

Baseline proposal for 200G/L PMD specification for 4 wavelengths over a single SMF in each direction with lengths up to at least 2km

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Overview

- Compliment to [welch_3dj_01_0323](#)
 - *Baseline proposals for 200G/L PMD specifications for single wavelength 500m and 2km standards*
- Two options shown
 - Option A (Type 1[†]): Use RS(544,514) FEC protection for PMD
 - Option B (Type 2[†]): Use RS(544,514)+Inner Code FEC protection for PMD
- Key differences vs. 400GBASE-FR4
 - Increase in signaling rate to reflect higher data rate
 - 1.5dB upward shift in power budget
 - Additional 0.2 dB to TDECQ budget (for Option A): Allocation for higher dispersion
 - 0.1 dB additional for Option B (Due to different target SER)

† From [brown_3dj_optx_adhoc_01a_230222](#)

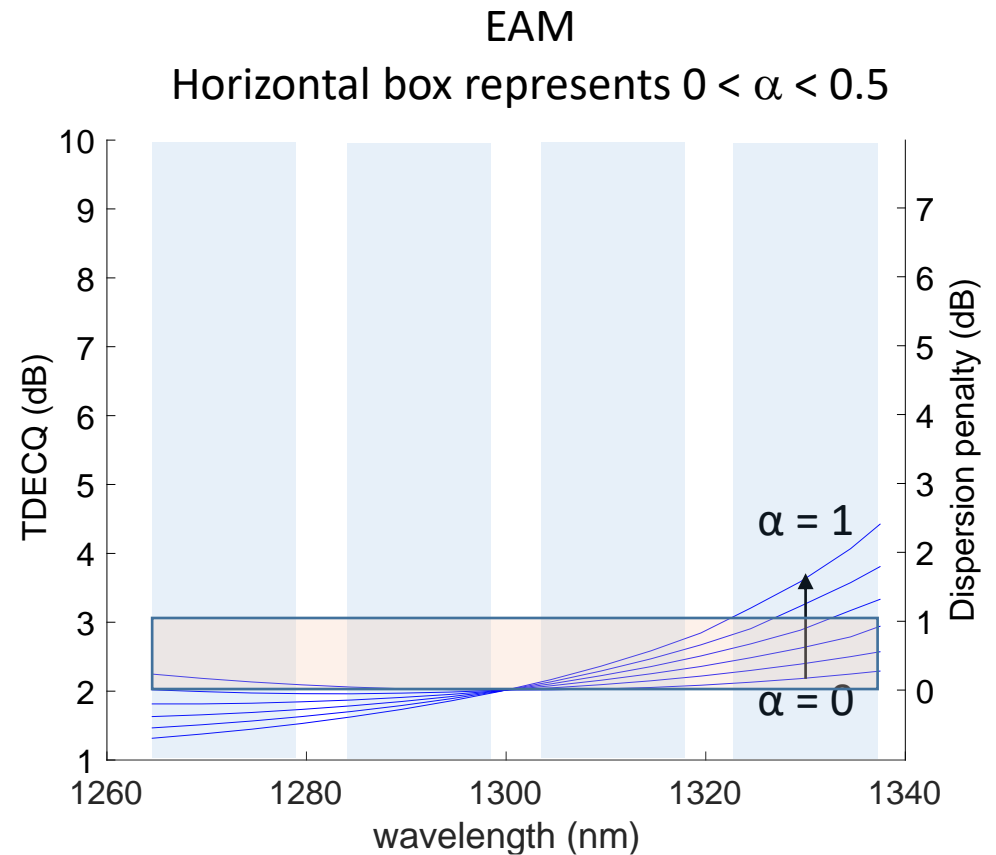
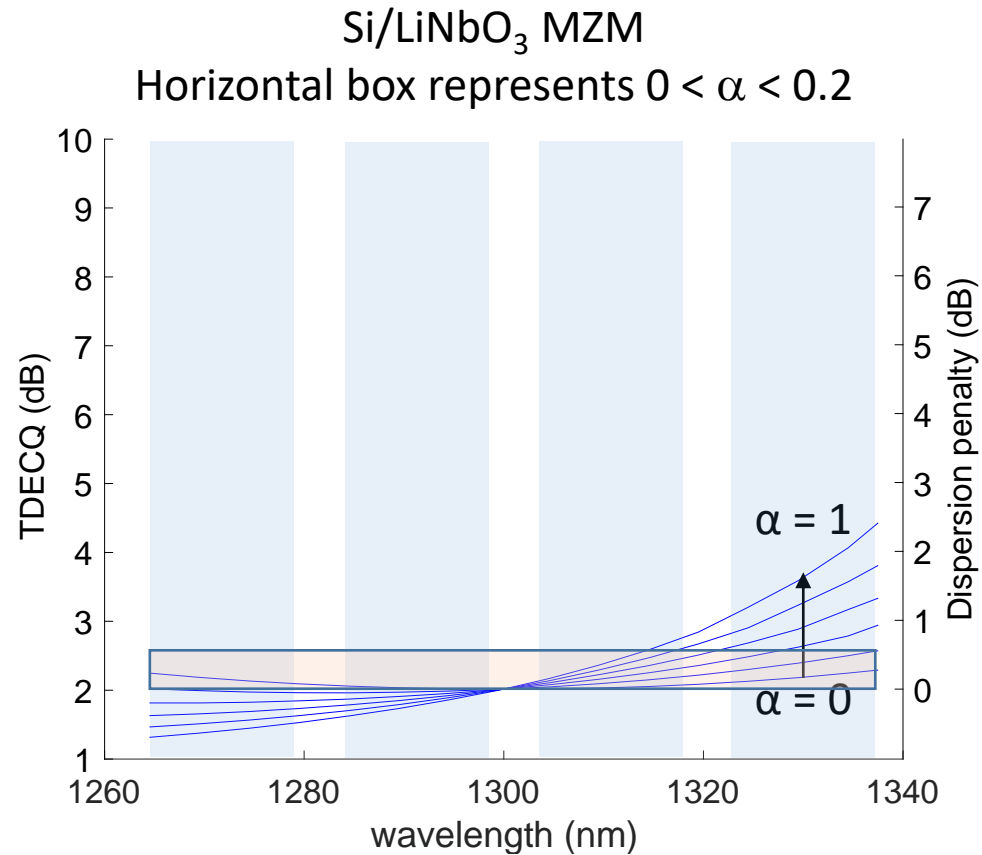
BER Requirements

- **Option A:** The BER of the PMD link shall be less than 2.4×10^{-4} provided that the error statistics are sufficiently random that this results in a frame loss ratio of less than 1.7×10^{-12} for 64-octet frames with minimum interpacket gap when processed with an 800GBASE-R PCS.
- **Option B:** The BER of the PMD link shall be less than 4.85×10^{-3} provided that the error statistics are sufficiently random that this results in a frame loss ratio of less than 1.7×10^{-12} for 64-octet frames with minimum interpacket gap when processed with an 800GBASE-R PCS and inner code FEC sublayer.
 - Note: Exact pre-FEC BER level for Option B may vary.

TDECQ reference equalizer

- Propose to continue the use of a 5-tap T-spaced FFE as the TDECQ reference equalizer
- Longer reference equalizers reduce the demand on the Tx but transfer this to the Rx, since the test signal for the stressed Rx sensitivity test is calibrated using the reference equalizer
- Longer reference equalizers may lead to interoperability issues, as they mask a wider range of Tx impairments
- Rx implementations may use significantly more capable equalization, even MLSE, to achieve margin relative to the specifications. A longer reference equalizer reduces the potential margin
- Target SER for TDECQ measurement: Option A = $4.8e-4$, Option B = $9.7e-3$

CWDM TDECQ with chirp factor ranges

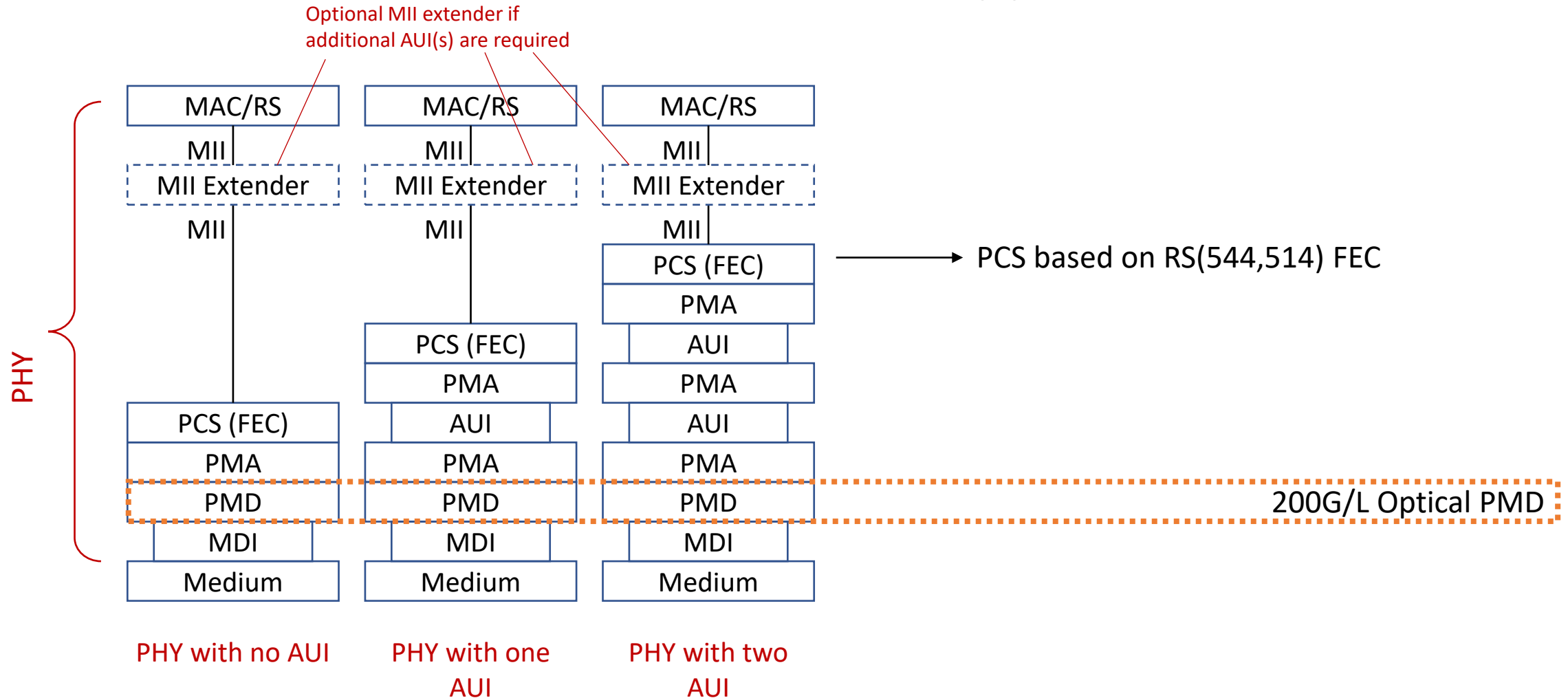


106.25 GBd with TDECQ SER target of 4.8×10^{-4}
2 km SMF
5-tap FFE reference equalizer

From ingham_3df_01_221011

Option A (Type 1): RS(544,514)

Location in Ethernet Stack: Type 1



Proposed Transmitter Specifications

Option A: RS(544,514), Pre-FEC BER = 2.4e-4

Description	800GBASE-FR4	Unit
Signaling rate, each lane (Range)	106.25 ± 50 ppm	GBd
Modulation Format	PAM4	
Lane wavelengths (range)	1264.5 to 1277.5 1284.5 to 1297.5 1304.5 to 1317.5 1324.5 to 1337.5	nm
Side-mode suppression ratio (SMSR), (min)	30	dB
Average launch power, each lane (max)	4.9	dBm
Average launch power, each lane (min)	-1.5	dBm
Outer Optical Modulation Amplitude (OMA _{outer}), each lane(max)	4.3	dBm
Outer Optical Modulation Amplitude (OMA _{outer}), each lane(min)		
for TDECQ < 1.4dB	1.3	dBm
for 1.4 dB ≤ TDECQ ≤ 3.6 dB	-0.1+TDECQ	dBm
Transmitter and dispersion eye closure (TDECQ), each lane (max)	3.6	dB
TECQ (max)	3.6	dB
TDECQ - TECQ (max)	2.5	dB
Average launch power of OFF transmitter, each lane (max)	-15	dBm
Extinction ratio, each lane, (min)	3.5	dB
Transmitter transition time (max)	8.5	ps
Transmitter over/under-shoot (max)	22	%
RIN _x OMA (max)	-137	dB/Hz
Optical return loss tolerance (max)	17.1	dB
Transmitter reflectance (max)	-26	dB

† Measured with FFE5 reference equalizer and SER = 4.8e-4

Proposed Receiver Specifications

Option A: RS(544,514), Pre-FEC BER = 2.4e-4

Description	800GBASE-FR4	Unit
Signaling rate, each lane (Range)	106.25 ± 50 ppm	GBd
Modulation Format	PAM4	
Lane wavelengths (range)	1264.5 to 1277.5 1284.5 to 1297.5 1304.5 to 1317.5 1324.5 to 1337.5	nm
Damage threshold, each lane	5.9	dBm
Average receive power, each lane (max)	4.9	dBm
Average receive power, each lane (min)	-5.5	dBm
Receive power, each lane (OMA _{outer}) (max)	4.3	dBm
Receiver reflectance (max)	-26	dB
Receiver sensitivity (OMA _{outer}), each lane (max) for TECQ < 1.4dB for 1.4 dB ≤ TECQ ≤ 3.6 dB	-3.1 -4.5 + TECQ	dBm dBm
Stressed receiver sensitivity (OMA _{outer}), each lane (max) [†]	-0.9	dBm
Conditions of stressed receiver sensitivity test:		
SECQ [†]	3.6	dB
OMA _{outer} of each aggressor lane	3.5	dBm

[†] Measured with FFE5 reference equalizer and SER= 4.8e-4

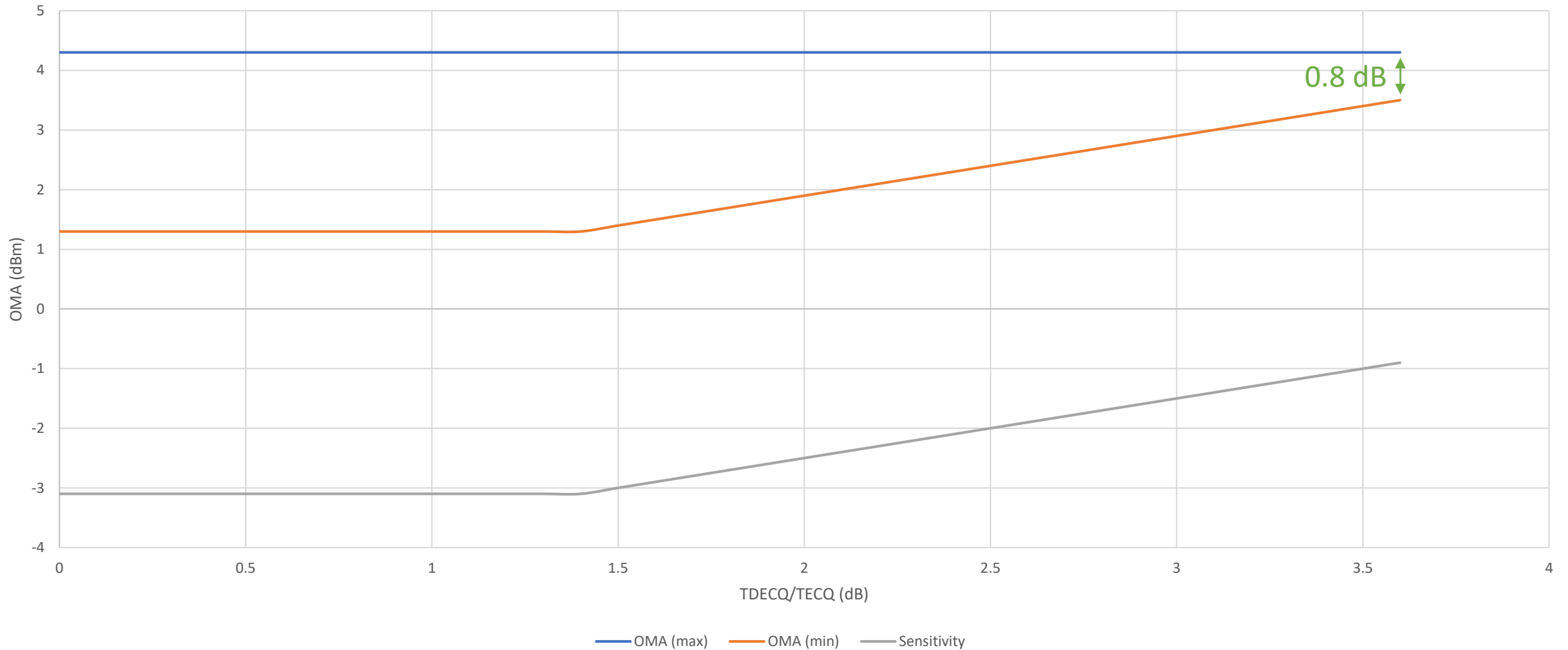
Proposed Link Budget

Option A: RS(544,514), Pre-FEC BER = 2.4e-4

Description	800GBASE-FR4	Unit
Power budget (for max TDECQ)	8	dB
Operating distance	2000	m
Channel insertion loss	4	dB
Maximum discrete reflectance	-35	dB
Allocation for penalties (for max TDECQ)	4	dB
Additional insertion loss allowed	0	dB

Illustrative Spec

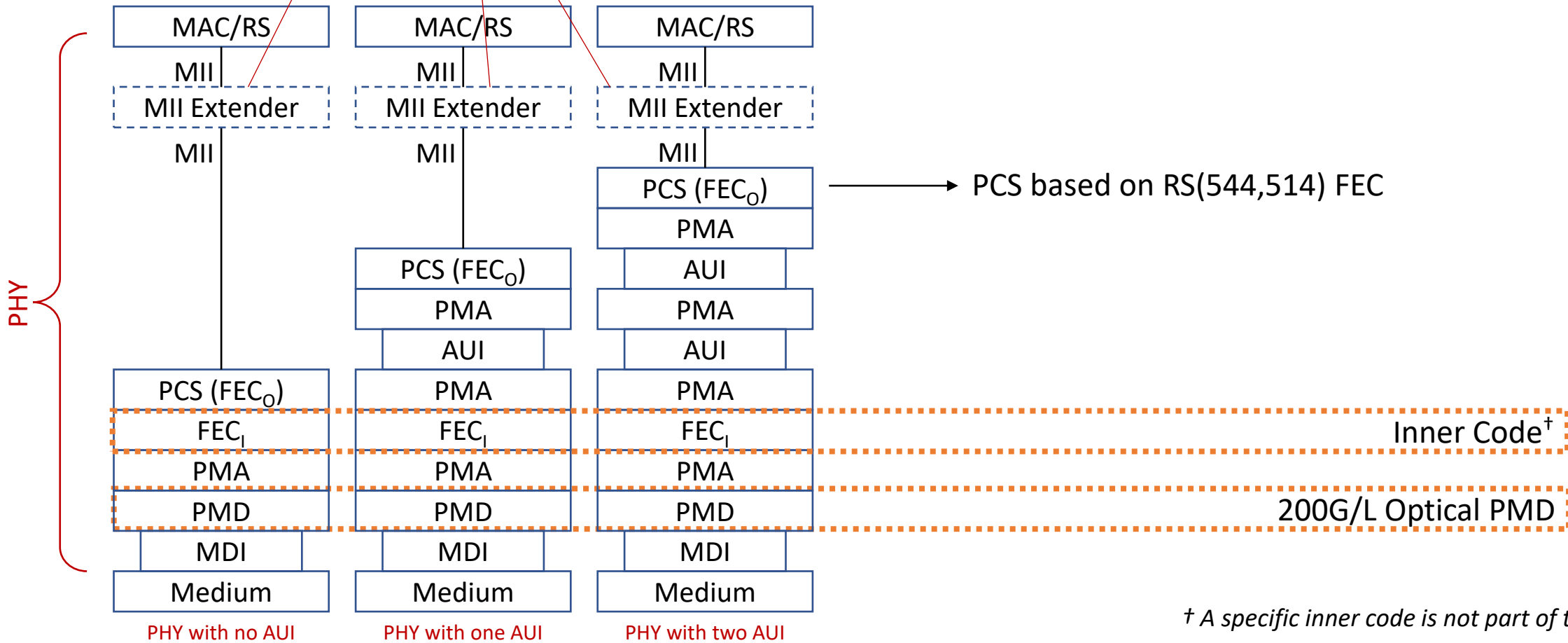
Option A : 800G-FR4



Option B (Type 2):
RS(544,514)+Inner Code

Location in Ethernet Stack: Type 2

Optional MII extender if additional AUI(s) are required



[†] A specific inner code is not part of this proposal

Proposed Transmitter Specifications

Option B: RS(544,514) + Inner Code, Pre-FEC BER = 3.85e-3

Description	800GBASE-FR4	Unit
Signaling rate, each lane (Range)	112.5 -113.4375 ± 50 ppm	GBd
Modulation Format	PAM4	
Lane wavelengths (range)	1264.5 to 1277.5 1284.5 to 1297.5 1304.5 to 1317.5 1324.5 to 1337.5	nm
Side-mode suppression ratio (SMSR), (min)	30	dB
Average launch power, each lane (max)	4.9	dBm
Average launch power, each lane (min)	-1.6	dBm
Outer Optical Modulation Amplitude (OMA _{outer}), each lane(max)	4.3	dBm
Outer Optical Modulation Amplitude (OMA _{outer}), each lane(min) for TDECQ < 1.3dB	1.2	dBm
for 1.3 dB ≤ TDECQ ≤ 2.9 dB	-0.2+TDECQ	dBm
Transmitter and dispersion eye closure (TDECQ), each lane (max)	2.9	dB
TECQ (max)	2.9	dB
TDECQ - TECQ (max)	1.9	dB
Average launch power of OFF transmitter, each lane (max)	-15	dBm
Extinction ratio, each lane, (min)	3.5	dB
Transmitter transition time (max)	8	ps
Transmitter over/under-shoot (max)	22	%
RIN _x OMA (max)	-137	dB/Hz
Optical return loss tolerance (max)	17.1	dB
Transmitter reflectance (max)	-26	dB

‡ Measured with FF5 reference equalizer and SER = 9.7e-3

Proposed Receiver Specifications

Option B: RS(544,514) + Inner Code, Pre-FEC BER = 3.85e-3

Description	800GBASE-FR4	Unit
Signaling rate, each lane (Range)	112.5 -113.4375 ± 50 ppm	GBd
Modulation Format	PAM4	
Lane wavelengths (range)	1264.5 to 1277.5 1284.5 to 1297.5 1304.5 to 1317.5 1324.5 to 1337.5	nm
Damage threshold, each lane	5.9	dBm
Average receive power, each lane (max)	4.9	dBm
Average receive power, each lane (min)	-5.6	dBm
Receive power, each lane (OMA_{outer}) (max)	4.3	dBm
Receiver reflectance (max)	-26	dB
Receiver sensitivity (OMA_{outer}), each lane (max)		
for $TECQ < 1.3$ dB	-3.3	dBm
for $1.3 \text{ dB} \leq TECQ \leq 2.9$ dB	-4.6 + TECQ	dBm
Stressed receiver sensitivity (OMA_{outer}), each lane (max) [†]	-1.7	dBm
Conditions of stressed receiver sensitivity test:		
SECQ [†]	2.9	dB
OMA_{outer} of each aggressor lane	2.4	dBm

† Measured with FFE5 reference equalizer and SER = 9.7e-3

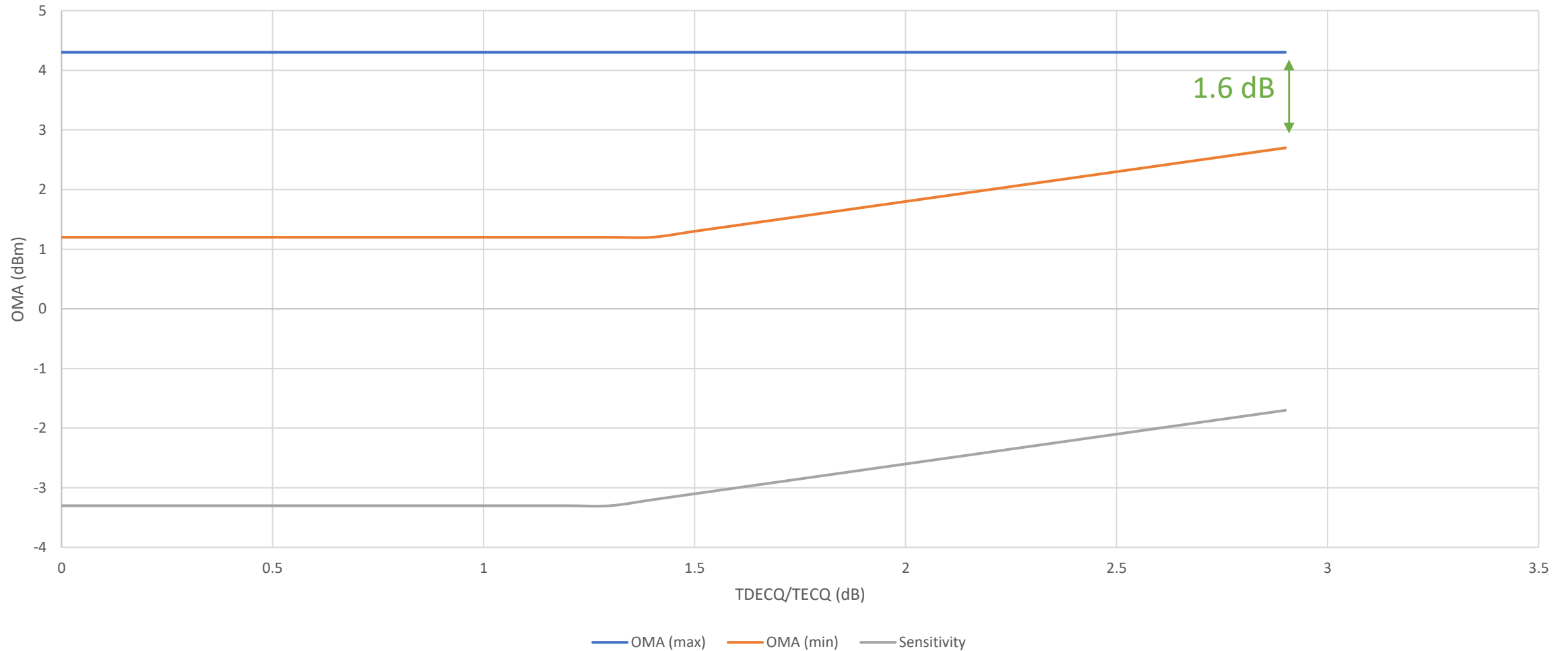
Proposed Link Budget

Option B: RS(544,514) + Inner Code, Pre-FEC BER = 3.85e-3

Description	800GBASE-FR4	Unit
Power budget (for max TDECQ)	7.3	dB
Operating distance	2000	m
Channel insertion loss	4	dB
Maximum discrete reflectance	-35	dB
Allocation for penalties (for max TDECQ)	3.4	dB
Additional insertion loss allowed	0	dB

Illustrative Spec

Option B : 800G-FR4



Summary

- Baseline proposals are presented for the 800G 2km four wavelength reach objective, for two different FEC options [RS(544,514) only vs. RS(544,514) + inner code]
 - Options differ from each other in signaling rate and BER/SER specifications (and affiliated specifications).

Backup

Relationship to 200G/L AUIs

