TekExpress®
HEAC (HDMI Ethernet Audio Return Channel) Automated Solution

Online Help

077-0388-02

Tektronix

TekExpress®
HEAC (HDMI Ethernet Audio Return Channel) Automated Solution

Online Help

www.tektronix.com
077-0388-02

Tektronix

HEAC Automated Solution Online help, 076-0191-03.

Contacting Tektronix

Tektronix, Inc.
14200 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.

Table of Contents

TekExpress Programmatic Interface

Troubleshooting

Reference

Index

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

Use proper power cord. Use only the power cord specified for this product and certified for the country of use.

Use proper voltage setting. Before applying power, ensure that the line selector is in the proper position for the source being used.

Connect and disconnect properly. Do not connect or disconnect probes or test leads while they are connected to a voltage source.

Ground the product. This product is indirectly grounded through the grounding conductor of the mainframe power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

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.

The inputs are not rated for connection to mains or Category II, III, or IV circuits.

Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.

Power disconnect. The power cord disconnects the product from the power source. Do not block the power cord; it must remain accessible to the user at all times.

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.

Use proper AC adapter. Use only the AC adapter specified for this product.

Do not operate in wet/damp conditions.

Do not operate in an explosive atmosphere.

Keep product surfaces clean and dry.

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.*

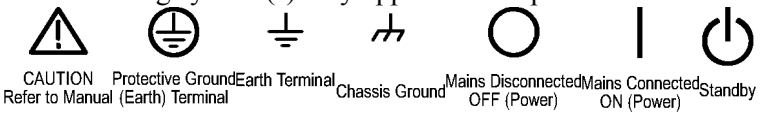
CAUTION. *Caution statements identify conditions or practices that could result in damage to this product or other property.*

Symbols and Terms on the Product

These terms may appear on the product:

- DANGER indicates an injury hazard immediately accessible as you read the marking.
- WARNING indicates an injury hazard not immediately accessible as you read the marking.
- CAUTION indicates a hazard to property including the product.

The following symbol(s) may appear on the product:



Using Online Help

Select Help from the menu to open the help file. You can also find an electronic copy of the help file in the Documents directory.

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 to bring up 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.

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.

Table 1: Icon descriptions (cont.)

Icon	Meaning
	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.

Documentation

The following table lists the documentation that is available for the product and shows where you can find it.

Table 2: Product documentation

Item	Purpose	Location
Online Help	In-depth operation and UI help.	
User Manual (adapted from the online help)	In-depth operation and UI help.	 www.Tektronix.com
Quick Start User Manual	Provides operation and application information.	 www.Tektronix.com

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, and FAX number.
- Please indicate if you would like to be contacted by Tektronix about your suggestion or comments.

Application Specific Information

- Software version number.
- Description of the problem such that technical support can duplicate the problem.
- If possible, save the setup files for all the instruments used and the application.
- If possible, save the 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

Test Setup

Test Fixtures

The Tektronix fixtures used are:

- TF-HEAC-TPA-KIT consisting of:
  - TF-HEAC-TPA-MAIN, Tektronix part number 863-0482-00
  - TF-HEAC-TPA-AP, Tektronix part number 863-0478-00
  - TF-HEAC-TPA-CP, Tektronix part number 863-0479-00
  - 2 each TF-HEAC-TDR-AR, Tektronix part number 863-0480-00
  - 2 each TF-HEAC-TDR-CR, Tektronix part number 863-0481-00
- TF-HDMI-TPA-CE (EDID board, Tektronix part number 878-0475-00), consisting of:
  - EDID fixture PCBA
  - EEPROM with HDMI 1.4 software
  - Ribbon cable
- TF-HDMID-TPA-KIT (required for HEAC testing of Type D devices) consisting of:
  - Plug assembly
  - 2 each Receptacle cable assembly

Oscilloscopes

The recommended oscilloscopes are:

- Tektronix DPO7000 Series Digital Oscilloscope
- Tektronix DPO70000 Series, DPO70000B Series, DSA70000 Series, and DSA70000B Series Digital Oscilloscope
- Tektronix MSO70000 Series Mixed Signal Oscilloscope

Probes

The recommended differential probes are:

- Tektronix P6247, P6248, P6330, or P7330 for Tektronix DPO70000 Series, DPO70000B Series, DSA70000 Series, and DSA70000B Series Digital Oscilloscopes
- Tektronix P6247, P6248, P6330, or P7330 for Tektronix MSO70000 Series Mixed Signal Oscilloscopes
- Tektronix P6330, TDP1000, TDP1500, or TDP3500 for Tektronix DPO7000 Series Digital Oscilloscopes

The recommended single-ended probes are:

- Tektronix P6243 or P6245 for Tektronix DPO70000 Series, DPO70000B Series, DSA70000 Series, and DSA70000B Series Digital Oscilloscopes
- Tektronix P6243 or P6245 for Tektronix MSO70000 Series Mixed Signal Oscilloscopes
- Tektronix P6243, P6245, or TAP1500 for Tektronix DPO7000 Series Digital Oscilloscopes

Arbitrary Waveform Generators

The recommended arbitrary waveform generators are:

- Tektronix AWG5000 Series and AWG5000B Series
- Tektronix AWG7000 Series and AWG7000B Series

Minimum System Requirements

The minimum system requirements for a PC to run the application are as follows:

Table 3: System requirements

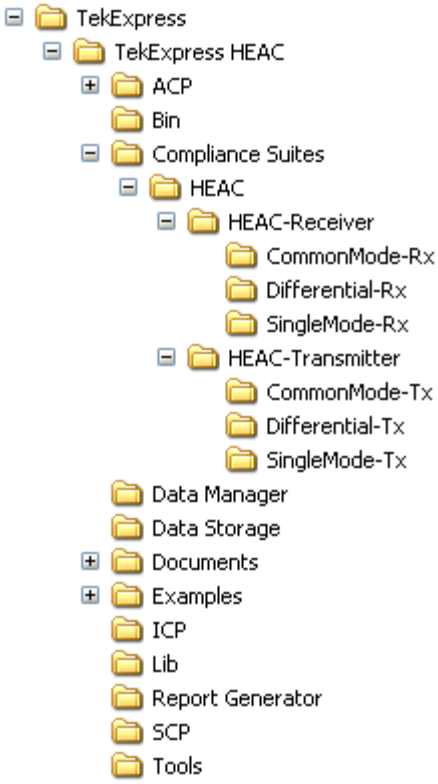
Processor	Pentium 4/M or equivalent processor.
Operating System	Windows XP Service Pack 2.
Memory	512 MB of memory.
Hard Disk	Approximately 2 GB of available hard-disk space for the recommended installation, which includes full TekExpress installation and distributed components.
Drive	DVD drive
Display	Super VGA resolution or higher video adapter (800x600 minimum video resolution for small fonts or 1024x768 minimum video resolution for large fonts). The application is best viewed at 96 dpi display settings [1].
Software	■ Microsoft Excel 2002 or above. ■ Microsoft Internet Explorer 6.0 SP1 or later. ■ Adobe Reader 6.0 or equivalent software for viewing portable document format (PDF) files.
Other Devices	■ Microsoft compatible mouse or compatible pointing device. ■ Two USB ports (One USB port minimum). ■ PCI-GPIB or equivalent interface for instrument connectivity [2].

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

2 If TekExpress is installed on a Tektronix oscilloscope, the virtual GPIB port cannot be used by TekExpress for communicating with oscilloscope applications.
If external devices like USB-GPIB or equivalent are used for instrument connectivity, ensure that the Talker Listener utility is enabled in the DPO/DSA oscilloscope's GPIB menu.

Application Directories and Usage

The application directory and associated files are organized as follows:



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

Table 4: Default directory names and their usage

Directory names	Usage
`InstallDir\TekExpress\TekExpress HEAC`	Contains the application and associated files.
`TekExpress HEAC\ACP`	Includes instrument and application specific interface libraries of TekExpress.
`TekExpress HEAC\Bin`	Includes instrument and application specific interface libraries of TekExpress.
`TekExpress HEAC\Compliance Suites`	Has compliance specific sequence files. The folders under this directory represent the devices to be tested.
`TekExpress HEAC\Compliance Suites\HEAC`	Includes the “HEAC-Receiver” and “HEAC-Transmitter” folders.

Table 4: Default directory names and their usage (cont.)

Directory names	Usage
TekExpress HEAC\Compliance Suites\HEAC\HEAC-Receiver	Includes the “CommonMode-Rx“, “Differential-Rx”, and “SingleMode-Rx” folders.
TekExpress HEAC\Compliance Suites\HEAC\HEAC-Transmitter	Includes the “CommonMode-Tx“, “Differential-Tx”, and “SingleMode-Tx” folders.
TekExpress HEAC\Data Manager TekExpress HEAC\Data Storage	Includes the result management specific libraries of TekExpress are present in these folders.
TekExpress HEAC\Documents	Includes the technical documentation for the application.
TekExpress HEAC\ICP	Includes instrument and application specific interface libraries of TekExpress.
TekExpress HEAC\Lib	Includes the miscellaneous libraries of TekExpress
TekExpress HEAC\Report Generator	Includes the result management specific libraries of TekExpress are present in these folders.
TekExpress HEAC\SCP	Includes instrument and application specific interface libraries of TekExpress.
TekExpress HEAC\Tools	Includes the miscellaneous libraries of TekExpress.

NOTE. *Ensure that you maintain the directory structure and do not accidentally modify it.*

File Name Extensions

The software uses the following file name extensions:

File name extension	Description
.TekX	The session file will be saved in this format.
.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 report file is saved in this format.

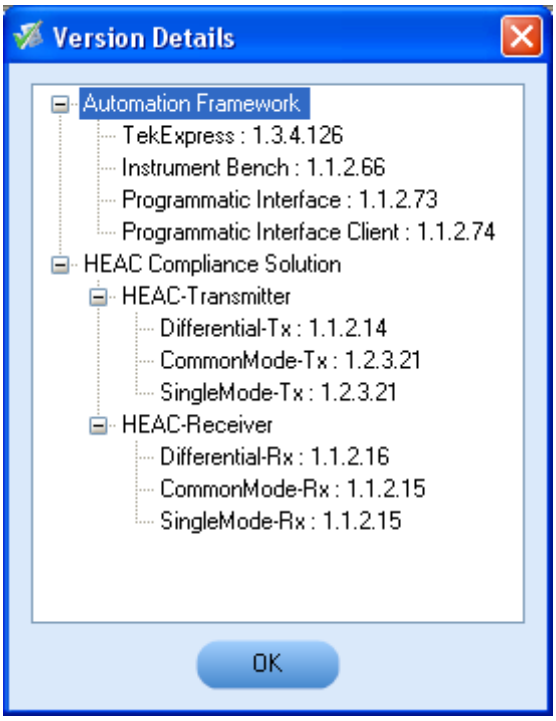
How To Activate the License

You can directly activate the license from the menu. Select **Help > Activate License**. Enter the License Key in the License Info dialog box.

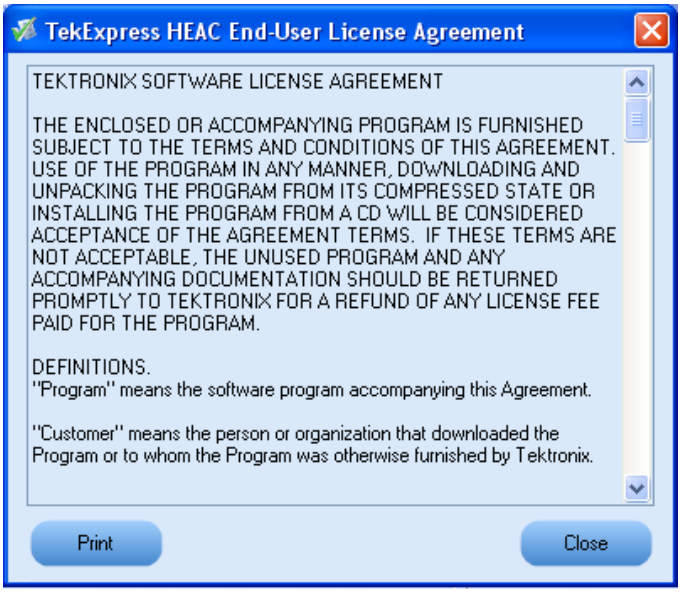
You can also activate the license in another manner. Follow the steps below to activate the license:

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.

Before You Click Run

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

- `\My Documents\My TekExpress`

NOTE. *Ensure that the "My TekExpress" folder has read and write access. Ensure that you maintain the directory structure and do not accidentally modify it.*

NOTE. *If a user with a different Windows login ID launches TekExpress, a new `My TekExpress` folder is created under that user's `My Documents` folder.*

- `\My Documents\My TekExpress\HEAC`
- `\My Documents\My TekExpress\HEAC\Untitled Session`. Every time the `HEAC.exe` is launched an `Untitled Session` folder is created under `HEAC` 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`).
- The above shared folder is mapped as X: (X drive) on to the PC where TekExpress is running.

NOTE. *Map the X: drive only when TekExpress is not running on an oscilloscope. Map the X: drive between the oscilloscope and personal computer or the laptop computer on which TekExpress is running.*

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

Do the following before you click Run:

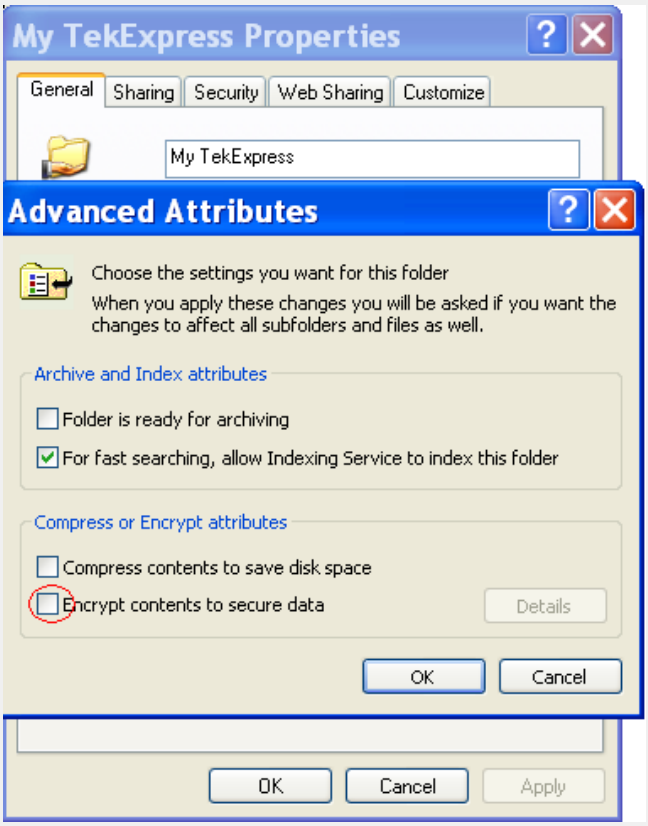
NOTE. *Ensure that the network connectivity is enabled on the PC running the TekExpress.*

1. Map (see page 13) the shared `My TekExpress` folder as X: (X drive) on all the instruments used in test setup running Microsoft Windows Operating System. This share folder is used to save the waveform files or any other file transfer operations.
2. Right click the `My TekExpress` folder and open the **Properties** dialog box. Select **General** tab and then **Advanced**. In the **Advanced Attributes** window, ensure that the option **Encrypt contents to secure data** is NOT selected. Click here (see page 14) to view the picture.
3. Ensure that all the required instruments are properly warmed up, Signal Path Compensation (SPC) (see page 14) is performed, followed by cable deskew.

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\ John's My TekExpress)
5. You can determine the IP address of the PC where "My TekExpress" folder exists by doing the following:
   - Select **Start > Run** menu on the PC where My TekExpress folder exists.
   - Enter `cmd` and click **Enter.**
   - At command prompt, type `ipconfig`.



You can find SPC by following the steps below:

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

Application Overview

TekExpress is the Tektronix Compliance Test Automation Framework, developed to support current and future test automation needs of customers. Developed using National Instruments' TestStand, TekExpress leverages on the capabilities of the Microsoft .NET framework.

TekExpress HDMI Ethernet Audio Return Channel (HEAC) addresses the testing and compliance needs of HEAC and HEAC /CTS1.4, and provides the following features:

- Reliable testing
  - Conformance to HDMI 1.4 (HEAC) standards and test specifications CTS 1.4 ensures reliable results
  - Accurate Transmitter (Tx), Receiver (Rx), and violation testing ensures reliable tests
  - Sophisticated measurement techniques eliminate errors in jitter measurements
  - Closed loop measurements eliminate non-linearities of test setup enables precise testing
  - Significantly reduced test times for Sink and Audio tests
  - Optimal setups ensure accurate results
- Fast testing
  - Remote control of signal sources automates Source and Sink tests and reduces test times
  - One-button selection of multiple tests ensures faster testing
  - Automatic mask fit, measurements, and Pass/Fail notification delivers quick results
  - Test margins and statistical information aid analysis to help find answers quickly
  - One-button csv-format summary and MHT report saves time
- Complete testing
  - Wide range of tests for Source and Sink devices enables complete validation
  - Complete compliance solution with a test fixture and signal sources

Starting the Application

To start the application, do one of the following:

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

When the application is launched it displays the splash screen providing launch information.

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

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.

Exiting the Application

To exit the application, do one of the following:

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

Global Controls

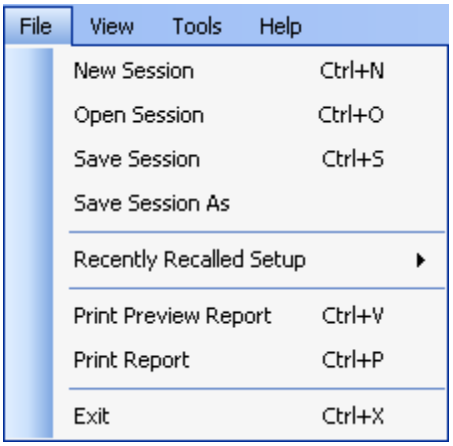
The menus and controls that appear outside the individual tabs are called “Global Controls”. These are used to specify the devices to be tested.

Table 5: Controls and Functions

Control name	Function
DUT	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 length of characters allowed is 32.
	This indicates whether your PC has enough memory to run and test a measurement.
	You will be able to run, pause, resume and stop the tests.

File Menu

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

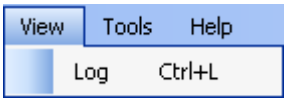


The File menu has the following selections:

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 recent setups.
Print Preview Report	Previews the report before printing.
Print Report	Opens the Windows “Print” dialog box.
Exit	Closes the application.

View Menu

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

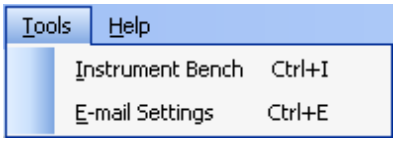


The View menu has the following selection:

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

Tools Menu

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



The Tools menu has the following selection:

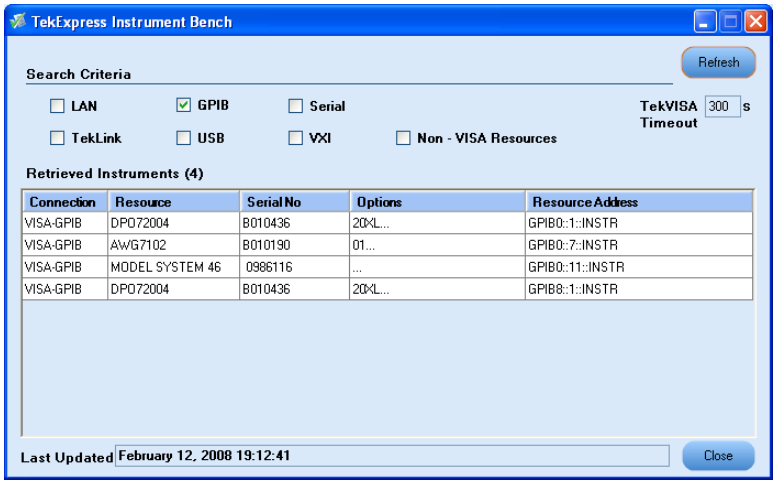
Menu	Function
Instrument Bench	Opens a dialog box showing the list of instruments attached to the test setup.
E-mail Settings	Opens a dialog box showing the e-mail setting details.

Tools > Instrument Bench

The Instrument Bench window shows the list of VISA and Non-VISA 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. **Non-VISA 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.

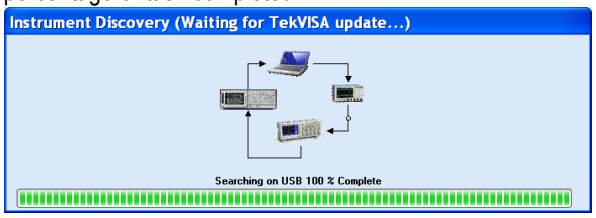
NOTE. *TekExpress uses TekVISA for instrument search. Ensure that TekVISA is running on your system before you refresh the instrument bench window.*

Table 6: Retrieved resources properties in the Instrument Bench window

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

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

Table 7: Button controls on Instrument Bench dialog box

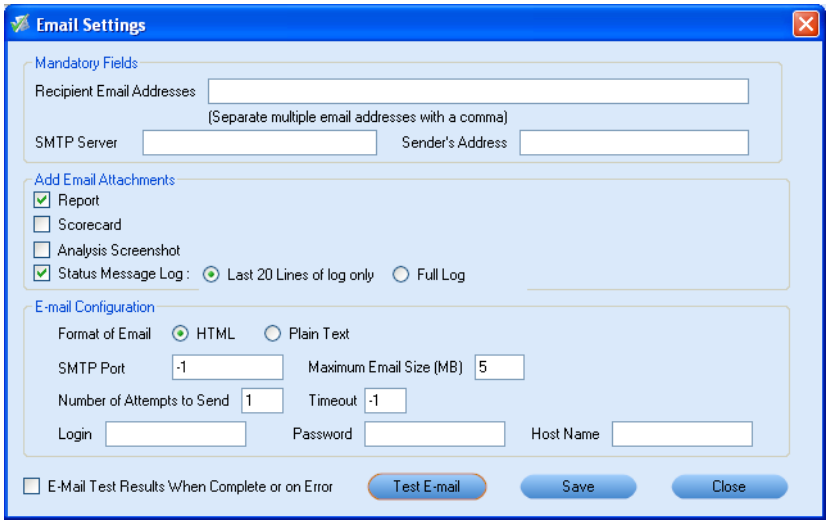
Button	Function
Refresh	The application searches on the selected connection for resources. While searching resources it shows the Instrument Bench discovery window. The Discovery window shows the connection currently being scanned and the percentage of task completed. 
Close	Closes the dialog box.

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 notification from TekExpress:

- Recipient E-mail Addresses. For example, User@domain.com.
- Sender's Address.
- SMTP Server address of the Mail server configured at the client location.

NOTE. *The application will not send an e-mail notification if any of these fields are left blank or you do not save the settings.*

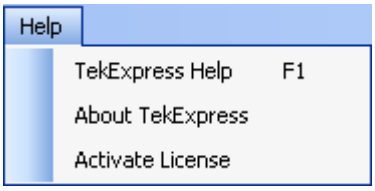


Select the option E-mail Test Results When Complete or on Error to receive the e-mail. The attachment list depends on what you selected while configuring the e-mail setup.

NOTE. *The **Analysis Screenshot** option is not yet functional.*

Help Menu

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

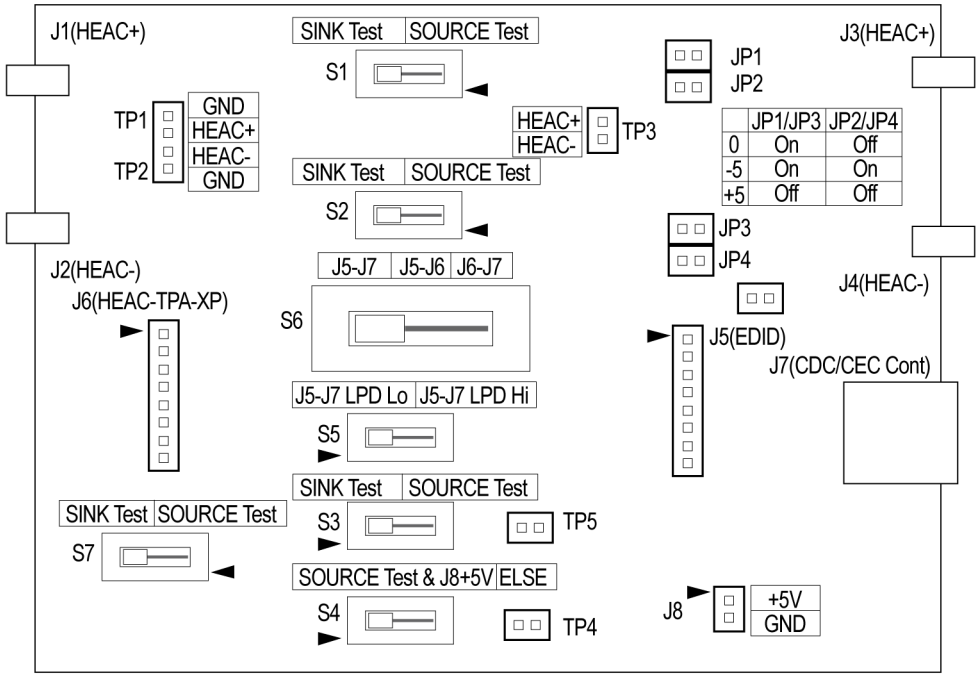


The Help menu has the following selections:

Selection	Description or Function
TekExpress Help	Displays TekExpress Help (F1).
About TekExpress (see page 11)	Displays application details such as software name, version number, and copyright.
Activate License	Displays a dialog box to enter the license key.

Set Up the Switches on the HEAC-TPA-MAIN Fixture

The following diagram shows the fixture configuration switches on the HEAC-TPA-MAIN fixture.



The following table shows the switch settings to configure on the HEAC-TPA-MAIN fixture.

Table 8: HEAC-TPA-MAIN switch setup

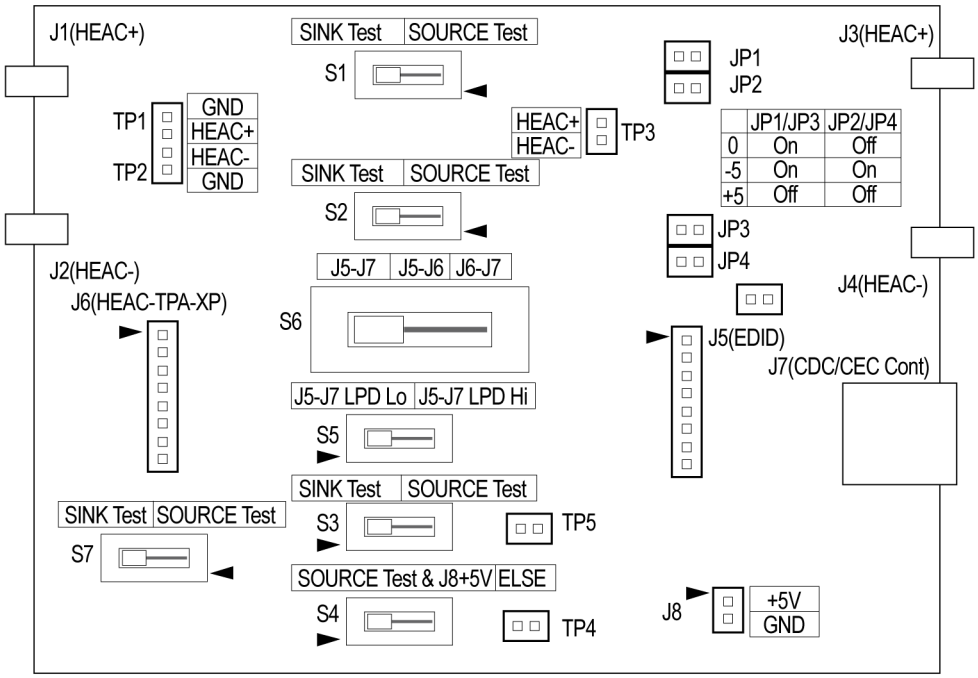
Test ID	Description	DUT	+5 V from	S1	S2	S3	S4	S7
5-1	Differential Mode Operating DC	Source	J6, J8	Right	Right	Right	Left	Right
		Sink	J8	Left	Left	Left	Right	Left
5-2 to 5-5	Differential Mode Transmitter	Source	J6	Right	Right	Right	Right	Right
		Sink	J8	Left	Left	Left	Right	Left
5-6 to 5-10	Common Mode Transmitter	Sink	J8	Left	Left	Left	Right	Left
5-11 to 5-15	Single Mode Transmitter	Sink	J8	Left	Left	Left	Right	Left
5-16	Differential Mode Receiver	Source	J6	Right	Right	Right	Right	Right
		Sink	J8	Left	Left	Left	Right	Left

Table 8: HEAC-TPA-MAIN switch setup (cont.)

Test ID	Description	DUT	+5 V from	S1	S2	S3	S4	S7
5-17	Common Mode Receiver	Source	J6	Right	Right	Right	Right	Right
5-18	Single Mode Receiver	Source	J6, J8	Right	Right	Right	Left	Right
5-19	Common Mode Operating DC Voltage	Source	J6, J8	Right	Right	Right	Left	Right
5-20	Single Mode Operating DC Voltage	Source	J6, J8	Right	Right	Right	Left	Right

Set Up the Jumpers on the HEAC-TPA-MAIN Fixture

The following diagram shows the fixture configuration jumpers on the HEAC-TPA-MAIN fixture.



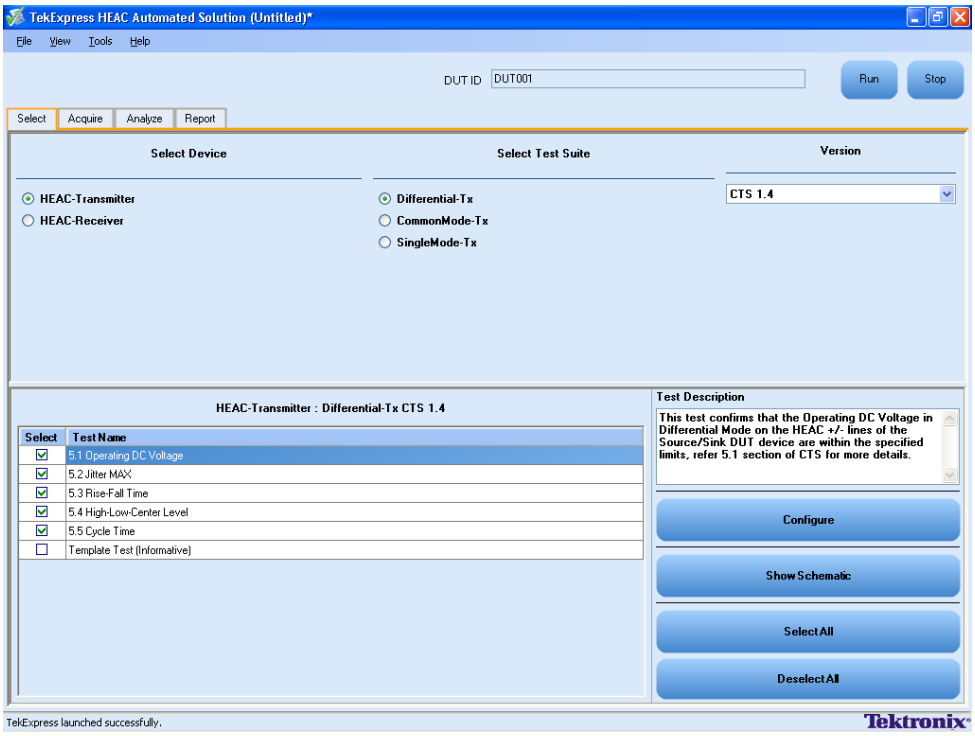
The following table shows the jumper settings to configure on the HEAC-TPA-MAIN fixture.

Table 9: HEAC-TPA-MAIN jumper setup

Test ID	Description	Termination	Signal source output impedance	JP1	JP2	JP3	JP4
5-1 to 5-5	Differential Mode Transmitter	50 Ω	-	ON	OFF	ON	OFF
5-6 to 5-10	Common Mode Transmitter	50 Ω	-	ON	OFF	ON	OFF
5-11 to 5-15	Single Mode Transmitter	55 Ω	-	OFF	OFF	OFF	OFF
5-16	Differential Mode Receiver	-	110 Ω	OFF	OFF	OFF	OFF
			100 Ω	ON	OFF	ON	OFF
			90 Ω	ON	ON	ON	ON
5-17 to 5-19	Common Mode Receiver	-	50 Ω	ON	OFF	ON	OFF
5-18 to 5-20	Single Mode Receiver	-	55 Ω	OFF	OFF	OFF	OFF

Select the Test(s)

The application tests HEAC transmitter and receiver devices for compliance. Use the Select panel to select, configure, and run the tests.



This panel provides the following functions:

Select Device

Select the Device type. The test suite options will be automatically updated according to the selected device.

Select Test Suite

The application allows you to select a subset of tests to execute, such as Differential-Tx and Differential-Rx. Based on the selected test suite, different measurement lists will be populated and can be configured.

Version

Select the appropriate version. For example, CTS 1.4.

The table has the following two columns:

- **Select**: Include or exclude any test for analysis.
- **Test Name**: Displays the name of the test.

NOTE. *If any of the check boxes in the Select column is grayed, you cannot make any changes. It implies that the test is mandatory.*

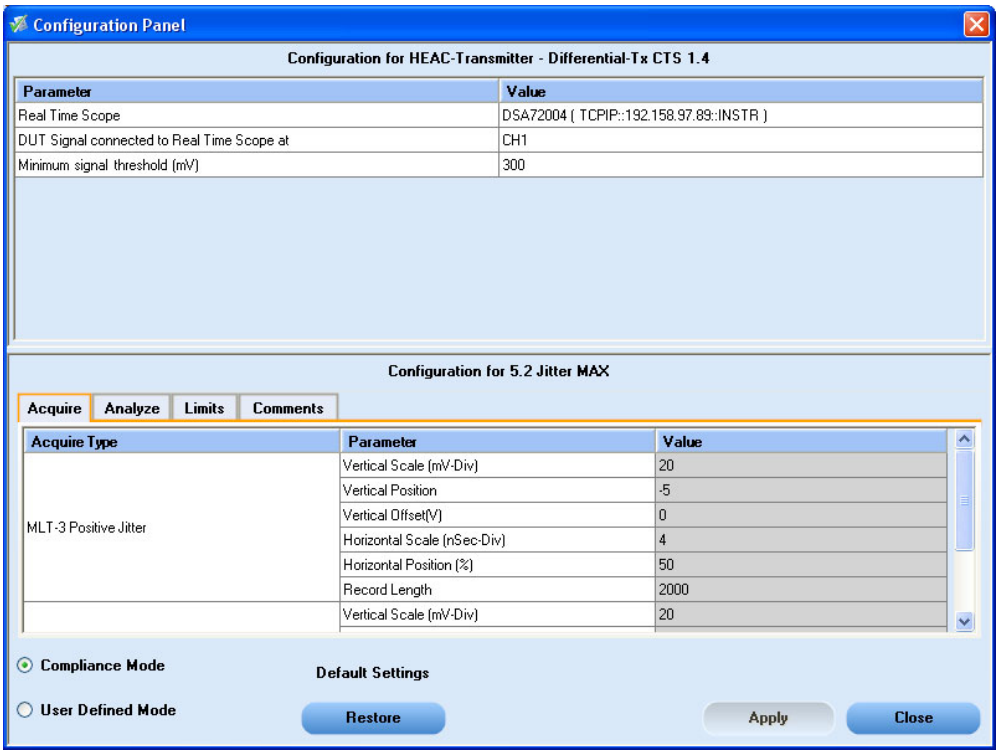
Once you select a row, the following options are available:

Table 10: Button controls on the Select panel

Button	Description
	Opens the configuration panel for the selected test.
	Opens the equipment setup diagram for the selected test. This is useful if you want to verify the test setup before running the test.
	Selects all tests in the table.
	Deselects all tests in the table.

Configure and Run the Test(s)

The configuration panel is used to create, view, and edit the parameters associated with the acquisition and the analysis of the selected test. In the Select panel, click **Configure**.



In the Configure panel, you have the following options:

- Choose to run the tests in Compliance or User Defined Mode.
- Reload compliance mode values.
- Change the parameters associated with the configuration of acquisition.
- Change the parameters associated with analysis configuration.
- Change the test limits in User Defined Mode.

The upper part of the Configure panel has editable parameters that are common for all the tests under the selected test suite. These parameters allow you to:

- Select the appropriate instrument.
- Specify the channel to which you are connecting the signal.

The lower half 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 11: Test parameters

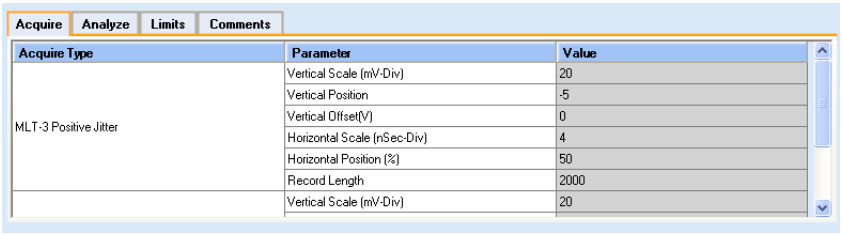
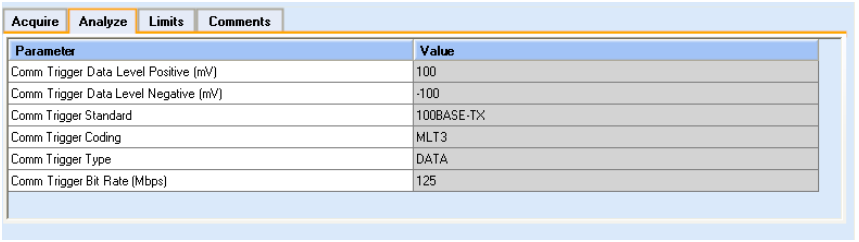
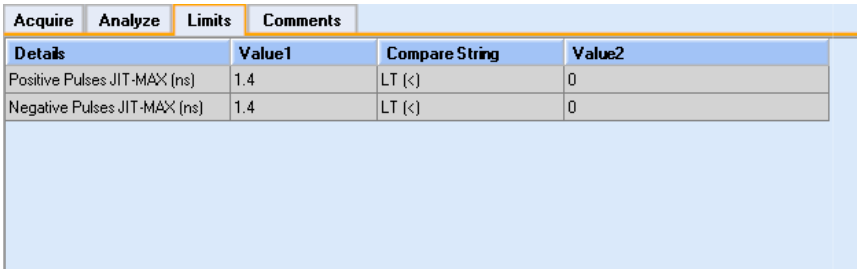
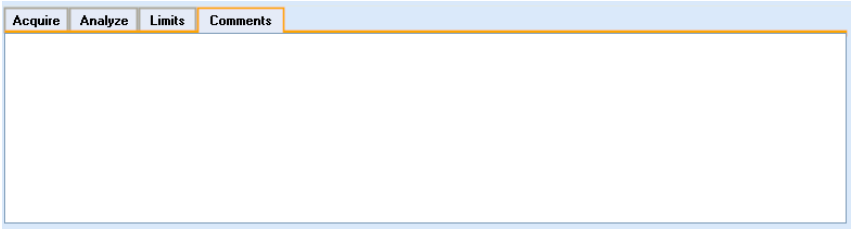
Parameters to configure	Description
Acquire  	Shows the various parameters related to acquisition of a selected test. These parameters can vary from one test to another.
Analyze  	Shows the default analysis parameters for the selected test.
Limits  	Applies to a specific test. It shows the measurement limits using different types of comparisons.
Comments  	Enter a comment up to 256 characters long for the selected test.

Table 11: Test parameters (cont.)

Parameters to configure	Description
Compliance settings	
	Restores the compliance settings.
	Accepts all changes that you made.
	Dismisses the dialog box and does not apply changes.

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

Refer to the following table for different test limit comparisons:

Table 12: 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
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
GELE(>= =<)	Greater than or equal to and Less than or equal to

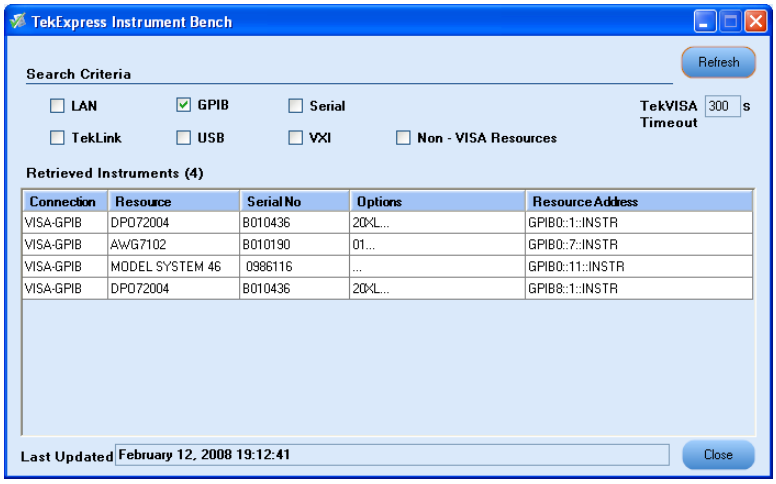
View and Select Connected Instruments

Viewing Connected Instruments

The **Tools > Instrument Bench** menu item is used to discover connected instruments that are required for the tests. The application uses TekVISA to discover the connected instruments. Once the operation is done, 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 GPIB as the search criteria in the Instrument Bench dialog and click Refresh, the TekVISA Instrument Manager checks for the instruments availability over GPIB and the details of the instrument are displayed under **Retrieved Instruments** table.



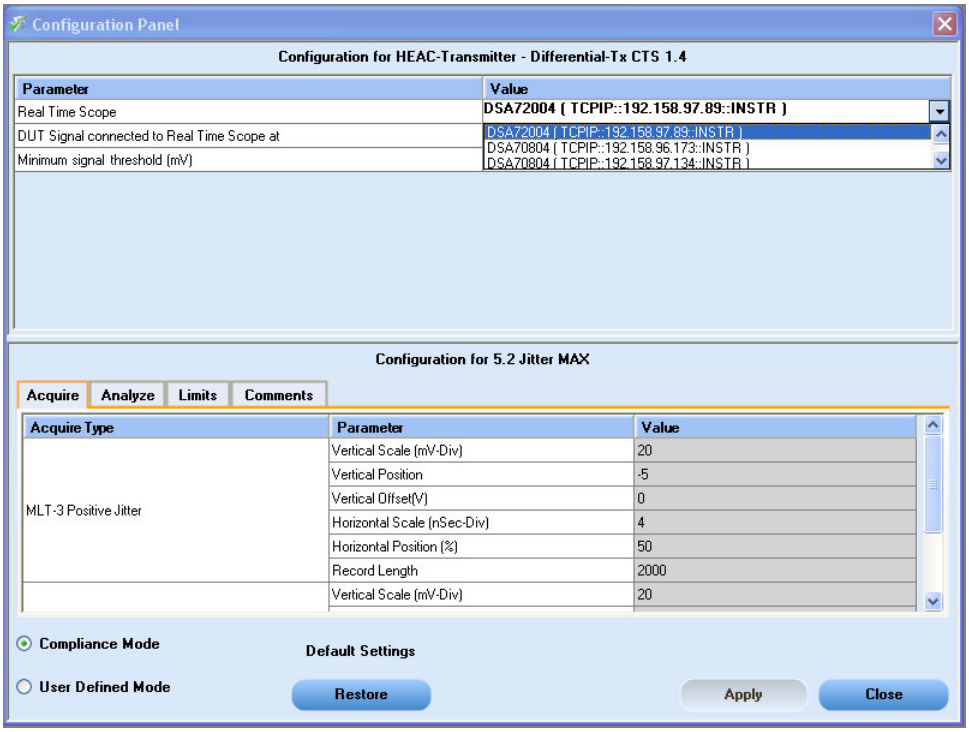
You can provide the time in the **TekVISA Timeout (Seconds)** field, within which if the TekVISA Instrument Manager does not find the instruments, the TekExpress application resumes the operation.

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

Selecting Connected Instruments

You can view the connected instruments in the Configuration panel. The upper half of the panel displays the general parameters for the tests under the selected test suite.

Choose the instruments from the drop-down list as shown in the following figure:



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

Use Prerecorded Waveforms for Analysis

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

Prerecorded waveforms are available only for Differential Receiver analysis.

NOTE. *You can use prerecorded waveforms only when a session is saved.*

Column name	Function
Acquisition	Acquisition Name
Test	Name of the tests performing acquisitions. One or more test can perform the same acquisitions.
Status	Test acquisition status of the running test passed at intervals.
Waveform File(s)	Prerecorded waveform files of unique acquisitions. Select waveform files by selecting browse on individual cells. This allows you to select any waveform file using the standard file open window.

The following Acquire source options are available:

- **Use Prerecorded Waveform files**: Enabling or disabling the option shows or hides 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).

- **Acquire Step by Step**: Selecting this prompts you at the end of each acquisition before proceeding to the next one.

- **Show Acquire Parameters**: On enabling this option, the acquisition parameters for each unique acquisition is displayed in the acquisition table.

When you select “Use PreRecorded Waveform Files”, the first column shows the waveform type and the second column shows the tests that use that waveform type for analysis. The following guidelines help you determine the correct prerecorded waveform for each test to be performed.

TIP. *Select "Show Acquire Parameters" to verify the acquire parameters and the corresponding waveform.*

The following is a list of prerecorded reference waveforms supplied with the application:

Location: `\MyTekExpress\HEAC\<SessionName>\<DUT ID>\<yymmdd_hhmmss>`

Naming convention: `<Acquire_Type><Trial_Number><Test_Name>.wfm`

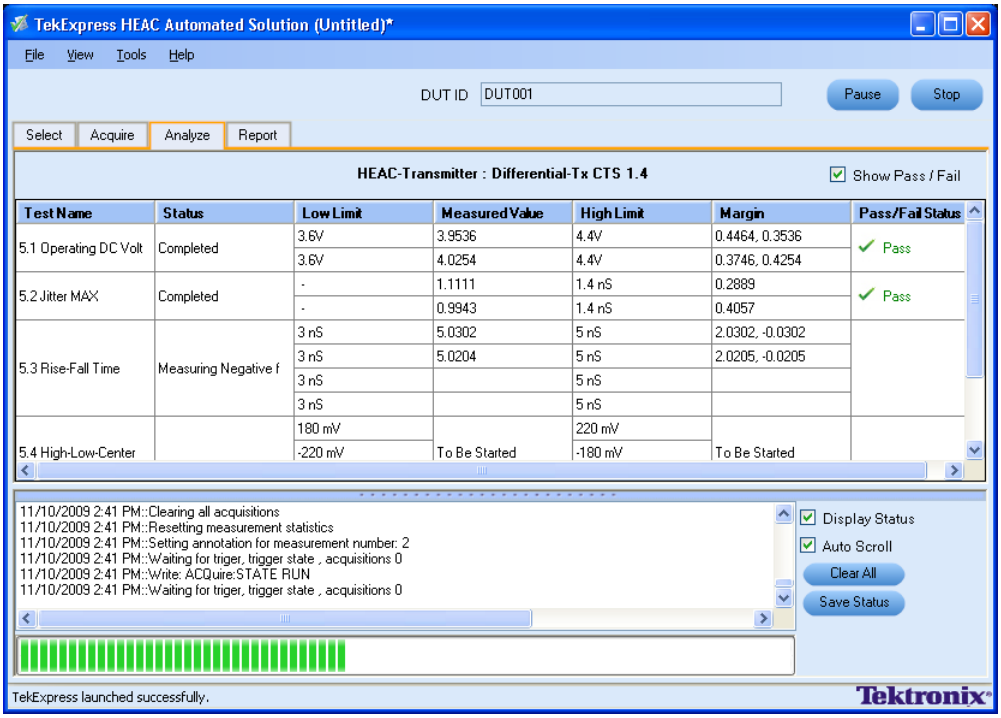
Waveform files:

- `ARPandPingResponse0WCC.wfm`
- `ARPandPingResponse3CMHigh.wfm`
- `ARPandPingResponse2CMHigh.wfm`
- `ARPandPingResponse1CMHigh.wfm`
- `ARPandPingResponse0CMHigh.wfm`
- `ARPandPingResponse1ClockLow.wfm`

- ARPandPingResponse0ClockLow.wfm
- ARPandPingResponse0ClockHigh.wfm
- ARPandPingResponse0AmplitudeLow.wfm
- ARPandPingResponse0AmplitudeHigh.wfm
- ARPandPingResponse0Nominal.wfm
- ARPResponseTrial0.wfm

View the Progress of Analysis

You can view the progress of the analysis in the Analyze panel. The result value is updated when the analysis of each test is complete.



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. A summarized status of the currently running test is shown on the Status Messages panel.

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

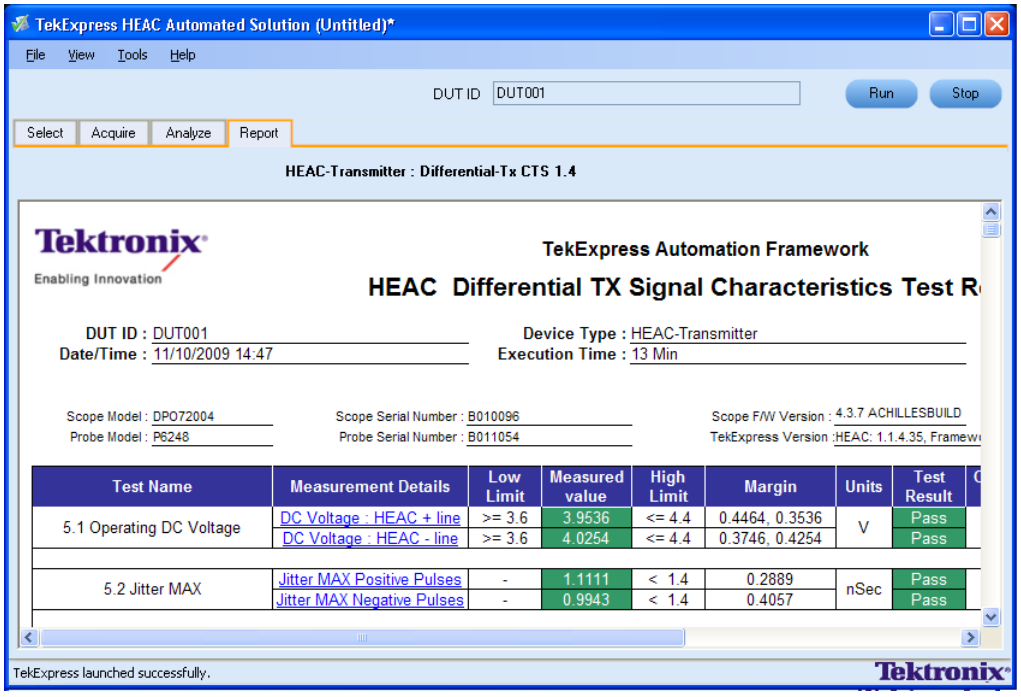
- **Display Status**: Enable/Disable status messages.
- **Auto Scroll**: The status messages are scrolled automatically.
- **Clear All**: Clear all status messages in Status Window.
- **Save Status**: Save all status messages in text file. Displays a standard save file window and saves the status messages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

NOTE. *The Status Messages window is dockable and can be resized.*

View the Report

After the analysis, the application automatically generates a report is which is shown in the report panel. The report shows the results of the tests, including device information and the pass/fail status of each test.

The Report View Area contains an HTML version of the report template. You can select any area of the report and copy it to the clipboard to make it available to other application.



View Test Related Files

All the test related files for currently selected tests are always saved under `My Documents\My TekExpress\HEAC\Untitled Session.`

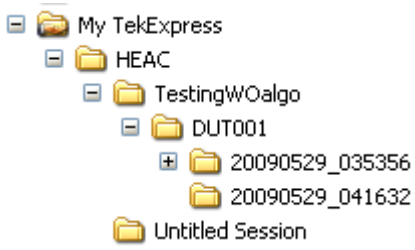
When you save a session, it is saved with the session name under the path `My Documents\My TekExpress\HEAC\SessionName` for future references.

The session that is currently running will be stored in the same path as "Untitled" until you save it.

WARNING. *Do not save a session named "Untitled" or "Backup" because there are application-specific files and are deleted 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.

The following image shows the directory structure for saved sessions:



Select a Differential Mode Transmitter Test

In TekExpress, the Select panel allows you to select and configure the transmitter tests.

1. Launch TekExpress HEAC.
2. Select the device as **HEAC-Transmitter**.
3. Select the Test Suite as **Differential-Tx**. The version is already selected as CTS 1.4.
4. Enter the DUT ID in the field provided.
5. Select a test from the list: **Operating DC Voltage, Jitter MAX, Rise-Fall Time, High-Low-Center Level, Cycle Time** and **Template Test (Informative)**.

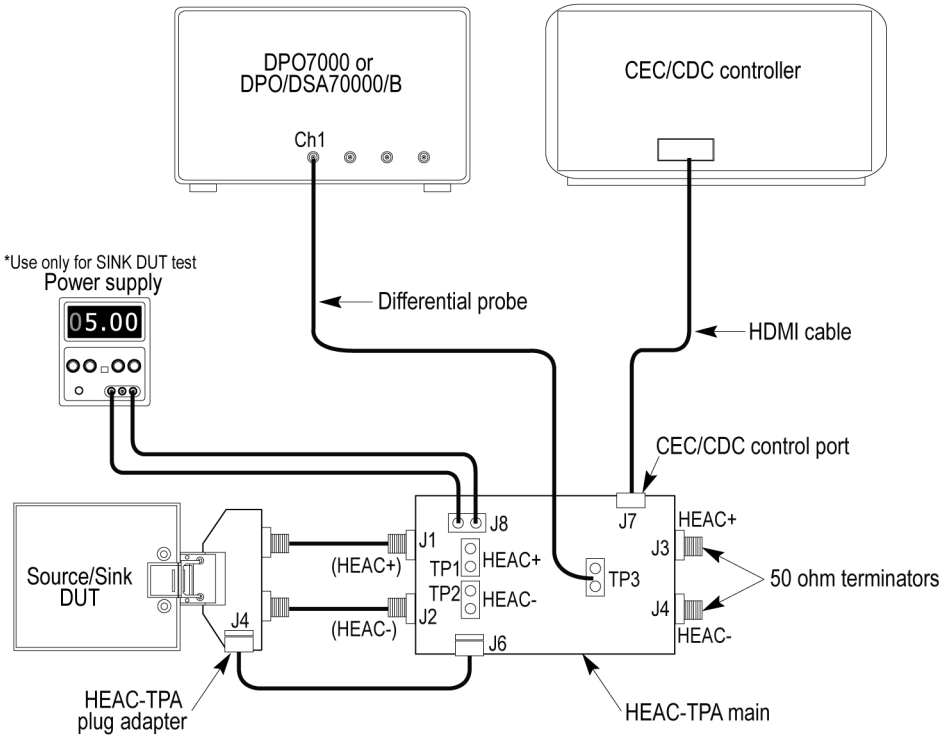
NOTE. *All differential mode transmitter tests, except the Template Test, are selected by default. To select a particular test, click Deselect All, and select the required test from the list.*

Make Connections for a Differential Mode Transmitter Test

For all differential mode transmitter signal tests except the Operating DC Voltage test, you need the following equipment:

Resource	Model supported
Real-time oscilloscope	Tektronix DPO7000 Series, DPO70000 Series, DPO70000B Series, DSA70000 Series, DSA70000B Series, and MSO70000 Series Digital and Mixed Signal Oscilloscopes
Probe	Tektronix P6247, P6248, P6330, or P7330 for a DPO70000 Series, DPO70000B Series, DSA70000 Series, DPO70000B, and MSO70000 Series Digital and Mixed Signal Oscilloscope Tektronix P6330, TDP1000, TDP1500 or TDP3500 for a Tektronix DPO7000 Series Digital Oscilloscope
Test fixture	TF-HEAC-TPA-P (A/C) or TF-HEAC-TPA-KIT, TF-HDMID-TPA-KIT
50 Ω SMA Terminators	Any terminator that meets the following requirements: ■ 50 Ω impedance ± 1% or better ■ Connects directly to the SMA female connector
DUT	An HEAC sink or source device
SMA Cables	Tektronix part number 174-1428-00 (1.5 meter) Tektronix part number 174-1341-00 (1 meter)
HDMI Cable	HDMI cable with HEAC capability

Connect the equipment as shown in the following diagram:



NOTE. *To view the equipment setup diagram, click the* ***Show Schematic*** *button.*

NOTE. *This equipment setup diagram and connections are the same for all differential transmitter tests except the Operating DC Voltage test.*

1. Connect the CEC or CDC Controller to the CEC/CDC Control Port on the HEAC-TPA main board.
2. Connect the HEAC-TPA plug board to the HEAC connector of the Source/Sink DUT.
3. Connect the 50 Ω SMA terminators to the HEAC-TPA main board.
4. Connect a differential probe to the HEAC± differential signal probe point on the HEAC-TPA main board.

5. If you are testing a Sink DUT, set the HEAC-TPA main board to enable the Sink DUT test. Set switch S7 to the left (Off position) on the HEAC-TPA main board.

   If you are testing a Source DUT, set the HEAC-TPA main board to enable the Source DUT test. Activate the +4 V bias by using the +5 V power from the Source DUT. Set switch S7 to the right (On position) on the HEAC-TPA main fixture.

   Set Up the Jumpers on the HEAC-TPA-MAIN Fixture (see page 24) and Set Up the Switches on the HEAC-TPA-MAIN Fixture (see page 23)

6. Activate the HEC transmission on the HEAC Source/Sink DUT using the CEC/CDC Controller.

Configure and Run a Differential Mode Transmitter Test

To configure a differential mode transmitter test, do the following:

1. In the Select panel click **Configure**.
2. In the Configure panel, select either **Compliance Mode** or **User Defined Mode**. In the User Defined Mode, you can modify the test parameters but you will no longer be testing against the compliance standards. In the Compliance Mode, you cannot modify any of the parameters.

   Configure the following general parameters that are common for transmitter tests.

Table 13: General parameters for transmitter tests

Parameter	Description
Real time scope	Select the oscilloscope to connect to.
DUT signal connected to real time scope at	Select the oscilloscope channel to which the DUT signal is connected.
Minimum signal threshold (mV)	Specify the minimum signal threshold value, in mV, for signal validation.

NOTE. *In the Compliance Mode, none of the acquisition and analysis parameters are editable.*

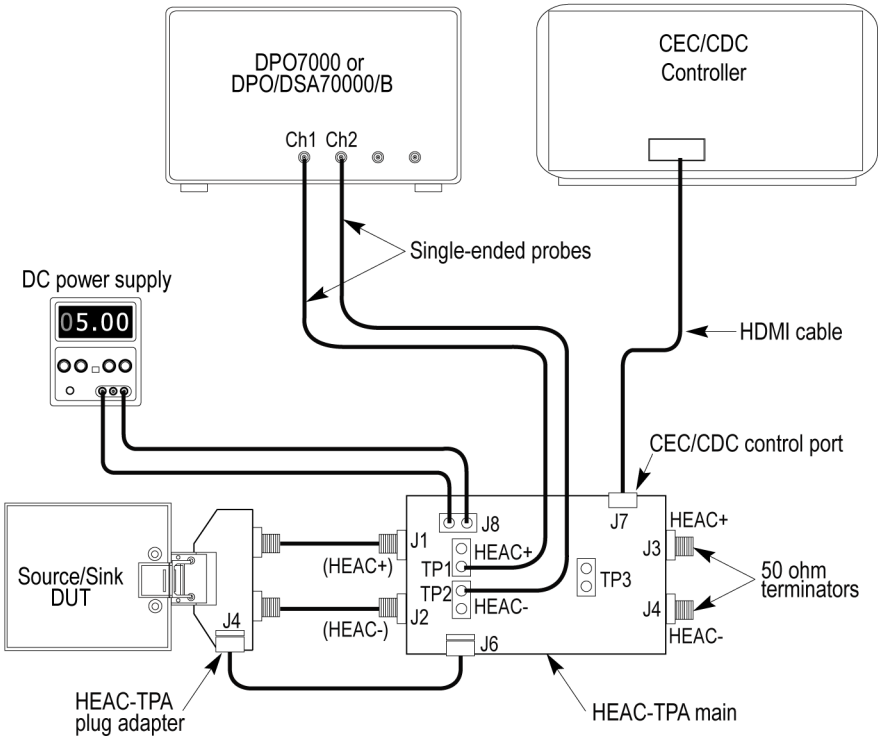
3. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.

Make Connections for the Operating DC Voltage Test

For a differential mode transmitter operating DC voltage test, you need the following equipment:

Resource	Model supported
Real-time oscilloscope	Tektronix DPO7000 Series, DPO70000 Series, DPO70000B Series, DSA70000 Series, DSA70000B Series, and MSO70000 Series Digital and Mixed Signal Oscilloscopes
Probe	Tektronix P6247, P6248, P6330, or P7330 for a DPO70000 Series, DPO70000B Series, DSA70000 Series, DPO70000B, and MSO70000 Series Digital and Mixed Signal Oscilloscope Tektronix P6330, TDP1000, TDP1500, or TDP3500 for a Tektronix DPO7000 Series Digital Oscilloscope
Test fixture	TF-HEAC-TPA-P (A/C) or TF-HEAC-TPA-KIT, TF-HDMID-TPA-KIT
DUT	An HEAC sink or source device
50 Ω SMA Terminators	Any terminator that meets the following requirements: ■ 50 Ω impedance ± 1% or better ■ Connects directly to the SMA female connector
SMA Cables	Tektronix part number 174-1428-00 (1.5 meter) Tektronix part number 174-1341-00 (1 meter)
HDMI Cable	HDMI cable with HEAC capability

Connect the equipment as shown in the following diagram:



Make connections as follows:

1. Connect the CEC or CDC Controller to the CEC/CDC Control Port of the HEAC-TPA main board.
2. Connect the HEAC-TPA plug board to the HEAC connector of the Source/Sink DUT.
3. Connect the 50 Ω SMA terminators to the HEAC-TPA main board.
4. Connect the first single-ended probe from Ch1 of the digital oscilloscope to the HEAC+ probe point on the HEAC-TPA main board, and the second single-ended probe from Ch2 to the HEAC- probe point.
5. If you are testing a Sink DUT, set the HEAC-TPA main board to enable the Sink DUT test. Set switch S7 to the left (Off position) on the HEAC-TPA main fixture.

   If you are testing a Source DUT, set the HEAC-TPA main board to enable the Source DUT test, and use +5 V power from the DC Power Supply. Set switch S7 to the right (On position) and switch S4 to the left (Off position) on the HEAC-TPA main fixture.

NOTE. *Do not use +5 V power from the Source DUT.*

Set Up the Jumpers on the HEAC-TPA-MAIN Fixture (see page 24) and Set Up the Switches on the HEAC-TPA-MAIN Fixture (see page 23)

6. Connect and configure the DC Power Supply to supply +5 V to the HEAC-TPA main board.
7. Power on the Source/Sink DUT.
8. Activate the HEC transmission capability for the HEAC Source/Sink DUT using the CEC/CDC controller.

Configure and Run the Operating DC Voltage Test

To configure and run the operating DC voltage test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. Select the User Defined Mode to configure the following parameters for DC Voltage HEAC+line and DC Voltage HEAC–line. The following table lists the compliance mode values and the permitted range of values.

Table 14: Acquisition parameters for the operating DC voltage test

Parameter	Compliance mode	Permitted user defined mode values
Vertical Scale (mV-Div)	200	100, 200, 400
Vertical Position	0	Do not change
Vertical Offset (V)	Auto	Auto, 2, 4, 6
Horizontal Scale (µs)	10	5, 10, 20
Horizontal Position (%)	50	50, 70, 90
Record Length	2500000	1250000, 2500000, 5000000

NOTE. *In the User Defined Mode, during test execution the specified horizontal acquisition parameters (such as horizontal scale and record length) might not be applied exactly as specified in the configuration panel. Depending upon the oscilloscope model, the nearest possible value is applied.*

4. Click **Analyze**. Configure the following analysis parameters:

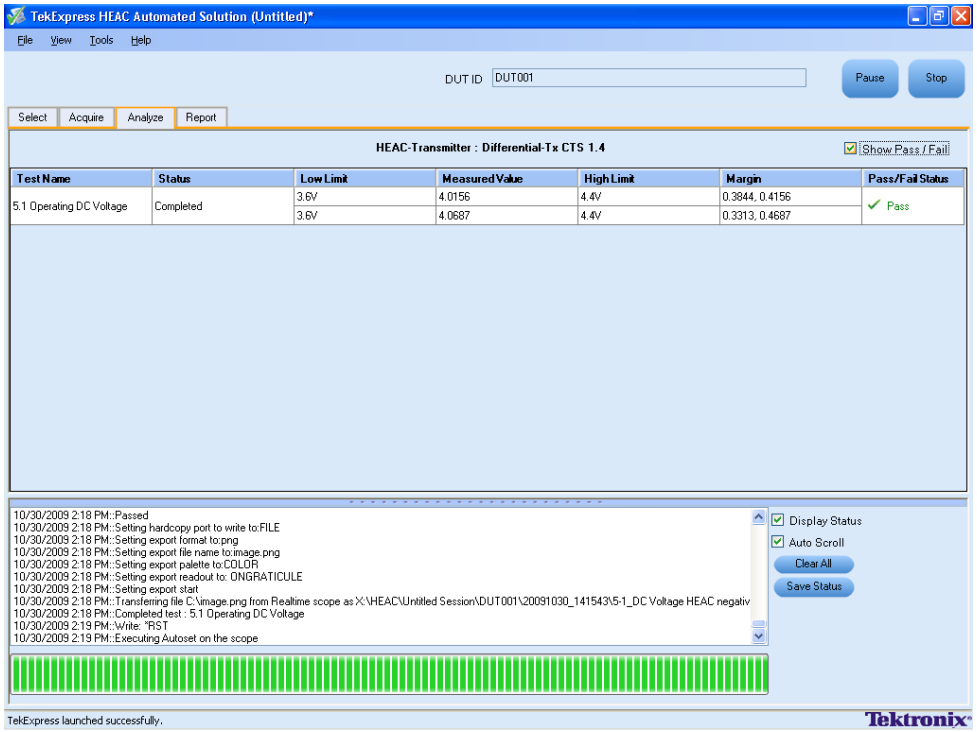
Table 15: Analysis parameters for the operating DC voltage test

Parameter	Compliance mode	Permitted user defined mode values
Edge Trigger Level (V)	4	2, 4, 6
Edge Trigger Slope	Positive	Positive, Negative

5. Click **Limits** to view and change the DC Voltage HEAC+line and DC Voltage HEAC–line values and the compare string.
6. Click **Comments** to enter comments. The comments are shown in the test report.
7. Click **Apply** to effect the changes, and then click **Close**.
8. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.
9. Follow the on-screen prompts and the schematics to change the setup.

View Analysis of the Operating DC Voltage Test

Click **Analyze** to view the analysis of the operating DC voltage test.



Configure and Run the Jitter MAX Test

To configure and run the jitter max test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. Select the User Defined Mode to configure the following parameters for MLT3 Jitter. The following table lists the compliance mode values and the permitted range of values.

Table 16: Acquisition parameters for the jitter max test

Parameter	Compliance mode	Permitted user defined mode values
Vertical Scale (mV-Div)	60	30, 40, 60
Vertical Position	0	Do not change
Vertical Offset (V)	0	Do not change
Horizontal Scale (nSec-Div)	10	0, 5, 10
Horizontal Position (%)	50	50, 70, 90
Record Length	1000	500, 1000, 2000

NOTE. *In the User Defined Mode, during test execution the specified horizontal acquisition parameters (such as horizontal scale and record length) might not be applied exactly as specified in the configuration panel. Depending upon the oscilloscope model, the nearest possible value is applied.*

3. Click **Analyze**. View and change the following analysis parameters:

NOTE. *In the User Defined Mode, adjust the oscilloscope settings and use those settings to perform the measurements.*

Table 17: Analysis parameters for the jitter max test

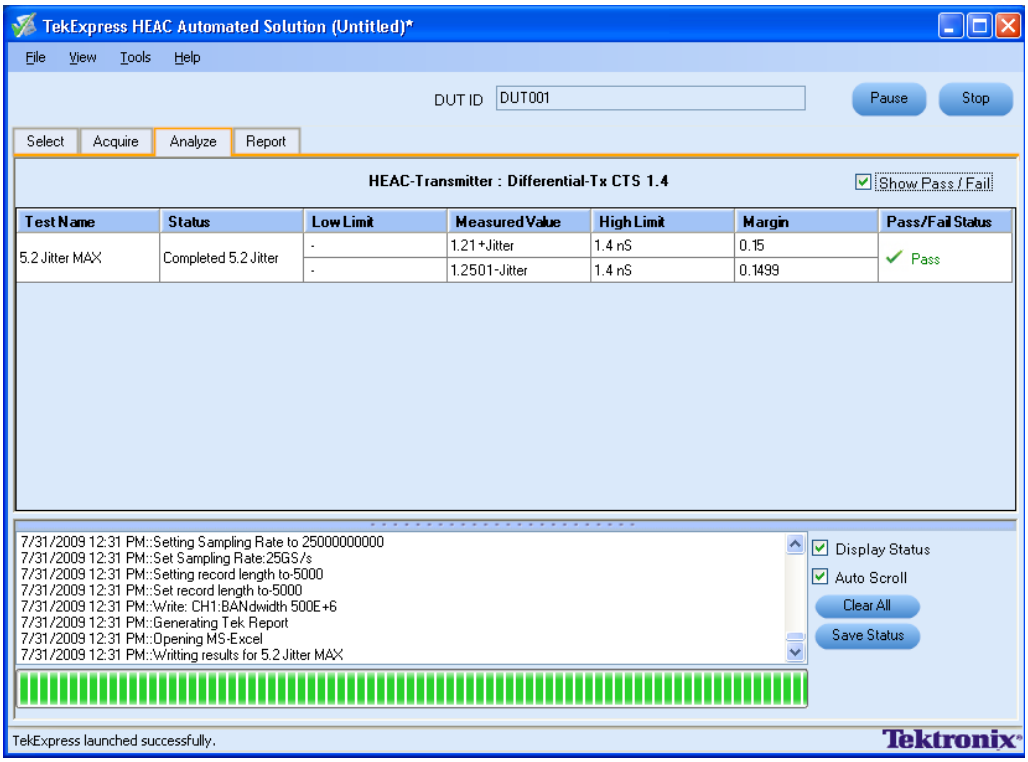
Parameter	Compliance mode
Comm Positive Trigger Data Level Positive (mV)	100
Comm Negative Trigger Data Level Negative (mV)	–100
Comm Trigger Standard	100BASE–TX
Comm Trigger Coding	MLT3
Comm Trigger Type	DATA
Comm Trigger Bit Rate (Mbps)	125

4. Click **Limits** to view and change the Positive Pulses JIT-MAX, the Negative Pulses JIT-Max values (in ns), and the compare string.

5. Click **Comments** to enter comments. The comments are shown in the test report.
6. Click **Apply** to effect the changes, and then click **Close**.
7. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.

View Analysis for Jitter MAX Test

Click **Analyze** to view the analysis of the jitter max test.



Configure and Run the Rise-Fall Time Test

To configure and run the rise-fall time test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. Select the User Defined Mode to configure the following parameters for MLT3-Positive Rise, MLT3-Positive Fall, MLT3-Negative Rise, and MLT3-Negative Fall. The following table lists the compliance mode values and the permitted range of values.

Table 18: Acquisition parameters for the rise-fall time test

Parameter	Compliance mode	Permitted user defined mode values
Vertical Scale (mV-Div)	60	40, 60, 80
Vertical Position	0	Do not change

Table 18: Acquisition parameters for the rise-fall time test (cont.)

Parameter	Compliance mode	Permitted user defined mode values
Horizontal Scale (nSec-Div)	20	10, 20, 50
Horizontal Position (%)	70	50, 70, 90

NOTE. *In the User Defined Mode, during test execution the specified horizontal acquisition parameters (such as horizontal scale and record length) might not be applied exactly as specified in the configuration panel. Depending upon the oscilloscope model, the nearest possible value is applied.*

3. Click **Analyze**. Configure the following analysis parameters:

NOTE. *In the User Defined Mode, adjust the oscilloscope settings and use those settings to perform the measurements.*

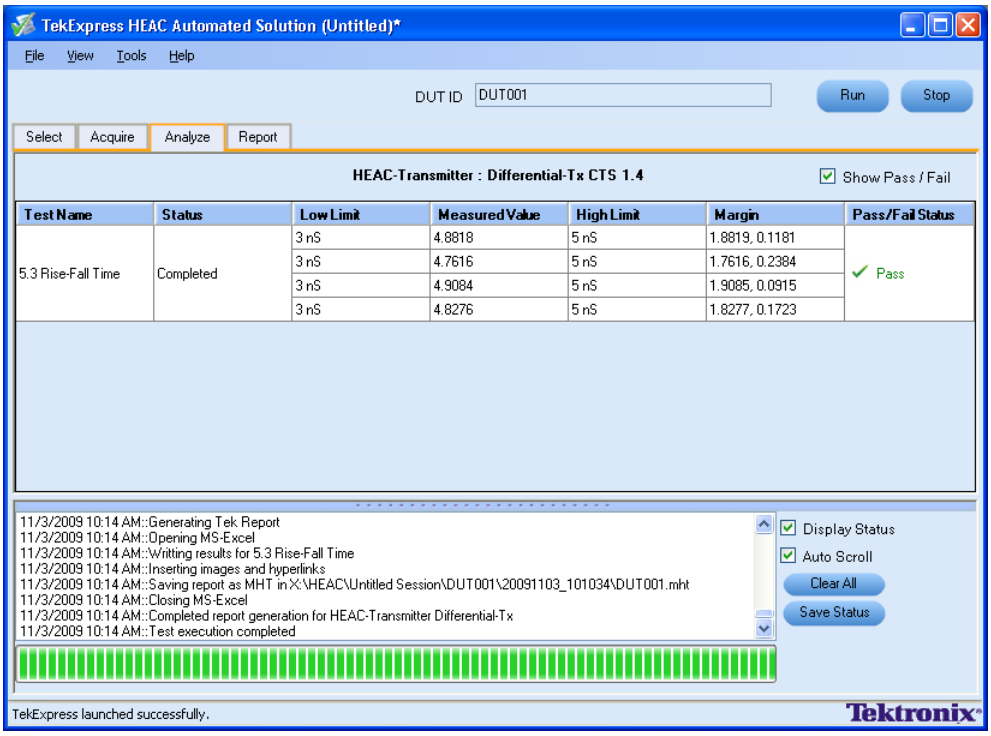
Table 19: Analysis parameters for the rise-fall time test

Parameter	Compliance mode	Permitted user defined mode values
Serial Trigger Positive Data Level (mV)	100	Do not change
Serial Trigger Negative Data Level (mV)	–100	Do not change
Serial Trigger Pattern for Positive Pulse	00000000011111	Do not change
Serial Trigger Pattern for Negative Pulse	11111111100000	Do not change
Serial Trigger Clock Source	R Clk	Ch3, Ch4, R Clk
Serial Trigger Standard	100BASE-TX	GB Ethernet, 100BASE-TX
Serial Trigger Coding	NRZ	Do not change
Serial Trigger Bit Rate (Mbps)	125	Do not change

4. Click **Limits** to view and change the Rise time positive pulse signal, Rise time negative pulse signal, Fall time positive pulse signal, and Fall time negative pulse signal values (in ns) and the compare string.
5. Click **Comments** to enter comments. The comments are shown in the test report.
6. Click **Apply** to effect the changes, and then click **Close**.
7. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.

View Analysis for Rise-Fall Time Test

Click **Analyze** to view the analysis of the rise-fall time test.



Configure and Run the High-Low-Center Level Test

To configure and run the High-Low-Center level test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. Select the User Defined Mode to configure the following parameters for MLT-3 High Level, MLT-3 Mid Level, and MLT-3 Low Level. The following table lists the compliance mode values and the permitted range of values.

Table 20: Acquisition parameters for the high-low-center level test

Parameter	Compliance mode	Permitted user defined mode values
Vertical Scale (mV-Div)	60	40, 60, 80
Vertical Position	0	Do not change
Horizontal Scale (nSec-Div)	20	10, 20, 50
Horizontal Position (%)	70	50, 70, 90

NOTE. *In the User Defined Mode, during test execution the specified horizontal acquisition parameters (such as horizontal scale and record length) might not be applied exactly as specified in the configuration panel. Depending upon the oscilloscope model, the nearest possible value is applied.*

3. Click **Analyze**. Configure the following analysis parameters:

NOTE. *In the User Defined Mode, adjust the oscilloscope settings and use those settings to perform the measurements.*

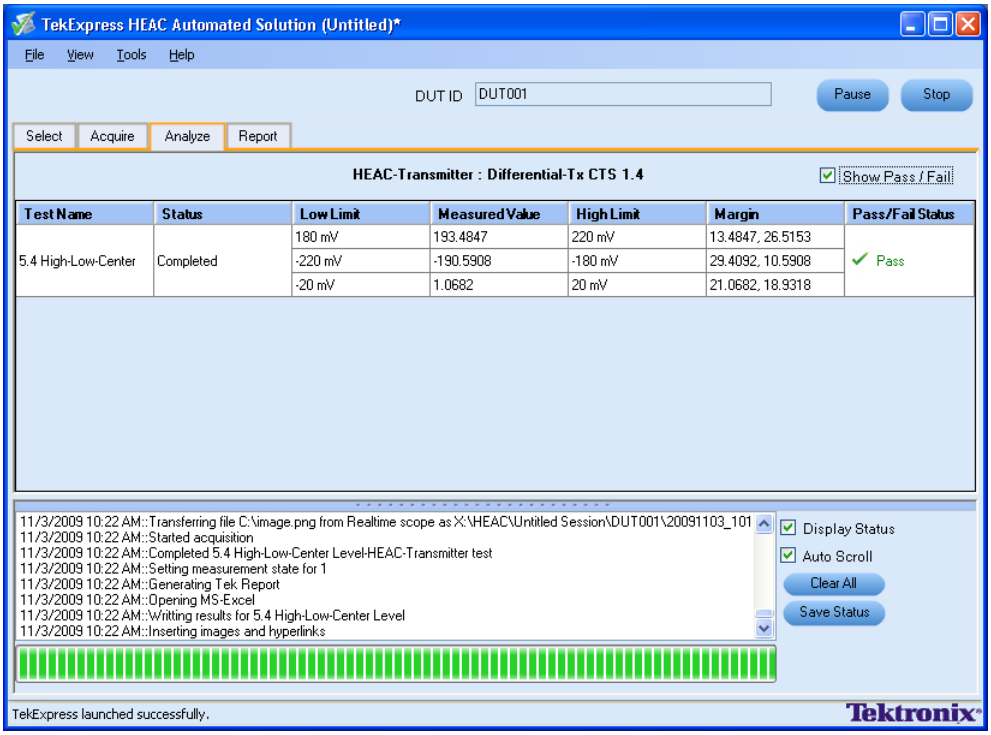
Table 21: Analysis parameters for the high-low-center level test

Parameter	Compliance mode
Window Trigger Upper Data Level-High Level Voltage (mV)	250
Window Trigger Lower Data Level-High Level Voltage (mV)	150
Window Trigger Upper Data Level-Low Level Voltage (mV)	–150
Window Trigger Lower Data Level-Low Level Voltage (mV)	–250
Window Trigger Upper Data Level-Center Level Voltage (mV)	50
Window Trigger Lower Data Level-Center Level Voltage (mV)	–50
Window Trigger Width (nSec)	80

4. Click **Limits** to view and change the (Vep) High level voltage, (Ven) Low level voltage, (Vec) Center level voltage values (in mV), and the compare string.
5. Click **Comments** to enter comments. The comments are shown in the test report.
6. Click **Apply** to effect the changes, and then click **Close**.
7. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.

View Analysis for High-Low-Center Level Test

Click **Analyze** to view the analysis of the high-low-center level test.



Configure and Run the Cycle Time Test

To configure and run the Cycle Time test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. Select the User Defined Mode to configure the following parameters for MLT-3 Positive Cycle and MLT-3 Negative Cycle. The following table lists the compliance mode values and the permitted range of values.

Table 22: Acquisition parameters for the cycle time test

Parameter	Compliance mode	Permitted user defined mode values
Vertical Scale (mV-Div)	60	40, 60, 80
Vertical Position	0	Do not change

Table 22: Acquisition parameters for the cycle time test (cont.)

Parameter	Compliance mode	Permitted user defined mode values
Horizontal Scale (nSec-Div)	20	10, 20, 50
Horizontal Position (%)	70	50, 70, 90

NOTE. *In the User Defined Mode, during test execution the specified horizontal acquisition parameters (such as horizontal scale and record length) might not be applied exactly as specified in the configuration panel. Depending upon the oscilloscope model, the nearest possible value is applied.*

3. Click **Analyze**. Configure the following analysis parameters:

NOTE. *In the User Defined Mode, adjust the oscilloscope settings and use those settings to perform the measurements.*

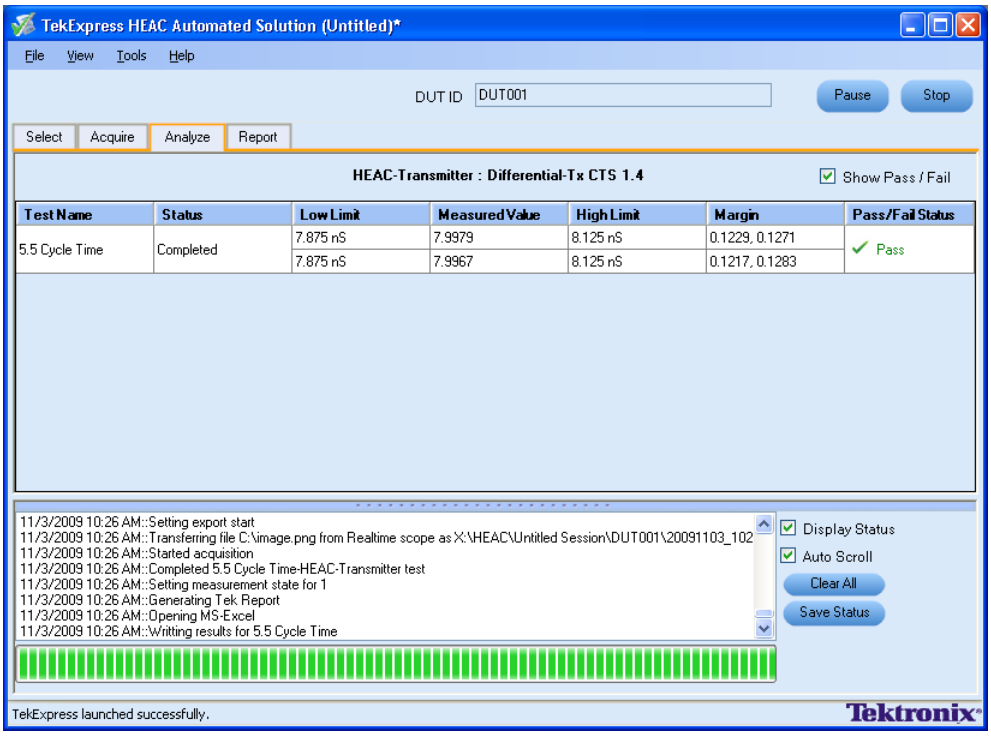
Table 23: Analysis parameters for the cycle time test

Parameter	Compliance mode	Permitted user defined mode values
Serial Trigger Positive Data Level (mV)	100	100
Serial Trigger Negative Data Level (mV)	–100	–100
Serial Trigger Pattern for Positive Pulse	0100010001000	Do not change
Serial Trigger Pattern for Negative Pulse	1011101110111	Do not change
Serial Trigger Clock Source	R Clk	Ch3, Ch4, R Clk
Serial Trigger Standard	100BASE-TX	GB Ethernet, 100BASE-TX
Serial Trigger Coding	NRZ	Do not change
Serial Trigger Bit Rate (Mbps)	125	Do not change

4. Click **Limits** to view and change the Positive Cycle Time, Negative Cycle Time values (in ns), and the compare string.
5. Click **Comments** to enter comments. The comments are shown in the test report.
6. Click **Apply** to effect the changes, and then click **Close**.
7. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.

View Analysis for Cycle Time Test

Click **Analyze** to view the analysis of the cycle time test.



Configure and Run the Template Test

The template test is purely informative and only the User Defined Mode is available. To configure and run the template test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. The following table lists the compliance mode values and the permitted range of values for the user defined mode.

Table 24: Acquisition parameters for the template test

Parameter	Default values	Permitted user defined mode values
Vertical Scale (mV-Div)	60	20, 60, 200
Vertical Position	0	Do not change
Vertical Offset (V)	0	Do not change

Table 24: Acquisition parameters for the template test (cont.)

Parameter	Default values	Permitted user defined mode values
Horizontal Scale (nSec-Div)	4	0, 4, 8
Horizontal Position (%)	50	50, 70, 90
Record Length	1000	500, 1000, 2000
Delay Mode	ON	ON, OFF
Horizontal Delay (nSec)	80	80, 100
Mask Pass-Fail Test Samples	1000000	Do not change

3. Click **Analyze**. Configure the following analysis parameters:

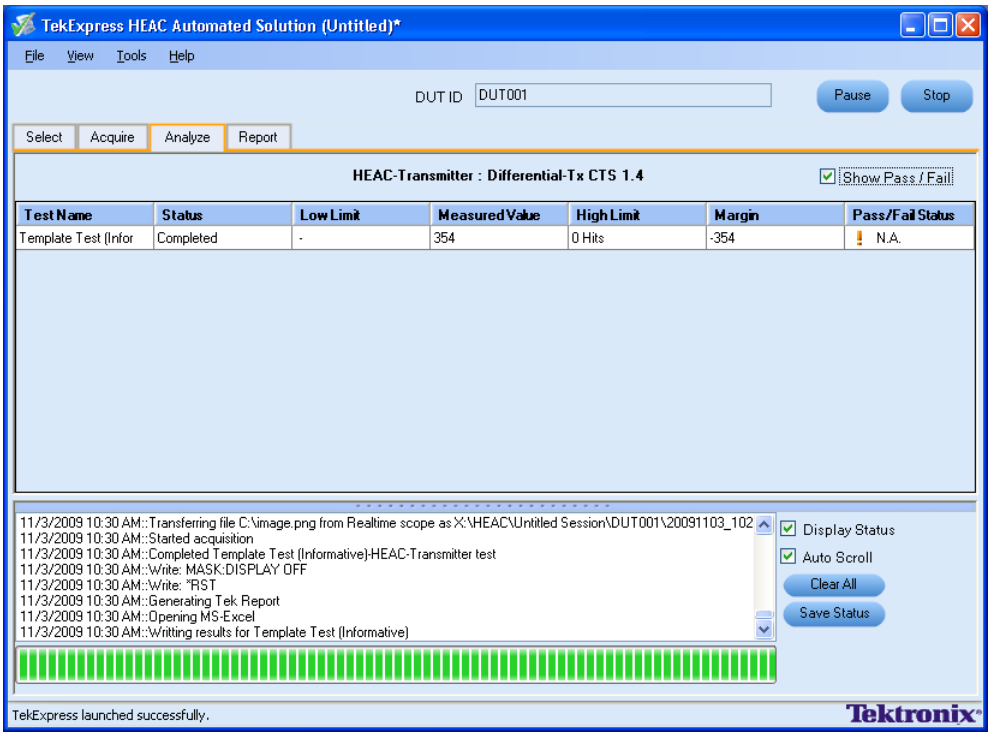
Table 25: Analysis parameters for the template test

Parameter	Default values
Comm Trigger Data Level (absolute mV)	100
Comm Trigger Standard	100BASE-TX
Comm Trigger Coding	MLT3
Comm Trigger Type	DATA
Comm Trigger Bit Rate (Mbps)	125
Mask File Path	HEAC.msk

4. Click **Limits** to view and change the Hit Count values and the compare string.
5. Click **Comments** to enter comments. The comments are shown in the test report.
6. Click **Apply** to effect the changes, and then click **Close**.
7. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.

View Analysis for Template Test

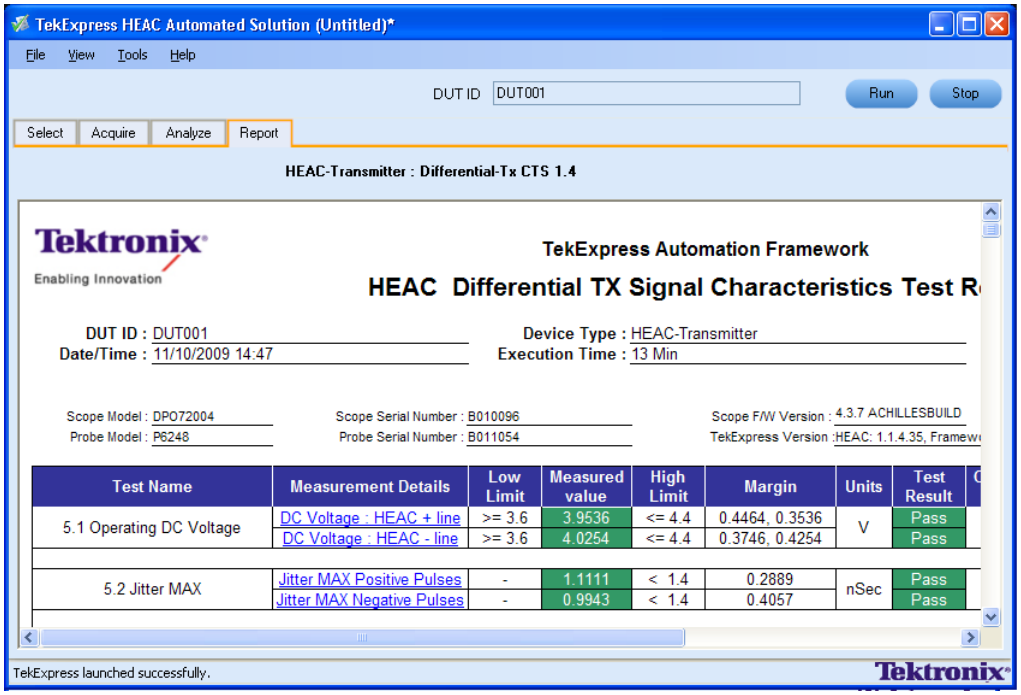
Click **Analyze** to view the analysis of the template test. The results do not show pass or fail because the template test is not a compliance test.



View Results for the Differential Mode Transmitter Tests

You can view the differential mode transmitter test results in the Analyze panel. A table shows the test name, status of the test, measurement details, CRC status, and the pass/fail status. The application also automatically displays a report in the Report panel once the test is successfully completed. Save this report as an MHT file using the **File > Save As** option.

The following screen shows the results for differential mode transmitter tests.



Select a Common Mode Transmitter Test

In TekExpress, the Select panel allows you to select and configure the transmitter tests.

1. Launch TekExpress HEAC.
2. Select the device as **HEAC-Transmitter**.
3. Select the Test Suite as **CommonMode-Tx**. The version is already selected as CTS 1.4.
4. Enter the DUT ID in the field provided.
5. Select a test from the list: **Operating DC Voltage, High-Low-Center Level, Rise-Fall Time, Transmit Jitter MAX/Clock Frequency,** and **IEC 60958-1 Stream Verification**.

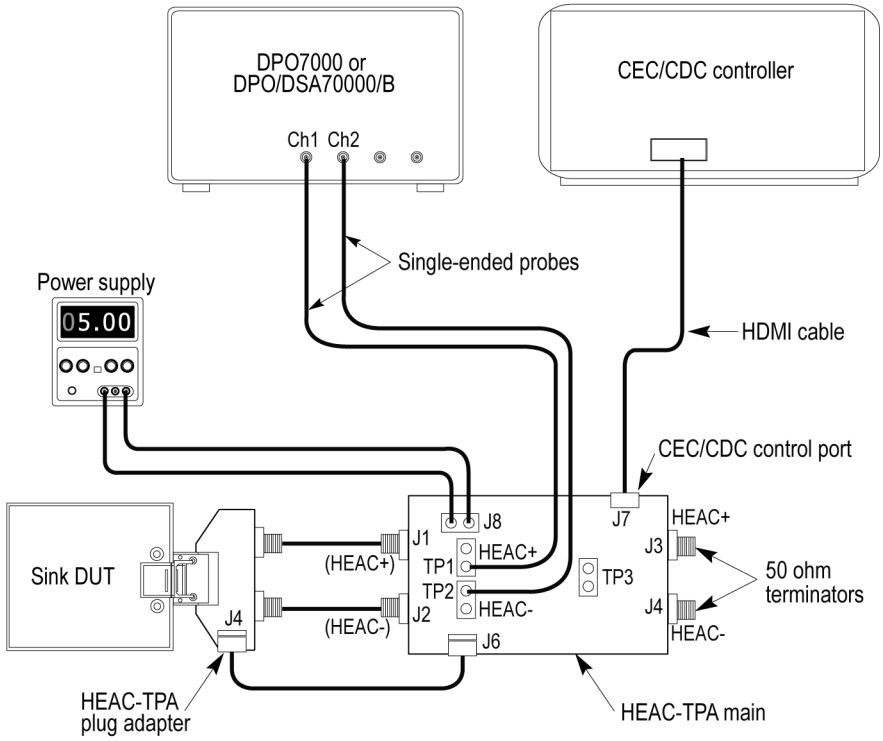
NOTE. *All common mode transmitter tests are selected by default. To select a particular test, click Deselect All, and select the required test from the list.*

Make Connections for a Common Mode Transmitter Test

For a common mode transmitter signal test, you need the following equipment:

Resource	Model supported
Real-time oscilloscope	Tektronix DPO7000 Series, DPO70000 Series, DPO70000B Series, DSA70000 Series, DSA70000B Series, and MSO70000 Series Digital and Mixed Signal Oscilloscopes
Probe	Tektronix P6243 or P6245 for Tektronix DPO70000 Series, DPO70000B Series, DSA70000 Series, and DSA70000B Series, and MSO7000 Series Digital and Mixed Oscilloscopes Tektronix P6243, P6245, or TAP1500 for Tektronix DPO7000 Series Digital Oscilloscopes ***NOTE.*** *You can also use two differential probes in single-ended mode.*
Test fixture	TF-HEAC-TPA-P (A/C) or TF-HEAC-TPA-KIT, TF-HDMID-TPA-KIT
DUT	An HEAC sink device
50 Ω SMA Terminators	Any terminator that meets the following requirements: ■ 50 Ω impedance ± 1% or better ■ Connects directly to the SMA female connector
SMA Cables	Tektronix part number 174-1428-00 (1.5 meter) Tektronix part number 174-1341-00 (1 meter)
HDMI Cable	HDMI cable with HEAC capability

Connect the equipment as shown in the following diagram:



NOTE. *To view the equipment setup diagram, click the* ***Show Schematic*** *button.*

1. Connect the CEC or CDC Controller to the CEC/CDC Control Port of the HEAC-TPA main board.
2. Connect the HEAC-TPA plug board to the HEAC connector of the Sink DUT.
3. Connect the 50 Ω terminators to the HEAC-TPA main board.
4. Connect the first single-ended probe from Ch1 of the digital oscilloscope to the HEAC+ probe point on the HEAC-TPA main board, and the second single-ended probe from Ch2 to the HEAC- probe point.
5. Set the HEAC-TPA main board to enable the Sink DUT test.

   Set Up the Jumpers on the HEAC-TPA-MAIN Fixture (see page 24) and Set Up the Switches on the HEAC-TPA-MAIN Fixture (see page 23)

6. Connect and configure DC Power Supply to drive +5 V to the HEAC-TPA main board. Set switch S7 to the left (Off position) on the HEAC-TPA main fixture.
7. Power on the Sink DUT.
8. Activate the ARC (Common mode) transmission on the HEAC Sink DUT using the CEC/CDC controller.

Configure and Run a Common Mode Transmitter Test

To configure a common mode transmitter test, do the following:

1. In the Select panel click **Configure**.
2. In the Configure panel, select either **Compliance Mode** or **User Defined Mode**. In the User Defined Mode, you can modify the test parameters but you will no longer be testing against the compliance standards. In the Compliance Mode, you cannot modify any of the parameters.

   Configure the following general parameters that are common for transmitter tests.

Table 26: General parameters for common mode transmitter tests

Parameter	Description
Real time scope	Select the oscilloscope to which to connect.
DUT High Signal connected to real time scope at	Select the oscilloscope channel to which the DUT high signal is connected.
DUT Low Signal connected to real time scope at	Select the oscilloscope channel to which the DUT low signal is connected.
Minimum signal threshold (mV)	Specify the minimum signal threshold value, in mV, for signal validation.

NOTE. *In the Compliance Mode, none of the acquisition and analysis parameters are editable.*

3. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.

Configure and Run the Operating DC Voltage Test

To configure and run the operating DC voltage test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. Select the User Defined Mode to configure the following parameters for DC Voltage HEAC+line and DC Voltage HEAC–line. The following table lists the compliance mode values and the permitted range of values.

Table 27: Acquisition parameters for the operating DC voltage test

Parameter	Compliance mode	Permitted user defined mode values
Vertical Scale (mV)	200	100, 200, 400
Vertical Position (div)	0	Do not change
Vertical Offset (V)	Auto	Auto, 2, 4, 6
Horizontal Scale (µs)	10	5, 10, 20
Horizontal Position (%)	50	50, 70, 90
Record Length	2500000	1250000, 2500000, 5000000

NOTE. *In the User Defined Mode, during test execution the specified horizontal acquisition parameters (such as horizontal scale and record length) might not be applied exactly as specified in the configuration panel. Depending upon the oscilloscope model, the nearest possible value is applied.*

3. Click **Analyze**. Configure the following analysis parameters:

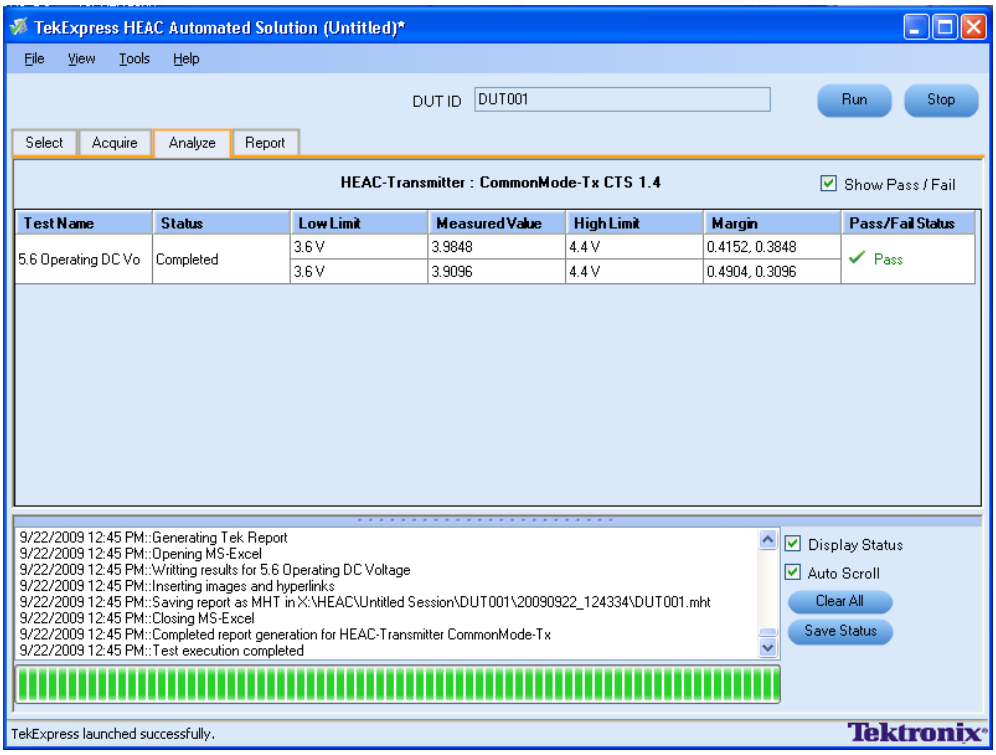
Table 28: Analysis parameters for the operating DC voltage test

Parameter	Compliance mode	Permitted user defined mode values
Edge Trigger Level (V)	4	2, 4, 6
Edge Trigger Slope	Positive	Positive, Negative

4. Click **Limits** to view and change the DC Voltage HEAC+line and DC Voltage HEAC–line values and the compare string.
5. Click **Comments** to enter comments. The comments are shown in the test report.
6. Click **Apply** to effect the changes, and then click **Close**.
7. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.

View Analysis for Operating DC Voltage Test

Click **Analyze** to view the analysis of the operating DC voltage test.



Configure and Run the High-Low Level Test

To configure and run the high-low level test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. Select the User Defined Mode to configure the following parameters for SPDIF High Level and SPDIF Low Level. The following table lists the compliance mode values and the permitted range of values.

Table 29: Acquisition parameters for the high-low level test

Parameter	Compliance mode	Permitted user defined mode values
Vertical Scale (mV)	100	50, 100, 200
Vertical Position (div)	0	Do not change
Vertical Offset (V)	4	2, 4, 6

Table 29: Acquisition parameters for the high-low level test (cont.)

Parameter	Compliance mode	Permitted user defined mode values
Horizontal Scale (µs)	10	5, 10, 20
Horizontal Position (%)	50	50, 70, 90
Record Length	5000000	2500000, 5000000

NOTE. *In the User Defined Mode, during test execution the specified horizontal acquisition parameters (such as horizontal scale and record length) might not be applied exactly as specified in the configuration panel. Depending upon the oscilloscope model, the nearest possible value is applied.*

3. Click **Analyze**. Configure the following analysis parameters:

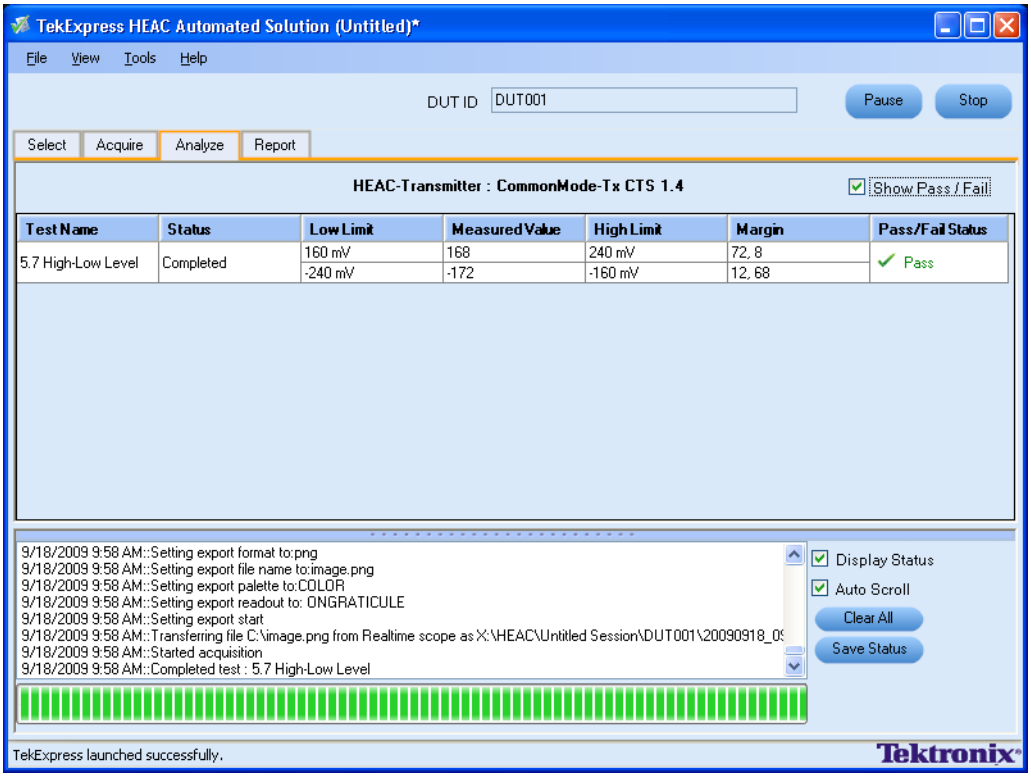
Table 30: Analysis parameters for the high-low level test

Parameter	Compliance mode	Permitted user defined mode values
Edge Trigger Level (V)	4	2, 4, 6
Edge Trigger Slope	Positive	Positive, Negative
High Level: Histogram Top Limit (mV)	260	Do not change
High Level: Histogram Bottom Limit (mV)	150	Do not change
Low Level: Histogram Top Limit (mV)	–150	Do not change
Low Level: Histogram Bottom Limit (mV)	–260	Do not change

4. Click **Limits** to view and change the (+Vei swing) High Level and (–Vei swing) Low Level values and the compare string.
5. Click **Comments** to enter comments. The comments are shown in the test report.
6. Click **Apply** to effect the changes, and then click **Close**.
7. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.

View Analysis for High-Low Level Test

Click **Analyze** to view the analysis of the high-low level test.



Configure and Run the Rise-Fall Time Test

To configure and run the rise-fall time test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. Select the User Defined Mode to configure the following parameters for SPDIF Rise, SPDIF Fall, SPDIF-MLT3 Rise, and SPDIF-MLT3 Fall. The following table lists the compliance mode values and the permitted range of values.

Table 31: Acquisition parameters for the rise-fall time test

Parameter	Compliance mode	Permitted user defined mode values
Vertical Scale (mV)	100	50, 100, 200
Vertical Position (div)	0	Do not change

Table 31: Acquisition parameters for the rise-fall time test (cont.)

Parameter	Compliance mode	Permitted user defined mode values
Vertical Offset (V)	4	2, 4, 6
Horizontal Scale (ns)	100	50, 100, 200
Horizontal Position (%)	70	50, 70, 90
Record Length	50000	25000, 50000

NOTE. *In the User Defined Mode, during test execution the specified horizontal acquisition parameters (such as horizontal scale and record length) might not be applied exactly as specified in the configuration panel. Depending upon the oscilloscope model, the nearest possible value is applied.*

3. Click **Analyze**. Configure the following analysis parameters:

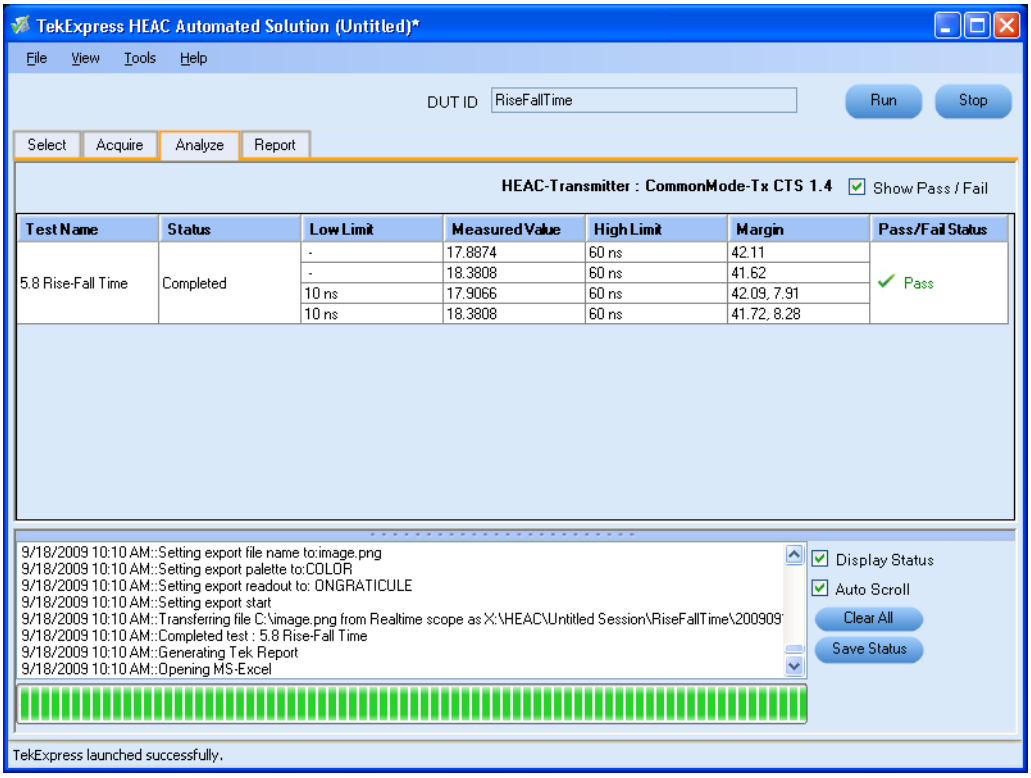
Table 32: Analysis parameters for the rise-fall time test

Parameter	Compliance mode	Permitted user defined mode values
Serial Trigger Data Level (V)	4	2, 4, 6
Serial Trigger Pattern for Rise-time	0011	Do not change
Serial Trigger Pattern for Fall-time	1100	Do not change
Serial Trigger Clock Source	R Clk	Ch 3, Ch 4, R Clk
Serial Trigger Standard	Custom	Do not change
Serial Trigger Coding	NR2	Do not change
Serial Trigger Bit Rate (Mbps)	6.144	4.096, 5.6448, 6.144
Math1 Vertical Position (div)	–66	Do not change
Math1 Scale (mV)	60	40, 60, 80

4. Click **Limits** to view and change the Rise time and Fall time values and the compare string.
5. Click **Comments** to enter comments. The comments are shown in the test report.
6. Click **Apply** to effect the changes, and then click **Close**.
7. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.
8. Follow the on-screen instructions. When prompted, configure the DUT to transmit or disable an MLT-3 signal.

View Analysis for Rise-Fall Time Test

Click **Analyze** to view the analysis of the rise-fall time test.



Configure and Run the Transmit Jitter MAX-Clock Frequency Test

To configure and run the transmit jitter MAX-clock frequency test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. Select the User Defined Mode to configure the following parameters for SPDIF Clock 6.144 MHz, SPDIF Clock 5.6488 MHz, and SPDIF Clock 4.096 MHz. The following table lists the compliance mode values and the permitted range of values.

Table 33: Acquisition parameters for the transmit jitter MAX-clock frequency test

Parameter	Compliance mode	Permitted user defined mode values
Vertical Scale (mV)	100	50, 100, 200
Vertical Position (div)	0	Do not change

Table 33: Acquisition parameters for the transmit jitter MAX-clock frequency test (cont.)

Parameter	Compliance mode	Permitted user defined mode values
Vertical Offset (V)	4	2, 4, 6
Horizontal Scale (ms)	2	1, 2, 4
Horizontal Position (%)	50	50, 70, 90
Sample Rate (GS/s)	1.25	1, 1.25, 1.5

NOTE. *In the User Defined Mode, during test execution the specified horizontal acquisition parameters (such as horizontal scale and record length) might not be applied exactly as specified in the configuration panel. Depending upon the oscilloscope model, the nearest possible value is applied.*

3. Click **Analyze**. Configure the following analysis parameters:

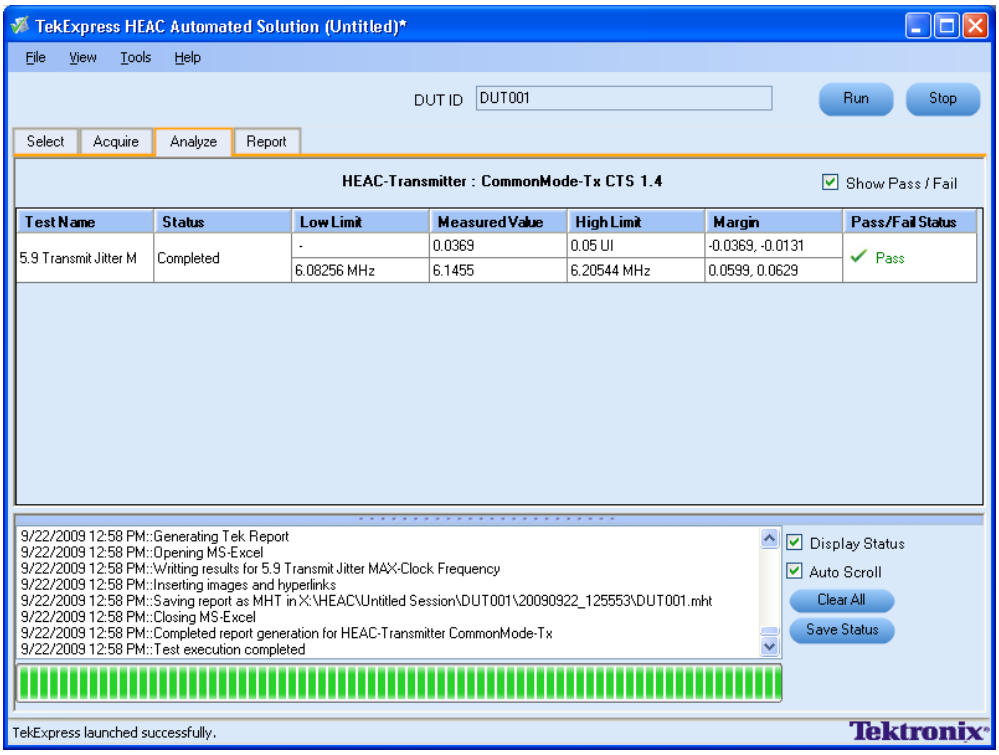
Table 34: Analysis parameters for the transmit jitter MAX-clock frequency test

Parameter	Compliance mode	Permitted user defined mode values
Edge Trigger Level (V)	4	2, 4, 6
Edge Trigger Slope	Positive	Positive, Negative
Math1 Position	–40	–35, –40, –45
Math1 Vertical Scale (mV)	50	40, 50, 60
Math2 Position	0	–5, 0, 5
Math2 Vertical Scale (mV)	60	40, 60, 80
Clock Recovery - CUSTOM BW (Hz)	700	Do not change
Clock Recovery - PLL ORDER)	Type I	Type I, Type II

4. Click **Limits** to view and change the Jitter MAX and Clock Frequency values and the compare string.
5. Click **Comments** to enter comments. The comments are shown in the test report.
6. Click **Apply** to effect the changes, and then click **Close**.
7. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.
8. The Transmit Jitter MAX test is run at three frequencies. The application prompts you to configure the DUT for each of these frequencies: 4.096 MHz, 5.688 MHz, and 6.144 MHz. If your device supports the frequency, configure the DUT for the frequency when prompted.
9. If your DUT frequency is not supported, then select **Not Supported** and proceed to next step to set at other frequency.

View Analysis for Transmit Jitter MAX-Clock Frequency Test

Click **Analyze** to view the analysis of the transmit jitter MAX-clock frequency test.



Configure and Run the IEC60958-1 Stream Verification Test

To configure and run the IEC60958-1 stream verification test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. Select the User Defined Mode to configure the following parameters for SPDIF. The following table lists the compliance mode values and the permitted range of values.

Table 35: Acquisition parameters for the IEC60958-1 stream verification test

Parameter	Compliance mode	Permitted user defined mode values
Vertical Scale (mV)	100	50, 100, 200
Vertical Position (div)	0	Do not change
Vertical Offset (V)	0	–2, 0, 2

Table 35: Acquisition parameters for the IEC60958-1 stream verification test (cont.)

Parameter	Compliance mode	Permitted user defined mode values
Horizontal Scale (ms)	2	1, 2, 4
Horizontal Position (%)	50	50, 70, 90
Sample rate (MS/s)	125	100, 125, 150

NOTE. *In the User Defined Mode, during test execution the specified horizontal acquisition parameters (such as horizontal scale and record length) might not be applied exactly as specified in the configuration panel. Depending upon the oscilloscope model, the nearest possible value is applied.*

3. Click **Analyze**. Configure the following analysis parameters:

Table 36: Analysis parameters for the IEC60958-1 stream verification test

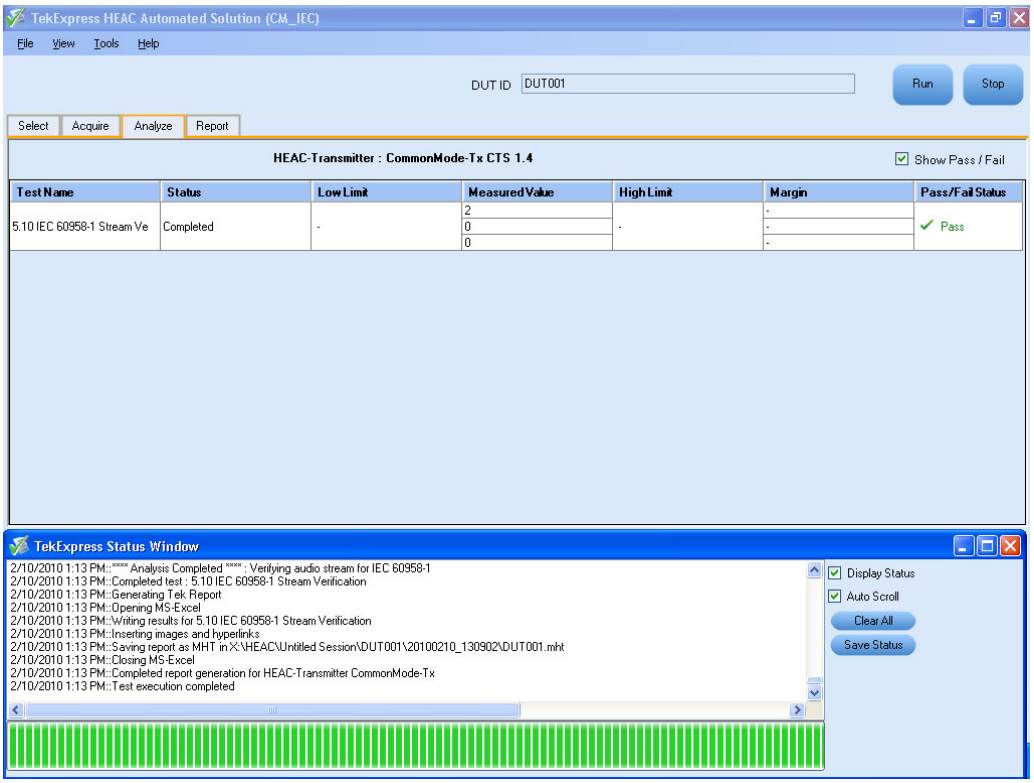
Parameter	Compliance mode	Permitted user defined mode values
Edge Trigger Level (V)	4	2, 4, 6
Edge Trigger Slope	Positive	Positive, Negative
Math1 Position (div)	–40	–35, –40, –45
Math1 Vertical Scale (mV)	100	80, 100, 120

NOTE. *The Limits tab has no configurable parameters.*

4. Click **Comments** to enter comments. The comments are shown in the test report.
5. Click **Apply** to effect the changes, and then click **Close**.
6. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.
7. The IEC Stream Verification test is run under three conditions: With +5 V power turned on and ARC activated, With +5 V power turned off, and With +5 V power turned on and ARC not activated. Follow the on-screen prompts to run the test using the three conditions.

View Analysis for IEC60958-1 Stream Verification Test

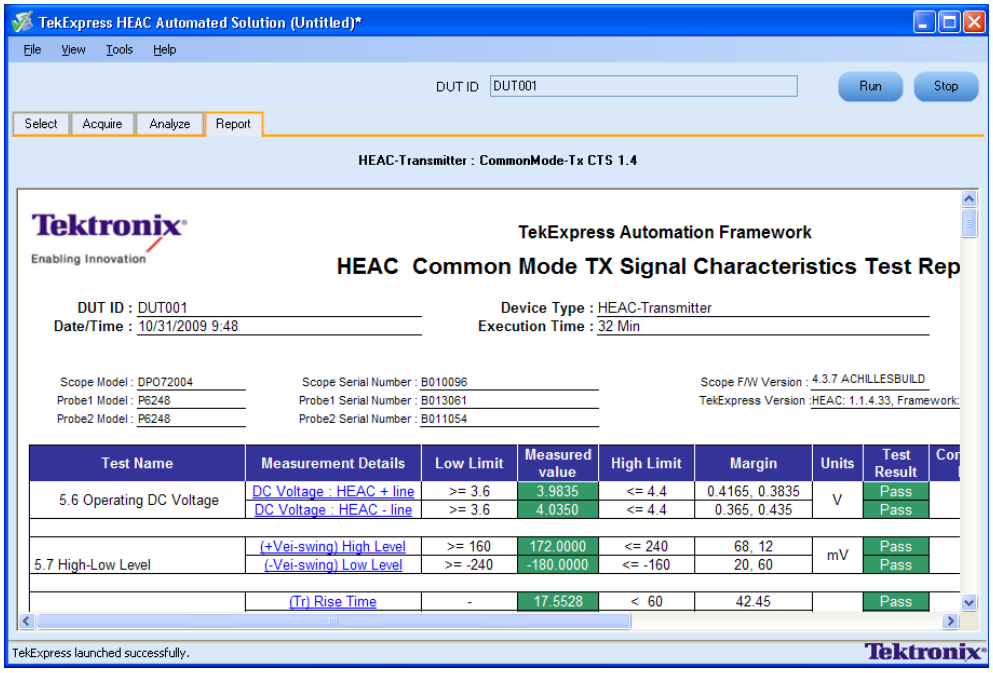
Click **Analyze** to view the analysis of the IEC60958-1 stream verification test.



View Results for the Common Mode Transmitter Tests

You can view the common mode transmitter test results in the Analyze panel. A table shows the test name, status of the test, measurement details, high and low limits, margins, units, and the pass/fail status. The application also automatically displays a report in the Report panel once the test is successfully completed. Save this report as an MHT file using the **File > Save As** option.

The following screen shows the results for common mode transmitter tests.



Select a Single Mode Transmitter Test

In TekExpress, the Select panel allows you to select and configure the transmitter tests.

1. Launch TekExpress HEAC.
2. Select the device as **HEAC-Transmitter**.
3. Select the Test Suite as **SingleMode-Tx**. The version is already selected as CTS 1.4.
4. Enter the DUT ID in the field provided.
5. Select a test from the list: **Operating DC Voltage, Signal Amplitude, Rise-Fall Time, Transmit Jitter MAX/Clock Frequency,** and **IEC 60958-1 Stream Verification**.

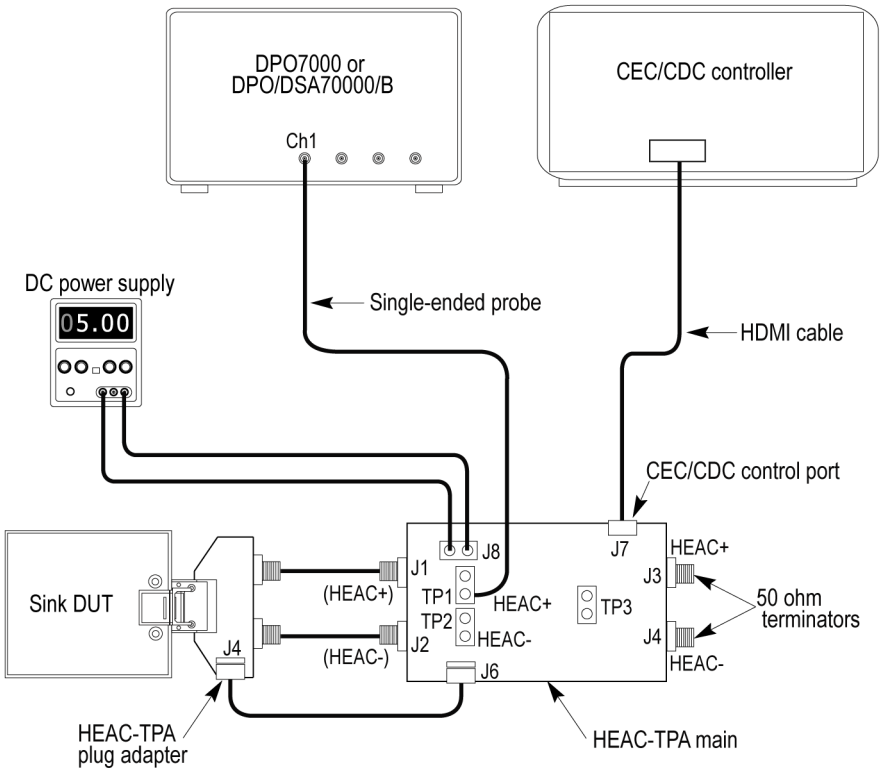
NOTE. *All single mode transmitter tests are selected by default. To select a particular test, click Deselect All, and select the required test from the list. You cannot deselect the Operating DC Voltage test.*

Make Connections for a Single Mode Transmitter Test

For a single mode transmitter signal test, you need the following equipment:

Resource	Model supported
Real-time oscilloscope	Tektronix DPO7000 Series, DPO70000 Series, DPO70000B Series, DSA70000 Series, DSA70000B Series, and MSO70000 Series Digital and Mixed Signal Oscilloscopes
Probe	Tektronix P6243 or P6245 for Tektronix DPO70000 Series, DPO70000B Series, DSA70000 Series, and DSA70000B Series, and MSO7000 Series Digital and Mixed Oscilloscopes Tektronix P6243, P6245, or TAP1500 for Tektronix DPO7000 Series Digital Oscilloscopes ***NOTE.*** *You can also use two differential probes in single-ended mode.*
Test fixture	TF-HEAC-TPA-P (A/C) or TF-HEAC-TPA-KIT, TF-HDMID-TPA-KIT
DUT	An HEAC sink device
50 Ω SMA Terminators	Any terminator that meets the following requirements: ■ 50 Ω impedance ± 1% or better ■ Connects directly to the SMA female connector
SMA Cables	Tektronix part number 174-1428-00 (1.5 meter) Tektronix part number 174-1341-00 (1 meter)
HDMI Cable	HDMI cable with HEAC capability

Connect the equipment as shown in the following diagram:



NOTE. *To view the equipment setup diagram, click the* ***Show Schematic*** *button.*

1. Connect the CEC or CDC Controller to the CEC/CDC Control Port on the HEAC-TPA main board.
2. Connect the HEAC-TPA plug board to the HEAC connector on the Sink DUT.
3. Connect the 50 Ω SMA terminators to the HEAC-TPA main board.
4. Set the Impedance Conversion Circuit on the HEAC-TPA main board to **55 Ω**:

   See Set Up the Jumpers on the HEAC-TPA-MAIN Fixture (see page 24) and Set Up the Switches on the HEAC-TPA-MAIN Fixture (see page 23)
5. Connect a single-ended probe from Ch1 of the digital oscilloscope to the HEAC+ probe point on the HEAC-TPA main board.
6. Set the HEAC-TPA main board to enable the Sink DUT test.

7. Connect and set the DC Power Supply to supply +5 V to the HEAC-TPA main board. Set switch S7 to the left (Off position) on the HEAC-TPA main fixture.
8. Power on the Sink DUT.
9. Activate the ARC (Single mode) transmission on the HEAC Sink DUT using the CEC/CDC controller.

Configure and Run a Single Mode Transmitter Test

To configure a single mode transmitter test, do the following:

1. In the Select panel click **Configure**.
2. In the Configure panel, select either **Compliance Mode** or **User Defined Mode**. In the User Defined Mode, you can modify the test parameters but you will no longer be testing against the compliance standards. In the Compliance Mode, you cannot modify any of the parameters.

   Configure the following general parameters that are common for transmitter tests.

Table 37: General parameters for single mode transmitter tests

Parameter	Description
Real time scope	Select the oscilloscope to which to connect.
DUT HEAC+ signal connected to real time scope at	Select the oscilloscope channel to which to connect the DUT signal.
Minimum signal threshold (mV)	Specify the minimum signal threshold value, in mV, for signal validation.

NOTE. *None of the acquisition and analysis parameters are editable in the Compliance Mode.*

3. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.

Configure and Run the Operating DC Voltage Test

To configure and run the operating DC voltage test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. Select the User Defined Mode to configure the following parameters for HEAC DC Voltage. The following table lists the compliance mode values and the permitted range of values.

NOTE. *You cannot deselect the Operating DC Voltage test.*

Table 38: Acquisition parameters for the operating DC voltage test (single mode)

Parameter	Compliance mode	Permitted user defined mode values
Vertical Scale (mV)	100	100, 200, 400
Vertical Position (div)	0	Do not change
Vertical Offset (V)	Auto	Auto, 2, 3, 4
Horizontal Scale (µs)	10	5, 10, 20
Horizontal Position (%)	50	50, 70, 90
Record Length	2500000	1250000, 2500000, 5000000

NOTE. *In the User Defined Mode, during test execution the specified horizontal acquisition parameters (such as horizontal scale and record length) might not be applied exactly as specified in the configuration panel. Depending upon the oscilloscope model, the nearest possible value is applied.*

3. Click **Analyze**. Configure the following analysis parameters:

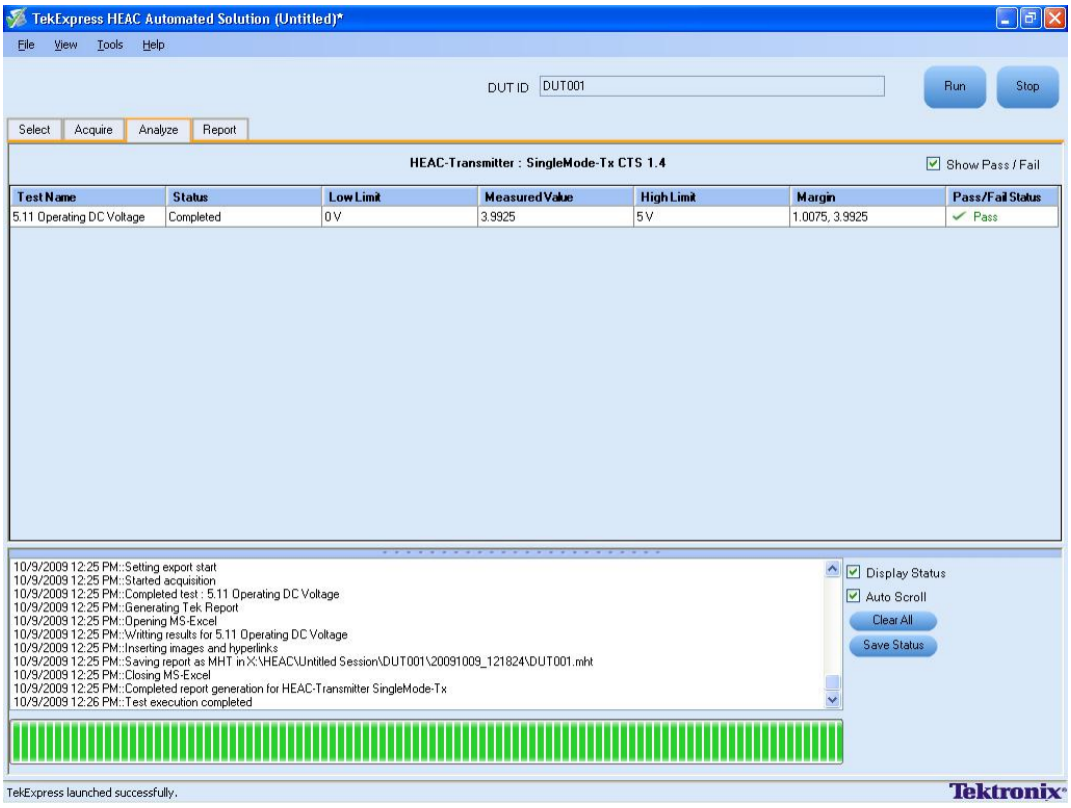
Table 39: Analysis parameters for the operating DC voltage test (single mode)

Parameter	Compliance mode	Permitted user defined mode values
Edge Trigger Level (V)	0.5	0.5, 1.0, 1.5
Edge Trigger Slope	Positive	Positive, Negative

4. Click **Limits** to view and change the DC Voltage:Vel (V) values and the compare string.
5. Click **Comments** to enter comments. The comments are shown in the test report.
6. Click **Apply** to effect the changes, and then click **Close**.
7. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.

View Analysis for Operating DC Voltage Test

Click **Analyze** to view the analysis of the operating DC voltage test.



Configure and Run the Signal Amplitude Test

To configure and run the high-low level test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. Select the User Defined Mode to configure the following parameters for SPDIF Level. The following table lists the compliance mode values and the permitted range of values.

Table 40: Acquisition parameters for the signal amplitude test

Parameter	Compliance mode	Permitted user defined mode values
Vertical Scale (mV)	100	50, 100, 200
Vertical Position (div)	0	Do not change
Vertical Offset (V)	4	2, 4, 6
Horizontal Scale (µs)	10	5, 10, 20
Horizontal Position (%)	50	50, 70, 90
Record Length	5000000	2500000, 5000000

NOTE. *In the User Defined Mode, during test execution the specified horizontal acquisition parameters (such as horizontal scale and record length) might not be applied exactly as specified in the configuration panel. Depending upon the oscilloscope model, the nearest possible value is applied.*

3. Click **Analyze**. Configure the following analysis parameters:

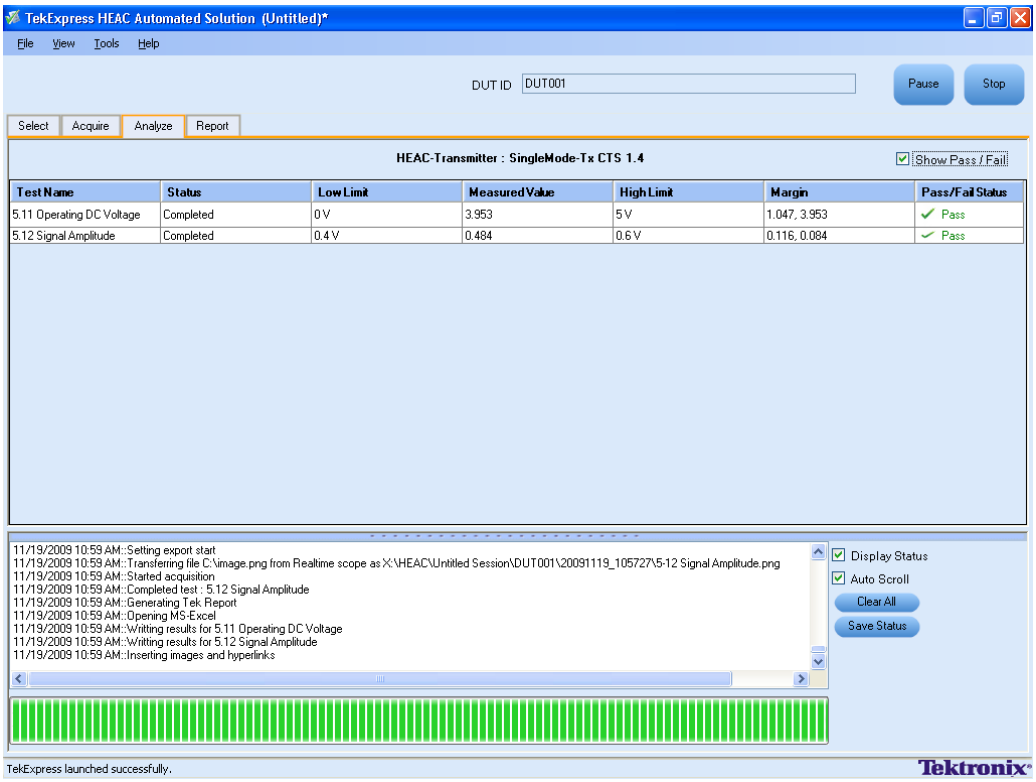
Table 41: Analysis parameters for the signal amplitude test

Parameter	Compliance mode	Permitted user defined mode values
Edge Trigger Level (V)	0.5	0.5, 1.0, 1.5
Edge Trigger Slope	Positive	Positive, Negative

4. Click **Limits** to view and change the Vel Swing Level values and the compare string.
5. Click **Comments** to enter comments. The comments are shown in the test report.
6. Click **Apply** to effect the changes, and then click **Close**.
7. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.

View Analysis for Signal Amplitude Test

Click **Analyze** to view the analysis of the high-low level test.



Configure and Run the Rise-Fall Time Test

To configure and run the rise-fall time test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. Select the User Defined Mode to configure the following parameters for SPDIF Rise and SPDIF Fall. The following table lists the compliance mode values and the permitted range of values.

Table 42: Acquisition parameters for the rise-fall time test

Parameter	Compliance mode	Permitted user defined mode values
Vertical Scale (mV)	100	50, 100, 200
Vertical Position (div)	0	Do not change
Vertical Offset (V)	4	2, 4, 6

Table 42: Acquisition parameters for the rise-fall time test (cont.)

Parameter	Compliance mode	Permitted user defined mode values
Horizontal Scale (ns)	100	50, 100, 200
Horizontal Position (%)	70	50, 70, 90
Record Length	50000	25000, 50000

NOTE. *In the User Defined Mode, during test execution the specified horizontal acquisition parameters (such as horizontal scale and record length) might not be applied exactly as specified in the configuration panel. Depending upon the oscilloscope model, the nearest possible value is applied.*

3. Click **Analyze**. Configure the following analysis parameters:

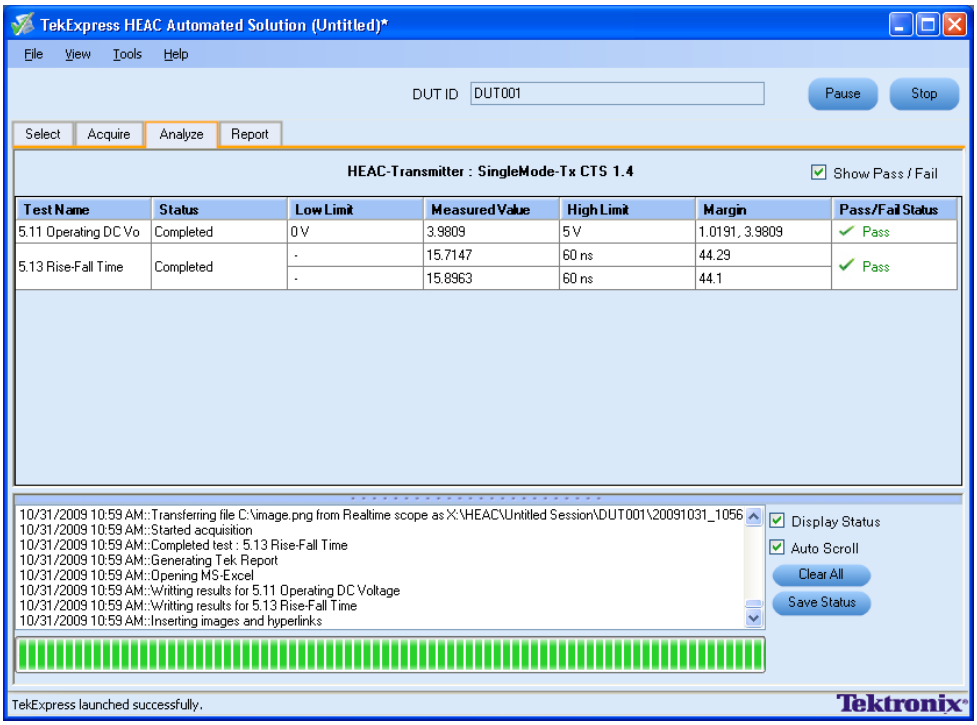
Table 43: Analysis parameters for the rise-fall time test

Parameter	Compliance mode	Permitted user defined mode values
Serial Trigger Data Level (V)	4	2, 4, 6
Serial Trigger Pattern for Rise-time	0011	Do not change
Serial Trigger Pattern for Fall-time	1100	Do not change
Serial Trigger Clock Source	R Clk	Ch 3, Ch 4, R Clk
Serial Trigger Standard	Custom	Do not change
Serial Trigger Coding	NRZ	Do not change
Serial Trigger Bit Rate (Mbps)	6.144	4.096, 5.6448, 6.144

4. Click **Limits** to view and change the Rise Time and Fall Time values and the compare string.
5. Click **Comments** to enter comments. The comments are shown in the test report.
6. Click **Apply** to effect the changes, and then click **Close**.
7. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.

View Analysis for Rise-Fall Time Test

Click **Analyze** to view the analysis of the rise-fall time test.



Configure and Run the Transmit Jitter MAX-Clock Frequency Test

To configure and run the transmit jitter MAX-clock frequency test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. Select the User Defined Mode to configure the following parameters for SPDIF Clock 6.144 MHz, SPDIF Clock 5.6488 MHz, and SPDIF Clock 4.096 MHz. The following table lists the compliance mode values and the permitted range of values.

Table 44: Acquisition parameters for the transmit jitter MAX-clock frequency test

Parameter	Compliance mode	Permitted user defined mode values
Vertical Scale (mV)	100	50, 100, 200
Vertical Position (div)	0	Do not change
Vertical Offset (V)	4	2, 4, 6

Table 44: Acquisition parameters for the transmit jitter MAX-clock frequency test (cont.)

Parameter	Compliance mode	Permitted user defined mode values
Horizontal Scale (ms)	2	1, 2, 4
Horizontal Position (%)	50	50, 70, 90
Sample Rate (GS/s)	1.25	1, 1.25, 1.5

NOTE. *In the User Defined Mode, during test execution the specified horizontal acquisition parameters (such as horizontal scale and record length) might not be applied exactly as specified in the configuration panel. Depending upon the oscilloscope model, the nearest possible value is applied.*

3. Click **Analyze**. Configure the following analysis parameters:

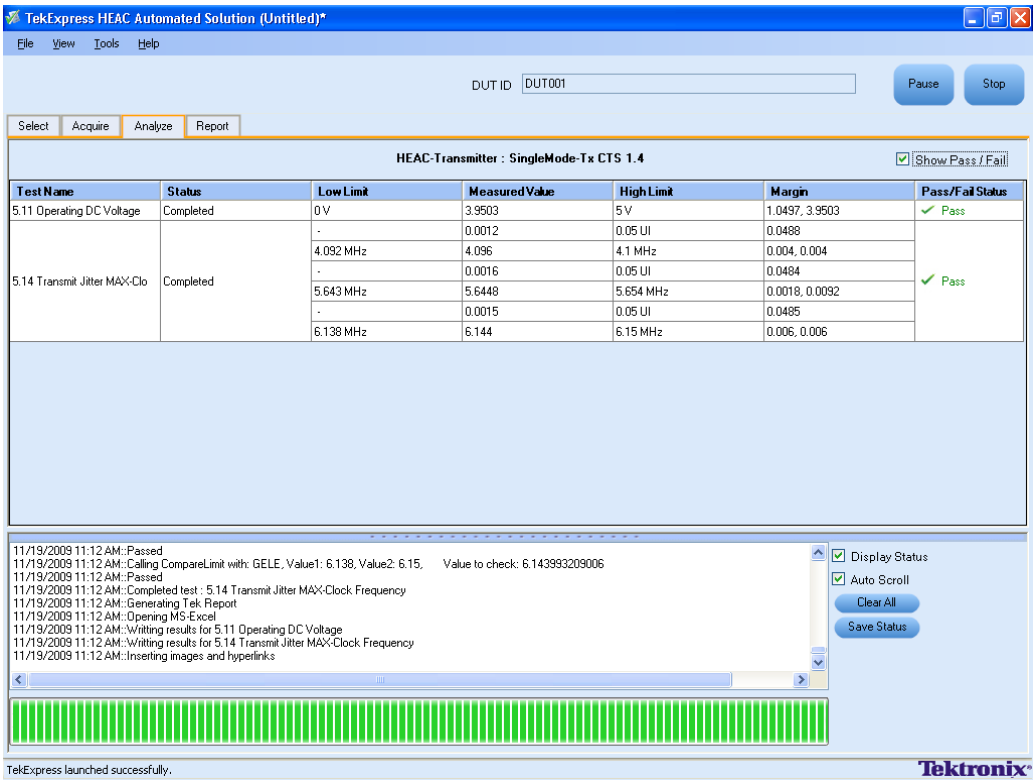
Table 45: Analysis parameters for the transmit jitter MAX-clock frequency test

Parameter	Compliance mode	Permitted user defined mode values
Edge Trigger Level (V)	4	2, 4, 6
Edge Trigger Slope	Positive	Positive, Negative
Math1 Position	–40	–35, –40, -45
Math1 Vertical Scale (mV)	50	40, 50, 60
Math1 Position (div)	0	–5, 0, 5
Math1 Vertical Scale (mV)	60	40, 60, 80
Clock Recovery - CUSTOM BW (Hz)	700	Do not change
Clock Recovery - PLL ORDER)	Type I	Type I, Type II

4. Click **Limits** to view and change the Jitter MAX and Clock Frequency values and the compare string.
5. Click **Comments** to enter comments. The comments are shown in the test report.
6. Click **Apply** to effect the changes, and then click **Close**.
7. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.
8. Follow the on-screen prompts to test the DUT for the available frequencies. The Transmit Jitter MAX test is run at three frequencies. The application prompts you to configure the DUT for each of these frequencies: 4.096 MHz, 5.688 MHz, and 6.144 MHz. If your device supports the frequency, configure the DUT for the frequency and proceed with measurement.

View Analysis for Transmit Jitter MAX-Clock Frequency Test

Click **Analyze** to view the analysis of the transmit jitter MAX-clock frequency test.



Configure and Run the IEC60958-1 Stream Verification Test

To configure and run the IEC60958-1 stream verification test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. Select the User Defined Mode to configure the following parameters for SPDIF Without +5 V DC Supply and SPDIF With +5 V DC Supply. The following table lists the compliance mode values and the permitted range of values.

Table 46: Acquisition parameters for the IEC60958-1 stream verification test

Parameter	Compliance mode	Permitted user defined mode values
Vertical Scale (mV)	100	50, 100, 200
Vertical Position (div)	0	Do not change

Table 46: Acquisition parameters for the IEC60958-1 stream verification test (cont.)

Parameter	Compliance mode	Permitted user defined mode values
Vertical Offset (V)	0	–2, 0, 2
Horizontal Scale (ms)	2	1, 2, 4
Horizontal Position (%)	50	50, 70, 90
Sample rate (MS/s)	125	100, 125, 150

NOTE. *In the User Defined Mode, during test execution the specified horizontal acquisition parameters (such as horizontal scale and record length) might not be applied exactly as specified in the configuration panel. Depending upon the oscilloscope model, the nearest possible value is applied.*

3. Click **Analyze**. Configure the following analysis parameters:

Table 47: Analysis parameters for the IEC60958-1 stream verification test

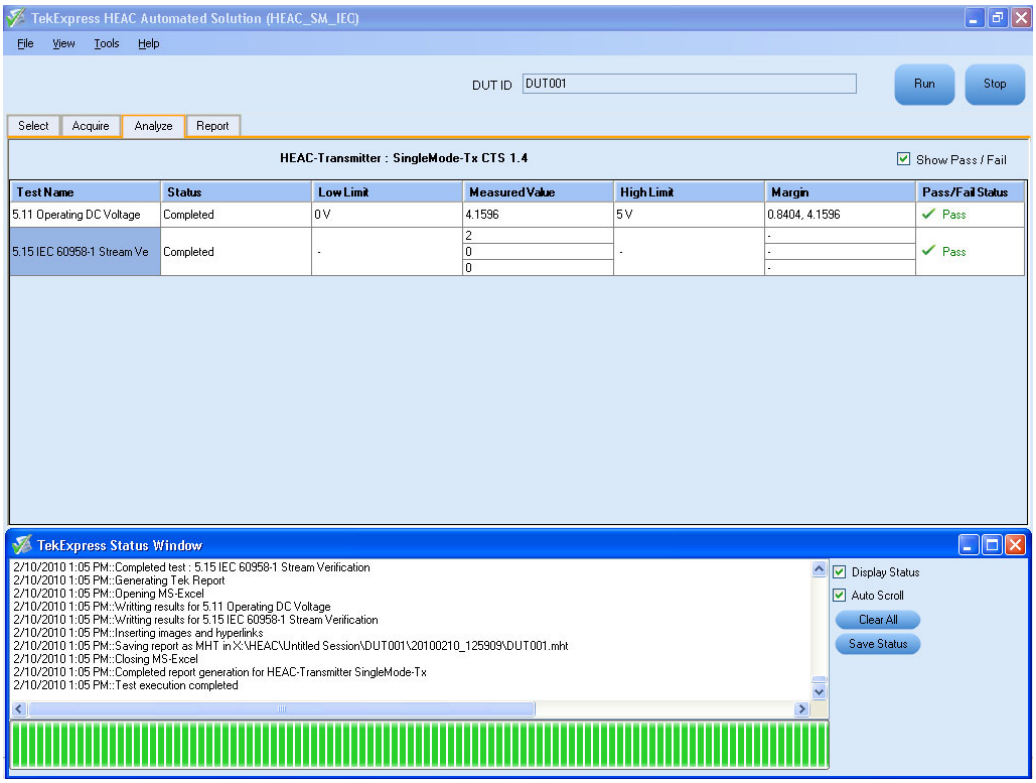
Parameter	Compliance mode	Permitted user defined mode values
Edge Trigger Level (V)	4	2, 4, 6
Edge Trigger Slope	Positive	Positive, Negative

NOTE. *The Limits tab has no configurable parameters.*

4. Click **Comments** to enter comments. The comments are shown in the test report.
5. Click **Apply** to effect the changes, and then click **Close**.
6. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.
7. The IEC Stream Verification test is run under three conditions: With +5 V power turned on and ARC activated, With +5 V power turned off, and With +5 V power turned on and ARC not activated. Follow the on-screen prompts to run the test using the three conditions.

View Analysis for IEC60958-1 Stream Verification Test

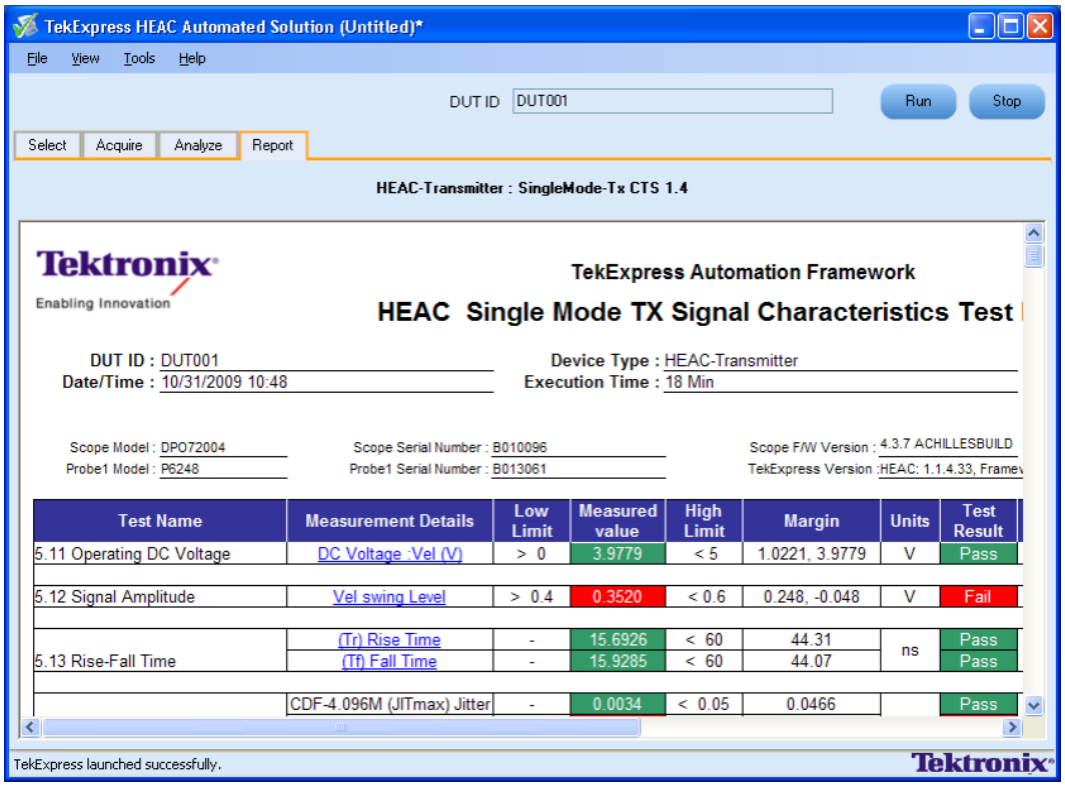
Click **Analyze** to view the analysis of the IEC60958-1 stream verification test.



View Results for Single Mode Transmitter Tests

You can view the results in the Analyze panel. A table shows the test name, status of the test, measurement details, high and low limits, margin, and the pass/fail status. The application also automatically displays a report in the Report panel once the test is successfully completed. Save this report as an MHT file using the **File > Save As** option.

The following screen shows the results for single mode transmitter tests.



Select a Differential Receiver Test

In TekExpress, the Select panel allows you to select, configure and run the receiver tests.

1. Launch TekExpress HEAC.
2. Select the device as **HEAC-Receiver**.
3. Select the test suite as **Differential-Rx** and the version is CTS 1.4.
4. Enter the **IP Address** of the DUT. By default, **Auto Detect MAC Address** is enabled. If you disable MAC Address, enter the MAC address in the field provided.
5. Enter the DUT ID in the field provided.
6. Select a test from the list: **Nominal Response, Receiver Performance-Amplitude, Receiver Performance-Clock Frequency, Receiver Performance-Common Mode, Receiver Performance-Signal Source Impedance** and **Receiver Performance-Worst Case Cable**.

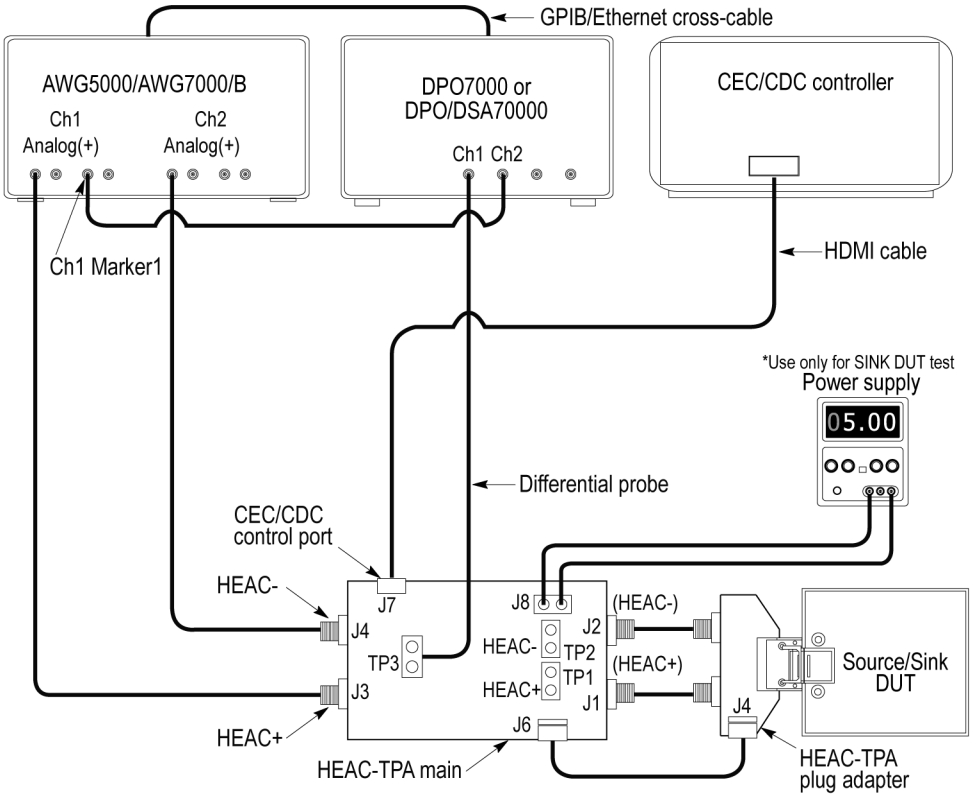
NOTE. *By default, all receiver tests are selected. To select a particular test, click Deselect All, and select the required test from the table.*

Make Connections for a Differential Receiver Test

You need the following equipment to perform a differential receiver test:

Resource	Model supported
Real-time oscilloscope	Tektronix DPO7000 Series, DPO70000 Series, DPO70000B Series, DSA70000 Series, DSA70000B Series, and MSO70000 Series Digital and Mixed Signal Oscilloscopes
Arbitrary waveform generator	Tektronix AWG5000 Series, AWG5000B Series, AWG7000 Series, or AWG7000B Series Arbitrary Waveform Generators
Probe	Tektronix P6247, P6248, P6330, or P7330 for a DPO70000 Series, DPO70000B Series, DSA70000 Series, DPO70000B, and MSO70000 Series Digital and Mixed Signal Oscilloscope Tektronix P6330, TDP1000, TDP1500, or TDP3500 for a Tektronix DPO7000 Series Digital Oscilloscope
Test fixture	TF-HEAC-TPA-P (A/C) or TF-HEAC-TPA-KIT, TF-HDMID-TPA-KIT
DUT	An HEAC sink or source device
SMA Cables	Tektronix part number 174-1428-00 (1.5 meter) Tektronix part number 174-1341-00 (1 meter)
HDMI Cable	HDMI cable with HEAC capability

Connect the equipment as shown in the following diagram:



NOTE. *To view the equipment setup diagram, click the* ***Show Schematic*** *button.*

1. Connect a LAN cross-cable from the digital oscilloscope to the waveform generator, and enable the TekVISA connection to the waveform generator and to the digital oscilloscope.
2. Connect an SMA cable to the Ch1 Marker1 output and to Ch2 on the digital oscilloscope.
3. Connect the HEAC-TPA plug board to the HEAC connector of the Source/Sink DUT.
4. Connect the Ch1 Analog(+) output of the arbitrary waveform generator to the HEAC+ SMA connector on the HEAC-TPA main board and the Ch2 Analog(+) to HEAC– SMA connector.
5. Set the Impedance Conversion Circuit on the HEAC-TPA main board to **50 Ω**:

   See Set Up the Jumpers on the HEAC-TPA-MAIN Fixture (see page 24) and Set Up the Switches on the HEAC-TPA-MAIN Fixture (see page 23)

6. Connect a differential probe to the HEAC± differential signal probe point on the HEAC-TPA main board.
7. Connect the CEC or CDC Controller to CEC/CDC Control Port of the HEAC-TPA main board.
8. If you are testing a Sink DUT, set the HEAC-TPA main board to enable the Sink DUT test. Set switch S7 position to the left (Off) on the HEAC-TPA main board.

   If you are testing a Source DUT, set the HEAC-TPA main board to enable the Source DUT test. Activate +4 V bias by using the +5 V power from the Source DUT. Set switch S7 to the right (On position) on the HEAC-TPA main fixture.
9. Activate the HEC transmission on the HEAC Source/Sink DUT using the CEC/CDC controller.

Configure and Run a Differential Receiver Test

To configure and run a differential receiver test, do the following:

1. In the Select panel click **Configure**.
2. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.

Table 48: General parameters for receiver tests

Parameter	Description
Real time scope	Select the oscilloscope to which to connect.
Signal Source	Select the signal source for the test.
DUT signal connected to real time scope at	Select the oscilloscope channel to which the DUT signal is connected.
AWG Marker signal connected to real time scope at	Select the oscilloscope channel to which the AWG marker signal is connected.
Minimum signal threshold (mV)	Specify the minimum signal threshold value in mV.
Number of retries for DUT response	Specify the number of retries if there is no response from the DUT.
Synthesis patterns every time	Specify whether to synthesize patterns every time the DUT address changes.

Configure and Run the Nominal Response Test

Before you perform the Differential Receiver test, check whether the receiver is responding to a nominal level of the signal without any impairment to it. Nominal response ensures that the receiver is responding to the packet sent by the AWG signal . This is required to ensure that the receiver is working properly at nominal signal levels.

1. In the Select panel, highlight the test and click **Configure**.
2. In the User Defined Mode, the parameters for ARP and ARP + Ping:Nominal are defined as in the following table. It is recommended that you do not change these values.

NOTE. *The Compliance Mode is not available for the Nominal Response test.*

Table 49: Acquisition parameters for the nominal response test

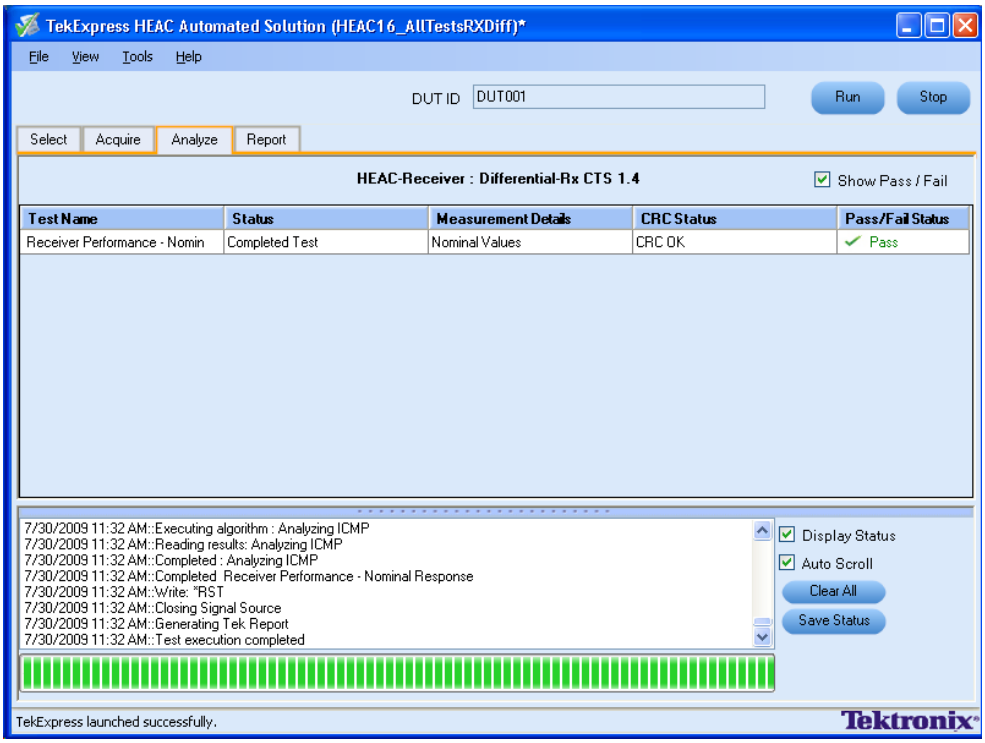
Parameter	Default
Differential Mode Amplitude	0.4
Common Mode Amplitude	0.4
Clock Frequency (MHz)	125

NOTE. *The Analyze and Limits tabs have no configurable parameters.*

3. Click **Comments** to enter comments. The comments are shown in the test report.
4. Click **Apply** to effect the changes, and then click **Close**.
5. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.

View Analysis for Nominal Response Test

Click **Analyze** to view the analysis of the nominal response test.



Configure and Run the Receiver Performance Amplitude Test

To configure and run the receiver performance amplitude test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. In the Compliance Mode, the acquisition parameters for ARP, ARP + Ping: Amplitude High, and ARP + Ping: Amplitude Low are defined as follows:

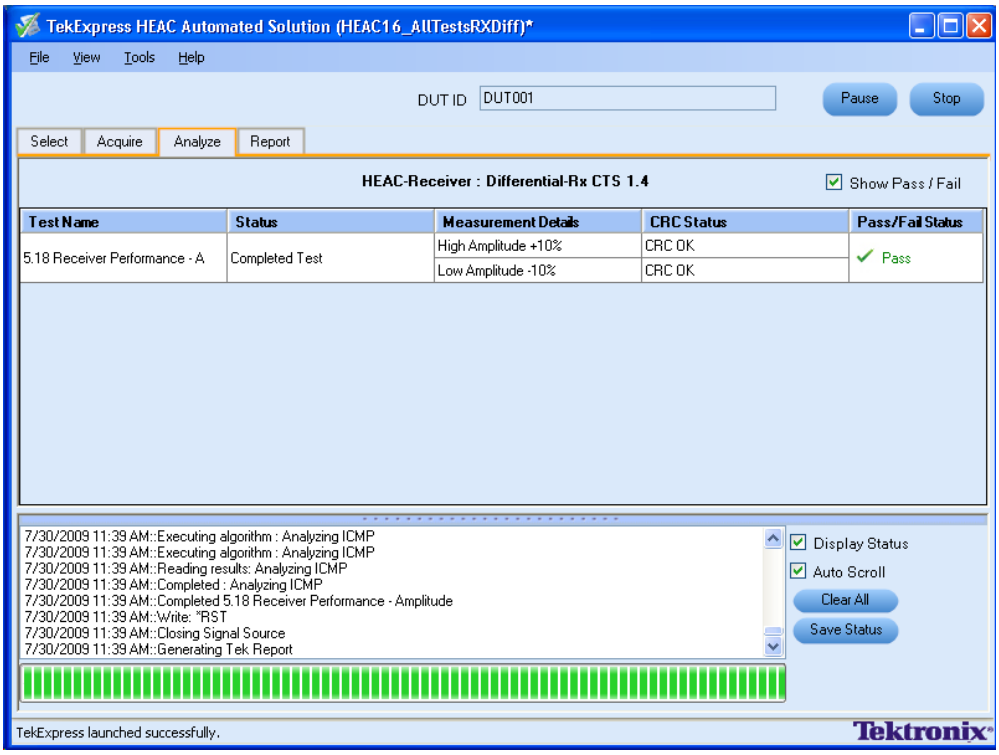
Table 50: Acquisition parameters for the receiver performance amplitude test

Parameter	Default
Differential Mode Amplitude	0.4
Common Mode Amplitude	0.4
Clock Frequency (MHz)	125

3. Click **Analyze**. Configure the +/– Amplitude Variation (%) parameter.
4. Click **Limits** to view the parameter values and the compare string.
5. Click **Comments** to enter comments. The comments are shown in the test report.
6. Click **Apply** to effect the changes, and then click **Close**.
7. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.

View Analysis for Receiver Performance Amplitude Test

Click **Analyze** to view the analysis of the receiver performance amplitude test.



Configure and Run the Receiver Performance Clock Frequency Test

To configure and run the receiver performance clock frequency test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. In the Compliance Mode, the parameters for ARP, ARP + Ping: Clock Frequency High, and ARP + Ping: Clock Frequency Low are defined as follows:

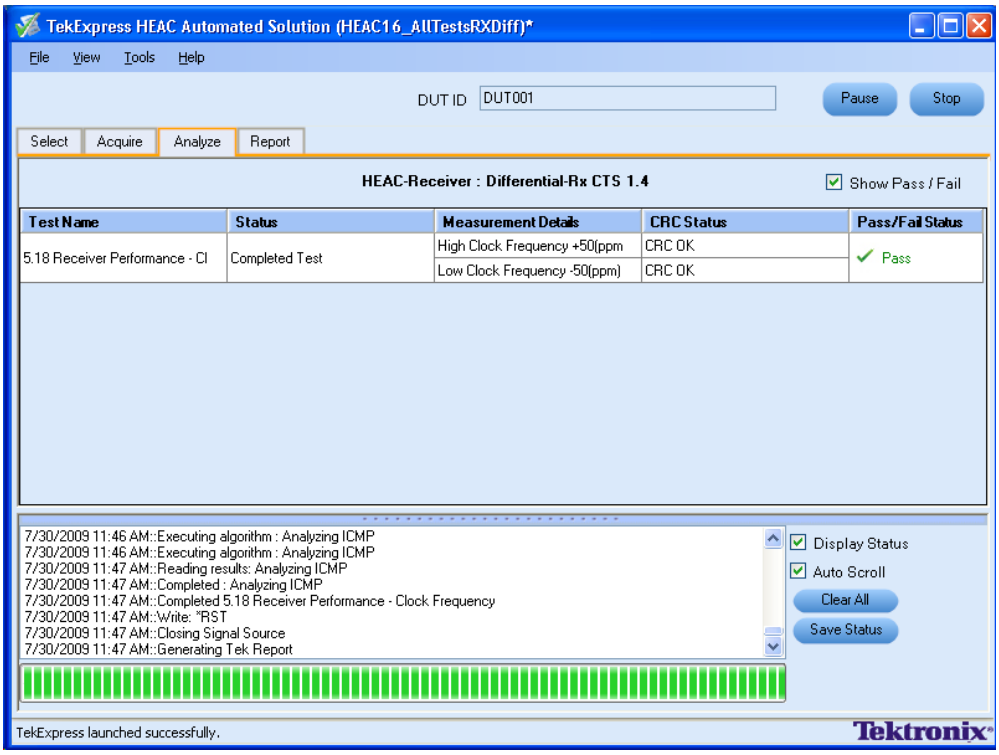
Table 51: Acquisition parameters for the receiver performance clock frequency test

Parameter	Default
Differential Mode Amplitude	0.4
Common Mode Amplitude	0.4
Clock Frequency (MHz)	125

3. Click **Analyze**. Configure the +/– Clock Frequency Variation (%) parameter.
4. Click **Limits** to view the parameter values and the compare string.
5. Click **Comments** to enter comments. The comments are shown in the test report.
6. Click **Apply** to effect the changes, and then click **Close**.
7. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.

View Analysis for Receiver Performance Clock Frequency Test

Click **Analyze** to view the analysis of the receiver performance clock frequency test.



Configure and Run the Receiver Performance Common Mode Test

To configure and run the receiver performance common mode test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. In the Compliance Mode, the parameters for ARP and ARP + Ping: Common Mode (high) are defined as follows:

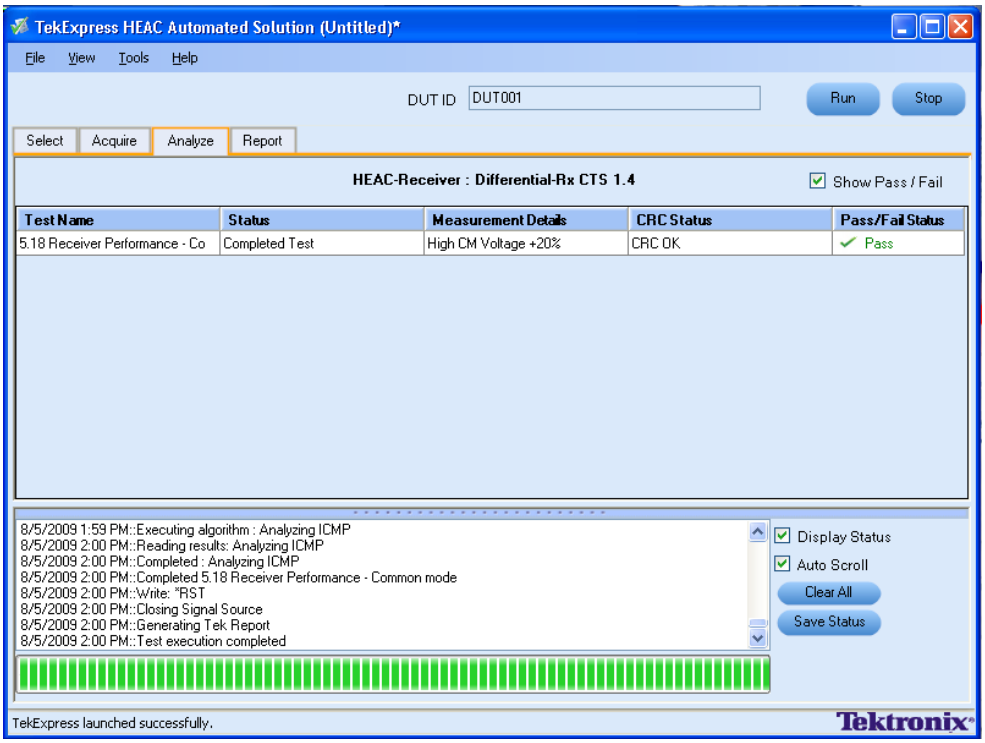
Table 52: Acquisition parameters for the receiver performance common mode test

Parameter	Default
Differential Mode Amplitude	0.4
Common Mode Amplitude	0.4
Clock Frequency (MHz)	125

3. Click **Analyze**. Configure the + Common Mode Variation (%) parameter.
4. Click **Limits** to view the parameter values and the compare string.
5. Click **Comments** to enter comments. The comments are shown in the test report.
6. Click **Apply** to effect the changes, and then click **Close**.
7. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.

View Analysis for Receiver Performance Common Mode Test

Click **Analyze** to view the analysis of the receiver performance common mode test.



Configure and Run the Receiver Performance Signal Source Impedance Test

To configure and run the receiver performance signal source impedance test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. In the Compliance Mode, the parameters for ARP, ARP + Ping: Impedance High, and ARP + Ping: Impedance Low are defined as follows:

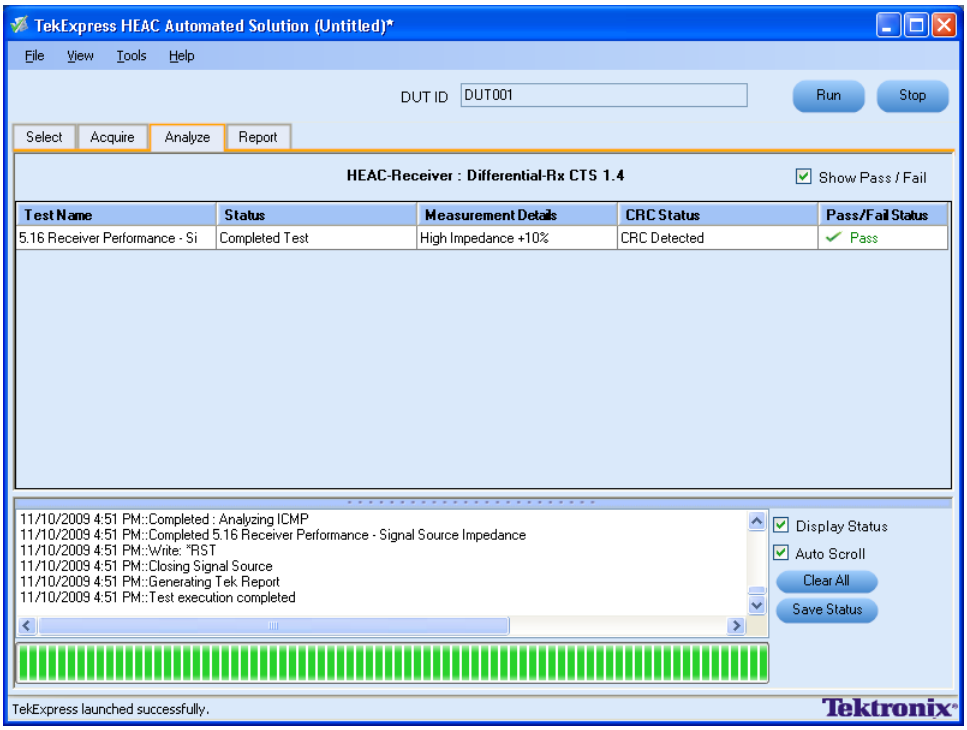
Table 53: Acquisition parameters for the receiver performance signal source impedance test

Parameter	Default
Differential Mode Amplitude	0.4
Common Mode Amplitude	0.4
Clock Frequency (MHz)	125

3. Click **Analyze**. Configure the Impedance Variation (%) parameter.
4. Click **Limits** to view the parameter values and the compare string.
5. Click **Comments** to enter comments. The comments are shown in the test report.
6. Click **Apply** to effect the changes, and then click **Close**.
7. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.

View Analysis for Receiver Performance Signal Source Impedance Test

Click **Analyze** to view the analysis of the receiver performance common mode.



Configure and Run the Receiver Performance Worst Case Cable Test

To configure and run the receiver performance worst case cable test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. In the Compliance Mode, the parameters for ARP and ARP + Ping: Worst Case Cable are defined as follows:

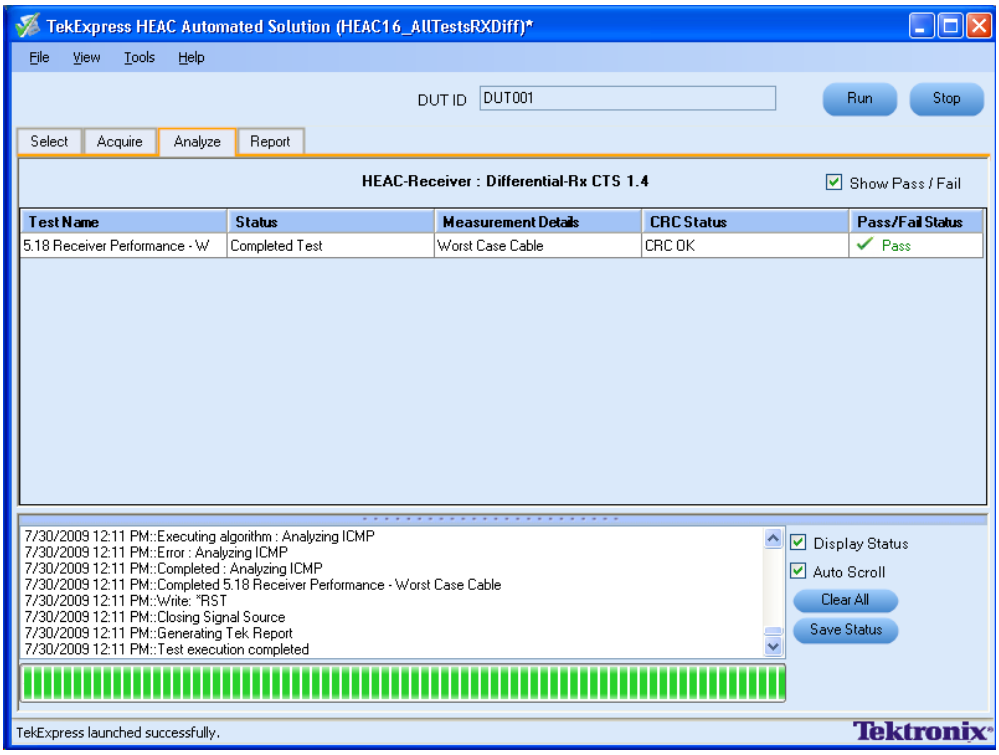
Table 54: Acquisition parameters for the receiver performance common mode test

Parameter	Default
Differential Mode Amplitude	0.4
Common Mode Amplitude	0.4
Clock Frequency (MHz)	125

3. Click **Analyze**. Change the Worst case cable filter file, if required.
4. Click **Limits** to view the parameter values and the compare string.
5. Click **Comments** to enter comments. The comments are shown in the test report.
6. Click **Apply** to effect the changes, and then click **Close**.
7. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.

View Analysis for Receiver Performance Worst Case Cable Test

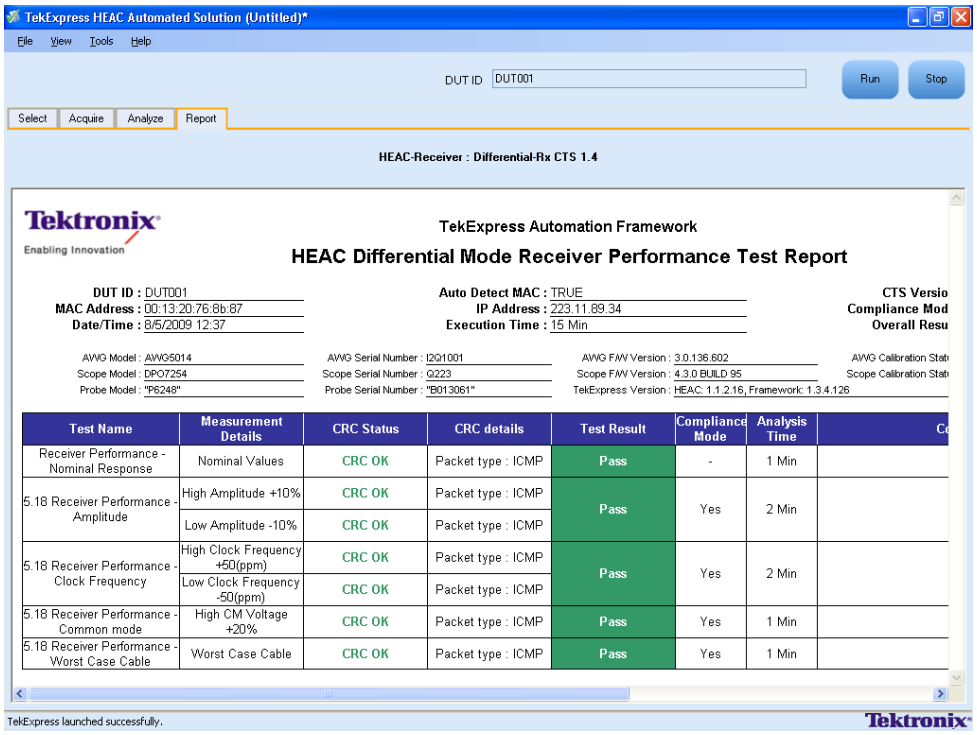
Click **Analyze** to view the analysis of the receiver performance common mode.



View Results for a Differential Mode Receiver Test

You can view the results in the Analyze panel. A table shows the test name, status of the test, measurement details, CRC status, and the pass/fail status. The application also automatically displays a report in the Report panel once the test is successfully completed. Save this report as an MHT file using the **File > Save As** option.

The following screen shows the results for differential mode receiver tests.



Select a Common Mode Receiver Test

In TekExpress, the Select panel allows you to select, configure and run the common mode receiver tests.

1. Launch TekExpress HEAC.
2. Select the device as **HEAC-Receiver**.
3. Select the test suite as **Common Mode-Rx** and the version is CTS 1.4.
4. Enter the DUT ID in the field provided.
5. Select a test from the table: **Receiver Performance-Nominal Response, Receiver Performance-Differential Signal Disturbance, Receiver Performance-Jitter Tolerance, Receiver Performance-Maximum Input, Receiver Performance-Minimum Input,** and **Operating DC Voltage**.

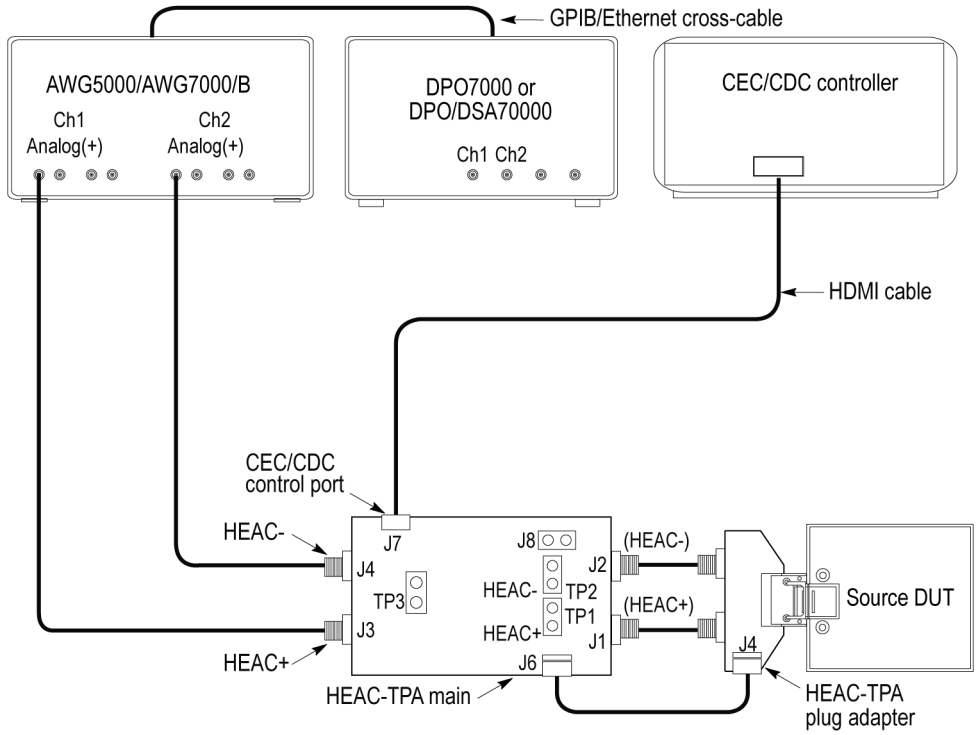
NOTE. *All common mode receiver tests are selected by default. To select a particular test, click Deselect All, and select the required test from the table.*

Make Connections for a Common Mode Receiver Test

You will need the following equipment to perform a common mode receiver test:

Resource	Model supported
Real-time oscilloscope	Tektronix DPO7000 Series, DPO70000 Series, DPO70000B Series, DSA70000 Series, DSA70000B Series, and MSO70000 Series Digital and Mixed Signal Oscilloscopes
Arbitrary waveform generator	Tektronix AWG5000 Series, AWG5000B Series, AWG7000 Series, or AWG7000B Series Arbitrary Waveform Generator
HEAC TPA-P adapter	Tektronix HEAC-TPA-P
Test fixture	TF-HEAC-TPA-P (A/C) or TF-HEAC-TPA-KIT, TF-HDMID-TPA-KIT
DUT	An HEAC source device
SMA Cables	Tektronix part number 174-1428-00 (1.5 meter) Tektronix part number 174-1341-00 (1 meter)
HDMI Cable	Any

Connect the equipment as shown in the following diagram:



NOTE. *To view the equipment setup diagram, click the* ***Show Schematic*** *button.*

NOTE. *This equipment setup diagram and connections are the same for all common mode receiver tests except the Operating DC Voltage test.*

1. Connect the HEAC-TPA plug board to the HEAC connector on the Source DUT.
2. Connect the CEC or CDC Controller to the CEC/CDC Control Port of the HEAC-TPA main board.
3. Connect the Ch1 Analog(+) output from a waveform generator to the HEAC+ SMA connector of the HEAC-TPA main board, and the Ch2 Analog(+) to the HEAC– SMA connector.
4. Set the Impedance Conversion Circuit on the HEAC-TPA main board to **50 Ω**:

See Set Up the Jumpers on the HEAC-TPA-MAIN Fixture (see page 24) and Set Up the Switches on the HEAC-TPA-MAIN Fixture (see page 23)

5. Set the HEAC-TPA main board to enable the Source DUT test.
6. Activate +4 V bias using the +5 V power from the Source DUT.
7. Activate ARC (Common mode) transmission capability for the HEAC Source DUT using the CEC/CDC controller.

Configure and Run a Common Mode Receiver Test

To configure and run a common mode receiver test, select one or more tests and do the following:

1. In the Select panel click **Configure**.

NOTE. *The nominal response test is provided (although not part of the CTS 1.4) for you to test whether your DUT is working with nominal signal levels. The Compliance Mode is not available for the Nominal Response test.*

Table 55: General parameters for common mode receiver tests

Parameter	Description
Signal Source	Select the arbitrary waveform generator as the signal source.
Real Time Scope	Select the oscilloscope to which to connect.
DUT High Signal connected to real time scope at	Select the oscilloscope channel to which the DUT High signal is connected.
DUT Low Signal connected to real time scope at	Select the oscilloscope channel to which the DUT Low signal is connected.

NOTE. *The Analyze and Limits tabs have no configurable parameters.*

2. Click **Comments** to enter comments. The comments are shown in the test report.
3. Click **Apply** to effect the changes, and then click **Close**.
4. In the Select panel, click **Run** to start the test. This loads the pattern file(s) for the test. As each test executes, you are prompted to verify the audio response from the DUT. If you detect the audio response, click **Detected**. If you do not detect the audio response, click **Not Detected**. The Acquire panel shows the progress and status of the test as it runs.

   If you select **Detected**, the Analyze panel is updated with the audio tone as detected and the test is reported as Pass.

   If you select **Not Detected**, the Analyze panel is updated with the audio tone as not detected and the test is reported as Fail.
5. After the selected tests are executed, a report is generated and displayed in the Report panel.

Configure and Run the Receiver Performance Nominal Response Test

To configure and run the receiver performance nominal response test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. In the User Defined Mode, the parameters are defined for the Audio Pattern in the following table. It is recommended that you do not change these values.

Table 56: Acquisition parameters for the receiver performance nominal response test

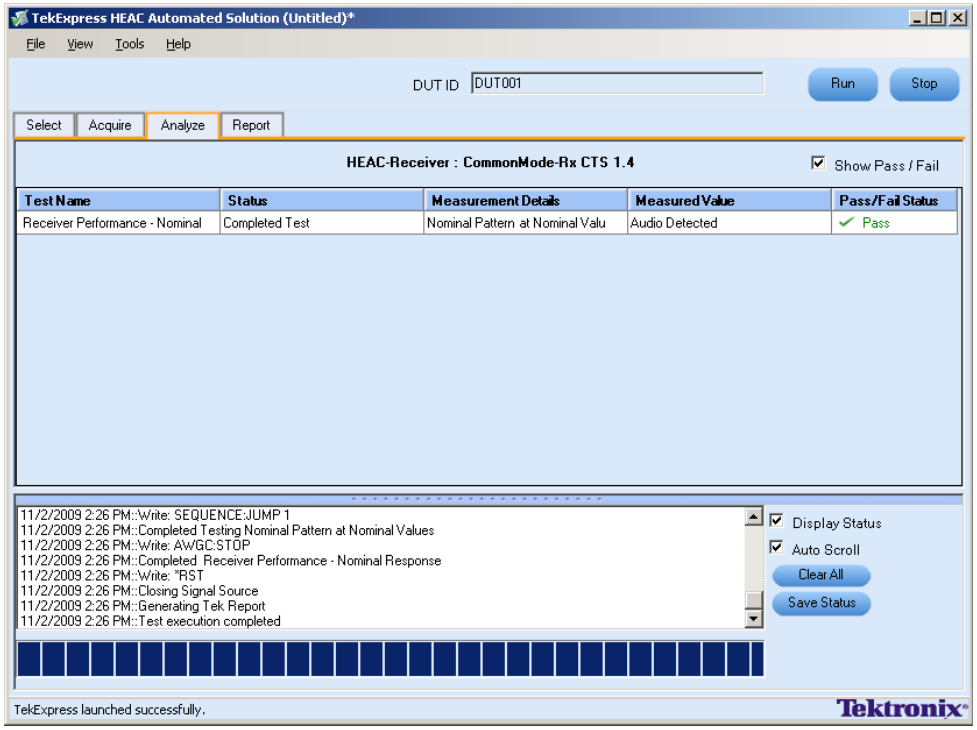
Parameter	Compliance mode	Permitted user defined mode values
AWG File Name	C:\HEAC Patterns\Audio\Nominal Response.awg	Do not change
AWG Index for NULL Pattern	1	Do not change
AWG Index for Nominal Pattern	2	Do not change

NOTE. *The Analyze and Limits tabs have no configurable parameters.*

3. Click **Comments** to enter comments. The comments are shown in the test report.
4. Click **Apply** to effect the changes, and then click **Close**.
5. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.
6. If you detect the audio response, click **Detected**. If you do not detect the audio response, click **Not Detected**. The Acquire panel shows the progress and status of the test as it runs.

View Analysis for Receiver Performance Nominal Response Test

Click **Analyze** to view the analysis of the receiver performance nominal response test.



Configure and Run the Receiver Performance Differential Signal Disturbance Test

To configure and run the receiver performance differential signal disturbance test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. In the User Defined Mode, the parameters are defined for the Audio Pattern in the following table. It is recommended that you do not change these values.

Table 57: Acquisition parameters for the receiver performance differential signal disturbance test

Parameter	Compliance mode	Permitted user defined mode values
AWG File Name	C:\HEAC Patterns\Audio\Differential Signal Disturbance.awg	Do not change
AWG Index for NULL Pattern	1	Do not change
AWG Index for 48KHz (6.144MHz)	2	Do not change

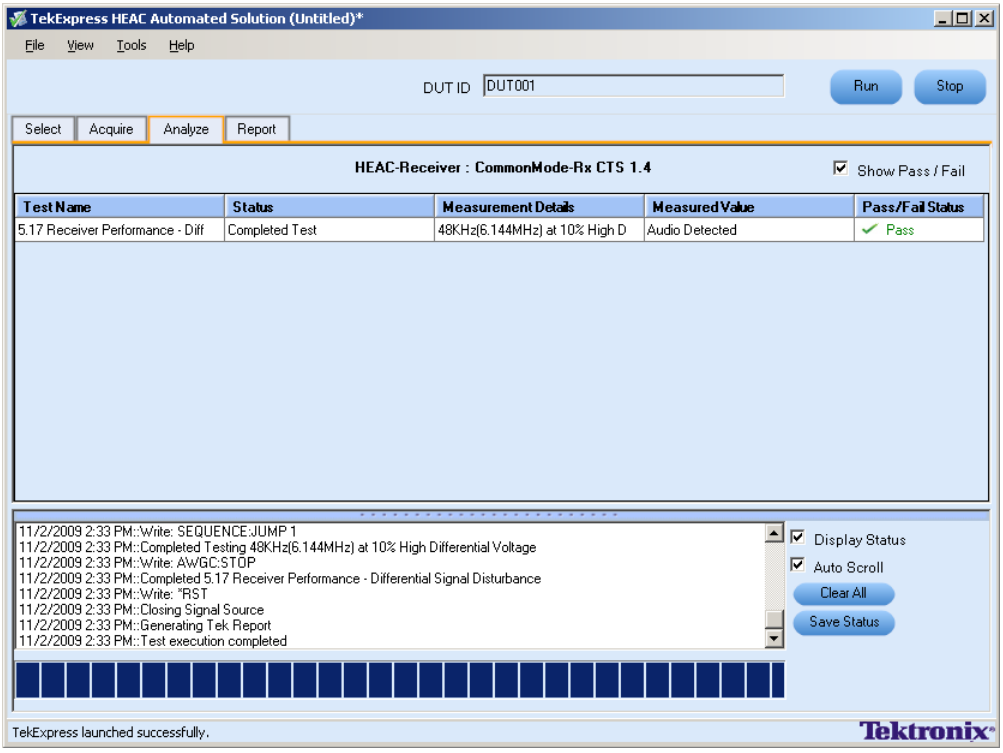
3. Click **Analyze**. Configure the Differential Signal Disturbance (%) parameter.

NOTE. *The Limits tab has no configurable parameters.*

4. Click **Comments** to enter comments. The comments are shown in the test report.
5. Click **Apply** to effect the changes, and then click **Close**.
6. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.
7. If you detect the audio response, click **Detected**. If you do not detect the audio response, click **Not Detected**. The Acquire panel shows the progress and status of the test as it runs.

View Analysis for Receiver Performance Differential Signal Disturbance Test

Click **Analyze** to view the analysis of the receiver performance differential signal disturbance test.



Configure and Run the Receiver Performance Jitter Tolerance Test

To configure and run the receiver performance jitter tolerance test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. In the User Defined Mode, the parameters are defined for the Audio Pattern in the following table. It is recommended that you do not change these values.

Table 58: Acquisition parameters for the receiver performance jitter tolerance test

Parameter	Compliance mode	Permitted user defined mode values
AWG File Name	C:\HEAC Patterns\Audio\Jitter Tolerance.awg	Do not change
AWG Index for NULL Pattern	1	Do not change
Pattern for 10UI, 5Hz@6.144MHz	Jitter5Hz10UI48k400Hz1kHz400mV_c	Do not change
Pattern for 0.25UI, 200Hz@6.144MHz	Jitter200Hz025UI48k400Hz1kHz400m	Do not change
Pattern for 0.2UI, 400kHz@6.144MHz	Jitter400kHz02UI48k400Hz1kHz400m	Do not change

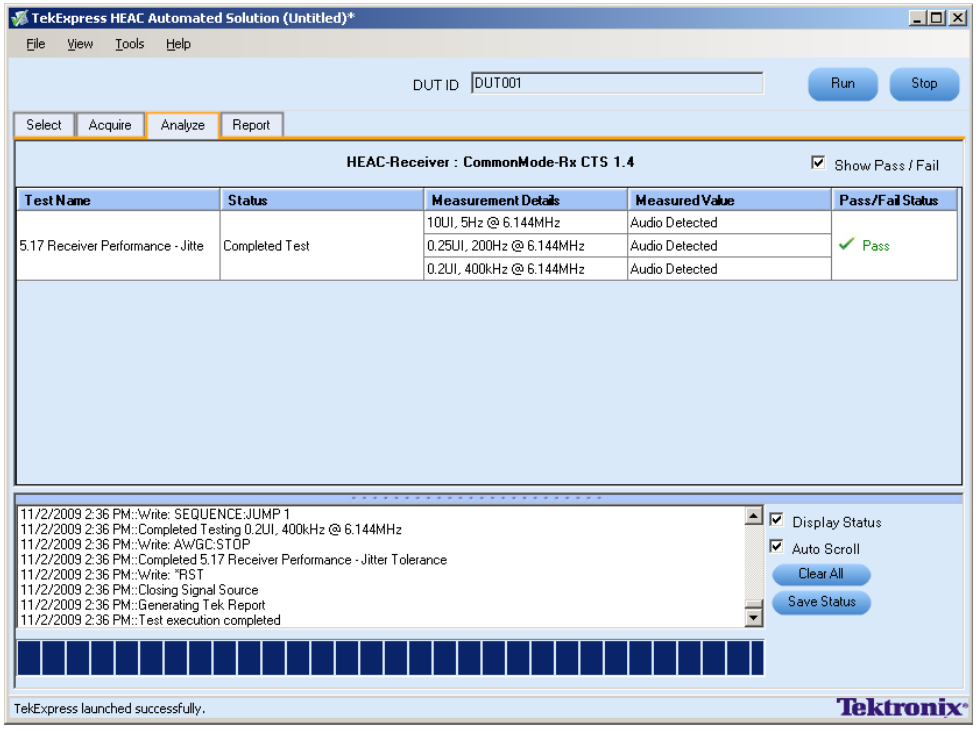
3. Click **Analyze**. Configure the 10UI, 5Hz@6.144MHz, 0.25UI, 200Hz@6.144MHz, and 0.2UI, 400kHz@6.144MHz parameters.

NOTE. *The Limits tab has no configurable parameters.*

4. Click **Comments** to enter comments. The comments are shown in the test report.
5. Click **Apply** to effect the changes, and then click **Close**.
6. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.
7. If you detect the audio response, click **Detected**. If you do not detect the audio response, click **Not Detected**. The Acquire panel shows the progress and status of the test as it runs.

View Analysis for Receiver Performance Jitter Tolerance Test

Click **Analyze** to view the analysis of the receiver performance jitter tolerance test.



Configure and Run the Receiver Performance Maximum Input Test

To configure and run the receiver performance maximum input test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. In the User Defined Mode, the parameters are defined for the Audio Pattern in the following table. It is recommended that you do not change these values.

Table 59: Acquisition parameters for the receiver performance maximum input test

Parameter	Compliance mode	Permitted user defined mode values
AWG File Name	C:\HEAC Patterns\Audio\Amplitude Deviation.awg	Do not change
AWG Index for NULL Pattern	1	Do not change
AWG Index for 10UI, 48KHz (6.144MHz)	2	Do not change

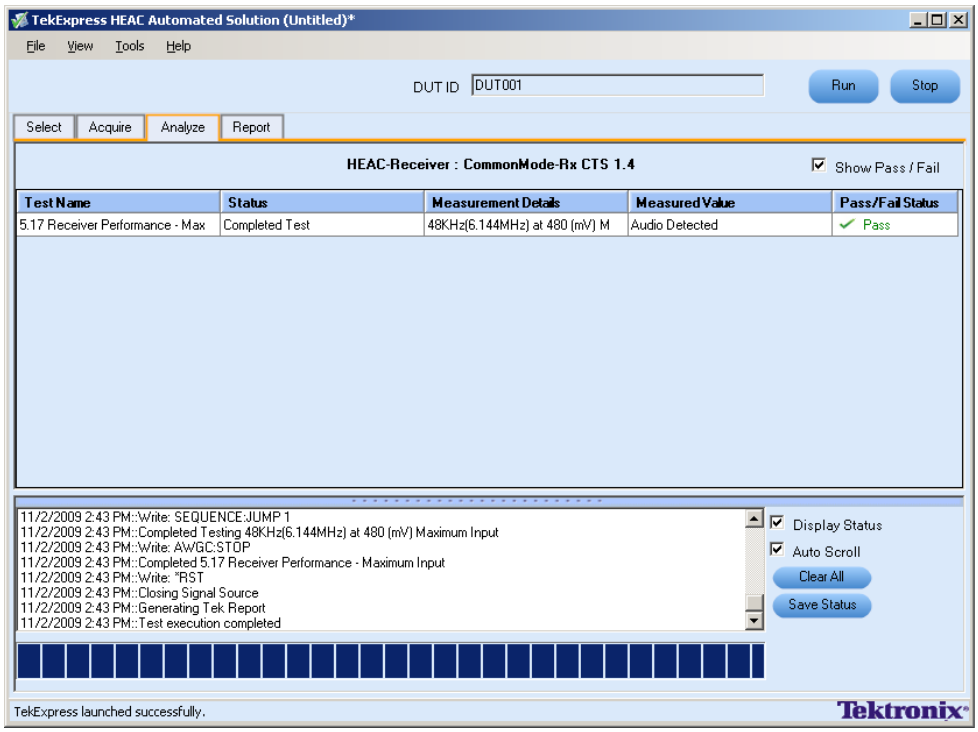
3. Click **Analyze**. Configure the Amplitude Deviation: Maximum Input (mV) parameter.

NOTE. *The Limits tab has no configurable parameters.*

4. Click **Comments** to enter comments. The comments are shown in the test report.
5. Click **Apply** to effect the changes, and then click **Close**.
6. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.
7. If you detect the audio response, click **Detected**. If you do not detect the audio response, click **Not Detected**. The Acquire panel shows the progress and status of the test as it runs.

View Analysis for Receiver Performance Maximum Input Test

Click **Analyze** to view the analysis of the receiver performance maximum input test.



Configure and Run the Receiver Performance Minimum Input Test

To configure and run the receiver performance minimum input test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. In the User Defined Mode, the parameters are defined for the Audio Pattern in the following table. It is recommended that you do not change these values.

Table 60: Acquisition parameters for the receiver performance minimum input test

Parameter	Compliance mode	Permitted user defined mode values
AWG File Name	C:\HEAC Patterns\Audio\Amplitude Deviation.awg	Do not change
AWG Index for NULL Pattern	1	Do not change
AWG Index for 10UI, 48KHz (6.144MHz)	2	Do not change

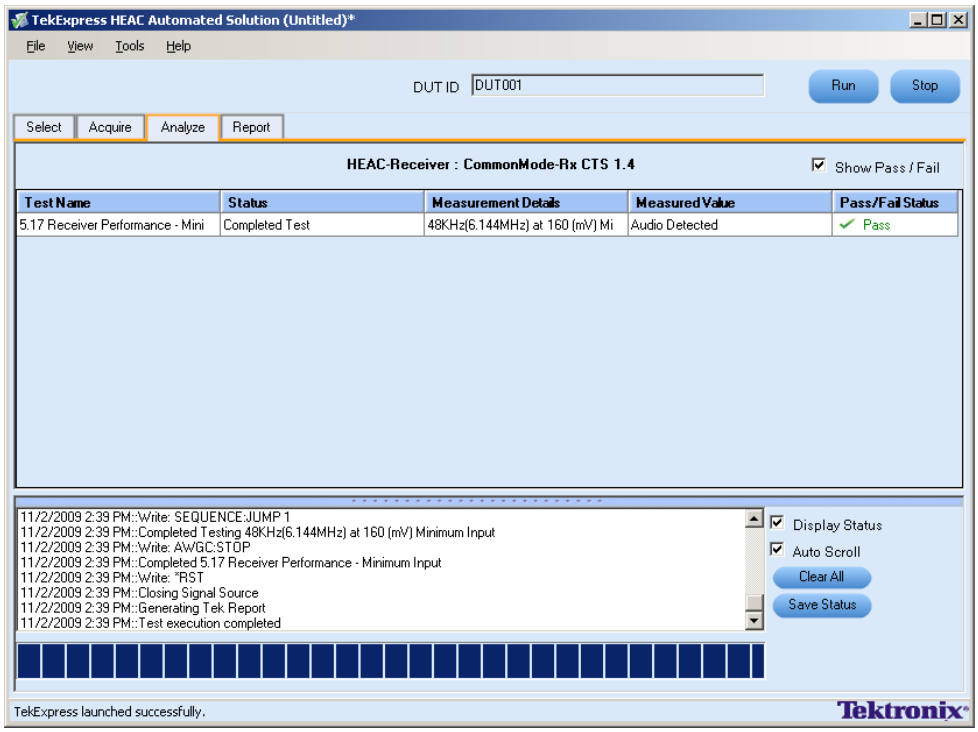
3. Click **Analyze**. Configure the Amplitude Deviation: Minimum Input (mV) parameter.

NOTE. *The Limits tab has no configurable parameters.*

4. Click **Comments** to enter comments. The comments are shown in the test report.
5. Click **Apply** to effect the changes, and then click **Close**.
6. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.
7. If you detect the audio response, click **Detected**. If you do not detect the audio response, click **Not Detected**. The Acquire panel shows the progress and status of the test as it runs.

View Analysis for Receiver Performance Minimum Input Test

Click **Analyze** to view the analysis of the receiver performance minimum input test.



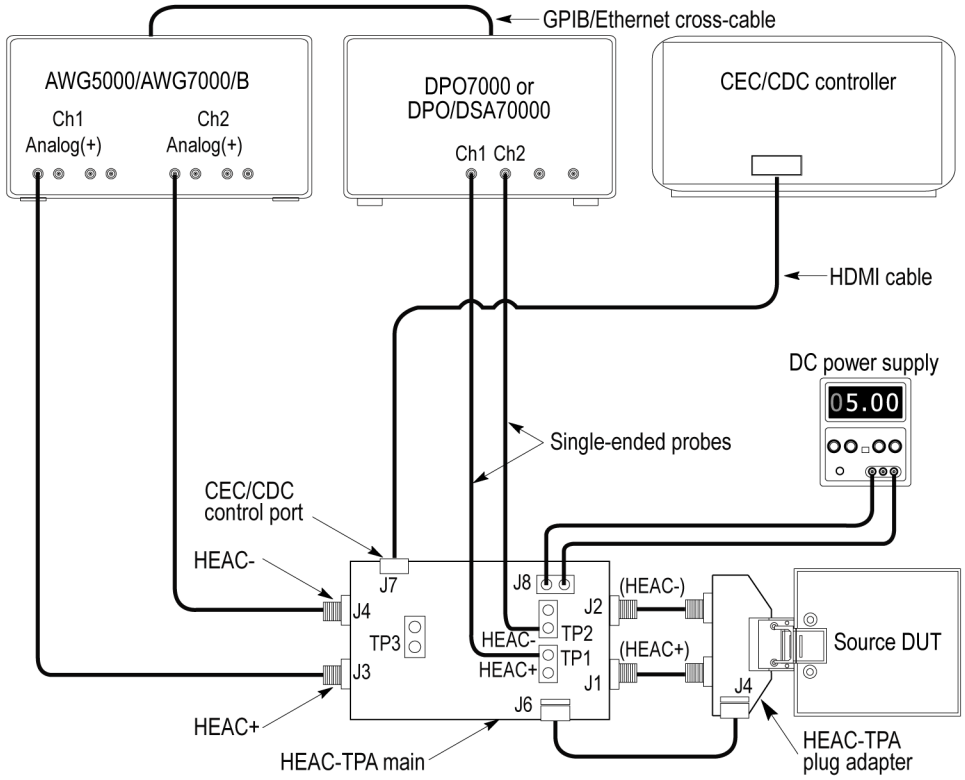
Make Connections for Common Mode Operating DC Voltage Test

You will need the following equipment to perform the common mode Operating DC Voltage receiver test:

Resource	Model supported
Real-time oscilloscope	Tektronix DPO7000 Series, DPO70000 Series, DPO70000B Series, DSA70000 Series, DSA70000B Series, and MSO70000 Series Digital and Mixed Signal Oscilloscopes
Arbitrary waveform generator	Tektronix AWG5000 Series, AWG5000B Series, AWG7000 Series, and AWG7000B Series Arbitrary Waveform Generator
Probe	Tektronix P6243 or P6245 for Tektronix DPO70000 Series, DPO70000B Series, DSA70000 Series, and DSA70000B Series, and MSO7000 Series Digital and Mixed Oscilloscopes Tektronix P6243, P6245, or TAP1500 for Tektronix DPO7000 Series Digital Oscilloscopes
HEAC TPA-P adapter	Tektronix HEAC-TPA-P

Resource	Model supported
Test fixture	TF-HEAC-TPA-P (A/C) or TF-HEAC-TPA-KIT, TF-HDMID-TPA-KIT
DUT	An HEAC source device
SMA Cables	Tektronix part number 174-1428-00 (1.5 meter) Tektronix part number 174-1341-00 (1 meter)
HDMI Cable	HDMI cable with HEAC capability

Connect the equipment as shown in the following diagram:



1. Connect the HEAC-TPA plug board to the HEAC connector on the Source DUT.
2. Connect the CEC or CDC Controller to CEC/CDC Control Port on the HEAC-TPA main board.
3. Connect the Ch1 Analog(+) output from a waveform generator to the HEAC+ SMA connector of the HEAC-TPA main board and the Ch2 Analog(+) to the HEAC– SMA connector.
4. Set the Impedance Conversion Circuit on the HEAC-TPA main board to **50 Ω**:

See Set Up the Jumpers on the HEAC-TPA-MAIN Fixture (see page 24) and Set Up the Switches on the HEAC-TPA-MAIN Fixture (see page 23)

5. Connect a single-ended probe from Ch1 of the digital oscilloscope to the HEAC+ probe point on the HEAC-TPA main board, and a second single-ended probe from Ch2 to the HEAC– probe point.
6. Set the HEAC-TPA main board to enable the Source DUT test, and use +5 V power from the DC Power Supply. Set switch S7 to the right (On position) on the HEAC-TPA main fixture.

NOTE. *Do not use +5 V power from the Source DUT.*

7. Connect and set the DC Power Supply to supply +5 V to the HEAC-TPA main board.
8. Power on the Source DUT.
9. Activate the ARC (Common mode) transmission on the HEAC Source DUT using the CEC/CDC controller.

Configure and Run the Common Mode Operating DC Voltage Test

To configure and run the Operating DC Voltage test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. In the User Defined Mode, the parameters are defined for the DC Voltage HEAC + Line and the DC Voltage HEAC – Line in the following table. It is recommended that you do not change these values.

Table 61: Acquisition parameters for the common mode operating DC voltage test

Parameter	Compliance mode	Permitted user defined mode values
Vertical Scale (mV)	200	100, 200, 400
Vertical Position (div)	0	Do not change
Vertical Offset (V)	Auto	Auto, 2, 4, 6
Horizontal Scale (µSec)	10	5, 10, 20
Horizontal Position (%)	50	50, 70, 90
Record Length	2500000	1250000, 2500000, 5000000

NOTE. *In the User Defined Mode, during test execution the specified horizontal acquisition parameters (such as horizontal scale and record length) might not be applied exactly as specified in the configuration panel. Depending upon the oscilloscope model, the nearest possible value is applied.*

3. Click **Analyze**. Configure the following:

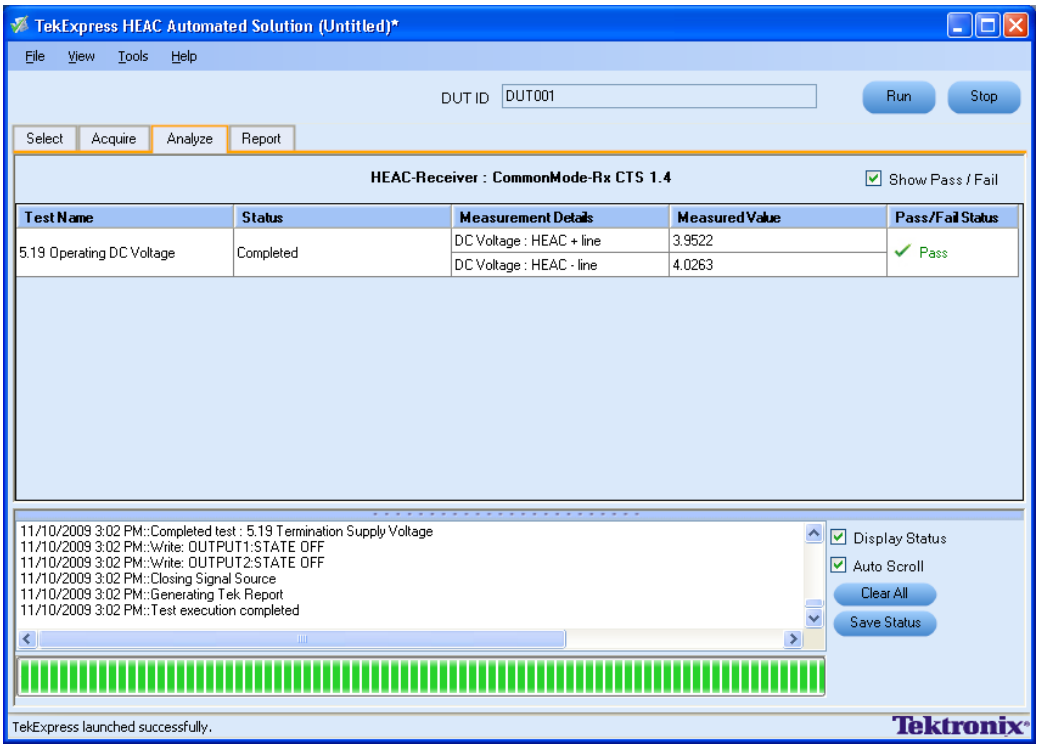
Table 62: Analysis parameters for the common mode operating DC voltage test

Parameter	Compliance mode	Permitted user defined mode values
Edge Trigger Level	4	2,4, 6
Edge Trigger Slope	Positive	Positive, Negative

4. Click **Limits**. Configure the DC Voltage HEAC + line and DC Voltage HEAC – line values and the compare string.
5. Click **Comments** to enter comments. The comments are shown in the test report.
6. Click **Apply** to effect the changes, and then click **Close**.
7. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.
8. If you detect the audio response, click **Detected**. If you do not detect the audio response, click **Not Detected**. The Acquire panel shows the progress and status of the test as it runs.

View Analysis for Common Mode Operating DC Voltage Test

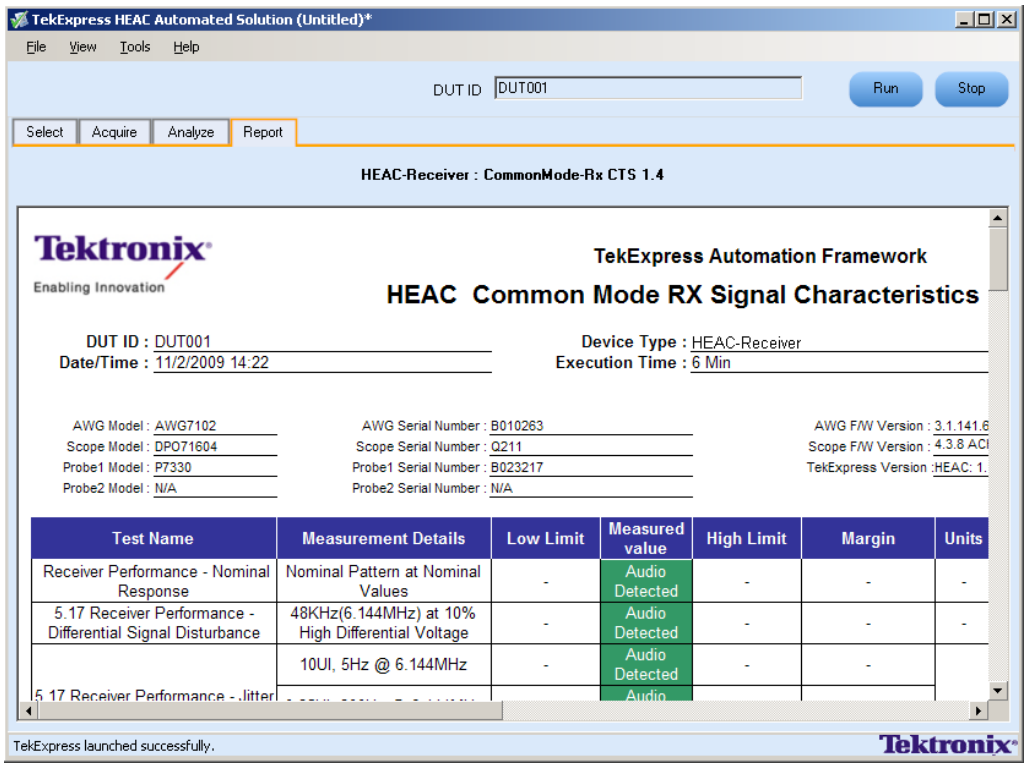
Click **Analyze** to view the analysis of the Common Mode Operating DC Voltage test.



View Results for a Common Mode Receiver Test

You can view the common mode receiver test results in the Analyze panel. A table shows the test name, audio status, measurement details, test result (pass/fail), Compliance Mode, and analysis time. The application also automatically displays a report in the Report panel once the test is successfully completed. Save this report as an MHT file using the **File > Save As** option.

The following screen shows the results for common mode receiver tests.



Select a Single Mode Receiver Test

In TekExpress, the Select panel allows you to select the receiver tests to configure and run.

1. Launch TekExpress HEAC.
2. Select the device as **HEAC-Receiver**.
3. Select the test suite as **SingleMode-Rx** and the version is CTS 1.4.
4. Enter the DUT ID in the field provided.
5. Select a test from the list: **Nominal Response, Receiver Performance-Amplitude, Receiver Performance-Jitter Tolerance,** and **Operating DC Voltage**.

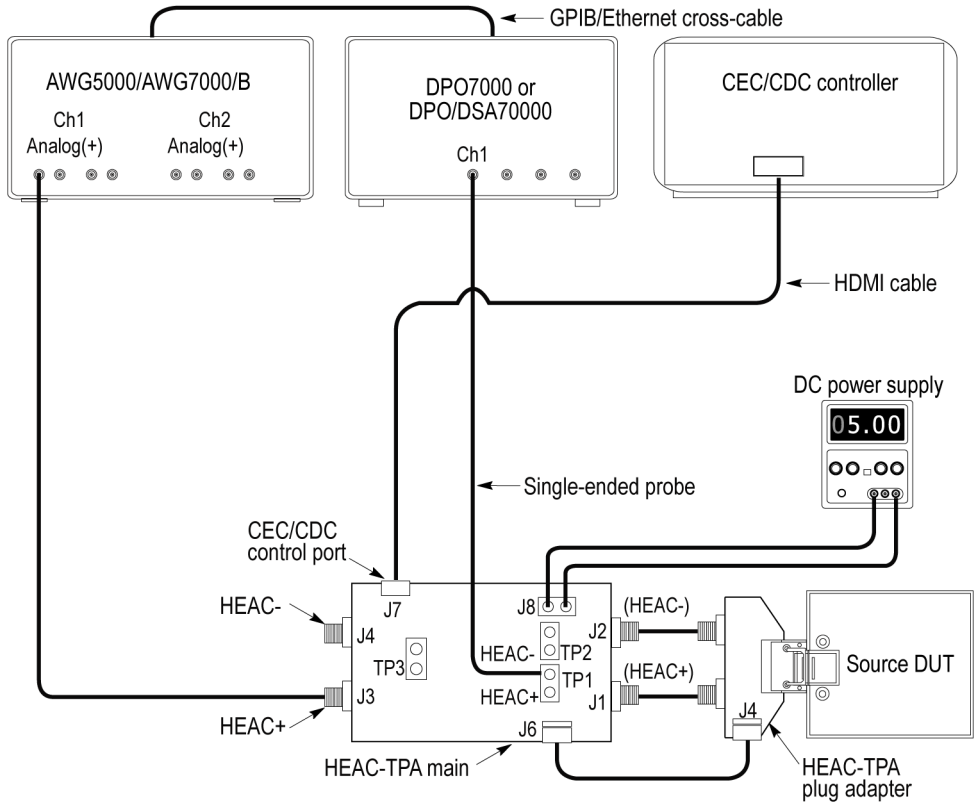
NOTE. *By default, all receiver tests are selected. To select a particular test, click Deselect All, and select the required test from the table.*

Make Connections for a Single Mode Receiver Test

You will need the following equipment to perform a single mode receiver test:

Resource	Model supported
Real-time oscilloscope	Tektronix DPO7000 Series, DPO70000 Series, DPO70000B Series, DSA70000 Series, DSA70000B Series, and MSO70000 Series Digital and Mixed Signal Oscilloscopes
Arbitrary waveform generator	Tektronix AWG5000 Series, AWG5000B Series, AWG7000 Series, and AWG7000B Series Arbitrary Waveform Generator
Probe	Tektronix P6243 or P6245 for Tektronix DPO70000 Series, DPO70000B Series, DSA70000 Series, and DSA70000B Series, and MSO7000 Series Digital and Mixed Oscilloscopes Tektronix P6243, P6245, or TAP1500 for Tektronix DPO7000 Series Digital Oscilloscopes
HEAC TPA-P adapter	Tektronix HEAC-TPA-P
Test fixture	TF-HEAC-TPA-P (A/C) or TF-HEAC-TPA-KIT, TF-HDMID-TPA-KIT
DUT	An HEAC sink or source device
SMA Cables	Tektronix part number 174-1428-00 (1.5 meter) Tektronix part number 174-1341-00 (1 meter)
HDMI Cable	HDMI cable with HEAC capability

Connect the equipment as shown in the following diagram:



1. Connect the HEAC-TPA plug board to the HEAC connector on the Source DUT.
2. Connect the CEC or CDC Controller to the CEC/CDC Control Port on the HEAC-TPA main board.
3. Connect the Ch1 Analog(+) output from a waveform generator to the HEAC+ SMA connector of the HEAC-TPA main board.
4. Set the Impedance Conversion Circuit on the HEAC-TPA main board to **55 Ω**:

   See Set Up the Jumpers on the HEAC-TPA-MAIN Fixture (see page 24) and Set Up the Switches on the HEAC-TPA-MAIN Fixture (see page 23)
5. Connect a single-ended probe from Ch1 of the digital oscilloscope to the HEAC+ probe point on the HEAC-TPA main board.
6. Set the HEAC-TPA main board to use +5 V power from the DC Power Supply and not from the Source DUT.

7. Load the waveform data on the arbitrary waveform generator and generate the waveforms.
8. Activate the ARC (Single mode) transmission on the HEAC Sink DUT using the CEC/CDC controller.

Configure and Run a Single Mode Receiver Test

To configure and run a single mode receiver test, select one or more tests and do the following:

1. In the Select panel click **Configure**.

NOTE. *The nominal response test is provided (although not part of the CTS 1.4) for you to test whether your DUT is working with nominal signal levels. The Compliance Mode is not available for the Nominal Response test.*

2. In the Configure panel, select either Compliance Mode or User Defined Mode. In the User Defined Mode, you can modify the test parameters but you will no longer be testing against the compliance standards. In the Compliance Mode, you cannot modify any of the parameters.

Table 63: General parameters for single mode receiver tests

Parameter	Description
Signal Source	Select the arbitrary waveform generator as the signal source.
Real Time Scope	Select the oscilloscope to which to connect.
DUT High Signal connected to Real Time Scope at	Select the oscilloscope channel to which the DUT High signal is connected.
Test at Vel = 0 V	Select whether to include or exclude the test at this voltage.
Test at Vel = 2.5 V	Select whether to include or exclude the test at this voltage.
Test at Vel = 5 V	Select whether to include or exclude the test at this voltage.

3. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.
4. The single mode receiver tests run at three terminal voltage levels (Vel): 0 V, 2.5 V, and 5 V. For each voltage level, the application prompts you to verify the audio response from the DUT. If you detect the audio response, click **Detected**. If you do not detect the audio response, click **Not Detected**.
5. Repeat this for different terminal voltage levels and audio patterns of various frequencies

Configure and Run the Receiver Performance Nominal Response Test

To configure and run the receiver performance nominal response test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. In the User Defined Mode, the parameters are defined for the Audio Pattern as in the following table. It is recommended that you do not change these values.

NOTE. *The Compliance Mode is not available for the Nominal Response test.*

Table 64: Acquisition parameters for the nominal response test

Parameter	Compliance mode	Permitted user defined mode values
AWG File Name	C:\HEAC Patterns\Audio\Nominal Response.awg	Do not change
AWG Index for NULL Pattern	1	Do not change
AWG Index for Nominal Pattern	2	Do not change

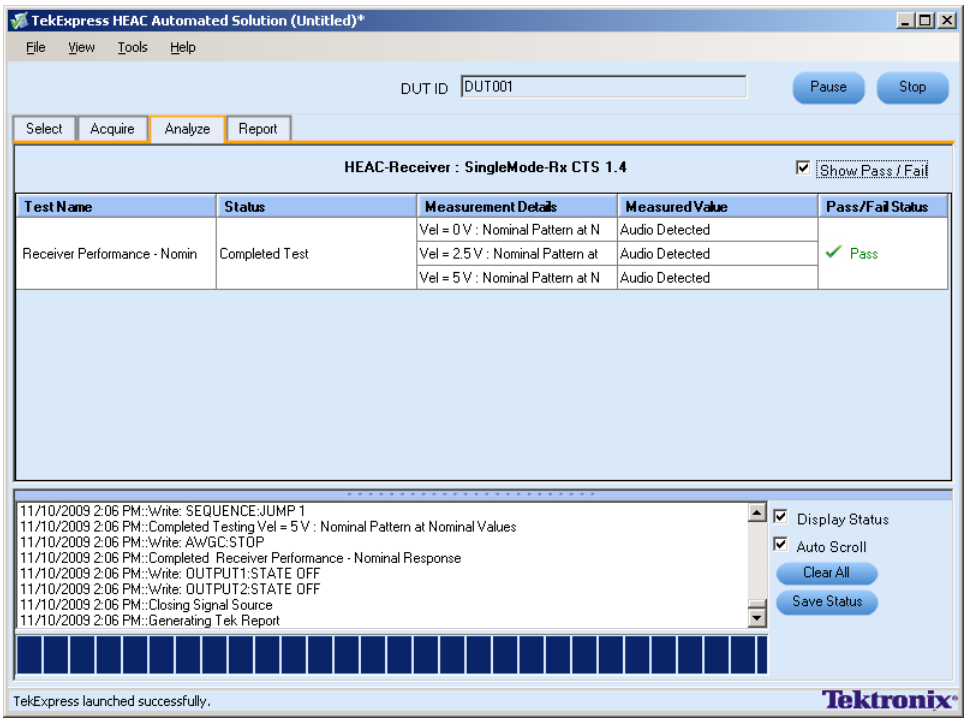
NOTE. *The Analyze and Limits tabs have no configurable parameters.*

3. Click **Comments** to enter comments. The comments are shown in the test report.
4. Click **Apply** to effect the changes, and then click **Close**.
5. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.
6. The single mode receiver tests run at three terminal voltage levels (Vel): 0 V, 2.5 V, and 5 V. For each voltage level, the application prompts you to verify the audio response from the DUT. If you detect the audio response, click **Detected**. If you do not detect the audio response, click **Not Detected**.

   Repeat this for different terminal voltage levels and audio patterns of various frequencies.

View Analysis for the Receiver Performance Nominal Response Test

Click **Analyze** to view the analysis of the nominal response test.



Configure and Run the Receiver Performance Jitter Tolerance Test

To configure and run the receiver performance jitter tolerance test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. In the User Defined Mode, the parameters for Audio Pattern are defined as in the following table. It is recommended that you do not change these values.

Table 65: Acquisition parameters for the jitter tolerance test

Parameter	Compliance mode	Permitted user defined mode values
AWG File Name	C:\HEAC Patterns\Audio\Jitter Tolerance.awg	Do not change
AWG Index for NULL Pattern	1	Do not change
Pattern for 10UI, 5Hz @ 6.144MHz	Jit-ter5Hz10UI48k400Hz1kHz400mV_c	Do not change

Table 65: Acquisition parameters for the jitter tolerance test (cont.)

Parameter	Compliance mode	Permitted user defined mode values
Pattern for 0.25UI, 200Hz @ 6.144MHz	Jit-ter200Hz025UI48k400Hz1kHz400m	Do not change
Pattern for 0.2UI, 400kHz @ 6.144MHz	Jit-ter400kHz02UI48k400Hz1kHz400m	Do not change

3. Click **Analyze**. Configure the 10UI, 5Hz @ 6.144MHz, Pattern for 0.25UI, 200Hz @ 6.144MHz, and Pattern for 0.2UI, 400kHz @ 6.144MHz parameters.

Table 66: Analysis parameters for the jitter tolerance test

Parameter	Compliance mode	Permitted user defined mode values
Pattern for 10UI, 5Hz @ 6.144MHz	Include	Include, Exclude
Pattern for 0.25UI, 200Hz @ 6.144MHz	Include	Include, Exclude
Pattern for 0.2UI, 400kHz @ 6.144MHz	Include	Include, Exclude

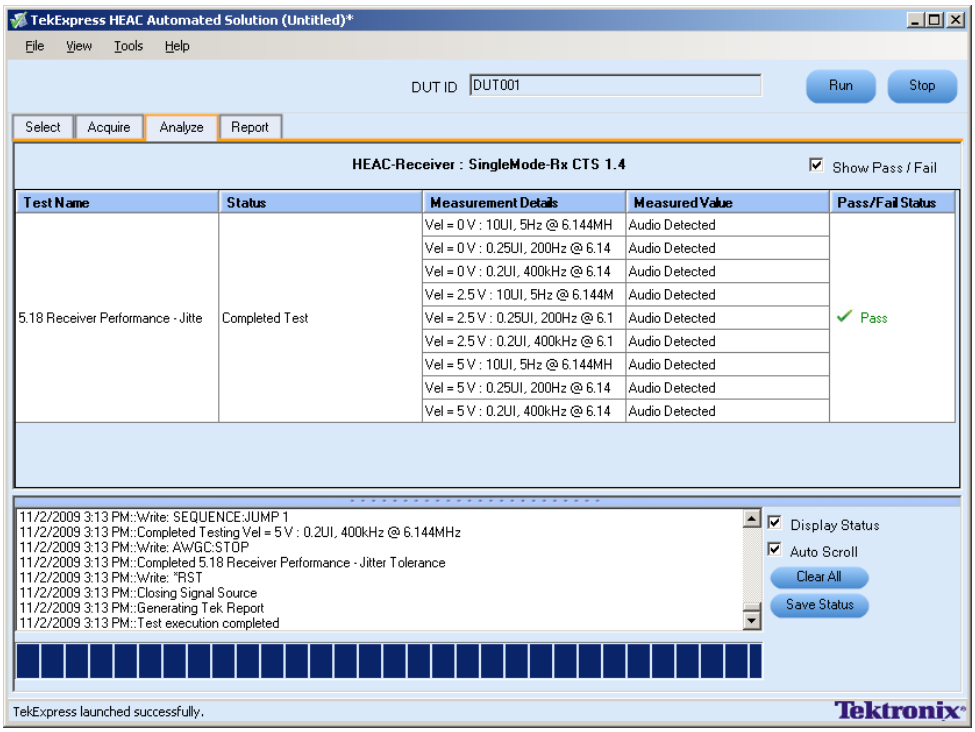
NOTE. *The Limits tab has no configurable parameters.*

4. Click **Comments** to enter comments. The comments are shown in the test report.
5. Click **Apply** to effect the changes, and then click **Close**.
6. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.
7. The single mode receiver tests run at three terminal voltage levels (Vel): 0 V, 2.5 V, and 5 V. For each voltage level, the application prompts you to verify the audio response from the DUT. If you detect the audio response, click **Detected**. If you do not detect the audio response, click **Not Detected**.

   Repeat this for different terminal voltage levels and audio patterns of various frequencies.

View Analysis for the Receiver Performance Jitter Tolerance Test

Click **Analyze** to view the analysis of the jitter tolerance test.



Configure and Run the Receiver Performance Maximum Input Test

To configure and run the receiver performance maximum input test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. In the User Defined Mode, the parameters are defined for the Audio Pattern in the following table. It is recommended that you do not change these values.

Table 67: Acquisition parameters for the receiver performance maximum input test

Parameter	Compliance mode	Permitted user defined mode values
AWG File Name	C:\HEAC Patterns\Audio\Amplitude Deviation.awg	Do not change
AWG Index for NULL Pattern	1	Do not change
AWG Index for 10UI, 48KHz (6.144MHz)	2	Do not change

3. Click **Analyze**. Configure the Amplitude Deviation: Maximum Input (mV) parameter.

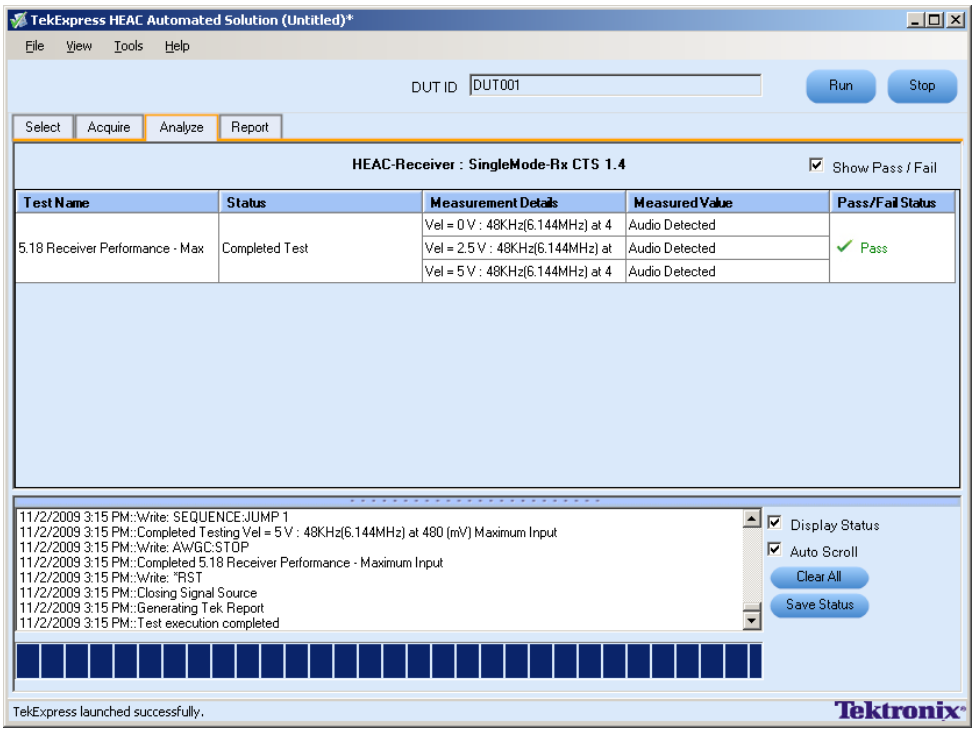
NOTE. *The Limits tab has no configurable parameters.*

4. Click **Comments** to enter comments. The comments are shown in the test report.
5. Click **Apply** to effect the changes, and then click **Close**.
6. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.
7. The single mode receiver tests run at three terminal voltage levels (Vel): 0 V, 2.5 V, and 5 V. For each voltage level, the application prompts you to verify the audio response from the DUT. If you detect the audio response, click **Detected**. If you do not detect the audio response, click **Not Detected**.

   Repeat this for different terminal voltage levels and audio patterns of various frequencies.

View Analysis for Receiver Performance Maximum Input Test

Click **Analyze** to view the analysis of the receiver performance maximum input test.



Configure and Run the Receiver Performance Minimum Input Test

To configure and run the receiver performance minimum input test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. In the User Defined Mode, the parameters are defined for the Audio Pattern in the following table. It is recommended that you do not change these values.

Table 68: Acquisition parameters for the receiver performance minimum input test

Parameter	Compliance mode	Permitted user defined mode values
AWG File Name	C:\HEAC Patterns\Audio\Amplitude Deviation.awg	Do not change
AWG Index for NULL Pattern	1	Do not change
AWG Index for 10UI, 48KHz (6.144MHz)	2	Do not change

3. Click **Analyze**. Configure the Amplitude Deviation: Minimum Input (mV) parameter.

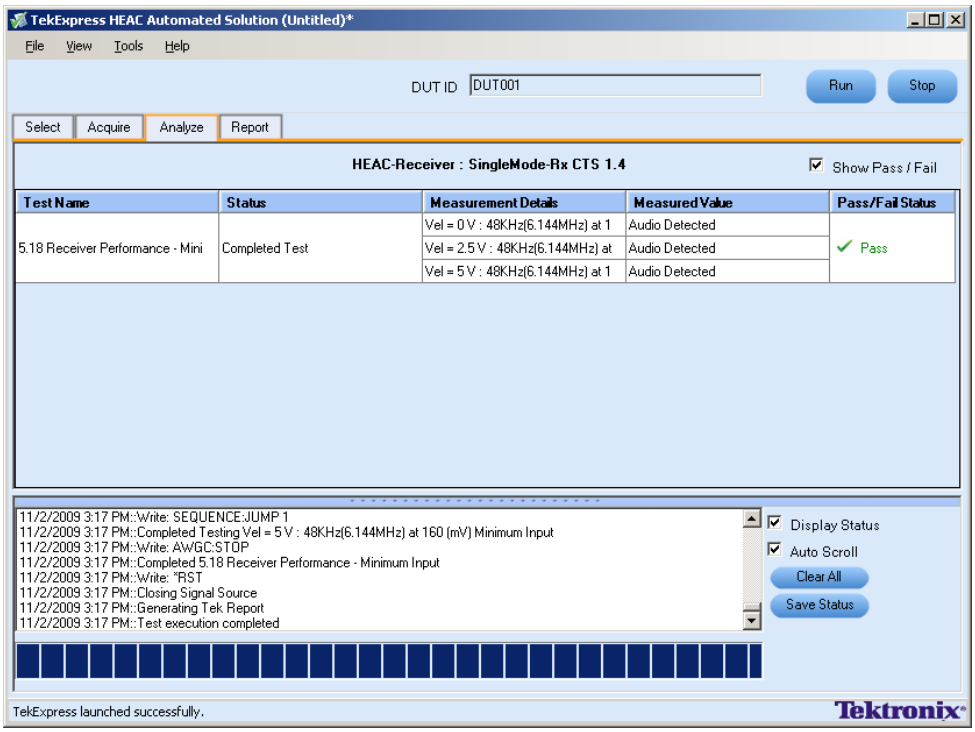
NOTE. *The Limits tab has no configurable parameters.*

4. Click **Comments** to enter comments. The comments are shown in the test report.
5. Click **Apply** to effect the changes, and then click **Close**.
6. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.
7. The single mode receiver tests run at three terminal voltage levels (Vel): 0 V, 2.5 V, and 5 V. For each voltage level, the application prompts you to verify the audio response from the DUT. If you detect the audio response, click **Detected**. If you do not detect the audio response, click **Not Detected**.

   Repeat this for different terminal voltage levels and audio patterns of various frequencies.

View Analysis for Receiver Performance Minimum Input Test

Click **Analyze** to view the analysis of the receiver performance minimum input test.



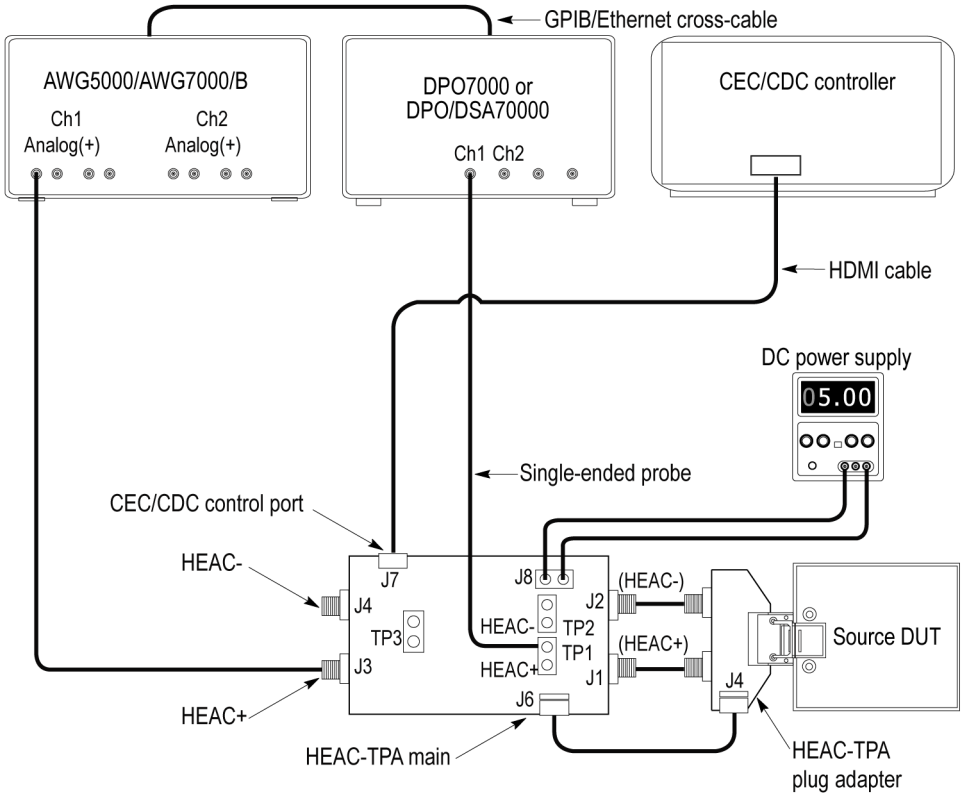
Make Connections for the Single Mode Operating DC Voltage Test

You will need the following equipment to perform a single mode receiver test:

Resource	Model supported
Real-time oscilloscope	Tektronix DPO7000 Series, DPO70000 Series, DPO70000B Series, DSA70000 Series, DSA70000B Series, and MSO70000 Series Digital and Mixed Signal Oscilloscopes
Arbitrary waveform generator	Tektronix AWG5000 Series, AWG5000B Series, AWG7000 Series, and AWG7000B Series Arbitrary Waveform Generators
Probe	Tektronix P6243 or P6245 for Tektronix DPO70000 Series, DPO70000B Series, DSA70000 Series, and DSA70000B Series, and MSO7000 Series Digital and Mixed Oscilloscopes Tektronix P6243, P6245, or TAP1500 for Tektronix DPO7000 Series Digital Oscilloscopes
HEAC TPA-P adapter	Tektronix HEAC-TPA-P

Resource	Model supported
Test fixture	TF-HEAC-TPA-P (A/C) or TF-HEAC-TPA-KIT, TF-HDMID-TPA-KIT
DUT	An HEAC source device
SMA Cables	Tektronix part number 174-1428-00 (1.5 meter) Tektronix part number 174-1341-00 (1 meter)
HDMI Cable	HDMI cable with HEAC capability

Connect the equipment as shown in the following diagram:



1. Connect the HEAC-TPA plug board to the HEAC connector on the Source DUT.
2. Connect the CEC or CDC Controller to CEC/CDC Control Port on the HEAC-TPA main board.
3. Connect the Ch1 Analog(+) output from a waveform generator to the HEAC+ SMA connector of the HEAC-TPA main board.
4. Set the Coupling and Impedance Conversion Circuit on the HEAC-TPA main board to **55 Ω**:

See Set Up the Jumpers on the HEAC-TPA-MAIN Fixture (see page 24) and Set Up the Switches on the HEAC-TPA-MAIN Fixture (see page 23)

5. Connect a single-ended probe from Ch1 of the digital oscilloscope to the HEAC+ probe point on the HEAC-TPA main board.
6. Set the HEAC-TPA main board to use +5 V power from the DC Power Supply. Set switch S7 to the right (On position) on the HEAC-TPA main fixture.

NOTE. *Do not use +5 V power from the Source DUT.*

7. Connect and set the DC Power Supply to supply +5 V to the HEAC-TPA main board.
8. Power on the Source DUT.
9. Activate the ARC (Single mode) transmission on the HEAC Source DUT using the CEC/CDC controller.
10. Load the nominal audio waveform data on the arbitrary waveform generator and generate the waveform.

Configure and Run the Single Mode Operating DC Voltage test

To configure and run the Operating DC Voltage test, do the following:

1. In the Select panel, highlight the test and click **Configure**.
2. In the User Defined Mode, the parameters for HEAC DC Voltage are defined in the following table. It is recommended that you do not change these values.

Table 69: Acquisition parameters for the single mode operating DC voltage test

Parameter	Compliance mode	Permitted user defined mode values
Vertical Scale (mV-Div)	200	100, 200, 400
Vertical Position (div)	0	Do not change
Vertical Offset (V)	Auto	Auto, 2, 4, 6
Horizontal Scale (µSec)	10	5, 10, 20
Horizontal Position (%)	50	50, 70, 90
Record Length	2500000	1250000, 2500000, 5000000

NOTE. *In the User Defined Mode, during test execution the specified horizontal acquisition parameters (such as horizontal scale and record length) might not be applied exactly as specified in the configuration panel. Depending upon the oscilloscope model, the nearest possible value is applied.*

3. Click **Analyze**.

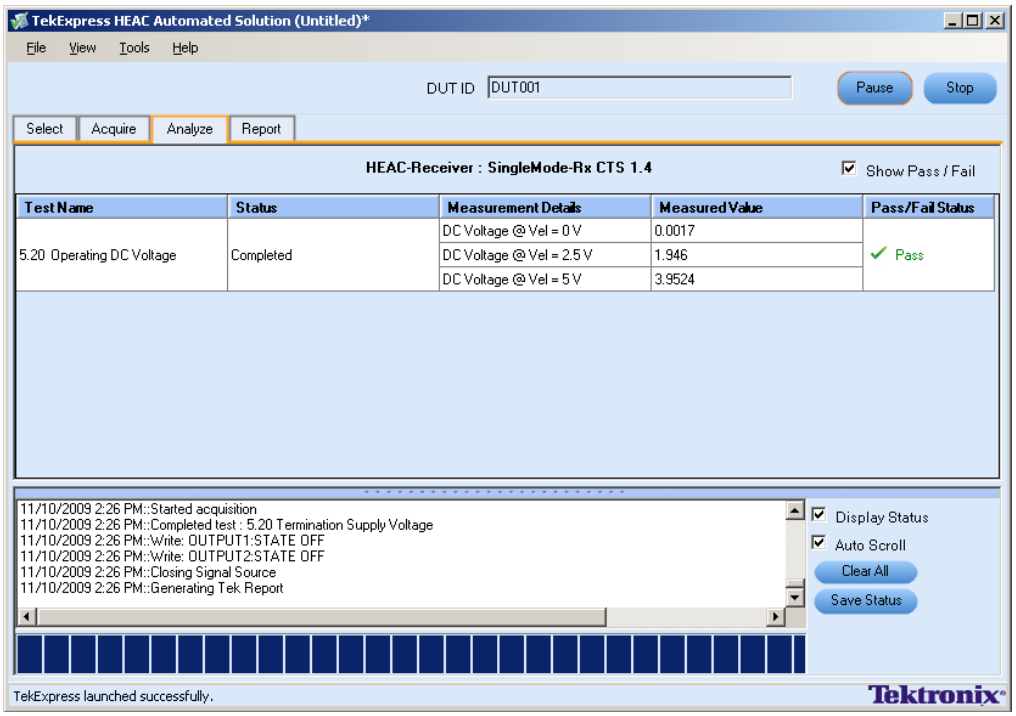
Table 70: Analysis parameters for the single mode operating DC voltage test

Parameter	Compliance mode	Permitted user defined mode values
Edge Trigger Level	4	2, 4, 6
Edge Trigger Slope	Positive	Positive, Negative

4. Click **Limits**. Configure the DC Voltage HEAC + line and DC Voltage HEAC –line values and the compare string.
5. Click **Comments** to enter comments. The comments are shown in the test report.
6. Click **Apply** to effect the changes, and then click **Close**.
7. In the Select panel, click **Run** to start the test. The Acquire panel shows the progress and status of the test as it runs.
8. The test runs at three terminal voltage levels (Vel): 0 V, 2.5 V, and 5 V. Adjust the voltage and click **OK** to proceed with the test.

View Analysis for the Single Mode Operating DC Voltage Test

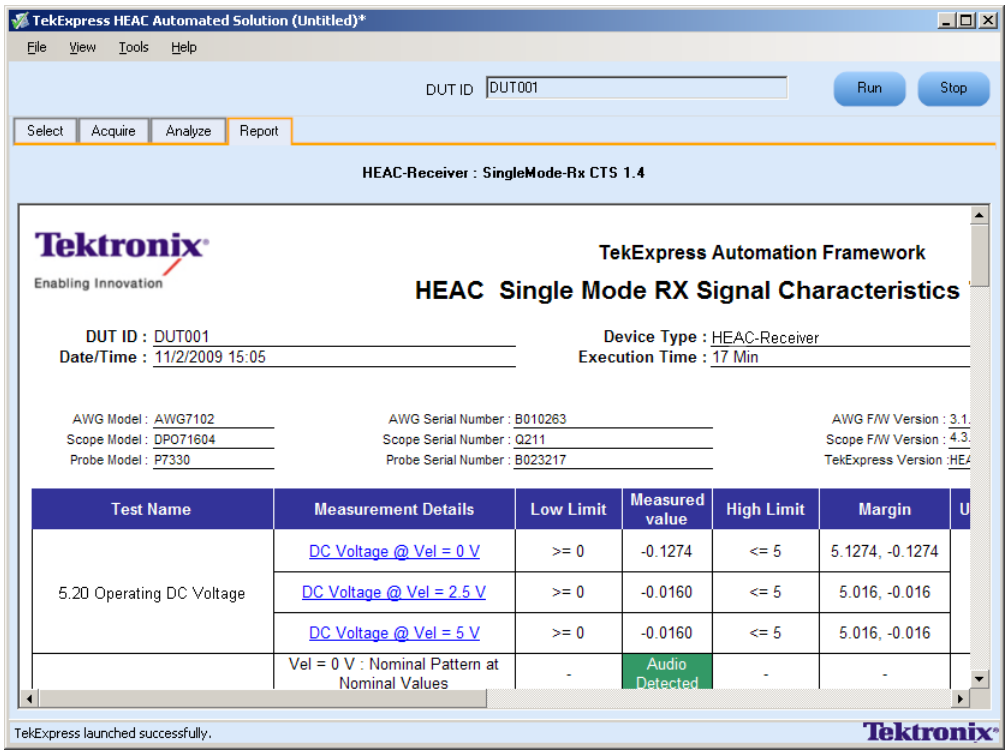
Click **Analyze** to view the analysis of the Single Mode Operating DC Voltage test.



View Results for Single Mode Receiver Tests

You can view the single mode receiver test results in the Analyze panel. A table shows the test name, audio status, measurement details, test result (pass/fail), Compliance Mode, and analysis time. The application also automatically displays a report in the Report panel once the test is successfully completed. Save this report as an MHT file using the **File > Save As** option.

The following screen shows the results for single mode receiver tests.



About the Programmatic Interface

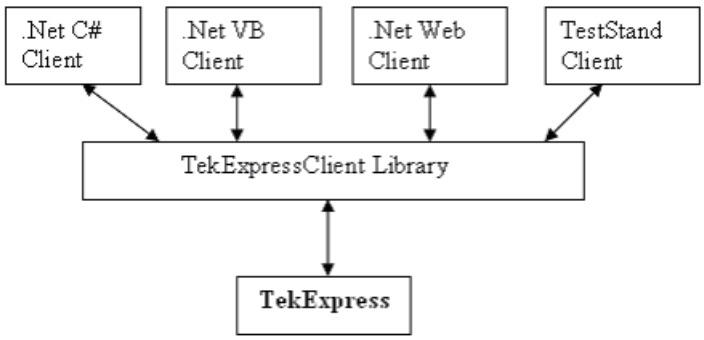
The Programmatic interface allows you to seamlessly integrate the TekExpress test automation application with the high-level automation layer. This also allows you to control the state of TekExpress application running on a local or a remote PC. Following operations can be performed using the programmatic interface exposed by TekExpress:

- (see page 146)Query DUT ID
- (see page 147)Set DUT ID
- (see page 148)SaveSession
- (see page 150)RecallSession
- (see page 151)Run the TekExpress execution
- (see page 152)Stop the TekExpress execution
- (see page 153)Query execution status
- (see page 154)Transfer result files
- (see page 156)Check the application status

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 does one need to have to develop TekExpress Client?

While developing TekExpress Client one needs to use the TekExpressClient.dll. The client can be a VB .Net, C# .Net, TestStand or web application. The examples for interfaces in each of these applications are in `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?

The following are the steps that a client needs to follow 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 needs to 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:

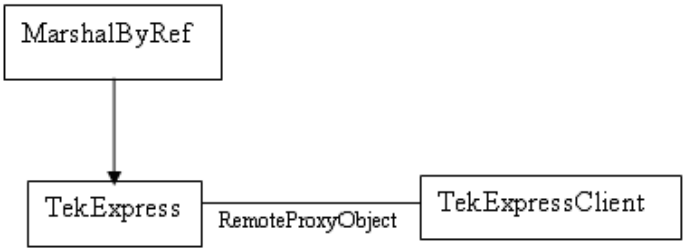
1. The client needs to provide the IP address of the PC at which the server is running to connect to the server.
2. The client needs to lock the server application to avoid conflict with any other Client that may try to control the server simultaneously. “Lock” would also disable all user controls on 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 notification 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 needs to be “unlocked” by the client.

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.

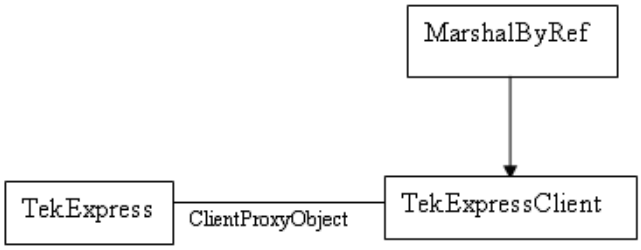
For example,

//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 Inteface");
```

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.

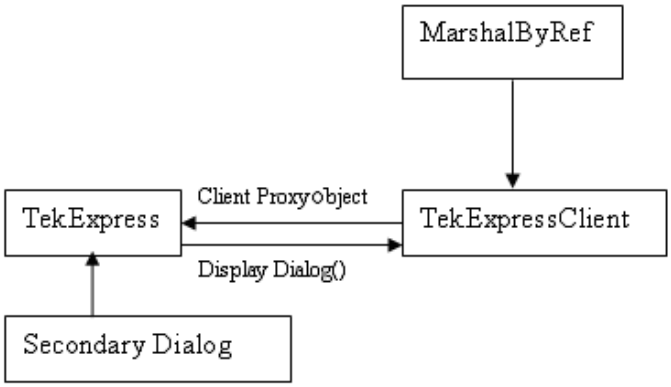
Click here to see examples.

```
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, *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
ipAdress	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.
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 occured. The return value is an object that can be a boolean value, returning 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 suggests the status of the operation after it has been performed.

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 can be 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 suggests the status of the operation after it has been performed.

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 notification 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 suggests the status of the operation after it has been performed.

Example

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

Comments

When the client is disconnected, it is automatically unlocked.

SetTimeOut()

SetTimeOut (*string* id, *string* time)

Parameters

Name	Type	Direction	Description
id	string	IN	Identifier of the client that is performing the remote function.
time	string	IN	The time in seconds which refers to the timeout period.

Return Value

String that suggests the status of the operation after it has been performed.

Example

```
if (ClientId == ClientID)
{
   if (locked == true)
   {
      tempTime = Int32.Parse(time);
   }
   if (tempTime < 0)
      return “Enter a valid Timeout Period”;
   else
   {
      timeout = tempTime;
      return “Timeout Period Changed”;
   }
}
```

Comments

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

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

GetTimeOut()

GetTimeOut (*string* id)

Parameters

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

Return Value

String that suggests the status of the operation after it has been performed.

Example

```
if (ClientId == ClientID)
{
   ResetTimer();
   return timeOut.ToString();
}
```

Comments

The timeout period is a positive integer.

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 setup.

Return Value

String that suggests the status of the operation after it has been performed.

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 suggests the status of the operation after it has been performed.

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 in a different name. Instead SaveSessionAs can be used.

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 suggests the status of the operation after it has been performed.

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 suggests the status of the operation after it has been performed.

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 is 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 suggests the status of the operation after it has been performed.

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 suggests the status of the operation after it has been performed.

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.

QueryStatus()

QueryStatus(*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 suggests the status of the operation after it has been performed.

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, *string* filePath)

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.
filePath	string	IN	The location where the report has to be saved in the client.

Return Value

String that suggests the status of the operation after it has been performed.

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`.

CheckSessionSaved()

CheckSessionSaved(*string* id, *out bool* saved)

This function is called when a check is to be made to know if the current session is saved.

Parameters

Name	Type	Direction	Description
id	string	IN	Identifier of the client that is performing the remote function.
saved	bool	OUT	Boolean which represents if the current session is saved.

Return Value

Void

Example

```
if (clientId == ClientID)
{
   returnVal = remoteObject.IsSessionSaved(id,out saved);
}
```

Comments

The saved parameter gives the boolean value suggesting if the current session is saved or not. This is used as a check in SaveSession() and SaveSessionAs() Functions.

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 can be in one of the following states at a given time:

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

ErrorCodes

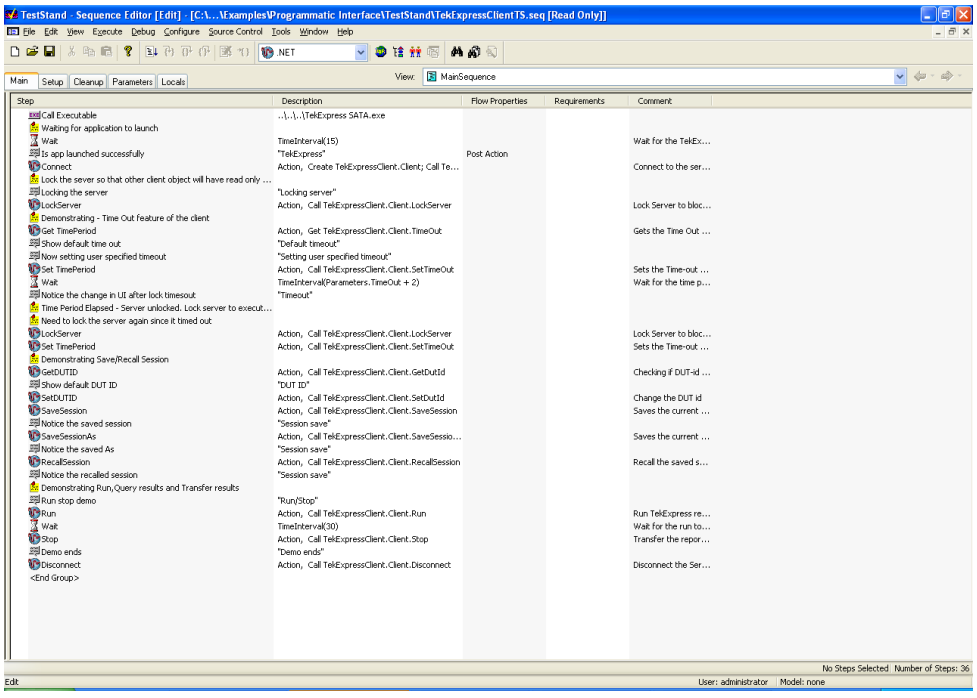
The return value of the remote automations at the server-end is OP_STATUS which is changed to a string value depending on its code and returned to the client.

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

Example

The following is an example for NI TestStand Client available in the path, `C:\Program Files\Tektronix\TekExpress\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.
- Ensure that VXI-11 Server is running on the instruments.

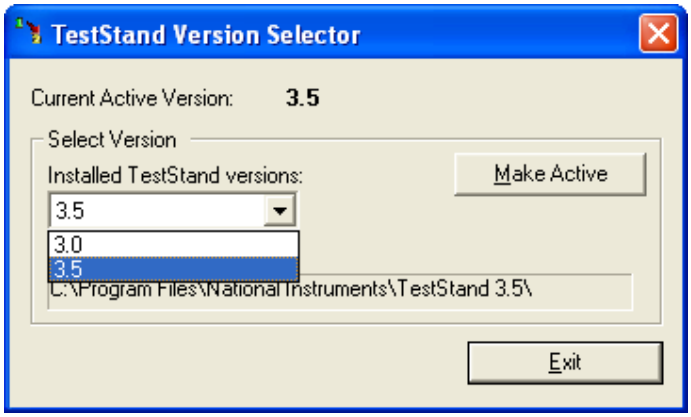
If Instrument initialization fails during test sequence execution, do the following:

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

TestStand Run Time Engine Installation

Managing multiple versions of TestStand installed on the system.

TekExpress installs TestStand version 3.5 runtime engine. If you have versions other than 3.5, while working with TekExpress, ensure that the version shipped with TekExpress is active. Do so by clicking **Start > Programs > National Instruments > TestStand 3.5 > TestStand Version Selector**.



Shortcut Keys

The following table lists the application shortcut keys:

Table 71: Keyboard shortcut keys

Menu	Shortcut keys
File	Alt + F
New Session	Ctrl + N
Open Session...	Ctrl + O
Save Session...	Ctrl + S
Save Report As...	Ctrl + R
Print Preview Report	Ctrl + V
Print Report...	Ctrl + P
Exit	Ctrl + X
View	Alt + V
Log File	Ctrl + L
Tools	Alt + T
Instrument Bench...	Ctrl + I
Help	Alt + H

Index