Updated Baseline for 100 Gb/s per Lane Optical PMDs Supporting 50 and 100m OM4 MMF

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February 18, 2021

IEEE P802.3db 100 Gb/s, 200 Gb/s, and 400 Gb/s Short Reach Fiber Task Force

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Baseline

- Baseline specifications proposed for OM4 50 and 100 m reach (and equivalent reach on OM3 and OM5) on Dec. 17, 2020.

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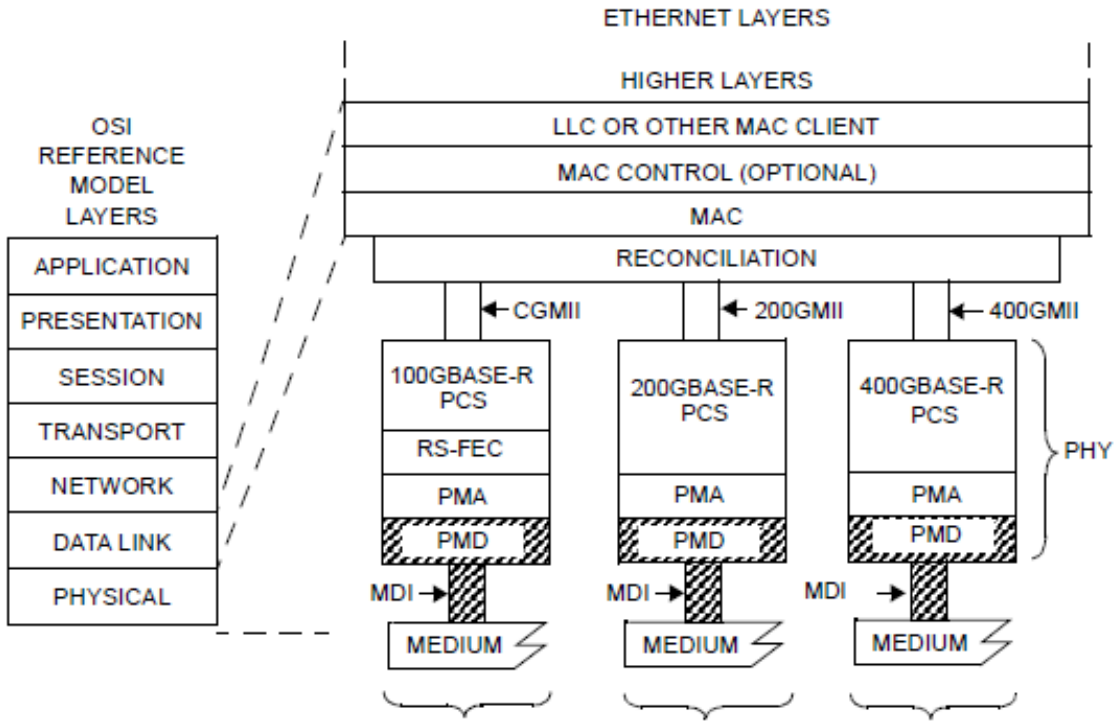
- Followed by several presentations and discussion of key items in the specifications.

➢ Today, presenting the updated and revised baseline.

Position in the 802.3 Ethernet Architecture



400GMII = 400 Gb/s MEDIA INDEPENDENT INTERFACE
200GMII = 200 Gb/s MEDIA INDEPENDENT INTERFACE
CGMII = 100 Gb/s MEDIA INDEPENDENT INTERFACE
LLC = LOGICAL LINK CONTROL
MAC = MEDIA ACCESS CONTROL
MDI = MEDIUM DEPENDENT INTERFACE
PCS = PHYSICAL CODING SUBLAYER

PHY = PHYSICAL LAYER DEVICE
PMA = PHYSICAL MEDIUM ATTACHMENT
PMD = PHYSICAL MEDIUM DEPENDENT
RS-FEC = REED-SOLOMON FORWARD ERROR CORRECTION

xR represents two PMDs (naming TBD)
PMD FOR MULTIMODE FIBER 50 m
PMD FOR MULTIMODE FIBER 100 m

Transmit Characteristics

Description	Value		Unit
	OM3 30m OM4 50m OM5 50m	OM3 60m OM4 100m OM5 100m	
Signaling rate, each lane (range)	53.125 ± 100ppm		GBd
Modulation format	PAM4		
Center wavelength (range)	TBD	844 to 863	nm
RMS spectral width (max)[a]	0.65	0.6	nm
Average launch power, each lane (max)	4		dBm
Average launch power, each lane (min)[d]	-5		dBm
Outer optical modulation amplitude (OMA_{outer}), each lane (max)	3.5		dBm
Outer optical modulation amplitude (OMA_{outer}), each lane (min)[b,d]	-3		dBm
Transmitter excursion, each lane (max)	2		dBm
Transmitter overshoot/undershoot as a fraction of OMA_{outer}	TBD	TBD	
Launch power in OMA_{outer} minus TDECQ (min)[d]	TBD	-4.4	dBm
TECQ, each lane (max)	TBD	4.4	
TDECQ, each lane (max)	TBD	4.4	dB
Average launch power of OFF transmitter, each lane (max)	-30		dB
Extinction ratio, each lane (min)	2.5		dB
Transmitter transition time, each lane (max)	17		ps
$RIN_{12}OMA$ (max)	-131		dB/Hz
Optical return loss tolerance (max)	12		dB
Encircled flux[c]	≥ 86% at 19 μm, ≤ 30% at 5 μm		

[a] RMS spectral width is the standard deviation of the spectrum.

[b] Even if TDECQ is less than 1.4 dB, outer OMA (min) must exceed this value.

[c] If measured into type A1a.2 or type A1a.3, or A1a.4, 50 um fiber, in accordance with IEC 61280-1-4.

[d] Based on stressed receiver sensitivity of -2 dBm, and may increase by up to 0.4 dB based on the choice of stressed receiver sensitivity.

Receive Characteristics

Description	Value		Unit
	OM3 30m OM4 50m OM5 50m	OM3 60m OM4 100m OM5 100m	
Signaling rate, each lane (range)	53.125 ± 100ppm		GBd
Modulation format	PAM4		—
Center wavelength (range)	TBD		nm
Damage threshold (min)[a]	5		dBm
Average receive power, each lane (max)	4		dBm
Average receive power, each lane (min)[b,g]	-6.8		dBm
Receive power each lane (OMA_{outer}) (max)	3.5		dBm
Receiver reflectance	-12		dB
Stressed receiver sensitivity (OMA_{outer}), each lane (max)[c]	Between -2.0 and -1.6		dBm
Receiver sensitivity (OMA_{outer}), each lane (max)[d,g]	max (-5, SECQ – 6.4)		dBm
Conditions of stressed receiver sensitivity test[e]			
Stressed eye closure for PAM4 (SECQ), lane under test	TBD	4.4	dB
OMA_{outer} of each aggressor lane[f]	3.5		dBm

[a] The receiver shall be able to tolerate, without damage, continuous exposure to an optical input signal having this average power level on one lane. The receiver does not have to operate correctly at this input power.

[b] Average receive power, each lane (min) is informative and not the principal indicator of signal strength. A received power below this value cannot be compliant; however, a value above this does not ensure compliance.

[c] Measured with conformance test signal at TP3 for the BER specified.

[d] Receiver sensitivity is informative and is defined for a transmitter with a SECQ up to 4.5 dB.

[e] These test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

[f] Only applies to 200GBASE-xR2 and 400GBASE-xR4.

[g] Based on stressed receiver sensitivity of -2 dBm, and may increase by up to 0.4 dB based on the choice of stressed receiver sensitivity.

Test Methodology

Test methodology is based on Clause 138.

Description	Value		Unit
	OM3 30m OM4 50m OM5 50m	OM3 60m OM4 100m OM5 100m	
Half-symbol-rate filter bandwidth	26.5625		GHz
TECQ reference response bandwidth	26.5625	26.5625	GHz
TECQ minimum value of cursor	TBD	TBD	
TECQ position of cursor	TBD	1, 2, 3, or 4	
TDECQ reference response bandwidth*	TBD	15.0	GHz
TDECQ minimum value of cursor	TBD	0.8	
TDECQ position of cursor	TBD	2, 3, or 4	
Number of taps on T-spaced FFE	TBD	9	

* TDECQ reference response -3dBe bandwidth is for the best fit 4th order Bessel-Thompson filter to the combined fiber modal and chromatic dispersion modeled as a Gaussian LPF, and the receiver modeled as a 4th order Bessel-Thompson filter with bandwidth of 26.5625 GHz.

Illustrative Link Power Budget

Parameter	Reach Objective A			Reach Objective B			Units
	OM3	OM4	OM5	OM3	OM4	OM5	
Effective modal bandwidth at 850 nm[a]	2000	4700		2000	4700		MHz.km
Power budget (for max TDECQ)	TBD			6.4			dB
Operating distance	0.5 to 30	0.5 to 50		0.5 to 60	0.5 to 100		m
Channel insertion loss[b]	1.6	1.7		1.7	1.8		dB
Allocation for penalties (for max TDECQ)[c]	TBD			4.6			dB
Additional insertion loss allowed	TBD	TBD		0.1	0		dB

[a] Per IEC 60793-2-10

[b] The channel insertion loss is calculated using the maximum distance specified and cabled optical fiber attenuation of 3.0 dB/km at 850 nm plus an allocation for connection and splice loss given in 138.10.2.2.1

[c] Link penalties are used for link budget calculations. They are not requirements and not meant to be tested.

Summary

- Baseline proposal updated and revised based on discussion. Certain items are listed as TBD and presentations are recommended to determine the values.