50 Gb/s and 200 Gb/s SMF PMD Specifications & Objectives Proposal

IEEE 802.3 50 Gb/s Ethernet Over a Single Lane Study Group

IEEE 802.3 Next Generation 100 Gb/s Ethernet & 200 Gb/s Ethernet Study Group

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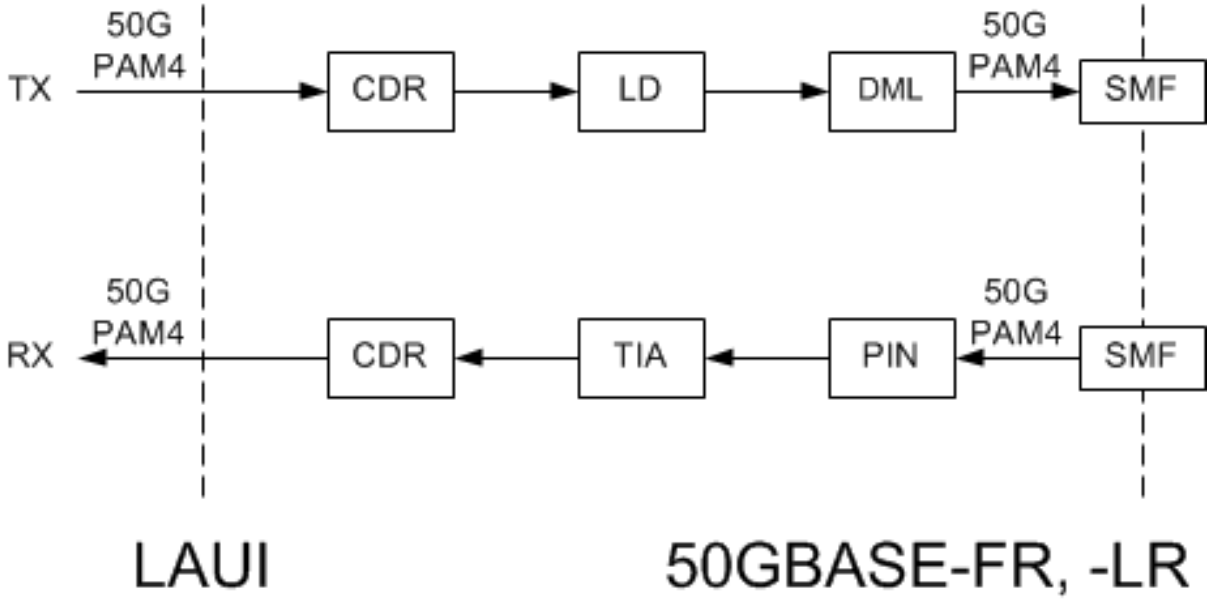
FINISAR

50 Gb/s SMF PMD Example Block Diagram



Transmit Characteristics

Description (PAM4)	50GBASE-FR	50GBASE-LR	Unit
Reach	2	10	km
Signaling Rate, each lane	26.5625	26.5625	GBd
Operating BER	2.0E-04	2.0E-04	
Total average launch power (max)	3.0	4.2	dBm
OMA_{outer}, each lane (max)	2.8	4	dBm
OMA_{outer}, each lane (min)	-2	-1	dBm
Launch Power in OMA_{outer} minus TDP, each lane (min)	-3	-2	dBm
Transmitter and dispersion penalty, (TDP) each lane (max)	2.3	2.5	dB
Extinction ratio (ER) (min)	4.5	4.5	dB
RIN OMA (max)	TBD	TBD	dB/Hz

Receive Characteristics

Description (PAM4)	50GBASE-FR	50GBASE-LR	Unit
Signaling Rate, each lane	26.5625	26.5625	GBd
Operating BER	2.0E-04	2.0E-04	
Receiver reflectance (max)	TBD	TBD	dB
Receiver Sensitivity (OMA_{inner}), each lane (max)	-11.8	-13.1	dBm
Stressed receiver sensitivity (OMA_{inner}), each lane (max)	TBD	TBD	dBm
Conditions of stressed receiver sensitivity test	TBD	TBD	

Illustrative Link Power Budgets

Description (PAM4)	50GBASE-FR	50GBASE-LR	Unit
Power Budget (for maximum TDP)	11.1	13.6	dB
Operating Distance	2	10	km
Channel Insertion Loss	4.0	6.3	dB
Maximum Discrete Reflectance	TBD	TBD	dB
Allocation for Penalties* (for maximum TDP)	2.3	2.5	dB
Allocation for Modulation Penalties	4.8	4.8	dB

* Includes MPI penalty

WDM Lane Assignment

50GBASE CWDM Lane	Center Wavelength nm	Wavelength Range nm
L0	1311	1304.5 to 1317.5

Alternate Lane Assignment to avoid worst case SMF dispersion spec.

50GBASE CWDM Lane	*Center Wavelength nm*	*Wavelength Range nm*
L0	*1291*	*1284.5 to 1297.5*

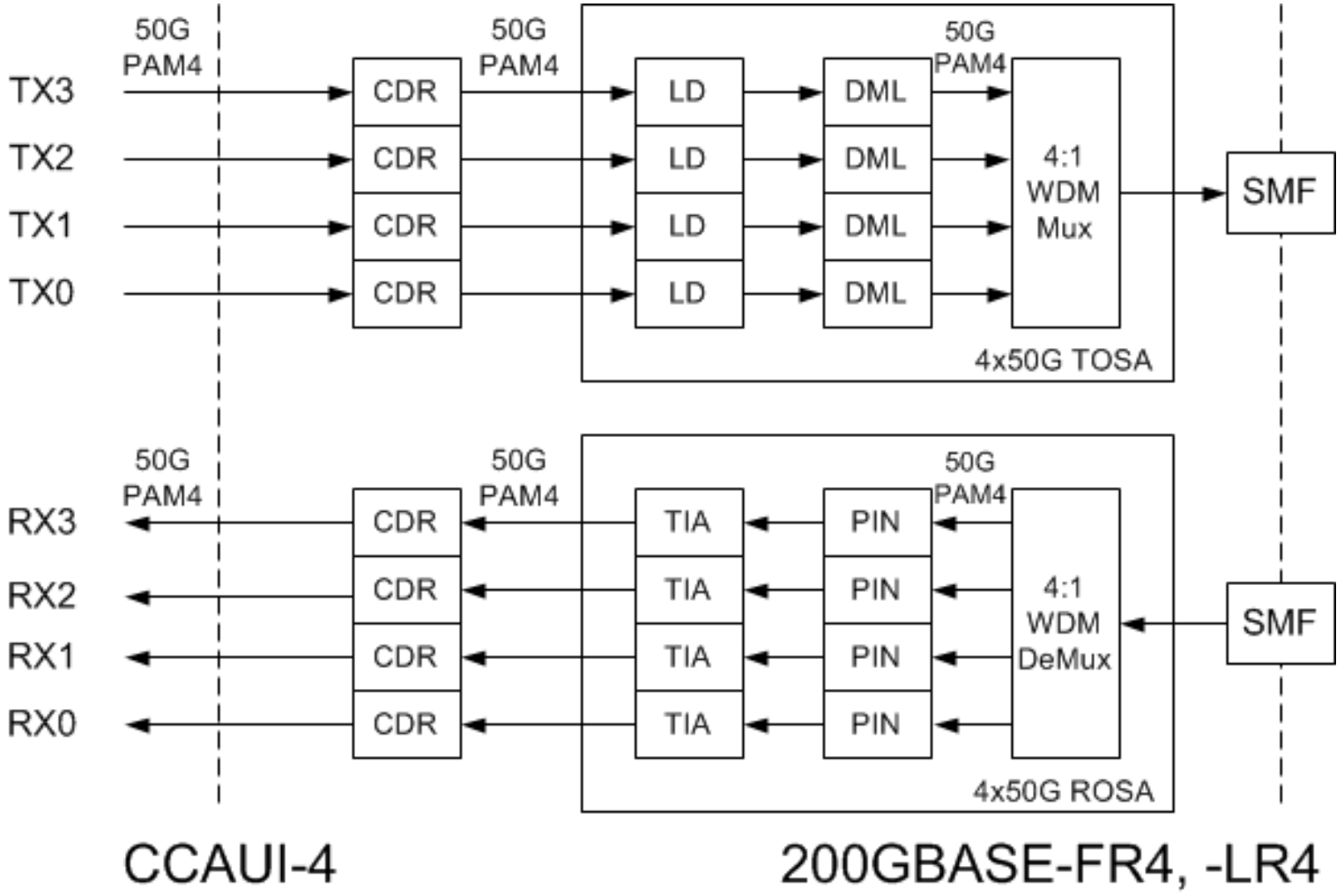
Optical Margin

Description	50GBASE-FR	50GBASE-LR	Unit
Receiver Sensitivity (OMA_{inner}), each lane, pre-DeMux (max)	-11.8	-13.1	dBm
DeMux Loss	0.0	0.0	dB
Cross-talk penalty	0.3	0.3	dB
Receiver Sensitivity (OMA_{inner}), each lane, post-DeMux (max)	-12.1	-13.4	dBm
Receiver Sensitivity (OMA_{inner}) single lane (typical measured)	-17.0	-17.0	dBm
Optical Margin	4.9	3.6	dB

Proposed 50 Gb/s Objectives

- Support a MAC data rate of 50 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)
- Support full-duplex operation only
- Preserve the Ethernet frame format utilizing the Ethernet MAC
- Preserve minimum and maximum FrameSize of current Ethernet standard
- Provide appropriate support for OTN
- Provide physical layer specifications which support 50 Gb/s operation over:
  - At least 2km of SMF
  - At least 10km of SMF
- Specify optional Energy Efficient Ethernet (EEE) capability
- Support optional Attachment Unit Interfaces for chip-to-chip and chip-to-module applications

200 Gb/s SMF PMD Example Block Diagram



Transmit Characteristics

Description (PAM4)	200GBASE-FR4	200GBASE-LR4	Unit
Reach	2	10	km
Signaling Rate, each lane	26.5625	26.5625	GBd
Operating BER	2.0E-04	2.0E-04	
Total average launch power (max)	10.9	11.8	dBm
OMA_{outer}, each lane (max)	4.7	5.6	dBm
OMA_{outer}, each lane (min)	-1.2	-0.2	dBm
Diff. in launch power between any two lanes (OMA_{outer}) (max)	4.5	4.0	dB
Launch Power in OMA_{outer} minus TDP, each lane (min)	-2.2	-1.2	dBm
Transmitter and dispersion penalty, (TDP) each lane (max)	2.4	2.8	dB
Extinction ratio (ER) (min)	4.5	4.5	dB
RIN OMA (max)	TBD	TBD	dB/Hz

Receive Characteristics

Description (PAM4)	200GBASE-FR4	200GBASE-LR4	Unit
Signaling Rate, each lane	26.5625	26.5625	GBd
Operating BER	2.0E-04	2.0E-04	
Receiver reflectance (max)	TBD	TBD	dB
Receiver Sensitivity (OMA_{inner}), each lane (max)	-11.0	-12.3	dBm
Stressed receiver sensitivity (OMA_{inner}), each lane (max)	TBD	TBD	dBm
Conditions of stressed receiver sensitivity test	TBD	TBD	

Illustrative Link Power Budgets

Description (PAM4)	200GBASE-FR4	200GBASE-LR4	Unit
Power Budget (for maximum TDP)	11.2	13.9	dB
Operating Distance	2	10	km
Channel Insertion Loss	4.0	6.3	dB
Maximum Discrete Reflectance	TBD	TBD	dB
Allocation for Penalties* (for maximum TDP)	2.4	2.8	dB
Allocation for Modulation Penalties	4.8	4.8	dB

* Includes MPI penalty

WDM Lane Assignments

200GBASE CWDM Lane	Center Wavelength nm	Wavelength Range nm
L0	1271	1264.5 to 1277.5
L1	1291	1284.5 to 1297.5
L2	1311	1304.5 to 1317.5
L3	1331	1324.5 to 1337.5

Optical Margin

Description (PAM4)	200GBASE-FR4	200GBASE-LR4	Unit
Receiver Sensitivity (OMA_{inner}), each lane, pre-DeMux (max)	-11.0	-12.3	dBm
DeMux Loss	2.0	2.0	dB
Cross-talk penalty	0.3	0.3	dB
Receiver Sensitivity (OMA_{inner}), each lane, post-DeMux (max)	-13.3	-14.6	dBm
Receiver Sensitivity (OMA_{inner}) single lane (typical measured)	-17.0	-17.0	dBm
Optical Margin	3.7	2.4	dB

Proposed 200 Gb/s 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)
- Support full-duplex operation only
- Preserve the Ethernet frame format utilizing the Ethernet MAC
- Preserve minimum and maximum FrameSize of current Ethernet standard
- Provide appropriate support for OTN
- Provide physical layer specifications which support 200 Gb/s operation over:
  - At least 2km of SMF
  - At least 10km of SMF
- Specify optional Energy Efficient Ethernet (EEE) capability
- Support optional Attachment Unit Interfaces for chip-to-chip and chip-to-module applications

Recommendations

- Form new 50 Gb/s and Next Generation 100 Gb/s Ethernet Task Force
- Change 802.3bs to 200 Gb/s and 400 Gb/s Ethernet Task Force
- Adopt Proposed 50 Gb/s Objectives (page 8) for the 50 Gb/s and Next Generation 100 Gb/s Ethernet Task Force
- Adopt Proposed 200 Gb/s Objectives (page 15) for the 200 Gb/s and 400 Gb/s Ethernet Task Force

50 Gb/s and 200 Gb/s Specs & Objectives

Thank you