Baseline proposals for 800GBASE-FR4

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Supporters

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Caveats and Disclaimers

This presentation is only intended to present options for baseline proposals for transmitter, receiver, and channel specifications. It is not intended to recommend a specific PMD approach for accommodating the two FEC modes (common PMD or separate PMD)

Overview

Revisions relative to welch_3dj_02_2307 and welch_3dj_03_2307:

- Consolidation of proposals for different FEC modes into a common presentation.

- Updates to nomenclature around FEC operation modes: Next Slide

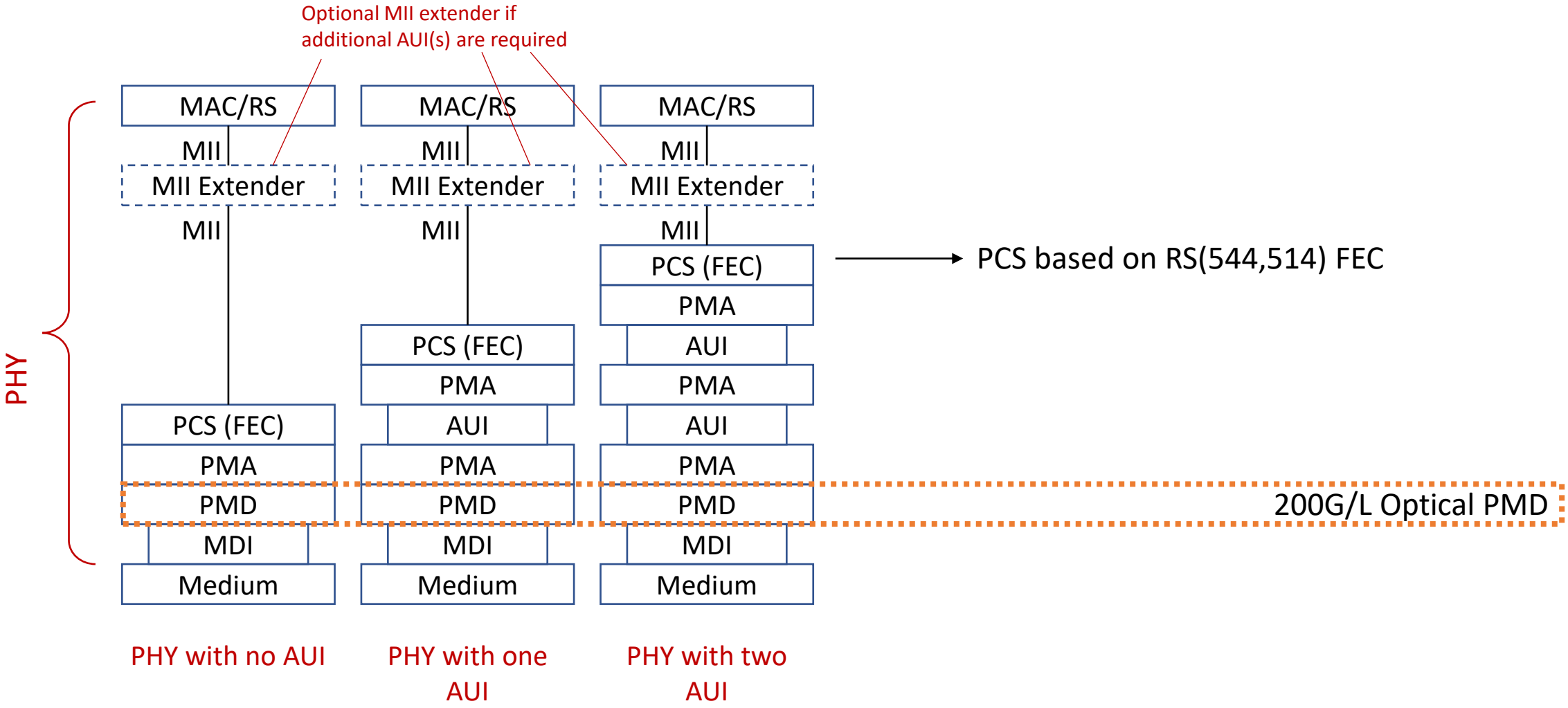
- Updates to BER for inner FEC: Revised to 4.8e-3
  - Previously tentatively indicated as 3e-3

BER Requirements

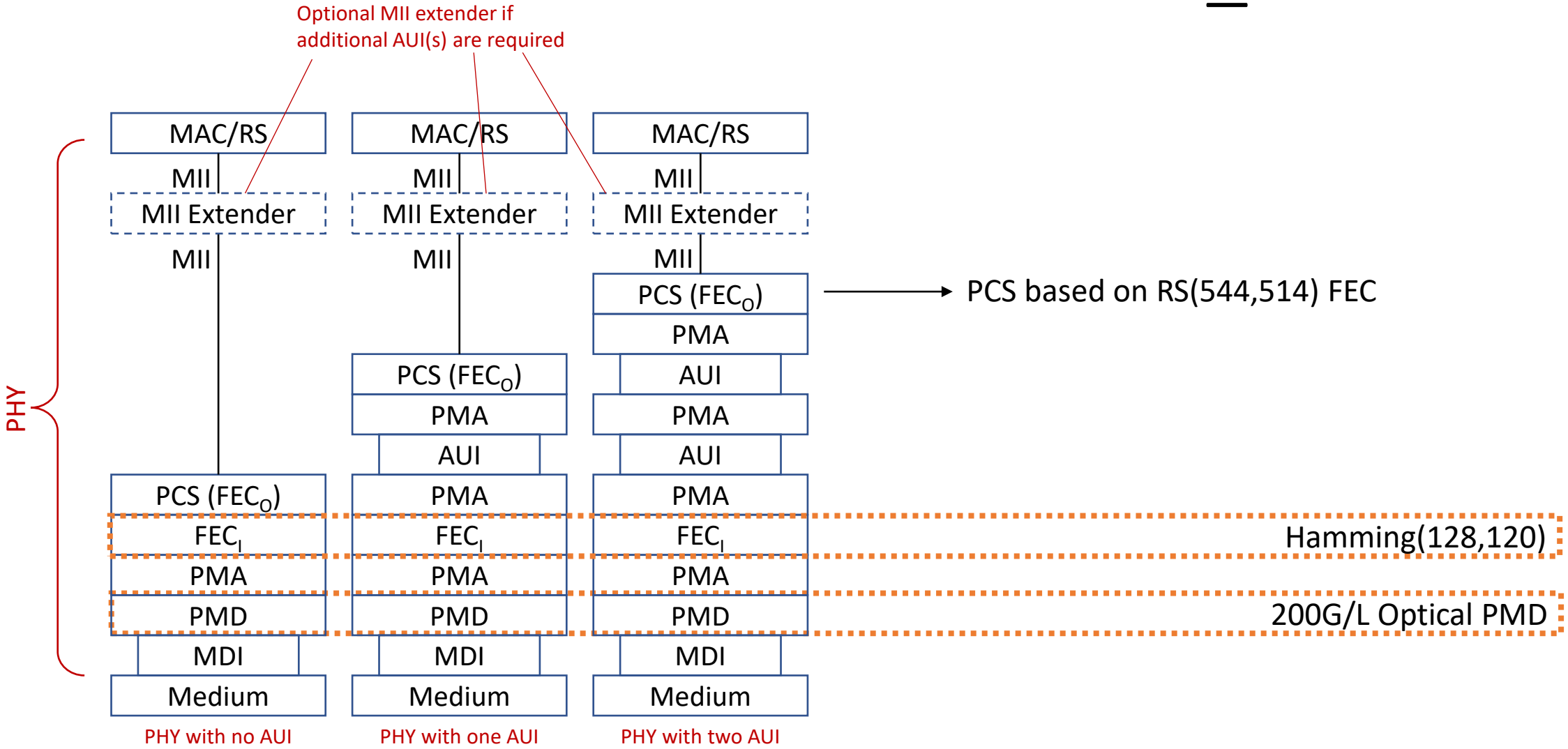
- **Mode_FECo** : The BER of the PMD link shall be less than **2.4×10^{-4}** provided that the error statistics are sufficiently random that this results in a frame loss ratio of less than 1.7×10^{-12} for 64-octet frames with minimum interpacket gap when processed with an 800GBASE-R/1.6TBASE-R PCS.

- **Mode_FECi** : The BER of the PMD link shall be less than **4.8×10^{-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/1.6TBASE-R PCS and inner code FEC sublayer.

Location in Ethernet Stack: Mode_FECo



Location in Ethernet Stack: Mode_FECi



Common Optical Specification

Single PMD

Common Optical Specification

- Transmitter is **allowed** to comply to **either** Mode_FECo or Mode_FECi operating condition

- Receiver is **required** to comply to **both** Mode_FECo and Mode_FECi operation conditions

Proposed Transmitter Specifications

Description	800GBASE-FR4		Unit
	Mode_FECo	Mode_FECi	
Signaling rate, each lane (range)	106.25 ± 50 ppm	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)	-1.8		dBm
Outer Optical Modulation Amplitude (OMA_{outer}), each lane(max)	4.8		dBm
Outer Optical Modulation Amplitude (OMA_{outer}), each lane(min) for TDECQ < 1.4 dB for 1.4 dB ≤ TDECQ ≤ TDECQ (max)	 1.3 -0.1+TDECQ		 dBm dBm
Transmitter and dispersion eye closure (TDECQ), each lane (max)	3.6[a]	TBD[b]	dB
TECQ (max)	3.6[a]	TBD[b]	dB
| TDECQ - TECQ| (max)	2.5[a]	TBD[b]	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_xOMA (max)	-139		dB/Hz
Optical return loss tolerance (max)	17.1		dB
Transmitter reflectance (max)	-26		dB

[a] Measured with FFETBD reference equalizer with SER = 4.8e-4
[b] Measured with FFETBD reference equalizer with SER = 9.6e-3

Proposed Receiver Specifications

Description	800GBASE-FR4		Unit
	Mode_FECo	Mode_FECi	
Signaling rate, each lane (range)	106.25 ± 50 ppm	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)	4.8		dBm
Receiver reflectance (max)	-26		dB
Receiver sensitivity (OMA_{outer}), each lane (max) for TECQ < 1.4 dB for 1.4 dB ≤ TECQ ≤ SECQ	 -3.2 -4.6 + TECQ		 dBm dBm
Stressed receiver sensitivity (OMA_{outer}), each lane (max)	-1.1	TBD	dBm
Conditions of stressed receiver sensitivity test:			
SECQ	3.6[a]	TBD[b]	dB
OMA_{outer} of each aggressor lane	1.9		dBm

[a] Measured with FFETBD with SER = 4.8e-4
[b] Measured with FFETBD with SER = 9.6e-3

Proposed Link Budget

Description	800GBASE-FR4		Unit
	Mode_FECo	Mode_FECi	
Power budget (for max TDECQ)	8	TBD	dB
Operating distance	2000		m
Channel insertion loss	4		dB
Maximum discrete reflectance	-35		dB
Allocation for penalties (for max TDECQ)	3.6	TBD	dB
Additional insertion loss allowed	0		dB

Separate Optical Specifications

Separate PMDs

Separate Optical Specifications

- Distinct PMD/PHY specifications for Mode_FECo and Mode_FECi
  - Each with unique transmitter, receiver, and link specifications

- No IEEE requirement for interoperability between the two
  - Ie, Mode_FECi receiver does not have to interoperate with Mode_FECo transmitters.
  - Informative interoperability specs may still be advantageous

- **Note**: This isn't a nomenclature presentation. As such "mode" designations are presently being used in the case of separate PMD/PHYs to avoid confusion.

Proposed Transmitter Specifications

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	Mode_FECo	Mode_FECi	
Signaling rate, each lane (range)	106.25 ± 50 ppm	113.4375 ± 50 ppm	GBd
Modulation Format	PAM4	PAM4	
Lane wavelengths (range)	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	nm
Side-mode suppression ratio (SMSR), (min)	30	30	dB
Average launch power, each lane (max)	4.9	4.9	dBm
Average launch power, each lane (min)	-1.8	-1.8	dBm
Outer Optical Modulation Amplitude (OMA_{outer}), each lane(max)	4.8	4.8	dBm
Outer Optical Modulation Amplitude (OMA_{outer}), each lane(min) for TDECQ < 1.4 dB for 1.4 dB ≤ TDECQ ≤ TDECQ (max)	 1.3 -0.1+TDECQ	 1.3 -0.1+TDECQ	 dBm dBm
Transmitter and dispersion eye closure (TDECQ), each lane (max)	3.6[a]	TBD[b]	dB
TECQ (max)	3.6[a]	TBD[b]	dB
| TDECQ - TECQ| (max)	2.5[a]	TBD[b]	dB
Average launch power of OFF transmitter, each lane (max)	-15	-15	dBm
Extinction ratio, each lane, (min)	3.5	3.5	dB
Transmitter transition time (max)	8	8	ps
Transmitter over/under-shoot (max)	22	22	%
RIN_xOMA (max)	-139	-139	dB/Hz
Optical return loss tolerance (max)	17.1	17.1	dB
Transmitter reflectance (max)	-26	-26	dB

[a] Measured with FFETBD reference equalizer with SER = 4.8e-4
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Damage threshold, each lane	5.9	5.9	dBm
Average receive power, each lane (max)	4.9	4.9	dBm
Average receive power, each lane (min)	-5.6	-5.6	dBm
Receive power, each lane (OMA_{outer}) (max)	4.8	4.8	dBm
Receiver reflectance (max)	-26	-26	dB
Receiver sensitivity (OMA_{outer}), each lane (max) for TECQ < 1.4 dB for 1.4 dB ≤ TECQ ≤ SECQ	 -3.2 -4.6 + TECQ	 -3.2 -4.6 + TECQ	 dBm dBm
Stressed receiver sensitivity (OMA_{outer}), each lane (max)	-1.1	TBD	dBm
Conditions of stressed receiver sensitivity test:			
SECQ	3.6[a]	TBD[b]	dB
OMA_{outer} of each aggressor lane	1.9	1.9	dBm

[a] Measured with FFETBD with SER = 4.8e-4
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Proposed Link Budget

Description	800GBASE-FR4		Unit
	Mode_FECo	Mode_FECi	
Power budget (for max TDECQ)	8	TBD	dB
Operating distance	2000	2000	m
Channel insertion loss	4	4	dB
Maximum discrete reflectance	-35	-35	dB
Allocation for penalties (for max TDECQ)	3.6	TBD	dB
Additional insertion loss allowed	0	0	dB

Summary

- Baseline proposals for 800GBASE-FR4 have been presented.

- Proposals contain requirements for operation with and without an inner FEC