

BER Evaluation Beyond 400G 32/64 Gbaud Multichannel PAM4 BERT Signal Quality Analyzer-R MP1900A

PAM4 PPG MU196020A
PAM4 ED MU196040A



The next-generation 400 GbE standard specifies faster speeds using PAM4 to achieve 53 Gbaud. Since the amplitude of the three Eyes of the PAM4 method is one-third that of the NRZ method, the receive circuits require sufficient input sensitivity as well as the FEC function, etc. Additionally, the pulse width at 53 Gbaud is just 18.8 ps (1 bit), which increases the importance not only of Rx sensitivity but also of signal quality, including Tr/Tf time, jitter, etc.

The Signal Quality Analyzer-R MP1900A series PAM4 BERT module is a bit error rate tester optimized for measuring high-speed interfaces, such as 400 GbE and the future 800 GbE standard. It provides powerful support for design testing of PAM4 devices using high-quality waveforms up to 64 Gbaud and high input sensitivity performance. Additionally, with an all-in-one architecture offering Jitter Addition, Clock Recovery, Emphasis, PAM4 Pattern Editing, and SER functions, the MP1900A is the ideal high-reproducibility and easy-to-configure system for PAM4 measurements.

[Target Applications] 200/400/800 GbE, CEI-56G/112G, InfiniBand HDR, 64G Fibre Channel

PAM4 One Box Test Solution

Emphasis 4Tap, 20 dB

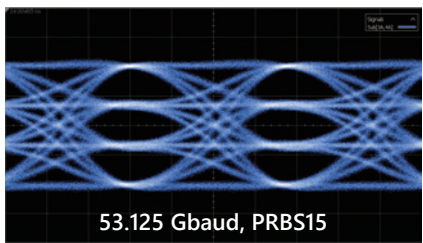


Jitter/Noise Addition

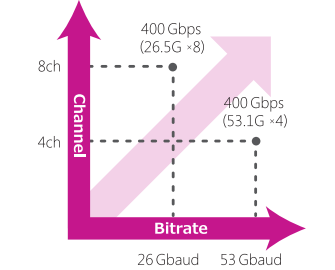
Built-in Clock Recovery

Jitter Tolerance Test

Highest Level Waveform Quality



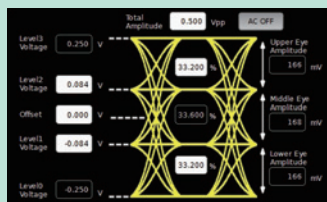
Next-Generation Terabit



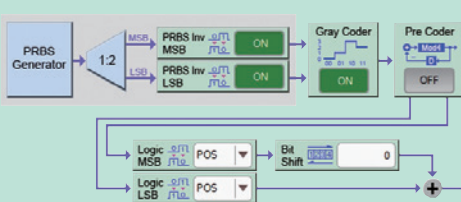
All-in-One PAM4 BERT
 Built-in Clock Recovery
 Built-in Noise* and Jitter Addition
 Emphasis and Linearity Control
 Symbol Error Measurement
 *: 32.1G max.

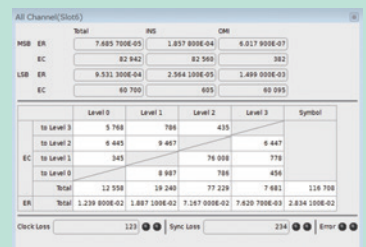
High-Quality Waveforms and Excellent Input Sensitivity
 Fast Tr/Tf: 8.5 ps
 Low Intrinsic Jitter: 170 fs rms
 High Input Sensitivity: 23 mV (PAM4)
 Stressed Input: BER < 1E-12

High Transmission Capacity and Good Expandability
 512 Gbit/s max. Transfer Capacity (all-in-one, Tx)
 4ch (max.) Multichannel Expandability
 2.4 Gbaud to 64.2 Gbaud PAM4/NRZ Support



4 Level, Encode/Pattern Setting





Symbol Error Measurement Screen

Typical Specifications

PAM4 PPG MU196020A

Operation Rate (PAM4/NRZ)	2.4 Gbaud to 32.1/58.2/64.2 Gbaud (option selection)
No. of Channels	1
Output Amplitude	70 mVp-p to 800 mVp-p (Single-end) 140 mVp-p to 1600 mVp-p (Differential)
Offset	-2 V to +3.3 V
Emphasis	4 Tap, -20 to +20 dB
Channel Emulator	Generates waveform with insertion loss and simulates waveform with corrected insertion loss Set by loading S-Parameter file (S2 P, S4 P)
ISI	Simulates ISI generation waveform Set using loss (-8.00 to 8.00 dB) at CEI-specified Nyquist frequency Used in combination with channel board, such as J1800A/J1758A (optional accessories parts), or Noise Generator MU195050A
Independently Variable PAM4 3 Eye	20 to 50% (PAM4 Amplitude 0/3 level = 100%)
PAM4 Pattern	SSPRQ, PRBS13Q, PRBS31Q, RS-FEC, etc.
PAM4 Pattern Error Addition	MSB Error, LSB Error, LSB&MSB Error, RS-FEC Symbol Error
Tr/Tf (20 to 80%)	8.5 ps (typ., NRZ)
Random Jitter	170 fs rms (typ., NRZ)
I/O Connector	V (f)
Jitter Emphasis (Using MU181500B)	SJ, RJ, BUJ, SSC
Noise Addition (Using MU195050A)	CMI, DMI, White Noise (<32.1G)

PAM4 ED MU196040A

Operation Rate (PAM4/NRZ)	2.4 Gbaud to 32.1 Gbaud
No. of Channels	1
Input Amplitude	PAM4: 300 mVp-p to 1000 mVp-p NRZ: 50 mVp-p to 1000 mVp-p
Input Sensitivity	PAM4: 23 mV (typ., PRBS31, Eye height for each Eye, 26.5625 Gbaud) NRZ: 23 mV (typ., PRBS31)
Stressed Margin	BER < 1E-12*1
Clock Recovery	Yes (25.5G to 32.1G)
PAM4 Pattern	SSPRQ, PRBS13Q, PRBS31Q, etc.
PAM4 Counter	MSB/LSB, Symbol 0 to 3
I/O Connector	K (f)

*1: At input of PAM4 Stressed waveform equivalent to CEI-56 G-VSR

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.
Contact your sales representative for more details.

Model/Order No.	Name
MU196020A	PAM4 PPG
MU196020A-001	32 Gbaud
MU196020A-002	58 Gbaud
MU196020A-003	64 Gbaud
MU196020A-011	4Tap Emphasis
MU196020A-030	Data Delay
MU196020A-040	Adjustable ISI
MU196020A-042	FEC Pattern Generation
MU196020A-050	Inter-Module Synchronization
MU196040A	PAM4 ED
MU196040A-001	32.1 Gbaud Decoder
MU196040A-022	25.5 to 32.1 Gbaud Clock Recovery
MU196040A-041	SER Measurement

Model/Order No.	Name
MP1900A	Signal Quality Analyzer-R
MU181500B	Jitter Modulation Source
MU181000B	12.5 GHz 4-Port Synthesizer
MU195050A	Noise Generator
J1792A	Paired Matched Skew Semi-rigid Cables (V-K Connector, Data Input1) (For Noise Addition (32.1 Gbaud max.))
J1789A	Coaxial Specified Electrical Length Cable (0.4 m, V-connector)
J1790A	Coaxial Specified Electrical Length Cable (0.8 m, V-connector)
34VFK50	Coaxial Adapter V (f)-K (m)*2
J1800A	ISI Board V

*2: The MU196020A PPG data outputs and the J1789A/J1790A cables use V-connectors, but the MU196040A ED data inputs use K-connectors. Use the 34VFK50 adapter.