



PON Test Set

30G BERT

30/50GHz Sampling Scope

25G Optical Scope

in cPCI 2U blade format

1 – 30 Gbps BERT
SFP28 & XFP Ports
AWG for Burst Mode PON
32/50GHz DSO with CDR
25GHz Optical Ref. Receiver
Front panel-selectable PON
Filters

Jitter Analysis and calibration

Eye Measurements

Eye Mask Test

Advanced Pattern Acquisition

Pre-emphasis Measurement

Automated J2/J9 measurements

CDR and O/E Out connector

1.25, 2.5, & 10.3125 Gbps H/W filters

High-voltage option 4 Vpp

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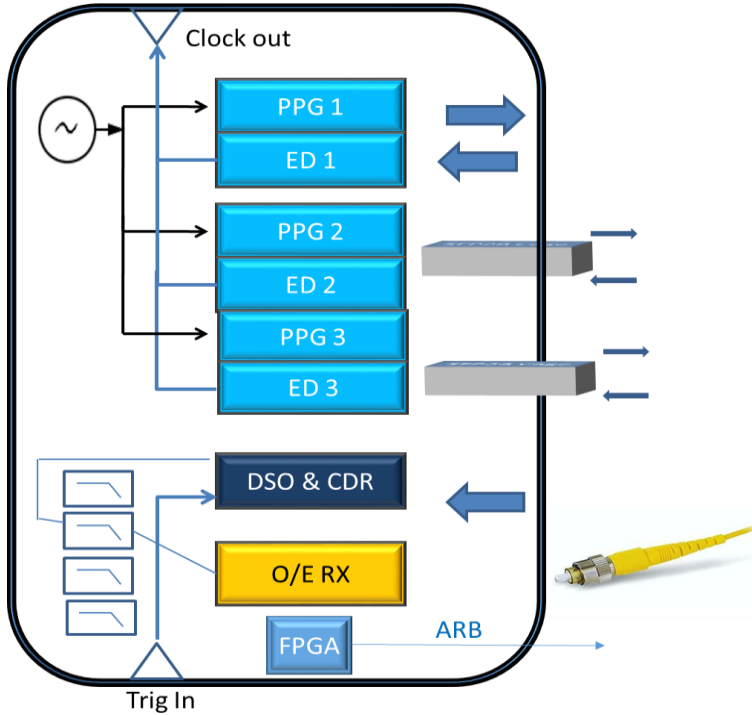
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ML4003BX

Fully Modular BERT, Scope, SFP28 and XFP Hosts and a 25GHz Optical Scope with CDR



adjustable levels between 2 and 4 V pk-pk at 25 Gbps. The available options are:

Option	Description
B16S	1-16 Gbps BERT + 32 GHz DSO + SFP28
B16X	1-16 Gbps BERT + 32 GHz DSO + XFP
B30S	1-30 Gbps BERT + 32 GHz DSO + SFP28
B30X	1-30 Gbps BERT + 32 GHz DSO + XFP
O10	Add a 10 GHz Reference Optical Receiver (includes B16 or B30)
O25	Add a 25GHz Reference Optical Receiver (includes B16 or B30)
50	Substitute 32 GHz DSO with 50 GHz
HV	High Voltage Output 4 to 8Vpp diff.)

Key Features

differential. The HV option will give you

Summary

The **ML4003BX** is a state of the art, low cost PON tester consisting of a BERT, Digital Sampling Oscilloscope and an optical scope, all integrated in a compact 2U cPCI form factor. It supports burst mode PON by providing a programmable AWG output that can be programmed by the user to output a custom 64 bit TTL signal, synchronous to the high-speed data.

The ML4003BX can be ordered as a low cost 16 Gbps Bit Error Ratio Tester with 32 GHz DSO and can be expanded to include a 10G / 25GHz Optical sampling scope.

The full-fledged configuration contains in addition to the BERT, a 32 GHz (50GHz optionally) DSO, one SFP28 or one XFP port in addition to a 25 GHz (Optionally 10 GHz for a lower cost) optical sampling oscilloscope. The PPG has an output swing up to 800 mVpp

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**BERT:**

- BERT data rates: Any rate from 1 to 16 to 30Gbps
- CTLE auto-tune function for each receiver
- Automated J2/J9 measurements
- Eye Contour measurements
- Bathtub and vertical bathtub

AWG:

- User-defined pattern 64 bits in hex
- 200 MHz maximum frequency (assuming 0xcccc... square signal)

Electrical DSO:

- Differential and single-ended operation.
- External ref clock input (710 MHz max)
- High input BW achieved with industry-leading sample-and-hold amplifiers
- CDR function
- S21 Insertion Loss measurement wizard
- An array of software filters and equalizers including CTLE, FFE, Bessel-Thomson, etc...

Optical DSO:

In addition to the features stated above, the O/E comes with

- FC connector UPC.
- Can be ordered as either single-mode or multi-mode receiver (25 GHz version)
- Burst control TTL output with programmable pulse width
- Faceplate accessible hardware filters for 1.25, 2.5 and 10 Gbps – single-ended

General Features:

- Windows and Linux APIs are provided allowing users to develop their own automated tests
- Repeatable, traceable measurements
- Low intrinsic Jitter
- Low power consumption

Target Applications

- Interconnect testing
- Backplane testing
- Interference and crosstalk testing
- Receiver sensitivity testing
- In-situ oven testing
- PSM4 testing
- FTTx EPON/GPON testing – ONU and OLT

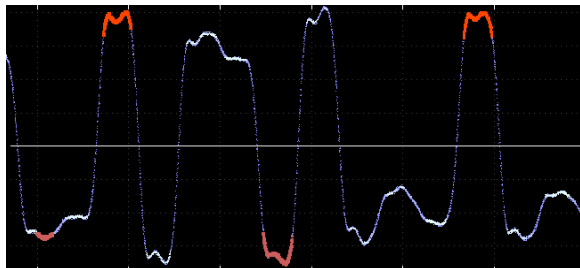


Figure 1 Pattern capture mode

DSO Features

- NRZ and PAM4 measurements
- 800 mV amplitude resolution
- Eye opening, height and width, eye amplitude, top, base, Hi, Lo, max, min, peak to peak.
- Rise/ Fall Time, Crossing percentage.
- Zooming, markers, X and Y histogram overlays, statistics over multiple measurements.
- Eye & pattern measurements on specific properties of the pattern.
- Pre-emphasis positive and negative (amplitude and width) measurements.
- SW filters applicable include PTB, CTLE, FFE, De-Embedding, Moving Averages
- Total jitter and jitter decomposition
- Mask margin testing

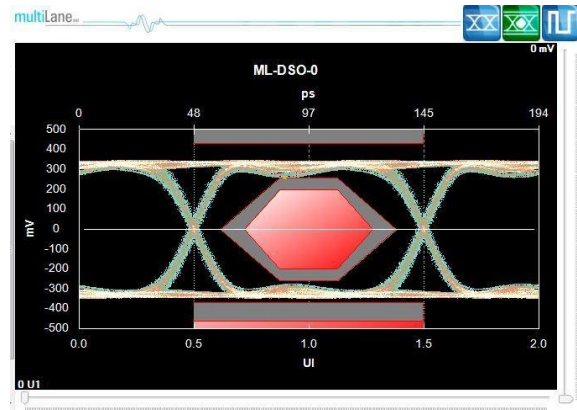


Figure 2 Mask Test on a 10G Signal

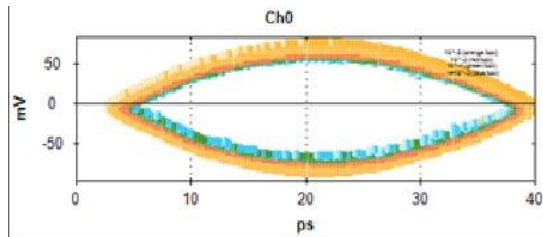
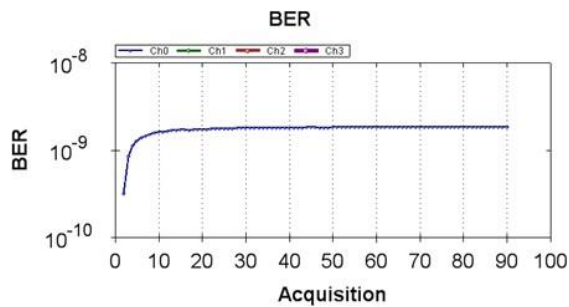
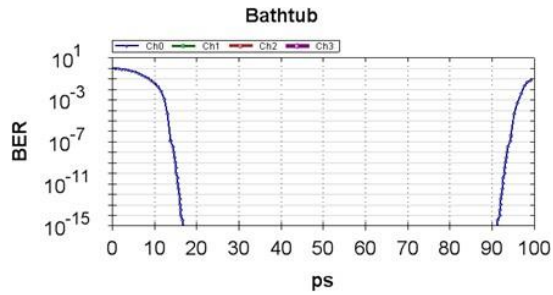
PAM4 Measurements
Symbol Levels
Vertical Eye Amplitudes
Vertical Eye Openings
Horizontal Eye Openings
Vertical Eye Closure (dB)
Openings by BER (soon)
Max, Min, Peak-to-Peak...

PAM4 scope measurements are currently following the OIF contribution: 2014.051.0

BERT Features

- 1 to 16 or to 30 Gbps data rate
- Continuous Linear Time Domain Equalizer with greater than 10dB dynamic Range

- Automated measurements on received signal that include automated J2/J9, Dual Dirac, Mask Test



HV Option

- Nominal HV output is 4 to 8 V peak-peak differential
- The input range of the error detector is limited to 1.2 Vpp. Do not loop back an HV signal directly to the error detector. Use 18dB attenuators

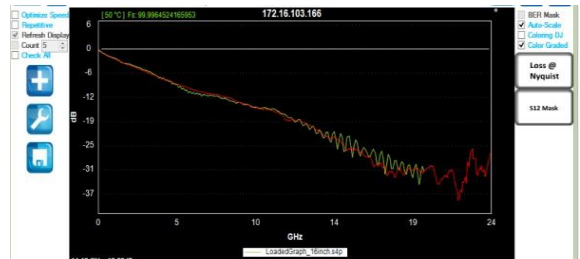
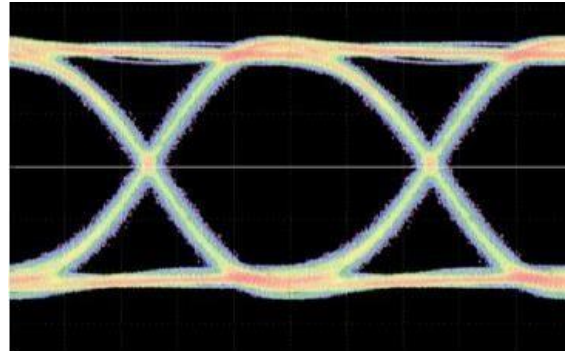
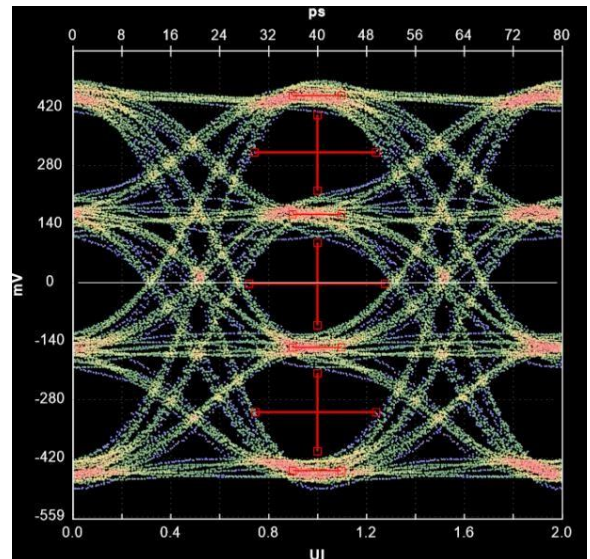


Figure 3: S21 measurement correlation with VNA (green)



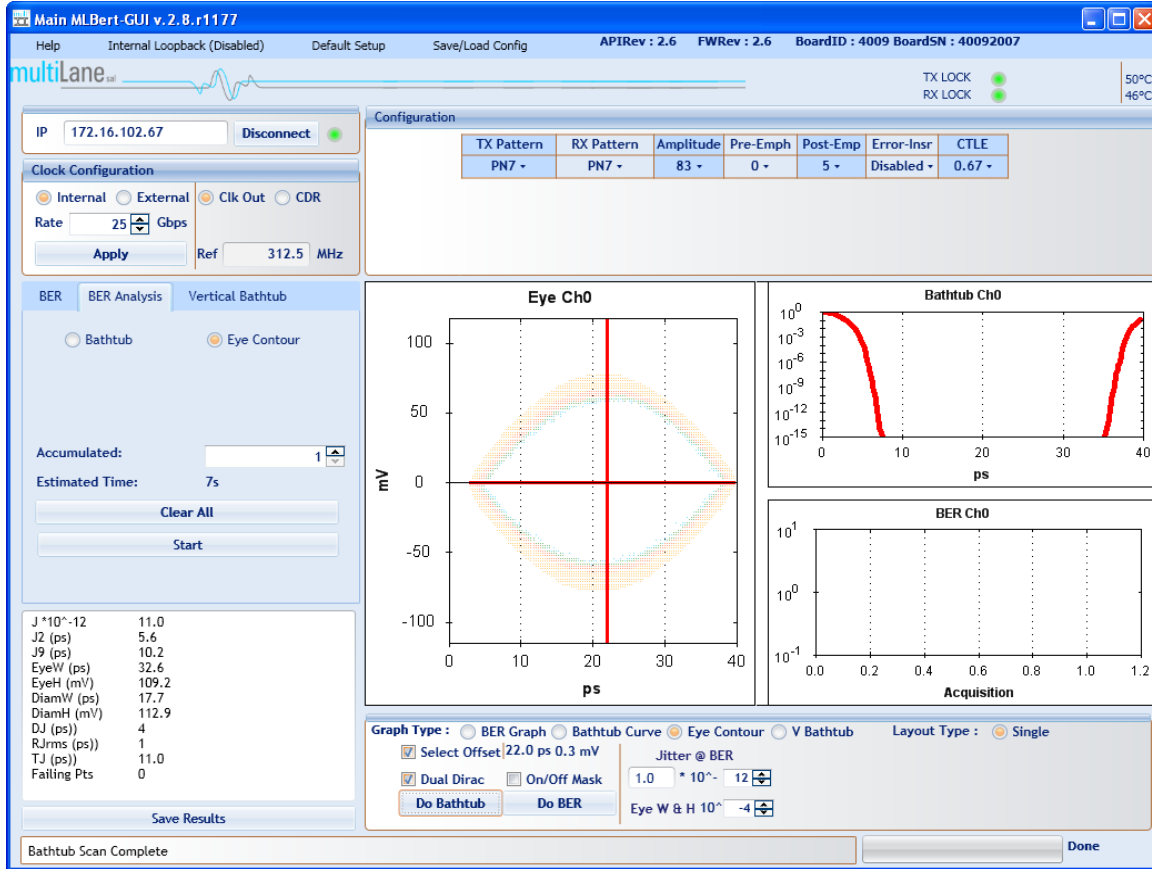


Figure 4 BERT Application

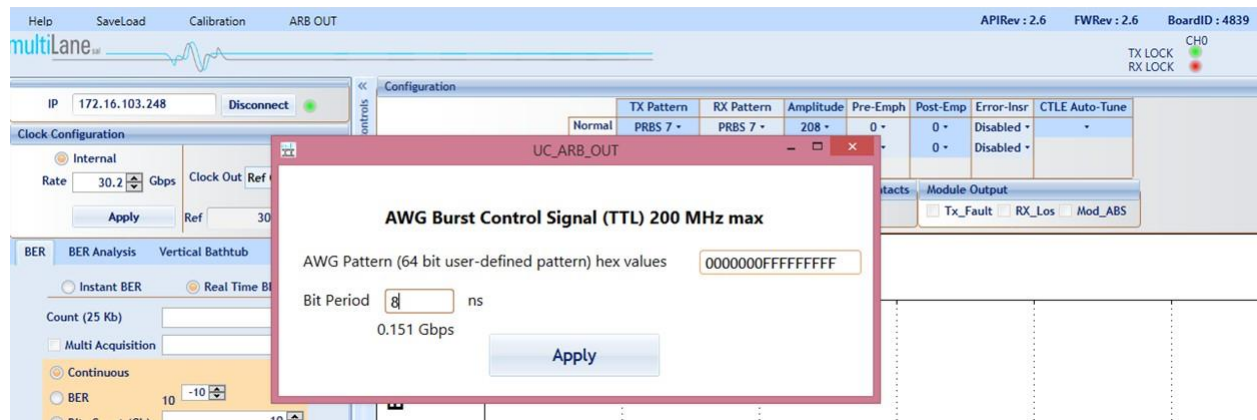


Figure 5: Burst Control AWG for PON Applications

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The application allows you to put the BERT and Scope GUIs side by side

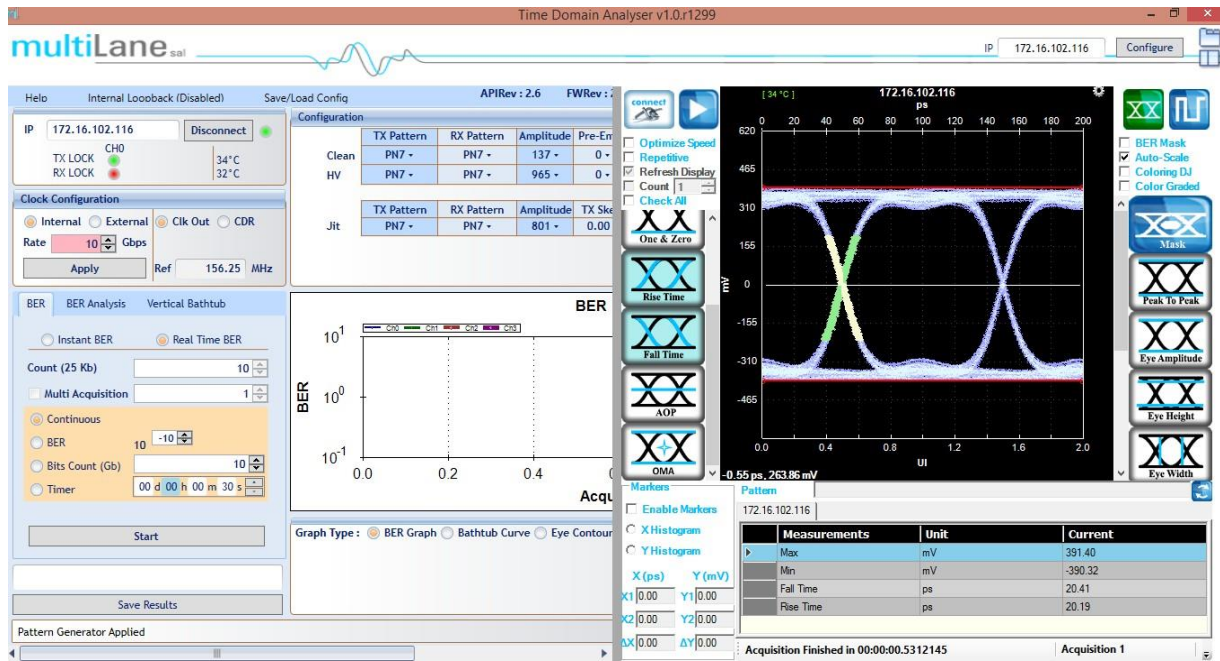


Figure 6 Composite BERT / Scope GUI

Electrical Specifications		
PPG1	Bit Rates	1 – 16Gbps or 1 –30Gbps
	TX Amplitude Differential	250-800mV
	Patterns	PRBS 7/9/15/23/31 User Pattern 80 bits
	Pre-Emphasis	10 dB
	Pre-Emphasis Resolution	10 steps
	Equalizing Filter Spacing	1UI
	Random Jitter RMS	<300 fS @25.78125Gb/s
	Rise/ Fall Time (20–80%)	14 pS
	TX Skew control range	N/A
	TX Skew control	N/A
	Output Return Loss up to 10GHz	< -12 dB
	Output Return Loss (10-25GHz)	<-8 dB
ED1 / ED2	Error Detector Phase Margin	5 pS
	Error Detector Maximum Input	1200 mVpp Diff
	Error Detector Sensitivity	30 mVpp @ bitrates <12 Gb/s 50 mVpp @ bitrates >12 Gb/s
	Phase Scan Resolution	6 Bits
	Vertical Scan Resolution	8 Bits
	TX/RX connectors	2.92 mm connectors
	Reference clock output amplitude	550 – 850 mVpp
	Reference clock output rate	62.5 - 750 MHz
CTLE support	Auto-tune	
DSO	Input Bandwidth	32 GHz or 50 GHz
	Input Amplitude (Single ended)	AC: 600 mVpp S-E
	Input Rise / Fall Time	11ps
	Diff. Input Return Loss	< -8dB
	Vertical Resolution	12 bits
	CDR sensitivity	100 mV single-ended
	Clock Input Range (Normal Mode)	50 - 525 MHz
	Clock Input Range (Bypass Mode)	50 - 125 MHz
	Clock Input Amplitude	200 - 1000 mV
	Input Impedance	50 Ω
	Intrinsic Jitter (excluding DDJ)	200fS
	Amplitude Error	5 mV
	Data Format Support	NRZ / PAM4
	PRBS Pattern Capture	up to PN13
	Spurious-Free Dynamic Range	-58 dBc at 10 GHz, 500 mVpp, 1GS/s -53 dBc at 30 GHz, 500 mVpp, 1GS/s
	Temperature range	0-65C
Power Requirements	0.9A @ 12V	
Memory Depth	256K sample	

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25GHz Optical Receiver Specifications			
	Typical		Unit
	MM	SM	
Wavelength Range	750 - 950	1000-1650	nm
Bandwidth (-3dB electrical)	25		GHz
Sensitivity @ 850 nm	-15		dBm
Sensitivity @ 1310 nm	-19		dBm
Overload	+2		dBm
Conversion Gain @ 1310 nm	450		V/W
Electrical Return Loss (< 8 GHz)	-15		dB
Optical Return Loss	-30		dB
Connector Type	FC APC		