

Keysight U7236A/B 10GBASE-T Compliance Application

Notices

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In This Book

This book is your guide to programming the Keysight Technologies U7236A/B 10GBASE-T 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 11, **Chapter 3**, “Test Names and IDs,” starting on page 19, and **Chapter 4**, “Instruments,” starting on page 23, provide information specific to programming the U7236A/B 10GBASE-T 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.

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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 where 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/scope-apps-sw"](http://www.keysight.com/find/scope-apps-sw). The U7236A/B 10GBASE-T Compliance Application uses Remote Interface Revision 3.40. 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.

Licensing

To enable programming of compliance applications on your oscilloscope, please visit "www.keysight.com/find/scope-apps" to purchase an N5452A remote programming option license.

1 Introduction to Programming

2 Configuration Variables and Values

The following table contains a description of each of the U7236A/B 10GBASE-T 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 (PSD Test)	PwrSpecDenAvg	(Accepts user-defined text), 10, 20, 30, 40, 50	Select number of averages for PSD test using Spectrum Analyzer.
Configure	#Averages (Power Level Test)	PwrLvlAvg	(Accepts user-defined text), 10, 20, 30, 40, 50	Select number of averages for Power Level Test using Spectrum Analyzer.
Configure	#Averages (Transmitter Linearity Test)	TransLinAvg	(Accepts user-defined text), 10, 20, 30, 40, 50	Select number of averages for Transmitter Linearity Test using Spectrum Analyzer.
Configure	Apply Bandpass Filter for Jitter Tests	JitterBPF	True, False	Apply a bandpass filter to the input of the Jitter Tests.
Configure	Band Pass Filter Band width	HPFBand width	(Accepts user-defined text), 100E+3, 500E+3, 1E+6, 2E+6, 3E+6, 4E+6, 5E+6, 10E+6	Select the Band width of the Band Pass Filter.
Configure	Band Pass Filter Center Frequency	CenterFreq	(Accepts user-defined text), 1E+6, 5E+6, 10E+6, 50E+6, 100E+6, 200E+6, 300E+6	Select the Center Frequency of the Band Pass Filter.
Configure	Command File (PSD Test)	PwrSpecDenComdFile	ESA, MXA, EXA, PSA, Script1, Script2, Script3	Select the command file for Spectrum Analyzer.
Configure	Command File (Power Level Test)	PwrLvlComdFile	ESA, MXA, EXA, PSA, Script1, Script2, Script3	Select the command file for Spectrum Analyzer.

Table 2 Configuration Variables and Values (continued)

GUI Location	Label	Variable	Values	Description
Configure	Command File (Transmitter Linearity Test)	TransLinComdFile	ESA, MXA, EXA, PSA, Script1, Script2, Script3	Select the command file for Spectrum Analyzer.
Configure	Connection Pair (Negative)	DNChan	CHAN1, CHAN2, CHAN3, CHAN4	Select the channel number for connection pair negative.
Configure	Connection Pair (Positive)	DPChan	CHAN1, CHAN2, CHAN3, CHAN4	Select the channel number for connection pair positive.
Configure	Frequency Resolution Step (PSD Test)	PwrSpecFreqRes	200E+03, 300E+03, 400E+03, 500E+03, 600E+03, 700E+03, 800E+03, 900E+03, 1E+06, 2E+06, 3E+06, 4E+06, 5E+06	Select the frequency resolution step use in plotting the graph for external Spectrum Analyzer. For smaller step, test run will be longer to acquire the data. Unit: Hz.
Configure	Input Impedance (Power Level Test)	PwrLvlInputImpedance	1, 2	Select the input impedance for the power level test.
Configure	Intermodulation Tolerance (Transmitter Linearity Test)	TransLinInterTol	100E+03, 200E+03, 300E+03, 400E+03, 500E+03, 600E+03, 700E+03, 800E+03, 900E+03, 1E+06, 1.1E+06, 1.2E+06	Select the tolerance for intermodulation.
Configure	MDIO Device Address	MDIODeviceAddress	(Accepts user-defined text), 00, 01	The MDIO Device Address. Only if MDIO automation is available.
Configure	MDIO Port Address	MDIOPortAddress	(Accepts user-defined text), 00, 01	The MDIO Port Address. Only if MDIO automation is available.
Configure	MDIPairB_ReturnLoss	MDIPairB_ReturnLoss	(Accepts user-defined text)	To enable RPI access to Return Loss data files.
Configure	MDIPairC_ReturnLoss	MDIPairC_ReturnLoss	(Accepts user-defined text)	To enable RPI access to Return Loss data files.
Configure	MDIPairD_ReturnLoss	MDIPairD_ReturnLoss	(Accepts user-defined text)	To enable RPI access to Return Loss data files.
Configure	MDI_ReturnLoss	MDI_ReturnLoss	(Accepts user-defined text)	To enable RPI access to Return Loss data files.
Configure	Memory Depth	MemDepth_Power	8388608, 4194304, 2097152, 1048576	Select the memory depth of the oscilloscope for power tests.

Table 2 Configuration Variables and Values (continued)

GUI Location	Label	Variable	Values	Description
Configure	Memory Depth	MemDepth_TransLin	8388608, 4194304, 2097152, 1048576, 524288	Select the memory depth of the oscilloscope for Transmitter Linearity tests.
Configure	Reference Level (PSD Test)	PwrSpecDenRefLev	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 20	Select the reference level for Spectrum Analyzer.
Configure	Reference Level (Power Level Test)	PwrLvlRefLev	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 20	Select the reference level for Spectrum Analyzer.
Configure	Reference Level (Transmitter Linearity Test)	TransLinRefLev	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 20	Select the reference level for Spectrum Analyzer.
Configure	Resolution Bandwidth (PSD Test)	PwrSpecDenResBW	10E+03, 30E+03, 100E+03, 300E+03, 400E+03, 500E+03, 600E+03, 700E+03, 800E+03, 900E+03, 1E+06, 2E+06, 3E+06, 4E+06, 5E+06	Select the resolution bandwidth for Spectrum Analyzer.
Configure	Resolution Bandwidth (Power Level Test)	PwrLvlResBW	10E+03, 30E+03, 100E+03, 300E+03, 400E+03, 500E+03, 600E+03, 700E+03, 800E+03, 900E+03, 1E+06, 2E+06, 3E+06	Select the resolution bandwidth for Spectrum Analyzer.
Configure	Resolution Bandwidth (Transmitter Linearity Test)	TransLinResBW	10E+03, 50E+03, 100E+03, 200E+03, 300E+03, 400E+03, 500E+03	Select the resolution bandwidth for Spectrum Analyzer.
Configure	Sampling Rate	SamplingRate	20E+09, 40E+09	Select the Sampling Rate to use.
Configure	Signal Check	EnableSignalCheck	1.0, 0.0	When signal check is enabled, the input signal is pre-tested and verified to be within a reasonable range of timing and voltage limits. This can be useful for detecting problems like cabling errors before a test is run.

Table 2 Configuration Variables and Values (continued)

GUI Location	Label	Variable	Values	Description
Configure	Signal Type	cmbConnectionType	Differential, Single-ended	Select the type of signal supplied to the oscilloscope. Differential Signal - 2 channels is needed and only a single 10G pair can be connected at once. Single-Ended Signal - each pair requires only 1 channel and up to 4 pairs can be connected at once. A balun can be used to convert a single-ended signal to differential signal.
Configure	Spectral Windowing (PSD Test)	PwrSpecDenWindow	1, 2, 3, 4	Select the windowing function applied to the input data segment before implement FFT using oscilloscope.
Configure	Spectral Windowing (Power Level Test)	PwrLvlWindow	1, 2, 3, 4	Select the windowing function applied to the input data segment before implement FFT using oscilloscope.
Configure	Spectral Windowing (Transmitter Linearity Test)	TransLinWindow	1, 2, 3, 4	Select the windowing function applied to the input data segment before implement FFT using oscilloscope.
Configure	Start Frequency (PSD Test)	PwrSpecDenStarFreq	300E+03, 10E+04, 1E+06, 2E+06, 3E+06, 5E+06, 10E+06, 20E+06, 30E+06	Select the start frequency for Spectrum Analyzer.
Configure	Start Frequency (Power Level Test)	PwrLvlStarFreq	300E+03, 10E+04, 1E+06, 2E+06, 3E+06, 5E+06, 10E+06, 20E+06, 30E+06	Select the start frequency for Spectrum Analyzer.
Configure	Start Frequency (Transmitter Linearity Test)	TransLinStarFreq	1E+06, 2E+06, 3E+06, 5E+06, 10E+06, 20E+06, 30E+06	Select the start frequency for Spectrum Analyzer.
Configure	Stop Frequency (PSD Test)	PwrSpecDenStopFreq	1E+09, 2E+09, 3E+09, 4E+09, 5E+09, 6E+09, 7E+09	Select the stop frequency for Spectrum Analyzer.

Table 2 Configuration Variables and Values (continued)

GUI Location	Label	Variable	Values	Description
Configure	Stop Frequency (Power Level Test)	PwrLvlStopFreq	200E+06, 300E+06, 400E+06, 500E+06, 600E+06, 700E+06, 800E+06, 900E+06, 1E+09, 2E+09, 3E+09	Select the stop frequency for Spectrum Analyzer.
Configure	Stop Frequency (Transmitter Linearity Test)	TransLinStopFreq	350E+06, 360E+06, 370E+06, 380E+06, 390E+06, 400E+06, 450E+06	Select the stop frequency for Spectrum Analyzer.
Configure	Supress change pair prompt	10GSupChangeConn	False, True	Prevent the prompt to change pairs from being shown when a single pair is selected.
Configure	Test Pair	10GTestPair	ALL, Pair A, Pair B, Pair C, Pair D	Determines the 10GBase-T pair or pairs tested. This setting applies to all tests.
Configure	Test Type (PSD Test)	PwrSpecDenTestType	Auto, File, Manual	Select the test type for Power Spectral Density tests.
Configure	Test Type (Power Level Test)	PwrLvlTestType	Auto, File, Manual	Select the test type for Power Level tests.
Configure	Test Type (Transmitter Linearity Test)	TransLinTestType	Auto, File, Manual	Select the test type for Transmitter Linearity tests.
Configure	Timeout (Power Level Test)	PwrLvlTimeOut	30000, 60000, 100000, 150000, 200000	Set the timeout for the power level test.
Configure	Timeout (Transmitter Linearity Test)	TransLinTestTimeOut	30000, 60000, 100000, 150000, 200000	Set the timeout for the Transmitter Linearity Test.
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	Balun Corr Filepath	txtBalunCorrFilepath	(Accepts user-defined text)	Balun Corr Filepath Balun Corr Filepath
Set Up	RemoteConnection	RemoteConnection	None, SASICL, SAIP, NASICL, NAIP	Select external instrument address type

Table 2 Configuration Variables and Values (continued)

GUI Location	Label	Variable	Values	Description
Set Up	ckBAmpCorrectData	ckBAmpCorrectData	0.0, 1.0	Enable Balun Correction
Set Up	ckBypassVNACal	ckBypassVNACal	0.0, 1.0	Bypass VNA Calibration
Set Up	ckUSBMPC	ckUSBMPC	0.0, 1.0	USBMPC Connection
Set Up	pcbRemoteIP	pcbRemoteIP	(Accepts user-defined text), 141.183.183.101	Set IP sicl address
Set Up	pcbRemoteSicl	pcbRemoteSicl	(Accepts user-defined text), gpib1, 17	Set gpib sicl address
Set Up	pcboReturnLoss	ReturnLossTest	Connect to External Instrument, Use Data File	VNA connection

2 Configuration Variables and Values

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
MDI Return Loss	110	To verify the MDI Return Loss is more than the conformance limits as specified in 55.8.2.1 of IEEE 802.3an.
Maximum Output Droop Negative	102	The magnitude of both the positive and negative droop of the device under test (DUT) must be within the conformance limits specified in 55.5.3.1 of IEEE Std 802.3an-2006.
Maximum Output Droop Positive	101	The magnitude of both the positive and negative droop of the device under test (DUT) must be within the conformance limits specified in 55.5.3.1 of IEEE Std 802.3an-2006.
Power Level	112	To verify that the transmitter power level is within the conformance limits as specified in 55.5.3.4 of IEEE Std 802.3an-2006.
Transmit Clock Frequency	113	The transmit clock frequency of the device under test (DUT) must be within the conformance limits specified in 55.5.3.5 of IEEE Std 802.3an-2006.
Transmitter Power Spectral Density	103	To verify that the transmitter power spectral density meets the conformance limits as specified in 55.5.3.4 of IEEE Std 802.3an-2006.
Transmitter Timing Jitter (Master)	100	The transmitter timing jitter of the device under test (DUT) must be less than the conformance limits specified in 55.5.3.3 of IEEE Std 802.3an-2006.
Transmitter Timing Jitter (Slave)	104	The transmitter timing jitter of the device under test (DUT) must be less than the conformance limits specified in 55.5.3.3 of IEEE Std 802.3an-2006.
Two Tone Frequency Pair 1	105	To verify that the spurious free dynamic range of the transmitter meets the conformance limits as specified in 55.5.3.2 of IEEE Std 802.3an-2006.
Two Tone Frequency Pair 2	106	To verify that the spurious free dynamic range of the transmitter meets the conformance limits as specified in 55.5.3.2 of IEEE Std 802.3an-2006.
Two Tone Frequency Pair 3	107	To verify that the spurious free dynamic range of the transmitter meets the conformance limits as specified in 55.5.3.2 of IEEE Std 802.3an-2006.

Table 4 Test IDs and Names (continued)

Name	TestID	Description
Two Tone Frequency Pair 4	108	To verify that the spurious free dynamic range of the transmitter meets the conformance limits as specified in 55.5.3.2 of IEEE Std 802.3an-2006.
Two Tone Frequency Pair 5	109	To verify that the spurious free dynamic range of the transmitter meets the conformance limits as specified in 55.5.3.2 of IEEE Std 802.3an-2006.

3 Test Names and IDs

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
VNA	The Vector Network Analyzer.
pulsegen	The pulsegen.
pwrsupply	The power supply.
sa	The Spectrum Analyzer.
scope	The primary oscilloscope.

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