

# **Consideration of the 100GBASE-BR10 and 100GBASE-BR20 optical specifications**

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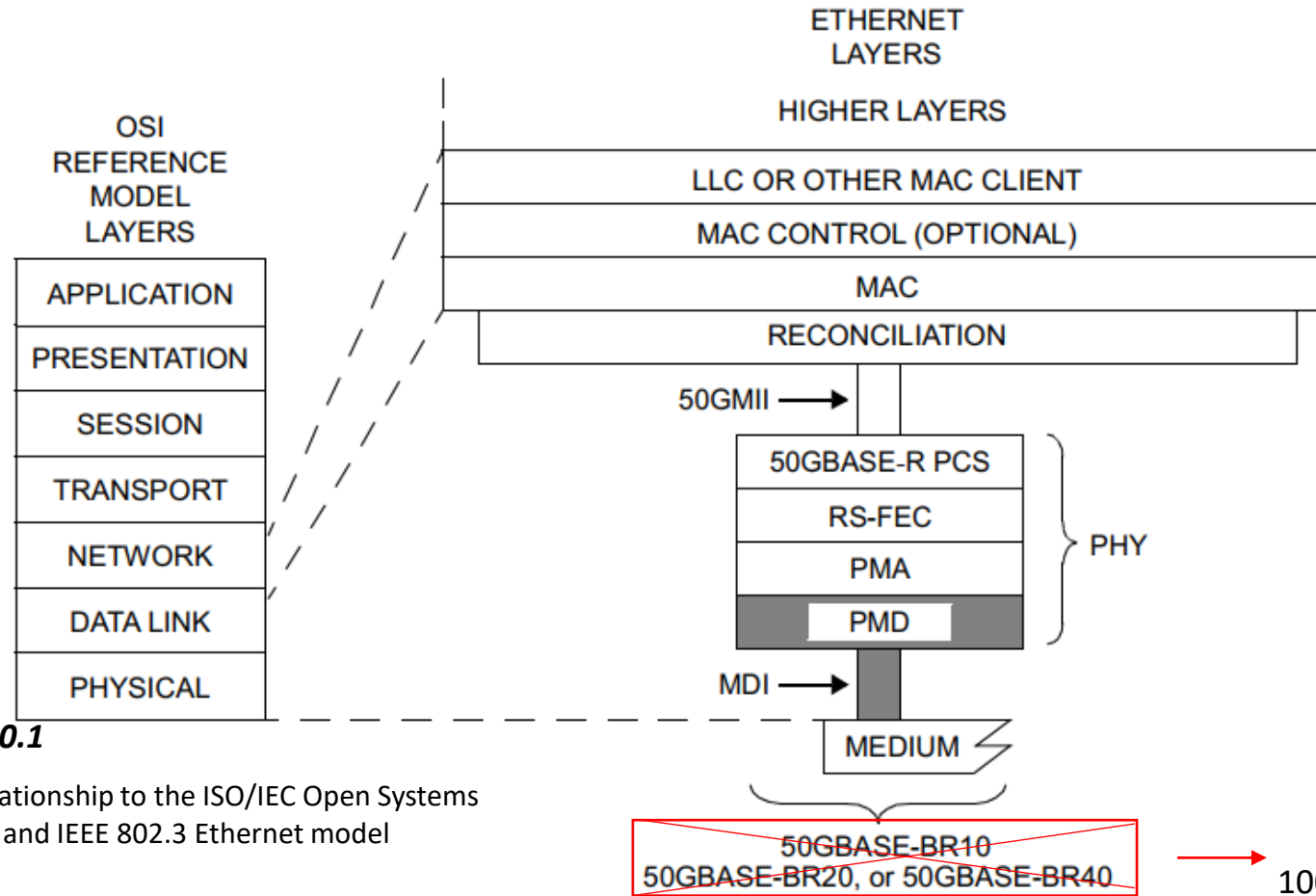
# Overview

- In 2023.05 interim meeting, we reached an agreement on the signaling rate and wavelength plan for 10km 20km Bidirectional 100 Gb/s Optical Access PHYs

*The motion of “Specify 100 Gb/s PAM4 modulation using wavelengths 1304.5 +/- 1 nm upstream and 1309.1 +/- 1 nm downstream for 10 km and 20 km PMDs” passes without objection.*

- For 100Gb/s 40km applications, more discussions are needed to support the decision on both optical signaling rate and its wavelength plan.
- This contribution kicks off the draft editing work with some basic proposals starting from 100GBASE-BR10, 100GBASE-BR20, which is generated from the baseline of 50GBASE-BR10 and 50GBASE-BR20 (clause 160, IEEE 802.3cp-2021) , and 100GBASE-LR1 (clause 140, IEEE 802.3cu-2021)

# 100GBASE-BRx PMDs Relationship to the IEEE 802.3 Ethernet Model



**IEEE Std 802.3cp-2021, clause 160.1**

Figure 160–1—50GBASE-BRx PMDs relationship to the ISO/IEC Open Systems Interconnection (OSI) reference model and IEEE 802.3 Ethernet model

50GMII = 50 GIGABIT 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

# Table for 100GBASE-BR10,100GBASE-BR20 Transmitter Spec

	IEEE Std 802.3cp-2021, clause 160.6 Table 160-6—50GBASE-BRx transmit characteristics		IEEE Std 802.3cu-2021, clause 140.6 Table 140-6—100GBASE-DR, 100GBASE-FR1, and 100GBASE-LR1 transmit characteristics	IEEE Std 802.3dk, new clause		
Description	50GBASE-BR10	50GBASE-BR20	100GBASE-LR1	100GBASE-BR10	100GBASE-BR20	Unit
Signaling rate (range)	26.5625 ± 100 ppm		53.125 ± 100 ppm	53.125 ± 100 ppm		GBd
Modulation format	PAM4		PAM4	PAM4		-
50GBASE-BRx-D center wavelength (range)	1320 to 1340	1306 to 1322	N/A	1303.5 to 1305.5		nm
50GBASE-BRx-U center wavelength (range)	1260 to 1280	1281 to 1297		1308.1 to 1310.1		nm
Wavelength	N/A		1304.5 to 1317.5	N/A		nm
Side-mode suppression ratio (SMSR), (min)	30		30	30		dB
Average launch power (max)	4.2	3.6	4.8			dBm
Average launch power <sup>a</sup> (min)	-4.5	-2.6	-1.9			dBm
Outer Optical Modulation Amplitude (OMA <sub>outer</sub> ) (max)	4	4.4	5			dBm
Outer Optical Modulation Amplitude(OMA <sub>outer</sub> ) (min) <sup>b</sup> : for TDECQ < 1.4 dB for 1.4 dB ≤ TDECQ ≤ 3.2 dB	-1.5 -2.9+TDECQ	0.4 -1+TDECQ	N/A			dBm dBm
Outer Optical Modulation Amplitude(OMA <sub>outer</sub> ) (min): for TDECQ < 1.4 dB for 1.4 dB ≤ TDECQ ≤ 3.4 dB	N/A	N/A	1.1 -0.3+TDECQ			dBm dBm

a Average launch power (min) is informative and not the principal indicator of signal strength. A transmitter with launch power below this value cannot be compliant; however, a value above this does not ensure compliance.

b The OMA<sub>outer</sub> (min) requirement holds even if the TDECQ < 1.4 dB. Even though the representation of the OMA<sub>outer</sub> requirement is different from that in Clause 139, they are consistent.

# Table for 100GBASE-BR10,100GBASE-BR20 Transmitter Spec

	IEEE Std 802.3cp-2021, clause 160.6 Table 160-6—50GBASE-BRx transmit characteristics		IEEE Std 802.3cu-2021, clause 140.6 Table 140-6—100GBASE-DR, 100GBASE-FR1, and 100GBASE-LR1 transmit characteristics	IEEE Std 802.3dk, new clause		
Description	50GBASE-BR10	50GBASE-BR20	100GBASE-LR1	100GBASE-BR10	100GBASE-BR20	Unit
Transmitter and dispersion eye closure for PAM4 (TDECQ) (max))	3.2		3.4			dB
TDECQ – 10log <sub>10</sub> (C <sub>eq</sub> ) <sup>c</sup> (max)	3.2		—			dB
TECQ(max)	3.2		3.4			dB
TDECQ-TECQ (max)	2.5		2.5	<b>2.5</b>		dB
Over/under-shoot (max)	N/A		22			%
Transmitter power excursion (max)	N/A		2.8			dBm
Average launch power of OFF transmitter (max)	-16	-20	-15			dBm
Extinction ratio (min)	3.5	6	3.5	<b>3.5</b>		dB
Transmitter transition time (max)	34		17			ps
RIN <sub>x</sub> OMA (max) <sup>d</sup>	-132		-136			dB/Hz
Optical return loss tolerance (max)	15.6	15	15.6	<b>15.6</b>		dB
Transmitter reflectance <sup>e</sup> (max)	-26		-26	<b>-26</b>		dB

c C<sub>eq</sub> is a coefficient defined in 121.8.5.3, which accounts for the reference equalizer noise enhancement.

d In RIN xOMA, “x” is the optical return loss tolerance (max) for the PHY under test.

e Transmitter reflectance is defined looking into the transmitter.

# Table for 100GBASE-BR10,100GBASE-BR20 Receiver Spec

	IEEE Std 802.3cp-2021, clause 160.6 Table 160-7—50GBASE-BRx receive characteristics		IEEE Std 802.3cu-2021, clause 140.6 Table 140-7—100GBASE-DR, 100GBASE-FR1, and 100GBASE-LR1 receive characteristics	IEEE Std 802.3dk, new clause		
Description	50GBASE-BR10	50GBASE-BR20	100GBASE-LR1	100GBASE-BR10	100GBASE-BR20	unit
Signaling rate (range)	26.5625 ± 100 ppm		53.125±100ppm	53.125 ± 100 ppm		GBd
Modulation format	PAM4		PAM4	PAM4		-
100GBASE-BRx-D center wavelength (range)	1260 to 1280	1281 to 1297	N/A	1303.5 to 1305.5		nm
100GBASE-BRx-U center wavelength (range)	1320 to 1340	1306 to 1322	N/A	1308.1 to 1310.1		nm
Wavelength (range)	N/A	N/A	1304.5 to 1317.5	N/A		nm
Damage threshold <sup>a</sup>	5.2	4.6	5.8			dBm
Average receive power (max)	4.2	3.6	4.8			dBm
Average receive power <sup>b</sup> (min)	-10.8	-17.6	-8.2			dBm
Receive power (OMA <sub>outer</sub> ) (max)	4	4.4	5			dBm
Receiver reflectance (max)	-26		-26	-26		dB
Receiver sensitivity (OMA <sub>outer</sub> ) <sup>c</sup> (max) for TECQ < 1.4 dB for 1.4 dB ≤ TECQ ≤ 3.2 dB	-8.4 -9.8+TECQ	-15.1 -16.5+TECQ	N/A			dBm dBm
Receiver sensitivity (OMA <sub>outer</sub> ), (max) for TECQ < 1.4 dB for 1.4 dB ≤ TECQ ≤ 3.4 dB	N/A	N/A	-6.1 -7.5+TECQ			dBm dBm
Stressed receiver sensitivity (OMA <sub>outer</sub> ) <sup>d</sup> (max)	-6.6	-13.3	-4.1			dBm
Conditions of stressed receiver sensitivity test: <sup>e</sup>						
Stressed eye closure for PAM4 (SECQ)	3.2		3.4			dB

a The receiver shall be able to tolerate, without damage, continuous exposure to an optical input signal having this average power level.

b Average receive power (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 Receiver sensitivity (OMA<sub>outer</sub>) (max) is informative and is defined for a transmitter with a value of SECQ up to 3.4 dB.

d Measured with conformance test signal at TP3 (see x.7) for the BER specified in x.1.1.

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

# Table for 100GBASE-BR10,100GBASE-BR20 illustrative link power budgets

	IEEE Std 802.3cp-2021, clause 160.6 Table 160-8—50GBASE-BRx illustrative link power budgets		IEEE Std 802.3cu-2021, clause 140.6 Table 140-8—100GBASE-DR, 100GBASE-FR1, and 100GBASE- LR1 illustrative link power budgets	IEEE Std 802.3dk, new clause		
Description	50GBASE-BR10	50GBASE-BR20	100GBASE-LR1	100GBASE-BR10	100GBASE-BR20	unit
Power budget (for maximum TDECQ)	10.1	18.7	10.6			dB
Operating distance	10	20	10	10	20	km
Channel insertion loss	6.3 <sup>a</sup>	15 <sup>b</sup>	6.3			dB
Maximum discrete reflectance	-26	-26	-35			dB
Allocation for penalties <sup>c</sup> (for maximum TDECQ)	3.8	3.7	4.3			dB

a The channel insertion loss is calculated using the maximum distance specified in Table x-5 for 100GBASE-BR10 and fiber attenuation of 0.43 dB/km plus an allocation for connection and splice loss given in x.10.2.1.

b The channel insertion loss is calculated using the maximum distance specified in Table x-5 for 100GBASE-BR20 and fiber attenuation of 0.5 dB/km plus an allocation for connection and splice loss given in x.10.2.1.

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

Channel insertion loss:

Option 1:

- BR10 = 6.3dB
- BR20 = 15dB

(From 802.3cp-2021, table 160-8)

Option 2:

- BR10 = 0.5 dB/km \* 10 km + 5 dB connectors
- BR20 = 0.5 dB/km \* 20 km + 5 dB connectors

(Proposed in 3dk\_Effenberger\_2304\_1.)

# Next Step

- Seek Baseline proposal of 100GBASE-BR10, 100GBASE-BR20 based on the baseline of 50GBASE-BR10 and 50GBASE-BR20, and 100GBASE-LR1.
- Find the way of optical specification alignment between ITU-T and IEEE
- Working on the solution of 40km application and MPI issues.



# Thank you

Any questions?