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Cost Saving in CWDM Uncooled Solution with FEC for 500m SMF

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CWDM 802.3 100GBASE Link Budget Proposal

Transmitter and Receiver Characteristics Parameter	IEEE Std 802.3ba 100GBASE-LR4 10km	100GBASE-CWDM 500m w/o FEC	100GBASE-CWDM 500m w/ FEC	Unit
Signaling rate, each lane (range)	25.78125 ± 100 ppm	25.78125 ± 100 ppm	25.78125 ± 100 ppm	Gbd
Lane wavelength (range) (nm)	1294.53 to 1296.59 1299.02 to 1301.09 1303.54 to 1305.63 1308.09 to 1310.19	1264.5 to 1277.5 1284.5 to 1297.5 1304.5 to 1317.5 1324.5 to 1337.5	1264.5 to 1277.5 1284.5 to 1297.5 1304.5 to 1317.5 1324.5 to 1337.5	
Optical modulation amplitude (OMA), each lane (min)	-1.3	-2.0	-2.15 (-4.45)	dBm
Launch power in OMA minus TDP, each lane, (min)	-2.3	-3.0	-5.45	dBm
Transmitter and dispersion penalty (TDP), each lane (max)	2.2	2.2	3.3	dB
Extinction ratio (min)	4	4	4	dB
Receiver sensitivity (OMA), each lane (max)	-8.6	-7.0	-9.45	dBm
Link Power Budget Parameter	IEEE Std 802.3ba 100GBASE-LR4 10km	100GBASE-CWDM 500m	100GBASE-CWDM 500m w/ FEC	Unit
Power budget (for maximum TDP)	8.5	6.2	7.3	dB
Operating distance	10	0.5	0.5	km
Channel insertion loss	6.3	4.0 ^a	4.0 ^a	dB
Allocation for penalties (for maximum TDP)	2.2	2.2	3.3	dB
Additional insertion loss allowed	0	0	0	dB

^a The channel insertion loss is calculated using maximum distance of 0.5km and fiber attenuation of 0.5dB/km at 1264.5nm plus an allocation for connection and splice loss of 3.75dB

Advantages of incorporating FEC in CWDM (1)

Incorporating FEC in CWDM relaxing the following requirements:

- Lowering the receiver sensitivity requirement at -7.0 dBm at 1E-12 to -9.45 dBm at 5E-5, and hence increasing the power budget to 7.3 dB.
 - Lowering launched power in OMA minus TDP requirement from -3.0 dBm to -5.45 dBm, and hence ease the output power requirement of lasers.
 - Increasing TDP from 2.2 dB to 3.3 dB, relaxing the requirement on lasers, and hence improving yield and lowering cost of lasers.
 - Increasing power budget from 6.2 dB to 7.3 dB, covering the increased TDP of 3.3 dB, and hence relaxing the requirement, improving yield and lowering cost of lasers.
 - Lowering minimum OMA from -2.0 dBm to -2.15 dBm, AND accommodating full TDP of 3.3 dB at the same time, and hence improving yield and lowering cost of lasers.
- Minimum OMA for 1 dB TDP is -4.45 dBm, which would further lowering cost of lasers.**
- 100G KR4 100G FEC in clause 91, threshold at BER=5e-5, is on host board, it will not add extra cost and power consumption to module.

Advantages of incorporating FEC in CWDM (2)

Business and market advantages of incorporating FEC in CWDM:

- In increasing the TDP margin and power budget, CWDM now can accommodate different technologies in implementing CWDM.
- With the relaxed requirements on lasers, CWDM now can have more laser suppliers.
- With the help of FEC, the yield of uncooled lasers meeting requirements will be increased.
- With the relaxed requirements on lasers and more laser suppliers, the cost of lasers is lowered.
- With the help of FEC, the CWDM PMD can also address the 2km IP market applications with better margin.
- Presence of FEC further reduces power consumption of the transmitter, and hence increases the yield of meeting CFP4 and QSFP28 3.5W power requirements.

Conclusions

- **Incorporating FEC into 100G-500m CWDM solution improves the link power budget and relaxes the requirements on lasers. This embraces more technological approaches to CWDM PMD and includes more component suppliers, especially laser suppliers, in the 100G-500m CWDM market. Incorporating FEC into 100G-500m CWDM solution also makes the solution more robust in 2km IP and other applications.**

Thank you
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