200 Gb/s over OM4 & OMyy Baseline link proposals

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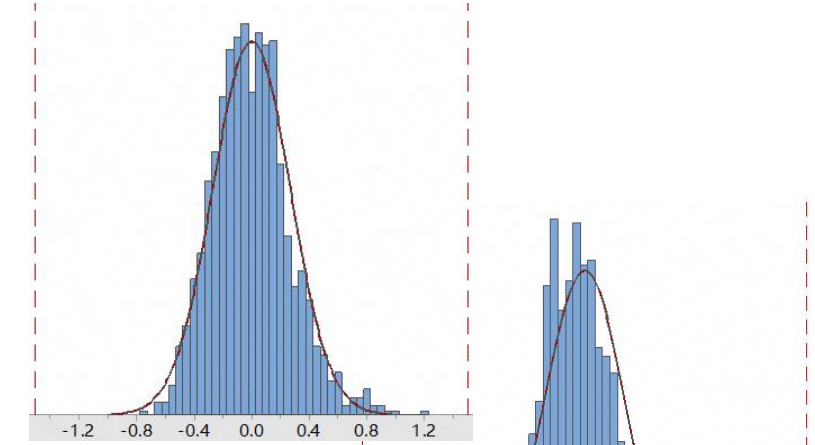
Overview

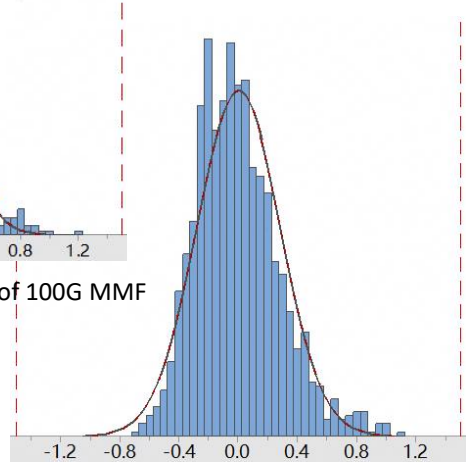
- TDECQmax 4.6dB was proposed in Jan interim meeting 2026
  - 200 Gb/s over OM4 &OM4+ Baseline link proposals
- In this presentation, We further verify the reasonableness of the TDECQmax 4.6dB.
  - Impact of DFE on TDECQ

Review the proposal of the TDECQ

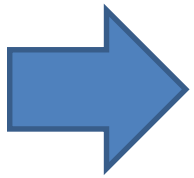
- Tested and collected $TDECQ_{max}$ data of 200G MMF modules@30m Over OM4 fiber.
  - The value of TDECQ max @30m ranges between 2.77 dB and 3.79 dB, the mean value is 3.25dB
- Collected and analyzed the TDECQ distribution of 50G and 100G MMF optical modules.
  - The distribution span of TDECQ for both 50G and 100G MMF optical modules is around 2.2 dB.
- Based on current 200G MMF TDECQ test data and historical experience, we proposed TDECQmax 4.6dB.

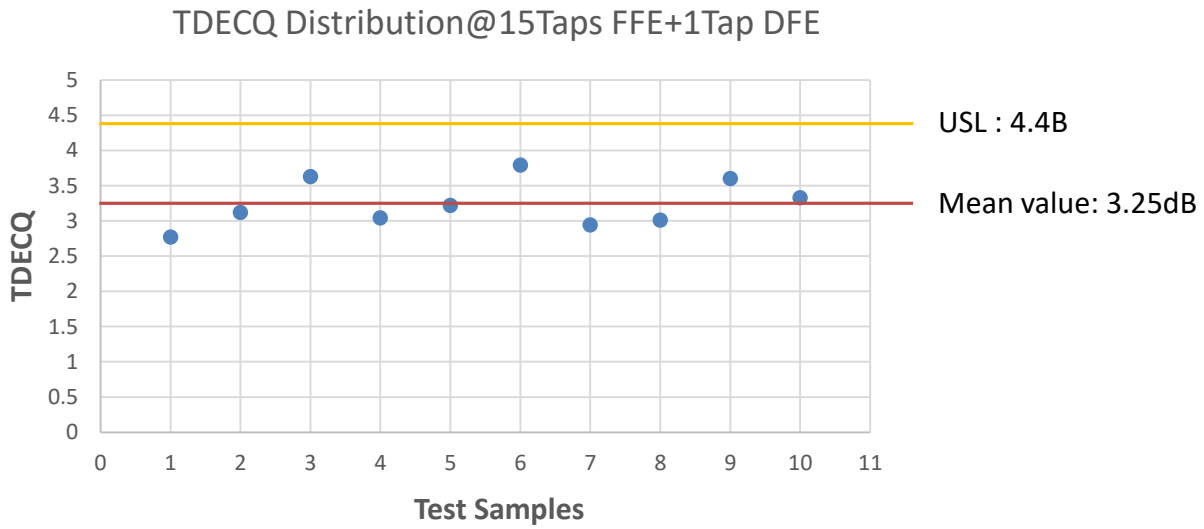


TDECQ normalized distribution of 100G MMF



TDECQ normalized distribution of 50G MMF



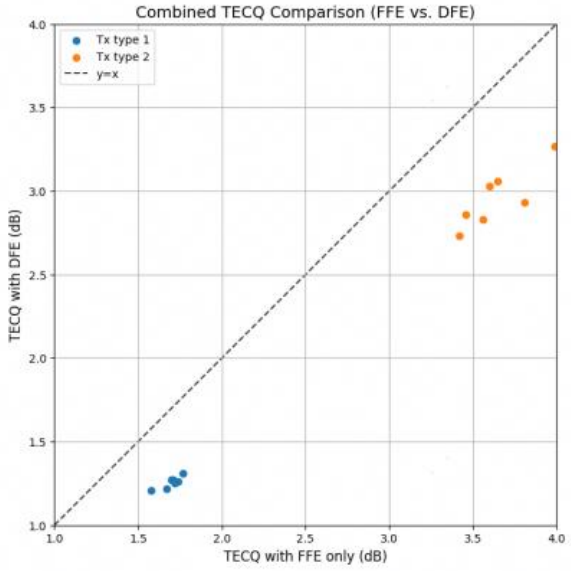


200G MMF TDECQ distribution analysis

DFE gain for SMF TDECQ

- In 802.3dj discussion, DFE gain for SMF TDECQ was showed in [rodes_3dj_01a_2509].
- The contribution indicated that DFE gain for SMF TDECQ was 0.55dB

▪ DFE in reference Rx reduced TECQ value by an average of 0.55dB

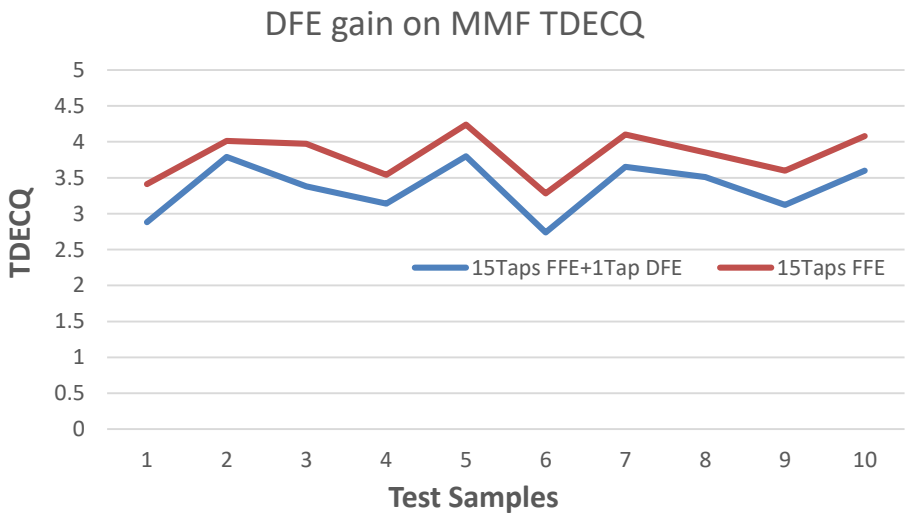


Refer to rodes_3dj_01a_2509

- In this presentation, we further shows some DFE gain date for MMF TDECQ.

Impact of DFE on TDECQ

- For TDECQmax 4.6dB, the concern was how much impact the DFE would have on the TDECQ.
- We tested ten samples from two optical module vendors with PRBS13 and compared the TDECQ with and w/o DFE.



- The average difference between TDECQ with and w/o DFE is 0.45 dB, which is close to the number of SMF.
  - Among the 10 samples, the three largest TDECQ are 3.8 dB, 3.79 dB, and 3.65 dB, and the corresponding DFE benefits are 0.44 dB, 0.22 dB, and 0.45 dB.

Illustrative Baseline Preview

Illustrative Transmitter Specifications

Description	200GBASE-xx1 400GBASE-xx2 800GBASE-xx4 1.6TBASE-xx8	200GBASE-yy1 400GBASE-yy2 800GBASE-yy4 1.6TBASE-yy8	Unit
Signaling rate, each lane (range)	TBD	TBD	GBd
Modulation Format	PAM4	PAM4	
Lane wavelengths (range)	844~868	TBD	nm
RMS spectral width	TBD	TBD	nm
Average launch power, each lane (max)	TBD	TBD	dBm
Average launch power, each lane (min)	TBD	TBD	dBm
Outer Optical Modulation Amplitude (OMA_{outer}), each lane(max)	TBD	TBD	dBm
Outer Optical Modulation Amplitude (OMA_{outer}), each lane(min) for TDECQ < 1.8 dB for 1.8 dB ≤ TDECQ ≤ TDECQ (max)	TBD TBD TBD	TBD TBD TBD	 dBm dBm
Transmitter and dispersion eye closure (TDECQ), each lane (max)	4.6	TBD	dB
TECQ (max)	4.6	TBD	dB
Average launch power of OFF transmitter, each lane (max)	-30	-30	dBm
Transmitter power excursion, each lane (max)	TBD	TBD	dB
Extinction ratio, each lane, (min)	2	2	dB
Transmitter transition time (max)	8	8	ps
Transmitter over/under-shoot (max)	TBD	TBD	%
RIN_xOMA (max)	TBD	TBD	dB/Hz
Optical return loss tolerance (max)	TBD	TBD	dB
Encircled flux	≥86% at 19 um ≤30% at 4.5 um	≥86% at 19 um ≤30% at 4.5 um	dB

Illustrative Receiver Specifications

Description	200GBASE-xx1 400GBASE-xx2 800GBASE-xx4 1.6TBASE-xx8	200GBASE-yy1 400GBASE-yy2 800GBASE-yy4 1.6TBASE-yy8	Unit
Signaling rate, each lane (range)	TBD	TBD	GBd
Modulation Format	PAM4	PAM4	
Lane wavelengths (range)	844~868	TBD	nm
Damage threshold, each lane	TBD	TBD	dBm
Average receive power, each lane (max)	TBD	TBD	dBm
Average receive power, each lane (min)	TBD	TBD	dBm
Receive power, each lane (OMA_{outer}) (max)	TBD	TBD	dBm
Receiver reflectance (max)	TBD	TBD	dB
Receiver sensitivity (OMA_{outer}), each lane (max) for TECQ < 1.8dB for 1.8 dB ≤ TECQ ≤ SECQ	 TBD TBD	 TBD TBD	 dBm dBm
Stressed receiver sensitivity (OMA_{outer}), each lane (max)	TBD	TBD	dBm
Conditions of stressed receiver sensitivity test:			
SECQ	4.6	TBD	dB
OMA_{outer} of each aggressor lane[c]	3.5	3.5	dBm

Illustrative Link Budgets

Description	200GBASE-xx1 400GBASE-xx2 800GBASE-xx4 1.6TBASE-xx8	200GBASE-yy1 400GBASE-yy2 800GBASE-yy4 1.6TBASE-yy8	Unit
	OM4	OMyy	
Effective modal bandwidth at 850 nm	4700	TBD	MHz.km
Power budget (for max TDECQ)	TBD	TBD	dB
Operating distance	0.5 To 30/50	0.5 To 30/50	m
Channel insertion loss	1.6	1.7	dB
Maximum discrete reflectance	-20dB	-20dB	dB
Allocation for penalties (for max TDECQ)	TBD	TBD	dB
Additional insertion loss allowed	0.1	0.1	dB

The channel Insertion loss (30m)=0.1(fiber)+1.5(connector)=1.6dB

The channel Insertion loss (50m)=0.1(fiber)+1.6(connector)=1.7dB

The channel insertion loss is calculated using maximum distance and optical fiber attenuation of 3.0dB/km at 850nm plus an allocation for connection and splice loss

Summary

- 200G MMF Baseline Proposal further updated, data show that DFE gain is around 0.45dB
- Based on current 200G MMF TDECQ test data, TDECQmax 4.6dB is a reasonable value.