

# Optical Modulation Amplitude (OMA) Specifications

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# Previous presentations on OMA

- Donhowe et al.

[http://www.ieee802.org/3/10G\\_study/public/sept99/donhowe\\_1\\_0999.pdf](http://www.ieee802.org/3/10G_study/public/sept99/donhowe_1_0999.pdf)

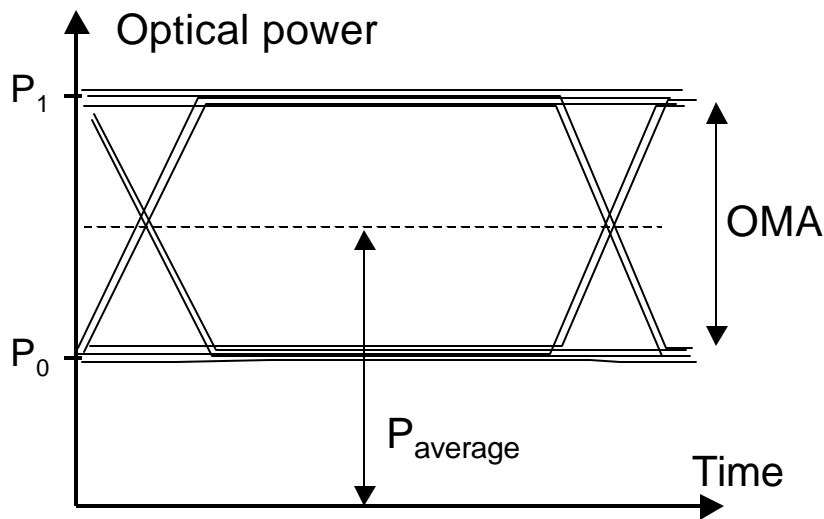
- Frojdh and Ohlen

[http://www.ieee802.org/3/ae/public/may00/frojdh\\_1\\_0500.pdf](http://www.ieee802.org/3/ae/public/may00/frojdh_1_0500.pdf)

[http://www.ieee802.org/3/ae/public/jul00/frojdh\\_1\\_0700.pdf](http://www.ieee802.org/3/ae/public/jul00/frojdh_1_0700.pdf)

[http://www.ieee802.org/3/ae/public/sep00/ohlen\\_1\\_0900.pdf](http://www.ieee802.org/3/ae/public/sep00/ohlen_1_0900.pdf)

# What is OMA ?



$$\text{OMA} = P_1 - P_0$$

$$P_{\text{average}} = (P_1 + P_0) / 2$$

$$\text{ER} = P_1 / P_0$$

- Used by FC
- At high ER:  
 $\text{OMA} / 2 = P_{\text{average}}$
- Measurements are somewhat different
  - Changes in 52.6
- You could measure
  - $P_{\text{average}}$  & ER
  - and calculate OMA

# Why use OMA ?

- At the receiver OMA matters not  $P_{\text{average}}$ 
  - With average power, we have to consider extinction ratio penalty (2.2 dB @ ER=6dB)
- With OMA, it is possible to use low or high extinction ratio, provided that
  - eye safety is OK at the transmitter
  - we do not overload the receiver
- At this point we do not change the numbers

# How to specify OMA ?

- OMA in mW:
  - + Simple measurement on oscilloscope
  - Hard to track changes to current draft
- OMA/2 in dBm:
  - Needs conversion if measured on oscilloscope
  - + Easy to track changes to current draft, at large extinction ratio  $P_{\text{average}} = \text{OMA}/2$
  - + All the link budgets and penalties are in dB

# Introduction of OMA

- 850 serial: Spec @ 6.5 dB extinction ratio
  - ER penalty = 1.98 dB → decrease powers by 1.98 dB
- 1310 serial: Spec @ 6 dB extinction ratio
  - ER penalty = 2.23 dB → decrease powers by 2.23 dB.
- 1550 serial: Spec @ 8 dB extinction ratio
  - ER penalty = 1.39 dB → decrease powers by 1.39 dB.
- Add eye safety (Tx) and overload (Rx) specs

# Changes for 850 serial

Description	Old value	New value
Tx power (min)	$P_{\text{average}} = -5.5 \text{ dBm}$	OMA/2= $-7.48 \text{ dBm}$
RIN	-125 dB/Hz	N/A
RIN_OMA	N/A	-123.02 dB/HZ
Rx sensitivity	$P_{\text{average}} = -13 \text{ dBm}$	OMA/2= $-14.98 \text{ dBm}$
Stressed Rx sensitivity (50 um MMF)	$P_{\text{average}} = -8.5 \text{ dBm}$	OMA/2= $-10.48 \text{ dBm}$
Stressed Rx sensitivity (62.5 um MMF)	$P_{\text{average}} = -7.6 \text{ dBm}$	OMA/2= $-9.58 \text{ dBm}$
Rx max. input power	$P_{\text{average}} = -1$	$P_{\text{average}} = -1 \text{ dBm}$

# Changes for 1310 serial

Description	Old value	New value
Tx power (max)	$P_{\text{average}} = 1 \text{ dBm}$	OMA/2= -1.23 dBm
Tx power (min)	$P_{\text{average}} = -4 \text{ dBm}$	OMA/2= -6.23 dBm
Average launch power for eye safety	$P_{\text{average}} = 1 \text{ dBm}$	$P_{\text{average}} = 1 \text{ dBm (TBD)}$
RIN	-130 dB/Hz	N/A
RIN_OMA	N/A	-127.77 dB/HZ
Rx sensitivity	$P_{\text{average}} = -14 \text{ dBm}$	OMA/2= -16.23 dBm
Stressed Rx sensitivity	$P_{\text{average}} = -11.45 \text{ dBm}$	OMA/2= -13.68 dBm
Rx max. input power	$P_{\text{average}} = 1$	OMA/2= -1.23 dBm



# Changes for 1550 serial

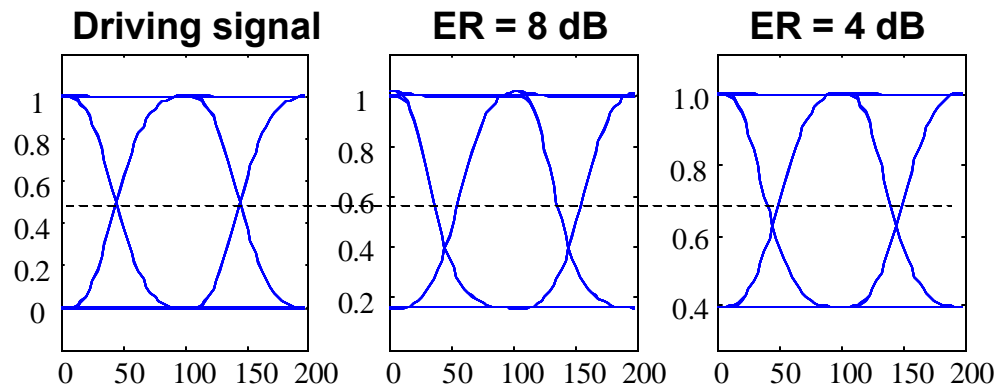
Description	Old value	New value
Tx power (max)	$P_{\text{average}} = 2 \text{ dBm}$	OMA/2= 0.61 dBm
Tx power (min)	$P_{\text{average}} = -2 \text{ dBm}$	OMA/2= -3.39 dBm
Average launch power for eye safety		$P_{\text{average}} = 2 \text{ dBm (TBD)}$
RIN	-140 dB/Hz	N/A
RIN_OMA	N/A	-138.61 dB/HZ
Rx sensitivity	$P_{\text{average}} = -20 \text{ dBm}$	OMA/2= -21.39 dBm
Stressed Rx sensitivity	$P_{\text{average}} = -15.41 \text{ dBm}$	OMA/2= -16.8 dBm
Rx max. input power	$P_{\text{average}} = -8$	OMA/2= -9.39 dBm

## Extinction ratio

- With OMA we can use a low or high extinction ratio to optimize a transmitter
- Proposed changes to extinction ratio:
  - 1310 nm: 6 dB  $\rightarrow$  4 dB
  - 1550 nm: 8 dB  $\rightarrow$  4 dB
  - 850 nm: 6.5 dB  $\rightarrow$  4 dB

## Reasons for low ER, external modulator

- Electrical driving easier
- Easier to get symmetric eye with an electro-absorption modulator



- Short modulator  $\rightarrow$  lower modulator loss.

**BACKUP**

## Reason for low extinction ratio, directly modulated laser

- You want to stay well away from the threshold
  - Laser is slowest near the threshold
  - Low ER improves high-speed performance
- Simpler driving electronics
- Lower dispersion penalty, important for 1550 nm