

BA-4000 Bit Analyzer

100G/800G BIT ERROR RATE (BER) TESTER



Electrical BER tester supporting NRZ and PAM4 coding, with advanced FEC tools and with testing capabilities up to 800G.

SPEC SHEET

KEY FEATURES

Support NRZ and PAM4

Support PRBS 7/9/11/13/15/23/31/13Q/31Q, SSPRQ

Advanced FEC tools

Channel simulator

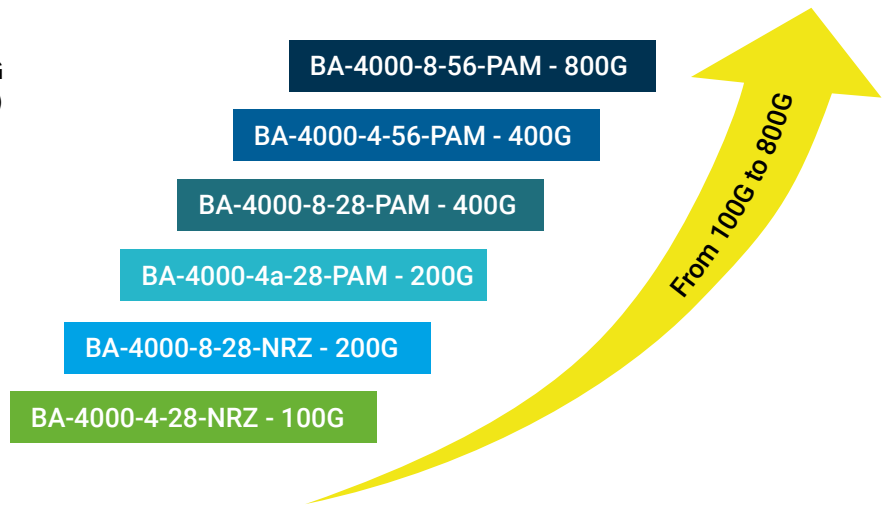
Burst/random error injection

Support linear/Gray mapping

O-SMPM connection

BA-4000 READY FOR 800G TESTING

The BA-4000 is a world-class series of 100G/800G electrical BER testers (either 4 or 8 channels) supporting PAM4 or NRZ coding.



POWERFUL AND SIMPLIFIED USER INTERFACE

The BA-4000 user interface provides simplified and real-time test results per channel.

Channel	Pre BER	Pre Errors	Corrected	Post BER	Margin	# Bits	Time
Channel 1	8.737e-09	4,696	4,696	0.000e+00	80% (max: 3)	537,460,265,600	10 s
Channel 2	2.372e-09	1,279	1,279	0.000e+00	80% (max: 3)	539,295,804,160	10 s
Channel 3	3.636e-05	19,674,924	19,674,924	0.000e+00	40% (max: 9)	541,134,126,592	10 s
Channel 4	3.834e-09	2,082	2,082	0.000e+00	80% (max: 3)	542,968,437,504	10 s
Channel 5	3.671e-11	20	20	0.000e+00	80% (max: 3)	544,804,921,728	10 s
Channel 6	3.489e-06	1,907,057	1,907,057	0.000e+00	80% (max: 3)	546,644,141,824	10 s
Channel 7	2.545e-05	13,961,536	13,961,536	0.000e+00	60% (max: 6)	548,487,245,696	10 s
Channel 8	1.976e-06	1,052,889	1,052,889	0.000e+00	80% (max: 3)	532,769,596,416	10 s

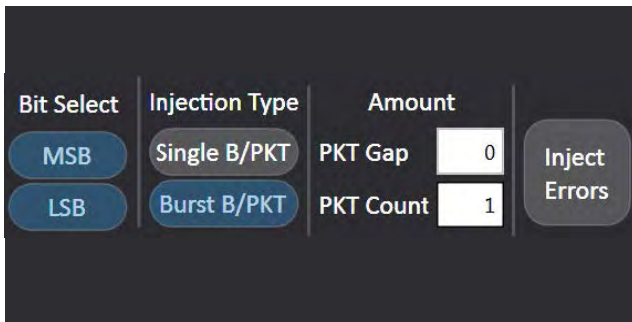
FEC SIMULATION

The BER tester includes FEC simulation capabilities. This provides powerful analysis of burst error.

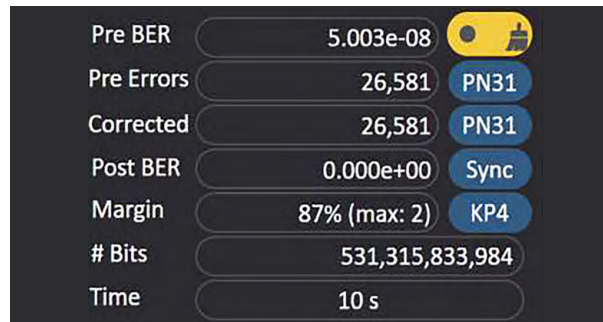
Main features include:

- PRBS error check and correction
- Pre-FEC and Post-FEC BER
- KP4/KR4 and low latency FEC protocols
- FEC lane striping function
- FEC symbol error distribution plot: codewords vs symbol errors
- FEC margin auto-calculation

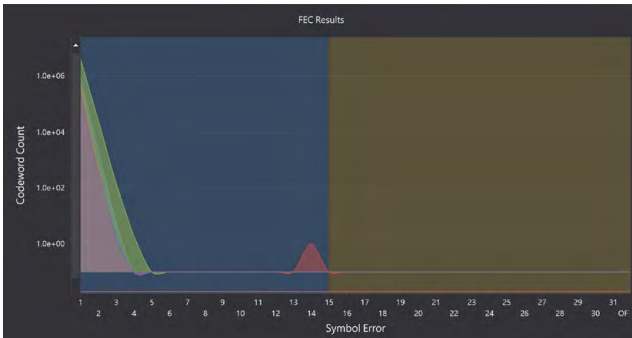
WITH PAM4 CODING, SIMPLE BER TEST IS NOT ENOUGH



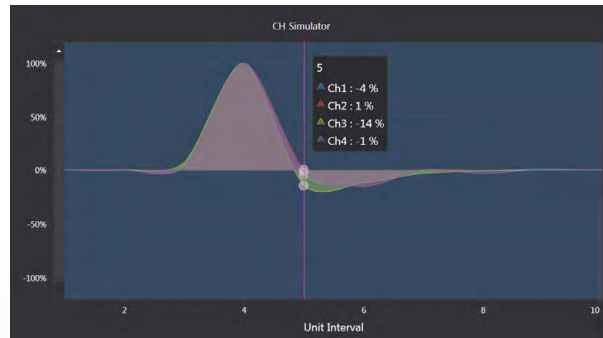
Burst and random error injection



FEC symbol error margin



FEC symbol error distribution plot



Channel response simulation

All specifications are typical, at 23 °C ± 2 °C unless otherwise specified.

SPECIFICATIONS			
BA-4000	x-28-NRZ	x-28-PAM	x-56-PAM
Number of channels	4 (x = 4) 8 (x = 8)	4 (x = 4) 8 (x = 8)	4 (x = 4) 8 (x = 8)
Modulation	NRZ	NRZ/PAM4	NRZ/PAM4
Data rate per lane ^a (GBd)	9.95328, 10, 10.3125, 10.709, 11.3176, 12.5, 14.025, 24.33024, 25, 25.78125, 26.5625, 27.95, 28.05, 28.125	25.78125, 26.5625, 27.95, 28.05, 28.125, 28.9	25.78125, 26.5625, 27.95, 28.05, 28.125, 28.9, 49.765, 53.125, 57.8
Data rate adjustment (ppm)	0 to ±300	0 to ±300	0 to ±300
PAM4 coding	n/a	Linear code/Gray code	Linear code/Gray code
Pattern supported by PPG and ED	PRBS 7/9/15/23/31	PRBS 7/9/11/13/15/23/31 PRBS 7Q/9Q/11Q/13Q/ 15Q/23Q/31Q Only PPG supports PRBS16Q, SSPRQ, and user-defined pattern	PRBS 7/9/11/13/15/23/31 PRBS 7Q/9Q/11Q/13Q/ 15Q/23Q/31Q Only PPG supports PRBS16Q, SSPRQ, and user-defined pattern
Maximum amplitude (mV _{ppd})	800 ^{b,c} (typical)	800 ^{c,d} (typical)	800 ^e (typical)
Rise time/fall time (20% to 80%) (ps)	15/15 ^c (typical)	11/11 ^c (typical)	9.5/9.5 ^f (NRZ 53.125G, typical) 9.5/9.5 ^c (NRZ 25.78125G, typical)
PAM4 eye width (zero hit) (ps)	n/a	23 ^d (typical)	6.5 ^e (PAM4 53.125G, typical) 24 ^d (PAM4 26.5625G, typical)
Jitter RMS (fs)	750 ^c (typical)	450 ^c (typical)	400 ^f (NRZ 53.125G, typical) 400 ^c (NRZ 25.78125G, typical)
Sensitivity (mV _{ppd})	100 to 800 (NRZ 25.78125G, typical)	200 to 750 (PAM4 26.5625G, typical) 150 to 1000 (NRZ 25.78125G, typical)	200 to 550 ^h (PAM4 53.125G, typical) 200 to 750 (PAM4 26.5625G, typical)
CTLE (dB)	0 to 7	0 to 8	n/a
Clock output amplitude (mV _{ppd})	300	400	400
Clock ratio	/8, /16 (Clock frequency / Symbol rate)	/2, /4, /8, /16, /32, /64 (Clock frequency / Symbol rate)	/2, /4, /8, /16, /32, /64 (Clock frequency / Symbol rate)
Connector type	O-SMPM connector (up to 67 GHz bandwidth)	O-SMPM connector (up to 67 GHz bandwidth)	O-SMPM connector (up to 67 GHz bandwidth)

GENERAL SPECIFICATIONS

Size (H x W x D)	103 mm x 442 mm x 300 mm (4.1 in x 17.4 in x 11.8 in)
Weight	≤ 10 kg (22 lb)
Temperature	Operating: 5 °C to 40 °C (41 °F to 104 °F) Storage: -20 °C to 70 °C (-4 °F to 158 °F)
Relative humidity	20% to 80%
Power ⁱ	100/120 Vac (50/60/400 Hz) 220/240 Vac (50/60 Hz) 60 W typical/80 W max.

a. Fixed rate

b. Amplitude step is 200 mV_{ppd}

c. NRZ 25.78125 GBd signal measured by 50 GHz bandwidth scope with 40 GHz 2.92 mm, 15 cm RF cable

d. PAM4 26.5625 GBd signal measured by 50 GHz bandwidth scope with 40 GHz 2.92 mm, 15 cm RF cable

e. PAM4 53.125 GBd signal measured by 50 GHz bandwidth scope with 50 GHz 2.4 mm, 15 cm RF cable

f. NRZ 53.125 GBd signal measured by 50 GHz bandwidth scope with 50 GHz 2.4 mm, 15 cm RF cable

g. Measured by direct loopback from PPG to ED with 40 GHz O-SMPM, 20 cm RF cable

h. BER ≤ 10⁻¹⁰

i. Operate with supply voltage fluctuations up to ±10 % of the nominal voltage.

OPTION AVAILABLE

BA-4000	FEC4	FEC8	FGC4	FGC8
4-28-NRZ				
8-28-NRZ				
4-28-PAM	✓			
8-28-PAM		✓		
4-56-PAM	✓		✓	
8-56-PAM		✓		✓

ORDERING INFORMATION

BA-4000-XX-XX-XX

Models ■

4-28-NRZ = 4x28 GBd NRZ BERT with O-SMPM connector
 8-28-NRZ = 8x28 GBd NRZ BERT with O-SMPM connector
 4-28-PAM = 4x28 GBd NRZ/PAM4 BERT with O-SMPM connector
 8-28-PAM = 8x28 GBd NRZ/PAM4 BERT with O-SMPM connector
 4-56-PAM = 4x56 GBd NRZ/PAM4 BERT with O-SMPM connector
 8-56-PAM = 8x56 GBd NRZ/PAM4 BERT with O-SMPM connector

Options ■

FEC4 = 26G PAM4 FEC simulator software 4CH^a
 FEC8 = 26G PAM4 FEC simulator software 8CH^b
 FGC4 = FEC pattern generator and checker 4CH^c
 FGC8 = FEC pattern generator and checker 8CH^d

Accessories ■

ICBOS-KM-7 = 40 GHz, 1x8 O-SMPM to K(male) cable, 7 cm
 ICBOS-KM-15 = 40 GHz, 1x8 O-SMPM to K(male) cable, 15 cm
 ICBOS-KM-30 = 40 GHz, 1x8 O-SMPM to K(male) cable, 30 cm
 ICBOS-KM-60 = 40 GHz, 1x8 O-SMPM to K(male) cable, 60 cm

ICBOS-QM-7 = 50 GHz, 1x8 O-SMPM to 2.4 mm (male) cable, 7 cm
 ICBOS-QM-15 = 50 GHz, 1x8 O-SMPM to 2.4 mm (male) cable, 15 cm
 ICBOS-QM-30 = 50 GHz, 1x8 O-SMPM to 2.4 mm (male) cable, 30 cm
 ICBOS-QM-60 = 50 GHz, 1x8 O-SMPM to 2.4 mm (male) cable, 60 cm

ICBOS-SMPM-7 = 50 GHz, 1x8 O-SMPM to SMPM (female) cable, 7 cm
 ICBOS-SMPM-15 = 50 GHz, 1x8 O-SMPM to SMPM (female) cable, 15 cm
 ICBOS-SMPM-30 = 50 GHz, 1x8 O-SMPM to SMPM (female) cable, 30 cm
 ICBOS-SMPM-60 = 50 GHz, 1x8 O-SMPM to SMPM (female) cable, 60 cm

ICBOS-OS-20 = 50 GHz, 1x8 O-SMPM to O-SMPM cable, 20 cm
 ICBOS-OS-30 = 50 GHz, 1x8 O-SMPM to O-SMPM cable, 30 cm
 ICBOS-OS-60 = 50 GHz, 1x8 O-SMPM to O-SMPM cable, 60 cm

ICBOS-VM-15 = 67 GHz, 1x8 O-SMPM to 1.85 mm (male) cable, 15 cm
 ICBOS-VM-30 = 67 GHz, 1x8 O-SMPM to 1.85 mm (male) cable, 30 cm
 ICBOS-VM-60 = 67 GHz, 1x8 O-SMPM to 1.85 mm (male) cable, 60 cm

ICBOS-VF-15 = 67 GHz, 1x8 O-SMPM to 1.85 mm (female) cable, 15 cm
 ICBOS-VF-30 = 67 GHz, 1x8 O-SMPM to 1.85 mm (female) cable, 30 cm
 ICBOS-VF-60 = 67 GHz, 1x8 O-SMPM to 1.85 mm (female) cable, 60 cm

Exemple: BA-4000-8-56-PAM-FGC8-FEC8

- a. Available for BA-4000-4-28-PAM and BA-4000-4-56-PAM
 b. Available for BA-4000-8-28-PAM and BA-4000-8-56-PAM
 c. Available for BA-4000-4-56-PAM. Must be ordered with FEC4 software option
 d. Available for BA-4000-8-56-PAM. Must be ordered with FEC8 software option

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