Keysight N6467A/N6467B BroadR-Reach Compliance Application

KEYSIGHT TECHNOLOGIES

Programmer's Reference

Notices

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A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

In This Book

This book is your guide to programming the Keysight Technologies N6467A/N6467B BroadR-Reach Compliance 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 N6467A/N6467B BroadR-Reach Compliance 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 N6467A/N6467B BroadR-Reach Compliance Application uses Remote Interface Revision 4.56. 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 N6467A/N6467B BroadR-Reach Compliance 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	#Averages (Droop test)	DroopAvgs	2, 4, 8, 16, 32, 64, 128	Specify the number of averages acquired for droop test.
Configure	#Averages (Frequency test)	FreqAvgs	2, 4, 8, 16, 32, 64, 128	Specify the number of averages acquired for transmitter frequency test.
Configure	#Averages (PSD Test)	PSDAvgs	(Accepts user-defined text), 16, 32, 64, 128, 256	Specify the number of averages acquired for spectrum analysis. For spectral analysis using oscilloscope, each sample is 15 µs in length.
Configure	Clock/Data Edges	ClockEdge	RISing, FALLing, BOTH	Specifies direction of the clock edge.
Configure	Command File (PSD Test)	PSDCmdFile	ESA, MXA, EXA, PSA, Script1, Script2, Script3	Specify the command file for external Spectrum Analyzer.
Configure	DUT Channel	DataChan	CHAN1, CHAN2, CHAN3, CHAN4	Specify the oscilloscope channel to use for a differential input. Used when Differential Probe is selected in Connection Type.
Configure	DUT D+	DataPosChan	CHAN1, CHAN2, CHAN3, CHAN4	Specify the oscilloscope channel to use for D+. Used when SMA cables is selected in Connection Type.

Table 2 Configuration Variables and Values (continued)

GUI Location	Label	Variable	Values	Description
Configure	DUT D-	DataNegChan	CHAN1, CHAN2, CHAN3, CHAN4	Specify the oscilloscope channel to use for D-. Used when SMA cables is selected in Connection Type.
Configure	Offline Return Loss	ReturnLossPath	(Accepts user-defined text), (none)	Offline Waveform - Return Loss Test
Configure	Offline TM1 Falling Edge	TM1FallingPath	(Accepts user-defined text), (none)	Offline Waveform - TM1 Falling Edge
Configure	Offline TM1 Rising Edge	TM1RisingPath	(Accepts user-defined text), (none)	Offline Waveform - TM1 Rising Edge
Configure	Offline TM2	TM2Path	(Accepts user-defined text), (none)	Offline Waveform - TM2
Configure	Offline TM2 Jitter	TM2JitterPath	(Accepts user-defined text), (none)	Offline Waveform - TM2 Jitter
Configure	Offline TM3	TM3Path	(Accepts user-defined text), (none)	Offline Waveform - TM3
Configure	Offline TM3 Jitter	TM3JitterPath	(Accepts user-defined text), (none)	Offline Waveform - TM3 Jitter
Configure	Offline TM4	TM4Path	(Accepts user-defined text), (none)	Offline Waveform - TM4
Configure	Offline TM5	TM5Path	(Accepts user-defined text), (none)	Offline Waveform - TM5
Configure	Offline TM5 Peak Differential	PeakDifferentialPath	(Accepts user-defined text), (none)	Offline Waveform - TM5 Peak Differential
Configure	Offline testing enabled	OfflineEnable	(Accepts user-defined text), false	Offline testing enabled
Configure	PSD Measurement type	PSDMeasType	MAG, PSD	Specify the type of measurement for PSD test

Table 2 Configuration Variables and Values (continued)

GUI Location	Label	Variable	Values	Description
Configure	PSD Smoothing Points	PSDSmoothPoints	(Accepts user-defined text), 13, 25, 37, 49	Specify the number of data buckets used for smoothing.
Configure	Reference Level (PSD Test)	PSDRefLev	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 20	Specify the reference level for Spectrum Analyzer.
Configure	Resolution Bandwidth (PSD Test)	PSDResBW	10E+03, 20E+03, 30E+03, 40E+03, 50E+03, 100E+03, 300E+03, 500E+03, 700E+03, 900E+03, 1E+06, 2E+06, 3E+06	Specifiy the Resolution Bandwidth for the spectrum analysis in the Oscilloscope or Spectrum Analyzer. If external Spectrum Analyzer being used, the resolution bandwidth for Spectrum Analyzer is set to the value. Unit: Hz.
Configure	Spectral Windowing (PSD Test)	PSDWindow	1, 2, 3, 4	Specify the windowing function applied to the input data segment before implementing FFT. Used for spectrum analysis on oscilloscope.
Configure	Start Frequency (PSD Test)	PSDStartFreq	300E+03, 10E+04, 1E+06, 2E+06, 3E+06, 5E+06, 10E+06, 20E+06, 30E+06	Specify the start frequency for spectrum analysis. Unit: Hz.
Configure	Stop Frequency (PSD Test)	PSDStopFreq	200E+06, 300E+06, 400E+06, 500E+06, 600E+06, 700E+06, 800E+06, 900E+06, 1E+09, 2E+09, 3E+09, 4E+09, 5E+09, 6E+09, 7E+09	Specify the stop frequency for spectrum analysis. Unit: Hz.
Configure	Test Type (PSD Test)	PSDTestType	Auto, File, Manual	Specify the test type for Power Spectral Density tests when using external Spectrum Analyzer.
Configure	Video Bandwidth (PSD Test)	PSDVidBW	10E+03, 20E+03, 30E+03, 40E+03, 50E+03, 100E+03, 300E+03, 500E+03, 700E+03, 900E+03, 1E+06, 2E+06, 3E+06	Specify the Video Bandwidth for the spectrum analysis in the Spectrum Analyzer. Unit: Hz.

Table 2 Configuration Variables and Values (continued)

GUI Location	Label	Variable	Values	Description
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	Comp Filepath	txtBalunCorrFilepath	(Accepts user-defined text)	Comp Filepath

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
DummyTest	99999	This should not be called.
MDI Output Jitter, JTXOUT (Master)	21	The RMS (Root Mean Square) value of the MDI output jitter, JTXOUT, relative to an unjittered reference shall be less than 50ps.
MDI Return Loss	60	The MDI return loss shall meet or exceed the equations listed in Section 8.2.2 for all frequencies from 1MHz to 66MHz (with 100 ohms reference impedence) at all times when the PHY is transmitting data or control symbols.
Slave TX_TCLK jitter (w/TX_TCLK)	31	When in normal mode of operation as SLAVE, the RMS value of the SLAVE TX_TCLK jitter relative to an unjittered reference shall be less than 0.01 UI (Unit Interval) after the receiver is properly receiving the data.
Slave TX_TCLK jitter (w/o TX_TCLK)	32	When in normal mode of operation as SLAVE, the RMS value of the SLAVE TX_TCLK jitter relative to an unjittered reference shall be less than 0.01 UI (Unit Interval) after the receiver is properly receiving the data.
TX_TCLK Frequency (Slave)	30	The symbol transmission rate of the MASTER PHY shall be within the range if 66 2/3 MHZ ± 100ppm. The TX_TCLK of the PHY operating in slave mode is sourced from the recovered clock.
Transmit Clock Frequency (Master)	20	The symbol transmission rate of the MASTER PHY shall be within the range of 66 2/3 MHZ ± 100ppm.
Transmitter +Vout Droop	10	The magnitude of both the positive and negative droop measured with respect to an initial peak value after the zero crossing and the value 500ns after the initial peak, shall be less than 45%.
Transmitter -Vout Droop	11	The magnitude of both the positive and negative droop measured with respect to an initial peak value after the zero crossing and the value 500ns after the initial peak, shall be less than 45%.
Transmitter Distortion(w/ Disturbing Signal)	40	The peak distortion values measured at minimum 10 different equally-spaced phases of a single symbol period should be less than 15mV.

Table 4 Test IDs and Names (continued)

Name	TestID	Description
Transmitter Distortion(w/o Disturbing Signal)	41	The peak distortion values measured at minimum 10 different equally-spaced phases of a single symbol period should be less than 15mV.
Transmitter Peak Differential Output	51	The Peak Differential Voltage obtained must conform to the requirements specified in IEEE802.3bw-2015 Sub-clause 96.5.6. When measured with 100 Ohm termination, transmit differential signal at MDI shall be less than 2.2 V peak-to-peak. Specification only applicable for IEEE 802.3bw-2015 Std.
Transmitter Power Spectral Density	50	In test mode 5, the power spectral density (PSD) of the transmitter, using the test fixture shown in Figure 5.3, shall be between the upper and lower bounds specified in Table 5.3.

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
extradevice	The Extra Device
ruby	The pulse generator.
scope	The primary oscilloscope.
somedevice	Not used.
vna	8753D

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