P2MP PMD Baseline

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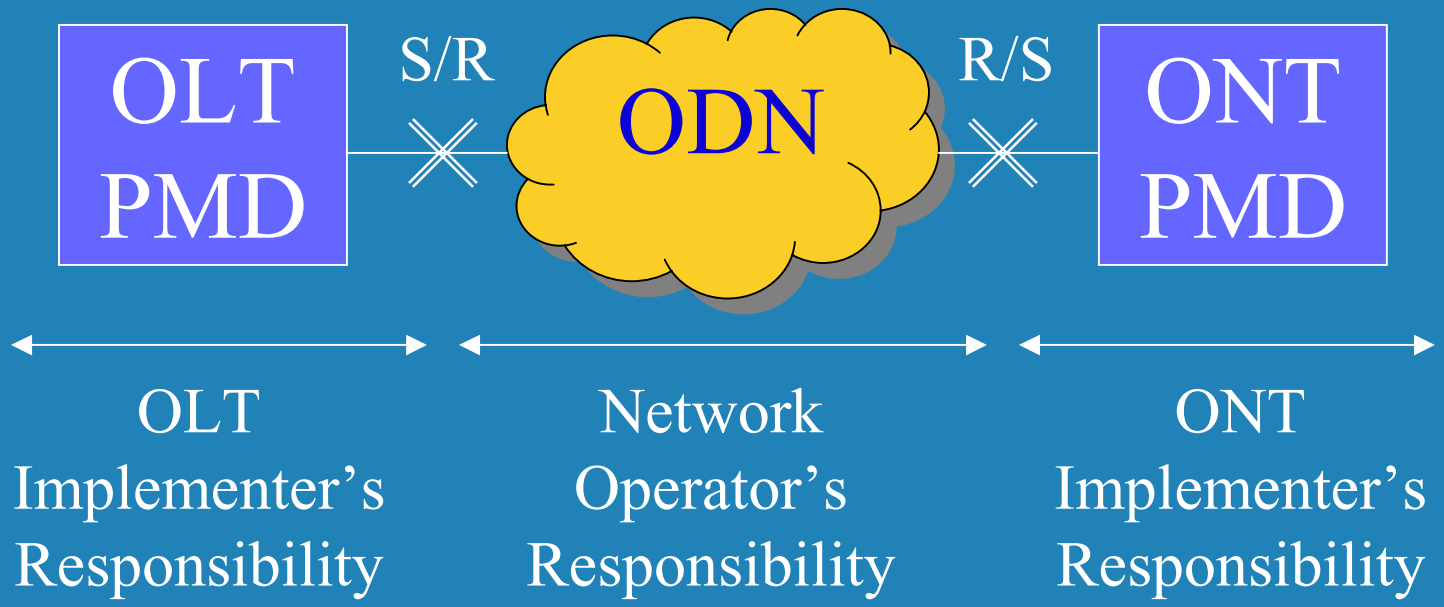
Overview

- Definitions
- Type 1 PMDs
- Type 2 PMDs
- Issues under discussion

Interface Definitions

- The OLT fiber interface is named the S/R point
- The ONT fiber interface is names the R/S point
- All Specifications herein refer to values measured at S/R and R/S points

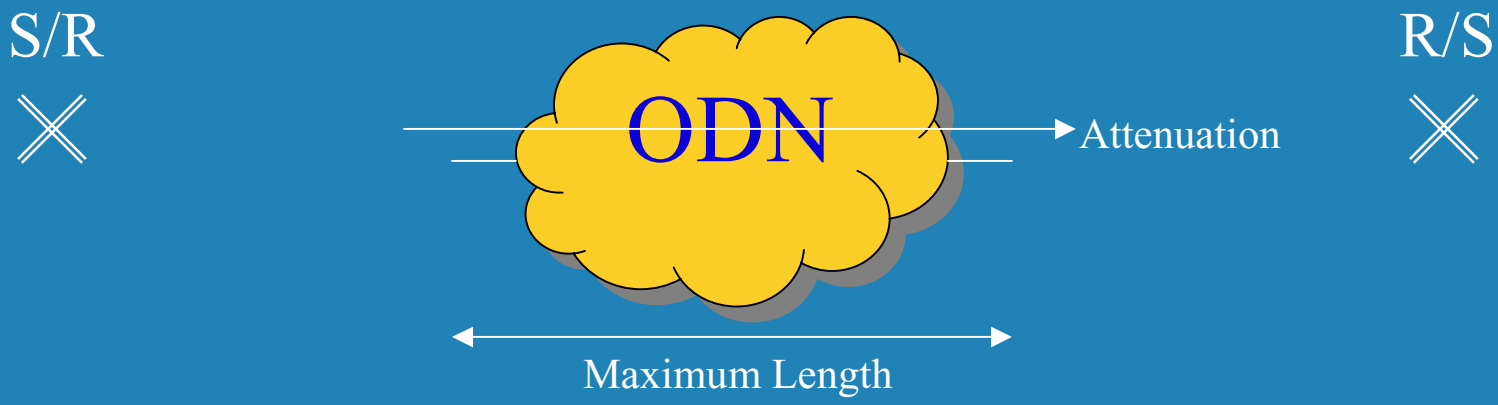


S/R Optical Definitions

- ORL from viewpoint of OLT
- Launch power, extinction ratio, and Tx wavelength and spectral width
- Rx power and equipment reflectance at Rx wavelength

ODN Optical Definitions

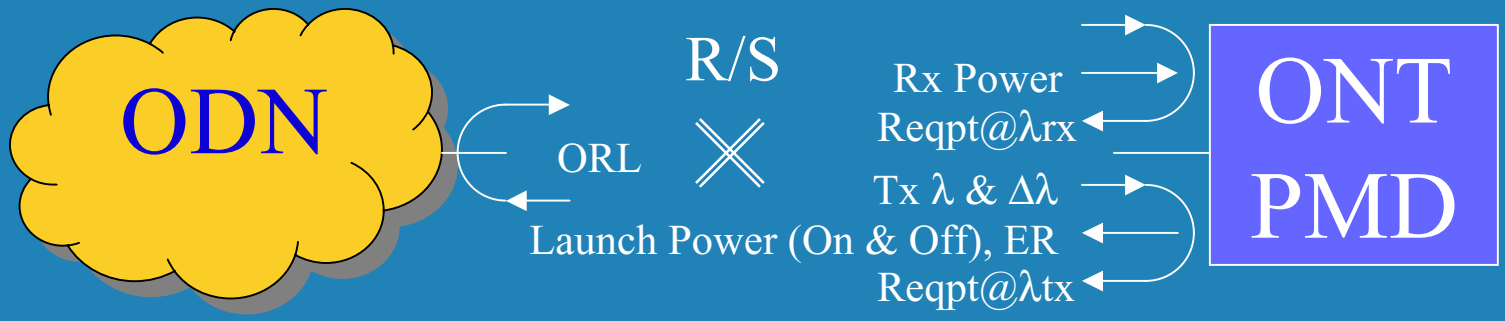
- Fiber type
- Attenuation range
- Maximum length
- Maximum optical path penalty



Optical Path Penalty. Df: The difference in apparent link budget between a link that contains only loss (back to back measurement) and a link that contains the maximum optical impairment (e.g. maximum length, worst wavelength, etc.)

R/S Optical Definitions

- ORL from viewpoint of ONT
- Rx power and equipment reflectance at Rx wavelength
- Launch power (on and off states), extinction ratio, Tx wavelength and spectral width, and equipment reflectance at Tx wavelength



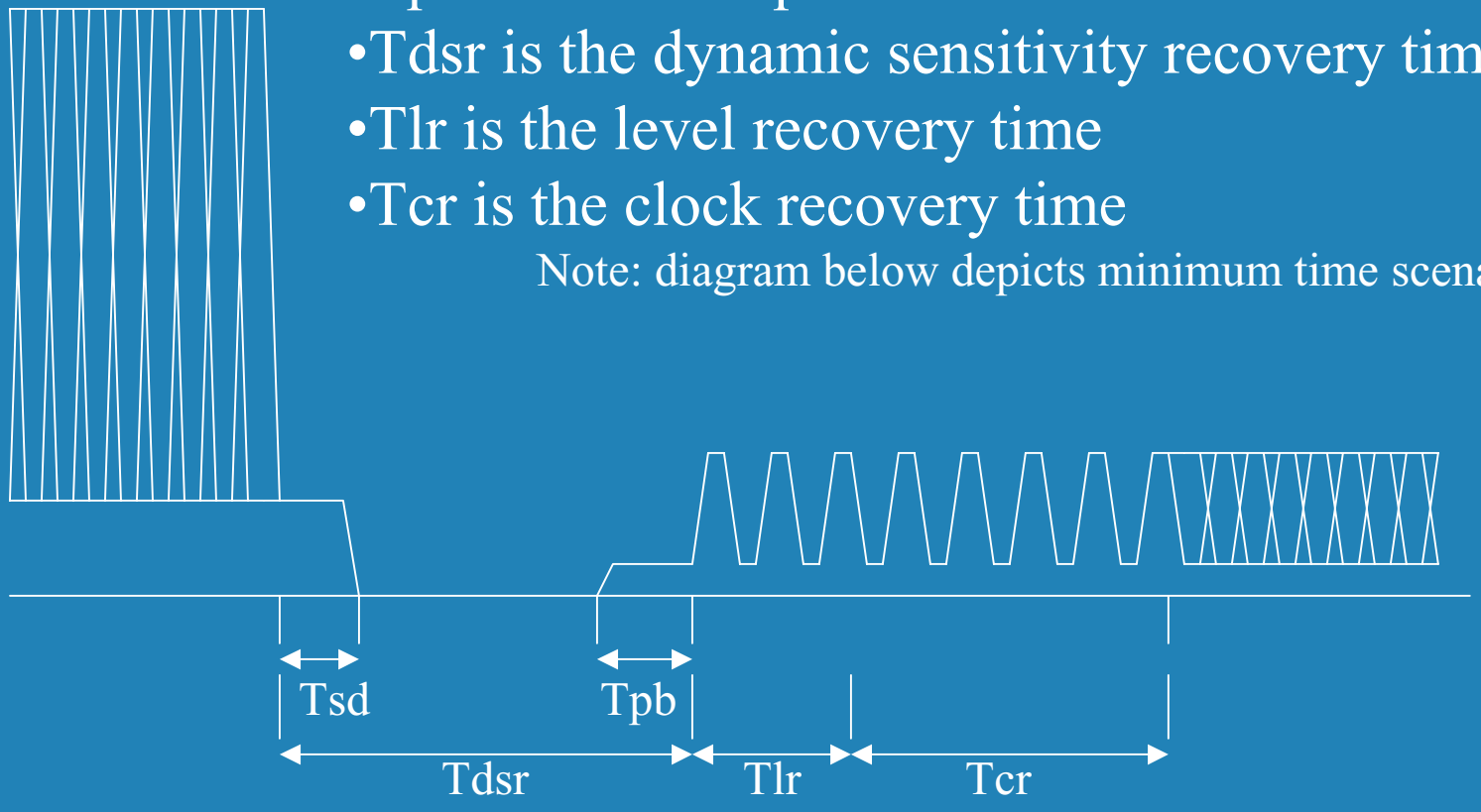
Logical Link Definitions

- Data Rate
- Coding method
- Bit error rate

Burst Mode Definitions

- Tsd is the laser shut down time
- Tpb is the laser pre-bias time
- Tdsr is the dynamic sensitivity recovery time
- Tlr is the level recovery time
- Tcr is the clock recovery time

Note: diagram below depicts minimum time scenario.



Two sets of PMDs

- Type 1 (short)
- Loss and dispersion matched to 10km, 1:16 split
- Allows PIN-based OLT

- Type 2 (long)
- Loss and dispersion matched to 20km, >1:16 split
- Requires APD-based OLT, DFB ONT

Maximal interoperability maintained

- ONT power levels are the same for both
- Intermixing of PMD types allowed
- Given technology advances, a single ONT type might be possible

Type 1 ODN Specs

Items	Unit	Values
Fiber type	–	IEC 60793-10 Type B1.1 or B1.3
Attenuation range	dB	5-20
Differential optical path loss	dB	15
Maximum optical path penalty	dB	Downstream: 1 Upstream: 3
Maximum fiber distance between S/R and R/S points	km	10
Minimum supported split ratio	–	1:16
Bidirectional transmission	–	1-fiber WDM

Type 1 OLT Tx Specs

Items	Unit	Values
Nominal bit rate	Mbit/s	1250
Operating wavelength	nm	1480-1500
Line code	–	8b10b
Minimum ORL of ODN	dB	more than 20
Mean launched power MIN	dBm	-4
Mean launched power MAX	dBm	+0
Extinction ratio	dB	more than 9
SLM Laser – Maximum –20 dB width	nm	1
SLM Laser – Minimum side mode suppression ratio	dB	30

Type 1 OLT Rx Specs

Items	Unit	Values
Maximum reflectance of equipment at Rx wavelength	dB	less than –20
Bit error ratio	–	less than 10^{-12}
Minimum sensitivity	dBm	-26
Minimum overload	dBm	-3
Maximum time for dynamic sensitivity recovery	Bits	tbd
Maximum time for level recovery	Bits	tbd
Maximum time for clock recovery	Bits	tbd

Type 1 ONT Tx Specs

Items	Unit	Values
Nominal bit rate	Mbit/s	1250
Operating wavelength	nm	MLM 1270~1360
Line code	–	8b10b
Maximum reflectance of equipment at Tx wavelength	dB	less than –6
Minimum ORL of ODN	dB	more than 32
Mean launched power MIN	dBm	-3
Mean launched power MAX	dBm	+2
Launched optical power without input to the transmitter	dBm	-39
Extinction ratio	dB	more than 9
Laser Pre-bias time	Bits	tbd
Laser Shut-down time	Bits	tbd
MLM Laser – Maximum RMS width	nm	2.4

Type 1 ONT Rx Specs

Items	Unit	Values
Maximum reflectance of equipment at Rx wavelength	dB	less than –20
Bit error ratio	–	less than 10^{-12}
Minimum sensitivity	dBm	-25
Minimum overload	dBm	-5

Type 1 Link Budgets

Downstream Direction

Sensitivity

- **Tx min: -4**
- **Splitters: -15.2**
- **Fiber: -4**
- **Connectors: -0.8**
- **Opt. Penalty: -1**
- **Rx Min: -25**

Overload

- **Tx max: 0**
- **Min loss: -5**
- **Rx Max: -5**

Upstream Direction

Sensitivity

- **Tx min: -3**
- **Splitters: -15.2**
- **Fiber: -4**
- **Connectors: -0.8**
- **Opt. Penalty: -3**
- **Rx Min: -26**

Overload

- **Tx max: +2**
- **Min loss: -5**
- **Rx Max: -3**

Type 2 ODN Specs

Items	Unit	Values
Fiber type	–	IEC 60793-10 Type B1.1 or B1.3
Attenuation range	dB	10-25
Differential optical path loss	dB	15
Maximum optical path penalty	dB	Downstream: 1 Upstream: 1
Maximum fiber distance between S/R and R/S points	km	20
Minimum supported split ratio	–	1:16
Bidirectional transmission	–	1-fiber WDM

Type 2 OLT Tx Specs

Items	Unit	Values
Nominal bit rate	Mbit/s	1250
Operating wavelength	nm	1480-1500
Line code	–	8b10b
Minimum ORL of ODN	dB	more than 20
Mean launched power MIN	dBm	+1
Mean launched power MAX	dBm	+5
Extinction ratio	dB	more than 9
SLM Laser – Maximum –20 dB width	nm	1
SLM Laser – Minimum side mode suppression ratio	dB	30

Type 2 OLT Rx Specs

Items	Unit	Values
Maximum reflectance of equipment at Rx wavelength	dB	less than –20
Bit error ratio	–	less than 10^{-12}
Minimum sensitivity	dBm	-29
Minimum overload	dBm	-8
Maximum time for dynamic sensitivity recovery	Bits	tbd
Maximum time for level recovery	Bits	tbd
Maximum time for clock recovery	Bits	tbd

Type 2 ONT Tx Specs

Items	Unit	Values
Nominal bit rate	Mbit/s	1250
Operating wavelength	nm	SLM 1270~1360
Line code	–	8b10b
Maximum reflectance of equipment at Tx λ	dB	less than –6
Minimum ORL of ODN	dB	more than 32
Mean launched power MIN	dBm	-3
Mean launched power MAX	dBm	+2
Maximum launched optical power when 'off'	dBm	-39
Extinction ratio	dB	more than 9
Laser Pre-bias time	Bits	tbd
Laser Shut-down time	Bits	tbd
SLM Laser – Maximum –20 dB width	nm	1
SLM Laser – Minimum side mode suppression ratio	dB	30

Type 2 ONT Rx Specs

Items	Unit	Values
Maximum reflectance of equipment at Rx wavelength	dB	less than –20
Bit error ratio	–	less than 10^{-12}
Minimum sensitivity	dBm	-25
Minimum overload	dBm	-5

Type 2 Link Budgets

Downstream Direction

Sensitivity

• Tx min:	+1
• Splitters:	-15.2
• Fiber:	-8
• Connectors:	-1.8
• Opt. Penalty	-1
• Rx Min	-25

Overload

• Tx max:	+5
• Min loss:	-10
• Rx Max:	-5

Upstream Direction

Sensitivity

• Tx min:	-3
• Splitters:	-15.2
• Fiber:	-8
• Connectors:	-1.8
• Opt. Penalty	-1
• Rx Min	-29

Overload

• Tx max:	+2
• Min loss:	-10
• Rx Max:	-8

Compatibility matrix

	Type 1 OLT Type 1 ODN	Type 2 OLT Type 2 ODN
Type 1 ONT <10km away	Yes	Yes
Type 1 ONT >10km away	N/A	No, but won't disrupt others
Type 2 ONT <10km away	Yes	Yes
Type 2 ONT >10km away	N/A	Yes

Summary of Specifications

Table 1: Properties of the Passive Optical Networks

Items	Unit	Specification	
Fiber type	–	IEC 60793-10 Type B1.1 or B1.3	
		Type 1	Type 2
Attenuation range	dB	5-20	10-25
Differential optical path loss	dB	15	
Maximum optical path penalty downstream	dB	1	1
Maximum optical path penalty upstream	dB	3	1
Maximum fiber distance between S/R and R/S points	km	10	20
Minimum supported split ratio	–	1:16	
Bidirectional transmission	–	1-fiber WDM	

Table 2: Properties of the 1250 Mb/s OLT PMDs

Items	Unit	Values	
		OLT Transmitter	
Nominal bit rate	Mbit/s	1250	
Operating wavelength	nm	1480-1500	
Line code	–	8b10b	
Minimum ORL of ODN	dB	more than 20	
		Type 1	Type 2
Mean launched power MIN	dBm	-4	+1
Mean launched power MAX	dBm	0	+5
SLM Laser – Maximum –20 dB width	nm	1	
SLM Laser – Minimum side mode suppression ratio	dB	30	
Extinction ratio	dB	more than 9	
		OLT Receiver	
Maximum reflectance of equipment, measured at Rx wavelength	dB	less than –20	
Bit error ratio	–	less than 10^{-12}	
		Type 1	Type 2
Minimum sensitivity	dBm	-26	-29
Minimum overload	dBm	-3	-8
Maximum time for dynamic sensitivity recovery	Bits	tbd	
Maximum time for level recovery	Bits	tbd	
Maximum time for clock recovery	Bits	tbd	

Table 3: Properties of the 1250 Mbit/s ONT PMDs

Items	Unit	Value	
		ONT Transmitter	
Nominal bit rate	Mbit/s	1250	
Operating wavelength	nm	1270-1360	
Line code	–	8b10b	
Maximum reflectance of equipment, measured at Tx wavelength	dB	less than –6	
Minimum ORL of ODN	dB	more than 32	
Mean launched power MIN	dBm	-3	
Mean launched power MAX	dBm	+2	
Launched optical power without input to the transmitter	dBm	-38	
Extinction ratio	dB	more than 9	
Laser Pre-bias time	Bits	tbd	
Laser Shut-down time	Bits	tbd	
		Type 1	Type 2
MLM Laser – Maximum RMS width (Note 1)	nm	2.4	N/A
SLM Laser – Maximum –20 dB width	nm	N/A	1
SLM Laser – Minimum side mode suppression ratio	dB	N/A	30
		ONT Receiver	
Maximum reflectance of equipment, measured at Rx wavelength	dB	less than –20	
Bit error ratio	–	less than 10^{-12}	
Minimum sensitivity	dBm	-25	
Minimum overload	dBm	-5	

Summary

- P2MP PMD baseline presented
- Two PMD sets
  - A ‘short’ set: easy to build, but strands a significant market segment
  - A ‘long’ set: more difficult, but addresses the longer distances
- Motion: To accept this presentation as a part of the baseline