

Detailed changes needed for king_01_0617_smf

Pete Anslow, Ciena

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Introduction

[king_01_0617_smf](#) proposes to:

- increase of TDECQ (max) and SECQ specs for each PMD
- decrease the $\text{OMA}_{\text{outer}}$ minus TDECQ spec

[anslow_01_0617_smf](#) listed all of the changes that would be required to make the power budgets add up.

This contribution shows the detailed changes that would be made if it were agreed to change the values by 0.9 dB.

Table 121-6

Table 121-6—200GBASE-DR4 transmit characteristics

Description	Value	Unit
Signaling rate, each lane (range)	26.5625 ± 100 ppm	GBd
Modulation format	PAM4	—
Lane wavelength (range)	1304.5 to 1317.5	nm
Side-mode suppression ratio (SMSR), (min)	30	dB
Average launch power, each lane (max)	3	dBm
Average launch power, each lane ^a (min)	-4.6	dBm
Outer Optical Modulation Amplitude (OMA _{outer}), each lane (max)	2.8	dBm
Outer Optical Modulation Amplitude (OMA _{outer}), each lane (min) ^b	-2.5	dBm
Launch power in OMA _{outer} minus TDECQ, each lane (min)	-3.5 <u>-4.4</u>	dBm
Transmitter and dispersion eye closure for PAM4 (TDECQ), each lane (max)	2.5 <u>3.4</u>	dB
Average launch power of OFF transmitter, each lane (max)	-16	dBm
Extinction ratio, each lane (min)	3.5	dB
RIN _{21.4} OMA (max)	-132	dB/Hz
Optical return loss tolerance (max)	21.4	dB
Transmitter reflectance ^c (max)	-26	dB

^aAverage launch power, each lane (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.

^bEven if the TDECQ < ~~1.9~~ 3.4 dB, the OMA_{outer} (min) must exceed this value.

^cTransmitter reflectance is defined looking into the transmitter.

Table 121-7

Table 121-7—200GBASE-DR4 receive characteristics

Description	Value	Unit
Signaling rate, each lane (range)	26.5625± 100 ppm	GBd
Modulation format	PAM4	—
Lane wavelengths (range)	1304.5 to 1317.5	nm
Damage threshold ^a , each lane	4	dBm
Average receive power, each lane (max)	3	dBm
Average receive power, each lane ^b (min)	-7.6	dBm
Receive power (OMA _{outer}), each lane (max)	2.8	dBm
Receiver reflectance (max)	-26	dB
Receiver sensitivity (OMA _{outer}), each lane ^c (max)	-6.6 <u>-7.5</u>	dBm
Stressed receiver sensitivity (OMA _{outer}), each lane ^d (max)	-4.1	dBm
Conditions of stressed receiver sensitivity test: ^e		
Stressed eye closure for PAM4 (SECQ), lane under test	2.5 <u>3.4</u>	dB
OMA _{outer} of each aggressor lane	2.8	dBm

^aThe receiver shall be able to tolerate, without damage, continuous exposure to an optical input signal having this average power level. The receiver does not have to operate correctly at this input power.

^bAverage 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.

^cReceiver sensitivity (OMA_{outer}), each lane (max) is informative and is defined for a transmitter with SECQ of 0 dB.

^dMeasured with conformance test signal at TP3 (see 121.8.9) for the BER specified in 121.1.1.

^eThese test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

Table 121-8

Table 121-8—200GBASE-DR4 illustrative link power budget

Parameter	Value	Unit
Power budget (for max TDECQ)	5.6 6.5	dB
Operating distance	500	m
Channel insertion loss ^a	3	dB
Maximum discrete reflectance	See 121.11.2.2	dB
Allocation for penalties ^b (for max TDECQ)	2.6 3.5	dB
Additional insertion loss allowed	0	dB

^aThe channel insertion loss is calculated using the maximum distance specified in Table 121-5 and cabled optical fiber attenuation of 0.5 dB/km at 1304.5 nm plus an allocation for connection and splice loss given in 121.11.2.1.

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

Table 122-9

Outer Optical Modulation Amplitude (OMA _{outer}), each lane (max)	4.5	5.1	dBm
Outer Optical Modulation Amplitude (OMA _{outer}), each lane (min) ^b	-0.7	0.1	dBm
Difference in launch power between any two lanes (OMA _{outer}) (max)	4		dB
Launch power in OMA _{outer} minus TDECQ, each lane (min): for extinction ratio ≥ 4.5 dB for extinction ratio < 4.5 dB	-1.7 <u>-2.6</u>	-0.9 <u>-1.8</u>	dBm
	-1.6 <u>-2.5</u>	-0.8 <u>-1.7</u>	dBm
Transmitter and dispersion eye closure for PAM4 (TDECQ), each lane (max)	2.4 <u>3.3</u>	2.5 <u>3.4</u>	dB
Average launch power of OFF transmitter, each lane (max)	-30		dBm
Extinction ratio (min)	3.5		dB
RIN _{16.5} OMA (max)	-132	—	dB/Hz
RIN _{15.1} OMA (max)	—	-132	dB/Hz
Optical return loss tolerance (max)	16.5	15.1	dB
Transmitter reflectance ^c (max)	-26		dB

^aAverage launch power, each lane (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.

^bEven if the TDECQ < ~~+1.9~~ dB for an extinction ratio of ≥ 4.5 dB or TDECQ < ~~0.9~~ 1.8 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.

Table 122-10

Outer Optical Modulation Amplitude (OMA _{outer}), each lane (max)	5.5	5.7	dBm
Outer Optical Modulation Amplitude (OMA _{outer}), each lane (min) ^c	0	0.7	dBm
Difference in launch power between any two lanes (OMA _{outer}) (max)	4		dB
Launch power in OMA _{outer} minus TDECQ, each lane (min): for extinction ratio ≥ 4.5 dB for extinction ratio < 4.5 dB	-1 <u>-1.9</u> -0.9 <u>-1.8</u>	-0.3 <u>-1.2</u> -0.2 <u>-1.1</u>	dBm dBm
Transmitter and dispersion eye closure for PAM4 (TDECQ), each lane (max)	2.2 <u>3.1</u>	2.4 <u>3.3</u>	dB
Average launch power of OFF transmitter, each lane (max)	-30		dBm
Extinction ratio (min)	3.5		dB
RIN _{16.5} OMA (max)	-132	—	dB/Hz
RIN _{15.1} OMA (max)	—	-132	dB/Hz
Optical return loss tolerance (max)	16.5	15.1	dB
Transmitter reflectance ^d (max)	-26		dB

^aAs the total average launch power limit has to be met, not all of the lanes can operate at the maximum average launch power, each lane.

^bAverage launch power, each lane (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.

^cEven if the TDECQ < ~~1.9~~ 1.8 dB for an extinction ratio of ≥ 4.5 dB or TDECQ < ~~0.9~~ 1.8 dB for an extinction ratio of < 4.5 dB, the OMA_{outer} (min) must exceed this value.

^dTransmitter reflectance is defined looking into the transmitter.

Table 122-11

Damage threshold ^a , each lane	5.7	6.3	dBm
Average receive power, each lane (max)	4.7	5.3	dBm
Average receive power, each lane ^b (min)	-7.7	-9.2	dBm
Receive power (OMA _{outer}), each lane (max)	4.5	5.1	dBm
Difference in receive power between any two lanes (OMA _{outer}) (max)	4.1	4.2	dB
Receiver reflectance (max)	-26		dB
Receiver sensitivity (OMA _{outer}), each lane ^c (max)	-6 <u>-6.9</u>	-7.7 <u>-8.6</u>	dBm
Stressed receiver sensitivity (OMA _{outer}), each lane ^d (max)	-3.6	-5.2	dBm
Conditions of stressed receiver sensitivity test: ^e			
Stressed eye closure for PAM4 (SECQ), lane under test	2.4 <u>3.3</u>	2.5 <u>3.4</u>	dB
OMA _{outer} of each aggressor lane	0.5	-1	dBm

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

^bAverage 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.

^cReceiver sensitivity (OMA_{outer}), each lane (max) is informative [and is defined for a transmitter with SECQ of 0 dB](#).

^dMeasured with conformance test signal at TP3 (see 122.8.9) for the BER specified in 122.1.1.

^eThese test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

Table 122-12

Damage threshold ^a , each lane	6.3		dBm
Average receive power, each lane (max)	5.3		dBm
Average receive power, each lane ^b (min)	-7	-8.6	dBm
Receive power (OMA _{outer}), each lane (max)	5.7		dBm
Difference in receive power between any two lanes (OMA _{outer}) (max)	4.1	4.5	dB
Receiver reflectance (max)	-26		dB
Receiver sensitivity (OMA _{outer}), each lane ^c (max)	-5.3 <u>-6.2</u>	-7.1 <u>-8.0</u>	dBm
Stressed receiver sensitivity (OMA _{outer}), each lane ^d (max)	-3.1	-4.7	dBm
Conditions of stressed receiver sensitivity test: ^e			
Stressed eye closure for PAM4 (SECQ), lane under test	2.2 <u>3.1</u>	2.4 <u>3.3</u>	dB
OMA _{outer} of each aggressor lane	1	-0.2	dBm

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

^bAverage 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.

^cReceiver sensitivity (OMA_{outer}), each lane (max) is informative and is defined for a transmitter with SECQ of 0 dB.

^dMeasured with conformance test signal at TP3 (see 122.8.9) for the BER specified in 122.1.1.

^eThese test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

Table 122-13

Table 122-13—200GBASE-FR4, 200GBASE-LR4, 400GBASE-FR8, and 400GBASE-LR8 illustrative link power budgets

Parameter	200GBASE-FR4	400GBASE-FR8	200GBASE-LR4	400GBASE-LR8	Unit
Power budget (for maximum TDECQ): for extinction ratio \geq 4.5 dB for extinction ratio $<$ 4.5 dB	6.7 <u>7.6</u>	6.5 <u>7.4</u>	9.3 <u>10.2</u>	9.2 <u>10.1</u>	dB
	6.8 <u>7.7</u>	6.6 <u>7.5</u>	9.4 <u>10.3</u>	9.3 <u>10.2</u>	dB
Operating distance	2		10		km
Channel insertion loss	4 ^a		6.3		dB
Maximum discrete reflectance	See 122.11.2.2		See 122.11.2.2		dB
Allocation for penalties ^b (for maximum TDECQ): for extinction ratio \geq 4.5 dB for extinction ratio $<$ 4.5 dB	2.7 <u>3.6</u>	2.5 <u>3.4</u>	3 <u>3.9</u>	2.9 <u>3.8</u>	dB
	2.8 <u>3.7</u>	2.6 <u>3.5</u>	3.1 <u>4</u>	3 <u>3.9</u>	dB
Additional insertion loss allowed	0		0		dB

^aThe channel insertion loss is calculated using the maximum distance specified in Table 122-8 for 200GBASE-FR4 and 400GBASE-FR8 and fiber attenuation of 0.5 dB/km plus an allocation for connection and splice loss given in 122.11.2.1.

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

Table 124-6

Lane wavelength (range)	1304.5 to 1317.5	nm
Side-mode suppression ratio (SMSR), (min)	30	dB
Average launch power, each lane (max)	4	dBm
Average launch power, each lane ^a (min)	-2.4	dBm
Outer Optical Modulation Amplitude (OMA _{outer}), each lane (max)	4.2	dBm
Outer Optical Modulation Amplitude (OMA _{outer}), each lane (min) ^b	-0.3	dBm
Launch power in OMA _{outer} minus TDECQ, each lane (min)	-1.3 <u>-2.2</u>	dBm
Transmitter and dispersion eye closure for PAM4 (TDECQ), each lane (max)	2.5 <u>3.4</u>	dB
Average launch power of OFF transmitter, each lane (max)	-15	dBm
Extinction ratio, each lane (min)	3.5	dB
RIN _{21.4} OMA (max)	-136	dB/Hz
Optical return loss tolerance (max)	21.4	dB
Transmitter reflectance ^c (max)	-26	dB

^aAverage launch power, each lane (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.

^bEven if the TDECQ < +1.9 dB, the OMA_{outer} (min) must exceed these values.

^cTransmitter reflectance is defined looking into the transmitter.

Table 124-7

Modulation format	PAM4	—
Lane wavelengths (range)	1304.5 to 1317.5	nm
Damage threshold ^a , each lane	5	dBm
Average receive power, each lane (max)	4	dBm
Average receive power, each lane ^b (min)	-5.4	dBm
Receive power (OMA _{outer}), each lane (max)	4.2	dBm
Receiver reflectance (max)	-26	dB
Receiver sensitivity (OMA _{outer}), each lane ^c (max)	-4.4 <u>-5.3</u>	dBm
Stressed receiver sensitivity (OMA _{outer}), each lane ^d (max)	-1.9	dBm
Conditions of stressed receiver sensitivity test: ^e		
Stressed eye closure for PAM4 (SECQ), lane under test	2.5 <u>3.4</u>	dB
OMA _{outer} of each aggressor lane	4.2	dBm

^aThe receiver shall be able to tolerate, without damage, continuous exposure to an optical input signal having this average power level. The receiver does not have to operate correctly at this input power.

^bAverage 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.

^cReceiver sensitivity (OMA_{outer}), each lane (max) is informative and is defined for a transmitter with SECQ of 0 dB.

^dMeasured with conformance test signal at TP3 (see 124.8.9) for the BER specified in 124.1.1.

^eThese test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

Table 124-8

Table 124-8—400GBASE-DR4 illustrative link power budget

Parameter	Value	Unit
Power budget (for max TDECQ)	5.6 6.5	dB
Operating distance	500	m
Channel insertion loss ^a	3	dB
Maximum discrete reflectance	See 124.11.2.2	dB
Allocation for penalties ^b (for max TDECQ)	2.6 3.5	dB
Additional insertion loss allowed	0	dB

^aThe channel insertion loss is calculated using the maximum distance specified in Table 124-5 and cabled optical fiber attenuation of 0.5 dB/km at 1304.5 nm plus an allocation for connection and splice loss given in 124.11.2.1.

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

Thanks!