

# 100m MMF reach objective Tx and Rx parameters working document

Post 13<sup>th</sup> December 2012

MMF ad hoc

- Recap of Tx and Rx tracker tables from 8<sup>th</sup> Nov MMF ad hoc, with formulae for dependent parameters agreed on Dec 13<sup>th</sup> MMF ad hoc

# Transmitter characteristics (each lane)

Description	Type	Unit	Petrilla_02a_09 12	dawe_01a_0912	Table 86-6, Cl. 86	Fibre Channel	Proposed
Signal rate		GBd	25.78125 100ppm			28.05 100ppm	25.78125 100ppm
Center wavelength	range	nm	<i>TBD</i>	840 to 860	840-860	840-860	840-860
RMS spectral width	max	nm	0.6	0.65 / 0.6	0.65	0.57	0.6
Average launch power	max	dBm	<i>TBD</i>	2.4	2.4		<i>TBD (2.4)</i>
Average launch power	min	dBm	<i>TBD</i>	-7.6	-7.6		<i>TBD</i>
Optical Modulation Amplitude (OMA)	max	dBm	<i>TBD</i>	3	3		<i>TBD (3)</i>
OMA	min	dBm	<i>TBD</i>	-5.6	-5.6		<i>TBD</i>
OMA at max TDP	min	dBm	-3.0	<i>TBD</i>	-3.0	-3.2	-3.0
Launch power in OMA minus TDP			<i>TBD</i>	-6.5	-6.5		<i>TBD</i>
Difference in launch power between any two lanes (OMA)	max	dB	<i>TBD</i>	<i>TBD</i>	4		<i>TBD</i>
Transmitter & dispersion penalty (TDP) at target BER before FEC			<i>TBD</i>	<i>TBD</i>	3.5		<i>TBD</i>
Extinction ratio (min)		dB	4	3	3		3
RIN <sub>12</sub> OMA (max)		dB/Hz	-130	No spec	No spec	-129	no spec
Transmitter reflectance		dB	-12	No spec	none		no spec
Optical return loss tolerance (max)		dB	12	12	12		12
Encircled Flux			<i>TBD</i>	<b>&gt;= 86% at 19 μm, &lt;= 30% at 4.5 μm</b>	> 86% @ 19um, < 30% at 4.5um		<b>≥ 86% @ 19um, ≤ 30% at 4.5um</b>
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}, 5 10 <sup>-5</sup> hits/sample			<i>TBD</i>	Around 0.25/0.21, 0.36/0.32, 0.45, 0.27, 0.35, 0.4	0.23, 0.34, 0.43, 0.27, 0.35, 0.4	<i>TBD</i>	<i>TBD</i>
Average launch power of OFF transmitter	max	dBm	-30	-30	-30		-30

# Receiver characteristics (each lane)

Description	Type	Unit	Petrilla_02a_0912 Link model values	dawe_01a_0912	Table 86-6, Cl. 86	Fibre Channel Link model values	Proposed
Signal rate		GBd	25.78125 100ppm			28.05 100ppm	25.78125 100ppm
Center wavelength	range	nm	840-860	840 to 860	840-860	840-860	840-860
Damage threshold	min	dB	TBD	+3.4	+3.4		TBD (3.4)
Average power at receiver	max	dBm	TBD	2.4	2.4		TBD (2.4)
Average power at receiver	min	dBm	TBD	-9.3/-9.5	-9.5		TBD
Optical Modulation Amplitude (OMA)	max	dBm	TBD	3	3		TBD (3)
Stressed receiver sensitivity in OMA	max	dBm	TBD	-5.4	-5.4		TBD
Unstressed Rx sensitivity BER=5x10 <sup>-5</sup> , (BER=10 <sup>-12</sup> )	max	dBm	-10.5 (-7.8)	No spec	NA	-10.2 (-8.5)	No spec
SRS test conditions			TBD				TBD
Receiver reflectance		dB	-12	-12	-12		-12

- *Note: Jitter tolerance test – starting point is scaled version of clause 86*

# Link and Cable Characteristic

Parameter	Unit	Petrilla_02a_0912	dawe_01a_0912	Proposed
Supported fiber types		<b>OM4</b>	<b>OM4, OM3</b>	<b>OM4, OM3</b>
Effective Modal Bandwidth	MHz*km	<b>4700</b>	<b>4700, 2000</b>	<i>4700, 2000</i>
Power Budget	dB	<b>7.3<sup>1</sup></b>	<b>8.0<sup>2</sup> to 9.5<sup>1</sup></b>	<i>TBD (7.3)</i>
Operating Range	m	<b>0.5-120</b>	<b>TBD (20 to 100)</b>	<i>TBD (120)</i>
Channel insertion loss	dB	<b>1.9</b>	<b>1.6 to 1.9</b>	<i>TBD</i>

- Note 1: with KR4 FEC – power budget depends on required uncorrected BER and is for further study
- Note 2: without KR4 FEC, BER =  $10^{-12}$

## *Update:*

- *Anslow\_01a\_1112, reviewed in the November 29<sup>th</sup> MMF ad hoc, recommended that the BER at the PMA service interface should be less than  $5 \times 10^{-5}$*

- 100m objective remaining TBDs - 13<sup>th</sup> Dec

# 100m Tx TBDs

Description (Tx)	Type	Unit	Name	Proposed Formula	Proposed
Average launch power	max	dBm	$Tx_{av\_max}$		<i>TBD (2.4)</i>
Average launch power	min	dBm	$Tx_{av\_min}$	$=Tx_{OMA\_min} - 2$	<i>TBD</i>
Optical Modulation Amplitude (OMA)	max	dBm	$Tx_{OMA\_max}$	$=Tx_{av\_max} + 0.6$ note 1	<i>TBD (3.0)</i>
OMA	min	dBm	$Tx_{OMA\_min}$	$=Tx_{OMA@TDP} - TDP + 0.9$ note 2	<i>TBD</i>
OMA at max TDP	min	dBm	$Tx_{OMA@TDP}$		<i>-3.0</i>
Launch power in OMA minus TDP	min	dBm	$Tx_{OMA-TDP}$	$=Tx_{OMA@TDP} - TDP$	<i>TBD</i>
Difference in launch power between any two lanes (OMA)	max	dB	$Tx_{\Delta P}$		<i>TBD (4 or greater)</i>
Transmitter & dispersion penalty (TDP) at target BER before FEC	max	dB	<b>TDP</b>	<i>link model output</i>	<i>TBD</i>
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}, 5 $10^{-5}$ hits/sample					<i>TBD</i>

Note 1: Average power to OMA conversion factor for ER = 5.65 dB is 0.6 dB

Note 2: 802.3 ba used 0.9 dB for 40G SR4, 0.8dB for 40G LR4 and 1 for 100G LR4

# 100m reach Rx TBDs

Description (Rx)	Type	Unit	Name	Proposed Formula	Proposed
Damage threshold	min	dBm	$P_{dmg}$	$= Tx_{av\_max} + 1$	<i>TBD (3.4)</i>
Average power at receiver	max	dBm	$Rx_{av\_max}$	$= Tx_{av\_max}$	<i>TBD (2.4)</i>
Average power at receiver	min	dBm	$Rx_{av\_min}$	$= Tx_{av\_min} - IL$	<i>TBD</i>
Optical Modulation Amplitude (OMA)	max	dBm	$Rx_{inOMA\_max}$	$= Tx_{OMA\_max}$	<i>TBD (3)</i>
Stressed receiver sensitivity in OMA	max	dBm	SRS	<i>link model output</i>	<i>TBD</i>
SRS test conditions					<i>TBD</i>

- Proposal: set max Rx average power to match max Tx average power value
- Proposal: set Rx min damage threshold to 1dB higher than max Rx average power



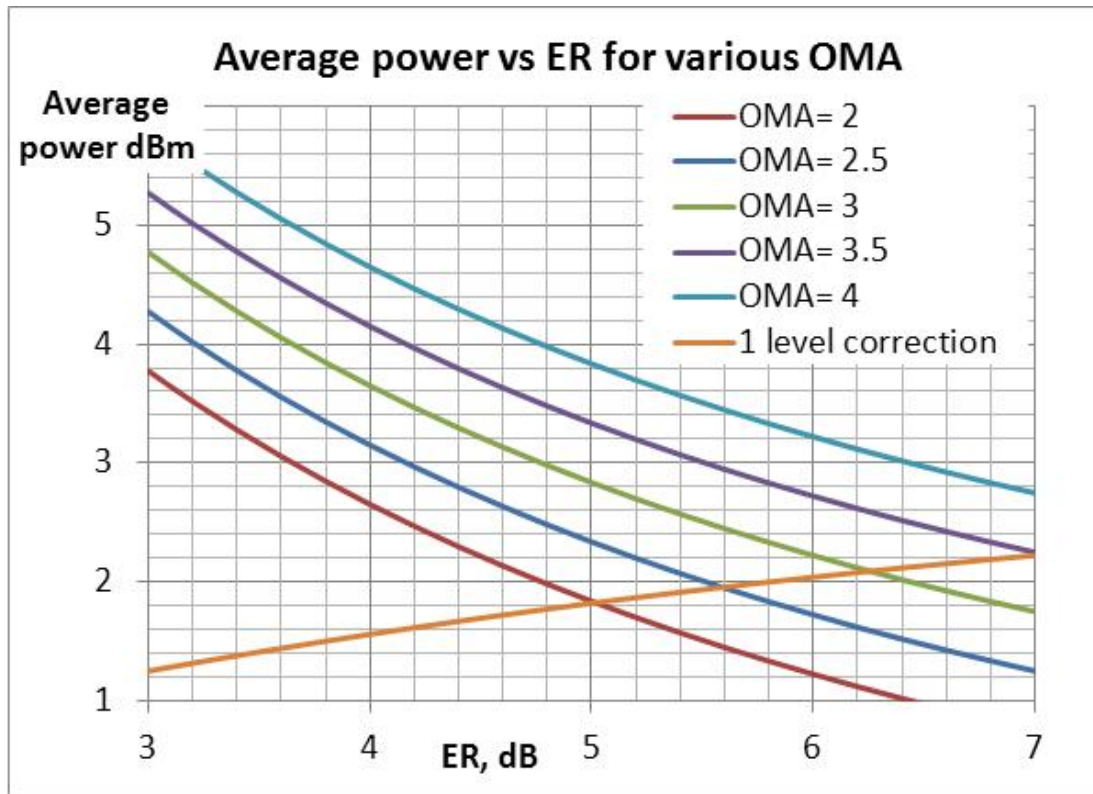
# Link characteristic TBDs

Parameter	Unit	Name	Proposed Formula	Proposed
Power Budget	dB	<b>PB</b>	<i>link model output</i>	<i>TBD (8.3) note 1,2</i>
Operating Range	m		<i>link model output</i>	<i>TBD (110) note 1</i>
Channel insertion loss	dB		<i>link model output</i>	<i>TBD (1.9) note 1</i>

- Note 1: the values in brackets are updates from petrilla\_03\_1112, but are 'unapproved' by the MMF ad hoc.
- Note 2: the power budget should be min Tx OMA at max TDP minus the unstressed receiver sensitivity at  $5 \times 10^{-5}$

# Back up

# Tx average power, ER, OMA



- A max OMA of +3 dBm gives reasonable range of Tx OMA for max TDP
  - Corresponds to ER = 5.6 dB at average power of +2.4 dBm
- Add the '1 level correction' to the average power to calculate the optical 1 level
- Typically, VCSELs ER is set in the range of 4 dB to 7 dB range; for a max average power spec at +2.4 dBm, and max OMA of 3 dBm, the max 1 level power is +4.4 dBm