Technical Feasibility to Support 200GbE 40km Objective

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Background and Motivation

- During the P802.3cd TF meeting in January 2018, for section 140.7.8 of D3.1, receiver sensitivity definition was agreed to become a variable value as a function of SECQ as in king_3cd_04_0118.
- Xu_b10k_01a_0118 provided test results from 5 vendors on 4X50G PAM4.
  - The tested receiver sensitivities without SECQ consideration are in a range of -15.5dBm to -18dBm (OMA_{outer}).
  - The strawpoll on technical feasibility of a PAM4 approach, based on 50 Gb/s PAM4, targeting 40km, some indicated to want more information.
- In this presentation the illustrative link budget for 200G over 30/40km has been reevaluated using the updated definition of receiver sensitivity.

Key Parameter to Support 200GbE 40km Link Budget

- Test Scenario

Parameter	Vendor 1	Vendor 2
Pattern	~PRBS31	KP4 Frame
GBaud	26.56	26.56

- Fiber

Parameter	Value	Unit
Reach	40	km
Attenuation	18	dB
L0	1294.53-1296.59	nm
L1	1299.02-1301.09	nm
L2	1303.54-1305.63	nm
L3	1308.09-1310.19	nm
MPI	0.5	dB
Dispersion (min)	-114	ps/nm
Dispersion (max)	36	ps/nm

Key Parameter to Support 200GbE 40km Link Budget(Cont'd)

- Transmitter

Parameter	Vendor 1	Vendor 2
Tx output power outer, after Mux	-	6.7 dBm
ER	5 dB	7.6 dB
SECQ	1.7dB	2.0 dB
Assumption CD Penalty	0.5dB	0.5dB
Assumption TDECQ	2.2dB	2.5dB

- Receiver

Parameter	Vendor 1	Vendor 2
Rx Sensitivity, before Demux	-17.1 dBm @ 1.7dB SECQ	-16.6 dBm @2.0 dB SECQ

- *According to yamamoto_b10k_01a_0118, the dispersion penalty for 200G 40km transmission could be taken as 0.5dB*

Optical Margin of 200GbE 30/40km Link Budget, tested

Description (Outer Eye)	Value	Unit
Tx OMA_{outer}, tested	6.7	dBm
Reach	30/40	km
SECQ tested Tx	2	dB
Insertion loss	18	dB
CD penalty assumption	0.5	dB
MPI	0.5	dB
TDECQ assumed	2.5	dB
Receiver sensitivity OMA_{outer} required @ SECQ = 0.9dB	-13.4	dBm
Receiver sensitivity tested @ SECQ = 2.0dB	-16.6	dBm
Receiver sensitivity calculated from tested value @ SECQ = 0.9dB	-17.7	dBm
Optical Margin for DGD penalty = 0	4.3	dB
Optical Margin for DGD penalty = 1dB	3.3	dB

- In this table, Tx OMA and Receiver sensitivity are tested numbers, this table is just to verify the feasibility, not for specification suggestion. In real product, those numbers could be relaxed for yield.

Consideration to 30/40km Reach Link Characteristics

- Refer to 802.3ba 100GBASE-ER4, suggest 40km reach channel insertion loss consistence with following table to enable new 40km standard defined product to be easy plug and play to upgraded from current 100GbE 40km link.
- Reflectance would need to be different, which could discussed during the baseline study.

Table 88–9—100GBASE–LR4 and 100GBASE–ER4 illustrative link power budgets

Parameter	100GBASE-LR4	100GBASE-ER4		Unit
Power budget (for maximum TDP)	8.5	—		dB
Power budget	—	21.5		dB
Operating distance	10	30	40[a]	km
Channel insertion loss	6.3[b]	15	18	dB
Maximum discrete reflectance	–26	–26		dB
Allocation for penalties[c] (for maximum TDP)	2.2	—		dB
Allocation for penalties[c]	—	3.5		
Additional insertion loss allowed	0	3	0	dB

[a]Links longer than 30 km are considered engineered links. Attenuation for such links needs to be less than the worst case for B1.1, B1.3, or B6_a single-mode cabled optical fiber
[b]The channel insertion loss is calculated using the maximum distance specified in Table 88–6 for 100GBASE–LR4 and fiber attenuation of 0.43 dB/km at 1295 nm plus an allocation for connection and splice loss given in 88.11.2.1.
[c]Link penalties are used for link budget calculations. They are not requirements and are not meant to be tested.

- Based on the analysis of optical margin for 200GbE 30/40km link budget, it is reasonable to say there are commercial components now can satisfy the transmission requirement.

Summary:

- Based on the study, we would like to recommend the following objectives:
  - Support a MAC data rate of 200 Gb/s
  - Support a BER of better than or equal to 10^-13 at the MAC/PLS service interface (or the frame loss ratio equivalent) for 200 Gb/s
  - Provide physical layer specification which supports four-lane 200 Gb/s operation over at least 40km of SMF.


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blagodaram
vinaka
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gracias
tapadh leat
хвала
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