Keysight N8841A CAUI-4 Compliance Test Application

KEYSIGHT TECHNOLOGIES

Programmer's Reference

Notices

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In This Book

This book is your guide to programming the Keysight Technologies N8841A CAUI-4 Compliance Test Application.

- Chapter 1, “Introduction to Programming,” starting on page 7, describes compliance application programming basics.
- Chapter 2, “Configuration Variables and Values,” starting on page 9, Chapter 3, “Test Names and IDs,” starting on page 15, and Chapter 4, “Instruments,” starting on page 19, provide information specific to programming the N8841A CAUI-4 Compliance Test Application.

How to Use This Book

Programmers who are new to compliance application programming should read all of the chapters in order. Programmers who are already familiar with this may review chapters 2, 3, and 4 for changes.

Contents

1 Introduction to Programming

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This chapter introduces the basics for remote programming a compliance application. The programming commands provide the means of remote control. Basic operations that you can do remotely with a computer and a compliance app running on an oscilloscope include:

- Launching and closing the application.
- Configuring the options.
- Running tests.
- Getting results.
- Controlling when and were dialogs get displayed
- Saving and loading projects.

You can accomplish other tasks by combining these functions.

Remote Programming Toolkit

The majority of remote interface features are common across all the Keysight Technologies, Inc. family of compliance applications. Information on those features is provided in the N5452A Compliance Application Remote Programming Toolkit available for download from Keysight here: www.keysight.com/find/rpi. The N8841A CAUI-4 Compliance Test Application uses Remote Interface Revision 3.50. The help files provided with the toolkit indicate which features are supported in this version.

In the toolkit, various documents refer to "application-specific configuration variables, test information, and instrument information". These are provided in Chapters 2, 3, and 4 of this document, and are also available directly from the application's user interface when the remote interface is enabled (View>Preferences::Remote tab::Show remote interface hints). See the toolkit for more information.

2 Configuration Variables and Values

The following table contains a description of each of the N8841A CAUI-4 Compliance Test Application options that you may query or set remotely using the appropriate remote interface method. The columns contain this information:

- GUI Location – Describes which graphical user interface tab contains the control used to change the value.
- Label – Describes which graphical user interface control is used to change the value.
- Variable – The name to use with the SetConfig method.
- Values – The values to use with the SetConfig method.
- Description – The purpose or function of the variable.

For example, if the graphical user interface contains this control on the **Set Up** tab:

- Enable Advanced Features

then you would expect to see something like this in the table below:

Table 1 Example Configuration Variables and Values

GUI Location	Label	Variable	Values	Description
Set Up	Enable Advanced Features	EnableAdvanced	True, False	Enables a set of optional features.

and you would set the variable remotely using:

```
ARSL syntax
-----------
arsl -a ipaddress -c "SetConfig 'EnableAdvanced' 'True'"

C# syntax
```

```
---------
remoteAte.SetConfig("EnableAdvanced", "True");
```

Here are the actual configuration variables and values used by this application:

NOTE Some of the values presented in the table below may not be available in certain configurations. Always perform a "test run" of your remote script using the application's graphical user interface to ensure the combinations of values in your program are valid.

NOTE The file, "ConfigInfo.txt", which may be found in the same directory as this help file, contains all of the information found in the table below in a format suitable for parsing.

Table 2 Configuration Variables and Values

GUI Location	Label	Variable	Values	Description
Configure	Bandwidth	BW	(Accepts user-defined text), 50e9	Enter the scope bandwidth.
Configure	Disable Pattern Check	DisablePattern	Enable, Disable	Select "Disable" to disable the pattern verification for square 8 pattern tests and suppress pattern error pop-ups. Select "Enable" to ensure that the correct pattern is being tested as per specification.
Configure	Eye Height/Width Probability	EyeProb	1e-3, 1e-4, 1e-5, 1e-6	Select the eye probability to test to for Eye Height and Width tests. Note: selecting 1e-6 is the default as direct measure due to spec requirement. This setting does take longer. User can set to lower probability for quick results.
Configure	Host - CTLE for Eye Height A.	EHACTLE	0, 1, 2	Select the CTLE option to test Eye Height A and Eye Width.
Configure	Host - Recommended CTLE value	HostCTLE	Off, 1, 2, 3, 4, 5, 6, 7, 8, 9	Select the recommended CTLE value by the host. Note: This will be used in Eye Height B in measuring all three CTLE measurements.

Table 2 Configuration Variables and Values (continued)

GUI Location	Label	Variable	Values	Description
Configure	ISI Filter Lag	ISILag	(Accepts user-defined text), 5	When using Arbitrary mode for the Jitter Pattern Length, set the Lagging ISI filter coefficient. Go to www.agilent.com for application note 5989-4974EN to help select the correct ISI filter.
Configure	ISI Filter Lead	ISILead	(Accepts user-defined text), -2	When using Arbitrary mode for the Jitter Pattern Length, set the Leading ISI filter coefficient. Go to www.agilent.com for application note 5989-4974EN to help select the correct ISI filter.
Configure	Jitter Pattern Length	PatLength	Periodic, Arbitrary	Choose Periodic or Arbitrary. Periodic is used for data patterns that are period and repeat through the scope memory. Arbitrary is used for random data patterns that does not repeat. Set ISI filter options below as well when selecting Arbitrary.
Configure	Number of UI	NumUI	(Accepts user-defined text), 1e6	Enter in the number or UI to test. Memory depth will be set accordingly.
Configure	Rj Bandwidth	RjBandwidth	NARRow, WIDE	Choose the Rj Filter used in the jitter measurements.
Configure	Sample Rate	SR	(Accepts user-defined text), 80e9	Enter the scope sample rate.
Configure	Save Tested Waveforms	SaveWFM	No, Yes	Select Yes to save the waveform files of the tested signals. Files will be saved to directory set in Select waveform directory.
Configure	Select Waveform Directory	DirWFM	(Accepts user-defined text), C:\Temp\KRwfm	Type in a directory path to save your measured waveforms.

Table 2 Configuration Variables and Values (continued)

GUI Location	Label	Variable	Values	Description
Configure	Signal Channels	CHANPAIR	1, 2, CHANnel1, CHANnel2, CHANnel3, CHANnel4, 3, 4, WMEMory1, WMEMory2, WMEMory3, WMEMory4, FUNCtion1, FUNCtion2, FUNCtion3, FUNCtion4	Select the oscilloscope input channel pair if connected dual single-ended. Or select the channel used for differential connection. All single channel, waveform memories, or functions that contain the word "differential", must be a single probe or signal that is differential. The channel or waveform memories with two channels are for dual single-ended connections. Note: All functions must be differential.
Configure	Signaling Rate	SignalingRate	(Accepts user-defined text), 25.78125e9	Set the Signaling Rate to be tested. Enter value in the format 10.3125e9.
Configure	Start value for CTLE utility for Eye Opening	StartCTLE	1, 2, 3, 4, 5, 6, 7, 8, 9	Select the starting CTLE setting to use for the "Find optimal CTLE Eye Opening" test. The test will test the range of settings from this start value, to the stop value set in the next config.
Configure	Stop value for CTLE utility for Eye Opening	StopCTLE	1, 2, 3, 4, 5, 6, 7, 8, 9	Select the last CTLE setting to use for the "Find optimal CTLE Eye Opening" test. The test will test the range of settings from start value selected in the previous config, to the stop value set here.
Configure	Switch Matrix Scope Channels	CHANPAIR2	3, 4	This configuration variable is automatically set. This is for information purposes, to show the user which channels were selected in the setup tab.

Table 2 Configuration Variables and Values (continued)

GUI Location	Label	Variable	Values	Description
Configure	Use Optimized CTLE for Eye Opening.	UseCTLE	Off, 1, 2, 3, 4, 5, 6, 7, 8, 9	Select the optimized setting to use. Default is off. Run "Find Optimal CTLE Eye Opening" Test under "Utilities" to find the optimal setting. When the utility is run, it will automatically set the optimal setting. This value will only be automatically set if utility is run any time after app load or if project is loaded with setting. All other instances, the setting will be the default of off and will need to be manually selected. Note: This is the optimized CTLE setting, For Host Eye Height B, the app will automatically run 1dB below and 1dB above. For Host Eye Height A, select which value to measure in Host - Eye Height A CTLE.
Run Tests	Event	RunEvent	(None), Fail, Margin < N, Pass	Names of events that can be used with the StoreMode=Event or RunUntil RunEventAction options
Run Tests	RunEvent=Margin < N: Minimum required margin %	RunEvent_Margin < N_MinPercent	Any integer in range: 0 <= value <= 100	Specify N using the 'Minimum required margin %' control.
Set Up	ChanPair	ChanPairOpt	Real Edge, Channels 1 and 3, Channels 2 and 4	This option allow user to select the scope channel pair.
Set Up	Device ID	pcboOverallDeviceID	(Accepts user-defined text)	This option allow user to key in related test details.
Set Up	External Address	txtExternalInstrumentAddress	(Accepts user-defined text)	This option allows user to connect an ENA or PNA. Please select ENA or PNA in the pull down menu and press the Connect PNA/ENA button.
Set Up	LaneNumOption4Lane	LaneNumOption4Lane	Lane0, Lane1, Lane2, Lane3	This option allows user to select which lane is testing when testing Single Lane.
Set Up	PNAENA	PNAENA	PNA, ENA	This option allows user to select which device is being used to measure return loss. PNA or ENA.

Table 2 Configuration Variables and Values (continued)

GUI Location	Label	Variable	Values	Description
Set Up	Speed Grade	DeviceType	CAUI-4	This option allow user to select specific speed grade.
Set Up	Switch Option	SwitchOptionVar	Switch Matrix, Single Lane	This option allow user to select specific speed grade.
Set Up	User Comment	txtOverallUserComment	(Accepts user-defined text)	This option allow user to key in related test detail.
Set Up	User Description	pcboOverallDeviceDescription	(Accepts user-defined text)	This option allow user to key in test detail.

3 Test Names and IDs

The following table shows the mapping between each test's numeric ID and name. The numeric ID is required by various remote interface methods.

- Name – The name of the test as it appears on the user interface **Select Tests** tab.
- Test ID – The number to use with the RunTests method.
- Description – The description of the test as it appears on the user interface **Select Tests** tab.

For example, if the graphical user interface displays this tree in the **Select Tests** tab:

- All Tests
  - Rise Time
  - Fall Time

then you would expect to see something like this in the table below:

Table 3 Example Test Names and IDs

Name	Test ID	Description
Fall Time	110	Measures clock fall time.
Rise Time	100	Measures clock rise time.

and you would run these tests remotely using:

```
ARSL syntax
-----------
arsl -a ipaddress -c "SelectedTests '100,110'"
arsl -a ipaddress -c "Run"

C# syntax
---------
remoteAte.SelectedTests = new int[]{100,110};
remoteAte.Run();
```

Here are the actual Test names and IDs used by this application:

NOTE The file, "TestInfo.txt", which may be found in the same directory as this help file, contains all of the information found in the table below in a format suitable for parsing.

Table 4 Test IDs and Names

Name	TestID	Description
AC Common Mode Output Voltage Test	5103	Test the AC common mode voltage. This test can only be tested in dual single ended connection
AC Common Mode Output Voltage Test	206103	Test the AC common mode voltage. This test can only be tested in dual single ended connection. Must be DC coupled.
AC Common Mode Output Voltage Test	306103	Test the AC common mode voltage. This test can only be tested in dual single ended connection. Must be DC coupled.
Bounded Uncorrelated Jitter	5202	Bounded Uncorrelated Jitter measurement
Common-mode Output Return Loss	10001	Common-mode Output Return Loss measurement
Common-mode to Differential Output Return Loss	210003	Common-mode to Differential Output Return Loss measurement
Common-mode to Differential Output Return Loss	310003	Common-mode to Differential Output Return Loss measurement
DC Common Mode Output Voltage Test	5101	Test the DC common mode voltage. This test can only be tested in dual single ended connection
DC Common Mode Output Voltage Test	206101	Test the DC common mode voltage. This test can only be tested in dual single ended connection. Must be DC coupled.
DC Common Mode Voltage Test	306101	Test the DC common mode voltage. This test can only be tested in dual single ended connection. Must be DC coupled.
Differential Output Return Loss	10000	Differential Output Return Loss measurement
Differential Output Return Loss	210000	Differential Output Return Loss measurement
Differential Output Return Loss	310000	Differential Output Return Loss measurement
Differential Output Voltage Test	306102	Test the maximum voltage with the TX enabled
Differential Peak to Peak Output Voltage Test	5102	Test the maximum voltage with the TX enabled
Differential Peak to Peak Output Voltage Test	206102	Test the maximum voltage with the TX enabled
Differential Peak to Peak Output Voltage Test with TX disabled	5100	Test the maximum voltage with the TX disabled
Differential Peak to Peak Output Voltage Test with TX disabled	206100	Test the maximum voltage with the TX disabled
Even-Odd Jitter	5201	Even-Odd Jitter measurement
Eye Height	306600	Measures the height of each the eye at user selected CTLE

Table 4 Test IDs and Names (continued)

Name	TestID	Description
Eye Height A	206600	Measures the height of each the eye at user selected CTLE
Eye Height B	206603	Measures the height of the eye at Host recommended CTLE, 1dB higher, and 1dB lower of optimal CTLE
Eye Width	206601	Measures the width of the eye at user CTLE
Eye Width	306601	Measures the width of the eye at user CTLE
Find Optimal CTLE Eye Opening	6602	Measures the eye width and height with each CTLE setting and reports the optimal setting to use in Eye Width and Eye Height measurements. The optimal value is automatically set in the configure tab after this test has run.
Linear Fit Pulse Peak	5301	Linear Fit Pulse Peak
Minimum Output Fall Time (20%-80%)	206401	Fall Time measurement
Minimum Output Fall Time (20%-80%)	306401	Fall Time measurement
Minimum Output Rise Time (20%-80%)	206400	Rise Time measurement
Minimum Output Rise Time (20%-80%)	306400	Rise Time measurement
Post-cursor equalization Local_eq_c1(0)	5504	Measures Post-cursor equalization for c(1) weight 0
Post-cursor equalization Local_eq_c1(1)	5505	Measures Post-cursor equalization for c(1) weight 1
Post-cursor equalization Local_eq_c1(2)	5506	Measures Post-cursor equalization for c(1) weight 2
Post-cursor equalization Local_eq_c1(3)	5507	Measures Post-cursor equalization for c(1) weight 3
Post-cursor equalization Local_eq_c1(4)	5508	Measures Post-cursor equalization for c(1) weight 4
Post-cursor equalization Local_eq_c1(5)	5509	Measures Post-cursor equalization for c(1) weight 5
Pre-cursor equalization Local_eq_cm1(0)	5500	Measures Pre-cursor equalization for c(-1) weight 0
Pre-cursor equalization Local_eq_cm1(1)	5501	Measures Pre-cursor equalization for c(-1) weight 1
Pre-cursor equalization Local_eq_cm1(2)	5502	Measures Pre-cursor equalization for c(-1) weight 2
Pre-cursor equalization Local_eq_cm1(3)	5503	Measures Pre-cursor equalization for c(-1) weight 3
Signal-to-noise-and-distortion ratio	5302	Measures the SNDR
Signaling Rate	5200	Signaling rate of the signal

Table 4 Test IDs and Names (continued)

Name	TestID	Description
Signaling Rate	206200	Signaling rate of the signal
Signaling Rate	306200	Signaling rate of the signal
Single-Ended Output Voltage Test	206104	Test the minimum and maximum voltages of the single-ended signals
Steady-State Voltage Vf	5300	Steady-State Voltage Vf measurement
Total Uncorrelated Jitter	5203	Total Uncorrelated Jitter measurement
Vertical Eye Closure	306602	Measures the Vertical Eye Closure 20*log(AV/EH15)

4 Instruments

The following table shows the instruments used by this application. The name is required by various remote interface methods.

- Instrument Name — The name to use as a parameter in remote interface commands.
- Description — The description of the instrument.

For example, if an application uses an oscilloscope and a pulse generator, then you would expect to see something like this in the table below:

Table 5 Example Instrument Information

Name	Description
scope	The primary oscilloscope.
Pulse	The pulse generator used for Gen 2 tests.

and you would be able to remotely control an instrument using:

```
ARSL syntax (replace [description] with actual parameter)
------------------------------------------------------------------------
arsl -a ipaddress -c "SendScpiCommandCustom 'Command=[scpi
command];Timeout=100;Instrument=pulsegen'"

arsl -a ipaddress -c "SendScpiQueryCustom 'Command=[scpi
query];Timeout=100;Instrument=pulsegen'"


C# syntax (replace [description] with actual parameter)
------------------------------------------------------------------------
SendScpiCommandOptions commandOptions = new SendScpiCommandOptions();
commandOptions.Command = "[scpi command]";
commandOptions.Instrument = "[instrument name]";
commandOptions.Timeout = [timeout];
remoteAte.SendScpiCommand(commandOptions);

SendScpiQueryOptions queryOptions = new SendScpiQueryOptions();
queryOptions.Query = "[scpi query]";
queryOptions.Instrument = "[instrument name]";
```

```
queryOptions.Timeout = [timeout];
remoteAte.SendScpiQuery(queryOptions);
```

Here are the actual instrument names used by this application:

NOTE The file, "InstrumentInfo.txt", which may be found in the same directory as this help file, contains all of the information found in the table below in a format suitable for parsing.

Table 6 Instrument Names

Instrument Name	Description
scope	The primary oscilloscope

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