

Tektronix

DSA8300 (Equivalent Time Instrumentation) Optical Tx



敏盛企業有限公司

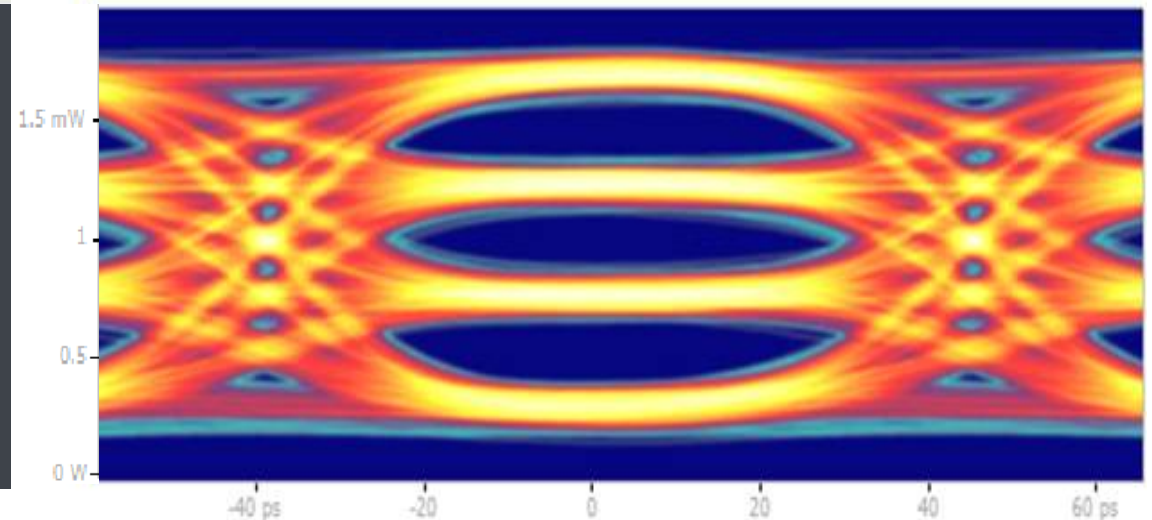
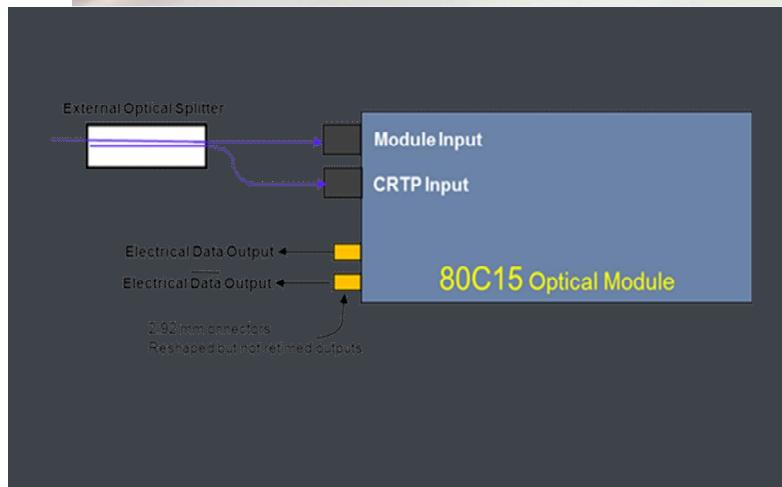
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80C15 – CRTP (Clock Recovery Trigger Pickoff)

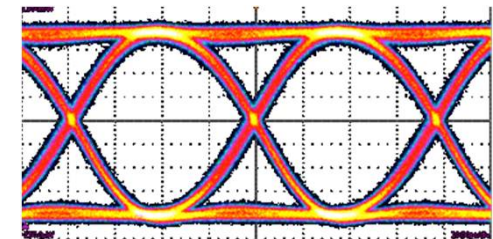
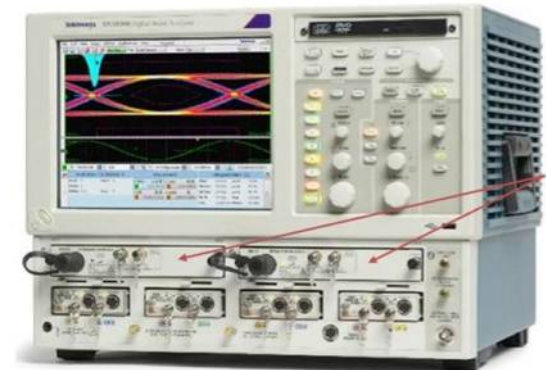


Excerpt of 80C15 CRTP training deck

Tektronix 80C15 module, optional CRTP (Electrical Out)

80C15 CRTP

- Single-Channel Optical Plug-in Module for DSA8300 with optional **Electrical Clock Recovery Trigger Pickoff (CRTP)**
- Unfiltered Optical Bandwidth >32GHz
- 62.5/125 μm **Multi-Mode** Fiber Input
- **Short-** and Long-Wavelength Support (800 -1600 nm)
- 200 kS/s Acquisition Rate
- **Jitter Floor <150 fs RMS (with 82A04B) ~380fs RMS (without 82A04B)**
- Optical Receiver Filters:
 - **32G Fibre Channel (28.05 Gb/s)**
 - OTU-4 (4 x 27.95 Gb/s)
 - 100Gbase-LR4/ER4/SR4 (25.78 Gb/s)
 - 26G EDR Infiniband (25.78 Gb/s)



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SR4/EDR/AOC Require CDR's at the Spec level

Prevalence of re-timing drivers is widespread across 100G

Draft Amendment to IEEE Std 802.3-2012
IEEE P802.3bm 40 Gb/s and 100 Gb/s Fiber Optic Task Force

IEEE Draft P802.3bm/D3.2
18th September 2014

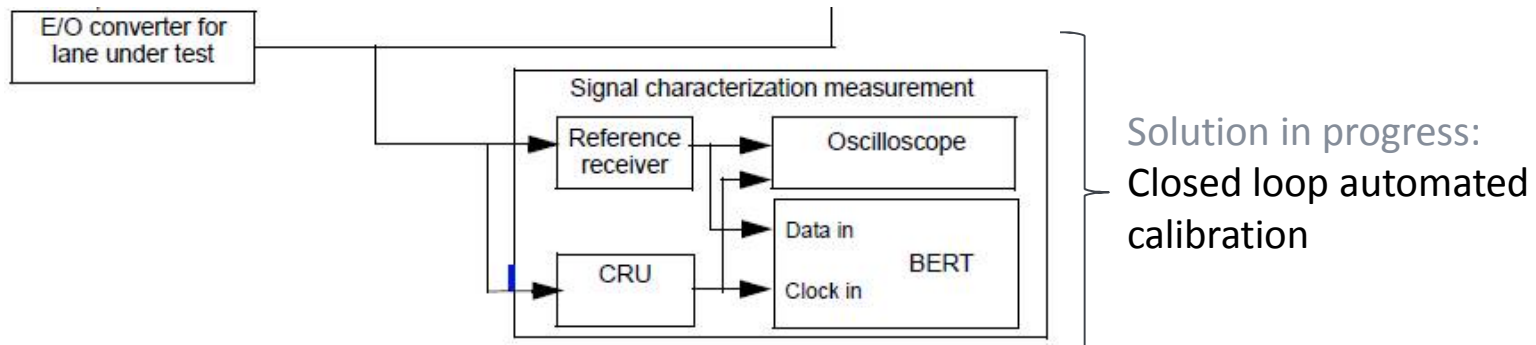


Figure 95-5—Stressed receiver conformance test block diagram

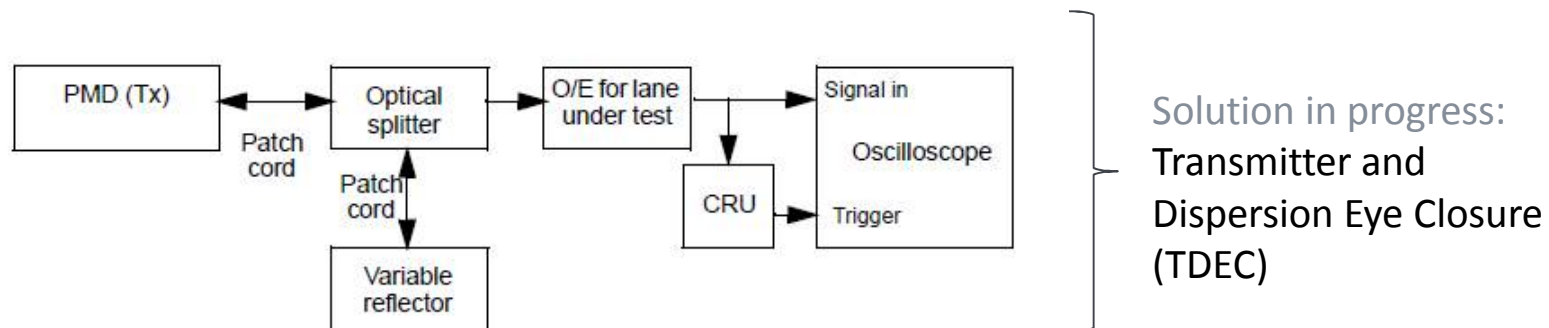


Figure 95-3—TDEC conformance test block diagram

95.8.8.4 Stressed receiver conformance test signal verification

The stressed receiver conformance test signal can be verified using an optical reference receiver with an ideal fourth-order Bessel-Thomson response with a reference frequency f_r of 19.34 GHz. Use of G.691 tolerance filters may significantly degrade this calibration. The clock output from the clock source in Figure 95-5 is modulated with the sinusoidal jitter. To use an oscilloscope to calibrate the final stressed eye J2 Jitter and stressed eye J4 Jitter that includes the sinusoidal jitter component, a clock recovery unit (CRU) of Figure 95-5) is required.

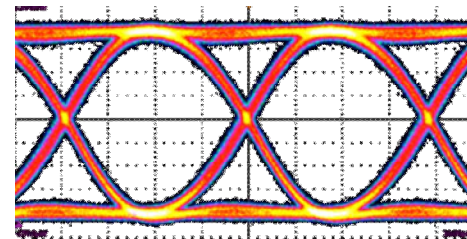
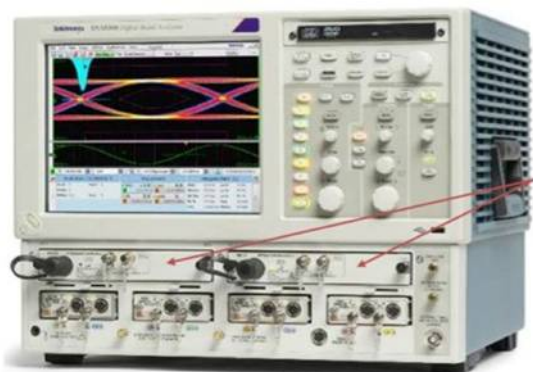
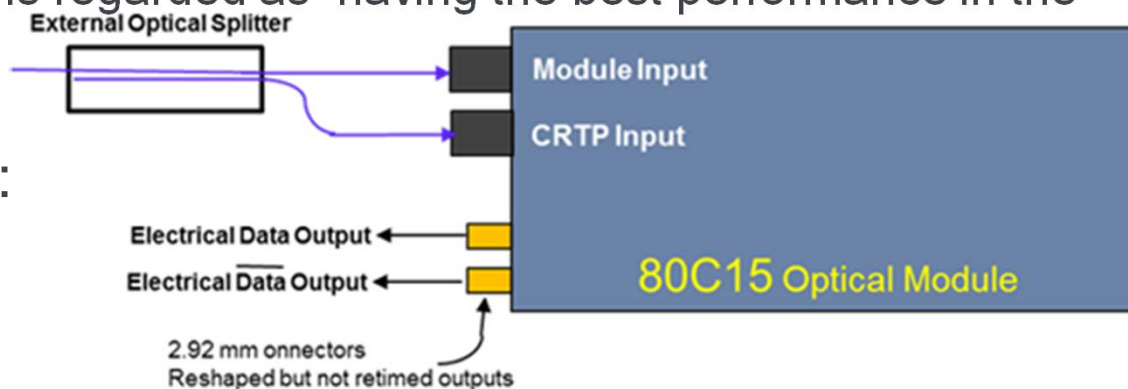


80C15/CRTP TX Instrument Details

The 80C15 is the latest in a family of optical DSA8300 modules designed to support the optical networking ecosystem. This is a portfolio where Tektronix has some key differentiators and is regarded as having the best performance in the industry.

Optical Transmitter test:

- Single-Mode
- Multi-Mode



80C15: Tektronix Optical portfolio with unmatched accuracy, noise performance, and flexibility

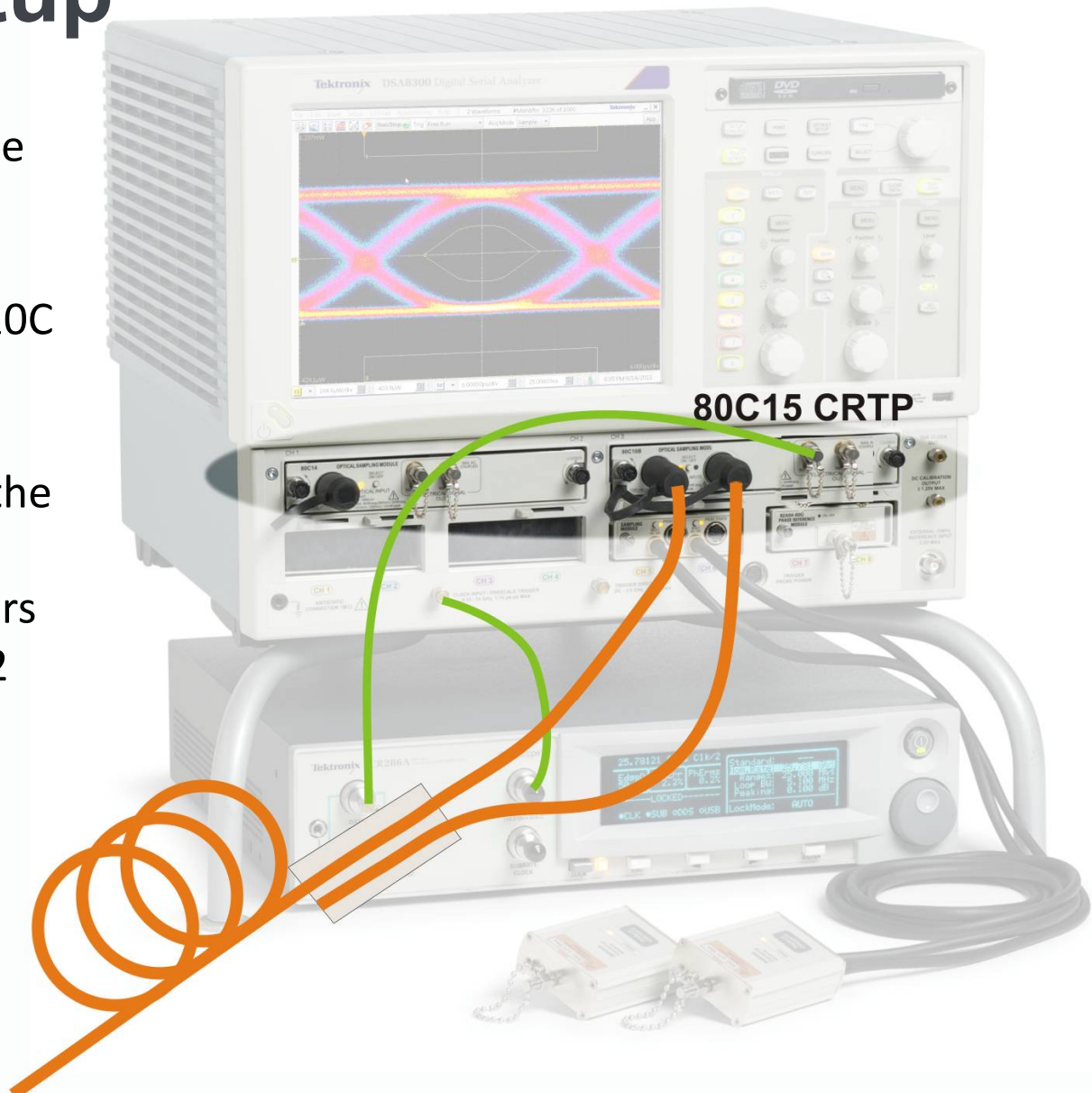
The 80C15 fits between 80C14 and 80C10C models

Feature / Specification	80C14	80C15	80C10C
Input Fiber Type	SMF + MMF 9, 50, 62.5 μm	SMF + MMF 9, 50, 62.5 μm	SMF 9 μm
Wavelength Range	700-1650nm	780nm-1650nm	1290-1620nm
Unfiltered Optical Bandwidth	14 GHz	32+ GHz	80+ GHz
Unfiltered Risetime, typ	31 ps	14 ps	6 ps
Filter Rates	8.5 – 14.06 Gb/s	25.78 – 28.05 Gb/s	25.78 – 44.5 Gb/s
26 Gb/s Mask Test Sensitivity AOP @ 1310nm	-16.5 dBm	-9 dBm	-7.5 dBm
Usable Electrical Out	>20 Gb/s	32 Gb/s	> 44 Gb/s



Splitter setup

- User can select the divide ratio in an external splitter
- (just like the 80C10C HSTP)
- Even when 90 % energy goes into the oscilloscope the Electrical Out offers strong signal at 32 Gb/s for normal amplitude optical signal



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80C15 CRTP only SR4 conformant solution

The IEEE 802.3bm 100GBASE-SR4 DUT's go down to 6.4 dBm OMA ...

Competitive CR sensitivity is -3 dBm before splitter! (i.e. 0 dBm with splitter)

95.7.1 100GBASE-SR4 transmitter optical specifications

Each lane of a 100GBASE-SR4 transmitter shall meet the specifications in Table 95-6 per the definitions in 95.8.

18
19
20
21

Table 95-6—100GBASE-SR4 transmit characteristics

Description	Value	Unit
Signaling rate, each lane (range)	25.78125 ± 100 ppm	GBd
Center wavelength (range)	840 to 860	nm
RMS spectral width ^a (max)	0.6	nm
Average launch power, each lane (max)	2.4	dBm
Average launch power, each lane (min)	-8.4	dBm
Optical Modulation Amplitude (OMA), each lane (max)	3	dBm
Optical Modulation Amplitude (OMA), each lane (min) ^b	-6.4	dBm
Launch power in OMA minus TDEC (min)	-7.3	dBm
Transmitter and dispersion eye closure (TDEC), each lane (max)	4.3	dB
Average launch power of OFF transmitter, each lane (max)	-30	dBm
Extinction ratio (min)	2	dB
Optical return loss tolerance (max)	12	dB
Encircled flux ^c	≥ 86% at 19 μm ≤ 30% at 4.5 μm	
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3} Hit ratio 1.5 × 10 ⁻³ hits per sample	{0.3, 0.38, 0.45, 0.35, 0.41, 0.5}	

^aRMS spectral width is the standard deviation of the spectrum.

^bEven if the TDEC < 0.9 dB, the OMA (min) must exceed this value.

^cIf measured into type A1a.2 or type A1a.3 50 μm fiber in accordance with IEC 61280-1-4.

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Minimum optical modulation power to achieve lock
(at the input of the N1075A)

N1070A with N1075 M14

850 nm multimode path

-9 dBm @ 10 Gb/s
-9 dBm @ 14 Gb/s
-3 dBm @ 25 Gb/s
-1 dBm @ 28 Gb/s

1550 nm single-mode path

-10 dBm @ 10 Gb/s
-9 dBm @ 14 Gb/s
-5 dBm @ 25 Gb/s
-1 dBm @ 28 Gb/s

N1070A with N1075 S32

1550 nm single-mode path

-15 dBm @ 10 Gb/s
-14 dBm @ 14 Gb/s
-12 dBm @ 28 Gb/s
-10 dBm @ 32 Gb/s

From Keysight Data-Sheet “The N1075A-M14 system is rolling off above 16 Gb/s. However, if the signal power is large, phase lock can be achieved at 25 and 28 Gb/s.”
0dBm optical signals are only found in laboratory conditions.



Feature Benefit

Key Features of DSA8300 + 80C15, Opt. CRTP:

- Enables Single-Channel Optical Module with optional Electrical Out for DSA8300
- Unfiltered Optical Bandwidth >32GHz
- 62.5/125 μm Multi-Mode Fiber Input
- Short and Long Wavelength Support (800 -1600 nm)
- Jitter Floor <150 fs RMS (with 82A04B)
- Electrical CRTP Option Compatible with CR286A Clock Recovery Instrument
- Optical Receiver Filters:
 - **Multimode (short wavelength)**
 - 32G Fibre Channel (28.05 Gb/s)
 - 26G EDR Infiniband (25.78 Gb/s)
 - 100GBASE SR4 (25.78 Gb/s)
 - **Single-Mode (long wavelength)**
 - OTU-4 (4 x 27.95 Gb/s)
 - 100GBASE-LR4 (25.78 Gb/s)
 - 100GBASE ER4 (25.78 Gb/s)

Key Benefits and Features:

Feature	Benefit
Integration of the Option CRTP into the 80C15 Optical Sampling module enables effective use with short reach topologies (SR4) with optical signals as low as -6dBm up to 32 Gb/s.	One solution for all key SM and MM test requires from 25.7 to 28.6 Gb/s and beyond, test result confidence, reduced cost of test. .
The 80C15 equipped with Opt. CRTP allows the user to capture the signal in a BER (Bit Error Ratio) Error Detector or by a Real Time Oscilloscope (for troubleshooting) at these high speed signals with better sensitivity than any other solution	Faster time to market with versatility to support debugging activity, in combination with a BERT or a realtime scope, and compliance testing of 100G designs with a single system
The 80C15 with, or without, Opt. CRTP has the lowest noise and highest sensitivity signal acquisition on the market.	Improved first pass rate and test margins with the best available signal integrity



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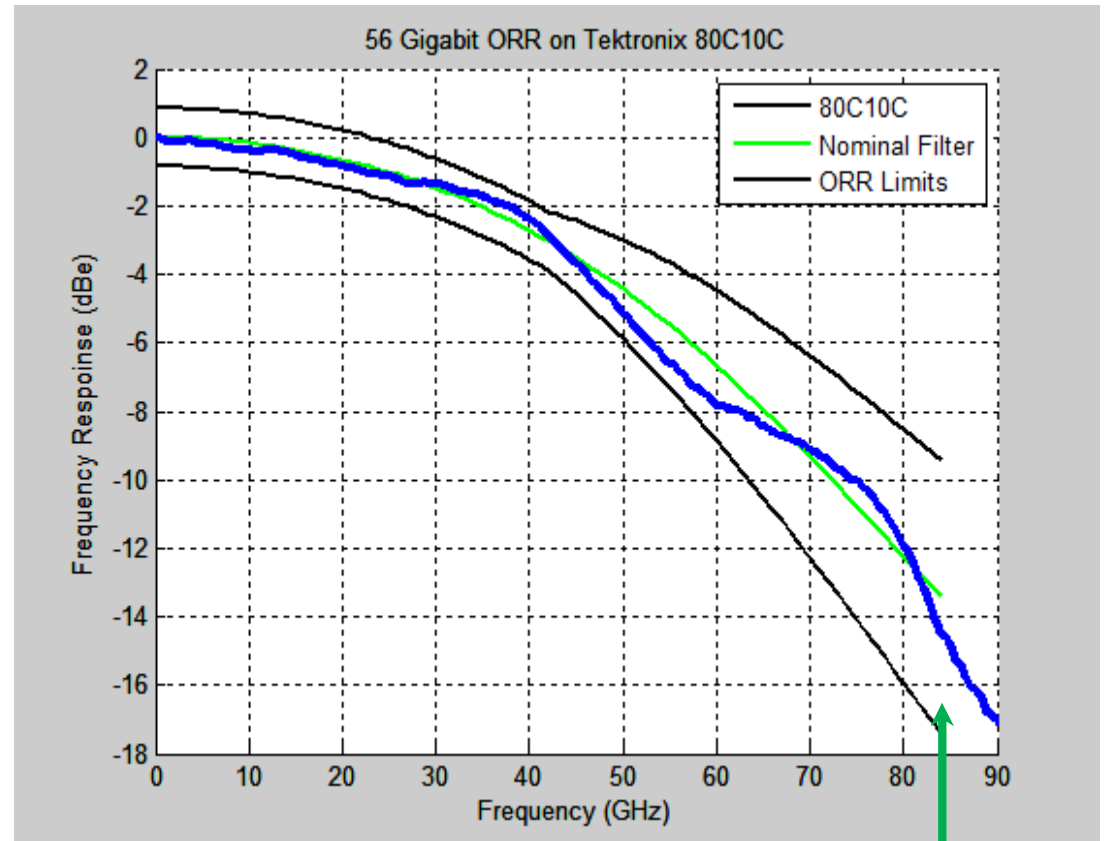
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56Gbps Optical Reference Receiver on Highest optical Bandwidth oscilloscope 80C10C, 80C10C-CRTP

- High sensitivity with and without CR
- Support for Optical Bessel-Thompson Filter in HW (no DSP, no special pattern needed)
- Electrical Data Out (optional) for:
 - Clock Recovery,
 - Real-time oscilloscope for troubleshooting
 - BER analysis
- Best noise performance at 40G, 56G → best system for PAM4 @ 56 GBd
- **~100 GHz optical Bandwidth**



Compliant
@ 84 GHz !!!

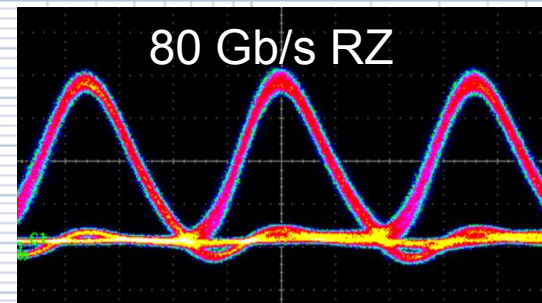
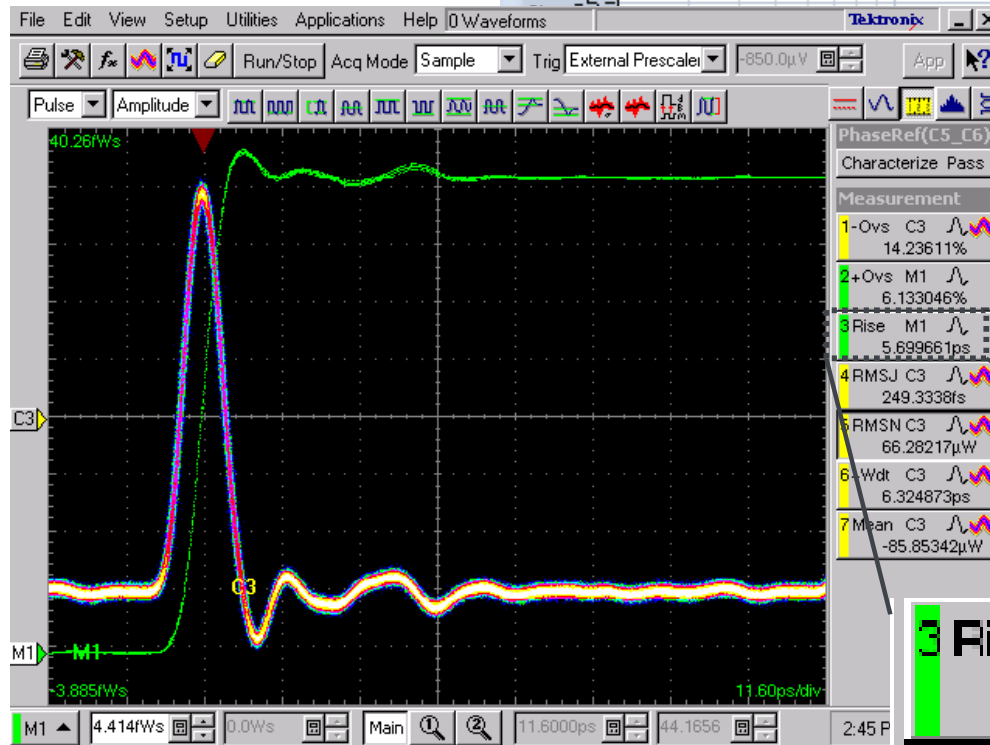
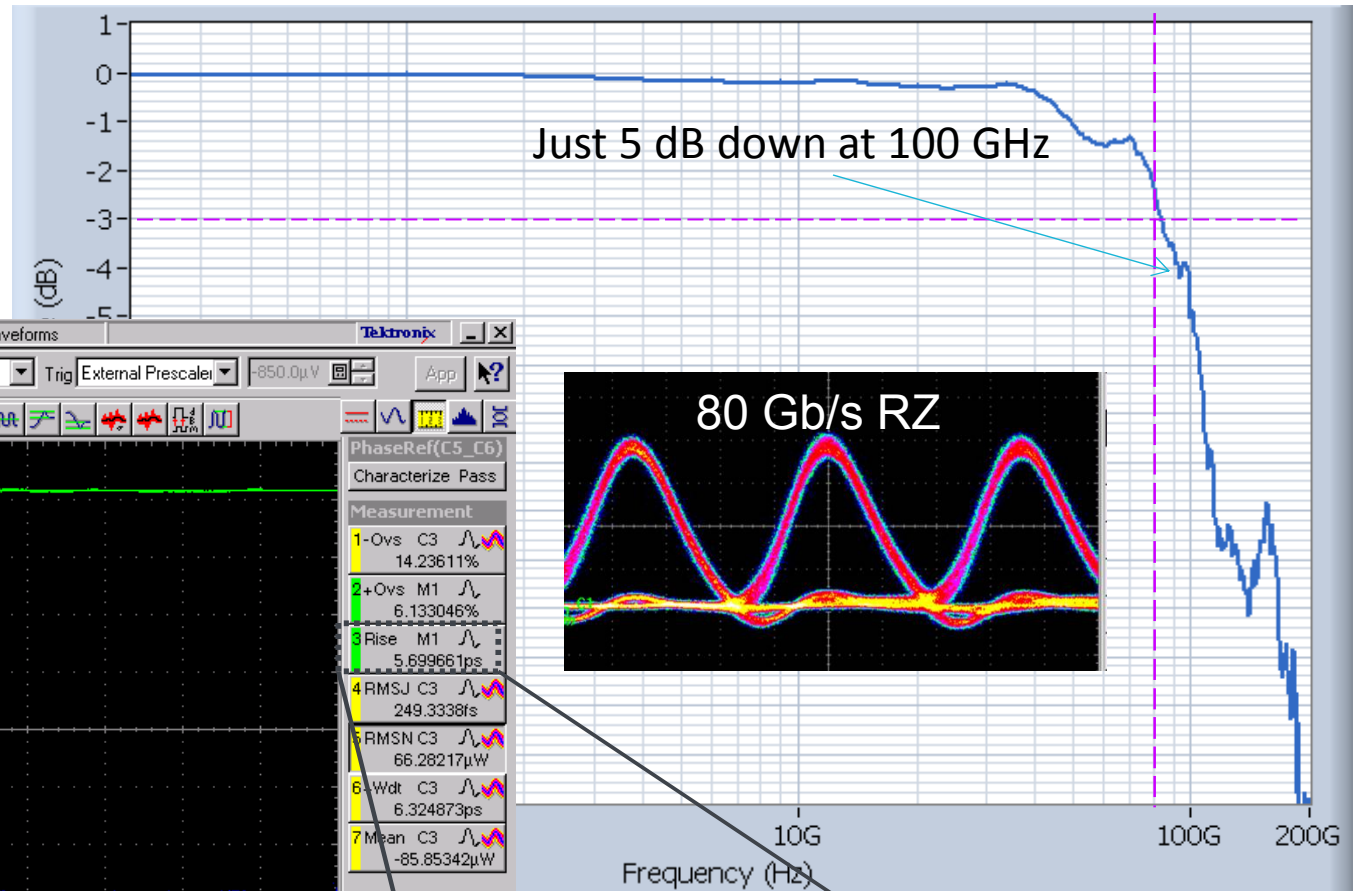


Single-mode optical standards

(100Gb/s stable since 802.3ba ratified in 2011)

- Current technology satisfies 56 Gb/s as well as current 25 Gb/s

Tek 80C10C optical module:



Measurement	Value
1-Ovs C3	14.23611%
2+Ovs M1	6.133046%
3 Rise M1	5.69966ps
4 RMSJ C3	249.3338fs
5 RMSN C3	66.28217μW
6 Wdt C3	6.324873ps
7 Mean C3	-85.85342μW

3 Rise M1 5.69966 ps



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