

Baseline proposals for 10 & 40 km 800 Gb/s single wavelength optical specifications

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Overview

802.3dj includes the following 800Gb/s objectives that are suitable for a coherent optical solution

- over 1 wavelength over a single SMF in each direction with lengths up to at least 10 km
- over a single SMF in each direction with lengths up to at least 40 km

A logical specification based on coherent modulation and BCH coding has been proposed

- https://www.ieee802.org/3/dj/public/23_05/maniloff_3dj_01a_2305.pdf

This contribution provides proposed optical specifications to meet the objectives

Since there is debate about whether C band or O band provides an optimal solution both specifications are presented

- The intent is to allow task force discussion on these two options
- Either is suitable for meeting the objectives

802.3dj 10 km & 40 km Coherent implementation

The 10 km solution is defined to support a 6.3dB loss budget consistent with existing 802.3 10km specifications

- Reduced loss in C band provide unallocated margin – useful for applications with additional loss (switches, splitters, combiners, patch panels)
- O band losses are consistent with 802.3cu 10km optical loss budgets

The 40km solution is defined based on fiber losses based on C band operation in IEEE 802.3 10GBASE-E

- https://www.ieee802.org/3/dj/public/adhoc/optics/0423_OPTX/stassar_3dj_optx_01a_230427.pdf

C band operation allows multiple technology solutions to meet a higher Tx output power for 40km reach

- Mature EDFA and SOA technologies in modules can boost Tx power to meet 40km link loss

A C-Band coherent solution for 10 & 40km allows definition of a specification resulting in interoperable 10km and 40km interfaces

O Band 10km provides a path to a potential reduced complexity DSP design

- https://www.ieee802.org/3/dj/public/23_05/carusone_3dj_01a_2305.pdf,
https://www.ieee802.org/3/dj/public/23_05/gui_3dj_01a_2305.pdf

800GBASE-LR1 and 800GBASE-ER1 C Band Link parameters



	800GBASE-LR1	800GBASE-ER1	
Operating Distance	10	40	km
Fiber Loss	2.8	10.9	dB [1]
Additional Loss	3.5	1	dB [2]
Chromatic Dispersion Max	200	800	ps/nm [3]
Chromatic Dispersion Min	0	0	ps/nm
Polarization Mode Dispersion	5	10	ps
Allocation for penalties	0.5	1	dB

Note 1: C band losses based on existing 802.3 allocations, as discussed in https://www.ieee802.org/3/dj/public/adhoc/optics/0423_OPTX/stassar_3dj_optx_01a_230427.pdf

Note 2: 800GBASE-ER1 provides 1dB of allocation for patch panels.

Note 3: Chromatic Dispersion is allocated based on G.654 maximum CD value, which is greater than the worst-case G.652.D

800GBASE-LR1 and 800GBASE-ER1 C Band Tx Parameters

	800GBASE-LR1	800GBASE-ER1	Unit
Signalling rate	123.7±50 ppm	123.7±50 ppm	Gbaud
Modulation Format	DP-16QAM	DP-16QAM	
Optical Frequency	193.7	193.7	THz
FEC	RS(544,514,10) +BCH(126,110)		
Average Launch Power (Max)	-6	0	dBm
Average Launch Power (Min)	-10	-4	dBm
Optical Frequency Accuracy	TBD	TBD	GHz
Laser Linewidth	1	1	MHz
In Band OSNR	36	36	dB/12.5 GHz
Power difference between X and Y polarizations (max)	1.5	1.5	dB
Skew between X and Y polarizations (max)	5	5	ps
EVMmax (max)	TBD	TBD	%
Instantaneous I-Q offset per polarization (max)	-20	-20	dB
Mean I-Q offset per polarization (max)	-26	-26	dB
I-Q amplitude imbalance (mean)	1	1	dB
I-Q phase error magnitude (max)	5	5	deg
I-Q quadrature skew (max)	0.3	0.3	ps
Average launch power of OFF transmitter (max)	-20	-20	dBm
Transmitter reflectance (max)	-20	-20	dB
Transmit output power stability	± 1	± 1	dB
RIN average (max)	-145	-145	dB/Hz
RIN peak (max)	-140	-140	dB/Hz

800GBASE-LR1 and 800GBASE-ER1 C Band Rx Parameters

	800GBASE-LR1	800GBASE-ER1	Gbaud
Signalling rate	123.7±50 ppm	123.7±50 ppm	
Modulation Format	DP-16QAM	DP-16QAM	THz
Optical Frequency	193.7	193.7	GHz
→ Optical Frequency Tolerance	TBD	TBD	dBm
Sensitivity at TP2	-16.8	-16.9	dBm
Sensitivity at TP3	-16.3	-15.9	dBm
→ Optical Power (Max)	-4	-4	dBm
Damage Threshold	+5	+5	dBm
Receiver reflectance (max)	20	20	dB
Allocation for Penalties	0.5	1	dB

Note [1] 800GBASE-LR1 and 800GBASE-ER1 are compliant over the 10km link

Note [2] 4 dB minimum loss included for ER Tx

800GBASE-LR1 O Band Link parameters

	800GBASE-LR1	Unit
Operating Distance	10	km
Fiber Loss	4.5	dB [1]
Additional Loss	1.8	dB
→ Chromatic Dispersion Max	11	ps/nm [2]
→ Chromatic Dispersion Min	-11.3	ps/nm [2]
Polarization Mode Dispersion	5	ps
Allocation for penalties	0.5	dB

Note 1: Losses based on existing 802.3 allocations, as discussed in

https://www.ieee802.org/3/dj/public/adhoc/optics/0423_OPTX/stassar_3dj_optx_01a_230427.pdf

Note 2: CD Min/Max based on G.652, values consistent with 802.3-2022, (ex: Table 122-16) for a wavelength of 1312nm.

800GBASE-LR1 O Band Tx Parameters

	800GBASE-LR1	Unit
Signalling rate	123.7±50 ppm	Gbaud
Modulation Format	DP-16QAM	
→ Optical Frequency	228.5	THz
FEC	RS(544,514,10) +BCH(126,110)	
Average Launch Power (Max)	-6	dBm
Average Launch Power (Min)	-10	dBm
→ Optical Frequency Accuracy	TBD	GHz
Laser Linewidth	1	MHz
In Band OSNR	36	dB/12.5 GHz
Power difference between X and Y polarizations (max)	1.5	dB
Skew between X and Y polarizations (max)	5	ps
EVMmax (max)	TBD	%
Instantaneous I-Q offset per polarization (max)	-20	dB
Mean I-Q offset per polarization (max)	-26	dB
I-Q amplitude imbalance (mean)	1	dB
I-Q phase error magnitude (max)	5	deg
I-Q quadrature skew (max)	0.3	ps
Average launch power of OFF transmitter (max)	-20	dBm
Transmitter reflectance (max)	-20	dB
Transmit output power stability	± 1	dB
RIN average (max)	-145	dB/Hz
RIN peak (max)	-140	dB/Hz

800GBASE-LR1 O Band Rx Parameters

	800GBASE-LR1	Gbaud
Signalling rate	123.7±50 ppm	
Modulation Format	DP-16QAM	THz
Optical Frequency	228.5	GHz
Optical Frequency Tolerance	TBD	dBm
Sensitivity at TP2	-16.8	dBm
Sensitivity at TP3	-16.3	dBm
Optical Power (Max)	-6	dBm
Damage Threshold	+5	dBm
Receiver reflectance (max)	20	dB
Allocation for Penalties	0.5	dB



Summary

Optical specifications are provided for operation over 10 & 40km SMF using a RS544/BCH(126,110) FEC code

The proposed specification is based on fiber specifications consistent with previous IEEE 802.3 clauses

Two options are provided for the wavelength specifications:

- C Band for both 10 & 40 km
- O band for 10 km

Thanks!