

FEC Based 400/800GbE PAM4 Signal Jitter Tolerance Test

FEC Analysis/FEC Symbol Capture Functions

PAM4 ED MU196040B / FEC Analysis MU196040B-042

Signal Quality Analyzer-R MP1900A Series



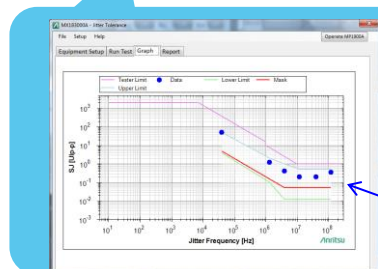
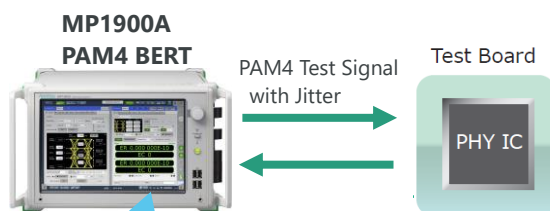
Outline

High-speed and large-capacity transmission standards using PAM4 signaling, such as 400 GbE, stipulate use of Forward Error Correction (FEC) to assure transmission quality. Consequently, jitter tolerance tests for SERDES, DSP, and CDR used by transceivers are required at both pre-FEC evaluation of bit error rate performance as well as at correctable/uncorrectable FEC symbol error performance.

The Signal Quality Analyzer-R MP1900A series PAM4 BERT is a high-performance bit error rate tester for PHY-layer evaluation of PAM4 transmissions, such as next-generation 400 and 800 GbE networks. Due to its high sensitivity-input performance (36 mV EH at 53 Gbaud), it not only supports more accurate jitter tolerance evaluation, but can also measure FEC Symbol Errors in real-time by addition of the FEC Analysis option; it also supports jitter tolerance evaluation based on correctable/uncorrectable FEC symbol error count. Additionally, the FEC Symbol Capture function supports factor analysis of uncorrectable FEC Symbol Errors, such as burst errors. [Target Applications] 50, 100, 200, 400, 800 GbE

Features

- Real-time detection of bit errors and FEC Symbol Errors
- Jitter tolerance measurement based on FEC Symbol Error count
- Real-time display of FEC Symbol Error per codeword distribution
- Burst error debugging and analysis using Capture function



High Sensitivity Performance (36 mV at 53 Gbaud PAM4)
Supports more accurate jitter tolerance evaluation using 116 Gbit/s PAM4 ED based on correctable/uncorrectable FEC Symbol Error count

Detects uncorrectable codewords and measures jitter tolerance automatically (MX183000A-PL001)

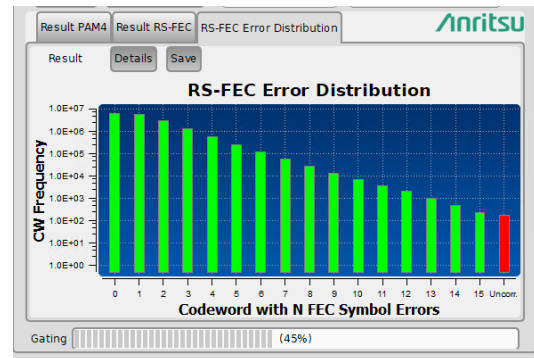
Analysis, FEC Symbol Capture Functions

Uncorr. Codeword	FEC Symbol	Bit
ER 5.120 000E-08	3.504 500E-03	1.804 400E-04
EC 1	1.861 800E+07	1.917 100E+07
%EFl	0.000 000	
EI 1	10	

Frequency(kHz) 53 124 999 Clock Count 5.312 400E+10

Real-time FEC Symbol Error Measurement

Real-time display of uncorrectable codewords, FEC Symbol Errors and bit error measurements on one screen



FEC Symbol Error Distribution

Real-time error distribution display

Bit	LSB	Center Addr 2097015	Position 2097015	Pattern Addr 1108710883	Block Length 3284000	Symbol
02096910 MSB	0	1	0	1	1	1
02096910 LSB	0	1	0	1	1	1
02096940 MSB	1	1	0	1	1	1
02096940 LSB	1	1	0	1	1	1
02096970 MSB	1	0	1	1	1	1
02096970 LSB	1	1	1	1	1	1
02097000 MSB	0	1	0	1	1	1
02097000 LSB	1	1	1	1	1	1
02097030 MSB	1	1	0	1	1	1
02097030 LSB	0	1	1	1	1	1
02097060 MSB	1	1	0	1	1	1
02097060 LSB	0	1	1	1	1	1
02097090 MSB	1	0	1	1	1	1
02097090 LSB	0	1	1	1	1	1
02097120 MSB	0	0	0	0	0	0
02097120 LSB	1	1	1	1	1	1
02097150 MSB	0	1	1	1	1	1
02097150 LSB	0	1	1	1	1	1

FEC Symbol Capture

Burst error factor analysis

Ordering Information

Model	Name
MU196040B	PAM4 ED
MU196040B-001	32G baud (2.4 to 32.1 Gbaud)
MU196040B-002	58G baud (2.4 to 64.2 Gbaud NRZ/2.4 to 58.2 Gbaud PAM4)
MU196040B-011	Equalizer
MU196040B-021	29G baud Clock Recovery (2.4 to 29 Gbaud)
MU196040B-022	32G baud Clock Recovery (2.4 to 32.1 Gbaud)
MU196040B-023	58G baud Clock Recovery Extension (51 to 58.2 Gbaud)
MU196040B-041	SER Measurement (Requires FEC Symbol Capture option)
MU196040B-042	FEC Analysis (required option for real-time FEC Symbol Error, jitter tolerance, and error distribution functions)

MP1900A Main Unit, PPG, and Software for Jitter Tolerance Test

MP1900A	Signal Quality Analyzer-R
MU196020A	PAM4 PPG (Opt-002, 011, 040, 042)
MU181000B	12.5GHz 4Port Synthesizer
MU181500B	Jitter Modulation Source
MX183000A-PL001	Jitter Tolerance Test