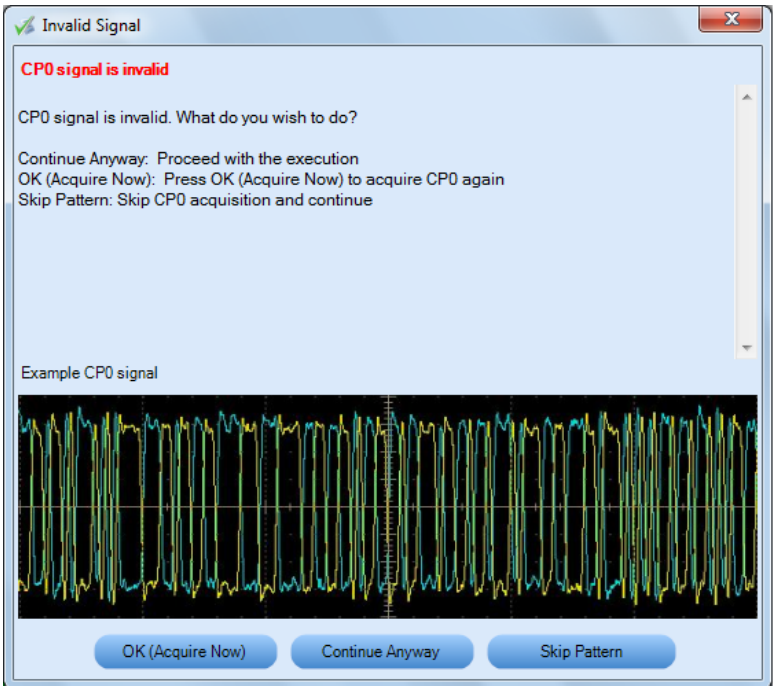
NOTE. *If Pattern type validation is selected as "No", then the measurement continues with the acquired waveform.*

Choose how to continue.

- Select OK (Acquire now) to start the acquisition again.
- Select Continue Anyway to cause the measurements to continue with acquired waveform.
- Select Skip Pattern to skip all LFPS tests. The rest of the selected measurements continue.

CP0 Pattern Type Validation

When the Pattern type validation is set to Yes, during the acquisition of a CP0 pattern, a validation occurs. If the pattern is valid, the measurement continues normally. If the pattern is invalid, the following pop up displays.



NOTE. *If Pattern type validation is selected as "No", then the measurement continues with the acquired waveform.*

Choose how to continue.

- Select OK (Acquire now) to start the acquisition again.
- Select Continue Anyway to cause the measurements to continue with acquired waveform.
- Select Skip Pattern to skip all CP0 tests. The rest of the selected measurements continue.

CP1 Pattern Type Validation

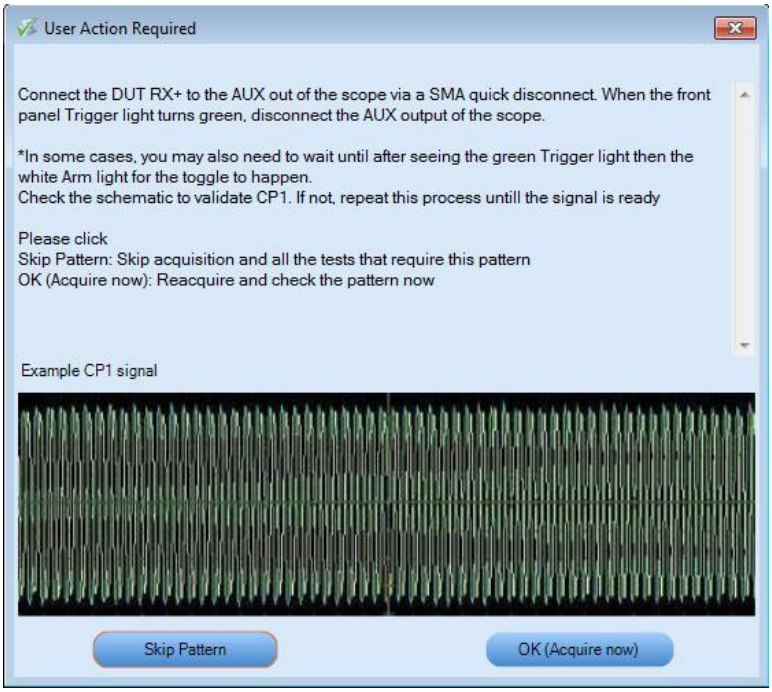
Refer to the topic Oscilloscope-Based Toggle (see page 45) and its related topics.

Oscilloscope-Based Toggle

To use the oscilloscope based toggle, follow this procedure.

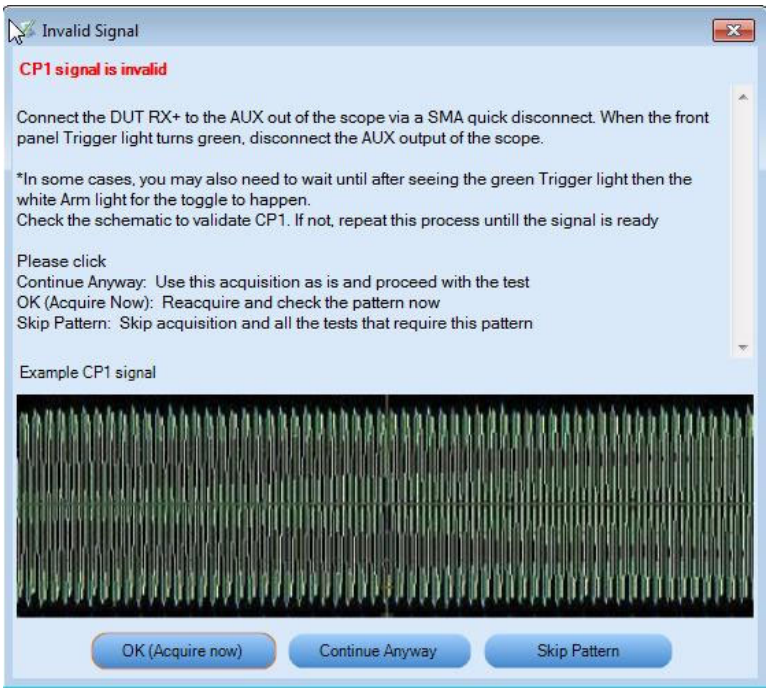
NOTE. *Oscilloscope based toggle is not guaranteed to work for all DUTs.*

1. In the configuration panel, for the parameter CP0-CP1 Toggle using, select an oscilloscope (For example DPO72004 (TCPIP::192.158.96.152::INSTR)).
2. Connect the AUX OUT from the oscilloscope to the USB 3.0 Device Fixture 2 RX+ and connect a USB cable from USB 3.0 Device Fixture 2 to Device fixture 1.
3. Click the **Run** button. If the CP1 measurements are selected, then when the CP1 pattern is being acquired, a pop up displays to prompt you to make the necessary connections. Select to either skip the pattern or make a new acquisition after the DUT is transmitting CP1.



4. If you click OK (Acquire Now), the application does a new acquisition. If Pattern Type validation is set to Yes, a Pattern Type validation is done on the acquired signal to check if it is a CP1 signal. If it is a CP1 signal, the measurements continue normally. If not, the application shows the following dialog box.

NOTE. *If Pattern type validation is set to No, then the measurement continues with the acquired waveform.*



5. Choose how to continue:

   ■ Select **OK (Acquire now)** to start the acquisition again.

   ■ Select **Continue Anyway** to cause the measurements to continue with acquired waveform.

   ■ Select **Skip Pattern** to skip all CP1 tests. The rest of the selected measurements are taken. If CP1 is skipped and CP0 is aquired, TJ and RJ are computed on CP0 for informational purposes.

See Also:

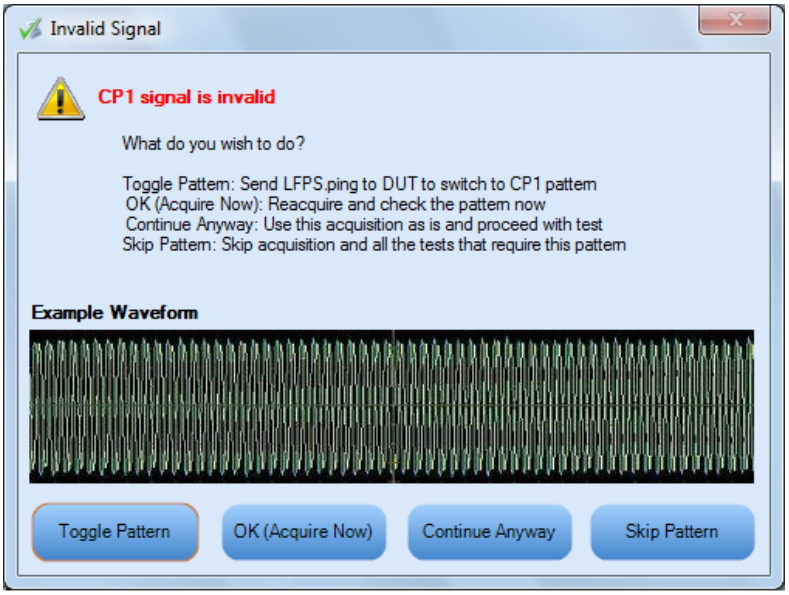
Oscilloscope-Based Toggle (see page 45)
AWG-Based Toggle (see page 46)
AFG-Based Toggle (see page 48)
No Toggle (see page 49)

AWG-Based Toggle

To use the arbitrary waveform generator (AWG) based toggle, follow this procedure.

1. In the configuration panel, for the parameter CP0-CP1 Toggle using, select an AWG (For example AWG7122C (TCPIP::192.158.96.152::INSTR)).
2. Connect the interleave (analog and $\overline{\text{analog}}$) output of Ch1 of the AWG to the USB 3.0 Device Fixture 2 (RX+ and RX-) and connect a USB cable from the USB 3.0 Device Fixture 2 to USB 3.0 Device fixture 1.

3. Click the Run button. If the CP1 measurements are selected, then when the CP1 pattern is being acquired, a command is sent to the AWG to send a trigger to toggle the DUT from CP0 to CP1. Next, the waveform is acquired. If Pattern type validation is set to Yes, then the validation occurs. If the pattern is valid, the measurement continues normally. If the pattern is not valid, the following pop up displays.



NOTE. *If Pattern type validation is set to No, then the measurement continues with the acquired waveform.*

4. If you select **Toggle Pattern**, then the toggle sequence is initiated again to toggle the DUT. (The pop up remains displayed during this toggle process.) You can visually verify whether the acquired pattern is correct. If not, keep clicking the Toggle Pattern button until the correct pattern is acquired. Once you acquire the correct pattern, click **OK (Acquire Now)** to save the waveform and continue with the measurement.

5. At any time, you can select **Continue Anyway** to continue with the current acquired waveform. You can also select Skip pattern to skip the CP1 acquisition and continue with the rest of selected measurements.

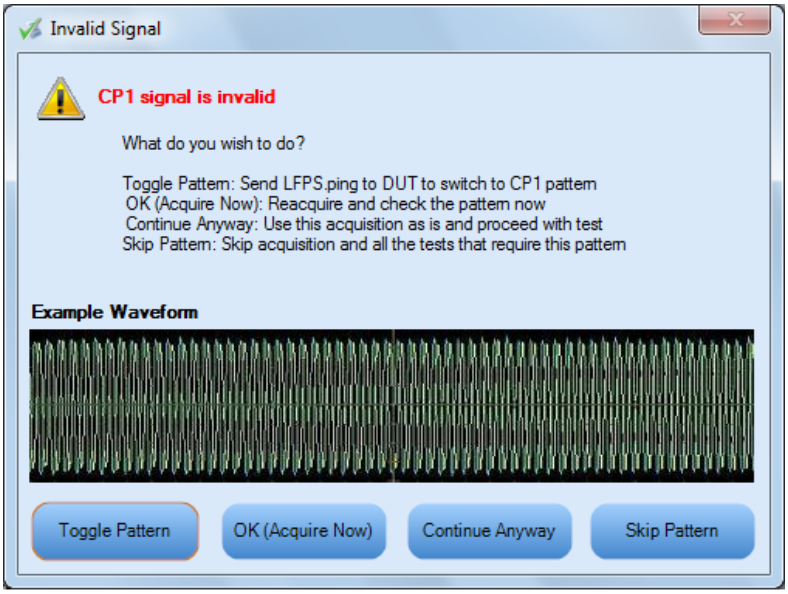
See Also:

Oscilloscope-Based Toggle (see page 45)
AFG-Based Toggle (see page 48)
No Toggle (see page 49)

AFG-Based Toggle

To use the arbitrary function generator (AFG) based toggle, follow this procedure.

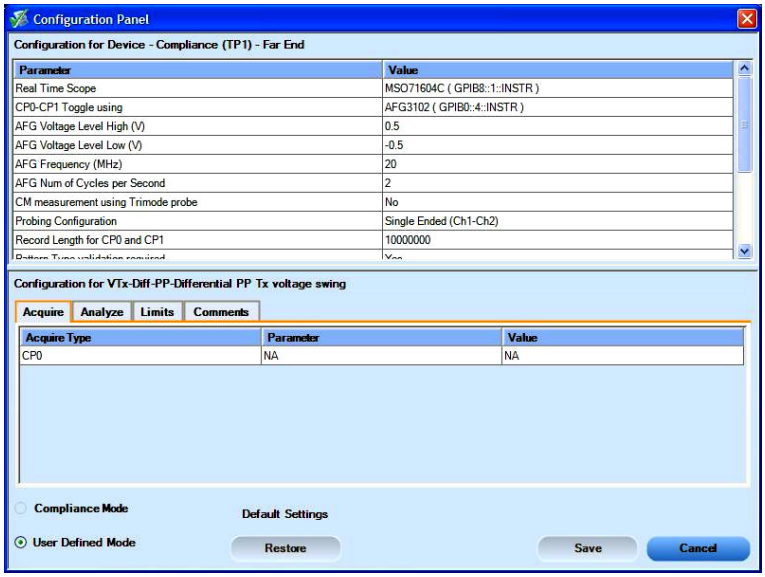
1. In the configuration panel, select an AFG instrument for the parameter CP0-CP1 Toggle (For example: AFG3102 (TCPIP::192.158.96.152::INSTR)).
2. Connect Ch1 of the AFG to the Device fixture 2 (RX+).
3. Connect a 3 meter USB cable from Device fixture 2 to Device fixture 1.
4. Click the **Run** button. If the CP1 measurements are selected, a command is sent to AFG, when the CP1 pattern is being acquired, to toggle the DUT from CP0 to CP1. Next, the pattern is acquired. If Pattern type validation is set to Yes, then the validation occurs. If the pattern is valid, the measurement continues normally. If the pattern is not valid, the application opens the following dialog box.



NOTE. *If Pattern type validation is set to No, then the measurement continues with the acquired waveform.*

5. If you click **Toggle Pattern**, then the toggle sequence is initiated again to toggle the DUT. (The dialog box remains displayed during this toggle process.) You can visually verify whether the acquired pattern is correct. If the pattern is not correct, continue clicking the Toggle Pattern button until you acquire the correct pattern. Once the correct pattern is acquired, click **OK (Acquire now)** to save the waveform and continue with the measurement.
6. At any time, you can click **Continue Anyway** at any time to continue with the current acquired waveform. You can also click **Skip Pattern** to skip the CP1 acquisition and continue with rest of selected measurements.

User-Configurable AFG Parameters



You can configure the following parameters in the Configuration panel before the start of Test Execution when AFG is set as the toggle tool:

- **AFG Voltage Level High (V)**: The range is from –5 V to 5 V. The default value is 0.5 V.
- **AFG Voltage Level Low (V)**: The range is from –5 V to 5 V. The default value is –0.5 V.
- **AFG Frequency (MHz)** : The range is from 10 MHz to 100 MHz. The default value is 20 MHz.
- **AFG Num of Cycles per Second**: The range is from 1 to 5. The default value is 2.

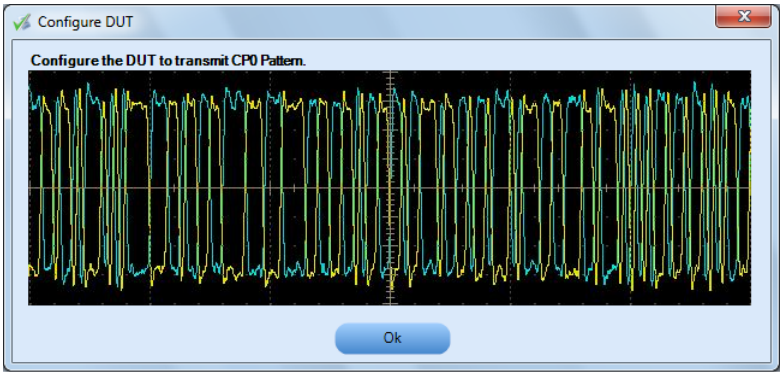
See Also:

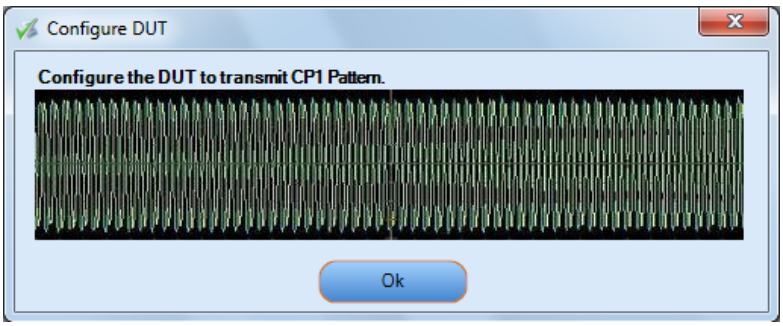
Oscilloscope-Based Toggle (see page 45)
AWG-Based Toggle (see page 46)
No Toggle (see page 49)

No Toggle

To not use the toggle tool, follow this procedure.

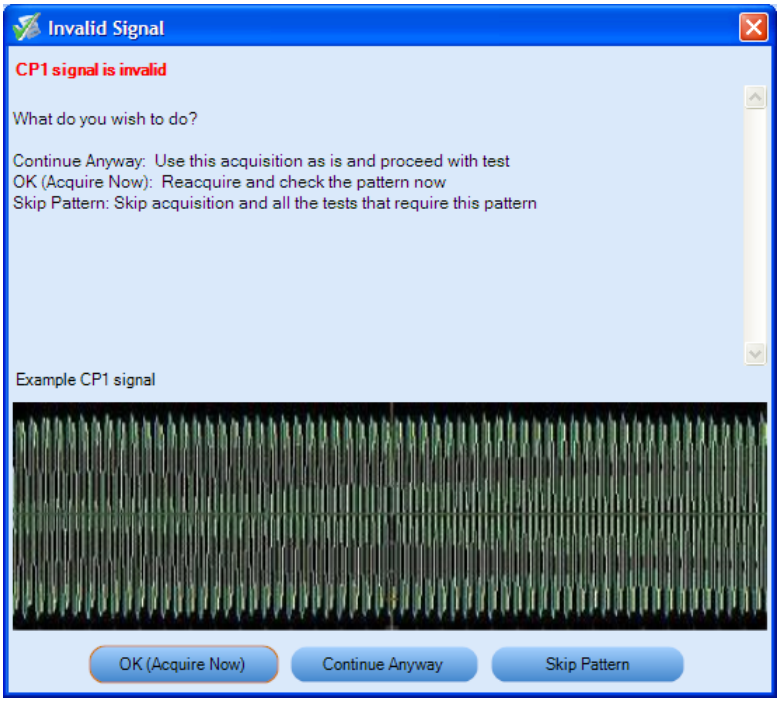
1. In the configuration panel, for the parameter CP0-CP1 Toggle using, set to Do not use.
2. The following pop up is displayed just before acquiring the CP0/CP1 pattern to allow you to manually transmit the desired pattern and acquire the waveform.



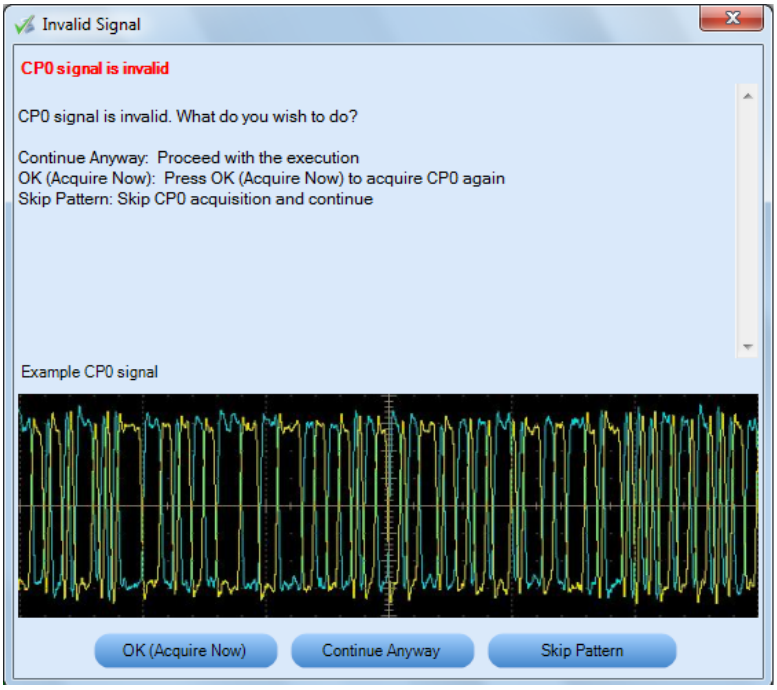


3. Click OK to acquire the waveform. If Pattern type validation is set to Yes, a pattern type validation occurs on the acquired signal. If it is a valid pattern, the measurement continues normally.

   If it is not a valid CP1 pattern, the following pop up displays.



   If it is not a valid CP0 pattern, the following pop up displays.



NOTE. *If Pattern type validation is set to No, then the measurement continues with the acquired waveform.*

4. Choose how to continue.
   - Select OK (Acquire now) to start the acquisition again.
   - Select Continue Anyway to cause the measurements to continue with acquired waveform.
   - Select Skip Pattern to skip all CP0-CP1 tests. The rest of the selected measurements continue.

See Also:

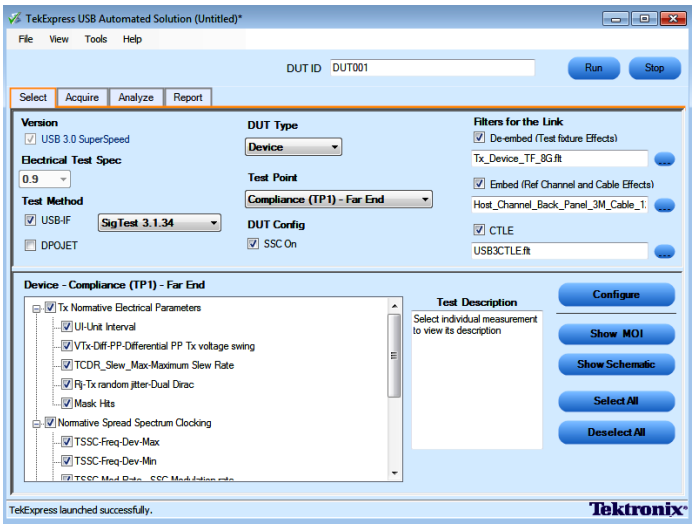
Oscilloscope-Based Toggle (see page 45)
AWG-Based Toggle (see page 46)
AFG-Based Toggle (see page 48)

Testing a Device Transmitter Using USB-IF Software

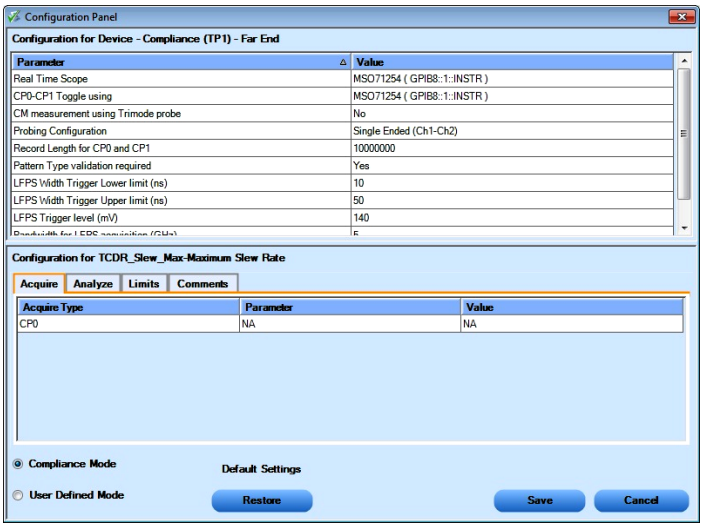
The following procedure describes how to use the USB-IF test method to test a device with a hardware channel. For the required equipment and setup diagram click here.

NOTE. *USB compliance testing is done by using software to emulate the channel and cable when Channel Definition is set to Software mode. When Hardware mode is selected, the same testing is performed with a physical channel.*

1. Select **Device** as the DUT type.
2. Select **USB-IF** test method.
3. Unselect the **DPOJET** test method if selected.

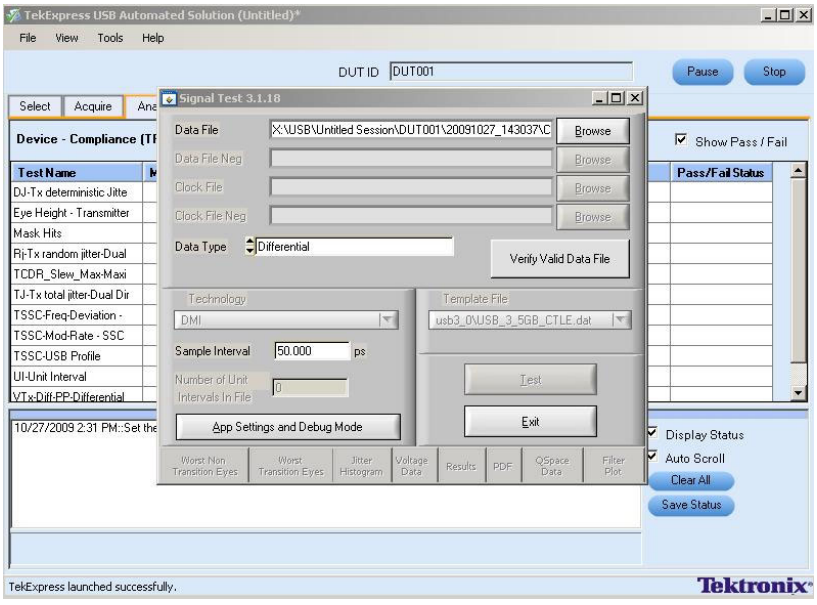


4. Click **Configure** to configure the test parameters. Note that the Configure panel will be Compliance Mode only.
5. You can configure any test to help you analyze measurement results. To refer to the *DPOJET SuperSpeed (USB 3.0) Setup Library Methods of Implementation (MOI)* document for information on how to configure the Deterministic Jitter test, click **Show MOI** in the Select panel.
6. Click **Close** to close the dialog box.

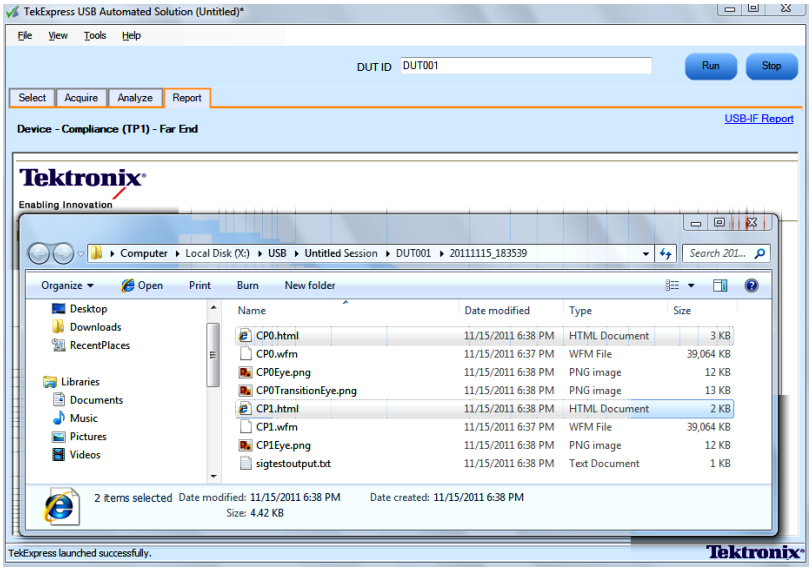


7. Click **Run** in the Select panel to run the selected test.
8. The Acquire panel shows the status of the waveform acquisition. To know more about the Acquire panel, click here.
9. The Analyze tab displays the Measured, High and Low limit values and a SigTest tool pop-up appears. The Analyze tab shows the DPOJET results, not the SigTest re sults.

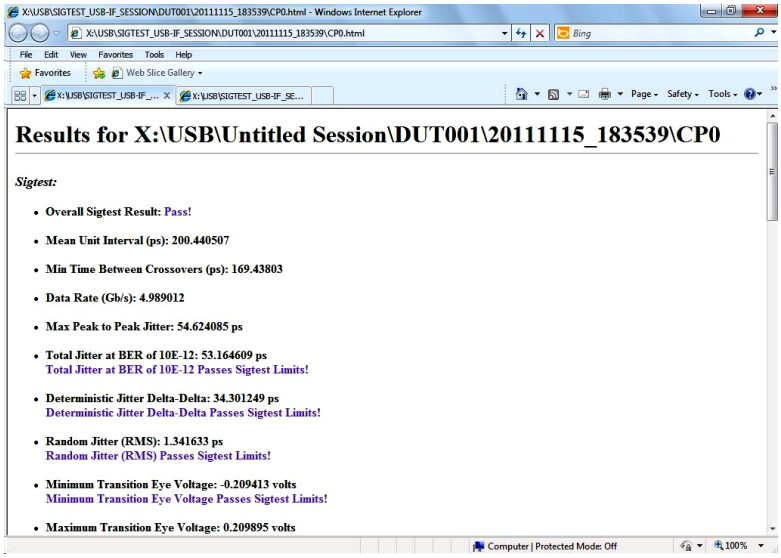
NOTE. *For toggling from CP0 to CP1, refer to topic Oscilloscope-Based Toggle (see page 45) and its related topics.*

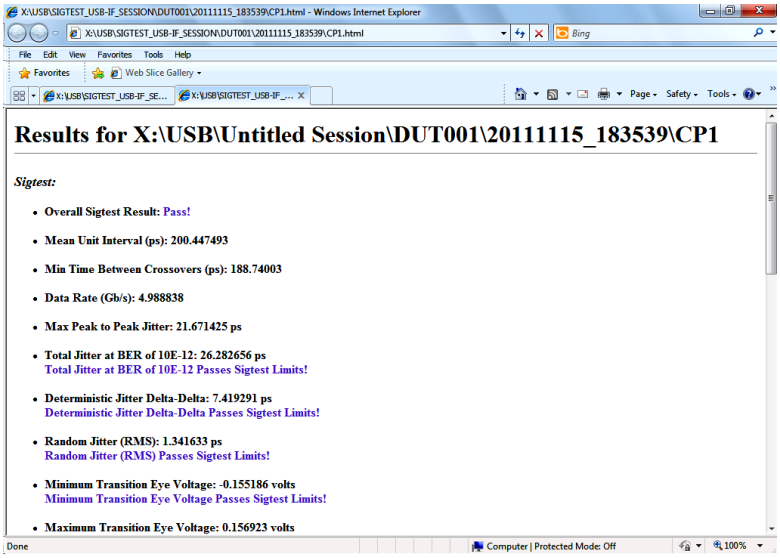


10. To open the USB-IF report location, click the **USB-IF Report** link on the Report tab to view the report location.



11. Double-click the .html file to view the test report. The following graphics show reports for CP0 and CP1 tests.




X:\USB\SIGTEST_USB-IF_SESSION\DUT001\20111115_183539\CP1.html - Windows Internet Explorer
Results for X:\USB\Untitled Session\DUT001\20111115_183539\CP1
Sigtest:
Overall Sigtest Result: Pass!
Mean Unit Interval (ps): 200.447493
Min Time Between Crossovers (ps): 188.74003
Data Rate (Gb/s): 4.988838
Max Peak to Peak Jitter: 21.671425 ps
Total Jitter at BER of 10E-12: 26.282656 ps
Total Jitter at BER of 10E-12 Passes Sigtest Limits!
Deterministic Jitter Delta-Delta: 7.419291 ps
Deterministic Jitter Delta-Delta Passes Sigtest Limits!
Random Jitter (RMS): 1.341633 ps
Random Jitter (RMS) Passes Sigtest Limits!
Minimum Transition Eye Voltage: -0.155186 volts
Minimum Transition Eye Voltage Passes Sigtest Limits!
Maximum Transition Eye Voltage: 0.156923 volts

Set Up the Equipment

You need the following equipment:

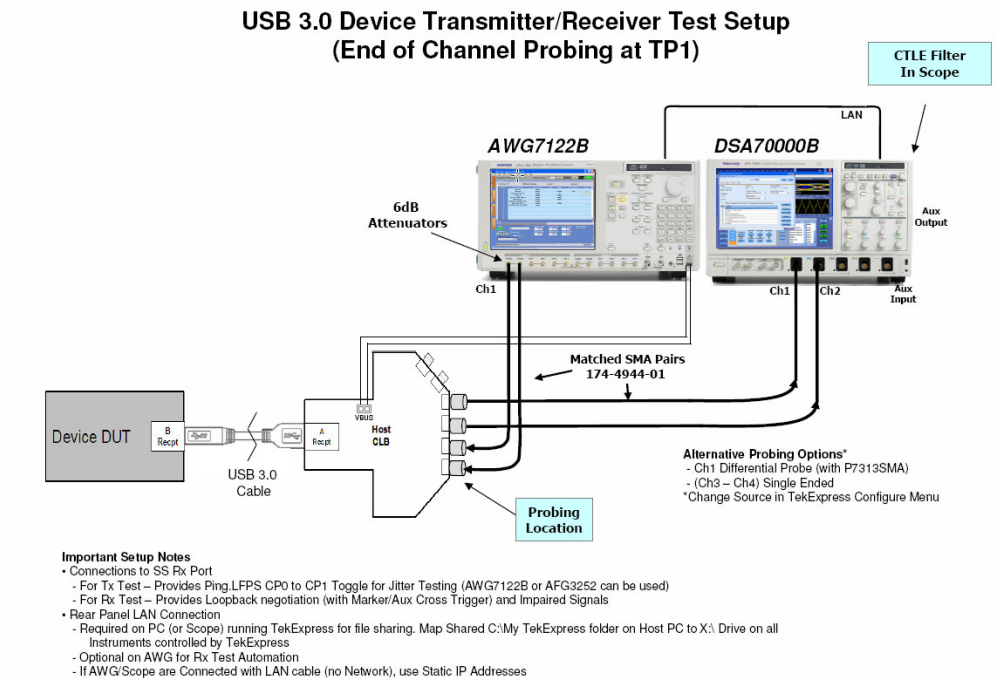
Table 10: Required equipment

Resource	Model supported
Real-time oscilloscope	Tektronix MSO/DPO/DSA71254 Series. Also MSO/DPO/DSA70804 Series is suitable for Normative measurements. A minimum of 12 GHz bandwidth is required for compliance testing.
Probes	Two TCS-SMA or one P7300SMA/P7500 differential probe.
Test Fixture	TF-USB3-KIT (includes short USB 3.0 cable) or USB-IF fixtures [1].
AWG/AFG (optional)	AWG7102 (v3.3), AWG7122 Series (v4.1.1.5), with options 6,8. AFG3252, AFG3251, AFG3102, AFG3101.

1 Available through USB-IF.

Connect the equipment as shown in the following diagram:

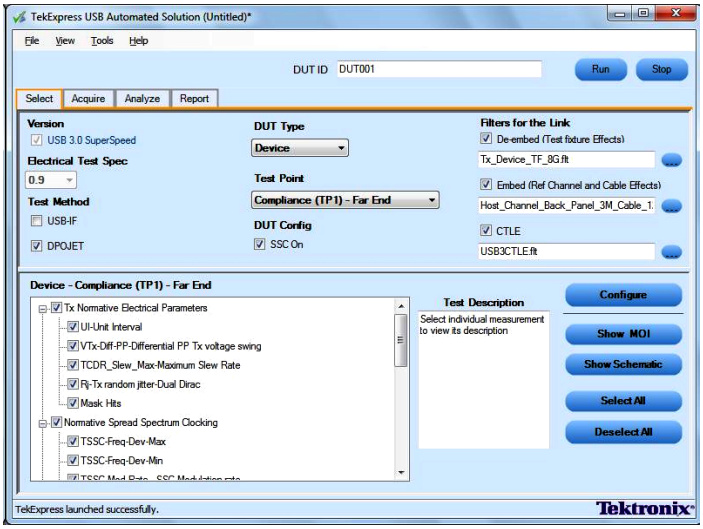
NOTE. *The VBUS on the device fixture is typically powered from an external power supply, not from the AWG.*



Testing a Device Transmitter

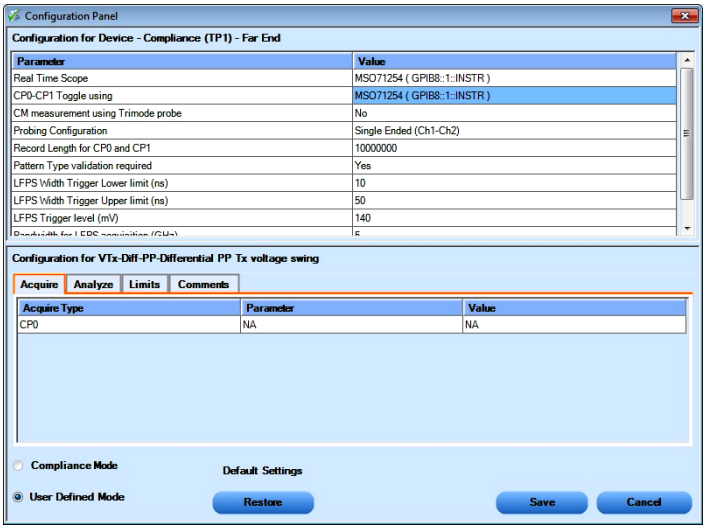
The following procedure describes how to use TekExpress to test the Device back panel.

1. Select **Device** as the DUT type.
2. Select **Compliance (TP1) - Far End** as the test point.
3. Select all tests.



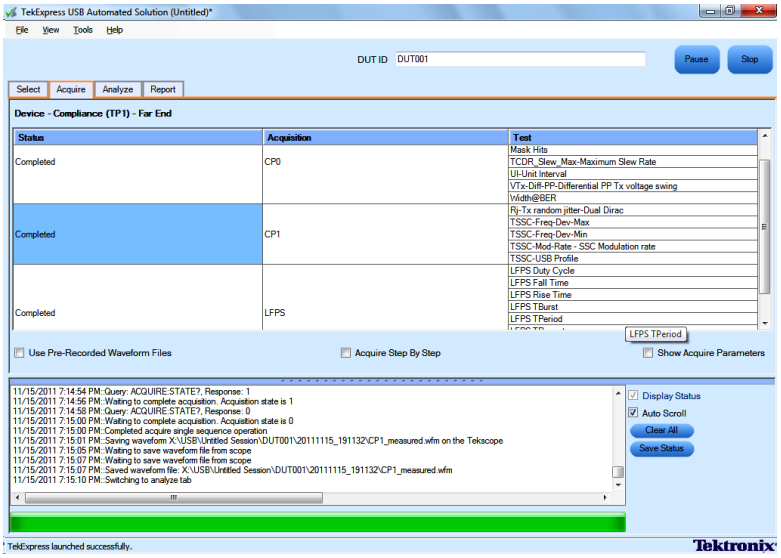
4. Click **Configure** to set the test parameters.
5. You can configure any test to help you analyze measurement results. Refer to the *DPOJET SuperSpeed (USB 3.0) Setup Library Methods of Implementation (MOI)* document for information on how to configure the Deterministic Jitter test (click **Show MOI** in the Select panel).
6. Once you change the parameters, click **Apply** to apply the new settings for the selected test. To restore the default settings, click **Restore**.

   Click **Close** to close the dialog box.

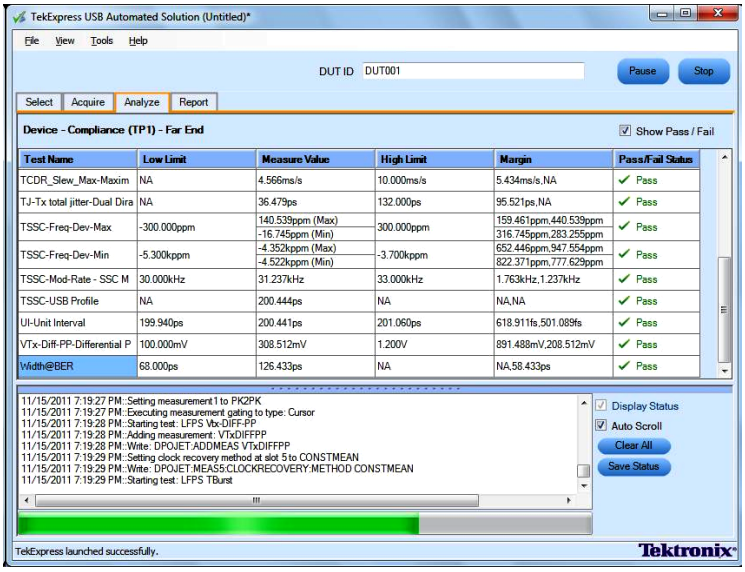


7. Click **Run** in the Select panel to run the selected tests.

8. The Acquire panel shows the status of the waveform acquisition. To know more about the Acquire panel, click here.

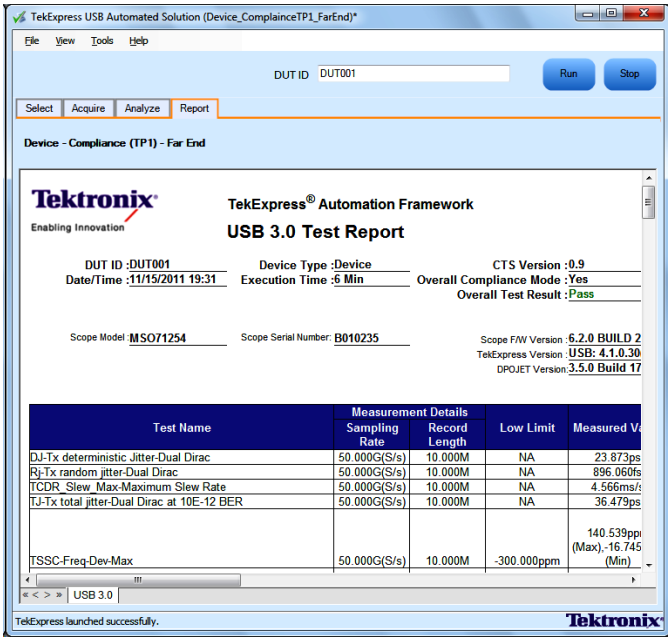


9. The Analyze tab displays the Measured, High, and Low limit values.

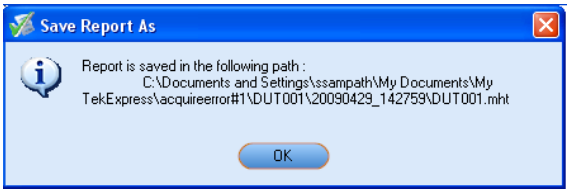


10. After the tests complete, a report is generated and displayed in the Report panel.

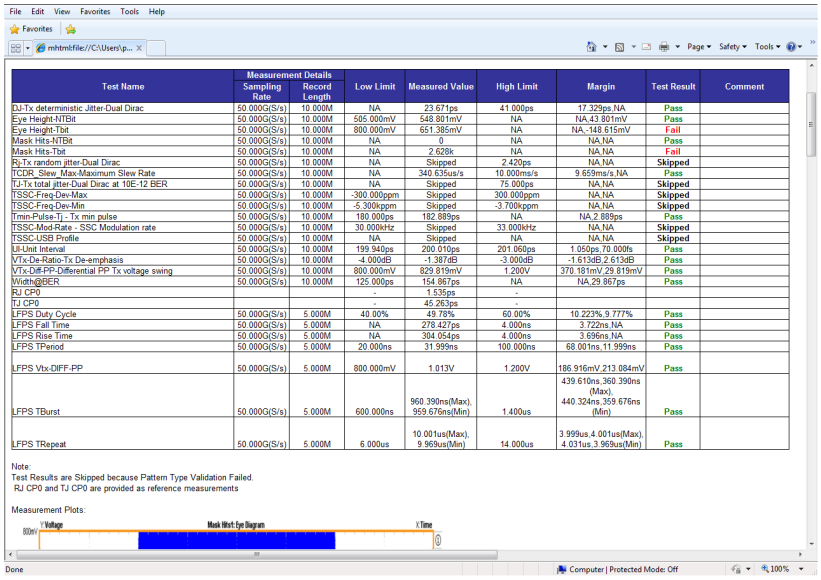
NOTE. *For toggling from CP0 to CP1, refer to topic Oscilloscope-Based Toggle (see page 45) and its related topics.*



You can save the report using the **File > Save Report As** option. The following dialog box is displayed.



If CP1 is skipped, then the measurements RJ and TJ are done on CP0 for information only.



Test Name	Measurement Details		Low Limit	Measured Value	High Limit	Margin	Test Result	Comment
	Sampling Rate	Record Length						
DJ-Tx deterministic Jitter-Dual Dirac	50.000G(S/s)	10.000M	NA	23.671ps	41.000ps	17.329ps,NA	Pass	
Eye Height-NTBit	50.000G(S/s)	10.000M	505.000mV	548.801mV	NA	NA,43.801mV	Pass	
Eye Height-Tbit	50.000G(S/s)	10.000M	800.000mV	651.385mV	NA	NA,-148.615mV	Fail	
Mask Hits-NTBit	50.000G(S/s)	10.000M	NA	0	NA	NA,NA	Pass	
Mask Hits-Tbit	50.000G(S/s)	10.000M	NA	2.628k	NA	NA,NA	Fail	
Rj-Tx random jitter-Dual Dirac	50.000G(S/s)	10.000M	NA	Skipped	2.420ps	NA,NA	Skipped	
TCDR_Slew_Max-Maximum Slew Rate	50.000G(S/s)	10.000M	NA	340.635us/s	10.000ms/s	9.659ms/s,NA	Pass	
TJ-Tx total jitter-Dual Dirac at 10E-12 BER	50.000G(S/s)	10.000M	NA	Skipped	75.000ps	NA,NA	Skipped	
TSSC-Freq-Dev-Max	50.000G(S/s)	10.000M	-300.000ppm	Skipped	300.000ppm	NA,NA	Skipped	
TSSC-Freq-Dev-Min	50.000G(S/s)	10.000M	-5.300kppm	Skipped	-3.700kppm	NA,NA	Skipped	
Tmin-Pulse-Tj - Tx min pulse	50.000G(S/s)	10.000M	180.000ps	182.889ps	NA	NA,2.889ps	Pass	
TSSC-Mod-Rate - SSC Modulation rate	50.000G(S/s)	10.000M	30.000kHz	Skipped	33.000kHz	NA,NA	Skipped	
TSSC-USB Profile	50.000G(S/s)	10.000M	NA	Skipped	NA	NA,NA	Skipped	
UI-Unit Interval	50.000G(S/s)	10.000M	199.940ps	200.010ps	201.060ps	1.050ps,70.000fs	Pass	
VTx-De-Ratio-Tx De-emphasis	50.000G(S/s)	10.000M	-4.000dB	-1.387dB	-3.000dB	-1.613dB,2.613dB	Pass	
VTx-Diff-PP-Differential PP Tx voltage swing	50.000G(S/s)	10.000M	800.000mV	829.819mV	1.200V	370.181mV,29.819mV	Pass	
Width@BER	50.000G(S/s)	10.000M	125.000ps	154.867ps	NA	NA,29.867ps	Pass	
RJ CP0			-	1.535ps	-			
TJ CP0				45.263ps				
LFPS Duty Cycle	50.000G(S/s)	5.000M	40.00%	49.78%	60.00%	10.223%,9.777%	Pass	
LFPS Fall Time	50.000G(S/s)	5.000M	NA	278.427ps	4.000ns	3.722ns,NA	Pass	
LFPS Rise Time	50.000G(S/s)	5.000M	NA	304.054ps	4.000ns	3.696ns,NA	Pass	
LFPS TPeriod	50.000G(S/s)	5.000M	20.000ns	31.999ns	100.000ns	68.001ns,11.999ns	Pass	
LFPS Vtx-DIFF-PP	50.000G(S/s)	5.000M	800.000mV	1.013V	1.200V	186.916mV,213.084mV	Pass	
LFPS TBurst	50.000G(S/s)	5.000M	600.000ns	960.390ns(Max), 959.676ns(Min)	1.400us	439.610ns,360.390ns (Max), 440.324ns,359.676ns (Min)	Pass	
LFPS TRepeat	50.000G(S/s)	5.000M	6.000us	10.001us(Max), 9.969us(Min)	14.000us	3.999us,4.001us(Max), 4.031us,3.969us(Min)	Pass	

Note:
Test Results are Skipped because Pattern Type Validation Failed.
RJ CP0 and TJ CP0 are provided as reference measurements

Measurement Plots:

About the Programmatic Interface

The Programmatic interface lets you seamlessly integrate the TekExpress test automation application with the high-level automation layer. This also lets you control the state of TekExpress application running on a local or a remote PC. Use the TekExpress programmatic interface to do the following operations:

- (see page 72) Query DUT ID
- (see page 73) Set DUT ID
- (see page 74) SaveSession
- (see page 76) RecallSession
- (see page 77) Run the TekExpress execution
- (see page 78) Stop the TekExpress execution
- (see page 80) Transfer result files
- (see page 81) Check the application status

NOTE. *The programmatic interface is not available for the following pop-up screens:*

Scope as Toggle Tool (User Action Required, two button pop-up for CP1)

AWG as Toggle Tool (Invalid Signal, four button pop-up)

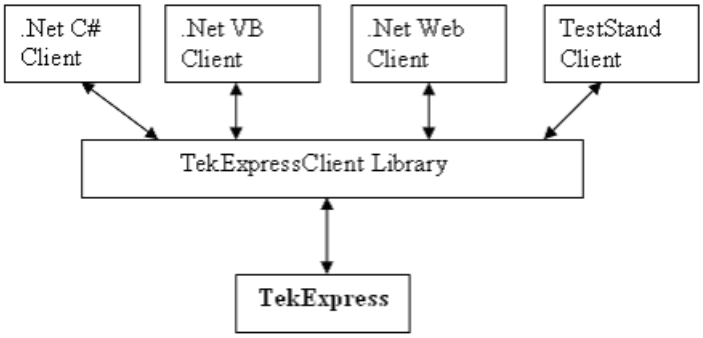
AWG as Toggle Tool (Invalid Signal, four button pop-up)

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

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

TekExpress leverages .Net Marshalling to enable the Programmatic Interface for TekExpress Client. TekExpress provides a client library for TekExpress clients to use the programmatic interface. The TekExpress client library is inherited from .Net MarshalByRef class to provide the proxy object for the

clients. The TekExpress client library maintains a reference to the TekExpress Server and this reference allows the client to control the server state.



Click the following links to get details on them:

What is needed to develop a TekExpress Client ?

You need to use the TekExpressClient.dll to develop a TekExpress Client. The client can be a VB .Net, C# .Net, TestStand, or a web application. The examples for interfaces in each of these applications are in `Samples` folder.

References Required

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

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

What steps does a client need to follow ?

Use the following information to use the TekExpressClient.dll to programmatically control the server:

A client UI has to be developed to access the interfaces exposed through the server. This client must load `TekExpressClient.dll` to access the interfaces. Once the TekExpressClient.dll is loaded, the client UI can call the specific functions to run the operations requested by the client. Once the client is up and running, it has to do the following to run a remote operation:

1. The client must provide the IP address of the PC at which the server is running so that it can connect to the server.
2. The client must lock the server application to avoid conflict with any other Client that may try to control the server simultaneously. “Lock” would also disable all user controls on server so that server state cannot be changed by manual operation.

3. If any other client tries to access a server which is locked, it will get a message that the server is locked by another client.
4. When the client has connected to and locked the server, the client can access any of the programmatic controls to run the remote automations.
5. Once the client operations are completed, the server must be "unlocked" by the client.

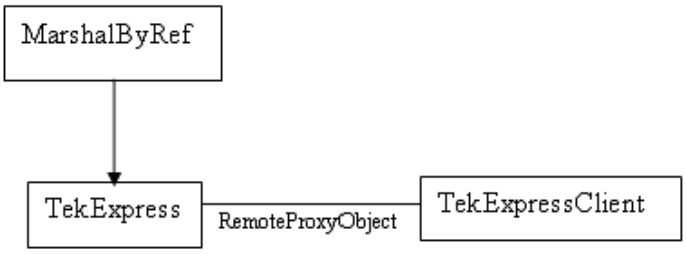
See Also:

Server and Client Proxy Objects (see page 65)

Server and Client Proxy Objects

Remote Proxy Object

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



The following is an example:

```
RemotingConfiguration.RegisterWellKnownServiceType (typeof (TekExpressRe-
moteInterface), "TekExpress Remote interface", WellKnownObjectMode.Singleton);
```

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

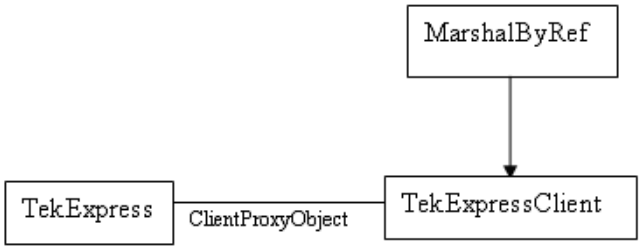
For example,

//Get a reference to the remote object

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

Client Proxy Object

Client exposes a proxy object to receive certain information.



For example,

//Register the client proxy object

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

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

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

//Expose the client proxy object through marshalling

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

The client proxy object is used for the following:

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

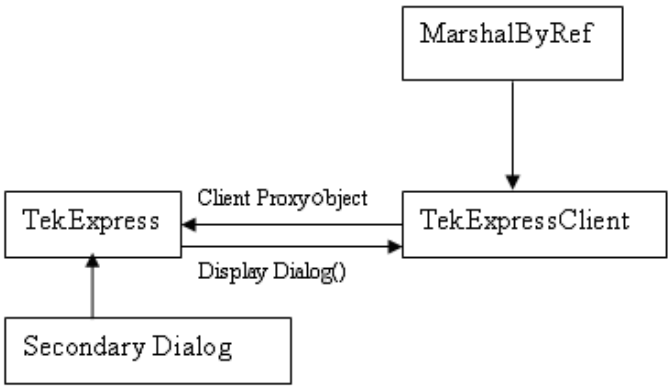
Click here to see examples.

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

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

To know more on the topics below, click the links.

Secondary Dialog Message Handling



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

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

File Transfer Events

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

Connect()

Connect(*string* ipAddress, *IRemoteClientInterface* clientIntf, *out string* clientID)

This method connects the client to the server. The client provides the ip address of the server to connect to the server. The server provides a unique clientId when the client is connected to it.

Parameters

Name	Type	Direction	Description
ipAddress	String	IN	The ip address of the server to which the client is trying to connect to. This is required to establish the connection between the server and the client.
clientIntf	String	IN	Is the handle of the remote object interface
clientid	String	OUT	Identifier of the client that is connected to the server. clientId = unique number + ipaddress of the client. For example, 1065–192.157.98.70

Return Value

Value that suggests the status if the connection was established or an error occurred. The return value can be a boolean value (true), or a string (returning the error message).

Example

```
try {
   IPAddress[] hostIPAddr = Dns.GetHostAddresses(Dns.GetHostName());
      // Connect to the remoter Server
   remoteObject.Connect(hostIPAddress, clientInterface, out clientID);
   return true;
}
catch (Exception error)
{
   return error;
}
```

Comments

The server has to be active and running for the client to connect to the server. Any number of clients can be connected to the server at a time. Each client will get a unique id.

Disconnect()

Disconnect(*string* id)

This method disconnects the client from the server it is connected to.

Parameters

Name	Type	Direction	Description
id	String	IN	Identifier of the client that is performing the remote function.

Return Value

Integer value that indicates the status of the operation upon completion.

1: Success

–1: Failure

Example

```
try
{
   string returnVal = UnlockServer (clientId);
   remoteObject.Disconnect (clientId);
   return 1;
}
```

Comments

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

LockSession()

LockSession(*string* id)

This method locks the server. The client has to call this method before running any of the remote automations. The server is locked by only one client.

Parameters

Name	Type	Direction	Description
id	String	IN	Identifier of the client that is performing the remote function.

Return Value

String value that indicates the status of the operation upon completion.

Example

```
if (locked)
   return “Session has already been locked!”;
returnVal = remoteObject.LockSession(clientId);
if ((OP_STATUS)returnVal == OP_STATUS.SUCCESS)
{
   locked = true;
   return “Session Locked...”;
}
```

Comments

When the client tries to lock a server that is locked by another client, the client gets a message that the server is already locked and it has to wait until the server is unlocked.

If the client locks the server and is idle for a certain amount of time then the server is unlocked automatically from that client.

UnlockSession()

UnlockSession(*string* id)

This method unlocks the server from the client. The client id of the client to be unlocked has to be provided.

Parameters

Name	Type	Direction	Description
id	string	IN	Identifier of the client that is performing the remote function.

Return Value

String that indicates the status of the operation upon completion.

Example

```
returnVal = remoteObject.UnlockSession(clientId);
if ((OP_STATUS)returnVal == OP_STATUS.SUCCESS)
{
   locked = false;
   return “Session UnLocked...”;
}
```

Comments

When the client is disconnected, it is automatically unlocked.

GetDutId()

GetDutId(*string* id, *string* dutId)

This method gives the DUT id of the current set-up.

Parameters

Name	Type	Direction	Description
id	string	IN	Identifier of the client that is performing the remote function.
dutId	string	OUT	The DUT id of the set-up.

Return Value

String that gives the timeout period (in seconds) of the client.

Example

```
returnVal = remoteObject.GetDutId(clientId, out id);
if ((OP_STATUS)returnVal == OP_STATUS.SUCCESS)
{
   return id;
}
else
   return CommandFailed(returnVal);
```

Comments

The dutId is an OUT parameter whose value is set after the server processes the request.

ChangeDutId()

ChangeDutId(*string* id, *string* dutName)

This method changes the DUT id of the set-up. The client has to provide a valid DUT id.

Parameters

Name	Type	Direction	Description
id	string	IN	Identifier of the client that is performing the remote function.
dutName	string	IN	The new DUT id of the set-up.

Return Value

String that indicates the status of the operation upon completion.

Example

```
If (dut Id.Length <=0 && locked == true)
   return “Enter a valid DUT-ID”;
returnVal = remoteObject.ChangeDutId(clientId, dutId);
if ((OP_STATUS)returnVal == OP_STATUS.SUCCESS)
   return “DUT Id Changed...”;
else
   return CommandFailed(returnVal);
```

Comments

If the dutName parameter is null, the client is prompted to provide a valid DUT id.

SaveSession()

SaveSession(*string* id, *string* name)

Saves the current session. The name of the session is provided by the client.

Parameters

Name	Type	Direction	Description
id	string	IN	Identifier of the client that is performing the remote function.
name	string	IN	The name of the session being saved.

Return Value

String that indicates the status of the operation upon completion.

Example

```
returnVal = remoteObject.SaveSession(clientId,sessionName);
if ((OP_STATUS)returnVal == OP_STATUS.SUCCESS)
   return “Session Saved...”;
else
   return CommandFailed(returnVal);
```

Comments

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

Once the session is saved under ‘name,’ you cannot use this method to save the session with a different name. Use SaveSessionAs to save the session to a new name.

SaveSessionAs()

SaveSessionAs(*string* id, *string* name)

Saves the current session in a different name every time this method is called. The name of the session is provided by the client.

Parameters

Name	Type	Direction	Description
id	string	IN	Identifier of the client that is performing the remote function.
name	string	IN	The name of the session being saved.

Return Value

String that indicates the status of the operation upon completion.

Example

```
returnVal = remoteObject.SaveSessionAs(clientId,sessionName);
if ((OP_STATUS)returnVal == OP_STATUS.SUCCESS)
   return “Session Saved...”;
else
   return CommandFailed(returnVal);
```

Comments

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

RecallSession()

RecallSession(*string* id, *string* name)

Recalls a saved session. The name of the session is provided by the client.

Parameters

Name	Type	Direction	Description
id	string	IN	Identifier of the client that is performing the remote function.
name	string	IN	The name of the session being recalled.

Return Value

String that indicates the status of the operation upon completion.

Example

```
returnVal = remoteObject.RecallSession(clientId,sessionName);
if ((OP_STATUS)returnVal == OP_STATUS.SUCCESS)
   return “Session Recalled...”;
else
   return CommandFailed(returnVal);
```

Comments

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

Run()

Run(*string* id)

Runs the setup. Once the server is set up and configured, it can be run remotely using this function.

Parameters

Name	Type	Direction	Description
id	string	IN	Identifier of the client that is performing the remote function.

Return Value

String that returns the status of the operation after completion.

Example

```
returnVal = remoteObject.Run(clientId);
if ((OP_STATUS)returnVal == OP_STATUS.SUCCESS)
   return “Run started...”;
else
   return CommandFailed(returnVal);
```

Comments

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

Stop()

Stop(*string* id)

Stops the run operation.

Parameters

Name	Type	Direction	Description
id	string	IN	Identifier of the client that is performing the remote function.

Return Value

String that indicates the status of the operation upon completion.

Example

```
returnVal = remoteObject.Stop(clientId);
if ((OP_STATUS)returnVal == OP_STATUS.SUCCESS)
   return “Stopped...”;
else
   return CommandFailed(returnVal);
```

Comments

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

Status()

Status(*string* id, *out string[]* status)

This method gives the status of the run as messages. The status messages are generated once the run is started.

Parameters

Name	Type	Direction	Description
id	string	IN	Identifier of the client that is performing the remote function.
status	string array	OUT	The list of status messages generated during run.

Return Value

String that indicates the status of the operation upon completion.

Example

```
returnVal = remoteObject.QueryStatus(clientId, out statusMessages);
if ((OP_STATUS)returnVal == OP_STATUS.SUCCESS)
   return “Status updated...”;
else
   return CommandFailed(returnVal);
```

Comments

The status messages are updated periodically after the run begins. The status is an out parameter which is set when the server processes the request.

TransferReport()

TransferReport(*string* id)

This method transfers the report generated after the run. The report contains the summary of the run. The client has to provide the location where the report is to be saved at the client-end.

Parameters

Name	Type	Direction	Description
id	string	IN	Identifier of the client that is performing the remote function.

Return Value

String that indicates the status of the operation upon completion.

Example

```
returnVal = remoteObject.TransferReport(clientId);
if ((OP_STATUS)returnVal == OP_STATUS.SUCCESS)
   return “Transferred...”;
else
   return CommandFailed(returnVal);
```

Comments

If the client does not provide the location to save the report, the report is saved at `C:\ProgramFiles`.

ApplicationStatus()

ApplicationStatus(string id)

This method gets the status (ready, running, paused) of the server application.

Parameters

Name	Type	Direction	Description
Id	string	IN	Identifier of the client that is performing the remote function.

Return Value

String value that gives the status of the server application.

Example

```
returnVal = remoteObject.ApplicationStatus(clientId);
return returnVal;
```

Comments

The application is in one of the following states at any given time:

- Ready: Test configured and ready to start
- Running: Test running
- Paused: Test paused

Select Panel Parameters

Parameters	Default Value	Options/Range	Example
Select DUT Type		Device, Host	SelectDevice(clientId, device, true);
Select Test			SelectTest(clientId, device, devicesuite, "UI-Unit Interval", boolSelect);
Select Test Method		USB-IF, DPOJET, Both	SetGeneralParameter(clientId, device, devicesuite, "", "Test Tool$USB-IF");
Select Test Point			SetGeneralParameter(clientId, device, devicesuite, "", "Version$Tx Pins - Near End");

	Parameters	Default Value	Options/Range	Example
Configure DUT			true, false	SetGeneralParameter(clientId, device, devicesuite, "", "SSC On$true");
Enable De-embed Link Filter (Test Fixture Effects)			true, false	SetGeneralParameter(clientId, device, devicesuite, "", "Deembed Filter Option$false");
Select De-embed Filter File				SetGeneralParameter(clientId, device, devicesuite, "", "Deembed Filter File Path$Tx_Device_TF_8G.flt");
Enable Embed Link Filter (Ref Channel and Cable Effects)			true, false	SetGeneralParameter(clientId, device, devicesuite, "", "Embed Filter Option$true");
Select Embed Filter File				SetGeneralParameter(clientId, device, devicesuite, "", "Embed Filter File Path$Tx_Device_TF_8G.flt");
Enable CTLE Filter			true, false	SetGeneralParameter(clientId, device, devicesuite, "", "CTLE Filter Option$true");
Select Embed Filter File				SetGeneralParameter(clientId, device, devicesuite, "", "CTLE Filter File Path$Tx_Device_TF_8G.flt");
Instrument Configuration	Real Time Scope	<Instrument Address>	List from Instrument discovery	SetInstrument(clientId, device, devicesuite, "UI-Unit Interval", " AnalyzeInstrument$Real Time Scope$ DPO71254C (GPIB0::1::INSTR)")
	Signal Generator	<Instrument Address>	List from Instrument discovery	SetInstrument(clientId, device, devicesuite, "UI-Unit Interval", "AnalyzeInstrument$Signal Generator$AWG7122B (GPIB0::2::INSTR)");
Selecting general parameters from Configuration panel	Probing Configuration		List from available probing locations	SetGeneralParameter(clientId, device, devicesuite, "", "Probing Configuration$Differential (Ch1)")
	Record Length		500 – 10000000	SetGeneralParameter(clientId, device, devicesuite, "", "Record Length$7000");
	CP0			SetAcquireParameter(clientId, device, devicesuite, "UI-Unit Interval", "CP0NA7")

Error Codes

The return value of the remote automations at the server-end is OP_STATUS which is changed to a string value depending on its code and returned to the client.

The values of OP_STATUS are as follows:

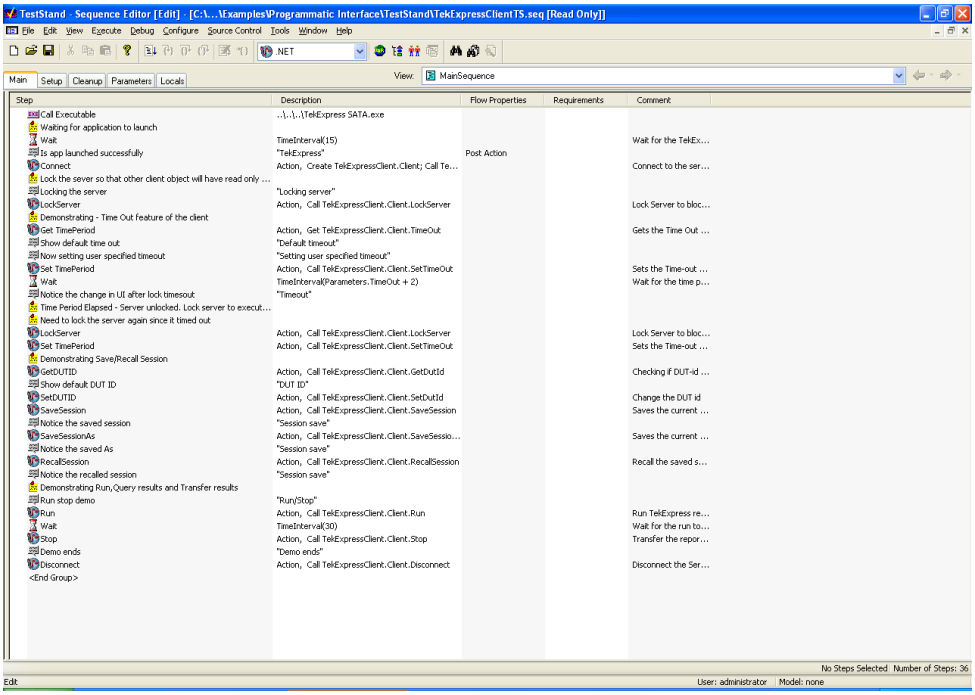
Value	Code	Description
FAIL	−1	The operation failed.
SUCCESS	1	The operation succeeded.
NOTFOUND	2	Server not found
LOCKED	3	The server is locked by another client, so operation cannot be performed.
UNLOCK	4	The server is not locked. Lock the server before performing the operation.
NULL	0	Nothing

NI TestStand Client Code Examples

The NI TestStand Client code examples are at the following paths:

For Microsoft Windows 7:
C:\Program Files (x86)\Tektronix\TekExpress\TekExpress USB\Examples\Programmatic Interface\TestStand.

For Windows XP and XP Embedded:
C:\Program Files\Tektronix\TekExpress\TekExpress USB\Examples\Programmatic Interface\TestStand



Instrument Connectivity

If the instrument(s) are displayed in TekVISA Instrument Manager but not in the TekExpress Instrument Bench, check the following:

- Only those instruments that respond to `*idn?` and `*opt?` queries successfully, are displayed in Instrument Bench.
- Make sure that VXI-11 Server is running on the instruments.

If Instrument initialization fails during test sequence execution, do the following:

It is observed that GPIB communication with instrument over Tek-VISA layer is not initialized if in TekVISA Instrument manager the search criteria is set to-off, even if a valid instrument is connected in the network. It is necessary to turn ON the respective search criteria by opening the TekVISA Instrument manager.

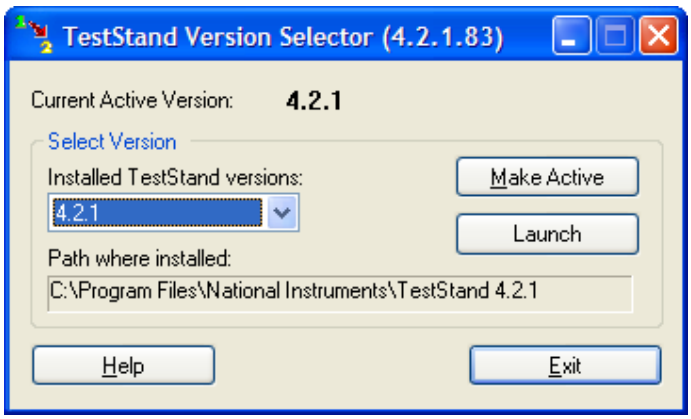
See Also:

TestStand Runtime Engine Installation (see page 85)

TestStand Run Time Engine Installation

Managing multiple versions of TestStand installed on the system.

TekExpress installs TestStand version 4.2.1 runtime engine. If you have other versions, make sure that the version shipped with TekExpress is active while working with TekExpress. You can do so by clicking **Start > Programs > National Instruments > TestStand 4.2.1 > TestStand Version Selector**.



Shortcut Keys

The following table lists the short cut keys to access the application:

Table 11: Keyboard shortcut keys

Menu	Shortcut keys
File	Alt + F
New Session	Ctrl + N
Open Session	Ctrl + O
Save Session	Ctrl + S
Save Session As	Alt + F + A
Save Report As	Alt + F + R
Print Preview Report	Alt + F + V
Print Report	Ctrl + P
Exit	Ctrl + X
View	Alt + V
Log	Ctrl + L
Tools	Alt + T
Instrument Bench	Ctrl + I
E-mail settings	Ctrl + E
Help	Alt + H
TekExpress Help (F1)	Alt + H + H
About TekExpress	Alt + H + A
Activate License	Alt + H + L

De-Embeding and Channel Embedding Overview

There are five basic filter files to meet the following combinations:

- Host + 3m cable (Host_Channel_Back_Panel_3M_Cable_12.5G.flt
- Device + 3m cable (Device_Channel_3M_cable_12.5G.flt)
- Device fixture (Tx_Device_TF_8G.flt)
- Host fixture (TX_Host_TF_8G.flt)
- USB3CTLE (same for Device and Host)

NOTE. *There is no filter for Host front + 3m cable.*

There are four S-parameter files; two for TF (Device and Host) and two for Reference channels (Device and Host).

- USB-IF_ENA_DEVICE_CHANNEL_3MCABLE.s4p
- USB-IF_ENA_HOST_CHANNEL_3MCABLE.s4p
- INTEL DEVICE FIXTURE_PLUS SHORT CABLE.s4p
- INTEL HOST FIXTURE.s4p

Front Panel and capacitive devices do not use a short cable. As the S-parameter files represent the combined reference channel and short cable parameters, the USB-IF does not provide S-parameter files for these devices. Front Panel and capacitive devices need a back channel with no cable

NOTE. *There is one set of filter files that support both 25 GS/s (8 GHz BW oscilloscopes) and 50 GS/s (12.5 GHz BW and above oscilloscopes) sampling rates. The difference between the 25 GS/s and 50 GS/s filters is that the 25 GS/s filters have a stop band setting of 10 GHz for embed filters.*

See Also:

Host Filter Information (see page 88)
Device Filter Information (see page 91)
DUT/Filter Combinations (see page 93)

Host Filter Information

Host Embed Filter

- The Host embed filter name is Device_Channel_3M_cable_12.5G.flt.
- This filter is applied for HOST DUT and for the normative CP0 and CP1 measurements.
- The test point location is compliance TP1. The application uses the device and cable compliance channels to test the host designs.
- The filter response is generated using the SDLA when the input is set as USB-IF for the USB-IF_ENA_HOST_CHANNEL_3MCABLE.s4p file. The S-parameter file represents the combined response of the HOST reference channel and the 3 meter cable.
- This filter embeds the response of the Host 5 inch reference channel and a 3 meter cable.
- The filter response BW is 12.5 GHz and the stop band is 15.625 GHz at a -80 dB.

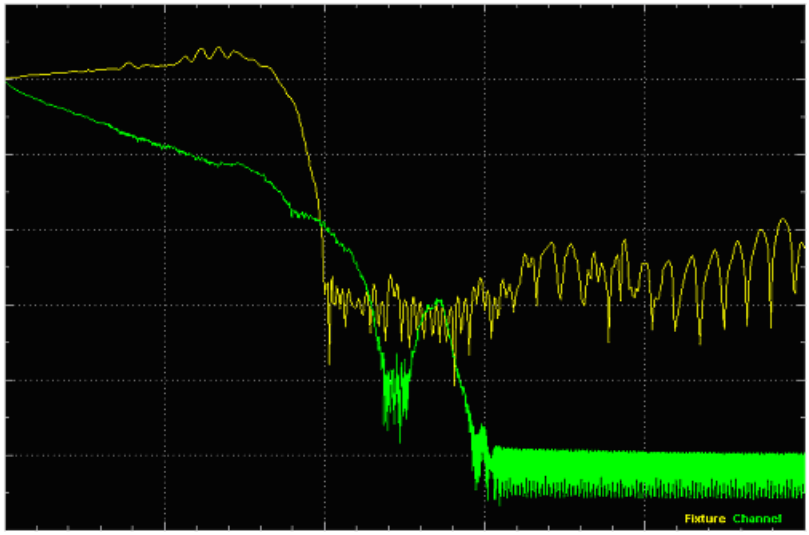
Host De-embed Filter

The Host de-embed filter file is Tx_Host_TF_8G.flt, which de-embeds the Host USB-IF test fixture. This filter is convolved with the Device_Channel_3M_cable_12.5G.flt filter to remove the effects of the test fixture.

The application uses the 'Intel Host fixture.s4p' S-parameter file to generate the filter response used by USB-IF.

The filter response BW is 8 GHz and the stop band is 10 GHz at a -80 db roll off.

The following is a representative plot, generated using SDLA. You can use this plot as a reference plot, or to view the response of the filter file.



Host fixture and channel response

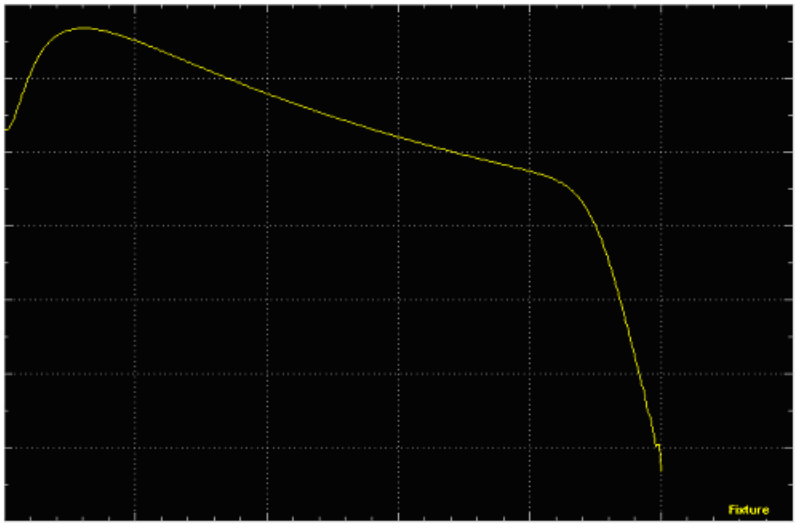
Continuous Time Linear Equalizer (CTLE) Filter

The USB3CTLE.flt filter is a Continuous Time Linear Equalizer (CTLE) filter. Due to the lossy nature of the channel (the combination of the reference channel, cable, and test fixture from TX pins(TP1)), the eye diagram at the receiver may be closed. This filter applies receiver equalization to meet the system timing and voltage margins.

The CTLE filter coefficients are generated by passing the following parameters to the SDLA:

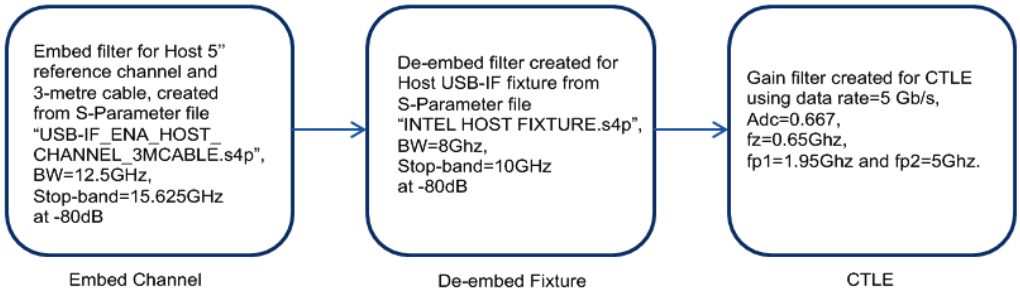
- DC gain (Adc) = 0.667
- Zero frequency (fz) = 650 MHz
- first pole frequency (fp1) = 1.95 Ghz
- Second pole frequency (fp2) = 5 GHz

The following is a representative plot, using SDLA, of the combined response of the convolution of Embed, De-embed and CTLE filters. You can use this plot as a reference plot, or to view the response of the filter file.



CTLE response

The signal connection path for HOST is HOST <-> TF (B connector) <-> 3 meter reference cable <-> standard (1 meter) SMA cable <-> Oscilloscope channel.



NOTE. *These filters are applicable for 12.5 GHz and above oscilloscopes. For 8 GHZ oscilloscopes, only the embed filters BW (8 GHz) and stop band (10 GHz) are different; the de-embed parameters remain the same.*

See Also:

De-Embeding and Channel Embedding Overview (see page 87)
Device Filter Information (see page 91)
DUT/Filter Combinations (see page 93)

Device Filter Information

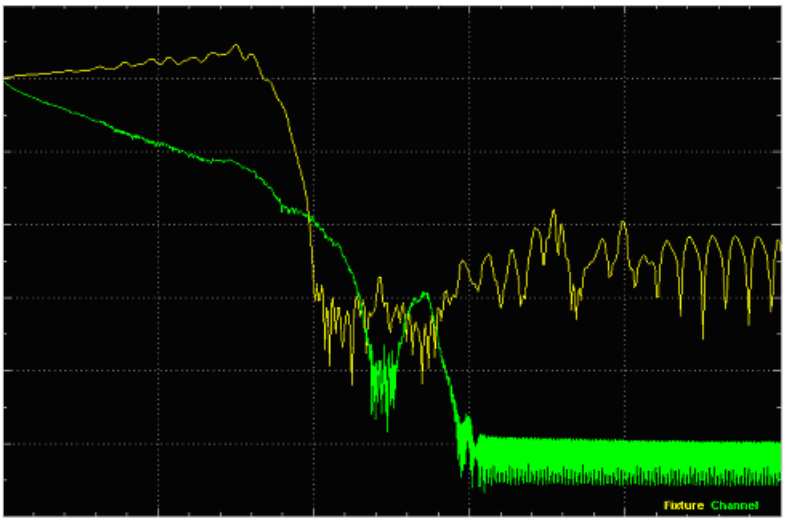
Device Embed Filter

- The embed filter file is Host_Channel_Back_Panel_3M_Cable_12.5G.flt, and is applied for the Device DUT for the normative (CP0 and CP1) measurements.
- The test point location is compliance TP1.
- The application uses host and cable compliance channels for testing of device designs.
- This filter response is generated using the Tektronix SDLA filter generation application, with input from the USB-IF S-parameter file (USB-IF_ENA_DEVICE_CHANNEL_3MCABLE.s4p).
- This filter embeds the response of the Device 11 inch reference channel and a 3 meter cable.
- The filter response BW is set to 12.5 GHz and the stop band is set to 15.625 GHz at a -80 dB roll off.

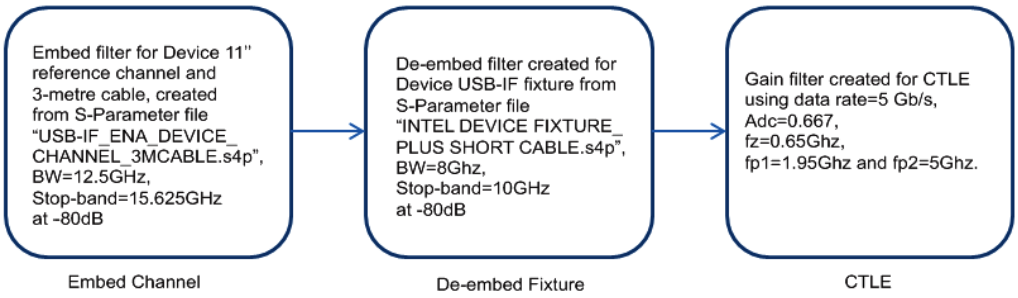
Device De-embed Filter

- The de-embed filter is Tx_Device_TF_8G.flt, and is applicable for Host.
- This is convolved with the Host_Channel_3M_cable_12.5G.flt filter to remove the test fixture effects.
- The filter response is generated using the 'Intel Device fixture.s4p' filter output provided by USB-IF.
- The filter de-embeds the DEVICE USB-IF test fixture.
- The filter response BW is set to 8 GHz and the stop band is set to 10 GHz at a -80 db roll off.

The following is a representative plot, using SDLA, of the combined response of the convolution of Embed, De-embed and CTLE filters. You can use this plot as a reference plot, or to view the response of the filter file.



The connection path for DEVICE is DEVICE <-> Short USB cable (4 inch) <-> TF (A connector) <-> 3 meter reference cable <-> TF_convertor* <-> standard (1m) SMA cable <-> Oscilloscope channel.



NOTE. *The TF_convertor uses input from the 3 meter USB cable and provides output as SMA. This convertor is needed for testing the far end of the DUT.*

NOTE. *These filters are applicable for 12.5 GHz and above oscilloscopes. For 8 GHZ oscilloscopes, only the embed filters BW (8 GHz) and stop band (10 GHz) are different; the de-embed parameters remain the same.*

See Also:

De-Embeding and Channel Embedding Overview (see page 87)
Host Filter Information (see page 88)
DUT/Filter Combinations (see page 93)

DUT/Filter Combinations

Use the following table to help select the appropriate filter for listed DUT and embed/de-embed configurations.

Table 12:

DUT	Test point (TP) location	Embed filter (reference channel + cable effects)	De-embed filter (test fixture effects)	USB IF recommendation
Host	Compliance TP1	N/A	N/A	Informative
Host	Compliance TP1	Device_Channel_3M_Cable_12.5G.flt (default)	Tx_Host_TF_8G.flt	Normative
Host	Tx Pins (host connector)	N/A	N/A	Informative
Host	Custom	Custom_Device_Channel_3M_Cable.flt	Custom_Host_TF.flt	Informative
Device	Compliance TP1	N/A	N/A	Informative
Device	Compliance TP1	Host_Channel_Back_Panel_3M_Cable_12.5Gflt (default)	Tx_Device_TF_8G.flt	Normative
Device	Tx Pins (device connector)	N/A	N/A	Informative
Device	Custom	Custom_Host_Channel_3M_Cable.flt	Custom_Device_TF.flt	Informative
Device	Far end (TP1)	Tx_Device_Channel_3M_Cable.flt	Tx_Device_TF.flt	Normative

See Also:

De-Embeding and Channel Embedding Overview (see page 87)
Host Filter Information (see page 88)
Device Filter Information (see page 91)

SDLA Filter Creation Requirements

You can use the optional Tektronix Serial Data Link Analysis (SDLA) software to create custom bandwidth filters using supplied or custom .sp4 files. See the SDLA documentation and online help for information on running the SDLA application.

Verify that you are using the correct versions of software before using SDLA to create filter files:

- **SDLA**: 1.2.90.34
- **Tekscope**: 5.3.4 Build 25

See Also:

Setting Up SDLA to Generate USB Tx Filters (see page 94)
To Create a CTLE Filter Using SDLA (see page 95)
To Create a Host Filter Using SDLA (see page 97)
To Create a Device Back Panel Filter using SDLA (see page 95)

Setting Up SDLA to Generate USB Tx Filters

Enter the following settings in SDLA to generate filter files for USB Tx.

- Recall the CP0.wfm file on Ref1 that was acquired with a 50 GS/s oscilloscope with 12.5 GHz and above bandwidth. Acquire waveforms with a 25 GS/s oscilloscope with 8 GHz bandwidth.
- Launch the SDLA application from the TekScope **Analyze** menu.
- Set the **SDLA** application parameters:
  - Oscilloscope Source: **Ref 1**.
  - Bit Rate: **5 Gb/s**.
  - Set the **Equalizer** parameters:
    - Source: **Ref 1**.
    - Rate: **5 Gb/s**.
    - Select **Standard** and CTLE.
    - Adc: **0.667**.
    - fz: **0.65 GHz**.
    - fp1: **1.95 GHz**.
    - fp2: **5 GHz**.
- In the next panel, make sure **No adapt**, **FFE/DFE**, and **PcieD** are not selected (unchecked).
- Use the To Create a CTLE Filter Using SDLA (see page 95), To Create a Device Back Panel Filter using SDLA (see page 95), and To Create a Host Filter Using SDLA (see page 97) topics to generate the required filter. Copy the generated filters to C:\Program Files\Tektronix\TekExpress\Setup Files\Filters for use in the USB Tx application.

See Also:

SDLA Filter Creation Requirements (see page 93)

To Create a CTLE Filter Using SDLA

1. In SDLA, click the **Equalizer** block. Unselect all other blocks.
2. Turn off test points **TpA**, **TpB**, and **TpC** (test point text changes to blue).
3. Click on the **Equalizer** block.
4. Click the **Run EQ** button. Wait until the status bar indicates **Single Run completed**.
5. Click **Ok**. The generated CTLE Filter (sdlaCtle.flt) is saved at C:\TekApplications\SDLA\output filters. Rename the CTLE filter file as needed.
6. Copy the generated filters to C:\Program Files\Tektronix\TekExpress\Setup Files\Filters for use in the USB Tx application.

See Also:

SDLA Filter Creation Requirements (see page 93)
Setting Up SDLA to Generate USB Tx Filters (see page 94)
To Create a Device Back Panel Filter using SDLA (see page 95)
To Create a Host Filter Using SDLA (see page 97)

To Create a Device Back Panel Filter using SDLA

1. In SDLA, click the **Fixture** block and set/verify the following parameters:
   - Fixture: **On**.
   - Data input Type: **S-Parameters**.
   - Touchstone Format: **4-Port**.
   - Click **Browse** and select the sparam file **Intel Device fixture_plus short cable.s4p**.
   - Derive Filter From: **Single Ended**.
   - Assign ports: **(1 Tx+, 3Rx+)** and **(2Tx-, 4Rx-)**.
   - Bandwidth Limit: **Custom**.
   - Click Filter: **BW->8 GHz** and **Stopband->10 GHz** (for example, 1.25 * BW) and **-80dB**. Click **Apply**.
   - Click **OK**.
2. Click **Apply**. The application saves the generated de-embed filter (sdlaTpA.flt) to C:\TekApplications\SDLA\output filters. Rename the filter as needed.

3. Click the **Channel** block and set/verify the following parameters:
   - Channel: **On**.
   - Data input Type: **S-Parameters**.
   - Touchstone Format: **4-Port**.
   - Click **Browse** and select the sparam file **AGILENT_ENA_DEVICE_CHANNEL_3MCA-BLE.s4p**.
   - Derive Filter From: **Single Ended**.
   - Assign ports: **(1 Tx+, 3Rx+)** and **(2Tx-, 4Rx-)**.
   - Bandwidth Limit: **Custom**.
   - Click Filter: BW->12.5 GHz and Stopband->15.625 GHz (for example, 1.25 * BW) and **-80 dB**. Click **Apply**.
   - Click **OK** Make sure that the **Fixture** and **Emphasis** blocks are set to**Off** (disabled).
4. Click **Apply**. The application saves the generated de-embed filter file (sdlaTpC.flt) to C:\TekApplications\SDLA\output filters. Rename the filter as needed.
5. Click the **Emphasis** block and set/verify the following parameters:
   - Emphasis: **De-**.
   - Data input Type: **Read From File**.
   - Click **Browse** and select the previously created file **USB3_Ctle.flt**.
   - Bandwidth Limit: **None**.
   - Click **OK**.
6. Turn on (enable) the **Fixture**, **Emphasis**, and **Channel** blocks.
7. Click **Apply**. The status bar shows the message 'Press Analyze to measure with DPOJET.'
8. Verify the SDLA plots.
9. Click **Analyze** to verify the eye using DPOJET. The application saves the generated convolved filter file as **sdlaTpC.flt**.
10. Copy the generated filters to C:\Program Files\Tektronix\TekExpress\Setup Files\Filters for use in the USB Tx application.

See Also:

SDLA Filter Creation Requirements (see page 93)
Setting Up SDLA to Generate USB Tx Filters (see page 94)
To Create a CTLE Filter Using SDLA (see page 95)
To Create a Host Filter Using SDLA (see page 97)

To Create a Host Filter Using SDLA

1. In SDLA, click the **Fixture** block and set/verify the following parameters:
   - Fixture: **On**.
   - Data input Type: **S-Parameters**.
   - Touchstone Format: **4-Port**.
   - Click **Browse** and select the sparam file **Intel Host fixture.s4p**.
   - Derive Filter From: **Single Ended**.
   - Assign ports: **(1Tx+, 3Rx+)** and **(2Tx-, 4Rx-)**.
   - Bandwidth Limit: **Custom**.
   - Click on Filter: BW->8 GHz and Stopband->10 GHz (for example, 1.25 * BW) and **-80 dB**. Click **Apply**.
   - Click **OK**.
2. Click **Apply**. The application saves the generated de-embed filter (sdlaTpA.flt) to C:\TekApplications\SDLA\output filters.
3. Click the **Channel** block and set/verify the following parameters:
   - Channel: **On**.
   - Data input Type: **S-Parameters**.
   - Touchstone Format: Select **4-Port**.
   - Click **Browse** and select the sparam file **AGILENT_ENA_HOST_CHANNEL_3MCABLE.s4p**.
   - Derive Filter From: **Single Ended**.
   - Assign ports: **(1 Tx+, 3Rx+)** and **(2Tx-, 4Rx-)**.
   - Bandwidth Limit: **Custom**.
   - Click on Filter: BW->12.5 GHz and Stopband->15.625 GHz (for example, 1.25 * BW) and **-80 dB**. Click on **Apply**.
   - Click **OK**.
4. Turn off (disable) the **Fixture** and **Emphasis** blocks.
5. Click **Apply**. The application saves the generated de-embed filter (sdlaTpC.flt) to C:\TekApplications\SDLA\output filters.

6. Click the **Emphasis** block and set/verify the following parameters:
   - Emphasis: **De-**.
   - Data input Type: **Read From File**.
   - Click **Browse** and select the previously created USB3_Ctle.flt filter file.
   - Bandwidth Limit: **None**.
   - Click **OK**
7. Turn on (enable) the **Fixture**, **Emphasis**, and **Channel** blocks and click **Apply**. The status bar displays the message 'Press Analyze to measure with DPOJET'.
8. Verify the SDLA Plots.
9. Click **Analyze** to verify the eye using DPOJET. The application generates the convolved filter file **sdlaTpC.flt**.
10. Copy the generated filters to C:\Program Files\Tektronix\TekExpress\Setup Files\Filters for use in the USB Tx application.

See Also:

SDLA Filter Creation Requirements (see page 93)
Setting Up SDLA to Generate USB Tx Filters (see page 94)
To Create a CTLE Filter Using SDLA (see page 95)
To Create a Device Back Panel Filter using SDLA (see page 95)

Save Channel Waveforms

The Save Channel Waveforms field in the Configuration panel sets the application to automatically save unfiltered channel waveform data from the current session to one or more files. You can use these waveform files to do further analysis in other applications.

The following tables list the file names created for different probing configurations.

Single Ended (Normative) Probing Configuration Saved File Names

NOTE. *Channel waveforms are not saved for TriMode acquisitions.*

Test method	Waveform	Save Channel Waveform = Yes	Save Channel Waveform = No
DPOJET	CP0	CP0_measured.wfm CP0ChX.wfm CP0ChY.wfm	CP0_measured.wfm
	CP1	CP1_measured.wfm CP1ChX.wfm CP1ChY.wfm	CP1_measured.wfm
	LFPS	NA	LFPS_measured.wfm LFPSchx.wfm LFPCchx.wfm
USB-IF	CP0	CP0.wfm CP0ChX.wfm CP0ChY.wfm	CP0.wfm
	CP1	CP1.wfm CP1ChX.wfm CP1ChY.wfm	CP1.wfm
	LFPS	NA	NA
Both	CP0	CP0_measured.wfm CP0.wfm CP0ChX.wfm CP0ChY.wfm	CP0_measured.wfm CP0.wfm
	CP1	CP1_measured.wfm CP1.wfm CP1ChX.wfm CP1ChY.wfm	CP1_measured.wfm CP1.wfm
	LFPS	NA	LFPS_measured.wfm LFPSch1.wfm LFPCch2.wfm

Single Ended (Informative) Probing Configuration Saved File Names

NOTE. *Channel waveforms are not saved for TriMode acquisitions.*

Test method	Waveform	Save Channel Waveform = Yes	Save Channel Waveform = No
DPOJET	CP0	CP0_probed.wfm CP0ChX.wfm CP0ChY.wfm	CP0_probed.wfm CP0ChX.wfm [1] CP0ChY.wfm [1]
	CP1	CP1_probed.wfm CP1ChX.wfm CP1ChY.wfm	CP1_probed.wfm
	LFPS	NA	LFPS_measured.wfm LFPSchx.wfm LFPCchx.wfm
USB-IF	CP0	NA	NA
	CP1	NA	NA
	LFPS	NA	NA
Both	CP0	NA	NA
	CP1	NA	NA
	LFPS	NA	NA

1 CM tests selected.

Differential (Normative) Probing Configuration Saved File Names

NOTE. *Channel waveforms are not saved for TriMode acquisitions.*

Test method	Waveform	Save Channel Waveform = Yes	Save Channel Waveform = No
DPOJET	CP0	CP0_measured.wfm CP0ChX.wfm	CP0_measured.wfm
	CP1	CP1_measured.wfm CP1ChX.wfm	CP1_measured.wfm
	LFPS	NA	LFPS_measured.wfm
USB-IF	CP0	CP0.wfm CP0ChX.wfm	CP0.wfm
	CP1	CP1.wfm CP1ChX.wfm	CP1.wfm
	LFPS	NA	NA
Both	CP0	CP0_measured.wfm CP0.wfm CP0ChX.wfm	CP0_measured.wfm CP0.wfm
	CP1	CP1_measured.wfm CP1.wfm CP1ChX.wfm	CP1_measured.wfm CP1.wfm
	LFPS	NA	LFPS_measured.wfm

Differential (Informative) Probing Configuration Saved File Names

NOTE. *Channel waveforms are not saved for TriMode acquisitions.*

Test method	Waveform	Save Channel Waveform = Yes	Save Channel Waveform = No
DPOJET	CP0	CP0_probed.wfm CP0ChX.wfm	CP0_probed.wfm
	CP1	CP1_measured.wfm CP1ChX.wfm	CP1_probed.wfm
	LFPS	NA	LFPS_measured.wfm
USB-IF	CP0	NA	NA
	CP1	NA	NA
	LFPS	NA	NA
Both	CP0	NA	NA
	CP1	NA	NA
	LFPS	NA	NA

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