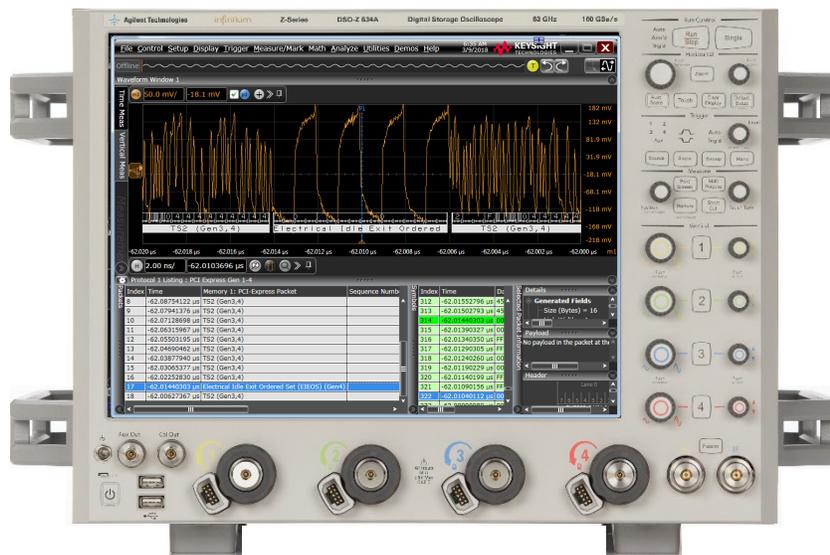


# Keysight Technologies

## N8816B

### PCI Express 4.0 Protocol Decode Software for Infiniium Real-Time Oscilloscopes

Data Sheet



Simplify the validation of your PCI Express<sup>®</sup> 4.0 design with a full capability protocol viewer for your real-time Infiniium oscilloscope



## Introduction

The Keysight N8816B Infiniium protocol viewer software for PCI Express 4.0 enhances the industry's premier and totally integrated oscilloscope-based protocol analyzer technology, providing time-correlated views of physical layer and data link layer protocol. You get packet-level decode for PCI Express® signals built into a real-time oscilloscope. This software provides you with a fast, easy way to isolate signal integrity problems from logic-level coding errors on bi-directional serial data streams. This capability allows you to test, debug, and characterize your designs to the logic and link layer. The N8816B Infiniium protocol analyzer software has decode options that support both PCIe 4.0 at 16GT/s as well as legacy PCIe speeds of 8GT/s, 5GT/s, and 2.5GT/s.

N8816B – Infiniium protocol viewer  
PCIe™ Gen1, Gen2, Gen3 and Gen4  
E2688A SDA (prerequisite)  
N5465A InfiniiSim Waveform Transformation Toolset  
(recommended for 16GT/s)

The N8816B Infiniium protocol viewer software is compatible with Keysight high performance Infiniium oscilloscopes.

## Features

The N8816B Infiniium protocol viewer software offers several features to simplify the validation of your PCI Express designs:

- Setup wizard for quick setup, configuration, and test
- Packet-level decode of ordered sets as well as link and logical physical layers
- Serial data analysis with 128/130 bit streams (Gen3, Gen4)
- Serial data analysis with 8B/10B symbols (Gen1, Gen2)
- Decode of scrambled and unscrambled symbols
- Bi-directional symbol and packet level decode
- Simultaneous display of packet/symbol lists and waveform overlay
- Capability to save symbol and packet data lists to .csv and .txt files
- Packet decode details tab provides detailed information on packets:
  - Channel information
  - Listing index
  - Link ordered set type
  - Control symbols
  - Reserved-bit settings
  - Data payload popup
  - CRC
  - Packet length
- Payload display shows data payload
- Unique packet-waveform correlation marker “blue line” makes it easy to scroll through waveforms to view synchronized
  - Comprehensive serial search capabilities
  - Trigger and stop on search
  - Primitive, control symbol, and packet search capability

## Comprehensive Decode Capability

With the N8816B Infiniium PCI Express 4.0 protocol decoder software, you can use the same oscilloscope you use for everyday debugging and signal-quality testing to perform protocol-level testing. The software automatically decodes symbols, packets and ordered sets, and provides informative results. It includes decode of reserved bit settings during training sequences and speed negotiation, greatly simplifying debugging of link training failures.

One of the difficulties in validating PCI Express communication links is determining whether link failures or instability is due to electrical problems or logic-level problems. The N8816B Infiniium PCI Express 3.0 protocol decoder software allows you to analyze the root cause of these issues with a single instrument.

## Easy Measurement Setup

The N8816B Infiniium PCI Express 4.0 protocol decoder software uses built-in, intelligent, automated setup algorithms to configure the software to decode your PCI Express 4.0 with little more than a single button push.

Select "Protocol Decode" to setup the protocol decode function for your signal.



Figure 1 Setting up your Infiniium oscilloscope to decode your PCIe waveform.

Use the "Auto Setup" button to automatically configure the N8816B to decode your Gen4 signal.



Figure 2. The "Auto Setup" feature of the N8816B makes it easy to configure the decoder for your specific Gen1, Gen2, Gen3, or Gen4 signal.

## Synchronized Analog and Digital

### Display

The N8816B Infiniium PCI Express 3.0 protocol decoder software provides the ability to perform 128/130 bit and 8b/10b based packet decoding via an innovative technique used to capture and display serial data synchronized with the analog view of traffic of a serial data stream. Decode is displayed directly on the analog waveform as well as in the decode list with associated time and index displays.

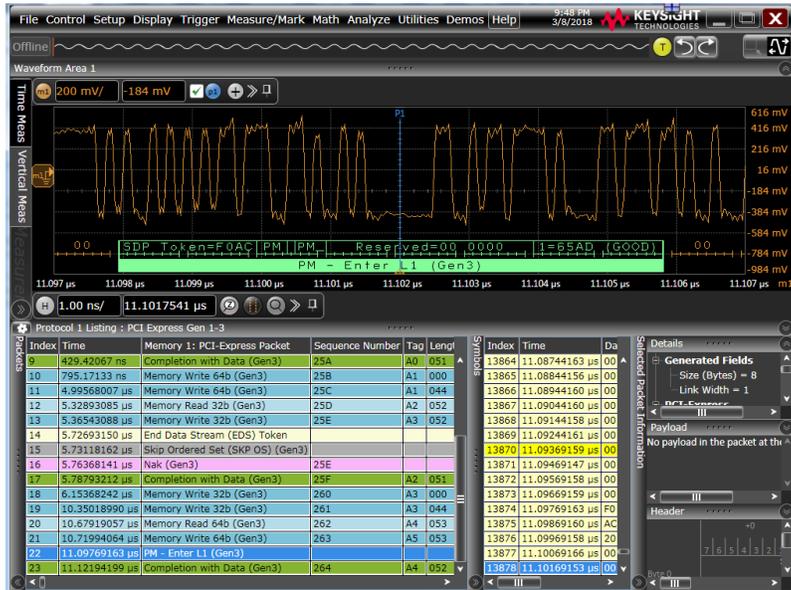


Figure 3. The decode of the analog signal is shown both in the listing window and on the analog waveform display.

In conjunction with the decode list, using the multi-grid waveform display you can simultaneously display analog bi-directional waveforms with corresponding decode listings.

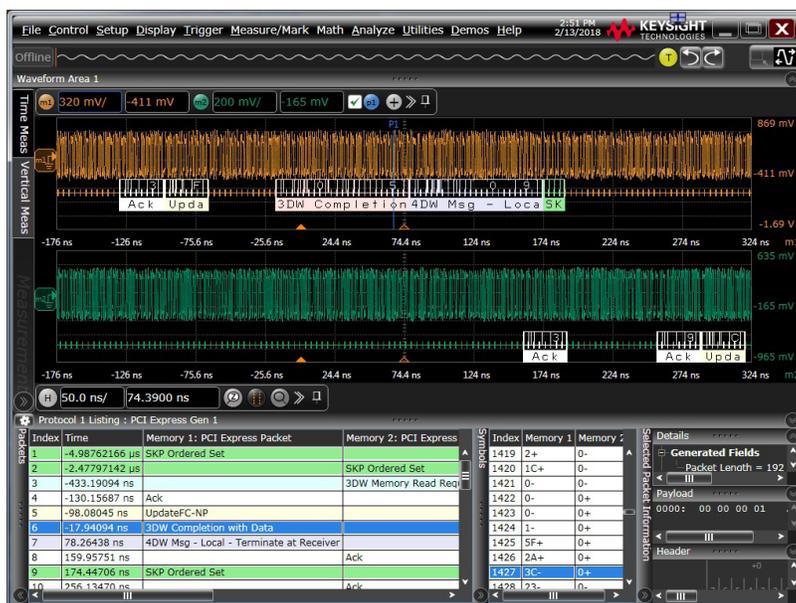


Figure 4. Bi-directional waveform and packet list are displayed simultaneously.

The unique packet-waveform correlation marker “blue line” (patent pending) allows for convenient and intuitive correlation of analog and digital domains. You can easily scroll to analog anomalies that are visually distinct, making navigating and checking for errors easy, even for industry leading record depths.

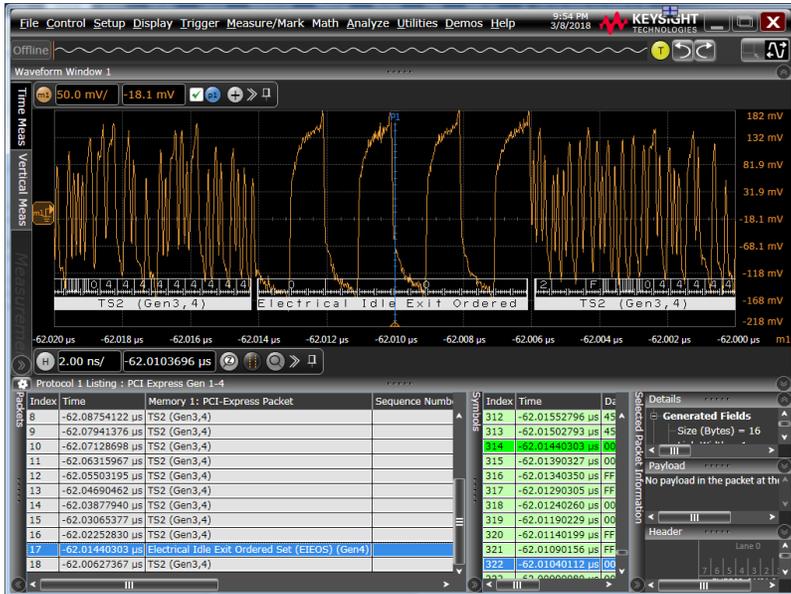


Figure 5. Blue packet waveform correlation marker identifies EIEOS symbol location in waveform

The expandable decode list window provides an extendable indexed view of packet decode for users who are more accustomed to logic analyzer “vertical style” packet decode traffic listings. The list includes color-coded packet types for easier visual searching of traffic patterns as well as a blue highlight that shows the packet that corresponds to the “blue line” in the waveform view. The side bar also shows how much of the waveform display is on the screen by providing a gray background on the index field, as shown in Figure 6.

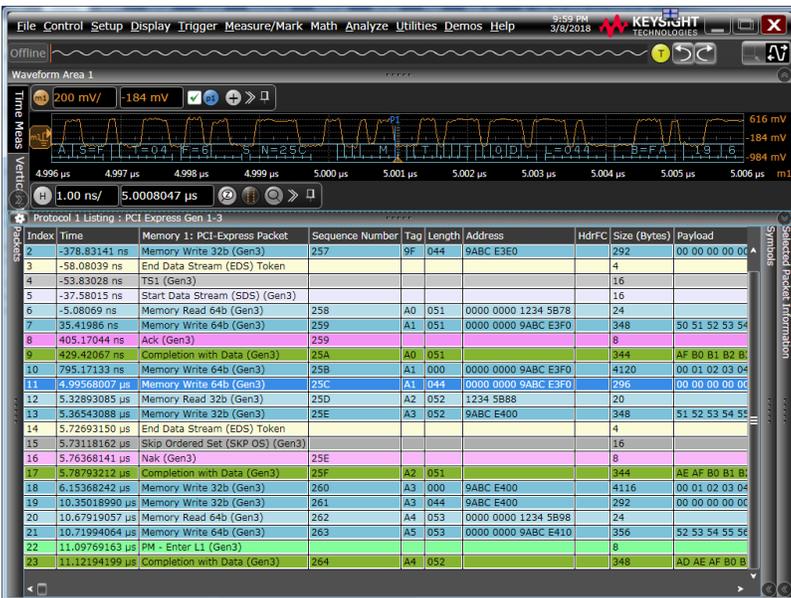


Figure 6. Expanded Decode List with correlation marker (line index 11).

## Comprehensive Search Capabilities

The N8816B Infiniium PCI Express 4.0 protocol decoder software includes a powerful serial search tool that allows you to search for a pattern that is a primitive, control symbol or packet, depending on the version of the PCI Express standard that is selected.

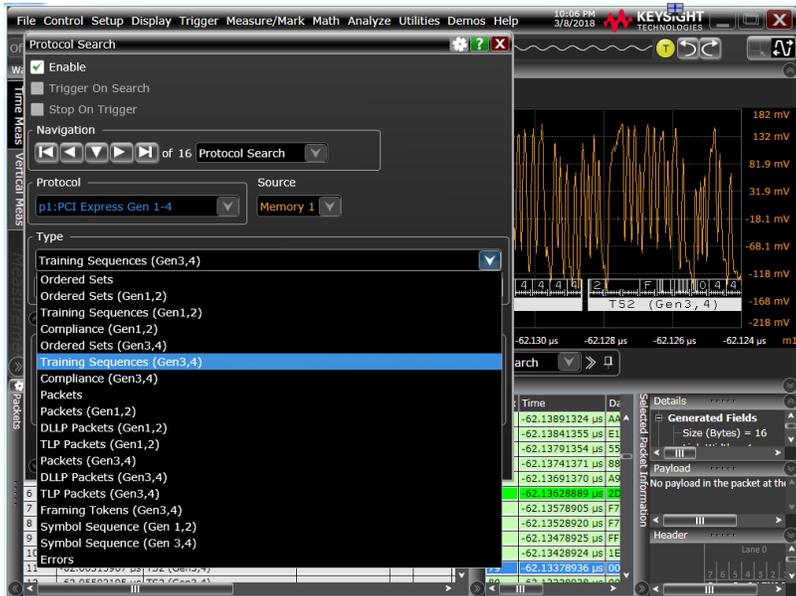


Figure 7. Searching Gen4 Training Sequences.

The search capability also includes a comprehensive packet search and trigger capability that allows you to specify search conditions such as errors or data packets. This allows you to specify desired trigger conditions and makes finding errors or packet types easy by eliminating the need to do manual searches of very long records.



Figure 8. Searching for PCIe errors quickly identifies problems in the data stream.

## Save Packet, Symbol and Waveform Data for Further Analysis

The N8816B Infiniium PCI Express 4.0 protocol decoder software provides save capabilities for the symbol and packet lists in easy-to-export .csv or .txt formats for analysis outside of the scope application. Since the packet decode is performed on the real-time capture of the oscilloscope, the corresponding waveform can also be saved for future analysis in both the oscilloscope and external tools.

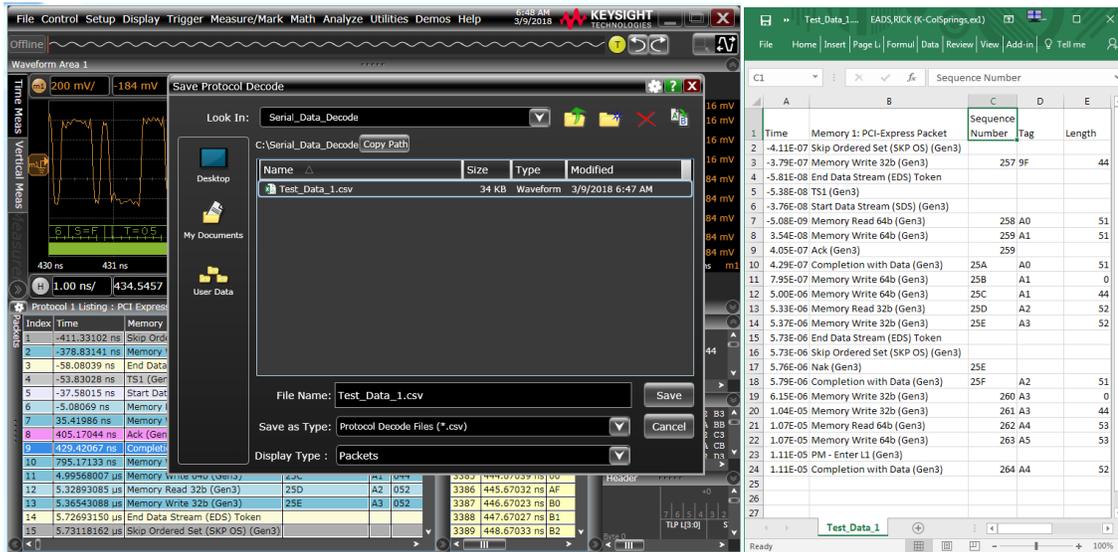


Figure 9. Saving symbol, packet, and waveform data.

## Recommended Oscilloscopes

The N8816B Infiniium protocol decoder software is compatible with Keysight Infiniium Series oscilloscopes with operating software revision 6.20 or higher. For oscilloscopes with earlier revisions, upgrade software is available here: [www.keysight.com/find/scope-apps-sw](http://www.keysight.com/find/scope-apps-sw).

Data Rate	Minimum Bandwidth	Minimum Channels	Description
2.5GT/s	6 GHz	2	Infiniium 90000A Series, 90000 X-Series, V-Series and Z-Series oscilloscopes
5GT/s	12 GHz	2	Infiniium 90000A Series, 90000 X-Series, V-Series and Z-Series oscilloscopes
8GT/s	12 GHz	2	Infiniium 90000A Series, 90000 X-Series, V-Series and Z-Series oscilloscopes
16GT/s	25 GHz	2	Infiniium 90000 X-Series, V-Series and Z-Series oscilloscopes

## Ordering Information

License Type		Infiniium Z-Series, V-Series, Q-Series, X-Series	Infiniium 90000 Series
New N8816B License* for PCI Express Protocol Decode Software (PCIe 1.0, 1.1, 2.0, 3.0, and 4.0)			
Fixed	Factory-Installed	DSOZ000-S28 DSOV000-S28	DSOZ000-S28 DSOV000-S28
	User-Installed	N8816B-1FP	N8816B-1FP
Floating	Transportable	N8816B-1TP	N8816B-1TP
			N5435A-134

\*Also requires that E2688A Serial Data Analysis software be licensed and enabled and Infiniium software version 6.20 or higher.

## Optional Probe Accessories and Software

Model Number	Description
N2802A InfiniiMax III	25 GHz probe amplifier
N5444A	2.92mm 3.5mm SMA probe head
N2849A	InfiniiMax III QuickTip probe head
N2836A	InfiniiMax III 26GHz solder-in probe head
15442A	Matched pair of SMA cables
N5461A	Serial Data Equalization Software

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N5461A	Serial Data Equalization Software

### Related Keysight Literature

Publication Title	Publication Type	Publication Number
Infiniimax III/III+ Probing System	Data Sheet	5990-5653EN
E2688A, N5384A High-Speed Serial Data Analysis and Clock Recovery Software For Infiniium Oscilloscopes	Data Sheet	5989-0108EN
Infiniium V-Series Oscilloscopes 8-33 GHz	Data Sheet	5992-0425EN
Infiniium Z-Series Oscilloscopes	Data Sheet	5991-3868EN
N5461A Serial Data Equalization Software for Infiniium Series Oscilloscopes	Data Sheet	5990-3330EN



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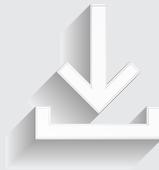
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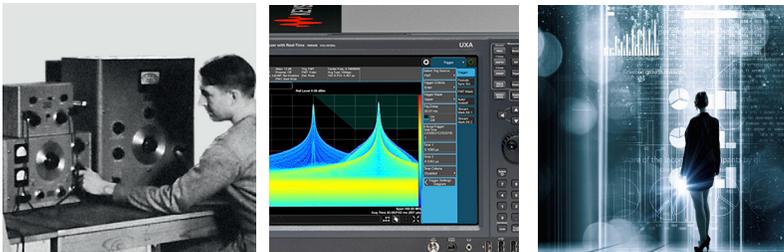
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