100GBASE-DR, FR1, and LR1 Average Power Min specs

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Comment 54

Cl **140** *SC* **140.6** *P* **41** *L* **18** # 54

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Comment Type **T** *Comment Status* **D** *Tx avg power*

The Average launch power max for 100GBASE-FR1 is calculated for an extinction ratio = ~14 dB. This is inconsistent with 100GBSE-LR1 as well as with 400GBASE-FR4 and 400GBASE-LR4-6, which all use an infinite extinction ratio in this calculation.

SuggestedRemedy

Use an infinite extinction ratio to calculate the Average launch power max for 100GBASE-FR1. Replace the value of -2.9 dBm in Table 140-6 with -3.2 dBm

Proposed Response *Response Status* **W**

PROPOSED REJECT.

We presume the commenter intends to modify Average launch power (min), not the maximum. If implemented this change would affect Average receive power (min) for -FR1.

Additionally the change would limit interop between -FR1 and -DR to less than the 3dB -DR channel. Maximum loss in the -FR1 to -DR direction would become 2.7 dB.

For task force discussion and decision.

Overview

- Tx Average Power Min is currently calculated with different Extinction Ratio (ER) for 100GBASE-DR, 100GBASE-FR1, and 100GBASE-LR1
- Values are to proposed to change the 100GBASE-FR1 values to an infinite ER
- This has potential implications for DR specs due to interop support
- Signal power and link budgets are based on OMA and TDECQ
  - The changes proposed will **not** impact link budgets

Current specs, D2.0

Table 140–6—100GBASE-DR, 100GBASE-FR1, and 100GBASE-LR1 transmit characteristics

Description	~~Value~~ 100GBASE-DR	100GBASE-FR1	100GBASE-LR1	Unit
Signaling rate (range)	53.125 ± 100 ppm			GBd
Modulation format	PAM4			—
Wavelength (range)	1304.5 to 1317.5			nm
Side-mode suppression ratio (SMSR), (min)	30			dB
Average launch power (max)	~~4~~	~~4~~	4.8	dBm
Average launch power[a] (min)	–2.9	–2.9	–2	dBm
Outer Optical Modulation Amplitude (OMA_{outer}) (max)	~~4.2~~	~~4.2~~	~~5~~	dBm
Outer Optical Modulation Amplitude (OMA_{outer}) (min)[b]	–0.8	–0.2	1	dBm

10dB ER 15dB ER Inf

- Different ER values are used to calculate the Average launch power (min) for the three PMDs
- Using an infinite ER for 100GBASE-FR1 would result in Average launch power (min) = -3.2 dBm

Tx and Rx Specs

	Description	~~Value~~ 100GBASE-DR	100GBASE-FR1	100GBASE-LR1	Unit
Tx	Average launch power[a] (min)	–2.9	–2.9	–2	dBm
	Loss Allocation	3dB	4dB	6.3dB	
Rx	Average receive power[b] (min)	–5.9	–6.9	–8.3	dBm

[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.

- Average receive power (min) is calculated from the launch power (min) – Loss Allocation
- Reducing Tx Launch Power will also impact the average receive power (min)
- The editor's concern was that changing the 100GBASE-FR1 values would result in < 3dB loss allocation between a 100GBASE-FR1 Tx and a 100GBASE-DR Rx
- This concern is not a link budget concern, as link budgets are based on OMA and TDECQ.
- Ideally, all three PMDs would have their Average power specs aligned with infinite ER
- Note: Footnote b is not accurate without using infinite ER to calculate minimum average power

Proposed modifications

Current

	DR		FR1		LR1
Tx					
OMAmax	4.2		4.2		5
OMAmin	-0.8		-0.2		1
Ermin	3.5		3.5		3.5
Pavemax	4		4		4.8
Pavemin	-2.9		-2.9		-2
Rx					
Ave Max	4		4		4.8
Ave Min	-5.9		-6.9		-8.3

Proposed

	DR		FR1		LR1
Tx					
OMAmax	4.2		4.2		5
OMAmin	-0.8		-0.2		1
Ermin	3.5		3.5		3.5
Pavemax	4		4		4.8
Pavemin	**-3.8**		**-3.2**		-2
Rx					
Ave Max	4		4		4.8
Ave Min	**-6.8**		**-7.2**		-8.3

- The values highlighted would align the three PMDs to using infinite ER for average power min specs
- Only 100GBASE-FR1 is currently in scope, however ideally we should aim to align these

400GBASE-DR4 average powers

Table 124–6—400GBASE-DR4 transmit characteristics

Description	Value	Unit
Signaling rate, each lane (range)	53.125 ± 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)	4	dBm
Average launch power, each lane[a] (min)	–2.9	dBm
Outer Optical Modulation Amplitude (OMA_{outer}), each lane (max)	4.2	dBm
Outer Optical Modulation Amplitude (OMA_{outer}), each lane (min)[b]	–0.8	dBm

[a] Average 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.

[b] Even if the TDECQ < 1.4 dB, the OMA_{outer} (min) must exceed these values

- 400GBASE-DR4 has average power defined using 10 dB ER, which is the same value as currently used for 100GBASE-DR
- 400GbE breakout to 4x100GbE is an important application, we should consider modifying this to align to infinite extinction ratio

Recommendation

- Calculate 100GBASE-FR1 average power specs with infinite extinction ratio in 802.3cu
- Modify 100GBASE-DR and 400GBASE-DR4 specs in a similar manner
  - Mechanism for this can be discussed

Thanks!