Updated baseline proposals for 200GBASE-FR4 and 200GBASE-LR4

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Introduction

- During the SMF Ad Hoc on 19 April a first baseline proposal was made in stassar_01_0416_smf for 200GBASE-FR4 and 200GBASE-LR4 power budgets, including some considerations on options for associated wavelength specifications.

- During the SMF Ad Hoc on 4 May an updated baseline proposal was made in stassar_01_0516_smf, including a specific proposal for a CWDM scheme for 2km and DWDM (LAN-WDM) scheme for 10km.

- In this presentation a step back is made to review the pros & cons of the several wavelength options, while maintaining the 200GBASE-FR4 and 200GBASE-LR4 power budget proposals

Wavelength options for 200GBASE-FR4 and LR4

- No consensus was reached during the April / May SMF Ad Hoc calls on proposals made in stassar_01_0416_smf and stassar_01_0516_smf.

- In cole_01_0516_smf test results were presented for the TDP for approximately 10km SMF on the basis of a single data point
- Some concerns were expressed about the completeness of this test
- Others felt sufficient performance of CWDM at 10km was demonstrated.
- Most however didn't express their opinion on the wavelength choice

- In this presentation an attempt is made to put 2 choices into perspective

Realistic options for 200GBASE-FR4 and LR4 wavelengths

- stassar_01_0416_smf included 3 options for FR4 and LR4 wavelength specifications
- Today 2 of those are seen as realistic:
  - Option 1: CWDM for FR4 (2km)and LR4 (10km)
    - Potentially lowest cost
    - Potential issues with dispersion at 10km
  - Option 2: CWDM for FR4 and DWDM (LAN-WDM) for LR4
    - If CWDM dispersion penalty at 10km too high
    - Potentially lowest cost for 2km and different solution for 10km
- This would imply CWDM for 2km

- **So the open issue is what to do for 10km SMF**

Did cole_01_0516_smf provide sufficient evidence?

- **NO!**

- Why no:
- cole_01_0516_smf provides:
  - A single data point of a single device, from a single vendor
  - Offline processing
  - DML room temperature performance
  - @ ~9km of dispersion instead of worst case 10km
  - Short, unstressed pattern only, PRBS15

Is other, historical evidence available?

- The last time CWDM 10km was investigated in IEEE802.3: during the BA project for 100GBASE-LR4 specification.
- BA decided to use a DWDM (LAN-WDM) wavelength set instead of a CWDM set. Evidence for 10km CWDM was insufficient.
- However,
  - 100GBASE-LR4 was under non-FEC conditions.
  - 25Gb/s NRZ per lane
- In the meantime CWDM was introduced in an MSA for 100GbE over 2km
- Another MSA was made for 100GbE over 10km SMF using CWDM
- However: no evidence is available from this MSA activity.
- There are rumours (no facts however) that 25G NRZ with KP4 FEC is challenging for worst case dispersion conditions at 10km/1337.5nm

Which evidence should we need for CWDM 10km

- Data points for multiple devices, from more than one vendor
- Online processing, with stressed test patterns, PRBS31 or SSPRQ
- DML high temperature performance (due to expected reduced BW), if we would intend to use uncooled DMLs.
- 2 data points for each device, one @ ~30 ps/nm and one @ ~34 ps/nm, to demonstrate that a 10% increment in dispersion gives an increment in dispersion penalty instead of an exponential increase
- If there would be an exponential increase in dispersion penalty going from 30 to 34 ps/nm, this would be a strong indicator of unstable system performance in a multi-vendor environment, where small variations in conditions may cause huge variations in BER performance with the risk that the system may “run off a cliff”.

Our dilemma for 200GBASE-LR4 wavelengths

- We know that a DWDM (LAN-WDM) scheme is mature and that it has a high confidence technical feasibility for 10km SMF
- From a desire to enable interworking with 2km implementations, CWDM may seem attractive for 10km.
- If we would choose DWDM now for 10km we seem to shut off the option of a potentially lower cost solution which interoperates with 2km CWDM
- If we would choose CWDM now for 10km, we may be defining a spec that in practice is either not manufacturable with sufficient yield or instable in performance, which we obviously shouldn't want

Baseline proposal for 200GBASE-FR4 wavelengths

200GBASE-FR4 wavelength specification as in Table 87-5 CWDM grid:

Table 87–5—Wavelength-division-multiplexed lane assignments

Lane	Center wavelength	Wavelength range
L_0	1271 nm	1264.5 to 1277.5 nm
L_1	1291 nm	1284.5 to 1297.5 nm
L_2	1311 nm	1304.5 to 1317.5 nm
L_3	1331 nm	1324.5 to 1337.5 nm

Baseline proposal for 200GBASE-LR4 wavelengths

CWDM (as proposed for 200GBASE-FR4,

OR

200GBASE-LR4 wavelength specification as in Table 88-5
800 GHz spacing
(often referred as LAN-WDM):

Table 88–5—Wavelength-division-multiplexed lane assignments

Lane	Center frequency	Center wavelength	Wavelength range
L_0	231.4 THz	1295.56 nm	1294.53 to 1296.59 nm
L_1	230.6 THz	1300.05 nm	1299.02 to 1301.09 nm
L_2	229.8 THz	1304.58 nm	1303.54 to 1305.63 nm
L_3	229 THz	1309.14 nm	1308.09 to 1310.19 nm

Power level baseline proposal

- As noted in stassar_01_0516_smf, the details of the proposal are intended to be consistent with 400GBASE-FR8 and 400GBASE-LR8 specifications in Draft 1.3
- In the following tables, only the parameters with values being different from 400GBASE-FR8 and 400GBASE-LR8 are shown
- Same values as in stassar_01_0516_smf

Baseline proposal for 200GBASE-FR4 and LR4

Parameter	200G-FR4	200G-LR4	Unit
Transmitter:			
Total average launch power (max)	9.7	9.7	dBm
Average launch power, each lane (max)	3.7	3.7	dBm
Average launch power, each lane (min)	–3.5	–2.8	dBm
OMA_{outer}, each lane (max)	5	5.2	dBm
OMA_{outer}, each lane (min)	–0.5	0.2	dBm
Launch power in OMA_{outer} minus TDP, each lane (min)	–1.5	–0.8	dBm
Receiver:			
Damage threshold, each lane	4.7	4.7	dBm
Average receive power, each lane (max)	3.7	3.7	dBm
Average receive power, each lane (min)	–7.5	–9.1	dBm
Receive power, each lane (OMA_{outer}) (max)	5.2	5.2	dBm
Receiver sensitivity (OMA_{inner}), each lane (max)	–10.6	–12.4	dBm

Q & A

Thank you