N5991 Receiver Compliance Test Automation Platform

PCI Express® Receiver Test Automation

Introduction

The N5991P PCI Express Receiver Test Automation Software family covers various specification revisions and form factors
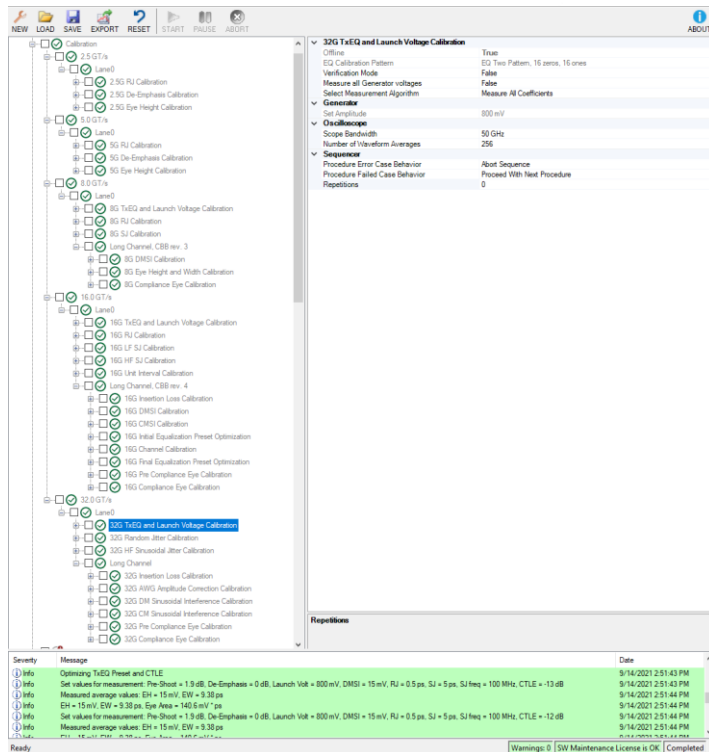
Table of Contents

N5991 Product Line

High-speed digital standards are quickly evolving to keep pace with emerging technologies such as 5G, Internet of Things (IoT), artificial intelligence (AI), virtual reality (VR), and autonomous vehicles.

Each generational change introduces new test challenges for your digital designs. You need to test your high-speed digital designs across all product development stages — from design and simulation to analysis, debugging, and compliance testing. The N5991 product line anticipates test challenges, optimizes performance, and accelerates time-to-market of your high-speed computing interfaces, data-center connections, and consumer electronics.

- Supported standards, which include PCIe, SAS, SATA, USB, HDMI, DisplayPort, and MIPI C-PHY. Other standards will be continuously added with the requirements for higher data-speed testing
- Guided setup with automated fast stress signal calibration and compliance measurement functions
- Modern look and feel with enhanced functionalities
- System modularity allows the user to enable only required functionalities
- HTML reports
- Node-locked and transportable licenses
- Characterization mode for in-depth testing
- Single- and multi-lane device testing

Keysight N5991 Receiver Compliance Test Automation Platform for PCI Express®, SAS and CCIX

Keysight N5991 software solution anticipates test challenges, optimizes performance and accelerates time to market of your high-speed computing interfaces, data-center connections, and consumer electronics
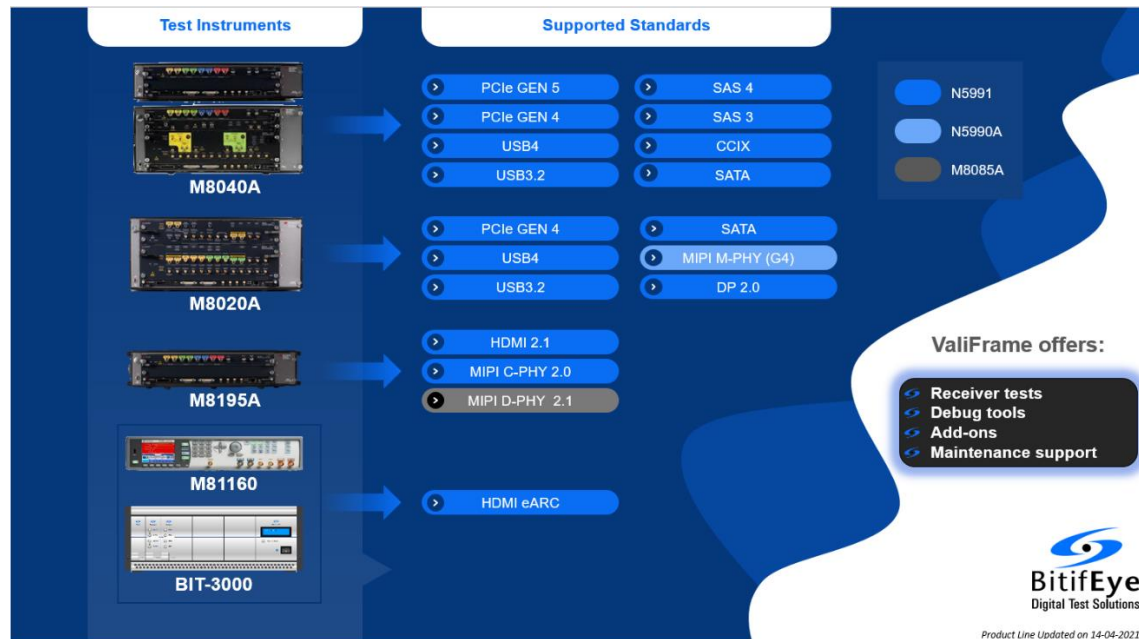

Figure 1: N5991 Software Solution Path

Turn Your Instruments into a Solution

An efficient test strategy is a proven competitive advantage. The Keysight Technologies N5991 is the successor to the well-known industry standard N5990A test automation software platform. It follows the same concept – combining the performance of your instruments with the convenience of your PC. The system's software provides unprecedented test integration, high-throughput, and ease-of-use for a wide range of stimulus and response systems, providing a level of control that transforms a collection of instruments into a universal, user-friendly and highly productive test solution.
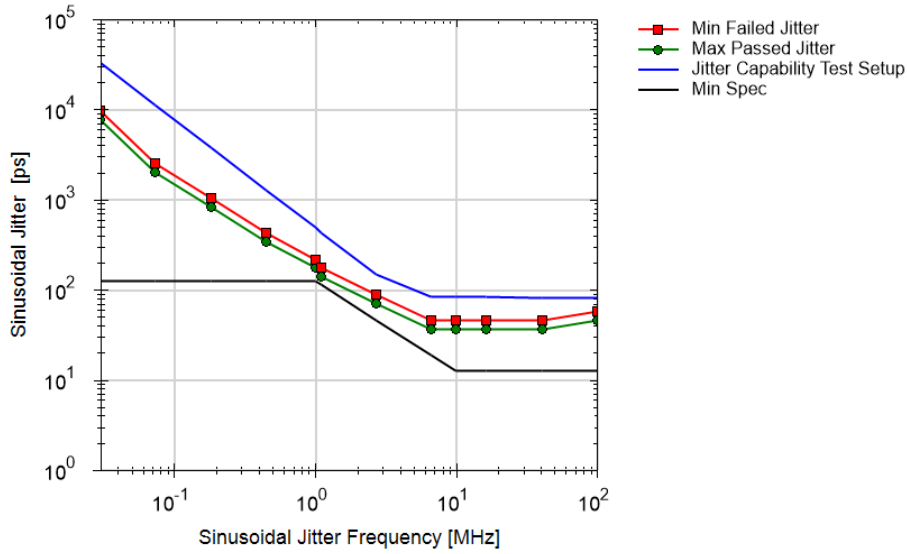
Standardize Your Test

The N5991 receiver-test options provide dedicated receiver compliance tests for popular and emerging digital buses. The user can choose compliance mode for fast reassurance, or characterization mode for in-depth analysis. The Receiver Test Automation Platform's compliance testing capabilities have been repeatedly proven at interoperability workshops ("plug fests"). The N5991 builds on the success of previous generations to deliver significant gains in productivity. Like its predecessor, the N5990A, the new system makes it easy to test multiple buses by using the same interface for all available standards. It delivers additional gains by using familiar HTML for reporting results.

Test Selection and Test Results

The test automation software platform lets you select tests from an intuitive tree structure with multiple levels of detail. Select the tests you want to run, together with the number of repetitions. Test results are provided in HTML format. When you measure a parameter range, it delivers a specific graph and a related data table (see Figure 2).

L0_Rx_8GTps_CBB3_JitTol

for PCIe 4.0 AddInCard

Offline	False
Frequency Mode	Equally Spaced Frequencies
Frequency Scale	Logarithmic
Start Frequency	30 kHz
Stop Frequency	100 MHz
Frequency Steps	10
Search algorithm	Logarithmic
Jitter Step Factor	1.25
Jitter Start Value	2.5 ps
Show Min Failed Points	True
Use Compliance RJ and DMSI Values	True
RJ Low Pass Filter Frequency	500 MHz
BER Mode	TargetBer
Target BER	1E-9
Confidence Level	95 %
Force retraining on each frequency	False
Use Preset	False
Pre-Shoot	3.5 dB
De-Emphasis	-3.5 dB
Data Rate Deviation	0 ppm
Link Training Mode	Interactive
Training through	L0-Recovery
Generator Full Swing	24
Generator Start Preset	P5
DUT Initial Preset	P5
DUT Target Preset	P5
Drop Link Method	LTSSM
Link Training Suite Settings File	C:\ProgramData\BitifEye\N5991\PCIe\Settings\TrainingScripts\Pcie3_8G_M8040A_ILT_Loopback.txt
Suppress Loopback Training Messages	False
Use CDR	True
CDR Loop Bandwidth	12 MHz
Peaking	1 dB
Analyzer Equalization	80
Sensitivity	Normal
Capture and Compare Mode	False
Pause before Auto-Align	False
Polarity	Normal
Relax Time	3 s
Use Power Switch Automation	True
Power Switch Channel Number	4
Power Cycle Off On Duration	10 s
Power Cycle Settling Time	10 s
Power Cycle max. Retries for LB Training	3
Manually align error detector sampling point.	False

Figure 2: Jitter Tolerance Measurement – Graphical and Tabular Results

Computer Bus Applications – PCI Express

The N5991 is designed to meet the needs of the data center application space, with many high-speed links within and between servers. It utilizes the Keysight M8040A High-Performance BERT with Baud rates up to 64 GBaud and the ability to encode data in NRZ and PAM4. This makes the software the center piece of Keysight's data center receiver test solutions, specifically targeting PCI Express receiver testing at transfer rates of 32 GT/s,16 GT/s and 8 GT/s.
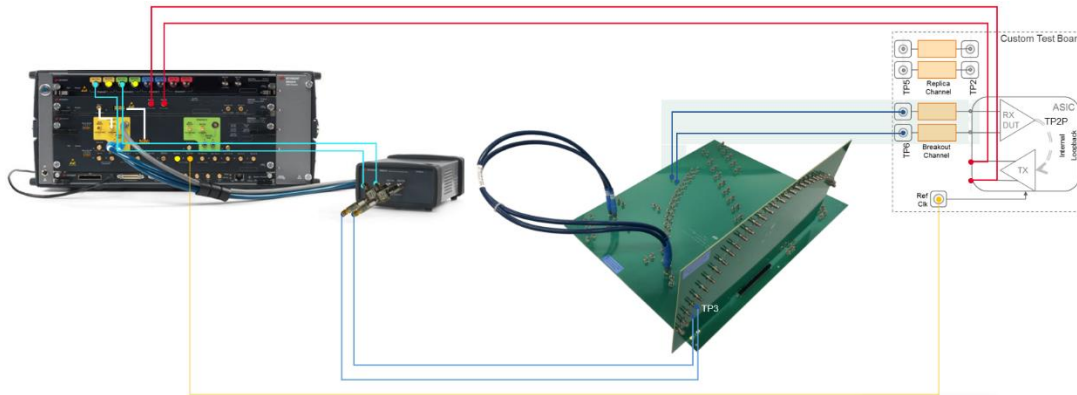

Figure 3: PCI Express 5.0 Base Specification Receiver Test Setup based on M8040A High-Performance BERT

PCI Express 4.0 and 5.0 calibration and receiver testing

Starting with PCI Express 3.0, the receiver stress signal calibration targets are defined as eye height and eye width after applying a reference receiver, which adapts to the stress signal. The concept of transmitter de-emphasis optimization also needs to be considered. This requires special tools to determine the eye height and eye width. For base specification calibrations, the preferred method is SEASIM, which simulates the stress signal and reference receiver using a step measurement through the setup to determine channel characteristics and impairment parameters. In contrast, stress signal calibrations following the PCI Express Architecture PHY Test Specification require the use of the waveform post processing tool SIGTEST. In both cases, multiple eye heights and eye width measurements must be averaged to achieve usable results per impairment and launch amplitude, de-emphasis, and pre-shoot combinations. This requires many measurements and lengthy processing times.

Actual stress signal calibration procedures differ for 8 GT/s, 16 GT/s and 32 GT/s. For instance, PCI Express 3.0 8 GT/s uses random jitter and differential mode sinusoidal interference as the main adjustments to achieve target eye height and eye width, while PCI Express 4.0 16 GT/s uses channel loss adjustment for a first eye height and eye width adjustment, followed by a tuning process using differential mode sinusoidal interference, sinusoidal jitter and launch amplitude. PCI Express 5.0 32 GT/s is like PCI Express 4.0 16 GT/s with a slightly modified stress signal calibration.

The test procedure for 8 GT/s receiver, as defined in PCI Express 3.0 Base specification, consists of stressed voltage tests for three different channel scenarios and one stressed jitter test. The PCI Express Architecture PHY Test Specification defines one combined test and, starting with PCI Express 4.0, the Base specification uses one combined receiver test too.

Automation software for the calibration and test process, as well as a high-power PC, are highly recommended.

PCI Express link equalization testing

The most significant change from PCI Express 2.0 to 3.0, other than the bit rate increase, is the requirement for dynamic link equalization. Link equalization is critical for PCI Express 8 GT/s, 16 GT/s and 32 GT/s because increases in data rates and server interconnect transmission path-lengths create challenges for signal integrity. Signal equalizers at one or more locations in the link compensate for signal anomalies by boosting the high-frequency components. Link equalization testing verifies the optimization of the link between a transmitter and a receiver. The test solution acts as a link partner and quickly negotiates transmitter to receiver communications using protocol handshakes.

Receiver link equalization testing exposes the device under test (DUT) to stress signals like the standard receiver tests but implements a protocol handshake process to fine tune the link's performance by requesting changes of the BERT data output's de-emphasis and pre-shoot. The link is successfully trained when the receiver achieves the required bit error rate. This is checked by the bit error ratio in a loopback.
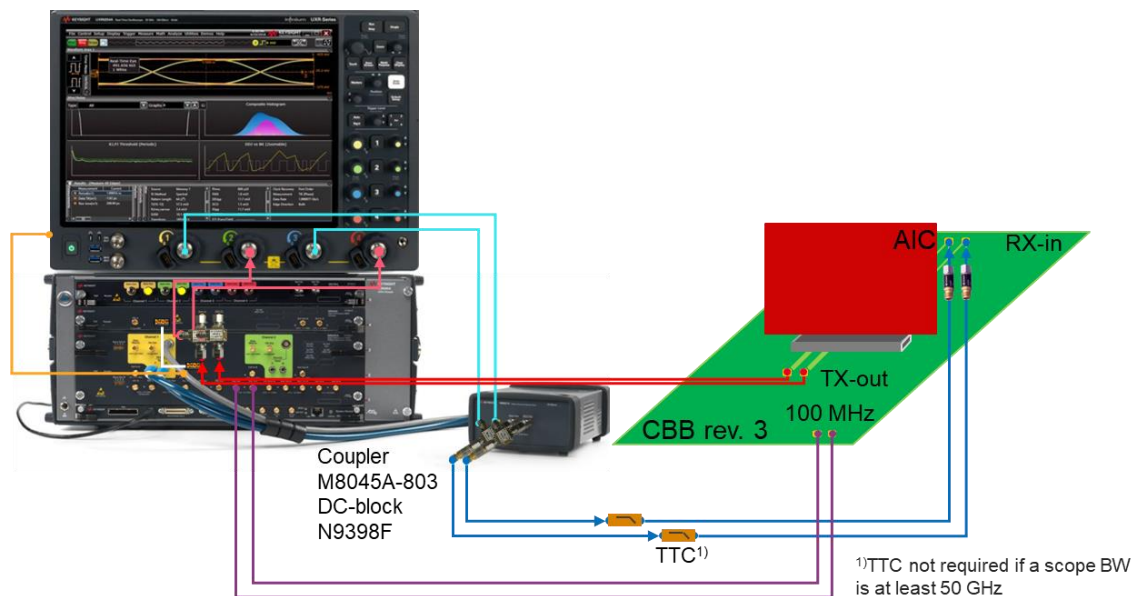

Figure 4: Link EQ Response Time setup

Transmitter equalization testing verifies that the DUT responds correctly to requests from the test equipment. The DUT's signal is analyzed by post-processing waveforms captured on an oscilloscope. Response times of a DUT are verified by capturing the handshake between the BERT and the DUT.

Software products for PCI Express 4.0 and 5.0

PCI Express base specification receiver tests

N5991PB5A implements receiver stress signal calibrations and tests according to PCI Express Base specification 5.0, while N5991PB4A implements receiver stress signal calibrations and tests according to PCI Express Base specifications 4.0. Link equalization receiver and transmitter testing can be added with the N5991PA3A-ADD PCI Express Link EQ Test Support Add-On. Link EQ testing at 32 GT/s is possible with the M8040A. There are no Link EQ tests for 5 GT/s and 2.5 GT/s. Other add-ons are available for multi-channel support, DUT built-in error counter support and switch matrix support.

Transfer Rate	N5991PB5A	N5991PB4A
32 GT/s	M8040A	n/a
16 GT/s	M8040A, or M8020A 16G	M8040A, or M8020A 16G
8 GT/s	M8040A, or M8020A 16G/8G	M8040A, or M8020A 16G/8G
5 GT/s	M8040A, or M8020A 16G/8G	M8040A, or M8020A 16G/8G
2.5 GT/s	M8040A, or M8020A 16G/8G	M8040A, or M8020A 16G/8G

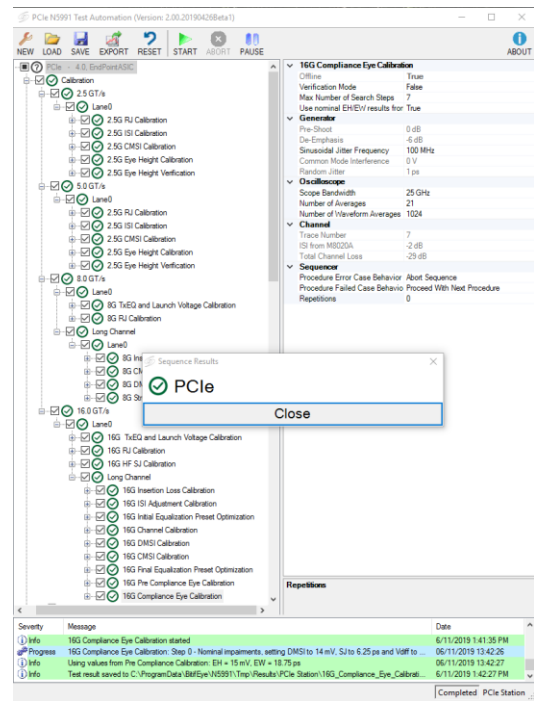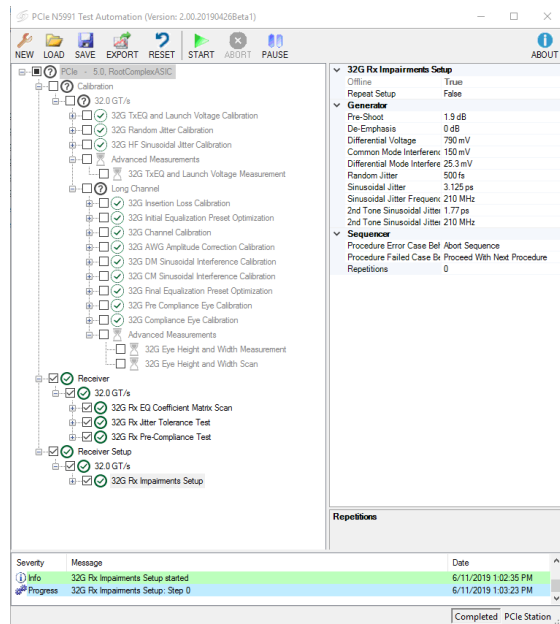M8020A 16G is a M8041A with opt. C16   M8020A 8G is a M8041A with opt. C08

Figure 5: N5991PB5A (left) & N5991PB4A (right) Calibration Steps

Measurement	N5991PB5A	N5991PB4A
32G Pre-Compliance Test	expert mode	n/a
32G Rx EQ Coefficient Matrix Scan	expert mode	n/a
32G Rx Pre-Shoot De-Emphasis Scan	expert mode	n/a
32G Jitter Tolerance Test	expert mode	n/a
32G Rx Sensitivity Test	expert mode	expert mode
16G Rx Stressed Jitter Eye Test	compliance & expert mode	compliance & expert mode
16 Rx Coefficient Matrix Scan	expert mode	expert mode
16G Rx Pre-Shoot De-Emphasis Scan	expert mode	expert mode
16G Rx Jitter Tolerance Test	expert mode	expert mode
16G Rx Sensitivity Test	expert mode	expert mode
8G Rx Stressed Jitter Eye Test	compliance & expert mode	compliance & expert mode
8G Rx Coefficient Matrix scan	expert mode	expert mode
8G Pre-Shoot De-Emphasis Scan	expert mode	expert mode
8G Jitter Tolerance Test	expert mode	expert mode
5G Rx Compliance Test	compliance & expert mode	compliance & expert mode
5G Rx Jitter Tolerance Test	expert mode	expert mode
5G RX Sensitivity Test	expert mode	expert mode
2.5G Rx Compliance Test	compliance & expert mode	compliance & expert mode
2.5G Rx Jitter Tolerance Test	expert mode	expert mode
2.5G Rx Sensitivity Test	expert mode	expert mode

PCI Express CEM specification receiver tests

N5991PC5A performs receiver stress signal calibrations and tests for 32 GT/s, 16 GT/s and 8 GT/s according to PCI Express Architecture PHY Test specification 5.0. Stress signal calibration and tests for 5 GT/s as well as 2.5 GT/s are implemented according to PCI Express CEM specification 5.0. Changes to the calibration and test routines are possible since PCI Express Architecture PHY Test specification 5.0 has not been released as of July 2021. Future releases will follow those changes which can be used as long as a software maintenance is kept valid for the test station.

N5991PC4A implements receiver stress signal calibrations and tests for 16 GT/s and 8 GT/s according to PCI Express Architecture PHY Test specifications 4.0 and 5 GT/s, as well as 2.5 GT/s receiver stress signal calibrations and tests are implemented according to PCI Express CEM specification 4.0.

Link equalization receiver and transmitter testing can be added with the N5991PA3A-ADD PCI Express LinkEQ Test Support Add-On. LinkEQ testing at 32 GT/s is possible with the M8040A. There are no LinkEQ tests for 5 GT/s and 2.5 GT/s. Other add-ons are available for multi-channel support, DUT built-in error counter support and switch matrix support.

Transfer Rate	N5991PC5A	N5991PC4A
32 GT/s	M8040A	n/a
16 GT/s	M8040A, or M8020A 16G	M8040A, or M8020A 16G
8 GT/s	M8040A, or M8020A 16G/8G	M8040A, or M8020A 16G/8G
5 GT/s	M8040A, or M8020A 16G/8G	M8040A, or M8020A 16G/8G
2.5 GT/s	M8040A, or M8020A 16G/8G	M8040A, or M8020A 16G/8G

M8020A 16G is a M8041A with opt. C16   M8020A 8G is a M8041A with opt. C08

Figure 6: N5991PC4A with N5991PA3A-Add LinkEQ Test Support add-on Compliance Tests

Measurement	N5991PC5A	N5991PC4A
32G Pre-Compliance Test	expert mode	n/a
32G Rx EQ Coefficient Matrix Scan	expert mode	n/a
32G Rx Pre Compliance Test	expert mode	n/a
32G Jitter Tolerance Test	expert mode	n/a
32G Rx Sensitivity Test	expert mode	n/a
16G Rx Pre Compliance Test	expert mode	expert mode
16 Rx Coefficient Matrix Scan	expert mode	expert mode
16G Rx Pre-Shoot De-Emphasis Scan	expert mode	expert mode
16G Rx Jitter Tolerance Test	expert mode	expert mode
16G Rx Sensitivity Test	expert mode	expert mode
8G Rx Preset Pre-Compliance Test – short channel (AIC only)	compliance & expert mode	compliance & expert mode
8G Rx Pre Compliance Test – short channel (AIC only)	compliance & expert mode	compliance & expert mode
8G Rx Coefficient Matrix scan – short channel (AIC only)	expert mode	expert mode
8G Rx Pre-Shoot De-Emphasis Scan – short channel (AIC only)	expert mode	expert mode
8G Rx Jitter Tolerance Test – short channel (AIC only)	expert mode	expert mode
8G Rx Sensitivity Test – short channel (AIC only)	expert mode	expert mode
8G Rx Preset Pre-Compliance Test – long channel	compliance & expert mode	compliance & expert mode
8G Rx Pre Compliance Test – long channel	compliance & expert mode	compliance & expert mode
8G Rx Coefficient Matrix scan – long channel	expert mode	expert mode
8G Rx Pre-Shoot De-Emphasis Scan – long channel	expert mode	expert mode
8G Rx Jitter Tolerance Test – long channel	expert mode	expert mode
8G Rx Sensitivity Test – long channel	expert mode	expert mode
5G Rx Compliance Test	compliance & expert mode	compliance & expert mode
5G Rx Jitter Tolerance Test	expert mode	expert mode
5G Rx Sensitivity Test	expert mode	expert mode
2.5G Rx Compliance Test	compliance & expert mode	compliance & expert mode
2.5G Rx Jitter Tolerance Test	expert mode	expert mode
2.5G Rx Sensitivity Test	expert mode	expert mode

PCI Express U.2 & M.2 specification receiver tests

So far compliance testing is defined for 8 GT/s only. Therefore, N5991PU4A and N5991PM4A offer testing at 8 GT/s only. 16 GT/s testing will be added once 16 GT/s testing is becoming part of the PCI Express compliance workshop testing. Valid software maintenance coverage will be required to use future N5991PU4A and/or N5991PM4A releases.

Measurement	N5991PU4A	N5991PM4A
8G Rx Preset Pre-Compliance Test – long channel	compliance & expert mode	compliance & expert mode
8G Rx Pre Compliance Test – long channel	compliance & expert mode	compliance & expert mode
8G Rx Coefficient Matrix scan – long channel	expert mode	expert mode
8G Rx Pre-Shoot De-Emphasis Scan – long channel	expert mode	expert mode
8G Rx Jitter Tolerance Test – long channel	expert mode	expert mode
8G Rx Sensitivity Test – long channel	expert mode	expert mode

PCI Express receiver test product add-ons

Different add-on licenses are available for the N5991PxxA PCI Express RX test automation product family. An add-on gives its capabilities to all test automation licenses of the family it belongs to.

N5991PA1A-ADD PCI Express Integrated BER Counter Interface Support

Support of the DUT integrated BER counter interface is added by the N5991PA1A-ADD add-on.

N5991PA2A-ADD PCI Express Multi-Channel Support

Support for multi-channel testing is provided by the N5991PA2A-ADD add-on. This add-on allows to configure more than two channels. It requires a multi-channel M8000 BERT system with more than two channels. Currently this is possible with M8020A systems up to 16 GT/s only. Up to two channels can be configured without the N5991PA2A-ADD option. Tests or calibrations are performed sequentially and not in parallel.

N5991PA3A-ADD PCI Express Link EQ Test Support

Link Equalization RX tests as well as Link Equalization TX require the N5991A3A-ADD add-on.

Measurements requiring N5991A3A-ADD	N5991PB5A	N5991PC5A	N5991PB4A	N5991PC4A	N5991PU4A	N5991PM4A
32G LinkEQ RX Compliance Test	comp. & exp. mode	comp. & exp. mode	n/a	n/a	n/a	n/a
32G LinkEQ JTOL	exp. mode	exp. mode	n/a	n/a	n/a	n/a
32G LinkEQ Rx Sensitivity	exp. mode	exp. mode	n/a	n/a	n/a	n/a
32G LinkEQ Initial Preset Test[1]	comp. & exp. mode	comp. & exp. mode	n/a	n/a	n/a	n/a
32G LinkEQ Phase 2 Preset and Response Time Test[1]	comp. & exp. mode	comp. & exp. mode	n/a	n/a	n/a	n/a
32G LinkEQ Phase 3 Preset and Response Time Test[2]	comp. & exp. mode	comp. & exp. mode	n/a	n/a	n/a	n/a
16G LinkEQ RX Compliance Test	comp. & exp. mode	comp. & exp. mode	comp. & exp. mode	comp. & exp. mode	n/a	n/a
16G LinkEQ JTOL	exp. mode	exp. mode	exp. mode	exp. mode	n/a	n/a
16G LinkEQ Rx Sensitivity	comp. & exp. mode	comp. & exp. mode	comp. & exp. mode	comp. & exp. mode	n/a	n/a
16G LinkEQ Initial Preset Test[1]	comp. & exp. mode	comp. & exp. mode	comp. & exp. mode	comp. & exp. mode	n/a	n/a
16G LinkEQ Phase 2 Preset and Response Time Test[1]	comp. & exp. mode	comp. & exp. mode	comp. & exp. mode	comp. & exp. mode	n/a	n/a
16G LinkEQ Phase 3 Preset and Response Time Test[2]	comp. & exp. mode	comp. & exp. mode	comp. & exp. mode	comp. & exp. mode	n/a	n/a
8G LinkEQ Rx Compliance Test – long channel	comp. & exp. mode	comp. & exp. mode	comp. & exp. mode	comp. & exp. mode	comp. & exp. mode	comp. & exp. mode
8G LinkEQ JTOL – long channel	exp. mode	exp. mode	exp. mode	exp. mode	exp. mode	exp. mode
8G LinkEQ Sensitivity – long channel	n/a	exp. mode	n/a	exp. mode	exp. mode	exp. mode
8G LinkEQ RX Compliance Test – short channel	n/a	comp. & exp. mode	n/a	comp. & exp. mode	n/a	n/a
8G LinkEQ JTOL – short channel	n/a	comp. & exp. mode	n/a	comp. & exp. mode	n/a	n/a
8G LinkEQ Sensitivity – short channel	n/a	comp. & exp. mode	n/a	comp. & exp. mode	n/a	n/a
8G LinkEQ Initial Preset Test[1]	comp. & exp. mode	comp. & exp. mode	comp. & exp. mode	comp. & exp. mode	comp. & exp. mode	comp. & exp. mode
8G LinkEQ Phase 2 Preset and Response Time Test[1]	comp. & exp. mode	comp. & exp. mode	comp. & exp. mode	comp. & exp. mode	comp. & exp. mode	comp. & exp. mode
8G LinkEQ Phase 3 Preset and Response Time Test[2]	comp. & exp. mode	comp. & exp. mode	comp. & exp. mode	comp. & exp. mode	comp. & exp. mode	comp. & exp. mode

[1] end point, AIC or device only   [2] root complex, system or host only

N5991PA4A-ADD PCI Express Receiver Test Switch System Support

Support for BitifEye switch matrixes can be added by the N5991A4A-ADD add-on. Supported are BitifEye's BIT-2100B Switch System x4, x6 and x8 configurations. For 2.5 GT/s, 5 GT/s and 8 GT/s it is possible to calibrate each lane individually. For 16 GT/s only lane 0 is calibrated and the user must ensure that all other lanes have similar characteristics since the lane 0 calibration is applied to all other lanes. Switch matrixes are not supported for 32 GT/s or higher. The multi-channel add-on N5991PA2A-ADD is not required.

PCI Express link training suite
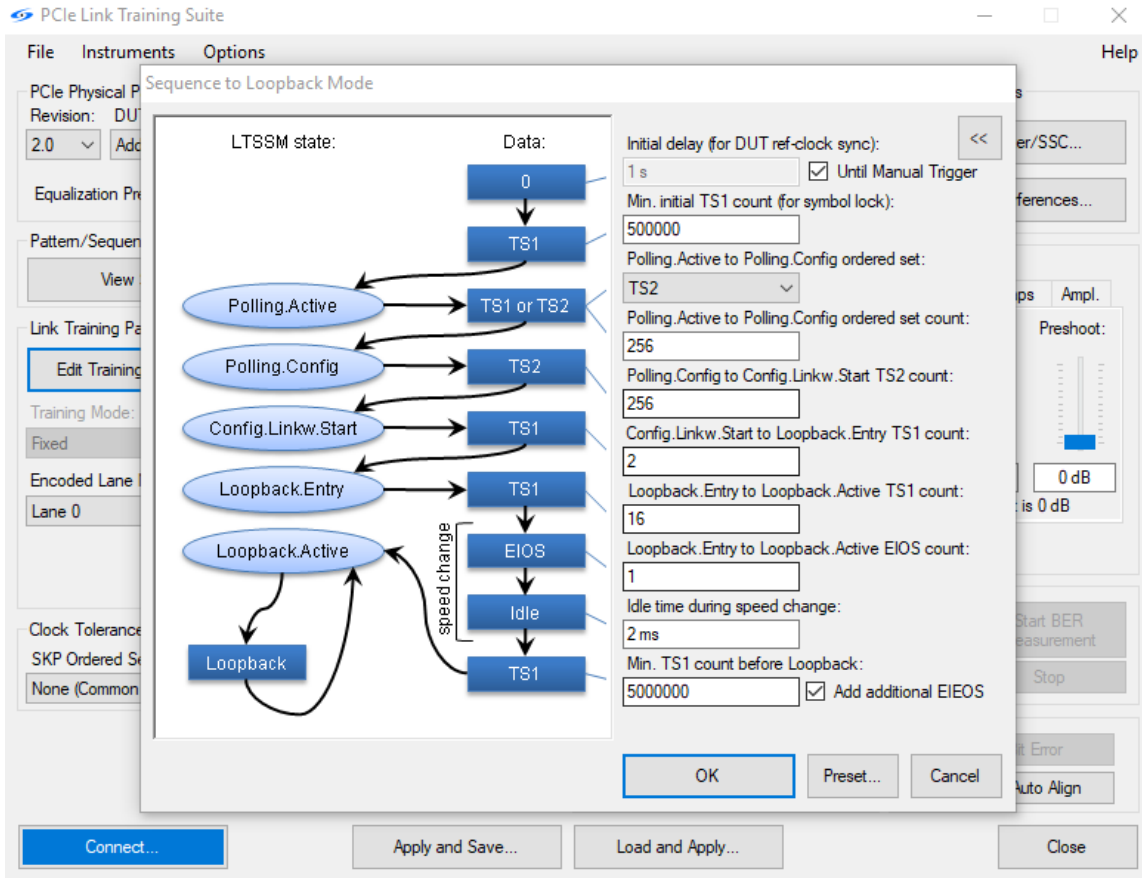
Figure 7: Generate Static Training Sequences for PCI Express using the PCIe Link Training Suite

The PCIe Link Training Suite simplifies the process of creating static training sequences Next to a graphical representation of the loopback path through configuration and the required parameters, the PCIe Link Training Suite software tools offer a scripting language which is helpful for the creation of more specialized sequences. N5991PL5A supports transfer rates from 2,5 GT/s through to 32 GT/s, while N5991PL4A supports transfer rates up to 16 GT/s. Both products support the M8020A BERT system, as well as the M8040A BERT system.

Instrument requirements for PCI Express receiver testing

The N5991PxxA Receiver Test Automation products for PCI Express support the M8020A BERT System as well as the M8040A 64 Gbaud High Performance BERT System. The BERT systems must cover the required data rates, be equipped with jitter injection and pattern generator de-emphasis capabilities. The reference clock multiplier option is required for system, host or root complex testing. RX testing can be performed using a DUT built in error counter if the error counter can be accessed programmatically. This requires the N5991PA1A-ADD PCI Express Integrated BER Counter Interface Support add-on. In most cases an error detector will be used for RX testing. The error detector must be equipped with internal CDR and SKP OS filtering. Link EQ testing requires an error detector with internal CDR and SKP OS filtering always. Additionally, required for Link EQ testing is the PCI Express LTSSM option for the J-BERT M8020A or M8040A 64 Gbaud High-Performance BERT system. Equalization capabilities will be required for many DUTs.

For sinusoidal interference in case of the J-BERT M8020A BERT System and for the transfer rates up to 16 GT/s, the sinusoidal interference option of the J-BERT M8020A system is required. In case of the M8040A 64 Gbaud High-Performance BERT system or transfer rates higher than 16 GT/s either a two channel M8195A AWG, a two channel M8196A AWG or the M8054A Interference Source is required. The M8045A-803 combiner pair is needed to couple the interference signal into the data stream.

Keysight Z Series and UXR Series real-time oscilloscopes are supported. The minimum bandwidth requirement for use with the M8020A BERT system is 25 GHz and for use with the M8040A BERT system is 50 GHz. The recommended scope BW for a M8040A is 59 GHz or higher. The oscilloscope must be equipped with embedding capabilities as well as serial data analysis capabilities. For transfer rates below 32 GT/s a 21 PS transition time converter can be used in which case 25 GHz of scope bandwidth is enough. For Link EQ testing the oscilloscope must be equipped with equalization capabilities. A four-channel oscilloscope is recommended for Link EQ testing. In case of a two-channel oscilloscope, differential probes supporting enough bandwidth and respective probe amplifiers are required.

Please ask for a complete configuration for details on instrument options, accessories, fixtures and additional software.

Ordering information for software products for PCI Express 4.0 and 5.0

PCI Express receiver test software products	
N5991PB5A	PCI Express 5.0 Base Specification Receiver Tests
N5991PC5A	PCI Express 5.0 CEM Specification Receiver Tests
N5991PB4A	PCI Express 4.0 Base Specification Receiver Tests
N5991PC4A	PCI Express 4.0 CEM Specification Receiver Tests
N5991PU4A	PCI Express 4.0 U.2 Specification Receiver Tests
N5991PM4A	PCI Express 4.0 M.2 Specification Receiver Tests

PCI Express link training suite software products	
N5991PL5A	PCI Express 5.0 Link Training Suite
N5991PL4A	PCI Express 4.0 Link Training Suite

Licensing options for receiver test and link training suite products	
1FP	Perpetual node-locked license
1TP	Perpetual transportable single license
SWM	SW maintenance – starting Dec 1st, 2020 -SWM is replaced by -SFM, -STM, -SF3 and -ST3
SFM	SW maintenance, 1-year, for -1FP license
STM	SW maintenance, 1-year, for -1TP license
SF3	SW maintenance, 3-year, for -1FP license – can be ordered together with respective -1FP license only
ST3	SW maintenance, 3-year, for -1TP license – can be ordered together with respective -1TP license only

Add-ons for PCI Express receiver test products	
N5991PA1A-ADD	PCI Express Integrated BER Counter Interface Support
N5991PA2A-ADD	PCI Express Multi-Channel Support
N5991PA3A-ADD	PCI Express Link EQ Test Support
N5991PA4A-ADD	PCI Express Receiver Test Switch System Support

System Requirements

Software

Requirements

- OS: Windows 10
- Microsoft .NET
- Keysight IO Libraries Suite
- Exact versions of software requirements are listed in the respective changelog file

 Recommendation

- Microsoft Office Excel 2010 or higher, English version

Hardware

Requirement

- Connectivity hardware for instrumentation, depending on configuration e.g. USB3, Ethernet

Recommendations

- Multicore processor with 12 logical processors or more
- 16GB RAM or higher

Remote Power Cycling

All N5991 Receiver Test Automation products can control programmable remote power strips to power-cycle a DUT. Ask your contact person at Keysight about supported models.

Application Programming Interface (API)

The N5991 ValiFrame remote interface allows ValiFrame functionality (such as test setup information, calibration, and test procedures, and results) to be accessed from external programming environments. Remote interface does not need a special license to be used, it is included in the base product of particular standards. The remote interface can thus be used to control the N5991 with external software.

In typical use, a top-level external test sequencer takes advantage of ValiFrame functionality.

Software Maintenance

The purchase of one -SFM maintenance license for -1FP product licenses or one -STM maintenance license for -1TP product licenses provides the ability to install updates for one year.

With the initial purchase of a product license, it is possible to purchase a 3-year software maintenance license. A -SF3 maintenance license covers a -1FP product license and -ST3 maintenance license covers a -1TP product license.

A software maintenance license is always valid for the respective RX test or Debug Tool e.g., Link Training Suite or Frame Generator product only.

Software Maintenance includes updates to newer instrument firmware as well as procedure and test limit changes for the test specifications covered by the products the software maintenance license belongs to. Upgrades to a different test specification are not covered.

All N5991 RX test or Debug Tool / Link Training Suite licenses which were purchased after November 30th, 2020 will no longer include an automatic Software Maintenance during the first year. Thus, it requires a respective software maintenance license to be able to install updates.

Products which do not have a software maintenance offering and are not an Add-On cannot be updated but are operational still when using the last version for which software maintenance was available.

Software without any extra software maintenance product associated with it, will have a maintenance expiration date of the license issue date + 14 days as a starting point. The software itself will still work, even if the maintenance is expired. If software maintenance has expired a new software maintenance license can be purchased for this product. But the new software maintenance will not grant coverage starting from the purchase date but from the date the previous software maintenance coverage expired. For example, the software maintenance expired on April 30th, 2020, and a new 1-year software maintenance is purchased on August 1st, 2020, the purchased coverage will take May 1st, 2020, and will end on April 30th, 2021.

Related Products

The N5991ST3A SATA 3 Receiver Test Automation Software covers SATA RSG testing.

The N5991SA3A and N5991SA4A SAS Receiver Compliance Test Automation Software cover SAS-3 12G and SAS-4 12G / 22.5G SAS receiver testing.

The N5991C25A CCIX Receiver Test Automation Software covers CCIX 20G / 25G receiver testing.

The N5991U40A USB4 Receiver Compliance Test Software covers USB4 and Thunderbolt™ 3 rates 10 Gb/s, 10.3125 Gb/s, 20 Gb/s and 20.625 Gb/s.

The N5991U32A USB 3.2 Receiver Compliance Test Software covers USB receiver testing for 5 Gb/s and 10 Gb/s.

Automated transmitter compliance testing is available. D9040PCIC PCI Express Electrical Performance Validation and Compliance Software covers PCI Express specification up to PCI Express 4.0. D9050PCIC PCI Express 5.0 Transmitter Electrical Performance Validation and Compliance Software covers PCI Express 5.0 specifications. The D9040SASC Serial Attached SCSI – 4 (SAS-4) Transmitter Test Application covers SAS transmitter testing for 1.5G, 3G, 6G, 12G and 22.5G. The D9030SATC SATA Compliance Test Software covers SATA PHY, TSG and OOB compliance testing. The D9040USBC USB4 Tx Test Software covers 10G, 10.3125G, 20G and 20.625G USB4 Tx testing. The D9020USBC USB 3.2 Tx Compliance Test Software covers USB3.2 5G and 10G Tx compliance testing.

Automated electrical receiver testing for 400G and 100G is offered by M809256PA, M8091BSPA and M809228XA.

The N4917BSCA Optical Receiver Stress Test Application addresses test needs for optical input test of transceiver modules for 400GBASE-LR8/-FR8 as well as 200GBASE-LR4/-FR4/-DR4.

The UXR-Series oscilloscope is ideal for testing PAM4 at 32 Gbaud.

The M8040A 64 Gbaud High-performance BERT is currently the only PAM4 BERT system used for link equalization testing for official integrators list testing at PCI Express compliance workshops.

Learn more at: www.keysight.com

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at: www.keysight.com/find/contactus

KEYSIGHT
TECHNOLOGIES