M8047C Redriver

Enabling Your Successful PCIe Design Deployments

Data Sheet – Version 2.0

Introduction

The Keysight M8047C, when paired with the M8040A or M8050A platforms, enhances your chip development process for PCIe by offering advanced equalization capabilities.

The M8047C Redriver enhances the equalization capabilities of the M8046A error detector for both PAM4 and NRZ applications. Additionally, the M8047C functions as a remote head for the M8046A error detector, allowing for the use of shorter cables.



KEYSIGHT

Description

The M8047C Redriver enables testing of devices with longer backchannels than the M8000 Series error detectors could accept by themselves. It offers a continuous-time linear equalizer. Used together with the M8046A error detector (analyzer) module, the M8047C Redriver extends the backchannel reach to approximately by 28 dB at 16 GHz for PAM4 signals (BER ≤ 1.0e-6). For NRZ signals (BER ≤ 1.0e-12), the reach is approximately 37 dB at 16 GHz.

It is designed to operate up to 32 GBd.

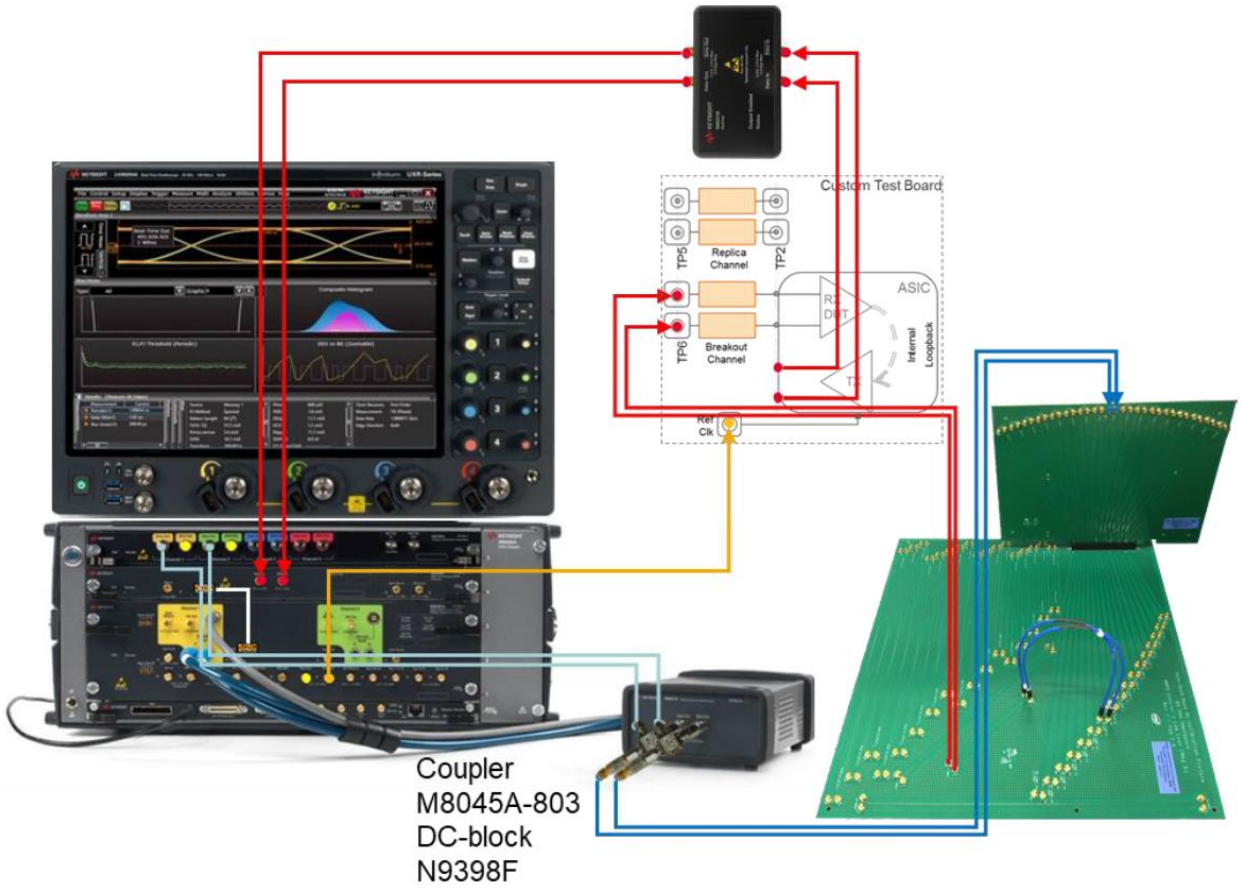

Figure 1. PCI Express receiver testing is a typical use case of the M8047C Redriver.

The M8047C Redriver targets PCI Express, OIF CEI, and IEEE 802.3 applications within its range of operation.

The M8047C is controlled through the M8070B graphical user interface. The Redriver appears as an additional module in the M8070B software.

Specifications

Achievable Backchannel Compensation for PCIe 64 GT/s

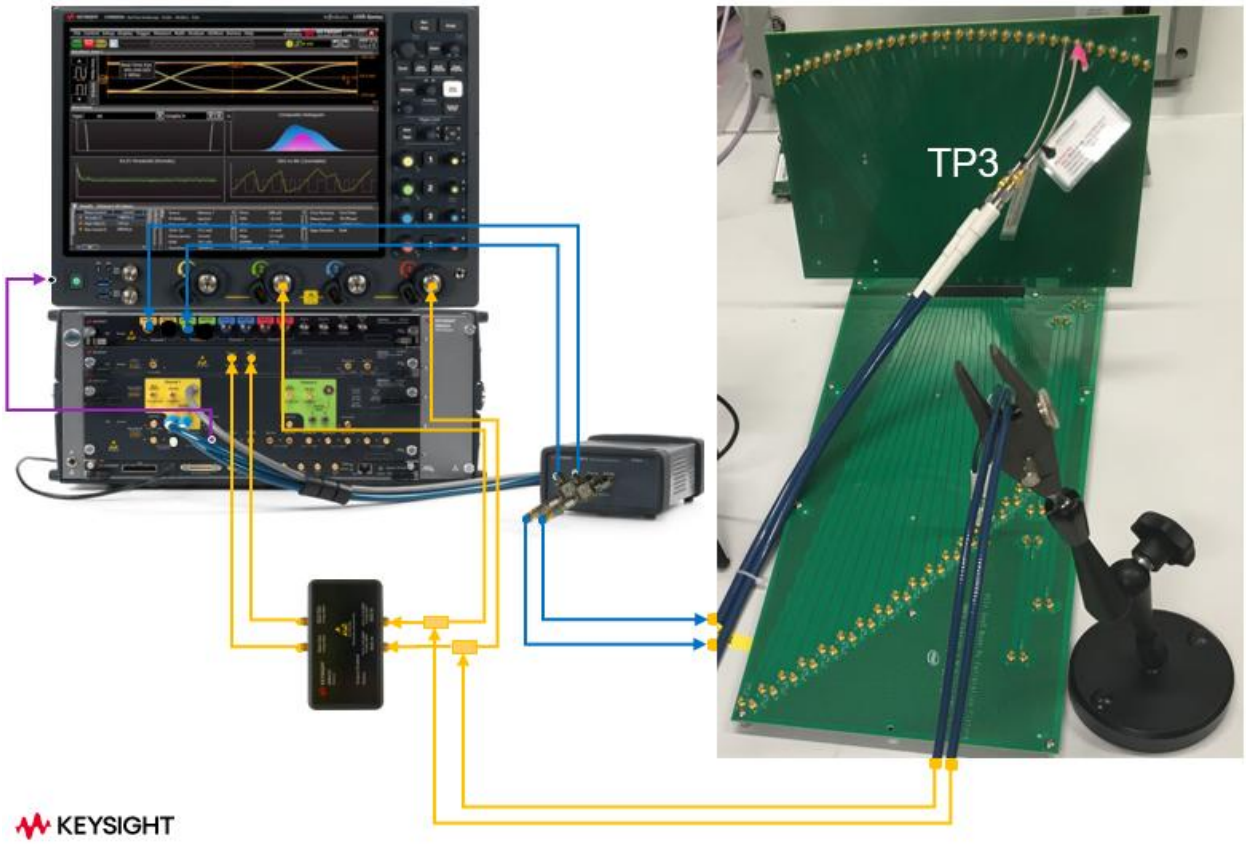

Figure 2. The setup above emulates a LinkEQ TX test scenario for PCIe 64 GT/s using PCIe 5.0 Base specification channels.

From a backchannel equalization perspective, the LinkEQ TX response time test is the most demanding setup. It splits the return signal between an oscilloscope and an error detector, which further reduces the signal at the error detector.

To emulate a PCIe 64 GT/s transmitter, the BERT pattern generator was calibrated and characterized at TP3. The SNDR was around 36.5 dB. RJ was calibrated to 250 fs rms using noise removal on the oscilloscope. Amplitude was calibrated to 800 $mV_{pp,diff}$.

Two cases were checked: transmission with SSC and without SSC.

For transmission without SSC, the error detector clock recovery was set to a first order PLL behavior with a 2 MHz loop BW. For transmission with SSC, the error detector CR was set to a second order behavior with 20 MHz loop BW and peaking to track the SSC.

In all cases the backchannel was optimized by varying the Tx EQ preset, M8047C equalization, M8046A FFE, input voltage window, thresholds and sampling point delay.

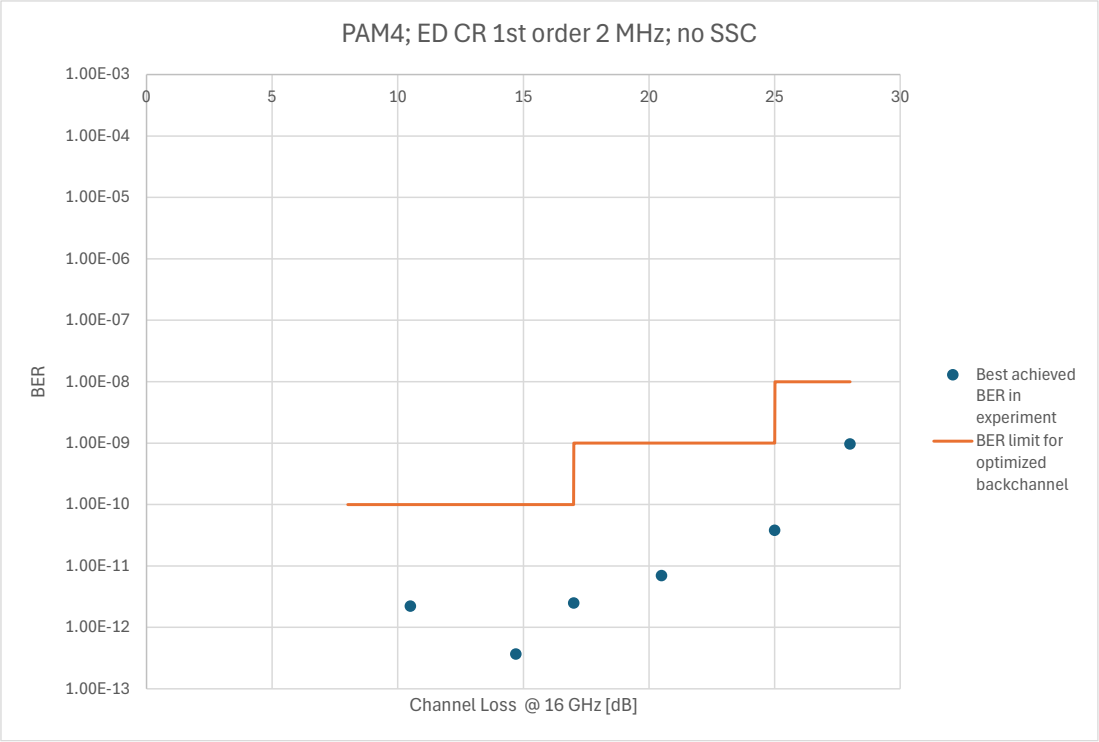

Figure 3. Measurements using a transmission without SSC. Blue dots show the lowest BER achieved by optimizing the Tx preset, M8047C equalization, M8046A FFE, input window, thresholds and sampling point.

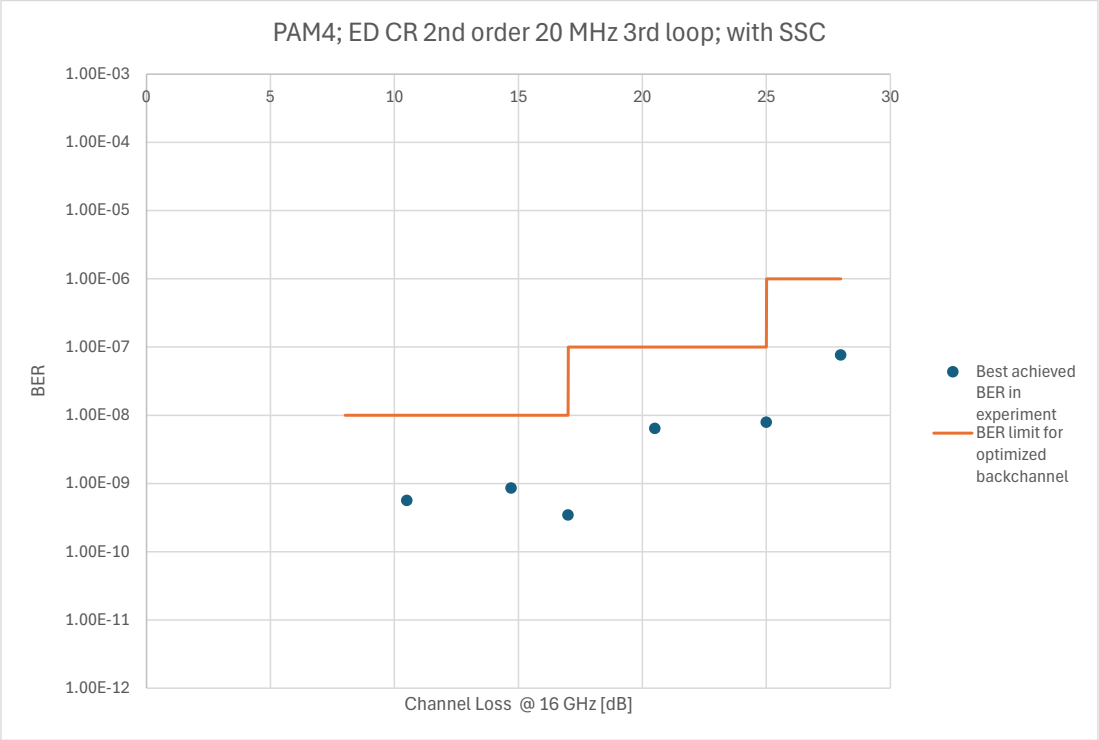

Figure 4. Measurements using a transmission with SSC. Blue dots show the lowest BER achieved by optimizing the Tx preset, M8047C equalization, M8046A FFE, input window, thresholds and sampling point.

The achievable backchannel BER is highly dependent on the transmitter signal characteristics like SNDR, PLM and jitter. The BER limit for optimized backchannel is intended to provide guidance for an achievable backchannel BER if a transmitter and channel with characteristics similar to the experiment above is used.

Data Input and Data Output

The M8047C Redriver has a differential data input and differential data output for insertion in the test setup. The adjustable CTLE of the M8047C compensates the channel loss.

Table 1. Data input specifications.

Parameter	Value
Symbol rate	2 GBd to 32 GBd
Line coding	NRZ / PAM4
Absolute maximum input voltage range	-2.0 V to +2.0 V
Maximum input amplitude	1.0 $V_{pp,differential}$
Input type	Differential Low frequency: DC coupled 50 Ω (nom.) to GND High frequency: AC coupled 100 Ω (nom.)
Connector	2.4 mm, female

Table 2. Data output specifications.

Parameter	Value
Output	On / Off
Maximum output amplitude	2.0 $V_{pp,differential}$
External termination	100 Ω Do not operate into open
Coupling	AC-coupled, differential
Connector	2.4 mm, female

Status Indicators, General Characteristics, and Physical Dimensions

Table 3. Status indicators specifications.

Parameter	Value
Output enabled, green LED	Off: Data output is turned off On: Data output is enabled
Instrument status, red/green LED	Off: M8047C is not powered Green, static: Instrument is ready Green, blinking: Used to identify the instrument Red: Indicates an instrument error

Table 4. General characteristics and physical dimensions.

Parameter	Value
Operating temperature	0 °C to 40 °C (32 °F to 104 °F)
Storage temperature	-40 °C to 70 °C (-40 °F to 158 °F)
Operating humidity	15% to 95% relative at 40 °C (non-condensing)
Storage humidity	24% to 90% relative at 65 °C (non-condensing)
Operating altitude	Up to 3000 m
Physical dimensions (W x H x D)	~110 mm x 80 mm x 170 mm
Weight net	0.28 kg
Weight shipping	0.85 kg
Interface to controlling PC	USB Type C
Power consumption	2.5 W max., powered through USB interface
Recommended recalibration period	2 years
EMC	IEC 61326-1
Safety	IEC 61010-1, UL61010-1, CAN/CSA-C22.2 No. 61010-1
Quality management	ISO 9001, 14001

User Interface and Remote Control

The M8070B system software for the M8000 Series of BER test solutions and the M8047C module driver are required to control the M8047C.

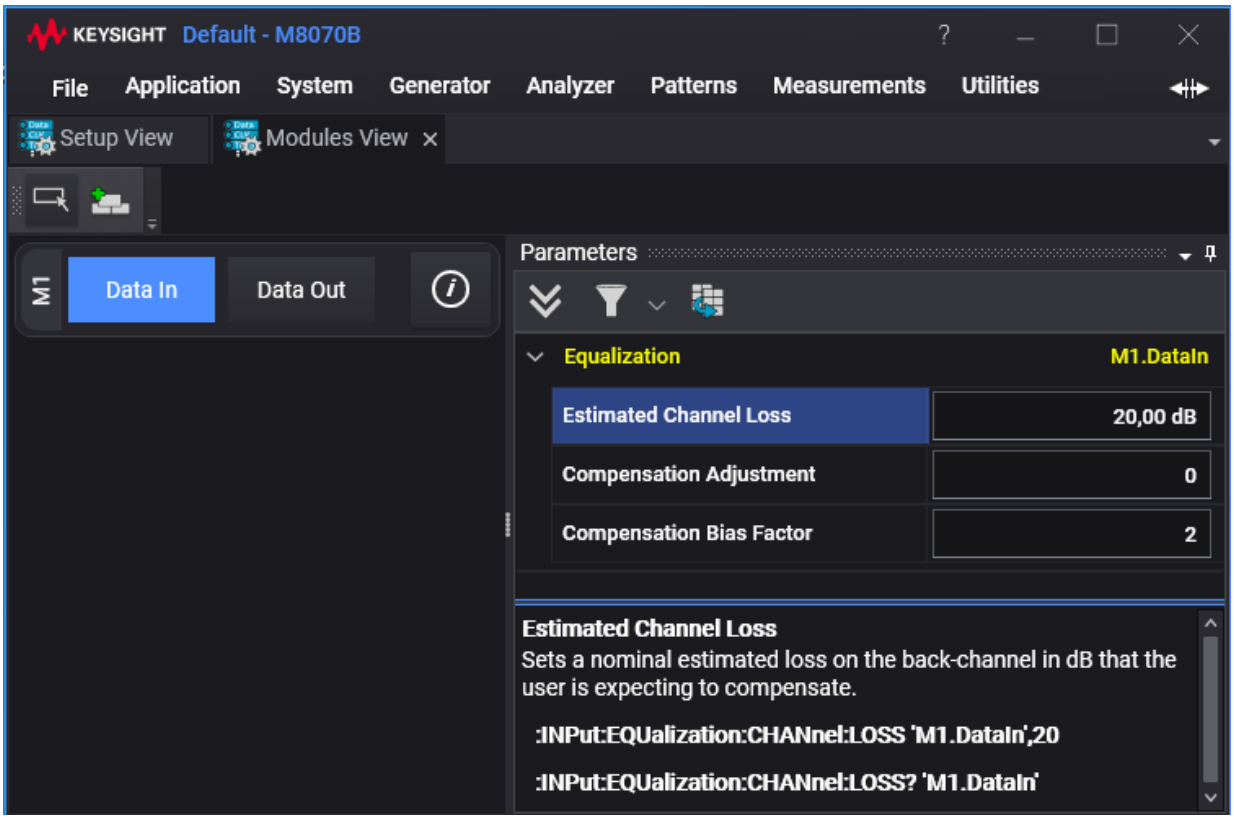

Figure 5. The user interface of M8070B system software provides control of all parameters. It provides a graphical user interface and remote control via SCPI. Shown is the Module View of the M8047C.

Estimated channel loss refers to the complete loss of the backchannel at 16 GHz. The Continuous Time Linear Equalizer (CTLE) in the M8047C will be set internally to compensate for the given estimated loss in the channel. The range can be adjusted between 8 dB and 37 dB.

Compensation adjustment can be used as a fine adjustment for the internal CTLE. It needs to be adjusted depending on the selected transmitter equalization. The range can be adjusted from -20 to +20.

Compensation bias factor provides some additional high frequency peaking for frequencies higher than 10 GHz. This value is automatically selected and overwritten in case the estimated channel loss is set. The range can be adjusted from 0 to +3.

Software

Table 5. User interface and remote-control interface of M8070B and M8047C.

Parameter	Value
Programming language	SCPI
Save/Recall	Yes
Software update	Under the help menu the M8070B can show if there are newer SW revisions of M8070B or M8047C module driver packages available for download from keysight.com.
Offline version	Yes. Can be used without M8047C hardware connected.
License types	Not licensed. M8070B baseline software and M8047C module driver do not require a license.

Control PC

Table 6. Control PC requirements. The M8070B system software and the M8047C module driver must be installed on the controlling PC, which also powers the M8047C via USB.

Parameter	Value
Interface to M8047C	USB type C
Memory	Minimum 8 GB RAM recommended
Operating system	Windows 10, 64-bit or Windows 11, 64-bit
Display resolution	Minimum requirement 1024 x 768
Software pre-requisites	Keysight IO Libraries Suite 2024 Update 1 (build 21.0.47) or above M8070B: version 11.0.240.16 or above M8047C module driver: version 1.0 or above

Specification Definitions

Specification (spec.)

The warranted performance of a calibrated instrument that has been stored for a minimum of 2 hours within the operating temperature range of 0 °C to 40 °C and after a 15-minute warm-up period. Within ±10 °C after auto calibration. All specifications include measurement uncertainty and were created in compliance with ISO/IEC 17025 methods. Data published in this document are specifications (spec) only where specifically indicated.

Typical (typ.)

The characteristic performance, which 80% or more of manufactured instruments will meet. This data is not warranted, does not include measurement uncertainty, and is valid only at room temperature (approximately 23 °C).

Nominal (nom.)

The mean or average characteristic performance, or the value of an attribute that is determined by design such as a connector type, physical dimension, or operating speed. This data is not warranted and is measured at room temperature (approximately 23 °C).

Measured (meas.)

An attribute measured during development for purposes of communicating the expected performance. This data is not warranted and is measured at room temperature (approximately 23 °C).

Accuracy

Represents the traceable accuracy of a specified parameter. Includes measurement error, time base error and calibration source uncertainty.

PCI-SIG®, PCIe® and PCI Express® are US registered trademarks and/or service marks of PCI-SIG.

KEYSIGHT

Keysight enables innovators to push the boundaries of engineering by quickly solving design, emulation, and test challenges to create the best product experiences. Start your innovation journey at www.keysight.com.

This information is subject to change without notice. © Keysight Technologies, 2024–2026,Published in USA, November 6, 2026, 3124-1732EN