DATA SHEET

M8054A Interference Source 32 GHz

KEYSIGHT TECHNOLOGIES

M8054A at a Glance

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

Key features:

- Key feat 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, enough for 58Gbaud 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)
- Graphical user interface and remote control integrated in the M8070B system software for M8000 series of BER test solutions

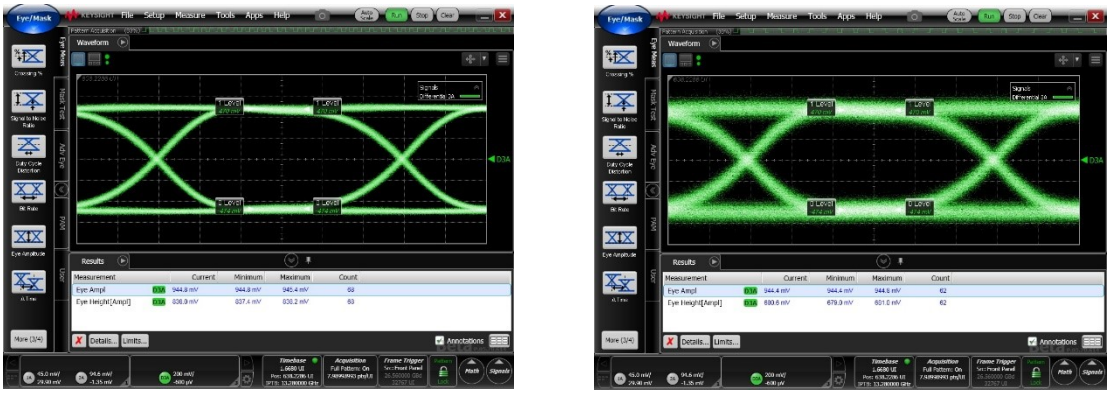

Figure 2. 26 Gbaud NRZ signal without interference (left) and with random level interference (right) added from M8054A. The example shows a signal from M8040A high-performance BERT without ISI channel.

Figure 3. Random (gaussian) interference signal with a flat spectrum and bandwidth of 26 GHz, which corresponds to half of Nyquist frequency at 52 Gbaud data.

Typical applications:

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

- PCIe 3/4/5/6 receiver testing
- SAS receiver testing
- TBT receiver testing
- OIF CEI - 56G and -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 IEEE802.3bs, bj, by, cd, Fibre Channel

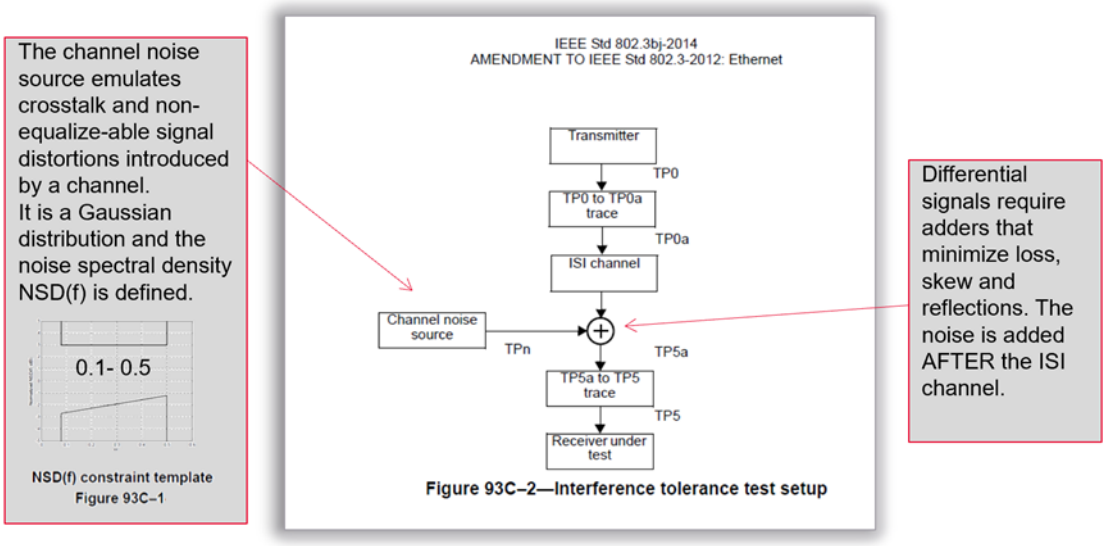

Figure 4. Typical interference tolerance test setup for Ethernet receivers. In this example a gaussian noise source is required for injecting level interference after the ISI channel. Example from IEEE 802.3bj™-2014, Annex 93A.

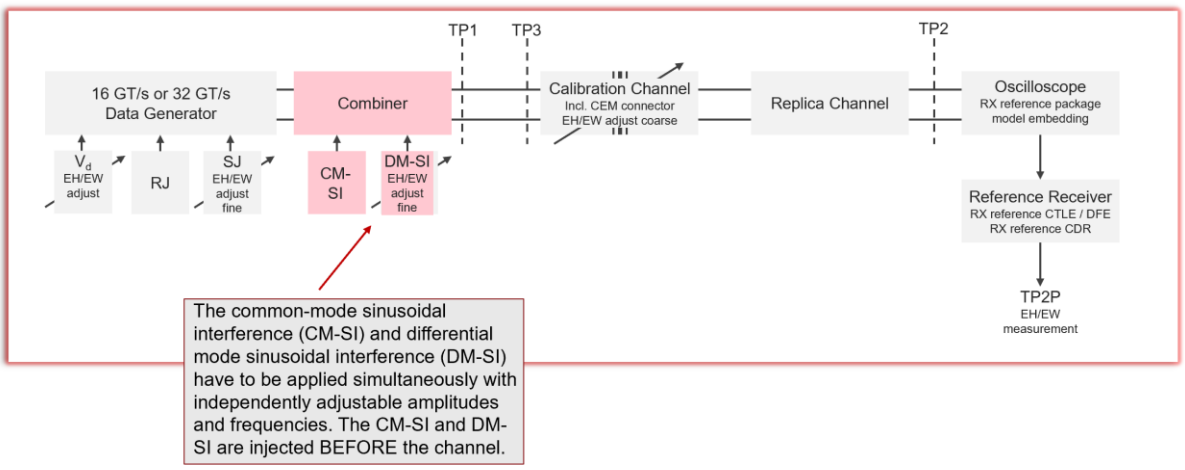

Figure 5. Typical PCI Express receiver stress calibration setup. In this case, the simultaneous injection of common mode (CM) and differential mode (DM) sinusoidal interference (SI) is required before the channel.

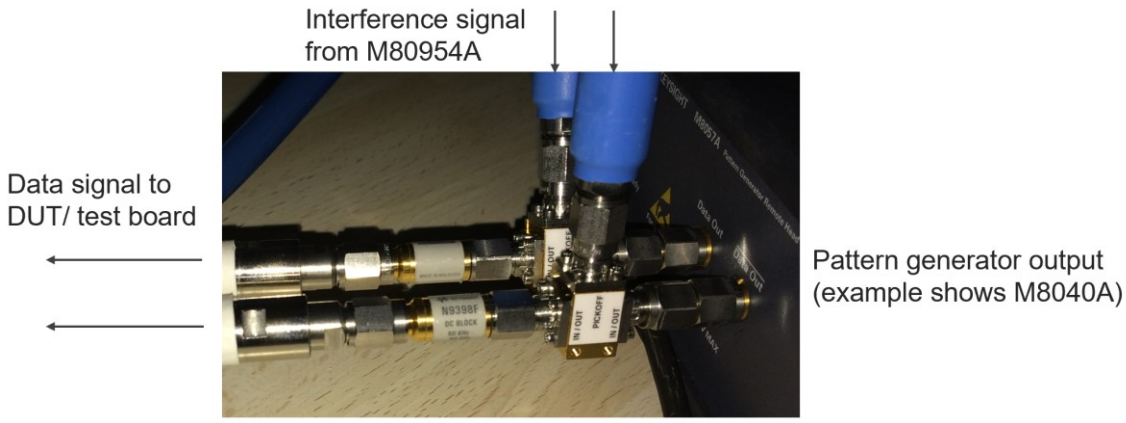

Figure 6. Keysight provides matched coupler pairs for injecting interference for differential signals minimizing differential skew, reflections and loss. Two versions are available (M8045A-802 and M8045A-803) for different bandwidth requirements. The image shows the interference coupler pair (M8045A-803) mounted directly to the data outputs of M8040A pattern generator. Matched coupler pairs with optimized loss ensure best signal fidelity even for symbol rates of 32 Gbaud and beyond.

Specifications

Output Channel 1, 2, 3, 4

Table 1. Specifications for M8054A output channels 1 - 4

Parameter	Description
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 100mV 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 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, bandwidth. Keysight provides matched directional coupler pairs for injecting the RI or SI signal before or after the channel (see recommended accessories).

Table 2. Specifications for M8054A output channels 1 – 4

Mode	Parameter	Specification
Random Interference (RI)		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)		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)		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)		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. Sum of amplitude has to be within 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 4. Reference clock input and output specifications

Parameter	Specification
Connector	SMA (female)

User Interface and Remote Control

The M8070B system software for M8000 series is required to control the parameters of M8054A.

Table 5. Software for M8054A module

System software	Description
Controller requirements	Embedded PC: Choose M8040A-BU1 or -BU3 for a pre-installed embedded controller M9537A including pre-installation of M8070B software. Otherwise: M9537A 1-slot AXIe embedded controller, choose options for Windows 7/8 or 10, 8 or 16GB RAM, SSD. External PC: USB connection recommended between external PC and AXIe chassis. Minimum of 8 GB RAM recommended. For PCIe connectivity please refer to list of tested PCs for AXIe Technical Note, pub. number 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 (8x (only for highest data throughput and desktop PC)
Programming language	SCPI
Remote Control Interface	Desktop or Laptop PC: LAN M8037A: LAN
Save/Recall	Yes
Display resolution	Minimum 1024 x 768
Software pre-requisites	M8070B software revision 6.5 or later
Software download	See for latest version: www.keysight.com/find/m8070b

General Characteristics and Physical Dimensions

Table 6. 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, UL61010, CSA22.2 61010.1 tested
EMC tested to	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

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-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	Comment
Interference Source 32 GHz, 1 slot AXIe module, 4 channels	M8054A	
Extended 3- / 5-year warranty	R1280	
Calibration services (3 and 5 year)	R1282	

Default accessories included: four 50 Ω terminations

Recommended accessories

Description	Product number	Comment
Matched cable pair 2.4 mm (m) to 2.4 mm (m), 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

M8040A	64 Gbaud High-performance BERT PAM4 and NRZ	Data Sheet	5992-1525EN
J-BERT M8020A	High-performance BERT	Data Sheet	5991-3647EN
M8049A	ISI Channel boards	Data Sheet	5992-3617EN

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