100GBASE-xR4 Discussion

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Introduction

This presentation contains the result of informal discussions held during the Denver meeting of the IEEE 802.3ba Task Force on the parameter values for the applications 100GBASE-LR4 and 100GBASE-ER4 aimed at achieving consensus on a suitable parameter set to be used for the first draft version of clause 158

100GBASE-xR4 lane assignments

- **Baseline in cole_01/02_0508 had:**

  “2nm window (precise pass-band TBD)”

- **Consensus to use 2.1 nm values from cole_01/02_0708 for first draft:**

Lane	Center frequencies	Center wavelengths	Wavelength ranges
L_0	231.4 THz	1295.56 nm	1294.53 – 1296.59 nm
L_1	230.6 THz	1300.05 nm	1299.02 – 1301.09 nm
L_2	229.8 THz	1304.58 nm	1303.54 – 1305.63 nm
L_3	229.0 THz	1309.14 nm	1308.09 – 1310.19 nm

[a] **Wavelength ranges calculated for center frequencies ± 23% of 800GHz spacing**

100GBASE-xR4 transmit characteristics

- **Baseline in cole_01/02_0508 had no values for red parameters**

- **Consensus to use values from cole_01/02_0708 as below for first draft**

Description	100GBASE-xR4	Unit
Signaling speed per lane	25.78125 ±100 ppm	GBd
Lane wavelengths (range)	1294.53 – 1296.59 1299.02 – 1301.09 1303.54 – 1305.63 1308.09 – 1310.19	nm
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}[a]	TBD	
Side Mode Suppression Ratio (SMSR), (min)	30	dB
Average launch power of OFF transmitter, per lane (max)	-30	dBm
RIN_{12} OMA (max)	-132	dB/Hz
Optical Return Loss Tolerance (max)	12	dB
Transmitter Reflectance (max)	-12	dB

100GBASE-xR4 receive characteristics

- **Baseline in cole_01/02_0508 had no values for red parameters**

- **Consensus to use values from cole_01/02_0708 as below for first draft**

Description	100GBASE-xR4	Unit
Signaling speed per lane	25.78125 ±100ppm	GBd
Lane wavelengths (range)	1294.53 – 1296.59 1299.02 – 1301.09 1303.54 – 1305.63 1308.09 – 1310.19	nm
Return loss (min)	-26	dB
Receive electrical 3 dB upper cutoff frequency, per lane (max)	31	GHz

[a] The receiver shall tolerate, without damage, the Average Receive Power (max) plus 1 dB

100GBASE-LR4 power budget

- **Values in cole_01_0708 and proposed changes in isono_01_0707 were discussed**

- **Consensus to use values from cole_01_0708 as modified by isono_01_0707 for first draft**

- **The resulting power budget is shown in the right hand column on the next slide. The red values are those that have changed with respect to cole_01_0708**

100GBASE-LR4 power budget with TDP

	cole_0508	cole_0708	isono_0708	Consensus	
Total ave power (max)		10.0		10.0	dBm
Ave power per lane (max)		4.0		4.0	dBm
Ave power per lane (min)		-3.0		-3.8	dBm
OMA per lane (max)		4.0		3.2	dBm
OMA per lane (min)	-0.2	0.0	-0.8	-0.8	dBm
TDP per lane (max)			2.0 - 2.5	2.2 *	dB
OMA-TDP per lane (min)			-1.8	-1.8	dBm
Extinction Ratio (min)	4.5	4.0	4.0	4.0	dB
Power budget	7.5	8.1	8.3 - 8.8	8.5	dB
Channel insertion loss	6.3	6.3	6.3	6.3	dB
Allocation for penalties	1.2	1.8	2.0 - 2.5	2.2 *	dB
Rx power, per lane OMA (max)		4.0		4.0	dBm
Rx power, per lane ave (max)		4.0		4.0	dBm
Rx power, per lane ave (min)		-9.3		-10.1	dBm
Sensitivity OMA per lane (max)	-7.7	-8.1	-8.1	-8.1	dBm
Stressed sens. OMA per lane		-6.3		-6.3	dBm
Vertical eye closure pen. per lane		1.8	2.0 - 2.5	1.8	dB

The value of 2.2 dB for TDP per lane (max) is a placeholder. The final value is expected to be between 1.8 and 2.5 dB

100GBASE-LR4 tables

- **The result of making these changes to the power budget for 100GBASE-LR4 is shown in the next three slides**

100GBASE-LR4 transmit characteristics

Description	100GBASE-LR4	Unit
Signaling speed per lane	25.78125 ±100 ppm	GBd
Lane wavelengths (range)	1294.53 – 1296.59 1299.02 – 1301.09 1303.54 – 1305.63 1308.09 – 1310.19	nm
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}	TBD	
Side Mode Suppression Ratio (SMSR), (min)	30	dB
Total average launch power (max)	10	dBm
Average launch power per lane (max) [a]	4.0	dBm
Average launch power per lane (min) [a]	-3.8	dBm
Optical Modulation Amplitude (OMA), per lane (max)	3.2	dBm
Launch power per lane (min) in OMA minus TDP	-1.8	dBm
Optical Modulation Amplitude (OMA), per lane (min) [b]	-0.8	dBm
Transmitter and dispersion penalty per lane (max)	2.2 *	dB
Extinction Ratio (min)	4.0	dB
Average launch power of OFF transmitter, per lane (max)	-30	dBm
RIN_{12} OMA (max)	-132	dB/Hz
Optical Return Loss Tolerance (max)	12	dB
Transmitter Reflectance (max)	-12	dB

[a] Informative

[b] Even if the TDP < 1 dB, the OMA (min) must exceed this value.

* The value of 2.2 dB for TDP per lane (max) is a placeholder. The final value is expected to be between 1.8 and 2.5 dB

100GBASE-LR4 receive characteristics

Description	100GBASE-LR4	Unit
Signaling speed per lane	25.78125 ±100ppm	GBd
Lane wavelengths (range)	1294.53 – 1296.59 1299.02 – 1301.09 1303.54 – 1305.63 1308.09 – 1310.19	nm
Receive power, per lane (OMA) (max)	4.0	dBm
Average receive power, per lane (max)[a]	4.0	dBm
Average receive power, per lane (min)[b]	-10.1	dBm
Return loss (min)	-26	dB
Receive sensitivity (OMA), per lane (max)	-8.1	dBm
Stressed receive sensitivity (OMA), per lane	-6.3	dBm
Vertical eye closure penalty, per lane	1.8	dB
Receive electrical 3 dB upper cutoff frequency, per lane (max)	31	GHz

[a] The receiver shall tolerate, without damage, the Average Receive Power (max) plus 1 dB
[b] Informative, equals min Tx OMA with infinite ER and max channel insertion loss

100GBASE-LR4 link power budget

Description	100GBASE-LR4	Unit
Power budget	8.5	dB
Operating distance	10	km
Channel insertion loss [a]	6.3	dB
Maximum Discrete Reflectance (max)	-26	dB
Allocation for penalties [b]	2.2 *	dB
Additional insertion loss allowed	0.0	dB

[a] Channel insertion loss includes fiber and connector losses for worst case wavelength lane

[b] Dispersion and other penalties for worst case wavelength lane

* The value of 2.2 dB for allocation for penalties is a placeholder. The final value is expected to be between 1.8 and 2.5 dB

100GBASE-ER4 power budget

- **The values in cole_02_0708 were discussed**
- **Consensus to use values from cole_02_0708 for first draft**