M8054A Interference Source 32 GHz

Data Sheet – Version 2.0

M8054A at a Glance

The Keysight M8054A interference source generates repeatable and accurate level impairments for testing high-speed digital receivers that support symbol rates of up to 64 GBd.



KEYSIGHT

Key Features

- Random level interference (so-called “white noise”) with crest factor > 5
- Sinusoidal level interference
- Common mode and differential mode
- Bandwidth adjustable from 160 kHz up to 32 GHz, sufficient for 58 GBd signals (fNyquist/2)
- 4 output channels with differential signals avoiding baluns
- Adjustable amplitude up to 1 Vpp (single ended), 2 Vpp (differential)
- 1-slot AXIe module for combined configurations with M8040A high-performance BERT
- Matched coupler pairs for interference injection before and after the ISI channel (NEXT, FEXT)

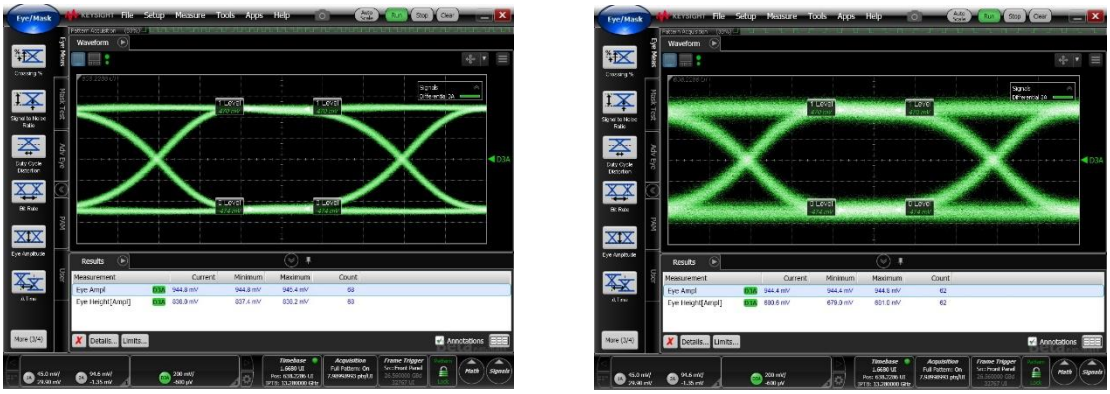


Figure 1. 26 GBd NRZ signal without interference (left) and with random level interference (right) added from the M8054A. The example shows a signal from an M8040A high-performance BERT without ISI channel.



Figure 2. Random (Gaussian) interference signal with a flat spectrum and bandwidth of 26 GHz, which corresponds to half the Nyquist frequency at 52 GBd.

Typical Applications

The M8054A allows emulation of level interference for digital receiver tolerance testing. Typical applications that require a sinusoidal or random interference signal are:

- PCIe 3/4/5/6/7 receiver testing
- SAS receiver testing
- USB 3.2 / 4 receiver testing
- DisplayPort 1.4 / 2.1 sink testing
- MIPI M-PHY up to G6 receiver testing
- Thunderbolt receiver testing
- OIF CEI-56G and CEI-112G receiver stress testing for medium and long reach
- Channel operating margin test as defined by IEEE 802.3bs, bj, by, cd, ck
- Optical receiver stress test according to IEEE 802.3bs, bj, by, cd, Fibre Channel

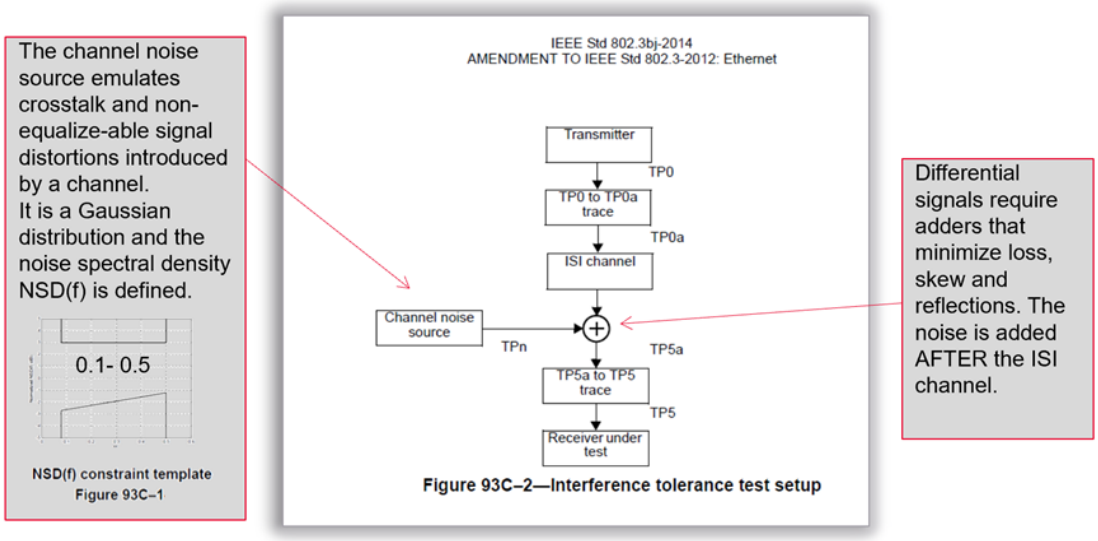


Figure 3. Typical interference tolerance test setup for Ethernet receivers. In this example, a Gaussian noise source is required for injecting level interference after the ISI channel. Example from IEEE 802.3bj-2014, Annex 93A.

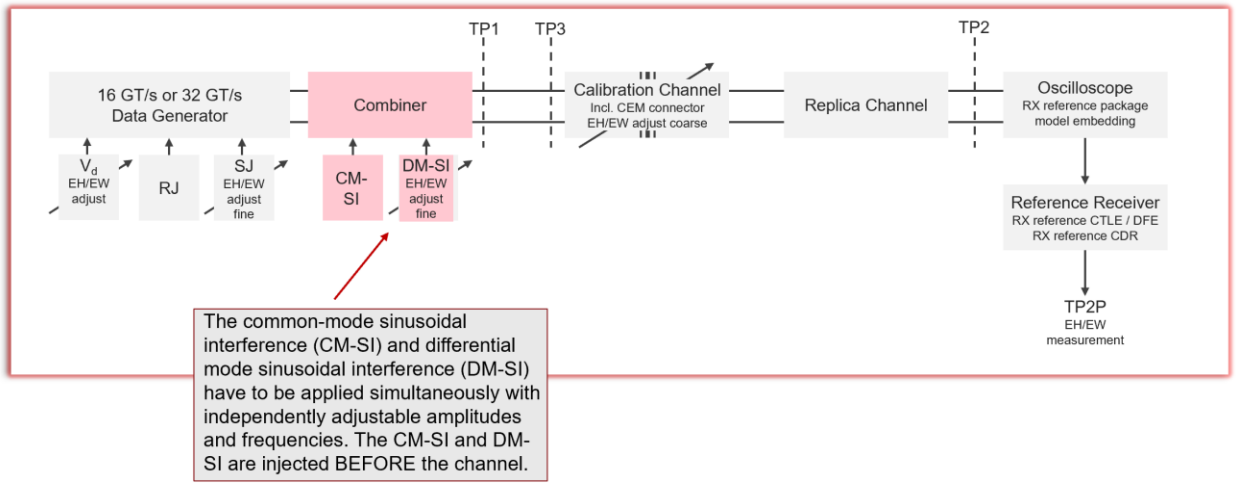


Figure 4. Typical PCI Express receiver stress calibration setup. In this case, the simultaneous injection of common mode (CM) and differential mode (DM) sinusoidal interference (SI) is required before the channel.

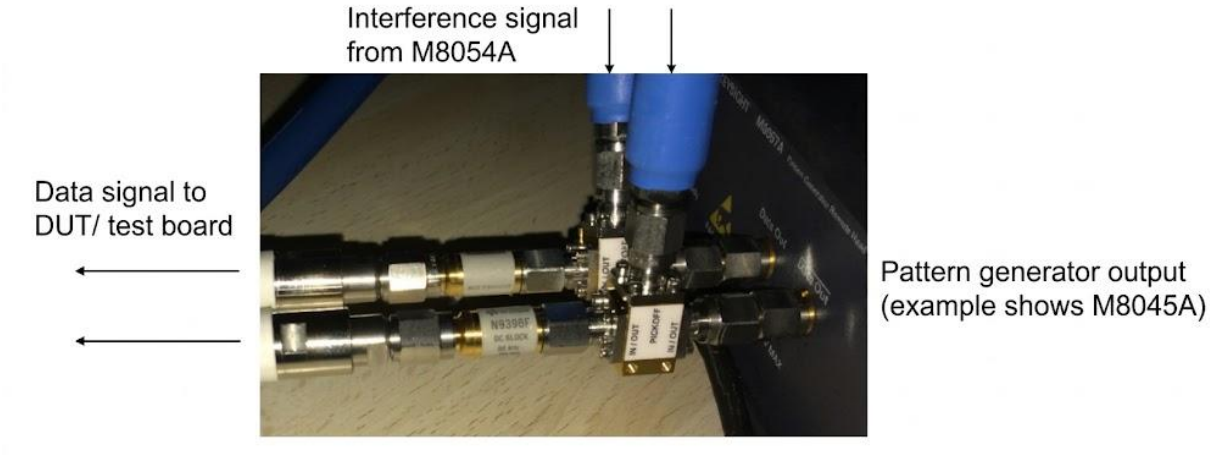


Figure 5. Keysight provides matched coupler pairs for injecting interference into differential signals with minimal differential skew, reflections and loss. Two versions are available (M8045A-802 and M8045A-803) for different bandwidth requirements. The image shows the M8045A-803 coupler pair (pick-off tees) mounted directly to the data outputs of the M8040A BERT pattern generator (M8045A). The optimized loss of the matched coupler pairs maintains signal fidelity for symbol rates of 32 GBd and beyond.

M8054A Interference Source Specifications

Output Channels 1 to 4

Table 1. Specifications for M8054A output channels 1 to 4.

Parameter	Value
Number of channels per M8054A module	4
Output type	Single-ended [1] or differential
Impedance	50 Ω (nom)
Amplitude	See Table 2
Voltage window	-1.0 to +2.5 V single-ended into 50 Ω
Offset range	-945 mV to 549 mV for 100 mV amplitude. Range depends on amplitude setting
Termination voltage window	-600 mV to 1.1 V
Skew between any pair of outputs	±7 ps typical
Skew between normal and complement [2]	3 ps maximum fixed
Frequency accuracy	±2 ppm
Connector type	2.4 mm (female)

1. Unused output must be terminated with 50 Ω to GND
2. Measured at channel OUT
3. Measured at channel 1 for frequency 5.14 to 5.8375 GHz with 500 mV amplitude, single ended

Sinusoidal and Random Interference

The Keysight M8054A interference source can be used as a level interference source with sinusoidal and random modulation (also called Gaussian or white noise).

The M8000 system software controls the interference parameters such as amplitude, frequency and bandwidth. Keysight provides matched directional coupler pairs for injecting the RI or SI signal before or after the channel (see recommended accessories).

Table 2. Interference characteristics of M8054A output channels 1 to 4.

Mode	Parameter	Value
Random Interference (RI)	Supported	Yes
	Amplitude [1]	0 mV to 1 V, 1 mV resolution
	Lowest frequency range	160 kHz to 32 GHz
	Highest frequency range	160 kHz to 32 GHz
	Crest factor (peak ratio)	> 5
Sinusoidal interference (SI)	Supported	Yes
	Amplitude [1]	0 mV to 1 V, 1 mV resolution

	Frequency range	160 kHz to 32 GHz, 1-tone
Common mode sinusoidal interference (CMSI)	Supported	Yes
	Amplitude [1]	0 to 995 mV, 1 mV resolution
	Modulation frequency range	1 MHz to 12 GHz, one and two tones
	Phase range	-360 to 360 deg
Differential mode sinusoidal interference (DMSI)	Supported	Yes
	Amplitude [1]	0 to 995 mV, 1 mV resolution
	Modulation frequency range	1 MHz to 12 GHz, one and two tones
	Two-tone	Yes. The sum of the amplitudes must be within the amplitude range.
	Channel coupling	Yes, for channel 1 & 2, channel 3 & 4
	Amplitude correction factor	0 to 10. Multiplies amplitude setting for each channel up to the maximum allowed amplitude. Can be used to compensate for different losses per channel in channel coupling mode.
	Phase range	-360 to 360 deg
Simultaneous injection of CMSI and DMSI	Amplitude	0 to 995 mV
Software pre-requisite		M8070B SW 6.5 or later

1. Single ended into 50 Ω. At DAC output. Amplitude range doubles in differential mode.

Reference Clock Input

For future use.

Reference Clock Output

For future use.

Table 3. Reference clock input and output specifications.

Connector	SMA (female)

User Interface and Remote Control

The M8070B system software is required to control the parameters of the M8054A.

Table 4. Software for M8054A module.

System software	Description
Controller requirements	Embedded PC: Choose M8040A-BU7 or -BU8 or M8050A-BU7 or -BU8 for a chassis bundle with pre-installed embedded controller M9538A including pre-installation of M8070B software. External PC: USB connection recommended between external PC and AXIe chassis. Minimum of 8 GB RAM recommended. For PCIe connectivity, refer to the list of supported PCs in the AXIe Technical Note, 5990-7632EN.
Operating System	Microsoft Windows 7 (64 bit) SP1, Windows 8 (64 bit), Windows 8.1 (64 bit). Windows 10 (64 bit) Version 1607 (Anniversary update) or newer (for detailed requirements please refer to M8070B release notes)
Controller connectivity with AXIe chassis	USB 2.0 (mini-B) recommended. PCIe 2.0 x8 (for highest data throughput, desktop PC only)
Programming language	SCPI
Remote Control Interface	Desktop or Laptop PC: LAN, USB 2.0, PCIe M9538A: LAN, USB 2.0, USB 3.1, PCIe
Save/Recall	Yes
Display resolution	Minimum 1024 x 768
Software pre-requisites	M8070B software revision 6.5 or later
Software download	Latest version: www.keysight.com/find/m8070b

General Characteristics and Physical Dimensions

Table 5. General characteristics for M8054A module.

Parameter	Specification
Power consumption	50 W
Operating temperature	0 to 40 °C
Operating humidity	5% to 80% relative humidity, non-condensing
Storage temperature	-40 to +70 °C
Form factor	1-slot AXIe module
Dimensions (W x H x D)	322.25 mm x 30 mm x 281.5 mm
Weight	3.15 kg
Safety designed to	IEC 61010-1, UL 61010, CSA22.2 61010.1
EMC	IEC 61326
Warm-up time	30 min
Calibration interval	1 year recommended
Cooling requirements	When operating the M8054A, choose a location that provides at least 80 mm of clearance at rear, and at least 30 mm of clearance at each side

Specification Definitions

Specification (spec)

The warranted performance of a calibrated instrument that has been stored for a minimum of two hours within the operating temperature range of 0 to 40 °C and after a 45-minute warm-up period. All specifications include measurement uncertainty and were created in compliance with ISO/IEC 17025 methods.

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).

Ordering Information

Description	Product number
Interference source 32 GHz, 1-slot AXIe module, 4 channels	M8054A

Default accessories included: four 50 Ω terminations.

Recommended Accessories

Description	Product number
Matched cable pair 2.4 mm (m) to 2.4 mm (m), matched within 2 ps, length 0.85 m	M8046A-802
Matched directional coupler pair, 50 GHz, 13 dB, 2.4 mm	M8045A-802
Matched coupler pair, 40 GHz, 12 dB, 2.4 mm	M8045A-803

Related Literature

Description	Publication Number
XE8-class M8050A High-Performance BERT 120 GBd – Data Sheet	3122-1338.EN
XE8-class M8050A High-Performance BERT 120 GBd – Configuration Guide	3122-1285.EN
XE8-class M8050A High-Performance BERT 120 GBd – Technical Overview	Coming Soon
XE7-class M8040A High-Performance BERT 64 GBd – Data Sheet	5992-1525EN
XE7-class M8040A High-Performance BERT 64 GBd – Configuration Guide	Coming Soon
M8053A Interference Source 64 GHz – Data Sheet	3124-1184.EN
M8054A Interference Source 32 GHz – Data Sheet	5992-3917EN
M8049A ISI Channel Boards – Data Sheet	5992-3617EN
M8067A ISI Channel Boards – Data Sheet	3122-2261.EN
M9502A and M9505A 2- and 5-slot AXIe Chassis – Data Sheet	5990-6584EN
M9506A High-Performance 5-slot AXIe Chassis – Data Sheet	5992-3786EN
M9538A AXIe Embedded Controller – Data Sheet	3125-1003.EN

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