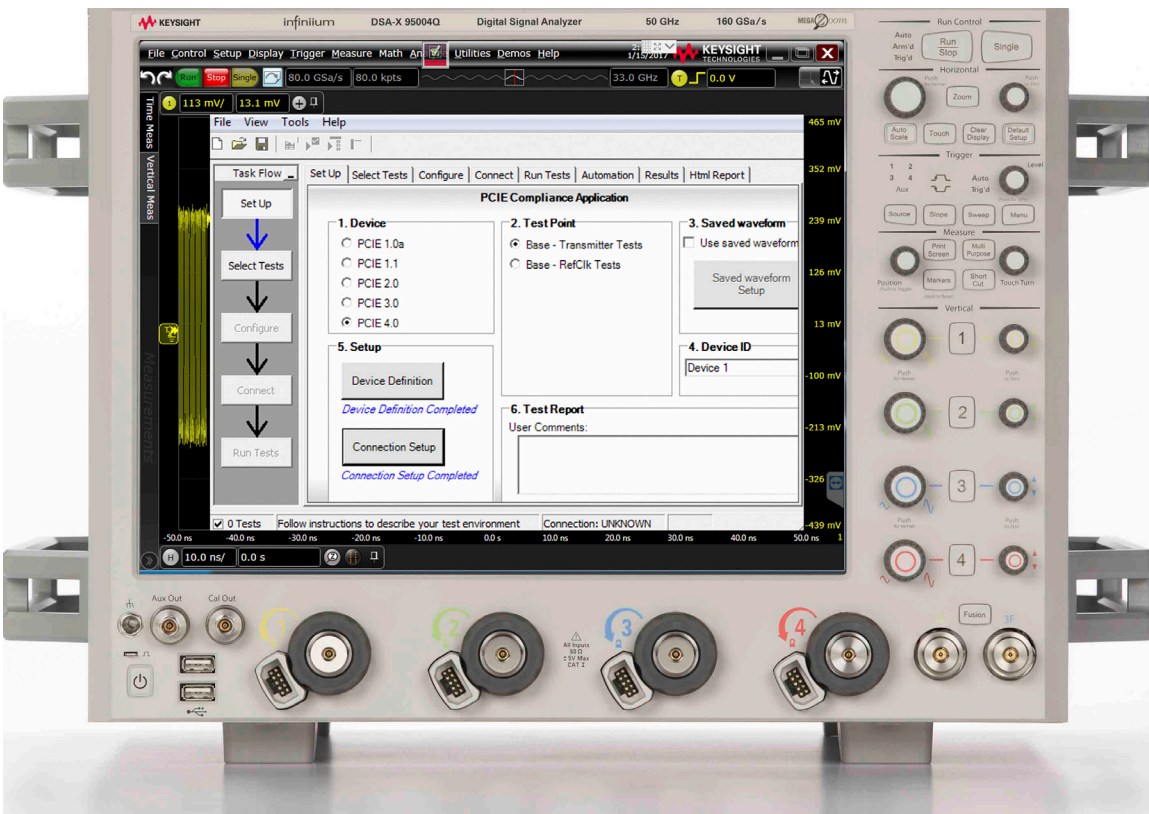


# Keysight N5393F/G

## PCI Express® 4.0 (Gen4) Software for Infiniium Oscilloscopes

(Preliminary)

Data Sheet



## Features

The Keysight N5393F/G PCI Express 4.0 electrical transmitter (TX) test software represents the latest PCI Express TX test tool that supports PCI Express 4.0 with speeds of up to 16 GT/s. Below is a list of a few of the key features of this software package.

- PCIe® 4.0 BASE TX measurements including uncorrelated TJ, DJ, and PWJ, pseudo package loss and other parameters defined in the 0.7 version of the PCI Express BASE specification.
- BASE spec TX measurements are supported at 16 GT/s, 8 GT/s, 5 GT/s, and 2.5 GT/s.
- Legacy support for PCI Express 3.x, 2.x, and 1.1 compliance tests (BASE and CEM).
- PCI 4.0 reference clock measurements as defined in v0.7 of the PCIe 4.0 BASE spec.
- Support for U.2 (SFF-8639) PCIe 3.0 CEM measurements for endpoint and root complex devices (8 GT/s, 5 GT/s, and 2.5 GT/s).
- Automated DUT control for endpoint and root complex testing using a Keysight 81150A or 81160A Pulse Function Arbitrary Noise Generator.
- New Workshop Compliance mode for rapid PCI SIG-style compliance testing including Sigtest HTML report files.
- Support for de-embedding of test fixtures, high speed switches and cables <sup>1</sup>.
- Support for Keysight and Bitfeye high speed switch networks to automate testing of multi-lane DUTs <sup>2</sup>.
- Test setup wizard for ease-of-use.
- Pass/fail margin analysis.
- Two-port (explicit clock and data) supported for motherboard signal quality testing.
- Support for both full-swing and low-power, half-swing devices.
- Supported on Keysight Z-Series, V-Series, Q-Series, X-Series, and 90000A real time oscilloscopes. Also supported for 2.5 G measurements only on the S-Series oscilloscope (See ordering information).

With the PCI Express N5393F/G electrical test software, you can use the same oscilloscope you use for everyday debugging to perform automated testing and margin analysis based on the PCI-SIG®-specified tests.

## PCI Express 4.0 testing

The PCI Express 4.0 specification elevates the data rate for PCIe 4.0 devices to 16 GT/s. This results in a maximum throughput of approximately 15.8 Gb/s per lane (taking into account encoding overhead). PCIe 4.0 shares many elements in common with PCIe 3.0 including 128/130 bit encoding. Nevertheless, at 16 GT/s, the signal is significantly attenuated by a typical FR4 channel which increases the importance of ensuring your design has the best signal integrity possible. With Keysight oscilloscopes, you are ensured of using instruments with the lowest noise floor in the industry which helps to ensure you will perform your compliance tests with the greatest margin possible.

1. Requires the purchase of the optional N5465B Keysight InfiniiSim Waveform Transformation Toolset for Infiniium Oscilloscopes.
2. Requires the purchase of N5393F-7FP software license (Z-Series, V-Series, Q-Series, X-Series) or N5393G-7FP (S-Series).

## Bandwidth requirements for PCI Express 4.0

PCI Express operates at 2.5 GT/s, 5 GT/s, 8 GT/s and 16 GT/s. The two tables below provide guidelines on the minimum bandwidth and sample rate recommended for PCI Express Transmitter measurements. In addition to transmitter measurements, phase jitter measurements of the PCIe 100 MHz reference clock also call for a minimum sample rate used to measure the clock as is also shown below. Use this information to help you select the proper oscilloscope for your specific requirements. Also remember that receiver testing requires adequate bandwidth to ensure the most accurate calibration of your bit error ratio tester (BERT). Automated receiver calibration using the N5990A Automated Compliance and Device Characterization tool and the Keysight M8020A J-BERT high performance BERT includes integration and control of Keysight high performance oscilloscopes for fast BERT calibration for receiver stressed jitter and stressed voltage testing.

**PCI Express bandwidth requirements by data rate for transmitter measurements and RX calibration (PCIe 3 and 4)**

Data rate	Bandwidth required	Minimum sample rate
2.5 GT/s	6 GHz	20 GSa/s
5 GT/s	12 GHz	40 GS/s
8 GT/s	12 GHz	40 GS/s
16 GT/s	25 GHz (recommended)	80 GSa/s

**PCI Express sample rate requirements for reference clock measurements**

PCIe standard	Minimum sample rate
1.1	20 GSa/s
2.x	20 GSa/s
3.x	20 GSa/s
4.0	20 GSa/s

## Ordering Information

You can order the N5393F PCIe 4.0 Test software as a factory installed option, as a user installed license for an existing oscilloscope or as a server based license. This software will also support legacy compliance testing for PCIe 3.x, 2.x and 1.1 in addition to supporting PCIe 4.0. If you're only testing at PCIe Gen3 speeds (or slower) you can order the license for PCIe 1.x, 2.x, and 3.x TX testing only. If you already have an N5393D license and want PCIe 4.0 TX testing capabilities, an upgrade license is available. To test PCI Express at 2.5G only on the S-Series oscilloscope, order the appropriate N5393G license. To enable switch matrix support for your N5393F/G software, an appropriate license is required. See the tables below.

License type		Infiniium Z-Series, V-Series, Q-Series, X-Series	Infiniium S-Series	Infiniium 90000 Series
<b>New N5393F/G license for PCI Express 1.x, 2.x and 3.x transmitter testing</b>				
Fixed	Factory-installed	N5393F-3FP	N5393G-3FP <sup>1</sup>	DS090000-096
	User-installed	N5393F-3FP	N5393G-3FP <sup>1</sup>	N5393F-3FP
Floating	Transportable	N5393F-3TP	N5393G-3TP <sup>1</sup>	N5393F-3TP
	Server based	N54354A-113		

License type		Infiniium Z-Series, V-Series, Q-Series, X-Series	Infiniium S-Series	Infiniium 90000 Series
<b>Upgrade to N5393F/G PCIe 4.0 transmitter testing (from existing N5393D/E license)</b>				
Fixed	Factory-installed			
	User-installed	N5393F-2FP	N5393G-2FP <sup>1</sup>	N5393F-2FP
Floating	Transportable			
	Server based	N/A		

License type		Infiniium Z-Series, V-Series, Q-Series, X-Series	Infiniium S-Series	Infiniium 90000 Series
<b>New N5393F license PCI Express 4.x transmitter testing</b>				
Fixed	Factory-installed	N5393F-1FP		DS090000-080
	User-installed	N5393F-1FP		N5393F-1FP
Floating	Transportable	N5393F-1TP		N5393F-1TP
	Server based	N5435A-112		

## PCIe switch matrix support

License type		Infiniium Z-Series, V-Series, Q-Series, X-Series	Infiniium S-Series	Infiniium 90000 Series
<b>New PCIe switch matrix license</b>				
Fixed	Factory-installed	N5393F-7FP	N5393G-7FP <sup>1</sup>	DS090000-716
	User-installed	N5393F-7FP	N5393G-7FP <sup>1</sup>	N5393G-7FP
Floating	Transportable	N5393F-7TP	N5393G-7TP <sup>1</sup>	N5393G-7TP
	Server based	N/A		

The N5393F/G requires that the E2688A serial data analysis package also be licensed.

1. The S-Series oscilloscope is limited to a maximum bandwidth of 8 GHz which is sufficient bandwidth only for 2.5 GT/s (PCIe 1.x) transmitter measurements. Transmitter measurements for 5GT/s (PCIe 2.x), 8 GT/s (PCIe 3.x) require a minimum scope bandwidth of 12 GHz; however, PCIe clock phase jitter measurements can be made with the S-Series oscilloscope and are thus enabled with this license. 5GT/s and 8GT/s transmitter measurements are not enabled on the S-Series oscilloscope as a higher minimum bandwidth is required.



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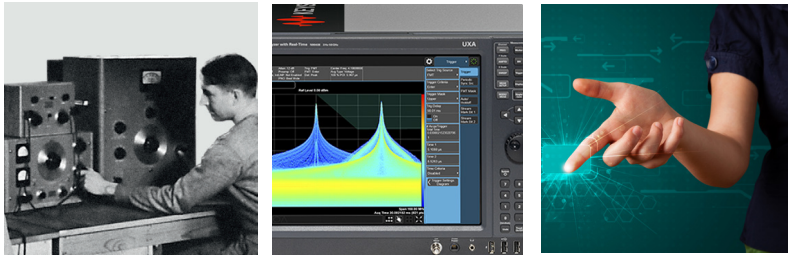
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