

Proposed Revisions to 100GBASE-LR Baseline Proposal

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Overview

- In May 802.3cu meetings the following motion passed:
Move to adopt a baseline for the “single-wavelength 100 Gb/s PHY for operation over SMF with lengths up to at least 10 km” objective based on the proposal in welch_3cu_02b_0519.pdf with the inclusion of additional penalty due to 5 ps DGD_max as outlined in anslow_3cu_01_0519.pdf
- This requires 0.25 dB of additional link budget to be allocated for DGD
- The following slides contain a proposal for how that could be accommodated
 - Shifting the transmitter specifications up by 0.25 dB where applicable
 - Changes indicated in **red**.

Proposed Revisions to 100GBASE-LR Transmitter Specifications

Description	100GBase-LR (Baseline)	100GBase-LR (Proposed)	Unit
PAM4 Signaling rate, (range)	53.125 ± 100 ppm	53.125 ± 100 ppm	GBd
Wavelength (range)	1304.5- 1317.5	1304.5- 1317.5	nm
Side-mode suppression ratio (SMSR), (min)	30	30	dB
Average launch power, (max)	4.5	4.8	dBm
Average launch power, ^a (min)	-1.4	-1.1	dBm
Outer Optical Modulation Amplitude (OMA _{outer}), (max)	4.7	5.0	dBm
Outer Optical Modulation Amplitude (OMA _{outer}), ^b (min)	0.7	1	dBm
Launch power in OMA _{outer} minus TDECQ, (min): for extinction ratio ≥ 4.5 dB for extinction ratio < 4.5 dB	-0.7 -0.6	-0.4 -0.3	dBm
Transmitter and dispersion penalty eye closure for PAM4 (TDECQ), (max)	3.4	3.4	dB
TDECQ – 10*log ₁₀ (C _{eq}) (max) ^d	3.4	3.4	dB
Average launch power of OFF transmitter, (max)	-15	-15	dBm
Extinction ratio (min)	3.5	3.5	dB
Optical return loss tolerance (max)	15.6	15.6	dB
Transmitter reflectance ^c (max)	-26	-26	dB
Transmitter transition time (max)	17	17	ps
RIN _{17.1} OMA (max) for FR, RIN _{15.6} OMA (max) for LR	-136	-136	dB/Hz

^aAverage 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 Even if the TDECQ < 1.4 dB for an extinction ratio of ≥ 4.5 dB or TDECQ < 1.3 dB for an extinction ratio of < 4.5 dB, the OMA_{outer} (min) must exceed this value.

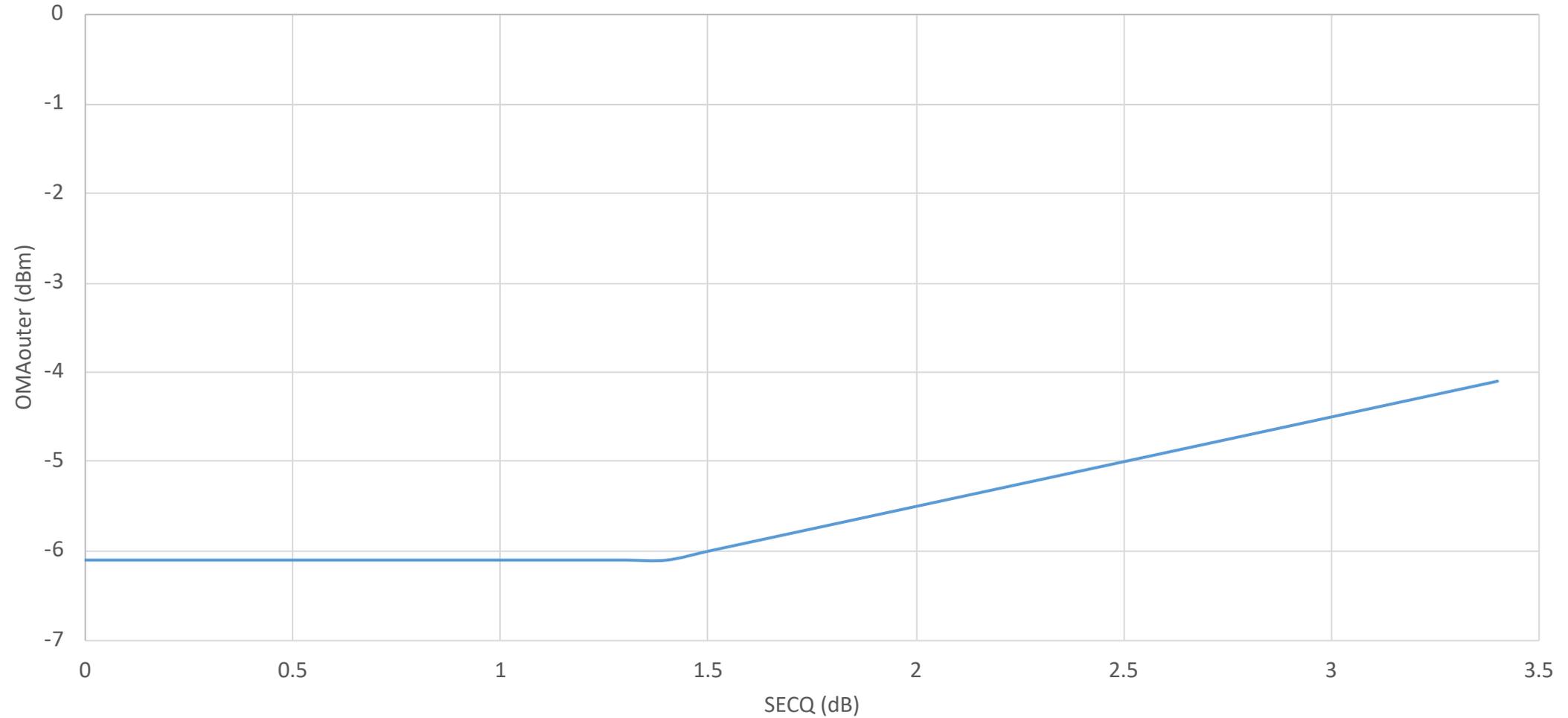
^cTransmitter reflectance is defined looking into the transmitter.

^d C_{eq} is a coefficient defined in IEEE Std 802.3-2018 clause 121.8.5.3 which accounts for reference equalizer noise enhancement.

Proposed 100GBASE-LR Receiver Specifications

Description	100GBase-LR (Baseline)	100GBase-LR (Proposed)	Unit
PAM4 Signaling rate, (range)	53.125 ± 100 ppm	53.125 ± 100 ppm	GBd
Wavelength (range)	1304.5 to 1317.5	1304.5 to 1317.5	nm
Damage threshold, (min) ^a	5.5	5.8	dBm
Average receive power, (max)	4.5	4.8	dBm
Average receive power, ^b (min)	-7.7	-7.4	dBm
Receive power, (OMA _{outer}) (max)	4.7	5.0	dBm
Receiver reflectance (max)	-26	-26	dB
Receiver sensitivity (OMA _{outer}), ^c (max)	= max(-6.1, SECQ-7.5)	= max(-6.1, SECQ-7.5)	dBm
Stressed receiver sensitivity (OMA _{outer}), ^d (max)	-4.1	-4.1	dBm
Conditions of stressed receiver sensitivity test ^e :			
Stressed eye closure for PAM4 (SECQ)	3.4	3.4	dB
SECQ – 10*log ₁₀ (C _{eq}) (max) ^e	3.4	3.4	dB
^a The receiver shall be able to tolerate, without damage, continuous exposure to an optical signal having this average power level. The receiver does not have to operate correctly at this input power.			
^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 _{outer}), (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 for the BER specified in IEEE Std 802.3cd clause 140.1.1.			
^e These test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.			
^e C _{eq} is a coefficient defined in IEEE Std 802.3-2018 clause 121.8.5.3 which accounts for reference equalizer noise enhancement.			

100GBASE-LR Receiver Specification



Illustrative Optical Link Budget

Description	100GBase-LR (Baseline)	100GBase-LR (Proposed)	Unit
Power budget (for max TDECQ) for extinction ratio ≥ 4.5 dB for extinction ratio < 4.5 dB	10.2 10.3	10.5 10.6	dB
Operating distance	10.0	10.0	km
Channel insertion loss ^a	6.3	6.3	dB
Maximum discrete reflectance	See table below	See table below	dB
Allocation for penalties ^b (for max TDECQ) for extinction ratio ≥ 4.5 dB for extinction ratio < 4.5 dB	3.9 4.0	4.2 4.3	dB
Additional insertion loss allowed	0	0	dB
^a The channel insertion loss is calculated using the cabled optical fiber attenuation of 0.43 dB/km at 1304.5 nm plus an allocation for connection and splice loss			
^b Link penalties are used for link budget calculations. They are not requirements and are not meant to be tested.			

Number of discrete reflectances above -55dB	Maximum value for each discrete reflectance for LR	Unit
1	-22	dB
2	-29	dB
4	-33	dB
6	-35	dB
8	-37	dB
10	-39	dB

Fiber optic cabling (channel) characteristics

Description	100GBase-LR	Unit
Operating distance (max)	10	km
Channel insertion loss ^{a,b} (max)	6.3	dB
Channel insertion loss (min)	0	dB
Positive dispersion ^b (max)	16	ps/nm
Negative dispersion ^b (min)	-18.6	ps/nm
DGD_max ^c	5	ps
Optical return loss (min)	22	dB
^a These channel loss values include cable, connectors and splices.		
^b Over the wavelength range 1304.5 to 1317.5 nm.		
^c Differential Group Delay (DGD) is the time difference at reception between the fractions of a pulse that were transmitted in the two principal states of polarization of an optical signal. DGD_max is the maximum differential group delay that the system must tolerate.		

Thank You